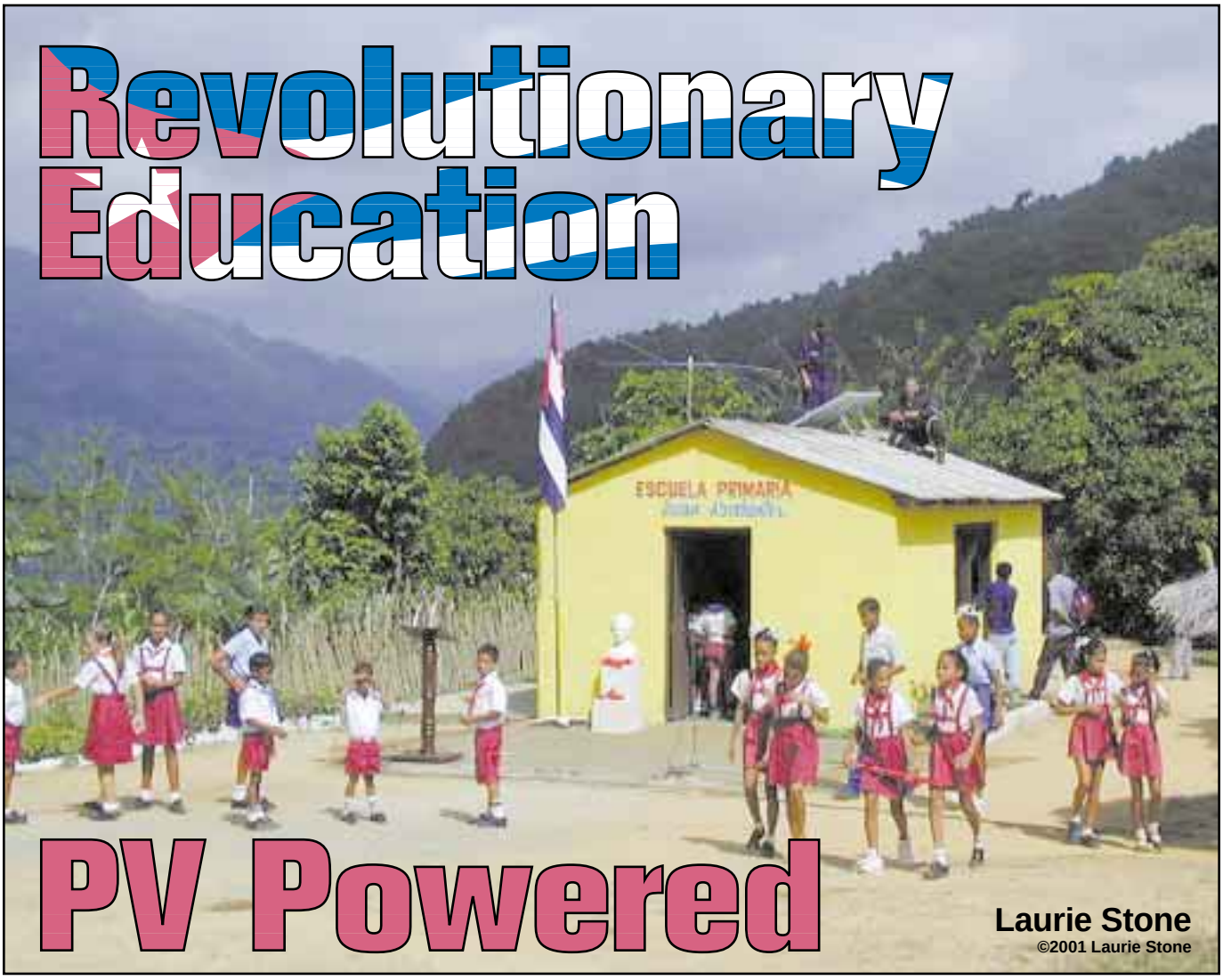
Revolutionary Education

PV Powered



Laurie Stone

Juan Abrahantes School, Imias Municipality, Guantanamo Province.

Travel around rural Latin America and you're sure to see schools without basic educational tools, let alone electricity. Not in Cuba. More than 34,000 children in rural areas of this small Caribbean island are reading, writing, and watching educational videos using the power of the sun.

Cuba's commitment to education is astounding. Although many countries have obligatory schooling, Cubans take mandatory schooling to mean that they are required to provide the best educational opportunities possible for their children.

They also take family seriously. In order to allow small children to remain close to their homes, every rural community, no matter how remote or how small, has a primary school. And every primary school in these remote areas is now powered by photovoltaics (PVs).

Before 1959, Cuba had 800 MW of electrical generating capacity, and the majority of it was in the large cities. After the Cuban revolution in 1959, the government made rural electrification a priority. In the next thirty years, 95 percent of the country was electrified with over 3,000 MW of capacity.

Recovering from Soviet Oil Dependency

Cuba had been buying oil inexpensively from the Soviet Union. The 1989 collapse of the Soviet Union, along with a tightening of the U.S. enforced economic blockade, led to the bottom falling out of the Cuban economy.

From 1989 to 1993, the island's gross domestic product (GDP) fell by half, from US$19.3 billion to US$10 billion. Since Cuba couldn't trade sugar for oil with Moscow, the country lost most of its petroleum supplies overnight. Imports fell by 75 percent—much of that was food, spare parts, agrochemicals, and industrial equipment.

Without oil, industrial production fell, factories closed, public transport collapsed, blackouts became common, and agriculture and food production were paralyzed. In

1993, at the height of the crisis, Cuba was spending 60 percent of its import bill on food and oil.

The years since 1989 are known as the "special period," a time when the Cuban people have had to figure out a way of coping with their grave economic problems. The state moved dramatically to restructure the economy. For the most part, Cubans sympathize with the state's efforts to distribute available food as fairly as possible. The special period has been a time of belt-tightening. But the consensus is that the problem is a national one, which all Cubans need to work on together to solve.

Cuba had to begin buying oil on the international market, which their fledgling economy could not afford. This led to a desire to decrease their dependence on fossil fuels and use more renewables.

Rural primary school in Pinar del Rio Province.

Cuba is now using biogas, biomass, solar, wind, and microhydro energy. The residue from sugarcane, Cuba's main export crop, is used to power the 156 sugar mills in Cuba. The excess electricity is put into the grid. Over 220 microhydro systems, from 8 KW to 500 KW, supply 30,000 Cubans with electricity. Besides the 9,000 mechanical windmills in Cuba, the island now has a 0.45 MW wind farm to supply electricity to the national electricity grid.

Students watch an educational video in the Giralda Baldoquin School, Jobabo Municipality, Las Tunas Province.

2,000 School PV Systems

Even during the special period, social programs, such as education and health care, were not cut, but remained a high priority of the Cuban revolution. To better the quality of education for their children, in the year 2000, the Cuban government financed a program to electrify all of the primary schools in the country that had no electricity. The program was carried out by PV distributor Ecosol Solar.

Ecosol Solar is a division of Copextel, a private Cuban technology company that specializes in computers, electronics, telecommunications, and other high technologies. Ecosol Solar sells, services, and installs photovoltaics, solar thermal, wind, biomass, and hybrid systems.

In less than one year from the time the first PV panel was installed on a primary school, 1,994 schools had photovoltaic systems. Each system consists of a 165

Students in PV Powered Cuban Schools

Student Population	*Number of Schools*
1	21
2 – 5	357
6 – 10	483
11 – 20	518
21 – 40	385
41+	180
Total	1,944

Antonio Guiteras School, Union de Reyes Municipality, Matanzas Province.

School System Costs

Item	*Cost (US$)*
PV module, 165 W	$970
Charge controller, 20 A	200
2 Batteries, 6 V, 220 AH	160
Inverter, 250 W	80
2 DC lights, 15 W	70
Total	$1,480

watt module, a 20 amp controller, a 250 watt inverter, and a 220 amp-hour battery bank. Three of the systems also include small wind generators.

Each school has two 15 watt DC lights, and an AC television and VCR for educational programs. The systems are designed to run five hours a day if students watch a video. Without the video, the systems can run for eight hours a day.

PV *Brigadistas*

To carry out such an ambitious project, the nongovernmental organization (NGO) Cubasolar and Ecosol trained brigades in each of the provinces on the installation of PV systems. The brigades were made up of representatives of Ecosol, university professors, students, teachers, and other volunteers from the provinces.

Cubasolar was founded in 1994. Its mission is to promote renewable energy, energy efficiency, and environmental education. Every two years, Cubasolar holds an international renewable energy conference in Cuba. The organization has introduced renewable energy into the national education system, and publishes books and magazines promoting the use of renewables.

Twenty-five brigades went to the rural areas, installed the systems, and trained local people in the maintenance of the systems. A maintenance video was shown to the teachers at each school. The teachers are in charge of monitoring the battery level, and occasionally cleaning the panels.

Every ninety days, each school receives a maintenance visit from a technician. There is also a repair shop in each province, and a minor repair shop in each territory (the provinces are made up of numerous territories) set up by Ecosol. An Ecosol technician also does a periodic inspection of the entire system.

No problems have been reported with any of the school systems so far. Even with the PV electrified health clinics program, which began in 1987 (see *HP66*), there have been very few system failures. Many of these systems have actually survived three hurricanes with no damage. Ecosol credits the lack of failures to user training.

Students at the environmental education classroom in Ciudad Libertad show drawings of renewable energy at work.

The PV electrified schools bring the total number of PV systems in Cuba to more than 2,400. These include 320 health clinics, 100 social centers, 4 rural hospitals, and numerous houses.

Cuba is importing part of their photovoltaic hardware. But they now build their own charge controllers, and they also have a PV manufacturing plant in Pinar del Rio where they are producing PV modules with 14 percent efficiency.

Due to their economic situation, the factory is not producing panels for public use yet. They just do not have the money to mass produce the PV modules. Right now, they are only being produced in a laboratory setting. With financing, the factory could produce 1 megawatt of PV panels a year. Their hope is that in the future, systems can be made completely with Cuban parts.

Computers for the Countryside

In June of 2001, Cubasolar received the United Nations' Environmental Program (UNEP) Global 500 award for this remarkable PV program. But the school electrification program is not finished yet.

The Cuban government wants every child in Cuba to have access to a computer. They plan to put a computer in every primary school by March of 2002. In the next few months, Cubasolar and Ecosol are committed to adding one more panel to each primary school, so that each system can also run a computer.

Environmental Education

Children in Cuba not only learn using PV technology, but also learn about PV technology. In the middle of Havana, young children learn about renewable energy in the environmental classroom in Ciudad Libertad. Ciudad Libertad (Freedom City) was an army barracks in prerevolutionary Cuba. After 1959, it was converted into a school complex. It now contains preschool through university classrooms.

Children from schools all over Havana use the environmental education classroom in Ciudad Libertad. They learn about environmental issues, including energy conservation, recycling, and renewable energy. On World Environment Day (June 5) alone, 1,340 students visited the classroom. On a recent visit, young children were drawing pictures of PV powered hospitals and schools.

Renewable energy education is integrated into other schools as well. The Basic Industry Ministry financed a book on environmental education for teachers. Cubasolar estimates that 98 percent of all Cubans know that PV panels produce electricity.

Cuba takes its commitment to education seriously. Their economic hardships and lack of access to fossil fuels do not deter them from providing high-quality education to every child in Cuba. Jose Martí, a Cuban hero who fought against Spain for Cuban independence said, "People can't be more perfect than the sun. The sun

Cubasolar Conference: Solar and Renewable Energy in Cuba

March 29 through April 7, 2002

We traveled for three hours by bus, open-air truck, and on foot to get to a remote PV installation in the Sierra Maestra, the mountains of eastern Cuba. This was no ordinary solar conference. This was a conference organized by Cubasolar, a nongovernmental organization that promotes renewable energy in Cuba.

Cubasolar has been organizing international renewable energy conferences since 1994. Every two years, scientists, engineers, and solar enthusiasts from around the world travel to Cuba to learn about what this small island is doing with renewable energy.

Unlike other solar conferences I have attended, the majority of the conference was not held in lecture rooms, but was spent visiting PV, micro-hydro, and biomass sites. During the 1996 conference, we visited a remote community powered entirely by photovoltaics, witnessed the grand opening of a remote PV powered health center, spent time in two communities electrified with microhydro systems, and visited a sugarcane factory run on biomass from the sugarcane stalks.

During the adventurous trips to these remote regions, we talked with our Cuban counterparts and with solar advocates from Europe and throughout Latin America.

Although it is illegal for U.S. citizens to travel to Cuba for tourism, there are certain licensed travel providers to Cuba. I traveled to Cuba with Global Exchange, a licensed provider that offers trips to learn about Cuba's programs in sustainable development, music, art, and culture. Global Exchange also obtains specific educational travel licenses from the U.S. treasury department for their trips to the Cubasolar conference.

The Cubasolar 2002 conference will be held in Pinar Del Rio province of western Cuba from March 27 to April 7. For information on the Global Exchange delegation, contact Pam at Global Exchange listed in the access section at the end of this article.

burns with the same light that it heats. The sun has spots. The unfortunate speak only of the spots. The fortunate speak of the light."

Cubans are using the light of the sun to combat their oil shortage, and to ensure a superior education for their children. Now every rural Cuban primary school proudly displays a Cuban flag, a bust of Jose Martí, and a photovoltaic system.

Access

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