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European Transmission System Operators

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for the project of European interest:

"Connection to offshore wind power in Northern Europe (North Sea – Baltic Sea)"

Working group for offshore/onshore grid development

5 February 2009, 10:00 – 16:30

Centre de Conférence Albert Borschette – Room 3.C

rue Froissart, 36 - 1040 Bruxelles

EWIS Offshore-Onshore Grid Perspectives

3rd Meeting WG Offshore-Onshore Grid Development, Brussels, 2009-02-05

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EWIS-Project Status

- **Present status-2008**
  - ⇨ Steady state analysis available
  - ⇨ Dynamic analysis- first results available
- **EWIS Scenarios- 2015 (best estimate, wind optimistic)**
  - ⇨ Scenario Data Base available
  - ⇨ Point in time scenarios selected
- **Steady State Analysis 2015**
  - ⇨ First results risk analysis/risk mitigation available
- **EWIS Interim report available (www.wind-integration.eu)**

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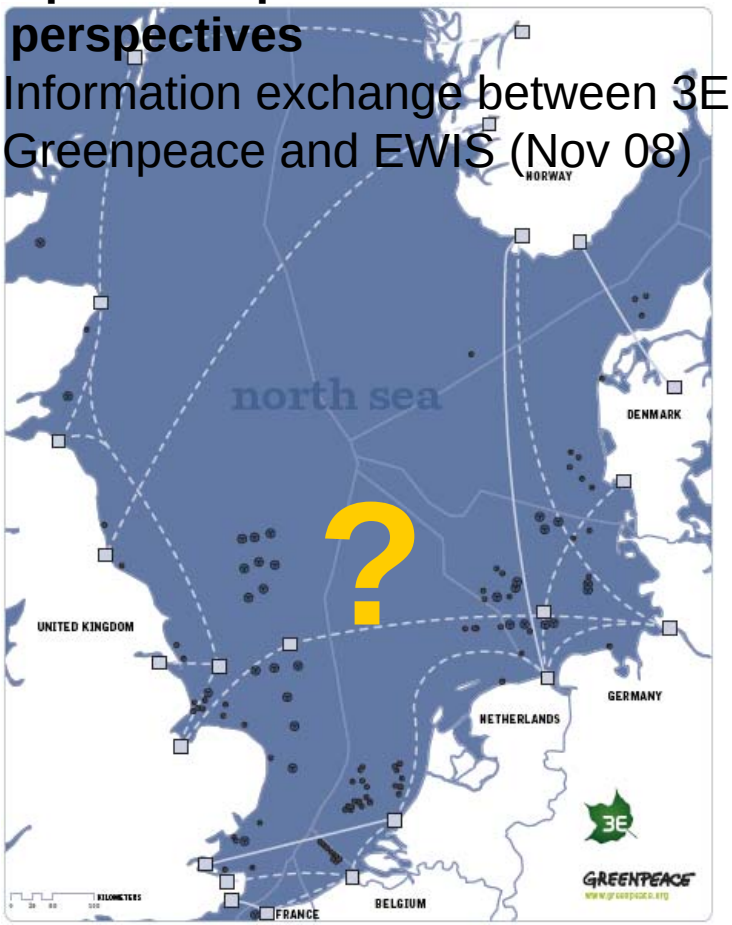
Offshore Grid Perspectives – a Vision

Greenpeace Report and EWIS Offshore grid perspectives

Information exchange between 3E, Greenpeace and EWIS (Nov 08)



Reducing Variability

An interconnected offshore system could be more reliable, and energy production more secure because the impact of maintenance or defects will be negligible ... but a lot of technical and leagal aspects are not solved yet

Combine the production of a fluctuating renewable energy source (e.g. wind) with dispatchable sources of renewable energy, such as the large hydro-energy capacity in Norway.

Strengthen the interconnencted continental system for better exchange of regional energy surplus ...

Grid Investments (Offshore, Onshore)

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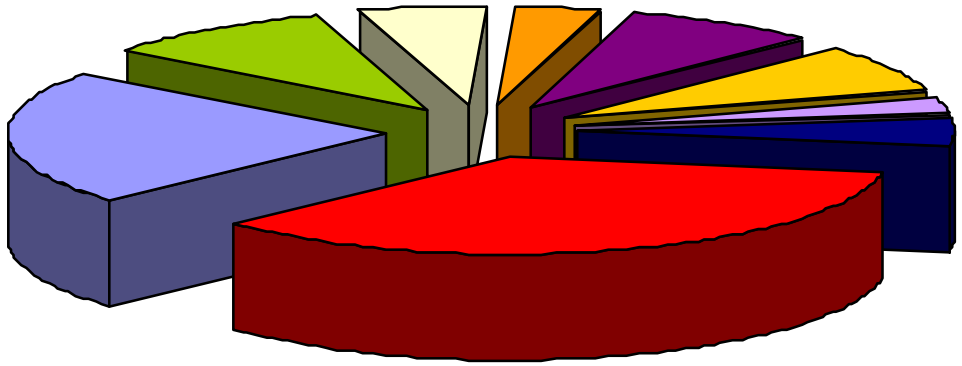
European Wind Integration Forecast

Medium Scenario (All countries) MW installed					
2005	2008	2010	2015	2020	2030
42331	66503	90019	143680	205835	279580

*** EWEA/TradeWind**

Country	Installed Capacity
DE	32%
ES	20%
GB	9%
PT	5%
DK	3%
FR	8%
IT	7%
IR	2%
NL	4%
SE	1%
AT	1%
GR	2%
NO	1%
PL	2%
BE	1%
HU	1%
FI	0%
CZ	1%



2015 installed capacity forecast in some European Countries

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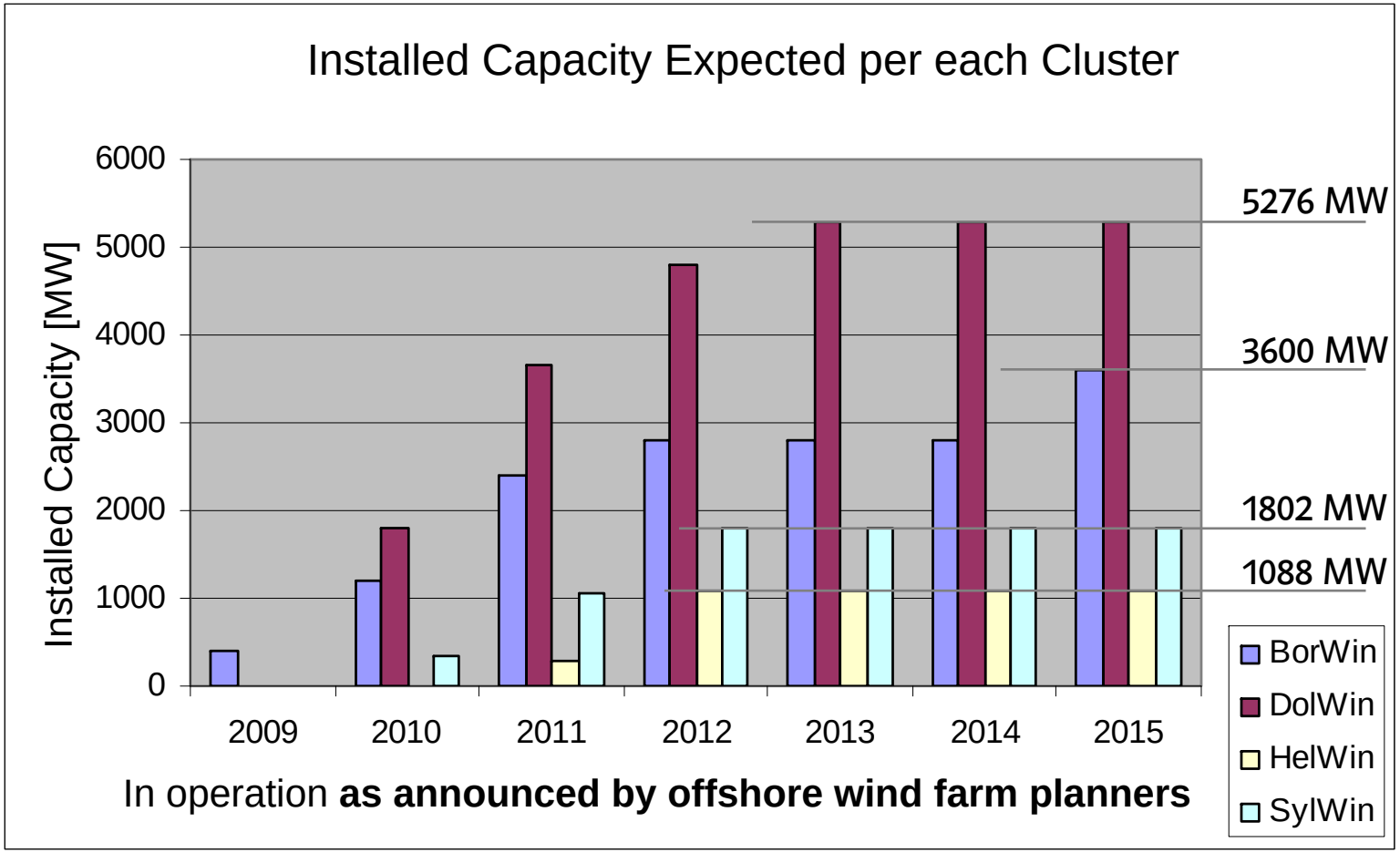
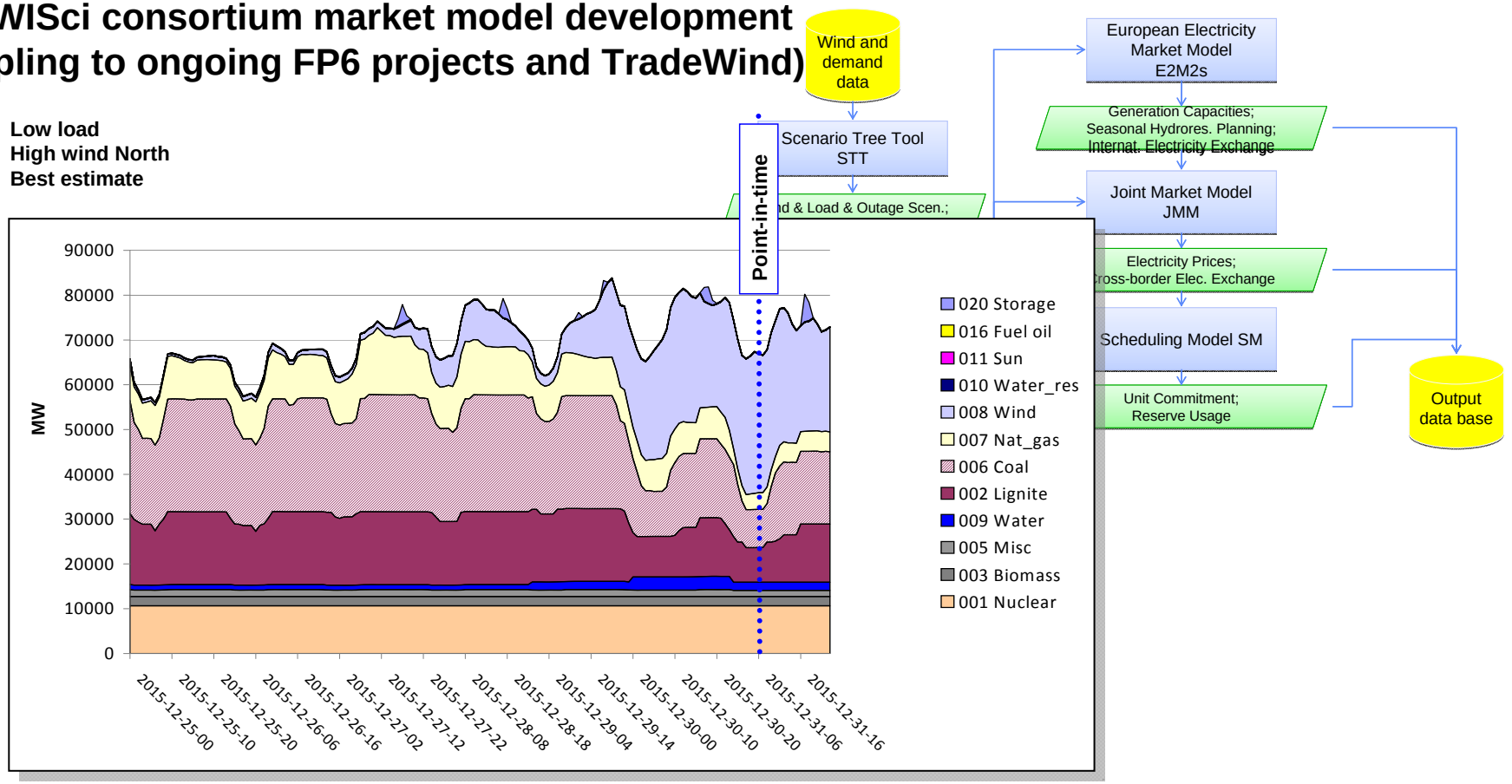
Offshore Planning 2015 (North Sea)



Market Model Scenario Data Base

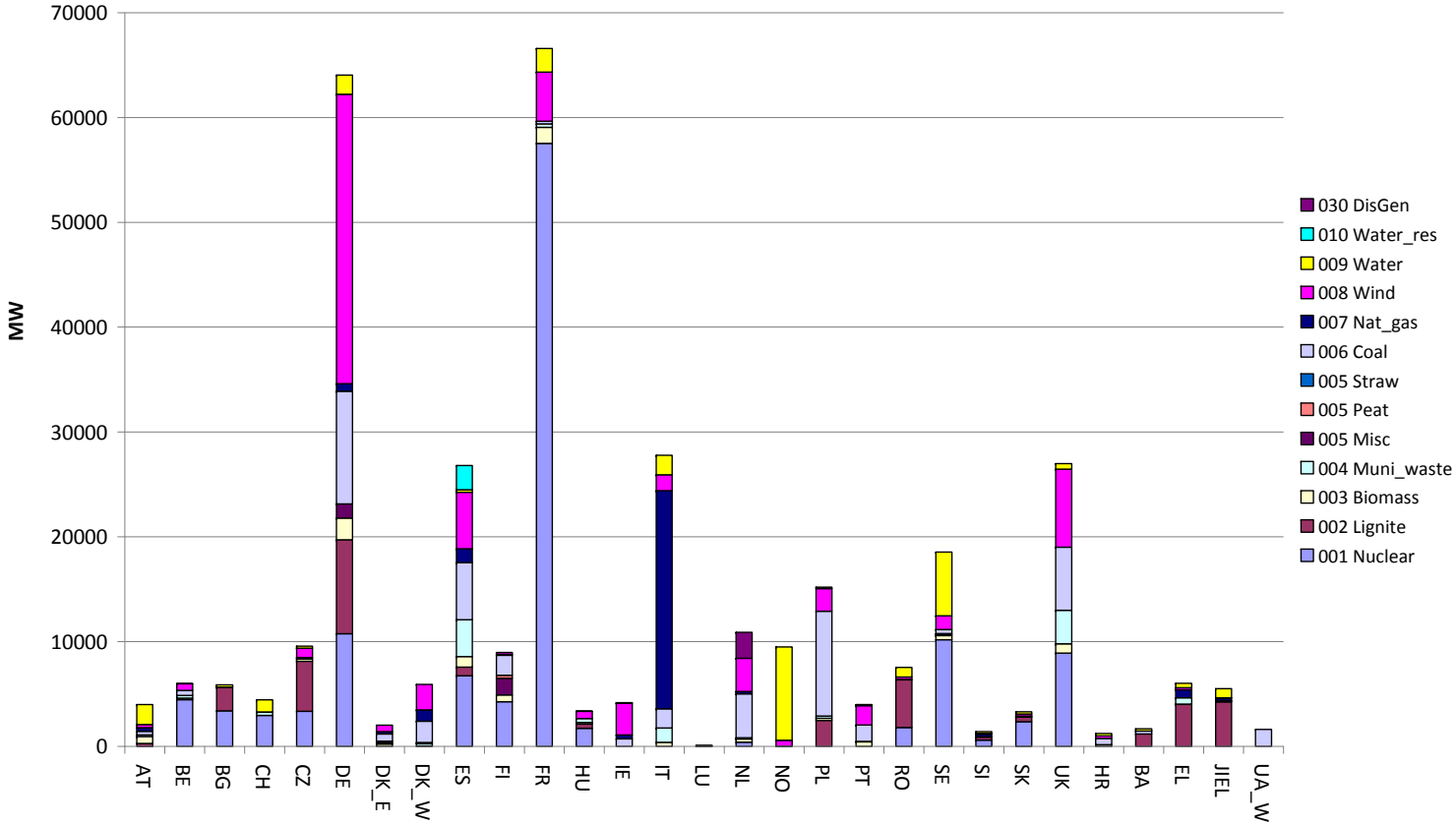
(time series year round simulation)

SUPWISci consortium market model development (coupling to ongoing FP6 projects and TradeWind)



Economic Dispatch (point in time)

Adjustment of Conventional Power Plants and Exchange Schedules



- Costs of electricity generation and balancing are minimized
- The generation priority serves as a ranking to reduce or increase the power generation from the power stations in response to the additional wind generation in the scenario

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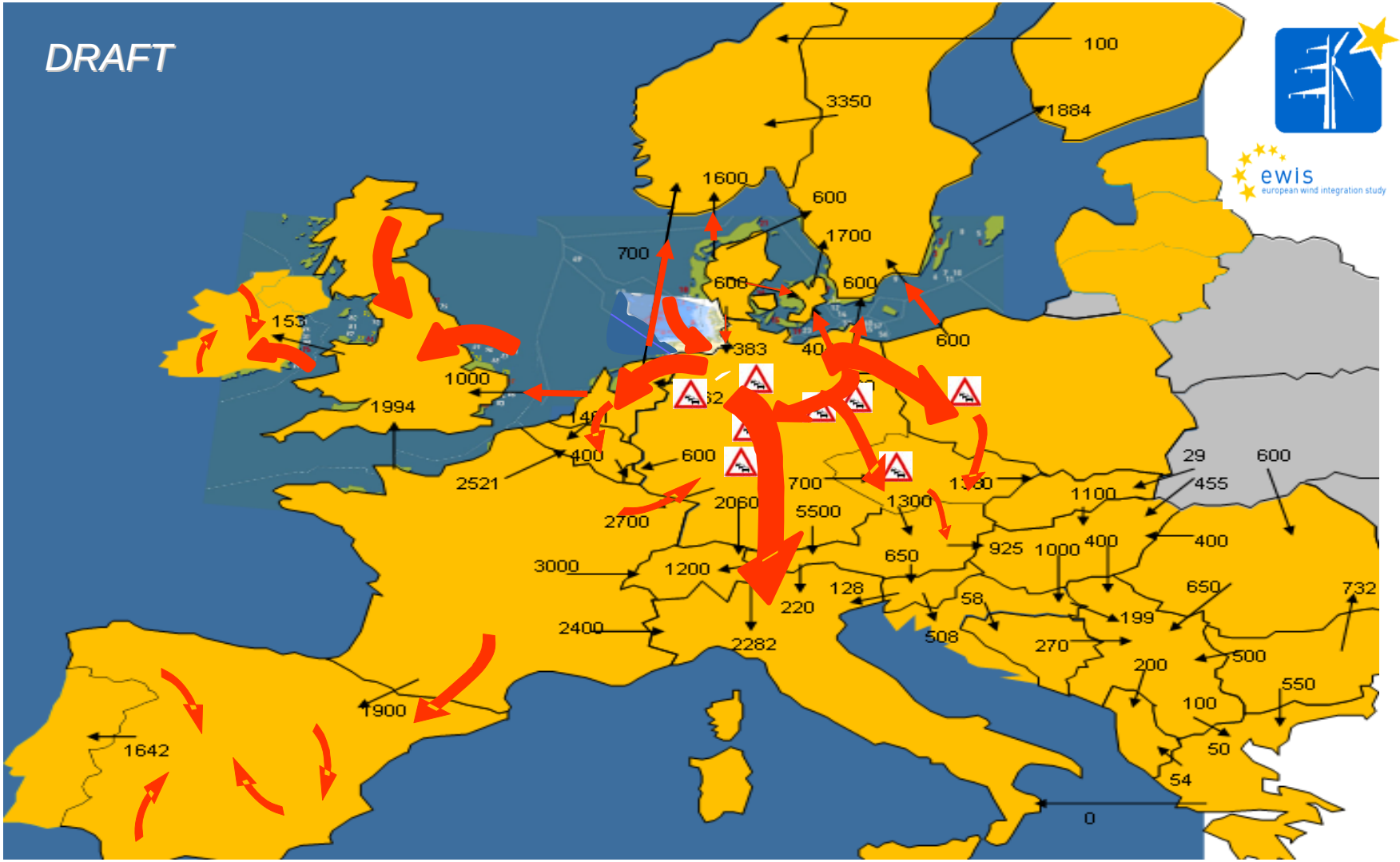
Flows in Europe (High Wind North)



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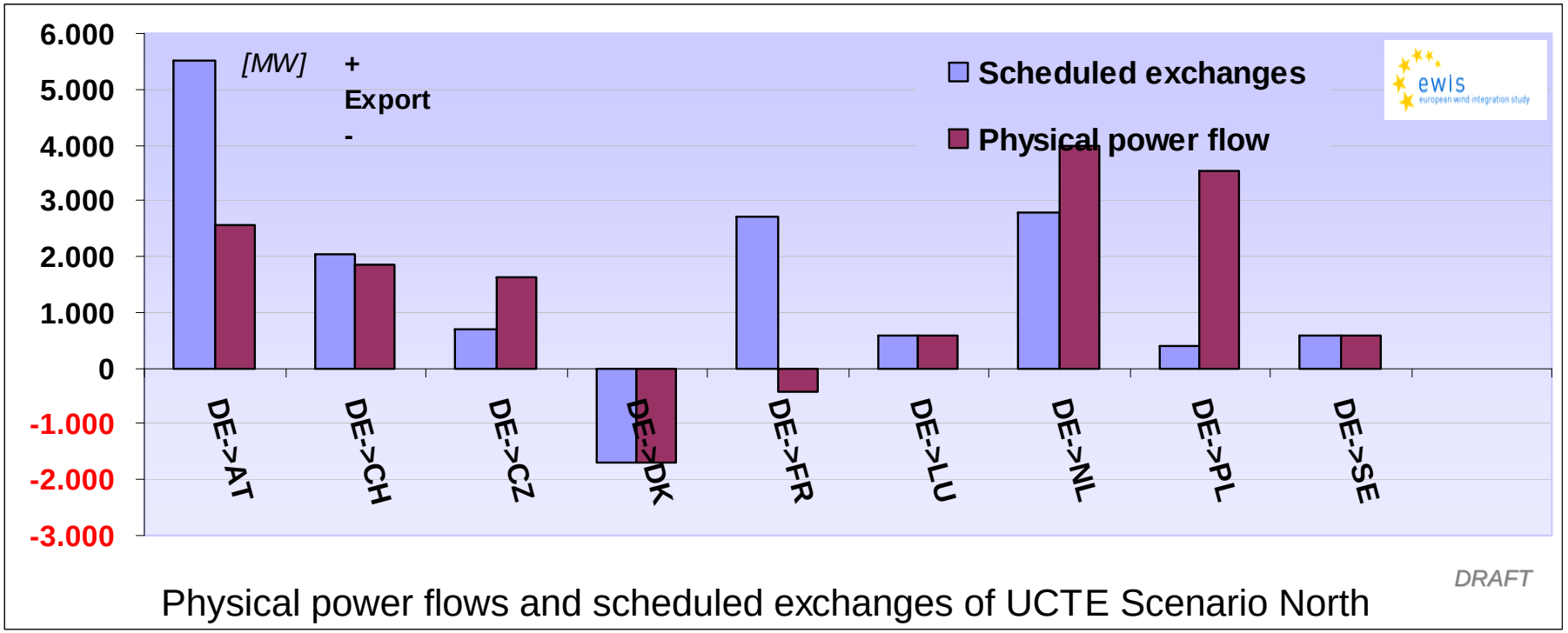
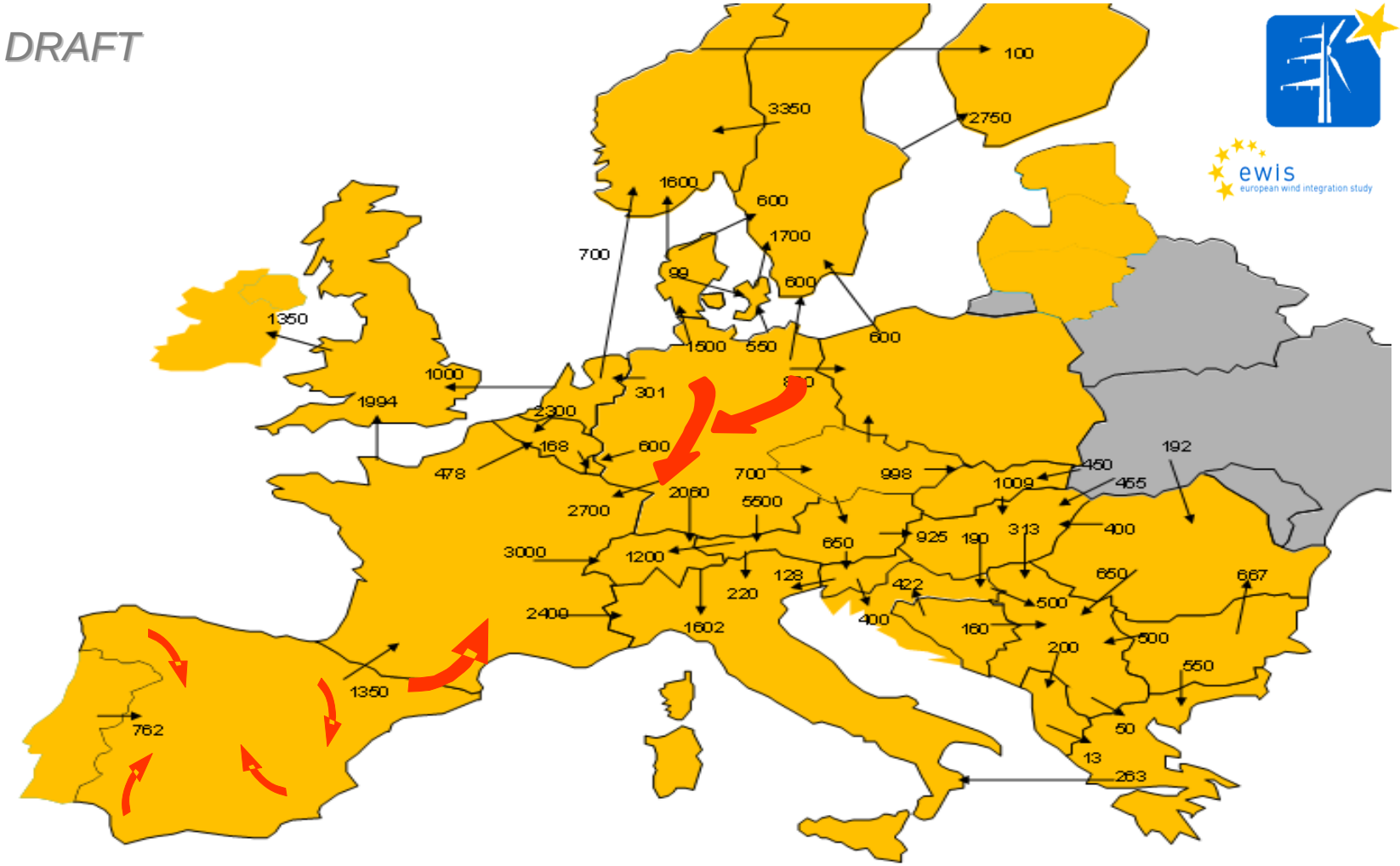
Scheduled vs. Physical Power Flow



Physical power flows and scheduled exchanges of UCTE Scenario North

Flows in Europe (High Wind South)



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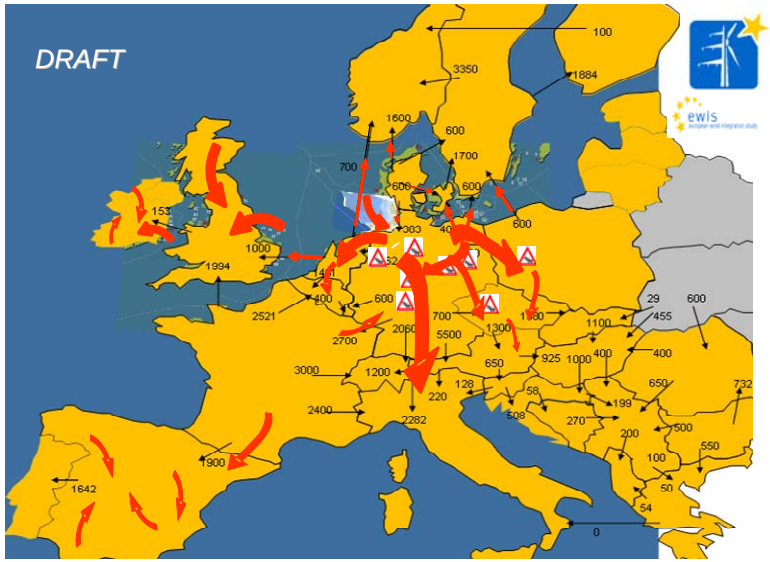
Technical Risk Mitigation (First Results)

- High wind power production causes regional overloading of transmission lines
- Regional high surplus of wind power generation results in large temporary load flows through neighbouring transmission systems

- Grid Re-Enforcement measures in all regions foreseen by 2015
  - Scenario North – need for additional measures
  - Scenario South – no additional measures as regards to the planned network 2008-2015



- Operational measures
  - Corrective switching
  - Phase shifters
  - Dynamic thermal rating e.g. in Germany for the relevant transmission corridor from North to South

- Congestion Management
  - Re-Dispatch of cost effective power plants (more than 5000 MW in Germany)
  - Monitoring and control (including curtailments) of wind generation by the TSO

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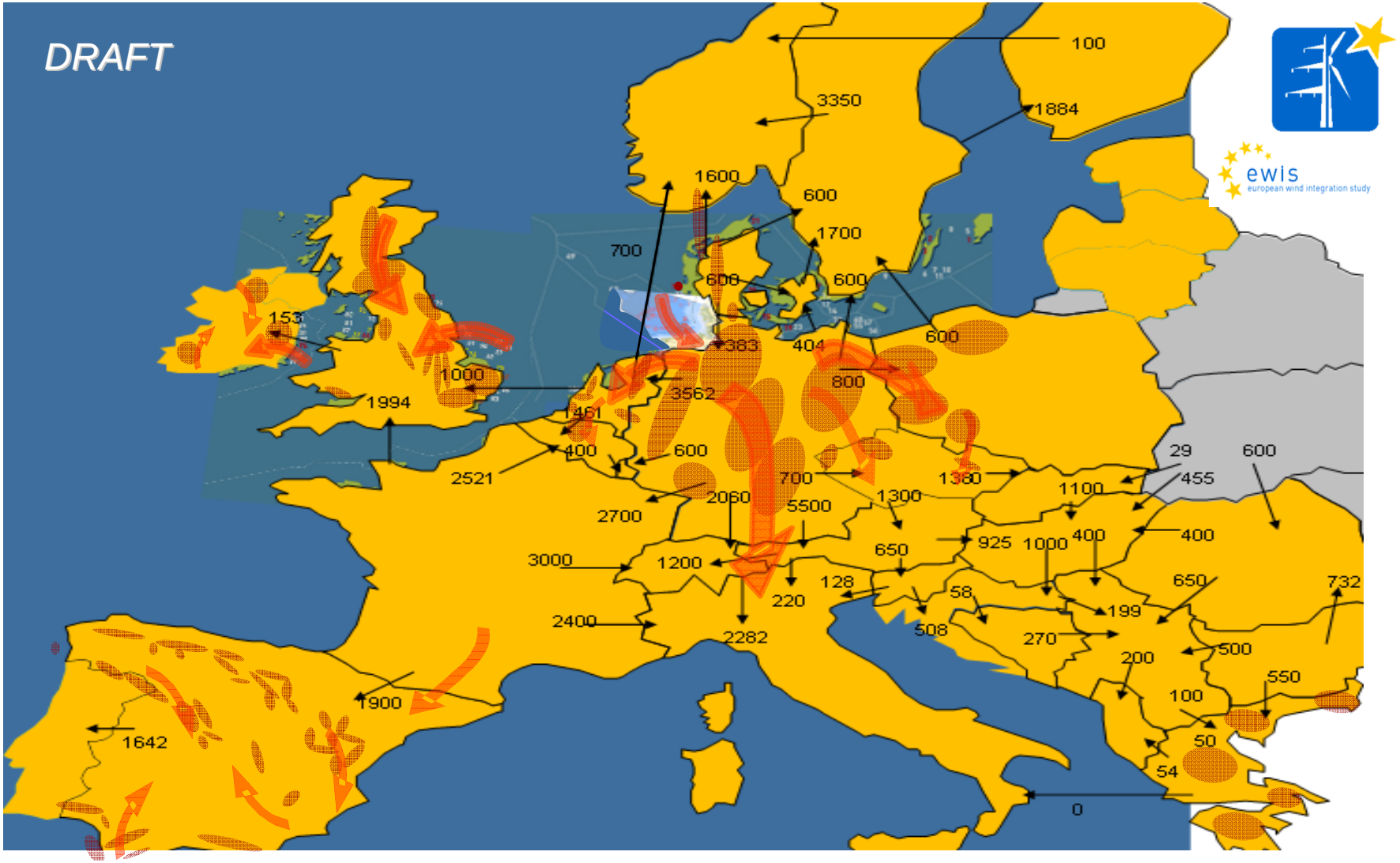
Necessary Grid Re-Enforcements by 2015



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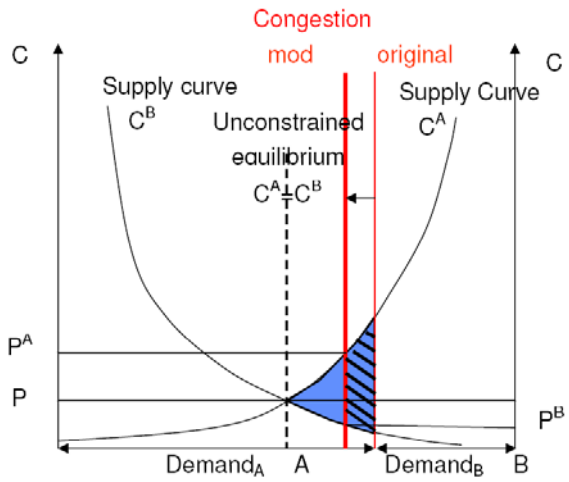
Line Loading and Voltage Profile

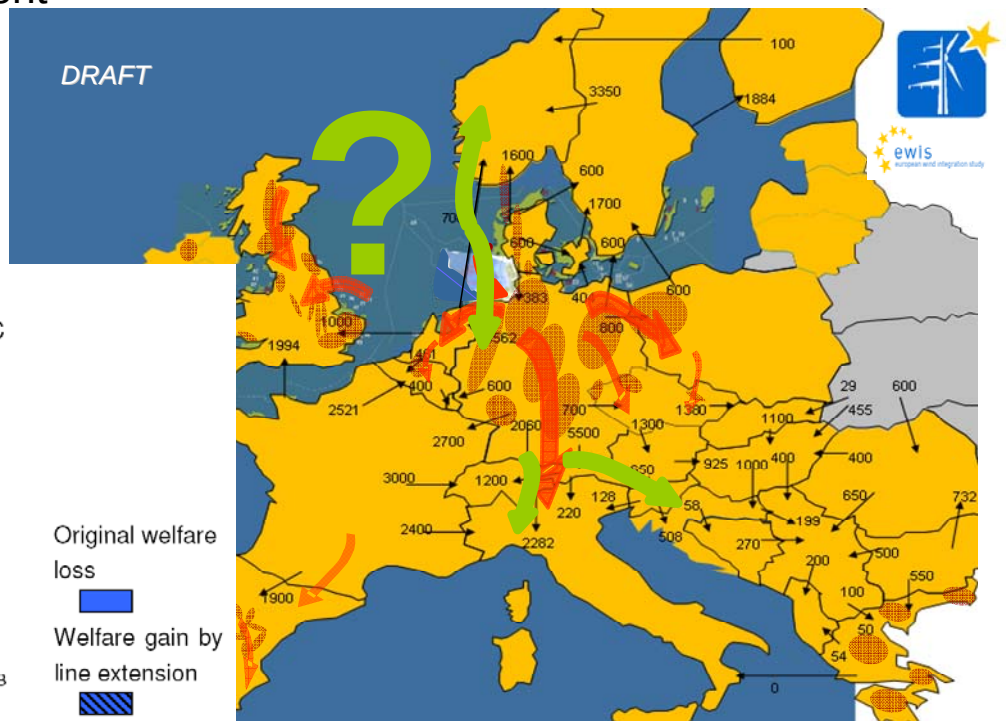
- Concentration of windpower and conventional generation in some regions, e.g. Northern Germany leads to overloading of lines along the transit corridors and within the neighboring systems
  - Reactive Power losses (Germany) more than 4 times higher (high wind north compared to high wind south, about ca. **18,000 Mvar**)
  - Active Power losses (Germany) about 2 times higher (high wind north compared to high wind south, about ca. **3,500 MW**)
- Additional reactive power compensation in regions with high wind power production required to keep voltage in nominal range
- Prerequisite: The grid re enforcement already foreseen for the time horizon 2015 must be in operation by 2015.
- Dynamic thermal rating required in the main corridor from North to South within Germany (Hamburg – Hannover – Frankfurt)

Grid Related Measures beyond 2015

- Further Grid re-enforcements will be investigated
- NTC sensitivities within EWIS market model (SupWiSci) Increasing exchange capacities between countries

- New HVDC Links between Northern Europe and Scandinavia (e.g. Nord.LINK)
- More flexible generation
- Demand Site Management





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Conclusion

- **EWIS – the reference study for the integration of wind power on the European transmission system**
- **Offshore Cluster Concept challenges – premises for a successful offshore performance**
  - Adequate return of investment and approval by national regulators
- **Increase of Onshore Congestions detected …**
  - European TSOs recently announced necessary Grid re-enforcements planned to be in operation by 2015 (e.g. 850 km new overhead lines for Germany **urgently needed** to enhance the transmission of renewable energy)
  - Authorization for **onshore grid investments** has to be **accelerated** (abandoning regional planning procedures, priority for new power lines),
  - **Incentives** to build, operate and profit by new grid re enforcements
  - Need for funding - **Capital procurement** and financial crisis
- **Transmission Flexibility – and Congestion Management**
  - Flexible line capacity management – Curtailment – Demand Site Management
- **Grid infrastructure 2015 & beyond**
  - High Capacity “North-Sea power socket” via expandable HVDC connections
  - EWIS/SUPWISci Market sensitivities for potential offshore and onshore routes

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Thank You For Your Attention

Your EWIS Team