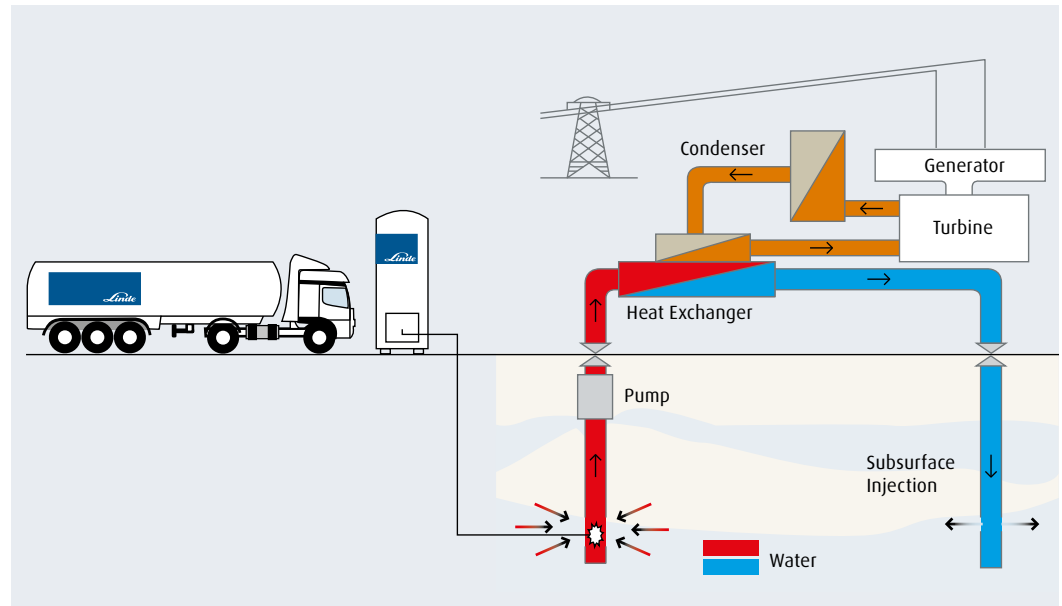




Geothermal pH Control with Carbon Dioxide

Improving the productivity of geothermal plants by avoiding scaling on wells and equipment



Overview of geothermal plant with CO₂ pH control

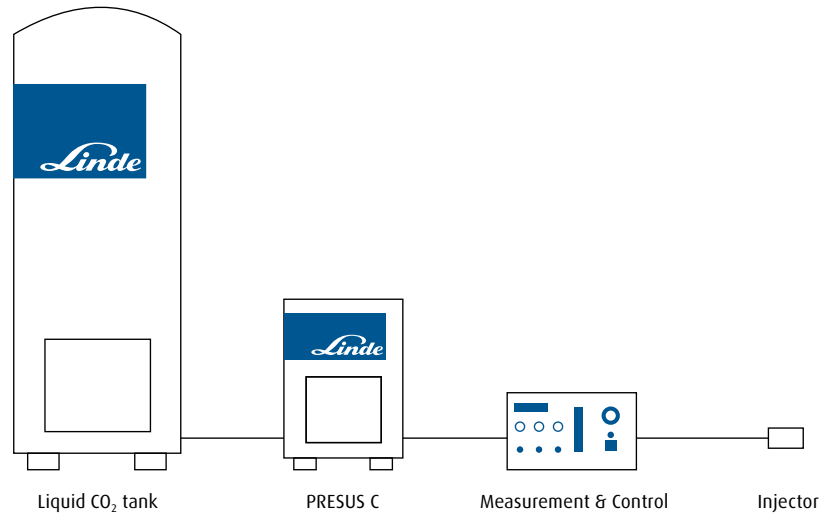
Challenge The productivity and specifically the flow rate of geothermal development projects can be compromised by scaling. This can affect the surface of geothermal wells and the equipment in use. It occurs when changes in pressure, temperature or pH value disturb the equilibrium of the system, causing minerals dissolved in the geothermal fluid to precipitate from the liquid and deposit on surrounding surfaces, potentially clogging installations such as well pipes, suction pumps, heat exchangers, filters, perforations and pores in the reservoir rock. Scaling is common, for instance, in brine fluids with elevated levels of carbonates such as calcite. It can throttle geothermal plant capacity by as much as 20%, compromise heat exchanger efficiency, result in unscheduled and lengthy downtime, shrink maintenance/overhaul intervals, and shorten the operational lifetime of costly installations such as heat exchangers and suction pumps. All of which pushes up maintenance and replacement costs.

Solution Linde has developed a geothermal pH control system which injects carbon dioxide (CO₂) into the geothermal fluid to avoid calcium carbonate forming in the first place. The CO₂ is injected underground at high pressure upstream of the submersible pump. CO₂ injection gives geothermal plant operators easy and precise control over the pH value of the geothermal brine.

- Benefits**
- Little to no scaling on geothermal wells or equipment
 - Higher productivity as geothermal plant can run at full capacity
 - Longer maintenance intervals and reduced maintenance cost
 - Extended lifetime for key components such as heat exchangers and pumps
 - Improved environmental performance compared with chemical/biological inhibitors or mineral acids (many of which have been banned by certain environmental agencies)
 - No harmful residues on geothermal equipment
 - Uninterrupted, accurate pH control, avoiding the downtime window typically required to overhaul pumps and heat exchangers once alternative acids have been applied two or three times
 - Opportunity to earn carbon credits as the mineralization of CO₂ in the geothermal brine removes carbon

Implementation

The cryogenic liquid carbon dioxide (LIC) in the tank is compressed by the PRESUS® C high-pressure booster. The compressed LIC is fed to the measurement and control system, where the pressure and flow rate are adjusted. The LIC is then injected underground into the suction pipe before the submersible pump. By delivering a low flow at high pressure, the PRESUS C booster offers efficiency and cost gains over conventional pumps. It can also supply CO₂ at higher pressures than conventional high-pressure tanks and is thus more efficient. The signaling path from the CO₂ measurement and control system is usually integrated in the safety circuit in place at the geothermal plant.



Service & Know-How

We offer a broad portfolio of support and optional services to help you assess the viability of geothermal pH control and execute your project cost-effectively and quickly.

- Geothermal pH control proof-of-concept tests for your individual processes
- Cost/benefit analysis
- Full project execution including delivery and installation of CO₂ supply equipment plus PRESUS C high-pressure booster, above-ground pipework, measurement and control system to adjust the supply pressure and flow rate, as well as connection to the geothermal plant and integration with the safety circuit
- Support during commissioning
- Reliable supply of LIC from stationary tank

Linde GmbH

Carl-von Linde Strasse 25, 85176 Unterschleissheim, Germany
Phone: +49-8931001-0, www.linde-gas.com