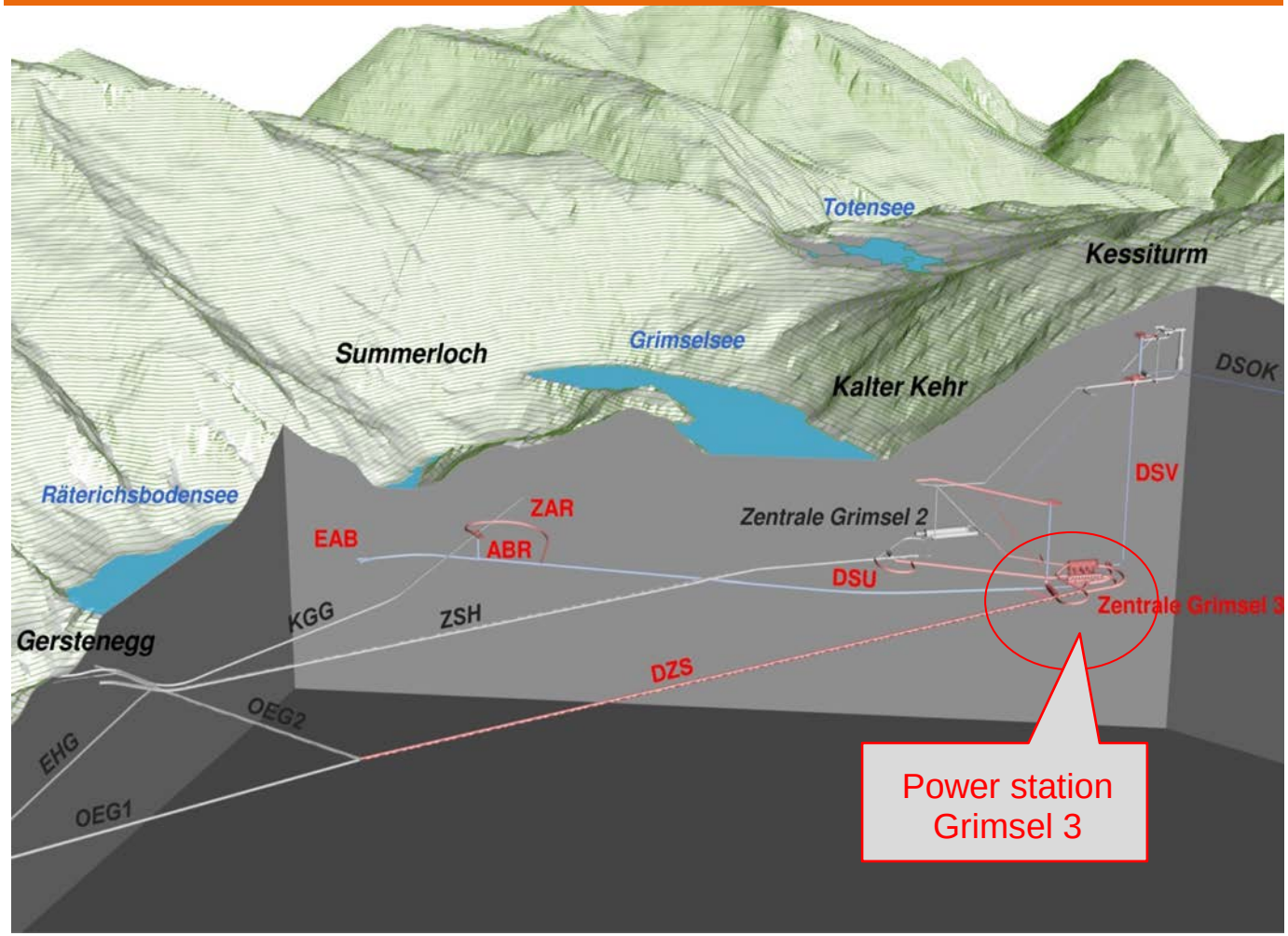
PUMPED STORAGE POWER PLANT GRIMSEL 3



Grimsel 3 Project, Innertkirchen, Switzerland

The power plant Grimsel 3 is designed for a power output of 660 MW, whereas a flowrate of 130 m^3/s with an altitude difference is required. For dimensioning of the huge powerhouse cavern, the high horizontal stresses in this area needed to be considered.

Scope

- Cavern of power house, width 30 m, length 30 m, height 40 m
- Pressure shaft approx. 700 m, diameter 6 m
- Headrace gallery, length 2'200m, 2 surge chambers
- Various access galleries, shafts and construction caverns

Challenges

- Site in high alpine area
- Demanding construction logistics, supply and material discharge for the different headings
- Varying overburden, high horizontal rock stresses.
- Geology, Grimsel Granodiorite, with steep fault zones and reduced rock strength, partly water conducting

Amberg Services

- General project planning of all subsurface constructions of Grimsel 3 project
- Variant study, detailed project and implementation project
- Submission project

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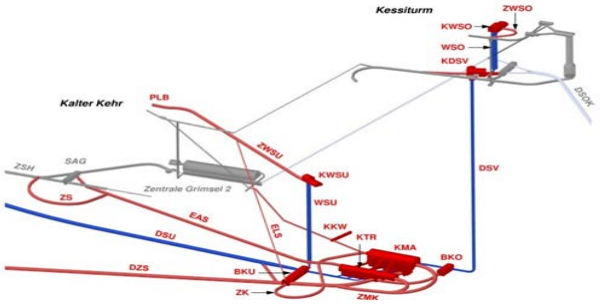
- Access tunnel power house



- Supply lines to the power centres

- Top view of the supply lines

AMBERG FACTS

Contracted value Engineering Consortium (JV)

- Total 7.2 Mio. CHF

Contracted value Amberg

- Total 2.9 Mio. CHF

Project phases & duration

- Planning 2010 – 2011
- Tendering documents 2012 – 2013

Project details

Power house cavern

- Width 30 m, length 30 m, height 40 m.
- High horizontal rock stresses
- Excavation drill and blast (D&B), lining shotcrete

Pressure shaft

- Total vertical length 700 m
- Excavation with raise drill and extension by D&B
- Reinforced concrete lining instead of steel lining

Underwater headrace gallery

- Headrace gallery, length 2’200 m
- Excavation D&B, lining cast in place

Surge Chambers and development galleries

- 2 surge chambers
- Various development galleries, development shafts and construction caverns.

CLIENT FACTS

Overall costs

- Total 1.0 Bio. CHF

Overview project

- Hydro power plant 660 MW
- Goal is the conservation and use of sporadic energy overcapacity in the power net (i.e. wind and solar energy). This leads to a solid stabilization of the Swiss power net.
- The pumped storage power plant is located under the earth surface and will use mainly the waters of the existing water reservoirs Oberaar and Räterichsboden lakes.

Grimsel 3, main components

- Pressure shaft from surge chamber Kessiturm to the cavern of powerhouse Grimsel 3
- Power house centre with 3 pump/turbine groups
- Headrace gallery to Räterichsboden lake
- Different auxiliary buildings

Geology

- Formation, fine banded Grimsel Granodiorite
- Steep faults with reduced stability

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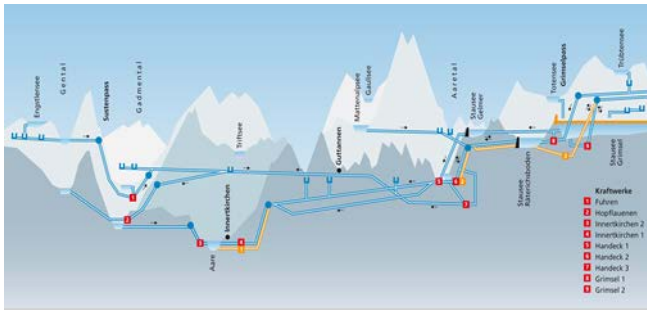
CHALLENGES



Layout of supply lines / galleries and power houses

Construction logistic development of subsurface sites, cavern and pressure shaft

- Supply and discharge as well as ventilation of the subsurface construction site
- Requirements for winter access with cable car
- High horizontal rock stresses influence severely the static of the power centre cavern
- High vertical shaft

TECHNICAL APPROACH

Difficult working in typical pressure shaft

Heading concept, pressure shaft

- Coordination for the different excavations (access galleries, cavern and shafts) in regard to construction logistics and ventilation
- Consideration of caverns for construction logistics and ventilation shaft
- Pressured shaft realized with raise drill and D&B extension

TECHNICAL SOLUTIONS

Typical access gallery

Power house cavern, pressure shaft

- Powerhouse cavern with single shell lining (shotcrete) and respective rock anchoring
- Pressured shaft with reinforced concrete lining instead of an expensive steel armouring

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