Hertie School
of Governance

Large Infrastructure Projects in Germany – Between Ambition and Realities

Fact sheet 4

Summary Part Two: Case Study
Offshore Wind Power Expansion in Germany
Scale, Patterns and Causes of Time Delays and Cost Overruns

This study, under the leadership of **Genia Kostka**, Professor of Governance of Energy and Infrastructure, analyses the scale, patterns and causes of cost overruns in 170 large public infrastructure projects in Germany. Of those, 119 were finished between 1960 and 2014 and 51 are currently still under construction. Projects from the building, transportation, defence, energy and ICT sectors are analysed based on systematically planned versus real budgets. Three detailed case studies on the Berlin Airport BER, the Elb Philarmonic and Offshore Wind Parks round out the investigation.

The study was made possible by the friendly support of the Karl Schlecht Foundation.

Main Findings

Offshore wind power is to become a key element of Germany's energy transition. The initial goal was for it to provide 15% to the electricity mix by 2030. Yet, by 2012 only 280 MW were installed and expansion targets were adjusted from 10 GW to 6.5 GW in 2020, and from 25 GW to 15 GW in 2030. By the end of 2014 1 GW was installed and 1,3 GW was waiting for a grid connection, in total that makes up ca. 1-1,5 % of Germany's electricity harvesting capacity.

For the private industry, offshore wind park construction and installation had cost overruns of 20%, low compared with other sectors.[1] But problems with the regulated grid connection slowed down the planned expansion, with time delays of 13 months on average per park, increasing costs for consumers by more than €1 billion until the end of 2014.[2]

Factors explaining time delays and cost overruns are pioneer risks for the industry and governance challenges:

- Pioneer risks were technological (e.g. first-time use of untested technology far from shore and in deep waters), supply chain-related (e.g. insufficient maritime infrastructure) and financial (e.g. high investor risk for capital-intensive projects)
- The key governance problem is the separation between the private wind park developers and the regulated transmission system operators (TSO), which leads to policy uncertainty (e.g. unclear liability in case of time delays)
- The industry has already learned much and could overcome many of the pioneer challenges in construction and installation, but cost overruns and time delays in grid connection and expansion could remain a challenge

To boost offshore wind power expansion, we recommend the improvement of grid construction and expansion by strengthening coordination between TSOs, wind park developers, suppliers, and North Sea countries' governments, developing a long-term policy framework with clear responsibilities and ordering regular, and independent assessments of potential risks.

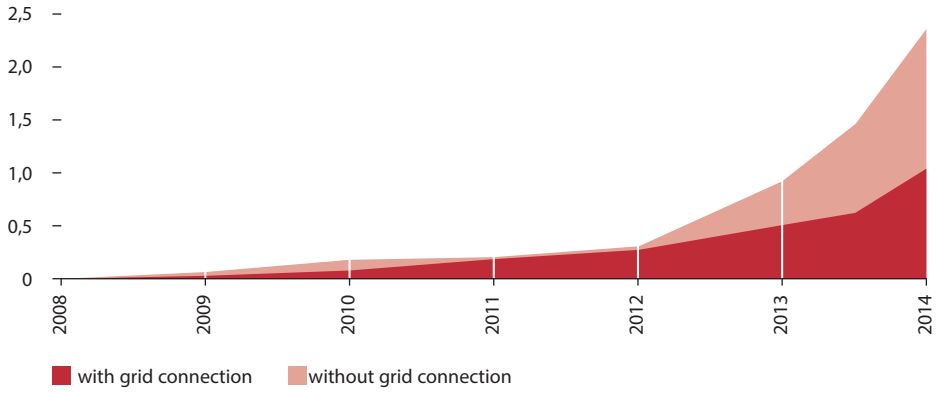
Introduction

This study analyses scale, patterns and causes of time delays and cost overruns in offshore wind power expansion in Germany. Since large-scale projects such as offshore wind parks are often challenging and the industry was in its infancy, this development faced difficulties. Currently, 42 wind parks in the North and Baltic Seas are planned to contribute to Germany's energy transition. Eight were constructed between 2007 and 2014, with about 1GW connected to the grid and 1.3GW awaiting grid connection. This study looks at the interplay of public policy and industrial development drawn from available data on finished parks, including four in-depth case studies.

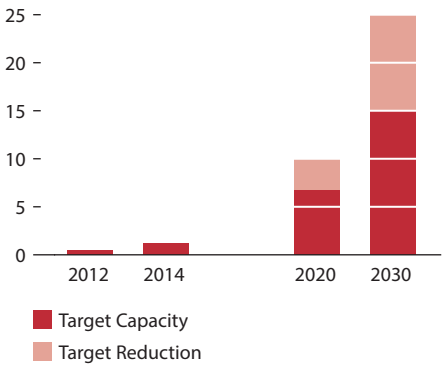
[1] The study refers to offshore wind parks as a "semi-private" projects, in contrast to projects by public procurement and PPPs. Investment in wind parks is by a private industry, but in a context of subsidies, incentive-based regulation (feed-in tariffs) and a regulated part of the value chain (grid connection). By selecting offshore wind parks, the study intends to learn about risks and responsibilities in a constellation with various private and public share- and stakeholders involved.

[2] This number is based on publications of a platform of the transmission service operators („Netztransparenz"). They estimate the compensation charges („Offshore Haftungsumlage") have been €295 million in 2013, €762 million in 2014, and €491 million in 2015.

Cumulative installed capacity, 2008–2014



Actual installed capacity vs. expansion target



Figures 1: Offshore Wind Power Capacity Development
Source: Deutsche Wind Guard (2015)

Operational offshore wind parks in Germany

Offshore wind Park name	Capacity (in MW)	Start of construc-tion	Time delay (months)	Planned cost (million)	Final cost (in million)	Cost Overrun (in %)
Alpha Ventus	60	Aug 2007	12	190	250	32
Baltic 1	48	Jul 2009	6	200	200	0
BARD I	400	Jun 2009	24	1500	2900	93
Nordsee Ost	295	Jul 2012	18	1000	1130	13
Borkum Riffgat	108	Sep 2012	6	480	480	0
Global Tech I	400	Aug 2011	12	1600	1800	13
Meerwind Süd/Ost	288	Sep 2012	18	1200	1300	8
DanTysk	288	Dec 2012	6	1000	1000	0
			Ø 13	Additional cost (Σ): 1890		Ø 20

The study looked at four wind parks in-depth to gain better insights into patterns and causes for time delays and cost overruns. Alpha Ventus was the first offshore wind park in Germany, with construction start in 2007. BARD 1 was the first larger park planned. Nordsee Ost is an example of an infant industry facing many challenges, such as technological and political difficulties. Riffgat is an example for grid connection problems and compensation charges.

Four in-depth case studies: Key factors explaining time and cost overruns

Name	Key factors
Alpha Ventus (Pilot Project)	» Pioneer risks of technology (unknown factors such wind strength, capacity and transmission). » Challenging installation logistics and maintenance far off coast. » Project management within a consortium of three firms had coordination problems and unclear responsibilities.
BARD 1	» Isolation from industry development: in-house operation of turbine manufacturing, steel construction, logistics and installation instead of contracting out. » The planners underestimated technological and financial challenges. » Firm declared insolvency and a subsidiary of a big bank took over; not operational to date because of transmission problems.
Nordsee Ost	» Supply chain and logistics bottlenecks, especially due to insufficient maritime infrastructure » Strongly delayed grid connection due to challenges of construction of converter platform and transmission » Regulatory uncertainty due to the liability-question led to a dispute between the wind park developer and the TSO.
Borkum Riffgat	» TSO had to pay €100 million for removal of underwater wartime material and compensation for forgone revenue » Inaccurate risk assessment before construction of grid connection.

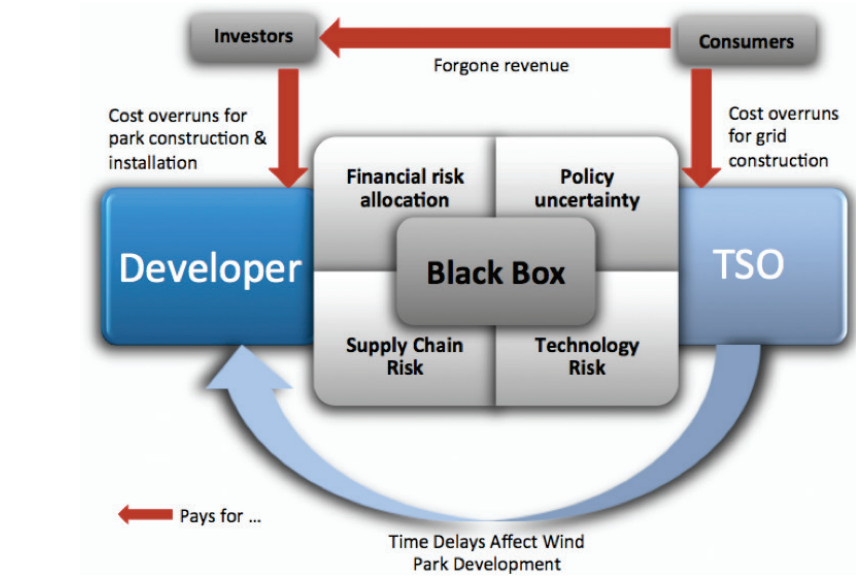


Figure: Governance model for the risk allocation between developer and TSO

Explanations

(1) Pioneer challenges: The industry faced significant technological challenges, supply chain bottlenecks, insufficient finance and policy uncertainty.

» Technology: first-time use of offshore converter platforms, underwater cables, direct current (DC) instead of alternating current (AV) transmission-to-grid.
» Supply chain: insufficient maritime infrastructure, installation challenges further offshore and in deeper water than e.g. in the UK, insufficient supplier market.
» Finance: TSOs needed secured finance for parks to invest in grid construction, but the investors wanted secured grid connection to invest in park (hen-egg problem); high capital investment initially too risky for big banks and utility firms.
» Policy uncertainty: questions of liability, spatial planning, sufficient feed-in-tariffs unclear.

(2) Governance issues: The energy governance model between wind park developer and TSO faces significant problems. The wind park developer, incentivized by feed-in-tariffs, is responsible for construction (e.g. procurement and installation of wind turbines and foundations) of the park. The TSO, regulated by the government, is responsible for the grid connection (e.g. construction of converter platforms and transmission). The wind park developers suffered time delays of grid connection by the TSO and demanded compensation for the "forgone revenue" from electricity generation. This so-called "interface" or "Black Box" problem led to various interface challenges (see Graphic 2).

Recommendations

Cost overruns and time delays for construction and installation of offshore wind parks are manageable issues as the industry is maturing. But the impact of cost overruns and time delays in grid connection and expansion is underexplored. We recommend:

» To strengthen coordination between TSOs, wind park developer and supplier industries.

» To coordinate with governments of North Sea countries to enable long-term planning, share best practices and develop trans-national scenarios for offshore wind and grid expansion and interconnection (e.g. North Seas Countries Offshore Grid Initiative).

» To develop a policy framework for the expansion of offshore wind after 2020 that enables investment security, competitiveness and regulatory coherence.

- To identify potential problems and find better solutions, the Federal Ministry for Energy and Economy should order a study on impacts of time delays and cost overruns in grid contruction on total costs of offshore wind expansion.

- To avoid further ad hoc measures, an independent auditor should assess potential sources of time delays and cost overruns, develop accurate estimates for financial contigency budgets as well as risk insurance models.

Authors

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Further Information

The detailed working paper and case studies are available for download at **www.hertie-school.org/infrastructure**. A book publication is forthcoming.

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