Chemical Treatments for Geothermal Brines

OFFICE OF POWER TECHNOLOGIES

Success Stories

The Office of Power Technologies is part of the Office of Energy Efficiency and Renewable Energy

DOE research helped develop a large, untapped geothermal resource at California's Salton Sea

The geothermal resources beneath the Salton Sea in California's Imperial Valley are very hot brines (500°–572°F, 260°–300°C) under high pressure, making them excellent for electric power production. These brines, however, are extremely difficult to work with. Eight times saltier than sea water, they are very corrosive and contain high concentrations of dissolved silica. The silica precipitates out during the power process and quickly clogs pipes and equipment. If not dealt with, silica scaling can cause a power plant to totally shut down.

To help tap this valuable natural resource, the U.S. Department of Energy's (DOE's) geothermal program joined with San Diego Gas and Electric Company to find a solution to the silica-scaling problem. The resulting technology, called the crystallizer/ clarifier process, forces silica to remain in the brine stream rather than deposit on equipment surfaces. As the brine is flashed to steam in the crystallizer, silica-seed crystals are injected, around which brine-borne silica precipitates and forms large amounts of sludge. The sludge is removed from the brine effluent stream in clarifier tanks, dewatered, and then disposed in landfills.

This process led to the successful development of the Salton Sea reservoir, but the capital and operating costs were high. Further research resulted in a less expensive silica mitigation technology, the pH-modification process, which keeps the silica and other elements in solution by adding hydrochloric acid to the

Highlights

- ***An innovative brine treatment eliminated scaling and made possible the development of the Salton Sea geothermal resource.***
- ***The Salton Sea reservoir now supports seven power plants, which produce nearly 1.7 million kilowatt-hours of electricity each year—enough to power a quarter-million homes.***
- ***Compared to gas-fired power plants, the Salton Sea plants avoid 170,000 pounds of (77,112 kg) nitrogen oxide emissions and 1,520,000 pounds (689,472 kg) of carbon dioxide emissions each year.***

NREL/PIX00449

This technology, developed jointly by DOE and industry, opened up the Salton Sea geothermal resource to electric power generation.

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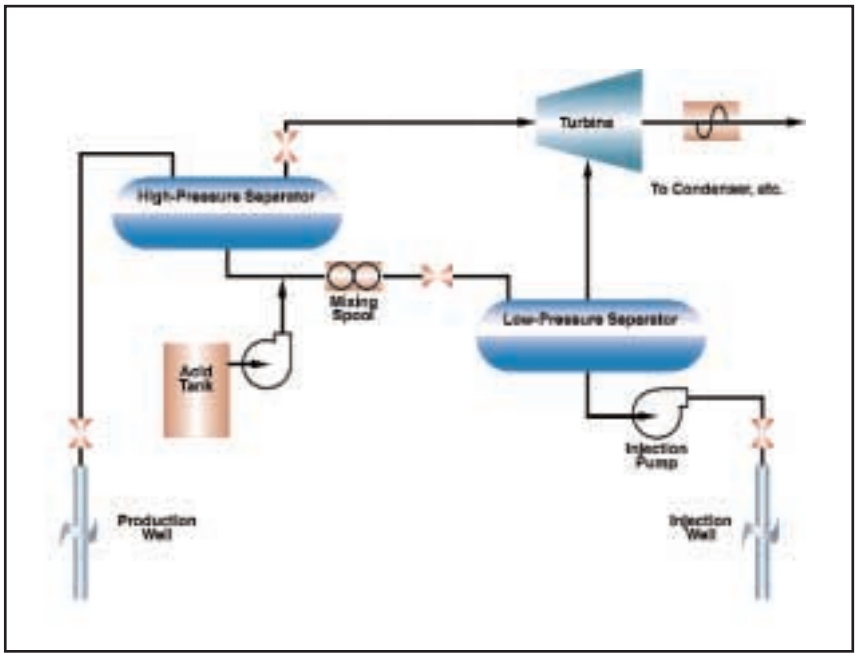
Today, seven power plants are operating, providing 248 megawatts of baseload power to southern California's power grid with minimal air emissions.



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A simplified flow diagram for the pH-modification process used at some Salton Sea geothermal power plants to remove dissolved silica from the brines.

effluent brine. The brine is then pumped back into the reservoir through injection wells, saving landfill disposal costs while replenishing the geothermal reservoir.

Today, seven power plants are operating at the Salton Sea reservoir, providing 248 megawatts of baseload power to southern California's power grid with minimal air emissions. The power plants, which employ 120 people, are a tribute to the joint industry/government research effort that made them possible.

Each year, the Salton Sea power plants produce nearly 1.7 million kilowatt-hours of electricity, thereby avoiding the annual emission of 170,000 pounds (77,112 kg) of nitrogen oxides from California's natural-gas-fired power plants. Since power production began in 1982, the plants have avoided the emission of more than 14.6 million pounds (6.35 million kg) of carbon dioxide.

Project Partners

U.S. Department of Energy

Lawrence Livermore National Laboratory

Magma Power Company

San Diego Gas and Electric Company

Southern California Edison Company

Unocal

For More Information:

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