Project 36 - Kriegers Flak CGS

The Combined Grid Solution (CGS) is a new AC offshore connection between Denmark and Germany with back-to-back stations in Germany. The project is a combined grid connection of the offshore wind farms Kriegers Flak, Baltic 1, 2 and an interconnection between both countries

Classification	Mid-term Project
Boundary	Denmark-East - Germany
PCI label	PCI 4.1
Promoted by	50HERTZ;Energinet.dk

Investments

Investment ID	Description	GTC Contribution	Substation 1	Substation 2	Present Status	Commissioning Date	Evolution since TYNDP 2014	Evolution Driver
141	The Kriegers Flak Combined Grid Solution is the new offshore connection between Denmark and Germany used for both grid connection of offshore wind farms Kriegers Flak and interconnection.	100%	Ishøj / Bjæverskov (DK)	Bentwisch (DE)	Under Construction	2018	Investment on time	New design due to result of first tendering process, where the offers exceeded expected prices by far. Second tendering process and construction is ongoing

Additional Information

This is the world's first combined solution of offshore wind connection AND interconnection of countries in one integrated solution. The project increases thus security of supply for offshore wind power plants and provides new transmission capacity for trading electricity in an integrated infrastructure as well. The usage of cable capacity is optimised, thereby increasing the project's socio-economic value.

Project Website:

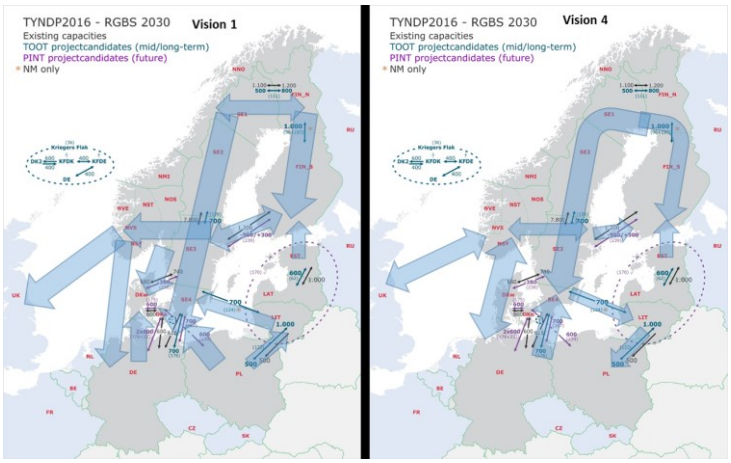
http://energinet.dk/EN/ANLAEG-OG-PROJEKTER/Anlaegsprojekter-el/Forbindelse-til-Tyskland-Kriegers-Flak-CGS/Sider/default.aspx

http://www.50hertz.com/en/Grid-Extension/Projects-of-Common-Interest-PCI

Investment needs

The project helps linking the Nordic and Central European powersystems in hours of low wind, enabeling access to the nordic hydro power. The power flows in the region tends, except in vision 4, to be from the nordics towards central Europe which the interconnector will support.

This is the world's first combined solution of offshore wind connection AND interconnection of countries in one integrated solution. The project increases thus security of supply for offshore wind power plants and provides new transmission capacity for trading electricity in an integrated infrastructure as well. The usage of cable capacity is optimised, thereby increasing the project's socio-economic value.



Project Cost Benefit Analysis

This project has been assessed by ENTSO-E in line with the Cost Benefit Analysis methodology, approved by the EC in February 2015.

The indicators B6/B7 reflect particular technical system aspects of projects based on a summation of qualitative performance indicators, in line with the CBA methodology; these cannot be used as a proxy for the security of supply indicator.

The assessment of losses variations induced by the projects improved in the TYNDP 2016 compared to the TYNDP 2014 with a comprehensive all year round computations on a wide-area model capturing all relevant flows.

The results must however be considered with caution and not totally reliable due to their very high sensitivity to assumptions regarding the detailed location of generation which are not secured.

General CBA Indicators	
Delta GTC contribution (2020) [MW]	DKE-DE: 400
	DE-DKE: 150
Delta GTC contribution (2030) [MW]	DKE-DE: 150
	DE-DKE: 150
Capex Costs 2015 (M€) Source: Project Promoter	350 ±50

Cost explanation	The uncertainty covers general project related risks, particularily related to the construction phase of the project.
S1	Negligible or less than 15km
S2	Negligible or less than 15km
B6	+
B7	+

Scenario specific CBA indicators	EP2020	Vision 1	Vision 2	Vision 3	Vision 4
B1 SoS (MWh/yr)	N/A	N/A	N/A	N/A	N/A
B2 SEW (MEuros/yr)	<10	<10	<10	<10	<10
B3 RES integration (GWh/yr)	<10	<10	<10	10 ±10	40 ±10
B4 Losses (GWh/yr)	50 ±25	0 ±25	25 ±25	25 ±25	25 ±25
B4 Losses (Meuros/yr)	2 ±1	0 ±1	1 ±1	1 ±2	1 ±2
B5 CO2 Emissions (kT/year)	-200 ±50	-200 ±100	-200 ±100	±100	±100

The project is assessed without the wind farm connection, as it is assumed this will be done regardless of whether a conncetion between DK and DE is a part of the project. The project is assessed with the TOOT methodology which will give a lower bound of the value of a interconnector. The socio economic value of the interconnector is in all visions assessed to be less than €10m per year while the project helps reduce the curtailment of RES a little. With regards to the CO2 emission the project is more or less neutral, only in vision 2 resulting in a reduction of emissions while it in the other visions has an impact of less than 100kT per year.

KF CGS is a hybrid project and also connects offshore wind beside its function as an interconnection. In contrast to other wind-connecting projects in the TYNDP, the benefits of wind generation have not been considered for TYNDP-SEW calculations for KF CGS.

In simulations, it was treated as an interconnector only – but considering less capacity than physically available, as the rest is used by the wind. Simulations setup was following the CBA rules and thus more pessimistic than the project actually is.

KF CGS is a medium term project – a major part of the benefit is caused by its early implementation.

KF CGS is an innovative project – this is not valued by TYNDP categories. KF CGS includes a new designed controller which translates the new bilateral joint regulatory model into action, also outbalancing uncertainty / variations of wind power production. The controller solves both technical and economic issues and defines the amount of electric power to be sent in each direction (prioritizing wind or trade depending on wind level, optimizing losses etc.)

KF CGS would not be built without EEPR grants.

The project's SEW accounts for saving in generation fuel and operating costs. The project could also enable savings avoiding investments in generation capacity, in particular for projects connecting electric peninsulas. The aspect has not been considered in the CBA methodology

Complementary information about the border on which the project is located	Vision 1	Vision 2	Vision 3	Vision 4
Average marginal cost difference in the reference case [€/MWh]	0.73	4.07	4.19	3.39

Standard deviation marginal cost difference in the reference case [€/MWh]	4.02	11.08	14.79	13.26
Reduction of marginal cost difference due to all mid-term and long-term projects [€/MWh]	7.92	8.57	11.80	9.05