BRICS
YEA
BRICS Youth Energy Agency

BRICS Youth Energy Outlook

2018

About BRICS YEA

Establishment of the BRICS YEA under auspices of the ENES International Forum, November 21, 2015

BRICS Youth Energy Agency (BRICS YEA) is a research and cooperation platform powered by the proactive youth from Brazil, Russia, India, China and South Africa to assemble expert, social, professional and student community, interested in development of energy potential of the BRICS countries.

In 2018, the Agency is guided by the agenda "Energy in the digital future", organizes meetings and roundtables to shape a common view among the BRICS youth about the role of digitalization in the fuel and energy industry and develops principles and approaches acceptable to all parties for full utilization of digital economy's potential.

The highest representative body of BRICS YEA is Board of the Agency. Its main goals are to form a strategy of agency development and to take consensus decisions on the key points. The Board comprises the representatives of member communities. One of the representatives of the leading BRICS country is appointed Secretary of Agency Council. Deputy Chairperson of the Agency is elected by secret ballot.

The Expert Council of the BRICS YEA is aimed at uniting leading experts in fuel and energy complex, heads of oil companies and representatives of scientific community within BRICS member countries. The Expert Council outlines relevant areas of research in energy and makes recommendations about the most promising projects. Taking into account the necessity of a comprehensive work to achieve the established goals, the Agency finds it wise to cooperate with local authorities, business representatives, scientific communities within BRICS and other parties concerned.

Team:

Arsenii Kirgizov-Barskii,
Dmitii Kryukov,
Ekaterina Kobeleva,
Monika Mhitaryan

Editors:

Leonid Grigoryev – Chief Adviser,
Anastasia Shklovskaya – Chief Editor,
Alexander Kormishin – Deputy-Chief Editor

Foreword

Leonid Grigoryev

Chief Adviser to Head,

Analytical Center of the Government of the Russian Federation

Expert, National Committee for BRICS Research, Editorial Board member, Russian Journal of Economics,
Trustee of the World Wildlife Fund

Dear participants of the Summit!

Nowadays youth involvement into the process of making strategically important decisions is acknowledged to be essential all around the world. The young generation's view on the main modern tendencies plays a significant role in the economy, policy, culture and other key areas of every country because it predetermines the future. Young people possess more flexible reasoning and can easily adapt to the new developments and up-to-date realities. Regarding the analytical activities, youth participation in the research could result in a deeper understanding of the actual needs and interests of BRICS-countries' economies and namely energy sectors. The possible benefits are conditioned by improving knowledge of current prospects and challenges, that all five states face today, and implementing this information so that the common collaboration can become prosperous and productive.

The BRICS Youth Energy Outlook is a wide vision of the modern trends in the energy sector. This work is worth considering because it embraces the most interesting research areas: energy efficiency, youth policy in the energy sector, development of the energy field within digitalization and Sustainable Development Goals. And what is more substantial, the Youth Analytical Outlook is developed by young people who are certainly not highly experienced analysts but unbiased and objective instead.

L. Grigoryev

Sustainable Development Goals

Sustainable Development Goals #7 calls for a substantial increase in the share of renewable sources (solar, wind, hydropower and geothermal, for example) in the global energy mix, as well as for a more efficient use of energy. With cost of environmental degradation at US $80 billion annually, or equivalent to 5.7% of GDP in 2009, environment could become a major constraint in sustaining future economic growth. Further, it may be impossible or prohibitively expensive to clean up later.

Model simulations suggest that policy interventions such as environmental taxes could potentially be used to yield positive environmental and health benefits with minimal economic costs.

In their joint statement, BRICS energy ministers commit to, among other actions:

- improve efficiency in the use of natural resources;
- promote energy efficiency technology to reduce the use of fossil fuels;
- strengthen energy security cooperation through joint research on strategic reserves, renewable energy and energy efficiency;
- develop investment opportunities for the New Development Bank (NDB), especially in the fields of renewable energy and energy efficiency.

A number of initiatives were set up to pursue these goals. In 2017, countries launched an Energy Research Cooperation Platform to support their work on energy efficiency and energy more widely. Its purpose is to conduct research and analysis, contribute to implementing BRICS investment projects in the energy sector, develop cooperation on energy technology, and improve training for personnel in BRICS countries. The platform is supported by two additional initiatives: the BRICS Network University and the BRICS Think Tank Council.

To mobilize investments, the BRICS established the Energy and Green Economy Working Group to encourage public-private partnerships for energy efficient technologies. The Working Group is part of the BRICS Business Council, which was created in 2013 to promote and strengthen business, trade and investment ties amongst the business communities of the BRICS.

The New Development Bank was set up in 2014 by the BRICS forum to help fund infrastructure in the BRICS countries of Brazil, Russia, India, China and South Africa.

A key aspect of the NDB's job is to set energy targets for the BRICS states, and provide sustainable and reliable investment to allow the countries to build their renewable energy capacity. The NDB set targets tailored to each of the BRICS countries, taking into account their plans and their existing renewable capacity. The bank is designed to offer loans quickly and flexibly to the BRICS countries to make achieving these possible.

It's a great step towards sustainability in the energy field. And these concerns of BRICS counties can lead to a better cooperation between them in future.

At the same time despite impressive advances in renewable capacity in the BRICS countries, some look set to miss their targets. If the NDB and other multilateral development banks and financial institutions manage to increase investment, the BRICS could have a massive effect on the

environmental damage currently being created by their energy systems.

Smart grid communications market (one of the most perspective and rapidly developing fields in renewable energy) among BRICS countries is predicted to reach $9.5 billion by 2020. The BRICS smart grid communications market will experience rapid growth over the next eight years, which we expect to follow three distinct phases. First will be the deployment of smart meters to establish a two-way communications system between utilities and subscribers. Following that will be the addition of new sensors and other devices at key junctures of the network to help utilities develop value-added services to leverage their smart grid infrastructure. Finally, will be the development of new services and software to optimize smart meter deployments and the overall grid itself.

India

The SE4ALL report on India notes that in a bid to meet the Sustainable Development Goals (SDGs) for energy, the Government has launched numerous schemes for the transformation of cities and villages. While 300 million rural Indians remain without power connections, the Indian Government has set a target of December 2018 for universal household electrification. The report identifies HIOs for the short-, medium- and long-term that support sustainable energy for all targets in several sectors. The selected HIOs include: energy efficient pumps for agriculture; super-critical coal-fired power plants, renewable energy sources, storage facilities and smart grids, for the energy sector.

India intends to increase its renewable energy production by 40% (a target of increasing the capacity of renewable energy to 175 GW) by 2030, as well as reducing emissions intensity by 33%-35% over 2005 levels. To reach this rather ambitious aim India undertakes the following steps:

In June 2018 Renewable solution provider Siemens Gamesa said it has bagged a wind order from ReNew Power, India's largest renewable energy Independent Power Producer, for the construction of a 150 MW wind farm located in the Kutch district, in the state of Gujarat.

Present in India since 2009 the accumulated base installed by Siemens Gamesa recently topped the 5 GW mark. The company has two blade factories in Nellore (Andhra Pradesh) and Halol (Gujarat), a nacelle factory in Mamandur (Tamil Nadu) and an operations & maintenance centre in Red Hills (Tamil Nadu). So it is foreseeable that the share of renewable energy will increase.

Developer Azure Power has commissioned its largest solar-power project in the Indian state of Punjab, with a capacity of 150 megawatts. The project occupies 713 acres of land and will cater to power requirements of the local community, while generating an estimated 1,000 jobs within the community. The new plant constitutes a portfolio of three projects each with a capacity of 50MW. The company noted that the weighted average tariff on these projects is INR 5.63 ($0.083) per kWh and Azure Power will supply Punjab State Power Corporation for 25 years.

Achieving these impressive targets an additional funding is obviously required. In this context, the Canara Renewable Energy Financing Scheme is proposed to support Canara Bank to finance renewable energy projects. The project is in alignment with the New Development Bank's (NDB) objective to accelerate green financing and promote renewable energy development.

The objective of the project is to support renewable energy financing. This financing scheme will help advance the Government of India's initiative in the renewable energy sector. The loan provided by NDB will be on-lent through Canara Bank to renewable energy sub-projects, including wind, solar, small hydropower, biomass, geo-thermal,

waste-to-energy, and other renewable energy projects. The project will help provide more liquidity for long term financing to renewable energy projects. It will also enhance institutional capacity of Canara Bank to scale up lending for sustainable development in the energy sector. The overall capacity of the Canara Renewable Energy Financing Scheme is estimated to be USD 500 million.

China

China's targets are even greater than ones of any other country, as it plans to reduce emission intensity by 60%-65% over 2005 levels, according to the IEEFA report. China is estimated to increase its solar capacity to 127GW by 2020 from 43GW at the end of 2015, and wind capacity from 145GW in 2015 to 250GW by 2020.

As China's goals in the development of the renewable energy are rather high, the issue of financing is also significantly important. For this reason, it is unavoidable to turn to the NDB that currently is engaged into three big energy projects in China.

The first one is a solar power project in Lingang. China is the leading country to drive this agenda forward, as the country moves to a more sustainable pattern of growth. With a plan to significantly raise the share of renewables in the energy mix, China aims to increase the share of non-fossil fuel energy to 15% of its primary energy consumption by 2020. The National Energy Administration established the development goal of 50 GW for solar power by 2020. In this context, the Lingang Distributed Solar Power Project is designed, supported by roof-top solar power technology advancements. The project is in alignment with New Development Bank's objective to accelerate green financing and promote clean energy development.

The objective of the project is to reduce carbon emission and promote renewable energy development, through using roof-top solar photovoltaic power technology to generate electricity in Shanghai Lingang Industrial Area. The project aims to reduce 73,000 tons of carbon emission per year, providing electricity generated through 100 MW roof-top solar photovoltaic power with 1,155 effective generation hours per year. With the benefits from near point electricity generation, the project helps save the costs of potential transmission losses from importing electricity from provinces outside Shanghai. The project will be divided into more than 30 sub-projects, sequentially implemented over a 3-year period. Closing year is 2019.

A 3 MW onsite pilot project has been successfully implemented to prove the concept. Electricity generated by the roof-top solar photovoltaic power will be sold to SLIA and the state grid.

The project contributes to a lower carbon environment. It aligns with the NDB's primary focus to support projects that aim at developing renewable energy sources. The project is estimated to reduce carbon dioxide emissions by approximately 73,000 tons per year and NOx emissions by 1,300 tons per year. The project will save gas consumption by 23,000 tons per year and save coal consumption by about 32,000 tons per year.

The second project is Putian Pinghai Bay Offshore Wind Power Project. The objective of the project is to increase offshore wind power capacity in Putian Pinghai Bay to provide adequate electricity supply to Fujian province and to catalyze offshore wind energy development with technological advances. The NDB will support the project through providing financing to the cost of equipment and civil works. The project is estimated to have a capacity of 3,490 hours of effective electricity generation per year. This capacity will provide electricity of 873 million kWh per year, to meet the demand of rising power consumption in Fujian province. The project has a total targeted capacity of

700 MW offshore wind power. The project contributes to a lower carbon environment. It aligns with NDB's focus to support projects that aim at developing renewable energy sources. Increased share of offshore wind power in China's energy mix will help build a greener environment, with reduced carbon emissions. The project will have a positive impact of avoiding 869,900 tons of carbon emissions per year. It is further estimated that the project will avoid emissions of 13,090 tons of NOX, 26,175 tons of SO2 and 237,300 tons of flue gas. It will avoid consumption of coal by 314,100 tons. For the socio-economic aspect, a new industrial cluster will develop, as an effect of this project, creating employment opportunities and helping the local economy to grow.

And the third project is Jiangxi Industrial Low Carbon Restructuring and Green Development Pilot Project. The objective of the Project is to upgrade traditional industries to achieve energy conservation and emissions reduction. NDB will support the Project through a Project Financing Facility (PFF) loan up to USD 200 million. The Project comprises of a series of subprojects, which on an aggregate level will promote energy conservation, reduce waste regeneration and pollutants emission and increase industrial water reutilization in the Jiangxi Province.

The approved subprojects will contribute to an energy saving level of 95,118 tons of coal equivalent per annum and a carbon emission reduction of 263,476 tons per annum on an aggregate level, through increased recycling ratios, upgraded factory machinery, increased utilization of heat waste, enhanced institutional capacity and improved energy conservation.

Russia

Russia is slightly different from the other BRICS countries as it has technically already met its target. Russia's goal was to reduce emissions by 25%-30% over 1990 levels, and emissions are currently around 40% lower than 1990 levels. However, the country is planning a 4.5% increase in the amount of renewable energy it produces by 2020.

Russia is making small progress predominantly due to a lack of investment from the country itself, only allocating $1bn for renewable technologies in all 17 Russian states in 2014.

Russia has vast untapped renewable energy resources, with non-fossil fuel based energy currently only accounting for 3% of total primary energy consumption of the country. In Karelia, a federal subject of Russia, energy generation capacity is low, with power imported from other regions of Russia. Power supply in Karelia is still not sufficient. Developing power generation projects in Karelia using renewable sources will help tackle this challenge and contribute to the region's sustainable development. In this context, the project, with Nord-Hydro as a model project, is designed to enhance power generation capacity in the region and facilitate renewable energy development. The project is in alignment with the New Development Bank's objective to accelerate green financing and promote renewable energy development.

The NDB will provide two loans to support Eurasian Development Bank (EDB) and International Investment Bank to renewable energy projects. The two loans will finance the Nord-Hydro project to increase energy supply in Karelia region through renewable energy resource. The project is supported by the Russian government with a preferential tariff. With this project, a small dam and two hydroelectric generation plants will be constructed, providing a total installed capacity of 49.8 MW. A 220 kV power transmission line of 10-km will be constructed. The proposed hydro power generation will avoid 48,000 tons of carbon dioxide emissions per year.

There is also a rather challenging project being developed in the territory of the Russian Federation. The experiment to build smart grids in Ufa was launched in January 2015 and slated to run for five years. The project is running on schedule. It should be completed by 2019 as was initially planned.

Concerning the effect expected after the smart grids are deployed, implementing the project in Bashkiria will raise the region's power supply system to a whole new qualitative level without having to increase the charges. It is planned to reduce power losses in Ufa by a factor of two. In money terms, this would translate to 400 million rubles in savings annually.

This experience is universal and can be used in any territories where the power grid infrastructure properties are the same as Russia's. The prospects of replicating and exporting this technology are significant.

Brazil

Brazil is arguably in the best position to achieve its goals in renewable energy sphere, as in 2015, 74% of its energy came from renewable sources. Brazil has been among the frontrunners in contracting renewable energy through the auction route. The country started with the auction mechanism way back in 2007, with the first alternative energy auction. Since then, the country has come a long way and auctions have been held at regular intervals for various technologies.

According to the IEEFA's report, "Brazil's 2024 Energy Plan envisages an increase in total installed renewable capacity, including large hydropower, from 106.4GW in 2014 to 173.6GW in 2024."

But the current political situation prevents the development of this field. In recent times, the country has witnessed a drop in its electric power load projections. This is in line with the negative outlook for the country's GDP growth. As per the new projections, there will be a reduction in demand to the extent of 3,480 MW in energy load in 2019. Already, the electricity consumption in Brazil has seen a dip and fell by 0.9% in 2016. Though in terms of these developments, this seems to be a logical move by the government, it does send negative signals to the industry.

The recent cancellation of the solar and wind energy auction in December 2016 has shaken the confidence of developers and investors. That there was significant interest in the auction is evident from the fact that there were 1,260 projects registered for the auction – 841 wind and 419 solar photovoltaic (PV) projects, totalling 35,147 MW of installed capacity.

The cancellation decision puts a question mark on the government's intent to support renewable energy projects going forward. Also, since this was the only tender in 2016 for renewable energy, its cancellation means that no wind or solar capacity was contracted in that year. Industry watchers feel that this could have a long-term impact on renewable energy investments in the country. The repercussions would also be felt by the supply chain, as it would put equipment ordering on a hold, hence slowing down investments.

The New Development Bank hasn't financed any renewable energy project in Brazil since 2017 which also illustrates the complicities in the renewable energy field.

At the same time growth in electricity consumption is expected to continue in Brazil, increasing at an average of 3.8% annually between 2018 and 2022 and driving the need for further investment in infrastructure. Beginning in 2012, Brazil's government set out on an ambitious plan to increase and diversify its energy mix, with goals to invest approximately $235 billion and install 36 Gigawatts (GW) of hydropower,

12GW of biomass, and 11GW of wind over the following 10 years.

Although Brazil has supported renewable energy projects, particularly wind, transmission infrastructure has been inadequate, delaying a number of projects. Brazil now requires that projects involved in energy auctions prove that they have transmission lines secured prior to participating in the auctions. This will reduce the problems of delays associated with insufficient transmission infrastructure, while helping to drive the market for T&D equipment.

South Africa

The Republic of South Africa is the most developed economy in sub-Saharan Africa, yet it is facing strong headwinds from slowing growth. Frequent electricity shortages complicate the challenge for the economy from the supply side. According to the country's National Treasury, GDP growth will increase by roughly 2% if the issue of electricity shortage is addressed. Securing energy supply and developing renewable energy are therefore the government's main policy concerns. Coupled with electricity shortage, grid facilities are getting outdated.

In line with the national commitment to transition to a low carbon economy, the Integrated Resource Plan (IRP 2010) which was promulgated in May 2011 set a very ambitious target of 17 800 MW of renewable energy to be achieved by 2030 in respect of the electricity generation mix. Within this 20 year planning horizon, about 5000 MW were planned to be operational by 2019, with a further 2000 MW expected to come online by 2020. Implementation of the IRP 2010 is carried out through Ministerial Determinations, which are regulated by the by the Electricity Regulations on New Generation Capacity based on the Electricity Regulations Act No. 4 of 2006. Already in 2017, 6 422 MW of electricity had been procured from 112 Renewable Energy Independent Power Producers (IPPs) using the competitive bidding process known as bidding windows. Out of this total, 3 162 MW of electricity generation capacity from 57 IPP projects was connected to the national electricity grid by end of June 2017.

In this context, the New Development Bank's (NDB) Project Finance Facility (PFF) is proposed to support the development of grid connection infrastructure, which is vital for the development of renewable energy projects. The project will also help increase electricity supply to the Soweto area for the town's sustainable development.

With the objective to develop grid connection infrastructure, the NDB will provide a PFF loan of USD 180.0 million to Eskom Holdings State-Owned-Company Limited (Eskom). The PFF will support renewable energy development and reduce the country's reliance on fossil fuels. The grid connection infrastructure will be used for renewable energy projects and augmentation of the Eskom transmission network to the Soweto area.

The PFF project will be divided into sub-projects. Current sub-projects include integration of 7 renewable energy projects of independent power producers, integration of expedited independent power producer project for Upington, construction of transmission lines and substation for Soweto area, and construction of transmission lines for Ankerlig-Sterrekus. Future sub-projects will be proposed by Eskom, subject to selection criteria and approval from the NDB, to ensure alignment with the overall development objective of the project.

The project contributes to the reduction of the country's reliance on fossil fuels. It will enhance the country's capacity for renewable energy while achieving sustainable growth. It also aligns with NDB's focus to support projects that aim at developing renewable

energy sources. The project will integrate a total of 670 MW of renewable energy to the grid by Eskom. This accounts for 10% of the national target for renewable energy capacity from 2020 to 2021. The transmission lines, once developed, will help meet the demand for electricity in the implementation regions and lay a foundation for future renewable energy development.

South Africa still relies on fossil fuels, increasing its renewable capacity to just 2.1GW in March 2016 from 1.8GW the previous year.

South Africa has the furthest to go of the BRICS, as at present it gets 94% of its energy from fossil fuels but has plans to install a further 17.8GW of renewable energy capacity by 2020.

Energy Efficiency and Energy Saving

The place where all the concerns and possibilities of the coming New Energy economy meet is called Energy Efficiency. Energy Efficiency offers a faster and more accessible path to meeting rapidly rising energy demand, providing energy security in an ever more dangerous world and addressing global climate change. It also offers jobs the sluggish economy urgently needs and the energy-cost savings that can fund the build-out of New Energy.

There is a ENES Forum, which was created in order to make some agreements in the increasing of energy efficiency.

According to the ENES 2015, the Minister of Energy of the Russian Federation Alexander Novak held the first meeting of the BRICS Energy Ministers, which resulted in the signing of a Memorandum of Understanding on energy saving and energy efficiency.

This resulted into heated discussions about technologies such as electric cars, energy-efficient lighting, the widespread introduction of individual heat points. All this needs to be implemented in order to withstand the challenges that BRICS countries can face in twenty years.

To date within BRICS organizations there exists Energy research platform that is intended to the development of energy efficiency strategies for each country. There is also a youth concept of this collaboration that is translated into International Festival TogetherBrighter where youngsters can realize their energy efficiency projects.

BRICS countries are keen to find their own way to the energy efficiency, but their initiatives are significantly different and that's why energy efficiency program of every country is worth detailed consideration.

Brazil

Ministry of Energy of Brazil announced the beginning of investment in the project and then the construction of a solar power plant of 350 MW. Experts note that placing it in the Amazon is a reasonable solution. The cost of electricity in this way will be approximately $ 68-77 per 1 MWh.

But this is only one aspect of the project. The second part is to refine the station to receive electricity from the kinetic energy of the currents. The hydroelectric part of this power plant will produce 250 MW of energy. The total capacity of this mega project will be 600 MW. With such characteristics, the Brazilian station will take the first place in the world rating of such energy-saving projects. Within the next four months, trial versions will be built at the dams of the country.

A unique advantage of a floating power plant is its ability to move through the water to places where people need electricity. And the value of such an opportunity is in compensating for the loss of electricity lost by overcoming a long distance over the energy networks.

By the way Brazil is currently the largest electricity market in Latin America and one of the world's most important emerging markets, but smart grid deployments have been slowed by regulatory and technical hurdles. The need to upgrade infrastructure is a common refrain in Brazil, but meeting the need has proved difficult. In 2012, Eletrobrás announced plans to invest heavily across generation, transmission, and distribution over the following two years, but it failed to reach its targets. Poor energy efficiency and average electricity losses in excess of 15% are pressing issues impacting Brazil's market. Aging transmission lines delivering power over long distances combined with rampant electricity theft in

segments of the distribution network are largely to blame.

Utilities in Brazil are now looking to smart grid infrastructure to solve these problems and large-scale deployments are already underway. The country is determined to invest $25.6 billion in modernizing its power infrastructure from 2015-2025 (according to a study published by Northeast Group)

Utilities in the region see smart metering as the most effective tool for combating rampant electricity theft. About 9 percent of South America's electricity is stolen, with some service territories' theft rates exceeding 30 percent. Smart grid infrastructure will also help the region to incorporate vast renewable energy potential by helping to manage the intermittency of these resources.

South America is emerging as a key geography for Chinese vendors hoping to steal market share from the European and North America vendors. Recently, Hexing acquired Eletra Energia to boost its position in Brazil and Wasion has announced smart meter projects in Brazil. Other Chinese vendors will be looking for similar deals.

Russia

Russia is heavily dependent on its rich oil and gas fields. The country produces about 11.5% of the world's primary energy (UNDP, 2009), while oil and gas exports account for 17% of Russia's GDP, which corresponds to 40% of the federal budget (Chechel, 2011). At the same time, in the country oil and gas resources are used irrationally. Russia traditionally subsidizes domestic energy prices, so consumers receive an unlimited amount of cheap energy. These measures perpetuated the wasteful behavior of the users of energy. In addition, centralized thermal and electrical systems often unequipped with modern management and accounting systems generates more energy than it is necessary. Obsolete and inefficient equipment poorly insulated pipes and buildings exacerbates the scale of energy losses. A report from the World Bank Group, entitled "Energy Efficiency in Russia: a Hidden Reserve," is often cited. It points out that Russia could save up to 45% of the total primary energy consumption through energy efficiency measures (World Bank, 2008).

Russia can cut its total energy consumption by 45 percent. Such a reduction includes:

- 240 bcm of Russia’s largest fuel source, natural gas;
- 340 billion kWh of electricity;
- 89 million tons of coal;
- 43 million tons of crude oil and crude oil equivalents in the form of refined petroleum products.

Much of this technical potential is economically viable, but not financially viable. Roughly 90 percent of the technical potential is economically viable. Only 13 percent of the technical potential is financially viable with domestic gas prices.

Russia would need to invest $106 billion to improve the efficiency of thermal power plants.

The efficiency of Russia’s condensing power plants is well below the average efficiency of similar plants elsewhere in the world. Russia’s condensing power plants operate, on average, at 36 percent efficiency with 345 gce/kWh average specific fuel consumption.

In contrast, coal- and oil-fired condensing power plants in OECD countries operate at an average efficiency of 38 percent, and gas-fired condensing power plants in OECD countries operate at an average of 41 percent efficiency.

Cogeneration (Combined Heat and Power Plants or CHPs) Russia’s co-generation plants (also called combined heat and power plants, or CHPs) operate at a level of energy efficiency well below that of most technologies used internationally. Russia’s

gas-fired CHPs currently operate at 39 percent efficiency in condensing mode. Liquid- and solid-fuel fired CHPs operate at 36 percent efficiency in condensing mode. The efficiency advantages of Russian CHPs over condensing plants are therefore minimal.

All of the technical potential for gas-fired CHPs (13.7 mtoe) are achievable through investments that are economically viable. As is the case with condensing power plants, most efficiency gains come from upgrading gas-fired facilities. Upgrading these plants to 51 percent efficiency could bring about a 14 mtoe (17 bcm) reduction in natural gas consumption.

In practice, the costs of new capacity in Russia are likely to be higher as these estimates exclude financing costs, licensing costs, and land acquisition costs.

Diesel power plants Russia's diesel power plants operate far below the efficiency of comparable plants abroad. These plants operate at an average efficiency of 25 percent, with an average fuel consumption of 495 gce/ kWh. Efficiency levels of 37 percent are achievable elsewhere in the world.

Upgrading Russian diesel power stations to 37 percent average efficiency would bring 0.59 mtoe in savings of both diesel fuel and natural gas. Only 0.47 mtoe of the technical potential is achievable through investments that are economically viable. Only 0.11 mtoe of the technical potential is achievable through investments that are financially viable.

Russia's electricity transmission and distribution losses exceed levels achieved elsewhere. Average electricity distribution losses in Russia were 12.2 percent in 2005. The potential for reducing Russia's electricity distribution losses accounts for 3.4 mtoe, or roughly 35 percent, of actual levels in 2005 (9.69 mtoe).

India

In 2009, the Government of India adopted the National Action Plan for the Effective Use of Energy and Environmental Protection, which aims to improve the energy efficiency of energy use and to increase the country's energy efficiency by 20% by 2020.

The Indian government says that the widespread use of renewable energy sources will occur three years ahead of schedule. 57 percent of the total electricity in India will come from non-fossil fuel sources by 2027. The national plan also notes that to meet the country's energy needs until 2027 it will not be necessary to build new coal-fired power plants.

The primary energy demand is expected to increase to about 1250 (estimated by International Energy Agency) to 1500 (estimated in the Integrated Energy Policy Report) million toe in 2030. This growth is also reflective of the current very low level of energy supply in India: the average annual energy supply in India in 2011 was only 0.6 toe per capita.

Government of India has undertaken a pronged approach to cater to the energy demand of its citizens while ensuring minimum growth in CO2 emissions. Efforts are being made to efficiently use the energy in the demand side through various innovative policy measures under the overall ambit of Energy Conservation Act 2001.

The EC Act was amended in 2010 and the main amendments of the Act are given below

- The Central Government may issue the energy savings certificate to the designated consumer whose energy consumption is less than the prescribed norms and standards in accordance with the procedure as may be prescribed;
- The designated consumer whose energy consumption is more than the prescribed norms and standards shall

be entitled to purchase the energy savings certificate to comply with the prescribed norms and standards;

- The Central Government may, in consultation with the Bureau, prescribe the value of per metric ton of oil equivalent of energy consumed;
- Commercial buildings which are having a connected load of 100 kW or contract demand of 120 kVA and above come under the purview of ECBC under EC Act.

Ministry of Power, through Bureau of Energy Efficiency (BEE), has initiated a number of energy efficiency initiatives in the areas of household lighting, commercial buildings, standards and labeling of appliances, demand side management in agriculture/municipalities, SME's and large industries including the initiation of the process for development of energy consumption norms for industrial sub sectors, capacity building of SDA's etc. The target of energy savings against these schemes during the XI plan period was kept 10,000 MW of avoided generation capacity. These initiatives have resulted in an avoided capacity generation of 10836 MW during the XI plan period.

China

In order to increase the energy efficiency China is working to create an "intellectual" highway. In Jinan, a road with integrated solar panels, sensors and chargers was built. It is assumed that such an innovative road will be able to charge about 45000 cars daily.

In addition, electricity generated by solar modules will be enough to illuminate the road and even 800 households.

Today, half of all sales of el electric cars in the world belongs to China. In 2015, China even bypassed the US in the development of this sector of the ecological mode of transport.

Experts predict that the project to build such a road will be a new milestone in the development of the world transport industry.

Russia-China Working Group on Energy Efficiency also carries much prestige and importance for its development in both countries. At the meeting that took place on 25th of April, 2018 some crucial issues and perspective directions of cooperation were discussed: schemes of financing energy saving projects, programs of utilization and exchange of energy efficient technologies were announced to be the most important ones.

South Africa

South Africa is giving due consideration to the energy it needs to fuel its growing economy and remains one of the most energy-intensive economies in the world. Total energy consumption per unit of GDP was more than twice as high as the global average in 2012 and its electricity consumption per capita was 40% higher than the world average. By 2030, tapping the economic potential of energy efficiency leads to a net reduction in primary energy demand and electricity of 15%.

Coal and oil are the most significant primary fuels in South Africa’s energy mix. Policy approaches to improve the energy intensity of its economy should target measures that effect coal and oil, as both are set to remain key primary inputs for power generation, production of synthetic fuels and use in transport. By 2030, oil savings from efficiency measures, notably via the deployment of hybrid vehicles, reach almost 200 000 barrels per day and offsets the need to build a refinery with an equivalent capacity twice that of the Secunda coal-to-liquids plant.

Efficiency measures reduce the oil import bill by almost 30%, thereby significantly improving the security of energy supply and the national trade balance. Efficiency gains by

2030 could also supplant about one-quarter of today's level of coal consumption.

The South African Government, in concert with the energy supply industry, is developing a strategy to address the near-term challenges of a constrained electricity system characterized by insufficient capacity and rolling black-outs. Rising economic activity and household incomes, together with enhanced access to modern conveniences, boost electricity demand by 1.2% per year to 2030 There is enormous potential to make the use of electricity more efficient in a wide array of end-uses from street lighting in communities to refrigerators in homes as well as for minerals processing at mines and aluminum production. The systematic adoption of efficient electric motors, heating systems and appliances could diminish electricity expenditures for end-use consumers. Households, which face electricity prices escalating at almost 3% per year, are the principal beneficiaries of energy efficiency measures. Households could potentially save up to 11% of their electricity bill yearly.

An effective electricity sector strategy must place emphasis on both improving the efficiency of the power generating fleet as well as that of end-use efficiency. Almost half of the existing coal-fired power generation capacity in South Africa is more than 30 years old and will need to be refurbished or replaced by 2030 As is being demonstrated with the construction of the two large-scale coal-fired power stations that are employing supercritical boiler technology at Medupi and Kusile, it is essential that the power system employs state-of-the-art power plant design and technology in new builds and applies intelligent management systems. By improving the average efficiency of the coal-based power generation fleet, South Africa could avoid burning 25 million tonnes of coal, forestall the need to build almost 10 gigawatts of new capacity, equivalent to the combined capacity of the Medupi and Kusile plants, and save $10 billion in coal power investments by 2030.1 The reduction in coal power capacity investment largely offsets the investment required to modernize the coal-based generating.

Digitalization of the BRICS countries' energy industry

As electrical grids evolve to meet the needs of the 21st century, one thing is clear: digitalization will embrace practically every sphere of modern life.

It's already helping keep the transmission grid stable by balancing reserves from intermittent sources like wind and solar. As more and more connected sensors are put in place, digitalization will contribute to cutting costs by increasing efficiency in homes and businesses. It will improve maintenance and keep components running better for longer. It will help consumers generate their own power at home and move it to the grid as needed. The payments will be considered seamless due to using blockchain.

The energy industry has undergone significant change in recent years. The combination of more renewable energy, more decentralized generation, and an aging grid means the industry needs to roll out even longer transmission lines and complex distribution systems. Meanwhile, consumers are procuring more behind-the-meter assets to generate power at home, and trade it with neighbors.

With the ability to collect increasing amounts of data, the energy industry has a chance to use digital technologies to address many of these new challenges.

Digitalization can improve safety, increase productivity and reduce costs in oil and gas, coal and power. The volume of oil and gas resources that can be produced is a critical factor in understanding the future trajectory of oil and gas prices. Remaining technically recoverable oil and gas resources around the world are currently estimated to be around 1.4 trillion tonnes of oil equivalent (toe) (IEA, 2016). Through the widespread use of existing and emerging digital technologies across the global resource base, the IEA estimates that this could be increased by up to 75 billion toe, or around 5%, equal to over 10 years of current world oil and gas consumption.

The digital technologies that could achieve an increase in recovery factors are wide-ranging and include advanced processing for seismic data to yield much more reliable and high-resolution digital images of the reservoir, enhanced modelling and tracking of fluids within the reservoir, and automated production control of wells. By improving reservoir simulations, digital technology can help operators optimize the spacing between wells, the lateral length of horizontal wells, and the amount of proppant used during hydraulic fracturing. All of these efforts are aimed at maintaining maximum output while minimizing the required capital investment in wells and facilities.

Looking at the oil and gas sector, the adoption of digital technologies to date has been uneven. Overall, it trails other sectors, such as finance, retail, medicine and automobiles. Several factors explain this lag:

Timing: The oil and gas industry is very capital intensive and large projects typically take many years to develop. Digital technologies, in contrast, evolve quickly. Once a large, multi-billion-dollar project has been designed and sanctioned, the industry's focus is generally on effective execution of the project; design changes are kept to a minimum, impeding the incorporation of emerging innovations.

Age of infrastructure: Many oil and gas facilities around the world were installed some time ago, and do not necessarily have the appropriate infrastructure to accommodate new digital technologies.

Retrofitting these facilities would carry additional costs, making the application of digital technologies less attractive.

Internal focus: Since oil and gas are commodities, it is hard for companies to differentiate between products and services to consumers. As a result, digital technologies have tended to be used more to enhance safety, operational reliability and reduce costs.

Small mistakes have big consequences: The oil and gas industry has developed a relatively risk-averse management perspective that can slow down the adoption rate of new technologies, regardless of their potential. The deployment of new equipment, including new digital options, often requires high-level management approval, which can lead to delays and add to costs.

Long-term demand trends: Oil and gas resources may be larger than the total amount that will be consumed given current trends in the deployment of low-carbon technologies and energy efficiency. While most reservoirs could technically benefit from the use of sophisticated digital applications, it may not always make sense economically to do so.

Information technology (IT) support infrastructure: While many digital technologies are already available, many operators are not well placed to exploit them, as their use requires well-developed IT infrastructure as well as a well-trained workforce.

Conservative management culture: The oil and gas industry's capital- intensive nature and operational hazards have historically forged a relatively conservative management culture. Oil and gas companies may look to service companies and third-party vendors to develop digital technologies rather than bear the risks and cost of large-scale in-house research and development programs.

Brazil

With the forthcoming digital disruption in the Energy Sector, ONS, Brazil's Electric System Operator, faces a critical decision regarding its future operation model.
In Brazil the increasingly relevant wind power not only brings huge variability, but also raises the challenge of aligning several new decentralized plants spread across the territory. Matching supply and demand has never been so complex.

At the same time alongside with the profits of the digitalization of energy sector there emerges an issue of cybersecurity. Importance of reliable energy supply is unquestionable, so significant measures are to be taken to prevent hacking and rerouting power over energy nets to the criminal groups.

Fortunately, to withstand this complexity, digitalization is also changing ONS's operation. Smart meters, remote controls, automated systems, real-time simulators, and other new technologies have increased their capability to predict, track, and respond to changes. The 2014 World Cup has been a unique opportunity to test great variability on the demand side (during the Brazil-Germany game, energy consumption fell ~30% in a matter of hours), and ONS was able to provide electricity uninterruptedly throughout the Cup. The temporary, short-term challenge was successful. Now, ONS needs to develop supply chain variability management into a long-term, lasting capability.

Russia

Specialists of JSC VNIIKTI (part of the corporate scientific and design complex of PJSC NK Rosneft) are implementing a project to create a unique model of "Hybrid twins" that allows to increase the safety of operation of industrial facilities.

The development of technological potential is one of the key elements of the Rosneft-2022 strategy. The company places much importance on innovation and the use of breakthrough digital and technological approaches, defining technological leadership as a key factor of competitiveness on the oil market.

The innovative "Hybrid Twin" model allows you to create a virtual clone of the object, its full digital copy, taking into account all technological features and to simulate the optimal mode of the production process for all phases of operation. This not only increases the efficiency of the use of technological equipment, but also increases the safety of operation of dangerous production facilities, allowing to predict the transition of equipment to a critical condition.

In 2016-2017 a number of projects on the introduction of digital technologies in the power grid complex of Russia were announced.

Such projects are cost and have a long payback period. The volume of capital investments for two municipal districts is estimated by Igor Makovsky, Director General of JSC Yantarenergo, at about 290 million rubles, with a payback period expected to be 8-9 years. For the whole region, these investments may amount to billions of rubles, and the cost of the country's transition to digital technologies in power networks was estimated by the head of the Ministry of Energy of Russia Alexander Novak at 4 trillion rubles with the prospect of further exports of technology to the world market and a possible share of the world market at 10-12 %. According to Pavel Livinsky, head of JSC Rosseti, 1.3 trillion rubles is required for digitalization.

India

Indian Prime Minister Narendra Modi called for strengthening partnership among the BRICS countries.

No one except a block of five key emerging economies, including Brazil, Russia, India, China and South Africa, can establish mutually complementary cooperation in the field of renewable and solar energy using digitalization and innovations.

He expressed the hope that the BRICS Development Bank will allocate more funding for projects in this sphere.

According to the Prime Minister, technology and innovation are the foundation for the next generation of global growth and transformation.

India also realized that technology and digital resources are powerful tools in the fight against poverty and corruption, "Modi said.

It is connected with the «Digital India» project. Digital India is a campaign launched by the Government of India to ensure the Government services are made available to citizens electronically by improved online infrastructure and by increasing Internet connectivity or by making the country digitally empowered in the field of technology. The initiative includes plans to connect rural areas and energy sector with high-speed internet networks.

China

China seems to be the most perspective country for the development of digital technologies, especially in energy sector, and this is predetermined by a number of factors.

First of all, nowadays China is considered to be a global digital leader. The massive scale of the Chinese market and a supportive regulatory and supervisory environment in the early years of digitalization made China a forefront in industries such as e-commerce

and fintech. Digitalization will continue to reshape the Chinese economy by improving efficiency, softening—but not reversing—slowing growth as the economy matures

Besides, according to China Energy Technology Innovation Action Plan 2016-2030, the majority of Chinese mining companies are aimed at digitalization and reducing costs is not the main point. Work accidents rates have decreased recently but this indicator still stays at the high level. Therefore, industrial automatization seems to be the only solution of this problem for Chinese coal industry.

Moreover, it should also be mentioned that expensive launching digital technologies into energy production (exploration, drilling and transportation) is developed at a higher pace when potential mineral deposits are significant and mining operations are cost-effective. It is common knowledge that China is considerably dependent of its coal reserves so great investments into digitalizing of energy sector must turn out to be rather profitable in future. Thus it conditions one more advantage of China's economy in the context of digitalization.

South Africa

Smart Grids is one of the flag ship programmes within South African National Energy Development Institute (SANEDI), aligned with the strategic objectives of the Department of Energy (Electricity Chief Directorate) and is dedicated to carrying out Applied Research Projects to test and deploy various smart grids concepts within the South African Electricity Distribution Industry (EDI). The Programme within its capacity facilitates the implementation of nine pilot projects, which are intended to improve the sustainability outlook of operating a utility.

The Smart Grid Programme addresses the Government's Medium Term Strategic Framework (MTSF) objectives of Energy Transformation and Service Delivery. With regards to Energy Transformation, technology innovation is used as an enabler for change. The introduction of Smart Grid technology is a key enabler for South Africa to achieve its energy mix. Without smart grids large scale integration is impossible. This allows South Africa to meet its climate change objectives at municipal level.

SANEDI has been overseeing 10 pilot projects across the country in order to assess the benefits around management and self-management of usage in particular. Through a signed Memorandum of Agreement with the Department of Energy, SANEDI's smart grids programme is tasked with the responsibility of implementing the EU donor funded smart grids programme with regard to the components that deal with the introduction of smart grid concepts within the South African electricity distribution industry (municipalities). The Department of Energy through the electricity chief directorate has identified five priority areas within the electricity distribution industry (EDI) to conduct applied research pilot projects.

The objective of the applied research projects is to provide policy and regulatory input through the experience and lessons learned from the pilot projects implemented. These five priority areas resulted in the selection of 10 municipalities to participate in the programme. The projects not only serve the broad objectives of the department but address burning issues within the municipality, thereby serving as a catalyst for change. The five priorities of the department are as follows:

- Distributed power generation;
- Enhanced revenue management;
- Energy efficiency demand side management (EEDSM);
- Active network management;
- Asset management.

Youth Politics

Nowadays unemployment is one of the most serious labor market problems in BRICS countries.

In each country more than 10% of young people are out of employment, which causes instability in the society.

There is also another problem: most gas and oil fields are almost exhausted that is why young specialists are afraid to find themselves out of employment some years later after their graduation. Moreover, as oil and gas prices are always fluctuating, the demand for the workforce in this sector in some countries is instable.

On the other hand, energy complex also offers a range of career opportunities, such as higher salaries and appealing working conditions. In all BRICS countries governments are actively supporting programs of development of the green energy, which means that specialists in energy sector will still be in demand in the decades to come. That is why the number of young people in the BRICS choosing to build their career in the energy complex is expected to rise every year.

India

The rate of unemployment among young Indian people was 13,2% in 2016 which is higher than the world average. Over 30% of youth aged 15-29 in India are not in employment, education or training. Moreover, the overwhelming majority of unemployed Indian youth is not looking for jobs.

As far as oil and gas sector is concerned, the situation is that on the one hand it is facing the problem of aging workforce and on the other hand it lacks skilled and talented employees.

The gap between the demand for trained manpower and its supply is widening annually. The situation is caused by the fact that young people are biased against oil and gas companies which do not have a reputation of steady employers as the demand for workforce in oil gas sector has not been stable for 50 recent years. Biggest Indian companies of this sector tend to attract youth organizing internships which do not seem to be popular. At the same time India is developing renewable energy sector and aims at employment of 300 000 people in it by 2022.

Brazil

In 2017, the estimated youth unemployment rate in Brazil was at 30.47 percent. The main characteristics of labour force participation among Brazilian youth can be described as:

- high unemployment rates;
- high labour turnover;
- high informality rates;
- long working hours, making it difficult to combine study and work;
- gender and ethnic inequality;
- low remuneration.

Brazilian oil and gas sector also faces the lack of young specialists, that is why Petrobras, the biggest Brazilian oil and gas company has launched several programs of trainings, scholarships and internships in order to prepare its future stuff. The company even has its own corporate university which welcomes dozens of thousands of students every year.

In Brazil, Petrobras gives the opportunity to everyone who is just starting to get to know technical careers and participate in the daily life of the company, in internships or in a program aimed at young apprentices. To prepare the energy market for new demands, Petrobras also invests in programs that offer training courses and scholarships to students from the technical to the

doctorate level. In addition to the outside training provided to empower its professionals, the company offers a wide variety of courses at Petrobras University in Rio de Janeiro.

South Africa

South Africa's unemployment rate is high for both youth and adults; however, the unemployment rate among young people aged 15–34 was 38,2%, implying that more than one in every three young people in the labour force did not have a job in the first quarter of 2018.

The oil and gas industry is employing an estimated 7 500 people. Moreover, the industry accounts for approximately more than 90 000 indirect jobs in the distribution and marketing segment of the industry value chain.

SAPIA (South African Petroleum Industry Association) plays a central role in ensuring the development of the human capital and the sustainability of skills in the industry The REI4P (South Africa's Renewable Energy Independent Power Producers Program Process) - a program recently launched by the South African Government - has been able to provide short term construction employment for local people and there have been some instances of technical training to enable locals to be employed during the operational life of the plant.

The renewable manufacturing industry has potential to employ more people, but growth in manufacturing is dependent on increasing the proportion of renewables in the energy supply plan.

Russia

Youth unemployment rate in Russia was 16,27% in 2017. From a labour market perspective, the significance of the oil and gas sector is small: production and transport of oil and gas as well as the oil refining industry employs approximately one million people in Russia, i.e. 1.5% of the employed.

Biggest Russian oil and gas companies such as Gazprom, Lukoil, Rosneft and others pursue a developing youth policy which allow young talented people who would like to gain experience combine studies and part-time work or internships. The companies support the principle "school – university – company". So, Gazprom collaborates with a school in St. Petersburg, Rosneft has organized "Rosneft classes" in schools in all regions of Russia and Lukoil offers to pupils an opportunity to visit its power plants.

As for students, all three companies collaborate with technical universities, and select and train the most outstanding young people. Every year dozens of young professionals find jobs in Gazprom oil branches, and although most of these young people have graduated from the company's "basic departments", Gazprom makes every effort to simplify the process of their adaptation and to make it more efficient. In the company's branches there is a 3-year program called "Three limits" which aims at developing professional potential of young specialists and includes different kinds of trainings as well as mentor system.

More then 4500 students every year get the opportunity to pass an internship in Rosneft after which one third of them get a job offer. Lukoil offers a possibility to work part-time for university students.

These companies also initiate and support scientific exchanges between their employees, regularly organizing scientific conferences for young specialists. The best solutions and proposals are to be applied in the company.

China

China University of Petroleum, Beijing has been maintaining good cooperation with energy enterprises. Since signing the first

joint-training agreement in 1997 with an overseas company, the University has established active cooperation with over 20 Chinese companies and over 10 foreign companies, and has cultivated over 1000 graduates for countries in Africa, Central Asia, Middle-East and South America.

Every year since 2013, the University and CNPC (China National Petroleum Corporation) will organize jointly a Job Fair for International Graduates in CUPB, offering a good job-hunting opportunity for international students. The graduates' career prospects are bright.

Reference materials

1) Derrick L. Cogburn and Catherine Nyaki Adeya (2001). Prospects for the Digital Economy in South Africa.
2) Elena Kosolapova (2017, September 12). BRICS Commit to Cooperate on SDGs, Climate Change
3) Stefan Jungcurt (2017, June 17). BRICS Countries Cooperate on Energy Efficiency
4) William Brent (2017, November 7). India: Interlinking the SDGs through Electricity Access
5) Paul Steel (2017, September 3). BRICS summit: an opportunity to lead a fairer more sustainable world
6) New Development Bank. Access Mode: [https://www.ndb.int]
7) International Partnership for Energy Efficiency Cooperation (2017, September 26). BRICS: A force for energy efficiency cooperation
8) A review of renewable energy investment in BRICS countries: history, models, problems and solutions. Access Mode: [https://www.sciencedirect.com/science/article/pii/S1364032117303325]
9) Srijanee Chakraborthy (2017, January 3). Azure Power commissions 150MW solarpower project in India
10) South Africa Overview – World Bank. Access Mode: [http://www.worldbank.org/en/country/southafrica/overview]

Supplementary materials

PowerPoint keynote to the BRICS Youth Energy Outlook 2018 presented at the “Russian Energy Week” International Forum 2018.

Link: https://global.yeabrics.org/wp-content/uploads/2018/09/BRICS-Youth-Energy-Outlook_Презентация_PDF.pdf *(Russian language)*

facebook.com/
yeabrics

Instagram.com/
bricsyea

youtube.com/
bricsyea

vk.com/
yeabrics

B R I C S
Y E A

BRICS Youth Energy Agency
E-mail: info@yeabrics.org

www.yeabrics.org