



A two-decade fuel shortage turned the island into a laboratory for energy conservation. **Education plays a key role in helping the economy function.**

Teaching Cuba's Energy Revolution

Text and photos by **MARIO ALBERTO ARRASTÍA AVILA** | Cubaenergía
with **LAURIE GUEVARA-STONE** | Solar Energy International

Mario Alberto Arrastía Avila holds a degree in education from the Pedagogical University of Havana in Cuba. He is an energy specialist at Cubaenergía, the Center for Information Management and Energy Development in Havana. marioalberto@cubaenergia.cu, cubaenergia.cu

Laurie Guevara-Stone is the international program manager for Solar Energy International in Carbondale, Colo. solarenergy.org

Before 1989, Cuba traded sugar for oil on very reasonable terms with the Soviet Union. Beginning in 1989, with the fall of the Soviet Union, the island nation was forced to buy oil on the open market. Imports from Russia dropped by 50 percent, and oil consumption dropped 20 percent, from 225,000 barrels a day in 1989 to 180,000 barrels a day in 1992. Transport was hit hard, along with electric generation. The United States also tightened its

A billboard in Pinar del Rio says, "A Revolution with Energy: Saving more we will have more"



blockade against Cuba, making the economic crisis even worse.

For two decades, Cuba has been developing renewable energy and energy-conservation strategies to cope with the fuel shortage. Educating citizens about energy conservation has been one of Cuba's programs to move toward a more sustainable energy future. Energy advocates quickly learned that behavioral changes require the introduction of new values in the whole society, and they determined that energy education is the most cost-effective method for saving energy.

The national newspaper Granma reported in 2006 that solving the energy problem "is not as simple as reducing carbon emissions in energy production and transportation; the current circumstances demand changes in the cultural framework of producers and consumers, and a promotion of an energy consciousness."

Educating a population of 11.5 million about energy is a tall order. Cuba's energy education program focused on creating a new energy culture and on achieving sustainable development.

An energy culture means one in which all citizens can responsibly manage energy consumption in their daily activities. It also means they understand that the generation, transmission and consumption of energy resources have both economic costs and environmental impacts. We must learn to value each alternative energy source according to its environmental impact and choose products by how efficiently they use energy and how little they impact the environment.

In 2006 the country took more drastic steps in confronting energy problems. Parliament declared it the Year of the Energy Revolution. The country undertook a shift toward a distributed generation system, phased out inefficient lighting, and instituted new economic and social measures. On the economic side, residential electrical rates went up for those who consume more than 100 kilowatt-hours per month. New social measures are purely educational, aimed at the formation of an energy consciousness in all of Cuban society, starting in early childhood. It was found that educating children can indirectly influence the rest of the family, and the whole community.

Educating Youth

Energy education is not a new topic in Cuba. During the 1970s, children from primary and secondary schools were organized in neighborhood "Click Patrols." They went door to door to ask that families turn off unused electric appliances.



A school electrified with solar panels in San Narciso, Cienfuegos, is an educational opportunity for the entire community.

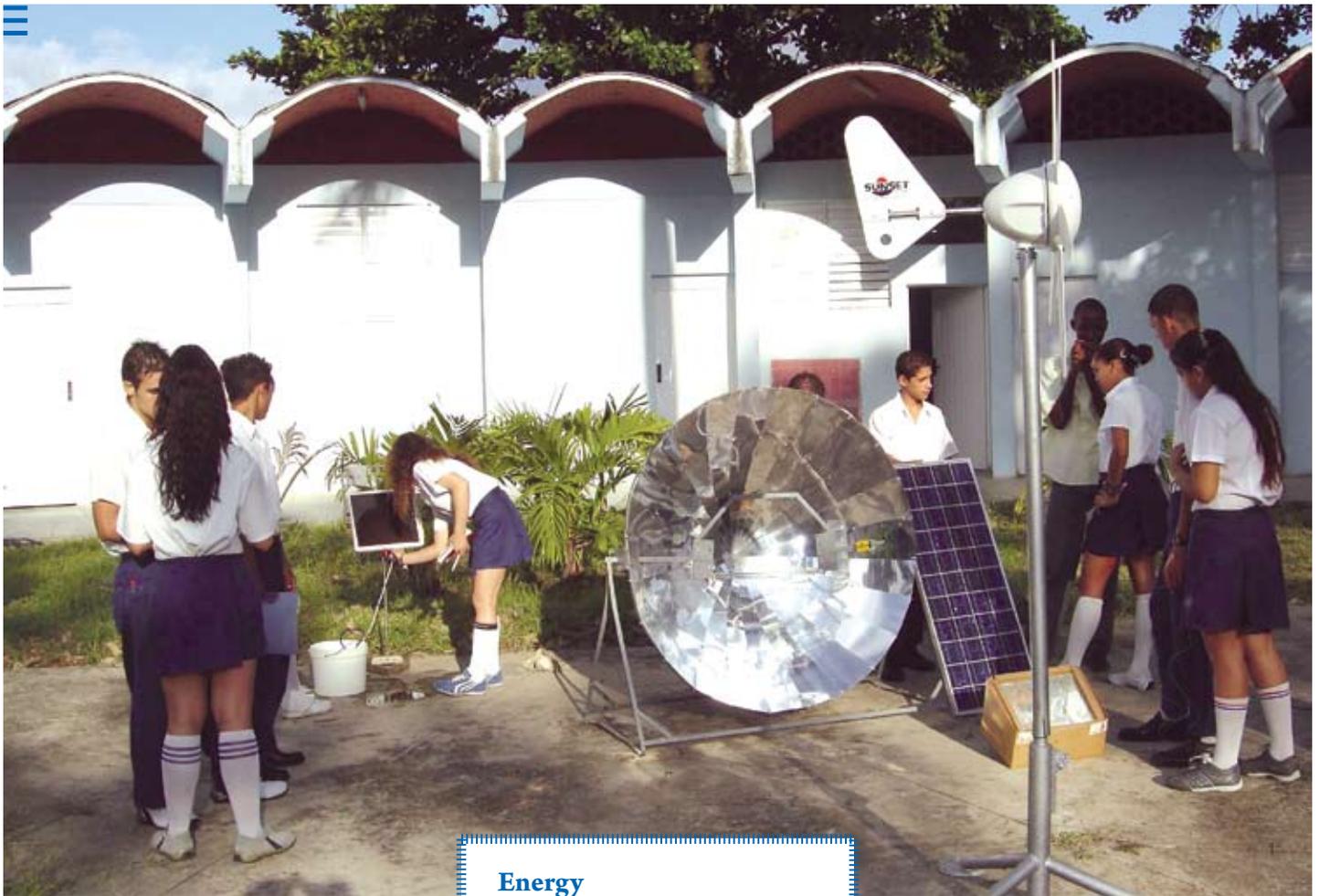


LAURIE GUEVERA-STONE

Schoolboys show their drawings of renewable energy applications at an energy education classroom in Havana.



Energy education is part of the curriculum at teachers' colleges.



Schools showcase a variety of renewable energy demonstrations. Students are encouraged to create art, music and poetry through the annual PAEME festival.

In 1984, President Fidel Castro, in the closing session of the First National Energy Forum, stated: “Our entire population, all the workers, youth, students, even young children, have to be aware of energy, and of their future, and ask themselves how we are going to produce electricity, steam and transportation in the future. Children have to ask themselves this question, in our country more than in any other.”

Today the agency responsible for promoting energy education in the schools is PAEME, the Energy Saving Program of the Ministry of Education (*Programa Docente Educativo de Ahorro de Energía del Ministerio de Educación*), created in 1997 in parallel with the Electricity Saving Program of Cuba (*Programa de Ahorro de Electricidad en Cuba*).

Energy themes are pervasive in Cuban schools. Almost all school subjects address energy issues. For example, in geography class students investigate the different renewable sources of energy and describe their application in the immediate future. Biology classes study the environmental

Energy

In my home saving energy.
Everything we should save,
And if we all contribute,
Together we can save.

Energy is very important
In school and in the home,
Because of it we listen to music,
And we can make things cold.

Friend I advise you
That you should save energy
And with care and happiness
Use solar energy.

Thanks to this energy
Some students can see
From their rural school,
Educational programs on TV.

The main source of energy,
For all the needs of humanity
Is the practically inexhaustible
Renewable Energy.

By Élide Rosa Sánchez Fuentes, 5th grade student at Camilo Cienfuegos school in Bartolomé Masó, Cuba

From El Camino del Sol by Enrico Turrini

impacts of electricity generation. In social studies students explore Cuban newspapers and magazines to report on how Cuba is using renewable sources of energy to generate electricity.

PAEME also promotes energy and environmental consciousness through extracurricular activities. One of these is the PAEME Festival, a national movement that mobilizes thousands of primary school children, teens, teachers and families across the whole country. The festival encourages children in each classroom to create songs, poetry and theater on energy themes. The children with the best energy-efficiency projects go on to the festival at the municipal level. From there, the best move on to the provincial level, and from there on to the national level.

PAEME Festival Participant Numbers (papers, drawings, songs, etc.)

Year	Provincial level	National level
2005	953	395
2006	1,010	419
2007	1,725	432
Total	3,688	1,246

The Direction of Rational Use of Energy of the *Unión Eléctrica de Cuba* or Cuban Electrical Union (UNE), along with the Ministry of

Education (MINED), organizes its own annual Energy Conservation Festival. In this event, children from Havana and outlying areas create energy-themed poetry, dance, music and plays.

Energy Conservation Festival MINED-UNE

Year	Activities	Participants	Presented works
2005	5	520	323
2006	6	715	401
2007	6	742	433
Total	17	1,977	1,157

Higher Education Takes On Energy Issues

Cuban universities have developed a master's degree in energy efficiency, and the Materials and Chemicals Institute of the University of Havana offers a diploma course in photovoltaic technology. Other universities in the country offer postgraduate courses on energy issues. Energy education is part of the curriculum at teachers' colleges.

CUBAENERGIA, the Information Management and Energy Development Center established in 2003, offers an energy education course broadcast by the national television network as part of the *University for All* program (*Universidad Para Todos*). Titled "Towards an Energy Consciousness," the course is accompanied by a print periodical distributed across the whole country. Training activities on energy-efficient management have also been developed for workers and managers of institutions that are high users of energy.

CUBASOLAR, the organization for the promotion of renewable energy and environmental respect, has education as its primary objective. CUBASOLAR has helped to create energy education projects in several provincial higher educational institutions: the Center of Solar Studies in Granma Province, the Solar Laboratory of the Volodia Educational Center in Havana, the Experimental Laboratory of CUBAENERGIA, and the first grid-tied PV system in Cuba, located at the Provincial Museum in Pinar del Rio.

Energy Education Through Mass Media

Mass media play an important role in energy education in Cuba. The press in all its forms — print, radio, digital and television — has taken on the task of educating its audience on energy issues. Programs focus on energy conservation, the use and care of home appliances, safety measures, renewable sources of energy, biofuels

and climate change. *The Round Table*, a debate-format TV show, dedicates time to energy issues. Printed tabloids are distributed to teachers, specialists and the general public.

Cubans, of course, are passionate about baseball. Between innings during baseball broadcasts, fans hear messages about the efficient use of electricity in homes during peak demand hours, since homes account for about 45 percent of the country's electrical demand. They hear the same messages during the popular sport show *Deportivamente* on the national radio station Radio Rebelde. There is also a five-minute weekly energy program on national TV, in an audience-response format. Consumers are invited to attend a lecture series held at energy facilities.

Communication Through Mass Media

Number of Articles/Broadcasts

Year	Newspapers	Radio	Television
2006	610	5,515	685
2007	629	5,919	1,670
2008*	173	1,952	690

*incomplete

In 2007, Havana's weekly newspaper, *Tribuna de La Habana*, began running a back-page feature, "Offensive Energy." It reports on workplace energy audits, highlighting areas for potential improvements.

There is no advertising for commercial products in Cuba. However, scattered along the

country's roads and highways are billboards promoting energy conservation. And neighborhoods have hosted more than 600 "Energy Debates" since 2006.

Social Workers Advance Energy Projects

The Programa de Trabajadores Sociales, or Social Workers of Cuba, was founded in 2000. Its young staff works in elder care, labor, education, culture, sports and energy. Their academic training includes a course in energy and sustainable development, and one group has been specially trained to help implement the nation's new solar water-heating program. Another group, charged with international outreach, has changed about 100 million incandescent bulbs for fluorescent lamps in communities across a dozen Latin American countries.

Carbon Emissions Reduced

It is estimated that between 2005 and 2007 Cuba reduced its CO₂ emissions by approximately 5 million tons, which represents 18 percent of the total emissions of the country in 2002, according to the last report rendered by Cuba to the International Panel on Climate Change.

CO₂ Emissions Avoided with the Energy Revolution (2005-2007)

Fuels	Savings*	Emissions avoided (tons of CO ₂)
Crude oil	961,419	3,749,534.1
LPG	124,183	335,294.1
Kerosene	28,076	899,443.2
Total		4,984,271.4

*(tons of oil equivalent)

Confronting climate change requires a worldwide energy revolution. In order for this to happen we need a revolution in consciousness. Changing poor energy habits is not an easy job; it takes time, intelligence, education, desire, effort and resources. Cuba has undertaken its own path towards a new energy paradigm, applying concepts like distributed generation, efficiency, education, energy solidarity and the gradual solarization of the country.

The answers needed to confront the complex energy-environmental global situation cannot be concentrated in the efforts of a handful of experts. Cuba has shown that only through educating the entire population on energy issues can we expect to make real changes in our energy use, and confront seriously the issue of climate change. **ST**

IIII RESOURCES

for further information

Cubaenergía, the Center for Energy Information and Development in Cuba, Calle 20 No. 4111-4113 e/ 18A y 47, Miramar, Ciudad de La Habana, CUBA, tel: 537.203.1412, comercial@cubaenergia.cu, www.cubaenergia.cu

Cubasolar, an NGO promoting the use of renewable sources of energy in Cuba, Calle 20 No. 4113, esquina a 47, Miramar, Ciudad de La Habana, Cuba, tel: 537.205.9949, sol@cubasolar.cu, www.cubasolar.cu

Join a renewable energy and energy education delegation to Cuba, March 8-15. This legal and licensed trip is sponsored by Global Exchange and Solar Energy International. Contact laurie@solarenergy.org or leslie@globalexchange.org for more information.