“Should the European Electricity Market restore administered prices?"

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The European electricity sector

- A common energy policy does not exist in Europe. Each country may implement its own policy and the targets are different from a country to another (28 countries)
- But a common rule must be observed: COMPETITION!
- In the electricity sector (as in the gas sector) competition is observed for production and for supply.
- Transmission and distribution networks are natural monopolies thus they are regulated activities; but for the networks the rule is now “ownership unbundling”, with an exception: France, where only legal unbundling is implemented (no ownership unbundling).
- Thus EDF remains the main producer, the main supplier and EDF is also the owner of the networks : RTE (transmission) and ERDF (distribution)
- **Competition is the rule but the market is falling!**
- It is the reason why a new regulation is now necessary; the difficulty is to find the good balance between competition and regulation!

What are the issues in the electricity market in Europe?

I The main problem : falling prices on the wholesale electricity market

Main cause: renewable electricity injection paid off market in a context where demand is low and installed capacity is too high

II The solutions

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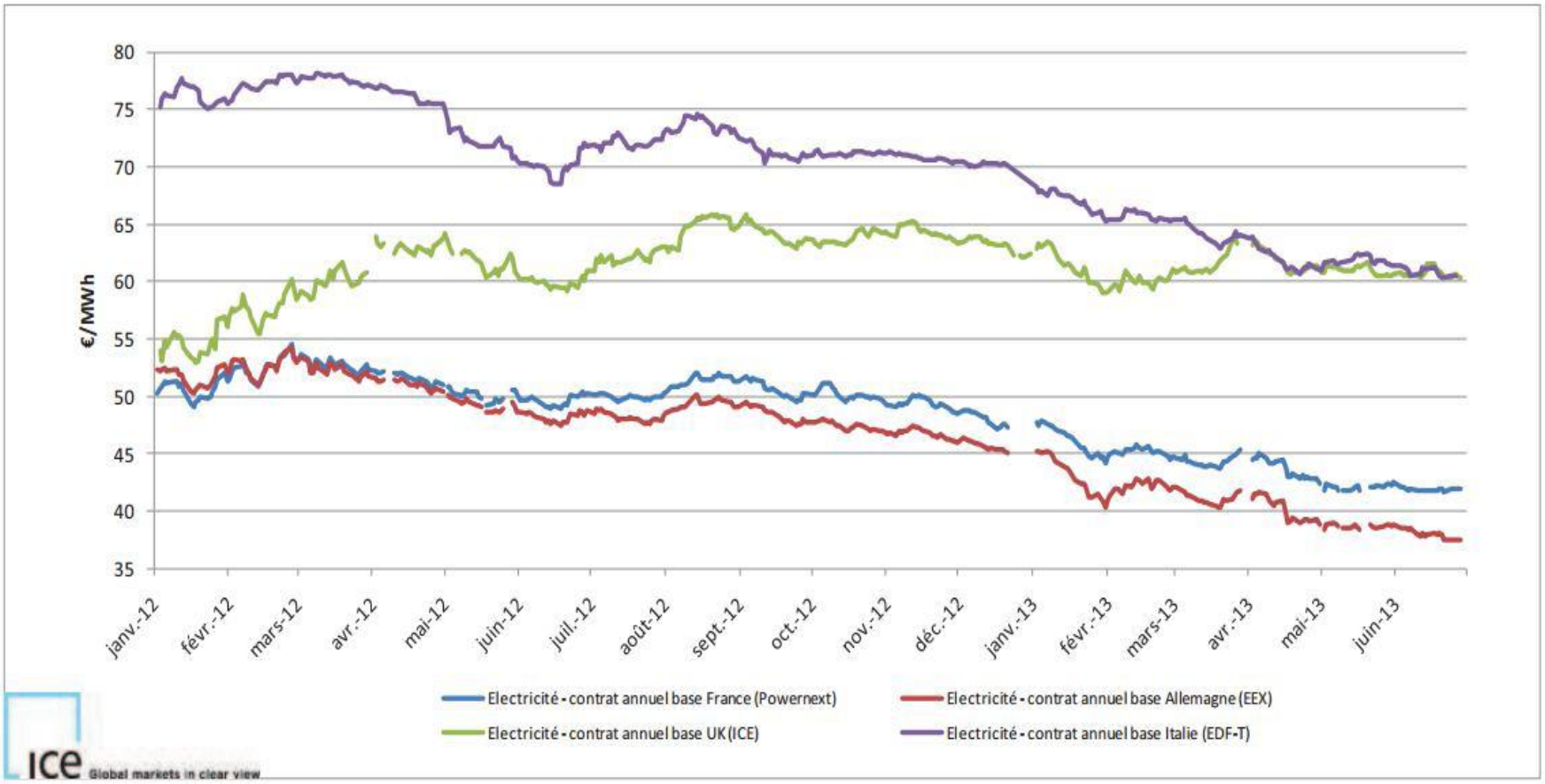
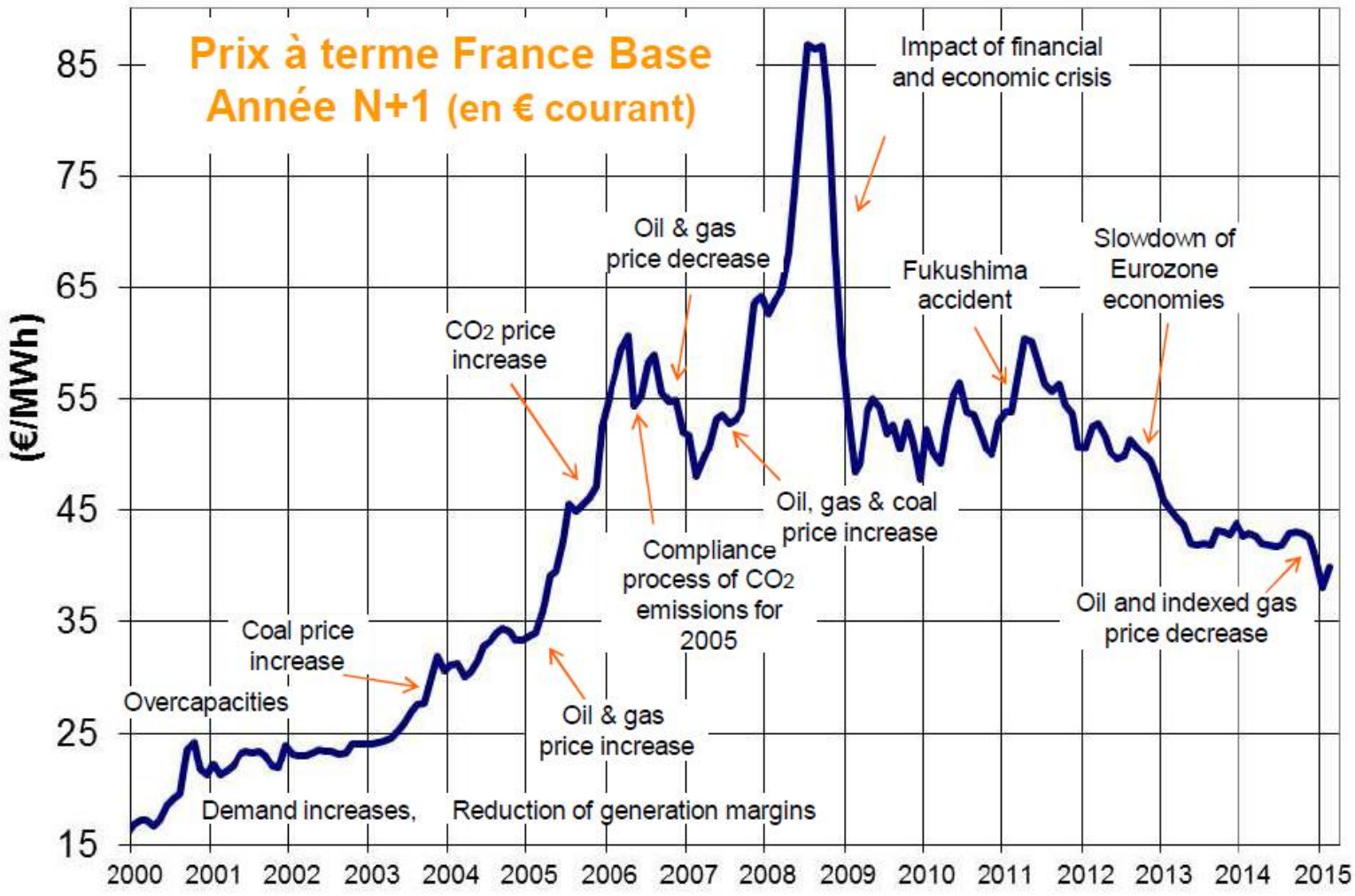
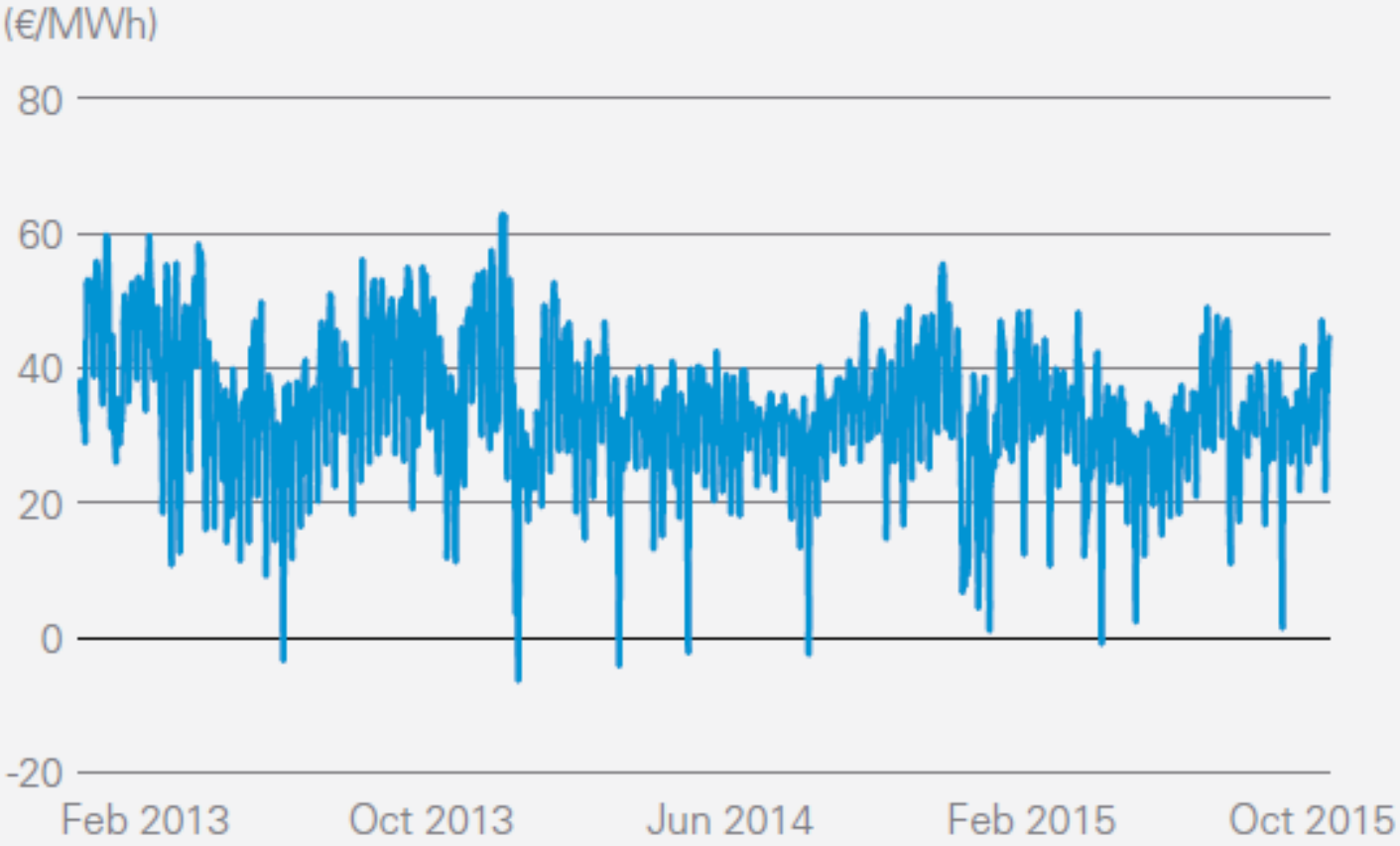
Electricity spot market in Germany, France, Italy and UK
(red: Germany; blue: France; green: UK; black: Italy)



Forward Electricity Prices in France
good correlation between electricity price and oil price



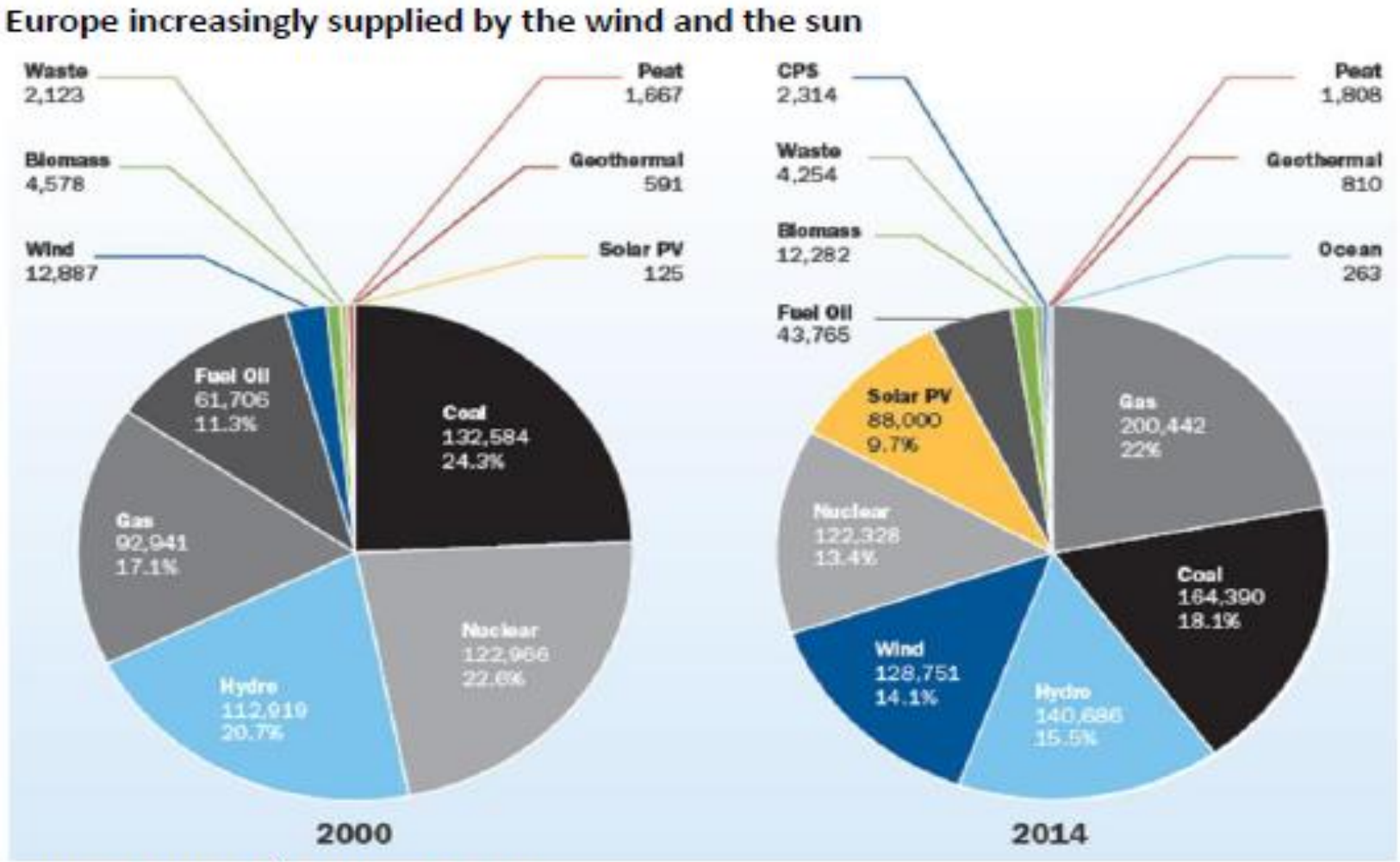
Germany Wholesale Power Spot Prices Have Been Negative at Times



As of 13 October 2015

Source: Bloomberg

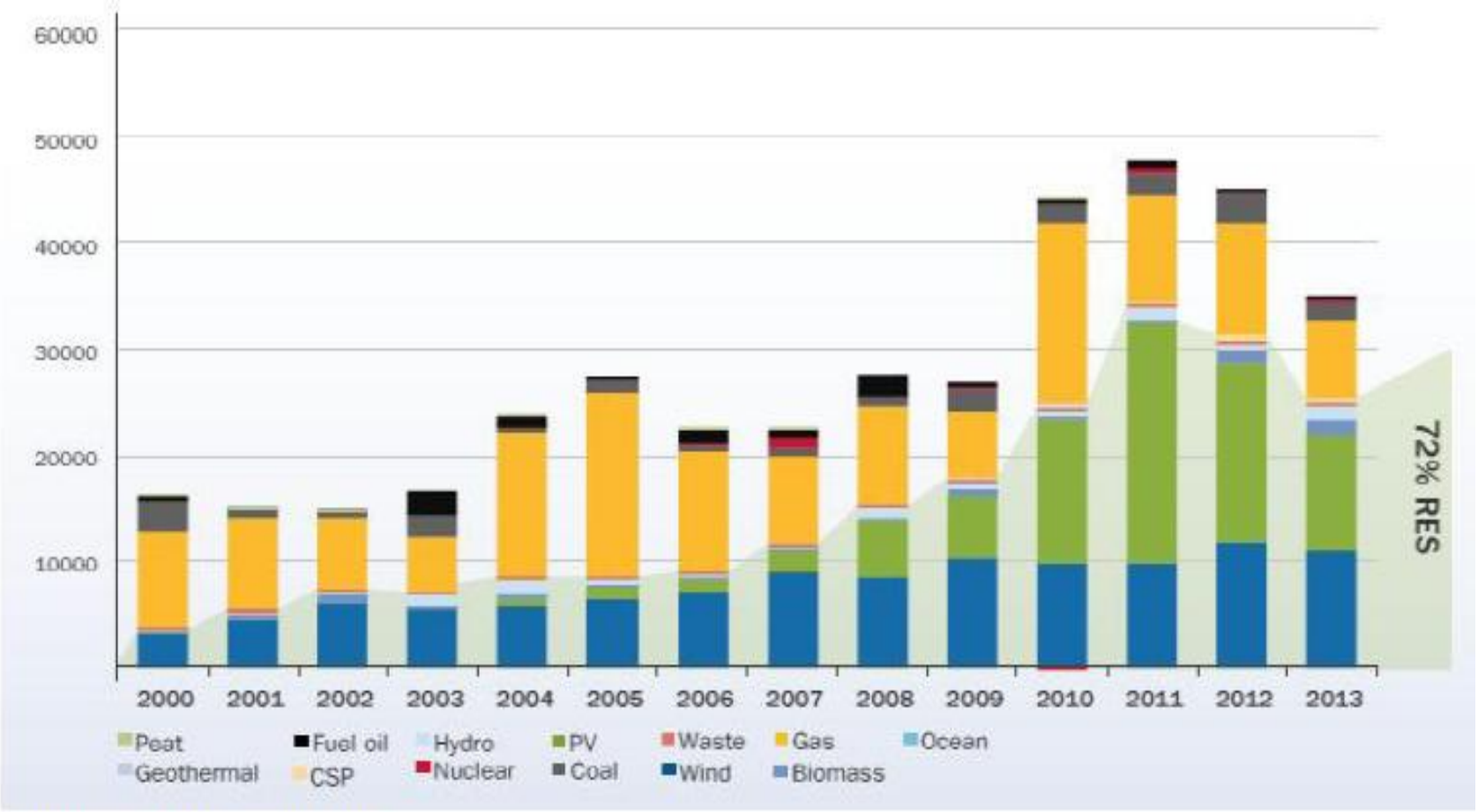
Electricity Generation in Europe



Source: Aiming High, EWEA, Nov 2015

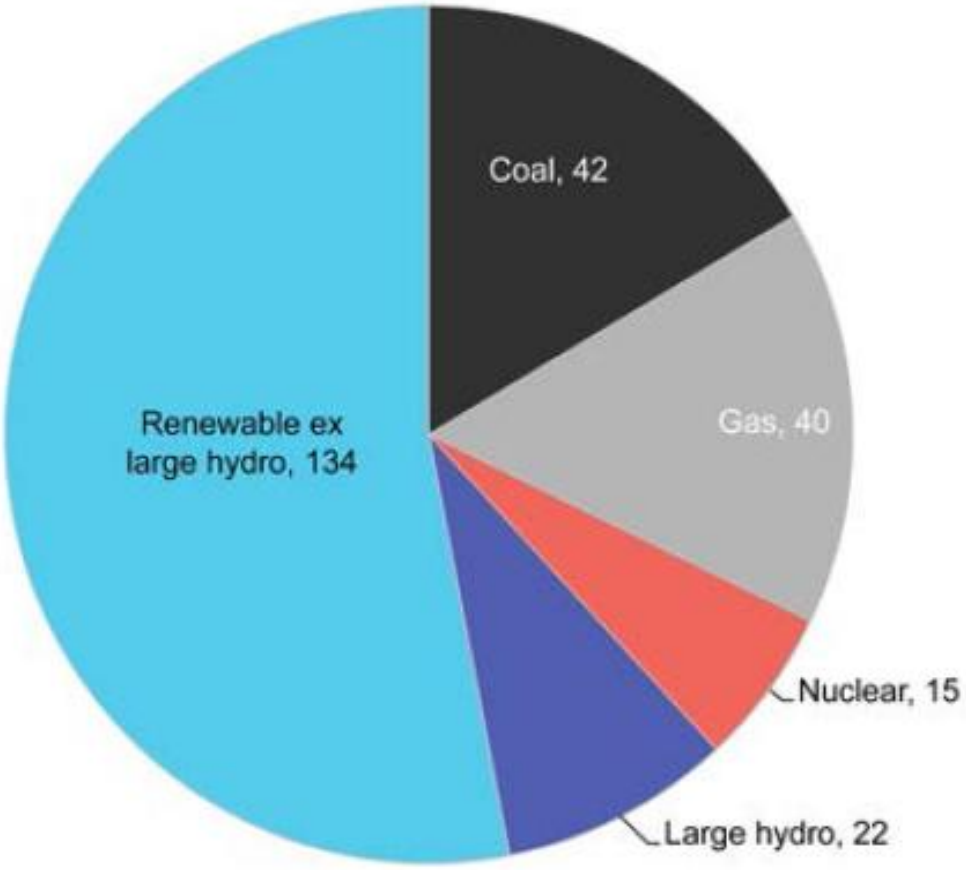
Installed Electricity Capacity per Year

(wind in blue; P.V. in green; gas in yellow)

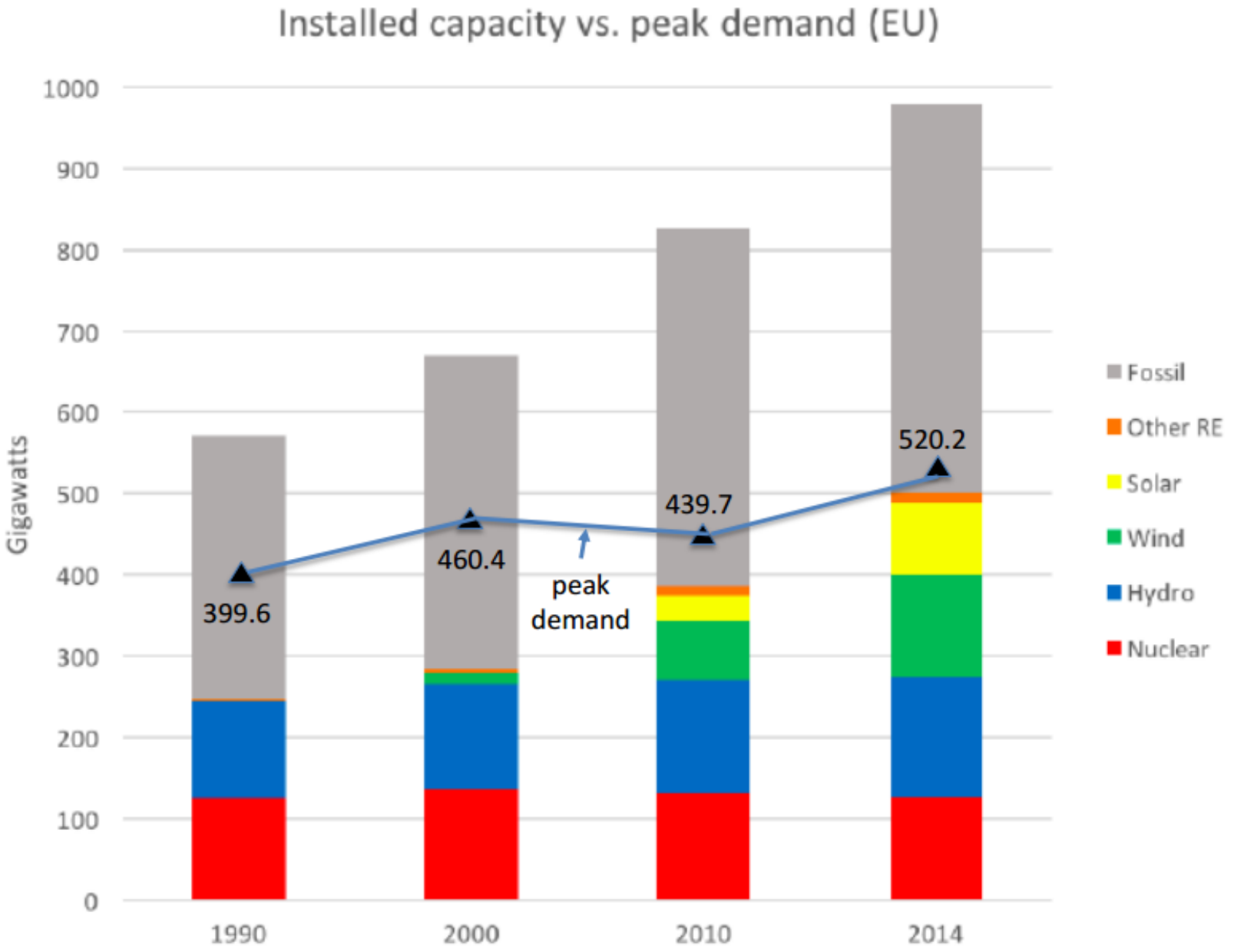


Source: EWEA (2014), p.7

FIGURE 25. NET POWER GENERATING CAPACITY ADDED IN 2015 BY MAIN TECHNOLOGY, GW



Source: Bloomberg New Energy Finance


Installed capacity vs. peak demand (EU)
Gigawatts
1000
900
800
700
600
500
400
300
200
100
0
1990
2000
2010
2014
399.6
460.4
peak demand
439.7
520.2
Fossil
Other RE
Solar
Wind
Hydro
Nuclear

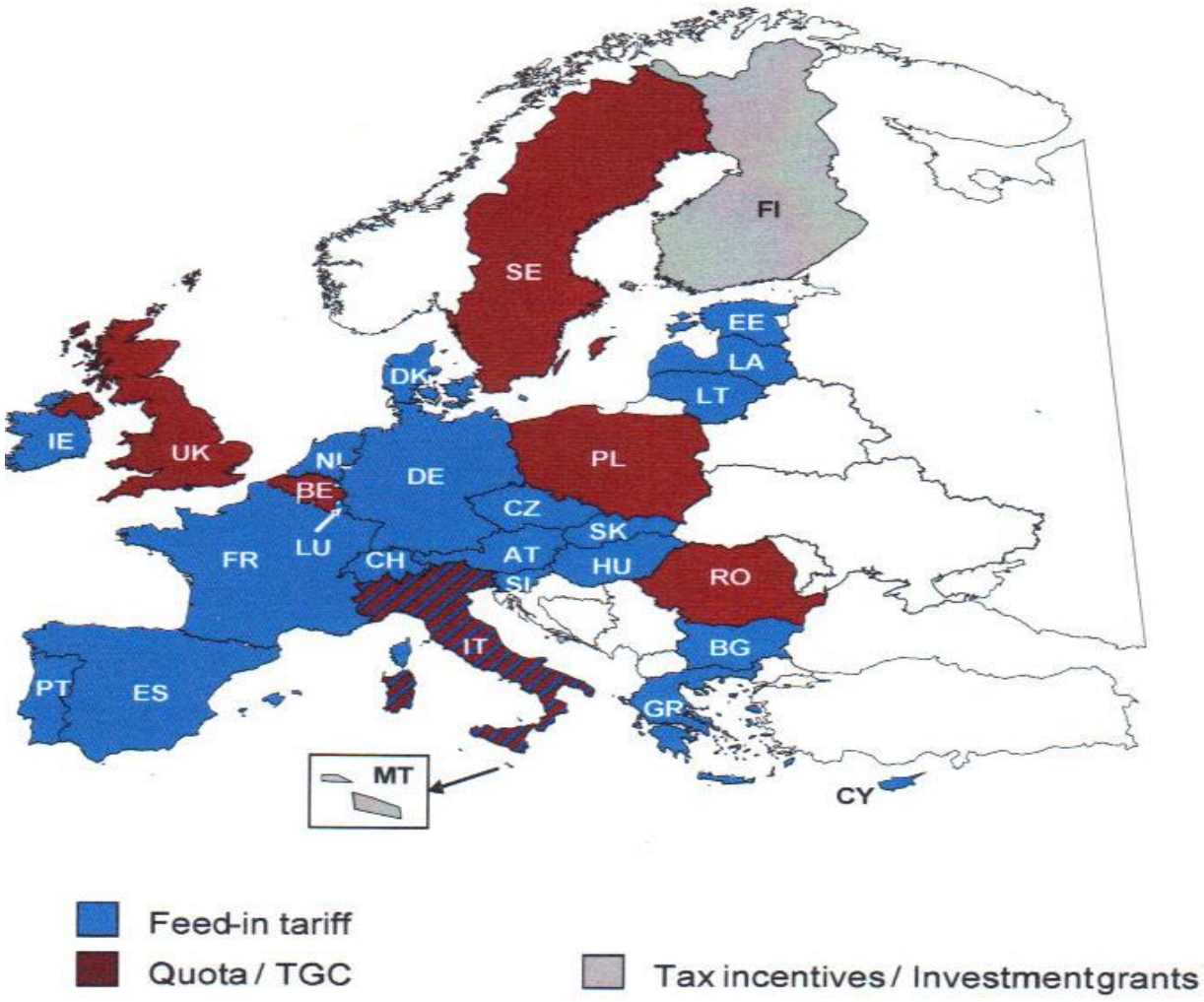
Feed-In Tariffs (FIT)

Feed-in Tariffs (FIT), which remain the main mechanism used in Europe for promoting renewable energy sources, are quite close to the system of import taxes and export subsidies introduced by the Common Agricultural Policy (CAP) at its beginnings in 1967-1968. And the FIT system now involves the same disadvantages as those observed with the CAP: overcapacity of supply.

French FIT in France in 2014

source DGEC/CRE

Renewable energy	Duration of contract (years)	FIT en euro cents/kWh
On-shore wind	15	8.2 during 10 years and 2.8 to 8.2 during 5 years (according to the site)
Off-shore wind	20	13 during 10 years and 3 to 13 during 10 years (according to the site)
Solar (PV)	20	7.36 (Power Station) to 28.51 (Building) according to the site
Biogaz	15	8.12 to 9.745 according to the level of power (+ a efficiency premium between 0 and 4)
Small Hydro	20	6.07 (+ premium according to the site)



Currently applied schemes for the support of electricity from RES in the EU-27 countries

- **A debate is now underway in Europe to decide whether or not the present system for promoting the penetration of renewable energy sources, in particular wind and solar (photovoltaic) energy, should be maintained in the energy balance.**

- **This system, based on feed-in tariffs, is increasingly contested because of the undesirable effects which have been observed; it is also costly for the consumer**

- **Other incentive schemes are possible, notably the FIP system.**
- **Necessity to reduce the level of FIT or to opt for a FIP system.**

The FIT scheme undoubtedly encouraged the growth of renewable energies, notably in the European countries where guaranteed prices were quite remunerative (e.g., Germany or Spain). But in a context of slower economic growth and stagnating energy demand, it led to the overproduction of electricity during certain periods, which provoked a decrease in electricity prices on the spot market. Consequently profits of Utilities are also decreasing.

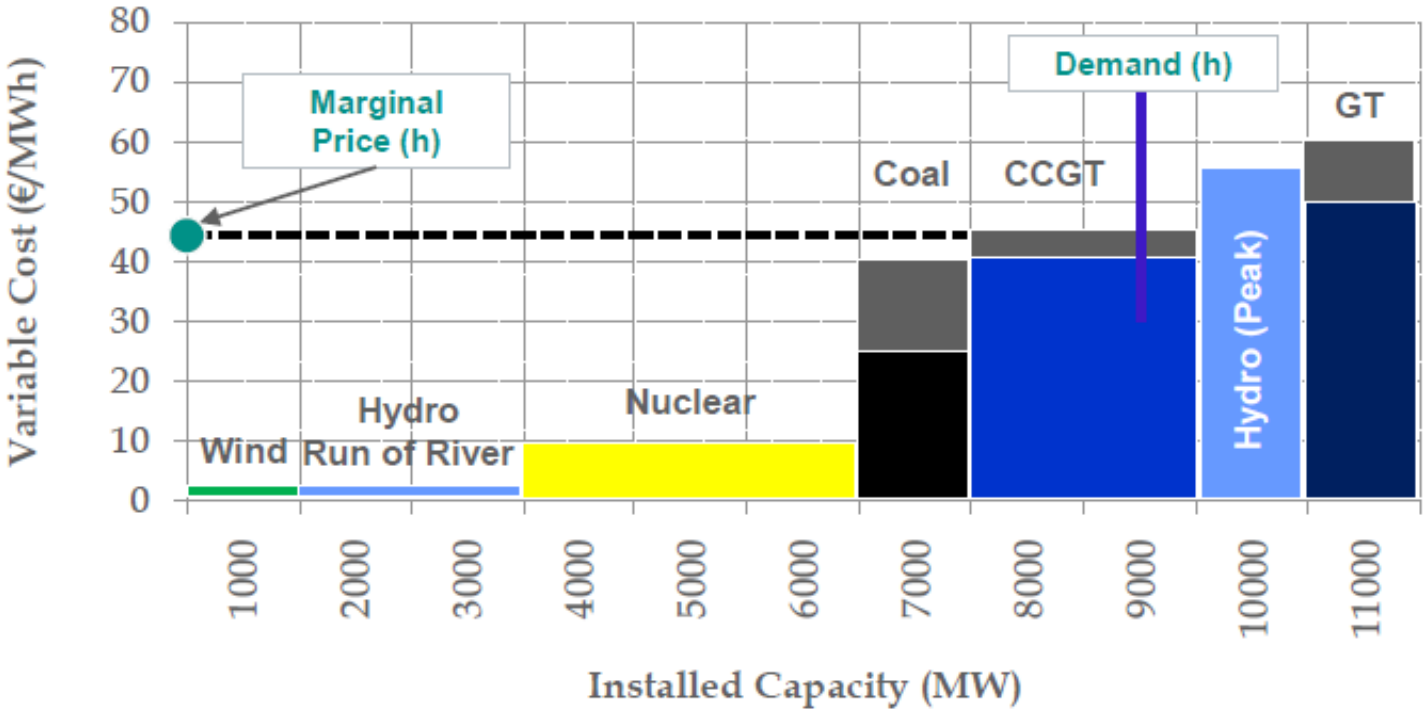
Given that renewable electricity producers do not want to interrupt their production, it is necessary to shut down the more expensive thermal plants (in particular the gas-driven plants). And since electricity cannot be stored, there has sometimes been an 'economic' destruction of the product via the system of negative prices (particularly in Germany where spot prices are often lower than in France); large sunk costs have been observed with gas power stations.

F. Benhmad and J Percebois "Wind Power Feed-in Impact on Electricity Prices in Germany 2009-2013"
published in the European Journal of Comparative Economics 2016

- **Econometric approach (hourly data)**
- **Our main findings suggest that intermittent wind power generation does not only decrease the spot electricity price in Germany (and in the countries interconnected with Germany) but also increases the price volatility. However, the downward effect of the feed-in of wind-generated electricity on spot prices and the upward effect on price volatility are limited by the possibility of exporting a part of the surplus of wind power to Germany's neighbours (including France). The negative impact of RES on electricity spot market prices and their volatility are thus made less pronounced by interconnections (interconnection with France and Poland plays the role of a positive externality for Germany)**

Market Electricity Pricing on the Spot

- The electricity price is always based on the marginal cost when electricity demand changes (merit order logic)
- With such a pricing system, fixed costs are recovered during peak periods when, for instance, nuclear kWh is sold on the base of the marginal cost of a thermal kWh

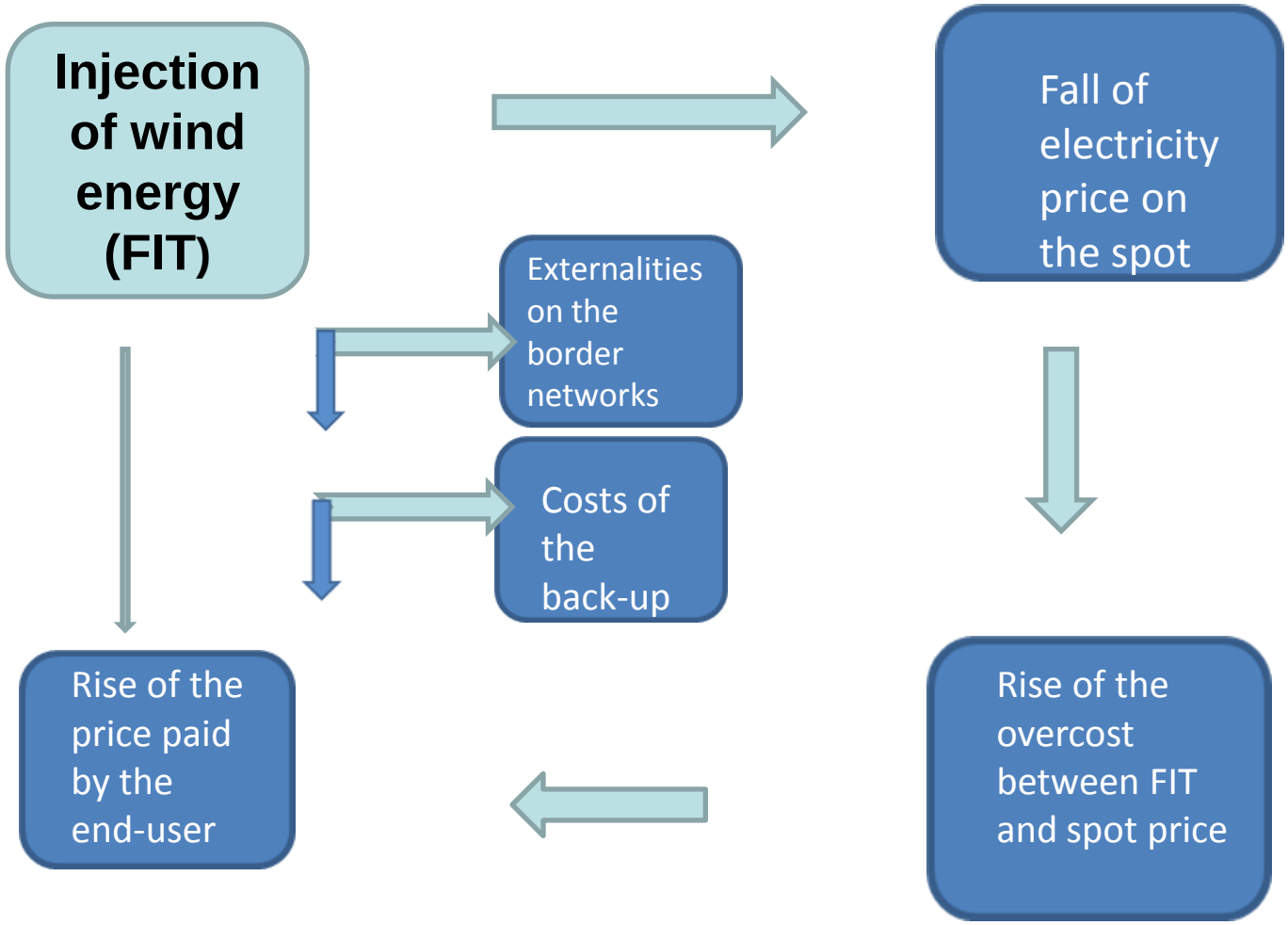


Source : CEEME, GDF Suez

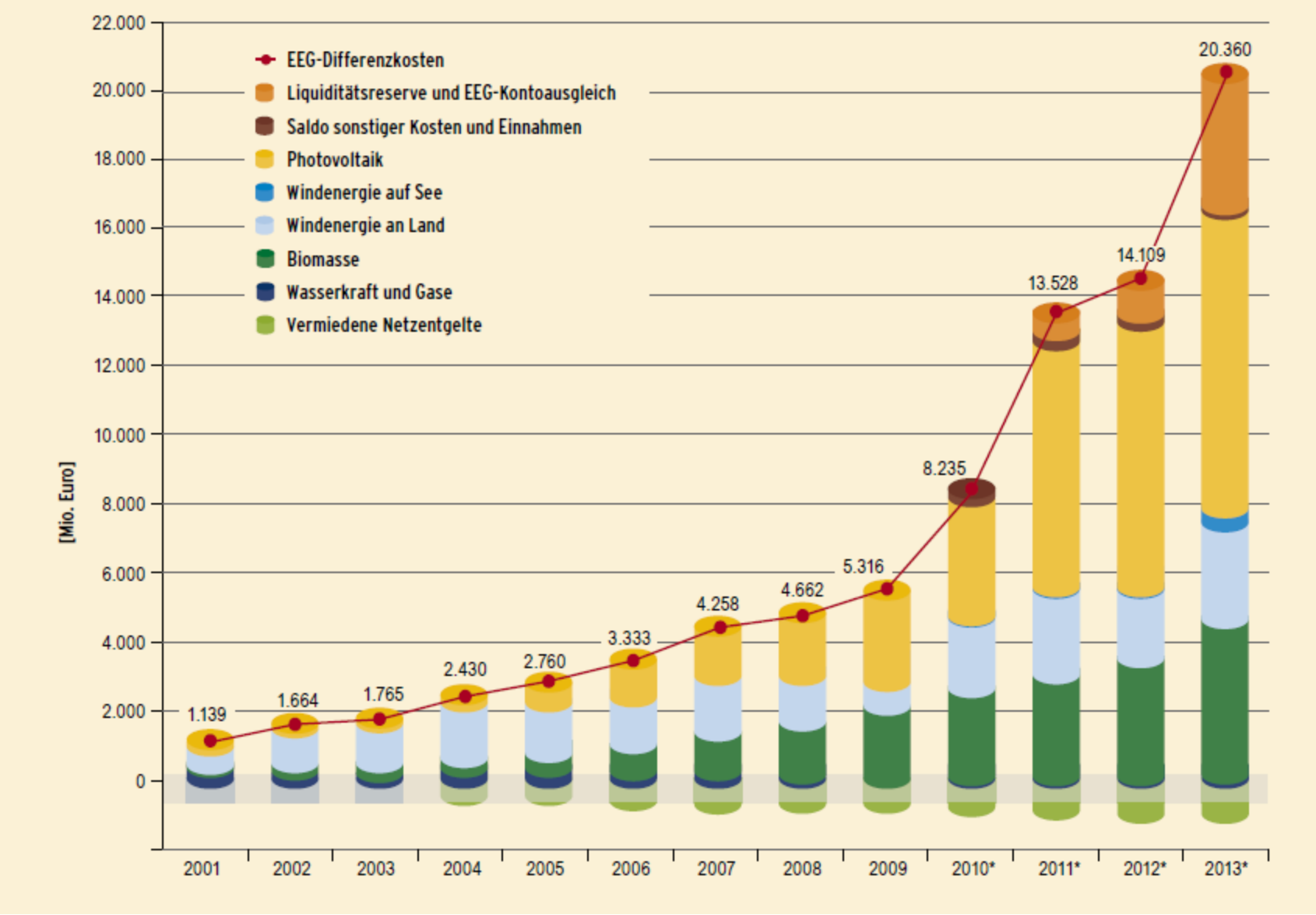
« Switching » caused by renewables: translation of the « merit order » curve

(see Hansen and Percebois 2010)

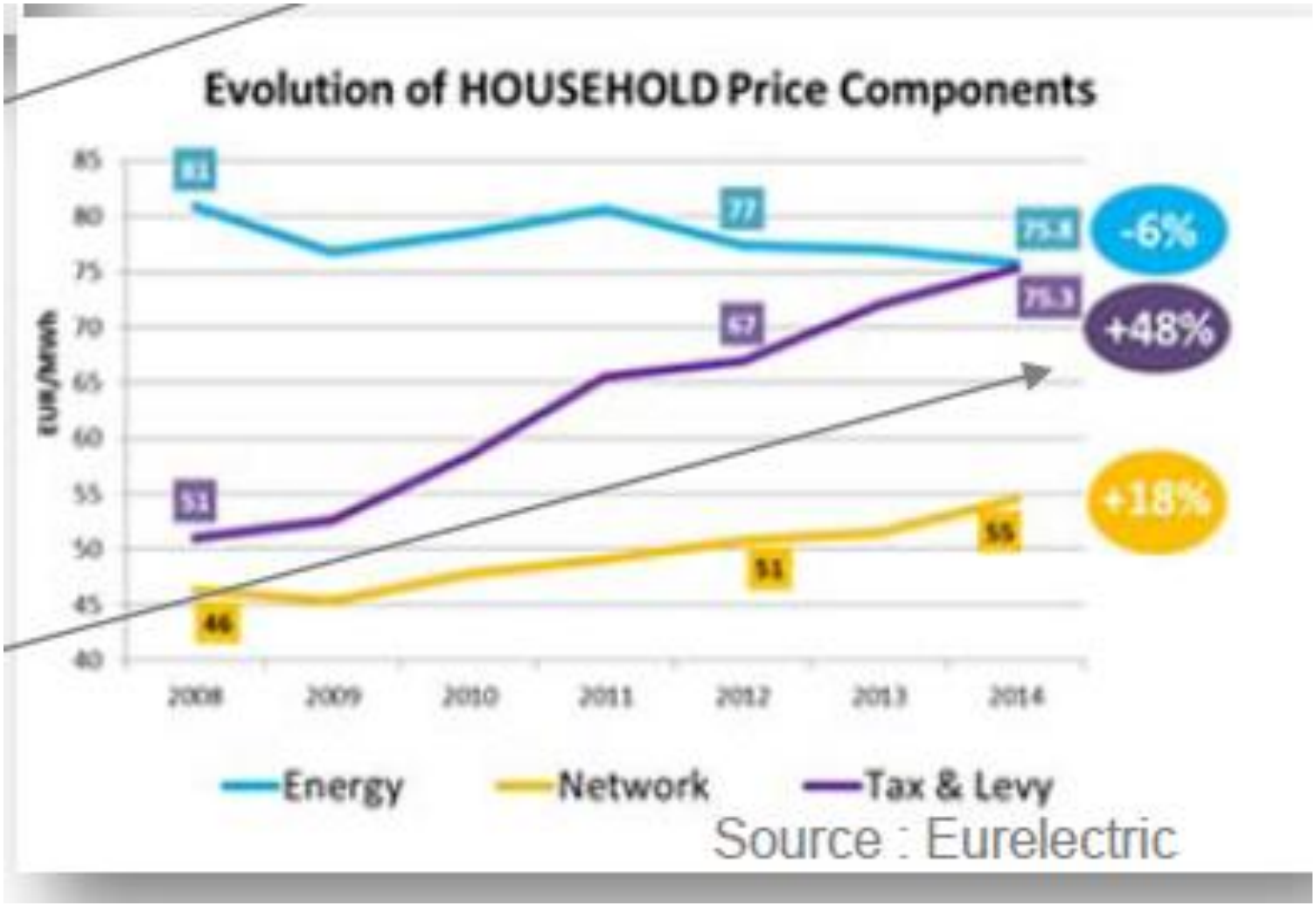
Perverse effects of FIT system (source J Percebois CREDEN)



Overcost paid by the consumer due to the FIT system (green: biomass; blue: wind; yellow: solar)



Evolution of the household electricity price in Germany
(here taxes include the overcost of Renewables)



Two factors shouldn’t be undersestimated

- **1) Breakdown of the electricity price: 35% (generation); 35% (access to transport and distribution); 30% (taxes, CSPE included) ;taxes include overcost of FIT**

- **2) It is necessary to take into account the cost of the « back-up » due to intermittence of the renewable power stations (euros 5 to 25 /MWh according to estimates of IAE?)**

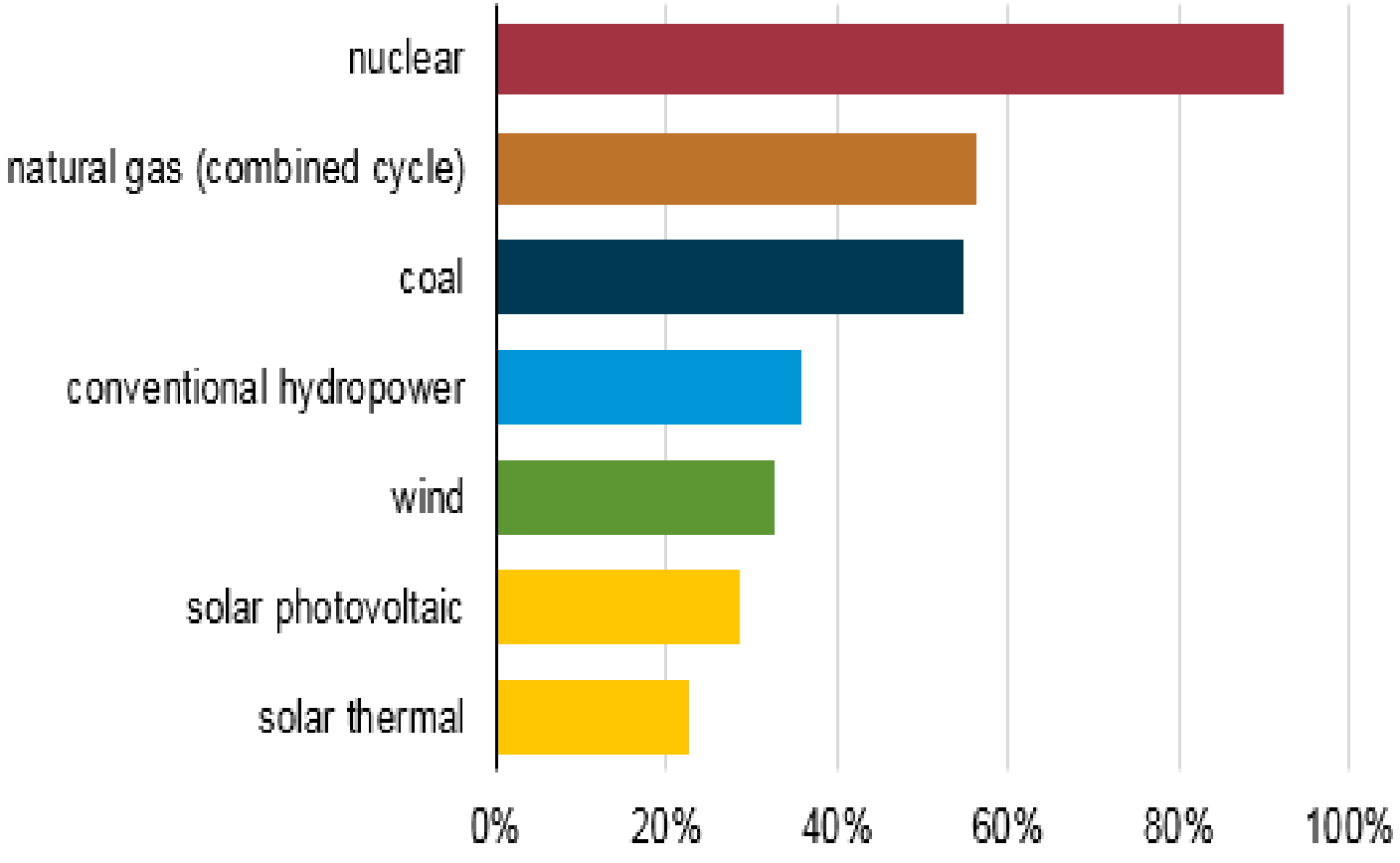
- **3) the priority given to RES compromises the take-off of nuclear energy in Europe (in a context where we observe a phase-out in Germany)**

Average cost of electricity in 2014 (externalities excluded) in euros/MWh (1 euro = 1.2 US$)

(Source: CRE, Cour des Comptes)

Solar (PV)	142
Wind on shore	82
Wind off-shore	180
Hydro	15-20
Nuclear (generation II; PWR)	50
Nuclear in France (generation III; EPR)	> 100
Nuclear in U.K. (generation III; Hinkley Point; CfD with regulated tariff)	109
Gas (Combined Cycles)	70-100 (70 in 2016)
Coal	60

Capacity factors of selected utility scale electricity generating technologies (2015)
capacity factor (output as a percent of full capacity)

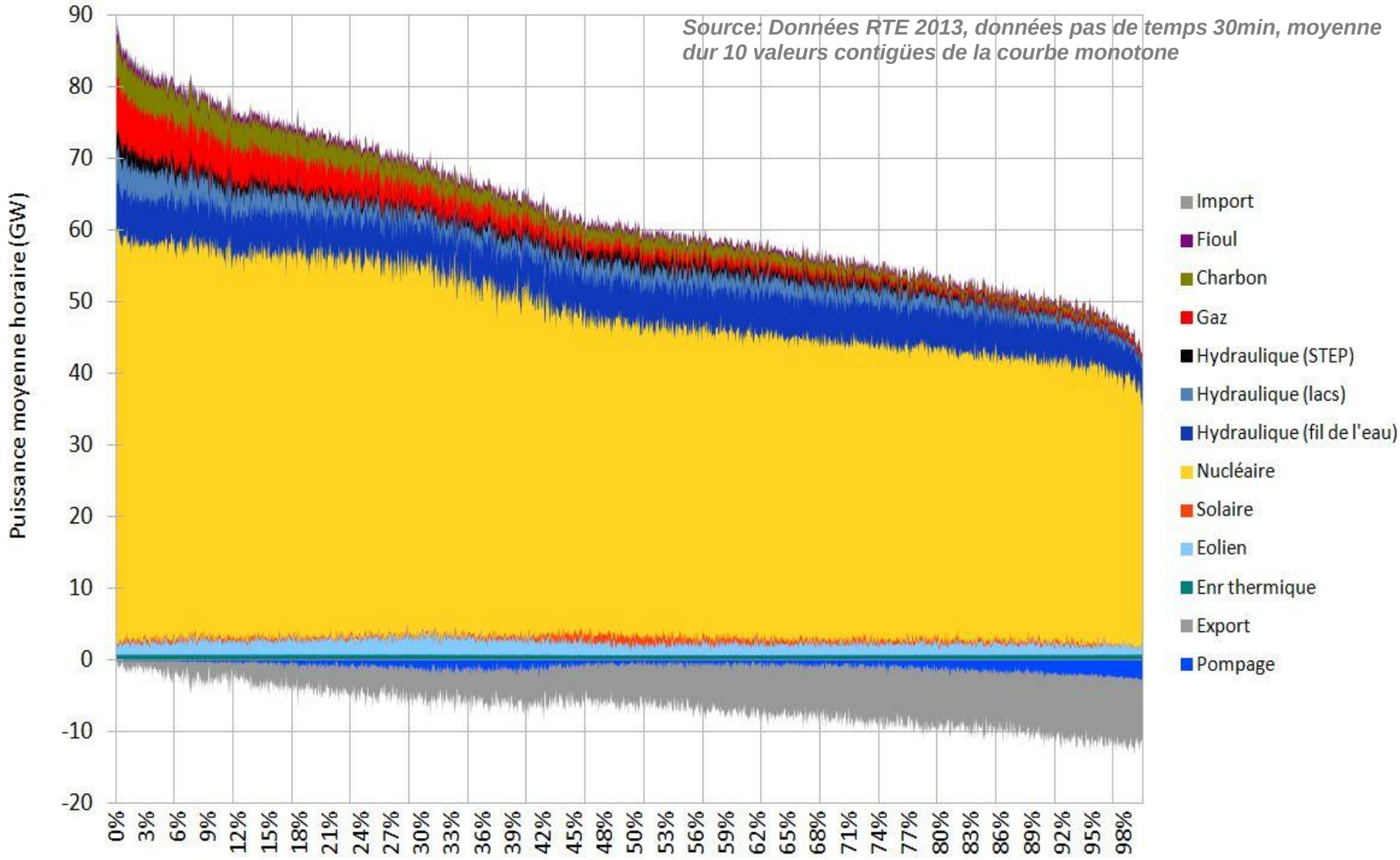


eia

Source: U.S. Energy Information Administration, *Electric Power Monthly*

Power Monotoneous Curve in France (2013)

With low spot prices, even profitability of nuclear is questionable



Nuclear Energy (source Marco Cometto, NEA,OECD 2016)
We observe a new take-off for nuclear in the world, Europe excepted

Reactors Currently under Construction or Planned

Region	Under Construction	Planned
Europe	4	19
Russia and FSU	11	30
China	27	56
Rest of East Asia	10	10
West Asia	2	8
South Asia	7	24
South East Asia	--	4
Africa	--	1
North America	5	7
South America	2	--
SUM	68	227

Source: WNA

In Europe, the non-subsidized power stations are penalised by the distorted electricity market prices

- **Restoring an equity and "equal opportunity" for nuclear energy in Europe needs to implement a "Contract for Differences" scheme for nuclear energy, like the model now gaining favour in the U.K.**

- **It is necessary to treat all the energy sources in an equal way and guarantee the nuclear industry that it will also recover its fixed costs over the long term.**

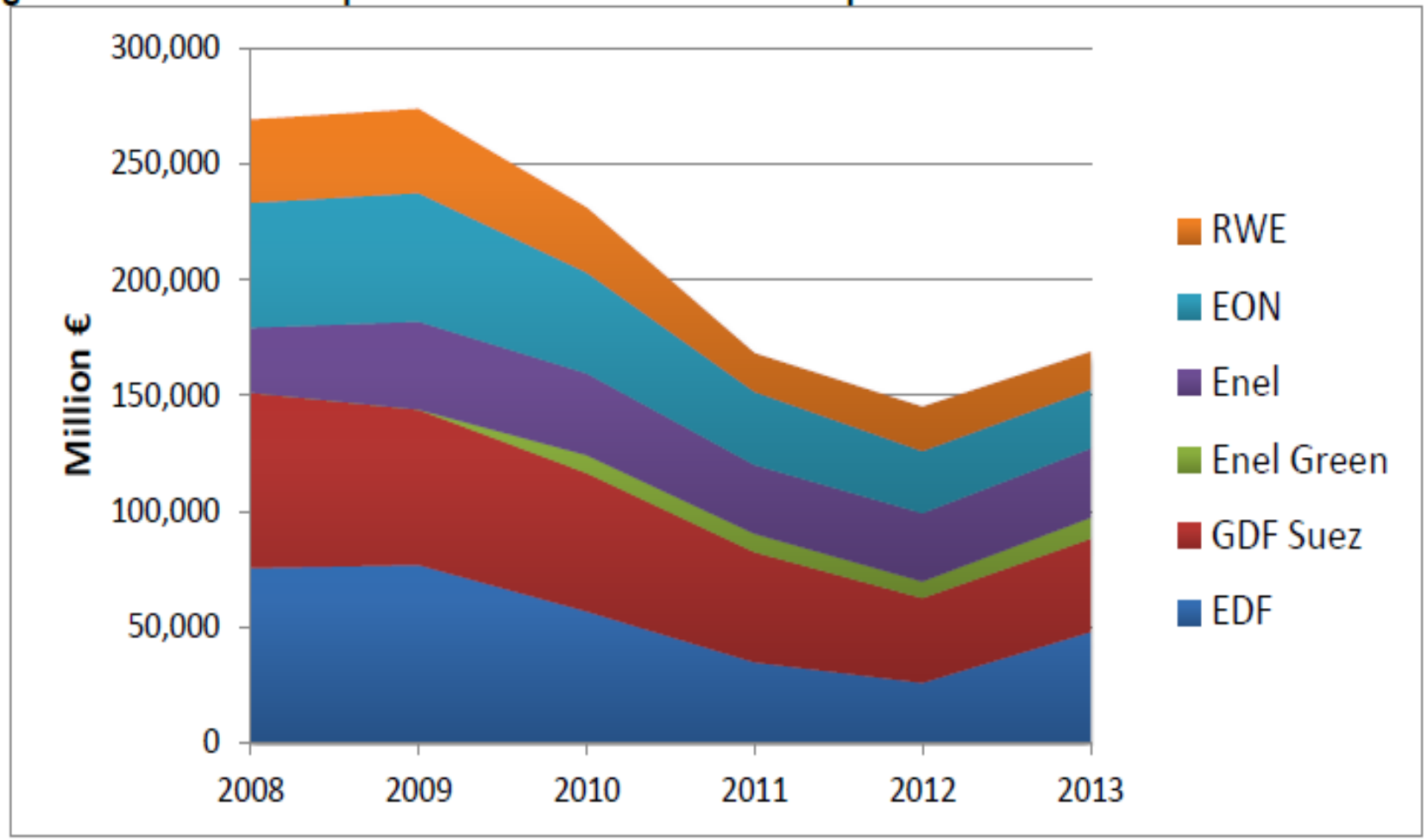
Implementing a Contract For Differences System as in U.K.: the best solution for a nuclear take-off in Europe?

- **It must be indicated at the outset that England's nuclear power stations (the two EPR reactors programmed at the Hinkley Point C site) will not benefit from a subsidised feed-in tariff but from a system close to the CfD (Contract for Differences).**

- **In practice, the EDF-led consortium responsible for constructing and operating the two reactors will not be remunerated off-market, as would be the case with a feed-in tariff applied to renewable energies (wind and photovoltaic). It will sell its electricity at the market price, which means that the price signal remains strong since the investor's primary income will be earned on the wholesale market.**

- **Once the EPRs come into operation, if the market price for electricity is lower than what is considered to be the project's break-even point (IRR =10%), the consortium will receive a payment corresponding to the difference between this virtual guarantee profitability and the market price for a period of 35 years.**
- **Conversely, if electricity prices are very high and the project payback is greater than the guarantee IRR, the consortium will have to share the profits with the British government (it is a two-ways system)**

Figure 2: Selected European electric utilities: market capitalization 2008–13



Source: Author figure, based on Bloomberg LP data, reproduced in *Coal: Caught in the EU Utility Death Spiral*, Carbon Tracker, June 2015.

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Feed-In Premiums (FIP)

With this system, renewable electricity producers sell their electricity at the market price but receive an additional payment (adder) in the form of a premium which can be set in function of either the quantity of electricity fed in (premium in euros per MWh) or the installed capacity (premium in euros per MW) or even an 'energy-capacity' mix.

The benefit of this system lies in the fact that producers are completely integrated into the spot electricity market and obtain an adder intended to cover additional costs. With the FIP, the adder is fixed; it was variable with the CfD.

1. The (fixed) premium per MWh injected

Electricity producers receive the spot-market price, which is volatile, with an additional payment which is proportional to the quantity of electricity fed in. The total revenue is thus variable because it depends on the load factor of the facility

2. The (fixed) premium per MW installed

Electricity producers receive a premium based on the capacity installed, whatever the rate of utilization of this capacity. It is a kind of "capacity mechanism"

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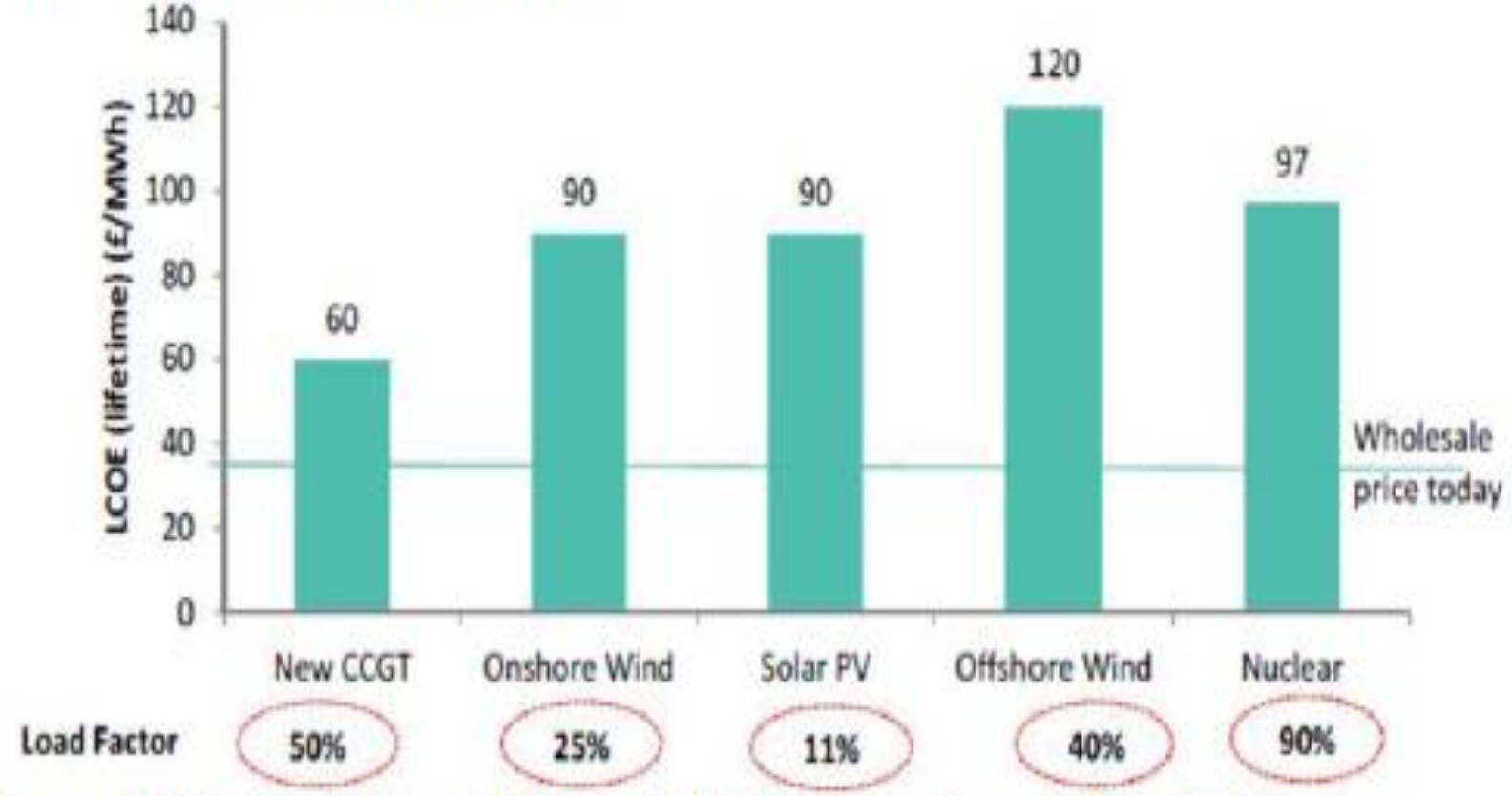
Who will invest in such a future?



Source: DECC, Bernstein analysis. reported in Energy Spectrum 29 Feb 2016

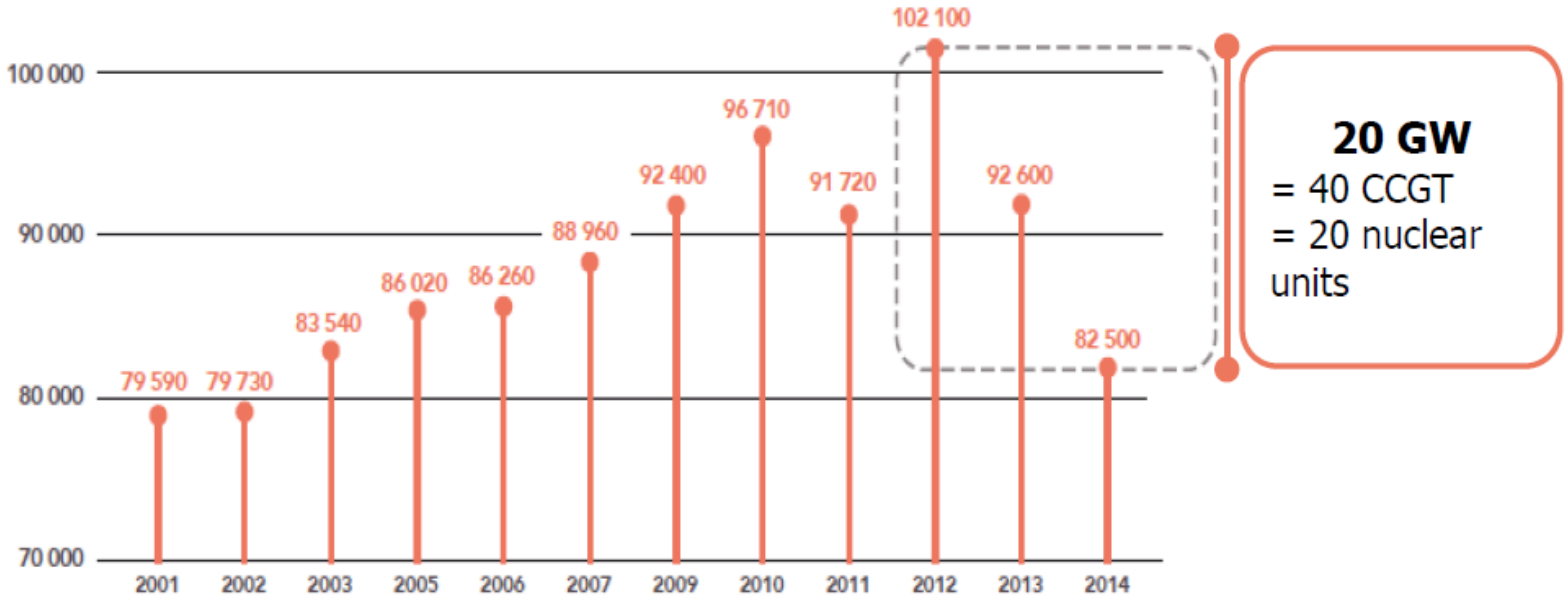
Security of supply in France: a real peak-load issue...

- The French electrical demand increases drastically during cold waves

→ **need to ensure adequacy (and not "*generation* adequacy")**

- Extreme volatility of the French peak load

→ **need to provide adequate economic signals to ensure investments and retirements (generation and demand response) according to system needs**



Evolution of the peak load in France since 2001

filet_bas2.png

1. Is it necessary to establish a capacity mechanism?

1. **For some economists the answer is no: the "energy only" market is sufficient but it is necessary to avoid to distort it:**

    1. **Market "energy only uncapped." With the market "energy only" generation plants are remunerated on the basis of MWh sold but we must accept high prices during peak hours and a failure probability "reasonable" (see Texas or New Zealand);**
    2. **Market "energy only capped." The government sets the ceiling price (3000 euros / MWh? It was 1938 euros observed on 8/2/2012 in France) and wants a low probability of failure (3 hours on average per year in France), for "political" reasons (social costs); hence the producer can not obtain sufficient margins to finance fixed costs.**

2. **For others it is yes because the market "energy only" fails to recover fixed costs (particularly for power stations in peak period) mainly because of distortions (see FIT for renewable funded outside market that depress prices on the day-ahead market), hence the need to pay for power capacity via a mechanism (necessity to solve the problem of "missing money" raised by Stoft)**

2. What are the main capacity mechanisms?

1. **Strategic Reserve (legal obligation for a supplier to have the maximum power subscribed by its customers, including risk of failure)**

2 Payment capacity (power is remunerated as such; expensive for consumers; Averch-Johnson effect)

3 Centralized capacity: TSO (transmission system operator) fixes a capacity target and organizes auctions involving all electricity producers and all consumers;

- TSO acts as a single buyer,

-bid may cover the missing capacity or all the capacity,

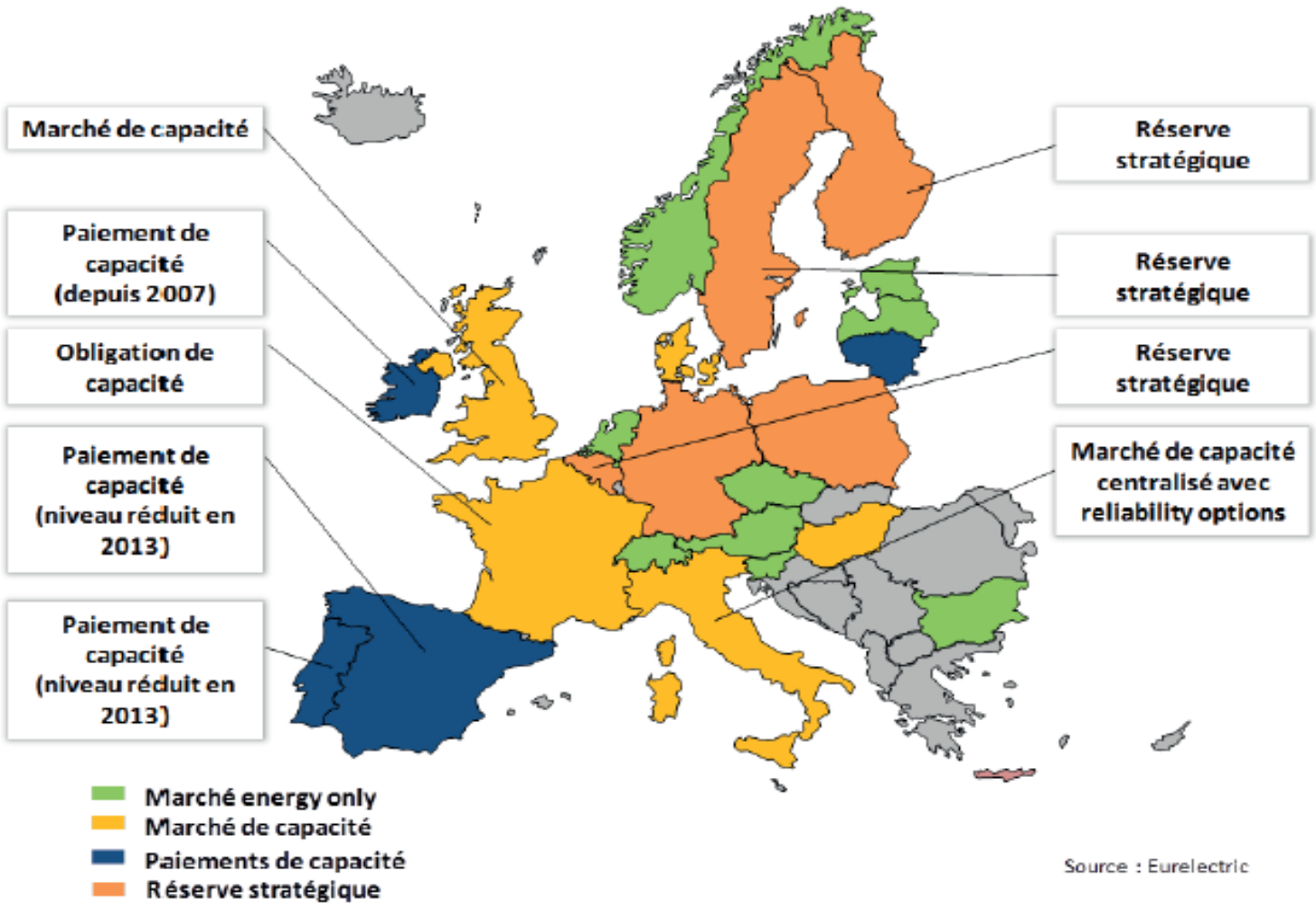
- in the UK the first auction had given nearly £ 20,000 / MW / year

4. Decentralized capacity market: planned system in France

O.I.E

Observatoire de l'Industrie Electrique

Comprendre le secteur de l'électricité en un seul clic



Source : Eurelectric

3. The decentralized capacity market planned for 2017 in France

(Decree of 01.23.2015 under the NOME law of 2010)

- **Electricity producers receive guaranteed capacity certificates by certifying their capacity through a contract with the TSO; capacity shall in particular be available at peak times of day PP2 (7h-15h and 18h-20h for 10 to 25 days PP2 / year between November and March); the duration of the capacity certificate is 1 year**

- **Electricity suppliers are obliged to have a sufficient amount of capacity guarantees to meet the demand of their customers at peak times. TSO takes into account a safety factor (of the order of 15%) (10 to 15 days PP1 / year). Suppliers that have not sufficient production capacity certificates will need to buy certificates on the market**

- **The ability of certificates held by producers can be sold to suppliers; but guaranteed capacity gives the holder any right to the energy produced by the capacity: a producer who sold his capacity guarantees remains the owner of its energy produced.**

- **In case where commitments are not observed, penalties are planned (maximal penalty: 40 000 euros/MW, which constitutes the price cap of the certificate)**

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Why a reform of the TPA pricing on the networks is necessary ? (1/2)

1.The current pricing TPA does not pay correctly the power (same problem as with the market "energy only" at the production level)

2. The energy share (euros / MWh) is around 70% on average in Europe for the residential sector and 55% on average for the non-residential sector (against 30% and 45% for the share of power price in Euros / MW); in France the energy share is 80% for residential and 70% for non-residential sector

3. Exceptions: Spain, Netherlands, where the power share is higher (100% of the pricing based on power in the Netherlands)

4.The pricing favors customers with a low rate of utilization of the power subscribed since they finance the network only when they buy electricity on the network (see second homes); the question will arise with the development of self-production of photovoltaics. A self-producer of PV will pay for the network only when he will buy electricity on the network, not when he will consume its production neither when he will sell its production in excess. Such a system generates cross-subsidies between consumers.

Why a reform of the TPA pricing on the networks is necessary ? (2/2)

5. We must learn from the entry fee to gas networks (pricing is based on the capacity reserved without considering the volume of natural gas transited)

6.We need to send a price signal including localization of injections of electricity (case of renewable energy that will introduce more uncertainty about localisation of injections) and consider the withdrawal periods to manage congestions (horo-seasonal pricing). With the end of the yellow and green regulated tariffs in France, providers can propose selling prices differentiated in space and time; yellow and green tariffs (reserved to non-domestic sector) have been cut at the end of 2015 in France; now the electricity price is negotiated through a "market supply" (exception: domestic tariffs, named blue tariffs)

Conclusion: necessity to implement network pricing largely based on power, with spatial and horo-seasonal differentiation?

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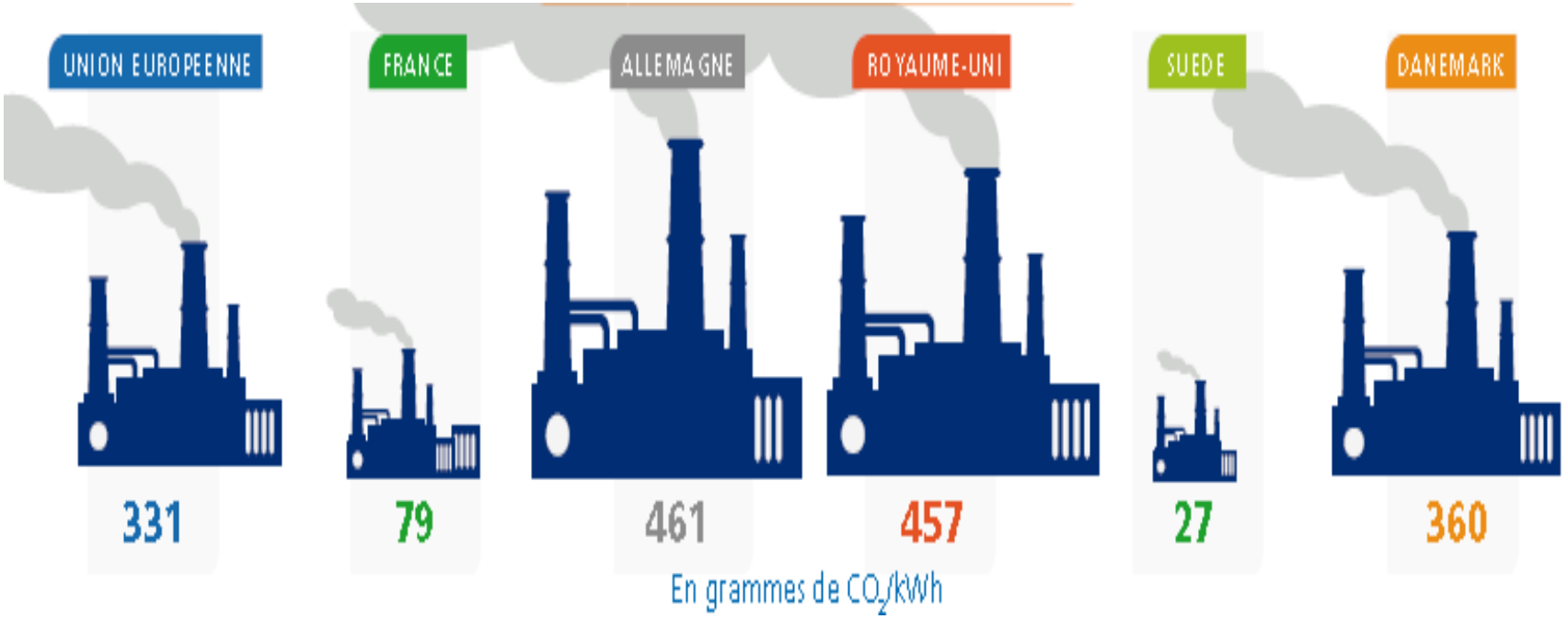
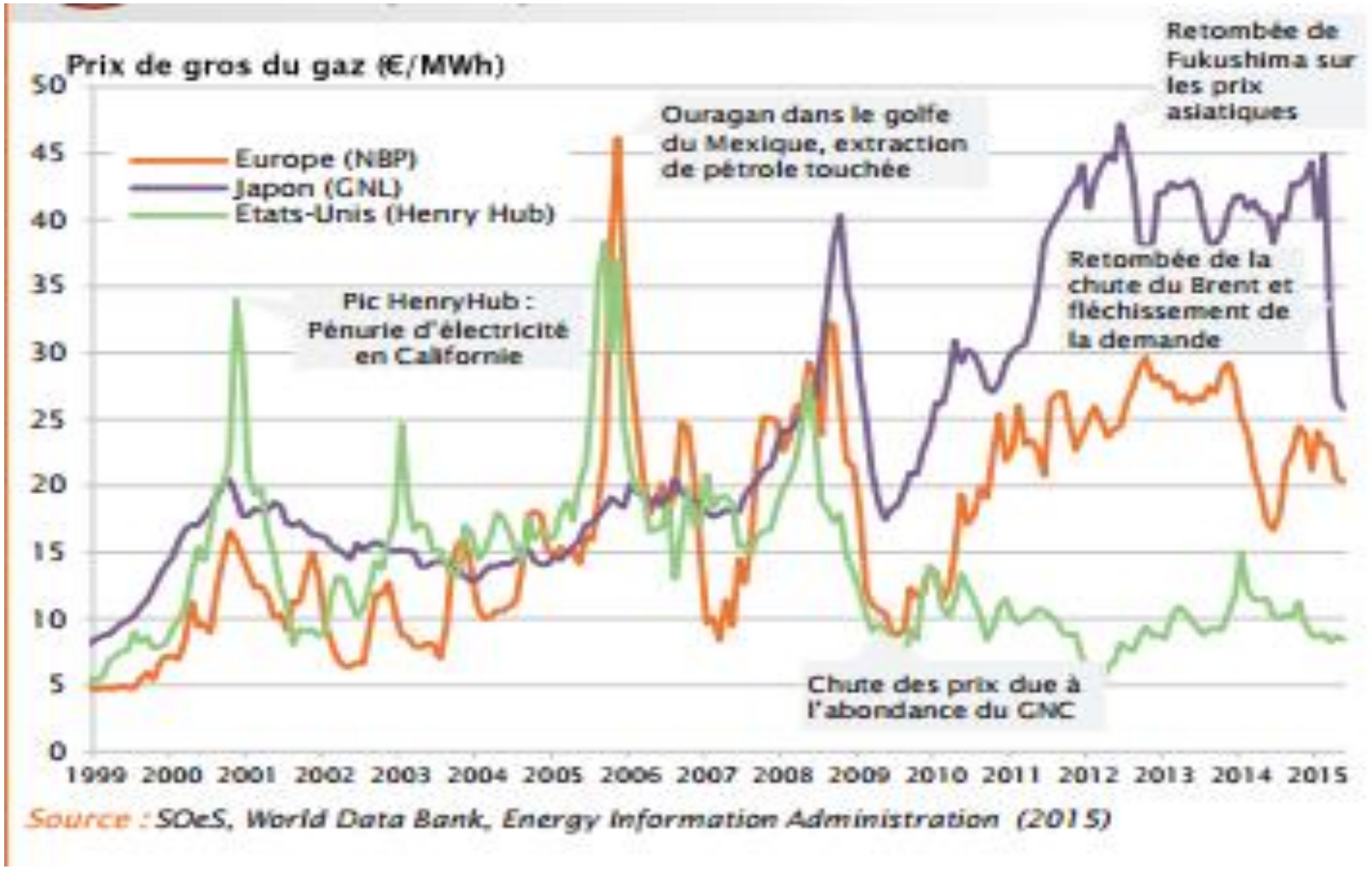
CO2 Emissions due the Electricity Generation in 2010 (source IEA)



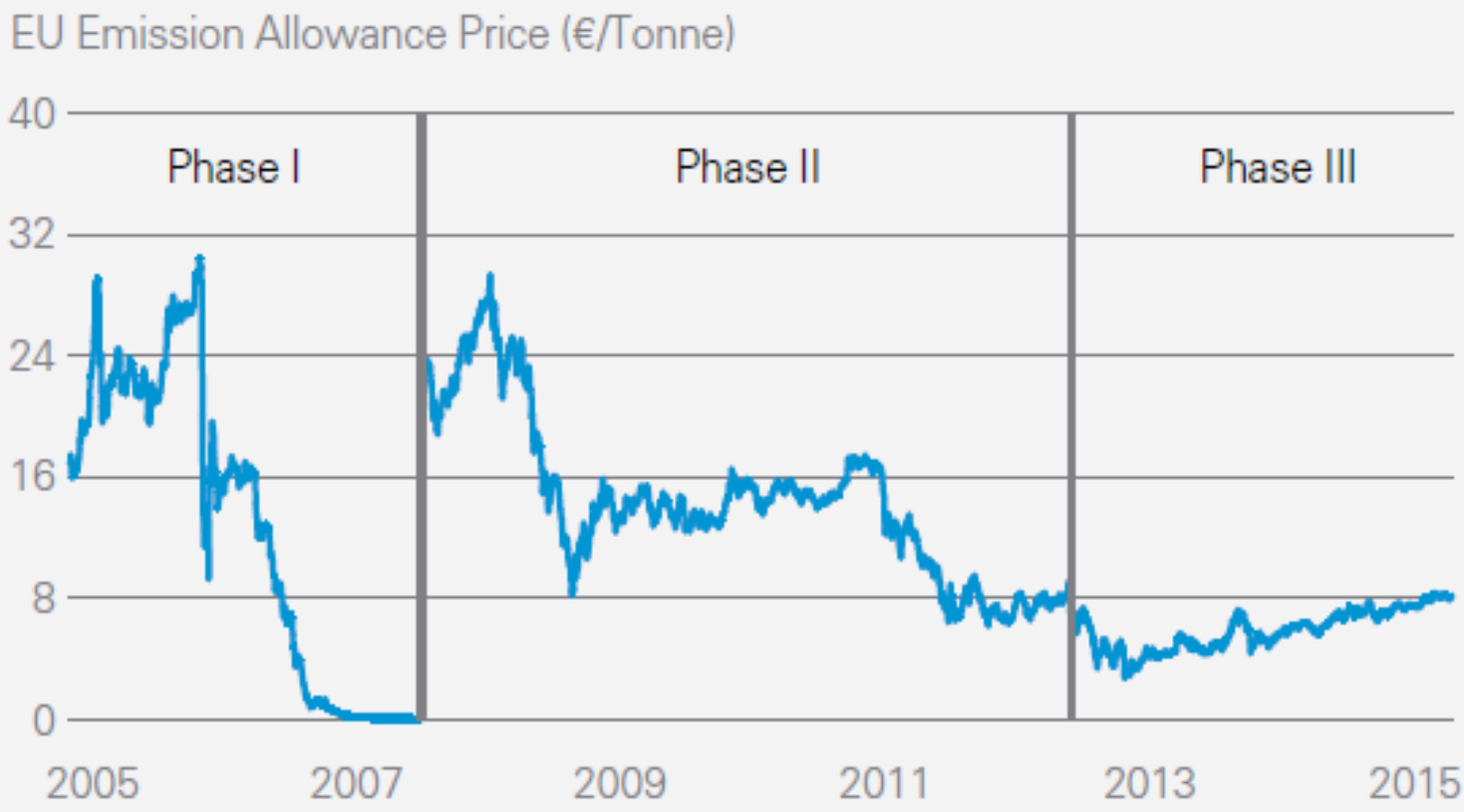
Natural Gas Prices in the World

Natural gas is the least polluting fossil fuel but coal is less expensive than natural gas in Europe

(US in green, Europe in red, Japan in blue)



EU ETS Carbon Price History



As of 5 October 2015

Source: Bloomberg

Floor-Price for CO2 in U.K.

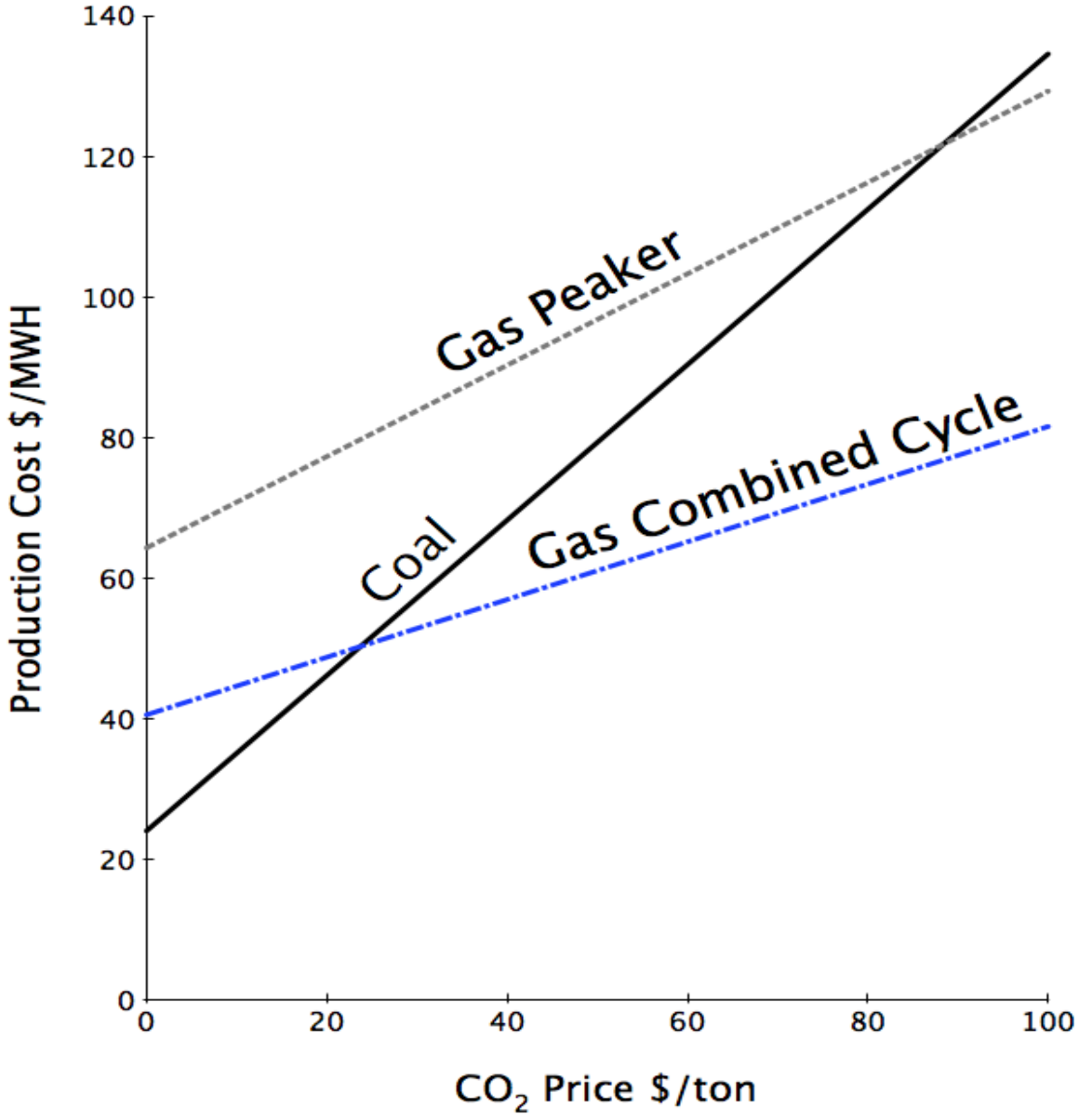
Fluctuations in the price of carbon in the form of EU ETS (Emissions Trading System) allowances have resulted in uncertainty for investors in low carbon technologies. This has contributed to a lower level of investment in these technologies, below what is required to meet UK carbon reduction and renewable targets.

- **To address this, the British Government committed to introduce a floor price carbon with a target price of £30 per tonne of CO2 in 2020.**
- **The floor price will start at about £16 per tonne in 2013 when the market price of CO2 was only 5 euros/t CO2.**

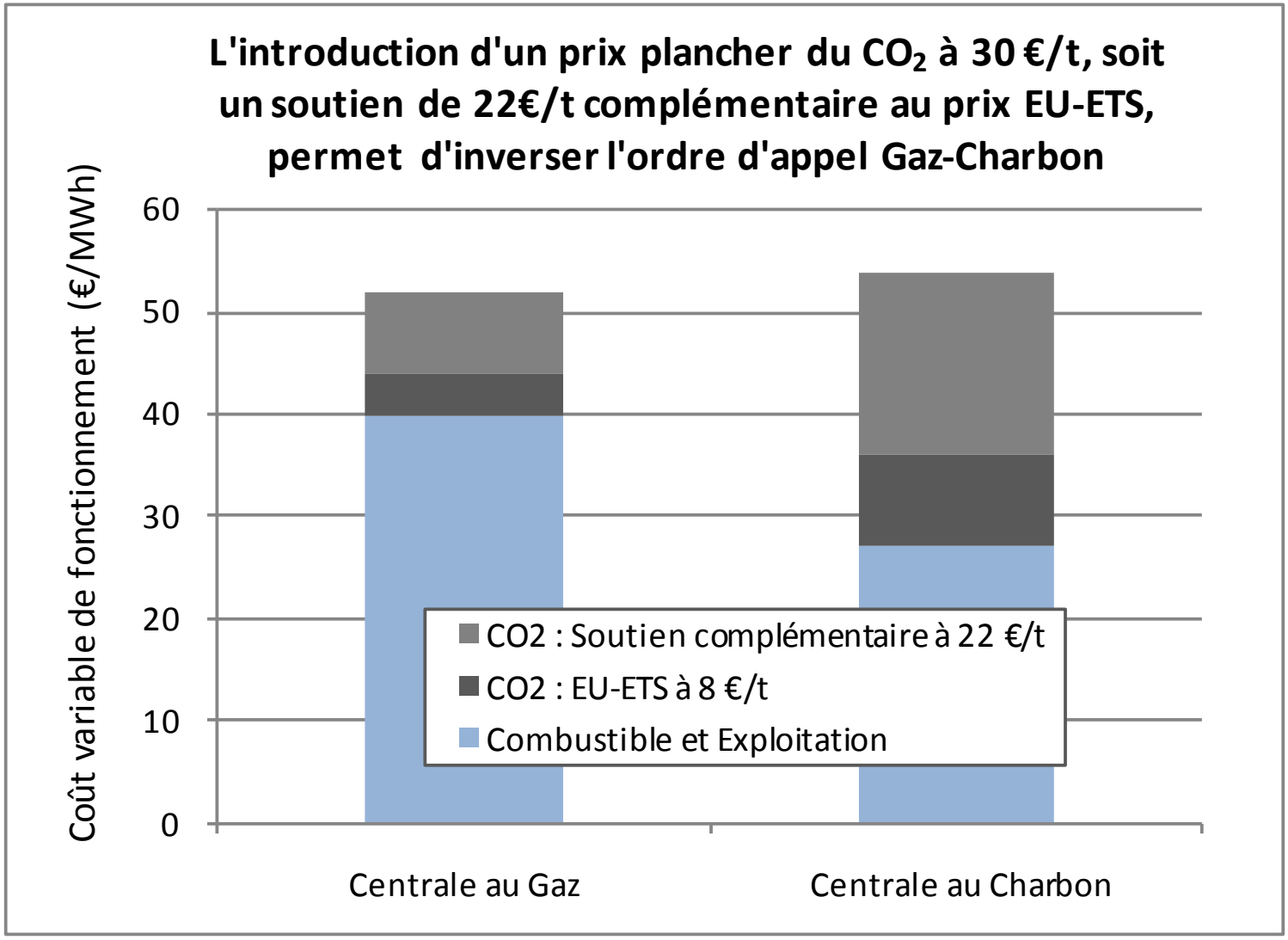
Observation: the carbon price will affect the marginal costs of coal plants more than those of an equivalent gas plant.

In France such a carbon floor-price of 30 euros/t CO2 will reduce CO2 emissions by 2 MtCO2; in Germany the reduction would be 13 MtCO2 due to the structure of the electricity generation (a large proportion of coal and gas power stations).

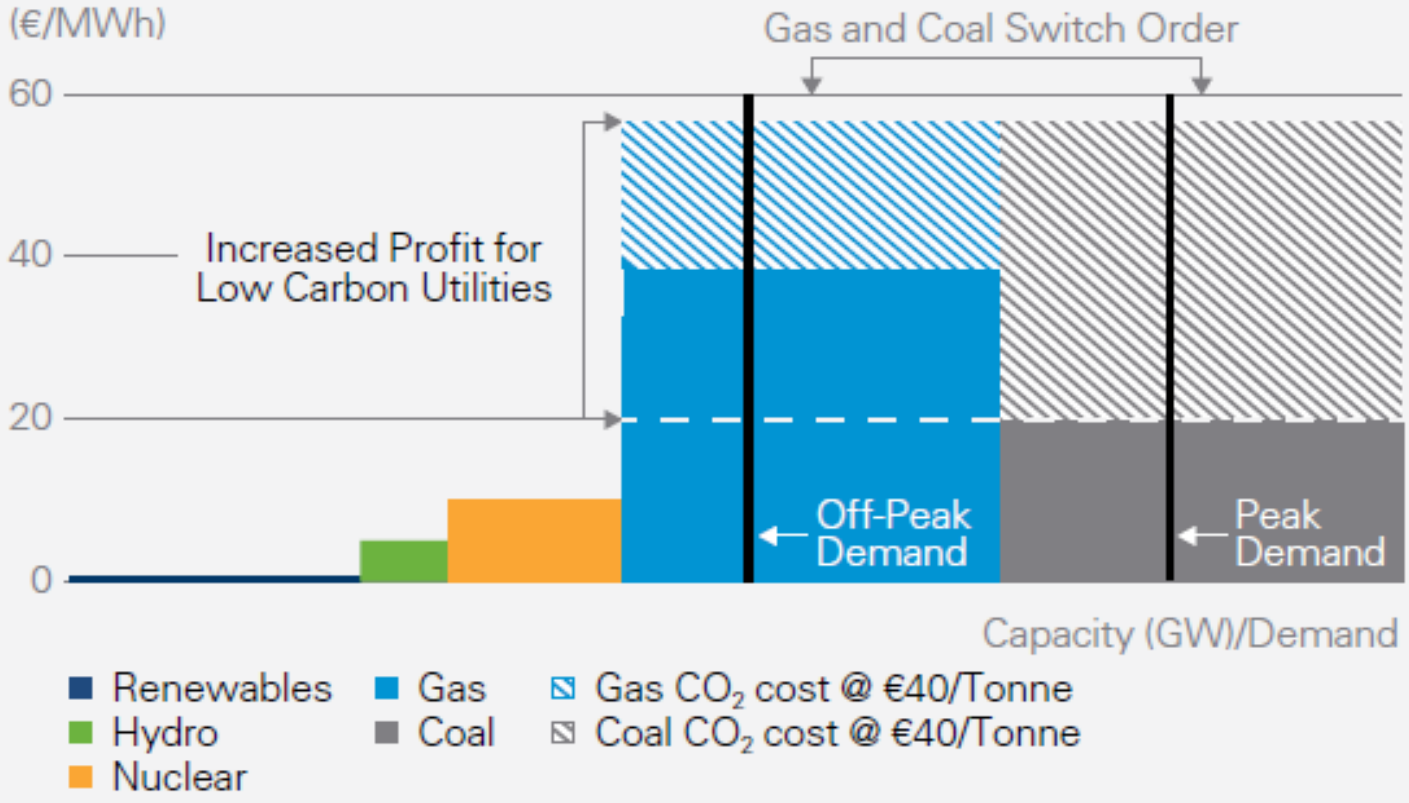
Switching gas/coal power stations (source Cullen and Mansur 2015)



With a floor-price of 30 euros/t CO2 (i.e 22 euros more than the market price of CO2, 8 euros/t), the merit order will induce a switching between gas and coal power stations.



EU CO_2 Price Estimated at €40/Tonne to See Switching from Coal to Gas Electricity Production



As of October 2015

Forecasted or estimated results are not a promise or guarantee of future results and are subject to change.

Source: Lazard estimates

CONCLUSION

The functioning of today's spot electricity market does not send the right signals to investors, not only because it is a short-term market but also because that functioning is distorted by the presence of electricity at a regulated price set off market in a context where an overcapacity of thermal power stations is observed.

There are two possible solutions to this problem: either the market is left on its own to send the signals to all investors (including those in renewable energies), which is likely to give rise to large fluctuations in investment cycles related to the sharp volatility of the spot prices, or a minimum of regulation is introduced in order to limit the costly surges of under- and over-capacity.

The choice is to restore a minimum of regulation today

-regulation for RES (FIP instead of FIT or lower FIT) and even for nuclear (CfD)

-regulation through a “capacity mechanism” to make investments during peak periods profitable (security of supply); + reform of the structure of the network pricing; energy only market is not able to implement the optimal capacity in the long term

-regulation through a floor-price for carbon (to penalise and cut a part of the thermal power stations, particularly coal power stations);

THANK YOU

FOR YOUR ATTENTION

ref: JP Hansen and J Percebois
« Energie: économie et politiques »

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(translation by Gerardo Rabinovich)