Next-generation geothermal equipment categories and supply chain considerations

The table below maps equipment across the stages of next-generation geothermal development. It is not exhaustive, as needs and proposed solutions vary across EGS, CLGS, and SHR approaches.

Equipment Category	Technology	Notes
Subsurface	*Drill rigs*	Drill rigs are widely available in North America; rig suppliers and geothermal firms are increasingly collaborating; and idle rigs can sometimes support geothermal projects. However, accessing greater depths requires rigs with high hook load capacity, and these rigs are in shorter supply and tend to be located near deep sedimentary basins rather than in regions where early geothermal deployment is most likely.
Subsurface	*Drill string components (piping and other materials connecting the drill rig to drill bits)*	American and European manufacturers supply drill string components for geothermal. Higher-temperature projects, particularly SHR, may require insulated drill pipe (IDP) or titanium drill pipe, each of which involves different upstream material sourcing.
Subsurface	*Drill bits (machinery for penetrating rock)*	Drill bit technology varies widely by approach. Conventional mechanical (rotary) drill bits, such as polycrystalline diamond compact (PDC) bits, are supplied by established domestic OEMs like Baker Hughes and SLB. PDC bits have been used in EGS development. Direct energy drilling technologies designed for superhot rock project development include plasma and millimeter-wave (MMW) system. The manufacturing base for these technologies remains nascent.
Subsurface	*Downhole tools (sensing and power electronics used in drilling management and wellbore data collection)*	Existing products can serve some EGS and CLGS applications, but most tools on the market today are rated for 175–200°C, well below what deeper-field and superhot rock projects will encounter. Scaling geothermal globally will depend on the availability of high-temperature steering and sensing equipment, as investors have noted, particularly for SHR. Both incumbent OEMs and startups are working to push temperature ratings higher, but high-temperature tool products have previously been pulled from the market after failing to attract enough orders to justify continued production. How downhole tools are paired with other temperature management strategies will shape the specific materials needed. Two materials highlighted for their potential in higher-temperature electronics, silicon carbide and gallium nitride, also figure in other strategic supply chains. Some downhole tools are sourced primarily from China.
Subsurface	*Casing materials and tubulars (support and, in CLGS, seal geothermal wells in preparation for heat extraction)*	Oil and gas OEMs produce tubulars and well cements, but these products require modification for the temperature and pressure profiles of geothermal wells. Some U.S. developers have already built supplier partnerships — XGS Energy, for instance, works with Vallourec, which has a manufacturing facility in Ohio. Despite their importance to higher-temperature project success, well casing and completion materials have received relatively little dedicated investment.
Subsurface	*Fluid management and well chemistry (water/circulating treatment, chemical treatment, H2S abatement, storage tanks, and related pumps)*	Geothermal operations involve managing corrosive brines, mineral scaling, and hydrogen sulfide (H_2S) emissions. Many of the materials and chemicals that the oil and gas industry uses for well stimulation and completion (such as certain drilling fluids, elastomers, and fracturing proppants) break down at the temperatures encountered in deeper geothermal wells. Proppants, for example, can degrade and create blockages above 200°C, working against the fracture networks they are meant to support. High-temperature cementing techniques, fracturing fluids, and multistage completion methods all require further development for geothermal conditions.
Surface	*Electricity production equipment and turbomachinery*	Turbines are one of the few next-generation geothermal components for which manufacturing cost modeling exists, but publicly available models are from 2018 and cover turbines much smaller than those now entering deployment or planned in modeling. Organic Rankine Cycle (ORC) turbines transfer geothermal heat to a secondary working fluid, which vaporizes and spins a turbine. They are a common example of a binary-cycle geothermal plant. Manufacturing for ORC units is concentrated among a small number of firms. Key manufacturers include Italy's Turboden (a subsidiary of Japan's Mitsubishi Heavy Industries), Ormat (which manufactures in Israel and Turkey), Kaishan (a Chinese firm with a U.S. subsidiary), Italy's Exergy (a subsidiary of China's Nanjing TICA), and Baker Hughes. TAS Energy has also manufactured ORCs in the United States, primarily in Texas. Domestic content incentives in Turkey have helped that country develop ORC production capacity. Outside of China, total ORC turbine manufacturing capacity as of 2018 is approximately 1.6 GW. Analysts widely anticipate shortages as next-generation geothermal scales. Fervo's CEO observed in 2025 that just one project in Utah would represent approximately 10% of the global ORC market. Steam turbines are used for conventional hydrothermal projects, and modified steam turbines are proposed for higher-enthalpy projects like superhot rock geothermal. Steam turbines share a global manufacturing base with nuclear and fossil fuel power generation, so procurement draws on an established supplier ecosystem. SHR applications, however, will expose turbines directly to corrosive geothermal fluids at extreme temperatures, requiring new product designs. Toshiba, Fuji Electric, and Mitsubishi Heavy Industries (all Japanese multinationals) are the principal producers. Both ORC and steam turbines rely on components sourced largely from China, including parts made with titanium and Inconel (a nickel alloy). Even when final assembly takes place in allied countries, key subcomponents may still originate from Chinese manufacturers. Today, these turbines are made at plants shared with other manufacturing activities, including waste-heat ORC system production. Gas turbine production facilities may be viable candidates for expanding geothermal turbine manufacturing without greenfield capital investment.
Surface	*Heat exchangers (transfer heat between working fluids, separating geothermal brine from the turbine working fluid in binary-cycle plants)*	In binary-cycle plants, heat exchangers keep corrosive geothermal brine separate from the turbine working fluid. Because heat exchangers are in direct contact with the brine, they must be built with high-performance alloys that can tolerate corrosive chemistry over long operating periods. Some domestic manufacturing capacity exists, but stakeholders have flagged concerns about both throughput and quality. Key components are sourced primarily from China.
Surface	*Air-cooled condensers (ACCs)*	ACCs cool and condense the steam exiting a turbine back into liquid using fans rather than water. This makes them particularly relevant for geothermal deployment in the arid western United States, where water availability is a constraint.
Surface	*Production well pumps*	Used in geothermal fluid and steam extraction. Domestic manufacturers supply production pumps for geothermal applications. Geothermal wells can demand higher pumping capacity than typical oil and gas operations.
Surface	*Grid-connection equipment (switchgear, step-up transformers, etc.)*	These components serve all forms of power generation, exposing geothermal projects to the same transformer and switchgear procurement delays facing the broader energy sector. ABB and Virginia Transformer are among those supplying grid connection equipment to geothermal developers.

This table may be updated as new information becomes available.

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