

## HAVSNÄS WIND FARM

The project financing of a Swedish wind farm



## 1. Introduction

In March 2008 the ground breaking project financing of the 95 MW Havsnäs wind farm was completed. Havsnäs represents one of the cornerstones in portfolio of Venus Vind, where sustainable Scandinavian strength is build through industrial scale wind farms with local presence.

At the time, Havsnäs represented the largest energy project financing in the market, it is also the first true project financing of a major Swedish wind farm.

The aim of this study is to highlight the process of project financing and additional lessons learnt from the Havsnäs transaction. Investment in renewable energy projects often includes international investors. We welcome the growing Swedish wind market to take part of our findings

Sponsorship provided by the Swedish Energy Agency (Energimyndigheten) has enabled the completion of this study.

Venus Vind is a portfolio of Swedish wind farms, where the size of the projects brings economy of scale and cuts operation costs. The portfolio is controlled by HgCapital.

Today, 2012, Venus Vind consists of three wind farms, in total 191 MW, developed and constructed by the same developer, Nordisk Vindkraft, part of the RES family, who also is in charge of operation and maintenancé.

Vestas was chosen as turbine supplier for all three projects, to ensure expected return on investments over time. The largest project in Venus' portfolio is the Havsnäs Wind farm, the case of this study.



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## 2. Swedish Electricity Market

### 2.1 Overview

Electricity from renewable energy sources constitute over 44% of Sweden's total electricity generation. This is largely made up of power from hydro, wind and biomass.

Sweden's green electricity certificate scheme (the Electricity Certificate Scheme) catalysed an increase in renewable energy capacity. It is estimated that the scheme has increased electricity production from renewable sources in Sweden by 9 TWh per year between 2003 and 2009. The Government's new aim is to increase electricity production from renewable sources by 25 TWh between 2003 and 2020 and it is anticipated that wind power will provide the bulk of this new capacity.

### 2.2 Swedish Electricity Certificate Scheme

The Swedish Electricity Certificate Scheme<sup>2</sup> was introduced in 2003. This is a market-based system to support the expansion of Swedish electricity production from renewable energy sources and peat. The system replaced earlier subsidies on renewable electricity production.

The basic principle behind the system is that electricity producers whose production meets the requirements of the Electricity Certificates Act (Lagen (2003:113) om elcertifikat) receive one certificate from the State for each MWh of electricity produced. Wind, solar, wave, geothermal facilities, certain biofuels, peat (burnt in CHP) and hydropower facilities are eligible for the green certificates.

In 2009, the Swedish and Norwegian Governments initiated the establishment of a joint Electricity Certificate market, setting 1 January 2012 as the target launch date.

Electricity Certificates can be traded, giving electricity producers an additional source of revenue aside from brown power sales. Trading on the Electricity Certificate market occurs through bilateral agreements, directly between producers and those having quota obligations, or through contract purchases involving the services of a broker.

## 2.3 Swedish-Norwegian green certificate system and Guarantees of Origin

On 8 December 2010, Sweden and Norway agreed to establish the green certificate system (GCS) for trading in green certificates. It came into effect on 1 January 2012 and will remain in place until 2035 (producer to be entitled to receive Electricity Certificates for 15 years or until the end of 2035, whichever date is earlier). The GCS is based on the Swedish model so there is a natural market expansion (both in terms of volume and number of participants), which will improve competition and stabilise green certificate prices.

Market commentators see the GCS as a driving force for increasing investment in wind power projects in both Sweden and Norway.

Sweden and Norway signed a letter of intent to allow power producers entitled to GCS to also receive a so-called Guarantee of Origin (GoO). 1 GoO represents 1 MWh of production, and each GoO is registered automatically in the same system as GCS's and can be sold domestically or to customers in other European countries.

### 3. What is Project Finance?

**Project finance is the long term financing based upon forecasted cash flows rather than the balance sheets of the sponsors. The loans are most commonly non-recourse loans, secured by the project assets, only paid entirely from project cash flow. Risk identification and allocation is a key component of project finance.**

In the financing of a wind farm, lenders are asked to take a view of where they believe power prices are going to be over the term of the loan as there are no long-term fixed-price offtake agreements in place at the outset. It is clearly more challenging to predict the forecasted cash flows of a wind farm than where long-term offtake contracts are in place, so lenders need to become familiar and comfortable with the electricity market regime in the relevant jurisdiction.



## 4. Key risks

In this section we discuss the key risks associated with project financing of a wind farm in Sweden based on experiences of the Havsnäs wind farm project.

### 4.1 Construction

The construction arrangements of the Havsnäs wind farm was based on structure provided by the Engineering, Procurement and Construction (EPC) contractor, NV Nordisk Vindkraft AB.

The EPC structure anticipates a single EPC construction contract between the project company and the EPC contractor under which the EPC contractor, has the sole responsibility for the design, technical specifications and performance of the wind farm in exchange for a fixed price. The EPC contractor then remains liable for any defects of liabilities arising from:

#### A. Designing the wind farm

- » **procuring all materials, equipment and machinery required to construct the wind farm**
- » **obtaining all construction permits**



## B. Constructing the wind farm

- » **engaging, managing, communicating and contracting with all subcontractors and vendors**
- » **commissioning and starting up the wind farm**
- » **training the project company's personnel and any operator of the wind farm (if not the same)**

The EPC contractor is then charged with negotiating the turbine supply contract with the chosen turbine supplier and any other construction contracts required to complete the wind farm (to the satisfaction of the project company and the project's financiers). They will also be responsible for ensuring that all parts of the construction of the wind farm is properly co-ordinated.





## 4.1.1 Havsnäs wind farm

**Although the EPC structure was adopted on the Havsnäs wind farm, it is not a structure that is characteristic of wind farms in Sweden, but rather is attributable to the choice of contracting with Nordisk Vindkraft.**

**Nordisk Vindkraft is one of the few EPC contractors in the wind farm market willing to accept full engineering, procurement and construction risk.**

Alternatively, the “multi-contract” approach might have been adopted, under which the construction of the project is divided into distinct contractual packages. For example, the project company might contract individually with:

- » an architect designer
- » a turbine supplier
- » a contractor responsible for the civil works
- » a contractor responsible for the electrical works
- » a construction manager

Multi-contracting is less popular from a financing perspective as less risk can be passed to each contractor and therefore a greater risk remains with the project company. The project company is also tasked with the responsibility of ensuring the project is properly co-ordinated.

In the Havnäs case Nordisk Vindkraft handled the multi-contracting, so that a special vehicle company (SPV) got the full EPC structure.

### **For the international investor it is vital to know that...**

There are a number of Swedish concepts and Swedish legislative references that will need to be taken account of in the construction arrangements for any wind farm in Sweden, these include (but are not limited to) the following:



### **Working hours and other labour related issues**

Construction is likely to be carried out in accordance with Swedish labour legislation including the Compulsory Holidays Act (Semesterlagen (1977:480)), the Restriction of Working Hours Act (Arbetsstidslagen (1982:907)) and the Occupational Safety and Health Act (Arbetsmiljölagen (1977:1160)). Working hours and other labour related issues, such as salaries and holidays, are often regulated by collective bargaining agreements entered into between a confederation of employers and a trade union. These cover all union members but it is common that employers use the collective bargaining agreement as precedent for non-union employees.

### **Civil works in Sweden are negotiated and performed based on standard contracts**

These are AB 04 for execution contracts and ABT 06 for design and build contracts, under which the parties make the required additions and deletions of provisions to adapt to the specific project. However, the general terms of the standard agreement and its liability provisions will, in most cases, remain, and knowledge of such provisions is important for sponsors and lenders.

## Design in the Works

The contractor's liability for any defect in the design of the works may be measured against the Swedish concept of a "totalentreprenör" being a turnkey contractor positioned as competent to take on work for such design in connection with the relevant works in Sweden. The concept of a turnkey contractor is part of the standard contract ABT 06.

## Health and Safety<sup>3</sup>

- » In order to ensure safety and effective co-ordination of the works on site, the contractor will be required to comply with the Work Environment Act (Arbetsmiljölagen, SFS1977:1160);
- » The contractor should also comply with the National Board of Occupational Safety and Health regulations on construction and plant work (AFS 1999:3) as appropriate, ensuring that there is a working environment plan (Arbetsmiljöplan) available at the site. The contractor should also comply with all applicable legislation and decrees relating to safety e.g. of high voltage equipment (Elsäkerhetslagstiftning and related föreskrifter)<sup>4</sup>;

## Governing law

The construction contracts for the Havsnäs wind farms were governed by Swedish law, however this is by no means mandatory. In the Havsnäs case English law might also have been chosen to govern the project documents. However the standard contracts (AB 04 and ABT 06) for civil works, were drafted on the assumption that they will be governed by Swedish law and replacing governing law for such contracts may result in interpretation issues. We would refer any analysis of the application of Swedish law to Swedish counsel for their expert opinion.

## Dispute Resolution

It may be agreed that disputes under any construction contract should be settled by arbitration in accordance with the Rules of the Arbitration Institute of the Stockholm Chamber of Commerce, or the Rules for Expedited Arbitrations of the Stockholm Chamber of Commerce. We would refer any analysis of the implications of such a nomination to Swedish counsel for their expert opinion.

## 4.2 Operational Management: Operation and Maintenance

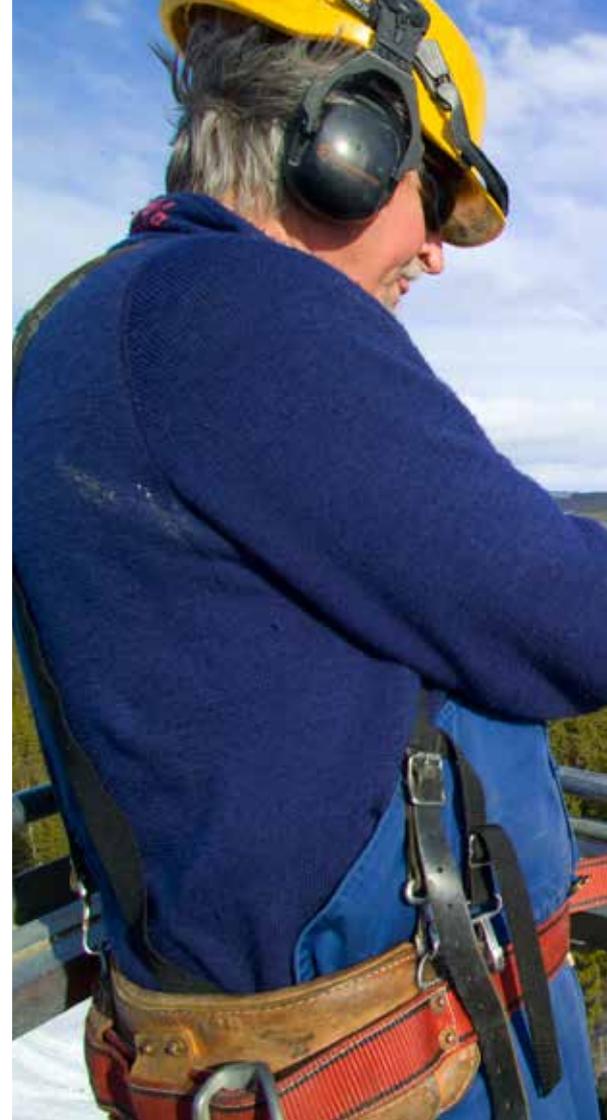
The turbines supplied to any wind farm project have traditionally been expected to come with a form of service and availability agreement (SAA) to provide:

- » regular scheduled and unscheduled maintenance for the turbines, and
- » a warranty from the turbine provider in respect of the availability of the turbines.

Liquidated damages should also be payable under such agreements for any failure of the turbines to achieve their warranted availability to provide cover against (or at least mitigate) the consequential fall in generation revenues.

In the Havsnäs transaction, the turbine supplier (Vestas) provided a service and availability agreement (SAA) for a term of five years, later extended to ten years. These terms are not out of the market-norm for an SAA, although at the time of writing, it should be noted that the market trend of project financing transactions appears to favour the provision of longer SAA terms (c. 10-15 years) as opposed to shorter ones (c. 2-5 years).

The warranted levels of availability for wind farms under an SAA are typically between 92% and 97%. Generally the warranted





level will be lower during the first year of generation, increasing to a higher level once any initial teething problems have been ironed out.

The project company might also enter into a separate operations and maintenance contract in order to provide:

- » general management and administration services for the wind farm
- » remote monitoring of the turbines on behalf of the project company
- » general maintenance services of the balance of the plant (i.e. for everything except the turbines)

Such agreements are essential.

In the Havsnäs case Nordisk Vindkraft had the ability to take on this responsibility. At the time of writing it is evident that this day-to-day operational management of Havsnäs is generating additional value and increased availability. For further information and statistics, please visit [www.vindstat.nu](http://www.vindstat.nu).

## 4.3 Land Issues

It is common, especially in the context of a large wind farm, for there to be multiple landowners with whom the project company has to enter into leases. Project finance lenders will require security over these leases as part of their overall security package. If not expressly granted in the lease, the project company must seek consent from the landowner prior to lenders granting security.

**It is advisable at the time of negotiating the land agreements to consider the granting of security to lenders. It is a time consuming process and can be difficult to obtain if there are numerous landowners.**

As the security will usually be granted by way of security assignment (säkerhetsöverlåtelse) the land lease agreement will also need to allow for sub-leasing of the lessor rights.

In the Havsnäs transaction for example, there were in excess of 15 land leases - this is not uncommon in the context of financing a large wind farm. It is vital that the relevant consents are sought and obtained at an early stage so as to avoid delays at financial close.





## 4.4 Merchant revenues

Given the nature of the Havsnäs wind farm project and the fact that the lenders providing the financing were participating in the first such project financing of a wind farm in Sweden, the lenders were keen to have as much control over the sale of the electricity certificates and brown power<sup>5</sup> to maximise revenues while minimising risk. On the other hand, the investor was keen to have as much freedom to trade the power and electricity certificates as possible.

A power sales strategy had to be negotiated to provide certain parameters around the sale of power and green certificates that would allow the generator sufficient flexibility to maximise revenues while preventing sales on a speculative basis. Adopting negotiated trading strategies for merchant power plants is not unique to the Swedish market, but as this was the first such financing in Sweden, it was important to ensure that the correct checks and balances were provided for.

Security over the brown power and electricity certificate sale agreements, Power Purchasing Agreement (PPA) can be created in the same way as security over any other contractual rights under Swedish law. If the contractual counterparty to the project company is a non-Swedish entity, it will be necessary to make an analysis of how that security is taken based on Swedish international private law rules.

## 5. Key financing considerations

### 5.1 Swedish specific issues with taking security

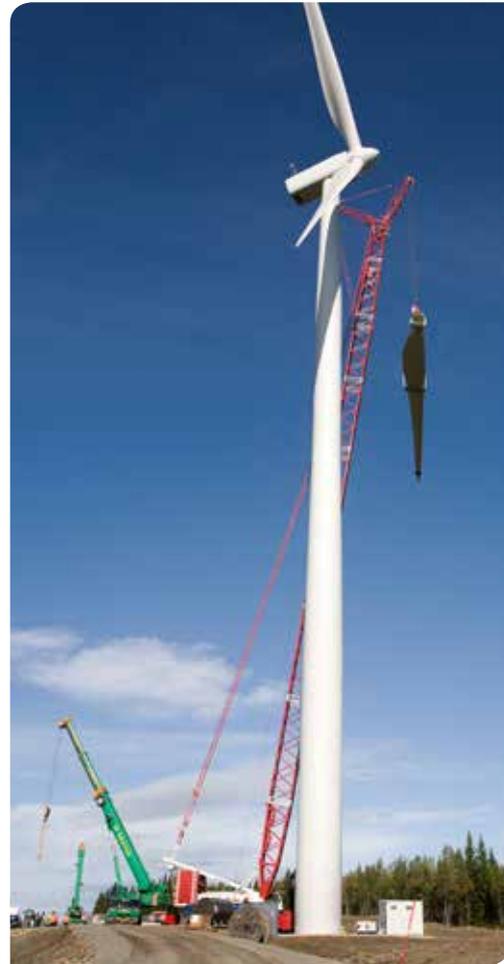
In a project finance transaction, as lenders are only able to look to the assets and revenues of the project company to secure any loan advanced, they are concerned about getting as robust a security package as possible.

The main issue faced in connection with the financing structure for the Havsnäs project was getting lenders comfortable with the security package on offer in Sweden. The range of assets the lenders were able to take security over was also a key concern.

The following is a summary of the key assets and types of security a project finance lender in Sweden can have access to:

- A. Equity:** pledge of shares and shareholder loans. In the UK, lenders would benefit from an analogous charge over the shares in the project company and any holding company together with an assignment of shareholder loans.
- B. Local law contracts:** pledge of rights (similar to an English law assignment) provided the counterparty has given its consent. However, in Sweden a pledge over the rights in respect of the grid connection agreement may not be possible to obtain. The grid owners are reluctant to accept such a pledge as they are obligated to ensure the safety of the grid and thereby want to maintain control over who is feeding electricity into it. Grid owners are legally obligated to connect a wind farm to its grid under law on the conditions set out in the Electricity Act (Ellagen, SFS1997:857).
- C. Land, turbines and other tangible equipment:** security assignment (säkerhetsöverlåtelse) of turbines and rights in leasehold agreements. Subject to the potential complications highlighted over the page, this is similar to what would be achievable in the UK.

- D. Revenues** pledge over receivables under insurance, Turbine Supply Agreement (TSA), Service and Availability Agreement (SAA), Project Management Agreement (PMA), Engineering, Procurement and Construction Contract (EPCC), Power Purchase Agreement (PPA).
- E. Accounts** pledge over accounts. As it is not possible to create security over VAT refunds from the Swedish Tax Authority, there is usually a specific VAT refund account over which security is created.
- F. Step-in rights** direct agreements in respect of, inter alia, TSA, SAA, PMA and EPC contracts are entered into to provide lenders step-in rights in respect of such contracts.



## 5.2. Potential complications

### Turbine pledge

It is customary that there is a retention of title arrangements in delivery contracts for the turbines, the security over a turbine is not effective until the turbine is built and the project company is the owner of it. Under the terms of the construction agreements in the Havsnäs transaction, ownership passed on taking-over so the lenders effectively did not have the benefit of security over the turbines during the construction period. To mitigate this issue, a robust guarantee from Nordisk Vindkraft's parent company, Sir Robert McAlpine, was obtained.

### Land security

As noted above, for the project company to be able to grant security over a land lease, it is imperative to obtain the consent of the landowner to the granting of such security. Obtaining these consents can be time consuming and difficult if the landowners are private individuals, as they will not be familiar with the legal effects of the security and the requested consent.

It is worth ensuring that each lease contains a provision stating consent is given and that such consent contains a right to sub-lease the land back to the project company. Checking this point is a key part of the lenders due diligence exercise.





## Charge over bank accounts

In a project financed transaction, one of the fundamental pieces of the security package is a charge over the project company's bank accounts. In Sweden however, a pledge over the proceeds of such accounts is not practicable unless the accounts are completely blocked and under the control of the lenders. To get around this problem, in the Havsnäs transaction the bank accounts were located in the UK and the lenders benefit from a charge over such bank accounts. One Swedish bank account was opened in order to meet project costs with a daily sweeping mechanism and a very low limit on the permissible balance on such an account, but all revenues, apart from Guarantees of Origin (GoO), are paid directly offshore.

## Electricity certificates

In terms of taking security over the electricity certificates, it is possible to take a pledge. The pledge is perfected by way of notice to the central certificates depository authority Svenska Kraftnät (SvK) (Swedish National Grid) – which is wholly-owned by the Swedish state, where all the electricity certificates are registered. However, a notice will need to be sent to the authority for each new certificate awarded to the project company, which makes the use of a perfected security rather cumbersome.

All suppliers of electricity (and some larger industries) and the obligated parties must be registered at SvK. According to Swedish

law, on 1 April each year, all obliged parties' SvK accounts will be updated to show the quantity of green certificates they have supplied and consumed. In case of a shortage of electricity certificates the obligated party shall pay a fee corresponding to 150% of the volume weighted average value of the number of electricity certificates missing. Pledged electricity certificates are not included in the counting. This means that the pledge would have to be waived before this date every year and a new pledge in the new electricity certificates accumulated as of 2 April must be taken.

Due to the complications identified above, a pledge over electricity certificates may not be taken in Sweden.

### **Security over contractual rights**

Swedish security over contractual rights is taken by way of a pledge of the financial rights under the relevant agreement. The pledgor, however, remains as the entitled party to all non-financial rights under the pledged contract. In order to perfect a pledge over a contract, all payments will need to be made to the pledgee (the banks), and the pledgor may not receive any payments under the pledged contract. This makes security over contractual rights cumbersome and usually the security is taken without the perfection requirements being met initially. Perfection is then agreed to happen at a future date if there is a default under the terms and conditions of the financing.





The table below shows some financial figures of the Havsnäs transaction.

Havsnäs (March 2008)	
Debt	€165,000,000
Equity	€57,500,000
Debt: Equity	75:25
Maintenance Reserve Account (MRA)	Yes in future + 10 years
Duration of loan	19 years

## 6. The investor sharing his experience



**Jens Thomassen**  
Member of the Renewable  
Energy team at HgCapital

Jens Thomassen, member of the Renewable Energy team at HgCapital, would like to share his view on the project financing experience of Havsnäs.

### Generally speaking, when do you prefer using project financing, and why?

*For asset based investments within renewable power generation. A good reason for using it is that the equity sponsors' risk is limited to the equity injected in the project company exposure. Banks cannot recover any potential losses from the equity sponsors other projects or corporate balance sheet. As the capital injection is clearly defined upfront and future funding is sourced from operational cash flows, project finance is also a very useful financing option for joint ventures where the partners have different abilities to raise capital.*

### Please explain why project financing was used when investing in Havsnäs?

*We found it to be the most efficient way to achieve the lowest cost of capital for this type of project.*

### And if you would highlight the disadvantages or risks for an investor?

*Project finance is a relatively technical discipline. All risks and responsibilities are regulated through contracts. The documentation can therefore come across as extensive, but it is required to ensure the project can operate effectively throughout the life of the financing.*

***"Note, as banks share the operational risk of the project it is also important to ensure the bank has a good understanding of the project economics. Establishing and maintaining a good relationship with lenders helps facilitate a smooth operation. It is recommended that a first time project finance investor seeks help from someone experienced with project finance. This could be a joint venture partner or an advisor."***

## How does the interest and bank fees paid for the loans differ compared to regular bank loans ?

*My experience is that pricing of traditional bank loans typically reflect the credit rating of the parent company and can therefore vary materially not only in terms of pricing, but also in terms of debt quantum. Project finance debt margins range between 1- 3%. The weighted cost of capital for a project financed wind farm is similar to the cost of capital of utilities. Traditional loans for shorter periods, longer loans mean power and generic costs can be lower.*

## What about the major differences in methodology and reporting requirements between project financing and regular bank loans?

*As lenders have underwritten the future performance and cash flows of the project, they need to monitor it's performance. This is typically done via annual or semi-annual reports. The level of reporting is typically less comprehensive than reports an equity investor would require.*

**Project financing seem to require a high degree of predictability in revenues. You managed to project finance Havsnäs despite the fact that green certificate prices are quite volatile and revenues from these are an important component in the total revenue. Did you find this challenging and how did you manage this?**

*I would say that the main challenge was to analyze and communicate the long term outlook for power and green certificate prices over a*



20 year timeframe and develop a hedging strategy that gave a medium term predictability sought by the investors and lenders, but also worked within the limits of the trading contracts available on Nordpool and in the green certificate market. I would also like to add careful attention to gearing levels, based on power prices and strong wind resource assessment.

***“You can get wind, power and green certificates wrong. If you get two or three wrong you are overgeared and it could get ugly - discipline and strong risk analysis is key to getting lenders across.”***

### **With your experience of being a foreign investor can you elaborate even more on the greatest opportunities and risks for an investor interested in investing in wind farms in Sweden?**

*My short answer would be: The greatest risk is not knowing what you are investing in!*

*What I mean is that there are many assumptions you need to take into account, the most important again being the wind assessment. The industry as a whole has often over-estimated production. This is usually a result of poor measurement campaigns and working with inexperienced developers, lenders and investors. I find Havsnäås to be one of very few wind farms producing above the P50 estimated production level in its first year of operation.*

*Secondly, the wind farm areas are often in remote locations, which requires infrastructure to be in place. Furthermore, as this is a young industry, there are risks associated with not using an experienced construction company for erecting the wind farm. Contracts should also stipulate penalty clauses if something goes wrong with construction, so that the project company will not suffer. But let me emphasize, if things are done right, it will be a stable investment offering decent returns over a long period.*

### **What is your experience on mitigation and/or control of the above mentioned risks?**

*We always ensure that a proper wind measurement methodology is used, with at least two met masts, combined with SODAR<sup>6</sup> and/or LIDAR<sup>7</sup> measurement technology. We work with experienced construction companies and developers with track records of delivering a product on time and to budget, and generates the expected production. In addition, we ensure that the contracts protect the project company if something goes wrong.*

## Which experiences from the Havsnäs investment would you like to share with other wind farm investors thinking about using project financing for funding their investments?

*My list would be:*

1. **Be well prepared.** *Understand the risks of the projects and how these will be allocated and managed to both the equity investors and the banks satisfaction.*
2. **Be aware of the importance of wind measurements.** *I find it increasingly important to develop comprehensive standards for performing wind measurements. This is the biggest risk and one where the industry as a whole has a lot to learn.*
3. **Do your due diligence with a lenders conservative eyes;** *they will not be as positive as you are as they are focused on the downsides.*
4. **Understand the market and revenues.**
5. **Do not over-gear the project.** *It will not only be the problem of the lenders, but also for the equity investor.*



## 7. Conclusion

The Havsnäs project was financed in 2008 under a challenging economic climate. At the time the project reached financial close, the banking market was on the brink of the worst liquidity crisis of the past decades. The Havsnäs transaction successfully completed due to the strength of the sponsors, HgCapital and Nordisk Vindkraft, the robust contracting structure and the lenders willingness to venture into previously uncharted territory.

While it is always challenging developing the first project of its kind in any given jurisdiction, lessons were learnt from the Havsnäs transaction, paving the way for the successful completion of additional Swedish wind farms. This was in most part due to the lenders becoming familiar with, and being able to find solutions to the differences in project financing in Sweden, and the differing security structures in particular.

Any investor with an interest in learning more about the possibilities for project financing can find additional information via the following institutions / banks:

- » **Financing of projects – Major investment banks**
- » **General advice in connection with investing outside of Sweden (Swedish investor) – Exportrådet (Swedish Trade Council)**
- » **For assistance with hedging of political risks or risks related to not receiving payment – Insurance company or government agency in your country**
- » **For assistance with hedging of political risks or risks related to not receiving payment (Swedish investor investing outside of Sweden) – Exportkreditnämnden (EKN)**

While it is always a challenge to develop the first project of its kind in any given jurisdiction, lessons were learned from the Havsnäs transaction, paving the way for the successful completion of additional Swedish wind farms in the portfolio of Venus Vind. This was in most part due to the lenders becoming familiar with, and being able to find solutions to the differences in project financing in Sweden, and the different security structures in particular.



## 8. HgCapital

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### OVERVIEW

- » >€580 billion in renewable energy funds under management – the largest dedicated renewables funds in Europe
- » 13-person dedicated renewable energy team; > 70 years sector experience

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### INVESTMENT STRATEGY

- » Lead investment in utility scale EU renewable energy projects using proven technology
- » Partner with leading developers in each market
- » Secure economies of scale through market position in operation and procurement
- » Invest pre-construction, arranging financing, construction and operations

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### HgCapital IN SWEDEN

- » No 1. investor in Swedish onshore wind
  - 191MW operating or in construction
  - three of five largest onshore wind farms in currently in construction or operation
  - Havsnäs 95MW, Ytterberg 44MW, Åmliden 52MW
- » Leading private equity investor in Scandinavia
  - Acquired VISMA accounting software in 2006 (Sweden and Norway)
  - Acquired Frösunda, specialist disability care provider in 2010 (Sweden)
  - Acquired Mondo Minerals, talc mining, in 2007 (Finland)

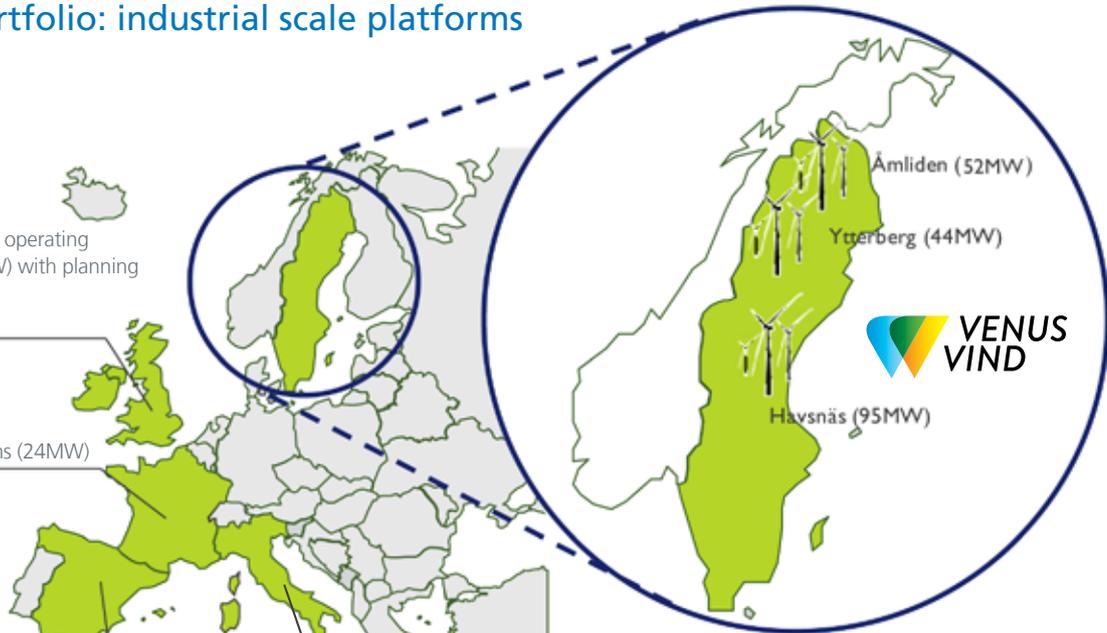
## HgCapital portfolio: industrial scale platforms

Six wind farms (113MW) operating  
Three wind farms (58MW) with planning approval  
Further pipeline

Two operating wind farms (24MW)

Seven Solar PV plants (61MW)

Four wind farms in planning (120MW)



### SCANDINAVIA WIND

- » Three wind farms (191MW) operating or in construction
  - three of five largest wind farms
  - 500 GWh annual production
- » Industrial platform
  - All turbines supplied by Vestas
- » Largest onshore wind farm owner in Sweden

## 9. Nordisk Vindkraft



**Arne Lorenzen**  
Managing Director  
Nordisk Vindkraft

Nordisk Vindkraft is a member of the RES group.

In addition to the ownership of wind farms in Sweden, the company is a provider of Development, Construction and Operational Management services. This flexible approach has been at the heart of Nordisk Vindkraft's success because we can tailor projects to fit customers' needs.

Nordisk Vindkraft has built and is currently building wind farms with a total capacity of more than 380 MW.



Havsnäs (95,4 MW)

Åmliden I & II (52 MW)

Hornberget (10 MW)

Sidensjö (144 MW)

Ytterberg (44 MW)

Håckstad (10 MW)

Kyrkberget (23 MW)

## 10. References

<sup>1</sup> For further information see section 9 of this report and [www.HgCapital.com](http://www.HgCapital.com)

<sup>2</sup> For further details please turn to [www.regeringen.se](http://www.regeringen.se) or [www.energimyndigheten.se](http://www.energimyndigheten.se)

<sup>3</sup> For further details: "Havsnäs Wind Farm A Guide on Health and Safety" available via [www.nordiskvindkraft.se](http://www.nordiskvindkraft.se). For hard copy please contact Nordisk Vindkraft on +46 (0)31 339 59 60, or [www.av.se](http://www.av.se) Arbetshiljoverket(the Swedish Work Environment Authority - SWEA)

<sup>4</sup> For more information turn to Elsäkerhetsverket (The National Electrical Safety Board) [www.elsakerhetsverket.se](http://www.elsakerhetsverket.se)

<sup>5</sup> Sales of electricity

<sup>6</sup> SODAR (SOUND Detection And Ranging) - A wind speed measurement device in the general class of devices known as Remote Sensing (RS) devices. RS devices are capable of measuring a parameter some distance from where the RS device is physically located, unlike, for example, an anemometer or a temperature sensor that measures the wind speed or temperature at the precise location of the instrument.

<sup>7</sup> LIDAR (LIGHT Detection And Ranging) - Same operational principle as SODAR but uses laser light transmitted in a typically conical pattern upwards above the device. Some of the laser light is reflected back from aerosols (dust, pollen, pollution) in the atmosphere and the wind speed is derived from the speed of these particles. Therefore the LIDAR is in theory easier to use in forests and so on as it does not suffer from fixed echoes. However clouds, fog, rain, snow and too clean atmosphere can all cause loss or corruption of measurements.





Pilot sponsor: Energimyndigheten



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