

# National and International Energy Policy

*Winter/Summer Energy School*

*2<sup>nd</sup> of February 2016*

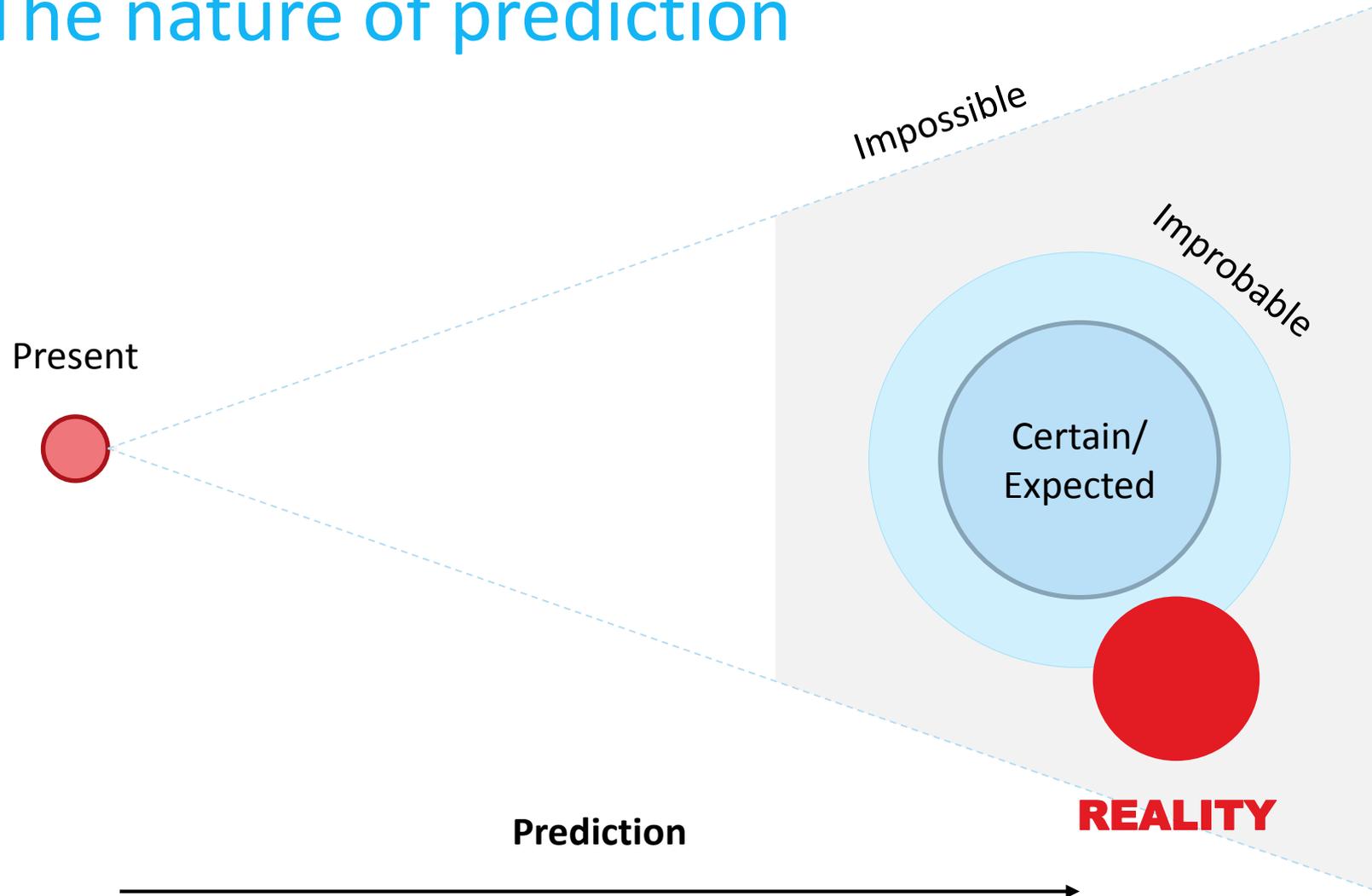
Czech Technical University in Prague



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Ministry of Industry and Trade

# The nature of prediction



# Lesson learned – „solar boom“

- ➔ Feed in tariffs – fixed for 20 year, guaranteeing 15 years payback time.
- ➔ Decision – **feed in tariffs can decrease by max. 5% annually** (motivated by ensuring the stability for the investors).
- ➔ „Unexpected“ fall of PV costs – approx. 50% decrease.
- ➔ Feed in tariffs could not change accordingly => wind fall profit.
- ➔ Investment boom in 2009 and 2010 => second largest capacity per capacity in the world (2010).
- ➔ Major increase in power consumer fee for RES – 6.9 => 23.9 USD/MWh (2010/2011) => 11.2% increase in consumer prices.
- ➔ State reaction solar tax => law suits, stop & go policy.

# The role of energy policy

## An effort to use „systematic“ policies:

Guaranteed demand of „green“ electricity/  
No license for „micro-sources“ (< 10 kW).



Feed-in-tariffs/feed-in-premiums.

European union emission trading scheme (EU ETS).



Target for renewable sources of 27 % in 2030.

# Green energy development policies

Low carbon policies - fossil fuel taxation, EU Emission trading scheme.  
Renewable energy policies.

Non-financial support (priority access to the grid, tax exceptions, no responsibility for intermittency, low administrative burden).

Investment support schemes (Czech state budget, EU structural funds).

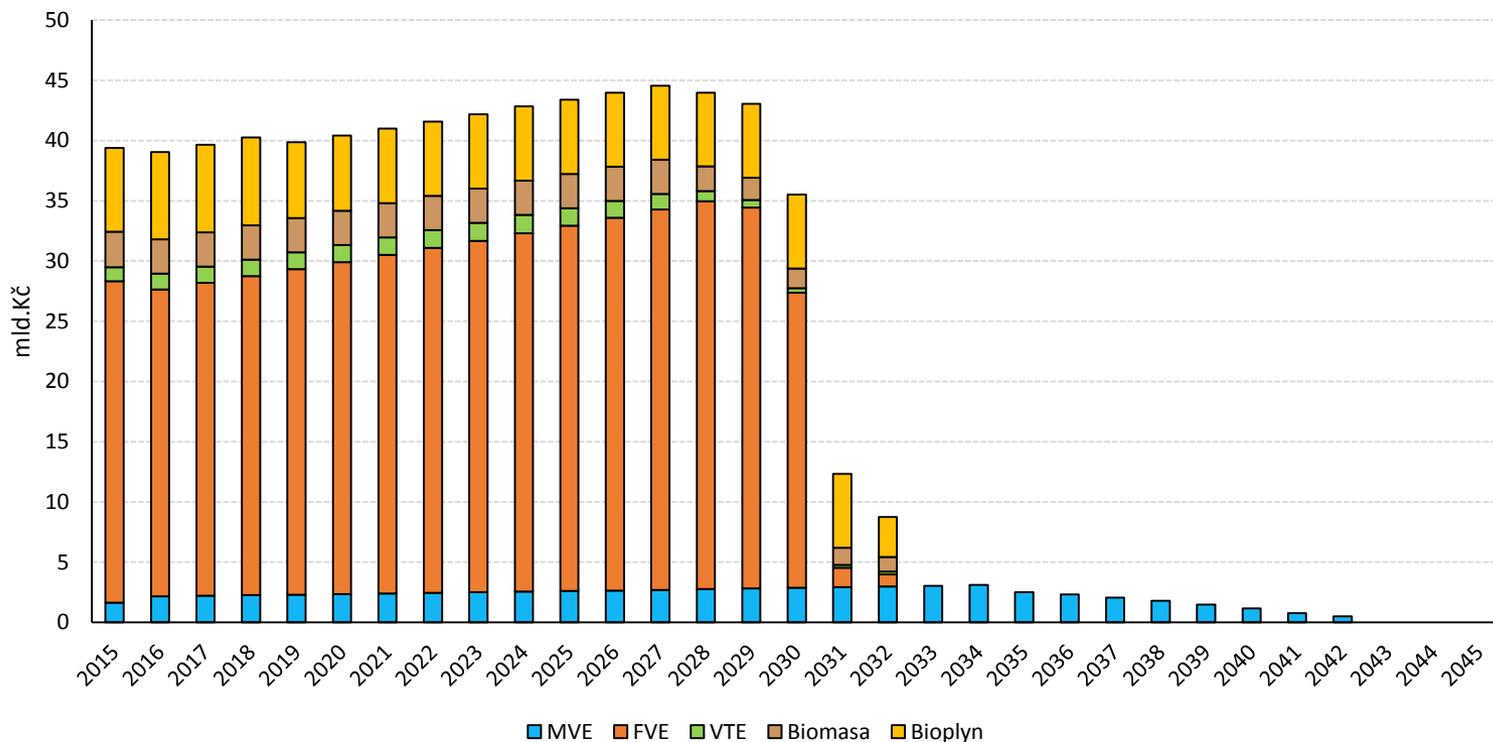
Feed in tariffs and premiums (payment for generated kWh) – quoted every year for new sources, different for different sources

Feed in tariff- guaranteed market purchaser, all generation sold, fixed price (not fixed to the market price), 15 year payback period.

Feed in premium (green bonus) – nonguaranteed market purchaser, fixed bonus to market price, payment for own consumption, green bonus + market price > fixed tariff.

Cost burden of RES support — state budget (tax payers).  
within regulated component of final price.

## Predikce vývoje výdajů na podporu stávajících obnovitelných zdrojů



Podporu stávajících podporovaných zdrojů budeme platit následujících přibližně 15 let.

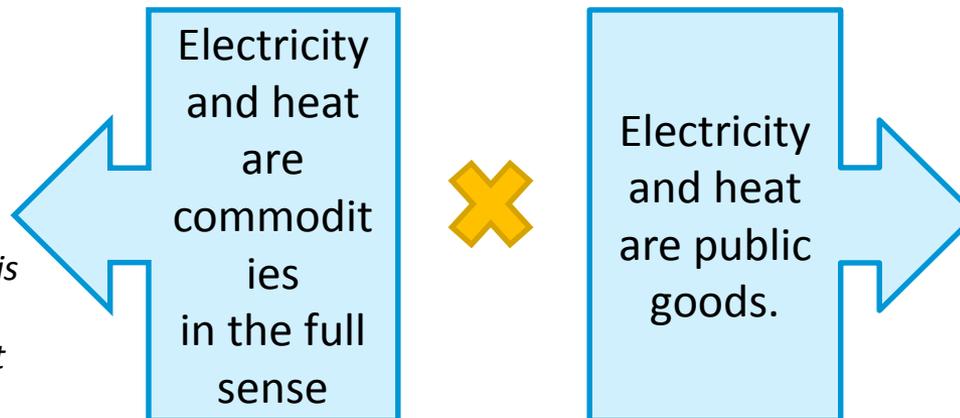
# The role of energy policy

**Public good** is a good that is both non-excludable and non-rivalrous in that individuals cannot be effectively excluded from use and where use by one individual does not reduce availability to others.

**Electricity and heat** are divisible goods - it is possible to exclude certain entities from consumption. These goods **do not therefore meet the definition of public goods** and can be seen as a purely private goods (these goods have long been seen as public goods due to natural monopoly in the sector of transmission and distribution).

## „Energy dilemma“

*The State does not care about the adequacy of production capacity. Due to the long investment cycle the situation might occur in which consumer is willing to pay an „appropriate“ price, but it is not possible due to insufficient capacity.*

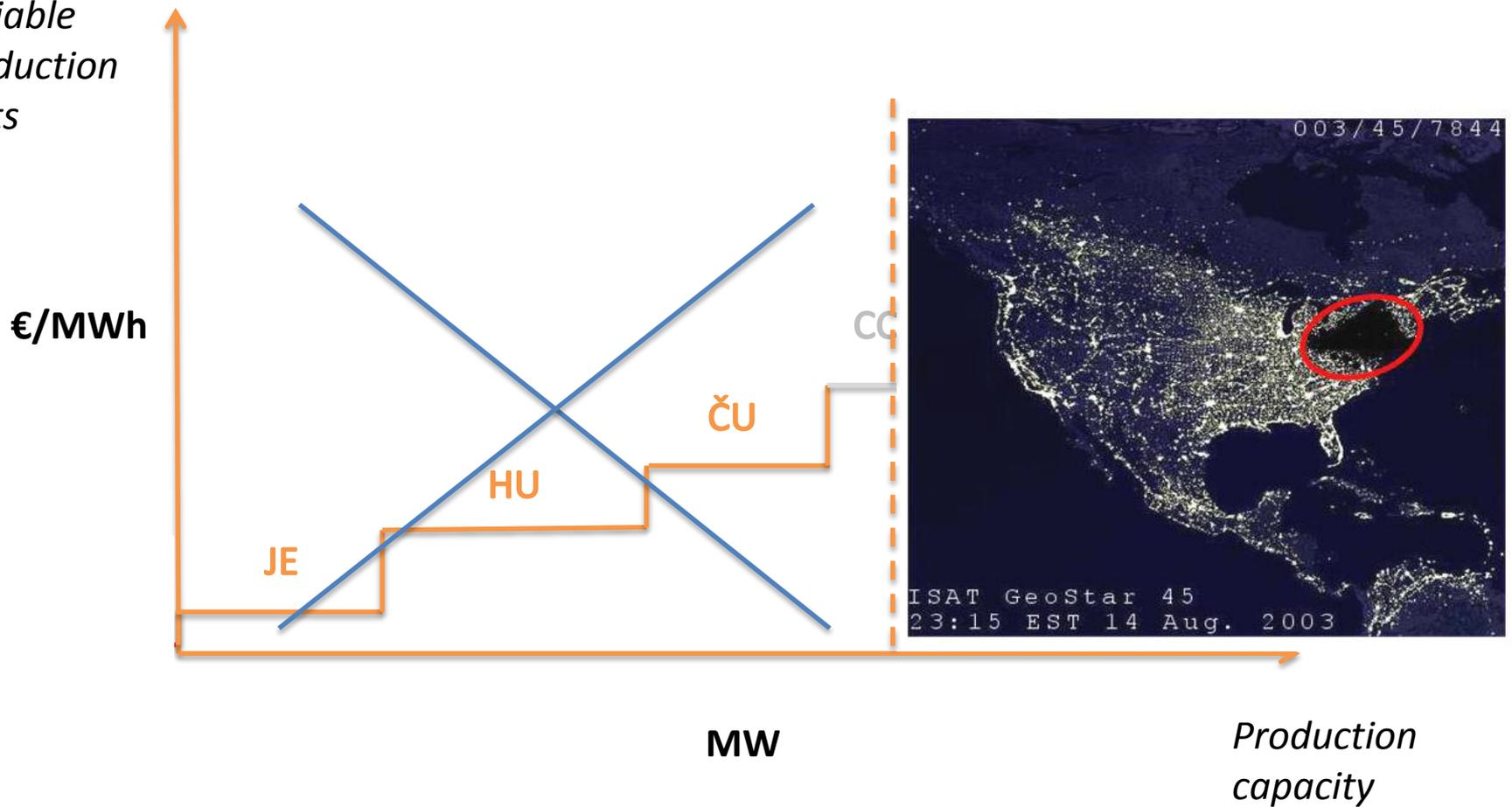


*The State reflects the fact that everyone has the right to connect to a source of electricity and heat. The state arrogates to itself the right to intervene in the free market in order to keep production adequacy. Regulation of supply side of power market.*

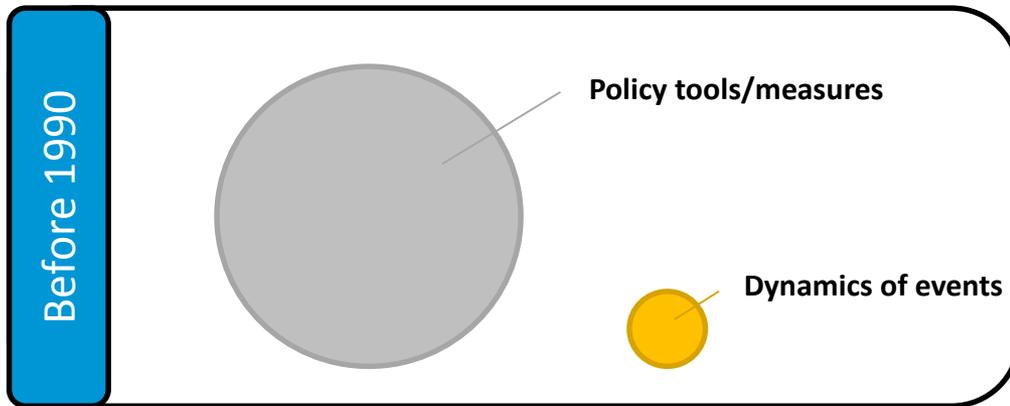
**Energy only market, capacity markets, price spikes energy poverty.**

On „classical“ markets the falling of the edge of supply is impossible due to elasticity (price), „closing of the business“ is experienced only by the last buyer.

Variable  
production  
costs

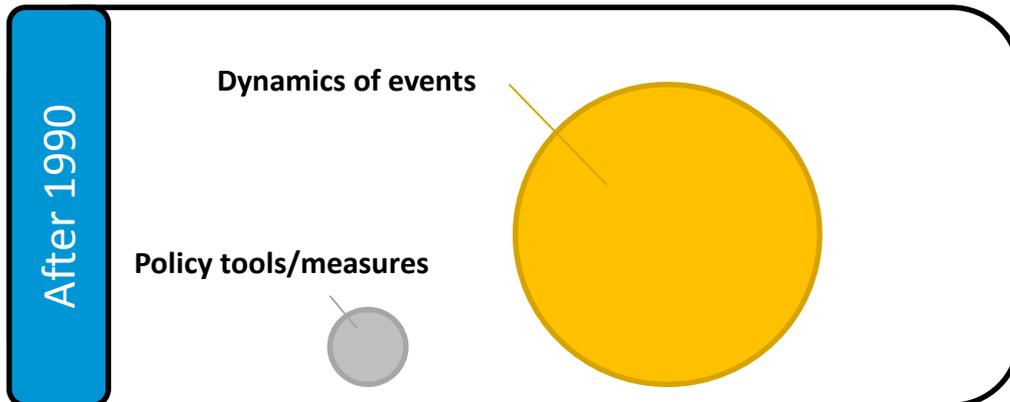


# The role of energy policy



- ➔ Fully regulated price of electricity.
- ➔ Fully regulated supply of power and heat.
- ➔ Regulated prices of energy commodities.
- ➔ Investment based on long-term plans.
- ➔ Limited cross boarder exchange.
- ➔ Raw materials fully in state control.
- ➔ Possibility to use expropriation institute.
- ➔ Research and development planned by state.

## Energy Policy



- ➔ Unbundling + privatization (ex. Net4Gas)
- ➔ Separation of regulated and non-regulated price of electricity.
- ➔ Common market– market coupling.
- ➔ Energy market only.
- ➔ Global markets – oil, gas, coal.
- ➔ Climate & Energy Framework of EU
- ➔ Investment based on market signals.
- ➔ Competitiveness assessed on global market.
- ➔ International transfers of capital.

# The role of energy policy

## State tools/measures in energy sector:

- ➔ Direct ownership of strategic subjects (ČEPS, ČEPRO, MERO, SSHR) x NET4GAS, refineries (in private ownership in CZ), mining companies.
- ➔ Legislative and executive measures (direct):
  - ▶ Licenses, authorizations, penalization, emission limits, obligatory biofuel content, norms and limits – restriction of coal imports, concession for mining.
- ➔ Legislative and executive measures (indirect) – fiscal/budgetary and tax:
  - ▶ Feed in tariffs, feed in premium/green bonus, state subsidy schemes (EFEKT), EU structural funds (OPPIK), ecological taxes, fee for extracted mineral, podpora výzkumu a vývoje (TAČR, GAČR).
- ➔ Regulation (in CZ in responsibility of ERO):
  - ▶ Regulated part of electricity, allowable expenses and revenues, regulated/directed price of heat etc.
- ➔ Foreign energy policy.

# Energy Union

## Ten main priorities of European Commission:

- 1) Jobs, Growth and Investment (Stimulating investment for the purpose of job creation)
- 2) Digital Single Market (Bringing down barriers to unlock online opportunities)
- 3) Energy Union and Climate (Making energy more secure, affordable and sustainable)**
- 4) Internal Market (A deeper and fairer internal market)
- 5) A Deeper and Fairer Economic and Monetary Union (Stability for the single currency, solidity of public finances and social fairness in implementing structural reforms)
- 6) A balanced EU-US Free Trade Agreement (Freer trade – without sacrificing Europe's standards)
- 7) Justice and Fundamental Rights (Upholding the rule of law and linking up Europe's justice systems)
- 8) Migration (Towards a European agenda on Migration)
- 9) A Stronger Global Actor (Bringing together the tools of Europe's external action)
- 10) Democratic change (Making the EU more democratic)

 An effort for holistic approach in energy sector (and climate).

# Energy Union

## Updated roadmap for Energy Union COM(2015) 572 final

Actions	Responsible party	Timetable (shown in the annex to COM (2015)80)	SoS	IEM	EE	GHG	R&I	Comments / Update
<b>Infrastructure</b>								
Effective implementation of the 10% electricity interconnection target	Commission Member States National Regulatory Authorities Transmission System Operators	2015-20	X	X		X		Adopted on 25 February 2015 (COM (2015)82)
2nd list of Projects of Common Interest (PCI) – leading to Commission Delegated Act	Commission Member States	2015	X	X		X		Delegated act adopted on 18 November 2015 (C(2015)8052)
Communication on the progress towards the completion of the list of the most vital energy infrastructures and on the necessary measures to reach the 15% electricity interconnection target for 2030	Commission	2016	X	X				
Establish an Energy Infrastructure Forum	Commission Member States	2015	X	X				First meeting of the Energy Infrastructure Forum took place 9-10 November 2015 in Copenhagen

„Actions“: i) communication; ii) directive; iii) regulation (public consultation, PCI etc.)

## Member states approved three climate-energy targets for 2030

*On 23rd and 24th of November 2014 (on the level of European Council)*

**min. 40 %  
decrease of emission  
of GHG gases  
compare to 1990.**

- **Binding on the European level**
- Partial goal for EU ETS: 43 % red. (2005 => 2020)
- Potentially stricter depending on COP21 follow up

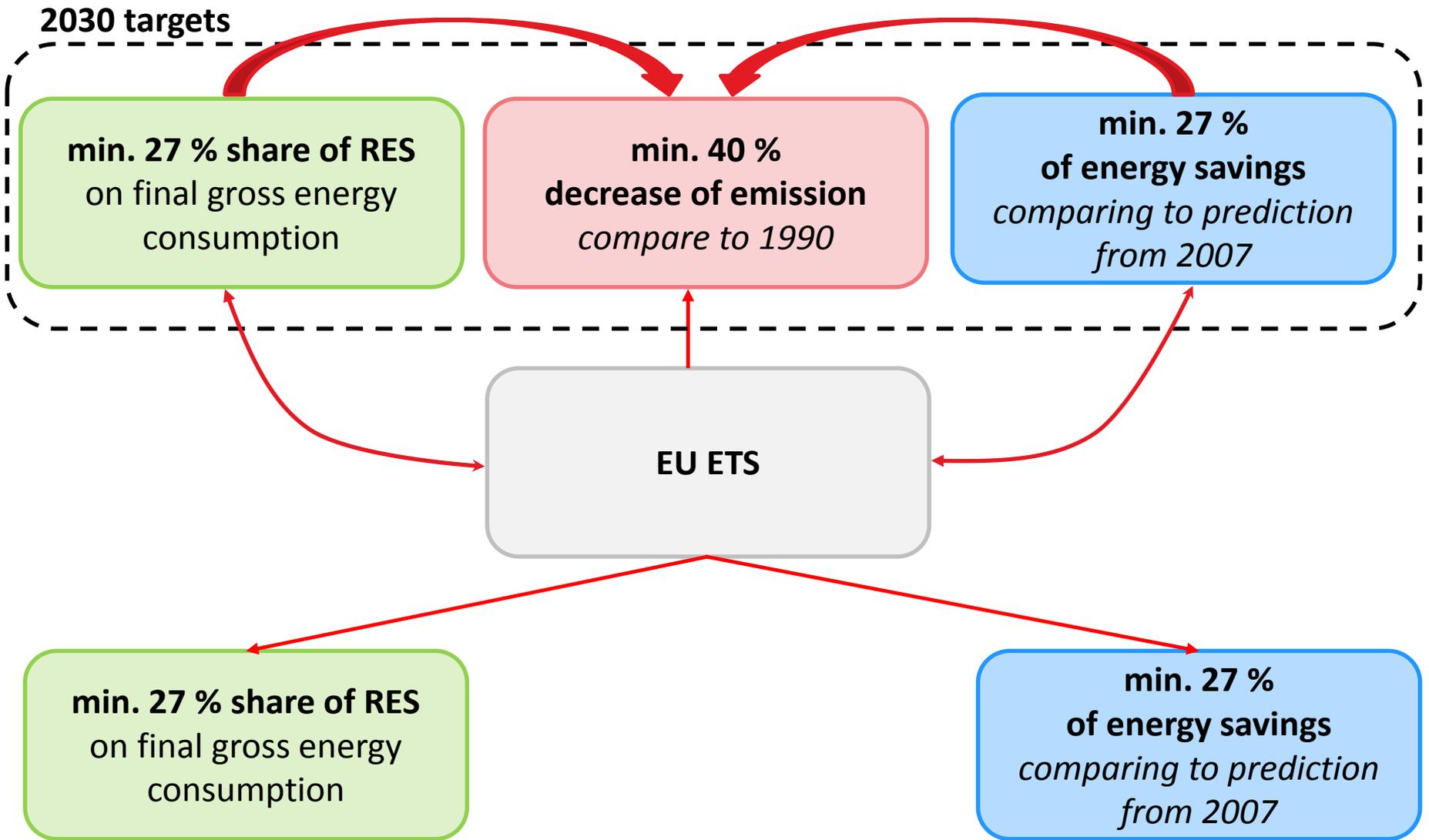
**min. 27 %  
share of RES  
on final gross energy  
consumption.**

- **Binding on the European level**
- It means app. 47 % of RES share on electricity
- Support should be primarily market based

**min. 27 %  
of energy savings  
comparing to  
prediction from 2007**

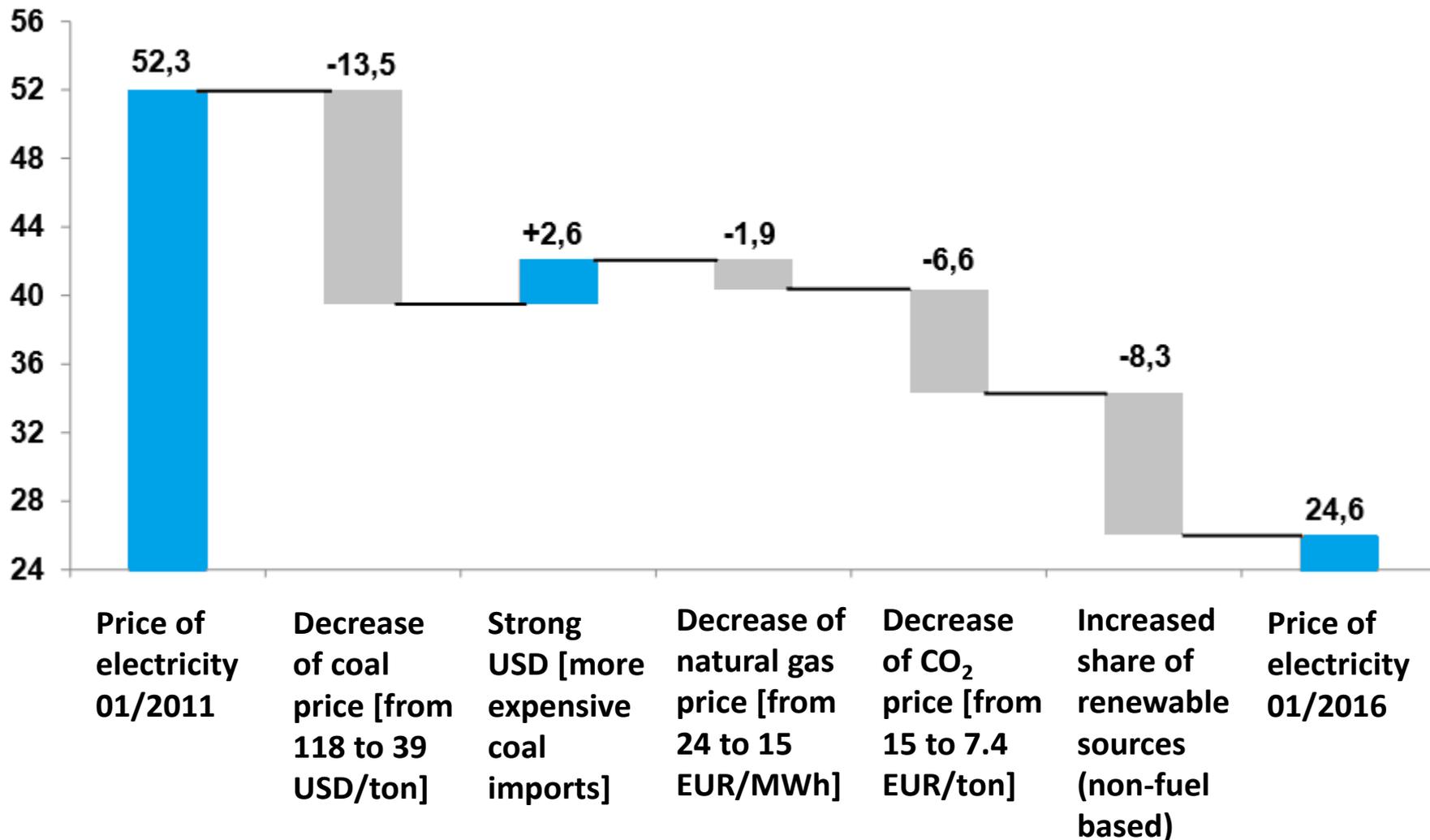
- **Indicative on the European level**
- Motivated mainly by decreasing of import dep.
- Might be increased to 30 %

- Target for interconnectivity – 10% until 2020, 15% until 2030 (already fulfilled in CZ)
- Targets are related to other measures, such as Market design, MRS for EU ETS etc.

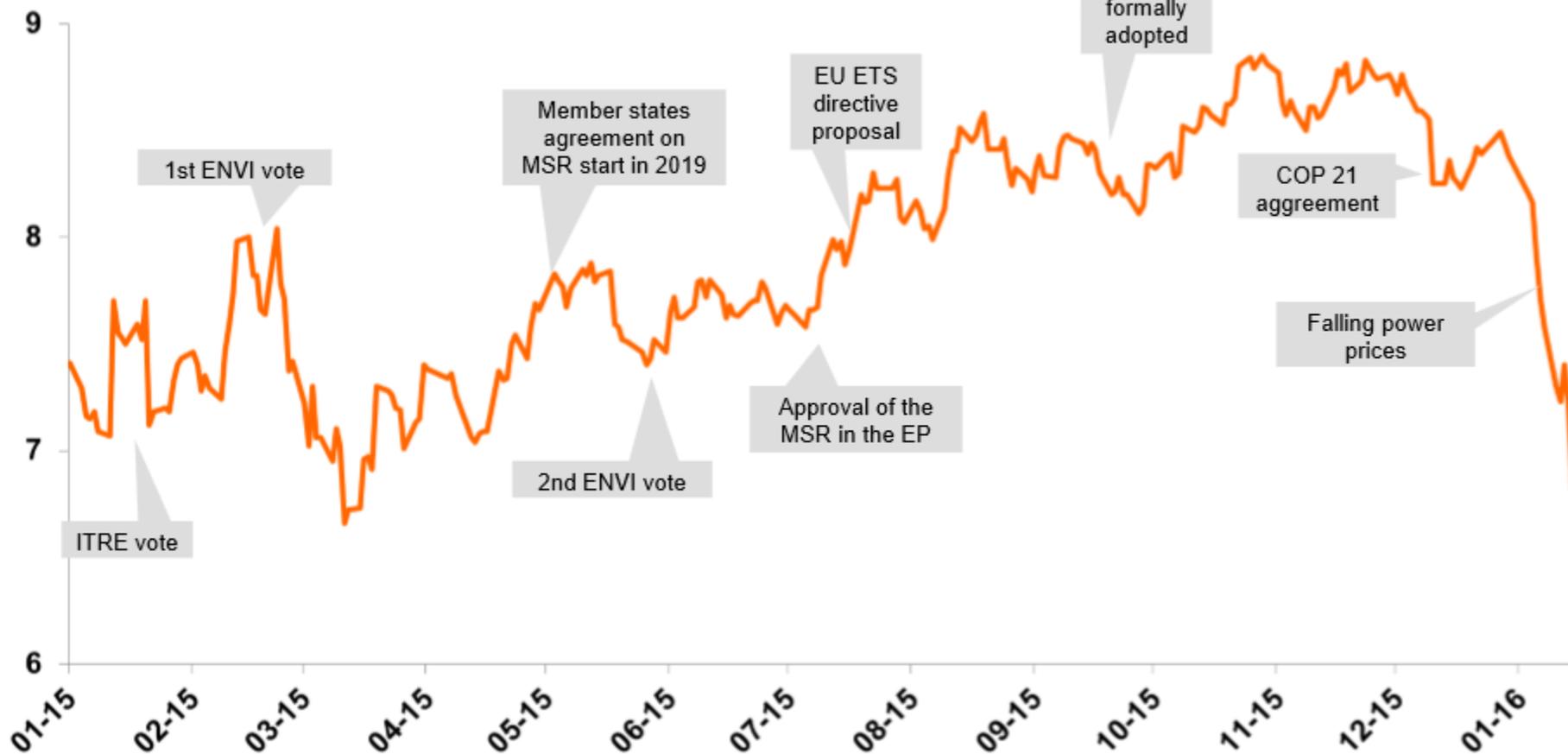


## Breakdown of electricity price change (01/2011 – 01/2016)

Germany, EUR/MWh, year ahead forward



## Carbon Price EUR/t, Cal17



# Energy Union

## „New“ renewable energy directive:

- ➔ At least 10% (2021-2025); 15% (2026-2030) of public support schemes should be opened to other Member States (2025 reassessment by the EC).
- ➔ Financial instrument (fund) - contribution from MS, support for European RES projects.
- ➔ Agricultural biofuels - a decrease from 7% to 3.8% in 2030 (according to the explicit trajectory).
- ➔ Minimizing the length of the permitting process - one administrative contact point (coordinating the issuance of all necessary permits); max. length of permitting process - 3 years.

# EU ENERGY NETWORK

DIAGRAMMATIC REPRESENTATION OF INTEGRATED EUROPEAN POWER GRID.

## Key to Lines

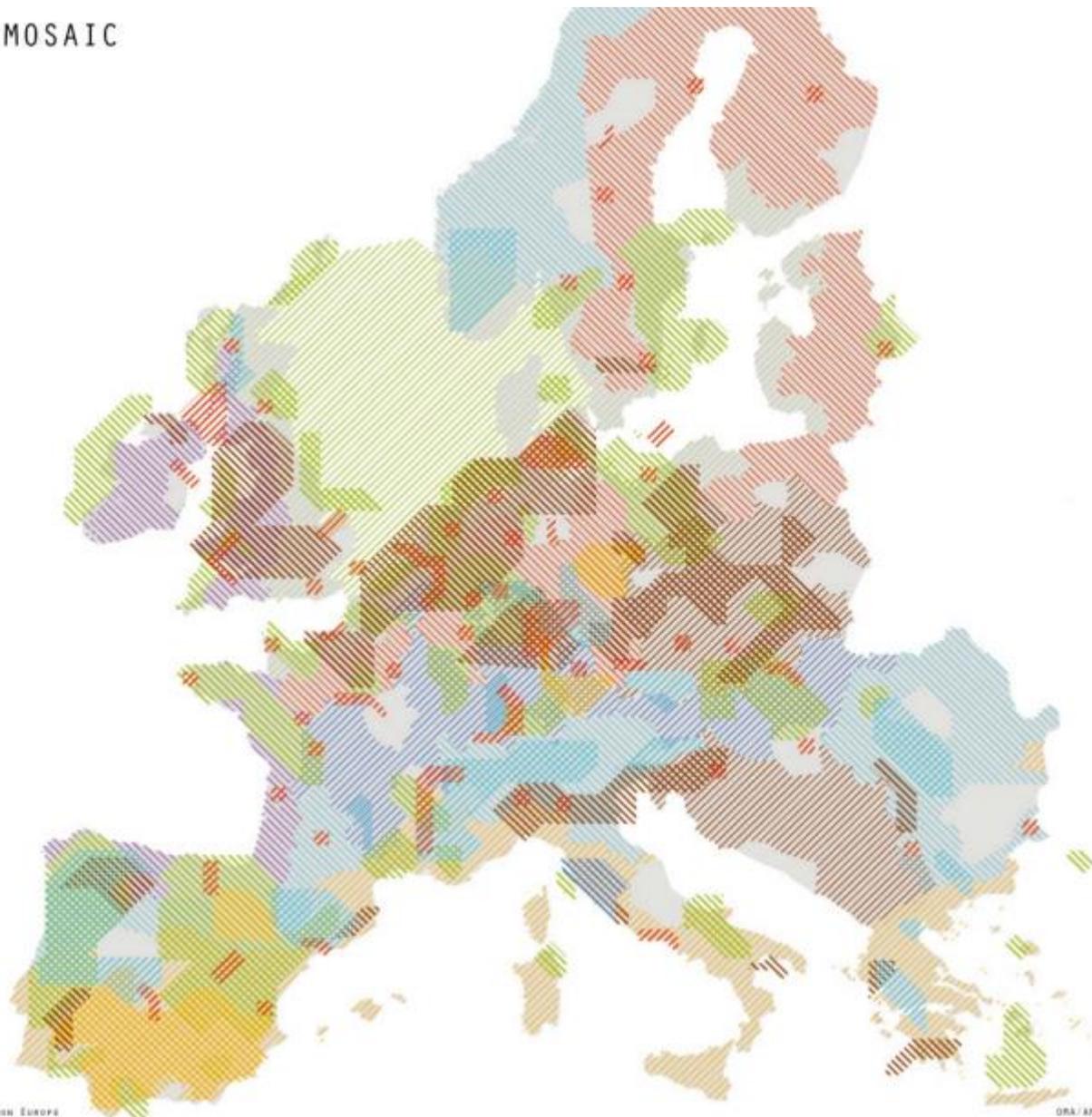
- |   |   |
|---|---|
|  |              |
|  |  Hydropower  |
|  |  Wind Power  |
|  |  Geothermal  |
|  |  Nuclear     |
|  |  Solar Power |
|  |  C.C.S.      |
|  |  Biomass     |



# EU ENERGY RESOURCE MOSAIC

OVERLAY OF CURRENT ENERGY USE AND THOSE REGIONS WITH THE HIGHEST ENERGY POTENTIAL.

- Energy types**
- Geothermal existing
  - Geothermal potential
  - Hydropower existing
  - Hydropower potential
  - Wind existing
  - Wind potential
  - Solar existing
  - Solar potential
  - Tidal potential
  - CCS / Biomass existing
  - CCS / Biomass potential
  - Nuclear existing
  - Nuclear potential

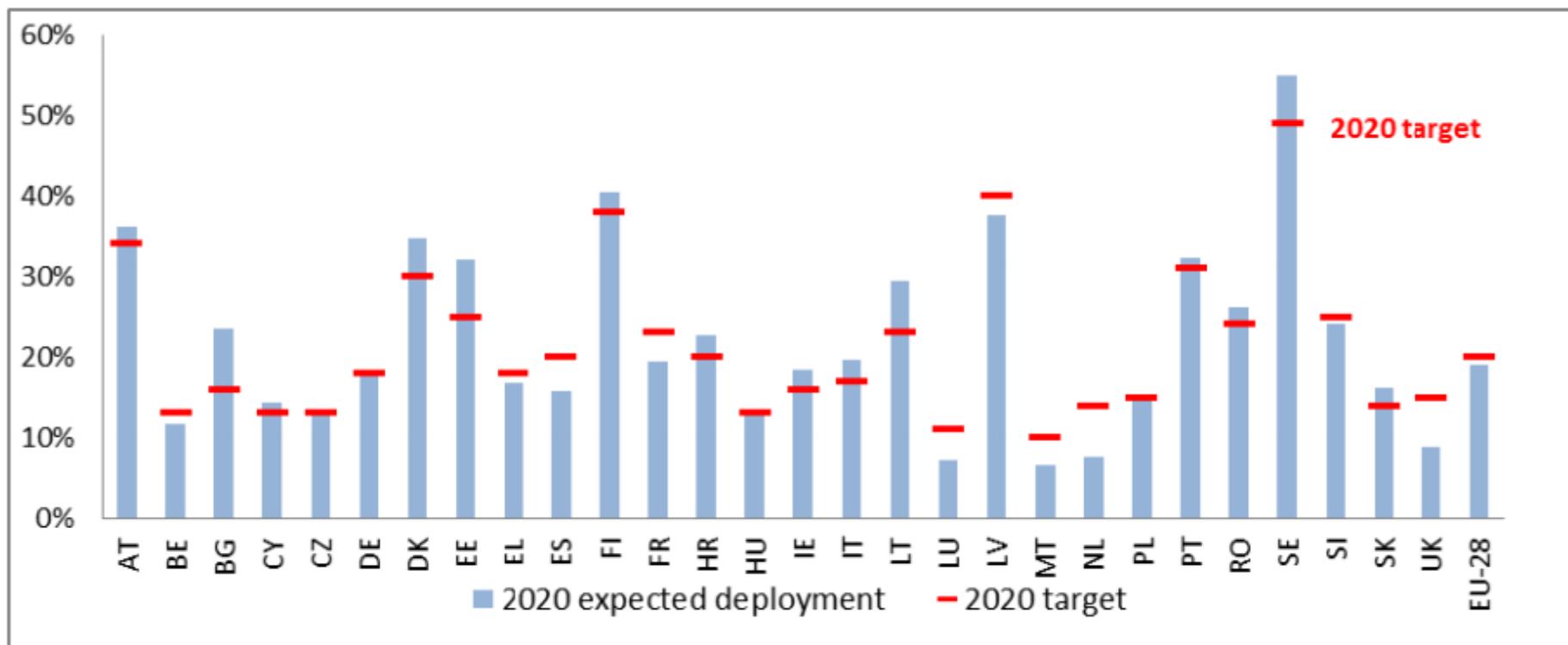


ROADMAP 2050: A PRACTICAL GUIDE TO A PROSPEROUS, LOW-CARBON EUROPE

ORA / ARD

# Rozvoj obnovitelných zdrojů (RED)

*Expected RES deployment in Member States and 2020 RES targets*



*Source: European Commission, based on TU Wien (Green-X) projections (2014)*

*Zdroj: Zpráva o pokroku v oblasti OZE (2015)*

# Internal energy market



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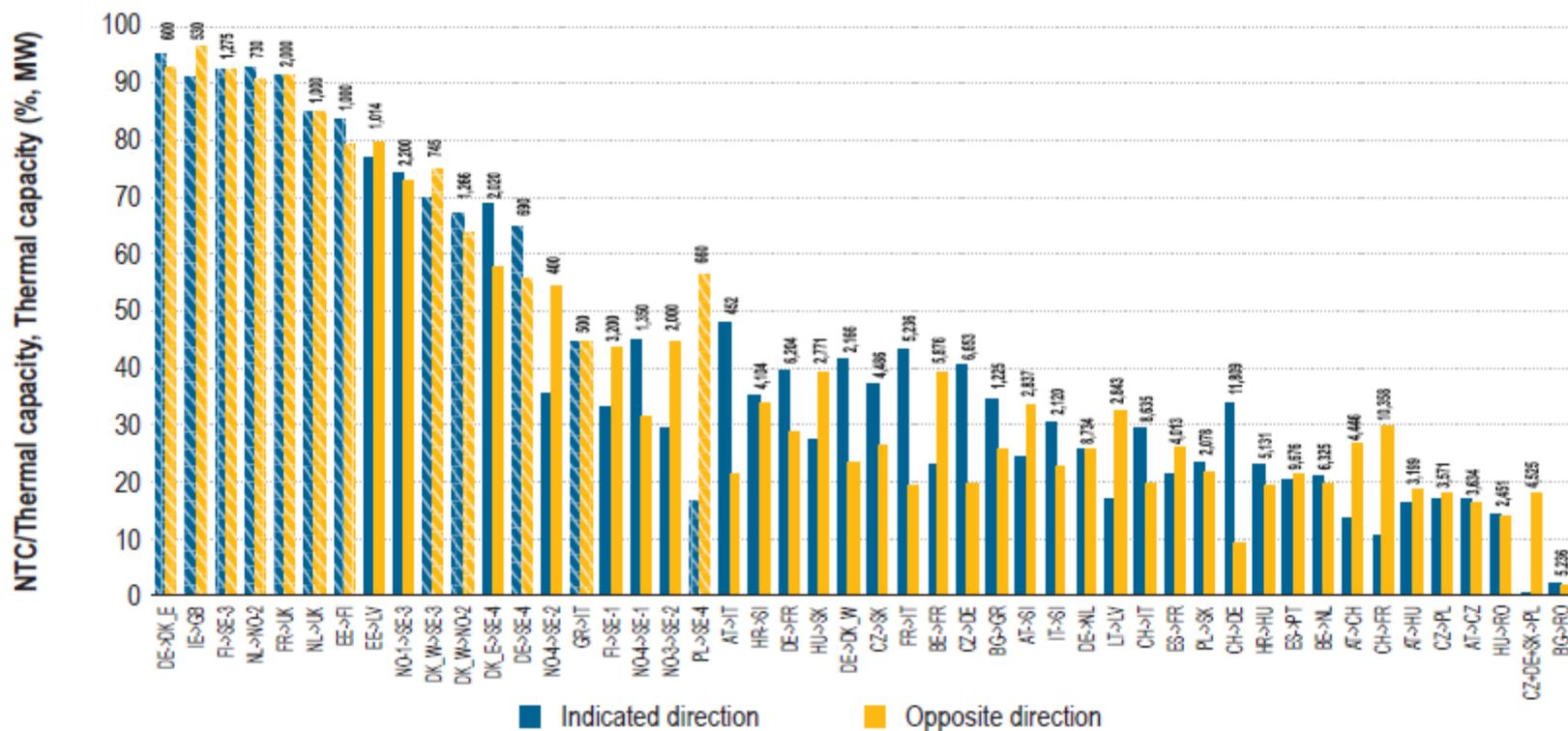
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## PROGRESS IN MARKET COUPLING IN 2014 AND 2015

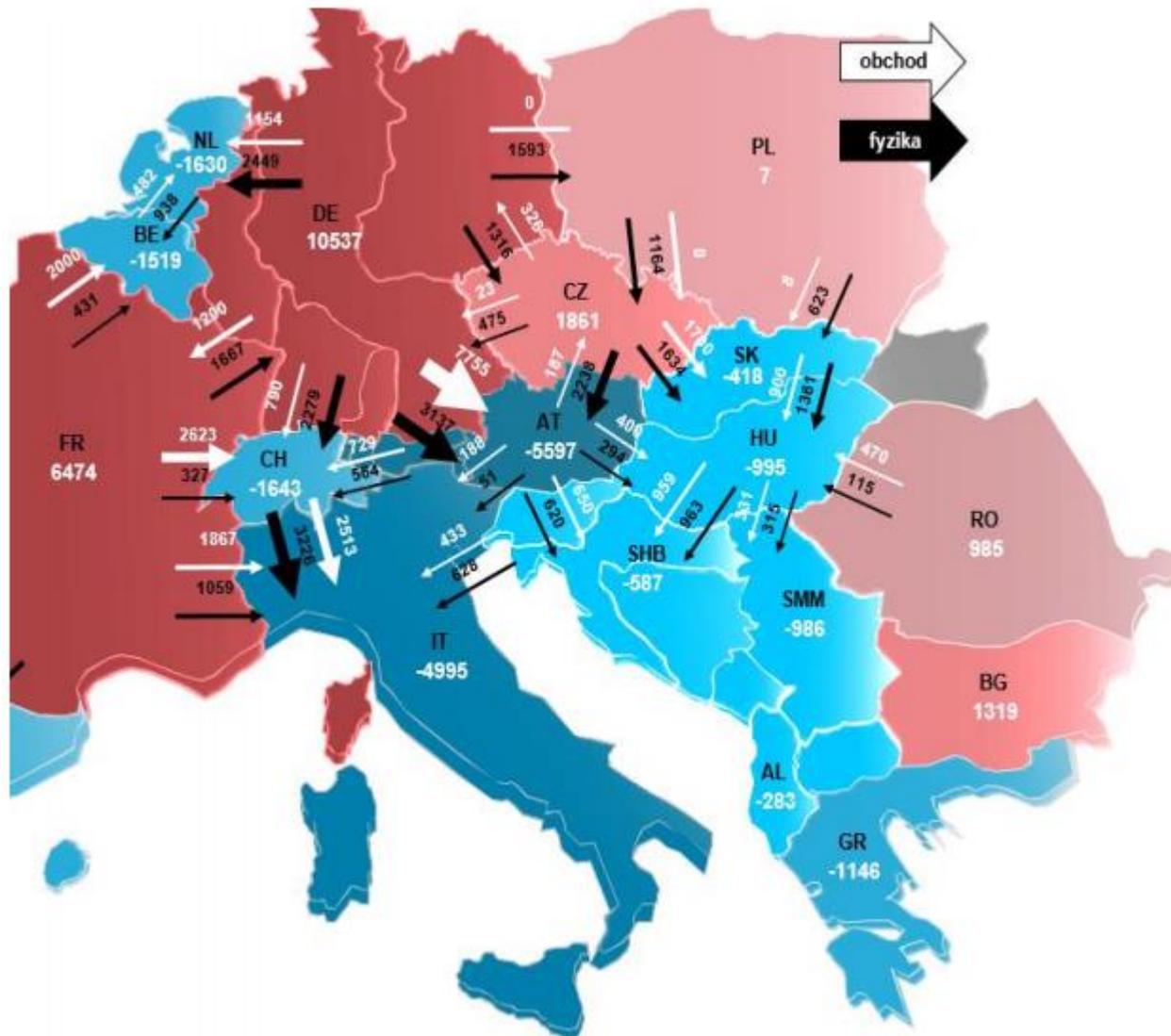


Source: ACER and ENTSOe; see EURELECTRIC report "Power statistics and trends: the five dimensions of the Energy Union", December 2015

## Ratio between available NTC and aggregated thermal capacity of interconnectors – 2014 (% , MW)

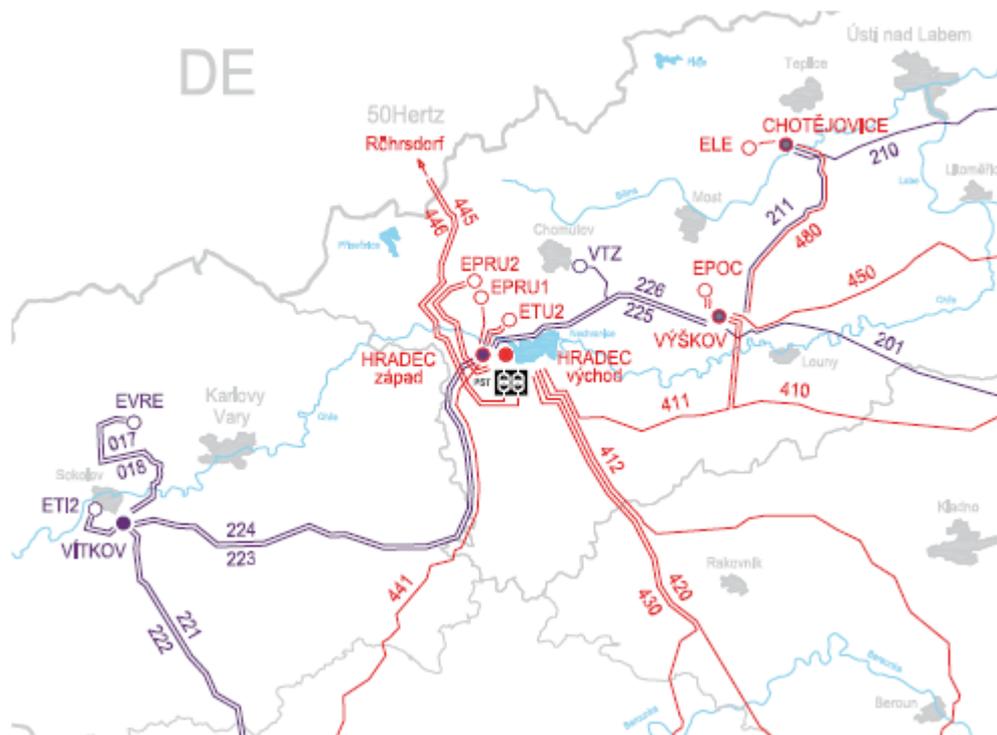


Zdroj: Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2014 (ACER/CEER)



# Phase shifter transformers

Schématické umístění PST na přeshraničním profilu ČEPS – 50Hertz



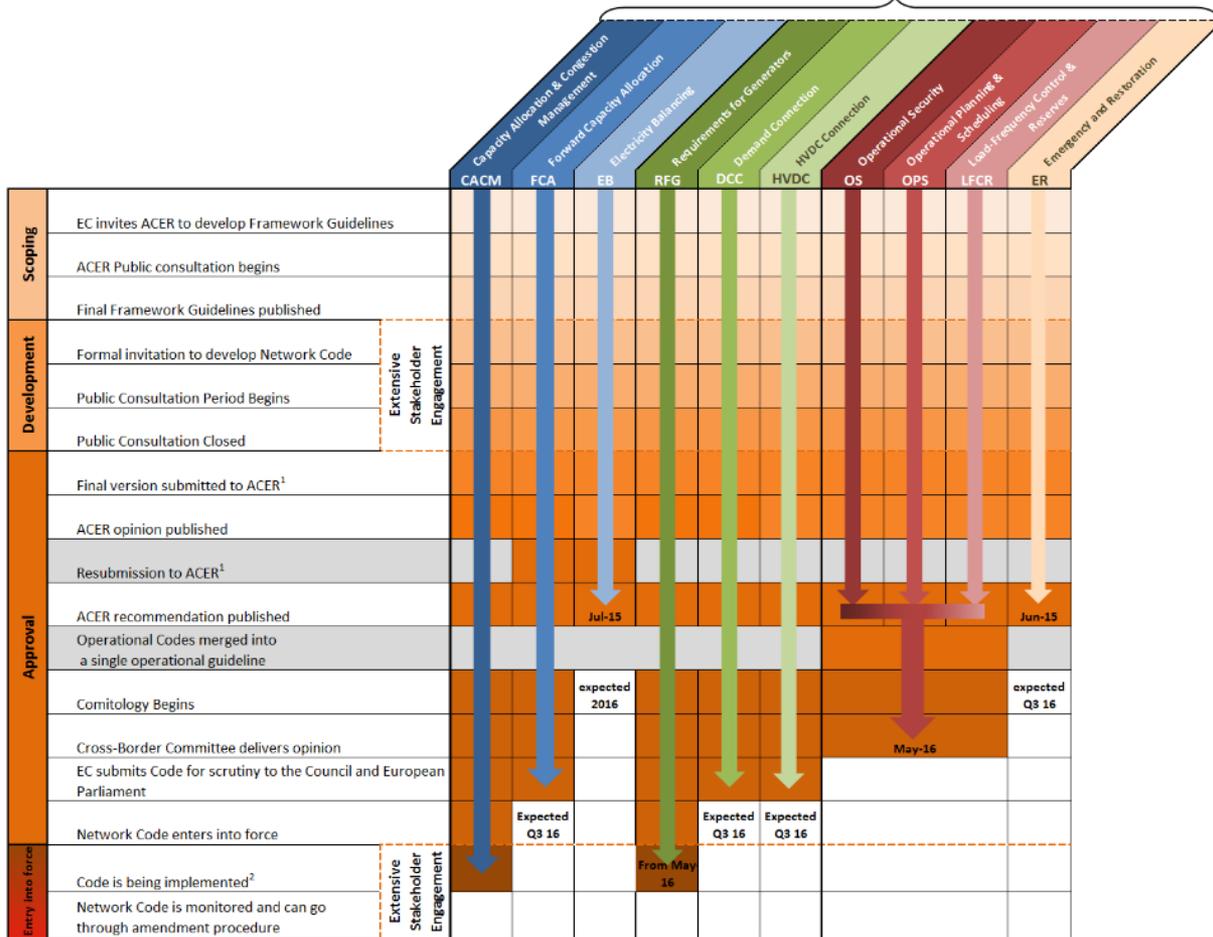
Zdroj: Stavba PST transformátorů (ČEPS, a.s.)

Application of capacity calculation methods on different borders at different timeframes – 2014 (%)

Border	Y	M	D	ID	D/ID res.	Score	Border	Y	M	D	ID	D/ID res.	Score
AT-CH	BIL	BIL	BIL		<24	15.6%	EE-FI	BIL	BIL	BIL	BIL	24	33.3%
AT-CZ	BIL	BIL	BIL		<24	15.6%	EE-LV	PC	PC	PC	PC	<24	58.3%
AT-HU	PC	PC	PC		<24	34.4%	ES-FR	PC	PC	PC		<24	45.8%
AT-IT	FC	FC			<24	37.5%	ES-PT	PC	PC	PC		<24	45.8%
AT-SI	BIL	BIL	BIL		<24	15.6%	FI-SE1	PC	PC	PC	PC	<24	58.3%
BE-FR	BIL	BIL	PC		<24	21.9%	FI-SE3	PC	PC	PC	PC	24	66.7%
BE-NL	BIL	BIL	BIL		<24	15.6%	FR-IT	FC	FC			<24	37.5%
BG-GR	PC	PC			<24	25.0%	FR-UK	BIL	BIL	BIL	BIL	24	33.3%
BG-RO	PC	PC			<24	25.0%	GR-IT	BIL	BIL			<24	16.7%
CH-DE	PC	PC	PC		<24	34.4%	HR-HU	BIL	BIL			<24	12.5%
CH-FR	PC	PC	PC		<24	34.4%	HR-SI	BIL	BIL			<24	12.5%
CH-IT	FC	FC			<24	37.5%	HU-RO	PC	PC			<24	25.0%
DE-PL	PC	PC	PC		<24	34.4%	HU-SK	PC	PC	PC		<24	34.4%
CZ-DE	PC	PC	BIL		<24	28.1%	IT-SI	FC	FC			<24	37.5%
CZ-PL	BIL	BIL	BIL	BIL	<24	18.8%	LT-LV	BIL	BIL	BIL	BIL	<24	25.0%
CZ-SK			BIL		<24	3.1%	NL-NO2	BIL	BIL	PC	BIL	24	41.7%
DE-DKE	BIL	BIL	BIL		24	25.0%	NL-UK	BIL	BIL	BIL	BIL	24	33.3%
DE-DKW	BIL	BIL	BIL		<24	20.8%	NO1-SE3	PC	PC	PC	PC	24	66.7%
DE-SE4			PC		24	16.7%	NO3-SE2	PC	PC	PC	PC	<24	58.3%
DE-FR	PC	PC	PC	PC	<24	43.8%	NO4-SE1	PC	PC	PC	PC	<24	58.3%
DE-NL	BIL	BIL	BIL	BIL	<24	18.8%	NO4-SE2	PC	PC	PC	PC	<24	58.3%
DKE-SE4	BIL		BIL		24	16.7%	PL-SE4			BIL		24	8.3%
DKW-NO2			BIL		24	8.3%	PL-SK	PC	PC	PC		<24	34.4%
DKW-SE3	BIL		BIL		24	16.7%	IE-UK	BIL	BIL	BIL	BIL	24	33.3%

Pure bilateral NTC calculation (BIL); Partially coordinated NTC calculation (PC);  
Fully coordinated NTC calculation (FC); Flow-based capacity calculation (FB)

Delivery of the Third Package



# Capacity mechanisms

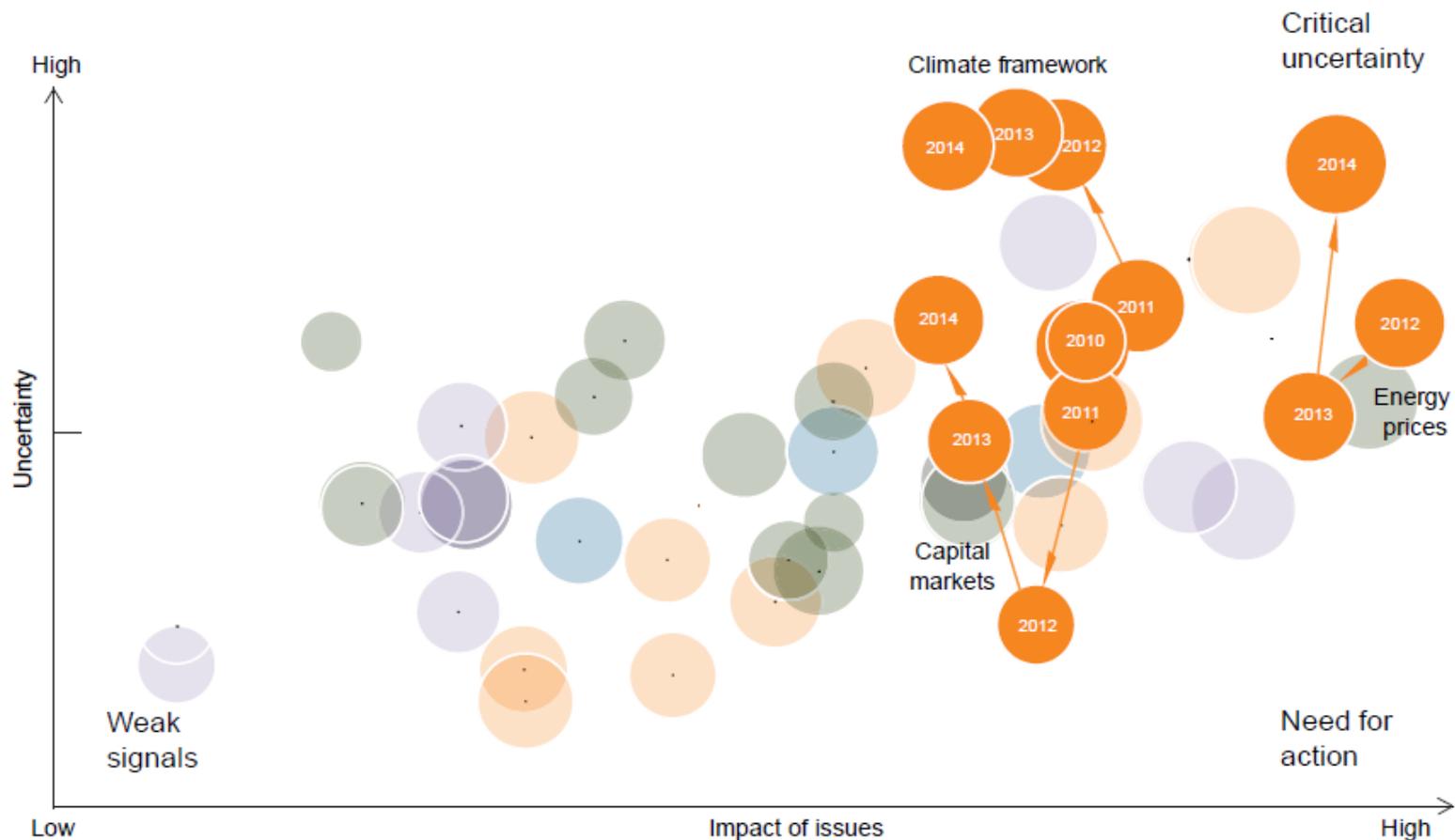


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# The lack of a global climate framework, the development of energy prices and capital markets are among the greatest uncertainties for energy leaders<sup>18</sup>

Source: WEC, 2014: World Energy Issues Monitor

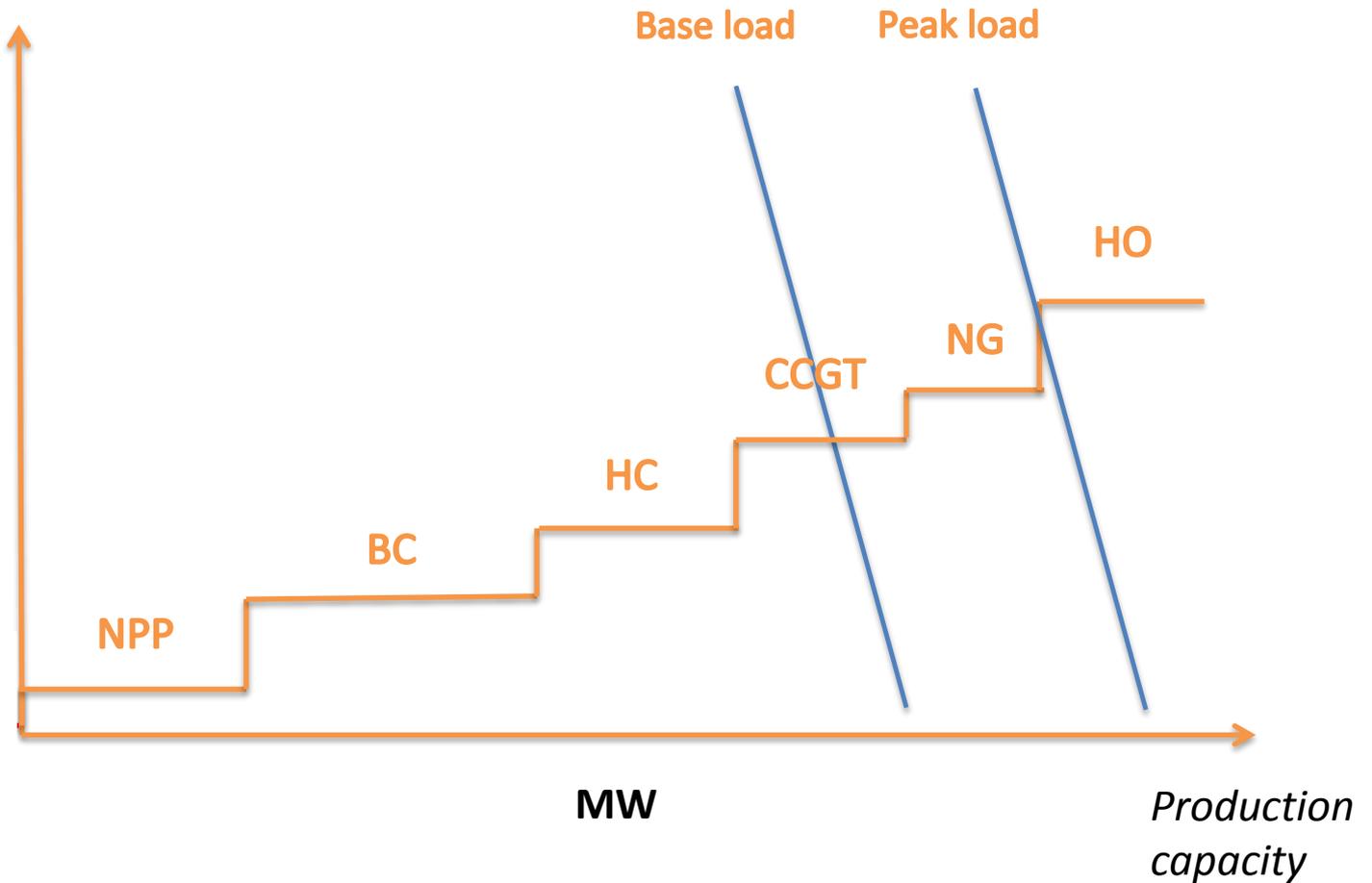


# Energy only market

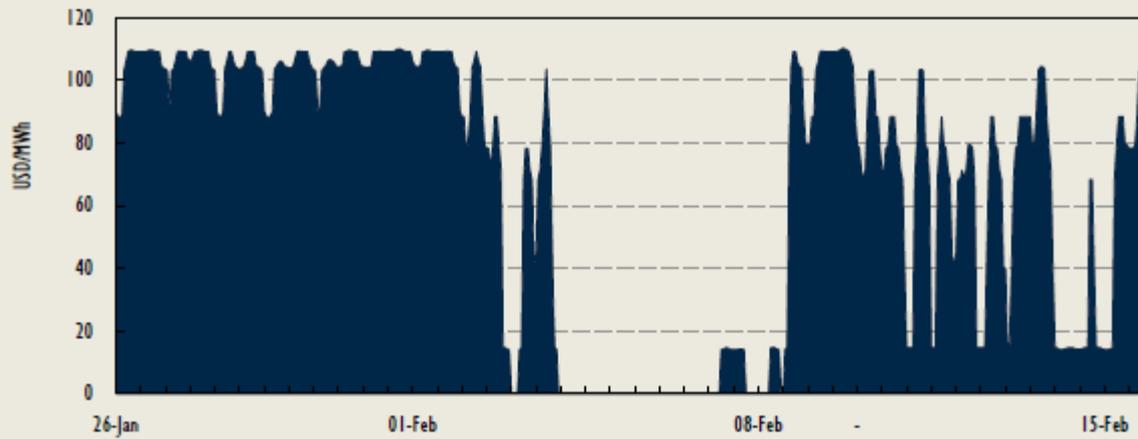
- ➔ In „normal“ markets there might be **excess of demand over supply** => in this case someone with relatively low willingness to pay will be left up empty handed.
- ➔ In power market **this situation cannot happen**, it would influence the quality of supply for everyone.
- ➔ The supply has to be „calibrated“ to **meet the highest possible demand**.
- ➔ Currently, **power plants profits through selling units (kWh/MWh)** of electricity, this should cover their variable cost (in short run) and fixed cost (in long run) => **it is assumed** that this should ensure long term investment ensuring/leading to sufficient power supply.

*Variable  
production  
costs*

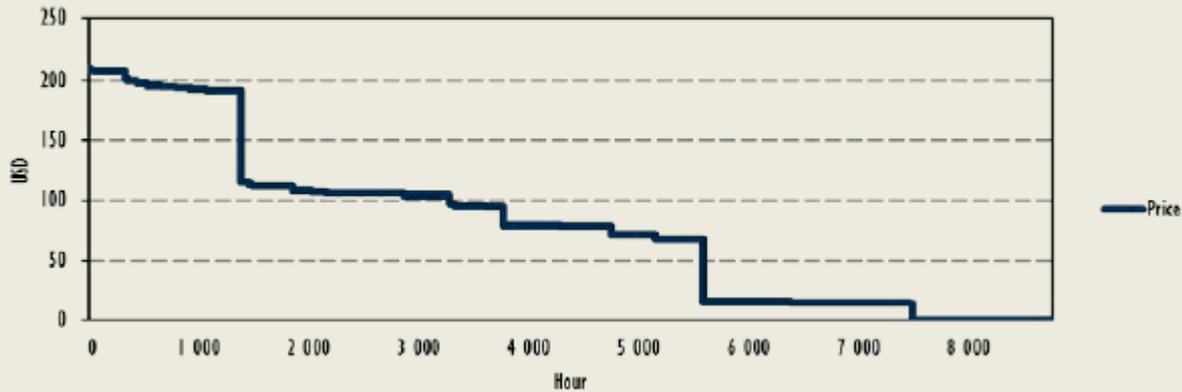
€/MWh



### Electricity prices, three weeks in 2050



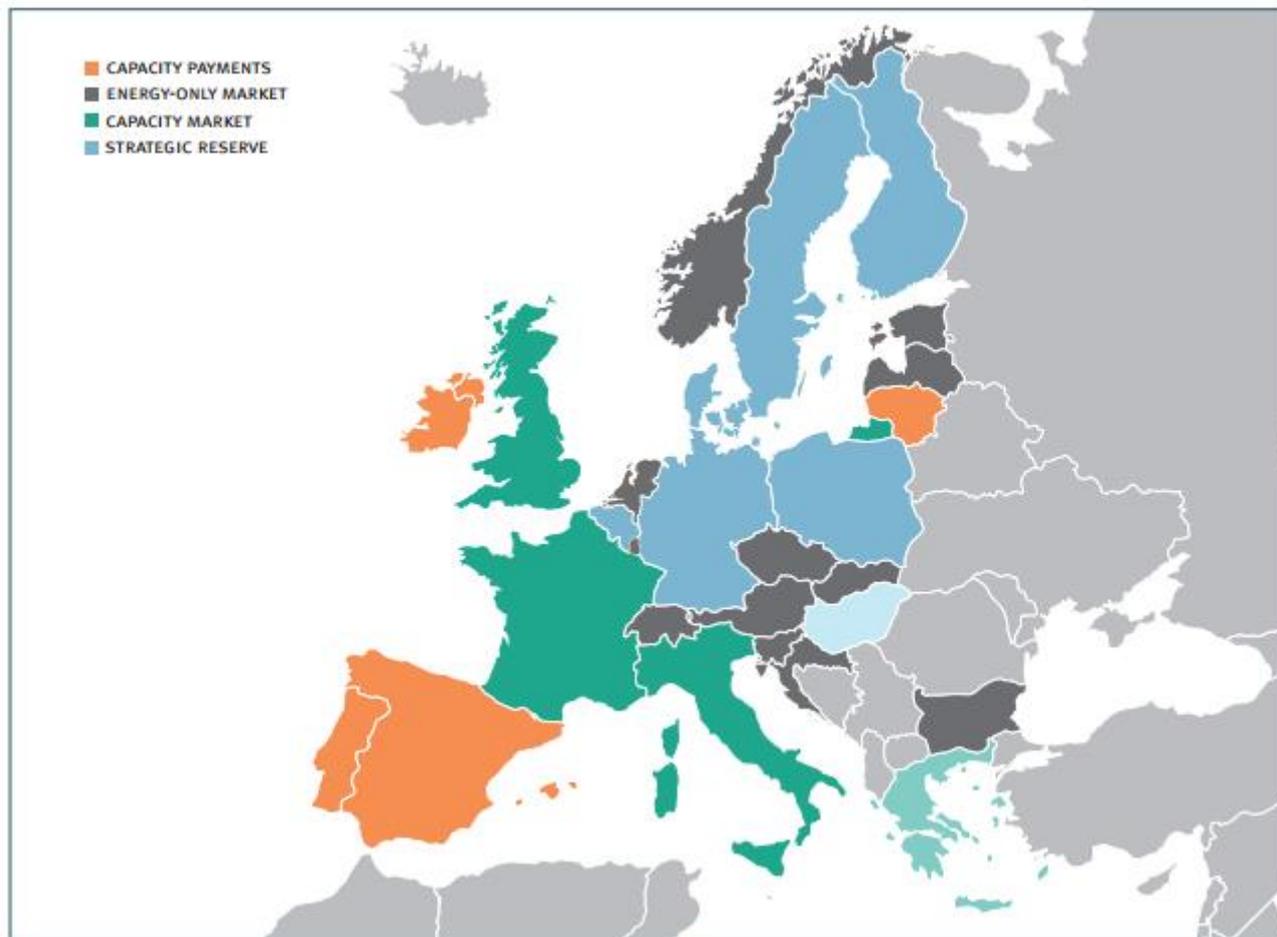
### Modelled price duration curve in ETP scenarios, 2050



# Capacity mechanisms

- ➔ A loss of confidence that price signals can ensure the long-term generation adequacy (lack of motivation to invest in the new sources).
- ➔ Capacity mechanisms – a payment for readiness to deliver (or to reduce consumption) of electricity in case of shortage of production on the market.
- ➔ „Sector inquiry“ (DG COMP) – 35 current or planned capacity mechanisms in 11 countries (BE, HR, DK, FR, DR, IE, IT, PL, PT, ES, SE).
- ➔ The main concern with respect to the capacitive mechanisms: i) distortion and fragmentation IEM and ii) public support for fossil fuels.

# Capacity mechanisms

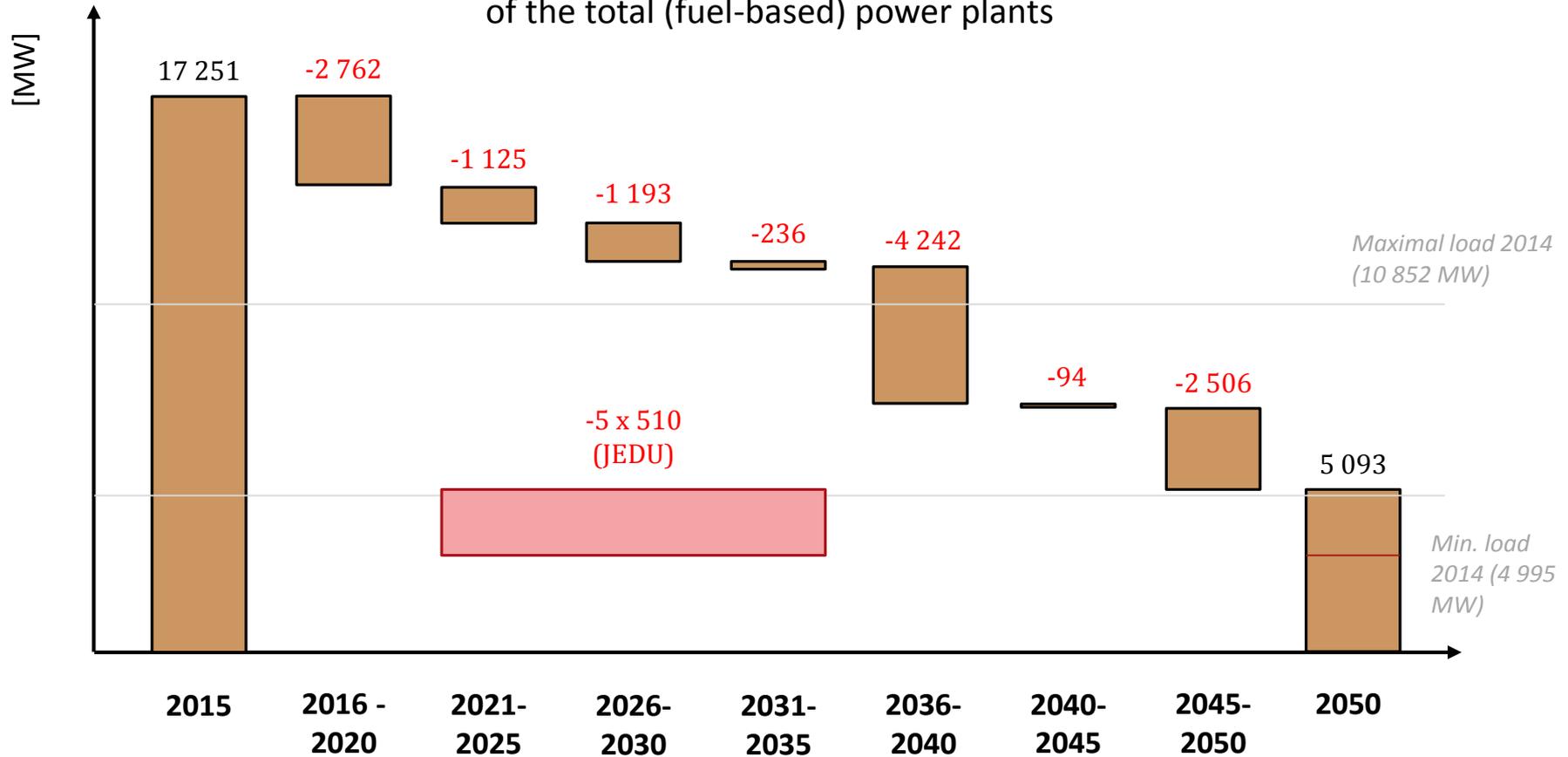


Zdroj: EURELECTRIC

# Capacity mechanisms

- ➔ „New market design“ – capacity mechanisms are not prohibited, however their implementation must be carefully justified.
- ➔ Conditions for implementation of capacity mechanisms: i) The analysis of the European generation adequacy (ENTSO-E, ACER); ii) lower GHG emission than 550 gCO<sub>2</sub>/kWh (five-year transition period for existing sources) - the de facto exclusion of coal resources.
- ➔ Negative reactions with regard to emission standards - breach of technological neutrality; different energy mixes; PL: the inability to use a significant portion of PL production portfolio after 2025 (expected shortage).

## Expected decrease of large combustion sources of the total (fuel-based) power plants



By the year 2050, essentially the entire (conventional) energy mix will be „renewed“.

# Capacity mechanisms



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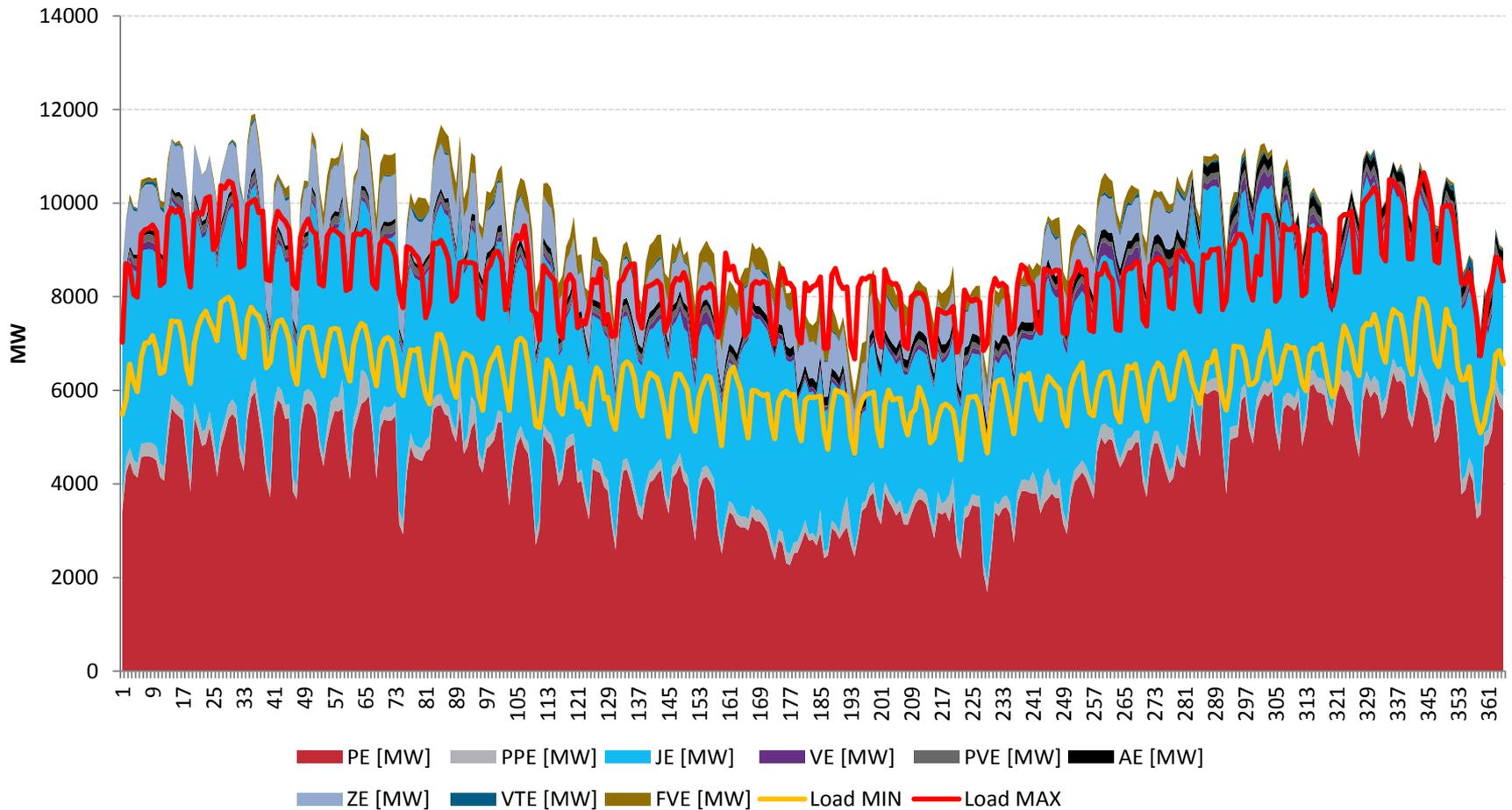
# Nuclear energy



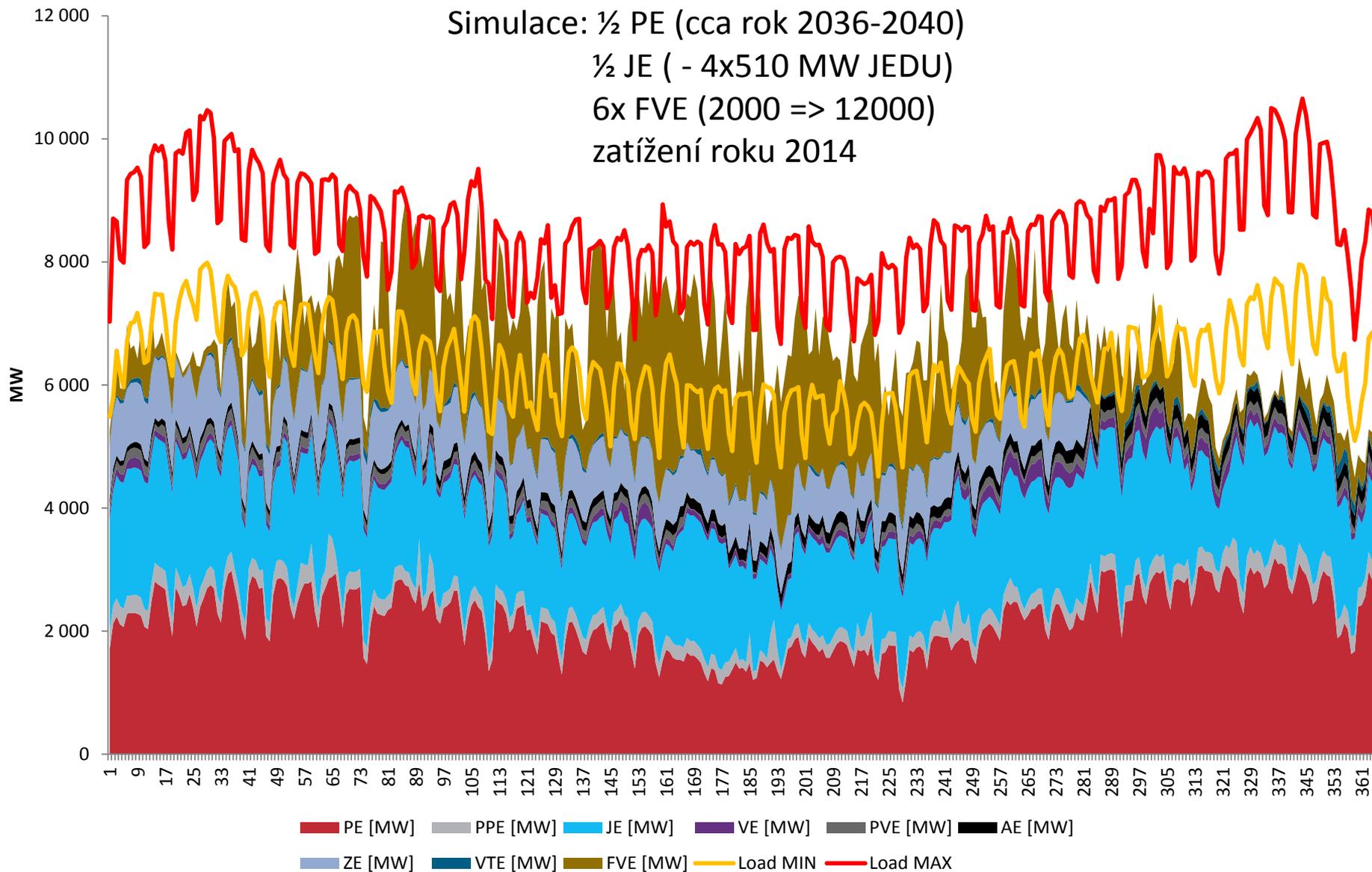
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## Výroba + load (day)



Simulace: ½ PE (cca rok 2036-2040)  
 ½ JE ( - 4x510 MW JEDU)  
 6x FVE (2000 => 12000)  
 zatížení roku 2014

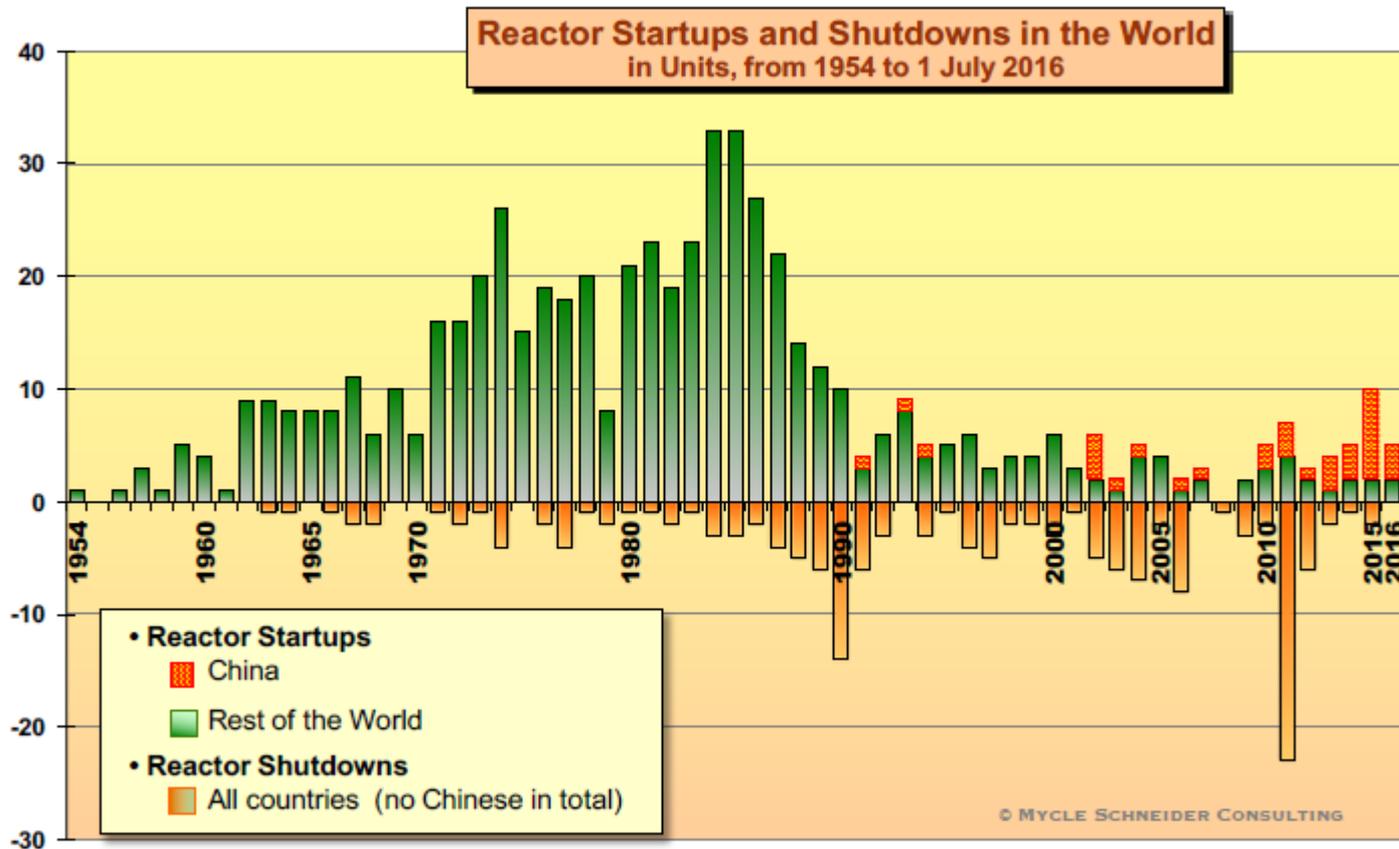


# Nuclear energy

- ➔ Cost decrease of RES x cost increase of NPP.
- ➔ Expensive versus „investment intensive“.
- ➔ Private capital versus public capital.
- ➔ Strategic consideration („dilemmas/pay-off“) => minimization of public funding-state guarantees/sustaining strategic involvement of the state/maximizing financial (capital) involvement of supplier/minimizing suppliers strategic involvement (for security reasons)/maximizing local involvement in supply chain.

## Nuclear Power Reactor Grid Connections and Shutdowns, 1954-2016

### *The China Effect*



Sources: IAEA-PRIS, MSC, 2016

# Thank you for your attention



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