

RUN OF RIVER HYDROELECTRIC POWER STATIONS



APPLICATION BACKGROUND

Run-of-the-river hydroelectric generation is a method of generating electricity from flowing rivers without making water storage or large dams.

Such plants are small and only divert a small amount of the river flow from the river for power generation, and then return that water flow back to the river a small distance downstream.

These smaller plants have less impact on the river, as they don't need to have a large dam to store water. However there is a strong regulatory requirement to ensure the river parameters are not changed during the diversion. The water parameters need to be measured very carefully at the in-flow to the power station and at the out-flow of the power station before water is returned to the river.

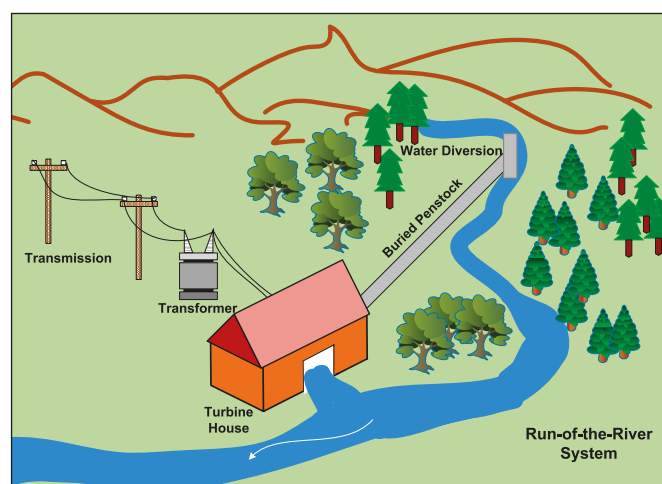
APPLICATION DETAIL

Water parameter measurement stations need to be installed at the intake and the outlet of the power station, and along the river at various points upstream and downstream from the power station. The measurements needed include water level, water flow, water quality / conductivity, and water temperature.

With reliable data at these points, the operator can ensure they remain within the regulatory requirements of the state or provincial authority responsible for river management. As with all river parameter measurement, a measurement method needs to be determined. Smaller and easier probes to install such as hydrostatic pressure probes are generally preferred as the terrain conditions are often challenging. Using a large stilling well is often not practical, and also may not be allowed as these structures impact the environment. Stilling wells may be affected by seasonal flood conditions.

Typically several instruments would be connected via one SDI-12 interface, as the application requires a very low power environment and the slower speed of SDI-12 is acceptable for the application. Example instruments would be the 6542D Hydrostatic Depth Probe, the 6526 Ultrasonic Doppler Flow Meter and temperature probes. The 6537 Starflow QSD SDI-12 Ultrasonic Doppler Instrument could be used to measure water depth, water velocity and conductivity / water quality.

As these installations are often in rugged mountain environments, cell phone coverage is usually not available and satellite based telemetry systems are needed. The Satellite Neon Remote Logger, either low earth orbit or equatorial earth orbit systems could



be chosen. The terrain also needs to be considered. As these installations are usually in deep valleys, the view towards the sky is less, and the high hills may block the view to the equatorial earth orbit satellite provider of your choice. If you choose a low earth orbit system (these systems transit the sky every hour or so) coverage would be available for the short period of time the low earth orbit satellite is visible from that location.

A review of the local conditions, especially the view of the sky is needed to determine the best choice. There are web based tools which provide the azimuth and elevation angles to different





(Source: Severn Wye Energy Agency)

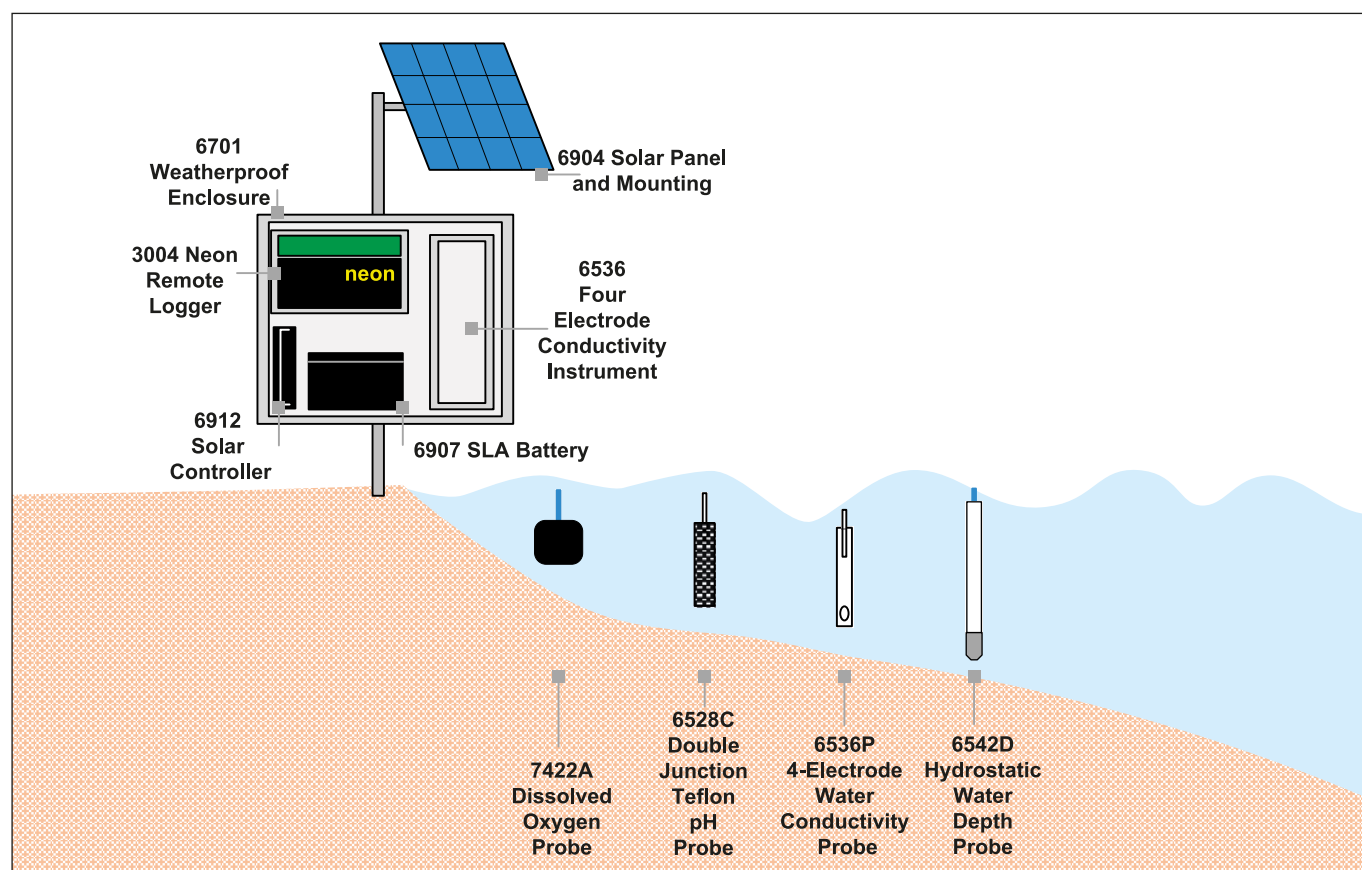
equatorial satellite providers based on the latitude and longitude of a particular location. With the azimuth and elevation angles, the site can be reviewed to determine if use of an equatorial elevation satellite provider is practical.

As these systems are remote, primary power is generally not available and solar panel and gel cell battery would be needed. Unidata engineers calculate a power budget, to determine size of the battery and solar panel needed for particular system. When calculating power budget, geographical location and number of associated sunny days during the winter time are taken into account. This is to make sure the system is operational even with an extended period of cloudy days. Also, it is common practice to only power up

the instruments when needed, for example the instruments would be powered up, perhaps one minute before the reading time, and then turned off after the reading, to conserve power.

The data collected at these measurement stations would be available to view on the Neon Server using a standard web browser, and anywhere on the web provided appropriate login credentials were set up on the Neon Server for this purpose.

Finally, we would expect for collected data to be passed on using Neon Server automatic reports, to a river monitoring / hydrographic analysis software package such as Aquarius or Hydstra for more detailed river hydrographic modeling and river gauging processes.



TYPICAL CONFIGURATION

APPLICATION SPECIFIC INSTRUMENTS / INPUTS

Options	Unidata Part Number	Description
Ultrasonic Doppler Instrument - velocity, depth & flow	6526J-21	Starflow Ultrasonic Doppler Instrument 0-2m
Ultrasonic Doppler Instrument - velocity, depth & flow	6526J-51	Starflow Ultrasonic Doppler Instrument 0-5m
Ultrasonic Doppler SDI-12 Instrument - velocity & depth	6527A	Starflow QSD Ultrasonic Doppler SDI-12 Instrument
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
Hydrostatic Water Depth Probes	6542D-A / B / C	PT12 Pressure / Temperature Sensor SDI-12 3.5m, 10m or 20m
Hydrostatic Water Depth Probes Titanium	6542D-T-A / B / C	PT12 Pressure / Temperature Sensor SDI-12 3.5m, 10m or 20m
4-20mA Pressure Transmitter	6548A-B / C	Submersible Pressure Transmitter 4-20mA 5m or 10m

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