

Energy Intelligence for Europe

The Euratom Treaty and future energy options: Conditions for a level playing field in the energy sector

Copenhagen, 23 September 2005

Transcript of the Debate: “Barriers to and Solutions for a level Playing Field in European Energy Policy”

The debaters were Dr. Bertrand Barré, President of the European Nuclear Society, Rebecca Harms, MEP, The Greens/European Free Alliance, and Mycle Schneider, International Consultant on Energy and Nuclear Policy. Debate chair was Stephen Tarlton, Editor of Nuclear Engineering International

STEPHEN TARLTON: I am Stephen Tarlton, editor of a trade magazine for the nuclear industry, called Nuclear Engineering International. I would like to thank the organisers of this meeting for inviting me to moderate on this debate, the title which is “*Barriers to and Solutions for a level Playing Field in European Energy Policy*”. There will be three panellists who will take part in this debate, Mycle Schneider, Rebecca Harms, MEP, and Bertrand Barré, who is the President of the European Nuclear Society.

Earlier this week we had a brief exchange of e-mails not everyone got, but to set out the scope of this debate: I feel that the subject is a little bit confusing, at least for me it is. One of the most unhelpful phrases often heard in the electricity generation industries is the term “level playing field”. To me this phrase can mean anything to anyone. I have been to many nuclear industry meetings and the phrase often comes up. “All we are asking for is a level playing field”, they say. And we heard that today as well. If we decide on an energy policy, there needs to be a mechanism to achieve that policy. For example, a government might decide on having a particular energy mix, a certain percentage of its generation coming from renewables, a certain percentage from coal, whatever it is going to be, that can only be achieved under conditions on the market. The scenarios in a couple of the presentations after lunch require a considerable number of conditions placed on the market to achieve those scenarios. Now, from my point of view that is hardly what I would call a level playing field. I would say that the terms “energy policy” and “level playing field” ought not to appear in the same sentence. I think that they are mutually exclusive terms. You cannot have one and the other. Anyway, I have asked the panellist to all define what they mean by the term “level playing field” before they discuss the barriers to and solutions for that level playing field.

The second point, I had difficulties with of the subject of this debate, is the scope. It is not really realistic to make much progress discussing such a huge topic in an hour. There are many things we could discuss: We could talk about price capping, we could talk about if we should start charging fossil plants for producing CO₂ and how much. Where does the money go to? We don't need to touch on nuclear. But the focus of this meeting is the Euratom Treaty, so at least after a couple of general introductions, I have asked the panellists to try to keep the focus of this debate on Euratom

and its effect on achieving a level playing field, whatever that might be. So, I should say that Mycle is not going to give a little introductory talk, to give more time to Bertrand Barré and Rebecca Harms. What we are going to do is to have a couple of presentations, starting with Bertrand Barré. Then, after the presentations, we can open it up for questions and comments. If you have any, please wait till after these two presentations.

DR. BERTRAND BARRÉ: Good afternoon, my name is Bertrand Barré. I am President of the European Nuclear Society. I have selected this picture to cheer you up a little, to show you that nuclear power is not yet completely dead in Europe. (*Bertrand Barré refers to slide no. 1 in his presentation*). This is a view of the worksite in Olkiluoto in Finland last July. So (with regard to) the European Nuclear Society, you probably don't know us. We are a federation of old learned societies on nuclear energy or nuclear science and technology, whichever, across Europe, Europe being a very extended and comprehensive meaning, because as you can see it includes even Russia and Israel. We are a learned society. We are not a lobby and I will not present you the view of the industry. I will present you with my view as a President of the European Nuclear Society.

I think a lot has been said about what the people in the nuclear industry or in the nuclear community say. Well, I will tell you what I say. First, I think this global picture is very important (*Bertrand Barré refers to slide no. 3 in his presentation*). I like it because it is very beautiful, but you can also see, where across this planet we do use energy. Some things are obvious. You can see the East Coast of America, Western Europe and Japan are all white. You can see that Africa is still today a dark continent. You can see that in China, where the average consumption per capita is low, there is still 1.3 billion Chinese, so a lot of not so much makes a lot of much. Even in India where the individual consumption is dramatically low, it is already weighing quite a lot in the global energy picture. Given the demographics, I show you this to tell you that our present picture of energy is changing drastically. What will happen in China, India, Brazil and in other places will be much more important than what will happen in Europe or even in the United States. That is why all projections of energy needs assume a growth which is in the demographic north and at least some part of growing in the development world, including – if one is optimistic – that parts of the industrialised world will be making efforts for energy conservation, which I hope that they will do.

Second point for me as a part of the big picture is the fact that now there is very little doubt left, that human activities and especially fossil fuel consumption have already modified our atmosphere and that this modification has already altered our climate. Successive reports from the IPCC – *the Intergovernmental Panel on Climate Change* - show anthropogenic interference with the climate system. You get this information from the IPCC in 1990 report: Well, it is possible that there is an influence, but it is within our margin somehow. In 1995 the balance of evidence suggests a discernible influence on global climate and the latest one in 2001 says that there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities. That is very important. I think that there is still a residual controversy about the exact amount of these modifications, but in effect it is now beyond that doubt. And that is very important.

During the next fifty years or so we have to reduce our CO₂ emission, while producing more energy, and the last part of the equation is that today 80% of the primary energy we use for combustion of coal, oil and gas. 10% is what we call traditional biomass, wood, dung, etc. The modern kind of energy – nuclear and renewables - is all together only 10%. So it is a huge challenge: Reduce emissions while producing more energy, when today 80% of our energy is combustion. So obviously, there will not be a single magic bullet and here I would like to correct

what has been said: We have not said that nuclear is the answer. At least I have never said that. And it is obvious that the first place where we have to do something is on the demand side. We will not be able to deal with such a challenge working only on the supply side. It is obvious. So it will have to start with conservation, energy efficiency, you can call it what you want, but you know what I mean. On the supply side we have to progressively reduce the share of combustion and we have to progressively increase the share of those energies, which do not emit significant carbon dioxide. That is why nuclear and renewables for me are part of the same package. It is also my deep conviction – this is still a bit controversial – that this is not enough and that we will have to implement carbon sequestration everywhere it will be reasonably practical, i.e. in all the central CO₂ producing stations: Coal power plants, refineries, cement factories, etc. I think if we are able to implement, in parallel, all those policies, maybe we stand a chance. So I will put nuclear and renewables in the same package. Let me emphasise the point: Basically, renewables are most of the time – at least when they are used for electricity production - intermittent, so they cannot be stand-alone base-load production. But of course this does not apply to heat production. Solar and geothermal for instance are best suited for heating, possibly together with heat pumps. But nuclear is another niche, and the competition for nuclear energy is not renewables. This is very clear. From country to country it might change. But it is either a question of coal or gas. We are not competing with wind power, but with gas or coal depending on the country in question.

Now this has already been mentioned, but nuclear power reduces CO₂ emissions already today. This comes from the IEA's 2004 Outlook¹ (*Bertrand Barré refers to slide no. 8 in his presentation*). If we were to replace nuclear with the average mix of non-nuclear sources, not with coal, then we would probably add to our present emissions 2.2 Bt. of CO₂. Remember that CO₂ is 44 and carbon is 12, so there is a factor 3 when you speak of carbon or CO₂. Those are figures taken directly from the International Energy Agency. This figure is already today bigger than the Kyoto target itself.

For Europe, the emissions are not the only issue. This has already been mentioned by the spokesperson of the Commission. Nuclear power also contributes to our security of supply. Even with nuclear power, the energy dependence of the European Union will grow from 50% to 70% by 2030 and the conclusion of the European Commission is that if you are serious about the Kyoto commitment, if you are concerned about the energy dependency, you must keep the nuclear option in Europe. I may add that nuclear has another advantage, which is stability of price. This has already been mentioned once. Uranium accounts roughly for 5% of the total KW/h costs from nuclear. If tomorrow the price of uranium is multiplied by two, so what? It will be 5% more for the nuclear KW/h. If tomorrow, as yesterday, the gas price is multiplied by 2, sorry, it is 63% more for the cost of a gas KW/h. And that is a fact.

What is the projection of nuclear generation? These are the forecasts of the International Atomic Energy Agency's forecast from July 2004 (*Bertrand Barré refers to slide no. 10 in his presentation*). Sometimes we tend to look only at our own small region of the world. If you take the full figure, you see that the colour code yellow is in the actual production of electricity in billions of KW/h in 2003. Green, light or strong, is the projection for 2010, low and high, then 2020 and 2030. In all the brackets it is going to grow in North America. It is going to grow in Eastern Europe, including Russia. It is going to grow drastically in the Far East Region, but when it comes to Europe, who knows? Everything is possible. The low projection has decreased. The high projection

¹ The report in its entirety is not available on the Internet, but an executive summary of the *World Energy Outlook 2004* can be found at <http://www.igu.org/database/2004/WEOEnglishExecSum.pdf>

has increased. It is very difficult to guess, because as you well know it varies a lot from country to country and even year by year.

Now, I could not resist driving something home. I think that it is quite paradoxical that we are here discussing some details under the Euratom Treaty, when we have these kinds of problems on our hands. Denmark is Niels Bohr country. He is one of the brightest minds of the 20th century and he was instrumental a lot in creating nuclear science. Denmark and all the Nordic countries are very environmentally conscious, that is the way we see you in the south. Denmark is a world leader in wind turbine technology. Yet, sorry, Denmark is one of Europe's worst CO₂ emitters per capita. And it is not improving. You see your emissions in 1990 were 70 Mt CO₂. The target of the burden sharing within the European bubble would call for a 21% reduction, leading you to 55 Mt. But according to a report from the European Commission from November 2003, under the present trend it will not be minus 21%, it will be plus 16%. This is straight out of this report, which can be found at the Commission Website². So, isn't today's conference a bit surrealistic? I think it is.

I was asked, what is my concept of a level playing field. I think it is a silly concept. I will tell you what I think and you may be surprised, but I do think what I say. Given their present state of development, most renewables must be subsidised and must be politically supported just as nuclear power used to be in the 50ies and the 60ies. A true level playing field would simply thwart and maybe kill renewables and co-generation. Is that what we want? We see here an illustration (*Bertrand Barré refers to slide no. 12 in his presentation*). What are the projected costs for most of the renewable technologies expected in 2007 and progress expected in 2015? The margin for progress is huge, but remember that at €30 at the far left, that is where nuclear stands. In France, if we had a level playing field, we would stop the wind turbines, because at present they are very interesting to build, because the electricity produced is both at a fixed price much above the normal market price and it is good, it is good, given its present state of development it is normal to induce development. We are obligated under the European Directive to go up to 21% of renewable electricity by 2010. But it is good. I am not at all advocating a level playing field. I think it is a silly concept.

And now about the subsidies implied within the Euratom Treaty. First you must know that in the original treaty there were provisions for loans, Euratom loans, with very low interest rates, extremely incentive. At present, quite a number of years later, these loans are completely restricted to safety improvements in the accession states. I don't think you would like to suppress them. There were not any Euratom loans for Kyoto and there will not be any Euratom loans for Flamanville³.

Second point: Within the European Framework Program, research and development. The budget for European R&D for fission in the Framework Program 6 amounts to €190 million. The budget for renewables R&D in the Framework Program 6 amounts to €90 million, roughly five times more. I think it is OK. They are not on the same level of maturity. I am not objecting to that. But that is not

² The report – *REPORT FROM THE COMMISSION under Council Decision 93/389/EEC as amended by Decision 99/296/EC for a monitoring mechanism of Community greenhouse gas emissions*, COM(2003) 735 final, Brussels, 28.11.2003 - can be found at http://europa.eu.int/eur-lex/en/com/rpt/2003/com2003_0735en01.pdf

³ Editor's note: The French energy company *Electricité de France* (EDF) is expected to build its prototype European Pressurized Reactor (EPR) at the Flamanville site in the department of la Manche, which already houses two units of 1,300MW each. It will take five years to build Flamanville 3 that should be commissioned in 2012. Operation costs will amount to €3 billion. Source: *The Basse-Normandie scientific & technologic newsletter*, May 2005, and *Nucleonics Week*, 28 July 2005.

level playing field. Level playing field is stupid. That concludes my speech, thanks (*applause from the audience*).

STEPHEN TARLTON: Now, Rebecca Harms.

REBECCA HARMS: You mentioned that Denmark is the country of Niels Bohr. For me Denmark is until today the country of the Tvind School and until today I like to think back to that time when pupils from the Tvind School came to the northern part of Germany, for example my home region, and told us something about of the possibilities of renewable energies, so very early you have been on top of this movement. I would like if Denmark could go on, especially after I visited these windmills near Copenhagen⁴ two days ago. I think it is a wonderful project, especially for a capital of a European country.

I am a little bit surprised that you really say that the nuclear industry and the nuclear technology can help us win the battle against climate change. I have asked myself again and again, whether this is a serious position, because I cannot recognise the development connected with the development of nuclear power, which helps us to win the battle against climate change. Maybe you have already seen these slides that Mycle Schneider presented about the development of nuclear power in the world. So I cannot recognise that this beside in Finland or maybe one or the other nuclear reactor in China, just in this very moment, is realistic. You are right, there are a lot of words in the international debate on energy policies about the renaissance and future of nuclear, but this is not the reality. Maybe one of our specialists can tell us something about the special conditions of this plant, which is now built in Finland. These are so special financial conditions and non-market conditions that I think is again an example that we do not have a kind of level playing field for nuclear power, but I have not prepared these figures. Another colleague of us was asked to speak especially about this. Maybe it is possible to bring it into this discussion.

For example, if you look into the situation in Germany, then you can say that after the government's decision to phase out nuclear power, only after this critical decision, you had something like a new development on the energy production market. Only this decision made it possible to push for renewables and in the end also to push for the construction of new centralised power plants and under those conditions, which we always wanted. So this kind of innovation we had in Germany was only possible after the decision to phase out nuclear power. And when you look now at the debate in Germany, what shall happen after the election, maybe under another government, nobody is talking about more renewables or more efficiency. In the parties that are against phasing out nuclear, there is only talk about prolonging the lifetime of the reactors. Maybe that is what the nuclear industry wants, but even if you want this, this will last for another ten years or maybe two decades. After this, there must be a future. And in Europe I cannot see a nuclear company maybe beside one in France, which is prepared to build new nuclear reactors in a bigger number like in Finland or perhaps in Flamanville. It is not credible and you know better than I that the reason is economy.

Another big issue is that phasing out nuclear is even a better way of fighting climate change, because then you can change the whole energy sector, if you take such a fundamental decision. Another big issue is the whole issue of nuclear waste. In the European Parliament I am responsible for these debates on decommissioning funds and we have just started our votes on the

⁴ Editor's note: Rebecca Harms probably refers to a visit to the offshore wind power farm "Middelgrunden" in Oeresund.

decommissioning funds. I can tell you that based on the documents of the Commission, that the situation of preparing of decommissioning funds and being prepared for the challenges of the waste management and final disposal, in most of the countries, which are nuclear countries, we are in a very bad situation. No money in most of the cases, most countries have not prepared their funds, even in Western Europe, and the other problem is that what we so easily call "waste management" is not prepared. Most of the countries have ideas on how to deal with this problem for an interim time, but with respect to the final disposal we are far away from acceptable and safe solutions. And this will cost a lot. In France, even the Court of Auditors stated that it is quite possible that the taxpayer will have to pay for the waste management and you have a lot of waste as a result of nuclear activities in France. You have more than any other country. In Great Britain there was recently a large payment from the government to the nuclear industry to start a fund, so the taxpayer has already paid for the start of this fund. For me it is really strange that until today after decades of debate on this problem, the companies have not prepared these funds and an even bigger problem is that not even today it is not possible to be sure that the money is actually there for period of thirty, forty or fifty years beyond us, because then the real decommissioning after us will start. I cannot see even on this economic level that this is acceptable what you have produced in the nuclear industry.

One problem I would like to mention in the whole energy debate, if we also look at the situation in Germany, is that we have up until today not concentrated on the demand side. Most activities of all those anti-nuclear politicians or activists ended in wind turbines, photovoltaic, biomass, solar power, etc., but we could not manage to organise the efficiency side of it. When we talk about climate change, this is the sector, which is in front of us. We are able to phase out nuclear, but if we want to win the battle against climate change we have to work on efficiency. In former times it was possible to talk about energy savings, today I learned that this is not a good term, because it is not so sexy, but I know that most people know better what you mean, when you talk about energy saving than when you talk about energy efficiency. My opinion is, and that is after decades of debates, that if we cannot convince all people to change behaviour and have another attitude to energy consumption, then this battle against climate change is not a battle we will win. This is my opinion today.

And one last sentence with regard to Euratom: I am working on this Framework Program 7 on research in the European Parliament too and I fear that we will lose all these votes concerning the use of the research funds. On the European level there will be a decision to give the biggest part of these research funds to nuclear fusion. And this is a completely wrong decision. I would have loved if you had said something critical against it, because if you want to go with new energy strategies against climate change, you cannot seriously be in favour of fusion. The first fusion reactor will not be able to produce electricity before 60 years from today. That is what Max Planck Society in Germany tells us, so if we are not able to do anything relevant against climate change before that time, then we already decide with the FP 7 today that we will lose the battle against climate change. There are still some millions in the Program concerning fission and some of this I support. There must be research concerning nuclear waste, because I am convinced that the industry by its own will not produce acceptable and safe solutions for the waste.

We had this conference on Euratom and I fear that we do not have the situation in Europe now to phase out the Euratom Treaty. I am not quite sure how the debate on the new Constitution in Europe will develop. I fear that the first approach for changing the Constitution failed. I must say this after visiting France several times and I must say this after several visits in the Netherlands. The first thing we have to work on at the European level is a good and acceptable Constitution and this

Constitution must solve the problem we have with the lack of democracy in the European Union, especially among the European institutions, so I am very much in favour of giving the Parliament a better position in the European Union. How we can deal, if we want to solve this first, with this treaty and other treaties, I am not sure. The other problem is that we have no majority against the Euratom Treaty maybe for an interim period, so this period of the European Parliament is for sure not a period to phase out the Euratom Treaty. You can see this quite clearly if you look at the decision, the actual decision, concerning the Euratom research program (*applause from the audience*).

STEPHEN TARLTON: Thank you. Lastly, Mycle Schneider will say some things. Obviously, there are quite a few points that Bertrand Barré might want to address. I just want to point out that there is going to be a talk on Finland later, so if we could not spend too much time on that subject. Are there any points that you want to elaborate on?

DR. BERTRAND BARRÉ: Well, just to set the record straight. There are presently 24 reactors under construction in the world.

REBECCA HARMS: (Inaudible)

DR. BERTRAND BARRÉ: No, actual reactors. So you are far from the mark. I don't know why there is always this preconception that nuclear and energy conservation are antagonists. I like the word conservation, it is a good term and I don't mind using it. As long as there are still one coal-fired plant and one gas-fired plant, I think nuclear power has a role to play. When you said "it is very good that we have been able to build some big gas-fired power plants", do you mean to say that replacing nuclear with gas plants is a good thing? If that is the case, then we cannot agree on anything.

REBECCA HARMS: In my opinion this is a good idea for a certain time. I would not say that we can use the gas forever to produce electricity, especially not if we continue to use electricity as we do it. But my experience with the risks of nuclear power is that I am very much in favour of getting out of this risk, because I really think that it is too big a risk. Just six months ago I came back from my fifth or sixth visit to Ukraine. I have been working on the Chernobyl accident since 1986. I was there for the first time in 1988 and when I came back the last time I had meetings with all the responsible in the new government and I can tell you that even if the IAEA says that only 4.000 deaths are probably to expect, it is a big mess until today and not only in Ukraine, but also in Russia and also in Belarus. A lot of the problems, also the economic problems, are caused by this Chernobyl accident. Maybe we would still have the Soviet Union or a kind of similar state if this accident had not happened. The IAEA stated in this report tabled in Vienna that this has been the worst documented accident in the whole history of the industrialised world. I do not want the risk of this happening in another country. I have faced some very difficult situations in nuclear power plants in the northern part of Germany during the last years. I remember quite well the accident in Wind Scale some months ago. I remember some other serious situations in France and in the United States and therefore I am really convinced that the risks we are facing connected with climate change should not be tackled by going into another risk or taking this nuclear risk. I would really prefer to work on overcoming both risks.

MYCLE SCHNEIDER: Thank you very much. I just would like to make a couple of comments on the first talk by Bertrand Barré. First of all, you showed an impressive picture, I am sure others have seen before, of the enlightened world. Now the point is that one can certainly argue that some of

this light you see up there only serves to be seen up there, because it is so dumb to enlighten, you know some of those uses of electricity are just pure waste. I don't know if it makes a lot of sense to light up Belgian highways during the night, when there are three cars going by, but that is another point. The interesting thing is that technologically speaking, you could probably save 70% or 80% of the energy that provides that light – and that is what I would call energy intelligence. It is the same service provided in a way, which reduces the consumption of energy in the first place. So it doesn't say anything as such, the light. The question is: How do you produce it and what is it actually serving?

The second point is that you said that nuclear power is not in competition with wind power. Now, you are from France. I have been living in France for 25 years. How would you explain then, that it took France pretty much twenty years to build as much wind power as in Germany in two months? If this can perfectly go along, I wonder why it didn't happen. It makes perfectly sense, because there is a lot of areas in France where it does make sense. And one can also ask: As of June 2004, according to the Energy and Environment Agency, there were over one thousand dossiers asking for grid connections of photovoltaic systems that were held back by the EDF⁵. If this all goes smoothly, one beside each other, I wonder why there is so massive hindering especially by the electricity utilities. But also by the entire lobby that has been put together over the years. EDF, I remember, has called co-generation a threat in a strategy paper, a threat. It was literally called “menace”, threat. I mean, this is very clear. I don't actually see where there is harmonic coexistence.

Finally, on this whole question of a level playing field, which has been raised by yourself, but also by Stephen Tarlton and others. I am not sure that it really makes sense to stick to the word, that it is so important, what we call it, but we all basically know what we mean, right? It is to remove certain barriers that we know that exist for other energy forms or for other ways to cover energy service needs. That is what it is all about to me: To cover energy service needs. Nobody can eat kilowatt hours. So to me it is the matter of development pattern that we are looking at. Therefore, this question of coexistence is so fundamental. I believe that you can actually show through history that centralised, large-scale power generation systems, whether they are coal, whether they are nuclear or whether they are gas, actually lead frequently to over-capacities in a large number of countries. And if that is the case in a system of over-capacities, energy efficiency just doesn't get any chance, because it cannot compete. That is what some people might call a level playing field that you can put out 500 MW and say: Compete on the market. You save it away or you build a power plant, perfectly under the same conditions. Then we could talk about something where it makes sense, but it doesn't as long as you are in a situation of structural overcapacity and it is something that you get much easier in with centralised overcapacity generation systems.

Last point: This is one of the reasons why today you have a development where the primary energy consumption in France has actually surpassed the one in Germany, whereas, you know, Germany started out much higher than France.

STEPHEN TARLTON: Thank you, before I give Bertrand Barré a chance to respond, can I just make one observation about this thing about wind power: I had a chap from the National Grid in the UK explaining that in the UK they are concerned that there is no comparison between nuclear and wind, one cannot replace the other, one is base-load, one isn't. He said that. You can have all the wind you like, it won't replace any base-load. I do find this generalisation made quite a lot. But I

⁵ EDF = the energy company *Electricité de France*.

would like to give Bertrand Barré a chance to address some of the points and then we can take a couple of questions from the floor.

MYCLE SCHNEIDER: Just to clarify, I didn't speak about replacing. I just took up the term of harmonic living together between nuclear power and wind power, which is not the same thing. It is a different aspect.

DR. BERTRAND BARRÉ: Well, I will start with the last sentence about primary energy. Primary energy is also a kind of a theoretical concept, because behind it, there are a lot of conversion factors when you want to translate coal into gas, gas into dams. For instance, nuclear energy and hydroelectric dams produce exactly the same amount of electricity in the world today. It might be a coincidence but it is 2.600 billion KW/h per year. But if you express it in terms of percentage of primary energy, then the official figure of the International Energy Agency is 6.8% nuclear (inaudible) . That is conventional, it does not mean a lot. It is used for conversion. What is important is that the amount of kilowatt hours that you can use in your grid is the same. In the comparison between Germany and France you have a lot that is not attributable to better energy savings in Germany, but the conversion factor.

MYCLE SCHNEIDER: Actually, I agree. It is better to use the final energy. Interestingly enough, if you look at final energy in France, nuclear power provides something like 17.5% of final energy. It gives a good idea about the significance. If you look at that figure, it is much less than the overall figure in the energy field than if we stick to the mere figure of the 80% of the electricity. It gives a much better picture. And in Germany of course, the final energy of nuclear power is less than 6%.

DR. BERTRAND BARRÉ: Yes, because in all of the world you have a 10 billion tonnes of oil equivalence in primary energy. Electricity is only one sixth. Electricity is a specific case. It has applications that the other forms do not have. And in this sector nuclear is important. My vision of nuclear extends far beyond the next decade and I look forward to the time, when nuclear will produce hydrogen cleanly in order to address the transportation needs.

STEPHEN TARLTON: Thank you, I am sorry that not all the points can be addressed, but I would like to open this up to the floor now. Any questions?

GUNNAR BOYE OLESEN (*question from the floor*): Yes, I am Gunnar Boye Olesen from the Danish Organisation for Sustainable Energy. First of all, I would like to add to the debate on whether renewables and nuclear compete. Some renewables compete with nuclear according to my understanding and I think that you have to recognise that it is not the base-load, but the replacement capacity which is keeping the power system alive and which is keeping the stability in the system. That is why the more nuclear power you have, the less regulation capacity you will have in a given system. Let me give you an example: In Denmark we have concluded that we can have 50% wind power with the current, quite flexible power systems based on gas mainly and some coal and the large import-export capabilities that we have. I do not think that that would be possible in a country with a lot of nuclear power, say France. Then I would like to go to a question and that is back to the Euratom question. This question is for Bertrand Barré: Could you agree that we should maybe go for a neutral Euratom solution, where there would be a Euratom cooperation, which would be our safeguard for nuclear waste and nuclear hazards, which I believe everybody in this room would think is a good idea? Thank you.

DR. BERTRAND BARRÉ: Sorry, I am not sure that I have fully taken in all of your points. Indeed, most of the importance of Euratom are the three things in the Euratom Treaty that have been mentioned over and over: Standardisation of safety standards - radiation protection - standards of regulation and safeguards. There is no doubt about it. It is funny - Euratom was not so popular in France at the time when we were building our nuclear program. It was considered a nuisance and not helpful at all. But it was felt more and more that it has a role to play in terms of regulation, which far outweighs any role it can have in promotion. The point you made that we could not have 50% wind power in France with nuclear: Yes, but we don't need it, because nuclear energy does not emit greenhouse gases. The need to replace fossil fuels is much more urgent and you are producing much more CO₂ than me. Because when you are close to coal and most of your electricity production comes from coal, what is the point of replacing wind by nuclear or nuclear by wind? The problem is diminishing the fossil share. That is the problem, I perceive - I deeply feel. I do not have the same priority as the person from Greenpeace, who wants to fight nuclear and climate change. I do not want to fight nuclear, but I do want to fight climate change.

BIRGITTA MOELLER (*question from the floor*): Birgitta Moeller, Helsingborg. I would like to put the question to Dr. Barré. It is about uranium. As we all know, I suppose, uranium is getting scarce. When you calculate with all this nuclear power, how long will it take before it ceases. That is the first question. The second question is: Will the prices be acceptable when uranium goes down?

DR. BERTRAND BARRÉ: Well, uranium is not really scarce. With the present development of nuclear power and with the present technology, we will have uranium for 130 years, no problem at all. The question is what will be the development of nuclear power from now on. If it is stagnation for ever, we can have uranium long after my children are dead, but what I hope is that in fact nuclear power will develop and that this stagnation was only a plateau for new growth. Then we will switch technology and we will use breeders, because breeders feed on depleted uranium, which is plentiful and already mined. We do not need to mine a gram of uranium to feed a breeder. It leaves only depleted uranium and then you are not speaking in terms of centuries, you are speaking in terms of millions of years. Yes, I see that you do not agree, but it is a fact.

STEPHEN TARLTON: Can I just make the observation that there are many in the industry who see no evidence of uranium scarcity. All the history of mining shows that at the moment. Can we have another question?

DR. BERTRAND BARRÉ: By the way, the question about the price: When we come to really burning depleted uranium, price has no meaning any longer. All of the costs are in investment. And that is huge, by the way.

TARJEI HAALAND (*question from the floor*): I have a question for you, Dr. Barré. What do you think about cogeneration? Nuclear power plants cannot be used for cogeneration, because they have to be located very close to inhabited areas to do that. Don't you see that as a bad thing with nuclear, that it cannot be used for cogeneration? Because of that you could have a situation, where you substitute a nuclear power plant with gas. That means that you would save some CO₂ emission by installing a cogeneration plant instead of a nuclear power plant.

DR. BERTRAND BARRÉ: In my vision, that is my vision, we will progressively improve on this. We already know that because of the high temperature, nuclear has quite a potential of being a hot

source, if you want. So cogeneration is quite possible. You can use the high part of your calories for generation and have a very efficient production and still use the lower part of your calories for process heat, no problem. With a high temperature reactor we can reach 1.000 degrees. A lot of new applications open. That is part of my vision today. That is part of Generation IV.

STEPHEN TARLTON: Just time for one last question. Apologies to everyone who hasn't got time to ask. Bertrand Barré has a plane to catch. He has got a taxi waiting for him now.

CHARLY HULTÉN (*question from the floor*): I am sorry that I have to say these last words to you, but I find it extremely provocative that you seem totally blind and deaf to all manner of externalities. When you talk about breeder reactors, you seem not to care about the environmental consequences of breeder technology, and when you talk about uranium mining, you seem not to care about all the devastation that uranium mining has caused all over the world. That is why Europeans refuse to let their uranium be mined. I mean, talk about reality. You tell the people that criticise your idea of the future of nuclear to face reality. But I ask you to please face the reality of the externalities of the nuclear industry. From the beginning to the end, there are unsolved problems today.

DR. BERTRAND BARRÉ: Well, in my past life I happened to be the boss of the Phoenix breeder reactor, so I pretty much know what I am talking about when I speak about breeder technology. The environmental impact of breeders is very low. Have you ever visited a breeder? Well, I operated one.

QUESTION FROM THE FLOOR: (Inaudible)

DR. BERTRAND BARRÉ: No, the Phoenix is still operating, but it will be shut down, because it is our oldest reactor. It was put into operation in 1973. Sorry, I do have to leave.

STEPHEN TARLTON: Thank you very much. I think we have to leave it there (*applause from the audience*).