

Renewable Energy Gets the “Green” Light in Chicago

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MOST OF US CAN EASILY NAME THE FAMOUS CHARACTERISTICS THAT symbolize Chicago. If we made a list it would undoubtedly include the Sears Tower, very cold winters, and deep-dish pizza. But one of the city’s best-kept secrets is its commitment to solar power, wind energy, and everything green in-between. Mother Nature herself describes this commitment best saying, “The answer, my friend, is blowing in the Windy City.”

The city’s electric utility [Commonwealth Edison (ComEd)] has been a major player in the efforts to make Chicago one of the greenest cities in the country. Through its many solar initiatives, it has committed millions of dollars to developing renewable energy technology throughout Chicago. A significant solar portfolio has helped Illinois rank fourth among U.S. states in terms of installed solar photovoltaic (PV) capacity, based on preliminary data compared against May 2003 National Renewable Energy Laboratory statistics.

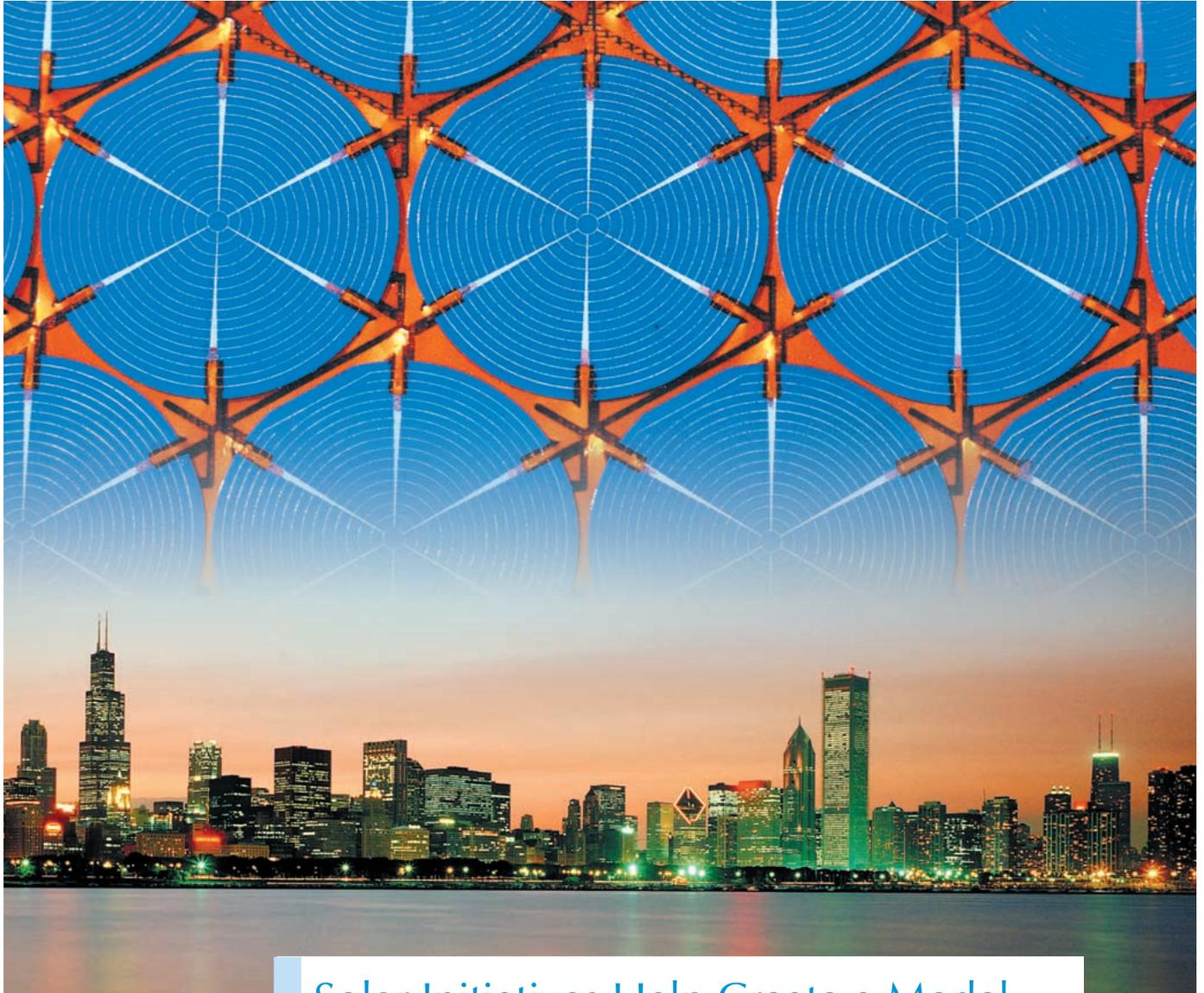
Driving the results are initiatives such as net metering that allows customers to sell their excess generation from solar electric systems back to the utility, easy-to-use interconnection guidelines for solar systems, and solar installation incentives for Chicago residents and businesses.

“ComEd is helping to spur the Midwest market for renewable energy,” said ComEd President Frank M. Clark. “As the energy provider for Northern Illinois, we are committed to helping explore renewable energy resources and bringing the benefits of this clean energy resource to our customers.” The installations in ComEd’s service territory account for nearly 80% of Illinois’ total installed photovoltaic capacity.

Some noteworthy results of these initiatives are the Chicago Solar Partnership, the Chicago Center for Green Technology, building integrated photovoltaic technology in Chicago’s Millennium Park, and adding solar to the Chicago 911 Emergency Communications Center, all of which are discussed in detail in this article. But first we begin with an influential and groundbreaking milestone—jumpstarting the green certificate market in the Midwest.

Midwest Green Power Market

A green certificate (also called a green tag or green ticket) represents the environmental attributes of the renewable energy resource, separate from the energy. Customers interested in promoting environmentally friendly power buy green certificates to encourage the development of additional generation from these resources. In March 2000, an agreement was signed



Solar Initiatives Help Create a Model Environmental City and Invigorate the Midwest Renewable Energy Market

between the electric utility and the Environmental Resources Trust (ERT) to begin marketing EcoPower® (a green certificate product) at wholesale to municipalities, retail electric suppliers, and other utilities. ERT is a nonprofit, Washington, DC-based group that promotes the development of renewable energy resources and markets. The EcoPower product is based on green certificates that come from renewable resources like the sun, wind, and landfill gas, and it has a net environmental benefit compared to conventional energy sources in the region.

As part of the ERT agreement, the utility has exclusive rights to sell green certificates produced in Illinois under the EcoPower name. Wholesale customers purchase EcoPower through bilateral contracts. In 2001, the utility entered into an

innovative agreement with ERT to support the City of Chicago's interest in green power. Under this agreement, the company sells EcoPower certificates to ERT who supplies them to the city and other local governmental agencies. The city has a goal of purchasing EcoPower certificates in an amount equal to 20% of its electrical usage in five years. The agreement is the largest clean energy deal ever signed by a municipality, and it will represent approximately 80 MW of annual renewable power capacity, enough to power 80,000 homes.

Initially the green power produced by 18 area landfills that converted landfill gas into energy was purchased. Up to 50%



figure 1. Field Museum of Natural History, 100-kW Solar PV system.



figure 2. Peggy Notebaert Nature Museum 33-kW solar PV system.

of the green power supplied under the agreement with ERT can be derived from landfill gas to energy.

Sources are being expanded to include wind and solar power. For example, the entire output of the Crescent Ridge wind project will be purchased. Illinois Wind Energy and Tomen Power Corporation are building Crescent Ridge on 2,200 acres of farmland in Bureau County, Illinois. When completed, the 51-MW facility will be one of the largest commercial wind developments east of the Mississippi River and will generate enough energy to power 20,000 homes.

Energy for the green certificates is also derived from grid-tied solar installations throughout the city. Through the Photovoltaic Incentive Program, ComEd and Spire Solar Chicago (a local PV manufacturer) offer rebates for locally manufactured and installed solar electric systems. Systems must be 1 to 50 kilowatts (kW) of direct current nameplate capacity and installed within the city. The incentives are offered through 2004 or while funds are available. Rebates are \$1,250 per kW in 2003 and \$1,000 per kW in 2004. The program complements other state financial incentives that are available through the Illinois Department of Commerce and Economic

Opportunity (IL DCEO) Renewable Energy Resources Program and the Illinois Clean Energy Community Foundation. For PV systems larger than 2 kW, the IL DCEO program offers grants of \$6,000 per kW, up to \$300,000 per project.

By the fifth year of the bilateral agreement with the city, it is estimated that the environmental benefits from the sale of EcoPower will include 249,151 fewer tons of carbon dioxide, 1,884 fewer tons of sulfur dioxide, and 1,007 fewer tons of nitrous oxides.

A substantial portion of the proceeds from EcoPower certificate sales is directed into a renewable energy reinvestment fund managed by ERT. The fund has been set up at a local Chicago bank and will be used to promote new renewable energy resources in northern Illinois. For example, the Fund will be used to purchase solar panels for the zero energy homes being built in Chicago this year and in 2004.

Chicago Solar Partnership

Much of the city's solar energy contributing to the green certificates is from public building installations completed through the Chicago Solar Partnership. The Partnership is a collaboration with ComEd, city and state government, business, and the community. This effort increases solar technology public awareness, provides PV rebates and incentive information, and helps address local zoning or permitting issues. Since its inception over three years ago, the Partnership has installed over 750 kW of photovoltaic generation on the roofs of Chicago museums, schools, and city and other public buildings.

Other partners include the City of Chicago Department of Environment, Spire Solar Chicago, the International Brotherhood of Electrical Workers, and the Chicago Public Schools. IL DCEO provides critical funding for this project. The U.S. Department of Energy Chicago Regional Office, U.S. Environmental Protection Agency Region 5 Office, and several nongovernmental organizations also are involved.

The Partnership developed from a 1999 contract between the electric utility and the City of Chicago to invest \$12 million in solar generation equipment through 2004. The utility allocated \$6 million of this amount to purchase solar electric equipment from Spire Corporation. The City of Chicago also agreed to purchase US\$2 million of solar generation equipment for public building installations. As a result of these commitments, a new Spire business unit, Spire Solar Chicago, was created.

Spire Solar Chicago provides the expertise and solar technology for the Partnership installations. The International Brotherhood of Electrical Workers and National Electrical Contractors Association provide highly trained installers and electrical contractors and help ensure a safe and proper PV system integration with the energy distribution network.

The Partnership's many installations include 100-kW solar arrays on the Art Institute of Chicago and the Field Museum of Natural History, a 50-kW array on the Mexican Fine Arts Center Museum, and 10-kW arrays on eight Chica-

go public schools (to date). According to Spire Solar Chicago, each school saves approximately 12,000 kWh per year. Over the 20-year life of the PV systems, the eight schools will save over US\$150,000 in electricity costs.

Because many of the solar school installations were on older buildings, each facility had to undergo a structural analysis to make sure the building infrastructure could accommodate the PV system. Chicago Public Schools currently is looking to construct new “PV ready” schools. The prototype design for the future new schools will allow the PV technology to be easily integrated into the facility.

A key Partnership goal is to make Chicago Public Schools the nation’s largest school-based solar energy network and a leader in environmental education. With this in mind, the “solar schools” have developed an innovative curriculum that

the American Solar Energy Society’s annual conference. To see the award-winning curriculum, schools and others interested in renewable energy can visit the Partnership Web site at www.chicagosolarpartnership.org.

Launched in November 2001, the site provides renewable energy information, a detailed Partnership history, and educational tools. Through real-time data displays, site visitors can check the performance and avoided CO₂ emissions from numerous Partnership solar electric installations throughout Chicago. The site also lists specific technical information for each installation including: system type, array angle, number and type of inverter, number and type of module, system size, installation date, mounting system, and average annual electrical output.

In October 2002, the site was recognized as “Outstanding Web site” in the Web Marketing Association’s annual competition.

Chicago Center for Green Technology

A key addition to the Partnership is the Chicago Center for Green Technology (CCGT), a national model for sustainable and environmentally friendly design. The building is working toward the Leadership in Energy and Environmental Design (LEED) “platinum” rating from the U.S. Green Building Council. The LEED Green Building Rating System™ is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. CCGT would only be the third building in the country to receive this distinction, and the first that is a renovation.

The first two “platinum” rated buildings—the Donald Bren School of Environmental Science and Management at the University of California, Santa Barbara, and the Phillip Merrill Environmental Center in Annapolis, Maryland—were both new construction projects. The CCGT project is centered around an existing building built in 1952 and located on a Brownfield site. The Chicago Department of Environment



figure 3. E. Franklin Frazier Elementary School 10-kW solar PV system.

integrates renewable energy education into their science and math lesson plans.

In 1999, the Frank W. Reilly Elementary School became Chicago’s first “solar” school. Reilly Elementary was also the first Chicago school to use the energy curriculum. Students used hands-on solar projects to help understand and have fun with the technology. For example, some students created miniature solar cars and made solar ovens from pizza boxes and tin foil. To complete the solar package, an Internet-ready kiosk was installed in the lobby so that students could observe the amount of energy the solar panels produced for their school.

IL DCEO and National Energy Education Development (NEED) created the K-through-12 energy curriculum for the program. NEED is a nonprofit organization that provides hands-on energy education and teacher training. For their work on the solar education curriculum, NEED and IL DCEO received the 2002 Interstate Renewable Energy Council Innovation Award at



figure 4. Frank W. Reilly Elementary School students admire 10-kW solar PV system.

took control of the property in 1997 after the previous owner violated city environmental laws, including accumulating 70-foot high piles of illegally dumped debris, one of which sank 15 feet into the ground.

After an 18-month clean up, the city cleared more than 600,000 cubic yards of construction and demolition debris from the site, selling crushed concrete and other materials to recycling firms and other city departments.



figure 5. BIPV in window awnings for Chicago Center for Green Technology.

A team of local architects, consultants, and engineers, led by Farr Associates Architecture and Urban Design, created the building's unique design using the U.S Green Building Council LEED guidelines. CCGT opened to the public in May 2002. Visitors can tour the facility to see the highest green technology standards first-hand.

For example, the building features several PV arrays including a 28-kW roof-mounted system, a 10-kW building integrated photovoltaic system (BIPV) of window awnings, a 27-kW ground-mounted system, and a 36-kW shade structure behind the building. Together, the PV systems provide over 35% of the building's electrical energy.

CCGT also includes rooftop low-growing plants (called a green roof) to absorb water runoff, large cisterns to catch rainwater for reuse in grounds maintenance, energy-efficient windows and lighting, and a passive solar greenhouse. Over 40% of the building materials are made from recycled products such as scrap cork and rubber flooring and bathroom tile from recycled aviation glass. In addition, the building features Chicago's first commercial geothermal heat pump system. The ground-source heat pump uses the Earth's constant temperature to heat or cool the building.

"A lot of other buildings only have a few sustainable strategies like recycled materials, or conserving water in a special way. This building really kicks things up a notch by combining just about every strategy you can image in environmental design," said Ron Dean of Farr Associates and project manager for the CCGT renovation.

In keeping with the CCGT philosophy, the building also houses "green" tenants: Spire Solar Chicago—the local PV

manufacturer active in the Chicago Solar Partnership; Green Corps Chicago—the City's community landscaping and job skills program; and WRD Environmental—an urban landscape design/build firm.

What used to be a neighborhood eyesore is now among an admired and elite group of the country's most environmentally friendly buildings, with the largest recycled item being the building itself.

Millennium Park

Including two park pavilions designed with building-integrated photovoltaic (BIPV) technology, Millennium Park is expected to be Chicago's newest world-class destination for families and tourists.

The Chicago Department of Transportation used some of the crushed concrete taken from the CCGT Brownfield clean up to lay the foundation for the Millennium Park underground parking garage. The pavilions are part of an overall city effort to build and enhance Millennium Park, which is intended to improve park, recreation, and cultural facilities along Chicago's lakefront.

"It's a public-private partnership initiated by the Mayor of Chicago, starting in 1997. The individual, privately funded projects within Millennium Park are what we call park enhancements, of which the pavilions are one of those," said Edward Uhler, Millennium Park project design director.

Each 6,000 square-foot pavilion will have a 37.5-kW system. The pavilions are expected to be completed in June 2004 and will be positioned on either side of the park's indoor Chicago Music and Dance Theater.

Uhler added that BIPV not only had aesthetic appeal but was also a practical solution over using a traditional solar roof installation. "Since this is a park, the opportunity to have lots of roof surfaces really doesn't exist. Even the Music and



figure 6. Graphic rendering of the West Pavilion.



figure 7. Electricians from the International Brotherhood of Electrical Workers and National Electrical Contractors Association installing the 38-kW system on the 911 Center.

Dance Theater is largely built underground, so the idea of using the PV in the wall system made a lot of sense,” said Uhlir. “And we thought if we could find the right system, it would be an attractive facade for the building as well.”

Pavilion designer Hammond Beeby Rupert Ainge Architects (HRBA) describes the buildings as two minimalist-style, black-glazed cubes. The PV modules will be integrated with the glass facades on the outside surfaces. “All of the black on the facades you see is PV. We think it is perhaps the first of its kind in Chicago, perhaps even in Illinois,” said HBRA architect Cyrus Subawalla.

The energy generated will help power both pavilions and the double wall system will reduce energy consumption costs. Each building’s heat loss or gain will be minimized through the wall’s ventilated cavity.

When completed, both pavilions will serve multiple roles of being park public information centers and display zones for Exelon Corporation (ComEd’s parent company) and the Chicago Park District. Specifically, the West Pavilion will have Exelon exhibit space, park offices, and client specific amenities. The East Pavilion will have additional exhibit spaces, including information about the value of PV and how it generates power for the pavilions.

The energy-efficient pavilions are just one part of the City of Chicago’s and Exelon’s partnership to support sustainable design and renewable energy. In 2002, Millennium Park was the location for the *Earth from Above* exhibit, an internationally acclaimed outdoor exhibition by world-renowned aerial photographer Yann Arthus-Bertrand. Presented by Exelon Corporation in cooperation with the Chicago Department of Cultural Affairs, *Earth from Above* was Millennium Park’s inaugural exhibition. ComEd provided PV to illuminate the exhibit.

According to the Public Building Commission of Chicago, Millennium Park will guarantee the city new jobs and revenues for decades to come. Conservative estimates say it could generate US\$100 million to US\$150 million of new tourist revenues each year.

Chicago 911 Center

When *Earth From Above* closed in September 2002, the solar panels were used to support other renewable energy initiatives, and the PV batteries were donated to Chicago’s 911 Emergency Communications Center—the City’s central location for routing emergency calls and Chicago’s point-of-contact with the U.S. Department of Homeland Security.

Earlier that year, Spire Solar Chicago installed a 38-kW solar electric system on the Center’s roof. The array supplies power to the building’s lighting on the first floor, which is home to the visitor’s area, locker rooms, classrooms, and press conference area for Richard M. Daley, mayor of Chicago.

For the 911 Center to use the donated *Earth from Above* batteries, the building’s existing PV system would have had to undergo a costly redesign. As an alternative, Spire Solar Chicago is installing an additional 10-kW system with the donated batteries as backup. This system and batteries will be used to power the lighting on the third floor, which is where the City’s 911 calls are received. The third floor also includes the Emergency Management Center.

“The Emergency Management Center is there in case the City threat level elevates above code yellow,” says Rich Enault, 911 Center chief operating engineer. “That’s where the Mayor and City department heads go to make decisions as to how to handle an emergency. It’s the most critical area for city operations during a crisis.”

The solar panels will provide clean, renewable energy to this vital part of the building and, should a power outage occur, the battery back up will enable the emergency services on the third floor to continue without interruption. ComEd, IL DCEO, the Chicago Department of Environment, and the State of Illinois provided the funding for the solar panels and installations.

The five-story building was built in 1995 and has other environmentally conscious features like energy-efficient lighting and ventilation. The 911 Center has attracted attention from business executives and politicians who are looking for ways to emulate what the Center has done.

“We’ve had a lot of influential people, like Senator Joe Lieberman, who have toured the building and have seen what has been accomplished,” added Enault. “This was a collaboration between city departments, the state, and ComEd, towards energy conservation and using an alternative fuel source.”

For Further Reading

For more information about ComEd, the Chicago Solar Partnership, or the Photovoltaic Incentive Program, visit www.chicagosolarpartnership.org.

Biography

Gabriela Martin is manager of environmental commitments for ComEd and is responsible for the development and implementation of the company’s renewable energy initiatives. 