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Securing the Future
NUCLEAR POWER: ONE YEAR AFTER FUKUSHIMA
Panel Discussion

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In cooperation with State Atomic Energy Corporation Rosatom

Moderator:

Michael Suess, Member of the Managing Board, Siemens AG

Panelists:

Denis Flory, Deputy Director General, Head of the Department of Nuclear Safety and Security, International Atomic Energy Agency (IAEA)

Sergei Kirienko, General Director, Rosatom State Nuclear Energy Corporation

Henri Proglio, Chairman, Chief Executive Officer, EDF

Taner Yıldız, Minister of Energy of Turkey

Front row participants:

Vladimir Asmolov, President, World Association of Nuclear Operators

Christine Marin, Chairperson of the Sub-Committee on Environment and Energy, Committee on Social Affairs, Health and Sustainable Development, Parliamentary Assembly, Council of Europe

Jan Mladek, Director, Institute for Applied Economics

Pavel Poc, Member Committee on the Environment, Public Health and Food Safety, European Parliament

Andrei Timofeev, Partner, Managing Director, The Boston Consulting Group

Dr. M. Suess:

Ladies and gentlemen, I am pleased to welcome you all to the opening panel discussion for this year's St. Petersburg International Economic Forum. The subject of today's discussion is, I would say, a really significant question about nuclear power, one year after Fukushima. It is a pleasure for me to introduce the panel participants. Today's speakers are, to my left, Sergei Kirienko, General Director of Rosatom State Atomic Energy Corporation; Denis Flory, Deputy Director General of the Department of Nuclear Safety and Security at the IAEA; Taner Yıldız, the Energy and Natural Resources Minister of Turkey; Henri Proglio, President and Chief Executive Officer of Électricité de France (EDF); and Tapio Kuula, President and Chief Executive Officer of Fortum Corporation.

In addition, participants in today's discussion include Vladimir Asmolov, President of the World Association of Nuclear Operators; Dušan Petrik, State Secretary at the Ministry for the Economy of the Slovak Republic; Jan Mládek, Director of the Czech Institute of Applied Economics; and Andrei Timofeev, Partner and Managing Director of The Boston Consulting Group, Russia.

I have been given the opportunity to make an opening statement before the gentlemen here have the chance to answer what I believe to be some very interesting questions. Prior to March 2011, nuclear power was again on the rise, and even our company considered strengthening its operations in the industry. There was even talk about a global nuclear renaissance. At the time, over 30 countries had declared their intention to build new nuclear power plants. However, after the devastating earthquake and tsunami in March 2011, the disaster at the outdated Japanese nuclear power plant in Fukushima shocked the world. Fukushima quickly became a crisis for the global nuclear industry itself, with authorities throughout the world beginning to reassess their nuclear plans. Some countries, like my home country Germany, but also Italy, Belgium, and Switzerland, immediately altered their energy policies following the Fukushima catastrophe. Most prominently, in Germany, the shift in policy was radical, and eight nuclear power plants were soon shut down permanently. In Italy, a public referendum rejected the country's

plans to exploit nuclear energy, and both Switzerland and Belgium put their nuclear plans on hold.

In concrete numbers, the events at Fukushima prompted the cancellation of plans for 25 gigawatts of new power plant capacity, primarily in the USA and Japan. China postponed 37 gigawatts of new capacity to a later date. Most countries, however, remained calm and maintained their expansion plans. In Europe, these countries included Russia, Britain, Finland, France, and most of the Central European nations. Turkey is continuing with its plans to enter the field of nuclear power generation, and China has since confirmed its ambitious nuclear construction programme after a one year moratorium, during which all plans in operation and under construction were subjected to safety reviews. In the USA, construction licences for four blocks have been approved in the last year. India, which, after China, is the country with the biggest nuclear power plant construction programme, has also announced no changes to its plans. The situation in Japan is of course the most difficult to evaluate. The future of nuclear power in Japan remains highly uncertain at this point. Last weekend, the government approved the reactivation of two reactors. Another reactor should follow by the end of July. Worldwide, around 400 nuclear power plants are currently being planned or under construction, which is equal to the existing fleet of some 435 nuclear power plants. The share of nuclear power in the global energy mix has remained relatively constant at 13–14% over the last 20 years.

I am convinced that nuclear power will remain an important carbon-free source of energy, but it alone is not enough to satisfy global energy demand and, with regard to economics, nuclear power is and will remain a technology that demands high investments and very long planning times. These conditions alone are today prompting many countries to think of alternatives to nuclear power for their energy mix, although Asian and Eastern European countries are sticking to their plans.

I would now like to open the panel discussion with what is perhaps a rhetorical question: what are the factors and conditions for further developing nuclear energy? How will the relationship between renewables, fossil-fired power plants, and nuclear

power develop? Will they compete with one another or complement each other? We are all interested in hearing our panelists discuss these questions. Afterwards, I would like the audience to vote on the discussion topics using the portable devices that are available at your seats. Just to inform you, if the device is off, you push the red button, then wait for the question with the numbers, and then type the number in next to the words.

Our schedule for the next 90 minutes will be as follows: the speakers at the podium have ten minutes each to speak and participants in the debate will be allowed approximately three minutes for their statements. I will keep track of time so that there is enough time for questions from the auditorium and from the public here.

The first speech will be made by the General Director of the State Atomic Energy Corporation, that is to say Rosatom, Sergei Kirienko. Mr. Kirienko has extensive experience in the energy industry. In 1997, he headed the oil company NORSI-Oil, and then served as First Deputy Minister and later Minister of Energy of Russia. In 1998, Mr. Kirienko became Prime Minister of Russia. From 2000-2005, he served as the Presidential Envoy to the Volga Federal District and, since the end of 2005, he has led the Russian nuclear industry, launching large-scale reforms and successfully establishing Rosatom in its current form. Mr. Kirienko, please.

S. Kirienko:

Thank you, Dr. Suess, and thank you, colleagues. I am pleased to welcome all the participants to our round table.

In addressing the task that our moderator has set for us, I recall that in this very room one year ago, at the last St. Petersburg International Economic Forum, immediately after the events at Fukushima, we discussed what Fukushima would mean for the nuclear power industry. There was a range of estimates then, some of them diametrically opposed. Perhaps the most pessimistic view was that expressed by my esteemed colleague Mr. Tanaka, Executive Director of the International Energy Agency. His forecast was that the number of new power-generating units on the horizon to 2030–2035 would be reduced by half after the events at Fukushima.

Whereas in 2010 the International Energy Agency's estimate was 360 gigawatts of new power-generating units, its estimate for the past year would be reduced by half, to 180 gigawatts. This was perhaps the most pessimistic estimate expressed at our Forum, made by a very professional and well-respected agency that is more than capable of doing these calculations.

What has actually happened over the past year? Today we can assert that these pessimistic estimates were not justified. I have not seen the new estimates of the International Energy Agency for 2012, but we do have the estimates of the World Nuclear Association and the IAEA, and they all show roughly 300–340 gigawatts of new capacity on the horizon, which is less than the pre-Fukushima forecasts. However, it is not half as much, but 10–12% less. That is quite a big difference. Thus the pessimistic forecasts about changes in nuclear energy development programmes are far from having been confirmed.

I fully agree with Dr. Suess that the situation in different countries is very different. Some countries actually decided to cut their programmes, not by half, as in Germany, but completely, 100%. There are other countries that decided, after Fukushima, not only to keep nuclear energy, but either to launch such a programme if it had not existed prior to Fukushima, or to significantly scale up the existing programme. The United States is one such country. As Dr. Suess said, the United States has issued its first licences in many years for the construction of new nuclear power plants. Another example is Great Britain, which has adopted an ambitious programme and launched it since Fukushima. There are quite a number of countries that previously had no experience with nuclear power. We have with us today my esteemed colleague Mr. Yıldız, Energy Minister of Turkey, and I would like to note that the nuclear energy programme announced by the Turkish Government can only inspire the greatest admiration and respect. Several other countries have gone in the same direction. Why is this happening? Why have the pessimistic forecasts not come about? Why are there such different attitudes and such diverse decisions?

In my view, there are several reasons. The first involves technical considerations, and the assessment of the real threat that Fukushima demonstrated to the world

and the world nuclear community. We have had to deal with some fundamentally new technical requirements, some new challenges: not due to technological conditions, but rather because of a terrible natural disaster. A year ago, the question was still being asked: did this natural disaster pose any insurmountable technical requirements for nuclear power? Or would we be able to overcome them? I think the most important factor that has affected the situation as it has developed a year after Fukushima has been the calm, careful, authoritative analysis of what actually happened at Fukushima.

I see before me Mr. Asmolov, who was working last spring at the Tokyo centre of WANO (the World Association of Nuclear Operators). After receiving permission from the Government of Japan, a few months ago I was able to visit Fukushima-1 and see how the work was going there. I returned with two strong impressions. The first was admiration for the courage and professionalism of the people who are working there today and are dealing with the aftermath of this natural disaster. The second, stronger, impression had to do not with the condition of the first four units (I knew a lot about them before taking the trip), but rather of the fifth and sixth units at Fukushima-1, units which had been built essentially as part of the same project as the old units, designed long ago, built before the Chernobyl accident. They had not been built to meet the requirements that the entire global nuclear industry has followed since Chernobyl. These two units are completely operational. They were hit by the very same earthquake, the very same 15-metre-high tsunami, and yet they are completely functional. What was the difference? That was my main question. There are basically two significant differences. First, they are located two or three metres above sea level, and second, the automated control system for their emergency diesel generators is not in the basement below the generators, but on the roof, above them. That is all. Two metres above sea level and automated controls raised above the emergency diesel generators. And a 15-metre tsunami and a maximum-strength earthquake did not wreck the functionality and safety of these units, which, remember, are very old, designed long ago. But this is technically a problem that is absolutely possible to solve, even for old designs.

Therefore, the main conclusions that can be drawn at present are these: there are no insurmountable technical problems in ensuring the safe operation of nuclear reactors, even under such extreme natural conditions as were experienced at the Fukushima nuclear power plant last year. This can also be achieved with respect to currently operating units, as stress tests carried out in all countries have shown. It is very important that these stress tests were held openly, with free communication between those involved. In my view, that also affected the public's confidence in and attitude toward nuclear power. In our country, when we conducted these stress tests, other specialists and our partners – from Électricité de France, for example – also took part. I would like to thank my colleague Mr. Proglia for the valuable assistance of experts from Électricité de France. Experts from the World Association of Nuclear Operators and the IAEA also helped out. We sent the results of these stress tests not only to the IAEA, but also to the EU, although we are not members of the European Union. These stress tests showed that the compensatory measures for existing power plants are perfectly realistic. I am pleased to be able to inform you that we in Russia have almost completed them. On June 30, we will have installed the last additional emergency diesel generator and additional water supply systems. At all the plants we have duplicated these systems repeatedly, even though we know that there is no risk of such an earthquake, and a tsunami is impossible. Nevertheless, we have implemented these post-Fukushima requirements at all currently operating plants. Most importantly, if the post-Fukushima requirements are so easily attainable at currently operating plants, then they can definitely be implemented at new plants, from the standpoint of the technology. These kinds of projects are not just on paper (although that is important); they have already been implemented in metal: you can touch them; you can physically convince yourself of their safety. Therefore, the first answer is that, technically, there is no insurmountable challenge for nuclear technology; the problems are soluble.

The second reason that the pessimistic predictions were not borne out, is the demand for electricity. It is obvious that forecasts of global growth in energy consumption, especially for electricity, have not fundamentally changed, despite all

the predictions of what the crisis would bring, despite all the instability in the European Union. The magnitude of these forecasts speaks for itself.

The US Department of Energy reports that before the crisis, world consumption was 19.2 terawatt hours. The forecast for 2020 is 25.4 terawatt hours, and by 2030, it is set to reach nearly 31.9, almost 32 terawatt hours. That means it will almost double. The world demand for energy will inevitably rise. Here, I think a very important factor is that both the decisions on nuclear energy and the demand for electricity have very differentiated natures in different parts of the world and in different countries. I am quite sure that those factors are related. There is demand for energy in the world as a whole, but it is also very differentiated. There are countries where the limited access to reliable, cheap sources of energy is a key constraint on economic growth, a key constraint on combating poverty. It was in these countries that the demand first arose for large-scale development of nuclear energy.

Thirdly, there is the issue of whether this demand for energy can be met without nuclear energy. There were, of course, high expectations for renewable energy sources. I am an optimist with regard to renewable sources of energy, and I believe they will grow. This is certainly true, but they have important limitations. First, only very wealthy countries can afford large-scale expansion of renewable sources today; such expansion requires substantial support and substantial subsidies: not just the direct subsidies that are provided today, but also large-scale subsidies for infrastructure. As soon as the share of renewable energy reaches 15–20%, there will be a need for massive investments in infrastructure so that the energy system can handle those new sources.

I have nothing but admiration for another factor that has had a powerful effect during the past year: the way the shale gas programme was implemented in the United States, resulting in a several-fold decline in natural gas prices: very impressive. But on the other hand, an analysis of the past year shows that while this is a very important factor for certain countries, it is unlikely to radically change estimates of energy supply and demand in the world as a whole. Not every country has access to shale gas; not every country has sufficient territory to cope with the ecological

demands of the large-scale use of shale gas, notably in terms of water pollution and water resources in general. And not every country has the money required to start up these technologies.

Thus, it seems to me that we can conclude the following from the year since Fukushima: there has been a certain decline in the pace of development of nuclear energy, but it is within the limits of tolerance, in the order of 10%. The scale of nuclear energy development as a whole is being maintained, but it is very much differentiated by country. There will be a shift in nuclear energy development programmes, primarily towards the more dynamically developing countries that have more limited resources and a deficit in electricity consumption, as well as countries that cannot currently afford extra investments to support the promising trends of the future.

What does this mean to countries with the full range of technology and companies that provide their services in this market? A more comprehensive approach is needed. We will have to provide our partners and customers not only with individual technologies; we must provide a 'turnkey' set of technologies. This will include post-Fukushima safety technologies, operational experience, authoritative guidance on safety decisions, assistance with staff training and operation, improvement of legislation, dealing with the reprocessing of spent fuel, decommissioning, integrated solutions to environmental issues, and dealing with public opinion. I believe that such a comprehensive approach will ensure the sustainable, reliable development of nuclear power in all those countries that have now opted for a significant contribution from nuclear energy in their energy balance.

Thank you.

Dr. M. Suess:

Thank you, Mr. Kirienko. As you mentioned in your statement, nuclear power plant safety has become the focus of public attention, especially after the Fukushima disaster. One of the first initiatives to amend international law was taken by Dmitry Medvedev, and the EU Commission also ordered so-called stress tests to review

the safety of all nuclear power plants operating within the EU. Fortunately, the results were very positive. The IAEA also had to deal with a very turbulent year, so I would now like to call on the Deputy Director General of the Department of Nuclear Safety and Security at the IAEA, Mr. Denis Flory. Mr. Flory has dedicated his entire professional career to the development of nuclear power, with a special focus on fast breeder reactors. His career has led him to jobs in the Soviet Union, Britain, and modern-day Russia. He has been working for the International Atomic Energy Agency since 2010.

Mr. Flory, what kind of impact has Fukushima had on the work of the IAEA? What measures have been adopted by your organization concerning nuclear power plant construction since then? Are there already concrete results, such as stricter safety recommendations for new projects? In which regions will nuclear power grow most rapidly and where will the share of nuclear power in the regional energy mix decline? Mr. Flory, please.

D. Flory:

Thank you and good morning. The accident at Fukushima Daiichi was a wake-up call, reminding us that nuclear accidents can and do happen. It further reminded us that, when it comes to nuclear safety, we cannot take anything for granted. Our common goal at the IAEA, as well as in the wider international community, is for nuclear accidents to become less and less likely. Our goal is also that, should an accident happen, all measures for minimizing the consequences are to be available, exercised, and effective. The accident was a jolt to the nuclear industry and to regulators and governments. It was triggered by a massive force of nature, but it was existing weaknesses regarding defence against natural hazards, regulatory oversights, accident management and emergency response that allowed it to unfold as it did.

Several countries are today planning to embark on new nuclear energy projects and this confirms our assessment in the IAEA that nuclear energy remains a valid option for many countries as they consider their future energy mix, with a view, inter alia, to

reducing their carbon emissions. Our records show that, in 2011, 13 reactors were indeed permanently retired, 12 of which were as a direct result of the accident. There were still several new grid connections, and it was the third straight yearly increase, but construction was started on only four new reactors. Nevertheless, the Agency's projections suggest that the drop in construction might be temporary and, indeed, there were 65 reactors under construction at the end of 2011, 44 of which were in Asia, which remains the centre of growth.

What did we do in March 2011? At 06:42 Universal Time, less than one hour after the earthquake struck the east coast of Japan, we activated our Incident and Emergency Centre (IEC), following notification from our International Seismic Safety Centre of the earthquake, the potential for damage at four nuclear power plants, and also the potential for a tsunami. Following this, our IEC worked continuously for 54 days on a 24/7 basis. Director General Amano visited Tokyo from March 17–19 to express the solidarity of the international community with Japan, to convey offers of assistance to Japan from more than a dozen countries, and also to obtain first-hand information about the accident. He also stressed the importance of the highest levels of transparency.

Concurrently, we sent four successive monitoring teams to Japan, a Joint Food Safety Assessment Team, and a Marine Monitoring Assessment Team to strengthen the activities of the Japanese authorities and provide assistance and expert advice. We shared information from Japan and our various teams with our 151 member states, as well as with the press, through daily briefings on the status of the nuclear power plant and the radiological status onsite and off-site. We then sent the International Fact Finding Expert Mission, which visited Japan at the end of May for a preliminary assessment of the safety issues linked to the accident, to identify areas that needed further exploration or assessment. It reported to the June 2011 Ministerial Conference that we organized in Vienna.

Fukushima confirmed once more that nuclear accidents do not respect borders, with the atmospheric releases detected in both hemispheres demonstrating that the primary responsibility for safety of operators and states that is enshrined in our

safety standards must be backed by an international approach to safety. This lesson and the mandate of the IAEA were the basis for the actions of the Agency during the crisis and led to the launch of the Action Plan on Nuclear Safety, which was adopted unanimously in September. This is the very first time in the history of the Agency that all member states have gathered all the nuclear safety tools together in a comprehensive programme to strengthen the global nuclear safety framework at the international, regional, and national levels.

The accident has raised questions as to the level of consideration given to safety issues for extreme events. In response to this, we developed a methodology for assessing the safety vulnerabilities of a nuclear power plant, based, of course, on our safety standards. We made it available to our member states and, on this basis, we sent an international expert mission to Japan in January this year to review the Japanese approach to what is called a stress test. During the same period, as mentioned by Sergei, national reviews of the safety of nuclear power plants have been carried out across the planet to identify the lessons learned from the accident and potential safety improvements. These reviews were carried out by operators and reviewed by national regulators to identify areas that needed particular attention. In addition, regional reviews have been conducted, for example in the EU and also the Ibero-American region. One key area in our Action Plan on Nuclear Safety concerns the strengthening of emergency preparedness and response. I must say that, in an era of instant communication, the accident demonstrated the need for a stronger role for the IAEA in meeting the expectations of member states and the public. Emergency planning cannot be left to individual initiatives, but must be governed by stringent, well-rehearsed legal requirements, including international conventions that involve all relevant stakeholders, support organizations, and governments themselves. An effective emergency response requires appropriate international frameworks that are built on international standards and guidelines. To this end, I must say that universal implementation of the IAEA Safety Standards on Emergency Preparedness and Response at the national level is crucial. It improves

preparedness and response, facilitates communication in an emergency, and also contributes to the harmonization of national criteria for protective actions.

Today, we are working with all member states to strengthen their emergency preparedness and response mechanisms to ensure that the necessary assistance is promptly made available. We are also working on revising our own Agency emergency response plans. Beyond the heated debates that led to the approval of the Action Plan by our member states, its resolute implementation is now recognized as an essential element of the international response. In proposing greater systematic use of IAEA Peer Review Missions, the Action Plan plays a decisive role in moving towards the harmonization of safety practices and rebuilding confidence in nuclear energy. Transparency and objective evaluation by peers are a key element of the Action Plan, which is a powerful tool that does create an obvious incentive for improvement and meets the expectations of the public.

Ladies and gentlemen, the Chinese expression for crisis, *weiji*, is a combination of two words – danger and opportunity. The experience gained in response to the Fukushima accident provides valuable input for enhancing and harmonizing the global nuclear safety and security framework. I believe that nuclear power plants have already become safer as a result of the measures taken at the national and international level. Safety will continue to improve, but we must avoid complacency at all costs. Our job is not to forget the remote possibility of an accident, but to develop and promote measures to make this possibility as remote as possible. Thank you very much.

Dr. M. Suess:

Thank you, Mr. Flory. Taking on board what you and Mr. Kirienko said, we should look briefly at the world map. We see that China has the largest number of nuclear power units under construction. By my count, there are 27. In general, Southeast Asia is the most promising region for nuclear power, since countries like China, India, South Korea and Vietnam plan to increase the share of nuclear in the energy mix significantly over the long term. However, there are also examples of first

nuclear power plants being constructed much closer to Europe and, in this regard, I welcome his Excellency, the Energy and Natural Resources Minister of Turkey, Mr. Taner Yıldız. Mr. Yıldız has been head of the Ministry since 2009. Prior to that, he served as an advisor to the Prime Minister on energy issues, was a legislator in parliament working on a commission for industry, trade, and energy, and was also involved in budget planning. He began his career in energy companies in the province of Kayseri, where he rose to CEO of Kayseri Electricity Generation Company.

Mr. Yıldız, would you tell us what the energy mix looks like in one of the most actively developing countries and economies? Why have you selected nuclear power as one of the sources of power generation? What are Turkey's plans in this field? You have signed a contract with Rosatom for four blocks at Akkuyu on a build-own-operate basis, which is a new financing model for the construction of nuclear power plants. You are also currently negotiating with other companies on the construction of additional blocks. Why did you decide in favour of this build-own-operate model? Do you think other nuclear power plant suppliers should also adopt this model? These companies would have to bear an enormous capital investment. So there are a lot of questions for your economy and specifically for you, Mr. Yıldız.

T. Yıldız:

Colleagues, government officials, participants, ladies and gentlemen, before I begin my speech, I would like to say how glad I am to meet with you here, and to thank the representatives of the Russian Federation for hosting this Forum. The decisions taken here will definitely have an important impact on the globalizing world economy. Of course, important reports will be presented today. I would like to tell you what is happening in Turkey's nuclear industry. Part of our policy is becoming national. There is significant government involvement in this process. The nuclear power sector's development is being determined by the growing demand for energy in recent years and by the participation of government agencies. We have the

opportunity, after the accident at Fukushima, to assess the major factors that will determine energy policy in the future.

After the accident, some countries completely closed down their nuclear plants. However, nuclear energy is an important part of an overall energy policy. If you want to establish a stable energy system in your country, you also have to be concerned about safety. Currently, 1.4 billion people around the world use nuclear energy, and the demand for nuclear energy is increasing every year, notably in Turkey. We must diversify our energy sources, take the necessary safety measures, and create an appropriate energy policy so that the energy sector as a whole moves forward. We are making these decisions and intend to develop this policy further.

After the disaster, it was suggested that some power plants should be closed, but that is the wrong approach. One country said that it would close all its nuclear power plants after 2031. But if the risk is so high, why wait until 2031? If you look closely, you will see that Turkey views this more simply. We are cooperating with Rosatom; we are building the Akkuyu nuclear power plant in Mersin province. I once joked that we were thinking about closing that plant, but it was only a joke. Currently, 13% of global energy is nuclear energy. We want to launch 12 plants; we have 12 nuclear power projects. We are engaged in talks with Japan, South Korea, China, and Canada. Maybe some other countries will also be interested. Our determination to build the new units is supported by all our citizens, and the entire country. We welcome any company, any country that wants to build a nuclear power plant here, provided it does so in a safe, high-quality manner. Turkey has been developing very rapidly, especially over the past ten years. The whole world knows that Turkey is now one of the most rapidly developing countries. Our GDP has increased threefold over the past few years, so the demand for electricity has also increased threefold. By 2023, we will have to use twice as much energy as we do now. I believe this is quite a reasonable calculation, based on the statistics. Therefore, given the current situation in Turkey and its growing need for energy, the nuclear energy sector is the most important source of energy for us. Just look: after Chernobyl, 144 plants were built; after Fukushima, 63 plants are still being built. And all this is going on in 30

countries, both developed and developing. Half of the world's nuclear power plants are in the United States, France, and Japan. Some say that that it is bad for tourism. Perhaps one of you will give some examples of this. In France, there are 14 power plants in the Loire. Despite the fact that this is a UNESCO Protected Area and an environmentally protected zone, these plants continue to operate and represent no danger to the environment. Notwithstanding the events in Fukushima, our country has maintained its commitment to our nuclear power sector. We will be developing this sector over the next seven to eight years. I have been the Turkish Minister of Energy for a long time, and I can tell you very definitely that we will continue to develop nuclear energy, despite the negative events of the past year.

I think that everyone present in the hall today, as well as their compatriots and colleagues, are all well aware that the risk posed by nuclear power plants is in fact very slight. We simply have to inform the public, to educate people to understand that the events at Fukushima were just an experience which has to be taken into account, and from which we must learn in order to construct new safety systems and to ensure that we improve the physical safety of the plant still further. We have to promote scientific and technological progress. No investors would risk their funds without knowing the future of nuclear energy. So we must realize that the world cannot do without nuclear energy. Our research over the last seven to eight years has shown that Turkey is truly an earthquake-prone country; however, there are many earthquake-prone countries in the world. Japan is also a very earthquake-prone country, yet Japan has a very large number of nuclear plants. Therefore, I believe that renewable energy sources must be developed in every country, but that nuclear power is both a necessary and inevitable way of generating electricity which will ensure the harmonious development of national economies in the future. On behalf of our country, I would like to express our confidence in the future of the nuclear energy sector.

Thanks to all who are present here today.

Dr. M. Suess:

Thank you very much, Mr. Yıldız. Now, after hearing the views of an investor, and representatives of a country and of an international organization, I think we should focus on the utilities that operate the facilities. I have some questions for one of the leading utilities in the world. What were the conclusions drawn by the nuclear operators from the events in Japan? What has been done to secure the planet against the recurrence of such incidents? We have the opportunity to hear from the head of the world's largest operator of nuclear power plants, Mr. Henri Proglio, President and CEO of EDF. Mr. Proglio began his career at Compagnie Générale des Eaux, where he worked for 18 years, advancing to head the company. He then ran companies such as Vivendi Universal and Vivendi Water, before being appointed Chairman and CEO of Veolia Environnement. EDF, which Mr. Proglio has led since 2009, not only operates nuclear power plants, but also other types of power generation facilities. Mr. Proglio, EDF and Rosatom see themselves confronted with an energy landscape that is undergoing radical changes, at least in some parts of the world, but specifically in Europe. Your neighbour Germany has shifted its policy to a completely different energy mix, or is at least on the way to doing so. What consequences has EDF seen from the developments during the past year? What role are renewables ready to play? Do they constrain nuclear power and what should operators focus on? Mr. Proglio, please.

H. Proglio:

I would especially like to thank Sergei Kirienko for the opportunity to be here among the members of our panel to discuss the development of the nuclear energy sector. Indeed, EDF is a very large company in terms of nuclear energy. We have 74 reactors: 58 in France and the rest in Great Britain. We are also building a new generation of plants in France, as well as several plants in China. We are the world's largest operator of nuclear plants. So, what conclusions can we draw from the results of the disaster at Fukushima? What are the current conditions in the nuclear energy sector? What is the share of nuclear power in the world energy balance?

Of course, we have drawn some conclusions about the results of the disaster in Fukushima, and we are seeing some of the consequences. The main thing, perhaps, is that it has shown that the risks associated with nuclear power are borne not only by a government (because a government is responsible for the safety of its citizens), but also by operators of nuclear power plants, who bear a significant share of responsibility. No plans should be made for the future development of our industry without competent, transparent interaction between experts and government agencies. There may not be many experts and operators who can meet these requirements today, but those in existence have already begun to work together closely. Rosatom, which is one of the world's largest operators, has joined with EDF in a very close relationship over the past year and a half. What are the qualities of an operator that is really capable of meeting expectations of transparency and safety, and even, I would venture to say, has the communication skills required to explain a situation? Of course, the operator must have great experience, both in the technical domain and in process management. Of course, it must also have skills in scientific research. But the operator also has to be able to count on the experience of other operators; that is, it has to be able to count on the presence of experience at virtually all the nuclear power plants in the world. It is on the basis of this accumulated experience that the operator will be able to solve problems that arise, and perhaps find a way out of any emergencies that occur. Such an exchange of experience is extremely important if the quality of existing operators is to be improved.

Of course, since Fukushima there has been significantly greater cooperation with government organizations that work in the field of nuclear safety, as well as with international organizations. I am talking in particular about our Nuclear Safety Authority, or similar agencies in other countries, such as Russia, Turkey, and China. They must be in touch with the operators constantly. We are also strengthening our cooperation with international organizations. I would like to specifically recognize the IAEA representative here, because the IAEA plays a very important role. We are also talking about cooperation with international associations of operators that audit

and monitor the various nuclear power plant operators. I think that operators should be a key factor in the development of new nuclear energy facilities, and in maintaining and developing existing nuclear power capacity.

On the other hand, why does nuclear power have an important place in tomorrow's energy balance? We have already heard presentations on the fact that consumption and demand for energy in the world are growing, notably because of factors such as population growth. It is assumed that in 30 years there will be nine billion people on Earth, not seven. Naturally, this population will need more energy, and that need is constantly growing. On the other hand, we are well aware of the limits of fossil fuel resources: gas, oil, and coal. Furthermore, the price of these resources will tend to rise over time, and so will the price of the energy that is produced from them. Of course, every country wants to have affordable energy resources for its citizens while at the same time limiting its imports of electricity, since imports restrict a country's independence and autonomy. This also explains why, after Fukushima, quite a number of countries not only affirmed their decision to develop nuclear power, but in fact became even more committed to it. This applies, for example, to Great Britain, Poland, the Czech Republic, all the countries of Central Europe, Turkey, South Africa, Brazil, the United States, Russia, India, Vietnam, and, of course, China.

Thus, after consideration of the issues raised by the disaster at Fukushima, and after the analysis of that situation that has been conducted, we can conclude that tomorrow's nuclear power industry is really the sector that can meet the needs of the world's population. I believe that the role of nuclear energy will grow. Of course, the energy of the future will not be limited to nuclear energy, and I must say that EDF is not engaged in nuclear energy alone. We also operate large thermal power plants, hydroelectric power plants, and so on.

Finally, I would also like to say that it would be wrong to set nuclear power in opposition to renewable energy sources. If there is such competition, I think the question is not being posed correctly. Nuclear power does not compete with renewable energy sources. Nuclear power is a kind of baseline energy which

competes more with energy from fossil fuels than with energy from renewable sources. The advantage of nuclear energy is, of course, its economic competitiveness, as well as its benefits compared with traditional energy sources in terms of environmental protection, since there are no greenhouse gas emissions. It is precisely because of the competitiveness of nuclear energy that the total energy balance can also include some renewable energy sources, particularly solar energy. I would say that only this kind of energy mix will allow us to create a competitive base, and nuclear energy is a very important part of the balance.

I would like to endorse the analysis presented today that a study of the situation after Fukushima confirms the need for cooperation amongst operators. I would also like to express my respect once again for Rosatom, which is one of the world's largest operators. This collaboration will allow us to make nuclear power one of the most important factors in tomorrow's energy balance.

Dr. M. Suess:

Thank you, Mr. Proglia. We will now hear from another utility with a different set-up, but one that has operated in the industry for a long time and also has lengthy experience. We are talking about Fortum, which is represented here by its CEO. Mr. Kuula is the Head of Fortum, which has power generation facilities in a number of European countries and, in Finland, operates the Loviisa Nuclear Power Plant. This plant has repeatedly been recognized by the professional community as one of the most reliable in the world. So what are your expectations regarding the development of the nuclear power industry? Are you willing to enter into new energy projects associated with the use of nuclear energy? Mr. Kuula, please.

T. Kuula:

Thank you, Chair, ladies and gentlemen. Nuclear power really plays a very important role in Fortum's power generation portfolio and we also believe that it is well-balanced with hydropower and CHP – combined heat and power production – where we have a lot of biofuels as fuels. We have stakes in nuclear power plants in

Finland and Sweden. We hold 43% ownership in Oskarshamn in southern Sweden, where we own three nuclear power plant units. We are also the second largest investor in Forsmark in Sweden, which is about 100 kilometres north of Stockholm, and in Teollisuuden Voima Oyj (TVO) in Finland. They have two existing units: Olkiluoto 3 is under construction and there is a licence to build Olkiluoto 4, which is undergoing pre-engineering work. As already mentioned, we operate and own 100% of Loviisa 1 and Loviisa 2, which were built in the late 1970s, together with our Russian colleagues, Atomstroyexport, at that time. Siemens also had a very significant role, especially in automation. I am very glad to know that these Loviisa power plants are held in high esteem by the nuclear power community.

But we are involved in a lot of activity at nuclear power plants. In Sweden, there is ongoing work to improve safety further, both in Oskarshamn and Forsmark, and there is also ongoing upgrade work to increase capacity. In Finland, as I already mentioned, Olkiluoto 3 is under construction and the current estimate is that the project will be completed in autumn 2014. Many of you know that there have been some difficulties and a time delay with that project, but, at the end of the day, what is most important is that we get a good, safe nuclear power plant, which will deliver high reliability. In that respect, I have very strong confidence that that will be the outcome. As already mentioned, there is even an Olkiluoto 4 undergoing a pre-engineering study.

The question was how we see the future of nuclear energy. We certainly think that nuclear power is needed in the world and one key reason is of course climate change. As we know, nuclear power has no CO₂ emissions and that kind of sustainable energy production will be highly appreciated in the future. We also see there to be a natural role for nuclear power, when correctly balanced with other types of power production. As I said, these are hydropower, CHP, and more renewable sources, although you do not always get wind power or solar energy. Of course, the challenge for nuclear power in that respect is that it has to be competitive price-wise in the future and, in light of the various subsidies for

renewables etc., that is a big challenge. Subsidies will most likely be reduced in the future so, in that sense, it will be a more even playing field.

What are Fortum's key interests in addition to these ongoing activities that I mentioned in the nuclear power sector? I would say that we feel that there is a lot of potential with existing nuclear power plants. In particular, we believe that we have the special competence to improve further the reliability and safety of existing power plants, and also to perform capacity upgrades and even lifetime extensions. We are, for example, working in close cooperation with Rosatom, so it is a great pleasure to be here today. Thank you.

Dr. M. Suess:

Thanks very much, Mr. Kuula. Now we would like to broaden the discussion somewhat to some of the discussion participants that we have in the centre block in the first row. I will have some specific questions for you, and please stay close to the question. First, Mr. Asmolov. You worked in the Tokyo Crisis Centre while the crisis at Fukushima was still unfolding. In your opinion, could the Fukushima accident have been avoided? What are the key things to take away from Fukushima? Mr. Asmolov, please.

V. Asmolov:

Chair, I did indeed fly to Japan three days after the accident, at the behest of Sergei Kirienko, and had the opportunity to view the situation with my own eyes: the eyes of a man who has worked for more than 40 years in various positions in the field of nuclear energy, including as a regulator and a high-ranking official. Today we are all talking about 'post-Fukushima requirements'. I want to promulgate the subversive idea that post-Fukushima requirements and pre-Fukushima requirements are exactly the same.

After Fukushima, Three Mile Island, and Chernobyl, the international community, via the INSAG group of advisors to the IAEA, developed the Safety Fundamentals. The

name says it all: all national organizations operate according to these basic principles.

The main technological principle is the principle of defence in great depth. It consists of two simple concepts. First you have to do everything possible to prevent an accident; then you postulate that an accident has occurred and show how you will handle it.

My trip to Japan showed, unfortunately, that my Japanese colleagues considered the second of these to be of extremely low priority. These are not just words; a power plant, built according to a 1965 design, could not be left the way it was designed by the people who built it back then. All the plants in the world, all operating organizations and the organizations that support them, guided by these principles, carry out an ongoing analysis of safety levels. Every time, a rather significant amount of money is spent on modernization to improve safety. For example, the Russian organization Rosenergoatom, which is part of Rosatom, and which I represent (it is also an operating organization) has spent approximately half a billion dollars over the last four years (including before Fukushima) on this kind of modernization to improve safety. All our colleagues do the same thing. Unfortunately, in order to understand and evaluate safety, there is a great deal one has to know. After each of these accidents, the international community did very interesting experimental, computational, and theoretical work, and developed a calculation tool that allows one to predict what will happen. The most important thing is that in order to prevent accidents, you must know for certain how much time the operator has to deal with the precipitating event. It is not important whether it is a tsunami or an earthquake; you can simply postulate the loss of all electric power, and calculate the time you have. Once you know the time, you start a countdown for what you have to get done during the time available to you.

Today I can say with utmost confidence that the knowledge developed by the international community exists; it is not final; it cannot be frozen; it has to continue to be developed. This knowledge exists in Russia, the USA, France, and Japan. So

when we discuss 'post-Fukushima', the first principles we are talking about are the basic safety principles that already exist; they only need to be followed.

With regard to the full responsibility of the operating organization, the operating organization, knowing its responsibilities and the amount of time it has to work under such extreme conditions, has to prevent an accident or mitigate its consequences to the maximum extent. Here are two examples from my visit to Japan.

Two weeks ago, at Expo 2012 in Moscow, the director of a nuclear power plant addressed us: not from Fukushima Daiichi, but Fukushima Daini, ten kilometres away. Sergei Kirienko talked about the fifth and sixth units of Fukushima Daiichi, but I am talking about the four units at Fukushima Daini. They encountered the same 15-metre tsunami, but what happened to Fukushima Daiichi did not happen at Fukushima Daini, because the operator was in place and did everything to prevent an accident.

I will now make my last point. Using boxing terminology, I would say that nuclear power has received a blow. This blow came after Fukushima, but it was not a knockout punch. The sector flinched, reassessed the situation, and moved on.

Dr. M. Suess:

Thank you very much, Mr. Asmolov. I would like to invite Mr. Petrik to speak. Slovakia is a nuclear power plant operator. Have the government's plans changed regarding your country's use of nuclear energy in the aftermath of the Fukushima disaster?

D. Petrik:

Good afternoon, Sergei Kirienko. Hello, colleagues.

I do not speak Russian very well, but I can answer this question. The Slovak Republic is continuing to build nuclear power plants. We plan to finish two more units at the plant in Mochovce. The Slovak Republic has conducted stress tests and they have all ended well. The Slovak Republic is carrying out construction as it

should be done, after the Fukushima accident. We are also getting ready to do more work on our plants in Bohunice and Mochovce. These plants have VVER reactors, which work well and meet all the requirements. Thank you.

Dr. M. Suess:

Mr. Petrik, thank you for your concise answer. I would like to proceed to Mr. Mládek and take the opportunity to ask the following question: the Czech Republic is currently planning the biggest, or one of the biggest, projects in Europe, namely the tender for the construction of extensions to the Temelín Nuclear Power Plant. How does Czech public opinion regard the use of atomic energy? It is known that protests are heard from your neighbour, Austria, all the time regarding your position. How do you address this, and what are the prevalent arguments for nuclear generation in your society?

J. Mládek:

Chair, ladies and gentlemen, allow me to say a few words on this subject.

The Czech Republic is preparing to build two reactors for the Temelín nuclear power plant. On the one hand, everything is fine, because 80% of the population supports construction at the nuclear plant, maybe because there are no earthquakes in the Czech Republic, and there can be no tsunamis because there is no sea. All the major political parties in Parliament support this construction. The Greens are against it, but they are not represented in Parliament.

But I must say that the world is rather more complicated. First of all, the question is whether only the citizens of the Czech Republic will be discussing the matter, because, as has already been mentioned, over the last 20 years we have had big problems with Austria, perhaps because the capital of Upper Austria is just 150 kilometres from the construction site. The capital of Bavaria is 200 kilometres away, and the first Bavarian village is something like 70 kilometres from this site. That is where the biggest problem lies: abroad. They are conducting training exercises and environmental impact studies. There have been around 40,000 pieces of critical

commentary from Austria. Unfortunately, and more importantly, the same thing is starting in Germany. Before Fukushima, Germany was very quiet about it, but after Fukushima there was a huge political shift: all the major political parties in Germany are now in favour of renewable resources and an end to nuclear power. Germany is very influential in the European Union, especially in the current crisis. Of course, Germany is very important to my country, because 40% of Czech exports go to Germany.

What does this mean from an economic point of view? I work on economic policy, and the construction of nuclear power plants is a powerful stimulus to the economy. But the fact is that we do not know whether Europe will support nuclear power. Investors do not want to take risks, but the risks are growing; this, of course, directly raises the price, raises the tariff. The biggest problem now in the construction of the Czech nuclear power plant is that anyone who is going to build wants a guarantee that he will get his money back. Corporate investors have even offered the state two options, but both of them are bad. The first option is that the construction will be guaranteed by the state. From an economic point of view this is very bad, because the EU would consider this guarantee an increase in the public debt, raising the deficit, which is not very good during a currency crisis. The second option they have proposed is a guarantee for the price of the electricity produced, because they do not know how the electricity will sell in the future.

Finally: renewable energy sources and the atom are complementary. However, it is not that simple, because these renewable resources take priority in terms of storage, and because of the unpredictability and irregularity of the production of these types of energy. They remain a great risk to the electrical grid. Specifically, in the Czech Republic, when the wind blows in northern Germany, it creates electricity which is needed in southern Germany, and that electricity travels through the Czech Republic. When there is no wind, the wind power stations stop transmitting energy to the grid, but energy transfer to Germany continues at the same volume. This threatens us with a black-out. So not everything is simple; it all depends on what the

political situation in the EU turns out to be. Therefore I am very glad that I have been able to speak at this Forum. Thank you very much.

Dr. M. Suess:

I think Mr. Mládek made a very strong comment on the perception of nuclear power and maybe we can now turn to Mr. Timofeev. You represent a consultancy company so, in your opinion, what will nuclear power specialists have to do to convince the public of the reliability of this type of power generation? What is the perception, and what steps have to be taken or solutions be found? Given that we have to finish at 11:00 sharp and there is something more to come, please try to be concise with your answer. Thank you.

A. Timofeev:

Thank you, Dr. Suess. I will be very brief.

This issue, in fact, is not a simple one. There is a lot of talk now about how to increase the popularity of the nuclear industry. There are two points to be made here. First, we at The Boston Consulting Group are working with many companies and organizations whose representatives are sitting in this hall today, on the openness of the nuclear industry, removing its veil of secrecy. We have to demystify our industry. Second, we need to intensify the international dialogue that has begun today and is continuing, after Fukushima and every day of the week.

Now, insofar as communication and openness and the demystification of the nuclear industry are concerned, we focus too much on analysing these tragedies or difficult events that have occurred in recent decades, while not enough is said about the positive things that are going on in the nuclear industry. First of all, there is the example that Sergei Kirienko cited: Russia has passed all the stress tests; international colleagues, in conjunction with the Federal Service for Ecological, Technological, and Nuclear Supervision (Rostekhnadzor), have established that all Russian nuclear power plants meet the standards that are needed to improve

safety. There is not enough information available about this, and it is insufficiently discussed. We have to increase the dialogue on precisely these issues.

Now, with regard to the development of the nuclear industry, many global operators and global companies are publishing their development strategies to 2030 and 2050. If you look at these strategies, it is clear that the nuclear industry is not defined merely as the work that goes on at nuclear power plants, but also as a significant investment in innovation and in the development of technologies that intersect the nuclear industry (mechanical engineering and nuclear medicine), as well as huge investments in addressing the issues of what we are leaving for future generations. This means primarily what to do with spent nuclear fuel, as well as the problems of radioactive waste and decommissioning.

The second point I wanted to mention is the strengthening of international cooperation. When something happens like what happened at Fukushima, we are all ready to rally together. But more important is investment in new-generation technology, new-generation reactors, new types of fuel, and new cooperation around the final stage of the nuclear cycle. I would like to see this dialogue not only at the level of governments and international organizations, but also at the level of technical specialists, independent platforms, and experts, in order to form a team for the development of these kinds of new technologies. Thank you.

Dr. M. Suess:

Thank you, Mr. Timofeev. Bearing in mind our time constraints, we should open up for a couple of questions from the auditorium.

We have a question. Please point out to whom you are directing the question, and speak clearly and concisely.

From the audience:

Mr. Kirienko, today several issues have been raised that concern special features of Central Europe. This is a traditional market for you; on the other hand, it is also a traditional market for many German companies. Therefore, how do you evaluate the

situation with regard to the tender for completion of the Temelín nuclear power plant? And how do you assess the prospects for nuclear power in the region, given Germany's rejection of nuclear energy? Thank you.

S. Kirienko:

Thank you. We respect the decision of the German government. It is Germany's right. If there is public consensus, it means that this decision is the correct one for that country. Although I cannot disagree with what my esteemed colleague Minister Yıldız said: that if the plants are not safe, they should not be operated for the next 20 years; whereas if we can operate them safely for 20 years, then the question arises: how long can we operate them? If we can do it for 20 years, then why not 40? The issue of safety does not permit such a prolongation. If I deem that a plant in Russia is not safe, we will close it immediately. If we believe that it can be operated, it will be operated for as long as permitted from a technical point of view.

With regard to the tender, you know that we are participating in it, insofar as we are part of a complex European consortium: about 60–65% of the equipment in this consortium is being manufactured by Czech companies, the automated control system by Rolls-Royce, and the turbine by ALSTOM. So it is actually a big European project. I think that what Mr. Mladek said is important: the issue here is investment, because we see no technical problems with this project, whereas there is a question about investment. Just the day before yesterday, we met with a delegation from the Czech Republic, and said that we were prepared to consider not only a technical design proposal for the power plant, but that we are also willing to participate in investment, if an opportunity is provided. We are absolutely convinced that we will implement this project.

And the choice? Every country in Europe will make its own choice. I agree with the logic of what my colleagues have said: in places where access to cheap and stable, reliable energy resources is a key limiting factor for development today, there is no alternative to nuclear power in the energy balance. I am not talking now about having 100% of the energy produced come from nuclear power; that would be ill-

advised. But a significant proportion should be nuclear energy. If what we are now discussing occurs, if the development of nuclear energy shifts to countries that did not previously have it, that would not be an imbalance so much as a restoration of balance. It is clear that where the share of nuclear energy is now, for example, 30% (as in Germany), or 70% (as in France), increasing it would perhaps be inappropriate. In countries where the share of nuclear energy was less, it is growing. This is the restoration of an objective balance. Therefore, each country must find its own optimum level, and safety requirements should be uniform, since safety knows no borders, as my esteemed colleague Mr. Flory said. Mr. Asmolov also talked about these requirements, and I fully agree with what he said. Thank you.

Dr. M. Suess:

Thank you. We have another question over there on the left side.

E. Kozinchenko:

Ekaterina Kozinchenko, Booz & Company. Mr. Flory, one of the main issues you spoke on was safety requirements. As we have heard, many of today's safety standards were developed prior to Fukushima. But many of them were recommendations, of a voluntary nature. How do you assess the effectiveness of making such requirements mandatory over the past year?

D. Flory:

Thank you. Indeed, the harmonization of nuclear safety is very important because again, as Sergei just said, an accident anywhere is an accident everywhere. For countries that passed stress tests, there is always the question of whether their stress test was good as my stress test, so this needs to be harmonized at an international level. We have developed about 150 safety standards for the last 50 years, but, what is most important – and I am in agreement with what Vladimir just said – is the implementation of these safety standards. The implementation of safety standards is verified, so to speak, at several levels. It is verified by the peer reviews

of WANO at the nuclear power plant level, but also by us at the international level. We organize international peer reviews in many different fields. We organized them for the regulatory authorities, as well as at the design and site-evaluation stage. We also organize reviews in nuclear power plants, again in cooperation with WANO. But these are recommendations. You are always limited by the sovereignty of states. Nevertheless, within the sovereignty of states, there are conventions, which are a great help and serve as powerful tools. Another powerful tool to impose recommendations in a different manner is transparency and, since Fukushima, we have pushed forward with this, and are placing all our recommendations and all the results of our peer review services on our public website. They are available there. I clearly remember that, in October, there was a presentation by a Japanese authority showing the recommendations that we gave in 2007 to the regulatory authority and the results of the fact finding mission in May last year. If we had implemented the recommendations, perhaps we would not be where we are now. So transparency is a very powerful tool to impose these recommendations in a soft way.

Dr. M. Suess:

Thank you very much. You see there are a lot of people who want to discuss this but I am so sorry, we have limited time remaining. I would like to ask the panelists to sum up the discussion. Please limit your remarks to one minute – the one minute elevator speech. We will start with Mr. Kuula.

T. Kuula:

Yes, I think that this indicates that there are a lot of activities going on in nuclear power and safety is certainly the issue. We have to get society – the general public – to be confident that we will manage that and will improve in this area. As has been said, transparency is really a key tool to making that happen.

Dr. M. Suess:

Mr. Proglia? Mr. Proglia, in just one minute, how would you sum up the discussion?

H. Proglio:

I think that transparency and safety are the key issues. Transparency should be provided at the operator level, and at the level of system control by the appropriate national and international authorities. This has been mentioned repeatedly. On the other hand, I believe that in most of the countries that we have talked about, nuclear energy is perceived positively by the public, even after Fukushima. We conducted an analysis and found that many countries have indeed regained confidence, and this is due to the accumulation of experience, the stress tests, and continuous public relations work, the explanations, and so on. Thank you.

T. Yıldız:

The location of the country and the sources of energy, of course, are different in each case. We cannot always agree with the general opinion about one source of energy or another, but the International Energy Agency and accredited agencies are always trying to find a common language and a universal approach to solving this problem. I am very grateful to Mr. Kirienko and all the participants on the panel for their emphasis on transparency and the importance of international cooperation, because we have to understand that safety cannot be confined within national borders. This is about, above all, the safety of all mankind. I would like to stress once again that nuclear energy is, for us, a way forward. I am very grateful to Mr. Kirienko and the Russian side for their hospitality and the attention with which they are welcoming us today.

S. Kirienko:

Colleagues, I too believe that the main issue is not technological, and our discussion today confirms it. It is more of a psychological issue, a question of confidence. This can be resolved in quite understandable ways. First of all, it is a matter of openness. This is the main factor in public relations. I concur with what Mr. Proglio said: in Russia, after Fukushima, the level of confidence in and support for

the development of nuclear energy fell from 72% to a critical level of about 50–51%. Now it has returned to 68–73% (estimates vary), nearly the pre-Fukushima level, just by means of openness: maximum transparency about the situation.

The second thing is uniform rules, as Mr. Flory said. It is very important that the IAEA has played the leading role here.

A third very important thing is confidence. This means experience, influence. The main capital of the nuclear industry, I am absolutely convinced, is the confidence of the professionals and other people who work in the industry. I would like to thank all our partners today for the great experience of this joint work and for that confidence. Thank you.

D. Flory:

Well, nuclear safety is of course the key to getting the support of the public and, I would say, the support of the public is just the collateral benefit of improving nuclear safety. For improving and maintaining nuclear safety, you need very competent operators. You need strong operators and very competent safety authorities. You need strong authorities and, behind all that, you need science. One of my key concerns is that countries that develop nuclear power from scratch need to have strong physics institutes and research in the background. This is really the baseline for building a nuclear power programme. This is something which exists in many, but not all, countries, and this needs to be increased. Thank you.

Dr. M. Suess:

So thank you very much, all of you, and now it is up to you in the auditorium to vote. As I said, first check if your equipment is working. If not, you have to push the green button.

Now we have the first question. I was told that we would see it on the screen but, if not, I can do it here. What impact did the Fukushima accident have on the development of the nuclear industry? 1) Practically no impact. Those who build nuclear power plants continue to build. 2) New construction has dropped by a

maximum of 10–15%. 3) An impact, but mainly in Europe. 4) A significant impact, and the nuclear industry programme is close to shutting down. So please vote now. No real surprise, there was a little drop. There was a 10–15% decline, which was something, but there will be new constructions and the world will proceed with nuclear programmes.

So let us move on to the second question. What is the main precondition for the development of the nuclear industry? 1) Public acceptance. 2) Experience of the operator and reliable operation. 3) Redundancy of reactor safety systems. 4) Other reasons. So again, please vote now. So there is, let us say, at least 50% saying public acceptance, and I think it worked very well with the three options, which covered 92% of your opinions.

So let us come to the third question. In your opinion, do the nuclear industry and energy sources like wind, solar, natural gas, shale gas, or others: 1) Supplement one another in the energy mix. 2) Compete with one another and mankind will choose one or the other. 3) These generation types are transitional until a new source of energy is discovered in the 22nd century. Please vote now.

So I think there is a clear decision on your side, not only from the panelists, but from the whole auditorium as well. The energy sources supplement one another in the energy mix and it is not about one size fits all. We need the whole energy portfolio.

So we are finishing at 11:00 sharp. I have to thank all of you, the participants and the keynote speakers here on stage. Thanks a lot for this very interesting and deep discussion. We will have another interesting two days here to continue further with that. Thank you very much to all of you.