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## GUIDELINES FOR THE ECONOMIC MODEL RELATED TO THE DANISH PART OF THE OS 2017

*All documents included in the Information Package are only intended to provide an initial and overall guidance to potentially interested shippers in the Baltic Pipe Project. Energinet advises shippers to also use other tools and seek other information for making calculations and evaluating a possible participation as shipper in the Baltic Pipe Project. Whereas Energinet has worked diligently to ensure that formulas, calculations, programming, etc. used and applied in the attached Excel spread sheet and the other documents in the Information Package are correct, Energinet does not assume any liability for the content, calculations, use, completeness, etc. of the attached spread sheet or the other documents. In addition, Energinet has made assumptions on which the calculations are based. Such assumptions are Energinet's best estimate based on current market information. However, Energinet does not assume any liability for such assumptions.*

### 1. Introduction to the guidelines

The economic model in the Excel spread sheet is shared as part of the Information Package 2 to provide potential participants in the Danish part of the OS 2017 an opportunity to view Energinet's current view on the economics of the Danish part of the OS 2017.

These guidelines should be read before using the economic model in the Excel spread sheet. The guidelines contain three sections. The first section is a general introduction to the economic model. The second section regards the assumptions in the economic model as well as a description on how to adjust some of the assumptions. Finally, the third section regards the output from the economic model.

The economic model contains a calculation sheet "Costs of transportation&tariff", which allows the user to adjust a few assumptions. Moreover, the sheet illustrates the economic effect on the transportation tariff simulations.

**This model replaces the previously shared model released in Information Package 1, which no longer represents the best view of Energinet.**

In Information 2, adjustments have been made to provide a more precise picture of the economics, since the release of Information Package 1, e.g. Energinet's analysis assumptions 2017 are applied. These adjustments have been made to improve the precision of the economic model.

The calculations are solely based on costs related to potential Danish components in the Baltic Pipe Project:

1. Norwegian Tie-In
2. Expansion of the Danish Transmission System
3. CS Zealand

It is expected that the costs of the Norwegian Tie-In and the Expansion of the Danish Transmission System will be included in the Danish cost base. Related to the cost of the CS Zealand, it is expected that Energinet covers:

- 36 per cent of CAPEX up to 140 MEUR<sup>1</sup> and all CAPEX above 140 MEUR (if any)
- 50 per cent of the fixed OPEX
- Variable OPEX related to flow above 7.5 BCM per calendar year
- If the sum of 50 per cent of fixed plus variable OPEX related to a flow of 7.5 BCM or below exceeds 10 MEUR/year or 12 MEUR/year, depending on whether CS Zealand is connected to the transmission- or distribution grid respectively, Energinet covers the excessive amount. 30 per cent of the stated limit (10 MEUR or 12 MEUR) is adjusted for change in electricity price in price area DK2 over time<sup>2</sup>. Current expectations to the price development are stated in Energinet's analysis assumptions from 2017, which is publicly available on Energinet's webpage. Please note that the caps are stated in real terms, i.e. no inflation is included.

In this information package it is assumed that CS Zealand is connected to the distribution grid, i.e. a cap of 12 MEUR/year is assumed.

The economic model includes entry- and exit capacity bookings and flow throughput for the 0-reference and for the potential Danish part of the Baltic Pipe Project route.

## 2. Assumption selection in the "Costs of transportation+tariff"-sheet

The calculation sheet ("Costs of transportation+tariff ") in the economic model contains several assumptions located at the top of the sheet. Some assumptions are marked in black and cannot be changed, while others are marked in red and can be changed from the Base Case assumptions presented in the Information Package.

The different assumptions are described in the sections below.

<sup>1</sup> The cap is adjusted with the inflation yearly

<sup>2</sup> The remaining 70 per cent of the cost is adjusted yearly by inflation

## 2.1 Asset assumptions

In the asset assumptions, the cells B6:B8 represent assumptions related to the maximum capacity of the assets (10.1 BCM). Cell D7 contains the assumed diameter of the Offshore Interconnector, which affects the OPEX cost of CS Zealand. Cell F8 indicates the assumed tie-in solution to Norway. None of these parameters can be changed.

Cell F7 shows the assumptions related to the electricity price of CS Zealand. The cost of electricity is essential, since CS Zealand has potentially high energy consumption<sup>3</sup>, dependent on the actual flow. It is possible to adjust this assumption and choose between:

1. "Spot price (raw energy price)" – cost of electricity without any taxes, VAT, etc.
2. "Electricity price w/o VAT" – cost of electricity without costs related to VAT and the part of electricity levy which is deductible
3. "Electricity price w/o PSO and VAT" – Same cost as "2.", but without costs related to Public Service Obligation (PSO). Energinet regards this as the basic assumption for the economic calculation

Changing the assumption of electricity price solely affects the OPEX related to CS Zealand.

In the area G6:G8, the CAPEX related to the Danish cost base is shown. Related to CS Zealand, the assumptions on CAPEX in DK cost base can be found in chapter 1. Please note that all assets are depreciated through a 30 year linear depreciation scheme. In the area J6:J8 the yearly OPEX assumptions for two out of three components are shown. The OPEX of CS Zealand varies on a yearly basis, as it is dependent on the development of the electricity price. In chapter 1, the OPEX of CS Zealand is described.

With regard to the assets in the Danish part of the Baltic Pipe Project, it is assumed that 100 per cent of cost related to the Expansion of the Danish transmission system and Norwegian Tie-In is included in the Danish cost base, while CS Zealand is included as described in chapter 1.

Figure 1 Asset assumptions

Asset assumptions	Max cap.	Diameter (interconnector)	Solution	Electricity price	CAPEX	CAPEX share DK until 140 MEUR	OPEX
Expansion of the Danish transmission system	10 bcm/y				376 MEUR		3,76 MEUR/y
CS Zealand	10 bcm/y		36	Electricity price w/o PSO and VAT	52 MEUR	36%	Based on "Input OPEX-CAPEX"-sheet
Norwegian tie-in	10 bcm/y		EP II - Pipeline to Nybro		303 MEUR		4,00 MEUR/y

## 2.2 Construction assumptions

This section, B12:B14, shows the assumption on when asset construction is done and is not changeable.

Figure 2 Construction assumptions

Construction assumptions	Construction done	Check
% of construction		
Expansion of the Danish transmission system	2022	OK
CS Zealand	2022	OK
Norwegian tie-in	2022	OK

The assumptions on timing of costs are not visible in the spread sheet but they are shown in the table below.

<sup>3</sup> Note however that only energy consumption related to flow above 7.5 bcm is included in the Danish cost base and tariffs.

Construction assumptions	2017	2018	2019	2020	2021	2022
Construction assumptions, Expansion of the Danish transmission system %	1%	3%	6%	35%	48%	8%
Construction assumptions, CS Zealand %	3%	5%	11%	29%	29%	23%
Construction assumptions, Norwegian tie-in %	3%	2%	10%	34%	35%	16%

### 2.3 Abandonment assumptions

This section, G12:H14, shows the current estimate of the future abandonment cost for each asset and the expected start of abandonment. The ABEX is included in the asset value, hence collected during the asset lifetime.

Figure 3 Abandonment assumptions

Abandonment assumptions	Value of ABEX (MEUR)	Abandonment start
Expansion of the Danish transmission system	40	2052
CS Zealand	3	2052
Norwegian tie-in	25	2052

### 2.4 Danish Open Season 2017 Capacity Agreements and flow

In this section, the assumptions of capacity booking duration of Danish OS 2017 Capacity Agreements and the flow is set to 15 years for all of Energinet scenarios. These assumptions cannot be changed.

Figure 4 Open Season 2017 Capacity Agreements

Danish Open Season 2017 Capacity Agreements and flow			
	Start year	Contract life	
Flow	2022	15 Years	
Capacity Booking	2022	15 Years	

### 2.5 Throughput after Danish OS 2017 Capacity Agreements

This section, G18:H19, regards the assumptions related to number of years with flow and capacity bookings after the end of the Danish OS 2017 Capacity Agreements. The assumption for all Energinet scenarios is that flow and capacity bookings will last 15 years after the Danish OS 2017 Capacity Agreements. It is possible to adjust the number of years with flow and capacity bookings.

Figure 5 Throughput after contract life assumptions

Throughput after Danish OS 2017 Capacity Agreements		
	Start year	Period with throughput
Flow	2037	15 Years
Capacity Booking	2037	15 Years

### 2.6 General assumptions

In this section, C23:C24, it is possible to see the discount rate and base year of the model. These parameters do not affect the transportation tariff simulation or the Costs of Transportation calculation. The economic model in this Information Package assumes 2017 as base year.

In Information Package 1, the exchange rate for EUR/DKK was shown as well. The expected development of the exchange rate can be found in Energinet's Analysis Assumptions 2017, which is located on Energinet's webpage.

Figure 6 General assumptions

General assumptions	
Discount rate	4%
Base year	2017

## 2.7 Capacity booking and load factor assumptions

In the area G23:G24, assumptions of the expected capacity booking related to the Danish OS 2017 Capacity Agreements are shown. The Base Case assumption on capacity booking is 12.070 MWh/h/y, however, this assumption can be changed. The load factor is assumed to be 0.85 in the Base Case and cannot be changed. Please note that the load factor affects the whole period, i.e. the 30 years of assumed economic asset life-time.

Figure 7 Capacity and flow BP

Capacity and flow BP	
OS 2017 booking	12,070 MWh/h/y
Expected LF	0.85

## 3. Output

In this section the various outputs of the model are described.

### 3.1 Cost-base

In this section, lines 52 to 141, the costs related to the Baltic Pipe Project are calculated. The lines "CAPEX, annual", "OPEX, annual" and "Cost-base new infrastructure" show the costs related to the Danish part of the Open Season 2017. Furthermore, the expected cost base of Energinet without the Baltic Pipe Project is presented in "0-ref cost-base". The cost base of Energinet is based on a projection of the expected annual OPEX and CAPEX from 2017 onwards.

Figure 8 Cost-base

	Unit	2017	2018
<b>Asset construction (CAPEX)</b>	MEUR	13	18
<b>Interest construction (CAPEX)</b>	MEUR	0	0
<b>Asset primo (CAPEX)</b>	MEUR	0	0
<b>Asset ultimo (CAPEX)</b>	MEUR	0	0
<b>Depreciation (CAPEX)</b>	MEUR	0	0
<b>Interest (CAPEX)</b>	MEUR	0	0
<b>CAPEX, annual</b>	MEUR	0	0
Expansion of the Danish transmission system	MEUR	0	0
CS Zealand	MEUR	0	0
Norwegian tie-in	MEUR	0	0
<b>Abandonment (CAPEX)</b>	MEUR	0	0
<b>Operations during OS contracts (OPEX)*</b>	MEUR	0	0
<b>Operation after OS contracts (OPEX)</b>	MEUR	0	0
<b>OPEX, annual</b>	MEUR	0	0
Expansion of the Danish transmission system	MEUR	0	0
CS Zealand	MEUR	0	0
Norwegian tie-in	MEUR	0	0
<b>Cost-base new infrastructure</b>	MEUR	0	0
Expansion of the Danish transmission system	MEUR	0	0
CS Zealand	MEUR	0	0
Norwegian tie-in	MEUR	0	0
<b>0-ref cost-base</b>	MEUR	60	60
OPEX	MEUR	32	32
CAPEX	MEUR	28	28
<b>Total cost</b>	MEUR	60	60

### 3.2 Flow

In this section, lines 148-158, the expected flows are presented. "0-reference flow" relates to the expected flow in the Danish Transmission System without the Baltic Pipe Project and is based on Energinet's Analysis Assumption 2017. "Base Case flow during OS 2017 Capacity Agreement" relates to the Danish part of the Baltic Pipe Project flow expected during the Open Season 2017 Capacity Agreement period. "Base Case flow after OS 2017 Capacity Agreement" relates to flow after the Open Season 2017 Capacity Agreements end. All flows are in MWh.

Figure 9 Flow

	Unit
0-reference flow	MWh
Base Case flow during OS 2017 Capacity Agreement	MWh
Base Case flow after OS 2017 Capacity Agreement	MWh
<b>Total volume throughput</b>	<b>MWh</b>

### 3.3 Yearly amount based on booked capacity

In this section, lines 166-180, the expected yearly amount of entry and exit capacity bookings of the 0-reference and the Base Case assumptions are presented. For the Base Case of the Danish part of the Baltic Pipe Project, it is assumed that entry capacity equals exit capacity. The yearly amount is calculated based on average capacity bookings in the unit MWh/h/year, which is multiplied by 24 hours and 365 days. The calculation is performed in order to calculate a total tariff in EUR pr. MWh transported for the Danish part of the Baltic Pipe Project.

Figure 10 Yearly amount based on booked capacity

	Unit
0-reference amount of capacity bookings (Entry)	MWh
0-reference amount of capacity bookings (Exit)	MWh
Base Case amount of capacity booking during OS (LF 0,85)	MWh
Base Case amount of capacity booking after OS (LF 0,85)	MWh
<b>Total capacity bookings</b>	<b>MWh</b>

### 3.4 Total Costs of Transportation calculation

In this section, lines 213 to 216, the Costs of Transportation are calculated based on the cost and flow estimates. The "0-ref Costs of Transportation" calculates the expected Costs of Transportation in EUR/MWh related to the 0-reference cost base and 0-reference flow. The "Total Costs of Transportation (Base Case flow)" relates to the total cost base (0-reference and Danish part of the Baltic Pipe Project) and the total flow transported.

Figure 11 Total Costs of Transportation calculation based on flow

	Unit
0-ref transportation cost	EUR/MWh
<b>Total cost of transportation (Base case flow)</b>	<b>EUR/MWh</b>

### 3.5 Simulation of the transportation transmission tariff

In this section, lines 226 to 242, the transportation tariff is simulated. The simulation assumes that all costs can be separated on the total flow and capacity booking (i.e. the transportation tariff principle). The formula behind the tariff calculation can be found in the Information Package 2.

*Figure 12 Simulation of the transportation tariff*

	Unit
0-ref	EUR/MWh
Base case assumptions	EUR/MWh
Scenario B assumptions	EUR/MWh
Scenario C assumptions	EUR/MWh