

erneuerbare⁺ Kühtai

Energy with a future



⁺
Information brochure about
the Kühtai expansion project



⁺
Photo montage of the new
Kühtai reservoir with dam

A changing world: our tasks

The effects of climate change, including rising temperatures and extreme weather conditions (drought, floods, etc.), are noticeable and cannot be denied anymore. If we want to counteract this development and make sure our planet is still liveable in the future, we must change our view on many social areas – especially when it comes to the design of our energy systems. This means that we must build on sustainable and renewable energy sources, such as wind power, photovoltaics and hydropower, in the future instead of fossil fuels.

Due to the mountains, streams and rivers in Tyrol, hydropower is one of the most valuable renewable energy sources from which clean, zero-carbon, environmentally friendly electricity can be gained. At the same time, the energy strategy of the Regional Government of Tyrol involves the energy supply becoming largely autonomous, the available energy being used efficiently and economically, and the energy demand of Tyrol being covered fully by these renewable energy sources by 2050.

For that reason, here at TIWAG, we are expanding the existing Sellrain-Silz power plant group. A project that is allowing us to shape the energy supply of Tyrol in a more independent, safe and environmentally friendly way and in turn make an important contribution to the energy transition. Using renewable energy generated from Tyrolean hydropower will secure the energy supply for future generations.

Our aspiration is to head towards a secure energy future with expertise and consideration.

We are securing the energy of our future. And the future of our energy.

Advancing the energy transition

It is one of the greatest challenges of our time to achieve supply security with renewable, zero-carbon sources of energy rather than with fossil fuels like in the past. However, since wind and solar energy fluctuate heavily or are even unavailable at times, we require reliable balancing and backup energy. This energy is provided safely and securely in a highly flexible way by storage power plants and by pumped storage power plants in particular.

Ensuring supply security

Electricity supply security means that there is a balance of production and consumption at all times and that we become ever less dependent on foreign energy imports. The Sellrain-Silz power plant group can achieve this by generating energy at any time, on demand, flexibly and at very short notice, as the installation has proven ever since it first opened in 1981. The expansion with a third reservoir and an additional pumped storage power plant will considerably increase this critical capacity and flexibility.

Minimising interventions

Every expansion of hydropower inevitably comes with interventions in nature. However, important parts of the infrastructure required are already available in Kühtai. Existing roads and electricity lines can be used during construction and in subsequent operation. This also means less impact on our natural environment.

Increasing efficiency

At TIWAG, we have been operating hydropower plants for almost 100 years and we are continuously striving to improve the efficiency of our plants. With our expansion project, 216 million kWh of renewable energy will be supplied to the electricity grid every year. What is more, the efficiency of the existing plant will increase sustainably by 15 million kWh per year.

Giving the Tyrolean economy a boost

Relying on local hydropower ultimately means investing in the domestic economy, creating jobs and promoting regional development. Our aim is to help shape not only the sustainable supply of electricity in Tyrol but the sustainable future of Tyrol overall.

Creating a balance

Several measures are required to compensate for the inevitable ecological interventions, for example, improvements to alpine pastures and forests in Kühtai, the restoration of built-up watercourse sections of the Inn river and the Ötztaler Ache river, and the conversion of existing transverse river structures to ensure the safe passage of fish.

↖ Silz power plant

Silz headrace tunnel

↖ Ötztal valley

↑ Inntal valley

↗ Sellraintal valley

The expansion project in Kühtai will contribute to the energy transition not just in Tyrol but also in the whole of Austria and in Europe.



2019

Start of preliminary construction work



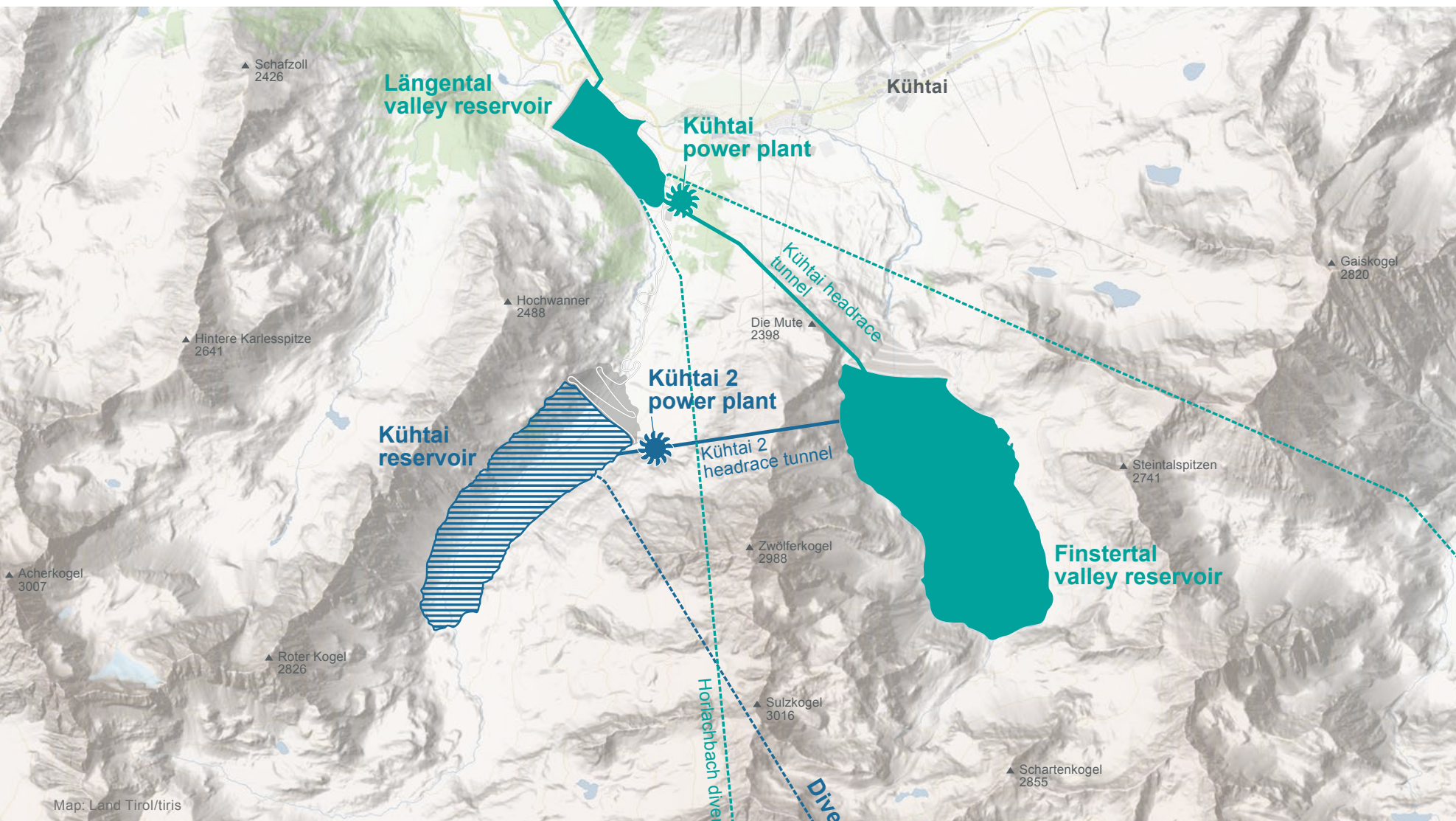
2021

Start of main construction work



127,000 tonnes of carbon

emissions avoided each year



Map: Land Tirol/Tirol

Existing plant

Expansion project

Overview of plant sections:

The new Kühtai 2 pumped storage power plant and the new Kühtai reservoir can produce renewable energy flexibly and on demand and can be used for the intermediate storage of electricity from other renewable sources.

The natural inflow of additional water from the middle of the Ötztal valley and the end of the Stubaital valley will considerably increase electricity production from the expanded power plant group.

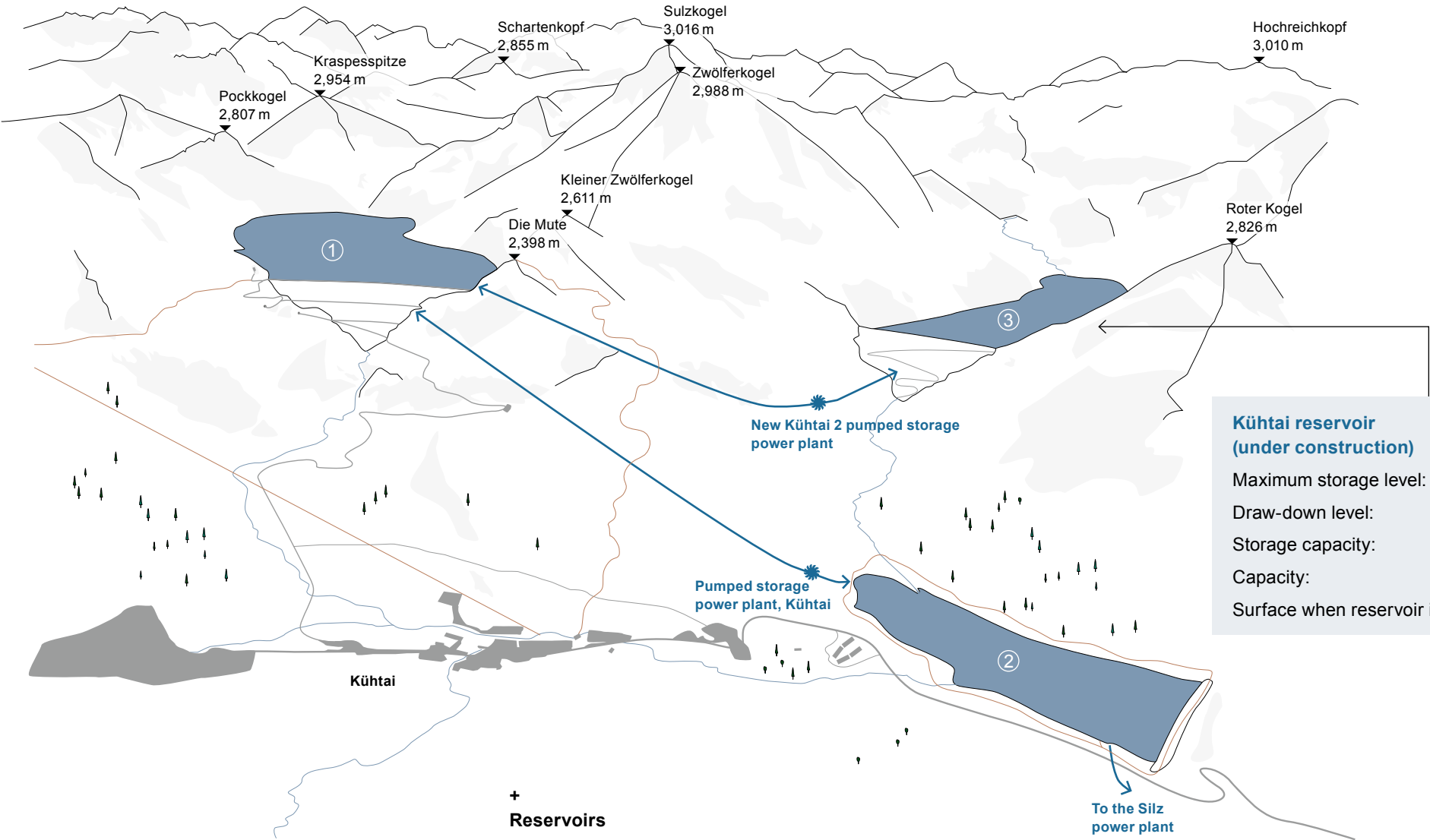
The new components:

- Kühtai reservoir with a rockfill dam
- Kühtai 2 pumped storage power plant
- Diversion tunnel with six water intakes

Melach diversion tunnel

The new Kühtai reservoir with a rockfill dam

With a usable storage capacity of about 31 million m³, the new Kühtai reservoir is about half the size of the existing Finstertal valley reservoir. The dam is designed as a rockfill dam with central earth core sealing and a height of 113 m (from the original valley floor to the dam crest). The maximum storage level is at 2,140 m above sea level (asl). All the material used for the rockfill dam is extracted on site from the future reservoir and the tunnel excavation. Similar to the two existing dams, natural stone and structural elements are used for the downstream dam surface to blend in the structure with the natural surroundings as effectively as possible.

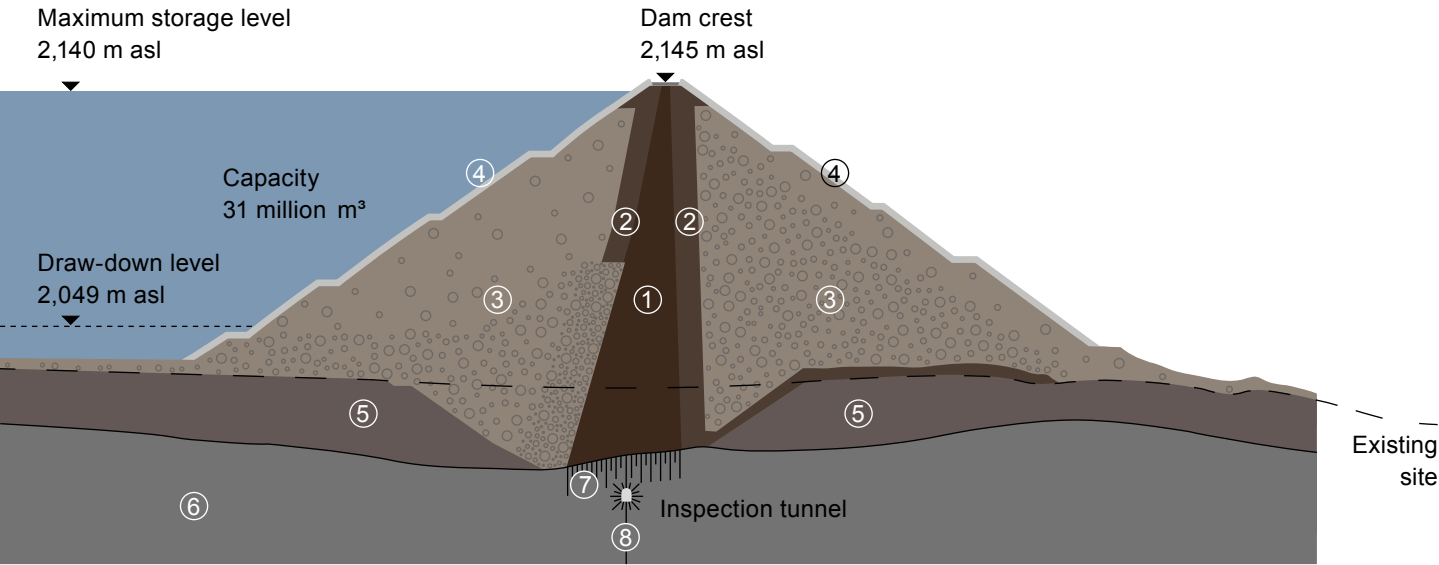


Kühtai reservoir (under construction)	
Maximum storage level:	2,140 m asl
Draw-down level:	2,049 m asl
Storage capacity:	33 million m³
Capacity:	31 million m³
Surface when reservoir is full:	59.5 ha

Kühtai dam	
Dam crest height:	2,145 m asl
Dam crest length:	510 m
Dam crest width:	10 m
Embankment slope:	upstream 1:1.6 / downstream 1:1.6
Sealing:	mineral core
Bulk volume:	6.9 million m³

- + Reservoirs
- ① Finstertal valley annual storage reservoir, 60 million m³ capacity
 - ② Längental valley reservoir, 3 million m³ capacity
 - ③ Kühtai reservoir, 31 million m³ capacity

The dam of the Kühtai reservoir has a height of **113m**



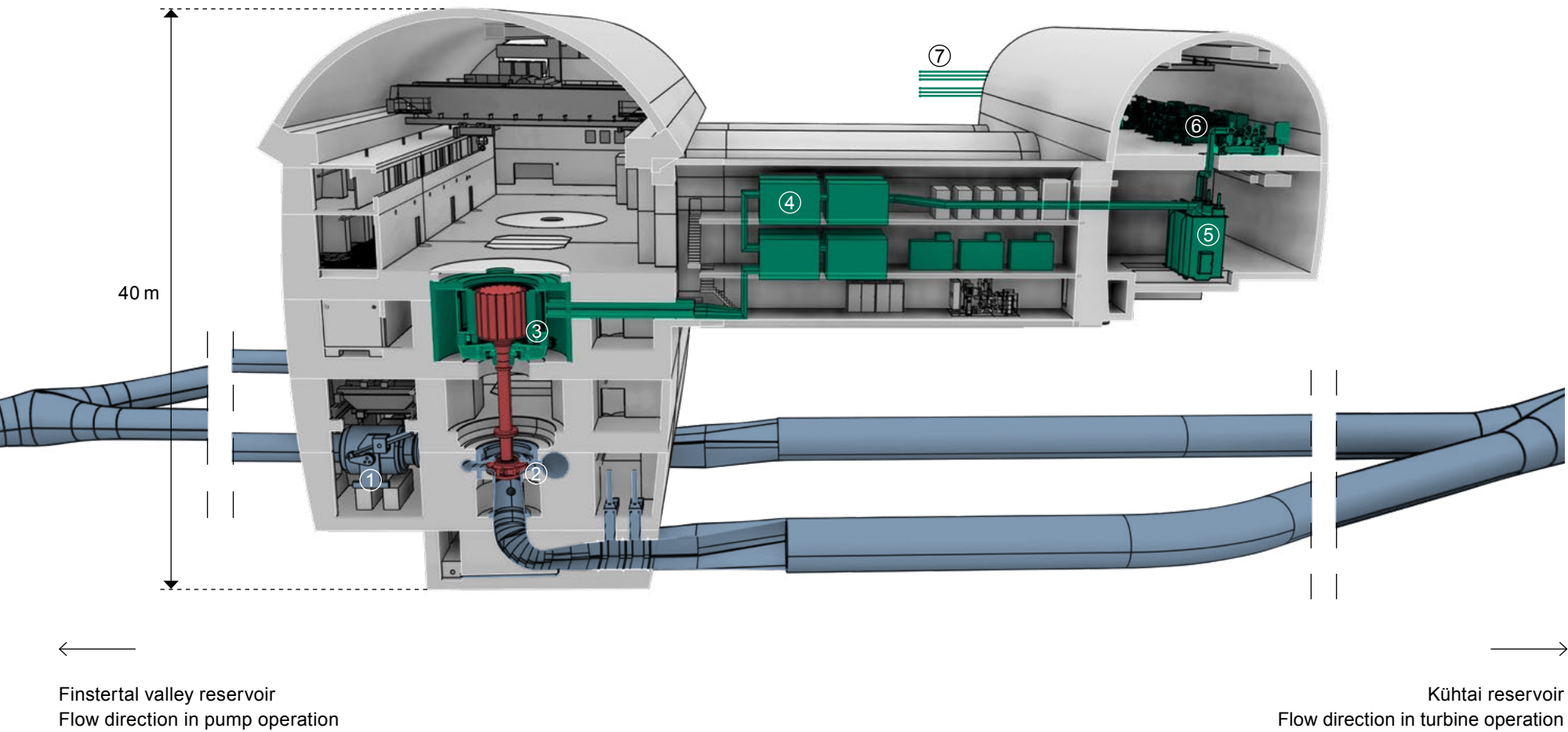
216 million kWh
of electricity from (natural) inflow will be generated by the expansion project

- + Structure
- ① Impervious core
 - ② Filter
 - ③ Shell zone
 - ④ Rip rap
 - ⑤ Solid ground
 - ⑥ Rock foundation
 - ⑦ Grout curtain
 - ⑧ Underground shielding construction

Approx. 50%
more storage volume

+ Components

- Hydraulic power
- Mechanical power
- Electrical power



The power plant within the mountain

The Kühltai 2 power plant with its headrace tunnel – a tunnel 4.5 m in diameter – connects the new Kühltai reservoir with the existing Finstertal valley reservoir. The power plant is built completely underground in a rock cavern and is designed for pumped storage operation.

Two pump turbines are at the heart of the power plant. These turbines are reversible, meaning their function and direction of rotation can be turned around. In turbine operation, up to 90 m³/s of water flows in the headrace tunnel from the Finstertal valley reservoir to the Kühltai reservoir, with the turbine driving the generator and causing the generator to feed electricity into the grid.

In pump operation, the generator turns into a motor that draws electricity from the grid. The turbine is now driven by the generator and acts as a pump, pumping water from the Kühltai reservoir up to the Finstertal valley reservoir.

This makes it possible to store water for electricity production later, similar to a storage battery but in much larger quantities. A short underground 220 kV cable supplies electrical power to the existing Kühltai power plant, which is already connected to the electricity grid. There is no need for a new high-voltage line to the Inntal valley. This is only one of many advantages of the location with its existing power plants and infrastructure.

+ Cavern power plant (cross-section)

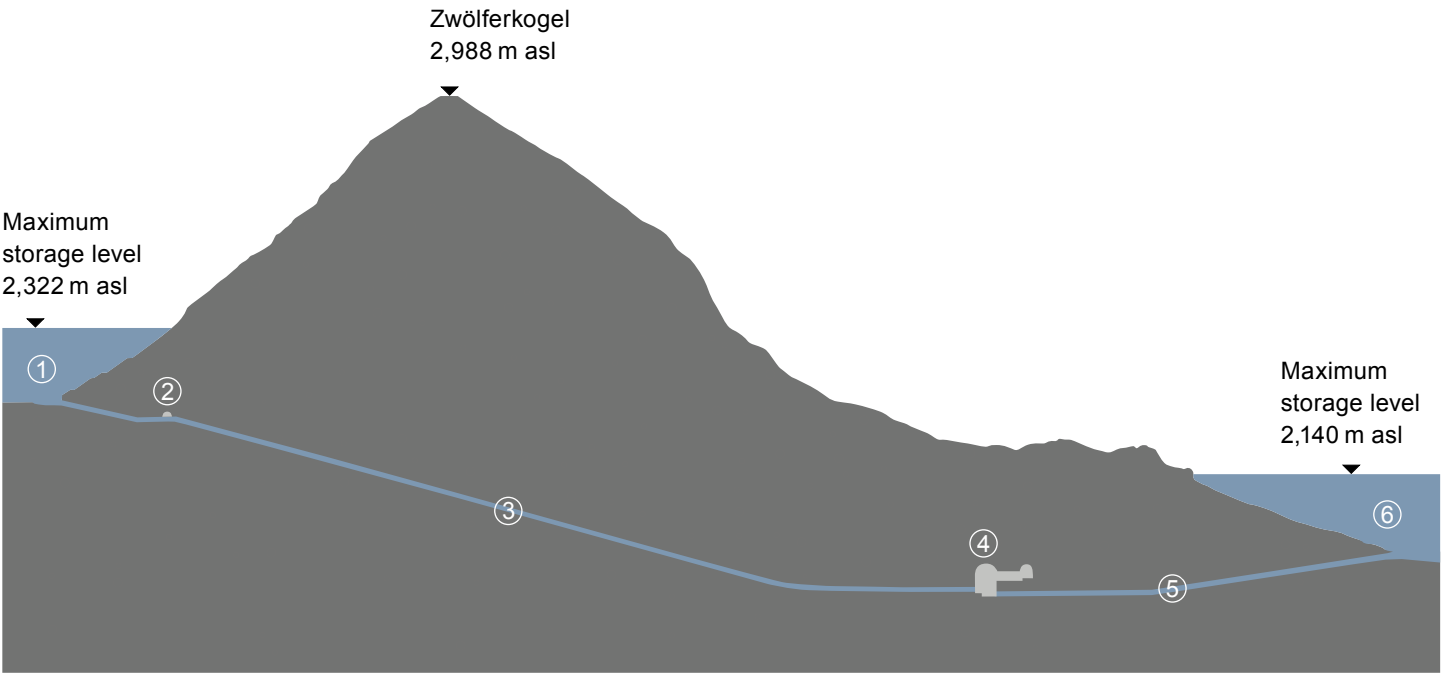
- ① Spherical valve
- ② Pump turbine
- ③ Motor generator
- ④ Full-power converter
- ⑤ Transformer
- ⑥ Switchgear
- ⑦ Power transmission (220 kV)



80,000 m³
of rock is being excavated for the new Kühltai 2 underground cavern power plant

+ Longitudinal section overview

- ① Finstertal valley reservoir
- ② Valve chamber with safety valve
- ③ Pressure shaft
- ④ Power plant cavern
- ⑤ Tailwater tunnel
- ⑥ Kühltai reservoir

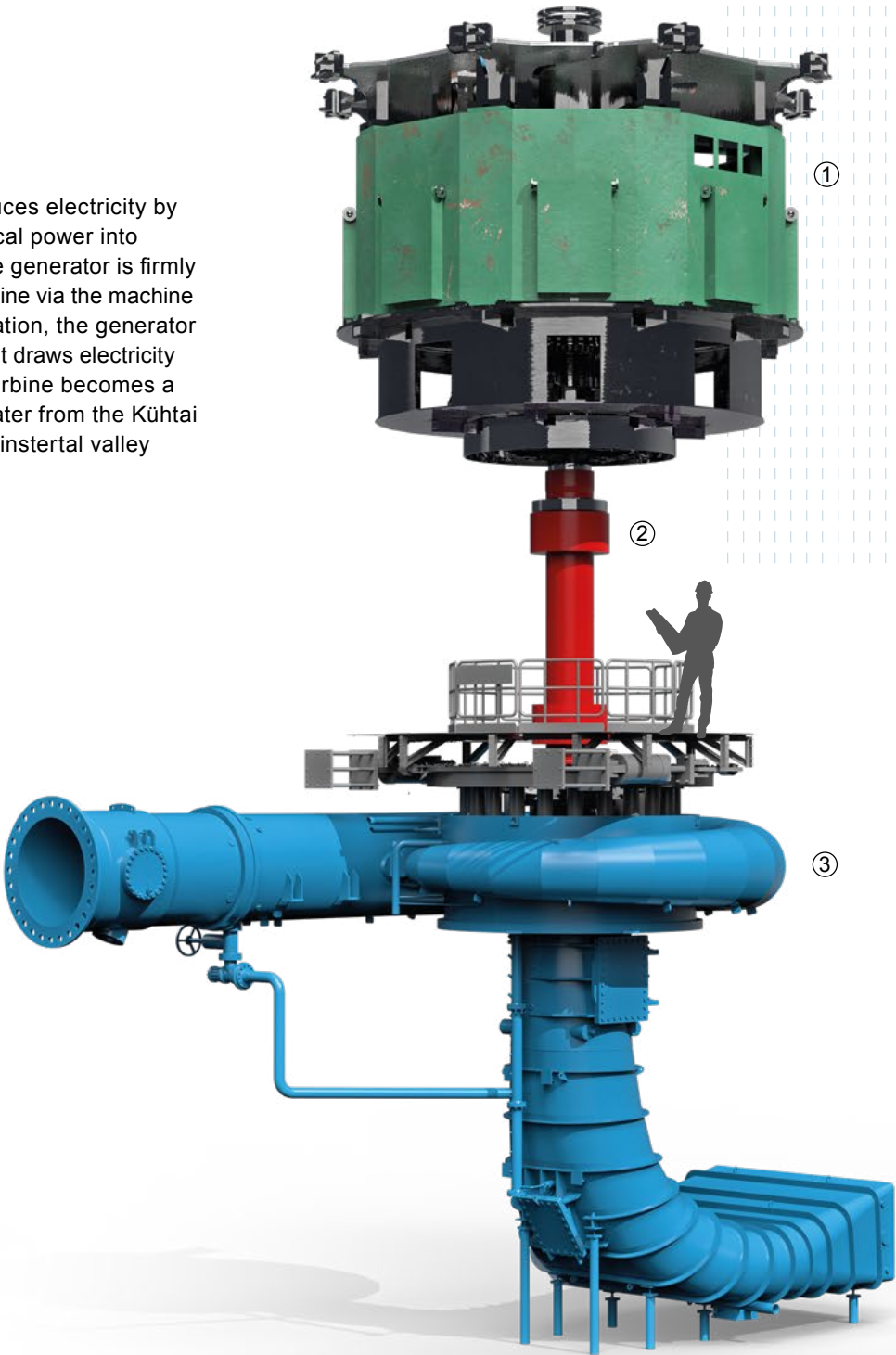


The machine set

The cavern houses mechanical and electrotechnical facilities. The power plant is designed for combined turbine and pump operation. Up to 90 m³ of water per second flows through the two machine sets. This corresponds to the volume of a living room measuring 36 m².

Motor generator

The generator produces electricity by converting mechanical power into electrical power. The generator is firmly connected to the turbine via the machine shaft. In pump operation, the generator turns into a motor that draws electricity from the grid. The turbine becomes a pump and pumps water from the Kühtai reservoir up to the Finstertal valley reservoir.



- + Machine set
- ① Motor generator
 - ② Machine shaft for power transmission
 - ③ Pump turbine

← Flow direction in pump operation → Flow direction in turbine operation

Machine sets	
Amount:	2
Turbine type:	reversible pump turbine
Installed power:	190 MW
Average development power	
- during turbine operation:	130 MW
- during pump operation:	140 MW
Gross head	
- minimum:	100 m
- medium:	178 m
- maximum:	274 m
Speed:	variable
Generator:	synchronous generator with full converter in stator circuits



Pump turbine

The turbine converts the flow of water into a rotary motion. It drives the generator. Two reversible pump turbines are installed in the Kühtai 2 power plant. Reversible means that the turbines are able to change their direction of rotation and switch to the functional mode of a pump.

+ Take a closer look in our free augmented reality app



Apple App Store



Google Play Store

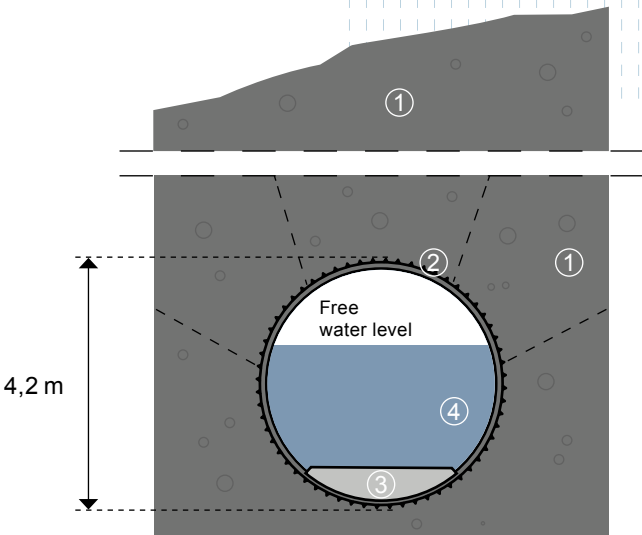
Diversion tunnel with six water intakes

The diversion tunnel – a tunnel measuring 4.2 m in diameter and 25.5 km in length – with its six water intakes opens up an additional intake area in the central, eastern part of the Ötztal valley and the end of the Stubaital valley. The harnessed water is fed into the Kühtai reservoir at a slight gradient. Two of the water intakes are situated slightly below the diversion tunnel due to local conditions, so a pumping station is used to raise the water drawn off there to the level of the diversion tunnel.

As a general principle, the amount of water drawn off at the intakes conforms to ecologically compatible levels. Natural flow dynamics are maintained even if at a lower level. During the winter months, no water is drawn off at all.



The diversion tunnel will be 25.5 km long.



- + **Diversion tunnel (cross-section)**
- ① Surrounding rock
 - ② Excavation and rock support according to the geological conditions (shotcrete, construction steel lattice, steel arches, rock bolt)
 - ③ Prefabricated concrete element (invert segment)
 - ④ Water (12.4 m³/s with maximum volume of water drawn off at the six water intakes)



+ The diversion tunnel immediately behind the cutter head of the tunnel boring machine



+ The ALESJA tunnel boring machine is being prepared for use



60.7 km² additional intake area

+ Inspection of the already constructed part of the diversion tunnel during the construction phase



To the time lapse TBM structure



+
Mitigation and compensation measures

Protecting our nature

No project this large can be carried out without having an influence on the surrounding landscape. However, in order to keep the impact as low as possible, we have not only carried out comprehensive measures during the planning stage, but we have also developed an extensive list of mitigation and compensation measures, which were also an important part of the environmental impact declaration and subsequently stipulated in the environmental impact assessment.

Water ecological measures to improve the habitat for fish and other living creatures in and around bodies of water are being carried out. The Inn river between Stams and Rietz is being widened, for example, enabling natural and dynamic development. At several spots, the estuary areas of the side streams are being redesigned, allowing the fish to migrate back from the Inn river into these watercourses. In Langkampfen, a three-hectare area is being restored, enabling the development and expansion of the special protection area Innauen. In addition to comprehensive measures along the Tyrolean main watercourses, a number of water ecological improvements and restoration measures along the Ötztaler Ache river and streams along the Stubaital valley and Sulztal valley are planned.

To compensate as much as possible for interventions in the natural balance, new biotopes for amphibians are being created, wetland habitats are being restored and valuable soils and plants are being protected, for example. In addition, comprehensive forest and alpine pasture measures to compensate for the interventions in agricultural areas are being planned and, in many cases, already being carried out.



+
The beetles are attracted with light and other things so they can be captured and monitored.



+
Small section of the 3 km long Stams-Rietz Inn revitalisation showing a new branch.



Water ecology



Bedload



Fishery



Animal ecology



Plant ecology

+
Monitoring programmes
During the complete construction phase and beyond, surveys and studies are being carried out in the areas above.



+
Europe's largest re-regulation reservoir close to Silz will significantly improve the water ecological situation along the Inn river from 2024 onwards (image shows re-regulation reservoir under construction).

+
The amphibians are gently collected during their most active time of the day in the Längental valley.



+ Mitigation and compensation measures

We protect, mitigate, compensate and improve

+ Overview of mitigation and compensation measures that will be implemented as part of the Kühtai expansion project

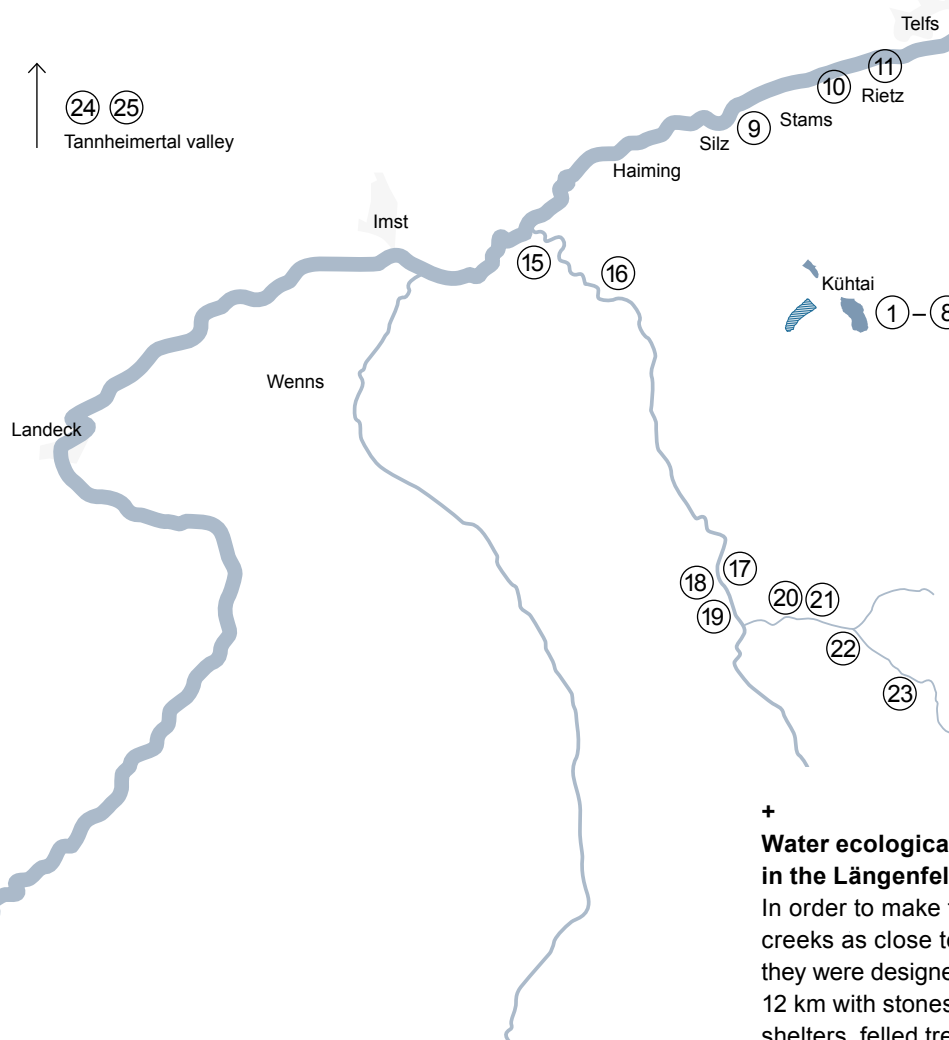
+ **Restoration of the Ötztaler Ache river near Sautens**
The Ötztaler Ache river was widened over a length of approx. 200 m and a historical branch was restored. This area was restored to its natural state by planting various native shrub and tree species. Deadwood was also left in this area to create additional structures and diverse habitats for animals and plants.



+ **Langkampfen Innauen revitalisation**
Part of the water of an irrigation creek is diverted through a new pipe under the motorway and a new body of water then meanders along a length of about 1.3 km, which is passable for fish, to the Inn river. A diversely structured flood-plain landscape is being created as a valuable addition to the existing nature reserve (Kufsteiner and Langkampfener Innauen).

Mitigation and compensation measures

- ① Creation of new biotopes for amphibians
- ② Transplantation of wetland soils with low moors
- ③ Initial areas for low moors
- ④ Improvement of alpine pastures
- ⑤ Forest improvement through afforestation
- ⑥ Preservation of a plant pool for recultivation
- ⑦ Species conservation measures through ant migration
- ⑧ Addition of a transmitter to chamois
- ⑨ Re-regulation reservoir to reduce positive surge at Silz power plant
- ⑩ Revitalisation of the Inn river between Stams and Rietz
- ⑪ Rietzerbach stream estuary design
- ⑫ Pettnauer irrigation creek – connection to Inn river, passable for fish
- ⑬ Herztalbach stream – connection to Inn river, passable for fish
- ⑭ Langkampfen Innauen revitalisation
- ⑮ Brunau weir restoration and reconstruction
- ⑯ Restoration of the Ötztaler Ache river near Sautens
- ⑰ Restoration of the Ötztaler Ache river near Unterried
- ⑱ Water ecological structuring measures in the Längenfeld irrigation creeks
- ⑲ Connection of four streams in the Längenfeld irrigation system, passable for fish
- ⑳ Biotopes for amphibians at Gries
- ㉑ Connection, passable for fish, and structuring of the Tieflehnbach stream
- ㉒ Widening of the Fischbach stream above Gries
- ㉓ Measures to enhance nature conservation aspects of Sulztalalm
- ㉔ Water ecological restructuring along the Stackler Laue stream in Neustift
- ㉕ Restoration of moor habitats in Zöblen (Tannheimertal valley)



+ **Fish pass:**
In order for fish to move upstream and downstream on their natural migration without hindrance, alternative routes to the natural course of the river have been established at all power plants.

+ **Re-regulation reservoir:**
Depending on the operation capacity of a power plant, the amount of water backflow into the Inn river changes. In order to minimise the size of any surge waves, re-regulation reservoirs are constructed, and the water is then returned to the Inn river in a regulated way.

+ **Water ecological structuring measures in the Längenfeld irrigation creeks**
In order to make the Längenfeld irrigation creeks as close to natural as possible, they were designed over a length of approx. 12 km with stones, wooden pilings, fish shelters, felled trees, branch packs, etc. in different construction types so that as many animal and plant species as possible can find new habitats.



Project milestones

We can look back on an extensive project history already. Submission planning started in 2006, with submission of the expansion project for environmental impact assessment and approval following in 2009. Construction started in September 2019 with the initial preparatory work. In April 2021, the main construction work started. The completion of the project and commissioning of the power plant are scheduled for 2026.

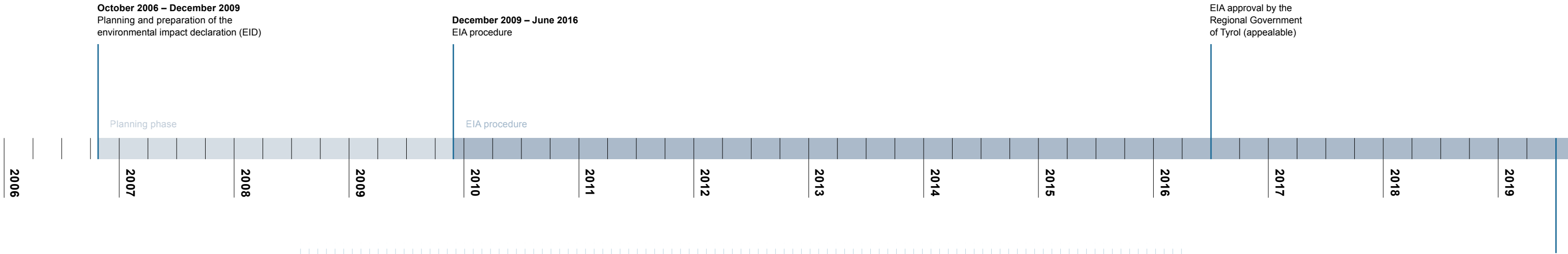
Environmental impact assessment (EIA)
The EIA is carried out by the relevant authority. In the case of the K htai expansion project, the Regional Government of Tyrol is the authority in charge. In the framework of this procedure, the potential environmental impact of large-scale (construction) projects is assessed on the technical basis of an environmental impact declaration (EID). All documents are made available to the public. This does not only include the population directly affected by the project. Environmental advocacy and environmental organisations are also integrated in the EIA through citizen participation initiatives and public discussions.



Watch this explanation video:
What exactly is an environmental impact assessment?



June 2016
EIA approval by the Regional Government of Tyrol (appealable)



Environmental impact declaration (EID)
With some specific, usually large-scale construction projects, the relevant project applicant (in this case TIWAG) must also submit an EID to the relevant authority in addition to the project description. An EID must comprise a detailed project description and at the same time also show the alternative solutions which have been examined. Starting with the description of the current status, the impact of the project is described and measures to prevent, minimise and compensate for this impact are developed. The result of the EID is an assessment of the environmental impact of the project.



> 10,000 pages
were written for the reports in the environmental impact declaration (EID) for the K htai expansion project



Hundreds of experts
from different disciplines were involved in drafting the environmental impact declaration (EID)



Autumn 2022
Work on the impervious core of the rockfill dam at the end of the first pouring season



June 2023
The structural steel work on the pump turbine spirals is proceeding according to plan alongside construction



Mid 2026
Commissioning of power plant



500 people
are employed here



The connection of the impervious core to the rock foundation is **approx. 40m** wide

September 2019
Start of preliminary work

Construction phase

2020

2021

2022

2023

2024

2025

2026

2027

2028

June 2020
Confirmation of EIA approval by Supreme Administrative Court

March 2022
The TBM started driving at the end of March 2022

Spring 2023
The cavity blasted out of the rock for the power plant

By the end of 2026
Completion of construction

April 2021
Start of main construction work in Kühtai



Take a look at the photo galleries and videos of the construction work in our media centre.



+ Renewable energy sources

Energy is not the same as electricity

Total consumption

- Renewable energy sources
- Non-renewable energy sources

Distribution of renewable energy sources

- Hydropower
- Wind power
- Biomass
- Solar energy
- Geothermal energy

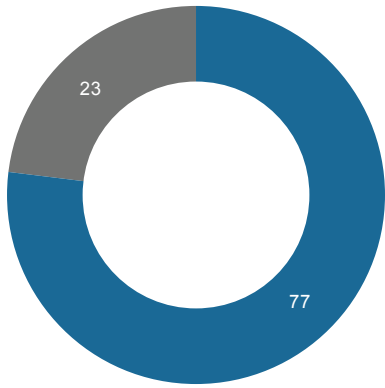
Distribution of non-renewable energy sources

- Natural gas
- Crude oil
- Carbon and coal gas
- Combustible waste
- Import balance of electrical power

Climate goal:
100 % renewable energy

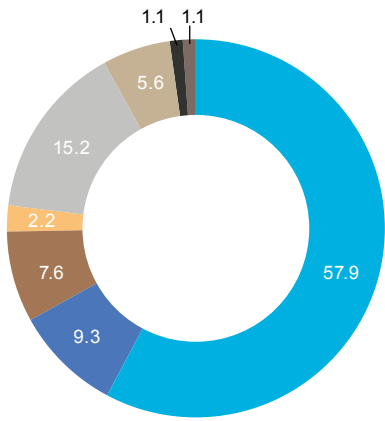
Electricity

consumption in Austria, 2019



Climate goal
2030:
To increase renewable energy from 77 % to 100 %

Distribution according to energy source (without imports)



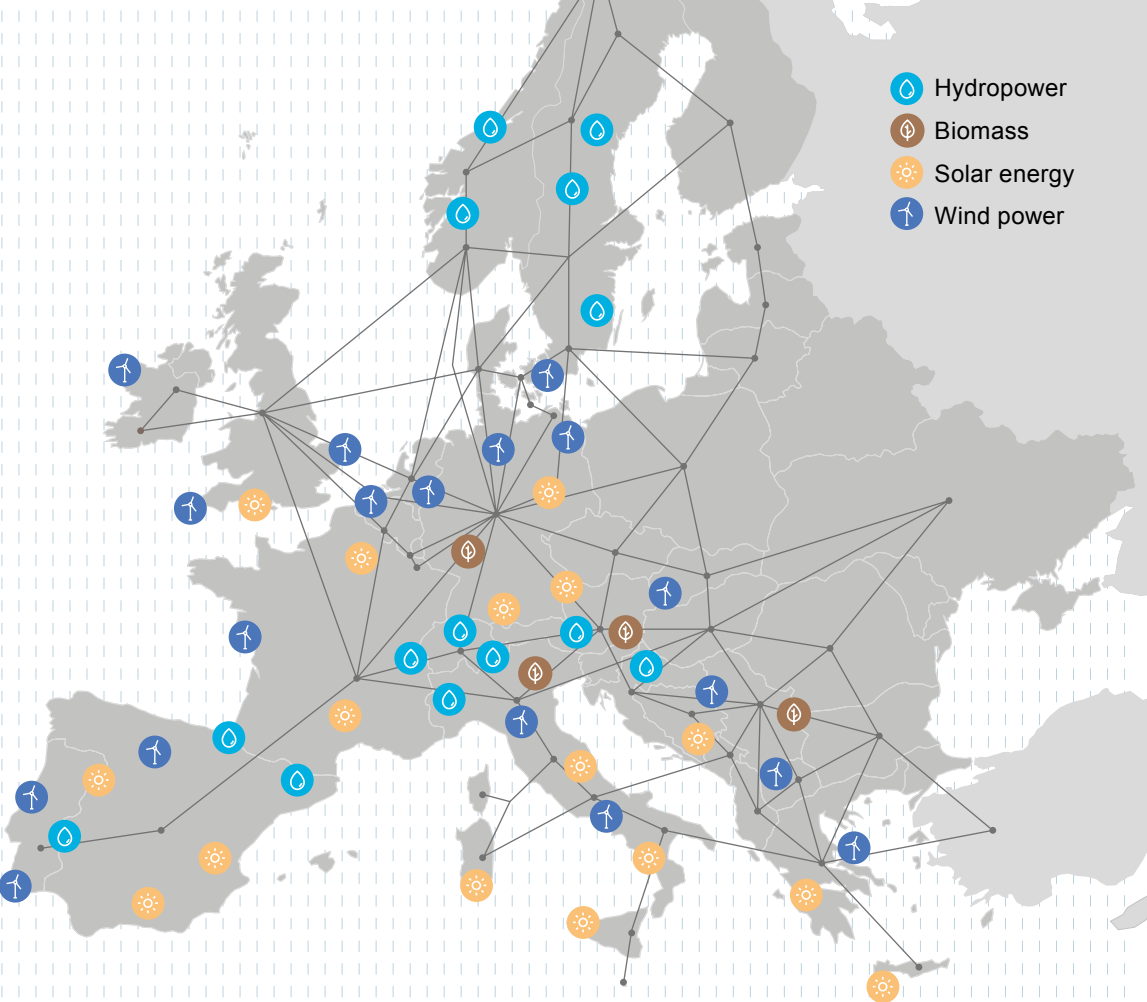
Why is an energy transition necessary?

We are right in the middle of the energy transition in Europe. Its progress is measured against the targets agreed by the European Union and Austria's #mission2030. In concrete terms, this means that by the year 2030, 100 % of the electricity consumed in Austria over a twelve-month period should come from renewable energy sources.

As for the overall energy consumed by our society, savings of up to 30 % are the target for 2030, with energy to be utilised much more efficiently. The plan is to use only completely renewable energy sources to cover the total energy consumption by the year 2050.

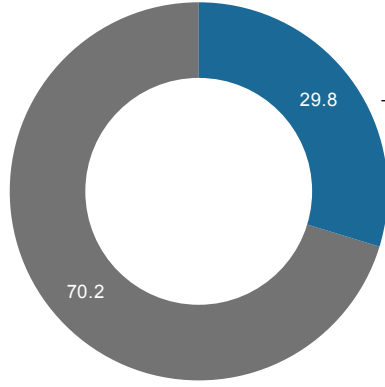
Sources for charts:
Figures in % | Last updated: 2020
Statistics Austria; bmtv.gv.at; Energie Österreich
Dates, facts and figures, 2020

Joining forces
To achieve these goals, all EU member states are called upon to contribute their individual strengths to the international energy network and to promote the most efficient production technologies on their national territory.



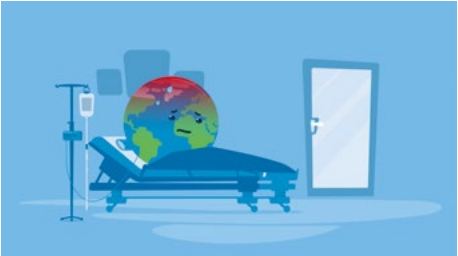
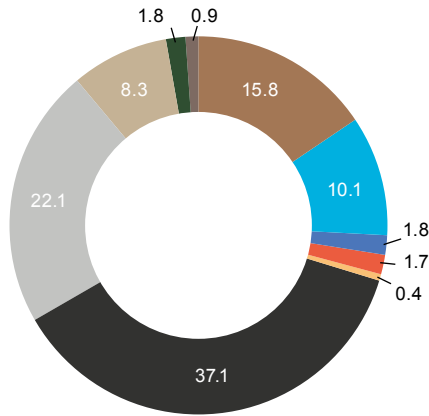
Total energy

consumption in Austria, 2019



Climate goal
2050:
increase renewable energy from 29.8 % to 100 %

Distribution according to energy source



Watch this explanation video:
Why is an energy transition necessary?



+ Use the app erneuerbare+ Kühtai to get a glimpse into the future and explore the finished plants.



Apple App Store



Google Play Store

A whole hydropower plant in your living room

Explore the project area whenever and wherever you want – conveniently on your smartphone or tablet. Not only does the brand-new app "TIWAG erneuerbare+" provide an overview of the Kühtai expansion project, but you can also use X-ray vision to visualise the pipelines and caverns deep in the mountain or take a close-up look at the generator.

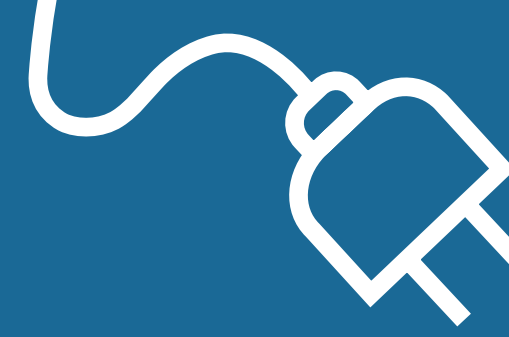
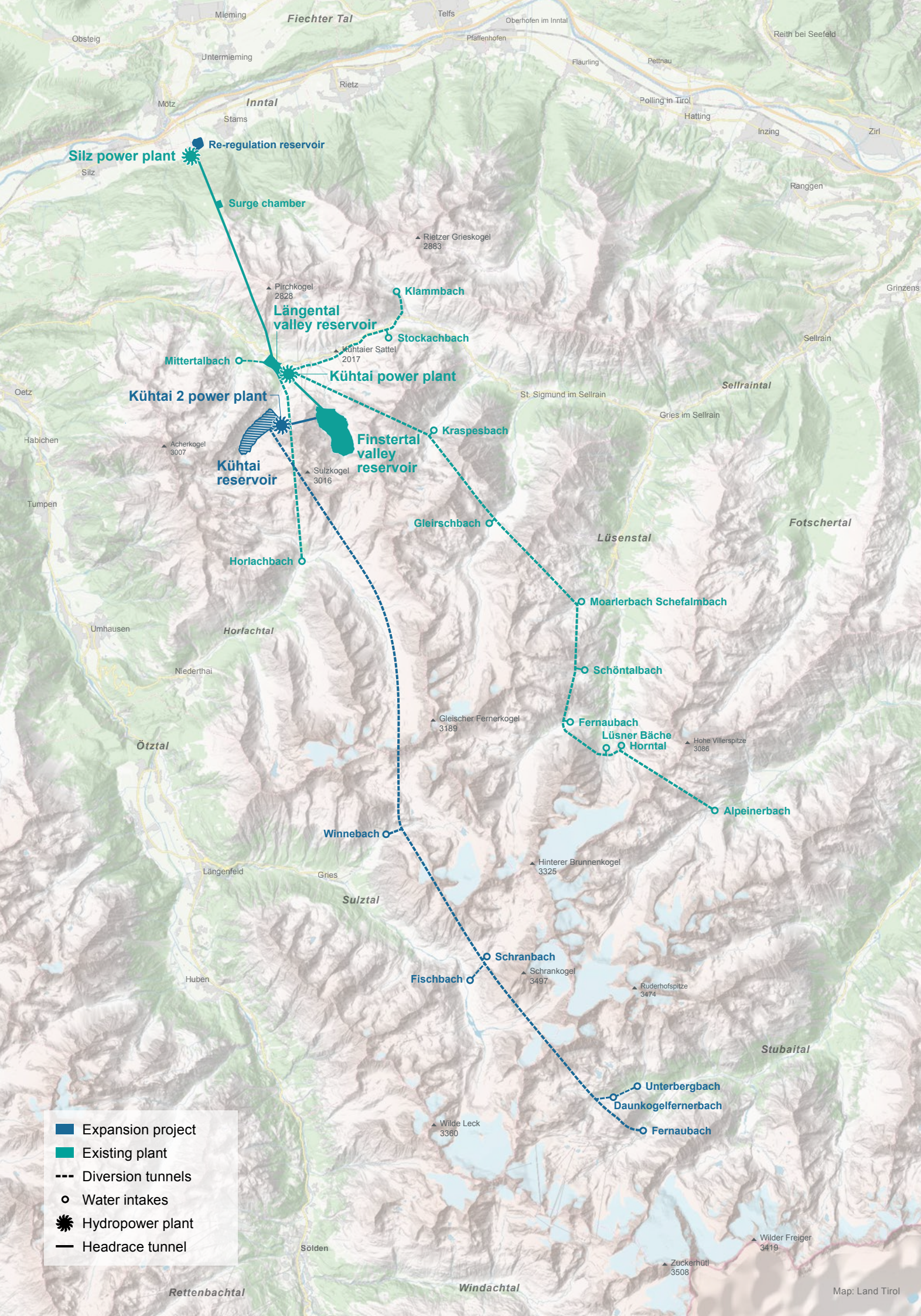
Our project website

Would you like to learn even more about the plus of hydropower in the mountains and our expansion projects? The erneuerbareplus.at website offers lots of information. Here you will find interesting background information, exciting videos and up-to-date photo galleries on the construction process.



+ Our project website:
www.erneuerbareplus.at





531 million kWh
annual production of clean electricity
from the existing power plant group

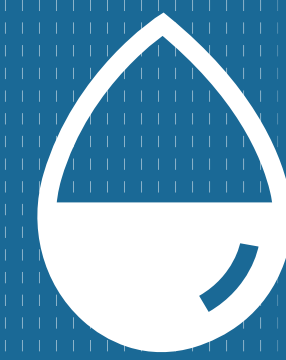
+ 216 million kWh
of electricity from natural inflow produced annually
upon completion of the expansion project

+ 15 million kWh
efficiency increase for the existing plant
through the project



erneuerbare+ Kühltal
is contributing to the
energy supply for future
generations

Around 50 %
more storage volume for added
flexibility in electricity production
and storage of other renewable
energy



+

Further information:

Would you like to find out more about the expansion project or take a closer look at the construction work?

Visit our project website:

www.erneuerbareplus.at



+

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+

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