

POWER



## GEOHERMAL STEAM TURBINE GOVERNOR CONTROL

**BACKGROUND:** The focus is growing on geothermal power as one of the most promising forms of renewable energy. Often referred to as limitless, reservoirs are found on fault lines and near volcanic active areas. These resources are naturally replenished through rainwater, snow melt, and reintroduction of leftover fluids. Unlike other forms of renewable energy, geothermal power is always available. It's important to maximize the use of geothermal fluids, whether steam, brine, or two-phase flow. Separator efficiency is key to sending the highest quality of steam to the turbine, while proper operation of the governor control valves sends the right amount of steam to the turbine. Their accuracy and reliability are important for maintaining the highest output and maximum megawatt hours to the grid.

**KEY TO SUCCESS** in controlling steam turbine speed is to accurately and reliably position governor control valves. Balancing steam load is critical for proper and stable operation of the turbine to design conditions. Trying to precisely throttle steam using the typical turbine OEM butterfly valves is no easy feat. In addition to modulating capabilities, these valves must also be able to close or trip to position in less than a second on load shed to prevent overspeed and potential turbine damage.

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Rev. 1

# ELECTRAULIC™ ACTUATION



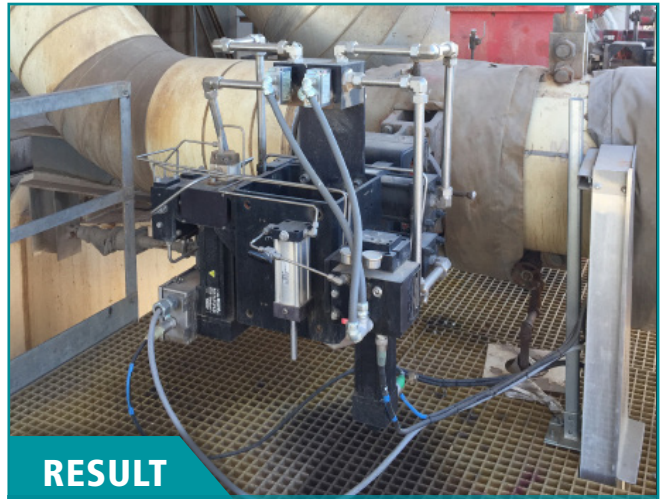
**PROBLEM:** In a dry steam or flash type plant, predictable operation of governor control valves driven by a Hydraulic Power Unit (HPU) is continually sought after. Long known as standard equipment on these large steam turbine valve installations, HPU based systems are very susceptible to environmental contamination through the oil sump. These plants have some of the most severe ambient conditions anywhere, due to the location of geothermal fields.

Though separation systems strip out most brine contaminants, there are still dissolved minerals and gasses embedded in the steam that enters the turbines. These impurities mix with the turbine lube oil, which is usually from the same source that powers the hydraulic operator system. By design, this is a built-in contamination path starting at the turbine. It doesn't take long to have an effect on HPU oil. This leads to unpredictable valve performance, fluctuating megawatt output, and ultimately turbine trips. Contaminated oil will detrimentally effect an operator's ability to maintain turbine speed.

Servo and proportional valves, which are used to move the actuators to position, are especially sensitive to poor-quality oil due to small working clearances and precise movements. Many hours are spent troubleshooting these systems, compounded by the massive expense of constant oil-based maintenance.

**SOLUTION:** REXA Electraulic™ Actuation offers a responsive and dependable solution for Geothermal Steam Turbine Governor Control Valve applications. Designed for continuous modulating service, the patented self-contained, closed loop, hydraulic circuit provides stiff, stable control in the harshest conditions (-40°F to +250°F). The closed hydraulic system requires no filters and does not require any oil based maintenance. A dedicated microprocessor control enclosure operates the drive unit and is usually located in a convenient area. Set-up and calibration are simple due to a membrane key pad on the enclosure cover. Performance is unmatched in the industry with an adjustable dead-band to 0.05% of stroke, resolution of <0.1% and frequency response of

1.5 to 5.0 Hz. Actuator standards include fail to position and fail in place options as well as rapid full stroke speeds (<2 seconds) with no hysteresis or overshoot. Fail safe options include a. mechanical spring module or a nitrogen charged piston accumulator system for higher outputs and longer strokes.



## RESULT

A geothermal plant operator will notice improved reliability and control of the governor steam valves immediately. The REXA actuator positioning will track control signals precisely, with a 90 Ms dead time and repeatability of <0.1%. Steam supply to both sides of the turbine can be easily balanced, allowing maximum MW output to the grid. Maintenance costs are also greatly reduced, eliminating the need for expensive servo valves and filter systems.

Since the REXA oil system is self-contained and positive pressure sealed, no oil maintenance is required. When it comes to reliability, choose to Rely on REXA.

**REXA**  
ELECTRAULIC™ ACTUATION

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