

# Project Dossier



## PROJECT DOSSIER

# HATTA PUMPED STORAGE HYDRO POWER PLANT

### PROJECT OVERVIEW

The Hatta Pumped Storage Hydro Power Plant Project envisages creating a new upper reservoir at a distance of 1.3 km and 150 m higher than the existing lower reservoir created by the Sadd Hatta Al Awwal Dam. The project is located near the community of Hatta, 140 km southeast of Dubai in the Hajar Mountains on the northern border with the Sultanate of Oman.

The HPP is a major component to achieve the targets of Dubai's Clean Energy Strategy 2050. The plan involved constructing two roller-compacted concrete (RCC) dams with heights of 70 m and 35 m close to an old meander in the Hajar Mountains. A 1.3 km long tunnel with 7 m diameter will connect the two reservoirs. With a capacity of approximately 200 m<sup>3</sup>/s and partially lined with steel, the tunnel is a key feature of the new Hatta Pumped Storage Power Plant. The powerhouse will have 2 units capable of generating a total net power of 250 MW over the 6 hours generation cycle.

The project also includes construction of two road tunnels with a length of approximately 470 m and 440 m using blast excavation as well as the construction of the reinforced outflow and intake structures, several ancillary buildings and mechanical and electrical systems.

| Project     | Hatta Pumped Storage Hydro Power Plant |
|-------------|--|
| Location    | Dubai, UAE                             |
| Client      | Dubai Electricity and Water Authority  |
| Contractor  | EDF                                    |
| Consultants | Strabag-Ozkar_Andritz JV               |
| Duration    | Mar 2020 – till date (Jan 2022)        |



## MONITORING SOLUTION

The monitoring instrumentation has a key role in accessing the behaviour of the Permanent Civil Works during construction and operation of the dam.

Monitoring instruments are being installed in the main civil works in order to monitor their behaviour not only during construction but also for long-term monitoring after construction. The monitoring data will allow the stakeholders to continuously assess the safety of the structures being constructed.

Different types of instruments are being used in different structures of the project, to monitor variety of parameters – like reservoir water level, ground water level, pore pressure, leakage, settlement, displacement and deformation.

### Sections instrumented

- Al Awwal Dam
- Main Dam
- Saddle Dam
- Cofferdam
- R3 Backfill
- Power House Backfill
- Power House Shaft
- HP Tunnel Portal Upper Intake, Upper reservoir, Northern portal & Southern portal

## ENCARDIO-RITE'S ROLE

### Turnkey services

Encardio-rite got sub-contract for the monitoring works that includes:

- Supply of geotechnical instruments, precise survey targets
- Installation of geotechnical instruments
- Integration, programming and commissioning of data acquisition systems
- Online web-based data monitoring service (WDMS) for data presentation, evaluation & interpretation for critical parameters and areas



Saddle Dam during construction



HP Tunnel Portal Upper Intake





## INSTRUMENT USED

### Instruments

Standpipe piezometer & Casagrande piezometer

3 head piezometer

Triaxial crack meter

Inclinometer

3D in-place inclinometer with settlement system

Temperature meter and Thermocouple

Long base strain temperature meter (LBSGTM)

### Application area/ section

Al Awwal Dam, Saddle Dam, R3 backfill, Power house backfill, HP Tunnel Portal Upper Intake & Cofferdam

Main Dam, Saddle Dam, R3 backfill

Al Awwal Dam, Saddle Dam, R3 backfill, Power house backfill, HP Tunnel Portal Upper Intake

HP Tunnel Portal Upper Intake, Northern portal, Southern portal, Upper reservoir, Power House & amp; Cofferdam

R3 backfill, Power house backfill

Main dam, Saddle Dam, Main dam & amp; Full Scale trial area

Saddle dam, Main dam & amp; Full scale trial area

### Purpose

Installed to monitor ground water/seepage water conditions in the foundation of structures and in the dams as well as in the dams' abutments

Installed in boreholes in the body of dams, to monitor uplift pressures in the dam body and dam foundation. This was an innovative instrument developed for this project for very first time. The system has manometer (1st head), an opening at top with ball valve and plug (2nd head) to allow manual readings with water level sounder and a vw piezometer (3rd head) to provide readings remotely to a central server/PC.

Installed to monitor ground water/seepage water conditions in the foundation of structures and in the dams as well as in the dams' abutments

Installed to monitor lateral movement of sections

Installed in backfill to monitor lateral movement as well as settlement/heave

Installed in dam body (RCC) to monitor temperature in mass concrete.

Installed across the alignment of induced joints, at different levels, to measure strain in mass concrete (RCC) and hence monitor deformation taking place. Also, LBSGTM are installed perpendicular to the dam axis (facing upstream to downstream) to measure strain in dam body when it comes into the operational phase.



Standpipe piezometer installation



Inclinometer installation



Installation work in progress

## INSTRUMENT USED

### Instruments

Digital plumb line

### Application area/ section

Main dam, Saddle dam, Power house shaft

### Purpose

Installed to measure internal and surface displacements. Normal plumb line installed to monitor relative displacement between dam top and gallery. Inverted plumb line installed to monitor relative displacement between gallery and dam foundation.

Seepage measurement device

Main Dam, Saddle Dam

Installed at the downstream side to monitor seepage through, around or under the dam

Geodetic targets

Main dam, Saddle dam

Installed to monitor 3D displacement of dam body and portal

## DATA COLLECTION AND PRESENTATION

The cables from sensors like three headed piezometer, crack meter, digital plumb lines, strain & temperature meter, temperature meter and thermocouple are routed to the lower gallery niche area. The data from all the installed sensors is collected by our advanced dataloggers.

The monitoring data will be transmitted from datalogger to the central server via fiber optic cables. Our in-house developed **data management system DRISHTI** will be installed at the central server. It is a web based real time automated monitoring system that collects data from multiple sensors, can store data from different sources and process large amount of data to provide meaningful data for risk management at fingertips, 24 x 7, with automated alarms and warnings.

The online data will help the stake holders in precise interpretation and evaluation of field data with respect to the construction progress in the respective area. Instant alerts help the stake holders in implementing preventive/corrective actions timely where required.



Datalogger being configured



Digital inclinometer monitoring



## RESULT

Encardio-rite's World class instruments and expertise in the field is helping to monitor construction of Hatta dam project. Monitoring instruments are being used in different structures like Al Awwal Dam, Main Dam, Saddle Dam, Cofer Dam, R3 Backfill, Power House Backfill, Power House Shaft and HP Tunnel Portal Upper Intake. The monitoring solution will help to monitor the behaviour of the permanent civil works during construction and also the behaviour of structures in long-term during the operation.

Encardio-rite's monitoring solution meets the precision standards required for the project. The data collected from installed instruments is allowing the safety of structures to be continuously assessed. The monitoring results helps in reducing risks, protecting existing assets and giving confidence to the construction process and successful completion of the project. The monitoring data is made available to all stakeholders seamlessly almost in the real time, in meaningful information, with advance warnings and alerts. This is possible with a combination of rugged sensors, advanced data collection, transmission, web-based data monitoring service and last but not the least an experienced and dedicated team.

Thus, the role of instrumentation and monitoring in the project is not only limited to design optimization and construction control but also to ensure the safety and stability of work at construction site and of the existing infrastructure within zone of influence.



Construction works in progress



Strain gage (LBSGTM) installation



TUNNELS



HYDROELECTRIC



CONSTRUCTION



STRUCTURAL



METRO & RAIL



BRIDGES



MINING