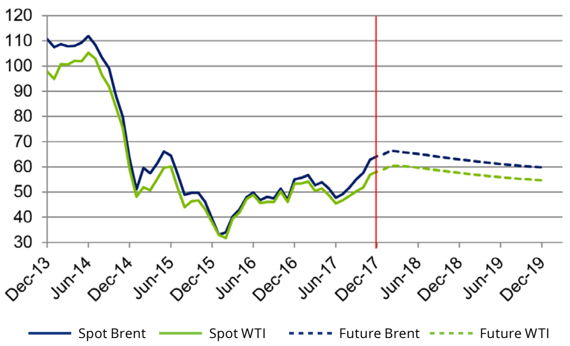
Newsletter
Power & Utilities in Europe

Commodities

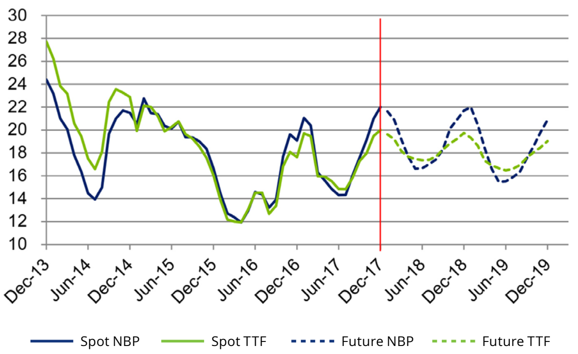
Crude oil ($/bbl)



Source Capital IQ

The recovery in crude oil prices continued in Q4 2017, with **prices closing the year at over $60 per barrel**. This is the highest level reached since 2015 and can be attributed to supply-side efforts from OPEC, including **an extension of production cuts to the end of 2018 as announced by OPEC and Russia in late November 2017**. OPEC's efforts to scale back oil production were supported by **pipeline disruptions in Libya and the North Sea** which further reduced global supply. On the demand side, OPEC's World Oil Outlook published in November 2017 forecasted oil consumption to increase to 103.2 million barrels per day in 2022 on the back of growing imports from China and India. On the other hand, the **upward pressure on prices may have been partially offset by rising production among non-OPEC members**. In particular, the US shale industry in Texas and New Mexico took advantage of recovering oil prices to expand production of shale oil. The uncertainty over the shale industry may be a reason for the modest downward trend in the forward curve towards the $60 per barrel mark by 2019.

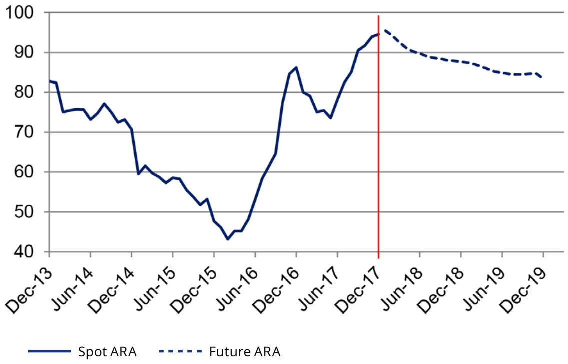
Gas (€/MWh)



Source Capital IQ

Gas prices exhibited a general upward trend in Q4 2017 and **closed 2017 at around €20/MWh**. The rise in gas prices was expected due to seasonally high demand for heating as winter in the Northern Hemisphere approached and temperatures dropped from the end of Q3 onwards. On the supply side, there was a negative shock from the **closure of the Forties pipeline in the North Sea in December 2017**. This pipeline transports oil and gas from 85 North Sea fields, amounting to almost 40% of North Sea production. Further gas supply shocks included an explosion at Baumgarten, Austria's main gas terminal and an outage at Norway's Troll platform in December 2017. In addition, the closure of the Rough storage facility by Centrica earlier in the year has led to greater reliance on imports from Norway and potentially LNG to cope with expected winter demand. The forward curve reflects market expectation that gas prices will continue in a seasonal pattern and decrease in Q1 2018 as temperatures rise at the end of winter months. However, if wintery conditions persist, gas prices may experience volatility amidst gas supply concerns.

Coal ($/metric ton)



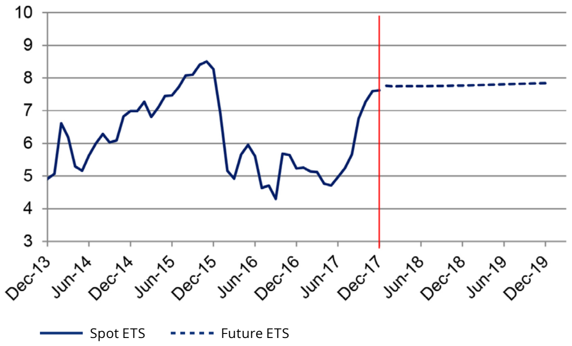
Source Capital IQ

Coal prices rose steadily in Q4 2017 in an upward trend that began in Q2 2017. By the end of 2017, **prices exceeded $90 per metric ton**. China's position as the world's largest producer and consumer of coal means its government's policies and domestic events have a large impact on global coal prices. The rise in prices may be attributed to the **sustained reduction in coal production to curb pollution led to an increase in coal imports into China and thus coal prices**. In addition, freezing temperatures led to **some Chinese provinces reversing a coal-burning ban** due to an under-supply of gas.

While the rise in gas prices may have led to **substitution towards coal for energy generation**, there was a further boost to global coal demand in the form of imports into South Korea due to nuclear outages and new-build coal power stations.

The downward trend observed in forward markets may reflect Chinese policy to curb pollution and switch to cleaner energy sources. Furthermore, the International Energy Agency forecasts **coal demand to stagnate until 2022**, effectively signalling the long-term decline of coal.

Carbon CO_2 (€/ton)



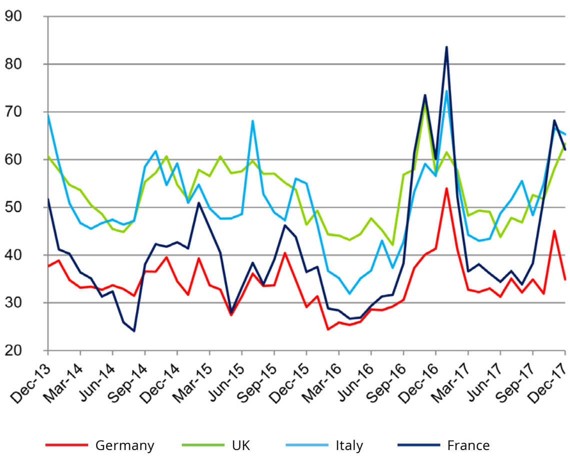
Source Capital IQ

There was modest but steady growth in carbon prices in Q4 2017, **with year-end prices around 2015 levels of €7-8 per ton**. The growth in prices continued a steady recovery from Q2 2017, when prices were below €5 per ton in May. Nevertheless, the growth in Q4 is likely to be due to seasonal highs in heating demands leading to carbon emissions.

The ETS continues to experience an **over-supply of EUAs**. Persistently low carbon prices can make it difficult for European governments to achieve carbon emission targets. In the EU's latest initiatives, member states supported the ETS Phase IV (2021-2030) reforms in November 2017, namely to reduce total carbon emissions annually by 2.2%. A key initiative **is doubling the rate at which the Market Stability Reserve (MSR) removes surplus EUAs starting in January 2019**.

While the latest EU initiatives should raise carbon prices, the relatively flat forward curve suggests cautious market expectation. Indeed, these efforts to support carbon prices may be partially offset by weak future demand for EUAs as countries continue their switch towards cleaner renewable energy.

Baseload Electricity Baseload Spot Day Ahead (€/MWh)



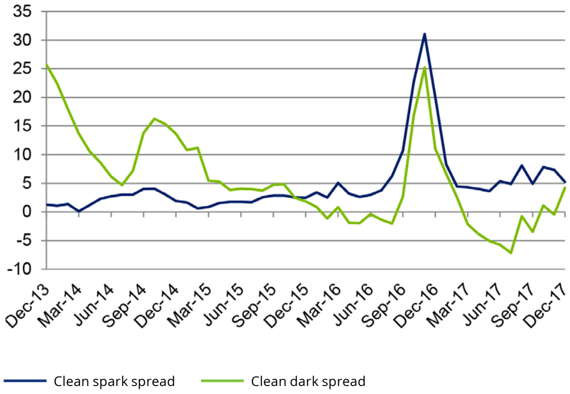
Source Bloomberg

Baseload spot electricity prices increased in Q4 2017 across the UK, France, Italy and Germany due to seasonally high demand for heating in winter.

In France, the rise in electricity prices in October and November 2017 occurred on the back of nuclear outages and the delay by EDF in reopening **nuclear reactors until December 2017**. These events, coupled with heavy reliance on nuclear generation, led to **France being a net importer of electricity in November 2017**. As Italy imports electricity from France, **prices in Italy were also affected by the events in France**. The seasonal rise in electricity prices in Italy included a spike in December 2017 relating to an explosion in Austria's main gas terminal, which consequently affected gas supplies to Italy.

In Germany, the **volatility observed in electricity prices is attributed to variability in wind power generation**, with prices inversely related to wind power generation. The small reduction in spot prices observed across the Continent in December 2017 are likely to reflect milder weather and the impact of nuclear reactors in France coming back online. In the UK, **the closure of the Forties pipeline and the cold temperatures** contributed to a rise in electricity prices and renewed some concerns over winter energy supplies, in particular, given the proposed closure of the Rough gas storage facility.

UK Clean dark & spark spreads (£/MWh)



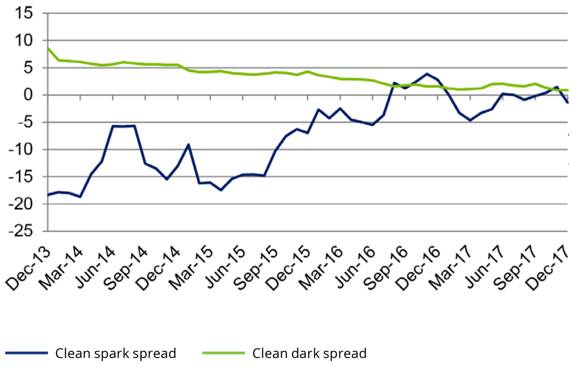
Source Bloomberg

Gas continues to be the marginal source of electricity supply in the UK, particularly in winter when gas-fired generation increases to meet higher seasonal demand. As such, electricity prices are closely linked to gas prices. Gas margins were **relatively stable in Q4 2017** but decreased slightly to £5/MWh in December 2017.

On the other hand, coal margins hovered around breakeven point and became positive in December 2017, thus continuing the recovery from Q3 2017. Movements in coal margins in Q4 may be attributed to the exchange rate, in particular the depreciation of USD against GBP. While coal prices increased in USD, prices in GBP have remained stable. As a result, **coal margins increased as electricity prices have risen**.

Overall, the recovery of coal margins sees coal plants edging towards similar levels of profitability achieved by gas plants.

German Clean dark & spark spreads (€/MWh)



Source Bloomberg

Both coal and gas margins in Germany were relatively stable in Q4 2017. **Coal plants were marginally profitable throughout the quarter while gas plants became unprofitable in December 2017**. Despite an increase in renewable energy generation, **coal remains the price setting plant in Germany**. As carbon prices remained low under the EU ETS, coal plants continued to be marginally profitable while meeting carbon emission targets.

Negative gas margins in December 2017 may be attributed to high gas prices due to an explosion at Austria's Baumgarten gas terminal. Furthermore, mild temperatures may also have contributed to low electricity prices at the end of Q4. Over the past year, coal and gas plants in Germany have moved towards similar levels of profitability.

Spotlight on Power and Utilities market

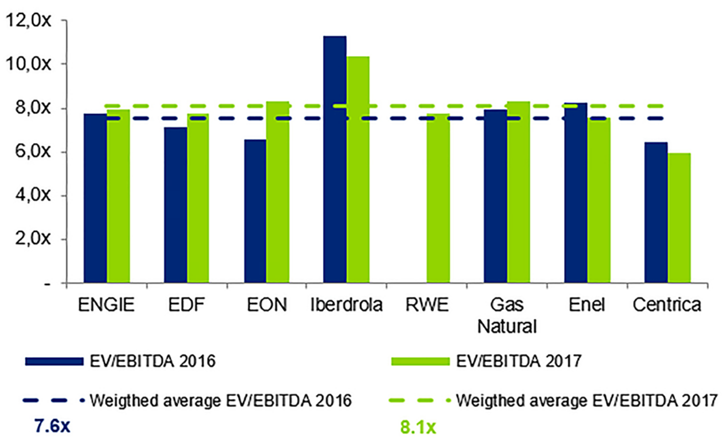
Capital market overview

	Deloitte Index (1)	Enel	Iberdrola	ENGIE	EDF	E.ON	Gas Natural	RWE	Centrica
Market cap. ratios									
Currency		EUR	EUR	EUR	EUR	EUR	EUR	EUR	GBP
Market cap. Dec. 31, 2017)		54 801	41 710	35 114	31 551	20 506	19 207	10 921	7 930
3m stock price performance	-2%	0%	-1%	-1%	1%	-4%	4%	-2%	-29%
YoY stock price performance	11%	22%	3%	17%	7%	35%	7%	58%	-42%
Market multiples									
EV/EBITDA 2016	8.0x	8.3x	11.3x	7.8x	7.1x	6.6x	7.9x	n.m.	6.5x
EV/EBITDA 2017	8.3x	7.6x	10.4x	8.0x	7.8x	8.3x	8.3x	7.8x	5.9x
P/E 2016	9.7x	21.3x	15.3x	n.m.	11.1x	n.m.	14.3x	n.m.	4.7x
P/E 2017	14.9x	15.2x	15.3x	14.3x	22.2x	15.0x	15.8x	9.0x	11.5x
Price/book value 2016	1.3x	1.6x	1.2x	0.9x	0.8x	n.m.	1.3x	1.5x	3.1x
Profitability ratios									
ROE forward 12m	0%	10%	7%	6%	4%	n.m(3)	8%	n.m(3)	26% (2)
ROCE forward 12m	8%	8%	4%	5%	4%	n.m(3)	6%	n.m(3)	16% (2)
EBITDA margin 2016	20%	21%	25%	14%	21%	16%	20%	5%	8%
EBITDA margin 2017	20%	21%	26%	15%	20%	13%	20%	12%	8%
EBIT margin 2016	12%	13%	15%	8%	10%	6%	12%	0%	5%
EBIT margin 2017	12%	13%	14%	8%	8%	8%	12%	8%	5%

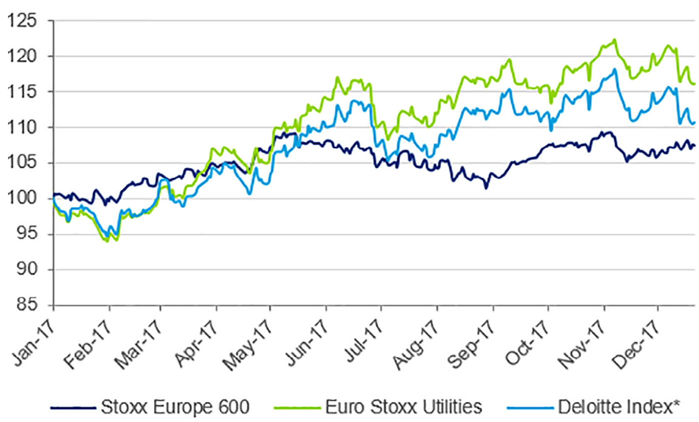
(1) Deloitte Index is composed of Engie, EDF, EON, Iberdrola, RWE, Gas Natural, Enel, SSE and Centrica

(2) Ratio linked to the expected level of non recurring income resulting from disposals program by Centrica

(3) Not meaningful due to non-reccuring items (E.ON: Nuclear tax refund and spin-off of Uniper and RWE: Nuclear tax refund and spin-off of innogy)



Source Capital IQ



Source Capital IQ

Key messages from brokers and analysts

"Carbon prices are on the rise, but unlikely to go up significantly"
(Morgan Stanley – December 18, 2017)

"Downside to power prices from renewables is not yet over"
(Morgan Stanley – December 7, 2017)

"UK capacity auctions looks ever-more supplied"
(Credit Suisse – December 7, 2017)

"European gas: can demand offset the likely excess?"
(Deutsche Bank – December 4, 2017)

"Utility 2.0: Sepring decentralised and centralised business"
(Morgan Stanley – November 13, 2017)

"ETS Reform: Surplus to go, but not before 2024"
(Credit Suisse – November 13, 2017)

"German power prices: contango signal in 2020"
(Morgan Stanley – October 24, 2017)

M&A Trends

Transactions involving Power & Utilities companies

2i Rete Gas SpA, a gas distribution company, **acquired 100% of Nedgia SpA and Gas Natural Italia SpA**, natural gas distribution companies, from **Gas Natural SDG SA** for **€727 bn**. (*MarketLine - October 18, 2017*)

SSE and Npower's, British Innogy subsidiary, have reached an agreement **to merge their operations**, worth a combined **£3bn** to create a new energy supplier in the UK, turning the Big Six energy suppliers into five. (*Press Association – December 4, 2017*)

EDF finalized the **acquisition of New NP from Areva**, a company specialized in the design and manufacturing of nuclear reactors and equipment, fuel assemblies and services to the nuclear installed base. EDF acquired 75.5%, Mitsubishi Heavy Industries Ltd 19.5% and Assystem 5% on the basis of an **adjusted valuation of €2.47bn** (for 100% of the capital), with no transfer of financial debt. (*DJDN– January 2, 2018*)

Total SA has agreed to **buy French utility Engie SA's liquefied-natural gas business** for as much as **$2bn**. (*Dow Jones Institutional News– November 8, 2017*)

Energa SA, a Polish power distribution company, has agreed to **invest $619m** in the construction and development of a **power plant** located in Siarzewo, Poland, with a capacity of **350GW** annually. (*MarketLine– December 1, 2017*)

Abengoa, a Spanish utility company, has agreed to **sell a 25% stake in Atlantica Yield Plc**, a UK-based company that owns, manages and acquires renewable energy including 1.7 GW of clean power generating capacity, to **Canadian utility Algonquin for $607m**. (*Renewable Now – November 2, 2017*)

The Portuguese utility **Redes Energéticas Nacionais (REN)** completed the **€532.4m acquisition of EDP Gàs** from **EDP Group**, a Portuguese energy company. (*Key Energy News– October 9, 2017*)

Ineos, a Swiss oil and chemical products manufacturer, has completed the **$250m acquisition** of the **Forties Pipeline System** (FPS) in the North Sea carrying 30% of the UK's oil, the Kinneil terminal and gas processing plant, and the Dalmeny terminal from **BP**. (*Key Energy News– November 3, 2017*)

Edison, EDF Italian subsidiary, and Gas Natural Fenosa, Spanish utility company, signed a binding agreement for the **acquisition of Gas Natural Vendita Italia, for €193m**, and for an **11TW** long-term gas supply contract with **Azerbaijan's Shah Deniz 2 for €30m**. (*Trend – December 19, 2017*)

Transactions involving equity funds

The Chinese state-controlled coal and power producer **Senshua Group** has signed an agreement to **buy a 75% stake in four wind parks** with a total installed capacity of **150 MW**, from the Greek infrastructure development group **Copelouzos**, for in an investment plan of **€3.0bn**. (*Key Energy New s- November 6, 2017*)

Pensionskassernes Administration AS and **PFA Pension**, Danish pension funds, have completed **the acquisition of 50% stake** in the **659MW Walney Extension** offshore windfarm from **Orsted** for approximatively **£2.0bn** (*MarketLine– November 6, 2017*)

Allianz Capital Partners, infrastructure investor **Macquarie and the State Pension Fund of Finland** have **bought the stake of 3i Infrastructure Plc, an infrastructure fund**, in the Finish power company **Elenia**, for gross proceeds of about **£725 m**. (*Reuters – December 13, 2017*)

Equitix Ltd., a British investment company has agreed to **acquire a 40% stake** in Sheringjam Shoal, an **offshore wind farm** in the North Sea with an installed capacity of **316.8 MW**, from **Statkraft AS**, an energy utility company, for **£558m**. (*MarketLine– December 16, 2017*)

Spain's Gas Natural has agreed **to sell 59.1% stake** of its Colombian retail distribution unit to **Brookfield Infrastructure**, an infrastructures fund, for **€482m**. (*Reuters– November 18, 2017*)

The investments funds UBS and **CDC** agreed **to sell to CapeOmega**, an Oil & Gas company, 100% of the shares in **Njord Gas Infrastructure**, operator and owner of the world's largest offshore gas transmission system running from Norwegian continental fields to Europe and UK, for **€431m**. (*Reuters – October 23, 2017*)

ERG Power Generation, an Italian wind energy operator, **will buy 100% of the solar facilities managed by ForVei**, a joint venture vehicle specialized in renewable energy infrastructures assets acquisitions, in Italy, for **€336m**. (*CTBR– November 17, 2017*)

Direct Energie, a power utility company, **has acquired the renewable energy firm Quadran** with an installed capacity of 360MW, from **Lucia Holding, a French investment company**, for **€303 m**. (*CTBRELS– November 1, 2017*)

European Power and Utilities companies wrap-up

EBITDA of the third quarter 2017 for most of European utilities is **down compared to 2016** due to adverse conditions: negative weather impact, **weak hydro and negative translation effect for operations in the UK**.

Almost all energy companies to confirm their guidance.

In Q4 the shortfall in French nuclear power plants availability and the low hydo production contribute to price increases.

The M&A activity of power companies is still very active in a context of transformation plan. Namely, EDF finalized the acquisition of **Framatome** (ex-Areva NP activities) and Engie reached an agreement with Total for the sale of its LNG activities (upstream and midstream).

Finally, **entities acting in the UK are still exposed to regulatory risks from OFGEM** namely on a potential default tarrif cap in addition to the current decision to optimize competition among energy suppliers.

	EDF	ENGIE
Q3 2017 Highlights	• **First quarter 2017 sales at €49.7bn, slightly down in organic terms** • **In France, sales in Generation and supply activities were down 3.6% in organic terms**, in connexion with the 2014 tariff adjustment in 2016, without equivalent in 2017 **and negative weather impact** mainly at the beginning of 2017. Restated for the impact of the 2014 tariff adjusdment, sales were up 0.9% in organic terms. • **Hydropower output amounted to 28.6TWh, down 16.4%** (-5.6TWh) compared to the first nine months of 2016 due to much lower than normal hydro conditions since the beginning of the year, the lowest since 2011 • **Nuclear output at the end of September** : - France: 283.3TWh, down 1.3% (3.8TWh) compared to 2016, due to a higher volume of reactor outages. - United Kingdom: 48.7Wh up 0.7TWh compared to 2016 due to good operational performance	• **Revenue of Q3 2017 at €46.8bn, up +1.3%** on a gross basis and +2.9% on an organic basis compared to end of September 2016. This organic increase is attributable to: - **Positive impacts of new assets commissioned**, of price rises in Latin America and of the 2016 price revisions in the gas infrastructures business in France - Partially offset by **reduced B2B sales** of natural gas in France and by a decrease in renewable energy generation in France, mainly coming from hydro • **EBITDA is down by 3.6% at €6.6bn** on a gross basis, mainly because of the scope effects linked to disposals, and up +3.8% on an organic basis compared to end of September 2016. Organic growth is due to very good performance of the growth engines, i.e. renewable and thermal contracted, infrastructures and customer solutions activities, which show a gross growth of +4.6% over the period, partly offset by adverse volume impacts (hydraulic and nuclear power production)
Key events in the period	• EDF finalized the acquisition of Framatome (Areva's large project, fuel and installed based activities) assets exluding OL3 contract • EDF finalized the disposal of EDF Polska assets to PGE • Decision to distribute an interim dividend of €0.15 per share for fiscal year 2017 • Disposal of a portfolio of around 200 office real estate and business assets • Edison, the Italian subsidiary of EDF, signed a binding agreement with Gas Natural Fenosa for the acquisition of Gas Natural Vendita Italia and the Shah Deniz II gas contract	• Engie reached an **agreement with Total for the sale of its LNG activities** (upstream and midstream) • **Disposal of the australian 1,000MW coal power station** Loy Yang B to Chow Tai Fook Enterprises • Award of **concession for transmission lines in Brazil** for an approx. investment of €500m • Engie won **concession contracts for a 30 year-period for two Brazilian hydropower plants for €950m** • **Acquisition of CNN MCO**, a French company specializing in the maintenance, management and upkeep of all types af naval vassal • **Issuance of a €1.25bn Green bond** • **Fitch credit rating agency assigned ENGIE SA a strong investment grade issuer rating of 'A'** with stable outlook
FY 2017 Outlook	• **Updated target announced in October 2017** : - Nuclear output: 383 - 387TWh - EBITDA: €13.4 - 14.0bn - Net financial debt/EBITDA: ~ 2.5x - Payout ratio of Net income excl. non-recurring items: 55% to 65%	• **FY 2017 guidance confirmed**

	E.ON	RWE
Q3 2017 Highlights	• **Q3 2017 sales declined by 1% at €27.9bn**, mainly because of lower sales volume and negative currency translation effects in the UK as well as the expiration of supply contracts for the wholesale customer business in Germany, which was transferred to Uniper • **EBIT is down by 8% at €2.1bn due to** : - **Energy Networks : +18% YoY**; higher regulated revenues in Germany and CEE and tariff increases in Sweden - **Customer Solutions : -36 YoY**; lower margins and increased competitors dynamic - **Renewables : -20% YoY**; Arkona book gain in Q2 2016 and lower wind conditions • **Adjusted net income increased by 51% at €1bn** mainly driven by significant lower interest accretion of nuclear provisions, other interest expenses and a taxe rate of 25% (vs 32% in 9M 2016) • **Investments increased by 12% due** to energy networks : €0.9bn ; customer solutions : €0.4bn and renewables : €1bn • **Net debt decreased by 25% at €19.7bn**	• **Sales in the third quarter went down by 2.5% at €32.4bn** due to a competition-induced sales shortfall in innogy'UK and Dutch retail business, and a negative currency translation impact of GBP • **Adjusted EBITDA of €4.2bn shows a 9.3%** increase compared to last period. This was due to a significantly improved trading performance. Furthermore, the subsidiary Innogy incurred lower expenses for the operation and maintenance of its distribution grids
Key events in the period	• E.ON's substantially strengthened balance sheet and planned additional debt reduction will give it the flexibility to increase the dividend payout to shareholders for the financial year 2018, E.ON aims to raise its **payout ratio from the current 50 to 60 percent to a minimum of 65 percent** • Over the next three years E.ON and CLEVER will establish a network of 180 ultra-fast charging stations for electric vehicles (EVs) in seven countries connecting Norway to Italy.	• **In mid-July, loans of €0.6bn and £0.4bn granted by the European Investment Bank (EIB), were transferred from RWE AG to Innogy** as part of a debtor switch. • **Innogy won a tender** for the Tritton Knoll offshore wind project from the UK Department for business, Energy and Industrial Strategy. The project involves the construction of wind turbines with a capacity of 860 MW off the Eastern Coast of England; the investment is an estimated £2bn
FY 2017 Outlook	• **FY 2017 guidance confirmed**	• **FY 2017 guidance confirmed**

	enel	centrica
Q3 2017 Highlights	• **Q3 2017 sales totaled €54.2bn, i.e. +5.3%** compared to Q3 2016, thanks to greater revenues from the sale of electricity to end users and the transport of electricity, from more electricity trading and fuel sales, partially offset by the negative impact of changes in the scope of consolidation • **EBITDA amounts to €11.5bn, i.e. -4.7%** compared to Q3 2016, due to declining margin in Iberia partially offset by the strong performance in Italy in retail and positive exchange rate developments	• **Centrica Consumer: delivery from the Group's efficiency** programme is offsetting overall gross margin decline • **Centrica Business**: significant market pressures in the North America Business retail power book, and in UK Business not yet seeing improved operational performance flowing through to the bottom line • **Net debt expected to be within the Group's targeted £2.5-£3.0bn range** • **2017 adjusted operating cash flow expected to be above £2bn**
Q3 2017 Highlights	• **Enel announced that its subsidiary e-distribuzione S.p.A had signed an agreement with the European Investment Bank (EIB)** for a total loan of €1 bn to finance the investments of e-distribuzione SpA in 2017-2021 period to replace smart meters in Italy under the Open Meter plan • **Enel Finance International N.V had repurchased in cash the the entire bond issue of $1.75bn** issued by EFI and guaranted by Enel. The repurchase was carried out in the context of the optimization of the structure of the Enel Group's liabilities through active management of maturities and of the cost of debt	• **Centrica Consumer**: - **UK energy supply accounts at the end of October had reduced by 823,000 since 30 June 2017,** - UK Home services account holdings are down 39,000 since the half year, having stabilised in recent weeks. - Ireland business continues to perform well, while in North America Home accounts have fallen slightly • **Centrica Business:** - **In North America highly competitive market conditions and low price volatility** putting significant downwards pressure on realised power margins, and low volatility also reducing opportunities for gas optimisation - **Distributed Energy & Power continues to see growth** with the number of active customer sites up 4% since the half year - **Energy Marketing & Trading continues to perform well**
FY 2017 Outlook	• **FY 2017 guidance confirmed.**	• **FY 2017 guidance confirmed.**

	IBERDROLA	gasNatural
Q3 2017 Highlights	• **Q3 2017 sales totaled €22.3bn, i.e. +3.5%** compared to Q3 2016, due the good performance of the Networks business in the US and the Generation and Supply business in Mexico, as a result of new capacity coming on line with the Growth Plan for the 2016-2020 period • **EBITDA is decreasing by 5% at €5.4bn** affected by negative extraordinary impacts of the low hydro in Spain resulting in 8.8 TWh shortage compared to 2016	• **Q3 2017 sales totaled €17.9bn, i.e. +8.2%** compared to Q3 2016, due basically to higher volumes and sale prices in the gas business compared to the previous year, to price increase in the electricity business compensated by a decrease in volumes, and to the currency effect • **EBITDA is decreasing by 12.3% at €3.1bn**, after restatement to reflect cessation of the gas distribution and supply business in Italy (-7.4% pro forma). That reduction was concentrated in the Electricity business in Spain, whose performance was shaped by anormal weather conditions, as Gas Natural Fenosa's hydroelectric output declined by 72.4%
Key events in the period	• **Increases and reductions of share capital**, complement to the information document regarding the first increase in paid-up share capital approved by the General Shareholders' meeting of Iberdrola SA of 31 March 2017. Within the framework of the execution of the first increase in paid-up share capital approved by the General Shareholders' meeting, a total of 77 515 000 new shares will be issued • **Completion of the incorporation by Neoenergia SA** of the activity and business of Elektro Holding SA • **Bond issue for the amount of €750m** with a coupon of 1.25% and maturing in September 2027	• **On August, it was agreed to sell 20%** of the gas distribution business in Spain to a consortium comprising Allianz and CPPIB – the transaction is expected to be completed by 31st January 2018 • **As a result of the social and political events that had occurred in Catalonia, the Board of Directors resolved to transfer the company's registered offices in Madrid.** • **Gas Natural Fenosa entered into separate agreements to sell its companies and assets in Italy** to i2 Rete Gas and Edison for a total of €1bn
FY 2017 Outlook	• **FY 2017 guidance confirmed**	• **FY 2017 guidance confirmed**

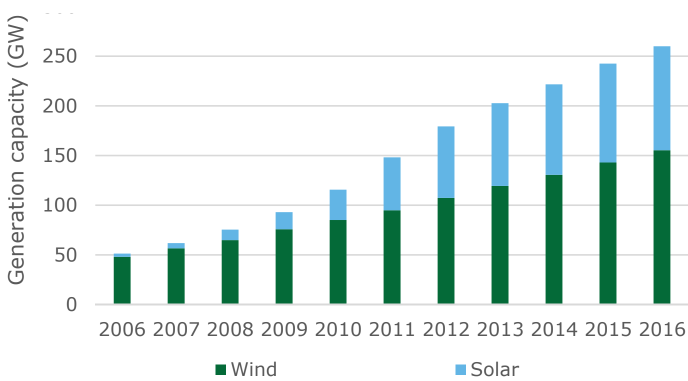
Talking points

Renewables, support schemes and cost-competitiveness

Sources: Florence School of Regulation & Microeconomix

The development of electricity generation from renewable energy sources (RES) is a crucial element of the ongoing energy transition in Europe. **In the past decade, Europe's efforts to promote RES have led to a spectacular increase in RES generation capacity**. The figure below shows the evolution of the installed capacity in Wind and Solar in Europe from 2006 to 2016. The installed capacity in Wind (both onshore and offshore) increased from 48 GW in 2006 to 155 GW in 2016. Solar capacity which was almost inexistent back in 2006 (3 GW only across all Europe), is now higher than 100 GW. At the end of 2016 RES (all sources combined) represented more than 20%[1] of the total generation capacity in Europe, and accounted for more than 25%[2] of the total electricity production at the European level that same year.

Fig. 1 Evolution of installed capacity of wind and solar generation in Europe



Source: IRENA (2017a)

Europe's efforts to promote RES have led to a spectacular increase in RES generation capacity.

Such an expansion of RES generation capacities was made possible by the different support schemes that were implemented across Europe following the European Commission's Directive 2009/28/EC[3] on renewable energy. Indeed, long considered less competitive than more conventional electricity generation sources, RES have benefited, through these support schemes, from subsidies taking the form of a guaranteed price of the electricity produced over a certain period.

1. Feed-in tariff vs. auction-based feed-in premium

The early support schemes implemented in Europe were based on fixed feed-in tariffs[4] that were determined *ex ante*. These schemes were implemented in countries such as France, Germany and Portugal for instance. However, **with rising concerns about the economic efficiency[5] of feed-in tariffs, the 2014 EU State aid guidelines[6] recommended that these fixed pre-determined tariffs be progressively replaced by feed-in premiums[7] based on competitive tenders.**

Most of the early support schemes were based on fixed inefficient feed-in-tariffs.

From a theoretical point of view, the passage to competitive tenders should enable the selection of the most efficient[8] projects to reach the related objectives of common interest.

These positive effects should be all the more reinforced that auctions are designed as technology-neutral for larger capacities and more mature technologies. Indeed such a design would drive competition within the whole RES sector and incentivize developers to lower their costs and to innovate.

Hence, the global cost of RES support should logically decrease and should be better correlated to the actual investment and generation costs[9]. Generators should be more transparent as they bid for the feed-in premium, which should help reduce the asymmetry of information in the sector and will support the strategies of legislators and regulators to reduce cost of supporting RES.

The 2014 EU State aid guidelines paved the way for the implementation of more efficient support schemes relying on competitive tenders and feed-in-premiums.

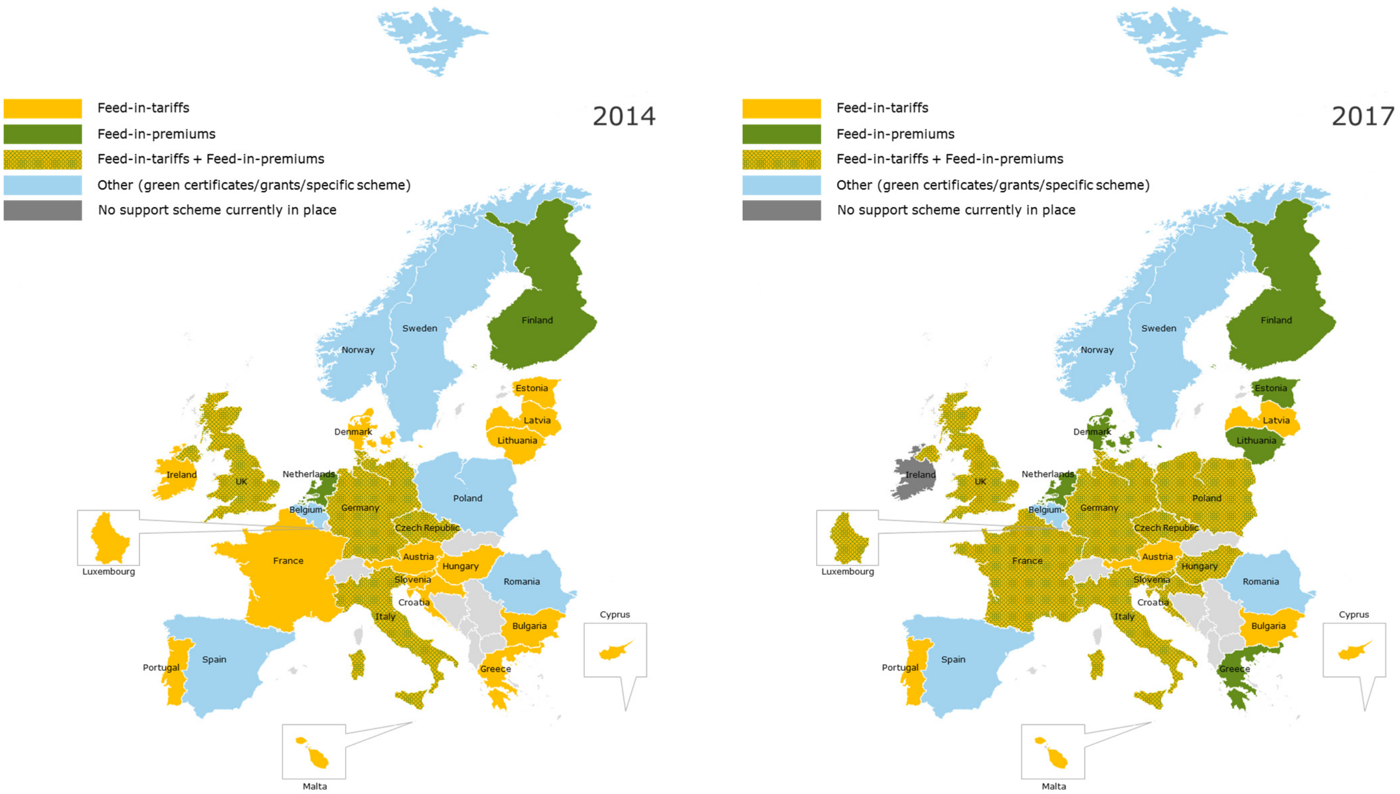
1 Eurostat (2017)
2 Eurostat (2017)
3 European Commission (2009)
4 With feed-in tariffs, RES electricity producers receive a guaranteed price (the feed-in tariff) for each kWh they produce, over a certain period.
5 Economic (allocative) efficiency is reach when resources are allocated optimally, meaning that it is not possible to find another allocation that can improve the welfare of a group of individuals without worsening the welfare of another group.
6 Guidelines on State aid for environmental protection and energy 2014-2020. Available at: *http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014XC0628(01)*
7 A feed-in premium is an additional revenue that is paid to RES generators on top of the electricity market price. Therefore, conversely to feed-in tariffs, feed-in premiums expose RES generators to market prices.
8 Here the term efficient refers to productive efficiency. In economic theory, productive efficiency is reached when a service/good is provided at the least possible cost.

The figure hereafter highlights the existing RES support schemes in place in 2014 in the current EU member states and those in place at the end of 2017. As one can notice on the figure, several member states have introduced feed-in-premiums since the publication of the 2014 EU State aid guidelines. Today, **most countries have hybrid systems combining feed-in-tariffs and feed-in-premiums**: Croatia, Czech Republic, France, Germany, Hungary, Italy, Luxembourg, Poland, Slovenia and the UK. Denmark, Estonia, Finland[10], Greece[11], Lithuania and the Netherlands support RES generation mainly through feed-in-premiums. However, **Austria**[12], **Bulgaria**, **Cyprus**, **Latvia**[13], **Malta** and **Portugal**[14] **still rely on a feed-in-tariff scheme**. The other member states[15] use alternative support schemes such as green certificates (Belgium, Norway, Romania and Sweden[16]) other specific schemes (Spain[17]).

Today, most countries have hybrid systems combining feed-in-tariffs and feed-in-premiums.

While subsidies are still needed to help RES progress further along their learning curve[18]**, the required levels of subsidy are constantly decreasing** as a result of more efficient production processes for RES installation equipment (e.g., PV modules, Wind turbines, etc.) and associated cost reductions (see following section). Thanks to the new support schemes, these efficiency gains and cost reductions are (at least partly) transferred to consumers since the level of subsidy is decreasing.

Fig. 2 Evolution of RES support schemes in EU member states



Source: RES LEGAL Europe (2018), Council of European Energy Regulator – CEER (2017)

9 It should be noted that feed-in premiums are based on market principles, which implies a higher cost of capital for RES generators (which are not isolated from market risks in contrast to feed-in tariffs) and higher risks of market power or windfall profits. Economic theory hence expects this mechanism to cost more to the final consumer to support RES generation. However, in practice, it does not seem to be the case since

10 In addition to feed-in-premiums, Finland also have a system of investment grants.

11 Feed-in-tariffs are still present in Greece, but they are applicable only a limited number of specific cases.

12 Austria also have a system of investment grants.

13 Latvia also have a system of investment grants.

14 In Portugal, the feed-in-tariffs are only applied to the RES generation plants that were registered before 7 November 2012. Since then, new RES plants are remunerated through a specific regime that includes a tender scheme.

15 Since January 2016, there is no RES support scheme in Ireland. However, a new support scheme is expected to be introduced in 2018.

16 Sweden also uses a system of investment grants.

17 In Spain, the current support scheme remunerates plants based on a reasonable internal rate of return.

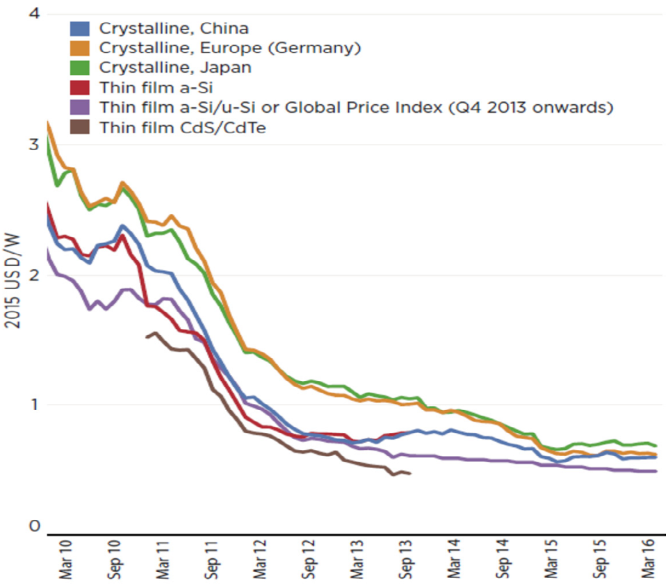
2. RES finally getting competitive?

In addition to creating favourable investment conditions, RES support schemes have been the main trigger for learning effect[19]. These learning effects were also accelerated by intensified R&D efforts from both governments and private companies over the last decade. For instance, **according to the International Renewable Energy Agency (IRENA), the average annual R&D investment in RES related projects amounted to about 8 USD billion[20] in Europe between 2006 and 2016**.

One of the most striking impacts of the RES' learning effects can be found in the cost-reductions in terms of capital investment. The most important cost reductions have been observed for solar PV as illustrated on the figure hereafter. Between 2010 and 2015, the price of PV modules divided by three[21] on average (see next figure).

RES support schemes have contributed to trigger learning effects and reduce RES production costs.

Fig. 3 Global PV module price trends 2010-2015



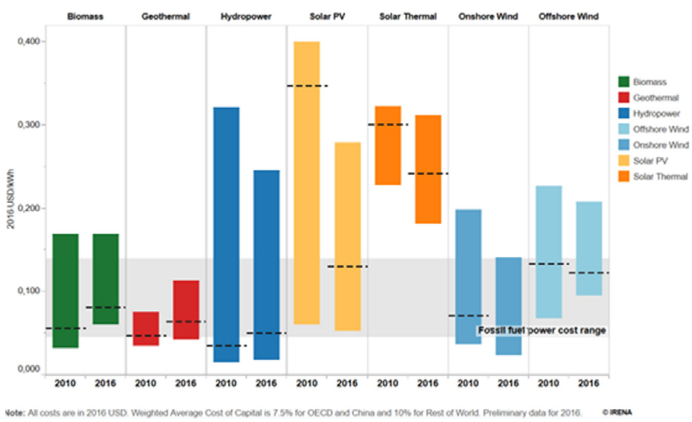
Source: IRENA (2016)

These cost reductions directly translate into lower electricity generation costs for RES. The indicator that is generally used to assess the cost-competitiveness of a technology regarding electricity generation is the Levelised Cost of Electricity[22] (LCOE). It measures the average total cost associated with producing electricity with a specific source of energy under a wide range of assumptions (regarding the lifetime of the power plant, the quantity of electricity produced, the discount rate, etc.)

The next figure shows estimates of the evolution of the LCOE for several types of RES between 2010 and 2016. Each vertical bar correspond to the computed range of the LCOE for a particular RES depending on a wide range of assumptions. The horizontal doted bars give the average LCOE. The grey horizontal band corresponds to the range of LCOE for fossil sources.

Except from thermal solar, all RES technologies have an average cost that is within the range of fossil fuels today. One can also notice a spectacular decrease of the cost of Solar PV between 2010 and 2016; a decrease that was mainly driven by reduced manufacturing cost of PV modules previously mentioned.

Fig. 4 Levelised Cost of Electricity 2010-2016



Source: IRENA (2017a)

18 The learning curve and learning effects are associated to the "learning-by-doing" process, which enables a progressive decrease in costs and a better competitiveness of RES in the long-term.

19 Learning effects correspond to the "learning-by-doing" process, which enables a progressive decrease in costs and a better competitiveness of RES in the long-term.

20 This includes Corporate R&D and Government R&D. For more information, see: *http://resourceirena.irena.org*

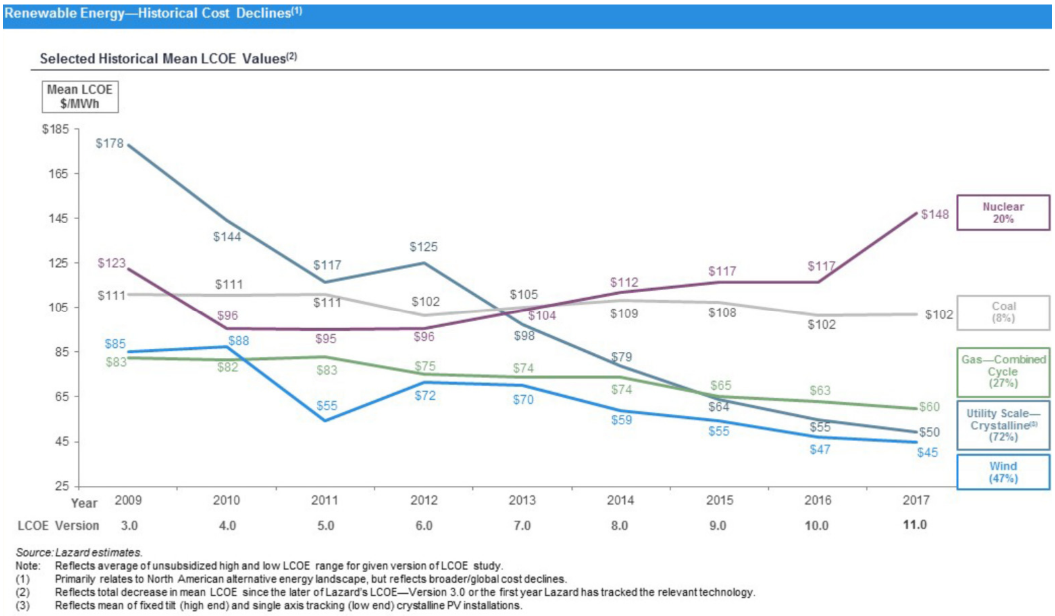
21 IRENA (2016) – The Power to Change: Solar and Wind Cost Reduction Potential to 2025. Available at: *http://www.irena.org/DocumentDownloads/Publications/IRENA_Power_to_Change_2016.pdf*

22 The LCOE can be defined as the total average cost (investment and operation) incurred to produce electricity with a specific technology over the lifetime of the plant.

23 Except for combined cycle gas that has benefited from the drop of gas prices in the US.

While the LCOE for Solar and Wind are decreasing, the LCOE of other conventional generation technologies (Nuclear, Coal, Gas) have been mostly constant or increasing[23] as illustrated on the figure below. The trends observed on this figure confirm that RES are becoming more and more competitive compared to conventional generation technologies.

Fig. 5 Historical evolution of LCOE by technology



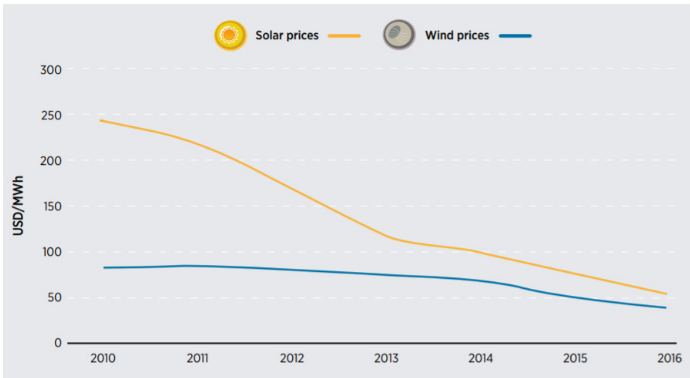
Source: Lazard (2017)

The increasing cost-competitiveness of RES is also perceptible through the auctions' results for RES projects in Europe, and more globally around the World. Indeed, project promoters' bids for feed-in premiums are lower and lower, which indicates their confidence in their ability to recover their costs through market prices.

The figure hereafter summarizes the results of the major auctions that took place in 2016 in Europe for utility scale RES projects. **In just one year and five auction rounds, Germany's auction program for Solar PV introduced in 2015, has led to a 20% drop in average auction prices compared to the first round**[24]**.** In the last auction organized in September 2016, the average auction price was USD 81/MWh[25]. Similarly, in Denmark, two offshore wind auctions were carried out in 2016, resulting in prices that were more than 39% lower than those of the 2015 auction. The awarded projects in 2016 were the Vesterhav project (350 MW at USD 71.5/MWh) and the Kriegers Flak projects (600 MW at USD 53.9/MWh)[26].

These numbers highlight the magnitude of RES catchup effect in terms of cost-competitiveness. In reality, depending on the considered country or region in the world, RES can be even more competitive. The lowest recorded auction price for a RES project in 2016 is attributed to a consortium of Chinese and Japanese companies that proposed to build a 350 MW solar power plant in the United Arab Emirates for a price of only USD 24/MWh[27].

Fig. 6 Evolution of average auction prices for RES projects in the World



Source: IRENA (2017b)

From a global perspective (all countries considered), between 2010 and 2016, average auction prices for RES projects were divided by five for solar and by two for wind as illustrated on the figure above. This trend is expected to continue in the near future as IRENA indicates that there is still a significant potential for cost reduction. **According to IRENA's estimates**[28]**, the LCOE of Solar PV could drop by 59% by 2025 compared to its 2015 level. For Onshore and Offshore Wind, the potential LCOE reductions by 2025 are estimated at 26% and 35% respectively (again, compared to 2015 levels).**

Between 2010 and 2016, average auction prices for RES projects around the World were divided by five for solar and by two for wind.

24 IRENA (2017b).
25 IRENA (2017b).
26 IRENA (2017b).
27 IRENA (2017b).
28 IRENA (2016).

If these expected cost reductions are actually achieved by 2025, Solar PV, Onshore and Offshore Wind will reach LCOE levels that are below 0.12 USD_{2015}/kWh, making them as competitive as fossil fuels generation or even more competitive. It seems that RES support schemes have succeeded in creating the intended learning effects. **Some even argue that the time has come for RES support schemes to pass the torch to markets** and this option will probably be at the center of future debates about energy policy in Europe.

If the current trend in cost reduction continues, RES may no longer need subsides as they will be as competitive as conventional technologies.

3. Conclusion

Europe's efforts to promote RES have been based on support schemes providing subsidies to these generation technologies. The implemented support schemes have helped spur investments in RES generation capacities during the last decade. They also contributed in triggering learning effects which in turn led to significant cost-reductions. Furthermore, **the recent EU guidelines**[29] **on State aid for environmental protection and energy enabled Member States to benefit from these costs reductions, through improved support schemes**.

Thanks to the aforementioned learning effects and cost reductions, **RES generation is becoming more and more competitive in terms of production costs compared to conventional generation technologies**. If the observed trends in cost reduction continue – which, according to experts, will be the case – the initial rationale that led to the implementation of support schemes may not hold anymore. Does this announce the end of RES support schemes? The question will probably be an important discussion point in future debates regarding Europe's energy policy.

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29 European Commission (2014).

Reaching the optimum: from monopoly to aggregators

The power sector industry used to be composed of vertically integrated monopolies. Since the early 2000's, EU has witnessed a dynamic of liberalization of the sector, leading to an increase in the number of players and the rise of market places to link them[30]. More recently, the IT revolution and the growing interest in renewables are leading to even more decentralization of generation (with distributed generation such as wind turbines and PV panels), pro-active consumption[31] and storage means. In a few decades, the sector has switched from large production means all owned by a single operator to multiple small means owned by various market players. **This trend towards decentralization has also led to the birth of a new kind of player in the power industry: the aggregator.**

The aggregator acts as an intermediary between multiple players[32] and a market place. Its added value can be twofold: **it enables small players to reach the required size to be able to participate in some markets**[33] ; and **it enables the global optimization of all aggregated assets**. In a recently liberalized industry going through disruptive changes related to the energy transition and IT revolution, how do aggregators emerge and find their place?

Aggregators gather multiple players to enable them to reach the required size to enter some markets and perform a global optimization of their asset.

1. Demand response

Demand response is the action of enhancing the flexibility that can be provided by consumption means, by reducing the level of consumption when receiving an external signal. This can be a price signal or an explicit demand from the TSO for example. Demand response can reduce peak consumption and avoid using expensive generation capacities or reinforcing the grid. The flexibility at stake comes from big industrial sites, tertiary buildings or even individual residential houses. Some large industrial sites already have demand response capacity on their own and do not necessarily need to rely on aggregators to value the flexibility of their heavy-consuming processes. Still, a vast majority of demand response is performed through aggregation[34]. Such aggregator included in 2016 Actily, EDF, Engie, Energy Pool, Smart Grid Energy, Valoris Energy and Voltalis[35]. **The aggregator can mutualize costs to enter the market of demand response**[36] **and help achieve the minimum required technical thresholds for those markets.** Through the aggregator, a large panel of sites can combine their flexibility resources, leading to a greater efficiency than individual optimization of each site[37]. **The aggregator optimally dispatches those resources in order to smooth peak consumption, hence reducing production costs and CO_2 emissions**[38]. For example, aggregators will dispatch consumption (heavy processes, electrical heating) during off peak period, avoiding high prices during peaks (e.g around 7PM in France during winter). Note that historically demand response only applied to large industrial sites given the fixed costs of the required control-command infrastructure to monitor processes and perform demand response. Now that those IT infrastructure costs have shrank with the digital revolution, aggregators can access new markets such as tertiary buildings and even individual houses[39].

30 Generation, transmission, distribution and supply used to be different activities performed by the same company. Today, generation and supply are liberalized and new markets have emerged, the biggest one in terms of volume being the day-ahead market where producers bid their production one day in advance. However, transmission and distribution are natural monopolies, hence regulated by authorities. Unbundling requirements ensure the separation between liberalized and regulated activities.
31 Demand response is one of the main decentralized pro-active consumption features enabled by IT.
32 E.g., small owners of PV power plants, industrial sites that can control their load, domestic consumers, …
33 E.g., an owner of a small wind farm with only a few turbines who wants to get capacity certificates to participate in the capacity market.
34 For example in France, the aggregators represent two thirds of the total demand response capacity (source: RTE, Bilan Prévisionnel 2016).
35 Source : RTE (link)
36 Such costs include, for example, financing the required infrastructure to bid in markets.
37 Mathematically speaking, a global optimization is more efficient than a sum of local optimization. For example, each residential consumer on its own has limited capacity to do demand response. Indeed, this would mean cutting its heating for several hours, leading to a significant decrease in the house's temperature. By aggregating several houses, the load reduction can be dispatched among different consumers, hence reducing the impact on each house (each consumer would see its consumption decreased for a shorter time).
38 Peak production mean, such as combustion turbines, have usually very high emission rate compared to baseload production.
39 The latter are not big enough to participate in demand response on their own, both from a regulatory and economic point of view.

Several solutions have been implemented to enable large-scale demand response participation in power markets. France is a good example: the country faces one of the biggest peak consumption in Europe and has been proactive in developing the regulatory infrastructure around demand response. Market players for demand response include aggregators and large consumption sites that participate on their own. Given the preponderance of aggregators, we will use in the rest of the article the term aggregators to refer to demand response players.

Aggregators in demand response optimally dispatches consumption from multiple sites to provide flexibility to the grid as well as reach minimum required side for some markets and reduce fixed costs. In France, market design had to be adapted to enable large scale participation of demand response.

- The NEBEF mechanism (Block Exchange Notification for Demand Response)[40], part of the *Loi Brottes (2013)*, enables a third-party player (such as an aggregator) to perform load reduction of a consumption site without having to obtain any permission from its supplier. In this context and from the network point of view, reducing load is exactly like producing the same amount of energy. This energy not consumed, for example by an industrial site, is sold on the market by the aggregator. The NEBEF mechanism specifies the financial flows between the industrial site, its supplier, the aggregator and markets[41]. It enables the aggregator to get a revenue in €/MWh of load reduction. It is important to highlight that the way to measure this reduction of load is crucial and very complex, as we measure something that has not been consumed.
- Besides NEBEF, aggregators are allowed to participate in the capacity market where they can make a revenue in €/MW of their maximum capacity. The authorisation to actually aggregate capacity to reach the minimum bidding capacity is key in the process.
- In addition, the French TSO RTE created a specific tender for tertiary reserve for demand response players (aggregators representing the majority of them), with a remuneration in €/MW as well. It should be highlighted that in France this dedicated market is by far the main source of profit for aggregators[42].

2. Renewable generation

In France, demand response has been the most suited playground for aggregators to appear; but in Germany, the business first grew for renewable production means.

The past decade has seen the rise of renewable generation and national support schemes to ensure the rapid development of these technologies, the most widespread being feed-in-tariff (FIT). Feed-in-tariffs guarantee to renewable producers a price per MWh, no matter how much and when they produce, thus enabling them to bypass markets. But recently (since 2012 in Germany), FIT tend to be replaced by feed-in-premium. Renewables then have to bid on the market and are paid ex-post the difference between the reference tariff (subsidized) and the market price. The major difference is that having to bid in energy markets, **renewables need to forecast their generation level**, a challenge for wind and solar capacities. Thus, if the sold generation differs from the actual level, an **imbalance penalty** will apply to the renewable power producer, reflecting the cost for the system to cope with this imbalance. Aggregation then makes sense for two reasons. First, **there are a number of fixed costs associated with bidding in the market, which aggregators can mutualize between multiple renewable power producers.** Second, forecast errors decrease as the number of wind turbines (or PV panels) increases, especially when generation means are not located in the same region. This phenomenon, often referred-to as the **diversity effect**, is due to the fact that wind speed forecast errors (or sun irradiation) for two different regions are likely to partly compensate each other as forecasts include different wind regime. An error on one wind regime will see its impact lowered thanks to other regimes' forecasts being more accurate. Therefore, **aggregating the bids of several sites can lower the uncertainty and then the amount of imbalance penalties to be paid**. In Germany, there are more than 70 aggregators for renewables with a total aggregated capacity of 40GW[43,44]. Some companies like Centrale Next are now entering less mature markets such as France, where the obligation for renewables to bid in markets is much more recent (2016).

Aggregators create value for renewables by being responsible for bidding in the market and by reducing penalty costs due to forecast errors thanks to the diversity effect.

Aggregators take care of the forecasting and bidding of the renewable generation while paying to producers the amount of energy they actually produced at a price defined in advance. Aggregators can thus be simple interfaces linking renewable capacities, but they can also be actual producers owning a thermal power plant, which are controllable unlike PV and wind power, who propose additional services. For instance, Uniper (previously E.on) proposes these aggregation services to reduce imbalance penalties and in addition compensates uncertainties due to remaining forecast errors with the flexibility provided by its thermal units. This implicitly means that **for Uniper the energy from its thermal plants has less value than their flexibility, and that this flexibility has greater value off the market (to avoid imbalance penalty for renewables) than within**[45].

Some power producers now prefer to sell their flexibility to renewables to accommodate forecast errors rather than selling it to the grid directly.

40 Link RTE
41 The demand response player pays to the supplier the amount of reduced load at the tariff previously set between the supplier and the consumption site. In exchange, it can sell that electricity in markets, at a higher price, and gets remunerated on the price differences.
42 Source : Energy Pool, leader of Demand Response in France.
43 Total intermittent capacity (wind and PV) in Germany is 90GW. Big players already do their own "aggregation" internally as an optimization.
44 Source : http://www.energie.sia-partners.com/20161117/complement-de-remuneration-pour-les-energies-renouvelables-le-role-renforce-des-agregateurs
45 Such as balancing market for example.

3. EV charging

Energy transition also means a huge increase of electric vehicles in a near future. Being decentralized assets very suitable with IT infrastructure and containing storage capacity, electric vehicles can be of high interest for aggregators.

Electric vehicles (EVs) are often considered as a corner stone of the 3D revolution of the energy sector: digitalization, decarbonisation and decentralization. Certainly, a fleet of EVs can be a game changer in the electricity sector, and turning them from a burden for the grid to a high benefit asset relies on the role of aggregators. Indeed, if not properly managed, a charge of nearly all EVs simultaneously (when people get back home around 7PM, i.e during peak time) can lead to a massive rise in the peak demand, thus requiring very expensive and polluting peak generation capacities and reinforcing the grid. A recent study from the European Climate Foundation shows that **in a 2050 scenario with 25.4 million EVs in Germany, smart charging could turn a €1.35b extra cost into a €110m net benefits**[46]. Not only can **aggregators shave the peak consumption by dispatching the charge of all EVs appropriately**, in particular during the night (by controlling directly the charge of all vehicles for example, or by sending financial incentives to end-users), they can also **use their batteries to provide services to the grid** such as frequency regulation, thus reducing costs for the network and for car users.

Still, a number of barriers are to be overcome for aggregators to successfully optimize charging of EVs. Among them and as in demand response, **interoperability** is of the essence. Interoperability means anyone with given permission can interface with the system. Hence, all charging stations should fit all EVs, for charging purposes as well as for information exchanges. **Standardization** is then required[47]. Another major barrier is at the social level and is much more complex to address: **acceptance** from people not to control their charging time. Indeed, minds will have to switch from an almost instant charging whenever the user decides it, to a simple guarantee of having the car being charged for the next morning, all control of when the car is actually charging being left to an algorithm.

4. Batteries

Aggregators look at using the batteries of EVs when plugged, but batteries on their own can also be of high interest.
The use of batteries is comparable to EVs'. Originally designed to store energy, **charging when energy is cheap and discharging when prices are high is not a reliable business model** given current costs for batteries and experienced spread in energy prices. However, **their ability to deliver very fast response finds value in frequency regulation services, and can be complementary with other means**. For instance, the international innovative flexibility services company REstore uses battery combined with heavy industrial processes for its demand response offer, making it more reactive and enhancing its value. When the signal asking to reduce load is received, the battery first discharges during the time needed for the industrial process to actually reduce its load. The value of the aggregator lies in the ability to combine efficiently different means (storage, industrial processes) to enhance reactivity.

Aggregators optimally dispatching the charge of EVs and using their batteries to provide services to the grid is key to turn EVs from an economic burden to a valuable asset for the grid.

5. Conclusion

Compensating renewable intermittency with flexibility is exactly what is done by the Transmission System Operator (TSO) to ensure the balance between supply and demand. **Had the power system not been liberalized, this optimization would have been done by a vertically integrated monopoly controlling all assets of the whole value chain (production, transport, distribution and retail), with a view to minimizing total cost and hence maximizing social welfare. Nowadays, producers, aggregators and traders**[48] **all seek to maximize their profit separately**. From a mathematical point a view, we have switched from a global optimization to a sum of local optimization for each player. Economics theories suggest that efficient markets can enable to coordinate players' decisions to reach a global optimum as the previous monopoly could have done. Unfortunately, in complex and technical problems the sum of multiples optimization problems very rarely matches results of a global optimization… Aggregators partly fill this gap.

46 Source: European Climate Foundation, link to publication.
47 Source : Ghazale Haddadian et al., Accelerating the Global Adoption of Electric Vehicles: Barriers and Drivers, In The Electricity Journal
48 Traders can buy and sell in market places without producing any energy at all.

Policy and Regulation Radar

This section summarizes the key changes respectively in the EU or in the country regulation that may significantly affect the power and utilities companies.

What is changing in the EU regulation?

Clean Mobility Package

Key features

On 8th November 2017, the European Commission (EC) presented the "**Clean Mobility Package**". It is a **legislative proposal** that sets new **CO_2 emission standards** for new passenger **cars and vans** in the European Union for the period after 2020. For both of them, the average CO_2 emissions will have to be **30% lower in 2030 and 15% lower in 2025**, compared to 2021. This will ensure that emission reductions occur as early as possible.

This package is the second mobility package that the EC presents this year. "Europe on the Move" Package was presented in May 2017 (see Q2 2017 Newsletter). It is a decisive step forward in implementing the EU's commitments under the **Paris Agreement** for a binding domestic **CO_2 reduction of at least 40% until 2030**.

The Clean Mobility Package consists of:

- A political **Communication** outlining the **long-term strategy to fight climate change** while improving the quality of life for Europe citizens and fostering competitiveness for its industry.
- **Legislative initiatives** on road transport vehicles, infrastructures and combined transport of goods. The initiatives focus on the reduction of greenhouse gas emissions and air pollutant emissions and aim for a broad take up of low-emission alternative fuels and low-emission vehicles on the market.
- **Non-legislative measures** presented in an **Alternative Fuels Action Plan** to boost investment in alternative fuel infrastructure and develop a network of fast and interoperable charging and clean refuelling stations across Europe.

Insights

The Package includes the following documents:

- **New CO_2 standards for cars and vans**: Average CO_2 emissions from new passenger cars and vans registered in the EU in 2025 will have to be **15% and in 2030 30% lower** compared to 2021. In order to increase the deployment of zero- and low-emission cars the proposal includes also a dedicated **incentive mechanism** for such vehicles.
- **Clean vehicles Directive**: to promote **clean mobility solutions in public procurement tenders** and thereby provide a solid boost to the demand and to the further deployment of clean mobility solutions.
- **Revision of the Combined Transport Directive**: Combined transport is a type of multimodal transport of goods where the major part of transport is carried out by rail, inland waterways or maritime transport and is served by a short road leg in the beginning or end of the transport chain. The objective is to **support** the shift from long distance road transport to **more sustainable transport modes**. This revision will make it easier for companies to claim incentives and therefore stimulate the combined use of trucks and trains, barges or ships for the transport of goods.
- **Passenger Coach Services**: The EC is proposing to amend the Regulation on passenger coach services in order to **stimulate the development of bus connections over long distances across Europe** and offer alternative options to the use of private cars.
- **Action Plan on alternative fuel infrastructure**: The Plan provides measures to support **synergies** between national plans, close gaps on the **trans-European transport network** and ramp up **investment** in urban areas. Charging an alternative-fuel vehicle along the motorway should become as easy as filling up on petrol today. This Action Plan includes new funding opportunities with up to €800. In addition, the EC has launched an initiative with additional €200 million to support European **battery development and innovation** from 2018 to 2020.

Next steps

The Clean Mobility proposals will now be sent to the co-legislators and the Commission calls on all stakeholders to work closely together to ensure the swift adoption and implementation of these different proposals and measures.

The EC will present the third and final part of the "Europe on the Move" package in the first-half of 2018.

Link: *Clean Mobility Package*

Third Report on the State of the Energy Union

Key features

On 24th November, the European Commission published the **third State of the Energy Union Report,** which **evaluates the progress** made towards building the **Energy Union** since the publication of the second State of the Energy Union Report in February 2017.

According to the report, the EU **is on track to implement the Energy Union project**, generating **jobs, growth and investments**.

The report also confirms that energy transition is not possible without **adapting the infrastructure** to the needs of the future energy system. Energy, transport and telecommunication infrastructure are interlinked. Thus, the report published is accompanied by a Communication on the **2030 electricity interconnection target of 15%** and **the third list of Projects of Common Interest** (PCI).

The energy transition should be **socially fair**, lead to **innovation** and be based on a future-proof **infrastructure**, while enhancing **security of supply**. In all these areas, considerable progress was made in 2017.

Insights

The report outlines several trends:

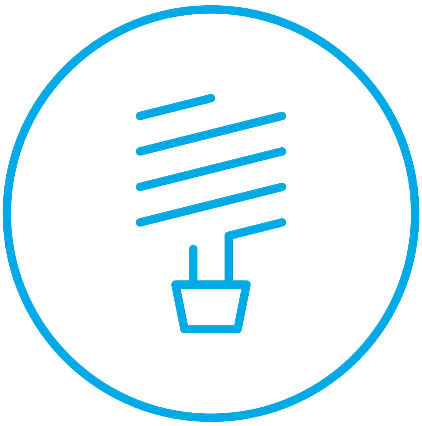
- **Renewable energy**: The share of renewable energy in the EU energy mix continues to rise and is on track to reach the 20% target in 2020. The EU achieved a share of 16.7% renewables in its final energy consumption in 2015.
- **Greenhouse gas emissions**: The decoupling of greenhouse gas emissions and Gross Domestic Product (GDP) has continued, mainly driven by innovation. In 2016, the recovery of Europe's economy led to an increase of 1.9% in GDP. Instead, emissions decreased by 0.7%. Overall, between 1990 and 2016, the EU's combined GDP grew by 53%, while total emissions decreased by 23%.
- **Energy efficiency**: Economic growth and energy consumption have also been decoupled primarily due to energy efficiency measures. In 2015, the EU consumed 2.5 % less primary energy than it did in 1990, while GDP grew by 53% over the same period. However, the EU still needs to reduce its primary energy consumption by 3.1% between 2015 and 2020 to reach the energy efficiency target.

Next steps

The completion of the Energy Union requires engagement and close cooperation between the Commission, Member States and society as a whole. Member States will need to finalise the draft integrated national energy and climate plans for the post-2020 period by early 2018.

The Energy Union has delivered but continued engagement is key in achieving the remaining tasks. All the Energy Union related legislative proposals presented by the Commission need to be addressed as a priority by the European Parliament and Council.

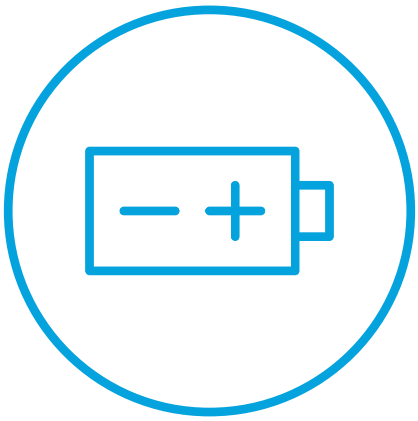
Link: *Third Report on the State of the Energy Union*



What is changing in country regulation?

United Kingdom			
Topic	**Key features**	**Insights**	**Next Steps**
CfD: proposed amendments to the scheme	The UK Government is **consulting** on proposed **changes** to the **Contract for Difference (CfD) scheme**. The aim of the changes are to ensure that the CfD scheme **continues to offer value for money** to bill payers into the future. The proposed policy changes include: • A proposed definition for '**remote island wind**' so that this can compete with less established technologies in future auctions. • **Further refinements to Advanced Conversion Technologies** (ACT), with the aim of ensuring that only the most innovative and efficient plants are awarded a subsidy through the CfD scheme. • **Increased efficiency requirements for Combined Heat and Power** (CHP), with the objective of supporting CHP plants that have a high overall efficiency. • In addition, other changes are proposed on the methods for determining an updated greenhouse gas emissions standard, and using new load factor assumptions towards the higher end of government forecasts when allocating budget.	• The proposed changes will not affect existing CfD contracts and will **only impact contracts for future CfD allocation rounds**. • It is clear that for new contracts, **enhanced levels of efficiency** will be required in order to qualify for the scheme, in particular for ACT and CHP. • With changes to certain assumptions, such as the load factors, the UK Government is trying to get as **much capacity as possible from its future budgets**.	Consultation is ongoing and invites responses by 9 March 2018
Capacity Market: improving the framework	Following the issue of a consultation document which asked for views on a number of **changes to the Capacity Market (CM) Rules**, the UK Government has published its response and decision. The changes to be implemented include: • **Limited duration storage and security of supply**: The class covering storage generating technology will be divided into separate **storage generation technology classes differentiated** by the amount of **time** for which a Capacity Market Units (CMU) can **generate** at its full connection capacity **without recharging** ('duration bands'), with these duration bands being set at 30-minute intervals. For new storage facilities that fall into classes that duration limited (for next auction, that means classes of <=3.5 hours minimum duration), a new de-rating methodology based on Equivalent Firm Capacity (EFC), will be used. • **Strengthening the arrangements relating to Satisfactory Performance Days** (SPDs): three SPDs will be required to be completed by CMUs during winter of the relevant year (with at least one between January and April). A failure will result in suspension of capacity payments until three further SPDs are completed. • Clarification on **Metering re-assessments**, which can now be re-taken by Capacity Providers where necessary. • **New deadline for planning consents** to be moved to early January for T-4, to avoid the period between Christmas and the New Year. • **Clarification** to the CM Rules that Adjusted Load Factor Capacity Obligation (ALFCO) calculation applies to interconnector CMUs	• The proposed changes the CM Rules will apply to the **capacity agreements awarded after the Rule changes have taken place**. It provides **greater clarity** for participants ahead of the capacity auctions that will take place in early 2018. • For both the upcoming T-1 and T-4 auctions storage generating technology classes of 3.5 hours minimum duration and below will be duration limited. • The aim of the changes to the CM Rules are to **ensure a more level playing field, improve the functioning** of certain areas and to better align specific segments of the Rules with the original policy intent. This should provide **clarity** to potential capacity market participants going forward but will not have an impact on existing capacity agreements.	Decision which has resulted in amending the CM Rules and will apply to the T-4 and T-1 Capacity Market Auctions scheduled to take place in early 2018.

United Kingdom			
Topic	Key features	Insights	Next Steps
Storage in a flexible energy system: changes to the electricity distribution licence	• Ofgem has published two consultations seeking views on the development of its work as part of its Smart Systems and Flexibility Plan. The proposals aim to **ensure that storage is sufficiently unbundled from network businesses**, such as electricity distribution network operators. • Ofgem wants to ensure that there is a **competitive market for storage** so that flexible services can develop. Where networks own and operate storage, this can lead to distortions and foreclosures which might affect storage by third parties, but also the uptake of other forms of flexibility – such as other flexible generation and demand side response – that provide similar services in the same markets. • Ofgem's proposal is to **include a new licence condition** in the electricity distribution licence that will ensure **electricity distribution network operators cannot operate storage**. • A separate consultation was published on modifying the electricity generation storage licence.	• The new condition in the electricity distribution licence is aimed at ensuring that distribution network operators (DNOs) cannot operator storage. This is aimed at supporting a **level playing field for market participants that want to invest in storage assets to provide flexibility** to the electricity network. • Ofgem also proposes that DNOs will need to seek permission from Ofgem to operate storage assets in a few, very specific, circumstances where this is not detrimental to competition and is in the interest of customers. • If implemented, this should provide greater certainty and clarity for investments in storage and other flexible services.	This consultation closed at the end of November 2017 and a further statutory consultation on modifying the licence is expected in early 2018. A final decision is expected in Spring 2018.



Spain			
Topic	**Key features**	**Insights**	**Next Steps**
Regulation about charging manager companies for electric vehicle	• In November 2017, the Spanish Government published a Draft Royal Decree about **charging manager companies for electric vehicle**. The new regulation includes a **simplification** of the **applicable requirements** to these companies. This simplification aims to remove obstacles in order to facilitate an agile and orderly deployment of the charging infrastructure. • The main changes included are as follows: - **Elimination** of the need to: • Include the charging manager activity in the **company´s corporate object** described in bylaws. • Have **independent measurement** for charging points. - It is permitted to **contract a specialized company** for the management of its obligations. - In addition, the reform minimizes administrative burdens by **removing annual reporting obligations** to the Administration. - A **geo-referenced database** will be maintained with all charging manager companies and their facilities.	• Now, **any company** that is a consumer of electrical energy (hotels, car parks, shopping centers, etc.) **can install recharging points**. • The reform will contribute to the deployment of charging points associated with different companies whose main activity is not the provision of charging services. It will have a positive impact by **increasing the number of charging managers** and consequently, the competition in the sector. • These modifications are part of the **MOVALT Plan**, which intends to give an impulse to the development of alternative mobility.	The MOVALT Plan will provide EUR 20 million to the purchase of alternative vehicles, EUR 15 million to the installation of charging points for electric vehicles and EUR 15 million to the promotion of R&D&I in projects related with this area.
Closure of the Power Generation Facilities	• In November 2017, the Spanish Government published a **Draft Royal Decree** about the **closure process of power generation facilities**. • The Government will **evaluate** each closure application received. The closure will be permitted if: - it doesn´t threaten the **security of electricity supply or raw materials supply**; - **no adverse effects** on electricity **prices** or **competition** in the electricity market are expected; - **no adverse effects** on the achievement of the objectives in the current **energy and climate planning** are expected. • This new regulation will apply to power generation facilities with a capacity higher than 50 Mw. • If the closure is denied, the operator may continue the activity or transfer the facility to a third party. The transfer may be made by a regulated auction.	• The aim is to ensure that decisions on the closure of power plants are **consistent with energy planning instruments and targets** on security of supply, climate change and energy prices.	This new regulation will apply to all closure applications submitted from September 15th 2017 onwards.

Germany			
Topic	**Key features**	**Insights**	**Next Steps**
Cut-back on Renewable Energy Surcharge Relief for CHP plants	• According to the applicable German Renewable Energy Act (EEG), operators of **highly efficient CHP plants** were eligible to benefit from a **relief of 60% from the EEG surcharge on the power consumed** by the operating company itself (own-consumption). Thus, the operator was only obliged to pay 40% of the EEG surcharge (for 2018: 6.79 ct/kWh). However, when this provision was originally introduced in 2014, it was subject to approval by the EU Commission as it is regarded as a state aid and must follow the rules of the EU Commission's guidelines on state aid in the energy and environmental sector. • **The EU Commission approved this provision only until 31 Dec. 2017**. As the provision was renewed on 1 Jan. 2017, the EU Commission had to approve it as from 1 Jan 2018, yet the EU Commission denied approval. • The **EU Commission has refused to prolong** its approval of the **German relief for highly efficient CHP plants** from the EEG surcharge. Thus, all highly efficient CHP plant producing power for own consumption with **commercial operation date after 1 Aug. 2017 must pay 100% of the EEG surcharge** (6.79 ct/kWh) **as of 1 Jan. 2018**. This applies until the German Government has found a compromise on a new provision with the EU Commission.	• Plant operators, mostly being industrial companies in the producing sector such as automotive and chemical industry, are now dependent on how the new relief scheme will look like. **New CHP plants should not be built until the new scheme is clear**. Different operating solutions should be discussed for plants in operation as well as for new plants.	Before summer of 2018 the German Government wants to introduce a new relief scheme.

France			
Topic	**Key features**	**Insights**	**Next Steps**
The objective to cap nuclear electricity production to 50% of the mix is postponed to 2035	• The law on Energy Transition passed in 2015 initially targeted to bring share of nuclear down to 50% of electricity generation by 2025. • In November 2017, the French Minister of Energy transition declared that this objective is postponed to 2035.	• This decision comes after the publication by RTE, the French TSO, of a series of energy scenarios for France. In its forecasts, RTE estimates that a too rapid reduction in the nuclear fleet would force the four French coal-fired power stations to operate and to build some twenty new gas-fired power plants. • This increased use of fossil fuels would have the effect of doubling current greenhouse gas emissions (about 22 million tons per year). Currently GNH emission related to electricity system represent less than 5% of France's total greenhouse gas emissions, due to the preponderance of the nuclear in the mix.	The law also introduced a 63.2 GW cap for nuclear capacities, that links the commissioning of any new capacity (Flamanville EPR) to decommissioning (Fessenheim).

Snapshot on surveys and publications

Deloitte

Tech Trends 2017 and the Power Industry: Disrupting the Utility – December 2017

This report identify the key trends that will likely revolutionize enterprise technology in the next 18-24 months. It talks about how the trends presented in Tech Trends 2017 are likely to impact the power and utilities industry.
Link to the survey

2018 Renewable Energy Industry Outlook – December 2017

This report outlines the unusual degree of policy uncertainty, but also some strong tailwinds that will likely promote longer-term growth. Which policies could have the most impact on the industry in 2018 and beyond? And which factors can help drive long-term growth.
Link to the survey

Powering the future of mobility – December 2017

As drivers buy more electric vehicles, power companies look to benefit from increasing demand. But the emerging mobility ecosystem offers even more promise for utilities: a possible "killer app" to—for the first time—directly engage customers.
Link to the survey

Agencies or research institutes

International Energy Agency

Digitalization & energy - 2017

This report seeks to provide greater clarity to decision makers in government and industry on what digitalization means for energy, shining a light on its enormous potential and most pressing challenges. It also lays out no-regret recommendations to help steer the world towards a more secure, sustainable and smarter energy future.
Link to the survey

The future of trucks - 2017

This report outlines the ways in which vehicle efficiency technologies, systemic improvements in logistics and supply chain operations, and alternative fuels can ensure that road freight transport will continue to support economic growth while meeting key energy and environmental policy objectives.
Link to the survey

Key World Energy Statistics 2017- 2017

This paper contains timely, clearly presented data on the supply, transformation and consumption of all major energy sources for the main regions of the world, proving everyone with an interest in energy key statistics on more than 150 countries and regions including energy indicators, energy balances, prices, RDD and CO2 emissions as well as energy forecasts.
Link to the survey

Market Report Series: Energy Efficiency 2017

This study deals with energy efficiency progress and underlines the fact that it is a resource for policy makers and companies seeking to reap the multiple benefits of energy efficiency.
Link to the survey

CO_2 Emissions from Fuel Combustion : Overview - 2017

CO_2 Emissions from Fuel Combustion 2017 provides comprehensive estimates of CO_2 emissions from fuel combustion across the world and across the sectors of the global economy.
Link to the survey

Technology roadmap : Delivering Sustainable Bioenergy - 2017

This Technology Roadmap re-examines the role of bioenergy in light of changes to the energy landscape over the past five years as well as recent experience in bioenergy policy, market development and regulation. It identifies the technical, policy and financial barriers to deployment, and suggests a range of solutions to overcome them.
Link to the survey

Energy Efficiency Indicators Highlights 2017 - 2017

This statistical report is designed to help understand what drives final energy use in IEA member countries in order to improve and track national energy efficiency policies.
Link to the survey

Global Gas security Review : How is LNG Market Flexibility Evolving - 2017

Global Gas Security Review offers an extensive assessment of recent gas balancing issues and related policy developments linked to security of supply, as well as lessons learned from recent events. This paper shows a continuing improvement in supply and contractual flexibility, which are expected to develop in the near future, along with the growing diversification of market participants and a lasting situation of oversupply.
Link to the survey

European Commission

Mitigating climate change: renewables in the EU : cutting greenhouse gas emissions through renewables – October 2017

This report provides a concise overview of CO2 and aggregated emissions (in both the ETS and the ESD sectors) including recent trends in the EU as a whole, an individual EU countries and an assessment of the role played by renewables in mitigating climate change in the EU and individual countries between 2009 and 2014.
Link to the survey

Shaping the future of energy in Europe : Clean, smart and renewable – November 2017

In the decade 2005-2015, the share of renewables in the EU's energy consumption nearly doubled from 9% to almost 17%. This papers notices some sectors and countries are leading the way towards clean energy and although their decline, fossil fuels continue to be the dominant source in Europe.
Link to the survey

Options for future European electricity system operation – September 2017

This paper deals with the increasing penetration of renewable energy sources (RES), as part of the transition to a de-carbonised power system, results in a need to continuously assess the adoption of alternative technologies, policies and practices.
Link to the survey

Eurelectric

Freedom of Charging : Opportunities and Challenges of Blockchain Technology for seamless Electro-mobility – November 2017

The Eurelectric blockchain platform engages key electricity industry stakeholders in identifying and co-developing the potential sources of value stemming from the deployment of the blockchain technology in the energy sector.
Link to the survey

Transformational perspective : Data as critical asset for the energy transition – November 2017

This brochure provides a collection of case studies which provide evidence of the effective value created by Distribution System Operators (DSO) by managing meters and grid data in different European countries.
Link to the survey

Oxford institute for Energy

Electricity market design for a decarbonized future : an integrated approach – October 2017

This paper contributes to the ongoing debate about power market designs by proposing an adaptive approach to market design within the context of the EU and its dynamic energy policy.
Link to the survey

Challenge to the future of gas : unburnable or unaffordable – December 2017

This paper questions the logic of suppliers who are waiting for a tightening in the global gas market to encourage prices back to a level that can incentivize investment, especially in greenfield LNG projects.
Link to the survey

Inquiry into the implications of Brexit for energy security in the UK by the EU Energy and Environment Sub-Committee of the House of Lords – October 2017

This paper argues that Brexit could have an impact on interconnecting-pipeline regulations. The use and value of these infrastructures could be affected by negotiations, leading to some new risks for UK in terms of not only Security of Supply but also energy pricing competitiveness vs the Continent.
Link to the survey

Newsletter contacts

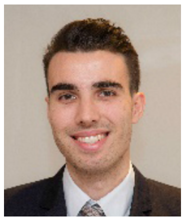
Véronique Laurent
Partner
France - E&R leader
vlaurent@deloitte.fr

Thomas Gounel
Partner
tgounel@deloitte.fr

Emmanuel Rollin
Director
erollin@deloitte.fr

François Lévêque
Senior Advisor
fleveque@deloitte.fr

Nuria Fernandez
Senior Manager
nufernandez@deloitte.es



Sébastien Douguet
Manager Energy
Deloitte Economic Consulting
sdouguet@deloitte.fr

Global Power Leadership contacts

Global Power Leadership	Name	Contact Details
Global Power Leader	Felipe Requejo	frequejo@deloitte.es
European Power Leader	Veronique Laurent	Vlaurent@deloitte.fr
Global Renewable Energy Leader	Jane Allen	janallen@deloitte.ca

Global E&R Function Leadership	Name	Contact Details
Global E&R Consulting Leader	Anton Botes	abotes@deloitte.co.za
Global E&R Tax Leader	Brad Seltzer	bseltzer@deloitte.com
Global E&R Financial Advisory Services Leader	Rajeev Chopra	rchopra@deloitte.co.uk
Global E&R Enterprise Risk Services Leader	Paul Zonneveld	pzonneveld@deloitte.ca
Global E&R Audit & Accounting Leader	Véronique Laurent	vlaurent@deloitte.fr

Deloitte
185, avenue Charles-de-Gaulle
92524 Neuilly-sur-Seine Cedex
Tél. : 33 (0)1 40 88 28 00 - Fax : 33 (0)1 40 88 28 28

Studio Graphique Neuilly