

European Energy Markets Observatory

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C/M/S/ Bureau Francis Lefebvre

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A strategic overview of the European energy markets

Editorial by Colette Lewiner

Welcome to the 11th edition of the European Energy Markets Observatory (EEMO), covering 2008 and the early 2009 period.

On top of summarizing the Observatory's key findings, this editorial analyzes the crisis' effect on the electricity, gas and environment sectors in Europe; gives an update on security of electricity and gas supply; and discusses the evolution of the energy's sector impact on the environment in the light of the European Union (EU) "Climate-Energy" Package.

The key challenges in the first half of 2008 were still about responding to the growing energy demand while decreasing CO₂ emissions

In 2008, the energy demand increase combined with the necessity of replacing ageing infrastructures, led to extremely high investments requirements: the EU estimated that for electricity and gas, €1,600 billion investments were needed by 2030¹. Building these infrastructures within these timeframes constituted in itself a considerable challenge. The obligation to reduce CO₂ emissions to combat global warming made this challenge even more complex.

As we analyze in this EEMO edition, the Utilities investments have continued to grow; in 2008 the total investments amounted to €120 billion with the largest share (53%) for electricity generation (including renewables) and 24% for the electricity grids and gas pipelines.

However, the energy mix choice continues to pose a problem: three quarters of the power stations under construction will be supplied by fossil fuels and therefore emit CO₂. In 2008, investments in sustainable energy (renewables and energy efficiency)

increased at a much lower pace (2%) than during the previous five years when the compound annual growth rate (CAGR) reached 56%².

Oil price reached a peak of around US\$150 per barrel in July 2008. Gas, coal and electricity prices increased also with peaks between the summer of 2008 and the beginning of winter 2008/2009. During the summer of 2008 the rise in oil and gasoline prices pushed the US to reduce its oil consumption. This unprecedented demand elasticity to price triggered a decrease in oil prices that was followed by a fall in all energy prices.

The crisis has positive and negative impacts on these challenges

On the positive side

■ *A fall in demand:* During the autumn of 2008 the economic recession triggered a decrease in oil prices and demand. The International Energy Agency (IEA) anticipates for 2009 the highest fall in global oil demand since 1982, to 84.6 millions barrels per day (bpd), a decrease of 1.9% compared to 2008³. In H1 2009, the electricity and gas consumption of the industrial sector declined significantly everywhere in Europe by 10 to 20% on a monthly basis (compared to the same months in 2008). However, the tertiary sector, where the main energy consumption is linked to buildings and the residential sector where energy is a vital need, have been resilient to the crisis. For the residential sector a small consumption increase (when corrected by temperature factors) was even observed in some European countries.

For the first time since World War II, electricity total consumption is expected to drop worldwide by 3.5% and gas

consumption by a similar amount in 2009. In H1 2009 the aggregated overall electricity consumption for the main European countries fell by about 5% and the gas consumption by 9% compared to H1 2008. In H2 2009, thanks to the (limited) recovery of certain industries, we should witness a lower decrease of the industrial sector consumption and thus a slow down of the overall consumption decrease compared to the same period in 2008 (where decline started). In 2010, if this trend continues and if the tertiary and residential sectors are not really impacted by the forecasted growing unemployment, we could witness a small growth in consumption compared to a dull 2009 year. However, with the slow and probably small economy recovery in Europe, it is hard to predict when the 2008 levels of energy consumption will be reached again.

■ *A drop in CO₂ emissions,* mainly resulting from the fall in energy consumption. In 2008, the drop for the ETS sectors emissions in Europe was around 3.7% (compared to 2007) and the total European CO₂ emissions should have dropped by around 1.5%⁴. With the economic recession, a further drop for 2009 is anticipated. This explains why the CO₂ prices have dropped on the exchange markets (€13 per ton of carbon equivalent in September 2009, or almost a 60% decline since the 2008 summer peaks). This market move was probably amplified by the credit crunch, as companies which received these emissions rights free of charge, were inclined to sell some of them, even at low prices, in order to generate cash. These relatively low ETS prices provide little incentive for generators to switch from coal to gas generation or to renewable energies.

¹ Inter-connecting Europe - New perspectives for trans-European energy networks, EC DG-Tren, 2008

² Global Trends in Sustainable Energy Investment 2009, UNEP/SEFI/New Energy Finance

³ Oil Market Report, IEA, October 10, 2009

⁴ Provisional data issued by the European Environment Agency, September 2009

- *A supply and demand balance improvement* for electricity and gas excluding exceptional events such as the cold spell in Europe in the beginning of January 2009 and the gas crisis between Russia and Ukraine (see below).
- *Falling prices:* The oil price fell from around US\$150 per barrel during the summer of 2008 to around US\$70 at the end of September 2009. According to some economists this price drop created a bigger relief in the present economic recession than the cumulated governmental stimulus plans. At the present stage governments will try to avoid a significant oil price increase that would jeopardize the recovery. Therefore, the UK and the US regulators have decided to strengthen their collaboration on oil related markets in order to limit speculation and increase transparency. The gas price which peaked at €32/MWh for a delivery in Zeebrugge (Belgium hub) in September 2008 reached the very low price of €7/MWh in September 2009. Coal price has also decreased from a peak of €216 per ton in July 2008 to about €70 per ton in September 2009. The same is observed for electricity prices on the wholesale market – EPEX Spot France – which, after peaking at €117/MWh in mid October 2008 reached €23/MWh in September 2009.

On the negative side

- *Investments are impacted:* The credit crunch combined with lower demand and lower Return on Investments (ROI) has pushed down the investments in the energy sector. These investments are, however, badly needed for long term energy security of supply. In Europe, the major Utilities, which recently spent their war chests for acquisitions, have announced postponed investments. In

Germany, E.ON has revised its investment plan for 2009-2011, from €36 to 30 billion. In Italy, Enel intends to reduce its 2009-2013 investment plan by €12 billion (from €44 to 32 billion), in Spain, Iberdrola has announced 2009 investments of only €4.5 billion down from the €13 billion initially planned and Gas Natural-Union Fenosa will slash investments from the previously announced €21 billion to €11-13 billion.

Fortunately, many stimulus plans contain incentives to investments:

- In Europe, a €4 billion energy infrastructure investment plan was voted in May 2009 by the EU Member States and the European Parliament;
- President Obama's "Stimulus Plan" allows for investments of US\$45 billion in new energy-related expenditure, US\$20 billion in new tax cuts for energy and US\$4.5 billion in the smart electrical grid.

However, because of administrative delays, the stimulus packages will only start to be implemented at the end of 2009 and early 2010 and could have tangible effects on investment levels next year and onwards.

- *Renewable energies are significantly impacted:* After significant growth in the past years, European investments in renewable energies fell by 14% in the second half of 2008 (compared to H2 2007) to US\$21.2 billion⁵. In the US, there was a 50% reduction to US\$10.7 billion. The IEA forecasts a global drop of about 38% in 2009⁶. The good news is that Q2 showed a recovery in investments compared to Q1 but still a decrease year-on-year. Wind turbine and solar panel manufacturers have suffered at the end 2008 and in Q1 2009 with some of them further impacted by Asian

manufacturers' competition. One can easily predict that this competition will become tougher in the future. China, for example, has ambitious targets for its own wind energy development and has adopted a national preference for Chinese manufacturers thus boosting its industry that should become, in 2009, the world's leading exporter of wind turbines.

One can wonder if this downward trend will continue.

On the one hand, the current economic signals don't give incentives to invest in renewable energies. The prices of fossil fuels (and especially in Q2 2009 with the very low gas price) make such investments even less profitable than before the crisis. In addition, at their current low price, CO₂ emissions represent only a small burden for gas or coal fired plants and, therefore, do not help to close the economic gap with the renewable energies.

But on the other hand, legislation and stimulus plans will push up investments in renewable energies:

- In Europe the "Climate-Energy" Package aims at increasing the share of renewables in final energy consumption to 20% by 2020. Meeting this objective would mean a significant boost from the present levels. In May 2009, the €4 billion energy infrastructure investment plan was adopted by the EU Member States; €565 million is earmarked for specific offshore wind projects; and €910 million for electricity interconnectors (helping the integration of renewable energy into the grid);
- In the US: the Obama plan aims, in particular, to double the proportion of renewable energies in the energy mix in three years (from 7 to 14%);

⁵ New Energy Finance

⁶ The impact of the financial and economic crisis on global energy investment - IEA background paper for the G8 Energy Ministers' Meeting, May 24-25, 2009

- In China: the €400 billion two-year stimulus plan announced by Beijing in November 2008 treats the environment generously with €35 billion or 8% of the total funds assigned to the protection of the environment.

Thanks to these stimulus plans announcements, “clean tech” financial deals are growing again. After a slowdown, green business is increasing again with fund raising, and mergers and acquisitions amounting to €8.8 billion in Q2 2009 compared to €1.1 billion in the previous quarter.

In summary, since the end of 2008, we have witnessed a green bubble deflation but thanks to the political decisions favoring a green economy development, some recovery is foreseen for the 2009 year end and for 2010.

- *Nuclear investments are differently impacted by the crisis depending on the region:* Nuclear energy is (with, to a certain extent, hydro power) the only competitive energy source that can be scheduled and that is capable of producing electricity on a large scale without generating CO₂ emissions. Combined with safety and operational improvements these are the reasons why, since a few years ago, we are witnessing a revival of nuclear power in a number of regions.

Since the last EEMO edition there have been two major events – the election of Barack Obama as the US president and the global financial crisis – which have had an effect on altering the approach to nuclear power in some regions:

- In Asia nothing much has changed with the crisis and development is going ahead as planned. Moreover, China has decided to speed things up with plans to put six nuclear reactors into operation each year for the next few years. India also has an ambitious program and has now access to Western technology, thanks to agreements it signed in 2008;
- In Europe, the former Eastern bloc countries have to a greater or lesser extent been hit by the recession, which is likely to delay their nuclear program.

However, this winter's Gazprom gas supply disruption made them realize their Russian gas dependency and resulted in strengthening their resolve to build new nuclear power stations. The financial and economic crisis has also been severely felt in Russia and will probably have the effect of slowing down their ambitious nuclear program;

- In Western Europe, there are two particularly interesting cases. The UK is probably the European country which is going to build the largest number of nuclear reactors. On the one hand, it has to replace its old nuclear power stations and on the other to maintain its energy independence in spite of gradually depleting North Sea natural gas deposits. The country has embarked on the process of authorizing and building these reactors in a very detailed and democratic manner, which should result in the first reactor connected to the grid around 2018. And in Germany, the CDU/CSU-FDP coalition won September elections, which is favorable to the extension of nuclear plants life time. However, a decision to build new reactors in the immediate future is unlikely;
- With the US Administration focused on renewable energies, the current ambition of building more than 30 reactors should be cut down. The 2005 Energy Bill Act included US\$18 billion guaranteed loans for the first three or four reactors. These selected reactor projects will go ahead, but it will be much more difficult for the others, as US Utilities – that are relatively small and now have difficulties to get loans – will hesitate in taking the risk of financing the large investments required.

In summary, the crisis has hit the planned investments in energy and, according to experts the signs remain alarming for the future. Certainly, the present unprecedented crisis, a slow post crisis growth in Europe, and the energy savings regulation impact should lead to lower needs. The UCTE revised down its prospects from 50,000 MW to 20,000

MW of additional electricity generation investment needed to maintain security of supply. This forecast assumes that current planned investments are not cancelled (which is challenging) and does not take into account additional plant closures (estimated at 8,000 MW of generating capacity by 2016) linked to early decommissioning triggered by the Integrated Pollution Prevention and Control Directive and the Large Combustion Plant Directive which were adopted in December 2008.

An upturn in investments after the crisis is anything but sure and could be insufficient as consumption restarts.

As a conclusion, we believe that, without a focus on investments now, the after crisis “wake- up” could be difficult.

The crisis has challenged the resilient character attributed to the Utilities sector

In previous years, Utilities have invested large amounts in cross border acquisitions thus decreasing their (previously large) war chests and increasing their gearing ratio. The combination of these financial factors with lower revenues linked to consumption and prices decreases has created a perception of financial risk and led to a drop in rating ratios.

To restore the situation, Utilities have announced large divestment plans:

- E.ON has a €10 billion divestment plan of which part will be in the high voltage electrical grid;
- ENEL has a €10 billion divestment plan. It has already sold its high-voltage power grid to Terna for €1.15 billion and plans to divest from “Green Power”;
- EDF has announced a €5 billion plan. It has sold 20% of British Energy shares to Centrica, and is looking at divesting some of its grid activities.

Other Utilities will bid for these assets but also new actors such as private equity funds, pension funds or sovereign funds will manifest themselves, especially in the infrastructure part of the value chain.

Security of supply: still to be monitored

Electricity security of supply improved in 2008 but was threatened in early 2009

The real margin⁷ hugely improved in 2008 from 5.3% in 2007 to 9.2% for the UCTE countries, due to decreases in peak loads and capacity additions. However, and despite the lower consumption, early January 2009 exceptional cold threatened the generation/consumption balance. For example, France had a 92,400 MW record electricity peak. It had to import around 1,000 MW during a few consecutive days (mainly from Germany). The situation would have been more tense in a “normal” period and RTE, the French TSO, estimates that with “normal demand”, 1,000 MW more imports would have been needed.

In the future, RTE foresees that peaks will be sharper and higher in France so tense situations could still happen despite a general improvement linked to lower consumption and past investments.

In the longer term, the impact of new technologies will have to be included in demand forecast. For example, the Third Legislative Package (adopted in April 2009) recommends that a target of 80% of the population will be provided with intelligent meters by 2020. This legislation should push more European countries to make this investment compulsory, as exists in Sweden. Smart meters, in conjunction with demand side management Utilities programs should lead to significant savings in electricity consumption, peak power and CO₂ emissions. A Capgemini study⁸ shows that dynamic programs launched in the EU-15⁹ countries could save 200 TWh per year by 2020 (which represents the combined residential consumption of Spain and Germany) and 100 million tons of CO₂ (a significant share of the gap to be filled between now and 2020 to reach the EU objectives).

However, energy efficiency programs and CO₂ saving programs tend to favor electricity usage by boosting heat pumps usage, public transportation and electrical cars.

For electrical cars the loading battery patterns should be carefully planned in order not to increase peak power demand.

Europe's high dependency on Russian gas supplies is an issue

As analyzed in last year's EEMO and in the previous ones, the EU's high dependency on Russian gas (25%) is a threat to security of supply. There were no improvements on this situation in 2008 and as much as 50% of EU gas could still be imported from Russia in 2030.

In January 2009, there was a second “wake-up call” as a consequence of this high Russian gas dependency. A commercial and political dispute between Russia and Ukraine had deprived Europe of nearly all Russian supplies during a period of 22 cold days. These cuts had dramatic consequences for countries like Bulgaria which is 100% Russian gas dependent.

Let's not forget that history repeats itself!

The dramatic fall of Gazprom's gas exports to non CIS countries (45%) in H1 2009 is more cyclical than structural and measures need to be taken to improve Europe's security of supply.

These measures are of different types:

- *Increase the LNG share in the total gas supply*, as LNG enables access to 80% of worldwide proven gas reserves thus providing a good supply diversification. In 2008, in a tense supply and demand situation, LNG trade movements rose by 5.8% above gas traded by pipeline growth of 4.7%. In early 2009 the situation changed; the LNG market that was seller's market

became a buyer's market for several reasons:

- On the supply side, in 2009, two liquefaction plants have been started by Qatargas; more are planned for 2010 and a product surplus is now forecasted for 2010;
- On the demand side, Asian demand has decreased notably because of the Japanese Kashiwazaki-Kariwa nuclear plant being progressively restarted. The development of unconventional domestic gas in the US combined with the recession has also very strongly decreased the US demand. In Europe, if all the new European LNG regas terminals are built, there should be a capacity surplus. However, due to a lack of demand combined with the credit crunch and difficulties in public acceptance, some of those investments could be differed or cancelled. On the longer term, the prediction is that it will take two or three years to absorb this LNG “bubble” and that a tense supply market could prevail again.
- *Increase storage*: The storage demand in the EU is set to grow quite significantly over the next few years, as the EU becomes more dependent on imports which are less flexible compared to indigenous production. The EU recommends that each country has a storage capacity of 16% of its annual consumption (60 days). Thanks to the past year's investments, storage capacity in Europe increased by 5% in 2008 representing 17% of its annual consumption. More than 100 new facilities or extensions projects have been listed but certain projects already have been cancelled or delayed for financial reasons.
- *Build new pipelines routes* enabling the import of gas from Central Asia (mainly Azerbaijan, Turkmenistan and Kazakhstan) without passing through Russia and thus avoid using Gazprom

⁷ Percentage of difference between real generation capacity – which integrates non-usable and unavailable generation capacities – and peak load

⁸ The Capgemini Point of View “Demand Response: a decisive breakthrough for Europe” is available at http://www.capgemini.com/resources/thought_leadership/demand_response_a_decisive_breakthrough_for_europe/

⁹ 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.

pipelines. The Nabucco pipeline is the EU's flagship project. Its expected supply capacity should amount to 6% of annual European consumption and it is planned to start operations in 2014. However, it is encountering a lot of difficulties. In addition to financing and construction hurdles, the greatest challenge for Nabucco is the competing South Stream project sponsored by Gazprom and Eni (Italy) and now other EU Member States companies are getting involved (including France's EDF). In order to fill in the South Stream, Gazprom has extended its importing gas contracts from some of those Central Asian countries, notably Azerbaijan, and is financing regional pipelines (or pipeline extensions) to enable more gas from these countries to flow to Russia. So today Nabucco's main challenge is to secure its gas supply as Central Asia will not be able to provide enough gas. Iran and Iraq gas could be additional resources to those providers, but the present political situation and security issues make these alternatives uncertain.

This situation illustrates the difficulty for EU Member States to switch from national security of supply concerns to a Europe-wide view and for Europe to implement a real European energy policy.

There has been tangible progress towards a European single market

A fluid and transparent market favors cross border exchanges thus increasing solidarity between Member States and improving security of supply for each of them.

- In 2008, *electricity* exchanges have increased thanks to new interconnectors and wholesale markets have started to consolidate (e.g. French Powernext and German EEX started their common operations in July 2009). Other actions such as enhancing market couplings and coordinating and optimizing grid operations (e.g. Coreso) have also contributed to progress towards a single European electricity market.
- To decrease the numerous physical congestions, investments in the gas market were budgeted in 2008 for

hundreds of millions of euros (a positive trend compared to previous years). In addition to physical capacity extensions, increased information transparency and probably the creation of a European gas price index are key enablers for quick decisions and acts during supply threats. It has to be noted that, after long negotiations with the European Commission, GDF SUEZ agreed in July 2009 to limit its reserved gas pipeline capacity for imports into France to less than half by 2014 from two-thirds. This decision will contribute to opening the market to new entrants and to increasing its fluidity.

- On the legislative front, a mild version of the EU Third Legislative Package was adopted in April 2009. It includes, in addition to the preferred option, Ownership Unbundling, two alternatives: the Independent System Operator (ISO), and the Independent Transmission Operator (ITO). In the latter option, which was supported by Germany and France, TSOs are allowed to remain part of the integrated Utility provided they comply with strong "arm length" rules with their Utility shareholder and accept that the regulator has a powerful role in investment decisions. As a consequence, this "sweetened" ITO solution, could prove to be very difficult to operate. The Third Legislative Package also establishes an EU Agency for the Cooperation of Energy Regulators (ACER), with powers to adopt binding decisions on cross-border issues and on the EU internal market.

Climate change: what real progress?

The "Climate-Energy" Package was adopted by the EU on April 6, 2009

By 2020, the EU is committed to reducing its overall Greenhouse Gas (GHG) emissions to at least 20% below the 1990 levels, to increasing the share of renewables in energy use to 20% and to reduce energy consumption by 20%.

For the sectors covered by ETS (mainly energy, Utilities, chemicals and large manufacturing firms) free allocation of

emission will be progressively replaced by rights auctioning, with a 100% auctioning by 2020. However, for the power generation sector, the auctioning of 100% of allowances will start in 2013. These certificates will then have a "real" price and windfall Utilities profits, as reported in 2007, should disappear.

Is the EU 3x20 objective likely to be reached in 2020?

Even if in 2008 and probably in 2009 we should observe a decrease in CO₂ emissions, these decreases are linked to a cyclical effect – the economic crisis – and not a structural one. Structural effects will appear when buildings and transportation related policies and regulations in favor of energy savings and CO₂ emissions reduction will start having tangible effects. In this respect 2020 is a short-time horizon for the renovation of a significant portion of the existing buildings, and for the switch of the present car fleet to electrical cars.

So, we are not yet on the right track and more actions should take place.

Before listing them, let's look at the international situation.

The international situation is unclear

A recent Energy Information Administration (EIA) report¹⁰ shows that by 2030, worldwide energy consumption should increase by 44% and CO₂ emissions by 39%. With continued heavy reliance on fossil fuels expected for most of the non-OECD economies, much of the increase in CO₂ emissions is projected to occur among the developing, non-OECD nations. In 2006, non-OECD emissions exceeded OECD emissions by 14%. In 2030, however, non-OECD emissions are projected to exceed OECD emissions by 77%.

As atmospheric pollution is global, it is crucial that commitments on CO₂ emission limitations be taken by other large emitting regions of the world. If not, European efforts will be a drop of water in the ocean and their cost could jeopardize Europe's development.

¹⁰ International Energy Outlook 2009, EIA, May 2009

With the exception of Japan's new prime minister's promise to make ambitious cuts in his country's GHG emissions, the recent news from this front is not positive:

- In August 2009 the Australian Government's proposed Carbon Pollution Reduction Scheme failed to pass in a Senate vote;
- The election of President Barak Obama raised hopes that the US would adopt binding limitations on CO₂ emissions, however the Waxman-Markey Energy law that includes a cap and trade system was adopted only with a thin majority by Congress and should encounter a lot of difficulties in the Senate. If the law is not passed by December 2009, the US will have additional difficulties, during the Copenhagen summit, to convince the developing countries to adopt quantitative GHG emissions limitations.

In any case these "post 2012 Kyoto Protocol" discussions will be very difficult as developing countries, notably China and India, want as counterparts not only strong commitments on Western countries' reductions but also more technology transfers and funding. In a nutshell, they are reluctant to sacrifice their economic development, needed for their social cohesion, to strong CO₂ emission reduction objectives.

What, in addition, can be done to meet EU objectives?

- *Electricity generation:* The contribution of renewable and nuclear plants to a lower carbon energy mix has already been touched on. Coal is an abundant energy resource with around 150 years of reserves (compared to oil reserves estimated at around 60 years) and well spread geographically.

It is thus important to invest in Carbon Capture and Storage (CCS) research and demonstration projects in order to lower significantly the cost of this technology. In 2008, CCS activities in Europe have increased but obviously more needs to be done: even if all the 50 reported

projects were to go forward, they would represent the annual avoidance of 80 million tons of CO₂ which is less than 4% of the total ETS allowances (that amount to two billion tons). Let's note that in the EU May 2009 energy infrastructure investment plan, €1.050 million was allocated for seven additional CCS projects. In addition to these demonstration or pilot projects, research efforts on the process itself are needed. A framework has also to be developed regarding the legal status of the CO₂ storage and, as there are already negative local reactions towards the CO₂ storage facilities, communication schemes for neighborhood citizens have to be worked on.

- *Energy savings:* This is a "no brainer" as it helps to decrease CO₂ emissions and to increase security of supply. However, related actions require a long term political will, significant investments and a dynamic participation of citizens.

These actions are multifaceted and include legislation decisions, companies' actions in industrial and tertiary sectors, Research & Development efforts as well as individual's behavioral changes

- Legislation has to provide for mature technologies deployment. The EU's decision to withdraw progressively incandescent bubbles from the market and its recommendation to deploy smart meters for 80% of the population by 2020 are good examples. At the countries level, legislations have been adopted to reduce energy consumption and CO₂ emissions. For example in France, the *Grenelle de l'environnement*¹¹ comprises various measures to improve building insulation (400,000 homes per year at cruising speed), to reduce the cars' CO₂ emissions 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.
- A lot has already been done in the industrial sector. In OECD countries,

the industrial energy intensity has been divided by two over the last 35 years and is at 0.07¹². This compares with much higher figures in developing countries – 0.63 in China and 1.23 in Russia – showing that these countries have a lot of room for improvement.

- In the computer industry major progress in computer consumption (leading to up to 40% reduction) and recycling has been made by IT hardware manufacturers. Additional 30% energy savings can be achieved by installing and running specific software that, for example, switches the computer to standby after it has been idle for an hour. Lastly, Internet development and video-conferencing enable working from home which cuts down on travel.
- More needs to be done in the tertiary sector by decreasing the buildings' energy consumption. This is a major point, as worldwide buildings' (residential and commercial) potential savings represent today's global transportation sector energy consumption!
- The proposed EU Public Private Partnership on buildings is a laudable attempt to reach the implementing intermediaries (construction industry, and architects) and achieve country relevant energy efficiency methods and standards. These buildings could be able to generate and store energy, thus avoiding peak demands by shifting loads.
- Efforts focusing at the optimization of cities' energy systems, i.e. integration and adjustment of energy production and consumption are necessary. Control, monitoring and supervision are needed for which Information and Communication Technologies (ICT) technologies are indispensable at the technology as well as at the system level. On both sides of the Atlantic, innovative smart cities projects are launched: in Freiburg (Germany),

¹¹ The "Grenelle de l'Environnement" is a Round Table on environmental issues, instigated by the President of France, Nicolas Sarkozy, 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>

¹² Measured in tons of equivalent oil per US\$1,000 GDP

BedZed (UK) and Malmö (Sweden) in Europe, and in Boulder and Miami (US). These projects usually gather the municipalities, technology and ICT firms and the local Utilities.

- Technologies: new energy technologies have a pivotal role to play in ensuring Europe meets its targets. The EU's Strategic Energy Technology Plan (SET-Plan) involves setting out a long-term energy research, demonstration and innovation agenda for Europe. The Seventh Framework Program for Research and Technological Development (FP7) paves the way for implementing the objectives of the SET-Plan. It runs from 2007 to 2013, and a €2.35 billion budget is dedicated to non-nuclear energy research. Despite these efforts, and given the huge challenges that lie ahead to transform the energy sector into a low carbon sector, the present European Research & Development and Demonstration effort pales in comparison to the

recent announcements and new initiatives by the US, Japan, China and Korea.

- Individual behaviors: It is extremely important to give the customers the right price signals and reward them for their energy conservation behavior changes.

In addition to increasing the level and quality of information on energy real issues, it is important to give to customers:

- ✓ Tools (as smart metering, energy audits, white products energy related labels...) enabling them to know better their daily energy consumption level;
- ✓ The right price signals that reflect the supply and demand situation and the competition. This implies eliminating artificial tariffs that don't reflect the energy market conditions;
- ✓ Price rewarding systems for lower consumptions during peak hours when electricity is provided by gas fired CO₂ emitting stations. We mentioned above the large savings

enabled by dynamic demand response Utilities programs;

- ✓ CO₂ taxes are also a way to push customers to buy or use less CO₂ rich products. These taxes have already been implemented in several European countries including Sweden, Denmark, Switzerland and Finland as well as in Canada. According to some economists, they have enabled a “green industry” growth and contributed for 0.5% to the countries economic growth. Their effectiveness is however controversial as delocalization of polluting industrial activities are partly responsible for the observed CO₂ savings. In 2010, a carbon tax will be imposed in France on fossil fuel products. The tax will be based initially on a price of €17/tCO₂ and all the revenues generated by this new tax will be redistributed to the consumers.
- On the longer term, we all need to rethink our economic model and our lifestyle. A few years ago some developing countries announced that they would build their own economic growth model adapted to their history and culture. It is disappointing to see that adopting the Western lifestyle and accessing to the same type of living standards is now the common goal of many people in these countries. In our Western lifestyle, success is measured by the ability to buy a larger house, to drive a big car, to fly intensively around the world, to acquire a lot of manufactured goods and to consume a lot of energy associated with high CO₂ emissions. These individual incentives have to change and a more frugal, perhaps more intellectual, lifestyle should be considered as a goal.

Conclusion

After the crisis, in the developed countries, slow recovery and energy and CO₂ saving measures will probably modify the way companies and individuals consume energy.

On a global level, it is more than likely that a large part of the previous problems related to demographic growth and rising standards of living will re-emerge. To convince ourselves, we only have to remember that annual population growth in developing countries is 1.2% and that their annual energy consumption is expected to increase more (by 1.7%) because of standard of living improvement.

This is why it is absolutely vital that the reductions in energy consumption in the developed countries aim at compensating for the increase in the developing countries.

It is also necessary, during the crisis, to continue to invest not only in demand management, energy infrastructures but also in achieving the right energy production mix. It is the duty of governments to provide the right legislative framework and financial incentives to make sure that these investments continue. Otherwise, because electricity and gas are heavy industries requiring long periods of time to build new infrastructures, the problems which existed prior to the crisis will be exacerbated further.

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Colette Lewiner

Global Leader of Energy,
Utilities and Chemicals Sector at Capgemini

Team and Authors

Research Leader

Philippe David

+33 1 49 00 22 11

philippe.david@capgemini.com

Core Team

Sopha Ang

+33 1 49 00 22 30

sopha.ang@capgemini.com

Philippe Coquet

+33 1 49 00 22 09

philippe.coquet@capgemini.com

Switching insights

VaasaETT

Dr Philip Lewis

+358 40 529 5852

philip.lewis@vaasaett.com

European Energy Policy insights

Mr Christophe Barthélémy

+33 1 47 38 55 00

christophe.barthelemy@cms-bfl.com

Competitive Power

Generation

Ana-Maria Popa

ana-maria.popa@capgemini.com

Arnault Prêtet

arnault.pretet@capgemini.com

Electricity Wholesale Markets

Sébastien Chiré

sebastien.chirie@capgemini.com

Electricity Retail Markets

Vincent Escoffier

vincent.escoffier@capgemini.com

Competitive Gas

Upstream Gas

Florent Andrillon

florent.andrillon@capgemini.com

LNG

Nick Sharma

nick.sharma@capgemini.com

Gas Wholesale Markets

Sébastien Chiré

sebastien.chirie@capgemini.com

Gas Retail Markets

Antonio Michelon

antonio.michelon@capgemini.com

Infrastructures and Regulated Activities

Electricity Transmission

Jagtar Basi

jagtar.basi@capgemini.com

Electricity Distribution

Philippe Chanel

philippe.chanel@capgemini.com

Gas Transmission

Antonio Michelon

antonio.michelon@capgemini.com

Gas Storage

Christian Sgard

christian.sgard@capgemini.com

Florent Andrillon

florent.andrillon@capgemini.com

Gas Distribution

Philippe Chanel

philippe.chanel@capgemini.com

Sustainable Energy and Climate Change

Alain Chardon

alain.chardon@capgemini.com

Oskar Almén

oskar.almen@capgemini.com

Strategy and Finance

François-Xavier Chambre

francois-xavier.chambre@capgemini.com

John Honoré

+33 1 42 13 51 55

john.honore@sgcib.com

Regional Focus

Belgium

Pierre Lorquet

pierre.lorquet@capgemini.com

Denmark

Jacob Stage

jacob.stage@capgemini.com

France

Vincent Escoffier

vincent.escoffier@capgemini.com

Germany/Switzerland

Jan Strobel

jan.strobel@capgemini.com

Italy

Antonio Michelon

antonio.michelon@capgemini.com

Netherlands

Sylvia Harskamp

sylvia.harskamp@capgemini.com

Norway

Magnus Häggström

magnus.haggstrom@capgemini.com

Portugal

João Torres

joao.torres@capgemini.com

Slovakia

Michal Géci

michal.geci@capgemini.com

Spain

Oscar Barrero Gil

oscar.barrero-gil@capgemini.com

Sweden

Oskar Almén

oskar.almen@capgemini.com

UK

Alistair Green

alistair.green@capgemini.com

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