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European Energy Markets Observatory

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Global Energy Think Tank

Contents

Tables

Country Focus

Topic Focus

A Strategic Overview of the European Energy Markets

Editorial by Colette Lewiner

The economic situation impacted energy trends

As foreseen, 2009 was a crisis year in Europe and in the US. While other regions in the world recovered by mid 2009, it was only at the end of 2009 that green shoots appeared in North America followed by Europe. Hopes were high in early 2010 that the economy would grow, albeit even slowly, however the solvency of certain European countries highlighted the eurozone fragility. Combined with a slower growth in the US and other countries, it has introduced doubts about a sustained recovery. Bumpy recovery scenarios have emerged again in Europe.

In China, India and other developing countries such as Brazil, the crisis, if any, was for a short duration and they are now enjoying a healthy growth.

While we need to acknowledge these regional differences related to economic recovery, let's recognize that many commodity markets including oil are global. Moreover, worldwide energy related resources are limited – around 40 years of consumption in conventional oil reserves; 60 years for conventional gas reserves (with non conventional gas, the technically recoverable gas resources would be worth 250 years of current production[1]); and much more for coal and uranium of around 100 years. Energy markets are, therefore, operating within not so long-term boundaries and what happens in one region of the world impacts the others. While oil and coal are true global markets, gas and electricity markets are not. However, the growing market share of liquefied natural gas (LNG) is allowing increasing global gas exchanges and, with electricity interconnections development, today's national electricity markets are moving regional.

Developing countries, and especially the Asian recovery, have triggered higher oil demand. Consensus now expects oil demand to increase by 1.8mb/d (+2.2%) and by 1.3mb/d (+1.5%) in 2010 and 2011 respectively[2]. With limited production growth from non-OPEC regions, and the expectation that few new fields will be brought on stream in the OPEC countries, one can forecast tighter oil markets. A tighter oil market, with a need for OPEC to increase production, should trigger higher oil prices. Prices have already increased from about US$50 per barrel in the spring of 2009 to about US$80 per barrel at the beginning of September 2010. In addition, the fall of the euro against the US dollar has made European imported energy even more expensive, possibly impacting the fragile economic recovery.

This upward oil prices trend should continue in the future as unconventional supply will be at a high cost. For example, heavy oil extracted from tar sands in Canada will be more costly to exploit (extracting oil from tar sands is economically viable with a barrel at US$80) and in addition the projects are facing opposition linked to their environmental impact. Needless to say that the BP Macondo well accident in the Gulf of Mexico will push regulators to tighten security rules on deepwater exploration and production and to possibly increase liability caps resulting in higher producing costs.

In an opposite movement, the spectacular development of unconventional gas in the US, that today provides around 50% of their production combined with the economic crisis, has led to a sharp gas price decrease. Prices in the US fell to historical lows of US$4/MBtu in September 2009 and have rebounded to US$6/MBtu in January 2010. They are significantly lower in the US than in Europe.

It is interesting to note that gas prices in the US and to a certain extent in the UK are no longer correlated to oil prices. On continental Europe, Gazprom is publicly opposed to gas contracts indexation to spot prices arguing that European trading hubs are not liquid enough and that prices could be manipulated by the large players who are at the same time their clients! However, during the winter of 2009/2010, due to surplus supply in Europe and full storages, Gazprom accepted some concessions to its usual contractual policy (take-or-pay contractual obligations and oil prices indexed contracts) by accepting to cancel some committed quantities and, for limited volumes, to sell at spot prices. Gas spot prices were down in 2009 with little rebound (at €12/MWh on average). On the contrary, and because of increases in oil prices, long-term continental European gas supply prices increased at the end of 2009 and into early 2010 (at €21/MWh on average). In certain countries such as France this wholesale price increase was reflected in retail tariffs that triggered public protests.

At equal energetic content, with these low spot prices, gas is significantly cheaper than oil while being less polluting. This anomaly should be corrected in the long-term. Two things could happen (or a combination of both): either a massive gas substitution to oil happens or gas prices go up as investments in gas exploration and production (onshore, offshore or shale gas) become less attractive, thereby, creating a tense supply situation.

In Europe, electricity wholesale prices went down on average in 2009 compared to 2008 and are stable since the beginning of 2010. Retail prices for all customer segments followed this trend.

1 IEA World Energy Outlook 2009

2 IEA Oil market report, August 2010

Some retail electricity tariff increases occurred in mid 2010. In France, for example, electricity tariffs were raised by 3.4% on average in order to finance heavy investments needed mainly in generation plants. Electricity tariff increases took place in other European countries (+2% in Germany in H1 2010; +4% in Spain; and +4.2% in Sweden announced on July 1, 2010).

Energy consumption decreased in 2009 and has started to increase again in early 2010

In 2009, we witnessed a historical consumption decrease worldwide for all forms of energy: oil, coal, gas and electricity.

In Europe, 2009 electricity and gas consumption decreased compared to 2008 (-4.7% and -6.1% respectively[3]) triggered by the industrial sector with, at the beginning of 2009, a 10% or more monthly decrease. The residential sector was resilient with, in certain countries, even an increase in demand.

In last year's edition of our Observatory, we predicted a recovery in 2010 which has happened. In H1 2010, electricity consumption increased by 3.4% and gas consumption increased even more by 10.3%[4].This apparent electricity and gas growth was, however, higher than in normal conditions as we experienced a very cold winter of 2009/2010 in Europe with temperatures below the decennial average by 2 to 4°C.

Future energy consumption evolution will be mainly linked to three factors:

- **Economic situation:** For certain sectors such as industry, there is a significant elasticity between the economic situation and energy consumption while elasticity is low for residential usages that are linked to the fundamental needs of heating or cooling for example. Accordingly, the economic crisis has triggered a decrease in the electricity and gas industrial consumption as plants' capacity was only partially needed. With the necessity to replenish low stockpiles, plants have operated, since the beginning of the year, at a higher capacity (the EU-27 industry production index gained more than four points since January 2010). However, this crisis has accelerated the industry production geographical shift to Asia despite governments' pressure to stop or at least slow down these relocations as they destroy European jobs. This trend should continue to bring down energy consumption and CO_2 emissions;
- **Future regulation effects:** In addition to the European Climate-Energy package effects, energy savings regulations recently adopted by the Member States will impact energy consumption in the mid-term. As an example, the French Grenelle de l'Environment[5] comprises various measures to improve building insulation (400,000 homes per year at cruising speed), to reduce the cars gasoline consumption with a "green sticker" (in order to meet the European standard of 120 g/km in 2012) and to encourage the use of rail transportation. The energy savings related to these regulatory effects will take longer to produce results but they will be more sustained than those linked to the economic crisis;
- **Customer behaviors** that are a key element for sustainability:
  - There is a general need for more comprehensive *public information* on energy. Explanations on energy resources boundaries, on energy savings necessity and also on the need to build energy related infrastructure should trigger savvier behaviors;
  - *Price signals*, as time of use rates or energy prices increases, also contribute to virtuous customer behaviors. However, during economic recession times, governments that try to avoid deteriorating their citizens' purchasing power were reluctant to increase electricity and gas prices. However, prices have to increase on a mid-term horizon;
  - *Demand response programs:* New devices – smart meters and intelligent home devices – are a key investment that improves customer energy consumption awareness and energy demand management efficiency. The EU 3rd Legislative Package (adopted in April 2009) recommends that 80% of the European population to be provided with intelligent meters by 2020. Up to now, this recommendation had little impact as the Return on Investment (ROI) for Utilities on smart meters and for individuals on intelligent home devices is not good enough. A key benefit for Utilities comes from the winter or summer demand peak shavings, thus avoiding new plants' or grids' construction. However, following the European market liberalization, the Utilities value chain is now split between regulated (transmission and distribution) and unregulated (generation, trading and sales) activities. As metering is usually part of the distribution regulated business and as a large proportion of savings related to smart metering investments come from the unregulated generation unit (i.e. peak load costs savings), the distribution unit's smart metering ROI is unattractive and investment decisions are difficult to take. In Italy, smart meters are fully implemented. Sweden took the roll out decision in 2003 while France has just decided to implement them

3 Amended geographical perimeter (EU-27 but Malta and Cyprus + Norway and Switzerland), the reference used in this report

4 SG Energy Pulse index tracks the monthly consumption of a focus group comprising, for electricity: France, the UK, Italy, Belgium, Greece Portugal, Denmark, Spain and Poland (i.e. 60% of EU-27 electricity consumption) and for gas: France, Portugal, Spain and the UK (i.e. 36% of EU-27 gas consumption)

5 The "Grenelle de l'Environnement" is a Round Table on environmental issues to define the key points of government policy on ecological and sustainable development issues for the coming five years. More information are available at http://www.legrenelle-environnement.fr

(September 2010[6]). Many other European Member States' governments have been slow to impose smart meters deployment. This is regrettable as smart meters, in conjunction with demand side management Utilities programs, should lead to significant savings in electricity consumption, peak power and CO_2 emissions. A Capgemini study[7] shows that dynamic programs launched in the EU-15[8] countries could save 200 TWh per year by 2020 (which represents the combined residential consumption of Spain and Germany). Remote control programs of electrical appliances that have shown very positive results in the US (for example in Florida and Texas) should also be considered in addition to or replacement of smart meters deployment in Europe.

In the mid-term, all these combined factors should lead to a slower electricity consumption growth.

The European energy mix is slowly becoming greener

According to the EU objectives, and in addition to the energy savings, the energy mix should evolve towards lower CO_2 emitting energy sources. Both energy usages and types of new plants impact this energy mix.

Energy usages

As an example, the transportation sector which is heavily oil dependant, is one of the biggest CO_2 emitters and has to evolve to both low consumption vehicles and other types of fuels (2nd generation biomass and / or electricity). Nearly all of the world's largest car manufacturers now plan plug-in hybrid vehicles or fully electric vehicles within two years. Battery improvement is a bottleneck for the massive deployment of electric vehicles. Manufacturers are developing efforts to increase batteries' autonomy between two loads and to decrease their weight. Commercial innovations such as renting batteries instead of buying them will also help the electric vehicles deployment. Massive electric cars adoption, when it happens, will impact the distribution grid management and, if not carefully thought out, could push up evening electricity peaks. It is worthwhile noting that electric vehicles while contributing to reduce local pollution do not automatically reduce global CO_2 emissions unless the electricity generation is predominantly CO_2 free produced by renewable and nuclear plants. This is the case in France but not in Germany for example.

New generation plants

As predicted in last year's edition of our Observatory, real engagements in new generation plant constructions have slowed down in 2009, while the longer term plans are officially untouched. This is a reflection of the financial crisis, the Utilities sector financial situation, and the short-term consumption decrease.

- *Gas:* Our Observatory also shows that Utilities are investing mainly in gas-fired plants, taking advantage of lower investment costs than for other types of plants, shorter construction duration and hoping that the present low gas prices will remain in the future. In France, for example, these plants are mainly used in peak and semi-peak hours. As in many European countries, winter (and even summer) load peaks are predicted to be sharper and sharper; the related gas consumption should go up unless efficient demand side management projects, helping to "shave" the peaks, are implemented;
- Despite the dominance of gas and other fossil fuels, year-after-year the primary energy mix tends to become "greener". In 2009, regional investments in *renewable energies* were impacted differently by the crisis. Global investments in clean energy only decreased by 7% to US$162 billion according to Bloomberg New Energy Finance with contrasted situations: growth in Asia especially in China (+53%) which offsets falls in North America (-38%) and in Europe (-10%). China is now the biggest wind power market, doubling its installed wind capacity in 2009 by adding over 13,000 MW, and the biggest wind turbines manufacturer. China is also the world's leading solar panel producer, with a 32% market share in 2008, and solar panels exports valued at US$15 billion.

In 2010, worldwide funding is increasing as US$248 billion of the stimulus funding should go on green projects. In Europe, a €4 billion energy infrastructure investment plan was adopted by the EU Member States in May 2009 of which €565 million was dedicated to specific offshore wind projects and €910 millions to smart grids.

However, this improved 2010 investments' situation could be hit again by governmental subsidy decreases linked to the rigorous plans that are being adopted in most European countries. Many countries, including Spain, Italy, France and Germany, have reduced their subsidies to renewables (especially wind and solar energy). Recently, in addition to cuts on subsidies to wind and thermo-solar plants, Spain announced in June 2010 its intention to cut by 45% guaranteed subsidized electricity prices paid to new solar photovoltaic (PV) power plants. In France, on September 1, 2010, the government decreased the solar PV feed-in tariffs by 12% in an attempt to prevent a speculative bubble.

Until green energy becomes profitable, the industry will rely on government incentives to keep it alive. Solar power, for example, is still about three times more expensive than coal and onshore wind is the only green energy source considered a break-even prospect. However, higher and sustained oil prices could improve green energy development.

We are continuing to witness a *nuclear renaissance* in Europe and more countries now have a positive attitude towards nuclear plants. Lifetime extension programs have been launched in Belgium, Spain and are envisaged in France (with an investment spending of around €3 billion). Provided safety is kept at high levels, these programs have a high ROI: in France, around €0.5 billion should be spent per reactor for a ten year – or more – lifetime extension compared to around €5 billion cost of a new EPR plant.

In Germany, the coalition government has taken a position in September 2010 to extend the nuclear power plants lifetime by 12 years on average. To compensate

6 Decree imposing the start of smart meters roll out in 2012 and 95% of clients equipped in 2016 – September 2, 2010

7 "Demand Response: a decisive breakthrough for Europe", a Point of View by Capgemini, Enerdata and VaasaETT, 2008

8 EU-15: original 15 Members of the European Union until May 1, 2004: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the UK

for the windfall profits that they make because of lifetime extensions, nuclear power plant operators will have to pay a "fuel-element tax" totaling €2.3 billion per year for six years. They will also have to pay a supplementary "eco-tax" that amounts to an estimated €15 billion during the remaining lifetime of Germany's nuclear units. They will continue to pay a voluntary contribution of €300 million a year in 2011 and 2012, and €200 million a year from 2014 to 2016 for the construction of renewable energy plants. They will pay more after 2016 when the windfall-profit tax will no longer be payable. Despite all these extra taxes, analysts view these decisions as favorable for the German nuclear operators, E.ON, RWE and EnBW.

Finland, France and the UK were the first European countries to take decisions to build new plants. They were followed by a number of Eastern European countries including Slovakia, the Czech Republic, Bulgaria and Romania. In July 2009, Italy removed its nuclear moratorium and in June 2010 Sweden voted to allow new plants to be built. Other countries will follow (possibly Switzerland and the Netherlands).

However, the first European plant completion (Olkiluoto in Finland and Flamanville in France) are delayed mainly because of EPR's[9] design complexity and construction difficulties.

These EPR delays are also an illustration of the necessity for the industry as a whole to ramp up its facilities, quality insurance and human capabilities as it seems to be more painful than forecasted. On the positive side, as consumption growth is slowing down, the need for these new plants is delayed, thus leaving more time for their completion. On the negative side, the present delays are increasing the final electricity cost as initial investment accounts for 60 to 80% of the generated electricity costs. These construction risks could threaten the nuclear energy competitiveness and render new nuclear plants more difficult to finance.

Many Utilities are focusing on reducing their debts

As a consequence of a bullish acquisition strategy from 2006 to 2008, many large Utilities' war chests have significantly decreased triggering divestments in order to restore the balance sheet. Networks, having long-term recurrent revenues, were seen as easier to sell assets. For example, EDF has agreed to sell its UK distribution networks to a consortium headed by Hong Kong billionaire Li Ka-Shing for UK£5.8 billion.

In addition to cash, Germany's transmission network sales allowed E.ON and Vattenfall Europe to obtain from the EU DG Competition a drop of their charges.

In a similar move, Italian Eni announced that it plans to sell stakes in three major pipelines (valued at €1.5 billion) as part of a potential settlement with the EU regulators over alleged anti-competitive behavior by the company's natural gas pipeline business.

Following the same trend, Enel sold 80% of Endesa's gas pipelines to two Goldman Sachs' infrastructures funds for €800 million.

This cash situation explains that, while we are witnessing many mergers and acquisitions in the Oil and Gas sector, there are fewer in Utilities. However, GDF SUEZ after the time needed to digest their initial merger has announced the first very large acquisition since the crisis. By combining GDF SUEZ Energy International assets (which includes North America, Latin America and the Middle East) with International Power's and adding UK£1.4 billion in cash, GDF SUEZ took a 70% stake in the new International Power Company. This new company, will be a leading global energy producer with strong market positions in America, Europe, the Middle East, Asia and Australia with a total generating capacity of 66 GW. GDF SUEZ is also planning €4 to 5 billion divestments in 2011-2012 and has started this program by selling its 5% stake in Gas Natural.

Finally, rigor plans and a commitment to reduce national debts are pushing governments to consider privatizing their Utilities: ESB and Bord Gáis in Ireland; Galp, EDP and REN in Portugal; Enea in Poland; and PPC in Greece. Others could follow.

Electricity and gas security of supply have generally improved except during the very cold winter in certain regions

Electricity security of supply was threatened during extreme weather conditions

During the observed period, thanks to a consumption slow down and new plants' commissioning, security of supply improved globally (from 9.2% in 2008 to 9.8% in 2009). However, the exceptionally cold weather threatened electricity supply in a few countries. A case in point was the French situation, where in December 2009 and in early January 2010, temperature was 6 to 8°C degrees below normal. Each one degree drop in temperature triggers an extra electricity capacity need of 2,100 MW and the electricity peak went up to a record of 92,400 MW. At the time, the nuclear plants' availability was not good so France had to import up to 8,000 MW from its neighbors for several consecutive days. This import level was near the upper possible limit of 9,000 MW. The situation was even more tense in certain French regions having a fragile transmission grid and messages were sent by the TSO, RTE, to the population asking them to lower their consumption around 7 PM (the peak time). These messages were very well received and the population behavior helped to avoid black-outs.

This demand and supply balance in peak load situations is a real threat to security of supply.

What to do?

- *Peak power plants* investments: In France, in the RTE scenario, peak load demand is estimated at around 30,000 MW at 2025 horizon which represents an investment of €15 to 20 billion to be matched;
- *Network investments:* Let's not forget that the origin of many recent black-outs was linked to grids' collapse. There is,

9 EPR: European Pressurized Water Reactor

thus, a necessity to reinforce both the transmission and distribution grids. Smart grids' investments are also aimed at improving grid reliability. Progress has been made on this front as reflected by the 2009 increase of 15% in the national transmission grids investments;

- As extreme weather events don't always happen at the same time in European countries and as the demand/temperature correlation (often linked to electric heating market share) is not the same in all countries, increasing importation capacity increases security of supply. Investing in European interconnections and decreasing the bottlenecks is, thus, important. While little progress in interconnections investments has been made in 2009 some new large electrical links such as Spain-Portugal, UK-Netherlands or Ireland-UK should be commissioned in 2010 and 2011;
- The importance of *demand response programs* has been demonstrated again during the 2010 exceptionally hot summer in the US. This could have triggered electricity black-outs on the East Coast as transmission capacity was insufficient. These black-outs were avoided thanks to the dynamics demand response programs – as those deployed by PJM[10] – that resulted in peak shavings and increased electrical supply reliability.

In conclusion, European Utilities and regulators need to move quickly on smart metering implementation and other devices deployment in order to boost demand side management and load management programs thus increasing electricity supply reliability.

Gas security of supply is a long-term concern

During the crisis, gas consumption decreased even more significantly than that of electricity as it was hit both by direct consumption decrease and indirectly by the gas-fired electricity plants' consumption decrease. While impacting negatively the Utilities' revenue, this consumption decrease was positive on the European gas security of supply, as shown by the high March 2010 gas level in the European reservoirs despite a cold winter.

Even if in 2009, Gazprom's gas share in Europe's imports fell from 39% to 35%, in the long-term, as much as 50% of EU gas could be imported from this Russian supplier. This could be a threat to the security of supply as demonstrated in the previous years when disputes between Russia and Ukraine (one of the transit countries) deprived the EU of Russian gas during three very cold weeks in early 2009. This year's shorter dispute between Russia and Belarus had a much smaller impact as the crisis was of a shorter duration and gas storages were full.

What to do?

- *Increase storage capacity:* The EU recommends that each country has a storage capacity of 60 days of consumption. The situation is very different from one country to another. Germany, France and Italy having the largest capacity while the UK has one of the smallest. Thanks to the past year's investments, storage capacity in Europe has increased by 15% in 2009 representing 19% of its annual consumption. More than 120 new facilities or extensions projects have been listed but only 23% of these projects benefit from a final investment decision;
- *Increase LNG's share in the total gas supply,* as LNG enables access to 80% of worldwide proven gas reserves thus providing a good supply diversification. 2009 and early 2010 have seen the opening of LNG terminals in Wales and near Venice (an offshore terminal able to supply 10% of Italy's needs) and the partial opening (20%) of Fos Cavaou in France. However, the economic crisis had an impact on the 30 new terminal projects. Several of them (e.g. Brindisi, Rosignano, Civitavecchia and Alpi Adriatico in Italy; Dunkirk and Le Verdon in France) were postponed or cancelled. All together and boosted by cheap international gas prices, LNG imports increased by 27% in 2009;
- Since mid 2008, demand side events, such as the economic recession and the development of US non conventional gas[11] and those on the supply side, such as the commissioning of new liquefaction plants in Yemen and Qatar, have transformed the LNG market. From a 2008 suppliers' market it changed into a buyer's market creating today's LNG bubble. In the long-term, the prediction is that it will take a few years to absorb this LNG "bubble" and that a tense supply market could prevail again. However, this trend could be mitigated by domestic gas production in importing countries such as China or other developing countries. According to Wood Mckenzie studies, Chinese coal gasification, coal bed methane and shale gas are expected to cut from 2020 the country's need for new LNG to 8 million tons a year against 16 million annually during the next decade;
- *Develop unconventional gas production:* Europe has probably lower reserves than the US and they are not yet well known. The IEA estimation amounts to 35 tcm compared to conventional reserves of 3 tcm for the EU and 3 tcm for Norway. Exploration projects are underway in different parts of Europe and unconventional gas production would certainly contribute to security of supply improvement. However, the environmental issues could be more difficult to overcome than in the US;
- *Invest in reverse flows infrastructure:* Gas flows are mainly directed from East to West. The latest Russia-Ukraine crisis highlighted the difficulty in reversing flows and the importance of developing West to East gas flows. The projects (about 40 in total) aim at shipping more easily gas coming from North Europe and LNG terminals to the East and easing gas flows between neighboring countries in case of a supply crisis. These projects cost estimates have reached €1.5 billion, and some of them could benefit from EU subsidies (€80 million for reverse flows);
- *Improving gas market fluidity:* Some progress is being observed. The Balkans is a case in point with plans being implemented to integrate the various pipeline networks into a single system. The Greek pipeline operator, DEFSA, has been improving delivery capacity to neighboring Bulgaria with gas sourced via Greece's LNG import terminal near Athens. In December 2009, the opening of the Central European gas hub (CEGH) at Baumgarten in Austria, close to the Hungarian and Slovakian borders, is already improving the ability of the region to store and distribute gas

10 PJM is a Regional Transmission Operator (RTO), operating 51 million customers on the US East coast. PJM offers several demand response solutions such as economic load response (the customers reduce their consumption when locational marginal prices are high) or emergency load response (customers are compensated during emergency conditions on the PJM system)

11 Non conventional gas (or unconventional gas) designates: shale gas (the most important resource), tight gas and coal bed methane found in former coal mines

to neighboring states in Central and Eastern Europe;

- *Build new pipelines routes:* The EU's strategy is to enable the gas import from Central Asia (mainly Azerbaijan, Turkmenistan and Kazakhstan) through a new pipeline route so as to avoid Gazprom's infrastructure. On the contrary, Gazprom advocates that new pipelines avoiding transit countries (as Ukraine – 80% of transit – and Poland) and thus decreasing conflict situations that have in the past deprived Europe from gas supplies will improve security of supply. The Nabucco pipeline is the EU's flagship project with a forecasted 6% of annual European consumption capacity and a planned start operations date in 2014. However, this project is encountering a lot of difficulties to secure its future gas supply.
  On the contrary, the competing project, South Stream pipeline has made progress, on one hand, through intergovernmental agreements signed between Russia and future transit countries (Bulgaria, Serbia, Hungary, Greece, Slovenia and soon Austria) and, on another hand, in extending its shareholders portfolio with EDF's future entry at 10% in the capital.
  On the Northern side, the Russia/Germany led project, Nord Stream, has extended its shareholders with Gasunie from Netherlands, and GDF SUEZ from France. It is built to transport gas directly from Russia to Germany across the Baltic Sea, avoiding Poland (and Ukraine). Its construction started in April 2010 and the first gas delivery is scheduled for early 2012.
  However, with investments of around €10 billion per pipeline and the slower growth of pipeline gas supplies, the probability of having the three pipelines built before 2020 is slim.

Longer term view: the crisis has negatively impacted investment in energy infrastructures as well as energy consumption trends. It is hard to say if both decreases will match and if security of supply will improve or at least not deteriorate. According to ENTSO-E[12], generation adequacy should be maintained until 2025 in its best estimate scenario[13]. This is good news providing that current planned investments will not be delayed.

While the EU CO_2 reduction objective is likely to be reached, the renewables and the energy efficiency objectives could be more difficult to attain

Let us recall that in June 2009, the EU parliament adopted the so-called 3x20 objectives to be met by 2020: 20% CO_2 emissions reduction compared to 1990 level, sourcing 20% of all final energy consumed from renewable sources and 20% energy consumption reduction. Before looking at Europe's current situation and examining the likelihood of these objectives to be met, let us have a glance at the international situation.

On the international front, very little has been achieved

The results from the December 2009 Copenhagen conference fell short of the EU's goal of achieving maximum progress towards finalizing a legally binding global climate treaty to succeed the Kyoto Protocol in 2013.

The Copenhagen Accord endorses, at a global level, the objective of keeping warming to less than 2°C above the pre-industrial temperature. The Accord also lays the basis for a substantial "fast start" finance package for developing countries, approaching US$30 billion for the period 2010 to 2012, and medium-term financing of US$100 billion annually by 2020. However, this non binding Accord leaves many important details to be worked out in 2010 to make it operational. It seems that the UNFCCC[14] Bonn intermediate conference results were disappointing and that a lot of progress needs to be done before the year-end conference in Mexico.

Outside the EU, no new binding commitment CO_2 emissions reductions and/or on cap and trade system, were adopted at the country level. No legislation will pass in the US before the November 2010 mid-term elections (and even perhaps after) and the Australian law was rejected.

EU CO_2 emissions reduction objective is likely to be reached

Thanks to the economic recession and to national legislations (even if these will have mainly a longer time effect) the EU has basically achieved its Kyoto target as a bloc, although some Member States are still a long way away from their individual targets.

In 2009, a drop of around 7%[15] in the CO_2 emissions under the European Trading Scheme (ETS) system was observed and the 2020 target is less challenging. The EU will have to achieve a reduction of the same absolute magnitude as that expected over the years 1990 to 2010 but in only half the time and without the benefit of favorable one-off factors[16]. However, the probable soft economy and regulatory measures adopted at the EU and Member States levels will help.

Renewables share in final energy consumption is a challenging target

Even if lower than the previous 2008 exceptional growth, renewable energies generation continued to increase in 2009 (15% for wind and 53% in solar PV). However, despite this growth and as reflected in our projection, one can fear that the 20% target will be very difficult to meet. The European Commission's assumptions imply that by 2020 the renewables output will effectively double from around 600 TWh today to around 1,200 TWh by 2020, with about 500 TWh of this increase coming from wind. This could be very difficult to meet as:

- In much of Western Europe the most favorable onshore-wind sites have already been taken, necessitating the development of offshore wind farms that are more expensive and more technically challenging to build and maintain;
- Project finance capital is likely to be more constrained over the next decade than over the last; and
- The subsidies needed to drive the development of offshore wind and solar energy in many EU countries over the next few years will be negatively impacted by their financial situation.

12 ENTSO-E (European Network of Transmission System Operators for Electricity) was created at the end of 2008 and is operational since July 1, 2009. ENTSO-E is the unique association of European electricity TSOs comprising all former regional organizations such as UCTE or ETSO

13 ENTSO-E System Adequacy Forecast 2010-2025

14 UNFCCC: United Nations Framework Convention on Climate Change

15 http://www.eea.europa.eu/highlights/recession-accelerates-the-decline-in

16 Carbon Emission Reports, Deutsche Bank – 2010

Improving energy efficiency by 20% is a difficult but achievable goal

As far as the energy efficiency goal is concerned, this consists in significantly reducing the EU's primary energy consumption from 1,750 Mtoe in 2005 to 1,520 Mtoe by 2020. In 2009, primary energy consumption dropped by 5.6%.

While the Western European industry has already contributed widely to energy savings, improvements in new EU Member States could be expected.

In addition, this crisis has accelerated plant's relocating outside of Europe, resulting in lesser industrial energy consumption. One could believe that the industrial energy future savings are mainly linked to the economy softness level.

More savings should come from other sectors (buildings, transportation) with longer lead times. As already outlined, many national legislations are focusing on building's energy consumption – new isolation regulations and renovation programs – and transportation where huge investments and technology breakthrough are needed.

However, let's not forget that 2020 is a short-term horizon compared to car fleet's renewals or even more so to the renovation of buildings and thus, these new legislations will have only long-term effects.

This is why, unless the economy growth stays flat during the next decade, the EU goal is ambitious and all the more so given that – unlike the emissions and renewables targets – it is not legally binding.

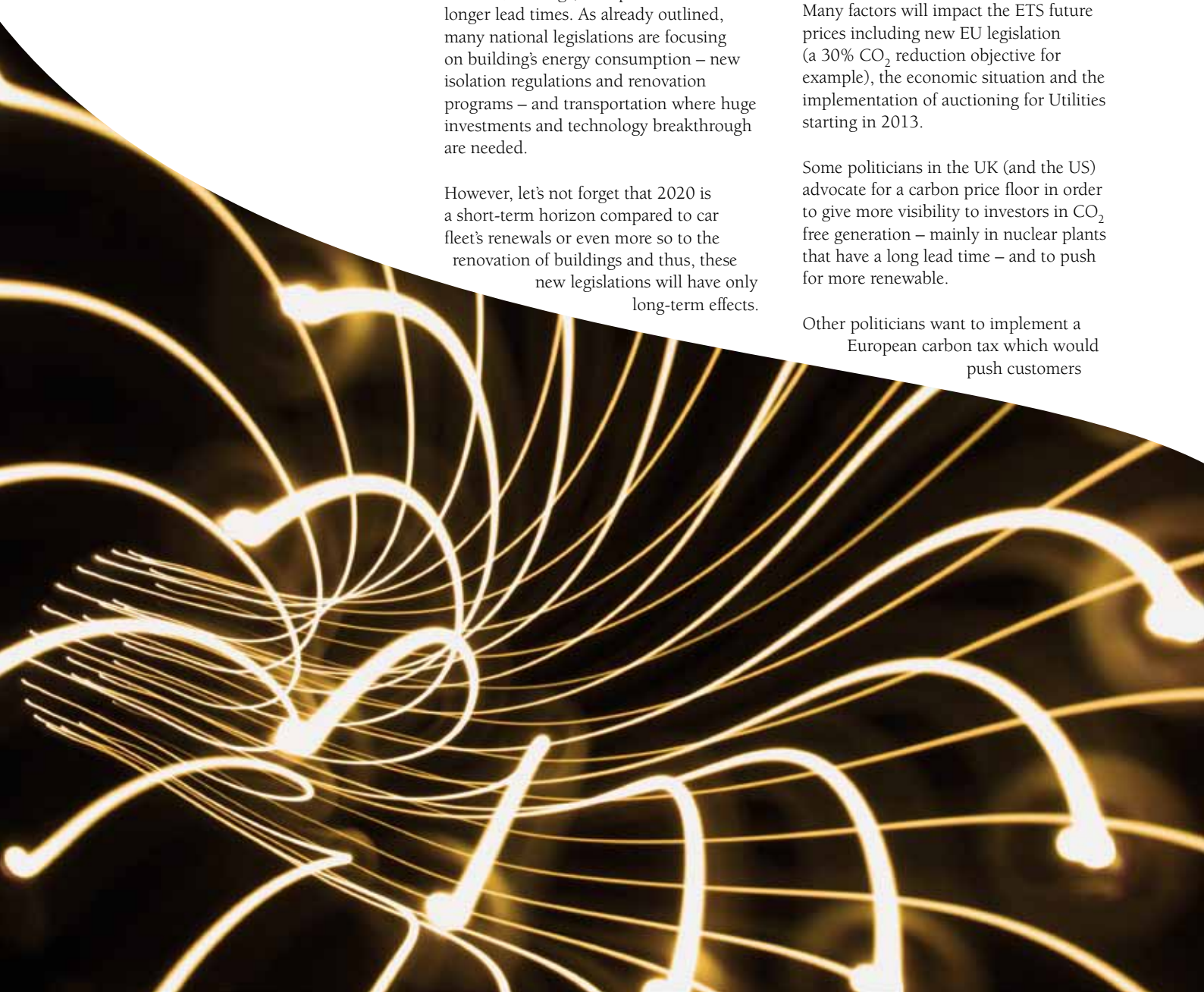
CO_2 prices were too low to trigger switches to lower carbon generation

As a consequence of the above analyzed factors, the spot EUA prices remained stable, in a €13-14/t of carbon range. Because of production slowdown, the industry had an excess of certificates while Utilities were short. Even with the present low gas spot prices, a price of €20/t would be needed (on a short run marginal cost) to trigger switches from coal to gas. This price level should rise to €80/t to economically justify Carbon Capture and Storage (CCS) equipment and this has a low probability to happen in the years coming.

Many factors will impact the ETS future prices including new EU legislation (a 30% CO_2 reduction objective for example), the economic situation and the implementation of auctioning for Utilities starting in 2013.

Some politicians in the UK (and the US) advocate for a carbon price floor in order to give more visibility to investors in CO_2 free generation – mainly in nuclear plants that have a long lead time – and to push for more renewable.

Other politicians want to implement a European carbon tax which would push customers



to buy or use less CO_2 rich products. According to some economists, these carbon taxes have enabled a "green industry" growth, reduced CO_2 emissions and contributed to the economic growth in the countries where they were implemented (Denmark, Sweden and Finland). Their effectiveness is, however, controversial as polluting industrial activities' relocations are partly responsible for the observed CO_2 savings.

Generation mix and customer behaviors changes are calling for smart grids

The above analysis concludes that while overall security of supply increased during the observed period, very tense situations were observed in electricity during the peak periods necessitating either significant peak power generation investment or vigorous demand response programs enabled by devices such as smart metering.

Boosted by the EU Climate-Energy directive, the generation mix is becoming greener implying a high growth of renewable energy share in electricity production.

These new trends related to energy mix and customer behavior, are strongly impacting the electricity grid management, which is a key factor in electricity security of supply.

Today, balancing supply and demand on the grid is a complex exercise requiring already sophisticated equipment, automatisms and data management. With the increase of the renewable energies percentage of generation capacity, the electrical grid's management is facing new challenges as these energies provide unforeseeable and intermittent power generation that is thus not schedulable[17].

Wind and solar power units are generally small providing decentralized type generation and normally they are connected to the distribution networks. Also, with decentralized generation, notably solar PV, customers will become occasional producers. Instead of receiving electricity from the grid they will inject it onto the grid. Today, the distribution network management is not designed to manage these decentralized and sometimes bi-directional flows.

To respond to these new challenges, a new grid concept, smart grids, has emerged. These smart grids will necessitate new equipments and will be more digitally managed. Managing a dramatic increase in data flow, data storage and exchanges both for grid balance and customer relations will become a significant and new challenge.

Thus, communication protocols will need to be standardized in order to manage the information flow on the net and with the customers as well as within buildings. The US Department of Energy took the lead on these crucial standardization points and, unfortunately, Europe is lagging behind which could penalize the European electrical equipment industry.

Smart grids implementation will necessitate new investments. Today, there is funding in Europe and, more so, in the US, for smart grid studies and prototype buildings but not for their real deployment.

As discussed above, with the European Utilities unbundled value chain, separate ROI for the regulated and unregulated entities is not obvious to demonstrate even for smart meters. Massive smart grids' deployment will need a regulatory push and funding through transmission and distribution tariffs increase and by consequence higher electricity prices. These are difficult but needed decisions to take during fragile economic periods.

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17 "The Impact of Renewables on the Electric Grid", Point of View by Capgemini – 2009

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