Making a difference

From the small island state of Tasmania to far north Queensland and now to other countries – including the massive Indian market – Entura is sharing expertise to support a pumped storage renaissance and the global renewable energy transition. **Richard Herweynen** and **Nick West** of Entura tell us more

Above, right and below: **Kidston pumped storage hydro project under construction**

ENTURA IS CURRENTLY ENGAGED in a number of pumped storage hydro projects across Australia, South Asia and Southeast Asia. We're proud to be contributing to these projects because we know that without a huge increase in energy storage, the clean energy transition simply can't happen at the pace and scale that is so critical to limiting global warming. Modern energy grids are becoming increasingly complex, requiring storage solutions that can respond to fluctuations in energy supply and demand while also helping to regulate voltage and frequency – and pumped hydro can make a very important contribution.

Supporting new pumped hydro in Australia: Genex's Kidston pumped storage hydro project

In Australia, despite the significant potential and benefits of pumped storage hydro, only three projects are currently operational (two in New South Wales and one in Queensland) and two are under construction – the Kidston Pumped Storage Hydro Project in far north Queensland and Snowy 2.0 in New South Wales.

Genex's Kidston project will complement the owner's adjacent solar and wind projects, forming part of a renewable energy hub. This is a very significant project, being Australia's first new pumped storage hydro in decades. Entura worked on the feasibility study for this project, continued to be involved throughout early contractor involvement, engaged with various independent due diligence assessments leading to financial close, and we are now acting as Genex's Owner's Engineer.

The development comprises a 250MW pumped storage hydro at the disused Kidston Gold Mine. It is unique in using two existing mine pits as the upper and lower reservoirs. The reservoirs form a closed-loop system, which will minimise environmental impacts during operation, on what is an already disturbed former mining site.

Wises Dam, a lined rockfill dam, raises Wises pit to form the upper storage. A concrete-lined pressure tunnel connects this upper reservoir to the underground generation powerhouse. A concrete-lined tailrace tunnel in turn connects the powerhouse to the lower reservoir. A shaft from the surface connects the underground infrastructure to a surface switchyard, which connects to the 275 kV transmission network.

Construction began in 2021 and completion is expected later this year.

A project close to home – at Lake Cethana, Tasmania

Entura has also been instrumental to the development of Hydro Tasmania's own proposal for a 750MW pumped storage project at Lake Cethana in Tasmania that could provide up to 20 hours of storage capacity. This included developing a pumped hydro screening process and a pumped hydro atlas to identify high-potential sites.

A number of sites in Tasmania were evaluated, with 14 shortlisted for pre-feasibility studies and three projects then selected for detailed feasibility studies. Finally, using a risk-based multi-criteria assessment the preferred project was selected at Lake Cethana. It is planned to use the existing Lake Cethana (created by a 110m-high concrete-faced rockfill dam) and construct a new off-river upper storage (a membrane-lined reservoir with 12Mm^3 active storage) with 530m head. The proposed project includes a surface approach channel leading to an upper intake structure, a vertical shaft and high-pressure tunnel leading to an underground power station containing four reversible pump turbine units, and a low-pressure tunnel to a lower intake structure on the shore of Lake Cethana.

Two campaigns of geological investigations have since occurred on the Cethana pumped storage project, and the reference design and documentation are nearing completion. Work is now underway to progress this project to a final investment decision.

Entura's pumped storage hydro screening identifies high-potential sites across India

Our Australian pumped storage hydro screening experience provided a springboard to adapt our screening methodology for India. Screening for potential sites is a complex process and has rarely been applied at scale in India. However, in a recent engagement, Entura identified 68 high-potential sites across three Indian states. At one of these sites, a proposed 2000MW pumped storage project is now working through the early stages of development.

Through our screening process, we can identify the most promising locations for pumped storage hydropower development and optimise site selection. This approach can help minimise the environmental impact of pumped storage projects while maximising their potential for energy storage and balancing the power grid.

Tackling a major new development in Odisha, India

Entura has now been appointed by ReNew to prepare the detailed project report for a 1,500 MW pumped storage hydro project in Odisha, one of the eastern states of India. The project is one of the biggest of its kind currently proposed in the Indo-Pacific region.

Developing the detailed project report involves a wide range of crucial investigations into the project's technical and economic feasibility, including the topographical surveys, surface and subsurface geological mapping and investigations, assessment of construction materials, hydrological assessment, engineering optimisation, and risk mitigation. The report will enable the developer to make informed decisions about the future of the proposed project, which may lead to submission to authorities for approval.

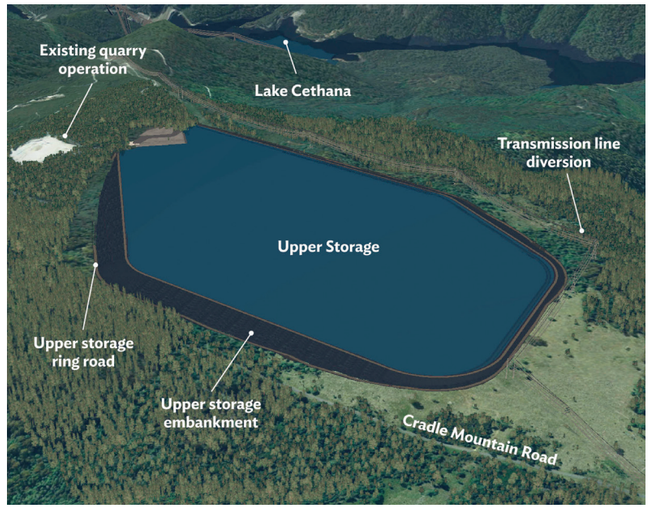
The proposed project is a closed-loop pumped hydro energy storage, which would be constructed in a mining area with good geological conditions and access to construction materials, a local labour force, and high rainfall to replenish any evaporation losses.

According to the Government of India, only about 5GW of pumped storage hydro has been developed so far out of an estimated capacity of around 181GW nationwide. The few pumped storage developments currently operating in India are old, so the resurgence of pumped storage hydro is a new concept for many developers – including for our client. This brings

Above: **Lake Cethana, Tasmania**

Below: **Investigations underway in 2024 at the site of the proposed Cethana project**

Below: **Proposed 750MW pumped storage project at Lake Cethana, Tasmania**



Above: **Pradipta Swain and Sunita Pant at Entura's booth at the 2024 ICOLD conference in India, at which Entura presented two papers on pumped storage hydro**

Above: **Entura specialists on a site visit in Odisha (L to R: Baijayanta Bhattacharjee, Vibhor Gupta, Pradipta Swain, Dipankar Dey)**

many opportunities for consultancies like ours to bring our Australian experience and skills to support the roll-out of new pumped storage hydro in India.

New opportunities for conventional hydropower

At Entura, we're excited about the resurgence in interest in pumped storage hydro as a viable and durable long-duration storage solution to firm variable renewables and provide stability to the grid. However, there's also much that conventional hydropower can provide to meet these needs if the scheme is configured to suit the changing needs of modern energy markets. At this stage, it is only hydropower with large reservoirs that can provide the multi-day or even seasonal storage that could be needed in times of sustained low output from wind and solar and to manage uncertainty in the power system, such as earlier-than-expected coal-fired power station retirements or major delays to storage projects.

In Tasmania, a staged program of upgrade works is underway to support a potential redevelopment of the 80+year-old Tarraleah hydropower scheme, adding more capacity and flexibility to enable this conventional hydropower scheme to better meet the changing needs of the electricity market.

The current construction works include excavation and construction of an approach channel, new intake excavation and concrete structure, a 950 m connecting tunnel, and a downstream portal. This infrastructure will prepare for the future replacement of two existing canals with a new pressurised water conveyance, which is proposed to replace the existing infrastructure, allowing water to be transferred more efficiently to the new higher capacity power station.

There'll surely be many opportunities around the world to consider similar approaches as older hydropower assets reach major decision points. ●

Above: **Lake King William intake under construction as part of the upgrade works underway to support a potential redevelopment of the Tarraleah hydropower scheme**

Right: **Tarraleah Power Station, Tasmania**