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For Professionals in Green Building and Environmental Systems Technology

## Recycled Energy and Co-generation Could Power the Future

By Staci Matlock, ConnectPress

Among the provisions in the new Federal Energy Bill is one that could boost the U.S. energy supply without increasing greenhouse gas emissions.

The provision mandates a study of the potential power from recycling waste energy in industrial processes and encourages the construction of co-generation, or combined heat and power plants. The recycled energy and co-generation potential has gone largely unnoticed in the mass media amid the focus on tax credits for renewable energy production from wind and solar.

But recycled waste energy and co-generation is something economist turned energy efficiency expert Thomas Casten has been promoting for three decades. Both have driven his work as former head of Trigen Energy Corporation and now as chairman of Recycled Energy Development, a Westmont, Il. company he runs with his son Sean Casten.

RED helps manufacturing companies capture and reuse waste energy from manufacturing processes requiring high heat such as steel, paper, silicon and glass manufacturers. A subsidiary, TurboSteam, also designs and installs on-site co-generating heat and power systems for hospitals, universities and other businesses. RED says its products produce more "efficient, reliable and clean energy." And it produces the electricity at a better price per kilowatt hour than from electricity generated by central power plants, solar or wind power, Tom Casten said. Reduced energy costs are essential to keeping American manufacturers competitive in a global economy.



Baltimore Refuse Energy Company—turbine generator installed by Turbosteam in Baltimore, MD

Casten's goals with RED are to reduce greenhouse gases while making money for the industry and his own company, and make industry more competitive. "I've been on a mission for 30 years," Casten said. "I became convinced global warming was an issue in 1975."

Like early climate scientists back then, he thought the process would be slower. "I thought there's no way I'm going to live long enough to see the polar ice caps melting," he said. "Gulp."

In the current rush to new renewable energy technologies, all of which are needed, the country's leaders are overlooking a vital, economical way to increase energy production while reducing greenhouse gas emissions, according to Casten.

Over the years, his companies have designed 250 recycled energy and co-generation projects around the country that are saving fuel and money. Sized correctly for the power needs, they prove highly efficient, saving both fuel and money, Casten said.

### **Increasing efficiency**

Recycling waste energy makes use of a natural byproduct of industries that require intense heat – more than 1,000 degrees – for their manufacturing processes. In a recycled energy installation, water-filled coils in a cooling tower harness the heat which boils the water which then makes steam which drives a turbine to make electricity. Heat can also be cooled so that it can be used to heat buildings and/or for industrial purposes.

Co-generation systems are on-site power and heat generators sized to suit the heat needs of a particular building. The systems are powered by fuel, like a conventional power plant, but because they are located on-site, they can use the waste heat normally lost when the plant is far from the end user. That allows the fuel to do double duty – creating electricity and heating a building. Excess electricity generated by the system can be sold, but usually only by cutting a deal with the local power company under current state laws, instead of selling it independently.

3D software plays a role in looking at a co-generation system from all angles, according to Bill Bullock, general manager of TurboSteam, a company that designs modular co-generation systems. Bullock said AutoCAD and some SolidWorks software, plus some proprietary programs they've created inhouse, are critical to helping them design modular co-generation systems and installing them quickly without causing a long, costly interruption in a company's work flow. "We're not doing new construction," Bullock said. "We're going into an existing operation."

Fitting new systems into some 100-year-old industrial buildings can be a challenge. "Anything we can do to model things ahead of time in 3D to make sure we aren't disrupting things we do, is good," Bullock said.



Dual turbine system ready for shipment from Turbosteam shop

### **An energy rebel**

Casten's book, *Turning off the Heat*, (1998, Prometheus Press), explains how the world can save money and reduce pollution. He recently co-authored a chapter in *Energy Myth and American Society, Thirteen Myths* (Sovacool and Brown), challenging the idea that the U.S. electric system is optimal.

Casten came to his recycled energy ideas while working as a director in the 1970s for the Cummins Engine Co. The company told him to figure out where Cummins needed to be in 25 years to stay competitive.

Casten's early research into climate change pointed to a looming catastrophe. More importantly, he discovered that while engine companies such as Cummins had steadily increased the efficiency of their designs, the same wasn't true for power plants. Most conventional power companies are about 33 percent efficient today, the same as they were in the 1960s, Casten said.

About two-thirds of the fossil fuels burned to create the electricity is lost at the power plant. Electricity transmission lines lose an additional nine to ten percent of the power before it reaches consumers.

"It hasn't changed in the last 48 years," Casten said. "My lack of an engineering background and my training as an economist lead me to a different question. What are we doing about the other two thirds (of energy lost)?"

Energy recycling finds ways to reuse the waste steam or thermal energy from industrial process and gas flares to make more electricity, effectively increasing the amount of electricity derived from a unit of fossil fuel, Casten said. Casten calculates recycling waste energy alone could produce 45,000 megawatts of power and reduce greenhouse gas emissions by 320 million tons. The power potential is equal to that produced by about 90 conventional coal-fired power plants.

The U.S. Department of Energy estimates as much as 200,000 megawatts of energy is available from combined heat and power, and recycled energy.

"Denmark makes over 50 percent of its power locally. California makes more than 20 percent of its power with combined heat and energy. Kentucky and South Carolina make zero," Casten said.

### **Overcoming hurdles**

A few major hurdles stand in the way of more co-generation and recycled energy. State rules giving monopolies to centralized power companies over distribution power lines are another hurdle. In some states

those rules allow a private homeowner to produce on-site power and feed it back into the electric grid. But most states make it illegal for co-generation plants to publicly sell excess energy at competitive retail prices.

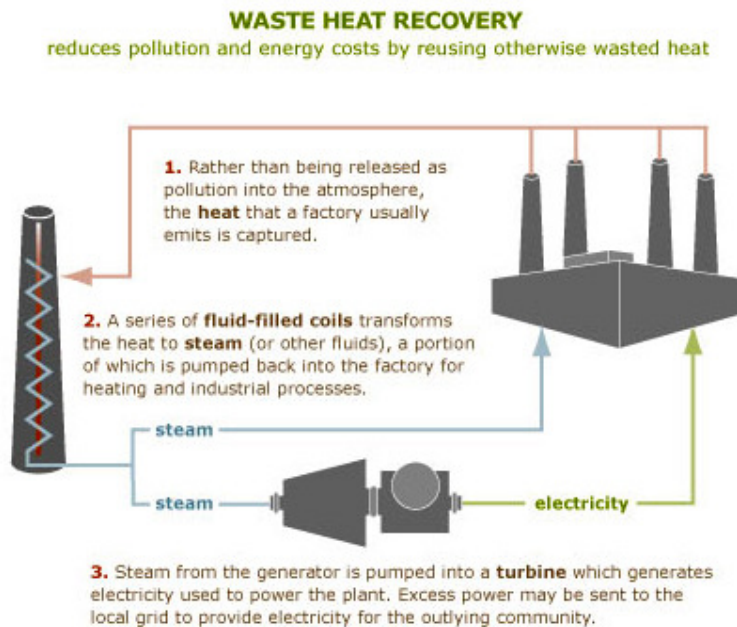
“All 50 states make it illegal to run a private electric wire across a public street. If I put a little onsite plant here and we had a little bit of extra electricity and wanted to run a line and sell it to the hospital across the street, I would go to jail.”

“The utility rules were set up to support rapid electrification,” Casten added. “We are certainly better off than we would have been without electricity. But we encourage inventions with a 20-year invention protection patent. We gave electric utilities a patent in perpetuity.”

Another hurdle is the Federal Clean Air Act, which was enacted to reduce sulfur dioxide, nitrogen oxide and particulate emissions from power plants and industries. But inadvertently, Casten said, the act became a disincentive for power plants to install cleaner technologies as they became available, and put new power plants at an economic disadvantage over older ones. The same scenario is about to play out, he said, as new carbon dioxide emission standards are passed, and states implement a cap-and-trade system. “The rule gives no credit for increased efficiency whatsoever,” Casten said.

For co-generation and recycled energy to reach their full potentials, those hurdles will have to be removed.

Most recently, Casten has preached his recycled energy mantra from Congress to the National Association of Regulatory Utility Commissioners. In late February, NARUC endorsed the development of recycled energy, and co-generation saying it “increases generation efficiency, reduces fossil fuel consumption, enhances generation diversity, and has the potential to improve system reliability, decrease line losses, reduce grid congestion, and reduce emissions of air pollutants and greenhouse gases.”



Waste heat recovery - illustration of the process by which RED reduces pollution and energy costs by reusing otherwise wasted heat

In November, Denham Capital Management, a global private equity firm, announced a \$1.5 billion equity partnership with RED for energy recycling projects. The first project funded under the joint venture is installing a hot exhaust recycling system with West Virginia Alloys (WVA), that will net 40-44 megawatts of electricity generation. That will offset about one-third of WVA’s electric consumption and reduce the plant’s carbon dioxide emissions by 30 percent, according to Casten.

For more information, see Recycled Energy Development at <http://www.recycled-energy.com/>

For more information about U.S. energy use and outlook, see the U.S. Energy Information Administration, <http://www.eia.doe.gov/>

Staci Matlock is a ConnectPress writer and a reporter for the daily Santa Fe New Mexican where she covers water, energy, agriculture and public lands issues.

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