

Energy efficiency and the repurposing of waste heat will be a significant factor to improve energy security in the United States. Echogen Power Systems, a private company based in Akron, Ohio is commercializing waste heat to power with a proprietary system. Since its founding in April, 2007, Echogen has developed a breakthrough power generation cycle called the Thermafficient® Waste Heat Recovery Engine. It uses a modified Rankine Cycle with supercritical carbon dioxide (ScCO<sub>2</sub>) as the working fluid. ScCO<sub>2</sub> is environmentally benign, non-toxic, and has favorable heat and mass transport properties which allow for an energy dense, compact thermodynamic system.

Echogen's target customer groups include power generation and large energy consumers in the Industrial sector with waste heat recovery opportunities found in their respective steam generating and direct-fired heating processes (e.g., furnaces, kilns, etc.). Prospective Industrial customer groups include chemical processing, petroleum refining, iron, steel, etc., typically operating with large sources of energy loss from hot exhaust gases and residual heat in liquid product streams. Waste heat reduction and recovery represents the greatest opportunity for reducing energy loss in these industries. Similar opportunities exist in Power Generation facilities (e.g., older fossil fuel fired generation assets and simple or combined cycle gas generation). Partnership with Utilities can include cooperative deployment of Echogen's system at Industrial plants within a Utility's service district as part of their Energy Efficiency Programs and compliance with local or State Renewable Portfolio Standards.

Echogen's Thermafficient® system is unique in several respects. First, it provides a solid value proposition in a broad system size range, scalable from 250kW to 50MW net electrical output (initial commercial unit for utility scale is a nominal 6MW system). Second, the power generating cycle is applicable across a diverse range of applications from industrial waste heat recovery to utility-scale solar thermal. Compared to organic and steam-based Rankine Cycle systems, the ScCO<sub>2</sub> cycle can achieve efficiencies up to 30% from a wider temperature range, with reduced component sizes resulting in a smaller system footprint and favorable project economics.

This combination of technological advantages allows Echogen systems to:

- ✓ Generates electricity from waste heat without burning fuel or producing the resultant emissions;
- ✓ Operates across broad temperature range of heat sources from 350 °F to greater than 1,000 °F
- ✓ Capable of achieving thermal to electric efficiencies above 30%
- ✓ Readily scalable from 250 kW to 50+ MW systems
- ✓ Exploit energy density of ScCO<sub>2</sub> to use system components 20-40% the size of conventional technologies, yielding a smaller system footprint and efficient installations

**Echogen products will enable our customers to:**

- ✓ Convert thousands of megawatts of waste heat generation into usable energy to offset the growing electricity demands in the U.S. and help reduce our dependency on foreign fossil fuel usage to support that demand.
- ✓ Offset new energy production with recovered energy, reducing increases in associated Greenhouse emissions by improving overall energy production efficiency.
- ✓ Reduce Levelized Cost of Electricity for energy-intensive US manufacturers across all economic sectors to improve their operating efficiency and bottom line performance.

**Modular Construction:**

EPS250Demo being delivered →



← EPS250Demo at test site

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