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**RENEWABLE ENERGY FOR POWER GENERATION  
Expanding Technology Horizons**

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**2011**

The dynamic development of the use of renewable energy in the world and in the EU over the past 10 years has led to a new understanding of the directions for the development of electrical power. Renewable energy accounts for more than half of all new capacity introduced for electrical power generation. Research in the field of renewable energy accounts for around 60% of the patents and know-how in the field of power generation. The use of renewable energy is developing rapidly both in countries which are completely supplied with hydrocarbons (Canada, Norway, Denmark) as well as those with limited natural fuel resources (Germany, Spain, France).

**Moderator:**

**Dominique Fache**, General Director for Russia and CIS, Enel; Chairman of the Board of Directors, JSC Enel OGK-5

**Panelists:**

**Fabricio Hernandez**, Deputy Minister for Energy, Ministry of Industry, Tourism and Trade of Spain

**George Rizhinashvili**, Deputy Chairman of the Management Board, RusHydro

**Jens Peter Saul**, Chief Executive Officer, Siemens Wind Power

#### **D. Fache:**

Thank you for staying with us; thank you for not going off on a walk around this wonderful city. My name is Dominique Fache. I am the Executive General Manager of Enel in Russia, and the Chairman of the Board of Directors at Enel-OGK-5. I am a Frenchman, but unfortunately I am not allowed to speak in French. Therefore, I am going to moderate this meeting in Russian, though half of our guests are English speakers and will therefore be speaking in English. We have interpreters, so if you need a translation, please take a headset.

Our topic today is very interesting, but first I would like to introduce our participants. On the very left you can see Ms. Khanjenkova from the European Bank. She is their Managing Director in Russia and she will talk to us about investments and financing in this area. On my left is Mr. Jens Peter Saul, CEO of Siemens Wind Power, he will speak to us about his German experience. To my right is my friend George Rizhinashvili, who will speak about the RusHydro's efforts in this area. And on the very right is Fabricio Hernandez, the Spanish Deputy Minister for Industry and Tourism with responsibility for energy issues. Each of them will make a short presentation, and then I think we will have a discussion and ask questions.

The current situation in the world is very interesting; events are taking place that give momentum to the development of the renewable energy industry. Our power generation cycle is coming to an end, as everyone understands. After Fukushima and the Deepwater Horizon incident, everyone understands that the power industry, access to energy, and providing security and independence for countries are the key issues of the 21st century. One cycle is coming to an end, another the cycle is beginning. The issue is that we do not know what the cycle is going to be like, we only know that it will be different. Are we going to use coal again, and if so, for how long? Mr. Tanaka said yesterday that we are entering a new era, the era of gas. How important are renewable energy resources going to be, and what business model are we going to use? We are talking about energy

sources, but the business is changing as well, undergoing globalization and decentralization at the same time.

Therefore, it will be very interesting to examine what is happening in the world today, and that is where we will start our discussion. Afterwards, in the second part of our discussion, we will talk about the situation in Russia, which steps can be taken in relation to regulations, legislation, investment and technologies. We will try to discuss all of these issues. I would like to give the floor to our colleagues from Siemens, because it is quite possible that the most complex situation at the present time is in Germany. They have extensive experience; I remember my conversation several years ago with the former Minister for Energy in Germany. He said that the situation with the nuclear power stations and their closure was Germany's greatest headache. I would like to let Mr. Saul speak, so it he could tell us how Angela Merkel's latest decisions regarding nuclear power are influencing—and will continue to influence—the development of renewable energy sources in Germany.

**J. Saul:**

Thank you very much.

With 400,000 employees globally and a turnover of USD 76 billion, we have got an energy sector in Siemens and Siemens Renewables, and specifically wind as part of this energy sector. Siemens Wind Power is one of the leading companies in technology in the wind business. We have installed around 2,300 megawatts last year and we have got over 9,600 turbines running at the moment and 7,000 employees globally.

We have often talked about Siemens as associated with Germany. Our headquarters for the wind business is specifically based in Denmark, also a country with a lot of experience in the wind business.

Coming to your question about Germany, it is quite interesting. A lot of people, when they hear about or think about Fukushima, they think that right away, from

today on, our order books are filled as a consequence of Fukushima. It is not the case. The wind industry at the moment is a very challenging industry. The effects of Fukushima will be, of course, noticeable for our industry, positively noticeable, in the medium-to-long term.

And why is that? Because, obviously, putting a new infrastructure in place takes time, and the challenge that Germany has now put itself up for is a big one. First of all, we do not have the same luxury as Russia. We do not have a lot of space. We are a very crowded place; therefore, if you want to switch off the nuclear fuel in the country, you will have to find space, and that space is not onshore, it is offshore.

So, a lot of the growth that we have to maintain in renewable energy will need to come from the offshore industry in Germany, specifically. But that also applies to other countries in Europe, like the UK, who have got very large and ambitious offshore plans.

The biggest challenge, however, revolves around how to bring the electricity to our customers, which therefore makes the grid necessary. The grid investments need to happen extremely fast if the government's targets to switch off all forms of nuclear fuel by 2022 are to become a reality. And that needs to be a focus, so decisions have to be taken very, very fast. Approval processes have to be taken very, very fast, and only then can we realize this target.

For us, in the wind industry, obviously it is good news, the decision. We will continue to invest heavily in that industry. We have already announced big plans to also build a big factory in the UK, as well as in other countries across Europe. By the way, also for Russia, we have announced a joint venture with the Russian Technologies State Corporation and RusHydro here for the Russian market, but specifically for the European market also.

And to give you a feeling of what growth can mean for the industry, we acquired Bonus Energy just five years ago, five to six years ago. It was a company with roughly 850 employees. We now have 7,500 employees in the wind industry. So

investing in wind has also always had a good effect in terms of investing in employment.

One challenge for the wind industry, obviously, will be to achieve stability. If you install a lot of renewables, you do need, obviously, a stable grid and that means also investing heavily into big interconnection projects in Europe—combining the hydro resources from Norway with the offshore wind in the UK and the onshore and offshore wind in Germany, as well as solar in southern Europe. That would be necessary for Europe to reach its tough targets going forward.

**D. Fache:**

Thank you, Jens.

You might have noticed that he mentioned grids twice, which is quite important. I think we will talk about this later.

**D. Fache:**

I want to ask you another question. I was really amazed about the reaction of the German power industry to Merkel's measures, especially the RWE. I do not know, Siemens says you were involved in this situation, because you cannot really have contradictory interests here, as wind power is clear. But as a manufacturer with different social interests, how much has Siemens reacted to this situation?

And basically, our second question about the regulatory environment in Germany is, will it change?

**J. Saul:**

First of all, how do we react? Our opinion is that you always need a balance in fuel, both fossil and also renewables. This is our position, contrary to some of our competitors in the wind industry. And that is also why I do not see a contradiction

here in Russia of gas versus renewables. It is not a contradiction actually, it fits together very well.

I do not want to specifically comment on whether we like the decision of the government or not, as Siemens as a company. Me, as the head of the wind business obviously, it is good for my personal business to drive it forward.

The legislation will need to change. As I said, if possible, it will have to accelerate dramatically. Finding the transmission routes will have to happen very quickly without too many interruptions. Otherwise, the target is not achievable. We have to brutally front-load now in investment.

Unfortunately, in nearly every country around the world, the decision is always taken politically, and later on, the private industry has to pick up speed and make good for those delays.

I fear that we will not be able to do that if a change in legislation does not happen which allows the programmes to be accelerated.

**D. Fache:**

Is the regional level the appropriate level? Or is the federal level more appropriate for the business of renewables?

**J. Saul:**

I think the federal level has to establish the ground rules and has to set a strategic priority so that there is a framework for the regions to follow. There can only be an overall strategy for a country, and then it is for the regions to basically implement it.

**D. Fache:**

Thank you, we will come back to the situation when we open the session to questions from the floor. I would now like to move a little further south, to Spain, where renewables have been actively developing for the last 10 years, and ask

our friend what the Spanish situation is like, especially taking into the account the problem of increased tariffs. We can see that this is one of the most complex problems, and it is something we see not only in your country, but also in France, in Italy, and everywhere else.

**F. Hernandez:**

Thank you, thank you very much indeed.

Well, let me tell you about the case in Spain a little bit. It has been a bit more than 10 years since we started investing in solar technology, in solar R&D in the mid 1980s in the Almeria desert. It has been all that development that really led us to the massive deployment of renewable energy sources since the start of this century, even at the end of the last century.

So, tariffs are one part of the story. It is clear that Spain has bet on renewables early. Betting early on renewables is a little bit more costly, yes, but it allows pushing down costs faster. So without pain there is no gain.

There has been an early investment decision from the Spanish government, early support, and that has allowed us to reach the very ambitious position where we are now. In June 2010, roughly a third of all electricity generated in Spain is generated with renewables. A third: this is important, we have more than 20 gigawatts of installed capacity in wind power, more than four in photovoltaic technology.

Spain is the leading country in terms of installed capacity in concentrated solar power technology, with around 800 megawatts already installed, and around 2,000 more in the coming years that will be installed. All that speculation, that entire process has been extremely fast, if we compare it with our expectations a few years ago at the start of this whole process.

But let me tell you one thing, the economics worked, and work very well, because first of all, like the rest of the European Union, in Spain we are heavily committed to reducing carbon emissions. This has allowed us by now to save approximately

35 million tons of CO<sub>2</sub> per year, which is a substantial amount if you put it in monetary terms, consider it EUR 25 per ton of CO<sub>2</sub>, and that is a substantial amount, and that is per year. But in Spain we do not have the luxury that Russia does, for instance: we have no gas, we have no oil. We are almost fully dependent on imports for all our fossil fuels.

Betting on renewables allows us to save an amazing amount of money on imports. We are talking about the period 2005–2010. Due to the support in renewables alone, we have saved the equivalent of almost 600 million barrels of oil during that period. In 2010, that amounts approximately to USD 8 billion of saved imports, which is an improvement in the balance of payments of the country. It is money that we can allocate to other ends, and that was in 2010. If we consider current oil prices, we will be talking about yearly savings of at least USD 10 billion, which is a very substantial amount, and which certainly, without a doubt provides an economic benefit, along with the benefit of reduced emissions, and the benefit of having developed a very strong industrial sector in renewables in Spain. Spanish companies have achieved a world-leading reputation in excellence, in research and development in renewables, in construction and in the operation of renewables.

And all that basically means that it pays very well for the higher tariffs that one could consider in the very first years of this process. Let me tell you something: the cost of deploying renewables has come down dramatically over the last few years. In the next 10 years, our new national renewable energy plan, which is even more ambitious than the 2005–2010 plan—because it is a 10-year plan—we are basically expecting to double renewable capacity, with half the cost that we had in the first five years. And that is thanks to the early investment decision, and thanks to the costs saved throughout this process.

Now, it is not just a matter of higher tariffs. Again, this is a long-term decision, and as a long-term decision, it pays off, and it has certainly paid off for a country like Spain. It has also other important challenges that have to be faced, and I fully

agree with my colleague from Germany, that investments in the grid are absolutely essential to support the integration of renewables in the electricity sector.

In Spain, we did that. We invested in renewables, not only because the sector was growing in itself, but also because much of that generation was intermittent, so integrating that in the grid was a challenge. We managed to do that. Not only that, our grid operator, Electrica, is a leader, a world leader in that role of integrating, it is the only company in the world—as far as I know—that has a separate control and dispatch centre to monitor the control and dispatch of renewables in the system, together with a more traditional control and dispatch centre for the whole of the grid.

So these are the advances. All this has to go a little bit hand in hand. It is true that early investment is more expensive, but in our case, it certainly paid off, and we continue to support renewables. We continue to think that the economics makes sense. It certainly makes sense for Spain as a country, and we think that this is the way that we can actually meet our future needs in terms of energy and our objectives in terms of reducing dependency on oil, particularly the current oil price scenario, and particularly also to achieve our CO<sub>2</sub> emissions objectives.

**D. Fache:**

Thank you, Fabricio. I was going to ask you a question about the grid, but you answered the question before. I am not going to ask the question about the famous connection with France because it is simply mayhem. I do not want to touch upon this issue. Here, my question is very simple, what is the relative weight today of renewables in Spain, in terms of the energy mix?

**F. Hernandez:**

In 2010, renewables accounted for 13% of primary energy consumption and that, as I said, was approximately... we have bet basically on electricity generation.

We are expecting to bet even more in the future on thermal uses of renewables in electricity generation. Last year, we covered approximately 33% of electricity generation with the renewables.

This year, we have attained even more impressive figures, the last figure I have I think is from the month of March. And in the month of March, wind generation was, for the first time in history, the first generation source in Spain. I think more than 22% of electricity generated in the month of March in Spain was wind-based.

And in our current scenario, which is already true now, but it would be more in the future, we have more than many, many hours around here, particularly off-peak hours, that are virtually fully served by renewables, particularly on obviously windy days. So we expect by 2020 to reach 40% of electricity generated with renewables.

**D. Fache:**

So thank you very much, Fabricio. You see the figures are quite impressive, things are happening. I think also we should keep in mind what Fabricio said about...

**D. Fache:**

I am going to speak in Russian. The process is already happening; tariffs are converging, and the question of artificially low tariffs is probably already in the past, since the cost has dropped significantly in the last two years. It is a very interesting development. It is probable that in the future we will not have subsidies in this area and that there will be competition between different types of energy production. Now we should mention the issues surrounding financing. When we talk about the issues of financing, a banker generally pops up. This is why I will give the floor to Ms. Khanjenkova, who will tell us a little about the role of the European bank in this situation, at first on a general scale. Then, perhaps,

she will talk a little about the situation in Russia. What capabilities, what ideas do our European bankers have in this area?

**N. Khanjenkova:**

Thank you, Dominique.

I would like to thank Dominique and especially RusHydro for inviting me to participate in this discussion, because I am not an energy specialist, and so, of course, I have a different approach to many of the questions we are talking about today. I see them from the perspective of a banker who is interested in financing good projects. For the European Bank (EBRD), the question of supporting renewable energy sources is one of our main strategic priorities. We have even developed a special programme on sustainable energy, and we have been financing renewable resources for a long time. We are one of the largest investors in renewable resource projects in the countries of Eastern and Central Europe, as well as in the other countries where we operate. I would like to note that, in the last two years, we have financed 12 renewable resource projects worth a total of over EUR 400 million. These are very impressive numbers for us. These projects are located in Poland, Hungary, Bulgaria and Turkey.

The question is this: why is it that we can we finance renewable energy projects in these countries, but in Russia we are currently only working on thermal generation projects and, of course, large-scale hydroelectric projects from RusHydro? There are opportunities in Russia, and the government has set a goal to increase the share of energy provided by renewable resources to 4.5% by the year 2020. But we, as bankers and investors, we lack the sort of support system which we heard about from Fabricio. Poland, Hungary, Bulgaria, and the other countries where we work have various support measures in place for investors financing renewable resources. In these countries, there are surcharges on prices or fixed prices, energy grids have an obligation to purchase electricity from renewables before turning to traditional sources, and 'green certification' has

been introduced. All of this means we can say that the risks are acceptable, and that we can begin investing in these projects.

Of course, we were just talking about many technical issues; unstable energy production, the importance of reinforcing networks, system operators and so on. There is a certain de-facto stimulus in Russia to develop thermal generation due to the presence of conventional fuel sources. And, of course, the question of the cost of support is quite sensitive for Russia at the moment, given that there are currently many discussions regarding electricity tariffs. But as Fabricio told us just now, supporting renewable energy sources at an early stage allows for a sharp drop in expenses at the next stage, and a subsequent decrease in electricity prices.

For us, the importance of developing renewable energy resources in Russia is obvious. It is not just a question of diversifying resources. It is not just a question of ecology, which has not yet been mentioned. It is also a stimulus for Russia to develop new technologies and industries. Given the peculiarities of the Russian energy industry's development in the past, I think that the outlook for developing new technologies and manufacturing new equipment is excellent. But again, there is no stimulus for investors to move into this sector. This is why we have been collaborating with RusHydro for a long time in preparing legislation to encourage renewable energy projects. At the moment, together with consultants from Mercados, we are actively working with the Market Council, helping them to assess the possibility of using surcharges as a development stimulus in this sector. At the moment there are many debates regarding which of those measures are acceptable and which are less acceptable. We think that it is very important to make a quick decision and to implement a working support system. This will lay the foundation for developing renewable energy sources in Russia.

**D. Fache:**

Thank you, Ms. Khanjenkova. Are you working on any specific projects at the moment? Which ones? What are your feelings about them? Have you made any positive decisions regarding financing? If so, according to which criteria?

**N. Khanjenkova:**

You know, Dominique, as I already said, we are considering many projects in Eastern and Central Europe. In Russia we often meet with potential investors who are already testing the water and looking at solar energy and biomass projects. But from the investment point of view, at this stage we do not see any projects where we are prepared to take the risk.

**D. Fache:**

So what are the main stumbling blocks?

**N. Khanjenkova:**

Perhaps the greatest stumbling block is that we cannot see how the investment will make a return for the investor. It is very important for us to understand the source of the investment return. Considering current electricity prices, many of these projects are not feasible. This is why we think that the support measures during the first stage are very important.

**D. Fache:**

OK. I will refrain from making any comments about conventional power generation, because it has the same problems. It is my favourite topic, but I will not speak about it today. I would now like to pass the floor to George, so that we can finish with the presentations and begin a discussion, because I was invited not as a moderator, but as a *provocateur*. I would like to try and provoke some discussion a little later. Over to you, George.

## **G. Rizhinashvili**

Thank you. Got it. This topic is very important, and it is very encouraging that we have managed to attract a large audience to discuss it. So, the topic of renewable energy resources and investments from large companies. Technically, we should separate these two aspects. It is obvious that a large company such as RusHydro cannot have separate funding or special sources at this stage, working within the format of the investment programmes which are currently in place for investment in renewable resources. Neither the regulations for drawing up the investment programmes nor the profile of the company, which mainly consists of building large hydro-electric power stations, would currently allow for investment in large or average-sized renewable facilities.

In addition, there are certain challenges. There is the government strategy, key performance targets, which need to be reached. For example, by the year 2020, renewable sources should account for 4.5% of our electricity supply. What is 4.5% of the total capacity? It is a company with power production equal to 25,000–27,000 MW. This means that another large company needs to grow alongside RusHydro, working exclusively on renewable energy sources.

Strictly speaking, we also work with renewable resources. We have listened to a presentation from our Spanish colleague. But even our company is considered as a renewable-sector company; we are even investing in hydro storage stations. But this is a little different, because according to the same Federal law No. 35 regarding electrical power, they raise a clear division: to qualify for stimulus support, a renewable energy resource station can only generate up to 25 MW power. For better or worse, this restriction exists.

This means that, again, from the point of view of the executive government strategy, the main driving force for investing in renewable energy projects needs to come from the municipal investors, from the investors who are linked to local areas. RusHydro and the Ministry of Energy have to mainly act as infrastructure; as supporting mechanisms. Currently, the situation is poor. I think that neither the

shareholders of large thermal stations nor RusHydro have any motivation for investing in the renewable sector. And here, we come across the question of whether or not we need to encourage these forms of power generation. Is it logical? We carried out research with our colleagues from McKinsey, and agreed that there is sense in this. The upside will come in the form of investment in major construction projects. If we consider solar and wind power stations, then 1 kW will cost 25–40% more than in the equivalent power created by conventional energy sources.

But if we look at the big picture, if we consider the cost of the entire project, taking into account the lack of operational costs and fuel expenses, then renewable resource energy projects are extremely profitable. The slow response from large companies such as RusHydro does not allow the creation of new, smaller investment opportunities at present. Also, the current industrial framework does not always make investment in renewable resource projects worthwhile. Here is a good slide: we have Kamchatka, effectively an isolated zone, which contains geothermal energy sites which are clean, wasteless, environmentally friendly, and harmless to the local population. And current pricing arrangements are, essentially, unfair. We can see that the tariff for our geothermal sources at the present day is less than two roubles. At the same time, there are thermal power stations, which receive over five or six roubles. The reason, of course, is the effect of district heating supplies, which we cannot underestimate.

But we have to look at all regions. Today we looked at three or four zones and, together with our McKinsey colleagues, we analyzed the thermal generation situation. In some areas thermal generation can be turned off, not charged at the market rates, and replaced by power generated from renewable resources. The opposite effect leads to growing inflation, which leads to hyperinflation, and in the end the additional tariffs are paid by the government, because from the social

point of view charging 6 roubles, i.e. over 20 cents, without the surcharges that exist in Europe is unrealistic. This could lead to very negative consequences.

And finally, the question is this: what can we do about it? Our documents clearly show the advantages of investment in renewables in general and in terms of major construction projects. This includes the question of project planning. Currently, we are no longer discussing the necessity of introducing tariff surcharges through the electrical power market, through power delivery contracts. Thankfully we are beyond that stage now. We are being supported via the Ministry of Economic Development and the Ministry of Energy. We have a certain foundation, which is allowing us to move forward. This progress is not very fast, for obvious reasons. All mandates and decisions related to the conventional energy supply need to be edited, especially in relation to renewable resources. This includes both the wholesale electrical power market and the retail trade.

So here is the general outline of the work that we need to compete. First, we need to take a rather aggressive position in relation to implementing new documents, new mandates, which will essentially surpass all currently existing mandates and decisions set out at Russian government level. Second, we need to create an interdepartmental group at the level of the relevant Ministries: the Ministry of Energy and the Ministry of Economic Development. We are being supported by colleagues from other companies that are also interested in the development of this area. We need the Ministry of Economic Development to approve our forecasts that in the medium term the tariffs will not rise too quickly if renewable energy projects are to be included in the investment programmes. We have certain plans which need to be implemented before the end of this year. Third and final, is the orientation of large companies toward infrastructure projects. For example, currently we own a large number of design institutes. We own Mosgidroproekt and Lengidroproekt. These institutes possess an enormous volume of knowledge, which supports the technical decisions of other investors

and enables us to provide support to other departments in terms of infrastructure. It is very important that executive decisions are taken which will oblige us pass these technologies to other investors. This will allow us to become a consulting company, and not just a client or a participant in the project. The groundwork has already been laid for this. All in all, this will lead to additional income for the RusHydro group of companies, which is of course no bad thing for us. These three elements are very important.

I think that by the end of 2011, 90% of the government's mandates and resolutions will be passed allowing for an additional tariff surcharge, creating motivation for energy producers by building substations and generators supplied by renewable energy. Of course, this is all stated within the documents, this is a usable technique which has already been approved by the relevant authorities. I have a question for the financial institutions and our colleagues from other companies: how realistic is investment in this project starting from 2012, participating in tenders, being involved in power take-off mechanisms, and so on? The foundation for this exists, and I think that in 2011 a breakthrough was made in terms of making such projects financially worthwhile, because when we were just starting, this was not obvious even for us. I think that we have made a shift, and that progress is being made even now. Thank you.

**D. Fache:**

Thank you. Mr. Rizhinashvili, I have a very tricky question for you: do you think that the existing market model, which may not exist tomorrow, assists in the development of renewable resource projects in Russia? I think that this is an important question for you—does an almost total monopoly on export permit you to develop them?

**G. Rizhinashvili:**

Actually, this is a question about the regulatory framework. All key decisions, for instance, if we talk about the infamous regulation 643, have already been approved, and the mechanisms already allow for investment in renewable energy projects. All we need to do now is to approve the tender mechanism and the locations of these renewable energy projects at agency and company level; agree on where these tender competitions will be held, and work out where the consumer can pay for the power generated by these renewable resource projects. All of the key decisions have already been passed.

Perhaps we need to talk about separate zones. If we talk about the small-scale hydro objects, then we should talk about the north-western region (especially since we are currently in St. Petersburg), the Far East, and probably Southern Siberia. For example, in the Altai region, the potential of hydro projects is great and allows us to use not just local sources, but, theoretically, to export the excess electricity to neighbouring territories. An additional bonus is that a company such as RusHydro can sign long-term contracts for energy supply, based on its financial status. Not technical contracts, since unfortunately we do not have a market-approved legal mechanism for such contracts, but financial ones.

All these infrastructure projects will play a key role for our colleagues from partner financial organizations. If there is no long-term guarantee for electricity offtake, these projects will not be financed. The key decisions are embedded in this complex issue. However, I believe that starting from next year, investments in renewable resources will surge. We are comprehensively supported by the government in this area.

#### **D. Fache:**

This brings us nicely to our debates. But since Mr. Popov has asked to speak, I will gladly give him the floor. Please keep it brief. Do you have a microphone? Go ahead please.

**N. Popov:**

Please put my slides on the projector. Begin with the first. I would like to draw your attention to the fact that, in the field of geothermal energy, the future efficiency of the industry's development depends upon the appropriate distribution of investment. Of course, the question of modernizing the technologies is important, but for geothermal energy there is another issue—the issue of accurately assessing geothermal energy volumes, and of obtaining information about distribution of these volumes within our country. The assessment of geothermal resources has changed dramatically and fundamentally over the past 10–15 years, thanks to developments in geophysics. At first, we thought this information was only of use in theory, but it actually directly influences practice in relation to the prospects for developing geothermal energy generation.

Next slide, please.

**D. Fache:**

How many slides do you have?

**N. Popov:**

Three or four.

**D. Fache:**

OK.

**N. Popov:**

I will be brief. Here you can see a map of Russia's geothermal resources. It was compiled and published, and is the only representative map of Russia of its type.

For a long time, the global community thought that temperatures at levels below 300m were stable, and therefore this map was constructed on the basis of heatflows measured in shallow boreholes.

Next slide. Here you can see deep and super-deep scientific boreholes around the world. The last two decades of the last century was the time when deep scientific drilling came into its own. This drilling programme has fundamentally changed our understanding of the thermal conditions of our planet. You can see that more boreholes were drilled in Russia than anywhere else. These boreholes were unique. The drilling included full core recovery and the careful study of various geophysical characteristics. You can see the results on the next slide.

Here you can see comparative data regarding heatflows prior to the drilling of deep boreholes; the heatflows which we used for compiling the geothermal resource map in Russia and globally, and the new data. The new data are marked in red, and the earlier numbers are in blue. Have a look at this column, and the difference between the old and the new data: 80%, 50%, 70%, 100%. Our understanding about the thermal conditions of the planet has dramatically and fundamentally changed. The extra-deep Kola borehole, forecasted temperature: 100°C. This forecast was made by the world's leading specialists at the USSR Institute of Physics of the Earth. The actual temperature is 180°C. You can see that the forecasted and actual temperatures differ not only at 10, but also at 5 and 4 degrees. What are the reasons for this? Imperfect assessment methodology, the use of shallow boreholes, and other scientific and methodological errors which could not have been detected at the time.

In conclusion, I can say this: alongside the modernization of technologies that we are speaking about today, we need to invest in methods of accurately assessing our geothermal resources. We need to find an organization which can act as a leader in organizing and carrying out the long-term integrated collection of information from various types of borehole, whether those are oil wells or RosAtom wells used for the storage of radioactive waste. This problem cannot be

solved in one, two, or even five years, because nobody will carry out research into a representative network of boreholes. This is why we need to begin careful and slow work with appropriate funding.

According to this data, the geothermal resources must be assessed taking into account new patterns in thermal conditions through 3-D geothermal mapping of energy distribution not only at surface level, but also at depth. After what I have said, I think you might agree with me that Russia's geothermal resources can be assessed more optimistically. Thank you very much.

**D. Fache:**

Thank you for being brief. I know this issue in detail, because my company, Enel, has been carrying out geothermal research in Russia since the 1990s. You mentioned a company which is quite similar to mine. Thank you. I was not surprised to hear what you have to say. I would like to pass the floor to Mr. Kopylov. No more than two minutes, please.

**A. Kopylov:**

Hello, my name is Anatoly Kopylov. I represent Mercados, a company which has already been mentioned today. I would like to talk about an issue which was mentioned as one of the most pressing: the question of the economics of renewables. Just recently, we carried out some calculations for some countries in the former USSR: for Russia, Ukraine, Kazakhstan, Kyrgyzstan and so on. What did we find out?

If you take the average cost of various generation technologies, including renewables, then at the moment, most renewable technologies are more expensive than existing thermal generation. But as soon as the calculations take account of carbon emission restrictions, which are, from our point of view, completely justified and logical, then the cost of producing electricity using ground level wind power generators is lower than the cost for coal power

stations. Today someone mentioned the lowering of fixed tariffs for solar energy: this has happened in Spain, Czechoslovakia, and other European countries. We know that many countries are looking at this issue.

We could say that it is a problem. However, it is not a problem, it is a major advantage—technical progress has overtaken the expectations of both the governments who once set tariffs, and of representatives of the power industry. I have a question related to this for our panel. The issue is this: the growth of renewables is driven by those energy companies which are currently present on the market, including thermal energy companies. But we are saying that we do not really believe that anyone will cut off the branch he is sitting on. We should try and create new development drivers in the economy which will work specifically with renewables.

And here is a question, which I would like to ask both of Mr. Fache, as a nominal representative of the conventional power industry, and Mr. Hernandez, as the representative of the Spanish government: do we believe that conventional energy companies can become the driving force behind the development of renewable energy? It does not matter which country we are talking about, it could be Spain, Italy, Russia, USA and so on.

**D. Fache:**

Thank you for the question, we will try to answer it. What can I say from my side? I have not spoken about Enel Green Power which, as you know, is probably one of the largest firms in its industry. This is an attempt to develop renewable energy almost separately from the main company, an attempt at diversification. We are not stupid or blind, we can see what has been happening, and we have to find a solution within the corporate framework of our company. We were the first to make an initial public offer, because we control the main part of the shares. We are developing internationally, and we have a presence in 25 countries: Spain,

and countries in North and South America. Just recently we invested about 300 million into solar energy production in Nevada, I believe. It is a large project.

I do not want to speak just for myself; I think that many energy companies are making these attempts, and this is a very good thing. It is possible that we will continue to buy companies; that keeps on happening. There is coal development in California, what is known as clean coal, and work is continuing apace. And now, my German friend, I would like to let you speak.

**J. Saul:**

The decisions of traditional suppliers of energy will be connected to a business case, and most of the customers that we have globally are also customers that are active in the traditional fuels.

And I wanted to specifically comment, therefore, on the cost situation. It was discussed a lot. Because I do not think that a lot of people are aware that—specifically, the wind industry—in the last 40 years, we have made it possible to decrease the cost of energy from wind by 30% to 40% per decade. That is what we have achieved so far.

We are, at the moment, 30% to 40% away globally from reaching a competitive level with fossil fuels. So if we have not managed to reach the same level within the next decade, I think then we will have failed. And I think our industry is very much committed to that.

Now, in Russia, it might take a slightly different length of time here because of the low cost of fuels that are here. We said, are incentives necessary? Yes, because we, as the industry, need the money to also invest and get these costs down. And if you now take a look at, specifically, the Russian situation where it was discussed whether the price of energy will go up here by 6% to 7% until 2020 if we do invest here in renewables. That only considers a drop of the energy price of 0.2%. That is what is in the McKinsey Model.

Last year alone, just by improvements in technology, not by cost-cutting measures, we were able to get 6% to 7% more energy out of the wind by aerodynamics and by profiles. So it can be that also here for Russia, in a very short time, that wind would become affordable. And the combination of having strong gas resources and the combination of using these brilliant wind resources—700 GW are in this country, that is a resource that is just waiting to be harvested here in this country—is an ideal combination that you would have.

Now, you could easily say, let us wait until the wind industry and the renewable industry has reached that level. But sorry, then you will not get the benefits of job creation in this country. If you look at countries like Germany, like Denmark, who had done this up—and Spain specifically, I think it was very well mentioned—the upfront investment by supporting the country with support mechanisms supporting renewable energy, the support mechanisms pay back in terms of creating an industry.

And for instance, we are waiting. We are just waiting here for an attractive tariff system to come in place, and then we will fund a joint venture. We will invest EUR 100 million in this country with our partners, The Russian Technologies State Corporation and RusHydro, and create 500 jobs directly and probably the same at the beginning. Five hundred jobs, that is at the beginning. That can easily grow much more, and then specifically, also, attract the industry and the supply industry to get them ready for the time when this is the case.

I would like to really point out that the cost situation of renewable energy will always go down. The cost situation for fossils will always go up. So there will be a point in time, and then having the fluctuating wind combined with the fast-acting gas-supplied power station is the best combination that you can have. Russia has the best conditions to have a balanced renewable and fossil fuel system.

#### **D. Fache:**

Thank you very much, Jens. I would like to nominate Fabricio to speak.

**F. Hernandez:**

Thank you.

Just a couple of comments to answer your question. Firstly, when we think about traditional energy companies, we think about fossil fuel companies and/or companies that are generators, and at the same time are integrated vertically into, say, the distribution and sale of energy.

There is absolutely no reason why a traditional energy company should not be in the business of renewables. Our experience in Spain has proven that. Most traditional energy companies—some more than others—have bet on renewables and are now world leaders in renewables, without losing their competitive advantage in their traditional business.

And why is that? I think there are two key issues here that have to be remembered. One is that renewables are not, at least in most countries, 100% substitutes for fossil fuels. Actually, intermittent renewables require backup fossil-fuel generation.

The important thing is that when that intermittency problem becomes more and more severe, in the sense that the percentage of wind generation in a country becomes higher and higher, the amount of hours with no wind or with less wind will also increase.

And that will pose the need for fossil generation to be ready, to stand ready, and be available to generate. So this integration between the two types of technologies, there are many types of technologies, but I mean renewables and fossil, is something that traditional energy companies are in an ideal position to actually master.

The second important level is that the integration of renewables in the grid requires, among other things, smarter grids. And smarter grids are necessarily—not necessarily—but logically, one of the areas where investment by traditional

energy companies in infrastructure, particularly distribution networks, is likely to be more important.

On top of that, one key issue for the integration of renewables is the availability of interconnections. The small countries talk about interconnections. In large countries, you can talk about connecting parts of the country with more or less renewables because when there is excess renewable in one area—excess energy with respect to demand—the excess will naturally integrate with other parts of the country.

This is something that, in the context of the European Union, is a part of the active discussions at the moment, the concept of super grids. Very high-voltage transmission grids that could connect Northern Europe with Southern Europe, so that when there is excess wind in Northern Europe, that can complement the lack of wind in Southern Europe. On the other hand, excess sun in Southern Europe will complement lack of sun in northern Europe.

And that type of complementarity will be key in the future to actually have the least-cost system overall, so that renewable energy can be backed up by fossil fuel at the lowest possible cost, and that will feed in through lower tariffs and also to have a lower need for infrastructure. You need to invest in infrastructure at the start, but if you invest wisely in renewables and wisely in infrastructure, that will come up, at the end of the day and in the longer term, with a lower need for infrastructure.

So I think traditional energy companies that have, by definition, diversified in all the different parts of the value chain are natural players in the new world of renewables.

#### **D. Fache:**

Thank you, Fabricio.

I would like to highlight the importance of what Fabricio said about the grid. Yesterday, we were discussing the issue of smart grids. You know, we have

magic words such as 'innovation', 'modernization', and 'energy conservation'. These words: 'smart grid', 'smart meters'—they are the same, and I will refrain from mentioning any other possible smarts. But I would like you to understand why this is so important.

This is not a fad, it is a solution to a situation. Firstly, to lower our losses. Secondly, so that the issue of who is paying how much and where will be understandable and transparent. And thirdly, to provide the consumers with new options. These are the three issues that we need to deal with today. And I think that the reforms have to happen in all areas, not just in power generation, i.e. in all areas from fuel to billing, to meters and payments, to avoid cross-subsidies and other issues. And the second topic which I would like to mention is that this industry, like the Internet, creates employment. Yes, some conventional jobs will vanish, but new ones will be created. The Internet creates 2–2.5 jobs on the market in place of each that is phased out. So, to answer your question, new companies will be created, and they will have their own existence. They will be different companies, specialising in solar energy, wind energy... and, of course we need to encourage this to happen in Russia as well.

I would like to let Mr. Gribkov speak. Please, be brief. You have two minutes.

**S. Gribkov:**

Dear ladies and gentlemen and colleagues, I represent the Committee on Issues in Implementing Renewable Energy Sources, from the Russian Union of Scientific and Engineering Non-Governmental Organizations. We have just hosted the 8th International Conference on Renewable Energy. The conference went very successfully. We came to conclusions about the development of this technology in Russia, and made forecasts for its implementation.

When we talk about the development of renewable energy resources today, it should be said that they need to develop in parallel with conventional energy sources: they must not replace them but develop together harmoniously. What

needs to be done for this to happen? And why do we lack this kind of intensive development in Russia? The first problem is legislative, the second is economic, and the third is technical.

I would like to talk about the technical issues, since I am an engineer; I work on wind power generator design and engineering. First of all, it needs to be said that there are two areas in this field: high-power and low-power installations. If we look at this from the technical point of view, then our low-power installations are well-developed; we have good solutions and design, and everything is fine. Now, regarding the large installations. We are planning a development programme involving the construction of a number of stations. They include the Gelendzhik station (98 MW), the Eyskaya station (75 to 124 MW), and the Ulyanovskaya station (25 MW). And this is the technical issue. Yes, we want to build, but what are we actually going to construct? We have nothing that we can construct. Russia used to be a leading country in terms of wind power generator development, we used to have interesting solutions. Now it is all lost, and we are lagging very far behind. We need a transfer of technologies. On the basis of this transfer, we could develop powerful wind power generation strategies. From our point of view, this is a very important field.

**D. Fache:**

Thank you. Thank you. Now we can have some questions. There must be some. Patrick, I can see that this lady would like to ask the first question. Patrick Williams.

**P. Willems:**

Thank you, Dominique. My name is Patrick Willems, I head up the International Finance Corporation: the IFC. My colleagues and I genuinely hope that development in Russia will progress as it does in other countries. I have one favour to ask you. Can we stop talking constantly about support and about the

subsidies which are required for renewable energy? The only thing I ask is that renewable energy be given the same financial support as conventional energy receives today. The subsidies given for conventional fuels are 6–7 times higher than those received by the renewables sector. In Russia, according to figures from the International Energy Agency (IEA), the fuel industry receives USD 35 billion per year. USD 35 billion! If I understand you correctly, the RusHydro numbers mentioned were even larger: USD 40–60 billion. So why not simply take the money that we have been spending for the last 20 years on conventional resources and hydropower and spend it on renewable resources instead? As the representative from Siemens said, we will have the money, and the cost of energy supplied from renewable and conventional sources will be the same. To be honest, when I look at the plans for building new coal power stations in Russia, I do not understand the logic. Who knows how much coal will cost in 20 or 30 years? Although the financial sector requires a return on investment within 10 years, these stations will work for 35. I know how much the wind will cost in 35 years. Thank you.

**D. Fache:**

Patrick, tell us honestly please...

**P. Willems:**

Honestly? Here?

**D. Fache:**

How much is the IFC prepared to invest in new Russian renewable energy projects every year for the next five years?

**P. Willems:**

Dominique, I think the answer is very simple, and I think my colleagues will say the same. According to our programmes, we have the most...