ENERGY Energy Efficiency & BUILDING TECHNOLOGIES PROGRAM

Renewables Make a Powerful Case as Hospital Energy Source

Rapidly rising energy costs and tightening regulations on carbon emissions are making renewable energy, or "renewables," increasingly compelling to hospitals. Renewables were once viewed as niche technologies, but improved funding, incentives, and technology have positioned renewable energy to enter the mainstream.

Renewable energy is energy generated from natural resources that are naturally replenished. These sources include sunlight, wind, and biomass. Renewables require the right mix of government policy support, market conditions, and natural resource availability to be economically viable and to sustain their increasing growth and popularity. This fact sheet has been developed by the U.S. Department of Energy's Hospital Energy Alliance to assist hospital facility owners, designers, and operators in developing cost-effective renewable energy projects.

Benefits of Renewable Energy Use

- Reduced energy costs.
- Enhanced reputation.
- Better community health.
- Assistance in achieving green building certification.



Hospitals consume about two and one-half times the energy used by the average commercial building. Because they use so much energy, hospitals are in a position to realize better than average energy savings—and energy cost savings—through the use of renewable energies. Hospitals that use these clean energy sources also contribute to a more healthful environment.

Renewables can help hospitals reduce energy costs and hedge against price increases, but their benefits extend well beyond the bottom line (see box at left).

Hospitals that utilize renewables stand out among their peers through their commitment to community health and to providing leadership in environmental stewardship. Renewables can reduce the impact of hospital operations on power plant emissions and thus have a positive effect on environmental health. For an example of a tool that calculates the community effect of your hospital system's power plant emissions, see Practice Greenhealth's Energy Impact Calculator at www.practicegreenhealth.org/ tools/eic/.

Do Renewables Make Sense for Your Hospital?

When considering the use of renewable energy, there are several important market- and policy-related factors to consider.

- *Availability*—The availability of natural resources and the practicality of each type of renewable energy source vary widely by location (see maps on page 2).
- *Costs*—Capital costs, operating costs, scale of operation, and financing structure are all critical to making a well-informed decision.
- *Policies and Incentives*—Government and utilities offer incentives that may strengthen the business case for renewable energy.
 - Many states have a Renewable Portfolio Standard, a regulation that requires that a specific fraction of electricity be produced from renewable energy sources.
- Net metering laws encourage renewables by permitting a special metering/billing agreement between customers and utilities. Buildings' renewable energy-generating systems are connected to the power grid, and owners receive a credit for electricity generated in excess of their own needs and contributed to the grid.

Commercial Building

Initiative

- For a list of federal and state incentives, consult the Database of State Incentives for Renewables & Efficiency at www.dsireusa.org/.
- *Market Factors*—The feasibility of a renewable energy project is affected by the price of electricity, cost of the fuel mix, transmission congestion, and market regulation.

Which Type of Renewable Energy is Best for You?

Three types of renewable energy are considered in this fact sheet—solar, wind, and biomass.

Solar—Solar-powered electrical generation can be accomplished through "photovoltaics" and through "solar thermal" energy. Photovoltaics, the world's fastest-growing energy technology, uses solar cells to convert sunlight directly into electricity. Solar thermal uses solar radiation to heat a fluid. Typically, solar water heaters use pumps to circulate fluid through heatabsorbing solar thermal collectors.

Photovoltaics—When considering these systems, decision-makers must answer questions about mounting, orientation and tracking, shading, weather, and electrical interconnection with the utility.

- *Mounting*—Solar arrays may be mounted on the ground, the roof, or integrated into the building. A roof's ability to support weight and wind loads must be determined before that option is chosen.
- Orientation and Tracking—There are "fixed-tilt" systems and "tracking" systems. In the Northern Hemisphere, fixed-tilt systems typically face southward or toward the sky and are oriented at an angle that optimizes panel efficiency or system size and output. Some can be seasonally adjusted.

Tracking panels follow the movement of the sun throughout the day. These systems, which usually are groundmounted, generally have a greater power output per panel than fixed-tilt systems. However, they tend to take up more land and upfront costs may be higher.

- *Shading*—Shade produced by surrounding objects, such as trees, buildings, and other solar panels, can greatly reduce efficiency in many systems. Placement that eliminates shading makes solar power more reliable and more economical.
- *Weather*—In climates with significant snow or ice, thought should be given to how design alternatives affect, and are affected by, accumulation.

• *Electrical Interconnection*—It is important to determine whether a load/ utility side interconnection is available. In some cases, such as where net metering is permitted, a hospital can sell excess power generated back to the grid.

Solar Thermal—Solar thermal systems have many mounting, orientation, shading, and weather issues similar to those discussed in the previous section. Others include:

- Solar thermal collector types should be evaluated for their sensitivity to tilt angle and ability to shed snow and ice.
- There are "flat-plate" (glazed or unglazed), "evacuated-tube," and "concentrating" collectors. Glazed flat-plate and evacuated-tube collectors can achieve temperatures necessary for a hospital's domestic hot water or space heating and are the types that would most commonly be used.
- In climates with freezing temperatures, solar thermal systems need freeze protection.
- Solar thermal tanks vary greatly in size; the space required to house them may be a determining factor in deciding their location.

Wind—Wind can be harnessed by turbines to produce electricity through a generator. Small-scale turbines can offer



These maps provide a view of where three renewable energy sources are located in the United States.¹

1. Adapted from NREL. Solar: http://www.nrel.gov/gis/solar.html; Wind: http://rredc.nrel.gov/wind/pubs/atlas/maps.html; Biomass: http://www.nrel.gov/gis/biomass.html;

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renewable energy opportunities for hospitals in select regions. A variety of issues must be considered.

- Wind turbines are mounted on a tower to take advantage of the faster and less turbulent wind at 100 feet or more above ground. Placement away from trees, buildings, and other tall objects further facilitates power production.
- Wind speeds vary locally and should be measured onsite before a system is purchased. Small wind systems often are not cost effective unless the site is in Wind Power Class 2 or higher.
- Turbines should be located far enough from buildings to ensure noise control and safety.
- Availability of a load/utility side interconnection means that the hospital may be able to sell excess generated power to the grid.
- Mounting on buildings is discouraged due to vibration transmission and structural concerns.

Biomass—Biomass energy is produced by burning organic materials such as plant matter, residues, and waste to produce electricity or heat. Commercialscale biomass heating has particular potential for rural hospitals. The following should be considered:

- The availability of nearby natural resources is a key cost factor.
- Particulate emissions can be high for some systems.
- Different biomass feedstocks have different costs, properties, and sustainability considerations.
- Wood pellets and chips are popular sources of biomass energy. Pellets are easier to store and involve lower capital costs—but the fuel cost is higher. The opposite is true of chips.
- Alternate financing options are available, particularly for combined heat and power (CHP) plants.

Case Study

Gundersen Lutheran Health System La Crosse, Wisconsin • Program began May 2008

Gundersen Lutheran is in the vanguard of health systems using renewable energy. Early in 2008, the La Crosse, Wisconsin, health system set a goal of achieving energy independence by 2014. Gundersen's Envision Program for energy management and environmental stewardship expected to achieve a 20 percent reduction of baseline consumption and costs by the end of 2009. The remaining consumption is to be offset by generating energy from renewable sources.

2008 Renewables Project

• *Power from the sun*—Installed photovoltaic solar panels on a parking garage roof. These generate 73,000 kWh of electricity per year and assist in lighting the garage.

2009 Renewables Project

- Power from waste—Through a partnership with a local brewery, Gundersen installed a "cogeneration" (combined heat and power) system, in which methane gas from a brewery process is captured to fuel a biogas engine that produces electricity. It began operation in October 2009.
 - Will produce 3 million kWh of electricity per year.
 - Will offset 8 to 10 percent of the electricity used annually at Gundersen's La Crosse and Onalaska campuses.
 - Brewery uses heat from the engine in the waste treatment process.

2010 Renewables Project

• *Power from the sun*—Gundersen is installing a solar thermal system on its child-care center. The system is expected to offset 85 percent of the facility's hot water needs.



Renewables Projects Under Exploration/Development

- *Power from wind*—Gundersen will be constructing wind turbines at two sites. They are likely to be in use by midyear 2011 and are expected to provide 25 million kWh of electricity annually.
- Power from biomass, power from landfill biogas, and power from rivers— Preliminary work in each of these areas has been under exploration and/or development. Also under consideration are plans to expand the brewery project.

Financing

- Primarily self-financed.
- Applying savings from energyefficiency projects toward renewables.
- Wisconsin's Focus on Energy Program covers 5 to 10 percent of project costs.

Financing a Renewable Energy Project

Obtaining sufficient financing sometimes is the biggest road block to the use of renewable energy. When evaluating a project, hospitals should consider the merits of financing through direct ownership—in which there is an onsite, renewable energy asset-or third-party ownership-where there is a power-purchase agreement between the hospital and the owner of the renewable energy asset.

Direct Ownership Financing Options:

- Internally generated cash/general corporate financing—Typically, 70 to 90 percent of long-term financing comes from internally generated cash. This is considered to be the best option unless the project is perceived as having a low return and not as a strategic investment.
- Secured lending—Smaller companies may not have the debt capacity to borrow easily; secured loans can be obtained by offering collateral. Using the energy asset as collateral is a relatively new financing option.
- Vendor financing—This is when a vendor helps a manufacturer sell its product by facilitating financing, typically through a third party familiar with the technical aspects of the project. This type of financing is useful for hospitals that require dedicated financing for renewable energy projects.
- Leasing—An investor would retain legal ownership of the equipment, which would be made available to the hospital through rental payments. There are capital leases and operating leases, which are not capitalized. Leasing mitigates the risk of an investment in renewable energy but limits the financial upside.

Third-Party Ownership:

• Energy Service Companies (ESCOs)—These are businesses that help customers to finance, plan, and implement energy-efficiency projects. They establish a partnership with customers by means of an energy-savings performance contract. Renewable energy projects can be packaged as part of a larger energy-savings performance contract. The ESCO pays to purchase and install the energy-savings equipment, and the customer repays the ESCO over the contract period out of energy savings. ESCOs guarantee a certain level of energy cost savings; financing is linked to savings. This method typically is used in the public sector for energyefficiency projects.

First Things First

When all is said and done, efficient use of energy-renewable or otherwiseoffers hospitals the greatest opportunity to save energy, reduce energy costs, and improve the environment. Hospital decision-makers should examine opportunities to improve energy efficiency prior to-or alternative energy options. This could include reducing loads and upgrading the HVAC system, for example. Building systems are interdependent. All energy-efficiency upgrades need to be considered together, in sequence, so that every system is right-sized and optimally used.

Hospital Energy Alliance

HEA is a forum in which healthcare leaders work together with DOE, its national laboratories, and national building organizations to accelerate market adoption of advanced energy strategies and technologies.

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

ENERGY Energy Efficiency & **EERE Information Center** Renewable Energy 1-877-EERE-INFO (1-877-5 1-877-EERE-INFO (1-877-337-3463) www.eere.energy.gov/informationcenter

Commercial Building Initiative

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