Energy, Utilities and Chemicals | the way we see it

European Energy Markets Observatory

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A Strategic Overview of the European Energy Markets

Editorial by Colette Lewiner

Introduction

This year was very rich in events that make the energy situation complex to analyze and even more complex to forecast.

On one side the most significant energy-related events are the "Arab spring", the Japanese Fukushima nuclear plant accident and their negative consequences on energy security of supply.

On the other side, the weakness of the financial system combined with the high US and EU Member States' sovereign debts are threatening the Western countries' economies and leading to fears of a second recession that would, as in 2009, impact energy consumption and prices. As in 2009, such a recession would mitigate the negative above-mentioned effects on the security of supply.

Using the findings of this 13th European Energy Markets Observatory we are in this editorial going to examine those contradicting impacts on the:

- Energy short- and long-term security of supply;
- Energy mix evolutions;
- Sustained development;
- Energy-related investment needs.

The Arab spring

The uprising in certain Muslim countries, among which oil- and gas-producing countries such as Libya, Syria and Yemen, together with concerns that the movement could spread to Gulf countries, is creating supply tensions in the oil market.

The supply and demand situation has evolved since the end of the 2009 economic crisis. During H1 2011, oil demand was growing again driven by economic growth and increased requirements in the developing countries. The new 2011worldwide consumption projections[1] are at 87.99 mbpd[2], a 1.06 mbpd increase compared to 2010 and the 2012 projections still show a 1.27 mbpd growth. The two main mid-term concerns are reserve replacement and National Oil Companies' dominant control of resources. The new production capacity to address only the current decline rates will be 45 to 50 mbpd by 2030, which is more than twice the current Middle East production and half of today's global production. About 80% of the projected increase in oil output to 2030 is to come from the National Oil Companies. The Middle East remains critical as, together with Africa, it accounts for about two thirds of global reserves.

Oil prices are still driving many other energy prices. However, thanks to the unconventional gas production growth in the US, the Henry Hub spot market is no longer correlated to the oil price. Oil price forecasts are not only important for the energy sector but also for the global economy perspective. Forecasting them is even more difficult than for other commodities as financial speculation is a key factor (an oil barrel traded once on the physical market is traded around 35 times on the financial market). In 2011, oil prices (Brent) have increased from US$95/bl in January to more than US$125/bl in April and then decreased in September to about US$110/bl.

Unexpectedly during its June 8, 2011 meeting chaired by Iran's oil minister, OPEC decided not to increase the cartel's output quotas. In order to push prices down, the IEA decided on June 23, 2011 to release 60 million oil barrels of its six-month worldwide consumption reserves. This decision did not change the June upward oil prices trend.

However, as seen during the summer of 2008 when oil prices reached US$148/bl, there is some consumption/price elasticity. During that summer and for the traditional American driving season, Americans used their cars less for vacations and consumption (followed by prices) started to decrease.

More generally will high oil prices trigger an economic slowdown? Or on the reverse will an H2 2011 economic slowdown push oil prices down? It is a chicken and egg question.

Fukushima nuclear plant accident

This very bad nuclear accident happened during exceptional circumstances. The north-east coast of Japan was hit by a 9.0-magnitude undersea earthquake on March 11, 2011 triggering a tsunami that traveled up to 10 km inland.

The Fukushima Daiichi site comprising six boiling water reactors (BWRs) operated by TEPCO (Tokyo Electric Power Company), was hit by the earthquake and tsunami. Reactors 4, 5 and 6 were shut down for maintenance prior to the earthquake. The remaining reactors shut down automatically after the earthquake. Grid electricity supply for cooling purposes collapsed and then the tsunami flooded the plant, knocking out emergency generators supplying the water pumps. In order to avoid nuclear core meltdown, it was critical to release the remaining heat generated by secondary nuclear reactions. This had to be done without normal cooling means using sea water poured by helicopters rather than non-salted water normally used.

Very quickly, on March 12, 2011, TEPCO took the sound decision to evacuate a 20 km radius around the plant.

During the following months, TEPCO struggled to cool the reactor cores and the spent fuel storage pond, master the atmospheric radioactivity generated by

1 Organization of the Petroleum Exporting Countries (OPEC) September 2011 report, showing lower growth projections for 2011

2 mbpd: million barrels per day

containment building integrity loss, and to store and treat the huge amounts of radioactive water resulting from their actions. Of course, the radioactivity exposure of the workers and the surrounding population had to be monitored in a sound way.

Many criticisms were addressed to TEPCO for its crisis and communication management. Even if they were justified, one has to remember that this terrible accident happened in a country badly hit and in a region partially destroyed by the earthquake and tsunami. The accident has got the highest rating (level 7) on the International Nuclear Event Scale since the Chernobyl accident.

On July 25, 2011, after a site inspection, M. Yukiya Amano, head of the International Atomic Energy Agency, declared that TEPCO's plan to achieve a cold shut-down by early 2012 "could be possible".

The first lessons learned include items such as:

- The need to design nuclear plants for really exceptional earthquakes and tsunamis;
- The considerations to be taken during the reactor design phase to cope with simultaneous natural catastrophes;
- The onsite spent fuel storage conditions re-assessment;
- The cooling systems redundancy re-assessment;
- The emergency measures redesign;
- The need for a radiological permanent control management on, and around, the site;
- A sound operational crisis management and crisis communication design;
- A new foundation for nuclear regulatory bodies, nuclear operators and industrial companies' roles, responsibilities and relationships.

Following the Fukushima reactor accident and its heavy coverage by the media, all countries' governments decided to launch safety inspections for their existing and future plants. The European regulators have coordinated their actions and defined common nuclear "stress tests" to be applied to all nuclear facilities. The first results of European tests should be known in autumn 2011.

In Japan, only 11 nuclear reactors out of 54 are in operation mid-September. The restart authorization of the reactors, other than the Fukushima Daiichi damaged reactors, is pending on the Japanese regulator's post-Fukushima stress tests results. In August 2011, Tomari 3 reactor was allowed to restart and it is conceivable that a further four more reactors could be restarted as the country's economy is badly penalized by the lack of nuclear electricity generation. However, the new Japanese Prime Minister announced that his country would no longer build new reactors or extend the operations of those at the end of their lifespan.

Many countries and regions such as China, South Korea, Russia, the Middle East, France, and the Netherlands, confirmed their commitment to nuclear energy. Similarly, in mid July 2011, the UK government confirmed "that new nuclear power should be able to contribute as much as possible to the UK's need for new capacity". A British parliamentary vote followed a decision to reform the UK electricity market in favor of low-carbon generation.

However, some European countries decided on a moratorium on nuclear: Italy, following the mid June 2011 referendum, abandoned their plan to build the country's first four reactors with the French company EDF. The Swiss government decided during the spring and summer of 2011 to phase out by 2034 present reactors but it does not close the door to build new generation plants.

On May 30, 2011, mainly for emotional reasons, Germany took the radical decision to stop immediately its seven oldest nuclear reactors and not to restart its Kruemmel reactor, already stopped. This decision that deprives the European network system of 8,000 MW, impacting the European electricity grid balance, was taken with no consultation at the EU level.

Reversing its December 2010 decision, the German coalition also decided to phase out, between 2015 and 2022, its remaining nine reactors. However, the nuclear tax (amounting initially to €2.3 billion per year and decreasing to €1.3 billion now after the seven oldest reactors were shut down) will remain. This has raised protests from German Utilities that are incurring a double penalty (their plants' forced closure and the nuclear tax). This double penalty explains their H1 2011 negative results, triggering large people lay-offs (10,000 for E.ON) for the first time in their history.

Impact on short- and long-term nuclear output

Before the Fukushima accident, there were 440 reactors in operation, 62 under construction and 496 planned or proposed around the world. All three categories of reactors' future needs to be examined:

- It is too early to assess precisely the number of existing reactors that would successfully pass the "safety stress tests" and comply with the requested design and operating mode changes. Except for Germany and perhaps some Japanese reactors, it seems likely that the vast majority of them should be allowed to continue operations;
- More than three quarters of the 62 reactors under construction are in Asia (28 are in China, five in India, five in South Korea, two in Japan) and in Russia (10).Those countries are facing high energy needs and, except perhaps for Japan, they should continue construction. In Europe, new projects are in France, Finland and Slovakia, all countries that have confirmed their nuclear commitment. In addition, the United Arab Emirates have launched the construction of four reactors and will go forward with them. So, one can conclude that nearly all reactors under construction will be completed, with probably some delays;
- The number of new "planned or proposed" reactors forecast is more difficult to establish. At the moment, three things are clear:
  1. The proportion of new, safer "Generation 3 reactor" builds will increase;
  2. The new projects will be impacted not only by the political decisions following the Fukushima accident but also by economic factors such as lower demand and low gas prices. It is the latter factor that is slowing down the US' decision to build new reactors;
  3. The assessment done by the IEA shortly after the accident, dividing by two the 496 figure is too pessimistic. More projects than that should go forward in order to meet the need for large carbon-free electricity generation;
- Finally, the numerous lifetime extension requests will be scrutinized. In Europe, there are many 40-year-extension requests pending as reactors are newer than in the US, where the Nuclear Regulatory Commission (NRC) has in past years granted many 60-year lifetime extensions. It is interesting to note that the French regulator accepted a 40-year lifetime extension for Fessenheim (the oldest reactor in operation in France) provided some modifications and its compliance with the post-Fukushima stress tests. This recommendation has to be confirmed by the French government. Also, in September 2011, Spain's nuclear regulator has approved a 10-year operating license extension for the two-unit Ascó nuclear power plant in Catalonia.

Short- and longer-term European security of supply

Electricity security of supply

- **This winter's issue:** The immediate German nuclear plants' closure is threatening European electricity security of supply.
  Following its nuclear shut-downs, Germany started to import electricity from its neighbors, including more than 2,000 MW per day from France that had available capacity thanks to its nuclear plants' good performances.
  The real question is the black-out risk during peak time for the winter 2011/2012 (and the following winters) knowing that the electricity demand during these periods is increasing year over year (for example, last year growth in Germany was +9.5% and in France +4.7%).
  In 2010, the real electricity generation capacity margin for Europe was globally at a stable and satisfactory 9.0% level. With the German 8,000 MW missing, these margins will deteriorate. Moreover France, which has a large portion of electrical heating, is very sensitive to cold weather (one degree less in winter temperature triggers 2,300 MW additional demand), was in the "red" zone (see Table 2.2 in the Centralized and Decentralized Electricity Generation chapter) and had to import on the peak days around 8,000 MW... mainly from Germany.

What will happen if we have a cold winter?

- **A more fluid electricity grid would improve security of supply:** In 2010 and early 2011 there was some progress on the European electricity interconnections front; the most important project completed was the UK/Netherlands BritNed submarine High Voltage DC (HVDC) 1,000 MW cable that was commissioned in April 2011.
  In the coming years, many high voltage links should be put into operation. The most important ones in Continental Europe should be: the France-Italy 600 MW connection due in 2012, the Germany-Denmark 1,000 MW in 2013 and the France-Spain 2,800 MW link that should become operational (after years of delays) in 2014.
  In 2010, investments in national grids from the main European TSOs[3] amounted to more than €6.5 billion, up 13% from 2009.
  Despite this progress, bottlenecks remain important in Europe. The two main obstacles encountered by these high voltage line projects are local opposition and unattractive return on investment

3 TSO: Transmission System Operator

linked to the tariff levels. The European Commission, Member State governments and regulators should intensify their efforts to remove these obstacles in order to accelerate the integration of the European Electricity grid and thus improve security of supply.
In addition to investments in infrastructures, tighter European TSO cooperation is improving the electricity flows' fluidity which in turn improves solidarity between countries during difficult periods.

Gas security of supply

In 2010, the EU imported 113 bcm[4] by pipe from Russia. This represents 33% of total gas imports.

In the future, gas flowing through Gazprom pipelines, should amount to 50% of all European gas supplies in 2030, which is a worry for the gas security of supply. In addition, Germany's decision to phase out nuclear power over the next decade should increase Europe's reliance on Russian gas as is illustrated by the German Utility RWE and Russian Gazprom mid July 2011 deal. This deal should secure additional competitive gas supply to RWE and lead to "mutually fruitful growth opportunities" as stated then by RWE's CEO.

As already detailed in previous editions of our Observatory, the ways to improve the European gas security of supply are: accelerating new importation pipelines construction, increasing storage facilities, improving gas network fluidity boosting the recently discovered unconventional gas exploration and production, and increasing LNG imports. These actions are examined hereafter:

- **New importation pipelines projects:** Three main new large pipelines are under construction or in advanced stage of design: Nord Stream, South Stream and Nabucco.
  1. *Nord Stream* was initiated by Russian and German companies' agreements in 2005, since then other companies have followed. Presently, Gazprom holds a 51% stake in the joint venture together with German, Dutch and French Utilities.
     Its construction through the Baltic Sea is well advanced and in September 2011 Line 1 of the twin pipeline system was inaugurated. When fully operational in 2013, the two lines will supply 55 bcm of Russian gas a year to the EU for at least 50 years.
  2. *South Stream* was launched in November 2006 by an agreement between Gazprom and Eni (Italy). It aims to create a southern route for Gazprom to supply southern and Central Europe across the Black Sea. During 2008-2010 intergovernmental agreements on the project implementation were signed and EDF (France) and the BASF subsidiary Wintershall (Germany) joined the project by signing, in March 2011, a Memorandum of Understanding with Gazprom. They both acquired a 15% stake in the company South Stream AG. This gas pipeline should have a 63 bcm/year capacity and its cost is estimated at US$25 billion. It should be in operation in 2015. As for Nord Stream, its trajectory avoids Ukraine, the traditional Russian gas transit country and this is a positive point for security of supply as recurring Russia-Ukraine disputes are threatening European gas supplies. South Stream also aims at controlling a large part of gas supplies from the Caspian region and Kazakhstan, thus competing directly with the Nabucco project that is sponsored by the EU and the USA.
  3. *Nabucco*: When completed in 2017, the 3,900 km pipeline project should have a capacity of 31 bcm/year. The pipeline should link the Caspian region with the eastern border of Turkey to Baumgarten in Austria.
     It is a controversial project with its budget of €7.9 billion under review and potentially rising as high as €15 billion according to some analysts.
     Its second weak point is the origin of its gas supplies because Gazprom has signed numerous agreements with Central Asian gas-producing countries to nail down its South Stream gas sourcing.

One year ago it seemed improbable to have both South Stream and Nabucco projects completed in the coming years. However with the post-Fukushima gas

4 bcm: billion cubic meters

demand increase, this assessment has to be revisited.

- **European domestic gas networks:** As for electricity, improving the gas network fluidity and transparency for shippers is also increasing security of supply. Investments in 2010 were above €5.5 billion, up by 11% compared to 2009. Investments have also been engaged in 2011 for some important cross-border interconnectors such as the Interconnector Greece-Bulgaria to be commissioned in 2014.
  With recent developments of gas-fired plants for electricity generation – in particular during electricity peak demand time – or as renewable plant back-ups, gas flow variability is increasing. Thus pipeline management has to be adapted to a more variable demand to both improve response time and increase gas reserves.
  The gas networks are mainly designed for unidirectional flows (mainly from east or north to the rest of Europe). Developing reverse flows necessitates a limited amount of investment but allows countries having excess gas to send it to others during a supply crisis. In 2010, reverse flows continued to develop thanks to EU funds (€70 million spent on 13 projects in 2010 and 2011) and TSOs' investments.
- **Storage capacity:** Having enough storage capacity is also important for security of supply as it mitigates the risk of a supply crisis. The European Commission recommends 60 days of consumption in storage capacity. Certain countries like France, Germany or Italy are above this threshold while others such as the UK (which used to have a natural gas storage with its North Sea reserves) are below it.
  In 2010, the EU storage capacity was 91.7 bcm, an 8% increase from 2009.
- **Unconventional gas:** Thanks to the hydraulic fracturing technologies, unconventional gas (mainly shale gas) had a spectacular development in the US. This country accounts for three quarters of global unconventional output.
  Taking into account these new developments, the IEA increased its estimation of the worldwide gas resources from around 60 years to 250 years of consumption[5]. This has a strategic impact on the gas resource status and transformed it from a transitional energy to a long-term energy resource.
  The latest EIA report[6] increases significantly the European unconventional domestic gas resources' estimation. EU Member States having the most resources are France (5,040 bcm) and Poland (5,236 bcm) representing respectively 108 and 366 years of their consumption. Many European countries have allocated exploration permits to assess the resources and the way to exploit them. These projects are encountering public opposition (like many other industrial projects) linked to the fear that the liquids used for fracturing would contaminate the aquifers. It is clear that sound and responsible production processes have to be designed and implemented. Contrary to the UK, which is encouraging shale gas development, the French government decided in early 2011 for a moratorium on all shale gas permits. One should wait until after the 2012 elections to see if this decision is revised.
- **Increase LNG supplies:** Coming mainly from African and Middle East countries, they represented 22% of European gas supplies in 2010. Because Europe could import LNG from around 70% of producing countries, increasing these importations is reducing geopolitical risk. During the last three years the LNG market has changed considerably, moving from a supplier's market to a buyer's market. New liquefaction plants were commissioned in Yemen and Qatar, increasing the worldwide liquefaction capacity to 594.1 bcm/year in 2010 (versus 540.1 bcm/year in 2009) and new re-gas terminals became operational.
  This supply increase combined with a lower demand linked to the US shale gas production, and the 2009 economic crisis' negative effects on consumption have created a LNG bubble in the European market. However, following the Fukushima accident, LNG demand is increasing again allowing the European LNG market to rebalance quicker.

Network ownership is changing radically as Utilities are divesting to restore their balance sheet and to comply with the Third EU Directive. Networks, having long-term recurrent revenues, are attractive for investment funds.

Many transactions on the transmission grids, as on the distribution grids, were closed in the last 18 months. The main electrical transmission grid transactions are: E.ON (Germany) to TenneT (the Netherlands) for €885 million; Vattenfall (Germany) to a joint venture between Elia (Belgium) and IFM (an investment fund) for €810 million; and RWE (Germany) for 75% of its grid (Amprion) to a financial investors' group for €1.3 billion.

As seen before, high investments are needed to create a unique European grid by building new interconnection lines. As will be discussed later, the renewable energies' increased share in the energy mix generates new construction needs including offshore wind farms' HVDC connections to the main grid. Also, new grid equipment and information systems have to be implemented in order to operate the grids in a "smarter" way.

The challenge is thus to find the right regulatory incentives to encourage the new private investment funds' owners to invest enough to meet these large needs.

Change in energy mix

The Fukushima accident has significantly impacted public opinion in European countries and has triggered a debate on the present and future energy mix. In a few countries, politicians and anti-nuclear groups are asking for a nuclear phase-out. Before asking ourselves if a nuclear phase-out is feasible, one needs to ask if it is desirable.

As discussed above, an immediate nuclear phase-out while keeping the lights on is challenging.

A long-term phase-out is possible but needs to be assessed against the following criteria:

- Sustained development: global warming and greenhouse gas emissions decrease;
- Security of supply;
- Electricity generation costs.

The energy mix should evolve after the Fukushima accident. Nuclear energy

5 World Energy Outlook 2009, published in November 2010

6 World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States, published in April 2011

should decrease its worldwide share while gas and renewables should grow theirs and it would be more than desirable to have an increase in energy savings (negawatts).

After having debated previously on nuclear energy's future, we shall now discuss the changes for the other fuels and their consequences on grid management and energy costs.

Gas

As analyzed above, gas' long-term perspective has changed and one could foresee increased gas usages.

- **Gas markets:** Gas demand growth is significantly impacted by the economic situation. European consumption decreased during the crisis by 6.1% and increased again (in 2010) by 7.0%.
  The pre-Fukushima 2011-2016 growth triggered by gas-fired plant needs was forecasted at 2.4% CAGR[7]. The EU gas market was oversupplied and had an overhang between 10-30 bcm.
  Recent events have impacted this situation:
  - Missing Libyan gas to Italy[8] will lead to a 3 bcm EU gas overhang reduction in 2011 with a further 1.1 bcm reduction in 2012;
  - The Fukushima accident has generated additional short-term demand: 5 bcm/year for Japan and potentially more in the future; and for Germany 2.1 bcm in 2014 and 4.2 bcm in 2015[9].

  The post-Fukushima accident forecast is an EU gas market returning to physical balance by early 2014 versus 2015-2020 previously forecasted.
  In the longer-term: According to IEA, during 2011-2035, worldwide gas consumption should grow by 50%. Its energy market share should grow to 25% (from 21% now), only slightly lower than oil's (27%).
- **Prices:** Gas is not a global market as the main exchanges are through regional pipelines. LNG's share is increasing but today represents only 30% of global exchanges. This situation leads to very different regional pricing systems and levels.
  While the US market is dominated by spot exchanges, the continental European market is based on long-term contracts indexed on oil prices. Because of the spectacular shale gas development on one side and on the oil price increase on the other side, the price discrepancy has widened and today US gas is three times cheaper than continental European gas!
  When looking at historical evolutions, one could think that the spot/long-term price ratios could change over time. These changes could be triggered by increased shale gas production costs linked to rising environment issues and public opposition, and also to coal substitution by gas in electrical plants. The latter will notably be triggered by the new EPA Cross-State Air Pollution Rule (CSAPR) that should lead to coal-fired plant closures.
  Another recurring question is related to the gas price index on the oil price system's longevity. On one side, thanks to unconventional gas, the latter is no longer an oil production by-product. On the other side, Gazprom, the main European supplier, rejects spot pricing saying that it needs long-term pricing to mitigate its risks linked to the large pipeline construction cost and that the European gas exchange hubs are not fluid enough. Whatever will be the end game, Gazprom has already agreed to include a small part (10 to 15%) of spot prices in its pricing system.

Renewables

Their development has to be put in the context of:

- The EU objectives aiming at a 20% renewable share in the end energy consumption;
- The Fukushima accident's consequences on nuclear energy that should boost their development. However, because of its lower cost, gas should benefit more than renewables from nuclear phase-outs (see above);
- The stability of regulators' and governments' commitments (including incentives and feed-in tariffs) to their development and the present policy fluctuations observed in many countries are detrimental to an industry that needs a long-term perspective.

While wind power provides the largest output, solar energy is the fastest growing energy source as it grew by 80% in 2010.

7 CAGR: Compound Annual Growth Rate

8 If the Libyan outage lasts only until the end of 2011

9 Deutsche Bank's forecast

Because of the onshore wind farms' favorable sites saturation and the neighboring population's negative reactions, and despite their higher costs, many governments have or are launching large offshore programs in order to comply with the EU objectives. For example, a 300 MW offshore wind farm was inaugurated in September 2010 off the south-east coast of England, and on July 11, 2011 France launched a tender for 3,000 MW of offshore wind to be installed by 2018.

Governments and regulators have had fluctuating policies on renewables. For about six months starting in September 2010, the Italian solar market was booming driven by a feed-in tariff guaranteeing a minimum price for solar electricity for 20 years and offering internal rates of return to generators of up to 17% compared with 7-8% for similar German projects. However, that support mechanism was too generous and it has since then been scaled down. Since 2008, France has modified its incentives framework every six months. As the last one was generous with no cap, the French government decided to freeze photovoltaic projects for three months.

In the longer-term, renewable energies should increase their market share as can be seen by analyzing the future generation plant programs. As of May 2011, 10% of the generation plants under construction are from renewable sources compared to 7% in 2009 but on those that are planned, the percentage is higher: 33% as of May 2011 compared to 24% in 2009.

The recent events have mixed impacts on renewables' development. The post-Fukushima reduction in nuclear output should boost the alternative CO_2-free energy sources and Germany, which is phasing out its nuclear plants quickly, should lead this accelerated development. However, the situation there is less rosy than announced. The German government is now planning to install 10,000 MW of wind farms in 10 years. This plan seems very ambitious for technical feasibility reasons notably because most of the German coastline is a national park and offshore wind farms have to be installed further from the coast and in deeper waters. Project financing will remain difficult and more problematic still will be the retooling of the national grid to flow electricity from renewable energy sources in northern and eastern Germany to the big industrial centers in the south and west.

The present European Member States' huge deficits and financing problems should push them to reduce their spending and thus slow down their subsidizing policies to renewable.

Moreover, solar photovoltaic panel producers are strongly hit by the massive importations from China at low prices. Many companies went bust in the United States and are in difficulties in Europe. One can question the government's policies as they are subsidizing photovoltaic installation using cheap and low performing imported cells instead of funding more Research and Development (R&D) efforts that could lead to Intellectual Property on better performing cells manufactured in Western countries.

All these factors could threaten the 20% renewable share in the final energy consumption EU 2020 objective achievement.

Negawatts

Energy efficiency is one of the most cost-effective ways to enhance security of energy supply, and to reduce emissions of greenhouse gases. This is why the EU has set a target for 2020 of saving 20% of its primary energy consumption.

In the 12th edition of our Observatory, we forecasted that this target would be very difficult to meet.

This was confirmed in early 2011 by the European Commission which estimated that the EU is on course to achieve only half of the 20% objective.

Following the February 2011 European Council asking for "determined action to tap the considerable potential for higher energy savings", the Commission has developed a new draft "Energy Efficiency" Directive published on June 22, 2011 focusing on instruments to trigger better energy efficiency of public buildings, the launch of demand response programs through the roll-out of smart meters, white certificate mechanisms and better usage of cogeneration especially for district heating.

In 2013, the Commission will check whether Member States will deliver the European 20% cut objective. If it shows that the overall EU target is unlikely to be achieved, the Commission will consider proposing legally binding national targets for 2020.

One way to enable energy management is through smart meter installation combined with boxes providing the consumer with easy access to their consumption and related expenses.

According to the Third Directive, 80% of the European population should benefit from smart metering by 2020.

In Europe, the fragmentation of interests created by the EU directive's obligation to unbundle the Utilities' value chain and to split between regulated and non-regulated entities, has led to an uncertain return on investment for smart metering projects at the distributor level. This difficulty, combined with the 2009 crisis, explains their slow adoption in Europe. Italy and Sweden have led their adoption with full installation in 2009 for Sweden and earlier for Italy.

After the large "Linky" smart metering experiment led by the French ErDF (300,000 meters), deployment to all French residential customers (30 million) should be decided in the autumn of 2011. This would be the world's largest smart meter project.

Legislation has passed in other countries such as in the Netherlands (the law passed in November 2010 for the start of a roll-out in 2014), Norway (full deployment is expected by 2017) and in the UK where the policy design phase held by Ofgem ended in March 2011 and marked the start of the implementation phase.

In addition to smart meters and other devices, time-of-use tariffs, electricity curtailment incentives and public education are key elements to implement.

Renewable energies and more flexible consumption patterns are strongly impacting grid management.

Smart grid

Despite R&D efforts, there are presently no good answers for massive industrial electricity storage. This is why the new challenges described above (renewable share increase, decentralized generation, new consumption patterns, etc.) have to be addressed through the implementation of a grid with more intelligence (smart grid). This would require large investments.

Worldwide, smart grid investments are estimated during 2008-2015 to be US$200 billion (out of which US$53 billion is in the US)[10]. One large investment component is ICT (Information and Communication Technologies) systems. For example, Cisco sees US$15-20 billion of investment opportunities to link smart grids with ICT systems over the next seven years.

However, a lot of issues have to be worked out, among which:

- Transmission and distribution tariffs will have to be redesigned (and increased) in order to incentivize grid operators to invest as needed. Regulators, governments and customers will have to accept these price increases;
- Industrial R&D is necessary to develop new equipment (such as large competitive storage) or improve existing equipment (such as HVDC connections);
- Communication standards are crucial and have to be established and implemented at all levels of grid equipment and on the grid backbone itself.

Regulators have a key role to play in gathering all stakeholders and establishing a new comprehensive retail market model.

Electricity generation costs will increase as a result of:

- Fuel price increases: as discussed earlier, many factors will in the medium- and long-term push oil prices and probably gas prices upwards;
- Energy mix change will result in increased costs because of the replacement of some nuclear energy (one of the most competitive sources of electricity despite its cost increase after implementation of post-Fukushima safety requirements) by more costly renewables. In the longer-term, the renewable costs (especially solar energy) should decrease significantly over time but presently their share increase in the energy mix means more costly electricity. As an illustration, after their nuclear phase-out, the German electricity baseload wholesale price is predicted to increase by €5-6/MWh per year over 2012-2015[11];
- Grid and other large investments (see below) should push electricity tariffs up.

To maintain a healthy Utilities sector able to invest in order to keep the lights on, these cost increases have to be passed on to the end customers. Of course, vulnerable consumers have to be protected. For the others, higher energy bills are certainly a way to incentivize them to save energy. And this is crucial.

The sustainability challenges

Worldwide events: Global warming is a worldwide challenge. This is why curbing CO_2 and other greenhouse gases emissions to limit the worldwide temperature increase to 2°C have to be looked at on the global level.

After a disappointing UN Copenhagen conference in 2009, the 2010 Cancun conference did not reach an agreement on quantitative emissions limitation. However, participants reached an agreement on the US$100 billion a year (by 2020) Green Climate Fund in order to protect poor nations against climate impacts and assist them with low-carbon development.

The December 2011 Durban UN conference preparation suggests that the discussions will be difficult and that gathering the Green Climate funds will be challenging, especially with the current governmental debt crisis in many developed countries.

CO_2 allowance prices remained too low in 2010 and 2011 to incentivize CO_2 reduction policies. Despite the German nuclear plants' closure announcement at the end of May 2011, the publication of the Commission's Energy Efficiency Directive, the fall in the Brent Crude price, concerns about European economic activity, and the expected sale of 300 $MtCO_2$ from the Phase III NER 300 funding program all contributed to the

10 Pike Research

11 Deutsche Bank forecast

20% drop in the CO_2 allowance price in late June 2011. They stabilized in the €13-14/t range with a short drop at €12/t in early August 2011.

However, in the future CO_2 allowance prices could rebound as:

- In March 2011, the UK government announced a CO_2 emissions price floor as power generators would pay a minimum of £16/t (€18.40/t) in 2013, rising to £30/t (€34.50/t) in 2020;
- The end of ETS[12] phase 2 (2012) where most permits were given to industry for free and the start of phase 3 (2013-2020) where the majority will be sold through auctions, could push prices up even ahead of the 2013 starting date;
- Australia plans to introduce a carbon tax on July 1, 2012 at AUD$23/t (€16/t) with corresponding legislation expected to pass in November 2011, and this could influence the ETS pricing system.

Emissions decrease: The 2009 economic crisis and its consumption reduction had a positive effect on EU greenhouse gases emissions that dropped by 7.1%. Encouraged by this drop, in March 2011 the European Commission proposed to adopt a "Roadmap to a competitive low carbon economy in 2050" including a tougher 30% reduction target (from 1990 levels) by 2020. However, on June 21, 2011, the European Parliament rejected this proposition. With Poland – Europe's biggest coal user – taking over the EU presidency for the following six months and opposed to the increase in carbon emissions cuts, it is unlikely that the 30% target will happen before the end of the year and in time for the Durban conference.

Some industry representatives, including the chemicals sector's, were also opposed to this move as it might lead to perverse effects such as increased carbon leakage and industry competitiveness deterioration.

As forecasted in the 12th edition of our Observatory, the 2010 economic rebound led to a 2.2% greenhouse gases emissions increase. In 2011 we could also have an increase in CO_2 emissions because the first half economy was good and as the eight German nuclear reactors' immediate phase-out will increase emissions by 370 Mt over 2011-20. However, the probable end 2011 and 2012 economic slowdown should have the same effects as in 2009 and push energy consumption and CO_2 emissions downwards. In these conditions the EU countries could well reach their 20% reduction objective.

Investments

Investment needs increases result from:

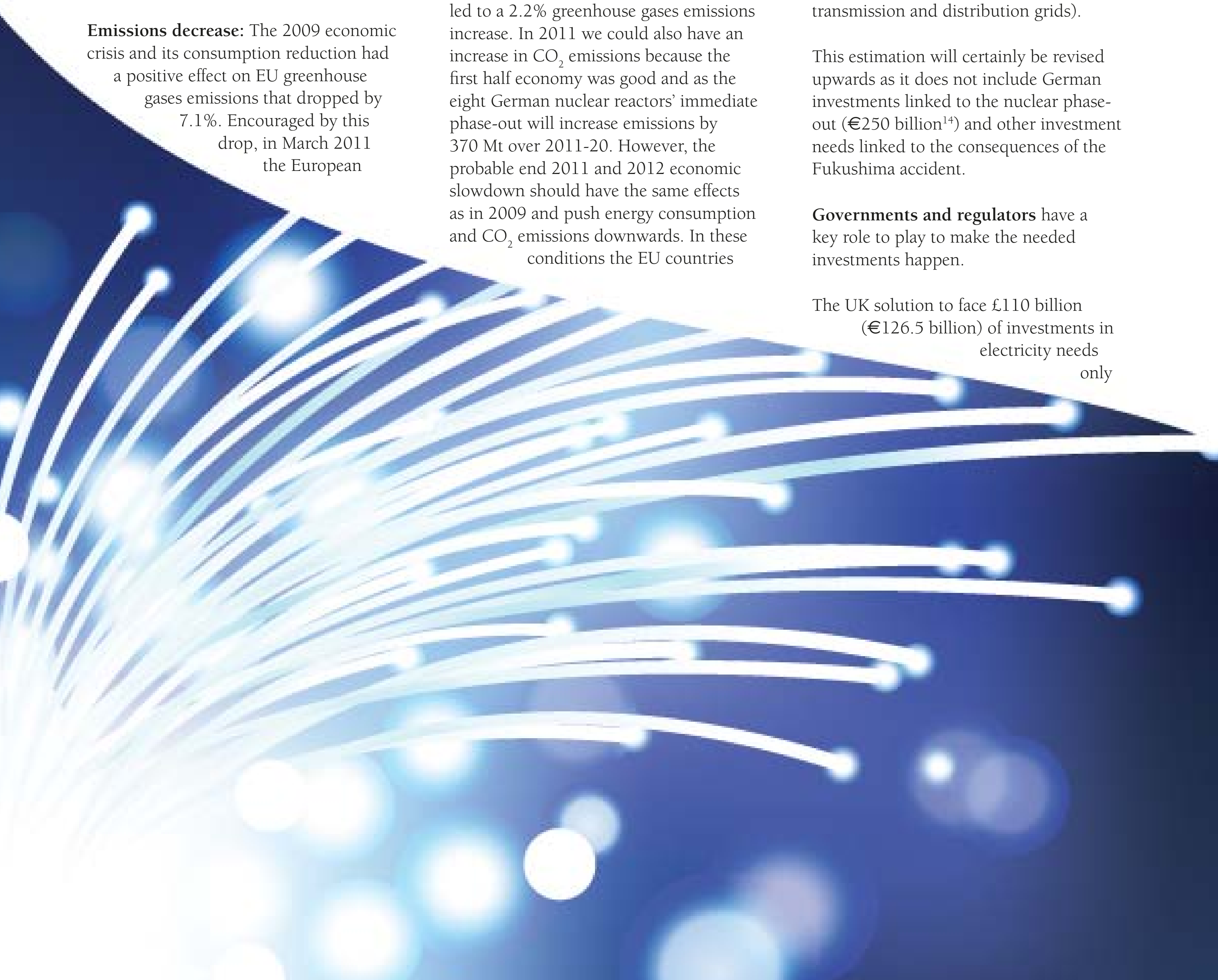
- Generation plants' construction to replace old generation plants, and nuclear reactors phased out and to accommodate the electricity consumption increase;
- Investments in electricity and gas grids to improve security of supply, to accommodate decentralized and renewable generation plants and to transform present grids to smarter ones.

Energy system investment needs for 2020 were estimated by the EU[13], before the Fukushima accident. Total investment in the electricity and gas sector between 2010 and 2020 would amount to around €1.1 trillion (€500 billion for power generation plants and €600 billion for transmission and distribution grids).

This estimation will certainly be revised upwards as it does not include German investments linked to the nuclear phase-out (€250 billion[14]) and other investment needs linked to the consequences of the Fukushima accident.

Governments and regulators have a key role to play to make the needed investments happen.

The UK solution to face £110 billion (€126.5 billion) of investments in electricity needs only



by 2020 described in the "Planning our electricity future" White Paper, approved by Parliament in July 2011 is an interesting example.

Key elements of the reform package include:

- A Carbon Price Floor (see above);
- New long-term contracts to provide stable financial incentives to invest in all forms of low-carbon electricity generation;
- An Emissions Performance Standard (EPS) set at 450g CO_2/kWh so that no new coal-fired power stations are built without Carbon Capture and Storage (CCS);
- A capacity markets mechanism, including demand response as well as a generation capacity rewarding mechanism.

Out of the total investment of £200 billion (€230 billion), £30 billion (€34.5 billion) is requested for grids. To secure these investments, Ofgem, the UK regulator, has launched "RIIO": a new regulatory framework adopting "a carrot and stick approach" and is creating a £400 million (€460 million) innovation fund for the transmission and gas distribution companies.

Other Member States, governments and regulators should think of launching similar bold actions.

Conclusions

Recent events have put energy questions in the spotlight.

In 2010 and H1 2011, energy consumption growth, especially in developing countries, has created new tensions on the energy markets. These tensions were amplified by the 2010 BP Macondo platform accident in the Gulf of Mexico and the resulting moratorium on permits. They have also highlighted the deepwater oil production difficulties and have resulted in stronger regulations and thus increasing costs.

Since spring 2011, Arab countries' political instability is threatening oil and gas supply. Many countries are still in fragile situations and this movement could propagate to the Middle East's large oil- and gas-producing countries.

On the nuclear front, the very bad Fukushima nuclear plant accident is leading to increased nuclear costs, delays in new reactor construction projects, in some countries to nuclear phase-outs and an overall decrease of the projected nuclear output.

These events have negative consequences on the energy and environment landscapes and we can expect:

- Decreased short- and long-term security of supply;
- More greenhouse gases emissions linked to the reduced nuclear generation output;
- An increased need for investments that should amount, for the EU, to more than €1.1 trillion by 2020;
- Increased energy prices.

However, in the short- and mid-term, these negative effects could be mitigated by a second economic crisis triggered by the US and EU Member States' sovereign debt crises. As in 2009, the energy consumption and the CO_2 emissions growth could be stalled or decreased, consequently the short-term security of supply stabilized and the energy prices growth temporarily stopped.

However, the economic crisis will have longer-term negative effects as the needed investment will not be made making it difficult to keep the lights on and to curb our planet's temperature rise.

Paris, September 30, 2011

Colette Lewiner

Global Leader of Energy,
Utilities and Chemicals Sector at Capgemini

12 ETS: Emissions Trading Scheme

13 "Energy infrastructure priorities for 2020 and beyond" by Jean-Arnold Vinois, Head of EU Unit "Security of supply & networks", March 22, 2011

14 According to a study published on September 19, 2011 by KfW, the state-owned investment bank

Team and Authors

Research Sponsor
Philippe David
+33 1 49 00 22 11
philippe.david@capgemini.com

Project Director
Sopha Ang
+33 1 49 00 22 30
sopha.ang@capgemini.com

Our partners

European Energy Regulation insights
CMS Bureau Francis Lefebvre
Mr Christophe Barthélémy
+33 1 47 38 55 00
christophe.barthelemy@cms-bfl.com

Switching and Demand Response insights
VaasaETT
Dr Philip Lewis
+358 40 529 5852
philip.lewis@vaasaett.com

Jessica Strömbäck
+358 40 725 6023
jessica.stromback@vaasaett.com

Gas Wholesale Markets insights
Société Générale Commodities
Emmanuel Fages
+33 1 42 13 30 29
emmanuel.fages@sgcib.com

Finance and Valuation insights
Société Générale Global Research
John Honoré
+33 1 42 13 51 55
john.honore@sgcib.com

Energy Regulation and Policies Overview
Sustainability, EU 3x20 objectives and Cleantechs
Alain Chardon
alain.chardon@capgemini.com

Electricity Markets
Centralized and Decentralized Electricity Generation
Ana-Maria Popa
ana-maria.popa@capgemini.com

Jeanne Michon-Savarit
jeanne.michon-savarit@capgemini.com

Electricity Transmission and Distribution
Benjamin Hall
ben.hall@capgemini.com

Electricity Wholesale Markets
Sébastien Chirié
sebastien.chirie@capgemini.com

Electricity Retail Markets
Philippe Coquet
philippe.coquet@capgemini.com

Gas Markets
Upstream Gas
Florent Andrillon
florent.andrillon@capgemini.com

Gas Transmission and Distribution
Antonio Michelon
antonio.michelon@capgemini.com

Gas Storage
Alexandre Leondaridis
alexandre.leondaridis@capgemini.com

Gas Wholesale Markets
Sébastien Chirié
sebastien.chirie@capgemini.com

Gas Retail Markets
Antonio Michelon
antonio.michelon@capgemini.com

Companies' Overview
Finance and Valuation
François-Xavier Chambre
francois-xavier.chambre@capgemini.com

Strategy and Organizational Challenges
Philippe David
philippe.david@capgemini.com

Topic Boxes
Sustainable cities
Selma Guignard
selma.guignard@capgemini.com

Capacity markets
Sébastien Chirié
sebastien.chirie@capgemini.com

Cost to Serve / Cost to Acquire
Philippe Coquet
philippe.coquet@capgemini.com

Antoine Arens
antoine.arens@capgemini.com

People 2.0.
Emmanuel Duguay
emmanuel.duguay@capgemini.com

Retail Digital Transformation
Sherif Choudhry
sherif.choudhry@capgemini.com

David Winckles
david.winckles@capgemini.com

Smart Pilots
Marc Chemin
marc.chemin@capgemini.com

Demand Response
Alain Chardon
alain.chardon@capgemini.com

Challenges in the nuclear market
Olivier Phalippou
olivier.phalippou@capgemini.com

Acknowledgements to Marianne Delay, Djothi Ficot, Bettina Grötschel, Inderraj Gulati, Subhash Jha, Pierre Musso, Sundhar Parthasarathy, Mike Pini, Martin Pfruender, Laurent Saiag, Caline Sioufi, Lucie Stembirkova, Stéphane Sun and Stéphane Tchirieff.

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