

DESIGNING

A WORLD THAT WORKS

FOR ALL

**Solutions & Strategies for
Meeting the World's Needs**

2005–2013 Labs

**by Medard Gabel
and the
Design Science/Global Solutions Lab**

Copyright ©2014 BigPictureSmallWorld Inc.

All rights reserved

Printed in the United States of America

Fourth Edition

Designed by Mary Gabel, Gabel Graphics, Media, PA, www.gabelgraphics.com

ISBN: 978-1499214369

Available at

www.designsciencelab.com

www.amazon.com

TABLE OF CONTENTS

Participants	6
Acknowledgements.	8
Introduction	10
<i>Design Science/Global Solutions Lab</i>	10
<i>Designs for Changing the World</i>	12
Global Preferred State	17
Overview and Problem State:	
Context and World Systems	19
Part I: Food and Water for All	21
Context/State of the World Food System	22
Global Food System Preferred State	25
Strategies for achieving the Millennium Development	
Goals and Preferred State.	26
<i>Strategic Area I: Increasing Food Production/</i>	
<i>Decreasing Loss</i>	27
1. <i>The Giving Tree</i>	28
2. <i>Trash to Treasure/WonderWaste:</i>	
<i>Urban Compost/Rural Fertilizer</i>	32
3. <i>Sky Farms</i>	36
4. <i>Seven Generations Ag/Integrated</i>	
<i>Cropping Systems</i>	39
5. <i>Post Harvest Loss: Cool Pot and Veggie</i>	
<i>and Grain Gain</i>	43
6. <i>Moringa in Motion</i>	46
7. <i>Sustainable Urban Agriculture</i>	54
8. <i>E.A.T.: Educating Aquaponic Technology</i>	55
<i>Strategic Area II: Water Management</i>	63
9. <i>Waterment: Clean Water Access</i>	64
10. <i>Drops for Crops</i>	65
11. <i>WaterWorks</i>	67
12. <i>Water = Life</i>	72
13. <i>Increasing Household Water Security</i>	78
14. <i>Sanitation and Waste Management in Informal</i>	
<i>Communities: Dharavi, India</i>	87
<i>Strategic Area III: Governance</i>	97
15. <i>Subsidy Reduction</i>	98
16. <i>Land Reform: This Land is Our Land</i>	102
17. <i>Microfinance</i>	106
18. <i>Food for Thought</i>	109
Photos: Orientation at the United Nations.	110

Part II: Clean Energy for All. 111

Context/State of the World Energy System 112

Global Energy System Preferred State 113

Global Energy Strategies 114

Strategic Area I: Local Energy Systems. 115

 1. *Powering the Future—Harvesting Human Mechanical Power/The Power of You 117*

 2. *Improving Cooking in the Developing World . 122*

 3. *Electricity Rate Restructuring 130*

 4. *Energy-in-a-Box 133*

 5. *Green Mobile Homes 134*

 6. *Green Energy: Recycling Waste from Thermo Energy to Biosynergy 135*

 7. *Urban Energy and Public Transit 146*

 8. *Transition to Renewable Energy 155*

 9. *Airvengers 171*

Strategic Area II: Regional Energy Systems 171

 10. *Efficiency or Catastrophe 178*

 11. *Rural Electrification via Small Scale Wind Power. 183*

 12. *Tidal Power. 187*

Strategic Area III: Global Energy Systems. 192

 13. *Market Driven Energy Strategies. 193*

 14. *Global Energy Corps. 197*

 15. *Carbon Subsidy Removal 198*

 16. *EmPower Book 200*

 17. *Manufacturing Renewable Technologies. . . 201*

 18. *Sustainable Extension Network 202*

 19. *REST: Revamping the Energy System Today. . 203*

Part III: Education for All for Life 220

Context 221

Global Education Strategies 224

 1. *SIB: School-In-A-Box 227*

 2. *WE CAN: World Educational Cooperative for All Nations. 232*

 3. *School/Community eHub 235*

 4. *eMobile Educational Resources 236*

 5. *Wi-Fi for Education 237*

 6. *SEED: SYNERGETIC EDUCATIONAL EXPERIENCE AND DEVELOPMENT. 238*

 7. *Education For Everyone 243*

 8. *All Knowledge, All People, All the Time. . . . 253*

9. *Elimu Sasa Hivi Project: Leveraging Technology to Provide Quality, Accessible Primary Education for All* 261

Part IV: Global Health for All 267

- Context/State of the World Health System 268
- Global Health System Preferred State 268
- Global Health Strategies 269
 1. *Hooked-Up HealthHuts* 270
 2. *Cambodia Water Network:* 274
 3. *Eradication of Malaria:* 278

Part V: Fair Economic Systems/Participatory Governance/

Sustainable Life for All 281

1. *Community-In-A-Box* 286
2. *Living Wage for All Humanity* 287
3. *NGOs: Millennium Development Goal Realization* 293
4. *United Nations Empowered* 297
5. *Where in the WORLD is our Sustainable Capital?* 303
6. *Investing in Opportunities* 314
7. *iWANT to know:* 317
8. *Human Trafficking:* 329
9. *Accounting for the Real World.* 338
10. *Project Tires on Foot* 346
11. *Fast Tracking Poverty Eradication* 351
12. *Urban ReGeneration:* 358
13. *Earth Dashboard* 364
14. *WorldGame.* 367
15. *Surpassing the Digital Divide* 370
16. *uVote.* 382
17. *unSlumming* 390
18. *commUNITY* 395
19. *I Am Human* 400

Part VI: Summary/Synergy 403

- Summary/Synergy 404
- Appendix: The UN Millennium Development Goals . . . 406
- Endnotes 408
- Photos: Design Science/Global Solutions Labs in Action . 414
- About the Author 422

PARTICIPANTS IN THE DESIGN SCIENCE/GLOBAL SOLUTIONS LAB

2005

Meredith Aach, Bamini Balaji, Jeremy Bang , Milly Barolette, Jean-Baptiste Bassene, Jennifer Bodenstab, Natasha Cline-Thomas, Cara Collier, Daniel Eida, Eric Fedus, Medard Gabel, Allard van Hoorn, Jochen Hartmann, Abbe Horswill, Wayne Jacoby, Noah Brooks Katz, Jai Lakhanpal, Leah Lowthorp , Kristina Mader, Chuck Michelson, Zoë Richards, Eric Rimpel, Sidharth Shah, William Sheehan, Ilya Smirnoff, Arthur Steiner, Elizabeth Thompson, Adrian Salinas Valdez, John Yuan

2006—Global Solutions Lab

Bamini Balaji, Jeremy Bang, Jean-Baptiste Bassene, Akeem Bello, Jennifer Bodenstab, Jon Brett, Yoshimi Brett, Ross Brockwell, Melissa Callender, Fabiola Carrasco, Kasia Chmielinski, Natasha Cline-Thomas, Ben Cohen, Sergio Cordiero, Gonzague de Raulin, Douglas Diaz, Kevin Dye, Easy, Daniel Eida, Sharif Ezzart, Victoria Farmer, Eric Fedus , Medard Gabel, Alexandra Heeney, David Heeney, Florence Johnson, Erica Jain, Wayne Jacoby, Erica Kane, Zane Kripe, Gabriel Kennedy, Fiona Kinniburgh, Jai Lakhanpal, James Lual, Kristina Mader, Morgan Maher, Ryan Martin, Marty McCrea, Chuck Michelson, Alexandra Montes, Aiesha Morris, Priyanka Pandit, Xena Parsons, Lexi Quint, Elizabeth Ramaccai, Ignez Renault, Stephen Rowley, Ariel Ruvinsky, Zoë Richards, Eric Rimpel, William Sheehan, Charles Sheldon, Elizabeth Thompson, David Walczyk, Vera Zago, Gregory Zuccolotto

2006—Local Solutions Lab

Charlotte Anthony, Jeremy Bang, Paul Beaton, Neha Bhatt, Jonah Butcher, Robin Cape, Julie Clark, Nick Consoletti, Darcel Eddins, Dee Eggers, Gloria Howard Free, Joel Vann Fuller, Medard Gabel, Alan Glines, Mark Hanf, Peter Harrison, Sarah Hausman, Nancy Hodges, Cathy Holt, Kimberly Hundertmark, Reo Jones, Kim Kubicke, Janet Lowe, Patricia Major, Alex MacKay, Stephanie Monson, David McConville, Ruth Meyers, Michael Miller, Charvee Patel, George Reynolds, David Silverman, Molly Sprengelmeyer, Harris Stewart, Elizabeth Thompson, Gail Thomas, Susie Watson, Sharon Willen, Ari Zitin

2007

Zeynep Arhon, Aruna Arjunan, Brett Boye, Ross Cameron, Dale Castle, Andy Cavatorta, Natasha Cline-Thomas, Gonzague de Raulin, Elke Esmeralda Dikoume, Kyle Fedus, Dustin Feider, Theodora Filip, Angela Fuller, Medard Gabel, Eric Goldfischer, Briana Graves, Iman Griffin, Samah Hanaysha, Jim Hausman, Mael Jaffres, Brent Jones, Joshua Kauffman, Michael Khayyat, Karen Lau, Anne Loyer, Kevin Machoka, Shivani Mathur, Lucas McConnell, Susan Moore, Thomas Pang, Rafi Pelles, Veronica Peña, Ben Pullman, Alex Reiner, Zoë Richards, Alex Rinomato, Ethan Rosch, Annika Semmler, Ivan Serezhin, Razi Shawahdeh, Hyoung Suk Seo, Lexi Quint, Don Whilsmith, Pollan Wong, Rachel Wong

2008

Angela Burcham, Katherine Cali, Sabrina Cusimano, Amanda Dachille, Robert Fink, Karen Guwurriro, Medard Gabel, Emily Gleason, Lauren Horneffer, Wayne Jacoby, Dave Keefe, Sam Little, Bart Misano, Brittany Mixson, Komal Patel, Daniele Seldomridge, William Sheehan, Michael Turri, Jacqui Yalango

2009

Alexis Baranov, Rebecca Berkowitz, Sabrina Cusimano, David Fand, Medard Gabel, Saroj Humagain, Wayne Jacoby, Tyler Knowlton, Barbara Kreider, Iwanka Kultschycky, Emmanuel Laguerre, Bryce Langlotz, Tran Le, Devin Massaro, Bart Misano, Jake O'Donnell, Nathan Owens, George Pavlosky, Alfonso Rivas, Robert Steele, Anna Swarbrick, Ren Shiroma, Brandin Watson, Darlene Williams

2010

Frances Brindle, Katey Fardelmann, Sarah Ferst, Medard Gabel, Kiersten Alicia Hawes, Wayne Jacoby, Marquita James, Margaret Anne Lovallo, Kathlene McGuinness, Bart Misano, Sushil Pakhrin, Ihsan Pashley, Danielle Radacosky-Pentoney, Sarah Raimondo, Brent Ritzel, Archana Sharma, Charles Sheldon, Katherine Tohanczyn, Christina Walsh

2011

Melissa Day, Zarima Fayikova, Medard Gabel, Christine Harb, Christine Hebert, Wayne Jacoby, Hien Lam, Shelby Miner, Tri Nguyen, Uyen (ana) Nguyen, Ogheneruno ('Runo) Okiomah, Joshua Pang, Sean Powers, Donovan Preddy, Alen Saju, Michael Smith, Anna Swarbrick, Karolyn Wojtowicz, Will Wright

2012

Ayuen Ajok, Sheetal Akole, Julia I Blumberg, Medard Gabel, Nino Gagua, Aizaz Gill, Vicki Goldsmith, Wayne Jacoby, Kellie Jingoian, Katrina Mattern, Joseph Mutumu, Denis Okema, Leszek Pochron-Frankowski, Sean Powers, Rabia Sana, Anne Schiffer, Haruko Takeuchi, Yosuke Tanabe, Eric Wu, Rachel Zanders

2013

Judith Anokwu, Tariq Ausaf, Chris Cepil, Luca Dragani, Kaycee Flore, Hillary Fronk, Medard Gabel, Tobias Gabel, Tselane Hall, Hoang Nguyen Ngoc Hieu, Wayne Jacoby, Giorgi Jashiasvili, Beka Khatiasvili, Leah Knappage, Heather McAdams, Lisa Nowinski, Nhu Phan, Sean Powers, Thayvie Sinn, Dennis Yeh

- | | |
|-----------|--|
| 2013 | Lab directed by BigPictureSmallWorld in cooperation with Global Education Motivators and Delaware Pacem in Terris |
| 2005–2012 | Labs directed by BigPictureSmallWorld in cooperation with Global Education Motivators |
| 2005–2007 | Labs produced by Buckminster Fuller Institute and directed by BigPictureSmallWorld in cooperation with Global Education Motivators |

ACKNOWLEDGEMENTS

The *Design Science/Global Solutions Lab* would like to acknowledge and thank the following people at the United Nations for their much-appreciated and many-faceted support:

Kathleen Abdalla, UN Department of Economic and Social Affairs

Dr. Richard Alderslade, World Health Organization/Senior External Relations Officer, Health Policy

Mandeep Bains, Senior Policy Advisor/ UN Millennium Campaign

Nazim Benchikh, Youth Program Fellow, United Nations Population Fund

Vivian Bernstein, UN Academic impact

Suzanne Bilello, UN Education, Science and Culture Organization

Marcia Brewster, Department of Economic and Social Affairs, Sustainable Development Division

Juan Carlos, Chief NGO Section

Margaret Carrington, UN FAO, World Food Programme

Florence Chenowith, UN Food and Agriculture Organization

Albert Cho, UN Development Programme

Elisabeth Clemens, UN Development Programme

Ramu Damodaran, Chief, Civil Society Section, United Nations Department of Public Information

Swati Dave, UN, Visitor's Services

Ilaria DiMatteo/ Chief, Energy Statistics Section/DESA

Yamina Djacta, Deputy Director, UN Human Settlements Programme

Ellen Gustafson, UN FAO, World Food Program

Arunabha Ghosh, UN Human Development Report, UN Development Programme

Angel Gomez, UN Habitat/NY Office

Shamina de Gonzaga, Office of the President of the United Nations General Assembly

Donna Goodman, Program Advisor/ Water, Environment and Sanitation Section, UNICEF

Patrick Haverman, Project Manager Millennium Village, Regional Bureau for Africa, United Nations Development Programme

Patrick Hayford, Director, Office of the Special Adviser on Africa, UN Development Programme

Liz Hallett, UN World Food Programme

Bashir Jama, Millennium Villages Project, United Nations Development Programme

Kefilwe Koogotsitse, Youth Program Fellow, United Nations Population Fund

Karoly Kovacs, Department of Economic and Social Affairs/Environment, Energy and Industrial Statistics

Jakob Krupka, UN Human Settlements Programme

Julie Larsen, Department of Economic and Social Affairs, Program on Youth

Jennifer Longo, UN, Visitor's Services

Bettina Luescher, Spokesperson, World Food Programme

Changu Mannathoko, UNICEF, Education Section

Cecilia Martínez, Director, UN Habitat/ NY Office

Mathew Mcilvenna, UN World Food Programme

Giorgia Passarelli, Office of the United Nations High Commission for Human Rights

Gonzalo Pizarro, Policy Specialist on Water Resources, United Nations Development Programme

Arturo Requesens, Secretariat of the United Nations Permanent Forum on Indigenous Issues, Division for Social Policy and Development

Mary Roodkowsky, Special Advisor for United Nations Affairs, UNICEF

Renata Rubian, Policy Specialist, Poverty Practice, Bureau of Development Policy/UNDP

Guido Schmidt-Taub, Associate Director UN Millennium, Project/The Millennium Village

Vanessa Tobin, United Nations Children's Fund

Broddi Sigurdarson, UN Department of Economic and Social Affairs

Jim Sniffen, Programme Officer, UN Environment Programme

Leonardo Souza, UN Department of Economic and Social Affairs

Friedrich Soltau, UN Department of Economic and Social Affairs

Sergio Vieira, Department of Economic and Social Affairs, Social Perspective Development Branch

Lucy Wanjiru/UNDP Gender Team

Carol Welch, US Coordinator, Millennium Development Goals Campaign/ UN Development Programme

Gregory Woodsworth, UN Development Programme

Bill Yotive, UN Department of Public Information

At the United Nations International School

Jean-Baptiste Bassene

Dr. Lidana Jalilvand

Abraham Muslin

Dr. Radha Rajan

Teaching Assistants: **Daniel Eida**,

Michael Khayyat, **Zoë Richards**

and Natasha Cline-Thomas

UNIS Administration, Staff, and Students

At Chestnut Hill College

S. Cecelia Cavanaugh

S. Mary Jo Larkin

Ursula Lavin

S. Rosemary Scheirer

Kenneth J. Soprano

Don Visser

At the Woodcock Foundation

Steven Liebowitz

At HSBC Securities

Raphael Dumas

At the Smithsonian Cooper-Hewitt National Design Museum

Cynthia Smith

At the Buckminster Fuller Institute

Josh Arnow

Matt Baring

Jochen Hartmann

Angela Molenaar

Elizabeth Thompson

Kallie Weinkle

At Cadient Group

Jim Walker

INTRODUCTION

Design Science/Global Solutions Lab

What you are about to read is the product of many young people from around the world.

This book represents the work of hundreds of young people from five continents and 35 countries. They came together each summer and worked extraordinarily hard on understanding what the most pressing problems facing their world are, and even harder at designing solutions

and strategies for eliminating these problems.

This book was developed over a period of nine years (2005–2013). It would not exist if not for some extraordinary people at the United Nations who provided their input, guidance and feedback along the way. These people took time out of

Design science is the organized use of imagination and science to develop innovative and viable solutions to critical real-world problems.

their busy schedules and provided not only the guidance but also the inspiration that was needed to complete our tasks. They are listed above in the Acknowledgements.

The youth who participated in the programs that produced this book were part of the *Design Science Lab*. These Labs are ongoing and take place each June. Other *Design Science Labs* take place during the school year. The *Design Science Lab* is a workshop where the tools of design science are used by groups to collaboratively develop creative solutions to global and local problems and strategies for the implementation of those solutions.

These particular Labs are focused on developing solutions and strategies for reaching the UN's Millennium Development Goals¹ and are held each summer between 2005 and 2015. Each year's Lab focuses on a specific topic, such as poverty, food, energy, health care, education or environmental sustainability.

These *Design Science Labs* have taken place in New York at the UN and the UN International School, in Philadelphia at Chestnut Hill College and at the University of North Carolina in Asheville. They are put on by three organizations—BigPictureSmallWorld, Global Education Motivators and Pacem in Terris.²

The goals of the Lab included:

- Develop strategies for meeting the basic human needs of everyone in the world
- Learning about the Millennium Development Goals, their usefulness to the world, and how we can use them to make the world a better place
- Developing viable strategies for achieving one or more Millennium Development Goals
- Develop strategies for meeting the basic human needs of everyone in the world
- Learning design science and how to apply it to global and local problems
- Increasing our understanding of global dynamics, world resources, human trends and needs, and options for humanity's success
- Increasing the public's understanding of these issues through disseminating the strategies as widely as possible
- Serving as an incubator and growing force for developing and disseminating design science techniques for complex problem solving and development of viable solutions to the world's problems
- Learning a methodology for changing the world.

Attending the Labs are groups of college and high school students and professionals ranging in age from 16 to 55 with the average age of 22. Labs run for one very intense week, where participants learn and apply the concepts and tools of design science as they develop their strategies to achieve the Millennium Development Goals (MDGs). The participants are briefed by UN staff from the UNEP, UNDP, UNICEF, WHO and others on the MDGs, their context, history, measurement,

The work of the Design Science Labs are focused on demonstrating how, using present day technology, known resources, and limited financial wherewithal global and local problems can be solved in sustainable and affordable ways. The overall strategies developed by the participants of the Lab, as will be seen in this book, are more than the sum of their parts. Together, they describe a world where the basic human needs of all of humanity are met, the Earth's environmental life support systems are allowed to regenerate, and the world is safe and secure from war and crime.

the progress made so far, and strategies in use for reaching them. An introduction to design science is then provided. Lab participants typically work ten to twelve hours a day on developing their solutions. On the last day of the Lab, participants go to the UN where they conclude the Lab with a presentation of their work to, and feedback from, UN staff, as well as corporate and foundation executives. An overview of this work is what is presented in this book.

The ideas and words describing the strategies are those of the Lab's participants. I (Medard Gabel) edited for consistency and filled in a few spots here and there where appropriate. Each chapter is different and reflects the team or individual that developed it, as well as the nature of the problem or issue being addressed.

Designs for changing the world—Design Science

Design Science is a methodology for changing the world. It involves the application of the principles and latest findings of science to the creative design and implementation of solutions to the problems of society. It is a way of recognizing, defining, and solving complex problems that is based on innovation and thrives on transparency. It takes a whole systems, global, anticipatory and regenerative approach that fosters creative collaboration and synergy in the development of comprehensive solutions to both global and local problems.

Unlike many planning and political processes that compartmentalize issues and seek to develop solutions in a vacuum, Design Science stresses comprehensive thinking based on a clear understanding of the state of the world, available resources, appropriate technology, culture, environmental constraints, and the interconnections between world problems and opportunities. The Design Science planning process provides a framework for devising solutions to current problems as well as anticipating future needs.

Design Science is also different from other problem solving and planning methodologies in its comprehensive, anticipatory, inclusive, and transparent approaches to the development of solutions. It takes a 'whole to particular' approach that is both global in perspective and in its examination of options. It seeks to build capacity rather than merely solve problems, and to develop solutions that are transformative rather than merely the reforming of already inadequate systems. It is informed

“If a problem can’t be solved as it is, enlarge it.”

—Dwight Eisenhower

by a moral vision that places a priority on designing ways of meeting unmet basic human needs in ways that are environmentally sustainable and socially just.

The core of this approach to problem solving and planning is both a concern with whole systems—the whole Earth, the entire history of the planet, the global economy, all of technology, and all of humanity, both those living now and those yet to be born—as well as a recognition that everything is implemented locally, and that the “whole” is merely the context for the local. Design science has both a global perspective and a local focus. It recognizes that it is the local upon which the success or failure of a particular design solution will thrive or die.

Design Science is *comprehensive*, in that it starts from the whole system and works back to the special case. It deals with all facets of a problem including the larger system of which the problem is a part; in this sense, design science seeks to build capacity, not just solve problems. It is *anticipatory*, in that it seeks to recognize the threats coming down the pike before they arrive full blown on an unsuspecting or ill-prepared society; and it deals with the way things are going to be when the solution is going to be implemented, not just the way things are in the present. It is a *design* strategy, in contradistinction to a political or ‘let’s pass-a-law-and-change-human-behavior’ approach; it seeks to change the larger system of which the specific problem is a part through the introduction of innovative artifacts or policies.

This “comprehensive anticipatory design science” is at least as much a perspective on the problems of the world as it is a methodology for tackling those problems. When applied to contemporary problems, it can lead to strikingly fresh insights and solutions.

Design science is a tool that is based on a global perspective and a systems approach to the problems of the world. It assumes that globalization has made the world an ever more interconnected whole, and any successful problem solving of society’s systemic ills needs to be an approach that is global, comprehensive, visionary, and based on science, not politics, ideology, or wishful thinking. The entire world is now the relevant unit of analysis, not the city, state, or nation. We are

We need to focus on creating wealth, not just reducing poverty. Development, not growth is our goal; we need to transform society, not just enlarge it.

onboard, as Buckminster Fuller pointed out, “Spaceship Earth,” and the illogic of 200+ nation state admirals all trying to steer the spaceship in different directions is made clear through this metaphor—as well in Fuller’s more caustic assessment of nation states tending to act as “blood clots” in the world’s global metabolism.

The design science process is augmented by vast quantities of statistical information about the state of the world, its resources, human trends, needs, and technology. With the advent of personal computers and the Internet this information became almost universally available—and with it, design science found its perfect complement. Coupled with the tools of the information age, design science gains the power to reach its potential. The Internet has not leveled the global playing field so much as expanded it, and the good-ol’-boy-status-quo-maintaining political process can now be subverted by a process that brings Thomas Jefferson into the twenty-first century.

In Fuller’s words, design science is a process where individuals or teams of people can “make the world work, for 100% of humanity, in the shortest possible time, through spontaneous cooperation, without ecological offense or the disadvantage of anyone.”

Making the world work for 100% of humanity reflects Fuller’s global perspective as well as his values. We are not here just to make ourselves rich, famous, or top consumer of the day or decade, or here just for the 5% living in our part of the world; we are here for all humanity. The “spontaneous cooperation” is instructive in light of the previous discussion. The phrase does not read, “make the world work for 100% of humanity through a central government, or through enforced coercion by a strong military” but through cooperation that arises from a fundamental transparency of society and its needs. If everyone knows what the situation is, has a clear vision of what should be and what needs to be done, we cooperate to get it done—as we do as a society in times of emergency.

Fuller said: *“I am enthusiastic over humanity’s extraordinary and sometimes very timely ingenuities. If you are in a shipwreck and all the boats are gone, a piano top buoyant enough to keep you afloat that comes along makes a fortuitous life preserver. But this is not to say that the best way to design a life preserver is in the form of a piano top.*

I think that we are clinging to a great many piano tops in accepting yesterday's fortuitous contrivings as constituting the only means for solving a given problem."

Design science is a method for developing the life preserving and enhancing solutions to society's problems.

The *Design Science/Global Solutions Lab* uses the principles and methodology of design science and applies them to developing comprehensive strategies for the solution of global problems, primarily under the aegis of the United Nation's Millennium Development Goals. The *Design Science/Local Solutions Lab* takes an identical approach but the focus is on solutions that are to be locally implemented.

In summary, design science is a problem solving and strategic design and planning process based on the following "big picture" assumptions and design protocols:³

- *Whole world*—The whole world is now the relevant unit of problem solving; problems need to be seen from a global perspective.
- *Long-term*—The long term is the framework in which we must operate; given this perspective, prevention, rather than treatment or cure, is the logical and most economical option.
- *Think Comprehensively*—Framing problems in their widest possible context helps see upstream interconnections and causative factors that can impact downstream problems and options.
- *Everybody wins*—Solutions with winners and losers are not sustainable.
- *Transparency* is key; solutions that don't make their assumptions and true costs and impacts visible to everyone are not sustainable.
- *Capacity, not problems*, is the focus; we need to see "problems" not as something that needs to be "solved," but as a symptom of something larger—the need to enlarge the capacity of a system; we need to focus on creating wealth, not just reducing poverty.
- *Needs as markets*—the world's needs are real or potential markets;

"A map of the world which doesn't include Utopia isn't even worth glancing at."

—Oscar Wilde

"You can no longer save your family, tribe or nation. You can only save the whole world."

—Margaret Mead

problems are unmet needs that can often be met through creative products matched to the real needs of real people; poverty is a mandate for design and entrepreneurial innovation and creativity, not just government intervention and paternalistic imposition of top down “solutions.”

- *Design replaces politics*; design sees what is needed, not what is just expedient or politically easy, and figures out how to make it happen; design starts with a vision of what is needed, not what is popular; it seeks to find or design an artifact that solves a problem or builds the capacity of a system in such a way that the source of the problem is eliminated.
- *More with less* is the design ethic; getting ever-higher performance out of every gram of material and erg of energy invested in every function performed by our human-made life-support is critical to making the world’s limited resources meet the needs of our growing population and to reducing our impact on our environment.
- *Biology replaces mechanics*; viewing the world as a living system fosters a respect for a problem’s complexity, an awareness of the context or environment in which it is embedded, and the possible solutions that can result in strengthening the health of the system and the elimination of the problem.
- *Development, not growth* is our goal; we need to transform society, not just enlarge it.
- *Respect Gestation Rates*—everything has its own gestation rate, and working with these is essential, whether it is the growth and development of a technological option or societal change.
- *Scalability* is essential; if a solution to a problem, or a product or service for a market cannot be scaled up from the prototype stage to wide spread adoption and use, it is still born.
- *Look for the trim-tab*—Small and strategically placed interventions can cause large-scale and profound change; find the design leverage points where a small amount of change can bring about large impacts.
- *Preferred state planning*—what we want and where we want to be in ten years is more important than what the problem is right now; the vision of the ideal is more important and powerful than reacting to what is thought possible given current limitations; perspective adds opportunity, vision drives action; resources follow vision. The design science process begins with a vision

“The fundamental difference between creating and problem solving is simple. In problem solving we seek to make something we do not like go away. In creating, we seek to make what we truly care about exist.”

—Peter Senge

statement of where we *want* the world to be. This vision of the preferred future is based on and informed by an ethical view of what should be, and then transformed through comprehensive design into an economically compelling solution.

Global Preferred State

Strategies for achieving the Millennium Development Goals and Preferred State

As listed in the above assumptions and protocols, the Design Science problem solving process begins with a vision of how the world should be. This vision is usually specific to the general issue or problem being addressed, such as poverty, food and hunger, energy supply, education and the like. It is often helpful though to begin the design process with a broader preferred state for the whole world that encompasses the well being of all the world's life support systems. The following is such a global preferred state:

All of humanity—every child, woman, and man in every country in the world—has, on a sustainable basis,

- Abundant supplies of nutritious and culturally appropriate food.
- Adequate housing complete with sanitation facilities and clean running water.
- Abundant supplies of energy that are clean, safe, and affordable.
- Access to local comprehensive health care and the latest advances of medical science.
- Access to education, so that literacy is universal, as are opportunities for advanced (college level) education; access to the Internet is universal.
- Access to communication and transportation facilities that are readily available and affordable, so that anyone can communicate

with anyone else on Earth who wants to be communicated with, and people can travel anywhere they want to go.

- Access to employment opportunities and fulfilling work—including vocational alternatives, re-training, and on-the-job-training—are available to all.
- Access to open borders, free of trade and emigration restrictions, subsidies, and other barriers to market-driven economies.
- Access to information so that all public negotiations (for example, labor contracts, legislation, and government contracts), accounting practices, and elections are transparent and open to inspection by anyone at anytime.
- Access to decision making, so that all citizens have a significant role in decision-making processes that affect their lives, and each lives in a peaceful, democratic, secure and safe world that is free from crime, terror, and nuclear, chemical, and biological weapons.
- Access to a clean, healthy environment that is free of toxic wastes, pollution of all kinds, soil erosion, and damaging industrial and agricultural practices.
- The biosphere and its resources are self-regenerating, with humans cooperating to ensure this.
- Biodiversity is increasing throughout the world.
- Around the globe, strong social incentives foster democracy personal initiative, trust, cooperation, respect, and love—and discourage all forms of torture, degrading treatment, and punishment.
- Access to an independent and impartial tribunal to which each person is entitled, on an equal basis; each person has the right to nationality and to perform public service in one's own country.
- Access to rest and leisure.
- Access to special protection, care, and assistance for mothers and children.
- Freedoms of speech, of the press, and of religion are the rule everywhere.
- All forms of prejudice—against another's ethnicity, race, religion, origins, gender, age, sexual preference, or income level—are gone.
- Every culture and nation respects and celebrates the unique value of all others, and provides strong social supports for individuals,

families, and communities.

- The arts in all forms are widely appreciated and cultivated.
- Spiritual growth and fulfillment is the norm for all humans.⁴

OVERVIEW AND PROBLEM STATE

Context/World Systems

In a very real sense the state of the world today is the preceding Preferred State with a negative qualifier attached. That is, all of humanity does *not* have “abundant supplies of nutritious and culturally appropriate food and clean water”; they do not “live in more than adequate housing complete with sanitation facilities and clean running water,” etc.

In addition, and more specifically, the world today is characterized by⁵:

- 1 billion people are not adequately nourished or face the specter of hunger
- 884 million do not have access to clean water
- 1.6 billion people are without access to adequate sanitation
- 2 billion people are inadequately housed; 600 million live in urban slums
- 100 million people are homeless
- 800 million to 2.5 billion people have no access to essential health services
- 10 million children under 5 die from easily preventable causes each year
- 42 million people who die from curable infectious and parasitic diseases each year
- 40 million people are infected with the AIDS virus
- 300 million people seek treatment for malaria each year
- 2 billion people are infected with tuberculosis
- 900 million adults are illiterate
- 100 million children are not in primary school
- 1 billion people are without access to electricity
- 3 billion people are without access to adequate supplies of energy
- 1.2 billion people live on \$1.00 per day or less
- 2.8 billion people live on less than \$2.00 per day

- 40 million children are laborers
- 50 million people are refugees or displaced
- 7 million tons of carbon are added to atmosphere each year
- 2.5 billion tons of topsoil are eroded from world croplands per year
- 6 million acres of desert land are formed annually by mismanagement
- 15 million acres of forest are destroyed each year

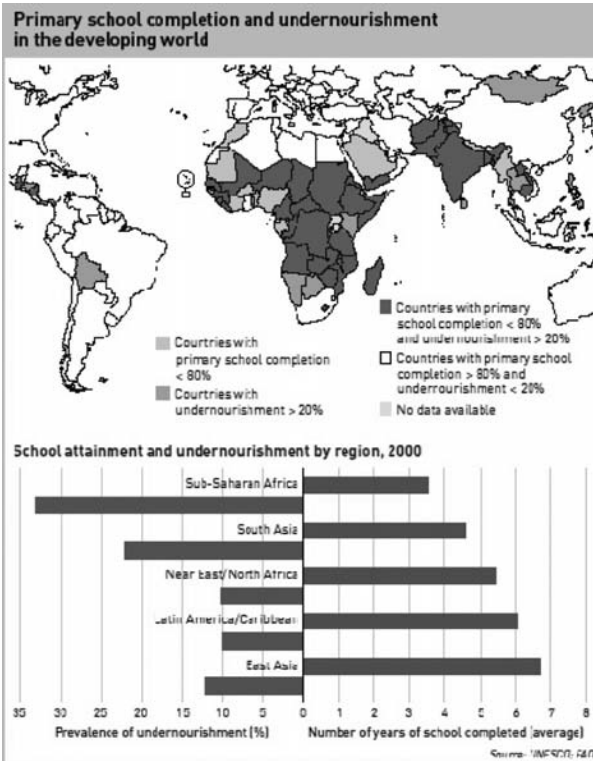
PART I

**FOOD &
WATER
FOR ALL**

Context/State of the World Food System

The work done by the Design Science Lab is embedded in a context of the global conditions surrounding the world's population and the global food system that supplies that population with its food. The following basic facts lay out this context:

- World population in 2010: *6.8 billion*.
- Over 50% of the world's total population—over 3.5 billion people—are living in urban areas.
- Number of well nourished people in the world: *5.8 billion people*.
- Number of hungry or malnourished people in 2010: *1 billion*.
- Hunger and malnutrition are killing nearly six million children each year—a figure that roughly equals the entire pre-school population of a large country such as Japan.⁴ Many of these children die from a handful of treatable infectious diseases including diarrhea, pneumonia, malaria and measles. They would survive if their bodies and immune systems had not been weakened by hunger and malnutrition.
- People living in rural areas constitute nearly 80% of the 1 billion hungry people in the world, and over 50% of these are small, subsistence farmers.⁵

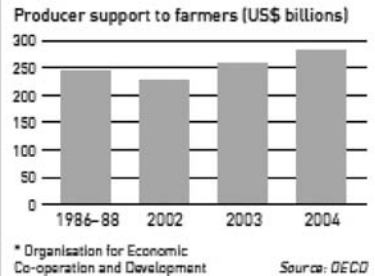


- Percent of hungry or malnourished people in 2010: *14.7%*.
- Percent of hungry or malnourished people in 1970: *24%*.
- 2.7 billion people were *added* to the world's population in this same 35-year period. This reduction, and the continuing yearly removal of 5 to 8 million additional people from the rolls of the malnourished,⁶ is one of humanity's greater accomplishments.
- At the rate we are "improving" it will take 100 to 163 years to eradicate hunger from the world.

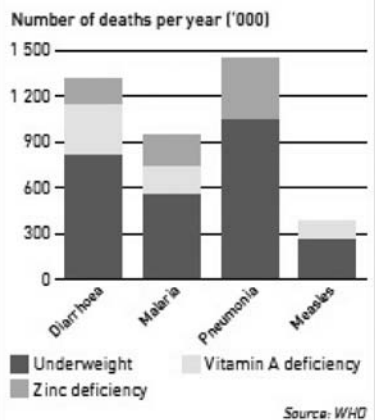
- Water resources play a critical role in the global food system. Not only is water essential for human survival, it is needed for producing crops. Irrigated farmland, which accounts for less than 20% of global food production land, produces 40% of all food.⁷ Irrigation increases yields of most crops by 100 to 400%.⁸
- There are close to 1 billion people in the world without access to clean water and 1.6 billion without access to sanitation.⁹
- Fertilizer plays a key role in global food production. Without adequate fertilizer, total food production would not be enough to feed the world.
- Lack of education and undernourishment are linked.
- The global economic system and social/political arrangements play at least as big a role in the global distribution of food and hunger as does the weather. Subsidies given to wealthy country's farmers to encourage their production has serious and deleterious impacts on the farmers in the poorer parts of the world.
- Low-income food producers' lack of access to credit keeps these populations from moving up the economic ladder.
- Having a clear vision of how things should be is essential for getting there. Having specific and measurable goals for the global food system is critical for making those goals real.

All charts on these two pages and the next are from *The State of Food Insecurity in the World, Food and Agriculture Organization of the UN annual hunger report, November 2005*.

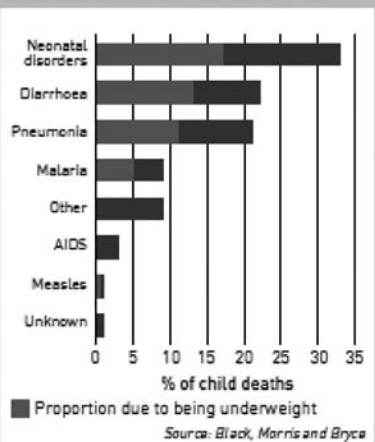
Farm subsidies in OECD* countries, 1986–2004



Child deaths from infectious diseases attributed to hunger and malnutrition



Global child deaths by cause



The Millennium Development Goals and links to reducing hunger

MDGs	Selected targets	Links to reducing hunger
1 Eradicate extreme poverty and hunger	<ul style="list-style-type: none"> • Halve, between 1990 and 2015, the proportion of people whose income is less than US\$1 a day • Halve, between 1990 and 2015, the proportion of people who suffer from hunger 	<ul style="list-style-type: none"> • Hunger perpetuates poverty by reducing productivity • Poverty prevents people from producing or acquiring the food they need
2 Achieve universal primary education	<ul style="list-style-type: none"> • Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling 	<ul style="list-style-type: none"> • Hunger reduces school attendance and impairs learning capacity • Lack of education reduces earning capacity and increases the risk of hunger
3 Promote gender equality and empower women	<ul style="list-style-type: none"> • Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015 	<ul style="list-style-type: none"> • Hunger reduces school attendance more for girls than for boys • Gender inequality perpetuates the cycle in which undernourished women give birth to low-birth weight children
4 Reduce child mortality	<ul style="list-style-type: none"> • Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate 	<ul style="list-style-type: none"> • More than half of all child deaths are caused directly or indirectly by hunger and malnutrition
5 Improve maternal health	<ul style="list-style-type: none"> • Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio 	<ul style="list-style-type: none"> • Undernourishment and micronutrient deficiencies greatly increase the risk of maternal death
6 Combat HIV/AIDS, malaria and other diseases	<ul style="list-style-type: none"> • Have halted, by 2015, and begun to reverse the spread of HIV/AIDS • Have halted, by 2015, and begun to reverse the incidence of malaria and other major diseases 	<ul style="list-style-type: none"> • Hunger spurs risky behaviour that accelerates the spread of HIV/AIDS • Undernourished children are more than twice as likely to die of malaria
7 Ensure environmental sustainability	<ul style="list-style-type: none"> • Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources • Halve the proportion of people without sustainable access to safe drinking water and basic sanitation 	<ul style="list-style-type: none"> • Hunger leads to unsustainable use of resources • Restoring and improving ecosystem functions are key to reducing hunger among the rural poor
8 Develop a global partnership for development	<ul style="list-style-type: none"> • Develop further an open, rule-based, predictable, non-discriminatory trading and financial system • Address the special needs of the least developed countries • Deal comprehensively with the debt problems of developing countries 	<ul style="list-style-type: none"> • Subsidies and tariffs in developed countries hamper hunger-reducing rural and agricultural development

Global Food System Preferred State

If the Millennium Development Goal #1 were reached in 2015 there would be over 400 million people in the world that were *still* undernourished.

The Design Science Lab's *Preferred State 2025* was developed from the values of the participants of the Lab, which dictated that 400 million+ people being hungry in 2015 (although a great improvement over 1 billion being hungry in 2010) was not morally justifiable, economically desirable, or politically tenable. It was also a recognition that the global processes set in place in order to meet the MDG by 2015 would not just disappear in 2015 but would continue into the future and, if nurtured and expanded for an additional ten years, would result in the total elimination of hunger from the world.

This vision of how we wanted the world food situation to be in twenty years informed all the work of the Lab. It was not a prediction of what we thought the world would look like. Rather, it was a preference for what we wanted it to be. It was a statement of values as well as a definition of success and what a healthy global food system should look like.

The following are the major components of the Lab's preferred state vision:

By 2025:

- 100% of humanity is well nourished with safe, abundant, affordable food supplies.
- The production of food is done in environmentally regenerative ways.
- There is an ever increasing diversity of food choices and biological resources.
- There is an ever increasing resource efficient food system that is knowledge, rather than energy intensive.
- There is ever increasing local self-reliance in the production of food and a corresponding global interdependence of our local food system and supplies.
- National and local food systems are subsidy free, open market, and fair trade based.
- There are emergency backup systems and anticipatory crisis management systems in place.
- Local and global food systems are adaptable, flexible, and transparent.
- Local and global food systems are conflict free; food is never used as a weapon or bargaining chip.
- The global commons are managed for global well being, not national, local, or individual gain.

The strategies that follow this section were designed to achieve the MDG #1 by 2015 and the above preferred state by 2025.

STRATEGIES: **for achieving the UN Millennium Development** **Goal #1 by 2015:**

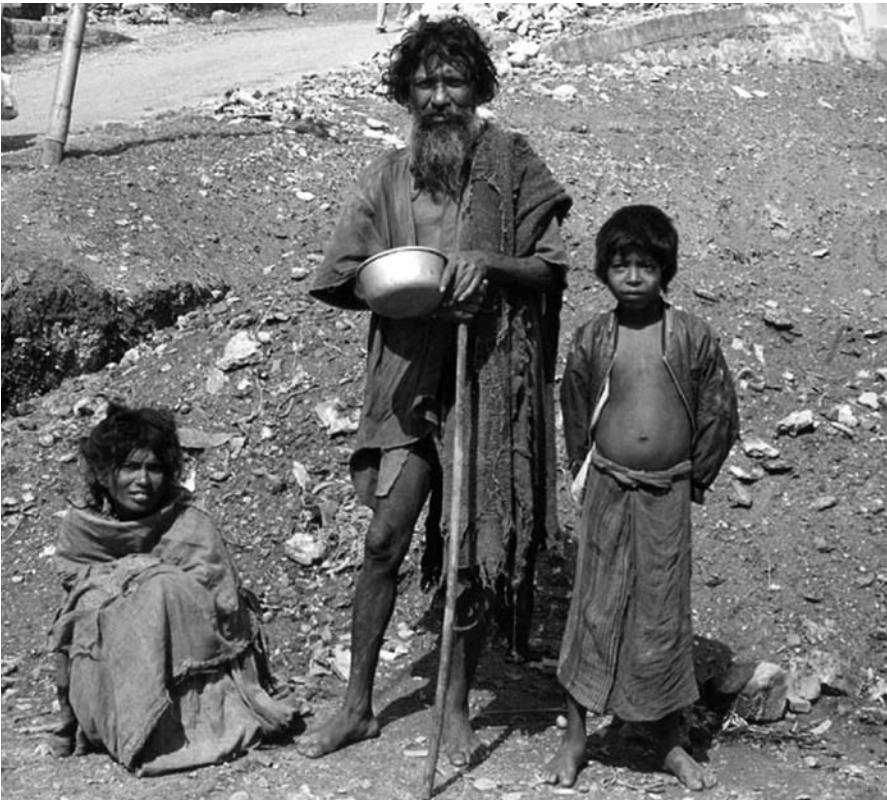
Eradicate Extreme Poverty And Hunger

- Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day.
- Halve, between 1990 and 2015, the proportion of people who suffer from hunger.

for achieving the Design Science Lab Preferred **State by 2025:**

Eradicate Hunger

- Reduce to zero, between 2005 and 2025, the number of people who suffer from hunger.





STRATEGIC AREA I: INCREASING FOOD PRODUCTION / DECREASING LOSS

- 1. The Giving Tree**
- 2. Trash to Treasure**
- 3. Sky Farms: Urban Food Production**
- 4. Seven Generations: Regenerative Agriculture/
Integrated Cropping Systems**
- 5. Post Harvest Loss: Cool Pot and Grain Gain**
- 6. Moringa in Motion**
- 7. Sustainable Urban Agriculture**
- 8. E.A.T.: Educating Aquaponic Technology**

1. THE GIVING TREE

By Cara Collier, Leah Lowthorp, Chuck Michelson

Strategic Summary: Increase food production, income, and employment in food short areas of the world by increasing fertilizer use through fast growing, nitrogen fixing trees. Simultaneously reduce atmospheric carbon thereby helping reduce global climate change. Finance through carbon abatement credits.

Introduction

People living in rural areas constitute nearly 80% of the 1 billion hungry people in the world, and over 50% of these are small, subsistence farmers.¹⁰ Limiting factors for food access and production for these people include deforestation, centralized monoculture, poor soil quality, and restrictive factors for cultivation (i.e. fertilizer costs). *The Giving Tree Program* proposes a creative strategy in agroforestry centered on an amazing tree that gives and keeps on giving.

Leucaena: The Tree that Keeps on Giving

The leucaena tree (*leucaena leucocephala*) represents an enormous opportunity for doing more with less, and an amazing resource for reducing world hunger. It is highly adaptive, able to grow in both tropical and arid climates, and is highly drought-resistant. It is one of the fastest growing trees on the planet (10–12 ft/yr),¹¹ and is thus able to be harvested annually for its wood. It is a prodigious nitrogen fixer—more than 100 to 200 kg of nitrogen (or 500-1000 kg ammonium sulfate) per hectare is fixed annually¹²—delivering desperately needed nutrients directly into the soil without the need for costly and environmentally degrading chemical fertilizers. Its rapidly decomposing leaves are also a great source of green manure and cattle fodder.

The fertilizer response curve, which dictates that upwards of 50% more agricultural output is created when non-fertilized land becomes minimally fertilized, shows that natural fertilization through the leucaena tree would have an enormous impact in regions where fertilizer is currently un- or under-used. In addition, leucaena provides a renewable way to feed livestock. Its leaves have the



L. Leucaena (pronounced loo-say-na)
grows 10 to 12 feet per year.

nutritive value of alfalfa and are a great protein source for cattle. It can feed humans as well, through harvesting of its beans, shoots, and seeds, which can be made into tempeh. It is a soil stabilizer and erosion controller, preventing vital nutrients in the soil from being washed away. It is an incredible source of raw materials, and can be used to make anything from paper, roofing felt and hardboard, to particleboard and rope. It is thus both a food and cash crop, sales of which can provide entry into local and global markets, as well as a sustainable source for organic fertilizer. It can also be used in symbiotic relationships with crops like cacao and coffee thereby providing additional crops for the economic development of the small farmer. And finally, critical to our funding strategy, due to its fast growth it sequesters carbon from the atmosphere at an unusually high rate, storing 50 lbs of carbon per year (forty trees will remove a ton of carbon from the atmosphere).



Leaves and seeds can be animal and human food and fodder.

Strategy

The Giving Tree Program will be part of a non-profit organization¹³ that cooperates with small farmers in developing countries to grow leucaena trees on their own land. The organization will claim carbon emission credits based on carbon sequestration through new tree growth. It will then sell the credits to heavy-polluting first-world corporations who are required to limit emissions as a result of the Kyoto Protocol.

The organization will primarily do three things:

- Employ local business people to work directly with farmers
- Provide training seminars for these business people
- Provide seeds

An initial grant from an appropriate foundation or government agency is needed to fund the Giving Tree demonstration program on 1,000 farms throughout developing countries. Additional plantings

Leucaena can grow under conditions of extreme drought.



will be made possible from revenues received through sales of carbon emission credits.

Based on current projections, the startup costs total \$3,865,000, which includes \$3,000,000 for an emission credit license, costs for seeds, staff, and land rental. The total cost of planting seeds is \$100 per farm. The same farm will generate \$300 per year in carbon emission credits based on current carbon market prices. The Giving Tree Program will have substantial profits with which to fund further tree plantings.

This model has been tested. We are aware of one example in which the Japanese government funded a similar operation to plant leucaena trees in Columbia, with positive results.

Finally, two factors make this an ideal time in history for such a venture. Rising oil prices make oil-based fertilizers increasingly prohibitive. The passing of the Kyoto Protocol means the market price of carbon emission credits is likely to rise. Kyoto Protocol Article 2.1 advocates protecting and enhancing sinks and reservoirs of greenhouse gases *while* promoting sustainable forms of agriculture. The Giving Tree strategy does both.

Conclusion

The Giving Tree strategy is an economically feasible way to directly target the Millennium Development Goal. It represents a locally and globally appealing case and comes with fringe benefits. Playing an integral part in creating a preferable global food system for the future, this venture emerges during an ideal time in history with a window of opportunity.



Leucaena is an excellent source of firewood and lumber.



Leucaena leaves, which are 5% nitrogen, make an excellent animal fodder.

The Giving Tree Strategy Financial Summary

Total Investment: \$3,865,000

- **Startup:** \$3,265,000
 - **Seeds:** \$15 per farm x 1,000 farms = \$15,000
 - **Rental Capital:** \$50 per farm x 1,000 farms = \$50,000
 - **Training Program:** \$200,000
 - **Emission Credit License:** \$3,000,000
- **Running:** \$600,000 per year
 - **Salaries:** \$500,000
 - **Training:** \$100,000 per year

Needed Resources:

- **Materials:** Seeds, educational supplies, office, and supplies
- **Labor:** Administrators, traveling educators, thousands of local reps/investors.

Output:

- **Measurable Positive Results:** \$300 per farm in carbon emission credits, minus \$100 in total investment per farm = \$200 profit per farm. 1,000 farms provide \$200,000 profit per year. This will offset the cost of operating expenses after the first year. “Free” source of fertilizer, business opportunities, entry into local and global markets.

2. TRASH TO TREASURE

By Bamini Balaji, Natasha Cline-Thomas, Abbe Horswill, Zoë Richards

Strategic Summary: Reduce urban organic waste and landfill mass; increase food production; reduce synthetic fertilizer use and costs by increasing organic fertilizer made by composting urban biodegradable waste; and increase job opportunities.

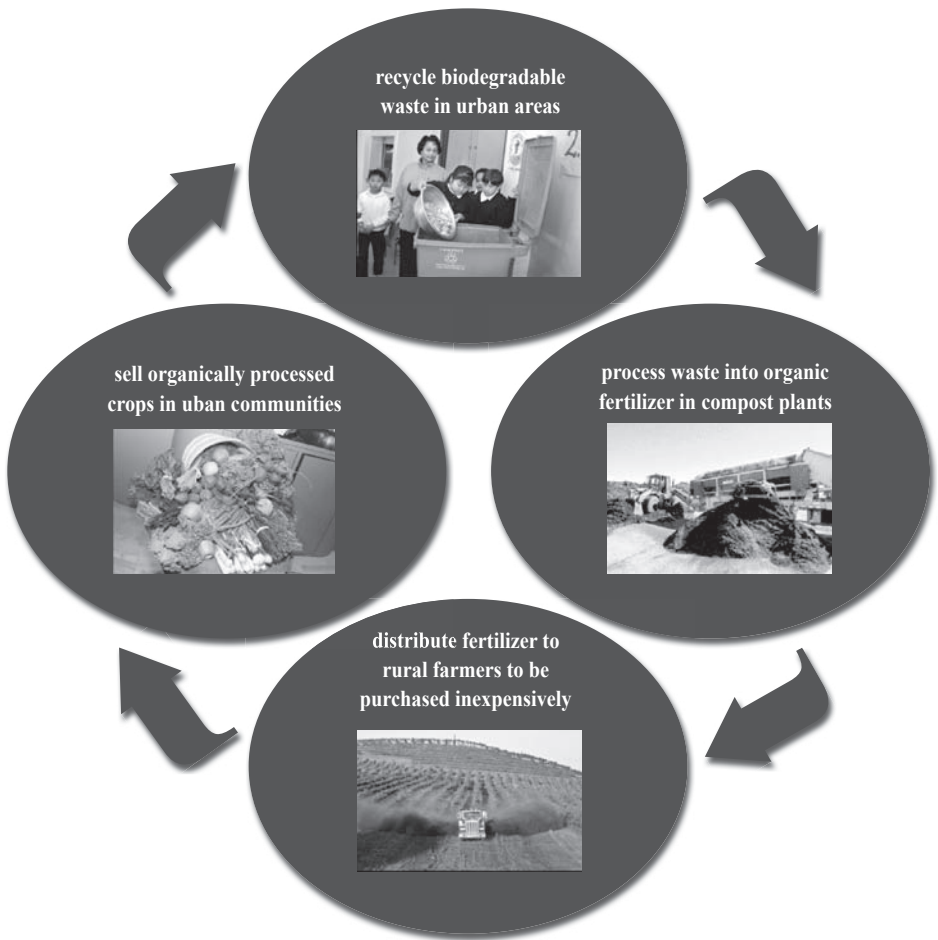
Introduction

Close to 530 million metric tons of organic wastes are generated each year in urban environments.¹⁴ Given that total fertilizer consumption around the world is about 140 million metric tons,¹⁵ urban organic waste could make a significant difference in increasing the amount of fertilizer available in the world.

Strategy

The *Trash to Treasure* strategy involves the collection of urban organic waste and the subsequent composting of this waste into valuable organic fertilizer. These materials are an excellent soil additive that adds nitrogen and other soil nutrients. This strategy calls for the compost to be sold to regional farms at less than half the cost of synthetic nitrogen fertilizer. The results will include increased food production, healthier soils, and less urban waste destined for rapidly filling landfills. Another impact of this program will be an increase in the number of jobs.

Various forms of this strategy are in place in different parts of the world. For example, in San Francisco, Sunset Scavenger Company,¹⁶ has a successful program underway where urban organic waste is collected, composted, and sold to local farmers. In Japan, Toyonaka City Osaka Prefecture has set up a *Waste-to-Food Composting Program* that supplies fresh vegetables for school cafeterias. This waste-to-food composting program has been underway in since 2004. Local farmers, the municipal government, and a non-profit organization all work together. Under the program, food waste from school lunches are composted together with branches pruned from trees in parks and along streets. The resulting compost is used as fertilizer to grow vegetables, which then become ingredients for school meals.¹⁷ A related program takes place in Sendai City in northern Japan. Here, people can exchange organic waste for fresh vegetables at morning markets. Under this system, when a consumer brings organic waste that has been dried



and compressed by organic waste compactors to one of five vegetable markets in the city, each kilogram will be exchanged for 100 yen (about US 91 cents) worth of fresh vegetables. The material collected at the markets is then used by farmers for growing more vegetables.¹⁸

The chart above illustrates the process:

- First, organic wastes are collected by schools, restaurants, other institutions, as well as homes. For optimal success, a local government or private sector actor would establish a network of public deposit sites using color-coded dumpster bins.
- Second, biodegradable deposits at these sites would be collected and transported to the central composting center.

Costs to Implement Trash to Treasure

In the Developed World

Expenses	
Ag-Bag Composting Machinery	\$500,000
Regional Collection Bins	\$50,000
8 Collection/Delivery Trucks	\$480,000
Labor for 10 people (maintenance cost per year)	\$300,000
Total Initial Cost	\$1,330,000
Revenue	
50,000 tons of compost	\$5,000,000
Net Gain First Year	\$2,340,000

In Developing World Urban Environment

Expenses	
Ag-Bag Composting Machinery	\$100,000
Regional Collection Bins	\$50,000
8 Collection/Delivery Trucks	\$48,000
Labor for 10 people (maintenance cost per year)	\$30,000
Total Initial Cost	\$228,000
Revenue	
50,000 tons of compost	\$2,500,000
Net Gain First Year	\$2,272,000

- Third, this waste is processed at compost centers. The biodegradable substance goes through a ninety-day composting process where temperature and oxygen levels are maintained.
- Fourth, the processed compost is sold to farmers who in turn sell food products produced with the aid of the compost back to city dwellers (which results in organic waste that starts the cycle again).

As illustrated in the chart on p. 34, the costs for the implementation of this program in a developed world urban environment would be approximately \$1.3 million, excluding land. The costs in a developing world urban environment would be substantially less.

Conclusion

The expected output from the composting plant (in tons) would be over 50,000 tons per year, generating revenue of over \$5 million in a developed country where the compost could be sold at half the going rate for synthetic fertilizer. In the developing world, the compost product could replace high priced fertilizer imports at less than one-fourth of the cost and still show a net gain. At this level of production and sales, the plant and equipment in either setting would pay for themselves in less than six months of full operation and projected sales. In addition, these figures do not reflect the decreased cost to a city for dumping its waste in a landfill. Assuming a dumping fee of \$20 per ton, a city would save about \$1 million per year in reduced landfill costs.

3. SKY FARMS: URBAN FOOD PRODUCTION

By Daniel Eida, Jai Lakhanpal, Eric Rimpel, Allard Van Hoorn, Adrian Salinas Valdez

Strategic Summary: Sky Farms would rest on top of existing urban structures, producing food and energy, collecting water, and utilizing urban organic waste. This would increase food production, freshness and quality of food, and employment in urban areas by growing crops in enclosed structures on rooftops.

Introduction

Over 50% of the world's total population, over 3.5 billion people, are living in urban areas. Over the next twenty years this percentage will rise to over 60% of the world living in urban environments. Most of these people are right now, and will be in the future, in developing regions of the world. Most of the urban poverty, and hence urban hunger, in the world is also in these developing regions. Un- or under-employment is also high. In addition, many of the recent arrivals to urban areas are former farmers who are escaping the poverty of the countryside brought about by increasing population, mechanization of farms, lack of land and other resources, and low commodity prices due to subsidized imports. These "agricultural specialists" have very valuable knowledge and experience that is, under usual urban conditions, at best severely discounted or, more likely, seen as worthless.

The need for additional supplies of fresh, affordable, high quality food as well as employment of both new urban emigrants and existing under- or unemployed urban residents is high. *Sky Farms* are a creative response to the opportunities of this situation.

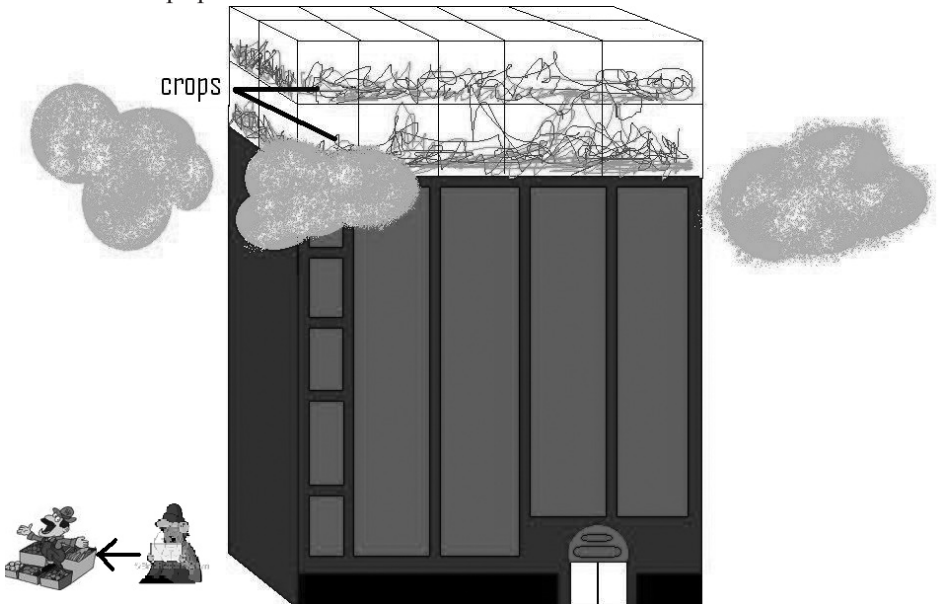
Strategy

Sky Farms is the name of an organization (which could be a non- or for-profit corporation) that would establish farms on city rooftops. The farms would be in lightweight enclosed structures that rest on the top of high-rise urban buildings. The Sky Farm structures are in a flexible variety of models or configurations, including multiple levels. These urban greenhouse farms would be attached to the top of existing buildings and

begin growing food almost immediately. Rainwater will be collected from the structure to provide water for plants. Excess heat trapped by the structure will be pumped to heat or cool (via heat pumps) the building on which it is resting. Sky Farms would help transform buildings and cities into green buildings and green cities, being a valuable part of urban revitalization and economic growth—while supplying year-round sustainable supplies of fresh food to urban residents.

Costs

An average Sky Farm would be approximately 30,000 square feet and would cost \$3.00 per square foot to build and install in a developing region of the world. It is expected that such a structure would be able to eventually supply fresh vegetables for 1,000 people if intensive farming techniques were used. The \$90,000 building startup costs, coupled with maintenance, materials, and salaries would total approximately \$150,000. This would come to \$150 per person fed by the Sky Farm in the first year. Each year the Sky Farm would produce additional food for urban residents thereby lowering this startup cost per fed person to negligible amounts over five years. The annual costs of running the Sky Farm would include salaries for the two to three urban farmers who plant, cultivate, and harvest the crops and maintain the structure, as well as “rent” to the building owners and residents. These costs would be covered by the sale of the food crops produced.



Sky Farms would rest on top of existing urban structures, producing food and energy, collecting water, and utilizing urban organic waste.

Implementation/Startup

Sky Farms would get off the ground in each city through a private sector initiative subsidized by government tax abatements, market guarantees, insurance, and regulation changes, where needed. Prospective buildings would be identified, inspected, and rooftop rights would be secured. These building could include apartment houses, factories and office buildings. A low-cost loan would be made available through the city government or local bank to fund startup costs. As the structure is being built, potential farmers would be identified and trained in urban rooftop food production and the maintenance of the Sky Farm.

Soil for growing the Sky Farm food will come from construction sites outside the city and will be supplemented by urban compost (see Trash to Treasure strategy, p. 32).

Impacts

The impacts of Sky Farms include increased urban food production, fresher and healthier produce, shorter lines of distribution and the savings of fuel for transportation, increased awareness of citizens, corporations and cities of green issues, better-fed urban residents, increased employment and tax revenues, lower cooling and heating costs, and lower sewage costs through rainwater collection and reuse.

4. SEVEN GENERATIONS: REGENERATIVE AGRICULTURE/ INTEGRATED CROPPING SYSTEMS

By Ilya Smirnoff and Eric Fedus

Strategic Summary: Increase food production, employment, and income through a knowledge-intensive agriculture that integrates multiple production techniques into one sustainable system. Simultaneously reduce expensive agriculture inputs such as fertilizer, pesticides, hormones, and antibiotics; improve water quality and availability; and slow or end desertification.

Introduction

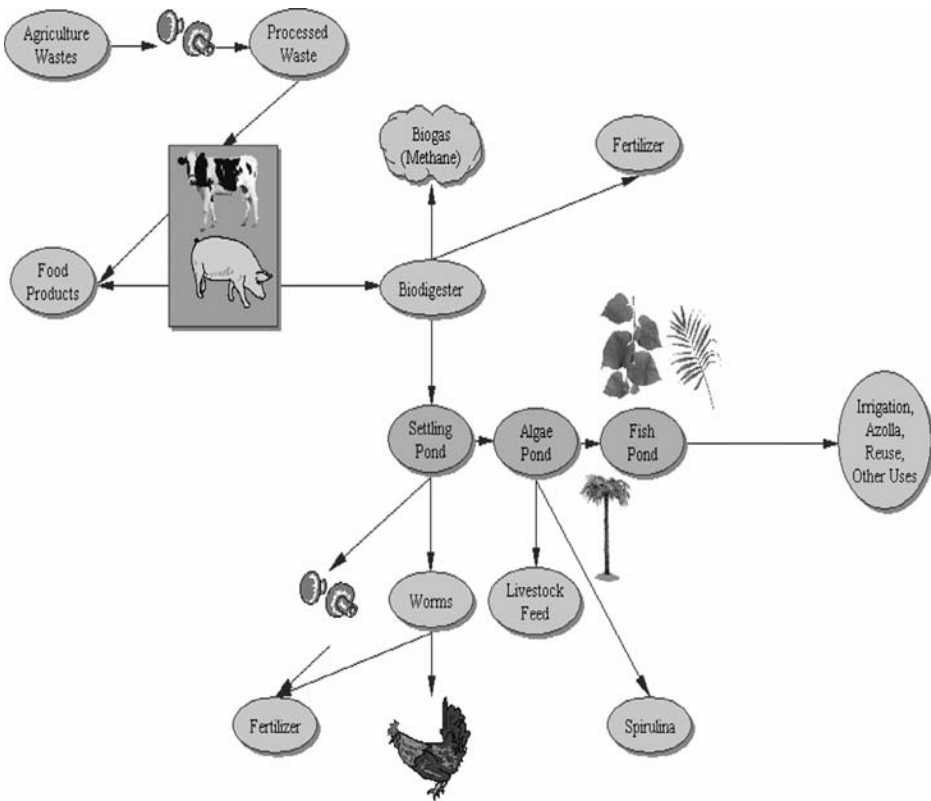
As indicated in *The Giving Tree* chapter, small farmers constitute nearly half of the hungry people in the world today. According to a 2005 report from the UN, there could be as many as 50 million additional refugees fleeing their home regions because of environmental breakdowns. Increasing food production, in environmentally sustainable or regenerative ways, is essential to helping the current situation and helping avert an even more disastrous situation in the future.

Strategy

Modern monoculture is “efficient” in the short term, as long as environmental impacts are ignored. Integrating a number of food production techniques into one food production system that more closely mimics natural systems is more productive¹⁹ in both the short and long term. Growing crops on farmland that is fertilized with the waste products of other biological processes that are part of the food production regime makes both ecological and economic sense. As the illustration on p. 40 points out, waste products from meat and milk production can produce both fertilizer and energy that is used in other parts of the food production system.

Producing fish, animal meat and milk, traditional crops, algae, worms, chickens, and the so-called waste products of all these in an integrated system, where the inputs of one food production system are the outputs of another system, is simultaneously resource efficient, highly productive, economical, and environmentally regenerative. Such integrated food production systems are sustainable over the long term (“seven generations”) under tight resource limitations.

Integrated Farming System



Regenerative agricultural methods include nutrient cycling, diverse production regimes, zero or minimum tillage (farming with little or no plowing), companion planting, diversified farms that raise both crops and livestock, composts, mulches, biological pest control, and soil and nutrient conservation, as well as water-conserving, small-scale drip irrigation, and post-harvest loss reduction. All these add together in ways that increase the health and productivity of agricultural lands and communities, and build economic wealth for the local area and world.

Widespread institution of these methods coupled with the increased availability of fertilizer would help guarantee both local abundance and future productivity.²⁰ In addition to increasing local food production

and self-reliance, such an approach would decrease soil erosion and dependence on foreign imports of food and petrochemical products. Furthermore, using locally available organic fertilizers and regenerative agriculture techniques would enhance crop resistance to drought and pests.²¹

The basic farm tools required to tap into local nitrogen fertilizer sources, expand irrigation, bring crops to market, and reduce the loss of crops due to insects and rodents can be manufactured domestically by any developing country, adding to its industrial production and providing employment.²² In addition, the incomes of farmers would rise with their higher productivity, even as their newly enriched croplands become more resistant to soil erosion and salinization.

Global Extension Service for Regenerative Agricultural Systems

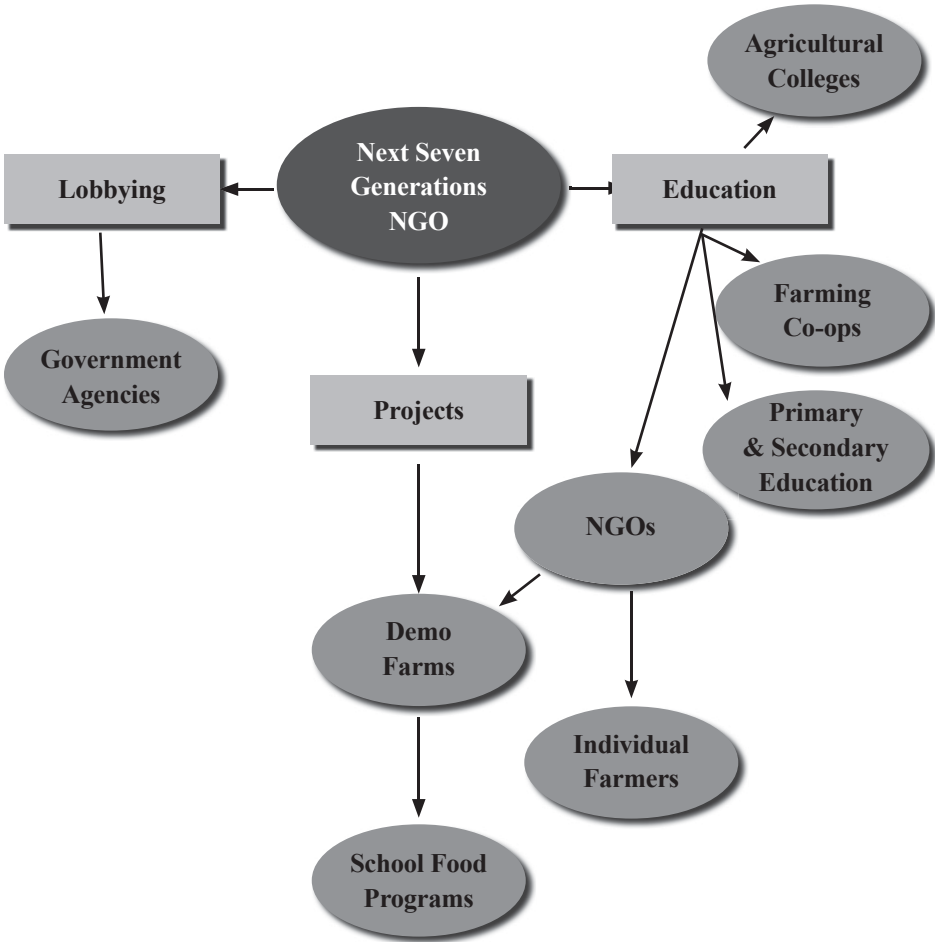
To scale this food production system to the level where it has a significant impact on the food-short areas of the world will take a serious, persistent, locally implemented and globally facilitated development effort. It will involve an aggressive program for teaching and demonstrating regenerative farming methods to traditional small-scale farmers, coupled with financial incentives and economic safety nets that strongly encourage the switch-over. A global extension service for regenerative agricultural systems would be instituted to make the transition as smooth, risk-free, and fast as possible. Modeled after the highly successful US Agriculture Extension Service, it would assume responsibility for teaching regenerative farming techniques to food-short areas of the world—demonstrating fertilizer, irrigation, animal and cropping systems that build up the ecological underpinnings of our food supplies.

Key functions of this service would include providing on-farm extension workers on an order of magnitude greater than the world presently has, along with demonstration farms, education materials, transportation vehicles, communication equipment, tools and support facilities, and the financial incentives to encourage farmers to learn the new agriculture methods.²³

New Wave Agriculture

“The Peacemaker taught us about the Seven Generations. He said, when you sit in council for the welfare of the people, you must not think of yourself or of your family, not even of your generation. He said make your decisions on behalf of the seven generations coming, so that they may enjoy what you have today.”

—Oren Lyons, (Seneca) Faithkeeper, Onondaga Nation



5. POST HARVEST LOSS: COOL POT AND GRAIN GAIN

By Jeremy Bang and Arthur Steiner

Strategic Summary: Increase food availability by reducing post harvest loss.

Introduction

Addressing hunger throughout the world has taken on many forms, the tail end of which has as much to do with saving what is produced as it does with producing more. Current figures regarding post-harvest losses from all over the world range from 10% to 80% crop losses, depending on what you measure and the area in which the food is produced. The two specific areas where the most loss occurs are highly perishable foods (i.e. fruits and vegetables), and less perishable but highly important grains.

Fruits and vegetables in arid regions can have almost total post-harvest losses. Considering that most of these losses come from subsistence farmers, the effects are directly on the hungry population of the world. Whereas grain losses are mainly the misfortunes of those living below the poverty line, it become clear that curbing post-harvest losses directly impacts the success of the first millennium development goal.

There are many strategies and techniques for reducing post harvest loss. Two of the most effective and affordable are the following:

The ‘pot-in-pot’ storage is a cheap electricity-free cooling system. The other is an efficient storage system for grains designed and distributed by a company called GrainPro.

Pot-in-Pot

The ‘pot-in-pot’ system is just as it sounds: one clay pot with a smaller pot inside of it that has a wet sand barrier in-between the two pots. Perishable food is placed in the inner pot and as the heat of the day evaporates water out of the sand barrier the food inside is kept at up to fourteen degrees cooler than the outside temperature, extending food life dramatically. For example, spinach in parts of Africa rots in one day, in the ‘pot-in-pot’ system, it can last twelve days.

The earthenware-cooling device





Earthenware cooling system to preserve perishable foods in developing countries with arid climates.

costs about \$.50 to produce. The 'pot-in-pot' system also creates local employment opportunities, especially in countries where unemployment rates and agricultural unemployment rates are very high. A factory that could produce these 'pot-in-pot' systems could employ people in local villages with a yearly operating cost estimated at \$14,000, and first-year profits estimated at \$7,000. The initial investment could come from governments, non-profit development organizations, or private enterprise. This strategy is capable of creating employment, increasing the amount of available food, increasing productivity, and still making a profit for the investors. It is an extremely attractive low-level solution to curbing hunger in sub-Saharan Africa and elsewhere.

GrainSafe

The grain storage system has similar results with improving grain storage. This has many implications for the profitability of the crop because it removes a bottleneck to people's food needs, and lessens the need to get rid of rotting crops.

The grain storage system is simple yet effective: it consists of a large bag and a protective cylinder. The flexible white bag is impermeable to water, water vapor, and air. This allows the grain to be stored and protected from one of the major elements that causes grain rot:

moisture. The cylinder is made of polypropylene and further protects the grain from pests and other natural elements. The purchaser of this system would have to construct a platform that can be made from local resources such as wood, mud bricks, or bamboo. For further protection, this storage bin has a spout at the bottom allowing the farmer to dispense the desired amount of grain without exposing all of the stored grain to moisture and air. This storage method is simple enough so that the small-scale farmer would not have to acquire any expensive complex machinery but efficient enough to reduce post harvest losses to 1%.

The cost and expenses of this system are significantly lower compared with the benefits of reducing post-harvest losses, but in some cases financial help of a microfinance program may be necessary for the purchase. ProGrain has distributors in Bangladesh, China, Ethiopia, Ghana, India, Indonesia, Latin America, Turkey, Uganda, and other countries, making these storage bins accessible in many key areas needing improved grain storage.



Above left: assembly; Center: loading grain; Right: the finished GrainSafe. Below left: sealed bag; Right: extracting grain



6. MORINGA IN MOTION

By Brent Jones, Michael Khayyat, Karen Lau, Lexi Quint, Zoe Richards, Alex Rinomato, Pollan Wong

Strategic Summary: The moringa tree is a fast-growing, drought-resistant plant with highly nutritive leaves and the potential to be used in a number of small- and large-scale industrial processes. The stems, seeds, and leaves of the moringa tree can all be processed into useful byproducts and sold on local or world markets. Step one is creating seed banks and demonstration farms in villages where local farmers can come to get moringa seeds, learn about the plant, and deposit extra seeds for others to use. Step two is scaling up these seed banks/demonstration farms to a regional level after a pilot program.

Present State of Wealth and Health in Less Developed Regions

In most less developed regions there is often a general lack of:

- infrastructure/transportation/roads
- communication tools (i.e. Internet connectivity)
- access to capital
- adequate supplies of food/water
- training/resources/education
- accessible and affordable healthcare
- small business opportunities

1.37 billion people live on less than \$1 per day⁷

1 billion people are chronically malnourished and approximately a third of the world's population lack food security

30% of children between the ages of one and five are underweight according to international standards⁸

203 million people are malnourished in sub-Saharan Africa

An analysis of long-term trends shows the distance between the richest and poorest countries was about:

- 3 to 1 in 1820
- 11 to 1 in 1913
- 35 to 1 in 1950
- 44 to 1 in 1973
- 72 to 1 in 1999

Micro loans are allowing some people opportunities to start small businesses and gain an income. However, the existing programs are

not widespread enough to be effective on a scale large enough to eliminate the problem.

Many farmers in less developed regions are forced to grow cash crops like cotton and rubber to supply raw materials to global markets. This can reduce food output and lead to soil erosion.

Preferred State of Wealth and Health in Less Developed Regions

By 2030:

Eradicating poverty in both urban and rural areas by facilitating the creation of local businesses that:

- Are sustainable, ecologically-sound, regenerative
- Have access to capital for further expansion
- Have access to adequate infrastructure
- Have access to training programs
- Are run by and employ locals
- Are as locally sourced in terms of resource use and other inputs as possible
- Are connected/networked with urban areas
- Provide affordable/free healthcare for employees



The above shows the overlap between where moringa is needed (areas with large numbers of malnourished people and struggling local economies) and where moringa grows.

- Create artifacts that help meet the basic needs of the community using surrounding resources
- Are able to connect globally via export/trade
- Create a globally networked world where people have Internet communication access to the outside world, where resources are shared, and motives and operations are transparent

Project Goals

By 2030, the following goals need to be met in order to consider this project a success:

- A large thriving market for the products produced from the moringa tree
- 10,000 moringa seed banks distributed throughout the developing world
- Unemployment rate reduced by 75%

The Moringa Tree

Moringa is a tropical multipurpose tree. It is resistant to drought and is fast growing. It also has a variety of uses from nutritional to industrial and can be marketed in the form of a number of different products, from cosmetics to food supplements.

Moringa Uses and Products

Aside from the ease of growing and cultivating moringa and its nutritive properties, the tree provides a number of other benefits.

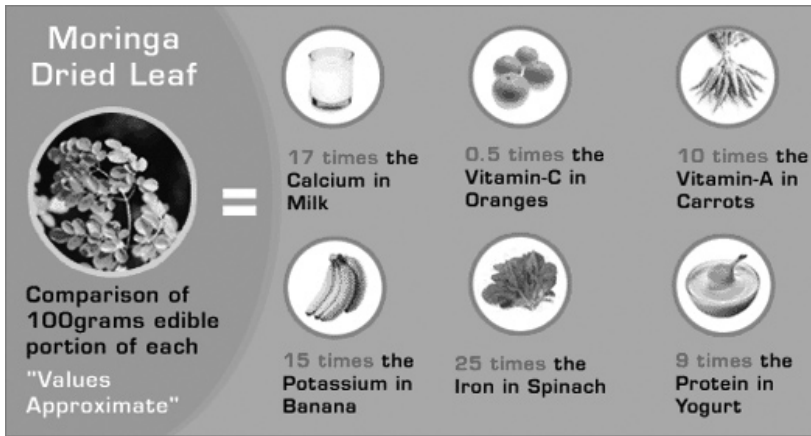
Nutrition

One rounded tablespoon (8 g) of leaf powder will satisfy about 14% of the protein, 40% of the calcium, 23% of the iron and nearly all the vitamin A needs for a child aged one to three. Six rounded spoonfuls of leaf powder will satisfy nearly all of a woman's daily iron and calcium needs during pregnancy and breast-feeding.¹⁰

Moringa leaves can be easily dried (in the shade to reduce loss of vitamins) and rubbed over a wire screen to make a powder, which can be stored and conveniently added to soups, sauces, etc.

Water Purification

One hundred kg of moringa seeds will produce about 1kg of polyelectrolyte, a chemical compound which is used for water filtration;



powder from ground-up seeds and also the presscake left over from the extraction of moringa oil can both be used for the treatment of turbid, dirty water.¹¹

Treatment of water with moringa is by no means a fail-safe measure, but where other methods are not available (or too costly), moringa is a great alternative and certainly better than drinking untreated water.

Antibiotic

A compound found in the flowers and roots of the moringa tree, pterygospermin, has powerful antibiotic and fungicidal effects.

Fresh Food and Drink

The young pods, when cooked, taste like asparagus. They are sold fresh and canned in many Asian markets. Tinned drumsticks are exported from India, Sri Lanka and Kenya to Europe and Asia. They are eaten much like green beans.

After about 8 months, the tree begins to flower and continues to flower year round. The flowers can be eaten or used to make a tea. In Haiti tea from the flowers is considered a powerful cold remedy. The flowers provide good amounts of both calcium and potassium.

Moringa seeds can be extracted and eaten as "peas" (boiled or fried) when still green. The mature seed is about 40% oil. Moringa oil is of excellent quality for cooking. It is used in cooking, perfumes and as a watch lubrication. It is also used for making soap and—when burned in lamps—for light as well. The oil is slow to become rancid.¹²

Strategy

This strategy takes place in three stages, starting with Phase 1 in 2010 proceeding through Phase 3 in 2015.

Phase 1

The first phase of the Moringa in Motion strategy will function as a pilot program to determine what works, what needs adjustment, and what aspects of the project may not work in a given location. A target village will be identified for the pilot program and provided with:

- Moringa seeds
- Fertilizers
- Basic training in moringa cultivation as part of an Agricultural Resource Center (ARC), which will also provide basic information about a number of other local staple crops, water management and conservation training, and communications infrastructure (i.e., phone line, Internet connection—if needed)
- Creation of a growers cooperative network linking farmers from the village and region to markets and to each other to share knowledge

This phase will also be the first attempt at growing, marketing, and selling moringa products. The first product identified is Moringa leaf powder.

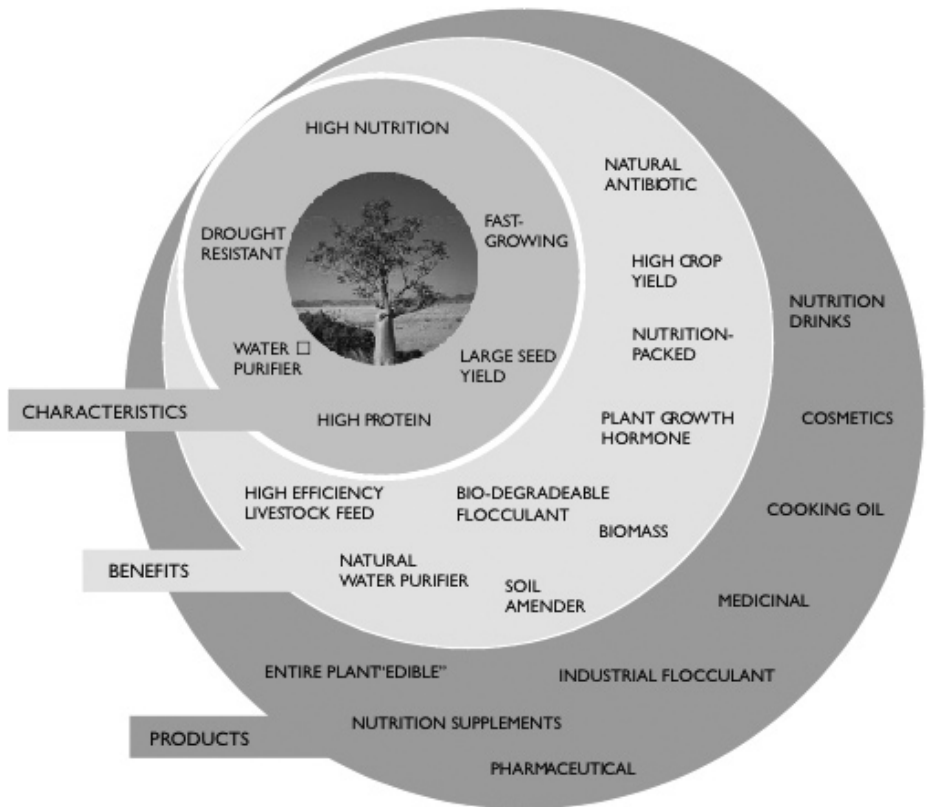
Once the pilot portion of Phase 1 is well-established, the project will be expanded to several nearby villages and the networking aspects of the strategy will begin to develop.

This will be accomplished by establishing additional ARCs with transportation and communication links in the surrounding markets. In this way, a small, regional market for moringa seeds, byproducts, and cultivation know-how will be created as well as a support system for general agricultural needs.

Phase 2

Following the initial pilot program and its regional expansion, the Moringa in Motion strategy will enter Phase 2. This will be a scaled-up expansion with a focus on broadening the market, expanding into other moringa product sales areas, and pursuing larger-scale manufacturing of moringa products. Several components of this phase are:

- Expanding the reach of existing ARC centers and building additional regional centers



As depicted above, the moringa tree and its various parts can be used in a variety of ways to address poverty in all its forms and manifestations. While the most pressing need for the moringa may be as a source of food, the tree fulfills numerous secondary roles from water purification to fertilizer production. The moringa tree alone cannot solve the problem of poverty in less developed regions, but it will provide a solid foundation for health and wealth to build from.

- Drawing foreign investment into local moringa production efforts to expand production, begin global marketing initiatives, and create a brand
- Expanding seed collection and distribution for water treatment

Phase 3

The primary goal of this phase of the strategy is to move moringa production towards a self-sustaining endeavor, decreasing and eliminating the need for foreign capital and other assistance and placing the entire operation

in the hands of locals. This phase will focus on expanding the market for moringa products, investing in more and better infrastructure linking villages producing moringa to market centers, and investing profits from the enterprise directly into social support and services such as healthcare, education, and job training.

The ability of this strategy to be scaled-up dramatically is one of its greatest strengths. The images on the following pages illustrate this scaling process.

Projected Costs

PHASE 1: STARTUP COST

- (1 Agricultural Center + Outpost Network)
- Staff: Agricultural Extension Agent knowledgeable in moringa cultivation, product development, and marketing
- 3 Bikes
- 1/2 ton fertilizer/farm
- 2,000 seeds/farm
- 2 oil presses
- Packaging
- Water Management Tools + Techniques
- Main Agricultural Center
- Outposts/Storage Center

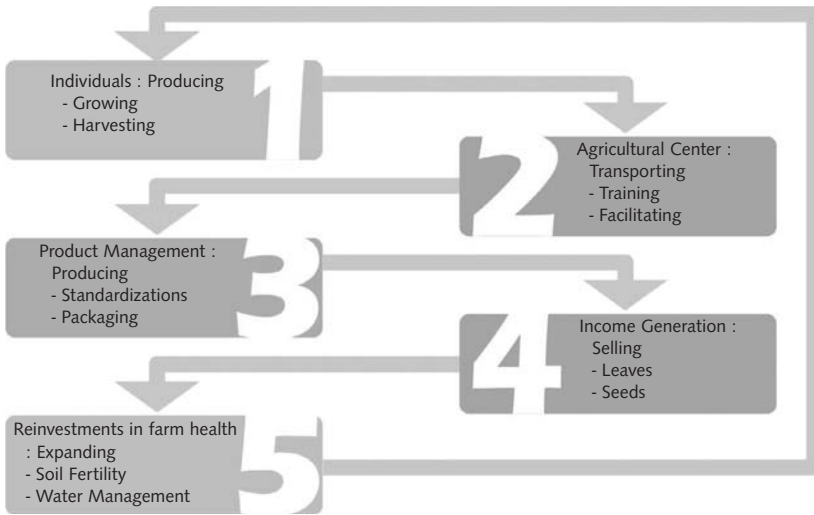
\$165,000 (\$300/acre of farmland)

YEARLY COSTS:

Labor Cost:

- (\$30/day labor for two local farmers X 260 days of labor) = \$15,600 labor
- Ag Extension Agent = \$25,000

\$40,600



Long-term plan for the expansion of moringa-based enterprises.



7. SUSTAINABLE URBAN AGRICULTURE

The Sustainable Urban Agriculture program will establish community gardens in all neighborhoods and at all schools in the demonstration community of Asheville, North Carolina, region of the United States. These urban gardens/farms will produce fresh vegetables and fruits for the local market as well as teach students and adults the latest sustainable food production techniques.

In addition, the Sustainable Urban Agriculture program will plant greenways on the region's floodplains that contain diverse native plantings. Native animal species will also be reintroduced, where appropriate. The program will institute a green-roofs and rooftop gardens program for all appropriate municipal buildings. This will help decrease energy needs (cooling costs are often reduced by 20% in green roof systems), collect and purify rainwater, decrease storm runoff, increase habitat for native species, and reduce urban heat island effect.

The Sustainable Urban Agriculture program will also implement a downtown "Edible Walkways" program, and establish compost systems in every garden. It will work with regional trash collectors to increase the amount of organic waste that is composted to 80% or more. It will also build cisterns for roof water catchments, and swales to water fruit trees.

In stage two of this strategy, the program will begin working on the production of mushrooms, and the cleaning up of brownfields. In some locations it will build greenhouses to extend the growing season. It will also forge linkages with Asheville Sister City programs in Mexico, Russia, and Greece to both share its programs, methods, and technology, and to learn from these cities what they are doing in these areas.



Benefits

Each 100 x 100 foot garden can produce up to \$35,000 worth of food each year under intense cultivation regimes. In addition to this revenue stream for local residents, local food production will result in improved nutrition, increased local food security, green space for urban dwellers, waste recycling, pollution reduction, reduced environmental contamination from pesticides and fertilizers use, and increased employment.

8. E.A.T. EDUCATING AQUAPONIC TECHNOLOGY

By Anna Swarbrick, Runo Okiomah, Hein Lam, Donovan Preddy

Strategic Summary: Hunger exists for a variety of political, economic and environmental reasons. The fundamentally result, no matter what the cause, is the inability of a person, family or society to get access to a regular, affordable, and sustainable supply of food. When all else has failed, a humane society is left with no other option than to mount expensive famine-relief efforts. The strategy presented here takes an anticipatory approach to hunger. Its goal is to provide the resources and knowledge needed to generate enough food in each region of the world so that basic food needs are met locally. It does this through the relatively new technology of aquaponics and a creative education and distribution method of this technology.

PROBLEM/PRESENT STATE

A Global Epidemic

Hunger is one of the most serious problems facing the world in the 21st century. Close to one billion people are “chronically hungry”, which means their hunger is long-lasting or recurrent.

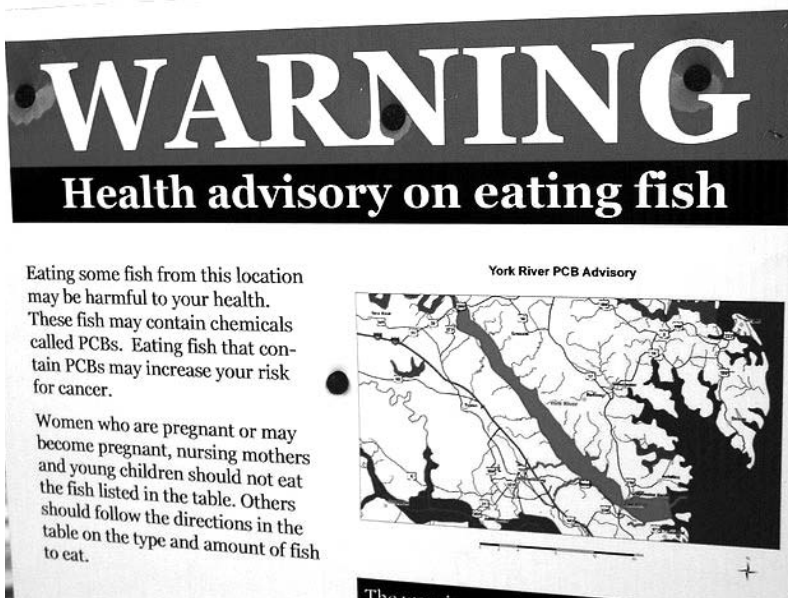
A Dynamic Problem

Hunger is complicated. It can come in many forms and is often complicated by malnutrition, or “the condition that develops when the body does not get the right amount of the vitamins, minerals, and other nutrients it needs to maintain healthy tissues and organ function.”¹

The Urban State Of Affairs

By 2050, 70% of the world’s population will live in an urban environment.² The global solution to hunger will need to take this trend into account to be successful. While it may not seem possible for such densely-populated areas to produce most, if not all of the needed food for its residents, the story of Havana, Cuba suggests otherwise. This city serves as a example of a self-sufficient habitat, one that has created a ripple effect of positive, social benefits.

Throughout the mid- to late-twentieth century, Cuba developed a strong dependence on the former Soviet Union for resources like fuel and food. In 1991, when the communist regime in the Soviet Union collapsed, Cuba lost not only its petroleum, but its steady supply of imported food. As a way of coping with this problem, Cuba decentralized its food production and shifted its focus from large state farms to more urban-based cultivation systems. Today, more than 50 percent of Havana's fresh produce is grown within the city limits. Furthermore, 350,000 new well-paying jobs have been created³, four million tones of fruit and vegetable are produced annually⁴ and the city now has 2.2 million agriculturally, self-sufficient inhabitants.



Unfortunately, this example is more of the exception than the rule. As cities become denser, finding arable land for food production becomes increasingly difficult. The production of protein-based foods is also something cities are no longer able to sustain. While many cities are located along major rivers and water ways, most of those bodies of water can no longer provide residents with sustainable supplies of healthy, protein-rich fish due to pollution.



STRATEGY

Aquaponic Technology

Aquaponics is a sustainable food production system that is a combination of two unique methods of growing food: hydroponics and aquaculture. It is a symbiotic environment wherein water, purified through a hydroponic system, is fed into a fish tank. Water from the fish tank, rich in nutrients from fish excrement, is then pumped through the hydroponic system as a way of providing the plants with the nutrients they need. The fish feed the plants and the plants provide the fish with clean water. This closed-loop system provides aquaponic farmers with a steady supply of the fruits, vegetables and fish needed to sustain a healthy active lifestyle.

Aquaponics has a number of proven, tangible benefits that make it an excellent option around the globe. When compared to traditional soil-based growing methods, it has been found to use less water



and energy and can produce more crop yield. When communities take control of this technology, it can foster financial and agricultural independence while supplying food that is organic, natural and healthy. In addition, community-based systems provide food which requires little to no transportation or refrigeration. Aquaponics proponents also claim that aquaponic systems also eliminates soil-borne diseases and have no weeds.

Aquaponics is ideally suited for producing high quality, affordable protein in sustainable ways in urban environments. Unfortunately, its use is hampered by the lack of knowledge about its capacities and the resources and technology needed to make it work.

The strategy presented here calls for the development of a global aquaponics knowledge network about individual and urban aquaponics food production. One way of spreading this knowledge network and the advancement of aquaponic technology is through a school-based competition. The scaling up of such a strategy could have a positive impact on reducing hunger around the world.

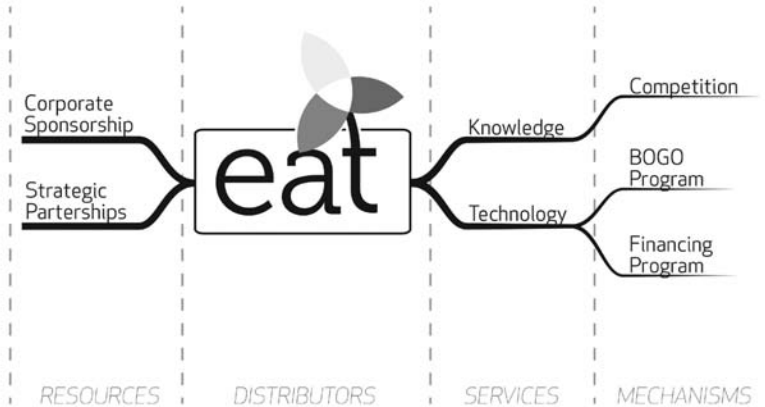
The Utility of Competition

Competition has long been an effective way to motivate behavior. One contemporary example that is relevant is a high-school league in the United States called F.I.R.S.T. Robotics. Started in 1992 by inventor/designer Dean Kamen, this league challenges students to build robots that are able to accomplish certain tasks established at the onset of each season. The robots then compete in local, regional and national events. For example, one year, the robots had to be able to pick up inflated inner-tubes and hang them from a metal structure. The goal of this league goes much deeper than the practice of building inventive robots.

As the F.I.R.S.T. literature says, its purpose is “To transform our culture by creating a world where science and technology are celebrated and where young people dream of becoming science and technology leaders.”⁵

What makes this league so effective (hundreds of schools and thousands of students take part) is the way the competitive season is structured. Each team begins the season with a competition kit that includes all the basic components needed to construct a robot. Because each team starts at the same point, the league promotes qualities in students like collaboration, innovation and “gracious professionalism”.

A BUSINESS OF SERVICE DISTRIBUTION



Putting It Together

Aquaponic technology is already making a contribution to food production in some areas. Unfortunately, this contribution is largely based in developed countries like the United States and Australia. This strategy aims to spread aquaponic knowledge and technology in developed and developing countries through a F.I.R.S.T-like competition. Our competition is called E.A.T. (Educating Aquaponic Technology). It works in the following way:

There are two teams that are paired. A team in a developed country, like the US, would raise money to cover an entry fee. For the price of this fee, they would receive a basic aquaponic starter kit that would include items like a water pump, growing medium, seeds, etc. At the same time, a second starter kit would be sent to a school in a developing country like Nigeria. These two schools become a single team that works together.

Each year, the challenge to the paired schools is to grow the most food. The winner is the team that has, collectively, produced the most fruit, vegetables and fish. Each season the challenge shifts to a different type of food that is to be grown. The systems developed by each team needs to be optimized for that year's particular challenge. Points will also be awarded for categories such as the degree of innovative design. Each team will also need to document their work so that as the year's

go by there will be a build-up of designs and knowledge that can be accessed by other people around the world.

At the end of each season, all school teams would donate their constructed aquaponic systems to eligible candidates in their respective communities. This would create a flow of food-producing systems and knowledgeable individuals throughout the world.

BUSINESS MODEL: Overview

Educating Aquaponics Technology (EAT) would be created as a 501(c)(3) non-profit organization to facilitate the dissemination of aquaponics technology and knowledge across the developed and developing world. The methodology for dissemination is the E.A.T. Competition.

The goal of the EAT business model is the efficient dissemination of the technology and knowledge of aquaponics. It aims to be socially responsible, environmentally sustainable and economically profitable.

The strategy's preferred state envisions a society where every community grows at least some of their own food. To accomplish this vision, the strategy will disseminate aquaponics technology, knowledge and hardware.

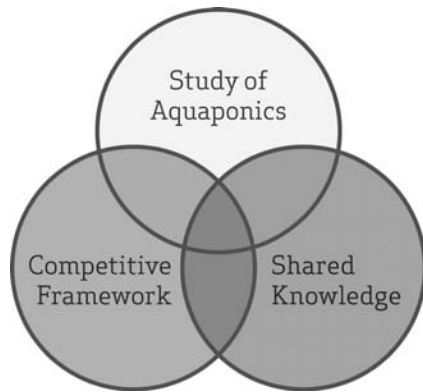


Corporate Sponsorship

The E.A.T. business model needs a capital investment from corporate or foundation sponsors. These start-up sponsors could consist of industry leaders in agro-production, or large agribusinesses interested in securing the allegiance of a young and growing demographic of independent growers. Companies like John Deere, Burpee Seeds, Del Monte etc. could take on this challenge and receive tax breaks for their financial contributions. Aquaponics kit suppliers could also donate starter kits for this venture, and other corporations, like Coca-Cola, could become joint sponsors. In return, sponsors could get advertising space and branding rights on the E.A.T. Challenge as well as on the aquaponics kit-of-parts.

Strategic Partnerships

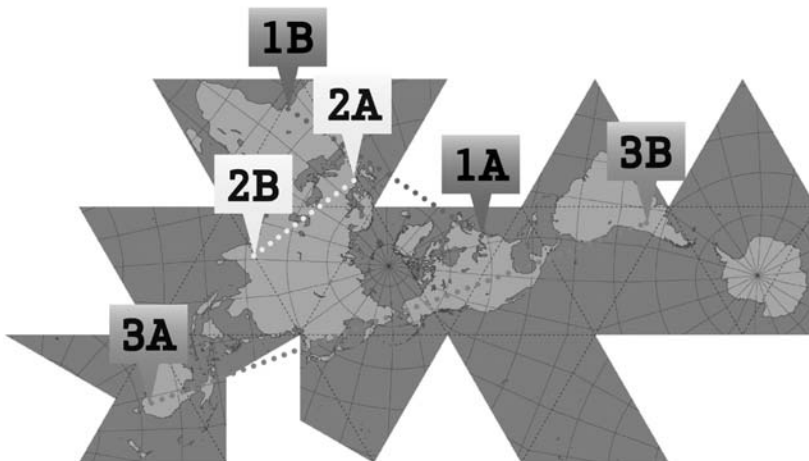
As the financing is secured through sponsorships, strategic partnerships with educational systems will also be developed. There are strong support networks for schools that exist at the local, regional and global level that are typically linked with non-governmental organizations and international government organizations like UNICEF and UNDP. These organizations are well acquainted with the locations, existing resources and monitored academic standards of schools across the globe. EAT is a value-adding business that will equip young people to grow food for their community.



Knowledge Distribution: Competitions

EAT is in the business of distribution, disseminating technology and knowledge to communities via the education of youth. EAT maintains interest among youth via competitions that serve the dual purpose of capturing the interest of young minds in innovative projects and also providing the conduit for aquaponics knowledge transfer. After supplying the aquaponics technology and knowledge at the schools we are affiliated with via the NGOs and IGOs

COMPETITION TEAMS: A PARTNERSHIP



network, we ignite the youths' ingenuity and excitement by pitting schools against each other in competitions, with expenses covered by our corporate sponsors.

Summary

The dissemination of knowledge and technology happens through the supply of aquaponics kits that are funded by contest entry fees and corporate sponsors. The “Buy one give one” model is cost-effective. It is similar to the successful model used at Tom’s Shoes. Once a school in the developed world pays its entry fee or is sponsored to receive an aquaponics kit, there is a donation of a similar kit-of-parts to another school in the developing world. This “sister-school” partnership is tasked with jointly optimizing the aquaponics systems’ output.

As this strategy unfolds, young students will become conversant with aquaponics technologies and capable of growing some of their community’s food. EAT is strategically poised to supply these aquaponics kit-of-parts to the interested schools and students who see the financial value of expanding aquaponics production at the community level.

Endnotes

- 1 <http://medical-dictionary.thefreedictionary.com/malnutrition>
- 2 Anna Tibaijuka, director of UN-Habitat.
- 3 Nelso Companioni Concepción, La Agricultura Urbana: Un Sistema Alternativa de Produccion de Alimentos en Cuba, powerpoint presentation, slide 35, INIFAT, la Habana, 2007
- 4 Adolfo A. Rodríguez Nodals, Nelso Companioni Concepción, and Rosalia Gonzáles Bayón, “La Agricultura Urbana y Periurbana en Cuba: Un Ejemplo de Agricultura Sostenible,” Powerpoint Presentation, slide 9, presented at the VI Encuentro de Agricultura Organica, May 2006, Havana
- 5 <http://www.usfirst.org/aboutus/content.aspx?id=34>



AREA II

WATER MANAGEMENT

- 9. Waterment: Clean Water Access**
- 10. Drops for Crops**
- 11. Water = Life**
- 12. WaterWorks**
- 13. Increasing Household Water Security**

9. WATERMENT:²⁴ CLEAN WATER ACCESS

By William Sheehan

Strategic Summary: Increase accessibility to clean water and efficient use of water in irrigation through government efforts.

Introduction

There are over 1 billion people in the world without access to clean water and 1.6 billion without access to sanitation.²⁵

Strategy

Waterment refers to a government agency that would establish laws, codes, and regulations for water use by industry, agriculture, and households. It would guarantee access to clean, safe, and abundant supplies of water to every citizen. Its primary focus would be on water conservation—making sure that water is not being wasted in any part of the water system—and providing clean safe water to families.

The later is accomplished through mass production and distribution of the Kisii Water Filter²⁶. This relatively low-cost, easy to maintain, efficient filter costs about \$10 in small production runs. When mass-produced, the costs could be lowered to less than half this amount. The filter removes virtually all the harmful bacteria that cause cholera, dysentery, and other water-borne diseases. It can provide 100 to 700 liters of clean water per week. If every house in the world that currently does not have access to clean water were to receive one, the incidence of water caused diseases would be nearly eliminated, saving the world economy hundreds of billions of dollars in health care costs and lost productivity—to say nothing of the 2 million lives lost annually due to this cause. The mass production and distribution of the Kisii Water Filter would also provide employment for thousands of people.

Another component of the Waterment Strategy is the construction and maintenance of local wells in town centers in arid areas where water is scarce. The Kisii water filter and town wells would go a long way to eliminate the lack of access to clean water throughout the world. In addition, if these two strategies were undertaken by a government authority, such as the “Waterment” agency proposed here, the delivery of water could also be a public service that could employ thousands of additional people.



The Kisii Filter

10. DROPS FOR CROPS

By John Yuan

Strategic Summary: Increase food production through increased use of water-efficient irrigation.

Introduction

Not only is water essential for human survival, it is needed for producing crops. Irrigated farmland, which accounts for less than 20% of global food production land, produces 40% of all food.²⁷ Irrigation increases yields of most crops by 100% to 400%.²⁸

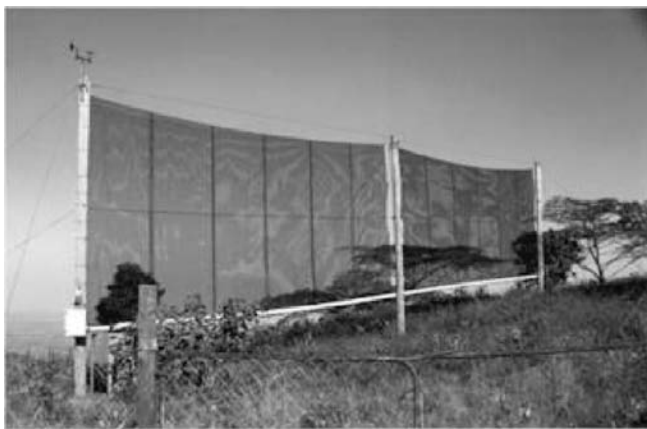
Rainwater Harvesting

There are a number of innovative ways of “harvesting” water in arid regions of the world. One set of technologies revolve around rainwater catchments. The goal here is to capture and store rain water when and where it is abundant, often times in super-abundant quantities, for use in the dry season. The Kuis method of rainwater harvesting is from western India. It involves the digging of a crater, at the bottom of which is a tiny opening leading into a hole where the water is stored and kept from evaporating. Heavy rainfall gathers in the craters where it then flows into the water holding hole. Once the holes are built, they will last for years and years. Water stored in these holes can be channeled into wells and irrigation systems for use in water short seasons.



Fog Harvesting

Another technique for gathering water in arid regions is what is called “fog harvesting.” This technique is good for arid climates where access to water is seriously limited. It involves the use of a net that lets humid early morning air pass through. As the air goes through the netting, its moisture collects and drips into the gutter at the bottom of the net. From here, the water flows into a collection basin where it is stored until needed.



Drip Irrigation

Another technique for meeting the water needs of water-short areas is through the conservation of this scarce resource. The largest user of water is irrigation. In most parts of the world, including wealthy areas such as the US, irrigation water uses 50% or more of all fresh water. Using the least efficient irrigation technique, that of open field flooding, wastes 70 to 90% of the water.

Drip irrigation is a method of irrigation particularly suitable to arid climates where water is scarce. It is also suitable to any climate where there is an interest in conserving water. Precise water application is possible and runoff is eliminated, thereby reducing erosion and loss of soil nutrients. Drip irrigation is also helpful in other ways—it allows precise application of nutrients to depleted soils.

The primary disadvantage of drip irrigation is that it is more expensive in the short term. In the US it costs between \$500 and \$1,000 per acre, depending on the technology used. In the developing world, there are low-cost drip irrigation techniques that utilize bamboo or inexpensive plastic tubing. Using these materials, illustrated below and at right, the cost for drip irrigation is an order of magnitude lower. Water savings and increased crop production will pay for the apparatus in less than one season.



The “curled” micro-tube dripper: simple, low cost, if it clogs, one can simply blow through it to clean out the clog.

The bucket kit for low cost drip irrigation in the test laboratory of IDE India near New Delhi. A simple product with a long trial-and-error phase to make it suited to the needs of poor horticulturists.



11. WATERWORKS

By Devin Massaro, Nathan Owens, Bryce Langlotz, Tyler Knowlton, Jake O'Donnell, Barbara Kreider

Strategic Summary: Safe, clean, affordable and sustainable supplies of drinking water can be made accessible to poor people in developing countries throughout the world using existing technology. The funding for this technology comes from people living in developed countries through the savings that they accrue from water-conservation measures they implement in their homes, offices and schools.

Introduction—Problem State

- Over one billion people lack access to safe drinking water supplies.
- 1.6 billion people lack adequate sanitation.
- Diseases related to unsafe water, sanitation and hygiene result in an estimated 1.7 million deaths every year. A child dies every eight seconds from contaminated water.
- Annually, water related diseases—cholera, hepatitis, dengue fever, malaria, and other parasitic diseases—cause four million deaths.
- Humans struggle to distinguish safe from unsafe drinking water.
- Natural processes may be insufficient to purify scarce and variable water supplies.
- Contamination of water supply comes from inadequate sanitation.
- Water consumption causes disease in humans when infectious agents are present in sufficient quantity.
- Climate changes are likely to further exacerbate the lack of water in water-poor areas.



Strategy

Preferred State

Everyone in the world has safe, abundant, affordable and sustainable supplies of drinking water.

More specifically:

By 2015, resources for 100,000 individual and 5,000 home water purification systems are provided annually.

By 2030, resources for 250,000 individual and 10,000 home water purification systems are provided annually.

Strategy—WaterWorks

Reaching the preferred state requires a complicated series of actions. Providing water purification systems to those who need them involves technology, policy, distribution and funding, among other things. The WaterWorks strategy is focused primarily on an innovative financing design that raises the funds needed for the purchase of clean water technology for the developing world.

The core of the WaterWorks strategy involves two major initiatives. One is the raising of money in relatively wealthy developed countries through an incentives-laden water conservation program that saves money for the wealthy water consumer (as it reduces their water use). These monetary savings are split between the wealthy water consumer and the program delivering clean water technology (individual and home water purifiers) to the people in need in the developing world.

Hardware—Water Purification Technology

The primary technology required for WaterWorks is water purification. Many systems are currently available. Some of these include LifeStraw and the Kisii filter.



Individual Water Purification System



Water purifier system for a family—the ideal water purification system would be produced by and in the communities where they will be used.

Product	Purifier Cost (\$)	Filtration Speed (L/Day)	Filter Life (Months)	Filter Replacement Cost (\$)	Built For (# of people)	Portable?
Life Straw	5	—	12	—	1	yes
Ceramic Water Pot	15	50	18	4	10	no
Kisii Water Filter (High Speed)	3	25	6	4	5	no
Kisii Water Filter (Low Speed)	1	3	6	2	1	no
Biosand Filter	75	75	18	—	15	no

Software—Water Conservation

The second core initiative of this strategy is partnering with an experienced NGO that has a long-standing and trusted presence in the delivery of clean water systems in developing countries. As a way of locating the most appropriate NGO, WaterWorks will issue an RFP (request for proposal) from clean water delivering NGOs. The funds raised through the WaterWorks water conservation program in wealthy parts of the world will be funneled to the chosen NGO (or NGOs) to fund their clean water programs.

In summary: The WaterWorks strategy uses the funds saved as a result of water conservation taken by intense water users to pay for the technology to get clean water to those most in need.

The money-raising strategy requires robust participation by municipal water users in an incentivized water conservation program. Water users will be enrolled in a water conservation program as a way of saving money on their water bill. Fifty percent of the water bill savings will be used as seed money to fund the “WaterWorks” program of obtaining and delivering water purification technology to those in need in the developing world.

In order to attract large numbers of consumers to the program we will announce the incentives for the water conservation program on the bills consumers receive from the local municipality’s water departments. Other citywide advertising programs, such as direct mail, social networking websites, and school-based programs will also be conducted to get the word out. Educational outreach will continue until there is at least a 50% participation rate.

When funds begin to come in from the savings in water bills, water purifiers will be obtained and distributed through the partner NGO.

NGOs with experience in distributing water purification systems will provide distribution services as well as micro-credit services. Should better water purification systems be developed, this strategy calls for their use instead of the Life Straws or ceramic pot filtration systems described below. The idea is to always be using the best, most efficient, low-cost, and sustainable technology matched to local needs.



Local Partner

An existing company that is currently doing something structurally similar to what we are proposing is RecycleBank. This company has an incentives laden program that rewards people for recycling trash. They contact with municipalities to manage trash recycling. RecycleBank currently provides rewards for curbside recycling and e-waste management (electronic devices). WaterWorks will work

with Recycle Bank on expanding and modifying their successful program so that it can handle water conservation.

Here is a model of how it will work: when consumers, domestic and industrial, receive their water bill, they will receive information about how much water they have conserved relative to the previous year's usage. Consumers will be given a link to RecycleBank. On RecycleBank, consumers can translate their savings in water into points that can be used to purchase rewards or donate money to WaterWorks, the not-for-profit company that provides water purification systems to areas with unsafe drinking water.

The WaterWorks strategy adds a third category to the Recycle Bank business: water conservation.

Model WaterWorks Water Bill

When a consumer logs in to the WaterWorks water conservation site, they:

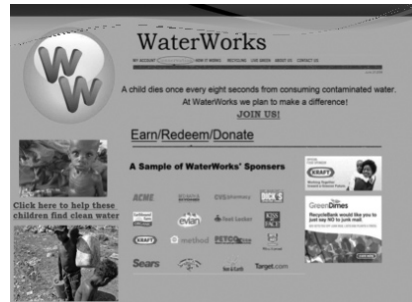
1. Learn how to conserve water in their home, business and community.
2. Learn about global water issues.
3. Donate money to WaterWorks and direct where (what country) those funds should go.
4. Redeem points for rewards.

ACCOUNT NO.	005-11111-11-1	CITIZEN	1111 TEST PL
Water Usage Meter Size: 0.75 (0.75) 15.18 7 HCF @ \$2.3620 = 16.53 8 HCF @ \$2.4610 = 19.69 8 HCF @ \$2.7750 = 22.20			
Water Usage 2.31 Current Charges 117.01 TOTAL AMOUNT DUE \$114.74			

Action Plan

To get the WaterWorks program off the ground it will be prototyped in a relatively small town in New Jersey. The local municipality will be contacted to discuss the feasibility of starting an incentivized water conservation program. These savings will be used to pay for the contract with Recycle Bank to maintain a link to their website with points and donation links. Over the next five years WaterWorks will invite additional municipalities to participate in the incentivized water conservation program.

A secondary outcome of the WaterWorks program is the raising of awareness about water conservation in the US and clean water needs in the developing world. This outcome can be measured by monitoring the percentage of municipal water consumers who participate in the water conservation program.



12. WATER = LIFE

By Brett Boye, Briana Graves, Iman Griffin, Kevin Machoka, Susan Moore, Thomas Pang, Ben Pullman, Alex Reiner, Ivan Serezhin

Strategic summary: Water = Life is focused on water poverty. Water is an essential part of life; one that is all too scarce for many people around the world. This group developed a plan to provide abundant, clean water to as many people as possible, relying on locally-devised and culturally-appropriate methods of storage and distribution that can be scaled up to meet the needs of individuals, small villages, towns, and cities.

Present State of the Global Water System

- Of all water on earth, 97.5% is salt water, and the remaining 2.5% is fresh water. 70% of the fresh water is frozen in the polar icecaps. The remaining 30% is mostly present as soil moisture or lies in underground aquifers. *Less than 1% of the world's fresh water is readily accessible for direct human uses*¹
- More than half of the world's fresh water is found in Latin America (31%) and Asia (27%)
- An estimated *one billion* people worldwide have little or no access to clean water and 6,000 children die every day because of infections linked to unclean water, according to UNICEF²
- Most of those affected by lack of access to clean water live in Asia (550 million) and Sub-Saharan Africa (400 million). Asia is making progress toward improving these statistics, while Africa is *falling far short of the MDG target*³
- Lack of clean water for cooking and basic sanitary needs leads to disease and poor health
- Rural communities are 50% more likely than urban communities to lack basic sanitation
- Purification and desalination both require enormous energy inputs
- Agricultural processes account for 70% of fresh water use globally⁴
- In African and Asian regions where agriculture is the primary source of income, droughts are devastating to both human health and the economy
- According to a study conducted by the United States Department of Defense, dwindling supplies of fresh water and climate changes worldwide could fuel resource wars.⁵



The Lifestraw is an example of a simple, affordable, mass-produced solution to problems like the spread of water-borne diseases. Lifestraw uses a series of filters, iodine, and carbon to remove impurities and parasites from water.



The Q-Drum addresses the needs of people in less developed regions to transport water, often over long distances and rugged terrain in hot, dry weather. The Q-Drum reduces physical strain and prevents loss of water during travel using a unique design and durable materials.

Preferred State of the Global Water System

Affordable, clean, efficiently used and distributed water is available for all people.

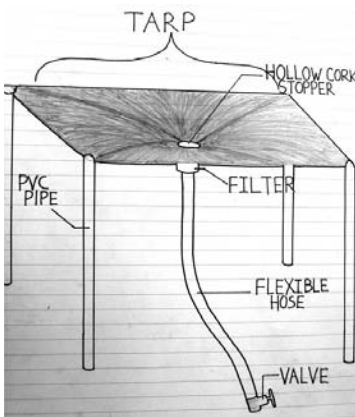
This means:

- Reducing pollution to both freshwater and seawater worldwide. This will not only *improve potable water supplies*, but improve ecosystems as well
- Devise better water collection, storage, and distribution systems, especially in less developed regions
- *Utilize emerging, appropriate technologies* such as the Lifestraw and the Q-Drum that enable water to be purified and transported (respectively) at the source on a human scale
- Meet or exceed the World Health Organization's (WHO) minimum levels for the quantities of drinking water: *1 liter water/day for a 10 kg (20 lb) child 2 liter water/day for a 60 kg (130 lb) adult*
- Promoting local education initiatives focusing on daily water needs, disease prevention, storage and collection procedures, and water conservation.

How Do We Get There?

Water Collection Kit

- Each Kit will cost approximately \$100 retail and include: 1 Plastic 55 gallon barrel; 4 10 x 10 tarps; 32 3-foot PCV pipes; 4 filters; 4 flexible hoses; 1 bag heavy rubber bands; 4 PCV valves; 4 siphon pumps; 4 heavy duty plastic liners; 4 hollow cork stoppers
- The 55 gallon barrel will contain all the supplies needed for four 10x10 foot water collection and storage kits.



Short Term Goals

- Phase 1: Create and ship 1,250 water collection kits.
- Phase 2: Provide additional water for 5,000 people.
- Phase 3: Create a design solution for under \$100 per kit.

Long Term Goals

- Provide Irrigation kits for the pilot villages
- Build permanent storage systems (5th year)
- Add more sophisticated pumps (5th year) powered by solar or wind power
- Add composting toilet systems for additional water savings.

Collection

A kit containing a 10 x 10 foot tarp can collect enough water for approximately 100 days of personal use for one individual.

Tarp Size (feet)	Potential Water Collected (gallons)*
10 x 10	500

*for every 8 inches of rainfall

Storage

Trenches that hold water in large plastic bags are already being used in India. These containers hold 500 or 1000 liters of water and also serve to keep water cooler in hot summer months. This storage method could easily be used elsewhere.

Irrigation

- Any extra water collected can be used for drip irrigation in times of drought. This method of irrigation is extremely efficient and little water is wasted.
- The plastic tubing included with the kits is well-suited for drip irrigation

Human Resources Needed

- Start-up Phase
 - Project Manager
 - Communications Manager
- Deployment Phase
 - Team of 6 trainers to teach initial set up and use on site

Example of
a small water
storage trench in
India



A simple drip
irrigation
system utilizing
components
similar to those
found in the kit



What Can Businesses and Individuals Do?

Funding Strategy:

- Form strategic partnerships with hardware stores (e.g. Home Depot) to provide free or discounted kit components
- Individuals shopping in these stores can provide a 'physical donation' (an actual component of the kit) and put it directly in the 55 gallon drum to be shipped out. This way, people feel a sense of ownership in the process and see exactly what they're giving.

Project Summary

- The proposed design will provide water for 5000 people
- 1,250 Kits will be used to provide 2.5 million gallons of potable water for personal use
- The system will provide affordable, clean, efficiently used and distributed water by 2015.



13. INCREASING HOUSEHOLD WATER SECURITY

By Frances Brindle PhD and Ihsan Pashley

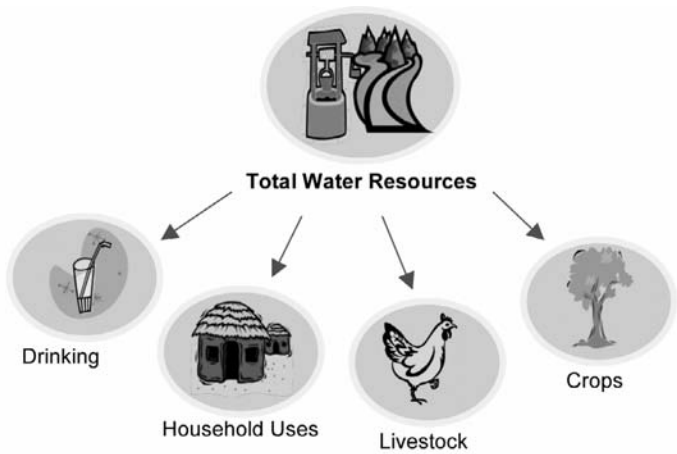
Strategic Summary: Tomorrow morning, 884 million people will wake up and the water they drink will be potentially lethal. Of these people, 746 million live in rural areas. Although these numbers are staggering, low cost methods for supplying and purifying water could reduce these numbers dramatically. The strategy described below addresses this dangerous water situation in rural areas with a three-faceted approach which targets: improving the quality of drinking water, increasing water security by capturing and storing rainwater, and reusing/recycling greywater. These three actions can dramatically reduce the shortage of clean and affordable water in the world.



The Present State

Water is a precious resource with only a small percentage (less than 1%) of all the freshwater on Earth accessible for direct human use.¹ Because of this scarcity, the poorest are the ones who suffer most, with 884 million people relying on unimproved water sources from surface waters, lakes, rivers, and unprotected wells or springs, for all their water needs, as depicted in Figure 1.² These families are forced to spend a great deal of time and energy obtaining their daily supply of water and/or spending much of their income on this precious resource.

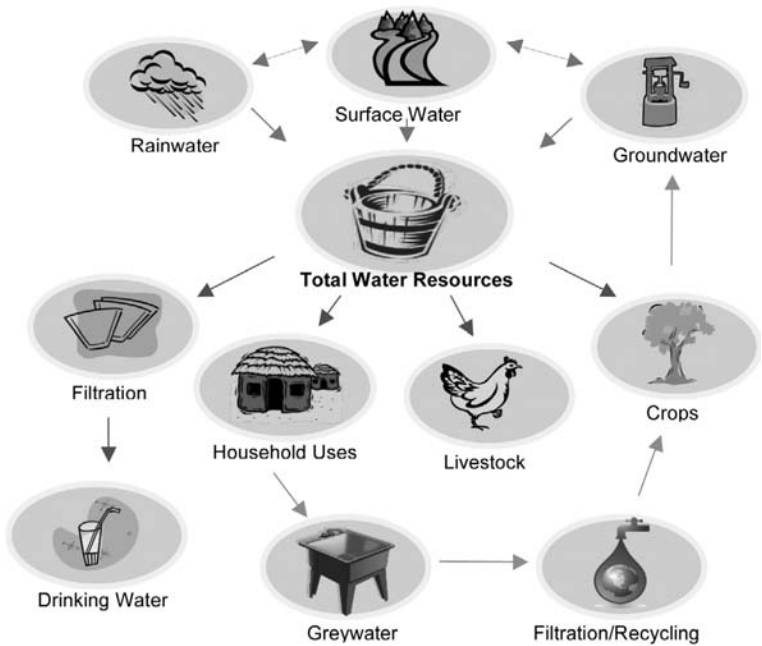
Figure 1: Present State of the Water Supply



The Preferred State

What’s missing is: readily available, quality drinking water; a water source which is more secure year round; and systems for reusing and recycling greywater. Our Preferred State provides for these needs, as depicted below.

Figure 2: Preferred State of the Water Supply



Strategy



Part I – Increasing Water Quality: Drinking Water

Easily accessible, affordable, and quality drinking water brings many benefits. In addition to reducing illness from water-borne pathogens and injuries from hauling water, it has been proven to save money³, increase worker productivity, improve the quality of life, and free up time for productive work.

The SODIS Method in use



Inexpensive quality drinking water can be made available by both ultraviolet irradiation and filtration.

- The **SODIS** (solar water disinfection) method is a virtually cost free method of water purification making use of the ultraviolet radiation from the sun. By simply placing a clear, label free, PET (Polyethylene terephthalate) bottle filled with clear water in direct sunlight for 6 hours, microorganisms are killed, thereby providing safe drinking water. *While this method is not recommended as a permanent solution*, and does not address water contaminants such as heavy metals, it can have an immediate impact on the quality of drinking water for everyone in sun-intense areas and/or seasons with minimal costs, until more sophisticated methods are available for use.⁴

The Filtron Method

- The **Filtrón** water filtration method is a low cost household filter

which treats bacteria-contaminated water making it safe to drink. This system can provide safe drinking water for an entire family for up to a year with an initial cost of \$10.00 per household and an additional investment of \$4.00 per year for a replacement filter (water turbidity directly affecting filter longevity). This system uses a filtering element which contains tiny pores that allow the water to pass through, but excludes bacteria, and is impregnated with colloidal silver to prevent bacterial growth. Additionally, the pot serves as a water reservoir to store clean drinking water. Another advantage to using this method is its ability to provide local industry. These units can be made by local potters after a short period of training, and are made using local materials without use of either electricity or advanced technology.⁵

Filtrón Unit



How Filtrón works



Filtrón unit in use



Part II – Increasing Water Reserves: Rainwater Harvesting

On average, women and girls in developing countries walk 6 kilometers a day carrying 20 liters of water for their family, greatly reducing their time for other productive work and for girls to attend school.⁶ By supplementing the existing water supply through rainwater harvesting from rooftops, greater water stability and quality is assured and more time can be freed up for productive activities.

Rainwater harvesting can be accomplished by attaching bamboo or PVC gutters to catch water running off a roof, directing it to a holding tank, such as a water bladder or ferrocement cistern. This captured rainwater does not have to be treated and is safe for drinking.

- **Water Bladders** are relatively inexpensive, portable, and ready for immediate use. However, their manufacture does not provide for local industry.
- **Ferrocement Cisterns** are more expensive and permanent, but can be made locally from local materials after some training. Their manufacture can provide employment and a source of continued income.

Water Bladder
10,000L — \$73

Ferrocement Cisterns
10,000L — \$200 160,000L — \$800



Part III – Reuse/Recycling of Greywater

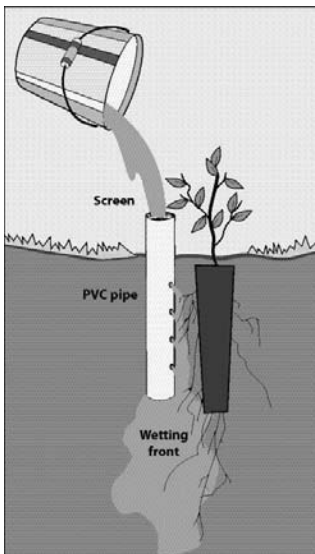
Greywater is generated from household water use, such as bathing, dishwashing, and doing laundry. While it can become a health problem if left untreated, it is a valuable water resource. Making use of the natural microorganisms in well-mulched soil, greywater can be readily filtered to provide irrigation for fruit-bearing trees and in turn provide food and potential income for a family while returning the water to the natural hydrologic cycle.

Greywater Reuse Process

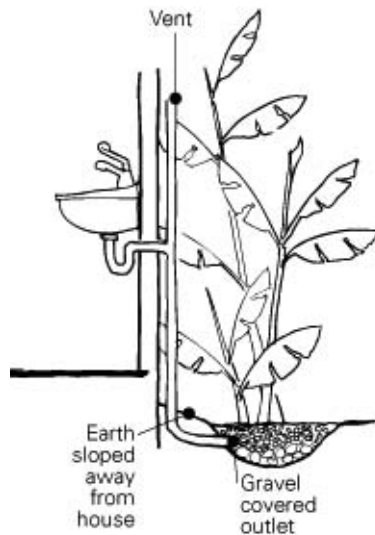


Two possible approaches:

- An open system, as shown below, consists of a bamboo or PVC pipe with holes drilled into the sides, inserted into the ground next to each seedling tree. Collected greywater is then poured into the pipe.
- A closed system, as shown far right, is an alternate approach which allows for more automatic reuse of greywater. Attachment of a simple hose to the drain of a sink leads the greywater away and underground to a well-mulched garden planted with fruit trees.



Open System



Closed System

Implementation and Next Steps

The plan we are proposing allows for flexibility. It can be applied in part or in whole, depending on the needs of the individual families, communities, or environments in Africa, Central America, and all other parts of the world where water is seasonal.

For example, in the African village of Murutunguru, on an island in Lake Victoria, a plan such as this would have a huge impact. The Filtrón System would gain easy acceptance and rainwater harvesting into ferrocement cisterns would provide water security during the dry season from mid-June until October.⁷

Another potential example is in Central America where in some rural areas of Nicaragua a rainwater harvesting system, together with a greywater harvesting irrigation system, would be most valuable.

The proposal can be accomplished by obtaining investments and partnering with local NGOs to disseminate information through public presentations and public service announcements, pamphlets and pictorial posters, manuals in native languages, text messages via mobile phones, and through the education system by training teachers to utilize these methods in school settings, allowing the children to be forces of change within the community.

Costs

Part 1: Quality Water

- SODIS (solar water disinfection) \$0 / household
- Filtrón \$10 / household and \$4 annually

Part 2: Rainwater Harvesting:

- Water Bladder 10,000L \$73/household
- (In time, this water bladder could be replaced by a cistern)
- Ferrocement Cistern 10,000L \$200/household

Part 3: Greywater Management:

- Bamboo and/or tubing minimal cost / household

Funding

Funds could be raised through a number of innovative approaches:

- “DIY” material suppliers in the developed world (such as Home Depot) could mount a funding campaign at point of purchase—thereby encouraging more affluent shoppers to purchase or contribute to the purchase of the necessary water harvesting and conserving equipment which would then be used in the developing world
- Micro-credit arrangements, with the community members providing the needed labor

- Government subsidy in the form of healthcare vouchers aimed at improving the health of rural populations.

Endnotes

Images

- 1 John Hopkins Bloomberg, School of Public Health: The Fabric of Public Health: <http://www.jhsph.edu/fabric-of-public-health/vision/>
- 2 SODIS: http://www.sodis.ch/methode/index_EN
- 3 SODIS: http://www.sodis.ch/methode/anwendung/index_EN
- 4 Patricia Foundation: <http://www.practicafoundation.nl/products/water-filters/ceramic-water-filter/>
- 5 Potters Without Borders: <http://potterswithoutborders.com/forum/?cat=11>
- 6 Engineers Without Borders – International: www.ewb-international.org/solutions0304.htm
- 7 DIY Trade: http://www.diytrade.com/china/4/products/5446846/water_bladder.html
- 8 RUCHI: <http://www.volunteer-ruchi.org/index.php?pageID=4&projectID=10>
- 9 Treehugger: <http://www.treehugger.com/2009/05/31-week/>
- 10 Roadside Revegetation: http://www.nativevegetation.org/learn/manual/ch_10_4.aspx
- 11 Australia's Guide to Environmentally Sustainable Homes - Technical Manual, design for Lifestyle and the Future: <http://www.yourhome.gov.au/technical/fs74.html>

Figures

- 1 and 2: Microsoft Word 2007 Clip Art

Footnotes

- 1 UN Water Statistics, Statistics: Graphs and Maps: http://www.unwater.org/statistics_res.html
- 2 John Hopkins Bloomberg, School of Public Health: The Fabric of Public Health: <http://www.jhsph.edu/fabric-of-public-health/vision/>
- 3 The United Nations World Water Development Report 3, Water in a Changing World, World Water Assessment Program, UN Water, 2009: http://www.unesco.org/water/wwap/wwdr/wwdr3/pdf/WWDR3_Facts_and_Figures.pdf
- 4 SODIS: http://www.sodis.ch/index_EN
- 5 Filtrón: <http://pottersforpeace.org/wp-content/uploads/ideass-brochure-english.pdf>
- 6 UNICEF, Water, Sanitation and Hygiene, Children and water: global statistics: http://www.unicef.org/wash/index_31600.html
- 7 Personal communication, Bartemelo Misano

14. SANITATION AND WASTE MANAGEMENT IN INFORMAL COMMUNITIES

DHARAVI, INDIA

By Aizaz Gill, Katrina Mattern, Rachel Zanders, Sheetal Akole and Eric Wu

Strategic Summary: *There are approximately one billion people living in slums around the globe. Even more alarming is the United Nation's estimation of that number growing to two billion by the year 2030.¹ Most of the inhabitants of these settlements do not have proper or safe sanitation and waste management services. Therefore, it is imperative to develop these services as soon as possible. The need for effective, safe and affordable sanitation and waste management in these informal communities is critical. Our strategy for meeting this need is to use a specific informal community, Dharavi, which is located in Mumbai, India, as our prototype and model for other communities throughout the world. The need is clear: in this informal community, there is only one toilet for every 1,440 residents, sanitation related illness and death runs rampant, most human waste goes into the local waterway "Mahim Creek" and most unrecyclable domestic waste is simply disposed of in the streets.*

Figure 1: Dharavi²

Introduction

Dharavi has a population of over one million people who live on a mere 550 acres of land.³ To put this into context, Central Park in New York City is approximately 843 acres, which means that over one million people live in an



area smaller than Central Park. As many as 18,000 people crowd into a single acre, which means that Dharavi is six times as populously dense as Manhattan. Despite the horrid living conditions this situation creates, the residents of Dharavi are a proud people who have often lived there for several generations.⁴ As a result, many have refused to relocate despite various government and private enterprise efforts.



Figure 2: Dharavi Land Area⁵ relation to Central Park.

In some ways Dharavi is a study of contrasts within India. On one hand, Dharavi is an informal community yet it possesses a unique economy. For instance, the residents of Dharavi manage to produce somewhere in the vicinity of \$600 million to \$1 billion every year.⁶ Unfortunately, that production comes at the cost of human misery as the workers often swelter in deplorable conditions. One example of this is a shop in Dharavi where twenty-two employees worked from 8am to 11pm. Those workers slept in the same cramped shop and began a new work cycle the next day.⁷

Dharavi represents a geographical contrast in the city of Mumbai as it is located right next to the Bandra Kurla complex,

a commercial center which exemplifies the technological growth of modern India. The Bandra Kurla complex represents the rising economic power that India possesses while Dharavi represents the poverty which still plagues India. These two landmarks stand right next to each other in the largest city of India.⁸

There are a variety of factors contributing to the deplorable conditions in Dharavi. These include a lack of government recognition, awareness and finances.

Recognition

The informal community of Dharavi is not recognized by the government.

The residents are seen as squatters, not legal residents. Therefore, the government provides no infrastructure. There is a lack of sanitation and no effective waste management system. Public services such as water, electricity, and sewage are not provided. The residents of Dharavi depend on a local mafia of sorts meet their many consumer needs.⁹

Awareness

An information gap also plays a part in Dharavi's conditions. There is a lack of education and awareness about sanitation issues, the connection between sanitation and illness and affordable alternatives.

Finances

Furthermore, there is a lack of finances needed to install proper infrastructure. It would be unfeasible to support a large, centralized waste management system, and so nothing is done. For this reason, our methodology fosters community involvement and bottom-up growth using initial financial stimulus from corporate, government, and NGO sponsors.

Preferred

State

Our preferred state is to provide an affordable, safe, clean, effective, expandable and sustainable sanitation system, and a profitable, job-creating waste management system for Dharavi, India and then spread that prototype to other areas of the world.

Strategy

Stage One: Mapping Local Resources

Our strategy is modeled on a successfully implemented project within the informal communities of Chennai, a city located in the southern region of India.¹⁰ This project, known as the “Thideernagar Project”, has been successful due to the carefully detailed step-by-step strategies that specify the ways in which anticipated economic, social, and environmental growth are reached. Adapting this model to Dharavi, our strategy selects and tweaks various areas of this Chennai strategy in order to fit the larger, and more spread out Dharavi informal community. Mapping local resources is the first step. It is the basis of our strategy to provide vital sanitation and waste reduction services to the people of Dharavi. One attraction of the mapping process is that it encourages participation and this strengthens the community. For example, when needing to locate areas of dense human and domestic waste, the people who live within the

community will be able to pinpoint exact locations for waste eradication. This helps the waste removal process to be more efficient, and allows the community to exercise some form of control over its resources. This, in turn, helps the community to keep their territory clean and disease free.

Mapping local resources will also help in the process of locating community leaders. Community leaders are essential for motivating and educating the people that live within the community. Throughout the process of mapping the resources of the community, residents experience a sense of control and empowerment that aids in the growth and development of the community.

Using the results of the mapping process to locate the best sites, the next step is to provide one working latrine per 400 people. Among other things, this would result in a decline in the incidence of waterborne disease. The general target date for achieving this level of sanitation is the year 2016.

Waste management

In order to develop effective sanitation and waste management systems in informal communities such as that of Dharavi, India, the strategy deals with two different, but related, issues: domestic waste and human waste. Each waste stream is handled separately to provide the community with the most efficient and sustainable process.

To build a sustainable, resilient and expandable infrastructure, three important considerations need to be kept in mind when implementing domestic and human waste management systems. *First*, the project must be economically viable. There is already a uniquely vibrant economy existing in Dharavi.¹¹ Any design needs to foster the positive aspects of a community as it also lessens the impact of negative aspects. *Second*, the project needs to be culturally acceptable. This is an issue when dealing with human waste, as many cultures have their own reservations and beliefs about how waste products must be handled. Our strategy relies heavily on community involvement to make sure it has community buy-in. In order to provide for Dharavi residents, the project needs to draw advice and support from its residents. Mapping allows the community members' input to have a direct effect. *Third*, the strategy needs to be environmentally friendly. It will be impossible for an environmentally degrading process to be successful in the long run.

Domestic Waste Management

To reach the preferred state with respect to domestic waste management, a system needs to collect trash from individual households, thereby preventing that trash from ending up in the streets or in Mahim Creek. The strategy we are proposing requires large amounts of community participation while simultaneously benefitting the community economically and environmentally.

Community participation begins with the previously mentioned community resources mapping process. By collecting information on community borders, resources, and problem spots leaders within each section of the community can be located. If empowered successfully, these leaders will establish a grassroots movement that will grow to encompass the whole community. The leaders are trained in the importance of sanitary conditions and the economic and other benefits of collecting trash in an organized manner. These leaders establish a community trash collection system. They reach out to other members of the community who are able to take up the position of trash collector. Once the trash collector has been educated by community leaders, their role is to travel from household to household, handing out two trash cans to each and extending their educational reach to the rest of the community. Part of the trash collector's duty is to explain that one trash can will be used to collect compostable material such as rotten vegetables or fruit peels while the other trash can is for any other recyclable waste such as plastics or paper. Trash collectors are paid a salary for the work they do. The money for this salary comes from a minimal (half rupee) service fee that is collected from each household every week. The service fee enables the building of waste management infrastructure to play a part in the local economy. It also encourages community members to take up the position of trash collector. By involving all members of the community in the sanitation system in various roles (whether that be the role of a leader, collector, or household member) the duration and effectiveness of the system is helped.

Separating wastes into compostable and recyclable is environmentally friendly. The compostable wastes can be used to create fertilizer for the benefit of the community, and in the case of crowded informal communities such as Dharavi, can be sold for a profit. The recyclable wastes will be integrated into the existing Dharavi Recycling Compound. This is a sector of the community and local industry that sells recyclable material (including wood, plastic, scraps, and paper)

to other processing plants in the city. In Dharavi, the residents can make about 14,000 rupees per day depending on the type and weight of material they sell.

Finances I

In order to ensure that this method of waste management remains sanitary, the community is provided with tools. Each household receives two trash bins to collect and separate their trash. Collectors require gloves, masks and carts to properly handle the wastes. An NGO and/or the government would need to jump-start the strategy by providing start-up financing. These resources would be used to purchase the necessary tools. Contributions are minimal: in the specific case of Dharavi, the needed investment would be approximately \$400,000. This would be enough to cover the wastes management needs of the entire one million people community. Residents would need to contribute \$30,000. The residents' fee converts to approximately two rupees per person in the community. This amount is an affordable, one-time fee for each resident of the community.

Human Waste Management

The preferred state will be reached by using two different systems of human waste management—a composting toilet and an anaerobic methane digester—both of which will utilize locally made separation toilets.¹²

As shown above, the toilet has a simple design. It is manufactured locally to stimulate the economy as well as provide for household human waste disposal needs. Decentralized separation toilets will be used to

separate human waste into its separate components of solid fecal matter and urine. This separation is crucial as solid, dry feces and urine (liquids) need to be totally distinct if they are to be processed to make fertilizer. Minimizing the contact of liquids and solids also eliminates the majority of foul odor typically associated with localized latrines.



Figure 3: Locally made urination/defecation separation toilet (household scale)¹³

The small, domed structure is a localized anaerobic methane digester. Essentially, this tank harvests the methane that occurs naturally in human feces to produce energy in the form of heat, electricity, or even cooking fuel.

Finances II

The artifacts needed for implementing this phase of the strategy are compost toilets, methane digesters, carts for transporting solid waste, and dry material to be used in soaking up liquids from the latrines to promote dry composting.¹⁵

It will cost an estimated \$150,000 to install 2,500 toilets in Dharavi. The \$50 cost of manufacturing each toilet stays in Dharavi, as local pottery workers already have the skills and facilities to build such toilets. A \$10 labor cost of installation also is money that goes into the pockets of residents. Thereby the toilets have intrinsic value (sanitation) as well as an extrinsic value (economic stimulus).



Figure 4: Localized (self-sufficient and contained) anaerobic methane digester¹⁴

Long-Term Management

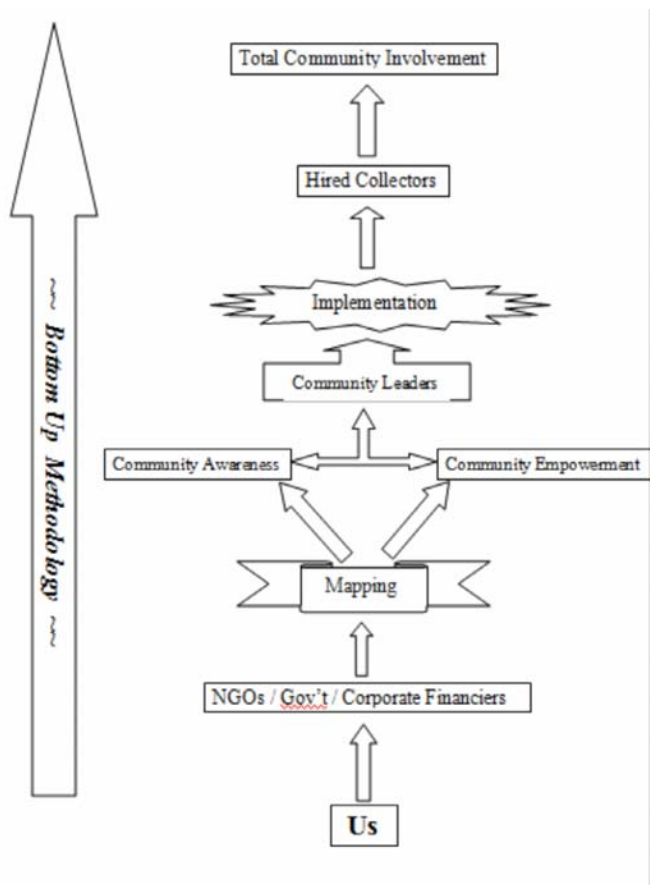
The strategy has been designed so that it continues to be operational for the long term. It supports the community socially, environmentally and economically. It designed to be sustainable, and require little financial support in following years. In order to help the system grow and spread, it needs to develop and adapt to fit the community's needs. The community resource mapping process needs to be regularly updated to detect changes that help better target the community's resources. Outside NGOs need to conduct regular reviews to ensure that the infrastructure has not been subjected to any form of corruption. Through these methods, implemented on a regular basis, the sustainability of the community's newly formed human and domestic waste management infrastructures can be guarded.

Conclusion

Dharavi has incredible potential and valuable resources that are waiting to be better harnessed. It is important to recognize is that our strategy does not impose a strategy on Dharavi residents but rather grows programs and fosters sustainability awareness. The methodology is bottom-up rather than top-down, which, if successful will foster self-reliance and a sustainable enterprise.

With continuous community resource mapping resulting in enhanced community awareness and empowerment, the strategy will be both flexible and powerful. Worldwide, many slums have similar characteristics to those found in Dharavi, thereby making this strategy of use around the planet.

Figure 5: Process Flow Chart



Works Cited

- 08, September. "Where Every Inch Counts." *Los Angeles Times*. Los Angeles Times, 08 Sept. 2008. Web. 17 Sept. 2012. <<http://articles.latimes.com/2008/sep/08/world/fg-dharavi8>>.
- Aroon, Preeti. "Photo Essay: India's Real-World Slumdogs." *Foreign Policy*. Foreign Policy Magazine, 4 Feb. 2009. Web. 17 Sept. 2012. <http://www.foreignpolicy.com/articles/2009/02/03/photo_essay_indias_real_world_slumdogs>.
- "Biogas." *Amm-mcrc.com*. Shri AMM Murugappa Chettiar Research Centre, 15 Mar. 2007. Web. 17 Sept. 2012. <<http://www.amm-mcrc.org/programmes/biotech/Biogas.html>>.
- "Dharavi Redevelopment Project." *Www.sra.gov.in*. Slum Rehabilitation Authority, n.d. Web. 17 Sept. 2012. <<http://www.sra.gov.in/htmlpages/Dharavi.htm>>.
- "Ecosan." *SOIL | Transforming Wastes into Resources in Haiti*. Sustainable Organic Integrated Livelihoods, n.d. Web. 17 Sept. 2012. <<http://www.oursoil.org/>>.
- "FAQ - Composting Toilet World." *FAQ - Composting Toilet World*. Envirolet, 2010. Web. 17 Sept. 2012. <<http://compostingtoilet.org/faq/index.php>>.
- Fulhage, Charles D., Dennis Sievers, and James R. Fischer. "Generating Methane Gas From Manure." *University of Missouri Extension*. University of Missouri, Oct. 1993. Web. 17 Sept. 2012. <<http://extension.missouri.edu/p/G1881>>.
- India. Thenmadurai Vattara Kalanjiam. Congressional Budget Office. *Implementation of Solid Waste Management System in Thideernagar Slum*. Chennai: CBO, 2007. Print.
- Ito, Ryusei, Hiroki Yamazaki, and Naoyuki Funamizu. *DEVELOPMENT OF LOW COST COMPOSTING TOILET FOR DEVELOPING COUNTRIES*. Tech. Hokkaido, Japan: Department of Environmental Engineering, Hokkaido University, 2007. Print.
- Jacobsen, Mark. "Dharavi: Mumbai's Shadow City." *National Geographic Magazine*. National Geographic Society, May 2007. Web. 16 Sept. 2012. <<http://ngm.nationalgeographic.com/2007/05/dharavi-mumbai-slum/jacobson-text/3>>.
- Kamath, Naresh. "More Stumbling Blocks for Dharavi Revamp." *BBC News*. BBC, 27 Jan. 2011. Web. 16 Sept. 2012. <http://news.bbc.co.uk/2/shared/spl/hi/world/06/dharavi_slum/html/dharavi_slum_intro.s tm>.
- "Life in a Slum." *BBC News*. BBC, 15 Aug. 2007. Web. 16 Sept. 2012. <http://news.bbc.co.uk/2/shared/spl/hi/world/06/dharavi_slum/html/dharavi_slum_intro.s tm>.
- "Quick Vital Stats on Dharavi." *Mumbai Matters*. N.p., 31 Aug. 2007. Web. 17 Sept. 2012. <<http://mumbaimatters.bombayaddict.com/2007/08/quick-vital-stats-on-dharavi.html>>.
- Reporting., Jim Yardley; Hari Kumar Contributed. "INDIA'S WAY; In One Slum, Misery, Work, Politics and Hope." *The New York Times*. The New York Times, 29 Dec. 2011. Web. 17 Sept. 2012. <http://www.nytimes.com/2011/12/29/world/asia/in-indian-slum-misery-work-politics-and-hope.html?_r=2>.
- Seale, Shelley. "How the Other Half Lives." *Worldpress.org*. Worldpress.org, 21 June 2007. Web. 16 Sept. 2012. <<http://www.worldpress.org/Asia/2831.cfm>>.
- "Twenty-First Session of the Governing Council Programme." *UN Habitat*. UN

Habitat Features, Apr. 2007. Web. 16 Sept. 2012. <<http://www.unhabitat.org/>>.

Endnotes

- 1 "Twenty-First Session of the Governing Council Programme." *UN Habitat*. UN Habitat Features, Apr. 2007. Web. 16 Sept. 2012. <<http://www.unhabitat.org/>>.
- 2 Aroon, Preeti. "Photo Essay: India's Real-World Slumdogs." *Foreign Policy*. Foreign Policy Magazine, 4 Feb. 2009. Web. 17 Sept. 2012. <http://www.foreignpolicy.com/articles/2009/02/03/photo_essay_indias_real_world_slumdogs>.
- 3 Kamath, Naresh. "More Stumbling Blocks for Dharavi Revamp." *BBC News*. BBC, 27 Jan. 2011. Web. 16 Sept. 2012. <http://news.bbc.co.uk/2/shared/spl/hi/world/06/dharavi_slum/html/dharavi_slum_intro.stm>.
- 4 Jacobsen, Mark. "Dharavi: Mumbai's Shadow City." *National Geographic Magazine*. National Geographic Society, May 2007. Web. 16 Sept. 2012. <<http://ngm.nationalgeographic.com/2007/05/dharavi-mumbai-slum/jacobson-text/3>>.
- 5 Image courtesy of Google Maps
- 6 "Life in a Slum." *BBC News*. BBC, 15 Aug. 2007. Web. 16 Sept. 2012. <http://news.bbc.co.uk/2/shared/spl/hi/world/06/dharavi_slum/html/dharavi_slum_intro.stm>.
- 7 708, September. "Where Every Inch Counts." *Los Angeles Times*. Los Angeles Times, 08 Sept. 2008. Web. 17 Sept. 2012. <<http://articles.latimes.com/2008/sep/08/world/fg-dharavi8>>.
- 8 Reporting., Jim Yardley; Hari Kumar Contributed. "INDIA'S WAY; In One Slum, Misery, Work, Politics and Hope." *The New York Times*. The New York Times, 29 Dec. 2011. Web. 17 Sept. 2012. <http://www.nytimes.com/2011/12/29/world/asia/in-indian-slum-misery-work-politics-and-hope.html?_r=2>.
- 9 Jacobsen, Mark. "Dharavi: Mumbai's Shadow City." *National Geographic Magazine*. National Geographic Society, May 2007. Web. 16 Sept. 2012. <<http://ngm.nationalgeographic.com/2007/05/dharavi-mumbai-slum/jacobson-text/3>>.
- 10 India. Thenmadurai Vattara Kalanjiam. Congressional Budget Office. *Implementation of Solid Waste Management System in Thideernagar Slum*. Chennai: CBO, 2007. Print.
- 11 Seale, Shelley. "How the Other Half Lives." *Worldpress.org*. Worldpress.org, 21 June 2007. Web. 16 Sept. 2012. <<http://www.worldpress.org/Asia/2831.cfm>>.
- 12 "Ecosan." *SOIL | Transforming Wastes into Resources in Haiti*. Sustainable Organic Integrated Livelihoods, n.d. Web. 17 Sept. 2012. <<http://www.oursoil.org/>>.
- 13 Photo Courtesy of Flickr.com
- 14 "Biogas." *Amm-mcrrc.com*. Shri AMM Murugappa Chettiar Research Centre, 15 Mar. 2007. Web. 17 Sept. 2012. <<http://www.amm-mcrrc.org/programmes/biotech/Biogas.html>>.
- 15 "FAQ - Composting Toilet World." *FAQ - Composting Toilet World*. Envirolet, 2010. Web. 17 Sept. 2012. <<http://compostingtoilet.org/faq/index.php>>.



STRATEGIC AREA III

GOVERNANCE

15. Subsidy Reduction

16. Land Reform: This Land is Our Land

17. Microfinance: Meeting the Demand

18. Food for Thought

15. SUBSIDY REDUCTION

By Sidharth Shah

Strategic Summary: Increase food production, employment and wealth in developing regions through reducing subsidies to developed countries' farmers. Make developed countries' food systems stronger by removing subsidies.

Introduction

International trade has enormous potential for reducing global poverty. For example, a 1% increase in the developing countries' share of world exports would lift 128 million people out of poverty.²⁹ The current global trading system discriminates against developing countries and hinders poor country participation in the global economy. Two of the biggest problems are agricultural subsidies in rich countries and lack of access by poor countries to international markets.

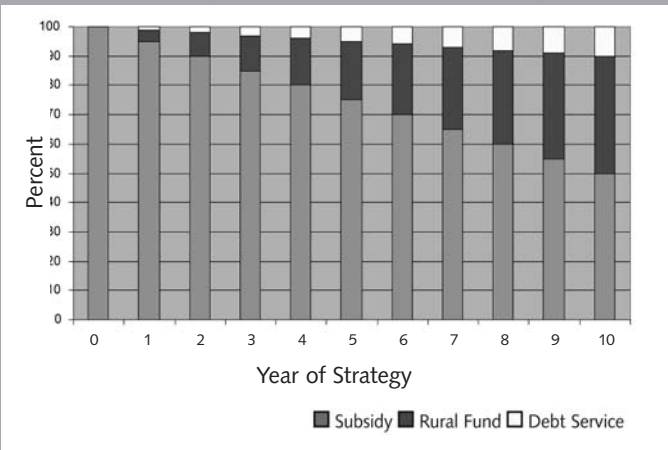
Agricultural subsidies are government payments or financial benefits (e.g. tax breaks) to farmers. Subsidies reduce the marginal cost of producing a crop for a farmer. Farmers therefore produce more crops and sell them at a lower price than without the subsidy. The lower price means that crops imported from poor states at the world market price cannot compete with the cheaper subsidized products in developed countries. Subsidized farmers produce more than the economically efficient quantity. They also often sell the surplus crop at cheap rates to other countries, a practice known as dumping. This means local farmers are able to sell fewer crops. Agricultural subsidies in wealthy states therefore have an adverse effect on the livelihood of farmers in developing countries as well as on the economy of these countries and, because the subsidies can put local farmers out of business, on the long term viability of local food systems.

The Extent of Agricultural Subsidies

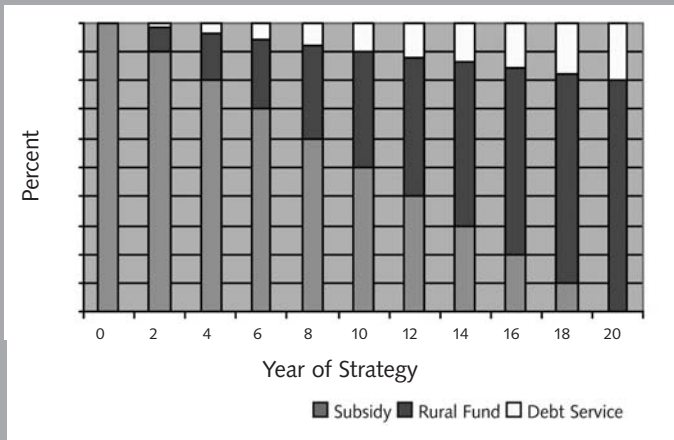
Some brief statistics on farm subsidies:

- In 2003, the US subsidized agriculture by almost \$40 billion³⁰; major subsidies went to cotton: \$3.9 billion in 2002³¹
- European Common Agricultural Policy (CAP) provided \$138 billion subsidies in 2003³²; \$9.7 billion EU sugar subsidies annually³³
- US exports cotton at 65% below production cost; EU exports

Decreasing Subsidies Over 10 years



Decreasing Subsidies Over 20 years



sugar at 44% below normal market value³⁴

- Approximate negative effect of U.S cotton subsidies in 2001–2002 on the GDP of selected African cotton producers³⁵:
 - Burkina Faso—\$145 million
 - Mali—\$179 million
 - Benin—\$108 million

Goal

Halve the \$40 billion American and \$138 billion EU farm subsidies by 2015. Special emphasis should be placed on American cotton subsidies and EU sugar subsidies as these have the largest adverse effect on farmers in poor countries.

Strategy

The strategy requires a gradual diversion of money that is currently used for subsidies towards other forms of investment in rural communities in developed countries. Some money could also be used towards payments on national debt. Eighty percent would go back to farming communities and 20% would go towards debt payments.

Each year, less money is allocated as an agricultural subsidy and more towards investment in farm communities or debt payments. The objective is to demonstrate to farmers in developed countries that despite cutting subsidies, their government is committed to supporting rural communities. It should be explicitly advertised that money is not being taken away from citizens; rather, rural communities are being given the opportunity to reallocate funds towards other local needs. This will weaken the appeal of pro-subsidy groups as well as reducing public hostility towards freer trade in agriculture. Additionally, this program should alleviate some of the political “damage” that politicians are afraid of enduring if they cut subsidies, thereby encouraging more legislative decisiveness in reducing farm welfare.

The central government will lead this program, but local administrative authorities, including farmers’ councils, should be able to choose how to spend the redirected money allotted to a particular district. However, the central government should impose basic controls on how the money is spent to ensure that it is not used to directly or indirectly subsidize farming operations. For example, acceptable uses for the money could be to buy computers for local schools or to improve roads.

With the domestic political situation under control, the US and the EU should use the institutional framework of the WTO to multilaterally and simultaneously roll back subsidies. This would entail closing the various loopholes that allow for significant exemptions to anti-subsidy laws, such as the *de minimis* clause in the 1994 Agreement on Agriculture.³⁶

Costs

- Initial* Zero, as current government spending is simply being redirected
- Running* A negligible sum that will be used to administer rural funds for redirected money
- Sources* A combination of central and local governments

Results

The halving of subsidies will mean that poor countries can sell their agricultural products on the world market at a fairer price. This will increase their GDP and the income of their farmers. This, in turn, will facilitate a long-term reduction in hunger, as more people will have the financial resources to buy food. The strategy will reduce the debt of the US and the EU. The reduction in subsidies will also force farms in developed countries to be more efficient in the crops they plant (they can only plant those in which they have a comparative advantage). A major non-tangible benefit is that farmers in developing countries will develop a sense of income security as their crops will have clear access to foreign markets.



16. LAND REFORM: THIS LAND IS OUR LAND

By Kristina Mader

Strategic Summary: Increase food production and economic well being by increasing access to land ownership in developing countries.

Introduction

It is vital for the rural and urban poor to own land in order to help them confront the challenges of the 21st century. Not only do property rights and access to land provide economic and social support for the rural and urban poor, but efficient and equitable laws are a key factor in allowing a country's citizens to experience a sense of security. This, in turn, helps increase production and standards of living.

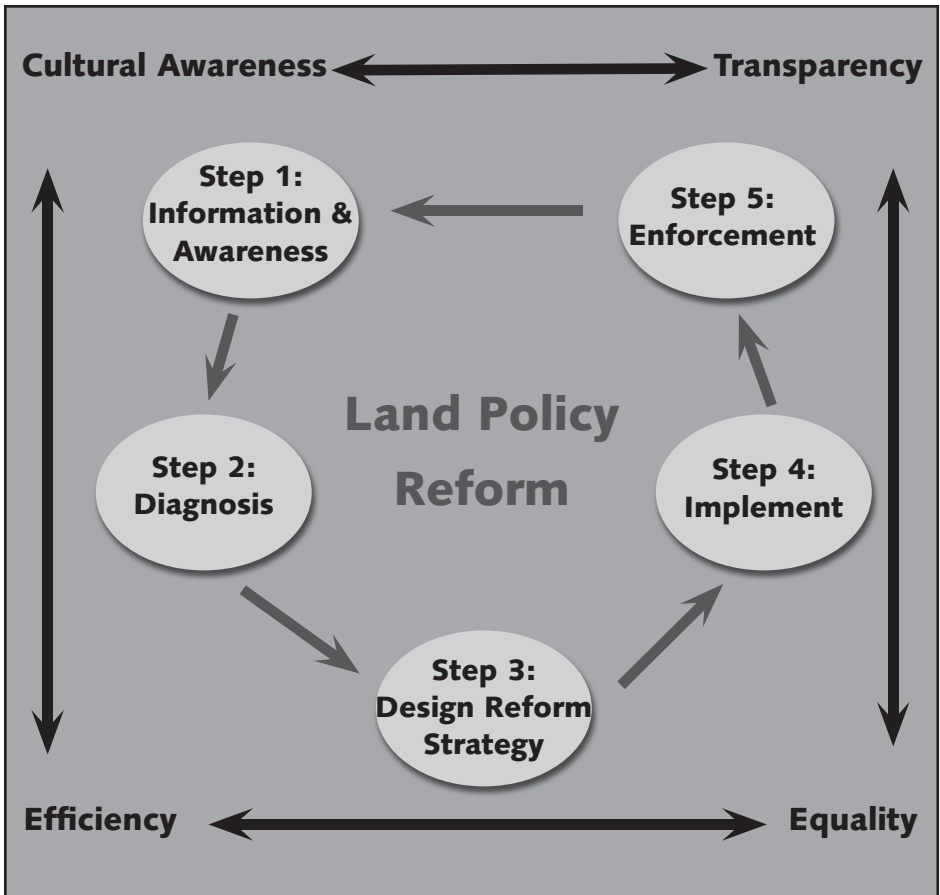
A surprising number of people informally occupy land that technically or legally does not belong to them. This lack of land ownership undermines access to credit and other economic services. Having ownership of the land your family lives and works on is vital for economic security as well as social vitality.

Strategy: Land Policy Reform

Existing government land policies need to be transformed in many developing parts of the world. To facilitate this change, a new NGO, called the *Our Land* organization, would be funded at a scale that would enable it to undertake the changing of government land policy and to enforce existing policies so as to implement more equitable access to land.

This Land Policy Reform plan will take place over the next 10 years. The Our Land NGO would be funded from grants and partnerships with other organizations, as well as corporations. The Our Land organization would coordinate with governments at national and local levels to develop equitable, transparent, efficient, and culturally sensitive policies relating to land tenure. The success of these policies will be measured by the number of registration and ownership claims to land, as well as the increase in land value, which is a result of titling land.

The following is an explanation of the chart above. All the steps are overlapping.



Step 1: Awareness and Information

This step is mostly informational. It includes making an economical case to governments that illustrates the benefits of land reform to everyone in their society. It would include how the plan should be implemented, its costs, and how it will benefit both the poorest people in the country as well as the entire society. This aspect of the program has four key issues: cultural awareness, efficiency, equality, and transparency.

Step 2: Diagnosis

This step analyzes data and discovers the problems and inequalities in the current land system in each country. Included in this step is collection of data on current ownership of land, both legally owned and extra-

legally “owned,” as well as accurate border maps. Environmental and geographic issues are identified, as well as any economic, cultural, and religious impacts on the system.

It is important to look at the historical reasons for the current land reform system but not to get bogged down in blaming people. Recognizing that there are historical inequalities and attempting to fix them in the present is key to being able to diagnose the country’s problems using a transparent process and to target them efficiently.

Step 3: Design Land Reform Strategy

Step 3 is to be completed within two years of starting the diagnosis process. The reforms created in this step shouldn’t necessarily completely overhaul current policies, but should reform problem areas, paying special attention to equality in distributive, inheritance, and ownership rights. Traditionally underrepresented groups, such as women, indigenous people, and the poor should be included equally. A process to collect and update land data, such as borders, ownership, etc. should be designed. This benefits the country as a whole, but also specifically this strategy, because it creates a base of information to use for enforcement. It is vital that this plan not be corrupted and care should be taken to maintain transparency through public access.

The process created to gain ownership must be cheap and fast, therefore encouraging the acquisition of rights. Local access should be emphasized for many reasons. Jobs created within the new sector will benefit the local economy. In addition, if the data is easily accessible to all, there will be a higher level of participation in rural areas which are key to the success of the program.

It is also important to remember to account for extra-legal land. Care must be taken so as not to punish current owners of illegal property, thereby discouraging legal registration. In this step, the strategy should also take into consideration any environmental, transportation, technological, educational, and communication reforms that need to be made so as to make this plan conducive to the country’s overall development.

Step 4: Implementation

This step is carried out by specific countries’ governments with the help of the Our Land NGO plus other civil society organizations that worked with the government from step one. This step will work only if effort is made by the country’s citizens and lawmakers to create or reform land laws.

In implementing the reforms, rural organizations and governments must be included. This will require better communication and transportation between organizations and regions. Most importantly, the implementation process must be culturally sensitive to each country's unique religious, ethnic, and cultural makeup.

Step 5: Enforcement

In the final step, followup of the progress of the reforms is ongoing. It signals the end of one stage of reform and the beginning of the next. Local agencies and organizations need to be made part of a mechanism that will allow reports of misuse or illegal acts regarding the new land policies. Whether the existing judicial infrastructure is used, or a new system is created, it is important that the process be transparent so as to allow the reforms to be their most effective.

Cost

The cost for this strategy varies widely from country to country, depending on how it is organized and the amount of reform necessary. The amount that current landowners are compensated will be the largest expense. This could be funded from the general budget or from a special tax on the revenues produced by the new owners of the land. If this strategy is integrated into the legislative agendas of each country, then the cost will be minimal, but the benefit to the government and its citizens from having millions of additional legal landowners will be immeasurable.

Conclusion

Through the hard work and dedication of those within each country, land ownership and use laws can be reformed. Ownership of land has proven to be an effective way to increase the economic well being of impoverished citizens in many areas around the world and will contribute to reaching the UN Millennium Development Goal of halving poverty by 2015.

17. MICROFINANCE: MEETING THE DEMAND

By Meredith Aach

Strategic Summary: Increase availability of credit to new entrepreneurs; meeting the need for microfinance. Making small-scale loans available by greatly expanding resources of existing microfinance institutions.

Introduction

The demand for microfinance has not been met due to the non-profit sector's lack of resources to finance it. Currently, it is estimated that 95% of the people who could use microfinance are not able to take advantage of this engine of economic development. Money allocated from the donor community to microfinance institutions around the world cannot fund enough loans to make a difference at the scale needed to radically improve the economic well being of the poorest segments of the global economy.

To meet this demand, the microfinancial system needs to be supported by for-profit institutions. The combination of investment from the for-profit community would be directed towards providing funds to offer credit and savings options to the economically active poor. The rest of the money given to these institutions by the donor community would be directed towards the extremely poor in terms of services (training and education).

One critique of microfinance claims that microfinance does not meet the credit needs of the poorest of the poor. This is because the extremely poor cannot take out a loan. It is generally believed that if these people were given a loan without any training or education, the loan might be spent on consumption. With more resources from the for-profit community to meet the demand for credit of the economically active poor, more funds could be made available for pre-loan services to those who cannot take out a loan.

Microfinance has proven to be one of the more efficient tools in the "toolbox" of development. It allows individuals and families in poverty to access financial services such as credit, savings, and insurance, which they would not have been able to do in a regular commercial bank because they generally lack collateral. With the met demand for

microfinance being only about 5%, more innovative ways must be implemented to meet the demand for microfinance.

Goal

Expand microfinancial resources by at least an order of magnitude and encourage investment into existing microfinance institutions in order to meet the global demand for microfinance.

Strategy

Because the great demand for microfinance has not been met, microfinancial institutions need more resources to offer loans, services, and improve their present infrastructure. In order to do this, these institutions need to become sustainable institutions that can meet their costs (without support from NGOs, governments, or other donor agencies) through the efficiency of their financial transactions.

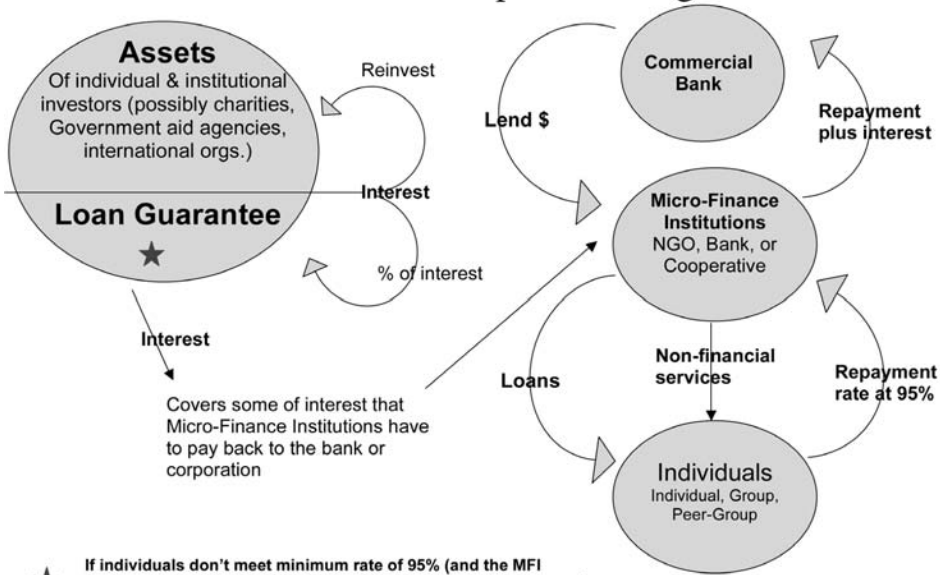
Many for-profit institutions feel the return is not high enough to loan out to so-called “high-risk” clients because they are poor. In fact, they have higher repayment rates than most clients in developed countries, especially in times of crisis. To increase incentives for microfinance, the strategy calls for:

- Increased transparency for all government and corporate transactions.
- Standardized financial reporting across all industries.
- Reduced transaction costs. Transaction costs of providing credit to the poor can be high due to the fact that there are many loans and they are small. Certain innovations, like a personal digital assistant (PDA) that is shared among microfinancial workers, can decrease these costs.
- Global information exchange for the microfinance industry.
- Reliable information marketplace to facilitate exchange of quality data. This will enable corporations to feel confident that they are getting true costs of transactions and repayment rates so they can decide whether their investments are profitable.
- Increased percent of financial expertise in the microfinance institutions. A large percentage of workers who work personally with clients is necessary because these workers increase social impact.
- Increased incentives for the commercial lending institutions to invest in microfinance (see chart). If commercial banks were

guaranteed money if repayments rate were not up to “par,” there would be little to no down-side for these institutions to invest. Even though commercial banks are focused on increasing shareholder value and returns on investment, improving their social image and the value of their brand will serve to help the company in the long-run.

Much of the current money for microfinance institutions comes from donor agencies, NGOs, and governments. If commercial banks and for-profit institutions invested money in microfinance institutions (which is becoming more widespread through socially responsible investing), resources of microfinancial institutions would increase substantially. The money invested in these institutions from for-profit institutions could be directed towards providing credit, savings, and insurance for the poor, while money donated from the non-profit community can be used for services like training and education.

The Microfinance Expansion Program



18. FOOD FOR THOUGHT

By Milly Barolette and Jennifer Bodenstab

Strategic Summary: Increase food availability and decrease malnutrition in every food short region of the world by instituting school lunch programs; expand markets for local farmers while increasing school attendance, enrollment, and health of students.

Introduction

Over 100 million school-age children do not attend school in the developing world. Many of these children are forced to drop out to earn money for their families so that food can be purchased. Some drop out because there is not enough food for them to eat, and attending school on an empty stomach is not viable.

Strategy

Feeding students while they are at school through a school lunch program will solve a number of problems as well as increase the capacity and well-being of the local economy. Students will be healthier as well as better students as they will not be distracted by hunger. Parents will have a strong incentive to send their children to school and the students will have an equally strong incentive to stay. In addition, local farmers and the local economy will benefit as farmers gain access to a reliable and steady market. The income they receive will cycle through the local economy as they purchase products with their new wealth.

Instituting school lunch programs in every school in food short regions of the world will go a long way towards eliminating hunger. This action will provide an important stimulus to the expansion of local commercial food markets by providing local farmers with an assured market for some of their crops, as well as improving the nutritional well-being of students. Markets for surplus crops are essential for providing incentives for local farmers to increase production. The added income from these markets will help reduce the level of poverty in rural regions and increase the capacity for further wealth generation. In addition to a school lunch program, hospitals, restaurants, and government offices could purchase additional surplus crops produced by local farmers. Such programs should have incentives so that small farmers have a competitive advantage in this budding market.





PART II

CLEAN ENERGY FOR ALL

CONTEXT / STATE OF THE WORLD ENERGY SYSTEM OVERVIEW AND PROBLEM STATE



The global energy system is characterized by the following:

- 6.8 billion people do not have access to an abundant, secure, clean, affordable, sustainable, energy supply
- 1.6 billion people do not have access to electricity, and 67% of these live in rural areas⁴
 - Because the majority of the people who do not have access to electricity live in remote areas far from urban areas, connections to national grids to supply electricity are not the most practical or feasible way of providing access
- The current energy system pollutes the air, land, and water systems of the world
- Indoor air pollution kills 1.6 million people every year (four times the number of American deaths in WWII)
- 3 billion people are at risk from indoor stoves that burn biomass fuels⁵ (WHO ranks indoor air pollution 8th among all environmental risks to human health). Women responsible for cooking and young children are most vulnerable
- Inefficient biomass fuels used for indoor stoves result in massive deforestation and cost families much of their income
- Having a clear vision of how things should be is essential for achieving that state. Having specific and measurable goals for the global energy system is critical for making those goals real.

Global Energy System Preferred State

The Design Science Lab's Energy Preferred State was developed from the values of the Lab's participants.

By 2030

20 years from the present, 100% of humanity has access to fuel, electricity, and energy-related technologies that are:

- Sustainable
- Clean
- Ever-increasingly efficient
- Appropriately matched to local needs
- Affordable
- Abundant
- Reliable
- Adaptable
- Flexible
- Transparent
- Safe
- Secure
- Health promoting

The following are the major components of that vision:

- 100% of humanity's energy needs are met with safe, abundant, affordable energy supplies
- The production of energy is done in environmentally regenerative ways
- There is an ever increasing diversity of energy choices
- There is an ever increasing resource efficient energy system that is knowledge, rather than energy and materials, intensive
- There is ever increasing local self-reliance and global interdependence of our energy systems and sources
- National and local energy systems are subsidy-free and open-market based
- There are emergency backup systems and anticipatory crisis management systems in place
- Local and global energy systems are adaptable, flexible, and transparent
- Local and global energy systems are conflict free; energy is never used as a weapon or bargaining chip
- The global commons are managed for global wellbeing, not national, local or individual gain.

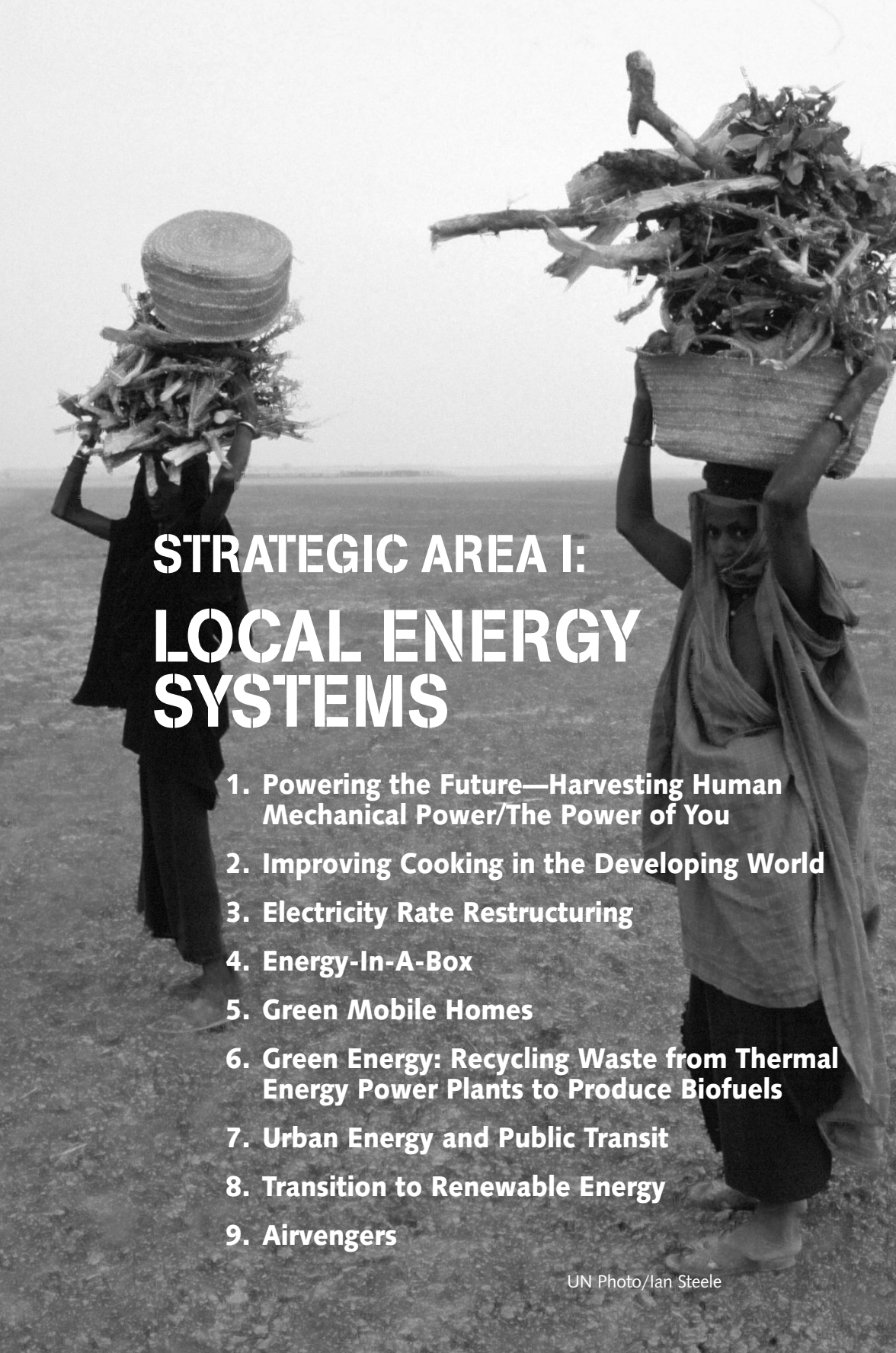
The strategies that follow this section were designed to achieve the Millennium Development Goals by 2015 and the above Preferred State by 2030.

GLOBAL ENERGY STRATEGIES

**Millennium Development Goal:
Cut Energy Shortages by 50% by 2015**

**Design Science Lab Preferred State:
Eradicate* Energy Shortages completely
by 2030**

*Target: Reduce to zero, between 2010 and 2030, the number of people who suffer from energy shortages

A black and white photograph of two women in a dry, open landscape. They are carrying large, woven baskets filled with biomass (sticks, branches, and leaves) on their heads. The woman on the left is wearing a dark dress, and the woman on the right is wearing a light-colored sari. The background is a flat, open field under a bright sky.

STRATEGIC AREA I: LOCAL ENERGY SYSTEMS

- 1. Powering the Future—Harvesting Human Mechanical Power/The Power of You**
- 2. Improving Cooking in the Developing World**
- 3. Electricity Rate Restructuring**
- 4. Energy-In-A-Box**
- 5. Green Mobile Homes**
- 6. Green Energy: Recycling Waste from Thermal Energy Power Plants to Produce Biofuels**
- 7. Urban Energy and Public Transit**
- 8. Transition to Renewable Energy**
- 9. Airvengers**

"The green revolution is about how we produce abundant, cheap, clean, reliable electrons, which are the answer to the big problems we face in the world today. I would point to five problems, and they're all related: Energy and resource supply and demand, petrodicatorship, climate change, biodiversity loss, and energy poverty. They all have one solution: abundant, cheap, clean, reliable electrons. The search for and the discovery of a source of those electrons is going to be the next great global industry. And I think the country that mounts a revolution to be the leader of that industry is going to be a country whose standard of living is going to improve, whose respect in the world is going to improve, whose air is going to improve, whose innovation is going to improve, and whose national security is going to improve."

—Thomas Friedman

"If you don't have a system, you don't have a solution. Only a system will allow ordinary people to do extraordinary things. And if ordinary people can't do extraordinary things, we have no chance to achieve the scale we need to address this problem."

—Thomas
Friedman



Teleconference
briefing by UN
officials.

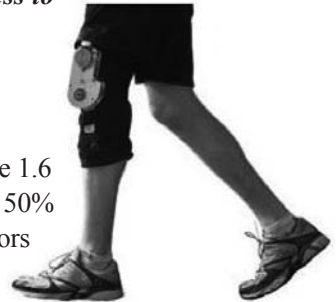
1. POWERING THE FUTURE: HARVESTING HUMAN MECHANICAL POWER/ THE POWER OF YOU

By Komal Patel

Strategic Summary: The human body has the capacity to generate useful amounts of energy in non-coercive, sustainable, and non-exhausting ways. Recent technology harnesses this power in ways that produce significant amounts of electricity that can power lighting and communications devices in areas of the world currently without any other reliable electricity supplies. This strategy shows that making high-tech devices that harvest human mechanical energy available to those who lack access to electricity holds enormous promise for meeting the electrical needs of individuals and families. Furthering development in rural areas by combining human energy harvesting and micro-finance techniques will increase the access to this form of electricity production.

Introduction

People living in rural areas constitute nearly 80% of the 1.6 billion people without electricity in the world, and over 50% of these are small subsistence farmers.⁶ Limiting factors for energy access and production for these people include no access to a national grid, little access to credit to put in place appropriate energy infrastructure, and lack of access to affordable energy supplies. *The Human Power: Electricity from Human Action Program* proposes a creative strategy centered on some revolutionary new technology that harnesses the power of the human body.



Strategy

Decentralized methods of providing rural peoples with electricity need to be developed and implemented to improve the standard of living for rural people by providing them with a greater opportunity for

communication and productivity. One method of providing decentralized power to rural populations is to make available to them new technologies that harvest energy from human mechanical power that can then be used to power radios, flashlights, lights for home illumination during the night or to charge cell phones.

Biomechanical Energy Harvester

One of the newest technologies that captures energy from human mechanical power is a knee brace that converts power from muscles into electrical energy while a person walks.⁷ The device uses a mechanism similar to that used by hybrid cars that recharge their batteries when the brakes are applied to the car.

The knee brace, called the *Biomechanical Energy Harvester*, was developed by scientists and weighs three and a half pounds. It generates up to 13 watts of power from each leg without requiring any additional human effort. Enough energy to power a cell phone for 30 minutes of talk time is generated for every minute of walking.⁸ Current estimates for the cost of the knee brace power pack are approximately \$1,000. It is estimated that with further development and mass production the price of the product will be able to be reduced to a more affordable rate that would make it a viable solution to providing electricity in rural areas.⁹ Additionally, the knee-brace is easily

The *Pull-Cord Generator* weighs 14 oz. and has an average power output of 30 watts

would also promote healthy living, as it is a means of exercise.

Adaptations of the *Biomechanical Energy Harvester* might also be developed for cattle and other animals, thereby greatly expanding the power available to rural families.

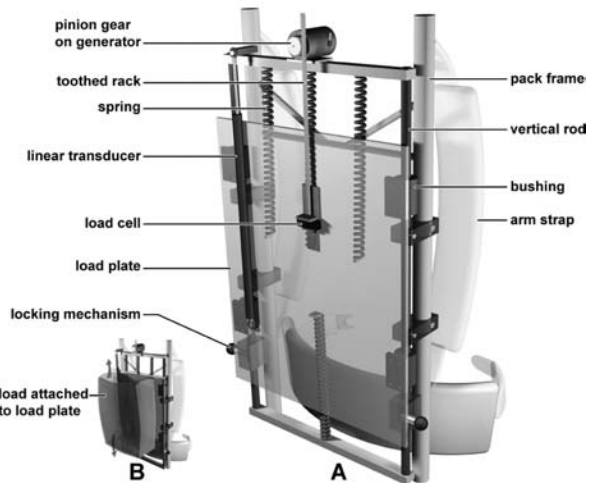


Pull-Cord Generator

Another piece of newly developed technology is the *Pull-Cord Generator* developed by Potenco Inc. The *Pull-Cord Generator* is a device that weighs 14 oz., has an average power output of 30 watts, and can produce enough energy to power a cell phone for 20 minutes of talk time, an iPod shuffle for 4 hours, or an hour of ultrabright-LED flashlight use with one minute of use.¹⁰ The device produces energy in a similar manner to hand-crank generators, but is much more efficient, compact, and portable.

The *Pull-Cord Generator* is not yet available on the market (as of late 2008) but field research is being done by introducing the product to rural communities in parts of Bangladesh, India, Africa, and Brazil.¹¹ Potenco plans on partnering with the One Laptop Per Child program by providing a *Pull-Cord Generator* with each laptop so that children have a way to recharge their computers.¹²

The cost of the Pull Cord Generator is estimated to be between \$3 and \$5.



Suspended-Load Backpack

Another prospect for harvesting human mechanical energy is the *Suspended-Load Backpack* that generates power from the vertical oscillation of the pack that occurs while the person wearing it walks. Currently, the *Suspended-Load Backpack* requires loads between 40 and 80 pounds to generate a significant amount of energy and the marketing for these products is focused on soldiers and hikers.¹³ With further development, the *Suspended-Load Backpack* could be adapted to meet the needs of women in rural communities who carry their small children on their backs. If the *Suspended-Load Backpack* could generate power with lighter weight loads and a safe carrier for children

Baby carried on mother's back at the market in Chichicastenango, Guatemala, in a traditional backpack/sling.



were created, rural women could produce electricity while carrying their children on their backs as they walk to perform their daily chores such as fetching firewood and water and walking to the market place.

MicroPower MicroLoan

In order to finance a project to give people in rural parts of developing nations access to devices that harvest human mechanical energy, a micro-finance scheme similar to that of the Grameen Bank in Bangladesh could be established to work specifically with the proposed technology. The basic framework of the *MicroPower MicroLoan* institution would be that small loans would be made to individuals in rural communities so that they could purchase either a *Biomechanical Energy Harvester* or *Pull-Cord Generator*. The individual who buys the device can then start a business by renting out the device to other members in the community who may need to harvest electricity to power their cell phones or the lighting in their homes. The income earned through the rental business would then be used to pay off the loan and additional earnings are kept as profits for the individual and their family, leading to an increased standard of living and development within the community.

Human Power: Electricity from Human Action

Financial Summary

Investment needed to reach ten million families with mass produced Pull-Cord Generator per year for ten years:

COSTS

YEAR 1

Startup funding:	\$10,000,000
Product (1 million units @ \$5 each):	\$5,000,000
Business management/delivery logistics:	\$1,000,000

YEARS 2–10

Product (10 million units/year @ \$3 each):	\$30,000,000/year
Management/delivery logistics:	\$2,000,000/year

INCOME

YEAR 1

1 million units sold @ \$6.00 each: \$6,000,000

YEARS 2–10

10 million units sold @ \$4.00 each: \$40,000,000/year

Measurable Positive Results

After ten years, nearly 100 million families, approximately 500 million people, will have access to electricity for small-scale lighting, communication devices and battery recharging.

Conclusion

The *Human Power: Electricity from Human Action* strategy is an economically feasible way to directly target the energy needs of reaching the Millennium Development Goals. It is a locally and globally viable strategy that is affordable and scalable. It can play an important part in reaching a future global preferred global energy system.



2. IMPROVING COOKING IN THE DEVELOPING WORLD: A BLUEPRINT FOR A NEW COTTAGE INDUSTRY

By Kit Cali, Lauren Horneffer, Bartolomeo Misana, Michael Turri

Strategic Summary: One form of energy use that directly impacts the quality of life for everyone in the world is the energy we use to cook our food. In many parts of the developing world, the use of biomaterials such as wood and dung has large negative impacts on the health of families and the environment. There are current technologies that can replace

existing inefficient and dangerously polluting cook stoves while also creating local industry and employment. This strategy shows how this can be done in three phases, leading to improved health, increased productivity and sustainable economic development.



Present State

Indoor air pollution kills 1.6 million people every year, primarily in the poorer parts of the developing world. There are more deaths each year from this cause than from AIDS. Three billion people are at risk from using biomass fuels in their indoor cooking stoves. In addition, the use of inefficient biomass fuels result in massive deforestation and cost families much of their time, income and health.

Many women and girls spend hours searching for firewood—which in some parts of the world exposes them to harassment, attack, rape or murder. There is also seriously damaging denudation of trees and other vegetation cover, which can, and has, led to soil erosion and desertification. And the problem is getting more serious as more

biomass is used for fuel, out stripping the environment's capacity for renewal, thereby leading to environmental destruction and longer and longer times to collect the firewood needed to cook food.

Overuse of biomass fuels for cooking also result in decreased animal grazing land; dry, dusty winds; and increased CO₂ emissions.

Preferred State

The Preferred State for developing country cooking stoves is a system that provides a convenient, affordable, clean, safe and easy way of cooking food in ways that are culturally appropriate and not damaging to the environment. For this to happen, the fuel source for cooking needs to be abundant, inexpensive, and usable by an efficient technology that is affordable. In addition, the preferred state for developing country cooking systems needs to be one that helps stop and then reverse desertification, does not increase the amount of CO₂ in the atmosphere nor produce indoor air pollution.

Strategy

East-African Cooking Technology¹⁴

One technology that meets most of the above criteria, and would be a good transition to a solution that meets all the design goals of our preferred state, is the ceramic-metal jiko stove.

At the moment, 80% of urban families in East Africa use a traditional metal "jiko" charcoal stove. In rural families, 90% use a three-stone fireplace and wood stove. It is this technology that is doing the most damage to the most people's health and the surrounding environment.

The burning of wood is used for cooking, light and heat by 96% of the families in rural Tanzania, 90% of the families in rural Uganda, and 80% of the families in rural Kenya. An improved ceramic-metal jiko stove could reach all the families in these regions (and else where). One such stove is currently in limited use. Our strategy seeks to scale up and make its use pervasive.

Improved Ceramic-Metal Jiko¹⁵

This stove features an intuitive design derived from the familiar metal jiko. A single pot rests directly on the stovetop.

The familiarity of the design will help insure its rapid adoption. The stove features an hourglass-shaped cladding manufactured locally from scrap metal and a perforated interior ceramic liner.

There is also a larger version—an institutional Jiko that incorporates a thin, insulating layer and a self-contained ash collection box.

Advantages of the ceramic-metal Jiko¹⁶

- Reduces charcoal use by 40%
- 50% more efficient
- Safer
- Affordable: domestic jiko sells for \$1–\$3 USD (Fuel cost savings pay for jiko in two to three months)
- Fosters local economic growth (It can be fabricated locally from scrap and renewable materials— the ceramic parts can be made from readily available clay)
- Decreases cooking time (Boils water faster for longer)
- Durable; Lightweight: (3kg–6kg)
- High adoption rate: there are already 150,000 current users

Health benefits of the ceramic-metal Jiko

- Brings CO levels within WHO guidelines
- Substantially lowers airborne particulate matter

Environmental benefits

- Current users save 5,000 hectares of forest per year
- 100,000 tons of CO₂ emissions per year averted

Blueprint of a New Cottage Industry

There are four phases in our strategic plan for the development of a sustainable Ceramic-Metal Jiko stove cottage industry.

Phase 1: Increase Ceramic Jiko Adoption

Phase 1 introduces biomass briquettes to the target markets as a superior fuel source to the traditional use of gathered firewood. These biomass briquettes use agricultural and/or paper waste as feedstock. The resulting product is cheaper and cleaner burning. Its use will reduce deforestation.

The biomass briquettes burn 75% hotter than charcoal and are therefore more efficient and require less fuel. Two briquettes per

Traditional three-stone fireplace cooking

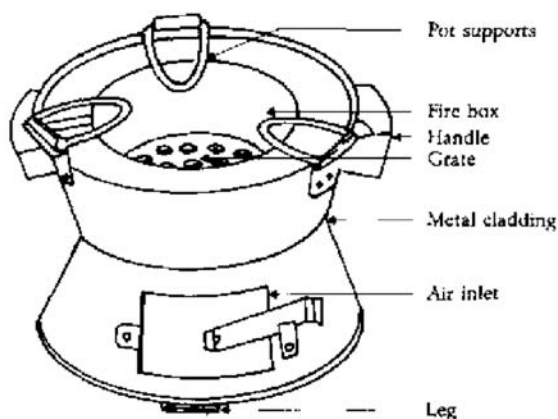


Above: Ceramic Jiko;
Above right: Ceramic-Metal Jiko;
Right: Old style metal Jiko



Production of
Ceramic-Metal Jiko

Ceramic-Metal Jiko



person (250g briquette vs. 1.2kg charcoal) per day is needed to cook the average family's meals. Replacing charcoal and gathered wood with biomass briquettes will lead to the growth of a new cottage industry.



New Briquette Industry



The new cottage industry would be organized around the production of the biomass briquettes. Presses made from very simple, local parts are used for this operation. The basic fabrication process is clean and uses free or low-cost and renewable raw materials. A six-person team operates a single biomass briquette press. Such a press typically produces 750 to 1,000 briquettes per day—the amount needed to supply the daily fuel needs for 375 to 500 people.

Biomass Briquettes

Phase 2: Box-Type Solar Cooker

Phase 2 of the strategy features the introduction and widespread adoption of a box-type solar cooker. These solar cookers would supplement or replace the biomass briquette burning Ceramic-Metal Jikos when the sun was shining. This would reduce the emissions of CO₂ from the use of biomass briquettes.

The box-type solar cooker could be easily fabricated from jiko materials. It can easily reach 150°C (300°F) and so is therefore hot enough to cook any food. It is safe, and can allow unsupervised cooking, thereby allowing the food preparer to do other activities. The solar cooker requires minimal training to make it work effectively, can be used by a family or business, and can be used to pasteurize water or milk. And in combination with a Jiko stove, a family would be able to cook when the sun is not available, such as in the early morning, night, or when it is raining.

Phase 3: Scheffler Reflectors

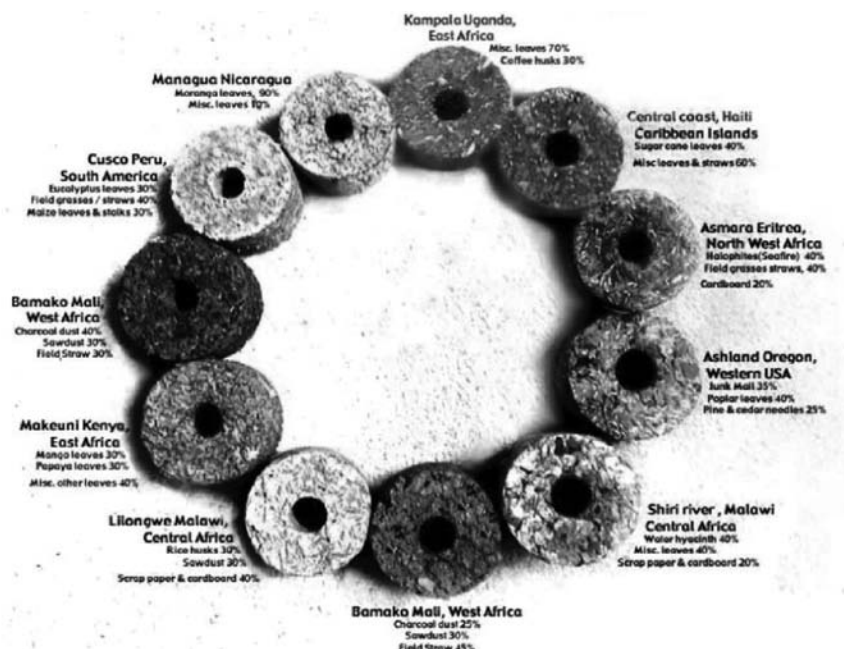
Phase 3 of the strategy features the introduction and widespread adoption of Scheffler Reflector solar stoves. These solar powered stoves can be used indoors or out, and at times when the sun is not shining. Iron cylinders are used to store heat for night cooking.

There are a number of specialized designs of this type of stove. Most use simple materials and can be manufactured locally by a welder. They are ideal for large scale cooking such as is needed in institutions such as schools, hospitals and community center.

Phase 4: Community Solar Steam

Phase 4 of the strategy features the introduction and adoption of community solar steam plants that produce steam for electricity generation. The solar steam engine drives an electric generator that supplies the local area with electricity.

One solar steam engine currently in use is spreading throughout India. The Indian Ministry of Non-Conventional Energy is helping this happen. The device is popular for use in rural schools.



Solar steam power plant



Financing the Jiko System/Expanding/Bringing it to Scale

One way of generating the revenue needed to bring the Jiko cottage industry to scale is to generate funds by selling the Jiko stove in retail outlets in the developed world.

If a Jiko stove was sold for \$25 in US outlets like Home Depot or Target, it could generate enough funds to bring a new Jiko stove to four families in the developing world.

\$ 2.50	per jiko
\$ 2.50	for shipping, packaging, etc.
\$ 5.00	standard 100% profit to retailer partner
<u>\$ 15.00</u>	<u>tax-deductible donation</u>
\$25.00	TOTAL

This provides four stoves to needy families plus \$5.00 to the Solar/Steam Fund

Conclusion

The Improving Cooking in the Developing World: A Blueprint for a New Cottage Industry strategy is an economically feasible way to directly target the energy needs of reaching the Millennium Development Goals. It is a locally and globally viable strategy that is affordable and scalable. It can play an important part in reaching a future global preferred energy system.

3. ELECTRICITY RATE RESTRUCTURING

By Dee Eggers, Alan Glines, Nancy Hodges, Janet Lowe, Stephanie Monson, Ari Zitin

Local energy strategies that could be implemented throughout the developed and developing world are needed if the world is to meet its energy needs in ways that do not undermine the planet's environment and climate.

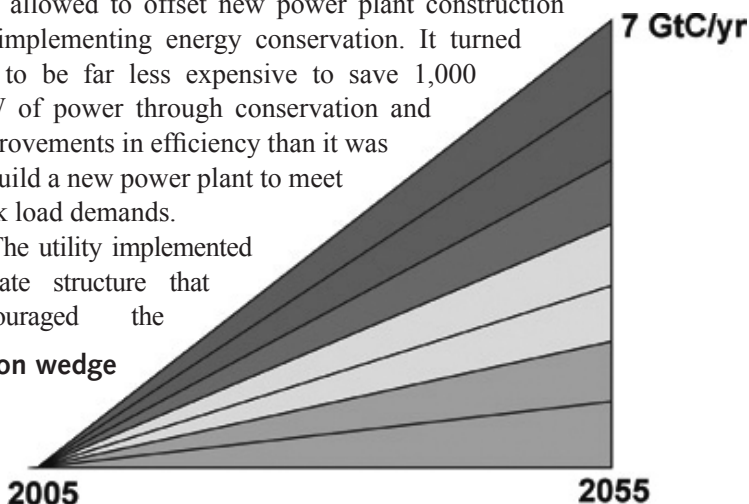
One approach that the Design Science Lab took was that of the “stabilization wedges” described by Robert Socolow and S. Pacala of Princeton University.¹ This approach points out that “humanity already possesses the fundamental scientific, technical, and industrial know-how to solve the carbon and climate problem for the next half-century. A portfolio of technologies now exists to meet the world's energy needs over the next 50 years and limit atmospheric CO₂ to a trajectory that avoids a doubling of the preindustrial concentration and climate problem over the next half-century.” The Lab developed a local plan that goes down this path.

The wedge approach at the local level involved a series of actions. One was decreasing the reliance of electric utilities on fossil and nuclear fuels while increasing their use of renewable energy sources and energy conservation.

One way of doing this is to allow electric utilities to be in tune with undistorted market realities—rather than taking their cues from subsidized energy sources that lead to non-sustainable choices. One example of this is in Austin, Texas. Here, the local electric utility was allowed to offset new power plant construction by implementing energy conservation. It turned out to be far less expensive to save 1,000 MW of power through conservation and improvements in efficiency than it was to build a new power plant to meet peak load demands.

The utility implemented a rate structure that encouraged the

Stabilization wedge



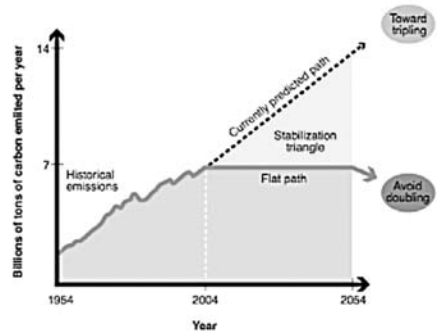
driving down of peak use, and the use of conventional (fossil fuel) energy sources. New demand was, in effect, met with a “conservation power plant.” The results of this electricity rate restructuring included the avoidance of constructing an additional 600+ MW of electrical generating capacity. The utility also avoided over 50% of the cost of constructing a 600 MW power plant, as well as the pollution, health, and environmental effects that would have gone with it.

Austin’s utility was successful in doing this through a variety of actions and policies, including the encouragement of conservation, green buildings, district cooling, and education of the building trades (electricians, builders, plumbers, contractors).

If the US as a whole implemented the city of Austin’s energy program, it would, in 10 years, save over \$73 billion in electricity costs. Assuming half of this amount would run the conservation (and other) programs, there would be a net savings of approximately \$36 billion. Additional savings from avoided health care costs, improved crop yield, materials damage, etc., would also accrue.

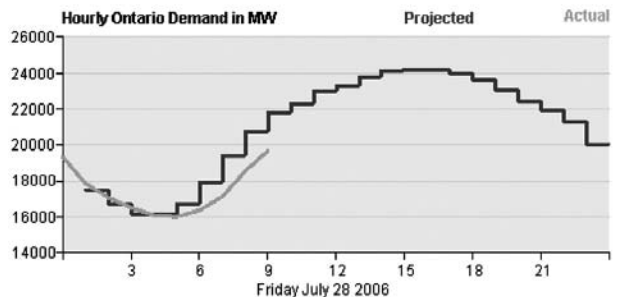
On a local level, for example in North Carolina, if the Austin energy program was implemented, it would result in the avoidance of building 9,000 MW of new power plants (about five coal and three nuclear plants) over the next ten years (saving over \$5 billion in plant construction alone). The net savings to rate payers

Figure 1a. Historical carbon emissions with two potential pathways for the future

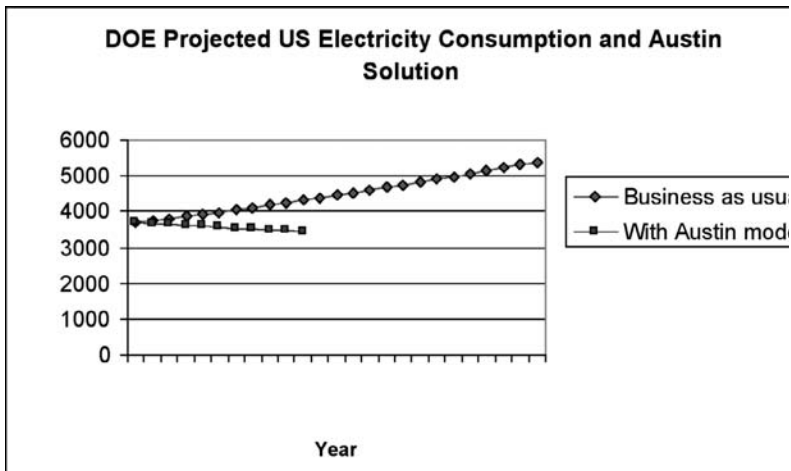


NOTE: Our currently predicted path (dotted black line) will probably lead to at least a tripling of atmospheric carbon dioxide (CO₂) relative to its preindustrial concentration, while keeping emissions flat (solid line) would put us on track to avoid a doubling of CO₂.

SOURCE: R. Sociolew, R. Horvski, J. B. Greenblatt, and S. Pacala.



Note: Projected Ontario Demand uses a step graph to show the highest expected demand within the hour. Actual Demand uses a line graph to show average demand for that hour.²



in North Carolina would be \$2.5 billion. The return on investment for programs of this kind is substantial and rapid: most of Austin's energy projects paid back their initial costs in one to three years. Some of the projects took longer—but all were eight years or less. The return on investment in the form of decreased electricity costs makes these programs generate a net profit for the ratepayers quickly.

Endnotes

- 1 S. Pacala¹* and R. SocolowS. "Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies." *Science*, August 13, 2004 Vol. 305.
- 2 IESO: http://www.theimo.com/imoweb/siteShared/demand_price.asp?sid=ic

4. ENERGY-IN-A-BOX

By Jonah Butcher, Peta Harrison

Energy-In-A-Box is a community education campaign that assists in baseline energy efficiency audits through providing the core essentials for increasing energy efficiency in the average dwelling. The “Box” contains all the ingredients and tools needed to implement the easiest energy efficiency improvements in all homes. Local home improvement suppliers would be one of the primary sponsors.

A demonstration project in the Asheville area of North Carolina has a target of reaching 10,000 homes in two years. 125 volunteers from surrounding colleges and technical schools, in partnership with local home improvement stores, will lead the effort. Savings of close to \$200/year per house (\$2 million total/year) are projected. Implementing the *Energy-In-A-Box* program in half of the households in the state could offset the need for a new coal fired power plant.

The Energy-In-A-Box kit includes:

- Four compact fluorescent light bulbs (which last more than ten times longer than incandescent bulbs and use a quarter of the electricity)
- Two bottles of non-toxic caulk and one caulk gun for sealing openings in walls, doors, or ceilings. Caulking is one of the easiest and most cost-effective means of reducing energy waste, allowing people to save up to 10–15% on heating and cooling costs annually
- One roll of weather-stripping tape for securing windows and exterior door frames from the elements. Drafty windows and door frames are one of the leading causes of unnecessary heating and cooling, and repairing this problem is quick, easy, and economical
- One surge protector to reduce phantom load or “vampire” power.



This is the energy that is drained by electronics like televisions and computers even when they are not turned on. Plugging these electronics into a surge protector allows users to switch them all off easily, with the potential to reduce energy consumption by as much as 10–15%.



5. GREEN MOBILE HOMES

By Nick Consoletti

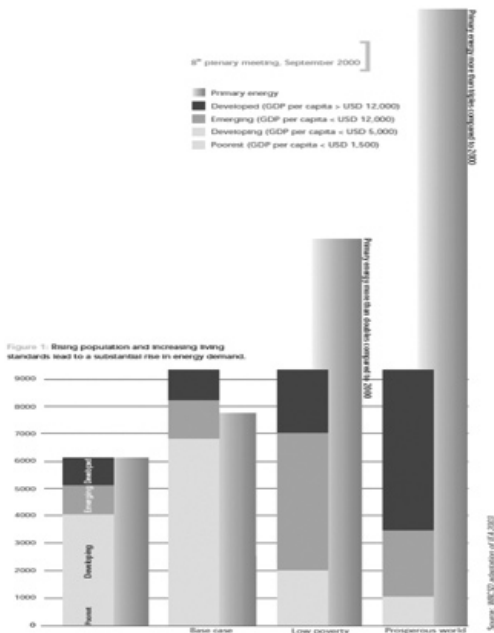
Green mobile homes would provide suitable, affordable, resource efficient housing that can be integrated into existing urban and rural environments. They would be a component in urban slum revitalization, rural housing needs, and new “eco-village” developments.

The current mobile and pre-fabricated housing industry, or new entrants into this business, could build the green mobile homes. In developing countries, local manufacturing networks could be used to manufacture these units. Using local materials and labor, the impact on the economy and housing quality would be large. The housing units would have solar panels, greenhouses, water catchments, composting toilets, and other resource conserving devices as standard features thereby providing a higher quality of life for those living in the units, as well as building a growing body of expertise in these technologies.

6. GREEN ENERGY: RECYCLING WASTE FROM THERMAL ENERGY POWER PLANTS TO PRODUCE BIOFUELS

By Katherine Tohanczyn and Sarah Raimondo

Strategic Summary: Think Green. Think Algae. Over the last one-hundred years, there has been a dangerous increase in carbon dioxide (CO₂) emissions into the atmosphere which is causing global warming. One of the main contributors of these emissions is the CO₂ released from the burning of fossil fuels in electric power plants and in transportation vehicles. The expanding use of biofuels, such as ethanol from crops, has been postulated as a help to mitigate fossil fuel caused environmental problems as well as to serve as a replacement for petroleum, whose natural supply is steadily decreasing. Biofuels derived from food crops have serious problems; biofuels derived from algae have several advantages that make them a greener fuel feedstock than crops like maize and wheat. Unlike conventional biofuels, algae can produce more fuel per area of land and can be grown on land that is not arable¹. If algae production facilities were retrofitted into existing coal and nuclear power plants, the use of waste energy, the recycling of water, and the selling of byproducts would lower environmental and economic costs of electricity production as well as provide increased employment.



Introduction—Present State

Environmental Impacts: The Importance of Green Energy

The decline of the Earth's environmental life-support systems can be seen in a number of ways, including increased air pollution, global warming, loss of biodiversity, quantities of waste, and inefficient land resource management. For

example, the environmental consequences of using oil include the impact from the searching, drilling, pumping, refining and transporting of oil to the end user who then emits CO₂ by burning it as fuel. In 2006, the world emitted a total of 11,219 million metric tons of carbon dioxide from the consumption of petroleum alone². This environmental impact, coupled with economic factors such as increased gas prices and military expenditures needed to secure reliable sources, not only affect the current state of the Earth but also its future.

Based on these issues, it becomes increasingly apparent that every country needs to cut down its dependence on fossil fuels and increase the resources used for developing alternative energy sources that are both cleaner and more efficient.

If we continue to use finite resources (such as petroleum) for energy, not only will the environment continue to deteriorate but we will also not be able to produce enough energy to meet the world's increasing demands. The figure below displays how an increase in population and living standards correlates to an increase need in energy.³ Ultimately, this rising energy demand will lead to increased competition for the world's dwindling reserves. Biomass, however, in particular algae, is a versatile and renewable resource that can fulfill a substantial amount of this growing demand.

Algae is a valuable resource for the living systems on the Earth, and can become one for industrial processes. Algae converts sunlight and carbon dioxide into oxygen. It is responsible for about 40 percent of the oxygen on Earth. Coupled with carbon-dioxide producing industrial processes, such as coal fired power plants, it could also be a major force in limiting our impacts on the atmosphere.

Preferred State

A preferred energy state to where the world is now, and towards which it is heading, consists of:

- Increasing the supply of energy that is both green, abundant and affordable
- Developing a viable, sustainable biofuel industry that enhances local, national and global energy security, provides environmental benefits, reduces global dependence on oil, and creates economic opportunities— all with out infringing on food production capabilities

- Cost-effective production of electricity and biofuel achieved by utilizing waste heat from current thermal power plants as the energy feedstock for algae-producing facilities.

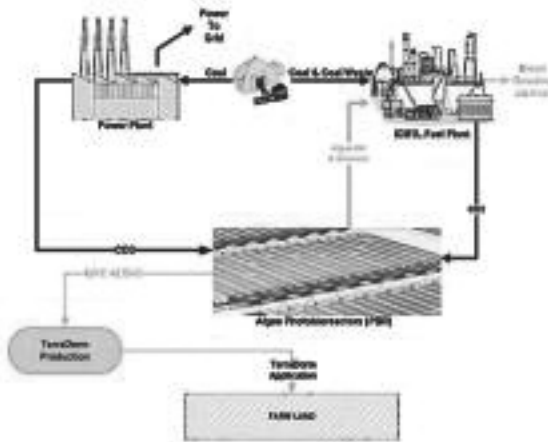


Figure 2: Source: <http://www.pottsmmerc.com/articles/2010/08/01/news/srv0000008941256.txt>

In order for this to be achieved, *Biosynergy Plants* (algae production/thermal power plant facilities) need to be implemented in all new thermal energy power plants in both developed and developing countries. In addition, *Biosynergy Plants* need to be aggressively retrofitted to all existing thermal power plants in the world.

Strategy

Our strategic plan calls for adding algae-producing facilities to existing nuclear and coal power plants. These new Biosynergy Plants would recycle water, waste heat, CO₂, and NO_x and turn them into biofuels produced from algae. In addition, the production of byproducts such as oxygen, hydrogen, fly ash, fertilizer, livestock feed, and aquaculture products would make these plants more productive and affordable by providing new resources, products and lowering the cost of production and maintenance of the facilities. For example, Hawaiian-based company BioEcoTek was able to lower the production costs of algae by retrofitting algae plants into existing wastewater systems through a combination of licensing, mergers, and acquisitions⁴.

There are over 2,700 power plants in the US⁵, and more than 50,000 in the world.⁶ Outfitting less than half of these with algae production facilities could produce enough barrels of oil to eliminate global gasoline consumption and significantly reduce oil consumption. One design being proposed for a Pennsylvania site will produce around 336,000 gallons of fuel per day (123 million/year).⁷ At \$3.00/gallon, that is \$370 million in sales per year— in just fuel sales. By-product sales will increase this revenue stream significantly.

Figure 2

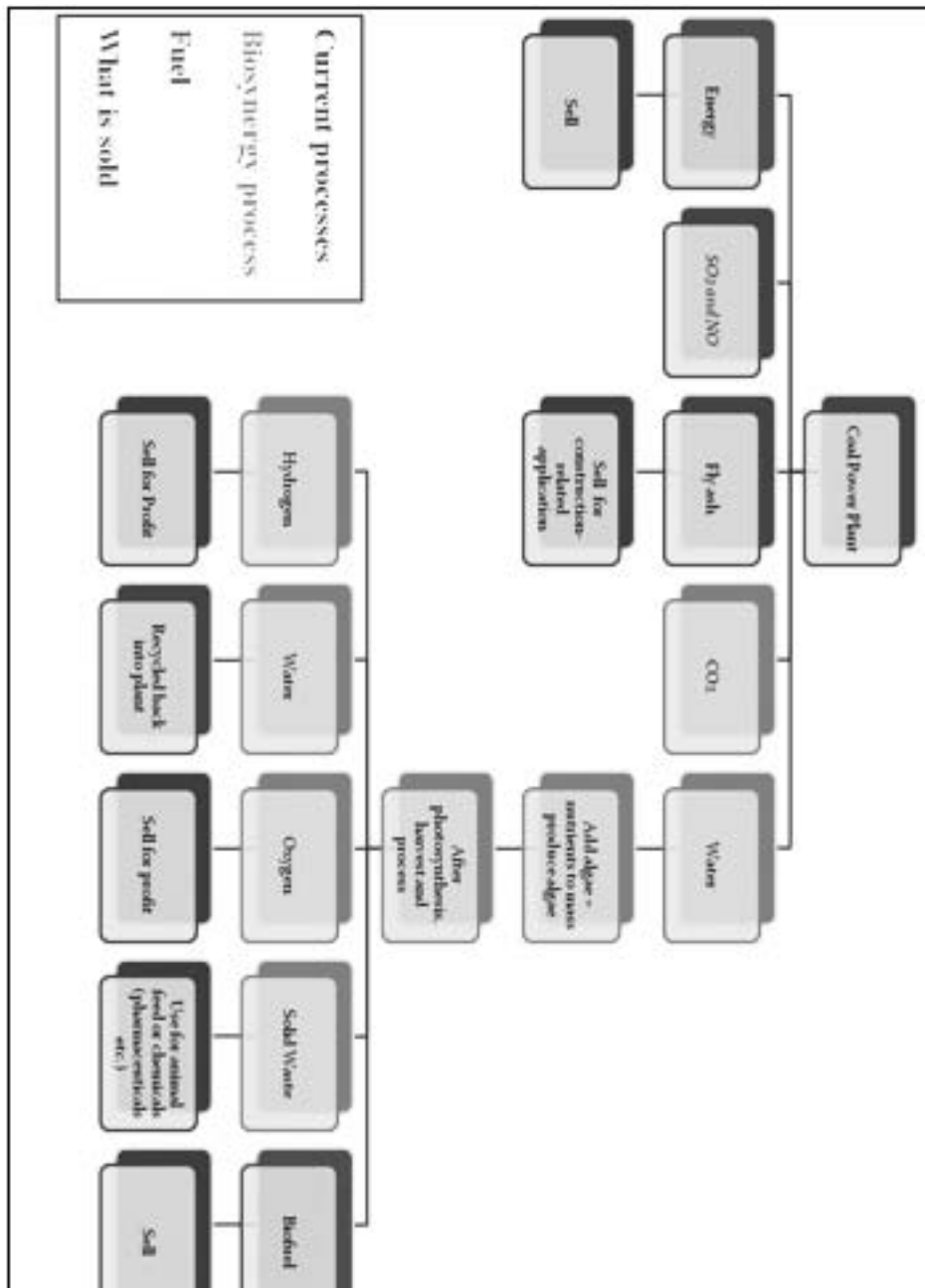
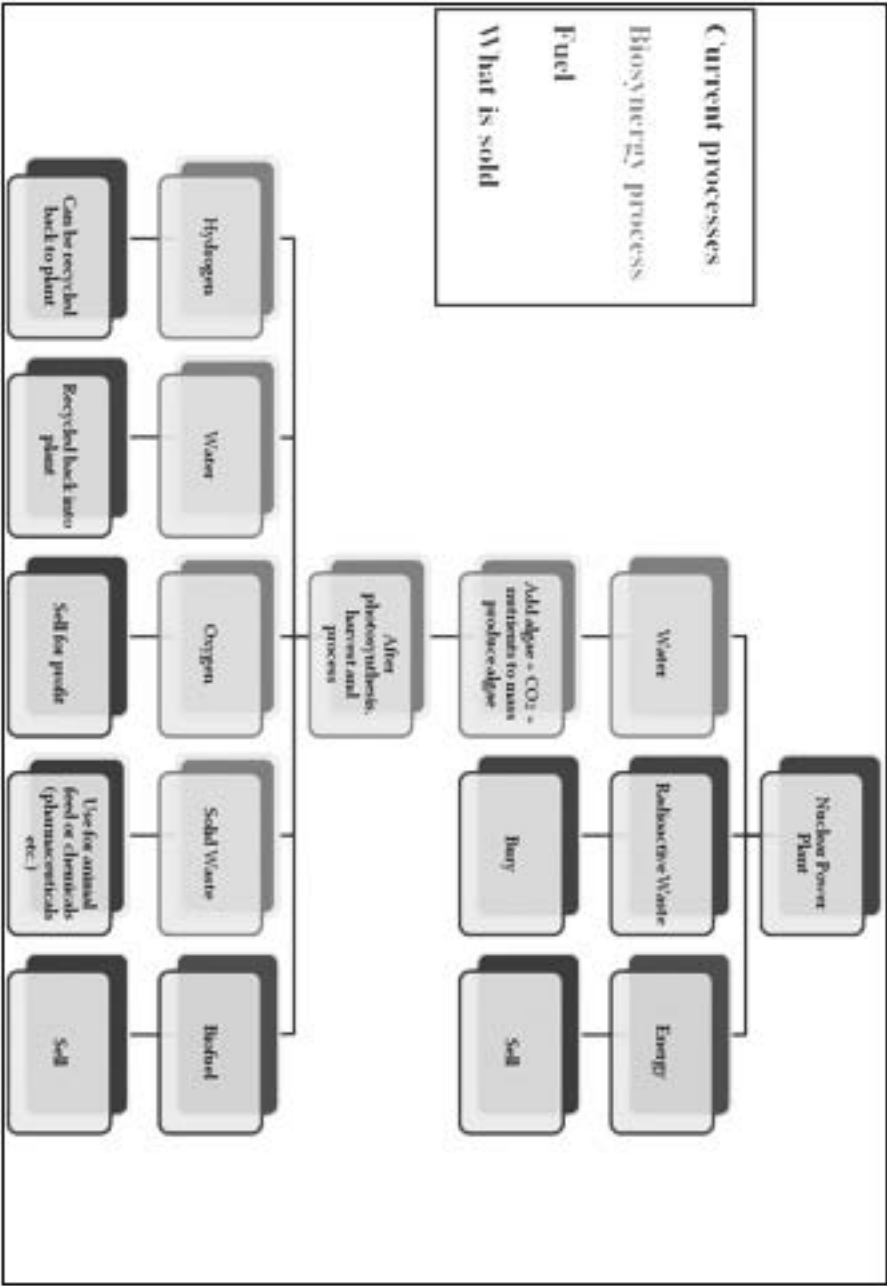


Figure 3



Yearly consumption of gasoline is around 142 billion gallons per year in the US.⁸ Twelve hundred of the above algae plants would produce over 147 billion gallons of fuel per year, more than matching total gasoline needs of the US.

Using a different algae production facility, Michael Briggs at the University of New Hampshire determined that 7.5 billion gallons of algae bio-diesel could be produced on roughly 500,000 acres (about 780 square miles). Using these numbers as benchmarks, it can be determined that the US would need roughly 9.5 million acres of land on which to grow algae to replace the oil needed for ground transportation needs. 9.5 million acres is less than 3% of the 450 million acres of land now used to grow crops. Furthermore, algae can be grown vertically as well as horizontally, which allows for even more efficient use of land.

Dr. Briggs also provided an estimate of \$12,000 per hectare (\$4,860 per acre) for operating costs. This figure includes power consumption, labor, chemicals, and fixed capital costs. The annual operating costs for a 250-acre algae farm would be \$1.25 million.⁹ Extensive research continues to lower this cost. In addition, the creation of jobs, reduction in CO₂ and additional economic benefits makes such investments compelling. For example, research done by the company, Inventure, indicates that CO₂ sequestering plants could generate over \$350 million in gross revenue each year with an absorption rate 70%.¹⁰ Such a profit is possible since this process allows for CO₂ reduction mandates to be met and thus, eliminating the need for carbon credits. In addition, the sale of chemicals and biofuel from algae quickly cover the cost of the facilities.

The following figures (Figures 2 and 3) demonstrate coal and nuclear power plant resources and components and resulting biosynergies. Both types of power plants share the common factor of heated water in their production of electricity. This energy flow can be recycled and applied to the production of algae. This leads to a decrease in the amount of water that coal power plants take from rivers and re-dump after usage. In addition, the coal power plant emits CO₂, which is a valuable resource in the algae's photosynthetic process. All algae are photosynthetic organisms capable of harvesting solar energy and converting CO₂ and water into O₂ and macromolecules such as carbohydrates and lipids.¹¹ By feeding the CO₂ released from the coal power plant to the algae production facility, there is less pollution emitted and more algae created.

In a similar fashion, Figure 3 demonstrates the same process for the nuclear plant except instead of utilizing CO₂, waste heat energy

is converted and used in the growth and maintenance of the algae. The algae is then processed and results in the following end uses:

- biofuel/biodiesel
- renewable hydrocarbons
- Oxygen and Hydrogen
- alcohols
- biogas
- co-products such as: animal feed, fertilizers, industrial enzymes, bioplastics, etc.¹²

Why Algae Over Other Biofuels?

One only has to look at the recent BP oil spill in the Gulf of Mexico; or the destruction of wildlife and biodiversity, loss of fertile soil, and degradation of farmland cause by oil production in Nigeria; or the thin layer of oily film that covers the Caspian Sea— to realize that a new form of fuel is necessary. One new form of fuel that many are turning to is biofuels. The question then becomes, which is the best choice for the feedstock for biofuels? Examining production figures leads to algae. There are four reasons: algae is abundant, affordable, efficient, and sustainable.

Algae is better than first generation biofuels (such as corn) due to the fact that it does not reduce traditional food supplies and which has led to inflation in food prices in many parts of the world. In addition, it can be grown year round and at a faster pace than most feedstock. Finally, it produces between seven and thirty times more energy (or quantity of oil) per acre than the next best crop, the Chinese tallow tree.¹³

The synergy between algae and thermal plants works in a variety of ways depending on the configuration and type of power plant. Different configurations are a result of geographical variations and resource availability between the type of plant. These differences can have a considerable impact on reducing costs.

The optimal design for a Biosynergy Plant is for it to be constructed as near a CO₂-emitting plant as possible. Diverting CO₂ from power plants to algae could reduce emissions by as much as 85% according to a project done at the Massachusetts Institute of Technology in 2008.¹⁴ Availability, recycling, re-usage, and waste utilization of water will further contribute to the efficiency and functioning of the plants.

No Longer a Thing of the Future

Many people believe that research and technology for the use of algae to create fuel is years away. Recent developments in this field prove that this is not the case. Research has been conducted for years by many different organizations, including those in academia, national labs, and private industry. This work, and corporate investment, demonstrates that fuel derived from mass production of algae is economically viable with present day cutting edge technology. For even more biosynergies to be created, additional research and development needs to be conducted into additional by-products and efficiencies of scale.

The advancements in this area are also being put into practice in a number of countries. For example, in 2009, the American energy company, Sapphire Energy, created the first car to operate on algae-based biofuel known as Algaeus. A Toyota Prius Hybrid completed a 3,750-mile trip from San Francisco to New York City.¹⁵ That same year, Continental Airlines, in collaboration with CMF International and Honeywell's UOP, conducted a test flight of a Boeing 737 Next-Generation aircraft over the Gulf of Mexico using algae derived jet fuel. The airplane ran on a combination of algae biofuel and traditional jet fuel.¹⁶ In addition, the European Aeronautic Defence and Space Company flew a slightly modified Austro AE300 in June 2010 equipped with dual engines, one operating on standard jet fuel, the other using pure algae biofuel. The test flight proved not only that algae biofuel is more environmentally friendly but also that it is more efficient by using 1.5 fewer liters per hour for the same performance.¹⁷

Cost

Two of the main obstacles hindering the advancement of algae biofuels are the initial start-up costs of the algae plant and the power that is needed in harvesting, extracting, and maintaining the algae. In addition, other costs include water and fertilizers, as well as land prices.

It is important to note that both public and private sectors have been substantially increasing the amounts of their investments in algae fuel-producing capabilities. Improved biological productivity and fully integrated production systems could bring the cost down to a point where algal biofuels could compete with petroleum at approximately \$100 per barrel.¹⁸ Exxon Mobil and Synthetic Genomics have already

invested \$600 million in the production of algae-based biofuels and are expected to invest billions more to globally scale up the technology and bring it into commercial production.¹⁹

Funding

In addition to the Exxon investment, funds are also being invested through various government entities worldwide. The US Department of Energy (DOE) with the input of more than 200 scientists, engineers, industry representatives, research managers, and other stakeholders, is presently studying the state of technology for algae-based fuels at a commercial scale.²⁰ European Union subsidies have provided half of the funding for a project called MiSSION (Microalgae Supported CO₂ Sequestration in Organic Chemicals and New Energy) started by Swedish energy group Vattenfall. In July 2010, Vattenfall launched a major project using algae to absorb greenhouse gas emissions from a coal-fired power plant in Eastern Germany.²¹

With their growing demand for energy, big emerging markets such as Brazil, India, China and Africa have also invested in algae and have used the global economic recession as a stepping stone to join in the market, attract capital, and scale up their enterprises in algae investments. This has included the dedicated research, development, collaboration and diversification needed to prepare for rapid, transitional changes in regulations, mandates, markets, technologies and subsidies.²² Funding for algae production has also been through the combination of university-industry partnerships. For example, the University of Toledo has created a pilot-scale facility which is part of a research project linking research capabilities of Ohio colleges, universities, and nonprofit research institutions with the needs of industry in the state.²³ This allows state businesses involved in the energy industry to collaborate and use the facility to conduct research, grow algae using different multiple growth systems, as well as to convert algae to fuel. The result is a collaborative effort to perfect algae growth and extraction at a reduced and affordable rate.

Achieving the Millennium Development Goals

The development of an alternative energy source that is green, abundant and affordable can help countries achieve almost all of the Millennium Development Goals (MDGs), especially eradicating poverty and sustaining the environment. More specifically, the use of Biosynergy Plants can help

accomplish the first MDG by enhancing food security, increasing labor productivity and creating employment. Biofuels derived from algae/thermal power plant combinations can help fulfill the MDG of environmental sustainability because they are more efficient and renewable.

Solution 6: Green Energy

- 1 Michael Gross. "Algal Biofuel Hopes". <http://www.cell.com/current-biology/fulltext/S0960-9822%2807%2902431-1>
- 2 <http://www.eia.gov/emeu/international/oilother.html>
- 3 World Business Council for Sustainable Development. Facts and Trends to 2050: Energy and Climate Change. www.wbcsd.org
- 4 "BioEcoTek Hawaii". <http://www.bioecotek.com/>.
- 5 www.eia.doe.gov/cneaf/electricity/ipp/html1/ippv1te1p1.html
- 6 Carbon Monitoring for Action <http://carma.org/>
- 7 Evan Brandt, "Berks lawmaker courts algae farms for Pennsylvania" The Mercury, Pottstown, PA Aug. 1, 2010 <http://www.pottsmmerc.com/articles/2010/08/01/news/srv0000008941256.txt>
- 8 US Energy Information Agency, http://tonto.eia.doe.gov/oog/info/twip/twip_gasoline.html#demand
- 9 <http://www.americanenergyindependence.com/algae farms.aspx>
- 10 http://www.inventurechem.com/co2_sequestering.html
- 11 http://www1.eere.energy.gov/biomass/pdfs/alg al_biofuels_roadmap.pdf. pg. 11.
- 12 http://www1.eere.energy.gov/biomass/pdfs/alg al_biofuels_roadmap.pdf. pg.v.
- 13 <http://www.wired.co.uk/news/archive/2010-06/30/algae-biodiesel>
- 14 "German Power Plant Testing CO₂-scrubbing Algae". [http://www.spacedaily.com/reports/German_power_plant_testing_CO₂-scrubbing_algae_999.html](http://www.spacedaily.com/reports/German_power_plant_testing_CO2-scrubbing_algae_999.html).
- 15 <http://www.sapphireenergy.com/press-article/67367-algae-fueled-car-completes-3-750-mile-cross/22046-events>
- 16 http://www.boeing.com/aboutus/environment/environmental_report_09/_inc/flash-2-3-1.html
- 17 http://www.avweb.com/avwebflash/news/algae_fuel_diamond_da42_berlin_efficient_202700-1.html
- 18 http://www1.eere.energy.gov/biomass/pdfs/alg al_biofuels_roadmap.pdf. pg 104.
- 19 "Exxon Sinks \$600M Into Algae-Based Biofuels in Major Strategy Shift". NYTimes. July 14, 2009
- 20 http://www1.eere.energy.gov/biomass/pdfs/alg al_biofuels_roadmap.pdf. pg i.
- 21 Ibid. "German Power Plant Testing".
- 22 "Algae Investment Trends & Advanced Biofuels Insight" By WILL THURMOND, Columnist, Biofuels Digest Monday, March 1, 2010.
- 23 <http://toledocatalyst.com/index.php/2010/06/ut-receives-grant-to-build-algae-biofuels-research-facility-at-scott-park-campus/>. "UT receives grant to build algae biofuels research facility at Scott Park Campus". By Innovation Enterprises - The University Of Toledo, June 29, 2010.

7. URBAN ENERGY AND PUBLIC TRANSIT

By Melissa Day, Christine Hebert, Tri Nguyen, Uyen Nguyen, Michael Smith

***Strategic Summary:** High population density in cities means that energy usage is often more efficient per person than in sprawling suburban or rural environments. Urban transportation, however, is still a significant energy sink. Traffic congestion wastes time and fuel; the emissions also negatively impact human health and the environment. Streamlining public transportation and increasing ridership is therefore an important strategy for reducing a city's energy demand while increasing public health. This strategy proposes tactics that incentivize public transit.*

Introduction

Cities house over half the global population and have a profound effect on this planet. The 21 megacities in the world, each home to 10 million or more people, occupy only 2% of the Earth's surface but command 75% of the global energy demand¹. In the United States, a full quarter of all energy use derives from transportation². This is the second highest energy consumption sector after electricity generation and one in which large gains in efficiency are not only possible, but immediately technologically feasible. Transportation is therefore a smart area to target for cities looking to conserve their energy demand.

Problem and Present State

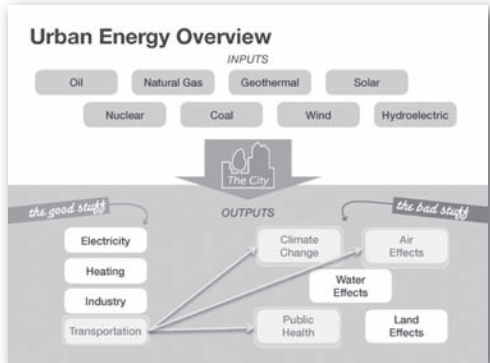
At its present state, urban transportation produces a number of undesired side effects, including increased emissions, reduced air quality and poor public health. Road transportation alone emitted 10.5% of the world's greenhouse gases in 2005³. Besides contributing to climate change, emissions pose a risk to public health. Traffic congestion-related



emissions in 83 U.S. cities caused approximately 4,000 premature deaths in 2000. During the same year, these communities paid an estimated \$60 billion in congested-related cost of wasted time and fuel⁴.

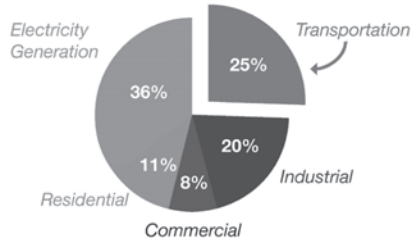
One approach to dealing with these issues in an urban environment lies in effective public transportation systems. According to the American Public Transportation Association, residents that live closest to public transportation drive an average 4,400 fewer miles a year than those who do not live near bus or rail lines. This effectively reduces the nation's carbon emissions by 37 million metric tons a year, which is equivalent to the electric power used by 4.9 million households⁵.

While public transportation systems have the potential to dramatically reduce the harmful effects of private transportation, these systems must be designed carefully to achieve this potential. In *Why People Don't Use Mass Transit*, it is said "the only way to diminish reliance on the automobile is to create a mass transit system that is superior to the automobile by the standards of automobile users"⁶. In many cities, public transportation does not save enough time or money and is not as safe or dependable as private transportation. These factors must be addressed in order to design truly effective public transportation systems in urban environments.



Present State: Energy and Transportation

Estimated U.S. Energy Use in 2009



Present State: Health

In 83 U.S. cities, traffic congestion-related emissions caused about

4,000
premature deaths
in 2000.



Present State: Money

These communities paid an estimated
\$60 billion
in congested-related cost of
wasted time and fuel
during the same year.



Preferred State

The preferred state of urban transportation is one in which there is attractive, effective, clean, affordable and sustainable public transportation options that result in beautiful cities with high air quality, increased personal travel, and reduced traffic congestion, accidents and transportation-related public health incidents.

Strategy

To achieve the preferred state, this strategy calls for a public transit experience that is the most desirable transportation option. To provide a starting context, the public transportation system of Philadelphia, PA is used as a case study.

Based on research, the following set of goals were developed to accomplish the design challenge:

- A cost-effective, time-effective, dependable, and safe public transit system
- An attractive user experience
- Added incentives to ride.

Present State: Philadelphia

Philadelphia, PA

- Population: 5.3 million
- Peak Travelers: 3.0 million

Congestion Costs Per Capita

- Annual Travel Delay: 39 hours
- Excess Fuel Consumed: 30 gallons
- Cost: \$919



Design Overview

End goal:

Reduce the number of cars in cities.

Design Challenge:

Create a **public transit experience** that is the **most desirable option**.

Case Study:

Philadelphia, PA

System upgrades

The first two aspects of the overall strategy can best be addressed by minor system upgrades. A mass-transit system needs to be cost-competitive, dependable, timely, and safe. Analysis of the fee structure against other options (personal transit, bus, train, etc.) would be completed and adjustments made accordingly. Routes should be re-evaluated based on the percent of the urban population living within walking distance of the stops, peak ridership congestion, adoption of routes and ease of transport to major sights and businesses. These routes should not require significant (>15 minute) wait

times at peak travel hours. To minimize confusion, transit stations need clearly posted and understandable schedules and maps. Street corner stops need to be labeled with the associated bus lines. Incorporating a barcode option for smartphone users to look up more information would be implemented. Status indicators, including time to arrival and departure, will be installed at major stops. Key routes will operate at all hours; if this is not possible, bike rental kiosks and a transit partnership with major taxi companies would reduce difficulty and increase ridership. Increased lighting, rules of conduct and law enforcement around transit sites and on the vehicles themselves will increase safety and perceived safety for riders. Finally, increasing the user experience of longer-haul transit options through comfort (spacious seating, work surfaces, privacy screens), amenities (wi-fi, outlets), and activities (texting games) will make transit more attractive. Implementation of these improvements will be split between retrofits and implementation of a newer fleet as old vehicles are aged out. Introducing energy-efficient vehicles will also increase the public's affinity towards the transit system.

Considered Design Interventions

■ *Dependability*

More buses/trains
Available GPS data for buses/trains
Status indicators at stops
24-hour routes
Taxi partnership



Considered Design Interventions

■ *Riding Experience*

Comfort:

Spacious seating
Tables/working
surfaces
Privacy screens
Refreshments

Amenities:

TVs
Wi-Fi
Outlets

Activities:

Games
Exercise



Incentives Program

In addition to making bus rides an enjoyable and interactive experience, this strategy proposes three additional incentive programs to further

persuade commuters, students and the general public that the public transportation system is superior to private transportation.

Since Philadelphia is a thriving metropolis with over 80 universities and higher education institutions and students that need to move around the city, one strategy is to work with these institutions to encourage students to leave their private transportation at home and rely solely on public transportation. Such a scheme has already been put in place by Ripon College⁷. In exchange for leaving their cars at home and pledging ten hours of community service, Ripon students are rewarded with a free bicycle. Unlimited bus passes will also be incorporated in the Philadelphia program.

Concurrently, the strategy will work with businesses within Philadelphia to put in place incentives for public transit commuter programs for employees. In this way, businesses will subsidize public transportation to discourage congestion and eliminate unnecessary parking spaces⁸.

Finally, another incentives program will reward individuals for “good deeds.” For instance, doing things that benefit society, such as recycling or paying tickets on time, would be rewarded with free transportation tickets. This type of strategy has been used very effectively in Brazil⁹. Individuals will also be rewarded with subsidized public transportation if they trade in their private transportation vehicles, which would encourage people to move away from private vehicles more quickly.

Expected Benefits

The benefits of transitioning to a more comprehensive and sustainable transportation system are widespread. A safe and accessible transportation system that is appealing to all will greatly reduce the energy demanded by Philadelphia and ideally, after scaling to other cities, by the world in general. A society that is less reliant on private transportation will also decrease its air pollution and experience increased environmental health. In addition, the new and more expansive transportation system will greatly benefit Philadelphia’s economy. It has been estimated that for every dollar invested in public transportation, approximately four dollars are gained in economic returns¹⁰.

Furthermore, the incentives programs will not only encourage the use of the new and improved transportation system, but will have extensive social benefits. As citizens are rewarded for paying tickets on time and cleaning up the city, the city will become a more beautiful,

healthy and efficient place to live. This buoys both property value and personal well-being – a win-win for the city and its occupants.

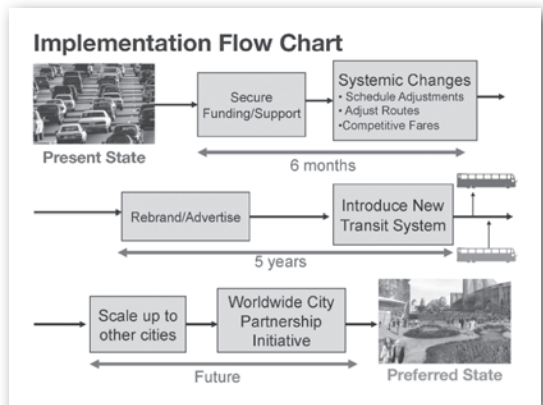
Implementation

The following timeline visualizes the proposed implementation. Over the first six months, the plan will secure funding and implement the systemic changes, including schedule and route adjustments. The incentive programs will also be tested during this time. Over the next five years, the plan calls for the rebranding of SEPTA, Philadelphia's primary public transportation provider. The goal is to remove the negative stigma attached to public transportation and encourage people to think of buses, trains and other public transit options in a more positive way.

Concurrent with the rebranding campaign, the strategy calls for the introduction of the new system. Rather than replacing the entire existing infrastructure in Philadelphia at once, the strategy will add an additional 300 energy-efficient buses to the current SEPTA system. It will replace old and inefficient buses with the most cost effective and environmentally friendly vehicles available. In the future, it will scale up to other cities, and eventually, reach a worldwide public transportation partnership. In this preferred state, private transportation will no longer be the most attractive option, and public transportation will be the preferred choice of the majority of all city residents.

Costs of Implementation

There are a number of current options for new buses. The cost of the initial 300 buses called for by this strategy is revealing. The current cost of diesel buses, in comparison to hybrid buses and solar alternatives such as the Tindo bus being used in



Bus Options

Diesel buses

• 300 buses = \$18 million

Hybrid buses

• 300 buses = \$25 million

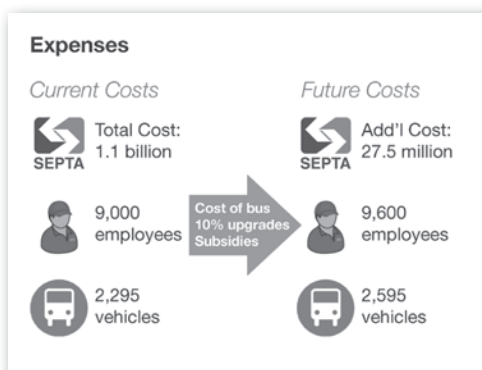
Tindo solar electric buses

• 300 buses = \$36 million

Note: Philadelphia spends \$3.3 billion per year on congestion.



Adelaide, South Australia,¹¹ points to a number of options. With the 80% of the total cost covered by the Federal Transit Administration (FTA) and the 90% of the incremental cost of alternative fuel buses covered by the federal Clean Fuels Grant Program, the costs of hybrids or Tindo solar-electric buses as compared to diesel buses are as follows: Currently, the city of Philadelphia spends \$3.3 billion annually on congestion alone¹². In comparison, the cost of this strategy scheme is minimal, given current subsidies for public transportation and for fuel-efficient transportation. A city that is less reliant on private transportation saves even further in terms of increased environmental health and decreased congestion.



Expenses and financing

SEPTA currently employs approximately 9,000 employees, has a fleet of 2,295 vehicles, and has a total operating cost of \$1.1 billion¹³. Including the cost for an extra 300 hybrid buses and an additional 600 drivers (assuming two shifts per

day), in addition to a blanket 10% for system upgrades, the extra cost for this strategy would be approximately \$30 million if the least-cost diesel option is chosen.

This is a significant but not insurmountable sum. One way of raising some of the additional funds could be to form strategic partnerships with green businesses, or businesses looking to project their environmental stewardship to the community. Step one of this process would be to identify these businesses. Increased advertising revenue from additional bus sideboards and station space would be available. Once the system shows some success in terms of ridership, jobs created, and fewer cars and congestion, parking meter and lot fees could be increased for further revenue. This also serves as an incentive to consumers to continue their public transit ridership. Finally, if the United States enacted a \$19/ton CO₂ carbon tax, \$105 billion in revenue would be generated for green initiatives such as urban transportation¹⁴. Even if performed just

at a local scale, this would be a major source of potential funding for transit initiatives. Pursuit of a combination of these options will result in funding for this strategy.

Conclusion

Urban public transportation is an investment in health and business. Fewer private vehicles leads to reduced air pollution, congestion, and energy waste. The ability to make public transit highly competitive has never been greater. A cost-effective, time-effective, dependable and safe public transportation is the key to increased ridership. Increased ridership is essential to making mass public transit sustainable. Providing an enhanced user experience, in addition to incentive programs, further aids the cause, costs the city very little and has significant returns.

Endnotes

- 1 Oliver, Rachel. All About: Cities and energy consumption. CNN.com, December 31, 2007. <http://edition.cnn.com/2007/TECH/12/31/eco.cities/index.html>
- 2 Estimated U.S. Energy Use Flowchart, Lawrence Livermore National Laboratory, DOE/EIA-0384 (2009), August 2010. https://flowcharts.llnl.gov/content/energy/energy_archive/energy_flow_2009/LLNL_US_Energy_Flow_2009.png
- 3 World Greenhouse Gas Emissions in 2005, World Resources Institute, http://www.wri.org/image/view/11147/_original
- 4 Levy, Jonathan; Buonocore, Jonathan; von Stachelberg, Katherine. The Public Health Cost of Traffic Congestion: A Health Risk Assessment. Harvard Center for Risk Analysis, Environmental Health 2010, 9:65. <http://www.transportationconstructioncoalition.org/Docs/TCC-Harvard-Traffic-Congestion-Report-Final.pdf>
- 5 Jones, Charisse. Transit systems travel ‘green’ track. USA Today, 5/8/2008. http://www.usatoday.com/news/nation/environment/2008-05-07-greentransit_N.htm
- 6 Dutch, Steven. Why People Don’t Use Mass Transit. Created July 27, 2005. <http://www.uwgb.edu/dutchs/pseudosc/masstransit.htm>
- 7 College bike program entices new students to ‘just say no’ – to cars. Ripon College, February 12, 2008. http://www.ripon.edu/news/2007-08/velorution_021208.html
- 8 Conlin, Michelle. Suddenly, It’s Cool to Take the Bus. Bloomberg Businessweek, April 23, 2008. http://www.businessweek.com/magazine/content/08_18/b4082000049320.htm
- 9 Interview with Jaime Lerner. SustainableCitiesCollective, March 7, 2011.

- <http://sustainablecitiescollective.com/dirt/21822/interview-jaime-lerner>
- 10Facts at a Glance. American Public Transportation Association, ©2011. <http://www.publictransportation.org/news/facts>
- 11Tindo: The World's First Solar Electric Bus. Adelaide City Council. http://www.adelaidecitycouncil.com/adccwr/publications/guides_factsheets/tindo_fact_sheet.pdf
- 12Performance Measure Summary – Philadelphia PA-NY-DE-MD. Texas Transportation Institute, Texas A&M University (TAMU). http://mobility.tamu.edu/ums/congestion_data/tables/phila.pdf
- 13Fiscal Year 2010 Operating Budget. SEPTA (Southeastern Pennsylvania Transportation Authority). <http://www.septa.org/reports/pdf/opbudget10.pdf>
- 14Friday Infographic: Carbon Tax and the U.S. Federal Deficit. Weathervane, Resources for the Future. 5/20/2011. <http://www.rff.org/wv/archive/2011/5/20/friday-infographic-carbon-tax-and-the-u-s-federal-deficit.aspx>
- 15Performance Measure Summary – Philadelphia PA-NY-DE-MD. Texas Transportation Institute, Texas A&M University (TAMU). http://mobility.tamu.edu/ums/congestion_data/tables/phila.pdf

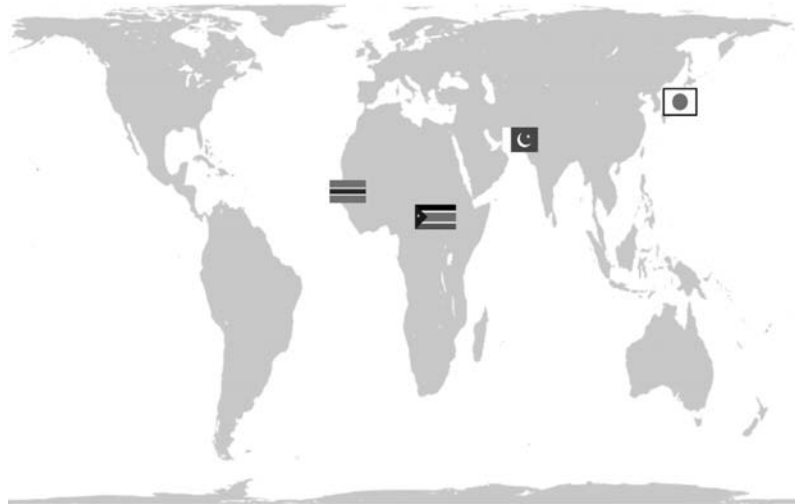
8. TRANSITION TO RENEWABLE ENERGY

A global solution locally applied

by Ayuen G. Ajok (South Sudan), Rabia Sana (Pakistan), Anne Schiffer (Germany/ UK), Yosuke Tanabe (Japan)

Strategic Summary: The global transition from a linear energy model of extraction, consumption and emissions to a regenerative or circular one relies on a complete switch to renewable energy sources. The team members chose their countries of origin, or ones with which they have significant experience, to develop local strategies for this global aim: South Sudan, Pakistan, The Gambia and Japan.

This transition also requires a shift away from mono- and oligopolies of energy markets to empowerment of individual people and communities [1]. Therefore the team decided to develop strategies from the bottom up, focusing on the individual and community level.



Peters projection
highlighting the
countries chosen for
this project.²

Problem State

Globally, the majority of energy appropriated for human consumption is generated following a linear model that heavily relies on large scale infrastructure and non-renewable fuels. Symptoms of this model include environmental degradation, climate change and fuel poverty.



Global Problem State.^{3,4,5}

The following section outlines the major energy challenges facing the specific contexts that were chosen by the team members.

South Sudan *by Ayuen G. Ajok*

The 22 year long civil war between north and south Sudan has left the newly founded country of South Sudan severely underdeveloped.⁶ Over the course of the conflict industries and infrastructure including entire road networks were destroyed and the country has so far not managed to rid itself of a chronic state of poverty.⁷

South Sudan is rich in oil resources but this has also led to an economic dependency on these: Ninety-eight percent of the country's revenue comes from oil exports.⁸

In the city of Juba, as in many cities across the country, the majority of electricity is produced by diesel generators [9]. Contradictory to the fact that South Sudan is rich in oil, the country has to import refined fuel which makes electricity production using generators very costly. In addition, this method is polluting to the environment and damaging to human health.¹⁰

Pakistan *by Rabia Sana*

Pakistan has been suffering from a severe energy crisis resulting in long hours of load shedding (power cuts) throughout the country. Compressed Natural Gas (CNG) filling stations remained closed for three days a week in Punjab Province which has had a significant impact on industries located in the region and the wider economy. Load shedding has resulted in violent riots throughout the country.

High dependence on aid from the World Bank and the International Monetary Fund (IMF) is causing inflation and increased energy prices. Furthermore, a general lack of energy supply including transport fuel and electricity is exacerbating the situation.¹¹

Approximately 81 percent of electricity production in Pakistan is based on oil and natural gas. The huge potential for renewable energy is currently totally ignored.¹²

The Gambia *by Anne Schiffer*

In this West African nation wood fuels still form the most important source of energy. The use of firewood and imported charcoal includes cooking, smoking fish and brewing Ataya, a local tea. A growing population is putting increasing pressure on these resources which are no longer regenerating as quickly as they are being depleted (pers. communication).

The country is increasingly dependent on imported fossil fuels for electricity generation and transport. Rising costs and unreliable or lack of electricity supply are exacerbated by a fast growing demand for electronic devices, particularly in the area of communications technologies

Mass charging of
mobile phones in
Gambian village.¹³



Japan by Yosuke Tanabe

Ninety-six percent of primary energy resources consumed in Japan are imported.¹⁴ Nuclear power has been regarded as a major player to become more self-sufficient because uranium can be regarded as long lasting energy due to nuclear reprocessing technology.¹⁵ Amongst Japanese nuclear power enjoyed the reputation that it is cheap, reliable and safe.

The Fukushima Daiichi nuclear disaster which was induced by an



60,000 people demonstrate against nuclear power in Tokyo on 9/19/2012.¹⁷

earthquake that measured magnitude 9.0 on the Richter scale, brought the flaws of nuclear power to the awareness of the Japanese. It revealed that the true cost should include protection against natural disasters and terrorism, disaster management, post-disaster recovery and the long-term management of radioactive waste.

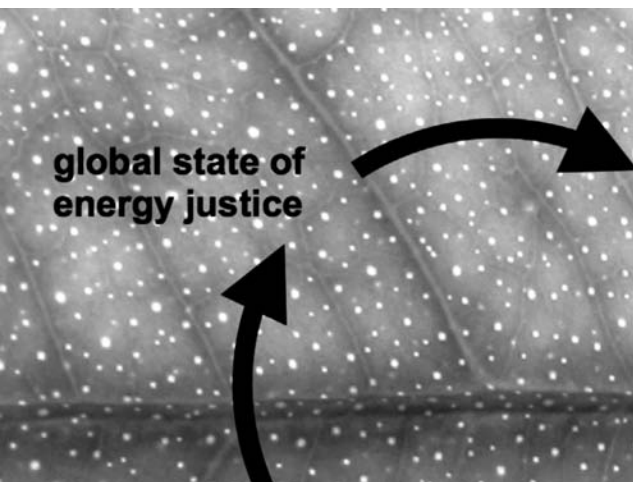
Following the explosion

at Fukushima Daiichi 74% of people favoured a complete phasing out¹⁶ and 60,000 people demonstrated against nuclear power at a rally in Tokyo (Image 4).

Preferred State

The preferred global state of energy follows a regenerative or circular model

inspired by nature. In this vision 100% of energy needs are met, energy is abundant and affordable, all solutions rely on renewable energy sources and a global state of energy justice is reached.



Preferred state.¹⁸

Local Strategies for a global solution

South Sudan *by Ayuen G. Ajok*

Due to the current difficulties in the area of energy development in South Sudan, Juba, the capital city, was chosen as the geographical area to develop a local strategy. This underdevelopment of the city means a strategy based on renewable energy can be designed and implemented without competing against existing infrastructure.¹⁹

Currently, residents in Juba are dependent on the use of diesel generators for electricity which is very expensive.²⁰ Developing an energy system that is cost efficient or better yet, economically beneficial to residents would help decrease the level of poverty in the city.²¹ There is great potential to develop solar and wind energy schemes in Juba which would eradicate the cost of fuel.²² Juba is located on the border of the White Nile, so there is also potential to install micro-hydroelectricity systems on smaller arms of the river.

The benefits from the implementation of renewable energy would include²³:

- Reduced dependency on generators to produce electricity will cut pollution and hazards to human health.
- Juba's infrastructure will improve drastically in the long run.
- Following the Stiftung's Solar Energy in Ethiopia model, explained below, will create training and employment opportunities.
- Economic benefits to residents through fuel cost reduction and business opportunities such as mobile phone charging or other services that rely on electricity.
- In the long-term, the potential to export of electricity to other parts of the country.

Off-grid
solar
system.²⁴



Neighbouring Ethiopia offers a template for the spread of renewable energy systems in Juba. The Solar Energy Foundation (Stiftung Solarenergie), a German charity, partnered with the Ethiopian town of Rema in 2008 to bring solar electricity to the community. Instead of merely installing solar systems, the foundation helped to set up a training centre for off-grid systems. The result is social development and economic prosperity with more than one million people who have benefited from the scheme so far. Replicating this system in Juba will generate electricity for local communities.²⁵

Every installation consists of the following components²⁶:

- A photovoltaic module which generates electricity from sunlight
- A rechargeable battery to store electricity so it is available both day and night
- A charge controller which prevents the battery from being over-charged or deep discharged.

The cost of a solar system is approximately \$260, including manufacturing and installation. A basic fee to pay the local technicians for regular maintenance work costs each household between \$0.09 and \$1.20.²⁷



Installation of off-grid solar energy by Solar Energy Foundation.²⁸

Funding to replicate this system in Juba can come from:

- Diversion of oil profits towards renewable energy systems

Micro-finance

Partnership with NGOs and the World Bank

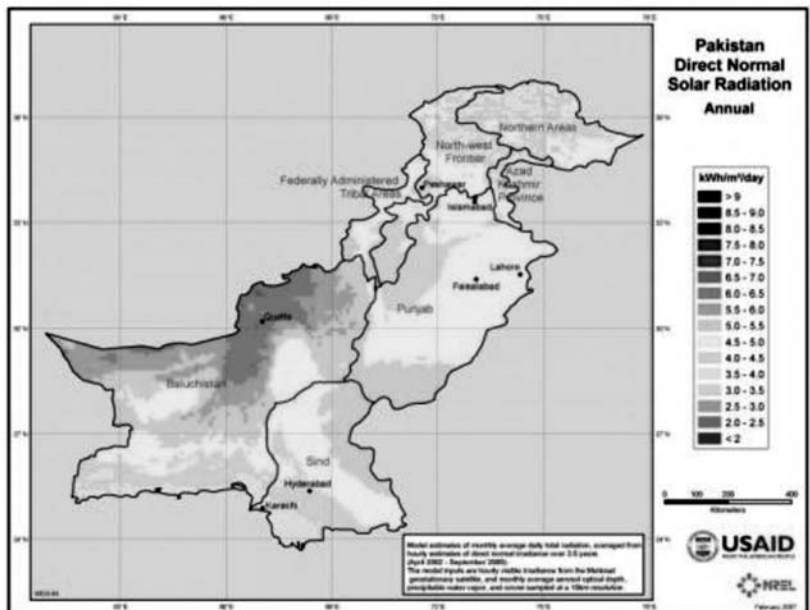
Pakistan by Rabia Sana

Pakistan's energy supply currently comes primarily from indigenous natural gas which amounts to 45% of the energy mix. Oil imports contribute 35%, hydro power 12%, coal 6% and nuclear power 2% respectively.²⁹ Our strategy calls for this predominately fossil fuel reliance to give way to a diverse portfolio of renewable energy supplies that provide green jobs and sustainable supplies of relatively clean energy.

Steady growth in renewable energy sources including micro-hydro, solar and wind needs to become the foundation for a diverse energy mix to maximise Pakistan's economic and social wellbeing.

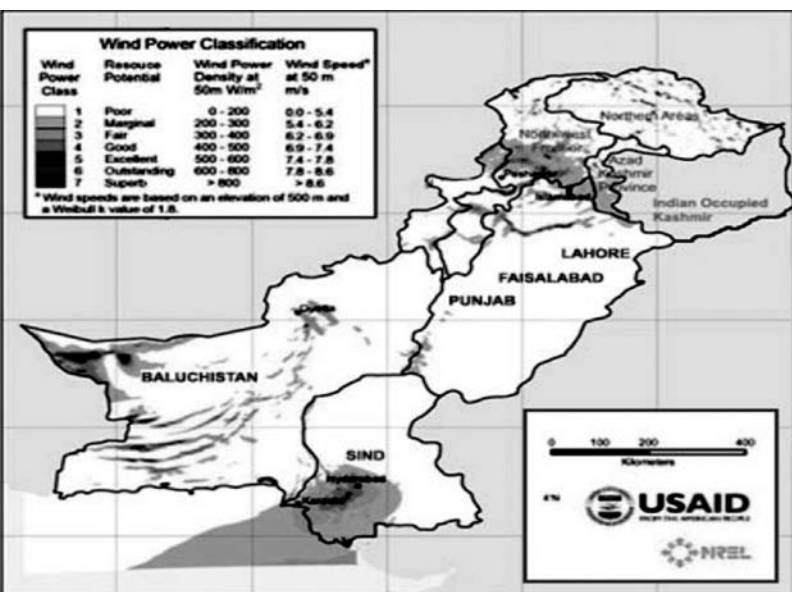
There are 50,000 villages in Pakistan that are not connected to the national grid according to a report by the Solar Energy Research Centre (SERC). Due to distances to grid infrastructure, providing these households with a solar system would be more cost-efficient than connecting them to the distant grid. This would empower people both economically and socially.^{30, 31}

Direct
Normal
Solar
Radiation:³²



Being an agrarian economy, Pakistan generates vast amounts of agricultural waste which is currently burnt, left in the fields or used as fodder. There is an opportunity to turn this waste into a valuable resource in the form of bio-fuels. Research conducted by the University of Agriculture, Faisalabad, indicates that Pakistan has almost 3,000 MW power generation potential in just the sugar industry through biogas production from sugar cane waste. At the moment, the sugar cane industry is producing some 700 MW. In addition, it is estimated that Pakistan has almost 159 million animals that produce almost 652 million kilograms of manure daily from cattle and buffalo only, which can be used to generate 16.3 million-cubic-meters biogas per day and 21 million tonnes of bio fertiliser per year. It can easily compensate around 20 per cent of nitrogen and 66 per cent of phosphorus requirement in the crop fields as well. [footnote]

Similar to solar energy and biofuels potentials, Pakistan has an enormous potential for wind energy. According to data published by Miriam Katz of the Environmental Peace Review, Pakistan is fortunate to have something many other countries do not, which is high wind speeds near major cities. Near Islamabad, the wind speed varies from 6.2 to 7.4 meters per second (between 13.8 and 16.5 miles per hour). Near Karachi, the range is between 6.2 and 6.9 (between 13.8 and 15.4 miles per hour). However, purchasing wind turbines from foreign manufacturers is costly. An alternative strategy would be the development of an industrial sector in Pakistan which is able to manufacture wind turbines. This could reduce the capital investment required for large scale deployment of wind power plants and also create employment opportunities along the way.



Wind Power Classification³³

Apart from drastically increasing the effort to spread renewable energy technologies that benefit individuals and communities, society needs to increase the efficiency of energy usage. A local Pakistani organisation conducted audits of 25 textile mills and suggested improvements in their energy management systems. This resulted in savings of 10 MW or Rs400 million (equivalent to \$4.25 million) for these 25 mills combined. The total investment of these mills to improve their energy management systems and conducting energy consumption audits was only \$532,000.

The Gambia by *Anne Schiffer*

The coastal town of Kartung in the south of the country has been chosen for the development of a local energy strategy. Two of the major concerns regarding energy in Kartung are an over-consumption of natural resources and a lack of infrastructure to provide a growing demand for electricity.

Locally there is an appreciation for the human impact on the natural habitat. Groups have formed with an interest to reverse these trends through such means as the restoration of mangrove forests.

Stand alone photovoltaic solar systems have been introduced into the community and are used both domestically and to power vital services such as Kartung's water supply.

Within the foreseeable future Kartung will be connected to national grid infrastructure. As the electricity provided through this will come from a diesel generator, it is likely to be costly and may not be available 24 hours a day. However, it does offer an opportunity to create a mini-grid based on renewable energy in Kartung that in turn is connected to the larger grid. The benefits of this include:

- promotion of renewable energy in Kartung that is based on solar energy
- an alternative to electricity storage in batteries
- an opportunity for Kartung to export electricity through a feed-in tariff scheme
- balancing out the intermittent supply of renewable energy particularly during the rainy season.

A similar scheme has already been pioneered approximately 30km north in the town of Batakunku and could be used as a template for Kartung. Batakunku is home to West Africa's first large wind turbine (150kW) which powers a mini grid that is connected to national grid infrastructure.



150kW wind turbine, in Batakunku, The Gambia.³⁴

To be able to build upon these trends and opportunities, and design a coherent energy management system it is necessary to first measure and estimate present and future demand for and availability of energy resources. At present, there is no accounting methodology used in Kartung to quantify these. Therefore the proposed strategy focuses on this first step and advises a partnership between local groups and an external expert to develop an appropriate methodology to account for energy resource demand and availability.

This will be accomplished in the first six months of the overall strategy. The goals include:

- generation of quantitative data to monitor energy supply, needs, and resource availability
- empowerment of local decision makers
- local employment for the development and maintenance of the energy management system
- development of a tool that can be used in other parts of the global south to help meet energy needs in sustainable ways.

The approximate cost for a six month project of this kind is \$8.600 (Table 1).

Wage for local expert and external energy consultant over six months	\$1560
Transport of energy consultant	\$2000
Equipment	\$2000
Miscellaneous	\$1000
Dissemination of methodology	\$2000
Total	\$8560

Table 1: Cost of six month project to develop an energy management system for Kartung

The following points may be explored during the development of an accounting methodology:

- The high dependency on locally sourced wood fuel in Kartung and the fact that forest areas are in direct competition with other activities including rice cultivation, grazing livestock and the expansion of housing, suggests a methodology that quantifies areas of land available for energy resources. This also has the benefit that the methodology can be transferred to other essential issues such as local food production and energy systems become an integrated part of overall land management.
- In addition the methodology has to account for fuel and services imported into the community which could be measured in economic terms. Potential export of electricity and the current sales of wood fuels to urban areas may also be considered here.
- On the demand side, cost for imported energy fuels and services, the amount of wood fuels consumed per capita and the number of households without electricity supply should be considered.
- The emphasis is on developing a methodology from the bottom-up to ensure local ownership and usability.

Japan *by Yosuke Tanabe*

Under severe pressure from the public, the Japanese government introduced a national Feed-in Tariff on the 1st July 2012. Under this scheme individuals and co-operatives are able to generate electricity and sell this to the national grid. This is an opportunity for a radical change in mindset where economic gain from the electricity generation is no longer reserved for large corporations³⁵ but accessible to individuals³⁶.

Japanese people have real power to change the country's energy system:

1. The Japanese Feed-in Tariff is funded by a surcharge added on electricity bills.³⁷ In other words, it relies on the capital of individual people.
2. The average household pays \$102.35/month (\$1=JP¥80) for conventional electricity.³⁸ If 100,000 people who took part in the anti-nuclear rally³⁹ decided to invest the money they spend on energy bills in renewable energy it would amount to \$10 million investment each month.

What is urgently needed is comprehensive information that enables

individuals and community groups to exploit the Feed-in Tariff to help Japan achieve the transition to renewable energy sources. Our strategy proposes to develop a free *Guide to Renewable Energy in Japan*. It would be available online and as a document that the electric company would distribute to all its customers. The following is an outline of the *Guide*:

Guide to Renewable Energy in Japan⁴⁰

1. Towards Renewable Energy

The introductory chapter outlines a vision of Japan based on renewable energy with a strong emphasis on community schemes and the role of this guide in promoting that vision.

2. Current Energy State in Japan

This chapter describes the current state of energy in Japan. A deeper understanding of the problem provides an incentive for a quick transition to the renewable energy. This section will be updated regularly to reflect ongoing changes in the energy system.

3. Action as Individual

Chapter three offers practical tips for individual households such as energy saving and understanding domestic energy consumption. This chapter is simple and fun in order for the reader to enjoy challenges to improve the energy consumption in their home.

4. Getting Together

Armed with information from chapter 1-3, chapter four will guide the reader to start a group with people who share a similar interest in energy issues. It is intended to inspire the reader to think big and beyond the limitations of their home.

5. Community Generation in Renewable Way

This chapter offer guidance on how to sustain group action. The reader will learn how to make the most of the Feed-in Tariff with different renewable energy technologies.

6. Make It

Chapter six will help the reader test the feasibility of ideas and offer

practical advice to move theoretical plans into reality.

7. Case Study

This chapter offers case studies from Japan and across the world with helpful links to find more information. This section will be updated frequently.

8. Resources

This section lists essential resources, including books, websites and relevant organisations.

The approximate cost for a six months project to develop the *Guide to Renewable Energy in Japan* portal and document is \$15,000 as shown in Table 2.

Wage for web designer	USD 1000
Wage for local staff to maintain web page (2 person)	USD 2000/month
miscellaneous	USD 2000
TOTAL	USD 3000 + 2000/month

Table 2: Cost to establish *Guide to Renewable Energy in Japan*

Conclusion

The renewable energy advocate Hermann Scheer recognised that a transition to a global state of renewable energy needs a decentralised supply that matches decentralised consumption and shifts power to individuals and communities.⁴¹ In line with this, the key strategies developed by the team are as follows:

South Sudan

Setting up solar energy training centre to spread solar technology and shift dependency away from oil.

Pakistan

Creating a diverse energy mix based on renewables.

The Gambia

Developing an appropriate energy accountancy methodology to inform

the design and management of sustainable electricity and wood fuel systems.

Japan

Creating an online information portal that will help individuals and co-operatives implement renewable energy systems and make use of the newly introduced Feed-in Tariff.

Sources

- 1: Scheer, H. (2010) *Der Energethische Imperative: 100 Prozent jetzt: Wie der vollständige Wechsel zu erneuerbaren Energien zu realisieren ist*. München, Verlag Antje Kunstmann.
- 2: *Peters Projection (without flags)*. (n.d.) [Online Image]. Available from: < http://upload.wikimedia.org/wikipedia/commons/thumb/f/f5/Peters_projection_blank.svg/1024px-Peters_projection_blank.svg.png > [Accessed 22 July 2012].
- 3: *Coal mine*. (n.d.) [Online Image]. Available from <http://www.news-business.net/wp-content/uploads/2010/05/Mining_Companies.jpg> [Accessed 22 July 2012].
- 4: *Nuclear power plant*. (n.d.) [Online Image]. Available from <http://www.jstevenwood.com/images/UK05_085.jpg> [Accessed 22 July 2012].
- 5: *Effects of global warming: drought* (n.d.) [Online Image]. Available from <http://www.instablogsimages.com/1/2011/08/26/drought_and_heat_wave_7lbyg.jpg> [Accessed 22 July 2012].
- 6: http://pdf.usaid.gov/pdf_docs/PDACP157.pdf
- 7,8,9,10: http://www.ifdc.org/Nations/South_Sudan
- 11: Iqbal S., 2012 *Energy crisis, causes & remedies*, Pakistan Observer. <http://pakobserver.net/detailnews.asp?id=35838>
- 12: Khalid A., 2012, *5 steps to solving Pakistan's energy crisis*, The Express Tribune Blogs. <http://blogs.tribune.com.pk/story/10507/5-steps-to-solving-pakistans-energy-crisis/>
- 13: Schiffer, A. (2010) *Mass charging of mobile phones in Gambian village* [Photograph].
- 14: Agency of Natural Resources and Energy 2010, *Energy in Japan 2010*, Fig.10, page 9, *Ministry of Economy, Trade and Industry*. <http://www.enecho.meti.go.jp/topics/energy-in-japan/english2010.pdf>
- 15: Agency of Natural Resources and Energy 2010, *Energy in Japan 2010*, page 11, *Ministry of Economy, Trade and Industry*.
- 16: Renewable Energy World Editors, 2011, *Japan Poll: Switch to Renewables, But Take it Slow*, *Renewable Energy World.com*. <http://www.renewableenergyworld.com/rea/news/article/2011/08/japan-poll-switch-to-renewables-but-take-it-slow>
- 17: Willacy, M., 2011, *Tokyo anti-nuclear rally draws thousands*, *ABC News*. <http://www.abc.net.au/news/2011-09-20/tokyo-anti-nuclear-rally-draws->

- thousands/2907108
- 18: *Chlorophyll* (n.d.) [Online Image]. Available from <[[http://rpmedia.ask.com/ts?u=/wikipedia/commons/thumb/a/a1/Citrus_leaf\(crop\).jpg/140px-Citrus_leaf\(crop\).jpg](http://rpmedia.ask.com/ts?u=/wikipedia/commons/thumb/a/a1/Citrus_leaf(crop).jpg/140px-Citrus_leaf(crop).jpg)]> Accessed 22 July 2012.
 - 19, 20, 21, 22: http://www.ifdc.org/Nations/South_Sudan
 - 23: <http://www.stiftung-solarenergie.org/Pilot-Solar-village-Rema,602.html>
 - 24: [Online Image] Available from <<http://www.greenpowerup.com/wp-content/uploads/2012/05/Indigo-South-Sudan2.jpg>>
 - 25: <http://www.stiftung-solarenergie.org/Pilot-Solar-village-Rema,602.html>
 - 26, 27: <http://www.planetedentrepreneurs.com/planete/?p=910&lang=en>
 - 28: [Online Image] Available from <http://farm3.staticflickr.com/2786/4132138328_78e1d00b0b_z.jpg>
- PAKISTAN
- 29: *Pakistan Energy Conference*, April 10-12, 2011, Sarena Hotel, Islamabad. <http://www.pakistanenergyconference.com/>
 - 30: Kartz M., 2012, *The feasibility of renewable Energy in Pakistan*, Triple Bottom-Line Blog. <http://www.tbl.com.pk/the-feasibility-of-renewable-energy-in-pakistan/>
 - 31: Munawar A., Solar Energy, *Energy and Renewable Energy Scenario of Pakistan* Page 5, Pakistan Council of Renewable Energy Technologies. [www.research.org.pk/Energy and renewable energy scenario in pakistan.pdf](http://www.research.org.pk/Energy_and_renewable_energy_scenario_in_pakistan.pdf)
 - 32: [Online Image] Available from <<http://www.cleanbiz.asia/image/pakistans-solar-energy-potential>> 27 July 2012.
 - 34: Schiffer, A. (2010) *Batakunku wind turbine* [Photograph].
 - 35: Kaneshima, H. and Yamauchi, R., 2012, "Feed-in tariff energy system gets under way", *Daily Yomiuri Online*. <http://www.yomiuri.co.jp/dy/national/T120702004231.htm>
 - 36: Asahi Shimbun Writer, 2012, "No more Nuke: Farm group in Fukushima starts production with Solar energy", *The Asahi Shimbun Digital*. <http://www.asahi.com/special/10005/TKY201207170113.html> (in Japanese)
 - 37: Johnston, E., 2012, "New feed-in tariff system a rush to get renewable in play", *The Japan Times ONLINE*.
 - 38: Statistical Research and Training Institute, 2012, "Report of family budget survey 2011", Table I-1-2, page 7, *Ministry of Internal Affairs and Communication*. www.stat.go.jp/data/kakei/sokuhou/nen/pdf/gk01.pdf (in Japanese)
 - 39: Tabuchi, H., 2012, "Tokyo Rally is Biggest Yet to Oppose Nuclear Plan", *The New York Times*. <http://www.nytimes.com/2012/07/17/world/asia/thousands-gather-in-tokyo-to-protest-nuclear-restart.html>
 - 40: Clark, D. and Chadwick, M., 2011, *THE ROUGH GUIDE to Community Energy*, *ROUGH GUIDES*. http://roughguide.to/communityenergy/RG_Community_Energy.pdf
 - 41: Scheer, H. (2010) *Der Energetische Imperative: 100 Prozent jetzt: Wie der vollständige Wechsel zu erneuerbaren Energien zu realisieren ist*. München, Verlag Antje Kunstmann.

9. AIRVENGERS

by Kaycee Flore, Hillary Fronk and Heather McAdams

Strategic Summary: Air pollution causes more deaths than AIDS and malaria combined. Green walls and roofs are an efficient and effective way of dealing with this problem that is affordable. Benefits include the removal of particulate matter from the air as well as other harmful toxins that can cause health issues such as respiratory illness, asthma, cancer, and can even lead to death. The technology is available and the workforce is ready. What are lacking are the incentives to move forward. Through a set of tax and other incentives, cities can quickly implement enough green roofs and walls throughout their area to impact the quality of air and the health of their citizens.

Introduction

According to the World Health Organization, approximately 3.3 million people died in 2013 from outdoor air pollution. This makes air pollution the source of more deaths than AIDS and malaria combined.¹

One of the most dangerous forms of air pollution is particulate matter. This pollutant can be broken down into two subclasses, PM10 and PM2.5. The subclasses of particulate matter differ by particle size and the way that they enter the body; PM10 enters the body through the lungs and PM2.5 enters the body through the blood stream.² Unfortunately, there appear to be no safe exposure levels for particulate matter (PM2.5 and PM10).

In addition to particulates, there are toxins in the air that very dangerous. These include formaldehyde (CH₂O), which is found in plastic products. It enters the indoor environment through natural sources such as forest fires and certain human activities, including burning tobacco, gasoline and wood. It is present, in its breathable gas form, in virtually all homes and buildings. Studies have suggested that people who are exposed to low levels of formaldehyde for long periods of time are more likely to experience asthma-related respiratory symptoms, such as coughing and wheezing. In higher amounts formaldehyde is known to cause cancer of the nasal cavity.³

Volatile organic compounds (VOC's) are found in all petroleum products. The main reason to be worried about VOCs is because

they are the primary precursor to the formation of ground level ozone and particulate matter in the atmosphere which are the main ingredients of the air pollutant referred to as smog. The negative health effects of smog are well documented.⁴

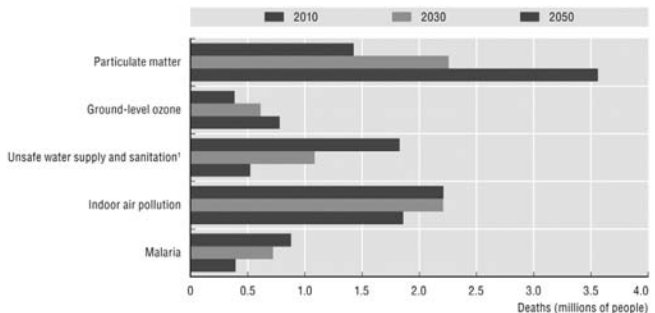
Carbon monoxide (CO) is present in high concentrations in cigarette smoke and vehicle exhaust. Low level exposure causes dizziness and headaches while more acute exposure can lead to death because CO actually prevents the delivery of oxygen to the body's cells.⁵

Benzene (C₆H₆), Toluene (C₇H₈) and Xylene (C₈H₁₀) are found in the vapor of products such as gasoline, oils, paints, glues, inks, plastics, and rubber. They are skin and eye irritants and are known carcinogens, in connection to human leukemia.

According to the Environmental Protection Agency, "people living and working in buildings of manmade materials inhale over 300 contaminants every day." Concerns about these contaminants arise from the hypothesis that, when combined, the toxicity of hundreds of different chemicals can add up to create major health hazards.⁶

An ancient Chinese proverb states *"If we do not change our direction, we are likely to end up where we are headed"*. The below graph illustrates the predicted global killers in 2010, 2030

and 2050 if we continue at are current levels of pollution without mitigation.⁷



Strategy: Green Walls and Green Roofs

As a way of dealing with many forms of air pollution, including particulate matter, our strategy calls for the widespread use of green walls and roofs. These are building walls covered in plants that transform the barren wall in to a living wall. Green walls are self-sustaining vertical gardens attached to the exterior or interior of a building. Green roofs are self-sustaining rooftop gardens.

The benefits include the removal of particulate matter from the air as



well as other harmful toxins that can cause health issues such as respiratory illness, asthma, cancer, and can even lead to death.

Other benefits of green walls and roofs include the filtering and removal of toxins. They also add energy rich oxygen. This reduces respiratory illness related to air pollution. In addition, recent reports carried out at American and European Universities show that simply having a

view of plants in a working environment provides positive physiological responses. This translates into greater employee efficiency that results in increased earnings for a company. A study carried out at Washington State University had participants' blood pressure and emotions monitored while completing a simple, timed computer task in the presence or absence of plants. It concluded that when plants were added to this interior space, the participants were more productive (12% quicker reaction time) and less stressed (lower blood pressure).⁸

Utilizing green walls and green roofs reduces the “urban heat island effect.” Instead of storm water running off of the building it is collected by the green wall, thereby providing thermal insulation and cooling the air. In addition to also collecting water and creating a cooling effect green roofs also keeps the buildings warm in the winter because the added soil provides an extra layer of insulation that keeps some of the heat from escaping through the top of the building.



Cost-Benefit Analysis

Tax and other policy options can encourage the widespread utilization of green roofs and walls as a way to mitigate the complex environmental problems facing urban centers in developing and developed countries.

Green roofs and walls are not used more because they have a high installation cost which deters initial investment.⁹ Looking at the benefits of green roofs and walls and not just the costs leads to a more balanced rationale for their immediate and widespread use. Specific benefits that should be noted are roof longevity, reduced storm water runoff, decreased energy consumption, biodiversity benefits, reduced urban heat-island effects, and air pollution mitigation.¹⁰

One study, conducted at the University of Michigan, showed *annual* health benefits of \$895 to \$3,392 for a 2,000 square meter vegetated roof for the removal of just nitric oxide from polluted air. This study also assessed large-scale roof greening within the Detroit and Chicago metropolitan areas. Greening ten percent of metropolitan roofs

would result in 15,300 to 18,500 Mg of NO_x reduction (from direct and indirect uptake) reducing annual public health costs between \$25.8 million to \$97.7 million in Detroit and between \$31 million to \$118 million in Chicago.¹¹



Funding Green Roofs and Walls

The public sector can provide incentives to small and large corporations, and private apartment houses and residences to incorporate green roofs and walls into their buildings. Tax breaks and rate reductions for public utilities would be the primary tools for this.

Case Study

In order to demonstrate the need and utility of green walls, we performed a case study comparing Philadelphia (United States) and Ludhiana (India). Both cities are affected by smog and possess similar population sizes (both hold about 1.5 million people), but Ludhiana is one of the most polluted cities in the world.

Green walls have recently come to Philadelphia through an advanced green wall program. The state of the city in terms of air pollution required this—it is one of the most polluted cities in the United States, with 35 “unhealthy” days in 2012 (according to the Air Quality Index), and hundreds of thousands of people plagued by lung diseases (there are 150,000 cases of asthma, 50,000 cases of chronic bronchitis, and 20,000 cases of emphysema).¹² Philadelphia is an attractive location for a green wall center. It has 49 skyscrapers, which have the flat surfaces and roofs ideal for green walls.¹³

In rough comparison, there were 620,000 air quality related deaths in 2009 in India. That same year, environmental degradation cost India \$80 billion, or 5.7% of its GDP.¹⁴ In Ludhiana specifically, 200 people die prematurely due to air pollution every year. Unlike Philadelphia, which has 35 unhealthy days per year, most of Ludhiana’s year qualifies as unhealthy—its particulate matter concentration averages two to four times the healthy limit.¹⁵ The smog in the city is attributed



to boilers, thermal power plants, and cars. Meanwhile, the condition is exacerbated by seasonal rain and excessive dust.¹⁶

Ludhiana is an ideal city to implement green walls for a number of reasons. It is just recently beginning to develop in terms of skyscraper number, so the green walls can be added as the skyscrapers are built, rather than as retrofits. It also consists mostly of buildings with flat roofs and walls, making it easier to install green roofs on existing buildings.

Green Roofs and Walls Website

One facet of our strategy for spreading the use of green roofs and walls is the development of a *Green Roof and Walls website*. Its purpose is to inform the public, policy makers and the business community about the problems and severity of particulate matter in the air— and the options afforded by green roofs and walls. The site will provide a list of air pollutions for each city (utilizing in the U.S the *Toxic Waste Inventory* that the US EPA maintains) as well as which plants remove those pollutants. There will be a list of which companies output what air pollution. This will allow individuals to see which industries are the main polluters and encourage informed consumerism and enabling transparency in the marketplace.

The website will provide a list of cities implementing green walls and their progress. It will sponsor a competition to see which city has the most green roofs and walls. In addition there will be information-based games related to green walls and roofs that will help inform and engage youth. The website will feature a meter that counts how many people in the world suffer from repertory illness related to air pollution, as well as the number of green walls and roofs. There will be a section on which plants are the most effective to keep around the house for indoor clean air, as well as facts, tips and ideas for people to create a clean air living environment.

The Future

The implementation of green walls and green roofs in urban environments will bring with it economic, environmental and social benefits, including:

- The reduction of smog and airborne pollutants
- The addition of jobs and long-term employment opportunities

- A decrease in expenditures on air pollution related illnesses
- A decrease in expenditures on waste water management.

Endnotes

- 1 <http://www.who.int/ceh/risks/cehair/en/index.html>
- 2 <http://www.who.int/mediacentre/factsheets/fs313/en/index.html>
- 3 <http://greenovergrey.com/green-wall-benefits/overview.php>
- 4 *ibid*
- 5 *ibid*
- 6 *ibid*
- 7 <http://www.oecd.org/env/indicators-modelling-outlooks/49846090.pdf>
- 8 *ibid*
- 9 http://www.erb.umich.edu/News-and-Events/colloquium_papers/Clarketal.pdfAdam
- 10 <http://0go.galegroup.com/bianca.penlib.du.edu/ps/i.do?action=interpret&id=GALE%7CA334277799&v=2.1&u=udenver&it=r&p=ITOF&sw=w&authCount=1>
- 11 http://www.erb.umich.edu/News-and-Events/colloquium_papers/Clarketal.pdfAdam
- 12] <http://blogs.phillymag.com/bewellphilly/2012/04/25/tenth-polluted-city/>
- 13] <http://www.emporis.com/statistics/most-skyscraper-cities-worldwide>
- 14 <http://blogs.worldbank.org/endpovertyinsouthasia/indias-air-pollution-woes>
- 15 <http://www.tribuneindia.com/2010/20100331/punjab.htm#4>
- 16 <http://india.blogs.nytimes.com/2012/02/01/indias-air-the-worlds-unhealthiest-study-says/>



STRATEGIC AREA II: REGIONAL ENERGY SYSTEMS

10. Efficiency or Catastrophe

**11. Rural Electrification via
Small Scale Wind Power**

12. Tidal Power for India

10. EFFICIENCY OR CATASTROPHE: HOW A DEVELOPED COUNTRY CAN BECOME MORE EFFICIENT WHILE DECREASING EMISSIONS

By Brittany Mixson and William W. Sheehan

Strategic Summary: Inefficient use of energy is one the primary causes of our energy and environmental problems. There are numerous policies, programs and actions that can be taken that will increase the efficiency of our energy use throughout society.



Problem State

Inefficiencies in the use of energy cause everyone to suffer. Inefficient energy use is the main cause of pollution and climate change as well as a major culprit in using up our limited supply of fossil fuels.

Increasing utility bills, driven by increasing costs and the inefficient use of energy, are driving people out of their homes.

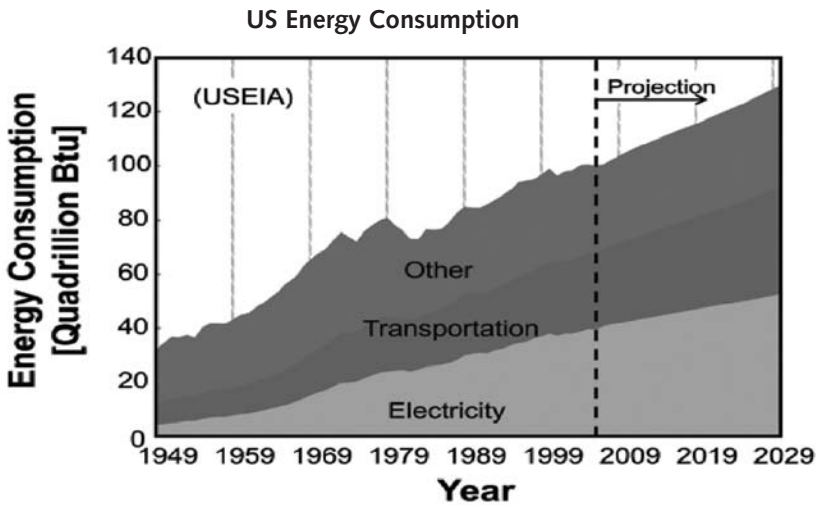
Inefficient transportation, such as 18-wheel trailer trucks that get four miles to the gallon of diesel fuel and use 50% of their fuel solely to counteract drag forces are raising the cost of basic necessities as well as putting people out of work. Up until the present day, efficiency standards were not valued as much as the low purchase price of an item.

Preferred State

An ever increasing energy-use efficiency results in a cleaner, more affordable, abundant energy supply and a healthier economy.

More specifically, the energy efficiency preferred state calls for:

- motor vehicles getting at least 60 miles per gallon
- powered by non-fossil fuel energy sources such as ethanol made from non-food feed stocks and/or bio-diesel
- houses being at least twice as efficient as they are now.



Strategy for Reaching the Preferred State

Part 1

Energy Efficiency Assistance Agency and International Efficiency Standards

Part 1 of the *Efficiency or Catastrophe* strategy is to establish a global energy efficiency agency and international standards for energy efficiency.

The mission of the *Energy Efficiency Assistance Agency* (EEAA) is to educate the private and public sectors as well as individuals on energy and fuel efficiency. Part of this mission is to work with the United Nations on the establishment of *global* energy efficiency standards. These efficiency standards will be set for appliances, housing, vehicles and industrial processes.

Part 2

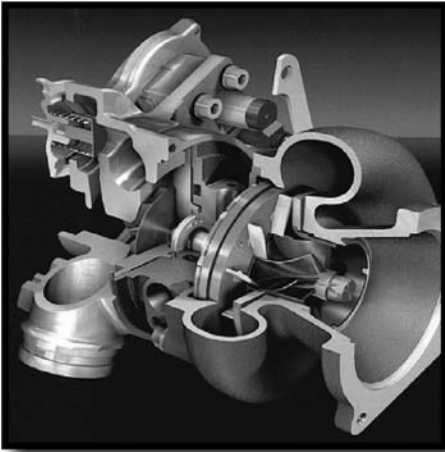
Green Training

Part 2 of the *Efficiency or Catastrophe* strategy is to set up *Green Training* programs all over the developed world for workers displaced by globalization. Graduates of these programs will work as retrofitters and installers of energy conserving measures for housing and businesses.

Part 3 Green Trucking and Shipping

Part 3 of the *Efficiency or Catastrophe* strategy will have the EEAA team up with the EPA and other regulatory agencies in other countries in regulating emissions and rewarding increases in the efficiency of trucking and shipping.

Some of the new engine efficiency technologies that will be encouraged through incentives and, where needed, penalties, are



Humid-Air-Motors

Humid-Air-Motors and Variable-Turbine-Geometry turbine add-ons. Both are turbo-charger add-ons. The former sprays an aqueous mist into the combustion engine alongside the fuel that purifies the emissions and maintains the engine. It is most effective with diesel engines, primarily those that run on bunker fuel (ship engines). The Variable-Turbine-Geometry turbine comes

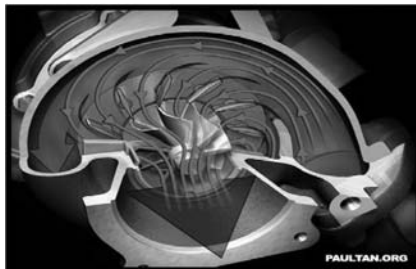
in the form of a turbo-charger add-on. It works with self-adjusting turbines that channel the force of the exhaust in such a way that it recycles the exhaust, increasing the efficiency of engines and reducing emissions (nitrous oxide emissions are reduced by 80%).

Another technology that will be used will increase the efficiency

Truck Drag Resistors



Variable-Turbine-Geometry turbine



of trucks as it cuts down on their wind resistance. Drag resistors are easily attachable for trucks and have a payback in saved costs of less than a month.

Part 4 Green Rewards

Part 4 of the *Efficiency or Catastrophe* strategy will have the EEAA working with country based regulators to reward and/or enforce efficiency standards on residential buildings. Part of this effort will be to reward those who consume 20% less than the average amount for a house of their size and to tax those who consume more than 20% of the average. Tax funds from this operation will fund the rewards that go to energy conserving households and to finance low-interest loans for energy efficiency improvements for low-income households.



What the UN Could Do to Make this Strategy Real

To make this strategy real the United Nations needs to either add an “efficiency clause” to the Millennium Development Goals, create an additional set of Millennium Goals dealing with energy, or set up a new *Global Energy Agency*. This agency would advocate efficiency treaties and standards among world governments, develop renewable energy sources in global commons areas, and be the advocate for getting basic electricity into all the parts of the world. In addition the UN would make itself—its numerous buildings and operations—energy efficient as an organization in order to model its benefits.

11. RURAL ELECTRIFICATION VIA SMALL SCALE WIND POWER

by Angela Burcham and Daniele Seldomridge

Strategic Summary: There are over 1.6 billion people in the world without access to electricity. Nearly 80% (1 billion) of these people live in rural areas where the electric grid does not reach. Decentralized electricity production devices could make an enormous contribution in these regions. Small-scale wind generators, as outlined in the following, could meet many areas' electricity needs.



Problem State

Almost all of rural Africa does not have electricity to meet basic needs. Electricity is unavailable, and when it is available, it is unreliable and not affordable by the people who need it the most.

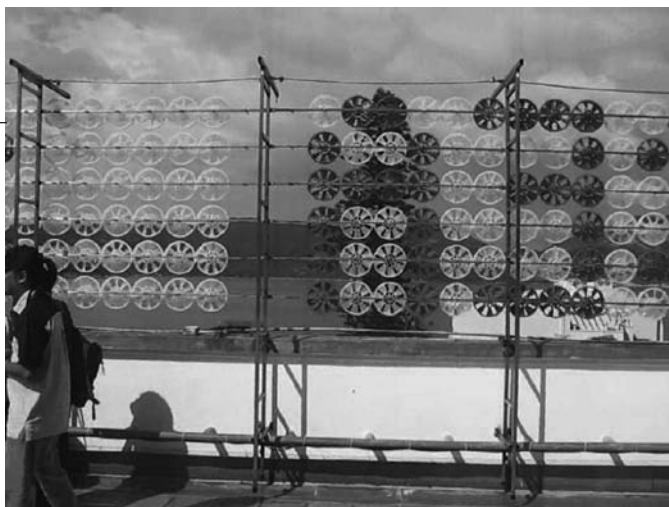
Preferred State

Less developed areas of the world will have access to clean, safe, affordable, and renewable sources of energy.

Strategy

Motorwind is a small-scale wind powered electric generator capable of powering lights, radios, mobile phones and re-chargers for numerous battery powered devices. It is lightweight, easy to use, adaptable, modular and mobile.

Motorwind Turbines in Hong Kong



Very importantly, it works without being connected to the grid and its low cost makes it affordable for many areas of the world.

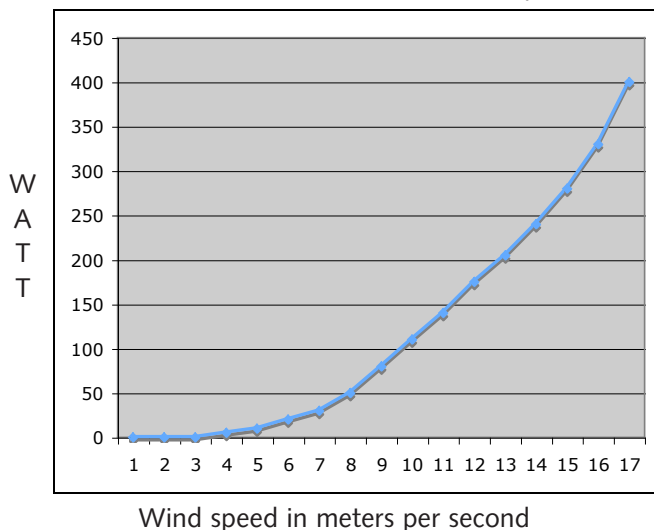
The *Motorwind* generator works in a minimum wind speed of 2m/s (4.47mile/hour) and can work in high wind speeds as well. It is a fairly low-tech device that can also store excess power in batteries. It is made from recycled plastics and is recyclable when its three- to five-year life span is over.

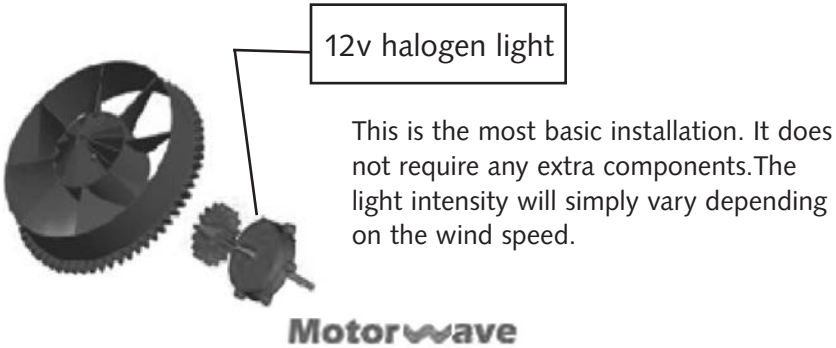
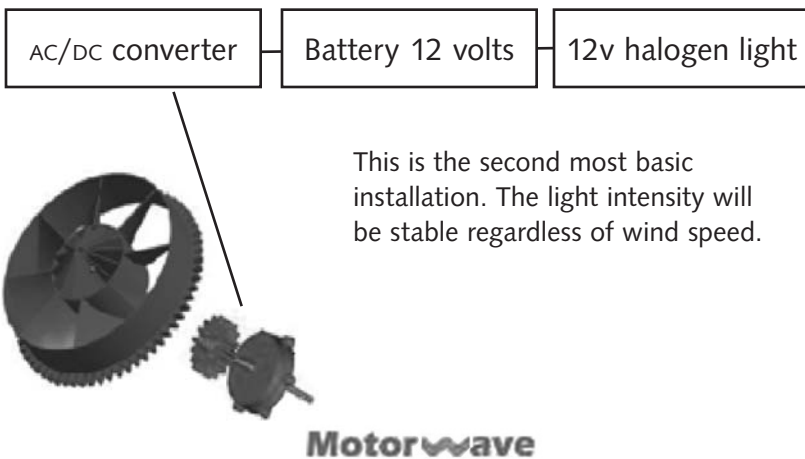
The cost for a set of eight *Motorwind* turbines is currently \$150. Cost will be reduced when the units are mass-produced.

This strategy calls for the mass distribution of *Motorwind* turbines to rural areas in Africa by economic development non-governmental

organizations. The costs of the devices will be borne by the recipients of the power. The initial capital to purchase the devices will come from microloans. These will be paid back through the sale of electricity and the recharging of batteries to

Power collected with 20 turbines = 1 square meter

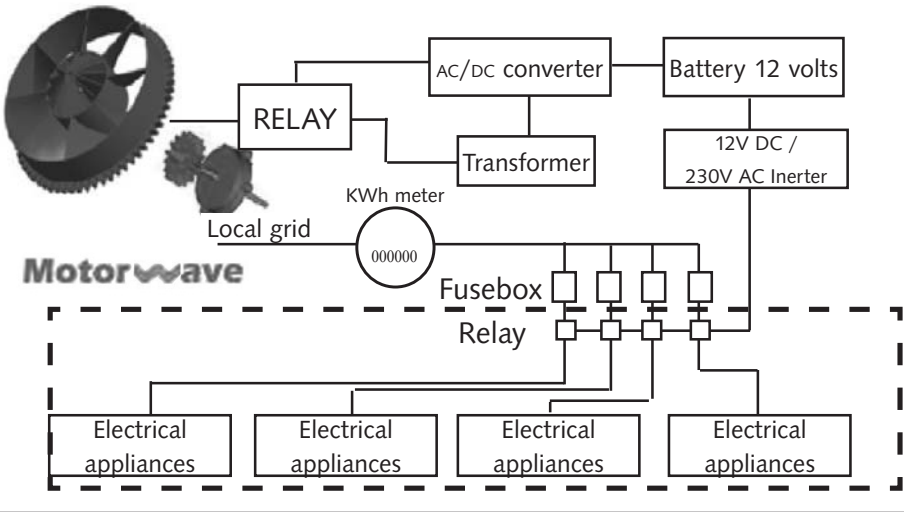


From Basic Installations to supplementing the grid:¹⁸**Electrical installation** for basic lighting**Electrical installation** for basic lighting

surrounding neighbors and other electricity using organizations and people.

To supply a million families with basic electricity per year for ten years, so that approximately 50 million people are reached, would cost about \$100 million per year.¹⁷

Electrical installation with switch to the grid for unstable winds



Tanzania Case Study

In Tanzania, the average annual wind speed is 19 miles per hour. A single Microwind turbine will generate approximately 6.5 kWh/year in wind speeds of 5 meters per second (11 miles per hour). In wind speeds of 18mph, 25 kWh per year is generated. A 20 Microwind turbine installation would generate 500 kWh per year in Tanzania.¹⁹ A million Microwind installations in Tanzania would generate 500 million kWh of electricity. This is 41% of Tanzania’s total current consumption of electricity.²⁰ As such, this amount would have a profound impact of the availability of electricity in the country.

Motorwind Power Output

Wind speed m/sec.	2	3	4	5	6	7	8	9	10
Wind speed miles/hr	4.5	5.5	9	11	13.5	15.5	18	20	22
kWh w/ 8 turbines	0.4	1.3	3	6	10	17	25	36	50
kWh w/ 20 turbines	1	3.3	8	15	27	42	64	91	125

12. TIDAL POWER: HARNESSING AN INFINITE RESOURCE—INDIA AND BEYOND

By Emily G. Gleason

Strategic Summary: Tidal energy is a vast untapped energy source that could provide significant amounts of energy throughout the world. It can do this without increasing carbon inputs into the atmosphere. This strategy shows how developing nations, in particular India, can increase their electricity supply through tidal power.



Present State

India is growing. Its population is at 1.1 billion people,²¹ and an increasing amount of resources are needed to sustain its booming population and economic growth. India's energy demand grew by 6.8% in 2007, the third largest growth after China and the United States.²²

One of the most significant energy resources needed is electricity. So far, India has approached this problem largely through coal power. India's coal consumption grew by 6.6% in 2007, compared to the average global rise of 4.5%.²³ Thirty-eight percent of India's energy consumption is coal powered.²⁴ In 2007, India consumed 208 million metric tons (in oil equivalent) of coal.²⁵ India's overall energy demand is 404.4 million metric tons (in oil equivalent).²⁶ Sectors that consume the most coal in India are the industrial sector at 29.4 thousand metric tons, the commercial sector at

2.9 thousand metric tons, and the public services and residential sector at 2.7 thousand metric tons (in oil equivalent).²⁷

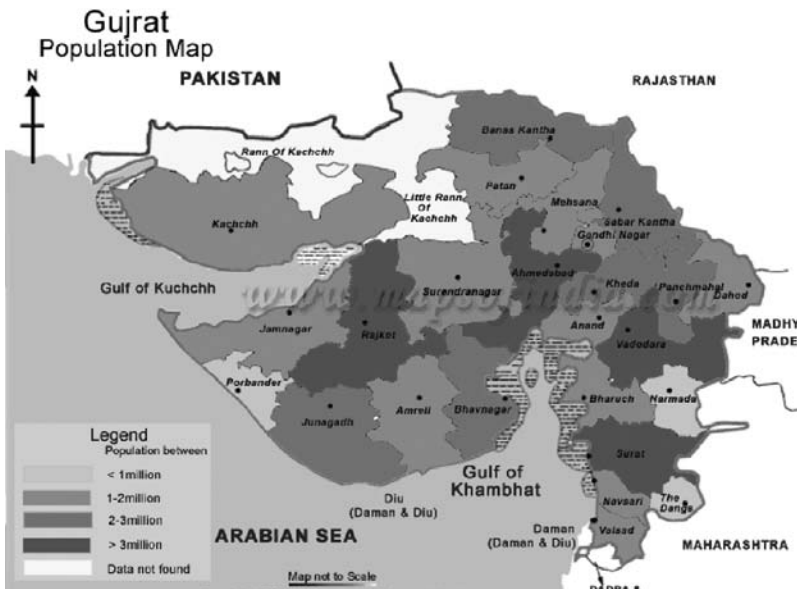
We have known for decades that coal combustion, although inexpensive in today's current monetary accounting systems, is very expensive in other areas. For example, it is unhealthy for the environment and detrimental to human health. Every year an average coal plant generates 3.7 million tons of carbon dioxide, 10 thousand tons of sulfur dioxide, 10 thousand tons of nitrogen oxide, 720 tons of carbon monoxide, as well as significant amounts of arsenic, mercury, lead, and airborne particles.²⁸ These emissions have been proven to cause fatal illness such as respiratory disease and cancer. Sulfur dioxide is a source of acid rain that degrades the environment; carbon dioxide acts as a heat-trapping gas in the atmosphere and is the major contributor to global warming.

Preferred State

A preferred state to the current energy situation in India is one where India has a clean, abundant, affordable, and reliable supply of electricity that is produced in a sustainable manner.

Strategy

Tidal power electricity generation has minimal environmental impact, unlike coal and other fossil fuel power generation. It requires no fuel, and

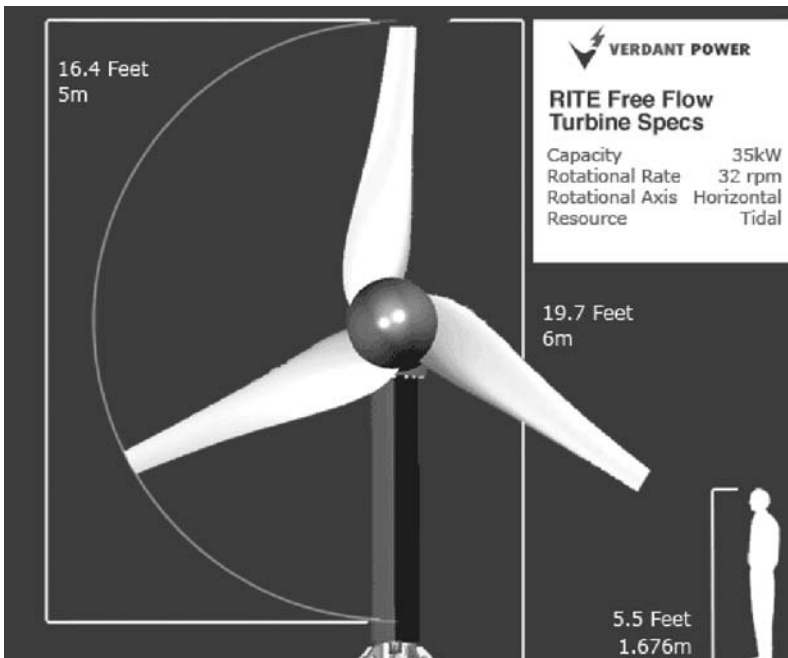


generates no pollution. Unlike wind turbines, there is little visual impact, as the turbines are submerged under water. Unlike hydroelectric dams, tidal turbines do not alter the flow of the current, block migration paths, nor require flooding and displacement of populations on surrounding land. Some scientists even suggest that the turbines can become hubs of aquatic life as small organisms latch on the turbine attracting larger species.

Negative environmental effects are possible, such as sediment stir-up in the water, possible collisions with the moving blades by fish, and also a restriction on boat movement, depending on water depth. The major disadvantage of tidal power is that the technology for harnessing it has, up to now, been only suitable for large-scale tidal sites, and there are relatively few of these in the world.

Tidal power—the energy harnessed from the in and out-flows of the currents and tides—is an old energy source. But new technology for harnessing that energy source, made possible by advances in materials, turbines, and wind power, is now available. Some of the technologies are available now, others are in the testing stages.

One new technology is a turbine that is anchored to the sea or riverbed. Blades turn with the flow of the tidal (or river) current, which then turns a generator that feeds electrical current through a cable to a grid. These new tidal power turbines are comparable to wind turbines in design and mechanics.



India Case Study

India could remedy its contributions to global climate change and reduce health risks to its citizens by reducing reliance on coal as an electricity source. This reduction should be part of a long-term plan to completely phase out coal as a source of electricity, and replace this energy with clean and sustainable energy. Although India has invested in wind turbines and a hydroelectric dam, a vast waterpower resource is left un-tapped in its two western gulfs: the Gulf of Kutch, and the Gulf of Khambhat. Both gulfs possess large tidal ranges and offer ideal environments for tidal power deployment.²⁹

At its current stage of mechanical and economic development, tidal power is ideal to power small residential areas with a relatively low electricity demand—such as in the area around the Gulfs of Kutch and Khambhat.

There are several tidal power prototypes that have proven successful. A New York company, Verdant Power, has six three-blade tidal power turbines currently deployed in the Manhattan East River. The project was initiated in 2006, and completed in May 2007. The turbine units are six meters tall, with blade diameters of roughly five meters. Rated at 35 kilowatts, each turbine produces 665 kilowatt-hours running nineteen hours per day. The cost to consumers is 7 cents per kilowatt-hour. The cost per *prototype* turbine unit is \$4,800 per kilowatt. This high per-kilowatt amount will be lowered with mass-production of the turbines.³⁰

The electricity generated by the turbines is being used to power a local grocery store, Gristede's Supermarket. The company projects that further expansion of turbines in the East River can produce up to 10 megawatts, enough to power 8,000 New York City homes.³¹

Given enough space, the number of turbines can be increased to generate far greater amounts of electricity. The deployment of 1,000 turbines would produce 243 million kilowatt hours per year. Such an installation would cost an estimated \$70 to \$85 million, depending on the economics of turbine mass production.

Current prices for tidal turbine units are high relative to coal fueled power plants, but this cost discrepancy is expected to come down with mass production of the turbines, the removal of subsidies to the coal industry, and the added operating costs of coal plants when carbon emissions are figured into total costs.³²

Government subsidies of tidal power and green energy could also help to cut costs significantly. Over all, tidal power right now costs less

in the long term, as it does not require fuel with its associated monetary and environmental expenses. Coal power, like other fossil fuel power generation, faces carbon taxation that will further hinder affordability. Coal, unlike tidal power, is a finite resource with serious environmental impacts and should therefore not be relied upon and invested in for the future.

With the goal of lowering India's coal dependence, and providing electricity for a growing population and economy, a tidal power plant could be installed in the Gulf of Kutch and the Gulf of Khambhat, using Verdant Power Inc.'s or similar technology.

Ideally, the Verdant Power tidal turbines would utilize and train local labor in installation and maintenance of the power system. One great advantage of the Verdant tidal power system over previous tidal power systems is that it can be expanded modularly. This will allow the tidal power system to grow as need expands.

In order for this tidal power project to have the most positive and sustainable impact on the local population, and India in general, the community needs to be informed and involved from the very beginning. Besides local employment opportunities, informational "town hall" type of meetings need to be held to answer questions and describe changes and opportunities the project will bring about.

Funding for the project could be obtained in a number of ways. Private investment, or a government or foundation grant to Verdant Power, or a similar company, would reduce their risk. Assistance from the Indian government could also provide incentive and reduce risk. Private investors with an interest in green energy could also be a funding source. The NGO community could be of help working with local citizens and insuring their interests and needs were fulfilled.

Beyond India

The governments of wealthy polluting nations, such as the United States, need to assume responsibility for their current and past environmental impacts. One constructive way of doing this that helps both a country such as the US, developing countries such as India, and the rest of the world, is for the US to fund, either outright or as a subsidy, the expansion of green energy technology in developing countries.

Through economic aid to energy-short developing countries and economic incentives within the US for an expanded use of green energy, a worldwide green energy revolution is feasible.

STRATEGIC AREA III: GLOBAL ENERGY SYSTEMS

- 13. Market Driven Energy Strategies**
- 14. Global Energy Corps**
- 15. Caron Subsidy Removal**
- 16. EmPower Book**
- 17. Manufacturing Renewable Technologies**
- 18. Sustainable Extension Network**
- 19. REST: Revamping the Energy System Today**

13. MARKET DRIVEN ENERGY STRATEGIES: CONVERTING CONVENTIONAL TO SUSTAINABLE

By Karen Guwuriro and Sam Little

Strategic Summary: The global energy market is one of the most important tools for providing manageable energy solutions to communities around the world. Through the removal of subsidies to the unsustainable and carbon-intensive sectors of the energy system, market forces will be able to assist in the transformation of the world's energy system.

Present State

The current problems of the global energy system market include:

- Government subsidized energy supplies that mask the true costs of energy to the users of energy and its impacts on the environment
- Lack of incentives to invest in renewable energy
- Failure to internalize environmental and social costs in price of energy
- Unbalanced distribution and use of energy worldwide
- Overall low efficiency and high pollution of world energy market
- Newer, more sustainable energies with higher costs are in competition with subsidized conventional energies.

In summary, the current global energy system and market is centered around and held in place by artificial props in the form of monetary and other subsidies. The result is an artificially expensive, high profit for the few inefficient, polluting, non-sustainable industries that do not meet the energy needs of the world.

Preferred State

A global energy system and market that would be preferable to the current system is one that:

- Meets the needs of 100% of humanity
- Systematically reduces emissions and pollution and increases efficiency of energy generation, delivery and use
- Provides affordable energy for everyone from metropolitan areas to developing rural areas
- Is based on sustainable, renewable, clean and affordable energy sources.

Strategy

Globalizing Renewable Potential: Part 1

Markets tend to make better decisions the more informed they are. To make the transition from conventional carbon-intensive energy systems to sustainable, cleaner energy systems, the global energy market place will need some adjustments that, minimally, level the playing field so that renewable energy sources can compete.

Step 1: Subsidy Eradication

Step 1 in this process is to begin the phase-out of all subsidies to carbon-intensive energy systems. Currently these worldwide subsidies are \$250–\$300 billion for conventional energy sources. World coal receives \$63 billion.³³ Subsidies are provided to large energy companies for producing energy, and they are given by governments to promote the consumption of energy. Table 1 provides a glimpse of the positive impacts that could occur if these subsidies were removed.

We propose that this subsidy removal be done over a five-year period, with a 10% reduction immediately, a 25% reduction in year two, a 25% reduction in year three, a 25% reduction in year four and a 15% reduction in year five.

Step 2: Global Inventory and Assessment

Step 2 calls for a global inventory and assessment of best practices in the efficient use of energy in the industrial sector. Incentives for corporations to reduce their energy consumption by half or more will be set in place.

Table 1 Impact of the removal of energy consumption subsidies

Country	Average rate of subsidy (% of market price)	Annual economic efficiency gain (% of GDP)	Reduction in energy consumption (%)	Reduction in CO ₂ emissions
China	10.9	0.4	9.4	13.4
Russia	32.5	1.5	18.0	17.1
India	14.2	0.3	7.2	14.1
Indonesia	27.5	0.2	7.1	11.0
Iran	80.4	2.2	47.5	49.4
South Africa	6.4	0.1	6.3	8.1
Venezuela	57.6	1.2	24.9	26.1
Kazakhstan	18.2	1.0	19.2	22.8
Total Sample	21.1	0.7	12.8	16.0
Total World	n.a.	n.a.	3.5	4.6

Step 3: Global Efficiency Standards

Step 3 will set up high efficiency standards for all energy-consuming appliances, buildings and vehicles—and establish incentives and penalties for achieving these standards in ten years.

The *United Nations Framework Convention on Climate Change Technology Subprogramme* is a clearinghouse on technology transfer. We propose that an expansion of this system be used in the greening revolution needed to make the transition to a clean global energy system.

This UN program seeks to improve the flow of, access to, and quality of the information relating to the development and transfer of environmentally sound technologies.³⁴ By expanding and focusing it on green technologies, and specifically renewable energy harnessing and efficiency technologies, the market will be able to have access to reliable energy-related information.

Energy Assessments

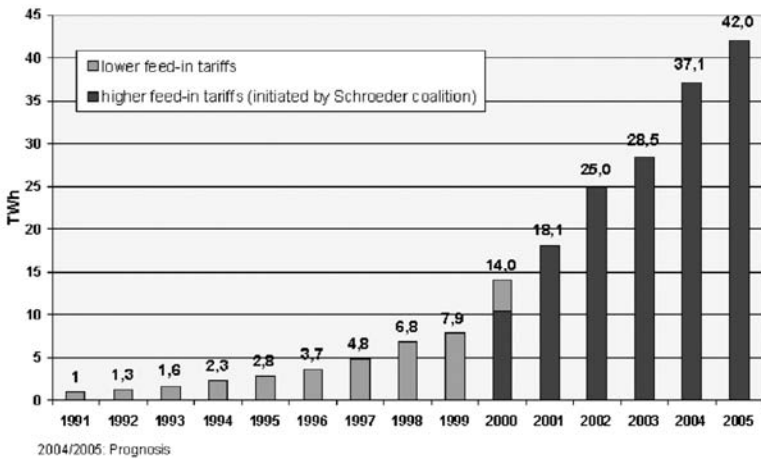
Another part of the strategy is for development banks to offer voluntary energy saving assessments for all energy-intensive industrial sectors. For example, the European Bank for Reconstruction and Development (EBRD) instituted a system of “Polluter Pays” —a system that charges pollution emitters according to the cost of cleaning up their pollution, and that also provides compensation to non-emitters.

Fixed Feed-in Tariffs

Another tactic is the “Fixed Feed-in Tariffs” (FITs) that have been widely adopted in Europe. These have proved extremely successful in expanding wind energy in Germany, Spain, and Denmark. A feed-in tariff promotes renewable energy technologies that are not currently cost-competitive with subsidized fossil fuels. It does this by requiring electric companies to buy electricity that is produced from renewable energy producers at fixed prices over a fixed time period. This purchase price is fixed by estimating the cost of production or by paying a premium over the cost of subsidized fossil fuel electricity production. The additional costs of this electricity from renewable energy sources are passed on to the consumer in the form of higher end-user prices.³⁵ Chart 2 documents the results of this strategy in Germany.

Germany gets more than 12% of its total electric energy from renewable power at a cost of about \$2.20 per month per home.

Chart 2 Development of the feed-in of renewables to the power grid in Germany



Globalizing Renewable Potential: Part 2

Renewable Targets

Establishing legally binding targets for renewable energy in large energy consuming countries will help undo the harm of decades-long subsidies to fossil fuel consumption. Using the EU's "Renewable Energy Roadmap" as a guideline, every country will establish similar binding targets for renewable energy.

The EU targets are:

- Renewable sources make up 12% of energy use by 2010
- Renewable sources to provide 21% of all electricity consumed by 2010
- Biofuels used in transport to reach 5.75% by 2010
- Electricity production from renewable sources will increase from the current 15% (in Europe) to approximately 34% of overall electricity consumption in 2020.

14. THE GLOBAL ENERGY CORPS

By Robert Fink

Strategic Summary: A Global Energy Corps will be formed. It will be open to anyone from any country willing to make an 18- to 24-month commitment. Its mission will be to train members to be skilled green workers that can go into any part of the world and install renewable energy harnessing technology.

Problem State

Affordable or clean energy supplies are not accessible by 100% of humanity. There is widespread inefficient consumption of energy resources. There are high emissions of CO₂ and other by-products of inefficient energy use. There is a lack of skilled workers able to install green technology and there is a lack of overall global communication and effective coordination among nation states concerning the global energy system.

Preferred State

One hundred percent of humanity has access to affordable, clean and abundant energy resources and these resources are used efficiently. As renewable energy is developed and fossil fuels are phased out, employment opportunities are made available to millions of people worldwide.

Strategy

A *Global Energy Corps* is set up with funds from governments, foundations, and investors. Continuing funding will come from an extremely small (0.001%) tax on all energy resource company's profits. In 2007 such a tax would yield over \$80 million.³⁶

The Corps recruits members who are then trained in reducing energy consumption through efficiency as well as in the installation of solar, wind, hydro, geothermal, and other renewable energy harnessing technology. These projects will be funded by the country where the projects are located and that benefits from the projects. If the country(s)

does not have the financial capability to fund the project, the Global Energy Corps will provide a loan. This loan will be paid back from revenue provided by the new energy installation.

The Global Energy Corps is simultaneously organized around different regions of the world and different energy sources. Solar workers would be in touch with all other solar workers around the world— while “African solar workers” would be in touch with all other workers in Africa.

15. CARBON SUBSIDY REMOVAL

By Ryan Martin, Bamini Balaji, Ross Brockwell, Kasia Chmielinski, Douglas Diaz, Victoria Farmer, Alexandra Heeney, Charles Sheldon

Fossil fuels receive many subsidies from governments around the world. These are in the form of price supports, tax breaks, low to no-cost licensing fees, publicly funded research and development, military expenditures in strategic locations to keep favorable governments in power and energy supplies secure, and unaccounted environmental and social costs. The amount of these subsidies is in the range of \$250 billion per year.²

A key strategy in reaching the preferred energy state is the phasing out of subsidies to fossil fuels so that they more accurately reflect their real costs to society and the global economy. This would include:

- Five year graduated (from current levels to zero) removal of all government subsidies to coal, oil, and natural gas
- The reallocation of R&D funds from fossil fuel industries to renewable energy industries
- Economic incentives that encourage investment in renewable energy and energy conservation.

The results of these moves would be a savings to global society of over \$200 billion in current expenditures on subsidies, plus, in just the US, a \$30 billion utility bills savings, \$6 billion in additional rural income, 90,000 new jobs (twice that from fossil fuels), plus less smog, acid rain, mercury contamination, and water use.³ On top of this the U.S would have a burgeoning industry of the future that can sell its products worldwide.

16. EMPOWER BOOK

By Ross Brockwell, Bamini Balaji, Kasia Chmielinski, Douglas Diaz, Victoria Farmer, Alexandra Heeney, Ryan Martin, Charles Sheldon

The *EmPower Book* is a local energy development manual. Its goal is to make energy-saving and -producing technology available in the developing world. It is a comprehensive guide/resource catalogue/manual that helps individuals and communities obtain access to energy and the conservation of energy—in its many forms and technologies. The “book” comes in a variety of forms—an actual paper book or online website and search engine with appropriate links to micro-loans and other services.

Funding would come from manufacturers whose products are listed in the EmPower Book and from ad revenue generated at the website by energy product companies whose products might be sold through the site. Micro-financing for obtaining the needed energy products will be part of the services offered by the EmPower Book.

Recipients of loans could sell the energy they produce to surrounding communities, thereby making enough money to repay the loan and to earn a steady income.

“The removal of fossil fuel subsidies has been advocated as the first order of priority in instituting economic policies to protect local and global environments.”

—World Bank

17. MANUFACTURING RENEWABLE TECHNOLOGIES

By Paul Beaton, Neha Bhatt, Harris Stewart

This strategy is designed to nurture a renewable energy manufacturing industry in Sub-Saharan Africa, and to diversify and spur economic activity and create jobs.

Sub-Saharan African countries can be attractive locations for renewable technology manufacturing plants. By removing some of the financial barriers, offering incentives, and providing reliable insurance and markets to companies that make such equipment, Sub-Saharan countries can become homes to a burgeoning renewable energy industry.

In developed, richer nations, renewable technology companies often have a tough time competing in the market of heavily subsidized industries such as oil, coal, gas, and nuclear power electricity. Manufacturing renewable energy technology in Sub-Saharan Africa could reduce capital and operating costs for some of these companies, and allow them to develop markets in places where the traditional coal/petroleum/nuclear powered grid has not already become the dominant system.

Just as the information technology field was nurtured and blossomed in India, it would be similarly feasible for the renewable energy industry to be nurtured and grow in Sub-Saharan Africa.

The renewable technologies that could be nurtured include wind, solar, geothermal, micro-hydro, and biomass. To begin this nurturing of the renewable energy manufacturing industry in Sub-Saharan Africa, governments would offer incentives to developed world manufacturers. These would come in the form of guaranteed orders for large quantities of renewable energy technology. The orders would be substantial and yearly, so that the risk to initial direct investments by the company would be so reduced as to make the investment compelling.

18. SUSTAINABLE EXTENSION NETWORK

By David Silverman

One of the most successful economic development programs in history was the US-based Agricultural Extension Service. This program trained educators/farmers that would teach other farmers about the latest agricultural techniques for increasing productivity, reducing soil erosion, and managing resources. Agricultural productivity and economic well-being of farm communities was greatly accelerated.

The Sustainable Extension Network would be modeled after the US Agricultural Extension Service. “Sustainability agents” would be trained and offices established throughout a developing country. The number trained would be a function of the number needed to cover the entire country. (In the US, every county had an extension agent.)

Sustainability agents would be responsible for increasing the energy, water, and resource efficiency use throughout the area they were stationed in. They would maintain currency with all sustainability research, document local efforts, and communicate these to other sustainability agents, as well as link local sustainability related organizations and help new organizations to form. The agent would collect community sustainability indicators and publish these, foster collaborative sustainability research, and foster local economic development.

19. REST: REVAMPING THE ENERGY SYSTEM TODAY

“Without a shift to cleaner energy supplies it will be impossible to adequately tackle climate change.”

— U.N. Secretary General Ban Ki-moon¹

By Tariq Ausaf, Chris Cepil, Luca Dragani, and Dennis Yeh

Strategic Summary: With the world population continuing to grow, and expected to grow until at least 2050, and with modern, affordable, clean and reliable energy supplies still unavailable to a good percentage of that total population, there is need for more efficient and greener energy system. This strategic plan encompasses changes in the public sector and utilization of current technologies to generate an abundance of clean energy.

Introduction

There are problems in the current energy system that is over-reliant upon fossil fuels. The system is economically, and environmentally unsustainable. It has high emissions, is inefficient in energy transmission and use, and has huge government subsidies. In addition, much of the rural and some of the urban areas suffer from shortages in electric energy that cause rolling blackouts year-round. In other parts of the world, energy is available but costly, inefficient, and polluting. A byproduct of this form energy usage is air pollution.

Problem State

Sixteen out of the twenty most polluted cities in the world are in China.² The most polluted city in terms of air quality is by far Linfen. Located in the Shanxi Province, Linfen is also the source of more than two-hundred unregulated coal mines. Once the coal has been mined, skipping the refining and cleaning phases that would reduce pollution, it passes directly to the coal-fired power plants where it produces electricity. As

expected, this process creates pollution. When coupled with the fact that coal fired power plants produce half of China's energy, the problem becomes as serious concern to the entire planet. Pollutants deriving from this process include carbon monoxide, nitrogen oxides, particulate matters 2.5 and 10, sulfur dioxide, arsenic, lead, ammonia, and fly-ash.³ Adding to the list, more than 50% of well water was found to be so toxic that it could not be purified.

Statistics cannot describe how the citizens live every day, but this anecdote might begin to illustrate the underlying issue: Linfen was formerly known for its crystal spring water, arable agriculture, and diverse flowers. In its present state, a citizen of Linfen cannot even hang laundry outside for drying because the clothing turns black from fly-ash. Furthermore, three million people living in Linfen are affected by pollution caused by polluting energy sources.

Present State

Fossil fuel subsidies, according to the International Monetary Fund, are currently \$1.9 trillion per year.⁴ More than 2.5 billion people have inadequate access to energy to meet their needs.⁵ Of these, almost 830 million are without electricity, never having flicked a switch to turn on a light. In addition, every year, \$25 billion is lost in the transmission of fossil fuels.⁶

Biofuels, considered clean by most, consume about 6.5% of the world's grain and 8% of its vegetable oil.⁷ With so many still hungry, biofuels cannot be considered an ethical source of energy. In addition, burning biofuels produces greenhouse gases, including nitrous oxide, carbon monoxide, and carbon dioxide.

There are many causes for this situation. A lack of willingness in policy makers to challenge current energy subsidies and policies contributes to the problem. The development and start-up costs of new, cleaner energy solutions are too high due to the lack of subsidies for clean energies. The electric grid has not been updated in over fifty years. As a result, electricity cannot be transferred more than 1500 miles.

A number of experts expect the world population to exceed 9 billion by 2100.⁸ Currently, the power sector struggles to safely provide energy to 4 billion people. The power sector cannot expect to provide for more than double current consumption without innovation and cleaner energy solutions.

Preferred State

The preferred state that our group envisions is a world where: energy is *abundant* for all nations; it is *efficient*—the power grid loses less than 3% of its electricity over the course of 1500 miles; it is *affordable*—it is priced competitively and run by the private sector; it is *sustainable*—cities are self-sustaining, able to export supplies to other regions when necessary; it is *clean*—air pollution is kept to a minimum as fossil fuel usage is phased out; and, finally, it is *safe* and *reliable*.

Progress towards this preferred state will be measured in terms of the number of people with access to power, the number of blackouts and brownouts each year per area, the prices of clean versus unclean energy sources, relative pollution rates, and total and averaged reliable available power.

Strategy

Introduction

The sun is responsible for powering all life processes on Earth. Fossil fuels represent stored solar energy that has been collected by life forms more than two million years ago.⁹ It would be more efficient, and significantly safer to collect energy directly from the source. The entire human race uses about 400 quads Btu per year.¹⁰ Each year though, an excess of 8.2 million quads Btu reaches us on the surface of the Earth. This is more than 10,000 times the energy that all fossil fuel combustion in the world equal, in a year.

Strategy 1: Solar Windows

Solar Windows are a transparent solar panel that is four times more efficient at producing electricity than regular solar panels. These panels also act as insulators much like a heat sink, absorbing the heat from sunlight. Pythagoras Solar, based in Israel, manufactures them.¹¹

Solar Windows are ideal for cities with a high density of skyscrapers. Tall buildings are ideal. For example, the Willis Tower in Chicago (formerly the Sears Tower) has already started using solar glass. The south facing windows on the 56th floor of the Willis Tower were replaced with Solar Windows in November of 2011.¹² Each window,



about 1 square meter, is capable of generating an excess of 120W of electricity. Each square meter costs about \$1500. Each year, the one south facing side of the 56th floor of solar panels not only provides power for multiple floors and reduces heat indoors, but also saves the Willis Tower \$2 million on their energy bills. The glass pays for itself within five years.¹³

Assuming New York has 500 skyscrapers (it has more than this), there are at least 645 square kilometers of south facing surface area on which solar glass can be placed. These 500 skyscrapers alone could produce 1,000 Kwh of electricity, enough to power 50,000 average American homes. In the top 100 skylines in the world, there are 76,117 skyscrapers.¹⁴ Globally,



there are more than 200,000 skyscrapers. To produce *all* the electricity that the world currently uses, Solar Windows would only require about 100,000 skyscrapers.

There are obvious economic benefits to utilizing Solar Windows on skyscrapers.

- Saving an average of \$2 million per year per floor
- Solar Windows come with a lifetime guarantee
- Solar Windows pay themselves off completely within five years of installation, also guaranteed.

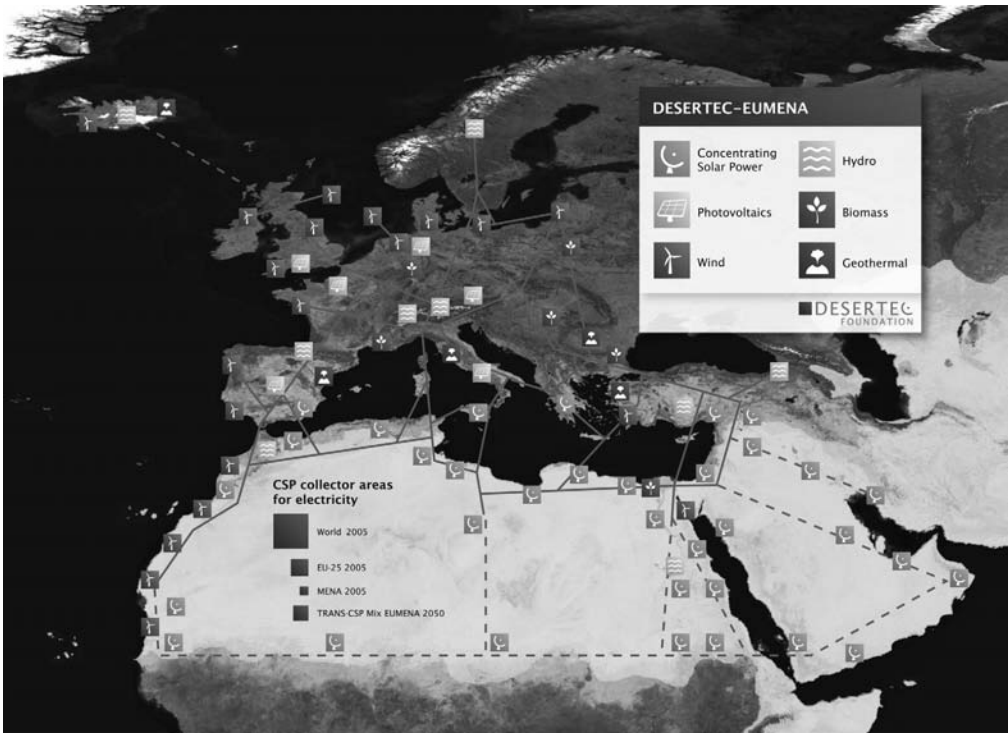
Strategy 2: Solar Farms

Dr. Gerhard Knies and Franz Trieb noticed that in just six hours of daylight, more energy reaches the Sahara than the entirety of mankind uses in one year.¹⁵ This research is the basis for DESERTEC, a non-profit foundation dedicated to creating cleaner and abundant energy supplies. The aim of this foundation is to generate renewable energies for the world through solar power in the Sahara Desert.

DESERTEC's solar farms are applicable all over the world. The vast deserts that have been previously considered barren can now be considered abundant sources electricity. The Sahara desert (9,400,000 km²), Arabian Desert (2,330,000 km²), Gobi Desert (1,300,000 km²), Kalahari Desert (900,000 km²), Patagonia Desert (670,000 km²), Great Victoria Desert (647,000 km²), Syrian Desert (520,000 km²), Mojave Desert (124,000 km²).¹⁶ occupy most inhabited time zones. Solar panels can be placed in these various deserts based on population and energy demand in nearby populated regions. About one percent of the Sahara desert (94,000 km²) would exceed all current human energy usage.

The Mojave and Patagonia deserts have slightly higher altitudes than most deserts, and because of this, have higher average wind speeds. This wind sweeps up the sand, which will in turn corrode and weather solar panels. Under proper conditions and optimal climate, solar panels will only last about twenty five years.¹⁷ Under harsh desert conditions with high winds, solar panels will probably last half as long. To compensate for this, the solar panels in zones that are deemed, "high risk," can be treated with a nanoparticle coating that would keep them from weathering and increase efficiency.¹⁸

Solar power can only be collected twelve hours a day on average



in each time zone. In addition, some areas will have “bad weather,” meaning clouds blocking sunlight, not permitting the collection of solar power. This presents a problem involving a need for excessive energy production during sunlight hours to power time zones during nighttime. There are two feasible options to provide for this: energy storage and an updated “smart grid.”

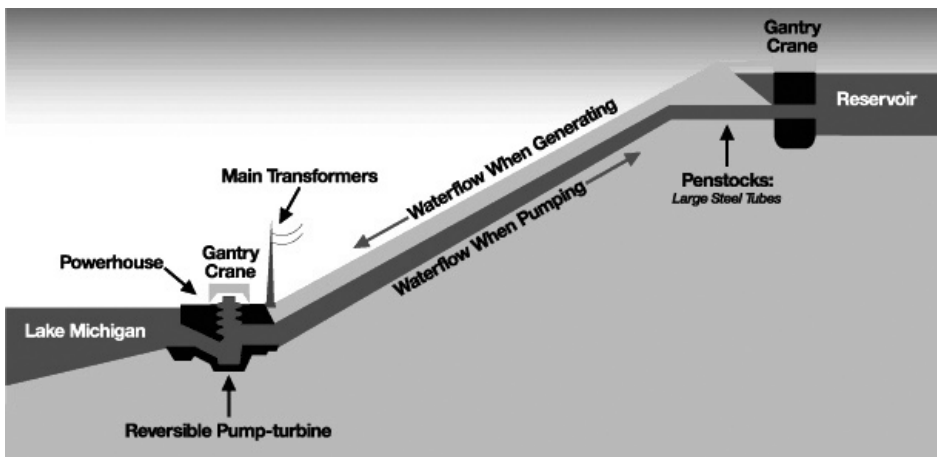
Strategy 3: Energy Storage

Conventional energy storage methods, i.e. current batteries, will not be able to economically store excessive amount of energy produced by Solar Windows and solar farms when implemented worldwide. Many other unconventional methods of energy storage are far too expensive and require nonrenewable resources. However, there are two methods, less expensive and more efficient, that will work when storing massive amounts of electricity for reuse: pumped-storage hydroelectricity and thermocline energy storage.

Pumped-storage hydroelectricity is a method widely tested and used. It involves pumping water back into the reservoir, using surplus energy and storing it (as water in the reservoir) for later use. Pumped-storage hydroelectricity works with between 80% and 87% efficiency, meaning that at least 80% of initial energy invested will be available for consumption.¹⁹ This is highly efficient compared to other methods of energy storage. (For example, electromechanical methods of energy storage are less than 75% efficient²⁰, super capacitors are around 60% efficient, and the majority of other methods are between 70% and 75% efficient.²¹)

The cost of using pumped-storage hydroelectricity would be less than \$100 per kWh, far less than sodium ion flow batteries, which cost more than \$400 per kWh.²² Additionally, the more hydroelectric storage is used, the less it costs per kWh. This method is also completely green, reliant only upon water.

Because pumped-storage hydroelectricity takes advantage of pumping water back up into a reservoir, it can be implemented anywhere there is an already existing dam. More than 80 countries host dams already pumped-storage prepared or capable of being turned into a pumped-storage dam. These dams have the combined ability to store more than half a year's worth of the world's energy consumption. Additionally, the cost of implementation is low because these already existing dams can easily be turned into pumped storage systems for storage huge amounts of energy. No people need to be relocated in order to flood a river at this point; more than enough dams are in working order for implementation.



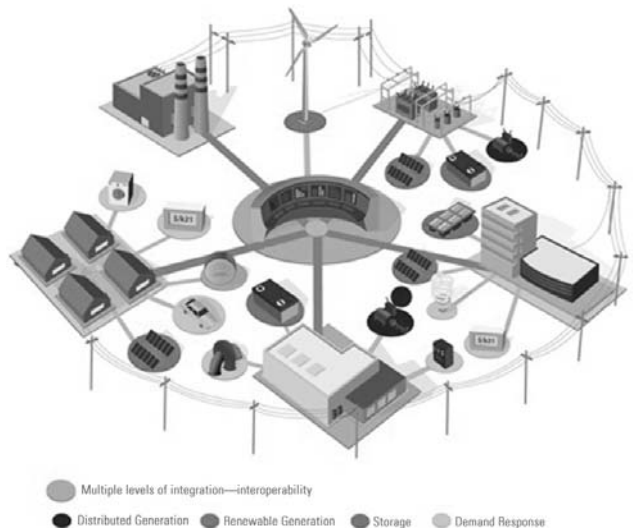
Thermocline energy storage is another efficient and less expensive energy storage system. It costs \$.078 per kWh.²³ To give you an idea of how inexpensive this is, the US Department of Energy goal is \$15 per kWh. The average efficiency of the thermocline energy storage system is 93.7%. There are currently two methods of thermocline tank storage: single tank systems and double tank systems.²⁴

In a double tank thermocline system, the hot and cold liquids, which are typically molten salts, are stored in separate tanks. Energy is stored by transferring excessive heat from the hot to the cold tank. When energy is extracted, the process is reversed and heat is turned back into electricity and delivered to the power block. Single tank thermocline systems prove to be more efficient and cost-effective than double-tank systems by integrating both tanks into a single unit where electricity is not lost in the transfer of heat between tanks. In this system, the cold remains at the bottom while the hot remains at the top. The one tank system is thus most effective and should be used in tandem with our system.

The thermocline energy storage one tank system was developed with implementation in mind. One-tank systems were meant to store energy specifically from solar farms. At each solar facility there can be a storage area where thermocline tanks have been installed and connected to a power block for maximum efficiency.

Strategy 4: The Smart Grid

The current U.S. electrical grid was designed between 1900 and 1920, when it was built and connected individual power utilities to each other after already connecting to households.²⁵ It has been over fifty years since this grid, has been system wide updated. Current weaknesses include occasional blackouts and



brownouts, the inability to transmit electricity further than 7000 km, loss of 4.2% of electricity every 100 mi, and a host of other issues.²⁶ Although the system was designed to transmit electricity from areas with excess to areas with minimal electrical production, it no longer can meet the needs of our electrical system.

More than 500 companies run the current energy grid in the United States. Government regulation is needed to insure that there is complete coverage, adequate supplies and investment and no price fixing.

Our group's aim is more comprehensive than just an update of the current system of electrical transmission. The system we are proposing would be automated with efficient transfer of energy between nations and cities to keep all regions amply powered. It would be a system that connects the world to solar desert collection centers, Solar Windows outfitted cities, pumped-storage hydroelectric and other energy storage facilities.

A feasible goal for this is high-voltage direct current (HVDC) energy transfer is where less than 3% of energy is lost every 1500km, which has been researched extensively and proven cost effective in Germany. Our system would make the grid more reliable, flexible and economical. Our Smart Grid system would allow and incentivize current energy companies to transition into the new green system, which is addressed in our next section.

Strategy 5: The Transition

The Smart Grid can be implemented anywhere, existing power grid or not. The first focus for the smart grid is to implement it in developing countries, mainly where power grids are not already in place. Developing countries with no power grids in place are generally the ones without power to begin with— thereby addressing our goal to supply those without any power first. Excess power can be supplied to those in need first, before being stored.

There are at least three ways the Smart Grid and other facets of our overall strategy could be implemented. The private sector could pay for the solution, the government could, the private individual or family could pay for their part of the grid— or there could be a combination of the three. Whoever pays for the grid, it should be a public utility and regulated as such. There could be energy usage limits per household, mandatory installation of smart grid capable meters and other requirements.

Strategy 6: Costs and Subsidies

“Who is going to pay for these solutions?”

One recommendation set forth by the UN in Agenda 21 was a tax on fossil fuels in order to develop and implement “environmentally sound technologies.”²⁷ By taxing an average of \$50 per ton of fossil fuels in the U.S., more than \$500 billion could be generated each year.²⁸

Subsidies are responsible for great inefficiencies in the global energy system. Fossil fuel subsidies are extraordinary: \$1.9 *trillion* according to the IMF. Subsidies supporting green technologies are comparatively nonexistent. Part of our strategy is to increase subsidies for green technologies. Over time, the fossil fuels subsidies need to be reduced to nothing, while subsidies for green technologies can gradually increase, and then, once established, dramatically decrease.

After implementation of green technologies, much less is required for upkeep than in fossil fuels, and subsidies will not be needed to keep the technologies cost effective. What is being paid for by subsidies after implementation of green technology is development and eventual revision of green technologies. Saving money in the long term is the outcome of subsidizing green technology.

Some of these subsidies could be focused on grants and programs incentivizing current companies harvesting fossil fuels to move toward completely green technology. In this way, the fossil fuel industry would not want to hinder the program, but capitalize on it.

Projected Timeline (2013–2050)

The strategies described here will take at least twenty years to implement fully. Our implementation timeline runs from the present day to-2030 to from the present day to 2050. It is our contention that the Preferred State could be reached by 2030 if an all-out effort was undertaken.

The UN’s Millennium Development Goals are focused primarily on developing countries. The energy system strategies described here should, based on the notion that those in greatest need should have priority, be implemented in the developing world before the wealthy world.

According to the UN, 68% of the population of developing countries lack access to reliable supplies of electricity.²⁹ We think our strategy is better implemented in places without reliable energy. It will have the biggest impacts in these locations. Developing, energy-short countries

could use additional energy for better irrigation, power for equipment in schools and health centers, lighting, heating and cooling, and communication technologies.

The idea is not to replace the current market for energy. It is to transform and expand it. Overlap is also likely and will occur between technologies being implemented.

Phase 1: Example Argentina (2015–Dec. 2020)

To illustrate how our energy strategy will work, we will use Argentina as a demonstration.

Argentina is an ideal country to implement the testing phase of REST. Thirty percent of the population of Argentina is without power. There are many thousands of square miles of unused space in Argentina coupled with skyscrapers capable of hosting solar glass. The climate is mixed enough to test solar farms, with much of the Patagonia Desert's flat lands located in the western part of the country. The population, at 41 million, about 13% the population of the U.S., is large, but not overwhelming. Implementation in a country without an existing power grid might be easier, but Argentina's large power grid will serve as a test ground for implementation under tight economic conditions. 75% of the electricity sector of Argentina is owned by the private sector, so it could serve as a test of government and private sector cooperation and ownership of electrical utilities. In addition, hydroelectric dams are already in place where energy can be stored.

How it could work:

Working with the Argentina government and private energy sector, convene an *Energy Strategic Planning Consortium*. This would start with an Energy Sector Strategic Plan Workshop. This event would introduce REST to Argentinian government and private industry owners that are looking to expand economically and meet the energy needs of their country.

After this, there will be the need to formulate and implement policy changes over a two-year period (2015-2017). Developing incentives and subsidies that urge market forces to move in the direction of the Argentina Energy Preferred State that is developed at the Energy Sector Strategic Plan Workshop is essential. One way to fund the program would be a 1% tax on fossil fuels. This would be used to finance the energy transition described here.

1. **Solar Windows (2015-2020).** The first technology to be implemented is Solar Windows. With 50% or more of the skyscrapers in Buenos Aires and other large cities in Argentina fully using Solar Windows, cities will become increasingly electricity self-reliant, if not self-sufficient (and possibly electricity exporters). The 1% Fossil Fuel Tax will be used to as a revolving loan fund to get the Solar Windows facet of our strategy off the ground and rapidly implemented.
2. **Smart Grid (2015-2018).** The smart grid would be implemented between solar glass and energy storage, as it is necessary for effective transportation of electricity between solar farms, energy storage, and rural areas. The way this would happen is the current grid governing agency, Fondo Fiduciario para el Transporte Eléctrico Federal, would have increased funding (from the 1% Fossil Fuel Tax), that would pay for the implementation of the new Smart Grid.
3. **Energy Storage (2017-2019).** Argentina has a lot of hydroelectric power. They have 19 hydroelectric dams and facilities capable of being converted into energy storage systems. The Yacyreta dam alone is capable of storing 3,400 MW of electric energy. Thermo-cline energy storage would also work well in Argentina.
4. **Solar farms (2017-2019).** More than half the eastern side of the Patagonia Desert would be a perfect place to test not only solar farms, but also the nanotechnology films resistance to wind and particulate matter that would ordinarily stick to the panels or damage them.

Consequences

Hydroelectric dams block the natural flow of water, as well as necessitating the relocating of people, wildlife and ecosystems in some areas. Dams, although rarely, can overflow and cause damage to the environment. They require attention and maintenance. Solar Windows and solar panels require energy to produce silicon. These solutions still use natural resources, and require an initial energy investment and monetary investment. These alternatives aren't blemish-free, but they are less expensive and environmentally destructive.

Simultaneous with rollout in Argentina, the energy strategy would be tested and improved in at least two additional countries—for example, the Philippines and South Africa. Implementation would be similar

to Argentina, with the process tweaked to accommodate the unique opportunities and challenges in these countries.

The Philippines would be ideal for testing solar farms and glass in a tropical climate. Because of the scattered island geography, test the implementation of the smart grid and electrical storage systems. South Africa is slightly larger economically than Argentina. It will be a good start on the African continent.

Conclusion

Revamping the Energy System Today is economically feasible and would ensure a greener future for following generations. Global goals for energy should include universal access to modern, clean, abundant, secure, safe, and affordable energy supplies for all. The REST system is capable of meeting these goals.

ENDNOTES

- 1 United Nations. "ENERGY, DEVELOPMENT AND SECURITY: Energy issues in the current macroeconomic context." United Nations Industrial Development Organization. www.unido.org/fileadmin/user_media/Publications/documents/energy_development_and_security.pdf (accessed July 10, 2013).
- 2 World Bank Group. "Environment - Cost of Pollution in China: Economic Estimates of Physical Damages." The World Bank. <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/EXTEAPREGTOPENVIRONMENT/0,,contentMDK:21252897~pagePK:34004173~piPK:34003707~theSitePK:502886,00.html> (accessed July 10, 2013).
- 3 The Blacksmith Institute. "Linfen, China." Worst Polluted. www.worstpolluted.org/projects_reports/display/22 (accessed July 11, 2013).
- 4 Lipton, David. "'Energy Subsidy Reform: The Way Forward' Presentation by David Lipton, First Deputy Managing Director, International Monetary Fund." International Monetary Fund. <http://www.imf.org/external/np/speeches/2013/032713.htm> (accessed July 11, 2013).
- 5 El-Badri, Abdallah Salem. "Striving for Stability in Global Energy Markets." Organization of the Petroleum Exporting Countries.
- 6 National Energy Technology Laboratory for the U.S. Department of Energy. "MODERN GRID BENEFITS." The NETL Modern Grid Initiative. www.netl.doe.gov/smartgrid/referenceshelf/whitepapers/Modern%20Grid%20Benefits_Final_v1_0.pdf (accessed July 11, 2013).
- 7 Walsh, Bryan. "Food Prices: Crisis Deepens as Biofuels Consume More Crops." TIME Science & Space. <http://www.time.com/time/health/article/0,8599,2048885,00.html> (accessed July 11, 2013).

- 8 Discovery Communications. "Population to Bulge, But Will Hit Ceiling." Discovery News. <http://news.discovery.com/human/population-boom-110729.htm> (accessed July 11, 2013).
- 9 University of California - San Diego. "The Electromagnetic Spectrum." Intro to Astronomy: The Live-Giving Sun. earthguide.ucsd.edu/virtualmuseum/ita/07_1.shtml (accessed July 12, 2013).
- 10 EcoWorld Media. "How Much Solar Energy Hits Earth?" EcoWorld Nature & Technology in Harmony. <http://www.ecoworld.com/energy-fuels/how-much-solar-energy-hits-earth.html> (accessed July 13, 2013).
- 11 Pythagoras Solar. "Pythagoras Solar Announces Photovoltaic Glass Unit (PVGU), First Green Building Material to Combine Energy Efficiency, High Density Solar Power Generation and Transparency." Pythagoras Solar. <http://www.pythagoras-solar.com/news/pythagoras-solar-announces-photovoltaic-glass-unit-pvgu-first-green-building-material-to-combine-energy-efficiency-high-density-solar-power-generation-and-transparency/> (accessed July 13, 2013).
- 12 Halverson, Nic. "Chicago's Willis Tower to Harness Sunlight." Discovery News. <http://news.discovery.com/tech/alternative-power-sources/chicagos-willis-tower-to-harness-sunlight-110328.htm> (accessed July 14, 2013).
- 13 Pythagoras Solar. "Corporate Backgrounder." Pythagoras Solar. www.pythagoras-solar.com/wp-content/uploads/2012/11/Pythagoras_Backgrounder_final2-1.pdf (accessed July 14, 2013).
- 14 EMPORIS GMBH. "Skyline Ranking." EMPORIS - Building data and construction projects worldwide. <http://www.emporis.com/statistics/skyline-ranking> (accessed July 29, 2013).
- 15 Knies, Gerhard, and Franz Trieb. "Sun cheaper than Oil." Franz Alt SONNENSEITE.com. www.franzalt.com/index.php?pageID=60&article:oid=a5823&template=article_detail.html (accessed July 15, 2013).
- 16 Geology.com. "Largest Desert in the World - Desert Map." Geology.com Geoscience News and Information. <http://geology.com/records/largest-desert.shtml> (accessed July 15, 2013).
- 17 CivicSolar. "How Long Do Solar Panels Last?." CivicSolar. <http://www.civicsolar.com/resource/how-long-do-solar-panels-last> (accessed July 16, 2013).
- 18 Tolley, Laura. "UH PHYSICS RESEARCHER DEVELOPS NANOPARTICLE COATING FOR SOLAR PANELS." University of Houston. <http://www.uh.edu/news-events/stories/2012/august/0813SolarPanelCoating.php> (accessed July 19, 2013).
- 19 Jacob, Thierry. "Pumped storage in Switzerland - an outlook beyond 2000." Stucky a Gruner company. www.stucky.ch/en/content/pdf/Pumped_storage_in_Switzerland_Dr_Jacob.pdf (accessed July 20, 2013).
- 20 Mempin, Genaro. "Modular Electromechanical Batteries for Cost-Effective Bulk Storage of Electrical Energy." Industrial Partnerships Office. https://ipo.llnl.gov/?q=technologies-modular_electromechanical_batteries (accessed July 21, 2013).
- 21 The Economist Newspaper Limited. "Energy storage: Packing some power." The Economist. <http://www.economist.com/node/21548495> (accessed July 21,

- 2013).
- 22 Mandel, Jenny. "DOE Promotes Pumped Hydro as Option for Renewable Power Storage." *The New York Times*. <http://www.nytimes.com/gwire/2010/10/15/15greenwire-doe-promotes-pumped-hydro-as-option-for-renewa-51805.html?pagewanted=all> (accessed July 21, 2013).
 - 23 Barile, Christopher. "Solar Thermal Energy Storage Systems." Stanford University Physics Department. <http://large.stanford.edu/courses/2010/ph240/barile2/> (accessed July 29, 2013).
 - 24 Flueckiger, S. M., Z. Yang, and S. V. Garimella. "Design of Molten-Salt Thermocline Tanks for Solar Thermal Energy Storage." *Perdue E-Pubs. docs. lib.purdue.edu/cgi/viewcontent.cgi?article=1191&context=coolingpubs* (accessed July 20, 2013).
 - 25 Borberly, A. and Kreider, J. F. (2001). *Distributed Generation: The Power Paradigm for the New Millennium*. CRC Press, Boca Raton, FL. 400 pgs. (accessed July 20 2013).
 - 26 Paris, L., G. Zini, M. Valtorta, and G. Manzoni. "Present Limits of Very Long Distance Transmission Systems." *Global Energy Network Institute*. <http://www.geni.org/globalenergy/library/technical-articles/transmission/cigre/present-limits-of-very-long-distance-transmission-systems/> (accessed July 20, 2013).
 - 27 United Nations. "ENERGY, DEVELOPMENT AND SECURITY: Energy issues in the current macroeconomic contex." *United Nations Industrial Development Organization*. www.unido.org/fileadmin/user_media/Publications/documents/energy_development_and_security.pdf (accessed July 10, 2013).
 - 28 Spross, Jeff. "Bombshell IMF Study: United States Is World's Number One Fossil Fuel Subsidizer." *ClimateProgress*. <http://thinkprogress.org/climate/2013/03/29/1791811/bombshell-imf-study-united-sates-is-worlds-number-one-fossil-fuel-subsidizer/> (accessed July 21, 2013).
 - 29 Watkins, Kevin. *United Nations Development Programme. "Human Development Report 2007/2008 Fighting Climate Change: Human Solidarity in a Divided World."* *Human Development Reports*. hdr.undp.org/en/media/HDR_20072008_EN_Complete.pdf (accessed July 21, 2013).



PART III

EDUCATION FOR ALL FOR LIFE

Mastering the art of writing, Karachi, Pakistan.
UN Photo/John Isaac

EDUCATION FOR ALL FOR LIFE

Strategic Summary: Achieve universal primary education and 100% literacy by 2015, and provide affordable access to secondary, tertiary, and lifelong educational opportunities by 2030 through a combination of low-cost, mass produced “school-in-a-box” programs; community Internet hubs; mobile educational resource vehicles; wi-fi educational linkages and programs; sustainable technology for turning educational institutions into energy, food, and water producers; and a global coordinating agency that makes all the preceding available.

“If you think education is expensive, you should try ignorance.”

—Derek Bok

Introduction

The education work of the Design Science Lab was focused on demonstrating how, using present day technology, known resources, and limited financial wherewithal, illiteracy could

be eliminated between now and 2015 (thereby achieving the Millennium Development Goal #2: Universal Primary Education), as well as providing affordable access to secondary, tertiary, and lifelong educational opportunities by 2030.

The overall strategy developed by the education teams in the Labs consisted of an interrelated multiple-part plan that, when aggressively implemented, would have a profound impact on the world. The results would include over 850 million people no longer suffering from illiteracy; as well as improved health, productivity, and longevity; higher employment and incomes for those in most need; and a world that is safer, more secure, stable, and immeasurably richer as more and more people become better and better educated and are able to participate in the creation of wealth.

The parts of this strategic plan are:

- o **School-In-A-Box 1.0, 2.0., and 3.0**
- o **WE CAN: Worldwide Educational Cooperative for All Nations**
- o **School Community eHub**
- o **eMobile Educational Resources**
- o **Wi-Fi for Education**
- o **SEED: Synergetic Educational Experience and Development and Sustainable Schools**

The following pages describe these strategies.

Why Education?

The essence of education is empowerment. Without access to the global informational environment a person is denied access to many forms of power that

can lead to self-, family-, community-, and global-improvement. Literacy is the key to opening the doors needed for economic, social, and personal health and well-being. Although great strides have been made in the last 50 years, the global education situation is stained by the existence of 850 million people who are illiterate and over 100 million children who are not in primary school.

“Enlighten the people generally, and tyranny and oppressions of body and mind will vanish like evil spirits at the dawn of day.”

—Thomas Jefferson

State of the World Education System

The work done by the education teams at the Design Science Lab is embedded in a context of the global conditions surrounding the world's population and the global educational system that supplies that population with its education. The following basic facts lay out this context:

- World population in 2010: 6.8 billion
- 850 million people are illiterate; 95% of those people are in developing nations; 75% of these live in Sub-Saharan Africa and South and West Asia
- 70% of these people are women; they entered the twenty-first century unable to read a book or write their names⁴
- Over 1.5 billion adults are functionally illiterate
- Over 100 million children are not in primary school; 133 million young people cannot read or write (this is about 20% of the total number of children in this age group globally)
- There is a shortage of necessary school supplies, buildings, and teachers
- Girls make up 54% of the children without access to education, the majority being in Sub-Saharan Africa and South Asia; in those two regions alone, 87 million children are out of school
- Failure to achieve gender equality in education by 2015 will contribute to over 10 million unnecessary



child and maternal deaths over the next decade

- Many schools in the poorest regions of the world do not have separate toilet facilities for boys and girls. This situation is a serious impediment for young girls and their attendance at school
- 250 million children between the ages of five and fourteen work in developing countries—at least 120 million on a full time basis. 61% of these are in Asia, 32% in Africa, and 7% in Latin America. Most working children in rural areas are found in agriculture; urban children worked in trades and services, with fewer in manufacturing, construction, and domestic service. In extreme poverty situations, families lose money if their children go to school instead of working⁵
- 4 to 5 billion people are without access to secondary, tertiary, and continuing education
- There are approximately 1.3 billion students enrolled in some form of school around the world (683 million students in primary education; 503 million students in secondary education; 132 million students in tertiary education)

“As literacy increases, the need for leaders decreases.”

—Buckminster Fuller

- There are approximately 54 million teachers in primary, secondary, and tertiary schools around the world
- Teachers in parts of Africa are being paid the same now as they were 1975 (and given

inflation, the net amount is considerably less than they were receiving in 1975), and cannot support their families

- About 70% of the poor live in rural areas. Education is an essential prerequisite for reducing poverty, improving agriculture and the living conditions of rural people, and building a food-secure world. Children’s access to education in rural areas is still much lower than in urban areas, adult illiteracy is much higher, and the quality of education is poorer
- There is prejudice and hate embedded in some curriculums around the world. In many countries where international tensions are present, extreme political opinions are expressed in curriculums
- A small proportion of nations currently include environmental awareness in their curriculum
- Existing school buildings are energy inefficient or lacking energy resources entirely.

Why This Needs To Change

- HIV/AIDS infection rates are double among young people who do not finish primary school. If every girl and boy received a complete primary education, at least 7 million new cases of HIV could be prevented in a decade (given current relationships between education and HIV infection rates).
- Education is a key economic asset for individuals and for nations. Every year of schooling lost represents a 10 to 20% reduction in girls' future incomes. Countries could raise per capita economic growth by about 0.3% per year—or 3% in the next decade—if they simply attained parity in girls' and boys' enrollments.
- Failure to educate girls and women perpetuates needless hunger. Gains in women's education contributed most to reducing malnutrition between 1970-1995, playing a more important role than increased food availability.⁶
- Achieving universal primary education will not only reduce the spread of AIDS and of other preventable diseases, but also contribute to reducing environmental damage, empowering girls, reducing child mortality, and improving mental health, as well as help lift people out of poverty by providing children “with choices and opportunities to create a better life for themselves.”
- Enrollment in school is directly proportional to life expectancy at birth. Years spent in school and literacy rate is also directly proportional to life expectancy at birth. Therefore, increasing enrollment and years in school will lead to increased life expectancy.
- Education is for life. The purpose of education is for life, liberty, and the pursuit of happiness—as well as economic well-being, health, democracy, and the empowerment of people. One of the primary elements of a true, functioning, representative democratic republic is that its citizens are well informed.

World Education System Preferred State

By 2015, 100% of humanity will have access to primary education and there will be 100% literacy in all nations. This includes not only literacy in one's own native tongue but also in at least one major language enabling people to communicate on an international basis.

By 2030, 100% of humanity will receive a full primary education for free and have affordable access to secondary, tertiary, and lifelong education; in addition, they will have:

- Universal Internet access
- Affordable access to study internationally and to study other cultures from their own location
- Affordable transportation to attend the schools of their choice
- Schools within a close proximity to students
- Schools that play a vital part in the community; that provide essential services where needed; that are suppliers of energy, water, and food to the community (rather than just consumers)
- Schools that are built with and powered by renewable resources
- Access to sports and the equipment needed to participate in sports
- Affordable access to educational resources and materials such as books, textbooks, computers, and advanced global library systems
- Access to cultural institutions
- Access to international press
- A peaceful and secure environment
- Gender appropriateness (different bathroom facilities for boys and girls)
- Access to healthcare facilities on campus
- Teachers who are well paid and respected members of the community
- Teachers and administrators who have global access to all educational resources; and who exchange education information readily
- Curriculum that:
 - o Is hate-free, unbiased, and contains opposing viewpoints
 - o Is interactive and relevant to community and cultural needs (things learned can be applied in real life to benefit the community in such areas as health, environment, food production, energy use)
 - o Accommodates different styles of learning
 - o Is globally centric (students learn about their region in the context of the entire world); contains environmental education in a global context
 - o Promotes creative exploration in arts and music
 - o Promotes compassion for oneself and others
 - o Promotes critical thinking skills
 - o Contains vocational training
 - o Is universal; culturally appropriate yet contains globally adhered to standards

- o Promotes physical as well as mental growth
- o Promotes extracurricular activities relevant to the community
- o Helps children come out of school responsible and aware citizens with skills that will allow them to secure meaningful jobs and to be fully included and engaged in society.



Two school children of Bhutan.
UN Photo/John Isaac

Strategic Vision: Education For Life

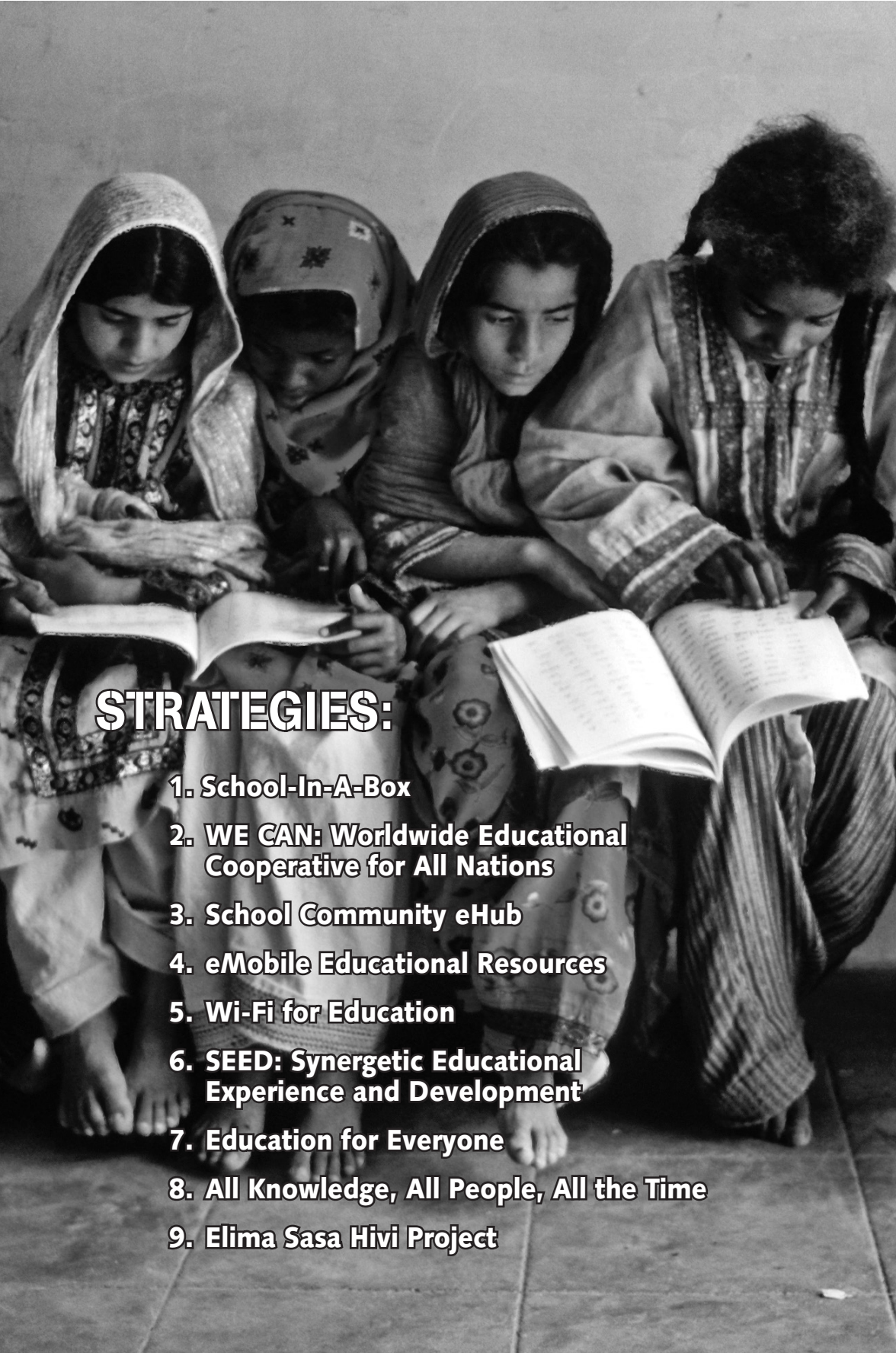
As documented above, there are many things wrong with the current educational systems of the world—as well as important directions to move that system towards. How can we get from the present to the preferred future? What needs to be done to eliminate illiteracy and make the advantages and prerogatives of life-long access to education available to everyone in the world?

In short, how can we increase the health, longevity, productivity, economic well-being, and political enfranchisement of all the people of the world by increasing the world’s access to education?

The following is one strategy for doing this that was developed by the participants of the Design Science Labs.

World Education System Preferred State Timeline





STRATEGIES:

- 1. School-In-A-Box**
- 2. WE CAN: Worldwide Educational Cooperative for All Nations**
- 3. School Community eHub**
- 4. eMobile Educational Resources**
- 5. Wi-Fi for Education**
- 6. SEED: Synergetic Educational Experience and Development**
- 7. Education for Everyone**
- 8. All Knowledge, All People, All the Time**
- 9. Elima Sasa Hivi Project**

1. SIB: SCHOOL-IN-A-BOX

By Kristina Mader, Fabiola Carrasco, Daniel Eida, Zane Kripe, Priyanka Pandit, Xena Parsons, Lexi Quint, Zoe Richards, Heath Robbins, David Walczyk

Strategic Summary: The core of this strategy⁷ is an enhanced version of an artifact developed by UNICEF called “School-In-A-Box.” UNICEF’s basic School-In-A-Box (SIB) was developed for disaster relief situations where a community’s school was destroyed. The box was packed with school supplies, laminated lesson plans, and teacher materials. The lid of its packing case transforms into a blackboard. In the hands of a local teacher, it enables a school to re-open or to be opened. Such a box, as is and in our more enhanced versions, would provide one of the key ingredients needed to eliminate illiteracy throughout the world.

Purpose

The purpose of the SIB is to provide universal access to education for all 100+ million primary aged children not in school. The distribution of such a “quick fix” solution, while simultaneously paying special attention to the educational needs of girls and the community, as well as providing a framework of support to teachers, and the inter-linking of communities, will go a long way towards eliminating illiteracy and providing universal access to primary education.

School-In-A-Box 1.0 Contents:

- Basic Essential Learning Tools (B.E.L.T.)
 - Laminated student packets (for basic reading and math)
 - Rulers, protractors, pencils, paper, multiplication tables
 - Blackboard (lid of box turns into blackboard)

School-In-A-Box 2.0 Contents:

- All the above, plus
- Girls Education Tools (G.E.T.)
 - *Gender Focused Learning Methods*
 - *Peer-to-Peer Tutoring Program*
 - *Leadership Development*
 - *Financial Empowerment*
- Health & Sanitation Awareness Materials

- Malaria Deterrence Tools
- Practical & Community Learning Materials
- Laptop computer/Cell phone
- Teacher/Facilitator Instruction Manual

School-In-A-Box 3.0 Contents:

- All the above, plus
- Internet access
- Ongoing training and access to educational materials, provided by WE CAN

The more advanced versions of the SIB (versions 2.0 and 3.0) are intended for immediate use in some areas that are ready for them, and for later use in areas that first receive SIB 1.0.

Schools-In-Boxes

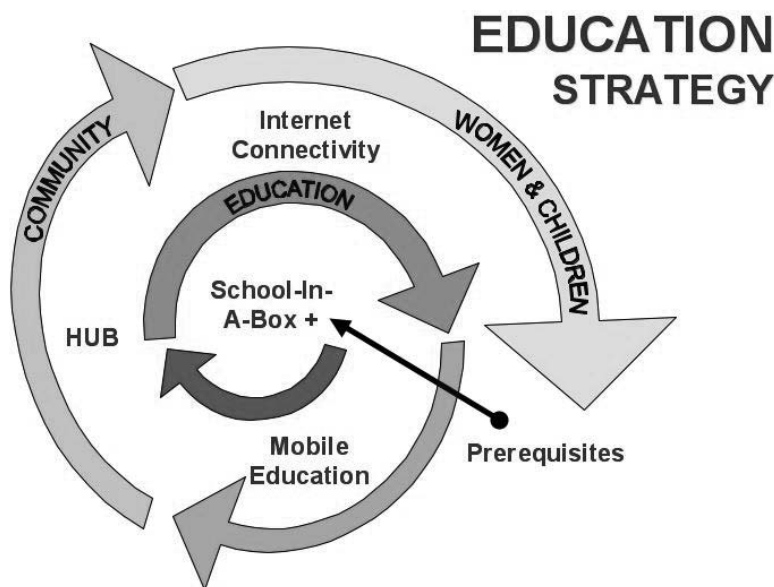
Because every locality is different it is assumed that a one-size-fits-all School-In-A-Box approach will not be an efficient, effective, or sustainable solution. Therefore our strategy calls for a series of Schools in a Box approaches.

The first SIB is almost identical to UNICEF's model. It is the bare minimum that a school needs to get started. It is intended to address the literacy needs of the 100+ million children, living mostly in Sub-Saharan Africa and Southeast Asia who are out of and/or do not have access to school. The most important function of the box is to serve as a quick fix in a rural village or urban setting, filling in as a short-term primary educational system. It directly addresses access to primary education, but not in a permanent manner.

SIB 1.0 is the first step in capacity building within a village, allowing it to move on to more permanent facilities, mobile options, and technological solutions, which are decided upon by the community and fill their specific needs.

SIB 2.0 has more components, including supplemental modules that address girls' education and environmental literacy. SIB 2.0 provides instructions on how to deal with different learning styles, leadership development, application of practical skills, and girls' empowerment.

SIB 3.0 contains further educational modules plus a personal computer. This SIB also emphasizes community participation, enabling community leaders to dictate their own development priorities.



SIB Costs and Funding

Cost

The current standard UNICEF SIB (SIB 1.0) costs \$476 per unit. Each unit will meet the educational needs of 80 children. To reach 100 million children currently out of school in the developing world would take roughly 1.25 million of these units for a retail cost (mass production will result in considerably lower costs) of about \$600 million.

Adding to the basic SIB 1.0 to create the SIB 2.0 and SIB 3.0 programs will add the following additional costs:

- \$50 for HIV/AIDS, gender empowerment, environmental and other subject information/instruction curriculum materials
- \$200 for laptop or cell phone with solar charger
- \$8.60 for mosquito nets
- \$125 for teacher training

for a total cost of \$860 per SIB 2.0 and 3.0 units. To reach 100 million children with this program will cost \$1.07 billion.

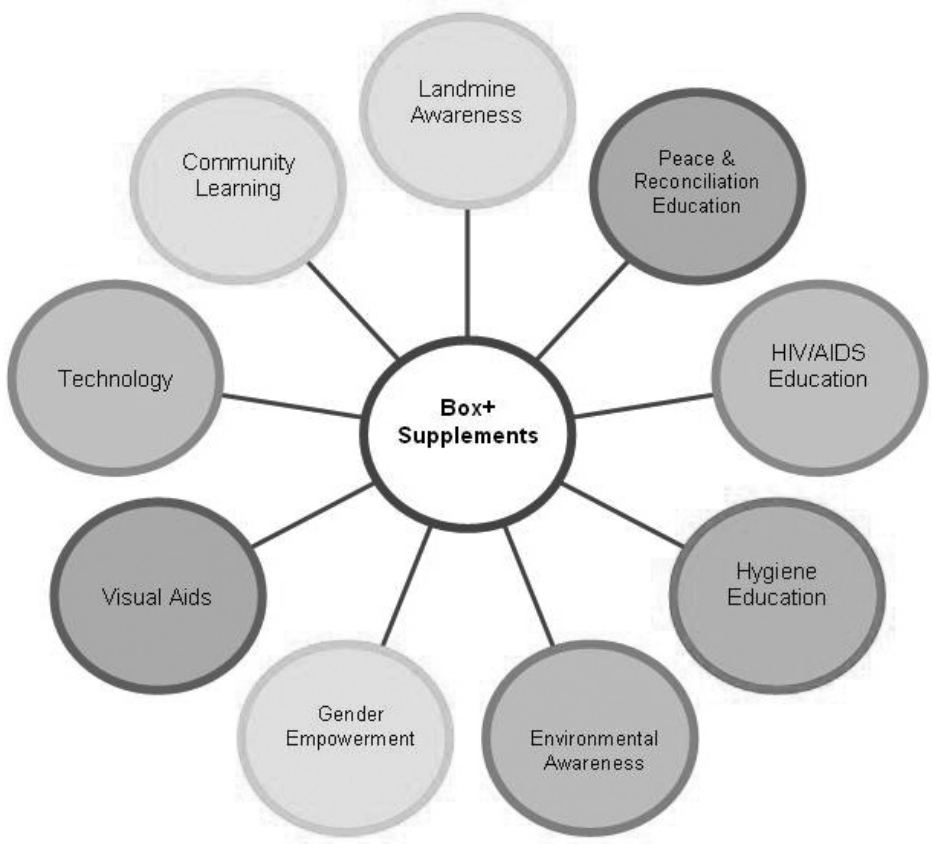


Funding

Funding for the SIB Program would come from a variety of sources. In addition to funding from national governments, UNICEF, UNESCO, and UNDP, SIB programs would be funded by grants and innovative private sector contributions.

An example of the later is an arrangement with UPS and/or other package delivery companies wherein they would deliver the SIB package to the appropriate village or urban school in the developing world and in return they would offer the rest of their customers the option of donating a small percentage of their shipping fees to the SIB Program. For example, UPS ships 14.8 million packages daily. An optional donation of 50 cents per package would generate over \$2.7 billion per year (assuming a 50% participation rate).

School-In-A-Box Curriculum



2. WE CAN: WORLD EDUCATIONAL COOPERATIVE FOR ALL NATIONS

By Patricia Major, Sarah Hausman, Reo Jones, Alex Mackay, Charvee Patel

WE CAN¹

WE CAN seeks to provide an education hub for teachers, students, administrators, policymakers, and others from around the world to work together to achieve universal literacy, enhanced educational opportunities, and greater international collaboration and cooperation. WE CAN's comprehensive website will serve as the organization's 'base of operations,' providing intellectual and physical resources to individuals and other organizations.

In addition, the School-in-a-Box (SIB) Program is delivered, administrated, and improved by WE CAN. This global coordinating organization performs a number of tasks in addition to overseeing the SIB Programs.

WE CAN's purpose is to make the world's vast educational resources available to the teachers and students of the entire world.² They will do this by providing regular mail, telephone, and website access to all educational resources, including those of all existing agencies, providers of supplies, and information. (It will also include SEED catalogue information and ordering links. See Strategy 6, p. 178.)

WE CAN's website will provide increasingly more services, including an equipment and supplies exchange, a supplies/tools/technology store that offers sliding-scale discounts, a teleconferencing link, downloadable software, and links to online classes.

WE CAN will also offer free telephone support for educators, providing information about available resources. All available information will be accessible on the WE CAN website, for those with access to the Internet. (The telephone network will include native-language-speaking operators who will have access to the website, and who can then assist callers by conveying information that the operator locates through the website.)

WE CAN services will include the following:

- Coordination and delivery of SIB Programs
- Customizable and adjusted SIB solutions for regional education efforts

- Distribution of SIB and other educational supplies and information
- Internet (and other), portals to educators, students, administrators, media
- Thematic entry points for topics such as school sustainability, curriculum, educational tools, educational programs, etc.
- Methods for cooperation between existing agencies, countries, school districts, teachers, and students
- A website in several languages that provides:
 - o Teleconferencing communication between agencies, school districts, teachers, and students
 - o Online meetings, classes, and training sessions
 - o Funding and scholarship information
 - o New tools and technologies information
 - o Downloading of free software and publications
 - o Ordering of supplies
 - o Global and regional announcements of educational events
 - o Crisis reporting and coordinated requests for assistance
 - o Job postings
 - o Links to other resources
 - o Contact directory by agency/country/region/subject area/topic and any other subsets that may be useful.

WE CAN Funding

WE CAN startup funding will be provided by philanthropic organizations, universities, sister cities cooperation, and private sector investment. Private sector revenue from fees for services will provide overhead and operating costs. School supply companies (including textbook providers, Staples, Microsoft, Apple, etc.) will provide revenue as a percentage of sales they receive as a result of WE CAN's global marketing efforts.



WE CAN

Worldwide
Educational
Cooperative
for All Nations

Your gateway to educational resources all over the world

1-800-xxx-xxxxxxx toll free

Select your language

عربي	فارسی	اردو
中文	हिन्दी	پښتو
РУССКИЙ	TÜRKÇE	SHQIP
MUNDO	УКРАЇНСЬКА	SRPSKI
BRASIL	TIẾNG VIỆT	বাংলা
ROMÂNĂ	INDONESIA	SOMALI

Emergency need bulletins:

Four schools were burned in Somalia yesterday.
Need: (for 4 groups of 30 students each) benches,
basic supplies. [details](#)

Flooding shorted out the existing Internet... [more](#)

[One week old](#) / [One month old](#) / [Sort by region](#) / [Sort by topic](#)

Global Education News: (streaming newswire goes here)

Purchase or Exchange: supplies / technology / search by topic or region / free!

Needs: global / search by topic or region / post your needs request

Calendars of education-related events: global / search by topic or region

Agencies or providers: global / search by topic or region / alphabetical listing

Special pages: for educators / for students / for providers / for agencies / for administrators

Arrange meetings: overview / teleconference via computer / telephone

News: Technology Updates / General Education / Job Postings / Funding / search by topic or region

Contact us directly: Email / Telephone 1-800-xxx-xxxx

WE CAN mission

Our partners

Supporting Partners

WE CAN is made possible by:

Staples

Cisco Systems

Office Depot

UNESCO

United Methodist Church

Nabisco

Robert F. Johnson Foundation

Mock-up of Webpage for WE CAN

3. SCHOOL/COMMUNITY eHUB

By Fabiola Carrasco, Daniel Eida, Zane Kripe, Priyanka Pandit, Xena Parsons, Lexi Quint, Zoe Richards, Heath Robbins, David Walczyk

eHub³

Another part of the overall *Education for All for Life* strategy is the use of schools as community education hubs. The goal of this strategy is to extend the educational process from just school-age children to the entire community. The School/Community eHub would bring education to people, formally and informally, throughout the life span and regardless of location (urban to rural) and development level.

Part of the process of the eHub would be an educational needs assessment that would determine what subjects were wanted and needed by the community. The primary delivery of educational content of the eHub would be via the Internet.

The School/Community eHub would be a “permanent” or fixed part of a community. For communities that could not be reached with this strategy, there would be the traveling educational resource center described below.

Advantages and Effects

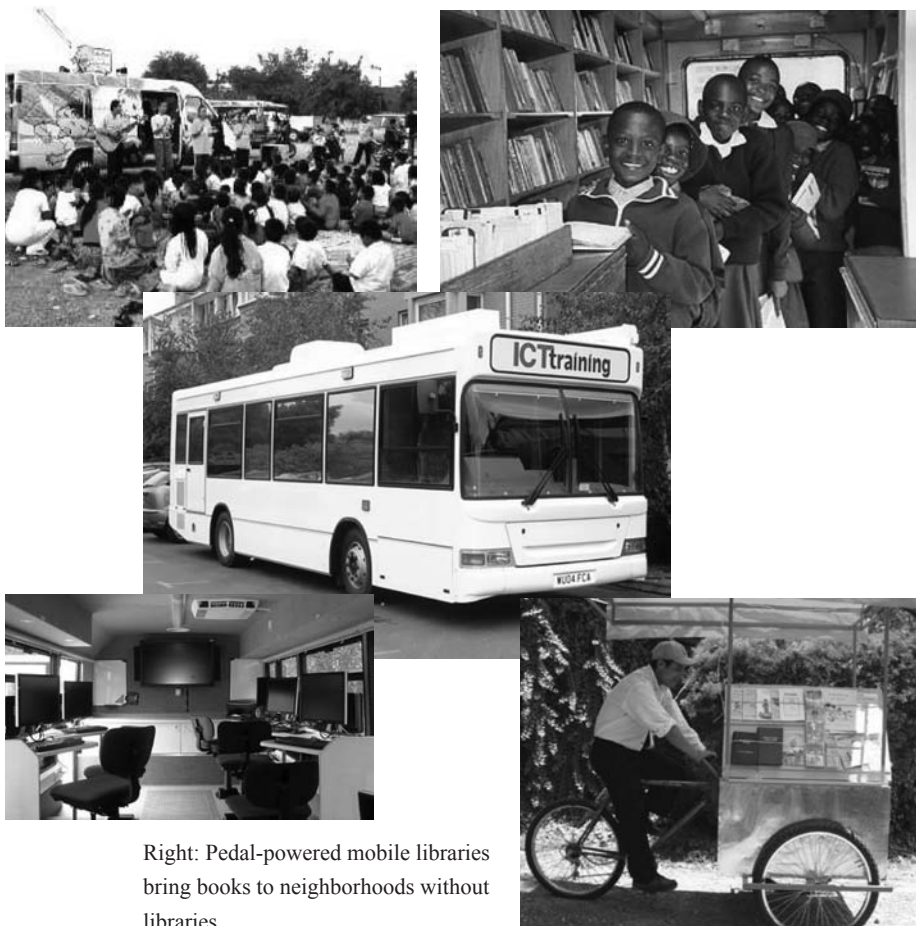
- Reach small and dispersed communities
- Continuous education
- Accessibility
- Community involvement
- Community development
- Relevance
- Training for local needs
- Flexibility
- Up to date resource sharing
- Cost effective
- People driven design

4. eMOBILE EDUCATIONAL RESOURCES

By Fabiola Carrasco, Daniel Eida, Zane Kripe, Priyanka Pandit, Xena Parsons, Lexi Quint, Zoe Richards, Heath Robbins, David Walczyk

Mobile Access to Education⁴

Yet another part of the overall education strategy is the use of mobile schools and training facilities. If people cannot get to conventional educational facilities, a mobile form of those facilities can go to the people. In Curitiba, Brazil, retired buses are used as mobile training centers. Curitibaans pay \$1.00 to take courses in auto mechanics, electricity, typing, hairdressing, artisan work, etc., in these mobile classrooms. At the end of these courses students are placed in jobs throughout the city or they often start their own businesses.



Right: Pedal-powered mobile libraries bring books to neighborhoods without libraries.

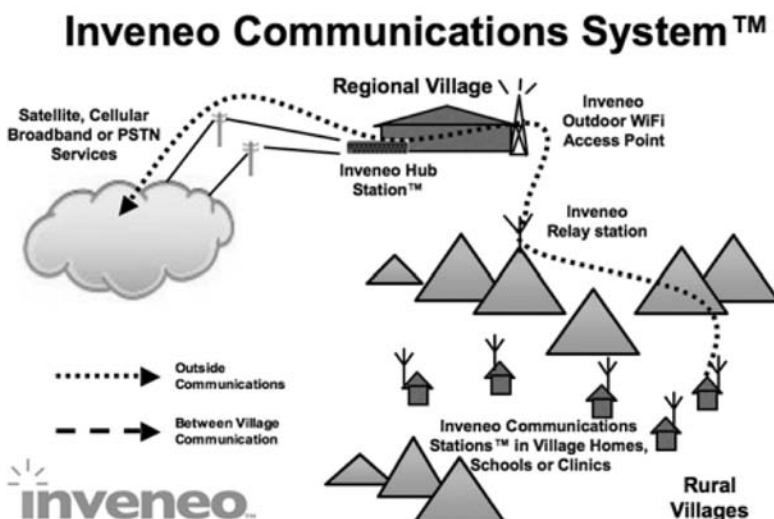
5. WI-FI FOR EDUCATION

By Priyanka Pandit, Fabiola Carrasco, Daniel Eida, Zane Kripe, Xena Parsons, Lexi Quint, Zoe Richards, Heath Robbins, David Walczyk

A key component of the *Education for All for Life* strategy is getting universal Internet access. One current technology for doing this is Wi-Fi, a wireless Internet access system. The *Wi-Fi for Education* strategy is intended to provide Internet access for everyone in the world. Its goals include providing Internet access (email plus phone service) to 4 billion people, living in the developing world, for \$1/month—and to use the Internet as a medium for education as well as commerce, telemedicine, communication, etc.

Global Wi-Fi Costs⁵

There are a variety of technologies and associated costs for achieving universal Internet access. Costs range from \$500 per village⁶ to \$1,000 per village to set up a wi-fi infrastructure (\$341 million to \$638 million for all of India's rural villages), to \$2,000 for a village-wide solar powered communications station.



6. SEED: SYNERGETIC EDUCATIONAL EXPERIENCE AND DEVELOPMENT

By Reo Jones, Sarah Hausman, Alex Mackay, Patricia Major, Charvee Patel

Sustainable Schools⁷

One of the goals of the SEED program is to increase the sustainability of the schools of the world. This includes the efficient use of energy, water, food, and other resources. It would provide a *SEED catalogue* to schools throughout the world (distributed with the help of WE CAN—see Strategy #2, p. 172). This catalogue would enable schools to learn of and to obtain energy conservation and production equipment, water catchment systems, food production systems, and other tools, equipment and facilities that will increase the school's use of sustainable technologies, decrease the school's ecological footprint, and increase its role as a net producer of energy, water, and food in its community.

SEED is designed to enhance existing science and environmental science curricula and provide curricula in places where none currently exists by encouraging hands-on learning experiences for students around the world. The basis of the SEED program is the SEED catalogue, a kit consisting of educational tools and resources designed to allow teachers and their students to create school and community gardens, design and build sustainable classrooms and school buildings from locally available materials, and involve the broader community in efforts to bring about a more sustainable world through education and action. This kit and the resources it includes will allow students and teachers to learn by doing.

The SEED catalogue makes environmental science curricula, green building, renewable energy, and other projects accessible and available to primary and secondary students globally at any level of need. SEED will work in partnership with WE CAN, ensuring that materials are available via the WE CAN website and telephone services.

Example of what the SEED catalogue includes:

- Horticultural kits with a list of necessary tools and instructions for gardening and growing herbs, fruits, vegetables, and trees
- Greenhouse construction templates and materials

- Green-school building design strategies and materials
- Energy-saving and energy-creating strategies and materials
- Cogeneration and district heating and cooling systems
- Local educational project opportunities with a SEED supporting organization
- Biofuels kits, tools, and instructions
- Green buildings blueprints
- Building energy management systems
- Recyclable materials use
- Environmentally friendly cleaners
- Environmentally friendly refrigerants
- Energy efficient cooling systems
- Water efficient systems, including composting toilets, grey water systems, rainwater collection

Possible collaborators with SEED include:

- WE CAN
- Individual city, state, and national governments
- UNEP, UNDP
- Alliance to Save Energy—green-school construction plans
- Architecture for Humanity—school plans
- The Collaborative for High-Performance Schools (CHPS)—green-school construction
- Energy Foundation—funding for sustainable-energy technologies and local projects
- Energy Star—renewable and energy saving products
- Green Building Supply—building materials, environmentally friendly cleaning materials
- The Green Engineer—sustainable design consulting
- Green House Mega Store—international greenhouse building supplies and templates for school projects, horticulture tools
- Potential collaborations and projects with universities and colleges

Results:

- Schools become local producers of food and promote energy efficiency as a way of saving both energy and money
- Students and teachers collaborate in environmental education and



Example of hands-on environmental educational experience.

community building

- Encourages a global network of educational cooperation

One of the goals of the SEED Program is to have schools become sources of food, energy, and water rather than just large consumers of these resources.

The SEED Program will assist schools in rural areas to outfit a small farm (one to two hectares) adjacent or nearby the school for students to help farm. Part of the curriculum will be the teaching of the latest resource-efficient farming techniques to students.

In malaria-infested areas, one crop could be chrysanthemums, (which could be sold as feed stock for the production of the anti-malaria pesticide pyrethrum; see Health Strategy #3, p. 278). In all areas, vegetables and fruit will be produced to provide children (and in some food-short areas, their families) with fresh produce.

Urban schools would use the same principle as the rural schools but would use solar panels to produce energy, rather than farms that produce food. Any energy produced that is above that needed by the school will be sold to nearby residences and businesses.



Solar energy facilities powering a school in Nigeria.

RECAP OF STRATEGIES 1–6

Cost

To implement all the strategies outlined above will cost \$10 to \$15 billion per year for ten years. The variable costs are a function of varying costs of implementation according to location and chosen strategies.

- The School–In-A-Box program costs are approximately \$1 billion per year for 10 years.
- The WE CAN: World Educational Cooperative for All Nations program costs are approximately \$500 million per year for 10 years.
- The School Community eHub program costs are approximately \$200 million per year for 10 years.
- The eMobile Educational Resources program costs are approximately \$500 million per year for 10 years.
- The Wi-Fi for Education program costs are approximately \$1 billion per year for 10 years.
- The SEED: Synergetic Educational Experience and Development program costs are approximately \$50 million per year for 10 years.

The total costs of all these programs are \$3.25 billion per year for ten years. The additional costs of achieving universal primary education by 2015 can also be inferred by examining the average (per-pupil) costs of primary education today, and multiplying this cost by the number of primary school-age children not in school (100 million). Since this unit cost varies substantially across regions (and across countries within regions), the resulting global estimate varies between \$10 billion and \$15 billion, depending on whether regional, national or global averages are used.⁸

Funding

In addition to the UPS partnership program described above in the SIB strategy that could bring in over \$2.7 billion per year, there are other sources of funding for the educational initiatives described here. Assuming that the amount needed is \$3.25 billion per year, there is a need for less than \$1 billion if the package delivery strategy is successfully implemented. This additional amount (or more) could come from government, philanthropic, and additional private enterprise sources.

The incentives for increasing educational funding from these sources are substantial. There is a direct and strong correlation between increased literacy and elevated worker productivity and higher GNP.⁹ Along with higher productivity comes higher incomes. One Organization for Economic Cooperation and Development (OECD) study points to a doubling of income for those who complete secondary education over those who do not finish.¹⁰ Annual return on investments in education for successful students range from 6.5% to nearly 17% in developed countries.¹¹ Life expectancy, infant mortality, and income per capita are all improved by education.¹² Economic growth and lowered fertility rates also result from increased education.¹³

In addition, governments have other compelling and cost-effective incentives to increase educational funding as the following figures make clear: 47% of the dropouts (in US schools) left school because classes were not interesting; more than 50% of those incarcerated are high school dropouts (in some regions this figure is as high as 85%); it costs \$23,200 to jail one inmate per year; it costs \$10,000 per school student. If students can be kept from dropping out of school the odds of their staying out of jail increases. Given the relative costs of jailing someone versus educating them, it is clear that the socially, morally, and economically wiser strategy is to invest more in education.

Summary

In summary, the educational strategies outlined above, if implemented aggressively, will enable the world to eliminate illiteracy, achieve universal primary education for all (thereby achieving the Millennium Development Goal #2), provide access for everyone in the world to secondary, tertiary, and lifelong educational opportunities—thereby increasing economic productivity; overall health and longevity; personal, community, and country-wide well-being; as well as increasing participation in local, regional, and global problem solving, governance, and democracy.

The return on investment for such a series of global and local strategies, in the short and long term, would be huge. The total cost for the educational strategies is less than the cost of two B2 bombers,¹⁴ or what citizens of the US spend on t-shirts each year.¹⁵

7. EDUCATION FOR EVERYONE

By Andy Cavatorta, Anne Loyer, Annika Semmler, Elke Esmeralda Dikoume, Natasha Cline-Thomas, Rafi Pelles, Theodora Filip, Rachel Wong

Strategic Summary

The Education for Everyone group developed a strategy that employs education and community-involvement in school construction, operation, and maintenance to address poverty from the ground up, providing opportunities for children and future generations. One of the largest barriers to school attendance for children in less developed areas of the world is the distance they must travel to get to a classroom. This plan has local communities construct their own schools, built with local materials and powered by small-scale wind and solar technologies.

Present State of the Global Education System

- Over 100 million children in the world do not have access to education.¹⁸ This silent emergency has a real and immediate effect on the capacity of countries to make inroads into poverty and on citizens' ability to realize their rights. Education, especially of women and girls, is the single most powerful weapon in the fight against poverty
- Adult Literacy Rate—Sub-Saharan Africa (SSA): 62%; World: 78%
- Adult Literacy Parity (females as percentage of males)—SSA: 76%; World 86%¹⁹
- Orphans and vulnerable children—estimates vary but there are approximately 13 million orphans, with the majority of them living in SSA
- Disabled children—World Bank recently estimated that nearly 40 million of 115 million out of school children are disabled²⁰
- Children in rural, hard to reach areas (including pastoralist communities) constitute most of the out of school children.
- Costs of schooling—the lack of enrollments in primary education is often attributed to the cost of schooling, both direct and indirect costs, or opportunity costs. Direct costs include: school fees, uniforms, school supplies, transportation and food. Indirect costs include: child labor, distance to school
- School fees—as a direct or indirect cost—are an impediment, partic-

ularly for girls and other disadvantaged children, from enrolling and regularly attending school

- Cultural or family perceptions about the value of basic education vary.

Preferred State of the Global Education

System

Everyone in the world has:

- culturally appropriate education
- the knowledge they need for their communities to thrive based on their own standards
- communities are as self-sufficient as possible
- people are healthy and have access to healthcare
- the society the community is a part of has a system of justice and individuals are aware of their rights
- people are able to participate in the world beyond their immediate communities—regionally, nationally, and internationally
- all female children have an education
- all members of the community have better business opportunities, resulting in a living wage
- there is gender equality in earnings, job opportunities, and inheritance, property, and other rights

Everyone in the world has access to education about the following:

- **SELF-SUFFICIENCY:** Shelter, Sanitation, Technological Self-sufficiency, Solving local problems, Health Practices, Resource Self-sufficiency/knowledge, Connected/Access to information, Creation of a better sustainable world, Effective local medicine
- **JUSTICE:** Human Rights Awareness, Empowerment/Equality for women, Local laws awareness

“Only a person who is aware that he or she has rights can better strive for those rights, whether it be the right to a job, to obtain adequate food, shelter or medical care, to participate actively in political life, or to benefit from the progress of science and technology”

—UNESCO Director-General Koïchiro Matsuura

- **HEALTH:** Family Planning, Disease, Sanitation, Health Practices, Effective local medicine
- **BASIC EDUCATION:** Reading, math, health, history, global awareness, money management.

Strategy

This plan of educational development addresses all of the Millennium Development Goals by providing the education needed to allow individuals to move out of poverty, to meet their basic food, health and sanitation needs, and to build sustainable environments from which they can share their intellectual, cultural, and material resources with the global community.

This plan develops an educational system made of self-sustaining, self-replicating schools; an online knowledge network; and a project-based, adaptive curriculum.

At the center of this plan is a self-sustaining demonstration school in each region. This school will feature:

- Energy self-sufficiency. The school will generate energy to meet its electricity needs. This will be produced from local renewable energy sources or imported photovoltaic cells. Energy generation will be demonstrated in classes for adults and children. This will encourage the community to develop similar methods for meeting their individual energy needs.
- Increased food self-reliance. The school will generate food to support a school lunch program. A demonstration farm will be an integral part of each demonstration school. One of its goals will be to allow adults and children to develop new methods of food production suited to their region. The farm's output will feed the students.
- A demonstration metal and woodworking workshop will allow students and their families to learn and share different skills. It will come with construction plans and blueprints for the creation of tools necessary for food production and the building and maintenance of power generation equipment such as simple windmills. The workshop will also be able to be used for the building and maintenance of tools for building construction. This knowledge and set of tools can then be used on outside projects in the community, and to create the tools necessary to build future schools.
- The school building itself will be a demonstration in building methods

suited to the local region, where passive heating and cooling are designed into the building. The design of the building will reference local architecture—so that it takes advantage of any techniques that may have been developed for that climate, and fits into the cultural and physical landscape. As the school grows, each addition can be the basis for a class project.

- The school will be connected to the Internet. Through a satellite link to the Internet, and a local network of \$100 laptops, the students and teachers will have access to outside expertise on all projects they decide to undertake. All the farming and community building experience from the Millenium Villages Project and similar efforts can be fed into the system, as well as access to regional agricultural exchanges.

Replication

Our model school can accommodate up to 500 students. It would be staffed by 10 teachers and 10 teachers-in-training. The schools would incorporate working examples of ideas and techniques that benefit the whole village. Each school will contain many resources and services that add wealth to the village in the short and long term.

The intention is that each school would be replicable. Groups of 10 teachers train alongside established teachers for one year and then move on to start schools of their own. Each school would produce a new batch of trained teachers every year. Since each school has a fabrication shop of tools that can be used to work with wood, metal, and other raw and recycled materials, that the shop and all its tools can be used to create the core of a new shop. Teachers will also be trained to direct the construction of their own school.

Network

A web-based educational network will connect all schools and contains educational materials that can be downloaded and used in the schools. The network will be designed to enable and foster a participatory sharing and creation of culture and knowledge. The content of the Education for Everyone educational network would be open-source, much like a wiki. Its users (teachers, students, villagers, administrators) are expected to be contributors, so they are invested in the process. This will help the content to adapt, evolve, and grow. It will also help to ensure that it's

relevant to its users.

Phase I: Planning (Months 0–6)

1. Initial Staff: Program Director + 10 teachers + 10 teachers-in-training + Educational Consultant + Systems Administrator/Data Analyst + School Construction Manager/Engineer + Architect (sustainable, vernacular architecture)
2. Set up teacher training program
3. Locate 10 schools in 10 different regions or climates (as in the Millennium Village Project model)
4. Purchase/obtain land in each community for school location
5. Community Meetings + School Design and Curriculum + Parent-teacher meetings + Youth Advisory Committee meetings + Plan incentives for girls
6. Design school lunch program
7. School design and review
8. Design farming plan
9. Set up Internet connection plan and service

Phase 2: Construction (Months 7–12)

- Gather/Create building materials from local sources
- School Construction using local materials, with energy supplies, water collection, water storage and sanitation
- Demonstration Farm planting
- Set up shops for basic wood and metal fabrication
- Build two windmills (one for electricity for computers, and one for water pump)
- Build water pump for irrigation and sanitation
- Weekly community meetings to review progress
- Purchase computer equipment for first ten schools (10 computers)
- Set up satellite or other appropriate devices for Internet connection
- Set up teacher training and professional development
- All teachers report back daily on their progress via a Webpage
- Provide contributing information from teachers, villagers, students (through teacher until 1 lap top per child reached).

Phase 3: School Start Up (Months 13–18)

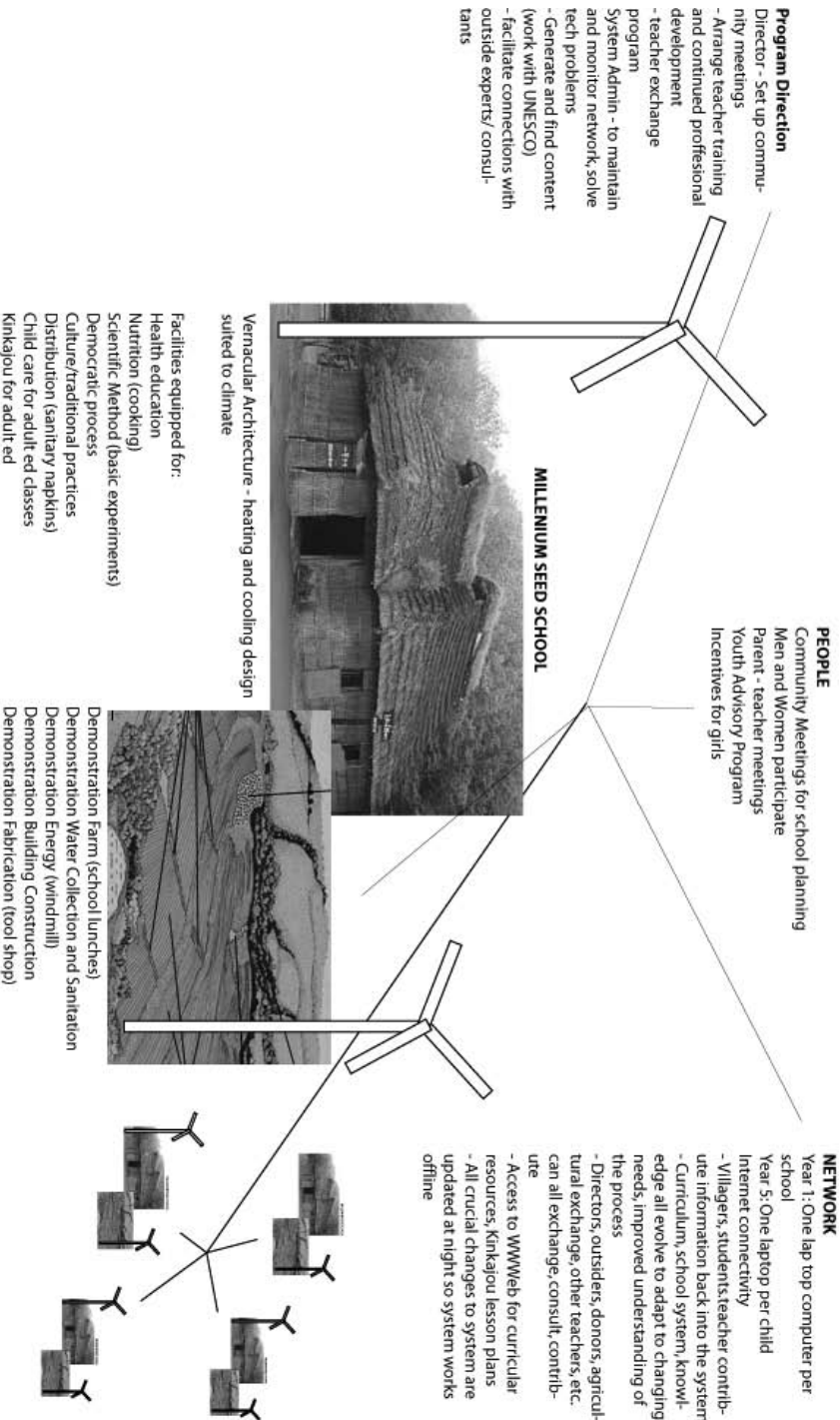
- Demonstration Farm – agriculture class
- Demonstration windmill – design and build windmill
- Demonstration Sanitation – design and build water system
- Demonstration Fabrication (tool shop) – build capacity for future projects
- Curricular adaptation to student needs; in consultation with student Advisory Committee
- Next round of teachers-in-training hired
- Data collection for reporting return on investment (students impacted, quality of life issues affected, skills acquired)
- Grow network by adding students using \$100 laptop.

Phase 4: School Replication (Year 2)

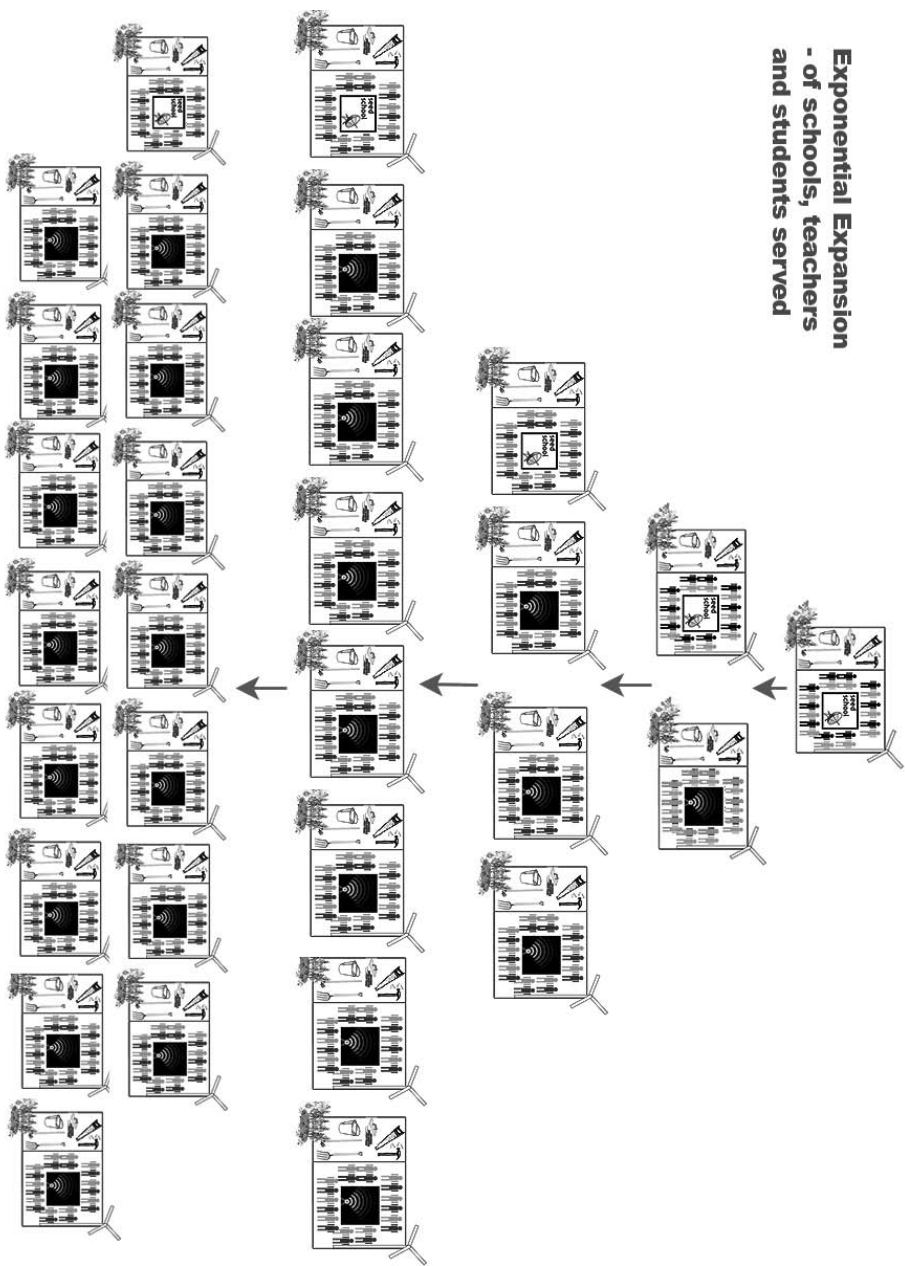
Repeat of phase 2 & 3 with teachers-in-training now acting as teachers, with a new batch of teachers-in-training acting as assistants.

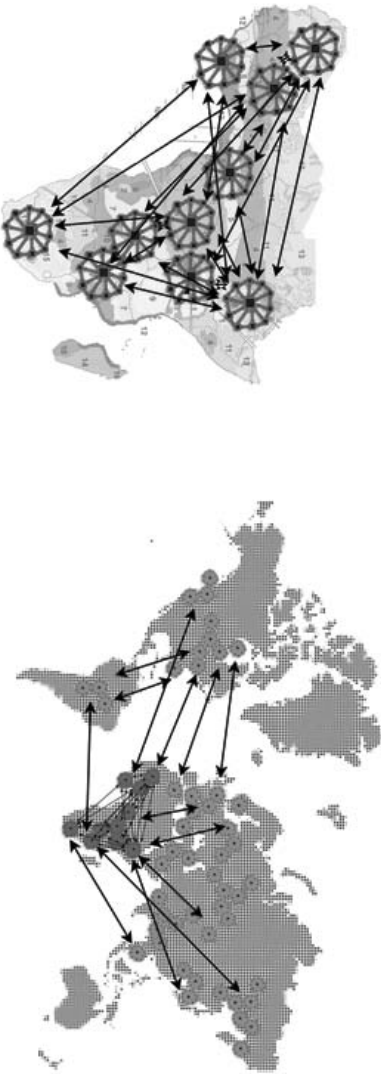
COSTS				
		ongoing	start up next 10 - per school	ongoing - next 10
start up costs				
teachers (10 per school)	10000	5000	10000	5000
staff (3)	3000	1000	1000	
seed & fertilizer	300	100	300	100
tools	500	50	200	50
computer	300		300	
internet connectivity	1450	1200/yr connection	200	
computer	300	50	300	50
lunches (\$37/kid/year - 500 kids)	1850	925	1850	925
windmill	100		100	
1 laptop per child		685000		6850000
	17800	692125	14250	6856125
for 10 years		6921250		68561250
Total	75514550			
TOTAL	75,514,550			

Costs associated with the program.

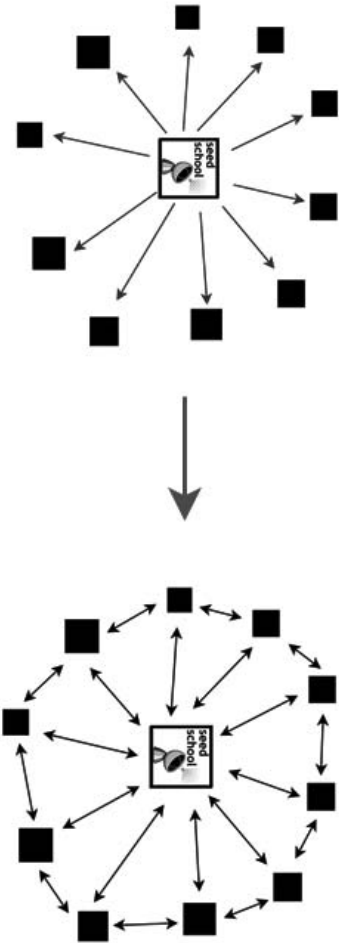


**Exponential Expansion
- of schools, teachers
and students served**





Initially information would flow from seed school to next generation schools. Soon all schools would be contributing to the network. Information sharing will grow regionally, across all of Africa, and with the global community.



8. ALL KNOWLEDGE, ALL PEOPLE, ALL THE TIME

By Rebecca Berkowitz, Saroj
Humagain, Iwanka Kultschycky,
Brandin Watson, Darlene Williams



***Strategic Summary:** High quality, affordable education on any subject at any time in any place can be made accessible to poor people in developing countries as well as the wealthy in the developed world through existing telecommunications technology. Instead of school in a classroom, telecommunication devices make possible school in your hand. These devices, coupled with a central access site that is a free call in, can raise the level of knowledge in the world by providing “just in time” information to people in need throughout the world.*

Introduction—Problem State

Literacy—“An estimated 776 million adults – or 16% of the world’s adult population – lack basic literacy skills. About two-thirds are women. Most countries have made little progress in recent years. If current trends continue, there will be over 700 million adults lacking literacy skills in 2015.”¹

Digital Divide—19% have easy access to fixed telephone lines; 61.1% have mobile cellular telephone subscriptions; 6.1% Fixed broadband subscribers; 5.0% Mobile broadband subscriptions; 23% used the Internet at the end of 2008. ²

“On current trends, despite important progress, by 2015 at least 30 million children in some of the world’s poorest countries will still be out of school. Education is absolutely central to achieving all of our development goals —we know that progress in education is a vital tool in making progress in poverty reduction, health and nutrition. And education will be the only way to deliver sustainable change, opportunity and hope for all the world’s children. At this time of global downturn, we cannot forget our promises to build a better future for them. The price of failure is simply too great.”

—Gordon Brown, UK Prime Minister

Failure to effectively share critical information not only between ourselves but between successive generations threatens everyone. Ignorance leads to crime, violence, wars and environmental destruction. Conversely, knowledge leads to commerce, sharing, peace and sustainability.

The global problem state for education and communication is characterized by:

1. Inequality in educational access based on, or as a result of, bias because of income, gender, age or social standing
2. High levels of student related debt needed to pay for higher education
3. Lack of qualified teachers and other educational professionals
4. Lack of administrative transparency
5. Lack of world unity in highly valuing education
6. Unmet basic needs of students
7. Lack of safety
8. Inadequate infrastructure such as broadband internet, devices, roads, water and electricity

As communication technology advances, the world is becoming more global. However, due to slow diffusion rates of technology many local communities do not have access to the global community which would provide communities with education to help meet essential and immediate needs within the community.

HDI rank	Adult literacy rate (% aged 15 and older)		MDG Youth literacy rate (% aged 15–24)		MDG Net primary enrolment rate (%)		MDG Net secondary enrolment rate ^a (%)		MDG Children reaching grade 5 (% of grade 1 students)		Tertiary students in science, engineering, manufacturing and construction (% of tertiary students)
	1985– 1994 ^a	1995– 2005 ^a	1985– 1994 ^a	1995– 2005 ^a	1991	2005	1991	2005	1991	2004	1999–2005 ^a
Developing countries	68.2 ^a	77.1 ^a	80.2 ^a	85.6 ^a	80	85	...	53 ^a	...	...	...
Least developed countries	47.4 ^a	53.4 ^a	56.3 ^a	65.5 ^a	47	77	...	27 ^a	...	...	...
Arab States	58.2 ^a	70.3 ^a	74.8 ^a	85.2 ^a	71	83	...	59 ^a	...	...	...
East Asia and the Pacific	...	90.7	...	97.8	...	93	...	69 ^a	...	...	...
Latin America and the Caribbean	87.6 ^a	89.9 ^a	93.7 ^a	96.6 ^a	86	95	...	68 ^a	...	...	...
South Asia	47.6 ^a	59.7 ^a	60.7 ^a	74.7 ^a	...	87	...	...	...	...	...
Sub-Saharan Africa	54.2 ^a	59.3 ^a	64.4 ^a	71.2 ^a	52	72	...	26 ^a	...	...	...
Central and Eastern Europe and the CIS	97.5	99.1	...	99.6	90	91	...	84 ^a	...	...	...
OECD	...	...	...	...	97	96	...	87 ^a	...	...	...
High-income OECD	98.9 ^a	99.1 ^a	99.4 ^a	...	97	96	...	92 ^a	...	...	...
High human development	...	94.1	...	98.1	93	95	...	...	...	...	...
Medium human development	...	78.3	...	87.3	...	87	...	...	...	...	...
Low human development	43.5	54.1	55.9	66.4	45	69	...	...	...	...	...
High income	98.4 ^a	98.6 ^a	99.0 ^a	...	96	95	...	91 ^a	...	...	...
Middle income	82.3 ^a	90.1 ^a	93.1 ^a	96.8 ^a	92	93	...	70 ^a	...	...	...
Low income	51.5 ^a	60.8 ^a	63.0 ^a	73.4 ^a	...	81	...	40 ^a	...	...	...
World	76.4 ^a	82.4 ^a	83.5 ^a	86.5 ^a	83	87	...	59 ^a	...	...	...

Source: *Human Development Report 2007/2008: Fighting Climate Change: Human Solidarity in A Divided World*, UNDP Table 12, p. 287

Digital Divide

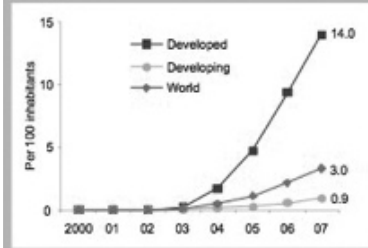
“The debate is no longer whether to use information and communication technologies (ICT) in education in Africa but how to do so, and how to ensure equitable access for teachers and learners, whether in urban or rural settings.”³

“Failing to recognize and remedy women’s severe under-representation in the development of ICT and related policies, regarding both access and leadership, limits our ability to advance our global society. ICT allows women to increase participation in political social and economic arenas and support empowerment for themselves, their families and their communities.”⁴

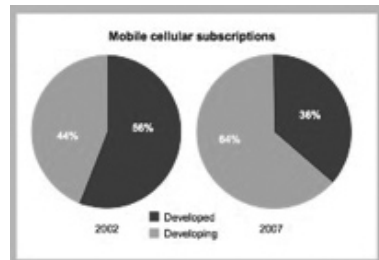
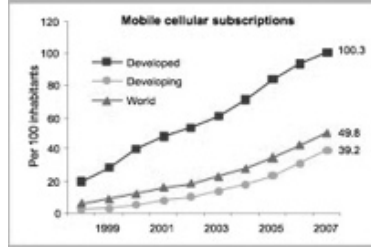
Strategy

OUR PLAN: Use the already existing communications technologies and current trends to build educational capacity.

Chart 2.5: Mobile broadband subscriptions



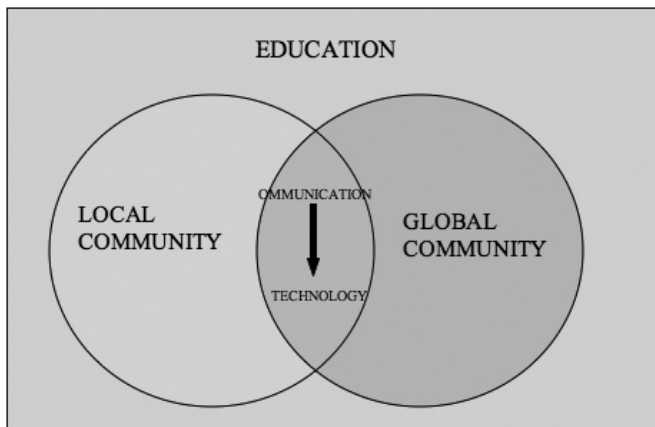
Source: ITU World Telecommunication/ICT Indicators database.



UNESCO School in a Box



School In Your Hand



ALL KNOWLEDGE

What is it?

An application that people can download to their mobile devices with content spanning the full range of human knowledge: Primary, Secondary, Tertiary, Life Knowledge.

How does it work?

Creates a portal that allows access to a network of educational multimedia files. Links content to participants enabling them to consume, produce, rate, and review.

Preferred State

1. 100% literacy
2. Access to education based on interest and ability not dependent on financial status
3. Available to all regardless of age, gender or social status and incorporates intergenerational learning
4. Ensure that all people complete a full course of formal education
5. Formal education includes the potential for global experience through Internet connection
6. Adapts to emerging challenges of people to maintain the preferred direction.
7. Provides equal and easy access to information for all participants

8. Increases transparency and accountability
9. Increases nutrition and health through education
10. Multilingual
11. Increases social and gender equality
12. Increases knowledge of human rights.

Strategy—All Knowledge, All People, All the Time

Global Education Preferred State

- Free education for all
- 100% literacy
- Affordable and accessible communication for all
- Synergize rate of change with communication technologies and education at a ratio of 1:1
- All knowledge is accessible to all humans all of the time via:
 1. An omnilingual educational network
 2. Trained mentors within each region to help people access technology and cultivate learning
 3. Help centers for technology
 4. Reiterative assessment techniques for the system.

Examples

- Smartphones—3G networks
- AMA—Med School applications
- Khanacademy.org
- Open Course Ware (OCW)
- DIY network—<http://www.instructables.com/>



Mobile Phone Use World Wide



“Today, there are more than 3.3 billion mobile-phone subscriptions worldwide, which means that there are at least three billion people who don’t own cell phones, the bulk of them to be found in Africa and Asia. Even the smallest improvements in efficiency, amplified across those additional three billion people, could reshape the global economy in ways that we are just beginning to understand.”

—The New York Times, 2008



The strategy will use the following artifacts to reach the preferred state:

- Option A: Create or expand sector(s) within the United Nations i.e. ITU
- Option B: Public sector, i.e. Government develops, implements and fosters the global education network
- Option C: Private sector, i.e. Company develops, implements and fosters the global education network
- Option D: Social sector, i.e. NGO develops, fosters and implements the global education network
- Option E: Interdependence of above entities model.

This entity will consist of:

- A qualified research team to design an accessible and flexible educational network
- A software engineering team to build it
- Graphic design work to make it attractive
- Administrative staff to oversee operations
- Maintenance staff to keep it healthy
- Community liaisons to market the system and get the community on board as both consumers and producers of educational content
- This entity needs to be able to operate in an environment that is by and large continually supportive of open education. It requires current trends to continue in mobile broadband penetration and electric grid expansion in developing countries. It also requires governing educational policies that allow technology to be the mover and the shaker of education
- A private company or NGO developing, fostering, and implementing the worldwide education network.

8-Year Plan

- 2010—Have support and direction of US leadership
- 2011—Buy In of UN/Civil Society
- 2012—Support and Contribution of interested States Members of the UN
- 2015—Implementation of objective
- 2017—Actualized network community via education/communication hand held devices.

Present System



Preferred System



Endnotes

- 1 UNESCO, Education for All Monitoring Report 2009
- 2 "Measuring the Information Society"—The ICT Development Index, 2009 Edition
- 3 <http://www.rocara.org/ChangingMindsets/>
- 4 World Summit on the Information Society—Geneva 03-Tunis 05 <http://www.itu.int/ws/is/index.html>

9. ELIMU SASA HIVI PROJECT: LEVERAGING TECHNOLOGY TO PROVIDE QUALITY, ACCESSIBLE PRIMARY EDUCATION FOR ALL

By Margaret Lovallo, Danielle Radacosky-Pentoney, Sushil Pakhrin,
Charlie Sheldon

Strategic Summary: The Elimu Sasa Hivi (Swahili for “Education Right Now”) Project focuses on improving primary education in rural Sub-Saharan Africa. By merging mobile technology based micro businesses and associated micro-lending with mobile device based educational content, a scalable primary education platform can be created that is community owned and operated, socially and economically sustainable, empowering to educators and easier for governments and NGO organizations to track and evaluate in rural communities.

Present State— Primary Education in Sub-Saharan Africa

Sub-Saharan African Primary School education is arguably the worst in the world. This presents a huge hurdle to national development. As of 2006 only 24% of primary age children had access to primary education and completion rates are the lowest in the world for primary school.





Preferred State

The preferred state to the current condition of primary school education in Sub Saharan Africa is one where:

- All children have access to education—where there is a 100% rate of enrollment for boys and girls
- All children have access to the highest quality of education, no matter where they are living
- All children complete primary school and enroll in secondary school
- Teachers receive more than adequate compensation for their work.

Strategy

Aligning Information Communication Technology and Rural Education Pilot Program: Burkina Faso Elimu Sasa Hivi

The *Elimu Sasa Hivi* strategy for reaching the above preferred state includes the formation of a partnership of the government of Burkina Faso's Department of Education, a cell phone manufacturing company such as Nokia, and UNESCO.¹ This partnership would offer subsidized and discounted cell phones to teachers and schools throughout Burkina Faso through the Burkina Faso telecommunications company Lazara.



Lazara is a very successful reseller of used mobile phones in Burkina Faso. This partnership and rural education support program would be publicized throughout Burkina Faso, and after the prototype is up and running, outreach would be to other parts of Africa. The first part of the publicity and educational program would use local radio stations.

Another component of the *Elimu Sasa Hivi* strategy would be the provision of cell phones to educators in rural parts of Burkina Faso through a micro-lending institution similar to the Grameen Bank of Bangladesh. These phones would be for both education uses in the rural classroom as well as for income production for the teacher. Income would come through the sale of time on the phone to other members of the community who do not as yet have telephone service.



3. Create Economic Opportunities for Teachers and Others

Provide the teacher with Grameen Bank style micro-finance to start a 'Phone Lady' business with other people in the community to support the school and assist with reporting.

4. Increase Education Infrastructure

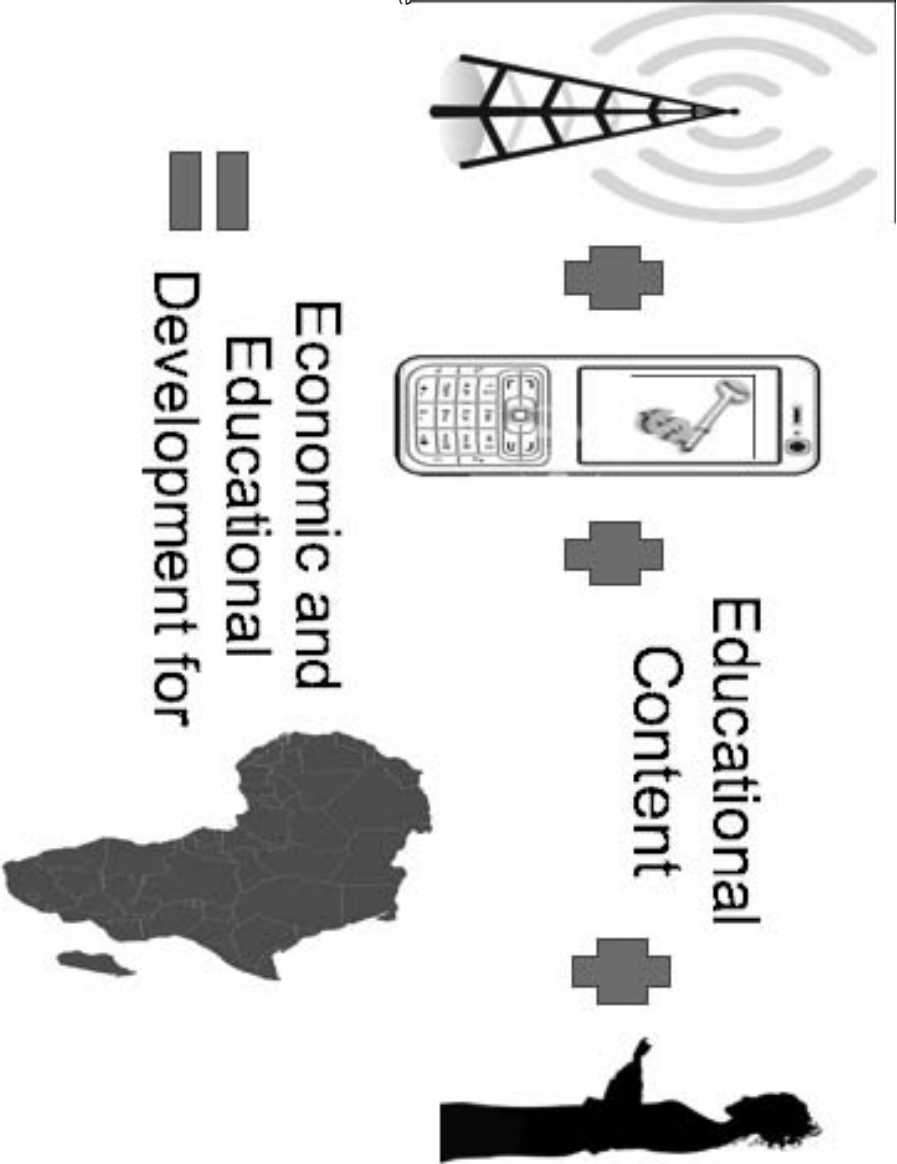
Allow flexible brokering of phone services for educational infrastructure improvements.

5. Self-Replication

Syndicate the project through the combination school-phone shop which accesses mobile teacher training content (TESSA- Teacher Education Sub Saharan Africa).²

The phone provides communication to teachers so they can contact other areas, other families, and reach other teachers thereby alerting them to the program.

Improving Primary
Education by Merging
Micro Business, Mobile
Technology and
Education





Benefits of the Elimu Sasa Hivi Project

Benefits for Teachers

- Income generation via rural phone access rental
- Support for family from extra income
- Increase stature and respect for education, and teachers within village
- Access to educational resources
- Decrease need for travel to head office
- Ability to discuss and establish best practices with other teachers participating in the program
- Become technologically proficient.

Benefits to Community and School

- Accurate reporting of school conditions resulting in better aid allocation
- Positive role models
- Opportunity for village to invest in school in exchange for mobile airtime
- Connectivity for village to assist in checking crop statistics, receiving health information, communicating in emergencies and general economic development

Benefits for Hand Set and Service Providers

- Access and potential first goer in emerging market
- Quick way to educate community on technology and develop market
- Brand awareness

Benefits for Governments

- More accurate educational statistics via sms services like chipata
- Direct line of communication to villages for emergencies and management efforts
- Supports economic development
- Stream rich e-learning content for both teacher training and classroom learning
- Pico projectors market could reach 30 million units by 2012³
- Open educational resources
- Mobile assisted language learning (MALL)⁴
- Qimo 4 kids & blackboard.Com for mobile
- E-learning via Kenya Institute of Education (KIE)

Endnotes

- 1 Plan, “Plan and Nokia partnership annual report 2009” http://plan-international.org/files/global/publications/about-plan/Plan%20Nokia%20Partnership%20Annual%20Report%202009%20-%20part_1.pdf
- 2 TESSA- Teacher Education in Sub-Saharan Africa. <http://www.tessafrica.net/>
- 3 Business wire -Pico-Projector Market Could Reach 30 Million Units by 2012 According to the ‘2008 Pico-Projector Market Segment Analysis’. <http://www.highbeam.com/doc/1G1-175628297.html>
- 4 George M. Chinnery, Goin to the Mall: Mobile Assisted Language learning (University of Maryland Baltimore County, 2006), 9-16. <http://llt.msu.edu/vol10num1/pdf/emerging.pdf>



PART IV

GLOBAL HEALTH FOR ALL

Baby in Sudan. WFP/Peter Smerdon

Context/State of the World Health System

The global health system is characterized by the following problems. It:

- Does not provide full medical coverage to everyone in the world
- Lacks good disease prevention education and has inadequate delivery of preventative medicine (vaccines, vitamins, medications)
- Lacks adequate hygiene
- Is overly-reliant on treating illness/disease rather than the prevention of disease
- Does not provide maternal health care and information to all
- Does not deal with inadequate sanitation, which leads to water-borne disease.

Global Health System Preferred State

By the year 2030, 100% of humanity will have access to basic health resources, health education, and a healthy social environment. In addition, known curable diseases will be eradicated, and everyone will have access to the following resources and services: potable water, sanitation, food supplies adequate to maintain good health, pre- and post-natal care, medical facilities, and medicines.

A health provider administers an injection to a baby at a health clinic in Kandahar, Afghanistan. Clinics such as these have increased the percentage of the population with access to basic health services in Afghanistan, from nine percent to eighty-five percent in four years.

21 April 2008

Kandahar, Afghanistan



STRATEGIES:

1. Hooked-Up HealthHuts
2. Cambodia Water Network
3. Eradication of Malaria: Flower Power

1. HOOKED-UP HEALTHHUTS

By Erica Kane, Erica Jain, James Lual, Kevin Dye, Eric Fedus, Chuck Michelson

There is a large global population that does not have access to accurate and reliable health information or care. This is the case in developed countries as well as developing, but is more extreme in developing parts of the world.

Hooked-Up HealthHuts are designed to deal with two fundamental problems of the health system:

- Lack of access to accurate medical information and health education, and
- Lack of communication between healthcare centers, providers, and contributors

“Every year the world’s poorest children are robbed of an estimated 130 million years of healthy life.”

—WHO, The World Health Report

HealthHuts are designed to provide access to an almost unlimited amount of health information and create a nation-wide (and eventually global) network of clinics, hospitals, and other forms of patient care.

HealthHuts are interlinked kiosk-type computer terminals where people can access health related information in an easy to use and intuitive manner. They are designed to address the lack of health information, and other health related problems. One use of HealthHuts would help users learn what might be wrong with them and how their health problem could be treated. Users would describe their symptoms and receive possible health remedies that are available locally and non-locally. They would be advised how to prevent their malady as well as how to treat it. They would be advised to seek treatment at the nearest clinic if the malady was beyond self-medication. Emergency medical information would also be available.

HealthHuts will be part of a network connecting HealthHut kiosks to clinics and hospitals that can provide for more through patient care for serious afflictions.

HealthHuts will help adults and children in rural villages learn about health in general, their health in particular, and health care options. One

of the goals is that people will learn how to take better care of themselves. Entire villages will have access to health information that will lead to decreased mortality rates, better health, and increased productivity. A global network of HealthHuts and more advanced health care delivery units will enable HealthHuts to communicate with clinics and hospitals for efficient service. They will also allow for patient-to-patient communication so that people with similar health problems can communicate with each other.

The primary manifestation of the Hooked-Up HealthHuts strategy is the use of computer stations at public central kiosks, as in the picture on p. 272.

“A state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity.”

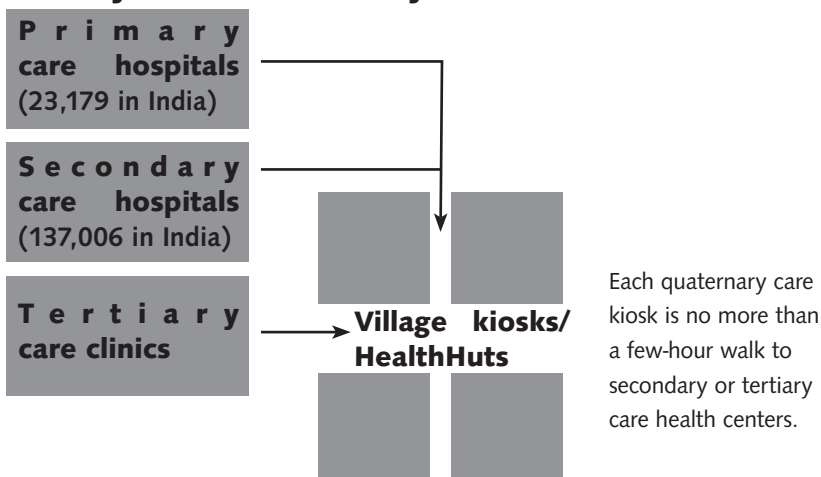
—WHO definition of health

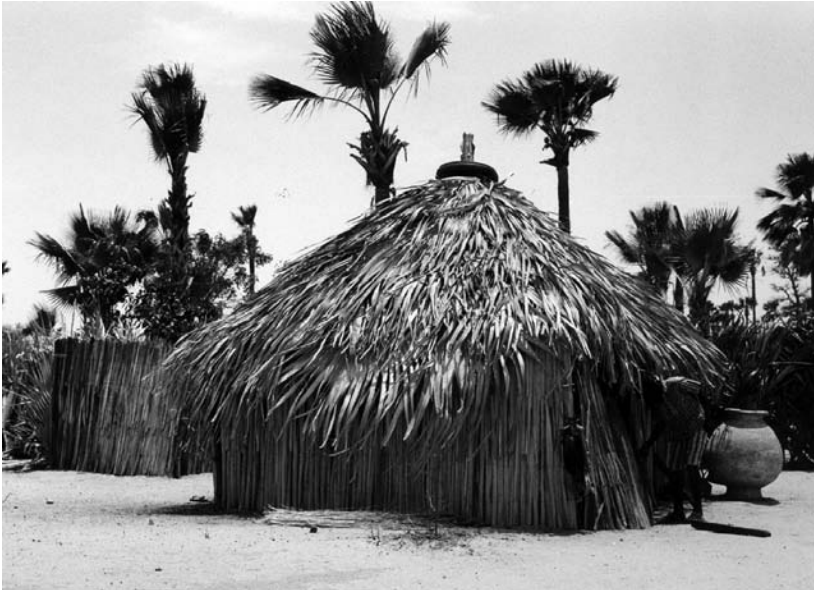
HealthHut Costs

To install two million HealthHuts in villages and urban neighborhoods around the world where health care coverage is sparse to nonexistent would cost the following:

- 1 HealthHut Kiosk unit: \$400
- 2 million HealthHut units: \$800 million
- Annual maintenance: \$50 million
- Network maintenance: \$50 million
- HealthHut content maintenance: \$300 million
- Total start up costs: \$1.15 billion
- Annual costs (for maintenance, additional kiosks, and expansion of services): \$500 million

Countrywide Healthcare System Schematic





HealthHut in Senegal

These so-called ‘hole-in-the-wall’ HealthHuts are run off of solar power. They provide children and others the opportunity to learn computer skills without training, while obtaining valuable health related information.¹





Young and old alike access health information and instructions and summon mobile emergency units. Information is illustrated, animated, and interactive. There are spoken instructions, visual maps, and directions to nearest clinic.

Another design is this earth brick building made from local ground. The cost is about \$2,000 per hut and comes with educational multimedia software, Internet connection, and a direct line to the nearest health clinic. Local companies have donated computers for this setup.



2. CAMBODIA WATER NETWORK: BRINGING CAMBODIA CLEAN WATER

By Jareb Gleckel, Ali Montes, Ben Cohen, Kevin Dye, Eric Fedus,
Chuck Michelson

There are over one billion people in the world without access to clean drinking water. Cambodia is one of the worst areas when it comes to such access. The percent of Cambodians with access to potable water and improved sources of drinking water remains startlingly low despite the presence of abundant supplies of water, most notably Lake Tonle Sap (The Great Lake of Cambodia).

Many people are getting drinking water from unsanitary rice paddies, ponds, and similar sites. The contamination of these sites is due to insecticides and fertilizers, plus animal and human feces. Lack of proper sanitation facilities impacts the cleanliness of the water supply and is a main contributor to the high rates of infant mortality and morbidity.²

According to UNICEF, 70% of Cambodians (or 9.7 million people) do not have a reliable source of clean drinking water. In rural areas 26% have access to safe drinking water; in urban communities, it is 54%. As would be expected, this lack of access to safe water results in a high infant mortality rate as well as acute respiratory infections like pneumonia, malaria, measles, and dengue fever. In addition, the most common ailment that afflicts tourists is diarrhea, directly stemming from the polluted water. This impacts the economy by lowering the amount of money the country can earn through tourism.

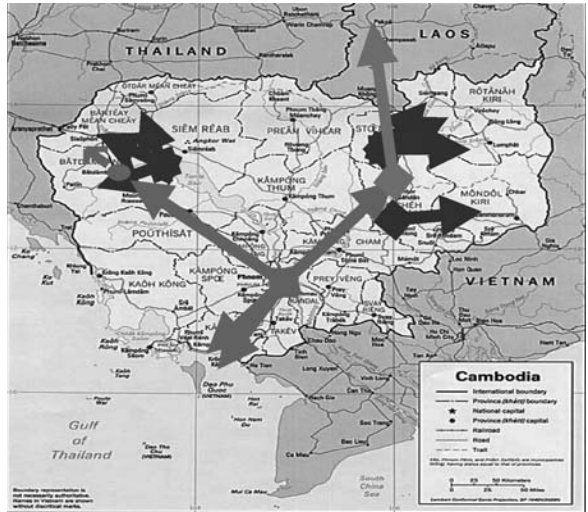


Poverty and Hunger in Cambodia

Preferred State

The goals of the Cambodian Water Network include achieving the following by 2015:

- Provide all Cambodians with a clean, safe supply of water
- Assist in establishment of sanitation infrastructure
- Purify the abundant sources of polluted water present in Cambodia
- Create additional employment
- Increase environmental awareness in Cambodia
- Facilitate a stronger, more independent economy
- Build a self-sufficient government/private enterprise initiative that generates economic development revenue from outside the country (and is a model for other countries).



Polluted waters of lake Tonle Sap during the high water season

Cambodian Water Network Plan

This three-stage strategy calls for 1) setting up a series of water purification plants (financed by the World Bank and private enterprise which will have a 50% equity stake in the new water company), that 2) sell 50% of the water from these plants to Singapore as bottled water (which is facing a serious bottled water shortage), and 3) using 50% of the revenue from these sales to finance the construction of additional water purification plants and sanitation facilities. The other half of the revenue will go to the private enterprise and its stockholders, to pay back the initial start-up costs and provide a fair return on their investment.

The first step is to set up filtration plants in three scattered areas in Cambodia: the tip of Lake Tonle Sap where three rivers branch off, and in two other cities at the intersections of rivers and roads that can be used for transport purposes (see map). A pump and filtration plant would also be set up in the capital Phnom Penh along the Mekong River. A bottling plant will be built and the water from this factory will be shipped by rail to a port on the Gulf of Thailand and then shipped by boat to Singapore.³

Other markets for Cambodian bottled water include Bangkok whose nearly 9 million people⁴ and large tourist industry are in need of bottled water. Another market is more developed nations such as Australia, Japan, and the USA. By exporting bottled water, jobs are created and revenue is obtained to fund the provision of clean water and sanitation facilities to all of Cambodia—thereby improving the overall health of Cambodia.

Costs

Startup:

- Water pumping and filtration plant: \$3.4 million⁵
- Bottling Factory: 5-gallon bottling facility; 1,200 bottles/hour
29,000 bottles/day; 10.5 million/year; 144,000 gallons/day = \$2 million
- **Subtotal: \$5.4 million**

Ongoing:

- Labor: 500 workers at \$2/hour, 8 hours/day, 340 days/year
= \$2.7 million/year
- Transportation: \$3,000 per trip (1 trip/week) = \$156,000/year
- **Subtotal: \$2.85 million**

Startup and first year operating costs total: \$8.25 million

Revenue:

- \$4 per 5-gallon bottle
- 5 million bottles/year (50% of total output; other 50% goes to meet domestic water needs) = \$20 million

Revenue total: \$20 million/year

Funding Partners

- A major water distribution corporation such as Nestle
- The World Bank, Asian Development Bank
- Governments

3. ERADICATION OF MALARIA: FLOWER POWER

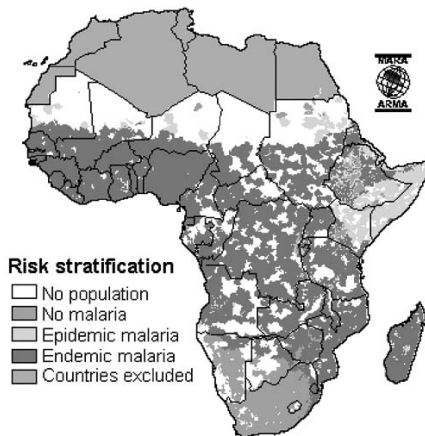
By Jai Lakhanpal, Taylor Zuccolotto, Kevin Dye, Eric Fedus, Chuck Michelson

Malaria is a life-threatening parasitic disease transmitted by mosquitoes. 41% of the world's population lives in areas where malaria is transmitted.⁶ There are 300 million cases of malaria each year resulting in 1 million deaths. 90% of these deaths occur in Africa, mostly in young children (only 41% of children under 5 years of age have access to anti-malarial drugs).⁷ Every 30 seconds a child dies of malaria. Malaria also impacts the economy. For example, in Africa, malaria causes an estimated loss of \$12 billion per year.⁸ The indirect costs of malaria include lost productivity or income associated with illness or death.⁹

The average cost for potentially life-saving treatments of malaria are estimated to be US13¢ for chloroquine, US14¢ for sulfadoxine-pyrimethamine, and US\$2.68 for a 7-day course of quinine.¹⁰ Although these costs appear low, providing these treatments for 300 million people proves extremely costly (\$39 million for chloroquine treatment, \$42 million for sulfadoxine-pyrimethamine treatment, and \$804 million for a 7-day course of quinine) and well beyond the means of the health care systems and resource-short governments in malaria-afflicted areas.

Preventing malaria through the control of the mosquito that delivers the disease is a more cost-effective means of reducing the negative impacts of malaria. The strategy outlined below will also result in additional benefits to local economic development and the reduction of poverty.

Malaria epidemics in Africa



Flower Power Strategy

The Flower Power strategy is a four-stage effort that involves the widespread production of the natural malarial mosquito controlling pesticide pyrethrum (derived from chrysanthemum flowers, and a relatively safe, non-harmful to mammals pesticide) by small, village-based subsistence farmers in many African countries. This provides an additional market and income for one of the poorest segments of African society. Along with the use of pyrethrum-laced bed nets to keep mosquitoes from biting while asleep, this strategy is designed to eliminate the most devastating impacts of malaria in Africa.

The strategy starts off with a series of farmer education posters, pamphlets, and demonstration farms that teach the best practices for growing the chrysanthemum flowers needed for the production of pyrethrum. This will be accompanied by a government backed guaranteed market for the next ten years' annual harvests of chrysanthemum flowers. With government incentives, the SC Johnson Company (or other private companies) will invest in the building of two or more plants in Africa to process the flowers into pyrethrum. This public-private partnership will increase the revenue of small farmers throughout many countries of Africa, guarantee a steady and dependable supply of chrysanthemum flowers for pesticide production, generate employment opportunities, and increase the availability of pyrethrum for use in fighting malaria and other mosquito-borne diseases. Tax revenues from the production and sale of pyrethrum will be used to implement the use of the pyrethrum, malaria education, and the purchase of mosquito killing bed nets.

The goals of this strategy include:

- The complete eradication of malaria and other mosquito-borne diseases from Africa by 2030
- Promoting the use of pyrethrum and pyrethroids in areas where malaria and other mosquito-borne diseases are prevalent, in order to eradicate these diseases by 2030
- Promoting the learning of the proper ways of treating and preventing malaria and other mosquito-borne diseases
- Stimulating the industry of safe insecticide production in Africa thereby creating increased employment
- Promoting production of drought resistant chrysanthemum flowers, thereby providing increased economic security for small African farmers
- Promoting the use of insecticides for the protection of crops in

order to increase food production, thereby reducing hunger

- Creating a partnership with private enterprise; specifically the pesticide producing company SC Johnson¹¹ in order to support the growth of insecticide production in Africa.

Cost

The costs of the Flower Power Malaria Eradication strategy include:

Seeds

- Chrysanthemum seeds cost approximately \$440 per hectare (52,000 seeds are used per hectare)
- To cover 66,000 hectares will cost \$29 million per year

Irrigation pumps

- To irrigate the 66,000 hectares will take approximately 22,000 foot-powered micro-irrigation pumps at a one-time cost of \$2.2 million.¹² Installation (\$2 million) and annual maintenance (\$2 million) will run another \$4 million per year.

Total seed and pump cost: **\$35.2 million**

Total annual costs, if seeds are paid for by government: **\$33 million**

Total annual costs, if seeds are paid for by farmers: **\$2 million**

HEALTH FOR ALL FOR LIFE

RECAP

Cost

To implement all the strategies outlined above will cost \$1.2 to \$2 billion for start up and \$536 million annually thereafter for maintenance and updating.

The variable costs are a function of varying costs of implementation according to location and chosen strategies.

- The HealthHut program start-up costs are approximately \$1.2 billion, with annual costs at \$500 million.
- The Cambodia Water Network start up cost is approximately \$5.5 million, with annual costs at approximately \$3 million
- The Flower Power program start up cost is approximately \$35 million, with annual costs at approximately \$2 to \$33 million, depending on cost sharing with farmers.

The total start up costs of all these programs is \$1.25 billion. The annual costs are about \$535 million.



An old lady at her window in a Nepalese village. *UN Photo/John Isaac*

Funding

Possible funding for the Health for All strategies include public and private investments at the local, national, and international levels.

One business model, based on Google's use of ad revenue, could generate substantial income for HealthHuts. For example, on the right hand side of each screen on the computer in each of the HealthHuts could be short ads for medications available locally that treat the health concern of the person at the HealthHut. These revenues would go towards the maintenance, updating, and expansion of the HealthHut and their contents. An added expense would be the vetting of the ads placed on the HealthHut screens.

Summary

In summary, the health strategies outlined above, if implemented aggressively, will provide health care coverage to the millions of people throughout the world who currently have little to no access. It will increase the healthcare self-reliance of these people, make them better informed about health, health problem treatments, and health care. The strategies will also reduce the incidence and severity of malaria in the world, and provide a private/public model for clean water provision.



PART V

FAIR ECONOMIC
SYSTEMS/
PARTICIPATORY
GOVERNANCE/
SUSTAINABLE
LIFE FOR ALL



Rural Women Sell Mango and Potato Jam

Women sell mango and sweet potato jam at the food processing shop in Bantantinnting, Senegal. They produced the jam with a Multifunctional Platform Project (MFP) introduced by the United Nations Development Programme (UNDP), helping women and girls to no longer spend several hours a day gathering firewood or collecting water. MFP is a diesel engine to which a variety of end-use equipment can be attached, including grinding mills, battery chargers, vegetable or nut oil presses, welding machines and carpentry tools.

14 June 2006, Bantantinnting, Senegal

STRATEGIES:

1. **Community-In-A-Box**
2. **Living Wage for All Humanity**
3. **NGOs: MDG Realization**
4. **United Nations Empowered**
5. **Where in the World Is Our Sustainable Capital?**
6. **Investing in Opportunities**
7. **iWANT to Know**
8. **Human Trafficking: Breaking The Cycle**
9. **Accounting for the Real World**
10. **Project Tires on Foot**
11. **Fast Tracking Poverty Eradication**
12. **Urban Regeneration**
13. **Earth Dashboard**
14. **WorldGame**
15. **Surpassing the Digital Divide**
16. **UVote**
17. **unSlumming**
18. **commUNITY**
19. **I Am Human**

1. COMMUNITY-IN-A-BOX

Community-In-A-Box is a packaged collection of tools, artifacts, instruments, materials, how-to manuals, and educational devices. It is aimed at helping the developing world meet its needs for shelter, energy, food, water, and sanitation. It is sent to a community to help the community solve the problems they face. Its contents are based upon the community's self-described needs as articulated on the *New Earth Exchange* website.

For example, the package could include the following items to help ensure an environmental problem is solved:

- Building construction kit
 - o Materials, tools, and 'how-to' manuals for building and/or using the following:
 - * Rainwater catchment systems
 - * Water purification systems
 - * Sanitation facilities
 - * Irrigation pump
 - * Food storage facility
- Energy systems
 - o Solar systems for electricity generation
 - o Small scale hydro system
 - o Communication Tools
 - o Cell phone
 - o Solar powered laptop computer with Internet access
- School-In-A-Box
- Health Education kit

Other *Community-In-A-Box* kits for meeting other community needs could be put together. Other needs include water, energy, sanitation, health, shelter, and employment.

Marketing, Finance, and Dissemination

Both strategies would need to partner with agencies already in under-developed areas to help people gain awareness of and access to these opportunities.

2. LIVING WAGE FOR ALL HUMANITY

By Aruna Arjunan, Zeynep Arhon, Dustin Feider, Don Whilsmith, Mael Jaffres, Kyle Fedus, Lucas McConnell, Angela Fuller, Gonzague de Raulin

Strategic Summary: The Living Wage group developed a strategy to create 500 million living wage jobs by the year 2015 using a set of economic development strategies designed to exponentially increase wealth throughout the world. The plan has three stages that follow economic development phases, starting with small prototype farms growing the “three sisters” crops (beans, squash, and corn), then moving into production-ready crops such as agave and hemp, and finally moving into larger-scale industrial algae farming to produce byproducts such as ethanol and oil.

Present State of Employment and the Global Economy

- 19% of world population lives in extreme poverty—1.25 billion people live on \$1/day or less
- 62% of world population lives on \$2 or less a day—2.8 billion people get by on \$2 a day or less¹³
- Poverty is mostly concentrated in Sub-Saharan Africa: 44% of the population there lives in extreme poverty
- Individuals, NGO’s and governments tend to focus on symptoms of poverty without looking at the bigger picture
- There are a number of political, social, religious, cultural, environmental, and economic barriers to people-centered, people-powered development in much of the world:
 - o **Social**—racism, domestic and international violence, hunger, lack of “win-win” options— general sense of apathy and powerlessness
 - o **Economic**—poor health (diseases), unsustainable systems, unstructured economies, shortage of revenue (cash flow), foreign and national subsidies that distort local markets
 - o **Political**—corrupt businesses, political instability, lack of stability provided by the “rule of law,” lack of transport (roads and ports)

- o **Cultural**—religious tension, lack of perspective to cooperate
- o **Environmental**—depleted soil, resource competition, industrial pollution and subsequent public health consequences

Preferred State of Employment and the Global Economy

By 2015:

500 million additional people making a living wage.

By 2030:

1.3 billion additional people making a living wage (thereby reducing to 0 the number of people living on \$1 or less per day)

Overall Goals

- A world without poverty
- Everyone has a job with a living wage
- A system that allows big business to create economic value on a local level
- Meaningful employment, and economic evolutionary opportunity (the capacity for personal and regional economic advancement)
- The attraction of global investment
- Creation of family and village level production capacity, employment and a living wage
- A sustainable system of farming which allows for the saving of seeds, continued improvements to the soil, intercropping and mulching.
- An agricultural middle class with small scale organic vegetable farming and algae farming at any scale
- Creation of infrastructure and infusion of wealth spurs additional enterprise.

Phase 1: Regeneration Kit (Farm-in-a-Box)

The initial artifact that will be required is a kit to help the small farmer to develop a small area of land in such a way as to be ever expanding and

self-replicating. The farming methods that have been promoted by global trade rules and some economic policies in the less developed world have led, in many places, to degraded soils and polluted water supplies. In particular, the focus on growing cash crops like cotton and raising livestock has led to a number of problems such as:

- loss of forests and grasslands to make room for grazing livestock or farm plots
- lack of locally edible agricultural products
- deterioration and erosion of soils
- monoculture food production susceptible to disease or attack by pests
- pollution from industrial fertilizers and pesticides

In order to help farmers move away from these destructive agricultural practices, the kit distributed in the pilot portion of this strategy (Phase 1) will be largely focused on revitalizing traditional and cultural practices and imparting knowledge about regenerative, permaculture farming.

Farm in a Box

Beyond instruction the kit will contain basic supplies including the seeds and equipment necessary to begin to implement the program. Through simple design and ingenuity, hand tools such as the rake can be made from local materials. The rake is a tremendous tool for the small-scale farmer. The ability to gather organic material for mulching the land can greatly improve the water retention and the fertility of the soils.

This first phase of the project will be focused on providing the know-how, the money, and the materials to grow three crops—beans, squash, and corn, commonly known as the ‘three sisters.’

The three sisters crops have been grown together for thousands of years by Native Americans and demonstrate principles of permaculture. Not only are these crops nutritious, relatively easy to grow, and beneficial to soils, but they can also be sold on regional and world markets to provide income and a host of employment opportunities (i.e. growers, transportation, supply vendors, etc.).

Phase 2: Hemp
Bootstraps



Once a demo project has been successfully set up and at least 30 pilot programs are underway in various villages, the next phase of the project will be to transition to new crops such as hemp and agave that will provide raw materials for small-scale manufacturing.

In hemp varieties grown for seed or fiber use, the plants are grown very closely together and a very dense biomass product is obtained that is rich in oil from the seeds and fiber from the stalks. These plants are also low in THC content (EU and Canadian regulations limit THC content to 0.3% in industrial hemp).

Experts estimate that hemp industries could generate \$500 billion to a trillion dollars per year in economic product and benefits—if allowed to flourish without government interference.

Some common uses of hemp include: textiles and fabrics, fiber and pulp paper, rope, twine and cordage, art canvas, paints and varnishes, lighting oil, biomass energy, medicine, food oils and protein, building materials and housing.¹⁴

Phase 3: ActionAlgae

The third phase of this strategy is to expand from the base of subsistence agriculture and the value-added semi-industrial agricultural production of hemp fiber to more information- and resource-intensive algal culture and large-scale manufacturing.

One acre of algal production can yield 136,000 pounds of algae. This can be converted to:

3,500 gallons of fuel oil

4,500 gallons of ethanol

78,000 pound of organic fertilizer¹⁵

Each of these has great value in our current and coming economy. They can be sold by the algae producer/converter in the local, national, and global market.

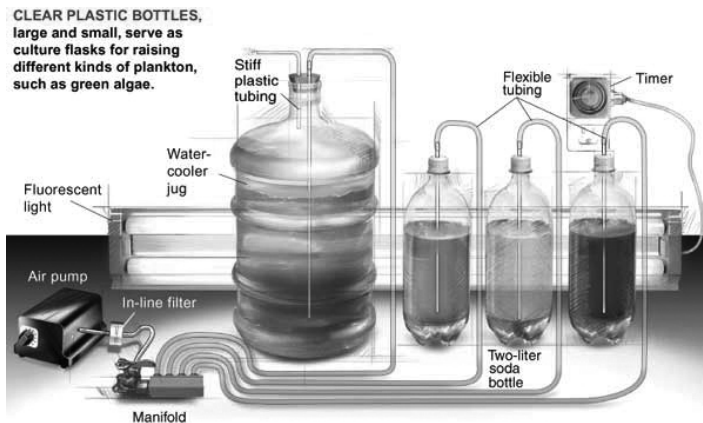
Raising Awareness of Phase 3

- Kick-off meeting, inviting targeted enterprises/donors, leading individuals and press members to listen to ActionAlgae
- Media campaign to be supported with investing enterprise, featuring their logos
- “I Love ActionAlgae” compressed t-shirts to be distributed with selected magazines, supported with advertorials in the same magazines
- Press tours to ActionAlgae towns in Africa

- Trips to ActionAlgae towns in Africa, as a memorable travel experience for adventurers

Benefits of This Strategy

- Family and village level production capacity, employment and a living wage.
- Sustainable methods of farming which allow for the saving of seeds, continued improvements to the soil, intercropping and mulching that retain moisture and improve soils.
- An agricultural middle class with small scale organic vegetable farming and algae farming at any scale.
- The creation of infrastructure and infusion of wealth that spurs additional investment and enterprise.
- Significant improvement of soil quality.
- Additional carbon makes arid soil more fertile and water absorptive.
- Carbon removal from the atmosphere reduces global warming as it sequesters it in the soil.
- It is a model that can be replicated in many places around the world.
- The number one requirement for algae culture is land and labor



Examples of small scale (above) and large scale (right) algae production.



Estimated Phase 3 Costs and Returns Through 2015

	Year	Source	Cost	New Use in Acres	# of People Employed
Year 1	2008	Seed Money	\$ 200,000	Demo Prototype	0
Year 2	2009	Loan	\$ 20,000,000	30 Pilots	150
Year 3	2010	Investment	\$ 60,000,000	20,000	100,000
Year 4	2011	Investment	\$ 400,000,000	1,800,000	9,000,000
Year 5	2012	Spontaneous	\$ 10,000,000,000	8,200,000	41,000,000
Year 6	2013	Spontaneous	\$ 20,000,000,000	11,800,000	59,000,000
Year 7	2015	Spontaneous	\$ 45,000,000,000	38,200,000	191,000,000
Year 8	2015			39,979,970	199,899,850
			\$ 75,480,200,000	100,000,000	500,000,000

which is in ready supply in these impoverished rural areas.

- Urban impoverished areas can be also impacted with concentrated farming techniques.

Resources Needed

Material Resources

“The Regeneration Kit” including:

Seeds for planting (corn, beans, squash, flax, hemp)

1. Agave tissue plugs
2. Fertilizer
3. Piping for irrigation system
4. “Water maker” drip system
5. “How to” manual in local language
6. Rake and other necessary tools

Human Resources

College Interns

NGO partners

UNDP and UNEP

Local population who are interested in pursuing this option

Local and national government

Experts in local climatology, weather patterns, soils, and cropping systems

3. NGOS: MILLENNIUM DEVELOPMENT GOAL REALIZATION

By Samah Hanaysha, Veronica Peña, Razi Shawahdeh

Strategic Summary: The NGO MDG Realization group propose a new way of structuring and employing non-governmental organizations (NGOs). The strategy seeks to bring NGOs more in line with what is needed on the ground and to move them away from donor interests and influence to better serve individuals and communities.

Present State of Global Civil Society

- 15% of development aid is channeled through NGOs
- 6,000–30,000 national NGO in developing countries
- 40,000 Internationally operating NGOs
- The United States has an estimated 2 million NGOs, most of them formed in the past 30 years
- India is estimated to have between 1 and 2 million NGOs
- In Kenya alone, some 240 NGOs come into existence every year.

Some general problems with NGOs

- Many NGOs operating but problems they seek to address continue to persist
- Too many one-shot efforts
- Competition: NGOs' efforts often conflict with each other
- Donor agendas often do not match recipients' real needs
- Often insufficient and unreliable funding
- Misuse of funds by some NGOs
- Lack of proper controls often leads to divergent and unintended results
- Unskilled and untrained staff often diminish value

NGOs in Palestine

- Palestinian Central Bureau of Statistics (2007) lists 1,664 registered NGOs in the West Bank and 1,061 registered NGOs in the Gaza Strip²¹
- Total of 2,725 NGOs serving a population of approximately 4.3 million; 1,578 people per NGO
- According to UNESCO, 50% of NGOs in the West Bank are small (1–5

- employees) and 35% of Gaza Strip NGOs are small.²²
- Palestinian gross domestic product dropped by 6.6 percent in 2006²³
- Poverty figures rose by 30 percent over the previous year, for an actual 75% of people living under \$2 a day
- Unemployment was over 30 percent
- Those who would be unable to feed themselves without aid reached 49% of Gaza's population.

Preferred State of Global Civil Society

Effective NGOs:

- Work transparently
- Have sustainable, self-perpetuating funding
- Train local people as staff
- Collaborate with communities they serve
- Network together to coordinate efforts
- Involve local businesses and governments as partners
- Promote self-reliance
- Meet needs and empower people (economically, educationally, culturally)
- Are autonomous and legitimate
- Have government endorsement of their activities
- Have aims that the people they serve accept
- Have their agenda directly influenced by the people they serve
- Are accountable for the results they do or do not achieve.

Other Considerations of Effective NGOs:

Effective NGOs have a clear understanding of existing NGO strategies and programs. They make a needs assessment of their constituents, see how many NGOs are needed, and what kind of enterprises and products are required to meet these needs. Effective NGOs in rural settings often focus on agricultural programs first. They train people to increase productivity, often provide micro-loans, and promote "green business." Effective NGOs have clearly stated goals on new enterprises and income generation. A national body that collects and monitors grants would be an effective procedure in many parts of the world, including Palestine.

Strategy

“NGO in a Box” kit—This kit would contain materials that would enable an NGO to be more effective. The kit would contain information on strategy consultancy, project management, accounting, human resources, fundraising, values and goals clarification, communication tools, agriculture training, etc. The box would also contain a micro venture capital and local incentive programs and media campaign “kit.”

NGO in a Box Kit

The purpose of this kit is to provide NGOs with a “crash course” in the tools, skills, and strategies they can employ to be as effective as possible. This kit will help NGOs with a variety of functions such as basic office management (accounting, human resources, etc.) all the way through fundraising campaigns and program creation and execution. Providing NGOs with these basic tools will help free their creative energies and allow them to focus on aiding the communities they work in.

Palestine Micro-Loan Venture Example

Start with \$500–\$1000 projects

- Establish local incentive programs for agriculture initiatives
- Fund subsidies, fairs, conventions, farmers’ markets to increase local market access
- Work as intermediaries between the occupation authority and farmers
- Help farmers to access international markets
- Work to consolidate farmers into cooperatives



Images of Palestinian communities in need. Communities like this would be the targets for aid from NGOs.

object	quantity	estimated cost	sub total
material needs			
computers	7	100	700
projector	1	2,000	2,000
printer	1	1,000	1,000
office furniture		5,000	5,000
camera	1	800	800
Investment			9,500
rent an office	1	1,000	12,000
printing materials		1,500	1,500
manager	1	1,500	18,000
secretary	1	900	10,800
accountant	1	1,100	12,200
Media officer	1	1,000	12,000
lawyer	1	1,300	15,600
experts trainers	4	1300*4=5200	62,400
media campain expenses	12	2,000	12,000
Operation			156,500
loans for farmers			100,000
			266,000

Cost break-down of the “NGO in a Box” and Palestine Micro Venture-Capital strategies.

- Help NGOs work as hubs to sell and buy larger quantities of agricultural products.

4. UNITED NATIONS EMPOWERED

By Ross Cameron, Dale Castle, Eric Goldfischer, Joshua Kauffman, Shivani Mathur, Ethan Rosch, Hyoung Suk Seo, Ani Shahinyan

Strategic Summary: Most of the nations that have signed on to the UN Millennium Declaration—and thereby agreeing to pledge 0.7% of their GDP as development assistance—have not fulfilled their pledge. Incentives for nations to fulfill their pledges and accountability measures for nations that don't are needed. In this plan, only those nations that make good on their pledge of 0.7% GDP to the United Nations will be allowed to bid on development projects—therefore allowing them the opportunity to see an income return on their development assistance investment. The strategy will be aided by the use of advanced project management software currently in use by the US government to track funding vs. results.

Present State of Global Development Assistance

- Governments have committed to .7% of their Gross Domestic Product (GDP) to Official Development Assistance (ODA) to fund the UN Millennium Development Goals (MDG) but are not fulfilling these pledges²⁴
- Governments are not held accountable for their MDG funding commitments
- There are no effective tool(s) for accountability
- MDG development funding is currently allocated by member states and not the UN
- There is not enough transparency as to who paid what, for what, and when
- There is not effective or efficient overall organization of the money that goes into MDG programs, nor is there a link between monetary input and project management and evaluation
- There is a lack of awareness of and responsibility for the MDGs in some countries.

The UN Empowerment group identified four overarching reasons why the MDGs are not being achieved, or being achieved more slowly than needed.

1. Poor governance—marked by corruption, short-sighted econom-

- ic policy choices, and denial of human rights
2. Poverty traps—where local and national economies are too poor to make needed investments
 3. Compartmental progress—where progress is made in one part of the country but not in others, leaving sizable persistent pockets of poverty. Even when overall governance is adequate, there are often areas of specific policy neglect that can have a monumental effect on their citizens' well-being
 4. All of the above—where all these factors occur together, making individual problems all the more challenging to resolve.

Preferred State of Global Development Assistance

By 2015:

- There is adequate funding to exceed all Millennium Development Goals
- Monies are collected and distributed unconditionally, without political inhibitions/agendas
- All governments will meet the MDG funding of 0.7% or greater of GDP for ODA
- MDG development funding will be monitored solely by the UN
- Transparency = Everyone can see what everybody is doing directly with MDGs.

Attitudes Toward the Amount of US Aid to Africa

"Thinking about the amount you pay each year in taxes, how many of your tax dollars would you be willing to have go to economic and humanitarian aid for African countries?"

\$20

[Actual amount of median taxpayer's tax bill that goes to Africa:]

\$3

"Do you think US aid to Africa should be increased, cut or kept about the same?"

Increased 33%

Kept about the same 46%

Decreased 13%

The chart above shows that people in the US are willing to give more money for global development aid, particularly to Africa.

This is the gap between where we are and where we want to be:

0.37% gap in average country fulfillment
\$106 billion cash on hand
\$119 billion of cash missing
= 0.53 % cash gap²⁵

Strategies

1. ODA Return on Investment (ROI) Motivation Initiative

This strategy, the *Official Development Assistance Return on Investment Motivation Initiative* focuses on providing the UN Development Programme (UNDP) with a sophisticated set of software tools to allow them to manage individual MDG projects, issue requests for proposals (RFPs), and track successes or problems at the project level. These tools would increase the effectiveness of the MDG project and provide donor countries with a window into how their money is being spent and how effectively it is being used.

An important aspect of this strategy is the incentive structure to encourage countries to give the full 0.7% GDP they have pledged. Incentives include:

Transparent management: UNDP prioritizes and manages all MDG projects through the MDG fund

- Request for proposals: The UNDP issues RFPs for needed projects
- RFP eligibility: Only governments who have fulfilled their 0.7% commitments are eligible to bid on the RFPs
- Preferred RFP bid weighting system to foster increased contributions
- The winning government RFP bid gets the right to the contract and recoup some of the money they have put into the fund
- Utilizing their own military industrial machine and/or subcontractors, the MDG Fund money flows back into the economic system of the donor country
- Transparency throughout entire process.

Existing resources the strategy will use:

- UNDP resources such as project management skills and staff, MDG development fund

Resources needed for the strategy:

- one additional project management director
- two additional project staff
- one additional MDG UN public communications liaison
- project management software

2. Lifeline Awareness Initiative

This strategy, the Lifeline Awareness Initiative, focuses on the development and use of a series of informational tools that increase the awareness and transparency of the use of all MDG funding. These tools include the MDG Index and the Lifeometer.

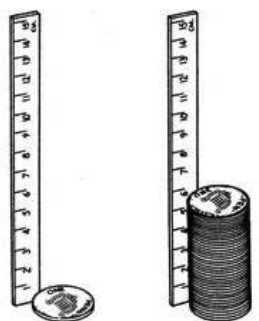
These tools will:

- Increase worldwide media awareness of the funding of the MDGs and which countries have met their MDG funding pledges. The MDG Index and Lifeometer will be prominently displayed on such publicly viewable sites as Google.com, all UN agency websites, the UN Earth Dashboard (see p. 303) and financial pages of newspapers throughout the world.
- The Index and Lifeometer will also be used by existing MDG campaign advocacy groups such as: One.org, Red Campaign, etc.
- The Index and Lifeometer will also be displayed on a large digital billboard outside the UN Headquarters. This display will also feature information showing how close we are to the MDG funding goals with a web address for further information.

Other graphic displays of MDG funding pledges will include:

Coin Stacks

- This graphic will illustrate how little is being asked of a citizen of a country. It will show two stacks of coins—one representing the GNP of a given country, the second showing what 0.7% looks like.



UNTV: In-Sight, In Mind

- This graphic display will be featured on “UNTV”—a new cooperative venture with major television systems throughout the world. Content will be based on MDG successes and needs.



UN Flag Flying

This graphic display will involve the use of the country flags that fly in front of the UN Headquarters in New York City. The flags will be raised or lowered based on how much of their aid pledge they have fulfilled. If a country has fulfilled their MDG pledge, their flag will be at the top of the flag pole. If, for example, a country has fulfilled half of their pledge, the flag would fly at half mast.

Anticipated Impacts of These Strategies

ODA ROI-Motivational Initiative:

- Accountability for auditable funds usage and associated governance.
- Increased MDG funding transparency
- Increased project management capability for UNDP as all MDG initiatives are coordinated through one software management system that has measureable goals, deadlines, and penalties built-in.

Lifeline Awareness Initiative:

- Global media exposure
- Enhanced awareness at citizen level
- Public pressures to achieve MDGs.

Short-Term Implementation Plan

ODA ROI-Motivation Initiative

- Create ODA trust fund managed by UNDP
- Outline duties of enhanced UNDP staffing
- Define qualifications of development projects
- Define qualifications to bid for projects
- Set up system, issue and award bids, monitor progress and results, report results to public

Lifeline Awareness Initiative

- Organize and consolidate data collection



One part of the awareness campaign involves raising or lowering the level of countries' flags in front of the U.N. Headquarters based on how much of their aid pledge they have fulfilled.

- Network with media for awareness campaign
- Design and implement campaign

Long Term Goals

- Development task forces managed by UNDP
- Infrastructure development process begins
- Global awareness and civil society accessibility 100%

Metrics for Success

ODA ROI-Motivation Initiative

- Initial increase in direct MDG funding
- Decrease in fulfillment gap
- Increase in project management accountability and visibility

Lifeline Awareness Initiative

- Global increase in MDG awareness across all sectors
- Increased citizen to government contact on MDGs
- Increase in individual donations to MDG Fund (governments, corporations, citizens)

What is needed to set this plan in motion and make it real?

- Prototype the ODA ROI-Motivation Initiative:
- Pilot a Performance Management Database (using current off-the-shelf software)
- Test run Request-Life-Cycle
- Create awareness campaign in the lobby of the UN Headquarters (i.e. Coin Stacks) and measure public response with on-site poll.

5. WHERE IN THE WORLD IS OUR SUSTAINABLE CAPITAL?

By Alfonso Rivas, Bich Tran Hoang Le, Ren Shiroma, and David Fand

Strategic Summary: There are over 200 countries and many more states in the world. There are over 36,500 cities in the world, and over 500 with a population of over one million.³ Each country and state has a capital city. Which city is the most sustainable in the world? This city should be the “Sustainable Capital of the World” and be recognized as such throughout the world. This strategy calls for a global competition for sustainability between cities. One goal of this strategy will be to determine the world’s most sustainable city. The process of competing for this title will educate people around the world about sustainability, its value, and what each person, neighborhood and city can do to increase the sustainability of their region. Most importantly, the contest and the competition between cities will increase the sustainability of cities throughout the world.

Sustainable urban development is “improving the quality of life in a city, including ecological, cultural, political, institutional, social and economic components without leaving a burden on the future generations.”¹

“Sustainable community development is the ability to make development choices which respect the relationship between the three “E’s”- economy, ecology, and equity.”²

A sustainable city is an integrative system that incorporates an economic, ecological, and equity dimension in its development choices.

Introduction—Problem State

More than half of the people in the world live in urban environments. These urban areas have numerous problems, including:

Energy

- Urban environments consume and waste huge amounts of energy. Just the developed country’s *buildings* consume approximately 43% of a nation’s energy.
- Most of the energy for all the cities of the world is imported to the

city—that is, it is not locally sourced, generated or stored.

- The energy consumed by our urban environments is expensive and primarily from fossil fuels, thereby contributing to global climate change.

Water

Cities waste large quantities of fresh water in leakage, sewage removal, run-off, inefficient water using appliances and wasteful recreational and industry uses.

- Cities rarely collect and recycle their water.
- Water is seen as a commodity that has a monetary cost only. Environmental impacts are not taken into account.
- There is a pervasive ignorance about the origins, uses, impacts and destiny of water use in the urban environment.

Carbon Emissions

- Cities emit large amounts of carbon dioxide thereby increasing the severity of climate change. For example, US buildings generate 35% of US CO₂ emissions.

Waste

- Cities do not reduce, reuse, or recycle all the materials they can.
- In most cities, dedicated recycle bins are not provided in all commercial and residential spaces.
- Excessive amount of recyclables are ending up in landfills or polluting the environment.

Travel distance, time and cost

- Daily commuters travel farther, burn more fossil fuels, and emit more carbon emissions because basic amenities are built farther away.

Accessibility

- Many city's services and amenities are not accessible for people with disabilities, or the elderly or poor.

Access to information

- Most urban residents are not aware how their actions concerning energy, water and other resources have an impact on the environment.

Housing

- Many people live in substandard housing where basic sanitation, affordable and safe water and energy are lacking, and health care, education and transportation networks are not readily available.

Choice and Participation

Many cities have governments that exclude participation in decision-making, are controlled by an elite inner circle that maintains an inequitable distribution of resources and prerogatives and fosters continuing states of abject poverty.

In addition to the above, urban environments are often characterized by:

- A higher death rate among people living in urban slum areas.
- A large amount of trash on the streets and dumpster sites.
- A majority of the city's food, water, and energy imported.
- The placement of businesses and services far away from residential areas forcing people to commute longer distances.
- Roads and sidewalks that are not pedestrian friendly, public transportation that is not thoughtful of people with disabilities, and which is often expensive and in competition with subsidized motor vehicle transportation only the wealthy have access to.
- A priority given to vehicles rather than humans—demonstrated by roads that cover 25% or more of many city's total surface areas, parks that are no longer filled with grass but rather asphalt or have become parking lots.
- A high unemployment rate.
- A large gap between the rich and the poor.

The severity of the problem can be measured by:

- **Energy use:** The percent of the population using renewable energy sources and the percent of energy wasted.
- **Water use:** The percent of the population collecting rainwater and using water efficiently—the number of gallons used per person, the amount lost through leaks, the cost of water. (Rainwater harvesting has the potential to meet nearly all of some city's water needs. For example, "The Austin Texas area receives an average of 32 inches of rain per year. A 2,000 square foot area can capture 36,000 gallons of water annually, which would meet 100 gallons per day of a household's water needs."⁴)
- **Air pollution and carbon emissions:** The number of people hospitalized or made unwell due to air pollution. (Upward of 20,000

air-pollution-related deaths per year per degree Celsius may be due to this greenhouse gas.⁵)

- **Waste management:** The amount of waste generated per person. (About 127 million tons of waste refuse goes into landfills each year in the US.)
- **Travel distance, cost and time:** The average amount of time it takes the commuter to get to work. (“Commuter travel, and the pollution it causes, has been growing faster than the population as more people live farther from their jobs.”)⁶
- **Accessibility:** Per-cent of curb-sides and entry ways that have handicap accessible curb-cuts. (“At least 20,000 polling places across the country are not fully accessible to voters with disabilities.”)⁷

Preferred State

A preferred state to the above description of a non-sustainable city is a city that incorporates an economic, ecological and equity dimension in its development choices.

100% of the people living in cities have, on a sustainable basis:

- **Equitable** opportunity for full participation in all activities, benefits, and decision-making of society.
- **Economic** opportunities that serve the common good, are self-renewing, and build local assets and self-reliance.
- **Ecological** perspectives that see humans as part of nature, nature having limits, and communities responsible for protecting and building natural assets.⁸

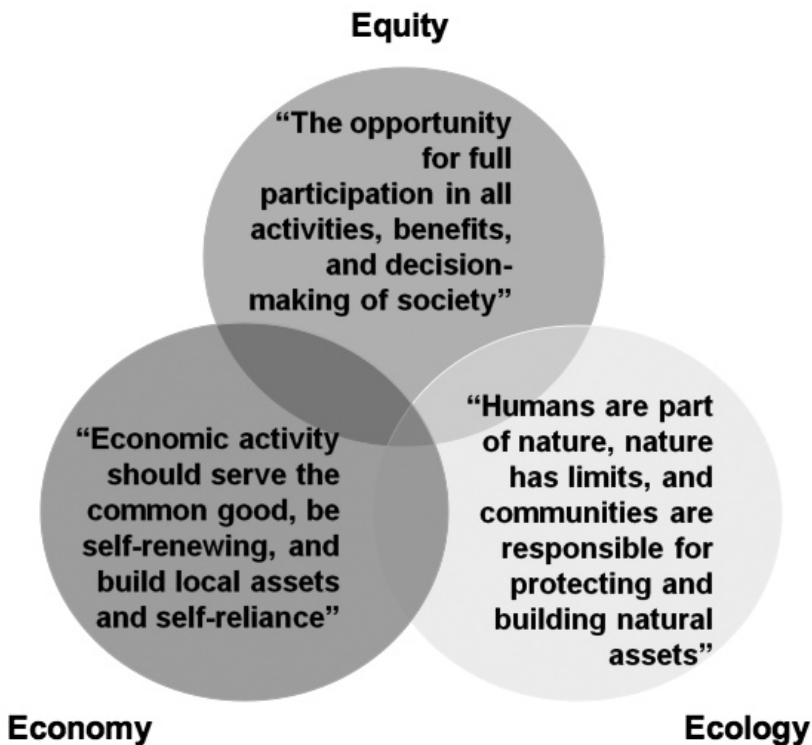
Core strategies that lead to these three preferred state foundations are:

- **Energy and water awareness and conservation:** A sustainable city provides a metered supply of clean water and energy to all of its residents that is locally generated and stored, thereby reducing—through increased transparency and knowledge—long-term environmental and monetary costs.
- **Carbon dioxide release:** A sustainable city has net CO₂ emissions at or approaching zero. CO₂ release is metered, made public and taxed. Resulting revenues are invested in carbon abatement actions.
- **Recyclable materials:** All materials used by a sustainable city for construction, consumer goods and other uses are metered and

recyclable. Dedicated recycling bins are located in all commercial and residential spaces.

- **Reducing travel distance, time, and cost:** A sustainable city has its residential needs situated within a one-mile radius of each neighborhood. Commuting is through efficient and eco-friendly transportation systems.
- **Accessibility:** A sustainable city is fully accessible for people with disabilities, as well as by the elderly and poor.
- **Transparent sources of information:** A sustainable city makes all government data, decisions, budgets, expenditures, contracts and appointments fully accessible to everyone in the city.

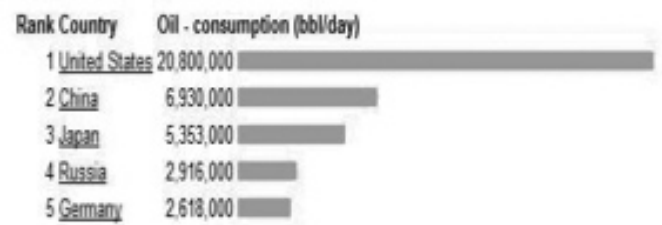
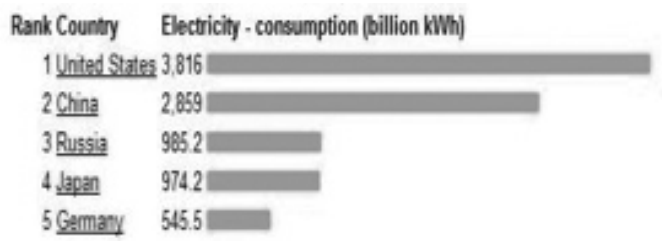
The above will lead to more efficient resource management, cost savings, lower environmental impact, and increased civic engagement.



Equity	Economy	Ecology
Energy and water supply: Provides a supply of <i>affordable</i> clean water and energy that is locally generated and available to all citizens.	Energy and water supply: Provides a supply of clean water and energy that is locally generated thereby reducing <i>monetary</i> cost compared to imported resources.	Energy and water supply: Provides a supply of clean water and energy that is locally generated thereby reducing the <i>environmental</i> costs.
Zero carbon emission	Zero carbon emission	Zero carbon emission
Accessibility: City is fully accessible for people with disabilities, elders, and the poor	Accessibility: City is fully accessible for people with disabilities, elders, and the poor	Accessibility: City is fully accessible for people with disabilities, elders, and the poor
Transparent Sources of Information: Promotion of sustainable awareness	Transparent Sources of Information: Promotion of sustainable awareness	Transparent Sources of Information: Promotion of sustainable awareness
Waste Management: Increase the usage of recyclable materials and decrease usage of non-recyclable materials	Waste Management: Increase the usage of recyclable materials and decrease usage of non-recyclable materials	Waste Management: Increase the usage of recyclable materials and decrease usage of non-recyclable materials
Reducing travel distance, time, and cost: Daily residential needs situated within 1 mile radius of each neighborhood and city commuting via forms of efficient and eco-friendly transportation	Reducing travel distance, time, and cost: Daily residential needs situated within 1 mile radius of each neighborhood and city commuting via forms of efficient and eco-friendly transportation	Reducing travel distance, time, and cost: Daily residential needs situated within 1 mile radius of each neighborhood and city commuting via forms of efficient and eco-friendly transportation

Present State

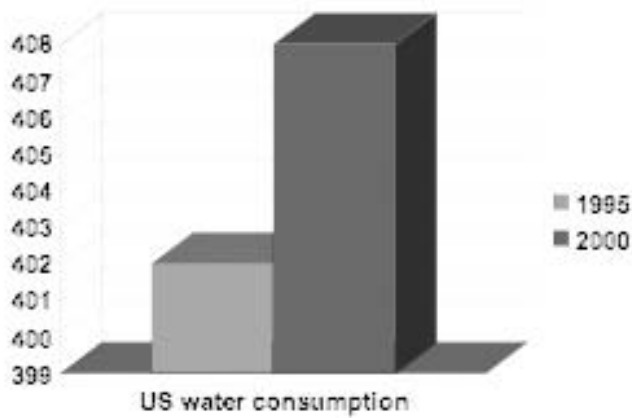
Energy

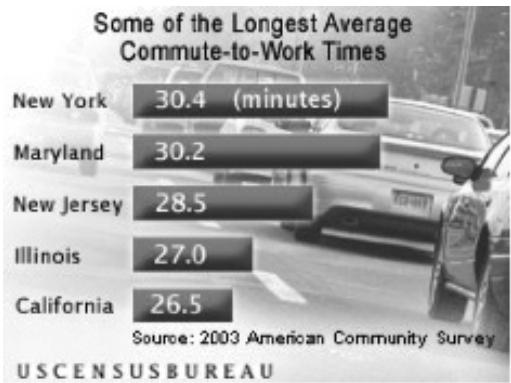


The average American household uses about 10,500 Kwhs of electricity per month.

Water

The average American household uses about 109,500 gal/household/year.





Transportation

Transportation sources accounted for approximately 29% of total US greenhouse gas emissions in 2006.

Strategy

In order to reach the preferred state—where cities around the world are sustainable or on the path to sustainability—our strategy calls for a worldwide competition to

determine the *Sustainable Capital of the World*. The intention of this contest is to motivate cities around the world, and the people who live in them, to make changes toward more sustainable cities. It will provide the motivation for informing citizens and decision makers about sustainability issues and options. This competition, like the Olympics, is meant to bring citizens of the world together and join in an effort to become a more sustainable planet.

One of the goals of the competition is for cities to teach and learn from each other. Cities will compete to win the title of *Sustainable Capital of the World* through the *Where in the World is our Sustainable Capital?* contest. This contest is open to all cities throughout the world.

Given the differences between the so-called mega-cities that contain 10 million or more inhabitants and cities with populations of less than 1—2 million, it is proposed that there be two prizes for different size cities, and that these prizes alternate every 2 years as do the Summer and Winter Olympics. That is, every four years a winner of the mega-city *Sustainable Capital of the World* contest will be awarded, and every four years there will be a similar awards ceremony for the smaller cities, but that these events will each occur separated by two years.

The competition is global, but in later years it will scale to the level of the country. That is, each country will have a contest that will determine the *Sustainable Capital of* _____ (France or Germany, the United States, China, Nigeria, etc.). At a latter stage, we also anticipate having a village-level contest and a country-level contest wherein the *Most Sustainable Village* and the *Most Sustainable Country* are determined. We chose to begin at the city level because it is small enough that realistic changes can be made faster and more effective, but big enough to impact a large population.

World Sustainable City Program

Implementation of the *Sustainable Capital of the World* contest will begin with the development of the World Sustainable City Program website that will oversee and administer the contest.

To win the title of *Sustainable Capital of the World* cities will enter the contest and be evaluated according to objective, numerical and well-known criteria. The city that scores the highest will be declared the winner. Those that do not win will see what they need to do to raise their scores.

The criteria and numerical weighing for each criterion for determining the winner of the *Sustainable Capital of the World* contest are below:

Competition Scoring Criteria

Criteria	Score
Carbon footprint per capita (zero carbon footprint=60pts)	50
% Recyclable materials recycled	30
% Clean water from sustainable supply	30
% Sustainable clean energy from sustainable supply	30
Number of major educational campaigns run throughout the city to raise awareness on sustainability	20
Miles of walkways and bicycle paths per capita	20
% Of bicycles to gas powered cars	20
% Of people commuting by car to people commuting by bikes or mass transit	20
% Of clean/hybrid being used to power transit	20
% Of green buildings	20
% Neighborhood with available community such as hospitals and food markets located within a one-mile radius	20
% Of disabled access to public space and all public and private buildings	20
Total points	= 300 pts

The contest is based on 300 points. Entry would be submitted and recorded online. The top five cities will be independently evaluated to verify their scores. The entry cost would be a sliding scale determined by per-capita income of the city and the country of which it is a part.

The Sustainable City web site would be a repository of sustainable options that have already been or could be implemented in cities around the world. In addition to this it would contain a support network, links to sustainable options suppliers and consultants, and online discussion forums.

The Sustainable City Prize would include the “Sustainable Capital of the World” trophy, one million dollars and the right to be the host site of the next World Sustainable Capital Award Ceremony.

One implementation option is for the Sustainable City Contest to partner with an existing UN (or other) agency like the UN Habitat, or The Commission on Sustainable Development. Corporate sponsorship will also be important on a number of levels—including product donation (for example, a large wind generator from GE or other renewable energy device from other manufacturers).

The monetary resources needed to make this program sustainable can come from private donations, corporate sponsorship, and registration fees.

World Sustainable City Award Ceremony

- International state-of-the-art ceremony presenting the *Sustainable Capital of the World* Award and recognitions.
- Featuring lectures/speeches, workshops and product showrooms on sustainable technologies for cities
- Who attends: All city delegates, manufacturers, NGO’s, and citizens
- Where: Hosted by the previous winner of the *Sustainable Capital of the World*
- When: Hosted every 4 years by the current *Sustainable Capital of the World*

Timeline

Year One:

Private sector sponsorship secured

Development of website for World Sustainable City Program

Year Two-Four:

Inaugural *Where in the WORLD is our Sustainable Capital?*
competition

Year 5:

Announcement of the first “Sustainable CAPITAL of the WORLD.”

Start of the search for the next “Sustainable Capital of the World” that will be declared in 4 years.

Success criteria after five years: At least 100 cities are competing.

Success criteria after twenty years: 80% of the cities of the world are competing.

Outcome: Increased global awareness and actions upon the implementation of sustainable strategies.

Additional success criteria:

- Increase in amount of renewable energy and recycled water used in cities
- Decrease in carbon emissions and material wastes
- Increase in amount of recycled waste
- Increase in number of bicycles and mass transit used for daily commutes
- Increase in accessibility by elderly and handicapped
- Increase in government and corporate transparency

In order to generate maximum effectiveness of permanent city sustainability, civil society is expected to spread awareness and implement citywide legislative policies. It is the civil society’s role to bind the city under a common goal.

Endnotes

- 1 The Regional Environmental Center for Central and Eastern Europe www.rec.org/REC/Programs/SustainableCities/What.html
- 2 <http://www.subjectmatters.com/indicators/Sustainability/DefinitionsCommunity.html>
- 3 www.peopleandplanet.net/section.php?section=5 and wiki.answers.com/Q/Total_number_of_cities_in_the_world
- 4 <http://www.austinenenergy.com/energy%20efficiency/programs/green%20building/sourcebook/rainwaterHarvesting.htm>
- 5 <http://www.stwr.org/climate-change-environment/each-degree-of-global-warming-linked-to-20000-deaths-a-year.html>
- 6 <http://www.environmentmaine.org/in-the-news/global-warming/global-warming/report-cites-maine-commuters-role-in-global-warming>
- 7 http://www.nysilc.org/press_rel/10-30-02voting%20niagra.htm
- 8 Mountain Association for Community Economic Development (MACED): Hart Environmental Data <http://www.subjectmatters.com/indicators/Sustainability/DefinitionsCommunity.html>

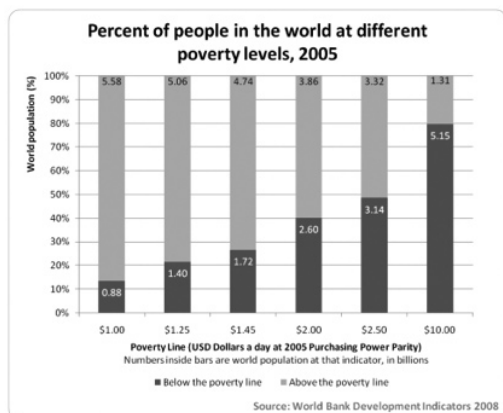
6. INVESTING IN OPPORTUNITIES

By George Pavlosky, Anna Swarbrick, Emmanuel Lagurre, Alexis Baranov

Strategic Summary: *Make credit and training available to low-income people and couple their business with fair-trade organizations that sell their production in wealthy parts of the world.*

Introduction—Problem State

- There are over 3 billion people living on less than \$2.50 per day
- Approximately 80% of poor people lack access to banking facilities
- Loans are rarely reaching the poorest of the poor
- Borrowers are uneducated on business sustainability and unable to rise out of poverty
- Poor villages do not have initial costs to start income generating businesses



- Women do not always have the opportunities to access loans (often due to lack of collateral, land titles, cultural practices)
- Lack of knowledge and access to loans



Almost half the world—over three billion people—lives on less than \$2.50 a day.

Preferred State

- Those living in abject poverty have access to micro-credit by 2015
- All developing countries have access to low interest micro credit by 2030
- Local village economies are linked to the global markets
- Communities are educated in sustainable business practices
- Women are provided equal business opportunities
- High capital mobility (faster, easier access to loans).



Strategy

- Step 1: Form a NGO *Investing in Opportunities* that partners with Ten Thousand Villages/Oxfam to provide business opportunities for crafts people in developing regions of the world.
- Step 2: Progressively expand from 5 villages until all communities in need have access to micro-credit *Investing in Opportunities* works with the community to provide credit, structure and support for the lending process.

Linking Local Communities with the Global Economy

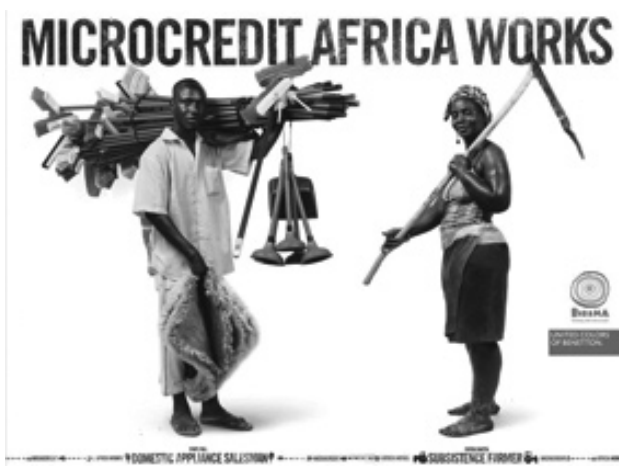
Investing in Opportunities will partner with fair-trade organizations such as Ten Thousand Villages and Oxfam as they have a strong and viable network, expertise in global fair trade with numerous outlets worldwide.

Action Steps

- *Investing in Opportunities* collaborates with Ten Thousand Villages/Oxfam
- Focus on the poorest communities in most need of credit
- Pick 5 communities with growth opportunity
- Inform community on micro-credit and how it applies to them
- Community selects local leader to be chair of micro-credit committee
- Community selects committee



- 2 weeks of training committee
- Committee educates community on micro-loans
- Community applies for loans with support from “Investing in Opportunities” for business ideas
- Committee decides on eligibility
- First loan comprises of \$50 or less with 6% interest
- 20-40% of borrowers produce items to be sold through Ten Thousand Villages/Oxfam
- Loans are paid back, credit is established and an increase of future loans to that member.



7. iWANT TO KNOW: AN INITIATIVE STREAMLINING MILLENNIUM DEVELOPMENT GOAL AWARENESS IN CANADA AND THE UNITED STATES

By Kiersten Hawes, Kathlene McGuinness, Christina Walsh

Strategic Summary: On average, American and Canadian youth appear to be politically inactive. This is not due to cynicism, but to apathy fuelled by being under-informed and having their modes of expression ignored by the political mainstream. The lack of awareness surrounding the Millennium Development Goals (MDGs) in North America can, in part, be attributed to this apathy/lack of information. Many organizations have implemented Millennium Development Goal outreach, but the lack of an emotional connection has resulted in a situation where the messages are not part of popular dialogue. iWANT to know is a multi-level awareness initiative promoting the MDGs for youth ages 14-24 in the United States and Canada. This emotionally-branded campaign uses online technology and focuses on three main components: education, connection, and action, that encourages North American youth to become an active global partner in the pursuit of the MDGs. By 2015, the iWANT to know campaign will ensure that North American youth understand the importance of, and are active campaigners (indirectly or directly) for the pursuit of the Millennium Development Goals.

PRESENT STATE

There has been a profound decline in Canadian and American youth political participation, on both electoral and civic engagement levels, since the 1970s and the gap between the older and younger generations in terms of political engagement has widened sharply as time has progressed.¹ This is felt throughout both countries' political systems, and it translates into many issues that affect not only government operations, but also the operations and initiatives of political non-governmental and multilateral organizations, including the United Nations and their initiatives, including the Millennium Development Goals (MDGs). It has

been found that it is not cynicism that drives the decline in engagement, but apathy, coupled with (and most likely driven by) a lack of political education and limited access to easily digested information.²

The United Nations is, among other things, a political organization. Although the organization could be said to have expanded its agenda to move beyond what would be considered a political mandate (the Millennium Development Goals are a prime example), it remains that the agencies which drive the United Nations are the governments and politicians of the U.N.'s member nations. As such, the political-will of the electorate in member nations (especially wealthier nations with a generally post-material culture, in which individuals place value on issues which reach beyond basic necessities, such as food and shelter, and into areas such as global politics and philanthropy³) will invariably drive the UN agenda. Member governments' delivery on agreements concerning United Nations' initiatives and programs that indirectly lead to MDG achievement, such as levels of Official Development Assistance (ODA)⁴ are also subject to member states agendas and priorities.

It appears that the youth of North America embody an interesting dichotomy of political viewpoints – youth who are near or have reached age of majority generally either views their federal government as unimportant, or as a positive force in the nation.⁵ In contrast, much of the older population in North American civil society view the government with a high-level of cynicism and suspicion, despite their general view that political involvement is important. Many psychological studies confirm that by their late twenties, individuals' values and beliefs are generally fixed for the rest of their lives.⁶ If that is so, the demographic targeted for generating MDG awareness should be one that is still forming their value-system and has a more positive association with the political process. According to a study on the research for a campaign targeting youth on issues of drug and alcohol prevention, an individual's personal associations with specific communities and social networks are established between the ages of 14-18.⁷ This can be viewed as an opportunity for the United Nations and other organizations (NGOs, government agencies) to foster increased political will for the achievement of the MDGs and other international development targets.

By targeting North American youth ages 14-24 for MDG-related outreach, a demographic can be created that will understand communities

beyond their own culture and geography as being a part of their social network. This understanding could translate in a profound generational shift from political apathy and disconnection, to an adoption of issues that concern everyone but (as of right now) only visibly affect certain parts of the global population.⁸

At present, there are a large number of organizations, both UN agencies and private NGOs, which have undertaken MDG awareness initiatives, many of which can be found online. Some seek to provide information about the MDGs as well as grassroots projects or political involvement/volunteer opportunities for development-related issues, or create modules and platforms to spread awareness through partnership with education professionals. Others still have created a place to view progress on the attainment of the MDGs and important statistical data. Yet, despite this plethora of publicly available information, there is relatively little awareness and no response or acknowledgement from the general public. In a WFUNA (World Federation of United Nations Associations) study on MDG awareness, 79.6% of people believed coverage of and information on the MDGs for the public, through various media, were either inadequate or non-existent.⁹ If these views are taken into account, there must be some form of disconnection between the awareness initiatives and the general public.

Emotional Branding

The primary question is, therefore, what is that disconnection? Our research has led us to the conclusion that it is a need for emotional branding and clarity. As noted, there are many organizations and agencies providing information,¹⁰ but no one is really attempting to create a deep, valued and emotionally connective relationship between North Americans and the MDGs.

Emotional branding is about association – the brand (in this case, a brand for MDG awareness) will “convey something that is in keeping with the consumers’ [demographics] aspirations,”¹¹ which is usually accomplished by creating imagery and construct which evokes a certain lifestyle or idea. If individuals feel that becoming part of the movement to attain the MDGs is characteristic of someone that they aspire to be or an expression of their values, then MDG awareness and outreach will be far more successful both in the size of audience that responds, and in the success and sustainability of public interest over both the short

and long-term.

The United Nations and its projects are viewed by much of the North American population as complex and in many ways incomprehensible.¹² If that is the case, there needs to be a simplified way to access MDG-related information, which, in this case, would most likely be best accomplished through a visually-clear and easily navigable website. This website would act as a trusted source for youth for any information, events, projects, and news pertaining to the MDGs.

Why is emotional branding a necessity? As the North American market is inundated with corporate and commercial branding, emotional branding connects to people through messages of transparency, honesty and connection, rather than part of the mainstream “hype” which is gradually being rejected by voters, consumers and youth.¹³ This can be seen in the 2008 Obama campaign, where personal connection through technology took the place of focus-group decided campaign slogans/movements. Instead, the Obama campaign became personal to individuals and simultaneously accessible to all, through the use of step-by-step instructions and promotional materials that individuals could use to start their own movements, and by web media that allowed the Obama platform and personality to be instantly accessible to and shared among a wide range of people. Many credit this ‘emotional branding’ as a major component of his success in becoming President.¹⁴

PREFERRED STATE

The Preferred State of MDG awareness and involvement is one where:

- All 14-24 year old North Americans are aware of and connected to the MDG and their attainment
- Nearly all of these same youth are involved, in one way or another, with actions that are leading to the realization of the MDGs.
- The United States and Canada have fulfilled their current financial and other commitments to the MDGs.

These goals would be accomplished through a unified and emotional web-based branding campaign. This online initiative would utilize a customizable and easily navigable interface targeted to a demographic of youth ages 14-24. This website would make it possible to create a new level of involvement from North American youth in projects that are working to achieve the Millennium Development Goals.

By 2012, this online community would number 110,000 (the same

amount believed to be consistent contributors to the online Obama campaign¹⁵) and another 100,000 would be indirectly involved through their exposure to educational modules in classrooms, or to grassroots projects/online donation options they have seen through social networks, media, or friends.

This newly informed and involved population will lead to huge increases in pressure on North American governments to deliver on all their MDG promises and targets.

By 2015, the MDGs will be comprehensively covered in popular media. This will be verified by surveys that document that 75% of North American civil society agrees that this is the case.

(This project does not seek to systemize or centralize any NGOs or UN agency. It is the specific and autonomous nature of these agencies that have created credibility for the overall organization and its initiatives.¹⁶ Moreover, this initiative is not a comment on the possible or perceived-by-some redundancy or ineffectual nature of any United Nations' MDG awareness initiatives. Instead, this effort seeks to create a program that is an umbrella brand narrative to carry the message of the many NGO organizations and UN agencies. The intention is to create a cohesive, holistic and accessible summation of the MDGs and their impact on North American society and economy and individuals. A new brand and logo needs to respect the autonomy of UN agencies and NGOs while creating a cohesive platform for North American youth to absorb and associate with MDG information. Such a new branding would also provide a canvas to create a specific emotional narrative, free of any particular associations that individuals may have with pre-existing agencies. This brand would be specific to the MDG campaign.)

STRATEGY – iWANT to know Campaign

PHASE ONE: Branding and Cooperation

The first part of this initiative involves the development of an umbrella slogan, campaign, and logo under which all UN Agencies' North American MDG outreach initiatives, as well as the initiatives of willing NGO and civil organizations, would be amalgamated.

This initiative would not concern itself with the systemization or centralization of any NGOs or UN agencies and their work. It is the unique and autonomous nature of these agencies that have created

credibility for the overall organization and its initiatives.¹⁷ This initiative seeks to create a program that is specific to the unique nature of ‘on-the-field’ response for MDGs in North America. This “umbrella” will be a brand narrative that carries the message of the many organizations and strategies implemented by the UN agencies and private NGOs. It will develop a cohesive, holistic and accessible summation of the MDGs and their impact on North American civil society and the individuals it is comprised of.

To do this, a new brand and logo will be needed. This logo and brand will respect the autonomy of UN agencies and NGOs, while also developing a cohesive platform for North American youth to absorb and associate with MDG information and action initiatives. It would provide a canvas to create a specific emotional narrative, free of any particular associations that individuals may have with pre-existing agencies. This brand would be specific to the MDG campaign and the actions that are available for youth to get involved with that will lead to their realization.

A mock-up of the brand and logo is demonstrated at right.



The *iWANT to know* slogan and logo were chosen through a system similar to the SENSE¹⁸ branding method. *iWANT to*

know is meant to evoke emotional associations which include, but are not limited to: integrity, demanding, curious, a stand, solidarity, vital, youth, story-telling, worthy, social, confidence, fresh, innovative, challenging, discovery, and self-decision.¹⁹

PHASE TWO: Online interface and public relations

The next phase of the *iWANT to know* campaign will be the establishment of a simple online interface that connects North American youth to:

- MDG updates, projects information, blogs, and news
- Volunteer and other opportunities at NGOs, government and UN agencies around the world where youth can get involved with MDG activities
- Downloadable/streamable classroom modules for education pro-

fessionals

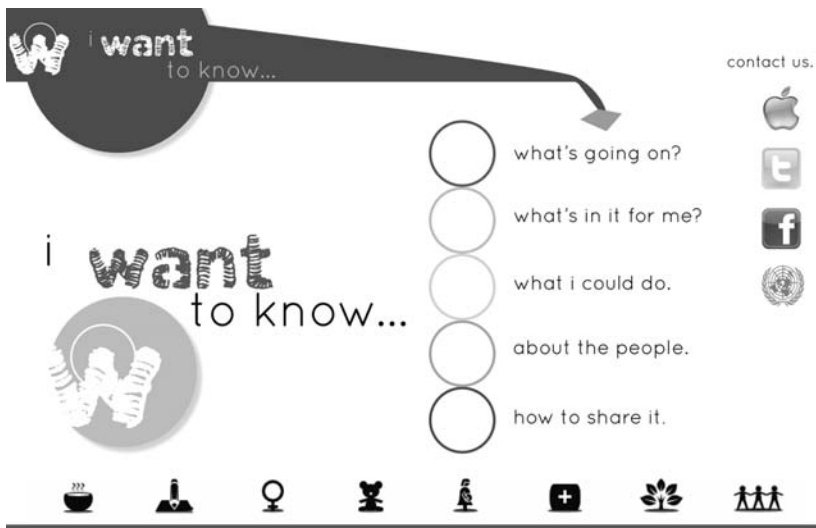
- Step-by-step instructions on creating civil/grassroots projects or political lobbying
- Social networking for interested/involved individuals/feedback and concerns
- Methods for donation


This interface will be managed and navigated through the *iWANT to know* website. The website itself will provide individuals in this age bracket with “honesty and transparency in communication via social media and the importance of building trust through truth.”²⁰ According to branding expert Marc Gobe, this is the key experience young people will emotionally respond to in online branding.

This site will be designed as a simplified, easily navigable gateway for youth. Below, a mock-up homepage is illustrated.

All of the above-listed connections in the interface are categorized into a hierarchy of five questions. Self-determination and customization are established from the homepage, as it is the user’s decision which question they choose to answer. It is also the user’s decision which information they become a party to throughout all subsequent time navigating the site.

Below illustrates the page linked to *iWANT to know* what I could do?” where there are step-by-step instructions on how to volunteer, obtain an internship, create grassroots action or lobby government representatives on international policy.






i want to know...


we'll tell you exactly what you **want** to know.

initiatives + projects.
home.
contact us.



large

or




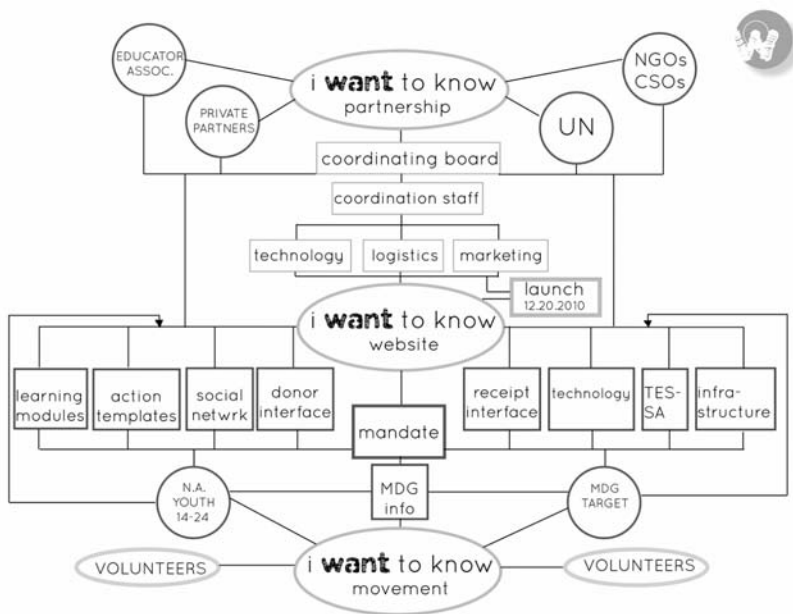
small

what i could do.

you could:

- change government.
- build something.
- connect with someone.
- start a movement.





Above, is an example of a customizable education module for high school or post-secondary educators, using video, interactive technologies, and simplified research/progress information.

The *iWANT to know* website's launch will be coupled with a PR campaign through third-party media (i.e. talk shows, blogs, social networks, news media, spots in prime-time) with two to three spokespeople who embody the brand's associative qualities listed above. There will be a large web-cast free-concert event from two urban centers (such as Vancouver and New York), that will be a part of the official website launch. This concert will become an annual event leading up to the 2015 MDG deadline. Third-party media is chosen as it is considered more credible than commercial advertising. If ads are issued, they would be present in print media and online media with similar brand associations and demographics to that of *iWANT to know*.²¹ Revenue from these ads would be used to fund the site and MDG youth related activities.

PHASE THREE: User feedback and sustainable expansion

In Phase Three, the core emphasis of the website will shift from educational aspects (*what's going on?* – see figure 2) to social networking, action and media (*what can I do? How can I share? And what's in it for me?*). Users will have established a strong online community that shares information about MDGs, project initiation and coordination, opportunities and experiences, and government/civil/NGO/UN policies, as well as thoughts and opinions. User feedback and involvement will determine the direction of the site, including what information is featured and what events and projects will be the site's (and brand's) future focus.

Costs: approximately \$50 million for five years

- \$13.3 million the first year 2010-2011
- \$9.2 million per year 2, 3, 4 and 5

COST Breakdown

\$3.65million for concerts for launch/subsequent events each year²²

\$100,000 for logo and branding development (one-time cost 2010)²³

\$25,000 for website and interface design/implementation (one-time cost 2010)²⁴

\$25,000 for website re-design and update (one time cost, year 3)²⁵

\$250,000 for website maintenance and growth²⁶

\$1.5 million for staff of 20 per year

\$7.5 million for ad campaign in first year, \$2.5 million in subsequent years²⁷

MEASURABLE RESULTS

By 2015

- 75% of North Americans polled say coverage of the MDGs in various media is comprehensive and accessible
- \$75 million has been raised for MDGs through concert ticket contests/promotions, DVD sales, grass-roots fundraising projects, mobile-phone donations, and the publicity campaign
- 200,000 North American youth are directly or indirectly participating in the *iWANT to know* campaign or its affiliated organizations through volunteering, lobbying, grassroots initiatives, donations, or awareness projects.

CONCLUSIONS

If the Millennium Development Goals are to be achieved by 2015, the cooperation of North American governments towards meeting all previous agreed-upon MDG terms and related ODA/international development targets must be met. To do so, the North American electorate must be rallied behind the MDGs. The *iWANT to know* campaign will provide a relevant, timely, and appropriate medium that motivates youth who have reached (or will soon reach) voting age. Using social media, online accessibility, resource-pooling, and emotional-branding with a narrative with transparency, honesty, and immediacy, enormous new pressure will be placed on North American governments to ensure they fulfil their MDG commitments and contribute to the realization of the MDGs with the comprehensiveness and attention befitting their roles on the international stage.

Endnotes

- 1 Hill, Lisa. "Low Voter Turnout in the United States: Is Compulsory Voting a Viable Solution?" *Journal of Theoretical Politics*. April 2006 vol. 18 no. 2 207-232
- 2 O'Neill, Brenda, "Examining Declining Electoral Turnout Among Canadian Youth." *Electoral Insight*. July 2003. 56-63.
- 3 Milner, Henry. "Political Knowledge and Participation Among Young Canadians and Americans." Institute for Research on Public Policy Working Paper Series. No. 2007-01. November, 2007
- 4 Gelissen, John. "Explaining Popular Support for Environmental Protection: A Multilevel Analysis of 50 Nations." *Environment & Behaviour*. Vol. 39. 2007.

- 392-415.
- 4 UN Department of Economic and Social Affairs. "The Millennium Development Goals: A Snapshot." New York. March, 2010. 9.
 - 5 Paul Howe and David Northrup, "Strengthening Canadian Democracy: The Views of Canadians," *Policy Matters* Vol. 1, No. 5 (July 2000).
 - 6 Ronald Inglehart, Miguel Basáñez, Jaime Diez-Medrano, Loek Halman and Ruud Luijkx (eds.) *Human Beliefs and Values. A cross-cultural sourcebook based on the 1999-2002 values surveys*. Coyoacan: siglo veintiuno editores. ISBN 968-23-2502-1. 2004.
 - 7 Diamond, Sara, et. al. "Building Xperience: A Multilevel Alcohol & Drug Prevention Intervention." *American Journal of Community Psychology*. Vol. 43. 2009. 297
 - 8 Thomas, Emma F., Craig McGarty, Mayor, Kenneth I. "Transforming 'Apathy into Movement': The Role of Prosocial Emotions in Motivating Action for Social Change." *Personality & Social Psychology Review*. November 2009 vol. 13 no. 4 310-333
 - 9 Foster, John W., Pera Wells, We The Peoples: A Call to Action for the UN Millennium Declaration,. WFUNA & The North South Institute, 2004.14
 - 10 A list of these organizations includes (but is not limited to): Cyber Schoolbus, World Affairs Council, End Poverty 2015 (Millennium Campaign), UNDP, UNU, The Borgen Project, 8 Goals: Make Poverty History, WFUNA, UNFPA, Global Education Motivators, The ONE Campaign, UNA Student Alliance, most major UN Agencies.
 - 11 Gobe, Marc. *Emotional Branding: the new paradigm for connecting brands to people*. Allworth Press, New York. 2009. 145
 - 12 Kennedy, Paul. *The Parliament of Man: The Past, Present & Future of the United Nations*. Harper Collins, Toronto. 2006. 243
 - 13 Levine, Michael. *A Branded World: Adventures in Public Relations and the Creation of Superbrands*. John Wiley & Sons, New York. 2003. 202
 - 14 Gobe, Marc. *Emotional Branding: the new paradigm for connecting brands to people*. Allworth Press, New York. 2009. 253
 - 15 Kravetz, Marc. *Obama*. Dalloz-Sirey, France. 2008
 - 16 Black, Maggie. *A No-Nonsense Guide to the United Nations*. New Internationalist Publications, Oxford. 2008. 28
 - 17 Black, Maggie. *A No-Nonsense Guide to the United Nations*. New Internationalist Publications, Oxford. 2008. 28
 - 18 Gobe, Marc. *Emotional Branding: the new paradigm for connecting brands to people*. Allworth Press, New York. 2009. 151
 - 19 Ibid. 277
 - 20 Ibid. 14
 - 21 Levine, Michael. *A Branded World: Adventures in Public Relations and the Creation of Superbrands*. John Wiley & Sons, New York. 2003. 22
 - 22 Figure was arrived at through comparison to Live 8 2005 concert production costs, which was a fundraising event of similar scope using similar technology and media for broadcast, fundraising, and advertising.
 - 23 All Business "How much does a brand cost?" November 24. 2004. *All Business: A D&B Company*. <http://www.allbusiness.com/marketing->

- advertising/branding-brand-development/1040-1.html (accessed July 5, 2010)
- 24 WebFX: “How much should a website cost?” <http://www.webpagefx.com/How-much-should-web-site-cost.html> (accessed June 19, 2010). Costing based on the model of a large corporate site implemented in 60-90 days with the following characteristics: 25 to 75 Webpages, Heavy use of flash, High-quality design work on all Webpages, Content management system, Extra components: Intranet, calendars, web site search, social media.
- 25 Ibid.
- 26 Ibid.
- 27 Clow, Kenneth E., Robert E. Stevens. *Concise encyclopaedia of professional services marketing*. Routledge, New York: 2009. (Estimation based on information in this source regarding media type, placement, campaign-size, &

8. HUMAN TRAFFICKING: BREAKING THE CYCLE

By Katey Fardelmann and Sarah Ferst,

Strategic Summary: Human trafficking is a moral outrage and an economic disaster. It could be eliminated if the supply and demand, “the market,” of men, women, and children for the purposes of sexual exploitation and forced labor could be eliminated. Human trafficking is a cycle that can be disrupted at multiple points. There are opportunities for trafficked persons to seek refuge, however a large portion of these individuals return to enslavement due to the lack of knowledge of other economic opportunities. Former slaves need a source of income. Many lack skills and education needed to enter other career paths. Current efforts to achieve the Millennium Development Goals neglect the issue of human trafficking despite its connection to seven out of the eight MDGs.

Journey to Freedom (J2F) is a strategy that addresses the need to free the human slaves caught in human trafficking. It works to provide education and training needed for recovering victims. In order to achieve this, stage one of the J2F calls for the building of eleven community centers throughout Southeast Asia where victims can go for refuge and training/education. J2F’s website will connect other organizations advocating for victims of human trafficking. This website will create a database of human trafficking offenders and a partnership among organizations with similar visions. J2F will bring international attention to the human trafficking situation. It will put pressure on local governments to follow international statutes and treaties.

Introduction— the Present State¹

- 2.4 million people are lured into forced labor, including sexual exploitation
- Of this number, 56% are in Asia and the Pacific; this amounts to three people per 1,000 inhabitants unwillingly trapped
- Women and children account for 80% of *detected* victims, as many victims go unnoticed
- The total market value of illicit human trafficking is equivalent to \$32 billion. \$9.7 billion of this market is generated in Asia and the Pacific

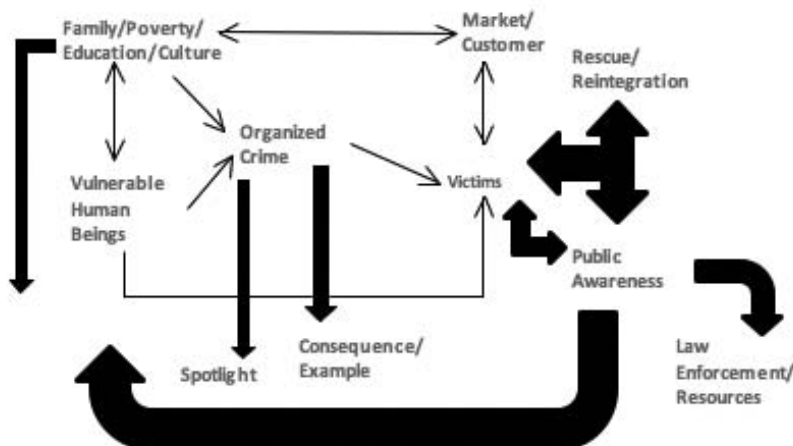
- The majority of trafficked victims are between eighteen and twenty four years of age and have obtained at least a middle level education
- In 46% human trafficking cases the recruiter was known to the victim
- For every 800 people trafficked, only *one* person was convicted.

There are few concrete statistics on the causes of human trafficking. There are however a number of general trends:

- Where there is organized crime, human trafficking is more common
- Where the rule of law is not enforced, human trafficking is more common
- Where human trafficking and slavery is kept hidden from scrutiny, human trafficking is more common
- Where there is a lack of tolerance for gender, religious and economic difference, human trafficking is more common
- Where there are unmet demands for cheap labor and prostitutes, human trafficking is more common.

There are many organizations and nations fighting human trafficking. J2F has identified a gap in these efforts in regards to public awareness, united community and regional efforts and in the opportunities for victims who are rescued to reintegrate into society. If this gap is not

HUMAN TRAFFICKING CYCLE



filled, the horrors of human trafficking will continue.

The above chart outlines the “human trafficking cycle.” Beginning on the left with the main causes of human trafficking, these include extreme poverty, levels of education, lack of awareness and various cultural norms and moving to the right through trafficking channels and the consequences. Victims themselves are extracted from the conditions of extreme poverty by organized crime and sold in human trafficking markets resulting in either more vulnerable human beings or in a very few cases rescue and reintegration.

Victims need to be rescued and reintegrated back into society as productive and confident citizens. *J2F*'s projects address both the supply and demand sides of human trafficking.

Preferred State

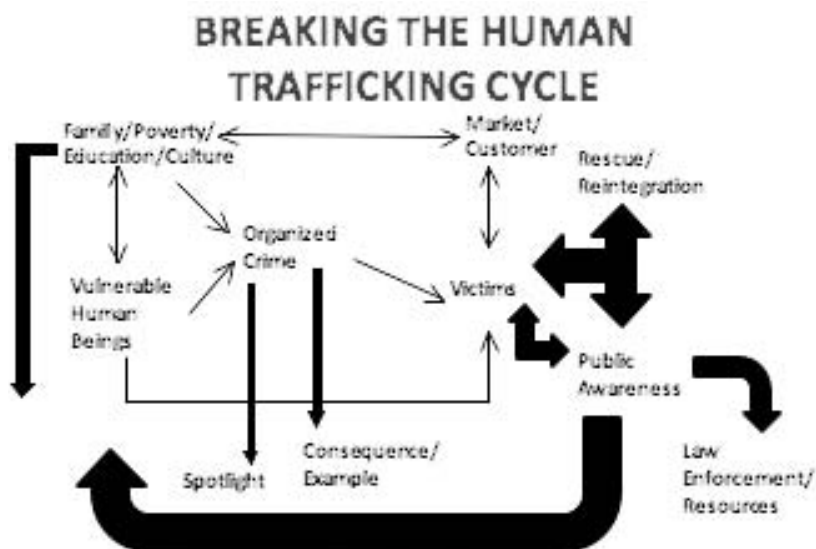
The preferred state to the one which exists today is one that is characterized by:

- No children, women and men trafficked, anywhere, for any purpose
- Human trafficking market reduced to \$0 annually
- The world socialized to see slavery as horrific, unacceptable and taboo
- Communities educated on the causes and consequences of human trafficking
- Communities provided with the tools to protect and prevent human trafficking
- All human beings fight aggressively and openly against the exploitation of fellow humans and cooperate to form a united front against all forms of human trafficking and human rights abuse.

Strategy: Breaking the Human Trafficking Cycle

J2F breaks the human trafficking cycle at four intervention points identified by the bolded arrows in the chart above. The *J2F* design includes four main components:

- Networking
- Establishing prototype centers in Southeast Asia sites
- Expanding these centers into community home bases
- Empowering local, national and international law enforcement.



Stage 1—Networking

J2F Website: The purpose of the *J2F* website is to unify the current global human trafficking eradication effort and create a link between cooperating international organizations to fight human trafficking. The website will be a communication tool as well as a news source and forum on the issue. The *J2F* website will promote awareness and help bring the underground activity of human trafficking to the surface.

Database for Human Trafficking Offenders: This database will provide the public information about human trafficking offenders, including their name, age, address, photo, gender, race, past convictions and current crime. (“Normal” privacy and identity concerns are waived and considered irrelevant for such serious crimes against humanity.)

The purpose of the database is to bring attention to offenders rather than innocent victims. *J2F* will provide a template for profiling offenders that will be put in the database. This database will be available to be viewed by the public and will be secured for authorized personnel to make updates.

Network of Organizations: *J2F* will create partnerships with local organizations with similar human trafficking eradication goals. While each organization will maintain their specialized efforts, they will work together to establish a “universal dictionary”²² of human trafficking terminology.

Such a “dictionary” will help human trafficking eradicators better present a united front against human traffickers locally and regionally.

The network of organizations will also have an increased ability to promote public awareness and put pressure on local law and government officials.

Stage 2— Establish J2F Centers

As the above-described network is being established, eleven centers will be built throughout the Southeast Asian region in human trafficking hot spots. These *J2F* Centers will provide shelter, refuge, education, awareness and training for those seeking employment.

The *J2F* training program will help victims regain security and self-worth and provide them with an opportunity to compete in the workforce. The training program will include courses such as literacy, teachers and counselor training programs, computers/new technology training, cosmetology and textile training. The staff at each *J2F* Center will be hired locally to account for cultural variations, local knowledge and economic opportunities.

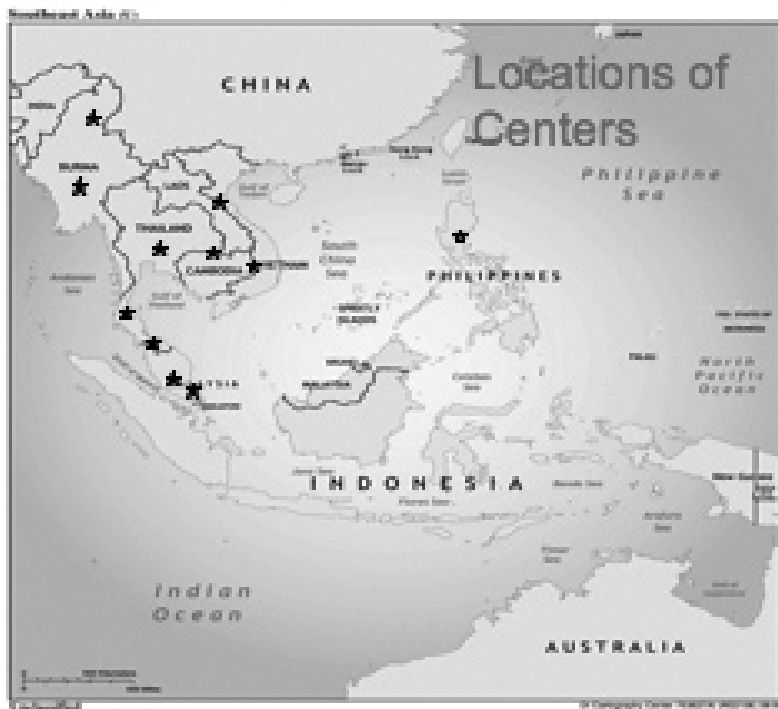
The stars in the map on p. 275 show where the *J2F* Centers will be located. These areas were chosen based on statistics regarding human trafficking hot spots and red-light districts.

Stage 3— Community Action Center

Training will be provided for victims who come to the center as well as for the local community. Every effort will be made to engage the community in the fight against human trafficking and to help combat poverty. Training will be provided on a “loan” basis. Upon graduation and accepting a job position students are expected to repay the cost (or a portion of the actual cost) of their rescue and training. The amount of the cost will be on a scaled basis based on the salary of the new job. The funds obtained in this way will both help the dignity of those being helped and help the center remain sustainable.

Stage 4— Law Enforcement

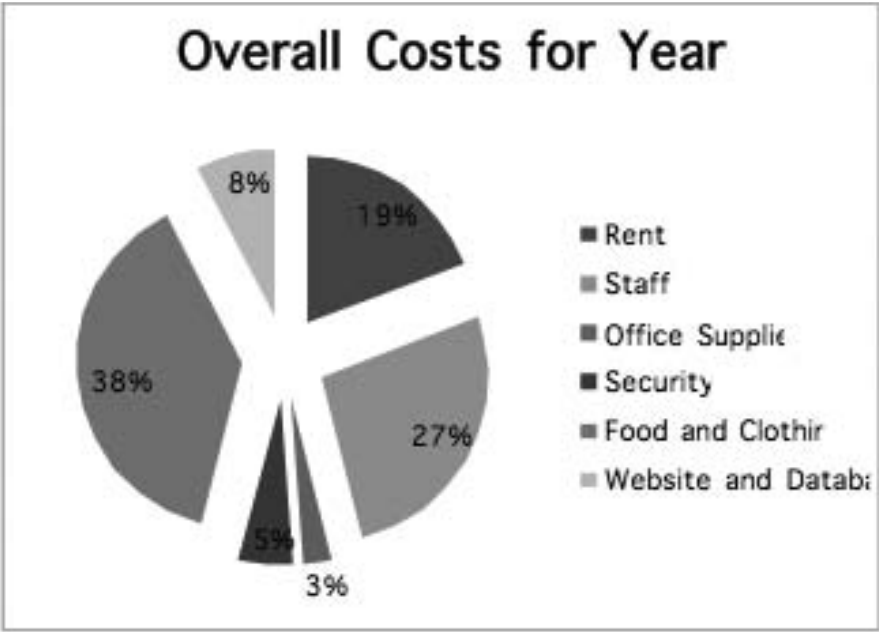
Through the *J2F* Network and Centers, increased pressure will be put on the local community and local law enforcement authorities to uphold domestic laws and international statutes regarding human trafficking. *J2F* will work with the other organizations addressing the lack of legislation enforcement.



Costs and Goals

Goals for each *J2F Center* include:

- Each Center serving 1,000 human trafficking victims per year, and 500 local residents per year
- 90% of the students trained at the Center earn above average wage
- Each Center raises \$5,000 a year through the 5% graduated program participants reinvest in the Center's programs (return on the original investment which allows the Center to be a self-sustaining business)
- Each of the local *J2F* network of organizations consists of 80% of the human trafficking organizations in each region
- The *J2F* database grows by 25% per year
- Local government contributions to combating human trafficking increases 45% by 2040
- Prosecution and convictions for human trafficking increase by 75%.



The cost of running a J2F Center in Southeast Asia is approximately \$100,000 annually. The majority of these funds are for food and clothing for victims, and staff training and salary. Start-up costs will need to cover computers and other educational technologies. As a social enterprise organization, possible funding can come from organizations like Big Issue Invest and Echoing Green.

Conclusions

The eradication of human slavery and the trafficking of human beings will advance the welfare of the millions of individuals caught up in this horrifying perversion of our basic humanity. Eradication will also have positive impacts on local and regional economies as the education, training and transformation of former victims into productive members of the economy will make everyone better off.

Human trafficking is connected to achieving at least seven of the eight MDGs. The chart below outlines these connections. Human trafficking is so interconnected with the achievement of the MDGs that it should be included as the ninth goal.



Journey to Freedom:
Decrease in poverty
in SEA

Journey to Freedom:
Provides health care
to pregnant women



Journey to Freedom:
Increases number of
educated in SEA

Journey to Freedom:
Cooperates in the fight
against HIV/AIDS



Journey to Freedom:
Promotes gender
equality

Journey to Freedom:
Creates a global
partnership



Journey to Freedom:
Reduces child mortality
rates

Journey to Freedom:
Fights to eradicate
Human Trafficking



*blue heart
campaign*
against Human
Trafficking

Endnotes

- 1 UN.GIFT: Global initiative to fight human trafficking. “Human Trafficking, the Facts”. http://www.unglobalcompact.org/docs/issues_doc/labour/Forced_labour/HUMAN_TRAFFICKING_-_THE_FACTS_-_final.pdf
- 2 “Human Trafficking Universal Dictionary”: the creation of a database of common phrases to be used universally regarding human trafficking. The misconception and the misuse of terminology has made awareness and the documentation of human trafficking issues near to impossible. The dictionary will close the gap and help create a universal understanding about human trafficking, the causes and the consequences.
- 3 Additional sources:
www.humantrafficking.org
http://www.unodc.org/documents/blueheart/Fact_sheet_english.pdf
http://www.unglobalcompact.org/docs/issues_doc/labour/Forced_labour/HUMAN_TRAFFICKING_-_THE_FACTS_-_final.pdf
http://www.unodc.org/documents/Global_Report_on_TIP.pdf
http://www.humantrafficking.neu.edu/responses/federal_human/
<http://www.ncjrs.gov/pdffiles1/nij/grants/216547.pdf>
<http://www.globalrights.org/site/DocServer?docID=643>
http://www.unodc.org/documents/treaties/organized_crime/Final_report_English_TIP.pdf
<http://www.ungift.org/ungift/en/initiatives/parliamentarians.html>
<http://www.visayanforum.org/portal/index.php?option=cms&mode=view&id=4>
<http://www.unesco.org/most/migration/ctsea.pdf>
http://www.unodc.org/documents/blueheart/Fact_sheet_english.pdf http://www.unglobalcompact.org/docs/issues_doc/labour/Forced_labour/HUMAN_TRAFFICKING_-_THE_FACTS_-_final.pdf

9. ACCOUNTING FOR THE REAL WORLD

By Bruce P. Hector M.D.

Strategic Summary: Informed consumers make more intelligent choices than uninformed consumers. When given the choice, consumers, in the long run, trend towards environmentally sound choices. Ecolabelling has developed over the last twenty years as a means for consumers to identify products that meet at least some elements of a wide variety of ecological goals and to allow producers to better distinguish their product in the marketplace. These goals and standards vary significantly by product and the potential environmental impact of the product's inherent resource utilization, energy consumption and disposal cost with some factors considerably more important in one industry than in another. This has led to rather specific third party or industry sponsored certification which producers may solicit and receive to enhance their product's customer satisfaction/demand.

Ecolabels currently provide little direct information on the product label but rather only an acknowledgement of certification. In most cases, rating criteria are available from the certifying agency. Currently over 400 different ecolabels exist in the international marketplace.

In response to this informational void, the author has developed a *Universal Ecolabel* (UE) format to assess the energy, matter and human component for any product or service during phases of production, use by consumer and post use. The standardized format provides transparency, comprehensive analysis and a consistent format for presentation of all data. Inclusion of the information accessible from the product barcode in a format for cell phone or home computer use provides the consumer with the potential to monitor his complete environmental footprint. It additionally allows a method for producers and consumers to distinguish products across multiple industries including those from developing nations. In essence, the UE provides a parallel accounting method for monitoring the finite planetary resources used by humanity in a manner not possible with the current monetary accounting system.

Present State

Despite the availability of eco-labeling on some products, almost all products sold in the global marketplace are purchased without the consumer knowing or having access to information about that product's environmental impact, energy use and the producer's adherence to socially responsible standards.

There are over 400 different labels that in some way assess a particular product's composition or resource utilization.¹ Sometimes there are multiple labels for the same industry. Most have different sponsors and accrediting agencies including producer organizations, consumer groups and independent third party entities. Each is usually only focused on specific environmental issues felt to be relevant to the specific product. No labels measure or even purport to measure comprehensively, the full extent of the product's environmental impact.

Preferred State

A preferred state is one where all products are labeled in such a way that consumers can easily find out the impacts on the environment and society of the product before purchase. This information would be available online and at the point of purchase through a barcode read by a cell phone or other form of handheld computer.

Such a *Universal Ecolabel* would include:


- Provision, by the producer of the product of complete, non-biased, and verifiable information (similar to a food label) on the material, energy and human components used in the production of the product from "cradle to retailer shelf."
- Provision of the similar information on the product's resource utilization and impact during consumer use and post-consumer use stage.
- Provision of this information in a consistent and easy to understand format for every product.

The complexity of industrial processes and materials, as well as consumer ignorance of the environmental significance of production, precludes meaningful presentation of all information during initial phases of implementation. This necessitates a focus on identification of materials/production methods with potential adverse impact on humans, other animals, plants, air, water and ecosystems, the forms of energy used in production, and adherence to a basic set of human rights and worker treatment.

What the Universal Ecolabel is

The *Universal Ecolabel* contains the information described in the below illustration. Each product would be evaluated in three general categories, *Input* (what goes into the making of the product), *Use* (the impacts of the product's use) and *Post-Use* (what happens to the product materials after useful life ends). For each of these categories, there are four measurements of impact: *Matter*, *Energy*, *Human* and *Packaging*.

Figure 1 below shows the basic Universal EcoLabel prototype

	Column A	Column B	Column C
	INPUT	USE	POST USE
Row	MATTER Adverse Effect on: Humans ____ Plants ____ Animals ____ Air ____ Water ____ Ecosystems ____ Recycled matter Into (% wt.) ____ Petroleum based (% wt.) ____ Waste Water (gal.) ____ Prod. Waste (%wt.) Upcycle ____ Down ____	Type: ____ Quantity: ____ Single use: ____ Lifetime: ____ Waste water (gal/use): ____	Biodegradable: short term ____ long ____ Technical: Reuse ____ Recycle ____ Return ____ Atmos. Emissions: ____ Waste water (gal): ____
Row	ENERGY Total Kwh or gallons: ____ % Fossil Fuel: ____ % Nuclear: ____ % Renewable: ____ Production Greenhouse gas (Gg): ____ (tons)	Kwh or gallons fuel Per Use: ____ Lifetime: ____ Energy Source: ____ % Fossil Fuel: ____ Nucl ____ Renew ____ Gg emissions: Single ____ Life ____	Energy Produced (Kwh): ____ Emissions ____ Energy Use (Kwh): ____ Fossil Fuel ____ Nuc ____ Renew ____
Row	HUMAN FL: CL: LU: Dsc: WS: LW: WH: WB:	(Determined by Consumer Choice)	FL: CL: LU: Dsc: WS: LW: WH: ____ Community Exposure: Type: ____ Quantity: ____
Row	PACKAGING Matter(% Wt): Petro ____ Org ____ Inorg ____ Energy (%) FF: ____ Nuc ____ Renew ____ Human: FL: CL: LU: Dsc: WS: LW: WH: WB:	Barcode Space	(% Weight): Biodegradable: short term ____ long ____ Reusable: ____ Return: ____ Landfill or Burn: ____
Row	DISTRIBUTION 	Human Codes: WH = Working Hours FL = Forced Labor CL = Child Labor LU = Labor Union Dsc = Discrimination WS = Worker Safety LW = Living Wage	Matter Adverse Effect Scale: A = Strong Evidence B = Good Evidence C = Possible Correlation D = Low Probability E = No Evidence F = Effect Unknown (Refers to any element of product or production methods)

Universal EcoLabel prototype

Row 1: MATTER, Column A

The *INPUT, MATTER* box reflects the potential adverse impact of the Materials and production methods on humans, animals and plants, as well as the air, water, and ecosystems. This box also contains the amount of the materials in the product made from recycled materials, the amount made from non-renewable materials (such as fossil fuels based materials), the amount of water needed to produce the product, the waste water released in the process of production and the total waste that results from the

product's production. Few consumers are aware of production waste. For example, it is estimated that for every truckload of new carpet product, there are 32 truckloads of waste². Similarly, there are 4,000 pounds of waste per pound of laptop computer and 100,000 lbs. waste per pound of semiconductor chip.³

Row 1, MATTER, Column B

The *USE, MATTER* box identifies the Materials added during single use by the consumer. This box also contains the product's expected lifespan (single use vs. long-life product), its expected lifetime use of additional materials, if any, and waste water resultant from product use.

Row 1, MATTER, Column C

The *POST USE, MATTER* box describes the fate of the Materials after they are "thrown away." Materials may naturally decompose rapidly or slowly, be returned to the producer, reused or recycled. These processes may result in atmospheric emissions or consume water with the remaining material either burned or dumped in a landfill.

Row 2, ENERGY, Column A

The *INPUT, ENERGY* box identifies the amount of Energy used to make the product, the source of that energy (fossil fuel, nuclear or renewable) and quantity of greenhouse gases emitted during production.

Row 2, ENERGY, Column B

The *USE, ENERGY* box notes the Energy that the product in question needed for both single consumer use and through the product's life. Energy source and greenhouse gas emissions are also noted.

Row 2, ENERGY, Column C

The *POST USE, ENERGY* box reflects the Energy that the product in question uses after it is "thrown away" or in its post-use cycle, including emissions and source. Disposal in some cases may result in Energy production that can be used elsewhere but also emits greenhouse gases.

Row 3, HUMAN, Column A

In the *INPUT, HUMAN* box basic human standards for workers are identified, reflecting all levels of production. These include forced, bonded, indentured or prison labor; child labor; freedom of worker

association and collective bargaining; discrimination, harassment and abuse; work place health and safety; fair wages, benefits and terms of employment; and reasonable working hours.

Row 3, HUMAN, Column B

The USE, HUMAN box is identified “determined by consumer choice” since each user is restrained in behavior only by himself.

Row 3, HUMAN, Column C

The *POST USE, HUMAN* box reflects both the workers’ rights of those responsible for product disposition after consumer use and the effect of those activities upon the surrounding community.

Row 4, PACKAGING, Column A

The *INPUT, PACKAGING* box identifies all 3 elements of producer inputs (matter, energy, human) but only for packaging. This is because the production and fate of packaging is usually quite different from the product.

Row 4, PACKAGING, Column B.

The USE, PACKAGING box is replaced by a space for the product barcode since packaging is rarely involved in product use and highly variable depending on consumer preference.

Row 4, PACKAGING, Column C

The *POST USE, PACKAGING* box identifies the post use disposal fate of Packaging noting if it is biodegradable, reused or recycled, incinerated or sent to a landfill distinguishing percent of packaging weight to each category.

Row 5, DISTRIBUTION

Products and their composite parts often travel great distances to reach a consumer yet the true cost of that travel is not reflected in the other described elements of the label or any other manner useful to the consumer. Producers send finished products to many different locations and therefore a score for this element cannot be provided until one knows the site of sale. To address this issue and promote a greater sense of purchasing locally, a small global map indicating the site of the production of the product has been added. The map is divided into the 24 time zones by

longitude and by latitude into 15 degree segments. Five latitude sections north of the equator and 4 south of it encompass almost all production zones. Presumably the consumer will know the zone of purchase. All sub-assembly locations are colored yellow and final assembly location colored orange.

OTHER LABEL ELEMENTS—BARCODE

Most manufactured products contain a barcode to provide unique product identification. This is a critical element of the label that is necessary to gain more detailed product information at the purchase site. Using a cell phone application to scan the barcode, the consumer connects to the “cloud” and receives detailed product data. Additionally, this design envisions a technology that allows the consumer to input the barcode of each purchase to a mobile or home computer allowing him to maintain a record of the environmental impact of his lifetime purchases.

Implementation Strategy

Several options exist for implementing the *Universal Ecolabel*. One way would be to have the *Universal Ecolabel* adopted by a major retail chain such as WalMart as a means of distinguishing itself from its competition—with expectation that competing retailers would gradually adopt the same standard. WalMart has indicated its interest in promoting sale of sustainable products and initiated efforts gathering environmental impact information from its supply chain producers as well as redesigning their own retail facilities to save energy and minimize adverse environmental impact.⁴ Provision of comprehensive label information to consumers is consistent with the company’s stated goal of serving consumers in a transparent manner. A retailer of this size has the capability to rapidly complete the research, implement and modify label presentation to best serve its customers.

Another option would be to have a government body, such as China, the United States, the European Union, or an international agency, such as the United Nations, adopt the *Universal Ecolabel* and insist that all suppliers to the government or agency use the label.

A third possibility is publication of a consumer oriented book designed to initiate greater consumer demand for label information on the environmental impact of all products to allow consumers to make informed choices.

Conclusions

Adoption of a labeling process as outlined above has several important implications for rapidly accelerating the movement to sustainable industrial and agricultural processes:

- By enhancing consumer knowledge of the environmental impact of products in a comprehensive transparent format, it will facilitate greater consumer participation in the sustainability movement.
- It will move toward elimination of “green washing” often disguised with certification labels that emphasize one positive product element but overlook other more important negative ones.
- When producers know that consumers are demonstrating concern for more than price, they will begin to focus on production methods that address sustainability issues.
- Comprehensive labeling will expose the practice of “externalizing liabilities” which often compels the public to pay for the adverse effects of producer environmental disregard.
- Petroleum based products will likely have significant detrimental “scores” that will stand out glaringly in contrast to those not using this resource. This will encourage producers to seek more renewable energy sources and non-petroleum based products facilitating preservation of this non-renewable resource for future generations.
- From the consumer perspective, by using a mobile or home computer application to scan all purchases, each consumer can monitor his/her environmental “footprint” in a comprehensive manner. This will facilitate meaningful progressive reduction of one’s adverse environmental impact.
- From a macro economic perspective, current accounting methods only monitor price. This presumes that resource scarcity or consumer preference will lead to price changes reflecting that scarcity or need. The *Universal Ecolabel* represents a potential parallel accounting system that actually tracks the real major components of goods and services. Since the planet only has a fixed amount of these resources, monitoring them to be able to meet the needs of a growing population will become more important. As resources become scarce, the label and personal monitoring become a tool society may even find more useful to base its taxation methods for individuals rather than personal income.

- Lastly, if humanity ever does learn to safely tap the available, vast sustainable energy resources, a system to monitor and account for the finite planetary material resources will be essential to insure all human material needs are met. The *Universal Ecolabel* represents a first step toward resource monitoring and Real World Accounting.

Endnotes

- 1 World Resources Institute, Global Ecolabel Monitor, http://www.ecolabelindex.com/downloads/Global_Ecolabel_Monitor2010.pdf
- 2 Ray Anderson, Interface Floor, UCLA lecture, 2-2010.
- 3 Paul Hawken, Amory Lovins, L. Hunter Lovins, *Natural Capitalism*, Little Brown and Company, New York, 1999, page 50.
- 4 <http://walmartstores.com/Sustainability/>

10. PROJECT TIRES ON FOOT

By Zeynep Arhon

Strategic Summary: *Project Tires on Foot (TOF) suggests a new source of employment and primary income for the poor, especially those in refugee camps, and envisions that every human being on this planet has at least one pair of shoes: The TOF Shoe. The TOF Shoe will be designed by a globally-known designer and produced from scrap tires sourced from a leading tire manufacturer. The TOF shoe will be “manufactured by people on bare feet for themselves and for the rich world” in a branded way, as a source of significant profit. This is about the poor world fighting with poverty with one of the most powerful tool of capitalism: Brand power. This is about getting one step ahead of the current charity paradigm based on the rich producing for the poor and donating a portion of generated revenues. Project TOF can also be used as a platform/tool to boost global awareness about UN Millennium Development Goal #1.*

Present State of Global Mobility

As with all basic rights; right-to-mobility is distributed unequally around the world.

In 2002 there were 590 million cars in the world. That is one for every ten people¹⁶

- In contrast, in the Central African Republic, Bangladesh and Tajikistan there is one car for every 2000+ people
- In the poor regions of the world, millions have no access to even the simplest vehicle. Mobility is on foot, sometimes bare foot
- Virgin Galactic prepares itself to send first civil astronauts into

MOST AND FEWEST CARS					
Rank	Territory	Value	Rank	Territory	Value
1	New Zealand	61.3	191	Afghanistan	0.16
2	Luxembourg	57.6	192	Chad	0.15
3	Iceland	56.1	193	Nepal	0.10
4	Canada	55.9	194	Ethiopia	0.10
5	Italy	54.2	195	Armenia	0.09
6	Germany	51.6	196	Somalia	0.08
7	Switzerland	50.7	197	Myanmar	0.06
8	Malta	50.5	198	Central African Republic	0.05
9	Austria	49.4	199	Bangladesh	0.05
10	Australia	49.3	200	Tajikistan	0.04

passenger cars per hundred people

space. In a decade of space tourism, each and every human being on the planet at least deserves a pair of shoes

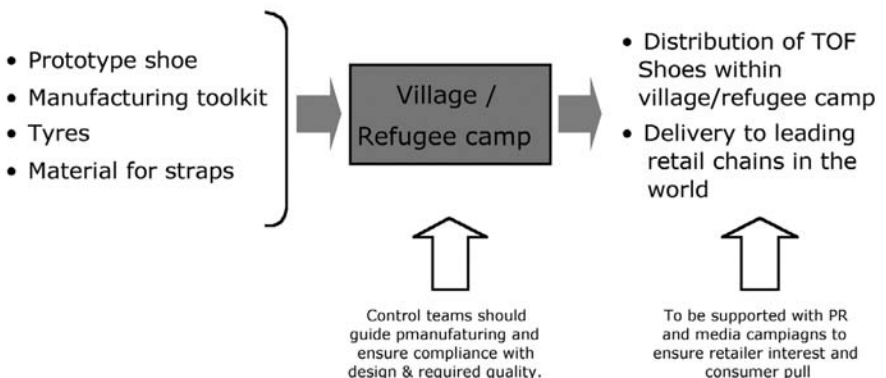
- One of the outcomes of high mobility in the developed world is scrap tires
- Today's technology does not allow for re-use of recycled tire rubber in the production of new tires
- Because of speed, safety and other performance requirements of tires, they need to be made mostly using virgin rubber compound
- Millions of tires find their way to landfills every year
- There are 20.8 million refugees in the world.¹⁷

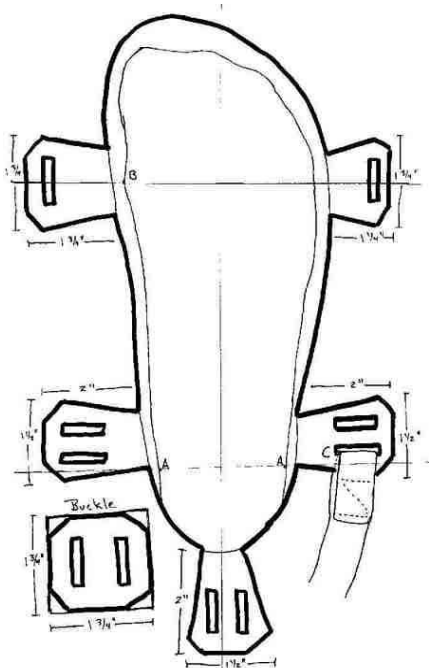
Solution

Project TOF will make durable, functional shoes from scrap tires. This is not a new idea. It is merely an idea whose time has come. In Germany, after the Second World War, scrap tires were used to make shoes. Scrap tires are still being used for this purpose by outdoor enthusiasts because of their durability. If tires can carry cars, they can easily allow people to walk long distances. In addition, it is relatively easy to make shoes out of scrap tires. A detailed description for one such shoe can be found at: <http://www.hollowtop.com/sandals.htm>

The TOF Shoe will be made out of 100% used materials. The sole will be made of scrap tires. The straps will be made out of used bag handles, car/aircraft safety belts, or the inner tubing of tires. The TOF Shoe will be manufactured by “people on bare feet, for themselves and for the rich world.”

Manufacturing Process





Strategy for Implementation

Strong partnerships are required in order to turn Project TOF into reality.

1. The first partnership will be with a leading tire manufacturer. The manufacturer will source scrap tires as the raw material of the TOF Shoe. It is likely that manufacturers will welcome the project since there is no proper/environmentally-friendly method of getting rid of used tires, which are an environmental hazard in themselves. Partnering manufacturer will be expected to collect back tires from its distributors.

2. The second partnership will be with a world-class designer. The TOF Shoe will be designed by a famous designer, willing to get involved in a cause-related project (i.e. Philippe Starck, Bruce Mau,

Ross Lovegrove...etc.). Alternatively, a leading shoe producer (i.e. Nike, Camper, Hush Puppies...etc.) may take over the design process. Partnership with a leading designer/shoe producer will yield an iconic TOF Shoe at minimum cost, and it will maximize the value of The TOF Shoe brand in the eyes of potential consumers.

3. The third partnership needs to be with a strong logistics company. This is to enable the used tires and The TOF Shoe manufacturing toolkits to be shipped to villages/refugee camps that will manufacture the TOF Shoe. The logistics company will also transport manufactured shoes to leading retailers that will sell the TOF Shoe. Ideally, the logistics company would see Project TOF as a corporate social responsibility initiative and assume all or parts of the delivery cost, until the project was able to cover these costs from the sale of The TOF Shoe.

Half of the TOF Shoes manufactured in the first year will go to the village or refugee camp where the shoes are made. The other half will be sold on the international market in brand name retail outlets. The profits will return to the workers who made the shoes.

The TOF Shoes will be a genuine source of profit for refugees, as they are introduced in leading retail chains in the world (i.e., Ikea,

GAP, Sainsbury, stores of the partnering designer/shoe manufacturer, Amazon.com etc.) Once they are available for mass consumption, the shoes will boost public awareness about poverty and UN Millennium Development Goal #1.

Strengths

Everyone will win:

No more bare feet—The TOF Shoe will help the poor travel to water, school, jobs, and back home

- The project will create employment and income opportunities in villages and refugee camps where there is currently little or no economic activity
- The TOF Shoe, if branded effectively, will be a global status symbol among both the wealthy and the poor
- Partnering companies will enjoy high corporate social responsibility (CSR) rating and PR value (Tire producer, designer/shoe manufacturer, logistics company)
- Retailer chains that carry the TOF Shoe will build image and profit
- The environment will win because fewer tires will go to landfills

Project TOF has the potential to attract possible media partners (i.e., TV stations, print media) and minimize announcement costs for demand creation. There is also potential for celebrity endorsement (i.e., actors, musicians, politicians turning into ambassadors of The TOF Shoe by actually wearing them). In time, the project may pave the way for alternative uses of tires in the fight against poverty. For example, tires can be used to build durable housing, refugee camps, social centers, schools, and playgrounds for children.

Finally, the massive outreach and sales of TOF Shoe will boost awareness about UN Millennium Development Goal #1. Each individual who hears about or buys the TOF Shoe will gain at least some notion of the scale of poverty in the world.



Challenges

Project TOF does not change the fact that tires are environmentally hazardous. It does convert tires into a different material that is friendly with the planet and useful to people without shoes. Even with Project TOF, the world will still have to deal with scrap tires at some point – even if they are in the form of shoe soles.

Once the TOF Shoe gains a certain level of awareness, it is expected to generate significant profit for the villages/refugee camps. However, in order to generate that awareness, media and PR investment is required. UN support may be a way to overcome this challenge. United Nations High Commissioner for Refugees (UNHCR) may be a potential source of necessary funds. UNHCR raises funds through governments, foundations and private donors so that refugees can be assisted immediately with food, shelter and other essentials distributed by the agency’s implementing NGO partners. There are 20.8 million refugees in the world and Project TOF may change the lives of some if not all.

Another challenge is to make sure tires are handled properly in villages / refugee camps. If not handled correctly, scrap tires make excellent breeding grounds for mosquitoes. A single tire can be the source of thousands of mosquitoes over the course of a summer and raise the risk of malaria.



Examples of shoes made from scrap tires.



11. FAST TRACKING

POVERTY ERADICATION:

MURUTUNGURU VILLAGE, TANZANIA

By Bartolomeo Misana

Strategic Summary: We need to pay attention to the poor in their communities if we are to meet their basic human needs. Community Learning and Development Planning (CLDP) is an approach to doing this. It emphasizes community dialogue as a central tenet in supporting communities in eradicating poverty and implementing Community Economic Development (CED). Community dialogue is the first activity that takes place before any projects are supported. The village (or urban equivalent) is critical to the definition of a community and is the default unit of count and center of activity.

In conducting community dialogue, women are the first to convene. They discuss until they agree on priorities they consider critical in their CED efforts. Next, the men do the same. Finally they meet in a plenary session to merge their gender-based priorities into one community version, which becomes the basis of a Community Future Vision (CFV) for that community. Projects are then developed to implement the CFV.

Present State of world poverty

Today, the world is divided between rich and poor and the gap between them is increasing. In a world sufficiently affluent to feed and ensure quality life for everybody, some have to starve while others contend with obesity. Twelve infants die every minute¹ from poverty-related causes that could easily be avoided.

Lester Brown says of the environment is true of many other sectors, including poverty eradication:

The question we face is not what we need to do, because that seems rather clear. The challenge is how to do it in the time available. Unfortunately we don't know how much time remains. Nature is the timekeeper but we cannot see the clock²

Preferred State for the world

Our preferred state is that everyone on Earth has access to enough resources for a *sustainable, quality life* in sync with others and the environment for their own good and for the good and continuity of future generations.

Strategy

The strategy for getting to the preferred state focuses on the village (or urban equivalent) as the unit of analysis and action. The following steps summarize the basics of the strategy:

1. A brief meeting to formalize the authorization, process, and relationship happens first.
2. Women and children meet to discuss their development (what development means to them, their strengths, challenges, etc). Each discussion is done first in small groups, by sub-village before compiling a gender or age based community consensus.
3. Men and children also meet, separately to do the same.
4. In a third meeting, the community merges the gender/age-based consensuses.
5. A Community Future Vision (CFV) is developed.
6. A Development (Project) Committee is formed by electing sub-village representatives.
7. The committee elects its leaders from its members.
8. Sub villages also form their own committees to be composed of 60% women.
9. The sub village committees and the Village Development committee handle all key community development decisions, plans, funds, activities etc.



Murutunguru Development
Committee

The open discussion helps community members sort out real from imaginary needs, rank them, set a Community Future Vision, and define standards, rules, and guidelines to ensure transparency, accountability, and a sense of direction. Honesty is discussed and stressed as a critical condition in the entire strategy.

In this way we do more than merely consult communities. It is critical to listen to community members as they argue back and forth among themselves about their own situation until they emerge with a consensus on priorities central to their development, help shape the priorities and then support them in implementing the priorities.

Murutunguru, one of two³ villages in Tanzania to have conducted such community dialogue with support from ICEDS⁴, identified and ranked 36 priorities:

- | | |
|--------------------------------|--|
| 1. Hospital | 20. Working equipment |
| 2. Water | 21. Community safety |
| 3. Secondary School | 22. Experts in various disciplines |
| 4. Micro credit | 23. Community Center |
| 5. Small industries | 24. Social services areas to be improved |
| 6. Road construction | 25. Revival of industries |
| 7. Market place | 26. Small businesses |
| 8. Electricity | 27. Investment |
| 9. A Village Passenger vehicle | 28. Moral values to be improved |
| 10. Grain mill | 29. Employment opportunities |
| 11. Leadership to be reformed | 30. Community open market |
| 12. Modern agriculture | 31. Village to be planned |
| 13. Technical College | 32. Stand for Vehicles |
| 14. Tree planting | 33. Environmental management |
| 15. Modern houses | 34. Sports field |
| 16. Telecommunications centre | 35. Services for people |
| 17. Environmental sanitation | 36. HIV/AIDS Education with disabilities |
| 18. Modern animal husbandry | |
| 19. Filling station | |

The Micro Credit Project

This project is tailored along the highly successful Grameen Bank group lending model of microfinance and local development. Immediately after the community dialogue sessions, community members who had organized themselves into project groups met in separate sessions with

the ICEDS Director. In Murutunguru Village, over 10 groups (50 people) participated in the discussion. The terms for the micro credit loans were discussed at length and agreed upon. Key aspects included:

1. Only residents of Murutunguru Village were eligible to participate.
2. One had to belong to a group of not less than five members to benefit from the project.
3. The principles governing their collaboration (group constitution) had to be written.
4. All group members need to be willing to operate through a bank account (or equivalent).
5. All group members need to be willing to collaborate with ICEDS and other relevant parties for the success of the project.



The initial loan amount of \$250 was then announced to the discussion participants. They were requested to agree on which group would get to benefit from this initial loan. The carpentry group was unanimously approved by the community to borrow the money. Each group member signed a loan agreement which specified the exact amount of money (principal plus interest), to be paid back on a specific date. The loan was to be paid back in six, monthly installments with 2% interest.

Repayment rate was excellent (100%) and always on time. By the end of the loan term, all principle had been paid back with 2% interest. In addition, the group had over \$100 net profit and surplus timber stock.

This impressive Phase 1 performance led to expansion into Phase 2 with a \$2,500 loan from the Ashburn Institute. In Phase 2, forty-five new community members borrowed \$50 each. The existing five individuals borrowed \$100 each, double their earlier loan amount. In this way a total of 27 micro-projects, some of which are highlighted here, were implemented by 50 community members during

Phase 2. Repayment rate with 6% interest⁵ was excellent (98%). Again by the end of the loan term, all principle had been paid



back with interest. That money is in safe keeping at the local Savings and Credit Cooperative Society (SACCOS) based at a Teacher Training College in the community.

Further expansion into Phase 3 requires a total of \$6,000. This would enable Phase 1 borrowers to triple and Phase 2 borrowers to double their loan amounts and would also involve seventy new borrowers at the starting level of \$50 each.

The entire project is organized into 8, six-month phases with a total cost of \$114,000, as illustrated in the table below. Full, steady implementation of the entire project would take four years. The community would then be able to support a neighboring village.



Project phases	1	2	3	4	5	6	7	8
Timing	<i>Sept</i>	<i>Apr</i>	?	?	?	?	?	?
Borrowers								
# existing borrowers	0	5	50	120	190	295	400	540
# of new borrowers	5	45	70	70	105	105	140	140
Total # of borrowers	5	50	120	190	295	400	540	680
Loans (in US \$)								
\$ existing loans	0	250	2,750	8,750	18,250	33,000	53,000	80,000
\$ new loans	250	2,500	6,000	9,500	14,750	20,000	27,000	34,000
Total loans in community	250	2,750	8,750	18,250	33,000	53,000	80,000	114,000
Loans + Interest								
Interest	5	165	525	1,095	1,980	3,180	4,800	6,840
Total \$ in community	255	2,915	9,275	19,345	34,980	56,180	84,800	120,840

Murutunguru Micro Credit Project Plan

Management accountability and transparency are core principles of not just the micro credit project but also of the entire poverty eradication effort. For this reason, a project committee consisting of two (male and female) community members from each of the village's seven sub villages, elected by their respective sub-villages to serve on the committee, was established by the community to oversee project implementation. The committee receives, evaluates and passes recommendations (for modification, or immediate funding) on community members' micro loan applications. The committee's treasurer keeps track of and reports on the functioning of the credit fund

which is managed through the SACCOS based at the Teacher Training College within the Village.

Fueling growth. If another two villages were supported to implement a micro credit project, along with Murutunguru Village, the combined interest raised in the three villages would, after eighteen months, be able to support one more village to start its own micro credit project, relying solely on interest raised in the initial three villages. This would set in motion a self sustaining growth initiative.

Beyond micro credit

Micro credit plays an important part in the effort to implement all the 36 priorities in the chart above, but it is not everything. The community dialogue that set the whole effort in motion is a permanent feature of the poverty eradication effort. It provides the community with a platform to continuously take stock of achievements, make new decisions and set new standards or review existing ones as appropriate. That the community identified these 36 priorities need not preclude the possibility of their coming up with yet another set of equally important priorities. In this way the community becomes an organic entity in command of its future, for the good of all.

Conclusions

While there is no silver bullet solution for eradicating poverty due to the uniqueness of each community, the Murutunguru Village in Tanzania poverty eradication initiative shows that a low cost approach to jumpstarting community development is possible. Community solidarity and mutual understanding are key tenets to the approach.

For the approach to work, there must be a conducive socio-economic environment (minimum functioning rule of law, peace, security). With adequate community preparation and appropriate initial support, chances of success are very high.

Scaling up depends on how well the initial effort is funded. If a three village approach is undertaken, the project can take care of its own expansion in teighteen months. This would be the beginning of a snowball effect since each additional village would mean further interest generated to support yet another village.

Endnotes

- 1 Population Reference Bureau: http://www.prb.org/pdf09/09wpds_eng.pdf
- 2 Lester R. Brown, (2009) Plan B 4.0 Mobilizing to Save Civilization, New York, London, W. W. Norton & Co. pp xiii - xiv
- 3 Gwata Village in Kisarawe District, Coast Region, Tanzania was the second village.
- 4 Integrated Community Economic Development (ICEDS) is a non-profit, Non Governmental Organization (NGO) registered in Tanzania to fight poverty.
- 5 At the beginning of Phase 2 community members freely decided to raise interest from 2% to 6%.

12. URBAN REGENERATION

FROM SINK TO SOURCE—TRANSFORMING PROBLEMS TO SOLUTIONS

By Ben Blum, Beth Emming, Medard Gabel, Don Hastay, Keith Hermann, Dan Jacques, Dick LaRiviere, Tony Milch, Fred Rose

Strategic Summary: Over 3.4 billion people (51% of the world's population) live in urban environments. Cities are tremendous importers and users of energy, water, and food, as well as producers of large quantities of waste. The Urban ReGeneration strategy seeks to reverse this. Instead of cities being resource sinks and waste sources, it turns them into resource sources, as well as increasing their viability as employment centers and sources of economic wealth and social well-being. This strategy incorporates a new approach to our city's problems by reconceptualizing the basic unit of analysis from single building to neighborhood and then employing existing technology in novel ways so as to leverage the appropriate scale of these technologies for maximum impacts.

**"The city is not the problem.
The city is the solution."**

—Jaime Lerner

Introduction—Present State

Over 80% of people in the US, and over 50% of all the people in the world, live in urban environments—and an even higher percentage will do so in the future. Many of the buildings, neighborhoods and infrastructures in all the world's cities are old, decaying, inefficient, unsafe, and in need of revitalization. The environmental support systems of nearly all our urban areas have been pushed to the extreme and our cities are a major source of greenhouse gas emissions and other pollution that is damaging the world's waters, air and land. These integrated problems present an enormous challenge and an even greater opportunity.

The revitalization of urban areas, if done in a visionary, comprehensive and integrated way that incorporates the latest findings of science and

green technology, can transform cities and their economies by providing opportunities for employment, increased well being, and decreased environmental and carbon footprints while enriching individual and social connections.

Since the installation of the infrastructure systems in the older cities of the world there has been numerous advances in energy production, use and conservation; food production and distribution business models; water use, conservation and collection; and waste collection, reuse and recycling. Bringing these new technologies into use in old and new urban environments in an integrated, whole systems design will have profound impacts on resource use and societal well-being.

Preferred State

The preferred state to where the world's urban environments are today is one that is characterized by:

- More energy is produced by cities than is consumed
- More water is conserved and collected than is needed by the city's residents
- At least 50% of the city's fresh food is produced within the city's borders
- Urban waste is reduced by 90%.

Strategy

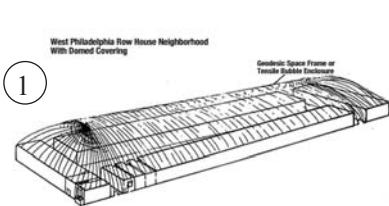
To reach the preferred state outlined above, it is necessary to view our urban environments in an entirely new way. We will need to reconceptualize the urban environment so that urban housing is not seen as single units (individual houses, row homes, apartments and the like), but as groups of approximately 60 houses (one city block rather than one single building). This changing of the unit of analysis can transform a city block of buildings into a single unit with scaled energy systems for heating, cooling, and electricity, water for drinking, waste disposal and food production.

The energy, water, and food needs of this city block (and surrounding neighborhoods) can be met with 10 or more small-scale heating and electricity cogeneration units, neighborhood-spanning water catchments and storage systems, and vegetable, fruit and protein production systems. All of these, and the neighborhood housing stock, are enclosed

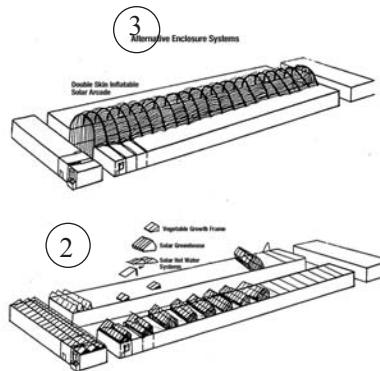
under an entire city block spanning domed covering that encloses the roof tops of each of the sixty buildings. This integrated system expands available space for each family by close to 50%, reduces heating and cooling loads, collects water and provides other amenities, such as increased social interaction and play areas.

In addition, the *Urban ReGeneration* technology can provide additional revenue streams for neighborhood residents through the sale of electricity, heating, cooling, fresh and frozen vegetables, fruit, and fish and animal protein. Increasing neighborhood identity, interaction, connection, cohesiveness, safety, security, and well-being is also a benefit.

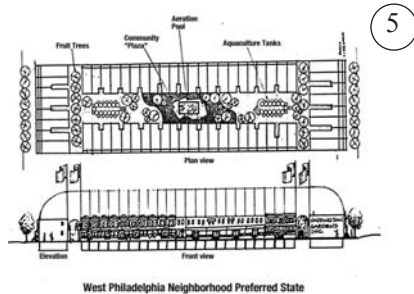
The *Urban ReGeneration* strategy represents a series of breakthroughs to the world’s urban problems. It transforms former sinks for energy, water, and food into sources; it builds community and employment, cuts down on greenhouse gas emissions from centralized coal-fired



A prototype neighborhood in Philadelphia, PA has been picked and the generic design adapted to the specifics of this city block of sixty multifamily two-story row homes with flat roofs.



Generic design of the project includes energy, water and food systems, domed enclosure and web social enhancement tools.



FIAT COGENERATION UNIT

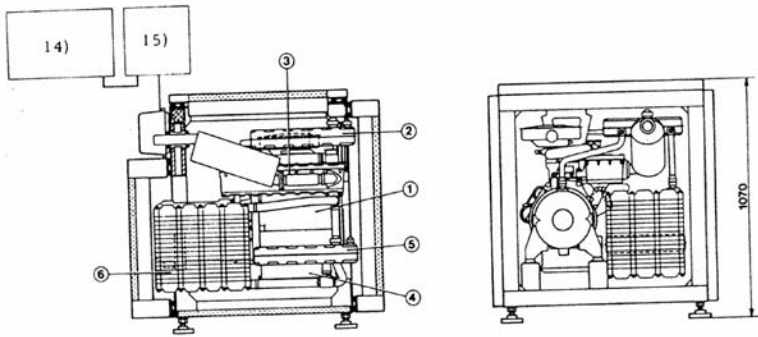


Fig. 10 - SET-UP DIAGRAMS AND DIMENSIONS

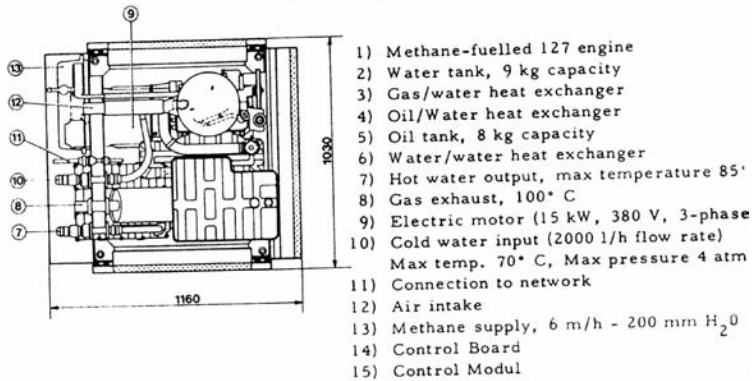


Illustration 5

electric power plants (and, when replicated in enough neighborhoods, can shut down *all* coal power plants). It dramatically cuts water use and storm water runoff—and thereby saves the neighborhood enough money each year to pay back the investment needed to implement this strategy and/or to cover the costs of purchasing additional cogeneration units or investing in additional energy saving appliances or retrofits.

The *Urban ReGeneration* project is illustrated in the following renderings.

Implementation Plan

One of the strengths of the *Urban ReGeneration* project is that it is not an “all or nothing” proposition. The various production systems are synergetic in totality, but provide enormous advantage even if implemented individually and sequentially. This has the added advantage of testing individual components on a pay-as-you-go basis and developing the compelling economic and social enhancement case for the replication of this design and its variants throughout the world.

The plan for turning this design into a real world prototype will move in five stages.

1. Energy systems

Part 1 of the implementation plan is to purchase a prototype cogeneration unit similar to that seen in Illustration 5. This unit will be installed and tested as the prototype heating system for two or more buildings in the chosen neighborhood. The electricity produced will be sold to PECO, the Philadelphia area electric utility. Revenue from this sale of electricity will be used to purchase the natural gas fuel for the cogeneration unit.

2. Water systems

Part 2 of the implementation plan is to purchase, install and test prototype water catchment and conservation devices for reducing the water use of two or more buildings in the chosen neighborhood. These will include cisterns, low-flow shower heads, and low-flow and composting toilets, and rooftop collection devices.

3. Food systems

Part 3 of the implementation plan is to purchase and set up and test small-scale aquaculture and other protein-production systems, as well as intensive fruit and vegetable production systems.

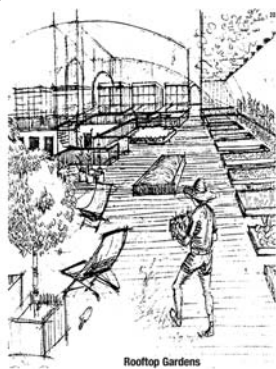
4. Roof-top systems

Part 4 of the implementation plan is to develop a prototype appropriate roof-top geodesic enclosure system that can be tested as part of the above demonstration project.

5. Social systems

An integral part of the implementation plan is the recruitment of a neighborhood and the individuals and families that live there so that they are enthusiastic supporters of the strategy and its implementation.

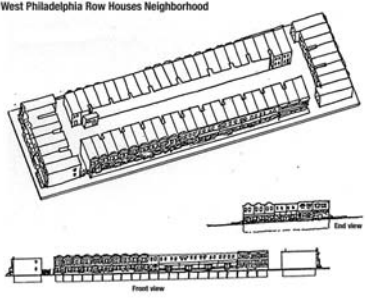
6



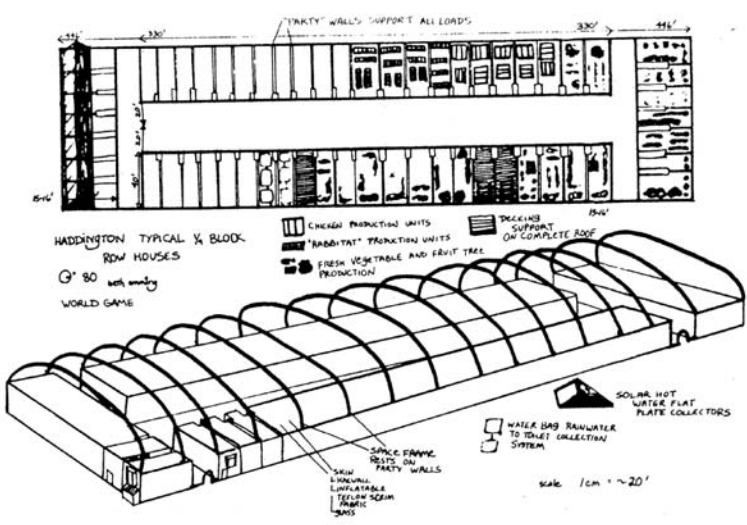
Rooftop Gardens

7

West Philadelphia Row Houses Neighborhood



30



HADDINGTON TYPICAL 1/4 BLOCK ROW HOUSES
G. 80 with many WORLD GAMES

13. EARTH DASHBOARD: REAL TIME MONITORING OF KEY INDICATORS OF GLOBAL PROBLEMS AND WELL BEING

“A dashboard is a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance.”

—Stephen Few, Information Dashboard Design

By Medard Gabel

Strategic Summary: The Earth needs a universally accessible dashboard where government leaders, corporate executives, civil society leaders, students, teachers and the media can easily recognize what is happening right now on board “Spaceship Earth.” Just as the dashboard of a vehicle describes the present state of the condition of the vehicle—it’s speed, remaining fuel, engine temperature, etc. —the world needs a similar capability to monitor in real time population growth, energy use, food production and other key indicators of the state of the planet. The Earth Dashboard, a forty-foot by eight-foot high-definition video wall installed at major UN buildings in New York, Paris, Geneva, Nairobi, Rome and elsewhere would provide world leaders and others with such a tool. An interactive web site and phone app would provide nearly everyone else in the world with access.

Introduction—Present State

The world has a critical need to see itself as one interconnected whole rather than disparate countries, cities, tribes, cultures, religions or special interests. Without this unitary view of intertwined fates, the parochial trumps the planetary, narrow self-interest beats enlightened self-interest, greed beats generosity—and the world is endangered through short-term and near-sighted thinking and actions. The lessons of history lead to the conclusion that humanity might not survive if these negative conditions win out.

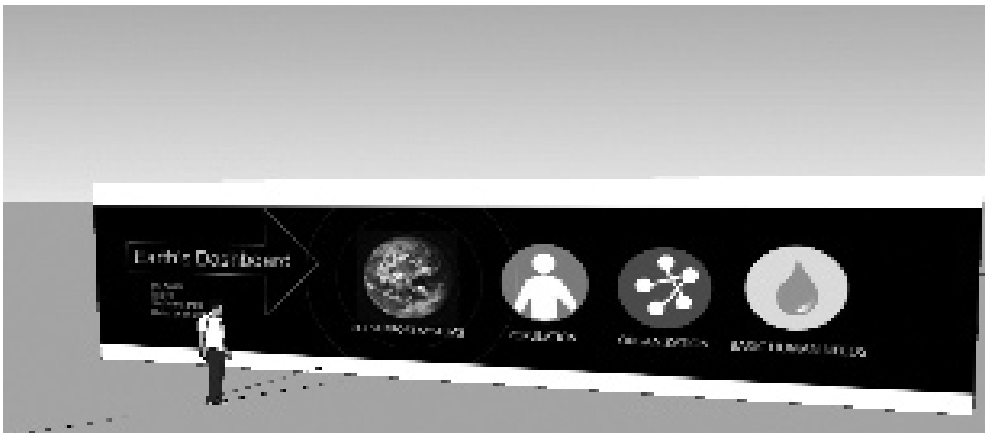
Because of the interconnections of science, technology, economy, culture, environment, problems and options—and the intertwined fate of all life on board “Spaceship Earth,” there is a critical need for a tool similar in purpose and function to a vehicle’s dashboard.

An *Earth Dashboard* is needed so that everyone from UN Representatives and world leaders to students and the general public can get an easy-to-understand fix on the condition of their ship, its resources, problems, crew and passengers. Because we are now, more than ever, one world, we need a one-screen dashboard type of display that shows us the key indicators of our ship. Because of the size and complexity of our ship, an *Earth Dashboard* also needs to be able to zoom in from the whole Earth to the local and to do so in a way that shows links between levels.

If the world had such a dashboard, and this dashboard was available in a highly visible and credible public (and web) location where all could get access and see it, the dashboard would function as a critical source of global visualization. Those viewing the dashboard will come away with an increased and more tangible sense of the whole world, its interrelations, problems, and options. If this dashboard is interactive and involves the viewer, its power and impact will be even greater.

The *Earth Dashboard* would contain a large number meters, gauges, maps, alarms and other data visualization tools that would provide an accurate present state condition of the Earth. Trends and time lines would provide a “rearview mirror” for seeing where we have come from, and data projections into the future would provide a short-range glimpse out the “windshield.” The *Earth Dashboard* will illustrate the present state of the world, in real time.

An *Earth Dashboard* located at the UN (and its web-based version)





will be a place where people come from around the world to see what is happening right now on the planet. This will be done through a series of live, real time meters, gauges, trends, maps, maps in time series, viability thermometers and alarms (among many other data visualization techniques) that transform UN statistical data into exciting visualizations. These historical data sets will be supplemented with live feeds from web cams, satellite images and other sources.

What It Could Look Like



14. WORLDGAME: GLOBAL PROBLEM SOLVING STRATEGIC PLANNING TOOLS

By Medard Gabel

Strategic Summary: The Earth needs tools that help us see the world from a global perspective, and to recognize, define and solve our problems and reach preferred states that use the whole world as the basic unit of analysis—not the nation state or political ideology.

The WorldGame is a tool to enable government, corporate and civil society leaders, students, teachers, private citizens and the media to develop and test out alternative solutions to global and local problems. It would encompass a digital inventory of the world's resources, human trends, needs, budgets and technological and policy options, as well as where these resources and needs are located. It would have a series of online strategic planning tools to help the problem solver see the problem they are addressing in a global context, the technological options for solution, impacts and costs. It would allow the problem solver to run simulations of the developed solution(s) implementation and to evaluate resulting impacts.

"The only way to understand a problem is to understand the system the problem fits into."

—Howard Odum

Introduction—Present State

We live on a single planet that is divided into over 200 countries, a variety trading blocs, different types of economies, conflicting ideologies, religious and cultural beliefs—along with a scarcity of critical resources that can pit all the preceding against each other in a sometimes life or death struggle. Growing populations and increasing standards of living and expectations for ever higher ones leads to the need for either ever stronger military might to prepare for the eventual Armageddon showdown with the opposite side—or a set of tools that will enable the different countries of the world to cooperate and collaborate on meeting their and the world's needs for a sustainable way of life. Given the destructive might of modern weapons, and their ubiquity, it is imperative that we develop a set of tools that every country, and every problem solver in the

world, has easy access to.

As H. G. Wells pointed out, “*We are in a race between education and catastrophe.*” If we are to avoid losing this race, we will need to harness the creativity of as much of the world as possible. We need tools that illustrate the benefits of collaboration and foster the development of global solutions to global problems in ways that build trust and further collaboration. We need a set of tools that, as Buckminster Fuller said, help the world to “solve the world’s problems in the shortest amount of time, through spontaneous cooperation, without the advantage or disadvantage of anyone, and without harming the environment.”

Preferred State

The *WorldGame* would be such a set of tools. At its foundation would be a complete digital inventory of the world’s resources, trends, human needs and technological and policy options for meeting those needs. Included in the global inventory would be the national expenditures and budgets of every country. This inventory would be coupled to a series of sophisticated mapping and other information visualization tools that would allow the problem solver to see relationships, patterns, opportunities, impacts and costs. These tools would be contained within a strategic planning process that provided function and purpose to the problem solver user.

All of the above—inventory, visualization and strategic planning tools—would, in turn, be embedded in an optional gaming context that provided incentive and rewards for the most creative minds on our planet—the youth of the world—but who are often times those least interested in solving complex basic human need problems because of the perception that such activity is of little use. This gaming aspect of the *WorldGame* would allow the high school student, activist, dissident and policy expert to compete with the real world leaders of the world’s countries. Using the same budgets that countries have at their disposal, the *WorldGame* player would explore and develop more cost-effective, just, abundant and environmentally sustainable paths to the future. Other games and contests to “make the world work for 100% of humanity in the quickest amount of time” would also be featured.

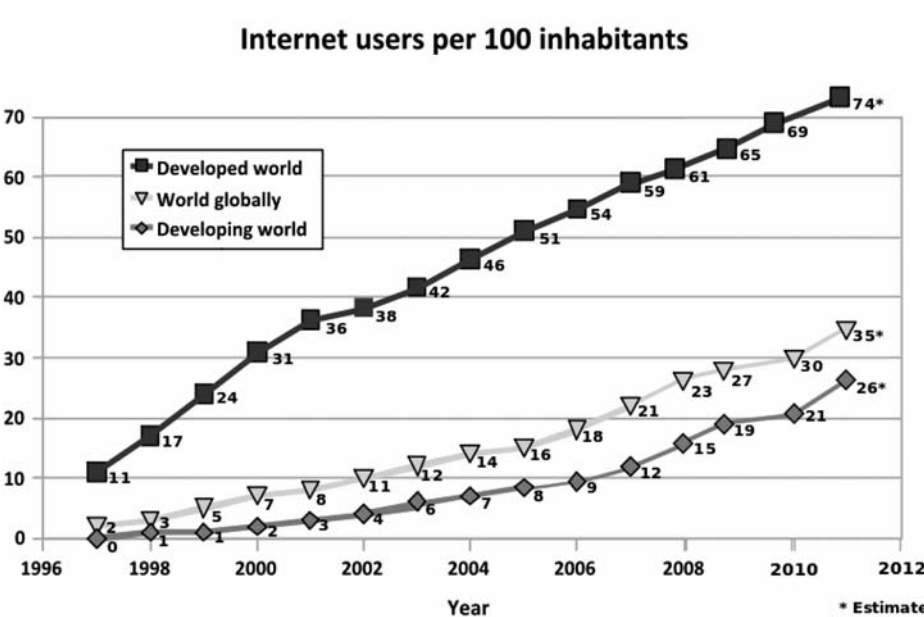
The *WorldGame* would be available online to everyone with Internet access. It would also be located in a physical facility such as the United Nations. The *Earth Dashboard*, or a modified and expanded version of it, (as described earlier), could be a powerful user interface for the

WorldGame. Using the dashboard or Spaceship Earth metaphor, the *WorldGame* can be explained as the control mechanisms for the space craft. The dashboard provides the reading of what is happening right now, trends provide a view out the rearview mirror of where we have been, projections into the future provide a view out the windshield, and the steering wheel, accelerator and brake provide control for determining where the craft is going. The most important aspect of the entire Spaceship Earth and dashboard metaphor is the pilot and their prerogatives and responsibilities. The perception of a threat out the windshield, such as climate change, suggests to the pilot of the craft that evasive maneuvers are in order. In addition to perceived threats to the well being of the spacecraft, the pilot will have a destination or goals where he or she is navigating to. These goals, such as a world free of hunger, are where the WorldGame set of tools will enable the “pilot” to figure out the best course of action.

15. SURPASSING THE DIGITAL DIVIDE

by Sean Powers (USA), Mutuma Thilange (Ghana), Leszek Pochron-Frankowski (Poland), Nino Gagua (Georgia), and Vic Goldsmith (USA)

Strategic Summary: More people are online today than at any other point in human history. This has resulted in an unprecedented level of access to information resources, but also a sizable gap between digital haves and have-nots. This situation is most pronounced in developing economies. A huge opportunity for development and positive change can be accelerated if more people and communities have access to the resources of the world wide Internet. By providing access to these resources, communities can be assisted in the process of development through facilitation of communication, education, governance, and economic systems.



Problem State/Present State

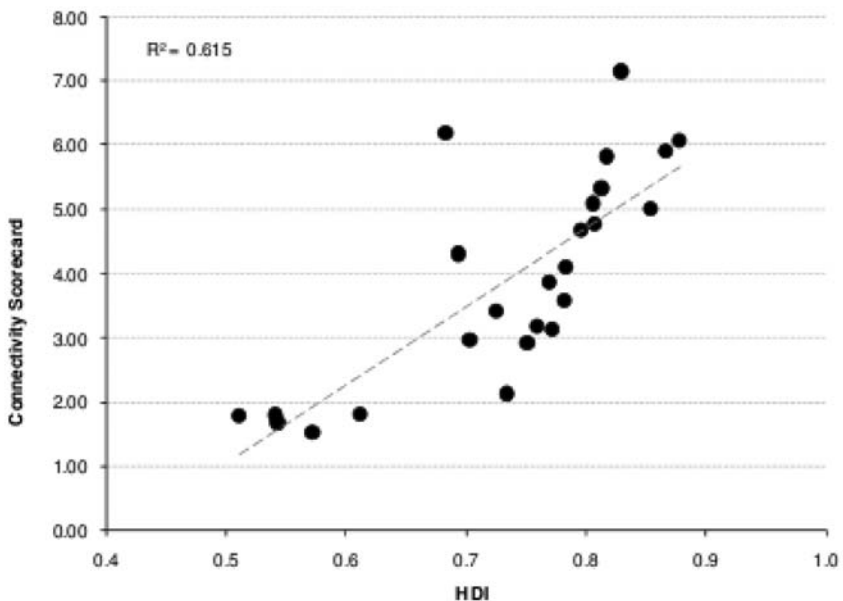
But despite the trend illustrated by the above chart¹:

By the end of 2011, 70% of the total households in developed countries had Internet, whereas only 20% of households in developing countries had Internet access.

- Broadband penetration remains low in some regions, such as Africa and the Arab States, with 0.2% and 2% respectively by the end of 2011.
- Major differences in Internet bandwidth per user persist between regions: on average, a user in Europe enjoys 25 times as much international Internet capacity as a user in Africa.
- The primary obstacle to the spread of this technology is the cost of centralized communication infrastructure. Being expensive to install and maintain, Internet Service Providers have no incentive to fund implementation in poorer or more insecure communities where they could lose the return on their investment.

And where access is available, costs for end-users tend to be prohibitively expensive. In some places a broadband Internet connection

Figure 4: Correlation between Connectivity Scorecard 2010 and UN Human Development Index — Resource and efficiency-driven economies



can cost more than 100% of monthly Gross National Income (GNI) per capita². Beyond this, end-users also lack control of both their network and their terms of service, creating an environment in which connectivity is tenuous, at best.

Preferred State

Information can function as a high-level leverage point. The right piece of data in the right place and time can influence the behavior of the actors involved in a situation, significantly altering the outcome. Knowing the price of a product on the global or regional marketplace, for example, can alter the profits of a transaction. Information, when channeled in the appropriate manner, towards building knowledge, skills, and social feedback, can be a powerful tool in assisting people to improve their living conditions.

Our preferred state is:

- Universal access to the community-building and information tools and resources available on the Internet
- Affordable access/low entry cost for all
- Sustainable, resilient, reliable, modular, expandable infrastructure
- Fully integrated with the global network
- All for the purpose of facilitating development.
- In order to achieve this it will be necessary to construct low-cost communication infrastructures in order to establish connectivity.

Strategy

Our strategy for reaching the above preferred state is low-cost wireless mesh networks. These networks would be deployed, at the start of our strategy, in what are called “informal settlements” (more commonly referred to as slums) in developing parts of the world. They would utilize affordable equipment that would allow the network system to be built out organically, one node at a time, and in an affordable manner whose costs could be covered by the community being reached. Functionally, the resulting network would connect the users to the global Internet, as well as being a local system for communication, governance and economic development.

The equipment for this system is described below:

All wireless devices operating on the 802.11 standard have the capability of operating in two distinct topologies:

Centralized

Operating in Master and Managed Modes, this topology is dependent upon delegating responsibility in a hierarchy of devices. A device running in Master Mode appears as a traditional access point. Clients can then connect to them, and the Master device manages all communications on the network. Client devices are running in Managed Mode. They cannot communicate directly with other clients, only with their associated Master.

Decentralized

Operating in Ad Hoc Mode, every device on the network communicates with all other Ad Hoc devices within range. This topology forms a structure known as a mesh cloud. If a device in the mesh cannot directly communicate with another, it will attempt to forward the data through intermediaries, passing from device to device until a route to the intended destination is discovered. Though previous generations of protocols were clumsy and inefficient at this, new developments like the “Optimized Link State Routing” (OLSR) and “Better Approach to Mobile Ad-Hoc Networking” (BATMAN) protocols significantly improve the process and make large-scale deployments much more feasible.

Networks constructed in this manner have numerous advantages over those using centralized infrastructure. The ad-hoc routing style is naturally adaptive, automatically discovering and self-healing routes as they break. The hardware has lower power requirements, and is generally cheaper as well. These characteristics make decentralized networks much more resilient. In addition, they require less

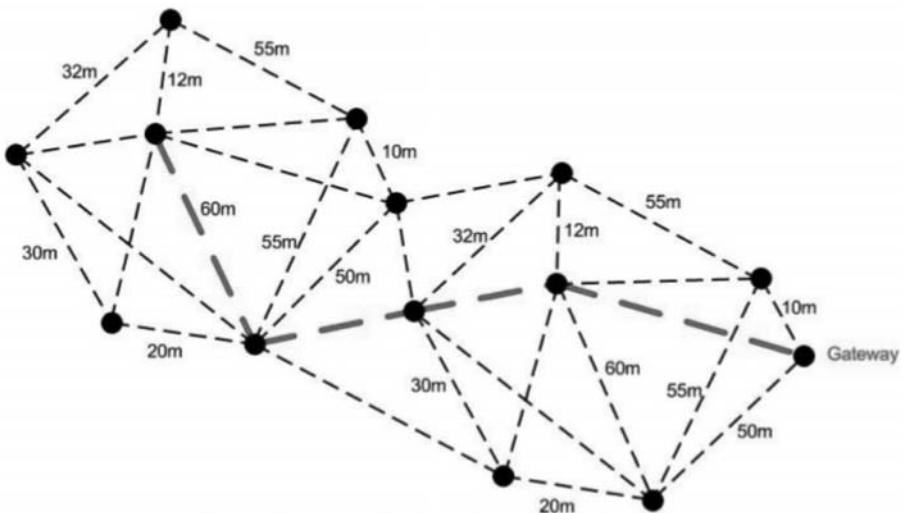


Figure 3: Network plot of mesh with backbone

time and energy investment for construction, scale easily, and offer users a higher level of control.

Components

Access Points, Repeaters

Access points and repeaters form the backbone of the mesh network, acting to connect individual users together. There are a number of existing products that can fill this role, such as the MeshPotato or Meraki's routers. But the lowest cost and most easily accessible solution is provided by Linksys.

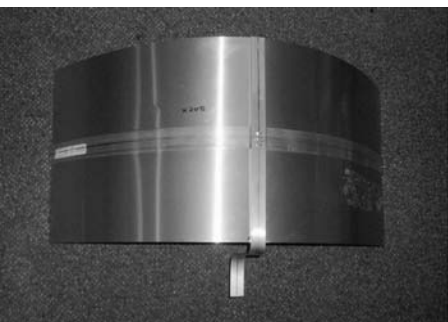
The firmware for Linksys' Wireless G router (WRT54G) is built on Linux. Because of Linux's GNU license, Linksys was obligated to release this firmware as open source, and they did that. This opened up a cheap (<\$60 new), off-the-shelf router for experimentation and development by the public.

Since then, a number of new firmware versions have been released for this router, among them solutions for mesh networking. Being a slightly older device, it has a solid foundation for interoperability, and its past popularity opens the possibility of finding it used for significantly less than the retail price.



Antennas

Long distance antennas help to extend the possible reach of the network. A simple reflector can increase the range of a device to multiple kilometers. Many designs exist, some of which are very effective at increasingly lower prices.



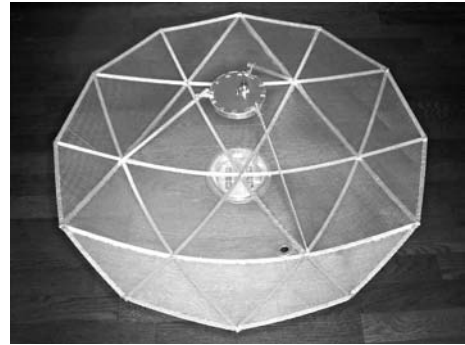
Linear Focus Parabolic

A linear focus parabolic antenna contains a parabolic curve in two dimensions only. The result is, instead of a focal point of energy as from a three dimensional parabola, you get a focal line.

This decreases the range slightly, but the measurement is still on the scale of kilometers. These can be easily constructed from a parabolic template with a wire frame and reflective material to be attached onto the existing rubber duckie antenna on an access point.

Geodesic Paraboloid

Geodesic geometry can be used to approximate a parabolic form. With the correct measurements, an antenna can be constructed from simple struts, a binding material, and a reflective surface such as aluminum foil or window screen. This sets the price-point very low for a high quality antenna.



Servers, Gateways

Servers act to host services, and Gateways act as a shared connection to the global Internet. Both take the form of computers on the network, and there are low-cost solutions that can serve this functionality.

For example, the Raspberry Pi is a credit-card sized Linux computer that sells for a price of \$35. It plugs into a television for a monitor, requiring only an associated keyboard, mouse, and SD card to operate. It also uses a 700Mhz ARM processor that requires a very small amount of power, small enough to be run on 4 AA batteries.



Existing Networks— Models for Our Work

Athens Wireless Metropolitan Network (AWMN)

The AWMN is the largest working model of this type of system in the world. Covering 9,000 square kilometers, this network effectively serves 5,000 users, with 9,000 more expressing an interest in joining.

FabFi

Operating in both Afghanistan and Kenya, FabFi is building resilient wireless networks using off-the-shelf routers and self-built antennas at a price of about \$60 per node. The network in Afghanistan serves 45 nodes at a speed of 11 Mbps, connecting a hospital, a university, the office of an NGO, and a local village. The network in Kenya serves 50 nodes at a speed of 30 Mbps.

Services

These networks are much more than just physical hardware. They tend to evolve organically, as a function of the need for the network, the cohesiveness of the social bonds of the community, and the value of the services offered.

Although the first two mentioned above are dependent upon pre-existing circumstances, the services we are proposing the community will have considerable influence over. By implementing services that are useful and valuable to the community, we can both incentivize new members to join and push the functionality of the network in positive directions.

Here are some examples of existing services and resources that could be deployed on the networks our strategy is calling for:

Communication

The most fundamental use of this system, these networks can offer communication services to communities that would not otherwise have access to them, such as:

Telephony is a basic functionality that could be provided via Voice Over IP, allowing voice communication with any other phone worldwide. The OpenBTS³ project is also working to create an open source, user-controlled cellular tower. By interfacing with the Global System for Mobile Communication (GSM) standard, any cell phone can be used on the network, integrating with existing hardware at a price point lower than large, industry-controlled cellular towers.



Social networks are a valuable tool for coordination and collaboration. Mesh networks can serve access to the more familiar communities of

Facebook and Twitter, as well as decentralized, user-controlled solutions such as Diaspora⁴, a privacy-oriented social network and Open Atrium⁵, a team collaboration oriented social network. Users would also have the ability to publish their own content via blogs and other services.



Governance

The platform created for communication represents one of the most critical facets for a system of truly inclusive, participatory governance. Using these networks as a platform, we can facilitate the creation of these participatory systems, developing the interface between citizens and government.

Discussion between elected officials and citizens can provide valuable feedback for the effective operation of government. Better Reykjavik⁶ is an online community in Iceland serving as a platform for precisely this function. Citizens post their ideas for discussion and debate, and officials draw from those discussions to address issues relevant to their constituency.

Voting is the foundation of any democratic system, and these networks can significantly improve this process. Online voting as a supplement to conventional systems can provide accessibility to remote users, reduce long queues, and help to eliminate intimidation and violence at the polls. Liquid Feedback⁷, an online platform for “Interactive Democracy,” is one example of a service that could be used for this purpose. It provides a structured interface for proposals, discussion of proposals, and voting within a group.

Voting
Cancel · Discard voting

Finish voting

Approval (first preference)

↑
↓

i108: Dark side of the moon should be illuminated

Janne P. Hukkinen

Show (new window)

Approval (second preference)

↑
↓

i111: Moon's dark side should blink in red

dogrush · Janne P. Hukkinen

Show (new window)

Abstention

Disapproval

Education

These networks can be of great assistance to education. They can provide access to educational resources, as well as educators. Video conferencing can bring teachers directly into homes in communities where classroom space is limited, and platforms can be deployed for the generation of content based on local knowledge.



Open Educational Resources like MIT Open Courseware⁸ and Open Yale⁹ publish the content of university quality courses online for free.



Wikis act as a participatory platform for access to and generation of information resources. Existing Wikis such as Appropedia¹⁰ and Akvopedia¹¹ host content on appropriate technology for food production, water management, sanitation, and other aspects of critical infrastructure.

Scribd.

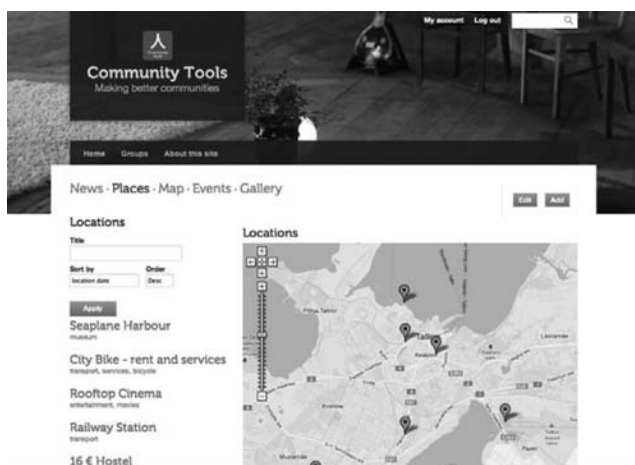
Digital libraries can be built in places where other options are unfeasible. A number of these already exist, such as CD3WD¹² and Soil and Health¹³, filled with free material relevant to

development. Platforms like Scribd¹⁴, an online document database, can be deployed to host these libraries.

Economics

Another valuable function that can be provided is to act as the social foundation for an economic system. In connecting individuals together the network acts as a forum for economic activity, offering a platform

for launching businesses and other endeavors.



The digital agora, online open and participatory marketplaces similar to the functionality of Craigslist¹⁵, could help to facilitate product, ser-

vice, and monetary exchange. The decentralized social network server Community Tools¹⁶ contains mapping/geotagging resources, as well as other tools for community organization, that could greatly increase the effectiveness of these marketplaces.

Crowd financing services like *Kickstarter*¹⁷ could be hosted to serve as a launching point for local community projects and businesses.

Alternative currencies can also be deployed on these networks. One example would be *Time Banking*¹⁸, which monetizes time, going around conventional currencies and empowering individuals to exchange existing knowledge and skills.



Implementation

For the purpose of facilitating the adoption of these systems, our strategy proposes an educational program to teach people how to build their own decentralized networks.

WirelessU.org

The existing community Wireless U¹⁹ provides

free access to a curriculum that could be utilized for this purpose. They also provide suggestions for trainers living in various locations around the globe.

In order to gather physical parts for the network, our strategy calls for the creation of a recycling program that reduces rich country waste by sending older hardware to locations across the globe that desire to construct their own network. The strategy also calls for getting tech companies involved, providing incentives such as increasing positive public image and expanding their customer bases.

The most expensive component of this implementation plan is the payment for the initial trainer to start the process. If this role is not occupied by a volunteer (possibly from a tech company or “Internet Peace Corps”), there are a number of possible sources to explore. Governments can invest a tiny fraction of the funds devoted to development of traditional centralized infrastructure into this project. Corporations could be incentivized to invest for the purpose of

expanding their customer base, or serving advertisements. And social, crowd-funding entities like Kickstarter could also play a role.

Dharavi

Our strategy begins with a pilot program at the Dharavi School²⁰ in the slum of Dharavi in Mumbai. This institution already teaches children basic computer literacy. They have access to both power and computers, and our strategy would be a supplement to this already existing structure. One trainer with the hardware to build ten nodes would be sent to Dharavi. Ten students would start an education and training program. Hosting a server at the school, the network thee students construct would be put to the purpose of assisting their education. Usage metrics would be monitored to track its evolution, patterns of use, and efficacy.



Following this pilot program, the training would be scaled up to assist other developing communities. As these networks grow to reach a critical mass worldwide, they will function as an open, integrated, resilient and sustainable alternative for access to the global communication network.

Footnotes

- 1 http://www.itu.int/ITU-D/ict/statistics/material/pdf/2011%20Statistical%20highlights_June_2012.pdf
- 2 <http://www.itu.int/ITU-D/ict/ipb/index.html>
- 3 <http://wush.net/trac/rangepublic>
- 4 <https://joindiaspora.com/>
- 5 <http://openatrium.com/>
- 6 <http://www.betrireykjavik.is/>
- 7 <http://liquidfeedback.org/>
- 8 <http://ocw.mit.edu/index.htm>
- 9 <http://oyc.yale.edu/>
- 10 <http://www.appropedia.org>
- 11 <http://www.akvo.org/wiki/>
- 12 <http://www.cd3wd.com/>
- 13 <http://soilandhealth.org/>
- 14 <http://www.scribd.com/>
- 15 <http://www.craigslist.org/>
- 16 <http://communitytools.info/en>
- 17 <http://www.kickstarter.com/>
- 18 <http://timebanks.org/>
- 19 <http://wirelessu.org/>
- 20 <http://www.dharavischool.org/>

16. UVOTE: MOBILE TECHNOLOGY FOR CIVIC PARTICIPATION

By Karolyn Wojtowicz, Christine Harb, Shelby Miner, Josh Pang

Strategic Summary: Success in the information age could be defined by access to and competence in computer technology and digital media. Great potential lays in the ever smaller and ever more powerful devices being churned out by 21st century technology. Smartphones are the current generation of the smallest and the strongest. The smartphone “app” transforms processing power and ubiquitous presence into utility. The power of information technology can enable the most knowledgeable to help the least powerful—in a sense, pairing the straight A student with the failing student. uVote is a mobile phone application that provides an avenue for binary yes/no polling, and in which all of the participants can view results. These results can then be used as aids in making decisions on a variety of levels. For example, the massive government debt in the United States could benefit from such technology that rapidly polled the citizens of the country.

Introduction/Problem State

Very few people around the world have access to the decision-making processes that governs their neighborhood, state, country and the world. Without such meaningful access, people are alienated from the political process and reduced to apathetic observers or frustrated victims.

Buckminster Fuller proposed a *World Democracy by Electronic Referendum* in his 1973 book, *Earth, Inc.*¹. What he described back then could be functionally achieved via today’s Internet and current information technology. The core idea is to allow any person with Internet access to be their own representative in governmental decision making through a yes/no referendum.

The Internet makes possible a condition where nearly all the information about anything and everything goes to a shared space where anyone can access it. The Internet is always growing to meet new interests and demands. Each person that has access to the Internet has, potentially, access into the minds of the other four to five billion people who have access to the Internet. The *uVote* strategy seeks to harness the collective intelligence, values and vision of all the people who have access to the Internet.

Preferred State

The *uVote* preferred state is one where the people in any given community—be that a neighborhood, city, state, country or the world—have a say in how the scarce resources of their community are allocated, and can participate in making the decisions that impact them are made. In the *uVote* vision, governments are transformed into responsive, transparent and effective decision-making bodies that reflect the values and vision of the people they serve. The *uVote* mobile phone application could spark change by making problems more visible, bringing more focused attention by more people to the problems of society, and through the development of solutions and their approval by those who will be impacted by the outcomes of the decision.

Individuals would gain understanding of what is happening in their government, and government officials would increase their understanding of the people they represent. By allowing more and more people to have more of a say in the governing process, participation and understanding will increase.

Present State

Some countries, such as Estonia, Russia and India, are beginning to implement various versions of the *uVote* strategy. Estonia has utilized new technologies to vote—such as in 2005, when more than nine thousand people participated in the country's first vote available through an Internet website². Since then, Estonia has become famous in this arena for the efforts made by TeliaSonera, the world's first company to create a mobile phone voting function that was used in February 2011³. Through both efforts, the numbers of active voters in the country have greatly increased—as well as interest in legislation affairs. Estonia provides an example of how easy it is to introduce voting through wireless technology.

Problem and Present State

The present situation is dire—in too many countries there is a lack of civic engagement, voting turnout, government knowledge of public opinion, and citizen knowledge of issues and government process. For example, voting within the United States presents a good case study of why the present state

exists. In the 2008 presidential election in the United States there was the highest voting turnout since 1968. Unfortunately this “highest voting turnout” was an appalling 56.8% of the eligible voters. Roughly half the people who voted chose the winning person, meaning the current president knows what roughly a quarter of the country’s voting-eligible population desired in legislation actions at the time of his election.

Ten of the top reasons why American’s do not vote include:

1. People feel their one vote does not count.
2. They are too busy to take time off from work or school.
3. They lack interest in voting.
4. There is an inability to vote if one becomes sick or disabled after the deadline to file for an absentee ballot.
5. Illegal immigrants are not authorized to vote.
6. Dislike of the candidates.
7. Lack of transportation to get to the polls.
8. Rules of absentee voting are complicated.
9. Forgetting to vote.
10. And voting lines seem too long⁴.

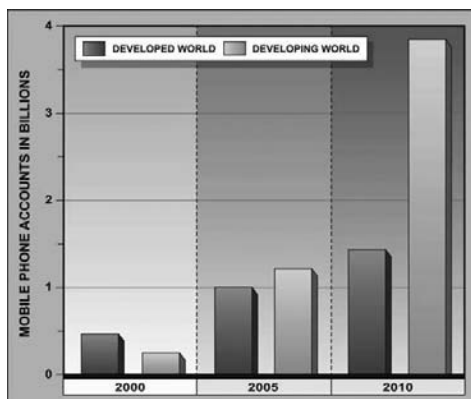
Because voting is not mandatory in the United States, these reasons and others help explain the general lack of civic participation and understanding of governmental processes.

How It Works

Technology now exists to change how voting occurs, and to eradicating many of these ten reasons. The *uVote* application would allow people to view choices and to vote on them. It would also allow the results of one vote to be compared with other results. By creating a mobile application that enables voting, the excuse of not having enough time is irrelevant as well as the inability through related absentee voting issues. There is

no long line to wait through on voting day and more people would have the opportunity to vote.

With regards to forgetting to vote, a free SMS or text message would be sent to mobile phones with the application, reminding them to spend a few minutes during the day to vote. One of the goals of the *uVote* app is to make voting and responding to polls “cool.”



By 2015, there will be as many cell phones as there are people on this planet. This increase in number of cell phones also correlates with an increased efficiency of phone networks, including locations in the third world—as evidenced by this graph. As technology improves, the present state gets ever closer to reaching our desired and preferred state of using mobile phones to encourage civic participation, an understanding of legislative issues by the general public, a way for politicians to view public opinion, and an increase in voting participation.

The Plan

Our strategy is to create an interface that is customizable to each user that would include an introduction to the legislation at hand, a summary and the ability to vote in a binary yes or no manner. This interface would be the same across the world as well as for the various types of voting that could occur—local, state, national and international. The summary for each item to vote over would come from the actual legislation document, to ensure as little bias can occur as possible while still making an informed decision. The results of the yes or no voting would go into a database that anyone can access, as well as links on various websites and media outlets. Social networking materials, such as Facebook, Twitter and Wikipedia will provide associated outlets for discussions, comments, concerns or questions for participants of the *uVote* application.



There is already a “proof of concept” application that does some of what the *uVote* app hopes to achieve. *Visible Vote* allows for public polling through mobile technology, with over 200,000 users. However, it is used primarily in the United States and for national issues. The *uVote* program is intended as a platform that would have more opportunities for voting on a variety of levels such as local, state, national and international. *uVote* will allow participants to see their vote in comparison to others in a results database. *uVote* will also utilize social media and pre-existing networks that encourage civic participation. This will set *uVote* apart from *Visible Vote* and other

voting apps. By showing the effect our program would have on such a variety of levels and all around the world, regardless of the type of government, we hope to gain the backing of the United Nations and international democracy focused organizations.

The *uVote* strategy will accomplish many things. It will increase the ease of voting that many governments and voters desire. It will enable voting and polling options for a variety of issues and at different scales, from local to global. It will also enable the user of *uVote* to propose polling questions, thereby opening the debate up as to what is important and the phasing of the questions that are to be asked.

Timeline

The timeline for the *uVote* program is as follows:

- 6 months: the application will be coded and on the market
- 5 years: the application will have gained popularity—every phone will have it
- 10 years: everyone with a phone will be participating in public option polls
- 20 years: the application will be used for voting in elections everywhere

In a few years, there will be as many phones in the world as there are people. As with all other forms of technology, the higher the numbers owning a technology, the lower the price. Our timeline takes into account this change in number of users, as well as the ever-growing technology that will be utilized. This timeline to some, may seem too ambitious—while to others, too conservative.

What Help is Needed?

Today's students are accustomed to using technology to get things done faster and more effective than ever before—including sharing information via social media applications. By encouraging teachers and college professors to use *uVote* and incorporate its usage in their lesson plans, the ideas of civic participation being fun, easy, interesting, and rewarding will become instilled in students.

The United Nations and other global organizations could benefit from international voting options. The following chart shows results from a poll from 126 countries in the world that took place over a three-year period⁵. Only 44% of the countries responded favorably over the actions made by the leadership of the United Nations. The majority of

the countries that responded most favorably are in Africa, including Sierra Leone, Mozambique, Uganda, and Liberia. A few of the countries that responded with the highest negative opinions of the United Nations include Tunisia, Algeria, Lebanon, and the United States. The United States, one of the most democratic countries in the world today, had a 48% disapproval of the performance of the United Nations. With such a dismal reality on how efforts are viewed by others, the need for education as to what the UN is actually doing becomes obvious. By using *uVote* as a platform for viewing opinions from around the world, organizations like the United Nations would be able to gain a clearer understanding of work that is desired to occur, in all parts of the world. And by using *uVote* to educate the people in the world about its work, the UN will gain an increase in understanding of its work. The United Nations would gain a stronger approval rating globally and within specific countries that are currently in the fifty and sixty percentages of disapproval.

Do you approve or disapprove of the job performance of the leadership of the United Nations?

	Approve	Disapprove	Don't know/Refused
Global medians	44%	17%	33%

Based on aggregated data from multiple surveys in 126 countries between 2007 and 2010.

GALLUP®

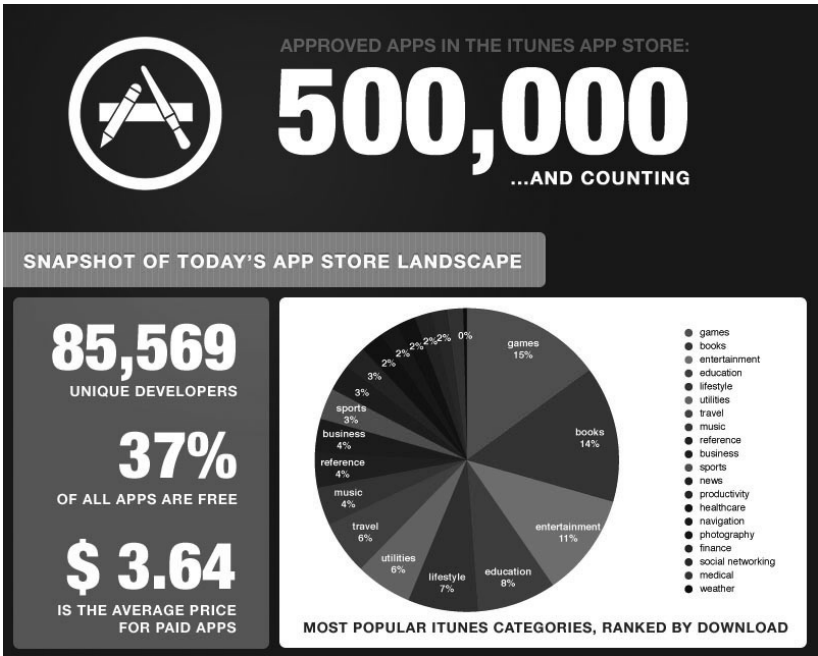
The *uVote* program focuses on polling and voting on legislation issues. Similar programs seeking public opinions and voting opportunities could exist on *uVote* or a similar platform. Businesses could create their own programs, with similar features, to seek their own improvements. Companies could ask their customers questions on the services they offer or McDonald’s could survey people regarding the change of food options

The Cost

The strategy of being a mobile phone application that can be adapted to any platform, across all infrastructures globally will mean a higher cost to developers— but one that is not any different than current app development. The application itself needs to be developed, and people need



to be employed to maintain the system and to regulate what information goes into the system. Those working on the project need to be committed to remaining as unbiased as possible (this will be elaborated within the ‘who does what’ section of this chapter). The costs of maintaining a staff,



as well as resources the staff will need (such as offices and networks in the various regions this application is implemented), have been calculated. Building similar applications have cost between \$600,000 (USD) and \$800,000 on average. By adding costs for the various factors mentioned above, such as human resources, technology, office space, marketing, etc.—it is clear that this is not a low-cost initiative. Foundation or government grant or funding or corporate investment could get the *uVote* app up and running, but to become sustainable it will need to develop alternative sources of revenue.

One of the next steps is to prototype *uVote* and test it in a regional and country level market. After this, scaling it to the rest of the world would be in order. A small team could get the ball rolling. Feedback on the system about possible improvements and added functions, such as the ability to contact one's local member of congress and collaboration with social networks, will help the program grow.

The long-term strategy of *uVote* is for it to morph from a polling app to a voting app, where people would be able to vote in local, state or federal elections.

Conclusion

uVote seeks to take the present state of the world and transform it into a preferred state. Voting through mobile technology is achievable today, as evidenced by Estonia. Civic participation as well as an understanding of legislation issues can increase. Citizens all over the world, regardless of their government type, will feel empowered through the making of their choices clear. The governments of the world will spend less money to have a reliable source of public opinion to draw upon. Stability within local, state and national levels will increase as governments become more transparent and responsive to the constituents.

Endnotes

- 1 Buckminster Fuller, "Ten Proposals for Improving the World", *Earth, Inc.* Anchor Press/Doubleday, New York, NY, 1973
- 2 <http://www.vvk.ee/index.php?id=11178>
- 3 <http://www.teliasonera.com/media/press-releases/2011/3/teliasonera-enables-the-worlds-first-mobile-voting-service/>
- 4 <http://san-antonio.movingtoanapartment.com/living/top-10-reasons-people-dont-vote.htm>
- 5 <http://www.gallup.com/poll/147854/Gets-Approval-Disapproval-Worldwide.aspx>

17. UNSLUMMING: TRANSFORMING SLUMS INTO “YOUNG CITIES”

By Sean Powers, Will Wright, Alen Saju, Zarima Fayikova

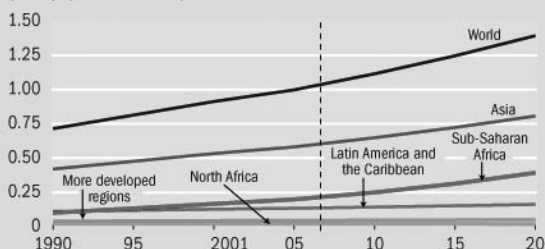
Strategic Summary: *More the half of humanity live in urban environments. A billion of these people currently live in slums that are associated with these cities. Each year more than 70 million people are added to this number. Slums can be transformed into new, young cities through creative strategies that deal with core problems.*

Introduction/Background

The growth of slums

More than one in every seven human beings now lives in an urban slum.

(slum population, billions)



Source: UN-HABITAT, Global Urban Observatory database (2005).

Note: Figures for 1995 are interpolated using estimates for 1990 and 2001. Figures for 2005 are projections; Australia, New Zealand, and Japan are included in the more developed regions.

The world is urbanizing at an extremely rapid pace, with the most rampant urbanization occurring in the developing world. This rapid urbanization has led to the growth of informal settlements, otherwise known as squatter cities or slums. Currently, 1/7 of the world's population (approximately 1 billion people) lives in slum conditions. An additional 70 million people are added to these informal settlements every year.

Slums, and the people living in them:

- Lack access to clean water and effective sanitation
- Live in unsafe structures with extreme population densities
- Lack security of tenure.



Despite the increasing numbers of people being added to the slums of the world, the ratio of slum dwellers to the total city population is dropping in cities across the developing world. This seeming paradox can be explained

by the existence of natural slum upgrading processes. These processes lift people out of slum conditions, but not at a rate which prevents the growth of slums. Think of a sink with a small drain and a large faucet. Turn the faucet on full blast and the sink begins to fill up because the drain is too small for that much water. But turn the faucet down, and the drain can keep up, keeping the sink from overflowing.



Strategy

Our strategy is actually the opposite—we're going to install a bigger drain. The natural processes of slum upgrading suggest that, when given the opportunity, slum dwellers find ways of relieving most of the conditions which qualify their homes and neighborhoods as slums. The strategy presented here seeks to support that initiative, provide the opportunities and, in so doing, expedite the natural slum upgrading process. Through this expedited process, we will not only eradicate urban poverty, but also create vibrant neighborhoods full of engaged, self-reliant citizens.

A core initiative of the program is securing tenure rights for residents of informal settlements. This is accomplished by economic development through business incubators. By assisting the development of high-value businesses within informal settlements, incentives for land-owners to provide guarantees of security of tenure are created. These incentives come in the two forms—revenue from the business themselves (either through explicit security of tenure contracts or increased rents) and pressure from external entities benefiting from the increased economic activity within the informal settlements.

Some of the funds coming into the slum through this economic development are designated for use for grassroots slum upgrading projects. As both the business incubator and slum upgrading are driven

by the residents themselves, this project encourages the natural slum upgrading processes and avoids the problems of many top-down approaches.

Business Incubator

The business incubator consists of three major components: Inspiration Stations, a Facilitator/Mentor, and an Advisory Board.

The *Inspiration Station* is modeled after the “Hole-in-the-Wall Computer” developed by Sigata Mutra, but incorporates a number of additional features to assist its usefulness and adoption by the community. The main feature is a slideshow-style screensaver which provides examples of potential business ideas and upgrading projects. This screensaver is supported by basic instructional videos which play when someone interrupts the screensaver (the video which plays is based on what was displayed when the screensaver was interrupted). After the video plays, the user will have access to a full suite of computer programs as well as Internet links that will enable them to explore the idea further.

Additional features include a cell phone and small electronics charging station, powered through locally renewable energy sources, and news radio playing while the screensaver is on.

The *Facilitator/Mentor* is the second component of the business incubator. This person works with and supports residents in developing their own businesses. This support includes everything from providing trainings in business basics to connecting the residents to external networks including suppliers and potential markets, and assisting with acquiring start-up capital. Additionally, the facilitator will train and mentor select residents to become facilitators themselves, thus creating the necessary resources for maintaining and expanding the program.

The third component is an *Advising Board* that acts as a final check for developed business plans, taking a big picture view and identifying potentially missed opportunities and upcoming challenges. This is



component is key to developing quality business plans which will in turn become successful companies.

Successful companies will connect to external markets and suppliers, thereby developing a constituency of supporters outside of the informal settlements. Additionally, they will share revenue with the land-owners in exchange for guarantees of tenure rights, and through a delayed fee plan, fund the continued operation of the business incubator and slum upgrading projects.

Budget

Inspiration Stations

- in—kind donations of computers
- labor for slide show and video development —\$5,000
- power source (renewable energy) —\$3,000
- labor for installation —\$7,000
- 2 years of internet access —\$1,400
- Micellaneous —\$1,000

Facilitator

- 2 year's of salary —\$40,000 —\$80,000
- Office space 2 years —\$6,000
- Supplies and expenses —\$5,000
- Contingency —\$10,000

The estimations above are for one program of 5 inspiration stations and 2 years of external facilitation. After these two years, the facilitation training and mentoring will have created an internal resource pool which will mitigate the need for additional funds.

Resource	Preferred Alternative Local Facilitator	Alternative B PeaceCorps / Volunteer	Alternative C Developed Country Facilitator	Multiplier	Funding Source
Computer	\$200.00	\$200.00	\$200.00	10	IKD
Power Source	\$700.00	\$700.00	\$700.00	10	G; MP
Installation Labor	\$500.00	\$500.00	\$500.00	10	MP; IKD
Facilitator Salary	\$15,000.00	\$10,000.00	\$36,000.00	2	G; MP
Total Cost	\$44,000.00	\$34,000.00	\$86,000.00		
Funding Sources: IKD = In-Kind Donation; G = Grant; MP = Micro-Philanthropy					

Summary

Benefits of strategy

1. Increased success rates for local business start-ups in slums
2. Profits to both land owners and slum dwellers
3. Self-propagating/sustainable system
4. increase of economic opportunities both within and outside of informal settlements with greater access to external resources for slum upgrading projects
5. Program has growth mechanisms (facilitator training and deferred fee payment structure) built in
6. Program is designed around local empowerment and relationship-building, making the primary concepts easily transferrable
7. Program will partner with Slum Dwellers International, creating a communication pathway for any interested settlement to start their own similar program.

Potential challenges

1. Engagement of disenfranchised people can be difficult. The profit incentive for land-owners may be dwarfed by the saleable value of the land.
2. Culture clash between individuals accustomed to informal economy and those operating within the formal economy.
3. Scalability / transferability of program.



18. commUNITY

PROMOTING COMMUNITY REUNIFICATION THROUGH YOUTH PEACE EDUCATION, DIALOGUE AND DEVELOPMENT PROJECTS

By Lisa Nowinski, Leah Knappage, Tobias Gabel, Nhu Phan

Strategic Summary: Ethnic conflicts and civil wars continue to plague various regions of the world and are a blight on the economic and cultural development of these regions. There is a need for an effective set of procedures for resolving these conflicts if the world is to move beyond them. . This strategic plan outlines a peace education initiative that offers short-term healing and long-term economic development for conflict ridden regions.

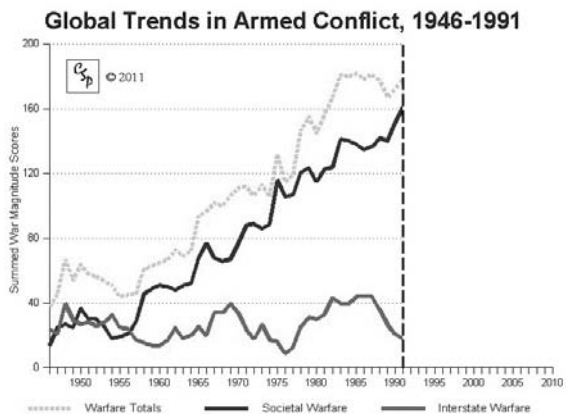
“Civilian fatalities in wartime have climbed from 5% at the turn of the century... to more than 90% in the wars of the 1990s.”¹

Introduction

Following World War II, global trends in armed conflict have shifted from predominantly between states to more civil conflict within states. (The blue line of the graph below visually explains this global trend.)

Civilians have been increasingly affected by internal conflicts and are at risk for displacement, sexual violence, violation of human rights, lack of access to basic services and family and community separation.

These internal conflicts often result in ethnic divides that are not only visible by physical barriers, but are fueled by ethnic fears and violence. After a conflict, the



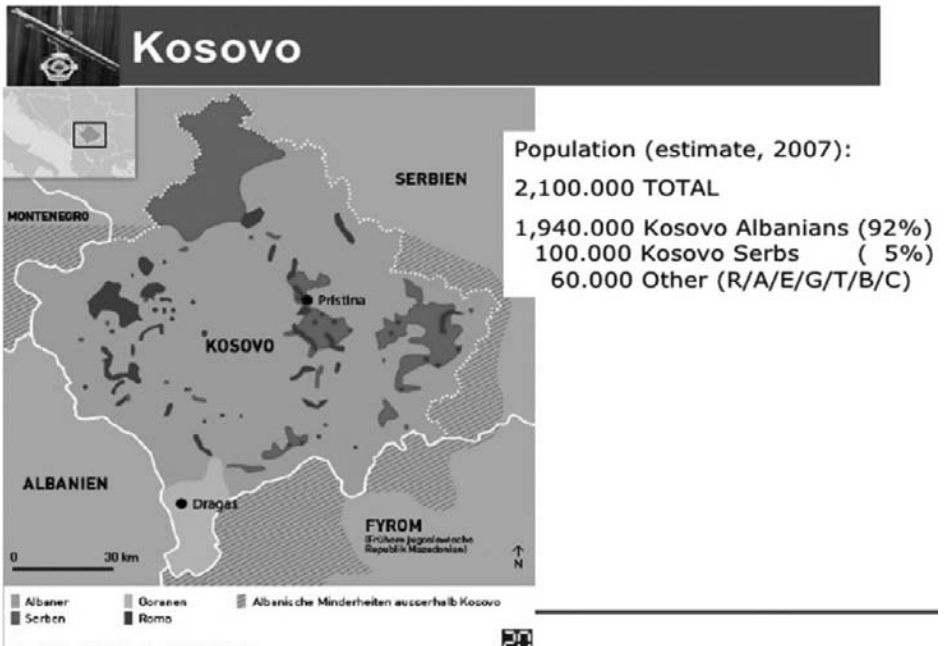


community may live in a state of negative peace (enforced peace based on ceasefires and peace agreements). However, in most cases, ethnically and culturally divided communities continue to live separately, often in fear of violence and lacking many basic human services. This divide hinders the community's ability to heal and recover from past traumas caused by a conflict, as well as to work towards developing their state socially, economically and politically.

An example of physical barriers dividing communities: Belfast, Northern Ireland (Taken during a field study trip by one of authors in October, 2012)

Setting the Stage: Conflict in Kosovo and Ethnic Divisions

Mitrovica, in north Kosovo has an estimated population of 2,100,000 people, of which 92 percent are Albanian and 5 percent are Serbian. After the war in 1999, Kosovo's north became a great ethnic divide between Albanian and Serb Kosovars, displacing people from their homes and creating an area highly prone to ethnically based violence.² The two populations are divided along the Ibar River by a barricaded bridge that attempts to keep the communities separate and at "peace".



Much of the Serbian population in Mitrovica is still receiving support from Serbia, however, much of what has been considered normal in this region is about to change due to the recently signed April 19th agreement between Kosovo and Serbia. I

In order to ensure that peace is kept between the two communities, as well as the nations of Kosovo and Serbia, it is more important than ever to bridge the gaps and reintegrate the two communities to work together and rebuild Mitrovica. Bridging the gap between these two estranged communities will benefit the states and people of Kosovo and Serbia in many ways. On one hand, it will keep both states in the running for European Union (EU) membership. It will also help reintegration in Mitrovica and will increase the chances of a unified Kosovo.³ A community working together and focusing their efforts on development rather than destruction will develop a better economy, as well as better social services and quality of living.

Preferred State

The implementation of a community reunification program would work towards achieving an ideal state. This ideal state would be a society

where all citizens, regardless ethnic, religious or cultural orientation, can move freely, receive a quality education and work and live without fear of discrimination based on their identity. Education would act as the epicenter in creating a society free of prejudice based on historical events, with ethnic and cultural acceptance and equal opportunity for all.

We are ultimately working towards a community that values healing and reconciliation, peace, inclusion, opportunity, empowerment, social responsibility and sustainable development.

Peace Education and Community Centered Development Projects
In order to work towards not only peaceful co-existence but also an integrated society, it is necessary to implement a peace education curriculum in schools in conjunction with community development projects.

This *Peace Education Program* ⁴ prototype and “proof of concept” would be implemented in the city of Mitrovica, North Kosovo, a city divided by a barricaded bridge. The majority of Serbs live in the north and Albanians live in the south. The peace education process begins with a peace curriculum that starts with four primary schools in both the north and the south for students of all ages.

The in-school Peace Education process involves a number of approaches to building and strengthening peace, including personal healing. Weekly classroom activities get students to understand the conflict and trauma they, their family and other community members have faced before, during and after the conflict. Art and music are used to encourage students to express their thoughts, share their feelings and allow for personal growth and healing— as well as community bonding.

Personal blogs and video conferencing using language translation software allow will children from both communities to understand that conflict from the perspective of the “other.” The blogs will be monitored to ensure that no harsh, destructive words are used. The blogs will allow children from both the Albanian and Serbian communities to see the similarities they share, while also allowing them to understand that both sides suffered from the war and both sides are looking for empathy and reconciliation.

After students have become more accepting of the other side, compassionate listening circles and face-to-face discussions take place.⁵ Videoconferencing will also be used to connect the children of Mitrovica to children of other divided societies that are working through similar

divides and towards reintegration and healing (i.e. Northern Ireland, Israel and Palestine, Rwanda, etc.).

Along with peace education in primary schools, the curriculum will also be present in secondary schools in conjunction with a leadership-training program. Leadership training for older students will prepare them to eventually be administrators of the peace education courses in primary schools. The idea is to give older students volunteer opportunities as well as leadership skills, while giving younger students positive role models, and aiding the acceptance of peace studies.

In order to ensure participation each student will be given an account that commUNITY will place reserve funds in that can be used by the youth for continuing educations or vocational training. Each year that the student participates they will be allotted funds that they may receive for continuing education upon graduating.

Another important component of the commUNITY program are the community development projects. These projects will extend from community urban gardens to peace murals and music and art workshops. These projects will bring children from both communities together in agreed upon neutral areas to allow children to learn how to plant and care for a garden. At the end of the season the students will harvest their crops and help prepare them for a interethnic community feast.

A peace mural, music and other art projects will be fashioned in a similar way. These projects will bring students together to use their creativity, bond as one community and have fun. In order to make these workshops even more effective, it would be ideal for local artisans and musicians to come together to use their skills and facilitate these workshops. In the end the children and adults will be helping to develop and beautify their community while building meaningful and lasting relationships.

Endnotes

- 1 The Impact of Armed Conflict on Children, UNICEF: <http://www.unicef.org/graca/patterns.htm>
- 2 Background on Kosovo: <http://www.osce.org/kosovo/38678>
<http://www.crisisgroup.org/en/regions/europe/balkans/kosovo/165-bridging-kosovos-mitrovica-divide.aspx>
- 3 International Crisis Group
- 4 Peace Education Models: <http://www.peace-ed.org/> and <http://www.unicef.org/education/files/PeaceEducation.pdf>
- 5 Compassionate Listening Project <http://www.compassionatelisting.org/>

19. I AM HUMAN: HUMAN RIGHTS AND HUMAN NEEDS

By Thayvie Sinn & Tselane Hall

Strategic Summary: Human rights are essential to the cultural, economic, social and psychological well being of humans. Many citizens of many countries throughout the world have little to no awareness of their human rights and are exploited by leaders and others who use this ignorance to their own advantage. Making people aware of their right to human rights, and what these rights are, is an effective technique for moving the battle for human rights forward. A specific country, Cambodia, is used to illustrate the overall strategy.

Introduction

Present day Cambodia has limited access to technologically advanced devices for promoting awareness of human rights and meeting all of its basic human needs. Much of the country does not have its basic human needs met and there are limited freedoms of expression and opinion.

Preferred State

The ideal Cambodia is one where there is universal access to basic human rights and where the country's basic human needs for food, water, shelter, energy, health care, and education are met.

Strategy

Our strategy features a creative mix of radio programming, music, collaborations with musicians to create songs that popularize human rights, wall murals, photography, mobile games, and comic books featuring a human rights super hero— will be blended together in a way that will reach Cambodian youth and the general public and transform their awareness of their basic human rights.

Radio

The weekly 30-minute radio program is focused on delivering unbiased information to its general audience. This information includes celebrations of the country's history, literature, culture, and tradition— as well as human rights awareness.

The production of the radio program begins with contacting various U.S.

and Cambodia based universities. Working with a university, we will develop a class in which students formulate episodes for the educational radio program. Episodes will contain segments on human rights plus Cambodian history culture and traditions.

Music

A part of our strategy is to sponsor a human rights song-writing contest. We would market this contest on YouTube to the music artists found there. The human rights songs would be distributed through iTunes and distributed throughout Cambodia via the above mentioned radio program.

Comic Books and Murals

Another part of the strategy is to develop a visual presentation of a world in which human rights are attained. The way we see doing this is through comic books and murals.

To begin this facet of the overall strategy, we will contact comic book artists and get one or more of them to develop a “super hero” character for a human rights comic book series. Each human right will have a comic book.

Mobile Phone Game

Another part of our strategy is the development of a mobile phone game that would teach players about human rights. This effort would be in collaboration with phone companies in Cambodia.

The chart at right shows that most of Cambodia has access to mobile phones. Developing a human rights mobile game with incentives for



high scoring individuals would be a quick way for Cambodians to learn about their rights. Presently Cambodia has three mobile phone companies and as the above chart suggests some Cambodians already have more than one phone. The three telecommunications companies will be approached to sell them the mobile human rights game as a help to them in selling more phones.



Cost

One way to raise the funds needed to move our strategy forward is the production and sale of wrist bands, t-shirts, ad bags, and more which will state each human right, one at a time, depending on the most needed-at-the-time human right. The first statement the merchandise will display will be the general message, I am human, I have rights. After the general merchandise, each wristband will be chosen by the human right considered to be most needed. Ex. Human Rights #26: The Right to Education.

Grants, sponsorships and partnerships will be sought to fund and help move the overall strategy and its various parts, forward.

PART VI

SUMMARY/ SYNERGY

UN Photo/Fred Noy

SUMMARY/SYNERGY

The whole is more than the sum of its parts.

This book documents the explorations of many young people as they sought to understand our world and to figure out and design ways of making it work better for everyone. What is missing from the individual chapters or strategies are the interactions and resulting synergies of these parts as they combine into a whole that is exciting in its possibilities.

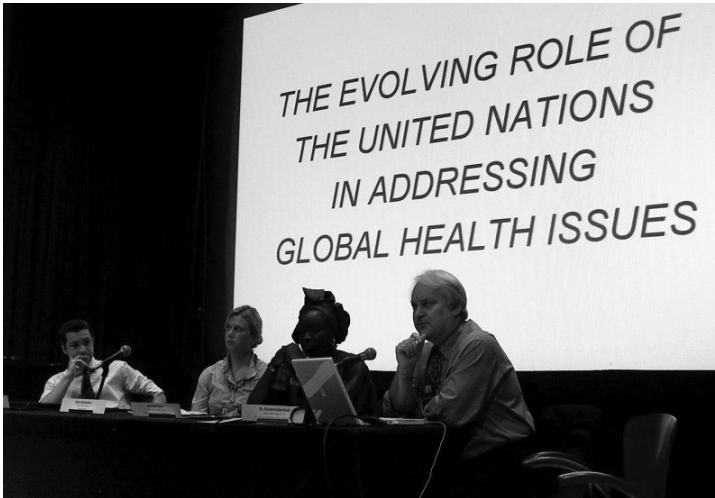
The preceding chapters describe a progression of technology, programs, policies and actions that, if implemented, transform the world as we know it to a world as we want it. Taken individually, each strategy can stand alone in making a significant contribution to improving some aspect of the human condition. Each strategy has links, interactions and impacts on the other strategies. Taken collectively, the strategies are more than the sum of their parts. They would, if implemented together, have a profound impact on our collective wealth, health, and potential. They would not only result in meeting the Millennium Development Goals, but also go beyond them and transform the world in even more profound ways.

These strategies for transforming the world are suffused with a sense of values and vision that is bold, inclusive and caring— and which is for the entire world, not just a part of it. In some cases, the strategies are revolutionary and transformative, in others, “merely” dealing with critical problems. Taken together, all the strategies add up to a synergetic whole that is revolutionary, transformative and regenerative.

The whole, the parts and the interactions of the parts, creates a world where the most egregious forms of brutal poverty are eliminated, hunger and malnutrition eradicated, health, longevity and the quality of life are improved and the environment is allowed to regenerate. Where, in short, basic human needs are met, basic human rights fulfilled, and our environmental life-support systems are strengthened.

The global and local strategies described in this book help illustrate the creativity, values, vision, and commitment of the youth and concerned citizens of the world. They also represent what an interdisciplinary, multigenerational group of non-experts can do when provided an opportunity and methodology for tackling the critical and complex problems facing the world.

Your feedback is most welcome—as is your ongoing participation in this evolving work. One way to do this is to send us your comments and suggestions by emailing us at info@designsciencelab.com. Those wishing to take part in upcoming Labs are urged to contact BigPictureSmallWorld at www.bigpicturesmallworld.com, or check in at www.designsciencelab.com.



Participants of the Design Science Lab presenting to the United Nations at the conclusion of the Lab.

APPENDIX: THE UN MILLENNIUM DEVELOPMENT GOALS

Goal #1: Eradicate extreme poverty and hunger

- Reduce by half the proportion of people living on less than a dollar a day.
- Reduce by half the proportion of people who suffer from hunger.

Goal #2: Achieve universal primary education

- Ensure that all boys and girls complete a full course of primary schooling.

Goal #3: Promote gender equality and empower women

- Eliminate gender disparity in primary and secondary education preferably by 2005, and at all levels by 2015.

Goal #4: Reduce child mortality

- Reduce by two thirds the mortality rate among children under five.

Goal #5: Improve maternal health

- Reduce by three quarters the maternal mortality ratio.

Goal #6: Combat HIV/AIDS, malaria and other diseases

- Halt and begin to reverse the spread of HIV/AIDS.
- Halt and begin to reverse the incidence of malaria and other major diseases.

Goal #7: Ensure environmental sustainability

- Integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources.
- Reduce by half the proportion of people without sustainable access to safe drinking water.
- Achieve significant improvement in lives of at least 100 million slum dwellers, by 2020.

Goal #8: Develop a global partnership for development

- Develop further an open trading and financial system that is rule-based, predictable and non-discriminatory. Includes a commitment to good governance, development and poverty reduction—nationally and internationally.
- Address the least developed countries' special needs. This includes tariff- and

quota-free access for their exports; enhanced debt relief for heavily indebted poor countries; cancellation of official bilateral debt; and more generous official development assistance for countries committed to poverty reduction.

- Address the special needs of landlocked and small island developing States.
- Deal comprehensively with developing countries' debt problems through national and international measures to make debt sustainable in the long term.
- In cooperation with the developing countries, develop decent and productive work for youth.
- In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries.
- In cooperation with the private sector, make available the benefits of new technologies—especially information and communications technologies.

ENDNOTES

INTRODUCTION: DESIGN SCIENCE LAB

- 1 For more information on the Millennium Development Goals, see <http://www.un.org/millenniumgoals/>
- 2 The 2005–2007 Labs were also put on in cooperation with the Buckminster Fuller Institute. For more information on these organizations, see: <http://www.bigpicturesmallworld.com>; <http://www.gem-ngo.org/> and <http://www.bfi.org>
- 3 *Regenerative Development* <http://www.designsciencelab.com/resources>
- 4 The description of the future was synthesized over a twenty-year period from over one thousand groups of anywhere from 30 to 250 people each in size. Each group answered the question: *What do you want the world to look like in twenty-years?* Adding the members of all the groups together resulted in over 200,000 people combining their collective expertise to answering that question.
- 5 For footnotes on each of the numbers, see: http://www.bigpicturesmallworld.com/war-peace/context_chap1.shtml

PART I: FOOD & WATER FOR ALL

Context

- 4 *The State of Food Insecurity in the World*, Food and Agriculture Organization of the UN annual hunger report, November 2005.
- 5 Elizabeth Becker, “Number of Hungry Rising, UN Report Says” *New York Times*, 12-8-04
- 6 “Stop blaming the weather,” (*The Economist*, June 10, 2002, p.13); Hunger strikes,” (*The Economist*, October 21, 2001, p. 76); “Food shortages,” (*The Economist*, October 28, 2000, p. 102)
- 7 UN FAO, AQUASTAT <http://www.fao.org/waicent/faoinfo/agricult/agl/aglw/aquastatweb/main/html/background.htm>
- 8 FAO, *Water and Food Security* (Rome, Food and Agriculture Organization of the UN, 2002) www.fao.org
- 9 *Ibid.*

Strategic Area I: Increasing Food Production/Decreasing Loss

- 10 Elizabeth Becker, “Number of Hungry Rising, UN Report Says” *New York Times*, 12-8-04
- 11 Ruskin, F.R. (Ed.). (1984). *Leucaena: Promising Forage and Tree Crop for the Tropics*. Washington, D.C.: National Academy Press
- 12 *ibid.*

- 13 It could possibly also be part of the UNDP, FAO, or UNEP.
- 14 Assuming 3.2 billion people live in urban environments and each produce one pound of organic waste/day.
- 15 The Fertilizer Institute <http://www.tfi.org/Statistics/worldfertuse.asp>
- 16 <http://www.jepsonprairieorganics.com/compostprocess.htm>
- 17 http://www.japanfs.org/db/database.cgi?cmd=dp&num=1175&dp=data_e.html
- 18 http://www.japanfs.org/db/database.cgi?cmd=dp&num=1076&dp=data_e.html
- 19 More productive as measure by total output per hectare.
- 20 Various nomenclatures are used in different parts of the world and academia to describe the core practices here referred to as regenerative farming. These include alternative, sustainable, low-input, organic, agro-ecological, ecological, and information intensive agriculture. Each name comes with its own emphasis and nuances, but all are distinct from “modern” resource intensive, mechanized and large-scale agriculture.
- 21 See for example, M. Gabel, “The Regeneration of Africa: Resources, Needs and Capacities” (Philadelphia: World Game Institute, 1985) and M. Gabel and A. Heiland, “National Implications of Resource-efficient Farming Methods for Tanzania” (Emmaus, PA: Rodale Press Inc., 1985).
- 22 See, for example, M. Gabel and A. Heiland, “National Implications of Resource-efficient Farming Methods for Tanzania,” pp. 3-4. (Emmaus, PA: Rodale Press Inc., 1985)
- 23 Quoted text from *Seven Billion Billionaires*, Sierra Club Books/University of California Press, forthcoming 2006.

Strategic Area II: Water Management

- 24 “Waterment” is a contraction of government water management and as such refers to the strategy of government-led initiatives to provide the basic human right to water to all citizens.
- 25 FAO, Water and Food Security (Rome, Food, and Agriculture Organization of the UN, 2002) www.fao.org
- 26 Developed in Kisii, Kenya, by a Dutch NGO.
- 27 UN FAO, AQUASTAT <http://www.fao.org/waicent/faoinfo/agricult/agl/aglw/aquastatweb/main/html/background.htm>
- 28 FAO, Water, and Food Security (Rome, Food and Agriculture Organization of the UN, 2002) www.fao.org

Strategic Area III: Governance

- 29 UN Millennium Campaign: <http://www.millenniumcampaign.org/site/pp.asp?c=grKVL2NLE&b=1184423>
- 30 Oxfam briefing paper 76, “A Round for Free” http://www.oxfam.org.uk/what_we_do/issues/trade/bp76_modalities_and_dumping.htm
- 31 http://www.oxfam.org.uk/what_we_do/issues/trade/bp30_cotton.htm
- 32 Oxfam briefing paper 76. “A Round for Free”
- 33 http://www.oxfam.org.uk/what_we_do/issues/trade/art_bloomer_cottsug.htm

- 34 Ibid
- 35 http://www.oxfam.org.uk/what_we_do/issues/trade/bp30_cotton.htm and CIA World Factbook
- 36 Oxfam Briefing Paper 76, “A Round for Free.” The de minimis clause allowed developed states to exempt a maximum of 5% of total agricultural output and a maximum 5% of subsidized products from a subsidy-reducing scheme known as the Amber Box. Developing states were permitted an exemption of up to 10% of agricultural output and up to 10% of subsidized products.
- 37 *Price of Peace Chart: Programs and Their Costs*, <http://www.bigpicturesmallworld.com/war-peace/programcosts.shtml>.

PART II: CLEAN ENERGY FOR ALL

Context

- 4 http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/gaye_amie.pdf
- 5 Ezzati, M., and D. M. Kammen.. “The health impacts of exposure to indoor air pollution from solid fuels in developing countries: knowledge, gaps, and data needs.” *Environmental Health Perspectives*. 2002

Strategic Area I: Local Energy Systems

- 6 Elizabeth Becker, “Number of Hungry Rising, UN Report Says” *New York Times*, 12-8-04
- 7 J. M. Donelan, et. al., “Biomechanical Energy Harvesting: Generating Electricity During Walking with Minimal User Effort,” *Science*, Vol. 319, 2-8-2008 p. 807-809.
- 8 <http://news.bbc.co.uk/2/hi/technology/7226968.stm>
- 9 <http://blog.wired.com/wiredscience/2008/02/knee-brace-harv.html>
- 10 <http://www.potenco.com/whats-new/>
- 11 <http://www.potenco.com/products.html>
- 12 <http://blog.wired.com/gadgets/2007/09/potencos-yo-yo-.html>
- 13 <http://www.cnn.com/2005/TECH/09/09/backpack.power/>
- 14 International Development Research Center “101 Technologies From The South, For The South” 1992
- 15 Ibid
- 16 EnterpriseWorks/VITA - Gyapa Charcoal and Wood Stoves Shell Foundation - *Energy for Sustainable Development Journal*

Strategic Area II: Regional Energy Systems

- 17 Each Motorwind turbine unit prices at \$100/unit
- 18 Serengeti Genesis www.serengetigenesis.org
African Wind Energy Association t

- Sustainable Africa www.sustainable.org.za
- 19 As measured in wind tunnel tests by Microwind
 - 20 Total electricity consumption is 1.199 billion kWh in 2008 (*2008 CIA World Factbook*)
 - 21 Population Council. "Population." Asia:India. 2008. [3 August 2008] <<http://www.popcouncil.org/asia/india.html>>.
 - 22 BP p.l.c. BP Statistical Review of World Energy 2008. Beacon Press, 2008. Pg. 2
 - 23 Ibid, 3.
 - 24 International Energy Agency. "Share of Total Primary Energy Supply in 2005." 2007. [3 August 2008]
 - 25 Ibid, 35
 - 26 Ibid, 40.
 - 27 International Energy Agency. "2005 Energy Balances for India." 2007. [3 August 2008]
 - 28 The Union of Concerned Scientists. "Environmental Impacts of Coal Power: Air Pollution." 2005. [3 August 2008]
 - 29 India Energy: http://www.kpmg.co.il/Events/india/conference/thought%20leadership/IndiaEnergy_07.pdf
Gulf of Kutch Tidal Range <http://books.google.com/books?id=hUkFUPp9pWoC&pg=PA6&lpg=PA6&dq=tidal+range+arabian+sea&source=web&ots=>
 - 30 New York Tidal Project <http://www.reuk.co.uk/New-York-Tidal-Power-Project.htm>
 - 31 Verdant Power Inc. "The RITE Project." 2008. [29 August 2008] <<http://www.verdantpower.com/what-initiative>>.
 - 32 Coal power plants produce electricity for about 5¢ to 8¢ per kWh. This cost will go up considerably when carbon has a cost associated with it and coal plants have to pay for dumping it into the atmosphere.

Strategic Area III: Global Energy Systems

- 33 "Reforming Energy Subsidies: An Explanatory Summary of the Issues and Challenges in Removing or Modifying Subsidies on Energy That Undermine the Pursuit of Sustainable Development" UN
- 34 <http://ttclear.unfccc.int/ttclear/jsp/index.jsp>
- 35 "How Have Feed in Tariffs Affected Renewable Energy Production in Germany?" <http://www.colby.edu/personal/t/thtieten/Nair.htm>
- 36 In 2007 Exxon/Mobil reported that it beat its own record for the highest profits ever recorded by any company, with net income rising 3 percent, to \$40.6 billion in 2007. If the Global Energy Corps taxed just the top ten petroleum refining corporations .001% of their profits, the Global Energy Corps would receive \$84,361,000 to fund its global renewable energy job training projects. <http://www.nytimes.com/2008/02/02/business/02oil.html>

PART III: EDUCATION FOR ALL FOR LIFE

Context

- 4 Details of this strategy can be found at <http://www.dslnc.bigpicturesmallworld.com>
- 5 Further details of this strategy can be found at <http://www.dslnc.bigpicturesmallworld.com>
- 6 <http://www.Firstmilesolutions.com>

Strategies 1–6

- 7 Further details of this strategy can be found at <http://www.dslnc.bigpicturesmallworld.com>
- 8 These figures are close to those obtained by UNICEF in their “minimum global estimate” of \$9.1 billion
- 9 Literacy correlates with cereal yields: 0.653; literacy with GNP/capita: 0.584; literacy with calorie consumption: 0.672. Correlations were done in the software program Global Data Manager. Literacy rate is from Central Intelligence Agency, *World Factbook 1989* (Washington, D.C.: CIA, 1989). GNP/capita is from The World Bank, pp. 178-179.; cereal yield is from World Resources Institute, pp. 278-279.; calorie consumption is from FAO, pp. 291-292; infant mortality and life expectancy are from *World Population Data Sheet 1990*. Also see The World Bank, *The Contributions of Education to Economic Growth: International Comparisons*. World Bank Reprint Series, No. 320 (Washington, D.C.: The World Bank, 1985), where it is pointed out that four years of primary education is associated with an average increase in farm productivity of 10% or more.
- 10 “Income by educational attainment,” (*The Economist*, June 23, 2001, p. 104).
- 11 “Returns to education,” (*The Economist*, November 2, 2002, p. 96).
- 12 Literacy with infant mortality: -0.815 ; literacy with life expectancy: 0.822. Correlations were done in the software program Global Data Manager. On average, each additional year of schooling is associated with a decrease in infant mortality rate of approximately nine per 1,000; K. Hinchliffe, *The Monetary and Non-Monetary Returns to Education in Africa*. The World Bank Education and Training Series, Report EDT46 (Washington, D.C.: The World Bank, 1986).
- 13 “No school, no future,” (*The Economist*, March 27, 1999, p. 45).
- 14 Center for Defense Information, <http://www.cdi.org/issues/aviation/B296.html>
- 15 *State of the World 2004*, (Washington D.C., Worldwatch Institute, 2004 p. 163).

PART IV: GLOBAL HEALTH FOR ALL

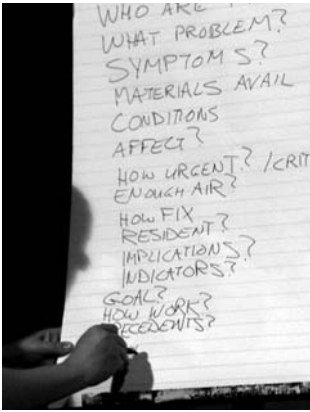
Strategies

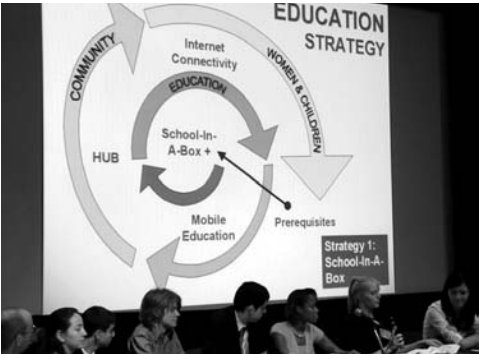
- 1 Dr. Sugata Mitra, NIIT, World Bank
- 2 74 of 1,000 children die during infancy (one of the highest rates of infant mortality in the world).
- 3 By 2011, the bottled water supply to Singapore from the Malaysian government will be cut off if a price for bottled water is not agreed upon. Singapore is actively looking for alternative suppliers.
- 4 World's Largest Urban Areas [Ranked by Urban Area Population] http://www.mongabay.com/cities_urban_01.htm
- 5 Based on a prototype facility built in Georgia, USA
- 6 Malaria Facts. National Center for Infectious Diseases, Division of Parasitic Diseases. Atlanta: Center for Disease Control and Prevention, 2004. 26 June-July 2006.
<http://www.cdc.gov/Malaria/facts.htm>
- 7 "Malaria in Africa." Roll Back Malaria. Roll Back Malaria, WHO. 26 June-July 2006. <http://www.rbm.who.int/cmc_upload/0/000/015/370/RBMInfosheet_3.htm>.
- 8 "Economic Costs of Malaria." Roll Back Malaria. Roll Back Malaria, WHO. 26 June-July 2006 <http://www.rbm.who.int/cmc_upload/0/000/015/363/RBMInfosheet_10.htm>.
- 9 *ibid*
- 10 *ibid*
- 11 The SC Johnson Company has been a producer of a commercial aerosol insecticide, Raid, since 1956. The active ingredient of this Raid is the natural insecticide pyrethrum.
- 12 Average size of small farm is 3 to 4 hectares, therefore 22,000 pumps are needed for 66,000 hectares; Each micro-pump costs \$100, therefore total cost is \$2.2 million

















ABOUT MEDARD GABEL

Medard Gabel is CEO of BigPictureSmallWorld and BigPicture Consulting, and the executive director of Pacem in Terris. He is the author of six previous books on the global energy situation (*Energy, Earth and Everyone*, Anchor Press/Doubleday), the global food situation (*Ho-Ping: Food for Everyone*, Anchor Press/Doubleday), the U.S. food system (*Empty Breadbasket*, Rodale Press), multinational corporations (*Global Inc.: An Atlas of the Multinational Corporation*, The New Press), strategic planning (*Environmental Design Science Primer*) and the global predicament and prospects (*Nine Billion Billionaires*, forthcoming).

Mr. Gabel has designed, developed, and delivered hundreds of experiential educational programs for corporate, government and academic clients around the world including Motorola, IBM, General Motors, Novartis, Chase Manhattan Bank, the United Nations and the U.S. Congress. He is the former executive director of the World Game Institute, a UN-affiliated NGO, where he developed the World Game™ global simulation, the Internet-based global simulation NetWorld Game, the socioeconomic database of global statistics Global Data Manager™, the interactive atlas and encyclopedia of world problems Global Recall, and other products. One of his recent projects is the UN Earth Dashboard, a 10 meter by 2.5 meter high-definition video wall on which will be displayed the world's vital indicators.

He worked with Buckminster Fuller for 12 years where he learned the power and utility of whole-systems thinking, global perspectives and a good sense of humor. The Design Science/Global Solutions Lab is the integration of all he has learned from all his teachers—especially those listed in this book.

Mr. Gabel lives in Media, Pennsylvania, with his wife, Mary, and his two children, Tobias and Zoe.