Annual Review 2018
A unique initiative by

the world’s largest power grid operators

for the development of stable, affordable and environmentally-sensitive energy
It is my honour and privilege to serve GO15 over the course of 2018 as its 10th standing President. I am energised and inspired by the level of commitment, as all 19 members unite around the common purpose of sustaining GO15 as a professional industry body and respected “CEO club” in an era of global sustainable energy. The Fourth Industrial Revolution demands that we position ourselves as innovators and early adaptors as we steer through economic, environmental, and technological shifts and advancements.

In recent years, the energy landscape has been driven by the growing desire for global sustainable development. We recognise that, as renewable energy costs continue to decline, and energy storage and demand management technologies are rapidly being developed, there are new opportunities to build cleaner and more efficient energy systems and expand energy access. It is crucial that our industry be ready and capable of balancing conflicting priorities as we continue to fulfil our mandate of providing green, reliable, and secure energy for economic and social growth and development.

In pursuit of this, the Steering Board commissioned three new strategic areas of research for 2018 and beyond. These are “economic sustainability of grid operators and the changing business model”, “integration of renewable generation and distributed energy resources”, and “reliability and resiliency” in terms of climate change, cybersecurity, and grid reliability services. Driven by a volunteer network of experts from each member company, the various research areas have already provided invaluable insight and, once completed, will lead the way for the global industry.

In addition, with the support of the GO15 leadership and members, I am pleased to provide information on the progress on the five commitments made at my inauguration as President in Brussels on 24 October 2017:

- **Facilitate the transition to our new strategic approach:** we have reaffirmed the GO15’s principal purpose as a chief executive club with the embodiment of trust and respect, while embracing our rich diversity.
- **Continue strengthening partnerships with associated bodies:** we have expanded our relationships with key international partners and been featured on their strategic agendas. In addition to the Memorandum of Understanding (MOU) signed with ICER in 2012 and with APEX in 2017, we will soon conclude a similar Memorandum of Understanding (MOU) with Cigre in 2018. GO15 is well positioned to demonstrate its relevance as a professional body and to provide invaluable contributions to the development of the power systems of the future.
- **Enhance, and ensure that we operate in, the framework of our new governance:** our governance framework enables mobilisation and drives performance. This framework continues to show its robustness, with open and constructive dialogue and firm decision-making.
- **Increase awareness of the GO15 brand:** we have adopted endorments by, and accepted speaking opportunities with, organisations that can further enrich our brand image. Africa Utility Week in South Africa and World Energy Week 2018, organised by the World Energy Council (WEC) and hosted by WEC Italy, are the first of many endorments that will further enhance our brand performance.
- **Be visible and hands-on:** I have prioritised communication and the building of healthier relationships with the Secretariat and GO15’s two Vice-Presidents. Attendance at the May 2018 Governing Board has provided valuable insight into the progress of our research studies and the performance of our communication workgroup. The remarkable enthusiasm with which our 19 international member associations have driven GO15’s growth in the past decade is inspiring.

I remain grateful for the wisdom and dedication of all 19 members and their representatives who have contributed to our efforts over the past year.

I would like to thank our two Vice-Presidents, Mr Fedor Opadchiy and Ms Audrey Zibelman, and Secretariat, Mr Alain Steven and Ms Salima Hebbache, for their invaluable guidance and support. As we transition into 2019, I wish our next President elect, Mr Fedor Opadchiy, success in the continuation of our strategy, and I commit my support to him as we continue to lead the way as a valuable industry energy player.
Power Grid Operators
Roles and Challenges

Roles of the Power Grid Operators
Power grids and continuous development of supporting infrastructure play an essential role in promoting social welfare of the world’s population. Reliable and safe supply of energy is a responsibility of the Power Grid Operators.

- Acting to ensure quality and security of supply, at an affordable cost to end-consumers
- Serving as an interface among direct users of the transmission grid: end-consumers, large industrials, generators, traders and distributors.
- Being interlocutors with regulators, competent authorities and governments.

Power Grid Operators are confronted with similar challenges:
- The large-scale penetration of renewable generation and other distributed resources embedded in the distribution grids increases uncertainty and volatility in power grid operations.
- Demand-side management and integration of electrical vehicles result in changing consumer load patterns and interactions with the grid operator.
- Improved grid resilience is needed to face increased exposure to natural or man-made disruptions to power grid operations.
- Smarter and stronger grids addressing the environmental objectives and the transition to a new energy mix require major investments and funding.
Background

GO15 (initially named VLPGO for ‘Very Large Power Grid Operators’) was founded in November 2004, as a joint initiative between 12 of the largest Power Grid Operators in the world. The initial intent was to create a top executive forum that could meet on a regular basis and discuss the challenges specific to the increasingly complex power grids.

This initiative was done on a voluntary basis, with members, working together on selected joint activities with annual deliverables. Several working groups were formed to address challenges through exchanges of experience, best practices and joint developments.

Today, the GO15 comprises 19 PGOs from the six continents, who serve over 3.5 billion customers on an aggregate basis. The GO15 members are well aware of the important role that they have to play in the great energy debate, and in particular, in providing their contribution to solving the Energy Trilemma defined by the WEC at the 2013 World Energy Conference in Daegu as: “The development of stable, affordable, and environmentally-sensitive energy”.

More specifically, the GO15 is working through dialog, joint workshops or collaborative efforts, with a number of international organizations such as APEX (Association of the Power Exchanges), Energy Charter, ICER (International Confederation of the Energy Regulators), IEA (International Energy Association), WEC (World Energy Council) and other associations.

Objectives

1- Power Grid Operators support the transition to the New Sustainable Energy Mix.

2- Power Grids are the backbone of economic development.

3- Resilience and Safety of the Power Grids imply investments at a reasonable cost for consumers.

Vision

To be a leader and a catalyst in the transition of the electric power industry to the power grid of the 21st century.

Mission

Innovative thinking: build international consensus on the strategic issues challenging the very large power grid and market operators.

Technology advancement: develop a common vision with respect to the technologies and best practices.

Industry leadership: through a common communication policy, the dissemination and implementation of a common vision via information exchange, collaborative projects and cooperation.
GO15 – 12 years of best practice exchanges and joint developments

May 2004
RTE, PJM and Tepco agree to develop a joint initiative regrouping the largest power grid operators of the world

November 2004
First meeting in Philadelphia, hosted by PJM. Initial meeting included MISO, National Grid, ONS, PGCIL, PJM, RTE, SGCC, Tepco and Terna

November 2008
GO15 incorporates in the State of Pennsylvania

April 2012, London
Signature of MoU between GO15 and ICER

November 2013,
Annual Meeting and 2013 CEO Declaration, Joint Meeting with APEX

2nd GO15 Forum 2015,
Dubai – UAE

3rd Workshop GO15 and ICER
2017, Washington - USA

3rd GO15 Forum in Collaboration with APEX
2017, Brussels – Belgium

October 2013
GO15 participates in the WEC Conference in Daegu

TSO/DSO Workshop - CEM7
2016, San Francisco - USA

GO15 incorporates in the State of Pennsylvania
POWER GRIDS
RELIABLE
AND
SUSTAINABLE

GO15 – 12 years of best practice exchanges
and joint developments
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2016, San Francisco - USA
3rd Workshop
GO15 and ICER
2017, Washington - USA
2017, Signature of MoU between
GO15 and APEX
3rd GO15 Forum
in Collaboration with APEX
2017, Brussels – Belgium
1st GO15 Forum 2014,
Guangzhou – China
2nd GO15 Forum 2015,
Dubai – UAE
3rd GO15 Forum
in Collaboration with APEX
2017, Brussels – Belgium
More than 150 experts working on technical, economic and regulatory topics

The World’s 19 largest power grid operators
More than 70% of the world’s electricity demand of which 21% from DER
3.5 billion consumers
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GO15 Steering Board Interviews 2018 – Russian power System Operator: advantages and current challenges

Fedor Opadchyi, “System Operator of the United Power System” JSC Deputy Chairman, Administrative Committee member and GO 15 Vice President in 2018 – speaks on peculiarities of the Russian power system and its operation dispatch control, its history and future, as well as on major challenges they face.

What are the peculiarities of the power system controlled by the Russian system operator?

Russia has the widest territory in the world, so its power system can be characterized as one of a high geographic extent. It consists of seven interconnected power systems, each of them, in its turn, including a significant number of regional power systems. Interconnected powers systems comprise large centers of electric power generation and consumption and are connected with extended main transmission network of 330kV, 500kV and 750 kV voltage types. 750 kV network is concentrated in the central part of the country. It primarily provides power delivery of the nuclear and the largest thermal power stations. The rest of the main transmission network infrastructure operates at 220kV-330kV and 500 kV. 220kV and 110 kV networks operate in the regions delivering power to the largest energy hubs. The existing topology of the backbone network was basically formed in the Soviet times. An important role in the process of operation of such an expanded power system is played by power flows in the main network as well as by system sustainability maintenance. Historical peak of consumption recorded in our power system amounted to 157.4 GW, annual power consumption in 2017 slightly exceeded 1,000TW/h, and the installed capacity as of 2017 reached almost 240 GW. Most power stations with capacity exceeding 25 MW and network facilities of 220-750 kV operating in the UPS of Russia serve as the objects of dispatch for the System Operator. 110 kV network facilities are managed by the System Operator only in case they have a systemic effect on regional electric power operation modes. Lower voltage type is represented by distribution networks managed mostly and locally by network companies. The principal part of the distribution network complex enters into PJSC ROSSETI, and alongside this there exist more than two thousand independent network companies. The United Power System of Russia (UPS of Russia) is a part of a large power pool operating synchronously and including power systems of 12 countries. The UPS of Russia is the largest part of the power pool. It shares about 70% of the total electricity consumption of the synchronous zone. The size, geographic location of the UPS of Russia and network topology place Russia under the duty of frequency regulation in the power pool. The Russian system operator pays fairly much attention to the parallel operation modes coordination both directly during modes management and during development and promotion of normative documents and market regulations. The UPS of Russia was formed by consecutive consolidation of regional power systems, so the current structure of dispatch control reflects such composition of the power sector. There are three levels of the dispatch control structure: Central dispatching office, 7 interregional dispatching offices and 49 regional dispatching offices. Such hierarchy is, in many ways, motivated by viability reasons of such a large and extended power system. Sharing responsibilities among the dispatching offices of the System Operator allows to provide control in complicated and emergency situations, as well as to deal more thoroughly with the issues of regional power systems development planning being highly important for the UPS of Russia which historically developed in the conditions of shortage of resources and has a significant number of bottlenecks.

How do the power system peculiarities affect its electric mode operation?

The Russian power system has good natural capabilities for optimization of modes of generation load, as well as for sustaining reliability.
First, wide capabilities of optimal usage of the existing generating capacities naturally originate from the high geographic extent of the power system due to location of the UPS of Russia synchronous zone within seven time zones. The load peak moves within the power system from the East to the West together with the sun allowing for a more effective usage of the existing power stations. Due to the coincidence of the load peak, when the total peak of the power system is significantly lower than the total of local load peaks in its parts, the requirements for the power system maximum capacity reserves decrease and a tighter time schedules of loading of power stations is achieved with a direct impact on the power generation effectiveness.

To fully use the effect, the System Operator implements procedures of consecutive planning of the system operation modes, which include hourly complete optimization of loading modes for all power stations operating at the wholesale electricity market, and there are about 400 of them. This planning system ensures the highest system effectiveness of fuel consumption by using the most effective generating equipment among that available at the moment considering the actual costs for power transmission. Due to the great geographical extent of the power system, the climate impact differs much in different regions: temperature can be higher than the forecast in some regions, and lower in other, and thus the task of rebalancing of the system operation to a mode close to the real time becomes more urgent. Secondly, we consider thermal generation, namely gas, as the main method of electric power generation because Russia possesses greatest reserves of the world’s gas resources. In Russia it is a relatively cheap fuel type and it is also much more ecology-friendly as compared to coal the reserves of which are significant as well. Thermal generation share in the total generation capacity of UPS is over 68%. After exploration of gas fields of West Siberia in the central part of the UPS of Russia in 1970s, large generation volumes originally designed for using coal were gradually redesigned for gas.

An important role is played by hydro generation responsible for over 20% of the total capacity of the country’s power system. Both thermal and hydro generation are highly flexible resources that give serious advantage for electric power mode operation. Low-flexible nuclear generation covers 11% of the total generation capacity of the UPS of Russia and is concentrated in the western part of the UPS of Russia up to the Ural.

An important feature of the UPS of Russia is a large share of thermal power stations with combined generation of electricity and thermal power, this being explained by the climate factors specific for Russia. Most of our cities and towns use systems of centralized heat and water supply, due to the fact that the most effective method of fossil fuel combustion is combined cycle operation with the theoretically possible efficiency approaching 100%. Thus, simultaneous introduction of heat supply and electric power generation allows for significant reduction of fuel costs. However, this imposes additional limitations on load maneuvers at such stations (primarily, on unloading below the value specified), because heat generation modes are of top priority in accordance with the federal laws. To some extent, the volumes of electric power generation in the cogeneration mode are considered by us as an analogue to the influence on the RES balance considering the difficulties of operating generating facilities based on RES due to instability of the latter. This cannot be a complete analogue, though, as the cogeneration modes are much more predictable than the RES, and there are alternative methods of heat generation; still in general, generation in the cogeneration modes is considered by us to be one of the main “consumers” of a power system flexibility in winter time. And it undoubtedly has a significant effect on all dispatch control procedures.

Third, some market instruments are used to support adequacy and stability. Primarily, it is the capacity market that stimulates generating companies to maintain the power objects in a proper operational state. Ancillary services market was formed several years ago to solve the issues of formation of necessary reserves of rated primary and automated secondary frequency control. It adds to the capacity market mechanisms creating resources needed to support reliability and operational quality of the power system. Economic mechanisms are also built in the structures of the day-ahead and balancing markets and aimed at more accurate compliance of power stations with time schedules and instructions of a dispatch control engineer. The market rules are not static, so they regularly require to be finely adjusted to the changing environment which includes new technologies appearing, changes in the macroeconomic situation etc. The System Operator is deeply involved in the procedures of design and promotion of normative documents and their modifications. The task is to keep balance between technical aspects of functioning of such a complex object of engineering as a power system, and economic innovations.

Nowadays, a number of the world’s largest power systems undergo processes of unbundling the functions of power system dispatching from the network operators structure and a transfer to the independent system operator model. Each country has its own reasons to do this. What were the reasons for Russia to choose the independent system operator model?

The independent status of the System Operator in Russia
came as a natural result of the influence of a series of economic conditions and technical particularities of the power system. In Russia the concept of the independent operational dispatch control was developed at the beginning of 2000s during preparation of the sectoral reform, in the course of which the power complex was unbundled as per activity types: generation, transmission, supply, scientific research and engineering and etc., and further competitive types of business were privatized. Under such circumstances, in order to ensure technological integrity of operation of such a large and extended power system as well as provide for the possibility of systemic optimization of its operation, which I described before, it was required to structurally incorporate within one company the functions of operational dispatch control of the UPS of Russia at large as well as of the interconnected power systems and the regional power systems which were formerly under control of vertically integrated regional holding companies.

Besides, in the circumstances of unbundling of the electric power industry by the activity types and competitive businesses privatization, nearly every technological action of the System Operator influence economic results of certain market players activities; and the scale and the scope of such influence increases dramatically upon rise of the level of centralization of operational dispatch control functions. The simplest example – coordination of repair schedules of the electric network and generating equipment. In our power system having a significant number of bottlenecks, it is often impossible to conduct all necessary works with the equipment owned by different owners, so their mutual coordination is required. It becomes critical during fulfillment of such function to avoid the conflict of interests and affiliation of the System Operator with any of the market members.

Another example. Modern power markets aim at optimizing the cost of power for consumers. With that it often happens that loading a cheaper power station, located remotely from the consumer, proves to be more effective than loading of an expensive one which is nearby, despite the fact that this leads to increased network losses. This is an advantage for the consumer who pays for the whole chain – generation plus transmission; but for a network company this means direct rise of costs related to compensation of additional losses. In case the System Operator enters a network company a new conflict of interests arises. By the way, we conducted special simulation together with the Trade System Administrator (electric power exchange) to learn what would happen if the wholesale market was restructured for the purpose of network losses optimization, and the results we got were catastrophic for the consumer meaning the price increase by 2 or 3 times provided that the current principles of price formation were preserved at the wholesale market. This means that the independence of the system operator is an important condition for the current organizational model of market relations within the Russian electric power sector to exist.

The System Operator is deeply involved in the processes of technological connection of new consumers and power stations to the network. According to the laws applicable in Russia, all technical specifications issued by network organizations for connection of generation and consumers with a capacity of more than 5 MW are mandatorily to be approved by the System Operator. In this process we act as an independent technical expert and this helps us to balance the problems of maintaining the power system reliability and economic results of specific technical solutions of different sectoral subjects. The independent status of the System Operator makes it possible to avoid the conflict of interests within this process as well as to ensure transparency of the suggested solutions for all participants of the process.

There are many other examples of potential conflicts of interests between the functions and the ownership structure of the System Operator. Just because of this, the variant of a completely independent system operator with 100% control over it being retained by the government was chosen while reforming of Russian electric power sector.

What are the main challenges that your company is facing now? How do you manage them? What kind of problems does this help to reveal?

As it is today, the System Operator has been existing for over 15 years. During this period, Russian electric power sector has overcome several serious challenges relating directly to the company’s functions. Thus, in middle 2000s, there was a forecast for the soonest shortage of generating capacity and power system networks capacity associated with the rapid growth of the Russian economy after the economy collapse in 1990s due to the demise of the USSR. For example, restrictions on electric power consumption were introduced even in Moscow during peak loads in autumn/winter, 2005-2006.

To solve this problem, the decisions were adopted on the government level aimed at stimulating investments in construction of generation facilities and network infrastructure development. Particularly, for generation development, the program of agreements for capacity supply to the wholesale market was developed and implemented stipulating signing of agreements with investors for capacity supply to the wholesale market. This is a program of facilitating investments in construction of new generation facilities within the time limits previously agreed upon, with the specified location and technical parameters as well as with the payback
equipment for reconstruction at different power stations. Nevertheless, simultaneous decommissioning of energy needs to be replaced. Other large-scale equipment of power stations also substitutional actions are required at decommissioning of such units, and sometimes even commissioning of new generating capacities may be needed. Solving of such matters requires a separate code of rules and procedures to be set, this is what we are actively engaged in today.

There are also other important issues set forth by today’s world. It is, for example, development of the common electric market with Kazakhstan, Belarus, Armenia and Kirgizia. This project is very interesting in all terms – technological, political, legal and organizational. Despite the fact that all our countries used to comprise the USSR and formed a unified state, there was not any unified policy considering rules of operation of power systems in different countries in the last years, thus, over more than 20 years, each state has formed its own specific structure of power sector management. In Belarus, there is for example, a vertically integrated power company and a tariff regulation; in Kazakhstan there is the monthly sales volumes market model. We assume that in Russia today one of the most advanced market models is used with respect to the experience of power markets functioning in many states of the world. So, now we face an ambitious task of synchronizing different models of power markets functioning in many states of the world. To achieve this, we need to develop and implement the following mechanisms facilitating modernization: develop mathematical models of power systems in different countries in the last years, thus, over more than 20 years, each state has formed its own specific structure of power sector management. In Belarus, there is for example, a vertically integrated power company and a tariff regulation; in Kazakhstan there is the monthly sales volumes market model. We assume that in Russia today one of the most advanced market models is used with respect to the experience of power markets functioning in many states of the world. So, now we face an ambitious task of building up a common energy market that will enable optimization of balancing of several countries’ power systems. I think, it will be quite difficult to synchronize different models of power markets functioning in many states of the world. So, now we face an ambitious task of building up a common energy market that will enable optimization of balancing of several countries’ power systems. I think, it will be quite difficult to synchronize different models of
power systems which vary so much. But still we believe that we will be a success in everything; this assumption is supported by the positive experience that we have had in synchronizing Russian market and Nord Pool (nowadays it is part of the European Internal power Market) during the power exchange with Finland. Speaking about internal challenges, three main directions can be determined. First of all, we are now executing a large project of implementation of a new-age operative-information complex (SCADA) in all of our 57 system control centers. The life cycle of the current solution is being finished, and we are in the process of designing of the new SCADA-system, as well as of phase implementation of its key blocks, such as the hierarchical manager of network models, calculated subsystems etc. The task is even more complicated due to the fact that, given the existing three-level structure of operating dispatch control, all our key IT-systems require a distributed structure on the one hand, and, on the other hand, it is critical for us to ensure not only data integrity and consistency in all system control centers at the same time, but also the possibility of autonomous operation of each of them in emergency situations. This task is very complicated and interesting with regard to IT. We consider very important and useful our GO15 colleagues’ experience and results of GO15 committee 4 “Grid Intelligence” research as well as such documents as White Paper “EMS for the 21st Century System Requirements” by CIGRE in 2011 for the designing process and practical work... All these enable us to consider most advanced global achievements during new SCADA-system development.

Second, we actively develop both new automation tools based on WAMS (Wide Area Measurements System) technologies and emergency automatics. The research conducted within GO15 committee 4 demonstrated that, as of 2015, the UPS of Russia ranked third in terms of the quantity of the mounted phasor measurement units (PMU). Within the framework of our technical policy, we implement a complex program of development of automation technologies based on phasor measurements. And third, we implement projects focused on operating-dispatch control organizational framework improvement. We integrate operational zones of regional control centers and pass control of a smaller regional power system where there are no big generating facilities or consumer centers to a neighboring larger control center. So instead of a fully functional control center, a small representative office remains in such region which is responsible for communication with local authorities on a number of issues, such as power system development planning. Such projects are implemented not only to optimize expenses, though this is important, but to improve the power system control by development of new technologies and strengthening of the personnel in the remaining system control centers. Such projects are quite complicated in terms of technology, as they require restructuring of the existing communication network and the IT-infrastructure, as well as training of staff. In such a way, we consolidated 16 system control centers over the last years.

What tasks System Operator is facing today in the field of normative regulation in power sector? What do you do to solve them?

This is another challenge among those that Russian electric power sector is facing today. At present, a basis for a new normative and technical regulatory system for the sector is being formed. The matter is that after reforming, the electric power sector lost a significant part of normative documents regulating, above all, the issues of the power system reliability. The majority of the documents comprised technical and other compulsory requirements to equipment and organization of processes developed as back as in the Soviet times. After the demise of the USSR, validity periods of these documents were prolonged in the beginning of 1990s, but as a result of reforming, which led to a fundamental change in the economic bases of the sector, the documents became non-applicable. While preparing the reforms, many thought that the issues previously regulated by the documents then would be regulated by the market. But that did not happen. Unfortunately, such approach to the issues of normative and technical regulations taking place during the reforming process led to a normative gap, and it is only now that we are bridging it. The United Power System™ managed to survive through the “legal vacuum” period thanks to the margin of safety, set at its establishment, as well certain technological traditions on which Russian electric power sector was always based. However, the margin turned out to be limited. Given the absence of a normative base, the owners of power facilities got a formal possibility to economize, even by means of neglecting the order which had been set over decades and which ensured existence and stable functioning of the UPS of Russia. The electric power entities, having become independent market companies, started to adopt their own technical policies which often collided with each other because of the absence of a general normative basis in the sector. Lack of coordination in technical solutions adopted at differently owned objects more and more often led to commissioning of equipment and devices that could not function cooperatively in the framework of the UPS of Russia due to differences in their parameters. Over these years, a certain quantity of equipment has been introduced into the power system with technical parameters and settings that do not meet the criteria of functional stability support.

“System Operator of the United Power System” —
an organization providing technological basis for the electric power sector functioning — was one of the first to recognize the problem trying to persuade the state and the sector authorities of the necessity to build up a system of unified compulsory technical regulations and requirements. Now the system of normative and technical regulation is starting to take shape. It includes three regulatory aspects.

The first aspect is – normative and legal regulation of the governmental and the ministerial level based on the Federal Law on Power Industry, documents of the ministerial level and documents established by ministries and departments. This part represents regulation of the highest level of technological activity: cooperation of the sector entities, functioning and development of power systems, principles of the power objects equipment operation, personnel training. This scope also includes normative requirements to reliability of electric power systems and objects ensuring their technological compatibility and effective co-functioning within the UPS of Russia.

The second aspect – technical regulation. It is based on the Federal Law on Technical Regulation, international agreements in the framework of the Eurasian Economic Union and technical regulations. This part of the system is aimed at ensuring product safety and allows solving issues related to setting up requirements to the generating equipment as to a product.

The third aspect – standardization based on the Federal Law on Standardization, and implementing national standards and those of the electric power entities as instruments. Both provide significant support to the whole system of normative and technical regulation of the sector specifying details and taking into consideration various technological peculiarities.

How is the problem of the power system development planning being solved in the UPS of Russia?

The System Operator takes part in a large number of mechanisms of the power system long-term development, starting with consideration of applications for technological connection to electricity networks and conducting long-term competitive capacity auctions and ending with working out a 7-year pattern and a program of “the the UPS of Russia development which is annually approved and confirmed by the Ministry of Energy of the Russian Federation.

Recently we have launched a new mechanism of finding solutions to problems of local shortages of generating capacities which eventually arise in certain energy hubs despite the general capacity surplus. The mechanism is based on the same principles as the capacity market: an investor is chosen for a new generation on a competitive basis, and, under the condition of commissioning of a certain capacity with the given characteristics and within the terms specified, for several years such investor will be granted a guarantee of loading of the generating facilities and a specified payment for the capacity. As of today, we already have two new power stations being built according to this mechanism.

For the last years the traditional state of the power sector was being changed under the influence of new technologies: distribution of RES, distributed generation, power electronics, “SmartGrid”. How does the power system dispatch control mechanism react to these changes in your country?

In Russia, a governmentally approved development program of wind and sun generation has been established for several years already. Project selection and earning income by the RES owners are in accordance with the principles well-proven on the capacity market. Development of such generation is, just like in many other countries, subsidized on the account of other market participants. Tenders for building a certain volume of the RES are held annually. As of today, 234 MW of solar generation have been commissioned; last year the first large wind farm with the capacity of 35 MW was put into operation. Localization of the corresponding equipment production on the Russian territory is an important requirement to these projects. All new projects that are annually submitted for tender contain requirements for a deeper localization of the equipment production facilities. Considering insignificant RES volumes, their commissioning has not yet had any effect on the principles and the major procedures of the Russian power system control. Nevertheless, the System Operator takes an active part in the process of setting up a normative and technological basis for RES functioning within “the UPS of Russia, and also works on determination of technical standards for interaction with such power stations. Requirement to the generating facilities’ staff, their observability at the dispatch control centers etc. are specified. According to the rules, right away such facilities are obliged to ensure readiness for operative disconnection from the network upon a dispatcher command. We assume that it is necessary to follow the route of extended requirements to RES participation in the processes of the power system control. For example, in frequency control. This, to the full extent, also concerns distributed generation. Under Russian conditions, these are mostly small thermal power stations using gas-fueled generating technology, or small gas turbines. Such stations are constructed by the end users to whom savings on the network tariff are significant. They can also be used by plants that have got gas as a by-product that must be disposed of in accordance with ecological requirements after all. In a
number of cases application of such solutions helps the consumer to economize significantly, particularly in cases when a new facility is connected to a system. Today this process develops dynamically, so it is very important to determine the unified rules that will not do any harm to other players.

Development of consumers’ generation caused new challenges: how should a consumer being an owner of generating facility interact with the power system; should the “big” power system consider this facility as a reserve, and if yes, then what volume of generation; what should be his economic relations with the UPS of Russia; and others. One of the solutions set up and promoted by us, as far as distributed generation is concerned, is the concept of a self-balancing utility company (SBUC). In its essence, it is a micro power system – a mini-VIC (vertically integrated company) which combines all: consumption, generation and transmission. The basic idea lies in the limited connection of such “cell” to the “big” power system – fixing relations with the “cell” strictly within the scope of such connection with full liberalization of internal relations between the entities. To our mind, such model could be suitable for economic clusters – industrial and business parks. At present the model is considered as a pilot model.

Does your power system use any economical demand response technologies? What do you think of their potential? If not used, do you plan to introduce any?

Yes, they are certainly used. This mechanism was developed and started working last year. Starting from January 1, 2017, this new mechanism has been included in the day-ahead market procedures. We use it to extend participation of our consumers in the procedures ensuring the market balance between demand and supply, as well as to increase competition. Today several large industrial consumers, particularly, aluminum plants, participate in the programs of economical demand response on the wholesale market. At present Demand Response rules are at the stage of development for the retail market.

“Power System Of The Future” term is becoming more and more popular in the global power field. What does this notion mean for you?

The notion of the “power system of the future” does not seem to have only one meaning to me. Of course, there is a constituent which is common to all of us. It includes, for example, the endeavor to increase power system energy efficiency and get maximum possibilities not out of extensive growth, but by implementation of innovative technologies. Extensive
GO15 - A unique initiative of the world’s largest Power Grid Operators’ transition challenge to the new energy mix

In order to better address the major challenges our members are facing, GO15 has reorganized its joint activities at its 2017 Steering Board Meeting in Brussels into Strategic Initiatives, aligned with the GO15 Member CEOs top concerns. Those initiatives are primarily dealing with the operational, technological, market, regulatory and financial aspects of the power grids of tomorrow, as the power system evolves towards low carbon energy sources.

Three major initiatives have emerged for 2018. These include:
- Pathways to a Low Emission Power System
- Resilience Models
- Analysis of the New TSO/DSO Business Models

Those strategic initiatives are being addressed by three Strategic Working Groups (SWG), who rely on Task Forces composed of subject matter experts selected from its international network of over 150 experts, built over the last 14 years.

The SWGs are under the responsibility of one or several co-chairs, who develop the multi-year road map and the work plans. Those work plans have annual deliverables to provide the GO15 Member CEOs with inputs and recommendations to feed their own company strategies. SWGs exchange their knowledge and best practices through regular webinars and face-to-face meetings.

These exchanges are complemented through conferences and regular workshops with major international organizations, such as ICER, APEX, Cigre and WEC.

In addition, a GO15 Communication Core Team (CCT) was created to promote the exchange of information, both among the GO15 members, and between GO15 and the major industry stakeholders, including policy makers, regulators, industry experts, and media.

### 2018 Strategic Working Groups

**Coordinator:** Pierre-Henri Gresse – GO15 Secretariat

#### SWG 1: Pathways to a Low Emission Power System Chair

Keith Casey (CAISO)

**Team Leaders:** Alison Demaria (AEMO), Wayne Schug (MISO) & Liang Zhiqiang (SGCC)

**SWG#1 Scope:** Develop a conceptual vision and pathway for what it would take to maximize emission reductions on three different member systems (AEMO, MISO and SGCC).

**Chairs:**
- Robert Koch (ESKOM)
- Jo Witters (AEMO)
- Carlo Sabelli (TERNA)

#### SWG 2: Resilience Models Chairs

**Chairs:**
- Robert Koch (ESKOM)
- Carlo Sabelli (TERNA)

**SWG#2 Scope:** Analyze practices and suggestions on the role of Public Authorities in recovering the Systems from disasters.

#### SWG 3: Analysis of the New TSO/DSO Business

**SWG#3 Scope:** Identify how the future role of the grid operator needs to evolve and keep pace with the energy transformation.

**Contributors**
- Oscar Hidalgo – CAISO
- Youcef Al Marwan – GCCIA
- Raeesah Waja – ESKOM
- Tatiana Telushkina - SO UPS
- Geraldo Pimentel – ONS

**CCT Scope:** Planning and Implementation of 2018 internal and external communication objectives, among the members as with all external organizations and energy transition stakeholders.
GO15 - A collaboration Framework for Mutual Assistance

Recent major disruptions of the power grids caused by weather or other related events have led the GO15 members to develop a Protocol of Mutual Assistance. This protocol, complemented by a Communication Network, enables any member in major difficulty to contact and seek assistance from other members on a timely basis.

Agreement for Mutual Cooperation

Each year the power grids are affected by natural or man-caused events, which impact millions of people around the world. Recent events such as the 2011 Japan earthquake or 2012’s Hurricane Sandy have caused serious damage to the power grids, resulting in major outages at the time where delivery of electric power was more crucial than ever to provide basic relief to the population.

Power Grid Operators play a crucial role in restoring power supply after a major power system disturbance. During such periods of scarcity, the Power Grid Operators are first in-line to provide limited available power to critical loads and consumers. In some cases, rolling blackouts have to be organized to maintain the stability of the power grid.

By sharing operational experiences and best practices, the capability of Power Grid Operators around the world to respond quickly to exceptional situations is greatly enhanced. In cases of extensive damage to the power grid transmission assets, restoration of the service is accelerated by obtaining spare equipment and resources from neighbor operators.

In this context, the GO15 members have developed a framework for Mutual Assistance, that includes a signed protocol which defines pre-agreed terms for such assistance, a library of relevant reports documenting how previous incidents were handled, and a mapping guide that helps members in need of assistance to quickly access subject matter experts that can be consulted to address specific types of incidents.

Communication Network

In addition to the Agreement for Mutual Cooperation, the GO15 Members have created a global Communication Network. The goal of this unprecedented initiative is to strengthen information exchange among the worldwide Power Grid Operators, to give our members an opportunity to share information in a fast and efficient way when needed, and to help them to be better prepared to handle unusual situations.
The magnitude of the changes that the energy industry is undergoing is unprecedented and cannot be addressed effectively unless the international organizations representing the various sides of the Energy Sector work together for comprehensive solutions. This suggests that government authorities, regulators, power generators, distribution and grid operators, as well as market operators need to embark on an industry-wide dialog that addresses the industry challenges in a holistic manner. To this effect, GO15 reached out to several key international organizations with the goal of developing information exchanges to address the challenges ahead.

In 2018, GO15 Steering Board has adopted endorsements by accepting speaking opportunities with organizations that can further enrich the organization’s vision in the international debate through participation in Conference Events of other organizations and stakeholders (such as Grids Power operators and utilities), with the objective of increasing awareness of the grid role in the energy transition.
2nd GO15 Forum 2015
Dubai, UAE, November 11th

At the occasion of the GO15 Annual meeting, the GO15 members met with industry executives, regulators, policy makers and major international associations to discuss how to best achieve the sustainability goals of governments around the world, while ensuring reliable power delivery to consumers at reasonable costs. Over 120 people attended this unique international event which gathered representatives from the various industry stakeholders. The event started with the opening ceremony and a tour of the exhibition area where GCCIA - Chairman, Dr Matar Al Neyadi and GO15’s President 2015, Mr. Daniel Dobbeni welcomed all the representatives of the invited companies, before addressing the audience in the plenary session.

The reliable integration of distributed resources in the Power Grids Chaired by Daniel Dobbeni, GO15 President 2015

Flexibility of Power Grids Chaired by Ahmed Ali Al-Ebrahim, CEO of GCCIA

This event was a real opportunity to all the stakeholders of the power grids industry to a concrete interaction and a fruitful debate about the challenges and the existing innovating solutions which could help all of them to go toward transition to a future Grids.

3rd GO15 Forum 2017
(Brussels, Belgium) – October 25th

On the occasion of the GO15 Annual meeting hosted by Elia Group, APEX & GO15 members came together to share their experiences and knowledge with industry peers from around the world. The Event was hosted by EPEX Spot and GO15, organized concurrently with the APEX Annual Meeting.

The event started with the opening speeches by GO15 President 2017 (Mrs. Audrey Zibelman – CEO of AEMO) and APEX Chairman (Mr. Stu Bresler), they welcomed all the panelists from GO15 and APEX as well as the invited experts, they have addressed an audience of 135 participants from 30 nations during the plenary session.
Panel 1: Risk Management in Markets and Operations  
Moderator & Summarizer: Audrey Zibelman (AEMO)  
Speakers: John Bear (MISO), Hervé Laffaye (RTE), Miriam Maes (Foresee Ltd), John Reynolds (Bearing Point), Phil Sheppard (National Grid).

Panel 2: Incentives for Transmission Investment to Ensure Reliable and Efficient Electric Grids  
Moderator & Summarizer: Carl Monroe (SPP), Hervé Laffaye (RTE)  

Panel 3: Impact of Energy Market Integrations  
Moderator & Summarizer: Wolfram Vogel (EPEX SPOT), Ahmed Al Ebrahim (GCCIA)  
Speakers: Florian Ermacora (EU Commission), Bente Hagem (ENTSO-E, Stattnet SF), Jonas Törnquist (EPEX SPOT), Olivier Devolder (N-SIDE), Fabien Roques (FTI Consulting, Compass Lexecon).

Panel 4: Distributed Energy Resources, Grid Operations and Global Impact  
Moderator & Summarizer: Keith Casey (CAISO)  
Speakers: Steve Berberich (CAISO), Marcos Valenzuela (CENACE), Mirko Düsel (Siemens Energy Management), Scott Baker (PJM).

Next GO15 Forum will be hosted by SO UPS

4th GO15 Forum  
October 2019 – Russia

www.go15forum.com
GO15 members share the same vision on the evolution of the power grids linked to the transition to the new energy mix, the changing load patterns, as well as the development of global consumption driven by increased demand in the major emerging economies.

The current rate of change in the electricity industry is unprecedented and presents many challenges. These are driven by the transition to lower emissions generated and a changing fuel mix, as well as changes in technology, economic factors and consumer behavior. In rapidly developing economies, this is further compounded by the need to expand the generation and grid infrastructures to meet the rapid growth in energy consumption. These factors necessitate an expansion or a reinforcement of the world’s power grids to bring the power from the generators to the load centers.

In the future, the Power Grid Operators will manage increasingly complex power grids that accommodate the progressive integration of renewable energy sources and electric vehicles, together with the flexibility of the consumer demand, in support of the transition to a new energy mix. To maintain or improve the reliability and resilience of the grids of the future, it will be necessary to develop smarter grids by leveraging advanced communication and information technologies that will play an increasingly critical role. Today GO15 members jointly develop innovative solutions by sharing their experience and best practices, in order to prepare the grids of the future that will combine strength and flexibility to meet the challenges of the new energy world.

Power grids are the backbone of economic development, ensuring simultaneously the quality and the security of supply of electricity adapted to the needs of the consumers.
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Providing customers with a reliable and safe supply of energy at a reasonable cost.

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