



A 2030 Framework for climate and energy policies

The view of Europe's nuclear energy industry

June 2013

The European Atomic Forum (FORATOM) is the Brussels-based trade association for the nuclear energy industry in Europe. Its main purpose is to promote the use of nuclear energy in Europe by representing the interests of this important and multi-faceted industrial sector.

The membership of FORATOM is made up of 16 national nuclear associations active across Europe and the nearly 800 firms that they represent.

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Following the launch by the European Commission (EC) in December 2010 of a public consultation for the preparation of its *Energy 2050 Roadmap*¹, FORATOM contributed actively to the energy debate in February 2011². It contributed again in October 2011, when it gave its assessment of the initial consequences of the accident that occurred at the Fukushima nuclear power plant³.

The present Policy Paper represents FORATOM's latest contribution to the debate. It has been written in light of the EC's recently published *Green Paper* entitled: *A 2030 framework for climate and energy policies*⁴, and in response to the associated public consultation.

¹ COM(2011) 885 final Communication from the Commission to the European Parliament and the European Economic and Social Committee and the Committee of Regions - Energy Roadmap 2050 – December 2011

² "Energy 2050 Roadmap – Contribution of Nuclear Energy", FORATOM, Brussels, February 2011

³ "Post Fukushima Update", FORATOM, Brussels, October 2011

⁴ COM(2013) 169 final, 27 March 2013

Executive Summary

Today, nuclear energy generates electricity in 14 of the 27 Member States, and produces over one quarter of the EU's electricity. During operation nuclear power plants do not release any significant greenhouse gas (GHG) emissions. They produce a reliable source of continuous supply of electricity because they operate at very high capacity levels. The cost of the electricity produced has shown itself to be stable and competitive and not heavily influenced by fuel prices. And uranium is a naturally occurring and relatively abundant global resource. Consequently, nuclear energy helps to reduce the quantity of carbon emissions emitted by the electricity sector, contributes significantly to security of supply and stimulates economic competitiveness thanks both to its reduced costs and to the important economic benefits that result from the required investments.

Nuclear energy, therefore, satisfies the triple objectives of the energy policy that the European Union (EU) has been promoting since the beginning of the 21st century, calling for the best possible compromise to be found in order to ensure the competitiveness of the EU's economy, to maintain security of energy supply, and to promote environmental sustainability.

In a globalised economy Europe must remain competitive and cannot, therefore, sustainably continue to accumulate current wage and energy costs that rank among the highest in the world. Consequently, competitiveness is of capital importance. It is essential that the organisation of Europe's energy markets (which in principle are deregulated, open and integrated), the measures taken to support public investment, R&D and innovation policies, climate protection measures, support for renewable energies and the choice of energy mix, reflect the shared objective of enhancing industrial competitiveness. The overall systemic costs associated with delivering energy to consumers – such as those linked to production, transmission, distribution, storage, potential back-up and environmental impact – must be taken into account.

Furthermore, increasing security of supply requires that dependence upon fossil fuels and/or imported technologies is reduced and that energy sources are more diversified – particularly in light of important geopolitical considerations. In addition, the instability resulting from the intermittent nature of renewables must be mitigated and long-term investment, including in cross-border electricity transmission infrastructure and other high-cost projects, must be encouraged. It is also necessary to determine whether the model for the organisation of energy markets that Europe has favoured since the 1990s is capable of meeting such demands and whether it sends the right signal to investors.

Finally, the environmental sustainability of energy policy, which is now inseparable from climate change policy, has become a subject of international controversy. The EU's objective of decarbonising its economy has led it to make an ambitious unilateral commitment, namely to reduce its GHG emissions by between 80 % and 95 % by 2050 below 1990 levels⁵, which exceeds the obligations imposed by existing international agreements. The nature and scope of the objectives that must be fixed – whether national or sectoral, whether mandatory or voluntary, whether favouring or not specific technologies – are the subject of debate, especially as a result of the costs associated with national policies that distort the market.

In recent years, a multitude of initiatives (roadmaps, frameworks, policy papers, consultations, etc.) and deadlines have generated considerable confusion and gradually created the illusion of an energy policy that is answerable to one overriding obligation – to mitigate climate change. Such confusion is prejudicial to the actual fulfilment of the three objectives of energy policy.

The EC's *Energy Roadmap 2050* recognises the potential contribution of nuclear energy towards meeting the three pillars of EU energy policy. It has shown that total energy costs are the lowest in those scenarios that have the highest nuclear share. But the EC did not want to favour any of the five scenarios put forward in support of its vision. The European Council set some quantitative objectives for 2020, basically related to GHG emissions, energy efficiency and especially renewable energies. These objectives did not include any reference to nuclear, and were not accompanied by specific demands relating to cost-effectiveness or systemic industrial costs, real sustainability, improvement of performance, public support, national and/or regional aid, investments in infrastructure or windfall effects. In addition, the Emissions Trading Scheme (ETS) that the EU brought in failed to fix an adequate uniform carbon price or provide an incentive for investors.

In fact, the question of nuclear energy has been globally ignored, until the public request from 12 of the 14 Member States using nuclear energy⁶ for the creation of an adequate framework for investments in an industry that they consider to be an integral part of the EU's low-carbon energy mix.

A consultation process was launched recently by the EC together with a Green Paper – *A 2030 framework for climate and energy policies*. FORATOM, which represents the interests of the European nuclear industry, takes advantage of this opportunity to restate its priorities.

⁵ European Council Presidency Conclusions, October 2009

⁶ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/140109/final_EU_Nuclear_Energy_Communicu_.pdf, March 2013

Key Messages

- An EU energy policy for 2030 should be built upon the three pillars of environmental sustainability, competitiveness and security of supply.
- The electricity market should reflect the real cost of delivering each type of low-carbon electricity to the consumer, i.e. the full system cost, including transmission, distribution and back-up when necessary. Nuclear has a net advantage over other technologies that cannot provide continuous supply of electricity.
- The 2030 framework should enable all low-carbon technologies – renewables, nuclear and Carbon Capture and Storage (CCS) – to compete fairly on price without technology specific subsidies, thus achieving emissions reductions in the most cost-effective way and promoting industrial competitiveness. Hence the potential contribution of nuclear energy should be recognised.
- Security of energy supply is enhanced by diversity, which avoids over-reliance upon intermittent sources.
- An overall low-carbon energy⁷ and/or electricity target could be worth considering, but not new sector-specific share of electricity targets, e.g. for renewables.
- The ETS is not working as intended and needs to be adjusted rapidly to deliver an effective carbon price. Until such time as it provides an effective stimulus for investments in low-carbon electricity generation, Member States should be allowed to fix a national carbon floor price.
- To compensate for the higher capital investments needed for low-carbon generation – including for nuclear –, long-term contracts, contracts for difference, share ownership/take-off schemes, or other viable market models should be accommodated.

⁷ i.e. currently renewables, hydro and nuclear, and CCS

EU Energy Policy: 2020 to 2050

1.1 A policy framework to 2020 was established by the EC in March 2007, including three headline targets to be achieved by 2020, i.e. a GHG emissions reduction of 20 % relative to emissions in 1990; a 20 % share for renewable energy sources in the energy consumed in the EU; 20 % savings in energy consumption.

The European Council has fixed quantitative objectives for renewable energy sources for 2020 without laying down any particular demands. In this way, it specifies nothing with regards to cost-effectiveness and systemic industrial costs, actual sustainability, improvement of performance, public support, national and/or regional aid, infrastructure investments and windfall effects.

1.2 In December 2011, the EC set out five illustrative energy mix scenarios in line with the objective of reducing GHG emissions by 80 % to 95 % by 2050. However, the EC did not want to favour any of the five scenarios that support its long-term 2050 vision. This approach created the illusion of an energy policy that is answerable to one overriding obligation – to mitigate climate change.

The resultant confusion is prejudicial to the real fulfilment of the three objectives of energy policy that the EU has promoted since the beginning of the current century and which require that the best possible compromise be found in order to meet the three complementary objectives of environmental sustainability, competitiveness and security of supply.

1.3 On 27 March 2013, the EC published its Green Paper “A 2030 framework for climate and energy policies”⁸. In the document’s introduction the EC explains that while there is a clear framework for 2020, intermediate targets for 2030 are needed if the EU is to achieve its goal of an 80 % to 95 % reduction in GHG emissions by 2050. It is suggested that a 40 % GHG reduction target for 2030 would keep the EU on track for meeting the 2050 objectives.

The EC recognises that there are gaps and shortcomings in the 2020 commitments it made. On the question of the ETS it admits that “The low carbon price is not providing investors with sufficient incentive to invest and increases the risk of ‘carbon lock-in’” and that the unilateral measures taken by some Member States have engendered “an increased risk of the fragmentation of policies, thereby threatening the single market” and “undermining the role of ETS and the level playing field it was meant to create.”

⁸ COM(2013) 169 final

The EC also recognises that “massive investments in transmission and distribution grids, including those related to cross-border infrastructure and the completion of the internal energy market will be needed in order to accommodate renewable energy”. It also emphasises the need “to ensure over time that renewable energy sources become more cost-efficient so as to limit the use of support schemes to those technologies and areas that still need them”. There has been the assumption that a major shift towards renewables was needed and was affordable without a real assessment of the cost and security of supply implications, i.e. without addressing the overall system implications. In its preliminary analysis the EC also suggests that based on current policies the 2020 target for energy savings will not be met.

Finally, on the question of organising the markets, the EC accepts that the previous measures taken “did not address the issue of whether the market offered the necessary incentives to invest in generation, distribution and transmission and storage capacity in a system that features a greater share of renewables”. It further accepts that “until renewable energy sources become cost-competitive, the objective of a more sustainable energy system must go hand in hand with the need for a fully liberalised and integrated market capable of mobilising and allocating investment efficiently”. Moreover, the EC appears to believe that the current organisation of energy markets cannot respond adequately to such demands and doesn’t send the right signal to investors.

1.4 EU energy and climate policy for 2030 should be built on all the three pillars of environmental sustainability, competitiveness, and security of supply.

In a globalised economy Europe must remain competitive and, therefore, cannot continue to unsustainably accumulate wage and energy costs that are among the most expensive in the world. Consequently, competitiveness is of capital importance.

Furthermore, increased security of supply requires that dependence upon fossil fuels and/or imported technologies is reduced, that energy sources are more diversified, that the instability resulting from the intermittent nature of renewables is mitigated and that long-term investments are encouraged. It is also necessary to determine whether the model for the organisation of energy markets that Europe has favoured since the 1990s is capable of meeting such demands and whether it sends the right signal to potential investors.

Finally, the environmental sustainability of energy policy is now inseparable from climate change policy. The EU’s objective of decarbonising its economy has led it to make an ambitious unilateral commitment, namely to reduce its GHG emissions by between 80 % and 95 % by 2050, which exceeds the obligations imposed by existing international agreements. The nature and scope of the objectives that must be fixed – whether national or sectorial, whether mandatory or voluntary, whether favouring different technologies or not – are a subject of great debate, especially as a result of the costs associated with national policies and the market distortions that they create.

A 2030 framework for Energy Policy

2.1 The framework for 2030 should enable the EU economy to compete against other global economies and emerging nations, knowing that the competitive advantage of American industry is being boosted by low energy costs, in part due to the exploitation of unconventional energy sources.

In particular the framework needs to promote a level playing field for all low-carbon energy sources, and to seriously address the malfunctioning CO₂ market. EU must recognise and reflect in its policy for 2030 the need for a balanced, low carbon, energy mix comprising of both technologies such as nuclear and hydro, which can be run as required (i.e. are “dispatchable”), with variable and intermittent renewables. The particular value of nuclear power in supplying continuous “baseload” electricity at stable prices for industrial consumers should be recognised.

The 2030 framework should enable all low-carbon technologies to compete fairly on price without technology specific subsidies, thus achieving emissions reductions in the most cost-effective way and promoting industrial competitiveness.

2.2 As regards total costs, a comprehensive cost assessment is a prerequisite to selecting a competitive energy mix. A recent Nuclear Energy Agency (NEA)'s study⁹ proposes that any assessment takes into consideration “not only the costs of grid connection, extension and reinforcement, as well as the technical and financial costs of intermittency, but also impacts upon security of supply, local and global environmental impacts, siting and safety”, i.e. the global system costs.

The report suggests criteria for calculating such system costs. Taking into account all these factors, the NEA study states that nuclear, coal and gas –that provide continuous supply, i.e. are “dispatchable”– have relatively low system costs (i.e. below 3 USD/MWh). By comparison, the equivalent costs for renewable and intermittent technologies (such as wind and solar) are more than 12 times higher than “dispatchable” sources’ (i.e. reaching 40 USD/MWh for onshore wind, 80 USD/MWh for solar at penetration levels of 30 %).

In addition, this study showed that as the proportion of variable renewables increases within a system, the economic cost of running non-continuous power stations also increases. This is because the low marginal cost, variable, renewables run whenever they are available, displacing existing generation, which means that their fixed costs need to be recovered over fewer running hours.

⁹ “Nuclear Energy and Renewables, System Effects in Low-Carbon Electricity Systems”, OECD NEA, 2012

The electricity market should reflect the real cost of delivering each type of low-carbon electricity to the consumer, i.e. the full system costs – including transmission, distribution and back-up when necessary.

This will involve increasing the transparency of power generation global costs at the “system” level and increasing the extent to which the system costs are internalised within the price offered to the market by each electricity source.

An interesting way of doing this could be an auctioning mechanism, whereby electricity providers bid to supply a guaranteed production (i.e. a number of MWh) –including back-up capacity when needed – over a given timeframe¹⁰ . Such a mechanism would enable “dispatchable” providers to be rewarded for the additional costs of being on stand-by for balancing intermittent output from variable sources.

The EU should give further consideration to mechanisms such as MWh “capacity auctions”, where each supplier bids for delivery of a guaranteed quantity of electricity over a given timeframe.

In its 2050 Roadmap, the EC has shown that total energy costs are lowest in those scenarios that have the highest nuclear share. This trend is reflected in the recent KEMA study commissioned by the EC through the European Nuclear Energy Forum (ENEF)¹¹.

Nuclear power’s contribution in the long-term will highly depend on construction costs. Lessons are being learned from current new build projects. Investments made in the supply chain over the past few years by industry will contribute to meeting future demand. Based on its past experience, industry is confident about future cost evolution and its ability to deliver future new build projects to time and budget.

2.3 The investment requirements for the electricity sector are substantial. It will sometimes be difficult for utilities to privately finance all projects on their own without some form of support: the current competitive market arrangements in the EU do not deliver the necessary signals for long-term investment in low-carbon technologies.

The market needs to be adjusted so that low-carbon investments are stimulated – for example by setting a high enough carbon price –, and then competition is encouraged on a level playing field between all the low-carbon technologies.

The financial conditions make it difficult to raise adequate funding from the private sector for any low-carbon projects unless they are subsidized. With the current pressures on the availability of capital and the associated importance of minimising investment risk, investors prefer energy projects with lower construction costs and shorter lead times. For instance, in the absence of a clear carbon price signal, the market will favour gas and/or coal.

¹⁰ “EMR and the Energy Bill: A Critique”, Dieter Helm, June 2012

¹¹ Prospective Analysis of the Evolution of the Electricity Costs Final Report December 2012 – KEMA Consulting GmbH, Bonn, Germany

The EU energy and climate framework for 2030 should be aimed at promoting EU-wide mechanisms to stimulate low carbon energy investments across the Union.

In order to enable the EU's successful transition to a low-carbon economy, it will need to make sure that all the tools for delivering secure and competitive low-carbon electricity – such as demand side management, investment in smart transmission infrastructure, storage, back-up capacity, as well as the actual generation of electricity – are taken into consideration.

2.4 For nuclear, the capital costs of a power plant have been estimated between 59 % and 76 % ¹²of the levelized cost of electricity. Hence the project financing costs and construction lead-times (up to 10 years) are critical. Most of the existing nuclear power plants in the EU were financed in a regulated environment with guaranteed customers and electricity prices high enough to deliver a positive rate of return on investments. With the emergence of electricity market deregulation and the need for a switch to low-carbon technologies, the risk for utilities has increased and at the same time the financial markets have become more competitive and global. This has led to private financial institutions being more likely to be attracted to nuclear power plant projects in countries with a more appealing investment environment than the one offered in the EU.

One key issue for the economic future of nuclear power is how the relationship between electricity market structures and commercial returns will develop. Nuclear new build projects are more capital intensive and high project costs will require high load factors during operation in order to ensure timely repayment of the initial investments. Long-term contracts between nuclear energy suppliers and users can facilitate investment decisions in new nuclear build, while giving predictability for future electricity supplies and helping to mitigate the uncertainty for operators on future income streams. They should be authorised as far as they comply with EU competition law¹³.

The EU should foster investment schemes adapted to long-term projects: long-term contracts, shareholders' agreements to take electricity on a wholesale cost basis as well as co-investment and other risk-sharing models.

In some Members States, nuclear energy is subject to specific taxes contributing to the discouragement of investors to the sector. Such discrimination towards low-carbon energy technologies should be removed to ensure a level playing field.

FORATOM fully supports that the Commission expand the current emphasis on support schemes for individual renewable energy sources to all low-carbon sources including also CCS and nuclear. Moreover, a clear pathway for the phasing-out of subsidies as new technologies become competitive should be decided.

¹² Projected Costs of Generating Electricity: 2010 Edition - IEA/NEA 2010

¹³ Examples of potential models to attract low-carbon energy investments include the Finnish Mankala-model and the recently proposed electricity market reform in the UK. This latter policy proposal puts forward a package consisting of Carbon price floor, Capacity mechanisms, Contracts for Difference.

The EU should encourage the gradual phase out of costly and inefficient support policies (such as some renewable or energy efficiency schemes) by 2020 whilst maintaining mechanisms that are efficient and aim to correct evident market failures.

2.5 While all power generation technologies are subject to the risk of changing regulations on environmental protection, nuclear projects face specific regulatory and political uncertainties¹⁴. For nuclear investments in general, the higher the uncertainties anticipated by the investors, the higher the capital costs for nuclear projects. Too many uncertainties can dissuade investors and lenders from financing nuclear projects.

“The mitigation of uncertainties in the regulatory and licensing process requires smooth cooperation of regulators, utilities, and nuclear plant vendors, in ensuring respectively a smooth plant siting and licensing process, a clear design certification procedure and the stability of the safety rules”¹⁵. Long-term political support and a stable and predictable legal and regulatory framework coupled with clear national energy policy can give a solid foundation for nuclear power investment.

Governments and regulatory authorities have a critical role to play in setting clear as well as consistent procedures for licensing design and authorisation procedures in the early phases of nuclear projects.

There exists a huge potential for EU nuclear companies to benefit from the global growth of nuclear power. In the coming years, however, European industry will face fierce competition as new suppliers from emerging markets are aspiring to go global. Russian, Korean as well as Chinese companies are making concerted efforts to export their own nuclear technologies.

2.6 The 2030 framework should put forward a challenging but achievable target for a reduction in GHG emissions by 2030 that can be used to maintain the momentum of 2020 to reach an 80 % to 95 % reduction by 2050. The 2050 Roadmap suggested that a 40 % target in 2030 would be cost-effective, and consistent with the 2050 target.

Emissions from the electricity sector represent around 36 % of total emissions in the EU. The power generation sector can efficiently contribute to Europe further decarbonising at both reasonable cost and without damaging the EU’s competitiveness. Environmentally, nuclear power is a significant contributor to limiting GHG emissions¹⁶.

¹⁴ Financing arrangements and Industrial Organisation for New Nuclear Build in Electricity Markets - Dominique Finon and Fabien Roques, 2008

¹⁵ Ditto

¹⁶ Currently, nuclear provides around two-thirds of the EU’s low-carbon electricity. In the EU as a whole, nuclear energy helps avoid 436 million tonnes of CO_{2eq} per year, when taking into account the current (2011) energy mix. FORATOM Nuclear Energy and Greenhouse Gas Emissions Avoidance in the EU – December 2012

In terms of climate change avoidance, it makes no sense to replace nuclear with other forms of low-carbon energy, such as renewables.

Further reducing GHG emissions can happen only if a sufficient and sustained carbon price signal is sent to generators and the economy as a whole. The current EU ETS price signal is widely held to be too weak to support the longer-term EU goal of full decarbonisation of the power sector¹⁷ and the price is not sufficient to discourage unabated fossil fuel generation. Consequently, additional intervention of the public authorities is needed to support the development of low-carbon generation technologies.

The EU ETS is not working as intended and needs to be adjusted rapidly to deliver an effective carbon price. Until such time as EU ETS acts as an effective stimulus to investments in low-carbon electricity generation, Member States should be permitted to establish schemes that set a national carbon price.

2.7 Externally, dependence on oil and gas imports should be minimised in order to increase security of supply. Rapidly growing economies such as China, India and Brazil alongside other established economies such as Japan and South Korea will provide ever-increasing global competition for access to energy resources the EU currently relies heavily upon. More generally, if sufficient diversity of technologies and resources is maintained, the EU will be less vulnerable to geopolitical risks and in a better position to negotiate with other regions.

Internally, security of supply requires that the whole generation and distribution system is able to meet peak electricity demand at all times. That security is increasingly challenged as more and more intermittent renewable energy is added to the system and as the generation units become smaller and more localised. Large consumers still have to be reliably supplied. This means that back-up capacity (with gas being favoured) has to be overcompensated, with consequent cost implications, in order to preserve supply security.

2.8 Whilst the expansion of renewable technologies is widely accepted there are challenges to be overcome in order to mitigate the impact on a grid system originally designed for power plants able to provide continuous supply but now required to handle the increasing share of variable electricity generators. It is predicted that the development of the EU grid will require investments between 1,500 and 2,200 G€ (to 2050) “with the higher range reflecting greater investment in support of renewable energy”¹⁸.

In the EU, the rapid roll-out of renewable technologies boosted by the EU’s 2020 targets initiative has led to a myriad of national support mechanisms (such as feed in tariffs) to assist their growth and viability in the market. A large proportion of the financial burden of

¹⁷ The Energy Investment Imperative: Towards a Competitive and Consistent Policy Framework – IHS CERA 2013

¹⁸ COM(2011) 885 final Energy Roadmap 2050 – December 2011

these support schemes is passed on to the consumer¹⁹. Across the EU support mechanisms in 2012 grew to an estimated 30 G€ annually, which is double the level from 2009²⁰. IHS CERA predicts that support costs for renewables are likely to rise by almost 70 % from today's level, to 49 G€ in 2020. This is a significant long-term cost-burden for consumers.

FORATOM does not support new sector-specific share of electricity targets, e.g. for renewables, although an overall low-carbon energy/electricity target could be worth considering.

2.9 The EU can foster the future of low-carbon technologies through investment in research and innovation. The 2007 Strategic Energy Technology Plan (SNETP) was conceived to be the vehicle for such investment. But, lacking a dedicated funding scheme, SNETP has failed to attract the required level of financing from the Member States. Limited support for nuclear fission safety research is provided under the EU Framework Programme, but the scale is not sufficient to make a meaningful contribution to the construction of nuclear demonstration facilities. Reconsidering the current exclusion of nuclear research from the NER 300²¹ Programme could be one answer; another could be the use of Structural Funds for the construction of Member State-based research facilities approved under the SET-Plan²².

Education and training are also key to the sustainability of the nuclear industry as well as meeting the industry's growth. The continued supply of well-educated and trained people will require Europe to have comprehensive science and engineering education capability and robust nuclear R&D programmes at national and EU levels. Such challenges need to be addressed in a cohesive and integrated EU strategy.

For all low-carbon technologies, the EU should refocus support towards Research and Development (R&D) and targeted measures, such as demonstration projects, at a pan-European level. Efforts should focus on smart technologies and solutions that will benefit and develop European industry.

The EU should strongly promote and support nuclear education and training initiatives in particular to help ensure the future supply of a skilled workforce.

¹⁹ German energy and environment minister Peter Altmaier has estimated the cost of Germany's transition to renewables at up to 1,000 G€, with feed-in tariffs accounting for more than half of the total and improvements to the grid costing between 27.5 G€ and 42.5 G€.

²⁰ The Energy Investment Imperative: Towards a Competitive and Consistent Policy Framework – IHS CERA 2013

²¹ "NER300" (New Entrants' Reserve of 300 tonnes of CO₂ emissions allowances) is a financing instrument managed jointly by the European Commission, European Investment Bank and Member States whereby the sale of these emissions allowances can be used to finance renewable energy and CCS projects (but not nuclear).

²² EU 2007 Strategic Energy Technology Plan

Conclusions

The contribution of nuclear power

Nuclear power is established as a key component of the world's electricity generating systems, and is set to increase. Around the world there are 436 nuclear reactors in operation²³. In addition, more than 60 nuclear power plants are under construction. In 2010, nuclear accounted for 13 % of the world's electricity supply. According to the New Policies Scenario outlined in the International Energy Agency (IEA)'s World Energy Outlook 2012, global nuclear capacity is expected to increase by nearly 50 % – from 394 GW to 583 GW – between 2010 and 2035²⁴.

In the EU, nuclear electricity is generated in 14 of the 27 EU Member States, and provides over one third of their electricity supply, whilst meeting around 28 % of the EU's overall electricity demand. The industry itself is multi-faceted and supports 250,000 highly qualified direct jobs, including engineers and researchers, and around 800,000 jobs in total²⁵.

During operation nuclear power plants do not emit GHGs. They produce reliable base-load electricity as they operate at very high capacity levels. The cost of the electricity produced has shown itself to be stable and competitive and not heavily influenced by fuel prices (uranium only accounts for a small portion of the overall cost of the generated electricity). And uranium is a naturally occurring and relatively abundant global resource coming predominantly from politically stable countries.

Looking at EU's future

However, more than 40 % of the EU nuclear power plants –representing almost 46 GWe of net capacity– will reach 40 years of operation in the next 5 to 10 years. Extending the life of nuclear power plants is by far the most economic option for power producers to maintain their production capacity. As we could have seen recently in Germany, trying to rapidly increase the share of renewables to replace nuclear not only leads to massive additional costs (the cost of Energiewende might reach 1,000 G€, see footnote 19) and risks to security of supply, but ironically also lead to increased reliance on coal for back-up when the wind is not blowing.

²³ IAEA PRIS database

²⁴ <http://www.worldenergyoutlook.org/publications/weo-2012/>

²⁵ ENEF Competitiveness sub-Working Group report 'Socio-economic benefits of the nuclear industry in the EU to 2050', May 2013

Logically it would be cheaper, better for security of supply, better for the climate and healthier for the population to keep the German nuclear plants running.

The EC's Energy Roadmap 2050²⁶ recognises the potential contribution of nuclear energy towards meeting the three pillars of EU energy policy – security of supply, competitiveness and environment. The EC set out five illustrative scenarios for reaching its ambitious level of decarbonisation. As compared to 28 % today, the percentage of nuclear electricity in 2050 ranged from 2 % – in the “Low Nuclear” scenario – to nearly 20 % – in the “Delayed CCS” scenario. Meanwhile, given the delays in getting pilot projects off the ground and doubts about the commercial viability and public acceptance of CCS, the “Delayed CCS” scenario – that could be considered nothing else than a high nuclear scenario –, is more likely to become a reality.

Nuclear new build plans announced by EU Member States since March 2011, together with life time extension to 60 years for plants operating now, already equates to 20 % of the EU's 2050 projected electricity demand being met by nuclear power. FORATOM expects that once the financial recession is over and climate change once again becomes an overriding priority, investments in capital-intensive nuclear reactors, rather than in lower-cost fossil fuelled plants, will become more attractive to hard-pressed utilities.

Before the events in Japan, many respected international organisations (IEA, WEC, EURELECTRIC, etc.) were predicting around 30 % nuclear in 2050. Now that the lessons from the catastrophe at Fukushima are being implemented, and public opinion has recovered in many Member States that continue to value the contribution from nuclear power, there is every possibility that a 30 % nuclear share can be realised.

Boosting Europe's competitiveness

Of the three overriding principles ruling EU's long-awaited coherent Energy Policy, competitiveness has been put back as the first priority to enable Europe to sooner and better recover from the recession it faces up to now. Nuclear continues to play an important role in Europe's economic development, providing a stable and competitive, continuous electricity supply for consumers, businesses and industry.

In 2010, the IEA²⁷ indicated that in nearly every region of the world nuclear power plants produced the cheapest electricity.

²⁶ COM(2011) 885 final Energy Roadmap 2050 – December 2011

²⁷ Projected Costs of Generating Electricity 2010 Edition - IEA

An analysis of the overall costs for electricity generation reveals that nuclear has an advantage over other technologies that cannot provide continuous supply. It also offers some advantages against other baseload technologies because of its low fuel costs. A doubling of the price of uranium would only increase the total cost of nuclear produced electricity by about 10 %, whereas for a gas-fired power plant an equivalent price increase would result in an electricity cost increase of around 70 %.

Incorporation of lessons from the events at Fukushima will have an effect on costs and new build timescales in the shorter-term, but is not expected to be a decisive factor affecting the longer-term contribution of nuclear energy. French estimates of the costs of implementing post-Fukushima recommendations suggest that these could add around 1 % to the price of electricity.

Ensuring security of supply

Nuclear energy contributes significantly to avoiding the risks related to increasing dependence upon imported fossil fuels. Uranium is imported into Europe from diverse regions across the world, mainly from politically stable countries. Current estimates of global uranium reserves indicate that there are enough resources to support a significant expansion of nuclear energy. On top, in the long-term, the development of more efficient fast reactors could drastically reduce the amount of fuel needed. Finally, the energy content of uranium is very concentrated, which makes it possible for EU operators of nuclear power plants to stock fuel supply for several years, thereby contributing to security of supply.

Benefitting the environment

The EU has decided that in order to achieve the decarbonisation of the electricity and transport sectors by 2050, it must make a shift to low-carbon energy technologies. Substitution of fossil fuels, increased use of electricity and energy efficiency improvements in the power plants will be driving this transition in the energy sector. It must be ensured that the additional provision of electricity generation does not come to the detriment of the EU's goal to curb GHG emissions but should be provided by low-carbon energy sources such as nuclear energy. In this context, nuclear power is a significant contributor to the reduction of GHG emissions from the power generation sector. In the EU as a whole, taking into account the current (2011) energy mix, it helps avoid 436 million tons of CO₂eq per year and currently provides around two-thirds of the EU's low-carbon electricity.

Annex – Answers to the Green Paper Questions

4.1 General

Q. Which lessons from the 2020 framework and the present state of the EU energy system are most important when designing policies for 2030?

- A contradiction has emerged between RES support instruments and the operating of the electricity market resulting in increasing prices for the end consumer in spite of low wholesale electricity prices and a low CO₂ price.
- The attractiveness of support mechanisms for renewable technologies and the low price of carbon in the ETS has hindered investment in other low-carbon energy technologies.
- Great care is needed in the design of policies to incentivise efficient choices in low-carbon technologies. The prevailing low prices in the ETS, combined with support mechanisms for specific renewable technologies has meant that signals for investment in other low-carbon technologies are too weak.
- The 2020 framework has not fully addressed the need for a clear foundation to attract financing for capital intensive low-carbon energy projects, which is due to the combined effect of energy market risk, regulatory risk and the financial crisis.
- Even with the 2020 renewables target, EU Member States are still reliant on coal due to its current low price and the failure of the ETS. A continuation of this trend will likely have a long-term negative impact of locking-in Member States to a reliance on fossil fuels, even taking in to consideration that they should be 'capture ready'.
- The EU is not isolated from the rest of the world and measures to counter issues such as carbon leakage, the volatility of fossil fuel prices (which are mainly imported) and the development (in the framework) of the role of unconventional energy reserves should be addressed by the EC.
- For nuclear energy in Europe, the investment in new power plants will be an important factor to maintain the European leadership in the sector and it will also allow foreign competitors a window of opportunity in the market.

4.2. Targets

Q. Which targets for 2030 would be most effective in driving the objectives of climate and energy policy? At what level should they apply (EU, Member States, or sectoral), and to what extent should they be legally binding?

- Global CO₂ emissions are continually increasing and between 2000 and 2010 rose by 30 %. Such increases put at risk the target for a maximum of +2°C global warming, above which scientists predict potentially dangerous effects from climate change.
- The European Commission's 2050 Roadmap suggested that a 40 % GHG emissions reduction target in 2030 would be cost-effective, and consistent with the 2050 target. Such a target should be at an EU level and be legally binding. The 40 % target would give the most flexibility to Member States to choose their favoured low-carbon energy mix and keep the EU on track to meeting the 2050 objective.
- The EU should develop an explicit security of supply target for the short and long-term.
- For the short-term an EU target should focus on internal security of energy and electricity supply which in particular would take in to account parameters such as power generation adequacy, reserve margins and grid stability.
- Globally the competition between countries for natural resources is intensifying. In order to help stifle the EU's import dependence, for the long-term the EU should set a universal independence target of either less than 50 % for energy dependency or an energy diversity index.
- There should not be a competitiveness target but instead emphasis should be put on the role of a well-functioning energy market, plus relevant performance indicators such as the levelised cost of energy, the total electricity supply cost and the cost of avoided tonne of CO₂.
- Energy efficiency and renewables should not have specific targets but instead be considered as important instruments contributing to achieving the objectives of emissions reduction, security of supply and competitiveness.
- The EU should focus on measures that will reduce the barriers to deployment of the most economically efficient technologies that contribute to meeting the energy policy goals.
- If any RES target is developed by the EU it should only be indicative and take into account the potential of individual Member States to exploit such technologies. Any binding RES target could potentially sky-rocket system costs.

Q. Have there been inconsistencies in the current 2020 targets and if so how can the coherence of potential 2030 targets be better ensured?

- Yes. In particular, setting targets for both GHG reduction and renewable energy deployment has led to higher costs and inefficient outcomes. Inconsistency between GHG policy and RES policy has resulted in a high cost per tonne of CO₂ avoided, and contributed in part to the collapse of ETS price.
- The EU should propose just one target for 2030: a reduction in GHG emissions.

Q. Are targets for sub-sectors such as transport, agriculture, industry appropriate and, if so, which ones? For example, is a renewables target necessary for transport, given the targets for CO₂ reductions for passenger cars and light commercial vehicles?

- No, a single overall target and universal instruments to drive a reduction in CO₂ would be the most effective policy. Sectoral targets would bring inefficiency and unintended and unpredictable consequences as well as create conflict between sectors and distract from the common goal.

Q. How can targets reflect better the economic viability and the changing degree of maturity of technologies in the 2030 framework?

- The EU should seek to avoid RES share targets. Instead, mechanisms should be proposed such as premium Feed in Tariffs (FIT) and Contracts for Difference (CfD) instead of current FIT models, to support bringing low carbon technologies to the electricity market. These mechanisms allow the cost of support to be quantified and progress in terms of competitiveness to be monitored.

Q. How should progress be assessed for other aspects of EU energy policy, such as security of supply, which may not be captured by the headline targets?

See above

- Member States are ultimately responsible for their own security of supply and could ensure this with specific obligations on utilities, system operators and the regulatory authority.
- The EU should monitor and report on the performance of national systems and of the EU as a whole, which would allow for a comparison between progress in reducing dependence in the different Member States.

4.3. Instruments

Q. Are changes necessary to other policy instruments and how they interact with one another, including between the EU and national levels?

- The current ETS price is too low to support longer-term EU decarbonisation in the power sector and is not sufficient to discourage unabated fossil fuel generation.
- Until the ETS acts as an effective stimulus to low-carbon investments, the EU should support Member State governments' introduction of technology neutral carbon pricing and trading systems.

Q. How should specific measures at the EU and national level best be defined to optimise cost-efficiency of meeting climate and energy objectives?

- The EU should seek to limit the number of policy targets (see above), and those which it does propose should be stable and sufficiently long-term in order to ensure the greatest impact.
- The EU should ensure proper market functioning as a competitive market will ensure the greatest cost-efficiency.

Q. How can fragmentation of the internal energy market best be avoided particularly in relation to the need to encourage and mobilise investment?

- If working as envisaged, the ETS is the instrument which is best-placed to ensure avoiding market fragmentation. However, the ETS could also be complemented with the introduction of a EU level carbon tax.
- The 2030 framework should promote a level-playing field for low-carbon investments.
- The EU should encourage competition in the market and ensure the Third Energy Package is fully implemented.

Q. Which measures could be envisaged to make further energy savings most cost-effectively?

- Transparency of costs for consumers at all levels is most likely to drive energy saving measures.

Q. How can EU research and innovation policies best support the achievement of the 2030 framework?

- It is extremely important that R&D for nuclear fission technologies be supported at EU level and in the long-term EU support should be increased, especially to support the building of demonstrators. Such investment helps drive innovation in the sector and helps maintain the industry's competitiveness in a global market.
- Public funding of R&D is the most efficient public aid instrument for the long-term.
- In the field of nuclear power, international collaboration is well established and should continue to be supported, and has the potential to provide a good return on investment.

4.4. Competitiveness and security of supply

Q. Which elements of the framework for climate and energy policies could be strengthened to better promote job creation, growth and competitiveness?

- The EU framework for 2030 should take a technology neutral approach.
- Financial support from the EU should be made available to First of a Kind (FOAK) demonstrators.
- The EU's market is open to competition from outside whereas it can be difficult for the EU nuclear sector to access other markets. The EC should work to address this imbalance through talks with international partners and Governments outside the EU.
- The EU should provide encouragement for the creation of European industrial collaboration in the nuclear sector, which would help to create strong local and international businesses.
- EU nuclear companies are in a position to become even more a part of international supply chains and exports, this can be better realised with support through loans to those companies wishing to compete in the global market.
- The EU should seek to ensure that current market failures and bottlenecks for investment in the EU are identified, that existing financing instruments are reinforced and that new ones are allowed to be established.

Q. What are the specific drivers in observed trends in energy costs and to what extent can the EU influence them?

- Global demand for energy will rise significantly in the coming decades. World primary energy demand is expected to increase by 35 % between 2010 and 2035, or 1.2 % per year on average. The majority of global energy consumption will still be met by fossil fuels carrying with it a 20 % increase in CO₂ emissions above the 2011 figures to 37.0 Gt in 2035²⁸.
- Fossil fuel prices will continue to be set in world markets as global energy demand and trading increases. The unpredictability of fossil fuel prices should influence the EU to decrease dependence on them.
- There is significant uncertainty over system costs for renewable technologies such as large scale deployment of wind and PV. Current FIT models are also costly on such a large scale.

²⁸ IEA World Energy Outlook 2012

- Due to various reasons, including the current global financial crisis, there are pressures on the availability of capital needed for low-carbon generation projects. Both national governments and the EU will need to continue to develop frameworks for investment, regulatory streamlining and mechanisms to help increase access to capital through risk mitigation.

Q. How should uncertainty about efforts and the level of commitments that other developed countries and economically important developing nations will make in the on-going international negotiations be taken into account?

- The EU should be applauded for pursuing an aggressive climate policy and is the global leader in this respect. However, the EU should ensure such climate measures come at a reasonable cost in order to remain competitive. One way to assist this would be to maintain and over-time increase the share of nuclear in the EU's energy mix.

Q. How to increase regulatory certainty for business while building in flexibility to adapt to changing circumstances (e.g. progress in international climate negotiations and changes in energy markets)?

- The EU should continue to demonstrate leadership in international negotiations on climate change action, and provide a framework for functioning markets in energy.
- The EU should avoid creating new regulatory structures which could be seen as creating barriers to investment, and should rely on market-based approaches as far as possible.
- It is vital that commercial freedom to enter into contracts is preserved, and that the rules around allowable aid are clear, and that cases that may be considered as State Aid are assessed consistently and quickly by the relevant competition authorities.
- Governments and regulatory authorities have a critical role to play in setting clear as well as consistent procedures for licensing design and authorisation procedures in the early phases of projects.
- Long-term political support and a stable and predictable legal and regulatory framework coupled with clear national energy policy can give a solid foundation for nuclear investment.

Q. How can the EU increase the innovation capacity of manufacturing industry? Is there a role for the revenues from the auctioning of allowances?

- The EU should not exclude nuclear energy from future programmes aimed at innovative low-carbon energy demonstration projects.
- The use of Structural Funds for the construction of Member State-based research facilities approved under the SET-Plan could also be considered.

Q. How can the EU best exploit the development of indigenous conventional and unconventional energy sources within the EU to contribute to reduced energy prices and import dependency?

- If they are competitive then the market will champion them. There is an issue of public acceptance that needs to be addressed. There needs to be a clear regulatory framework for their exploitation.

Q. How can the EU best improve security of energy supply internally by ensuring the full and effective functioning of the internal energy market (e.g. through the development of necessary interconnections), and externally by diversifying energy supply routes?

- Diversity of energy sources and their origin, with a diversity of technologies and domestic industrial know-how and capacity, are the main contributors to security of supply.
- Nuclear power provides over one quarter of the EU's electricity, and although the uranium is almost all imported, there are diverse sources of supply and thus nuclear provides a major contribution to the EU's energy security.
- The EU should limit the share of intermittent sources, which are bringing instability across the EU electricity grid. Likewise, the EU should not be encouraged in promoting costly counter-measures, for example energy storage.
- As concerns grid infrastructure, the EU should give priority to interconnections which maximise efficient use of existing assets, and improve security of supply.

4.5. Capacity and distributional aspects

Q. What mechanisms can be envisaged to promote cooperation and a fair effort sharing between Member States whilst seeking the most cost-effective delivery of new climate and energy objectives?

- A properly functioning ETS which delivers a valid investment signal.
- Member States should be allowed to pursue efficient investments which will benefit the EU overall, and should adopt measures to reduce the barriers to trade and investment.

Q. Are new financing instruments or arrangements required to support the new 2030 framework?

- Lending institutions in Europe, such as the European Investment Bank (which will come forward with its new energy sector lending policy in the summer of 2013) should give preference to investments in low-carbon energy projects.
- The EU should allow innovation in financing arrangements, including the use of long-term contracts to underpin investment which would otherwise not be available.



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