

/ the firm submitting the application

Why do you think this project should receive an award? How does it demonstrate:

- innovation, quality, and professional excellence
- transparency and integrity in the management and project implementation
- sustainability and respect for the environment

1. A series of key technical problems are overcome and many innovation results are in the leading position of the industry.

(1) The lowest temperature at upper reservoir is -34.5 °C, and the maximum annual temperature difference is 70.7 °C. The reservoir water level changes frequently and largely, so normal asphalt concrete can not meet the requirement of operation. It is initiated for Xilongchi pumped storage station to use SBS modified asphalt concrete as the facing for seepage control in a cold area. The temperature sensing performance of modified asphalt concrete is -34.5°C~70°C, within which, the modified asphalt concrete can maintain good mechanical properties, and meet the requirement of upper reservoir construction. This will provide practical experience for design and construction of asphalt concrete facing in cold regions in the future.

(2) The dam of the lower reservoir is a rock-fill dam with asphalt concrete facing, which is the highest rock-fill dam (dam height: 97.4m) built in deep overburden. The depth of dam foundation overburden is generally 20~50m, and 100m in maximum. Rational design scheme adopted has solved the problems of the deformation and instability of dam in deep and uneven overburden.

(3) The shaft intake/outlet is successfully adopted in China. Based on numerically simulated calculation and verification through hydraulic model test. Basic principles are firstly for parameter design of each part of shaft intake/outlet, which may provide references for similar projects.

(4) The internal water pressure in bifurcated pipe is designed to be 10.15MPa, and the PD value is 3552.5 m², which is at forefront of the world. The buried crescent-rid bifurcated pipes were firstly designed under the consideration of internal water pressure shared by surrounding rocks. The idea, principle and method of this design can help to save the steel consumption, reduce the fabrication and installation difficulties while increasing the technical feasibility. The results have been compiled into industrial specifications, which can promote the generalization of this technology.

(5) The dimension of underground powerhouse is 149.3m×22.25m×49m. The surrounding rocks of large-scaled underground cavern group are in interbedded thin layers, with developed textures, gentle occurrence of stratum, poor bonding force of

conditions, so roof collapse are easily to occur during
em of such horizontal thin layered surrounding rocks
are successfully solved by utilizing the anchor hole and central heading pilot hole for
excavation and two-ended cables for top arch pre-anchorage.

〔6〕 The pre-qualification test of 500kV dry type cable terminal (including cable
system) is conducted and achieved a successful application according to the IEC 62067
in the world.

2. High quality and professional excellence

〔1〕 The SBS modified asphalt concrete is firstly used in Xilongchi project as the
facing material for seepage control in cold region. The application area is 101,800m²,
ranking first in the world. This technology has helped to solve the problem of frost crack
of asphalt concrete facing under severely cold temperature. Since 7 years after
impoundment, the maximum value of total seepage quantity in upper reservoir is 3.26L/s,
so the seepage control effect is good.

〔2〕 The high asphalt concrete-faced rockfill dam is built in thick overburden, which
is at a leading level in existing pumped storage power stations. The monitoring results
indicate that the maximum settlement of dam is 1.015m, the dam has a safe structure
and is in good operation conditions.

〔3〕 The running head of Xilongchi project is 640m, the inclined shaft of pressure
pipe is 857.66m long and the PD vale of bifurcated pipe is 3552.5m², which are all at
the leading level in the world. The monitoring results show that the buildings and
structures of the waterway system are operating normally.

〔4〕 This project has solved key technical problems of large and medium-sized
cavern structures in horizontal thin layered surrounding rocks, which has provided new
ideas and ways for crown treatment of large underground caverns. The monitoring
results show that the maximum displacement of underground powerhouse surrounding
rocks is 19.16m, and the vibration sensing of powerhouse is small.

In October 2012, the project passed the acceptance of China Renewable Energy
Engineering Institute jointly with Shanxi Development and Reform commission, and the
State Grid Corporation of China, so the project was completed and put into commercial
operation in 2011. Through the test of 4 flood seasons, the monitoring results indicate
that the main structure is well functioning, the 4 units are normally operation with rated
output, and the main electrical so is mechanical equipment.

Xilongchi pumped storage power station has a high response to the grid peak
shaving, as well as mature technology and reliable operation, which has largely
improved the power source quality, and ensured the safe, stable and economic
operation of grid. It plays an important role in "holiday power protection, peaking in

er supply", and takes the responsibility of ensuring the
the economic development of the region.

This project has achieved 2 patents, 1 proprietary technology, and resulted in 1 monograph of Industry standard in China. According to the identification made by foreign and domestic experts, many techniques of the project are on top level of the world. The project won 4 prizes of industrial scientific and technological advancement, excellent design of Power Construction Corporation of China, and gold medal of National Outstanding Water Conservancy and Hydropower Engineering Survey.

3. Transparency and integrity in the management and project implementation

(1) Xilongchi pumped storage power station is one of the key projects in "the tenth five-year plan" period in China. Public bidding is adopted in the mode of transparency, high efficiency and competitiveness. Powerchina Beijing Engineering Corporation provides the Client with professional, objective and judicial service and suggestions for the project based on the quality.

(2) Xilongchi pumped storage power station consulted by HYDROCHINA, the key technical difficulties are rechecked through the specific study conducted by the scientific research institution and universities in domestic hydropower field. The engineering techniques are transparent and open, and the technical achievements stand the test.

(3) To establish occupational moral system for consulting engineers, and in the bidding of construction and procurement, adhere to the principle of technical priority, propose rational suggestions to the Client and protect the Owner's interests.

(4) The follow-up auditing is executed during whole project so as to ensure the normative and rational fund usage.

4. Sustainable environmental protection

(1) Xilongchi pumped storage power station is a clean energy project, with a total installed capacity of 1200WM and annual energy output of 1805 GWh, which may save the standard coal of 259,000 tons and reduce carbon dioxide emissions of 670,000 tons. Meanwhile, the operation of this project may improve the operation conditions of thermal power units and help the power grid adopt more clean energies such as wind power, nuclear power and solar power generation so as to increase the proportion of clean energy and decrease the proportion of fossil energy and carbon emission, with remarkable environmental benefits.

(2) Prior to the project construction, the environmental impact assessment has been conducted. The guidelines of green construction are executed during construction, to ensure the remarkable effects of the low carbon (namely energy saving, land saving, water saving, material saving) and environmental protection.

(3) A special fund is used to conduct the environmental protection, soil and water

sure that the facilities of environmental protection and constructed and put into operation at same time.

(4) According to the investigation on excavation and filling balance through laboratory and field experiments, the rockfill materials for upper reservoir main dam are all from the excavated materials of the project, and those for auxiliary dam are all from the excavated materials at upper reservoir. This reduced the adverse impact on the environment as well as the land acquisition and resettlement.

(5) The tunnel excavated materials of about 200,000m³ are used as the rockfill materials for main dam at lower reservoir, which effectively reduced the exploitation of the quarry and accordingly the adverse effect on the environment.

(6) The scheme of tunnel excavation for public road No.2 and slag transportation at lower reservoir has not only mitigated the adverse effect on the environment, reduced the area of land acquisition but also saved the investment in the project.

(7) The excavated slopes along the access roads are planted with dwarf flowering straws, and different vegetations are planted on both sides of the access roads according to different soil and landform conditions, which are harmonious with nature.

During the construction of Xilongchi project, corresponding environmental protection facilities and measures were taken, and the project passed the environmental protection acceptance of environmental protection organization in 2013. A questionnaire survey was conducted in the surrounding publics and 99 questionnaires were collected. The respondents are all satisfied with the environmental protection measures taken for the project. Routine maintenance for environmental protection is well done after the project is put into operation, which is supervised by Shanxi Environmental Protection Agency.

What services did the member firm provide to the project? Please describe briefly.

Powerchina Beijing Engineering Corporation has provided whole process service from early stage to execution of the project. Pre-feasibility and feasibility study reports were prepared at early stage, in which the construction conditions and design schemes are discussed and the design preliminary estimate, economic benefit analysis, as well as social and environmental impact assessment are included. In preparation period, the construction planning report, tender document and detailed design were finished. During construction, engineers were assign on site, who were in long-term presence to solve the related technical problems, attend the site acceptance and meetings, and propose design optimization schemes according to the geological conditions exposed and take part in the acceptance.

Please use additional pages as needed. Maximum 5 pages per project.