

ÅNGERMANÄLVEN

A journey along one of Sweden's magnificent river

FROM LAPLAND'S HIGH COUNTRY DOWN THROUGH ÅNGERMANLAND FLOWS ONE OF SWEDEN'S LARGEST RIVERS. ÅNGERMANÄLVEN WENDS ITS WAY THROUGH BEAUTIFUL FELL LANDSCAPES, CULTIVATED VALLEYS AND FORESTED MORAINES. NOWHERE ELSE HAS THE ICE AGE SHAPED THE LAND SO DRAMATICALLY.

ÅNGERMANÄLVEN'S JOURNEY ENDS AT THE HIGH COAST, WHICH HAS RISEN 286 METRES ABOVE SEA LEVEL IN ONLY 9,600 YEARS.



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.

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.

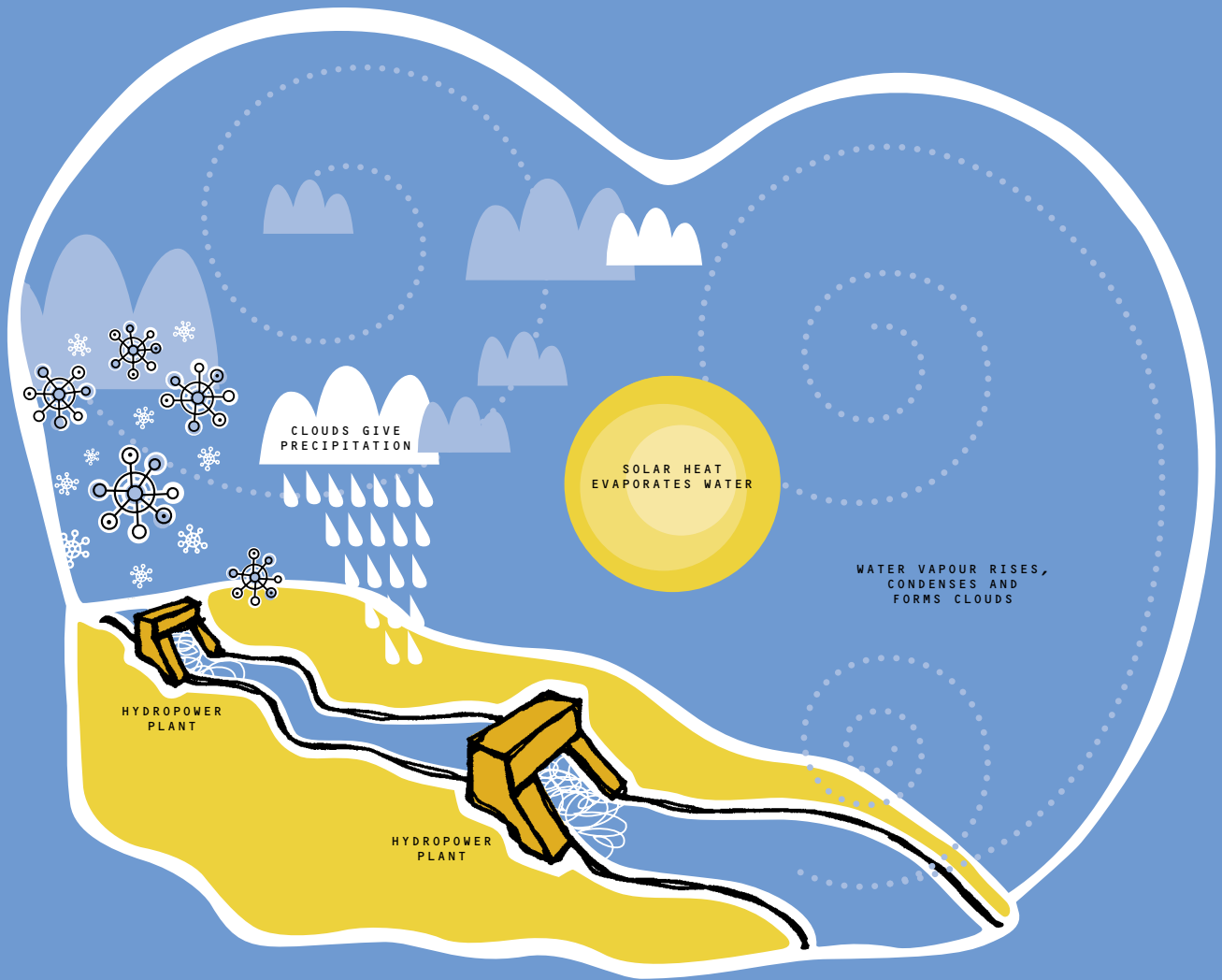
FOR VATTENFALL, THE ENVIRONMENT COMES FIRST.

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,



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.

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.



UNIQUE HIGH-VOLTAGE GENERATOR AT PORSI.

Vattenfall was first in the world to use a unique high-voltage generator that eliminates the need for a step-up transformer. The Powerformer generator, as it is called, was developed by ABB and installed at the Porsi generating station. The new Powerformer generator gives several advantages, such as a higher rated voltage, lower environmental impact and lower operating costs.

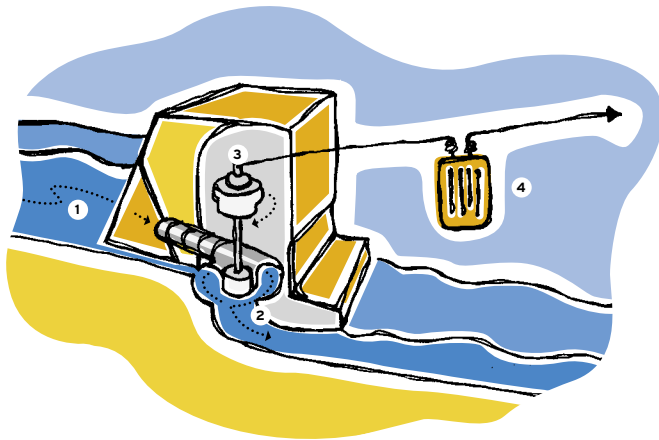


VATTENFALL'S HYDROPOWER PLANTS ON ÅNGERMANÄLVEN

- | | |
|-----------------|-------------|
| 1 Stalon | 5 Lasele |
| 2 Stenkullafors | 6 Kilforsen |
| 3 Åsele | 7 Nämforsen |
| 4 Långbjörn | 8 Forsmo |

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 ÄNGERMANÄLVEN

Station	Starting year	Normal annual prod. GWh	Max. output MW
Stalon	1961	538	130
Stenkullafors	1983	235	58
Åsele	1981	116	27
Långbjörn	1959	401	100
Lasele	1956	665	141
Kilforsen	1953	970	288
Nämforsen	1946	453	112
Forsmo	1948	730	160

GWh = Gigawatt hours

MW = Megawatts

In all, there are 16 hydropower plants on Ängermanälven, of which Vattenfall owns eight.

YOUR OWN JOURNEY OF DISCOVERY ON ÅNGERMANÄLVEN.

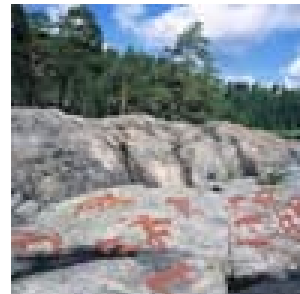
When it comes to skiing and winter activities, southern Lapland has so much to offer. Kittelfjäll, Klimpfjäll and Saxnäs are just a few examples of winter-sport and ski resorts. But summer is when most people are attracted to Ångermanälven, above all, for the fantastic fishing. Anglers from far and wide make the pilgrimage to this famous river to try their luck at catching record-sized sea trout of these waters. Make a point of visiting Trappstegsforsen on Kultsjöån. Here, the water cascades over hundreds of staircase-like rock formations, presenting a majestic display of Nature's artistry. While you are in the vicinity of Saxnäs, take an opportunity to visit Fatmomakke, an ancient and sacred meeting place where the Sami, and later settlers, have gathered over the centuries for festivals and on religious occasions. Traditional Midsummer celebrations are still held here.



Trappstegsforsen at Saxnäs, one of Sweden's most beautiful rapids.



A big sea trout. Every angler's dream can be reality on Ångermanälven.



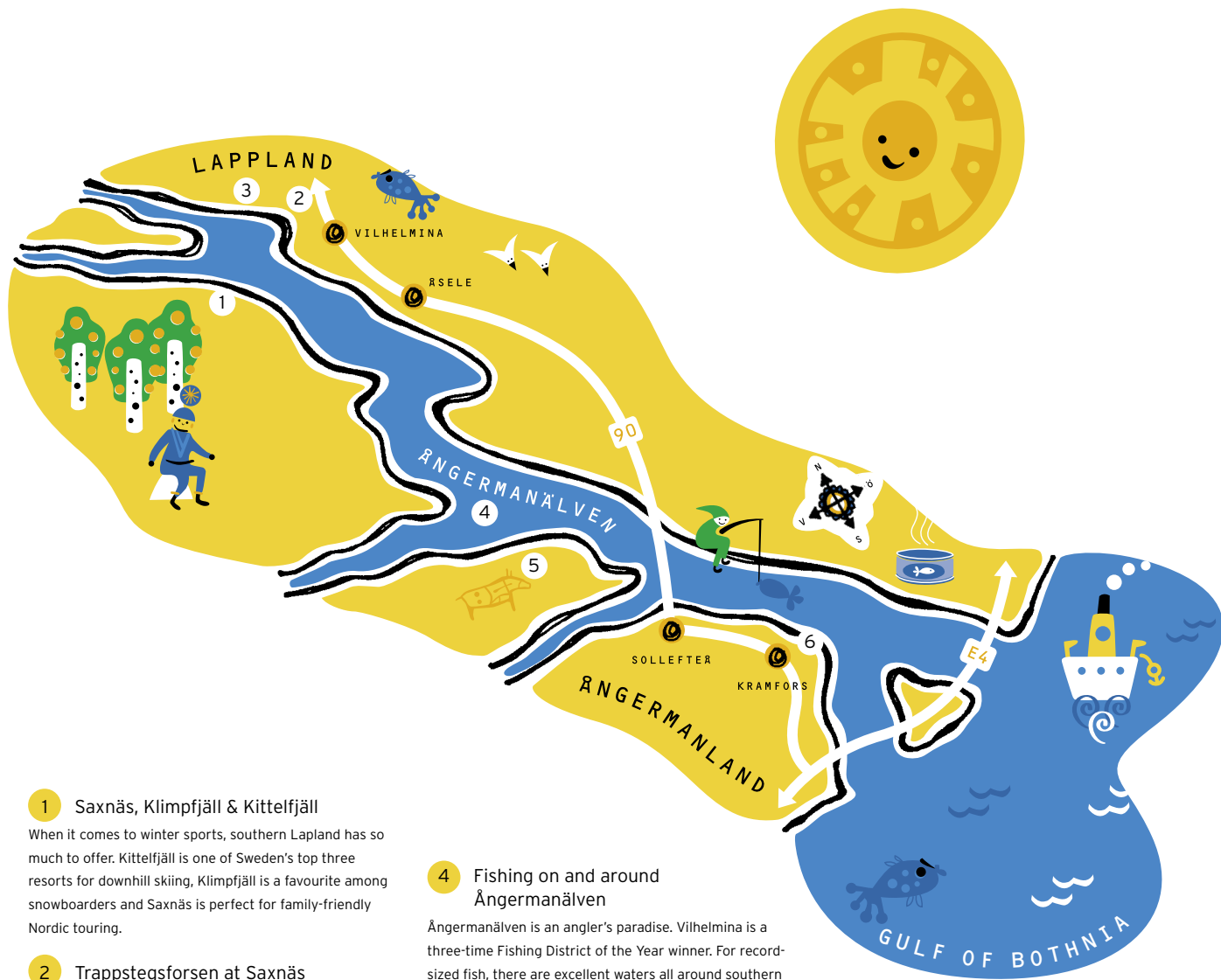
The petroglyphs at **Nämforsen**, one of Northern Europe's largest prehistoric rock-art sites.



Höga Kusten. World heritage in every sense.

A LAND ONCE RULED BY ICE.

5,000 years ago, an Atlantic climate prevailed, and oak, elm and hazel grew here. Nomadic hunters, who followed the migrating reindeer, made a lasting mark on history. Nämforsen is the location of one of Northern Europe's largest and most distinctive petroglyph sites, with some 2.300 figures. Daily, from mid-June to mid-August, the Nämforsen rapids come to life when Vattenfall unleashes the river, allowing it to rush freely along its original course. In the summer, the power station is also open for guided tours. Ångermanälven's journey ends in what is perhaps Sweden's most remarkable and beautiful archipelago. Höga Kusten - the High Coast - is listed as a World Heritage site. The central part of the massive ice sheet covered an area where thousands of years of isostatic rebound can be traced. Since the retreat of the inland ice, the land has risen by 286 metres.



1 Saxnäs, Klimpfjäll & Kittelfjäll

When it comes to winter sports, southern Lapland has so much to offer. Kittelfjäll is one of Sweden's top three resorts for downhill skiing, Klimpfjäll is a favourite among snowboarders and Saxnäs is perfect for family-friendly Nordic touring.

2 Trappstegsforsen at Saxnäs

At Trappstegsforsen on Kultsjöån, one of Sweden's most beautiful rapids, the water rushes over hundreds of staircase-like rock formations, presenting a majestic display of Nature's artistry.

3 Fatmomačke - a sacred place

For centuries, Fatmomačke was the most important gathering place in the Vilhelmina district. Worship, weddings, christenings and funerals have taken place here since the 1700s.

4 Fishing on and around Ångermanälven

Ångermanälven is an angler's paradise. Vilhelmina is a three-time Fishing District of the Year winner. For record-sized fish, there are excellent waters all around southern Lapland. Sweden's biggest sea trout was caught on a fly at Stenkulla, north of Åsele. Don't miss the very popular Nipstadsfisket in Sollefteå.

5 Nämforsen's petroglyphs and power station

Gustaf Hallström began his painstaking inventory of one of Northern Europe's largest petroglyph sites at Nämforsen in 1906. The Nämforsen power station is open daily for guided tours from mid-June to early August.

6 World Heritage Höga Kusten and Veda Bridge

With one of Sweden's most beautiful archipelagos, Höga Kusten, has been designated a World Heritage site for very good reasons. Nowhere else in the world has the land risen so dramatically; 286 metres in 9,600 years. Stretching across the mighty Ångermanälven, the Veda Bridge, popularly known as the High Coast Bridge, is the world's ninth longest suspension bridge.

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.

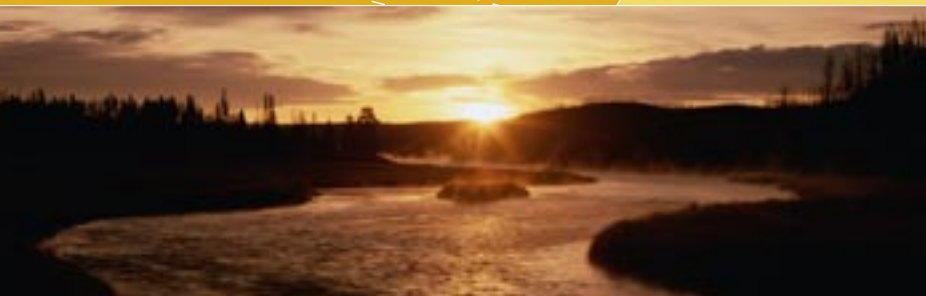
We are making an ongoing effort to improve efficiency and the environment in our production facilities, always keeping human health and wellbeing, working environment and safety in focus. Vattenfall works in compliance with recognized environmental management systems.

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 VattenEi 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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