Creating a secure and undistorted European energy market

Bird & Bird

Steigenberger Grandhotel

4th February 2014 Brussels

Session 4 – Interconnectors

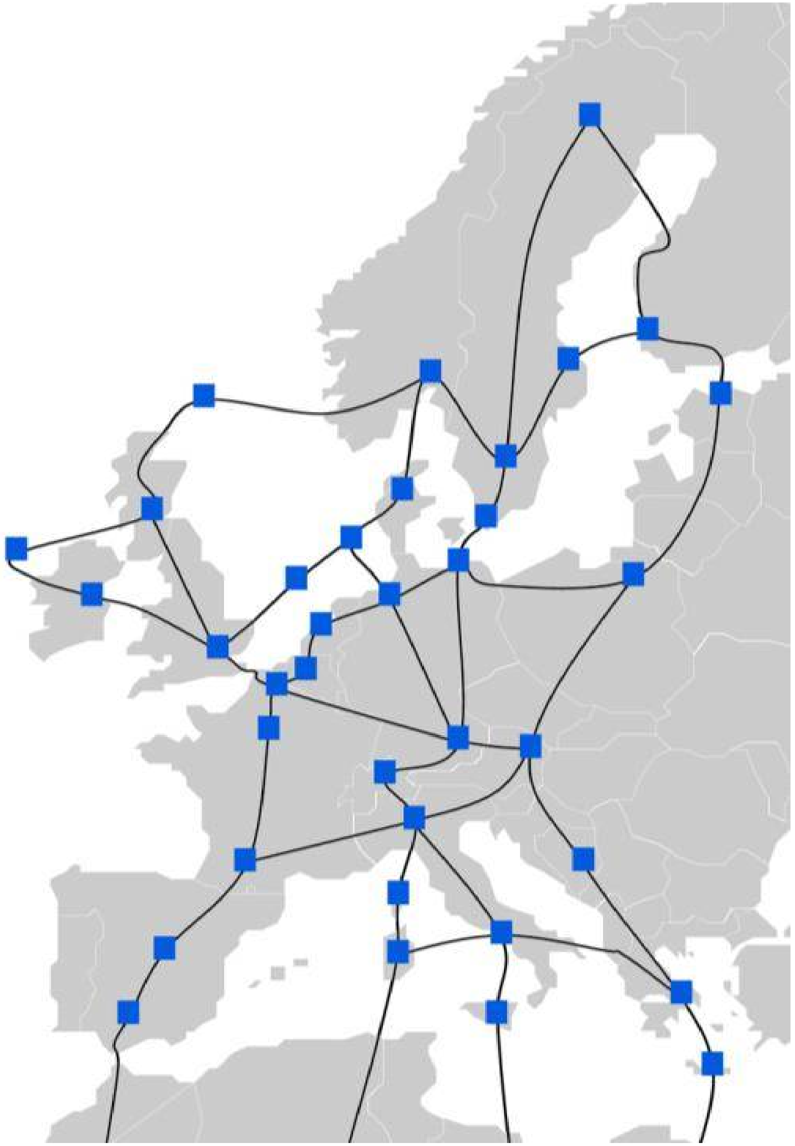
Interconnectors in Europe – Current & future obstacles to delivering security & integration – Stephanie McGregor, Director Grid Systems UK, ABB

Stephanie McGregor, Director Grid Systems UK – Brussels, February 2014.

Interconnectors in Europe
Current & future obstacles to delivering security & integration

Power and productivity
for a better world™

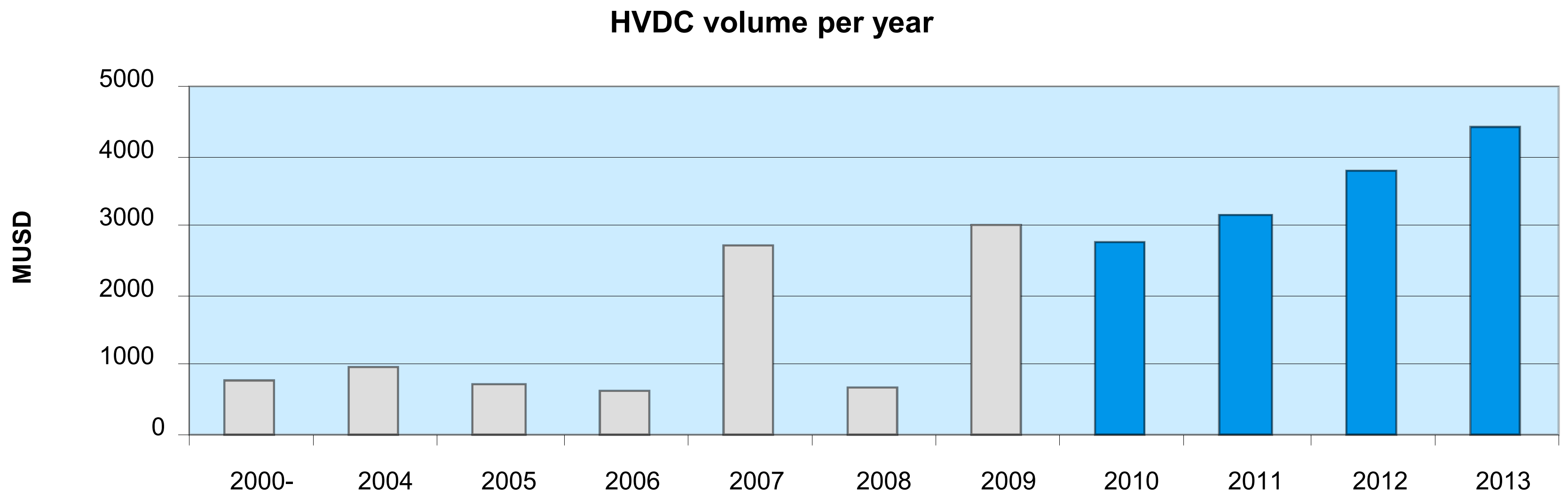
Interconnectors = future for an interconnected Europe?



Obstacles:

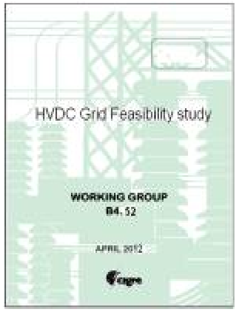
- Technology
- Certainty
- Regulation & network harmonisation
- Risk & contracting strategy
- Time & market for procurement

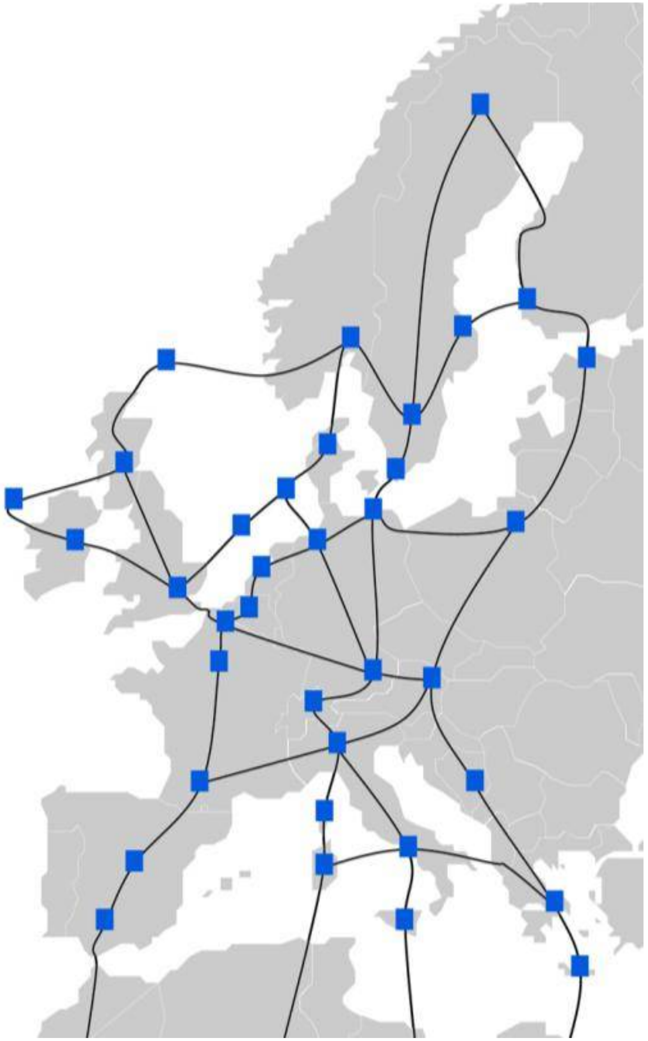
HVDC is a growing technology
Driving forces: environmental and de-regulation



ABB

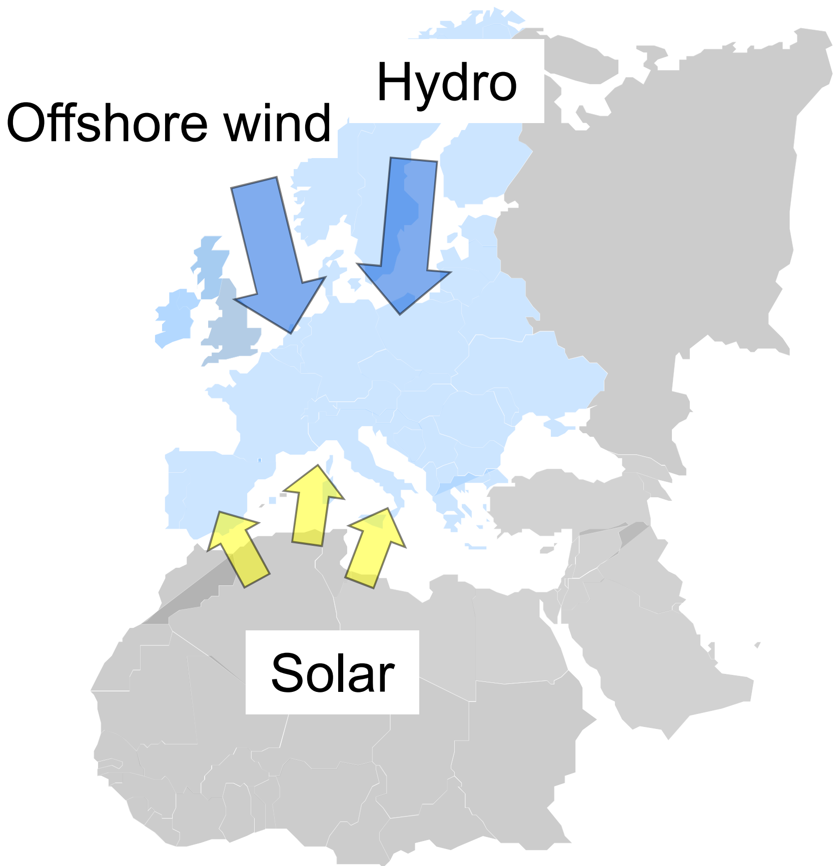
A European DC Super Grid





- An interregional HVDC grid is defined as a system that needs several protection zones for DC earth faults, has the same voltage level and very high power rating
- New developments needed, e.g.:
  - HVDC grid breakers
  - Grid power flow control
- Long-term development, e.g.
  - High voltage DC/DC converters for connecting different regional systems
  - On-going Cigre & ENTSO-E work
  - EU 10 year plan & projects of common interest

Drivers for DC interconnection
Renewables and balancing



- Europe needs a new controllable transmission system:
  - Landing-point for offshore wind and solar power will be at the "out-skirts" of the grid
  - Changing generation patterns, e.g. the closing of German nuclear power
  - A wish for more interconnections and energy trade
- The transmission grid must be redesigned to meet the new transmission needs, such as
  - Long distance bulk power transmission
  - Low losses
  - Minimum environmental impact

Background Information
Example projects & Technology Information

Example Project- NorNed HVDC Cable Interconnection

Customers:
Statnett/TenneT

Commissioned:
2008

Customer’s need

- Optimize production system in northern Europe
- The hydropower in Norway is back-up to wind power in the Netherlands

ABB’s response

- Turnkey 700 MW HVDC system with innovative ±450 kV converter system
- World’s longest cable - 580 km

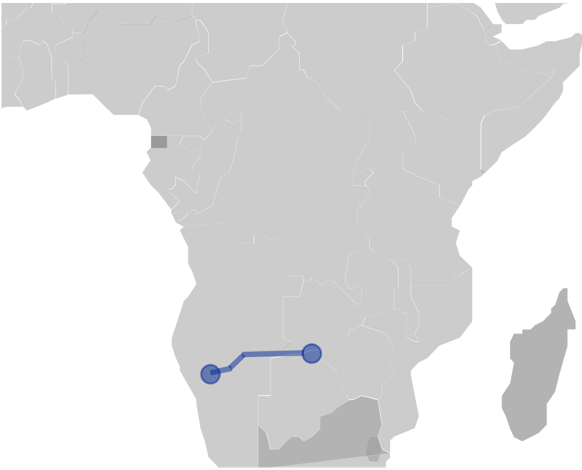
Customer’s benefits

- Increased security of supply in both markets
- Sharing of balancing power
- Improved power market
- Low transmission losses – 3.7 %
- Reduced CO_2 emission with nearly 1.7 million tons per year

Example Project - Caprivi Link Interconnector

Customer: NamPower

Year of commissioning: 2010



Customer's need

- Connect the grid in the north west with the grid in the central parts of the country

ABB's response

- Turnkey 350 kV 300 MW HVDC Light®
- Option for another 300 MW
- First HVDC Light® with overhead lines

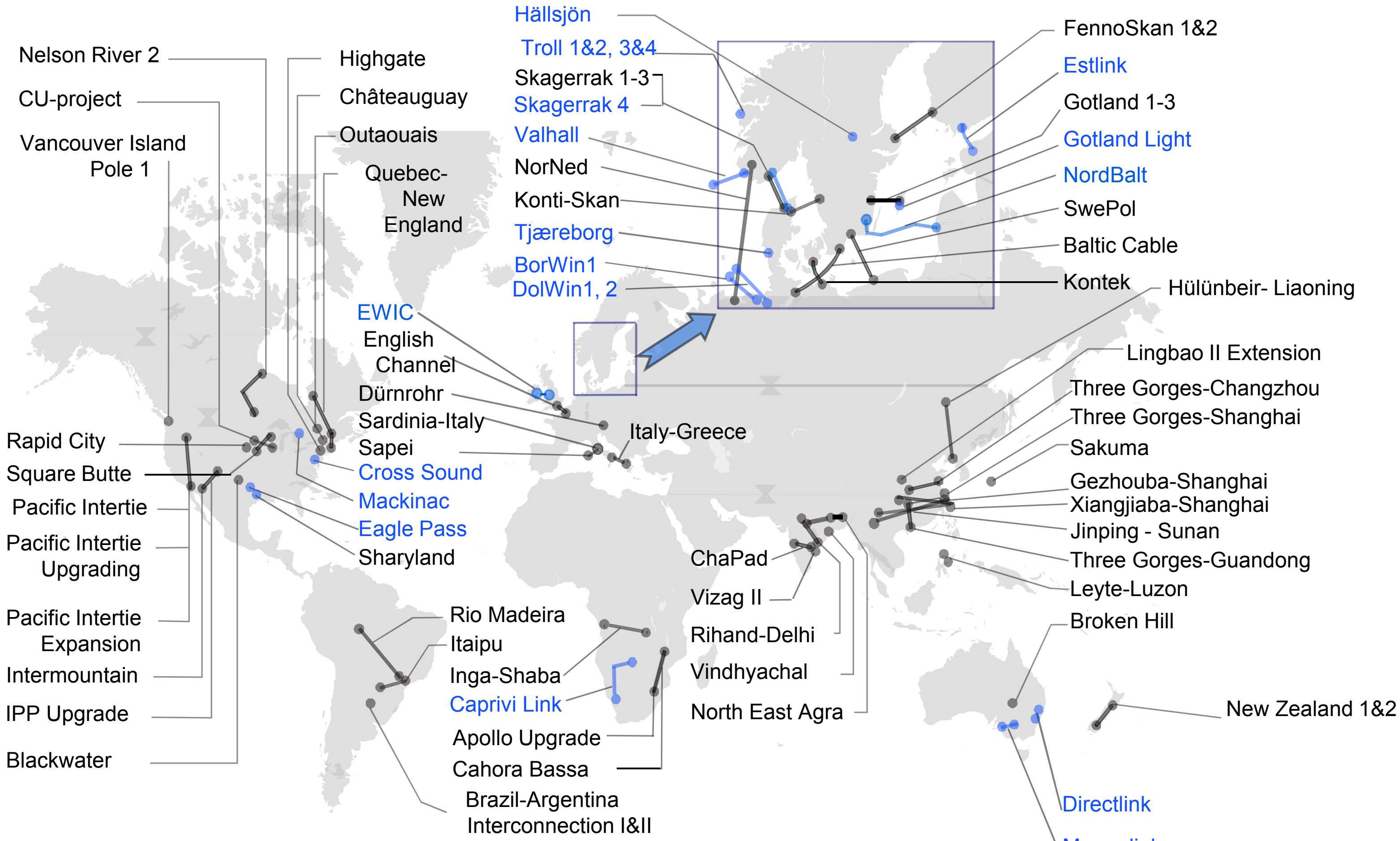
Customer's benefits

- Stability in two very weak AC networks
- Enables future power trading in the expansive region of southern Africa

Types of HVDC Technology for Interconnectors

- Two types of HVDC Technologies
  - Classic (LCC) - since 1954
  - Light (VSC) – since 1999
- HVDC is more controllable than AC
- Light is more controllable than Classic
- HVDC market is increasing and driven by
  - Environmental aspects (CO_2 reduction)
  - De-regulation of the electricity market

HVDC by ABB
Let our experience work for you



58 HVDC Classic Projects since 1954
14 HVDC Classic Upgrades since 1990
19 HVDC Light Projects since 1997

THANK YOU !!!!

Session 4 – Interconnectors

TuNur Project – Utility scale climate change mitigation – Kevin Sara, CEO, Nur Energie

TuNur Project

Utility scale climate change mitigation. Opening new energy corridors.

Bruxelles, 4th February 2014

TUNUR تـونـور

NUR ENERGIE

What is the TuNur Project?

2GW Solar Energy Export Project between Tunisia and Europe

- TuNur consists of a **2GW solar plant in Southern Tunisia**; and a **2GW submarine cable** from Tunisia to Italy.
- TuNur will generate **~9,400GWh** of 100% renewable power and dispatchable power per annum.
- Once landed in Italy power can be transported to **all other European countries such** as the UK.
- TuNur will be capable of supplying energy to circa **2.5 million European homes** by 2018.
- TuNur is being structured in two collaborating entities:
  - Gen-Co
  - Trans-Co

How TuNur works

Mirrors reflect solar rays

Heliostats (mirrors) track the sun and concentrate direct solar rays atop the central receiver (boiler).

Power Generation and Transmission

The rays heat the boiler to create super heated steam (>550 ºC). This thermal energy is then sent into a standard turbine generator.

Excess heat can be stored and released into the system when the sun goes down to continue generating energy (base-load power).

Sub-sea HVDC Transmission

Electricity is transported from Tunisia to Italy through a high voltage DC connector cable with minimal losses (3% per 1,000km).

Once landed in Italy power can be transported to European countries.

Electrical Transmission throughout Europe

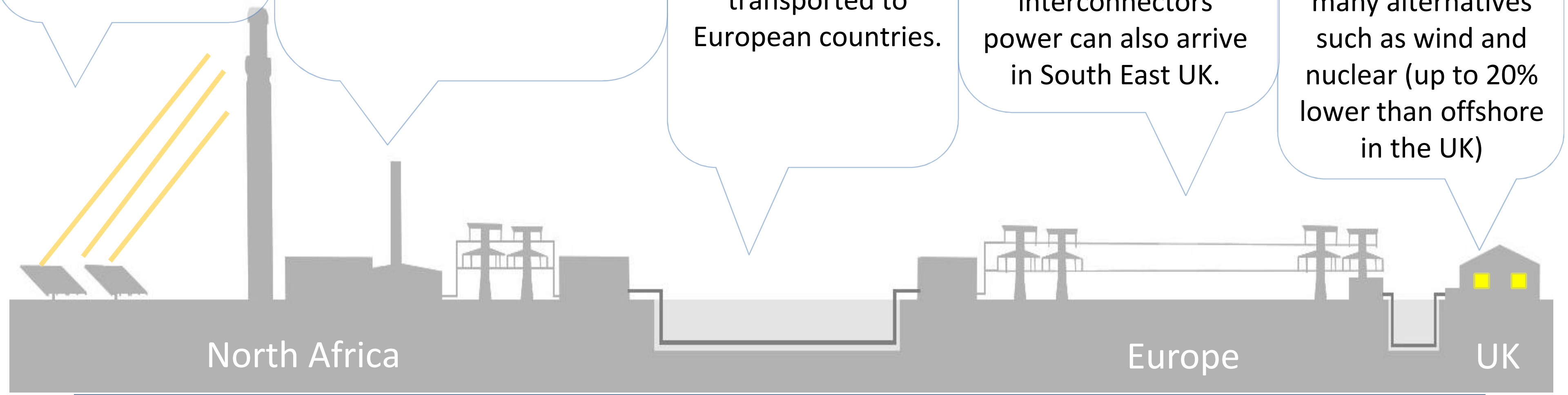
The whole European grid is connected so once power lands in Italy it can be sent across Europe without any need for network upgrades or new transmission.

Through existing interconnectors power can also arrive in South East UK.

Distribution to Europe and the UK

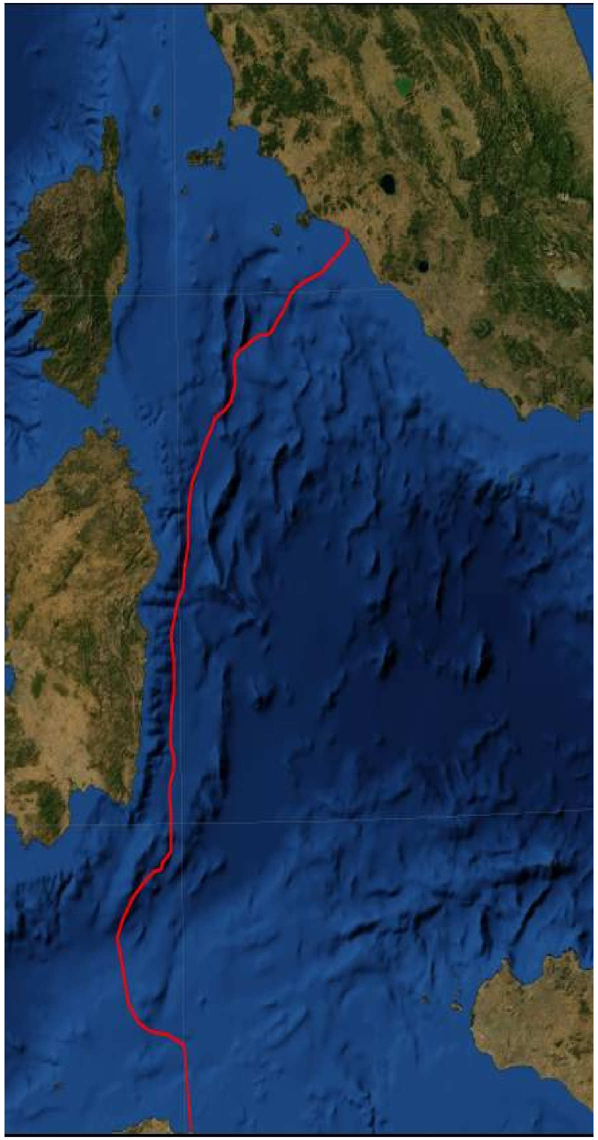
TuNur will provide 9,000 GWh per annum by 2018, equivalent to 2.5 million European homes.

This base load power can meet peak demands and will be cheaper than many alternatives such as wind and nuclear (up to 20% lower than offshore in the UK)



Mission of TuNur

- Export cheap baseload solar power from North Africa to Europe, to allow European countries to meet their renewables targets, and offer a replacement for phasing-out nuclear and ageing coal plants.
- Economic optimization and political strategy: could be seen both as an extension of the Italian (European) grid to Sahara or as a grid to grid international interconnector which enables network services: power reserve, balancing, etc.
- Under the concept that it is just one EU market pool, and under article 6, power can also be consumed in Italy and "credited" to other EU countries (such as UK)
- Under the same concept in North Africa as in EU, and through the application of Art. 9 e.g. "Montenegro exemption", virtual export is possible, although exact mechanisms still unclear. A cable must eventually be built, but "exports" can begin immediately.
- Under Article 9, power can be counted toward 2020 objectives before and after cable is built.
- Could be a new cable or ELMED cable, but capacity issues for ELMED mainly on the Italian side.
- EU regulation: some countries may insist on physical imports: need commercial and regulatory pathway to move power from Italy to customer countries



The power injection in Montalto helps offsetting Italian import

- Regulation in Tunisia: TuNur is the first of a kind, has been the blueprint for the Tunisian energy regulation reform, and several regulatory aspects are still being defined
- New market concepts for energy flows, network services, etc. still to be developed, as e.g. after NW EU energy market coupling being implemented today
- TuNur is also a relevant technological challenge for both power generation (technology evolution, efficiency, reliability, utility scale) and transmission (cable depth and length, integration of overhead lines, desert crossing, VSC converters, multi-terminal scheme)

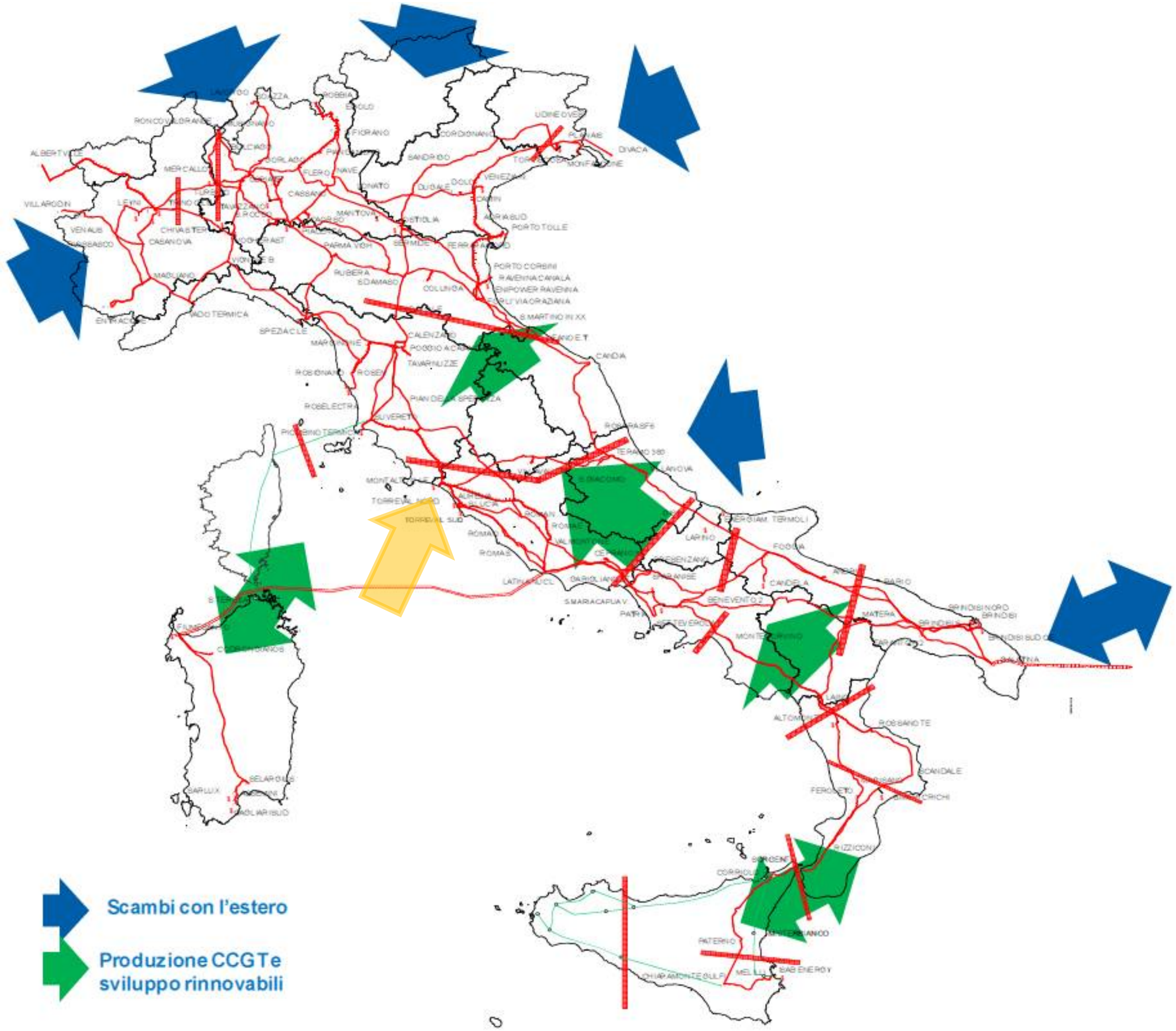


Figura 35 - Sezioni critiche

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Session 4 – Interconnectors

Interconnectors in the IEM – A TSO's Assessment of the technological, commercial and regulatory/legal challenges – Lars Kyrberg, Corporate Counsel, TenneT TSO

Interconnectors in the IEM

A TSO´s assessment of the technological, commercial and regulatory/legal challenges

Lars Kyrberg
Brussels, 4 February 2014

Overview

- Role and tasks of TSOs in the IEM
- European market integration and cross border infrastructure
- Technological, commercial and regulatory/legal challenges
- NORD.LINK project as case example

Role and tasks of TSOs in the IEM

From

- Stable, predictable (price-driven) energy generation
- Maintenance and (limited) replacement
- Focus on technology
- Local markets, separate price zones
- National focus and regulation

To

- Fluctuating (nature-driven) energy generation
- Large-scale new construction
- Technology and market
- North-Western European market, price convergence
- Grid planning and regulation at European level

New roles and tasks of TSOs

Interconnectors as integral part

European Market Integration

TenneT's contribution

Building infrastructure: cross-border interconnectors

- NorNed cable to Norway in operation (700MW, socialized cable)
- BritNed cable to the United Kingdom in operation (1,000MW, merchant cable)
- Interconnector linking Doetinchem in the Netherlands to Wesel in Germany (in realisation)
- Cable link NORD.LINK to Norway (under development – 1,400MW, socialized cable)
- Cable link to Denmark (under development – 700MW, socialized cable)

Optimal use of infrastructure (capacity allocation):

- Market coupling between Belgium, France and the Netherlands (2008) and Germany (2010)
- Cross-border intraday trading (2011)
- Intraday trading with Norway (March 2012) and the UK (May 2012)
- European market coupling between Scandinavia, the UK and Northwest Europe (2014)

European Market Integration

Benefits interconnections

- Increasing (social) welfare in one or more countries
- Ensuring improved security of supply in the two countries
- Integration renewable energy
- Increase market efficiency

Interconnector Challenges

Technical perspective

- Specific offshore construction risks
  - Soil conditions
  - Cable laying methods
  - Vessel transport capacity
  - Weather

- Redesign of onshore grid for import and export of full capacity

- Change of flow direction from full import to export

→ Technical challenges limited from a TSO perspective

→ Technology is mature (TenneT has two offshore interconnectors in successful operati

Interconnector Challenges

Commercial perspective

- Interconnectors as consistent part of infrastructure investments
  - During the next decade TSOs need to invest significant amounts in the required electricity transmission capacity (TenneT: approx. € 13 bln/ EU: € 140 bln)
  - Financeability of investments
  - Equity invests in projects in development phase

- Tendering/Contracting
  - Market capacity
  - Tendering/Contracting strategy (turnkey, multi-contract approach)
  - Public procurement requirements

Interconnector Challenges
Regulatory/Legal perspective

- Subject to two regulatory regimes
- Regulation and investment rationale
- Socialized vs. merchant cable
- Projects of Common Interests (PCI)
- Practical legal issues
  - Legal regimes (including EEZ)
  - Ownership and legal body of cooperation
  - Licensing and cable route contracting

Interconnectors

Case: NORD.LINK project

- Planned interconnector between Germany and Norway (1400 MW)
- Socialised/ regulated interconnector
- Project partners: Statnett, TenneT and KfW
- Operational by 2018
- Optimisation of socio-economic business case
- 50:50 partnership between Norway and Germany
- Third party equity investor: Norway's Statnett will own 50% (Norwegian part); KfW and TenneT will jointly own 50% of the project (German part)
- Project part of regulated asset base and thus part of regulated tariff income

TenneT is Europe's first cross-border grid operator for electricity. With approximately 20,000 kilometres of (Extra) High Voltage lines and 36 million end users in the Netherlands and Germany we rank among the top five grid operators in Europe. Our focus is to develop a north-west European energy market and to integrate renewable energy.

Taking power further

www.tennet.eu

Session 4 – Interconnectors

The role of power exchanges in interconnecting energy markets – Dr. Wolfram Vogel, Director Public Affairs & Communication, EPEX SPOT

The role of power exchanges in interconnecting energy markets

Brussels, February 4th 2014

Dr. Wolfram Vogel │ Director Public Affairs & Communication, EPEX SPOT

EPEX SPOT
EUROPEAN POWER EXCHANGE

Liberalization of the European electricity market

- 1990 : Creation of the UK pool
- 1992 : Creation of NordPool in Norway
- 1996 : European Directive on energy market liberalization
- 2000: Creation of two exchanges in Germany
- 2001 : Creation of Powernext in France
- 2006 : Launch of 1st market coupling in continental Europe
- 2008/09: **Creation of EPEX SPOT**, fusion of FR & DE exchanges
- 2010 : EEG Law in Germany; launch of CWE market coupling
- 2011 : Internal Energy Market 2014; NOME Law in France
- 2013 : European Network Codes

- The creation of EPEX SPOT and the development of power trading is one of the most **visible results of the liberalization of the European Power Market**.

EPEX SPOT
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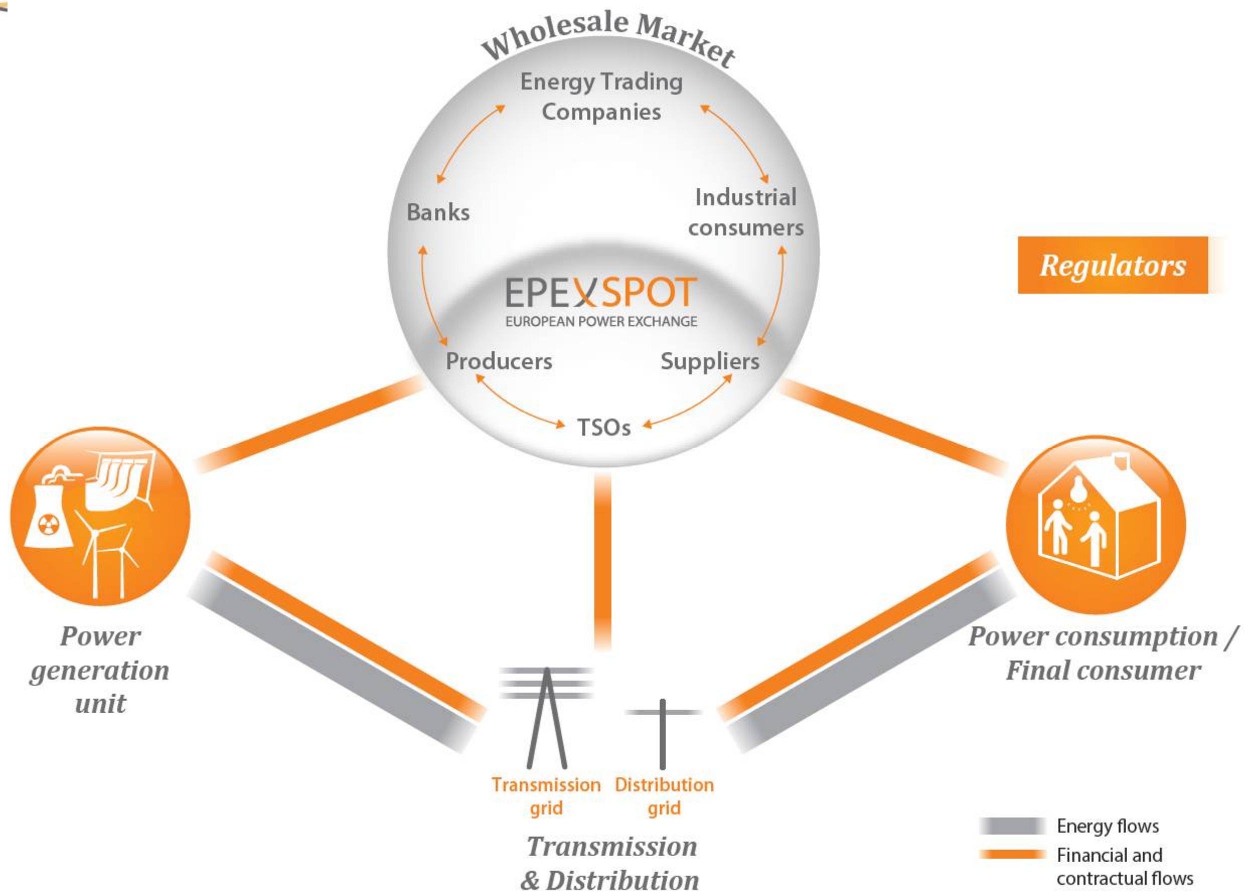
The organized market: Third pillar of the energy value chain



Source: EPEX SPOT

- The **power exchange centralizes buy and sell orders of energy professionals** (producers, retailers, brokers, banks, large industrials)
- The power exchange thus promotes the **emergence of a transparent, regular , fair and neutral market price**

The role of the Exchange in the timeline of the market

EPEX SPOT
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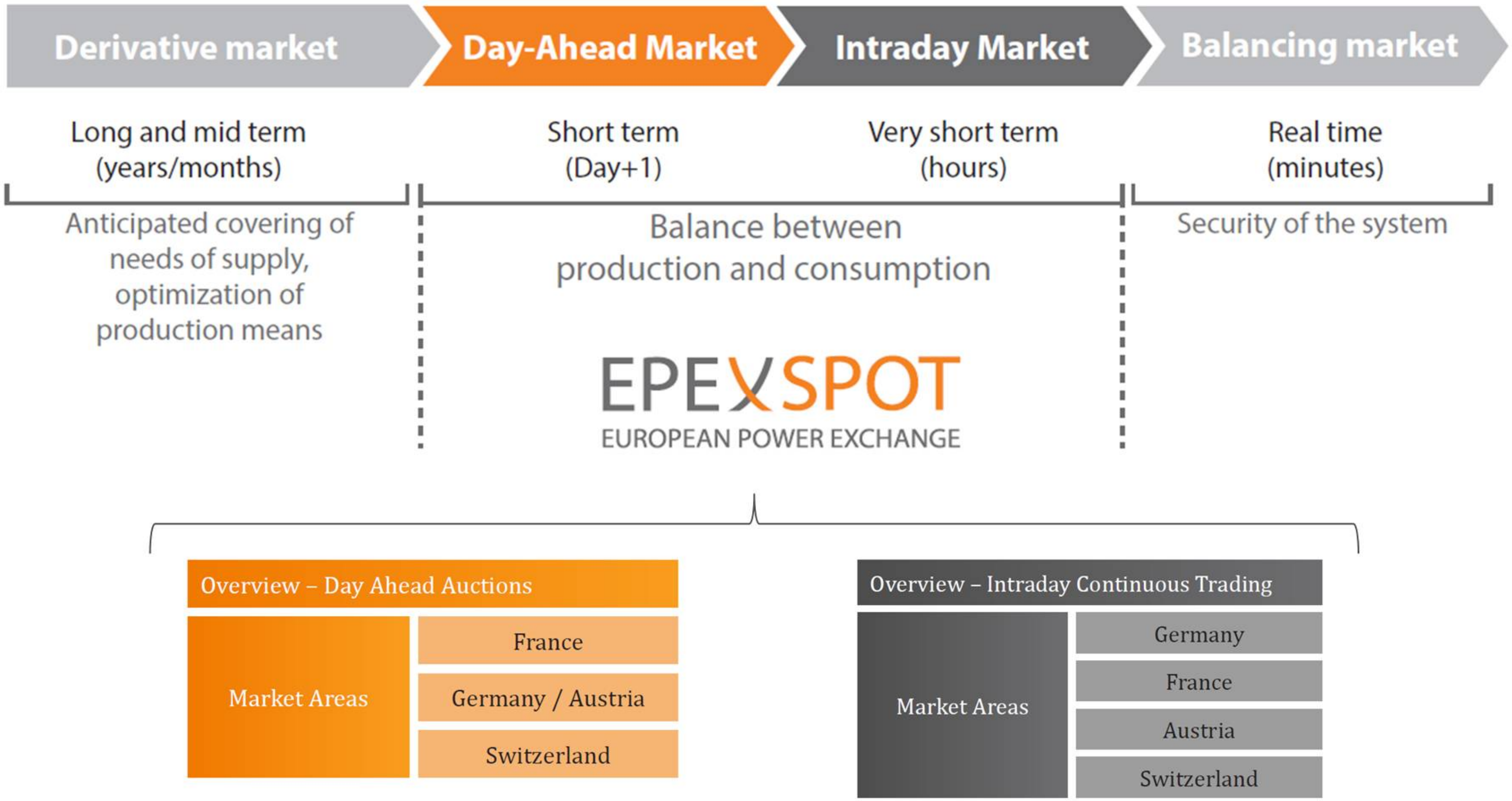

Source: EPEX SPOT

Day-Ahead and Intraday markets are complementary:

- **Day-Ahead**: blind auction, anonymous, without price indication → optimization of liquidity
- **Intraday**: continuous price formation, near real time → flexibility tool

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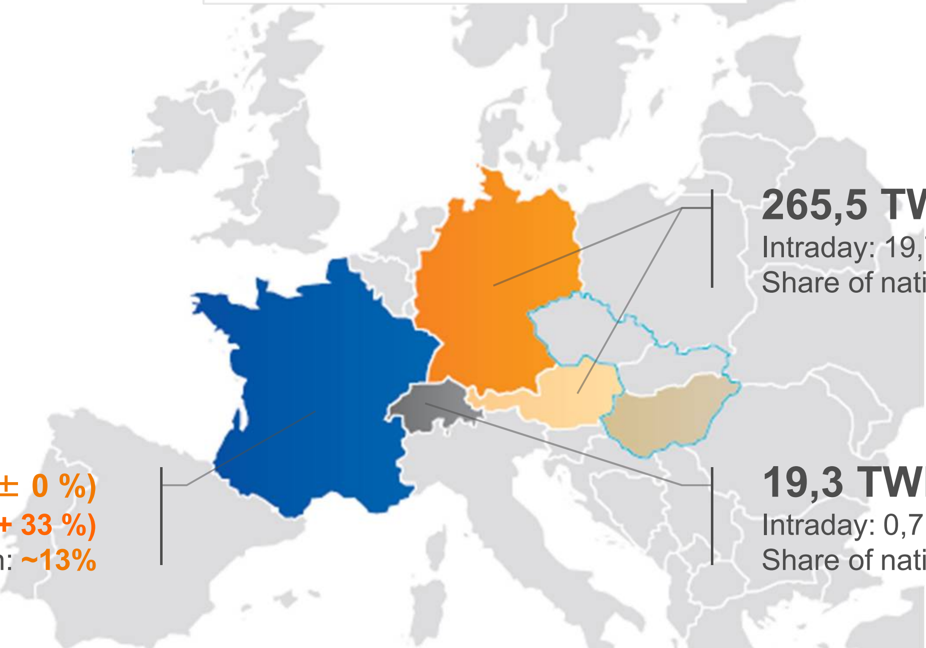
Markets, services & volumes

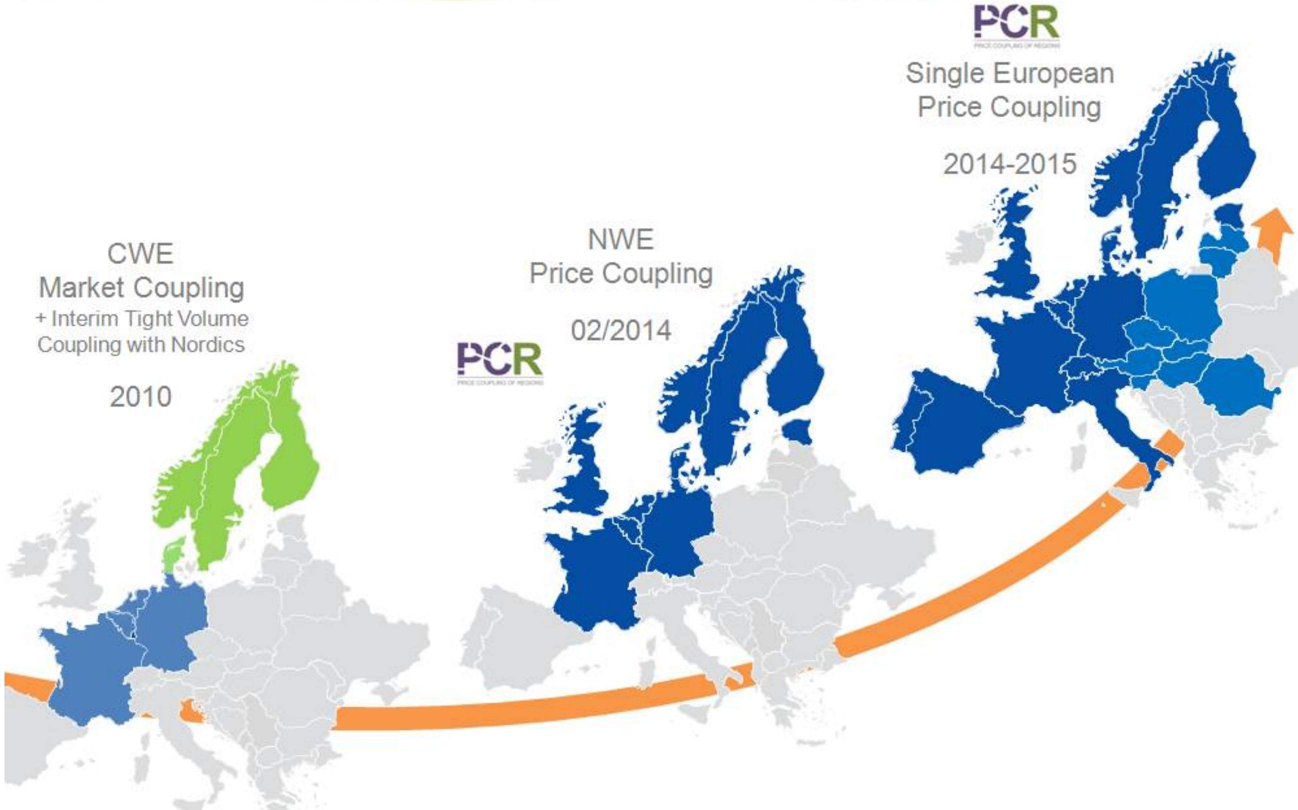
346 TWh
in 2013 on all EPEX markets
+ 2 % increase



Source: EPEX SPOT

- EPEX SPOT's market areas cover **1.200 TWh of yearly power consumption**, which represents **40% of EU's Integrated Electricity Market**.
- EPEX SPOT has an inherent incentive to **integrate European power markets**. We support this process by our **harmonized cross-border trading systems**.

European Market Coupling: Integrating the EU electricity market by end of 2014



Source: EPEX SPOT

- **European Target Model** for Day-Ahead markets: **cross-border trade optimization** based on implicit auctions of cross-border capacities
- Development of a single and harmonized method to calculate electricity prices on a European level („**Price Coupling of Regions**“)
- Regional model allows to adjust political objectives, cross-border cooperation unlocks **macroeconomic benefits**

European Market Coupling: Benefits

Optimal use of interconnectors facilitating congestion management

Price convergence of market areas in case of sufficient border capacity (~50% of hours in 2013 for Germany & France)

Absorbing extreme weather conditions (i.e. cold spell, storm front) across several market areas

Smoothing effect on negative or positive price spikes

Higher security of supply through market integration and no longer depending on the individual country

Source: EPEX SPOT

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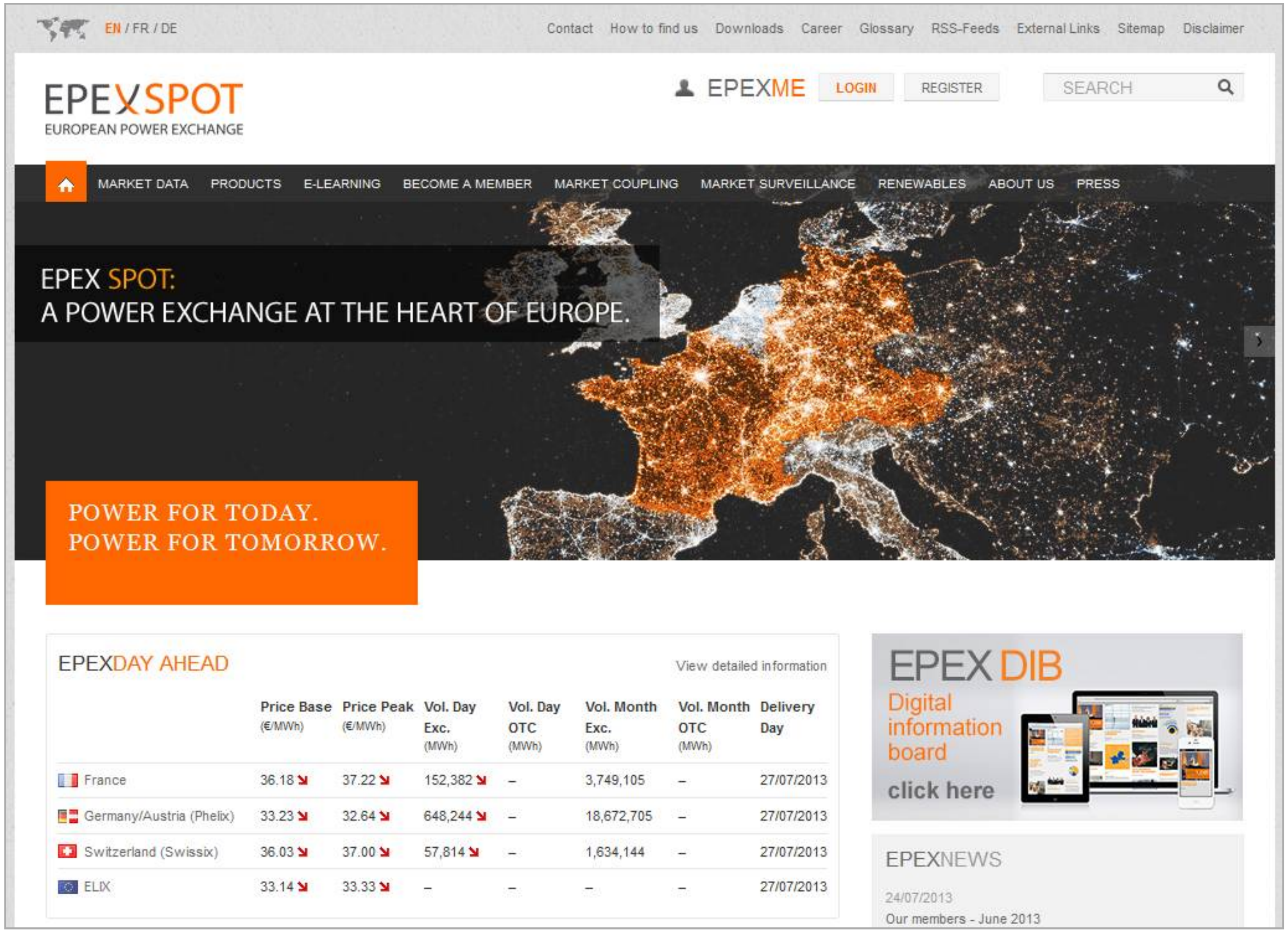
Thank you for your attention!



Please find market results and further information on our website:

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Thank you & Bird & Bird