

Nam Che 1 power station in Laos commenced regular operation in June 2019. The Austrian hydropower allrounders at GLOBAL HYDRO Energy provided the entire electromechanical and control infrastructure for the power plant.



AUSTRIAN EXPERTISE CHOSEN FOR NAM CHE 1 POWER STATION IN LAOS

Completion of the Nam Che 1 hydropower station in Laos in 2019 marked another success for the Austrian hydroelectric all-rounders – GLOBAL Hydro Energy – adding a further satisfied client to their south-east Asian customer reference list. The power station was designed to serve as a water diversion plant, and implementation was extremely work-intensive as regards construction. This demanded the erection of a 23-m concrete dam across a 50-m span of the eponymous Nam Che River. As the main project contractor, GLOBAL Hydro was responsible for the provision and installation of a comprehensive turnkey package of electromechanical and control infrastructure – the centrepieces of which were two high-performance Francis spiral turbines. Working at maximum capacity the turbines guarantee a power output total of over 16.8 MW. All the electricity produced is fed into the public mains grid along an above-ground power conduit approximately 15 km in length.

Laos has a population of around seven million inhabitants and hydroelectric power production is one of the country's key industries. Approximately two thirds of the energy generated by hydroelectric plants are exported to neighbouring countries. According to a report in the state-run Vientiane Times, at the end of 2018 there were 51 large-scale power plants in total spread across the country, producing around 7000 MW. There were also an additional 112 projects with an overall output of over 8,600 MW in the project planning phase. The vast majority of Laos's large-scale hydroelectric plants are situated along several hundred kilometres of the Mekong River, which forms a natural border with Myanmar and Thailand. Furthermore, numerous rivers in the country's interior ensure optimal conditions for the generation of power from renewable re-





Immense effort and financial outlay was required for the construction of a 23-m Nam Che wall to dam water across a width of 50m.

sources. Increased exploitation of the potential for hydroelectric energy production in Laos also provides attractive investment opportunities for foreign businesses. B. Grimm is a corporate group based in Thailand and is active in the fields of health, energy, construction, industry, real estate, e-commerce, traffic and transportation. The Nam Che 1 power plant, completed in 2019, was their second successful hydropower project in Laos

FOLLOW-ON CONTRACT FOR GLOBAL HYDRO ENERGY

Having gone operational with the ‘Xenamnoy 2 – Xekatom 1’ plant in southern Laos in 2017, the following year B. Grimm went online with the country’s centrally-located hydropower plant Nam Che 1. As with the first station, the corporate group placed its trust in the expertise of the immensely experienced, internationally active Austrian hydropower specialists at GLOBAL Hydro. The Upper Austrian company

again came out on top after the public call for bids, and was selected to deliver a comprehensive package of electromechanical and control infrastructure. Nam Che 1 Hydropower Co. Ltd was established for legal purposes and is owned by B. Grimm Power (Lao) Co. Ltd. and the Laos-based Daosavanh Co. Ltd. planning office. After a project planning phase lasting several years, implementation of the construction plans commenced in Xaisomboun Province at the beginning of 2017.

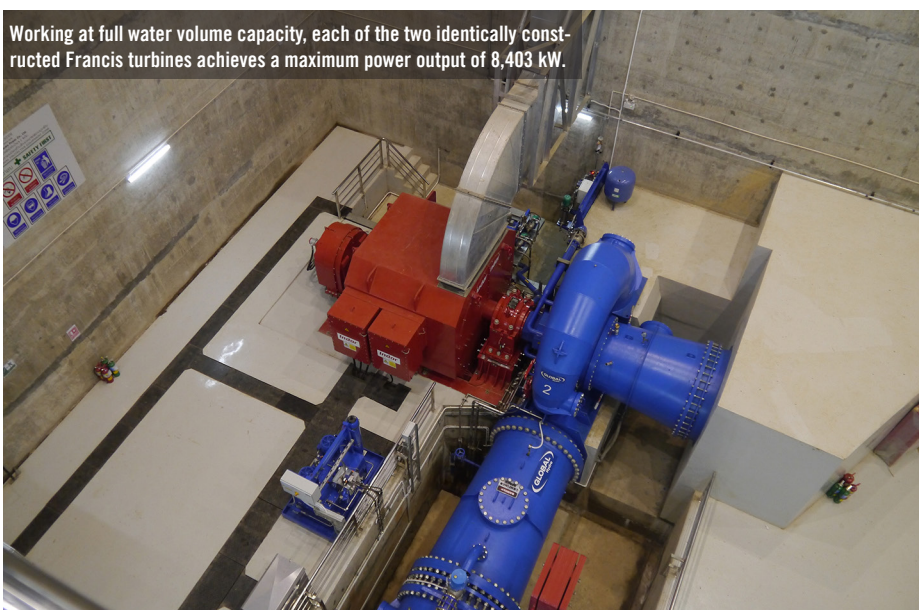
HYDROPOWER PLANT REQUIRES INTENSIVE CONSTRUCTION ACTIVITY

GLOBAL Hydro’s Project Manager, Thomas Kuffner, points out that building the power station was an immense engineering achievement: “The plant was designed as a water diversion set-up to bring in feed water to the machine room turbines via an enclosed concrete channel. A dam wall, 23m high and 50m across, was built to store the water and ensure

the available water volume capacity of the dam guarantees smooth and uninterrupted hydro-power plant operation.” The structure of the dam incorporates an overflow edge and two hydraulically operated weir gates. Sediment in the water settles out in the chamber ahead of the high-pressure channel when flow velocity is reduced, negating the need to install a desander. The majority of the (+/-) 300-m power descent stage is encased in an underground concrete conduit, and the water only emerges into an above-ground steel channel just before it reaches the machine room. The contract was signed in February 2017, after which GLOBAL Hydro immediately commenced engineering work on the hydromechanical infrastructure. Although each of the two identical Francis spiral turbines with an intake capacity of 12 m³/s were standard scope-of-delivery items for GLOBAL Hydro, the dimensions of the turbines necessitated a special transport solution. The diameters of the two DN1800 turbine intakes made it impossible to transport them in conventional containers. Consequently, the machinery had to be conveyed by flat-rack containers – open at the sides and above. Furthermore, another detail had to be taken into account when transporting the technical infrastructure: In order to comply with the conditions of the insurance policies covering transportation of the turbines, and the generators supplied by the Spanish manufacturers Indar, it was necessary to send each of the turbines separately.

MACHINES UNDERGO A TWO-MONTH JOURNEY

Subsequent to the pressure tests carried out in the presence of customer representatives, and the trial assembly carried out by site staff, the first turbine and pre-mounted distributor blades were dispatched in November 2017. The



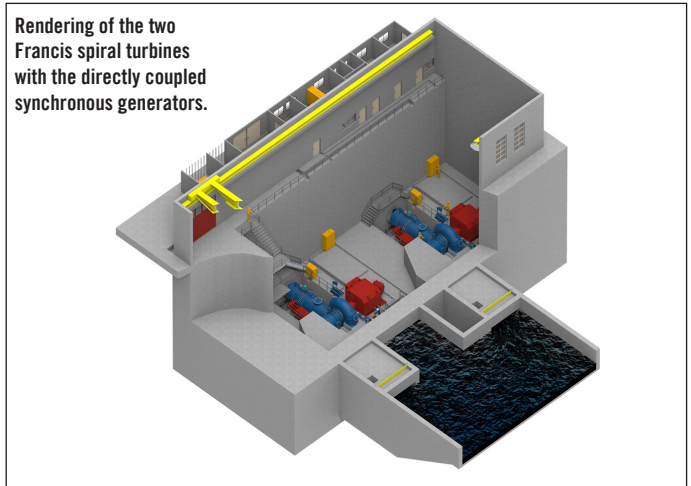
Working at full water volume capacity, each of the two identically constructed Francis turbines achieves a maximum power output of 8,403 kW.

Technical Data

- Flow rate: 24 m³/s
- Gross head: 80 m
- Gross head: 76 m
- Turbines: 2 x Francis spiral
- Nominal speed: 2 x 500 rpm
- Runner ϕ : 2 x 1,287 mm
- Output: 2 x 8,403 kW
- Manufacturer: GLOBAL Hydro Energy
- Generator: 2 x Synchronous
- Nominal speed: 2 x 500 rpm
- Output: 2 x 10,000 kVA
- Manufacturer: Indar Electric S.L.
- Total annual average capacity : ca. 64 GWh



GLOBAL Hydro Project Manager Thomas Kuffner in the middle of a group of customer representatives during commissioning procedures in Upper Austria.



Rendering of the two Francis spiral turbines with the directly coupled synchronous generators.

consignment was first loaded onto an HGV at the manufacturing plant in Upper Austria bound for the Port of Hamburg, from where it was loaded onto a ship headed across the ocean to the Thai port of Laem Chabang. The remainder of the route to the Laos site for each of the 16-ton turbine loads was completed by road, each of the deliveries taking a total of two months. Delays completing the concrete sections of the dam's water intake channelling, and at the machine room, meant the turbines had to be kept in intermediate storage until they could be built into the plant. Ultimately, installation of the turbines in the machine room commenced mid-May 2018 and the assembly of the mechanical and electrical infrastructure was completed by local subcontractors under the supervision and direction of GLOBAL Hydro's own supervisors.

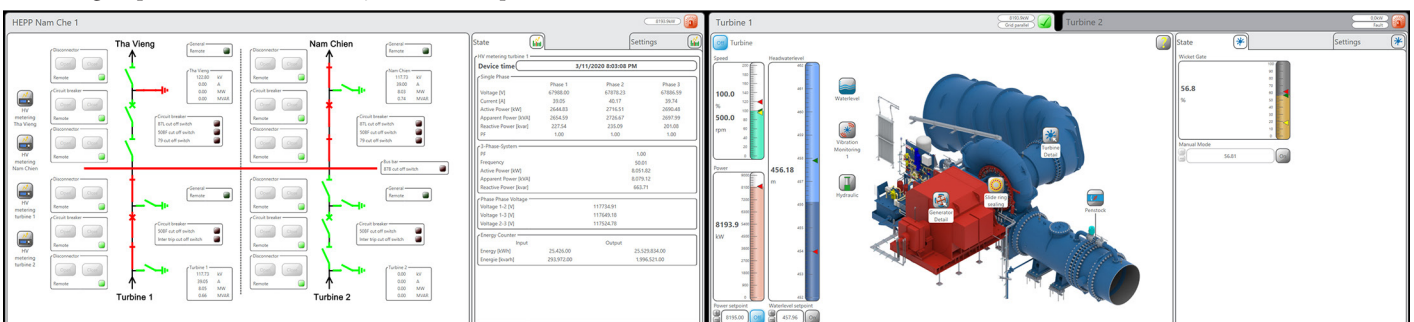
TURNKEY EQUIPMENT – MADE IN AUSTRIA

The high-pressure steel channel emerges above ground on the final section of its journey to the machine room. A Y-pipe was installed to split off the pressurised feed water and distribute it to the two turbines ahead of the building. Apart from the high-voltage switchgear, which was provided by the end customer, the entire hydroelectric, control and data delivery equipment for the machine room was provided by GLOBAL Hydro. In addition to the machine groups, each involved two hydraulic

engines, two lubricating units, two fresh-water drive units for the mechanical seals of the turbines, two DN1800 butterfly valves, the medium-voltage switchgear system, a diesel-powered emergency generator and two transformers. The 76-m gross head allows each of the two horizontal-axis Francis turbines to pump through a volume of up to 12 m³/s. Each machine rotates at precisely 500 rpm and, working at maximum capacity, can generate a constant peak power output of 8,403 kW. The air-cooled synchronous generators are directly coupled horizontally with the turbine shafts and set up to ensure a nominal capacity of 10,000 kVA. The power generated is then conducted at a voltage of 13,200 V from the generator terminals to a medium-voltage switchgear, then to transformers and straight on to the (+/-) 15 km energy conduit via the high-voltage switchgear. GLOBAL Hydro developed the HEROS in-house for station automation purposes – an intelligent turbine and plant control system linked up with visualisation infrastructure and a SCADA system. “Although control functionality can be remotely regulated and monitored reliably around the clock via a secure online connection, the power plant is always physically manned – as is common practise in Asian countries”, states Project Manager Kuffner, adding that GLOBAL Hydro's HEROS solution is continually being developed and optimised.

PLANT NOW IN OPERATION FOR ALMOST ONE YEAR

Construction site delays necessitated a two-stage commissioning process. Pre-commissioning involved a comprehensive range of dry runs in January of year prior to launch, and the ultimate commissioning procedures were completed around three months later. The hydropower went into regular operation in June 2019 and the official opening ceremony was attended by numerous illustrious invited guests the following November. In his public address, Khammany Inthirath, the Laos Energy Minister, noted that the operational launch of the Nam Che 1 power plant marked a significant and ecologically responsible step towards the continued economic development of Xaisomboun Province. About one year after completion, GLOBAL Hydro's Project Manager Mr. Kuffner issued a positive summary: “As opposed to small hydropower projects, the sheer size of the structure, a power output of almost 17 MW, the immense challenges, and the significantly greater investment of labour, materials and money mean this plant can definitely be categorised as a medium-sized hydro project. Excellent communication with customer representatives and the high quality of workmanship provided by the various subcontractors on site enabled all plans to be implemented to perfection from start to finish.”



Visualisation of the HEROS control solution developed by GLOBAL Hydro to enable fully automated regulation of electricity production at the power plant.