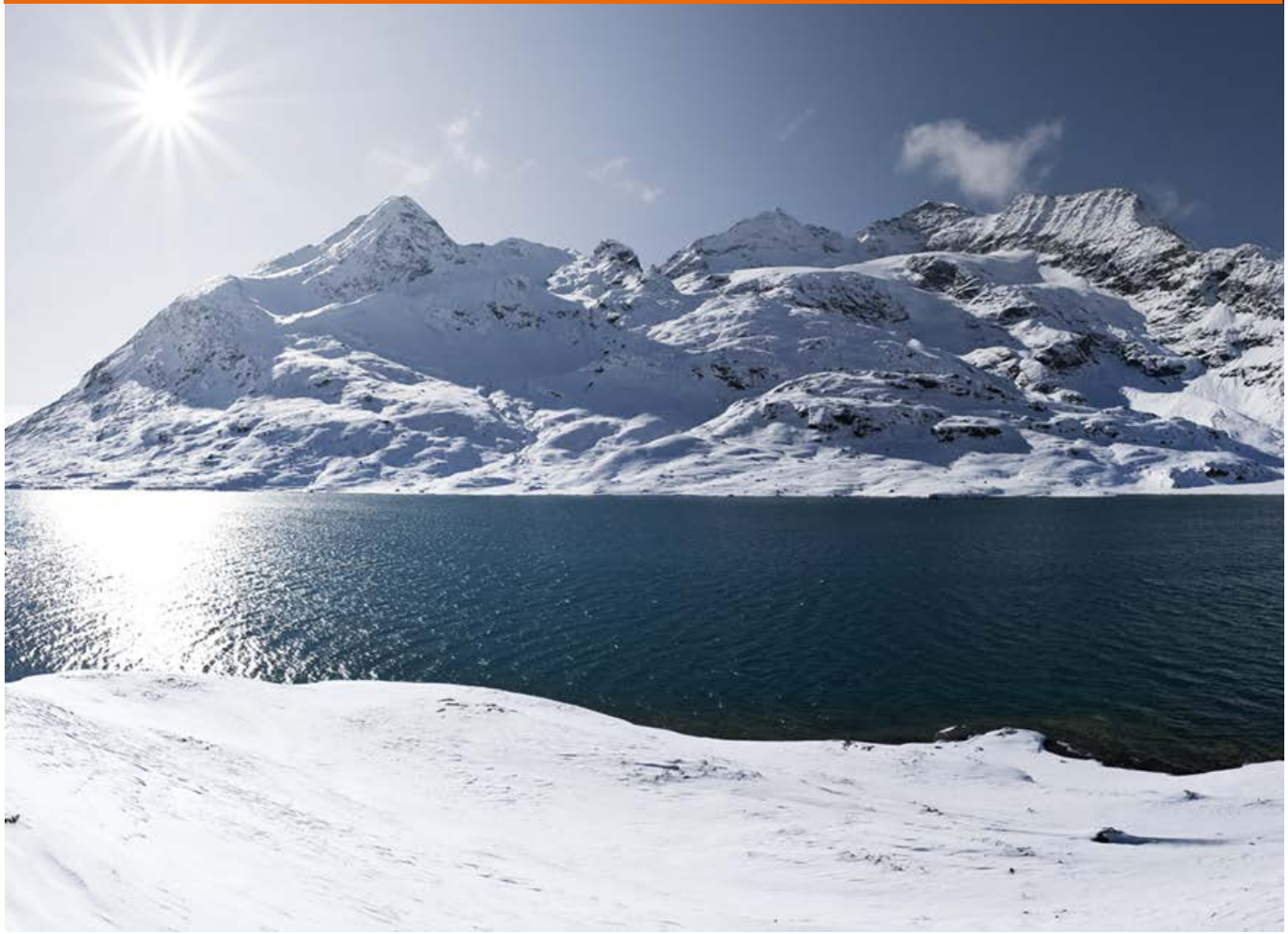
PUMPED STORAGE PLANT LAGO BIANCO



Lago Bianco, Pumped Storage Power Plant, Poschiavo, Switzerland

The new pumped storage plant Lago Bianco in the canton of Grisons uses the Lago Bianco (approx. 2230 m above sea level) and the Lago di Poschiavo (approx. 960 m above sea level) as storage. A headrace gallery and a pressure shaft connect both reservoirs. The altitude difference between the reservoirs is about 1'270 m. The existing dams at the Lago Bianco are enlarged by 4.35 m. Thus, the usable volume of the lake increases from 18 to 26 Mio. m^3

Scope

- Headrace gallery 18 km, inner diameter 5.5 m
- Pressure shaft 3.0 km, inner diameter approx. 4.2 m and excavated diameter approx. 5.5 m. The altitude difference of the shaft is approx. 1'000 m
- Additional facilities like surge chamber plus auxiliary galleries

Challenges

- Exposed position in alpine area
- Geology with crystalline rock and metamorphic parts, fault zones with insertions and Kakirites

Amberg Services

- General planner for engineering consortium (JV)
- Conceptual design
- Planning entire construction project

AMBERG ENGINEERING

- View of lake Bianco

- Layout new headrace gallery and pressure shaft

- View of lake Poschiavo

AMBERG FACTS

Contracted value engineering consortium
- Total 10.5 Mio. CHF

Contracted value Amberg
- Total 1.25 Mio. CHF

Project phases & duration
- Project planning and investigations 2011 – 2013

Project details
Water withdrawal system / discharge system Lago Bianco / Lago di Poschiavo
- Creation of constructions Lago die Poschiavo without lowering of lake

Upper apparatus chamber Cambrena
- Safety-armoured-door as closure headrace gallery

Headrace Gallery
- Headrace gallery of 18 km length between Lago Bianco and Plan di Laghet on the right side of the valley of Puschlav

Lower apparatus chamber and surge chamber Plan di Laghet
- Throttle valve for pressure shaft to avoid prohibited pressure surges in the vertical shaft

Pressure shaft
- Reinforced pressure shaft by installation of armoured conduits
- altitude difference almost 1’200 m

Subterraneous power house Camp Martin
- 6 Machine groups each 175 MW
- Pump- and turbine operation (Pelton turbine)

CLIENT FACTS

Overall cost
- Total 1.8 Bio. CHF

Overview project
- Construction of a new 1'000 megawatts pumped storage hydropower plant with an 18 km long headrace gallery, 3 km long pressure shaft plus all required auxiliary buildings

Geology
- Crystalline rock 95 %, partially covered by thrusts of other layers (Mylonites, Kakirites)
- The separation layer between the Margna / Sella and the Bernina-Stretta-formation consists of metamorphic carbonate breccia, dolomite and marmot, partially lime sandstone and quartzite

AMBERG ENGINEERING

CHALLENGES

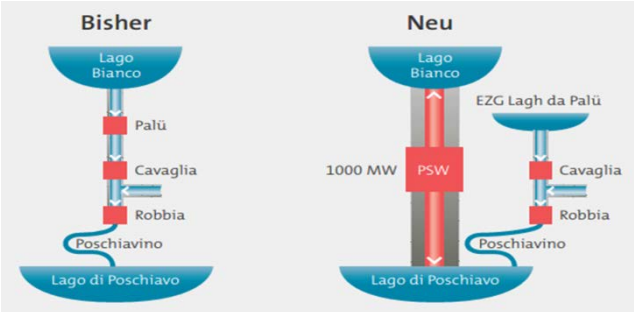
Previous dam of Lago Bianco

Exposed location, construction logistics and geological conditions

- Development of the logistics for the 18 km long headrace gallery, intermediate attacks and opposed advance including cable car transportation
- Construction in alpine area, difficult access, especially in winter
- Variable geology including fault zones.
- Occasional appearance of Chrysotile in Serpentines. Excavation and processing is bearing the acute danger of asbestos poisoning, special protection measures had to be applied

.

TECHNICAL APPROACH



Previous (left) and new power plant scheme (right)

Adaptation of the power plant to a new setting with a large surplus of sporadic energy

- Replacement of previous smaller, generating plants without capability of pumping
- Variant study for headrace gallery, pressure shaft and powerhouse cavern, especially alignment, cross-section (profile) and lining
- Optimization of profile, lining and machine typesetting for power generation and pumping.
- Consideration of material logistics for re-use of excavated material for construction
- Compliance with various environmental requirements

TECHNICAL SOLUTIONS

Schedule advancing headrace gallery and shaft

Advance of headrace gallery and pressure shaft

- Partially passive pre-tensioning of cast in place lining by means of injections
- In parts segment lining for TBM heading with injections of annular gap
- Spiral surge shaft, built a gallery with spiral form alignment. Sealing with spray applied membrane.
- Inclined shaft with TBM heading and steel armouring including injections
- Construction of discharge system Poschiavo without lowering the level of the lake

AMBERG ENGINEERING