513479

# Energy in Minds!

Integrated Project

Priority 6.1.3 Concerto

**WP 2.3-D5**

**Report – Development of New Wind Power in Falkenberg**

## Due date of deliverable: Month 60

Actual submission date: Month 60

Start date of project: 30/05/2005 Duration: 60

Organisation name of lead contractor for this deliverable: H-Uni

Revision: 1

| Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006) | | |
|---|---|---|
| **Dissemination Level** | | |
| **PU** | Public | X |
| **PP** | Restricted to other programme participants (including the Commission Services) | |
| **RE** | Restricted to a group specified by the consortium (including the Commission Services) | |
| **CO** | Confidential, only for members of the consortium (including the Commission Services) | |

| Work package: | **WP 2.3-R/I** | **Bio-fuelled co-generation** |
|---|---|---|
| Deliverable no: | WP 2.3a-D5 | |
| Due Date: | 60 | |

| **Participants** | ID | |
|---|---|---|
| WP-leader: | 15 | H-Uni |
| Participants: | 15 | H_Uni |

## Introduction

Within Energy in Minds H-Uni has made a scientific study of the technology, practicability and potential of running cogeneration plants fuelled with rape-seed oil on farms and rural industries. As the cost for the made investigations were lower than planned, three additional studies on topics and activities carried out within Energy in Minds has been made.

Within Energy in Minds the municipality of Falkenberg has realized 5 new turbines of 2.3 MW each by the sea shore of Falkenberg. This wind power park gives valuable experience for the planning of the future expansion of wind power, especially for the planned off-shore park with 30 turbines som e 8 km out in the sea.
Falkenberg has since the 80-ties actively contributed to the utilisation of wind power in Sweden, both in terms of careful planning of where and how wind turbines should be placed in the landscape but also in terms of participating in the technical competence and manufacturing of turbines.

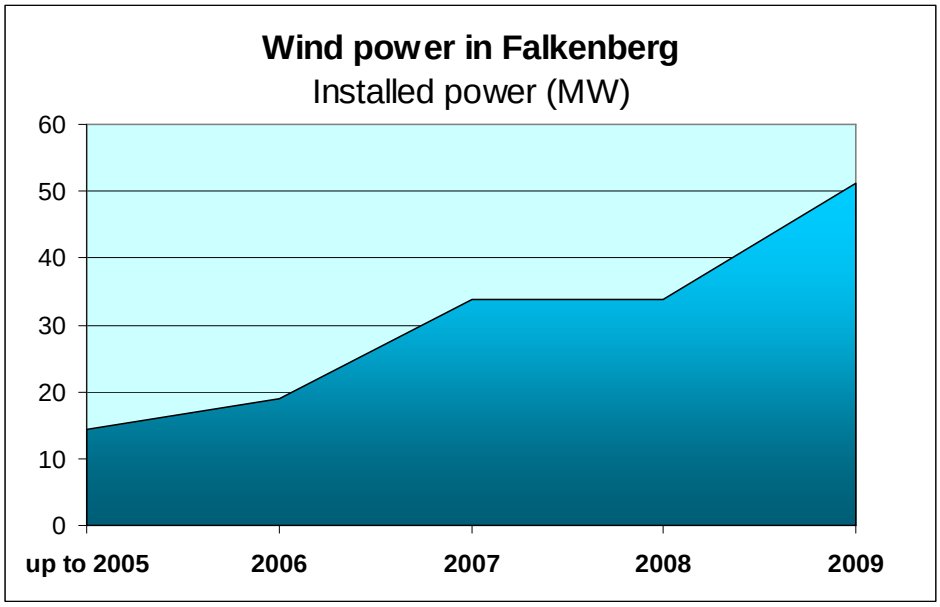
Attached a report on the development of wind power in Falkenberg since the 80-ties, accomplished by Göran Sidén at the Halmstad University.

**WP2.3a-D5 Attachment 1**

# Development of New Wind Power in Falkenberg

# Development of new wind power in Falkenberg

## Contents




*With large new turbines wind power has grown fast in recent years. At end-2009 were 43 wind turbines in operation in Falkenberg with a total power of 51.1 MW.*

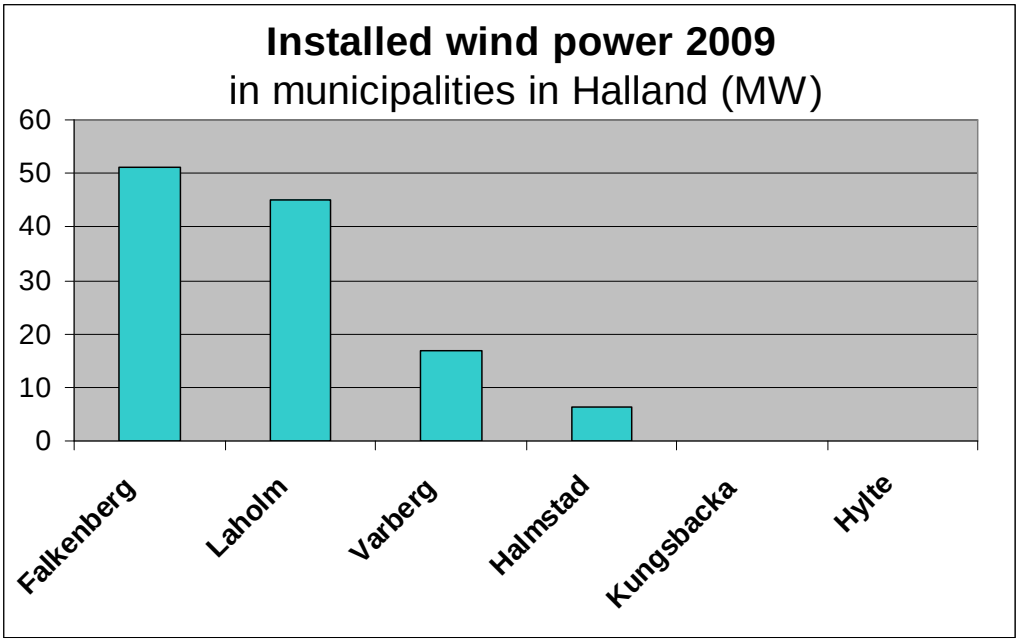
# 1 Introduction - Falkenberg and wind power

Scince long ago there is an interest in energy issues in Falkenberg. After the first 1973 oil crisis, which was a huge awakening from believe on oil, many efforts have been taken. The oil crisis meant that we became aware that the oil, which acounted for 80% of the energy supply in Sweden, was a finite resource. Access was limited and prices could increase. Gradually, also an awareness of climate issues has increasingly clear showed that we must find alternatives to fossil energy.

In Falkenberg people were early aware of the importance of using energy efficiently. Energy adviser was introduced. The inhabitants have become good advices on how to organize their energy use efficiently and cheaply. Since the 70-ties Energy Advisor has been a great resource when it came to spread the "Energy in Minds" all activities in society.

Many measures followed. Already in 1983, first in Sweden, became a new factory-made wind turbine erected in Tågarp, a Vestas V-20 55 kW. The outdoor bath in Vessigebro got solar heating. A large field of solar collectors, the largest in the world, for district heating was built in 1989. The same year, on the initiative of the municipality Zephyr Energy AB began their production of wind turbines.

When there was a searching for partners in the EU project "Energy in Minds", with the goal to in a measurable way reduce carbon emissions in a region of Europe, Falkenberg was a natural partner.




*The county Halland has with its location near the sea Kattegat and large open plains good conditions for wind power. Falkenberg had most installed by the end of 2009. Two municipalities have no wind power, but they plan it now.*

Wind power has always had a strong position in Falkenberg. Conditions are excellent for wind power with large open plain areas near the sea. The municipality's early attempts to get manufacturing of wind turbines is now continuing with Vertical Wind AB, which is established in the municipality and already has erected the first turbine.

The technical solution chosen, a vertical axis wind turbine with the rotor in the tower top, a straight axis down to the ground located generator, is the simplest solution for a wind turbine, few moving parts and no gearbox. Hopefully, it will be a cheap and reliable facility that will provide only small sound disturbances to the surroundings.

Falkenberg is already one of the leading wind power municipalities in Sweden. It has, with strong competition from neighboring municipality Laholm, the largest installed capacity of wind power in the county of Halland. If the planned Skottarevet wind farm is constructed, electricity generation from wind will be larger than the yearly electricity use in the whole municipality. But the map (March 2010) from the planning office in Falkenberg of wind farms in operation and under investigation shows that, even if Skottarevet is delayed, it will likely be as much production from the approximately 70 wind turbines, that is planned on shore. So the municipality's goal, to get 100 percent of electricity from renewable energy, will surely be fulfilled in the near future.


*In March 2010 a total of 45 wind turbines were erected in Falkenberg Municipality. There were requests for about another 100 turbines. Now many want to build even in inland areas. The municipality is well positioned to achieve 100 percent renewable electricity generation.*

*In the winter 2010 the first 200 kW vertical axis wind turbine manufactured by Vertical Wind AB was erected in Falkenberg. Photo: Lars Owesson*

# 2 Vertical axis wind turbines from Vertical Wind

At the end of February 2010 the company Vertical Wind AB erected the first large vertical axis wind turbine in Sweden. It was erected in Torsholm near the highway in Falkenberg. Commissioners of the wind turbine were Falkenberg Energi AB and E.ON. The project is supported by Swedish Energy Agency with over one million euro.

The power plant is a prototype that will demonstrate a new concept of wind power, a wind turbine with a vertical axis and the generator on the ground level, instead of today's conventional technology, horizontal axis and generator.

The technology is expected to have a great potential to reduce the cost of electricity produced from wind. The vertical axis wind turbine will be cheaper to operate and it will generate less noise.

The new design includes a series of innovations. The wind turbine is controlled electrically, unlike conventional wind turbines.

**Box**

## Vertical Wind 200 kW

Type: Vertical axis Darrieus-type, the H-rotor
Tower: Octagonal, wood composites of wooden beams and fiberglass
Tower: Height: 40 meter
Rotor diameter: 26 meter
Overall height: 52 meter
Rotational speed: 15-32 rpm
Wings: Three fixed
Blade length: 24 meter
Start wind: 4 m/s
Stop wind: 25 m/s
Generator: Permanent magnet, synchronous low-speed, 2.5 meters in diameter, placed on a 3 meter concrete base.
Direct drive, no gearbox
Frequency converter
Made in Uppsala and Falkenberg and erected 18 to 26 February 2010.

The tower is built of wood composites instead of steel or concrete. The composites consist of fiberglass and wooden beams. The material provides environmental and technical advantages.

The turbine has fixed blades that capture energy from the wind provides lift forces on the leaves. The power is controlled with traditional stall control, which is improved by the electrical control of the generator.

The direct drive generator is placed on a concrete foundation on the ground in the bottom of the tower. It is a permanent magnet synchronous cable-wound generator. The low-speed generator is capable to generate electrical energy directly from the wind turbine speed. This eliminates the need for gearbox, which the last years have been many wind turbines weak point. The gearbox will also cause a few percent losses, energy must be dissipated.

Thanks to the unique design of the generator it can also function as an electric brake, so the mechanical brake on the horizontal axis wind turbines can be excluded.

Vertical Wind's wind turbine has a vertical axis, while the conventional turbines rotate around a horizontal axis. The vertical axis wind turbines produce

regardless of wind direction. The turbines do not need to be turned up against the wind, which is done with horizontal axis wind turbines.

With the vertical axis to the generator, it can be placed at ground level, and therefore need not be weight optimized.

Vertical Wind AB's new wind turbine has been developed in close cooperation with the Department of Electricity at Uppsala University where wind energy research has been conducted since 2001.
Advantages:

A total of four vertical axis wind turbines will be built in a common park in Falkenberg. All four are produced in the Vertical Wind newly established factory in Falkenberg. Each unit is 200 kW, about one tenth of the size of today's conventional wind turbines.

**Box**

## Vertical axis wind turbines

Savonius rotor, the Darrieus turbine and Giromill are the three main types of vertical axis wind turbines. Vertical Wind's H-rotor is a type of Darrieus turbine. The Darrieus turbine normally has an oval shape with two to four wings. The wings are forming arcs from tower top to bottom, with machinery located at ground level.
Sometimes, a Savonius rotor is used for starting a Darrieus-turbine because it is not self-starting. H-rotor is started electrically.
In Giromill, which is visually similar to the H-rotor, blade angle is set in rotation. This makes them self-starting, but they must also be yawed against the wind. The only type of large vertical axis wind turbines manufactured in greater numbers is FloWind that was raised in California in the 1980s. It was up to 300 kW of power.
The picture shows a Taiwanese Darrieus turbine with a Savonius rotor for self-start.

# 3 New wind turbine factory in Falkenberg

Starting in October 2009, the company Vertical Wind located some of its activities to Falkenberg. The vertical axis wind turbines developed by Vertical Wind in Uppsala is now manufactured in Falkenberg. The establishment will give around ten new jobs in the community.

- The factory in Falkenberg is strategically important for us to build an effective production of large vertical axis wind turbines, says Björn Hellström, CEO of Vertical Wind.
- Here, production and assembly of generators, towers and wings to three of the four 200 kW wind turbines as Eon and Falkenberg Energi commissioned by Vertical Wind will be done.

- We will have many sub-contractors but all the assembly will be done in Falkenberg, particularly the production of the proprietary, direct-drive generator. The key to a good wind turbine is control over how the electricity is generated, "says Bjorn Hellstrom.

From the start the factory in Falkenberg have four employees, but it is estimated that there will soon be 10-12 employees.

- If this works well it can become a big business. The large wind power producers have basically abandoned wind turbines of this size and we can enter the market with a niche product, " says Björn Hellström.

The company is now ready to take orders of its 200-kW plants.
Ultimately Vertical Wind expects to build much larger turbines, perhaps 80 meter height towers and up to 3 MW of power.

- We feel it is important to contribute to the development of new wind energy technology in Sweden. The production of wind turbines in Falkenberg that

Vertical Wind open is a fantastic opportunity for the municipality and the region to take part in an exciting development, "said Jens Melin, Environmental Manager at Falkenberg Energi AB.

*In the area Lövstaviken close to the port of Falkenberg has five large wind turbines built in the "Energy in Minds" project. Photo: Margareta Gunnarsson*

# 4 The wind farm at Lövstaviken

In the spring of 2006 he foundation work begun for five new wind turbines at Lövstaviken. In November the first mill was erected. When winter storms had passed even the wings could become mounted and since mid-March 2007, five new municipal wind turbines are in normal operation.
Each individual wind turbine has an effect that is more than three times the size of wind turbines in the park with 15 turbines along the highway (E6) at The Falkenberg Gate.
The wind turbines at Lövstaviken have no mechanical gearboxes. Electrical energy is generated in a so-called low-speed generator, which can produce even at low speed. The generator also has varying speeds. This means that the generated current frequency varies with the speed of the rotor. This current is converted to DC and then to AC before it is fed into the grid. The plant generates electricity already when the wind is over 2.5 meters / second. The park is owned by Falkenberg Municipality.

| **Facts about the wind farm at Lövstaviken** | |
|---|---|
| Location: Approximately 1 km from city buildings | |
| Number of wind turbine | 5 |
| Type of turbine | Enercon, E70 |
| Hub height | 64 m |
| Rotor diameter | 71 m |
| Power | 2.3 MW / turbine |

| | |
|---|---|
| Production / year | Nearly 30 million kWh |


*Skottarevet offshore wind farm is planned about 8 kilometer out from Falkenberg. When it comes to operation almost all the demand of electricity is fulfilled in the municipality.*

# 5 Skottarevet – offshore wind farm

Skottarevet is a one meter deep due north of approach channel to the port of Falkenberg. It flattens out over a sizeable area with over ten meters deep. In the late 90s the first offshore wind farm in Halland was planned here. The proposal was met with resistance. Many feared that they would come too close to the town, interfering with the experience of pretty sunsets and provide noise and wandering shadows. Requirements were raised about alternative placement. The planning came to a halt.

In 2003 the Swedish Energy Agency made an inventory of suitable sites for wind power. The sites pointed out of the inventory, were designated as "national interest for wind power", and would be given priority to the continued expansion of wind power in Sweden. The proposal was an area further out than the Skottarevet heritage outside the port of Falkenberg.

Favonius AB is the company that wants to build Skottarevet. Its managing

director Jan-Åke Jakobsson says:
- We kept the name, but moved the project out from the ground to a sloping bottom with depths around 25 meters. Here we will locate the 30 wind turbines in a hexagon. It gives the smallest impression on shore.

In the photomontage made over the wind farm from shore Skrea only small turbines can be glimpsed just above the horizon line. Shortest distance to shore is 7.7 km. The wind turbines are planned for a power of 4-6 MW and a total height of 140 meters.
- Skottarevet will make Falkenberg self-sufficient in electricity. I think we were the first to formulate that goal. Perhaps we also will become the first to get there, according to Jan-Åke Jakobsson.

In December 2009 the highest Environmental Court gave their judgment. It was surprisingly a rejection. The judgment has been appealed. The decision now lies on the Supreme Court. There is still a cautious optimism that the project will be realized.

| **Skottarevet project in figures** | |
|---|---|
| Number of turbines | 30 |
| Hub height | 90 m |
| Overall height | 140 m |
| Power / turbine | 4 - 6 MW |
| Total power | Up to 180 MW |
| Electricity generation / year (est.) | 470 GWh |
| Annual requirements in Falkenberg Municipality | 520 GWh |
| Water depths | 21-26 m |
| Shortest distance to shore | 7.7 km |

Published: Monday, May 31, 2010

## No to Skottarevet

There will be no wind farm in Skottarevet off Falkenberg. The Wind Company Favonius denied review in the Supreme Court. Thus is the Highest Environmental Court's decision against the plan left.

The reason is that the endangered cod in the Kattegat are affected too much.

- The Court refers to the other places that may be of interest to us. Now we will take decisions if we are to move forward, says Favonius CEO Jan-Åke Jacobson.

*A Danish wind turbine Vestas V15, 55 kW, 30 meter high, was the first mass-produced wind turbine that was erected in Sweden. It was erected at Roland Bengtsson's farm in Tågarp, a small village in Falkenberg Municipality.*

# 6 Danish wind turbine in Tågarp 1983

A Swedish pioneer in wind power is Roland Bengtsson in Tågarp, Falkenberg Municipality. He was the first that bought a series-produced Danish wind turbine in Sweden. In 1983 he purchased a turbine from the Danish manufacturer Vestas. Roland is a farmer raising chickens and a major user of electricity. Approximately 95 000 kWh per year have been delivered to light and heat in his chicken farming.

But it was a special coincidence that made Roland Bengtsson to pioneer. He had a cousin, Bernth Alexandersson in Vessigebro thirty kilometers away. His company Soli Energy och Machine AB sold farm machinery from the Danish company Vestas, which had started producing wind turbines. He had seen the popularity of small wind turbines in Denmark so as a speculation he has taken a turbine to the agricultural exhibition in Elmia Agricultural Fair.

After the fair there was a machine on the hill in Vessigebro.
The only potential customer was his cousin Roland with newly hatched chickens

which requires light almost around the clock and the 30 degree heat.

Cousin Bernth courted authorities, and got some money from various funds, which together accounted for half of the investment of 350 000 SEK.  A large water tank with immersion heaters were included to store energy when the turbine provided more electricity than the farm drug. It didn't pay to feed surplus energy to the grid, the compensation was too low.

Roland Bengtsson accepted to buy it, asked for and received building permits. It was not so complicated then. The inauguration in August 1983 became a public story, Halland County Governor John Antonsson spoke. The event was widely publicized by the media. Now 27 years later, the turbine is still in operation.

| **Zephyr WTS 28.250** | |
|---|---|
| Control principle | Passive pitch |
| Hub | Flapping |
| Turbine diameter | 28 meter |
| Rotational speed | 36/54 rpm |
| Tower type | Steel shell |
| Hub height | 32 meter |
| Generator power | 75/250 kW |

*The wind turbine Zephyr 250, manufactured by a local manufacturer, was erected in 1989 at Lövstaviken, Falkenberg*

# 7 Zephyr – wind turbine from Falkenberg

Falkenberg municipality has for a long time considered environmental issues important. In late 1980, when production of wind turbines had begun in Denmark, the municipality asked manufacturer in Falkenberg, if they were interested to start manufacturing of wind turbines. An entrepreneur in the municipality, Leif Svensson, accepted the municipality's desire and started Zephyr Energy AB. The company began to operate in1988.

As a consultant for the project, the municipality had engaged a wind power and aerodynamics expert, Sven Svenning. He had a long experience in wind power.

Already in 1940s he had built a small wind turbine in the village Heberg in Falkenberg, which gave light to a summer cottage. Sweden's largest wind turbine in 1981 was his Tostared II. It had a rotor diameter of 12.7 meters and the tower height was 50 meters. It was natural for Zephyr to choose Svennings concept. The first turbine had 250 kW power, tower height of 30 meters and rotor diameter 26 meters.

The turbine was constructed after a soft concept. It would reduce the load on the turbine parts and reduce the need of materials. Unique to the turbine were the wings, and how they regulated the power they took up from the wind. The wings were divided into two parts, the outer part was sprung and twisted by the wind pressure directly, a passive rotation that was gentle on the whole turbine. The entire wing has also been suspended with a hinge in the wing root, so that it could turn back when heavy wind gusts occurred. Therefore, the wing had to have good distance from the tower. Most of the nacelle was located in front of the tower, which gave the plant an unusual appearance. The first turbine worked well and the production of electricity was high.

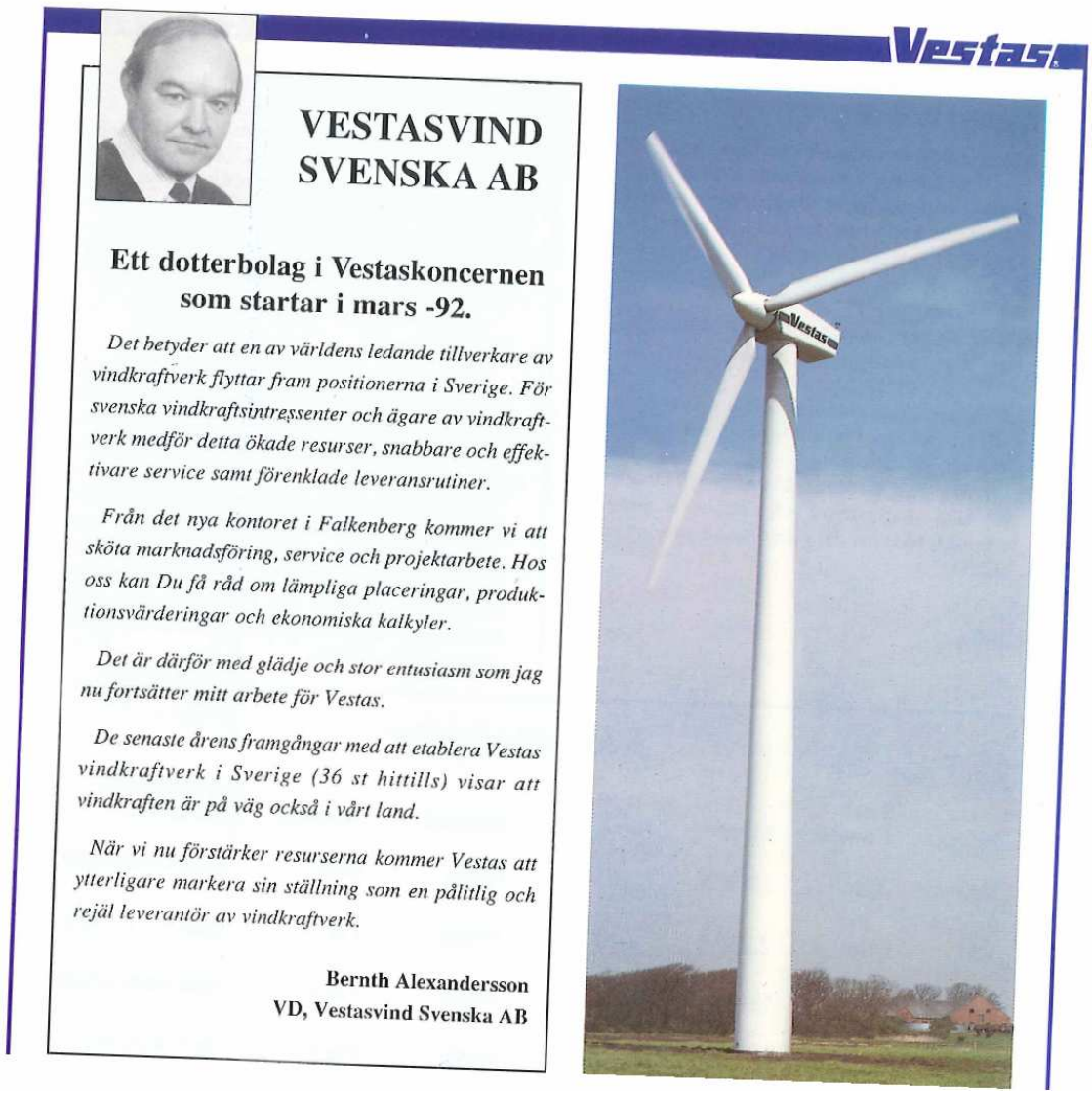
The wind turbines were commissioned by Falkenberg Energi and Vattenfall. Zephyr had trouble getting their first wind turbine certified. Certification was a requirement for the buyer, to get the investment grants that were introduced in Sweden 1991.

The development of the first two wind turbines was supported by the state. The support was relatively small. Until 1994, NUTEK, the State Enterprise Office, contributed with approximately 4 million Swedish crowns to Zephyr.

In mid-1990's, Zephyr had wind in the sails. The company negotiated with a few municipalities in Halland on an order of five to fifteen turbines. NUTEK urged the company to develop larger turbines to get more state aid and a feasibility study of a 750 kW variable speed turbine was worked out. But neither the deal with the municipalities or the production of the 750 kW plant became realized.

In total Zephyr manufactured and sold seven 250 kW wind turbines. The turbines got problems with strength. Bearings in the wings moving leads broke down too often. The wind turbines were not a commercial success, and production was discontinued. Zephyr was closed down in 1998.

Sven Svennings ideas are still alive in a smaller wind turbine; a farm turbine with power 20-30 kW in the company PitchWind Systems AB. The small turbines have the same power control but also a newly developed low-speed synchronous generator.



VESTASVIND SVENSKA AB

**Ett dotterbolag i Vestaskoncernen som startar i mars -92.**

*Det betyder att en av världens ledande tillverkare av vindkraftverk flyttar fram positionerna i Sverige. För svenska vindkraftsintressenter och ägare av vindkraftverk medför detta ökade resurser, snabbare och effektivare service samt förenklade leveransrutiner.*

*Från det nya kontoret i Falkenberg kommer vi att sköta marknadsföring, service och projektarbete. Hos oss kan Du få råd om lämpliga placeringar, produktionsvärderingar och ekonomiska kalkyler.*

*Det är därför med glädje och stor entusiasm som jag nu fortsätter mitt arbete för Vestas.*

*De senaste årens framgångar med att etablera Vestas vindkraftverk i Sverige (36 st hittills) visar att vindkraften är på väg också i vårt land.*

*När vi nu förstärker resurserna kommer Vestas att ytterligare markera sin ställning som en pålitlig och rejäl leverantör av vindkraftverk.*

**Bernth Alexandersson**
**VD, Vestasvind Svenska AB**

*Vestas Wind Systems A/S in Denmark, the world's largest manufacturer of wind turbines, started in 1992 a subsidiary in Falkenberg, Vestasvind Svenska AB.*

# 8 Vestasvind Svenska AB

Bernth Alexandersson operated the company Soli Energy och Maskin AB in Vessigebro, a village in Falkenberg. It was he who imported the wind turbine that was erected in Tågarp, Falkenberg, and that became the first mass-produced wind turbine in operation in Sweden. The company then worked as an agent for Vestas in Denmark, the company that afterwards became the world's largest manufacturer of wind turbines.

As business grew, Vestas wanted to organize the sales activities in Sweden themselves, by forming a Swedish subsidiary, Vestasvind Svenska AB. It started in March 1992 and Bernth Alexandersson became its first CEO.

Initially, Vestas of Denmark, was majority owner of the company and the CEO had a minority ownership. It was taken over in 1995 by parent company and the company became a wholly owned subsidiary of Vestas Wind Systems A/S.

The activity of the company in Sweden began in a relatively small scale. In the beginning, the company had four employees, mainly involved in sale and service. Gradually, as the business grew, they saw the need to develop a service organization and other jobs were made. The company purchased a service vehicle to provide service and maintenance for the wind turbines sold in Sweden.

An important channel to the market for the company was the Swedish Wind Power Association, which Bernth Alexandersson was one of the founders of in 1987. Vestas Wind Swedish AB was for many years the leading supplier of wind turbines in Sweden with a market share above 60 %. The company was the hub for everything related to wind power in Sweden and Finland. The company grew to 35 employees where the majority worked with service and maintenance. Service organization was spread over Sweden to cover all the country geographically.

Eventually in late 2007 the Danish Vestas, the world's largest manufacturer of wind turbines, decided to reorganize and created a joint Nordic sales office in Malmö, which would handle all sales and service operations in Northern Europe. The 30 employees in Falkenberg received offers of employment at the new office in Malmö and the activities were closed down in Falkenberg.

# 9 Triventus AB

The CEO of Triventus AB, Gert-Ove (Måns) Holst entered the wind power industry in 1996, when he was working at Vestasvind Svenska AB. This company he left in 2003 to start Triventus AB. From the beginning it was a pure consultancy company but now the business has expanded. The company covers all the wind power topics, from feasibility studies, investigations, licensing, planning, construction, operation, maintenance and ownership of their own wind turbines.
Now Triventus AB is a renewable energy company with focus on wind, hydro and biogas. The company has become a group company with subsidiaries Triventus Consulting and Triventus Energy Technology.

Operations are now scattered in several places, with offices in Vessigebro, Falkenberg, Falun, Östersund, Linköping and Stockholm, and service offices in Falköping and Mjölby. The company has grown rapidly in recent years and has now 65 employees.
- Falkenberg Municipality is a leader in renewable energy and there is a really great interest. Wind power is really going on and we want to help make more wind power in the municipality, "says CEO Gert-Olof Holst.

Recently new premises were inaugurated for Triventus close to the highway at Falkenberg. Here Triventus Consulting will operate their business while the parent company and Triventus Energy stays in Vessigebro. The Mayor of Falkenberg Mari-Louise Wernersson contributed to the inauguration of the new premises.
- It really belongs to the future with renewable energy and a lot is happening right now, including all wind power ventures. It's really good that this kind of companies think that Falkenberg is a stimulating environment to work in, "says Mari-Louise Wernersson.

*"A clip for the future." With this words Mayor Marie-Louise Wernersson, Falkenberg Municipality, inaugurated Triventus new office 12 December 2008.*

*View from the office of Falkenberg Energi AB, with the wind farm at Lövstaviken.*

# 10 Falkenberg Energi

Falkenberg Energi AB is a company which is wholly owned by Falkenberg Municipality. The company produces and sells renewable electricity and heat, and builds and maintains the electricity and district heating grids within the town of Falkenberg. The company has been an important resource for the municipality's ability to improve the environment and reducing emissions of greenhouse gases.

All electrical energy sold by the firm is labeled as "Good Environmental Choice" under the criteria from Swedish Society for Nature Conservation. This means that electricity is produced free from fossil fuels, but is renewable with minimal carbon emissions.

Falkenberg Energi AB has for years been working purposefully with renewable energy and environmental issues associated with the energy industry. The business concept is to make a business contribution to a sustainable society by offering renewable energy.

The year 2009, 96% of delivered energy was renewable. Within the company’s concession area, electricity volumes have a total of 360 GWh. In the district heating the total output was 79 GWh, of which the small scale district heating that has expanded during the "Energy in Minds' project accounted for 7.4 GWh.

Falkenberg Energi has made many efforts to promote wind energy.
- It was the originator and owner of the Zephyr-mills, the first plants manufactured in the municipality.
- The Company manages the operation of the five Enercon turbines in Lövstaviken that is supported from EU in the project “Energy in Minds.
- They are client and partner with Vertical Wind AB, that now starts

manufacturing and building of a new type of vertical axis wind turbines on municipal land.
- Falkenberg energy has been at the forefront of promoting co-operatively owned wind power.

The first wind-cooperative was FVEF (Falkenberg Wind Economic Association). Today, about 500 members have shares in their wind turbine in Simrishamn. One share of the association gives the right to buy 1000 kWh wind power electricity per year to a low price. Additional electricity is supplied by Falkenberg Energi AB, which has the balance responsibility.

SVEF (Swedish Wind Power Cooperative Economic Association) was formed in 1998, and has approximately 1300 members. Individuals and businesses, condominium associations, cooperatives, foundations, agriculture, etc. are members. The goal for the association is to produce electricity from wind power to its members to as low cost as possible.

A major benefit of wind power cooperatives is that it engages a lot of people, who actively have the opportunity to make an effort to increase the share of renewables in our energy balance.

Falkenberg Energi has also made a great effort on solar energy field. In the year 1989 they built the world's largest field of solar collectors. The total area of solar collectors amounted to 5500 square meter. This solar collector plant has won wide acclaim and contributed to Falkenberg's reputation as an environmental community. It has now been taken out of service because of technological life has come to an end and the field has been dismantled. The materials in the solar collectors have been recovered. For 20 years the field gave cheap energy with low environmental impact to the district heating in the municipality.

Municipal ownership of Falkenberg Energi has been an important contribution to the fact that the municipality has been able to make so much effort on environment and energy. Falkenberg Energy supplies the citizens with renewable energy with low environmental impact and gives an important contribution to sustainable development.