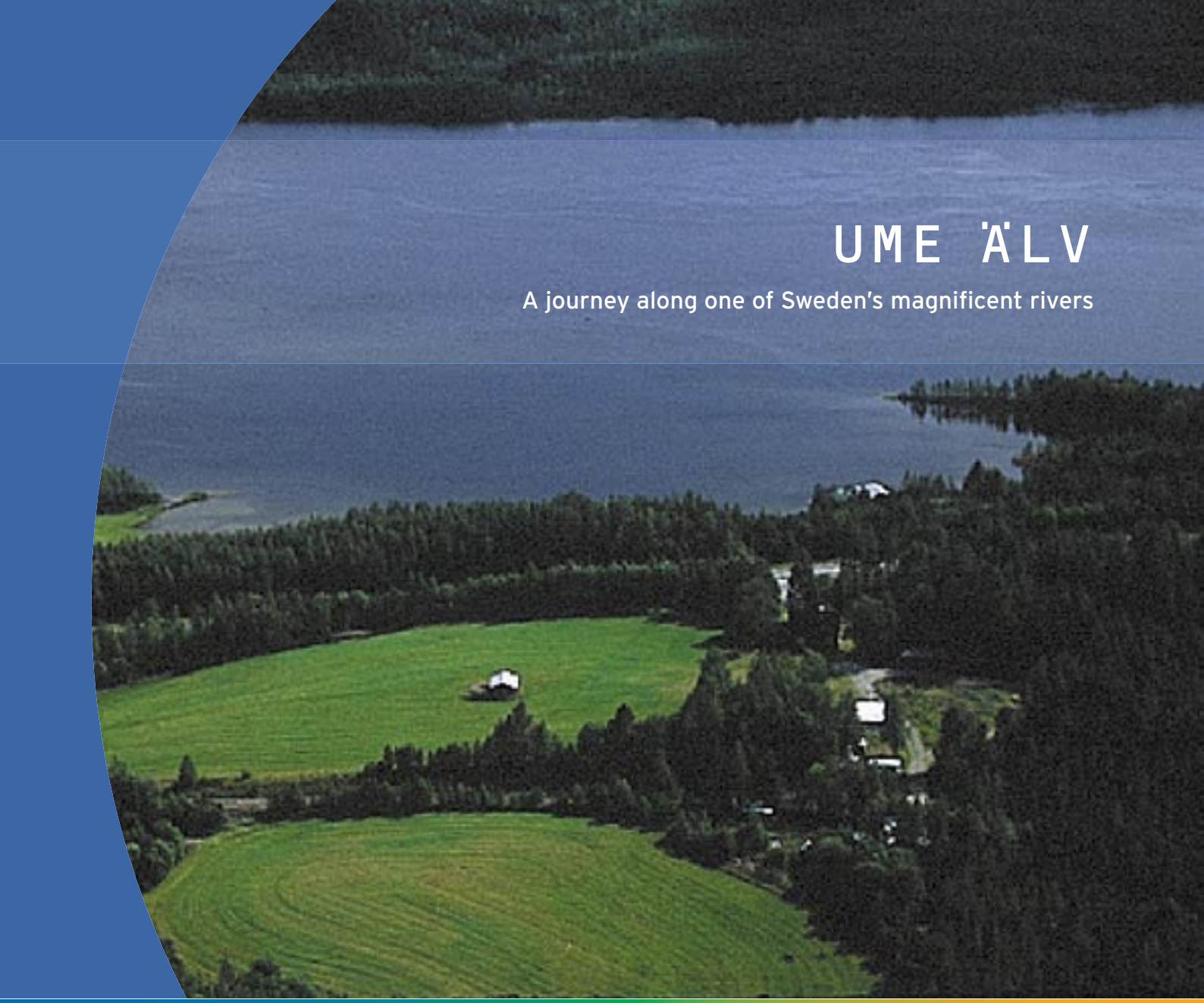


UME ÄLV

A journey along one of Sweden's magnificent rivers

VATTENFALL

UME ÄLV IS BORN IN THE CLEAR, TRANQUIL MOUNTAIN WATERS OF ÖVERUMAN. SOUTHEAST OF NASAFJÄLL, UME ÄLV'S SISTER RIVER, VINDELÄLVEN, EMBARKS ON HER OWN JOURNEY, WHILE UME ÄLV FLOWS ALL THE MORE SWIFTLY. UNRELENTING, THE RIVER RUNS ITS COURSE OVER ROCKY SHOALS, THROUGH CALM POOLS AND PAST ISLANDS BEFORE REUNITING WITH THE VINDEL BELOW VÄNNÄS.

UME ÄLV IS ACCOMPANIED BY VINDELÄLVEN FOR 444 OF ITS 470-KILOMETRE JOURNEY DOWN TO THE COAST.

VINTER REKLAMBYRA. PRINTING: GTC PRINT AB. PHOTO: ROLAND NILSSON, PER MAGNUS PERSSON/JOHNÉR BILDBYRÅ, PETER LILJA, MIKAEL LUNDGREN/NORRLANDIA AND OTHERS. ILLUSTRATION: LISA KARLSSON.

THE HISTORIC JOURNEY — FROM THE ICE AGE TO THE FUTURE.

About 12,000 years ago, the inland ice receded. The climate grew successively warmer and Scandinavia, entombed under three kilometres of ice for tens of thousands of years, would soon burgeon forth. The inland ice melted quickly, retreating to the point when, after only a couple of thousand years, eternal winter was replaced by a new landscape. Meltwater followed ancient furrows, eroding mountains and transforming the face of the land. The water deposited fertile soil along the river valleys. And where the ice had released its grip, people lost no time in finding new grounds in which to hunt and gather.

The first inhabitants, hunters and gatherers, lived well on the plentiful game and fish. Soon, they also learned to farm the fertile river valleys and, eventually, that the power of the rivers could be harnessed. Waterpower was utilized as early as the 1200s. Gristmills and sawmills were built, logs were floated downstream and the rivers became vital for transport. But their most important contribution to the development of society had yet to be realized.

With the late industrial revolution came large-scale use of electricity. For centuries, only a tiny fraction of the kinetic energy from the rivers had been utilized. Then, at the turn of the last century, engineers began to see the enormous potential of hydropower. In 1910, Sweden's first hydropower plant, Olidan, on the Göta River, began to supply power for industry and the railway. That signalled the start of the development of our rivers. Today, hydropower accounts for nearly half of Sweden's total electricity demand. In the future, hydropower will continue to play an important role, perhaps the most important role, as a renewable energy source.

The rapid melting of the inland ice contributed to the formation of river valleys and enriched the soil. For thousands of years, the rivers have played an important role in the development of society. The power of the river, once used for log driving, now accounts for nearly half of our total electricity demand.

WATER IS ON A NEVER-ENDING JOURNEY.

Waterpower is a sensible way of using a natural eco-cycle. Water vapour, which forms when the sun warms the lakes and oceans, rises to the higher, colder layers of air, where it condenses and forms clouds. When the clouds move in over the land, they release their burden in the form of rain or snow. That rain and snow is what keeps our rivers flowing. On its journey to the coast, we take advantage of the water's potential energy. Still within the eco-cycle, the water returns to the lakes and the sea, and the process begins again. Hydropower comes from a renewable source and makes use of Nature on Nature's terms.

Average annual rainfall in Sweden is between 600 and 700 mm. Abisko, on the other hand, gets about 300 mm of rain per year, which is about the same as the Gobi Desert.

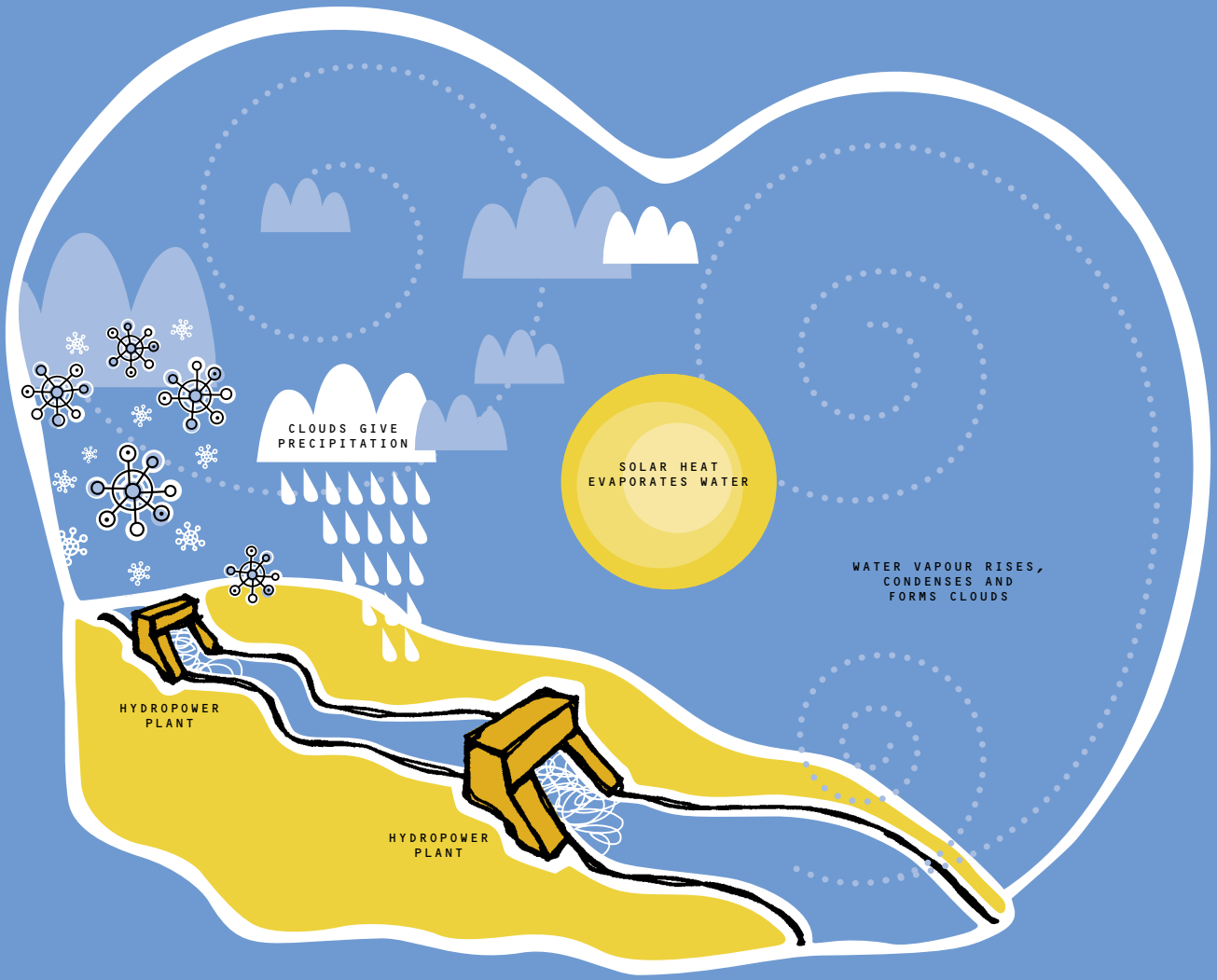
ENERGY DEMAND CONTROLS PRODUCTION.

Electricity from large-scale production cannot be stored, but must be used the instant it is produced. That is why we control hydroelectric generation with the help of reservoirs.

During the spring and early summer when the snow melts, and even during the autumn when it rains more often, huge volumes of water are stored. We can then use this water to produce electricity during the winter months, when power demand is greatest and the rivers receive no inflow from precipitation. In a river that has been developed for hydro production, water levels are controlled very carefully. The release of water from reservoirs is determined by energy demand in accordance with regulations establishing water levels and flow rates.

FOR VATTENFALL, THE ENVIRONMENT COMES FIRST.

Hydropower is a green energy source that does not harm the air we breathe or the water in our rivers. The process creates no hazardous wastes and no emissions are discharged to the air or water. Even so, hydropower production does give rise to a certain degree of environmental impact. The power stations, dams and reservoirs that are essential for utilizing the power of rivers have a great impact on the flora and fauna, both upstream and downstream. The natural reproduction of salmon species is disrupted. Vattenfall is therefore working to minimize the environmental impact caused by hydropower production. Salmon ladders have been built to help the fish bypass the dams. Vattenfall also releases around 1.3 million salmon and sea trout smolt annually in order to maintain the balance of growth. Today, environmental aspects are given very careful consideration when hydro stations are renovated or enlarged. Together with other power companies, Vattenfall is also involved in several projects of which the aim is to reduce environmental impact on our regulated waterways.



THE WATER CYCLE IS ETERNAL. THE SOURCE OF ALL LIFE.
BY USING NATURE ON NATURE'S TERMS, WE HAVE ACCESS TO A
SUSTAINABLE, RENEWABLE ENERGY SOURCE.

HYDRO TALK

How much energy does it take to light a 60-watt light bulb for 24 hours, to vacuum for one hour, or to watch a full-length film on TV?

Look at your household electrical appliances. Somewhere you'll find a label stating power requirement (in watts). If you multiply the power in kW by the number of hours you use the appliance, you get the total power requirement (in kWh).

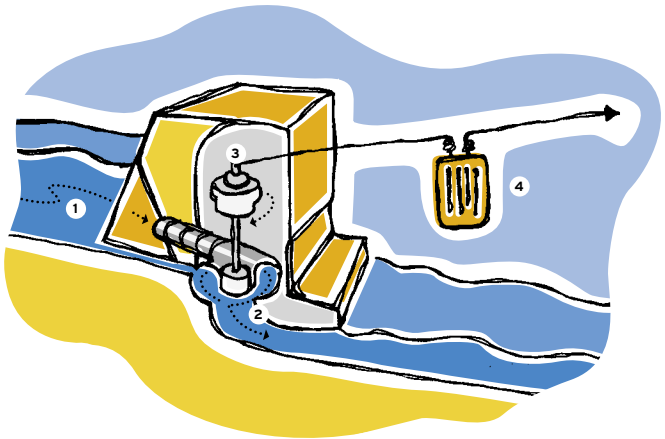
Example: 60W light bulb for 24 hours: 0.006 kW x 24 = 0.144 kWh.

VATTENFALL'S HYDROPOWER PLANTS ON UME ÄLV

1. Gejmån
2. Ajaure
3. Gardikfors
4. Juktan
5. Umluspen
6. Stensele
7. Grundfors
8. Rusfors
9. Tuggen
10. Stornorrfors

THE ENERGY JOURNEY — FROM RIVER TO CUSTOMER.

The amount of energy that can be converted is directly related to two factors: head and flow. Head is the difference in height between the water surface above and below the dam. Flow is the amount of water passing the turbine per unit of time. Since power is the product of head and flow, a higher head and a higher flow give a higher output. The energy utilized is referred to as potential energy. Quite simply, we make use of the height difference between two water surfaces to drive a turbine, which in turn drives a generator. The generator converts mechanical kinetic energy from the turbine into electricity. A transformer steps up the voltage and the electricity can be distributed around the country.



1. Reservoir
Water is dammed up to create higher head and for storage, so that power production can be controlled.

2. Turbine
On its way to the lower level below the dam, the water passes through a turbine. The turbine shaft, driven by the flowing water, drives a generator.

3. Generator
The generator converts mechanical energy from the rotating turbine shaft into electricity.

4. Transformer
In order for the transmission lines to carry the electricity efficiently over long distances, the low generator voltage is increased to a higher transmission voltage by a step-up transformer.

VATTENFALL'S HYDROPOWER PLANTS ON UME ÄLV

Station	Starting year	Normal annual prod. GWh	Max. output MW
Ajaure	1967	280	75
Gejmån	1970	265	66
Gardikfors	1963	287	60
Juktan	1979	90	26
Umluspen	1957	401	94
Stensele	1960	248	50
Grundfors	1958	464	100
Rusfors	1962	184	45
Tuggen	1961	441	110
Stornorrfors*	1958	2,298	590

* Part ownership by the Municipality of Umeå.

GWh = Gigawatt hours MW = Megawatts

There are 18 hydropower plants on Ume älv, of which Vattenfall owns ten.

YOUR OWN JOURNEY OF DISCOVERY ON UME ÄLV.

In southern Lapland, not far from the Norwegian border, there is a little village that will always be associated with skiing. Tärnaby has fostered many fine slalom skiers, among the more notable of which are Ingemar Stenmark and Anja Pärson. Hemavan, a bit farther north, is known not only for great skiing. Here, at 600 m above sea level, the Alpine Botanical Garden has over 400 plant species. The Vindelfjällen Nature Reserve, in the municipalities of Storuman and Sorsele, is one of Sweden's largest conservation areas, covering 560,000 hectares.
A visit to Stensele Church is a must. Built in 1886, this is the country's largest remaining wooden church. Continuing your journey downstream, you arrive in Lycksele, the site of Sweden's northernmost zoo, which specializes in Nordic fauna and has an aquarium and terrarium. Visitors to Lycksele will also want to stop at Gammplatsen, an open-air cultural heritage area with many old buildings and logging and hunting museums.

HYDRO HISTORY AND PRE-HISTORIC HUNTERS.

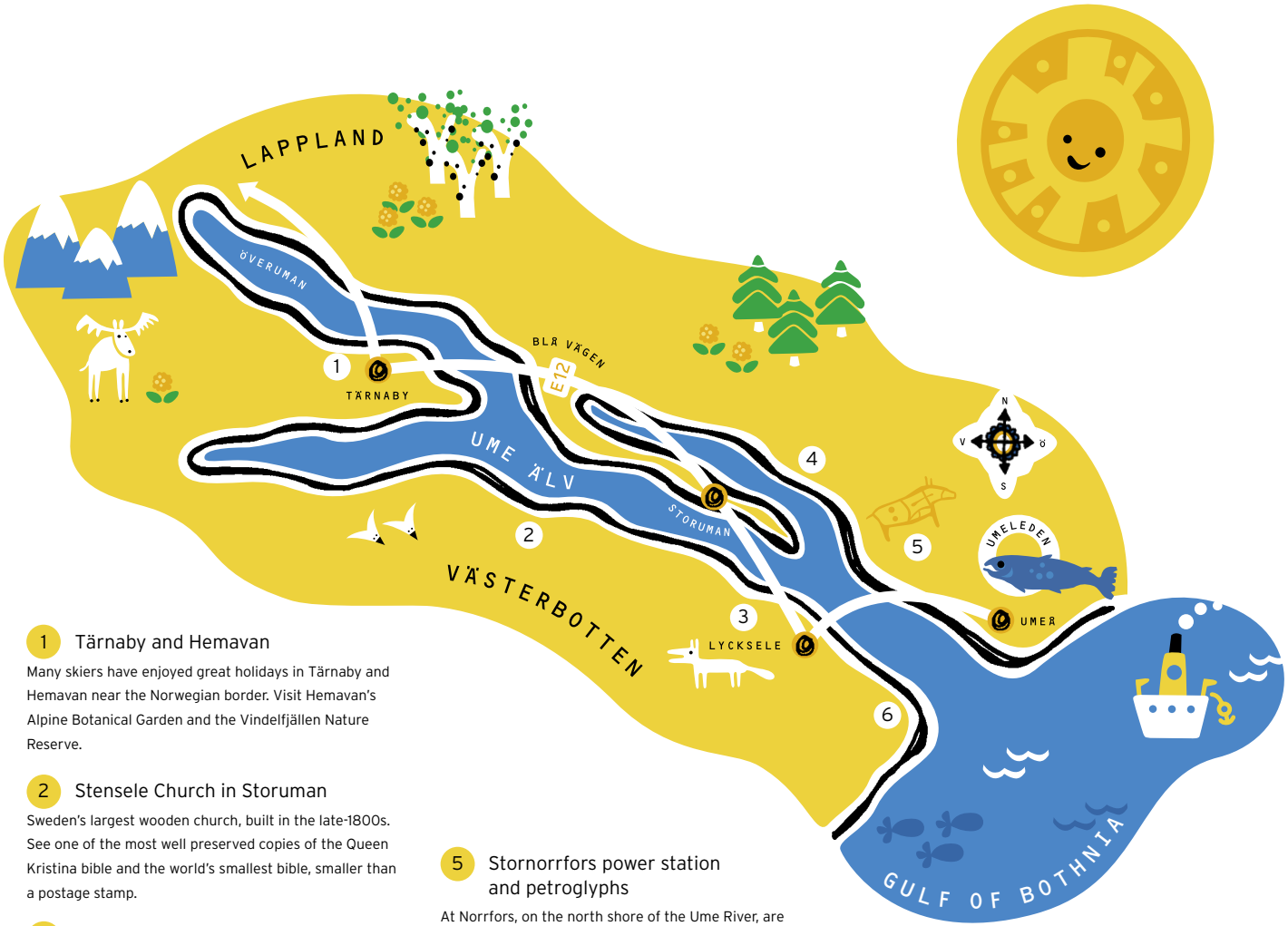
For tech enthusiasts who love the smell of petrol, we recommend a visit to the motor museum in Vännäs, where the railway has been the focal point of the community for over a century. On our journey to the coast, we approach the hydropower plant at Stornorrfors, which is Sweden's biggest in terms of output. In the summer, the enormous machine hall, 90 m under ground, is open for tours. Watch salmon and sea trout jump the salmon ladder at Norrfors, where a completely new ladder is being built. In the summer of 1984, an unusual discovery was made on an island in the Ume River. These petroglyphs, dating from 2000-3000 BC, depict hunting scenes and are the northernmost discovery of prehistoric rock art in Sweden to date. Downstream from Stornorrfors lies Klabböle, the site of the Ume älv's first power station, built in 1899. In 1958, when Stornorrfors began operating, Klabböle was decommissioned and the great turbines stopped turning. Klabböle now has an energy exhibit and café.

Hemavan, skier's paradise in southern Lapland.

Lycksele has Sweden's northernmost zoo.

Stornorrfors hydropower plant, Sweden's biggest in terms of output.

Kungens kåta near Tärnaån.



1 Tärnaby and Hemavan

Many skiers have enjoyed great holidays in Tärnaby and Hemavan near the Norwegian border. Visit Hemavan's Alpine Botanical Garden and the Vindelfjällen Nature Reserve.

2 Stensele Church in Storuman

Sweden's largest wooden church, built in the late-1800s. See one of the most well preserved copies of the Queen Kristina bible and the world's smallest bible, smaller than a postage stamp.

3 Lycksele Zoo

Visit Sweden's northernmost zoo, which specializes in Nordic fauna. There is also a children's petting zoo, and Lyckoland, a giant playground with miniature cars, ATVs and much more.

4 Vännäs Motor Museum

A motor museum where you can learn all about motoring, railway and fire-fighting history. Exhibits featuring cars, motorcycles, aeroplane and boat motors, stationary motors and much more.

5 Stornorrfors power station and petroglyphs

At Norrfors, on the north shore of the Ume River, are Sweden's northernmost petroglyphs. Stornorrfors, with a normal annual production of 2,300 GWh, is one of Europe's largest hydropower stations. Watch salmon jump the salmon ladder in spawning season.

6 Klabböle hydropower museum

Visit Umeå Energy Centre and Klabböle hydropower station, the Ume River's first hydro station, built in 1899. Klabböle delivered power until 1958, when Stornorrfors was commissioned. Energy exhibits, salt mill and café. Guided tours during the summer.

VATTENFALL'S JOURNEY — FROM HYDRO PIONEERING TO HIGH-TECH GENERATION.

As early as 1909, Vattenfall was producing electricity from the Trollhätte Canal and waterworks. Sweden's growing industries, railways and cities had an insatiable hunger for inexpensive energy. The power stations at Porjus, Olidan and Älvkarleby were built mainly to supply the railways with electricity. This was the start of hydropower development and a major step forward for Swedish industry.

HYDRO, NUCLEAR AND WIND POWER.

Today, by means of hydro, nuclear and wind power, as well as with fossil fuels, biofuels and waste, Vattenfall produces both electricity and district heat. In Sweden, hydro and nuclear energy are the basis of electrical power production. We operate three nuclear power stations and about a hundred hydropower plants. With forty wind-power plants, we are one of Sweden's largest producers of wind-generated electricity.

ONE OF EUROPE'S LEADING ENERGY COMPANIES.

Deregulation has enabled Vattenfall to expand its market area over a large part of Europe. Our goal is to become one of Europe's leading power producers. We have the capacity and know-how to supply our customers with energy, mainly electricity and heat, that is economical, makes good sense environmentally and is tailored to individual needs. We give our customers value for money by providing energy for quality of life, heat, light, comfort, safety and security, with reliability and good resource management. Now and in the future.

EFFICIENCY AND ENVIRONMENT.

We are making an ongoing effort to improve efficiency and the environment in our production facilities, always keeping human health and wellbeing, working environment and safety in focus. Vattenfall works in compliance with recognized environmental management systems.

Our customers can now choose to take delivery of environmentally friendly electricity from our renewable power sources. We guarantee that 95% of this electricity is from hydropower sources and 5% is from wind power. We also offer VattenEl EPD, which means that the electricity is produced on the Lule and Ume Rivers. EPD stands for Environmental Product Declaration.

We are committed to the environmentally sound development of future energy alternatives and to making Vattenfall the customers' number-one choice where both economy and environment are concerned.


POWER YOU CAN RELY ON

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