

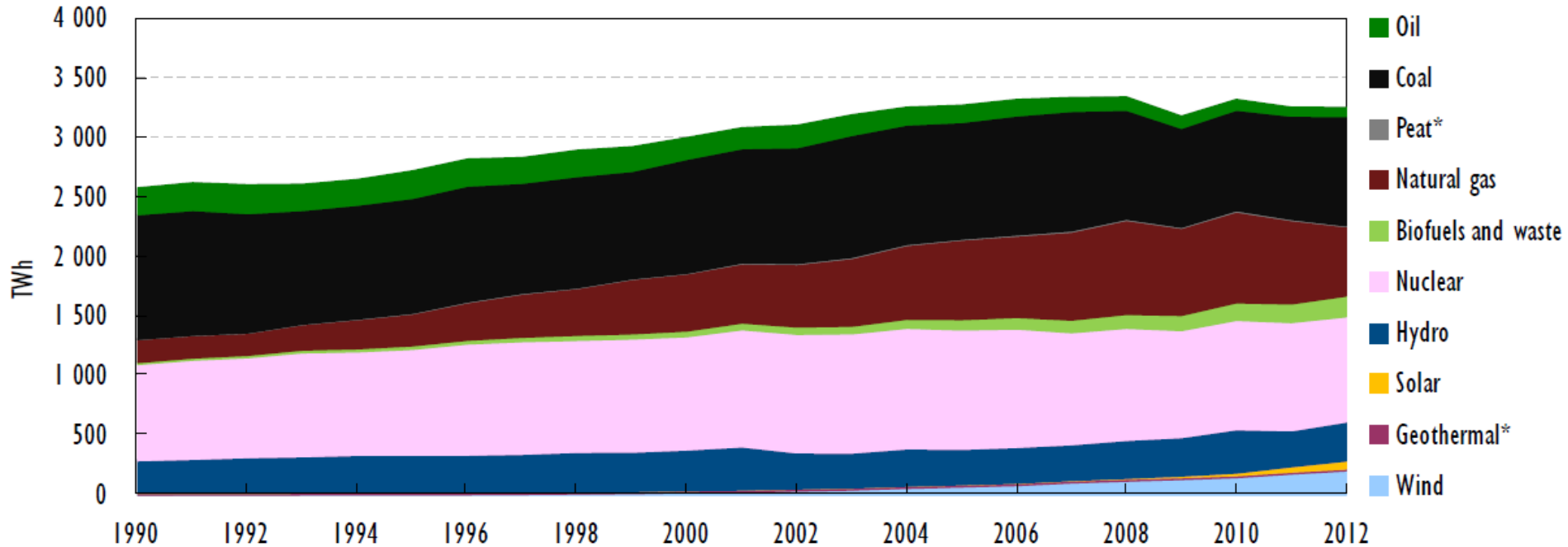
IEM: Electricity Market

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Key data (2012)

- Installed capacity – 952 GW
- Total electricity generation 3264 TWh (+5% since 2002)
- Electricity generation mix: coal 28,4%, nuclear 27%, natural gas 17,8%, hydro 10,3%, wind 6,3%, biofuels and waste 5,2%, oil 2,2%, solar 2,2%, peat 0,2%, geothermal 0,2%
- Electricity consumption by sector: industry 36%, commercial 32,1%, residential 29,6%, transport 2,3%

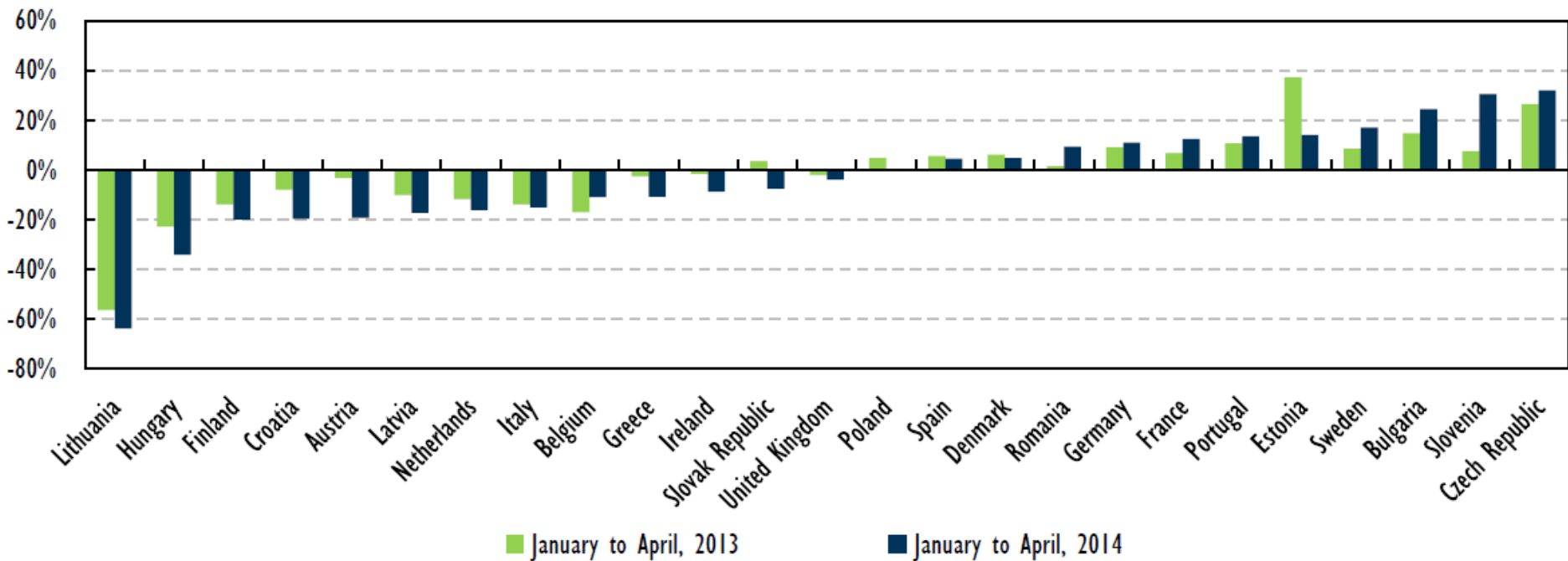
Electricity generation by source, 1990-2012



* Negligible.

Sources: IEA (2014a), *Energy Balances of OECD Countries*, OECD/IEA, Paris; IEA (2014c), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

Intra-EU power import and export positions, 2013 and 2014



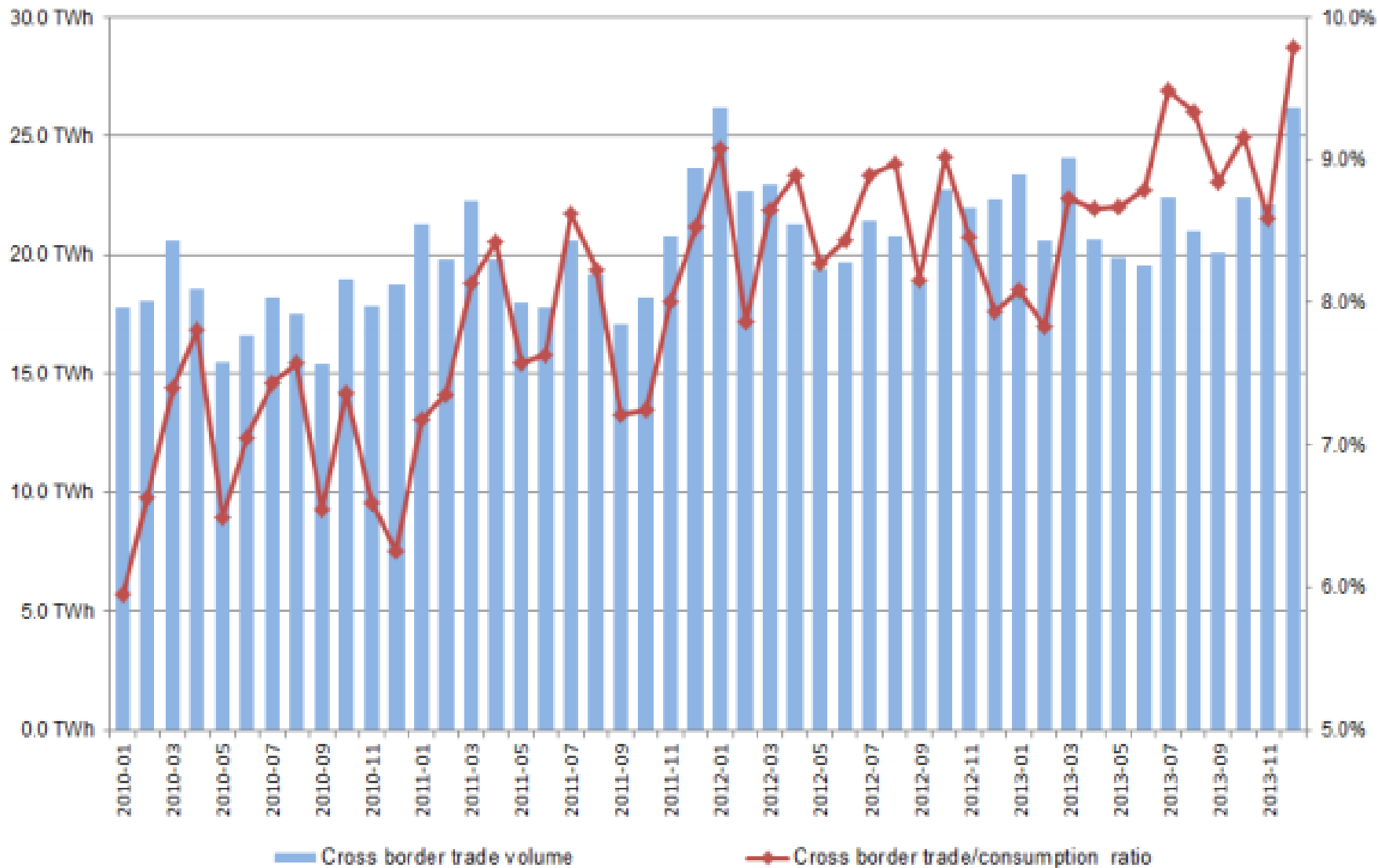
Notes: data represents the difference between power generation and consumption. Data for Cyprus, Malta and Luxembourg are not included.

Source: ENTSO-E, European Commission, 2014.

Wholesale electricity market

- Cross-border trade has been growing, in 2011 around 10% of gross production.
- Germany surplus of 22,8 TWh, France exported 44 TWh (both in 2012), increasing trade activity in Norway, Sweden, Austria, Switzerland (hydroelectric capacities).

Monthly cross border electricity flows in the EU and the ratio of cross border flows compared to the gross inland electricity consumption

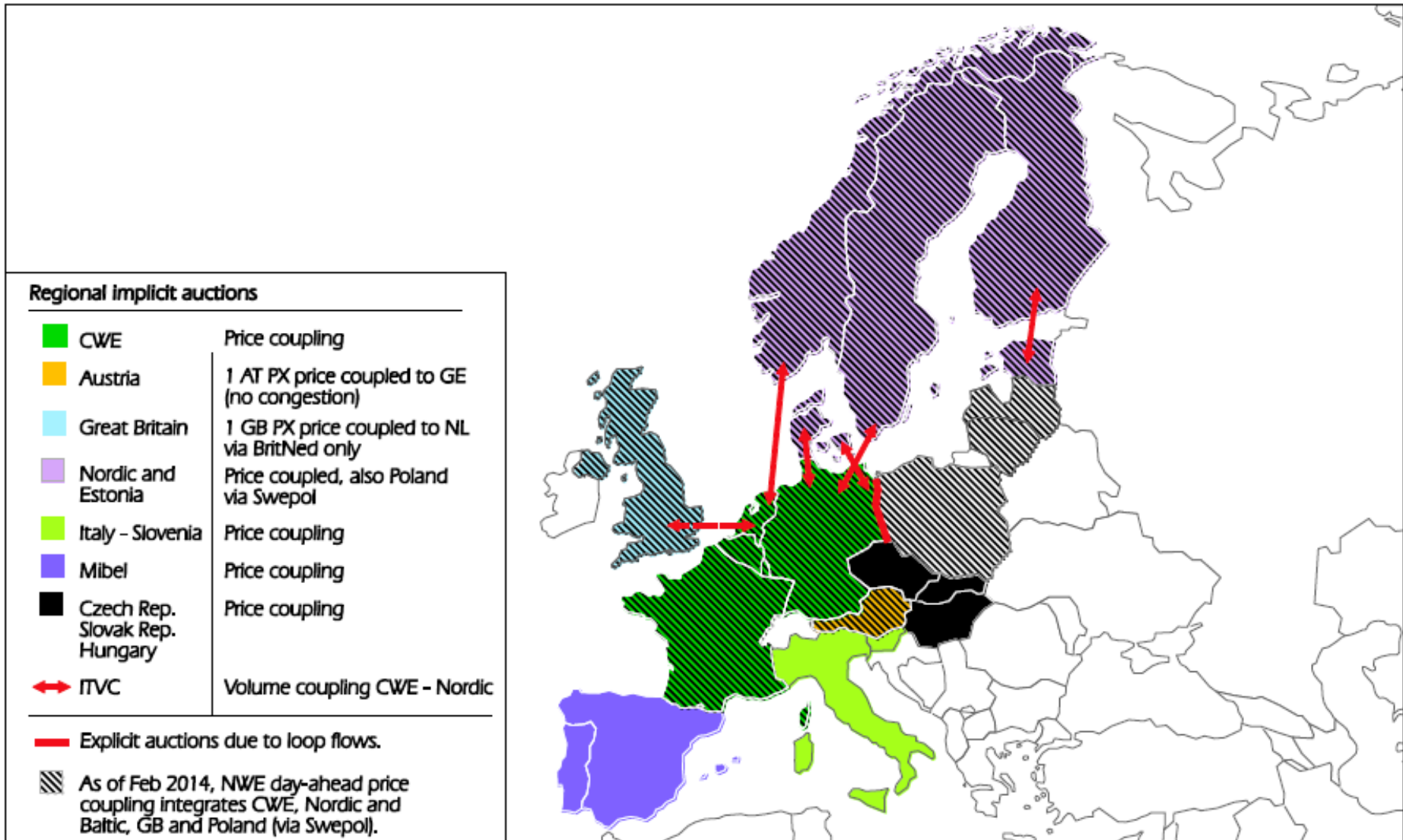


Source: ENTSO-E

Wholesale electricity market

- Day-ahead market coupling through the coupling of cross-border electricity exchanges. Coupling of regional electricity markets – Nordic market, Central West, North West Europe...
- (Day-ahead) market coupling optimises interconnection capacity utilisation (calculation and allocation) and facilitates linking of buyers and sellers on either side of a border
- Cross-border capacity allocation is carried out together with the financial energy settlement in one single operation at the exchange (no need for prior reservation of capacity) = implicit auctioning

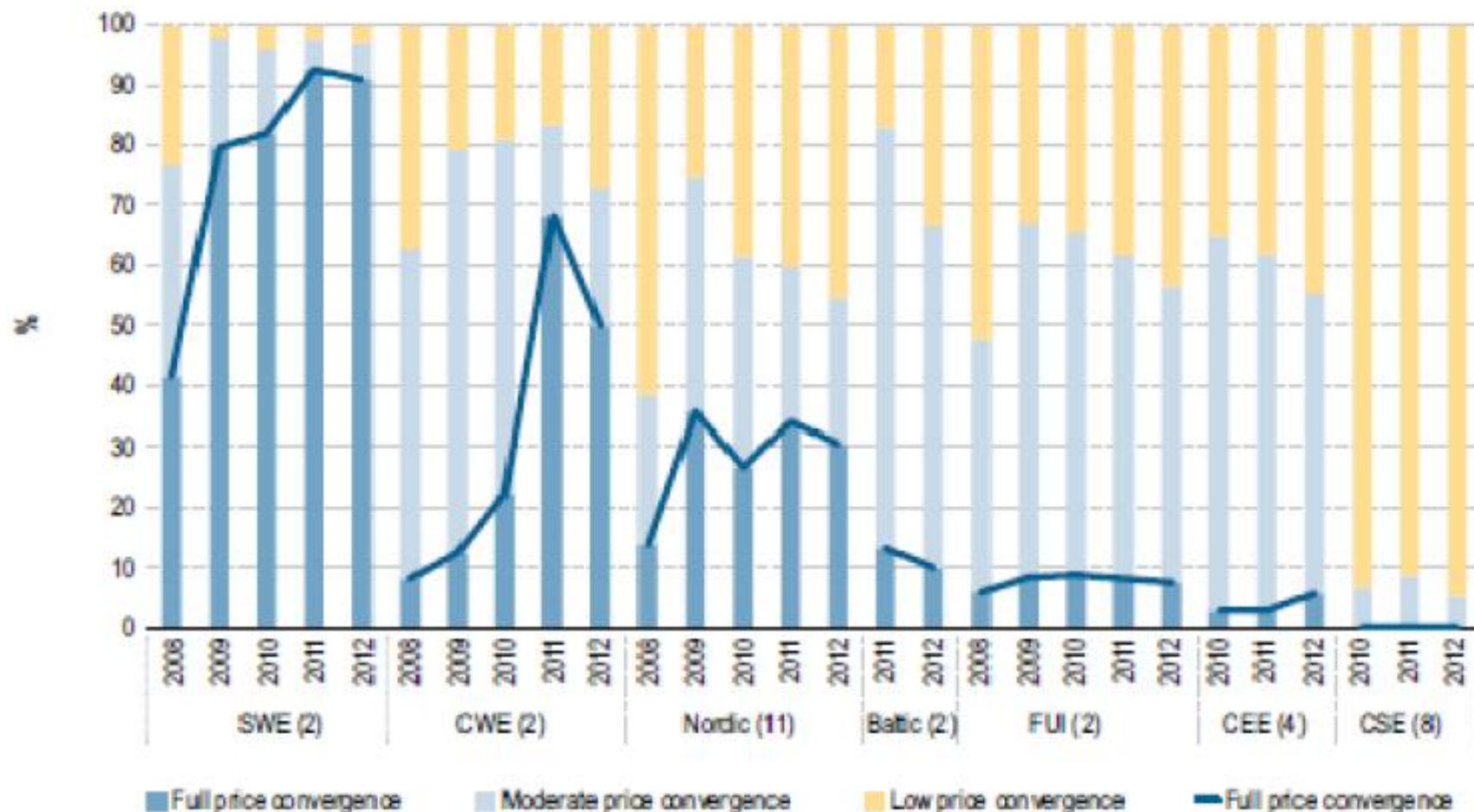
Overview of market coupling towards a European day-ahead market



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Price convergence in Europe by region, 2008-2012 (%)

Price convergence in Europe by region (ranked) – 2008 to 2012 (%)



Source: Platts, PXs and data provided by NRAs through the Electricity Regional Initiatives (ERI) (2013) and ACER calculations

Note: The numbers in brackets, e.g. SWE(2), refer to the number of bidding zones per region included in the calculations.

Intra-day markets

- Intra-day and balancing markets largely national or bilateral
 - Dutch-German border
 - Dutch-Belgium border
 - Nordpool Elbas platform
 - Dutch-Norwegian NorNed interconnector
 - Great Britain on BritNed

Retail market

- Still fragmented, regulated, with low level of switching
- Still high generation concentration. In 8 MS more than 70% of generation controlled by historic incumbent

Overview of incumbent's presence and foreign supply side substitution to promote retail market integration, December 2012

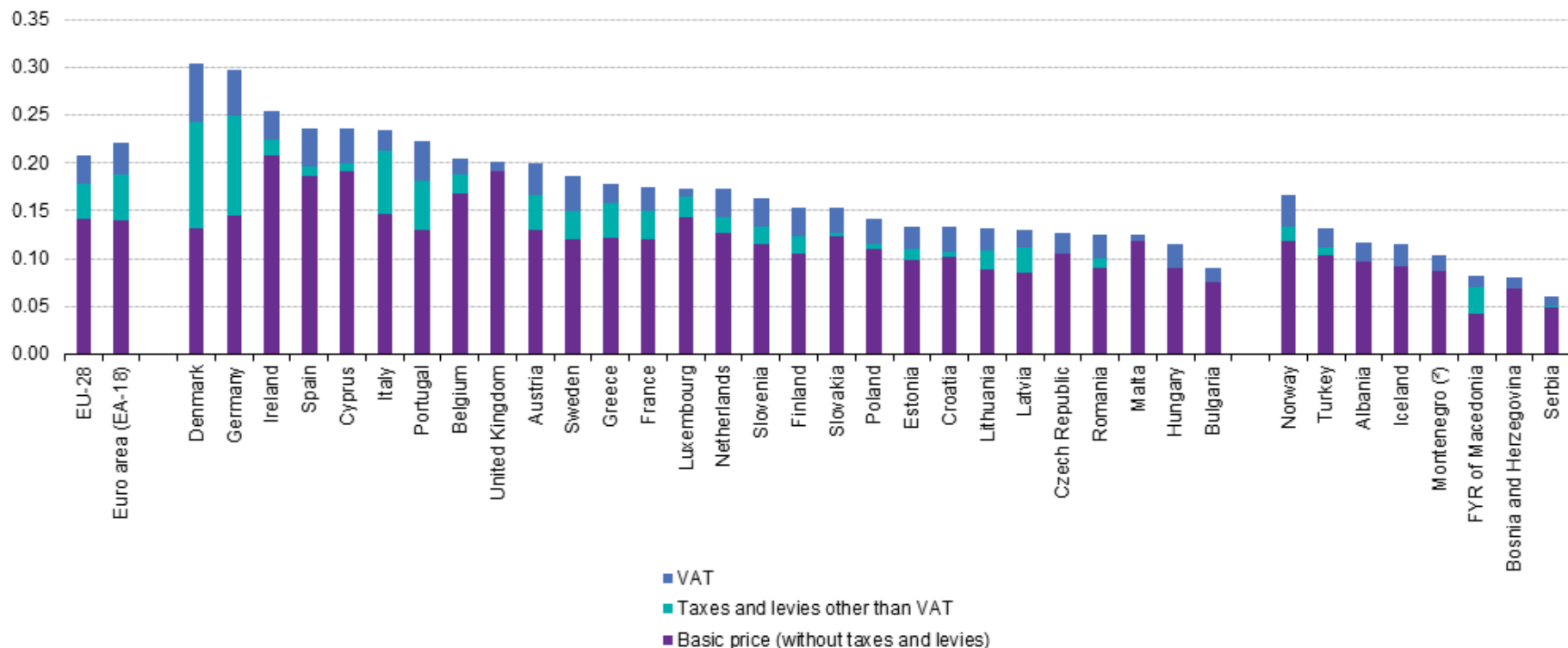
| Presence of foreign players (capital city) | Estimated incumbent market share in the household market – December 2012 (capitals) | | |
|--|---|--|----------------------|
| | More than 90% | Between 50% and 90% | Less than 50% |
| More than 50% | Bulgaria (1/1); Hungary (1/2); Romania (1/1) | | |
| Between 20% and 50% | | The Czech Republic (5/24); Spain (4/16); The Netherlands (6/18); Portugal (2/4); Belgium (2/6) | Great Britain (4/14) |
| Between 0% and 20% | Northern Ireland (1/4); The Slovak Republic (6/16) | Germany (1/14); Finland (2/37); Ireland (1/4); Italy (2/7) | Sweden (4/41) |
| 0% | Cyprus (0/1); Malta (0/1); Greece (0/1); Lithuania (0/1); Luxembourg (0/6); Latvia (0/1); Estonia (0/1); Poland (2/7); France (1/9) | Austria (0/18); Denmark (0/19); Slovenia (0/8) | Norway (0/11) |

Source: ACER/CEER 2013.

Prices

- Gap between household (EU-28 average of €140/MWh) and industry (€90/MWh) – different levels of taxation and RES surcharges
- Since 2008 the wholesale prices have been falling by 1/3, retail prices have increased by 4%/y
 - Due to the persistence of regulated prices and market concentration, the higher level of levies, taxes and network cost and low responsiveness of consumers to switch suppliers to better offer

Prices for household consumers, second half 2014 (eur/kWh)

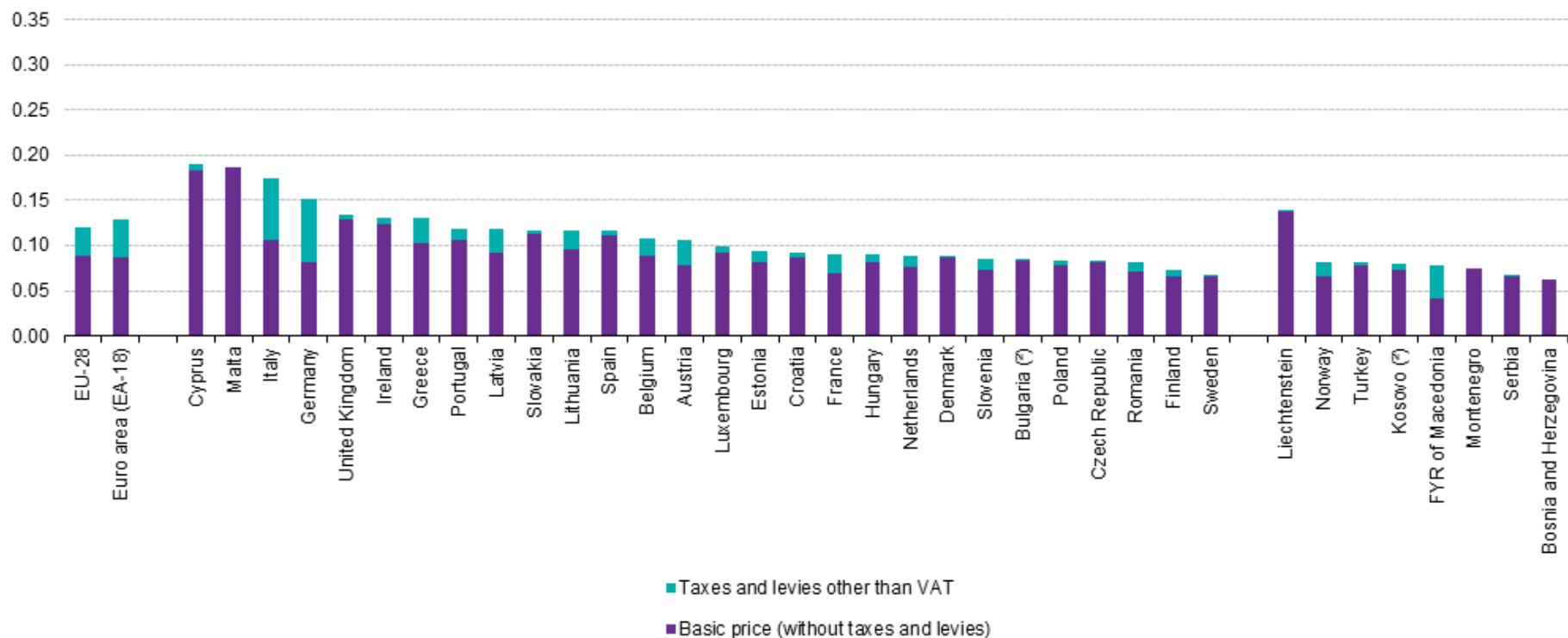


(*) Annual consumption: 2 500 kWh < consumption < 5 000 kWh.

(?) Taxes and levies other than VAT are slightly negative and therefore the overall price is marginally lower than that shown by the bar.

Source: Eurostat (online data code: nrg_pc_204)

Prices for industrial consumers, second half 2014 (eur/kWh)



(*) Annual consumption: 500 MWh < consumption < 2 000 MWh. Excluding VAT.

(*) Provisional.

Source: Eurostat (online data code: nrg_pc_205)

Impact of IEM on security of supply

= power system's capability to meet changes in requirements through investment, operational and end-use responses

- EU market integration and electricity trade increases interdependency among jurisdiction. But lack of integrated policies regarding a fuel mix
 - + diversification (more flexibility, lower the risk of shortages)
 - -/+ exposure to market, price and generation development in neighbouring countries
- EU legislation, network codes (network security and reliability code, code for operational procedures in an emergency...)
- Cooperation of TSOs (Ten year network development plan, regional investment plans...)

Electricity market – current situation

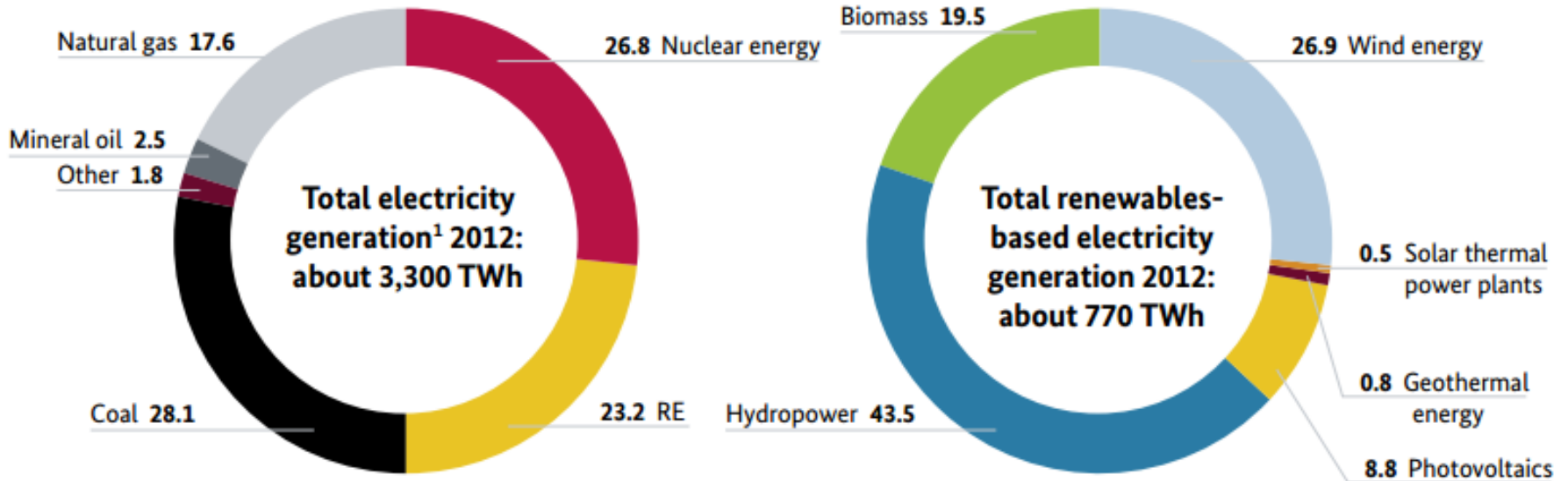
- Electricity markets still strongly impacted by national energy and climate policy decisions (RES, capacity mechanisms, retail market regulation, carbon prices...). Necessary is
 - to improve functioning of national markets by limiting state intervention (RES, capacity mechanisms, regulated tariffs)
 - to improve cross-border capacity (infrastructure investment, balancing and intra-day markets)
 - to optimise cross-border flows

Renewables

- 14,1% in total final energy consumption. 24,1% of electricity generation
- Aim of having 27% of RES energy in the EU in 2030
- Main drivers of development are a) goals of the EU b) that lead to national subsidy schemes c) plus increasing competitiveness of technology
- RES significantly changes the way the electricity is produced and traded

Electricity generation in the EU

in per cent

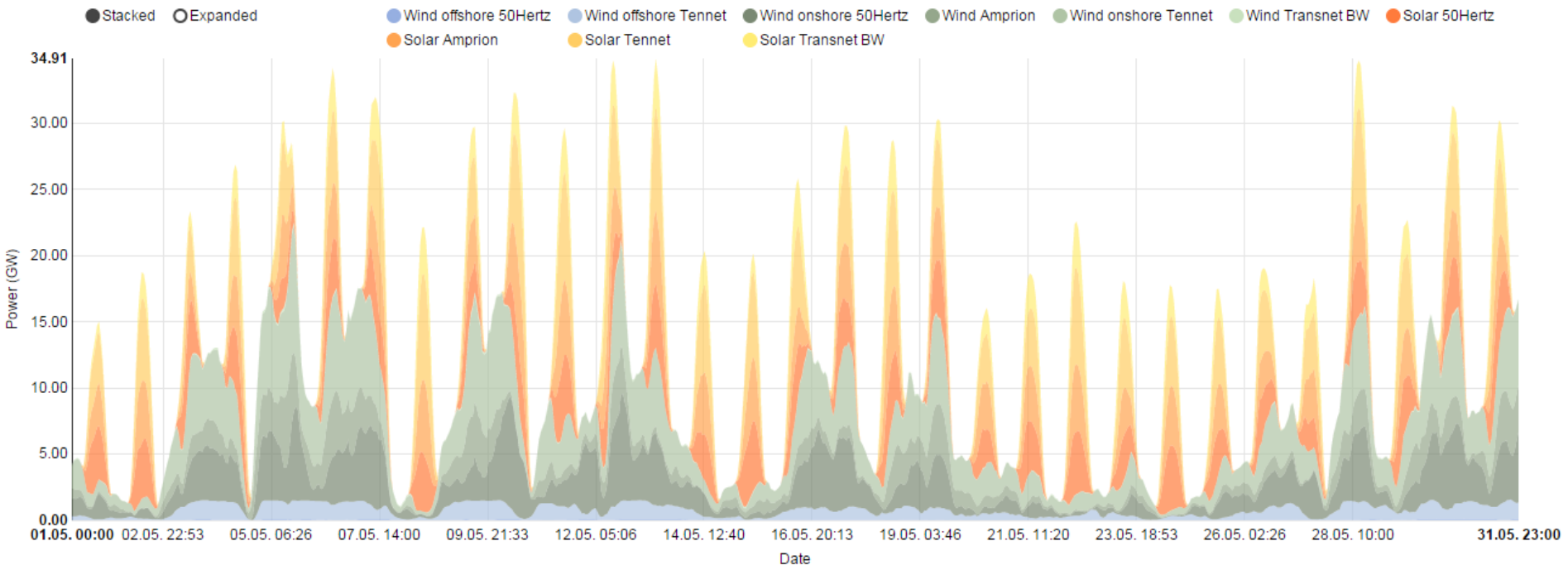


Other = industrial waste, non-renewable municipal waste, pumped storage, etc.
Marine energy is not shown due to the small quantities involved.

1 does not include net imports, which is why the share of renewable energy is 0.1 percentage points higher than in the following table

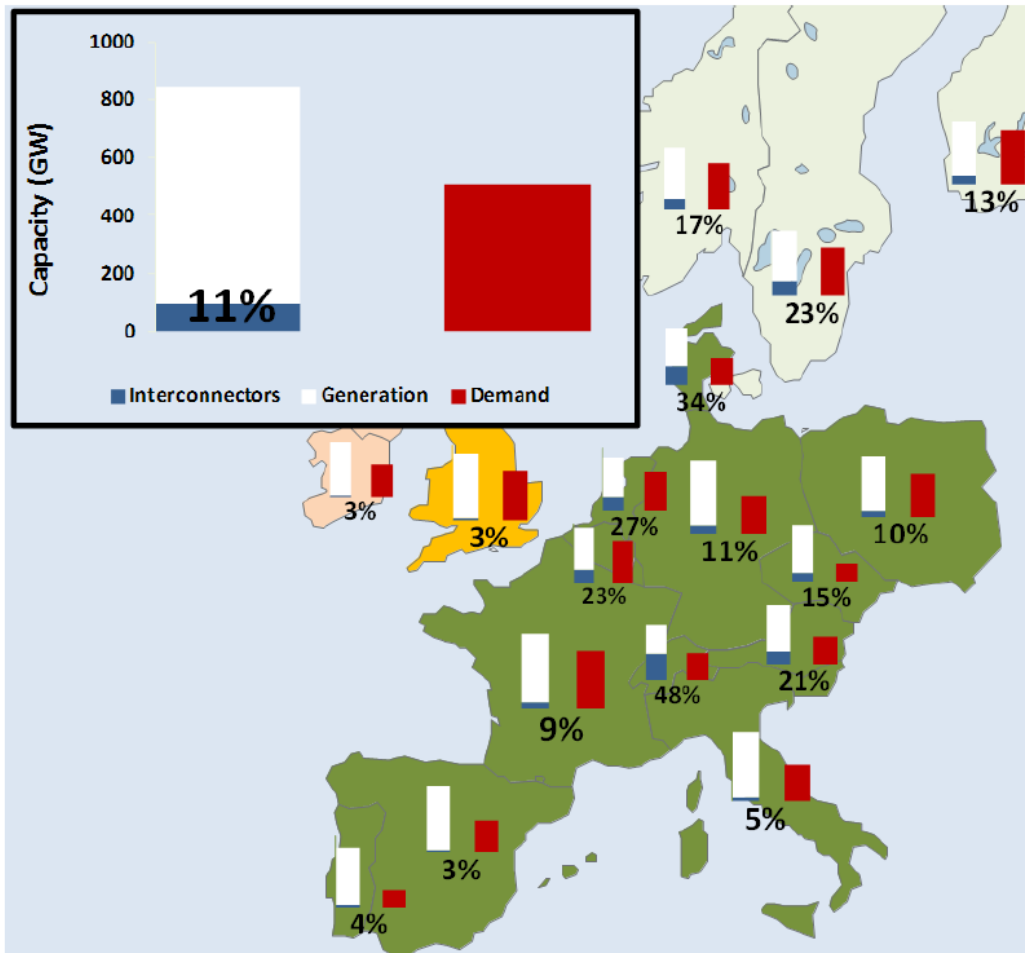
Source: ZSW based on Eurostat [32]

Production from non-dispatchable RES, May 2015, Germany

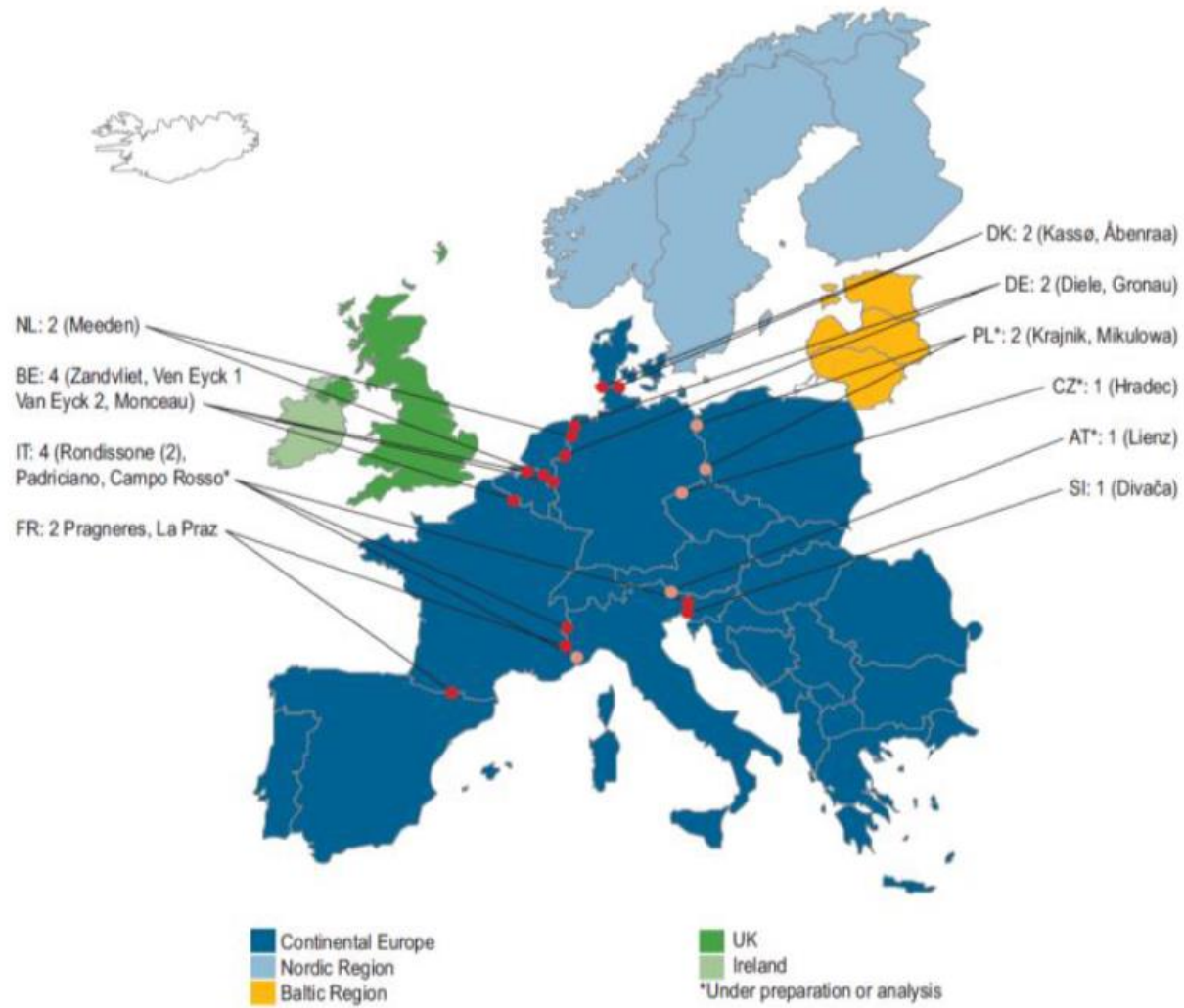


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Interconnections, generation and demand in selected EU/EEA countries and Switzerland



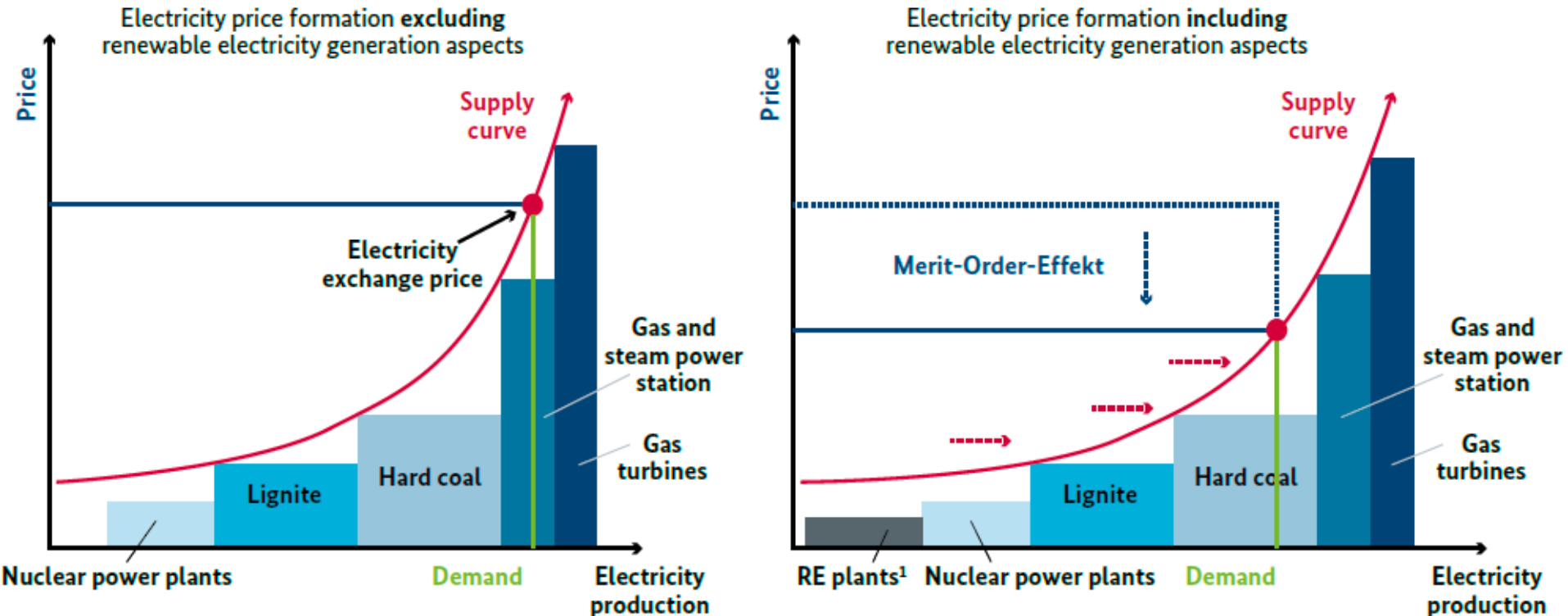
Source: IEA graph based on data from ENTSO-E, 2013b.



Source: ACER/CEER (2012).

Merit-order effect

Schematic description of the merit-order effect



Note: The RE plants shift the supply curve in the right-hand diagram to the right. This lowers electricity prices at the exchange, assuming demand remains unchanged. The price difference is the merit-order effect.

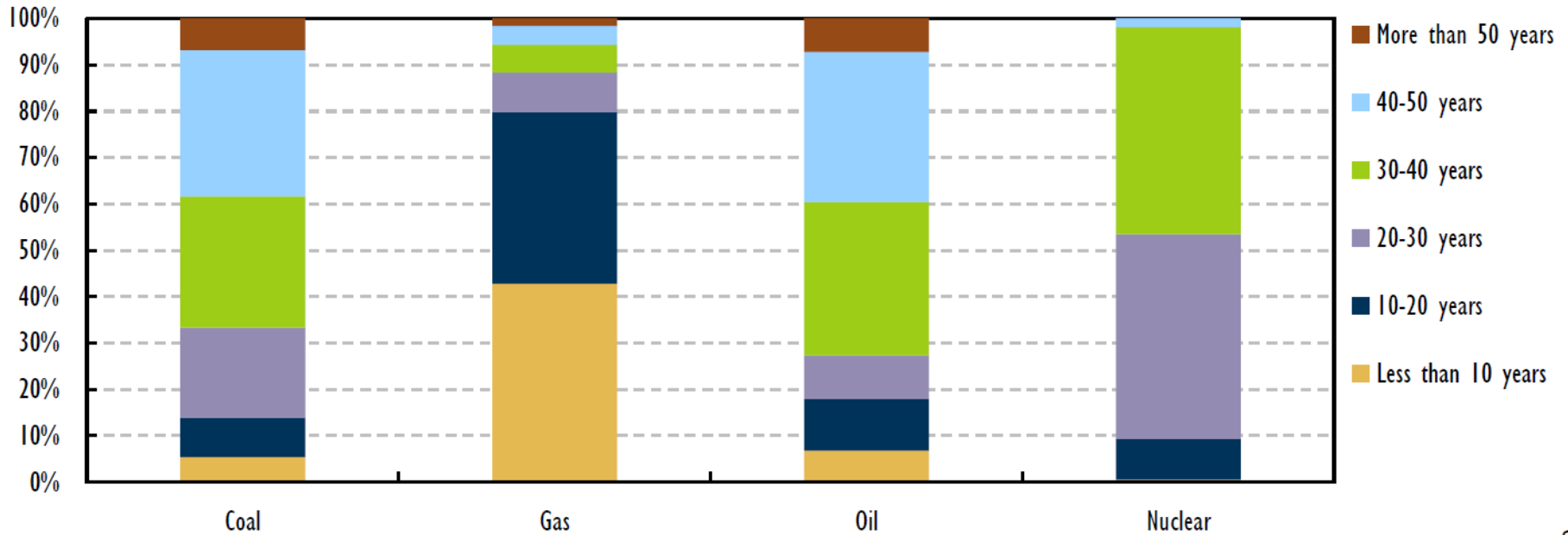
1 electricity from fluctuating renewable energy sources (PV, wind): marginal costs = 0

Generation adequacy

- Aging generation fleet (20% of coal and oil-fired plants constructed 40-50 years ago. Almost half nuclear capacities run 30-40 years)
- During 2016-2025 thermal installed capacity of around 150GW is expected to retire
- IEA concludes that „...*generation adequacy at the EU-wide system level can be met in most situations but adequacy margins are considerably decreasing until 2025*“

Generation adequacy

Age profile of installed thermal capacity, end-2013 (GW)



Source: Platts World Electric Power Plants Database, December 2013 edition.

Sou

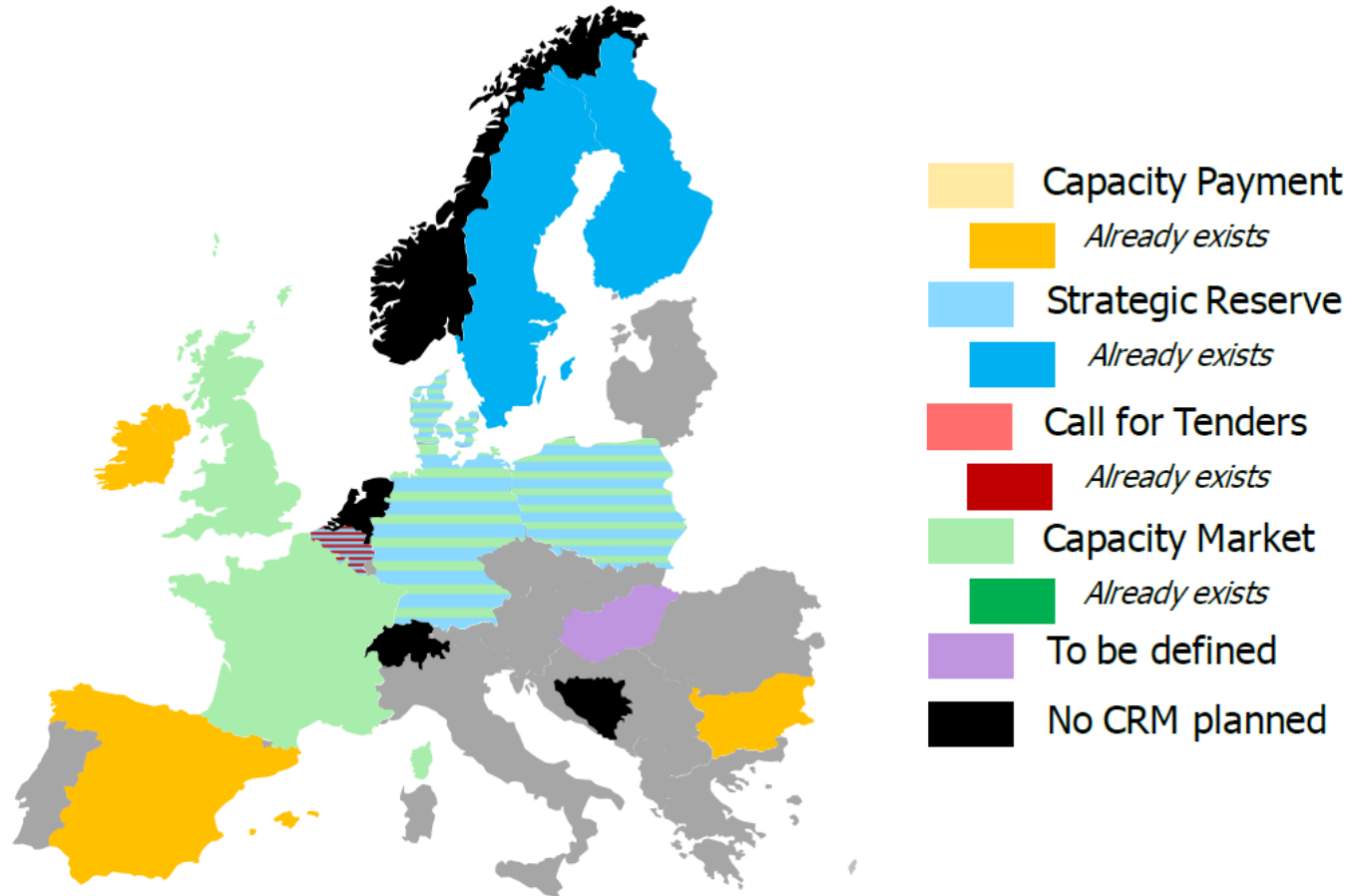
Capacity mechanisms

= capacity remuneration

- To solve problem of weakened investment incentives
- But they replace market-driven investment with central planning – considerable regulatory risk and cost for investors and consumers

Capacity mechanisms

Overview on existing and planned capacity mechanisms in the EU



Sources

- IEA (2014): Energy Policies of IEA Countries – The European Union.