

G E O

T H E R

M A L



We can help you take the heat.

The success of your geothermal projects relies on specialized technologies and services to extract heat from wells. Whether you're an operator independently completing geothermal wells, a drilling contractor seeking to expand your capabilities, or a service company in need of geothermal toolkits, we work with you to provide services and equipment that help complete your wells as efficiently and cost effectively as possible.

With a long history of supporting operations across a variety of markets, our global reach and innovative product portfolio make up the foundation with which we can deliver success in the geothermal space. We've maintained a solid presence in the drive for renewable energy, delivering proven products, reliable services, and engineering expertise for geothermal applications for several decades. It's this success that makes us uniquely positioned to support your project's needs and the growth of geothermal operations worldwide.



As green energy initiatives continue to push the growth of geothermal projects, the right technologies are required to ensure peak performance and cost-effective operations. Fit-for-purpose tools that can withstand harsh, high-temperature environments and experienced personnel are key to the economics of a geothermal operation.

Our comprehensive product portfolio serves as a customizable geothermal kit, providing a simple solution that allows power generators and service companies to independently use, maintain, and service our tools for their operations.

- From a 67% higher ROP with a single bit run in New Zealand to drilling 8% farther and 36% faster in an Indonesian operation, ReedHycalog drill bits can handle the harsh environment of your geothermal applications.
- Our proprietary TK™ coatings have been used in geothermal applications throughout Germany for nearly 20 years, and they are currently being tested for geothermal projects in France and Canada.
- Our TK™-Liner system has recently been deployed into geothermal producers in the Netherlands, which is the world's first application for this type of product in geothermal production wells.
- Our motor displayed extreme durability by drilling through hard, abrasive, and fractured basalt in two extensive runs in a geothermal well in Iceland. The motor drilled a total of 1,827 ft (557 m) and withstood 295 operating hours.
- In the hottest geothermal wells of Central Europe, our motor withstood drilling 100-plus hours with an average circulating temperature of 275°F (135°C) and a maximum temperature of 336°F (169°C), outperforming several competitor motors that failed.
- Our XLF connector's flush OD/ID, metal-to-metal seal and full pipe body pressure ratings make it ideal for geothermal slim well applications, and the connector has had great success in New Zealand, California, and Latin America geothermal applications.
- Our fiberglass-reinforced pipe (FRP) and composite tanks have been used for mineral extraction from geothermal brine in North America operations, and 497 miles (800 km) of our composite piping was installed for district heating and cooling applications in France.
- Our STAR™ glass-reinforced epoxy (GRE) tubing and casing continues to be the leading pioneer in our industry, successfully supporting geothermal operations in Europe for more than 20 years.



Geothermal solutions for a sustainable future

We've seen sustained success in geothermal applications across our entire portfolio. Our full selection of geothermal products has delivered proven performance in harsh environments, and we have the global infrastructure required to support your geothermal supply chain.



Geothermal rig technologies

Our Euro and Ideal™ drilling rig systems are designed to provide versatility and reliable performance in even the most difficult and unpredictable drilling conditions. As a complement to these systems, our rig equipment team engineers and manufactures advanced drilling equipment packages and the related capital equipment (including top drives, iron roughnecks, drawworks, blowout preventers, mud pumps, risers, pipe handling, and power and control systems) necessary to drill geothermal wells. We fully support the entire life cycle of our equipment through our Aftermarket Operations teams as well as remote equipment monitoring, technical support, field service, and customer training.

Rig equipment

Our tested equipment packages are outfitted with technology that enhances your overall drilling efficiency while maintaining our high standards of safety and reliability. Our team fully supports your crew and the equipment during your project, providing you with a single point of contact to keep operations running smoothly.

- Top drives and hoisting
- Pipe handling systems
- Pressure control
- Drilling controls and instrumentation
- Power generation
- Pumping and circulation
- Direct connection to the grid

System Integration | Sync your drill floor with customized solutions

NOV Automation | **Materials Handling** | **Controls** | **Remote Solutions**

High-temperature equipment | **Lifecycle support**

Emissions reduction | Connect your rig to the grid and eliminate diesel



Fluid systems

Our MISSION consumables lead the industry in the design, supply, and support of drilling fluid equipment, fluid-end expendables, fluid transfer systems, and fluid-end modules, and accessories to geothermal customers worldwide.

- Mud pump expendables
- Centrifugal pumps
- Dies and inserts
- Manual handling tools



NOV Automation

For geothermal applications, NOV's autonomous solutions can be integrated into existing equipment and controls, giving you the ability to retrofit your rig operation to fit your needs. As the industry evolves, we continue to deliver process improvements that pioneer how wellbores are constructed, and we can provide the fully-automated rig to achieve it.

Materials Handling | Controls | Remote Solutions



ATOM RTX

Our robotics system can perform multiple material-handling functions on the drill floor, keeping humans from harmful rigfloor operations and high heat. The system uses advanced changeability to perform tasks like doping, guiding when stabbing, tailing, mud containment, and standbuilding.



AURA

AURA is our family of remote-enabling products, solutions, and lifecycle service programs that are designed to enable optimal performance and uptime for your equipment.



NOVOS

This reflexive drilling system performs a series of actions when prompted, similar to human reflexes when acted upon by a specific stimulus. The NOVOS™ reflexive drilling system provides greater control, consistency, and enhanced performance that can be valuable in dynamic environments and hard-rock formations. The system can be expanded to include full closed-loop automation, which allows for even greater predictability in your geothermal drilling campaigns.

- Scalable fleet-wide
- Uploads well plan
- Sends commands through apps
- System sends command to tool
- Machines perform drilling operations

Aftermarket service

NOV provides equipment for thousands of rigs around the world, and we provide comprehensive aftermarket products and service solutions to keep that equipment up and running. With an integrated network of strategically located facilities around the world, we're available when and where you need our support.

- Technical support
- Field service and repair
- Spare parts
- eHawk™ remote support
- TrackerVision
- Training
- Installation and commissioning
- Rentals
- Field engineering
- Automation Lifecycle Management





Geothermal drilling tools and services

From site planning and analysis to drilling optimization and pipe lifecycle management, NOV provides optimized wellbore technologies that improve every facet of the drilling process. NOV works with you to identify ideal equipment for your geothermal applications, design better drilling programs, and streamline your supply chain through our proven technologies and expertise.

Drill bits, coring, and borehole enlargement services

Optimized drill bit design is key to reducing the number of trips required to minimize drilling challenges and reaching target depth in your geothermal applications. Our ReedHycalog team has been continuously developing polycrystalline diamond compact (PDC) cutter technology to deliver a more robust, thermally stable, and abrasion-resistant drill bit product. In conjunction with advanced bit design and modeling capabilities, as well as new bit body materials, our PDC drill bits can perform in the most challenging hard and harsh formations. These applications are common to the geothermal market, for which we've developed a specialized hybrid Phoenix™ drill bit platform that utilizes our latest ION+™ cutter technology, cutter shapes and unique secondary cutting structure components. The Phoenix bit design can take on the durability and drilling efficiency challenges of volcanic formations, and they have delivered impressive performance in a variety of geothermal applications globally.

The diverse ReedHycalog portfolio also offers conventional and wireline coring systems that get the data you need to evaluate and manage your formation. With a full range of innovative coring solutions, we can minimize your risk and provide the largest diameter, highest quality, and fit-for-purpose cores available.

Our DL Reamer has a unique eccentric bi-directional design that enables active and efficient wellbore trimming and conditioning while drilling. Our proprietary Multifunctional Advanced Placement Software (MAPS™) ensures optimal tool positioning in the BHA, and the reamer is proven to work with rotary and motor BHAs, delivering performance in vertical to horizontal wells.

- PDC drill bits
- ION PDC cutter technology
- Thermal index modeling - Bit designs utilize patent-pending thermal analysis and optimization software to analyze heat transfer on every single cutter for improved cutter and bit life
- Struts™ high-density impregnated (HDI) cutting elements
- Coring
- Borehole enlargement

Directional drilling technologies

As the world's largest independent original equipment manufacturer (OEM) of directional drilling tools, NOV can provide the technology and global support needed for your geothermal operations. Our fit-for-purpose directional drilling tools are rated to withstand and succeed in the high temperatures, harsh environments and cost-sensitive nature of geothermal drilling. Paired with our global support, our simple to operate and maintain tools enable geothermal drilling contractors and operators to perform their own directional drilling operations, eliminating expensive third-party services.

- BlackStar™ II MWD tools
- Tolteq™ iSeries measurement-while-drilling (MWD) platform
- Vector™ rotary steerable systems (RSS) platform
- Teledrift™ low cost man-less survey on connection tools
- Magnetic MultiShot – High-temperature survey tools



Downhole drilling tools

With decades of experience in a variety of challenges in geothermal fields and global applications, Downhole drilling tools empower sustainable energy by drilling deeper, farther, and faster in harsh environments. Our engineering capabilities allow us to develop tools for our customer needs, and with supply and service centers around the globe, we can provide proven tools and support where you need them, when you need them.

- Drilling jars
- Vector™ motor bearing packs
- Specialized power sections
- ERT power sections and XTH elastomers
- FluidHammer tool
- AgitatorHE™ systems
- Workshop equipment





Wellsite services

WellSite Services has served the geothermal market for more than 25 years. Our library of products spans multiple functions during geothermal operations, including BRANDT™ solids control, waste management, managed pressure drilling systems, and fleet of generators and portable lighting from Portable Power. We conduct operations in every part of the world where drilling and production take place with a continual focus on servicing the wellbore and streamlining logistics at the wellsite.

- Shakers and screens
- Mud conditioners
- Mud chillers
- Centrifuges
- Desanders
- Desilters
- Dewatering units
- Cuttings transport and waste management
- Mud Vac
- Portable Power generators and other portable power equipment
- Chokes and other MPD equipment



Data solutions

M/D Totco™ is the leader in real-time drilling data acquisition, visualization, analytics, and data delivery that supports all data requirements operators demand. Our products feature flexible alarms, concise information, and many other capabilities that ensure safe, efficient geothermal operations. Our broad range of drilling instrumentation meets worldwide certification requirements and supports industry-standard data protocols. Additionally, M/D Totco provides extensive user training with a superior service support infrastructure that is recognized throughout the world. Our solutions are designed to provide the most accurate and dependable drilling information platform to help your customers make confident, well-informed decisions during geothermal operations.

Optimum Execution of Well Plans

- RigSense™ data acquisition and delivery
- Pressure monitoring
- Communication and information services

Streamline Operations

- RigSense electronic drilling instrumentation system
- Management reporting services
- Business integration services
- AutoTally™ and Max™ Track asset maintenance and management
- Max Maintenance preventative maintenance
- Gas sensors
- Max Edge visualization and analytics at the wellsite with cloud connectivity

Precise Downhole Data Acquisition

- BlackBox™ memory tools
- Downhole instrumentation services

Superior Drilling Processes

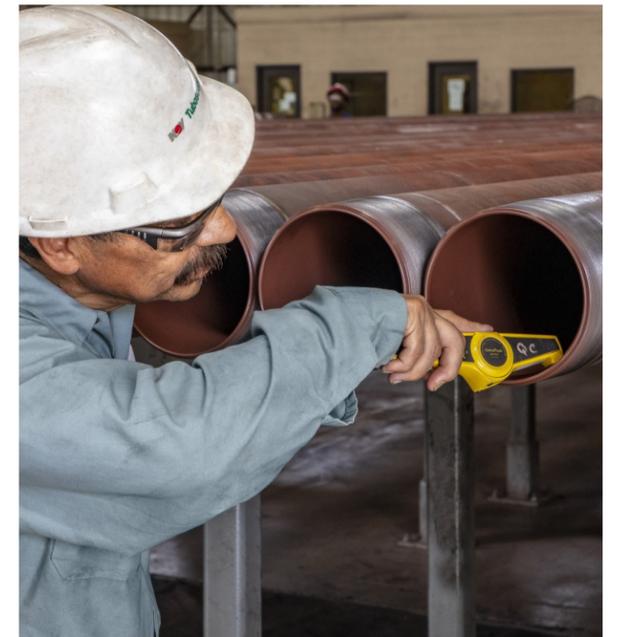
- eWildcat™ 2.0 electronic auto driller
- SoftSpeed™ II stick/slip mitigator
- Kaizen intelligent drilling optimizer



Tubular services

For more than 80 years, Tuboscope has provided tubular expertise and an unmatched suite of value-added solutions to help you get the most out of your assets. We maximize useful life, helping you drill safer and more efficiently while increasing production and reducing downtime. Worldwide, our offerings include the latest technologies and services to help you optimize tubulars used in geothermal applications. Our suite of proprietary corrosion control products provides unrivaled corrosion and wear protection in the most challenging environments.

- Tubular inspection
- Corrosion control
 - Tube-Kote™ (TK) Internal plastic coatings
 - TK™-Liner GRE lined systems
- Manufacturing and thread repair of API and premium connections
- Hardbanding
- Connection systems for welded and mechanically connected pipelines
- MSI Pipe Protection
- Specialty inspection services



Drill pipe and drill stem accessories

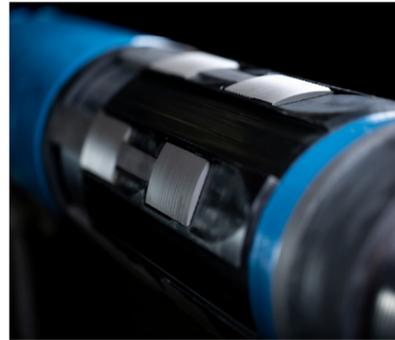
Grant Prideco is the largest supplier of drill pipe and drill stem accessories, worldwide. We specialize in providing innovative solutions for drilling, completions, and intervention operations – from the simplest well to the harshest environments. Depending on the application, your drill pipe may require hardbanding for heat resistance, tungsten carbide for durability, or sour service grades for corrosive H2S environments. With our expert engineering and design resources, worldwide operations, and global service network, we are well suited to meet all your drill stem needs.

- Proprietary and API drill pipe
- Heavyweight drill pipe
- Drill collars
- Subs
- Pup Joints



Geothermal completions and production

From well construction components like premium connections, liner hangers and cementing equipment to downhole multistage fracturing tools, pumpers, blenders, and sand storage solutions, our tools allow operators to optimize the completion of a well. Once a well is completed, our robust suite of coiled tubing and wireline equipment allow for cost-efficient and reliable intervention work from the truck to the software to the BOP stack. From our flagship products with 100 years of history to our newest technologies, we're here to help you customers achieve lasting success in your geothermal projects.



Completion tools

Having run successful liner hanger systems for geothermal operations for more than a decade, we can handle projects ranging from high-profile, deep-well applications for international clients and regional communities to shallow, simple wells for community heating projects. Our partnership with Tuboscope allows us to offer equipment with the highest performance fiberglass TK liner protective lining to mitigate corrosion concerns. Our team has access to 20 CNC machines and has various accreditations including ISO 9001:2015, API Q1, API 11 D1, API 5CT, API 7-1. Additionally, we are a VAM™ Licensee with the ability to cut premium coupled connections such as VAM 21 HT™ to flush/semi-flush connections such as VAM SJIJ II™ etc.



Connectors

As a leading provider of robust and reliable connector products for onshore and offshore conductor and surface casing strings, our integral and weld-on connectors range from 16 to 72 in. in diameter and are used in some of the most challenging applications around the world. Our product development process includes advanced digital simulations and full-scale physical testing to benchmark product performance.

- Viper
- Scorpion
- XLW & XLW-GT
- XLC-S
- XLF



Intervention and stimulation equipment

From one job to the next, you need a partner that works smarter, safer, and more efficient. From cementing and coiled tubing to wireline solutions, we don't just piece together a solution that "gets it done." We combine years of technical expertise in all areas of the energy industry with trusted brand names such as:

- Hydra Rig™
- CTES™
- Texas Oil Tools™
- Elmar™
- Enerflow™
- Rolligon™
- Anson™
- Quality Tubing™
- Wilco™

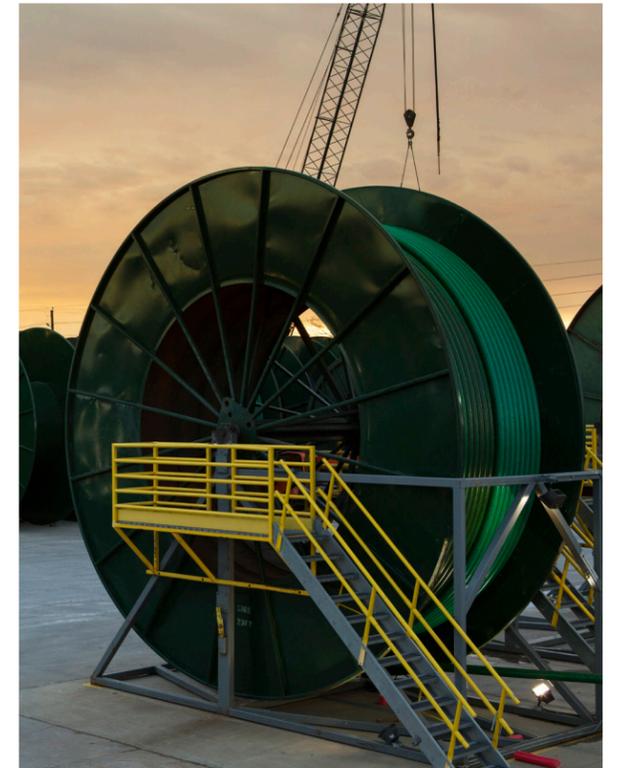
Composite solutions

With 60+ years of composite solutions experience, our Fiber Glass Systems business unit manufactures and designs fiberglass reinforced (FRP) composite tanks, pipes, and fitting products. We provide custom-made, large-diameter pipe based on operating conditions up to 200°F (93.3°C) and cooling and firewater piping applications for geothermal applications.

- Bondstrand™
- Red Thread™
- STAR™
- Starwell™
- Fiberspar™
- Z-Core™
- RB-2530
- Ershigs
- Belco

Our composite storage tanks have been used for the process of mineral extraction from geothermal brine in North America operations since 1979. Our earliest geothermal mineral extraction tanks supported a 1998 zinc recovery project in the Salton Sea, CA region.

Our composite pipes have also supported 497 miles (800 km) of installation for heating and cooling in France. Additionally, we've successfully supported geothermal operations in Europe and Asia (Japan) for more than 20 years with our STAR™ glass-reinforced epoxy tubing and casing line of products.



Process and flow technologies

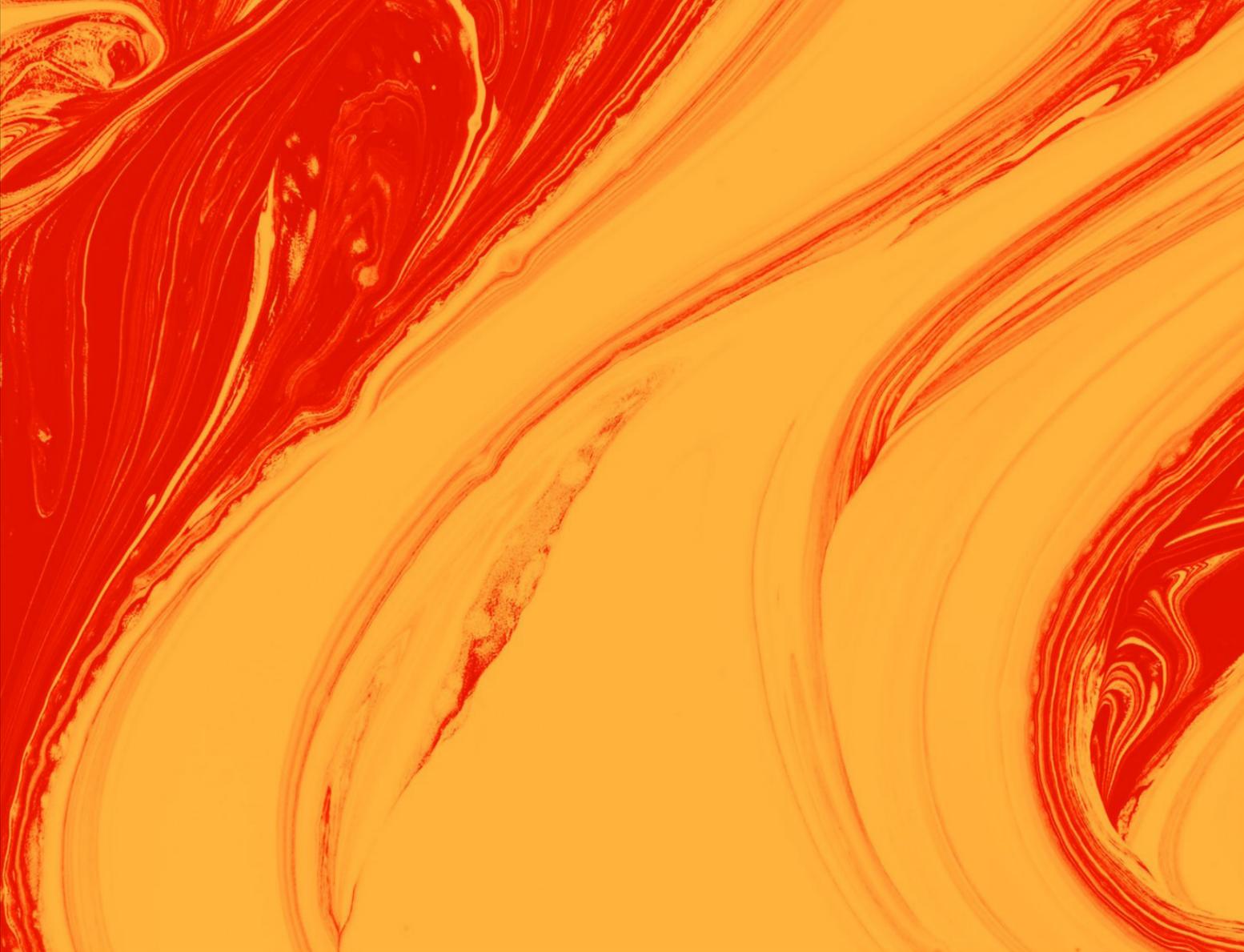
We provide process expertise and innovative technologies that enhance the efficiency and profitability of your business. For our customers in the geothermal industry, we work with you to develop customized solutions with superior performance—maximizing your project lifecycle economics. From pumps, chokes, and other high-performing technologies, we can handle your equipment needs.



Fluid motion solutions

We have provided pumping and mixing technologies across the globe for more than 85 years. With proven success in various applications, our trusted brands of Mono™, Moyno™, Chemineer™, Kenics™, Greerco™, and Prochem™ deliver superior performance for chemical dosing, separation/cleaning, high pressure, and gas mixing system applications that are well-suited for the geothermal energy space. Our integrated systems provide superior performance and operating efficiency that you can trust.





A reliable partner in your geothermal projects

As a leading manufacturing company, we know how to design fit-for-purpose technologies that deliver success in harsh environments. Along with our robust, reliable tools, and our global support network, we work with you to select the right products that ensure performance improvements in your operations.

We offer a geothermal toolbox of more than 70 products and services, which allows us to collaborate as an active partner in the development of your assets or to serve as a comprehensive, turnkey provider for your projects. With a range of customized business models, we leverage multiple NOV product lines to empower your efforts around integrated geothermal solutions and help you tackle your toughest operational and financial challenges.

Visit nov.com/GeothermalSolutions or contact us at Geothermal@nov.com for more information.

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