SolarQuest®

MicroSolar Distance Learning

A Program Overview

SolarQuest® Mission

The mission of SolarQuest® Education Foundation, Inc. is to expand access to Information & Communications Technologies (ICTs) to primary and secondary schools in "deep rural" communities in developing nations of the world that lie beyond access to the services of the telecommunication and power grids, in order to support the delivery of a full range of educational services to underserved populations. The Foundation's goal is to accelerate the potential of deep rural communities to achieve human capacity building for sustainable economic development. To achieve this goal SolarQuest® provides technical assistance and technology-aided, educational program services under the SolarQuest® MicroSolar Distance Learning Program (MicroSolar).

The United Nations' *Preamble to the World Declaration for Education for All* provides the context for the SolarQuest® MicroSolar program:

MEETING BASIC LEARNING NEEDS

"More than 40 years ago, the nations of the world, speaking through the Universal Declaration of Human Rights, asserted that 'everyone has a right to education.' Despite notable efforts by countries around the globe to ensure the right to education for all, the following realities persist:

- More than 100 million children, including at least 60 million girls, have no access to primary schooling;
- More than 960 million adults, two-thirds of whom are women, are illiterate, and functional illiteracy is a significant problem in all countries, industrialized and developing;
- More than one-third of the world's adults have no access to the printed knowledge, new skills and technologies that could improve the quality of their lives and help them shape, and adapt to, social and cultural change; and
- More than 100 million children and countless adults fail to complete basic education programs; millions more satisfy the attendance requirements but do not acquire essential knowledge and skills;

At the same time, the world faces daunting problems: mounting debt burdens, the threat of economic stagnation and decline, rapid population growth, widening economic disparities among and within nations, war and occupation, civil strife and violent crime, preventable deaths of millions of children and adults, and widespread environmental degradation. These problems constrain efforts to meet basic learning needs, while the lack of basic education among a significant proportion of the population prevents societies from addressing such problems with strength and purpose."

- From the World Declaration for Education for All (1990)

What is MicroSolar?

MicroSolar is a cost-effective, financially sustainable systems-integrated ICTs and energy technologies model to provide technology-aided educational systems delivery to deep rural communities of developing countries. It employs a unique pedagogical approach – Productivity-centered, Service learning – that engages multiple stakeholders in the learning process with the goal to improve the economic welfare of a community.

Since the *World Conference on Education for All* convened in Jomtien, Thailand, progress in ICTs and renewable energy systems is making it technically practicable and financially feasible to deliver an "expanded vision" of *Education for All* through distance education services. ICTs (broadband satellite telecommunications services) powered by renewable energy technologies (solar electric systems) offer an alternative infrastructure to deliver a full range of educational services and provide access to the ever-expanding pool of knowledge previously unavailable to deep rural communities. ICTs are both a quantitative (reaching far greater populations) and qualitative (providing nearly unlimited access to the canon of world knowledge) improvement in educational delivery. ICTs hold the potential to accelerate the distribution of educational services decades in advance of conventional delivery systems.

MicroSolar emerged as a model in the 1990's when SolarQuest® joined with the White House to research Information and Communications Technologies for Development, referred to as "ICT4D" in the international academic research community. From 1998 to 2001, SolarQuest® conducted ICT4D research in Africa and South America in partnership with the White House Millennium Council and various agencies of the United States Government, resulting in the development of the first rural telecenter under the "G-8 Mandate for Universal Service." Since 2002, SolarQuest® has collaborated with the e7 Network of Expertise on the Global Environment (e7), the United Nations Foundation (UNF), and the United Nations Development Programme (UNDP). This collaboration established the first MicroSolar proof-of-concept in the Province of the Galapagos, Ecuador. Prior to the Galapagos demonstration project, elements of the MicroSolar program were field tested in Bolivia, Ecuador, Guatemala, Honduras, Mexico, Peru, Venezuela, Bhutan, Tanzania, and Uganda.

Five key components define the MicroSolar concept:

MICROSOLAR COMPONENTS

- TECHNOLOGY (ICTs): Broadband satellite, wireless telecommunications, and ultra-energy-efficient micro-computing technologies;
- SOLAR ENERGY: Cost-effective, reliable solar energy systems with integrated balance-of-systems components that provide electricity for ICTs;
- SERVICE-LEARNING: Productivity-centered, service-learning programs that meet and exceed national education standards;
- CAPACITY BUILDING: Multi-stakeholder, intergenerational human capacity building that integrates learning with multiple sectors in a community; and
- SUSTAINABILITY: Revenue models to self-generate funds to sustain MicroSolar infrastructure costs and education services.

Productivity-centered, Service-learning

Heavy debt burdens in developing countries draw precious government resources away from critical investments in education and other sectors necessary to improve lives in the poorest countries. MicroSolar productivity-centered, service-learning is emerging as a viable education reform initiative and bold new finance strategy designed to mitigate declining government resources for education. By focusing learning on and applying knowledge to economic productivity, and reinvesting productivity gains in education, productivity-centered, service-learning represents a self-generating revenue model for education finance that leverages existing economic assets and provides an economic incentive for communities to reinvest in education.

PRODUCTIVITY-CENTERED, SERVICE-LEARNING

"Productivity-centered, service-learning is a teaching methodology in which a mutually supportive intentional group of inter-generational learners utilize a wide array of public and private resource – including traditional academics – to enrich the learning experience, and who are committed to a process in which they employ Information and Communications Technologies (ICTs) to acquire new information and relevant knowledge, and share that knowledge with other learners and the general public, in order to identify and solve critical social and economic problems for the betterment of their community with the specific goal to improve the general well-being of that community through the multiple benefits of increased economic productivity."

- Allan E. Baer

MicroSolar addresses pressing social and economic needs of rural communities with the potential for viable, real-world outcomes. By example, students in the MicroSolar Galapagos program (ACTS 2004) identified excessive consumer spending totaling nearly $1 million dollars annually due to defective refrigerators in one third of the islands' households. On a per household basis this represents 15% to 20% of annual disposable income.

Students calculated that a paid-from-savings "Demand-Side-Management" (DSM) program would recover an investment in new energy efficient refrigerators in just over two years. Once the new equipment is paid from energy savings consumers could redirect limited income to other essential family services, such as health care and education. A portion of the savings can accrue to the education sector to sustain MicroSolar infrastructure and expand academic program services. A 6-months payback extension will recover the initial MicroSolar infrastructure and training costs; an additional six month payback extension can provide program replication or program sustainability for two years.

Another outcome of MicroSolar in the Galapagos is that student research is now providing baseline data for the development of a Global Environment Facility (World Bank Group) funded DSM industry in Ecuador. The UNDP (Quito) and the Ministry of Energy, Mines, and Minerals (Republic of Ecuador) scheduled a briefing by MicroSolar students in December of 2004. The presentation by the students helped profile a nation-wide DSM program to reduce energy consumption by 1,500 megawatts over 10 years. As a consequence, nationwide expansion of MicroSolar productivity-centered, service-learning is being discussed as a key component of the emerging DSM industry in Ecuador. If implemented, MicroSolar replication at this scale would represent a potential investment opportunity in education of $1 billion over the next decade.

MicroSolar Development, Expansion, and Sustainability

MicroSolar relies upon a combination of donor assistance and self-generated revenues to develop project sites and achieve financial sustainability. SolarQuest® is establishing a committed donor base to support program development and building a geo-spatial "*Ecological Observatory Network*" in the Galapagos Archipelago to self-generate revenues from subscription fees.

Donor assistance is required to fund two critical needs:

USE OF DONOR FUNDS

i) To expand the existing MicroSolar infrastructure in the Galapagos from a proof-of-concept beta site into an archipelago-scale research instrument consisting of geographically distributed electronic infrastructure, cutting-edge laboratory and field instrumentation, and dedicated broadband computational networks to support content delivery for collaborative research and science education; and

ii) To develop a subscription-based, geo-spatial observatory user network consisting of approximately 1,500 public schools in the U.S. (grade levels 6 – 12) in order to self-generate program revenues. The user network will allow teachers and students access to real-time data streams for individual and group participation in innovative learning environments fostering science research and education in collaboration with scientists in the field.

To facilitate the development of the *Ecological Observatory Network*, SolarQuest® and the Galapagos National Institute (the provincial Office of the President of the Republic) are establishing a coalition of international research institutes, universities, government agencies, corporations, and non-governmental organizations committed to conservation objectives in the Galapagos. The Visualization Lab at San Diego State University, in collaboration with the San Diego Super Computer Center at the University of California at San Diego, is providing the broadband delivery services to U.S. schools for geo-spatial observatory content.

Beginning in the Galapagos Archipelago – and expanding to other designated World Biosphere Reserve Network sites of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) – the *Ecological Observatory Network* will generate subscription revenues from U.S. schools to financially sustain MicroSolar program sites. A core universe of 31,000 public schools in the United States represents a revenue potential of over $70 million. A conservative projection of a 5% subscription base (approximately 1,500 schools at $2,500 per subscription) represents revenues of nearly $4 million annually. Preliminary surveys conducted by SolarQuest® indicate that the annual observatory subscription base in U.S. public schools may exceed 11% of the core universe of 31,000 schools. There are 92,000 public schools in the U.S.

The relevance of Galapagos as a catalyst to expand and sustain the development of MicroSolar is evidenced by the importance of the Archipelago to science research and education. Since Charles Darwin first conducted research in the "Enchanted Islands" in 1835, the Galapagos has become synonymous with evolutionary theory: The Galapagos contains numerous unique marine and terrestrial ecosystems that allow scientists to observe and document evolutionary change.

In the U.S., over 52 million students learn scientific concepts such as evolution and natural selection that have become almost exclusively identified with Charles Darwin and the research Darwin conducted in the Galapagos. Home to a world-class scientific research facility – the Charles Darwin Research Station – the Archipelago hosts hundreds of scientists from universities and research institutes worldwide. The *Ecological Observatory Network* will enable collaborative research in the "Living Laboratory of Evolution" among the world's leading scientists.

While MicroSolar programs are focused primarily on technology-aided education reform in schools in the developing world, a SolarQuest® geo-spatial observatory network in U.S. schools will transform education and ecological research by enabling America's students and world class scientists to collaborate on studies that monitor major environmental challenges and evolutionary responses. Teachers and students, scientists and engineers will utilize the *Ecological Observatory Network* to conduct real-time ecological studies spanning macro- and micro-levels of biological organization, at temporal and geographical scales. The potential for enhanced cognitive development is unparalleled: Geo-spatial technologies are now demonstrating the potential for abstract (as compared to sensory) neuro-spatial development in young learners.

SolarQuest® International Learning Resource Center

Ministries of education, non-governmental organizations, colleges and universities in developing countries throughout Africa, Asia, and Latin America are requesting advanced training and direct technical assistance from SolarQuest® to replicate the MicroSolar program in urban and rural communities. With donor support, and an *Ecological Observatory Network* in U.S. schools self-generating revenues from subscriptions, SolarQuest® anticipates establishing an international learning resource center focusing on building human capacity for MicroSolar program management. An international learning resource center will also provide professional development for U.S. science teachers on the use of geo-spatial technologies in the classroom, and instruction on collaborative science education and research opportunities utilizing the *Ecological Observatory Network.*

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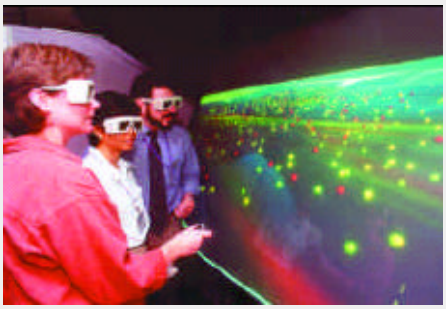

Science-based collaborative research utilizing geo-spatial visualization technologies represents an opportunity to improve learning in U.S. schools while generating revenue for MicroSolar Distance Learning Program expansion in developing countries.