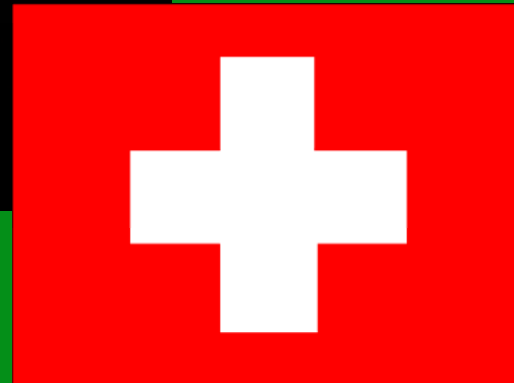


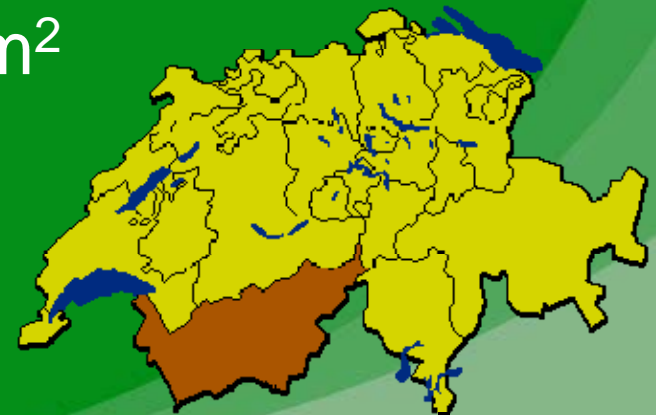
Grande Dixence Dam

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CVEN 5838



Geographic Information

- Located in Switzerland in the Canton of Valais on the Dixence river
- Supplies water to the Rhône Valley
- Holds back Lac des Dix
- Lac des Dix is 3.65 km² (902 acres) in area
 - Holds 400,000,000 m³ (324,285 acre-ft) of water
 - Up to 284 m (932 ft) deep
- Catchment area is 46.3 km² (17.9 mi²)



Physical Information

- 285 m (935 ft) tall (5th tallest dam in the world & highest gravity dam in the world)
- 695 m (2280 ft) long
- 200 m (656 ft) wide at base sloping to only 15 m (49 ft) wide at top
- Weighs 15 million metric tons (16,534,669 tons)
- Grout curtain extend 200 m (656 ft) deep and 100 m (328 ft) outward in each direction



Dam Objectives

- Built to produce hydropower
 - Grande Dixence represents 1/5 of the storable energy produced in Switzerland
 - Dam strives to:
 - Optimize water level so there is maximum availability before heavy demand periods
 - Maximize profits by calculating the cost of pumping water in the summer and income by generating energy during winter
- Now serves as recreation area also
- Tourism around the dam is quite popular

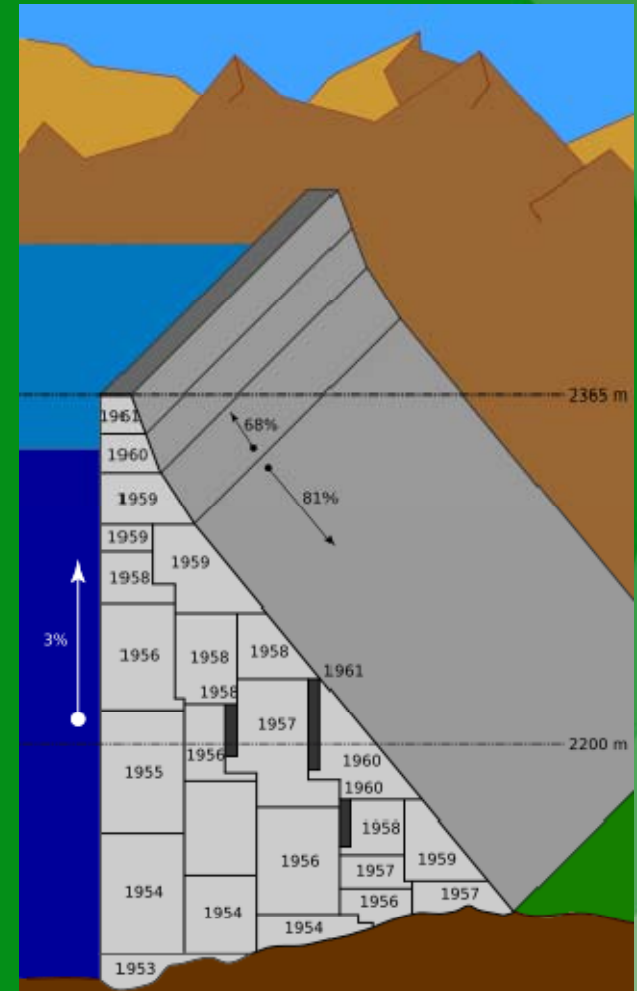
Dam Construction

- First Dixence dam was built in 1929
- Construction on the new dam started in 1950
 - New dam submerged the old dam, but when water levels are low, the old dam can still be seen
- 6,000,000 m³ (7,847,703 yd³) of concrete used
- 10 years to complete
- Major issues were how to enlarge current Lac des Dix and how to bring water from neighboring valleys
- 100 km (62 miles) of tunnels constructed to bring water to and from Lac des Dix 75 intakes
- 4 pumping stations to pump water to level of Lac des Dix
 - Z'mutt, Stafel, Ferpècle, Arolla



Dam Construction

- Two large accidents during construction
 - Roof section on the Cheilon tunnel collapsed
 - Avalanche swept away 3 inspectors
- Challenging environment to build a dam
- Originally, provided water to 3 power stations (Fionnay, Nendaz & Chandoline)
 - In 1993 construction began on the Bieudron Power Station
 - Operated from 1998 through 2000 when the penstock ruptured
 - Reconstruction started in 2005



Pumping Stations

- Increase catchment basin to 357 km² (138 mi²)
- Z'Mutt
 - Fed by water from the Bis, Gorner & Schali glaciers
 - 4 pumps pump up to 140,000,000 m³ (113,450 acre-ft) of water per year
 - Starts at elevation of 1972 m (6470 ft) and pumps to Trift tunnel at an elevation of 2400 m (7874 ft)
 - Located almost entirely underground
- Stafel
 - Located at the base of the Matterhorn
 - Fed by water from the Z'Mutt, Mischabel, Finelen, Upper Theodul, and Furgg glaciers
 - Pumps 100,000,000 m³ (81,071 acre-ft) of water per year
 - Starts at elevation of 2180 m (7152 ft) and pumps 250 m (820 ft) up to main collection conduit



Z'Mutt dam

Pumping Stations

- Ferpècle
 - Fed by water from the Ferpècle glacier
 - 3 pumps pump 60,000,000 m³ (48,643 acre-ft) of water per year
 - Starts at elevation of 1896 m (6220 ft) and lifts water 212 m (696 ft) up to La Maya reservoir
 - Located inside mountain
- Arolla
 - Fed by water from the Ferpècle pumping station and the Tsidjiore Nouve and Bertold glaciers
 - 3 pumps pump 90,000,000 m³ (72,964 acre-ft) of water per year
 - Starts at elevation of 2009 m (6591 ft) and lifts water 312 m (1024 ft) up to main collection conduit

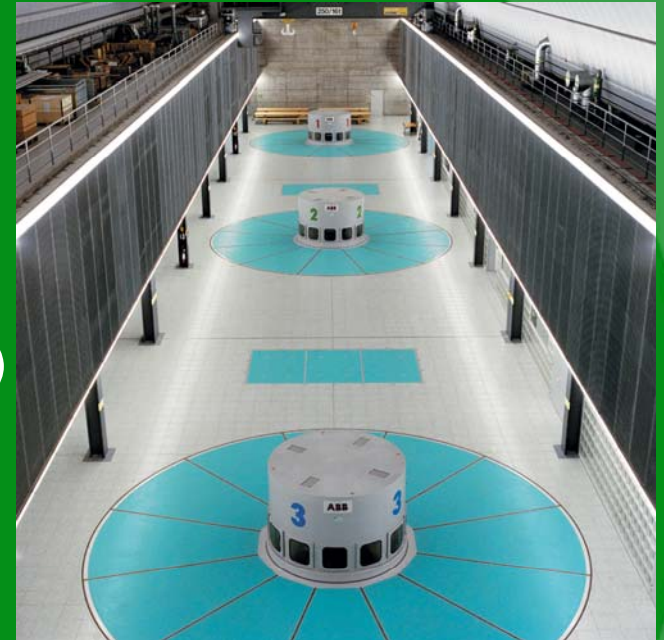
Power Stations

- Current total capacity of 800 MW
 - Will be 2000 MW by 2010 and was 2000 MW during 1998-2000
- Fionnay
 - Underground pressurized tunnel 9 km (5.6 mi) long brings water from Lac des Dix
 - Averages 10% slope
 - Penstock descends 800 m (2625 ft) with a slope of 73%
 - Capacity of 290 MW
 - Located at an elevation of 1490 m (4888 ft)
- Nendaz
 - Water comes from the Fionnay power station via 16 km (9.9 mi) long pressure tunnel
 - Surge chamber is 1000 m (3281 ft) above the power station
 - 2nd largest hydroelectric power station in Switzerland (Bieudron is #1)
 - Capacity of 390 MW

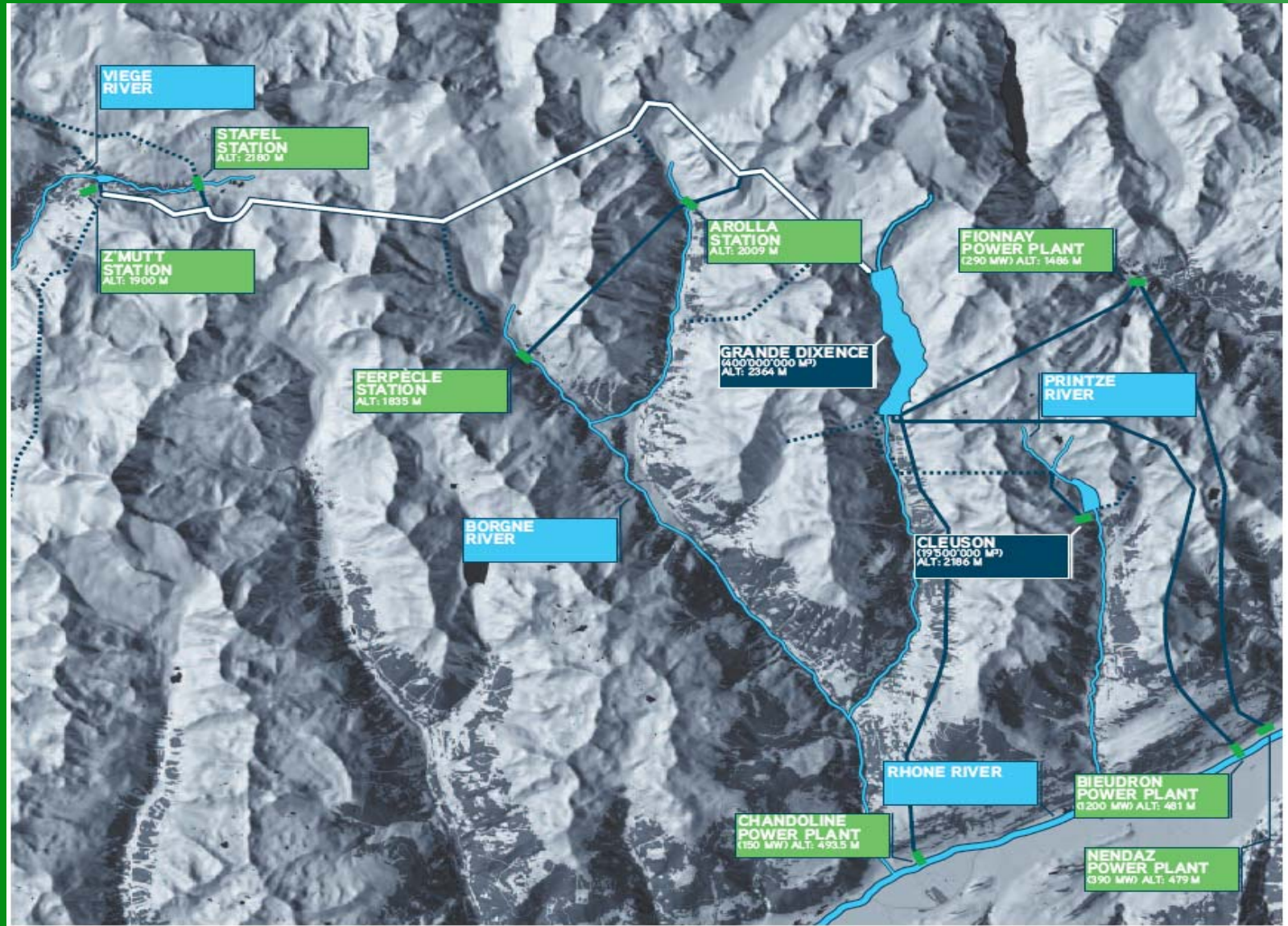


Power Stations

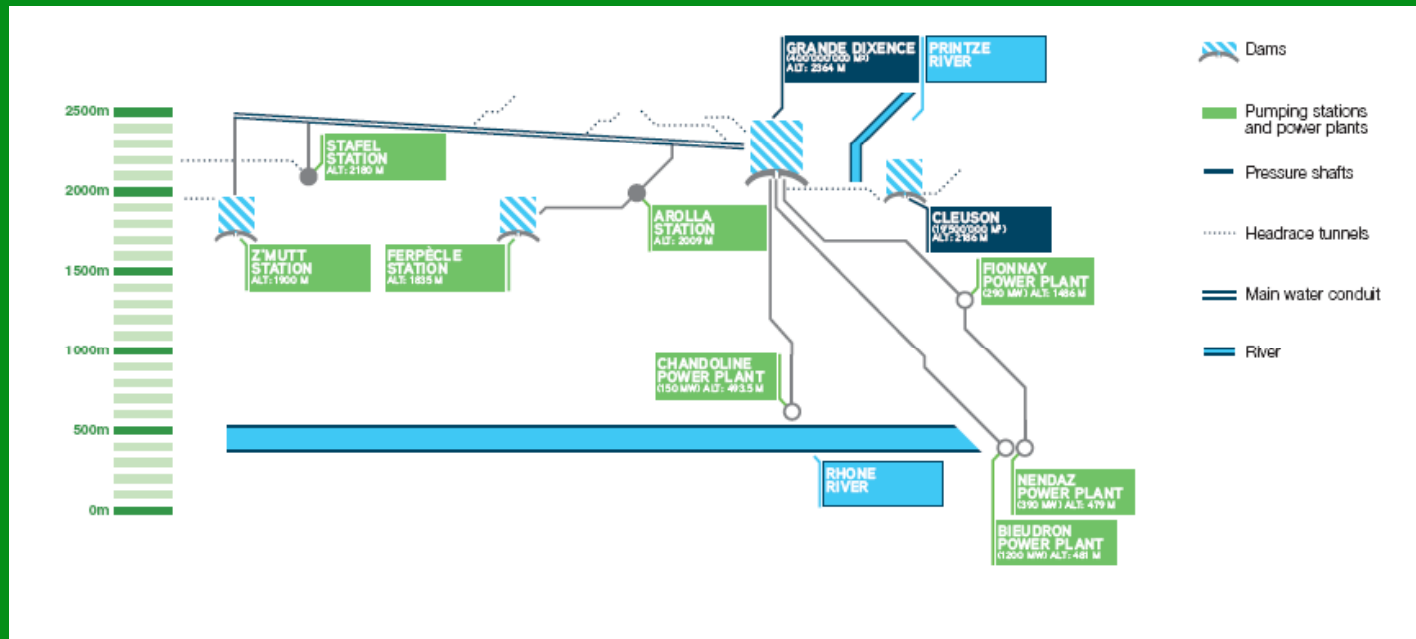
- Bieudron
 - Part of the new project titled Cleuson-Dixence complex
 - Constructed between 1993 and 1998
 - Holds three world records
 - Height of its head - 1883 m (6178 ft)
 - Output of each turbine (3) – 423 MW/turbine
 - Output per pole of the generators – 35.7 MVA
 - Capacity of 1269 MW
 - In December 2000 the penstock ruptured killing 3 people
 - Reconstruction began in 2005 and should be recommissioned in 2010
- Chandoline
 - Owned by EOS
 - 150 MW Capacity



Locations of Installations



Elevations of Installations



Dam Operation

- Collects water from 35 glaciers
- Water pumped into Lac des Dix by 4 pump stations
- Water pumped to full storage during the summer as glaciers melt, then drains out during winter
- Power generated by 3 power stations currently
- Benefits the shareholders by producing ample amounts of peak use energy and super peak use energy
- Water then returned to the Rhône river

Environmental Points

- Created a nature reserve around Lac des Dix
- Uses a precise computerized management system to control pumping and power stations
 - Losing 1 m³ of water represents more than 4kWh of energy lost
- Power stations and pumping stations are mostly underground or in the mountainsides to increase aesthetics



Owners

- Total share capital of \$277,000,000 +
- Owned by 4 partner companies
 - 60% by Energie Quest Suisse (EOS)
 - 13 1/3% by Kanton Basel-Stadt , BKW FMB Betwiligungen AG, and Nordostschweizerische Kraftwerke (NOK)

Questions

