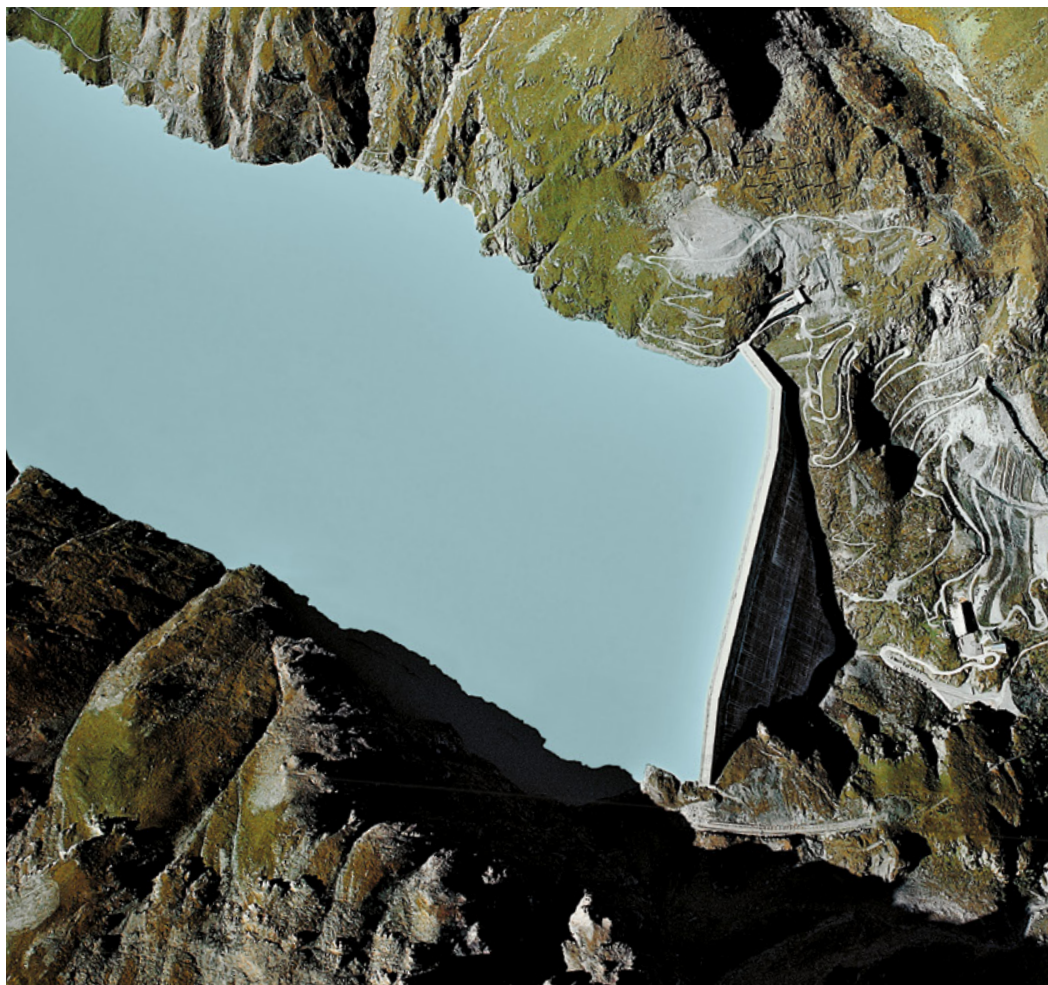
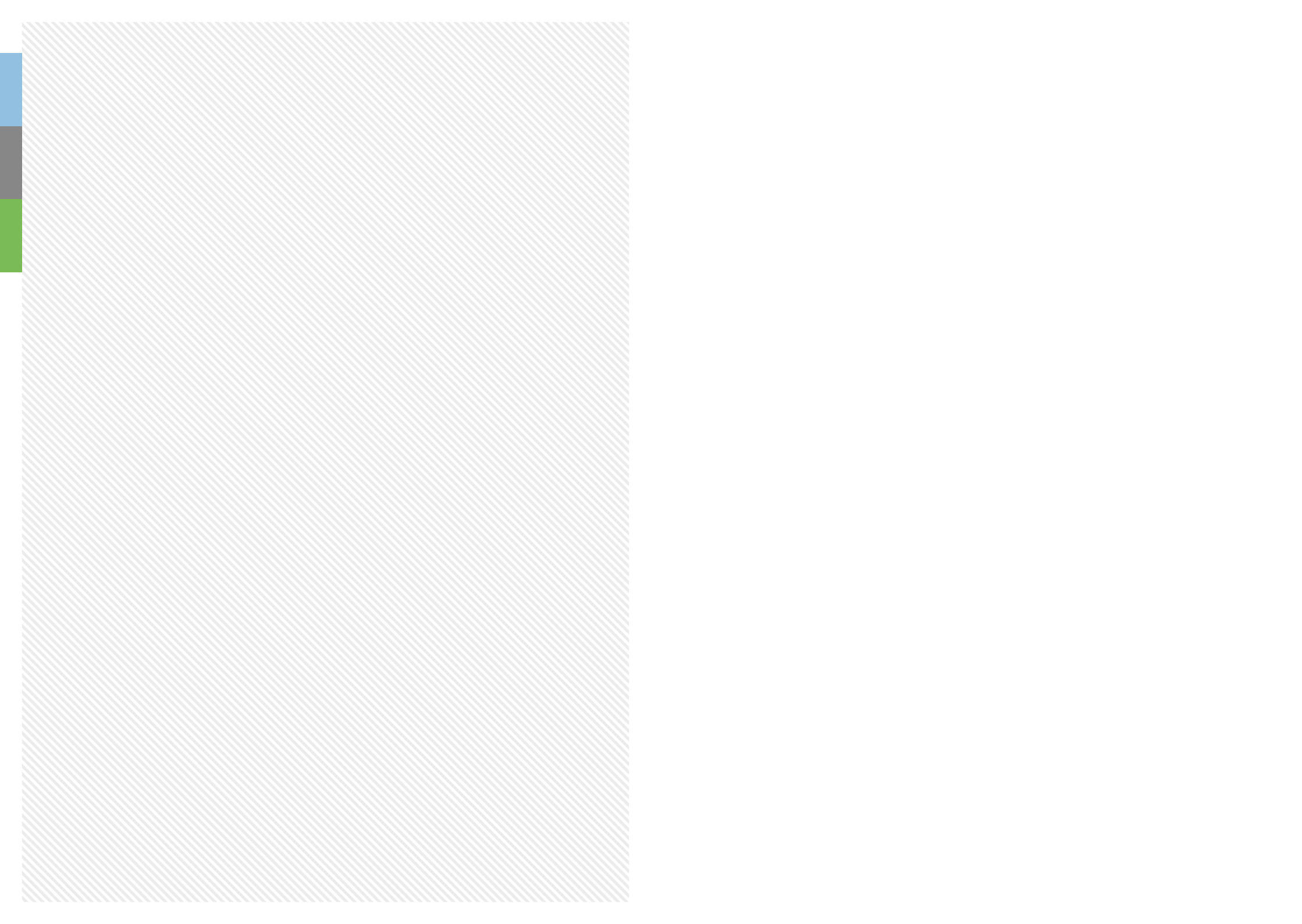


# GRANDE DIXENCE

EXPERIENCE THE ENERGY AT  
THE HEART OF THE ALPS





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A FACILITY  
WHICH IS  
UNIQUE IN THE  
WORLD







## THE HIGHEST GRAVITY DAM IN THE WORLD

### FED BY THE WATER FROM 35 GLACIERS



Grande Dixence is not only the highest gravity dam in the world, it is also a living legend.

Level with the highest mountains in the Valais, this structure is a masterpiece in technical skill and boldness channelled into energy. At first sight, you are astounded by the 285 m of concrete which tower in front of you, but once at the top of the facility, you will be stunned by the beautiful view of the Lac des Dix and the valley. The top of the dam forms a gigantic panoramic terrace 15 m wide and nearly 700 m long at an altitude of 2,365 m.

In 1961, Grande Dixence replaced the first Dixence dam, which is today submerged beneath the Lac des Dix. It took more than 10 years to build this new construction, set within a vast hydroelectric facility that was completed in 1965. The reservoir holds all the water from a catchment area of 420 km<sup>2</sup> half covered by glaciers. It is these 35 glaciers which, via 75 water intakes, 5 pumping stations and 100 km of tunnels, feed the Lac des Dix.

The 400 million m<sup>3</sup> of water stored behind the Grande Dixence dam powers the Fionnay, Nendaz and Bieudron plants. The more than 2 billion kWh produced every year represent 20% of the electrical energy stored in Switzerland.

Alongside this powerful machine dedicated to energy, a vast nature reserve occupies the Val des Dix. The plants and animals there are protected to preserve the reserve's richness and diversity. As part of this concern for conservation, the companies Grande Dixence and Alpiq, in collaboration with Pro Natura Valais, created the Ibex Trail. This is a nature trail on which you can discover the flora and fauna of the Val des Dix, upstream of the Grande Dixence dam. This trail goes via the Col des Roux, at an altitude of 2,800 metres. You should allow approximately 4 hours to complete the trail on foot.





Walk around the top of the dam



Tour inside the wall of the dam







Lac des Dix: the starting point for many a beautiful mountain walk

The Ibex Trail



© Theytaz Excursions SA – Photo: Etienne Bornet

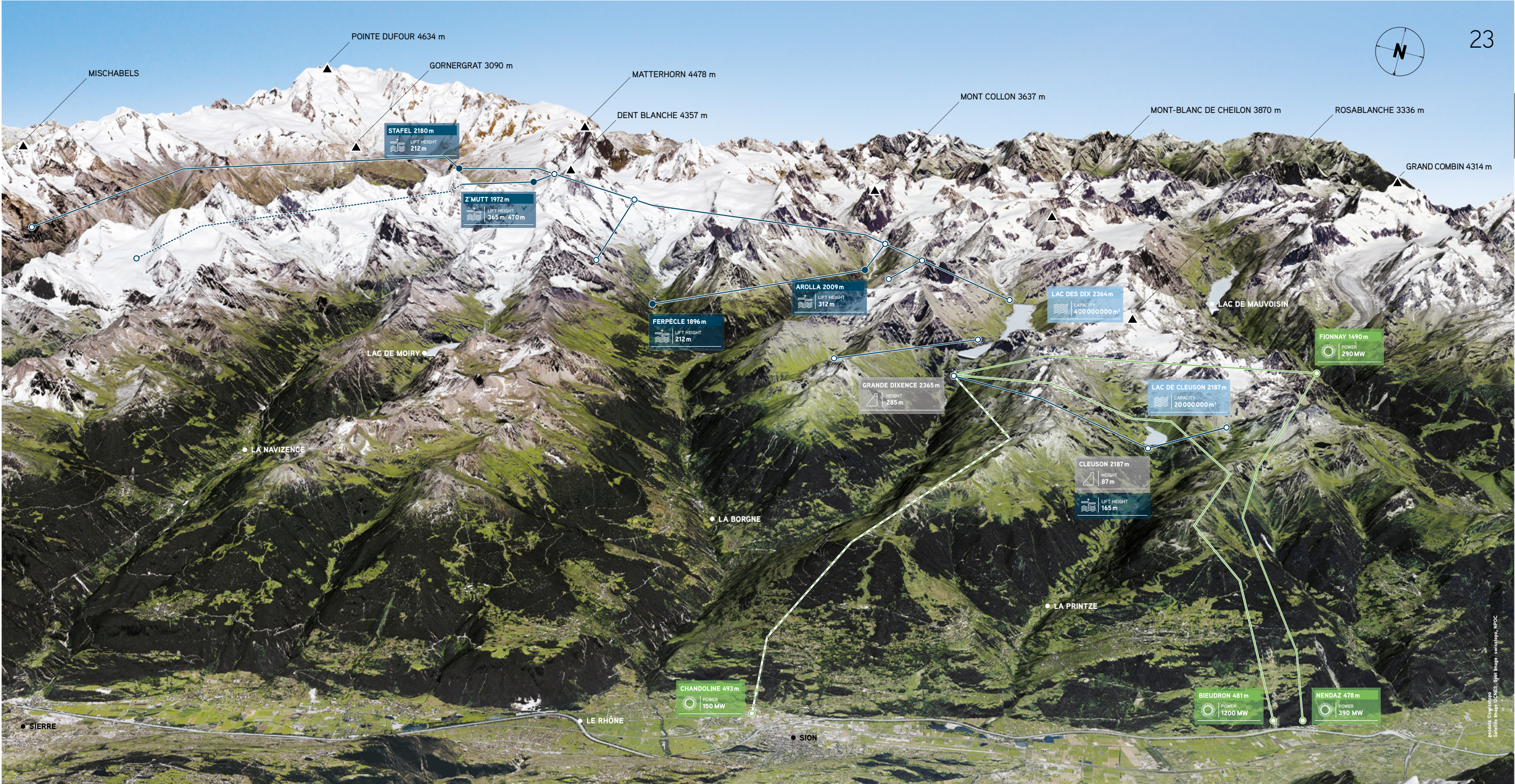


TURNING  
THE ENERGY  
OF WATER  
INTO POWER



PANORAMIC VIEW OF THE FACILITIES

- Headrace gallery
- Penstock
- Non-operating power plant
- Dam
- Lake
- Production plant
- Pumping station





The hydroelectric complex at Grande Dixence and Alpiq is the result of successive development of the waters from the Dixence, Printze, Chennaz, Borgne and Visp rivers.

Grande Dixence SA is a company which produces electricity for its partners; it is the main supplier of hydroelectric power to Alpiq.

Alpiq is one of Switzerland's leading energy companies. It operates throughout Europe and offers its customers comprehensive services in the fields of electricity generation, sales and energy optimisation.

It has been generating sustainable, climate-friendly electricity from flexible, CO<sub>2</sub>-free Swiss hydro-electric power for over 100 years. As an international energy trader, it is active on all the major European markets.



**Grande Dixence SA and its facilities :**

- The Grande Dixence complex (1951-1965) with a dam in the Val des Dix of a total storage capacity of 400 million m<sup>3</sup>, submerging the first Dixence dam. A capacity of 50 million m<sup>3</sup> belongs to Alpiq to store the waters granted to the company. The facility includes 2 production plants with a total power output of 680 MW and 4 pumping stations.

**Alpiq and its facilities :**

- The first Dixence (1930-1935), a dam in the Val des Dix with a storage capacity of 50 million m<sup>3</sup> the waters of which were turbined at the Chandoline power plant (150 MW).
- Cleuson (1947-1951), a dam built in addition to the previous facility, with a storage capacity of 20 million m<sup>3</sup>, the waters of which are pumped to the Lac des Dix.

**Complementary Cleuson-Dixence complex constructed by Grande Dixence SA and Alpiq :**

- With a view to increasing the power of their facilities, the companies Grande Dixence and Alpiq joined forces to build the Cleuson-Dixence complex (1993-1998) which includes a new plant, the Bieudron power plant (1200 MW).



Arolla water intake



## LONGITUDINAL PROFILE

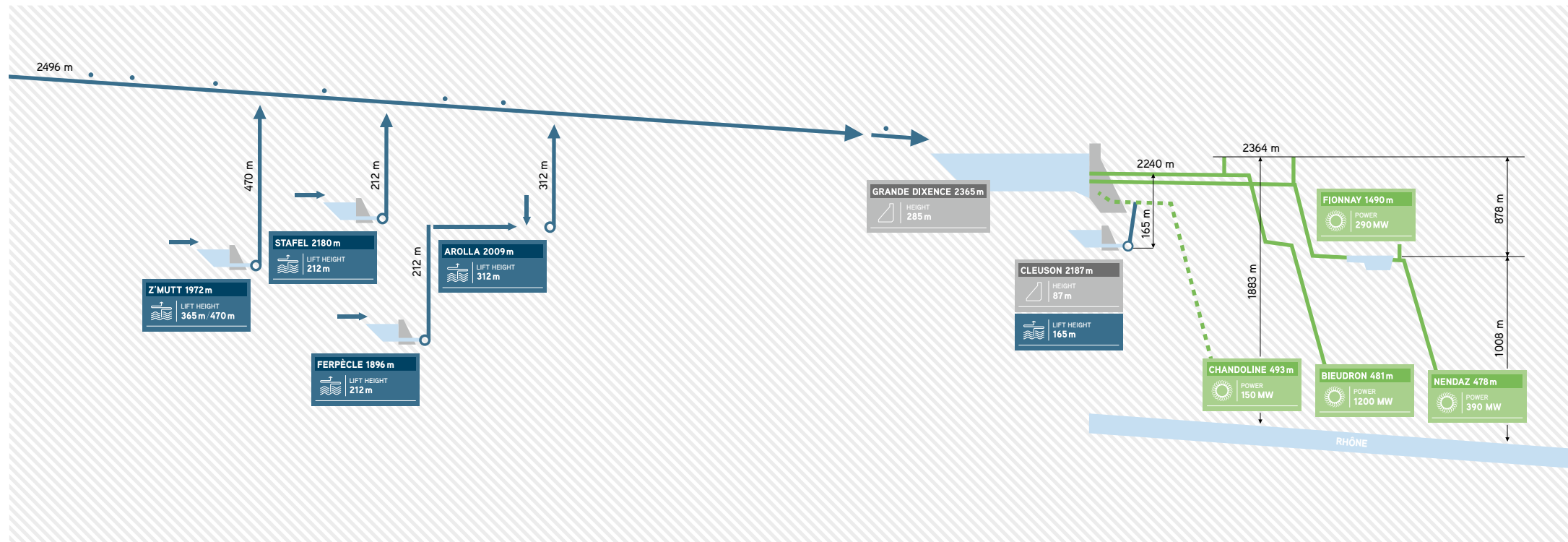
**TO MAKE USE OF THE WATER FROM THE LAC DES DIX,  
THREE PRODUCTION PLANTS ARE NEEDED.**

The 400 million m<sup>3</sup> stored in the Grande Dixence reservoir represent a major energy potential. They represent a fifth of all energy stored in Switzerland. To make the hydraulic force of the Lac des Dix as profitable as possible, Grande Dixence drives water through its turbines at two levels. The first is at an altitude of 1490 m in the Fionnay power plant. The second is level with the Rhône, 1000 m lower at the Nendaz power plant. To transform this mass of water into electricity, to domesticate this tranquil force into billions of kWh the power plants at Fionnay and Nendaz work in relay.

With the current installations at Fionnay and Nendaz, the Grande Dixence complex produces a total power output of 800 MW. The Bieudron power plant enables this power output to be increased by 1,200 MW, thereby taking the total power output of the complex to 2,000 MW. Like other hydroelectric facilities, the main purpose of Cleuson-Dixence is to provide power instantly, on demand. In just 4 minutes, the installation is able to provide the network with power equivalent to that of a nuclear power station!

The energy produced across all the Grande Dixence-Cleuson-Dixence facilities reaches more than 2 billion kWh per year, which corresponds to the average annual consumption of 500,000 households.

- Collecting works
- Storage
- Production
- - - Non-operating power plant



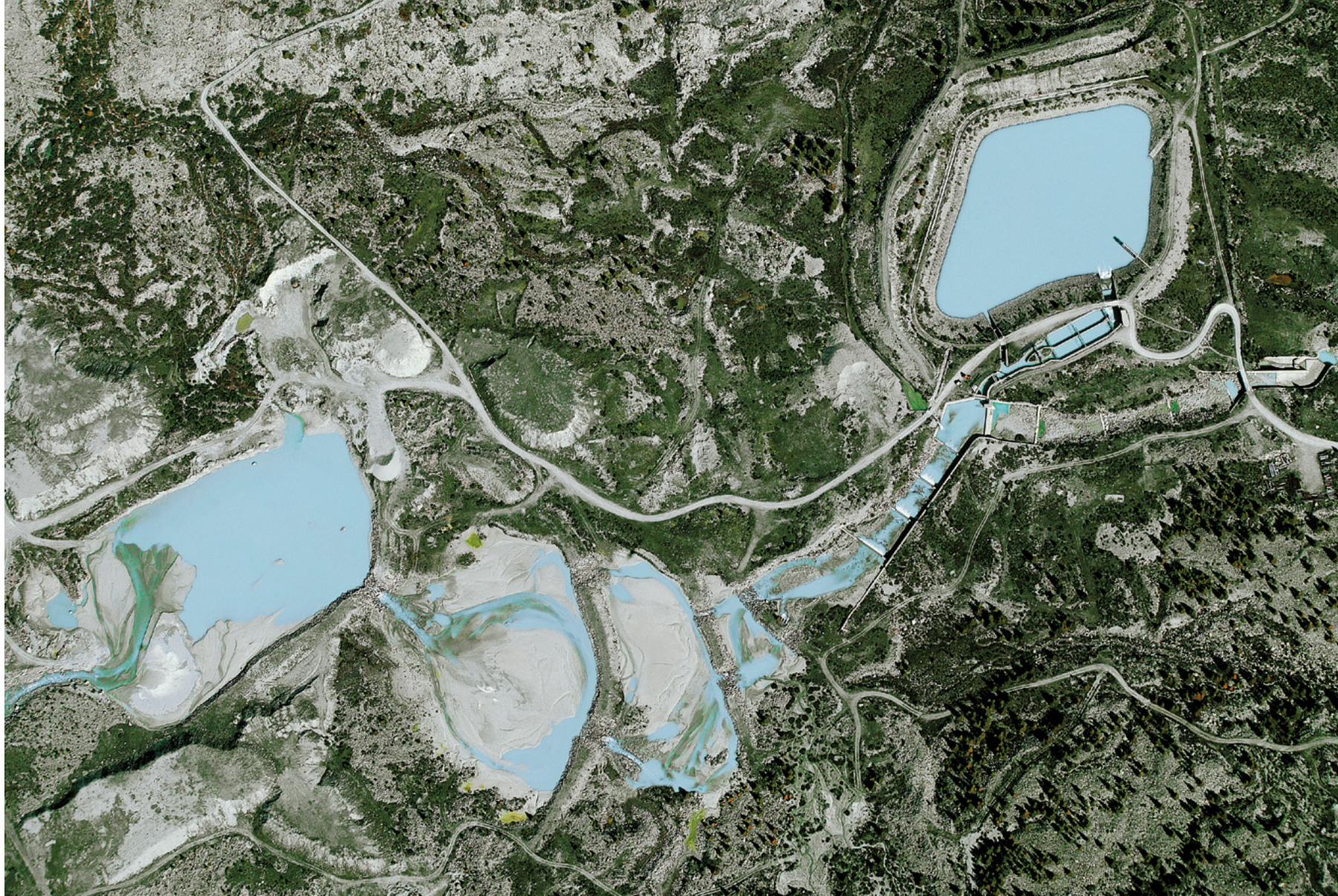


Inlet of the collector in the Lac des Dix in Cheillon



Bringing together waters from a catchment area of 420 km<sup>2</sup>, two-thirds of which is covered in glaciers, that is the task of the facility's network collector. 100 kilometres of galleries, including a main tunnel which is 24 kilometres long, at an altitude of 2,400 metres, in the heart of the mountain, bring together the waters which run between the Mischabel, Matterhorn and Mont Gelé mountains. 35 glaciers therefore supply the facility's raw material, via 75 water intakes and 5 pumping plants, on average around 500 million m<sup>3</sup> of water every year.

Stafel pumping station, at the foot of the Zermatt valley

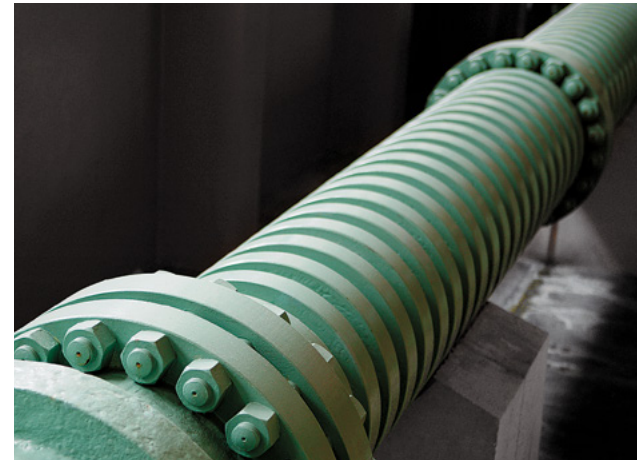




Running the complex to maximise performance requires a fine balance between the demand for economy and technical capacities. The operating centres at Grande Dixence and Alpiq receive the constant information required for management and supervision of the whole facility directly from the

various plants as well as from numerous measuring points. They are also able to intervene at any moment on any of the operating components.

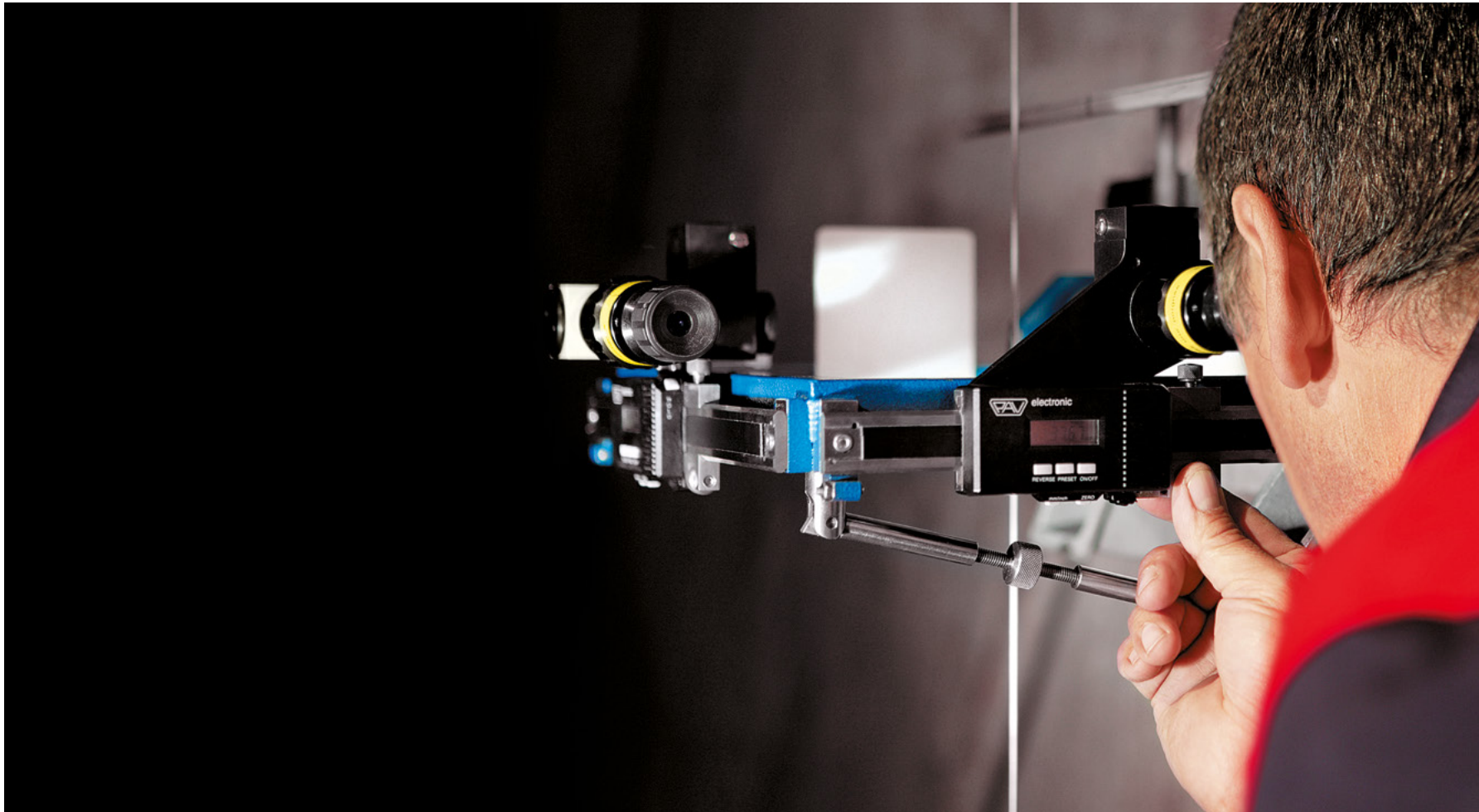
400 billion litres of water : the largest reservoir in Switzerland





The artificial lakes of Dix (left) and Cleuson (right) are the keystone of the Grande Dixence complex

A dam inspection officer measures the movement of the dam using a plumb line



Towering at 285 m, the Grande Dixence is the highest gravity dam in the world. It retains 400 million m<sup>3</sup> of water. It forms the largest artificial lake in Switzerland (in volume). This concrete wall has a volume of 6 million m<sup>3</sup>, the base is 200 m thick and the top of the dam is 700 m long, and it weighs 15 million tonnes. Inside the wall of the dam, there are 32 kilometres of tunnels and inspection chambers which allow the dam supervisors to continuously inspect the facility.

The Cleuson buttress dam is a hollow gravity dam which is 87m tall. It retains 20 million m<sup>3</sup> of water from a catchment area including the Printze river and its influents on the left bank up to Tordin.



Storage lakes are a reserve of energy available on demand. While nuclear power plants and run-of-river hydroelectric power plants produce ribbon power, 24 hours a day, storage power plants make it possible to generate what is known as peak and regulating energy that is available as quickly as possible and can flexibly compensate for fluctuations in electricity demand. Particularly with the development of new renewable energies, such as solar and wind power, whose production is intermittent and random, and the gradual decentralisation of power generation to many smaller units, storage power plants help to provide the right amount of electricity around the clock.



The facility has 3 production plants with a total power output of 2000 MW (Fionnay in the Bagnes valley, Nendaz and Bieudron on the banks of the river Rhône at Riddes). After fulfilling their mission and driving the turbines, the waters are returned to the river Rhône. The energy produced by the complex represents a fifth of the electricity stored in Switzerland.

Nendaz power plant





The additional facility at Cleuson-Dixence produces two and a half times the power of the Grande Dixence and Alpiq hydroelectric complex. In less than four minutes, it is able to provide the high-voltage electricity network with the same level of power as a large nuclear power station. It is able to produce the peaks of power that the network needs, at times where there is a high demand for energy. In a class of its own, it offers an alternative which can overcome the weaknesses of other production methods or difficulties in importing electricity.

The Cleuson-Dixence complex is therefore able to increase the average power production by 1,200 MW, almost tripling the water flow through the turbines. Built between 1993 and 1998, it consists of a new water intake drilled through the Grande Dixence dam, a 15.8 km long headrace gallery, a 4.3 km long penstock and an underground plant located on the bank of the river Rhône, at Bieudron, next to the Nendaz power plant, property of Grande Dixence.



Construction of the Cleuson-Dixence facility  
Left: Bieudron power plant







The current facility has contributed to the creation of an extended nature reserve in the Val des Dix, filled with rich and varied flora and fauna. The Cleuson-Dixence has been subject to various major ecological offsetting measures to preserve the environment. These measures consist of cleaning up the Dixence, creating numerous biotopes, developing a nature area covering around 150,000m<sup>2</sup> close to the river Rhône and monitoring the impact on the river of returning water to it from the turbines.

Conscious of the need to limit the environmental effects of its activities as far as possible, Grande Dixence SA has undertaken to develop its own environmental management system which received ISO 14001 certification

in July 2001. The hydraulic energy which it produces has also obtained the naturemade basic "renewable energy" label (janvier 2002).

The construction of the Grande Dixence and Alpiq hydroelectric complex has contributed to the development of the mountain regions concerned. It ensures high quality electricity is supplied to the country. The licensing authorities for Grande Dixence SA collect some significant financial contributions in the form of taxes and royalties.

In addition, the Cleuson-Dixence facility is a tool which Switzerland can use as an asset to strengthen its position internationally. Finally, on expiry of the licenses, the Alpiq-Grande Dixence hydroelectric complex will become in large part the property of the communes which granted the licences.



# THE PARTNER COMPANIES

## GRANDE DIXENCE SA PARTNERS

The energy produced by Grande Dixence SA is supplied in its entirety to the four partner companies which have the share capital of the company (300 million CHF), i.e.:

60 %

**ALPIQ SUISSE SA, LAUSANNE**

**ALPIQ**

13 1/3 %

**AXPO POWER AG, BADEN**

**axpo**

13 1/3 %

**BKW ENERGIE AG, BERNE**

**BKW**

13 1/3 %

**IWB INDUSTRIELLE WERKE BASEL, BÂLE**

**iwb**

## GRANDE DIXENCE SA SHAREHOLDING PORTFOLIO

45

- **Elektrizitätswerk Zermatt AG (EWZ)**, industrial services for the municipality of Zermatt, with 45 % of the share capital held since November 2001. This partnership has allowed EWZ and Grande Dixence SA to develop synergies to exploit and process the water in the Zermatt basin.
- **HYDRO Exploitation SA**, created in June 2002 jointly with EOS Holding and FMV SA, joined in 2007 by Romande Energie Holding, to manage their facilities. Grande Dixence SA holds 35 % of the share capital.
- **Cleuson-Dixence**, an ordinary partnership created jointly with EOS in 1992 to increase the capacity for electricity production. Grande Dixence SA's holding is 15/22.
- **Forces Motrices de la Borgne SA (FMdB)**, with 29 % of the share capital since January 2009. FmdB owns the Bramois development, located downstream of the Grande Dixence installations, and uses the waters of the Borgne river. FmdB's other shareholders are the communes of Hérémence, St-Martin, Vex, Mont-Noble and Sion (51%) and the company FMV SA (20%).



# CONTACT INFORMATION

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Activities at the Grande Dixence dam	+41 27 328 43 43	<a href="http://www.visit-grande-dixence.ch">www.visit-grande-dixence.ch</a>

