Framatome ANP position on European Commission Green Paper

Green Paper "Towards a European strategy for the security of energy supply"

1 Introduction

Framatome ANP is pleased that this strategic analysis of the European security of energy supply be launched by the European Commission and to take part to the debate. As a matter of fact, with a forecast of 90% increase of the present European Union GDP between 1998 and 2030 and an energy supply dependence estimated to grow simultaneously from 50% to 70%, one can imagine the considerable importance of preparing the energy supply in order it not to act as a break upon such expansion. The Californian crisis comes as a dramatic precursor warning to those who would underestimate the need for a strategic analysis. This concern is all the more important that it has also to deal with other concerns such as limitation of the green house effect and preservation of a clean environment.

We would like this debate on strategy for the security of energy supply to be as objective as possible and to go to the end of the subjacent logic. As a matter of fact, security of energy supply means:

- Protection against economic disruption, e.g. development of means to induce more stability of the international market, in particular for oil and gas, availability of large energy reserves with possible exchanges within the European Union and reduction of the energy supply import bill.
- Protection against physical disruption, e.g. reduction of the vulnerability to the imported energy and insurance of a diversity of energy supply
- Protection against social risks from disruption of supply.
- Protection against environmental risks, e.g. reduction of the green house effect in the framework of the Kyoto commitments and development of clean energy in particular in the transport sector which will cause 90% of the CO2 projected growth.

Considering all the above listed conditions, it is striking to see how well the civil nuclear energy fit them . So we take the opportunity of this note to bring out how nuclear energy can be used in a strategy for the security of energy supply because we are convinced it will play a role which must not be underestimated when looking for a solution. We will not mention here all the arguments which could be thought of, many of which have already been presented in the Foratom position paper. Nevertheless, we will add or underline some remarks which we feel of particular importance from a nuclear power plant and nuclear fuel supplier standpoint.

2 General remarks

2.1. De-coupling of energy demand growth from economic growth

On the one hand, the Green Paper (Part 3, I.B.1.b) assumes a de-coupling of energy demand, which is projected to grow by only 11% between 1998 and 2030, from the European Union GDP which is projected to grow by 90%. One may wonder why this energy projection is less than in the European Energy Outlook to 2020 which already projects an energy demand increase by 16% from 2000 to 2020, i.e. on a smaller period.

On the other hand, it is generally projected that the electricity consumption will grow at a higher rate than the total energy consumption. Refer for example to the European Energy Outlook to 2020 which forecast a 54% electricity demand increase from 1995 to 2020 when the energy demand is projected to increase by 25% on the same period.

In any case, the point is that the assumed de-coupling minimizes the energy demand projection in 2030 and thus also minimizes all the consequences on associated problems: energy dependency, green house effects, clean environment, etc.. Even with this assumption, the Green Paper clearly states that the EU energy supply is already in a difficult position and that this position will worsen in the coming decades; it suggests solutions based on development of renewable energies, strengthening of strategic oil stocks mechanism, construction of new oil and gas pipelines, etc., with almost no room for nuclear energy: its production is even assumed to decrease by 4% between 1998 and 2020, and by 50% between 2020 and 2030 (Part 3, I.B.1.b.), with no construction of new nuclear plants.

In fact, the reality will be probably even worse with an increase in the energy demand larger, and an increase of the electricity demand much larger, than assumed. It would be better to provide politicians and more generally people who have to take strategic decisions on energy supply with more realistic figures in order to allow them to better assess the consequences of their decisions: we will need all energy sources and also highest energy efficiency; to reach the goal of ensuring the security of energy supply without nuclear energy is hopeless, not speaking of limiting the green house gas emission and preserving the environment. The recourse to nuclear energy cannot be escaped when facing the problems raised by the use of fossil fuels and by the development of renewable energies and thus has to be considered as an important part of the EU energy mix not only to be maintained but to be further developed.

(We could note on this issue that the US Energy Plan forecast an increase of electricity consumption by 45 % over the next 20 years, even though it is based on a much larger increase of the population and a higher consumption per capita.)

2.2. Nuclear energy: high tech with low import costs

Nuclear energy is a high tech field and most of its parts require specific expertise to be designed, manufactured, built and operated. Concerning nuclear power plants, this expertise is needed not only for the design and supply of mechanical and electrical parts, but also for the nuclear fuel and nuclear services.

As is detailed in hereunder answer to question 1, the cost of natural uranium represents only 5% of the kWh cost produced by a nuclear power station, whereas, gas cost amounts as much as 70% of the kWh from a gas-fired plant. Thus, when electricity is produced by a nuclear power plant, most of its cost is devoted to added value which can benefit European industry and work force, whereas fossil fuel plants benefit first of all to fossil fuel suppliers with the associated dependency and sensitivity to the fuel price.

Besides, it is noteworthy that in a context of globalization where numerous industries suffer from competition from developing countries, the production of electricity by nuclear power plants is a good way of maintaining a high technology field where EU has still the lead over developing countries.

2.3. Nuclear industry: a threatened industry

The nuclear industry faces a difficult political environment in Europe and, as a result, there has been a significant decline in most areas of nuclear activity in Europe. In EU, the last nuclear power plant was ordered in 1991 (Civaux 1-2 in France). Due to the shrinking market volume, the nuclear industry faces significant overcapacity. The trend is similar worldwide except in Asia, and consolidation of the nuclear industry has become inevitable to pool engineering forces, manufacturing capacities and R&D efforts: several successive mergers have led to the present BNFL/ Westinghouse/ ABB/ Combustion Engineering group, General Electric has created with Toshiba and Hitachi a worldwide joint-venture in the nuclear fuel area Global Nuclear Fuel (GNF), Framatome and Siemens have merged their nuclear activities into Framatome ANP.

At present the European nuclear energy industry is on the edge to lose its technological capabilities and know-how: to-day many of the people involved in the 1970/1980 construction of nuclear power plants are retired or about to retire. Without new orders there will be no means to transmit the know-how to a new generation and maintain the level of expertise needed in many jobs specific to nuclear energy: overall design, nuclear process, design of nuclear systems and equipment, manufacture of primary equipment, project management, construction site management, economic analyses. Due to this lack of development, only very few students are choosing nuclear energy as a field of study and work. Changes will need several years. In the meantime, other countries keep on developing nuclear energy, e.g. China, Korea, Japan, the last two with the support of US suppliers and, if no impulse in favor of nuclear energy is made in the EU, the European suppliers of nuclear

power plants will first lose their export market and then their own technical capabilities.

In the meantime, USA has a new look at nuclear energy and the National Energy Policy Development (NEPD) Group's report on a national energy policy issued on May 17th, recommends, among other steps, to stimulate the construction of new nuclear power plants.

Decision makers have to know clearly the consequences of possible choice for energy supply and should realize that making no choice for nuclear power is in fact the choice of death of the European nuclear industries and capabilities and of submission to Asiatic countries and US suppliers.

2.4. Ethical considerations

Nuclear energy may contribute to an ethical approach on the best use of available resources in a way connected to the Sustainable Development concept. As a matter of fact, it can be used to enlarge the technical and economically viable energy basis to preserve as well the future of generations to come, as the well-being of developing countries.

- When we burn fossil fuel we waste natural resources which, at the same time, become scarce and are vital for chemistry, pharmaceutical and medical use, food, etc..If we keep on burning them in an irrational way, the future generations will be handicapped and will reproach us for it. It is our duty to guarantee the mankind future and to be watchful on the world energy patrimony. Fuels such as Uranium and Thorium are only appropriate for the energy production and a limited number of metallurgical uses. Thus, nuclear energy should be maintained and developed to allow future generations to make their own choices.
- All of us are also responsible of the well-being of developing countries. They are entitled to a standard of living adapted to their tradition. Our sympathy is of no help, but we can provide them with financial and technological support. An efficient way of doing is to limit our own fossil fuel consumption which could thus be used by these countries to satisfy their vital needs.

2.5. Production costs of electricity of different technologies

Footnote 60 provides a table named "Production costs of electricity of different technologies" whose figures are themselves computed from Table 1 of Annex 2: "Note on the impact of fuel taxation on technology choice". These documents do not mention whether they are relative to existing or projected plants and do not specify all the main parameters used generally in this type of comparison, e.g. economic lifetime, discount rate, gas price (how many USD/MBTU) and the Euro/$ exchange rate value. All these parameters influence considerably any comparison analysis, the last two one more strikingly the last two years.

Costs estimates for nuclear power plants in countries where no one is operated (Ireland, Austria, Denmark) is at least questionable, and leads to unrealistic

differences between Ireland on the one hand and Austria/ Denmark on the other hand.

The same kind of argument may be used concerning the averaging of generation costs of a same energy source on several countries. For the nuclear case, for instance, should this type of energy be further developed in the European Union, its generation costs will have a tendency to harmonize on the cost where it is most used (e.g. Belgium, Finland, France) which, then, seems to be a better reference for nuclear costs. The same would apply for gas as far as construction cost and O&M cost are concerned but not for its fuel cost component due to inherent differences coming from transportation costs and sudden price changes. Also, a possible methodological remark is that an average on a set of data lose sense when such data are scattered on a too large range.

So we consider that the production costs mentioned in Table 1 and footnote 60 are irrelevant and in no case demonstrate a 42% difference in favor of gas when compared to nuclear energy. On the contrary, and on the basis of what is written above, available surveys for new power plants show that, for base load operations, nuclear energy has an economical advantage over gas except when, at the same time, the gas price is very low and US$ is weak compared to Euro. For the time being, those two conditions are very far from being met and nuclear energy has a fair advantage over gas.

3 Answers to questions in the Green Paper

We provide hereunder answers to questions 1, 2, 3, 7, 8, 9, 10 and 12 which are of particular relevance to nuclear energy.

Question 1
"Can the European Union accept an increase in its dependence on external energy sources without undermining its security of supply and European competitiveness? If this were the case, for which sources of energy would it be appropriate to contemplate a framework policy for imports? In this case, is it appropriate to favor an economic approach in terms of energy cost, or a geopolitical approach in terms of the risk of disruption?"

The use of nuclear energy is in itself a way of increasing the diversification of external energy sources with respect to the only oil, gas and coal supply. Furthermore, it provides an additional step in the diversification since fissile material under the shape of uranium extracted from the mine or mixing of uranium and recycled fissile material can be supplied by a number of suppliers worldwide.

Also, natural uranium represents only a small fraction of the kWh cost produced by a nuclear power plant: in this kWh cost, capital investment typically accounts for some 60%, O&M for slightly less than 20% and fuel costs for slightly more than 20%. For a gas-fired plant, the percentages are changed dramatically: investment 20%, O&M 10% and fuel cost 70%. Hence, the natural uranium cost

(being itself only about 25% of the above mentioned nuclear fuel costs) represents only 5% of the kWh cost produced by a nuclear power plant, compared to 70% for the gas cost in a gas-fired plant. Thus, every kWh produced by a nuclear power plant instead of a fossil fuel plant provides substantial savings on the EU energy imports bill.

Moreover, the use of nuclear fuel reduces the sensitivity to fuel price evolution since the doubling of the natural uranium price only results in a 5% kWh cost rise, whereas the doubling of gas price results in a 70% kWh cost rise for a gas plant. Economically speaking it is worth noting that the soaring of the oil price alone between 1999 and 2000 has caused the growth of the European inflation rate by 1% and had by itself macroeconomic consequences. The use of nuclear energy could thus contribute to smoothening the sensitivity to fuel price evolution.

Also, a significant share of nuclear energy in the EU energy mix is an efficient way of reducing the influence of the fossil fuel international market on the EU and the consequences of crisis from oil price soaring.

Question 2
"Does not Europe's increasingly integrated internal market, where decisions taken in one country have an impact on others, call for a consistent and co-ordinated policy at Community level? What should such a policy consist of and where should competition rules fit in?"

Energy policy in the EU is mainly addressed through common policies such as competition policy and the building of an integrated market, or environment policy. The subsidiarity principle gives each member State the choice of its options, so that it can take benefit of its own resources or of the competitive advantages of its industry.

Beyond these principles, those common policies are currently based on anti-nuclear *a priori* aimed at penalizing nuclear energy. One can give a number of examples of these underlying grounds which need to be corrected when emphasizing the issue of the security of supply :

- Competition for power production? The electricity directive organizes (article 8.3) a privilege for renewables and co-generation : they are given a priority for matching the demand, notwithstanding their real cost, and this can affect the economy of centralized means such as nuclear plants.

- Competition for servicing eligible customers? This competition is aimed at reducing the prices; a negative impact, therefore, is the volatility of demand which makes more difficult any forecast for investment planning. This difficulty biases the choices towards least investment cost facilities, with a fast return on investment. The answer of the directive is not quite satisfactory : the dual procedure of authorizations for decentralized production facilities and calls for tenders for the so-called strategic investments cannot maintain a good balance between facilities under the basic regime of authorization and those which might be decided under the regime of call for tender aimed at

preserving the strategic planning in a country. If not under control, the development of decentralized facilities might indeed induce unbalance in the electricity generation.

- Development of renewable? This development is favored by the new directive of December 2000, and by national policies in most countries. It is certainly wise to develop production facilities based on local resources which might contribute to the general objective of cutting green house gas emissions. One should consider however that this policy has its limits. When usually, in most case studies, the price of Carbon in the future market of emission trading could be in the range of 20 to 50 $/ton (the ecotax in project in France is based on 35 $/t), wind energy is heavily subsidized through electricity rates at a level which, both in France and in Germany, is equivalent to some 350 $/t of Carbon. This is certainly incoherent and could result in an explosive and artificial development of wind energy with negative consequences on the overall cost of electrical energy.

As a conclusion, if one addresses energy policy only through environmental considerations focused on renewable energy or through competition considerations, the security of supply will not be optimized. The issues raised by the Green Paper on the security of supply are welcome to reach a better balance between the need for a secure production system and the diversification with other energy sources. As long as nuclear will be an obstacle on a common vision of the future in Europe, it is certainly better to leave each country responsible of meeting the common objectives set up by the EU with its own national choices.

Question 3
"Do tax and State aid policies in the energy sector impair competitiveness in the European Union or not? Given the failure of attempts to harmonize indirect taxation, should the whole issue of energy taxation not be re-examined in view, in particular, of the energy and environmental targets?"

The possible taxation of energy is a touchy matter; however, it could help to achieve a lower rate of increase of energy consumption as a ratio of GNP, together with inducing the use of energy resources which do not contribute to the emission of green house gas in the environment. In fact the taking into account of the energy and environmental targets need to consider at the same time and in a balanced way, not only the taxes but more globally all other means by which these target could be reached: State aids, energy savings, market mechanisms of the Kyoto protocol.

Question 7
"The development of some renewable energy sources calls for major efforts in terms of Research and Development, investment aid and operational aid. Should co-financing of this aid include a contribution from sectors which received substantial initial development aid and which are now highly profitable (gas, oil, nuclear)?"

We have one remark on the wording of Question 7: in the past, nuclear energy was developed, from scratch, because it was a totally new way of producing energy. Public aids for nuclear energy were mainly directed to fundamental R&D actions or to safety or to environment; the R&D for nuclear industrial purposes was requested and financed by the nuclear industry itself.

On the question itself, first, we strongly oppose the principle of mature energy types providing co-financing to new types of energy production. There should not be ostracism in an aid policy. The renewable energies can be supported but not in a way detrimental to nuclear energy which has to continue its R&D activity funding.

Second, the security of energy supply is obviously a strategic concern for the EU and a wide recourse to nuclear energy provides an effective solution to most of the problems raised in this field. Thus, it would be counterproductive to penalize it by a system of contribution, whichever it is, to the development of other energy sources.

In particular we disagree with Part 1, II.A.1.a, footnote 32: "The system of setting ceilings in the amount set for the civil responsibility of operators in the case of a major accident could amount to a state aid". As a matter of fact, an indemnification mechanism is implemented to ensure that appropriate resources will be available to cope with possible accidents which would affect the public or the environment and to indemnify victims in priority. The purpose of the ceiling is to be prepared to the worst case: the operator of a nuclear power plant covers by compulsory insurance, or by financial guarantee, the amount up to a first ceiling which is the minimum amount required by law in its country, and has a high cost. Besides this first ceiling, are two other ceilings: one provided by the considered state itself, the second by a pool of States members of international convention. Nuclear energy is one of the very rare cases where measures are taken to cope with possible accidents of extreme magnitude.

Question 8
"Since nuclear energy is one of the factors in the debate on tackling climate change and energy self-sufficiency, how can the Community find a solution to the problem of nuclear waste, enhancing nuclear safety and expanding research into the reactors of the future, and in particular fusion technology?"

Nuclear energy has an important role to play in the strategy for the security of energy supply to cope as well with the climate change as with the energy self-sufficiency. Several steps have to be taken.

NEW GENERATION OF NUCLEAR REACTORS
A European fleet of new nuclear power plants should be launched. It has to be prepared well in advance because six to ten years are needed between the order and the connection to the electrical network, depending on the site preparation and the licensing procedures.

A first phase could rely on evolutionary nuclear reactors, part of the so-called Generation III reactors, developed by the international suppliers. Framatome ANP has developed the EPR (pressurized water reactor) and the SWR (boiling water reactor). The design of these reactors is ready and the construction of a "First Of A Kind" reactor can be launched once an order is placed. These reactors provide significant improvements compared to the present generation of reactors. A few examples are as follows for the EPR:

- Lower economic power generation costs competitive with other primary energy sources with an improved availability.
- Reduction of radioactive effluents in normal operation.
- Improvement of the safety level with mitigation of hypothetical severe accidents restricting their consequences to within the plant itself.
- Increase of the fuel burn up, i.e. improvement of the efficiency of the fuel use by producing more energy from a given weight of fissile material and extending the cycle length between two fuel loading.
- Flexibility in recycling the nuclear fuel, with associated reduction of the final plutonium inventory.

It is expected that HTR would achieve a good competitiveness with other sources of power generation; however, as for any new industrial process, the competitiveness of HTR could be correctly assessed only after its development.

As a second phase, the next generation of reactors (so-called "Generation IV") can be developed: a new type of reactors needs first to be designed (5 to 10 years), then a first prototype has to be built and tested before it could be put on the market on its basis. The whole process may need 12 to 20 years depending on the priority given to the development of these reactors and on the technical difficulties which will have to be overcome. At present, several designs for High Temperature Reactor (HTR) are being developed worldwide, in particular the Gas Turbine Modular Helium Reactor (GT-MHR), which could also efficiently burn the excess weapons grade plutonium , and which will provide valuable experience for the development of a European HTR prototype. We recall hereunder some of the advantages of the HTR type reactors:

- Small power output allowing small power increments
- Low investment per unit and shorter construction period
- High helium temperature allowing a higher efficiency
- Inherent safety which can rely only on passive safety features
- Considerable increase of the fuel burn up
- Significant reduction of long life radioactive wastes for a given energy production.

As a third phase, R&D on fusion reactors have to be developed in the mean time, for the very long term, if feasible, but other technical solutions either ready to be implemented (see above phase 1) or to be developed (see above phase 2) have to be used before the fusion could possibly take over.

NUCLEAR SAFETY

An effective way of enabling the development of nuclear energy in the EU would be to develop coordinated European nuclear safety requirements. For the time being each country has its own set of safety rules, codes and standards, and its own safety organization and licensing regulation. Even though many areas are common or similar, nuclear safety and licensing regulations are, at present, a hurdle to the export of nuclear power plant from one EU country to another EU country and to standardization of nuclear power plant which is of considerable importance in lowering the investment and maintenance costs. A way of smoothening this obstacle would be to set up European nuclear safety rules, so that the design of new reactors be based on common safety rules at the European level.

Such a process has already been launched between France and Germany when designing the new European Pressurized Reactor (EPR) and led to significant achievement:

- The French and German regulators and safety experts have been working closely together. They have been actively reviewing the EPR safety concept on the basis of their jointly issued "Proposal for a common safety approach for future pressurized water reactor".
- Further, the utilities and vendors, on their side have set up an organization to produce common codes: "EPR Technical Codes" (ETC), laying down requirements for the EPR design. With these common codes, the EPR can be developed on a uniform basis in more than one country.
- Finally, a group of European utilities have issued the "European Utilities Requirements" (EUR), to which complies the EPR, thus providing the basis for wide acceptability, without the need for significant adaptations to meet the requirements of particular customers.

Also, at the European level, West European Nuclear Regulatory Authorities (WENRA) was created in February 1999 by several European safety authorities:

- To develop a common approach to nuclear safety and safety regulation in particular in the EU
- To have an independent capability to check nuclear safety in Candidate countries
- To assess and set up a common approach to problems raised in the field of nuclear safety and its regulation.

Nuclear safety rules could be built on these developments.

Besides, the actions already launched to improve the safety of nuclear reactors in Central Eastern European Countries should be continued on the basis of the existing PHARE and TACIS programs.

All these steps are necessary and have all the more to be launched urgently since, as said in the above § 2.3, the nuclear industry is threatened by the present decline of nuclear energy in the EU . A quick nuclear energy revival is necessary otherwise Europe will lose its nuclear energy skills and consequently

its ability to successfully compete on the international market in a high technology field with considerable added value as said in the above §2.2.

Question 9
"Which policies should enable the European Union to meet its obligations under the Kyoto Protocol? What action could be taken in order fully to exploit potential energy savings which would help to reduce both our external dependence and CO2 emissions?"

Energy savings and renewable energies will not be sufficient to reach the Kyoto protocol commitment. Contrary to the assumption made in the Green Paper, the nuclear energy contribution in the European Union should not be limited to the existing nuclear power plants with no construction of new ones. As said in the Green Paper, nuclear energy supplies 35% of the electricity generated in the EU. If no new nuclear power plant are constructed, the position of the EU will be all the more worsen that, as said in the above §2.1, the assumption of de-coupling the energy demand growth from the economic growth minimizes inter alia the projections of green house gas emissions. Thus, a European fleet of new reactors should be launched on the basis described in the answer to question 8.

Also, the inclusion of nuclear energy in the carbon reduction emission policies and eligible to the Kyoto protocol flexibility mechanisms will contribute to achieve environmental and security of energy supply targets.

Questions 10 and 12

"Can an ambitious programme to promote biofuels and other substitute fuels, including hydrogen, geared to 20% of total fuel consumption by 2020, continue to be implemented via national initiatives, or are co-ordinated decisions required on taxation, distribution and prospects for agricultural production?"

"Energy savings in the transport sector (32% of energy consumption) depends on redressing the growing imbalance between road haulage and rail. Is this imbalance inevitable, or could corrective action be taken, however unpopular, notably to encourage lower use of cars in urban areas? How can the aims of opening up the sector to competition, investment in infrastructure to remove bottlenecks and intermodality be reconciled?"

According to the Green Paper 90% of the projected growth in CO2 emission will be from the transport sector. As a consequence, promotion of substitute to fossil fuel is welcome. Nuclear energy can provide an efficient support, with no green house gas emission, in an ambitious program of substitution. It is particularly well fitted to produce energy without emission of green house gas for hydrogen generation to be used in fuel cells, thus enabling the development of fleets of collective and individual electric vehicles. Such hydrogen generation can be

economical since its production can be easily done by electrolysis of water outside from peak hours, i.e. when the kWh selling price is at its lowest level.

Electricity from nuclear power plants can also be used to support an increased use of railways and buses electrically motored.