Sandia National Laboratories

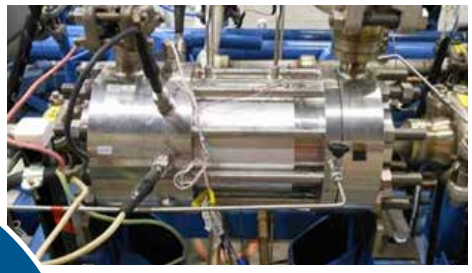
Energy, Climate, & Infrastructure Security

Advanced Energy Conversion

The Advanced Nuclear Concepts Organization is actively developing advanced power generation cycles for advanced reactors, small modular reactors, space reactors, concentrated solar power, gas turbines, and fossil energy.

sCO2 compressor wheels

Current work is centered on development of the Supercritical Carbon Dioxide (sCO2) Closed Brayton Cycle. Using supercritical fluids, Brayton Cycles can achieve higher energy conversion efficiencies in 1/100th of the volume and 1/10th the cost of comparable steam Rankine cycles. The technology is being demonstrated in the Nuclear Energy Systems Laboratory/Brayton Lab (Brayton Lab Link). Commercialization efforts are underway with the goal of demonstrating a 10 megawatt electric (MWe) system scalable to nuclear reactor power levels of 300 to 1000 MWe by 2020.



125 kWe sCO2 Turbine Alternator Compressor

A key feature of the sCO2 Brayton cycle is the ability to reject heat without using fresh water and reduces carbon dioxide emissions. The following table provides a comparison between a coal/steam power plant and a nuclear/ Brayton power plant.

Key components to the success of this technology are compact, highly efficient heat exchangers. Technology is under development to evaluate printed circuit heat exchangers for efficiency and durability in a sCO2 environment. These plus advanced lower cost designs under development will be tested in a dedicated sCO2 loop under construction in our Brayton Laboratory.

Other advanced energy conversion projects include micro-miniature radioisotope thermoelectric power supplies, and direct energy conversion power supplies.

Size Comparison of Turbine Technologies

Vision

To enhance the nation's security and prosperity through sustainable, transformative approaches to our most challenging energy, climate, and infrastructure problems.

Electrical Power Produced (kWh)

Coal/Steam - 3 (thermal, 1 (electrical)

Nuclear /Brayton - 3 (thermal), 1 (electrical)

CO2 Produced (lbs)

Coal/Steam - 1.35

Nuclear Brayton - 0

Fresh Water Consumed (gal)

Coal/Steam - 2

Nuclear Brayton - 0

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U.S. DEPARTMENT OF ENERGY

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND2013-7809W