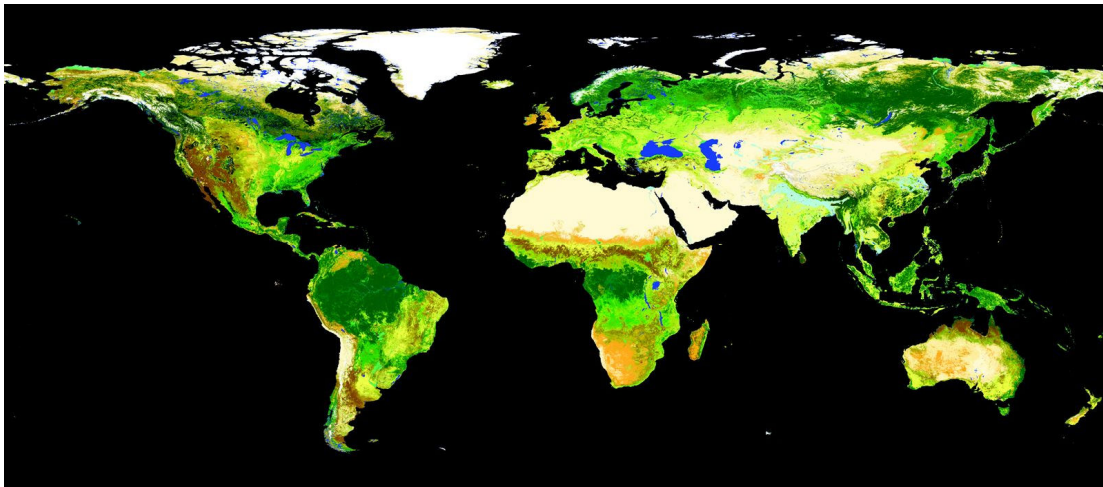# World Resources Simulation Center

## Proposal



*How do we make the world work for 100% of humanity
in the shortest possible time through spontaneous cooperation
without ecological damage or disadvantage to anyone?*
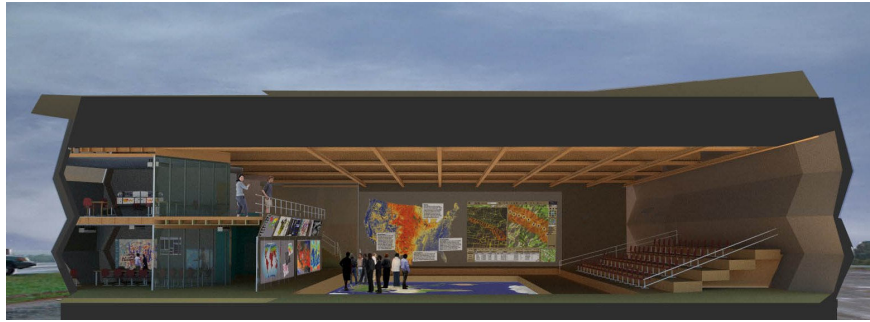
**-R. Buckminster Fuller**

March 2010

For Your Personal Review
Not for Distribution

# Table of Contents

# 1.0 Executive Summary



The World Resources Simulation Center (WRSC) is a non-profit immersive visualization and simu-lation facility. With access to world resource inventory statistics, it is designed for world leaders and decision makers to experience deeply the interconnected nature of Earth's living and non-living systems and understand the systemic problems and opportunities facing humanity. With the urgency of a 'command-and-control' center, the WRSC provides global leaders a unique resource for collaborating efficiently with others from business, governments, universities and NGOs for optimal outcomes for everyone. Using the latest in visualization and simulation technologies, users can experiment easily with a range of scenarios, creatively design answers to problems and find new commercial opportunities. The WRSC allows decision makers to decide quickly on policies, strategies and plans for making informed and sustainable choices benefiting humanity as a whole.

The issues that assault us daily are individual expressions of complex, interconnected geophysical, economic and social / cultural conditions. The complexity of these interrelationships demands that we deal with multiple issues simultaneously. Cutting edge visualization and simulation technologies along with geographic information system (GIS) technology, mapping software and other technologies provide a much needed multi-dimensional view not previously available. Through collaborative design processes, users give meaning to what they discover at the WRSC. A paradigm shift can result that inspires breakthrough solutions to global and local problems. This is precisely the role of the World Resource Simulation Center.
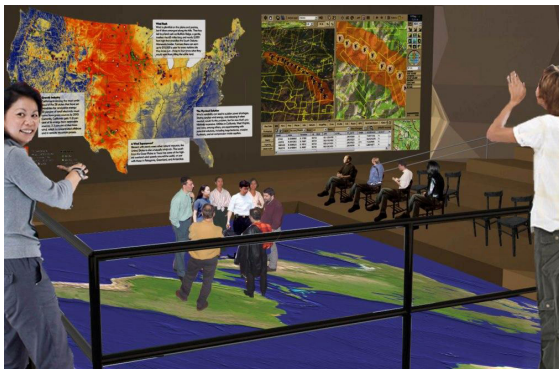


Artist Renderings of the World Resources Simulation Center

The WRSC creation will be led by Peter Meisen, Founder of Global Energy Network Institute (GENI). Additional members of the start-up team will be Josh Arnow, Michael Ben-Eli, Kirk Bergstrom, Bonnie Devarco, Ashley Gardner, and Joe Sterling. All members of the start-up team possess extensive experience in their chosen fields. (For more detailed biographical information, please refer to 6.0 Start-up Team Summary.)

To achieve our objectives, the WRSC is developing in a phased approached. Our first phases are intended to build support and partnerships, including

the creation of an ongoing demonstration facility. These phases will culminate in pledged investment of approximately $8,000,000 in total funding for the creation and initial operating budget of the Center.

## *Development Stages*

**Phase I Development individual partnerships**
➢ Engage individual partners in the WRSC vision, developing core support from current contacts and referrals.
➢ Secure initial funding from supporters for travel, materials costs and demonstration conference.
➢ Refine business plan and supporting documents with feedback from partners and advisors.
➢ June 12-13, 2009 - Plan and host the "Designing the WRSC Prototype – A Roundtable Event" for key supporters and partners, utilizing visualization technology, eliciting feedback and critique in preparation of Phase II.

**Phase II Development Institutional Partnerships  (Current Phase)**
➢ Meet and gain support from key institutional partners: research institutes, universities, government agencies and aligned corporations.
  Example commitments:
  - Exchanges of information, technical data, researchers, experts, bandwidth and storage space
  - Cooperative research projects and ongoing communication
  - Joint venture agreements with contributions of equipment, expertise, data and technology
  - Future joint projects and funding
➢ Secure letters of endorsement and usage interest for the Center.
➢ Secure collaborative partnerships for data acquisition, software and technology.
➢ Define and conduct feasibility studies based on user responses.
➢ Develop facility partner and refine architectural requirements.
➢ Refine business model and financial requirements based on partner support, facility sighting, available technology and collaboration agreements.
➢ Build Advisory Board from key supporters and institutional partners.
➢ Seek Foundation grants and contact major funders with WRSC proposal.

**Phase III – Ongoing Demonstration Facility**
➢ Obtain funding of $275,000 to create and staff a smaller scale version of the Center using off-the-shelf technology of projectors and computers, utilizing a donated or highly discounted available flexspace or warehouse as a two year ongoing demonstration of the capabilities of the fully funded WRSC.
➢ Make available GENI's current budget of approximately $240,000 and personnel to the Ongoing Demonstration facility.
➢ Gain technological know-how and host smaller scale collaborative events to test and further refine the processes of the Center.
➢ Lay the groundwork for gaining more institutional and corporate partners and total funding for the full scale Center in Phase IV.

**Phase IV – Secure Funding**
➤ Fully fund the Center with $8 million for the creation and operating budget from lead funders: angel investors, high-net worth donors, foundations and businesses

**Start up - Facility Preparation**
➤ Sighting, architectural design and development of Center with facility partner in a donated or leased building.
➤ Staffing and personnel recruitment
➤ Center construction and hardware testing
➤ Center inauguration

The phases presented here are intended to serve as a broad outline of the full development of the WRSC. An internal, comprehensive project map will be available for review, including detailed development, marketing and public relations campaigns, plus budgeting requirements throughout the phases and into the operational period of the Center.

## *Mission Objectives*

The overarching objective of the WRSC is to provide a central location for world leaders, businesses and students to conduct thoughtful, comprehensive planning and design solutions for the world's myriad challenges. Ultimately these solutions will benefit 100% of humanity. In the shorter term, the greatest beneficiaries will be the 1.6 billion people in the world who have no electricity, potable water or basic health care. The ability of the WRSC to visualize development options, using best practices, will accelerate sustainable development to millions who live on the economic edge. Comparing successful development trends and projections will enable governments and business leaders to make informed policies and investments that elevate the quality of life for all their citizens.

Since the WRSC core mission is to accelerate sustainable development globally, we also anticipate an accelerated shift to jobs in the renewable energy and clean tech sectors. In the energy case, businesses that lead the shift to low-carbon power and transportation will benefit from the visualization and comparative analysis at the WRSC.

## *Center Location within Existing Structure*

The WRSC location will be dependent on investor and partnership requirements, with an estimated need of approximately 20,000 square feet. Our plan incorporates an existing structure, and will not require additional or new construction. However, Center locations to be considered will utilize or have the ability to be retrofitted to LEED-EB (Leadership in Energy and

Environmental Design Green Building Rating System – Existing Building) standards. A Center devoted to the sustainable usage of resources must, at a minimum, utilize such green practices as water conservation, efficient heating and cooling, and attain some of its power requirements from alternative energy sources. In a partnership scenario, a university or business campus facility location would be utilized. These variables may alter significantly the start-up expenses related to Facility and Rent expenditures.

# 2.0 World Resources Simulation Center Introduction

The World Resources Simulation Center (WRSC) is a large format, immersive visualization and simulation facility that compiles an inventory of world resources, analyzes and assesses historical and projected trends, and studies best practices and solutions to current and anticipated problems. It provides global leaders from business, governments at all levels, education and NGOs a resource for cooperation and collaboration to make informed and sustainable choices for humanity as a whole in the shortest possible time.



The WRSC takes advantage of current and evolving technologies which allow us to gather and turn data into accessible information, layered and displayed as 4-D map projections. This gives users the ability to conduct geospatial analysis, and to explore, visualize and create optimal scenarios that add insight and certainty to decision making. This visualization and simulation infrastructure provides access to in-depth, networked, globally distributed data on world resources, global trends and conditions.

> The philosophical foundation for **The World Resources Simulation Center** is in its founding premise posed as a question in R. Buckminster Fuller's World Game™:
>
> *"How do we make the world work for 100% of humanity*
> *in the shortest possible time through spontaneous cooperation*
> *without ecological damage or disadvantage to anyone?"*

## *Major Functions*

- Resource assessment
- Visualization and simulation to facilitate informed decision making
- Long range forecasting and trend analysis
- Education for students as well as decision makers in business and governments

## *The Center*

The WRSC utilizes dynamic, state-of-the-art, 4-D visual displays to bring to life layers of complex datasets on natural, physical and human resources, making scientific data comprehensible to and usable by decision makers.

The largest of these displays is a room-sized map interconnected with the world's digital knowledge archives.
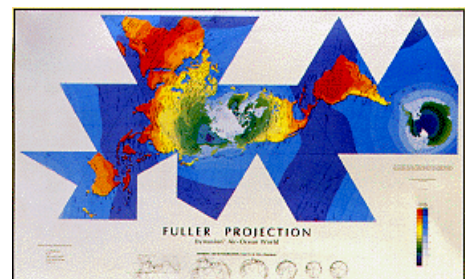
The WRSC will use the Dymaxion map, because it is the most accurate display of the planet without visible distortion of relative shapes and sizes of the land and sea areas and without breaks in the continental contours. On the map are displayed resource trends over time for long range trend analysis on major issues.

*"Walking around on the Dymaxion 'Big Map' of Buckminster Fuller*
*is the best experience of the Earth I have had since returning from the moon."*
Buzz Aldrin, second astronaut to walk on the moon

Participants have the ability to layer trend information on multiple issues to see and understand causal relationships amongst seemingly unconnected conditions when viewed separately. Using high bandwidth technologies, a growing network of internet mapping software, database content with advanced capabilities to link GIS tools and applications, information can also be stored and transmitted simultaneously to universities and others centers for critical review.



Dozens of networked computer terminals and interactive visual displays on large-scale plasma screens are linked to a variety of work and meeting areas. The impression is of a "command-and-control" environment. It is. In this case, it is used for peaceful and sustainable purposes.

Using gaming technologies as well as forecasting and scenario modeling tools, participants collaborate on strategies to find new insights and optimal solutions for a sustainable future from a perspective of global and regional solutions.

## *Capabilities*

1. 4-D visual display of high resolution information to large groups
2. Integration of environmental resource and geographic data from satellite images into decision-making processes
3. Large-scale planning and development that is environmentally sustainable
4. Market demand and resource forecasting
5. Facilitated gaming and scenario planning for entire cultures, communities, and region

## *User Advantages and Possibilities*

*"Our greatest problem is the educational problem*
*of getting man to realize what his problems are*
*and what the most effective priorities may be for solving them."*
**-R. Buckminster Fuller**

While it is true that much of the information that will be displayed at the WRSC is accessible to individuals on the Web, it is important to appreciate that there is a wholly new dynamic that occurs when leaders and decision makers gather to consider issues and make decisions in a defined context. The WRSC context is that of finding solutions to our global challenges that work for everyone, quickly, while minimizing our environmental impact on global systems.

**What is unique and powerful about the WRSC are the large scale visualization and scenario simulations, in person interactive discussions, the group discovery process and the face-to-face research.**



Insights are gained; new levels of understanding are available when bright minds have access to new ways of *experiencing* complex data and are creatively guided through vision, strategy and problem solving discussions in the context of workability for all. Multiple implications of decisions can be simulated and explored in the moment. "What ifs" can be examined until the optimal solution is reached.

In his 1998 speech introducing "Digital Earth," Al Gore quoted several examples of using tools such as applications of GIS and sensor data:

> "**Conducting virtual diplomacy:** To support the Bosnia peace negotiations, the Pentagon developed a virtual-reality landscape that allowed the negotiators to take a simulated aerial tour of the proposed borders. At one point in the negotiations, the Serbian President agreed to a wider corridor between Sarajevo and the Muslim enclave of Gorazde, after he saw that mountains made a narrow corridor impractical.



> **Preserving biodiversity:** Planning agencies in the Camp Pendleton, California region predict that population will grow from 1.1 million in 1990 to 1.6 million in 2010. This region contains over 200 plants and animals that are listed by federal or state agencies as endangered, threatened, or rare. By collecting information on terrain, soil type, annual rainfall, vegetation, land use, and ownership, scientists modeled the impact on biodiversity of different regional growth plans.

> **Predicting climate change:** One of the significant unknowns in modeling climate change is the global rate of deforestation. By analyzing satellite imagery, researchers at the University of New Hampshire, working with colleagues in Brazil, are able to monitor changes in land cover and thus determine the rate and location of deforestation in the Amazon. This technique is now being extended to other forested areas in the world.

> **Increasing agricultural productivity:** Farmers are already beginning to use satellite imagery and Global Positioning Systems for early detection of diseases and pests, and to target the application of pesticides, fertilizer and water to those parts of their fields that need it the most. This is known as precision farming, or 'farming by the inch.'"

At that time, Vice President Gore said, "We have an unparalleled opportunity to turn a flood of raw data into understandable information about our society and our planet. This data will include not only high-resolution satellite imagery of the planet, digital maps, and economic, social, and

demographic information. It will have broad societal and commercial benefits in areas such as education, decision-making for a sustainable future, land-use planning, agricultural, and crisis management."

From Al Gore speech "The Digital Earth," 1998

And there is another aspect. The WRSC is about having vast amounts of data presented visually in a way that allows us collectively to see our world in the most scientifically accurate way. Just as seeing Earth from outer space for the first time shifted forever our experience of planet Earth, so seeing multiple streams of resource information layered and presented in the context of benefit-to-all will shift forever how leaders approach the decisions they make.

There needs to be a place, a Center, where that conversation resides. Leaders can revisit to reinforce their new level of insight and understanding, their grasp of a newly realized causal reality and continue to learn at deeper levels. The WRSC is a place where they can send others: "You have to see for yourself what I have discovered."

*"You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete."*
**-R. Buckminster Fuller**

Some users may find business opportunities in observing changing world conditions in an evolving and shared marketplace. Fellow participants may collaboratively develop new artifacts and prototypes. Policy makers can test best-practice scenarios for their respective and some-times highly dissimilar environments. After leaving, users can also collaborate remotely, through internet based tools, to address complex questions, seek optimal solutions on an on-going basis, and revisit the source of their new vision for support.

## Methods and Technologies

1. ***Resource Inventories*** are developed mainly by accessing existing datasets from the United Nations, World Bank, World Resource Institute, numerous universities and many other multi-lateral organizations and NGOs.
2. ***Resource Trends*** through time are plotted using compilation, simulation and visualization of data.
3. ***Resource Strategies*** are studied taking synergies into account.
4. ***Resource Scenarios*** are proposed, again taking into account synergy amongst inventories, trends and researchers' experience.

Working with resource inventories, trends, strategies and scenarios, the WRSC becomes a hub for partnering with other like-minded people as well as antagonists who need an environment in which to explore workable solutions jointly and peaceably**. In this environment, politics, prejudice, war and ignorance are not options when proposing strategies and solutions.**

The WRSC recognizes that every solution to a current problem situation has a consequence (actions cause reactions), and that all unintended and unanticipated consequences must be considered as part of any solution. The visual displays, interactivity and simulation technologies

demonstrate long term, future scenarios to those engaged in these strategic development processes. With this approach, strategies based on design and tested through simulation find a path to action and implementation . . . **a future by intentional design!**

The following list (taken from The Fifth International Symposium on Digital Earth, Call for presentations, Jun 5-9, 2007) represents the vast array of technologies that have advanced rapidly over recent decades, making the proposal for the WRSC a potential reality today. As appropriate, these technologies will be incorporated to facilitate the vision of a sustainable future:

- Virtual Globes
- Semantic operations
- Mobile mapping from land-based, airborne platforms
- Interoperability
- Internet services
- Grid computing
- Language interoperability
- Remote Sensing
- Web-based GIS and Information sharing
- Data mining and AI
- Data fusion and integration algorithms
- 3D rendering
- Multidimensional (3D and 4D) spatial data modeling and data quality
- Database building
- Visualization and numerical simulation
- Fuzzy logic
- Knowledge systems for browsing and analysis
- Search engines and Spiders
- Semantic-based engines and translators for search and analysis
- Visualization and imaging
- Wireless, mobile computing
- Standards
- Taxonomies
- Location based services (LBS)
- RFID and GPS
- Maintenance of historical data
- User interfaces
- SDI, NSDI, ISO, and OGC
- Open System Economies
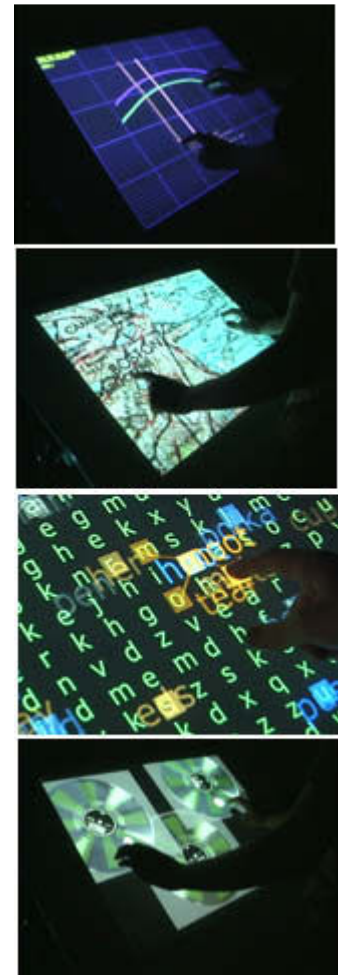
> *"Only by means of* **'comprehensive anticipatory design science'**
> *could the world's resources be fairly distributed among all people,*
> *and the need for war made obsolete."* Excerpt from BuckyWorks, Jay Baldwin

## Usage Groups

> **Policy-makers** and their advisers who plan infrastructure development in the region

Example: Climate change is altering weather patterns over the continents. Some areas are receiving more rain and others are experiencing drought conditions. Regional water planners could use the WRSC to visualize the entire water basin, the region's existing water storage capacity and yearly usage. They could then simulate future scenarios that would enable the region to meet their water needs--using a combination of conservation, additional storage capacity, recycling, desalination or additional imports.



Another example: Wangari Maathai, Nobel Peace Prize winner from Kenya, has said that much of the country's water supply and electricity is derived from the rivers emanating from mountain forests. The Green Belt Movement (GBM), which she created to employ mainly women to plant trees, is seeking to protect and rehabilitate these forests. GIS technology, one of the technologies that would be used in the WRSC, is helping to show the effects of deforestation over time and to delineate areas in need of tree planting. She explained that the visualization capabilities of GIS technology have enabled government leaders to see clearly where the forests need restoration and to provide for that work.

> **Businesses** who want to visualize potential markets and technology penetration

Example: A cell phone manufacturer wants to expand into a new international market. The WRSC could visualize the existing wireless service in that market and show the numbers of potential customers who remain un-served. By mapping demand, installed cell towers, and domestic economic factors, a company could make more informed decisions on expanding into that marketplace and also understand the consequences of their market approach.

> **Students/interns** engaged in global studies and academics doing research, especially on sustainability issues

Example: A class studying global conflicts and cooperation could get a visual overview of current global conflicts. They could drill in (as with Google Earth technology) to see specific details of lives affected, refugees, military strengths. History and key players could be visualized and better understood. The WRSC could help students see all the stakeholders and come up with plans to mollify existing civil wars and mitigate problems before they arise.



> **Conference Venue**. The WRSC would be an ideal location for conferences for business groups, trade associations, NGOs, global, national or local in scope. Companies or common interest stakeholders could also hold small sessions, events, focus groups or receptions at the Center. Possible examples could be:

- UNEP – United Nations Environment Program
- US Conference of Mayors-Climate Protection Summit
- ACORE – American Council on Renewable Energy
- CERES – California Environmental Resources Evaluation    System

- Chambers of Commerce
- SANDAG (San Diego Association of Governments)

Could the visualization of water use in Oregon and California have shown earlier that diversion of rivers in Northern California for farming and cities would lead to the collapse of the salmon fishery? The WRSC can visualize problems that frequently lead to discoveries of unintended consequences or benefits.

The WRSC could host key sessions of a conference for organizations planning large meetings at other venues, such as hotels or a convention center. These types of events expand the exposure and income for sponsors of the WRSC – whether it be universities, businesses or government agencies – plus tourist dollars to the community, all ways to attract significant money.


## WRSC Prototype Design Event

In early June 2009, we brought together 50 leaders in GIS mapping and comprehensive thinking to test out the concept and process of collaborative decision-making on global issues in an immersive visual environment.



For our prototype design event, we used projectors and laminated maps to imitate the digitized, high tech interior of the WRSC. In three simulations over two days, we examined issues of; population and demographics, energy and climate, water and sanitation, and oceans and fisheries on the global, national and regional levels, pushing our experts to find and present the best visual data and analysis on these topics.

What we discovered was that an abundance of information about both the state of our planet and the solutions for solving global issues already exists and that it is accessible with a laptop and an Internet connection. The further good news is that there are numerous smart people and organizations doing critical work in planning a sustainable future.



However, we quickly determined that in just the few topics we examined, although all are interconnected in cause and consequence, the data exists within silos of narrow specialties. We also learned that much research and data is needed to both visualize the trends and issues of where we are and to project the best solutions going forward. Seeing first hand that we are facing a multitude of impending crises that are not adequately being addressed underscored the urgent need for the WRSC.

Something else happened in the space of these two days.

Working together, people who were strangers at breakfast began to collaborate, discuss and cooperate as they searched for solutions. "Ah-ha" moments occurred, as attendees listened to experts in other fields and experienced the information visually. Surrounded by visual data on large screens served at first to overwhelm the senses and then to awe, as the magnitude of the crises we face now became proportional to its image onscreen.

Friendships were forged across fields of specialty. Entrepreneurs interacted with geographers and each brought new insights and ideas into the solution process. Many of the participants at the design event are now partners in the process of bringing the WRSC into reality. Most importantly, in bringing us all together under one roof, we experienced the importance of face-to-face interaction in the processes of collaboration and cooperation.
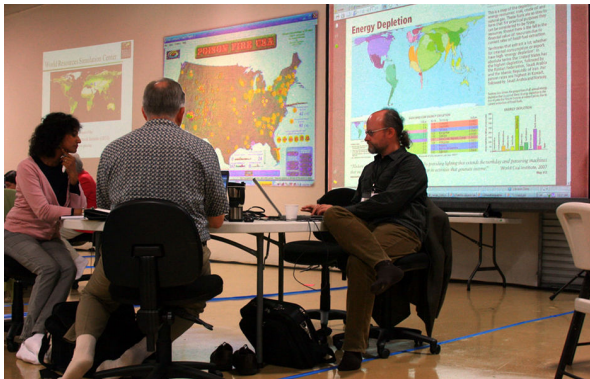
In just two days, we were not able to solve, nor did we attempt to solve any of the issues we tackled. We were able to prove that the concept of a World Resources Simulation Center dedicated to solving global issues will not only work, but is urgently needed.

For More information on our Prototype Design Event please visit www.wrsc.org and click on Prototype Design Event.

# 3.0 Global Need for the WRSC

For decades, world leaders, environmentalists, scientists and concerned citizens have attended thousands of conferences, seen countless, impressive presentations on the world's many challenges and heard the proposals to solve them. Clearly, there is no scarcity of thoughtful, knowledgeable, committed people working to make the world a better place.

Yet, in reviewing these PowerPoint slides, maps, charts and documentaries over the years, something has been missing. We are struck by the multiplicity of issues and trends -- climate change, deforestation, fishery and aquifer depletion, topsoil erosion, coral bleaching, population growth, disease migration, hunger and poverty. So many of these issues are interrelated, and we yearn for a way to "see" them presented with a view on the whole in the most comprehensive manner.

The conference format itself has a fundamental shortcoming. Smart people convene for a few days, show their latest work and then go home. We ask, where is that place where we can all meet for an extended time to analyze these issues, propose strategies and test implications? Where is the neutral ground, equipped with the latest, most sophisticated technology and the urgency to address peacefully the interrelated, interdependent, global issues of our times? Large scale simulation and visualization tools now allow us to layer information on multiple issues and test best practices. Using these tools, business leaders and policy-makers could foretell outcomes of their decisions and thus make better decisions affecting the whole.

**As of 2009, the world is far from providing for the well being of 100% of humanity.**

Consider these current conditions:

> Over 3 billion people, 45% of the world's total population, earn less than $2/day. [1]

> 1.5 billion lack access to safe drinking water. [2]

> 2.6 million lack basic sanitation. [3]

> **The global water crisis is the leading cause of death and disease in the world**.  The estimates vary, but under these conditions, each year worldwide about 3.1 million adults and children under the age of 5 die from water-related illnesses, such as diarrhea and malaria. [4]

> At the same time, 6 million children under the age of 5 die annually from hunger.

> With global climate change, caused by increasing levels of fossil fuel-generated $CO_2$ emissions, we are seeing a rise in sea levels, an increase in extreme temperatures, more
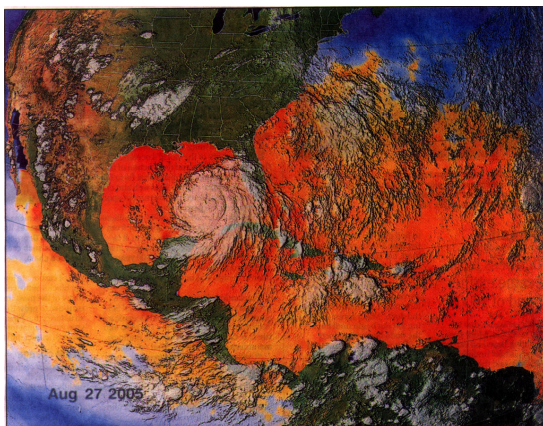


Warm ocean temperatures, in dark orange, strengthened Hurricane Katrina.

violent storms and devastating droughts and the spread of diseases which destroy food production and human habitability in many regions.

➢ Compounding these already inadequate conditions, population growth will add another 2-3 billion people by mid-century, from the current approximate 6.5 billion to about 9 billion people, with almost all of this growth in developing nations where the greatest deficiencies already exist today.

➢ Today, 25% of humanity has no access to electricity and another third has only limited access.

➢ By 2050, global energy consumption is projected to double.[5]
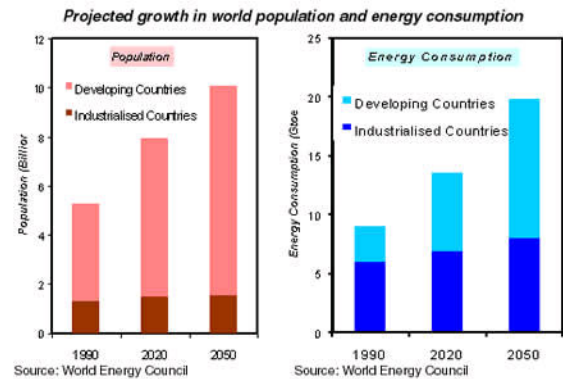


The rich nations live well, consuming most of the world resources, while the poor nations struggle daily just to survive. This chart shows per capita energy consumption for several countries. Note that total energy consumption is higher in the cold countries which have a more comfortable lifestyle than in the countries located in mid-latitudes but also with the same comfortable lifestyle. Especially noticeable is that countries with a poor lifestyle consume only a small amount of energy.
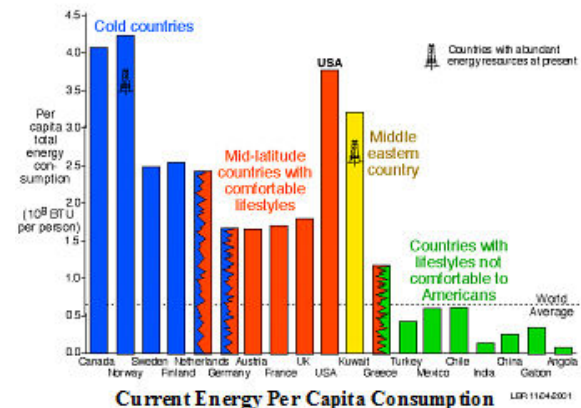


## *Interconnection of Environmental Issues*

Newspaper headlines around the world bombard us daily with problems: hurricane Katrina, melting glaciers, crop devastation, blackouts, regional conflicts, refugees, water shortages, and the list goes on. Most often these are treated as isolated events. Around the globe, prestigious, well-funded, sophisticated, cutting-edge organizations and institutes are studying these issues, gathering and publishing data, and solving problems. **What is missing is a comprehensive perspective from which to observe these conditions**.

"**Synergy**: the behavior of whole systems unpredicted by behaviors of any of the components . . . taken separately from the whole."

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In fact, the issues that assault us daily are individual expressions of a complex, inter-connected geophysical, economic and social/ cultural condition. **The complexity of these inter-relationships demands that we deal with multiple issues simultaneously. This is precisely the role of the WRSC**. Here, participants view and analyze issues as discrete events and then further research and analyze them for the interconnections, especially causal connections, amongst them, from the point of view:

There is no "it can't be done." We don't know that until we've tried. We do know that ephmeralization, doing more with less, has enabled 2 billion people to live very well. Our challenge is to extend quality of life to all in a sustainable manner.

Following are the major global issues and their multiple aspects (only a partial list) that will be addressed at the WRSC:

➢ **Population**
  - Population growth vs. resources
  - Women/girls as second class   citizens
  - Human rights
  - Education/Illiteracy
  - Refugees and migration
  - Regional conflicts and wars (often over resources)

> "As we know, women are the center of the development process.  When they are empowered, these are the results:
>   - Faster economic growth
>   - Less corruption in governance
>   - Better childhood nutrition
>   - Lower child mortality
>   - Increased agricultural production
>   - More children in school, including girls
>   - Reduced health hazards
>   - Greatly improved overall health and wellbeing of society
>                              -The Hunger Project, September, 2004

➢ **Shelter**
  - Housing: Mega-cities and Urbanization
  - Lack of housing, especially in Africa
  - Increase of waste with urbanization
  - Terrorism, mass destruction of shelter

➢ **Food supply**
  - Grain production: measure of adequacy of food supply
  - Hunger and poverty (food production and distribution)
  - Changing agricultural regions due to climate change
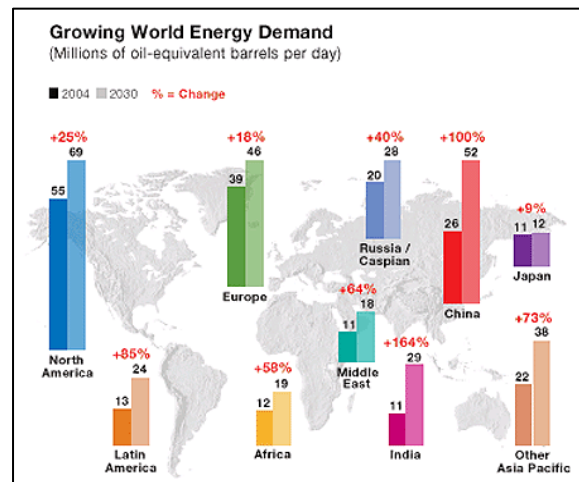  - Aquifer depletion (water for irrigation of crops as well as for drinking)

➢ **Energy (sources & utilization)** [6]
  - Production, distribution and consumption of oil, natural gas and coal
  - Global climate change from the burning of fossil fuels
  - Development of renewable energy (solar, wind, ocean, geothermal, hydro, biomass)
  - Solar power technologies and growth rates
  - Wind generating capacity
  - Bicycle production and use Nuclear energy and its impact on weapons' proliferation
  - High voltage transmission grids



Growing World Energy Demand
(Millions of oil-equivalent barrels per day)
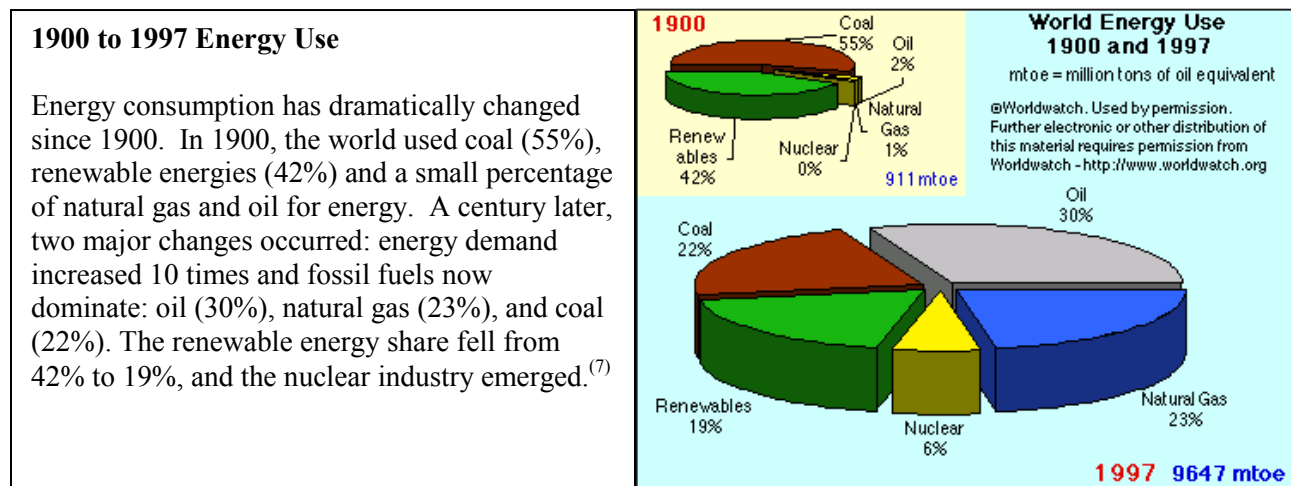
The world energy demand will increase everywhere during the next 30 years, especially in the poorer countries

➢ **Health – Environmental: "pollution"**
- Drinking water safety
- **Water scarcity: the most underrated resource issue facing the world toda**y
- World fish catch: measures productivity and health of the oceanic ecosystem
- Loss of fisheries
- Disease control (AIDS, malaria, polio, measles, etc)
- Pollution (air, water, land: toxins, chemicals and nuclear waste)
- Species loss (loss of genetic resources or biological diversity, i.e. biodiversity)
- Global temperature change: measure of our global health and well-being
- Melting ice & glaciers: effects on rising global temperature & weather patterns
- Carbon emissions: the atmospheric concentration of $CO_2$ changes the earth's temperature
- Ozone layer loss (and recovery)

**1900 to 1997 Energy Use**

Energy consumption has dramatically changed since 1900. In 1900, the world used coal (55%), renewable energies (42%) and a small percentage of natural gas and oil for energy. A century later, two major changes occurred: energy demand increased 10 times and fossil fuels now dominate: oil (30%), natural gas (23%), and coal (22%). The renewable energy share fell from 42% to 19%, and the nuclear industry emerged.[7]



➢ **Resources (location) – land, atmosphere, ocean**
- Forest Cover: loss is indicator of changes in land use
- Resource depletion: deforestation, desertification, topsoil loss, aquifer depletion, energy resource depletion
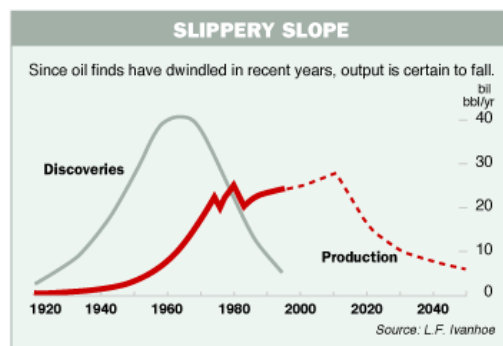- Coral reef bleaching

"Nearly 1 billion people depend on fish as their primary source of protein."
 -Global Environment Facility, January, 2002

➢ **Natural Resources (types)**
- Loss of biodiversity
- Topsoil erosion
- Aquifer depletion
- Oil depletion and Peak Oil

➢ **Transportation**
- Increase pollution
- Increase price of oil
- Hybrids/Fuel cells/Bio Fuels

➢ **Communications**
  • Languages and customs barriers
  • Cell phones vs. land line phones
  • Computer and Internet access

➢ **Economy**
  • Economic growth: measure of the mounting pressure on earth's environment
  • Income distribution – gap between rich and poor
  • Racial strife (economic inequity)
  • International and local drug trade
  • Arms sales, nuclear, biological and chemical weapons

**What the foregoing listing does not provide is a sense of the interconnection amongst all the various issues.  Looked at graphically, that becomes more evident…**
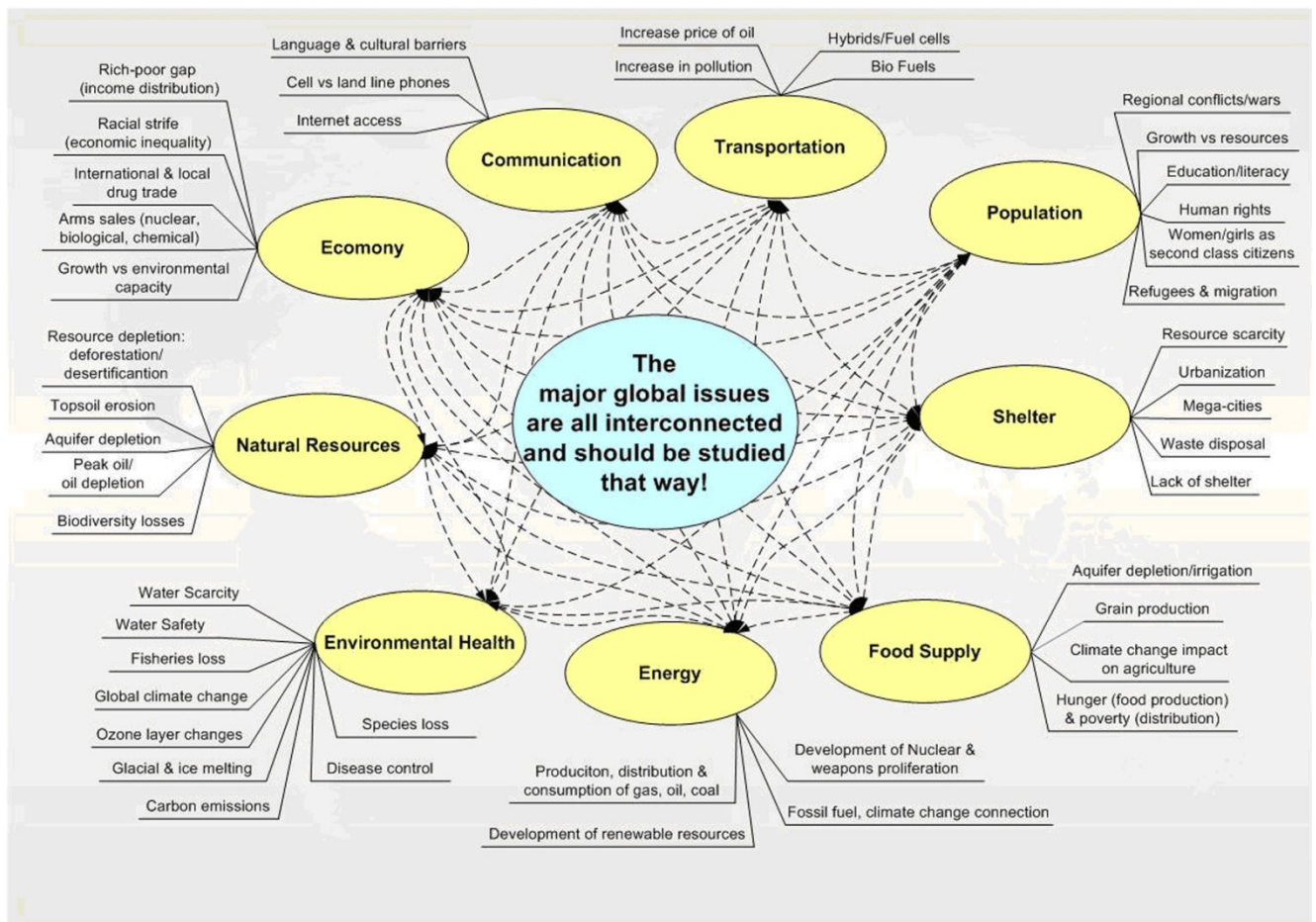
# 4.0 Market Analysis Summary

The following is not an exhaustive list of organizations. All of these organizations provide essential components of the vision that is the WRSC. There are many others. They are not, however, the entire large format, immersive visualization and simulation center which we envisage and which is designed for collaboration to enhance our ability to resolve world problems rapidly for the benefit of all humanity.

In 1972, **The World Game™ Institute** was established by Fuller and two colleagues, Howard Brown and Medard Gabel. The Institute has brought the World Game™ experience to hundreds of thousands of participants around the world. The World Game™ Institute also used a 70' x 35' Dymaxion map (often laid on a basketball court) and delivered educational resources designed to teach interdependence, collaboration, respect for diversity, and individual participation in a global society [8] [9]

**The Design Science Lab**, presented by Medard Gabel, President of BigPictureSmallWorld[10] and the Buckminster Fuller Institute, offers a week-long opportunity for international students to develop solutions to global and local problems. It features hands-on training experience in complex problem solving employing an approach pioneered by R. Buckminster Fuller and others called comprehensive anticipatory design science.

In July 2005, in the UN International School in New York, twenty-five students in the 2005 Design Science Lab focused on the world's problems and developed strategies for reaching the UN's Millennium Development Goals. Labs around the country are ongoing. [11]
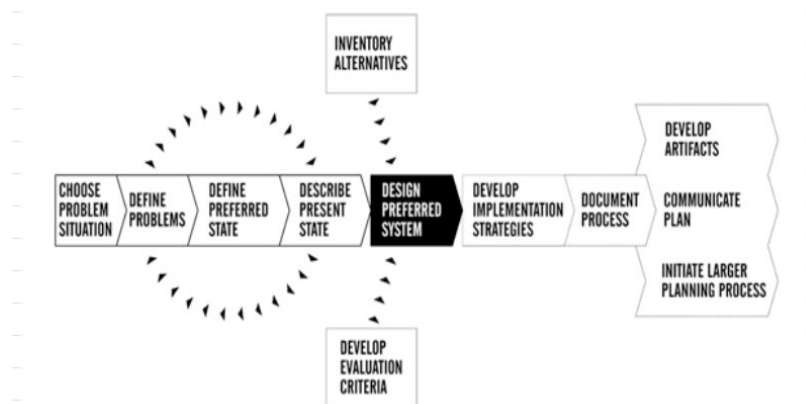


**The o.s. Earth Global Simulation**, founded by Howard Brown and Medard Gabel, is a direct descendent of Fuller's "World Game™." In a Global Simulation, Fuller's original idea is enhanced with state-of-the-art multimedia, the inclusion of relevant current issues, and dynamic game play. What results is a challenging and moving experience that participants remember for a very long time.

The game simulates the next 30 years of global economic development. Players represent geopolitical regions (for example, Sub-Saharan Africa, North America, South Asia), multinational conglomerates of corporations (with invented names) and global organizations dedicated to special issues (health, education, human rights and the environment). [11] [12] [13]

**The Federal Geographic Data Committee (FGDC)** is an interagency committee that promotes the coordinated development, use, sharing, and dissemination of geospatial data on a national basis. This nationwide data publishing effort is known as the National Spatial Data Infrastructure

(NSDI). The NSDI is a physical, organizational, and virtual network designed to enable the development and sharing of this nation's digital geographic information resources. FGDC activities are administered through the FGDC Secretariat, hosted by the National Geospatial Programs Office (NGPO) of the U.S. Geological Survey. The NGPO oversees other geospatial programs including The National Map and the Geospatial One-Stop activity.

**International Society for Digital Earth (ISDE)** is a non-political, non-governmental and not-for-profit international organization founded by the Chinese Academy of Sciences.  It's purpose is to promote international cooperation in the **Digital Earth\*** vision, and enable the Digital Earth technology to play key roles inter alia, in economic and social sustainable development, environmental protection, disaster mitigation, natural resources conservation and improvement of human beings' living standards.

**\*Digital Earth** is a label given to a visionary concept, made popular in 1998 by former US Vice President Al Gore, for describing a virtual representation of the Earth on the Internet that is spatially referenced and interconnected with the world's digital knowledge archives. The Digital Earth community has dedicated itself to building a global commons promoting down-to-Earth solutions based on cooperative use of standards, databases and tools. Four international symposia (International Symposium on Digital Earth) have been held around the world.



**World Resource Institute and Worldwatch Institute**
are world class research institutes and think tanks which publish studies and reports on world resources, problems and conditions, environmental sustainability, but neither does simulation or visualization.

**The Environmental Systems Research Institute (ESRI)** designs and develops the world's leading geographic information system (GIS) technology and GIS mapping software. This technology will be an essential component of the WRSC.

**National Oceanographic and Atmospheric Agency (NOAA)**, is a U.S. federal agency focused on the condition of the oceans and the atmosphere. It plays several distinct roles within the Department of Commerce: They supply weather warnings and forecasts through the **National Weather Service**. NOAA conducts Applied Scientific Research in four Ecosystems, Climate, Weather & Water and Commerce & Transportation. Their resources will be utilized by the WRSC.

Japan's **Earth Simulator** supercomputer, housed in a hangar-sized building in Yokohama, has a singular weather focus and is intended to calculate long-term patterns in the interaction of atmospheric pressure, air temperatures, ocean currents and sea temperatures.  The results will help establish predictable routes for typhoons and identify areas that are recurring targets for heavy rains, abundant snow, high waves, heavy winds, scorching heat or crop-threatening droughts.

**California Institute for Telecommunications and Information Technology (Calit2)**, of the University of California focuses on development and deployment of prototype infrastructure for testing new solutions in a real-world context.



Calit2 builds horizontal links among departments to foster multidisciplinary studies; creates research teams consisting of members who can be located anywhere because of the Internet; supports involvement by faculty, students, industry, government, and community partners; enables prototyping in Calit2 "living laboratories;" and provides technical professionals as the bridge between academia and industry. At Calit2, the focus is on a competitive edge and industrial innovation.

**San Diego State University Center for Information Technology and Infrastructure (CITI)** was established to promote the vision of empowering SDSU to take advantage of emerging tools in optical networking, wireless communication, and human-computer interactions through visualization. It focuses on existing efforts in environmental monitoring, student safety, transportation studies, law enforcement and first responder interaction, homeland security, collaborative education, Internet technologies, and other high interest areas.

CITI pursues four major themes which provide framework for the center, and a pathway for diverse projects:
- Homeland Security
- Natural disaster mitigation and response
- Global sharing of information and collaborative visualizations
- Remote sensing and environmental monitoring

**Al Gore's "An Inconvenient Truth,"** a popular movie in 2006 that visually and graphically focuses on climate change and global warming. While a study program is designed around the movie to keep the information alive, its format and purpose differ from that of the WRSC.

**BP Center for Visualization, University of Colorado at Boulder** is the most advanced large-scale visualization facility in the oil and gas industry. Its purpose is oil and gas exploration and tracking.



**TerraSpark Geosciences,** L.P., conducts Research and Development, provides Consulting Services, and licenses new Technology Products to clients in the energy and mining industries.

**Gapminder and Google** share an enthusiasm for technology that makes data easily accessible and understandable to the world. Gapminder's Trendalyzer software unveils the beauty of statistics by converting numbers into compelling interactive animations. Google's acquisition of Trendalyzer will speed up the achievement of this goal. The Stockholm-based Gapminder Foundation will continue to spearhead the use of new technology for data animations. The goal is to promote a fact-based worldview by bringing statistical story-telling to new levels. In

collaboration with producers of accurate statistics who are eager to give the public free access to databases, Gapminder hopes to recruit and inspire many users of public statistics.

**Arizona State University's Decision Theater** facilitates applied solutions for some of society's most significant challenges. Simulation, advanced, immersive visualization and collaborative decision making technologies are combined with science creating an innovative collection of user-friendly tools specifically for policy makers, practitioners and others. Decision Theater's project portfolio embodies the New American University by using its capabilities to address real regional issues, such as water management, land use, public health, and education.

# 5.0 Start-up Team Summary

As mentioned previously, The World Resources Simulation Center has its origins with Buckminster Fuller (see Appendix) and his SIU Executive Director, Tom Turner. Turner compiled the original source document but passed away before its realization. In the early 90's, Tom shared this document with Peter Meisen, Founder of Global Energy Network Institute (GENI). GENI is focused on the global energy grid strategy proposed by Bucky, which he identified as the highest priority strategy of the early World Game™ simulations. GENI's goal is to demonstrate visually that linking renewables between nations will mollify conflicts, grow economies, reduce pollution and increase the quality of life and health for all.

Peter shared the WRSC proposal with Joe Sterling, President of Sterling Insights, a colleague who conducts strategic corporate training programs with real-time visual documentation. Joe is also a student and supporter of Fuller's work. What followed in San Diego in December, 2005, was a 2-day working group of seven people to put flesh on the WRSC proposal: defining its mission, function, clientele and partnerships. Individually, each had expressed a desire and commitment to bringing the WRSC into reality. Those people and their affiliations are as follows:

**Peter Meisen, President of the Global Energy Network Institute, a non-profit research and education organization**
Peter Meisen is a graduate (1976) of the University of California, San Diego with an Applied Mechanics and Engineering Sciences degree. Meisen founded GENI in 1989, to conduct research and educate world leaders to the strategy of linking renewable energy resources around the world. He is an internationally recognized speaker on the global issues of renewable energy, transmission and distribution of electricity, quality of life and its relationship to electricity, the environment and sustainable development. Peter is a member of the following professional associations: IEEE Power Engineering Society, World Affairs Council of San Diego, Union of Concerned Scientists, United Nations Association, and is an Honorary member of the Rancho Bernardo Sunrise Rotary Club. In 1983, he co-founded SHARE (Self Help and Resource Exchange), North America's largest private food distribution program.

**Ashley Gardner, Producer of the Bucky Centennial and GENI CD-ROM**
Ashley Gardner was Producer of the Buckminster Fuller Centennial 19995 Opening Ceremony and of the "There's No Energy Crisis" CD for the Global Energy Network Institute which was distributed to key leadership in every nation. She has also served as a volunteer assistant at GENI exhibits at World Energy Conferences, Rotary International Conventions and World Game presentations.

**Josh Arnow, past President of the Buckminster Fuller Institute (BFI)**
Josh Arnow has for the last 10 years helped build and oversee a variety of financial investment portfolios while pursuing his real passion; innovative research, ventures and not for profit initiatives that advance humanity's transition to sustainability. From 1985 to 2007, Josh served on the Board of the Buckminster Fuller Institute and as its president from 1999 to 2005. In 2005, he joined the board of directors of Green Map which is developing a cutting edge social mapping web site designed to help connect the worldwide green living, development and ecotourism movements. The same year he joined the Board of the Worldlink Foundation which produces public engagement campaigns that encourage individuals to actively participate in creating a

sustainable future. In 2006, Josh conceived and managed a joint project between The Threshold Foundation and The Harvard Center for Health and the Global Environment to produce an internet movie about the global loss of biodiversity. In 2007, he played a leading role with SavingSpecies.org to preserve a 346 acre parcel of degraded coastal Atlantic rainforest that scientists determined was one of the most important conservation priorities in the Americas. Josh is currently devoting much of his time collaborating on two major initiatives: the Buckminster Fuller Challenge and establishing an international Sustainability Laboratory to research, develop, demonstrate and facilitate adoption of effective sustainability practices by all sectors of society.

**Michael Ben-Eli**
Michael Ben-Eli is an international consultant on management and organization. He was a student and close associate of Buckminster fuller, with whom he collaborated on projects involving research on advanced structural systems and exploration of issues concerning the management of technology and world resources for the advantage of all. He is the President of Cybertec Consulting Group, Inc., and founder of Sustainability Initiatives, an effort aimed at helping accelerate transition to sustainability practices in both private and public sectors.

**Kirk Bergstrom, President of World Link Productions and BFI Board member**
Dr. Kirk Bergstrom is founder and President of WorldLink Foundation. In this capacity, he has directed special projects for such clients as the United Nations, State of the World Forum, PBS, Walt Disney Imagineering, and Tech Museum of Innovation. A filmmaker and social entrepreneur, Kirk has developed and produced award-winning television, interactive multimedia, websites, museum exhibits, and educational curricula. He recently wrote and directed the PBS special Power Shift, a half-hour program on energy and sustainability. He also directed and produced Spaceship Earth: Our Global Environment, winner of two national Emmy Awards. In 1995, Kirk produced A Place to Stand, the official global television program for the UN's 50th Anniversary.

**Bonnie Devarco, online education consultant, past Executive Director of BFI**
Bonnie Devarco explores the leading edge of visualization technologies. She has served as an education technology consultant to non-profit, corporate and educational organizations for the past 18 years. She also lectures worldwide on emerging technologies in education, virtual worlds, next generation geographic information systems, information visualization and culture of cyberspace. From 1989 to 1995 Bonnie was chief archivist for the Buckminster Fuller Archive and continues to support the better understanding and advancement of fuller's geoscope concept. She serves on the Boards of Accuracy & Aesthetics, the Synergetics Collaborative and the Advisory Board of the international exhibition series, "Places & Spaces: Mapping Science." Bonnie is currently co-authoring a book on the history and evolution of visual language.

**Joe Sterling, President of Sterling Insights, a strategic consulting organization**
Joe Sterling has 15 years experience facilitating groups of 10 to 1,000 participants to accelerate their progress toward organizational goals and sustainable success. He leads the strategic planning engagements for Sterling Insights. In the capacity of graphic facilitator and multi-client program designer, Joe contributed to the Center for Business Innovation (CBI), an Ernst & Young think tank in Cambridge, MA, from 1997 through 2000. Application of complexity theory to business issues was the centerpiece of the work for the CBI. From 1999 to 2003, Joe contributed to the IBM think tank, Institute for Business Value. Joe's formal education includes a bachelor's degree in humanistic psychology, and master practitioner and trainer certificates in Neuro-Linguistic Programming. In addition to serving corporate clients, Joe has worked with

many not-for-profit groups including facilitating strategic planning work for the boards of the MIT Enterprise Forum (San Diego); Society for Human Resource Management; Global Energy Network Institute; and the San Diego-Tijuana Border Initiative.



Joe



Peter, Josh, Michael, Kirk, Ashley



Bonnie

# 6.0 WRSC Revenue Model

The WRSC revenue model utilizes a hybrid approach, capturing value from both traditional non-profit development, as well as business revenues earned from hosting conferences, events, seminars and usage rental to corporate clients. Using both approaches will create a dynamic synergy between the two, with partners hosting events and conferences, while new users, after seeing the potential of the center, transition to partners. An effective marketing team and development team will work together to create, manage, and cultivate these relationships.

## *Development & Partnership Possibilities*

The WRSC, to be established as a non-profit organization, will initially be a collaborative effort in conjunction with established partner organizations and equipped through donations, corporate and university partnerships. **The following is a wish list for illustration only of the types of partners we are seeking. Further, it is by no means a complete list.**

- ➢ **Educational institutions**: U.C.S.D, Scripps Institute of Oceanography and the SDSU Visualization Lab, Stanford University (home of the Fuller archives), MIT Media Lab, Cornell Center for a Sustainable Future

- ➢ **Institutes/Societies**: ESRI, World Resource Institute, Worldwatch Institute, NOAA, CalIT2, Earth Policy Institute, Society for Computer Simulation, International Society for Digital Earth, United Nations Environment Program

- ➢ **Alliances**: GENI Founders and Supporters

- ➢ **Fullerites**: Buckminster Fuller Institute, ESRI, o.s.Earth, GENI, Eluminati

- ➢ **Other Educational and Institutional supporters:** Rockefeller Foundation, Ford Foundation, Bill and Melinda Gates Foundation, Skoll Foundation, Turner Foundation

- ➢ **Corporations:** Qualcomm, Dell, Gateway, HP, IBM, Microsoft, Silicon Graphics, Google, Yahoo, Advanced Visual Systems

- ➢ **Government agencies:** NOAA, Japan's Earth Simulator supercomputer, NASA, World Bank

- ➢ **Leading individuals/potential supporters**

## *Conference & Event Revenue*

The WRSC, once operational, will host ongoing conferences and events for business groups, trade associations and NGOs, global, national and local in scope. Companies or common interest stakeholders can also hold strategic meetings, planning sessions, focus groups or receptions at the Center. Both large scale and small scale events will be possible, depending on the needs of user groups. Some conferences will be sponsored by the WRSC, incurring costs in marketing and

planning. Revenues from other events, such as a conference hosted by a trade association, will essentially be usage fees for the time and space costs of the Center.

## *Research Projects - Long/Short Term Center & Personnel Lease Time*

Utilizing the Center's technological assets, and expertise of WRSC personnel, the Center will also be available for research projects and other independent studies by interested NGO's, businesses and other groups. Projects may last from a few hours time, to long-term projects spanning months or years. Costs for research projects will be determined individually and as needed.

## *Other Revenue Streams*

As a center for ideas and innovation, and with a team of intelligent, dedicated and creative personnel, the WRSC will rapidly explore new avenues of revenue. The following is a short list of potential ideas that the Center may incorporate.

- Educational seminars
- Software development and licensing
- Software consulting
- Naming rights
- Expert Consultation
- Franchising Fees

## *Marketing and Development Strategy*

As revenue is sought from both traditional, non-profit development sources, and conference and event revenue, so too will marketing efforts often overlap, with the potential to attract revenue on either or both sides. The WRSC will generate interest by implementing a fully comprehensive marketing strategy to attract revenue and donation from both approaches.

For Conference and Event Revenue, the Center will first focus on locally interested groups and companies to gain credibility and leadership within the community. Additionally, local convention center conferences will be targeted to host side events at the WRSC. With feedback and experience from these smaller projects, the Center will broaden its marketing scope to elicit use by nationwide corporations, trade associations, government organizations and academic institutions.

In conjunction, a traditional non-profit development program will be launched to gain support from private individuals and corporations. As mentioned, many of these targets will be potential targets for conferences and events, and can be transitioned to either and potentially both sides of the revenue equation.

# SUMMARY

The World Resources Simulation Center is an environment designed to enhance exploration and development of strategies for making the world work for all humanity in an environmentally sustainable manner. The Center combines powerful information and geo-visual technology with interactive decision support tools, simulation and gaming capabilities that facilitate designs for a sustainable future. The Center provides a platform for innovative, multidisciplinary learning as well as global problem solving and policy formulation.

Decision makers, scientists, business leaders, students, planners, designers and members of the general public from around the world are able to collaborate and continue to interact remotely, through internet based tools and by visiting a global network of unique visualization facilities.

The world is currently deficient in providing for the needs for our current population. World population will increase by 40% in 2050, especially in the poor countries -- and consequently, dramatically increase the demand for energy, food, and health care. If we do not act now, energy, food, water and shelter will remain in deficit for millions of people. It is our position that this is unacceptable in a world that can put a man on the moon, dissect the atom and map the humane genome.

Realization of this project requires a large financial investment and commitments of many people. Anticipating large donors inspired by the concept and mission, the WRSC core team is committed to building this resources simulation center on a timetable commensurate with the need . . . in the shortest possible time.

## *Contact Information*

For more information or to visit us on the web: www.wrsc.org

Contact: Peter Meisen
Tel: 619-595-0139
Email: peter@geni.org

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1250 Sixth Ave. Suite 901
San Diego, CA  92101 USA

> *"Never doubt that a small group of thoughtful committed citizens can change the world. In fact it's the only thing that ever has."*
> -Margaret Mead

# Appendix

## *History*



R. Buckminster Fuller

The World Resources Simulation Center is the brainchild of Richard Buckminster "Bucky" Fuller (July 12, 1895 – July 1, 1983), an American visionary, designer, architect, and inventor, working in conjunction with Tom Turner, Fuller's Executive Director at Southern Illinois University. It is based on Design Science for finding solutions to complex global problems.

Bucky defined Design Science this way:

It is *"the effective application of the principles of science to the conscious design of our total environment in order to help make the Earth's finite resources meet the needs of all of humanity without disrupting the ecological processes of the planet."*

*–R. Buckminster Fuller*

Buckminster Fuller is best known for the invention of the geodesic dome. This is the lightest, strongest, and most cost-effective structure ever designed and is able to cover more space without internal supports than any other enclosure.

Throughout his life, Fuller was concerned with the question of whether humanity has a chance to survive and be successful on planet Earth -- and if so, how? He chose to devote his life to this question, trying to find out what an individual like himself could do that large organizations, governments, or private enterprises inherently could not do to improve humanity's condition.

> **Bucky envisioned a "great logistics game," like a war game, which he initially called a "World Peace Game." He referred to it as moving from "weaponry to livingry."**

Out of his early participation in war games at the U.S. Navy War College, Fuller eventually developed the world game process. It was intended as a tool to be used by people around the world to understand and develop solutions to what he called the real enemies of humanity: hunger, illiteracy, lack of health care, environmental degradation, and "you or me" thinking.

Later, Fuller proposed to house The World Game™ in a giant geodesic dome that he designed as the U.S. Pavilion for the 1967 Montreal World's Fair. His giant dome was built, but the US Information Agency rejected his World Game™ exhibit as too "revolutionary." Undaunted, Fuller continued to develop his World Game™. Fuller later said that the world needs a revolution - not to bring everyone down, but a "design science revolution" that elevates all humanity to higher living standards for all.

**The World Game™**

In 1969, Bucky Fuller described his vision for the World Resource Simulation Center, designed around a large Dymaxion Map and the World Game™ mission statement/question:

*"How do we make the world work for 100% of humanity in the shortest possible time through spontaneous cooperation without ecological damage or disadvantage to anyone?"*

In his own words, Bucky describes his idea for the WRSC, and in his visionary fashion, long before most of the technology currently available to us today was invented.

*"I propose that on this stretched-out, reliable, accurate world map of our Spaceship Earth a great world logistics game be played by introducing into the computers all the known inventory and whereabouts of the various metaphysical and physical resources on the Earth.*

*We would then enter into the computer all the inventory of human trends, known needs, and fundamental behavioral characteristics.*

*I propose that individuals and teams would undertake to play The World Game™ with those resources, behaviors, trends, vital needs, development desirables, and regenerative inspirations. The players as individuals or teams would each develop their own theory of how to make the total world work successfully for all humanity. Each individual or team would play a theory through to the end of a pre-declared program."*

**"We have today, in fact, 200 supreme admirals and only one ship – Spaceship Earth. We have the 200 admirals in the 200 staterooms each trying to run their respective stateroom as if it were a separate ship. We have the starboard side admiral's league trying to sink the port side admiral's league. If either is successful in careening the ship to drown the 'enemy' side, the whole ship will be lost."**



World population arranged by income

Distribution of income

Richest

The richest fifth receives 82.7% of total world income

Each horizontal band represents an equal fifth of the world's people

Poorest

The poorest fifth receives 1.4% of total world income

*"The world game idea forsakes the political expedient of attempting to reform man and commits man to reforming his environment in such a manner as to "up" the performance per each unit of invested world resources until so much more is accomplished with so much less that an even **higher standard of living** will be effected **for 100% of humanity** than is now realized by the 40% of humanity who may now be classified as economically and physically successful."*

*"We will invite participating teams of key scientists, corporate and government executives and other leaders from all around the world – to confront the problems and list their theories on how to solve them for all mankind."*

**"For the first time in history it is now possible to take care of everybody at a higher standard of living than any have ever known. Only ten years ago (1970), the 'more with less' technology reached the point where this could be done. All humanity now has the option to become enduringly successful."** (14)

(15)
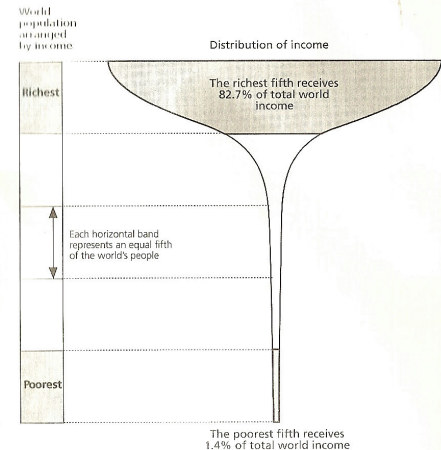
**"There is no energy shortage. There is no energy crisis. There is a crisis of ignorance."**
**-R. Buckminster Fuller**

## *Citations for Data Presented*

(1)http://www.usaid.gov/locations/sub-saharan_africa/features/worldwaterday06.html
(2)http://environment.about.com/od/environmentalevents/a/waterdayqa.htm
(3)http://www.usccb.org/sdwp/placeatthetable/worldpoverty.htm.
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(17)http://travel.yahoo.com/p-travelguide-191501843-action-pictures-montreal_vacations-i
(18)http://www.olats.org/pionniers/pp/buckminster/biographyBuckminster.html

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