

Renewable Energy, Empowered Women



PHOTOS (left to right): Newly-trained women solar technicians in South Africa; Vietnamese woman unloading new solar panels for her village; Tibetan refugee women learning computer skills at the Paljorling Settlement in Nepal.

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■ Background: The Many Divides

The digital divide captures many of the headlines, but the new century and millennium are riven by many other, equally serious inequities which, like the digital gap, are at their most extreme in developing nations. Among these are divides based on culture, economy, environment, gender, and – in a sense that goes beyond computers and the Internet – technology.

All these divides interlock with and reinforce each other. Finding ways to close and heal them is the urgent imperative of our time.

SELF, the Solar Electric Light Fund, takes its mandate from the words of Freeman Dyson, the Templeton Prize-winning physicist and SELF board member, who wrote in his recent book *The Sun, The Genome and The Internet* that "The new century will be a good time for new beginnings. Technology guided by ethics has the power to help billions of poor people all over the earth."

Narrowing the technology divide can also reduce other, interconnected divides. SELF works at the very base of the technology divide, the lack of electrical power.

Today, two billion human beings still live without electricity, primarily in developing nations' remote and rural reaches. For many of these people, connection to a utility grid is nowhere on the horizon. Their countries' economic struggles, high foreign debt, and public health burdens make grid extension, at as much as US\$20,000 a kilometer, far too expensive. The cost to the planet of bringing conventional, fossil fuel-fired electrification to so many people is also forbidding. The evidence for global warming – both lofty and peer-reviewed, and down-to-earth and common-sense – is now unassailable.

■ Energy and the Gender Divide

With or without electricity, homes must be illuminated and heated. Meals must be cooked. Water must be secured.

In the rural developing world, these burdens fall most heavily on females. Invariably, it is women and girls who each day must seek out wood or dung or some other biomass that can be burned for light or heat. Or who must find water, and then shoulder it home in back-breakingly heavy pots. The gender division of labor in rural Tanzania, depicted in the chart below, is typical throughout the Global South.

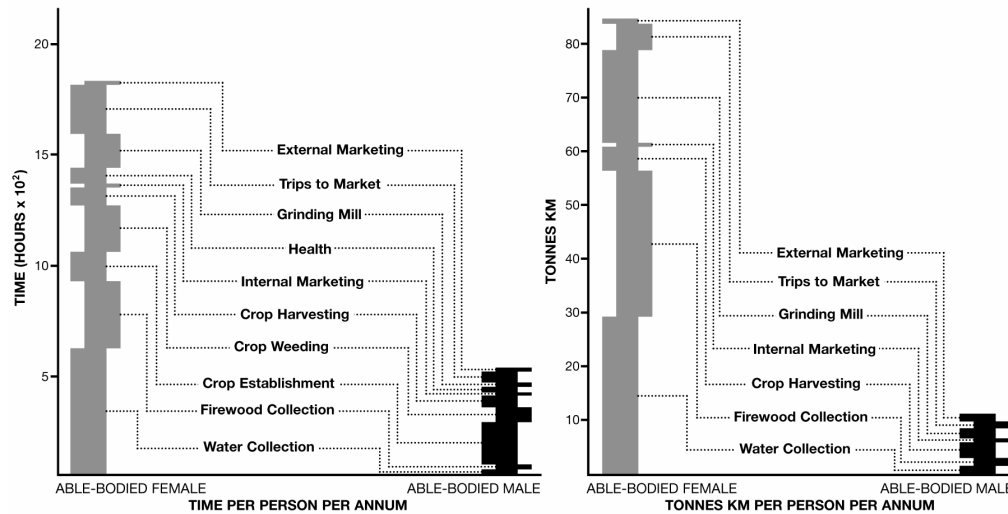
The effort of gathering fuel and hauling water is becoming even more arduous as population growth and environmental degradation relentlessly reduce supplies. The United Nations Development Programme (UNDP) estimates that the proportion of rural women encountering fuelwood scarcity is 40 percent in Latin America, 60 percent in Africa, and nearly 80 percent in Asia. The effort of securing fuelwood can take a woman between 1 and 5 hours every day.¹

¹ See *Human Development Report 1995: Gender and Human Development*, United Nations Development Programme, at <http://hdr.undp.org/reports/global/1995/en/default.cfm>.



Water scarcity is equally serious. It affects 32 percent of rural women in Asia, 45 percent in Latin America, and 55 percent in Africa. The median time investment by women in water collection during the dry season is 1.6 hours.²

CHART: Rural transport activities by females and males in rural Tanzania. (Source: *Energy After Rio*, 1997, United Nations Development Programme)



The time women spend in the drudgery of finding and transporting fuel and water is time lost to other activities, including microenterprises that could generate additional family income. There can also be negative effects for children if they are enlisted to help, and in doing so sacrifice schooling. To the degree that this involves girls more than boys – and it usually does – gender disparities in literacy and employment prospects result. In some developing nations, girls spend 3.5 times as many hours in wood and water collection as boys (and 7 times as many hours as adult males).³

Since they are almost exclusively responsible for cooking, women and girls also suffer inordinately from the extreme indoor air pollution created by biomass and kerosene burning. As summarized in the April 2001 issue of the journal *Environmental Health Perspectives*:

Epidemiologic studies in households in developing countries have strongly linked exposure to indoor air pollution from solid fuels to acute lower respiratory infections (ALRI) in children, chronic obstructive lung diseases and associated heart conditions, and lung cancer. Growing evidence also implicates asthma and tuberculosis (TB) as well as the nonrespiratory conditions of cataracts and adverse pregnancy outcomes (stillbirth, low birth weight, and infant death).

Of these, ALRI appears to have the greatest health impact in terms of the number of people affected and the number of life years lost. Overall, studies indicate that exposure to wood smoke from cooking fires in poorly ventilated conditions may increase the risk of a young child contracting a serious respiratory infection from two to six times. Adults suffer the ill effects of severe indoor pollution as well. Strong links have been found between chronic lung diseases in women and exposure to smoke from open cooking stoves. Transition up the energy ladder from dirty to clean fuels will greatly reduce the threat from indoor air pollution in developing countries.⁴

■ Up the Energy Ladder

Since 1990, the Solar Electric Light Fund has been showing the role that solar photovoltaic and other renewable energy technologies can play in improving the lives of rural people in developing countries.

² See *The World's Women 2000: Trends and Statistics*, United Nations, at <http://unstats.un.org/unsd/demographic/ww2000/overview.htm>.

³ Ibid, footnote 1.

⁴ See <http://ehs.sph.berkeley.edu/krsmith/publications/ehp.pdf>.



SELF's projects have now reached 13 developing nations on four continents. Christopher Flavin, president of the Worldwatch Institute, recently remarked that "I know of few small non-profits with SELF's impact." Mikhail Gorbachev, presenting SELF with the 1998 Green Cross Millennium Award for International Environmental Leadership, praised the organization's "dedication, leadership, and vanguard efforts in creating a value shift for the new millennium." In 2002, SELF was selected from among nearly 500 nominees as one of 25 Laureates in Silicon Valley's Tech Museum of Innovation Awards.

Because energy in the rural developing world is inextricably a women's issue, all of SELF's projects have had women as beneficiaries. But some projects have gone farther, involving local women very centrally as project planners and leaders. Since it is women who have the biggest personal stake in a positive outcome, it is perhaps not surprising that these projects have been among SELF's most successful.

■ Looking Backward: Women-Led SELF Projects in Vietnam and South Africa

VIETNAM

In 1994 SELF launched a first-of-its-kind household solar photovoltaic project in Vietnam in association with the Vietnam Women's Union (VWU).

The VWU is a nationwide social service organization with eleven million members. It works to improve the knowledge and capacity of women, to support income-generating activities, to improve health care, family planning and nutrition, and to mobilize women to participate in creating new laws and public policies.

Then four years old, SELF had conducted successful projects in China and Sri Lanka that innovatively used microcredit to make solar home systems affordable to poor, rural families. The VWU wanted to replicate these successes with pilot solar home electrification projects in the provinces of Tien Giang and Tra Vinh in the Mekong Delta, and in Hoa Binh Province near Hanoi.

SELF dispatched its then-technical manager, Marlene Brown, to work with the VWU to train 25 Vietnamese women as solar technicians. In addition, the VWU trained 20 "motivators" to sign up families and collect down-payments.

The microcredit system was structured such that purchasers put 10% down, followed by monthly payments of \$3 to \$4 over four years. Because the installments were about the same sum families were already spending on the smoky, polluting kerosene commonly used for lighting in Vietnam, late payments were rare, and defaults even rarer. As the loan fund was replenished, additional loans were made. Soon, hundreds of households were getting the benefit of clean solar electricity from photovoltaic systems sold and serviced almost exclusively by women.

Coupled with larger solar power units that SELF helped the VWU to install in community centers and village markets, these household systems have improved women's and children's health, facilitated literacy and learning through bright lights and educational television, and assisted in development of small-scale garment-making businesses.

The project has also empowered Vietnamese women to participate in the development of their nation's energy policies. Mme. Nguyen Thi Minh Phuong, a member of the presidium of the VWU, has observed that by showing women's capacity to implement energy projects, the collaboration with SELF has given women influence in energy planning that they never before enjoyed.



Outside evaluators presented their findings about the project in the July 1997 newsletter of Energia, an international group that grew out of the 1995 Beijing Conference on Women, and which links individuals and groups concerned with energy, environment and women:

The VWU Solar Energy project is a remarkable project in many ways. In our view, it is exceptional that women have been trained in PV technology, and are successfully promoting, selling, installing, maintaining and using photovoltaic SHS [Solar Home Systems].

Not only is the project completely implemented by women, it is also implemented on a commercial basis with full cost recovery. Although initial funds were made available by American donors, the users pay back the costs of the systems over a period of four years, thereby renewing the fund and enabling more households to purchase a SHS...

It is interesting to take a closer look at the Vietnam solar energy project from a gender point of view, and use this example to discuss what 'women and energy' can mean.

When thinking of how to integrate women in an energy project, the first association that many people have is that more women should be involved in the project. The VWU project is a clear and successful example of such involvement by women. The women of the VWU are doing the marketing of the SHSs. They are evidently doing a good job; new households are constantly signing up for purchasing SHSs. Probably because the "saleswomen" of VWU know the energy needs of women best, they are very effective marketers.⁵

On the strength of its continuing achievements in solar electrification of rural Vietnam, the Vietnam Women's Union was presented with a 2002 Energy Globe Award, known as the "Sustainable Energy Oscar." The award was conferred by Mikhail Gorbachev on March 6, 2002 at a gala ceremony in Linz, Austria.⁶

SOUTH AFRICA

When apartheid collapsed in 1994, only 12 percent of rural black households had access to electricity. Given the acute need for power, and the prohibitive cost of universal grid extension, in 1996 SELF was invited by South Africa's Ministry of Energy to lead a pilot solar electrification project in the community of Maphephetheni in KwaZulu/Natal's Valley of a Thousand Hills.

The Zulu Nkosi (or chief) of Maphephetheni was a young progressive who saw the solar electrification project as a means to help the area's women not only lessen their dependency on inferior energy resources, but to gain new skills and employment opportunities as solar technicians.

As in Vietnam, SELF worked with area women to establish a revolving microcredit program to support sales of solar home systems, with 10% down and three-year repayment periods. A Women's Solar Cooperative was organized to both administer the loan program and handle system installation and upkeep.

Solar power was enthusiastically embraced by all involved. In addition to the economic benefits that accrued to the women trained as solar technicians, a scholar who recently analyzed the project's long-term effects noted the income-generating uses to which solar home systems are put, including providing lighting for the weaving of grass mats, and for the keeping of books in a gardening enterprise.⁷

Success in the household use of solar power also stirred interest in community applications of the technology. This ultimately led to SELF's solar electrification of the community's Myeka High School, again using the technical talents of local women. It may be no exaggeration to say that today Myeka is the most famous solar-powered school in the world. Its tremendous advances even drew the attention of *The New York Times*. As reported in the *Times* of September 9, 2001:

⁵ See <http://www.sms.utwente.nl/energia/july1997/solarenergy.html>.

⁶ See http://www.esv.or.at/aktuelles/energyglobe/globe02/winners_e.htm.

⁷ See Annecke, Wendy 1998. "Assistance to NREL in determining the non-economic determinants of energy use in rural areas." Energy and Development Research Centre, University of Cape Town.



Now that the students can download materials from the Internet and have access to the [distance education resources of the] Learning Channel, the graduation rate has shot up [from 30] to 70 percent. Some students have won science awards, and many are applying for college. "I never thought the sun could do all this," said Melusi Zwane, Myeka High School's principal... "Everything comes from power."⁸

Perhaps even more moving are the observations of young Samantha Dlomo, a Myeka student whose essay about her school experience won a global competition staged by the International Solar Energy Society. This achievement brought Samantha, who had never been more than a few kilometers outside her village, halfway across the planet for an awards ceremony in Mexico City. Here's what Samantha wrote in her essay:

Solar energy has not only changed my school life, it has brightened up my future as well. I am sixteen years old and have lived in the rural area for the past fourteen years. In all these past years I used a candlestick to study and do my homework. The chalkboard has been the mainstay teaching aid at school.

When a few solar panels were installed at school, I did not have even a faintest notion of how it was going to work. A few months later we received an overhead projector. That was the beginning of a new school experience. The following equipment was later received: 20 computers, two television sets and a video machine. Recently we have been connected to the Learning Channel Campus and the Internet through the satellite.

Learning is now going to be research orientated. That is we shall use worksheets and we shall use the Internet as the main source of information. In the past we spent much of our time copying notes from the chalkboard.

The school has set itself a new vision for the new millennium. By the year 2005 it wants to produce learners who will follow careers in the field of Science, Technology, Engineering, Medicine and others. This was a far fetched dream a few years ago.

I have learnt that the electricity generated from coal and water is a hazard to our planet. On the other hand I have learnt with amazement of how the use of solar electricity could save the world from pollution. I have taken a decision that I will do whatever it takes to contribute to the campaigns aimed at saving our planet from the hazard of pollution.

Solar energy has brightened my future and it is destined to brighten the future of millions of others.⁹

■ Looking Forward: Women-Led SELF Projects in Tanzania and Ladakh

The exceptionally strong outcomes of SELF's projects in Vietnam and South Africa argue strongly for putting women at the center of project leadership whenever possible, a commitment made explicit in SELF's new three-year Strategic Plan. 2003 will present two such opportunities for women-driven efforts:

TANZANIA

The Kigoma region of northwestern Tanzania is desperately poor, with a per capita income under US\$100. In the most recent census in 1988, the region's population stood at 1,000,000. Today's number is certainly dramatically higher, both because the area has Tanzania's highest fertility rate, and because of a massive influx of refugees fleeing strife and genocide in Rwanda, Burundi, and the Democratic Republic of Congo, Kigoma's neighbors around Lake Tanganyika. 85 to 90 percent of Kigoma's people reside in rural areas, virtually always without electricity.

The region's population surge has exacted a harsh toll on the local environment, with a deforestation rate twice the national average. The Miombo woodlands that once blanketed the area have been reduced to just 46% of their original extent, with consequences for women all too sadly predictable.

⁸ Read the full text of this lengthy article at http://www.self.org/news/nyt_solar_power_is_reaching_where_wires_cant.pdf.

⁹ Samantha's essay and beautiful drawings of the school and the solar power project are at this sizable address on the ISES website: http://www.ises.org/ISES.nsf/5c990687ba31ff01c12568b3004ef917/6908fc3d975fe818c125694a00257653/PageContent/M3/Pages_03-05_Myeka_Secondary_school.pdf?OpenElement.



The Kigoma region is famous as the home of the Gombe Stream Research Centre, where Jane Goodall and her colleagues have spent four decades in trailblazing research on chimpanzees, our closest genetic relatives. Among the discoveries to emerge from Gombe are that chimps make and use tools, hunt and eat meat, come together in family groupings in periods of stress, and at times succumb to the same warlike ways as human beings. The late biologist and author Stephen Jay Gould said that "Jane Goodall's work with chimpanzees represents one of the western world's greatest scientific achievements."

No less than for humans, the loss of forest in the Kigoma region poses dire challenges for chimpanzees, whose very survival may hang in the balance. Africa's wild chimpanzee population, at least 1 million animals in 1960, is today fewer than 200,000. "Because chimpanzees are very slow breeders and give birth only at five-year intervals," worries Goodall, "the species could be on its way to extinction if nothing is done to protect the animals and their habitat."

Recognizing that the welfare of chimpanzees and humans are indissolubly linked, in 1994 the Jane Goodall Institute joined hands with local leaders to create TACARE, The Lake Tanganyika Catchment Reforestation and Education Project. TACARE seeks to arrest the rapid environmental degradation of the Kigoma region by improving the lives of the area's people and – particularly and explicitly – its women.

TACARE is at work on many fronts in thirty villages throughout the Lake Tanganyika watershed. It is delivering conservation education, helping women grow fruit trees and vegetables, and promoting reforestation. It is running a very successful family planning program,¹⁰ teaching young people how to avoid AIDS, underwriting scholarships for academically-gifted girls to attend secondary school, and championing women-led microenterprise.

Additionally, TACARE is actively seeking ways to ease the energy burden on Kigoma's women. It has so far introduced fuel-saving stoves in 22 villages, and now seeks to disseminate the benefits of solar energy. In this task it has asked the assistance of the Solar Electric Light Fund.

SELF and TACARE have conceived a phased solar electrification project that will begin at the Gombe Stream Research Center, then radiate outward to surrounding villages. Women will be not only key project beneficiaries, but also project leaders.

In the first phase, SELF staff will team with locally-recruited women and men to install solar arrays at the Research Centre. These local recruits will receive intensive training in their KiSwalihi language in how solar power works, how it is implemented, and how systems are properly maintained.

Upon the completion of this phase, this vanguard group of local technician-evangelists will fan out to the TACARE villages, spearheading broad-based solar-electrification of homes and community institutions such as schools, health clinics, tree nurseries, and microenterprises.

One very exciting new microenterprise will be directly spawned by the project itself: a women-run business that will produce energy-efficient lamps and lighting fixtures ideally suited to use with solar power. These innovative lamps will be based on clustered light-emitting diodes. Optimism for the success of such a lamp-making venture is founded on the very positive results of a quite similar undertaking involving rural women in Bangladesh, recently described by the UNDP in its excellent publication *Generating Opportunities: Case Studies on Energy and Women*. Among the conclusions of that case study:

¹⁰ Read a recent U.C. Berkeley evaluation of this program at <http://big.berkeley.edu/tacare.pdf>.



Lamp production provides a new opportunity for women to earn a living, one in which their labour is highly valued. Non-farm labour among women was not significant in the area prior to the project. Now their employment prospects have increased.

Besides increasing the non-farm skills of rural women, the project has also allowed them to generate income, play a role in decentralised energy service delivery, improve their quality of life through better lighting, and raise their status in the household and community...

Women who are involved with lamp construction and, by extension, with addressing the overall energy needs of the region, are being heard more. Project participants and their associates now run meetings to discuss prospects and problems in microenterprise operations, regional sales and electrification issues.

The husbands of the project members offer assistance to the working team of women, especially in marketing and sales. Individually and collectively, the women are encouraged to bring their husbands to monthly meetings with the marketing manager in order to discuss potential business prospects. Such interactions have been found to build women's confidence, and interest in the project among the men. As a result, the project has been successful in removing some of the social and cultural discrimination experienced by women.

Regular participation in project activities requires women to spend time outside their homes, thereby overcoming a traditional social barrier. In addition, other family members are found to support the women by taking on household responsibilities in order to help them participate in training and production activities. With the electric lamps, housework can be done at night and women can restructure the time they spend on household activities... Such shifts in priorities of households in remote rural areas of the country are a sign of the social changes achieved by the project.¹¹

The observation regarding the supportiveness of men is especially encouraging, since both Bangladesh and Tanzania are Muslim nations where male privilege is pronounced. Further evidence of the viability of a women-led microenterprise in Muslim Tanzania comes from a new study, *The Role of Women in Sustainable Energy Development*, from the U.S. National Renewable Energy Laboratory:

Although conflicts and differences of interests between women and men can and do exist, men often support the efforts of women to save time and improve their families welfare. Even in a Muslim country like Yemen, the openness of both women and men to women's role in renewable energy was evident in a baseline survey for a biogas project: It revealed that women were ready to acquire new skills and knowledge that would improve their lives and that of their families. It also indicated that the male heads of households welcomed the release of women from their difficult tasks, within and outside the home, and the utilization of the time for education and improvement of family conditions.¹²

LADAKH

In late 2001, SELF was asked to bring solar power to Tibetan exiles in the southern Indian state of Karnataka, specifically for a new Prayer Hall at the Gaden Jangtse monastery in Mungod. Gaden Jangtse is also the occasional residence of His Holiness the Dalai Lama, who blessed the Prayer Hall at a ceremony in which Bob Freling, SELF's executive director, was privileged to be included.

In a private audience, His Holiness voiced keen interest in the role that appropriate technologies such as solar power can play in improving the welfare of Tibetan and other peoples. His Holiness asked Mr. Freling to confer with representatives of the Tibetan Government-in-Exile to determine what refugee communities might most benefit from SELF's help. The Government-in-Exile's Home Office was quick with a response: the Sonamling Refugee Settlement in Ladakh.

A breathtakingly beautiful area of broad valleys and spiky, soaring Himalayan peaks, Ladakh is also a sere desert landscape of remorseless wind and fierce sun. In the Sonamling Settlement, 4,000 Tibetan refugees eke a hardscrabble subsistence from small, boulder-strewn farms. The extreme cold and aridness of the area limits crop growing to a few short weeks in the summer. Over the rest of year, economic activity is minimal, and in the winter the region is completely cut off by deep snow, with air travel providing the only viable route of transportation and communication.

¹¹ See http://www.undp.org/seed/eap/publications/2001/files_2001a/03_bangladesh.pdf.

¹² See <http://www.nrel.gov/docs/fy00osti/26889.pdf>.



People in the area have asked the Government-in-Exile for assistance in diversifying their economic base. Of particular interest is information technology, which the Ladakhis understand has worked great positive change for other Tibetan refugees at the Paljorling Settlement in nearby Pokhara, Nepal.

SELF will develop a computer center in the Sonamling Settlement of Ladakh together with the American group that facilitated the accomplishments in Paljorling, Students for Change (SFC). SFC was started in 1998 by Robyn McClintock, who saw the need and opportunity while doing field research in Nepal for her master's thesis. SFC defines its mission as "striving to increase the socioeconomic well being for the population of each community by providing education and tools for generating income."

Sonamling Settlement is far removed from grid electricity, so SELF staff will work with local people to install solar energy to power a computer center and satellite Internet hookup. Then American college students from SFC will arrive for a semester of coaching area residents in information technology and small business management. In Ladakh, this assistance will concentrate on women, who today have few job opportunities beyond the home, and who face educational and cultural obstacles to departing the region to seek work in an urban center in India.

The local Ladakhis who will provide project leadership are Mr. Yeshe Dhundup and Mrs. Sangey Chodon, both of the Ladakh-based Tibetan Environment Network. The explicit charge of Mrs. Chodon, an accomplished and very tech-literate professional woman, is to ensure that the initiative delivers benefit to as many Ladakhi women as possible.

Mrs. Chodon sees many exciting economic opportunities for women springing from the project. As at Paljorling in Nepal, Mrs. Chodon wants women to begin using the Internet to market their handicrafts. She also wants women to be the principal employees at the center, and later to aspire to being owner-operators of cyber-café's, which have recently become popular in Leh, Ladakh's main village. There is also the prospect of women providing offshore data-entry services, something being done with great success in Cambodia through an organization called DigitalDivideData.org.

■ **Conclusion: Divides United**

Renewable energy cannot by itself span all the daunting divides and fault lines that make our age so unsettled and, at times, so frightening. But, together with goodwill, such technology can and should play a significant role.

All humanity deserves electricity to reduce drudgery, to purify water, to light and heat their homes, to refrigerate vaccines, to use modern communications, to discover and reach their full potential as people. Developing world women are particularly harmed by lack of electricity, and their empowerment with renewable energy will pay immense dividends. Join SELF in reaching across this divide.

It is fully within our power.