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Securing the Future
POWER INTEGRATION: IN SEARCH OF A NEW GLOBAL PARADIGM

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In cooperation with the Federal Grid Company of Unified Energy System

Moderator:

Andrei Volkov, Dean, Moscow School of Management SKOLKOVO

Panelists:

Oleg Budargin, Chairman of the Management Board, Federal Grid Company of Unified Energy System (FGC UES)

Vyacheslav Kravchenko, Chairman, NP Market Council

Alexander Novak, Minister of Energy of the Russian Federation

Bernhard Thies, Chairman of the Board of Directors, DKE German Commission for Electrical, Electronic and Information Technologies of DIN and VDE

Daniel Yergin, Executive Vice-President, Chairman, IHS Cambridge Energy Research Associates Inc (CERA)

Front row participants:

Sergei Kuzmin, Director of Sales, Energy Transfer Department, Siemens AG

Evgeny Zagorodny, General Director, Hevel LLC; Vice-Chairman, Russian Association of Solar Energy (RASE)

A. Volkov:

Good morning.

Ladies and gentlemen, guests of the Forum, We will begin. My name is Andrei Volkov. I represent the Moscow School of Management at Skolkovo, and today I will be moderating this round table. We will be discussing the energy sector, and, in particular, ambitious plans for energy sector integration on a global scale.

I would like to introduce the participants of our round table. We are in the presence of a small, but very distinguished, group of people: Oleg Budargin, Chairman of the Management Board of the Federal Grid Company of Unified Energy System; Dr. Daniel Yergin represents the famous CERA organization, a research consulting centre in the USA; Dr. Bernhard Thies is a member of DKE, the German Commission for Electrical, Electronic, and Information Technologies; and, finally, Vyacheslav Kravchenko, the Chairman of Market Council, a non-profit partnership. The discussion will be in Russian. If you need interpreting, please use your headphones.

Today we will be discussing an important issue which is becoming more pressing with each passing day. On the one hand, over the past 20–30 years, we have all noticed that the demand for energy has been growing and will continue to grow. Nobody would argue that this trend will be coming to an end any time soon. On the other hand, this demand must be met by constantly maintaining energy infrastructure in a proper condition. This is a complex issue not only for developing countries, but also for the leaders of the world economy – the USA, Europe, Russia, China, and other countries. Ladies and gentlemen, I hope that together, we will be able to map out a road to resolving this issue.

I would like to begin our discussion with a question for Dr. Yergin. Dr. Yergin represents the well-known research and consulting centre CERA. One of their projects is the development of a policy for regulating global energy resources and energy systems in specific countries. Here is my question: what, from your point of view, is the Achilles' heel of the energy industry? What is the most difficult issue for

the global energy industry? What will the world's politicians and decision-makers consider as a first priority? Dr. Yergin, please.

D. Yergin:

Dean Volkov, thank you very much for the introduction and the opportunity to contribute to this panel and respond to your question. Also, on behalf of everybody, I would like to express appreciation to the Federal Grid Company of Unified Energy System for sponsoring this discussion on this most important issue, because electricity is at the foundation of everything else that happens in the world, and the central issues which you, Mr. Volkov, have already pointed to, are growth and how to implement growth.

Let us reflect for a moment on the fact that the demand for electricity worldwide has doubled since 1980, and in the next twenty years will double again, and that estimates of the cost of supporting that kind of growth have been made to the tune of USD 14 trillion. We clearly face some major challenges! What we are really talking about are fundamental questions about the future of the economy. We also note that electricity consumption around the world is growing faster than the direct use of oil, gas, or coal. One of the characteristics of the modern age is that every day we become more dependent on electricity: the fundamental needs of the economy, networks, computer bases, the Internet, the cloud, all of this depends upon electricity. We also see the growth of what we call gadget watts, and gadget watts are all the different things we have in our pockets and our homes that we did not have 10, 15, or 20 years ago. When you look at the amount of electricity that these are using, and the amount of growth that is associated with them, it is very high.

There are major challenges, and of course, the challenges vary by region. I think the question of the fuel mix – what type of fuel choices to make – is faced everywhere, but the answers vary from region to region and country to country. Securing investment is a fundamental question, and also what we have seen time and again is the importance of diversification and not being too reliant in one area or another,

because the unexpected always happens. In terms of investment, in order to promote it you need transparency and stability. From the investor's viewpoint, you need some sense that the long-term market and investment rules will be stable, and that you know what you are doing, so that investors and other players can remain financially healthy. Their financial health is ultimately good for consumers who depend upon them.

I shall just say a few words about how the challenges differ in different parts of the world. Europe is faced with the retirement of many power plants. It needs new investment. The incentives are not there for new investments in general. There is a very strong drive on the part of the European Union, and Germany in particular, for much greater use of renewable energy. This brings, as any grid operator knows, a whole new set of challenges which involve managing the intermittency on a large scale. That really has not been tested, and I guess Germany will be the first test of that. As it is, the German decision to back away quickly from nuclear power creates uncertainties, not only for Germany, but also for all of Europe. One might look at Europe and say that it underestimates or does not put proper emphasis on the role of natural gas in electricity generation. In North America, we see an energy or electric power market that has been transformed. It has been transformed by inexpensive shale gas, and also by policies from the Federal Government that are aimed at reducing the role of coal. Once you consider it, this change is very dramatic. Just a decade ago, coal provided 50% of electricity in the United States, while natural gas provided just 18%. As at last month, coal provides 37% and natural gas provides 28%, so that shows what the impact of abundant, inexpensive natural gas will do in the market. Renewable energy continues to have support in the United States, but in the United States, as in some parts of Europe and other parts of the world, the support for renewable energy is lowering, due to financial austerity. Finally, when you look at Asia you see a wide variety of markets. Some are highly regulated, some are liberalized. Many of them are low-income countries, and this creates a particular challenge, because of a desire to avoid raising power

rates (power prices) due to people's income level. That means that it is more difficult to attract new investment.

As a growth engine of the whole economy, Europe has great needs for new investment in power infrastructure – questions that were talked about involve generation, transmission, and distribution. And it has the kinds of growth rates and electricity demand in Asia as one used to see in other countries at that stage of economic development. Chinese electricity demand is growing at 10% a year. That was the kind of growth the United States had 50 years ago, so it is at that stage of development, plus there are all the new uses.

Finally, I will just comment on the Middle East, which also has enormous power needs. It is a fast-growing region, and they are struggling with it, trying to shift to more natural gas in their electricity generation, but they also have great problems concerning raising prices to consumers, so therefore their demand is growing very fast. It is interesting now to see a country like Saudi Arabia searching for shale gas in order to use it as a fuel in electricity generation in order to free up oil for exports. So on your question of one integrated system from Lisbon to Vladivostok, it would certainly be a great effort to bring together systems with many different market designs and many different approaches to regulation into one system, but I think the focus should be on the need for investment, which you laid out, and on the recognition that what we do in electricity affects the foundations of our modern economy from day to day, and that is what makes the questions that we are addressing in this round table so significant and so important.

A. Volkov:

Thank you, Daniel. That is just the point that we are trying to bring to this table.

Dr. Yergin has just told us that in the past 25 years, demand has grown not only in developed countries, but in the emerging markets as well. Mr. Budargin, taking these into account, what do you think about possibilities for transit or integration?

O. Budargin:

Thank you very much. First, I would like to thank everyone for paying close attention to this issue.

Talking about our relationships with foreign partners about building next-generation grids, I must say that we have come very far in recent years. Moreover, everyone believes that we are looking at serious, large scale integration of energy grids. We have been discussing these issues for several decades, but now is the time to act. We are ready for this. We need to seriously consider all the pros and cons, but I am sure that there will be more pros.

There are a number of reasons for this. Firstly, economies have become more open, there are common markets, common trade regulations, and particular specialization of the territories. Not all territories are aiming to be self-sufficient at this stage, because this is often an expensive process. They are aiming to make the best possible use of the advantages of neighbouring territories, where development of the energy sector will be more economically efficient.

The second reason is a technical one: we are on the brink of major changes, and not just on the brink. These changes are already taking place. For instance, we are using new materials, and new grid architectures for transferring energy, which allow us to significantly minimize losses during long-distance transferral. We can see examples of this in projects that have been successfully implemented in the USA and China. I am convinced that this is not the limit – test projects and projects implemented in pilot territories show that we are standing on the brink of even more significant technological advances. We could even call them 'breakthroughs'.

This is the third time that we are meeting at this Forum for a round table to discuss the formation of a new energy system, based on 'smart grid' networks. Moreover, this is precisely the place where, three years ago, we established that these are not just distribution grids, counters and checking – this is also about grid management; the creation of a smart energy sector, which will allow us to consider demands and interests of energy generating companies and consumers, and also to effectively supply high-quality energy. However, today, we understand that for smart grids, we need smart consumers, smart generation, and smart architecture. Now, the USA

and European countries have begun to upgrade their energy grids on large scale. It would be inappropriate to construct separate smart grids in each country or in every region, considering that these grids are most effective when used as an integral whole within a framework of an entire continent, or perhaps even on a larger scale. This is the third reason for integration. We have already discussed that the modern consumer demands not simply standby energy, but standby capacity on a large scale. Demands in regard to the quality and reliability of energy supply have also significantly increased. Today, energy grids must not stop providing energy to consumers even for a short period of time – this poses significant economic risks for supply companies and high risks for consumers, because new technologies and industries require continuous energy supply.

Russia's geography is a perennial issue, and one which I think will always be relevant. The sheer scale of the country creates great advantages for us, and Russian territory should be used for creating energy links, in particular an energy link from West to East. We could extend our reach to fully take advantage of high loads, and utilize the movement of the Sun. Germany is currently actively discussing this topic and I support it. I am also a supporter of green energy. The supplier and consumer should follow the Sun, and then this wealth of energy should be transmitted over the entire territory. Thank you.

A. Volkov:

Thank you, Mr. Budargin. Dr. Thies, considering what Dr. Yergin has just said, how is Europe planning to deal with this demand? How will this demand be met? To what extent are you planning to use transit to resolve it?

How are you going to resolve the issue of meeting European energy demand, considering Germany's ban on nuclear energy production, the implementation of a solar energy generation project in the Sahara, and the readiness of power grids to be integrated, which Mr. Budargin just spoke about?

B. Thies:

Thank you very much, Mr. Volkov, for introducing me. It is a great honour for me to be here at this conference and to talk about these issues of new electrical energy.

In Europe, we have three scenarios for the future of electricity demand. One could be that the demand for electricity will go down. Another scenario is that the electricity demand will remain stable in the future. We do produce more products, but we are reducing the energy used in production due to energy efficiency projects which are underway in Germany and some European countries, amongst others. The other scenario is that the demand for electricity will grow because, as Daniel said before, a lot of electronic products are on the market. There will continue to be more, and we will need electricity for these things. So we can see that it could be very stable in the future. It could also be stable because we need to implement a lot of energy efficiency measures, for example, some of the car manufacturers in Germany are saying that they are not making just the cars green, but also the production of the cars green, so that means we can reduce energy consumption in a good manner.

If you look to this area of energy efficiency, I think it would help to think about the main source of energy in the future in system aspects. We have to find out not only the energy efficiency or wattage of the product itself, we have to look to the system and make a lot of estimations that we could then find out and analyse in the system. You could have a reduction in electricity consumption of up to 40–50%. This means you have to bring in new technologies to this end. The main thought here is saving energy. The other thing is – if for example in Germany we have a lot of renewable energy on the market, which means we have photovoltaic generators and windmills – the problem for the historically built-up grid is that the grid was built for energy to flow in one direction only. It comes from the power plant and is transmitted through distribution lines to the consumers. When we integrate the photovoltaic system, then energy will flow each way and in both directions. That means that the consumers are also producers – they are both producing and consuming energy. That means normal people using energy also give energy back.

We have to think about bringing new technologies together into a so-called smart grid or intelligent grid. That means we have to bring in the electro-technical industry, utilities industry, and the relative newcomer in this area of IT technology. They have to find a way to make the distribution network intelligent. In Europe, our transmission lines are already intelligent; it is one of the best systems in the world. That means that in terms of distribution, the companies are running their electricity in a really blind way.

In the future, when renewable energy is also part of the system, we must also find a way to control the consumers. For example, washing machines must not run while the network is experiencing the highest peak of energy demand. That could be controlled by these things. The only thing missing is work on international standardization. We need programme standards to describe the technologies, interoperability between the utilities, the consumers, and also the factories.

Mr. Budargin also mentioned economies of scale. The only way to find out worldwide economies of scale is to work on international standardization so that the products which are used for these new technologies in intelligent goods are the same everywhere in the world. This will allow you to send your products to Europe, to Russia, to China, and so on. That reduces the costs for these things and also reduces the entrance costs for taking advantage of the new technologies in the smart grid. With these international standards can also come reliable system recommendations to the industry to invest their money in these things. This means that by using the international standards, their future is much more secure in terms of their investments. I think that there are challenges for Europe and also challenges for Russia and other countries to implement this intelligent grid. With this intelligent grid we can find a totally new way, and if you find out a way to make an Internet of energy, to make the world of energy connected around the world so that you are independent of time zones, then we can shift the energy from one part to the other part. The technologies exist already. The question is, is there enough willingness to do that, and is there enough money and investment for that? That is my short statement. Thank you very much.

A. Volkov:

Thank you.

Ladies and gentlemen, I would also like to welcome two new participants in our discussion – Alexander Novak, Minister of Energy of the Russian Federation, and Zhang Cheng, the President of China's largest power company.

I would like to give the floor to Mr. Kravchenko, to continue with the European topic. What do you think about the possible creation of a pan-European or Asian-European energy market, considering the issues of standardization when it comes to integrating smart grids? Is this a journalist's dream, or could it be based on reality?

V. Kravchenko:

Thank you, Mr. Volkov. I would like to welcome all of those participating in today's discussion.

This is quite a good question. I think that it is more of a plan for the future. Unfortunately, if we talk about energy grids in Europe and Asia, they are isolated and technologically different from each other. Due to these differences, they naturally work according to different rules. If we consider the idea of having a single market from Lisbon to Vladivostok then, perhaps, a single system for trading energy as a product would have to be introduced. I do not think that it will be significantly different from the existing system, because all market participants, primarily in Europe, work according to very similar rules. There is nothing new in trading energy – it involves spot sales, long-term contracts, and financial derivatives, which allow us to hedge risks of non-supply or supply at different prices.

To be honest, I do not see any particular problem with this issue and I am not ready to discuss which trading system is better – the one that exists in Russia, France, Germany, or the UK. Selling presupposes that we have the appropriate product, and the appropriate technological conditions for selling this product. I have listened closely to the presentations by the other speakers, who have spoken at length about

integration. They were talking about integration of production at the primary stage, primarily about diversification of energy production from different types of fuel. I think that this is without doubt the right approach. This diversification must not be just a technical issue. To make it work to the fullest extent, we must unify systems and expand market boundaries, and only then we will be able to talk about single trading mechanisms for this product.

Here is a silly example for you – we have 10 little shops, which sell specific products, like milk, meat, or nails. But if these little shops were to unite under one roof, and the products were sold in a large supermarket, not much would change in respect to product availability. In this particular case, we are talking about the end product which we all consume – energy with particular characteristics, i.e. 110 or 220V at a frequency of 50Hz. The end product is quite simple, and so I think that we should not make its sales dependent on what type of fuel is being used for its production, and, subsequently, dismantle markets to a certain extent. I believe that it would be much more appropriate to integrate markets for energy produced by using various technologies.

I would like to come back to the question of trading methods – I do not see any particular problem here, because the trading method largely depends on technical issues, and primarily on centralized control. Centralized control methods, speaking in global terms, are about 90% compatible. So, the trading method is largely dependent on technologies. I think that first, we need to resolve the issue of market expansion, and only then talk about the options for how we can sell the product to the consumers. In any case, all of this has to be as open, understandable, and accessible as possible.

This is all I have to say. Thank you.

A. Volkov:

Thank you, Mr. Kravchenko. As far as I understand, in principle, your answer is 'yes', conditional on adherence to certain conditions related to technological compatibility, standardization and, perhaps, even geopolitical factors.

As we have been joined by two more participants, I would like to discuss the Asian and Russian markets. Prof. Cheng, Dr. Yergin has begun the discussion about energy demands. How would you describe demand in China? Are you expecting an integration of power grids, or does China view its power grid as an isolated one? What do you think about these processes?

Zhang Cheng:

Chinese power production is already moving towards market relationships. Since 2002, we have been separating generation and distribution. We have been carrying out this reform for the last 10 years, and now it is being implemented at a deeper level – we are separating grids according to their voltage.

We have achieved significant successes in power generation – development is very quick, and production volume is sufficient for the demand of the Chinese economy. At this stage we have not finally determined in which direction we are going to take these reforms, or the shape of our future energy industry. In any case, it will become more open to the outside world. The prices for energy products will closely depend on market factors. This is a general trend. At the same time, we would like to create a smarter and safer grid for our consumers. Thank you.

A. Volkov:

Thank you.

Mr. Novak, it might be too early to torture you with a question about the general Russian agenda in respect to energy, but we do not have a choice – you will have to get straight into in this discussion. What do you think is the most pressing problem for the Russian Federation in respect to the energy industry? In fact, I would like to ask a deeper question: where is the long-term money for investing in the general energy industry? This issue has already been described as a pressing one for all market participants.

A. Novak:

Thank you.

I would like to thank the Federal Grid Company for organizing this round table. This is a very important topic. Energy production falls under the jurisdiction of the Ministry of Energy, but in a different way from the oil or gas industry: we are responsible for normative and legislative regulation, and therefore the Ministry pays particularly close attention to the power industry. In every country, the energy industry consists of an infrastructure which is essential for the development of the economy and, especially, of related industries. It has a particular significance for the general public, because the public is also a consumer of this product.

I was late to this event, because almost half of the government staff were involved in a meeting organized by Sberbank with investors and experts. In particular, we were discussing the government's plans and goals. One of the questions, which was answered by many participants, was this: what are the government's priorities? The answer was that the most important priority for the government is improving the standard of living of the general public. This is the goal of every country. The energy industry has to be guided by this priority.

As we know, the players on the energy market are the producers of power and heat, consumers, transmission companies, grid companies, the population, governments, regions, and even municipal organizations. There are many entities involved in the process, and, naturally, there are conflicts of interest. It is very difficult to find a balance between the interests of all of these bodies. The goal of the government of Russian Federation, as I see it, is to provide a balance which satisfies all of the market participants, including consumers, who require a reliable and timely energy supply. A lot has already been done. China has been implementing reforms for 10 years. We have been doing it only for seven; however, during this time, we have already taken a very big step towards creating a competitive market, and towards separating generating companies, grids, and supply companies. During this period, especially in the last few years, we have created a large normative and legislative foundation. Significant generating capacities are being introduced. In the past three years, we have attracted large-scale investment – both from the public and the

private sectors. For example, in the last three years, over RUB 2.7 trillion was invested in this industry, including RUB 600 billion from private investments. This money is slowly beginning to have an effect.

Of course, all of those involved in the market understand that there are certain problems in the industry which need to be resolved, and this includes issues related to normative and legislative control. I would like everyone present to consider – and I think this hall is filled with professionals and experts – a small problem, related to the fact that the market is not transparent, in particular for consumers. How are the energy tariffs set, especially for the end consumer, for the general public? People only see their bills: they see how much they have to pay for energy consumption, but they do not see how these pricing structures are calculated. At the same time, many market participants cannot agree on how energy pricing is formed at each stage, beginning with production and ending with supply and consumption. I think that one of our tasks is to make the industry more open; to publicly discuss existing problems. We are planning to create a public council with an affiliated council of energy industry specialists, which will be a forum for discussing the current agenda. What other areas can I mention? We understand perfectly well that we have inherited relatively dilapidated infrastructure from the Soviet era. One of the items of the agenda is upgrading these fixed assets by using modern, innovative technologies. I think that this issue needs to be resolved by energy and heating producers, consumers, and grid companies. The Department of Energy has already prepared a programme for industry modernization. I think that it will be sent to the government for discussion very soon, and we will consider it in the autumn. I think that there are certain flaws in the industry, related to the fact that the mechanism of fair revenue distribution and timely settling of bills within the system is not completely smooth. We need to pay special attention to this, since companies' investment programmes must be based on ongoing contracts and investment plans. These programmes must be reliable. We need to come back to RAB-based tariff setting system (Regulatory Asset Base). This decision was previously accepted, but for certain reasons, final decisions on tariffs were postponed until autumn.

Introduction of the RAB regulation will be one of the key issues from the point of view of attracting investments and modernizing the industry, and this is why we will also move in that direction.

I would also like to say a few words about investment programmes. I think it is obvious why this topic is important. As far as I know, the required gross revenue in our industry is RUB 1.8 trillion, and the lion's share of these funds is used in investment programmes. It is very important that these funds are spent effectively, so that every rouble brings in maximum return, and so that the infrastructural base which is created with these funds will also be effective.

What I mean is this: we must synchronize investment programmes in the energy industry with the local planning programmes in the regions of the Russian Federation and municipal administrations, and development plans in other areas of the economy. This will remove bottlenecks and will allow us to distribute generating capacities and attract investments. On the basis of our power delivery contracts, about 30GW will be introduced by 2017; our goal is to introduce around 80GW by 2020. This is a serious investment programme; considering that we have about 220GW total capacity in the Russian Federation, we will need to modernize about a third of existing capacities or replace them with new systems.

Therefore, obviously, there is a strong outlook for future work, but there are important tasks for the industry to resolve. I think that all of us – companies producing energy and heat, supply companies, consumers – must work together openly, discuss the problems of the industry, and find common solutions with the goal of providing the balance which I mentioned at the beginning of my presentation.

A. Volkov:

You mentioned an enormous investment programme. Is privatization going to continue? And does the energy industry have a stake in privatization from your point of view?

A. Novak:

You know, the issue of privatization is an issue of increasing efficiency – management efficiency, attracting investments, and allocating funds. From my point of view, certain companies must be privatized, and we can see that, at present, the private sector is already actively involved in the energy industry. We must create a stimulus for attracting private investments into the energy industry. Unfortunately, at this stage, due to our internal failings, the level of private capital, including investments, is quite low. Therefore, I think that privatization is our next step.

I cannot say when we will take this step, but I think that, overall, this industry should be privatized. This will allow us to attract new knowledge and new technologies, and to turn to innovative solutions and new management methods, which will allow the industry to develop more actively.

A. Volkov:

We do not have much time. In a few words, what you think of the integration which we have discussed today; about the mutual penetration of energy grids?

A. Novak:

I think that nobody in this hall would oppose integration. At least, I have not heard anybody talk against it during my months as the Minister of Energy. The CIS countries inherited their integrated energy grid from the Soviet Union. We cannot get away from this; we must preserve the system, despite the fact that some former Soviet republics have become members of the EU. At present, we are actively working towards agreements in parallel synchronization and working together. We have a single system, and we do not just want to work within the boundaries of our own country. We would need enormous capital investments to change this system, not only in Russia, but also in the countries which may not want to integrate with our grid. Energy export – exporting the final product, something which was mentioned by my colleagues – seems to be a lot more feasible than exporting natural resources. In any case, we would need to consider the attractiveness of the

investment programme, returns on investments, and profits from capital. But, in general, I support integration.

A. Volkov:

Ladies and gentlemen, Our round table about energy integration has opened the Forum's expansive energy agenda. We have to work quickly. In literally three minutes' time, the next event on the energy industry is going to take place – an awards ceremony – and many participants of our round table are needed there. Therefore I cannot present a list of 'burning' questions from the audience, but I can make some general conclusions.

The problems of energy demand, which were discussed by our colleagues from the USA, problems of technical control, and market problems are no obstacle to integration. We can say that our round table has laid the foundation for discussing processes of energy integration at this Forum.

Thanks to everybody for participating in this discussion.