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San Giorgio Group Case Study: Jädraås Onshore Windfarm

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September 2013

A CPI Report

Descriptors

Sector	Multilateral Climate Finance, Institutional Investment	
Region	Global, Europe	
Keywords	Renewable energy, climate finance, onshore windfarm, institutional investors, pension funds, export credit agency, export guarantee	
Related CPI Reports	San Giorgio Group Case Study: Walney Offshore Wind; The Challenge of Institutional Investment in Renewable Energy	
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Disclaimer

This report is based on publicly available information and interviews with selected key stakeholders. Detailed information on the financing and contracting of the project was not available due to confidentiality and sensitivity of the information.

About CPI

Climate Policy Initiative is a team of analysts and advisors that works to improve the most important energy and land use policies around the world, with a particular focus on finance. An independent organization supported by a grant from the Open Society Foundations, CPI works in places that provide the most potential for policy impact including Brazil, China, Europe, India, Indonesia, and the United States.

San Giorgio Group Case Study Overview

This paper is one of a series - prepared by Climate Policy Initiative for the San Giorgio Group - examining the use of public money to catalyze and incentivize private investment into low carbon technologies and drawing lessongs for scaling up green, low emissions funding. The San Giorgio Group case studies seek to provide real-world examples of what works and what does not in using public money to spur low-carbon growth. Through these case studies CPI describes and analyzes the types of mechanisms employed by the public sector to deal with the risks and barriers that impede investment, establish supporting policy and institutional development, and address capacity constraints.

Acknowledgements

The authors thank the following organizations and professionals for their collaboration and input: (in alphabetical order): Peter Nygren (Arise Windpower AB), Tomas Sjoberg (Axpo Group AG), Jens Lundsgaard (Danish Ministry of Business and Growth), Julie Sonne (Danish Ministry of Economic and Business Affairs), Salvatore Santoro (DNB ASA), Lars Molte Jakobsen (Eksport Kredit Fonden – EKF), Torben Möger Pedersen, Claus Lyngdal and Kim Nielsen (PensionDanmark A/S), Mikael Schoultz and Simon Page (Platina Partners LLP), and Jonas Millqvist (Vestas Wind Systems A/S).

Finally the authors would like to acknowledge inputs, comments and internal review from CPI staff: Ruby Barcklay, Barbara Buchner, Brendan Pierpont, Elysha Rom-Povolo, Tim Varga and Jane Wilkinson.

Table of Contents

Executive Summary

Renewable energy deployment is an important part of decarbonizing the energy sector, reducing emissions, and transitioning to a low-carbon economy. However, it requires significant new investment.

Commercial banks have traditionally been a major source of lending to infrastructure projects, increasingly including renewable energy projects such as onshore wind energy. However, a drawn out economic recession has limited these banks' lending capacities, leading policymakers and renewable energy project developers to look elsewhere for financial backing. With approximately USD 71 trillion in assets under management, institutional investors, such as pension funds and insurance companies, are often regarded as other promising sources of possible funding.

The potential is certainly there. At first glance, their investment appetite and objectives appear to align with the long-term financial needs of renewable energy projects. However, policy barriers and long-standing management practices prevent all but a few from actively engaging in renewable energy projects (see Nelson and Pierpont, 2013).[1] This means when institutional investors do engage in renewable energy projects, it is important to draw out lessons to understand what worked, what was needed to encourage their participation, and what potential exists to replicate and scale similar approaches.

This case study examines how a combination of state-backed policies and financial instruments facilitated more than EUR 360 million of private investment to develop the Jädraås Onshore Windfarm – the largest onshore windfarm in Sweden and Scandinavian Europe at commissioning in May 2013. Importantly, the financing arrangement included a guarantee backed by the Kingdom of Denmark that allowed project developers to secure one-third of this, or EUR 120 million, from a Danish institutional investor, PensionDanmark.

The Jädraås financing arrangement had two overarching objectives:

1. In the context of limited long-term commercial bank lending capacity, to secure alternative funding and realize Jädraås Onshore Windfarm project financing needs.
2. To bolster Danish economic interests by supporting wind industry exports, and maintaining investments in renewable energy projects despite widespread economic recession.

The Jädraås project attracted a wide range of stakeholders:

- **Project co-sponsors**, including Arise Windpower AB, Sweden's largest windfarm developer, and Platina Partners LLP, a UK private equity investor, provided a total of EUR 120 million in equity.
- **Long-term debt providers** which contributed EUR 240 million in debt financing - 50% from Danish pension fund PensionDanmark, and 50% shared between two Scandinavian commercial banks (DNB ASA and SEB AB).
- **Export credit guarantor**, Danish export credit agency (EKF[2]), ultimately backed by the Kingdom of Denmark, which provided an export guarantee to facilitate PensionDanmark's involvement. The use of Danish wind industry technology from Vestas Wind Systems was a necessary prerequisite to secure the participation of EKF, given the Kingdom of Denmark's interest in supporting the local wind industry at a time of economic recession.
- **The Government of Sweden** established the Swedish renewable energy certificate scheme which provided a stream of financial incentives paid for by rate-payers that will total approximately EUR 200-225 million in revenues over a 15-year period.

The following table summarizes how the Jädraås project financing arrangement addressed stakeholder-specific barriers to taking part in the investment:

1 The potential for institutional investment may only cover a portion of the necessary levels of required investment. CPI found in (Nelson and Pierpont, 2013) that if all policy barriers were removed and investors optimized their renewable energy related investment practices, institutional investors could supply one quarter to one half of the investment needed to fund renewable energy projects through to 2035.

2 Eksport Kredit Fonden, see http://www.ekf.dk.

ACTOR	ISSUE	JÄDRAÅS
PROJECT SPONSORS: ARISE WINDPOWER, PLATINA PARTNERS	Limited long-term commercial bank lending appetite forced project developers to look elsewhere for funding.	A guarantee provided by the Danish export credit agency allowed PensionDanmark to provide half the debt, on the same terms as commercial lending, while also allowing commercial banks (Norway's DNB and Sweden's SEB) to contribute the remaining debt without straining their lending abilities.
	No long-term power purchase agreements mean the majority of project revenues were exposed to market movements.	Jädraås project developers arranged hedging contracts to secure stable revenue streams by selling a portion of electricity on a 5-year basis, and on a 3-year basis for green certificates. Commercial banks required these contracts before providing debt.
DEBT PROVIDER: PENSIONDANMARK	Renewable energy investment presents new challenges and risks for non-traditional investors such as institutional investors.	PensionDanmark received an AAA rated state-backed guarantee from the Danish export credit agency, allowing the pension fund to earn returns above those of government bonds without accruing additional risks.
EXPORT GUARANTOR: DANISH EXPORT CREDIT AGENCY, EKF	Existing export lending approaches were unsuitable for the project.	EKF worked with PensionDanmark and financial advisor, Norwegian commercial bank DNB, to design an innovative long-term lending agreement on the same terms as commercial lenders. The agreement offered additional flexibility to also accommodate commercial bank lending.
	Export loan guarantees were only available to projects that support Danish economic interests.	Jädraås met EKF requirements to support Danish economic interests through the export of Denmark-based wind turbine technology.
GOVERNMENT OF SWEDEN	Wind energy projects were not commercially viable without support.	The project benefited from the Swedish renewable electricity certificate which provides a 15-year stream of revenue and safeguards project viability.
	Lack of funding jeopardized project, energy and climate targets, and the generation of corporate tax revenue.	Jädraås financing structure facilitated alternate and additional lending capacities.
GOVERNMENT OF DENMARK	Lack of financial support potentially jeopardized project, putting Danish economic interests at risk.	The state-backed export guarantee secured Danish economic interest by supporting the export of Denmark-based wind turbine technology.

Key elements in the design and development of the project

This case study highlights three ingredients in the Jädraås financing arrangement that were essential to get Jädraås off the ground, and which could inform the design of other similar green investments:

1. **Strong public support with clear policy signals was essential to facilitate alternate funding opportunities and ensure project viability.** Two public support mechanisms reinforced Jädraås' project economics and ultimately proved necessary to overcome investment barriers. First, the Danish state-backed guarantee of export financing facilitated lending from a pension fund, and second, the Swedish renewable policy incentive provided a long-term revenue stream which assured commercial viability. While the latter is typical in regions aiming to encourage renewable energy development, the export loan guarantee demonstrates the potential to secure alternate long-term lending from, but not limited to, institutional investors.

2. **The willingness and commitment of the Danish export credit agency to guarantee funding underpins the Jädraås financing structure, and was essential to facilitate significant investment from PensionDanmark.** To overcome lower export levels and reduced lending to renewable energy projects, the Danish export credit agency, EKF, acted to bolster national economic interest and encourage private renewable energy investments. Jädraås shows that an organization such as EKF can successfully align public and private stakeholder interests and safeguard project financing during a period of limited lending capacities. **While Jädraås**

benefited from a state-backed export credit agency guarantee, our analysis suggests that other actors are in positions to provide similar export loan arrangements.

3. **The experience and regional 'know-how' of actors was essential to appropriately implement risk management measures, and arrange effective financing around existing relationships.** The Jädraås financing structure took a significant amount of time and innovation from project collaborators, and its success rested on the effective management of existing relationships spanning both public and private settings. Regional expertise and existing relationships ensured a smooth and rapid project development. Where these conditions are absent, it may be more difficult for other project developers to achieve the same level of success. However Jädraås demonstrates that notwithstanding the barriers, there is significant potential to encourage new collaborations between public actors, private project developers, and investors.

Our analysis suggests that the Jädraås financing structure can be applied to support green infrastructure investments in different geographies, using alternative (green infrastructure) technology providers, alternative long-term pools of capital, national export credit agencies with access to domestic sources of long-term pools of capital or, possibly, using guarantees from institutions other than export credit agencies.

Using similar models to scale-up investments in green infrastructure

Already, some key elements of the Jädraås financing structure are being replicated. For instance, the Swedish Lingbo Onshore Windfarm, and the Belgian Northwind Offshore Windfarm have replicated, or are planning to replicate, the Jädraås financial structure. However, other experiences show that complex financial packages are often not attractive to potential lenders which, ultimately, may limit the long-term pool of available capital. The success of the Jädraås financing structure suggests ideas for unlocking other effective investments in green infrastructure:

- **A simple financing structure increases appeal and usability.** In the Jädraås case study, the EKF-PensionDanmark-DNB structure was administered within these actors' normal operations, and so did not over burden their existing workload.
- **A common agreement to enable pre-packaged financing structures could be applied to investments in a variety of regions and technologies**, and could also appeal to alternative long-term sources of funds. This would assist project developers which typically prefer project financing options, but may be unfamiliar with all the steps necessary to secure risk coverage evident in the Jädraås structure and achieve similar results without accruing significant transaction costs.
- **Alternative guarantee providers other than export credit agencies, such as private financial institutions or insurance companies, could address the risk-return concerns of institutional investors.** Export credit agencies are not the only institutions capable of providing the guarantee instrument that underpins the Jädraås financing structure. A dedicated global vehicle designed to mimic the effect of the Jädraås financing structure, without necessarily requiring engagement by a national export credit agency, could open the structure to new actors and use an expanded suite of other instruments such as first-loss insurance and other new risk coverage mechanisms.

The Jädraås Windfarm project case study shows that public support can be used to encourage institutional investment in green technologies, provided they are offered risk coverage. Given the scale of the potential available lending capacity from institutional investors,[3] we hope that the lessons learned in this case study will provide policy makers, project developers, financial investors and lending institutions with a better understanding of the role of public policy and financial incentives in assisting private investment in less conventional energy technologies such as renewable energy.

3 Noting that existing policy barriers and internal management practices, in the short-to-medium term, may limit their potential contributions to lending: see (Nelson and Pierpont, 2013).

1. Introduction

In October 2011, Climate Policy Initiative and the World Bank Group, in collaboration with China Light & Power (CLP) and the Organization for Economic Co-operation and Development (OECD), established a working group of key financial intermediaries and institutions engaged in green, low-emissions finance: the San Giorgio Group.[4]

The San Giorgio Group recognizes that a major barrier to scaling up climate investment flows is the limited availability of clear, 'on the ground' examples of financial practices, environmental policies, and political signals that make green investment effective. The goal of the San Giorgio Group is to fill this gap by drawing on the experience of its members to track and analyze the life cycle of existing projects, programs, and portfolios. In so doing we aim to distil lessons about evolving financing practice and provide insights on how to scale up climate finance and spend resources more wisely.

Our enquiries are framed by four overarching questions:

- What is the role of public money?
- How can public money be best delivered (instruments and institutional channels)?
- How to ensure alignment of international and national public investment flows with each other and with private investment?
- How can continued learning be ensured?

San Giorgio Group case studies share a systematic analytical framework. They explore in depth the role of project stakeholders, the sources of return for the various stakeholders, the risks involved and arrangements to deal with them, and lessons on how to replicate and scale up best practice.

The Jädraås Onshore Windfarm offers an example of how an institutional investor, not traditionally an investor in renewable energy projects, was successfully engaged to provide a large proportion of overall finance for a large-scale renewable energy venture. The Jädraås Onshore Windfarm was project financed with equity contributions from developers Arise Windpower and Platina Partners LLP, and debt from PensionDanmark and two Scandinavian commercial banks. The financing was made possible through an arrangement under which the Danish export credit agency guaranteed the contribution from PensionDanmark, and a consistent revenue stream from Sweden's 15-year renewable electricity certificate scheme.

When fully commissioned in May 2013, the 203 MW project with 66 turbines was the largest in Scandinavian Europe. Using a capacity factor of 33.1% (based on the stated 2,900 full load operational hours per year), Jädraås will generate approximately 570-590 GWh in a typical year, delivering enough energy to supply almost 100,000 Swedish homes per year.

Institutional investors manage USD 71 million in assets, which remain largely untapped in the context of green infrastructure financing. Understanding how government policies and the interactions of different actors helped to unlock this potential in the Jädraås project may provide valuable lessons for the future financing of other onshore wind and renewable energy technologies.

In Section 2, we provide an overview of the Jädraås project, its main stakeholders and investors, and the policy environment in which it was developed. We examine the project economics such as costs and benefits of the project as a whole in Section 3. In Section 4, we discuss individual returns for the major stakeholders and investors, and individual risk allocation(s) according to the various technical, economic and financial risks associated with the project. Section 5 explores in more detail the financing arrangement. We particularly focus on the conditions and relationships that supported the establishment of a *Synthetic Loan*[5] which made alternate finance available at a time when commercial banks were restricted in their ability to do so. In Section 6, we draw out key lessons from Jädraås to determine its replication and scale-up potential and likely routes to unblocking such potential, before concluding in Section 7.

4 See the CPI website for additional information: http://climatepolicyinitiative.org/sgg/.

5 We use the term "Synthetic Loan" here to represent this arrangement as it effectively provides an alternate source of project financing lending at commercial terms and rates, slotting in alongside typical commercial bank lenders. See Section 5 of the report for more information.

2. An Overview of Jädraås Onshore Windfarm

- The Jädraås Onshore Windfarm highlights that strong public support has an important role in mobilizing private investment for green infrastructure.
- A state-backed guarantee catalyzed alternative project financing avenues when traditional commercial banks faced long-term lending constraints.
- In addition to the state-backed guarantee, policy incentives and an appropriate allocation of risks among stakeholders made it possible to attract commercial bank and pension fund investors.

2.1 Project background

Onshore wind has become the leading renewable energy technology in many countries. Robust policy frameworks, generous and novel financial support, and a maturing technology track record have ensured rapid onshore wind development and deployment, with some 282 GW of capacity installed worldwide by the end of 2012 (GWEC 2013). While a large wind energy project like Jädraås is economically viable on paper, securing sufficient project financing remains challenging because of a shortage of long-term lending capacity. In order to overcome this challenge in the Jädraås project, public and private actors across four nations worked together to achieve an alignment of interests.

The Government of Sweden aims to integrate its energy and climate policy in line with short-/medium-term targets from the European Union, in addition to proposing some of the most ambitious longer-term objectives in the world. These include:

- Reducing greenhouse gas emissions 40% relative to 1990 levels by 2020;
- Delivering at least 50% of gross final energy consumption, and 10% of transport sector energy consumption with renewable energy sources by 2020;
- Increasing energy efficiency 20% by 2020 compared to 2008; and
- Generating 20 TWh of energy from onshore wind and 10 TWh offshore, enough to power a total of 20% of national demand for electricity (based on 2011 figures (SEA 2012)); a substantial increase from the current wind energy supply of 6.1 TWh in 2011/2012.

Unlike many countries, Sweden's climate ambitions do not necessarily entail shifting the power sector to low-carbon generation sources, since the country already has one of the world's most decarbonized power sectors with hydroelectricity and nuclear energy making up 88% of the total electricity supply in 2011 (SEA, 2012). Importantly, these technologies were, and still are, substantially easier to finance than other forms of zero-carbon generation, meaning today, there are mixed incentives for project developers looking to develop and deploy increasingly larger renewable energy installations, such as windfarms.

Yet, Sweden is particularly well placed to employ wind energy technology. Much like the rest of Nordic Europe, the country has access to high average onshore wind speeds, a strongly integrated electricity network with neighboring countries, and the availability of land to construct large onshore windfarms with little impact on the local population.

With this in mind, in 2003, Sweden established a tradable market for renewable electricity certificates to encourage generation of electricity from renewable sources, obliging certain parties to meet a portion of their energy from new renewable sources and issuing certificates to eligible renewable energy projects.[6] The Jädraås project benefits from the incentive for 15 years, earning one certificate for every 1 MWh of energy generated from the windfarm.

As a result of its focus on wind energy, Sweden has experienced a large growth in deployment, installing approximately 450 MW of capacity per year since 2007. A combination of policy incentives (a stable and enduring renewable electricity certificate incentive), information tools (support in planning and permitting by developing a national network for wind use[7]), and

6 See Box 1 for further information on the Swedish renewable electricity market and the Nordic energy market.

7 The purpose of the network is to facilitate the development of wind power in Sweden by strengthening the country's knowledge on planning and admission processes; labor, business development, and operations and maintenance of wind power. See http://www.natverketforvindbruk.se/.

experienced energy engineering and financial capabilities in Scandinavia, spurred interest in the technology.

Denmark is also a world leader in the development and provision of wind turbine technology, and wind technology exports account for some EUR 6.5 billion in 2011 (EKF, 2012) or 3.1% of gross domestic product (IMF, 2013). Denmark has a national interest in growing or, at a minimum, maintaining the value of these exports, and supports export credit agency measures to achieve this end. It was because the Jädraås Onshore Windfarm project involved Danish wind turbine manufacturer Vestas, that Danish export credit agency, EKF, was willing to provide a state-backed export loan guarantee.

2.2 Project timeline

Plans to develop Jädraås began in 2008 with discussions between a privately-held project developer and one of Sweden's largest landowners. Swedish windfarm developer Arise Windpower AB purchased the Jädraås project in 2011, later receiving equity backing from the UK infrastructure fund Platina Partners LLP. At an early stage, the project developers secured the backing of the world's largest wind turbine manufacturer, Denmark-based Vestas Wind Systems A/S,[8] to provide turbine technology.

At the same time, the project developers approached an experienced energy investor, Norwegian commercial bank DNB ASA,[9] to become project's financial advisor, later gaining interest from Swedish bank SEB AB.[10] The financial advisor initiated a search for additional sources of funding because of the volume of the long-term debt required in the project. Danish pension fund PensionDanmark agreed to fund 50% of the project debt, backed by an export guarantee from Danish export credit agency EKF.

Project financing closed in October 2011, with Phase I construction commencing immediately and the first energy generation beginning one year later. The 132 MW Phase I consisted of 43 turbines completed at a rate of approximately one turbine every 7 working days. Phase II began in mid-2012 and installed 23 turbines totaling 71 MW in capacity in the second quarter of 2013. The project was officially opened in May 2013.

8 A/S (Aktieselskab: Danish Limited Company).
9 ASA (Allmennaksjeselskap: Norwegian Public Limited Company).
10 SEB: Skandinaviska Enskilda Banken, AB (Aktiebolag: Swedish Limited Company).

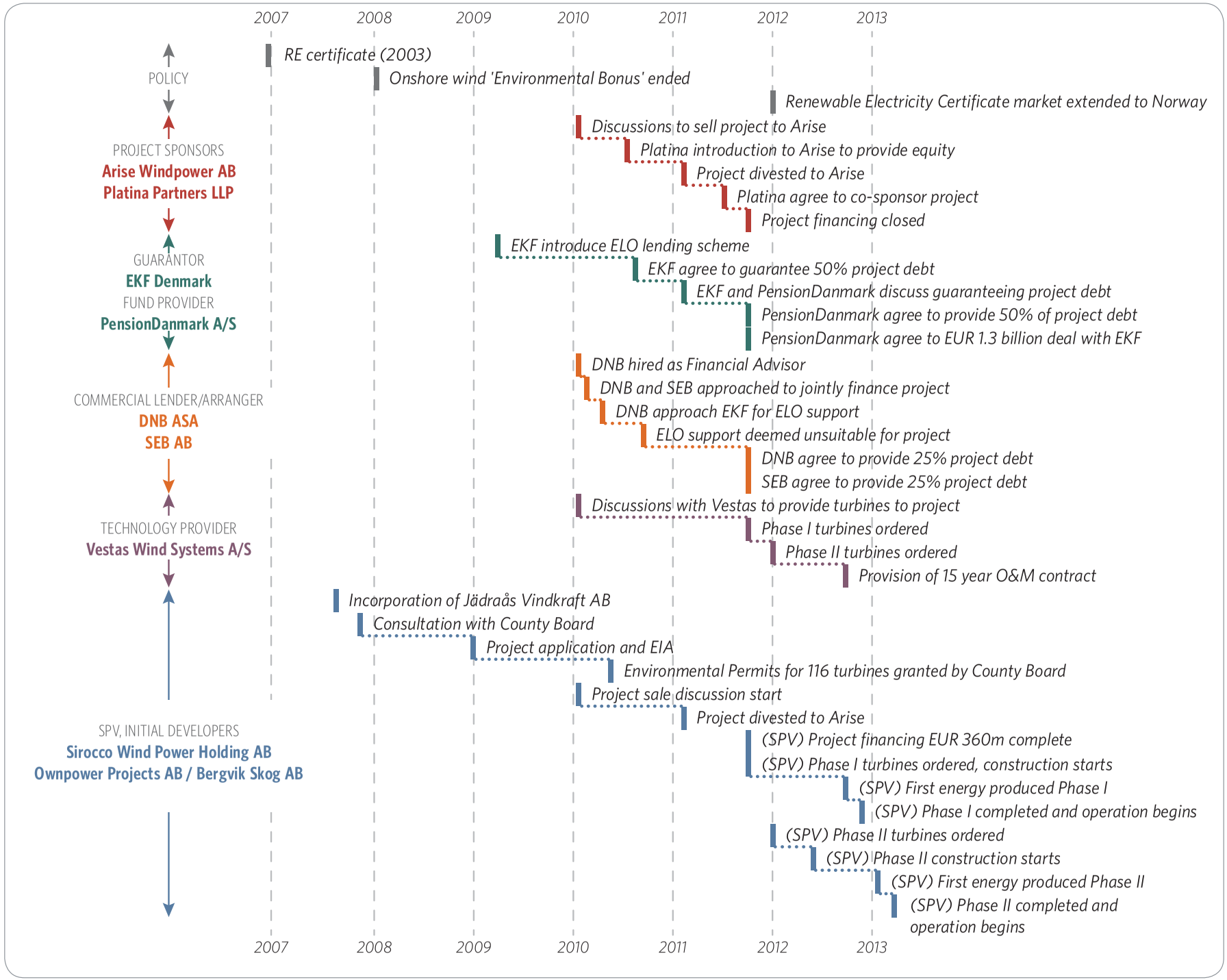
Table 1: Jädraås Onshore Windfarm stakeholders description and financing role.

STAKEHOLDER		DESCRIPTION AND ROLE	FINANCING ROLE
NATIONAL GOVERNMENT AND PUBLIC BODIES	Government of Sweden: SEA - Swedish Energy Agency (Energimyndigheten) Energy Network Operator (Svenska Kraftnät) Swedish Tax Agency (Skatteverket)	• Utlimately incentivizes wind energy development through policy by issuing renewable electricity certificates to eligible projects. • SEA regulates market and oblige certain electricity consumers to participate. • Svenska Kraftnät responsible for operating the renewable electricity market. • Swedish Tax Agency collects taxes generated by the SPV.	• Channels incentives from electricity rate-payers to project.
NATIONAL GOVERNMENT AND PUBLIC BODIES	Government of Denmark: Ministry of Business and Growth	• Strong interest to promote Denmark's world-leading wind technology industry through export.	• Insurer-of-last-resort of EKF state-backed export guarantee.
	FSA - Financial Services Authority (Finanstilsynet)	• Danish FSA regulates national financial markets and supervises market participants such as pension funds and their investment portfolios.	
PROJECT SPONSOR	Arise Windpower AB	• Sweden's leading windfarm developer established in 2007, responsible for operating 342 MW of wind capacity; directly owns 241 MW. • Operator of Jädraås Onshore Windfarm. • Aims to have 1,000 MW constructed and under management by 2017, retaining approximately 50% under company ownership. • Has a clear business strategy to annually co-invest in 100 MW of 'ready-to-build' capacity.	• Provided EUR 60 million in equity. • Co-owner, 50% of project SPV.

STAKEHOLDER		DESCRIPTION AND ROLE	FINANCING ROLE
PROJECT SPONSOR	Platina Partners LLP (Platina)	• Independent UK-based equity-investor focusing on wind and solar energy infrastructure projects. • Manages some EUR 500 million in investments, totaling 1,000 MW in capacity. • Investment strategy explicitly identifies opportunities in Scandinavian wind projects because of land availability and good wind resources. • Also co-sponsor with Arise in larger Lingbo Windfarm (see Section 6)	• Provided EUR 60 million in equity. • Co-owner, 50% of project SPV.
PENSION FUND / DEBT PROVIDER	PensionDanmark A/S	• Labour union/employee-owned not-for-profit pension fund established in 1993, with EUR 18.5 billion (end of 2012) of assets under management. • Active in green infrastructure investment with a strategy that includes diversifying portfolio into export guarantees or buying long-term debt from banks. • Strong portfolio focus on wind energy[a] which now accounts for around 8-10% of its assets under management. • Aims to have EUR 26 billion in assets by 2017, 10% of which will be in renewable energy with another 10% in loans to infrastructure projects (IPE, 2012).	• Contributed EUR 120 million in debt. • One of three key members in Jädraås Synthetic Loan structure.
EXPORT GUARANTOR	EKF (Eksport Kredit Fonden)	• Profit-making entity owned by the Danish state, EKF can provide AAA rated financing (S&P, 2012). • Total exposure of around EUR 10 billion (end of 2012), of which wind exports account for around 50%. • EKF guaranteed 20% of the total EUR 6.5 billion Danish wind energy exports in 2011 (EKF, 2012). • Jädraås is first project of an overarching three-year EUR 1.3 billion EKF-PensionDanmark export guarantee agreement.	• Provides PensionDanmark with an export loan guarantee for its full contribution, valued at EUR 120 million. • One of three key members in Jädraås Synthetic Loan structure.
COMMERCIAL LENDER AND FINANCIAL ADVISOR	DNB ASA	• One of Norway's largest financial services group. Renewable energy (focus on wind and solar) accounts for 40% of group's total energy investments. • Norwegian state owns 34% of shares (via the Ministry of Trade and Industry). • Acted as both commercial lender and financial advisor in Jädraås.	• Provided EUR 60 million in debt. • Financial Advisor of project. • One of three key members in Jädraås Synthetic Loan structure.
COMMERCIAL LENDER	SEB AB	• Commercial lender in Jädraås. • Major Scandinavian financial services group. Assets under management of EUR 154 billion by 2011, of which EUR 2 billion investment is in renewable energy projects and equipment.	• Provided EUR 60 million in debt.
TECHNOLOGY PROVIDER	Vestas Wind Systems A/S	• Denmark's leading wind technology provider and world's largest supplier of wind turbines. • At the end of 2012, Vestas has installed some 20% of the total global 282 GW capacity across 73 countries, or 55 GW of wind energy (Vestas, 2013) (GWEC, 2013). • Delivered, installed and maintain Jädraås project wind turbines. Supplier of 15-year operation and maintenance contract.	• Denmark-based technology was essential to unlock the export credit guarantee.

a PensionDanmark CEO Torben Möger Pedersen is a strong advocate of pension fund involvement in renewable energy investments, especially wind energy which Pedersen explains is "a very interesting opportunity for investors who can commit large amounts and can accept investments with a low degree of liquidity" (EWEA, 2012).

Figure 1: Timeline for Jädraås Onshore Windfarm highlighting major stakeholders involved and key project milestones.



Source: CPI based on all the sources mentioned in this report, including interviews with stakeholders.

The Jädraås timeline (Figure 1) shows the important milestones of the project, including the roles of individual stakeholders.

2.3 Project stakeholders

A project of this size, with this project financing arrangement, inevitably includes a broad range of stakeholders from initial project sponsors through to commercial lenders and technology providers. We identified nine public and private stakeholders from four European countries that were fundamental in realizing the Jädraås project. Stakeholders' roles and contributions to the project are summarized in Table 1. A Special Purpose Vehicle (SPV), **Sirocco Wind Power Holding AB**, was established by the project co-sponsors Arise Windpower AB and a fund of Platina Partners LLP. This SPV will be the focus of the returns and risk analysis in Sections 3 and 4, respectively.

Box 1: Markets for Nordic energy and Swedish renewable electricity certificates

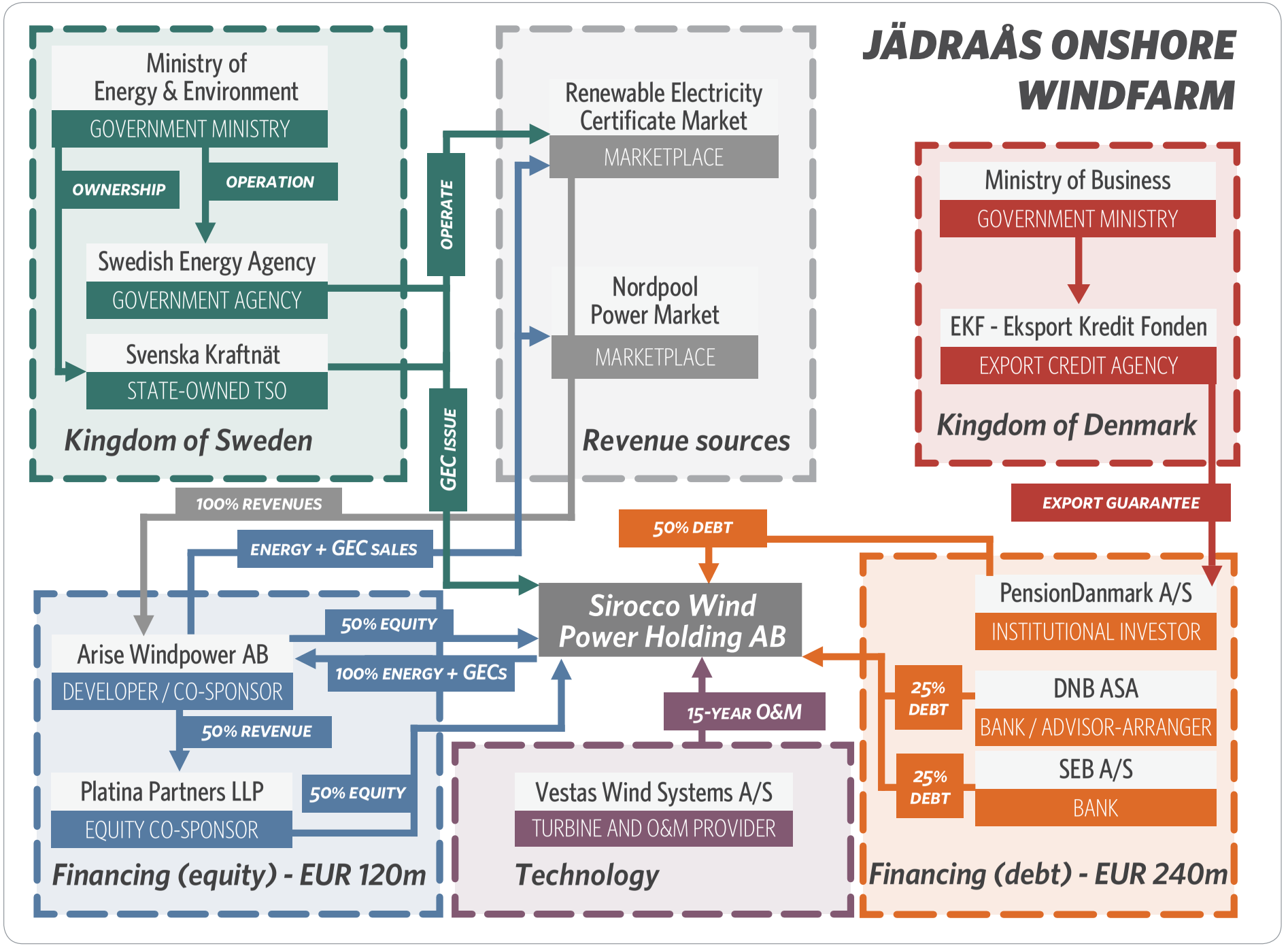
The Nordic energy market is one of the world's most decarbonized.[1] The Nordic countries also offer one of the earliest examples of a cooperative and liberalized operating energy market, robust and stable political economies, and a long history of financing and realizing large-scale energy projects. The region played an important part in the successful implementation of the Jädraås Onshore Windfarm, relying on the expertise and cooperation of three Nordic countries, and revenues from the Nordic energy market.

- **Nord Pool Spot Power Market:** started in 1991 as Norway's energy market was liberalized, and slowly expanded to include Sweden, Finland, Denmark and other surrounding countries. It has developed into one of Europe's, and the world's, most stable and liquid power markets, operating day-ahead (spot market) and intra-day physical markets.[2] It plays an important role in the Nordic energy industry, with almost 80% of the power generated in the Nordic countries traded on the Nord Pool day-ahead market in 2012 (NordREG, 2012). Since 2007, quarterly prices in Nord Pool have varied widely: averaging around EUR 42 per MWh, with a minimum at EUR 23 and maximum of 73 per MWh.
- **Swedish Renewable Electricity Market:** began in 2003, with the aim of incentivizing increased production of renewable energy electricity by 25,000 GWh on 2002 levels by 2020. In 2011, 13,300 GWh of new and additional renewable energy was eligible for renewable electricity certificates,[3] up from 6,500 GWh in 2002. Swedish households pay for approximately 50% of the system via additions to their electricity bills, with the remaining added to electricity bills other energy users (Swedish Energy Agency, 2012b). The certificates replaced previous public grants and subsidy structures provided by the government, including an 'environmental bonus' for onshore wind which was in place until 2009. Recent structural changes include Norway joining the scheme in 2012; both countries aim to increase production of renewable energy electricity by 13,200 GWh between 2012 and 2020. Since 2007, the certificate price has averaged around EUR 26 per certificate with a quarterly range of EUR 16-36 per certificate.

1 Hydroelectricity and nuclear energy account for over 60% of the total installed capacity and 75% of the energy generated in Norway, Denmark, Sweden and Finland. Including non-hydro renewable energy sources, approximately 70% of the 100 GW of generation capacity, and 85% of the 377,000 GWh energy generated is zero-carbon (2011 figures: (NordREG 2012), (Nord Pool Spot 2012)).

2 It has expanded operations to most Northern European and Baltic countries following European interconnections and energy market regulation which calls for increased market coupling across Europe.

3 In 2011, a total of 19,800 GWh was generated and eligible to receive certificates for each MWh generated (31% wind, 13.5% approved hydro, 55.5% biofuels, and a small share of solar).



Note to reader. Acronyms used: GEC - Green Electricity Certificate; O&M – Operation and Maintenance; TSO - Transmission System Operator.

3. Investment, return and profitability of Jädraås Onshore Windfarm

- The Jädraås project generates energy at a levelized cost of EUR 60-70/MWh which compares well with other onshore wind energy projects.
- Public policy incentives provided sufficient future revenue certainty (around EUR 770 million over the project lifetime) to address concerns of private investors who provided the total volume of project capital.
- Hedging contracts helped investors address market downsides, smoothing and generating returns around EUR 50-70 million per year.

This section addresses two main San Giorgio Group questions: *What are the public and private financial inputs and what are the main outcomes of Jädraås Onshore Windfarm?* To do this, we attempt to quantify cost inputs, returns and impacts that will derive from the investment to the extent possible using information about project specifics if it is publically available, or industry standard assumptions if it is not.

3.1 Investments: Who pays for what?

The Jädraås project cost an estimated EUR 360 million with private actors providing the total volume of investment. While public actors did not contribute funds directly to the Jädraås project, a commitment of EUR 120 million from the Danish export credit agency (ultimately backed by the Kingdom of Denmark) guaranteed PensionDanmark's contribution.

3.2 Project costs and sources of return

To assess the return profile of the Jädraås project, we first consider the total project costs broken down across contributors of equity and debt, before analyzing the sources of returns for the Jädraås project, and its profitability.

3.2.1 Cost breakdown

The Jädraås project **capital expenditure** (CAPEX) totals approximately EUR 360 million to deliver 203 MW (around EUR 1.68-1.75 million per installed-MW). Figure 2 provides a breakdown of the financing, arranged by financial source and instrument, where project developers provide equity financing for one-third of the total cost, and secure debt for the remaining EUR 240 million. Overall, this is similar to a 'typical' onshore windfarm of this size, but remains in the upper end of the scale,[11] Returns for investors are expected to be higher given the use of larger than average onshore turbines (3 MW each compared with 1.5-2 MW on average), which are expected to deliver up to 30% higher energy yields (BNEF, 2011).

Capital cost elements differ from project-to-project meaning that the total capital costs also fluctuate widely as identified in the literature:[12]

- The majority of **planning and development costs** were borne by the initial project developers, and the Special Purpose Vehicle (Sirocco Wind Holding AB) was not subject to additional fees borne by Arise in the project acquisition.
- No information is available on the exact cost structure of the **grid connection**, nor the network usage fees payable by the project. Based on the electricity network map (Svenska Kraftnät 2012) and discussions with project stakeholders, Jädraås appears to be located in the vicinity of strong network links meaning we can assume grid connection costs to be low or typical.[13]
- We estimate approximately EUR 30 million for **civil works** including foundations and roadways. This accounts for around 8-10% of total capital costs and is in line with literature estimates.
- Although not disclosed, **decommissioning costs** of onshore wind turbines are relatively

11 Around 4-8% above the 2010 average installed cost for turbines in Sweden (IRENA, 2012), or around 15% above global average (BNEF, 2011).

12 Typical values of total capital costs (IRENA 2012, IEA 2011, EWEA 2012), include: wind turbine cost between 70-85% of overall project cost; grid connection between 2-11% and is largely dependent on the network regulation on how grid connections are paid for; foundations and civil works range between 2-16%; planning and other development cost at 3-9%.

13 Grid connection in Sweden is borne by either the generator if significant network upgrades are required (a network usage fee is applied in any case), by the system operator Svenska Kraftnät if no upgrades are needed, or a mixture if agreed upon (Eclareon 2011).

consistent. *IEA Wind* estimates that Swedish onshore wind decommissioning costs are around EUR 1.6/kW installed (IEA, 2011), meaning Jädraås decommissioning could cost around EUR 0.33 million.

Operation expenditure (OPEX) has not been disclosed, but the project benefits from a 15-year operations and maintenance (O&M) contract from turbine provider, Vestas. Arise Windpower estimates an OPEX (O&M plus administrative costs) around EUR 10 per each MWh generated from its portfolio of Swedish windfarms, which is in line with the literature.[14] Jädraås O&M costs are therefore in the range of EUR 6-7 million per year. We estimate that this increases by around 2% per annum due to inflation, component use and degradation, and weather impacts over time.

Financing expenditures (FINEX) result from interest payments on outstanding debt. For our cash flow analysis, we calculated the FINEX associated with EUR 240 million in principal using typical assumptions based on expected interest rates (estimated around 4-5%) and loan tenor (over a period of 15 years). Over the lifetime of the project, we estimate total financing expenditures around EUR 60 million (including tax rebates associated with interest payments).

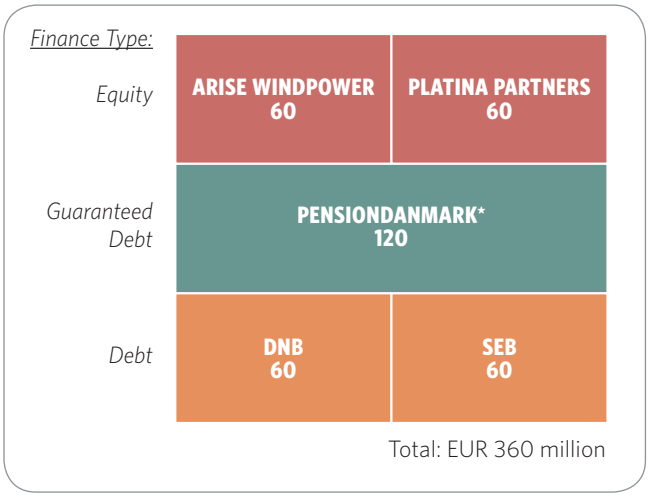
3.2.2 Expected generation and sources of revenue

The Jädraås project will largely rely on *merchant revenue*, meaning that the majority of its revenue will be market-based and thus subject to market prices. More specifically, Jädraås project revenues will be generated on two complementary markets: the **Nord Pool power market** where energy is sold and traded among Scandinavian and Northern European countries; and the **Swedish Renewable Electricity Certificate System**, a green certificate market operated jointly by the state-owned energy network operator and the Swedish Energy Agency (see Box 1):

- The Nord Pool system enjoys a power price that is typically more stable, albeit lower, than market prices in continental Europe.[15] The Nord Pool area is split into several pricing areas, each with their own power price, and since November 2011, Sweden has had four pricing areas from South to North. The Swedish system price has fallen from around EUR 47/MWh in 2009-2011, to around EUR 32/MWh in 2012, and shows signs of seasonality as water levels in reservoirs fluctuate, affecting hydroelectricity supply. For comparison, the German baseload power price has consistently been around or above EUR 50/MWh since 2005.
- Similarly, since 2007, average prices for certificates traded on the Swedish Renewable Electricity Market have hovered around EUR 25/MWh (from Svenska Kraftnät). Market participants consider the certificate market to be more volatile because of its relatively low trading activity. However, its expansion into Norway in the period 2012 to 2020 may be a move towards price stabilization.

In addition to the renewable energy certificates, the Swedish government introduced the Market Introduction Program in 2003. The scheme provides grants to support the technical development of large-scale wind projects offshore or in cold climates. While Arise Windpower received EUR 5.4 million (SEK 50 million) for 'large-scale wind power in southern forests', it is not possible to attribute financial support for Jädraås to these funds and so we do not include them in the analysis.

Figure 2: Attribution of project costs by source and financing type (amounts in EUR millions).



*PensionDanmark provides the debt with an EKF guarantee, DNB act as arranger/financial advisor.

14 The IEA estimates that Swedish onshore windfarm O&M costs are relatively similar to the global reference case – that is, EUR 11/MWh, totaling approximately EUR 6.4 million per year in the Jädraås project, while IRENA (2012) estimates the range EUR 4.466 million – 14.73 million.

15 As a result of the large installed capacity of low-marginal priced generation in Nordic Europe such as hydro and nuclear energy, and the somewhat limited interconnection capacity with mainland European countries.

Table 2: Jädraås project cash flow analysis outputs and associated comments.

JÄDRAÅS PROJECT RETURN BREAKDOWN	VALUE		COMMENT
ANNUAL ENERGY GENERATION	570–590 GWh		The Jädraås Onshore Windfarm is expected to generate its maximum rated energy output for 20 years, reaching maximum output within one year of construction.
TOTAL ANNUAL REVENUES	EUR 50-70 million		The range of annual revenues depends on input assumptions.[a] Our cash flow model is based on revenue structure assumptions which include both hedged and un-hedged revenue streams for power and renewable certificate sales.
• Sales on power market	EUR 35-55 million		
• Sales of renewable electricity certificates	EUR 20-25 million		
REVENUES OVER PROJECT LIFETIME	EUR 770 million		Based on approximate revenues from electricity sales and renewable certificates over the project lifetime. Approximately 65-75% will originate from the power market, and 25-35% from sales of renewable certificates.
COSTS TO SPV OVER PROJECT LIFETIME	EUR 450 million		Costs to the SPV associated with the project including investment, taxes, interest payments and operation expenses.
LEVELIZED COST OF ENERGY (LCOE)	EUR 60-70/MWh		The Jädraås LCOE is in line with the European benchmark in (Varadarajan et al., 2011). We calculate that approximately 71% of the LCOE is capital expenditure, while the remainder is shared between discounted operational and financial expenditures.
INTERNAL RATE OF RETURN (IRR)	13.7-17.7% (after-tax equity IRR)	5.4-7.9% (after-tax project-level IRR)	Range of IRR depends on the input assumptions (see footnote 23). Figures are in line with benchmark estimates of 4-13% (Hervé-Mignucci, 2012), and expectations of the project developers.

a The range is sensitive to assumptions: growth expectations of market prices; optimizing and handling taxes – accounting for European Commission tax arrangements, or length of time for carrying forward tax credits (if any).

3.2.3 Jädraås project generation, cash flow and levelized cost of energy (LCOE) calculation

Based on the energy generated, our discounted cash flow analysis[16] uses a methodology developed in previous CPI Reports (Hervé-Mignucci 2012, Varadarajan 2011, etc) to estimate revenues and costs over the project lifetime when details are only partially disclosed or not publically available. Table 2 summarizes the results from our project cash flow analysis.

Note: for the purpose of this study, we express returns as the present value of future project revenues over the project lifetime (discounted at 5%[17]), or annual returns that are not discounted.

Figure 3 illustrates the cash flow results showing revenues and costs over 20 year project lifetime.

3.3 Individual returns to project stakeholders

Each stakeholder involved in the Jädraås project benefits either financially or in some other tangible way.

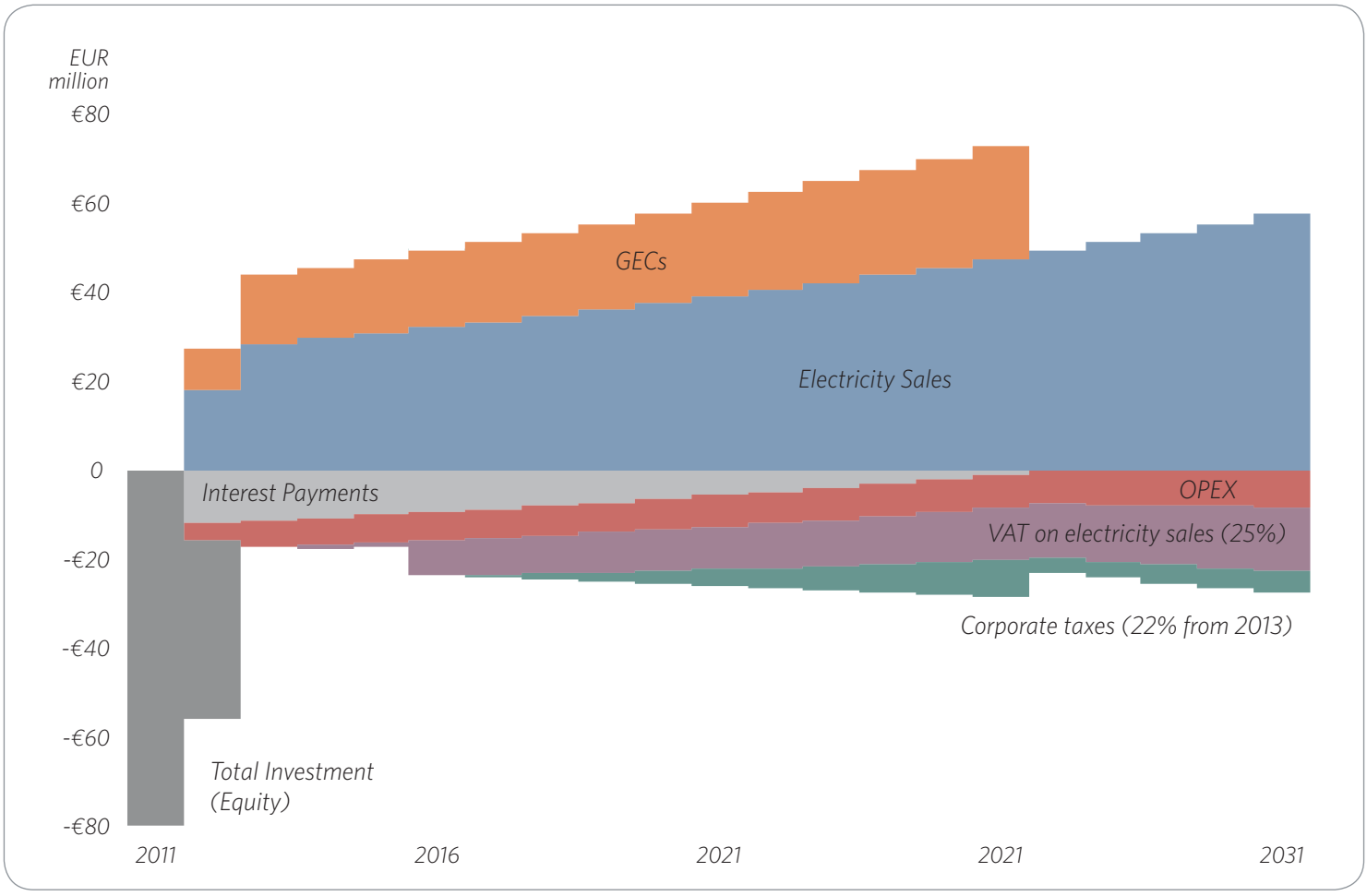
Overall, the public sector incentivizes the project through favorable policies and a commitment to guarantee an export loan. In return, the Swedish and Danish public sectors benefit by: strengthening their wind industry reputation; receiving contributions to clean energy generation thus increasing the likelihood of achieving national emission reduction targets; and enabling the right environment to meet socio-economic objectives such as (green jobs) and growth. On the other hand, the private sector contributes the total project costs, ultimately generating financial returns, improving learnings and building up financing expertise for future renewable energy projects.

Table 3 categorizes the sources of financial and tangible benefits for the major stakeholders involved in the project, namely: 1) the governments of Sweden

16 By a levelized cost, we mean the (present value of) total project costs for each kWh of energy generated by the Jädraås windfarm. This provides a single, aggregated measure of costs associated with energy production that can be compared across technologies (Varadarajan et al., 2011). The levelized cost of energy actualizes all cash flows related to a specific energy source. Consistent with previous CPI reports, the calculation has been based on the expected after-tax internal rate of return of the project, based on anticipated cost and revenue estimates.

17 As is typical for such projects, and consistent with literature (IEA/OECD/NEA, 2010).

Figure 3: Jädraås Onshore Windfarm project-level cash flow (in EUR million).



Source: CPI elaborations.

and Denmark (and export guarantor, EKF); 2) project sponsors Arise Windpower and Platina Partners; 3) fund provider PensionDanmark; 4) commercial bank lenders DNB and SEB, and; 5) technology provider Vestas Wind Systems.

3.3.1 Public Sector Returns and Benefits

Government of Sweden

Although it does not contribute directly to the Jädraås project financing, the Government of Sweden contributes indirectly to project revenues and receives benefits:

- It redirects **approximately EUR 200-225 million towards the project over 15 years via the renewable electricity certificates.**
- It collects **approximately EUR 180-200 million in tax contributions**[18] from the Jädraås project SPV over the project's life.
- Additional zero-carbon capacity improves the likelihood of Sweden achieving its energy objectives. Unlike other European approaches, the Swedish electricity network operator is not obliged to accept renewable electricity into the electricity network, i.e. there is no priority dispatch for renewable electricity,[19] which must compete in the electricity market and may only replace other low-carbon generation sources in the energy market 'merit order'.[20] Based on Jädraås project assumptions, the volume of zero-carbon energy accounts for almost 0.5% of Sweden's national electricity demand, or 2.9% of its 2020 onshore wind electricity production

18 Swedish companies pay corporate taxes of 26.3% in 2012, and 22% from 2013 on all taxable income, and value added tax of 25% on electricity sales.

19 In Germany for instance, system operators are obliged to pay for any renewable energy generated given it priority over other sources, and are then responsible for accepting it into the network(s).

20 A ranking used by the electricity market operator based on the electricity production marginal costs and energy demand. Low-carbon energy sources, such as wind or hydro have low marginal costs (i.e. no fuel or production costs), and so are chosen early in the merit order, followed by nuclear, then conventional generation.

Table 3: Sources of return/benefits for the major project stakeholders.

		PUBLIC: GOV. OF SWEDEN	PUBLIC: GOV. OF DENMARK	PUBLIC: EXPORT GUARANTOR (EKF)	PRIVATE: PROJECT SPONSORS (ARISE, PLATINA)	PRIVATE: DEBT PROVIDER (PENSIONDANMARK)	PRIVATE: COMMERCIAL LENDERS (DNB/SEB)	PRIVATE: TECHNOLOGY PROVIDER (VESTAS)
NON-FINANCIAL RETURNS / BENEFITS	CLIMATE / ENVIRONMENTAL GOALS	●		●	●	●		
	STRATEGY / FUTURE LEARNING	●	●	●	●	●	●	●
	GREEN GROWTH	●	●	●				
	GREEN JOBS	●	●	●				
FINANCIAL RETURNS	SPV REVENUES				●	●	●	
	NON-SPV REVENUES			●				●
	TAXES / PUBLIC BENEFITS	●	●					

target from renewable sources (based on 2011 figures (SEA, 2012)). As the largest commissioned onshore wind project in Nordic Europe, Jädraås may help establish Sweden as an attractive country in which to invest and develop large-scale windfarms.

- The power output also improves the likelihood of Sweden achieving its climate objectives. However, because of the existing volume of zero-carbon energy sources in Sweden, it is difficult to estimate avoided greenhouse gas emissions that result from the Jädraås project, and so we did not estimate the monetary value of these savings.

Government of Denmark and Export Guarantor EKF

Similarly, the Government of Denmark did not contribute directly to the Jädraås project financing. However, state-backing of the Danish export credit agency generates tangible indirect benefits. The export credit agency played a critical role in the project financing by unlocking additional and non-traditional lending capacity. Importantly, by guaranteeing lending premised on the exports of Denmark-based technology (in this case Vestas Wind Systems), EKF not only enhances Danish economic interest, but helps to further strengthen Denmark's reputation as the world's leading wind technology provider.

This arrangement ultimately augments Denmark's global wind industry reputation and market position, safeguards Danish jobs[21] and generates corporate taxes.[22] In return for its investments, we estimate that EKF will receive around 2.5% in interest on the lending volume over the debt tenor (in this case EUR 120 million over 15 years). Given an approximate interest rate of 4% which is in line with commercial rates[23] and assuming that the loan guarantee facility is not called upon during the life of the project, **we estimate EKF's overall return to be around EUR 18-20 million over the loan period.**

21 It is estimated that approximately EUR 130 million in exports secures around 1,000 industrial jobs in Denmark (Information.dk, 2011). In 2012, EKF assured approximately EUR 3.5 billion of Danish turnover, thereby securing approximately 17,500 Danish work places (EKF, 2013b).

22 Contributions by Vestas towards Danish corporate taxes were not estimated.

23 As an export credit agency, according to European State-Aid law, EKF is obliged to provide loans at commercial market rates to avoid distorting the lending environment.

3.3.2 Private Sector Returns and Benefits

Project Sponsors – Arise Windpower and Platina Partners

By contributing equal amounts of equity to the project (approximately EUR 60 million each), project sponsors Arise Windpower and Platina Partners are each eligible to receive 50% of revenues from the sales of power and renewable electricity resulting from the project. **We estimate that over the 20-year project lifetime, the Jädraås project will generate approximately EUR 770 million in revenues.** Both sponsors stand to receive around EUR 385 million in revenue, noting that Arise receives a fee from Platina for operating the plant.

Lender – PensionDanmark

PensionDanmark provided EUR 120 million in debt to the Jädraås project over a 15-year period, backed by an AAA rated loan guarantee from the Danish export credit agency. While arrangement specifics are not available, we estimate that PensionDanmark has secured a return of approximately 1-1.5% above that of government bonds for little-to-no additional risk. Over the 15 year loan tenor, **we estimate PensionDanmark will generate a return of around EUR 7-9 million** depending on expected returns and loan payback assumptions.

Commercial Bank Lenders – DNB and SEB

Both commercial banks DNB and SEB provided EUR 60 million in debt to the Jädraås project over a period of 15 years. Given a commercial debt interest rate of 4% which they will receive in full, **we estimate that both commercial banks will earn around EUR 18-20 million over the loan term.** We expect DNB to earn an additional fee because of its role as financial advisor and arranger for the PensionDanmark-EKF export loan.

Technology provider – Vestas

Vestas provided all 66 wind turbines to the Jädraås project, and was responsible for their delivery and installation. While specific project costs are not available we expect that around 70-85% of the total capital expenditure is payment for the Vestas turbines in line with the major literature (IRENA 2012, IEA 2011, EWEA 2012). This means **we expect Vestas to receive around EUR 250-300 million for the turbines** based on the total project cost of EUR 360 million. The agreement also includes a 15-year operations and maintenance (O&M) contract: **we estimate O&M costs to be approximately EUR 60 million over the 15 year life of the contract.** At the same time, Vestas is able to increase deployment of one of their newest wind turbines which, until now, has not been done at scale.

3.4 Has the Jädraås Onshore Windfarm arrangement been effective?

A key objective of CPI San Giorgio Group analysis is to assess whether public money is being spent effectively. As a first step toward answering this question, we track progress from initial financial **inputs** (international and domestic public resources and private investment) and consider what that investment actually pays for (that is, the **output** it enables). Next, we consider interim **benefits** that flow from (and are contingent on) the outputs, through to the **outcomes** that go toward meeting the program's overarching environmental and economic objectives.

Our approach develops further CPI's effectiveness framework which aims to evaluate the relationship between inputs and returns/benefits which could be relevant to other sectors, countries or portfolios (see Table 4). In order to apply this approach across different cases, we have adopted a common set of appropriate criteria and indicators that can be applied to systematically measure the performance of the investment in question. Where possible, effectiveness indicators have been quantified for the Jädraås project.

In the case of Jädraås, the following highlights the main outcomes achieved by the project in terms of project economic return, return to individual stakeholders, technology development, environmental benefits, and economic results.

- **Private investment:** Private investment totaled some EUR 360 million and was used to deliver 203 MW of zero-carbon renewable energy capacity and enough energy to power up to 100,000 Swedish homes per year.
- **Project revenues and taxes:** We estimate that the project special purpose vehicle will generate an internal rate of return between 5.4-7.9% after taxes, generating approximately EUR 770 million in revenues over the project lifetime. At the same time, the project will pay around EUR 180-200 million in corporate and value added taxes to the Swedish government.
- **Contribution towards Denmark's economic interests.** The exports of Vestas turbine technology provides a positive effect on Denmark's economic interest and secures the

loan guarantee from the Danish export credit agency.

- **Contribution towards Sweden's environment goals:** The volume of zero-carbon energy generated accounts for almost 0.5% of national electricity demand, or 2.9% of its 2020 onshore wind electricity production target from renewable sources (based on 2011 figures (SEA, 2012)).

Table 4: Summary of the effectiveness of the Jädraås Onshore Windfarm.

INPUT	OUTPUT	INTERIM BENEFITS	OUTCOME
Private capital: EUR 360 million	**Installed wind capacity:** 203 MW	**Clean energy:** 580 GWh per year of wind energy generation, for up to 100,000 Swedish homes	**Increased technology learning / LCOE reductions**
Danish State-backed guarantees valued at EUR 120 million	**Maintains jobs for construction:** 200 employees for construction	**Creates skilled jobs for operation:** 10 new and additional jobs for O&M	**Generates Danish exports:** EUR 250-300 million
Swedish Government Incentives (renewable certificates): EUR 200-225 million over 15 years	**IRR for SPV:** After tax 5.4-7.9% (project) After tax 13.7-17.7% (equity)		**Contributing towards Sweden's energy and emissions targets** Once commissioned provides 0.5% of Swedish electricity demand (2011 annual figures (SEA 2012)), contributes 2.9% of Sweden's 2020 renewable electricity production target. No emissions savings calculated. **Taxes** EUR 80-90 million corporate taxes and EUR 90-100 million VAT to Sweden over project life

4. Risk Allocation in Jädraås Onshore Windfarm

- The public export loan guarantee played a key role in mitigating investment risks for PensionDanmark, while offering returns above those of government bonds.
- The Jädraås project offers evidence of effective risk-sharing. Contracts were crucial in allocating the highest impact revenue and technology risks among the private actors who are best suited to bear them.
- Successful identification and management of appropriate risks was made possible because of project participants' expertise and experience.

To evaluate the risk profile of the Jädraås project, we apply a typical risk management framework and assess inherent risks.[24] We identify the risks associated with the project; analyze and present the risk response for the three most important risks that if unaddressed would cause the project to fail, and lastly, outline the final risk allocation implications for the major stakeholders.

4.1 Risk identification and assessment

To ensure we capture all significant sources of risk (non-material and low probability risks are excluded from the analysis), we categorize risk along three major dimensions (in line with the effectiveness framework as described in the previous chapter, and with typical project finance stages):

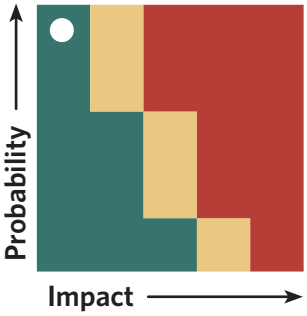
- **Development risks** cover project development *per se*, that is all the risks incurred before the project begins to operate, including procurement (equipment / technology), construction, and financing.
- **Operation risks** cover all the risks related to project output (production and availability risks), operating costs (notably O&M risk), and revenues (power price but also all the regulatory and price risks relative to the associated benefits).
- **Outcome risks** cover the risks more specific to overarching public policy objectives and strategic private investor objectives. They include the risk of not meeting renewable energy deployment and emissions reduction targets, the risk of overpaying for incentives, and the risk that green growth and green jobs co-benefits are not delivered.

We collected an exhaustive list of categorized risks that could affect the Jädraås project before systematically assessing those risks according to two criteria: their probability of occurrence / frequency (from very low to very high) and their impact on the project's financial and non-financial objectives (again from very low to very high):

24 On a static basis, as opposed to the project developer approach where risk management is a dynamic process and includes continuous feedback mechanisms.

LOW-RISK EVENTS

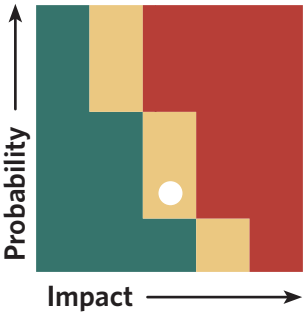
Risk events with low probability of occurrence and low to medium impact:



- **Market price changes:** All renewable energy project developers face some level of revenue volatility given the nature of renewable energy generation and energy market prices. In most cases, up- and downside impact to revenues is continually measured and tracked within acceptable limits, and is naturally borne by the onshore windfarm SPV.
- **Higher-than-expected insurance or administrative costs:** Project administrative costs are present in all large-scale projects. Although not addressed by any specific management practice, project developers address these costs in SPV accounting provisions.

MODERATE-RISK EVENTS

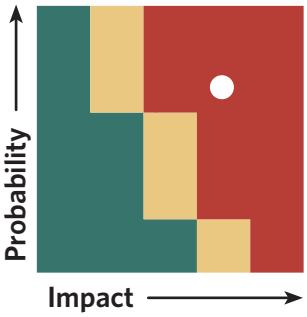
Risk events with moderate-probability of occurrence, but medium-high impacts.



- **Currency or interest rate risks:** The Jädraås project involves investors and project developers from four European countries, each with different currencies,[25] interest rates or timeline expectations. Management or monitoring for such risk is possible by individually using hedge/swap derivatives, or by agreeing on one working currency like in Jädraås.
- **Risk of calling upon the export loan guarantee:** EKF provides an export loan guarantee to PensionDanmark for its debt contribution to the financing of Jädraås. PensionDanmark's investment risks are covered by EKF should the project fail to pay back on schedule. The Kingdom of Denmark, as insurer-of-last-resort, bears this risk on behalf of the Danish public.

HIGH-RISK EVENTS

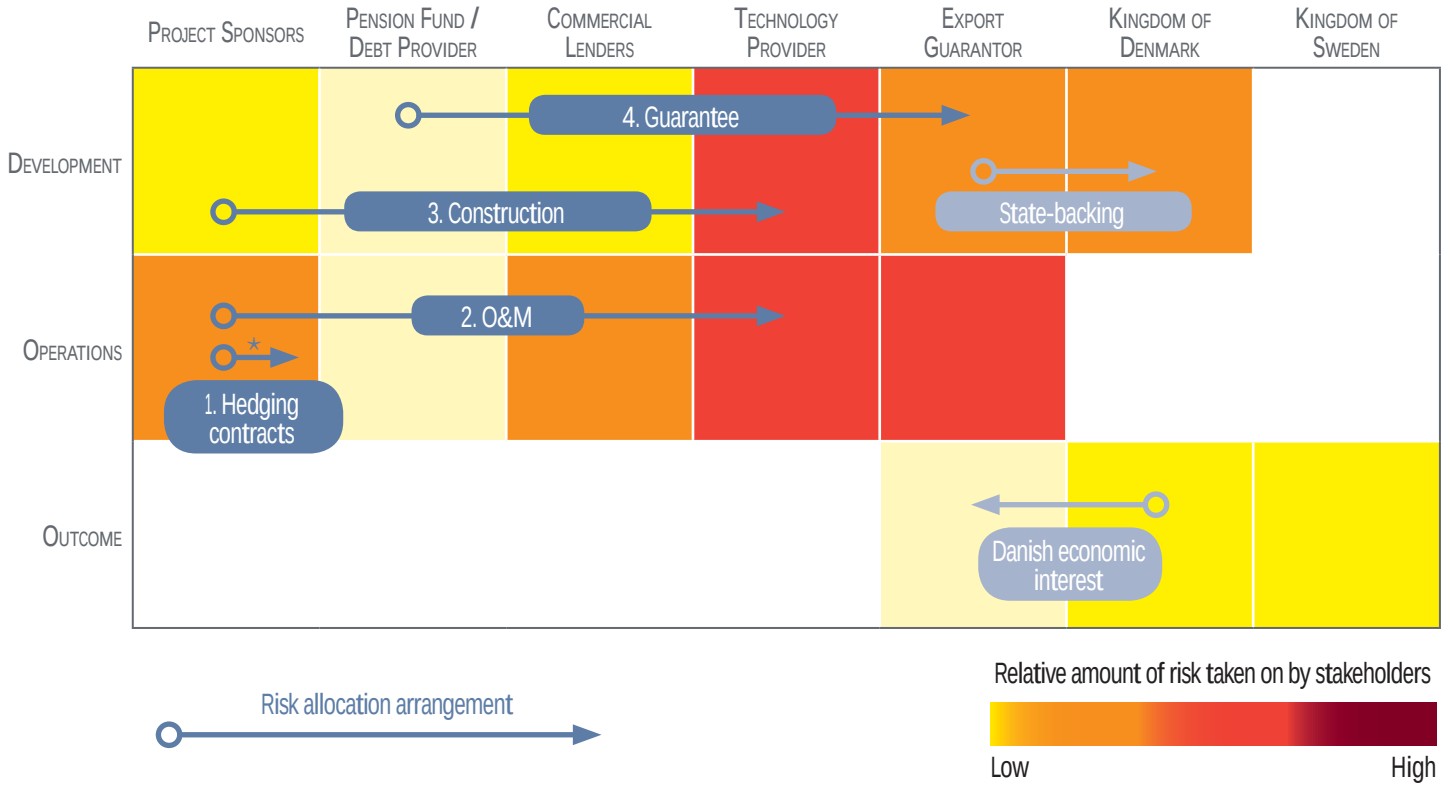
Risk events with high to very high impact whatever the probability of occurrence:



- **Extreme power and renewable electricity certificate market price variation:** Significant market price changes can substantially alter project developer revenues. This impact can be minimized with specific risk management measures such as hedging a portion of energy and renewable electricity certificates against significant market price changes like in Jädraås. Hedging contracts were required by commercial banks before committing debt lending to Jädraås.
- **Wind turbine malfunction, defect and other performance failures:** Wind turbine performance is the most important influence on project revenues. Jädraås project developers mitigate performance risks by arranging technical contracts with appropriate project actors (construction/installation, wind turbine performance, operations and on-going maintenance, etc.).

25 We understand that Jädraås financing is EUR based, but actors are based in regions using several different currencies: Danish krone-DKK/Swedish krona-SEK/UK pound-GBP/Norwegian krone-NOK.

Figure 4: San Giorgio Group Jädraås Onshore Windfarm dynamic risk matrix.



* Price risk is allocated to broker.
Risk is categorized according to the estimated 'magnitude of risk' multiplied by the 'likelihood of risk': from 'very high' in dark red, to 'high' in orange, 'moderate' in light orange and 'low' in yellow. Given the lack of contract-level data available on this project, this weighting system is subjective. Numbers relate to risks as discussed in the text.

4.2 Risk analysis, allocation and response strategies

There is evidence to suggest the project participants adopted a balanced approach to risk management by allocating risks and uncertainties to those best placed to manage them.

Our analysis shows that the success of the Jädraås project and its risk management rests with the Jädraås project participants' ability to conclude arrangements that: 1) shield particular stakeholders from price downsides, and 2) ensure technical risk aspects are shifted to appropriate project participants with the ability and expertise[26] to manage them.

The dynamic risk allocation matrix in Figure 4 illustrates two aspects: **risk allocation**, how risks are borne and by which stakeholder at project initiation, and **risk response**, how the overall risk profile shifts through the use of risk transfer instruments.

From the high-risk events identified earlier, we focus on the drivers and impacts of those we deem the most important to overcome in order to ensure the viability of the project, namely, **revenue risks** (points 1 and 2 in Figure 4), **construction risk** (point 3), and **financing risk** (point 4 – discussed separately in more detail in Section 5).

4.2.1 Revenue risks – price and turbine performance

Revenue from onshore windfarms such as Jädraås is a function of two factors: quantity of energy that is brought to market, and the price received for energy generated. Since revenues are the most important driver of return in the Jädraås project, its stakeholders have an interest in managing revenue risks as much as is reasonably possible.

Project developers took two important steps to mitigate revenue risks: they hedged against market price movements from two separate markets (one for power, and one for renewable electricity certificates), and; developed a turbine performance contract with the technology provider.

26 Stakeholder 'know-how' also played an important role in the project risk allocation, and ultimately in the project success. It is also a crucial topic that the SGG case studies try to address: what makes the project successful and whether the project structure is replicable and scalable. See Section 6.

Risk 1. Project sponsors are well placed to handle risks associated with energy and renewable electricity market prices, and develop hedging arrangements to shield and benefit from market prices.

Low and volatile market prices, like those in the Nordic region (see Section 3), can negatively impact project profitability, and so need to be managed accordingly. Where market prices are more lucrative, project developers often turn to power purchase agreements to shield sellers and buyers from wide price fluctuations. In contrast, faced with a low-priced but stable market for power, and a low-priced but volatile market for renewable certificates, renewable energy generators in Nordic Europe are generally unwilling to lock in power purchase agreements that may result in lower returns for longer periods of time. This means project developers faced the prospect of earning insufficient or volatile future revenue flows that, if unmanaged, could threaten the profitability of their investments (Project Finance Magazine, 2012).

Both Arise and Platina are experienced in developing, operating and financing Nordic European windfarms. **To overcome the risk of locking in low returns and price volatility risk with long-term power purchase agreements, Jädraås project developers chose a so-called merchant approach** to maintain an acceptable level of return. This means that while the markets still provide the majority of project revenue (two-thirds of the energy is sold at the market prices), one-third is hedged to shield revenues from times of very low prices (Project Finance International, 2013).

While details of the contracts are not fully available, we understand that Arise opted for an arrangement where **prices for power and renewable electricity certificates are hedged for five years and three years, respectively.** After this time, the contracts are rolled forward subject to a review by the project shareholders.[27] We expect the adjustment process to include many factors dependent not only on various prevailing market conditions such as current price levels, trade volumes, market growth, or expectations of future prices, but also on the fundamental details of the hedge contract.[28]

By using hedging contracts, the **project developers reduce the impact of price volatility, smooth project returns, reassure commercial bank investment and, at the same time, shift a portion of the price risk away from the project SPV toward stakeholders more suited to managing this risk such as traders/brokers.**[29] Project sponsors and hedge arrangers benefit from upside price movements, while project sponsors are protected from the downside.

Risk 2. Vestas offers a robust operations and maintenance contract to Jädraås that protects project sponsors from under-performance and ensures turbine energy output.

Our analysis shows that a drop in turbine availability[30] **from a hypothetical 100% to around 80-85% significantly impacts on the Jädraås project's profitability** by reducing the internal rate of return to around the project cost of capital (see Annex 1 for sensitivity test results).

For large scale windfarms such as Jädraås that cover a considerable area of land and consist of many individual wind turbines, fluctuations in availability and any subsequent effects are amplified across the windfarm.[31] We understand from Jädraås project developers that the Nordic wind resources fluctuate by approximately 15% over a 30-year average. If left unmanaged, this presents a significant challenge to project developers as they aim to maximize turbine availability in order to limit any impact on project revenues. The choice of turbine and turbine provider is therefore critical to help ensure a consistently high level of windfarm performance and stable project revenues.

While the Jädraås turbines are relatively new to the global market and are untested in Sweden, they are expected to generate more energy, given their location and higher capacity than typical onshore turbines, which helps offset any drops in availability. **Jädraås project developers mitigate much of the performance related risk by using wind turbines from technology provider**

27 While Arise typically attain hedge levels some 10-15% above those of the combined market prices, hedges will only be used from September 2013 because of exceptionally low prices as a result of the European recession. As a response to this in our cash flow model, we assume prices in both markets increase around 2-4% per annum.

28 Hedging readjustments could also include altering the share of energy that is hedged. For instance, project developers would be encouraged to hedge less given a long period of higher and more stable market prices.

29 In Jädraås, we understand project developers approached broker Axpo Group to construct the hedging arrangement. Arise may also have in-house expertise in this area given their large wind portfolio.

30 Availability of a wind turbine is a measure of how successful it converts wind energy to electrical energy. Since wind turbine performance is a function of the wind resource and quality, availability is a proxy for changes in energy output. Technological factors (e.g. gearbox failure) can impair the turbine availability, as can external influences such as adverse or severe weather (e.g. strong/storm-like winds can stall turbines, or prevent staff from performing routine maintenance).

31 Fluctuations in wind resource and technology performance affect the energy output and thus influence revenue generation significantly depending on the size of the variation, area affected, and number of turbines involved.

Vestas. Vestas has installed and maintained onshore wind turbines throughout the world, with approximately 10% of their installed capacity situated in Nordic Europe, and many underpinned with operation and maintenance contracts to ensure turbine availability.

Together with a 15-year operations and maintenance contract, **Jädraås project developers benefit from Vestas's proven track record and relationships with reputable developers and sub-contractors.** While specifics of the contract are not publically divulged and typically project site-specific, they are standard in their general contents. It is likely the Jädraås includes a performance guarantee covering both turbine availability and energy output, which provides certainty that minimum generation outputs will be achieved.

4.2.2 Construction risk

Construction is the major cost element of windfarm projects. Small changes in upfront capital-expenditure or the construction time can severely affect windfarm project viability.

> **Risk 3. Project developers mitigate technology risks associated with construction cost overrun and delay**

One turbine in the first phase of Jädraås was built every seven working days. Delays to such a process puts at risk financial timelines or policy deadlines (such as changes in renewable support).

Jädraås project developers purchased the windfarm as 'ready-to-build' so avoided delays associated with permitting and public approvals, but were keen to keep construction time and excess costs to a minimum. Our analysis shows that **increasing the planned EUR 360 million capital cost by around 10-15%, which is reasonable given delays or original cost underestimations, brings the internal rate of return close to the overall project cost of capital and jeopardizes project viability.**

We expect **Jädraås project developers to address risks of construction cost and time overrun by securing construction management contracts with relevant contractors.**[32] While details are not public, **we hypothesize that a construction management contract exists between Arise as project developer and Vestas as main technology provider.** Vestas is best placed to supply an operation and maintenance contract for the turbines and is in a natural position to cover engineering and construction responsibilities and risks. This arrangement shifts most of the cost risks associated with construction from Jädraås project sponsors to Vestas.

4.2.3 Financing risk

> **Risk 4. The financing structure developed by PensionDanmark, EKF, and DNB played a crucial part in realizing the Jädraås project.**

The financial advisor/arranger targeted a funding arrangement that was flexible enough to engage lending from commercial banks, but structured in a way that adhered to export credit agency processes and stayed within the limits of normal operations (discussed in more detail in Section 5). As a result, PensionDanmark and EKF both take risks they are well placed to handle: PensionDanmark with liquidity, currency and interest rate risks, and; EKF with commercial, political and non-payment risks.

In addition, the Danish AAA rated state-backing of EKF guarantees a strong funding package to attract commercial investors. By providing a long-term assurance of funds, the Government of Denmark indirectly attracted financing which was crucial to the Jädraås project. In return, the government enhances Danish economic interests and reiterates its long-running commitment to the national wind technology industry.

32 Connection to the electricity network is the responsibility of national system operator Svenska Kraftnät. While there is no stated deadline to connect Jädraås to the electricity network, we expect no major delay given its vicinity to the electricity network.

5. How a Synthetic Loan Facilitated Institutional Investment Funds in Jädraås Onshore Windfarm

- Public and private cooperation avoided a potentially project-jeopardizing financing risk. Jädraås project developers overcame a dearth of traditional lending capacity by using a state-backed guarantee to bring on board PensionDanmark which provided 50% of the project debt.
- The arrangement, engineered by commercial bank DNB acting as financial advisor to the project, effectively created a *Synthetic Loan* that provided an alternative project financing with little-to-no added risk to participants.
- The arrangement supports Danish economic interests through ensuring wind industry exports, a requirement for EKF to play a role.

This section analyzes the most striking aspect of the Jädraås project financing structure, and highlights the importance of public and private cooperation to overcome potentially jeopardizing financing risks. **The export loan guarantee arrangement between a pension fund and export credit agency was a crucial element to realizing Jädraås project financing.** We use the term *Synthetic Loan* to represent this arrangement as it effectively provides an alternate source of project finance at commercial rates, slotting in alongside typical commercial lenders.

5.1 An innovative approach to addressing financing risk and potential delays

Historically, Nordic energy projects have been financed on the balance sheets of state-owned entities (Project Finance International, 2013), meaning commercial lenders have less experience lending project finance to large-scale renewable energy projects in Nordic countries relative to other regions. Compounding the situation is that renewable energy projects in Nordic countries, such as Swedish wind energy activities, typically rely on market-based revenues for future revenue, so shorter-term hedging contracts are preferred over long-term power purchase agreements to mitigate price uncertainty (see Section 4).

Few banks have experience putting together financial arrangements for wind energy projects without power purchase agreements, which in turn reduces the overall volume of available lending capacity. From the approximately 360 banks involved in financing renewable projects in the period 2010-2012 on the global level, we find that only seven to nine banks in Europe[33] may have the appetite to lend to Swedish onshore windfarms in the absence of power purchase agreements (see Annex 2 for breakdown according to project finance specialization).

Although the Jädraås project was able to engage two commercial banks from this small subset of banks, these two could not cover the total required debt financing of EUR 240 million. While it is feasible that a larger consortium of commercial banks could provide the required finance, each with smaller debt contributions, the added financing complexity would be likely to cause delays or increase transaction costs which, ultimately, would compromise project viability. To alleviate the financing gap, project stakeholders thus engaged a number of public and private actors to create a *Synthetic Loan* in parallel to the Jädraås project financing. **Essentially, the *Synthetic Loan* adds lending capacity to existing availability.**

5.2 Development timeline

Creating the *Synthetic Loan* involved a number of different processes and actors, required a certain degree of innovation and know-how from the stakeholders, and as discussed below, needed overarching alignment of national economic interest. Table 5 illustrates the parallel processes of project financing timelines and the creation of the *Synthetic Loan*.

33 Including the largest Nordic banks: Norway – DNB ASA; Sweden – Swedbank AB, SEB AB, Svenska Handelsbanken AB, Nordea Bank AB; Denmark – Danske Bank A/S; and potentially German banks Commerzbank, Deutsche Bank; and Dutch banks ABN Amro, ING, Rabobank. (FT 2012, Bloomberg 2012, interviews with stakeholders).

Table 5: Parallel timelines for Jädraås project financing and creating the Synthetic Loan.

	PROJECT FINANCING STAGE	DESCRIPTION	SYNTHETIC LOAN: SOLUTIONS, ACTORS' ROLES AND ACCOMPANYING BENEFITS
1	Project developers seek additional financing.	Project developers appoint experienced energy investor DNB as project financial advisor. DNB approach fellow Scandinavian commercial bank SEB to share project debt of EUR 240 million.	Actor: DNB Synthetic Loan role: financial advisor, lead arranger. Benefits to actor: • Additional experience and reputation in renewable energy financing; • Established cooperation with project participants to develop further projects with financing structures similar to Jädraås. • Arranger and financial advisory fees.
2	Lack of commercial bank renewable energy financing appetite.	DNB and SEB unable to provide entire project debt themselves. Further evidence of lack of commercial lenders able or willing to take the debt financing. DNB and project sponsors decide to look elsewhere for additional sources of lending capacity.	
3	Alternative sources considered: EKF export loan deemed unsuitable for project.	Jädraås developers and financial advisor DNB seek alternative sources of funding, including the existing EKF export lending scheme.[a] Commercial bank lenders and project sponsors decide this option is unsuitable for Jädraås.[b]	
4	EKF agree on debt guarantee, separately begin discussions with PensionDanmark.	EKF agrees to guarantee 50% of the project debt, asking DNB to find a provider. EKF begins discussions with PensionDanmark to provide export loan guarantee alongside debt financing.	**Synthetic Loan facilitates additional investor capital to secure Jädraås project financing.** Actor: EKF Synthetic Loan role: provider of export loan guarantee on PensionDanmark funds. Benefits to actor in the Synthetic Loan: • Support Danish economic interest on behalf of Danish state. • Administrated within normal operational mandates. • Improves access to financing and lending capacity.
5	PensionDanmark and EKF agree on three-year export loan guarantee deal.	PensionDanmark and EKF agree to three-year DKK 10 billion/EUR 1.3 billion export loan guarantee arrangement, of which Jädraås (at EUR 120 million) is the first deal. EKF ensures the deal is not a 'price leader' and funds are lent at commercial rates, to comply with EU competition regulations regarding State Aid.	Actor: PensionDanmark Synthetic Loan role: provider of investment capital. Benefits to actor: • Return on investment above those of AAA rated government bonds with little-to-no additional risk. • Diversification of investment portfolio – strategy to invest in renewable energy. • Secured larger agreement with EKF of DKK 10 billion/EUR 1.3 billion export loan guarantees.
6	Project financing completed. DNB retained financial advisor for PensionDanmark-EKF deal.	DNB and SEB agree on sharing the other 50% of the project debt. DNB continue to provide financial advice in PensionDanmark-EKF agreement.	

a For more information on the EKF Export Loan Support Scheme see Annex 4.
b Largely as a result of its inflexible design and restrictive elements (such as its drawdown and prepayment plan, and participant's exposure to interest rates) which make it more akin to a bond than a loan (Project Finance International, 2013).

5.3 How an alignment of interests underpinned Jädraås project financing needs and unlocked benefits

The agreement between PensionDanmark and EKF, and its replication (see Section 6) shows how the commitment of **public resources mitigated commercial and policy risks, enhanced national economic interests and, ultimately, enabled project developers to secure the long-term mobilization of private resources.**

An on-going economic recession exposed the Danish economy to two distinct but related risks. First, that lower export volumes, including those in Denmark (UNSD 2012), would continue, and secondly, that financing for renewable projects which slowed in late 2008, only to pick up again slowly from mid-2010 (FS-UNEP 2013), would still be insufficient to unlock new projects. Simultaneously, exporters increasingly relied on export credit agency risk assistance (e.g. export loan guarantees, insurance instruments) (Berne Union 2012 and 2013). Because of their natural ability to handle export related economic risks, export credit agencies were looking for ways to address new and different demands for guarantees, as in the Jädraås case with EKF.

The wind industry plays an important role in Danish annual exports; amounting to EUR 6.5 billion in 2011 (EKF 2012) (or 3.1% of gross domestic product (IMF, 2013)), of which EKF guaranteed approximately 21%. As such, the wind industry makes up a significant share of EKF export loan guarantees: in total approximately 50% of EKF guarantees are directly related to the wind industry. As illustrated in Table 6, between July 2010 and the end of 2012 the EKF guaranteed approximately EUR 3 billion total and 70% of this was directed to the wind industry. Vestas was involved in around 60% of EKF wind-industry guarantees since July 2010, showing EKF's strong support for Denmark's leading wind industry company.

The success of the *Synthetic Loan* also highlights that **institutional investors are willing to invest in renewable energy projects if their risks can be covered, and is arranged in a way to make project financing lending available at commercial lending rates.**

Exact benefit figures are subject to confidentiality agreements and individual benefits differ depending on the stakeholder. However we expect Jädraås financing entities to each receive the commercial lending rate,[34] with PensionDanmark and EKF splitting this rate (see Annex 3). We assume EKF receives around 2.5% from the project SPV for taking on commercial, political and non-payment risks, with the PensionDanmark receiving the balance for taking on liquidity, currency and interest rate risks.

By participating in the lending arrangement, **PensionDanmark earns returns on its investment 1-1.5% above those of government AAA rated bonds while essentially taking on the same low level of risk.** From an asset allocation point of view, the PensionDanmark contribution to Jädraås project financing can thus be defined as a sovereign fixed income investment, rather than infrastructure debt. This is important because the alternative investment portion (which often includes infrastructure debt) of institutional investor assets allocation is typically much smaller than their fixed income portion (as with PensionDanmark).

The Synthetic Loan thus was created because several actors and their interests lined up bringing together a willing private provider of long-term capital with an appetite for renewable energy investment and generating stable returns (PensionDanmark), a willing and capable public entity to provide risk coverage whose interest was to bolster the Danish export economy in light of the recession (EKF), based on the specialized financial advice of an experienced Nordic energy financier (DNB).

Table 6: Volume of EKF exposure in guarantees to wind industry/Vestas in period July 2010 to end of 2012 (in EUR million).

	TOTAL EKF GUARANTEES	WIND INVESTMENT GUARANTEES	WIND SHARE OF TOTAL EXPOSURE	VESTAS SHARE OF WIND EXPOSURE
2010*	88	43	48.50%	100.00%
2011	1,557	1,085	69.70%	62.00%
2012	1,402	1,016	72.50%	56.30%
TOTAL	**3,047**	**2,144**	**70.30%**	**60.10%**

*2010 figures only July-end of year. Sources: EKF, OANDA for DKK:EUR exchange rates

34 We assume that commercial lending rates are 4% (European Central Bank, 2013).

6. Is the Jädraås financing structure replicable and scalable?

- The success of the Jädraås financing structure is based on three core elements: 1) a non-bank (in this case a pension fund) providing a long-term pool of capital; 2) an entity prepared to guarantee the funding and perform the necessary due diligence, and; 3) an agent bank to carry out financial advisory and servicing aspects of the arrangement.
- While other export credit agencies could motivate deals similar to that in Jädraås by providing backing for export situations, the structure is tied to technology-provision and the relative rating of the guarantee. Our analysis suggests that other actors are in positions to provide similar export loan arrangements.

To assess the potential to achieve scale-up, we analyze the Jädraås financing structure ingredients, consider the extent to which the barriers in this case are common to other investment structures, and why the policy mechanisms or financing arrangement have been successful.

6.1 Success in the Jädraås financing structure

The success of the Jädraås financing structure lies in the creation of a *Synthetic Loan* (see Section 5) which encapsulates the alignment of commercial and government interests, and is effective in filling a commercial lending capacity gap.

The formula for the *Jädraås financing structure* is based on three key elements:

1. A non-bank pool of capital (in this case a pension fund) to provide long-term financing;
2. An entity to guarantee the funding and perform the necessary due diligence such as, but not limited to, an export credit agency, and;
3. An agent bank to carry out financial advisory and servicing aspects of the arrangement.

A core reason for success is that each of the actors involved is able to continue operating within its normal administrative and risk management abilities, while taking advantage of returns of investments that exceed those with similar risk levels. By playing to the strengths and interests of each participant, the Jädraås financing structure attracts project finance debt, without only using typical actors such as commercial banks. In doing so, the structure offers a route to unlock alternative green investment.

6.2 Possible barriers to replicating or scaling-up the Jädraås financing structure

As described in Section 3, a strong public policy framework proved necessary for project viability and ultimately made it possible for developers to secure private investment. Here we identify possible issues that may make it difficult to replicate the Jädraås financing structure in other circumstances.

6.2.1 Legal and regulatory barriers

A number of barriers and rules may determine the extent to which similar actors participate.

- **Export loan guarantees are restricted by technology and country.** A national export credit agency guarantee requires a domestic technology provider, and a foreign project host country. In Jädraås, the Danish export credit agency provides a guarantee because of exports in technology from Denmark-based company, Vestas, to a project located in Sweden. To the extent that the export credit agency guarantees exports, its support mechanism is essentially tied to a local technology provider or a technology provider with local industry capacity.
- **Export loan guarantees are typically bound by specific guidelines.** For an export credit agency to guarantee a project finance loan, it must show that the loan terms adhere to investment guidelines, and do not distort the existing competitive market for lending as regards to private sector alternatives.[35] However, if a guarantor is

35 Investors including export guarantors must adhere to investment rules and guidelines as set out by industry regulators and or international bodies. In the EU, export credit agencies must show that such support adheres to State Aid Rules, and does not undercut commercial lending alternatives.

not an export credit agency, its guarantee may not be covered by the same explicit guidelines that reinforce the importance of commercial-rate lending. In this case, there may be a potential to distort the lending environment.

- **Providers of long-term capital have regulatory and internal management constraints.** Fiduciary rules mandated by international and domestic financial regulations place limitations on the potential long-term lending capacities of investors looking to fund green infrastructure, which typically require high up-front capital investment with variable returns into the future (BNEF, 2013, and CPI, 2013).[36] In addition, a recent CPI paper investigating renewable energy investment by institutional investors (Nelson and Pierpont, 2013) shows that existing policy barriers and management practices may already constrain their potential capital allocations.

6.2.2 Economic barriers

Economic barriers such as a poor project credit rating could affect a project's ability to receive loan guarantees and even limit the pool of capital available to the project.

- **Export credit agency ownership and the creditworthiness of projects can limit the available pool of capital.** In Jädraås, PensionDanmark entered into the financial arrangement because, among other reasons, the interest rate provided by the debt was higher than for sovereign AAA rating investment, with an approximately equal level of risk. The Jädraås arrangement aligned public interest with private investment appetites, but not all arrangements may access such robust backing. In the *International Union of Credit & Investment Insurers*,[37] the majority of the member export credit agencies have a state as the insurer-of-last-resort,[38] with only some backed by AAA rated states as in Jädraås. As such, not all export loan guarantees translate into investment-grade credit enhancements, which can have strong implications on the creditworthiness of the project, and limit the subsequent availability of lending capital.
- **Project economics have to be acceptable regardless of an export guarantee.** An export credit agency guarantee is unlikely to be a 'silver bullet' for projects that fail to pass project feasibility tests, as it too is exposed to the very same project risks that its involvement might otherwise overcome. In the end, if project economics are unacceptable for all parties involved, then the project will be unsuccessful irrespective of the credit-enhancement that export loan guarantees can provide.
- **Large ticket investments are needed to enhance export loan guarantee efficiency.** The scale of the investment and guarantee is important. At the moment, the financing structure is unlikely to work for small-scale investments given: the time it takes to carry out the additional cost associated with due diligence and advisory provisions, and export credit agencies setting minimum levels of support.

6.2.3 Investor practice barriers

Institutional investors have diverse investment objectives[39] and their investment behaviors differ widely meaning not all are willing or able to invest substantially in renewable energy, and few currently do.

- **A move away from business-as-usual investments can be encouraged with changes in public policies and management practices.** In Jädraås, PensionDanmark is a relatively innovative investor in this respect, after adopting a strategy to invest actively in renewable energy projects over the next three to four years. Removing energy policy barriers, improving existing management practices, and developing appropriate pooled investment vehicles could facilitate more participation from

Likewise, export credit agencies typically cooperate on the international level on topics such as: creating consensus for fair conditions for export credit (e.g. following guidelines as set out by the OECD Arrangement on Officially Supported Export Credits, at: http://search.oecd.org/officialdocuments/displaydocumentpdf/?cote=tad/pg(2011)13&doclanguage=en); cooperating among public and private credit insurers to develop common understandings of the required conditions for better credit insurance (e.g. Berne Union), or; bilateral exchanges with other export credit agencies on best practices, or agreements such as reinsurance procedures.

36 Two financial market regulations, Basel III and Solvency II, require capital investors to hold additional reserves compared with their ongoing investments (among other requirements).

37 Also known as the Berne Union (see http://www.berneunion.org). Our analysis of the 78 export credit agencies in the Berne Union shows that: 57 are state-owned, 14 privately held, and seven are of mixed ownership.

38 In the Jädraås arrangement, the Kingdom of Denmark ultimately back EKF exposure and so are the insurer-of-last-resort.

39 Characteristics determining institutional investment type: investment objective; size of fund managed; style of investment; asset allocation preferences, and; regulatory environment. See (Nelson and Pierpont, 2013).

institutional investors (Nelson and Pierpont, 2013).

- **Portfolio diversification could limit institutional investment.** Institutional investors need to diversify and manage their exposure to any single asset class or industry, which may restrict the overall potential of long-term pools of capital investors to invest in renewable energy (Nelson and Pierpont, 2013). The extent of diversification is subject to internal strategic decisions.[40]
- **Infrastructure investment that is fully guaranteed by a public agency can be classified as sovereign debt lending, but only if the investor has the capability and investment mandate to do so.** Lending like that from PensionDanmark in Jädraås can ultimately be categorized as sovereign debt lending. PensionDanmark's investment was not classed as infrastructure debt because they had an in-house investment team with a mandate capable of assessing its opportunity as sovereign debt. As Nelson and Pierpont (2013) found, few pension funds have built the expertise needed to assess these types of investments, and for many small funds, building such a team may not make economic sense.
- **Existing experience and relationships can be critical.** The success of the Jädraås financing structure rests on the concentration of regional 'know-how' and existing relationships between technology providers, export credit agencies, government, commercial banks and other actors crucial to the financing structure. Where these conditions do not exist, it may be more difficult for other project developers to achieve the same level of success.

6.3 Existing use of the Jädraås financing structure

Notwithstanding these barriers, at the time of the analysis, **some key elements of the Jädraås financing structure are already being replicated and extended to incorporate offshore wind projects and diverse geographies:**[41]

- **Lingbo Onshore Windfarm** is a 160-250 MW project in Sweden similar to Jädraås involving the same project developers (Arise Windpower with Platina Partners), Vestas turbines, and DNB as financial advisor. The developers hope to use the same *Synthetic Loan* arrangement with EKF/PensionDanmark providing the export guaranteed debt (Project Finance International, 2013).
- **Northwind Offshore Windfarm** is a large project off the Belgian coast of about 216 MW using Vestas technology. In total, nine investors are involved, including PensionDanmark. Finances were closed in 2012 with EKF providing an export loan guarantee, along with two other export credit agencies (Belgium's ONDD, and Norway's GIEK[42]) (EKF, 2013a).
- **Wind Park Vader Piet** is a 30 MW onshore windfarm on the Caribbean island of Aruba using Vestas turbines and initially valued at some EUR 75 million. The prospect for long-term project financing from commercial banks of EUR 60 million failed in 2008 due to the recession. In a similar vein to Jädraås, EKF unlocked project financing by creating a new financing model to provide a 100% guarantee of the bank loans, and receiving a risk-sharing counter-guarantee of 30% from the arranging bank (EKF, 2013c).
- **Macarthur Windfarm** is a large-scale 420 MW onshore windfarm in Australia. Using Vestas turbines, it will be the largest onshore windfarm in the southern hemisphere. The structure lender in this case is ANZ Banking Group, who receives support under EKF's 2009 Export Loan Support Facility (see Annex 4 for details: the Facility was eventually deemed unsuitable for Jädraås).

The role of export credit agencies as per the Jädraås financing structure can clearly be applied to support green infrastructure investments: **in different geographies** (e.g. the Northwind project above); **using**

40 Such as: the range of technology/infrastructure investments available to them, including individual technology providers or even particular types of technology, project host countries they are will invest in, currencies they will/can manage, availability of project sponsors, or capacity to administer the arrangement.

41 In addition, only six months after the PensionDanmark deal, EKF entered into a similar agreement with Danish pension fund PFA Pension. It is not clear if these two agreements will be used solely for wind investment, but we can assume that EKF will continue their backing of wind industry exports with guarantees to the wind industry making up a significant share. We understand EKF are still active in looking for other possible investment partnerships.

42 Belgian ONDD: Office national du ducroire/Nationale Delcrederedienst (Belgian Export Credit Agency), and Norwegian GIEK: Garantiinstituttet for eksportkreditt (Norwegian Guarantee Institute for Export Credits).

alternative green infrastructure technology providers (e.g. Siemens wind technology can also qualify for Danish energy credit agency support by having industry facilities in Denmark); **using alternative long-term pools of capital** (e.g. commercial banks); **using different national export credit agencies with alternative long-term pool of capital** (e.g. US Export-Import Bank and a US pension fund), or; **using a guarantee from an institution that is not an export credit agency.** Table 7 explains the potential replication and scale-up of the Jädraås financing structure given changes in the input factors.

6.4 Overcoming barriers and reaching the scale-up potential

Jädraås demonstrates that notwithstanding the barriers, there is significant potential to encourage new investors and sources of finance. Three strategies may help to unlock this type of climate financing and realize the full potential of the Jädraås financing structure.

6.4.1 A simple financing structure increases appeal and usability

Financial products should be kept simple to improve transparency, enhance usability and appeal to a larger group of stakeholders. This includes simplifying operational guidelines, stakeholder role definitions, and the structures on which the design of financial products are based. The Jädraås case study has shown that innovative financial arrangements need not be complex and

Table 7: Replication and scale-up potential of the Jädraås financing structure.

JÄDRAÅS FINANCING STRUCTURE INPUT	REPLICATION AND SCALE-UP POTENTIAL
IN OTHER GEOGRAPHIES (I.E. OTHER PROJECT HOST COUNTRIES)	Potentially limited to developed countries and major economies in the near future because of: • High costs for nascent technology (e.g. offshore wind) a hurdle for investors, • Lack of host country project sponsors, or commercial lending, • Lack of export credit agency with investment-grade backing, • Unmanageable risks such as political/sovereign/currency risks.
WITH OTHER TECHNOLOGIES AND TECHNOLOGY PROVIDERS	Technology plays two important roles in the financing arrangement that affect replication and scale-up: • The technology provider determines export credit agency availability. The choice of technology should not be a limiting factor as long as the export credit agency and technology provider are located in the same country, and; • Investors may look to more mature technologies since there is likely more experience and less risk with managing their investments. The maturity and relative low cost of wind energy could therefore, on first glance, appeal to investors looking to reduce risks.
WITH ALTERNATIVE POOLS OF LONG-TERM CAPITAL	The risk-return profile in the Jädraås financing structure plays an important role in its replication with other lenders. Given PensionDanmark's return above those of sovereign debt with similar levels of risk, finding alternative funders is promising, yet the replacement should have an equally high tolerance for relatively illiquid assets under their management, and with wealth to match. As such, we envisage potential candidates including: large commercial banks; pension funds from other geographies, a wider role from other institutional investors (e.g. insurance companies, investment funds); foundations and endowments, sovereign wealth funds, or perhaps corporate actors and high-net worth individuals.
WITH OTHER EXPORT CREDIT AGENCIES?	Export credit agencies played an important role during the recession by providing additional liquidity by directly financing of exports, or guaranteeing funds used for exporting goods (as in Jädraås) (Berne Union, 2012), with demand for export credit agency support increasing perhaps some 50% on pre-crisis levels (Citigroup, 2013). This is principally because there are "no added costs to EKF and the venture will provide better risk sharing overall" (IPE 2012).
WITH A GUARANTEE NOT INVOLVING AN EXPORT CREDIT AGENCY	The provider of an export guarantee need not be an export credit agency as in Jädraås. We can therefore envisage a variant of the Jädraås financing structure that involves some other provider of credit-enhanced project debt, such as in the case of the European Commission-European Investment Bank Project Bond Initiative (Hervé-Mignucci et al. 2013). A restriction is that this body would need to be able to carry out due diligence and risk management procedures, a task that many export credit agencies already undertake in-house.

can be administered within the range of 'normal operations' and so did not over burden existing workloads. By way of comparison, in 2009, Jädraås commercial lenders deemed EKF's existing export lending facility which provided directly loans to exports as inflexible, and ultimately unsuitable, for the Jädraås project.

6.4.2 A common agreement enables pre-packaged financing structures

As we have seen, Jädraås financing structure elements are being replicated in other projects. To assist project developers who typically prefer project financing options, and minimize transaction costs, a pre-packaged financing structure should be constructed for investments in a variety of regions and technologies. Such structures could also appeal to alternative long-term sources of funds.

Export credit agencies and long-term pools of capital (or their representatives) should work to design a common procedure/agreement for the use of export loan guarantees that can be applied easily notwithstanding the presence of variables such as different technology providers and country specifics.

6.4.3 Alternatives to export credit agency guarantees are needed

Work is needed to tap alternative guarantee providers, other than export credit agency guarantees, to address the risk-return concerns of institutional investors. Export credit agencies are not the only institutions capable of providing the guarantee instrument that underpins the Jädraås financing structure, but they are currently the most suitable.

A dedicated global vehicle to mimic the Jädraås financing structure, but not necessarily requiring engagement by a national export credit agency, could open the financing structure to 1) new actors, such as private financial institutions or insurance companies, willing to provide investment guarantees with little exposure to risks but relatively high levels of returns, or 2) an expanded suite of other instruments such as first-loss insurance and other risk coverage mechanisms. A structure such as this requires cooperation and learning transfers among experienced actors who already provide such services.

7. Conclusion

While commercial banks have traditionally been a major contributor to financing renewable energy projects, these banks have less lending capacity in light of the ongoing economic recession. Policymakers and renewable energy project developers often point to institutional investors, such as pension funds and insurance companies, as a largely untapped source of funding. However, policy barriers and management practices mean all but a few institutional investors are currently willing or able to invest substantially in renewable energy.

The Jädraås Onshore Windfarm shows that pension funds are willing to invest in large-scale green technologies when offered appropriate returns and sufficient risk coverage, in this case delivered by a state-backed export loan guarantee.

The key innovation in Jädraås was the creation of a *Synthetic Loan* to provide alternate project financing, by using a state-backed export loan guarantee to ultimately facilitate pension fund investment. **Without such an arrangement, long-term lending from commercial banks would have been more difficult to attain because of the restricted lending environment, or would have required complex contracting structures that would have risked project delays.** At the same time, the pension fund was exposed to risks similar to that of AAA rated sovereign fixed income (government bonds), and still earned returns above those kinds of investments. At the end of the day, a *Synthetic Loan* funded one third of the project costs.

The Jädraås Windfarm project illustrates the alignment of interests among government actors, industry, and investors. Aligning the commercial interests of Denmark, and the world's largest supplier of wind turbines, with the Danish government's national interest in building its export markets, facilitated Danish pension fund investment and secured the Jädraås financing structure, and ultimately helped to deliver Swedish wind energy and zero-carbon goals.

Public resources not only ensured financing, but **government policy and project developer know-how provided investors with future revenue certainty.** The **Swedish market for renewable electricity certificates** offers financial returns for 15 years, and without it the Jädraås project would not have been financially viable, highlighting the importance of public policy support. In parallel, energy from Jädraås is sold into the **Nord Pool power market**. The combination potentially exposes project developers to volatile revenue streams, but by arranging hedging contracts for the sales of energy and renewable certificates, project developers shielded project revenues from this uncertainty.

The potential volume of investment originating from a Jädraås-type financial arrangement warrants work to identify where long-term pools of capital can be guaranteed on green technology exports. We find that the Jädraås financial structure is relatively unique, given the actors investing in a large-scale windfarm, but not overly complex as it can fit into normal administrative procedures. Interestingly, the financial structure is already being applied to other climate investments to some extent. Our analysis suggests a number of lessons about how to encourage effective investments in green infrastructure and secure alternative long-term pools of capital, such as: developing a simple financing structure, employing a pre-packaged approach, and opening up the structure to other providers of export loan guarantees and other suites of risk coverage mechanisms.

The Jädraås Windfarm project case study shows that public support can be used to encourage institutional investment in green technologies, provided they offer risk coverage that meets investor-specific concerns. Given the scale of the potential available lending capacity from institutional investors, we hope that the lessons learned in this case study will provide policy makers, project developers, financial investors and lending institutions with a better understanding of the role of public policy and financial incentives in assisting private investment in less conventional energy technologies such as renewable energy.

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Appendix 1. Risk Analysis Sensitivity Tables

Table 8: Sensitivity test of Jädraås project profitability as a function of turbine availability.

PRE-TAX	IRR SENSITIVITY TO WIND TURBINE AVAILABILITY			
-25%	-15%	-10%	-5%	Reference
75%	85%	90%	95%	100%
4.92%	**6.42%**	**7.13%**	**7.82%**	**8.49%**

Table 8 shows the sensitivity of project pre-tax internal rate of return to wind turbine availability (a proxy for windfarm energy output). A theoretical availability at 100% is based on the Jädraås windfarm generating its rated 570-590 GWh per annum. A reduction of 15% brings project pre-tax IRR in line with project average cost of capital (weighted by equity and debt contributions).

Table 9: Sensitivity test of Jädraås project profitability as a function of capital expenditure.

PRE-TAX	IRR SENSITIVITY TO CAPITAL EXPENDITURE							
-30%	-20%	-10%	-5%	Reference	5%	10%	20%	30%
-252	-288	-324	-342	-360	-378	-396	-432	-468
20.12%	**14.66%**	**11.08%**	**9.69%**	**8.49%**	**7.43%**	**6.50%**	**4.89%**	**3.56%**

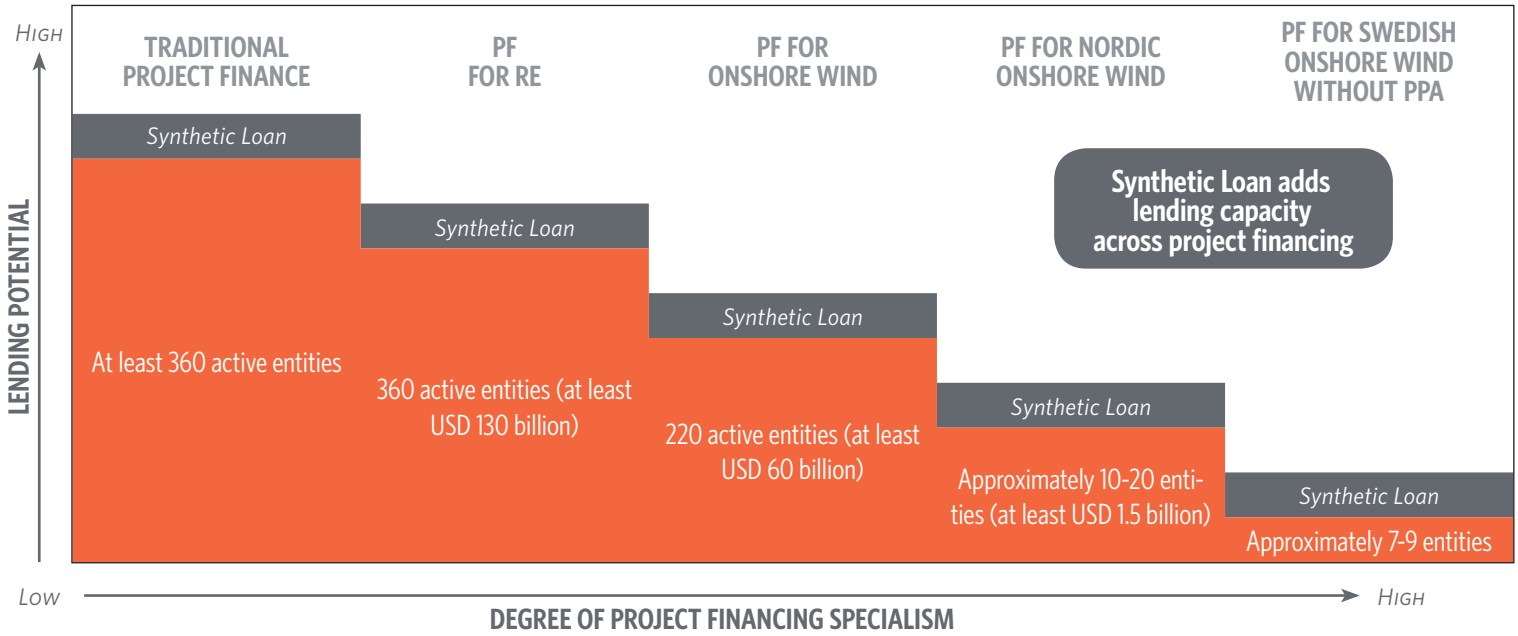
Jädraås project capital expenditure is approximately EUR 360 million. Table 9 shows the impact of capital expenditure on the project pre-tax internal rate of return. Increasing capital expenditure by 10-15% brings project pre-tax IRR in line with project average cost of capital (weighted by equity and debt contributions).

Appendix 2. Project finance lenders and arrangers in the period 2010-2012

Figure 5 is a stylized interpretation of the number of lenders in project finance, from the left (traditional project financing lenders) towards the right (specialized project financing lenders for renewable energy projects in Sweden without power purchase agreements).

In total, approximately 360 banks provided financing to renewable energy in the period 2010-2012 globally, of which: around 220 are active in onshore wind financing, and ultimately seven to nine banks in Europe have the appetites to lend to Swedish onshore windfarms without power purchase agreements, two of which are involved in Jädraås. Like in Jädraås, commercial banks typically would require hedging contracts for power and renewable certificates before providing financing.

Figure 5: Stylized interpretation of lenders and arrangers involved in project financing from 2010-2012 - traditional project finance (left) to lenders involved in projects such as Jädraås (right).



Notes: Stylized interpretation of syndicated lenders and lead arrangers involved in project financing. Data availability mean figures for financing volumes and active entities are approximate only. The financing arrangement between EKF+PD+DNB (depicted in the figure by Synthetic Loan) essentially adds lending capacity across the range of project financing entities. The Jädraås financing solution is anticipated to work in all markets (see Section 6). Acronyms: EKF - Eksport Kredit Fonden, Danish export credit agency; PD - PensionDanmark; DNB – Norwegian commercial bank. Sources: CPI elaboration, BNEF 2013, stakeholder interviews.

Appendix 3. Distribution of Jädraås financing structure benefits

No exact benefits figures are disclosed because of confidentiality agreements. However, these can be estimated from publically available information.

Table 10: Summary of estimated benefits to Jädraås financing structure stakeholders.

	LENDERS (PENSIONDANMARK)	GUARANTOR (EKF)	OTHER LENDERS (DNB, SEB)
BENEFIT TO STAKEHOLDER	PD(+EKF) (on commercial terms: e.g. same rates, tenor, and level of seniority) Spread over reference rate*: **TOTAL: 4%:** **PD → 1-1.5%** **EKF → 2.5%**	EKF premium over PD for administrative costs, due diligence etc.	DNB, SEB lend on commercial terms and rates, business-as-usual investment.
ESTIMATED RETURN EXPECTED ON INVESTMENT	**1-1.5%**	**2.50%**	**4%** (DNB to get advising/arranging bank premium)

*Note: EURIBOR – Euro Inter-Bank Offered Rate is the average interest rate at which loans are agreed between the major banks in the EUR money market (a reference Eurozone transactions using EUR). In the period 2010 to 2012, the EURIBOR 12-month rate was approximately 1.5-2% (see European Banking Federation EURIBOR website http://www.euribor-ebf.eu/).

Appendix 4. EKF support of export financing

ELO Eksport Låne Ordningen (Export Loan Support Scheme)

The EKF export loan scheme was originally considered for the Jädraås project, however its inflexibility in terms of drawdown, prepayment plan and interest rate exposure, forced participants to look elsewhere for funding. The development of the export loan scheme highlights EKF innovation to unlock export investment. In light of serious liquidity problems of commercial banks to lend money on the medium- to long-term, the EKF developed the ELO as a temporary support mechanism in consultation with the Government of Denmark.

- Established in March 2009, the ELO fund of DKK 20 billion (ca. EUR 3 billion) where the EKF would provide export loans up to 100% at commercial rates to ensure longer tenor loans would be made possible.
- In 2012, the Danish government agreed to extend the scheme by another three years with and additional DKK 15 bn.
- Before granting support, the applicants must meet the following criteria:
  - » The export loan must involve a Danish company
  - » There is no ceiling on loan volume, however needs to be appropriate for administrative expenditure
  - » The tenor will be between 2-15 years, and up to 18 years for renewable projects
  - » EKF requires the export loan to be set up with an export guarantee

A set of conditions also need to be satisfied:

- Promoting economic growth in Denmark; buyer is rated as *credit-worthy* based on thorough assessment to protect Denmark government from losses; business dealings must comply with good working practices (environmental and social responsibilities); and allow EKF to publish standard details of the transaction.
- Covers: extraordinary risks that private banks/ insurance companies will not cover; EKF pays compensation to Danish provider of loan if losses occur due to commercial or political risks.
- Covers commercial risks: if company's buyers unable to pay due to liquidation, insolvency, cancellation or unwilling to pay. EKF must deem foreign buyer as creditworthy.
- Covers political risk: if company doesn't receive payment for products due to impediments in the foreign country (war, domestic disruptions, currency shortage, etc).
- EKF pays out max of 90% of loss in compensation to exporter. Exporter takes the 10% for commercial and political risks.
- EKF covers up to 95% of commercial and political risks for banks.