BENCHMARKING STUDY ON OFFSHORE WIND INCENTIVES

COMPARISON OF THE SYSTEMS IN 6 NEIGHBOURING COUNTRIES

EXECUTIVE SUMMARY

Introduction, objective and scope

Offshore wind is expected to contribute significantly to the Belgian renewable energy targets. In the Belgian part of the North Sea, about 2.2 GW of offshore wind energy has been licensed by the federal authorities. The cost of these developments is often debated and is currently high on the policy agenda.

A sustainable and credible support system has two dimensions: the net support costs for society need to be reasonable, while at the same time it must incorporate enough incentives to attract third parties to provide the needed financing in order to realise the 2020 targets that are set by the government. The offshore wind developers therefore wish to provide the policy makers with an up-to-date study that analyses the net present value of both the net support costs for society and the gross project income, in Belgium and in the surrounding countries (Netherlands, France, Germany, UK and Denmark).

This should help to understand the dynamics of the different support systems, and should support the policy makers to design a cost-efficient system that is interesting enough to attract the necessary investments.

Main assumptions

To compare on an equal basis, the main assumptions from the case study of the CREG report[1] are used. The report thus analyses the total support costs for a 300 MW wind farm in the different countries, with 3500 full load hours and a CAPEX of 3800 €/kW.

The comparison in this report is based on the **current direct support systems** in the neighbouring countries or the public information of the latest tender (status January 2013), meaning:

- **BE:** GSC system with 102.24 €/MWh on average[2] during 20y + 25 M€ support for the connection.
- **DE:** FIT system with 190 €/MWh for 8y + extension, grid connection fully paid (25% of CAPEX since far from shore and in deep water)[3]
- **DK:** FIT tender system with 140.83 €/MWh for the first 15 TWh[4], grid connection fully paid (10% of CAPEX since closer to shore and in shallow water)

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[1] Studie 1061 over de analyse van de kosten en onrendabele topberekening voor offshore wind in België, CREG, 27 oktober 2011

[2] A 300 MW wind farm receives the following support in Belgium: 107 €/MWh for the first 216 MW installed, and 90 €/MWh for the other 84 MW installed. On average, this is a support of 102.24 €/MWh.

[3] Developers in Germany have the option to choose one of two possible support systems: a support of 150€/MWh during 12 years + possible extension, or a shorter and higher support of 190 €/MWh during 8 years + extension (with 150€/MWh). In practice, most developers in Germany working with project financing choose the shorter option with the higher support.

[4] Based on the latest tender price of the Anholt wind farm: 105.1 ore/kWh, 0.134 DKK/€, support during first 20000 GWh for a 400 MW wind farm. Note that the support is linearly scaled to a 300 MW wind farm while the price actually

- **FR:** FIT tender system with 175 €/MWh during 20y[5]
- **NL:** Tender with market premium system: 170 €/MWh during 15y[6]
- **UK:** ROC system with 2 ROCs/MWh at 40.71 £/ROC + 10% recycling payments during 20y

For the **electricity price**, the CREG assumption is not followed as it is higher than the current electricity futures prices (CREG uses 50.7 €/MWh vs current price of about 45€/MWh in January 2013) and takes into account neither the balancing & profiling costs that the wind farm operators face, nor the merit-order effect[7]. This report therefore uses a more realistic base load price of 45 €/MWh (based on ENDEX January 2013, for UK 48£/MWh based on APX) minus 15% for balancing and profiling[8]. For countries with a FIT system (DE, DK, FR) only a 10% reduction is assumed for balancing and profiling, since the smoothing effect of the larger portfolios lowers the costs for balancing. The electricity price in this study is furthermore set to increase with the inflation of 2% minus 0.5% as an assumption for the merit-order effect that lowers the value of wind on the power market. The assumptions are further detailed in Chapter 3 of the report. To analyse the impact of the electricity price, a short sensitivity analysis has been performed.

The study analyses both the viewpoint of society and the viewpoint of the project. The following is included in the calculations:

- For the **net support costs for society**:
  - the direct support (GSC, ROCs, FIT, tender bid price)
  - the support for the grid connection (in BE, DE and DK)
  - the electricity price is NOT included. In countries with a FIT or tender price (DE, DK, FR, NL), the electricity price is subtracted to come to net support, as this can be sold on the market and is thus not paid by society.
- For the **gross project income**:
  - the direct support (GSC, ROCs, FIT, tender bid price)
  - the support for the grid connection (in BE, DE and DK)
  - the electricity price for wind (in countries with a certificate system – BE and UK)

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includes economies of scale and a different kind of financing (developer Dong uses Balance financing which is a cheaper form of financing).

[5] Conservative assumption based on the tender price of Fécamp wind farm. The Saint-Brieuc wind farm even has a tender price of 200 €/MWh.

[6] This is based on the publicly available information of the last SDE tender (GEMINI OWF: 170 €/MWh).

[7] Whenever there is a lot of wind or PV, prices on the power markets tend to drop since the marginal cost of wind and PV is very low and this shifts the 'merit-order curve', i.e. the supply curve of electricity to the right. In the future with high amounts of renewables, this will have a big impact on the actual price at which wind and PV operators will be able to valorise their electricity.

[8] This 15% is also considered as a fair value by VEA (Flemish Energy Agency) for balancing costs, merit-order-effects etc. for onshore wind. See http://www2.vlaanderen.be/economie/energiesparen/milieuvriendelijke/monitoring_evaluatie/VEA_Parameterdocument_formeel_2012.pdf

In order to focus on the main support and income streams, the study **does not take into account** taxes, injection tariffs[9], costs for dismantling, support in financing (e.g. KfW or UK Green Investment Bank), Guarantees of Origin, balancing support[10], CO2 taxes, etc.[11]

The comparison in this study is done based on the **net present value** of support and income via a discounted cash flow analysis, and thus identifies the **real costs**. The support over the years is discounted since e.g. 100€ in 20 years from now is worth less than 100€ today. To determine the real net support cost for society a discount factor of 4% has been used; a figure which is recommended by the European Commission to be used in social cost benefit analysis[12]. To calculate a real gross income stream for the project, the following discount factors have been used, reflecting the cost of capital for the investor:

Discount factors used and risk:

Governments	4%	
Belgium	10.5%	risk from market fluctuations, wind risk, merit-order effect…
Denmark	9.0%	limited risk during support period
France	9.0%	limited risk during support period
Germany	9.0%	limited risk during support period
Netherlands	11.0%	policy risk + limited risk from market fluctuations, wind risk, merit-order effect…
UK	13.5%	risk from market fluctuations + ROC fluctuations, wind risk, merit-order effect…

The revenue streams in countries with a fixed feed-in are stable and lead to lower risks for the project development. The risks are taken by the government here, which leads to lower cost of capital for the project financing. Market based systems (especially the UK system where both the electricity price and the support price are fluctuating) lead to higher financing costs.

The discount factors for the gross project income mentioned above are based on data from Bloomberg New Energy Finance[13], and are adjusted for the current support systems with the following reasoning:

- The discount factors for Germany (9%) and the UK (13.5%) have been taken from Bloomberg.
- France and Denmark have been put at the same level as Germany (9%) since the risks are similarly low in both countries and the support is not dependent on e.g. the electricity prices.
- For Belgium, the discount factor has been increased from Bloomberg's 9% to 10.5% because of the risk of the electricity market fluctuations. The increase has been based on the difference

[9] In Belgium, a decision on abolishing the injection tariffs is currently still pending.

[10] The old support for balancing of offshore wind in Belgium (30% tolerance margin) is still in place. However, since the balancing mechanism has changed in 2012, it is not certain whether this is a support to offshore wind or an additional cost.

[11] These factors that have not been taken into account could of course have an important impact on the gross project income and as well on the net support costs for society. Some of these factors have been partly investigated already (e.g. CREG study 2011 estimates costs of dismantling), and could be a relevant topic for further studies.

[12] http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide2008_en.pdf

[13] Financing offshore wind: a UK perspective, Charlie Hodges for Bloomberg New Energy Finance, The Financing of Wind Energy, Palais de la Bourse, Paris, July 2010

between Germany (9%, low risks) and the UK (13.5%, risks on electricity price and ROC price). Approximately 1/3 of a project's revenue stream is being generated by selling electricity, the other 2/3 is coming from green certificates income. If we start from the most stable incentive scheme which is Germany with 9% and take UK as the most uncertain incentive scheme (13.5%) due to uncertain income streams from both electricity and ROC then an uncertainty of 1/3 of total income corresponds to a discount rate of 10.5% for Belgium.

- The discount factor for the Netherlands has been lowered compared to the Bloomberg New Energy Finance figure of 12.5%, to 11%. The link of the subsidy with the electricity price leads to a slightly lower electricity income risk than in Belgium. However, the policy risks are high.

Methodology

As written above, the report looks at the net present value of the net support cost for society and the gross project income. It is crucial to compare the real costs and therefore the support has been discounted over the years since money in the future is worth less than today. This is a very important factor in the methodology, and is often forgotten in other studies.[14]

The **methodology** used in this report for the comparisons is explained with the example of Belgium in Figure 1 and in the text below. The same methodology is used for the other countries.

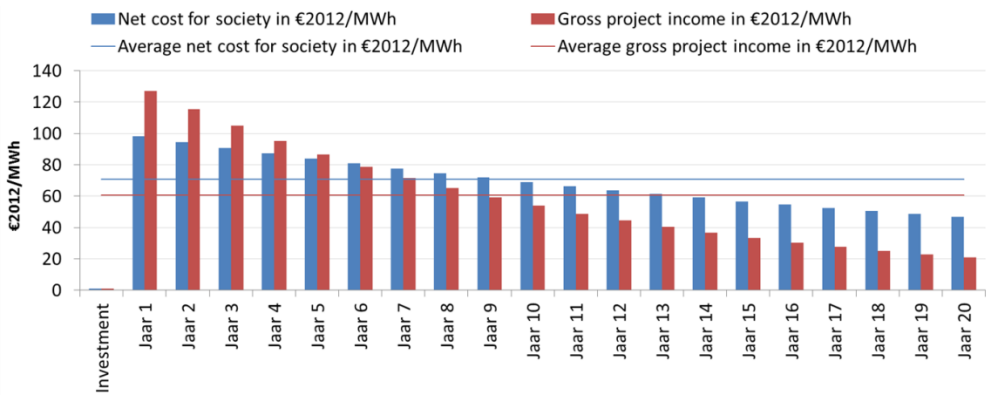

Figure 1: Explanation of the methodology for Belgium: Net support cost for society (discount factor 4%) vs Gross project income (discount factor 10.5%).

The figure shows the following:

- In year zero, the investment is done. A support of 25M€ is given for the connection of the wind farm by the TSO, which is paid by society via the grid tariffs. Per MWh wind energy produced over 20 years, this is a subsidy of 1.19 $€_{2012}$/MWh[15].

[14] E.g. the study 'High Level Group for a Sustainable Chemical and Plastics Industry in Belgium, Working Group Energy, KUL for Essencia, 2010' does not take into account discount factors and thus calculates with nominal values.

[15] This is more or less similar to the injection tariffs that are charged to the electricity producers in Belgium.

- In year one, the net support costs for society are 102.24 €/MWh. In real costs (discounted with 4%), this means 98.3 $€_{2012}$/MWh. The project receives the GSC and 85% of the electricity market price. Together this is 140 €/MWh. In real terms (discounted with 10.5% for the project financing) this means an gross project income of 127.1 $€_{2012}$/MWh.
- For the following years, the certificate value remains the same and the electricity price rises. However, in real terms the yearly amounts decrease over time. The support in 20 years from now is indeed worth only a fraction of today's support in real terms.
- The analysis lead to an average net support cost for society of 70.7 $€_{2012}$/MWh and an average gross project income of 60.6 $€_{2012}$/MWh.

Net support costs for society

Figure 2 shows the results for the total net support costs for society per MWh of wind production[16] along with the weighted average[17].

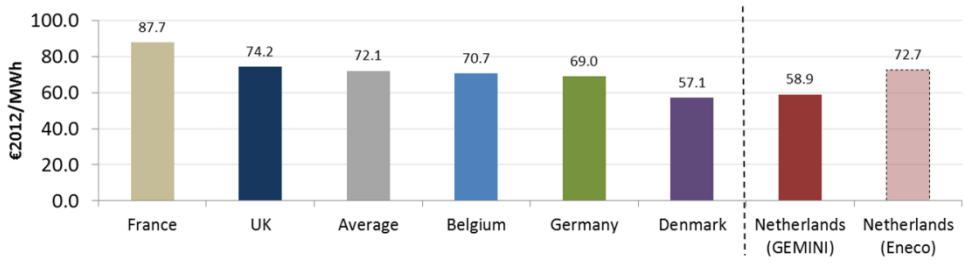

Figure 2: Net support costs for society for a 300 MW OWF per MWh produced over 20y [€2012/MWh]. The costs in Belgium are lower than the weighted average. The NL system is uncertain to materialise at this support (see text) and can therefore be left out of the comparison. An estimation of the support for the second wind farm in the NL tender is provided for information. This is much more in line with the other countries and lies above the average. The DK system is relatively cheap and is also a special case since DK wind farms are much cheaper to build than in the other countries as they are close to shore and in shallow water.

The net support costs for society in Belgium (70.7 $€_{2012}$/MWh) are a bit lower than the weighted average of the support costs in all six countries (72.1 $€_{2012}$/MWh). Germany, the Netherlands and Denmark are also below the weighted average, while the costs in France and in the UK are above. Note that:

- The cost in the Netherlands is very low. However, there are currently doubts whether offshore wind will materialise at this price. It seems that the owner of the wind farm is already trying for 2 years to sell its stake but faces difficulties due to the low support price. The Dutch system as calculated in this study can therefore be left out of the comparison[18].

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[16] Net present value of the total net support costs for a 300 MW wind farm divided by its energy production over 20y.

[17] Weighted with the offshore wind targets for 2020 in each country (BE: 2 GW, FR: 6 GW, DE: 10 GW, UK: 18 GW, NL: 6 GW, DK: 1.34 GW).

[18] The new SDE+ support system is not interesting for offshore wind (too low support) and for this reason no wind farms are expected to be built until 2020. More information can be found in Chapter 10.

To illustrate this, the net support cost for society is estimated for the second wind farm in the tender (see Figure 2). The tender bid price for the 129 MW Eneco wind farm is not publicly known, but can be roughly estimated with the rule of thirds[19] at about 200 €/MWh. The net support cost for society in this case would be 72.7 $€_{2012}$/MWh, which is more realistic and in line with the other countries.

- The Danish system has low net support costs for society. The main reason is probably that DK wind farms are cheaper to build because of low distances to shore and shallow water depths. It is therefore also a special case which makes it difficult to compare it with the Belgian system.
- In Germany and Denmark the connection costs are fully paid by society. They are charged via the TSO and its grid tariffs but are ultimately borne by the end-consumers. However, even with this large support included, the total net support cost for society is still among the lowest.
- In countries with a FIT system (DE, DK, FR), the balancing & profiling costs are borne by society.
- The French system has a relatively high net support cost for society. As written above, this is based on the tender from 2012, where the bid prices were much higher than expected by the French Government. Possible reasons are e.g. that project developers are bound to a binding offer whereas in UK developers have no obligation to realise their projects. It is important to mention that in the calculations it is assumed that the French support does not increase with inflation, even though the tender documents mention a predefined formula to adapt the support to price increases etc. As a conservative assumption, this has not been taken into account.[20]
- The costs for the UK are also higher than average. The support is quite high during a long period, while the electricity price in the UK is higher than in mainland Europe. The calculations are done with a ROC price of 40.71 £/ROC + 10% recycling payments during a period of 20 years. Not so long ago, ROC prices were even at 50 £/ROC + 10% recycling payments.[21]

A sensitivity analysis has been performed on the electricity price.

- With a starting electricity price of 50.7€/MWh, the net support cost for society for Belgium is still at 70.7 €/MWh, while the weighted average has dropped to 70.8 €/MWh.
- With an electricity price of 40 €/MWh, Belgium is still at 70.7 €/MWh net support while the weighted average increases to 73.4 €/MWh.
- With an electricity price of 45 €/MWh and a yearly price increase of 3.5% (increase of 2% above the inflation of 2% minus 0.5% for merit-order effect), Belgium (70.7 €/MWh) is now only slightly

[19] The GEMINI wind farm has a capacity of 600 MW, with an available total subsidy budget of 3.5 billion EUR at a tender bid price of 170 €/MWh. The ENECO wind farm has a planned capacity of 129 MW with an available subsidy budget of 900 million EUR. → tender price of second wind farm is estimated to be about 203 €/MWh.

[20] In France, the FIT is secured for 20 years and is adjusted for price changes with a predefined formula taking into account salary changes, steel price fluctuations etc. It is difficult to assess the impact of this formula. Therefore, as a conservative and safe scenario in order not to boost the support costs in France, it is assumed to be NOT indexed and subject to inflation as well.

[21] The ROCs will be phased out in the future. A new support system for offshore wind has been defined in the UK, the Contracts for Differences. In this system, the support is dependent on the price of the electricity on the market. The new system starts in 2017. For the wind farms which have been developed with the ROC system, a minimum ROC price will be defined. More information can be found in Chapter 11.

above the average which has dropped to 70.5 €/MWh, while France is still at 81.7 €/MWh and the UK at 74.2 €/MWh.

Gross project income

To complete the picture on the support systems, it is important to also analyse the other side – the gross project income (direct support + electricity price where relevant). Figure 3 shows the results along with the weighted average.

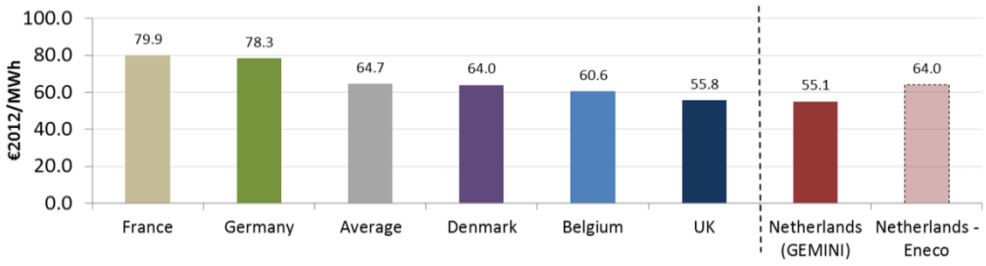

Figure 3: Gross project income in €$_{2012}$/MWh. Both direct support (GSC, FIT, ROCs, tender prices and grid connection support) and electricity prices (where relevant) are taken into account. The gross project income in Belgium is among the lowest and much lower than the weighted average. DE and DK have a relatively high gross project income, even though their net support cost for society is among the lowest.

Note that:

- The gross project income in Belgium is among the lowest at 60.6 €$_{2012}$/MWh and is also lower than the average.
- The systems in Germany and Denmark have a relatively low net support cost for society (Figure 2), and provide at the same time a relatively high gross project income. These systems are stable and have a low risk profile which makes the financing and insurances cheaper. Moreover, these two countries also support the full grid connection, which means that this can be developed at a lower cost since the cost of capital for society is much lower than that for the project financing.
- The system in the Netherlands provides a very low gross project income which – as discussed above - raises doubts on the realisation of offshore wind farms. With the estimation for the 129 MW Eneco wind farm under the SDE programme (see above), the gross project income is estimated to be 64.0 €$_{2012}$/MWh.
- The gross project income is often lower than the net support costs for society, even when the electricity price is taken into account (e.g. UK and BE). The reason is that the discount factor for the projects is a lot higher than the one for the society. This has a big influence on the final result and on the attractiveness of the support system. The higher the system risk of a support system, the higher the cost of capital for the projects. To create a sustainable system, stability and risk mitigation are crucial to limit the financing costs.

A sensitivity analysis on the electricity price is also performed here. With the same examples as above, the gross project income in Belgium always ranks among the two lowest, and is at least 3-5 €/MWh lower than the weighted average.

Conclusion

The analyses compare the net present value of the net support cost for society and the gross project income in Belgium, Germany, Denmark, France, the UK and the Netherlands. They show that the Belgium support system for offshore wind energy is neither the most expensive to society, nor does it deliver a high gross income for the projects. The net support costs for society are lower than the weighted average for the six analysed countries. The gross project income is among the lowest.

TABLE OF CONTENTS

1 INTRODUCTION

Offshore wind is expected to contribute significantly to the Belgian renewable energy targets. In the Belgian part of the North Sea, about 2.2 GW of offshore wind energy has been licensed by the federal authorities. The cost of these developments is often debated and is currently high on the policy agenda.

A sustainable and credible support system has two dimensions: the net support costs for society need to be reasonable, while at the same time it must incorporate enough incentives to attract third parties to provide the needed financing in order to realize the 2020 targets that are set by the government.

The offshore wind developers therefore wish to provide the policy makers with an up-to-date study that analyses the net present value of both the net support costs for society and the gross project income, in Belgium and in the surrounding countries (Netherlands, France, Germany, UK and Denmark). This should help to understand the dynamics of the different support systems, and should support the policy makers to design a cost-efficient system that is interesting enough to attract the necessary investments.

The study analyses both the viewpoint of society and the viewpoint of the project. It compares the current direct support systems in the neighbouring countries (status January 2013), taking into account:

- the direct support (GSC, ROCs, FIT, tender bid price),
- eventual support in the grid connection (25M€ in BE, full support in DE and DK)
- the electricity price (where relevant, so only in BE, UK, NL, and also in DK and DE when the support period is over.

The comparison is based on the net present value of the support and electricity price. This allows a comparison on real cost basis, which is essential when comparing the total amount of support over time in different systems. The analysis is furthermore based mostly on the case study from the CREG study (300 MW wind farm with 3500 full load hours). The assumptions are further detailed in Chapter 3 of the report.

The analysis in this report has been based on the offshore wind power support systems that are in place today (status January 2013). In countries with a tender system (DK, FR, NL), the amount of direct support that is available today is not fixed, and therefore assumptions have been made based on the publicly available info of the last tender.

2 OVERVIEW OF THE DIRECT SUPPORT FRAMEWORKS

In this study we analysed the costs of offshore wind in different countries. The focus in the analysis is twofold: on the one hand the net support costs for society are analysed, on the other hand the gross income stream for the project. The study compares the net present value of the direct support to offshore wind energy in Belgium with the situation in the surrounding countries.

The direct support in each of the investigated countries is briefly summarized in the following tables:

	Belgium	Germany	UK
System	GSC	FIT	ROCs
Direct support (€/MWh) incl. electricity price where relevant (85%*45 €/MWh)	140.49	150/190 (+ 35 for remaining period)	159.04
Period	20y	12y / 8y + prolongation	20y
Electricity price income?	YES	NO, unless step-out	YES
Additional support	25 M€ (cable)	Full connection to shore by TSO	
Discount factor developers	10.5%	9.0%	13.5%
Peculiarities	107 €/MWh for first 216 MW, 90 €/MWh for rest. Balancing cost is for the developer	Following assumptions are used for prolongation period: 30m water depth, 30 km from shore. --> 19 months prolongation. Step out of system is assumed after support period since electricity price will probably be higher then 35€/MWh. Balancing cost is for society during support period.	Based on current system and prices of 2 ROCs per MWh at 40.71 £ on average + 10% recycling payments. System will change in 2017 (CfDs). Electricity price UK is 48£/MWh. Balancing cost is for the developer

	Netherlands	Denmark	France
System	Tender system	Tender system	Tender system
Direct support (€/MWh) incl. electricity price where relevant (85%*45 €/MWh)	170	140.83	187.5
Period	15y	Period defined in tender (e.g. 50000 FLH, 20 TWh..)	20y
Electricity price income?	Not during support period	Not during support period	Not during support
Additional support		Full connection to shore by TSO	
Discount factor developers	11.0%	9.0%	9.0%
Peculiarities	The above is based on estimated price of last wind farm (GEMINI). The government only pays the difference between the bid price and the average electricity price (with minimum and cap). There is a new support system (SDE+ 2013), but it is not interesting and no OWF will be build. Balancing cost is for society.	Price shown was from last tender (Anholt), also possible to bid own projects at lower prices. Balancing is for society during support period.	Based on average of bids first tender (Fécamp 175 €/MWhand Saint-Brieuc 200 €/MWh). Tender price is much higher than expected. FIT system also exists but is not used. Balancing cost is for society.

Summarized, the following assumptions are used for the support systems in each country:

- **BE:** GSC system with 102.24 €/MWh on average[22] during 20y + 25 M€ support for the connection.
- **DE:** FIT system with 190 €/MWh for 8y + extension, grid connection fully paid (25% of CAPEX since far from shore and in deep water)[23]
- **DK:** FIT tender system with 140.83 €/MWh for the first 15 TWh[24], grid connection fully paid (10% of CAPEX since closer to shore and in shallow water)
- **FR:** FIT tender system with 175 €/MWh during 20y[25]
- **NL:** Tender with market premium system: 170 €/MWh during 15y[26]
- **UK:** ROC system with 2 ROCs/MWh at 40.71 £/ROC + 10% recycling payments during 20y

[22] A 300 MW wind farm receives the following support in Belgium: 107 €/MWh for the first 216 MW installed, and 90 €/MWh for the other 84 MW installed. On average, this is a support of 102.24 €/MWh.

[23] Developers in Germany have the option to choose one of two possible support systems: a support of 150 €/MWh during 12 years + possible extension, or a shorter and higher support of 190 €/MWh during 8 years + extension (with 150 €/MWh). In practice, most developers in Germany working with project financing choose the shorter option with the higher support.

[24] Based on the latest tender price of the Anholt wind farm: 105.1 ore/kWh, 0.134 DKK/€, support during first 20 TWh for a 400 MW wind farm. Note that the support is linearly scaled to a 300 MW wind farm while the price actually includes economies of scale and a different kind of financing (developer Dong uses Balance Sheet financing which is a cheaper form of financing).

[25] Conservative assumption based on the tender price of Fécamp wind farm. The Saint-Brieuc wind farm even has a tender price of 200 €/MWh.

[26] This is based on the publicly available information of the last SDE tender (GEMINI OWF: 170 €/MWh).

3 ASSUMPTIONS AND METHODOLOGY

To compare the different frameworks on an equal basis, the following assumptions have been used:

Wind farm capacity	300 MW
Full load hours	3500 h
Electricity price 1st year	45 €/MWh (48£/MWh UK)
Cost for balancing, profiling… (FIT / No FIT)	10% / 15% of elec. price
Inflation	2%
Evolution electricity price for wind (on top of inflation)	-0.5%
CAPEX	3800 €/kW
Percentage of the connection costs vs total	10-25%
Exchange rate £ --> €	1.22
Exchange rate DKK --> €	0.134
Discount factor for NPV (government)	4%

Discount factors used and risk:

Governments	4%	
Belgium	10.5%	risk from market fluctuations, wind risk, merit-order effect…
Denmark	9.0%	limited risk during support period
France	9.0%	limited risk during support period
Germany	9.0%	limited risk during support period
Netherlands	11.0%	policy risk + limited risk from market fluctuations, wind risk, merit-order effect…
UK	13.5%	risk from market fluctuations + ROC fluctuations, wind risk, merit-order effect…

- The **size** and **full load hours** of the wind farm are the same as the assumptions that the CREG used in their report on offshore wind[27].
- For the **electricity price**, the CREG study assumed a price of 50.7 €/MWh for the first year, rising with inflation. This is estimated too high and is not followed for the following reasons:
  - The ENDEX prices for CAL14 to CAL16 are currently at about 45 €/MWh on average
  - Balancing and profiling costs are significant but are not taken into account by CREG.
  - The merit order effect (lower prices when high wind production) is not taken into account in the CREG assumptions.

  For these reasons, the price that a wind farm operator receives for the electricity produced is quite a bit lower than the ENDEX price. Moreover, as the installed power of wind and other renewables will only increase in the future, the price for the wind energy is expected to decline further due to the merit order effect. In this study, the following assumptions are therefore made:
  - Electricity price first year (based on ENDEX in January 2013): 45 €/MWh (The price for the UK is higher at 48 £/MWh (APX))
  - Percentage of ENDEX price that the wind farm operator receives[28]: 85 %
  - To take the merit order effect into account, the electricity price for wind energy is set to rise with the inflation minus 0.5% (assumption).

[27] Studie 1061: Analyse van de kosten en onrendabele topberekening voor offshore wind in België, CREG, 27/10/11

[28] This 15% is also considered as a fair value by VEA (Flemish Energy Agency) for balancing costs, merit orders effects etc. for onshore wind. See http://www2.vlaanderen.be/economie/energiesparen/milieuvriendelijke/monitoring_evaluatie/VEA_Parameterdocument_formeel_2012.pdf

- In some countries, the **connection costs** are borne by the TSO (and thus by society via the grid tariffs). Therefore an assumption is needed about the percentage of the connection in the total costs. The CAPEX is taken from the CREG assumptions. The connection costs are estimated to be 25% of the CAPEX for Germany (deep waters far from shore) and 10% of the CAPEX for Denmark (shallow waters closer to shore).
- To calculate the net present value of the net support costs for **society**, a **discount factor** of 4% is used.
- The **discount factor for the projects** is another important assumption needed to calculate the gross project income in real terms. They depend on the local framework in each country and provide a view of the risk for offshore wind development. The revenue streams in countries with a fixed feed-in are stable and lead to lower risks. The risks are taken by the government, which leads to lower cost of capital for the projects. Market based systems (especially the UK system where both the electricity price and the support price are fluctuating) lead to higher financing costs.

  The discount factors for the project financing are based on data from Bloomberg New Energy Finance[29], and are adjusted for the current support systems with the following reasoning:
  - The discount factors for Germany (9%) and the UK (13.5%) have been taken from Bloomberg New Energy Finance.
  - France and Denmark have been put at the same level as Germany (9%) since the risks are similarly low in both countries and are not dependent on e.g. the electricity prices.
  - For Belgium, the discount factor has been increased from Bloomberg's 9% to 10.5% because of the risk of the electricity market fluctuations. The increase has been based on the difference between Germany (9%, low risks) and the UK (13.5%, risks on electricity price and ROC price). Approximately 1/3 of a project's revenue stream is being generated by selling electricity, the other 2/3 is coming from GSC-income. If we start from the most stable incentive scheme which is Germany with 9% and take UK as the most uncertain incentive scheme (13.5%) due to uncertain income streams from both electricity and ROC then an uncertainty of 1/3 of total income corresponds to a discount rate of 10.5% for Belgium.
  - The discount factor for the Netherlands has been lowered compared to the Bloomberg figure of 12.5%, to 11%. The link of the subsidy with the electricity price leads to a slightly lower electricity income risk than in Belgium. However, the policy risks are high.

In order to focus on the main support and income streams, the study **does not take into account** taxes, injection tariffs[30], costs for dismantling, support in financing (e.g. KfW or UK Green Investment Bank), Guarantees of Origin, balancing support[31], CO2 taxes, etc.

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[29] Financing offshore wind: a UK perspective, Charlie Hodges for Bloomberg, The Financing of Wind Energy, Palais de la Bourse, Paris, July 2010

[30] In Belgium, a decision on abolishing the injection tariffs is currently still pending.

[31] The old support for balancing of offshore wind in Belgium (30% tolerance margin) is still in place. However, as the balancing mechanism has changed, it is not certain whether this is a support to offshore wind or an additional cost.

The **methodology** used in this report for the comparisons is explained with the example of Belgium in Figure 1 and in the text below. The same methodology is used for the other countries.

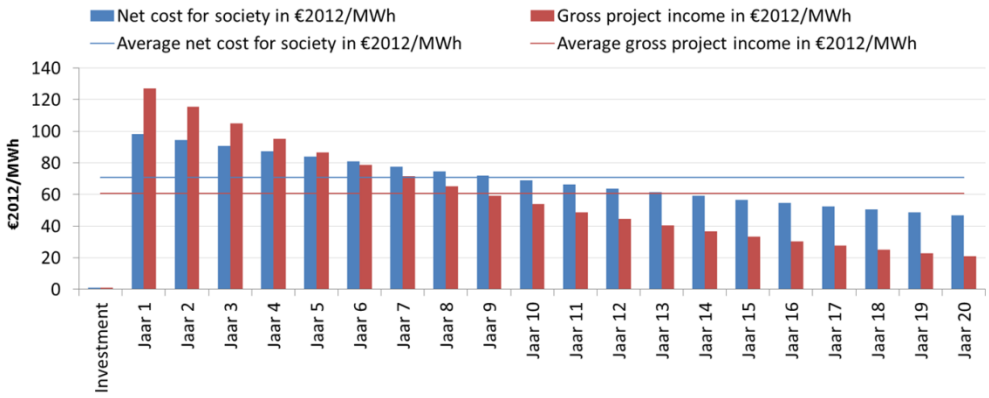

Figure 4: Explanation of the methodology for Belgium: Net support cost for society (discount factor 4%) vs Gross project income (discount factor 10.5%).

The figure shows the following:

- In year zero, the investment is done. A support of 25M€ is given for the connection of the wind farm from the TSO, which is paid by society via the grid tariffs. Per MWh wind energy produced over 20 years, this is a subsidy of 1.19 $€_{2012}$/MWh
- In year one, the net support costs for society are 102.24 €/MWh. In real costs (discounted with 4%), this means 98.3 $€_{2012}$/MWh. The project receives the GSC and 85% of the electricity market price. Together this is 140 €/MWh. In real terms (discounted with 10.5% for the project) this means an income of 127.1 $€_{2012}$/MWh.
- For the following years, the certificate value remains the same and the electricity price rises. However, in real terms the yearly amounts decrease over time. The support in 20 years from now is indeed worth only a fraction of today's support in real terms.
- The analysis lead to an average net support cost for society of 70.7 $€_{2012}$/MWh and an average gross project income of 60.6 $€_{2012}$/MWh.

4 RESULTS

The direct support is evaluated on an absolute and on a relative basis. Four analyses have been done:

1. **Direct support cash flow** in €$_{2012}$
2. Average net **society support per MWh** produced over 20 years (in €$_{2012}$/MWh)
3. Average **gross project income per MWh** produced over 20 years (in €$_{2012}$/MWh)
4. Total **installed capacity per capita** for the offshore wind target 2020 (in kW/cap)

The following paragraphs explain the results more into detail.

4.1 DIRECT SUPPORT CASH FLOW FOR A 300 MW WIND FARM

Figure 5 shows the results[32] for the discounted cash flow of the yearly amount of net support from society for a 300 MW wind farm in each country (in €$_{2012}$).

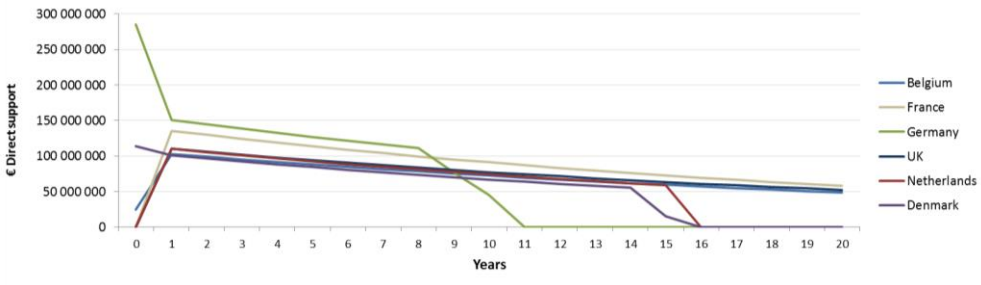

Figure 5: Direct support cash flow for a 300 MW offshore wind farm in different countries (net support cost for society)

The figure clearly shows the following:

- In Denmark and Germany, the support in year zero is high due to the investment in the connection to shore, but it stops earlier than in the other countries.
- Germany provides a high support during a short period, compared to other countries providing a lower support during a longer period.
- In Belgium, France and the UK the support continues for 20 years. In Belgium the support in the first year is higher than zero because there is 25 M€ support for the connection.
- The real support is decreasing every year since it is discounted and since the prices of green certificates, ROCs, bid price etc. do not increase with inflation. Note that for France this means an underestimation of the support, since the tender system does include a formula to index the support. However, for this study it is not taken into account to come to a conservative estimation.[33]

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[32] Note that the electricity price is not included in this analysis as it is not paid by the society. For the systems with FIT or tender price, the electricity price (minus 10% for balancing & profiling) has thus been subtracted from the support since the TSO or the party buying the wind energy can sell it back on the market.

[33] In France, the FIT is secured for 20 years and is adjusted for price changes with a predefined formula taking into account salary changes, steel price fluctuations etc. It is dificcult to assess the impact of this formula. Therefore, as a

4.2 NET SUPPORT COSTS FOR SOCIETY PER MWH

Figure 6 shows the results for the net support costs for society per MWh of wind production[34] along with the weighted average[35].

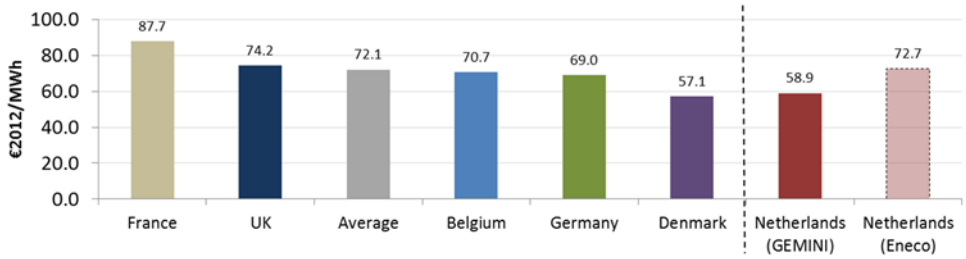

Figure 6: Net support costs for society for a 300 MW OWF per MWh produced over 20y [€$_{2012}$/MWh]. The costs in Belgium are lower than the weighted average. The NL system is uncertain to materialise at this support (see text) and can therefore be left out of the comparison. An estimation of the support for the second wind farm in the NL tender is provided for information. The DK system is relatively cheap and is also a special case since DK wind farms are much cheaper to build than in the other countries as they are close to shore and in shallow water.

The net support costs for society in Belgium (70.7 €$_{2012}$/MWh) are a bit lower than the weighted average of the support costs in all six countries (72.1 €$_{2012}$/MWh). Germany, the Netherlands and Denmark are also below the weighted average, while the costs in France and in the UK are above. Note that:

- The cost in the Netherlands is very low compared to other countries. However, there are currently doubts whether offshore wind will materialise at this price. It seems that the owner of the wind farm is trying already 2 years to sell its stake but faces difficulties due to the low support price. The Dutch system as calculated in this study can therefore be left out of the comparison[36]. To illustrate this, the net support cost for society is estimated for the second wind farm in the tender. The tender bid price for the 129 MW Eneco wind farm is not publicly known, but can be roughly estimated with the rule of thirds[37] at about 200 €/MWh. The net support cost for society in this case would be 72.7€$_{2012}$/MWh, which is more realistic and in line with the other countries.

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conservative and safe scenario in order not to boost the support costs in France, it is assumed to be NOT indexed and subject to inflation as well.

[34] Total support costs for a 300 MW wind farm divided by its energy production over 20 years.

[35] Weighted with the offshore wind targets for 2020 in each country (BE: 2 GW, FR: 6 GW, DE: 10 GW, UK: 18 GW, NL: 6 GW, DK: 1.34 GW).

[36] The new SDE+ support system is not interesting for offshore wind (too low support) and for this reason no wind farms are expected to be built until 2020. More information can be foundi n Chapter 10.

[37] The GEMINI wind farm has a capacity of 600 MW, with an available total subsidy budget of 3.5 billion EUR at a tender bid price of 170 €/MWh. The ENECO wind farm has a planned capacity of 129 MW with an available subsidy budget of 900 million EUR. → tender price of second wind farm will be about 203 €/MWh.

- The Danish system has low net support costs for society. The main reason is that DK wind farms are cheaper to build because of low distances to shore and shallow water depths. It is therefore also a special case which makes it difficult to compare it with the Belgian system.
- In countries with a FIT system (DE, DK, FR), the balancing & profiling costs are borne by society.
- In Germany and Denmark the connection costs are fully borne by society (via the TSO and its grid tariffs). However, even with this support and with the costs for balancing & profiling, the total net support cost for society is among the lowest.
- The French system has a relatively high net support cost for society. As written above, this is based on the tender from 2012, where the bid prices were much higher than expected by the French Government. Possible reasons are e.g. the protectionist measures in the CRE tender that ask for local employment, local manufacturing etc. Moreover, as explained above the support used in the calculations is an underestimation because it is assumed to be not indexed.
- The costs for the UK are also higher than average. The support is quite high during a long period, while the electricity price in the UK is higher than in mainland Europe. The calculations are done with a ROC price of 40.71 £/ROC + 10% recycling payments during a period of 20 years. Not so long ago, ROCs were even worth 50 £/ROC + 10% recycling payments.[38]

A sensitivity analysis has been performed on the electricity price[39].

- With a starting electricity price of 50.7€/MWh, the net support cost for society for Belgium is still at 70.7 €/MWh, while the weighted average has dropped to 70.6 €/MWh. The weighted average decreases since the net support decreases in the countries where support is fixed (FIT) or where support is linked to the electricity price (e.g. Netherlands).
- With an electricity price of 40 €/MWh, Belgium is still at 70.7 €/MWh net support while the weighted average increases to 73.4 €/MWh. The weighted average increases since the net support increases in the countries with where support is fixed (FIT) or where support is linked to the electricity price (e.g. Netherlands).
- With an electricity price of 45 €/MWh and a yearly price increase of 3.5% (increase of 2% above the inflation of 2% minus 0.5% for merit-order effect), Belgium (70.7 €/MWh) is now only slightly above the average which has dropped to 70.5 €/MWh, while France is still at 81.7 €/MWh and the UK at 74.2 €/MWh.

[38] The ROCs will be phased out in the future. A new support system for offshore wind has been defined in the UK, the Contracts for Differences. In this system, the support is dependent on the price of the electricity on the market. The new system starts in 2017. For the wind farms which have been developed with the ROC system, a minimum ROC price will be defined. More information can be found in Chapter 11.

[39] Please note that the weighted average always includes the low support for the first NL wind farm in the latest tender. When the estimation for the Eneco wind farm would be taken into account instead of the GEMINI wind farm, the weighted average would be quite a bit higher.

4.3 GROSS PROJECT INCOME PER MWH

In the previous sections the net support costs for society have been analysed. To complete the picture on the support systems, it is important to analyse the other side – the gross project income. This analysis takes into account:

- the direct support (GSC, ROCs, FIT, tender bid price),
- eventual support for the grid connection (in BE, DE and DK)
- the electricity price (where relevant, so only in BE, UK, NL, and in DK and DE when the support period is over.

Figure 7 shows the results.

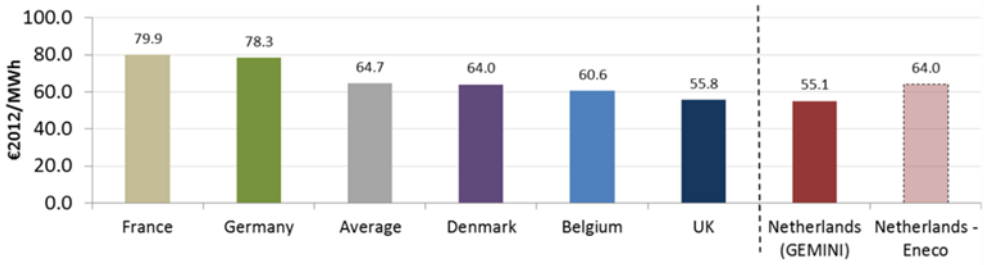

Figure 7: Gross project income in €$_{2012}$/MWh. Both direct support (GSC, FIT, ROCs, tender prices and grid connection support) and electricity prices (where relevant) are taken into account. The gross project income in Belgium is among the lowest and much lower than the weighted average. DE and DK have a relatively high gross project income, even though their net support cost for society is among the lowest.

Note that:

- The gross project income is among the lowest at 60.6 €$_{2012}$/MWh and also lower than the average.
- The systems in Germany and Denmark have a relatively low net support cost for society (Figure 6), and provide at the same time a relatively high gross project income. These systems are stable and have a low risk profile which makes the financing and insurances cheaper. Moreover, these two countries also support the full grid connection, which means that this can be developed at a lower cost since the cost of capital for society is much lower than that for the project financing.
- The system in the Netherlands provides a very low gross project income which – as discussed above - raises doubts on the realisation of offshore wind farms. With the estimation for the 129 Eneco wind farm under the SDE programme (see above), the gross project income is estimated to be 64.0 €$_{2012}$/MWh).
- The gross project income is often lower than the net support costs for society, even when the electricity price is taken into account (e.g. UK and BE). The reason is that the discount factor for the projects is a lot higher than the one for the society. This has a big influence on the final result and on the attractiveness of the support system. The higher the system risk of a support system, the higher the cost of capital for the projects is. To create a sustainable system, stability and risk mitigation are crucial to limit the financing costs.

A sensitivity analysis on the electricity price is also performed here.

- With a starting electricity price of 50.7€/MWh, Belgium is at 62.8 €/MWh gross project income which is still a lot lower than the weighted average (66.0 €/MWh).
- With an electricity price of 40 €/MWh, Belgium has a low gross project income at 58.7 €/MWh while the weighted average is now still 63.6 €/MWh.
- With an electricity price of 45 €/MWh and a yearly increase of 1.5% above the inflation (2% minus 0.5% for merit-order effect), Belgium still has the lowest gross project income 63.2 €/MWh, while the weighted average is 66.5 €/MWh.

In all of these cases, Belgium ranks among the countries with the lowest gross project income (UK, BE, DK) and there is at least 3-5 € difference with the weighted average.

4.4 IMPACT OF 2020 OFFSHORE WIND TARGET (INSTALLED CAPACITY AND TOTAL COST PER CAPITA)

To complement the analysis from the viewpoint of society and the viewpoint of the projects, the results have been put in perspective to the offshore wind targets for 2020 per country[40]. Figure 8 shows the offshore wind target 2020 in kW installed per inhabitant [kW/cap]. Compared to the surrounding countries, Belgium has a quite reasonable official target. The cost increase for the Belgian society is limited compared to the UK, the Netherlands and Denmark.

Figure 9 shows similar results but now for the total net support costs for society per MWh of consumption over the next 20 years. Again, the costs in Belgium are relatively low and significantly lower than the average, while the Netherlands, the UK and Denmark are facing relatively high costs.

[40] Taking the results from before, so the current situation. In several countries the support mechanisms are being changed or have a declination factor, but this is not taken into account here.

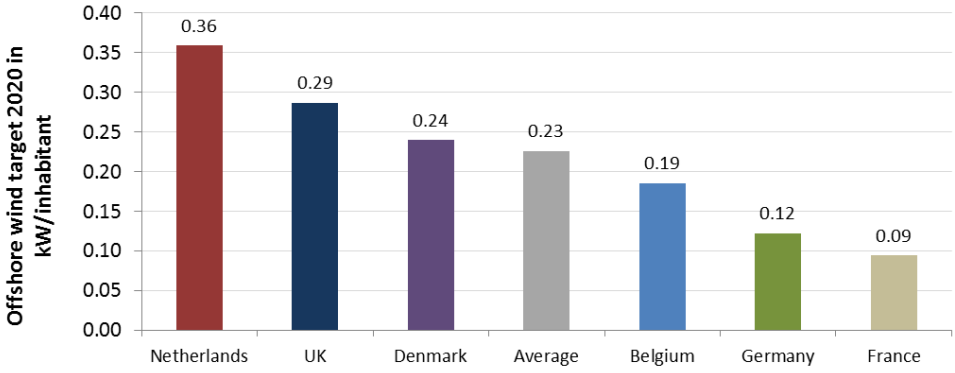

Figure 8: Offshore wind target for 2020: in kW installed per inhabitant

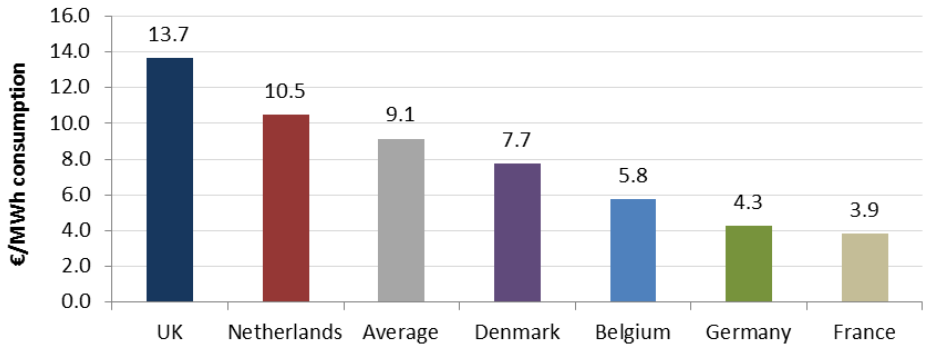

Figure 9: Total society costs for 2020 offshore wind target in $€_{2012}$/MWh consumption over 20y

5 CONCLUSION

The analyses (sections 4.2 and 4.3) compare the net support cost for society and the gross offshore wind project income in Belgium, Germany, Denmark, France, the UK and the Netherlands. They show that the Belgium support system for offshore wind energy is neither the most expensive to society, nor does it deliver the highest gross income for the projects. The net support costs for society (70.2 €$_{2012}$/MWh produced) are lower than the weighted average for the six analysed countries (72.1 €$_{2012}$/MWh). The gross project income is among the lowest (60.6 €$_{2012}$/MWh versus a weighted average of 64.7 €$_{2012}$/MWh).

The results show that the countries with a stable framework and a decent price for projects (e.g. Germany and Denmark) work the best. They have a lower cost to society while delivering an attractive gross project income. With a relatively limited support, they are able to attract the necessary investments and deliver offshore wind projects to reach their renewable energy targets.

6 ANNEXES: COUNTRY ANALYSIS BELGIUM

6.1 MARKET SITUATION

6.1.1 Electricity market peculiarities

In Belgium, the energy policy responsibilities are divided between the regions and the federal state.

- The three regions Flanders, Brussels and Wallonia are each responsible for
  - Distribution grids (gas, electricity, heat)
  - Renewable energy
  - Energy efficiency
- The federal government is responsible for the matters which need a national treatment:
  - Security of electricity supply
  - Nuclear energy
  - Transmission grid of electricity
  - Large infrastructures such as gas storage
  - The use of the sea – offshore renewable energy in particular

In the recent government negotiations, the responsibility over the energy tariffs has been transferred from the federal to the regional level.

- Belgium has a liberalised electricity market.
- Electricity can be traded on the ENDEX futures market and on the Belpex spot market.
- Elia – a privatised company – is the transmission grid operator and has to provide grid access to all generators at equal conditions. Also it is responsible for the system balancing and security of electricity supply.
- There are 19 distribution grid operators, united in 4 different companies: EANDIS, INFRAX, SIBELGA and ORES.
- The electricity generation is still mostly in the hands of the previous monopolist Electrabel. In 2011, Electrabel had 70% of all production capacity in hands. EDF Luminus had 14%, EON is the third biggest producer with 9% of generation capacity.
- There are many electricity suppliers in Belgium, but most are small. At the end of 2011, there were 26 suppliers in Flanders, 17 in Brussels and 18 in Wallonia. Electrabel, the incumbent, is still by far the largest. However, its market share is rapidly decreasing (at least for households) due to increased supplier switchings (e.g. from 60% in 2010 to 50% in 2012 in Flanders).
- There are four energy regulators in Belgium, one for each region (VREG in Flanders, Brugel in Brussels, CWAPE in Wallonia) and the federal regulator CREG. The CREG is responsible for offshore wind energy.
- An important grid bottleneck exists between West-Flanders and the centre of the country. The planned grid reinforcement is very important for the region, the Zeebrugge harbour, and the connection of the offshore wind farms. Elia is working on the onshore reinforcement (STEVIN project) but faces some delays.
- There are electricity interconnections to the Netherlands and France. Further interconnection is planned to Germany, and to the UK (offshore Nemo Cable).

In 2010, 5.1% of the total energy consumption has been supplied by renewables in Belgium. For electricity, 6.8% of total electricity consumption has been generated by renewables.

Due to a lack of new generation capacity, the planned phase-out of the nuclear park and the shut-down of a couple of big generation plants, Belgium will be structurally dependent on import of electricity for the coming years.

6.1.2 Wind Market Situation

In the frame of the EU Renewable Energy Directive, Belgium has committed to generating 13% of their energy from renewable sources by 2020. The NREAP from November 2010 states that the contribution in the electricity sector should be 21%. Offshore wind is expected to have a significant contribution to this target.

Belgium has four different support schemes for renewable energy, one federal and one for each region. For the production facilities connected to the distribution grid, the regulations of the region apply. For those connected to the transmission grid, the federal regulations apply. Therefore, offshore wind farms are covered by the federal laws and regulations.

In the Royal Decree of 20 December 2000, a designated zone has been defined for offshore wind energy. Seven offshore wind farms have been granted concession in this zone: C-Power (325 MW), NorthWind (216 MW), Belwind (330 MW), Rentel (288 MW), Norther (330-450 MW), Seastar (246 MW) and Mermaid (~450 MW).

At the end of 2012, two offshore wind farms were already connected to the Elia grid: C-Power (phase 1 and 2, totalling 215 MW) and Belwind (phase 1, 165 MW). Thus, in total, 380 MW is currently operating in the Belgian North Sea. Both existing wind farms have plans of expanding their production capacity. The total planned offshore wind capacity in the Belgium North Sea is about ~2.2 GW.

6.2 OFFSHORE WIND SUPPORT

6.2.1 Relevant laws

- Koninklijk besluit van 27 augustus 1993 tot uitvoering van het Wetboek van de inkomstenbelastingen 1992
- Wet van 29 april 1999 betreffende de organisatie van de elektriciteitsmarkt
- Koninklijk besluit van 20 december 2000 betreffende de voorwaarden en de procedure voor de toekenning van domeinconcessies voor de bouw en de exploitatie van installaties voor de productie van elektriciteit uit water, stromen of winden, in de zeegebieden waarin België rechtsmacht kan uitoefenen overeenkomstig het internationaal zeerecht
- Koninklijk besluit van 16 juli 2002 betreffende de instelling van mechanismen voor de bevordering van elektriciteit opgewekt uit hernieuwbare energiebronnen
- Koninklijk besluit van 30 maart 2009 betreffende productieafwijkingen op installaties voor de productie van elektriciteit uit wind in de zeegebieden

6.2.2 Direct support

The Belgian support for offshore wind consists of three major components:

- Green certificates under a quota system

- Cable cost contribution
- Balancing cost support - 30% balancing margin

Green certificates

As explained above, the support system for renewable energy is a regional responsibility. Each region works with a quota system and green certificates. The suppliers face a quota on the percentage of electricity that needs to be provided by renewables, that they need to prove by handing in sufficient green certificates. Green certificates are tradable in a market system and their price depends on availability and demand. The quota rises over the years and ensures the demand for green certificates. A penalty price ensures that suppliers are incentivised to buy certificates, and a minimum price at which the distribution system operator is forced to buy ensures investor confidence to keep projects economically viable.

Since offshore wind is a federal responsibility, there is also a national green certificate system where 1 green certificate is provided for each MWh of electricity produced. However, certificates are not tradable between the regions. Because the supply of electricity and the quotas are regional, there is no federal market for green certificates. This means that the offshore certificates are always sold at their minimum price to the system operator (Elia in this case).

The minimum price for offshore wind energy in Belgium is 107 €/MWh for the first 216 MW, and 90 €/MWh for everything above (per domain concession). Green certificates are provided during the lifetime of the project. The minimum price is guaranteed for a period of 20 years.

Cable cost contribution

For the connection of offshore wind farms, Elia is required to contribute one-third of the procurement and construction cost of the export cable and connection equipment. This contribution is capped at 25 million for a wind farm of 216 MW or larger, and at a (smaller) pro rata calculated amount for smaller wind farms. This contribution is spread over 5 years, starting at the time of construction.

Balancing costs support

To compensate the risk of larger imbalances in ARP portfolios containing offshore wind farms, a special regulation was set up. This regulation states that all energy surpluses from positive imbalances smaller than 30% should be purchased by Elia at 90% of the market price. Any energy deficit from negative imbalance would be supplied by Elia to the offshore wind farm ARP at 110% of the market price. Any imbalance outside this 30% margin is priced at the normal Elia imbalance tariffs. A study of the federal energy regulator CREG estimated the value of this special treatment at 7€/MWh (system before 2012, with serious precautions as it was based on data of one month only).

This regulation was based on the former Elia imbalance settlement rules so that it was always beneficial for the offshore wind farms. In 2012 however, these settlement rules were changed so that imbalance compensations are no longer related to the market price but rather to the incurred balancing cost of Elia. Since the special treatment of offshore wind farms was not revised, and since no study on this has been performed yet, the impact of the 30% balancing rule is unclear at the moment. It is possible that today it no longer results in a net positive advantage.

6.2.3 Other support

- Fiscal support is available in Belgium. The details can be found in section 6.4.
- In Belgium, injection tariffs exist for the injection of power to the Elia grid[41]. Power injections originating from green energy are exempted according to the provisions of the federal and/or regional regulations in force.

6.3 OTHER DETAILS OF THE OFFSHORE WIND FRAMEWORK

6.3.1 Permission process

For the construction of an offshore wind farm, a domain concession in the North Sea is required. Requests for concession granting, renewal, amendment, extension, transfer or withdrawal need to be submitted to the federal ministry of energy who will accept or reject the request after consultation of the federal energy regulator CREG, the grid operator Elia and the relevant ministries. Requests are then reviewed.

The current designated zone for offshore wind energy (see above) is now fully granted with the last concession going to the Mermaid project in 2012.

After receiving the concession, several permits need to be granted, including environmental permit, building permits, sea cable permit, cable landing permit…

6.3.2 Grid connection

Grid connection

In Belgium, Elia is obliged to provide any electrical regulation compliant third party access to the grid. However, the grid connection costs for production facilities are calculated using the 'shallow costing' mechanism. Consequently, production facilities only bear the costs of the connection up to the first switching field of a substation. Costs for internal reinforcement of the grid are borne by the grid operator.

Offshore production facilities, as explained above, enjoy a better arrangement and only bear two-thirds of this connection cost (support capped at 25 M€ per wind farm bigger than 216 MW).

For the future, the Belgian TSO Elia will develop an offshore electricity connection point to connect the newer offshore wind farms. Two stations will be developed (A and B). The investors in the Belgian offshore wind farms have gathered in the consortium Plug at Sea which is willing to co-invest in such an offshore grid connection point.

Injection costs

For generators in Belgium, injection costs have been applied for the energy injected into the grid. Based on the decision of the CREG, Elia charges a tariff of 1.1791 €/MWh for the reservation of the primary, secondary and tertiary control, and for the black-start service. On top of that comes a volume fee of 0.1137 €/MWh under the new balancing system. The injection tariffs are currently being discussed and a decision to abolish them is pending.

[41] A decision to abolish them is currently pending, see further.

6.4 TAXES

- **Corporate tax**: The nominal corporate tax rate in Belgium is 33.99%
- **Investment tax deduction**: Investments in renewable energy can be deduced from the taxes. The applicable amount is 13.5% for the fiscal year 2013. For 2014 this is 15.5%. Some parts of the investment can fall outside this regime.
- **Notional interest deduction:** In Belgium a tax deduction is developed for venture capital which alleviates the differences in tax treatment between finance raised through borrowed capital and finance raised through equity capital. The system allows companies to deduct from their tax base a notional interest charge (not stated in the accounts) corresponding to a specific percentage of their 'adjusted' equity capital.
  For large companies, the tariff is 3% for the fiscal year 2013. For 2014 this tariff has been reduced to 2.74 %.

6.5 MODELLING IN THE PROJECT

The present report looks at the net present value of the net support costs for society and the gross income for the projects. The main assumptions used to model the Belgium system are the following:

- 300 MW wind farm, 3500 MWh per year
- The nominal Green Certificates support is 102.24 €/MWh during 20 years (weighted average of 107/90 for a 300 MW wind farm).
- Electricity can be sold separately (assumptions in Chapter 3).
- The grid connection support is 25M€, modelled at the time of investment (year zero). The support is only 25% of the total grid connection costs per park, but for all parks in Belgium the support reaches the 25M€ cap.
- Discount factor for the government is 4%, for the project financing is 10.5%.
- Injection costs, Guarantees of Origin, CO2 prices, taxes and tax reductions etc. are not taken into account.

6.6 REFERENCES

- http://www.elia.be/nl/grid-data/productie/evolutie-productievermogen
- Elia, Standpunt van Elia betreffende het ontwerp van studie over de perspective van de electriciteitsbevoorrading 2008-2017. Available at : http://economie.fgov.be/nl/binaries/EPE_Avis_projet_Elia_NL_090403_tcm325-82862.pdf
- België: Nationaal Actieplan voor Hernieuwbare Energie, FOD Energie overeenkomstig Richtlijn 2009/28/EG, November 2010
- CREG, Groene Elektriciteit, http://www.creg.be/nl/greenelec6.html
- Studie 1061 over de analyse van de kosten en onrendabele topberekening voor offshore wind in België, CREG, 27 oktober 2011
- Studie 966 over de verschillende ondersteuningsmechanismen voor groene stroom in België, CREG, 20 mei 2010

- Studie 944 over de eerste raming van de kostprijs van de maatregelen bedoeld in artikel 7 van de wet van 29 april 1999 betreffende de organisatie van de elektriciteitsmarkt, CREG, 28 januari 2010
- Tarief notionele intrestaftrek zakt naar 2,74 procent, De Tijd, 20 november 2012
- Verhoogde investeringsaftrek voor energiebesparende investeringen, Aanslagjaar 2013, VEA, Februari 2012
- High Level Group for a Sustainable Chemical and Plastics Industry in Belgium, Working Group Energy, KUL for Essencia, 2010
- Alternatief ondersteuningssysteem voor offshore, Voorstel van de group Dralans, VBO, March 2012

7 ANNEXES: COUNTRY ANALYSIS DENMARK

7.1 MARKET SITUATION

7.1.1 Electricity market peculiarities

- Energy policy is the responsibility of the Minister for Climate, Energy and Building and the Danish Energy Agency.
- The Danish energy market is rather decentralised and consists of several cooperative societies and supply companies owned by municipalities. The electricity market is completely deregulated since January 2003.
- Energienet.dk is operating the transmission network and has to guarantee the grid access of all generators at equal conditions and is responsible for the security of electricity supply.
- The power exchange for Denmark as well as Norway, Sweden and Finland is Nord Pool. There are several interconnections between these countries and to Germany. An offshore interconnector to the Netherlands is also planned (Cobra Cable).
- In 2011, the total energy consumption was about 220 TWh, of which 22% was supplied by renewable energy. The total electricity production was about 35 TWh, of which 17% is produced with gas, 40% with coal and about 40% with renewable energy. Wind energy is the most important renewable electricity source and provides about 28% of total electricity production. CHPs are very important in Denmark and produce about 66% of total electricity.
- The long-term goal for Danish energy policy is to have the entire energy supply – electricity, heating, industry and transport – covered by renewable energy by 2050. By 2020, their aim is to supply approximately 50% of electricity consumption by wind power, and more than 35% of final energy consumption should be supplied from renewable energy sources.

7.1.2 Wind market situation

In the frame of the EU Renewable Energy Directive, Denmark has committed to generating 30% of their energy from renewable sources by 2020. In the NREAP Denmark stipulated its goal of more than 30% on the final energy consumption with onshore and offshore wind energy as an important corner stone. Until 2020 the total capacity is planned to be 1340 MW.

The NREAP is already outdated however by more ambitious targets. In March 2012 a new Energy Agreement was reached by a large and broad majority in the Danish Parliament. The Agreement states that by 2020 50 % of the electricity consumption will come from wind power (compared to 28 % today) which means that the current capacity will be extended with 2000 MW wind power before 2020. Of this 1500 MW will come from offshore wind farms – 400 MW at Krieger Flak, 600 MW at Horns Rev 3 and 500 MW as nearshore wind turbines.

Wind energy in Denmark is being developed since the 1980s. In 2011, wind energy produced about 28 percent of the domestic electricity production.

Today more than 872 MW of offshore wind energy are installed in Denmark (2012)[42]. 400 MW (wind farm Anholt) are under construction and scheduled to go online in 2013.

[42] http://www.ens.dk/en-us/supply/renewable-energy/windpower/offshore-wind-power/Sider/Forside.aspx

Tender status

Currently the tenders for the Kriegers Flak (400 MW) and Horns Rev 3 (600MW) are prepared (support option I see below).

Further 450 MW new offshore capacity will be tendered in the coming years. These are in coastal areas, and each park can be up to 200 MW. For these parks:

- The environmental impact assessment is carried out and paid by Energinet.
- The approval is given by DEA before the tendering process starts.
- The grid connection is to be build and paid by the developer.

7.2 OFFSHORE WIND SUPPORT

7.2.1 Relevant Laws

The following laws are designing the integration of renewable energies in Denmark in the electricity market:

- VE-Lov (Lov om fremme af vedvarende energi No. 1392/2008 – Law on the Promotion of Renewable Energy)
- Act on Electricity Supply (Bekendtgørelse af lov om elforsyning No. 1115/2006 – general provisions on the supply of electricity)
- LBK 224/2009 (Bekendtgørelse af lov om Energinet.dk – act on transmission grid operator Energinet.dk)

7.2.2 Direct support

- **Option I:** Answer to an offshore tender and bid a price per kWh for a certain amount of electricity, e.g. this was the case for Horns Rev II with 50 000 full load hours for 51.8 øre per kWh. However there are of course not always open tenders.
    - The environmental impact assessment is carried out and paid by Energinet.
    - The approval is given by DEA before the tendering process starts.
    - The grid connection is build and paid by Energinet. This includes the offshore transformer station.
    - Examples
        - Horns Rev 2: 50 000 full load hours for 51.8 øre per kWh
        - Rodsand 2: 50 000 full load hours for 62.9 øre per kWh
        - Anholt: 20 000 GWh for 105.1 øre per kWh
- **Option II:** propose your own wind farm.
    - The developer has to carry out the environmental impact assessment
    - The developer is responsible to obtain the approval from DEA.
    - 25 øre per kWh are paid for 22000 full load hours + plus 2.3 øre per kWh for the full lifetime of the turbine.
    - The developer has to pay the grid connection to shore.
    - The Danish Energy Agency has approved applications within the open-door procedure for the following offshore wind turbine projects:
        - Avedøre Holme, involving three demonstration wind turbines (DONG Energy);

- Frederikshavn, involving six demonstration wind turbines (NearshoreLAB);
- Sprogø, involving seven offshore wind turbines (Sund & Bælt).

The costs of the promotion system for renewable energy as stipulated by the Law on the Promotion of Renewable Energy are paid by the final consumers. The development and demonstration of new energy technologies for electricity production is supported by the EUDP fund which distributes 750 million DKK (100 million Euros) in 2009 and 1 billion DKK (134 million Euros) in 2010 and each year onwards.

7.2.3 Other support

- There is no additional support for instance by tax reduction
- The funding of feasibility study (VE-Lov) does not apply neither as offshore wind farms are normally larger than 10 MW

7.3 OTHER DETAILS OF THE OFFSHORE WIND FRAMEWORK

7.3.1 Permission Process

- Option I: If the location for the OWP is tendered by the Danish Energy Agency, the approval for the site exists.
- Option II: In case developers propose their own sites they need to obtain the approval by DEA and carry out the necessary assessments (e.g. EIA).

7.3.2 Grid connection

In Denmark (Option I) the grid connection is provided by the grid operator. The following laws are giving the framework for the Danish grid access:

- Act on Electricity Supply (Bekendtgørelse af lov om elforsyning No. 1115/2006 – general provisions on the supply of electricity)
- VE-Lov (Lov om fremme af vedvarende energi No.1392/2008 – Law on the Promotion of Renewable Energy)

Overview on grid regulations in Denmark

Grid connection supplied by	Grid operator
Grid connection costs	Plant owner and transmission grid operator
Connection responsibility	Principle of non-discrimination
Grid expansion	Grid operator is obliged to expand the grids with special attention to renewable energies, costs are borne by consumers
Priority connection	No, but priority for grid use
Grid extension facilitation	No

- In return for payment, all operators shall be granted connection to the grid without certain system operators being discriminated against.
- Renewable sources are not given priority in grid **connection**
- Under statutory law, the RES operators are entitled to priority **use** of the grids to be granted by the grid operator. Every plant operator whose plant complies with the technical requirements and who pays the charges for connection to the grid is entitled.
- The grid operator is statutorily obliged to expand the grids in order to guarantee the efficient transmission of electricity. Whenever possible, the national target of increasing the competitiveness and use of renewable energy sources is given special attention.

In 1998, it was decided to connect large offshore wind farms directly to the transmission grid over 100 kV. The grid connection consists of this transformer platform, a cable transmitting the power to shore and the land cable from the arrival point to the place where the grid connection is linked to the overall transmission grid onshore.

Under normal conditions, electricity cables do not have an impact on the environment, which means that basically it is not necessary to prepare an EIA report for this part of the overall facility operation.

The interface between the producer and the transmission company has remained the same for many years. A wind farm including its own internal grid is owned and operated by the producer, as is the case with power plants onshore, while the transformer platform and the grid connection transmitting the power to shore is owned and operated by the transmission company. The transmission company is also responsible for carrying out any necessary reinforcement of the underlying grid. The responsibilities are divided in this way to promote wind power by making the necessary grid available without costs to the producer.

Connection of an offshore wind farm must fulfil the connection rules set by the TSO Energinet.dk (Technical Guidelines TG 3.2.5). The Danish Energy Authority must be kept informed of these rules.

7.4 TAXES

- The nominal corporate tax rate in Denmark is 25%.
- There is no further support in the form of tax reductions.

7.5 MODELLING IN THE PROJECT

The present report looks at the net present value of the net support costs for society and the gross income for projects. The main assumptions used to model the Danish system are the following:

- 300 MW wind farm, 3500 MWh per year
- The support for the Anholt wind farm is taken as it is the latest reference (latest park given subsidies: 105.1 ore/kWh, 0.134 DKK/€, support during first 20 000 GWh for a 400 MW wind farm). For a 300 MW wind farm, this would mean a support of 140.83 €/MWh during the first 15000 GWh (conservative since economies of scale and the fact that the project is balance sheet financed etc. are not taken into account).
- Electricity cannot be sold separately during the support period and is included in the FIT price.
- After the support period, electricity is sold on the market (assumptions in Chapter 3).

- The grid connection is fully paid, and is modelled at the time of investment (year zero). Because of the short distances to shore and low water depths this is estimated to be 10% of the CAPEX costs of 3800 €/kW (CAPEX from CREG report).
- Discount factor for the government is 4%, for the project financing it is 9%.
- Guarantees of Origin, CO2 prices, taxes etc. are not taken into account.

7.6 REFERENCES

- Promotion of Renewable Energy Act, Act. No. 1392 of 27 December 2008
- Energy policy report 2012, Report from the Ministry of Climate, Energy and Building to the Danish Parliament, 9 May 2012
- Accelerating Green Energy Towards 2020, The Danish Energy Agreement of March 2012, Ministry of Climate, Energy and Building, 22 March 2012
- Email communication with Lisbeth Nielsen, Danish Energy Agency, December 2012.

8 ANNEXES: COUNTRY ANALYSIS FRANCE

8.1 MARKET SITUATION

8.1.1 Electricity market peculiarities

- Energy policy in France is the responsibility of the Ministry for Ecology, Sustainable Development and Energy (MEDDE) and ADEME, the French Environment and Energy Management Agency.
- The electricity market in France is liberalised since July 2007. But the market is still highly concentrated and dominated by a small number of suppliers. EDF is the largest player and the previous monopolist. According to Eurostat, they still have 86.5% of the generation market in hands (2010 figures).
- The electricity and gas TSOs are legally unbundled. RTE, an independent subsidiary of EDF, is the French electricity transmission system operator. It is a public service company responsible for operating, maintaining and developing the high and extra high voltage network.
- The French distribution grid is mainly managed by ERDF, a wholly owned subsidiary of EDF organised as a French public limited company. They manage 95% of the distribution grid of continental France, which belongs to local authorities but is subcontracted to ERDF as an operator.
- The French grid is connected to neighbouring countries by 45 cable lines of which 33 are high voltage transmission lines.
- In 2009, nuclear energy accounted for 75.5% of total energy production, gas for 4.7%, coal for 4%, hydro for 12% and wind for about 1.5%. In 2010, 12.9% of total energy consumption has been supplied by renewable energy. For electricity, 14.45% of total electricity consumption has been generated by renewables.

8.1.2 Wind market situation

In the frame of the EU Renewable Energy Directive, France has committed to generating 23% of their energy from renewable sources by 2020. The goals for wind energy are 19,000 MW of onshore and 6,000 MW of offshore wind power until 2020.

No offshore wind energy plants are installed in France so far. The first projects that are awarded under the ‘call for tenders’ scheme (as explained below) are expected to be operational from 2017-2018 onwards.

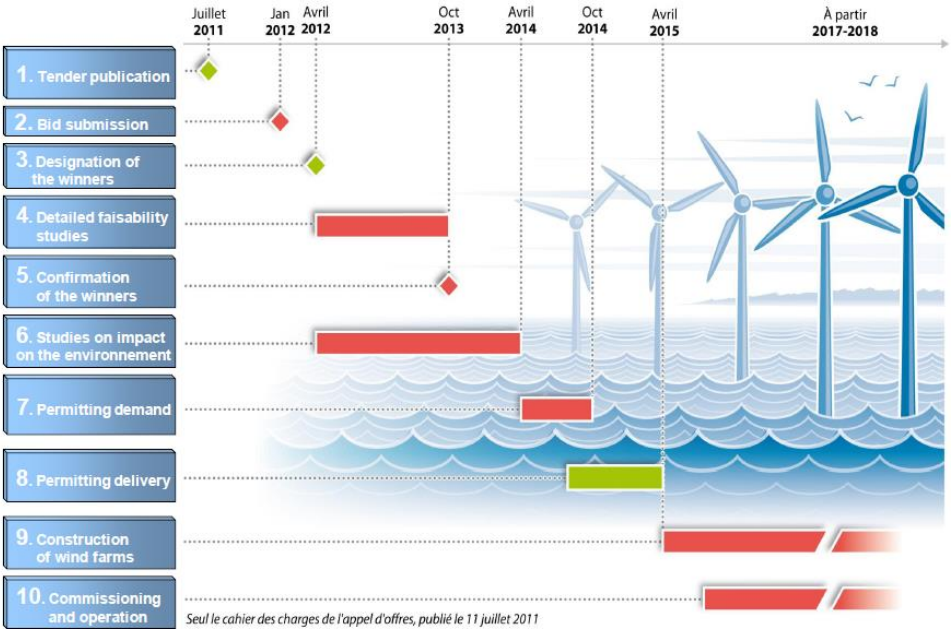

Figure 10: Offshore wind in France deployment

8.2 OFFSHORE WIND SUPPORT

8.2.1 Laws and support schemes for wind power

French law allows two support schemes - both are available for offshore wind. However it's important to note that NO offshore wind is installed under the FIT scheme. The first projects planned are all awarded under the call for tender procedure.

FIT scheme

- FIT of 130€/MWh available (~138€/MWh in 2011 with yearly update)
- But a single FIT is not well suited for offshore wind development in France
  - Limited part of French coasts suitable (water depth, wind potential, fishing, sea transportation, military)
  - Very different installation conditions from site to site

→ No offshore wind capacity installed under this scheme so far!

Table 1: Overview on offshore wind FIT strategy in France

Compensation model	Fix compensation
Compensation	Feed-in tariff
Geographical limitation	Only French territories, Wind energy is promoted within the French sea and exclusive economic zone only.
Feed- in obligation	No

Benefits or tax reduction	Yes, tax reduction
Fines	Yes

Offshore wind parks are promoted by the FIT scheme during a 20 years period. The first 10 years 13 cent/kWh are guaranteed, the following 10 years are depending on the amount of full-load hours (see Table 2). There is a yearly degression of 2 percent from the year of application.

Table 2: Overview on French feed-in tariffs for offshore wind (Sources: MINEFI 2006, Minister of Finance 2006)

Full-load hours	Tariff for the first 10 years (Cent/kWh)	Tariff for the following 10 years (Cent/kWh)
2.800 hours and less	13	13
Between 2.800 and 3.200 hours	13	linear interpolation
3.200 hours	13	9
Between 3.200 and 3.900 hours	13	linear interpolation
3.900 hours and more	13	3

Call for tender procedure

A thorough pre-selection process takes place, sites are defined in detail

- Sites technically suited are first identified and short-listed
- Sites with secured grid connection move forward in the process
- Best sites are defined in consultation with stakeholders
- Capacity range is defined for each site
- Government makes the final call on sites and capacity to be tendered
- Call is launched following EU regulations

The selected operators must sell the electricity produced by the facilities at the fixed tariff bid by the operator. Some adjustments will be made, most notably to take into account the actual price of connection to the grid. Winning consortia are guaranteed the FIT requested in the tenders, for 20 years and receive operating permit. This ensures access to the grid and de-risks grid connectivity costs. Furthermore this procedure gives security to investors as well as visibility. It offers as well a one-stop-shop for administrative procedures and facilitates work of relevant authorities.

Criteria for selection on the bid:

- Proposed electricity price (40%)
- Industrial aspects: technical experience, business model and financing plan, action plan for security of supply and construction feasibility (40%)

- Impacts on the environment (20%)

Figure 11: Winning consortia under the first call of tenders (as announced in April 2012)

The EDF Energies Nouvelles and Alstom group won the right to develop offshore wind at the Saint-Nazaire, Courseulles-sur-Mer, and Fécamp sites, totalling up to 1.5GW of capacity. That consortium also includes Danish development giant Dong Energy. Iberdrola and Areva can press ahead at the Saint-Brieuc zone.

The price is different for all projects depending on the conditions of each site and awarded in a range between 175 euro/MWh (Fécamp) to 200 euro/MWh (Saint-Brieuc).

The second tender round has recently been announced (January 2013). The tender offer is for a total capacity of 1000 MW (500 MW off Le Treport in northern France and 500 MW off the islands of Noirmoutier and Yeu).

8.3 OTHER DETAILS OF THE OFFSHORE WIND FRAMEWORK

8.3.1 Permission Process

The permission process for the offshore wind projects is covered by the tender regulations. This reduces risks of non-construction thanks to the severe selection process for tendered zones. As mentioned above, it offers as well a one-stop-shop for administrative procedures and facilitates work of relevant authorities.

The main regulations designing the permission and planning process are set in the Energy law from July 2005 (Loi No 2005-781 de programme fixant les orientations de la politique énergetique) in Article 37 and 29, which are integrated and extended in the laws „Grenelle 1" and „Grenelle 2".

8.3.2 Grid connection

The producer/owner of a new power plant has to apply for a grid connection to the public distribution system such as Réseau de Transport d'Electricité (RTE), Electricité Réseau Distribution France

(ERDF) or a local distributing company. Some agreements have to be made by the owner of the power plant for the distribution of the electricity that it produces:

- Public grid contract (Contrat d'accès au réseau public)
- Grid connection contract (Contrat de raccordement)
- Contract regarding the use of the equipment necessary for the grid connection (Contrat d'exploitation des ouvrages de raccordement)

The main law designing the grid connection in France are the following:

- Loi n°2000-108 (Loi n°2000-108 du 10 février 2000 relative à la modernisation et au développement du service public de l'électricité – Act on the modernisation and development of public electricity supply)
- Décret n°2001-365 (Décret n°2001-365 du 26 avril 2001 relatif aux tarifs d'utilisation des réseaux publics de transport et de distribution d'électricité – Decree on the grid usage fees)

Table 3: Overview on grid regulations in France

Grid connection supplied by	Grid operator
Grid connection costs	Plant operator (incremental part of the tariff in €/MWh)
Grid expansion	The grid connection agreement ("convention de raccordement") lays down terms on an expansion of the grid. The agreement is based on an offer on the costs and technical implementation (proposition technique et financière, PTF). The grid operator is generally obliged to expand the grid in order to provide "service public de l'électricité"

8.4 TAXES

The nominal corporate tax rate in France is 33.33%.

8.5 MODELLING IN THE PROJECT

The present report looks at the net present value of the net support costs for society and the gross income for projects. The main assumptions used to model the French system are the following:

- 300 MW wind farm, 3500 MWh per year
- The results of the lowest FIT of the latest tender have been used (Fécamp wind farm → conservative assumptions): FIT of 175 €/MWh during 20 years.
- Even though the FIT is indexed with a certain formula (to be calculated each year), this is not taken into account in the present study to have a conservative result.
- Electricity cannot be sold separately and is included in the FIT price.
- Discount factor for the government is 4%, for the project financing it is 9%.
- Guarantees of Origin, CO2 prices, taxes etc. are not taken into account.

8.6 REFERENCES

- IEA – Renewable energy technology deployment – capitalising on renewables, 2012

- NREAP France
- http://www.erec.org/fileadmin/erec_docs/Documents/Publications/EREC-roadmap-V4_final.pdf
- http://www.erec.org/fileadmin/erec_docs/Projcet_Documents/RES2020/FRANCE_RES_Policy_Review_09_Final.pdf
- KPMG: Offshore Wind Parks in Europa, Marktstudie, 2007
- http://ec.europa.eu/energy/climate_actions/doc/factsheets/2008_res_sheet_france_en.pdf
- http://res-legal.eu/en/search-for-countries/france.html
- http://www.ek.fi/ek/fi/ajankohtaista/uutiset/liitteet/2010/Tendering_as_a_part_of_a_feed-in_tariff_system__Final_Report_201001115.pdf
- Law on French Energy Strategy - 13th July 2005
- Grenelle 1 - LOI n° 2009-967 du 3 août 2009 de programmation relative à la mise en œuvre du Grenelle de l'environnement
- Grenelle 2 - LOI no 2010-788 du 12 juillet 2010 portant engagement national pour l'environnement
- Electrical Energy Statistics for France, RTE, July 2011

9 ANNEXES: COUNTRY ANALYSIS GERMANY

9.1 MARKET SITUATION

9.1.1 Electricity market peculiarities

- The German electricity market is liberalised since 1998. The electricity is traded at the EPX.
- About 80 percent of the electricity is produced by the four major generation companies in Germany (RWE, E.ON, Vattenfall and EnBW).
- The German transmission grid is operated by four different transmission grid operators by regions (Elia (50Hertz), Tennet, Amprion and TransnetBW).
- The German Federal Network Agency (Bundesnetzagentur) is the regulatory authority for the German electricity market and sets the prices for the use of the grid.

9.1.2 Wind market situation

About 200 MW of offshore wind energy are online in the German EEZ and 12sm-zone of the North and Baltic Seas.

Currently, offshore wind farms (OWP) with a total capacity of about 1 600 MW are being constructed; wind farms with a capacity of 9 000 to around 10 500 MW received an authorization. Moreover, further 94 projects with about 6 600 offshore turbines and a total capacity of up to about 30 000 MW are in the process of authorization so that all in all, about 40 000 MW are in the planning stage (as at September 2012).

9.2 OFFSHORE WIND SUPPORT

9.2.1 Laws and support schemes for wind power

The following laws are the main laws designing the integration of renewable energies in Germany in the electricity market:

- EEG (Renewable Energy Sources Act – general provisions on renewable energy)
- StromNZV (Stromnetzzugangsverordnung – regulation on electricity feed-in to and consumption from electricity supply grids)
- EnWG (Deutsches Energiewirtschaftsgesetz)
- Gewerbesteuergesetz
- Umsatzsteuergesetz

Table 4: Overview on the German offshore wind support strategies

Compensation model	Fix compensation or market premium model
Compensation	Minimum compensation for 20 y, with higher support during the first 8-12 years + possible prolongation period
Geographical limitation	Territory of Germany or within Germany's exclusive economic zone
Feed- in obligation	Yes
Benefits or tax reduction	No

Start of production	Base feed in tariff [ct/kWh]	Increased starting feed-in tariff – Option I [ct/kWh]	Increased starting feed-in tariff – Option II [ct/kWh]
2012	3.5	15.0	19.0
2013	3.5	15.0	19.0
2014	3.5	15.0	19.0
2015	3.5	15.0	19.0
2016	3.5	15.0	19.0
2017	3.5	15.0	19.0
2018	3.26	13.95	-
2019	3.03	12.97	-
2020	2.82	12.07	-
2021	2.62	11.22	-

- Degression of the increased starting feed in tariff: until 2017→ 0%; from 2018 on→ 7%; the base feed-in tariff is not decreased.
- Option I:
  - Increased starting feed-in tariff is paid for at least 12 years (see prolongation bullet point below). After 12 years 3.5ct/kWh are guaranteed until 20 years after start of production
  - Prolongation: the period of the increased starting feed in tariff (of Option I) is prolonged by
    - 1.7 months for each meter of water depth over 20m.
    - 0.5 month for each Nautical Mile (NM) beyond 12 NM.
- Option II:
  - Increased starting feed-in tariff is paid for 8years (see prolongation bullet point). After 8 years 3.5ct/kWh are guaranteed until 20 years after start of production. Option II is only available until 2017.
  - Prolongation: the period of the increased starting feed in tariff is prolonged by
    - 1.7 months for each meter of water depth over 20m.
    - 0.5 month for each Nautical Mile (NM) beyond 12 NM.

    but the increased feed-in tariff for the prolongation is only the one of Option I.
- It is generally expected that the projects will drop out of the support scheme after the period with high compensation (and possible prolongation), since the price they can get on the market can be expected to be higher than the 3.5ct/kWh minimum support.

9.3 OTHER DETAILS OF THE OFFSHORE WIND FRAMEWORK

9.3.1 Financing aid

The KfW (German Reconstruction Loan Corporation) bank group is financing the installation of up to ten offshore wind farms in the German North and Baltic Sea with credit at market rates via the special programme "Offshore-Windenergie". A total credit volume of 5 bn Euros is allocated for this purpose.

All project companies which invest in offshore wind farms in the German North and Baltic Sea are entitled to apply. The credit period for project financing is up to 20 years with three interest free initial years. Two projects had already used the KfW programme as at April 2012: the projects 'Meerwind' and 'Global Tech I'.

- The 'Meerwind' project, with a size of 288 MW, uses 264m Euros of financing from the KfW programme.
- The 'Global Tech I', project, which will have an installed performance of 400 MW, uses financing of over 280m Euros.

Partial financing via the KfW programme "Offshore-Windenergie" is being considered for a number of other projects.

Financing can be realised in the form of direct credit via banking syndicates or through a financing package made up of onlent credit and direct credit from the KfW. It is also possible to grant additional insurance against additional costs in the installation phase with a direct credit from bank syndicates.

9.3.2 The framework conditions of the programme

- KfW financing share of borrowing
  - For direct credits as part of bank syndicates to a maximum of 50% (also for borrowing needs with unpredicted additional costs)
  - For project financing as onlent credit in combination with KfW direct credit to a maximum of 70%
- Credit per project
  - For direct credits as part of bank syndicates a maximum of 400m Euros
  - For project financing as onlent credit in combination with a maximum KfW direct credit for the same amount, totalling a maximum of 700m Euros
  - For direct credits as part of bank syndicates as insurance against unpredicted additional costs to a maximum of 100m Euros.

The KfW bank group is a public agency and is charged with taking support measures with an official mandate, granting loans and other forms of financing to public stakeholders, financing social measures and taking measures to promote education and to grant other financing in the interest of the German and European economy.

9.3.3 Permission Process

The Bundesamt für Seeschifffahrt und Hydrographie (BSH, Federal Maritime and Hydrographic Agency of Germany) decides on the permission process for offshore wind plants. Most of the German offshore wind farms are planned to be installed in the EEZ (Exclusive Economic Zone). Within the 12 nautical mile limit responsibility for the approval of wind farms rests with the German coastal states.

An approval granted by the BSH for installations in the EEZ is not legally binding for approval procedures involving installations on land and in the territorial sea. In the course of the approval procedure, the BSH reviews whether the marine environment to be protected (e.g. birds, fish, marine

mammals, benthos, sea bottom and water) are put at risk by the project. Besides, offshore wind farm projects comprising more than 20 turbines require an environmental impact assessment based on the Environmental Impact Assessment Act.

9.3.4 Grid connection

Grid connection supplied by:	Grid operator (only for OWPs whose construction stared till 2012)
Grid connection costs:	Grid operator
Connection responsibility:	Immediate and preferential connection of the plant generating electricity from renewable sources by the grid operators
Grid expansion:	Paid by grid operator, has to be provided immediately, not if it is economically unreasonable
Priority connection:	Yes
Grid extension facilitation:	Energieleitungsausbaugesetz (enhanced law on the extension of the present high-voltage grid)

9.4 TAXES

- The nominal corporate tax rate in Germany is 15%
- Until today the offshore wind farm developers and operators do not have to pay taxes on securities. This is however currently under discussion.
- Apart from this there is no further tax benefit.

9.5 MODELLING IN THE PROJECT

The present report looks at the net present value of the net support costs for society and the gross income for projects. The main assumptions used to model the German system are the following:

- 300 MW wind farm, 3500 MWh per year
- The FIT system with the short and higher support is chosen most by the market and is used for this report. This means a support of 190 €/MWh during 8 years, with an extension of 19.1 months with a support of 150 €/MWh (assumed 30km from shore with a 30m water depth).
- After the support period, it is assumed that the electricity is sold directly on the markets instead of at 35€/MWh FIT (assumptions in Chapter 3).
- Electricity cannot be sold separately during the support period and is included in the FIT price.
- The grid connection is fully paid, and is modelled at the time of investment (year zero). Because German offshore wind farms in the North Sea are far from shore and in deep waters, it is assumed to be 25% of the CAPEX costs of 3800 €/kW (CAPEX assumption by CREG).
- Discount factor for the government is 4%, for the project financing it is 9%.
- Guarantees of Origin, KfW financing, CO2 prices, taxes and tax reductions etc. are not taken into account.

10 ANNEXES: COUNTRY ANALYSIS THE NETHERLANDS

10.1 MARKET SITUATION

10.1.1 Electricity market peculiarities

- The energy market in the Netherlands is fully liberalised since 2004.
- The transmission grid is operated by privately owned TenneT.
- Since 1999 power is traded at the APX (Amsterdam Power Exchange).
- The 4 major electricity companies (Electrabel, E.ON Benelux, Essent and Nuon) provide 65 percent of the installed capacity and offer 80 percent of the retail sales.

10.1.2 Wind market situation

The Dutch government's goal is to have renewable energy meet at least 14% of the overall demand for energy in 2020. Wind energy is one of the most important options available. The Cabinet Rutte-II increased the target from 14 to 16% renewable energy.

In 2010, the government expected offshore wind energy to provide a considerable share of the growth in renewable energy generation by 2020. Its target was to achieve 6000 MW of offshore wind in the Netherlands by 2020.

However, the Dutch policy is non-consistent and changes with each cabinet. The current cabinet has a different focus and it is now generally expected that only about 1 GW will be installed by 2020 (only the ones that have already been granted subsidy today).

Three 'rounds' for offshore wind can been distinguished until now:

- Round 1: Permissions for the wind farms Egmond and Amaila, the only two existing wind farms in the Netherlands (together 228 MW)
- Round 2: 12 permissions have been granted and three wind farms have been granted the availability of subsidies (together ~750 MW)
- Round 3: Is defined to find new areas for offshore wind energy, but there is currently no attractive subsidy mechanism to support offshore wind

The current energy policy of the Netherlands has been outlined in the 'Energierapport 2011'. In this context, the ‘Stimulering Duurzame Energie+’ (SDE+) has been developed as mechanism to support renewable energy. Its most important feature is that it only selects the most cost-effective solutions to provide renewable energy. Offshore wind energy is in principle not ruled out in this mechanism, but due to its costs it will not be able to compete for the available resources with other renewable energy techniques.

10.2 OFFSHORE WIND SUPPORT

10.2.1 Direct support

As outlined above, the current support mechanism for renewable energy in the Netherlands is not favorable for offshore wind energy. It is based on cost-effectiveness, and offshore wind farms are not able to compete.

The SDE+ system is a subsidy whereby producers receive a subsidy for renewable energy (renewable electricity, renewable (bio)gas and renewable heat) generated, and not for the purchase of production installations such as with an investment subsidy. The SDE+ has a limited budget, so: “first come first served”. Producers with the lowest production cost per GJ of renewable energy can apply first and accordingly have the best chance of a subsidy.

The SDE+ has four pillars:

1. **One integral budget ceiling**: There is only one total budget available per year. In 2012 this was €1.7bn, for the SDE+ 2013 this is € 3bn.
2. **Phased opening up**: The tender is opened in phases to give priority to the cheapest projects
3. **A maximum base amount**: Each phase has a maximum price under which projects can bid. In 2012 the lowest price was 7 €ct/kWh and there were 5 phases, in 2013 there is also an extra phase of 8 €c/kWh. The maximum base amount of the fifth phase is 15 €c/kWh (converted to 103.5 €ct/Nm3 or 41.67 €/GJ).
4. **A free category:** Each phase includes a free category where the maximum base amount is a bit higher. In this category are the following technologies: offshore wind energy, free flowing energy (hydro power), and osmosis.

In principle, offshore wind farms can thus bid for subsidies in the free category, but the total budget of the SDE+ regime is not sufficient to give offshore wind a chance.

Some details on the past Round 2:

In 2009, 12 permissions have been given to develop offshore wind farms in the Dutch sea. Following this, a tender has been organised in 2013 to grant SDE (Stimulering Duurzame Energie) subsidies as a support for the wind farms. A total budget of € 4.5 bn was available. Three farms have been granted subsidies under this framework:

- Buitengaats (previously Bard, now owned by TyphoonCapital)
- ZeeEnergie (previously Bard, now owned by TyphoonCapital)
- Q10 (Eneco, now the project is named Luchterduinen)

BARD sold its shares to TyphoonCapital, which works together with HVC and uses the name GEMINI for the two parks (total 600 MW). These parks receive a total maximum subsidy of € 3.6 bn.

The third wind farm, Eneco's Q10, has been granted the remaining subsidy (max € 989 million) to build a wind farm of around 129 MW. This wind farm will also demonstrate new technologies to stimulate innovative building techniques.

The system worked with a bid price and a base subsidy price. The government subsidy is equal to the bid price minus the average electricity price for each year and thus resembles a Contract for Difference scheme. Two exemptions apply, namely when the average electricity price is too low (the government subsidy is maximum equal to the bid price minus the base electricity price) or when the average electricity price is higher than the bid price (then the operator receives the extra income). This way the government subsidy is dependent on the electricity price and over- & undersubsidy is avoided. The government subsidy is valid for the first 2900 full load hours every year during 15 years. According to BARD, their bid price was 170 €/MWh (excl. distance correction).

10.2.2 Indirect support

Energy Investment Allowances

Other than the Guarantees of Origin and the CO2 prices under the EU ETS system, there are fiscal benefits in the Netherlands for sustainable energy production - the Energy Investment Allowances (EIA). This is an amortisation, depreciation and impairments system funding the investments into renewable energy production. The markdown of the investment is set very high which means that the taxable asset is reduced and the tax payment is minimised. The markdown is set every year based on the goals of development of renewable energies.

For offshore wind energy, the EIA amounts to 1000 €/kW. An SDE or NER-300 subsidy must be granted to be eligible for this tax relief.

The total amount of energy investments that is eligible for the tax relief per company is minimum €2300 and maximum € 118 million per calendar year. Of the investment amount that is eligible, 41,5% can be deducted from the fiscal profit in 2013.

Ecotax exemption

The generators of electricity from renewable sources are exempted from the environmental tax, which is levied on electricity consumption (Ecotax).

The 'energiebelasting' of ecotax is listed in the following table:

Jaar	0 t/m 10.000 kWh	10.001 t/m 50.000 kWh	50.001 t/m 10 miljoen kWh	meer dan 10 miljoen kWh particulier	meer dan 10 miljoen kWh zakelijk
2013	€ 0,1165	€ 0,0424	€ 0,0113	€ 0,0010	€ 0,0005

By producing renewable energy for self-consumption, this tax can be recuperated. As offshore wind energy production cannot be regarded as self-consumption, this tax exemption is **not valid for offshore wind**.

10.2.3 Green deal (innovation support)

Dutch companies have realised a turnover of around € 1bn in 2011 in the offshore wind sector. The government considers offshore wind to be a key sector in the Netherlands, but is not planning to support this by creating an internal market. Instead, it focuses on innovation.

In October 2011, the Government therefore concluded a Green Deal with the offshore wind sector (represented by NWEA), which strives towards a cost reduction of 40% by 2020, in exchange for

- Government support for innovation and further preparation
- A new release of concessions (Round 3)

The government support will be provided via the TKI (Topconsortium voor Kennis en Innovatie) for wind energy at sea. This has been recently erected and will coordinate the innovation in the sector. One of the things it will do is the realisation of a demonstration project 'Windpark op zee', for which a proposal will be handed in within two years.

A tender for innovative projects has been launched in 2012 with a total budget of € 7 million (closed in October 2012).

10.3 OTHER DETAILS OF THE OFFSHORE WIND FRAMEWORK

10.3.1 Permission Process

On 29th of December 2004 the Minister of Transport, Public Works and Water Management published the issuing scheme for construction permits of offshore wind farms. This scheme is applied in the Public Works and Water Management Act. Under the scheme the maximum size of an individual offshore wind farm is 50 km². Some areas on the Dutch continental shelf have been reserved for other activities, like military areas, shipping routes, disposal sites, sand resources and cable routes. A mandatory Environmental Impact Assessment (EIS) is part of the procedure to acquire a construction permit.

Permits thus have to be won separately from support. In the past Round 2, 12 permits have been granted. Initially, the concessions were only granted if the projects were realised in the following years, but due to the lack of subsidy they now have been prolonged until 2020.

10.3.2 Grid connection

Grid connection has to be paid by the project developers.

10.4 TAXES

- The nominal corporate tax rate for the Netherlands is 25%.
- As stated in section 10.2.2, a tax relief exists for offshore wind energy.

10.5 MODELLING IN THE PROJECT

The present report looks at the net present value of the net support costs for society and the gross income for projects. The main assumptions used to model the Dutch system are the following:

- 300 MW wind farm, 3500 MWh per year
- The publicly known tender price of the GEMINI wind farm has been used: bid price of 170 €/MWh for a 600 MW wind farm. The calculations are also done for comparison with a calculation for the ENECO wind farm (129 MW, estimated bid price of about 200 €/MWh).
- Electricity cannot be sold separately and is included in the tender price. It is assumed that the support always stays inside the given margins.
- Discount factor for the government is 4%, for the project financing it is 11%.
- Guarantees of Origin, CO2 prices, taxes and tax reductions etc. are not taken into account.

10.6 REFERENCES

- Ambitie rond windenergie op zee 2011Z25667, Letter from the Minister of Economic Affairs M. Verhagen to the 'Voorzitter van de Tweede Kamer der Staten-Generaal', 30 January 2012
- Voortgang windenergie op zee, Brief van Minister van Economische Zaken M. Verhagen aan de Voorzitter van de Tweede Kamer der Staten-Generaal, 19 June 2012
- http://www.agentschapnl.nl/programmas-regelingen/offshore-wind-energy
- https://www.agentschapnl.nl/programmas-regelingen/stimulering-duurzame-energieproductie-sde

- Innovatiecontract Wind op Zee voor Topconsortia voor Kennis en Innovatie, http://www.tki-windopzee.nl/
- Lost decade predicted for Dutch offshore wind, Recharge, March 2011
- Stichting De Noordzee, http://www.noordzee.nl/bibliotheek/windparkenopzee/
- Green Deal Offshore Wind Energie, NWEA, http://www.nwea.nl/greendeal
- Energie-Investeringsaftrek (EIA), energielijst 2013, Agentschap NL, Ministerie van Economische Zaken, December 2012
- Kabinet moet nu snel duidelijkheid geven over uitrol offshore wind, NWEA, 25 October 2012

11 ANNEXES: COUNTRY ANALYSIS THE UNITED KINGDOM

11.1 MARKET SITUATION

11.1.1 Electricity market peculiarities

- The United Kingdom (UK) has the most liberal electricity market in Europe. There is a horizontal competition between suppliers of electric energy and it is as well vertically decoupled: generators, operators and suppliers are independent companies.
- In England, Scotland and Wales the grid is provided by the National Grid Company. There are bottlenecks in the transmission grid as well as in the distribution grid, especially from north to south transport (northern part lower grid density due to smaller population density).
- The regulatory authority is OFGEM (Office of Gas and Electricity Markets), which is governed by GEMA (Gas and Electricity Markets Authority).
- The UK is currently undergoing an Electricity Market Reform (EMR), to attract the investment needed to replace its ageing energy infrastructure and meet the projected future increases in electricity demand from the electrification of sectors such as transport and heat. The main elements of EMR are Contracts for Difference and the Capacity Market (see further below).

11.1.2 Wind market situation

In the frame of the EU Renewable Energy Directive, the UK has committed to generating 15% of their energy from renewable sources by 2020. In 2009, the British Government formulated a renewable energy strategy to achieve its long-term climate change objectives. This stipulates an increase in renewable energies as a share of electricity consumption to 30 percent by 2020.

A significant part of this will come from wind energy. The UK has some of the best wind resources in Europe, both onshore and offshore. It is the expansion of offshore wind capacity that is expected to largely contribute towards attaining this 30% objective. Offshore wind energy is believed to contribute 33-58 TWh to the target in 2020.

At the end of 2011, UK had 18 wind farms installed with 636 turbines totalling 2093 MW, 55% of the total installed offshore wind capacity in Europe. During the first 6 months of 2012, another 114 offshore wind turbines or 422 MW has been successfully connected to the UK grid.

Offshore wind developers have registered their interest in deploying 46GW of capacity, of which around 10GW has been progressed to consent determination, construction and operation. The vast majority of new wind farms will be delivered as part of The Crown Estate's Round 3 programme (see further), consisting of nine offshore wind zones around the coast of the UK.

The Government's Renewables Roadmap set its sights on cutting the cost of wind power to £100 per megawatt hour (MWh) and installing 18GW capacity off the UK coast by 2020. The Crown Estate has set its own goal to see 25GW of wind power either commissioned or under construction by the end of the decade.

In the UK, 72% of approved wind farms are owned by large utilities, whereas just 12 percent are independently held.

Offshore Wind Farm Leasing

The Crown Estate (CE) owns the majority of the seabed, out to the 12-nautical-mile limit of territorial waters. Offshore renewable development on The CE's marine estate can only take place if The CE grants a lease over the site in question. Beyond this limit, in the Renewable Energy Zone, The CE issues a licence to develop a renewable energy installation, rather than a lease.

The CE leasing programme is designed to help speed up offshore wind farm projects, with quicker consenting decisions and, ultimately, more wind farms generating renewable electricity, more quickly.

- **Round 1** leases are typically close to shore, and have been mostly installed already – they total around 1 GW of capacity.
- **Round 2** identified three strategic areas, totalling 7.2 GW, which are under construction or in development and will be responsible for the capacity additions expected over the next 3-4 years.
- **Round 3** leases offer up to 32 GW of new generation in 9 zones, which are significantly larger than the areas identified under Rounds 1 and 2 and likely to use larger turbines. Many of the Round 3 zones are in deeper water, further offshore, and are therefore more technically challenging.
- **Scottish Territorial Waters:** The Crown Estate also granted exclusivity agreements in 2009 for the development of 6.4 GW in Scottish Territorial Waters. Northern Ireland is considering a leasing round of at least 600MW, subject to consultation.
- **Round 1 and 2 extensions:** In order to provide a stable flow of construction projects to the offshore wind industry, in May 2010 the Crown Estate also announced an additional 2 GW capacity by way of extensions to a number of awarded leases.

The seabed leases from The Crown Estate come with a price. The previous two tender rounds for development areas fixed fees at 1 £/MWh for Round 1 and 1.07 £/MWh for Round 2. For Round 3, The firms pay the Crown Estate a rental fee to run their cables along the seabed from the turbines to the shore. The companies also have to pay a percentage of the money they make from generating electricity.

11.2 OFFSHORE WIND SUPPORT

There are currently three UK-specific sources of support for renewable energy generators in the UK (explained further down in this document):

- **Renewables Obligation (RO)**
  Quota system with tradable ROCs (Renewable Obligation Certificates). Banded system (different number of ROCs per MWh for different technologies)
- **Climate Change Levy Exemptions for Renewables (CCL)**
  The Climate Change Levy is a climate protection tax, collected from the electricity suppliers, who pass it on to their consumers through the electricity price. Electricity from renewable sources is exempt from this tax.
- **Feed-in Tariff (FIT)**
  The Feed-in Tariffs scheme (FITS) from 1 April 2010 onwards works alongside the RO and encourages deployment of additional small scale (less than 5MW) low carbon electricity

generation, particularly by organisations, businesses, communities and individuals that have not traditionally engaged in the electricity market. This is thus not relevant to offshore wind farms.

A number of changes in policy have been decided upon and will come into force in the following years:

- **Contracts for Differences (CfD)**
  As part of its Electricity Market Reform programme, from 2014 the Government is introducing Contracts for Difference (CfDs) which will provide more cost-effective support for all low carbon generation, including renewables. Renewables generators will be able to choose between the RO and CfD until the RO closes to new generation on 31 March 2017.
- **UK Carbon Price Floor (CCL carbon price support rate)**
  In 2011 the UK government decided on a carbon price floor to reduce investor uncertainty, putting a fair price on carbon and providing a stronger incentive to invest in low-carbon generation now. The tax is levied from the electricity producers, starting from April 2013.

11.2.1 Relevant Laws

- Finance Act 2000, FA 2010, FA 2011, FA 2012
- Directive 2001/77/EC
- Electrcity Market Reform White Paper 2011
- CCL GenReg 2001
- Renewables Obligation Orders (ROO 2009, ROO SCO 2009, ROO NI 2009)

11.2.2 Direct support

Renewables Obligation (RO)

- **System:** The RO system is a banded quota system with tradable certificates (ROCs). The RO places a mandatory requirement on licensed UK electricity suppliers to prove that a certain proportion of electricity supplied was generated from renewable sources or pay a penalty. The scheme is administered by Ofgem who issue Renewables Obligation Certificates (ROCs) to electricity generators in relation to the amount of eligible renewable electricity they generate. Generators sell their ROCs to suppliers or traders which allows them to receive a premium in addition to the wholesale electricity price.
  Suppliers present ROCs to Ofgem to demonstrate their compliance with the obligation. Where they do not present sufficient ROCs, suppliers have to pay a penalty known as the buy-out price. This is set at £40.71 per ROC for 2012/13 (linked to the Retail Price Index (RPI)). The money collected by Ofgem in the buy-out fund is recycled on a pro-rata basis to suppliers who presented ROCs. Suppliers that do not present ROCs pay into the buy-out fund at the buy-out price, but do not receive any portion of the recycled fund.
- **Prices:** The ROCs are traded on the market and the price is thus not fixed. The current price for one ROC is about £40 (see Figure 12). Offshore wind generation currently receives two ROCs per MWh produced. The bands are reviewed periodically to ensure that subsidy levels are set as cost-effectively as possible. Over the following years, the level of support for offshore wind will apply the following degression mechanism:
  - 2 ROCs in 2013/14 and 2014/15

- 1.9 ROCs in 2015/16
- 1.8 ROCs in 2016/17.

The nominal value of a ROC is made up of

- the buyout payment that is avoided by the supplier presenting the ROC, plus
- the portion of the buyout fund redistributed to the supplier that presented the ROC.

The recycling payments are estimated to be 10% of the buyout price.

The banding levels (=amount of ROCs per MWh) are reviewed every 4 years. For existing plants, there is the 'grandfathering' principle which means that these stations remain subject to the old banding level so that they have a fixed level of support.

- **Timing:** The RO is currently the main financial mechanism by which the Government incentivises the deployment of large-scale renewable electricity generation. Support is granted for 20 years.
- **Costs:** The costs of the quota system are borne by the consumers through the electricity price.
- **Changes:** In April 2010, the end date of the RO was extended from 2027 to 2037 for new projects to provide long-term certainty for investors and to ensure continued deployment of renewables to meet the UK's 2020 target and beyond.

  The RO will close to new generation on 31 March 2017. Generation which is accredited under the RO will continue to receive its full lifetime of support in the "vintaged" scheme after 2017. This means that the ROC price will be fixed for the remaining 10 years of the RO at its long-term value, and Government will buy the ROCs directly from the generators (as set out in the Electrcity Market Reform White Paper 2011 and subject to parliamentary approval). This will reduce volatility in the final years of the mechanism. The long term value of a ROC is the buyout price plus 10% headroom, and is roughly £41 per ROC in 2010 prices. After these 10 years, the scheme will close in 2037.
- **Succes:** Since the RO's introduction in 2002, it has succeeded in supporting the deployment of increasing amounts of renewables generation from 3.1GW in 2002 to 13GW in the first quarter of 2012 and increasing the level of renewable electricity in the UK from 1.8% in 2002 to 9.4% in 2011. It is currently worth around £2 billion a year in support to the renewable electricity industry.

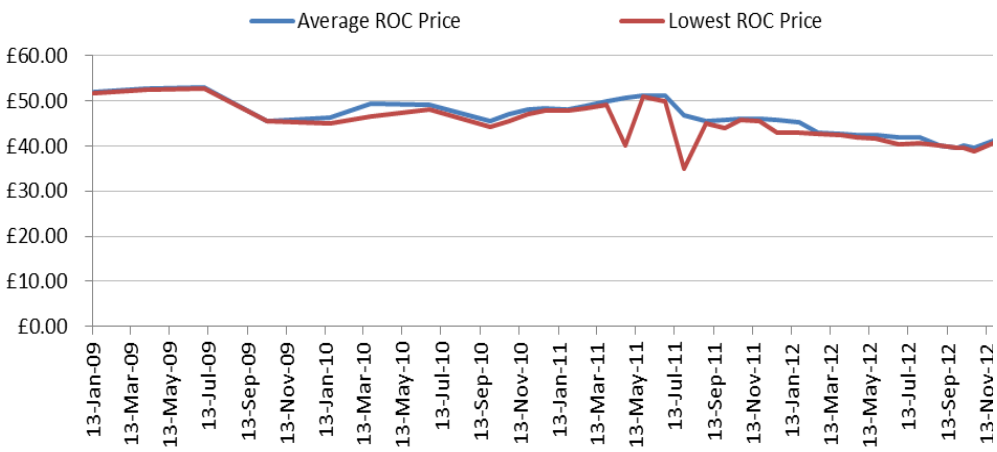

Figure 12: Historical evolution of the price of ROCs in the UK

11.2.3 Indirect support

Climate Change Levy Exemptions for Renewables (CCL)

In the United Kingdom, electricity generated from renewable sources is eligible for tax relief. The Climate Change Levy, which was introduced by the Finance Act 2000, applies to the consumption of electricity from traditional sources only.

The Climate Change Levy (CCL) is a climate protection tax, which is levied on the consumption of electricity from non-renewable sources by commercial and industrial final consumers and the public sector. Electricity from non-renewable sources shall mean electricity generated from traditional sources, gas, LPG (liquefied petroleum gas) and coal. The CCL aims at reducing greenhouse gases and promoting energy-efficiency in final consumers. The Climate Change Levy is collected from the electricity suppliers, who pass it on to their consumers through the electricity price. Electricity from renewable sources is exempt from this tax.

The amount of tax benefit equals the amount of the CCL which the suppliers are exempt from. Amount of the CCL per MWh of electricity:

Obligation period	Amount of CCL in £ (GBP)/MWh	Source
base rate	4.30	Schedule VI, § 42 FA 2000
1 April 2011 – 31 March 2012	4.85	Section 17 FA 2010
1 April 2012 – 31 March 2013	5.09	Section 23 FA 2011
1 April 2013 – onwards	5.24	Schedule 30 FA 2012

The cost of exemption from the Climate Change Levy is borne by the state in terms of lower tax revenue.

11.2.4 Upcoming support system changes:

UK Carbon Price Floor

In the Electricity Market Reform (EMR) 2011 and the White paper 'Planning our electric future: a White Paper for secure, affordable and low-carbon electricity', the UK government decided on a carbon price floor, to reduce investor uncertainty, putting a fair price on carbon and providing a stronger incentive to invest in low-carbon generation now.

The support is in the form of a Carbon Price Support (CPS) rate tax. If the ETS price is ever above the floor, the tax would be zero; if the EUA price is below the floor, the new tax makes up the difference. The government has announced a trajectory out to 2030 in real terms for the total carbon price (EUA price plus the Carbon Price Support rate) that electricity generators will face, while the level of the Carbon Price Support (CPS) rates has been set for financial years 2013/14 and 2014/15 in nominal terms

The tax will be introduced from 1 April 2013. The floor will start at £16 per tonne of carbon dioxide (tCO2) and follow a linear path to target £30/tCO2 in 2020 (both in 2009 prices), rising to £70/tCO2 in 2030 (2030 figure is indicative).

The CPS rates from 1 April 2013-14 were announced at Budget 2011, with the CPS rates of CCL legislated for in Finance Act 2011. The rates will be equivalent to £4.94 per tonne of carbon dioxide (tCO2). From 1 April 2014, the CPS rates of CCL and fuel duty will be equivalent to £9.55 per tCO2. Indicative CPS rates for 2015-16 and 2016-17 will be equivalent to £12.06 per tCO2 and £14.86 per tCO2 respectively.

The Government has decided that this is best achieved by the climate change levy (CCL) and fuel duty being levied on all fossil fuels used in the UK to generate electricity. In most cases, fossil fuels currently used to generate electricity are exempt from CCL. The Government proposes to remove these exemptions and to tax these commodities at rates that take account of the commodities' average carbon content.

For 2013-2014 and 2014-2015, the taxes decided are shown in Table 5. The indicative rates for 2015-16 and 2016-17 are shown in Table 6.

Table 5: UK Climate Change Levies and Fuel Duty taxes for 2013-2014 and 2014-2015

Supplies of commodity	CPS rate		Unit
	of CCL 2013-14	of CCL 2014-15	
Gas	£0.00091	£0.00175	per kilowatt hour (kWh)
Liquefied petroleum gas	£0.01460	£0.02822	per kilogram (kg)
Coal	£0.44264	£0.85489	per GJ
	of fuel duty 2013-14	of fuel duty 2014-15	
Fuel oil; other heavy oil; rebated light oil	£0.01568	£0.03011	per litre
Gas oil; rebated bioblend	£0.01365	£0.02642	per litre

Table 6: UK Climate Change Levies and Fuel Duty taxes for 2015-2016 and 2016-2017

Supplies of commodity	Indicative CPS rate		Unit
	of CCL 2015-16	of CCL 2016-17	
Gas	£0.00221	£0.00272	per kWh
Liquefied petroleum gas	£0.03564	£0.04393	per kg
Coal	£1.07962	£1.33063	per GJ
	of fuel duty 2015-16	of fuel duty 2016-17	
Fuel oil; other heavy oil; rebated light oil	£0.03803	£0.04687	per litre
Gas oil; rebated bioblend	£0.03336	£0.04112	per litre

Contract for Differences

The new system 'Contract for Differences' (CfD) is a fundamental part of the Government"s proposals under the Electricity Market Reform package. The CfD will work in concert with the Capacity Market and the Emissions Performance Standard to deliver Government"s aims and objectives of decarbonisation while minimising the cost to consumers and security of supply.

Generators will receive the price they achieve in the electricity market plus a „top up" from the market price to an agreed level (the "strike price"). Where the market price is above the agreed level, the

generator would be required to pay back and thus ensure value for money and greater price stability for consumers.

A stable revenue level should in turn reduce investment risk and financing costs, and so drive innovation and development of low-carbon technologies. Competition will then bring down overall costs and, eventually, provide a level playing field where low-carbon generation without subsidy can compete with other technologies in the electricity market.

Next Steps: DECC will continue to work on the implementation of the CFD system and the development of the CFD contract with a view to issuing the first CFDs in 2014. The aim is to publish the full contract terms in [July 2013] in advance of consulting on secondary legislation in late 2013. Indicative strike prices will appear in the Draft Delivery Plan in mid 2013, with final strike prices being published in the Final Delivery plan in late 2013 subject to Royal Assent.

11.2.5 Other relevant changes

Investment Contracts: The UK Government recognises that uncertainty during the implementation of changes to the market under the electricity market reform (EMR) programme could lead to some low carbon generation projects being delayed or indefinitely postponed. The Government committed to working with relevant developers through the 'Final Investment Decision Enabling' (FID enabling) process to consider what comfort might be offered to enable the taking of investment decisions on such projects before EMR implementation.

One form of comfort that might be available is for the Secretary of State to enter into a form of early contract for difference with such developers – referred to as an 'investment contract' in the Bill. The intention is to transfer any agreed contracts to the CfD counterparty once it is established. Developers of projects with the characteristics set out in the 'Technical update' can approach DECC at any time to discuss what form of comfort might be available through the FID-enabling process.

Capacity Market: DECC is legislating to enable for the introduction of a Capacity Market in order to guard against the potential risks to security of electricity supply. The Energy Bill sets out in primary legislation the broad framework to enable a Capacity Market to be implemented alongside the electricity market in Great Britain. The Department is currently developing the detailed design for the Capacity Market. They are working with the System Operator (National Grid), the regulator (Ofgem) and other stakeholders to develop the best design for the GB market in parallel with the primary legislation going through Parliament. A consultation on the detailed design of the mechanism will be done in October 2013.

However, in the annexes of the Energy Bill is already stated that low carbon plants that receive support through the Feed-in Tariff with Contracts for Difference (CfD) will not be able to participate in the Capacity Market, at least while CfD prices are set administratively. It will thus not be directly relevant to the cost of offshore wind, but will have an impact on the competitiveness versus conventional generation in the UK.

11.3 OTHER DETAILS OF THE OFFSHORE WIND FRAMEWORK

11.3.1 Permission Process

The Crown Estate may contribute to expenses including feasibility studies and planning applications.

11.3.2 Grid Connection

OFTO scheme

DECC and Ofgem have developed an innovative regime to 'connect offshore wind projects to the GB onshore grid in a cost effective, timely and secure way'. The regime involves competitive tenders run by Ofgem for Offshore Transmission Owners (OFTOs) to own and maintain (as well as design, finance and construct where required) the transmission assets for connecting offshore renewable projects to the onshore grid.

For the grid connection of their offshore wind farm developments, generators have the following choice:

- Constructing their own connections and transferring to an OFTO to operate upon completion (along the lines of the 'transitional' arrangements)
- Have an OFTO appointed to both construct and operate the connections.

Via the tender system, offshore transmission owners are selected on a competitive basis:

- For each wind farm the owner of the OFTO is to be selected competitively
- Ofgem screens bidders for financial, management, operational and technical capability
- Bidders that satisfy screening criteria will then submit the 20-year tariff they will need to receive in order to undertake the OFTO role. This tariff is fixed (other than RPI indexation) and not subject to regulatory reviews
- For each wind farm (or phase of a larger development) Ofgem will award one OFTO licence

The Offshore Transmission Licences will place certain rights and responsibilities on OFTOs, including the right to a regulated revenue stream for a period of 20 years in return for the provision of Transmission Services.

The OFTO is thus remunerated via National Grid, that recovers its costs through transmission charges to all electricity suppliers and all onshore and offshore generators.

There is significant interest in the OFTO market from new entrants to the sector, with almost £4 billion of bids for the first £1.1 billion of assets tendered by Ofgem.

Transmission charges

The transmission charges (Transmission Network Use of System charges: TNUoS) in the UK are dependent on the location of the generation and demand.

The purpose of TNUoS tariffs is twofold: firstly to reflect the impact that transmission users at different geographical locations have on transmission costs; and secondly recover the total allowed revenue of the transmission licences. The grid use is thus more expensive if the feed-in or is further away from the demand zones (in the south).

The TNUoS tariffs are made up of four components:

- **System Wider Locational tariffs:** A locational zonal tariff that reflects the cost of providing incremental capacity on the onshore transmission network.
- **Local Circuit tariffs:** A locational nodal tariff that reflects the cost of the transmission circuits from the point of connection to the main interconnected transmission system.

- **Local Substation tariffs:** A locational nodal tariff that reflects the cost of the transmission substation that the generator is connected to.
- **Wider Residual tariffs:** A non-locational tariff that ensures the correct revenue is recovered from generation users.

Apart from the offshore local circuit tariffs, offshore wind generators can also be liable to an Onshore Local Circuit tariff and to ETUoS charges (respectively for the onshore part if this is non-MITS (Main Interconnected Transmission System) and if the OWF is connected to the distribution network).

All these charges are defined in £/kW. Depending on the location, onshore substation and voltage level, distance from shore etc., they may vary significantly.

11.3.3 Financing aid

The UK's offshore wind programme could require £50-£100 bn of investment over the next 10-15 y. Overall it is estimated that to deliver an additional 12 GW by 2020 the needed investment is substantial at £35bn, rising to £64bn by 2025, excluding grid infrastructure. Most projects so far have been funded through construction phase using utility equity, but future projects must attract new sources of capital.

Government regulation plays a key role in determining the economics of offshore wind farms and boosting investor confidence. The policy framework created by government through the Electricity Market Reform (EMR) and existing Renewables Obligation incentive scheme is designed to support investment in offshore wind and provide long-term investor certainty, but might not be enough to secure the large amounts of capital needed.

Green Investment Bank (GIB)

The 'Green Investment Bank' has been created by the UK Government to create a range of products which accelerate and scale up investment in technologies and industries that will support the transition to a green economy. Offshore wind is one of the three priority sectors for the GIB, together with waste (treatment, recycling and energy) and non-domestic energy efficiency.

It is currently thought that the GIB can play an important role within the offshore wind sector by helping to free up utility balance sheets, either by co-investing or by helping to refinance after the end of construction, as well as helping to reduce project finance costs by helping to place debt in the capital markets and de-risking project finance. The initial product mix could consist of equity and debt instruments, including concessional finance, designed to address specific financing needs which have been identified through consultation with market participants.

The bank has been formed as a public company called UK Green Investment Bank plc. In October 2012 UK GIB was granted state aid approval by the European Commission and it became fully operational in November. The GIB has an initial capitalisation of £3 billion, which "the Government believes will leverage a further £15 billion of private investment".

From April 2015, the GIB will be given powers to borrow (subject to public sector net debt falling as a percentage of GDP) which will enable the up scaling of the GIB"s activity and further significant investment in low carbon renewable technologies

The GIB already announced investments in an anaerobic digestion plant in northeast England and fitting out energy-efficient buildings. At the end of Devember, it signed its first offshore wind power-

funding deal, contributing to a 224 million-pound loan for the 367 MW Walney offshore wind farm off Cumbria that's the largest operating in the world. This loan will refinance the purchase of 24.8% of the £ 1 bn Walney facility held by Dutch pension administrator PGGM NV and Ampere Equity Fund, a renewable-energy unit managed by Triodos Bank NV's Triodos Investment Management.

The Department of Business, Innovation and Skills is leading the Government's work to develop the UK Green Investment Bank. It is working with a number of other government departments including the DECC, DEFRA, HMT, DfT, CLG and Infrastructure UK.

11.4 TAXES

- The nominal corporate tax rate in Britain is 24%.
- This will be cut to 21% from April 2014 onwards.

11.5 MODELLING IN THE PROJECT

The present report looks at the net present value of the net support costs for society and the gross income for projects. The main assumptions used to model the UK system are the following:

- 300 MW wind farm, 3500 MWh per year
- 2 ROCs of 40.71 £/ROC during 20 years + 10% recycling payments → 109.3 €/MWh
- Electricity can be sold separately (assumptions in Chapter 3).
- Discount factor for the government is 4%, for the project financing it is 13.5%.
- The grid connection in the UK is developed by a third party OFTO. However, the developers have to pay the OFTO via the transmission charges, so for this project it is assumed to be not supported.
- Guarantees of Origin, Seabed leases, CO2 prices and CO2 price floor, Capacity markets, Climate Change Levies and Fuel Duty taxes, Green Investment Bank, taxes and tax reductions etc. are not taken into account.

11.6 REFERENCES

- Offshore Wind in Europe, 2010 Market Report, KPMG,
- http://www.legislation.gov.uk/uksi/2009/785/contents/made
- EWEA (2011) The European offshore wind industry - key trends and statistics 2011
- http://www.decc.gov.uk/en/content/cms/meeting_energy/wind/offshore/offshore.aspx
- UK Renewable Energy Roadmap, DECC, July 2011
- Updated short-term traded carbon values used for modelling purposes, DECC, 15 October 2012
- Electricity Market Reform (EMR), DECC Website: http://www.decc.gov.uk/en/content/cms/meeting_energy/markets/electricity/electricity.aspx
- Electricity Market Reform 2011 (EMR), Planning our electric future: a White Paper for secure, affordable and low-carbon electricity, DECC, July 2011
- Carbon Price Floor: Further Legislative Provisions and Future Rates, HM Revenue and Customs, Budget 2012, 2012
- U.K. Green Investment Bank Strikes Its First Offshore Wind Deal, Bloomberg, 20 December 2012

- Report from the Financing Sub-group to the Offshore Wind Developers Forum, UK Offshore Wind Developers Forum, 21 June 2011
- Corporation tax rate cut to 21% in autumn statement, The Guardian, 5 December 2012
- U.K. Crown Estate Bets Wind Output Will Boost Revenue (Update1), Bloomberg, July 8, 2009

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