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Hot trend: Recycling wasted heat to cut emissions, costs

By RENEE SCHOOF

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A new hospital is being built near Princeton, N.J., that won't depend on the local electricity grid, won't pump out the normal amount of greenhouse gases and won't pay peak prices for electricity.

The University Medical Center of Princeton at Plainsboro will have its own power plant that will use natural gas to make electricity and use the heat generated as a byproduct to create steam that will heat the building, sterilize equipment and provide cooling.

Interest in this kind of combined heat and power - and its cousin, the recovery of waste heat at factories to make electricity or mechanical power - has been growing as U.S. energy prices rise, old plants near retirement, and the country begins to get more serious about reducing global warming pollution.

America wastes vast amounts of heat that ends up in cooling towers or flared from factory roofs. Experts say that recycled heat could produce much more of the nation's power at competitive prices. Since this extra power comes without burning extra fuel, there also are significant savings in emissions.

NRG Thermal, the company that's building and will run the natural gas plant for the Princeton hospital, estimates that the power system and other measures - such as the use of natural light and electric-carts powered by solar panels in a parking lot - will allow the hospital to reduce its carbon footprint by 25 percent, the equivalent of taking 1,555 cars off the road.

Princeton HealthCare System President and CEO Barry Rabner said the company estimates that the power plant will save the hospital hundreds of thousands of dollars per year.

"Its value to the hospital is enormous from both a fiscal and operational point of view. It is twice as efficient as traditional power systems with a payback estimated to be less than five years, when used with a digital computer control system," he said.

The hospital will switch back and forth for power from the grid when that's cheaper. During peak hours when electricity is higher priced, it will use its own system. The plant also provides energy to chill water and store it, so that the hospital won't need as much energy during peak demand periods for its cooling systems.

NRG Thermal said combined heat and power also can have cost and environmental benefits at universities, shopping malls, data processing centers and energy-intensive industries such as chemical plants.

The hospital's plant will be about 70 percent efficient.

Coal-fired power plants are 33 to 40 percent efficient - only about one-third of the coal burned ends up as useful electricity, and the rest is wasted as heat.

U.S. coal-fired electric power plants haven't gotten much more efficient than they were in World War II, said Rob Thornton, the president of the International District Energy Association, a trade association that promotes district heating and cooling and combined heat and power.

A 33 percent efficiency rate, Thornton said, "is like buying a six-pack and the guy smashes four bottles before he hands it back to you."

Capturing that industrial waste heat is the specialty of Sean Casten, the president and CEO of Illinois-based Recycled Energy Development, and his father, Tom Casten, a pioneer of energy recycling. Their company says it can reduce greenhouse gas emissions profitably.

It designs and runs equipment to recycle a factory's waste energy into electricity. The host factory then buys back the electricity from the company on a long-term contract.

Sean Casten said that when heat-recovery equipment is added in a way that doesn't interfere with a factory's main operation, it's possible to generate power economically, because there's no need for additional fuel.

The company is working on a heat-recovery operation for an 80-year-old silicon factory in Alloy, W.Va. Its "power island" would recycle furnace heat that now is vented to the atmosphere.

"It's imprudent for us as a society to waste valuable energy," he said.

A 2008 Oak Ridge National Laboratory study concluded that combined heat and power was "one of the few options in the portfolio of energy alternatives that combines environmental effectiveness with economic viability and increased competitiveness."

Denmark gets 53 percent of its electricity from combined heat and power plants. In the past 30 years, Denmark has had economic growth and reduced carbon dioxide emissions.

Like much of Denmark, some U.S. downtowns have heating systems. However, only about 30 percent of the heat they produce is generated along with electricity, and that's mostly in New York.

Bryan Hannegan, the vice president for the environment and renewable energy at the Electric Power Research Institute, the research body of the utility industry, said only a few U.S. coal-fired power plants make use of their excess heat. Some sell steam that's not hot enough to make power to nearby factories that can use it in their industrial processes.

But if the government tightens emission controls for air quality and carbon dioxide, "I think there are possibilities some (coal-fired) units would look at this as a way to extend their lives," he said.

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