Will Gas Demand Rebound In Power?

Outlook for coal / gas switching in Europe

FLAME conference

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8 – 11 May 2017 - Amsterdam

Agenda

- Introduction to FTI-Compass Lexecon Energy
- Key drivers of the EU electricity market
- Outlook for coal / gas switching in the EU power sector
- Key regulatory developments to watch
- Conclusions

FTI-CL Energy presentation

FTI Consulting overview

Overview

- Global business advisory firm
- Dedicated to helping organisations protect and enhance enterprise value

History & scale

- Established in 1982
- >US$ 1.5 billion revenues, NYSE listed
- >4,000 staff across 24 countries on six continents

Global reach

Services

- Five divisions:
  1. Economic Consulting
  2. Corporate Finance / Restructuring
  3. Forensic & Litigation Consulting
  4. Technology
  5. Strategic Communications

FTI CONSULTING | COMPASS LEXECON | ENERGY

FTI – CL Energy operates across 5 service lines

FTI Consulting operates across 5 service lines

Corporate Finance	Forensic and Litigation Consulting	Economic and Financial Consulting	Strategic Communications	Technology
Provide strategic, operational, financial and capital needs of businesses. Address complete spectrum of financial and transactional challenges.	Independent dispute advisory, investigative, data acquisition/analysis and forensic accounting services.	Analysis of complex economic, regulatory and finance issues to assist clients in understanding the issues and opportunities they face.	One of the world's largest investor relations businesses specialising in advising companies in critical situations.	Provides e-discovery software, services and expertise to deliver smart solutions for clients.

We support clients across the energy value chain

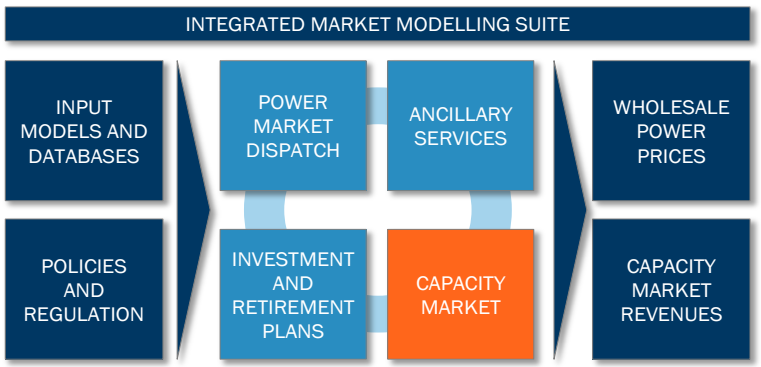
Strategic Evaluation	Project / Company Development Support	Operational Enhancement
• Market Entry/Exit Strategy	• Due Diligence (technical / financial) (with TÜV SÜD PMSS)	• O&M strategy
• Policy Evaluation	• Project Finance and Transaction Support	• Business Planning , root cause analysis, and performance improvement
• Resource, Technology & Market Assessment	• Dispute Resolution	• Procurement & Contracting Best Practices
• Supply chain evaluation / development	• Independent Engineer Review (with TÜV SÜD PMSS)	• **Turnaround and Restructuring**
• Asset Valuation	• PPA Negotiations	• **Liquidity management**
• Business Model Evaluation / Development	• Resource evaluation	• **Interim management (CRO, COO, CEO, CFO)**
• M&A / Transaction Support	• T&D Analysis	• **Insolvency**

FTI CONSULTING COMPASS LEXECON ENERGY

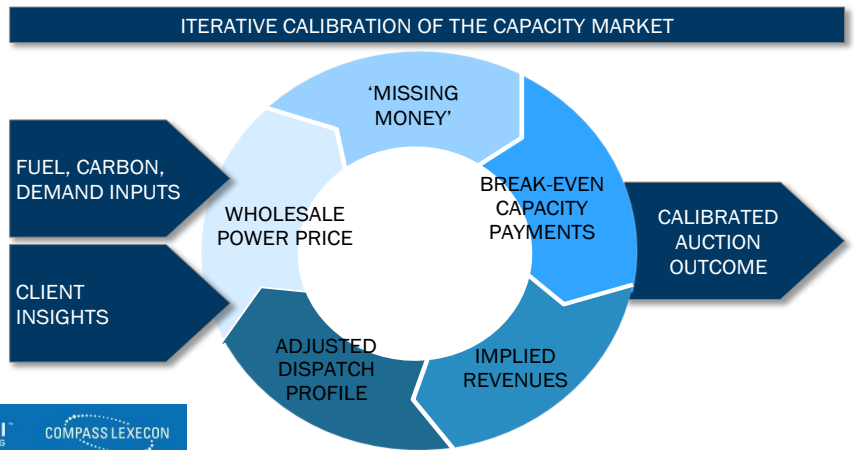
Our modelling approach

FTI-CL Energy Market Modelling and Calibration

Our Capacity Market model forms part of our integrated market modelling suite, which includes an hourly dispatch model, modelling the day-ahead power market:



To deliver a fully calibrated and consistent set of wholesale power prices and capacity payments across Europe, the approach iterates the dispatch model until and equilibrium is reached.



Collaborative modelling approach

Our approach to modelling gives the client maximum visibility over the inputs, development and the workings of the CM modelling – the 'no black box' approach.

Collaboration between the client and FTI-CL on both fronts is essential to utilise the client's own knowledge and insights into the market.

COLLABORATIVE APPROACH TO MODELLING

INPUTS	DISPATCH MODELS	DATABASES
	Proprietary hourly dispatch models including renewables and hydro modules	Proprietary databases including renewable projects and thermal power plant
ANALYSIS	CLIENT INSIGHTS	PARTICIPANT DRILL-DOWN
	Bespoke and subjective bidding factors (new build sunk costs, long term contract targets)	Detailed review of the register of the pre-qualified participants and previous bidding behaviour
OUTPUTS	IDENTIFICATION OF MARGINAL UNITS	SENSITIVITY ANALYSIS
	Proprietary databases including renewable projects and thermal power plant	Sensitivity to capex, wholesale price levels and regulatory changes

FTI CONSULTING COMPASS LEXECON ENERGY

FTI-CL European power market dispatch model covers the EU-28 power markets

Geographic scope

- GB and Ireland
- France, Germany, Belgium, Switzerland, Austria and the Netherlands
- Spain, Portugal and Italy
- Nordic countries: Denmark, Norway, Sweden and Finland
- Poland and the Baltic countries
- Eastern Europe and Greece, as well as Turkey

Model structure

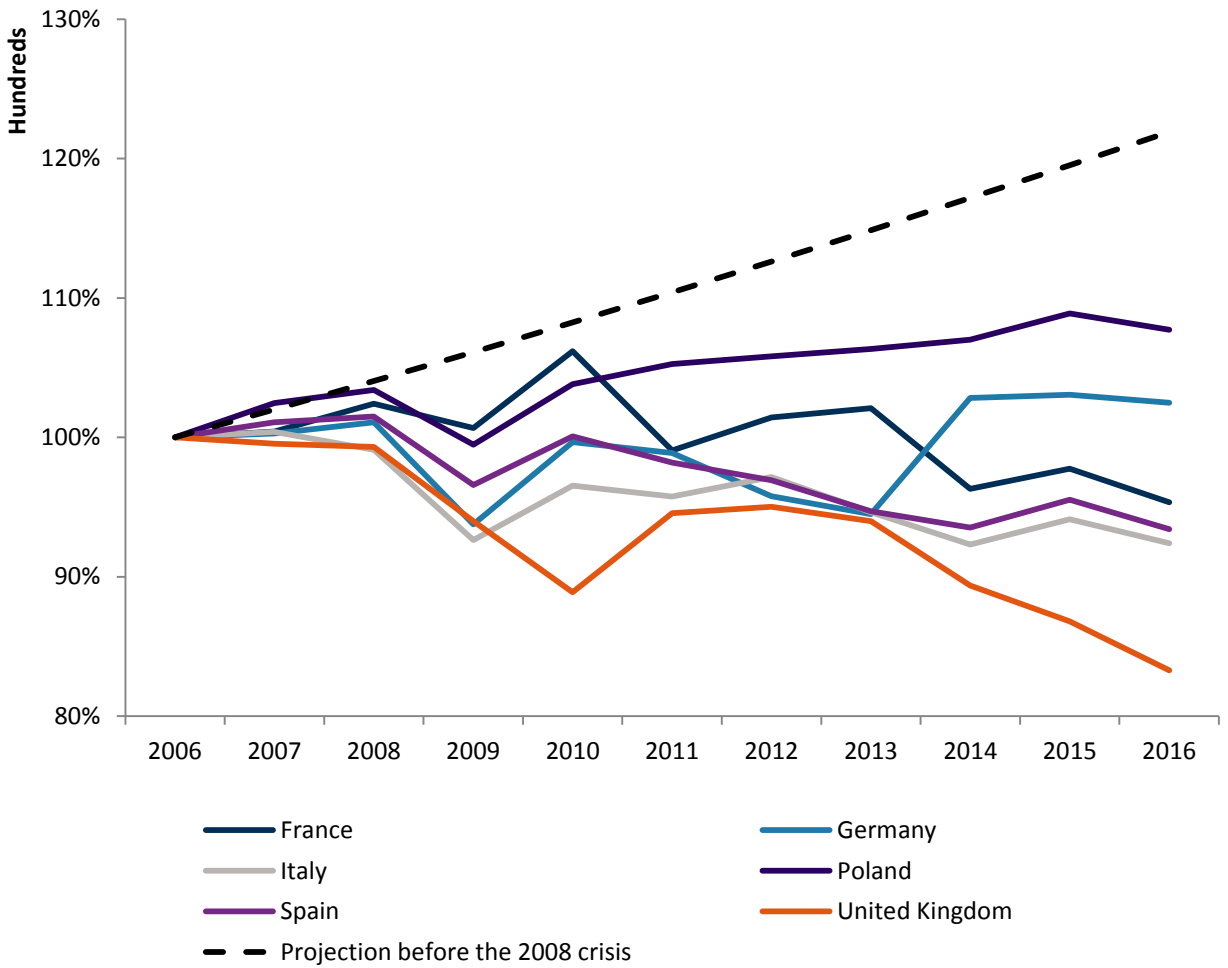
- The model constructs supply in each price zone based on individual plants.
- Zonal prices are found as the marginal value of energy accounting for generators' bidding strategies
- Takes into account the cross-border transmission and interconnectors and unit-commitment plant constraints
- The model is run on the commercial modelling platform Plexos® using data and assumptions constructed by FTI-CL Energy

Model geographic scope

Key drivers of the EU electricity market

Electricity demand: a structural break

Index of historical power consumption (base 100 in 2006)

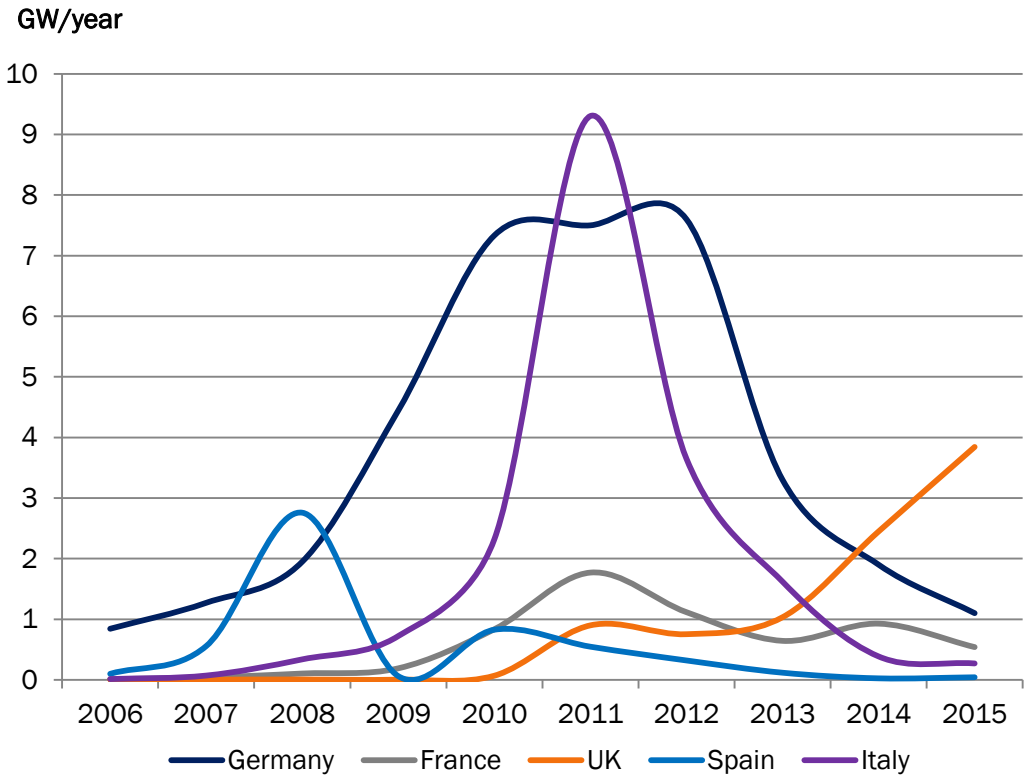


- Before the 2008-crisis, electricity demand was projected to increase at a 2% rate on average in Europe (e.g. 1.5% in France and Germany, 2-3% in Poland and Italy, more than 3% in Spain)
- The crisis has led to structural demand destruction in the industrial sector, and several countries have not yet recovered the pre-crisis consumption level
- Going forward, growth of embedded generation and energy efficiency improvements could further reduce transmission connected power demand

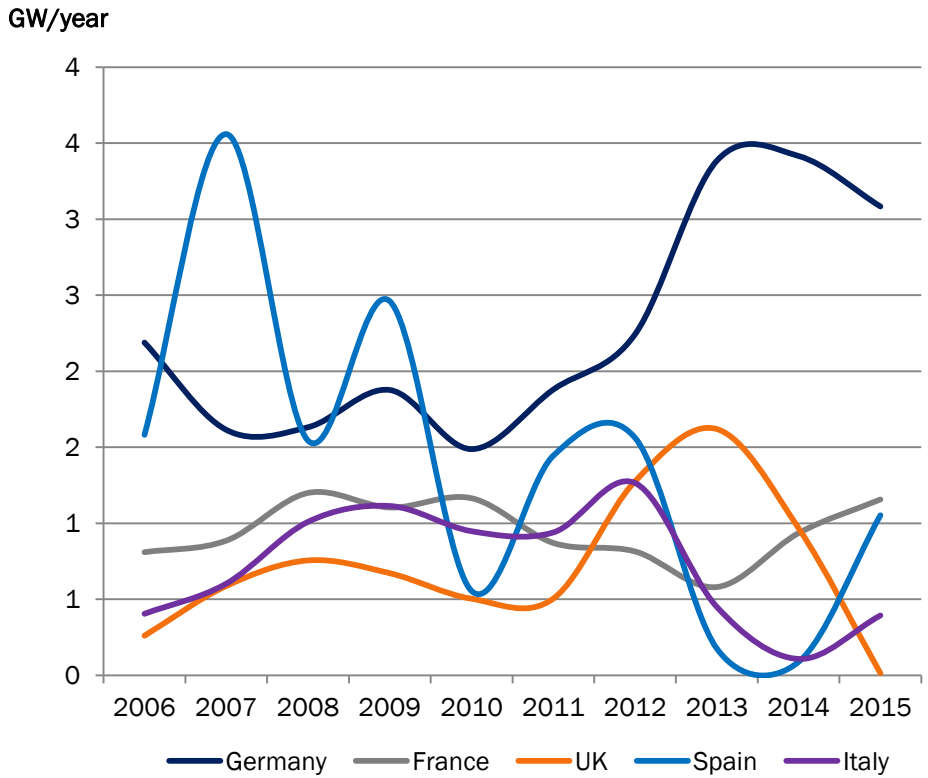
Source: EC. ENTSO-E, BP RTE 2007.

Solar and wind capacity additions: a mixed picture

Solar capacity additions



Onshore wind capacity additions

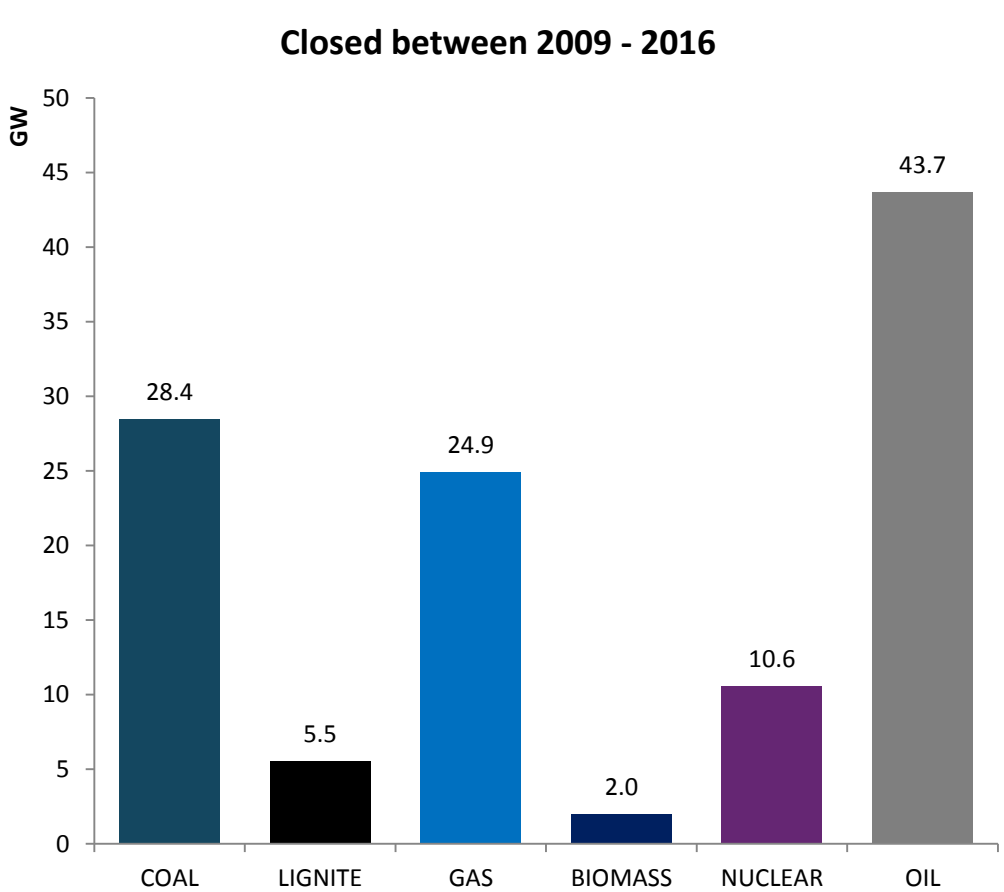


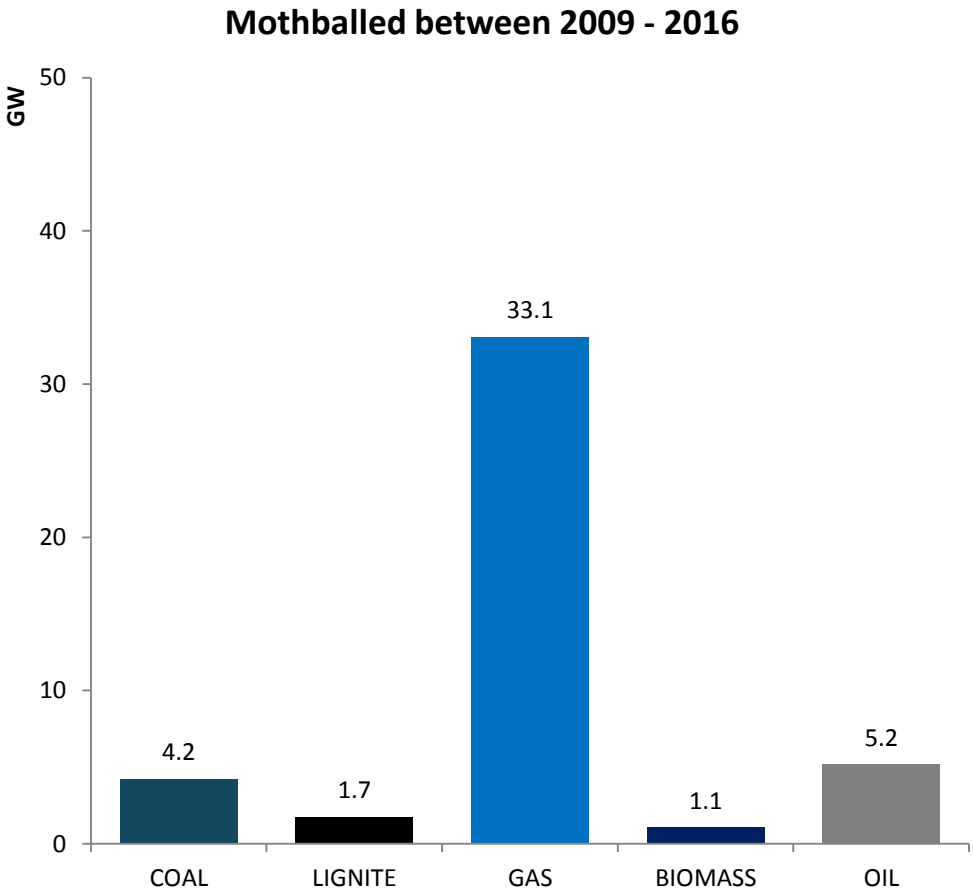
Source: BP Statistical Review 2016

- After a boom in renewable capacity expansion between 2009-2012, growth is slowing down in some major European countries.

The market is (slowly) rebalancing with significant thermal capacity mothballed and/or retired

- The low profitability of gas plants has driven significant impairments and more than 30 GW have been mothballed in Europe



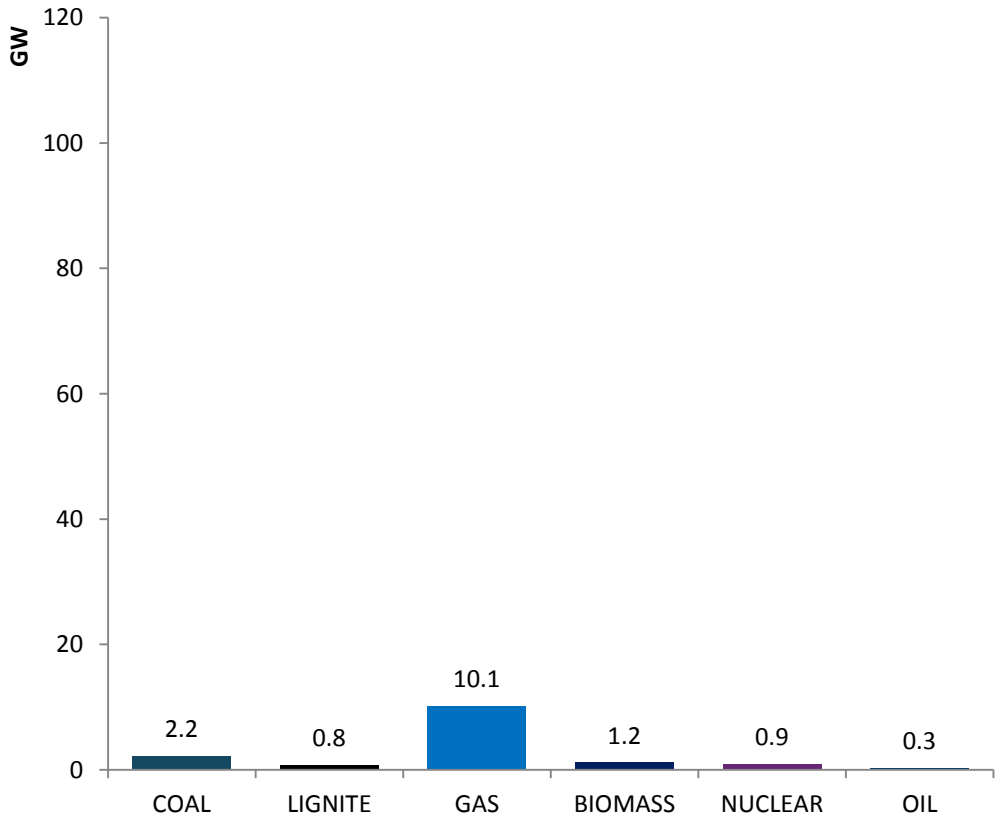


Source: Platts power vision data completed by FTI-CL analysis and data

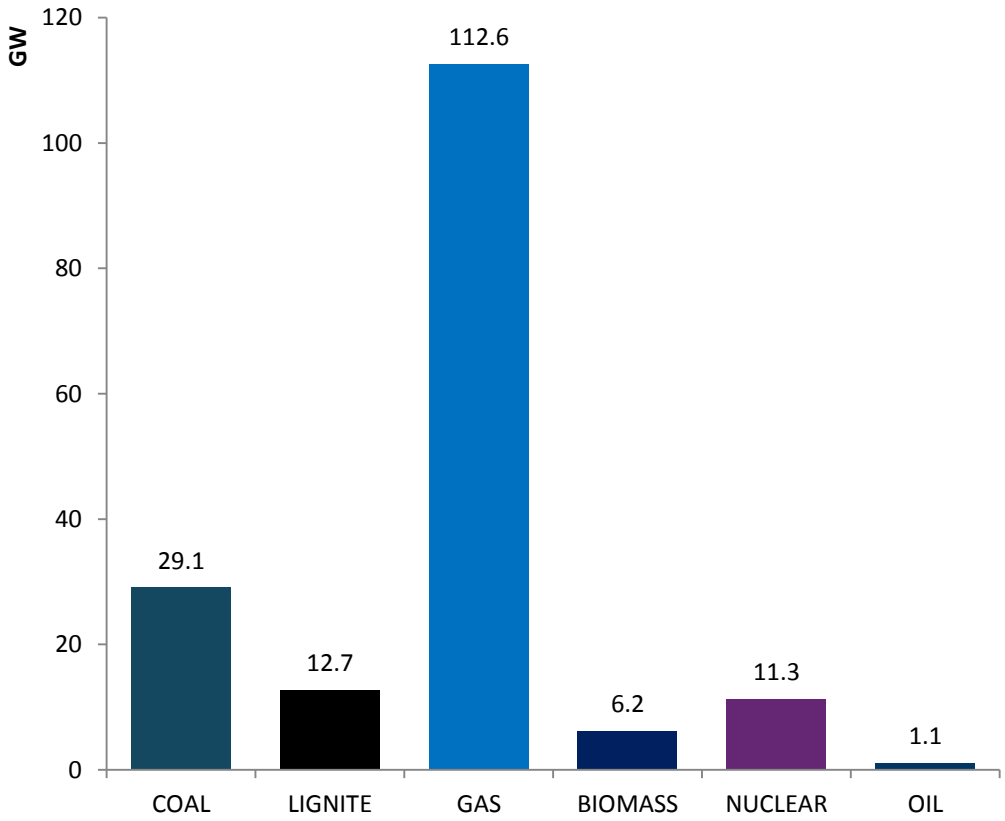
Overcapacity led to project cancellations

- Nearly all gas fired power plant projects have been cancelled. Coal plants are still being built with delays in Germany, the Netherlands and Poland.

New built between 2012 - 2018



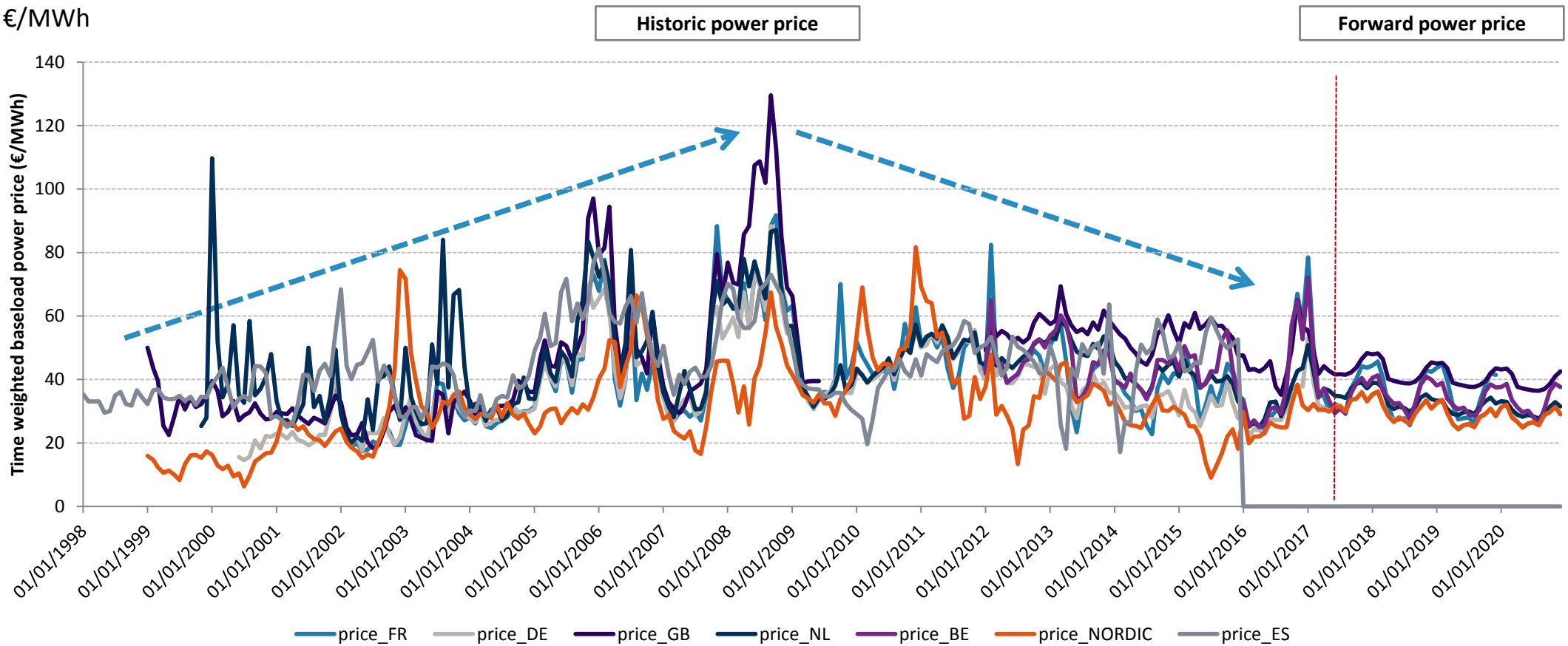
Planned or delayed for 2018 - 2030



Data : Platts power vision, FTI CL analysis

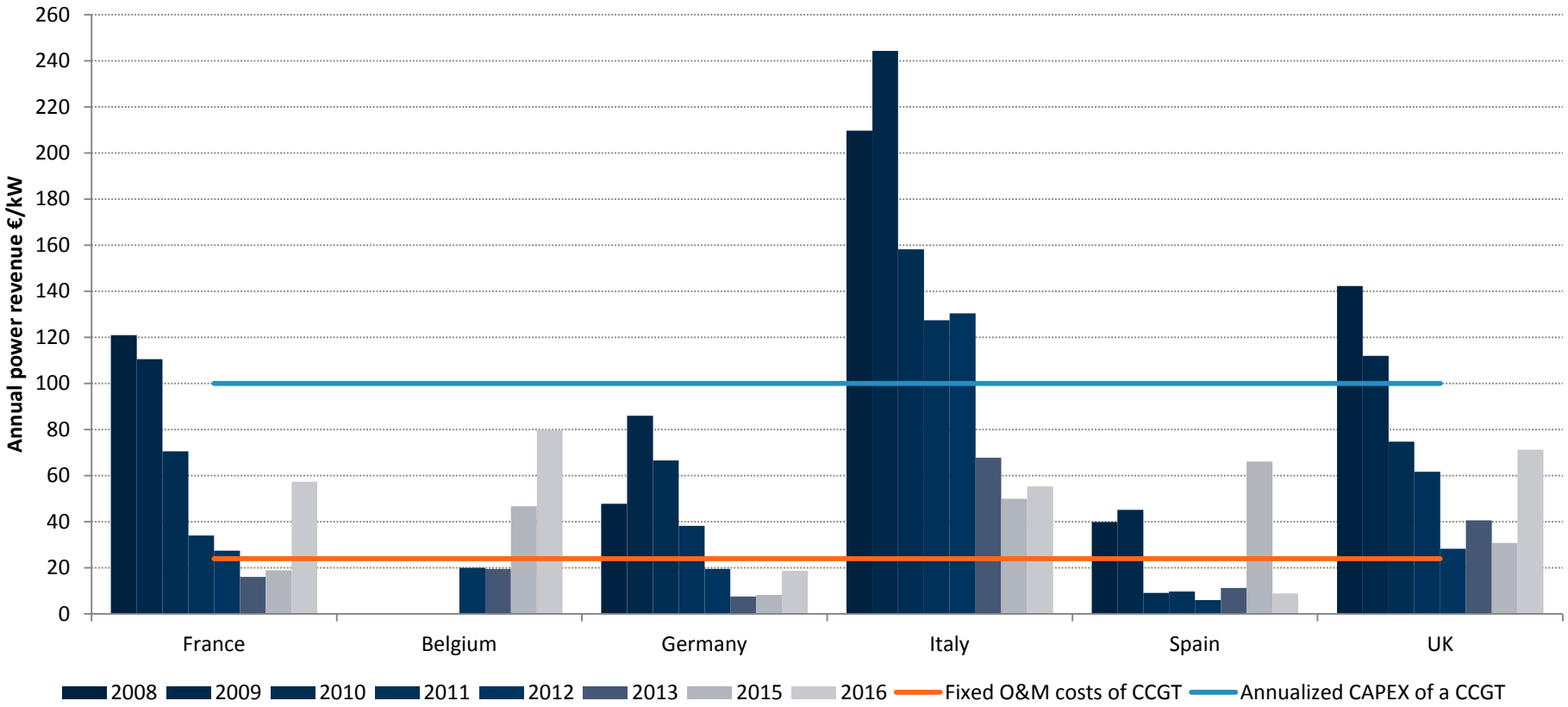
Power prices – have we reached the floor?

Spot prices in selected European markets



CCGT plants profits have recovered slightly in some markets

Power market revenue vs. fixed and O&M costs of CCGTs



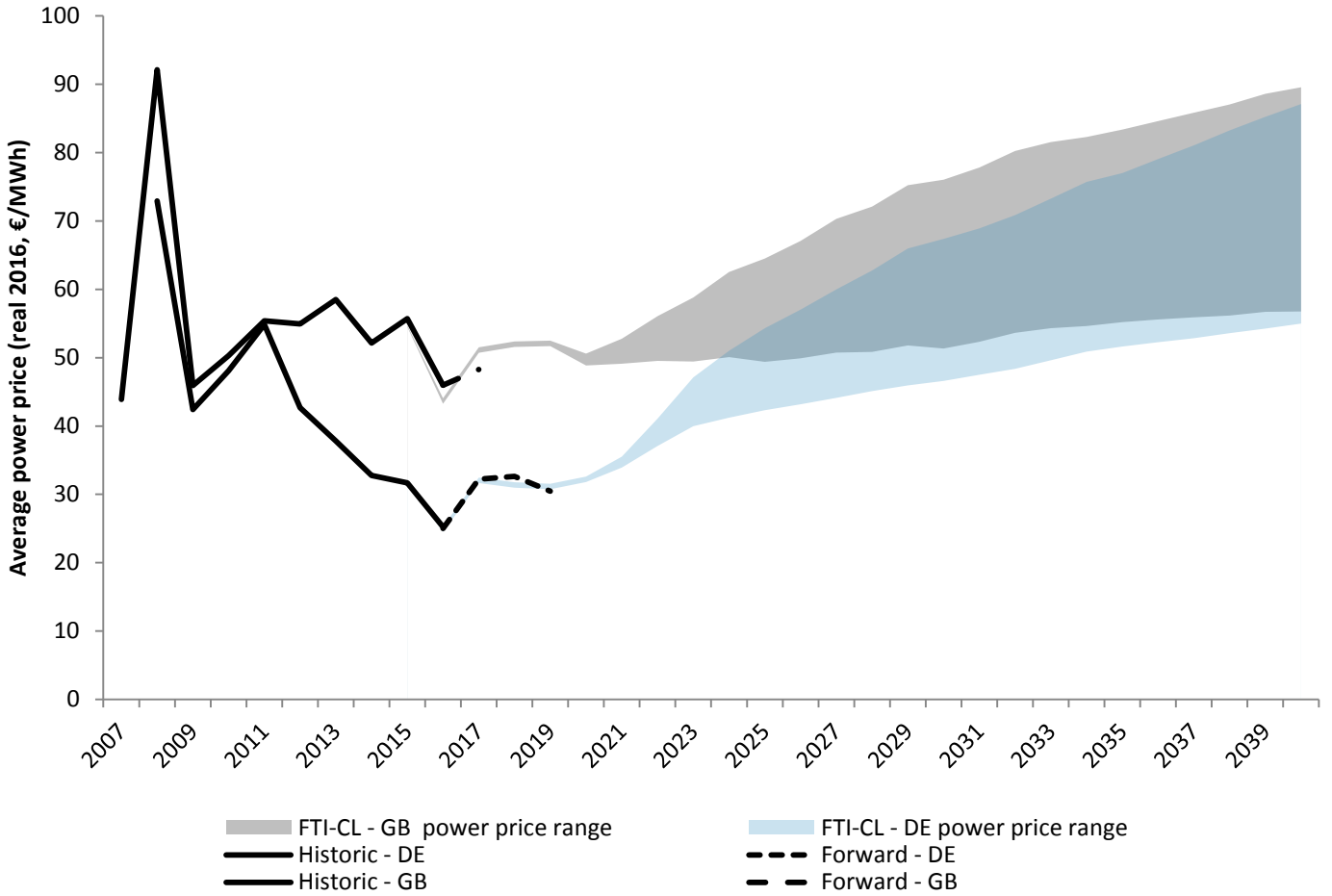
Note: Power market revenue is calculated based on the assumption that a CCGT is activated whenever power prices exceed SRMC, which account for fuel and CO2 prices.

Outlook for power prices in our 3 scenarios

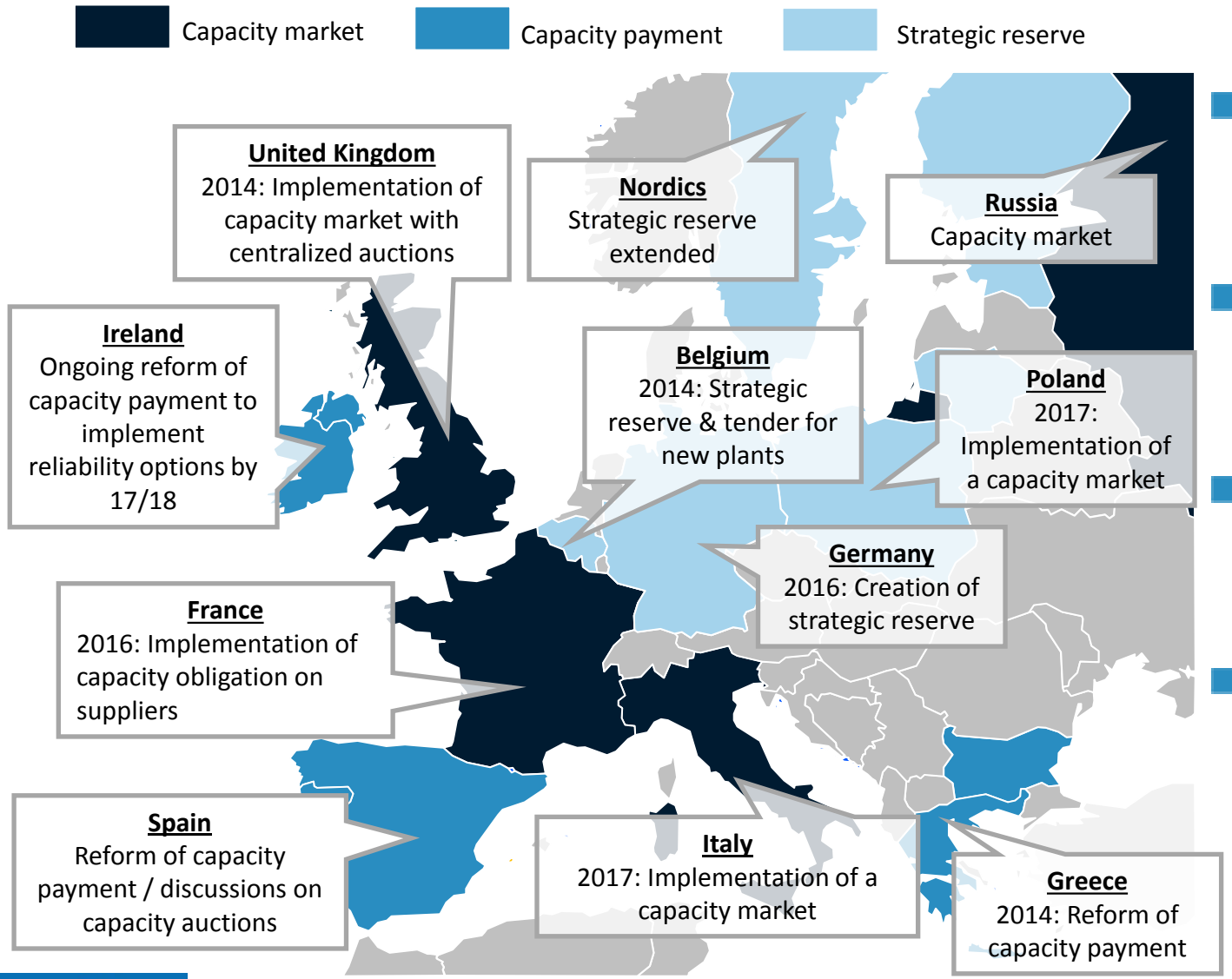
Projection discussion

- In the longer term, German and UK power prices increase following the upward trend of commodity and CO2 prices, and the progressive tightening of the power market.
- Power price outlooks are subjects to risk and uncertainties including:
  - **Regulation**: Future regional energy policies has a key impact on projected power price
  - **Capacity outlook**: Exact phasing-out of coal plants, interconnection new build, nuclear new build, CCGT new build, RES development
  - **Demand outlook**: electrification of new usages
  - **Commodities**: Future global economic growth has a major impact on commodity prices. European and international regulation on carbon pricing would be a key drivers of future power prices

Power prices (€/MWh)



Capacity mechanisms are being introduced / reformed in most members states



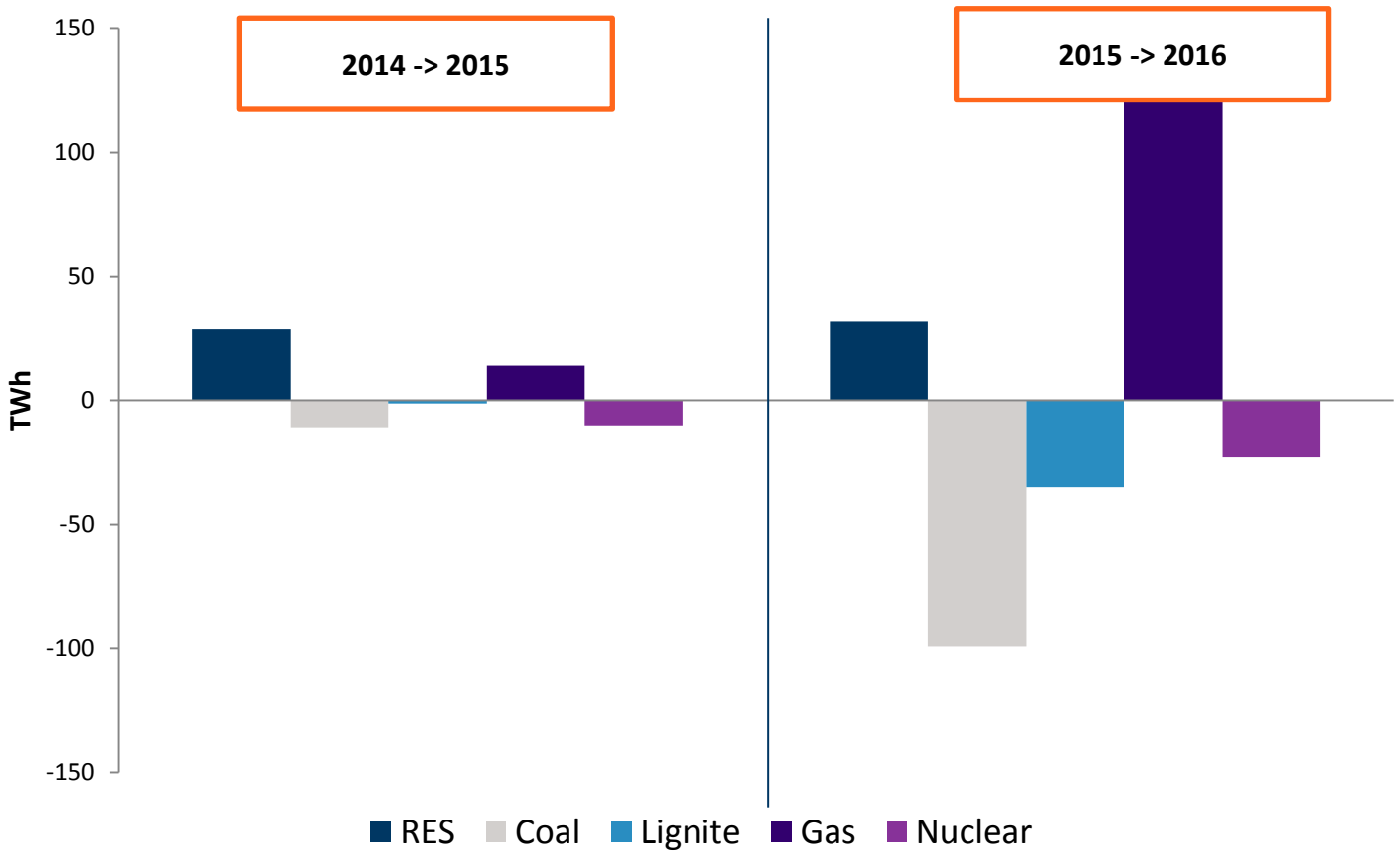
- Ongoing reforms / discussions mark a shift toward market based capacity mechanisms
- Reforms in France, Italy, and United Kindom share common structural (and permanent) approach
- Significant differences remain in the design of the different capacity markets
- Key issues revolve around cross border participation, and demand response

Outlook for coal / gas switching in the EU power sector

In the past two years, gas generation rebounded significantly primarily driven by the UK

Study scope

Evolution of power generation by source - 2014-2016



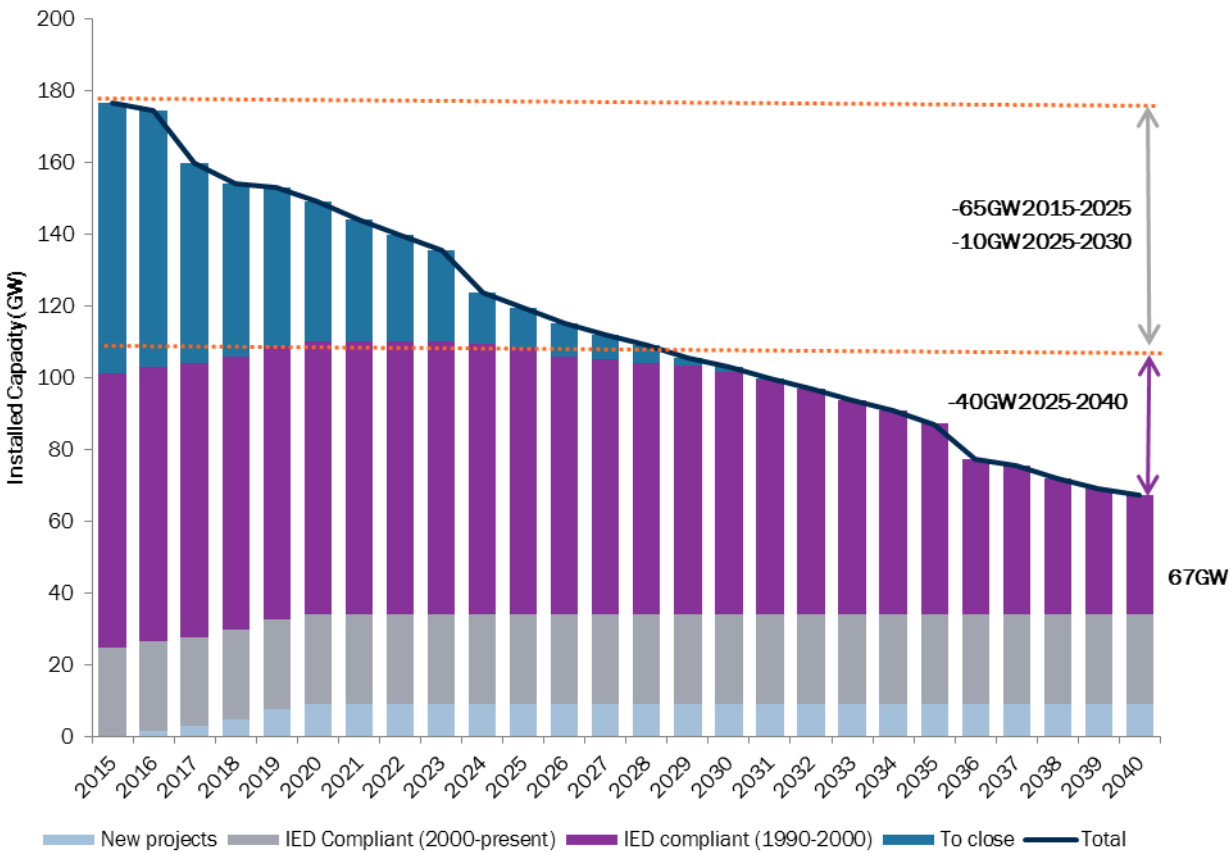
* Entsoe data

For the power sector, the challenge is to avoid costly lock-in of emissions by managing a transition away from coal and lignite plants

FTI-CL Energy modelling results

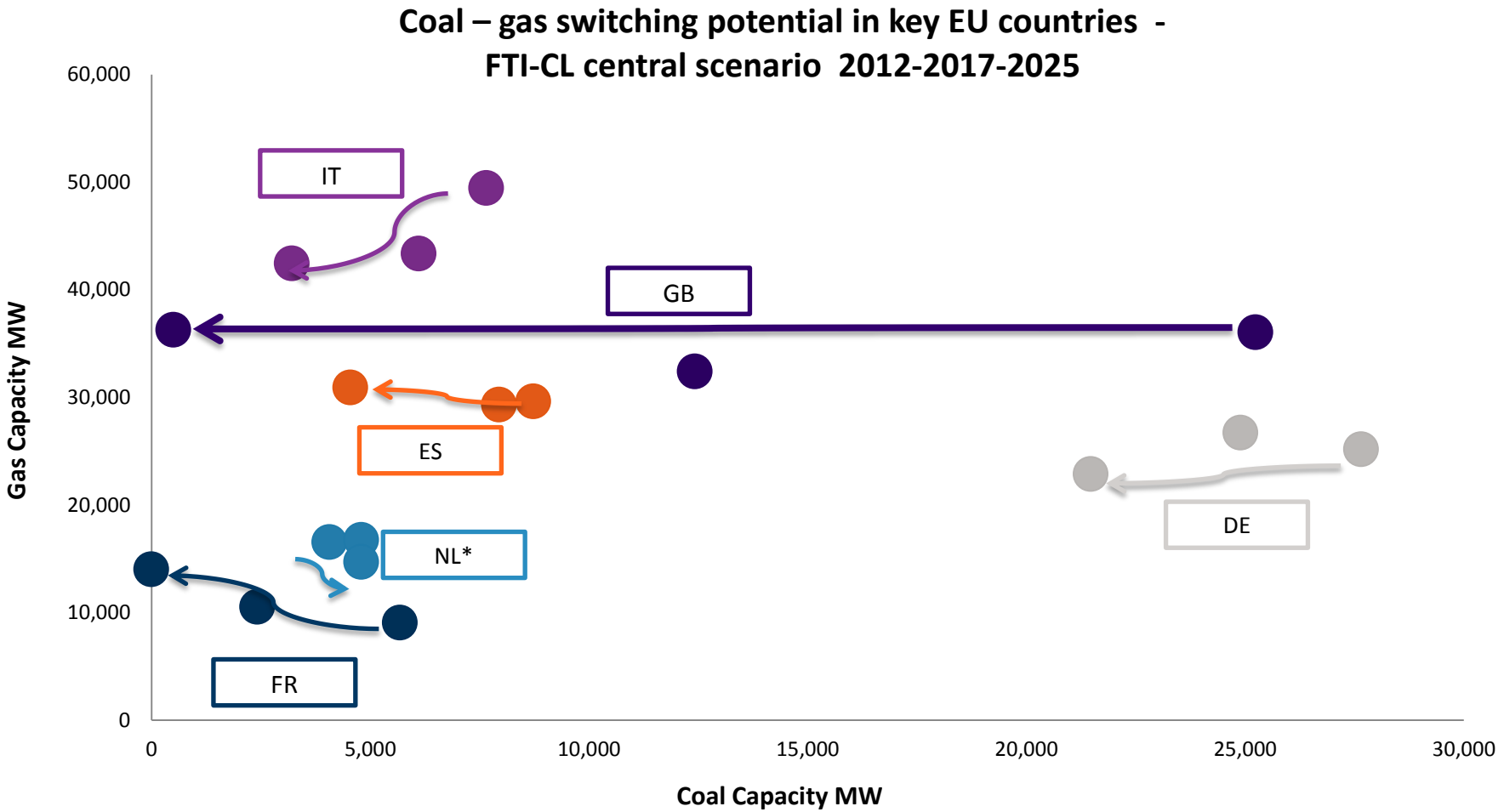
- Under our base scenario :
  - c75GW of the coal and lignite capacity will close by 2030 due to current national and European regulations.
  - However, c75GW are compliant with latest regulation and not subject to national phase-out plans.
  - 67 GW would still be in operation in 2040, representing a significant lock-in of CO2 emissions.

Coal and lignite capacity outlook



Note: We use plant-specific information on all coal & lignite plants, from Platts, national registers, LCP dataset, Transitional National Plan and operators announcements. In case of no data, assumption of a standard lifetime of 50 years coherent with Germany G7 Coal analysis (September 2015).

Coal – Gas switching potential will reduce by 2025 with coal plant closures in some countries but will remain significant



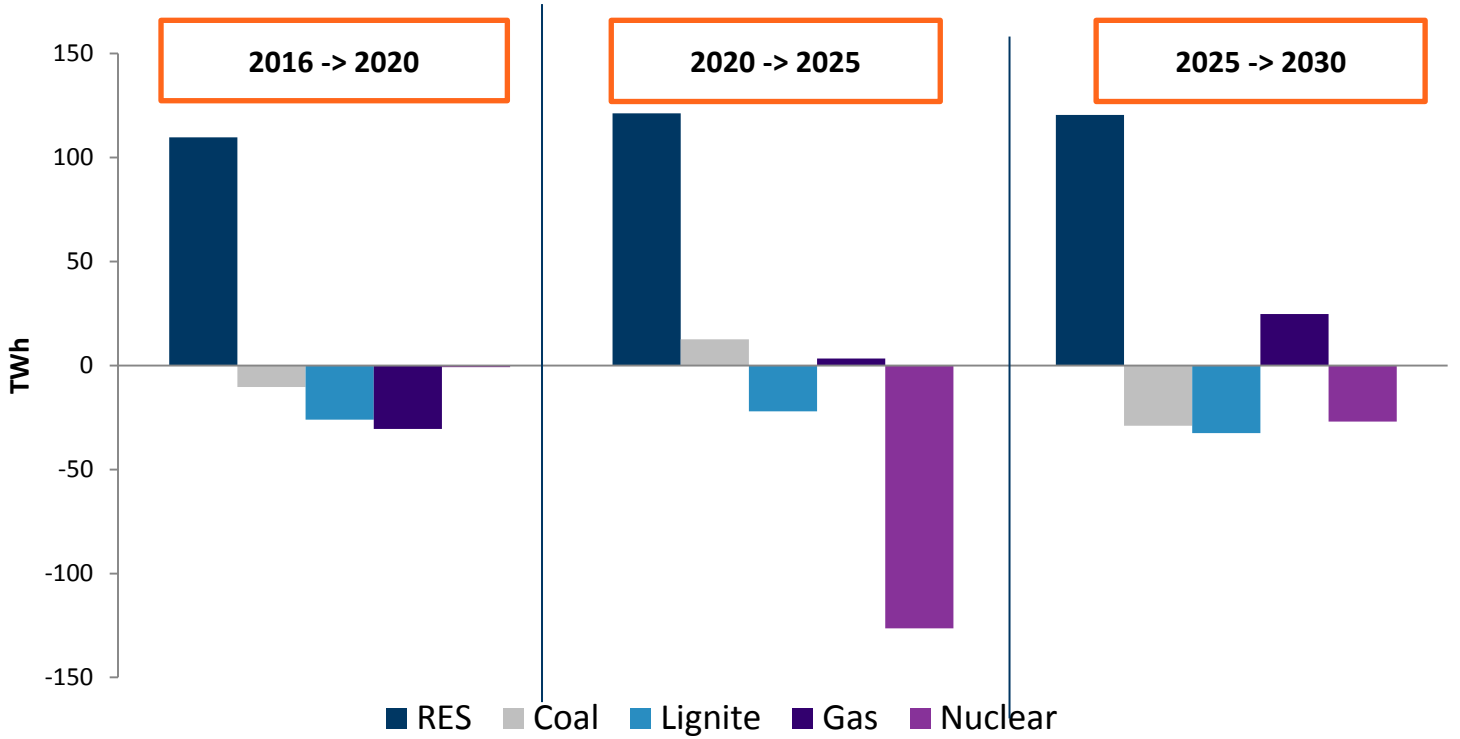
- Emissions standards (Industrial Emission Directive Emission Standards and mandated closures are the key drivers of installed capacity reduction by 2025

* NL : five coal plants closed and three opened beetween 2012-2017

RES growth will likely compensate most production decrease from nuclear plant closures leaving little upside for gas generation unless further coal plants are closed

Study scope

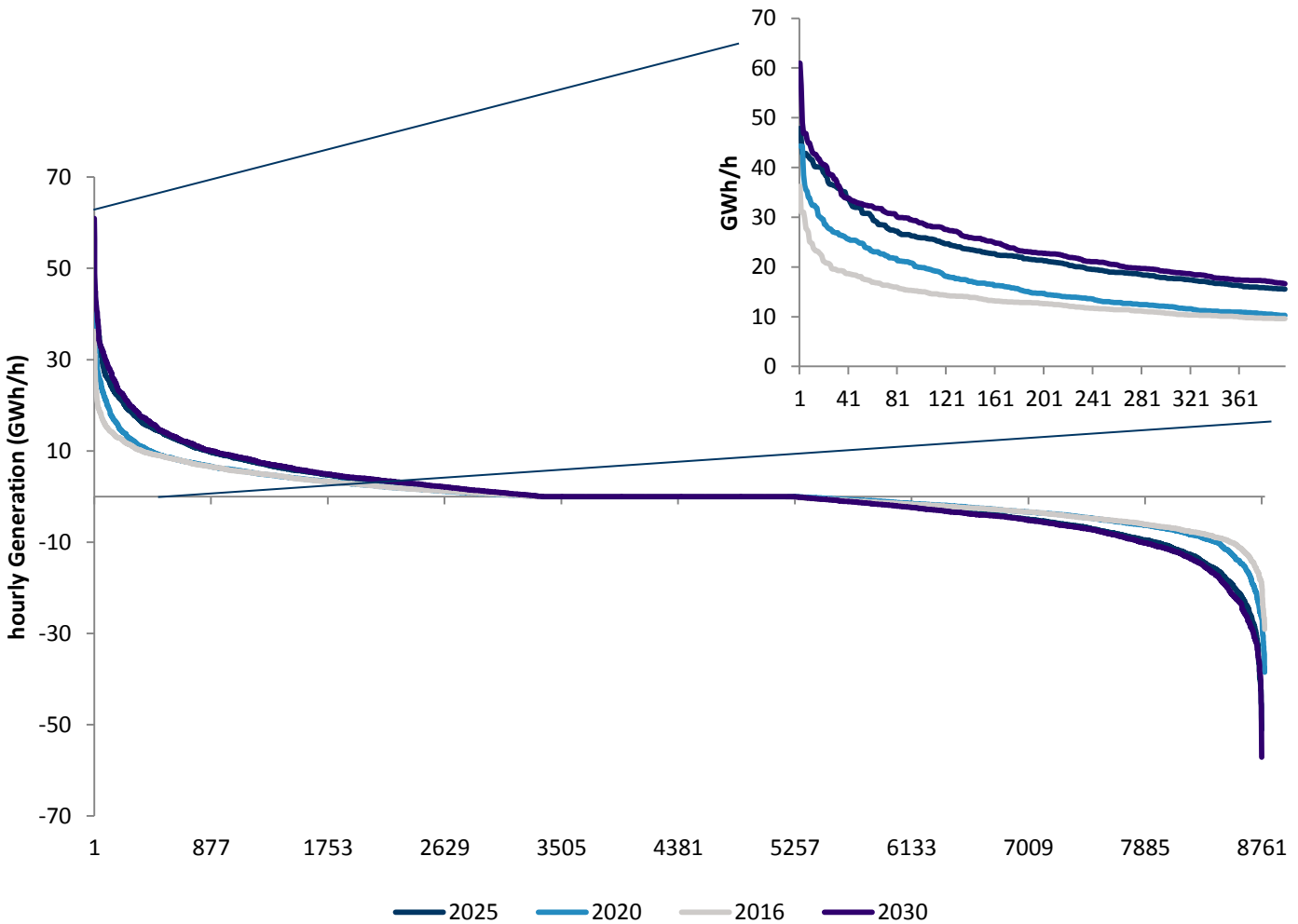
Evolution of power generation by source - 2016-2030



Unless a bold ETS reform drives CO2 prices up significantly, coal and lignite plant retirements will be insufficient to drive a significant rebound in gas burn

Gas generation will become increasingly variable raising challenges for network management & market design

Hourly distribution of gas fired generation in selected EU countries – 2016 - 2030



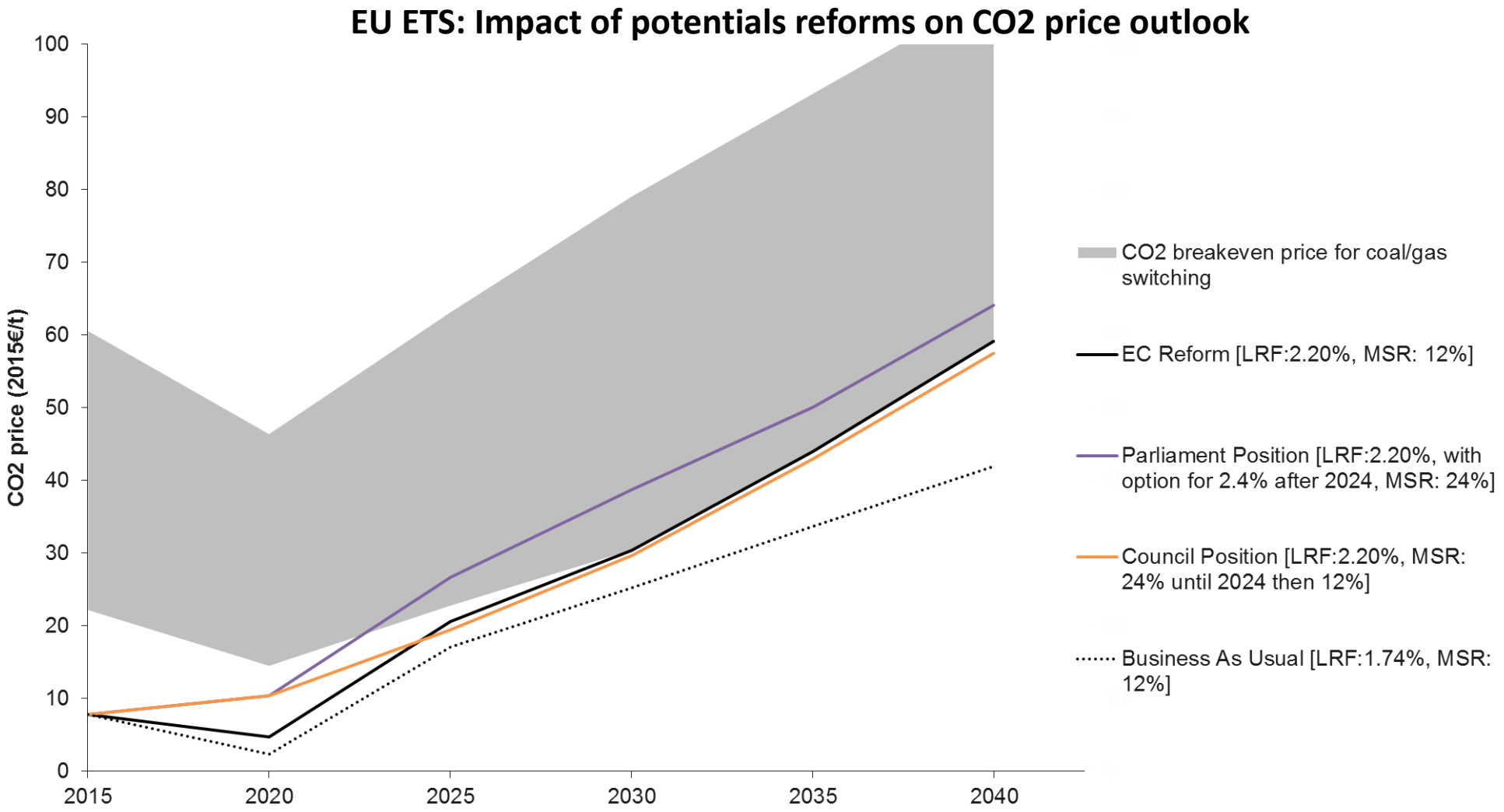
*To obtain gas consumption : /0.45

Same study scope

Key regulatory developments to watch

Beyond 2025, much uncertainty remains on the impact of EU environmental policies on coal and lignite plants

ETS reform: The options on the table would likely be insufficient to significantly boost CO2 prices



- **But will likely not be sufficient to drive significant coal / gas switching before 2025**

A range of complementary measures can be used to supplement the EU ETS

Measure		Description	Advantages	Drawbacks	Examples
Incentive regulation	**Emissions Trading Scheme**	Fixed emissions volumes, with cap and trade system	■ **Efficient** in finding the lowest abatement costs ■ Support **emissions conservation** for all installations	■ **Uncertain carbon price**, limiting support to low carbon investments ■ Potential harm to competitiveness (higher prices)	EU ETS Quebec and California ETS Chinese ETS
	Tax / Price floor	Fixed price of emissions, levied by government	■ **Raising government revenues**[1)] ■ **High predictability** leading to increased low carbon investments / R&D ■ Support **emissions conservation** for all	■ **Uncertain carbon emissions** reduction ■ Potential harm to competitiveness (higher prices)	Carbon Price Floor Carbon tax (?) Carbon tax (?)
Command and control	**Emissions Performance Standards (EPS)**	Mandate lower emissions for every installation	■ **Targeted results** ■ No direct impact on energy/goods prices	■ Potential requests for compensations	EPS (W. Coast & NY) EPS (coal only) EPS (annual) Efficiency standards
	Administrative closures	Close high-carbon plants / factories	■ **Targeted results** ■ No direct impact on energy/goods prices	■ Potential requests for compensations	2025 end of coal Climate reserve 50 year max. life
	Technology subsidies	Subsidise low/zero carbon technologies (renewables)	■ **Targeted results** ■ No direct impact on energy/goods prices	■ **Uncertain carbon emissions** reduction ■ **Significant costs to government budget**	EU renewable targets

1. Leading to potentially higher efficiency if redistributed through tax reduction on other economic activities

Key regulatory developments to watch

Conclusions

- European electricity markets are seeing some signs of a weak cyclical recovery with a rebound in thermal plants utilization rates but with different dynamics depending on the country
- Structural changes are underway with the development of new decentralized technologies (RES, storage, DSR, etc.) which are increasingly affecting market dynamics and reduce 'residual demand' for thermal plants
- The UK lead the way in 2015 for the recovery of gas burn in the power sector, and will likely be followed by 2025 by a number of other countries primarily as a result of the IED and national coal phase out policies (FR, Netherlands, etc.)
- The ETS reform is unlikely to be sufficient to provide a strong enough price signal to drive significant coal gas switching and could lead to insufficient lock in of emissions via coal and lignite plant extensions post 2025
- RES growth will thus likely compensate most production decrease from nuclear plant closures until 2025 leaving little upside for gas generation unless further coal plants are closed
- The weakness of the ETS price casts a new light on the old debate about the need for and optimal design of complementary policies such as Emission Performance Standards

Thank you for your attention

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Our recent work on the ETS and RES policies

Wake Up! Reforming the EU ETS: Comparative Evaluation of the Different Options

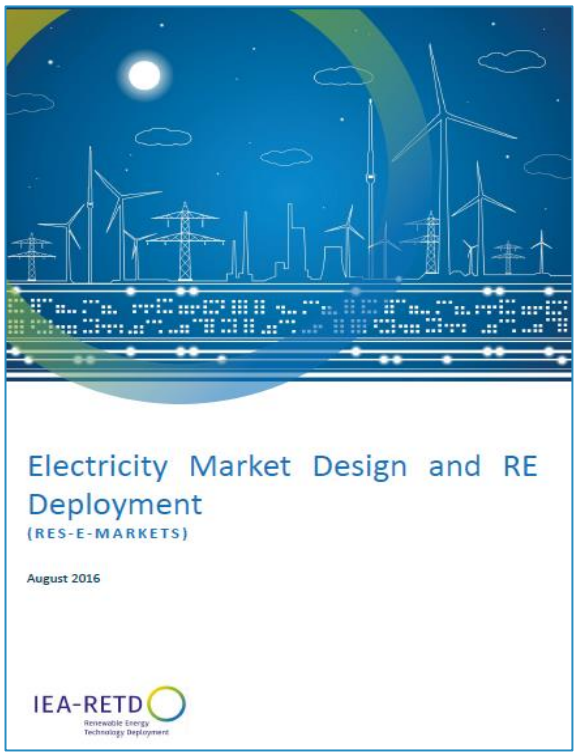
Web link

The new European Energy Union - Toward a consistent EU energy and climate policy?

Web link

Electricity Market Design and RE Deployment

Web link



Our recent work on electricity market design

Toward the Target Model 2.0 –

Policy Recommendations for a sustainable market design

Web link

Publications on capacity mechanisms

- Market design for generation adequacy: healing causes rather than symptoms Web link
- Coordinating capacity mechanisms – which way forward? Web link
- European electricity market reforms: the "visible hand" of public coordination Web link

Publications on European electricity markets

- The new European Energy Union - Toward a consistent EU energy and climate policy? Web link
- European electricity markets in crisis: diagnostic and way forward Web link