Case Study for Russia

Fall 2018
Seoul National University - The University of Tokyo
Instructor: Prof. K.Y. Suh, 031-109, SNU ☎ +82-10-5003-8324 kysuh@snu.ac.kr

Russian Energy Week International Forum

- Vladimir Putin addressed the plenary session of the second Russian Energy Week Energy Efficiency and Energy Development International Forum. The forum took place in Moscow October 3~6, 2018. Its main theme was 'Sustainable Energy for the Changing World.' The forum was attended by representatives of the largest international companies & organizations, and leading experts. About 60 business events were held within the framework of the official program.
- "Russia is one of the most powerful players on the global energy market. We are among the leaders in oil and gas production and export, as well as in terms of power generation and coal mining. It is highly important for us to keep track of global energy trends in order to use our competitive advantages efficiently and, together with other countries, create a common energy space and a common energy future..."

http://en.kremlin.ru/events/president/news/58701

Federal Subjects

- Russia is the largest country in the world by area, covering more than 1/8 of the Earth's inhabited land area, and the 9th most populous, with ~145 M people in 2018, excluding Crimea. About 77% of the population live in the western, European part of the country. Russia's capital, Moscow, is the largest metropolitan area in Europe proper and one of the largest cities in the world. Extending across the entirety of Northern Asia and much of Eastern Europe, Russia spans eleven time zones and incorporates a wide range of environments and landforms.
- Russia 85 federal subjects, including the disputed Republic of Crimea and federal city of Sevastopol. Federal subjects are grouped into 8 federal districts, each administered by an envoy appointed by the President of Russia. The federal districts are not a subnational level of government, but are a level of administration of the federal government.

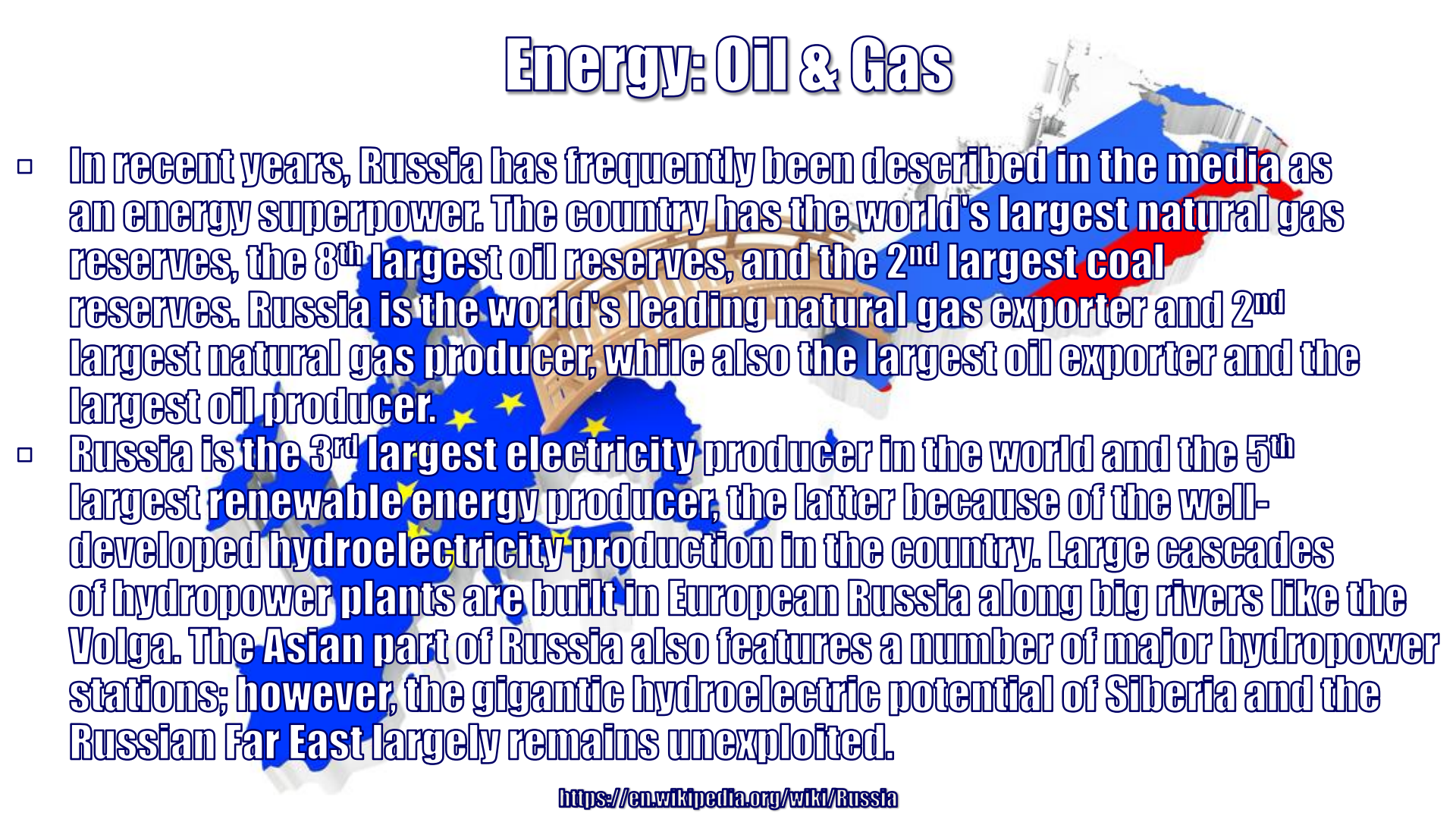
https://en.wikipedia.org/wiki/Russia

Topography & Climate

- Most of Russia consists of vast stretches of plains that are predominantly steppe to the south and heavily forested to the north, with tundra along the northern coast. Russia possesses 10% of the world's arable land. Mountain ranges are found along the southern borders, such as the Caucasus and the Altai. The Ural Mountains, rich in mineral resources, form a north-south range that divides Europe and Asia.
- The enormous size of Russia and the remoteness of many areas from the sea result in the dominance of the humid continental climate, which is prevalent in all parts of the country except for the tundra and the extreme southwest. Mountains in the south obstruct the flow of warm air masses from the Indian Ocean, while the plain of the west and north makes the country open to Arctic and Atlantic influences.

https://en.wikipedia.org/wiki/Russia

Energy: Oil & Gas



- In recent years, Russia has frequently been described in the media as an energy superpower. The country has the world's largest natural gas reserves, the 8th largest oil reserves, and the 2nd largest coal reserves. Russia is the world's leading natural gas exporter and 2nd largest natural gas producer, while also the largest oil exporter and the largest oil producer.
- Russia is the 3rd largest electricity producer in the world and the 5th largest renewable energy producer, the latter because of the well-developed hydroelectricity production in the country. Large cascades of hydropower plants are built in European Russia along big rivers like the Volga. The Asian part of Russia also features a number of major hydropower stations; however, the gigantic hydroelectric potential of Siberia and the Russian Far East largely remains unexploited.

https://en.wikipedia.org/wiki/Russia

Energy: Nuclear & More Gas

- Russia was the first country to develop civilian nuclear power and to construct the world's first nuclear power plant. Currently the country is the 4th largest nuclear energy producer, with all nuclear power in Russia being managed by Rosatom State Corporation. The sector is rapidly developing, with an aim of increasing the total share of nuclear energy from current 17% to 23% by 2020. The Russian government plans to allocate 127 B rubles (USD 5.42 B) to a federal program dedicated to the next generation of nuclear energy technology. About 1 T rubles (USD 42.7 B) is to be allocated from the federal budget to nuclear power and industry development before 2015.
- President Putin signed a deal on behalf of Gazprom for the Russian energy giant to supply China with 38 billion cubic meters of natural gas per year. The natural gas would begin to flow between 2018 and 2020 and would continue for 30 years at an ultimate cost to China of USD 400 B.

https://en.wikipedia.org/wiki/Russia

Railway Transport

- Railway transport in Russia is mostly under the control of the state-run Russian Railways monopoly. The company accounts for over 3.6% of Russia's GDP and handles 39% of the total freight traffic (including pipelines) and more than 42% of passenger traffic. The total length of common-used railway tracks exceeds 85,500 km,second only to the U.S. Over 44,000 km of tracks are electrified, which is the largest number in the world, and additionally there are more than 30,000 of industrial non-common carrier lines.
- Railways in Russia use broad gauge of 1,520 mm, with the exception of 957 km on Sakhalin island using narrow gauge of 1,067 mm. Trans-Siberian spans a record 7 time zones and serves the longest single continuous services in the world: Moscow-Vladivostok (9,259 km), Moscow-Pyongyang (10,267 km) and Kiev-Vladivostok (11,085 km).

https://en.wikipedia.org/wiki/Russia

Fast Facts: BP Statistical Review 2018

- Russia's natural gas production reached a new high growing by 8.2% (~1/3 of global growth) in 2017.
- Russia remained the world's largest oil and gas exporter. Oil production stayed put at 11.3 Mb/d, and accounted for 12.2% of the global total; Russia remained the 2nd largest (after the U.S.) gas producer with 17.3% of global output.
- Russian oil exports grew by 3.1% (to 8.6 Mb/d) and accounted for 12.7% of the global total; gas exports grew by 7.9% (to 231 bcm) accounting for 25.9% of global gas exports growth.
- Primary energy consumption (5.2% of the global total), increased by 1.5%; energy intensity exceeded the global average by 66%; primary energy production accounted for 10.4% of the global total.

https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review/bp-stats-review-2018-russia-insights.pdf

BP Statistical Review 2018

- Russia's energy consumption grew by 1.5% (+8.7 mtoe). Russia remained the 4th largest energy consumer in the world (behind China, the U.S. and India).
- Oil consumption grew by 1.0% (+31 Kb/d) in 2017, following resumption of economic growth and growth in car sales. Gas consumption grew slightly faster: 1.4% (+4.6 bcm) primarily on a colder winter (2016-17) and higher technical needs of the gas industry itself; gas-fired power generation grew by just 0.4%. Gas remained Russia's leading fuel with 52.3% of primary energy consumption, followed by oil (21.9%) and coal (13.2%). Coal consumption grew by 3.8% largely due to higher use in power generation (+3.0%).
- Energy intensity (the amount of energy required per unit of GDP) stayed flat in 2017 and was 66% higher than the world average.

https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review/bp-stats-review-2018-russia-insights.pdf

BP Statistical Review 2018

- Russia's CO_2 emissions increased by 1.3% in 2017. Russia's share of global emissions (4.6%) remained below its share of global energy consumption. Oil output was flat in 2017 (-0.1%) compared to the 10-year average growth of 1.3%. In contrast, gas output grew strongly: 8.2% (vs a 10-year trend decline of -0.3%). Coal output (+6.7%) also grew significantly above trend (+3.2%).
- Hydro declined by 0.5% (vs +0.6% trend), while nuclear (+3.6%) and renewables (+8.7%) grew above trend (+2.3% and 8.0%, respectively). Renewables were the fastest-growing fuel but contributed only 0.04% to Russia's primary energy consumption; in comparison, nuclear accounted for 6.6%.
- Russia accounted for 10.4% of global primary energy production. The most important contributions to global output were for gas (17.3%), oil (12.6%), nuclear (7.7%) and coal (5.5%).

https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review/bp-stats-review-2018-russia-insights.pdf

BP Statistical Review 2018

- Russia remained world's largest exporter of both oil (12.7% of the total) and natural gas (20.4%). Russias possesses the largest gas reserves in the world (35 Tcm, 18.1% of the total) and ranks 6th for oil reserves (106 Billion barrels, 6.3% of the global total).
- Prolific oil and gas resources, an experienced workforce, economical production costs and huge potential for growth. Russia has all the qualities to support strategic shift towards natural gas and highly competitive oil production.
- In 2015 Russia overtook Saudi Arabia as the world's largest exporter of natural gas.
- Russia was the 3rd largest fossil fuel producer, following China and the U.S., accounting for 12.4% of global oil output and 16.1% of gas in 2015.

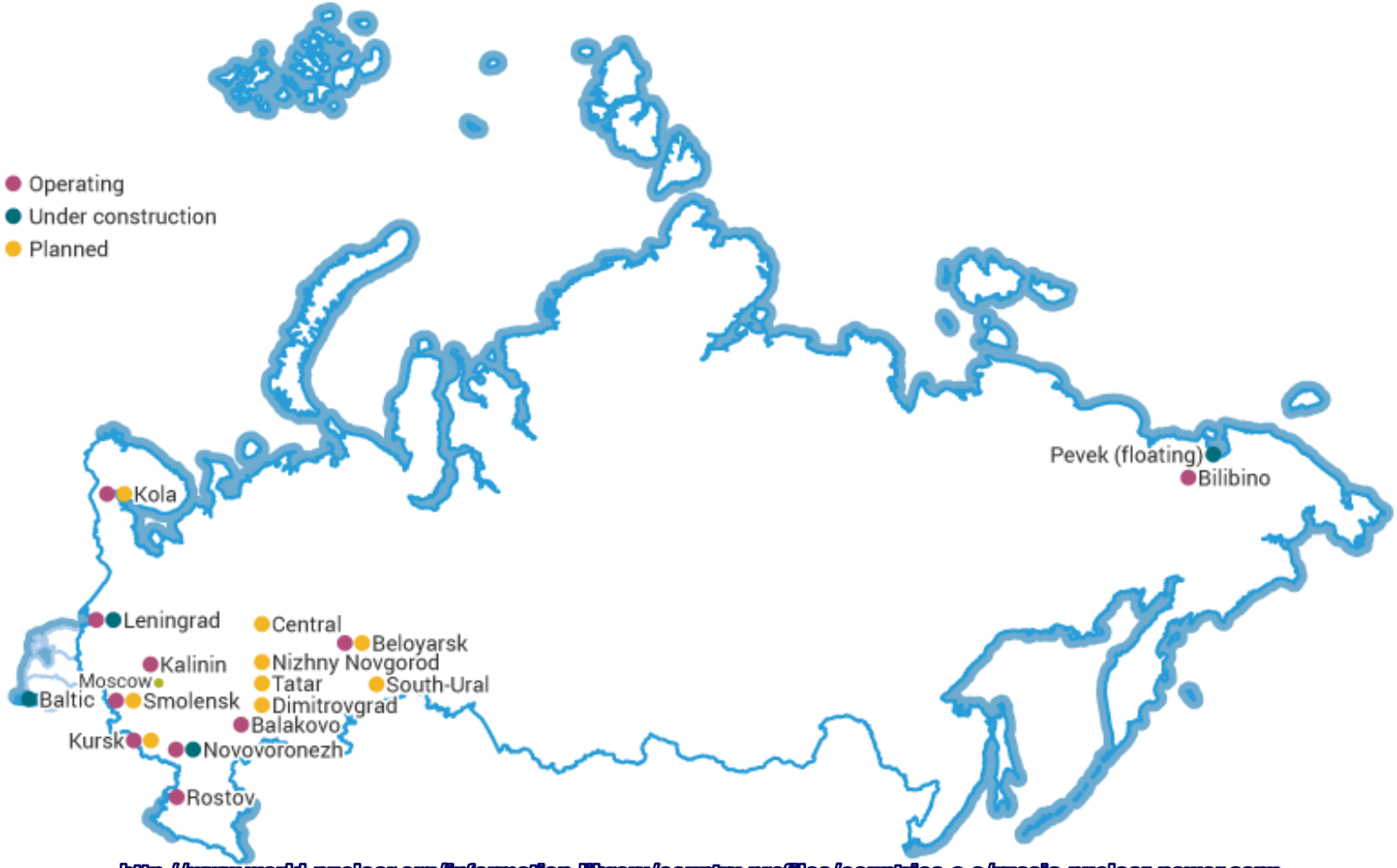
https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review/bp-stats-review-2018-russia-insights.pdf

Nuclear Power

- Russia is moving steadily forward with plans for an expanded role of nuclear energy, including development of new reactor technology. It is committed to closing the fuel cycle, and sees fast reactors as a key to this.
- Exports of nuclear goods and services are a major Russian policy and economic objective. Over 20 nuclear power reactors are confirmed or planned for export construction. Foreign orders totaled USD 133 B in 2017.
- Russia is a world leader in fast reactor technology and is consolidating this through its 'Breakthrough' project. Russia's first nuclear power plant, and the first in the world to produce electricity, was the 5 MWe Obninsk reactor, in 1954. Russia's first two commercial-scale nuclear power plants started up in 1963-64, then in 1971-73 the first of today's production models were commissioned. By the mid-1980s Russia had 25 power reactors in operation, but the nuclear industry was beset by problems.

http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx

Nuclear Power Plants in Russia



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Domestic Construction Program Revived

- Rosenergoatom is the only Russian utility operating nuclear power plants. Its ten nuclear plants have the status of branches. It was established in 1992 and was reconstituted as a utility in 2001, as a division of SC Rosatom.
- Between the 1986 Chernobyl accident and mid-1990s, only one nuclear power station was commissioned in Russia, the four-unit Balakovo, with unit 3 being added to Smolensk. Economic reforms following the collapse of the Soviet Union meant an acute shortage of funds for nuclear developments, and a number of projects were stalled. But by the late 1990s exports of reactors to Iran, China and India were negotiated and Russia's stalled domestic construction program was revived as far as funds allowed.
- Around 2000, nuclear construction revived and Rostov 1, the first of the delayed units, started up in 2001, joining 21 GWe already on the grid.

http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx

BP Statistical Review 2018

- This greatly boosted morale in the Russian nuclear industry. It was followed by Kalinin 3 in 2004, Rostov 2 in 2010 and Kalinin 4 in 2011.
- By 2006 the government's resolve to develop nuclear power had firmed and there were projections of adding 2-3 GWe per year to 2030 in Russia as well as exporting plants to meet world demand for some 300 GWe of new nuclear capacity in that timeframe. Early in 2016 Rosatom said that Russia's GDP gained three roubles for every one rouble invested in building nuclear power plants domestically, as well as enhanced "socio-economic development of the country as a whole."
- However, early in 2017 the CEO of Rosatom said that the government would end state support for the construction of new nuclear units in 2020, and so Rosatom must learn to earn money on its own, primarily via commercial nuclear energy projects in the international market.

http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx

The Rosatom Story...

- Rosatom had come from being a consortium of unprofitable, separately-run businesses a decade ago to a vertically-integrated state corporation with improved strategies and financial performance, thanks in part to a "large-scale" program of state funding. “In this situation ... we must learn how to earn money independently,” especially in the world market. “Optimisation of the management system should become the main theme of 2017.”
- In February 2010 the government approved the federal target program designed to bring a new technology platform for the nuclear power industry based on fast reactors. In June 2010 the government approved plans for 173 GWe of new generating capacity by 2030, 43.4 GWe of this being nuclear. However, by January 2015 this domestic 2030 nuclear target had halved. Nevertheless Rosatom said that it had reduced the cost of electricity production at nuclear power plants by 36% over 2011 to 2017.

http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx

The Breakthrough Project

- Rosatom's current long-term strategy up to 2050 involves moving to inherently safe nuclear plants using fast reactors with a closed fuel cycle, especially under the Breakthrough project. It envisages nuclear providing 45-50% of electricity at that time, with the share rising to 70-80% by the end of the century. The ultimate aim of the closed fuel cycle is to eliminate the production of radioactive waste from power generation. Early in 2017 the CEO of Rosatom said: "We took a punt on the Breakthrough project, on fast reactor technologies, and today we are leading in this field. It's necessary to make this leadership absolute and to deprive our competitors of their hopes of overcoming the gap in the technological race."
- Apart from adding capacity, utilization of existing plants has improved markedly since 2000. In the 1990s capacity factors averaged 60%, but they have steadily improved since and in 2010, 2011 and 2014 were above 81%.

http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx

Electricity Supply

- Russia's electricity supply, formerly centrally controlled by RAO Unified Energy System (UES)*, faces a number of acute constraints. First, demand rose strongly to 2010 after more than a decade of stagnation; secondly some 50 GWe of generating plant (more than a quarter of it) in the European part of Russia is approaching the end of its design life; and thirdly Gazprom cut back on the very high level of natural gas supplies for electricity generation because it can make about five times as much money by exporting the gas to the west (over 30% of EU gas comes from Russia).
- In 2012 Gazprom exports were expected to reach USD 84.5 B, USD 61 B of this to Europe. Gazprom gas exports to western Europe increased by 20% over 2010 to 2016, and in 2015 were 158.6 billion cubic metres. Russia is one of the few countries without a populist energy policy favouring wind and solar generation; the priority is unashamedly nuclear.

http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx

Electricity Production

- UES's gas-fired plants burn about 60% of the gas marketed in Russia by Gazprom, and plans were to halve this by 2020. (Also, by 2020, the Western Siberian gas fields will be so depleted that they would supply only one-tenth of current Russian output, compared with nearly three-quarters in about 2010.) Also there are major regional grid constraints so that a significant proportion of the capacity of some plants cannot be used. Some non-nuclear generators have been privatized.
- Electricity production was 1091 TWh in 2016, of which 522 TWh (48%) was from gas, with 197 TWh (18%) from nuclear, 187 TWh (17%) from hydro and 171 TWh (16%) from coal. Net exports were 14.5 TWh and final consumption was 745 TWh (after transmission losses of 107 TWh and own use/energy sector use of 225 TWh).

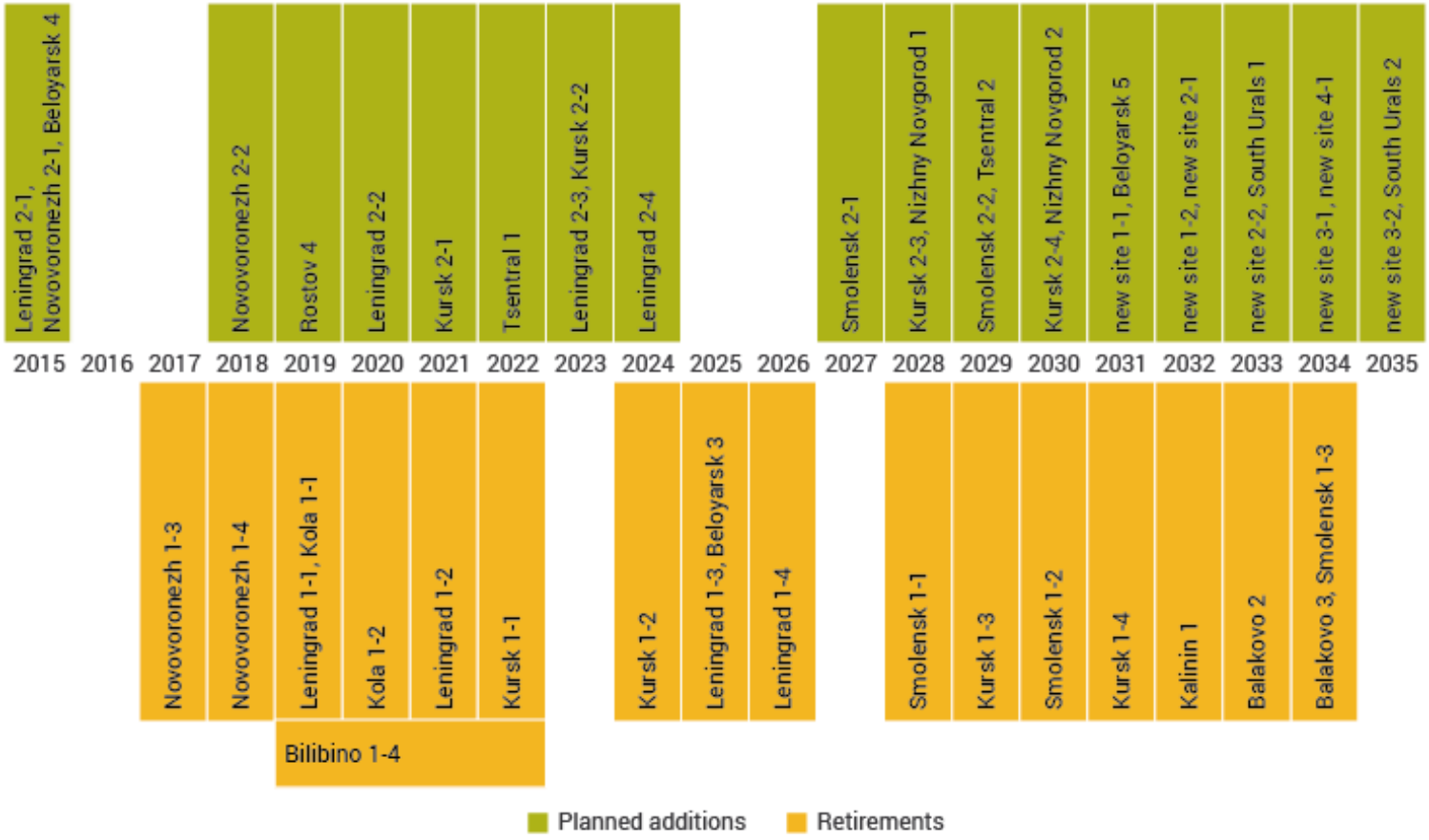
http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx

Present Nuclear Capacity

- Nuclear plants, with 35 operating reactors totalling 26,983 MWe, comprise:
  - 3 early VVER-440/230 or similar pressurised water reactors.
  - 2 later VVER-440/213 pressurised water reactors.
  - 12 current-generation VVER-1000 pressurized water reactors with a full containment structure, mostly V-320 types.
  - One new-generation VVER-1200 reactor.
  - 11 RBMK light water graphite reactors (LWGR) now unique to Russia. The four oldest of these were commissioned in the 1970s at Kursk and Leningrad and are of some concern to the Western world.
  - 4 small graphite-moderated BWR reactors in eastern Siberia, constructed in the 1970s for cogeneration (EGP-6 models on linked map) and due to be decommissioned by 2022.
  - One BN-600 fast neutron reactor and one BN-800.
- Apart from Bilibino, several reactors supply district heating.

http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx

Russian Nuclear Reactor Planned Additions and Retirements to 2035



Source: Rosatom, January 2015

Future of Nuclear...

Plant	Reactor type	MWe gross (net expected)	Status, start construction	Start or commercial operation
FNPP 1 for Pevek	KLT-40S	35x2	Const. 5/09	2019
Novovoronezh II-2	VVER-1200/V-392M	1200	Const. 7/09	Comm. 1/2020
Leningrad II-2	VVER-1200/V-491	1199	Const. 4/10	Comm. 2/2022
Baltic 1 (Kaliningrad)	VVER-1200/V-491	1194	Const. 4/12, suspended 6/13	?
Kursk II-1	VVER TOI/V-510	1255	Const. 04/18	04/2022
Subtotal of 6 under construction		4889 MWe gross		

Coolant	Demonstration reactor	Construction RUR billion	R&D RUR billion	Total RUR billion
Pb-Bi	SVBR 100 MWe	10.153	3.075	13.228
Na	(BN-600, BN-800)	0	5.366	5.366
Pb	BREST 300 MWe	15.555	10.143	25.698
multiple	MBIR 150 MWt	11.390	5.042	16.432
	Total:	37.1		60.7

http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx

Proryv (Breakthrough) Project

- The Proryv project is carried out under FTP Nuclear Power Technologies to 2020, to create a new generation of nuclear power technologies on the basis of a closed nuclear fuel cycle using fast neutron reactors.
- This is proceeding as a high priority in nine coordinated centres, with military focus and resolve.
- The basic concepts include elimination of severe reactor accidents, closing the fuel cycle, low activity radioactive waste, nonproliferation, reduced capital cost of fast reactors, and enabling 350 GWe of Russian nuclear capacity by the end of the century.
- Most of these initiatives are more fully described in the companion paper Russia's Nuclear Fuel Cycle.
- The nine responsibility centers are there.

http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx

The Nine Responsibility Centers

- Reprocessing technology and radioactive waste management for the reprocessing module of the pilot demonstration energy/power complex.
- Pilot production lines for onsite nuclear fuel cycle, including the fabrication/refabrication module and the fast reactor used fuel reprocessing module.
- Development of fuel elements and assemblies with mixed nitride uranium plutonium fuel, at Bochvar National Research Institute.
- Building and operating the BREST-OD-300 reactor, at JSC NIKIET.
- Development of materials for the BN-1200 fast reactor, at JSC Afrikantov OKBM.
- Design engineering the pilot demonstration energy/power complex (PDEC or PDPC) including nitride fuel fabrication and recycling, and developing an industrial energy complex.

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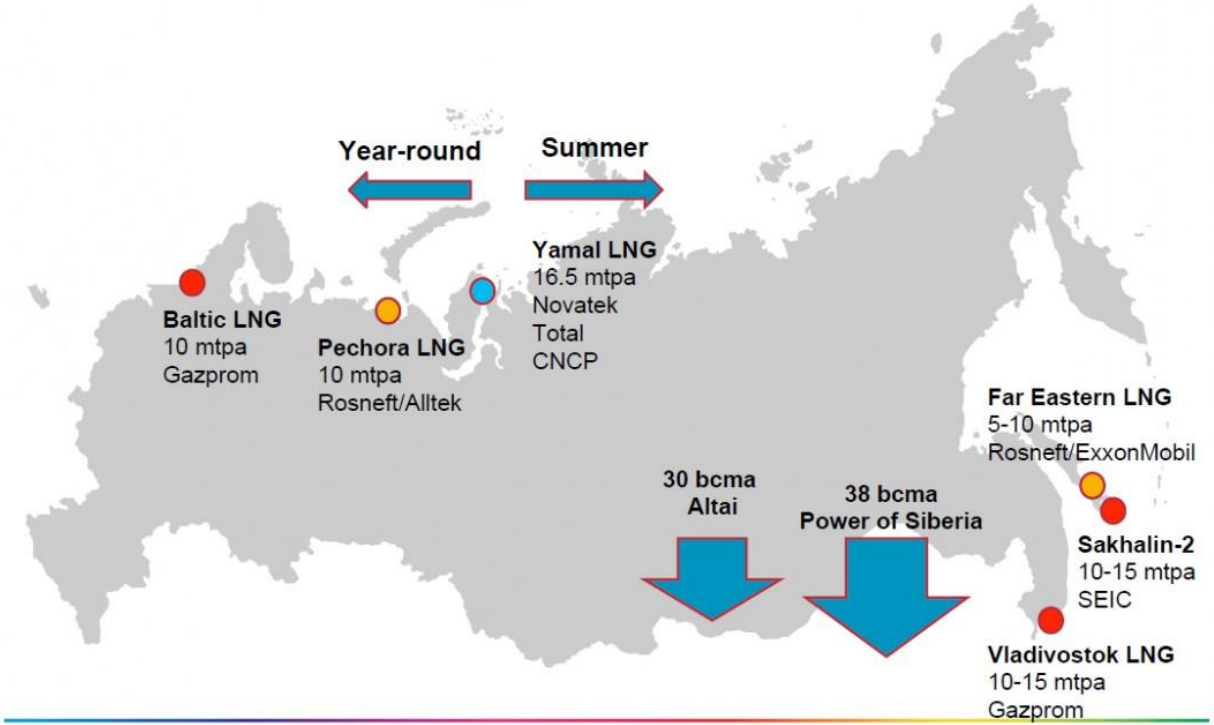
Russian LNG Projects



Warwick Business School

wbs.ac.uk

https://www.asiapacific.ca/ir/blog/russia-natural-gas-supplier-asia-pacific-region-conversation

Natural Gas Supplier to the Asia-Pacific Region

- In late January 2014, the Russian Federation Ministry of Energy published a draft 'Energy Strategy to 2035' that reinforces Russia's drive to develop new oil and gas export markets in Asia. This ambition is fueled not only by challenges Russia is experiencing in Europe, but also by Asia's rapidly growing demand for energy resources.
- A number of Russian oil and gas companies are seeking to grow their gas businesses through LNG exports to Asia. The Sakhalin-2 LNG facility, which is majority-owned by Russia's largest state-owned gas enterprise Gazprom, already exports LNG to Asia. There are also four LNG export projects in various stages of development that could ultimately export to the region: Sakhalin-2 Expansion, Sakhalin-1's Far Eastern LNG, Gazprom's Vladivostok LNG and Novatek's Yamal LNG. The first exports from these projects are projected to begin between 2017 and 2020.

https://www.asiapacific.ca/ir/blog/russia-natural-gas-supplier-asia-pacific-region-conversation

Expanding Pipelines to China

- Some of these projects have significant Asian investor involvement, reflecting the keen Asian interest in importing Russian LNG. Notably, the Sakhalin-2 expansion, one of the world's largest integrated oil and gas projects estimated at over USD 25 B, has Japanese companies Mitsui and Mitsubishi among its shareholders, and 20% of Yamal LNG is owned by China National Petroleum Corporation (CNPC).
- Russia is also expanding pipeline gas exports to China. In May 2014, Russia and China finally reached agreement on a deal for Gazprom to supply CNPC with 38 billion cubic meters (bcm) of natural gas per year from East Siberia via the Power of Siberia pipeline. This thirty year agreement underwrites Gazprom's Eastern Programme and makes a significant contribution to realizing the Russian government's goal of developing a significant new export market in the Asia-Pacific region.

https://www.asiapacific.ca/ir/blog/russia-natural-gas-supplier-asia-pacific-region-conversation

Domestic Conflict & Western Sanctions

- Discussions are now underway on a second deal for Russia to sell China an additional 30 bcm of natural gas per year from West Siberia via the proposed Altai pipeline, which would run from Western Siberia to North-Western China. These deals are of global significance as they will impact China's appetite for increased LNG imports and may set a benchmark price for gas to China.
- However, the success of Russia's LNG business is far from guaranteed. Conflict between the two Russian gas giants Gazprom and Rosneft is significant and adds to uncertainty over whether projects will be completed. Furthermore, in the aftermath of the Ukraine crisis, Western sanctions are reducing the flow of investment and needed technology into gas extraction and export projects.

https://www.asiapacific.ca/ir/blog/russia-natural-gas-supplier-asia-pacific-region-conversation

Russia, China, Japan…

- Russia diversifying its supplies to Asia can be a positive thing. It is not the case that Russia is able to play Europe off Asia by redirecting gas to Asia that could otherwise go to Europe. If the second pipeline from Altai materializes, Putin might want to say that Russia has linked the two markets. But the reality is the cost of moving gas the long distances to Europe doesn't make any sense. The gas reserve is significant enough to meet the demands of both markets.
- Without damaging European energy access, increased Russian exports to Asia could assist the energy security of Asian countries by reducing the amount of the gas traveling through the Strait of Malacca. That must be a positive, not a negative, thing from the Asian perspective. China is pursuing a policy of multiple energy suppliers, as is Japan. That means they will not find themselves overly reliant on any one particular supplier.

https://www.asiapacific.ca/ir/blog/russia-natural-gas-supplier-asia-pacific-region-conversation

Construction of Siberian Strength Gas Pipeline

http://caspianbarrel.org/az/2014/09/construction-of-siberian-strength-gas-pipeline-to-cost-russia-21-billion/

Gas Deliveries via the Eastern Route to China

- The initial cost of construction of the Siberian Strength gas pipeline is 770 billion rubles (USD 21 B). The gas pipeline will become a single transportation system for the Yakut and Irkutsk centres of gas production. Via the pipeline gas will be exported to China and to the Russian market. Total length of the gas pipeline will be 3968 km. The pipeline section Chayandinskoye oil and gas condensate field Blagoveshensk will be built at the first stage.
- Russian gas deliveries via the eastern route to China will begin in 2019. The eastern gas route envisages delivery of 38 B m^3 of Russian natural gas to China via the Siberian Strength gas pipeline.
- The contract on deliveries during the period of 30 years was signed between Gasprom and CNPC on May 21, 2014. The sum of the contract is about USD 400 B.

http://caspianbarrel.org/az/2014/09/construction-of-siberian-strength-gas-pipeline-to-cost-russia-21-billion/

Pipelines from Russia to China via Mongolia

- Moscow supports Mongolia's initiative to build oil and gas pipelines from Russia to China via Mongolia. "There are opportunities for cooperation in the energy industry," Putin pointed out. "Our Mongolian partners have come up with an initiative to build major oil and gas pipelines from Russia to China. We support [this initiative], it is a good idea. However, there is a need to conduct a thorough feasibility study, as always in such cases."
- The three countries had been working together to remove excessive administrative barriers in order to ensure uninterrupted trade flows. "To achieve this goal, [there is a need] to ensure the full implementation of the 2016 agreement on mutual recognition of customs control. Introducing an electronic data interchange system in accordance with the agreement has significantly eased the border crossing process and goods clearance," Putin added.

http://caspianbarrel.org/en/2018/06/putin-supports-idea-of-building-oil-gas-pipelines-from-russia-to-china-via-mongolia/

Next Trilateral Meeting in 2019

- Putin commended close inter-regional ties and cross-border cooperation between the three countries. “We believe it important to step up efforts aimed at boosting trilateral cooperation in the area of tourism. In this regard, I would like to mention the Tea Way cross-border tourist route that could connect the regions of Russia, China and Mongolia.”
- He also highlighted the importance of developing cross-border environmental protection programs aimed at preserving unique flora and fauna and develop protected nature areas. “Russia suggests considering the possibility to boost trilateral cooperation between public, scientific, cultural and educational organizations, as well as interaction between parliament members and political parties.” Moscow also supported the idea of holding the next trilateral meeting on the sidelines of the Shanghai Cooperation Organization summit in Kyrgyzstan in June 2019.

http://caspianbarrel.org/en/2018/06/putin-supports-idea-of-building-oil-gas-pipelines-from-russia-to-china-via-mongolia/

Gazprom to Supply Gas to China from End of 2019

- New sales contract signed on the sidelines of Chinese President Xi Jinping's visit to Moscow, while industry executives from both sides also held talks on expanding trade in crude oil. Russia's largest natural gas producer, Gazprom, will start supplying the fuel to China through a pipeline across Siberia on December 20, 2019, Gazprom Chief Executive Alexei Miller told reporters after a meeting with China National Petroleum Company.
- CNPC chairman Wang Yilin and Miller met during this week's visit to Moscow by President Xi Jinping and signed a supplementary purchase and sale contract, the state-owned Chinese company said on its website on Wednesday. It did not provide further details. The contract is part of a gas supply deal the two countries signed in 2014. The deal is the latest sign that Russia is tightening its ties with China, a major gas buyer. It comes at a time of turmoil for rival major exporter Qatar.

http://caspianbarrel.org/az/2014/09/construction-of-siberian-strength-gas-pipeline-to-cost-russia-21-billion/

Power of Siberia

- The new pipeline, dubbed the “Power of Siberia” has a planned annual capacity of 38 B m^3. CNPC said that it had agreed to speed up the construction of the pipeline and market development, as well as build natural gas processing plants and domestic underground gas storage facilities to make sure the project starts on time.
- While the start date appears ambitious, analysts said the volume on the pipeline by the end of 2019 would likely be low ,and ramping up to full capacity would take some time. Russia needs to develop two new gas fields to fill it. Russia may have offered China concessions on prices to secure its backing for the project, said Massimo Di Odoardo, vice-president of global gas and LNG research at Wood Mackenzie. “Clearly this announcement is a big push to show the project is still alive,” he said at a press briefing.
- “We wondered if this big push could also include some concessions.”

http://caspianbarrel.org/az/2014/09/construction-of-siberian-strength-gas-pipeline-to-cost-russia-21-billion/

ROSATOM Enters the Wind Energy Market…

- In 2018, ROSATOM enters the wind energy market. ROSATOM's experts assess that by 2024 its volume may be 3.6 GW and the annual turnover will be US $1.6 billion. This guarantees the demand for production of wind turbines and entire wind farms, necessary infrastructure and technical support services. Altogether, this is evaluated at USD 6.3 B.
- ROSATOM, which is the key domestic producer of energy which does not generate GHGs, has all resources and competences necessary to occupy a large share of this market, which is new for the company. The matter is the development of the brand new industry in Russia. ROSATOM sets tasks of not only building wind power plants but also creating the system of technical regulation, staff training, organization of WTs production localization, certification, and R&D. ROSATOM develops new industries to solve such tasks as part of nuclear power development home and abroad.

https://www.rosatom.ru/en/rosatom-group/wind-energy/

Wind & Nuclear in Tandem…

- In 2018 at ROSATOM's capacities in Volgodonsk it is planned to set up manufacture of boss, nacelle, generator and cooling system of wind turbine to Lagerwey technology. The Dutch partner will assist Red Wind in training of personnel who are necessary for WT production and operation.
- First wind power plants (WPPs) will be built in the south of Russia in the Republic of Adygeya (150 MW) and Krasnodar Territory (200 MW). In the Republic of Adygeya WPP will be built in the territory of two municipalities – Shovgenovskoe and Giaginskoye. At the first wind power plant in Adygeya – Adygeya WPP – micro siting (WPP configuration has been identified and assessment of power generation of the plant has been done) has been carried out. A set of engineering surveys in the territory of construction was carried out; the project documentation is worked out. Commissioning of the first generation is planned for 2018.

https://www.rosatom.ru/en/rosatom-group/wind-energy/

OPERATING PRINCIPLE OF WIND MEASURING COMPLEX

WHY DO WE NEED TO MEASURE WIND CHARACTERISTICS?

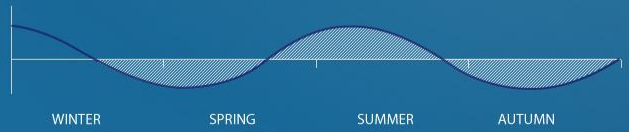
WIND IS THE SOURCE OF ENERGY
FOR WIND FARMS AS FUEL
FOR THERMAL POWER STATIONS.

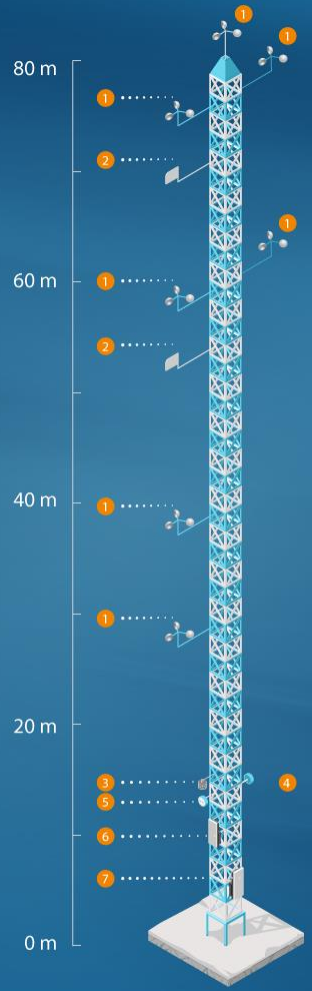
Wind speed changes influence the quantity of energy produced by a wind farm. The more energy produced, the more efficient it is.

BEFORE DESIGNING A WIND FARM, THE COMPANY STUDIES THE WIND SPEED AND DIRECTION AT THE SITE WHERE THE WIND FARM IS TO BE CONSTRUCTED. THIS DATA HELPS TO OPTIMIZE CONFIGURATION AND EVALUATE THE PAY-BACK AND OTHER ECONOMIC INDICATORS OF THE OBJECT.

HOW ARE MEASUREMENTS PERFORMED?

To measure the wind potential with the highest accuracy, a wind measuring complex (WMC) or few of them are installed at site.
For extended periods of time (a year or more) the complex collects information wind data at a different heights, according to project specification. These data make it possible to evaluate and predict seasonally fluctuated wind parameters.





Configuration of the wind measuring complex installed at prospective wind farm site

1 ANEMOMETER

Measures horizontal wind speeds. As wind speeds are different at various heights, anemometers are installed at several heights.

2 VANE SENSOR

Determines the wind direction: this parameter ensures the optimal positions of wind turbines.

3 TEMPERATURE SENSOR

Installed at a 10 m height to avoid influence of the heat emitted by the ground surface on obtained values.

4 HUMIDITY SENSOR

Helps to assess risks of ice formation at place of measurements.

5 PRESSURE SENSOR

Like other sensors, it is resistant to weather changes and works independently of the power grid.

6 DATA LOGGER

Collects data from all sensors and calculates average values per a 10-minute interval.

7 POWER SUPPLY CABINET

Contains a data logger, a communication system, components for power supply and any other accessories.

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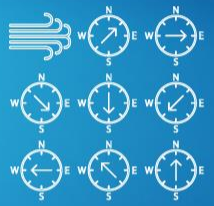
WIND TURBINE OPERATING PRINCIPLE

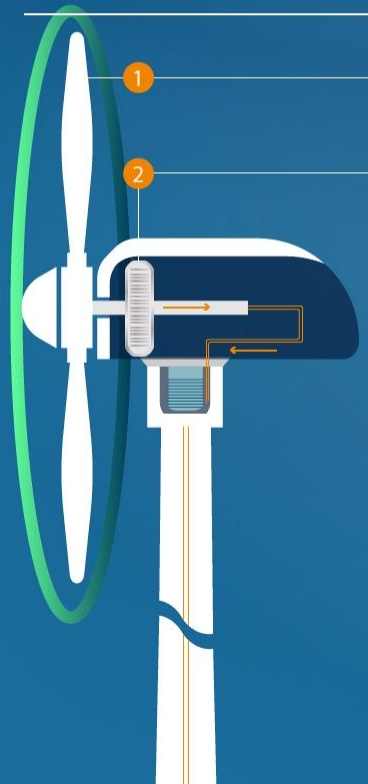
NovaWind

A WIND TURBINE (WT) CONVERTS WIND ENERGY INTO ELECTRIC ENERGY. WIND FLOW POSSESSING THE KINETIC ENERGY PASSES THROUGH A ROTOR.
THE ROTATION GENERATED BY THE WIND FLOW IS TRANSMITTED TO A GENERATOR THAT PRODUCES ENERGY.

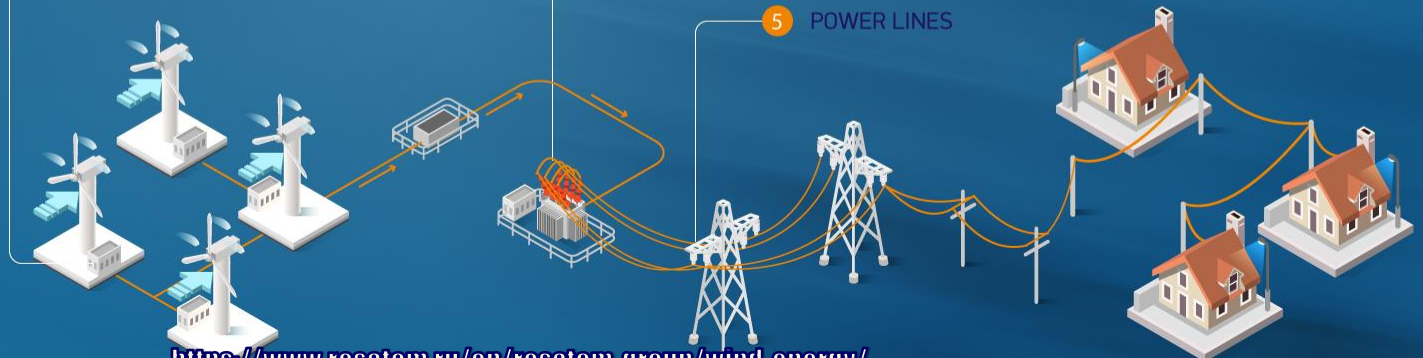
WTs USE UP TO 45-50% OF KINETIC ENERGY FROM AN AIR FLOW



Wind turbines are designed with continuous monitoring of weather conditions.
To use energy of air fow to the maximum, modern WTs are equipped with yaw and pitch systems.



1. **ROTOR**
   It converts wind energy into the rotational energy of the wind turbine axis. Diameter – from several meters to tens of meters, rotation speed – up to 100 rpm
2. **SYNCHRONOUS MULTIPOLE GENERATOR**
   It produces energy with changeable frequency and voltage
3. **FREQUENCY CONVERTER**
   It is used to form three phase commercial frequency voltage
4. **TRANSFORMER**
   It transmits energy from the converter to the grid
5. **POWER LINES**



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The biggest localization program in Russia

2018

57%

Pitch system, hub assembly, yaw system, nacelle skeleton, nacelle assembly, cooling system, converter, transformer. Wind farm design, construction, assembly, network connection.

2019

78%

Hub cover, generator, modular steel tower.

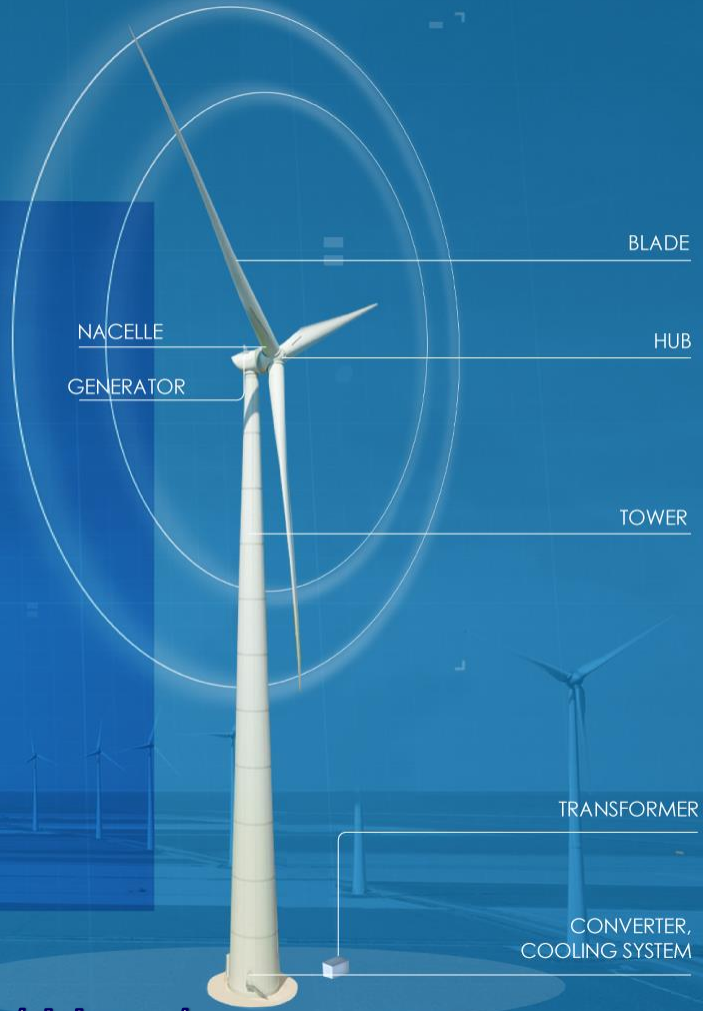
2020

88%

Blades.

PRODUCTION FACILITIES IN VOLGODONSK

Wind turbine components assembly factory: assembly of hub, nacelle, generator and cooling system.



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