CHAPTER 30

Cuba: Lessons from a Forced Decline

Pat Murphy and Faith Morgan

The end of the Cold War in the early 1990s was not the positive turning point some thought it would be; instead it marked the start of new crises. Worldwide inequity is at record levels. Military spending is at the highest level in modern history. Fossil fuel resources have become more limited, threatening economic hardship, at the same time that their emissions are causing dangerous climate change.

Of all these challenges, climate change is arguably the most severe and daunting. Stabilizing the climate seems unlikely without a significant reduction in fossil fuel consumption. In this context, Cuba has become an important example, since in the past two decades it has reduced its carbon dioxide (CO_2) emissions by 25 percent, from 3.2 tons per person in 1990 to 2.4 tons in 2009. Cuba's focus on meeting basic human needs instead of on economic growth and consumption offers an important example to the rest of the world.[1]

The context for Cuba's current situation is set by its long history of colonization and isolation. After several hundred years of Spanish domination, control of Cuba passed to the United States in 1898, which continued interfering in Cuba's political, economic, and military affairs. Cuba achieved full independence with the overthrow of General Fulgencio Batista at the end of the Cuban Revolution (1953–59) led by Fidel Castro. Although President Dwight D. Eisenhower officially recognized the new Cuban government, the relationship cooled after Cuba began nationalizing properties owned by American-based corporations. Eisenhower authorized a CIA-managed 1961 invasion of Cuba that failed. In1962 President John F. Kennedy imposed economic sanctions by banning all trade with Cuba except for nonsubsidized sales of food and medicine. To ward off the continuing U.S. threat and to find new trading partners, Cuba developed relations with the Soviet Union. This led to the very serious Cuban missile crisis of 1962, settled when Russia withdrew missiles from Cuba and the

Pat Murphy is research director and **Faith Morgan** is executive director of the Arthur Morgan Institute for Community Solutions in Yellow Springs, Ohio.

United States withdrew missiles from Turkey. The United States also agreed not to invade Cuba.[2]

The dissolution of the Soviet Union, beginning in 1990, had a devastating effect on Cuba. Trade with Cuba's former partners declined by more than 90 percent, cutting off 80 percent of the island's food imports. And imports of Soviet oil plummeted from 13 million tons in 1989 to 1.8 million tons in 1992. President George H. W. Bush added new economic sanctions with the 1992 Cuban Democracy Act, which prohibited foreign subsidiaries of U.S.-based companies from trading with Cuba. Travel to Cuba by U.S. citizens was banned, as were family remittances to Cuban relatives. President Bill Clinton signed the 1996 Cuban Liberty and Democratic Solidarity Act (also known as the Helms-Burton Act), further tightening the economic blockade against Cuba. This act, which is still in effect, prohibits recognition of any transitional government in Cuba that includes Fidel or Raúl Castro and provides for retaliatory action against any non-U.S.-based company that trades with Cuba.[3]

Since 1960, the United States has spent over $500 million trying to destabilize the Cuban government. This long-term U.S. effort forced Cuba to adapt to severe shortages of oil, medicine, and food after 1990. As a result of more than 20 years of such privations, Cuba now serves as an example of a country that has survived and thrived with very limited fossil fuel resources.[4]

Cuba's Special Period

Between 1989 and 1993, Cuba's gross domestic product (GDP) fell 35 percent, and in the absence of markets for its goods, exports dropped 75 percent. The decline in food imports caused severe food shortages. Electrical blackouts of 16 or more hours a day became common. In response to the crisis, Cuba announced the implementation of the *Período Especial* (Special Period) in August 1990. This was a series of contingency plans, austerity measures, and rationing schedules that had originally been developed for use during wartime.[5]

During the early years of the Special Period, daily energy intake fell from 2,899 calories to 1,863 calories per person. Fuel shortages forced people to walk or ride bicycles. The percentage of physically active adults increased from 30 percent to 67 percent. The average adult lost 9–11 pounds, or 5–6 percent of body weight.[6]

The availability of medical supplies and equipment was dramatically reduced. A report from the American Association for World Health noted that "a humanitarian catastrophe was averted only because the Cuban government has maintained a high level of budgetary support for a health care system designed to deliver primary and preventive health care to all of its citizens."[7]

Housing and transportation were similarly affected. New housing starts dropped precipitously; existing housing units deteriorated in the absence of construction materials, replacement parts, and the resources for routine maintenance. Overcrowding became common in Havana as families "doubled up" in domiciles, with adult children living much longer with their parents. Passenger transport fell by 58 percent, and Cuba's ability to move goods around the country was severely constrained.[8]

In response, major efforts were made to develop public transportation. Trucks were converted into buses, and local manufacture of buses began. Horse-drawn carriages, buggies, and carts were used extensively. Hitchhiking became a necessity, and state-owned vehicles were (and still are) required to pick up hitchhikers. An extensive taxicab service was introduced by the national government.[9]

The economic crisis also transformed Cuba's agricultural system. Prior to 1990, the country's agriculture had used a mixture of Soviet and U.S. farming techniques that were large-scale, export-oriented, heavily mechanized, and highly dependent on chemical inputs. Cuba's agriculture had used 1.3 million tons of fossil-fuel-based fertilizer annually before the economic crisis; afterward, fertilizer use dropped to 160,000 tons a year.[10]

John Morgan

An organic urban farm in Havana on land leased rent-free from the government.

Throughout the worst years, 1993 to 1995, two basic government policies kept the food crisis from becoming catastrophic. Food programs targeted the most vulnerable populations (children, the elderly, and pregnant and lactating women). And a ration-card system for distributing the greatly curtailed quantities of food supplied all Cubans with rice, beans, and other basic foods.[11]

Cuba developed agricultural techniques to deal with the lack of chemical inputs and limited fuel, electricity, and machinery. These included organic fertilizers, animal traction (oxen), mixed cropping, and biological pest control. The development of urban gardens and farms yielded a major increase in domestic fruit and vegetable production.[12]

In a 2001 report, Oxfam America stated that although inequity had increased, social unrest was minimal thanks to the government's agricultural-

reform strategies of the mid-1990s. The policies encouraged private enterprise and decentralized decisionmaking by distributing large state farms (41 percent of the arable land) to thousands of smaller farmers' cooperatives and by leasing government land to private farmers in rent-free lease agreements. Given the loss of chemical inputs and fuel for machinery, smaller farms were necessary to implement the sustainable agricultural practices, such as the use of oxen and increased manual farm labor, that were vital to maintain food production.[13]

In 1994 the ad hoc urban gardening movement was recognized by the government. Laws were enacted to support, promote, and regularize the movement's practices of ecological (organic) agriculture without stifling local initiative. Distribution reform allowed private farmers markets for the first time in nearly four decades. Prices paid by the government for food were raised in order to increase production incentives. Farmers were allowed to sell high-quality produce to tourist facilities in order to reduce the country's import bill. Cuba also benefited from its stable rural sector, where small farmers' land rights had been maintained and where earlier agrarian development policies had produced a well-educated peasantry, unique in modern Latin America.[14]

Cuba's Energy Response

Fossil-fuel energy has been at the forefront of Cuban concerns since 1959, when U.S. oil companies cut off shipments to Cuba. Before then, only 56 percent of Cubans had access to electricity; by 1989, this had increased to 95 percent. This improvement was possible due to shipments of oil from the Soviet Union, which continued until 1990.[15]

In 1993 Cuba's legislature passed the National Energy Sources Development Program. Its goals include increased energy efficiency (the first priority), reduced energy imports, and maximized domestic energy sources. Cuba began a drive to save energy and use more renewable sources. Off-grid schools, health clinics, and social centers were electrified with solar panels.[16]

The Cuban Electricity Saving Program and the Energy Saving Program of the Ministry of Education were launched in 1997 to promote energy education. The goal was to reduce the consumption of electricity in all Cuban households, industries, and enterprises. Children were educated about energy and then influenced their families and the rest of the culture. In 2000, Cuba and Venezuela signed an Integral Cooperation Accord under which Venezuela sends oil to Cuba in exchange for goods and services.[17]

From 2003 to 2005, malfunctioning power plants and increased hurricane activity brought the return of massive blackouts. Historically Cuba had averaged one hurricane every other year, but in 2008 Hurricanes Gustav, Ike, and Paloma devastated the island, causing $10 billion in damage. Two

million people were evacuated from the threatened areas. Many of Cuba's agricultural crops were destroyed, and that year imports had to supply 55 percent of Cubans' food, an increase from 16 percent.[18]

The effects of climate change will likely include a rise in the intensity and frequency of extreme weather events. The biggest threats to Caribbean island nations like Cuba are hurricanes, droughts, heavy rainfall, and a rise in sea level. Cuba has developed emergency preparations and evacuation plans based on the specific vulnerabilities of each of its 167 municipalities. When a hurricane approaches, power plants in its path are shut down and people are evacuated. In recent years this has affected hundreds of thousands of Cubans. After decades of energy shortages, and with the heightened danger from hurricanes, Cubans are aware of their vulnerability to both shortages and overuse of fossil fuels.[19]

In 2005 the parliament passed the Cuban Energy Revolution (CER) initiative. Its goal was to guarantee sustainable development of the economy and energy invulnerability. To meet the first of its five objectives, increased energy efficiency and conservation, Cuba distributed 9.4 million compact fluorescent light bulbs in the second half of the year to homes, businesses, and other institutions to replace nearly all of the incandescent lights used in the country. In 2006 millions of older, inefficient appliances were replaced: 1,043,709 fans; 2,404,035 old American and Russian refrigerators; 209,480 air conditioners; 216,149 televisions; and 267,568 electric motors. In addition, almost 3.5 million rice cookers and over 3 million pressure cookers were distributed for families to encourage the switch from cooking with kerosene to cooking with electricity (which also brought health and safety benefits). These were sold at a subsidized cost to about 4 million households. (The population of Cuba is 11 million.)[20]

Electricity is highly subsidized in Cuba, and prior to 2006 it was sold very cheaply to consumers. The efficiency measures reduced the government's costs by reducing electricity demand. To encourage conservation, a new electricity tariff was introduced that allows people using less than 100 kilowatt-hours (kWh) per month to continue paying the very low rate. Above that, for every increase of 50 kWh per month, the tariff goes up.[21]

The second CER priority, improving the availability and reliability of electrical service, involved changes in production, transmission, and use of electricity. In 2005 most of Cuba's 11 large oil-fired thermoelectric power plants were more than 25 years old, inefficient, and functioning only about 60 percent of the time. To improve energy security, Cuba decentralized its energy system, moving toward distributed generation. In 2006 Cuba installed 1,854 diesel and fuel-oil micro-electrical plants throughout the country and upgraded the transmission network. The new diesel generators were more efficient, using 234 grams of fuel to generate a kilowatt-

hour, compared with 284 grams for the older plants. This distributed generation system provides 25 percent of Cuba's electricity. Cuba also installed over 4,000 emergency backup generators in critical areas, such as hospitals, schools, bakeries, stores, and food production facilities. These maintain power to tourist hotels and meteorological stations as well. In 2006 and 2007, Cuba saved over 960,000 tons of imported oil through these measures.[22]

Micro-hydro plant near Santiago de Cuba.

John Morgan

The CER's third concern, renewable energy, is a vital part of Cuba's current and future energy mix. Distributed generation is key to developing regional sources of renewables, such as wind farms, hydropower, solar photovoltaic panels, solar water heating, biogas, and biomass from reforestation and sugarcane. Renewable sources account for about 6 percent of Cuba's installed capacity. Rivers in Cuba are not long, limiting the country to micro-hydro installations. Over 8,000 independent solar-electric systems have been installed in rural areas to provide electricity where it is difficult to extend the national grid. Today, all rural areas have solar-electric systems for school lights, computers, educational television, and health centers.[23]

The fourth focus of the CER, developing Cuba's own oil and natural gas resources, has done little more than replace declining oil production. In 2010 Cuba's oil production was just over 3 million tons, compared with 2.73 million tons in 2009; natural gas output was 1 million cubic meters, compared with 1.16 million cubic meters the preceding year. The national output of oil and gas amounts to the equivalent of about half of the 150,000 barrels per day that Cuba consumes. Venezuela provides the remainder in exchange for support from Cuba in the fields of education, health care, sports, science, and technology.[24]

To meet the fifth CER goal, international cooperation, Cuba is exporting the CER to other countries. It is working with Bolivia, Honduras, Lesotho, Mali, South Africa, and Venezuela, sharing strategies for reducing energy demand. Cuba has provided and installed solar-electric panels (over 1 megawatt of total capacity) in these countries. Cuban social workers have replaced about 100 million incandescent bulbs with compact fluorescents in a dozen Latin American countries.[25]

These efforts have paid off in terms of one of the key measures of sustainability: greenhouse gas emissions. (See Table 30–1.) Cubans on average use 43 percent less energy than people in the rest of the world (1.03 tons of oil equivalent compared with 1.8 tons) and account for 44 percent less CO_2 each year (2.4 tons compared with 4.29 tons). And compared with Americans, Cubans use 85 percent less energy on average and account for 86 percent less CO_2. Cubans have far fewer material possessions than people in more industrialized countries, but due to the country's commitment to a high level of education and social services, Cubans are far richer in other resources, such as social capital and a sense of community.[26]

Human Development and Survivability

Since 1960 Cuba has been committed to maintaining a high level of social services, devoting far more of its energy and resources to human development or social capital than the former Soviet Union, which abandoned social services for privatization in the 1990s.

Medical Care. Free high-quality medical care is a key part of the Cuban revolution. Article 49 of the constitution states:

> Everyone has the right to health protection and care. The state guarantees this right by providing free hospital and medical care by means of the installation of the rural medical service network, polyclinics, hospitals, preventive and specialized treatment centres, by providing free dental care and by the health publicity campaigns, health education, regular medical examinations, general vaccinations, and other measures to prevent the outbreak of disease. All the population cooperates in these activities and plans through the social and mass organizations.[27]

This commitment has placed Cuba first in the world in terms of physicians per person. In 1960 Cuba had 0.95 doctors per 1,000 people; today the ratio is 6.4 physicians per 1,000 people. The United States, in comparison, has 2.67 physicians per 1,000 people. Cuba has 5.9 hospital beds per 1,000 people while in the United States the figure is 3.1 beds. Medical expenditures in Cuba account for 11.8 percent of GDP; U.S. expenditures are 16.2 percent of GDP. Cuban doctors and other medical personnel also serve overseas, with about 37,000 Cuban doctors practicing in about 50 countries. Cuba's high ratio of doctors to patients gives family physicians more time to spend with each patient. Prevention is emphasized, with a holistic approach that seeks to integrate psychological and physical well-being. Under the U.S. blockade, acquiring needed medical supplies and equipment is very difficult, but Cuba has shown that people's health does not depend on a high-cost medical system.[28]

Cuba has also excelled in supporting the health of mothers and children. In a 2012 report from the nonprofit group Save the Children, 165

Table 30–1. Annual Energy Consumption and Carbon Dioxide Emissions per Person in Major Regions, Cuba, and the United States

Region, Country, or Economy	Population	Energy Use	Carbon Dioxide Emissions
	(millions)	(tons of oil equivalent per person)	(tons per person)
OECD countries	1,225	4.28	9.83
Middle East	195	3.03	7.76
Non-OECD Europe and Eurasia	335	3.14	7.46
China	1,338	1.70	5.14
Asia	2,208	0.66	1.43
Latin America	451	1.20	2.16
Africa	1,009	0.67	0.92
World	6,761	1.80	4.29
Cuba	11	1.03	2.40
United States	307	7.03	16.90

Source: See endnote 26.

nations were ranked according to a Mothers, Women and Children index. The Women's Index was calculated as a weighted average of health status (30 percent), educational status (30 percent), economic status (30 percent), and political status (10 percent). The Mothers' Index was calculated as a weighted average of children's well-being (30 percent) along with women's health (20 percent), education (20 percent), economic status (20 percent), and political status (10 percent). Among 80 mid-level developing countries, Cuba ranked first on the Mothers Index and second on the Women's Index.[29]

Education. Education in Cuba is free. The country ranks second in the world in the share of GDP allocated to education, at 5.5 percent. The United States, ranked first, spends 13.6 percent; the world average is 4.4 percent. Average length of time in primary, secondary, and tertiary schools is 18 years for Cuba, 15 years for the United States, and 11 years for the world. Cuba, with 2 percent of the population of Latin America, has 11 percent of the scientists. Having a well-educated population was a huge advantage in dealing with the massive social changes needed to surmount the difficulties faced during the 1990s. (See Box 30–1.) Indeed, a World Bank study notes:

> The record of Cuban education is outstanding: universal school enrollment and attendance; nearly universal adult literacy; proportional female representation at all levels, including higher education; a strong

Box 30–1. Who Was Behind Cuba's Response in the 1990s?

The crisis after the collapse of the Soviet Union was rapid and severe. Unprepared, industrial plants and factories reduced weekly work hours; some closed altogether. An additional 200 consumer goods were added to the ration list, and foods of all kinds became increasingly scarce. Cuba's mass organizations played a key role in this difficult period. The Committee for the Defense of the Revolution (CDR, founded in early 1960) had been extended to organize blood donations, vaccination campaigns, neighborhood cleanup, and recycling. There are 122,000 neighborhood CDRs in Cuba, each run by people selected from within the community.

In the crisis, CDRs took it upon themselves to find places to grow food and locate seed, quickly extending their scope to support backyard and urban gardens for cultivating produce and medicinal plants. Other mass organizations also aided during the crisis, including the Federation of Cuban Women, the Central Organization of Cuba Trade Unions, and organizations for students, writers/artists, and small farmers.

Cuba's nongovernmental organizations played a key part in overcoming the crisis. They are not anti-government but rather are smaller, more flexible groups of people working in parallel with the government to handle social, environmental, and economic programs and research. One such small research group, the Groupo de Agricultura Organica (GAO), developed integrated pest management, which was not an important part of Cuba's pre-crisis agriculture but became very valuable after the crisis. This and other GAO work on low-technological inputs was used immediately.

Coordination between government and people was critical. Television and radio were used to communicate the status of the crisis and government plans. Mass organizations played key roles in aiding people in their workplaces and neighborhoods. Out of necessity, people took spontaneous immediate action, such as hitchhiking and gardening. Later the government organized policies to support these grassroots movements.

The commonly held view of Cuba as a dictatorship slights the social solidarity of a people who have withstood invasions and colonization. This countrywide solidarity and cooperation is very much a part of the Cuban character and was important in dealing with the stresses of the Special Period.

Source: See endnote 30.

scientific training base, particularly in chemistry and medicine; consistent pedagogical quality across widely dispersed classrooms; equality of basic educational opportunity, even in impoverished areas, both rural and urban. In a recent regional study of Latin America and the Caribbean, Cuba ranked first in math and science achievement, at all grade levels, among both males and females. In many ways, Cuba's schools are the equals of schools in OECD countries, despite the fact that Cuba's economy is that of a developing country.[30]

Agriculture. Cuba has achieved high levels of success with a unique form of ecological agriculture. There are about 140,000 high-level professional and medium-level technicians, dozens of research centers, agrarian universities and their networks, government institutions such as the Ministry of Agriculture, scientific organizations supporting farmers, and farmers' organizations. Farmers and gardeners in Cuba are well educated and receive excellent remuneration.[31]

Urban farms and gardens have become a significant part of Cuba's agricultural system. There are 383,000 urban farms on 50,000 hectares of oth-

erwise unused land. Urban farms produce 1.5 million tons of vegetables a year without using synthetic chemicals and supply 70 percent or more of the fresh vegetables consumed in Havana and other cities.[32]

In 2006, Cuban rural farmers (using 25 percent of the agricultural land) produced 65 percent of the country's food. These farmers, along with Cuban researchers, have developed a unique form of agroecology science and practice that has achieved high levels of production. Vegetable production doubled from 1994 to 1998 and doubled again in 1999. Production of tubers and plantains, staples of the Cuban diet, tripled in the same period. Bean yields increased by 60 percent and citrus by 110 percent. From 1996 to 2005 Cuba had the best food production performance in the Caribbean and Latin American region, with an annual growth rate of 4.2 percent per person. Agrochemical use from 1988 to 2007 declined 72 percent for vegetables, 55 percent for beans, and 85 percent for roots and tubers.[33]

Under the Soviet system, Cuban agriculture focused on large-scale sugar plantations. Since 1990 it has been increasing its ability to provide a wide variety of foods. Cuba's food import dependency has been dropping for decades, despite brief upturns due to natural and human-made disasters. Large amounts of cooking oil, cereals, legumes (principally rice and wheat for human consumption and corn and soybeans for livestock), and powdered milk continue to be imported.[34]

Cuba's production efforts are focused on food sovereignty, defined as the right of everyone to have access to safe, nutritious, culturally appropriate food in sufficient quantity and quality to sustain a healthy life with full human dignity. According to the U.N. Food and Agriculture Organization, Cuba's average daily per capita dietary energy supply was over 3,200 kcal in 2007—the highest of all Latin American and Caribbean nations and an increase from the 2,899 kcal before the Special Period. This has been achieved while Cuba continues to decrease its per capita CO_2 generation and without the assistance of the International Monetary Fund or the World Bank.[35]

Other Indicators. Cuba's population growth rate is negative (–0.12 percent per year). Cuban life expectancy at birth is 77.7 years, just below the U.S. figure of 78.4 years. Cuba's infant mortality rate is 4.8 deaths per 1,000 live births, significantly lower than the U.S. rate of 6.06 deaths. Cuba's obesity rate among adults is only 11.8 percent. According to the U.S. Centers for Disease Control and Prevention, 35.7 percent of U.S. adults are obese.[36]

One very important success is Cuba's provision of health care for people living with HIV/AIDS. Key to this has been the political will to act without waiting for external assistance. Cuba's HIV/AIDS program is based on its comprehensive health care system, which has facilitated control over blood transfusions and blood products. It also supports the prevention of mother-to-child transmission of HIV. Cuba has developed its own antiret-

roviral drugs, largely through Cuban resources due to the U.S. embargo. With its large number of scientists, the country has the skilled workforce necessary to address diverse technological and scientific areas of need, including pharmaceutical research and development. Adult HIV prevalence is 0.1 percent for Cuba, compared with 0.8 percent for the world and 0.6 percent for the United States.[37]

The Cuba Paradigm

Cuba has a very low per capita income, yet in the non-materialistic, quality-of-life domain, it excels. Thus Cuba represents a paradox. It is a materially poor country that has First World education, literacy, and health care. It is rich in human development resources and low in environmental burdens, but its standard of living, and therefore its fossil fuel use and CO_2 emissions, is very low. Cuba has maintained its human service programs—free education, old-age support, basic nutrition, and free health care—throughout its Special Period. In 2006, Cuba was the only country in the world rated as having "sustainable development" in WWF's *Living Planet Report*.[38]

Fidel Castro has said that "consumer based societies are incompatible with the saving of natural resources and energy that the development and preservation of our species require," and Cubans simply have less of all material goods than people in industrial countries. They have much smaller homes (about 150 square feet per person in Havana compared with the U.S. average of about 800 square feet). Fewer than 10 percent of Cubans have private cars. They rarely fly. The consumption of common consumer personal goods is very limited. Yet Cubans don't need to fear cancelled medical insurance. They know their children will be educated without being saddled with student loans. Cubans are not weighed down with enormous debts. They know they will not go hungry or homeless.[39]

"We need a global energy revolution," according to Mario Alberto Arrastia Avila, an energy expert with the energy information center Cubaenergia in Havana. "But in order for this to happen, we also need a revolution in consciousness." A clear revolution of consciousness would involve the acknowledgement, strongly resisted by richer nations, that CO_2 emissions are directly related to material consumption. Cuba represents an alternative, where material success as measured by energy consumption is secondary, while other quality-of-life issues are given priority. The message is clear: humanity will survive and can even thrive in a resource-constrained world if it learns from the Cuban example.[40]

37. M. Specter, "The First Geo-vigilante," *New Yorker*, 18 October 2012.

38. Box 29–2 from "'Oxford Principles' Provide a Code of Conduct for Geoengineering Research," press release (Oxford: Oxford Martin School, University of Oxford, 14 September 2011).

39. Box 29–3 from R. Olson, "Soft Geoengineering: A Gentler Approach to Addressing Climate Change," *Environment*, September-October 2012, pp. 29–39.

Chapter 30. Cuba: Lessons from a Forced Decline

1. Figure for 1990 from United Nations, *Millennium Development Goals Indicators*, at mdgs.un.org/unsd/mdg/Data.aspx?cr=192; 2009 data from International Energy Agency, *Key World Energy Statistics* (Paris: 2011).

2. "Cuba's Special Period," in Louis A. Pérez, Jr., in *Cuba: Between Reform & Revolution*, at HistoryofCuba.com; "Operation Mongoose," Spartacus Educational, at www.spartacus.schoolnet.co.uk/JFKmongoose.htm; Thomas Blanton, "Annals of Blinksmanship," *Wilson Quarterly*, summer 1997.

3. Minor Sinclair and Martha Thompson, *CUBA, Going Against the Grain: Agricultural Crisis and Transformation* (Boston: Oxfam America, 2001), p. 8; American Association for World Health, *Denial of Food and Medicine: The Impact of the U.S. Embargo on Health and Nutrition in Cuba, An Executive Summary* (Washington, DC: 1997), p. 1; Zoë Amerigian, "Radio and TV Marti Should be Prime Targets for Budget Cutters" (blog), Council on Hemispheric Affairs, 7 April 2011.

4. Amerigian, op. cit. note 3.

5. Sinclair and Thompson, op. cit. note 3, p. 8; Pan American Health Organization, "Health Situation Analysis and Trends Summary—Country Chapter Summary from *Health in the Americas, 1998*," Washington, DC.

6. M. Franco et al., "Impact of Energy Intake, Physical Activity, and Population-wide Weight Loss on Cardiovascular Disease and Diabetes Mortality in Cuba, 1980-2005," *American Journal of Epidemiology*, 15 December 2007, pp. 1,374–80; Manuel Franco et al., "Obesity Reduction and Its Possible Consequences: What Can We Learn from Cuba's Special Period?" *Canadian Medical Association Journal*, 8 April 2008, pp. 1,032–34.

7. American Association for World Health, op. cit. note 3.

8. Pérez, Jr., op. cit. note 2; Dalia Acosta, "Transport-Cuba: Nearly There," *Inter Press Service*, 17 March 2009.

9. Liliana Núñez Velis, "Taxicab Service in Cuba: A Civil Society Approach," PowerPoint presentation, May 2011.

10. Sinclair and Thompson, op. cit. note 3, p. 9.

11. Ibid., p. 10.

12. Ibid., p. 4.

13. Ibid., pp. 10, 18–19.

14. Ibid., pp. 10, 13 , 31.

15. Laurie Guevara-Stone, "La Revolucion Energetica: Cuba's Energy Revolution," *Renewable Energy World Magazine*, April 2009, p. 2.

16. Ibid.

17. Mario Alberto Arrastía Avila, "Distributed Generation in Cuba: Part of a Transition Towards a New Energy Paradigm," *Cogeneration and On-Site Power Production*, November–December 2008, pp. 61–65; Mario Alberto Arrastía Avila and Laurie Guevara-Stone, "Teaching Cuba's Energy Revolution," *Solar Today*, January/February 2009, p. 31.

18. "Hurricanes Have Added to the Woes of the Downturn," *The Economist*, 30 December 2008; Miguel A. Altieri and Fernando R. Funes-Monzote, "The Paradox of Cuban Agriculture," *Monthly Review*, January 2012.

19. Ivet González, "Abrupt Shift from Drought to Flooding in Central Cuba," Inter Press Service, 30 May 2012; "Report on 2008 Hurricane Season in Cuba," World Meteorological Organization, at www.wmo.int/pages/prog/www/tcp/Meetings/HC31/documents/Doc.4.2.8_Cuba.doc; James Hansen, Makiko Sato, and Reto Ruedy,

"Perception of Climate Change," *Proceedings of the National Academy of Sciences*, 6 August 2012.

20. Arrastía Avila, op. cit. note 17, p. 65; Mario Alberto Arrastía Avila, presentation to Global Exchange, Havana, Cuba, April 2012; Guevara-Stone, op. cit. note 15, p. 3.

21. Arrastía Avila, op. cit. note 17, p. 65.

22. Guevara-Stone, op. cit. note 15; Anita Snow, "Cuba to Restructure Electric Grid and Utilize Wind and Solar Power," *Havana Journal*, 19 January 2006; Arrastía Avila, op. cit. note 17, p. 65.

23. Guevara-Stone, op. cit. note 15, pp. 5–6.

24. Marc Frank, "Cuban 2010 Oil Output Up, Natural Gas Down," *Reuters*, 13 June 2011; "Cuba–Venezuela Relations," *Wikipedia*, viewed June 2012.

25. Arrastía Avila, op. cit. note 17, p. 65.

26. Table 30–1 from International Energy Agency, *2011 Key Energy Statistics* (Paris: 2011).

27. Peter G. Bourne, "Public Health in Cuba," PowerPoint presentation, at www.pitt.edu/~super7/9011-10001/9881.ppt.

28. "Physicians Density" and "Hospital Bed Density," in Central Intelligence Agency (CIA), *CIA World Factbook*, at www.cia.gov; "Health Statistics: Physicians > per 1,000 People (1960) by Country," NationMaster.com; Conner Gorry, Marcio Ulises, Estrada Paneque, "Global Health, Cuban Health Cooperation and Disasters," *MEDICC Review*, chart 8, at www.pitt.edu/~super4/lecture/lec32661/index.htm.

29. Save the Children, *State of the World's Mothers 2012* (Westport, CT: 2012).

30. "Education Expenditures" and "School Life Expectancy," in CIA, op. cit. note 28; World Bank quote from Lavinia Gasperini, *The Cuban Education System: Lessons and Dilemmas* (Washington, DC: World Bank, July 2000). Box 30–1 based on the following: "Cuba's Special Period," op. cit. note 2; Ministry of Foreign Affairs of Cuba, "Cuba at a Glance: Social Organizations," at www.cubaminrex.cu/english/LookCuba/Articles/Others/2005/040005.html; Isaac Saney, *Cuba—A Revolution in Motion* (Winnipeg, Canada: Fernwood Publishing, 2004), pp. 65-67; Rachel Bruhnke, email to authors, 23 October 2012; Faith Morgan, "The Power of Community: How Cuba Survived Peak Oil," documentary, Community Solutions, Yellow Springs, OH, 2006; authors' interviews with Cubans.

31. Altieri and Funes-Monzote, op. cit. note 18.

32. Ibid.

33. Ibid.; Sinclair and Thompson, op. cit. note 3, p. 33.

34. Agri-Food Trade Service, "Agri-Food: Past, Present and Future Report Cuba," Agriculture and Agri-Food Canada, March 2012; Altieri and Funes-Monzote, op. cit. note 18.

35. Altieri and Funes-Monzote, op. cit. note 18; Sinclair and Thompson, op. cit. note 3, p. 43.

36. "Total Fertility Rate," in CIA, op. cit. note 28; CIA, op. cit. note 28, pp, 168, 694; Country Templates for Cuba and United States, *CIA Factbook*, at www.cia.gov/library/publications/the-world-factbook; Melissa Healy, "Obesity in U.S. Projected to Grow, Though Pace Slows: CDC study," *Los Angeles Times*, 7 May 2012; Eric A. Finkelstein et al., "Obesity and Severe Obesity Forecasts Through 2030," *American Journal of Preventive Medicine*, June 2012, pp. 563–70.

37. Jorge Pérez et al., *Approaches to the Management of HIV/AIDS in Cuba: Case Study* (Geneva: World Health Organization, 2004); Cuba and United States Comprehensive Indicator Reports, *HIV InSite*, University of California, San Francisco, at hivinsite.ucsf.edu.

38. WWF, *Living Planet Report 2006* (Gland, Switzerland: 2006).

39. Castro quote from Mario Alberto Arrastía Ávila, "Cuba: Energy and Development," PowerPoint presentation, at www.agdf.org.au/documents/item/15; Roberto Pérez Rivero, PEACB-FANJ Director, discussion with authors, June 2012; Pat Murphy, *Plan C: Community Survival Strategies for Peak Oil and Climate Change* (Gabriola Island, Canada: New Society Publishers, 2008).

40. Arrastía Avila quote in Guevara-Stone, op. cit. note 15, p. 7.