How smart grids are transforming the electricity landscape

The smart grid network is revolutionising the way electricity is delivered by providing a superior service that leaves outmoded grids in its wake. The challenge now is for governments to regulate the process in order to ensure consistent, universal standards

By Ella Kokotsis, G8 and G20 Research Groups

Energy and environmental security depends critically on smart grids that can reliably, efficiently and affordably deliver clean electricity from an optimal set of diverse generation sites, across high-voltage transmission lines, to where energy is ultimately needed – homes, schools, hospitals, businesses and other end users. The classic concern with ensuring reliability and preventing blackouts has now been compounded by new challenges associated with rising global energy demand, the need to 'wheel' power over longer distances, concerns over nuclear safety, terrorist threats to critical energy infrastructure, the drive for lower electricity costs and the urgent need for a cleaner, greener and more sustainable electricity system that helps control climate change.

Through advanced monitoring, analysis and communication capabilities, smart grids offer a new approach that optimises the operation of the entire electrical grid. In order to realise their potential, however, several questions must be addressed: How have technological advances made grids smarter and what does the future promise in this regard? How are national governments and industry working to realise this potential and overcome regulatory and jurisdictional barriers? How and why is international cooperation important?

> The success of smart grids depends on how well the various components are able to connect and interact

Technological challenges

Jurisdictions around the globe acknowledge the pressing need to modernise electricity grids as their existing ageing infrastructure and delivery systems are wearing out.

Increased demand for electricity consumption, thanks to population growth and the addition of countless electronic devices, is overtaxing fragile electrical grids, particularly during times of peak demand. As delivery systems are reaching the end of their life cycle, overall reliability is being compromised. But smart grids are well positioned to mitigate this problem by taking advantage of new, evolving technologies. Smart meters, plug-in electric vehicles, renewable integration, in-home generation, smart appliances and energy storage represent several leading-edge technologies that can significantly increase the efficiency and reliability of the entire electricity system. Smart grids can connect all of these information and communication technologies to expand the capacity of the current electricity infrastructure to provide enhanced reliability, efficiency and sustainability. Over time, technological advances in computing, communications, digital automation and business intelligence tools will be capable of seamless and secure interactions within a more mature and smarter grid.

The regulatory landscape

The success of smart grids ultimately depends on how these numerous components connect and interact. With smart grids so broad in scope and the standards so complex, national governments and industry must try to realise the potential of smart grids in a onerous and dense regulatory landscape. One particular major challenge lies in integrating devices from numerous providers worldwide.

Interoperability standards must allow utilities to buy equipment from vendors that will work across various interfaces and at all levels. These devices need to go beyond speaking the same language to understanding each other's 'thought processes'. The International Electrotechnical Commission is the only standardisation organisation that applies a truly international and consensus-based protocol to smart grid technical standards. To date, it has identified more than 100 standards. The ongoing development of such standards is vital in enabling new products, services and markets, as well as anticipating and responding to system disturbances, natural disasters and physical or cyber attacks.

The importance of international cooperation

Public interest groups around the world are pressuring politicians to reduce carbon dioxide emissions through the adoption of alternative energy sources and the implementation of energy-efficiency regulations. The integration of renewable energy into smart grid technology can reduce global dependence on fossil fuels, the production of atmospheric greenhouse gas emissions and the need to import energy. Investments in wind, solar, biomass, marine, geothermal and hydro, combined with energy storage technologies and vehicle electrification, can be used to leverage the smart grid to reduce toxic emissions significantly. Recent US studies estimate that by using smart grid-enabled mechanisms, US greenhouse gas emissions can be reduced by as much as nine per cent below 2005 levels by 2030. Smart grid deployment is clearly a key tool in addressing some of these climate change challenges, but it also enables environmentally

aware consumers to assess and react to their own environmental impacts. Continuous international dialogue, cooperation and consensus building are therefore necessary to harmonise and align smart grid programmes so that they will have a positive impact on environmental sustainability.

What the G8 can do at Deauville

At the 2009 L'Aquila Summit, the G8 leaders recognised that renewable energies "play an essential role" in meeting the dual challenge of reducing emissions and lowering fossil fuel consumption and dependence. The leaders committed to promoting the "research and development of and investment in smart grids" to enhance energy efficiency and "accelerate efficient and secure integration of renewable energy sources and distributed generation into the electricity system".

Assessments by the G8 Research Group of the G8's compliance with its L'Aquila commitments found several initiatives aimed at fulfilling their smart grid pledge, including the allocation by the US Department of Energy of 32 smart grid grants worth $620 million. For its part, Canada allocated $146 million towards 19 clean energy projects in smart grid, solar, wind, tidal and geothermal, while the United Kingdom announced its contribution of £18 million for start-up companies developing new fuel cell, marine, wind, photovoltaic and smart grid technology.

At Deauville, the G8 leaders can build on this foundation by establishing a task force to foster smart grid technology, innovation and economic development opportunities within the context of environmental sustainability. Such a task force would need to address the challenges of common standards that advance the growth and commercialisation of smart grid systems and technologies.

Existing methods of electricity supply can be improved upon by the introduction of smart grids, reducing emissions and addressing climate change challenges in the process

> "Investments in wind, solar, marine, geothermal and hydro can be used to leverage the smart grid to reduce toxic emissions"

Moreover, the task force would need to recognise that, in order to integrate renewable sources effectively into smart grids, new transmission lines will be needed. Current transmission planning, siting and construction can take upwards of 12 years with onerous government approvals. Engaging stakeholders and encouraging private and public sector support will be key in bringing the benefits of smart grids to end users. Deauville, therefore, is a historic opportunity to seize the enormous potential of smart grids and encourage innovation, offering better choices to consumers and, ultimately, promoting a cleaner and healthier global environment. ◆

Leading the (R)Evolution of Electric Mobility

Portugal has developed the first national integrated smart grid for e-mobility – the MOBI.E system. MOBI.E is an integrated charging solution for electric mobility. With a single card, it is possible to charge the battery of any electric vehicle at any charging point with electricity supplied by any retailer. MOBI.E promotes a faster adoption of e-mobility.

By Mr João Dias Coordinator of the Portuguese Office for Electric Mobility

Portugal is leading the way towards a more sustainable mobility. In June 2010 José Sócrates, the Portuguese Prime Minister, inaugurated in Lisbon the first charging point of MOBI.E. It was the first of a pilot infrastructure network comprising 1,350 charging points distributed around the country. This network will be completed until June 2011 and will be the first of its kind in the world. Private operators are already investing in their own charging points, adding to the pilot network.

Why is electric mobility so important for Portugal?

The share of renewable energy in Portugal increased significantly in recent years, reaching more than 50 per cent of the total electricity production in 2010. This change is mainly due to the growth of wind power, which augmented from 341GWh in 2002 to 7,440 GWh in 2009. However, other projects have been developed in areas such as photovoltaic and wave energy. The share of renewable sources in total electricity production will be 60 per cent in 2020.

Additionally, although EU Directives have led auto manufacturers to improve the consumption performances of cars, private transport is still running mostly based on fossil fuels, making cars one of the greatest sources of greenhouse gas (GHG) emissions. Electric mobility is the first proposal to change this situation in a structural way.

Therefore, electric mobility is the missing piece for a more sustainable mobility model. First, electric engines are more efficient than internal combustion engines. Second, electricity is locally produced, reducing the dependence on imported fossil fuels, which is crucial from both an external balance and a strategic perspective. It is expected that the energy dependence will be reduced to 74 per cent by 2020, from over 90 per cent currently. Third, electricity produced from renewable sources slashes GHG emissions and improves the air quality of urban areas. Fourth, it contributes to a better management of the electric grid, as smart systems, such as MOBI.E, will promote the storage of energy, transferring electricity consumption from peak- to low-demand periods. And finally, it reduces the cost of mobility.

Moreover, electric mobility is also important because it is creating jobs and wealth in the country, fostering the green economy.

Why is Portugal leading this revolution?

Several reasons are behind Portugal's leadership in the field of electric mobility.

First, the Portuguese government is committed to reinforce the role of Portugal as a competitive economy for the development and production of goods and services with a high technological content. This policy has been highly successful, as the data for research-and-development (R&D) expenditure confirms: in 2009, R&D expenditure reached 1.71 per cent of GDP, more than twice the 0.81 per cent figure of 2005.

Second, as was previously explained, important investments were made in the energy area. In fact, these investments in renewable energy, but also on energy efficiency and smart grids, were designed as a tool to promote economic development, promoting R&D and attracting private investments. Several measures are also being implemented in the area of energy efficiency. Two of the most important projects are InovGrid and MOBI.E. InovGrid is one of the most modern smart grid experiments in the world. A pilot is being conducted in the city of Évora, where approximately 50,000 houses do already have smart meters in the first large-scale experiment. MOBI.E is the electric mobility program, a natural evolution on this strategy.

Third, because Portuguese people are keen to try new technologies: Portugal has embraced new technologies as few other countries, as the experience with mobile phones, electronic payment tools or internet broadband penetration confirm.

Finally, and this is perhaps the most important factor, there is a national political consensus on the importance of these policies. It is worth mentioning that José Sócrates was the first prime minister in the world to use an electric vehicle as an official car for city travelling.

Portugal has developed the first smart grid for e-mobility – the MOBI.E system

The MOBI.E system is the first smart-charging system for electric mobility to be implemented in the world. There are some distinctive features of MOBI.E that are critical factor to promote electric vehicles penetration.

- MOBI.E is an integrated payments solution for sustainable

Portugal's MOBI.E national vehicle-charging network is the first of its kind in the world

mobility. With a MOBI.E Card, users may charge their vehicle batteries at any location. But they can also pay for car parking, public transportation or a car-sharing service. Thus, Mobi.E integrates other forms of sustainable transportation. As the system was optimised, it has a very low cost and it can eventually be used as a micro-payment system. Moreover, from any device connected to the internet, it is possible to reserve a charging slot at a specific station, to check the status of an ongoing charging or to know which charging operations occurred, how many kWh were used and the cost.

- MOBI.E is a smart grid for electric mobility, not just a set of charging stations. MOBI.E was designed as a smart grid, and it will be possible to control the charging processes, in order to transfer electricity consumption from low- to peak-demand periods. This is particularly relevant in a country such as Portugal, where renewable sources form such a large share of electricity production.
- MOBI.E is an ongoing project on a national scale. MOBI.E presents significant advantages over other initiatives as it has been developed since early 2008, is already being implemented on the ground and has a national scale, rather than being a fragmented local or a regional project.
- MOBI.E has an open-access and market-oriented philosophy. Since the program for electric mobility started to be developed, some conditions have been set. In fact, from the beginning it was defined that the system would have to:
- Have a national scope, rather than being a local or a regional initiative;
- Be interoperable and have an open-access philosophy, meaning that it has to have the capacity of integrating all the relevant stakeholders and preventing monopolistic situations and network effects;
- Attract private investors and be based on the private initiative, promoting a fast expansion of the system;
- Allow a more rational investment in the charging network, lower investments per player, higher demand per charging station, higher returns, lower cost for the user, faster adoption
- Have a positive impact on the electric system management through the application of the smart grid concept to the battery charging.

Taking all these conditions into account, a large number of public and private entities were involved in the development of what MOBI.E is today. And what is MOBI.E today? MOBI.E is the first integrated and large-scale experiment in electric mobility in the world facing a real test situation. MOBI.E is the most complete and comprehensive billing and management system for electric mobility ever developed, having the capacity of integrating all the existing and fragmented projects that exist in different countries.

Portugal, a living lab for electric mobility

Portugal was the scenario several auto-makers have chosen to launch their first electric vehicles in Europe, recognising the country's leadership position. But Portugal is also the place where many innovative products and services related to mobility are being developed and tested, creating opportunities for companies based in the country. The open and modular characteristics of MOBI.E allow the system to be implemented in other geographies. MOBI.E is the standard for electric mobility.

MOBI.E ELECTRIC MOBILITY

www.mobie.pt

Satellite observations

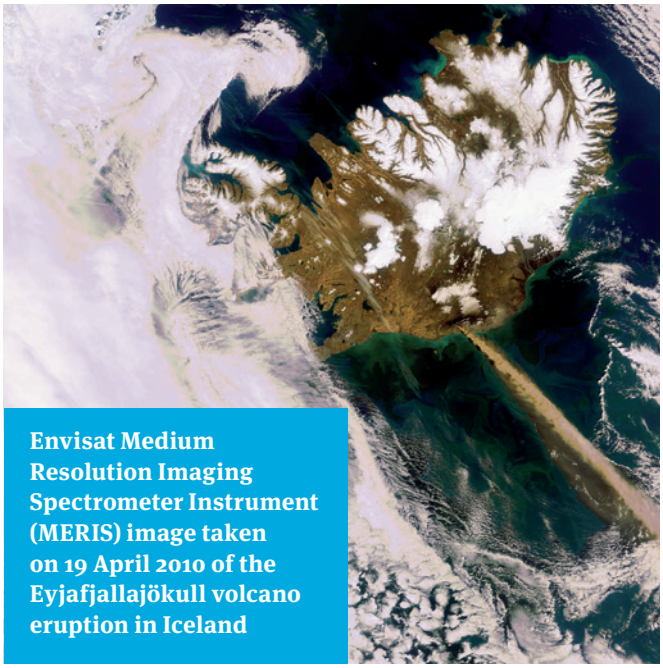
ESA's indispensable contribution to the challenge of climate change

Just as the cartographers of earlier centuries climbed mountains to have a better overview of their surroundings, we are sending satellites into space to get a better picture of our planet at large. However, it is not only photographs of Earth's surface that scientists are looking for – much more can be achieved through more sophisticated satellite applications. The fleet of silent sentinels in space helps us to better understand the global processes that shape our environment, and also our future.

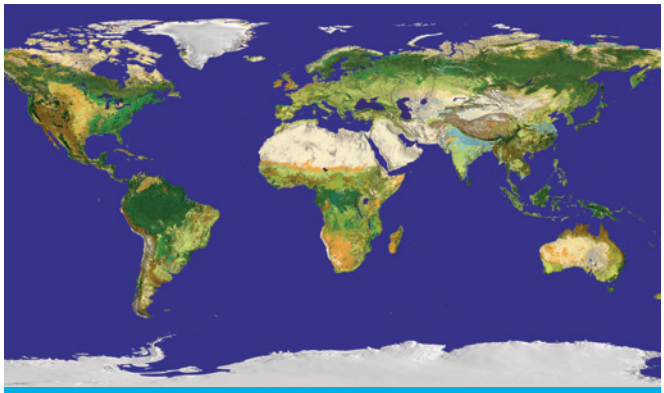
The European Space Agency is a pioneer in terms of Earth-observation satellites. It has been instrumental in making meteorology one of the first sustainable and operational space applications in Europe, having put efforts into the development of the Meteosat missions since the 1970s. The long-lasting ERS-1 and ERS-2 missions and Envisat, the world's largest environmental satellite, have provided an immense amount of valuable research data to more than 4,000 scientific projects worldwide and, routinely, to service providers every day. One of the most urgent topics of our time is the understanding of the underlying mechanisms of climatic change, and the contribution of humankind towards it.

In order to find out more about this urgent topic, it is indispensable to look at the state of, and more importantly the changes in, the Earth's climate that come about as the result of the interaction between various components – such as the atmosphere, the cryosphere, the hydrosphere, the land masses and, not least, the human sphere of influence. ESA is developing a veritable fleet of so-called Earth Explorer missions that shed light on open questions regarding these Earth systems. Three Earth Explorers are already in space.

GOCE, a mission to map the Earth's gravity field with unprecedented accuracy, was launched in March 2009. SMOS, the ESA Soil Moisture and Ocean Salinity mission, followed in November 2009. Only five months later, the third Earth Explorer – ESA's ice mission CryoSat – was delivered into orbit in April 2010. Another four Explorers are under development. Each mission uses the most modern technology, often never flown before, to close observation gaps and deliver accurate and reliable data for measuring the pulse of the planet.



Envisat Medium Resolution Imaging Spectrometer Instrument (MERIS) image taken on 19 April 2010 of the Eyjafjallajökull volcano eruption in Iceland



ESA's 2009 global land cover map was generated using 12 months worth of data, collected from 1 January-31 December 2009, from Envisat's MERIS instrument. GlobCover 2009 proves the sharpest possible global land cover map and can be created within a year. The map's legend uses the UN Food and Agriculture Organisation's Land Cover Classification System.

As important as satellites in space are, they nevertheless represent only one part of the quest to better understand climate patterns. Less spectacular, but equally important, is the utilisation of many years of archived data sets, their reprocessing with the newest scientific algorithms, their comparison and their interpretation. The Global Climate Observing System (GCOS), in the context of the UNFCCC, defined a set of Essential Climate Variables (ECVs), which shall be systematically monitored, in order to quantify the state of our climate in an objective and effective way. In response hereto, ESA has given birth to the Climate Change Initiative, which systematically generates, preserves and gives access to global data sets for many of these variables.

With the help of new satellite systems, such as those developed through the Global Monitoring for Environment and Security (GMES) programme of the EU and ESA, and the exploitation of the infrastructure already in space, it is possible to advance both scientific and political ambitions. Earth observation is a perfect example of linking research and technology development with the care urgently needed to work towards a sustainable future for all of us.

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Tough measures to ward off future fuel shocks

For energy security, economic and environmental benefits, governments need to act on climate policies, reduce volatility and phase out fossil fuel subsidies

By Nobuo Tanaka, executive director, International Energy Agency

Geopolitical events in North Africa sent oil prices surging during the first quarter of 2011, compounding the price rises of 2010 driven by steadily increasing demand in major economies. Together, these represented a 30 per cent price increase since September 2010. The uncertainty in energy markets again underscores the dependence of the global economy on fossil fuels.

Not only does this dependence contribute to global climate change in the longer term, but sustained high prices also threaten to undermine the economic recovery in the short term. Consumers are forced to endure higher costs for energy, and more expensive energy drives up prices of food and other necessities. An oil price averaging $100 per barrel through 2011 would inflict an 'oil burden' of around 5 per cent of global gross domestic product (GDP) – a level that has coincided with sharp economic slowdown in the past. The most vulnerable consumers are those in energy-importing developing countries and in emerging economies, where growth in demand is greatest.

Reducing dependence on imports

Even if countries take steps to reduce their energy demand, projections by the International Energy Agency (IEA) imply continued high levels of spending on oil and gas imports through the coming decades. In the 'New Policies Scenario' of the IEA *World Energy Outlook 2010*, which takes into account the broad policy commitments and plans announced up to mid-2010, global oil demand continues to increase, rising from 84 millions of barrels per day (mb/d) in 2009 to 99 mb/d in 2035. India's projected spending on oil imports is highest as a proportion of GDP, reaching 5.1 percent at market exchange rates by 2035.

However, under the IEA's more ambitious climate change scenario – in which countries meet a target of stabilising carbon dioxide emissions at a concentration of 450 parts per million – India's projected oil imports in 2035 would be $80 billion, or 29 per cent lower because of increased energy efficiency and the successful deployment of new energy technologies, such as electric vehicles. So policies focused on achieving climate change objectives can also bring substantial benefits to global energy security.

Transparency and oversight

While sustained high oil prices clearly have negative consequences, extreme volatility in energy markets is also destabilising, both for producers who must plan investments with uncertain future revenue streams and for consumers who must ensure adequate budgets to cover their energy needs. Such fluctuations affect not only fossil fuel investment, but also investment in other energy technologies, especially those that are not competitive below a particular price level.

The IEA has been working closely with other organisations – including the International Energy Forum (IEF) and the Organization of the Petroleum Exporting Countries (OPEC) – to understand the drivers behind price fluctuations. In particular, efforts have been made to examine the interaction between physical and financial markets for energy. Joint efforts have also been made to review the current regulatory framework for commodity futures and derivatives markets, as well as their objectives and the extent of proposed regulatory reforms in key market sectors.

The IEA holds the view that market fundamentals of supply and demand are still at the core of determining price, but that expectations, geopolitical risks and financial flows also play a role. Regulators are taking steps to improve the oversight of futures markets, but improved transparency of physical data is also necessary, especially in regard to oil demand and stock data in emerging economies. Continued cooperation and active dialogue among energy consumers and producers, on data and market outlooks, are important elements in improving understanding of shared concerns and in bringing greater stability to the market.

Enhancing energy security

One important factor that continues to exacerbate volatility by distorting price signals is fossil fuel subsidies, as highlighted in a report presented by the IEA, the Organisation for Economic Co-operation and Development (OECD) and the World Bank to the G20 summit in Seoul in November 2010. By setting prices below the market value, subsidies encourage energy consumption and waste, thereby driving up demand, increasing emissions of greenhouse gases and draining government budgets. Fossil fuel subsidies also undermine the competitiveness of renewables and more efficient energy technologies.

Ironically, subsidies often benefit not the poor for whom they are intended but rather the rich, as the latter tend to consume more energy. In its analysis, the

> "Extreme volatility is destabilising for producers and consumers"

Filling up at the petrol pump. Future consumers may be recharging their electric vehicles, under an optimistic scenario

IEA estimated that fossil fuel subsidies amounted to $312 billion globally in 2009, down from $558 billion in 2008. However, with rising oil prices, early signs of inflation in some emerging economies and the impact of the world recession lingering, it is uncertain if this downward trend continued in 2010.

The phase-out of fossil fuel subsidies would enhance energy security, reduce emissions of greenhouse gases and bring immediate economic gains. If these subsidies were eliminated by 2020, global energy demand would be cut by 5 per cent, or around 4.7 mb/d of oil – equal to the current consumption of Japan, Korea and New Zealand combined. A complete phase-out would also represent a significant step towards tackling climate change by reducing carbon dioxide emissions by 5.8 per cent, or 2 gigatonnes, by 2020. In 2009, G20 leaders committed to phase out fossil fuel subsidies. Failure to achieve this goal will be costly. The IEA estimates that these subsidies could amount to $600 billion by 2015 if no action is taken.

Progress towards climate goals

While fossil fuels are expected to remain a predominant portion of the global energy mix in coming decades, governments have the tools to lessen the impact of this dependence on their economies and the climate, while strengthening their energy security.

Climate policies that encourage energy efficiency, as well as the development and deployment of new energy technologies, reduce demand and so drive down countries' reliance on costly imports. Better regulation and understanding of price volatility can help governments to plan energy investment and avoid the economic damage of unexpected spikes or troughs in investment in all forms of energy. The elimination of fossil fuel subsidies will also help reduce global demand, thereby removing market distortion and cutting greenhouse gas emissions.

If governments take these necessary steps, they will not only enhance their energy security, but also make progress towards climate goals. ◆

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Europe must steel itself to rethink its unilateral emissions policy

Only massive R&D, deployment of breakthrough technologies and a competitive industry that is free to grow can help to reduce global greenhouse gas emissions

By Gordon Moffat, Director General of EUROFER, the European Confederation of Iron and Steel Industries

The current global commitments for reductions in greenhouse gas emissions will not deliver the result seen as necessary by the IPCC to limit the global temperature increase to two degrees celsius to avoid dangerous climate change. On the contrary, the commitments made by world leaders in December 2009 in Copenhagen and thereafter will lead to a further massive increase in global emissions. The EU did not succeed in its self-imposed role as world climate leader – in order to lead you need followers; in this instance no one followed and the European unilateral targets are now self-defeating.

For example, the commitment made by China to reduce its CO_2 emissions intensity by 40 per cent compared with business as usual effectively allows it to increase emissions by 75 per cent to 90 per cent by 2020. This is an increase of five billion to six billion tonnes of CO_2 in just 10 years, an increase that alone will be more than today's total European CO_2 emissions.

Experts predict global annual steel production will grow from 1.3 billion tonnes in 2010 to 2.3 billion tonnes in 2020. This growth will be generated outside Europe, mostly in emerging economies, with an increase in CO_2 emissions in the range of 2.5 billion tonnes in the global steel sector.

Vacuum Arc Remelted steel (VAR) for aerospace applications

Photo: Tata Steel

These examples show that the climate battle cannot be won without adequate commitments by both developed and emerging economies. It shows also the absurdity of an EU climate policy that does not allow for growth of the most carbon-efficient steel companies in the world and that leaves even the best performers unprotected, with billions of additional unilateral costs. The EU's steel industry may have costs in the range of €25 billion in the third EU emissions trading period (2013-20) – costs that its competitors do not have to bear. European companies will have less capacity to invest in R&D (research and development) in breakthrough technologies to reduce their own emissions and for innovative solutions that reduce emissions in other sectors. Yet massive investment in R&D and the deployment of breakthrough technologies is the only remedy for human-made climate change.

The idea of 'cap and trade' has been abandoned or rejected by every other major economy in the world – the US, Canada, Australia, Japan. Emissions trading is not the policy to drive climate action from manufacturing industry. Imposed on industries such as steel, which have process emissions that cannot be squeezed indefinitely, it simply imposes a burden that discourages investment, hampers growth, jeopardises competition and, if applied unilaterally, is environmentally counterproductive. This is why all other economies apart from Europe have rejected cap and trade.

The EU emissions trading directive and its 21 per cent cap fail to create a level playing field for Europe's industries. While our global competitors grow quickly, the quasi-ban on growth under the ETS will directly lead to leakage of CO_2, production and jobs. Further increasing the EU's own target as currently discussed will just drive production out of Europe – not overnight, but a steady process that has already been running for some time due to the framework conditions in the EU. Leakage is a fact: a study by Policy Exchange shows that the EU is only on track to meet its Kyoto target because emissions have been "offshored" to countries such as China. It says that "the total EU carbon consumption – including, for example, the carbon produced during the manufacture of steel exported from China to Europe – shot up by 47 per cent" between 1990 and 2006.

The answer to climate change is not to force the delocalisation of industry, but to use manufacturing industry as part of the solution – only industry can find the solutions for a sustainable approach to climate change.

The European steel industry reduced emissions per tonne of steel by about 50 per cent between 1970 and 2005. Between 1990 and 2005 alone, reductions were 21 per cent. The industry is now close to the limits of what current technologies can do, and any

Photo: ThyssenKrupp

No wind power without steel – on average, 70 per cent of a wind turbine is made from steel

further significant improvement will need the development of breakthrough technologies and heavy investment. Projects such as ULCOS (Ultra Low CO_2 Steelmaking), with several promising new technologies to further reduce emissions from steelmaking, will need heavy investment if they are to be successful. However, the absurdity of the EU's policy is that the revenues from auctioning of CO_2 allowances and other eco-taxes do not flow

The European steel industry has much to offer. It is an indispensable part of some of the world's most successful value chains, developing and manufacturing thousands of innovative steel solutions

back to serve the proclaimed goal of converting the economy as quickly and smoothly as possible into a low-carbon economy with competitive energy prices. These are, therefore, simply taxes that prevent rather than promote R&D.

The European steel industry has much to offer. It is an indispensable part of some of the world's most successful value chains, developing and manufacturing in Europe thousands of different, innovative steel solutions.

The industry provides the foundation for innovation, durability, CO_2 reductions and energy savings in applications as varied and vital as automotive, construction, machinery, household goods, medical devices and windmills.

A recent study by the Boston Consulting Group (BCG) on the German steel industry compares the CO_2 savings from innovative steel applications – such as more efficient power stations, wind turbines or lighter vehicles – with the CO_2 emissions from steel production. The study shows the savings potentials achieved through the use of steel are higher than the emissions from steel production in Germany. One-third of the German government's plans to cut greenhouse gas emissions by 40 per cent in 2020, compared with 1990 levels, can be achieved with innovative steel. Many reduction potentials can only be achieved through the use of steel, and not with other materials.

On average, 70 per cent of a wind-power installation is made from steel. In the near future, greater installed power using large-scale turbines from 7MW up to 12MW and totally new designs for 15MW to 20MW will be needed to further improve efficiency. New steel solutions will play a major role in achieving this goal, for example for the tower and the generator.

It is crucial to preserve a strong, innovative and competitive industry. Unilaterally applied climate policy has to be shaped and implemented to protect the competitiveness of industry in Europe until such time as a global level playing field for internationally traded, carbon-intensive goods is established. Pressure on industry should therefore not be increased by further unilateral targets that are not supported by technology. Policy must support rather than hinder the development of the technologies necessary for carbon reductions. Only industry can provide the applications that are essential.

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Beyond the nuclear option

Nuclear power had been on the rise until the recent earthquake and tsunami in Japan. Now, as governments around the world review their existing and planned nuclear programmes, they will need to consider what, if any, are the alternatives

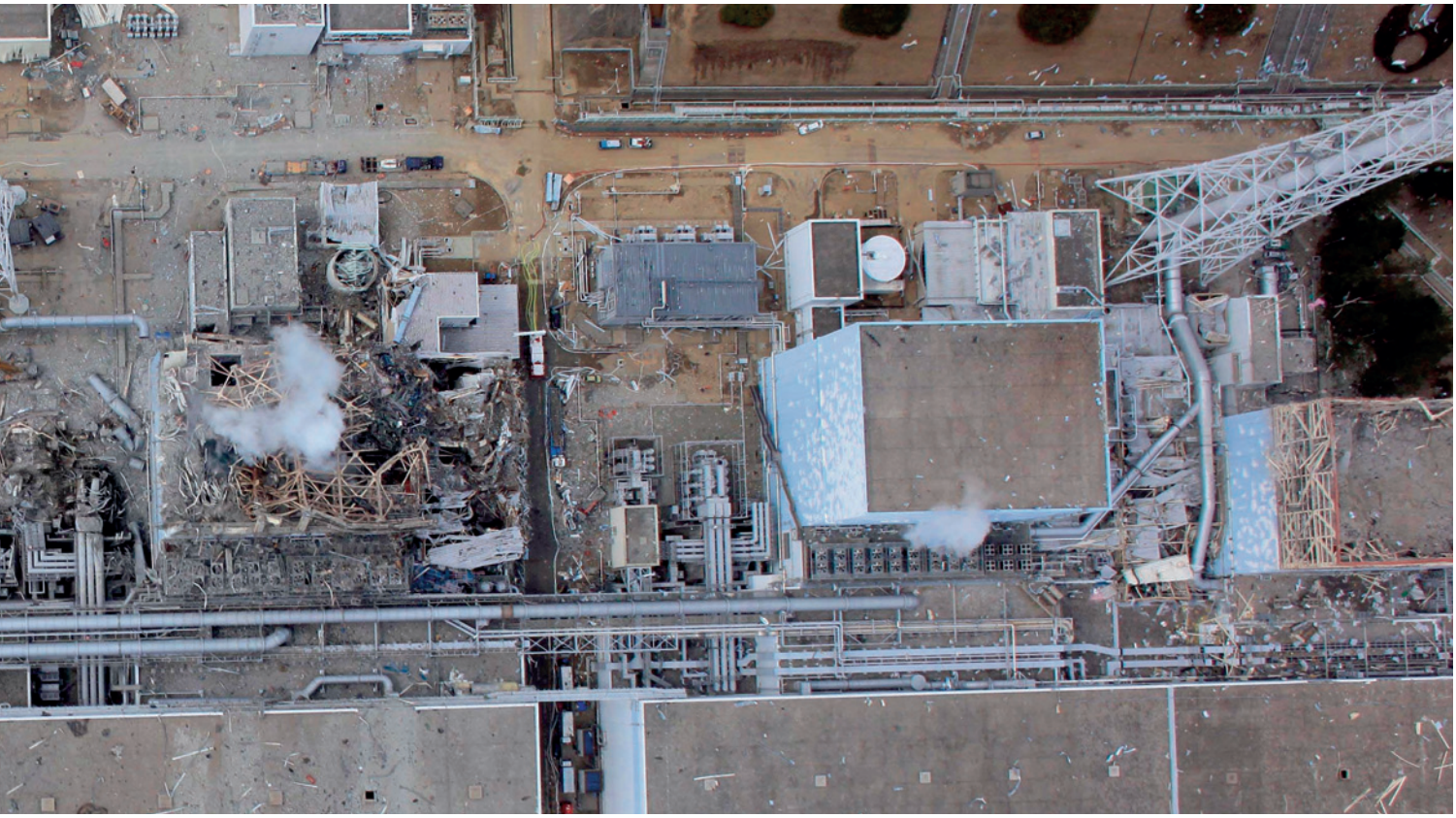
By Victoria Panova, Department of International Relations and Russian Foreign Policy, MGIMO University

Nuclear power has always been among the most controversial sources of energy, drawing substantial opposition from 'green' politicians and the general public. But, until recently, the idea of nuclear power as a legitimate and viable alternative source of energy had been slowly, but surely, gaining ground. One by one, European countries were becoming less resistant to the possibility.

Meanwhile, there were long-term strategies for developing nuclear energy and plans to build new reactors in the United States, Russia and France, not to mention the 'nuclear rush' of the 1990s in Asia, particularly in China, India and Korea. Indeed, lacking energy resources of its own, with 55 reactors Japan has traditionally relied heavily on nuclear energy. But most of those trends reversed within hours of the nuclear accident at Fukushima Dai-ichi, following the earthquake and tsunami that hit Japan on 11 March.

Fukushima has been compared to the accidents at Three Mile Island in the US in 1979 and Chernobyl in the former Soviet Union in 1986. It has been graded as severe as Chernobyl at a level of seven, according to the Nuclear Industrial Safety Agency – in comparison with Three Mile Island's five – although its fallout has affected a much smaller geographic area. However, technically, Fukushima is more like Three Mile Island. Both had problems with emergency systems that should have allowed for cooling of the reactors. Nonetheless, there are 1,760 tonnes of nuclear fuel at Fukushima, compared with Chernobyl's 180 tonnes.

The immediate reaction to Fukushima was fear, and even panic, on the part of the world's population and its leaders. There were public demonstrations. Several governments started reducing dependence on nuclear energy. German chancellor Angela Merkel announced the three-month closure of seven reactors that had begun operating in the 1980s. Even in the US – the country least likely to reject the nuclear option, which provides up to 20 per cent of its energy – Secretary of State Hillary Clinton called for an urgent review of its energy policies. Meanwhile, Russia continued to negotiate the construction of nuclear power plants with its partners and announced a deal with Belarus. Nonetheless, all the countries involved in developing atomic energy announced they would review the safety systems in functioning reactors as well as in those under construction.



Devastation at Japan's Fukushima Daiichi nuclear plant, after the earthquake and tsunami of 11 March

Apart from the real environmental and health damage as a result of the Fukushima tragedy, mid- and long-term strategies for developing nuclear energy must once again be reconsidered, as they were following both the Three Mile Island and Chernobyl disasters. Will Fukushima bury nuclear energy as an alternative to fossil fuels, or will it simply postpone its development until public fear subsides? Are there other alternatives to replace them, and how available are they?

Options for the future

Alternative sources, including renewable energy, have been on the global agenda since the energy crises of the 1970s. However, they have been concerned mostly with dependence on hydrocarbons and the associated challenges of climate change. At the 2006 G8 summit in St Petersburg, where energy security was a priority, the Russian host tried to push through nuclear energy as an environmentally friendly option. Even then, it was not perceived positively by all – a perception likely to continue at least over the medium term after the Japanese tragedy.

Yet there seem to be no dramatic options for increasing the use of hydro, solar, wind, tidal, geothermal and other types of low-carbon power generation, despite a strong political and economic push. Even before Fukushima, there was an active effort to expand those sources commercially.

Bloomberg New Energy Finance reported that global investment in clean energy rose from $186.5 billion in 2009 to $243 billion in 2010 – in part because of environmentally friendly stimulus packages – and doubled the 2006 figure. This increase was mainly due to research and development in renewables, higher than expected growth in China, efforts to replace dirty coal industries, and Japan's eagerness to ensure its own energy independence as well as American and European efforts, especially in the area of solar energy.

But even in terms of the immediate economic consequences of Fukushima, hydrocarbons remain the primary source of energy worldwide. Moreover, countries with nuclear weapons capacity will continue to operate nuclear power plants, as will high-tech threshold countries, such as Japan itself, for purposes beyond the guarantee of alternative energy supply.

> Even in terms of the immediate consequences of Fukushima, hydrocarbons remain the primary energy source worldwide

Priorities for 2011 and beyond

As the 2011 G8 chair, France has included green growth among its top priorities for the Deauville Summit. It sees the G8's task as assisting the European Commission and its Europe 2020 strategy for green growth, as well as the United Nations Environment Programme in its preparations for the Rio+20 conference in Brazil in 2012. The G8 will also encourage the Organisation for Economic Co-operation and Development in developing its green growth strategy later this year.

What could the G8 do in direct response to the Fukushima accident? It could begin by considering the following suggestions:

- The current monitoring system used to comply with the Comprehensive Test Ban Treaty should be enhanced to facilitate the international exchange of information among national early warning systems through a single, unified global system;
- International legally binding agreements should be implemented so that national authorities cannot impede immediate access to the site of an accident to permit international experts to evaluate the scale of the event;
- The work of relevant departments of the International Atomic Energy Agency – of nuclear energy, of technical cooperation and so on – should be strengthened, and recommendations should be made to develop an internationally recognised action plan for close to zero-possibility accidents;
- Legislative and financial incentives for renewable energy sources should continue and be expanded, so they can become commercially viable and submitted to the G20 for discussion at the Cannes Summit in November. ◆

Regulation regime undergoes a revolution

While shifts are taking place in energy production and consumption, energy market regulation is itself changing. But it still needs to maintain a strong, independent framework, and political support is essential in order to ensure this is achieved

By Lord Mogg, chair, International Confederation of Energy Regulators; chair, Ofgem; chair, Board of Regulators, Agency for the Cooperation of Energy Regulators

The origins of energy market regulation are rooted in the need to protect consumers in those industries where natural monopolies are central to the operation of the market. In the gas and electricity sector, historically the main role of energy regulators has been to regulate the pipe and wires networks to ensure investments are adequate and yet efficient – value for money – and to promote competition in those parts of the market that are not natural monopolies, such as gas shipping and electricity generation and supply.

It is critically important that the framework of energy regulation provides for a strong and independent regulator. Without this essential ingredient, the regulatory certainty that is so important to give confidence to investors and market participants will be absent, or at least in doubt. This overall regulatory approach has been tested in many countries across the world and has been found to work – and to work very well. Traditional energy regulation has targeted the achievement of the most efficient outcome for consumers. Ensuring prices are at a competitive level has been the priority, and this has been the single-minded focus of regulators.

But the game has changed. The challenge of climate change is one of the most serious issues facing the world's governments, with energy production and consumption being among the major sources of greenhouse gas emissions. Consequently, governments across the world are demanding that the way energy is produced be radically changed, and that energy consumption be made more efficient.

In almost any newspaper today, there are articles on the need to develop a particular type of zero- or low-carbon electricity generation, or on the need for smarter metering to help consumers become more energy-efficient. This public discussion of the future of energy in a carbon-constrained world is healthy. It indicates a substantial change already under way in the global energy industry as it prepares to tackle this problem. To meet the climate change challenge, energy markets will need to be re-engineered; major investments will be required, with the introduction of innovative technologies.

> "Energy regulators are committed to collaboration, to develop and share best practices within their areas of responsibility"

But those newspaper articles do not describe the revolution underway in the business of energy regulation. The result is that the role of regulators is little understood. Against a background of major changes, energy regulators have to do three things: develop a framework to enable this essential investment; ensure that the money is spent efficiently to minimise the impact on customer bills; and ensure that the risks inherent in such a major technology change are properly managed.

Energy regulation can help to create the necessary incentives and stable framework to encourage new energy-sector investments to come online, while at the same time safeguarding the public interest. All energy regulators recognise the fundamental role they play in seeking to respond to the global challenge of climate change. They are committed to collaboration, to develop and share best practices within their areas of responsibility.

The fourth World Forum on Energy Regulation took place in Athens in 2009, and the fifth is planned for Quebec in 2012. At the Athens meeting, the world's energy regulators issued a declaration on tackling climate change, and also established the International Confederation of Energy Regulators (ICER) as a means of enabling greater collaboration in tackling the global challenges affecting the energy market. ICER is a virtual organisation – it operates mainly through email, conference calls and other electronic means among the various regulators – and thus has a wide reach across the globe.

The declaration, in addition to creating ICER, also committed energy regulators to several concrete actions, which include:

- supporting the delivery of energy to all in developing markets within the context of rising energy costs and environmental constraints;
- promoting energy efficiency;
- conducting a review of renewable energy and distributed generation;
- sharing best practices and developing new approaches on regulatory issues that are central to meeting targets for greenhouse gas emissions;
- fostering stronger network interconnection and facilitating compatibility of regulatory frameworks in order to create more efficient energy systems; and

- further reinforcing engagement in the international climate change process.

ICER has now been operating for more than a year. Its work on climate change issues is led by one of its four virtual working groups. ICER fulfilled a commitment made by the G8's energy ministers when they met in Rome on 24-25 May 2009, where gas and electricity regulators from around the world committed to prepare a report on regulatory practices for energy efficiency. This was provided to G8 energy ministers at the time of the G8 Muskoka Summit of 25-26 June 2010. This report is important because it provides a – possibly unique – global overview of regulatory measures that have been taken to encourage energy efficiency. It will be updated periodically.

The confederation has also begun work on the review of renewable and distributed generation. This work could shed light on the regulatory issues associated with the integration of these new forms of generation into electricity systems. This work is likely to be completed later this year.

In addition, ICER has established many mechanisms to enhance communication among regulators to assist with the spread of best practices. Most of these are web-based tools, but ICER is also active in promoting physical workshops internationally. Indeed, it has an active programme of dialogue with other international organisations. It promotes conferences with other international bodies where there is a clear regulatory agenda. It is developing closer links with academic bodies – and already has close organisational links with the Florence School of Regulation – with the intention of strengthening the level of academic input into the development of energy regulation.

Climate change concerns are causing governments to demand that energy consumption be made more efficient

All of this activity demonstrates the strong commitment of energy regulators to playing their full part in tackling climate change. Energy regulators have put in place, and are continuing to develop, machinery to enhance their capability. Critical to success, however, is the political commitment to a strong and independent framework of energy regulation, with independent regulators at the centre of it. The G8 Deauville Summit should provide the political leadership to reinforce the importance of the role that energy regulators play across the world. ◆

ACHIEVING AN AFRICAN GREEN REVOLUTION THROUGH AN INTEGRATED APPROACH

Agriculture is at the centre of life and the economies of Africa. It is Africa's lifeline and the roadmap for moving tens of millions of Africans out of poverty. Three-quarters of Africans are farmers, with roughly 40 per cent of the continent's GDP coming from agriculture. Smallholder farmers, the majority of whom are women, produce most of Africa's food.

The Alliance for a Green Revolution in Africa (AGRA) believes that the continent's pathway to prosperity begins with investments in Africa's most valuable assets – its farmers. Success demands comprehensive change across Africa's battered value chain. Programmes in seeds, soils, markets, policy and innovative finance are creating transformational changes across the entire agricultural value chain. AGRA is calling for increased support for agricultural development in Africa by the G8 countries.

GROWING PROSPERITY

AGRA
Growing Africa's Agriculture
www.agra-alliance.org

Africa can achieve food security by unlocking the potential of its smallholder farmers

One would expect that the rising food prices on the global markets would translate into increased incomes for farmers in Africa since agriculture is their dominant occupation. Instead, we are seeing severe hunger among the rural poor, and more than 265 million people undernourished.

Smallholder subsistence farmers make up most of the 50 per cent of Africans living on less than US$1.25 a day and so are unable to invest on their farms to produce enough to feed themselves and their families and participate in the market economy. African governments spend some US$50 billion importing 43 million tonnes of food to feed the hungry. But these figures could grow exponentially with rising global food prices and reduced domestic production.

The incidence of drought and lack of good seed and the prevalence of poor soils are a few of the constraints contributing to African agricultural productivity falling behind that of every other continent. Productivity in Africa averages less than one tonne per hectare for grain crops, far below the global average of over four tonnes per hectare. Evidence suggests that increasing agricultural productivity by 10 per cent can reduce poverty by four per cent in the short term and 19 per cent in the long run. However, these figures would still remain unobtainable without policies and investments that support smallholder farmers.

It is anticipated that the growing food crisis, coupled with the impacts of the fuel crisis, will increase the cross-border movement of people, with Europe being a key target. Internal displacement, especially from rural to urban areas in Africa, is already happening, putting pressure on already limited urban resources. Prolonged food crises undoubtedly lead to an increase in the number of hungry people and can precipitate civil unrest, as has been witnessed in many African countries recently.

Smallholder farmers in Africa are keen to deliver long-term solutions to chronic hunger and poverty across the region. Africa has the land, the labour and the will to grow the food needed to end the undernourishment that affects more than one in three people.

But to realise its potential, Africa needs a Green Revolution to catalyse change across the entire agricultural system, thus enabling smallholder farmers to significantly boost their yields and income. This can be done by focusing investments in smallholder farmers, through integrated programmes in the areas of seeds, soils, market access, agricultural finance and appropriate policies that have full appreciation of the impact of climate change. Together, this holistic approach will trigger sustainable change. There is no one single solution but rather many small integrated interventions identified and implemented by farmers.

Currently, only about one-quarter of Africa's smallholder farmers have access to good seeds, compared to, for instance, 80 per cent of farmers in China. As a first step, we must rapidly increase the availability of high-quality, locally adapted seed, at prices farmers can afford. AGRA is doing this through investments in farmer-participatory crop-breeding, training the next generation of African crop scientists and providing start-up capital for the establishment or expansion of African seed enterprises.

To revitalise millions of hectares of degraded farmland over the next 10 years, AGRA is promoting the increased use of inorganic and organic fertilisers, combined with improved sustainable land and water management in an integrated soil-management system.

In addition, cost-effective regional fertiliser procurement facilities and national fertiliser production and distribution methods are being explored. National retail networks are being developed to distribute improved seed and fertilisers to rural farms. Already in 15 countries in Africa – including Ghana, Nigeria, Malawi, Tanzania, Kenya, and Zambia – 9,200 agro-dealers have been trained and certified.

Farmers need markets to sell their produce to be able to reinvest in inputs and land improvement. Emphasis should be on developing local and national markets. Improving infrastructure, reducing transaction costs and linking farmers to national, regional and global markets will serve as critical incentives to farmers. The potential to expand Africa's share of the global market beyond the present ratio of two per cent may only be realised by first expanding intraregional trade. A 2008 World Bank report indicated that Africa is the world's second most trade-restrictive region after South Asia.

At the core of agricultural transformation is the need for policies across Africa that support land security for women, and enhance their access to financing, extension services and education. In addition, policy support should focus on strengthening farmers' associations and civil society organisations that benefit smallholder farmers.

Moving African agriculture from subsistence to a market-oriented business is the vision that AGRA is propagating. Massive investments will be needed, especially in infrastructure. The International Food Policy Research Institute (IFPRI) estimates that Africa will need $32 billion to $39 billion annually to realise the full economic potential of its farm sector, not including the cost of climate-change adaptation.

These funds must come from many sources: African governments, official development assistance, foreign direct investment, philanthropic contributions from within and outside Africa and from Africa's own private sector. Africa needs investment on a par with that which was made in agriculture in Asia and South America in the 1960s and 1970s, which averted famine and spurred high, sustainable rates of economic growth.

While this investment is massive, it is achievable. If African governments meet their commitment to invest at least 10 per cent of their national budgets in agriculture under the Comprehensive Africa Agriculture Development Programme (CAADP), a minimum of $20 billion will become available from domestic budgets. Already, many governments have begun to do so.

At the same time, increased investments by the global community, including bilateral and multilateral partners, foundations, and especially the private sector, are needed to make up much of the remaining shortfall and, ultimately, unlock the continent's agricultural potential. Working together in partnership, African smallholder agriculture can be transformed into an efficient system that will lift millions of people out of poverty.

Dr Namanga Ngongi
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