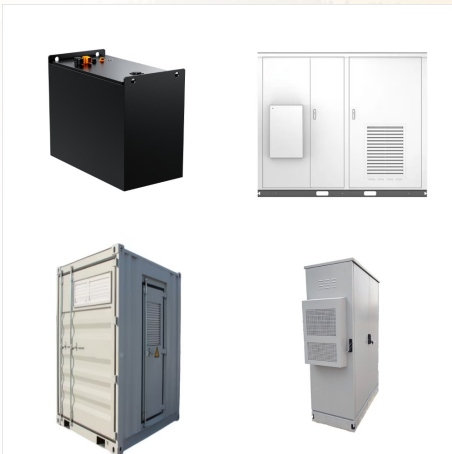




Echogen Power Systems is a team of experienced engineers working with elite service and equipment manufacturers to provide a world-class energy solution for our customers. Our People Learn about our management team members.



Dresser-Rand, a Siemens Business, partnered with Echogen to advance the design and construction of our waste heat recovery to power systems. Echogen is a key solution offering in the Dresser-Rand/Siemens renewable energy portfolio, focused primarily on the oil & gas market.



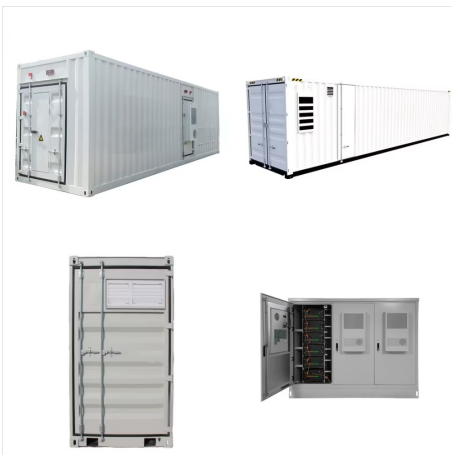
Echogen has developed next generation technology for a wide range of power generation applications. The sCO 2 cycle offers improved performance and significant operational advantages over steam and ORC cycles for both ???



,Echogen Power Systems,,??? ,Echogen, ???



Echogen then converted the heat pump to a WHP engine, reducing to practice a first approach to the power generation cycle. A second prototype system, completed in early 2009, used pure carbon dioxide and proved that a transcritical cycle heat engine could be built to produce electricity from waste heat for commercial applications, and



Our scalable heat engine is able to deliver a wide range of power outputs, currently from 1 to 9 MW of net power but feasible up to 500+ MW. Our flexible system allows our customers to source power back to their facility, or to sell to the local utility for alternative returns.

# ECHOGEN POWER SYSTEMS ANGOLA



Echogen Power Systems, Inc. is commercializing waste heat to power with a proprietary system. The company's breakthrough power generation cycle called the Thermafficient(R) Waste Heat Recovery Engine uses a modified Rankine ???



,EchogenEPS100,7~8 MW??? ? 1/4 ?? 1/4 ????  
20157, ???



The system will utilize a chemical process to store solar energy collected during the day. The Echogen power cycle, which uses supercritical carbon dioxide (sCO<sub>2</sub>) as the working fluid, will then convert the stored energy into electricity that can be generated at all hours - even at night.

# ECHOGEN POWER SYSTEMS ANGOLA



Echogen's EPS100 Heat Recovery System is an advanced Rankine Cycle for usable (waste) heat recovery. Our patent-pending technologies operate over a broad range of heat sources to extract a significant amount of energy and convert it into higher value, usable power. We use industrial-grade CO<sub>2</sub> as the working fluid, which allows our system



Thus, the Echogen PTES system maintains a low environmental footprint through its value chain. Why CO<sub>2</sub>? CO<sub>2</sub> is the best fluid for PTES, providing high-performance, low cost and low impact; Charging: CO<sub>2</sub> is one of the first heat pump fluids ever used (charging cycle), and condenses near 0°C; Generating: CO<sub>2</sub> power cycles are commercially



Echogen improves the efficiency of these industrial processes while increasing financial returns. Because of the thermal characteristics of our working fluid, Echogen's heat engine can generate electric power more cost effectively at ???

# ECHOGEN POWER SYSTEMS ANGOLA



We are looking for new partnerships to further the development of the PTES system. With 12 years and over \$85MM invested in water-free, sCO<sub>2</sub> power cycles, Echogen is uniquely positioned to develop a commercial pilot plant. Echogen is executing a \$3M contract to ARPA-E to design and build a proof-of concept kW scale PTES system.



At Echogen, we have designed an internship program that provides a practical, real-world experience geared to accelerate your knowledge beyond the classroom and prepare you for professional success. You will work alongside our employees and regularly interact with our management team.



The EPS heat engine uses industrial grade liquid CO<sub>2</sub> as the working fluid, which does not have practical temperature or pressure working limits.. The turbomachinery pumps the liquid CO<sub>2</sub> to high pressure and passes through a combination of recuperators and waste heat exchangers (without using a secondary oil loop) before entering the turbo-expander, which drives the shaft ???





Siemens Energy has licensed Echogen Power System's patented technology. Echogen's technology uses sCO<sub>2</sub> as the working fluid in a closed-loop power cycle to collect waste heat from the source and convert it to electrical power. By deploying sCO<sub>2</sub>-based waste heat recovery solutions, industrial operators in the oil & gas, power generation



A Comparative Study of Heat Rejection Systems for sCO<sub>2</sub> Power Cycles Presented at 5th International Symposium - Supercritical CO<sub>2</sub> Power Cycles, 28-31 March, 2016, San Antonio, Texas, U.S.A; Supercritical CO<sub>2</sub> Cycles for Gas Turbine Combined Cycle Power Plants Presented at Power-Gen International 2015, 8-10 December 2015, Las Vegas, Nevada, ???



ORLANDO, FL December 9th, 2014 ??? Echogen Power Systems,, a world leader in advanced power generation technology for waste heat recovery, today announces the commercial availability of its EPS100 heat engine system as a turnkey solution that satisfies energy demand, environmental requirements and bottom line cost savings for



Echogen is developing a solution called Electrothermal Energy Storage (ETES) ???where excess generation and off-peak electricity is converted and stored as heat and is later converted back to electrical power. Echogen has combined ???



Once commercial, applications for long duration storage on renewable-driven conventional grids include: Pairing with wind and solar ??? for high capacity factor power plants; Stand-alone storage ??? to defer investment in new transmission (larger scale) and new distribution (smaller scale) due to changes in power supply and demand locations; Islanded power grids ??? to lower power costs ???



Use waste heat from engines to produce electricity for onboard service power; Use waste heat to increase shaft power by gearing the Echogen engine into a propulsion shaft; Use the system as part of the onboard integrated power system (IPS) to function as an additional generator with no fuel consumption or emissions; Research with Navy SBIR



Echogen improves the efficiency of these industrial processes while increasing financial returns. Because of the thermal characteristics of our working fluid, Echogen's heat engine can generate electric power more cost effectively at lower temperatures, outperforming steam technologies in performance and overall cost savings.



With our partners, Echogen evaluated and developed design opportunities for a power plant/turbine system in such an application. In the proposed system, CO<sub>2</sub> would be pumped into an injection well and a portion of the injected CO<sub>2</sub> would be extracted through nearby wells.



Echogen is a leader in developing thermal systems utilizing carbon dioxide (CO<sub>2</sub>) as the working fluid, including industrial-scale high-temperature heat pumps, heat-to-power systems, and utility-scale long duration energy storage systems. Over the past 17 years, Echogen has designed and tested systems up to 7 MWe capacity, and is presently developing CO<sub>2</sub>-based energy storage ???

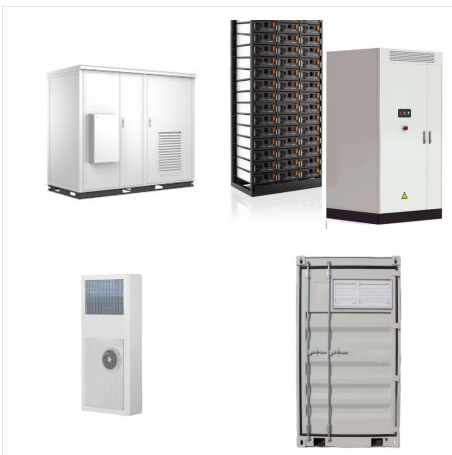




Echogen for Oil & Gas applications. The Echogen sCO 2 cycle is ideally suited for heat recovery of gas turbine exhaust and is capable of both electrical and mechanical (i.e. shaft) power output. This allows for potential applications in all three stages of Oil & Gas operations: Upstream - offshore exploration and recovery rigs, FPSO's



Echogen for Power Generation applications. Echogen has developed next generation technology for a wide range of power generation applications. The sCO 2 cycle offers improved performance and significant operational advantages over steam and ORC cycles for both combined-cycle systems and primary power plants.. Gas turbine combined-cycle



Today, we are a proud provider of an advanced waste heat recovery system that uses CO 2 as its working fluid, the first of its kind to provide at a commercial scale, allowing for a more compact, lighter and economical solution. We offer ???

# ECHOGEN POWER SYSTEMS ANGOLA



The Echogen Power Systems team will develop an energy storage system that uses a carbon dioxide (CO<sub>2</sub>) heat pump cycle to convert electrical energy into thermal energy by heating a "reservoir" of low-cost materials such as sand or concrete. During the charging cycle, the reservoir will store the heat that will be converted into electricity on demand in the ???



Echogen Power Systems is founded to develop an improved waste heat recovery system ; Our first prototype (5 kW) is completed with an absorption heat pump using carbon dioxide and a preferred secondary fluid ; 2008. A second ???