BUSINESSEUROPE

POSITION PAPER

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ENERGY FOR EUROPE: KEEPING ALL OPTIONS OPEN, INCLUDING NUCLEAR

A. Executive Summary

At the European summit in March 2007, Heads of State rightly decided to develop national and European energy policy initiatives following a more integrated approach designed to reach the goals of competitiveness, security of supply and climate protection.

As the Commission shows in its document "Indicative nuclear programme" (PINC), nuclear energy has excellent economic and technical characteristics to help meet these three objectives.

The size of the energy challenges that the EU must meet is such that it is crucial to deploy actively all the solutions offered by:

- improved energy efficiency;
- development of renewables;
- use of nuclear energy;
- development and application of carbon capture and storage (CCS) technologies.

A delay in development of efficient policy measures to promote any one of these four technological resources would have very harmful effects regarding the possibility to ensure security of supply and climate protection under affordable conditions.

Reducing the contribution of nuclear energy in countries where it today plays a substantial role would cause additional specific difficulties for these countries, causing very negative impacts. These negative impacts would also affect neighbouring regions.

This document seeks in particular to illustrate the potential that nuclear energy offers to help tackle energy-related economic and environmental challenges. It concludes that this potential can only be exploited if national and European strategic discussions give nuclear energy the same level of attention accorded to other energy or manufacturing sectors. This attention should target elimination of the obstacles which unnecessarily hold back the development of nuclear energy. In this regard, the following priority measures are required:

- greater harmonisation of safety requirements for nuclear installations in the EU;
- establishment of national plans for management of radioactive waste in countries which do not yet have one;
- simpler and more harmonised licensing procedures, based on closer coordination between national regulatory authorities, aimed at maintaining the highest safety standards;

THE CONFEDERATION OF EUROPEAN BUSINESS a.i.s.b.l.
AV. DE CORTENBERGH 168
BE-1000 BRUSSELS
BELGIUM
VAT BE 863 418 279
TEL +32(0)2 237 65 11
FAX +32(0)2 231 14 45
E-MAIL: MAIN@BUSINESSEUROPE.EU
WWW.BUSINESSEUROPE.EU

- mutual recognition of certificates issued by the Authorities responsible for assessing the new designs proposed for nuclear reactors;
- development of active knowledge management policies and anticipation of skills needs;
- support for research, development and demonstration projects;
- development of policies to address industrial bottlenecks;
- promotion of an open and well informed debate on nuclear energy, facilitating the understanding of economic issues, and highlighting the existing solutions regarding safety and long-term disposal of hazardous nuclear waste.

In all these areas, there is a wide margin for Community initiatives, which it is essential to exploit.

BUSINESSEUROPE attaches great importance to the newly created European Nuclear Energy Forum. This Forum should draw up a roadmap allowing efficient development of the Community initiatives needed to enable nuclear energy to make its full contribution to the EU's economic and environmental objectives.

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B. BUSINESSEUROPE Position

The major question in the new century is about how to meet our future energy needs without drastically increasing greenhouse gas emissions responsible for climate change, **in a way that maintains the competitiveness of European industry**. It is also about reducing our dependence on dwindling resources of fossil fuels located in politically unstable areas and traded on markets too volatile to ensure stable worldwide economic growth in the long run.

The European Union faces high and increasing energy dependence: 50% of its energy needs are met by imports and that proportion is likely to reach 70% in the next 20 to 30 years. Europe must renew its generation capacities by developing both industrially and economically efficient assets. Its main operators (E.on, EDF, RWE, Electrabel, Enel, Vattenfall, etc.) all base their industrial strategies upon such issues, as well as on national energy policies and the rules of open electricity markets.

After a period of relative abundance resulting from overcapacities in electricity generation, all countries in Europe are now facing progressive obsolescence of part of their generation capacities, combined with rising consumption and parallel growth in legitimate demands for environment protection.

The need for new generation capacities in Europe is real. First in order to tackle growth, even modest, in consumption, but especially in order to face up to future plant shutdowns that will impose the replacement of 300 GW in base load generation capacity. This new investment cycle has just begun and was anticipated by a 50% increase in electricity market prices throughout Europe from 2002 to 2004 – i.e. before increases in fossil fuel prices amplified this upward trend.

For decades, energy and environment policies had been essentially oriented towards securing national independence for each country, hence the choice of coal in Germany, gas in the UK, hydro and nuclear in France. Though energy remains the responsibility of individual countries, all member states' energy choices have an impact on their neighbours' economies, as has already been underlined in the EU's 2006 green paper on energy. The EU thus has a role to play in order to help member states coordinate their respective policies, both as a promoter of the European interest and in respect to securing the Internal Market as well as progressing towards implementation of the Lisbon strategy, which aims at making the EU the world's most competitive economy by 2010.

1. Developing low-carbon electricity generation in Europe

Electricity generation accounts for 40% of carbon emissions worldwide (vs. 20% for transport), two-thirds of which is emitted by coal, oil or gas. In Europe, electricity accounts for a mere 35% of carbon emissions, thanks to a greater share of carbon-free technologies in its electricity generation capacities (45% in Europe vs. 35% worldwide), including nuclear (32% of Europe's energy mix vs. 17% worldwide).

The electricity sector emits practically no CO_2 in countries where power is mostly generated by nuclear and renewables such as hydro power (e.g. France, Sweden), contrary to countries where operators mainly resort to coal and gas. Hence CO_2 emissions for power generation vary from just 100 g/kWh in France to a little more than 650 g/kWh in Germany.

In the enlarged EU, nuclear electricity saves the emission of nearly 600 million tonnes of CO_2 a year. To make an equivalent saving by reducing car use, the amount of motoring in the EU would have to drop by 80%.

That is why all options have to be kept open and nuclear energy can play a key role in fulfilment of the Kyoto commitments and is part of the solution in the struggle against climate change, alongside hydro and other renewables – notably wind, solar power and biomass, as well as clean coal and natural gas.

Solutions should also be investigated to limit CO_2 emissions in coal-fired electricity generation. New technologies are being developed through carbon capture and storage (CCS). Partial technical mastery of this complex technology is already secured today, with the ability to capture and transport carbon and a solid knowledge of aquifer layers where it could be stored. Problems still need to be solved regarding the costs of capture which, at today's rates, would lead to a double or even threefold increase in the price of electricity generated from coal. The reliability of aquifer layers also requires further testing, and cost constraints still presuppose that those layers remain within a reasonable distance of the power plants. Such issues require at least some 20 further years of investigations, which should act as an encouragement for R&D to be accelerated. Implementing these new technologies will of course entail preliminary organisation of public debates with all relevant stakeholders.

2. Bringing about conditions for acceptance of nuclear in Europe

Even with the further development of renewables and sustained efforts in demand-side management, nuclear is essential if current generation capacities are to be replaced without damaging the environment and without massive dependence on gas: the awareness of what is at stake has brought about a reopening of the debates in several countries where new nuclear plant projects – even some under construction – had been dropped during the last twenty years. In the USA, the 2005 Energy Policy Act is aimed at stimulating new projects through tax credits and financial guarantees. In the

UK, the government has concluded an Energy Review in July 2006 by stressing the role nuclear will have to play in tomorrow's energy mix and initiating a debate on the necessary regulatory framework with relevant stakeholders..

Acceptance of this source of electricity generation will ultimately depend on concrete and day-to-day illustrations of exemplary plant operation, alongside a collective acknowledgement of the long-term liabilities.

3. Nuclear: a competitive energy source

A closer look at nuclear's development perspectives raises the following questions: do we need more capacities? How acceptable is nuclear energy? How competitive? The answers seem clear today in major Asian countries that make up half of the world's new planned or decided capacities, i.e. 80 GW.

Comparing development costs of various sources of electricity generation is a tricky issue because of the numerous assumptions involved: capital costs are crucial in nuclear, while the cost of fuel accounts for two-thirds in the global cost of a combined-cycle gas turbine (CCGT). At the beginning of 2007, estimates rated the cost of base load generation at between € 50 and € 60/MWh for gas or coal (assuming a price for oil at $ 40-60 a barrel and a price for carbon emission permits at € 10-20 a tonne). EDF assessed the cost of generation from a first-of-a-kind European Pressurised Reactor (EPR) at € 46/MWh, but the economies of scale from a series of ten such reactors would bring down that cost by around 10%. Nuclear generation is therefore competitive with gas and coal in the new world energy context. This is confirmed by the economic analysis provided by the European Commission in its 10 January 2007 package. EURELECTRIC, in its "Role of electricity" study, arrives at the same conclusion.

Assessing the competitive advantages of nuclear also raises the issues of financing and risks. Investments are highly capital-intensive and involve eight to ten years of advance planning prior to grid connection, which suggests a close look at conditions under which operating licenses will be issued, electricity will be sold (i.e. market risk management) and long-term liabilities will be addressed (i.e. decommissioning and management of waste). The clarity of rules decided by public authorities is therefore paramount.. This aspect has got priority attention in the current British government's initiatives.

4. Nuclear energy contributes to Europe's energy independence

Nuclear means more security of supply through more diversified energy sources, thanks to lower dependence on raw materials that are widely available. Contrary to other fuel sources, uranium accounts for only 5% of the cost of electricity. This share soars to 40-50% for coal-fired generation and 60-70% for CCGTs.

Uranium resources are equally spread across the world and located in politically stable countries, thus guaranteeing greater visibility towards the future. According to international experts, they cover approximately. 60 years of current electricity consumption, without reprocessing. Undiscovered uranium reserves are estimated at 16 million tonnes, i.e. 200 to 250 years of consumption. Beyond 2040, the industrial deployment of new "Generation 4" nuclear reactors could reduce consumption of natural uranium sixty-fold and correspondingly multiply the duration of available reserves.

Though confronted with soaring fossil fuel prices and steady demand growth, and notwithstanding continued efforts in demand-side management, the EU27 boasts considerable energy clout: it is the world's largest nuclear producer, with complete mastery of the whole cycle. It is in such context that Finland and France have decided new investments (i.e. the EPR) while other member states are considering modernising, optimising or strengthening their nuclear parks.

Nuclear energy is a key contributor to Europe's energy independence, with a significant share of the energy mix in several countries: around 50% in Belgium, 40% in Switzerland, 25-30% in Germany, Spain, Great-Britain and Scandinavian countries. In France, nuclear electricity production generates a € 30 billion saving on the country's annual energy bill, for consumption roughly equivalent to all of Kuwait's yearly oil output.

With scientific excellence and world-class know-how, Europe's nuclear industry gives the EU a decisive edge not only in terms of economic competitiveness but also on the world trade stage, especially versus other builders of nuclear plants such as the United States and Russia. The choice of Europe for the siting of ITER reinforces this position of the EU as a centre of scientific and industrial excellence in the field of nuclear power.

5. Implications of nuclear exit strategies under consideration in some Member States

The circumstances surrounding the nuclear phase-out laws adopted several years ago in some European countries have changed substantially since.

Today we have a clearer image of the consequences that maintaining these decisions would entail. These can be seen inter alia in the report "Belgium's energy challenges towards 2030" commissioned by Federal Energy Minister Verwilghen from a multidisciplinary group of experts.

The study examines inter alia four energy scenarios to reduce energy-related CO_2 emissions in Belgium by 15% in 2030 as compared with 1990:

a) Bpk15: scenario with decommissioning of nuclear plants (“nuclear out-CCS on”)
b) Bpk15n :scenario with lifetime extension of nuclear plants + possibility to add a new nuclear unit + CCS available (“nuclear on- CCS on”)
c) Bpk15s : scenario with decommissioning of nuclear plants; CCS not available (“nuclear out- CCS out”)
d) Bpk15ns:scenario with lifetime extension of nuclear plants + possibility to add a new nuclear unit; no CCS (“nuclear on- CCS out”.)

The “carbon value” that needs to be integrated in energy prices to adapt the energy system in a way that meets the 15% emission reduction target is as follows:

a) Bpk15 (“nuclear out-CCS on”): 123 EURO/t CO2
b) Bpk15n (“nuclear on- CCS on”): 60 EURO/t CO2
c) Bpk15s (“nuclear out- CCS out”): 524 EURO/t CO2
d) Bpk15ns (“nuclear on- CCS out”):105 EURO/t CO2.

These figures above show clearly that scenarios excluding nuclear energy are always more costly.

In Germany there are 17 nuclear power plants being operated with a capacity of 21.400 MW. Electricity production in these nuclear plants was 167,4 billion KWh in 2006 corresponding to 26.3% of total electricity production in Germany. The phase-out of nuclear energy by 2021 would result in a loss of base-load capacity in the equivalent amount. This cannot be substituted by renewable energies. Consequently there would be an increase of CO2-emissions by 120 to 150 million tons depending on the substitution energy. A nuclear phase-out will also reduce energy security, reducing the diversity of energy supplies in the country through increased reliance on imports of fossil fuels, coal and gas in particular. In addition an increase in electricity prices is to be expected**.**

6 . Nuclear safety as prime priority

Safety is the condition for long-term operation of nuclear plants. Reaching the highest safety levels remains the absolute priority of nuclear operators, under the control of each member state’s safety authority.

Safety is based upon all technical, human and organisational measures taken during designing, construction and operation as well as decommissioning of nuclear plants, so as to protect persons and their environment under all circumstances. Those measures ensure normal functioning of the plants, prevention of incidents or accidents and mitigation of the consequences of potential failures. The possibilities of technical or human failure are taken into account right from the early stages of design, enabling a succession of independent defence lines to be set up. The principle of “deep defence” consists in setting up diverse and progressive lines of defence against potential failures and hence mitigate their consequences.

Nuclear manufacturers play an essential role concerning the functioning and safety of nuclear power plants.

Nuclear operators are responsible for their installations' safety and quality; they have an obligation to fulfil safety objectives set by public authorities as well as peer operators, to whom they regularly have to testify.

Safety relies on an array of fundamental aspects such as resilience of facilities, respect for safety rules and regulations, irreproachable professional skills of technicians and, above all, the "safety culture". That safety culture is developed through education and training, through constant comparisons of nuclear installations' and production units' safety results and good practices, and through a thorough analysis of all precursor incidents, making it possible to anticipate future potential failures.

Major nuclear plant operators support a progressive harmonisation of safety rules in Europe. In 2005, they joined forces inside Foratom (the association of European nuclear operators) in order to work closely with WENRA (Western European Nuclear Regulators' Association) towards progressive harmonisation in Europe. This development will favour public acceptance and should be acknowledged by the European Union.

7. A long-term commitment: managing nuclear waste

Like all industrial activities, nuclear electricity generates waste, some of it radioactive. That waste is subject to industrial management.

When dealing with waste, nuclear operators follow four main guidelines:

- Limiting quantities of waste
- Sorting waste by nature and radioactivity levels
- Packaging and preparing for long-term treatment
- Insulating waste from man and environment

Managing nuclear waste is part of the responsibilities of nuclear operators, whose design and operating methods strive to limit quantities of waste produced. Hence, the cost of waste management is factored into the cost of kWh.

Operating and decommissioning nuclear plants mostly generate short-life radioactive waste that loses at least half of its radioactivity levels every 30 years: such waste comprises filters, resins used for water purification in the circuits, used instruments, plastics and textiles used for maintenance, rubble from decommissioning, etc. All such waste is taken up to storage centres where it will be kept in high-security conditions until its radioactivity levels have reduced to zero.

Used nuclear fuel generates waste which comprises 96% of elements that can be reprocessed into new fuels and of 4% of high-activity long-life waste, i.e. ashes resulting from uranium combustion. All such waste is stored and isolated from man and environment in compliance with extremely tight security conditions. The first and foremost question raised in this regard is about which available industrial solution

should be chosen in order to deal with such waste in the longer term. Finland has chosen a storage site for its waste, and the choice of a site is also pending in Sweden. France has chosen deep storage as the reference solution for long-term management and a location for such storage is currently being examined and qualified. The financing of waste management relies on specific funds, with different management options depending on the member state but all with the single objective of being available when necessary.

8. Decommissioning nuclear plants

The lifecycle of nuclear installations is made up of three periods: construction, operation and decommissioning. Decommissioning is a normal and technically mature stage of this lifecycle, and goes itself through three different stages, in compliance with IAEA (International Atomic Energy Agency) recommendations issued in 1980:

- Controlled shutdown, i.e. reactor shutdown, unloading of fuels, evacuation of fluids (99.9% of radioactivity is then eliminated), then final shutdown (non-nuclear installations are then brought to a final standstill).
- Partial and conditional emptying of installations: this second step includes dismantling of all equipment and buildings (except the reactor building), packaging and evacuation of waste to dedicated storage centres and then surveillance of the reactor building.
- Complete emptying of installations: this last step entails total dismantling and removal of the reactor building and all other equipments. Surveillance is henceforth no longer necessary and the site can be used for other activities.

By 2025, at least one third of all reactors currently in operation will enter the stages of decommissioning.

9. Conclusions

At the European summit in March 2007, Heads of State rightly decided to develop national and European energy policy initiatives following a more integrated approach designed to reach the goals of competitiveness, security of supply and climate protection. Considering the urgency and breadth of these issues all available means for tackling them must be used:energy efficiency, development of renewable energies, development of fossil fuel generation with the progressive implementation of CCS (Carbon Capture and Storage) and the development of nuclear.

The Commission has made an important step when underlining the clear interest of nuclear energy in economic and climate protection terms. Given this, it is essential to allow nuclear to compete with other sources of low-carbon generation on a level playing field. BUSINESSEUROPE therefore calls for the national and EU authorities to give high priority to the removal of the obstacles which unnecessarily hold back the

development of nuclear energy. In this regard, the following priority measures are required:

- greater harmonisation of safety requirements for nuclear installations in the EU;
- establishment of national plans for management of radioactive waste in countries which do not yet have one;
- simpler and more harmonised licensing procedures, based on closer coordination between national regulatory authorities, aimed at maintaining the highest safety standards;
- mutual recognition of certificates issued by the Authorities responsible for assessing the new designs proposed for nuclear reactors. A US company which has developed a new reactor design only needs *one* license to industrialise it across the US. By contrast, a European company has to apply for a license for its new design every time it wants to sell in another EU Member State, which adds considerably to costs;
- development of active knowledge management policies and anticipation of skills needs;
- support for research, development and demonstration projects;
- development of policies to address industrial bottlenecks;
- promotion of an open and well informed debate on nuclear energy, facilitating the understanding of economic issues, and highlighting the existing solutions regarding safety and long-term disposal of hazardous nuclear waste. The fact that nuclear energy produces, in a CO^2 free way, 32% of electricity generated in the EU shows what is at stake in the public debate on the nuclear option.

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