

GEO THERMAL POWER STATION MONITORING



APPLICATION BACKGROUND

Geothermal electric power stations are generally located where high temperature geothermal resources are available near the surface, often near areas where there are natural hot springs.

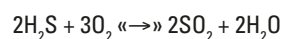
Geothermal power stations pull hot water / steam from the ground, use it to run turbines and then return the water back to the original source. The three basic designs for the geothermal power stations are:

- Dry steam - steam goes directly from the ground to the turbine
- Flash steam - hot water is “depressurised” in to steam that then drives the turbine
- Binary cycle - hot water is used to heat secondary liquid, one with the lower boiling point than water. Using secondary liquid allows for production to be varied, can be increased or decreased multiple times each day, so energy produced can match actual demand.

Geothermal energy systems offer a cleaner, more sustainable renewable energy, that can supply regular, continuous power but it can still have negative impact on the environment, people and wildlife. Water, air and land can be affected.

Water pumped from underground contains high levels of harmful chemicals like sulfur, so it is important to ensure that used water is not returned in to the environment. The power stations that have a loop air system emit gases from the extraction well, like hydrogen sulfide, known to smell like rotten eggs, into atmosphere.

The problem with hydrogen sulfide (H_2S) is that when in contact with the oxygen in the air (O_2) changes into sulfur dioxide (SO_2).



Sulfur dioxide is found to cause heart and lung diseases, acid precipitation, which then damages plants, soils and acidifies water bodies.

Pumping large amounts of water from the geothermal reservoir can cause land surface to sink and use of fracking process increases already high risk of earthquakes.

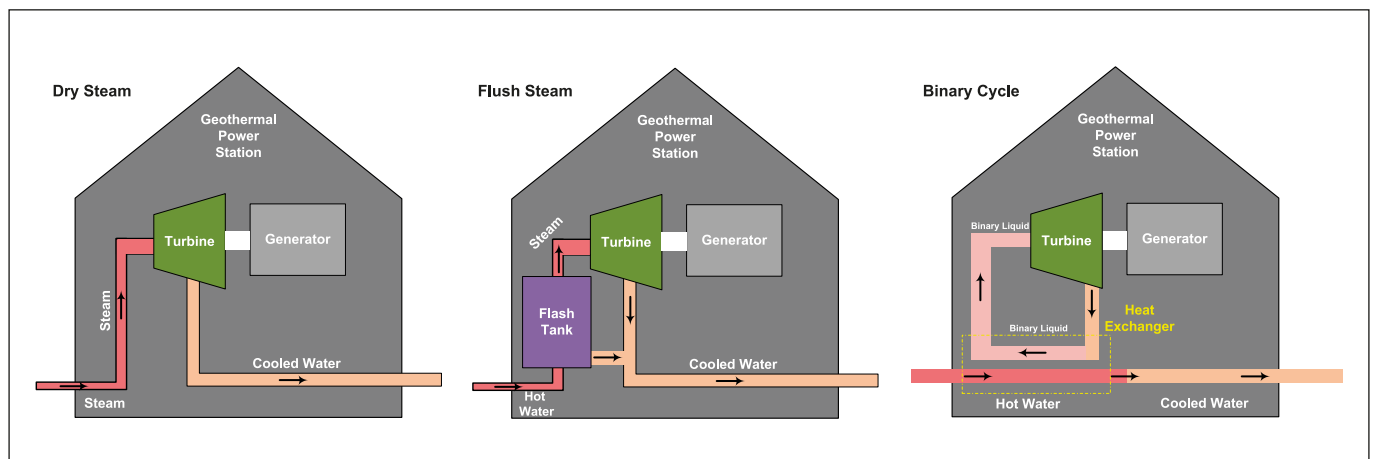
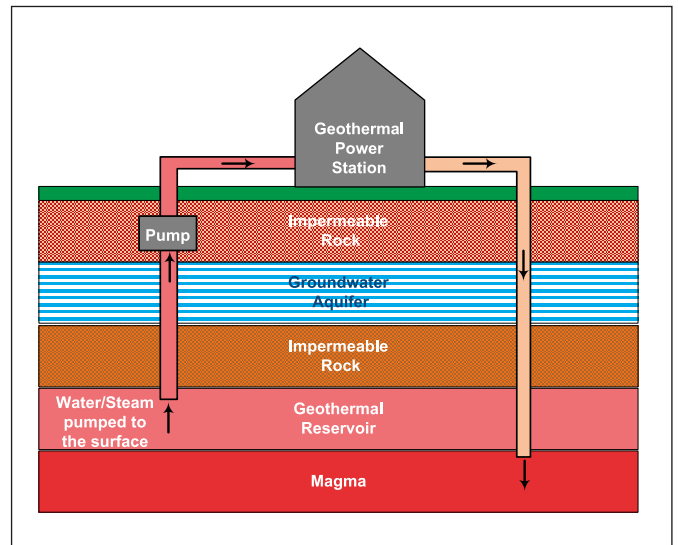
The constant monitoring and reporting is imperative when a geothermal power station is located near populated areas.

APPLICATION DETAIL

Firstly, there will be a requirement to monitor the weather in the area using Tier 2 weather station equipment to record the ambient conditions, especially wind speed and direction, so there is good knowledge of the general wind conditions to make sure emissions from the plant are not being carried by the wind to areas of population, such as a local town or city. There may be the need for one Tier 2 to be installed at the plant and at each perimeter fence of the facility to get a good reading for the local area.

Unidata supplies various weather station instruments, either a multifunction ultrasonic weather transmitter, which is very convenient to install, as well as separate discrete weather instruments. For this application, the simpler ultrasonic weather transmitter would most likely be the best choice for the application.

To provide telemetry option, a Neon Remote Logger can be connected to each weather station and be set up to read the instruments every minute, store the raw and average readings every 5 minutes, and then transmit the data to a central Neon Server every, say, 15 minutes.





As well as weather station equipment that measures weather conditions such as wind speed, direction, humidity, temperature, solar radiation etc, there would also be a requirement to add additional instruments to measure the presence of noxious gases and seismic activity.

There are many manufacturers of gas monitoring equipment. One such manufacturer is Dräger and there are sensors to measure noxious gases such as CO, CO₂, NO, H₂S, SO₂ as well as O₂ and N.

These instruments typically provide a 4-20mA analog output or a Modbus output which can be read by Neon Remote Logger routinely, perhaps every minute and then routinely send the data to the Neon Server every 15 minutes. The system could also be equipped with a ground seismic monitor to take daily readings of seismic activity. This way, so a clear pattern of the base level of seismic activity can be determined, and then used as a reference for monitoring the effects of the geothermal power station activities.

The Neon Remote Logger scheme / program can also be set up to check parameters each minute and raise an alarm and an immediate transmission to the Neon Server in the event of any reading is outside it's preset limits. The Neon Server can also be set up with alarm actions, to notify staff by email or text, with an escalation process, of any out of limits conditions.

As well as the immediate actions to deal with for high / dangerous gas levels, data can be analysed and long term trends can be determined to help minimise environmental impacts and optimise production.

Finally, water quality measurements for any outflows can be important, so a water quality instrument on any outflows would allow outflows to be checked for quality, to maintain environmental compliance. These instruments can also be connected with a Neon Remote Logger to the central Neon Server, either with a radio link, or by connecting directly into the plant network using an Ethernet cable.



TYPICAL CONFIGURATION

APPLICATION SPECIFIC INSTRUMENTS / INPUTS

Options	Unidata Part Number	Description
WXT536 measures barometric pressure, humidity, precipitation, temperature, wind speed & direction	6501V-H	Vaisala Weather Transmitter RS232 / 422 / 485 SDI-12
Dräger Gas detection Instrument	Dräger MiniWarn	CO ₂ / CO Gas Monitor
Water Electroconductivity Instrument	6536E	Water EC Instrument with Batt, 512K CMOS memory
Four Electrode Water Conductivity Probe	6536P-2-10 / 20 / 30 / 50	4EL Water Conductivity Probe - 10m, 20m, 30m or 50m
Temperature Thermistor Probes	6507E	Red Thermistor Probe 3K@25 with requested cable lengths
Linear Temperature Probe	6535A	Temperature Probe LM34 with requested cable lengths
Humidity and Temperature Probe	6539B	Humidity & Temp Probe (5-18V)
Rain Gauge	6506C	Rain Gauge / Tipping Bucket
Mounting Arrangement for Temp Probes	6704A / B	Radiation Gill Screen & Mount
Radiation sensors	7241C-A	Pyranometer Sensor High Output - Apogee
Mounting Arrangement for Pyranometers	7241M	Pyranometer Sensor Instrument Mounting & U Bolts

NEON TELEMETRY - NRL / RTU / FIELD UNITS

Options	Unidata Part Number	Description
Ethernet	3016A-000 / 3008A-000	Neon Remote Logger-16 or 8 Analog Ch / Touch Screen Display
Ethernet & 3G / 4G	3016A-C00 / 3008A-C00	Neon Remote Logger-16 or 8 Analog Ch / Touch Screen Display
Ethernet & 3G / 4G and LoRa	3016A-CL0 / 3008A-CL0	Neon Remote Logger-16 or 8 Analog Ch / Touch Screen Display
Equatorial Orbit Satellite - Inmarsat	3016A-00I / 3008A-00I	Neon Remote Logger-16 or 8 Analog Ch / Touch Screen Display
Equatorial Orbit Satellite - Inmarsat & 3G / 4G	3016A-C0I / 3008A-C0I	Neon Remote Logger-16 or 8 Analog Ch / Touch Screen Display
Low Earth Orbit Satellite - Globalstar	3016A-00G / 3008A-00G	Neon Remote Logger-16 or 8 Analog Ch / Touch Screen Display
Satellite - Iridium Short Burst Data	3016A-00R / 3008A-00R	Neon Remote Logger-16 or 8 Analog Ch / Touch Screen Display
Standalone RTU / NRL - Industrial	3004A-00 / 3004A-0L	Neon Remote Logger-4 Analog Ch with or without Touch Screen Display
Cellular RTU / NRL 3G / 4G - Industrial	3004AC0 / 3004A-CL	Neon Remote Logger-4 Analog Ch with or without Touch Screen Display
M – Series Standalone RTU / NRL	3004B-M000 / 3004B-M0B0	Neon Remote Logger-4 Analog Ch with or without Li Battery
M – Series Cellular RTU / NRL 3G / 4G	3004B-MC00 / 3004B-MCB0	Neon Remote Logger-4 Analog Ch with or without Li Battery
M – Series LoRa RTU / NRL	3004B-ML00 / 3004B-MLB0	Neon Remote Logger-4 Analog Ch with or without Li Battery
M – Series Ethernet RTU / NRL	3004B-MEBL	Neon Remote Logger-4 Analog Ch, Li Battery & LCD are optional
M – Series Microsatellite RTU / NRL	3004B-MHBL	Neon Remote Logger-4 Analog Ch, Li Battery & LCD are optional
M – Series Iridium Short Burst Data RTU / NRL	3004B-MIBL	Neon Remote Logger-4 Analog Ch, Li Battery & LCD are optional

NEON APPLICATION SOFTWARE - CUSTOMER SERVER

Options	Unidata Part Number	Description
Neon Applications Software	2302A	Neon Server Software Licence Incl 5 NAL
Neon Applications Software	2302A-10	Additional 10 NRT Access Licence
Neon Applications Software	2302A-20	Additional 20 NRT Access Licence
Neon Applications Software	2302A-50	Additional 50 NRT Access Licence

NEON HOSTING SERVICE - UNIDATA SERVER

Options	Unidata Part Number	Description
Neon Hosting Service	2301A	Neon Data Initial Subscription Setup Fee
Neon Hosting Service	2301A-01	Neon Data Service Fee for 1-50 NRT
Neon Hosting Service	2301A-02	Neon Data Service Fee for 51-100 NRT
Neon Hosting Service	2301A-10	Neon Data Service Fee Metering

DATALOGGER MANAGEMENT SOFTWARE

Options	Unidata Part Number	Description
Starlog V4 Management Software	6308A-AUE	STARLOG V4 Full Licence Key

AVAILABLE FROM: **Unidata Pty Ltd** | 40 Ladner Street, O'Connor, 6163 Western Australia | Tel: +61 8 9331 8600 | info@unidata.com.au