Asian interests

IWP&D spoke to Brian Selby of GE and Ajay Sharma of Entura to talk about their involvement in projects across Asia in recent years.

Brian Selby:

GE has personally joined GE’s hydropower businesses for about four months but the company has always been active in the Asia-Pacific region, looking back some 50 years. Since then, we have supported customers in every Asia-Pacific country ranging from small sites to river installations to the largest hydropower plant in the world (Three Gorges in China). One of our main Manufacturing Engineering Centres of Excellence (MCE) is based in Tianjin, China. It concentrates our best talents and skills and provides our customers in the region both with competitive and highly-efficient solutions. Our teams in Tianjin have already delivered over 60 projects and have over 10 projects currently under execution. The site hosts some of our latest advanced technologies, providing a lead site for GE’s Digital Welding, 3D measuring technologies, as well as state-of-the-art facilities such as our Durability Lab.

We provide a cradle-to-grave approach to our customers, helping them address the challenges that their hydropower plant assets face or exceed their performance with the highest efficiency and lowest cost. We constantly look for ways to improve our product designs, to increase efficiencies and lower operating costs through the life cycle of the dam, from design through to operation. We are always looking for design improvements, manufacturing innovation and recently embedding digital monitoring and predictive analytics into our technologies.

Ajay Sharma: Entura has worked on numerous hydropower projects in Asia. The following are the key highlights of some of the significant ones we have worked on.

- **Chapra-II in India:** This is a very special project for Entura as we have been involved with it since its inception. Entura was involved in the conceptualisation, front-end engineering, feasibility, tender, design, project management and commissioning. We provided technical expertise for the conceptual design and construction, costing, contract packaging, selecting equipment, scheduling and project management. The 200 MW hydropower station project in Chapra, Bihar, was commissioned in 2016 and is successfully operating. The project involved construction of a 169 km high head tunnel, a 4.1 km head race tunnel, two underground chamber stations, four underground pressure shafts and a surface powerhouse.

- **Nagmati dam in Nepal:** We were the lead consultant for the feasibility and detailed design for the Nagmati Dam on the Bagmati River in Nepal as part of the Bagmati River Basin Project (under funding from the Asian Development Bank). The 95 MW and 550 m long concrete faced rockfill dam stores water during the monsoons for environmental release during the dry season, improving downstream water quality, water security and amenity for the city of Kathmandu as well as increasing resilience to potential climate change impacts (such as water induced disasters) in the middle and lower reaches of the basin.

- **Baleh hydropower project, Sarawak in Malaysia:** Entura has had a successful working relationship with Sarawak Energy Berhad (SEB) over many years, supporting them by continuing to our involvement in hydropower and integrated renewables projects throughout Sarawak and beyond, including their extensive river basins. This regional approach will also continue to need capability development to support future energy generation and successful operation of existing assets, and the Entura Clean Energy and Water Institute, as well as working directly on a number of hydropower projects. We have recently been appointed to undertake the independent review of the major SEB/BIML Baleh hydropower project in Sarawak. Rather than engage a number of separate individuals for a panel, SEB selected Entura to undertake the independent review role. The project, which includes a 188 MW concrete faced rockfill dam and a large gated chute spillway, is estimated to take approximately eight years to design, construct and commission once the contracts have been awarded.

- **AkshaiKhukh hydropower project in Bhutan:** This 110 MW run-of-river hydropower project is being constructed on the Kharchu river in a right bank tributary of Mangdechhu River, in the Tongsa Dzongkhag in central region of the Royal Kingdom of Bhutan. The project includes a 386 MW concrete gravity dam with gated spillways, powerhouse to extract energy from underground powerhouse with two 59 MW Pelton turbines. Entura’s role, which began in 2015, included project execution advice to the client on all technical matters to protect the project’s interests, including quarterly project reviews during the construction period to assist with cost over runs, including design costs, schedule and lender’s risk, and assistance in commissioning.

Did you experience any specific successes or obstacles which had to be overcome?

Brian Selby: Hydropower projects are complex, multi-year construction developments that require detailed planning and execution over a wide range of technical and environmental issues, including approvals, social, environmental, resettlement, and stakeholder management, and ensuring that the project continues to build consensus among upstream developers with respect to the beneficial location and height, ever sensitive basin development plans and infrastructural development. Entura’s continuous involvement, timely advice and support during critical situations helped the project team stay on track of these challenges, and move the project forward at all times, even enabling early commencement of construction.

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Are there still plenty of opportunities for hydropower development across Asia?

Brian Selby: The most exciting development for hydropower developers in Asia is the necessity for hydropower storage as part of the answer to the rapid adoption of renewable energy into the energy industry’s portfolio mix. Intermittent renewable energy – wind, solar – does impact grid performance and reliability and hydropower storage solutions are there to solve – on a large scale when required – renewable, extremely cost-effective, highly efficient and recognizable as a mature technology.

China has for example planned to add 60GW of hydro storage by 2030 in the 13th Five Year Plan. It already has highly efficient assets such as the Jinping power plant designed to complement wind farm production while providing the grid with power for peak demand, supplemental power for periods of reduced production, and energy storage for emergency power standby and frequency regulation. GE Renewable Energy designs this pump turbine and motor generators of Hydrofit.

Ajay Sharma: All over Asia, it is recognized that electricity is a vital tool to improve the quality of life and alleviate poverty for growing populations as well as to build developing economies. Nation’s across Asia are also setting more ambitious clean energy targets in line with global movements. So that means there’s a huge expectation of renewables, whether in the form of hydropower or wind or solar or in combinations of renewables and storage.

Wherever wind and solar are coming (such as in India), hydropower still has a huge role in providing the necessary storage to firm weather-dependent renewables and support grids as they integrate increasing levels of intermittent renewables technologies. Pumped storage hydro power may be particularly useful in this context.

This is a global shift in the way hydropower has been viewed. Whereas hydropower was traditionally viewed as a stand-alone, established renewable technology providing both baseload and peaking capacity, now we’re seeing a much greater sense of integration with other renewable technologies as part of broader clean energy systems.

Another worldwide trend is the ongoing shift towards development of small to medium hydro power systems in areas where many of the larger opportunities have already been exploited. For example, in China, many of the large hydro schemes (10,000MW+ plants) have already been identified or developed, so new hydro developments are more likely to fall within the small to medium range, with the added benefit of lower construction and implementation times.

With favourable topography and water availability, high generation of load and growing new demand in small sparsely populated areas, hydropower can be a vital tool in sustainable development. A number of small to medium hydro schemes exist in Asia. So long as incentives are in place, these opportunities are immense.

In your experience are there specific barriers, such as politics, financing, climate and culture, which hinder such development in this region?

Ajay Sharma: Hydropower developments in Asia, like all power developments anywhere in the world, involve challenges: land acquisition, resettlement, environmental issues, rehabilitation, geology, technical challenges in dam and scheme design and construction, financing, approvals and so on. Those challenges can be considerable, but can also be overcome with the right expertise on hand.

- **Funding and envisaged building:** We’ve learned that viable opportunities, enthusiasm, government incentives and subsidies and policy certainty are important factors to the success of new developments, but another critical factor is reliable expertise, which may be less available to proponents of hydropower projects if they are new to the hydropower sector, although there is an opportunity for international consultants particularly in the area of training and capacity building. Existing utilities around the world are increasingly recognising the need to invest in the development of their own people as well as their systems and processes to help ensure the implementation of sound business strategies, including local expertise and skills for...
Spotlight

Above: Nagmati Dam in Kathmandu – Entura overcame a range of challenges to deliver a successful outcome

Entura Clean Energy and Water Institute collaborates with the Asian Water Institute and Universiti Tenaga Nasional in Kuala Lumpur. The Entura Clean Energy and Water Institute has been providing training across Asia for the last ten years, including extensive hydropower and dam safety training programs in India, Bhutan, Bangladesh, Malaysia, Laos, Cambodia and more. The Entura Clean Energy and Water Institute collaborates with the Asian Institute of Technology in Bangkok and Universit Tenaga Nasional in Kuala Lumpur.

Sustainable, basin-wide development planning: Another challenge we’ve noted in Asia, though this is not unique to the region, is the need for comprehensive and systematic basin-wide approaches to development. Project-by-project approaches rarely fully consider power-system-wide implications of new projects on generation capacity or water quality, the potential cumulative effect or increase in severity of social or environmental impacts, or long-term planning concerns at the basin level such as climate change and changed hydrological patterns. River-basin-wide planning, instituted and supported at the national level, can optimise economic, engineering, environmental and social outcomes. In India, we’ve carried out basin-wide optimisation studies in Uttarakhand, Himachal Pradesh and Meghalaya. Entura has also supported the sustainable development of the Mekong region through sustainability assessment and participation in regional forums.

Dam safety, flood management and emergency planning: The need for ongoing attention to dam safety, flood management and emergency planning are by no means unique to Asia; however, the 2018 failure of the Xepian Xe Namnoy dam in Laos and floods experienced in Kerala, India have focused attention on strengthening dam safety, flood management and emergency planning in these nations. We are actively participating in dam safety initiatives for the Central Water Commission in India, and we were involved in drafting a set of new dam safety guidelines for Laos in 2018. These related to aspects such as geology and geotechnical investigations; quality during construction and commissioning; ongoing safety surveillance; management and governance; training of personnel, and how to prepare and implement an Emergency Action Plan to deal with disasters.

IWP56DC: Have you learned any lessons from hydro development in other areas of the world which can be applied in Asia?

BRIAN SELBY: Hydropower is an equal and complementary partner in the renewable generation space. It provides long-term, affordable power either from a large generation plant or more frequently as a distributed, smaller output operation. It is a technology platform that blends easily into a comprehensive energy generation portfolio mix and hosts incremental generation opportunities - floating solar for example - that is cost effective and responsive to the needs of a region.

Incorporating digital into the running of hydropower plants is creating new opportunities for higher efficiencies and lower operating costs for customers. Harnessing the power of the data created every second by a hydropower plant - detecting, analysing and predicting - provides huge opportunities for even better performance and outcomes for our customers.

AJAY SHARMA: Our extensive asset-owner expertise in hydropower development, operation and maintenance, gained through our long-term involvement with Tasmania’s hydropower system, forms the foundation of the expertise and insight we bring to our international consulting work. We’ve identified six key considerations for successful hydropower development – and these principles are just as relevant wherever the development occurs.

1. What is the resource, and how might it change? It is essential to properly investigate the long-term history and variability of an area’s water resource, and to factor in the potential for changing climate impacts.

2. How stable is the proposed location? Thorough, specialised investigation of the proposed site’s topology, geology and seismic risk is crucial, and can greatly impact cost, financing and viability.

3. How much power do you need now and will that change in future? It is important to consider industrial demand, as well as the rate of population increase and the increasing demand for power due to changing technology and lifestyle expectations.

4. Can you get the power to where it is needed? A key consideration for a successful hydropower development is the ability to deliver the power to where it is needed through existing, upgraded or new transmission and distribution infrastructure.

5. What social and environmental impacts are possible? From the earliest thoughts and discussions about a new hydropower development, it is critical to consider the project’s stakeholders, community and environment.

6. Can you obtain finance? No hydropower project will succeed without available, secure project financing, and lenders around the world are increasingly cautious and will require evidence of best-practice and sustainability to release project funds. Using a framework such as the Hydropower Sustainability Assessment Protocol offers investors greater confidence that their investment is safe and that risks have been fully considered.