

The Sustainable

ENERGY AND ENVIRONMENT PROJECTS *on Gotland*

Society



The Island of Gotland- A centre for sustainable development in the Baltic Sea

The Island of Gotland- A centre for SUSTAINABLE DEVELOPMENT

In 1996 the municipality of Gotland set a target that the island should become a sustainable society by 2025. Sustainability will play a growing part in our everyday life not only on Gotland but also across the globe, as more and more governments, communities and individuals realise that we cannot continue draining the Earth of its natural resources.

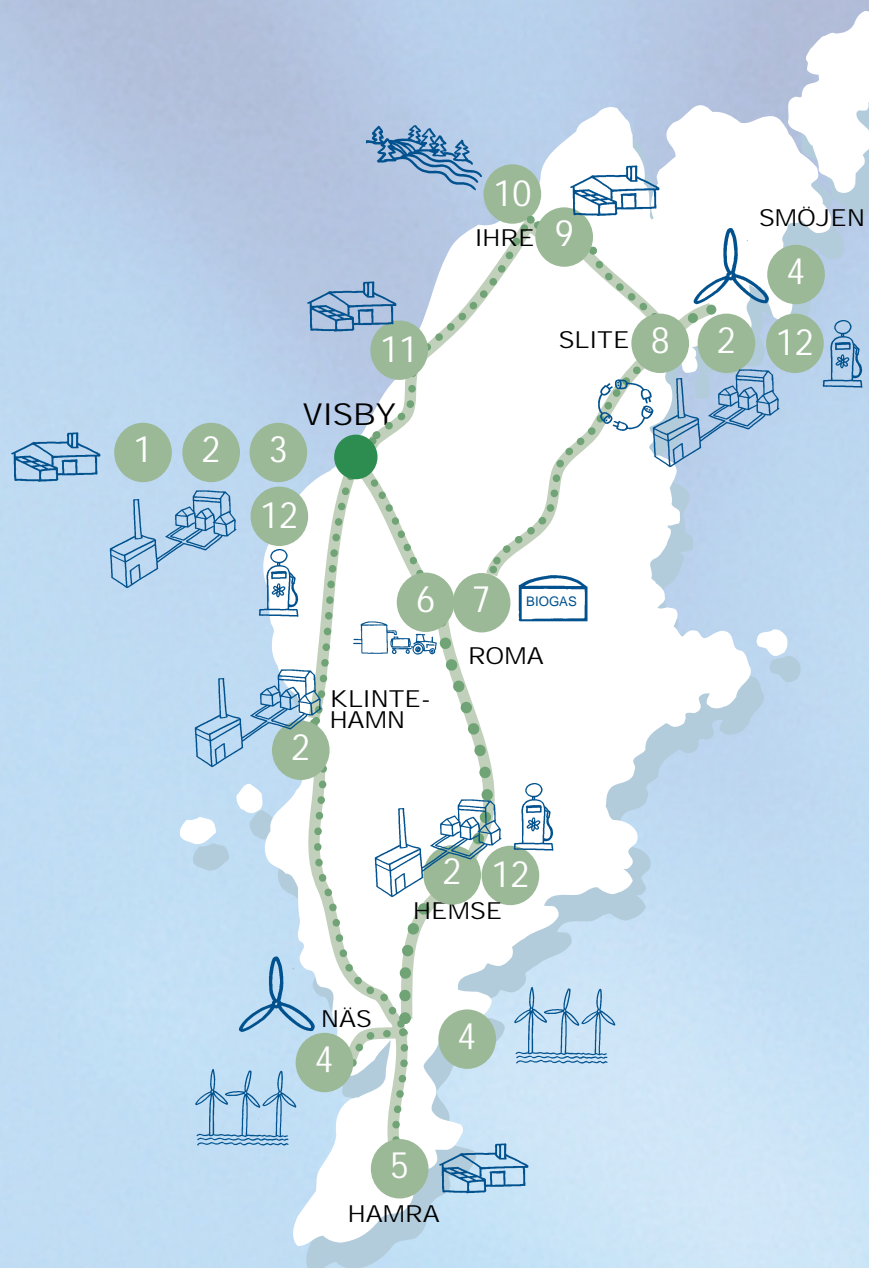
One of the requirements for achieving a sustainable society

is to reduce our consumption of natural resources to a level that is compatible with the Earth's ability to regenerate them - thereby ensuring the availability of these resources for future generations.

Using RENEWABLE ENERGY sources such as solar, wind, biomass, small-scale hydro and geothermal power helps to reduce society's dependence on finite and polluting energy sources such as fossil fuels and nuclear power.

The combination of renewable energy with measures that

increase the efficiency with which we use our natural resources is a central part of Gotland's strategy for realising a sustainable society. Today renewable energy accounts for around 10% of the island's total energy supply, so we still have a long way to go, but plans are in place to increase this to 100% within the next 25 years.



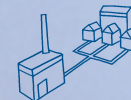
Sustainable building
Almedalsbiblioteket
Visby.

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District heating
Visby, Klintehamn,
Hemse, Slite.

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Sustainable building
Hansarhuset, Visby.

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Windpower
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Cool know-how

A new central library, Almedalsbiblioteket, Visby

A combined town-university library is being built adjacent to the attractive city park at Almedalen in Visby. The Municipality and Gotland's University College plan for the building to be a flagship example of sustainable architecture and a visible demonstration of their high environmental ambitions. Energy efficiency and the use of renewable energy resources feature strongly in the building's design. To reduce the need for energy intensive air-conditioning systems seawater will be used for cooling the interior spaces during the warmer months of the year. A sea-water based

heatpump will provide heat during the winter. The pumps are to be driven by electricity generated by photovoltaic cells mounted on the library's roof. The need for artificial lighting will be low, as daylight use is optimised by the building's design. The building's structure and ventilation systems have been designed so as to make the most of the structure's capacity for thermal storage. High performance facade systems will allow daylight penetration while keeping in heat in the winter months and providing shading during the summer.



Facts:

- A sea-water based cooling system is to be used instead of air-conditioning.
- A sea-water based heatpump will provide heat.
- 50m² photovoltaic panels will produce electricity to drive the pumps.
- Resource efficient and recyclable materials are given high priority.
- Large use of daylight will reduce energy needs for lighting.
- High performance glazing will give both passive solar gain and low energy loss.
- The project is due for completion by autumn 2001.

Project co-operation:

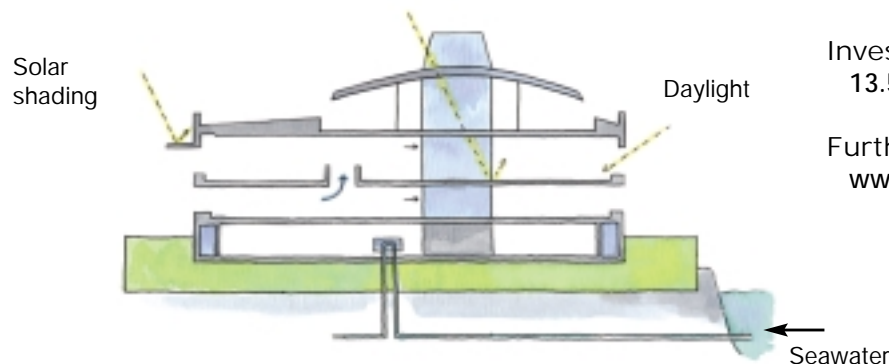
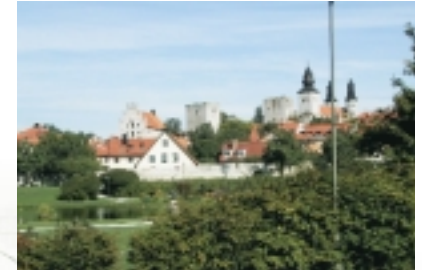
The Municipality of Gotland
Gotland's University College

Investment:

13.5 million Euro

Further information:

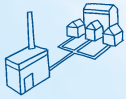
www.hgo.se



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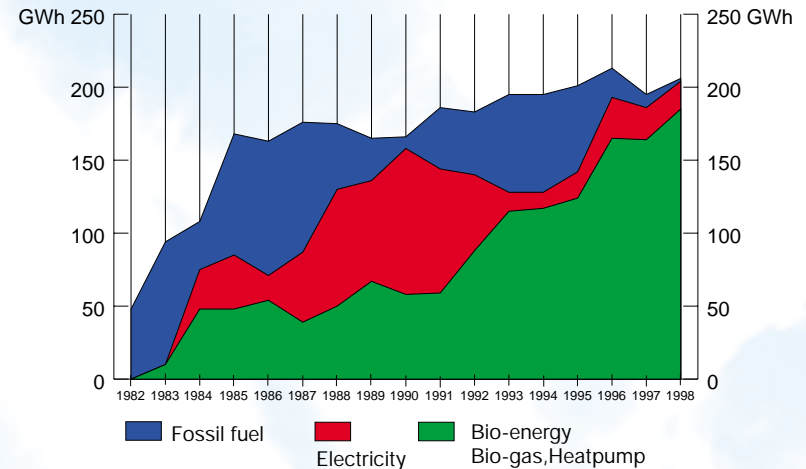
Clean energy from a distance

Bio-fuelled district heating in Visby



The World Heritage City of Visby consists of many unique buildings and mediaeval ruins that are built from limestone. These structures are particularly sensitive to air pollution - caused to a large extent by the emissions from oil-fired heating boilers. Due in part to a desire to protect

these valuable buildings from further decay a district heating system has been in operation in Visby for the last twenty years. Around 95% of the energy supplied to the district-heating network comes from renewable sources. This cleaner and CO₂ neutral energy comes in various forms, the largest contribution being from wood chips - a by-product of local saw mills. Biogas from the town's landfill site and wastewater treatment plant is also used to produce heat for the network. In addition to this a 10MW heat pump is used to extract 'free' heat from the sea. Altogether district-heating covers more than 75% of the city's heating needs- helping to keep the air free from pollution to the benefit of Visby's inhabitants and their cultural heritage.



Facts:

- The use of oil for heating has been reduced by 75% since 1980.
- Sulphur discharge from oil burning furnaces has been reduced by 95% since 1980.
- Emissions of CO₂, sulphur and nitrous oxides have been reduced.
- District heating networks also supply the towns of Hemse, Slite, and Klintehamn.



Renewable energy sources used in the district heating systems on Gotland:

- Bark, wood-chips, demolition wood and shavings from sawmills are burned in modern furnaces.
- A sea-water based heat pump with a 10 MW capacity.
- Industrial waste heat.
- Biogas from landfill.
- Biogas from the sewage treatment plant in Visby.

Co-operation:

Gotland's local energy company,
The Municipality of Gotland
Gotlandsflis AB
Vattenfall AB

Further information:

www.gotland.se/EKOKOM
www.gotlandsenergi.se
www.hallbarasverige.gov.se

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Building on new knowledge

Hansahuset, Säveskolan, Visby

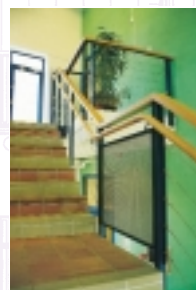
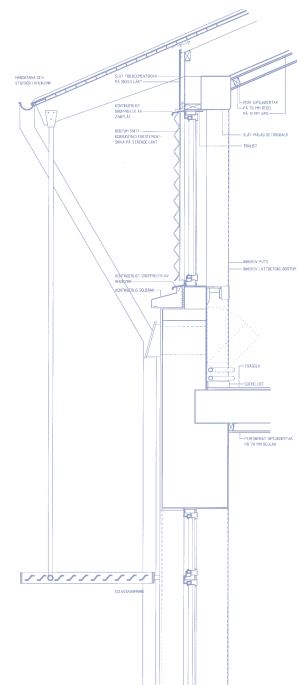


At Gotland's largest high-school the pupils come away with something more than the usual qualifications - an environmental awareness. Hansahuset, a part of Sävö college in Visby, is an excellent example of sustainable architecture in practice. This environmentally adapted building has been created with consideration for the use of

natural resources. Ecologically sound materials have been used to a large extent. Solar energy is used to provide hot water for the washrooms. Separation toilets enable urine to be collected and used as fertiliser. Large amounts of daylight, generous ceiling heights, natural ventilation and the absence of ventilation fans result in a healthy, quiet and attractive indoor climate. All together this provides the pupils with good conditions for succeeding with their studies and a building which has a low impact on the environment.

Facts:

- Low emission building materials are given high priority.
- Materials have been chosen to allow for future reuse and recycling.
- Natural ventilation is assisted by specially designed chimneys that adjust to the wind direction.
- Separation toilets are used (urine is collected for fertilising).
- 6m² solar panels for providing hot water.
- The building is also connected to the district heating network.



Project co-operation:
The Municipality of
Gotland/Fastighetskontoret
Visby Arkitektgrupp AB

Further information:
www.gotland.se/EKOKOM
www.visbyark.se

Clean energy is a breeze



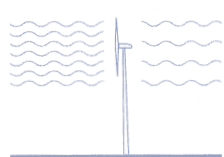
Wind energy installations in the sea and on land.

Gotland's central position in the Baltic provides the islanders with a never-ending natural resource - the wind. Wind power has been put to use on Gotland for many years and at one time over 500 traditional windmills provided power for the island's communities. Considering the global environmental advantages that this clean energy source provides windpower is destined to become an increasingly valuable resource in the future. Today more than 2000 households on Gotland own shares in wind turbines through local wind energy co-operatives. Windpower is currently responsible for around 15% of the island's total electricity consumption. There are clusters of wind turbines, so called wind farms or wind parks, at various locations around the island. At **Näsudden** in south-west Gotland lies Sweden's largest windfarm. From there one can also see Sweden's first offshore windfarm; **Bockstigen** 2.5MW. In northern Gotland there are

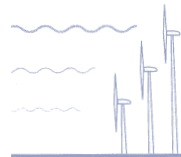
wind parks at **Smöjen** and **Storugns**.

Due to the shortage of sites on land there are plans to build more wind farms in the sea. The largest currently being planned is an 80MW installation to be located near **Grötlingboud** off Gotland's south-east coast. As well as large wind farms, single wind turbines are used to provide electricity for farms and factories. In Klintehamn, the companies Gotlandsflis and Lantmännen have both installed 500 kW wind turbines, which each produce around 1.1 GWh / year. Farms with forward thinking owners such as at Stafva gård and at Ryftes in Fole have also invested in their own wind turbines and use these to enhance their environmental profiles.

En modern vindturbin tar upp ca 50% av vindenergin.



Vinden ökar med höjden.

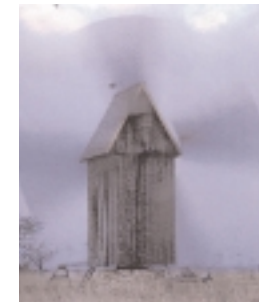


Facts:

- At the beginning of 2000 there were over 130 wind turbines installed on the island.
- Total energy production from wind power on Gotland is around 130 GWh / year.
- Electricity production by wind-power corresponds to around 15% of Gotland's consumption.
- Näsudden wind farm consists of 80 windpower stations with an installed effect of c:a 40MW.
- Bockstigen consists of 5 x 500kW turbines specially adapted for offshore use.
- Smöjen wind park consists of 2 x 500kW, 4 x 660 kW and 4 x 1.5 MW turbines with a total effect of 9.64 MW.
- Storugns wind farm consists of 6 x 660 kW turbines with total effect of 3.96 MW.

Project Co-operation:
Vindkompaniet AB
Siral System Co AB
Vattenfall AB
GEAB

Further information:
www.vindkompaniet.se
www.siral.se
www.windpowerphotos.com

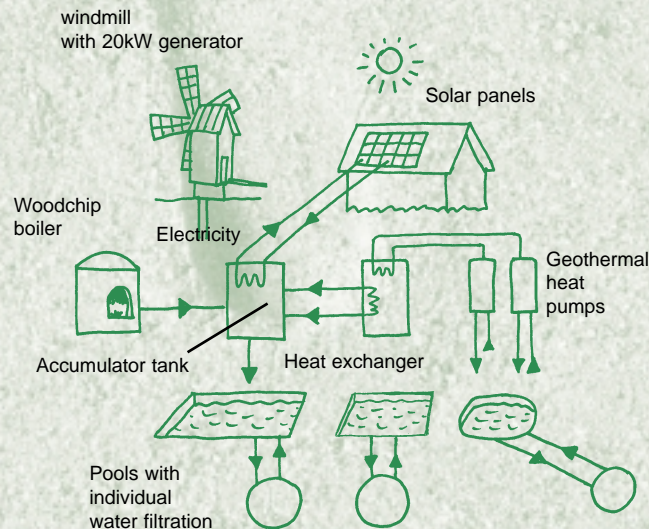


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Caring for body, soul and the environment



Suderhalsan, Hamra



Suderhalsan is a recreational spa in the south of Gotland that has included ecology in their vision of well being. The owner's are developing the spa to be a spearheading example of sustainable enterprise. One of the ways they aim to achieve this is by using energy solely from renewable energy sources. A traditional windmill equipped with a 20kW generator, 35 m² of solar panels, two geothermal heat pumps, and a wood-chip fired boiler already contribute to meeting over

90% of the centre's energy needs. To further minimise the impact on the environment the spa's water treatment facilities have also received particular attention. The water in the pools is purified every night in separate filters with a powder of seashells and chlorine, which is then separated before the water is released into the pools again. The whirlpool is purified in the same manner. The centre's waste water is purified and filtered out in a gravel bed.

Facts:

- 2 x 20 kW geothermal heatpumps.
- 35m² solar panels.
- Rebuilt traditional windmill with a 20kW generator.
- Wood-chip fuelled boiler provides c:a 80 kW (maximum effect 120 kW).
- Waste water is purified in a Finnish Biocler plant.
- Well water passes through double lime, iron and ground soil filters.

Project co-operation:

Suderhalsan
Gotland's County Administration
The Municipality of Gotland
Craftsmen from southern Gotland

Investment:

1.8 million Euro

Further information:

www.suderhalsan.com

www.gotland.se/EKOKOM

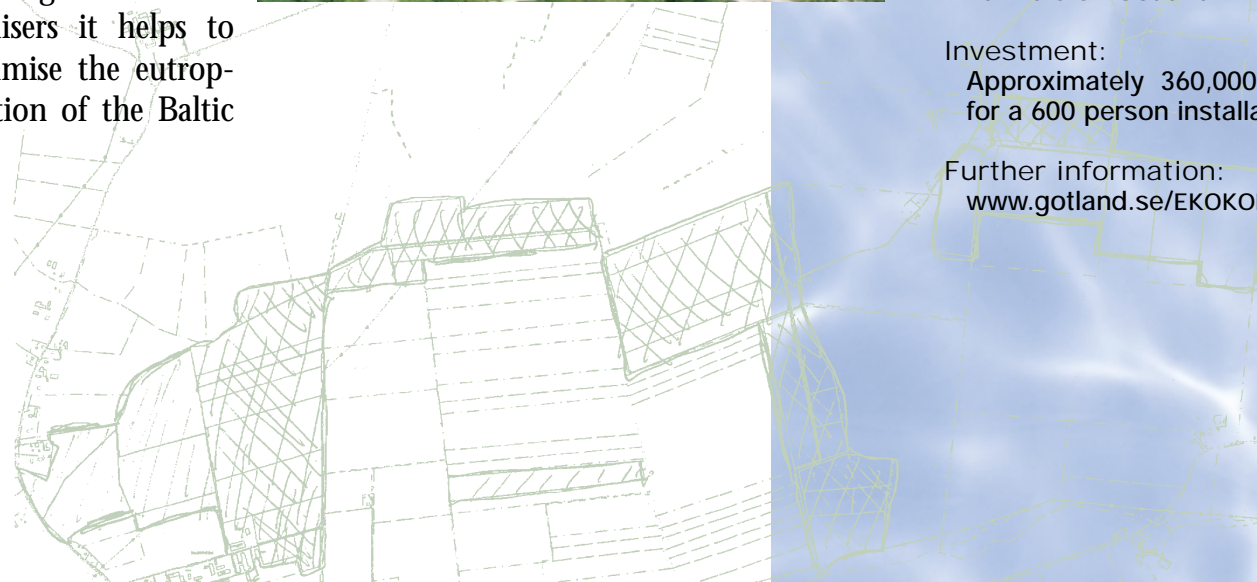
Fertile fields when nature calls



Wastewater treatment using the Gotland model, Roma

The principle of using waste water for irrigation is not new, only neglected for a number of years. This method is now being revitalised on Gotland. The waste water is collected in man-made pools where it is contained for several months, whereby a natural decomposition of disease-generating microorganisms takes place. Irrigation using the purified wastewater allows the soil to absorb the nutrients contained in

the water leaving the soil naturally fertile. By using this method, the soil is enriched with valuable nutrients that would otherwise pollute the island's lakes and waterways. This method also has the added advantage in that by reducing the need for fertilisers it helps to minimise the eutrophication of the Baltic Sea.



Facts:

- Today there are municipal sites with waste water treatment pools at Havdhem, Hemse, Roma, Stånga, Träkumla, and Väske.
- 5000 people in Gotland and a dairy have their waste water purified using this method.
- 900 acres of land are irrigated with purified waste water.
- Crops which are irrigated include wheat, sugar beet, rape and clover.

Project co-operation:

The Municipality of Gotland
Farmers on Gotland

Investment:

Approximately 360,000 Euros
for a 600 person installation.

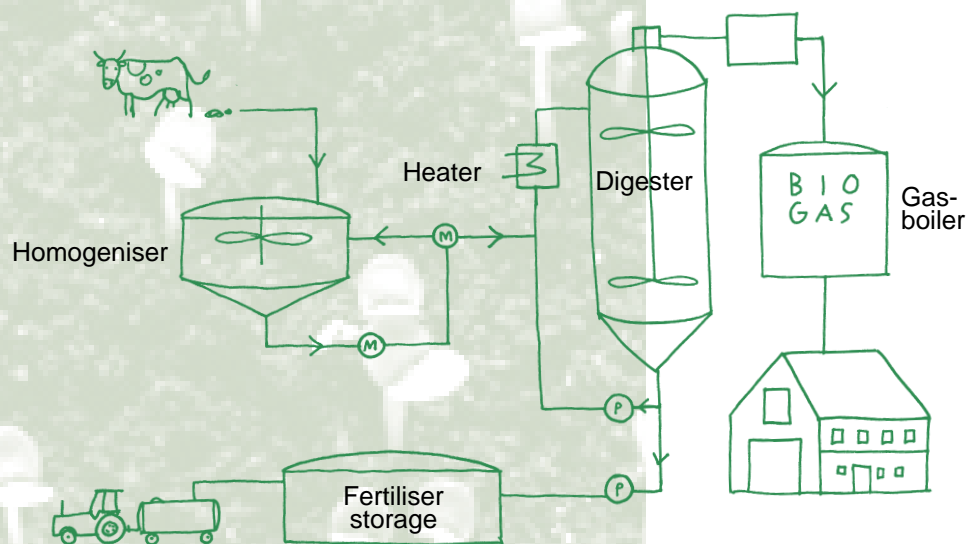
Further information:

www.gotland.se/EKOKOM

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Ecology by the book

Biogas installation at The Agricultural College, Lövsta



Lövsta Gård houses an agricultural college that aims to give its students the knowledge necessary to develop farming and forestry in harmony with nature. As part of their programme to demonstrate sustainable farming techniques the college is currently developing its own biogas installation that will use farm manure as a fuel source. The manure will be used to produce methane gas that will provide heating for the college buildings - thereby reducing the need to use fuel oil. An added benefit is that through the biogas process the manure becomes more homogenous resulting in more efficient nutrient utilisation when it is subsequently used as a fertiliser. Lövsta College also has plans to use wastewater ponds to purify the entire college's wastewater output and provide irrigation water according to the Gotland model.

Facts:

- Methane produced by the biogas installation will replace 50 m³ fuel oil per year.
- The use of commercial fertiliser will be reduced from 95 tonne to 35 tonne.

Project co-operation:

Lövsta Gård Agricultural College
The Municipality of Gotland
KTH

Further information:

www.gotland.se/EKOKOM
www.hallbarasverige.gov.se

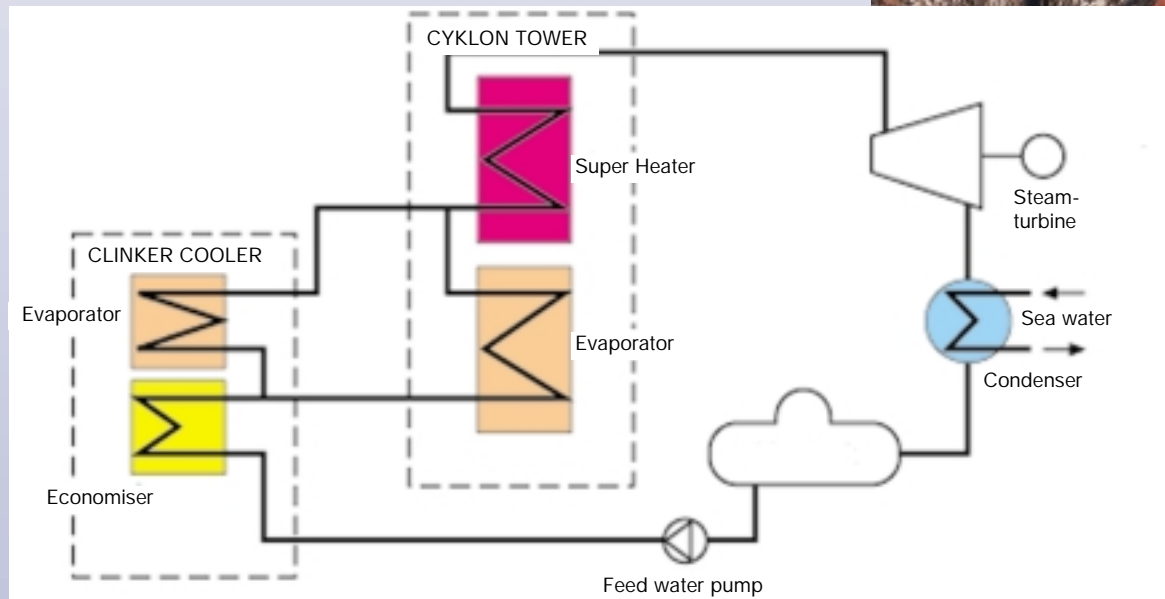
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"Concrete" recycling

Electricity generation from industrial waste heat at Cementa, Slite

Cementa's factory in Slite is one of northern Europe's largest cement factories. The plant accounts for around 25% of Gotland's total energy consumption. With the help of Vattenfall, the state owned electricity company, an action has been taken to reduce the factory's impact on the environment. An installation to generate electricity using steam created from

waste heat will be up and running during year 2000. Using this surplus production heat will provide an estimated 50GWh of electricity per year- a quarter of the factory's energy demand. In addition to this excess waste heat is also supplied to nearby greenhouses where it increases productivity and reduces the need to use fossil fuel.



Facts:

- Estimated electricity production: 50 GWh/yr
- Current electrical - consumption : 210 GWh/yr

Project co-operation:

Cementa AB, Slite
Vattenfall AB

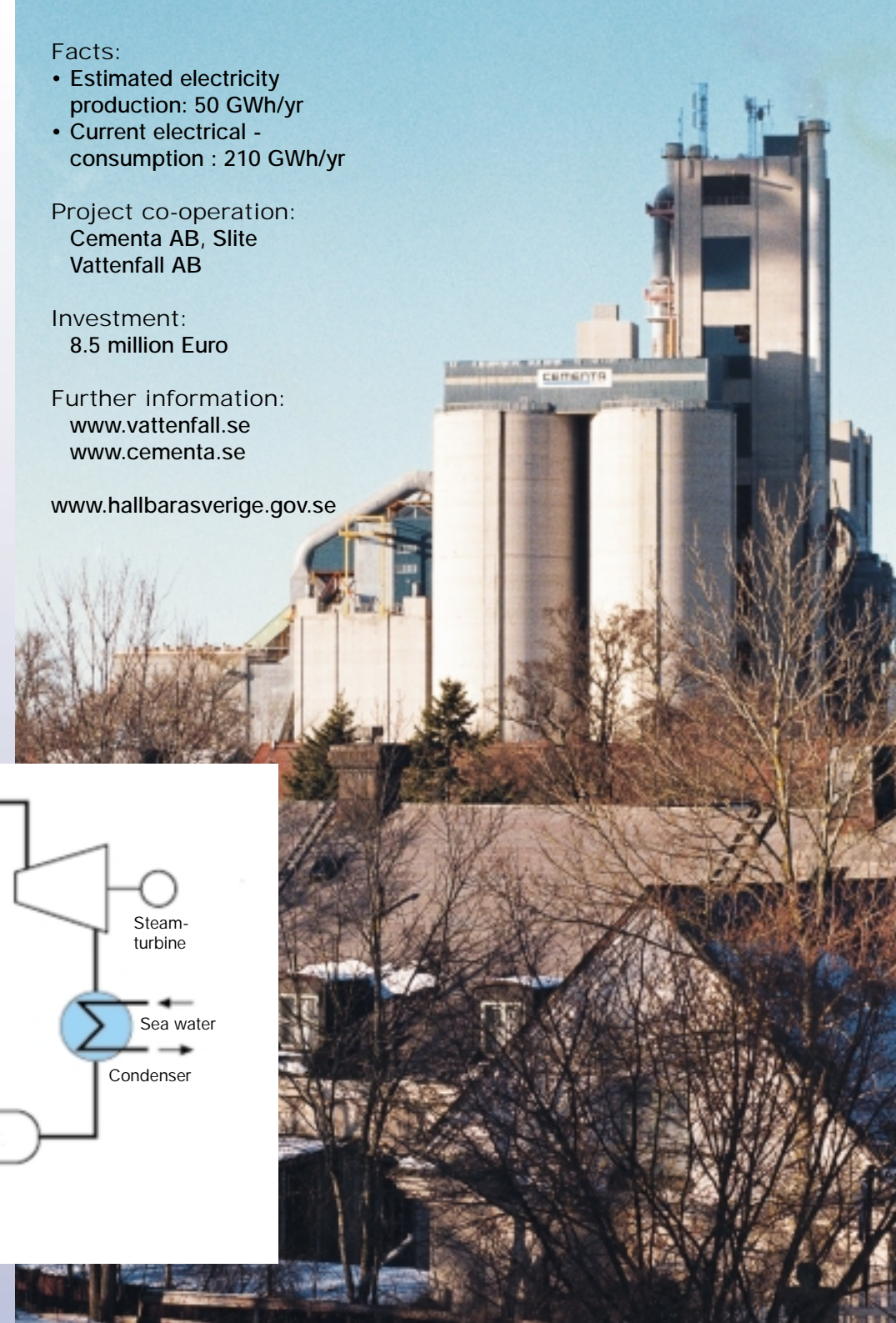
Investment:

8.5 million Euro

Further information:

www.vattenfall.se
www.cementa.se

www.hallbarasverige.gov.se



Nature's resources at work



Small-scale hydro-electric generation, "Rabbishuppet", Ihreån

Mankind has used the power of water for hundreds of years. As early as the middle ages several watermills were in use along the Ihre river. The new hydro power station at Ihre is today driven by two turbines dating back to the early 1900's. With the help of modern technology the turbines have been renovated and are almost as efficient as new ones. The turbine house is itself a work of architecture where both form and

function combine to enhance the natural setting. The energy produced is primarily used to provide heating and lighting for a nearby green-house and any surplus electricity is sold to Gotland's local electricity company. Rabbishuppet (bunnyhop), as the station is called, is also designed to receive groups of visitors so that anyone who is interested can see the turbines in action.

Facts:

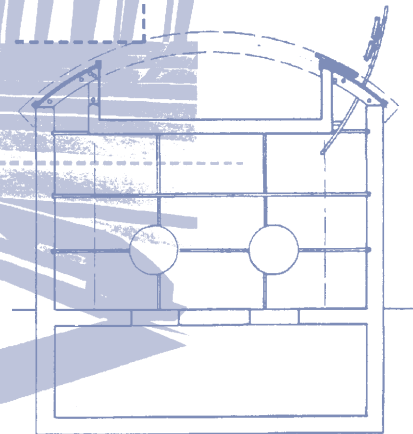
- Rabbishuppet produces c:a 100 MWh / year.
- The large turbine has a running-wheel diameter of 45 cm, receives 450 l water / sec., gives 18 kW power from the generator.
- The small turbine has a running wheel diameter of 28 cm, receives 250 l water / sec., gives c:a 9 kW power from the generator.
- With both turbines in action the station can be used with a water flow from 50 l / sec. to 700 l / sec.

Project co-operation:

Claes- Göran Appelquist
Claes-Henric Appelquist, (designer)

Further information

www.gotland.se/EKOKOM



Viewing platform

10

A house of the Future



A demonstration of straw bale building techniques, Ihre Gård



Could it be that the house of the future was already being built a hundred years ago? Building houses using bales of straw is a reliable method used in many areas of the world. By using locally grown, environmentally friendly material, building houses becomes sustainable, economical, and wholesome. Straw is renewable, fast-growing, and thereby has less impact on the environment than standard building materials. This allows sustainable thinking to even include the homes we build and live in. At Ihre Gård north of Visby there is a demonstration house built using the straw bale technique which can be visited.

Facts:

- Straw bales cast in reinforced concrete form the foundation of the house.
- Bales are stacked on a frame of steel and wood.
- Walls are stuccoed inside and out.
- The roof is insulated with two layers of straw bales and covered with earth and grass.

Project co-operation:
Ihre Gård

Further information:

www.ihregard.nu
www.gotland.se/EKOKOM

A larger straw bale house with its energy supply from solar panels is to be built during summer 2000.



Renovation with consideration

Demonstration of ecological buildings, Muramaris Art Centre, north of Visby



Facts:

- The sewage installation is designed for 200 visitors per day, all toilets are urine-separating.
- During periods of low use, an INDRAN-installation is used to drain the wastewater into the soil.
- Natural building materials are used such as limestone, cement, and natural stone.
- Ekofiber is used for insulation.
- Geothermal heating will eventually account for the entire complex's heating supply.
- Photovoltaic panels supply energy for the water fountains.

Project co-operation:

Muramaris
Jansson & Landahl Arkitektkontor AB

Further information:

www.muramaris.nu
www.gotland.se/EKOKOM

Muramaris has been a home for artists since the early 1900's. The house - which is an artwork in itself - was originally built as a summer home for Professor Johnny Roosval and his artist wife Ellen. Extensive renovation of Muramaris has been taking place since 1995. Ecological

building techniques have been applied wherever practicable in the renovation work, and also in new site developments. The centre's wastewater is collected in a tank, where ultraviolet light is used to kill disease-generating bacteria. The treated water can then be used as fertiliser in

the gardens and greenhouse. Geothermal heatpumps connected to boreholes will in future provide heating for the complex with the help of a culvert system. A former wood shed has been reconstructed according to natural ventilation principals and now houses a café. The resto-

ration work is continuing in stages and it will take a number of years before the work is completed. The current owner's aim is to create a dynamic centre for cultural and artistic activity that at same time is a permanent exhibition of ecological living.

12

Flower Power - Made in Sweden



RME as a vehicle fuel

Raps Methyl Ester or RME is an organic, renewable fuel produced from rapeseed oil - and made in Sweden. The use of RME in vehicles reduces the need to use fossil fuels; thereby decreasing the output of carbon dioxide into the atmosphere and reducing the greenhouse-effect. Many modern diesel engines can use both diesel oil and RME - either on its own or mixed with diesel. To set a good example and as part of its commitment to phasing out fossil fuel use, the local authority on Gotland has acquired around 60 vehicles that can be fuelled with RME. In Visby, Hemse and Slite there are now also commercial RME filling stations for public use. Other organisations on the island which have chosen to use RME driven vehicles as part of their environmental programmes include Skogsvårdstyrelsen and the Hassela collective. These organisations have their own pumps and stock their own RME fuel.



Facts:

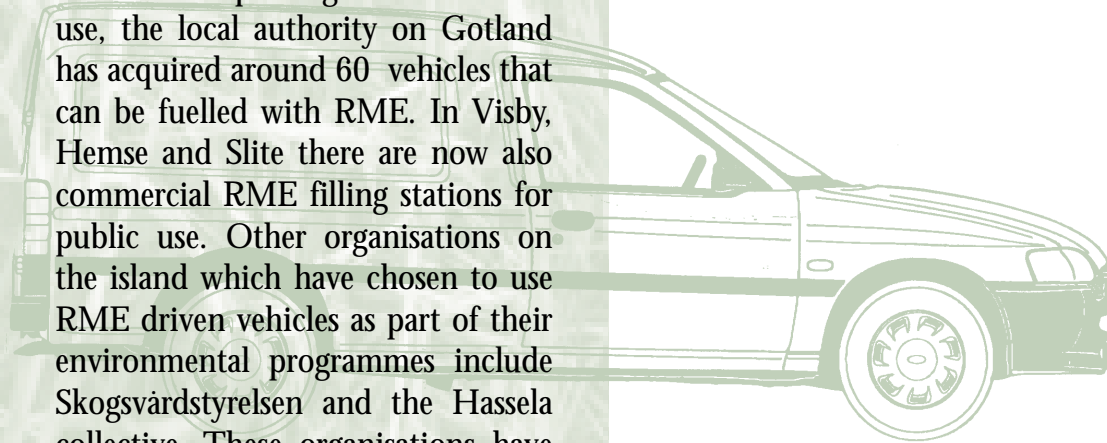
- Cars fuelled with RME have a fuel consumption of around 20 km / ltr.
- Many new diesel engines can run on RME.
- RME is available at Lantmännens filling stations in Visby, Hemse, and Slite.

Project Co-operation:

The Municipality of Gotland
Lantmännen
Skogsvårdstyrelsen
Hassela collective
Bil City, Visby

Further information:

www.gotland.se/EKOKOM





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For further information about the Ecology Project activities please contact the Eco-group, tel +46 498 269212, fax +46 498 269211 or visit our web site at:

www.gotland.se

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