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European Energy Markets Observatory

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In collaboration with

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vaasaETT

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A Strategic Overview of the European Energy Markets

Editorial by Colette Lewiner

Oil markets

In 2013, thanks to the spectacular expansion of shale oil and to a certain extent the curbing of domestic consumption due to the economic crisis, the US – which used to import two-thirds of its needs – imported only half, mainly from other North American countries (Canada and Mexico) and the Middle East.

This shale revolution is mitigating the impact of geopolitical events on oil prices. Since 2011 and the start of the Arab uprising, the world has experienced a cumulative disruption in supply equivalent to 3.5 million barrels a day (from places such as Libya[1]); this was cancelled out by a similar amount of US production that exceeded 10 mbl/d in 2013 to reach the highest level since 1986.

The increase in US shale oil production is one reason why, despite recent geopolitical issues (notably the annexation of Crimea by Russia, the Ukraine crisis, and the unsettled situation in the Middle East), the oil price remained stable and even decreased to less than $100/bl in September 2014. Other factors contributing to the decrease are slower economic growth and the effect of speculation.

The shale gas revolution and related gas spot markets developments have decreased the impact of the oil price on the overall energy economy, as gas prices (and hence electricity prices in certain regions) are less and less correlated to oil prices.

Power markets

Present situation

The chaotic situation on the electricity wholesale markets has continued with larger time intervals of negative prices; continued closures of gas-fired plants needed to guarantee security of supply (over 10 GW decommissioned in 2013); CO_2 prices too low on the EU ETS[2] to push for de-carbonized investments; increased retail prices; and a steady deterioration in the Utilities' financial situation[3].

The root causes are:

The Climate-Energy package: in order to comply with the 20% RES[4] share in the energy mix target by 2020, the European countries have massively invested in renewable energies. With around 7% of worldwide population,

1 BP 2014 annual oil statistics
2 EU ETS: European Emissions Trading System
3 As an example, in 2013 GDF Suez has depreciated its gas generation and storage assets by €14.9 billion
4 RES: Renewable Energies Sources

the EU has spent around €500 billion for renewable energies from 2004 to 2013 (included), nearly half of the worldwide investments[5]. The RES share in the energy mix increased from 8.3% (in 2004) to 14.1% in 2012. For electricity that benefited from the main part of investments, this share increased from 14.3% to 23.5% on the same period.

Flat or decreasing consumption (-0.5% for electricity, -1.4% for gas[6]). This is linked to the economic crisis and to a certain extent to energy efficiency measures. As usual, gas consumption is more impacted than electricity's[7] as the latter is favored by new applications such as ICT[8] and electric vehicles (EVs). For example, the new French law on energy transition forecasts that 15% of French travels in 2030 will use 100% renewable fuels and that 7 million electric battery-charging points (compared to 10,000 today) will be installed. This could have a big impact on the grid balance.

No anticipation of the economic environment on CO_2 emission allowances. According to CDC Climat[9], between 2005 and 2011 some 1.1 billion tCO_2 emission reductions occurred in installations covered by the EU ETS. Between 600 and 700 Mt of avoided emissions resulted from the climate and energy package objectives (500 Mt resulting from RES development and between 100 and 200 Mt from improving energy intensity). The economic crisis has also played a significant role in reducing CO_2 emissions, estimated at 300 Mt. As a consequence of this lack of anticipation, too many CO_2 emission allowances were issued by the European Commission (EC).

At the end of 2013, there was a surplus of over 2.1 billion allowances, hence the low prices. As a short-term measure to mitigate the effects of the surplus, the EU decided to postpone (backload) the auctioning of 900 million allowances in the early years of phase 3. This measure had little effect on prices, which stayed at €5.6/t on average in H1 2014.

Backloading is only a temporary measure; a sustainable solution to the imbalance between supply and demand requires structural changes to the EU ETS. This is why the EC proposes to establish a market stability reserve at the beginning of the next trading period in 2021[10]. This market stability reserve would function by triggering adjustments to annual auction volumes in situations where the total number of allowances in circulation is outside a certain predefined range.

Very generous feed-in tariffs subsidizing development of renewables. This policy was effective – the RES share in the energy mix grew to 14.1% in 2012 and the 20% objective for 2020 should be met. However, it led to increased electricity retail prices triggering customer dissatisfaction.

Many Member States and the EC are looking at reducing these tariffs and progressively bringing them into line with market conditions, which is, after all, normal for maturing technologies.

The Spanish situation is a good illustration of these considerations. In 2013, 42.4% of Spanish electricity was produced from renewables (of which 14% was hydropower). Wind power was the first generation source (21.1%) followed by nuclear (20%). The large renewable-related investments have generated a huge debt for Spanish Utilities (about €30 billion) because the government did not allow them to pass these extra costs on to their customers. Despite this restriction, electricity prices increased significantly. For example, until 2006 residential prices in France and Spain were similar, whereas in 2013 Spanish prices were 75% higher than those in France.

In recent years, successive Spanish governments have tried to reduce renewables costs, which amounted to €9 billion in 2013 (including cogeneration).

Recent developments

The European Council will make its final decision on the **new framework for climate and energy policies,** including further measures aimed at enhancing Europe's energy security and specific 2030 interconnection objectives, on October 23-24, 2014.

The latest EC proposal is to replace the 3x20 objectives by a *single objective on CO_2 emissions* (a 40% decrease compared to 1990 levels). No compulsory targets on renewables or energy efficiency would be set at Member States level, only at EU level (27% RES in the final energy consumption mix and 30% energy efficiency).

Energy efficiency is not only important for preserving our planet's resources and limiting CO_2 emissions, but also for guaranteeing energy security of supply. Recent events in Ukraine have highlighted European exposure with respect to energy imports and, Member States most exposed to gas imports from Russia are also those that have greatest potential to improve efficiency.

5 UNEP report

6 Data not corrected for the temperature effect

7 Around one third of gas is used for power generation plants, thus there is a double consumption decrease (direct gas usage and electricity consumption)

8 ICT: Information and Communication Technologies

9 CDC Climat Recherche: Octobre 2013 « Les facteurs explicatifs de l'évolution des émissions de CO_2 sur les deux phases de l'EU-ETS : une analyse économétrique »

10 Proposal for a decision of the European Parliament and of the Council concerning the establishment and operation of a market stability reserve for the Union

On April 9, 2014, the **Commission adopted new rules on public support for projects relating to environmental protection and energy.** The guidelines address market distortions that may result from subsidies granted to renewables. They promote a gradual move to market-based support for RES through the introduction of competitive bidding processes for allocating public support, and the gradual replacement of feed-in tariffs by feed-in premiums, which expose RES to market signals. These rules should slow down, but not stop, renewables development.

Promotion of European industry competitiveness: these new rules provide criteria to relieve energy-intensive companies that are particularly exposed to international competition in a limited number of energy-intensive sectors. Combining this measure with measures aimed at decreasing (or limiting) the electricity invoices for the low-income consumers (up to 30% of customers in certain EU countries), this means that only a subset of retail customers will carry the burden of increasing retail prices and this burden will be higher than if all customers would pay these levies.

Another new feature is to allow Member States to introduce **capacity remuneration mechanisms.** They are designed to ensure security of electricity supply during tense periods and to make new capacity investments profitable. Different types of capacity remuneration mechanism (CRM) exist:

- Security through prices (for example the capacity payment mechanism) where a fixed amount set by a central body is paid to generators for available capacity and for new investments. This mechanism has been used in Spain since 1998 and in Italy starting in 2014,
- Security through volume where the amount of capacity is fixed and the mode of remuneration varies. This is a strategic reserve scheme, where some generation capacity is set aside to ensure security of supply in exceptional circumstances (e.g. in Sweden, Finland and under review in Germany),
- Capacity markets, where two different mechanisms exist:
  - Capacity obligation: suppliers are required to contract a certain level of capacity from generators at a price agreed between the parties, and to pay a fine if this capacity is not sufficient (France is due to start this in 2016),
  - Capacity auction: the total required capacity is set several years in advance by the transmission system operator (TSO) or the regulator. The price is set by forward auction and paid to all participants in the auction. The cost is charged to the end customer (e.g. PJM and ISO-NE[11] markets in the USA).

These capacity markets will be gradually adopted in different EU countries and should enhance security of supply. However, their different designs will create competition issues on the EU electricity market.

Evolution in the next few years

For the coming years we could forecast:

- *Moderate economic growth* combined with energy-efficient measures leading to moderate consumption growth reaching pre-crisis levels only in 2020[12],
- *Slower growth in renewables' new capacity* linked to the subsidies decrease (see above) and to their impact on grid management (see below).

Taking these two factors into consideration, the present power overcapacity would remain (or grow).

Conversely, the EU's Large Combustion Plants Directive (requiring 15.8 GW of coal-fired capacity to be closed by the end of 2015 at the latest) and Industrial Emissions Directive (the closure of 65 to 70 GW of coal-fired capacity by 2020/23) will contribute to rebalance the market. *However, it can be predicted that the present chaotic situation will remain for a few more years.*

In the longer term, the International Energy Agency (IEA) estimates that despite slow growth in electricity demand (11% from now to 2035), Europe will need to add almost 740 GW of power capacity by 2035 to replace ageing infrastructure (40% of thermal plants' power capacity will be decommissioned by 2035) and to decarbonize the electricity mix. This represents $2,200 billion investments of which 70% will be for power plants and 30% for grids.

In order to achieve the right investment incentives, electricity prices need to increase by at least 20% in the next decade. Thus governments and regulators need to adopt a long-term view and act in a determined way.

With Utilities in a difficult financial situation, how will they be able to invest? The chapter Finance and Valuation describes the new financial instruments (such as hybrid debt emissions and project financing) that will help existing Utilities to find the resources they need. In addition, it is likely that infrastructure funds and non-European Utilities will take a significant share of new investment, having positioned themselves in this sector in previous years.

11 PJM: regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia of the US East coast. NE-ISO: New England Independent System Operator

12 IEA June 2014

Electricity grids

European electricity market fluidity has progressed. European interconnection capacity should increase by around 3,000 MW in 2013 and 2014. However, due to public opposition at local level and a complex bureaucratic system, it takes around 10 years to build a new transmission line in Europe. Congestion is still significant in certain cross-border links and several countries, such as the UK and Finland, still fall short of the 10% interconnection level required by the EC.

Extended market coupling. Since February 2014, the NWE region, stretching from France to Finland, has operated under a common day-ahead power price calculation using the Price Coupling of Regions (PCR) solution. This solution is also used in the SWE (France, Spain and Portugal) region in a common synchronized mode.

"Thanks to this NEW Price coupling for the first time Power Exchanges from countries which account for 75% (more than 2000 TWh) of European electric consumption, calculate electricity prices at the same time and in the same way – a revolutionary first step towards a common European power market. In time, Europe's power consumers will benefit from the more efficient use of the power system in the region, resulting from a more closely connected market."[13]

Economic impact of renewables on the grid system. The variability and unpredictability of wind and solar power production generate additional requirements in terms of flexibility for the supply-demand balance of the electricity system. These requirements generate additional costs.

The question is how to evaluate these extra costs (integration costs) in order to get an accurate comparison between different generation technologies and especially between dispatchable and non-dispatchable generation (e.g. thermal generation with variable renewables such as wind or solar).

The classic LCOE[14] is not enough and integration costs have to be added in order to get the right metric.

In order to evaluate them, one has to take into account the variable characteristics of renewables (wind and solar mainly):

- Their output fluctuates: wind speeds and solar radiation vary over time. Thus the value of this type of generation depends on when it is produced (high demand or low demand periods) – there is a profile cost,
- Their output is uncertain: wind and solar radiation is uncertain in day-ahead terms. For example, wind energy is subject to strong and sudden increases in production creating hourly variations in France of up to 300 MW (out of 7,500 MW installed capacity)[15]. Solar energy is subject to significant and very rapid variations in daytime production (from clouds). The development of large wind power plants improves statistically the accuracy of the forecast. Even taking this factor into account, the effects of forecast errors in France represent variations of up to 2 GW today and 4.6 GW in 2020. Forecast errors are costly and lead to extra balancing costs,
- They are bound to certain locations: their value depends on where they generate electricity. The grid-related costs can be high. For example, in Germany the shift of generation from centralized large nuclear plants to decentralized wind farms (onshore and offshore) and solar PV facilities has led to grid redesign and construction of new north-south transmission lines. The grid overhaul investment is estimated at €400/kW (solar and wind)[16].

The integration costs calculation is complex and varies between the different grids and generation mix. In Germany, integration costs of wind power can be in the same range as generation costs at a moderate renewable proportion of the electricity mix (~20%).

Integration costs can become an economic barrier to deploying variable renewables at a high proportion of the generation mix.

Integration costs will decrease with:

- Import/export interconnections that enable optimization of the system on a larger scale and,
- Demand-side management: demand increase or decrease would be managed according to fluctuation of short-term prices. An example would be using intermittent electrolysis during low electricity cost periods to produce hydrogen or methane out of CO_2 (methanation). Both gases are storable.

These integration costs will also significantly decrease if large storage capacity at competitive costs is available.

Smart grid development. A smart grid is a power grid that can integrate intelligent interaction between all users in order to provide economical, safe and sustainable electrical energy. Smart grid industrial deployment is not as rapid as expected, mainly due to the volume of investment required and the not yet fit-for-purpose regulatory and markets frameworks (especially in Europe).

13 Press release from EPEX Spot

14 LCOE: Levelized Cost Of Energy which is the full lifecycle costs (fixed and variable) of a technology per generation unit

15 ENR Pool, « Enjeux de l'intégration des EnR au réseau électrique », Smart Grid conference, Paris, June 2014

16 "Cost-Supply Curves of renewable electricity in Germany – First Results" M. Wiesmeth R. Barth A. Voß, Institute of Energy Economics and the Rational Use of Energy (IER). University of Stuttgart, IRENA-ETSAP Joint Session: REMAP 2030 17. June 2013, Paris

Smart grid pilot development is accelerating (so far more than $20 billion investments[17] worldwide).

Despite the different characteristics of each network and customer base, it is useful to study the outcomes of the pilot projects:

- Storage, real-time data management, and load balancing are among the most important devices and systems enabling accommodation of larger RES shares,
- Sustainable Demand Side Management is an important factor for lowering integration costs and optimizing renewables output,
- Norms, standards, regulatory frameworks, and market mechanisms need to be enhanced, clarified and implemented rapidly with a long-term vision.

Provided that the right regulatory framework is established and that technologies are available, a huge worldwide smart grid market is expected in the 10 to 20 years, especially in North America, China and Europe.

Gas markets

Global market perspective

US shale gas. In the US, unconventional gas development is changing the paradigm. In 2013, shale gas accounted for 39% of total gas production in the US vs. 25% in 2010. This share is expected to grow to 53% in 2040[18].

Seven export terminals have received DOE non-FTA[19] authorization (out of 26 applications). One Sabine Pass) got DOE and FERC[20] approvals. It is expected that five out of the seven will get FERC approval. On May 29, 2014, the US Department of Energy declared that it would authorize more LNG exports by lifting the soft cap of cumulative authorizations from 12 bcf[21]/d (90 Mt/year) to 20 bcf/d (5,150 Mt/year). Total export capacity is likely to be in the 6-8 bcf/d range by 2020 even if the new EPA[22] legislation on CO_2 emissions is enforced. The US will become a swing supplier in the global market and create a ceiling price.

Growth of global gas demand. Demand growth will be strong in Asia, Africa and the Middle East. China will double its gas consumption by 2019, offsetting slowdowns in regions such as Europe[23].

With very slow growth (or even a decrease) in European gas consumption projected, Russia is seeking alternative markets and on May 23, 2014 struck a landmark deal (worth $400 billion) with China. The deal represents 25% of the volume that Gazprom sold to Europe and places China second in the Gazprom market after Germany.

The IEA forecasts that global gas demand will rise by 2.2% in the next five years. LNG is expected to meet much of the growth in global demand, and is forecast to grow by 40% in the period to 2019.

European situation

Gas demand decreased by 1.4% in Europe in 2013 and no growth in demand is forecast for the 2013-2019 period. However, as European gas reserves are depleting, gas imports are likely to grow in Europe, weakening security of the gas supply. Shale gas development in Europe is controversial in many countries. The UK and Poland, the countries most in favor of shale gas development, were joined in June 2014 by Germany where fracking technology has been accepted under certain conditions. This last move is strongly correlated to the Ukraine crisis and the increasing tension with Russia.

On the other hand, France remains strongly opposed to fracking and refuses even to deliver exploration permits.

Shale gas development in Europe will be slower than in the US for many reasons including higher population density, different mining codes[24], and a less dense pipeline network. However, thanks to unconventional gas exploitation, Europe's dependency on gas imports could be reduced to 60% instead of the projected 80% by 2030[25].

Importation of US shale gas will improve European security of supply and lower gas prices. However, in the present market conditions it should have only a minor effect on prices, as the LNG exporters will favor Asian destinations where the price premium is higher. This situation could change if, following the Japan Nuclear Regulatory Authority (NRA) and the new Energy Minister recommendations, Regional Authorities allow some nuclear plants

17 Capgemini estimate
18 EIA Annual Energy Outlook 2014
19 DOE: Department Of Energy, FTA: Free Trade Agreement
20 FERC: Federal Energy Regulatory Commission
21 bcf: billion cubic feet
22 If the new EPA (Environment Protection Agency) Legislation on CO_2 emission reductions for coal plants is enforced, EIA predicts that the gas demand would increase (because of power plants switch from coal to gas) only by 5% in 2020.
23 IEA 2014
24 In Europe the underground belongs to the State while in the US it belongs to the surface owner
25 EC study

that were stopped after the Fukushima accident to restart again[26].

Gas prices and contract indexation. Long-term gas contracts were traditionally indexed to the price of oil. This indexation has been very advantageous for suppliers, as oil prices remained high; it is one of the reasons why gas prices are three times higher in Europe than in the US. Gradually, German Utilities, followed by others, have managed to reach a position where more than 50% of their supplies are linked to market prices. More recently, ENI signed a contract with Gazprom at market price (rather than at a rate linked to the oil price).

In the future, oil indexation of long-term gas contracts is likely to disappear, especially if shale gas is developed in Europe, and will be replaced by spot market related prices (as in all commodities).

Security of supply. In April 2014, Gazprom increased gas prices to Ukraine by 80% (from $268.5 to $485.5/1,000 m^3). Ukraine has a $4.5 billion debt towards Gazprom that it refuses to pay, arguing that the prices Gazprom wants are too high. The EU-brokered negotiations failed and on June 16, 2014, Gazprom cut supplies (for the third time in eight years). The situation was not as dramatic as during winter 2009. During the summer, gas consumption is low; Ukraine has roughly six months' reserves and thanks to a mild winter and decreasing gas consumption, the European countries gas stocks were high (64% full).

As a retaliation measure, the EC threatens to apply sanctions and could disrupt the South Stream pipeline (Gazprom's project to bypass Ukraine by moving gas through the Black Sea) by bureaucratic stalling. It has started to do so in Bulgaria.

Nevertheless, the Ukraine-Russia crisis was a wake-up call for European gas security of supply and strengthened the need for Europe to diversify its gas supplies: Russia accounts for 30% of Europe's total gas supplies and about 50% of this gas transits through Ukraine.

If the EU-Russia conflict about Ukraine stays tense and sanctions against Russia are increased, the gas supply situation could be worrying at the beginning of the 2014 winter heating season.

As already stated in our 2009 EEMO, and as was recently confirmed in May 2014 by the EC[27], in order to diversify its gas supplies Europe has several levers:

- Increase LNG imports,
- Sponsor alternative gas pipelines,
- Increase gas storage,
- Increase gas market fluidity,
- Develop shale gas,
- Increase energy efficiency.

However, the present gas market crisis does not provide the right economic incentives for implementation of these levers. For example, LNG imports, accounting for only 20% of Europe's total gas supplies, have decreased in Europe (-28% over 2012). This is mainly due to the Europe-Asia price differential in favor of Asia[28]. Consequently, there is no incentive to build new re-gases facilities as the existing ones are operating at low capacity.

Alternative pipeline routes bypassing Russia, such as the Nabucco pipeline (31 bcm[29]/year of capacity, due to transport Caspian gas), did not materialize, to the benefit of South Stream supported by Gazprom (a project that is also in trouble now as described above). Although no additional transportation pipelines are needed immediately, this shortsighted approach threatens longer-term security of supply.

Gas market fluidity is still much lower than for electricity: for example, in France it will not be until 2018 that the two gas zones are re-unified to form one gas marketplace.

Reverse flows have, to a certain extent, been developed. Ukraine (consuming about 50 bcm of natural gas per year) can now buy gas from Hungary and Poland (nearly 2 bcm was imported in 2013). Starting in September 2014 it should be able to receive 8 to 10 bcm per year from Slovakia. However, in retaliation against sanctions, Moscow is seeking to prevent European countries from re-exporting Russian gas to Ukraine, threatening to deepen the energy crisis Ukraine faces this winter.

Existing gas storage facilities are not currently fully used. Europe needs more underground gas storage but the current economic conditions don't provide the right incentives for building those facilities. Notably, the summer-winter price spreads have decreased and the incentive to purchase gas at lower prices in summer for winter consumption has weakened. This price spread decrease is directly linked to the decreasing use of gas-fired plants in winter (see above regarding the power market chaotic situation).

26 In July 2014, the NRA declared that some reactors (Sendai 1&2) fulfill the recent "post-Fukushima" safety requirements.

27 European Energy Security Strategy communication published by the EC on May 28, 2014 and validated by the European Council on June 27, 2014

28 This situation could change if a tense gas situation leads to higher gas prices in Europe and if Japanese nuclear plants would return to operations decreasing Asia gas demand and prices

29 bcm: billion cubic meter

Energy transition

Germany

The German energy transition Energiewende is facing many challenges. In May 2011, following the Fukushima accident, Germany took a very quick and political decision to immediately shut down nine reactors and to phase out the eight remaining reactors by 2022. It set very ambitious targets for the RES share of electricity generation to reach 80% by 2050 and for CO_2 emissions reduction (a decrease in the range of 80-95% compared to 1990). To meet these objectives, very generous feed-in tariffs were set. Renewable energies generated 81 TWh in the first half of 2014, accounting for 31% of German electricity generation, and the government's 2020 objective of a 35% share should be met. However when the 2011 decision was taken, the government had not forecast the *grid issues*, the difficulties of mastering the fast growth in renewables and the related costs.

The large nuclear plants located in the south of the country (where a large part of the industrial needs are located) are being replaced by decentralized solar PV installations and wind farms (situated in the North of the country). The cost of grid overhaul linked to energy transition will represent around €60 billion over the next 10 years, but the most dramatic issue is that there has been hardly any construction of the necessary new transmission lines. Offshore wind farms aren't yet connected to the grid, although the capital costs have already been spent.

Renewables, especially solar energy, grew in an uncontrolled way. For example, 2008 forecasts for solar PV generation in 2012 were four times lower than the actual figures[30]. Annual subsidies to renewables grew from €3 billion in 2005 to €23 billion in 2014. The related EEG tax rose from €53/MWh in 2013 to €62.4/MWh in 2014 and German residential customers pay twice as much as French ones.

This situation, and projected cost increases, pushed the new coalition government to review subsidies for renewables. The central element of the new law, which took effect in August 2014, is the winding down of the feed-in tariff, which will be phased out entirely by 2018 and replaced with a competitive tendering system. In the name of cutting costs, the average incentive per kilowatt-hour will drop significantly for new installations built after 2014. Moreover, caps will be put on the different renewable energy sectors, prescribing quantities over which the feed-in tariff will no longer apply. In addition, the new law will spread the additional costs to more customers by reducing the number of exempted industrial customers. All these measures should limit surcharges on renewables. The law has still to be approved at EU level.

France

The Energy Bill aimed at creating a new energy model for France was presented on June 18, 2014 by the Minister of Energy, Ségolène Royal. Many discussions will take place at different levels before Parliamentary adoption, probably late in 2014.

The bill aims to change the country's energy balance by reducing the share of nuclear energy and dependence on fossil fuels[31], making the country more frugal in its energy use, and developing renewable energy sources.

The bill sets very ambitious targets: energy consumption reduction of 50% by 2050 (compared to 2012), a 40% decrease in greenhouse gas emissions (GHG) by 2030 (compared to 1990), and a 32% RES share in final energy consumption by 2030.

To achieve the energy efficiency goal, two main levers will be used:

- Improving buildings' energy efficiency with a 30% tax break and other incentives and regulations,
- Promoting electric vehicles by setting a target of seven million vehicle-recharging points by 2030.

The goal of reducing the share of nuclear to 50% of electricity production by 2025 (compared with 75% today) is reaffirmed in the bill. But many strategic choices have been postponed.

Although the law limits nuclear capacity to today's level of 63.1 GW, it avoids specific mention of Fessenheim's[32] closure. However, the capacity cap should force a decision on closures as a 1,600 MW EPR[33] at Flamanville is due to come on stream in 2016 raising the overall capacity of the nuclear fleet. However, the present draft leaves all interpretations open, at least regarding the administrative procedure and timetable. Also, it does not oppose extension of nuclear plants' lifetimes, which, if safety permits, which is recommended by the "Cour Des Comptes"[34].

Under the proposed law, EDF will have, following the multi-annual plans established by the Minister of Energy, responsibility for recommending how to meet the target of a maximum 50% share for nuclear energy in electricity generation by 2025. Those recommendations have to be "consistent with the objectives of the law" and "approved by the State".

"We have to find a clear balance between the aims set by the state and

30 Source RWE
31 It called for a 30% reduction in fossil fuel consumption by 2030
32 Fessenheim is the oldest of the French nuclear plants located near the German border
33 EPR: European Pressurized Reactor
34 French General Accounting office

EDF's interests," declared Ségolène Royal (the French state holds 85% of EDF's capital).

However, the nuclear share reduction and the possible closure of nuclear plants before the end of their lifetime will erode France's credibility as a nuclear generating country and could handicap French nuclear export projects.

The law is also unclear on the *major topic of funding.* The transition is expected to require another €20-30 billion per year of investments for transport infrastructure, renewable energy, and buildings renovation. In times of budget shortages, France would have to be brave to commit funds immediately for a return on investment in 15-20 years!

The energy transition law will also have a big impact on French electricity costs. Today, thanks to nuclear energy, French electricity is 30% cheaper than the European average.

Even if in the future, the costs of existing nuclear plants will increase to €60/MWh[35], they are still cheaper than fossil fuel fired plants costs (at €70-90/MWh) and the cheapest renewable, onshore wind, which costs are around €73/MWh[36] (without allowing for the impact of renewables on the grid, which can double the total cost – see above).

According to UFE[37], the reduction of the nuclear share in the electricity mix should trigger an electricity cost increase of €30-40/MWh, in addition to a similar increase linked to former environmental commitments (the Grenelle de l'environnement).

These increases will affect customers, especially residential customers whose standard of living are already eroding.

It will also have a major impact on the survival of French industry, especially energy-intensive sectors facing international competition. These sectors are already struggling with European electricity prices twice as high as in the USA[38] and gas three times as high (while they were at the same price level ten years ago).

Climate change

The first lessons from the fifth IPCC report[39] are clear: global warming is unequivocal; human activity almost certainly accounts for most of the warming observed since the mid-twentieth century; and our planet will probably be exposed in coming years to more violent and more extreme weather.

The IEA[40] estimates that the global temperature increase could reach 3.6°C to 5.3°C in 2020, which is well over the 2°C threshold that nations have undertaken to comply with. Moreover, the global CO_2 emissions level has surged in 2013 at its fastest rate for 30 years.

To stand any chance of limiting our planet's increase in temperature by the end of this century to 2°C, profound changes in economic models and lifestyles will be essential, and emissions will need to be reduced by 40-70% before 2050. This is a formidable challenge.

While developed countries are managing to stabilize their emissions, the IEA estimates that 75% of increased CO_2 emissions between now and 2050 will come from developing countries, with India and China alone accounting for almost 50% of this increase.

Trying to recreate a new Kyoto Protocol, which would impose a mandatory emissions reduction on all countries by 2030, would not be acceptable in the eyes of Americans, who reject any idea of a new Kyoto, the Senate would not authorize the ratification of. Nor is it acceptable in the eyes of developing countries that refuse to allow Western countries to limit their necessary development.

However, we are witnessing some improvements from the two major players: the US and China.

The US plays a pivotal role in these discussions for many reasons:

- It is the second largest emitter of CO_2 after China (14% share in 2012, well behind China at 27%). It would be impossible to persuade emerging countries to curb emissions if the US were not to join in,
- Its emissions per head are roughly double those of leading Western European economies or Japan,
- The US has unsurpassed scientific and technology resources that are essential for tackling the challenge of combining low emissions with prosperity[41].

There is encouraging news from the US. For example, CO_2 emissions have decreased recently thanks to cheap shale gas replacing coal in power plants[42] and to new automotive emissions reduction regulations. In June 2014, *The President's Climate Action Plan* was published; its goal is to

35 Cour des Comptes report published in May 2014; EDF's investments in maintenance to extend nuclear reactors lifetime beyond 40 years are estimated at €55 billion investments over the next ten years

36 "Energies 2050" report 2012

37 UFE: Union Française de l'Electricité, 2013 study

38 The US energy prices have decreased thanks to the shale gas boom

39 IPCC: Intergovernmental Panel on Climate Change Fifth Assessment Report (AR5)

40 International Energy Agency's report "Redrawing the Energy-Climate Map", June 2013

41 Martin Wolf, Financial Times, July 2014

42 In 2012, US carbon dioxide emissions reached their 1992 level despite increasing population and a (somewhat) growing economy

cut GHG emissions by 17% below 2015 levels by 2020. This is why the EPA[43] has proposed a new regulation aimed at limiting emissions from coal plants.

Also, China needs to react quickly as it is confronted to the problem of excessive pollution in certain cities that creates health problems and hampers the country development.

In 2012, "the 18th National Congress of the Communist Party of China (CPC) wrote ecological civilization construction into the CPC constitution for the first time"[44]. However, given insufficient development and a lack of accompanying social side effects, tackling pollution in China, as in many other developing countries, requires more determination and courage than required from developed countries. One of China's goals is to reduce CO_2 emissions per unit of gross domestic product by 40-45% from 2005 levels by 2020. *"The Chinese people have to tighten their belts to achieve this target"* said Zou Ji, director of the Program of Energy and Climate Economics at Renmin University of China. It is estimated that to meet the goal, China needs to invest $78 billion annually, the equivalent of $166 per family.

Before the "Le Bourget" (France) Climate conference in 2015, negotiations between the EU and the two major emitters, China and the US (and between the two latter countries), will be crucial.

The transfer of low-carbon technologies is an important lever to moderate GHG emissions by developing countries. It is the role of the Technology Mechanism, created in 2009[45]. For example, refurbishment of existing coal-fired power stations, worldwide, using the best technologies available, would reduce CO_2 emissions by more than 1,000 million tons per year, or 3% of global emissions from the burning of fossil fuels in 2012.

The transfer of low-carbon technologies raises obvious intellectual property rights concerns for the states providing them. The CERNA[46] study addresses this dilemma facing developed countries and finds that benefits would exist for both recipients and providers of the technologies.

Only certain emerging countries (China, Mexico and South Africa) are already recipients of technology transfer from developed countries. However, India, the other developing Asian countries, and Africa receive insufficient technology transfer in view of their potential to reduce GHG emissions. The least developed countries, in particular, are practically left out of such transfers.

Energy efficiency

Our planet's energy resources are limited; in order to allow developing countries to grow their energy consumption, developed countries need to curb their energy consumption.

There is also growing societal pressure to decrease household energy bills. In view of the present economic crisis and energy price increases, a growing number of consumers are at risk of fuel poverty[47]. Their share of the total consumer base varies in Europe between 15 and 50%. As an example, 3.8 million French households (compared to 31 million in total) dedicate more than 10% of their budget to energy spending. With energy prices forecast to grow, the only solution is to decrease consumption.

43 EPA: Environmental Protection Agency

44 http://www.chinadaily.com.cn/opinion/2012-11/19/content_15942603.htm –

45 Copenhagen Climate Change Conference, December 2009

46 CERNA: Centre d'Economie Industrielle (Ecole des Mines de Paris)

47 In its broadest sense, fuel poverty is defined as the proportion of people unable to afford a proper indoor thermal comfort. Fuel poverty is also often defined as the proportion of people whose energy budget exceeds 10% of their revenue

These factors underline the importance of energy efficiency, sometimes called invisible energy, and measured in negawatts.

Energy intensity (measured in toe[48] to produce €1 million of GDP[49]) has improved in the last 20 years, especially in the industrial sector. In France, for example, in 1981, 122 toe of energy use was needed to produce €1 million of GDP. The figure was no more than 85 in 2012, which corresponds to an improvement of 30% in energy intensity[50].

However, there is still room for progress, especially in the transportation and building sectors.

In the housing sector, progress can be achieved through a combination of different factors:

Public awareness. In Japan, after the tsunami, a target of 15% reduction in electricity consumption was reached for summer 2011, and electricity demand fell by more than 4 GW (16.6 GW in summer 2010 and 12.5 GW in summer 2011), thus avoiding a blackout. In 2014 also, an energy savings campaign has been launched before the summer.

On peak demand days in France, RTE's[51] Ecowatt alerts ask consumers (notably in Brittany) to curb their demand during peak hours and they get a positive response.

However, in ordinary circumstances cultural habits take time to change.

Regulation. In a certain way new buildings are easier to deal with as low energy consumption regulations apply. Regulation also has an impact when property is bought and sold, as an energy audit is required from the seller, making the new owner aware of future energy expenses. The main problem lies in existing buildings, and is made more complex by the different objectives of owners and tenants.

Encouraging individuals to invest in modernizing their homes. Many incentives exist including financial subsidies (household premium tax credit, reduced VAT, Energy Efficiency certificates). However, they are not sufficient. At the end of 2013, in the general framework of the Public Energy Debate, the French government launched a "renovation passport" in order to overcome difficulties such as:

- Few structured and "end-to-end" energy efficiency offers and,
- Energy price levels that do not give sufficient financial return on energy efficiency works.

Various financial incentives for energy efficiency will be provided by France's new Energy Bill; however, the funding announced seems too low to have a significant impact.

Devices

Smart meter deployment. The EC's third package of legislative proposals for electricity and gas markets requires Member States to ensure implementation of smart meters. This implementation may be subject to a long-term cost-benefit analysis (CBA). Where the CBA is positive, there is a rollout target of at least 80% market penetration for electricity by 2020. To date, Member States have committed to rolling out close to 200 million smart meters for electricity and 45 million for gas by 2020 for a total potential investment of €45 billion[52].

By 2020, it is expected that almost 72% of European consumers will have a smart meter for electricity while 40% will have one for gas.

Smart meters are the norm in Italy and Sweden. Finland completed its deployment of 5.1 million smart meters by the end of 2013, becoming the third European country to finalize the mass rollout.

- In Spain, Endesa, Iberdrola and Gas Natural Fenosa are ordering devices for an installation program that should see 70% of households equipped by 2016 and universal adoption by 2018,
- In France, the decision to deploy electricity smart meters (cost estimated between €5 and €7 billion for the 35 million meters) was taken in early July 2013 with a first phase of three million meters to be installed by 2016. In August 2013, the French government approved deployment of 11 million gas smart meters to take place during the 2016-2022 period,
- In the UK, 59 million electricity and gas smart meters will be deployed by 2030.

Estimates vary across EU Members but the cost of a smart metering system averages between €77 and €766 per customer for electricity (for gas, it ranges between €100 and €268 per customer), while the meters deliver benefits per metering point of €160 for gas and €309 for electricity on average.

On energy savings, the estimates also vary widely with, on average, 3% energy savings. The peak load shifting varies greatly from 0.75% (UK) and 1% (Poland) to 9.9% in Ireland.

For greater energy savings, smart meters should be combined with incentive tariffs such as time-of-use tariffs. The emergence of smart household devices should increase overall energy savings efficiency.

48 Toe: ton of oil equivalent

49 GDP: Gross Domestic Product

50 But the weight of services in the French value added increased from 64% in 1980 to 79% in 2012, while the share of industry has declined from 24% to 12.5% over the same period.

51 RTE: Réseau de Transport d'Electricité, the French TSO

52 Cost-benefit analysis & state of play of smart metering deployment in the EU-27 (commission staff document June 18, 2014)

Internet of Things. This sector is developing rapidly. It is estimated that in France, in 2020 each household will have around 150 connected objects. Smart home appliances, embedded with sensors that connect them to the user's smart phone or tablet, promise to revolutionize our approach to energy use – and make the smart home a reality[53].

Nothing has highlighted these changes better than Google's $3.2 billion acquisition in January 2014 of Nest Labs, a start-up that offers smart thermostats and alarms for the home. Users can turn up or switch off their heating from anywhere using a smartphone.

Apple is working on a software platform that will turn the iPhone into a remote control for light security systems and other appliances. Samsung recently unveiled its Smart Home range of washing machines, refrigerators and TVs that can be controlled from its mobile phones and watches.

This new trend, while forcing Utilities to rethink their business models (see below), should enhance energy savings as it gives customers a direct sense of the energy (and money) they're spending.

Preparing for the future

In Europe, Research and Development (R&D) efforts are promoted at two levels: Member States research and EU funding. The EU funds projects through various types of initiative: project funding; partnerships between public institutions such as the European Energy Research Alliance (EERA) founded by leading European research institutes; public-private partnerships such as Joint Technology Initiatives (JTIs) involving industry, research communities, and public authorities; and industry-led initiatives such as European Industrial Initiatives (EIIs). The funding recipients have to comply with EU rules (for example, on the number of EU Member States involved and the inclusion of new EU Member States).

The amount of EU spending on energy research is difficult to assess. It is probably comparable with US spending, which is mainly led by the Department of Energy, but much more dispersed and probably less effective.

The Lisbon Strategy was adopted for a ten-year period in 2000 by the European Council. It broadly aimed to make Europe, by 2010, the most competitive and dynamic knowledge-based economy in the world.

It was heavily based on the economic concepts of:

- Innovation as the vehicle for economic change,
- The knowledge economy,
- Social and environmental renewal.

Translating the Lisbon Strategy goals into concrete measures led to the extension of the Framework Programmes (FPs) for Research and Technological Development. The Seventh Framework Programme (FP7) bundled all research-related EU initiatives together under a common roof; it ended in 2013, and was followed by Horizon 2020 (previously named FP8).

Horizon 2020 is the biggest EU Research and Innovation program ever, with nearly €80 billion of funding available over seven years (2014 to 2020), in addition to the private investment that this money will attract.

Within Horizon 2020[54], the Energy Challenge is designed to support the transition to a reliable, sustainable and competitive energy system.

53 Financial Times special report June 24, 2014

54 http://ec.europa.eu/programmes/horizon2020/en/h2020-section/secure-clean-and-efficient-energy

It is structured around seven specific objectives and research areas:

- Reducing energy consumption and carbon footprint,
- Low-cost, low-carbon electricity supply,
- Alternative fuels and mobile energy sources,
- A single, smart European electricity grid,
- New knowledge and technologies,
- Robust decision making and public engagement, and,
- Market uptake of energy and ICT innovation.

The cost of this initiative is estimated at €9 billion over ten years. A budget of around €6 billion has been allocated to non-nuclear energy research for 2014-2020.

The first work program will be split into the following focus areas:

- Energy efficiency: research and demonstration activities within this area will focus on buildings, industry, heating and cooling, energy-related products and services, integration of ICT, and cooperation with the telecom sector,
- Low Carbon Technologies: research activities within this area will cover solar PV power, concentrated solar power, wind energy, ocean energy, hydro power, geothermal energy, renewable heating and cooling, energy storage, bio-fuels and alternative fuels, and carbon capture and storage,
- Smart Cities & Communities: sustainable development of urban areas is a challenge of key importance. It requires new, efficient, and user-friendly technologies and services, particularly in the areas of energy, transport and ICT. However, these solutions need integrated approaches, in terms both of R&D leading to advanced technological solutions and of deployment. The focus on technologies for smart cities will result in commercial-scale solutions with a high market potential.

In all programs, data collection, processing and usage are essential technologies, demonstrating that digital technologies are key enablers for the future.

It must be hoped that all these numerous projects will be monitored in a coherent and sound way and that they will bring more economic growth and competiveness to Europe.

Utilities

The Utilities are in a difficult situation and must adapt to changes in their business environment and customer demands.

For consumers, residential or commercial, electricity and gas have become commodities; the consumer now expects services, including energy management, from the supplier.

Consumers have also become producers on the basis of solar and wind energies, which are decentralized and intermittent. This phenomenon is no longer marginal – Germany now has around 6.35 million prosumers[55]. Some communities wish to manage their own energy and even become self-sufficient by combining decentralized generation, energy savings, new devices such as smart meters, and up-to-date information and communication technologies. There are many European Smart City Models involving companies from various sectors: construction, IT and telecom, electrical equipment manufacturers, service companies, regulators and Utilities.

These concepts are certainly well suited to isolated regions with no or limited grid access. They represent a threat for Utilities but also open new opportunities for them.

New competitors are emerging. Traditionally, competition came from foreign Utilities wanting to conquer new markets in order to compensate for the loss of clients in their domestic market. But now competitors from different sectors are trying to penetrate the electricity and gas retail markets: for example, Magyar Telekom sells electricity and gas to residential and business customers; Marks and Spencer (M&S), the UK retailer, has teamed up with Scottish and Southern Energy (SSE) to offer energy packages with the promise of M&S vouchers for those who make the switch.

Under these pressures, Utilities have to become more reactive and flexible, and improve their competitiveness. To achieve these new goals, they will have to embed digital technologies and mobility in their business models.

With a growing share of renewables in electricity generation, **grid management** will have to become smarter, with a dual flow of electrons and Megabytes on the grid (see above). Also, the exchange of information by digital means will profoundly change the operation and maintenance of the network business (remote reading of meters, maintenance workers equipped with mobile terminals, etc). This digital revolution will only be efficient if internal processes are transformed and collaborators move to new work habits.

The client relationship is evolving quickly and new digital technologies will have to be widely used. For example, GDF Suez launched "Happ'e", a 100% online supplier offering electricity with

55 Financial Times, June 24, 2014

a price discount of 5 to 10% aiming to win 20-30,000 clients in 2014.

Utilities are also enhancing their client relationships by adding new services including energy diagnosis, building insulation improvement, and efficiency services via smart meters and connected devices. For example, British Gas (UK) recently launched a service called Hive Active Heating enabling its customers to remotely control their heating and hot water. Potential savings could be £150 per year per household.

Utilities have or are developing **Services Business Units** that are not capital intensive[56] and have few entry barriers. These Business Units can represent a significant portion of the workforce (78,000 employees in GDF Suez from a total of 138,000).

Others increase their presence through acquisitions: for instance, EDF acquired Dalkia France (13,000 employees) in late 2013.

Finally, Utilities want to continue to **expand outside Europe.** Some are already international:

- GDF Suez is the most diverse (number one in the Middle East, number two in Brazil),
- 40% of Enel's turnover comes from developing countries, and the objective is to reach 50% in 2017,
- Only 6% of E.ON's turnover is generated abroad (Turkey, Russia, Brazil) but its ambitions are strong.

There are many risks to manage: local country knowledge, political instability, local regulations, fluctuating exchange rates etc, but in counterpart these regions have more attractive growth than Europe where growth is stalled.

Conclusion

Compared to the previous period and following wide-ranging lobbying[57], the EC is realizing that reforms are needed to restore sustained electricity and gas markets in Europe.

It has embarked on changes such as setting a single CO_2 emissions reduction objectives for 2030 (instead of three distinct objectives); reducing funding for renewables and relating it to market conditions; creating a market stability reserve to manage the ETS market in line with the European economy; and accepting implementation of capacity markets in Member States (with different designs allowed).

However, more profound reforms are needed and the present situation of chaotic wholesale markets, with negative wholesale prices and increasing prices for retail customers, is likely to prevail in coming years.

A market design overhaul is needed, and the new EC will have to adopt a pragmatic position and implement new rules for the electricity and gas markets. With hindsight, the initial approach, derived from the telecommunications market, was not well suited to those parts of the Utilities value chain (such as generation and transportation) that are long-term, heavy investment industries. That liberal approach, based on enhancing competition, was better suited to retail businesses.

In-depth reforms are therefore urgently needed in order to restore stable market conditions and ensure that lights will stay on.

This winter, security of supply is already threatened in certain European countries (for example, Belgium). In one or two years, this could be the case in others, such as France.

56 Particularly significant in view of Utilities' high levels of debt

57 Magritte is an association of 11 large European Utilities CEOs aimed at lobbying the European Commission

In the longer term, investments are needed: by 2035, Europe will need to invest $2,200 billion in electricity infrastructure alone. With the present uncertain situation and the difficult financial environment for Utilities, these investments could be delayed and security of the electricity supply could be at risk in the long term also.

Energy transition plans continue to be developed in several European countries. Germany, which started its plan in 2011, is encountering many difficulties, and the lessons learned there should be taken into account by other Member States (such as France) adopting new energy bills. One drawback of these energy transition plans is the impact of electricity retail price increases on the residential, tertiary and industrial sectors.

The competitiveness of European industries is a key factor in the region's economy. Tax exemptions related to renewables' and grid costs have been implemented in Germany and could be extended to other countries. The problem with those exemptions is that the burden of cost increases is greater for non-exempted sectors, including residential customers. If special energy price discounts for fuel-poor consumers are added, the burden becomes even heavier for others.

Adoption of new technologies like fracking should (as in the US) decrease oil and gas costs, boost the energy-intensive industrial sector, and improve energy independence.

Security of the energy supply is a permanent objective that we, in the EEMO, have constantly stressed. This year the Ukraine-Russia crisis has been an eye-opener for security of the European gas supply, and could lead to supply cuts if the EU-Russia relationship stays tense.

The EU is committed to a well-funded R&D program (Horizon 2020), and many Member States are increasing their investments in R&D. In the longer term, these efforts should help improve the overall performance of European companies and the quality of day-to-day life for European citizens.

A recurring theme in the R&D priority actions is collecting, understanding and adequately using big data. This is a reflection of the digital world we are entering.

Utilities should take advantage of this revolution, especially in the grid management and customer relationship parts of their value chain. They must continue to transform themselves. Becoming true "Digital Utilities" will enable them to be more adaptive and competitive, and become the winners in these difficult markets.

Paris, September 15, 2014.

Colette Lewiner

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(a) Based on CRR-CRD4 rules published on June 26, 2013, including the Danish compromise - no phase-in except for DTAs on loss carry-forwards

Figures as at June 30, 2014

More information at www.natixis.com

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About VaasaETT
VaasaETT is a research and advisory consultancy dedicated to customer related issues in the energy industry. VaasaETT advises its clients based on empirical evidence brought about from extensive research in the area of customer behavior and competitive market behavior (including smart energy offerings, demand response, energy efficiency, smart home, smart grid). VaasaETT's unique collaborative approach enables it to draw on an extensive network of several thousand energy practitioners around the world who can contribute to its research activities or take part in industry events it organizes allowing VaasaETT to integrate global knowledge and global best practice into its areas of expertise. VaasaETT's truly global focus is reflected by research and strategic support having been provided to a diverse array of organizations on 5 continents including for instance 28 of the Fortune Global 500 companies, the European Commission, Government and public research bodies in Europe, Japan, the UAE, the Middle East and Australia.

More information at www.vaasaett.com

About the European Energy Markets Observatory

Initiated in 2002, Capgemini's European Energy Markets Observatory (EEMO) is an annual report that tracks progress in establishing an open and competitive electricity and gas market in EU-28 (plus Norway and Switzerland) and the progress in reaching the EU's 3x20 climate change objectives. The report looks at all segments of the value chain and analyzes leading-edge energy themes to identify key trends in the electricity and gas industries.

The analysis is made by a team of consultants and regional experts of **Capgemini Consulting**, the global strategy and transformation consulting organization of the Capgemini Group. Their in-depth knowledge combined with sector news crunching provide an insightful analysis which is enriched by the expertise from our selected partners: Natixis, VaasaETT and CMS Bureau Francis Lefebvre.

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