BUSINESS CASE DESCRIPTION

COBRACABLE

DCI 13-059

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1. Introduction

This documents presents the business case for the COBRAcable project and is to be used only for information purposes only. This document is an annex to the letter of TenneT TSO B.V. ("TenneT"), dated the 3rd of December 2013, with reference CRE-REG 13-174 regarding the regulatory approval of the regulatory framework for COBRAcable. In this document, the build-up of the investment costs of the COBRAcable is explained and illustrated. COBRAcable is increasing the interconnection capacity with 700 MW. Hence, the use of the auction revenues (from the Stichting Doelgelden) is a legitimate purpose within the meaning of article 16(6) of Regulation 714/2009.

The following conditions have to be met before construction of the COBRAcable can start:

1. Approval by the Dutch regulator (ACM) regarding the regulatory framework proposed by TenneT to be obtained ultimately May 2014;
2. The licenses for the preferred route M2, the fall back option M1 or the alternative route W2 to be obtained by the end of 2015;
3. The tendering results not to exceed the maximum investment budget of € 621 million for the entire project. The investment costs (after deduction of the EEPR grant of € 86.5 million) will be split 50/50 between TenneT and Energinet.dk ("Energinet"). This implies the following split in case of the maximum investment budget: TenneT € 267 million; Energinet € 267 million and the EEPR grant of € 86.5 million;
4. The EEPR grant of € 86.5 million is to be retained;
5. Approval by Energinet and the relevant authorities (Danish Energy Agency and the Ministry);
6. Approval by the TenneT Shareholder.

TenneT and Energinet aim at commissioning COBRAcable Q1 2019, with the contract award for construction by March 2016.

2. The COBRAcable project

2.1 Project description

COBRAcable is a joint project of TenneT and Energinet. COBRAcable is an approximately 325 km long (W2; longest or 'worstcase' route)[1] subsea electricity connection between Endrup (Denmark) and Eemshaven with a projected capacity of 700 MW. COBRAcable increases the international transport capacity from the Netherlands and establishes the first direct link to Denmark. The purpose of COBRA-cable is to allow the integration of more renewable energy into the European power grid through the Dutch and Danish power systems. The power link will also intensify competition on the northwest European electricity markets.

COBRAcable will consist of a 320 kV HVDC MIND/XLPE cable with VSC convertors, allowing the possibility to connect wind farms in the North Sea area with the COBRAcable (although not foreseen on the short term given the higher value of international trade).

[1] Considering the discussion with German authorities, it is not unlikely that the W2 route will be applied for (in terms of permitting and regulatory approval), while the alternative routes are more preferable.

2.2 Long-term key objectives of COBRAcable

The key objectives of COBRAcable are:

1. *To facilitate the transport of renewable energy.*

   Electricity demand and the (volatile) supply of wind energy are usually geographically spread. Adequate transmission capacity is therefore essential for the growth and success of renewable energy. Direct transportation of wind energy from offshore wind parks is foreseen in the design of the COBRAcable.

2. *To form a crucial part of a strong, interconnected, European electricity grid.*

   A power link between Denmark and the Netherlands is in line with the ambitions of the EU for a stronger and more interconnected European electricity transmission grid.

3. *To enhance security of supply in the Northwest European electricity market.*

   COBRAcable will contribute to ensure the security of energy supply in multiple ways. It will provide a back-up for other connections in case of break-downs and will serve as a balancing tool for volatile renewable energy supply.

4. *To enhance the level playing field in the internal European electirictiy market.*

   COBRAcable, like interconnectors in general, will contribute to the development of the internal European electricity market, which is a main priority in European energy policy. Specifically, COBRAcable contributes to the further integration of the Northwest European electricity market.

2.3 PCI status

COBRAcable has acquired the PCI ('Project of Common Interest') status by the European Commission by communication COM (2013) 711 final of 14 October 2013. This means that according to the European Commission COBRAcable would have a positive effect on reaching the environmental goals by lowering CO2 emissions, increasing RES integration besides strengthening European security of supply, integrating electricity markets and making a possible start to a meshed Nord Sea grid. As a result, projects of common interest should be given 'priority status' at national level to ensure rapid administrative treatment. Projects of common interest should be considered by competent authorities as being in the public interest.

2.4 EEPR grant

COBRAcable has been granted an European Energy Program for Recovery (EEPR) subsidy of € 86.5 million. EEPR supports the construction, laying and connection of the cable, and the research and development activities on new technologies necessary for the connection of wind farms to the cable. The motivation for awarding this grant relates to the possibility to connect new offshore wind farms to the cable as a first step towards a meshed North Sea offshore grid.

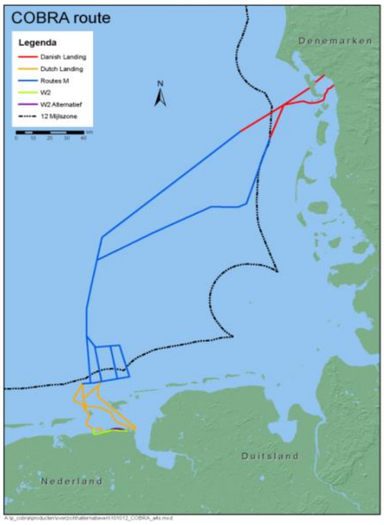

Figure 1. Possible routes of COBRAcable.

On May 7, 2013 the European Commission has sent a pre-termination letter stating that the European Commission intends to end the EEPR grant if no investment decision has been taken on December 31, 2013. However, based on a discussion with representatives of DG

ENER on June 25, 2013 it is probable that the EEPR will be continued if a final investment decision will be taken ultimately in May 2014. This final investment decision assumes approval of TenneT and Energinet as well as the national regulators in the Netherlands and Denmark.

2.5 Route

The COBRAcable runs from Eemshaven (The Netherlands) to Endrup (Denmark). This is where the converterstations will be constructed. Several alternative routes have been analysed, as depicted in *Figure 1*. Applications will be made for the north-eastern route via corridor V2 (indicated in red and blue in *Figure 1*) directly after regulatory approval by both the Dutch and Danish regulator has been received (expected ultimately May 2014).

In the (Dutch and German) Waddenzee no route has been agreed upon yet between the authorities of the Netherlands and Germany. The possible routes are depicted in Figure 2, where the Treaty area is shaded in light grey. Given that the [redacted] route M2 and [redacted] route M1 (indicated in green respectively blue in Figure 2) cross the Treaty and Disputed area between Germany and The Netherlands, authorization for these routes has not yet been received and is expected to be extremely difficult. Given the current discussions with the relevant authorities, there is the possibility that neither the M1 [redacted] nor M2 [redacted] will receive the necessary permits. In this case, will be forced to use the (longer) worstcase route W2 (indicated in yellow in Figure 2). The worstcase route has an impact on the investment cost ([redacted]). [redacted]

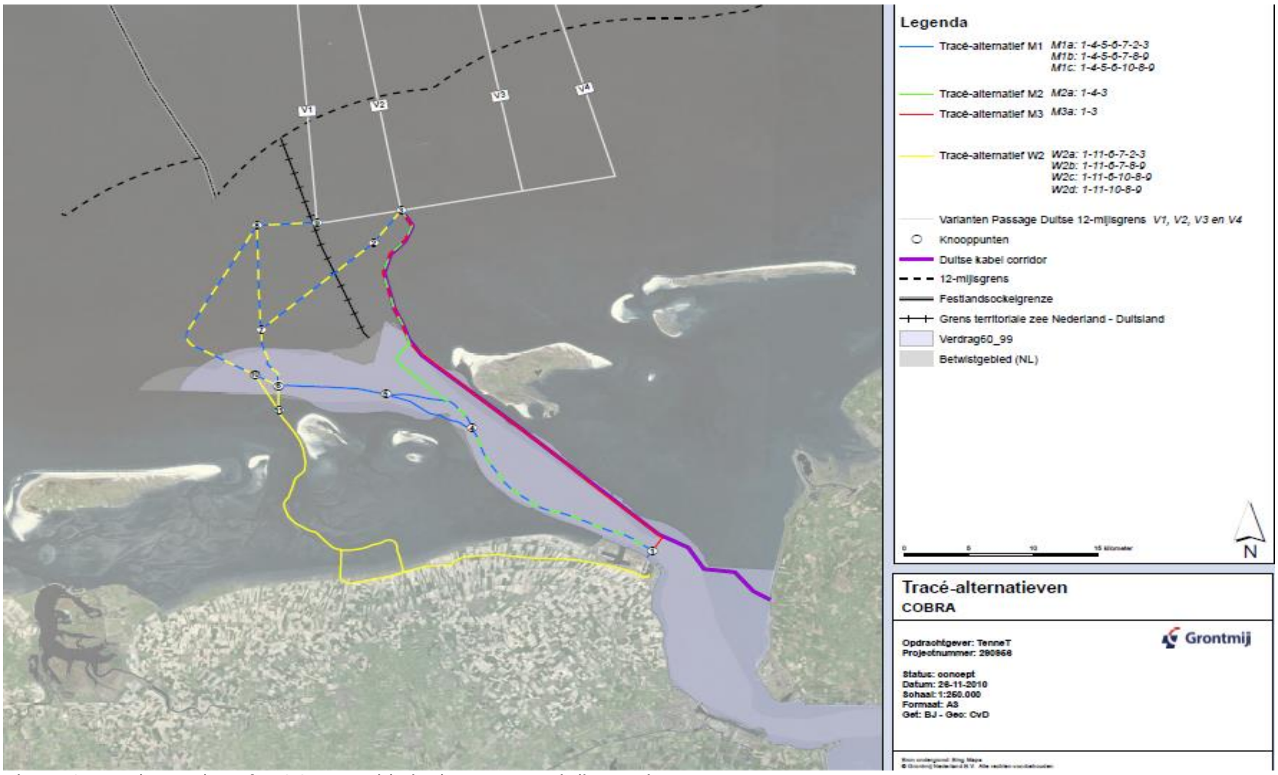

Figure 2. Routing options for COBRAcable in the treaty and disputed areas.

2.6 Financing

The construction of COBRAcable is increasing interconnection capacities within the meaning of article 16(6) of Regulation 714/2009 and therefore is a legitimate use of the congestion revenues. Analysis and forecasts by TenneT indicate that there will be sufficient auction revenues available for the recovery of the investment and operational costs of COBRAcable, and more specifically annual withdrawal of CAPEX and OPEX in accordance with the regulatory framework proposed by TenneT. The total investment costs amount to a maximum of € 267 million. With respect to the build-up of the investment costs, TenneT refers to paragraph 4.2 of the business case.

3. Technical design

3.1 Technical options

For COBRAcable two technical solutions have been reviewed: the *Line Commutated Converter* (conventional HVDC solution) and the *Voltage Source Converter* (VSC, also known as HVDC Light® or HVDC Plus). From a technical point of view, there are, at this moment, no decisive arguments to choose a specific technical option although both options have their benefits and drawbacks. However, as the EEPR grant demands that in the future wind parks may be connected to COBRAcable, the VSC technology has been chosen. A windpark should only be connected if the business case is sound and it is technically possible to do so. With regards to the cable itself two possibilities have been researched (MIND respectively XLPE cables). From a technical viewpoint no preference exists. Therefore, it seems preferable to leave this choice to the market and to base a decision on the best offer received.
An overview of the technical key figures is presented in

Table 1.

Table 1. Technical key figures of COBRAcable.

Key figures of COBRAcable	
Capacity	700MW
AC voltage Denmark **AV voltage The Netherlands**	400 kVac 380 kVac
DC Voltage	320 kVdc
Converter technology	Voltage Source Converter (VSC)
Cable type	MIND or XLPE
Trace length	Approximately 325 km
Submarine cable length	Approximately 2 x 300 km
Underground land cable length	Approximately 2 x 45 km
Technical lifetime	40+ years

3.2 Connection to the Dutch grid

In both the Netherlands and Denmark, several locations for the converter stations and the landing locations of the (DC) cable have been investigated. The preferred locations for the converter stations are Endrup in Denmark and Eemshaven in the Netherlands. The choice for Eemshaven is based on the fact that this site provides the logical possibility to connect the COBRAcable to the high voltage network at Eemshaven Oude Schip. The ground is already procured and (given the previous connection of the NorNed-cable) the licensing procedure will have a fair chance of success. It may even be considered to combine the technical rooms of the EDC (control centre of NorNed) to design a lean COBRAcable converterstation.

3.3 Connection of wind power

A main reason for granting the EEPR subsidy to COBRAcable has been the (future) possibility to connect an offshore wind farm to COBRA cable. This (technically) allows routing a total amount of 1400 MW of wind power on the two sides of the cable with 700 MW on each trunk (see Figure).
The exchange capacity between Eemshaven (NL) and Endrup (DK) will be 700 MW, when no wind power is fed into the cable. TenneT and Energinet have to evaluate each future request for connection of a wind park and assess associated socio-economical costs and benefits to ensure minimum negative economic consequences for the COBRAcable project.

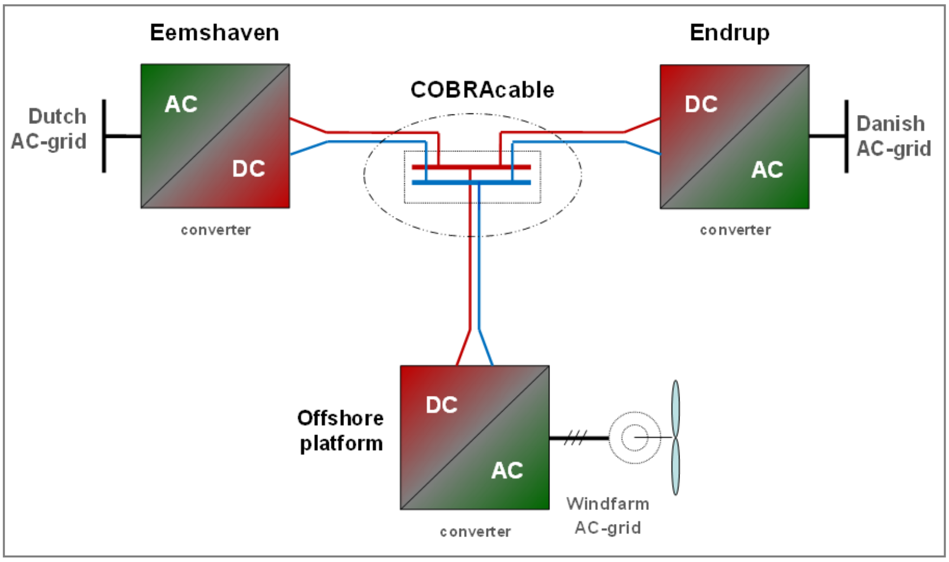

Figure 3. Electro technical representation of COBRAcable with a connected wind farm.

4. Business case for COBRAcable

4.1 Motivation for COBRAcable

The benefits of COBRAcable include a contribution to the development of the internal European electricity market, with more efficient dispatch of available generation capacity and increased socioeconomic welfare, as well as positive effects on achieving the objectives of EU climate and sustainability policy (RES, energy efficiency, CO_2), safeguarding security of supply and ensuring the technical resilience of the system. The following specific benefits, in accordance with the benefits of cable projects as specified by ENTSO-E, can be identified:

- The *congestion revenues* comprise the revenues directly generated by allocation of the transfer capacity of COBRAcable to market participants, either directly (through an explicit auction) or indirectly (by applying market coupling through power exchanges).

- The *increased socioeconomic welfare* refers to the ability of a power system to reduce congestion and thus provide an adequate grid transfer capacity so that electricity markets can trade power in an economically more efficient manner, increasing the total (consumer and producer) surplus in the connected countries.
- *Improved security of supply* refers to the ability of a power system to provide and/or safeguard an adequate and secure supply of electricity under ordinary condition.
- *Support to RES integration* is defined as the ability of the system to allow the connection of new renewable energy based plants and unlock existing and future 'green' generation, while minimising curtailments.
- *Reduction of losses* in the transmission grid is the characterisation of the evolution of thermal losses in the power system. It is an indicator of energy efficiency (and is correlated with the socioeconomic welfare).
- *Reduction of CO_2 emissions* is the characterisation of the evolution of CO_2 emissions in the power system. It is a consequence of the increased dispatch of generation with lower carbon content.
- *Technical resilience/system safety* is the ability of the system to withstand increasingly extreme system conditions (exceptional contingencies).
- *Flexibility* is the ability of the proposed reinforcement to be adequate in different possible future development paths or scenarios, including trade of balancing services.

Noteworthy is that the business case is already positive without other positive impacts which are more difficult to quantify:
- The *environmental impact* characterises the impact of the project on the environment. It aims at giving a measure of the environmental sensitivity associated with the project. Typically, the impact on nature and biodiversity is assessed through preliminary studies and expressed in terms of the number of kilometres an overhead line or underground/submarine cable (may) run through environmentally 'sensitive' areas.
- The *social impact* characterises the impact on the (local) population that is affected by the project as assessed through preliminary studies, and aims at giving a measure of the social sensitivity associated with the project. Typically, it is expressed as the number of kilometres an overhead line or underground/submarine cable (may) run through socially 'sensitive' areas.

4.2 Costs

This paragraph describes the expected and maximum investment costs from 2014 onwards for the development and construction of COBRAcable. The cost estimate is based on experience and cost indicators from TenneT's and Energinet's offshore projects. These cost estimates need to be verified through the tendering procedure planned for the end of 2014 and 2015.

The total project costs are estimated with a 50% probability interval at € 577 million ('P50') and with a 85 % probability at € 621 million ('P85'). The project costs (minus the EEPR grant) are shared between TenneT and Energinet. The expected investment costs amount to € 245 million (average costs 50% probability) up to a maximum of € 267 million (85 % probability).

[figure investments costs removed]

Figure 4. Overview of the total investments costs of COBRAcable per cost category and per annum for€ 577million

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Table 2. Cost breakdown of the expected investment costs of COBRAcable based on route W2.

Cobra budget	2014	2015	2016	2017	2018	2019	Total	Remarks
Cobra automation	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
Cobra land cable	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
Cobra sea cable	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
Cobra DC converter	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
Cobra civil works	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
Cobra licensing	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
Cobra project cost	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
CAR	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
Contingency PM	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-
Total p50	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	577.321	*expected investment cost*
Total p85	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	620.593	*expected investment cost including contingency*
EEPR grant income	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	86.500	*EEPR grant from DG ENERGY**
Investment TenneT (p50)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	**245.411**	*Expected cost from St. Doelgelden*
Investment TenneT (p85)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	**267.047**	*Maximum cost from St. Doelgelden*

* This includes already recovered and to be recovered costs up to 2013.

4.3 Methodology

The business case for COBRAcable has been established in 2009. Over the years updates using several modelling techniques and suppliers have been made. The assessments and updates executed in the previous years are:

- In 2010, the business case of COBRAcable has been assessed by Pöyry (*Evaluation of the COBRA cable*, Econ report no. R-2010-048, 19 May 2010).
- A re-assessment of COBRAcable was made by the Brattle Group in 2011 (*COBRAcable Analysis: Estimates of profitability and the impact on TSO revenues, welfare and competition*, 22 August 2011).
- Further calculations have been made by Energinet using their BID-model and published in an annual economic report. The most recent data is contained in the *Yearly Economic Update 2013 for COBRAcable*, published in April/May 2013.

The calculations contained in the present investment request are based on the results obtained from the *Yearly Economic Update 2013*.

4.4 Overview of previous analyses

Table 3 provides an overview of the expected benefits of COBRAcable in 2030 according to the previous and present business cases. Data for the *New Stronghold* scenarios represent an electricity system in 2030 mainly consisting of conventional generation, whereas the *Green Revolution* scenarios implement more wind and solar energy in the electricity system. The reference scenario of the *Yearly Economic Update* holds the midst between both scenarios and is based on the observed trend towards a Green Revolution scenario in the European market. The reference scenario is set up by TenneT NL, TenneT DE and Energinet. Data has come from bilateral studies and ENTSO-E.

In general, it can be concluded that the data of the Pöyry study are outdated (and partly based on doubtful assumptions). The results of the Brattle study still provide a suitable reference for the results of the most recent assessments made by Energinet. This latter study is the reference for the investment request.

Table 3. Overview of the benefits (socio-economic welfare, congestion rents of COBRAcable and reduced congestion rents at other interconnections) of COBRAcable for the different studies for 2030 (in million euros).

	Pöyry (2010)		**Brattle (2011)**		**Energinet (2013)**
	New Stronghold	*Green Revolution*	*New Stronghold*	*Green Revolution*	*Reference scenario*
Producer and consumer surplus DK+NL	-44	28	22	42	25
Congestion rents COBRA	22	88	24	62	40
Other interconnections	15	-36	-4	-34	-8
Total	**-7**	**80**	**42**	**70**	**57**

The analysis by Energinet covers more countries compared to the Brattle analysis, including the Nordics, the Baltics, Poland, Germany, France, Belgium, the Netherlands and UK. Norway and Sweden are modelled in more detail in the Energinet analysis (consisting of different price areas).

4.5 Modelling assumptions

The present investment request is based on the analysis as provided by Energinet. The main inputs are a list of installed plants in each country, details such as the capacity of the plant, fuel type, thermal efficiency etc., the cost of the fuels used to generate electricity, demand in each country, and the capacity of interconnection between countries. Some of the underlying assumptions are listed below.

4.5.1 Network capacities

The assumed network capacities for 2030 are graphically depicted in Figure 5. Data backgrounds are the three TSO's own data for Denmark, the Netherlands and Germany. Data for the other countries are taken fromm an extensive work done in Energinet. Here the sources are ENTSO-E's regional groups, national plans from the different countries and bilateral studies.

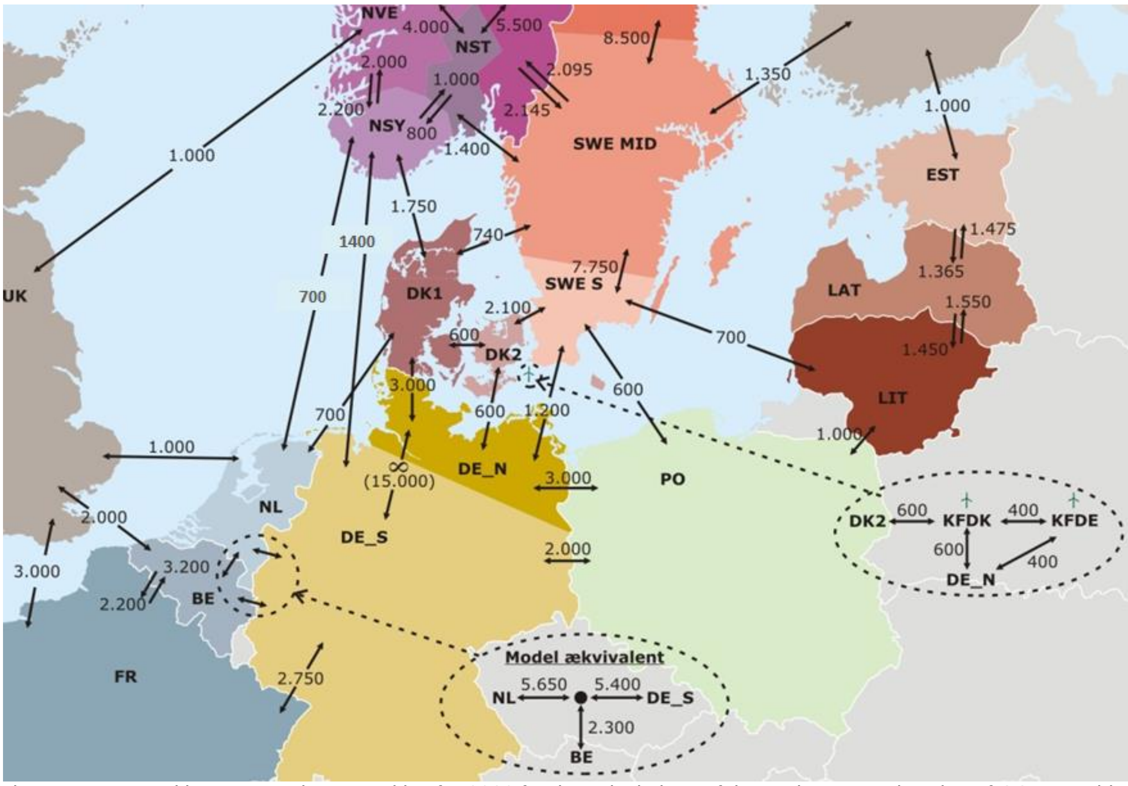

Figure 5. Assumed interconnection capacities for 2030 for the calculations of the socio-economic value of COBRAcable.

4.5.2 Fuel prices

The BID analysis has a reference scenario where fossil fuel prices are not as high as in the Green Revolution scenario of the Brattle study. The 2011 Internation Energy Agenacy expected fuel prices are used in the Energinet analysis (see Table 4). The modelling results are however highly dependent on the height of the fuel prices.

Table 4. Fuel price assumptions underlying the reference scenario of Energinet.

	Oil $/barrel	**Natural Gas – EU** $/MBTu	**Coal - OECD** $/ton	**CO_2-prices** €/ton
2018	106	10	105	30
2030	117	12	109	40

4.5.3 Discount rate

The net present value of COBRAcable is calculated by assuming a discount rate of 4,0 % (real rate) as recommended by ACER.[2] A sensitivity analysis is provided for discount rates of 3.6 % and 5.0 % as well.

4.5.4 Cable availability

For assessing the business case, it is assumed that COBRAcable will be commissioned March 2019, with an technical lifespan of 40 years. For the business case only the revenues from the 40 years of operation are taken into account, although it may be expected that the cable remains functional for some time afterwards. The expected cable availability is assumed to be 98.0 % on average.

[2] ACER deemed Frontier's short term approach reasonable: (i) a common discount rate of 4% (real) based on European Commission Impact Assessment Guidelines (ii) a common time range of 25 years lifetime for all projects, and (iii) a common reference year (present year) for discounting.

The investment cost of COBRAcable is expected to amount to € 577 million, with sensitivity analyses for investment costs of € 540 million and € 621 million. The OPEX for COBRAcable are estimated to amount to € 9 million/year. The annual losses are assumed to be 166 GWh (4.1 % of the annual energy sent through the cable). Based on an electricity price of 60 €/MWh the annual cost of cable losses equal € 9.9 million.

4.6 Business case

The business case has been calculated including the investment cost, the operational costs, the costs of losses and the reduced congestion revenues at other interconnections on the cost side, and the EEPR grant, the congestion revenues of COBRAcable and the increased socio-economic welfare (consumer and producer surplus) on the benefit side. Specifically for Germany, the value of the cost reduction of reduced necessary internal redispatch is included as well. Model calculations were made for 2018, 2023 and 2030. The values for intermediate years were estimated through linear interpolation. The annual costs and benefits after 2030 were assumed to remain unchanged with respect to the values for 2030.

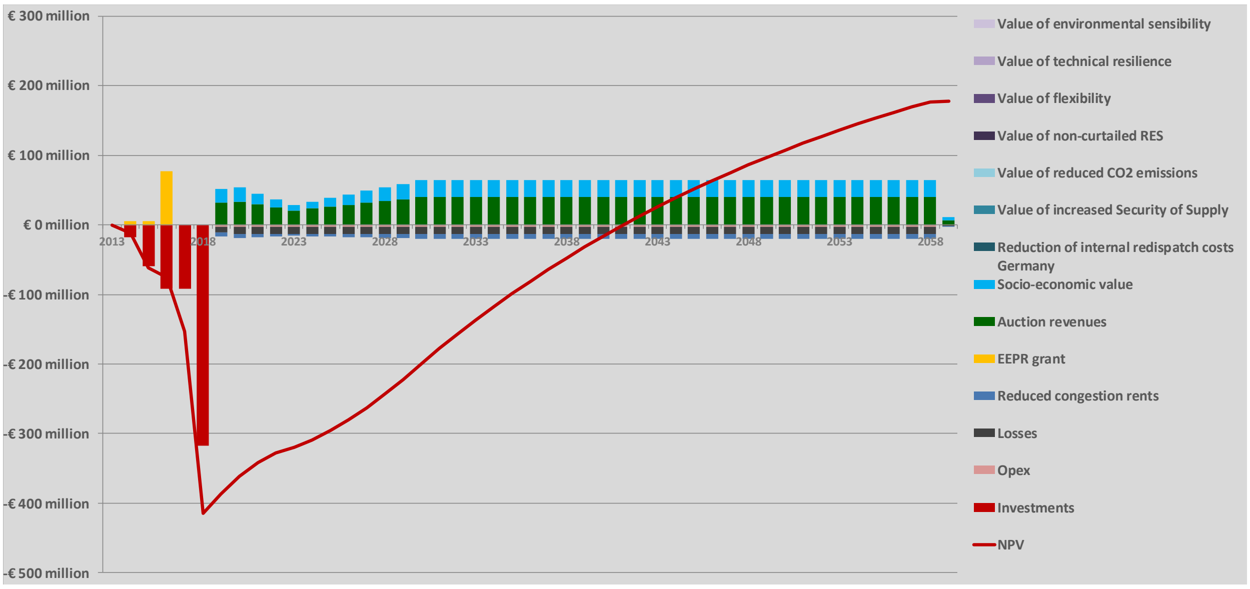

Figure 6. Business case of COBRAcable for Denmark and the Netherlands (BID-model of Energinet and under the assumptions given in §4.5). The net present value amounts to € 177.9 million.

The business case for COBRAcable based on the assumptions as described in paragraph 4.5 for the Netherlands and Denmark is presented in figure 6. Europe is provided for in Figure 67. Whereas the Nethelrand is provided fo in figure 8. The net present value of COBRAcable amounts to € 177.9 million for Denmark and the Netherlands combined and to € 403.1 million for Europe. The net present value for the Netherlands amounts to € 177.2 million.

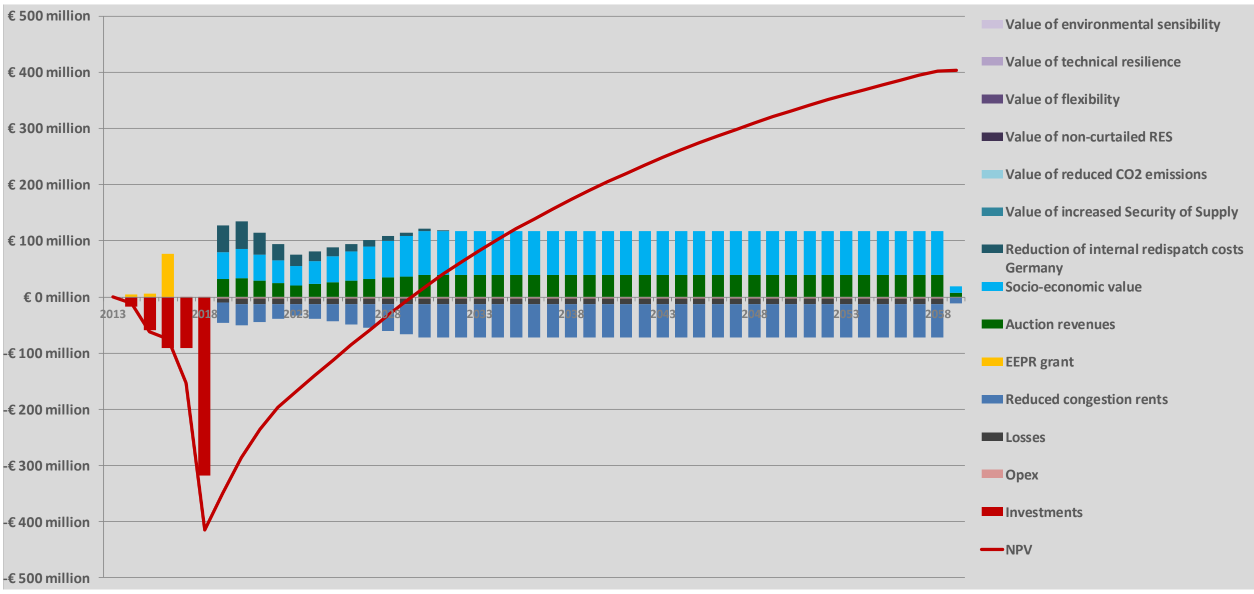

Figure 7. Business case of COBRAcable for Europe (BID-model of Energinet and under the assumptions given in §4.5). The net present value amounts to € 403.1 million.

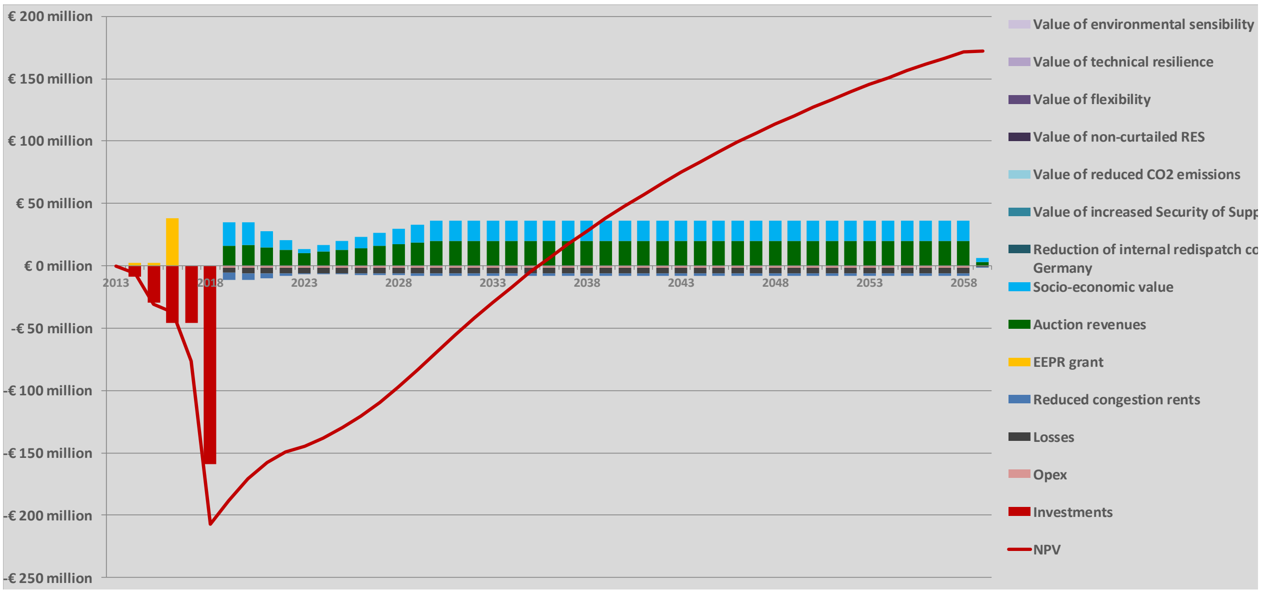

Figure 8. Business case of COBRAcable for the Netherlands (BID-model of Energinet and under the assumptions given in §4.5). The net present value amounts to € 172.2 million.

4.7 Other benefits of COBRAcable

4.7.1 CO_2 emissions and RES-integration

Energinet has assessed other benefits of COBRAcable as well. The benefits of COBRAcable with respect to reduced CO_2 emissions and the reduced system overload as an indicator for system integration of renewable energy are presented in Table 5. CO_2 emissions increase in Denmark due to more electricity production. On the other hand the Netherlands will experience lower CO_2 emissions due to the (net) replacement of fossil fuelled energy production by imports from Denmark. The increase of CO_2 emissions in Germany is mainly due to higher production outside the Schleswig-Holstein area (related to the increased transfer capacity from Germany to the Netherlands via Denmark).

With respect to RES integration it has been estimated that during approximately 44 hours per year per price area overproduction occurs. In these hours it is expected that the wind production is bound to a maximum. This means that approximately 1,364 MW of wind capacity will not be curtailed in these hours, corresponding to 60 GWh.

Table 5. Benefits of COBRAcable with respect to reduced CO_2 emissions and system integration of renewable energy (reduced system overload).

	CO_2 emissions *ktons/year*	**Overload due to RES** *GWh/year*
Denmark	154	-64
The Netherlands	-1.094	-7
Germany	884	11
Total	-56	-60

4.7.2 Security of supply

Only a qualitative assessment has been made with respect to security of supply. Taking into account that the current supply rates in all three countries are already above 99.99 % (ITAMS benchmark) it is assumed that an additional 700 MW interconnector does not significantly improve the security of supply. There is no real shortage in each of the countries, and, basically, any failure in each of the countries can be handled in the countries itself.

As has been expressed in the *Rapport Monitoring Leveringszekerheid 2012-2028* (June 2013) no supply issue is expected in the Netherlands. On the contrary, in 2020 a surplus of up to 11.7 GW of generation capacity will arise.

4.7.3 Reduction of losses

In the business case, annual losses of 166 GWh were assumed. Preliminary results based from the TYNDP 2014 modelling efforts (although related only to the most conservative scenario with respect to market integration and development of renewable electricity – see §4.9) show that the total losses in the system increase due to COBRAcable with approximately 269 GWh/year. The excess of 103 GWh above the estimated losses of COBRAcable itself are due to the dispatch of more efficient but geographically more distant plants, these are estimated as non-significant for the business case.

4.7.4 Technical resilience and system flexibility

The indicators for technical resilience/system safety and system flexibility have not been assessed by Energinet. However, in the preliminary analysis by TYNDP 2014, COBRAcable scores rather positive on both. These results are presented in Table 6.

Table 6. Tentative scores of COBRAcable on technical resilience and system (based on TYNDP 2014).

	Technical resilience	**System flexibility**
Denmark	++++ (out of 5)	+++++ (out of 5)
The Netherlands	+++ (out of 5)	+++ (out of 5)

4.8 Sensitivity analysis

Sensitivity analyses indicate that the value of the COBRAcable project remains positive under various assumptions. Variations with higher and lower investment costs (€ 621 million vs. € 530 million compared to the expected costs of € 577 million) show that the net present value for the Netherlands ranges from € 154.0 million to € 192.3 (see Figure). A sensitivity analysis for the cost of capital leads to a variation of the project value from € 108,4 million (for a cost of capital of 5.0 %) to € 203.6 million (for a cost of capital of 3.6 %).

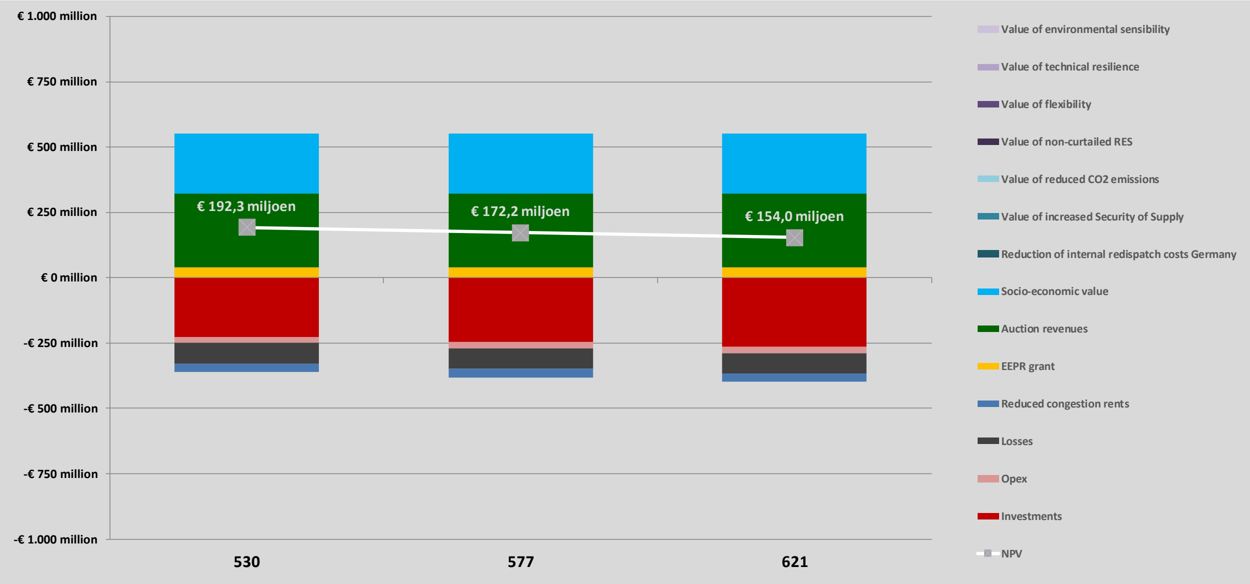

Figure 9. Sensitivity analysis for the investment cost of COBRAcable (€ 530 million, € 577 million and € 621 million) for the value for Netherlands.

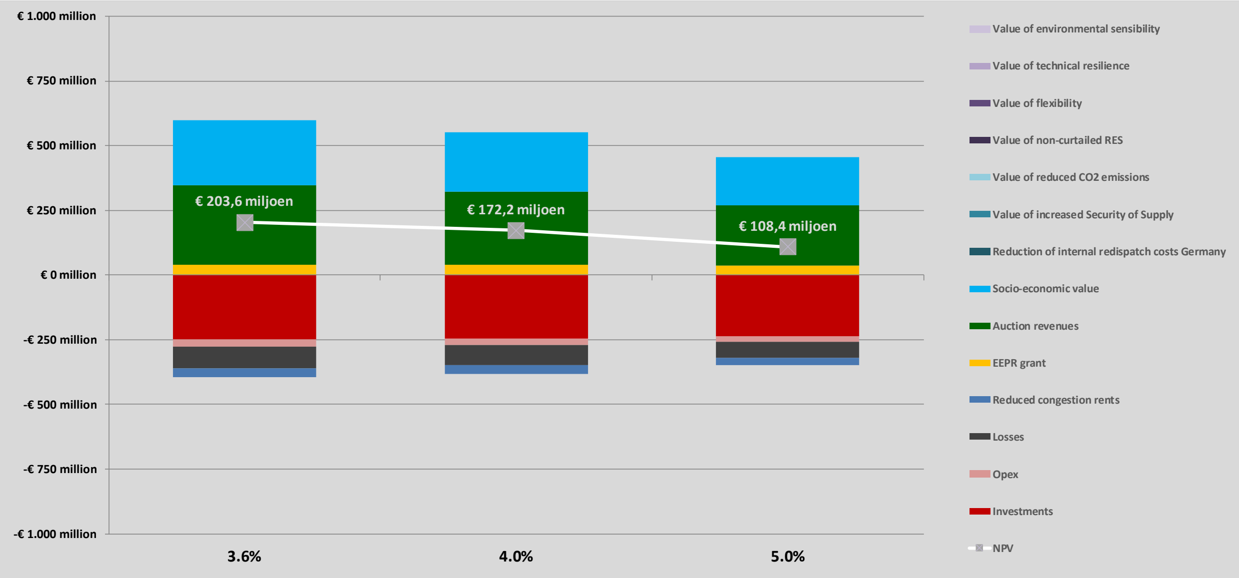

Figure 10. Sensitivity analysis for cost of capital (3.6%; 4.0% and 5.0 %) for the value of COBRAcable for the Netherlands.

4.9 TYNDP results

The results of our calculations are in line with the first results of the calculations of COBRAcable within the context of the Ten Year Network Development Plan (TYNDP) 2014 of ENTSO-E. TYNDP assesses the contribution of specific interconnections for four scenarios (related to the amount of market integration and the share of renewable electricity). However, the results of the most relevant scenarios will become available only in the course of 2014.

5. Project planning

5.1 Key dates

The key dates from the project planning of COBRAcable are given in Table 7.

Table 7. Project planning of COBRAcable.

November 12th 2013	Board approval Energinet
November 28th 2013	Board approval TenneT
April 2014	Preliminary route decision by Ministry of Economic Affairs
May 2014	Approval ACM (Dutch regulator)
May 2014	Approval Danish regulator
June 2014	Application of permits
October 2014	Tender cable/converter start
November 2015	Approval of permits
November 2015	Finalizing tender procedure
January 2016	Construction commitment TenneT/Energinet
March 2016	Contract award cable/converters
June 2017	Manufacture cable finalized
February 2019	Construction/installation completed
March 2019	COBRAcable in operation

5.2 Project risks

The project risks, their impact and the contingency regarding the development, construction and exploitation of COBRAcable have been assessed. The following sections cover the detailed description of the risks related to COBRAcable, the likelihood of occurrence, the impact they would have on the desired end result, the control measures which will be (or are already) put in place and the contingency plan which will be executed if the control measures do not have the planned effects.

5.2.1 Failure or delay in obtaining necessary permits

Risk 1	**Failure or delay in obtaining necessary permits**
Why:	The permit process is expected to run in coordination in DK,DE and NL. In Denmark the entire project is subject of EIA screening, though it should be uncomplicated. In Germany and the Netherlands this process will take about 2 years in lead time to date. This includes all main possible appeal processes against the COBRAcable that are currently foreseen. In the Netherlands the project has to adapt to a strategic EIA for the Eems area a decision on routing is expected by Q1 2016. This process determines the timeline for the Dutch and German licensing.
Impact:	The impact on the timing of the operation can be substantial: at least 2 years. Before the permits have been obtained, the work cannot start and COBRAcable will not become operational as the contracts cannot be awarded without all licences in place. Any delay (beyond the 2 year period) will result in further postponement of COBRAcable work.
Probability:	Although a planning is made with the Dutch ministry of Economic Affairs the 2 year period is very likely; any extra delay can be assessed during the permitting

	process. Getting a preferred route through the Waddenzee is challenging and will require substantial time.
Control measures:	TenneT and Energinet will employ or hire qualified personnel to assist in the permitting processes. A clear planning process has been agreed between the project and the Ministry of Economic Affairs.
Contingency plan:	Some permitting processes can run simultaneously and delays in one process will not affect the other. However: COBRAcable can, and will, not start without the necessary permits and therefore not plan for any work to start without the mandatory permits in place.

5.2.2 Environmental issues

Risk 2	**Environmental issues**
Why:	COBRAcable potentially runs through a number of determined (protected) natural areas.
Impact:	Delays due to environmental issues are included in the application process and timeline for permits. Eventual objections from environmental groupings, after permits have been granted, will be dealt with in the appropriate manner. Cost impact due to the need for development of new alternative routes can be substantial as parts of the procedures have to be done all over again.
Probability:	High. As infrastructural developments are sensitive we need to be responsible and committed to find the best option in all areas taking the full scope of views into account.
Control measures:	TenneT and Energinet are confident that all necessary precautions will be taken in the permit procedures. The COBRAcable will have no immediate impact on the landscape, with the exception of the converter locations, for these locations however, influencing from environmental groups is not expected. As far as the off shore parts are concerned, both TenneT and Energinet have a good track record on dealing with environmental aspects in similar projects
Contingency plan	If permits are denied on environmental issues: there are other different options with regard to routing: one or more of these may be addressed as alternatives in the obligatory environmental impact assessment studies. More routes have been surveyed and evaluated, they perform basis for the running licensing process in the Netherlands and Germany.

5.2.3 Weather conditions

Risk 3	**Weather conditions**
Why:	Weather conditions can play a role, especially during installation of the cable,
Impact:	Delay: As seen with the installation of earlier projects, weather conditions can delay the realization of the cable. It could also have impact during the development phase, weather conditions must allow a seabed study. Costs: During the COBRAcable seabed survey 2010 substantial costs for weather downtime were experienced.
Probability:	The influence of bad weather on the construction has been taken into account in the time schedule based on the experience gained with NorNed. Any deviations from these assumptions and predictions will be addressed during the construction phase.
Control measures:	As mentioned: there are different models used for the calculation of the business case and the planning of the construction. Both have a considerable amount of trading margins for deviations. Focus in subcontractor contracting on experience and a proven track record.
Contingency plan	Weather conditions will be closely monitored during construction so possible problems can be addressed with minimal impact on construction.

5.2.4 Additional (seabed) survey due to delay

Risk 4	**Additional (seabed) survey due to delay**
Why:	The Waddenzee area is morphological very active in terms changing sand dunes and trenches and constant relocating wild live. Further, sue to the project delay the used data for the EIA assessment can be outdated. It may therefore be expected

	that the permitting authorities would like the project to update it surveying data.
Impact:	Delay and cost: Additional surveys take time and cost money. They can only be conducted in a certain period of the year due to environmental issues. When needed the impact is estimated at half year delay and maximum of € 1.6 mln.
Probability:	It is likely that some data needs to be updated for the EIA and permit applications. What surveys are needed for this has to be seen.
Control measures:	This is not optional and will be determined by the authorities.
Contingency plan	The project aims at using existing data and updates slightly with already available data from other projects.

5.2.5 Amunition clean up

Risk 5	**Amunition clean up**
Why:	The German Offshore projects have seen immense increase in cost and delays due to ammunition clean ups in the Waddensea area in Germany.
Impact:	Delay and cost: cleaning up ammunition will take time and involve considerate cost that need tub be covered by the project.
Probability:	The executed surveys have not shown any ammunition. Probability is estimated as low.
Control measures:	Surveys in the Waddensea have not shown ammunition for any route alternative. Nonetheless when ammunition is found during construction it has to be removed.
Contingency plan	All additional surveys will also involve looking out for ammunition. When the cost increase to much an alternative route can be selected.