# INDUSTRY OVERVIEW

The Wind Energy Industry in Germany





# GERMANY'S ENERGIEWENDE – TRANSFORMING ENERGY SUPPLY

During the first half of 2014, renewable energy sources were the most important source for electricity in Germany – outstripping lignite for the first time. They produced 81 billion kWh (equivalent to 31 percent of generated electricity). The lion's share (26.7 billion kWh) of the power produced was wind generated. This milestone demonstrates that Germany's *Energiewende* or "energy transformation" is well underway, creating attractive investment opportunities and markets for green energy technologies. The German government's 2010 "Energy Concept" has identified an 80 percent reduction in greenhouse gas emission levels by 2050 (relative to 1990 levels) and an 80 percent renewable energy share of the power mix. Revisions to the renewable energies sources act in 2014 saw the German government introduce the ambitious target of covering 40 to 45 percent of electricity demand through renewable energy sources in 2025. This renewable electricity share is primarily supplied by wind energy, which with more than 34 percent of renewable production, constitutes the largest share of all renewable technologies. Germany's energy policy has placed the country at the global forefront of green-house-gas emission reductions and installed renewable energy share.

448

Finland

4,470

Sweden



# EUROPE'S LARGEST WIND ENERGY MARKET

In 2013, Germany was able to strengthen its leading position as Europe's largest wind energy market. By the end of 2013, 3.2 GW of new capacity was added, creating a total installed capacity of 34 GW (equivalent to an increase of around 33 percent in erected turbine capacity compared to 2012). Globally, Germany ranks third in terms of overall capacity, directly after China and the USA with respective installed capacities of 91 GW and 61 GW. Thanks to the continued expansion of wind energy projects, 8.9 percent of the electricity consumption in Germany is already being supplied by wind farms across the country (53.4 billion kWh in 2013). This is equivalent to the energy requirements of more than 15 million average households in Germany.

#### **DEVELOPING OFFSHORE MARKET**

The offshore wind energy sector is gaining momentum. As of July 2014, ten offshore wind farms with a capacity of over 2.3 GW were under construction with more preparing for construction in 2015. According to the Federal Maritime and Hydrographic Agency, the pipeline of approved wind farms currently under construction or in the planning phase is 9 GW. This makes the offshore industry an attractive field of investment for the years ahead.

#### **GROWING ONSHORE MARKET**

In recent years, German wind energy sector development has been driven by a strong onshore market. By the end of 2013, some 23,645 turbines were already installed in Germany. To encourage further growth, the federal states are cur-



#### GERMANY'S WIND MARKET: STATE OF PLAY AND DEMAND OUTLOOK

#### **OFFSHORE INDUSTRY**

- Status Quo: Groundbreaking offshore wind farm project pipeline
- Potential: Supply chain optimization and standardization
- Potential: Innovative service and logistical solutions
- Potential: Subsea installation and O&M concepts
- Potential: Safety training for maritime and wind industry personnel

#### INLAND DEVELOPMENT

- Status Quo: Expansion of wind priority zones in mid and southern federal states
- Potential: Technology and services for low wind speed sites and complex terrain

#### REPOWERING

Status Quo: Renewed development opportunities for wind rich sites

#### **GRID EXPANSION**

- Potential: Expansion of the transmission grid
- Potential: Installation of offshore grid connections (HVDC/HVAC)
- Potential: Optimization of the distribution grid

rently evaluating further sites for wind energy deployment. Federal states in central and southern Germany, where only a few wind energy projects have been realized to date, have especially intensified their efforts to increase wind power share. Wind power generation in Germany can look back on a history of more than 20 years as the foundation for renewable energy sector growth. Accordingly, the number of older generation turbines still in operation is considerable. Replacing these older turbines with more efficient, state-of-the-art wind turbines is becoming a major trend. In 2013, one quarter of all newly installed turbines were already classified as being "repowering" projects. Repowering allows wind farm power generation to be significantly increased, even where there are fewer turbines deployed on the site.

## **GERMAN ONSHORE WIND MARKET**

#### **GLOBAL MARKET DEVELOPMENT**

Germany ranks second after China in global terms, with expansion of 3.2 GW and newly installed capacity of around 16 GW in 2013. Within the European Union (EU), wind energy deployment in terms of installed capacity grew by 11 percent in 2013 - equivalent to a total investment volume of EUR 12.5 billion. Germany, the UK and Italy notwithstanding, growth in Europe was largely driven by emerging eastern European economies including Poland and Romania.

#### LEADING MARKET AND INDUSTRY

The domestic market represents a stable environment for wind industry development. In Germany, the wind energy industry is calling for EUR 8.2 billion of investment, along with an investment demand of EUR 1.2 billion

in operating performance. The German wind industry is not solely dependent on the presence of a strong domestic market, but also profits from the global expansion of wind-power generation. In 2013 the export quota of the German wind sector reached 67 percent. Thanks to its central position in Europe and its excellent logistics infrastructure, Germany is optimally situated to cater to the emerging wind markets in Eastern Europe.

Of global EUR 59.2 billion wind energy industry turnover generated in 2012, German wind-energy turbine manufacturers generated a production value of around EUR 6.3 billion - equivalent to approximately 11 percent of global turnover for the year. Germany therefore plays, and will continue to play, a decisive role in meeting global and European demand for wind-based power generation.

#### REPOWERING

Germany has been a pioneer in wind energy turbine development and deployment since the early 1990s. Firstgeneration turbines with nominal capacities of 300 kW and up to 1,500 kW were erected in the 1980s and late 1990s respectively. Evolved technology allows turbines installed in 2013 to achieve an average nominal capacity of 2,598 kW onshore.

Improved energy generation in modern turbines has made it economically viable to replace older turbines after an average run-time of just ten years. At the end of 2013, around 14,250 turbines were ten years or older, thereby creating repowering opportunities at wind-rich sites. Most of the older wind farms were actually built in prioritized zones for wind energy so that the future use of these sites would be secured. The German Wind Energy Association (BWE) expects an annual market of 1 GW (turnover of EUR 1.5 billion) in the years ahead.

#### **1** SCHLESWIG-HOLSTEIN

3,897 MW installed wind capacity in 2013. By 2020, the state expects a share of 300-400% of renewable energy (RE).

#### **2** NIEDERSACHSEN

With 7,746 MW installed wind capacity and its strong wind energy industry, it ranks first among the federal states. By 2020, it plans to have built an additional 7,500 MW of onshore wind energy plants.

#### **8** NORTH RHINE-WESTPHALIA

3,414 MW installed wind capacity in 2013. The state plans to increase the share of wind energy from 3% to 15% by 2020.

#### **4** RHEINLAND-PFALZ

2,303 MW installed wind capacity in 2013. By 2030, the state plans to supply its complete energy demand from RE. Wind energy is planned to be increased to 4,800 MW.

#### 5 SAARLAND

166 MW installed wind capacity in 2013. By 2030, the state plans to meet 20% of its energy demand from RE.

#### **6** BADEN-WÜRTTEMBERG

533 MW installed wind capacity in 2013. By 2020, the state plans to supply at least 10% of its energy demand from RE.

#### HESSEN

973 MW installed wind capacity in 2013. By 2020, the state plans to supply 20% of its power consumption from RE. Consumers will be supplied with 7,000 GWh wind power annually.



## 8 MECKLENBURG-VORPOMMERN

Over 40% of the state's electricity consumption is supplied by wind energy. By 2050, it plans to meet its complete energy demand from RE.

# **9** BRANDENBURG

## 10 SAXONY-ANHALT

gross energy demand.

**SAXONY** 

12 THURINGIA

# 13 BAVARIA

4

#### INLAND LOCATION DEVELOPMENT

Increasingly more sites for wind energy deployment are being developed in middle and southern Germany. This is creating new opportunities for the specialized technology and services required for more demanding sites with lower wind speeds. These include, for example, modern multi-watt systems with high towers of up to 160 meters in height and large rotors with a diameter greater than 120 meters. Most of the inland locations suitable for wind energy deployment are situated in hilly, wooded terrain. Highly specialized expertise is therefore required for wind measurement or erection of wind turbines in complex and environmentally sensitive terrain.

With 5,047 MW installed wind capacity, around one third of the electricity demand is produced from wind power. By 2020, the state plans a further expansion of RE up to one fifth of primary energy demand -50% of which will be supplied by wind energy.

The cumulated wind energy capacity increased from 500 MW to 4,048 MW within 13 years. By 2020, the state expects a capacity expansion of up to 6,000 MW. Wind energy would then supply more than half of its

1,039 MW installed wind capacity in 2013. Saxony plans to meet 24% of the energy demand by 2020 – with 2,530 GWh from wind energy.

993 MW installed wind capacity in 2013. By 2020, the state plans to meet 30% of its energy demand from RE.

With 872 MW installed wind capacity, wind energy contributed 1.4% to the total electricity generation in 2012. By 2020, the state plans to supply 30% of its electricity consumption from RE.

# OFFSHORE WIND STATUS QUO

From a global perspective, Europe is the leading market for the deployment of offshore wind energy plants with 90 percent of global cumulative offshore wind capacity. By the end of 2013, offshore turbines with a capacity of 6,600 MW had already been connected to the grid in Europe. China and Japan are the only countries outside of Europe to have realized offshore wind projects to date. The countries most involved in the European market are Germany, the UK, Denmark, and Belgium.

#### THE GERMAN MARKET

As of July 2014, ten projects with a capacity of over 2.5 GW were under construction, with more planned to enter the construction phase in 2015. Construction of the Riffgat wind farm (108 MW) was finished in July 2013, closely followed by BARD Offshore 1. This is the largest wind farm currently operating in German waters with a total capacity of 400 MW. Eighty turbines were installed 100 km northwest of the German island Borkum in 40 meter deep water. The parks join the North Sea test wind farm alpha ventus (60 MW), and Baltic Sea wind farm Baltic 1 (48 MW) which began operating in 2010 and 2011 respectively. To date, offshore wind turbines with a capacity of 628 MW are in place in the North Sea and the Baltic Sea and feeding power into the grid. In total, thirty-one offshore wind farms in the German North Sea and another six projects in the Baltic Sea were formally approved by January 2014. With a 30 percent share of all consented European offshore wind farms, Germany possesses the highest potential for the development of offshore in the years to come.



Erection of tripod foundations with the crane ship INNOVATION in the Global Tech I North Sea wind farm

# SECURE GRID CONNECTION LEGISLATION

In 2013 the German government implemented two new amendments to the energy industry law (EnWG) to secure offshore wind farm grid connection. The first component of this legislation requires transmission system operators (TSOs) in Germany to annually prepare a legally binding offshore grid development plan. The plan contains a reliable roadmap for the construction of grid connection systems including connection date, wind farm cluster connection sequence, and capacities of the grid systems.

In January 2013 the German government also introduced new liability rules for offshore wind grid connections. According to the amendment, Germany's TSOs have to compensate the wind farm operators financially if they fail to complete grid connections in time, in turn delaying the energy production of the offshore wind farms. This compensation adds up to 90 percent of the unrealized statutory tariff beginning on the eleventh day of interruption. Both of the newly implemented measures help to create planning security for future and ongoing offshore wind projects, raising investor confidence along the entire supply chain.

# INFRASTRUCTURE AND ECONOMIC ADVANTAGES

Germany's offshore wind industry has access to an excellent and wellconnected infrastructure along both its North Sea and Baltic Sea coastlines.

#### UNIQUE LOCATIONAL ADVANTAGE

Offshore wind industry companies based in Germany find themselves in a strategically favorable position; one in which they can cater to both German and other European offshore wind farm projects, many of which are located near the German coastline.



According to European Wind Energy Association (EWEA) statistics, 72 percent of all European offshore wind energy capacity installed in 2013 is located in the North Sea and 22 percent in the Baltic Sea. This gives Germany and its northern federal states of Niedersachsen, Bremen, Hamburg, Schleswig-Holstein, and Mecklenburg-Vorpommern a decisive locational advantage thanks to long coastlines along both seas.

#### SOPHISTICATED PORT INFRASTRUCTURE

Germany's ports all along the coasts are ideally prepared to meet the requirements of the heavy offshore industry as well as the related service industry. European Union and federal state level authorities and private companies alike have invested in port infrastructure such as terminals, quayside production sites and heavy load quays. As can be seen from the map of harbors and offshore wind farms above, German port infrastructure covers all important functions to perfectly cater to offshore wind farms in the sea.

#### DIVERSE INDUSTRIAL BASE AND SKILLED LABOR POOL

The German offshore industry profits from a well-established supply chain; not only along the coastline but also in the industrialized inland where the traditional machinebuilding industry is based. Around 50 percent of the turnover in the German offshore industry is generated in the inland federal states of Bavaria, Baden-Württemberg and North Rhine-Westphalia where most suppliers are situated. The extensive industrial value chain is a key factor to wind energy's success in the country. Germany's offshore wind industry is also a significant driver of employment across the country. Approximately 18,000 people are currently engaged in the offshore wind industry as engineers, metal construction and electrical engineering technicians, biologists, meteorologists, and skippers as well as industry climbers and divers. According to the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMU), some 117,900 people were directly employed in the German wind industry in 2012. To this end, specialized training and qualification measures are important to providing the gualified manpower needed for ongoing offshore wind energy expansion.

# RENEWABLE ENERGY SOURCES ACT (EEG)

Ratified in 2000, the Renewable Energy Sources Act (EEG) has been the main driver for renewable energy growth in Germany. Since its introduction, the act has prompted the rapid expansion of renewable energies in Germany by establishing a secure financial environment. Germany's progressive renewable energy policy has been taken up as an energy policy example in over 60 countries around the world.

Since its ratification, the EEG has been adapted several times in order to meet changing market conditions. The latest revisions came into force on August 1, 2014. The changes made will provide the necessary background for reaching the new ambitious goal of a 40 to 45 percent share of electricity production through renewable energy sources by 2025 as well as further integrate renewable energy into the market.

Fixed feed-in tariffs have been abolished, with the direct marketing of renewable electricity becoming mandatory for most renewable energy plants. In order to ensure an adequate level of generated income, a market premium is granted on top of the electricity price realized by the producer. The market premium consists of the difference between the fixed statutory tariff of the renewable energy plant and the monthly average electricity price in the spot market. For the future, a tendering procedure - which will be part of a further legislative initiative - is planned to determine tariff levels. An extension corridor for onshore wind has been put in place to manage expansion.

#### Fixed Statutory Tariffs for Wind Energy

	Onshore	Offshore	
Year of commissioning	2014	2015	
Initial tariff	8.9 ct/kWh minimum first 5 years	15.4 ct/kW minimum first 12 year <b>o</b> 19.4 ct/kW	
		first 8 years*	
Basic tariff	4.95 ct/kWh	3.9 ct/kWh	
Degression for later commissioning date	0.4% every 3 months, starting January 2016. Degression is higher or lower if extension corridor is not met.	0.5 ct/kWh en January 1, 2018 1 ct/kWh en January 1 2020 0.5 ct/kWh annual degression, starting 2021 <b>or</b> 1 ct/kWh en January 1, 2018	

\*available until December 31, 2019

Source: Renewable Energies Sources Act (EEG) 2014; Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, 2014

The annual extension for onshore wind will be 2.5 GW plus capacities from decommissioned plants. In the offshore sector, the target has been set at 6.5 GW in place in 2020 and 15 GW in 2030.

#### **ONSHORE WIND REMUNERATION**

The previous method of remuneration via feed-in tariff has been replaced by specific statutory tariffs for all renewable electricity sources, to be reached by granting a market premium to the operator on top of the achieved electricity price. The tariffs are fixed for 20 years plus the year of commissioning, thus providing a secure investment basis for the lifespan of all renewable electricity plants. For onshore wind plants, the EEG defines an initial tariff rate of 8.9 EUR ct/kWh for a period of at least five years. This period will be extended according to location and reference yield; thereafter, the final tariff of 4.95 EUR ct/kWh is set in place for the time remaining. The tariffs will decrease in accordance with a fixed degression rate.

The amount of degression is 0.4 percent every three months, starting January 2016. The degression is higher or lower subject to the extension corridor of 2.4-2.6 GW being met.

#### **OFFSHORE WIND REMUNERATION**

The initial EEG tariff in the offshore sector is equivalent to 15.4 EUR ct/ kWh for the first 12 years. A second option, the so-called acceleration model, is available for installations commissioned before January 1 2020 at a fixed rate of 19.4 EUR ct/ kWh for the first eight years. These time frames will be extended subject to installation water depth and distance to the shore. The tariff for the extension is 15.4 EUR ct/kWh. thereafter the final tariff amounts to 3.9 EUR ct/kWh. For the former option, an annual degression rate of 0.5 EUR ct/kWh is applicable to installations commissioned in 2018, followed by a degression of 1 EUR ct/ kWh in 2020, and 0.5 ct/kWh in 2021 and thereafter. The acceleration model tariff level will also be reduced to 18.4 EUR ct/kWh in 2018.



# BRINGING DOWN ENERGY COSTS

German renewable energy legislation was enacted to contribute to climate protection by reducing  $CO_2$  emission levels. However, it also strives to lower the cost of renewable energies in order to make them competitive with conventional energy sources.

#### **APPROACHING GRID PARITY**

The onshore wind energy industry in Germany has drastically reduced its costs over the past decade and now boasts the lowest electricity production cost levels of all renewable energy sources. At sites with favorable wind conditions (e.g. 2,700 fullload hours), levelized costs of energy (LCoE) of around 4.4-5.4 EUR ct/ kWh are achievable - slightly less than many fossil fuel power plants. As such, onshore wind energy has almost reached grid parity; the condition where renewable electricity prices become equivalent with those of conventional power sources on the energy exchange market.

#### COST REDUCTION POTENTIAL

Despite recording more full-load hours than onshore wind, levelized cost of energy (LCoE) forecasts for offshore wind are still relatively high at around 11.4-14 EUR ct/kWh (based on an underlying calculation of 4,000 full-load hours). However, experiences from alpha ventus, the first offshore wind farm in the German North Sea, recorded greater than 4,400 full-load hours in 2011 and 2012. Moreover, the offshore wind industry is just beginning to climb the learning curve which has huge potential for cost reduction in all related fields. This creates market opportunities in the areas of logistics, turbine development, foundations, and other components. Policy makers, industry leaders and think tanks are also currently working together to create strategies to reduce the costs of offshore wind energy.

#### INNOVATIVE TECHNOLOGIES AND EFFICIENT LOGISTICS

The most notable development in the wind sector in recent years has been the falling cost of wind turbines. From 2009 to 2011, turbine prices fell by 24 percent with forecasts suggesting a continuing price decline.

Although the offshore sector still has higher technology costs, major cost reductions - of up to a third are foreseen as a result of R&D advances made by a number of big manufacturers. Major cost-cutting potential also exists in the offshore logistics sector - which can account for up to 25 percent of total project budgets. Savings potential, for example, can be found in optimized vessel design, innovative transport and installation concepts, and improved port logistics. The offshore foundation expects the overall cost of offshore wind to drop by around a third of current levels.

Demand also exists for technological innovations which further drive down costs in both the onshore and the offshore sectors. These include lightweight construction, new materials, automation and standardization of production processes, optimized tower construction, and new foundation structures. New innovations will be a key factor in securing the competitiveness of the wind energy sector in the coming years.

# RESEARCH & DEVELOPMENT

Intensive research and development efforts are required to achieve the ambitious targets to transform the German energy system set out in the Energy Concept. The interaction of universities, research organizations, industrial research and other actors constitutes a division of labor in the creation of value-added new knowledge without global comparison. Companies benefit from a dense and decentralized network of more than 400 universities and technical colleges. Some of the world's most renowned fundamental research institutes are also located in Germany. Many R&D financial support programs promote partnerships between different project partners - particularly enterprises and research institutes. As a result, a broad base of international investors in R&D underlines Germany's strong position. Around 85,000 people work in R&D in German subsidiaries owned by international companies.

#### **ONSHORE WIND ENERGY**

Germany is at the forefront in addressing the technological and societal challenges posed by onshore wind development. To take full advantage of onshore wind energy, turbines must reach higher altitudes and have longer turbine blades. The Rheinisch-Westfälische Technische Hochschule Aachen (RWTH) is currently working on a three-year project within the framework of the current Energy Research Programme to make this possible. Using aeroelastic analysis, they are working to develop improved structural design principles for the design of nextgeneration turbine blades.



Complete blade tests for rotor prototypes up to 90 meters in length speed up certification and market entry at the Fraunhofer IWES rotor blade testing facility in Bremerhaven

#### **OFFSHORE WIND ENERGY**

Academic institutions across Germany are also contributing considerable time and resources to the development of offshore wind technologies. The universities of Stuttgart and Oldenburg, for example, are developing lidar systems and monitoring procedures in the context of various R&D projects. These systems will promote improved performance and reliability for energy capture. The Technical University of Berlin is also working on a new installation process to install concrete foundations. The aim is to have a cost-efficient solution with low sound emissions.

One of the largest and most prestigious research institutions in Europe, the Fraunhofer-Gesellschaft, is home to numerous onshore and offshore wind technology R&D projects. Wind energy projects are currently funded within the framework of the 6th Energy Research Programme with EUR 22 million funding. One of the research institute's primary research areas is the effect of offshore climate on the construction and lifecycle of wind farms. For example, Fraunhofer is working to develop an integrated measurement system for autonomous and continuous monitoring of weather conditions experienced by offshore wind farms.

#### MARKET ENTRY OPPORTUNITIES – OFFSHORE TEST FIELD

The Fraunhofer Institute for Wind Energy and Energy System Technology (IWES) and the *Stiftung Offshore-Windenergie* (The German Offshore Wind Energy Foundation) established the Offshore Test Field Research Project. The primary goal of this project is to support the testing and demonstration of innovative technologies for offshore wind farms. Working in partnership with private organizations, the two institutions are currently working on a concept for the coordinated offshore test field research cooperation. They are actively seeking new partners involved in the offshore wind industry who are interested in testing their own prototypes and processes.

#### STRATEGIC PARTNERSHIPS – WINDFORS AND FORWIND NETWORKS

The WindForS program is a jointresearch effort between six universities and institutes in southern Germany including Karlsruhe Institute of Technology, the Center for Solar Energy and Hydrogen Research Baden-Württemberg, and the Universities of Aalen, Munich, Stuttgart, and Tübingen. Here a variety of core competencies are brought together in order to understand the principles of design, construction, and integration of wind farms. WindForS is working in research areas such as meteorology, soil mechanics, foundation engineering, measurement technology, and grid integration. Another such partnership is the ForWind Center for Wind Energy Research, which is an initiative of the universities of Bremen, Hanover and Oldenburg. The research being conducted here focuses in part on the early detection of damage in turbine-supporting structures. ForWind is also engaged in offshore wind research.

#### THE ENERGY RESEARCH PROGRAMME

Program launched by the Federal Ministry for Economic Affairs and Energy (BMWi), the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMU), and the Federal Ministry of Education and Research (BMBF).

#### SUPPORT

Applied research in environmentally friendly and innovative technologies; wind energy identified as one of the core areas for research promotion; special focus on renewable energy as a whole and battery systems.

#### WORKING BUDGET

Around EUR 1 billion per year

#### **ELIGIBILITY CRITERIA**

Commercial enterprises, universities and non-university research organizations registered in Germany who also intend to commercialize research results in the country are eligible for funding. Small and medium-sized enterprises (SMEs) as well as projects in cooperation with foreign partners are preferentially asked to participate.

#### **FUNDING PROVIDED**

Financial support is provided in the form of a non-repayable cash grant. Commercial enterprises can receive up to 50 percent reimbursement of their eligible expenses, with higher rates for SMEs possible.

#### **PUBLIC R&D SUPPORT**

As well as specific R&D funding opportunities, wind energy projects in Germany can count on numerous forms of financial support. There are many programs allocating R&D grants, interest-reduced loans and special partnership programs. Many of the programs are made available by the federal government but the federal states also offer special R&D programs. One significant program for wind energy R&D projects is the Energy Research Programme. The program provides funds in the form of cash grants. R&D incentives programs generally provide money for R&D project personnel expenditure. Other costs for instruments and equipment may also be eligible if they can be clearly assigned to the relevant R&D project.

Germany Trade & Invest's experts will be pleased to provide you with more information on R&D programs and models for financing R&D investments in Germany. **Please con**tact invest@gtai.com

# **GRID EXPANSION**

The fast-growing share of renewable energy in the German energy mix requires major investment in infrastructure. Because the availability of sun and wind for electricity production is volatile and not evenly distributed throughout the country, balancing supply and demand and avoiding bottlenecks is one of the main challenges facing energy providers. This is why Germany's federal network regulator has developed an electricity grid expansion plan. The current draft calls for 3,500 km of new transmission grid power lines at an estimated cost of EUR 21 billion to EUR 26 billion through to 2024. The primary objective is to bring wind energy from Germany's windy northern coastline and offshore wind farms to the industrial centers in the south.

#### **OFFSHORE GRID CONNECTIONS**

Most of the German offshore wind farms in the German North Sea are located more than 100 km off the coastline. For this reason, connections under the sea to the onshore grid are predominantly realized using high voltage direct current (HVDC) transmission in order to minimize transmission loss. Connection to wind farms in the Baltic Sea on the other hand is mainly carried out using alternating current (AC) technology due to shorter distances to the coast.

HVDC transmission is a new area of application with only a few players currently participating in this demanding market. Innovative and cost-reducing solutions are required, for instance, in terms of improved cable technology and cable laying. This area offers especially attractive business opportunities for companies with offshore experience in the oil and gas sector.



60 kilometer-long three-phase subsea power cable weighing 3,500 tons connects the first German offshore wind farm alpha ventus to the German power grid

#### **OFFSHORE GRID INVESTMENT**

In the 2014 draft offshore grid development plan, TSOs forecast a required investment volume of up to EUR 23 billion to finance the construction of power lines in the North and Baltic Seas until 2024.

Tennet, the TSO in charge of connecting the offshore wind farms in the North Sea to the onshore grid, increased its planned investment amount for the German offshore grid by EUR 3 billion to more than EUR 10 billion. In January 2013, Mitsubishi Corporation announced its investment in four grid connection projects with Tennet. Ten transmission cable systems with a capacity of 7.4 GW are currently under construction or in late development in the German North Sea (at the time of writing, 1.8 GW were tendered). In the Baltic Sea, TSO 50Hertz is currently working on the grid connection system to the offshore wind farm Baltic 2.

# **INVEST IN SUCCESS**

Germany Trade & Invest looks forward to helping your company make a successful investment in the wind energy industry. Here you can benefit from the achievements already realized by companies like Falck Safety Services.

#### FALCK SAFETY SERVICES

Falck Safety Services is a Denmarkbased company providing training for oil & gas, shipping, military defense, aviation, and wind industries worldwide. Around the globe, Falck operates over 30 training centers in the oil & gas and offshore wind sectors.

Encouraged by the prominent offshore wind market in Germany, Falck decided to establish its first training center exclusively focusing on wind energy. The training center opened in Bremerhaven in July 2011 with Falck centrally located among its customer base. Offshore wind companies are densely situated around Bremerhaven; both as manufacturers and as service and maintenance providers. Falck also benefits from modern and reliable infrastructure and is situated directly adjacent to water. A former shipyard was rebuilt and a dock was flooded to meet the company's requirements. The resulting training center is extensive, consisting of facilities including a pool, wave machine, environmental simulator, realistic climbing facility, and fire simulator. These new facilities were established in just six months thanks to intensive support from the local economic development agency.



Falck Safety Services' facility in Bremerhaven

Falck's investment in Germany is already paying off. To date, the company has provided training to around 9,000 offshore wind industry employees. The initial staff of five employees has already doubled and the company is still hiring to meet demand. Falck Safety Services employs instructors from the emergency services, and counselors with relevant experience with a strong foundation in external professional and academic environments.

With offshore wind development well underway in Germany, this progress marks the beginning of the Falck Safety Services story in Germany. The company predicts an extremely positive wind industry market outlook with no foreseeable barriers to growth.

#### WRITE YOUR OWN SUCCESS STORY

Germany is the premier business location for the offshore wind industry. With dynamic R&D projects, clear economic potential, and unparalleled governmental support, there has never been a better time to invest in Germany. The offshore wind industry is still in its infancy, with no shortage of opportunities for new partners to enter the market.

# GERMANY TRADE & INVEST HELPS YOU

Germany Trade & Invest's teams of industry experts will assist you in setting up your operations in Germany. We support your project management activities from the earliest stages of your expansion strategy.

We provide you with all of the industry information you need – covering everything from key markets and related supply and application sectors to the R&D landscape. Foreign companies profit from our rich experience in identifying the business locations which best meet their specific investment criteria. We help turn your requirements into concrete investment site proposals; providing consulting services to ensure you make the right location decision. We coordinate site visits, meetings with potential partners, universities, and other institutes active in the industry.

Our team of consultants is at hand to provide you with the relevant background information on Germany's tax and legal system, industry regulations, and the domestic labor market. Germany Trade & Invest's experts help you create the appropriate financial package for your investment and put you in contact with suitable financial partners. Incentives specialists provide you with detailed information about available incentives, support you with the application process, and arrange contacts with local economic development corporations.

All of our investor-related services are treated with the utmost confidentiality and provided free of charge.

## STRATEGY

**EVALUATION** 

#### **DECISION & INVESTMENT**

#### **PROJECT MANAGEMENT ASSISTANCE**

Business oppor- tunity analysis and market research	Market entry strategy support	Project partner identification and contact	Joint project management with regional develop-	Coordination and support of nego- tiations with local
	/		ment agency	authorities
/	/		/	/

#### LOCATION CONSULTING /SITE EVALUATION

Identification of project-specific	Cost factor analysis	Site preselection	Site visit organization	Final site decision support
location factors				

#### SUPPORT SERVICES

/ / financial partners / / formalities	Identification of relevant tax and legal issues	Project-related financing and incen- tives consultancy	Organization of meetings with legal advisors and financial partners	Administrative affairs support	Accompanying in- centives application and establishment formalities
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#### About Us

Germany Trade & Invest is the foreign trade and inward investment agency of the Federal Republic of Germany. The organization advises and supports foreign companies seeking to expand into the German market, and assists companies established in Germany looking to enter foreign markets.

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