

## ALTERNATIVE ENERGY

# Jumpstarting the Americas

by Harley Shaiken

**A**t first glance, Detroit seems an unlikely place to learn about the potential of renewable energy to transform the Americas. Yet some of the most exciting work on renewable energy anywhere — from pioneering research to advanced production — is taking place on the outskirts of the Motor City. Alternative energy technologies developed here could help jumpstart sustainable economic growth for Latin America and the United States as economies worldwide continue to slide into tough economic times.

Detroit is hardly a stranger to industries that change the world. The auto-industrial age began when Henry Ford introduced the moving assembly line at his Highland

The abandoned General Motors Fisher Body Plant #21 in Detroit.



Photo by Derek Farr.

Park plant almost a century ago. Millions of Model T Fords rolled off the line, putting the world on wheels and transforming the 20<sup>th</sup> century in the process. In its heyday, the Detroit Model meant not only cars but also jobs and a growing middle class.

The plant is now an abandoned, rusting hulk in a neighborhood that has seen better days. A forlorn Michigan historical marker flags the site, pointing out that “mass production soon moved from here to all phases of American industry and set the pattern of abundance for 20<sup>th</sup>-century living.”

Few traces of that abundance can be found anywhere near the plant today. The shells of derelict houses and weed-covered, empty lots surround the beleaguered residents who remain, underscoring the devastating social cost of industrial collapse.

Thirty miles north, in Auburn Hills, Michigan, is a different scene entirely. In an unassuming one-story building, a remarkable machine stretching the length of a football field employs the power of mass production to manufacture flexible thin-film solar material in nine-mile runs.

Walking next to the massive, though strangely elegant machine, its soaring steel I-beams vaguely reminiscent of a cathedral, one has a sense of history being made. Perhaps this is what it felt like to walk next to the assembly line in Highland Park when the first Model Ts were rolling off in 1913.

The underlying science and technology for this pioneering production facility reflect a lifetime of work and the remarkable genius of Stan Ovshinsky, whom an editor of *The Economist* magazine called “the modern world’s most important energy visionary.” Ovshinsky has defined new paths as a scientist, inventor and entrepreneur. The range of what he has developed over the last five decades is awesome. It includes the mass production of thin-film photovoltaic solar material, the nickel-metal hydride battery that powers virtually all hybrid vehicles on the road today, solid hydrogen storage systems and new forms of nonvolatile computer memory.

Underlying these technologies is Ovshinsky’s paradigm-shifting scientific work on disordered or amorphous materials, which has resulted in a fundamentally new area of science named Ovonics in his honor.



Photo courtesy of FRED Oronces.

Workers move between two production lines during construction of the United Solar Ovonic plant in Greenville, Michigan.

## The Triple Challenge

What was visionary in 1960 has become urgent today. The countries of the Americas face a potent triple challenge: achieving energy independence; reducing global warming; and creating jobs in the midst of an economic meltdown. The soaring demand for energy — projections indicate a 45 percent jump in global demand by 2030 — coupled with a heavy reliance on fossil fuels provokes tensions that can lead to war. The geopolitics of oil is particularly critical for the United States, which consumes about a quarter of global petroleum output but has only 3 percent of known reserves.

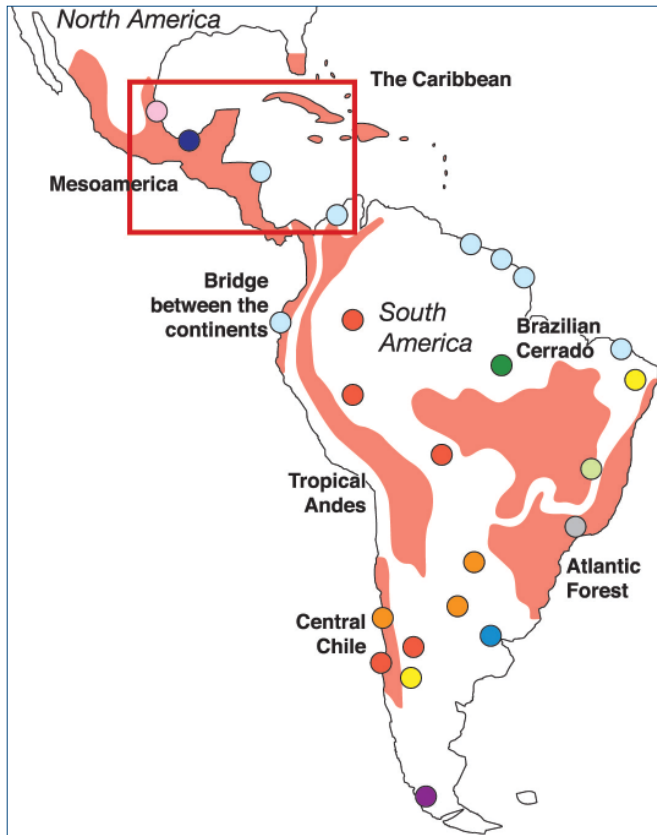
Climate change knows no borders and threatens catastrophic, irreversible results. Nobuo Tanaka, Executive Director of the International Energy Agency, points out that: “Current trends in energy supply and consumption are patently unsustainable — environmentally, economically and socially — they can and must be altered.” A new report from the Brookings Institution, *Rethinking U.S.–Latin American Relations*, predicts that “if current human activity remains unchanged, the hemisphere will likely suffer from a variety of ecological shocks, including declines

in agricultural yields, water shortages, the loss of animal and plant species, and more frequent and destructive storms in the Caribbean Basin.” The net result of these changes “could bring devastation to Central America, the Caribbean, and the southeastern United States.”

Creating jobs is vital at a moment when the financial meltdown is paralyzing economies throughout the Americas. Supporting new industries that manufacture renewable technologies and investing in energy infrastructure could create both employment and a longer-term economic stimulus. The danger, however, is that economic paralysis could derail action on both energy independence and climate change. “Just as the world seemed poised to combat global warming more aggressively,” The New York Times pointed out in a front page story in late November, “the economic slump and plunging prices of coal and oil are upending plans to wean businesses and consumers from fossil fuel.”

So far, President-elect Obama has held firm to his support for alternative energy, arguing that the solution to the economic downturn lies in moving aggressively on new sources of energy. “We’ll put people back to work,” he announced in a post-election radio address, “...building





## Environmental Hot Spots in the Americas

- Coral reefs and mangroves seriously threatened with warmer sea-surface temperatures
  - Under the worst sea-level rise scenario, mangroves are very likely to disappear from low-lying coastlines
  - Amazonia: loss of 43% of 69 tree species by the end of 21st century; savannisation of the eastern part
  - Cerrados: Losses of 24% of 138 tree species for a temperature increase of 2°C
  - Reduction of suitable lands for coffee
  - Increases in aridity and scarcity of water resources
  - Sharp increase in extinction of: mammals, birds, butterflies, frogs and reptiles by 2050
  - Water availability and hydro-electric generation seriously reduced due to reduction in glaciers
  - Ozone depletion and skin cancer
  - Severe land degradation and desertification
  - Rio de la Plata coasts threatened by increasing storm surges and sea-level rise
  - Increased vulnerability to extreme events
- Areas in red correspond to sites where biodiversity is currently severely threatened and this trend is very likely to continue in the future

From *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Working Group II Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Figure 13.5. Cambridge University Press.

wind farms and solar panels, fuel-efficient cars and the alternative energy technologies that can free us from our dependence on foreign oil and keep our economy competitive in the years ahead.”

Some Latin American countries have taken on an important leadership role. Costa Rica, for example, plans to become carbon neutral by 2021 and has begun adopting a range of policies to move in that direction.

To better understand the potential of alternative energy for the Americas, UC Berkeley’s Center for Latin American Studies organized a September workshop for academics, entrepreneurs, labor leaders and policymakers. They traveled to Detroit to spend a day and a half with Stan Ovshinsky and several of his colleagues. The workshop participants included Roberto Dobles, Minister of the Environment and Energy in Costa Rica; Cuauhtémoc Cárdenas, President of Fundación para la Democracia in Mexico; Christopher Edley, Dean of the UC Berkeley Law School; and David Bonior, the second-ranking Democrat in the U.S. House of Representatives from 1991 to 2002.

The visit was part of the U.S.–Mexico Futures Forum, a joint project convened by Berkeley and ITAM, a Mexico City university. The forum, now in its seventh year, brings together an innovative and influential group of people to address the challenges the U.S. and Mexico face.

The visit to Detroit underscored the fact that lack of technology is not the main obstacle to tackling the energy

challenges facing the Americas. New research is critical but should not displace the diffusion of the state-of-the-art renewable energy approaches that are available now. “Policy is going to be the place where we win or lose the global warming battle,” warned Daniel Kammen, the Class of 1935 Distinguished Professor of Energy at UC Berkeley.

## An Energy Revolution

Stan Ovshinsky has an unusually bold vision when it comes to energy. “The ages of civilization have been classified by the materials they use: the Bronze Age, the Iron Age, the Silicon Age,” he has often remarked. “We are at the dawn of the Hydrogen Age.”

Ovshinsky has done more than just about anyone to get us there. He began in the early 1960s defining what he calls the “hydrogen loop” as an alternative to fossil fuels. The hydrogen loop starts with the unlimited energy of the sun — itself composed of hydrogen — and seeks to harness its rays through photovoltaic solar material to produce energy across a growing field of applications. He points out that an hour of sunlight could meet the planet’s energy requirements for a year.

While his vision may reach to the stars — hydrogen was born in the big bang — the science and technology Ovshinsky has pioneered exist right here on earth in working factories and state-of-the-art prototypes. Some highlights of the Detroit trip were touring production facilities, talking to



Stan Ovshinsky in the Auburn Hills plant where thin-film solar cells are mass-produced.  
Photo by Brendan Ross.





Photo by Cristal Heinrich Berton.

Ben Chao presents a prototype hydrogen-powered car to (from left): Christopher Edley, Cuauhtémoc Cárdenas and Roberto Dobles.

engineers and technicians and evaluating the potential of solar energy production to meet current and future needs.

The solar production plant the group visited was built in 2003 by Energy Conversion Devices (ECD), the company Ovshinsky founded with his late wife Iris in 1960 and which he led until his recent retirement. Now the company operates six such facilities, with an additional four due to come on line by 2010. For Michigan, ECD's creation of several thousand new jobs — and the possibility that thousands more will be created in the near future — is welcome news in a dismal economic time.

The machine housed in this innovative plant represents a major advance over what has been tried before. Both the roll-to-roll technique and the scale are unprecedented. Skeptics abounded when Ovshinsky proposed expanding manufacturing capacity tenfold to a 30 megawatt machine in the late 1990s (1 megawatt serves 750 houses). Now, six rolls of thin stainless steel — each 14 inches wide and 1.5 miles-long — move in parallel through the largest high-frequency, vacuum-tight plasma deposition system in the world. A single run produces nine miles of solar material, achieving economies of scale reminiscent of the first moving assembly line.

The thin-film solar material “is cheap, durable and flexible enough to integrate into roofs,” according to The

New York Times, making it equally suited for industrial nations or emerging economies. Ovshinsky's panels now cover buildings ranging from warehouses in Southern California to houses in small Oaxacan villages; from a museum in Beijing to the world's largest solar roof on a General Motors assembly plant in Zaragoza, Spain.

“These are ideas that we can put to work right now if we can have the right regulatory environment and the right public and private investment to drive it forward,” Berkeley Law School Dean Christopher Edley observed after the Detroit workshop.

Cuauhtémoc Cárdenas concurred. “We have to open the possibility of using inventions like those of Stan Ovshinsky and using hydrogen or solar energy as a fuel,” he said. “And that will make our economies work much better than they are working right now.”

Cárdenas also observed that collaboration on these new technologies could improve living standards and bring the United States and Mexico together in more constructive, collaborative ways. “We should find the ways to cooperate and different ways to use renewable energies,” he stated. One idea discussed at the workshop was constructing a photovoltaic solar facility spanning the U.S.–Mexico border in the desert, a symbol both of the links between the two countries and of the unlimited power available from the sun.

Participants were also introduced to Ovshinsky's prototype hydrogen-fueled car, a Toyota Prius whose gas tank has been removed and replaced with a container filled with solid Ovonic material that safely stores hydrogen at low pressure. Reflecting his systems approach, Ovshinsky also demonstrated his prototype hydrogen refueling station that uses either photovoltaic solar energy or off-peak conventional power-plant electricity to generate hydrogen from water and then stores it in a medium similar to that used in the fuel container.

Ovshinsky's Prius made its mark at a 2007 event for hydrogen-powered vehicles sponsored by The New York Times and held at the site where the Hindenburg, the giant, hydrogen-filled zeppelin airship, crashed and burned 70 years earlier. The modified Prius drove 190 miles without refueling, the longest range recorded at the event.

The current economic meltdown underscores the importance of creating jobs in a new energy economy. Expanding employment is vital throughout Latin America and in places such as Detroit, the city that served as a particularly poignant and moving backdrop for the discussion. David Bonior stressed the importance for the United States of policies that link renewable technologies to the creation of jobs and production facilities, particularly in areas of economic despair such as Michigan. Others pointed to the ways these technologies could build new industries and spur development throughout Latin America. An Alliance for Green Prosperity across the Americas could link research and development, manufacturing and the application of new technologies, insuring that policies for job creation, energy independence and the reduction of carbon emissions work together rather than at cross purposes.



Photo © GM Corp.

A worker rolls out United Solar Ovonic material on the roof of the General Motors plant in Zaragoza, Spain.

## A Vision for the Future

Ovshinsky shares this social vision. Deeply concerned about these issues, he has formed a new research and development company called Ovshinsky Innovations to develop the next generation of renewable energy technologies. He has plans to build a new solar manufacturing machine capable of producing 1 gigawatt (1,000 megawatts) of power.

Dean Edley summed it up best: "Stan is one of the most remarkable figures of our age. And, the opportunity to get a deeper understanding of what he's been up to and the potential contributions to

attacking the crisis in climate change was really a terrific opportunity."

"We're going to have a revolution in energy technologies, there's no question about it," Edley added. "And it won't just be in developed countries like the U.S. It's going to be in developing countries as well. And it'll be a mix of technologies. But what I saw in Detroit, I'll bet you dollars to doughnuts, that it's going to be a big part of that mix."

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