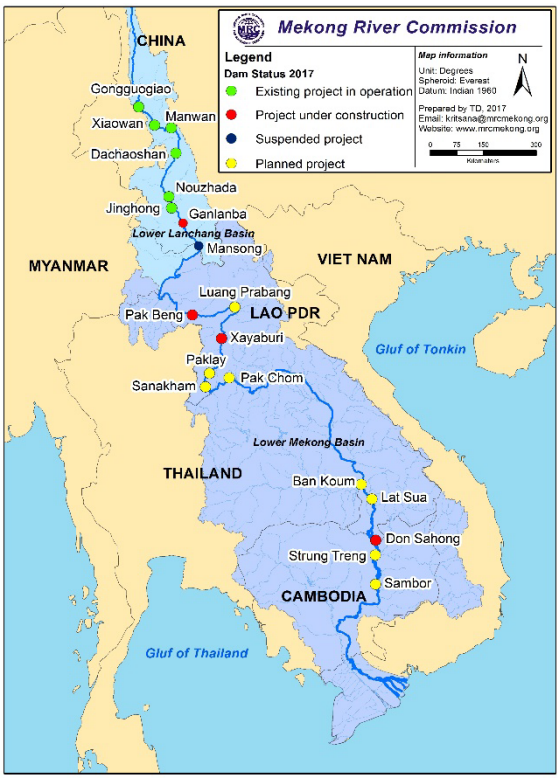
Fast Facts
about the Pak Lay Hydropower Project

**Information presented in this document is extracted from the project documents submitted by Lao PDR, except where stated otherwise.*

Location

The Pak Lay Hydropower Project (PLHPP) is the fourth hydropower project (from upstream to downstream) of the 11 hydropower projects planned for the mainstream of the lower Mekong River. Located in the Pak Lay district of Xayaburi province in north-western Lao PDR, the dam sits downstream of the Xayaburi hydropower station, which is under construction. It is about 1,829 km from the sea and 241 km upstream of Vientiane.



Run-of-river project

The project developer has indicated that the PLHPP is designed and operated as a run-of-river dam. It will operate continuously year-round, with a total storage capacity of 890 million cubic metres (m^3), at a normal water level of 240 metres above sea-level (masl).

Power generation

The PLHPP has an installed capacity of 770 megawatts (MW) of electricity, with 14 turbines or generators, each producing 55 MW. The annual average energy production pis 4,124.80 gigawatt per hour (GWh) and the annual operation of 5,357 hours. The project is intended for power generation for export and local consumption, but it is hoped to improve navigation and tourism.

Infrastructure and design

The complex structures of the project consist of water-retaining structures, water-release structures, a powerhouse, a navigation ship lock and a fish passage structure.

The **water-retaining structures** are the non-overflow gravity section on the right bank and the powerhouse section towards the left bank. They include an overflow section, a sediment-flushing section, a powerhouse section, a navigation lock section, and non-overflow sections. The dam crest elevation is 245 masl, the maximum dam height is about 51 m, and the dam crest length is 942.75 m.

The **water-release structures** consist of the high- and low-level flood gates, the sediment-flushing bottom outlets, the fish pass, and the navigation lock.

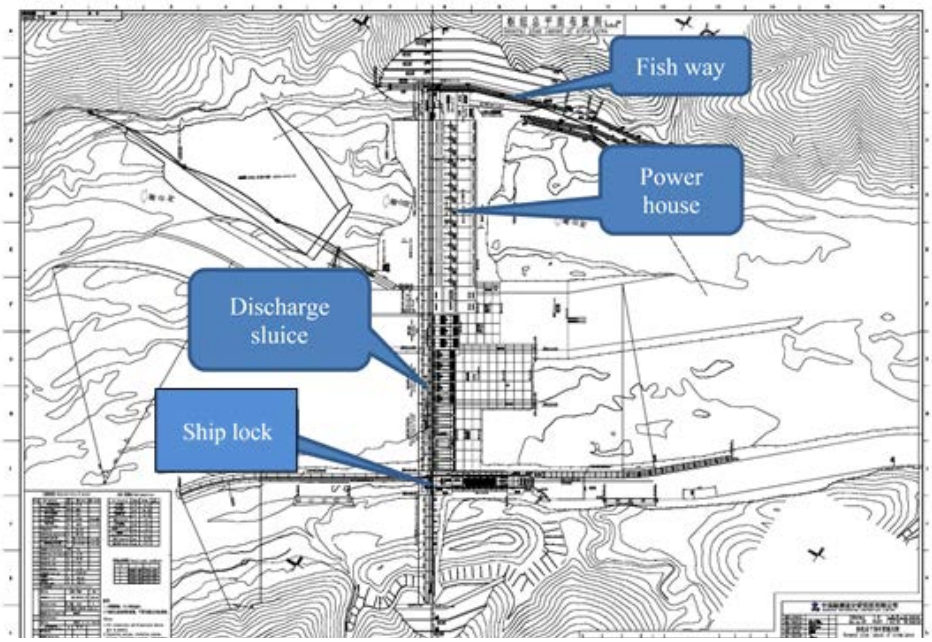
There are 11 high-level **flood gates**, located adjacent to the navigation lock, each 16 m wide × 20 m high. The three low-level flood gates, located to the left of the high-level flood gates, are 16 m wide × 28 m high.

The **sediment-flushing bottom outlets** are located between the flood gates and the powerhouse with two gates of 10 m wide × 10 m high and invert elevation of 201.02 masl. Together, all the outlets have a length of 85 m along the water flow direction and a bottom elevation of 205 m.

The **powerhouse**, containing 14 bulb turbines, is on the left side of the main river channel, with a design discharge of 6,101 m3/s. The main powerhouse comprises a generator hall and erection bay, with the dimensions of 400 m long × 22.50 m wide × 52.44 m high and unit spacing of 21.50 m. An auxiliary powerhouse is arranged downstream of the generator hall.

The **navigation structure** is a one-way one-step ship lock for 500-tonnes (t) ships, and a space for upgrading the ship lock into a double-way lock is reserved. The maximum working head of the navigation lock is 21 m, and the size of the lock chamber is 120 m long × 12 m wide × 4 m deep. The one-line way and a one-step lock is being designed, with a potential to expand this with a parallel lock. The passing time of a ship is guaranteed not to exceed 30 minutes (28.38 min). The access channel can generally accommodate two standard vessels of 500 t.

The **fish passage structure** includes the fishway, a water-charging system, and a large resting pool. A bilateral vertical slot **fishway** is arranged along the left bank slope of the powerhouse, with a net width of 6 m, a depth of 2.50 m, and a total length of 1,017 m.



Main components and infrastructure of the PLHPP.

The **water-charging system** is arranged along the right side of the fishway, with two outlets set downstream of the system. During operations, different fish attraction flow types could therefore be used, according to the species migrating at different times.

A large **resting pond** is arranged in the middle section of the fishway. The resting pool is about 56 m long, 23 m wide, and 3~4.5 m deep. The natural ecological slope will be replicated in the pond bank slope. Fishes can rest and prey in the resting pool to complete the migration. In addition to the large resting pool, a horizontal section, of about 10 m of length, is provided for the fishway every 50 m or so.

Dam safety

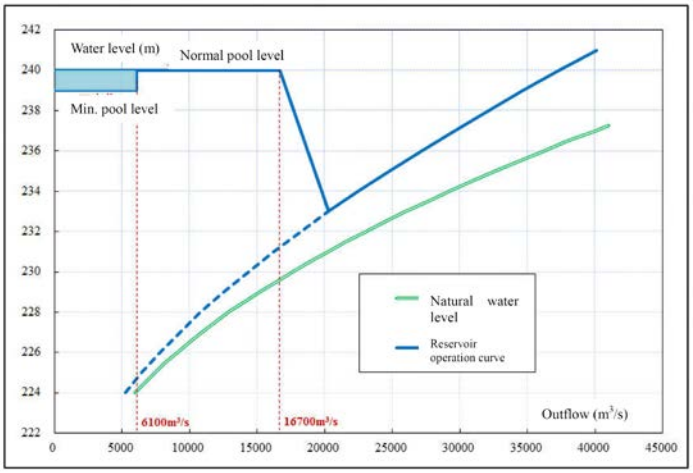
The structures have been designed to withstand extreme seismic and flood events. The adopted design parameters for the seismic standard are based on a 475-year return period with peak acceleration of 0.13 g (the acceleration due to Earth's gravity, equivalent to g-force) and 5,000 years with peak acceleration of 0.384 g. For the flood standard, the parameters are based on a 2,000-year return period under the normal operation and on a 10,000-year return period under the abnormal operation.

Social Impact Assessment

The Social Impact Assessment looked at two options for the dam site, the upper and the lower option. It was found the population impacted by inundation in the lower dam site scheme would exceed the population impacted in the upper one by 10,000 people. For the upper dam site, it is estimated eight villages with 744 households and 3,647 people will be affected by impoundment, 256 households and 1,377 people indirectly affected, 2,913 households and 15,363 people affected in downstream areas of the reservoir, and 354 households and 1,714 people affected in the hosting community for the resettled population, totalling 4,267 households and 22,101 people.

Operation consideration

The PLHPP is a low-head type. To reduce reservoir inundation impacts and facilitate sediment-flushing of the reservoir, natural water flow conditions shall be restored as far as possible in the flood season, and the reservoir level shall be as close to the natural water level as possible. According to this principle, and considering inflow characteristics into this project, two reservoir operation modes are proposed at this stage: reservoir operation for normal power generation and at higher than design flows.



Schematic diagram of the reservoir's operational rules

Reservoir operation for normal power generation: Expected inflows will be forecast with an upstream near real time flow and rainfall monitoring network. If the forecasted inflow is less than the design discharge (i.e. 6,100 m^3/s) at full load, the power plant will be operated at reduced load. However, to balance the generated load against the demand, the reservoir level may vary between the minimum pool level (i.e. 239 m) and the normal pool level (i.e. 240 m). The minimum operating water level of the reservoir will be no less than 239 m.

Reservoir operation at higher than design flows: During the flood season, if the forecasted inflow is larger than the design discharge (i.e. 6,100 m^3/s), but less than 16,700 m^3/s, the reservoir outflow must equal to the inflow. The generator units will be operated at their capacity for power generation, and the extra flow will be discharged through the flood discharge facilities, maintaining the reservoir at the normal pool level (i.e. 240 m).

If the inflow is larger than 16,700 m^3/s and is forecast to increase further, the power station will stop generating, and the flood discharge facilities will be fully opened. During the flood recession limb, if the inflow is less than 16,700 m^3/s and is forecast to decrease, the flood discharge facilities will gradually be closed until the reservoir level return to the normal pool level (i.e. 240 m), and the hydropower project will resume power generation.

Developer and cost

The project's total investment cost is estimated at USD 2,134 million, invested and developed by PowerChina Resources Ltd and China National Electronics Import-Export Corporation (CEIEC) in a form of Build-Operate-Transfer (BOT).

The investor and developer of the PLHPP are PowerChina Resources Ltd and China National Electronics Import-Export Corporation (CEIEC), who will run the project in the form of Build-Operate-Transfer (BOT). The construction is planned to commence in 2022 and will take about seven years, with the power station expected to start operations in 2029. The project is estimated to be worth around **USD 2,134 million**, in which about 50% is attributed to hydropower construction and about 4% to power transmission.

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