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We are a global consulting and engineering company dedicated to balanced sustainability and responsible business.

Our in-depth expertise extends to the fields of:
- energy
- forest industry
- chemicals & biorefining
- mining & metals
- transportation
- water and
- real estate

Pöyry has around 7,000 experts and an extensive local office network. Pöyry's net sales in 2011 were EUR 796 million and the company's shares are quoted on NASDAQ OMX Helsinki (Pöyry PLC: POY1V).
HYDROPOWER – OUR CREDENTIALS

- Pöyry is one of the world’s leading engineering consulting firms in hydropower with 120 years of hydropower expertise.
- Involvement in >100,000 MW of hydropower capacity worldwide (1/8 of total capacity)
- Strong position based on a wide spectrum of services and comprehensive international expertise accumulated from thousands of assignments over many decades.

Core areas
- Reservoir storage schemes
- Pumped storage schemes
- Cascade schemes
- Run-of-river schemes
- Multipurpose schemes
- Dam safety & environmental assessments
- Technical & financial due diligence
- River basin development & flood protection
- Electro & hydro mechanics
- Automation & control

MAJOR HYDROPOWER PROJECTS OF PÖYRY UNDER EXECUTION IN 2012

<table>
<thead>
<tr>
<th>Current Projects</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laja I, Chile</td>
<td>35</td>
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<tr>
<td>Macchu Piccu II, Peru,</td>
<td>100</td>
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<tr>
<td>Quitaracsa, Peru</td>
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<tr>
<td>Angel 1-2-3, Peru</td>
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<tr>
<td>Reisseeck II PSP, Austria</td>
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<td>Lehen HPP, Austria</td>
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<td>Ashta, Albania</td>
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<tr>
<td>Karlsdorf Gössendorf, Austria</td>
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<td>Nant de Drance PSP, Switzerland</td>
<td>900</td>
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<tr>
<td>Deriner, Turkey</td>
<td>670</td>
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<td>Ermenek, Turkey</td>
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<tr>
<td>Kavak Bendi HPP, Turkey</td>
<td>180</td>
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<tr>
<td>Beyhan 1, Turkey</td>
<td>550</td>
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<tr>
<td>Tuirial, India</td>
<td>60</td>
</tr>
<tr>
<td>Uma Oya, Sri Lanka</td>
<td>150</td>
</tr>
<tr>
<td>Xayaburi, Lao PDR</td>
<td>1285</td>
</tr>
<tr>
<td>Total capacity under construction</td>
<td>~5000</td>
</tr>
</tbody>
</table>

9 NOVEMBER 2012 XAYABURI HPP/PROJECT BACKGROUND

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MAIN FEATURES OF THE XAYABURI RUN-OF-RIVER HYDROPOWER PLANT IN LAO PDR

- Location: Xayaburi town, 80 km south of Luang Prabang, Lao PDR
- Commercial operation: October 2019 (expected)
- Construction cost: $3.8 billion
- Owner: Xayaburi Power Company Limited (XPCL)
- Dam height and length: 32.6 m/820 m
- Type of spillway: 7 x radial gates, 4 low level outlets
- Spillway capacity: 47,500 m³/s
- Pond Capacity: 726 Mio m³, filling time with mean Mekong flow about 50 hours
- Catchment area: 272,000 km²
- Full supply level: 275 m a.s.l.
- Hydraulic rated head: 18 m
- Turbines: 7 x 175 MW Kaplan-type, 1 x 60 MW Kaplan-type
- Maximum capacity: 1,285 MW
- Energy Production: 7,405 GWh, which means electricity to about 1 million people in Lao PDR and 3 million people in Thailand
RUN-OF-RIVER POWER PLANT PRINCIPLES

- The technology for run-of-river power plants is now about 120 years old, however, the technology and sustainability of the schemes have clearly improved over time.
- The reservoir level is kept largely constant (head) and inflowing water is constantly released either through the turbines or the spillway.
- The water is not stored and therefore the mean daily flow regime of the river is not affected.
- This is in contrast to high head storage schemes where large volumes of water are stored by means of high dams, creating large reservoirs and accumulating the river flow sediments.

TODAY THE FOLLOWING MAIN PRINCIPLES ARE USED IN THE DESIGN OF STATE-OF-THE-ART RUN-OF-RIVER POWER PLANTS

- To build the weir and power structure as flexible as possible allowing the routing of floods, sediments and nutrients directly through the system.
- To equip most of the larger run-of-river schemes with dams/weirs larger than about 20 m height with larger bottom outlets for sediment release.
- To allow migration of fish and other aquatic animals through or around the dam structure using fish locks, fish ladders, natural by-pass channels, fish lifts, etc.
- To have fish-friendly turbines with much lower mortality of fish passing through the turbines.
- To have the best available equipment to allow downstream fish migration and best use of the energy.
- To allow efficient navigation and to support recreation.
- To satisfy the highest safety standards according national and international standards.
- To support the general development of a region with the supply of safe, reliable and clean energy.
XAYABURI PLANT - DAM SAFETY

• General design principles
  – State of the art design principles and internationally accepted standards are being used which are in line with the size and importance of the project

• Flood design
  – Follows internationally accepted concepts for passing seasonal and extreme floods safely

• Seismic design (earthquake resistant design)
  – ICOLD (International Commission on Large Dams) guidelines will be followed such that the scheme will be designed to withstand the extreme earthquake event having a probability of a 1 in 10,000 year return period in the worst case

XAYABURI PLANT - SEDIMENT MEASURES

• Low level outlets
  – The original spillway outline design has been adapted by introducing large capacity low level outlets equipped with control gates
  – The low level outlets will allow, in combination with the spillway,
    – to route sediment loaded flood flows through the available low level and spillway openings and
    – to lower the reservoir level and to allow controlled flushing of the sediments downstream
  – This will prevent the accumulation of sediments in the reservoir and allow the sediment and associated nutrients to pass downstream

• Control of sediment concentration
  – Too high sediment concentrations in the water released through the low level outlets would be detrimental to the river fauna
  – The sediment concentration will be controlled by combined release operations through the low level outlets and the spillway

• Conclusion
  – A high percentage of the sediments entering the reservoir will pass through Xayaburi downstream and mitigate potential negative effects of sediment loss downstream to a minimum.
**XAYABURI PLANT - MEKONG RIVER FLOW**

- **Effect of Xayaburi on downstream river flow conditions**
  - The impact on the current flow conditions in the river has been mitigated by using the run-of-river scheme.
  - There will be no seasonal storage of water volumes and therefore the daily inflow into the reservoir corresponds to the daily flow passing through Xayaburi downstream.
  - Variations in the power production may change the water flow and cause daily water level variations which are limited to less than one meter.
  - The speed of the downstream water level variations can be controlled by operational measures, there will thus be no sudden water level rises.

- **Flushing operations**
  - Flushing, which can affect the downstream water flow for a longer river stretch, is only planned to be performed in the high flow season, when changes in the river flow are less felt.

- **Conclusion**
  - The current flow regime of the Mekong River should not have major impact from Xayaburi.

**XAYABURI PLANT - FISH PASSING FACILITIES**

- The very large number of migrating fish, during certain periods, and high number of fish species are the main challenge for the fish passing facilities.
- In order to maximise the efficiency of the system, several independent fish passing facilities are included in the design:
  - facility for upstream migration,
  - fish passage recording system for upstream migration,
  - facility for downstream migration,
  - the navigation lock adapted to serve as a fish lock (also during construction stage to allow fish passage during construction),
  - space for a fish lift included,
  - flexibility allowing later improvements if required.
- Additional baseline data on fish is being collected and will be used to fine tune the detailed design of the fish passing systems.
- **Conclusion**
  - The design employs state-of-the-art technology including several independent fish passing facilities, fish friendly turbines and flexibility allowing future improvements.
PÖYRY’S ROLE IN THE XAYABURI HPP PROJECT IN LAO PDR

IN 2011 PÖYRY ACTED AS A TECHNICAL CONSULTANT TO GOVERNMENT OF LAO (GOL)

- Pöyry’s assignment in 2011 was to report on whether
  - Xayaburi Power Company Limited (Owner) has complied with and satisfied the Mekong River Commission (MRC) Design Guidelines
  - GOL and the Owner have taken into consideration the comments submitted by the MRC member countries during the Prior Consultation Process
  - GOL and the Owner have complied with the terms of “Prior Consultation Project Review Report on Xayaburi Project”, dated 24 March 2011
  - Issues relating to development, construction and implementation of Xayaburi and any discrepancies, conflicts and needs for changes in connection with comments by the riparian countries
- Pöyry’s study was based on third party studies/reports that were provided to Pöyry by the Lao Government
- Pöyry’s study together with the Peer Review by CNR, France, established those areas where the project was not yet fully in compliance with the MRC design guidelines and proposed actions to bring the project into full compliance and to improve the technical design
CONCLUSIONS FROM THE TECHNICAL COMPARISON

After the following design changes recommended by Pöyry, the project follows the current state-of-the-art design for run-of-river hydropower schemes:

A. Sediment transportation
   - Provision of large capacity low level outlets, allowing passage of the sediments downstream
B. Fish passage
   - Fish passing facility in navigation lock, which allows fish passage also during construction period
   - Adaptation of fish ladder system (step height) using the findings of baseline studies
   - Provision of a fish lift if baseline studies indicate the need for it
C. Navigation locks
   - Improvements in upstream lock approach area and changes in lock feeding system
D. Additional studies during construction:
   - Fish survey and related studies for optimising fish pass facility
   - Additional socio-economic studies
   - Continuous measurements of flow, water quality and other parameters
   - Baseline study for sediment content and composition of Mekong river in project area

Government of Lao and Xayaburi Power Company Limited, the project owner, have confirmed that the recommendations made by Pöyry will be incorporated in the project design, with the approximate cost of about USD 100 million.

PÖYRY TO SUPERVISE THE CONSTRUCTION OF THE XAYABURI HYDROPOWER PROJECT AS GOVERNMENT OF LAO ENGINEER

Pöyry and the Government of Lao (GOL) have agreed that Pöyry will act as the Government of Lao Engineer in the construction phase of the Xayaburi hydropower plant project in Lao PDR

The scope of services include:
   - Review of the contractor’s design
   - Supervision of the construction
   - Supervision of the implementation of the agreed technical design improvements and additional studies

Pöyry’s services will be executed during the 8-year construction period until the commissioning which is expected in 2019
THANK YOU!

APPENDICES
Xayaburi scheme, Construction Sequences

River diversion phase 1: construction cofferdams at the right side of the Intermediate block

Cofferdam completion schedule
May 2013

Stage 1 Intermediate Block completion schedule
Jun 2014

Cofferdam completion schedule
May 2013
Xayaburi scheme, Construction Sequences

River diversion phase 1: construction Navigation lock and spillway

River diversion phase 2: construction cofferdam at the left side of the Intermediate block

Cofferdam removal schedule
Oct 2014

Cofferdam completion schedule
Jun 2015
River diversion phase 2: construction coffer dam at the left side of the Intermediate block

Main structure of Powerhouse & Fish ladder completion schedule
Mar 2018