



INTEGRATING LARGE SHARE OF FLUCTUATING POWER SOURCES INTO POWER ELECTRIC SYSTEMS

Impact on the Development of Transmission Networks

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CIGRE 2008 Opening Panel
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Wind Power Installed in Europe by end of 2007

Total Europe :

57 126 MW

- **Germany: 22 GW**
(peak load 78 GW)
- **Spain: 15 GW**
(peak load 42 GW)



Source EWEA

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Wind Power Development drivers in Europe

❖ **European Policy objectives in 2001:**

➤ 21 % of electricity consumption from renewable energy sources (RES) in 2010

❖ **New European objectives :**

➤ Share of RES in the EU final energy consumption reaches at least 20% by 2020

- National overall targets for each member state

- Electricity from renewable :

 - develop grid infrastructure to accomodate further developments of electricity from RES

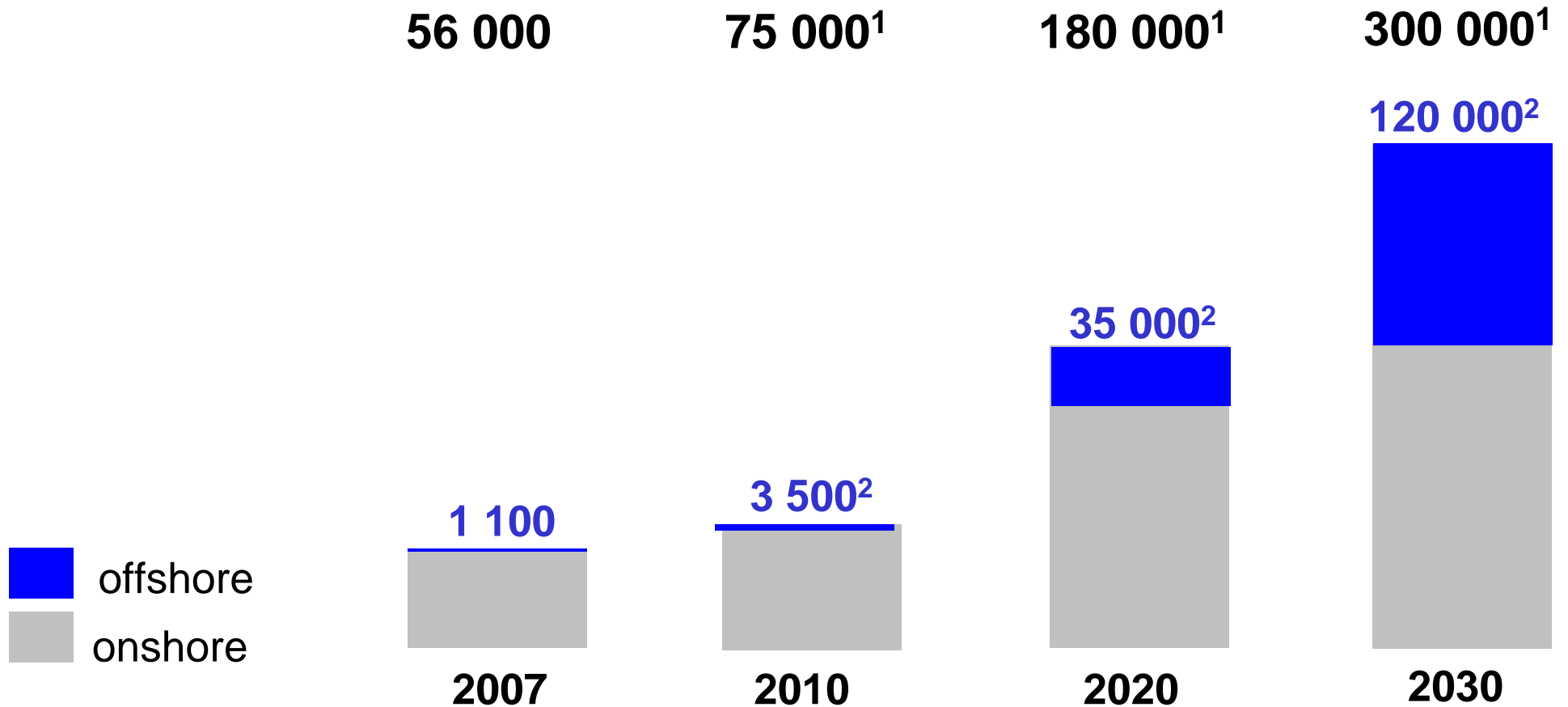
 - guarantee transmission of electricity produced from RES

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Wind Power Development Possible scenario for Europe



¹ EWEA 2008 Targets ² EWEA 2008 Projections
European Wind Energy Association

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Impact on network development needs in the short term

- ❖ **Wind power is largely concentrated in some regions which were beforehand “electrical deserts”**
 - **need of new links for connection to the main grid**

- ❖ **Wind power substitutes thermal units located closer to the loads**
 - **changes of usual flows**
 - **need of reinforcements of main grid**
 - ❑ **the German example**

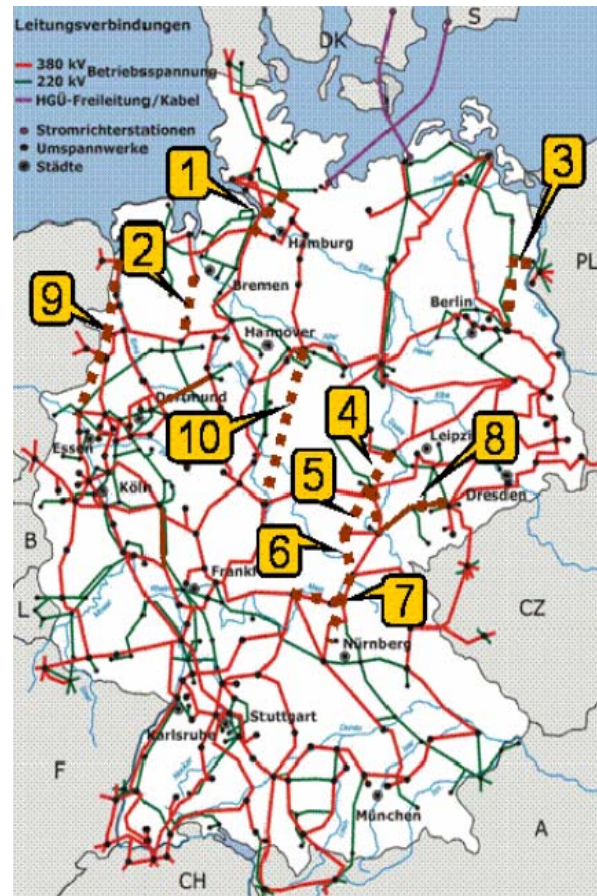
Example of the German network: the Dena Grid Study

❖ Around 37 GW wind capacity expected in 2015

❖ Grid extensions necessary

- 850 km of new 380 kV lines
- 400 km of existing 380 kV to be upgraded
- new components for active power flow control and reactive power compensation

A total cost of €1.1 billion



Until 2010: 460 km

- | | |
|--------------------------------------|--------|
| 1) Hamburg/Nord – Dollern | 45 km |
| 2) Ganderkesee – Wehrendorf | 80 km |
| 3) Neuenhagen – Bertikow / Vierraden | 110 km |
| 4) Lauchstädt – Vieselbach | 80 km |
| 5) Vieselbach – Altenfeld | 80 km |
| 6) Altenfeld – Redwitz | 60 km |
| 7) Netzverstärkung Franken | |
| 8) Netzverstärkung Thüringen | |

Until 2015: Additional 390 km

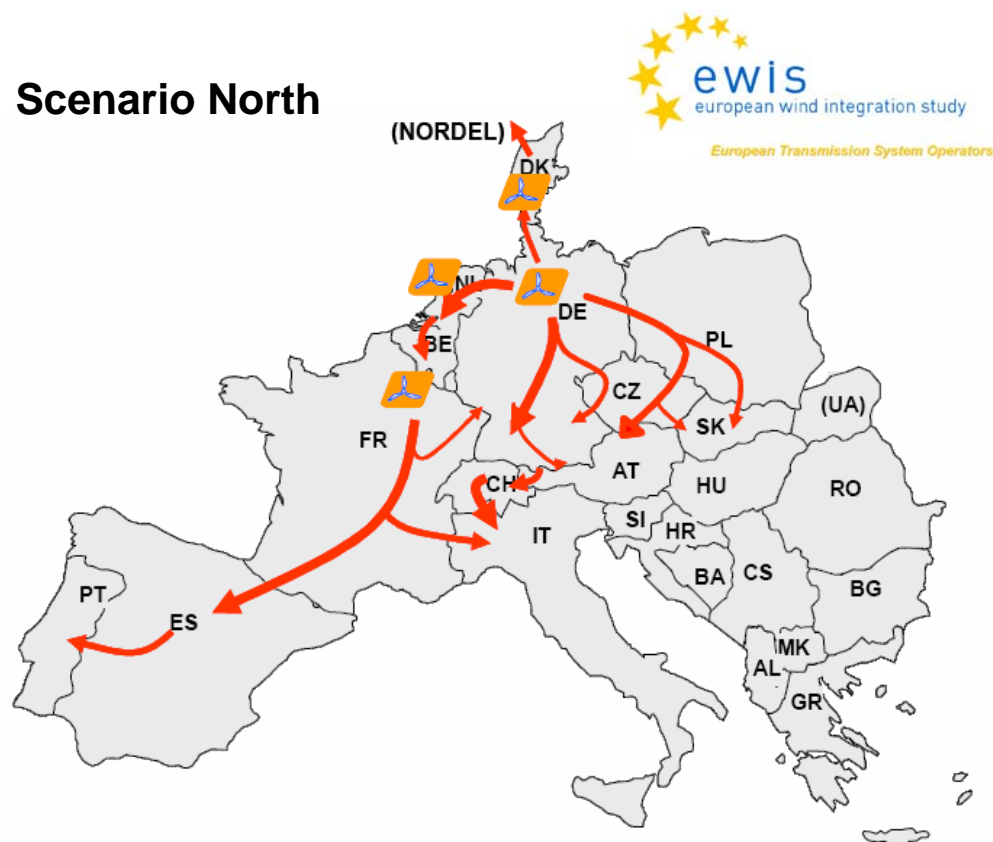
- | | |
|------------------------|--------|
| 9) Diele – Niederrhein | 200 km |
| 10) Wahle – Mecklar | 190 km |

Impact on network development needs in the short term

❖ at the European System scale

- Originates large load flows which affect neighbouring transmission systems
- Creates grid congestions and bottlenecks at European level
- Fluctuations reduce available cross border trading capacities

**Reinforcement of
interconnections needed!**





A new era for network development !

❖ Wind power development comes in addition to a more global change of generation mix

- End of over capacities
- Closure of oldest thermal units due to environmental constraints
- Move to gas
- European Market development



At UCTE level : €17 Billions for the next 5 years

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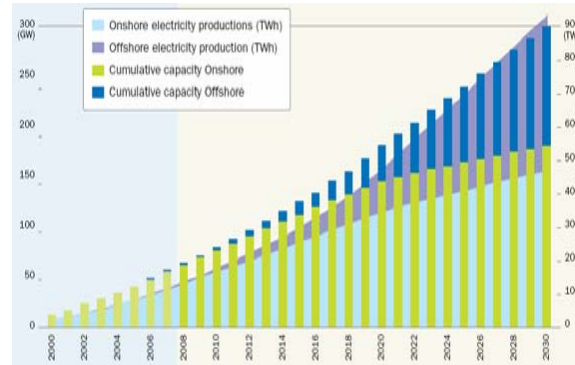
Main challenges : delivering investments in due time !

Wind Power development

Fast growth

Political support

Projects developed within short delay



Grid development

Time-consuming licensing procedures

Lack of political support

Uncertainties



- Speed up the authorization process
- Coordinate grid and (wind) power plant authorization procedures
- Work towards harmonised procedures

But more and more pressure towards innovative solutions including undergrounding

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Main challenges : Integrate the European dimension !

❖ From collection of national thinking towards European thinking....

➤ Stronger coordination between TSOs

- Common scenarios
- Common methodology
- Shared identification of the constraints
- Common assessment of the projects
- Consolidated list of projects

➤ First steps

set up organisational framework : regional coordinated planning groups within TSOs associations (next future ENTSOe)

➤ First results

- System Adequacy Forecast at regional and European level
- Transmission Development Plan at regional level (Nordel, UCTE...)
- Dedicated studies : EWIS...

❖ 20 to 40 GW in 2020

❖ Mainly concentrated in North Western Europe

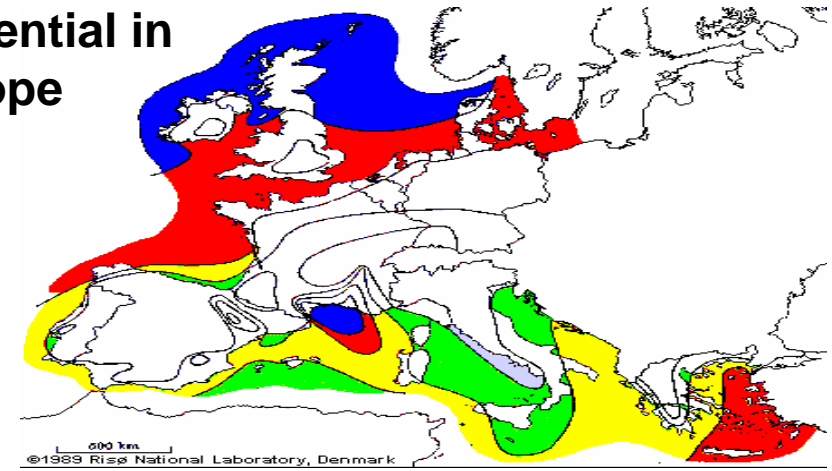
➤ How to design off-shore networks?

❖ Collection of connections to mainland ?

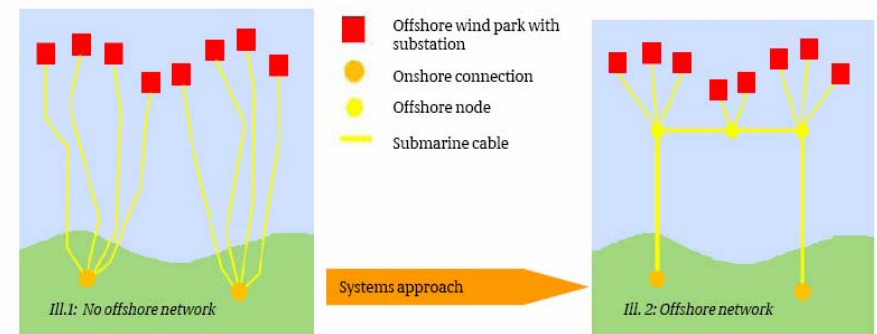
❖ Real offshore grid ?

➤ Wich coordination with on-shore grid developments ?

Wind potential in Europe



Cable spaghetti or offshore network.



The new Infrastructure Planning Acceleration Act promotes coordinated network planning. The cables can be bundled at sea and brought to land en bloc.



Towards a re-engineering of the European Power System?

❖ **Technical challenges**

➤ **Define basic technical principles**

- **respective part of AC and DC**
- **feasibility of DC multi-terminal links**
- **evolution towards DC networks**
- **flexibility**
- **reliability**
- **control....**

➤ **Consequences on on-shore grid development and operation**

- **Concentrated large intermittent infeeds**
- **Coordinated plan at European level ?**

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Towards a re-engineering of the European Power System?

❖ Offshore grids legal and regulatory issues

- Role of TSOs :
 - Owner ?
 - Operator ?
- Harmonisation of rules at European level ?

❖ Economical and financial matters

- How to finance ?
- How to recover the costs?
- Who will at the end support the costs?
- Are they compatible with a competitive economy?



To Conclude



- ❖ Onshore and offshore wind power development, in addition to renewal of thermal generation fleets, let the **European grid enter into a new era**
- ❖ Strong **TSO coordination** is a prerequisite to develop an adequate European grid
- ❖ **Speeding up the approval procedures** for new grid infrastructure is a condition to meet the energy policy objectives
- ❖ However **innovative solutions** including **under-grounding** will be required by external stakeholders
- ❖ **Offshore grids open new frontiers** for the electricity industry...
- ❖ ...but a lot of **issues** still need **to be examined** (regulatory, financial..)

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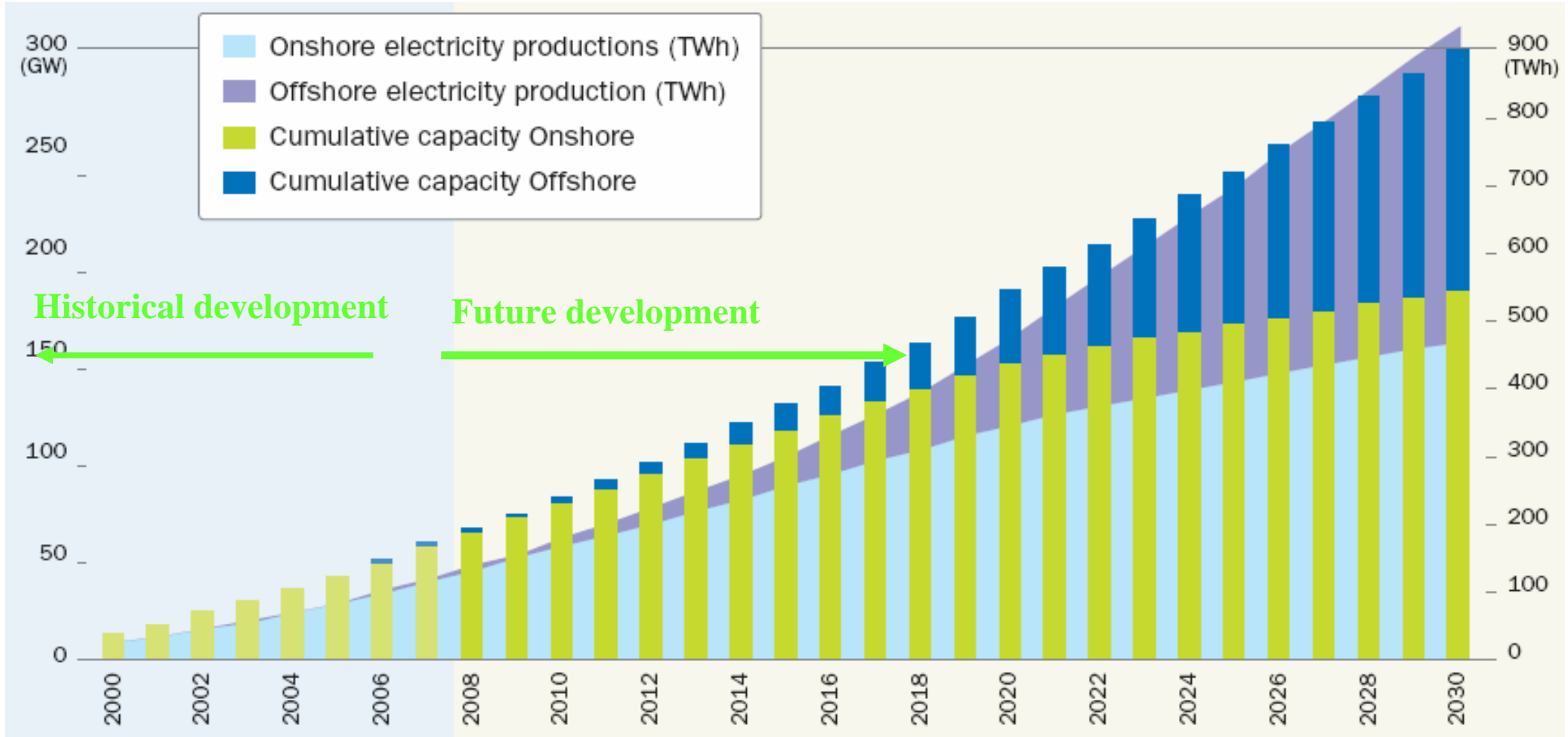


Thank you for your attention!



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Electricity from Wind up to 2030



Source : EWEA

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