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NUCLEAR ENERGY AFTER FUKUSHIMA
Expanding Technology Horizons

JUNE 17, 2011 — 17:30–18:45, Pavilion 3, Amphitheatre

St. Petersburg, Russia

2011 Moderator:

Hon. Bill Richardson, Former Governor of New Mexico, U.S. Secretary of Energy and U.S. Ambassador to the United Nations, Chairman of the executive advisory service Global Political Strategies (GPS), APCO Worldwide

Panelists:

Sergei Kirienko, Director General, State Atomic Energy Corporation 'Rosatom'

Jukka Laaksonen, General Director, Radiation and Nuclear Safety Authority (STUK)

Henri Proglio, Chairman, Chief Executive Officer, Electricite de France

Nobuo Tanaka, Executive Director, International Energy Agency

Front row participants:

Mikhail Abyzov, Chairman of the Board of Directors, E4 Group JSC

Ambassador Hamad Al Kaabi, Permanent Representative of the United Arab Emirates to the International Atomic Energy Agency Special Representative for International Nuclear Cooperation

Mark Benson, Chairman, APCO Insight

Alexander Bychkov, Deputy Director General and Head of the Department of Nuclear Energy, IAEA

Tapio Kuula, President, Chief Executive Officer, Fortum Corporation

Christine Marin, Committee on the Environment, Agriculture and Local and Regional Affairs, Parliamentary Assembly of the Council of Europe

Andrej Timofeev, Partner and Managing Director, The Boston Consulting Group

Tony Ward, Partner, Global Nuclear Power Leader, Ernst & Young

B. Richardson:

Good evening, everybody. We are going to get started exactly at 17:30 as we said we would. My name is Bill Richardson. I am a former Secretary of Energy in the Clinton administration. I am the Chairman of the group for Global Political Strategies of APCO.

This panel shall discuss Nuclear Energy after Fukushima. I am going to make some opening remarks, and then I will introduce our distinguished guests.

Following the earthquake in Japan, leading to a major nuclear crisis, the international community is redoubling efforts to assure nuclear energy is developed safely. Here are the questions that are going to be examined in this panel.

Number one: what is the future for development of nuclear power worldwide? Number two: what is the role of the state in the development of individual countries' national nuclear power? Number three: what steps should governments take to assure that the safety systems used in modern power plants are adequate? And number four: what is the role of the International Atomic Energy Agency, the IAEA, in strengthening the international legal framework for nuclear and radiation safety?

Again, I want to thank my old friend and the sponsor of this session, Dr. Sergei Kirienko, and Rosatom for sponsoring this event. Please give them a big hand. They have been our hosts, and they have been wonderful hosts.

I also want to thank the other experts joining us here today: Henri Proglio, Chairman and the Chief Executive Officer, Electricite de France.

I also want to thank the Executive Director of the International Energy Agency, Dr. Nobuo Tanaka.

And then, I would like to thank Jukka Laaksonen from Finland, the Director of the Radiation Safety entity in that country.

The nuclear energy industry is clearly at its crossroads as companies and countries evaluate what steps to take next after Fukushima. I think the response from the policy in the political community to the nuclear accident in Japan has been surprisingly sober and mature in most countries. We are certainly seeing a reevaluation of nuclear power across the board.

And while we may be in a temporary pause while safety concerns are addressed, I believe that new construction will continue in many places around the world that

have identified nuclear power as an important aspect of energy supply. It would be especially difficult for developing countries to maintain their growth rates without nuclear energy in the mix.

And governments are critical to the continued growth of the nuclear energy industry, whether through the licensing of new plants, relicensing existing plants or, for example, in the United States, providing loan guarantees for future construction, National Nuclear Energy requires the positive involvement of the government.

The work the Nuclear Regulatory Agency has done in the United States and the stress test that Rosatom has undertaken here in Russia for their existing nuclear power plants are incredibly important to rebuild public confidence in nuclear power. And I believe that the IAEA will play a significant part, as the United States, Russia, Europe and many other countries evaluate their existing plants and plans for future ones.

I applaud President Medvedev, as I do Dr. Kirienko and Rosatom, for the leadership role they have taken in the post-Fukushima period in calling for a strong role by the IAEA in strengthening nuclear and radiological security.

And in this connection, Dr. Kirienko has, as many know, a proposal on international safety standards that I am sure he will discuss today. And as G8 leaders agreed to last month in France, countries looking to move into the nuclear power sector should follow IAEA recommendations and relevant standards to ensure the highest security, and safety standards are maintained.

Ultimately, the market place, the investment community and governments will determine the fate of the industry, because of the critical role nuclear energy places in both our power sector and in mitigating climate change. However, we need to be measured, clear, purposeful and smart about how we look at the industry in the post-Fukushima world.

I am going to turn first to Sergei Kirienko. Dr. Kirienko, who recently travelled to Ukraine to mark the 25th anniversary of Chernobyl. Then I will go to Dr. Henri

Proglio, the Chairman and CEO of EDF, followed by Dr. Nobuo Tanaka, the Executive Director of the IEA. And then finally, Professor Jukka Laaksonen, the Director General of Radiation in Finland, who has some of the state-of-the-art issues in nuclear safety.

We are also joined by a distinguished group of participants and experts. Dr. Mikhail Abyzov, Chairman of the Board of Governors of JSC Group E4; Mr Mark Benson, the Chairman of APCO Insight; Mr Alexander Bychkov, the Deputy Director General of the IAEA; Mr Hamad Al Kaabi, Extraordinary Ambassador, the Representative of the UAE at IAEA; Mr Tapio Kuula, President and Chief Executive Officer of Fortum of Finland; Mrs Christine Marin, Chairman of the Sub-Committee for the Environment and Regional Issues of PACE; Mr Andrej Timofeev, Partner of BCG, Director of Atomic Energy Practice in the CIS; and Mr Tony Ward, an expert, a partner of the Director of International Practice and Assistance to atomic energy companies from Ernst & Young.

Now, each of the three speakers on the panel, the four speakers will make statements of no more than seven minutes, then we will go to this distinguished panel of experts. And then in the end, I want all of the participants that are attending to vote. We have automatic voting panels here, right next to you. Do not vote until you hear all the presentations. But please, be conscious that we will ask you to participate at the end of the session.

So I would like to turn first to Dr. Kirienko, who has been a leader in the nuclear safety issue. And the question that I would like to ask him is: what lessons have we learned in the last 25 years? How can they be applied to the nuclear industry post-Fukushima? And please outline the proposal that you have put forth on international safety standards. Dr. Kirienko.

S. Kirienko:

Thank you, Mr Secretary and colleagues. It is clear that some time has passed since the tragedy at the Fukushima Plant, and we have forgotten that the cause

of this tragedy was not a technological catastrophe but a natural catastrophe, the impact of which could hardly have been withstood by anything created by human hands. The technological disaster at the nuclear plant was merely the consequence of this natural cataclysm. However, regardless of the causes, one question has become obvious: do the events at Fukushima mean that the global economy must dump all large-scale use of nuclear energy? Today, after several months, we now have precise information about what happened at Fukushima and how, and we can analyze the causes and effects fairly accurately. We may draw some initial conclusions.

I will begin by stating that the main conclusion is as follows: nuclear energy in the next decade is a necessary condition for maintaining the global energy supply, and there are four reasons for this.

The first reason is this: the tragedy at the Fukushima Plant was not an inevitable consequence of the state of technology in nuclear power production. This is a problem that can be overcome, and today there exist tried and tested technologies providing a guarantee even in the event that a modern power plant were to be affected by the same sort of extreme natural disaster as that which happened in Japan. We have modelled this by conducting stress tests. We have assumed a scenario in which our modern plant undergoes the same as Fukushima, under the same combination of natural effects. The first answer is that our technologies make it possible to guarantee that such a development of events would be avoided.

The second reason for the necessity of nuclear energy is this: without the large-scale involvement of nuclear power, it will be impossible to balance the world's energy supply in the next decade. The presentation given by Mr Tanaka at the round table session on energy made a great impression on me. There were several scenarios presented, and even in the most conservative scenario for nuclear energy, it turned out that the share of nuclear energy, as predicted by the International Energy Agency, must be at least 10% by 2035. But 10% of the

energy supply in 2035 is approximately 1.5 to 2 times greater by volume than what we have today. And if I add to this the fact that by 2035, almost all existing production facilities will have to be decommissioned and rebuilt, this will mean that capacity will have to be increased by 2 to 3 times. Without this, we will not be able to ensure an energy balance, and I would like to add perhaps just one more thing: these days, when people discuss what might replace nuclear power plants, they often speak of renewable energy sources. But, while for a rich country like Germany this is an expensive but possible solution, for countries with a per capita income of two dollars per day (and this is the majority of countries in Africa), such a solution cannot even be on the table. This alternative does not exist for them, and hence my second reason: the contribution to the world energy supply.

The third reason is this: large-scale contribution to the world environment. This sounds a bit strange after Fukushima, but I would like to remind you that, as serious as the events at Fukushima have been, not a single person has died in this tragedy, and there is every reason to believe that no one will die from it in the future. So, if today we imagine for one second that a political decision is made to close all nuclear plants in the world, then the additional release of greenhouse gases, CO₂, would be approximately 1.7 billion tons above that which is already being released at present.

And my fourth reason is that nuclear energy today is the most important driving force for innovative development. We cannot say exactly what source of energy will supply humanity in 30 to 40 years, but we can state with certainty that the path to this new energy source and to these new technologies lies through the technologies, infrastructure, knowledge, and human capital that are being developed today as part of the development of nuclear energy, and humankind cannot back away from this. Moreover, the further we advance in our knowledge, humankind will have access to more serious sources of energy, and if these are used properly, they will be of enormous benefit. But of course, if they are not

used properly, they will also create serious problems. It is a matter of knowing how to work with energy sources. For many years, humankind heated its homes with an open fire using wood, which resulted in cities catching fire (and burning to the ground), with a significant number of people killed. But this does not mean that humanity should refuse to use fire. We just need to have some respect for these powerful forces of nature that we work with.

And now, the conditions. So, it is not possible to step back from nuclear energy altogether. But on the other hand, it is also impossible to develop it without being able to ensure safety. What are the conditions that we must meet in order for nuclear energy to develop? I will begin by stating that there are three such conditions in different time frames: short-term, medium-term, and long-term. In the short term: ensuring the reliability of current nuclear plants. This is that same program of stress tests, the first phase of which we have already completed. But we believe this must be open and transparent, and so when we were implementing our program of stress tests we included in them everything that our European and American partners had developed, and we did this as openly as possible. Based on the results of our stress tests, we underwent a partner inspection by the World Association of Nuclear Operators (which was headed, incidentally, by the chief technical director of EDF, for which I would like to thank my colleague Mr Proglia), because we believe it is extremely important that these inspections be open and transparent in nature. We have already stated that we are prepared to take an active part in the stress tests that are being conducted presently in Europe, sending our experts, jointly analyzing results, and – if necessary – we are prepared to repeat any stress tests and analyze them in-house, if the tests conducted by our European counterparts show up any additional problems that we have yet to check. This should be as open and transparent as possible.

In the medium term: the need to change legislation. I am referring to the initiatives put forth by the President of the Russian Federation – the initiatives

that were supported by the Deauville G8 Summit. The crux of these initiatives is that the problem of nuclear power plant safety is not a national problem. It is a transnational and international problem, which means that safeguards must also be transnational. Thus, the new safety requirements included in the IAEA standards should not have the status of recommendations as they do today, but must be made mandatory. Of course, each country must accept these standards of its own volition, but after accepting them, it must meet these requirements as though they are binding. The IAEA must have the authority to determine how effectively national oversight agencies monitor compliance with these rules.

We believe that it also makes sense to increase both the authority and the capabilities of the World Association of Nuclear Operators with regard to the transparent and complete submission of information. The responsibility of governments when participating in emergency response must also be stipulated, because the Fukushima experience has shown that if the operator is left to face the problem one on one, the crucial first hours and days of the crisis are lost. And, of course, the most important issue is the openness of information. This whole package of legislative initiatives has been introduced, and we are anticipating that it will come under review, starting on Monday at the special IAEA conference.

And finally, the long-term future. The long-term prospect is increased pace in the movement towards a new generation of nuclear power technologies. Today's generation of technologies is capable of guaranteeing safe development, ensuring people living near nuclear power plants that they are in no danger whatsoever, under any natural or technological conditions. But this requires a large number of compensatory steps and protective measures, and a highly skilled operating organization, which is especially important in establishing nuclear energy in new countries, and so here, it is extremely important to offer a comprehensive package. At present, we are trying to offer all of our partners not only to build nuclear plants, but to furnish them with a set of tools to build

infrastructure: legislation, personnel training, fuel delivery, shipment of spent fuel for reprocessing and, if necessary, the services of operating companies, as we are doing in a project being implemented in Turkey, where we are providing all the necessary infrastructure. But all of this is the complex and large infrastructure associated with the conditions of today's generation of nuclear energy. So the conclusion is that we need to move more quickly than we thought to a new generation of technologies, based on natural safety in nuclear reactors. We think that this will probably be done through fast-neutron reactors, and we believe that, like the other two conditions in the short and medium terms, this long-term condition for creating a new generation of technologies must also be done openly, transparently, and transnationally. We believe that this project must be implemented jointly, which is what we are currently doing with our partners in France and the United States. I would like to say that we are absolutely open in this process, as we believe that the development of nuclear energy for a secure energy supply, a safe environment, innovative development, and creating conditions for this development are an international task, which we must accomplish together. Thank you.

B. Richardson:

Thank you, Dr. Kirienko.

Let me turn to Director Tanaka. What would you say are the lessons learned from Fukushima, and what would you say the role of the IEA, your agency that you have directed so ably, should be in this post-Fukushima world?

N. Tanaka:

Well, thank you very much, Mr Richardson.

I will make a very quick presentation and that is a response to your question.

Fukushima, yes, it is my home country and I feel very guilty or apologetic about what happened in Japan. It has really made a critical impact, not only in Japan,

but throughout the whole world, and we are very sorry that this happened in Japan.

But I am sure that the people in Japan and the technicians and the government policymakers are making their best efforts to stabilize the situation, and by doing so, we will learn the lessons. At this moment, we do not know what the real reason is: there is a risk assessment issues, technical issues. There are plenty of lessons we will learn. So, we want to wait until that time to determine the next step, which we can learn.

But first things first, let me present to you what the IAEA has analyzed recently about this Fukushima incident. We are always developing world energy outlooks and making scenarios. Our famous scenarios are for 50-scenario stabilization of CO₂ emission reduction.

But with Fukushima, I think we have to change dramatically, because the reason is that many countries are now reviewing the situation and they are changing their minds as to how fast and how far we can utilize nuclear power.

So, the costs could be higher. We have to use alternative sources. Investments are necessary to replace this. So there is a whole set of parameters in the energy sector—not only nuclear, but whole parameters of the energy field—must be reviewed. Otherwise, we cannot describe our future in a sustainable, competitive and secured manner.

This is our lower nuclear case; we will make a much more detailed analysis in the IAEA World Energy Outlook, which is coming in November, in which we will assess the impact through energy trends, the costs of energy and security, and also with regards climate change and sustainability. This is the assumption of this lower nuclear case.

In fact, as Mr Kirienko said, in terms of primary energy demand now, about 14 percent comes from nuclear, but it will decline to about 10 percent. But it means that we still have to build a new capacity of nuclear power by 180 gigawatts over

current capacity. And it will happen: as we assume, construction plants planned under us will continue to be built.

Of course, the speed of the increase in capacity will decline in the OECD, but China, India, Russia, and Korea will continue to build as they are planning. So, then what would happen in this scenario?

We have already analyzed if it is replaced a third by coal, a third by gas, a third by renewable energy... how big this demand is going to be? For coal, it is the equivalent of about 130 million tons of coal, but it is about equal to current Australian steam coal exports. An additional Australia is necessary by 2035.

For gas, it is about 80 billion cubic metres, meaning that another Qatar is necessary. And for renewable energy, energy development running to about five times the current level in Germany is necessary.

So, huge increases in other sources will be necessary, and that means big costs. Electricity costs or fees will definitely increase. And that means many countries must import coal and gas, meaning less security. Security of supply will definitely be sacrificed.

What is the impact on CO₂ emission? The dark blue is the lower nuclear case, meaning CO₂ emission from the power plants will increase by 30 percent, and this makes the 450-PPM stabilization scenario very difficult and probably, we can say, practically impossible; technically possible, but the cost is prohibitively expensive and that is the consequence of the lower nuclear case.

We analyzed what would happen in Germany. The German plan is to phase-out all nuclear power plants by 2022, replacing them via a 10 percent reduction in consumption, a 35 percent increase in renewable energy, and a huge increase in gas use. And this means that gas use will be increased by 16 billion cubic metres.

Certainly, a 10 percent reduction in energy consumption is, again, a very challenging subject, because we are moving away from oil, we are moving away from coal, but a huge increase of electricity generation is necessary in any

country for economic growth. So to use 10 percent less, in terms of years, is probably a really difficult target for the Germans to achieve.

To conclude, yes, certainly, in each country we will face difficult challenges by this lower nuclear case. For example, the EU and Japan would require more gas, as I said, because that is the alternative, with relatively cleaner sources.

For the United States, yes, the US will use lots of shale gas; it is quite abundant, so this will happen. And certainly, China and India will move more onto coal, if CCS technology is not readily available. This expansion of coal usage will become firmly rooted, and that means there will be a huge increase of CO₂ emissions in the future.

So, Russia. Yes we know that Russia will maintain the nuclear option, but as a whole, the cost of building renewable energy sources, the cost of building smart grids, the cost of building other necessary establishments—this option is very costly. So we think, I do not say it is impossible, but this is a really costly option. Secondly, it is less secure because we have to import lots of gas. Well, it is a big business chance for Russia. We say that another aspect of this scenario is the golden age of natural gas, so this could be a huge potential for Russia. But also, it has an impact for importers.

Thirdly, the issue is less sustainable, because CO₂ emissions will increase. It is inevitable that we have to use more coal and gas.

The lesson from Germany is interesting. Of course, to take or not to take a nuclear option is a sovereign decision. It should be decided by the individual country, but there is an impact on the other countries. Germany is in the middle of Europe; it is connected by grids to the border countries.

So, the German decision means more imports from France, coming from nuclear power; yes, Mr Proglia will explain about that, or importing power from the Czech Republic or Poland produced by coal. So actually, the German decision is impacting the whole of Europe.

I am always saying that, yes it is important to talk about safety, but think globally or regionally. Otherwise, this decision will compromise security and sustainability for the whole of Europe. That is a lesson we have to learn.

Another lesson from the German decision is that if governments change their policies from time to time, it is very difficult for the private sector to invest such a huge amount of money in nuclear power. It is on and off, and very often, we can see it in Europe that this kind of very changeable policy brings a huge detrimental impact to investment. So that is a second lesson.

So we have to think carefully, and the IEA is very happy to provide these data for good discussions in each country, and to make a good decision, and solid decisions, which it can continue for a certain period of time. That is a very important thing, where have to take care.

Thank you very much.

B. Richardson:

Thank you very much. An excellent presentation.

Let me turn now to Mr Henri Proglia, who is an expert on French nuclear power, and I am going to ask him to be an expert on German nuclear power and explain the difference. What has happened in Germany, to their attitudes and their actions, compared to what France has done?

And then, in addition to that, some of his plans for exporting services, as well as some of the stress tests that he has conducted at some of the French power plants. But we are very pleased to have you.

Please proceed.

H. Proglia:

Thank you very much, Mr Richardson, for giving me the floor. I would like to extend my gratitude to Sergei Kirienko, who gave me the opportunity to be here

together with you today. Thank you very much again for your partnership and your friendship.

Now I would like to say a few words about energy as a whole, and nuclear power in particular. I also accept the idea that that energy needs will be huge for the coming 30 years, just for the reason that the number of people living on the earth will grow from seven billion up to nine billion and, at the same time, we today have one and a half billion people that do not have access to electricity.

If you add to this number the additional two billion people on earth in 30 years' time, then you have three and a half billion people that will need electricity. If you add to this the increasing development of emerging countries in terms of power generation needs, then you will see that there is no easy answer to the question of access to energy, first of all.

The second question is linked to the environment. Of course, the drama of Fukushima has been a considerable event and emotions ran very, very high. But it was not due to technical issues or concerns. It was not due to nuclear power, as such: it was due to a tsunami. And again, if we just consider the events of Fukushima, we have to work on understanding why it happened.

And this is what we did, since the first day together with Sergei—just to contemplate the Fukushima case, and see how we can merge to avoid a future Fukushima, and this is something we could command further.

So, the third thing is generation capacity and the cost of energy, because for most countries, the only consideration of renewable energy as the key driver is just to forget about affordability. It is just not affordable. So should we forget about—first of all—the effects on climate change and the environment, and then access to energy to most of the people on the planet; then we could just forget about nuclear.

If on the contrary, we pay some attention to the people, we pay some attention to the environment and to the cost of energy and to affordability, then what are the answers to the question?

The first answer is, of course, hydro, which is, of course, natural and renewable. And this is to be developed of course. And EDF is one of the key drivers of hydro development.

The second, of course, is gas and oil, but the cost of these energies will continue to increase. We had a meeting just before with President Medvedev and friends of Gazprom—Alexey Miller—he is expecting the cost of gas to increase or to double in the coming five years.

So just take a look at it and if the question is, is gas sufficient enough for energy needs? At what price? And this leads—together with environmental issues, and CO₂ emissions—to the question: is, or isn't nuclear power a part of the energy mix, is it the right answer to this?

And my own belief is that nuclear power will be a necessary part of the energy mix for the coming 30 years, at least under the condition that safety first is an absolute necessity and that technology on the road has to be continually improved, and research and development are the key drivers of nuclear, of course.

This is my strong and clear belief. France has built the most important nuclear network in the world over 50 years. 80% of our power generation is linked to nuclear: 15% to hydro. So we are among the countries in the world with the least CO₂ emissions, and we are among the only ones that do not contribute to the effects of CO₂, due to the origin of our power generation capacity.

We built through EDF skills because we, as EDF, as a company, did imagine, build, and operate on the French platform, so we have a particular presence in nuclear, rather the most nuclear companies in the world.

We built this expertise and engineering capacity, which is linked to the expertise and the technology-driven expertise that is ours, on top of the different other capacities in the company, in terms of power generation.

But today we see a number of countries that share the belief that nuclear power forms a significant part of their own future, in terms of efficiency, in terms of safety, in terms of security, concerning power generation.

Among these countries is Great Britain, number one. The British government, under the previous government, and again it was reinforced with the new government, decided that nuclear should be part of its own energy programme for the future years.

The same with Russia, the same with China, the same with Turkey, the same with Vietnam, the same with South Africa; all of these countries decided that in the mix, nuclear should form a significant part of it.

We have constructed new nuclear power generating capabilities in Great Britain, as a matter of fact. So I would like to share this with you, and the US decided that nuclear power should be part of its future commitment, even if because of shale gas development, the competitive value of nuclear is not obvious today and, probably, this is the only reason for the Fukushima mindset: not for safety reasons, but simply commercial reasons which are linked to new gas generation capacity.

So my strong belief is that the world needs some nuclear power in the energy mix, under some conditions. One is—and it is obvious through the Fukushima example—that safety is the responsibility of the governments and of the operators together. Nobody questioned the Japanese about who was the company that built Fukushima; everybody was focusing on TechCo, the operator. The operator and the government share the responsibility for nuclear and that's it. So you need strong operators, strong companies involved, committed to nuclear safety and development. These companies are not that numerous. Rosatom is one of them, for sure. The Chinese, the Japanese, French, not so many.

So, just a question: Who is responsible for nuclear? And then you have all—of course—the industrial companies.

The second question is: What is the responsibility of international organizations concerning nuclear, including, of course, the IAEA?”

And, I very much respect the presence of Mr Tanaka today, who represents one of the most important organizations in the world, the other one being WANO, the organization of international operators.

And, for sure, we have to improve the situation and the commitment of each and every one of the companies to these organizations, so that we put through safety improvements in the world, the post-Fukushima situation is, of course, different to the one before and we have to make sure the IAEA and WANO are better organized than before, more efficient, that the audits are more sophisticated, that all the companies refer to these organizations to improve safety in any case. These are the conditions. But, again, my strong belief is that nuclear power is part of the energy mix that should make it possible to achieve the first target, which is to give power to everyone in almost any country.

If not—and we are among the companies that develop largely renewable energy—the cost of renewable energy should be considered, possibly because of the direct costs, and then because of the grids, because it is energy that that is not clear with regards the grids.

We invest into grids largely if the investment for renewable energy is for import. So, the full cost of renewable energy is definitely much, much higher than the cost of nuclear power, even after taking into account the improvement of safety, for sure.

So, this is my vision. The French example has provided France, first of all, with security in power generation and efficiency, because France has the lowest prices in Europe when it comes to power, due to the nuclear output, and that gives me some ideas about the development of this energy and the efficiency of this energy.

B. Richardson:

Thank you very much. Thank you.

Professor Jukka Laaksonen—Mr Safety—the questions that I would hope that you would address are: should the international safety and radiation standards be strengthened and then, secondly, would you support an international pool of experts, out of whom assessments of national stress tests results would be selected for different countries?

J. Laaksonen:

Thank you. Maybe, I will start from the safety aspect and the role of IAEA in strengthening the international legal framework for nuclear and radiation safety. After Fukushima, we have heard several proposals saying that the Agency should assume a new role as a global nuclear regulatory body.

However, for everybody who works in this area, this is not a viable proposal, and probably would not lead to the progressive development of nuclear safety. It might even result in stagnation at the current level. The main role of the IAEA in nuclear safety has been, and should be also in the future serve as a cooperation forum where the member states can develop and approve common safety standards.

In addition, the IAEA needs to ensure that the safety standards are applied in a consistent manner across all states. And here, I would like to remind you that among these safety professionals, there is a perception that safety standards for new plants are already there.

So, we do not expect any new significant safety requirements which would influence the cost of nuclear power. Just three weeks ago, we approved a new standard for design for nuclear power plants in the Commission of Safety Standards of the IAEA. There was a common view that that this is good for future plants. We do not need to wait for any new things coming from Fukushima.

So, the issue is really how to implement safety standards, and this requires that the IAEA provides practical guidance and arranges peer reviews, where experts

who are coming from different countries assess the practices in the country to be reviewed.

Until now, such peer reviews have been conducted, but they have been based on voluntary invitations by the states, and it has always been under the discretion of each state whether they want to make the review results publicly available, and whether they want to take actions recommended by their international peers. In the future, it would be necessary to increase the obligations related to the peer reviews. Each IAEA member state should be committed to invite certain reviews at regular intervals, and these review reports should be open to the international community, and the states should be liable to respond in writing to each recommendation, either by taking actions as recommended or presenting solid arguments as to why they do not deem it necessary to take the recommended actions.

However, it must be emphasized that review groups should not have a formal authority to give any binding recommendations to the state players. Final decisions on safety measures should be left to the licensees and the regulators of each state, because they should have the widest knowledge on the relevant influencing factors.

However, it is important that we add a new feature. We extend the scope of peer review, so that we assess design aspects of nuclear power plants. Twenty years ago, we got, in fact, a very positive experience when we made reviews on the old Soviet Union-designed reactors and this work was a good example of cooperation between the national experts in the Soviet Union at that time, and the international team of experts, who came under the IAEA.

The joint recommendations given by those groups led to safety enhancement programmes that were carefully implemented over the course of many years and, evidently, this led to much strengthening of safety of all concerned plants.

We could start similar joint reviews to be conducted at all the facilities in all states, and not only older facilities, but also all facilities which are in operation.

We now have underway such targeted safety assessments in Europe, and we have included aspects of international peer review to this process.

So, this should serve as a good pilot project, and we could extend that idea globally, under IAEA management. So, this is the role I see for this international work, and as concerns the role of the state in the development of nuclear power, it is a generally accepted principle that the state has full responsibility for safety in using nuclear power under its jurisdiction. So, we can say that each state, although they have a right to use nuclear power, also have a responsibility to do it correctly and, therefore, each government which makes the decision to embark on a nuclear power programme needs to recognize its responsibility for a long-term commitment to the peaceful, safe, and secure use of nuclear technology.

Unfortunately, this is something which we do not see happening in all those countries which are planning to start their nuclear programmes. So, it would be necessary to give a clear political message to the countries that they should not expect somebody to build the nuclear power plants. The IAEA provides the safety, and they do not have to care about their responsibility. This is a very wrong way of thinking. This is a very dangerous way of thinking. So, this is a message which should be understood by the politicians. So, maybe that is enough on safety.

Thank you.

B. Richardson:

Thank you very much. We are going to go now to our panel of experts.

I am going to ask our panel. There are eight distinguished experts, but they will not have seven minutes. In fact, they will have far less. But, we want you to participate. Following our eight experts, I would like this panel here, our four panellists, to make concluding remarks on something they have not said, or in reaction to our panel of experts. And then, we are going to have a vote from the audience.

Let me first turn to Mr Mark Benson. We have been talking about attitudes in Europe and nuclear power, referendums, etc. Mr Benson is an expert on American attitudes towards nuclear power. There are 104 nuclear power plants in the United States. There are a lot of licensing issues, safety issues, concerns. But, if he could briefly tell us about some of the polling results that he has conducted on attitudes in America...

M. Benson:

Certainly and thank you.

Even a year ago, the perception was that the nuclear renaissance was well underway in the United States, and it is actually quite extraordinary, with the level of coverage that Fukushima has received, the awareness is very high, and the level of concern is very high.

We have taken surveys with the US energy policy community, and there has been virtually no decline in support for nuclear energy. The underlying logic is just as compelling to them now, as it was before Fukushima. We have seen about a 5% decline.

What we are seeing, though, is a tectonic shift—if you will—a move towards natural gas. There is a widely-held view that it is not a safety constraint or a political constraint that is holding back nuclear power at this point, but as Mr Proglione has indicated, it is a much higher priority being assigned to natural gas as an alternative. So it is indeed a possible golden age for gas.

A couple of other things are interesting. US policymakers continue to view nuclear power as having made more safety progress than other modes of energy. It compares favourably to oil, in particular, compares favourably to coal, so they have a pretty good view about nuclear in that respect.

The basic arguments about nuclear power are based on the fact that technology can, in fact, make the process safe. So there is faith that technology will be part of the answer moving forward, that it is cost-effective and its favourable

emissions profile continue to move opinion in a favourable direction for nuclear power.

So, what has happened in the US is really a recognition that nuclear power has got to be part of the energy mix in the future, notwithstanding Italy, notwithstanding Germany.

In fact, we have asked the policymakers about Fukushima—what does it mean? Does it mean that there is an on-going safety issue that should cause us to rethink our nuclear policy, or will nuclear energy end up safer as a result of Fukushima, will the outcome be better? And in fact, 75% of our policy panel thinks that indeed the future will be safer with regards nuclear power, as a result of this event. So, it has really proven quite resilient in the United States.

B. Richardson:

Well, thank you. Thank you.

Let me turn to Alexander Bychkov, the Deputy Director of the IAEA.

There has been a lot of talk about the IAEA up here, and I want to give you a chance to respond on the lessons learned after Fukushima. Maybe you might react to the criticism that the IAEA responded slowly.

I would like to give you the floor. Do not give us seven minutes, make it one or two, if you can.

A. Bychkov:

I will speak in Russian since most of the audience will understand this language. I would like to emphasize that this survey we have been given and the discussions being held lately essentially correspond to what we in the IAEA anticipate at the upcoming conference on nuclear safety. This conference will begin in three days, and we believe that it will give us the opportunity to bring about some 'good' in the strengthening of standards and, most importantly, in increasing the obligations to adhere to these standards on the part of countries

that operate nuclear reactors. We anticipate that development will begin on a new international mechanism to provide monitoring for the level of safety at the plants currently in operation and, in some cases, to allow us to use our capabilities as an organization that can provide fairly accurate expertise at a high level and advise countries and operating organizations to adhere to certain standards properly and meticulously. We anticipate that a discussion will unfold and that we will continue discussion of the possibility of a new international mechanism to respond to complex accidents. This should apply not only to the nuclear industry, but to other complex industries as well. After all, there have been, in fact, three serious accidents in the last two years that were related to energy production. I am speaking of the Gulf of Mexico, the Sayano-Shushenskaya Dam, and Fukushima-Daiichi. We hope that the conventions on mutual information will gain more respect as a document, and that the signatory countries will strictly adhere to their obligations. Although, of course, it is now often mentioned that in the first days of the crisis the IAEA was unable to perform some of its functions and could not provide sufficiently precise information to international organizations and member countries regarding what was going on at the nuclear plant. But I assure you that I was involved in these events almost from the first hours of the accident, even when all that had occurred was the earthquake; our agency crisis centre was activated and we began work on analyzing information and gathering information almost immediately. We believe that all possible information that we could obtain at that moment from the Japanese Ministry of Foreign Affairs, from NISA, from TEPCO, was received, while some clarifications did in fact arrive later, but at that moment the IAEA had all possible information that was available during the catastrophe. On that same Monday, we held our first briefing and presented all the available information to the member countries. But here a structural question arises: in cases involving major crises, is it really the case that all information of concern to member countries and neighbouring countries is available? Perhaps we really need those

same powers of international response that will assist both in responding to accidents and in identifying all of the problems that arise during the accident response, as it develops. This is a very important question, and we must learn lessons from this as well. IAEA has extensive experience in working with nuclear materials, in the area activity known as 'safeguards' in English. I believe that my colleagues at the agency also share my opinion that in certain aspects of nuclear safety in the broad sense, i.e. both nuclear safety and security, we really can organize an international operation that would approach a kind of executive mechanism. And I very much hope that the conference happening a few days from now will produce a resolution stating that such mechanisms must be developed.

In addition, I would like to emphasize that the set of measures to be taken and the list of lessons is quite clear, moreover having been discussed in some depth at a high political level. The proposals made by President Medvedev and President Sarkozy essentially encapsulated the proposals that have been made by IAEA member countries and other countries with a vested interest in the development of this process. I therefore hope that the IAEA will be given new powers in the wake of this crisis and will be able to conduct monitoring activities at a higher level, with regard to all areas of safety and security related to nuclear energy production.

B. Richardson:

Thank you. Thank you very much.

Let me turn to Ambassador Hamad Al Kaabi who is the Ambassador of the United Arab Emirates at the IAEA, and this country, as everybody knows, is a major oil producer, which has also established in the renewable energy agency sector a remarkable entity in Abu Dhabi. But I would like to have you explain briefly your experience, your nation's experience, with nuclear power.

H. Al Kaabi:

Thank you very much. I think the case for nuclear power was determined based on both commercial evaluation, as well as the environmental case for nuclear power, in addition to other factors related to security, supply and other socio-economic impacts of nuclear power to the UAE.

Before Fukushima, the case for nuclear power was reliable proven technology and reliability that is competitive, both commercially and environmentally.

Today, after Fukushima, the case is the same as many other countries. So the UAE government, from a policy perspective, continues to see nuclear power as a significant part of the future generation mix. Of course, we believe that nuclear power should come with responsibilities, and there are some real commitments that the government has to take, in terms of maintaining the high standard of responsibility.

And today nuclear safety forms the basis of discussions at a high political level. After Fukushima, it only emphasized the need for governments to take a very responsible approach, but also a very transparent and committed approach, from both the government policy perspective, but also establishing the right infrastructure to support it. I am trying to be brief, I do not want to say any more.

B. Richardson:

You have been. Thank you for being brief and succinct.

Let me go to Mr Tapio Kuula. I think everybody knows that Fortum operates Loviisa, the nuclear power plant that I guess is considered the safest in the world. What would you say to those that are opposing nuclear energy right now?

T. Kuula:

Yes Mr Chairman. We really built the Loviisa power plants together with our colleagues from Atomenergoexport, and as you said, the track record is very

good. Fortum has overall ownership in 11 different nuclear power plants. Six of them being in Sweden and five in Finland, and one is under construction.

I can say that I feel that we have heard many reasons why the world certainly needs nuclear power, climate change being one issue, growing demand for electricity being the other one. But I think that we also have to be humble in that respect, that after Fukushima, the world is not the same for the nuclear power industry.

And I think that we are pragmatic in Finland, we have had very high criteria all the time, as well as very demanding rules, and I think that, at the end of the day, that has been very beneficial for the whole industry in Finland, also for availability, etc.

But at this point in time, I think that the whole industry has to be ready to listen carefully to public opinion and also be ready to have a rethink. And, of course, safety is the number one issue for us to consider, and certainly we need more passive safety for reactors, but I would just test that we would also be ready and open for thinking, for example, whether we should—and the industry should develop—smaller, compact, standardized, I would say, half ready-made nuclear power plants, because with those one could act stepwise on the capacity and I think that we could significantly—and I really mean significantly—reduce the time of construction. And, of course, they would also be much easier to manage in extreme circumstances and, of course, this is coming from Finland and from Nordic countries, where district heating is important.

I would also very much prefer that always, when there is district heating available or in an intensive industry available, we would combine CHP nuclear power plants in the picture, so that we will produce heat and electricity at the same time and increase energy efficiency significantly. Thank you.

B. Richardson:

Thank you very much.

I would like to turn now to Mr Mikhail Abyzov, the Chairman of the Board of Governors of JSC Group E4 for his contribution.

M. Abyzov:

Thank you very much, Mr Chairman, and also to today's speakers for their exhaustive analysis of the current state of the nuclear industry and nuclear energy in general after Fukushima. Our company is actively involved in the design and construction of nuclear energy facilities not only in the Russian Federation, but also abroad (in Ukraine and Vietnam). And as one of the parties implementing these projects after Fukushima, we fully understand the reaction of our clients and partners to the events, to the tragedy that occurred. The world has undoubtedly changed, and changed greatly; it is not the same as it was before Fukushima, but it is important that our conclusions be the right ones. The two themes put forth by Mr Tanaka can be expressed in the following words: we must be pragmatic. Mr Tanaka stated that we must avoid extreme judgments. And I believe this is the most important thing that must guide those in the market, of nuclear energy construction, and operators in the near term. All of the speakers reached a consensus: there is no future without nuclear energy. The question is, on what scale should it be used, and how we can ensure that it is used properly. The Fukushima tragedy tells us that it is not important whether a crisis occurs at one unit or a hundred – the safety criteria and requirements must be the same either way. This means that the development of nuclear energy will be accompanied at the same time by a strengthening of safety requirements. There is a place here for the companies that invest in this industry, and also for governments. For companies investing in the nuclear industry, it is important at this point to comply with the most stringent requirements and standards, and to make these even more stringent, in light of what we have learned from the Fukushima tragedy. While new construction goes on, it is of no small importance to do an enormous amount of work on modernization and upgrading equipment

at sites currently in operation. For governments: this was not mentioned in today's discussion, but I believe it is extremely important for governments to support additional insurance for risks borne by both nuclear operators and consumers located in the construction zones of nuclear plants. The consumer must feel that he is protected by insurance companies and by governments, in all cases involving the operation of nuclear sites. This reduces the extent to which this issue becomes politicized, because it is clear to everyone that the decision made by Germany was certainly a politicized decision. Germany has already ceased operation of seven units and an eighth will be taken offline in March. This represents a 40% reduction in nuclear energy in Germany. They arrived at this in a streamlined manner. The decision was absolutely motivated by politics; this is Germany's strategy. They have the necessary financial capacity. They are preparing to spend EUR 40 billion by 2020 to replace nuclear energy with renewable energy sources. They have the budget for this, but many countries are not able to afford expensive energy sources. At the panel on global energy security today, Mr Tanaka stated, "Resource costs will increase, and increase dramatically". There are many places in the world where it is simply not logistically possible to provide an energy supply for consumers, and these places require either a nuclear solution or, if the economic situation allows, renewable sources – solar and wind. And so this requires a pragmatic approach and a balanced set of solutions, along with a strengthening of requirements regarding risk and safety.

B. Richardson:

Thank you, thank you very much.

We will now go to Mr Andrej Timofeev, Partner of BCG, Director of Atomic Energy Practices in the CIS, and to Tony Ward. He will be the last one, because he is in the predicting business. Ernst & Young is a distinguished company that

tells us what is going to happen in the future, so I am going to save him for last, so I will now go to Mr Andrej Timofeev, for his comments.

A. Timofeyev:

Thank you, Mr Richardson. A few words to probably add some topics that have not yet been put forth today. I would like to focus on three things. First of all, to add to the theme of 'lessons of Fukushima', to speak a bit about globalization and international cooperation, and then to talk about the role of governments, as was promised at this round table.

First, more about lessons of Fukushima. We at BCG are largely focused on successful business models for companies, and we now understand that in the coming years the integrative business model will gain in strength. What does this mean? The level of integration will vary, but especially in nuclear energy, we see that integrated companies will be more successful and better able to meet safety requirements. This pertains especially to integration in construction, operation, engineering, and reactor construction.

The second major topic that was not discussed very much today is that of increasing the role of the back end throughout the nuclear industry. We say that first and foremost the back end is the starting point for growth in the nuclear industry. What are we talking about? This means setting parameters for fuel and future generations of reactors to address the issue of spent nuclear fuel. We are talking about unloading pools for wet storage of SNF, about the certitude in many countries with regard to a permanent solution to the spent fuel problem, and we are talking about decommissioning facilities.

The final topic is the shift in technological parameters that is affecting the production profile of a number of players in the industry. First and foremost, we are talking about development of fourth generation reactors with various passive safety features. We are talking about floating nuclear power plants. But the topic of globalization and international cooperation is very important. This is the basic

condition for development of nuclear energy throughout the world, not only when it comes to safety, but also when it comes to development of international programs related to the nuclear fuel cycle. Most importantly, this is the International Nuclear Fuel Bank, international cooperation for a permanent solution regarding spent fuel.

And the last thing is cooperation on research and technology. It is very important for us in Russia to advance research in the future with regard to closing the fuel cycle, particularly in fast-breeding reactors. The important issues here are the selection of a cooling medium and achieving goals in reactor economy. And the role of government in the future development of nuclear energy will be crucial. In countries such as Russia, it will be necessary to urge the government to nurture integrated national champions in each segment of the nuclear energy market. The problem of succession requires an urgent solution and urgent attention, and an urgent institutional regulatory model for the back end must be created. We must clearly delimit the rules of the game and the areas of responsibility, and we must have legislative documentation of the funds reserved for SNF, radioactive waste handling, and for decommissioning. The government will also play a very important role in stimulating the development of new technologies. Thank you.

B. Richardson:

Thank you. Now, to Mr Tony Ward, the question is: is there going to be a nuclear renaissance, a nuclear pause, or a nuclear...? You tell us.

T. Ward:

Thank you very much, Chairman.

I think we have heard very clearly in the presentations this afternoon the reasons why I believe nuclear new builds will continue to be a very important part of the mix going forward.

I think we cannot afford not to have nuclear power in the mix for reasons of sustainability, economic viability and security of supply, which we have been talking about.

I think there is also a very clear urgency and imperative. Alternatives are not available. They are not available at scale, they cannot meet the basic needs that we have globally and they are clearly not economic to deliver.

But, having said all of that, I do think that it will be critical for the industry to acknowledge and learn lessons from the Fukushima incident. I sense that we will continue to find out more and learn more about the incident as the next months go by.

And one issue that we have not spoken about is, actually, how the new-build reactors will be financed. This will plan out differently in different parts of the world and it will depend very much on the local legislative and regulatory environments.

I think what we need to focus on is ensuring that we do not think that nuclear power has simply earned its place in the mix of the future by default, but it positively takes steps to improve its position. And I think that it will be very much dependent on learning the lessons which emerge from the Fukushima incident, but also dealing with, perhaps, some of these issues, in which we have not been quite so successful in the past.

And two particular points I would make is that I think collectively, as an industry, we need to work on openness, transparency and communication with our very many different stakeholder groups. I think there is more that we can do to build and rebuild confidence in that respect.

And finally, I think that the world expects the industry to demonstrate that it can deal with the waste and decommissioning liabilities that arise from committing to more nuclear builds.

And my sense would be that there needs to be a renewed focus on clearly demonstrating on the global level that we are capable of extinguishing those

liabilities and dealing with the back-end risks. Because I think that will be critical to enabling and encouraging the wave of new builds, which I think is what we are hearing today, and should necessarily remain convinced of it.

B. Richardson:

Thank you very much. Thank you.

We are now going to go to the concluding comments by our panel and then we will vote. You all have your little machines, but first, let me go with Mr Proglia first for his concluding comments.

H. Proglia:

In a few words, there is room for nuclear power regarding the need of energy in the world tomorrow.

There is basic acceptance for nuclear. Some countries have proven it, beginning with the US or Great Britain, for instance, even after Fukushima, under the condition that safety and evolution of the technologies make it possible for people to accept nuclear as part of the additional mix, not exclusively but part of it.

Now, nuclear would be limited to some countries, because it is not accessible to all the countries, of course, not for economic reasons, but for technology and reasons linked to technology and the ability of the people to operate in this industry.

But, again, if we want to succeed in unveiling the issues and to give almost everybody in the world access to energy, knowing that electricity will be the fastest-growing energy of tomorrow, because of urban needs, in particular, and the development of the newer applications of energy, like IT and everything, which all require electricity and mobility, for instance, then even if we do develop largely renewable energy as part of the energy mix, we still have a significant need to develop the nuclear side of things. So, everything is linked to the

conditions under which nuclear power is acceptable in all the countries where this industry will have to develop or will be developed.

And this is linked again to technologies, to the skills of the operators, to the ability of the industry and to the presence of international organizations, as part of the overall answer of safety and regulations that have to be reinforced. And again, the regulator will play a significant part in this, together with politics, to the development of nuclear tomorrow.

B. Richardson:

Thank you. Professor Laaksonen?

J. Laaksonen:

Thank you. Well I would like to echo what several speakers said in quoting Messrs. Kirienko, Kuulo and Timofeev, that the industry should move—in parallel with it developing the current reactors—towards a new technology, towards new reactors and targets to develop small-size fast breeders and an integrated fuel cycle.

This would provide us with several benefits: safety benefits, reasonable investment costs and—what is most important—with less availability of uranium. And at the same time, this could also help to resolve these back-end problems when you develop the fuel cycle for those reactors.

We already have seen such reactors a long time ago. We have the Phoenix, Soviet Union had the one at the Caspian Sea and this technology should be brought back and improved to make it more economical.

B. Richardson:

Thank you very much. Director Tanaka?

N. Tanaka:

Thank you. From what I have heard, it is obvious that we need to maintain the nuclear option. Of course, each country can decide their, let us say, choice. But as a group of countries like the European Union or the global community, we need this option; it is obvious.

But certainly, the energy issue is getting lots of attention and politicization. Emotional reactions always occur. It is quite unfortunate.

So as an international community, certainly an international organization like us, the IAEA, should play a very important role to make an objective observation and analysis, and contribute to each government's or country's discussion. And that is our role, and we wish that by these discussions, we would come to a very objective and longstanding decision for the future.

Otherwise, emotional discussion comes back all the time with small difficulties. And changing the course, it is a huge cost for the future and we cannot afford that. And for that, yes, this Fukushima incident is certainly a very difficult one, but as many of you said, we can learn a lesson. It is a huge lesson, and we will come back from these lessons, and that Japan can do that.

B. Richardson:

Let me turn now to our host, Dr. Kirienko, who has come up, probably, with the most serious proposal of international standards after Fukushima, and who has been our host, to make his concluding remarks.

S. Kirienko:

Thank you very much. I would probably add one thought: Mr Abyzov was right to note that the issue today is more one of scenarios. Nuclear energy will certainly exist. But what are the scenarios for its development?

I would like to say the following. Today we have examined what is likely a conservative scenario for the development of nuclear energy, and this is understandable: the emotional situation on the backdrop of the developing

tragedy at Fukushima and the subsequent decisions of Germany, Switzerland, and Italy, of course, push us from a purely psychological standpoint towards the most conservative scenarios. But in even the most conservative scenario, it is clear that we have a great deal of work ahead of us. And, incidentally, this conservative scenario seemingly leads to, among other things, what my colleague Mr Proglia mentioned: the number of participants will decrease, because some of those who planned to get into nuclear energy will now decide not to, since for them this will be too expensive to take on. And so the burden on those that remain will not only not be lessened, but might even increase. And this is the most conservative scenario.

I will try to take a slightly more optimistic view, and I believe there are at least two reasons why this is justified. The first is this: if you take a look and compare the map of nuclear energy development programs and the map of current decisions to suspend, slow, or cancel programs – they do not overlap at all, because the decision to end nuclear power has been made by countries that, in all honesty, had not made any decision to develop nuclear energy, but were merely considering it. It was accurately stated that Germany was planning to decommission nuclear power plants, and then thought, “Well, maybe we will not do that?” And now they have decided: no, we will decommission them. Italy was not in the process of developing nuclear energy, but was just asking the question, “Should we start development?” Then they said, “No, we will suspend that.” But the main factor in the scale of development in the nuclear industry worldwide in recent years and the work for the future in these programs is from such countries as China, India, France, Russia, the United States, and a number of countries in southeast Asia. None of these has yet decided to cancel programs for development of nuclear energy. So we have reason to believe that the picture may also be more optimistic, just because those making the largest contributions will be continuing their development programs. And the second factor that I would like to add from the optimistic point of view is this: everything that we have

analyzed here is absolutely correct, if we base our assumptions on the current generation of technologies. If we think on the scale in the next 5 to 10 years, there will be no changes in technology in that time. But if we are talking about 2030–2035, as in the presentation and analysis of Mr Tanaka, then there we might see dramatic changes in technology, because the emergence of a new generation of technologies based on natural safety, which provide large-scale solutions to the problems of safety, the amount of waste, and non-proliferation, by transitioning to the use of natural uranium – this might all change the situation drastically. Of course, this will not happen instantly. This is probably a prospect for the 2020s. The transition to this technology and the shifts in public opinion, the latter displaying a readiness to accept the fundamentally different level of reliability and environmental safety, will take about ten years. But if we focus our efforts on this today (and we believe this is one of the most important, if not the quickest, conclusions from analyzing the state of nuclear energy after Fukushima), then in the 2030–2035 timeframe the picture might look quite different. Thank you.

B. Richardson:

Thank you. Please give him a big hand, because he has been our host and has organized this panel, and we appreciate it. I am going to make some concluding comments, and then we are going to vote. I am going to ask Mr Benson to administer this vote here that we are going to do shortly. But what I would like to just say is, obviously, the expertise here is astounding from not just our panel up here, but our seven experts who spoke.

I think what is clear is that the nuclear energy sector is going to need to regain the trust of public and policy makers after Fukushima. And government and industry and regulators have to be prepared to answer the tough questions, as plants and operations are going to be more closely scrutinized around the world.

But what we have to do is recognize that these discussions have to occur in context.

The underlying logic of nuclear power is really not fundamentally changed by recent events. Nuclear energy is still cost-effective. It does not emit greenhouse gas emissions. If you want to avoid climate change, you are going to want nuclear power. It is an emission-free source of energy, in a world where climate concerns and better quality of life are important. Growing populations around the world are going to depend on more access to energy. Demand is going to rise by 65% for energy by the year 2035, and meeting that challenge is going to require a diverse energy portfolio.

I think if you look at the energy portfolio, nuclear energy's performance over the years compares very favourably. In fact, nuclear technology has steadily improved. It has been getting more efficient, more cost-effective and safer every year. But at the same time, as the technology and efficiency is improved, legitimate questions have been raised about the rigour and consistency of plant operations. What seems to be clear is what Dr. Kirienko has proposed, and I am just going to openly advocate this.

I think we need some type of implementation of global standards that are embraced by all operators. This is going to be an important debate in the future. Obviously, nuclear energy has good short-term and long-term benefits. Investment in nuclear energy is going to continue to be essential. In the long term it has been overlooked that nuclear energy technology is an essential platform, if we are going to achieve longer-term energy goals as an international community. So we need bold visions for the future. A hydrogen economy and fusion energy are less likely to be realized without a robust nuclear technology base. So I would ask Mr Benson to come up here and explain the vote. I would also, to the staff—I know two gentlemen from Spanish Energy here—they should be watched, because they vote in a funny way. See, I woke them up. They are my good

friends, so I know them. So please watch them as they vote. But let me go to Mr Benson and please explain what we are going to do now.

M. Benson:

Okay. Thank you, Mr Secretary. We have, for you, a three-question survey and I believe it is going to be depicted up here in the screen. So question one is: What is your opinion? Is it a necessity to impose IAEA recommendations in the area of peaceful use of atomic energy and should it be obligatory for all States?

A 'yes' indicates that you believe that to be true; a 'no' suggests that there is a de facto agreement with those standards, anyway. And if you have another opinion, please so indicate. So on your clickers there, one would be a 'yes', two would be a 'no'... other answer. Okay, pretty strong agreement with that proposal. We will give you about ten seconds before we close the voting, for those of you who might change your mind.

Okay. Let us go ahead and close the vote. And that is a very strong endorsement for the notion that the IAEA should be directly involved in creating standards.

Next question please. Okay. Do you consider the establishment of an international emergency response for, say, a sufficient measure capable to enhance the transparency in accident mitigation? Very straightforward. Do you believe that as a sufficient response, insufficient response, or do you have another opinion?

Okay. Much less of a consensus here, probably because we would need a lot more information about what that emergency response system would contain. So, let me compliment you, audience, on the good bit of scepticism. I was thinking the same thing myself: 54 to 42. Thank you, very much. Next question, please.

Do you think it is necessary to establish clear international rules, with respect to fastness, scope, and regularity of notification on the NPP safety and significant events? So do we need to have international rules with the way notice of these

events is produced and how that information is disseminated? A 'yes' would indicate that, because modern information would delay notification and lead to growth and suspicions. 'No' would indicate that previous international conventions on early notification are sufficient enough. Okay, so a very strong endorsement here for a 'yes' to an international set of rules with respect to how this information is disseminated.

Thank you very much, Mr Chairman.

B. Richardson:

Thank you. Well, let us give a big hand to all the panellists and the experts and please note that the Dr. Kirienko's proposal got 94.5%, so maybe that is what we should all do. Thank you all very much.