FORATOM

www.foratom.org

FORATOM in 2011

FORATOM in a nutshell

FORATOM is the Brussels-based trade organisation representing the interests of the European nuclear energy industry. As the respected and credible voice of that industry, it promotes the interests of a multi-faceted industrial sector that is a driving force behind Europe's efforts to achieve a sustainable and competitive low-carbon energy mix and that contributes significantly to human health and quality of life.

FORATOM provides a bridge between the industry and the European Institutions.

FORATOM acts as the voice of the nuclear industry in energy policy and legislative discussions with EU Institutions, principally with Members of the European Parliament, European Commission officials, and the Member States' Permanent Representations to the EU.

FORATOM delivers factual information and key messages on nuclear energy issues to the media and the public.

In addition, FORATOM interacts with international organisations such as the International Atomic Energy Agency (IAEA) and the OECD /NEA (Nuclear Energy Agency).

FORATOM cooperates with several other major nuclear associations around the world such as the Nuclear Energy Institute (NEI) in the USA, the World Nuclear Association (WNA), the World Association of Nuclear Operators (WANO) and with European associations interested in energy matters, like BUSINESSEUROPE, Eurelectric, etc.

Table of contents

Foreword

View from the bridge

Some events define eras and remain forever engraved on our memory. Man's first steps on the moon, the fall of the Berlin Wall, or the 9/11 terrorist attacks spring to mind. The year 2011 will forever be associated with the devastating earthquake and tsunami that struck Fukushima on 11 March and with the subsequent tragic loss of over 20,000 lives. Who could ever forget those chilling pictures live on our TV and PC screens of the awesome power of the tsunami as it annihilated everything in its path! This unprecedented sequence of events triggered the accident at the neighbouring Fukushima-Daiichi nuclear power plant, something that we all witnessed with consternation. Inevitably, events in Japan wrote a new chapter in the history of nuclear energy.

Europe's decision-makers, regulatory authorities and operators responded rapidly and in unison. The safety and risk assessment procedure ("stress tests") was launched to verify the capability of Europe's nuclear power plants to resist combined natural disasters of such a magnitude. Nuclear safety was more than ever under the media spotlight; more than ever the non-negotiable priority of an industry characterised by a strong safety culture. Public opinion polarised and hardened. Even industry leaders have asked themselves why such a combination of extreme events was not included in the design basis. Inevitably, political reaction across Europe was quick to follow, with Germany deciding to phase out by 2022, Italy reversing its decision, via a referendum, to revisit the nuclear option and Switzerland deciding not to renew its nuclear fleet when it comes to the end of its operational lifetime and phase out by 2035. Learning the lessons of Fukushima became the oft recited mantra.

But as we look back at 2011, was the nuclear industry's *annus horribilis* quite as *horribilis* as predicted? In spite of the magnitude of the accident, and it would be pointless and short-sighted to ignore or minimise its significance, the momentum of nuclear new build across Europe remained virtually unchanged. Some countries like France, Finland, Slovakia, the UK, Romania and Poland pressed ahead with existing or planned construction projects. Although there was an undoubtedly sharp initial decrease in public opinion in favour of nuclear, public acceptance across Europe held up well as a whole. Indeed, in the UK - where an ambitious new build programme is in place - public acceptance of nuclear recovered quickly and is now higher than it was before Fukushima!

The world's population is expected to increase to 9 billion by 2050. A secure, uninterrupted and competitive supply of low-carbon base-load energy will be absolutely essential for meeting this demographic challenge and for driving economic growth and prosperity. When one takes into account the need to urgently reduce the CO_2 emissions that so threaten our planet, it's a no-brainer: the largest base-load electricity source that can realistically fulfil our security of supply, climate change and competitiveness requirements is nuclear. These three pillars are essential to securing a sustainable energy

Mats Ladeborn Jean-Pol Poncelet FORATOM in 2011

future. This was the case pre-Fukushima and is still the case post-Fukushima. Safe nuclear remains a key component of that energy future and pragmatism and common sense have largely prevailed. It could be argued that the global financial crisis poses a greater threat to the continued development of nuclear energy worldwide than do the long-term effects of Fukushima.

So, what are the lessons that we must learn from Fukushima? Before identifying them, a sense of perspective and proportion is necessary. Firstly, while the nuclear industry is rightly preoccupied with redoubling its efforts to improve still further its excellent safety profile, what happened at the Fukushima Daiichi nuclear power plant fades into obscurity when compared with the fact that so many lives were lost following the earthquake and tsunami. Those who were quick to say that the Fukushima bell has tolled for the nuclear industry would do well to remember this fact. Secondly, it is equally important to remember that not one single life has been lost as a direct result of the nuclear accident at Fukushima.

When such an event occurs - thankfully extremely rarely - the global nuclear community assumes collective ownership and responsibility. And this is precisely what happened after Fukushima. Clearly, there are important lessons to be learned and applied from a technical and technological point of view, such as applying a beyond design basis approach to improving power plants' resistance to unprecedented natural disasters, or upgrading emergency management procedures, or ensuring that back-up power is available at all times. But there are also important non-technical lessons to be learned: the first one is that truth should never be the first victim of circumstance: open and transparent communication of the facts, at all times, is vital for responding to legitimate concerns and for rebuilding trust. The impact of such an accident should never be minimised, nor the resultant emotion and apprehension underestimated. Nothing should be swept under the carpet or revealed only partially. Knowledge is empowerment and the public's access to information is a right, not a privilege. We should never take things for granted. Instead, we should think the unthinkable and learn to prepare for and cope with the impossible.

Objectivity, honesty and above all humility must underpin all that we say. It is when something like Fukushima occurs that we really find out how well we perform when it comes to communicating; not just communicating the facts, but communicating exactly what the enduring values of our industry are. Only when such an approach is adopted consistently and globally can trust in nuclear energy be restored wherever it has been compromised. From that position of trust the real advantages of nuclear energy can be more effectively portrayed and our industry can look forward to a promising future. Perhaps that is the most striking lesson to learn from 2011.

Jean-Pol Poncelet
Director General of FORATOM
p.p. PONCELET MC^2 sprl

Mats Ladeborn
President of FORATOM
Head of Nuclear Development, Vattenfall AB

Making the voice of the industry heard

FORATOM is a Brussels-based non-profit making trade organisation that represents and promotes the interests of the European nuclear industry on the European political stage. Its mission is to be recognised and respected as the credible voice of a multi-faceted industry that is a driving force behind Europe's efforts to achieve a sustainable and competitive low-carbon energy mix; a progressive industry that is a core component of Europe's energy future. FORATOM's membership is a broad church that includes national nuclear associations in 17 countries and around 800 companies from all sectors of the business, most notably vendors, electricity producers, fuel manufacturers and national waste management organisations.

The European nuclear industry has a set of guiding principles and values that define what it stands for, what its vocation is and how it functions. The main ones are:

- The promotion of exclusively peaceful applications of nuclear energy
- The appliance of science for the benefit of human health, quality of life and the environment
- An enduring commitment to enhancing security of energy supply, promoting competitive electricity prices and mitigating the effects of climate change
- Openness and transparency in the communication of information to all stakeholders

Bridging the gap

FORATOM acts primarily as the voice of the European nuclear industry in energy policy discussions with EU Institutions and other key stakeholders. It provides a bridge between its members and European policy-makers, thereby ensuring that the industry's voice is heard and that it can maintain the significant role that it plays in the European energy policy debate.

A well-oiled team

The FORATOM Secretariat that coordinates the work that the Association does on behalf of its members is made up of a multinational team of 18 people, each with specialist skills in areas such as EU affairs, communications, engineering, languages, IT and administration.

FORATOM prides itself on having established a solid reputation as a reliable source of accurate information for the EU institutions, the media and the public, on all things related to nuclear energy. The information that it receives from the national nuclear associations and the companies that they represent is collected and analysed by FORATOM's Task Forces, each of which consists of experts with specialised knowledge in a specific policy area. This information is then channelled into discussions on EU energy issues with the European institutions. The various briefs of the Task Forces are as follows:

- Decommissioning Financing
- Education and Training
- Environmental Issues
- Financing
- Information and Communications
- Legal Affairs
- Management Systems
- New Build
- Radioactive Waste Management
- Research and Development
- Safety and Radiological Protection
- Security of Energy Supply
- Transport

ENISS

The European Nuclear Installations Safety Standards (ENISS) group, which operates under the FORATOM umbrella, brings together decision-makers, operators and specialists from the nuclear industry with European regulators in order to identify and agree upon the scope and substance of harmonised safety standards.

Nuclear power station of Tihange - picture by de BARSE Rudy

Nuclear power station of Tihange - picture by de BARSE Rudy

The A - Z of the nuclear fuel cycle

The nuclear industry is driven by the fuel cycle. Here is a simple guide to the main steps that define that cycle, from the mining of uranium, via enrichment and fuel fabrication, to the production of electricity at Europe's nuclear power plants and the management of spent fuel and radioactive waste

2011: a watershed year

Throughout 2011 FORATOM's Secretariat and Task Forces carried out lobbying and communications activities on behalf of its members. These centred on the major issues driving the EU energy policy debate, on the EU institutions' legislative timetable and on the work programme of the European Nuclear Energy Forum (ENEF) and its Working Groups and Subgroups. Here is a chronological account of the main events and policy developments that signposted what proved to be a watershed year for the nuclear industry in Europe.

January 2011

2011 began with FORATOM's Task Forces pressing ahead with their work in the main areas that had set the agenda in 2010. This included the Ad Hoc 2050 Roadmap Task Force's work on filling in the questionnaire that accompanied the public consultation on the EC's *Energy 2050 Roadmap* when it was launched in December 2010. Other focuses for FORATOM's work included the analysis carried out by the Transport Task Force on the possible regulations on registration of carriers of radioactive materials (RAM), and the fourth FORATOM EU Affairs Course, which was organised to familiarise participants with the EU decision-making processes and how the EU institutions function.

February 2011

The first ever EU Energy Summit, attended by EU heads of state, provided a strategic impulse to EU energy policy. A number of key initiatives were signed up to by EU Member States. The most substantive of these was the presentation of the EC's Communication, *Energy 2020: A strategy for competitive, sustainable and secure energy* (part of the overall Europe 2020 Strategy), which was published by the EC in November 2010. The major pillars of the strategy are the completion of an integrated energy market, added investment in renewables, the modernisation of Europe's energy structures, added resources for research and improved electricity interconnections.

Another significant initiative to emerge from the Summit was the affirmation of the EU's commitment to the development of a low-carbon economy by 2050. The only direct reference to nuclear energy in the Summit Conclusions was the importance of promoting the "highest standards of nuclear safety". However, emphasis on "safe and sustainable low-carbon technology" and reference to the Strategic Energy Technology Plan (SET-Plan), which defines nuclear energy as a low-carbon technology and provided a platform for the creation of a European Sustainable Nuclear Energy Industry Initiative (ESNII), endorsed the role of nuclear in EU energy policy. Later that month EU energy ministers adopted Council's Conclusions and the ten-year energy plan, entitled: *Energy 2020: A strategy for competitive, sustainable and secure energy*, was rubber stamped.

March 2011

"In electricity generation, I think we will be very successful and we will not have CO_2 emissions (by 2050). In other words, non-carbon technologies will be deployed for this particular purpose and all this has been incorporated into the energy roadmap, of course renewables have their place in this energy roadmap, but nuclear can keep its place, as well as coal, gas and cogeneration, however, only when we have a reduction of CO_2 emissions."

Günther Oettinger, Energy Commissioner on 8 March 2011 during the press conference devoted to the 2050 Low-carbon economy Roadmap and the Energy Efficiency Plan (source: FORATOM)

The Year of the Roadmap

The EC published its Communication entitled: *A roadmap for moving to a low-carbon economy by 2050*. The Communication proposed that the core components of the strategy needed to achieve the 2050 objectives are reducing EU greenhouse gas (GHG) emissions by 80% by 2050 compared to 1990 levels and increasing the share of low-carbon technologies in the EU's electricity mix, which includes nuclear energy, to almost 100% by 2050. The Communication outlined different energy models and scenarios resulting from a sector-by sector analysis and stressed how vitally important it is that the electricity generating sector should become CO_2-free by 2050.

Fukushima: a catalyst for action

Up until this point 2011 had progressed smoothly, with the EC's *Europe 2020 Strategy and the 2050 Roadmap* providing the main focus for FORATOM's work. Then, on 11 March, an unsuspecting world witnessed a chain reaction of catastrophic events for which 2011 will for ever be remembered. On that fateful day over 20,000 people lost their lives when a massive earthquake and resultant tsunami mercilessly struck Fukushima, on the Eastern coast of Japan. Apocalyptic images of death and destruction filled our TV screens. The unprecedented destructive force of Mother Nature was also unleashed on the nearby Fukushima Daiichi nuclear power plant, where four out of the six reactors in operation were destroyed or seriously damaged. The operator and the emergency forces fought desperately to contend with a catastrophic combination of loss of power, loss of heat sink and a series of hydrogen explosions.

The accident was given a maximum Level 7 rating on INES (the International Nuclear Events Scale), which is the same as that for Chernobyl in 1986. However, the French IRSN (Institute of Radioprotection and Nuclear Safety), in a report published in February 2012, estimated that the"radiological equivalent" of the radiation released by the Fukushima accident is "about 10% of the corresponding equivalent of Chernobyl". As far as the contaminated area is concerned, the IRSN concludes that the total area that has been contaminated by Fukushima corresponds to about 5% of the area contaminated due to Chernobyl.

Mining Enrichment Fuel Fabrication Electricity Generation

Uranium mining

Uranium is a naturally-occurring silvery-grey heavy metal that is present in many countries around the world. Australia, Canada, Russia and Kazakhstan were the main suppliers of uranium for the European nuclear industry in 2012. Uranium ore is extracted and treated chemically on the spot to obtain the uranium in the form of a yellow powder, called "yellow-cake."

Fukushima understandably polarised public opinion, mobilised anti-nuclear sentiment and provoked much fear and misapprehension across the world. Political action and reaction was quick to follow: Germany decided to phase-out its nuclear operations by 2020. Italian citizens voted in a referendum to reverse the government's decision to revisit the nuclear option. Switzerland decided not to replace its nuclear fleet when it comes to the end of its operational lifetime and to phase-out by 2034. Fukushima, to a large extent, set the agenda for rest of the year and led many commentators to baptise 2011 the nuclear industry's *annus horribilis*.

On 15 March, only four days later, the EC, EU energy ministers, national regulators and nuclear industry representatives met and decided to introduce risk and safety assessments ("stress tests") at all Europe's nuclear power plants. On 25 March, the Council mandated the EC to look into the revision of the Safety Directive.

Throughout 2011 ENISS played a pivotal role in the risk assessment ("stress tests") process that dominated the safety standards agenda following the Fukushima accident. That role primarily involved helping to define the stress tests' specifications. It set up a special Task Force called the Safety Terms of Reference Task Force (STORE) to propose the terms of reference for the stress tests, which re-evaluated the ability of nuclear power plants - both in operation and under construction - to withstand such extreme natural events.

From the outset, the industry lent its full support to the stress tests process that national regulators and the European Nuclear Safety Regulators Group (ENSREG) instigated, at the initiative of the EC, in response to the accident. The purpose of the stress tests was to assess three things: whether Europe's nuclear facilities are robust enough to resist extreme events beyond design basis, like those that devastated Fukushima; whether they are able to avoid the loss of vital safety functions (cooling systems, backup power, etc.) and whether they have the necessary severe accident management systems and procedures in place.

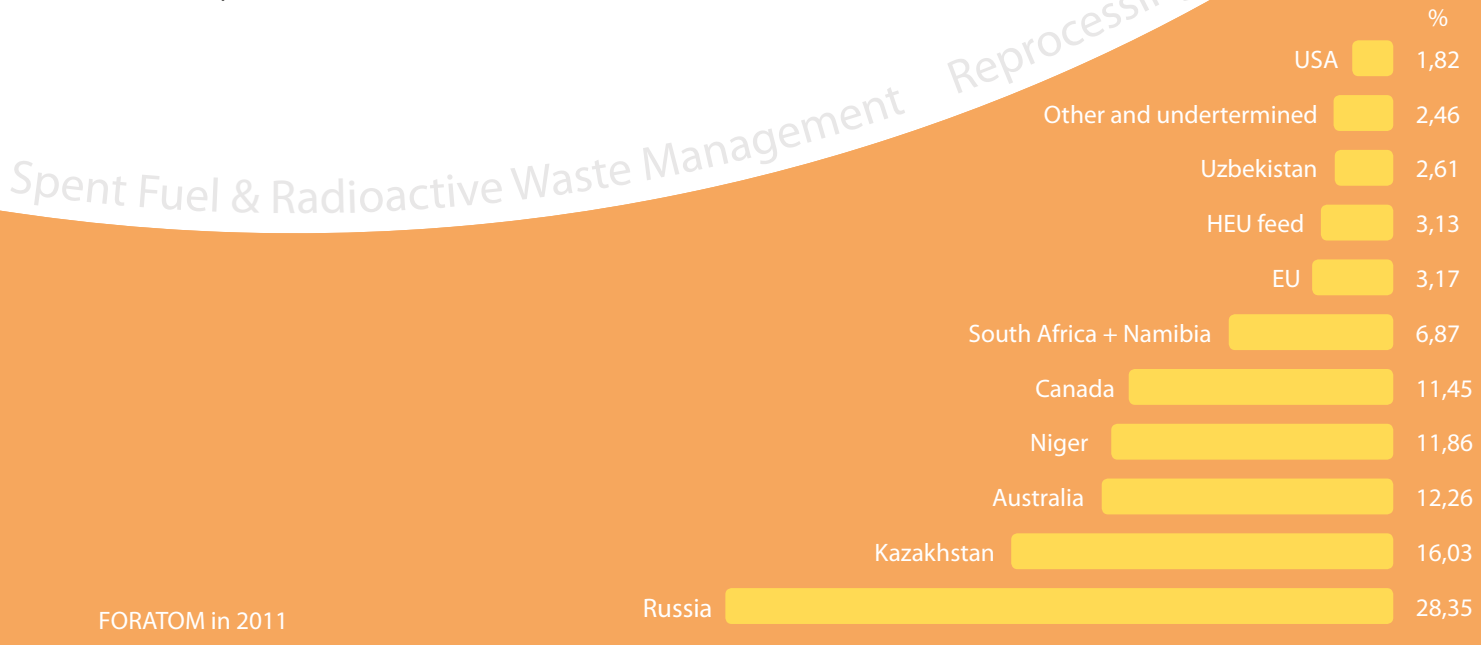
FORATOM responded immediately with a coordinated communications strategy. A special section of the website was created featuring updated news and statistics, the comments of experts and decision-makers and information and comment relayed via the social media. Among the many documents FORATOM created were a Q&A on Fukushima, a Q&A on the stress tests, a summary of political reactions across Europe, a report comparing Fukushima with Chernobyl, etc. In addition, FORATOM gave over 50 press, radio and TV interviews with international media representatives in Brussels and regularly provided the perspective of the European nuclear industry in responses to media enquiries.

"Of course it's time to review and analyse (safety) carefully but it wouldn't be right to make a rash decision, a 180 degree turn. Poland is not at risk of earthquakes and tsunamis. The problem in Japan was not the power plants themselves, but the earthquake. We need to make a decision based on rational analysis and not emotions."

Aleksander Grad, Polish Treasury minister on 5 April 2011 (source: The Guardian)

Reprocessing & Recycling

Spent Fuel & Radioactive Waste Management



source : EURATOM Supply Agency, Annual Report 2010

April 2011

"Of course it's time to review and analyse (safety) carefully but it wouldn't be right to make a rash decision, a 180 degree turn. Poland is not at risk of earthquakes and tsunamis. The problem in Japan was not the power plants themselves, but the earthquake. We need to make a decision based on rational analysis and not emotions."

Aleksander Grad, Polish Treasury minister on 5 April 2011 (source: The Guardian)

Learning the lessons of Fukushima remains a non-negotiable priority for the industry and FORATOM. In keeping with the guiding principle of continuous improvement, plant operators have always striven to maintain and upgrade safety standards at their facilities and they clearly restated their unequivocal commitment to safety.

Public opinion in favour of nuclear energy, not surprisingly, decreased in the immediate aftermath of the accident. However, it gradually increased again in a number of countries as the year progressed. This reflected an enduring belief in many countries - not just in Europe but globally - in the benefits of nuclear energy. In spite of Fukushima the momentum for nuclear new build was not lost. On-going new build projects in Finland, France, Slovakia and Romania were not significantly affected. Construction of a total of 6 reactors continued unabated (Source: *IAEA's PRIS database*). Plans for the construction of a further fourteen reactors, including those in the UK, France, Finland and Poland, were not changed.

Mining **Enrichment** Fuel Fabrication Electricity Generation

gace measuring fuel rods

Natural uranium has two main isotopes, U238, which accounts for about 99% of the total and U235, which accounts for roughly 1% of the total. However, it is the isotope U235 that is required for nuclear energy production because it is fissile, i.e. it splits when it comes into contact with neutrons. This splitting process, called fission, releases considerable energy in the form of heat and this is what occurs in a controlled way in a nuclear reactor. In order to obtain

Work on finalising the stress tests continued. The EC and ENSREG agreed on the stress tests' specifications. The tests were carried out on a voluntary basis because nuclear safety is an area of shared competence between the EU and the Member States. Nuclear operators carried out risk and safety assessments at all the NPPs in Europe and produced reports that were then analysed by the national regulatory bodies. Particular focus was given to the ability of nuclear power plants to withstand black-outs and loss of cooling systems, as well as issues linked with human error. Terrorist attacks on nuclear facilities were not included in the criteria because they are the exclusive remit of the national security authorities.

FORATOM organised a visit to the radioactive waste management facilities at Gorleben (Germany), in cooperation with the Deutsches Atomforum (DAtF), E.ON, RWE, EnBW and Vattenfall. Participating in the visit was a group of seven members of the Council's Atomic Questions Group (AQG) and MEP Pavel Poc (S&D, Czech Republic), who is responsible for drafting - together with some industry representatives - the ENVI Committee's opinion on the Draft Proposal for a Council Directive on the Management of Spent Fuel and Radioactive Waste.

FORATOM also participated in the annual plenary meeting of the European Nuclear Energy Forum (ENEF), which featured in-depth discussions about the specifications and definition of the stress tests in a session entitled: *The Aftermath of Japan: safety and risk assessment in Europe*. FORATOM was accompanied by some of its Task Force Chairmen. During the plenary some of the ENEF Working Groups presented their reports. However, not all did so as others opted to revise their reports in order to reflect events at Fukushima.

May 2011

"Germany now risks landing in a position with a very uneven energy policy. The decisive question now for Germany is that one most probably will need to increase the import of nuclear energy from France and that there is a risk they will not manage as quickly to halt the dependency on fossil fuels, especially coal-based energy,"

Andreas Carlgren, Swedish Environment Minister, on 30 May 2011 following the German decision to phase out nuclear by 2022 (Source: BBC)

a concentration level of up to 3% of U235, which is required for manufacturing nuclear fuel for use in most nuclear reactors, the uranium has first to be enriched by using either gas diffusion or gas centrifugation techniques. The remaining U238, referred to as "depleted uranium", is stored. The majority of uranium enrichment carried out in Europe is done by the specialised companies and FORATOM members, URENCO, in the UK, the Netherlands and Germany, and AREVA, in France.

Significant policy developments at EU level

Inevitably, Fukushima to some extent overshadowed significant policy and legislative developments in 2011. However, it did not prevent them from continuing their progress.

June 2011

"Germany's phase-out of nuclear power may compromise the security and sustainability of the European Union. Power will be more costly, and less secure, and even greater and more urgent investment in renewables is needed."

Nobuo Tanaka, International Energy Agency (IEA) Executive Director, at the annual Eurelectric conference in Stockholm on 13 June 2011 (source: IEA)

As part of its contribution to the EU's Roadmap, FORATOM launched its own one, entitled: *Energy 2050 Roadmap: Contribution of Nuclear Energy*. It highlighted the central role of nuclear in securing Europe's low-carbon energy future. The roadmap, which was created at the initiative of FORATOM's Ad Hoc 2050 Energy Roadmap Task Force (a subgroup of FORATOM's Security of Energy Supply Task Force), featured critical analyses carried out by the Paul Scherrer Institute, in Switzerland, of different scenarios drawn from studies published by international organisations like the International Energy Agency (IEA), the OECD/Nuclear Energy Agency, Eurelectric and the EC. Its main conclusion was that if the EU wants to achieve its security of supply, competitiveness and climate change goals, the share of nuclear in the EU's total electricity generation (around one third) should be at least maintained.

The EC published a Proposal for a Directive entitled *Protection of public health: radioactive substances in water intended for human consumption*. The European Economic and Social Committee (EESC) delivered its Opinion in November and the EP should provide its Opinion on the Proposal and adopt an own-initiative report in 2012. FORATOM's Safety and Radiological TF concentrated its work on Annex 1 of the Proposal and provided recommendations on the maximum permitted dosage level of tritium and radon in drinking water.

The Council agreed in principle to extend for a further two years Euratom's Seventh Framework Programme for nuclear research (FP7). The objective of the programme was to maintain Europe's leadership in nuclear research, encourage the transfer of technology between the research community and industry and maintain the highest possible safety standards. The EC proposed to extend the budget of the FP7 as follows: €2.2 billion (86% of the overall sum) for nuclear fusion research and, above all, to support the construction of the international experimental fusion reactor ITER, in Cadarache (France); €112 million for nuclear fission, education and training, and safety and radiation protection; €233 million for the activities of the Joint Research Centre (JRC).
FORATOM produced a position paper outlining the European nuclear industry's views on current and future priorities for fission research.

The NICE (Nuclear Information Committee Europe) group, which brings together nuclear communicators from the industry and research sectors, met to discuss the major communications challenges that arose after Fukushima, with a focus on communicating about the stress tests and reiterating the industry's commitment to safety.

Mining Enrichment **Fuel Fabrication** Electricity Generation

Fuel assembly

The enriched uranium is then converted into uranium dioxide (UO2) powder that is processed into pellet form. The pellets are then fired in a high temperature furnace to create hard uniform pellets of enriched uranium. The pellets are stacked into corrosion-resistant zirconium or stainless steel tubes,

Mochovce NPP , Slovakia

Spent Fuel & Radioactive Waste Management Reprocessing & Recycling

which are called fuel rods. The fuel rods are sealed and grouped in special assemblies that are then used to build up the core of a nuclear reactor. The main companies specialised in the production of nuclear fuel in the EU are AREVA, at their facilities in France, Germany and Belgium and Westinghouse, at their facilities in the UK and Sweden.

FORATOM in 2011

July 2011

"This is a major achievement for nuclear safety in the EU.… With this directive, the EU becomes the most advanced region for the safe management of radioactive waste and spent fuel."

Günther Oettinger, Energy Commissioner, on 19 July 2011 (source: EC)

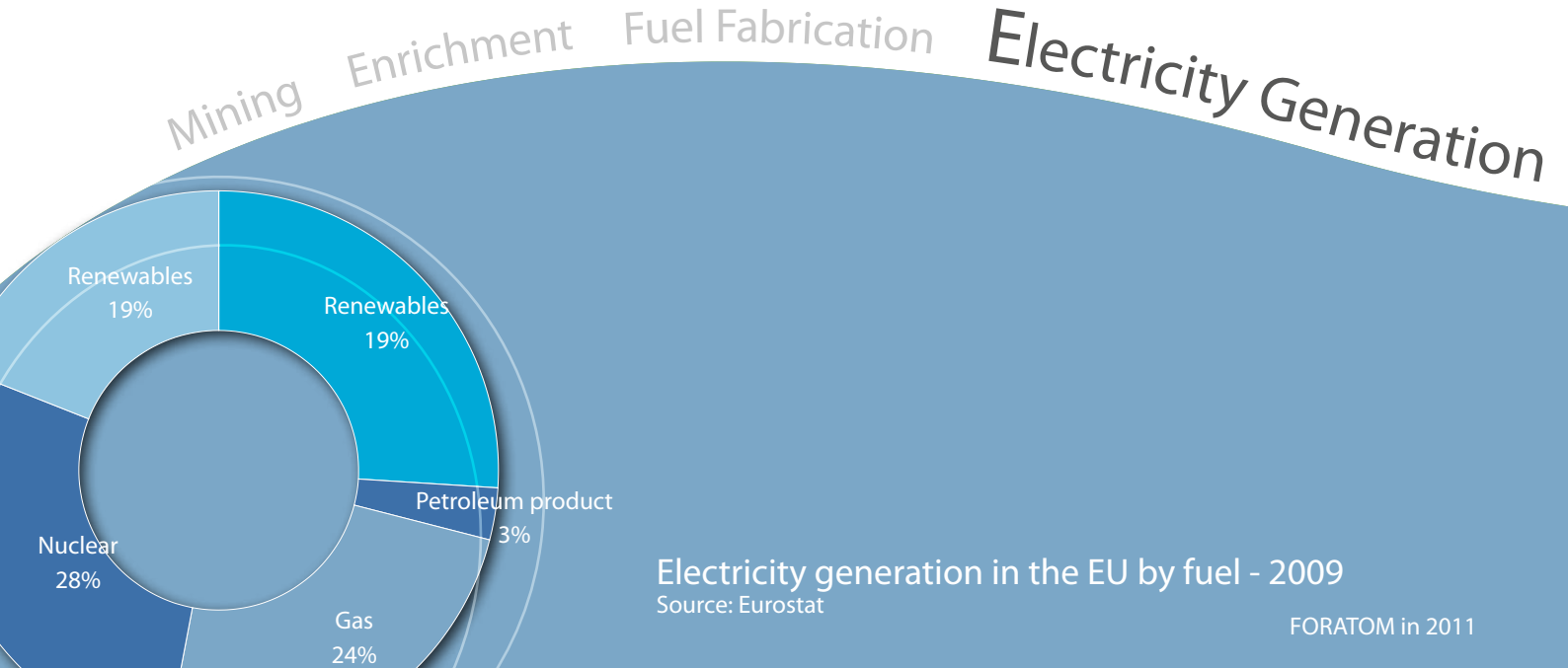
The European Council adopted its long-awaited *Directive Establishing a Community Framework for the Responsible and Safe Management of Spent Fuel and Radioactive Waste*. The "Waste Directive" established a first-ever Community-wide legal framework for the safe and sustainable management of the radioactive waste and spent fuel produced by Europe's nuclear power plants. Member States' governments were required to ensure that their national legislation is in line with the new Directive by July 2013 and to submit national radioactive waste management programmes to the EC that feature specific targets and time frames, inventories, estimations of the cost of the programmes over a 10-15 year period and a financing plan. The Waste Directive recognised that: "… at this time, deep geological disposal represents the safest and most sustainable option as the end-point of the management of high-level waste and spent fuel considered as waste."

FORATOM's Waste Management Task Force analysed the consequences of the Waste Directive for the European nuclear industry and continued to participate actively in the work of the ENEF Waste Subgroup.

August 2011

FORATOM announced that it had appointed Jean-Pol Poncelet its new Director General, succeeding Santiago San Antonio, whose five-year term in the Brussels hot-seat had come to an end. On taking up his post Mr. Poncelet emphasised the necessity for the European nuclear industry to regain the confidence of the public after the tragic events in Japan, but also saw it as a challenge that had to be met: "The Fukushima accident questions our ability to accept and manage severe hazards and accidents. We have to re-convince the public. This is a golden opportunity for the industry to demonstrate it can learn from experience and implement a strategy based on the principle of continuous improvement."

The quieter summer vacation period enabled work to progress on the updating and upgrading of FORATOM's website, with new materials, revised sections and the results of recent public opinion polls featuring among the improvements made.



Electricity generation in the EU by fuel - 2009
Source: Eurostat

Political momentum

The national regulators consolidated national interim reports that were communicated to the EC, ENSREG and the general public A number of recommendations emerged from them and from the subsequent reports produced by ENSREG.

A joint meeting of FORATOM's Transport Task Force and Radioactive Waste Management Task Force took place in Sellafield (UK). It was convened to discuss the Waste Directive and its consequences for the nuclear industry. Special emphasis was given to the transportation of radioactive waste in view of the EC's Proposal for a Council Regulation on the Registration of Carriers that was adopted in August 2011.

At the kind invitation of the Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA), in France, FORATOM held a Research &Development Task Force meeting at the CEA's research centre, in Cadarache. The meeting included interesting briefings on the sodium-cooled fast reactor demonstration project ASTRID and on the ITER fusion project. It was followed by a visit to the new Jules Horowitz Research Reactor that is currently under construction.

The EC published a Proposal for a revision of the Basic Safety Standards (BSS) Directive that fixes standards for radioprotection in the EU. ENISS reviewed the Proposal and produced a position paper in which it outlined a number of its concerns, especially with regards to environmental radioprotection, dose restraints, emergency exposure limits, employer undertakings and the role of Radioprotection Experts and Officers.

September 2011

"If you would like to abandon nuclear, then my question is: 'How are you going to meet the growing demand of energy when you are abandoning one of your sources? That question has to be answered by all those countries and governments who would like to abandon nuclear. If the answer is 'we'll do it with renewables', then my question will be 'how'? How cost effective are renewables? How much are they deployed at this moment? How are you going to speed up the curve of renewables so that they're going to be a greater part of the energy supply?"

Maria van der Hoeven, IEA Executive Director on 7 September 2011 (source: AFP)

"The Agency has updated its projections concerning the outlook for nuclear power in the wake of the Fukushima Daiichi accident. We now expect the number of operating nuclear reactors in the world to increase by about 90 by 2030, in our low projection, or by around 350, in our high projection, compared to the current total of 432 reactors. This represents continuous and significant growth in the use of nuclear power, but at a slower growth rate than in our previous projections."

Yukiya Amano, IAEA Director General on 12 September 2011 (source: IAEA)

Spent Fuel & Radioactive Waste Management Reprocessing & Recycling

Inside a nuclear reactor core the uranium comes into contact with neutrons and splits (fission). A continuous fissile chain reaction occurs inside the core. The massive amount of heat generated during fission heats the surrounding coolant (water or gas), which is then used to produce pressurised steam. This steam drives a series of turbines, which in turn generate the electricity that is then connected to the grid. In Europe there are 138 nuclear power plants generating electricity (in 15 EU Member States out of 27 and in Switzerland) and 436 worldwide. 28% of Europe's electricity is generated from nuclear energy.

October 2011

FORATOM finalised an updated version of the *Energy 2050 Roadmap: Contribution of Nuclear Energy* that it had launched in June. The update was produced in order to take into account the evolving context post-Fukushima. It was published in early November.

The New Build Task Force focused on the stress tests and their potential impact upon operators across Europe. It discussed design licensing harmonisation, a revision of the existing safety legislative framework and nuclear liability. Also on the meeting's agenda were the EC's upcoming Energy 2050 Roadmap and its Proposal for a Directive on Energy Efficiency.

The Legal Task Force meeting concentrated on the EC's *Proposal for a Directive on Basic Safety Standards for the Protection of the Health of Workers and the General Public against the Dangers Arising from the Effects of Ionizing Radiation*, a dossier in which ENISS had played the lead role within FORATOM.

Mining Enrichment Fuel Fabrication Electricity Generation

There are different categories of radioactive waste: low, intermediate and high-level waste, classified according to their degree of radioactivity and the time it takes for that radioactivity to reduce or "decay".
Low and intermediate-level waste, which accounts for 99% of all radioactive waste, consists mainly of used clothing, equipment and materials from nuclear power plants, hospitals or laboratories. This waste is stored in low and intermediate level waste repositories, like the ones at Olkiluoto and Loviisa, in Finland, or Soulaines, in France.

Focus on research

The EC launched *Horizon 2020*, a package of measures that follows on from Euratom's Seventh Framework Programme (FP7) and is intended to boost research, innovation and competitiveness in Europe up to 2020. FORATOM participated in the online consultation process. The EU's Commissioner for Research, Innovation and Science, Máire Geoghegan-Quinn, announced that *Horizon 2020* will provide €80 billion of funding for investment into key research and innovation projects across the EU for the period up to 2020. As far as nuclear fission research is concerned, €1 billion will be set aside for Euratom research programmes and €656 million for JRC projects. FORATOM published an updated version of its *Energy 2050 Roadmap: Contribution of Nuclear Energy* to reflect the evolving post-Fukushima context.

November 2011

"If we do not have an international legally binding agreement soon, and if it doesn't give a boost to a major investment wave of clean energy technologies by 2017, the door to 2 degrees will be closed forever. A shift away from nuclear power would definitely be bad news for energy security, for climate change and also for the economics of the electricity price."

Fatih Birol, Chief Economist, International Energy Agency on 9 November 2011 (source: Bloomberg)

Spent Fuel & Radioactive Waste Management Reprocessing & Recycling

Spent fuel from the reactor core, which accounts for 1% of total radioactive waste produced, results from nuclear fission. When treated as high-level waste, it is stored in spent fuel pools or dry repositories, where it is left to cool down. Deep geological repositories are a long-term storage option of choice for this category of waste. Spent fuel stored in steel or copper canisters is stored in concrete drums hundreds of meters underground, where it can safely decay over extremely long periods of time – up to millions of years.

December 2011

FORATOM organized its biggest event of the year, the European Nuclear Assembly (ENA 2011). This annual conference, which attracted around 100 delegates from across the world, provides a perfect platform for politicians, industry experts, think-tanks, the media and stakeholder representatives to discuss the latest political, economic and environmental developments in the nuclear field and to focus on how nuclear is pivotal to sustainable growth and to the achievement of the EU's energy and low-carbon economy goals.

The ENA 2011 agenda featured keynote speeches, presentations and roundtable discussions on a range of issues, including security of energy supply, new-build post-Fukushima and the energy supply and demand conundrum. Among the top-level speakers who led the debate at ENA 2011 were Anne Lauvergeon, former CEO of AREVA; Peter Faross, Acting Director General of DG Energy and Hergen Haye, Head of New Nuclear & Strategy, Department of Energy & Climate Change, UK Government.

The EC published its much-anticipated *Energy 2050 Roadmap*, which outlined the contribution of energy to achieving the EU's 2050 low-carbon economy goals. The Roadmap stressed the important contribution of nuclear energy in achieving the EU's goal of reducing CO_2 emissions by 80% by 2050, whilst at the same time ensuring security of energy supply and promoting competitiveness.

The Roadmap endorsed the fact that nuclear energy makes "a significant contribution to the energy transformation process" and is "a key source of low-carbon electricity generation." It also emphasised that nuclear energy "contributes to lower system costs and electricity prices". Different scenarios were analysed in order to determine how to achieve a low-carbon energy economy for the EU by 2050. Each scenario was based on the four main ways of decreasing CO_2 emissions: the promotion of energy efficiency, increased investment in renewables, the continued use of nuclear energy and carbon capture and storage (CCS).

FORATOM had published its updated *Energy 2050 Roadmap: Contribution of Nuclear Energy* in November 2011 as the industry's contribution to the EC's Energy 2050 Roadmap, and now that the EC's Energy 2050 Roadmap had been published FORATOM began working on an industry position paper on it, which was published in March 2012.

The EC presented a progress report report on the national stress tests' interim reports to the European Council to assess preliminary findings.

Mining Enrichment Fuel Fabrication Electricity Generation

Sellafield NPP, UK

Another option with regards to spent nuclear fuel is to reprocess and recycle it. Plutonium, as well as fissile uranium, are recovered from the spent fuel and recycled in the form of mixed oxide, or "MOX" fuel. This can be re-used in certain kinds of nuclear reactors. Reprocessing significantly reduces the resultant volume of high-level waste but does not eliminate radioactivity or heat

What does 2012 hold in store?

While many of the lessons of Fukushima still have to be learned, and much still needs to be done to further restore public confidence in nuclear energy, it is important to note that a majority of countries either maintained their commitment to nuclear or decided to press ahead with their ambitious new build programmes. Perhaps 2011 was not quite the *annus horribilis* for our industry that many predicted. But what is 2012 likely to hold in store for the European nuclear industry? What are the policy developments and issues that will drive FORATOM's work?

A major policy focus in 2012 will undoubtedly be **safety**. Because of Fukushima safety will continue to dominate the political landscape. The peer reviews managed by ENSREG - a combination of country-specific and topical reviews - began in early 2012 and were completed by April 2012. The EC will submit its report on the peer reviews before the European Council in June 2012. The Proposal for a revised Basic Safety Standards Directive that the EC published in September 2011, and which fixes standards for radioprotection in the EU, should be adopted by the Council in 2012. Finally, the EP should provide its Opinion on a Directive entitled Protection of public health: radioactive substances in water intended for human consumption.

The publication in 2012/2013 by the EC of an EU-wide **public opinion** poll (Eurobarometer Survey) on safety and waste will reveal how European citizens' perception of nuclear safety has developed since Fukushima. The survey is particularly significant as it will be the first one to combine both safety and waste issues.

Waste management will again feature high on the political agenda in 2012. Following on from the adoption in 2011 of the Waste Directive EU Member States will have to submit their national programmes by 2015. ENEF created a special Core Group called NAPRO that is mandated to develop guidelines for the national programmes and NAPRO will present its findings to ENEF at the May 2012 plenary. The guidelines should be finalised in March 2013.

Significant progress with the **Roadmaps** should be made in 2012: it is expected that the Low-carbon Roadmap 2050 will be voted on in the EP, both at Committee and Plenary level. In addition, the Council will endorse the EC's *Energy Roadmap 2050* and the EP will provide an Opinion on it.

As far as **financing** is concerned, the EC's Illustrative Nuclear Programme document (PINC), which should have been published in 2011 but was postponed due to the Fukushima accident, should finally see the light of day by the end of the year. Among the main components of the PINC will be recommendations on capacity projections, investments and other aspects of financing. Other initiatives in the fields of **transport,** the **harmonisation of design licensing** and the **long-term operation** of nuclear power plants in the EU are also likely to come to fruition during 2012.

Reprocessing & Recycling

Spent Fuel & Radioactive Waste Management

generation and, therefore, long-term storage of the remaining high-level radioactive waste, for example in a geological waste repository, is still necessary.

Reprocessing in Europe is carried out by AREVA at their La Hague facilities in France and by Sellafield Ltd. at their plant in Sellafield (UK).

Conclusion

There are currently 7 billion people living on planet earth and this number is projected to grow to over 9 billion by 2050. A phenomenal amount of uninterrupted base-load energy will have to be produced and supplied to industry and consumers if spiralling energy demand is to be satisfied. With this in mind nuclear, as a secure, reliable, competitive and low-carbon source of energy, will remain a cornerstone of Europe's and the world's energy mix for many years to come. This was the case pre-Fukushima and will remain so post-Fukushima.

FORATOM will continue to articulate the key messages about the security of supply, competitiveness and climate change credentials of nuclear energy, and in so doing continue to concentrate its time, energy and resources on promoting the interests of the European nuclear industry, in 2012 and beyond.

FORATOM in 2011

Olkiluoto NPP, Finland

Rue Belliard, 65
1040 Brussels
tel +32 2 502 45 95
fax +32 2 502 39 02
foratom@foratom.org

May 2012 - ref. 2012AR