It’s a waterworld after all: Hydropower industry set to take over the Asian market

With China firmly in lead, the development of hydropower in Asia is set to accelerate.

When the Chinese government announced the construction of the Baihetan Dam hydropower plant complex in Sichuan and Yunnan provinces, many believed that this firmly enshrined China’s status as a global superpower, not just in terms of the economy, but in the hydropower industry as well. Baihetan Dam, after all, is no ordinary hydropower plant. Upon its forecasted completion in 2019, the Baihetan Dam, sitting on the banks of the mighty Jinsha River, is expected to generate a whopping 13,050 megawatts (MW) of electricity, easily making it the world’s largest hydropower plant in terms of output, according to the World Energy Resources 2015 Hydropower Status report.

“As in years past, China dominated the market for new development and total installed capacity,” the International Hydropower Association (IHA) said in its 2015 Key Trends in Hydropower report last May.

The Baihetan Dam is but one example of China’s emerging clout in Asia’s hydropower industry. In the last decade, China’s influence in the hydropower sphere has vastly expanded in step with the industry’s growth in the region. “The Asia Pacific region really punches above its weight in the hydropower stakes, comprising around 32% of the total global hydropower generation,” says Matt Rennie, global energy reform and unbundling leader at EY.

Hydropower’s prominence, Rennie says, comes “as governments are clearly weighing the pressures of upwards movements in electricity demand as they develop, with their stated intentions to diversify into low-carbon sources of electricity.”

The last 10 years have proved to be a growth period for this renewable energy source. Catalysts for hydropower’s prominence worldwide include a “general increase in demand not just for electricity, but also for particular qualities such as reliable, local, clean and affordable power,” the IHA said.

“Since 2004, hydropower development has seen resurgence, particularly in emerging markets and less developed countries,” said Marie-José Nadeau, chairperson of the World Energy Council, in the latter’s report entitled World Energy Resources: Charting the Upsurge in Hydropower Development 2015.

Ashok Bhargava, director, energy division, East Asia department at the Asian Development Bank, argues that “today, hydropower provides more electricity in the region than all other renewable energy [forms] combined, a reality that is unlikely to change in next 10 to 15 years. So, we expect hydropower to play a dominant role in the regional renewable energy mix.”

Worldwide, there exists several opportunities for hydropower development Nadeau declares, and “although there is no clear consensus, estimates indicate approximately 10,000 terawatt-hours per year of remaining hydropower potential worldwide.”

Hydropower: a potent energy source for Asia

Hydropower brings a wide range of benefits to the Asian electricity market, a diverse region whose demand for power mirrors its economic growth potential. Nadeau notes that “significant new development is concentrated in the markets of Asia, Latin America and Africa, where hydropower offers an opportunity to bring much needed electricity supply to underserved populations and a growing industrial base, while at the same time providing a range of complementary benefits associated with multi-purpose projects.”

In addition, hydropower also complements other forms of renewable energy in the market by providing enough capacity to offset any load deficits. “As other renewable energy such as wind and solar grows rapidly in the region, there will be more demand for hydropower to enable integration of intermittent electricity generation produced from solar and wind in the system,”
Bhargava claims. Sawin agrees, adding “complementing existing hydro-dependent energy systems with non-hydro systems is one approach to reducing vulnerabilities.”

Meanwhile, another industry group believes that despite the already strong presence of hydropower worldwide, growth in the region is still certain in the next few years. “Looking forward, there remains significant undeveloped potential across all world regions, particularly in Asia, Africa and Latin America. Demand for electricity and other related reservoir services is also high in these areas, forming a strong foundation for continued growth in hydropower. In 2014, hydropower development continued its strong growth trend, with an estimated 39 gigawatts (GW) of pure hydropower capacity put into operation—bringing the world’s total installed capacity to 1,055 GW,” IHA said.

In the next 15 years, the combined percentage of hydropower generation relative to total power generation is expected to surge to 96% from 80% in countries such as Cambodia, Laos and Myanmar, claims Rennie—reflecting the huge, sustained demand for hydropower.

**China: a prime mover in hydropower**

It is within this attractive climate that China finds itself thriving, flexing its muscle and adding significantly to the region’s—and the world’s—growing hydropower portfolio. For instance, China accounted for a sizable chunk of the world’s total installed hydropower capacity last year, adding 21.85 GW of new capacity within its borders,” IHA said. Without question, China leads in hydropower capacity worldwide, assuming global frontrunner status by double-digits. “In recent years China has taken centre stage for hydropower capacity, accounting for 26% of global installed capacity as of 2013, far ahead of Brazil (8.6%), USA (7.8%) and Canada (7.6%). China has strengthened its dominant position by adding 29 GW in 2013, well over three times the new capacity of the next five countries combined,” Nadeau reveals.

With its place on top of the hydropower food chain secured, it is unlikely China will find itself backpedaling on hydropower anytime soon, with the country’s total capacity of pure hydropower and pumped storage forecast to hit 350 GW and 70 GW, respectively, in five years, Nadeau says.

“China is expected to maintain its lead in 2015 as well, with new developments completed at Xiluodu (13.9 GW), Xiangjiaba (6.4 GW), and Nuozhadu (5.9 GW),” Nadeau adds. These three plants, which form a chunk of China’s sizable $15.6 billion investment in hydropower infrastructure, are significant for their sheer size and output—concrete testaments to China’s seriousness and drive in hydropower development.

“The Xiluodu plant (13.86 GW), which started operations with two-thirds of its full capacity in 2013, was completed in 2014, becoming the third largest hydropower plant in the world after China’s Three Gorges and Brazil’s Itaipu,” according to Janet Sawin of Sunna Research, and lead author of the Renewables 2015 Global Status Report of the Renewable Energy Policy Network for the 21st Century. The Xiangjiaba plant, which houses the world’s highest capacity hydro units, is China’s third-largest hydropower plant, while the Nuozhadu plant became the fourth-largest with the latter’s final generating units coming online in April last June.

Beyond its expansive borders, China is also playing a key role in the development of Asia’s hydropower industry by extending infrastructure assistance to regional neighbors. “Chinese companies are also playing leading roles in developing hydropower beyond China’s own borders; in Laos, Cambodia, Myanmar and other Asian countries, as well as increasing their presence in Africa and Latin America,” Nadeau adds.

**Spending for and working in hydropower**

In addition to being a leader in hydropower plant construction, China is also making inroads in other crucial facets of hydropower development, namely in financing and employment. Hydropower plants, like any other infrastructure-related undertaking, require significant amount of capital to even get off the ground. Funding is sometimes hard to get.

“Hydropower projects are enormously capital intensive and involve very significant social and environmental considerations to be overcome. This combination of very large upfront capital costs, political risk, environmental and social issues provide governments and financiers with considerable uncertainty and risk to work through in the various stages of project development,” Rennie says.

In this case, China-based Asian Infrastructure Investment Bank (AIIB) emerges as a key financial institution that seeks to provide fresh funding for such projects. Despite being a relative newcomer to the region’s banking industry, the multilateral lender “has signaled its intent to include hydropower in its investment portfolio,” the IHA said. The AIIB, which describes itself on its website as a “modern, knowledge-based institution,” includes energy and power as one of the sectors it aims to develop in Asia.

Meanwhile, a first-ever global estimate by the International Renewable Energy Agency earlier this year revealed the presence of about 1.5 million direct jobs in hydropower, mostly in Asian countries such as China and India. “Most jobs are found in construction and manufacturing, followed by operations and maintenance,” Sawin said.

Once again, China ranks first in the world in this area: “China has firmed up its position as the leading renewable energy employer, with 3.4 million jobs. It has a commanding position in solar PV, solar water heating, wind power, small hydro and biogas.” As Asia’s hydropower market matures in the next few years, power companies are also expected to take on additional risks and expand the output of the plants they build, both in terms of scale and output. Easier access to financing, coupled with an attractive investment climate should usher in larger-scale projects...
in the near future. “Moving ahead, many mega hydropower projects in Asia also will have to be viewed and formulated with a regional perspective for investments to flow,” Bhargava says.

Rennie concurs. “We see a strong appetite for investors to take stakes in generation projects over 1,000 MW, provided that long term sovereign-backed PPAs can be put in place, or the financing risks otherwise dealt with,” he says.

Meanwhile, far from being a static and monolithic sector, the hydropower industry in Asia continues to innovate, with power companies moving toward the development of flexible, efficient, and reliable facilities, according to Sawin. For example, brisk demand for greater efficiency coupled with narrower generating costs “has contributed to the development of very large machines to achieve high operating efficiencies,” Sawin notes, citing the two 800MW units installed at China’s Xiangjiaba plant.

**Private sector support**

Aside from the strong involvement of governments in the development of hydropower projects, the private sector is also expected to seize key opportunities and jumpstart their own developments as well. “Previously, projects used to be developed through public sector or government-backed financing. With the renewed emphasis across Asia on renewable and clean energy, private sector investments have become more prevalent,” Bhargava observes.

Bhargava notes that ADB, for one, has provided nearly $2 billion in investments from 2009 to 2013 for hydropower development, over a third of which was channeled through private sector operations. This is clear proof of the private sector’s willingness to invest heavily in hydropower development in the region, especially among “developing countries which face funding shortfalls in financing and developing these projects, and limited infrastructure, which provides further challenges for both the private and public sectors.” He adds that this is a welcome trend and should continue further as the need for clean and renewable energy gains more momentum, and the regulatory framework further improves throughout Asia, providing much needed impetus for private investments. “Moving ahead, many mega hydropower projects in Asia will also have to be viewed and formulated with a regional perspective for investments to flow.”

IHA has noted a similar trend in the Indian subcontinent. “We have long been aware of an increasing role for the private sector in hydropower, and the evidence continues to mount in support of this trend,” the IHA said, citing some 19 Gw of hydro projects taking place in Bhutan, India, and Nepal that are being supported by private financing.

Many of these projects are being realised under the independent power producer model, and based on long-term power-purchase agreements. In the case of Bhutan and Nepal, these include cross-border trade with India. Within India, a few developers are currently considering the business model of operating as merchant plants, depending on confidence in market price projections,” IHA said.

**Hydropower adapts to climate change**

Little by little, Asia’s hydropower industry is also adapting to mitigate the impact of hydropower plants on the environment in the face of increasing concern over climate change. “The topic of sustainability remains prominent in the context of hydropower development,” Savin notes, adding that in general, there is increased research into “associated vulnerabilities” and the incorporation of climate change resilience into project design and operations. The Hydropower Sustainability Assessment Protocol, launched in 2011, is one such initiative, being recognized last year by the World Bank as a useful gauge in developing sustainable hydropower projects alongside its own policies and safeguards.

However, due to the overall emphasis on climate change, a number of hydropower plants in Asia—both planned and existing—have been subjected to closer scrutiny by their respective stakeholders. Earlier this year, for example, the United States government blocked the World Bank’s funding of the 108-MW Gulpur hydropower plant in Pakistan “on grounds of inaccurate and inadequate environmental risk assessment”, while in Vietnam, “allegations of illegal land acquisitions and mismanagement prompted authorities to consider revoking licenses,” Savin noted. In Turkey, the potential flooding of ancient archeological sites affected the operation of the 1.2GW Ilisu dam on the Tigris River, while in India, the 2GW Lower Subansiri project was further postponed on the back of local opposition there.

“On the issue of vulnerabilities, financial institutions are seeking more assurances of hydropower’s climate resilience before lending, highlighting the need for more robust analysis at the company and individual station level,” IHA said.

Bhargava acknowledges the hurdles when hydropower projects seek to meet sustainability standards. “Well-formulated hydropower projects have significant development impacts. But, environmental and social challenges go hand in hand with meeting development needs. In order for projects to develop on time and sustain operation, there needs to be good buy-in from local communities and support from downstream users of water,” he says. Moving forward, how will these affect the development of future hydropower projects? For one, hydropower plant developers are bound to be keener when it comes to demonstrating the climate resilience of their projects during the earlier development stages in order to meet financial and regulatory approval, Nadeau argues. “This may include provision of improved data analysis on climate change impacts, increased flexibility in project design to accommodate uncertainty, increased storage volumes, and revised operational regimes,” Nadeau adds.

In fact, hydropower plants may also serve a key role in addressing certain challenges brought about by climate change. “As a renewable energy, hydropower can serve as a tool for climate mitigation, where it is an accepted offset for fossil fuel technologies under UNFCCC (United Nations Framework Convention on Climate Change) methodologies,” Nadeau says.

Because it harnesses the power of water in providing electricity, hydropower plants may also protect against floods and drought. “In addition to providing a carbon offset when developed in place of fossil fuel technology, we see a greater recognition of hydropower’s ability to provide flood protection and mitigate drought impacts in the face of increasing extreme hydrological events,” the IHA said.