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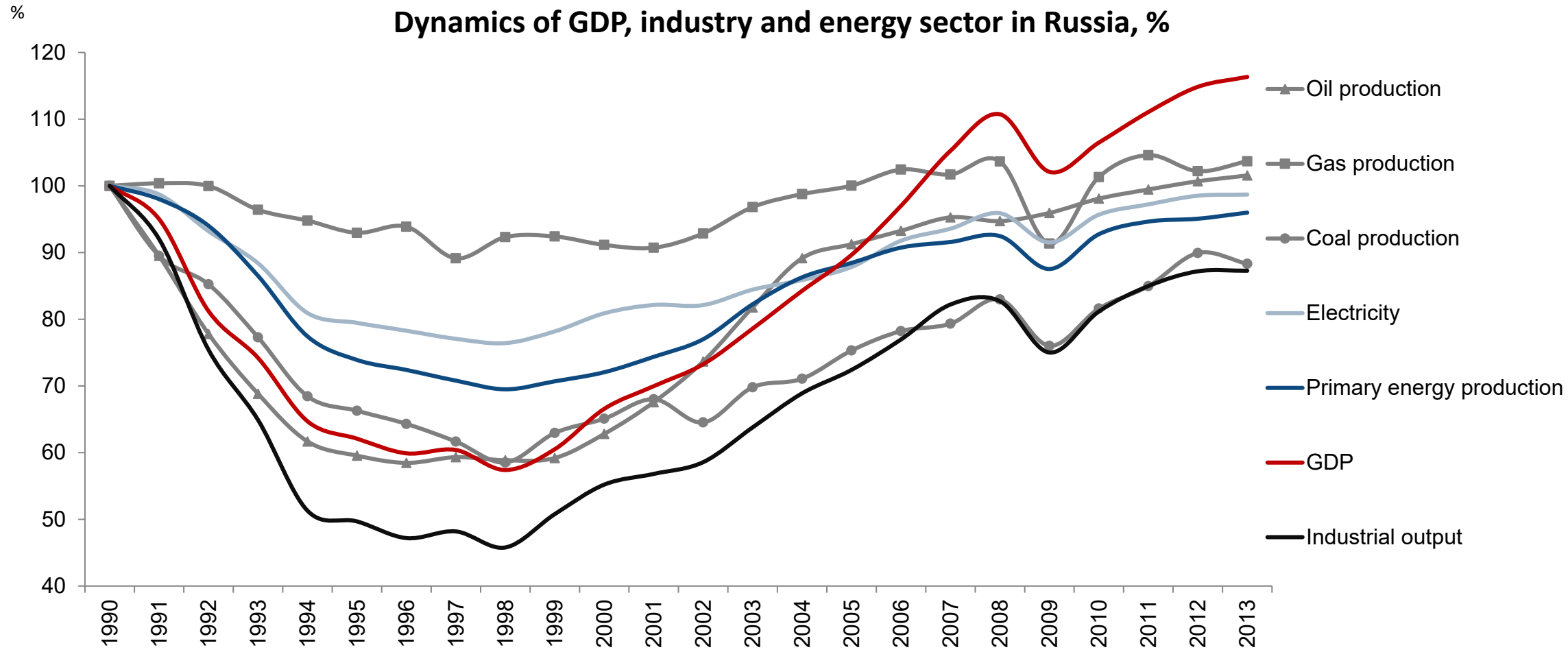
Dr. Tatiana Mitrova, Research Director
Energy Centre, Moscow School of Management SKOLKOVO

Russian Energy Sector

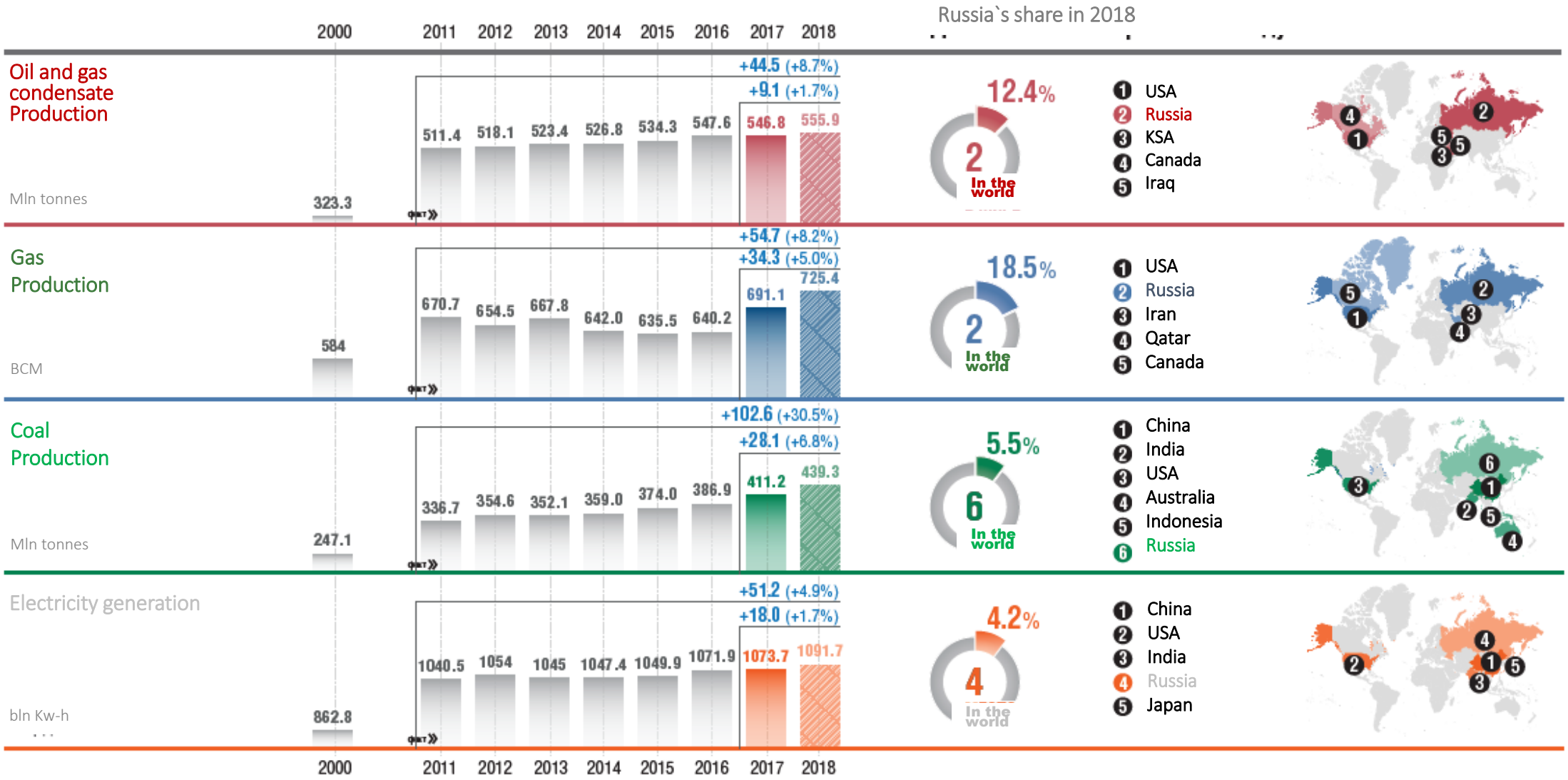
- **General overview**
- Oil&gas
- Nuclear
- Energy transition in Russia (RES&hydrogen)
- Q&A

In 1990-ies Russian economy and energy sector went through an incredible decline



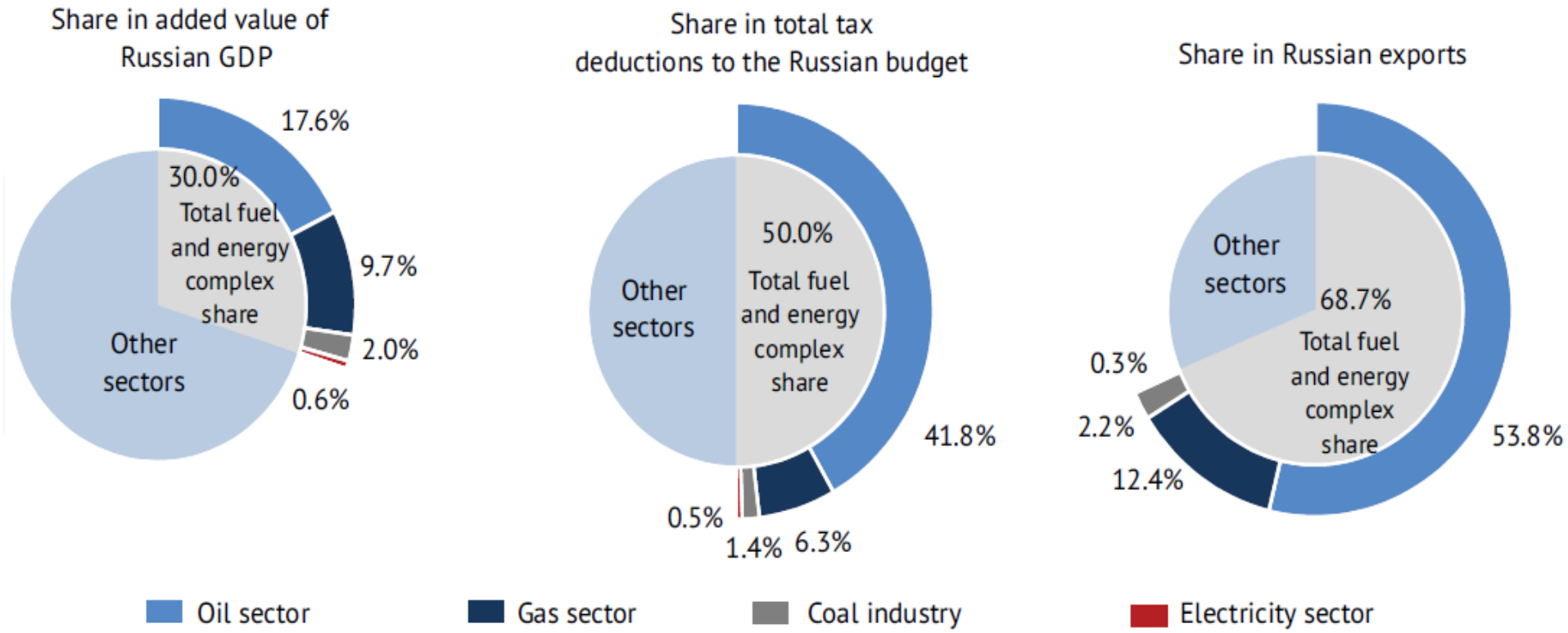
Source: Global and Russian Energy Outlook up to 2040. ERI RAS-AC. 2014.

Russia`s energy sector on the global map



The role of oil&gas revenues for the Russian economy is still extremely high

Shares of energy sector in Russian GDP, exports and budget

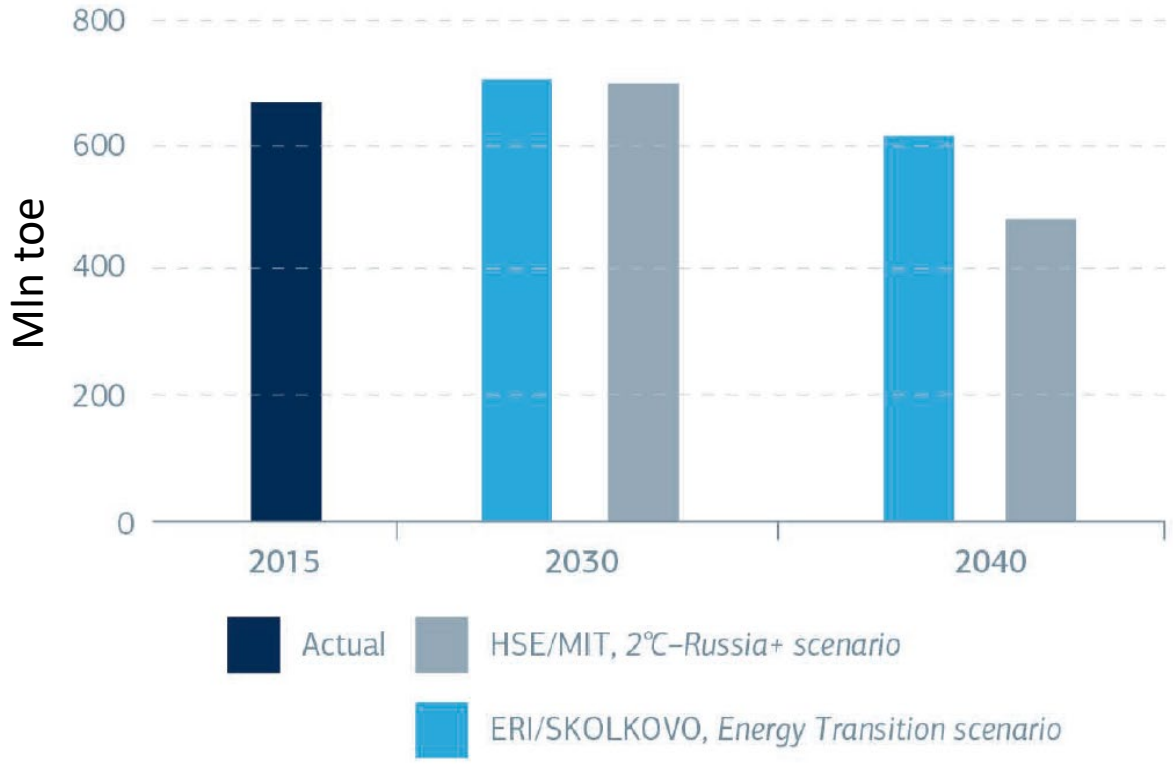


Source: Global and Russian Energy Outlook up to 2040

Energy transition globally and challenges for the Russian oil&gas exports

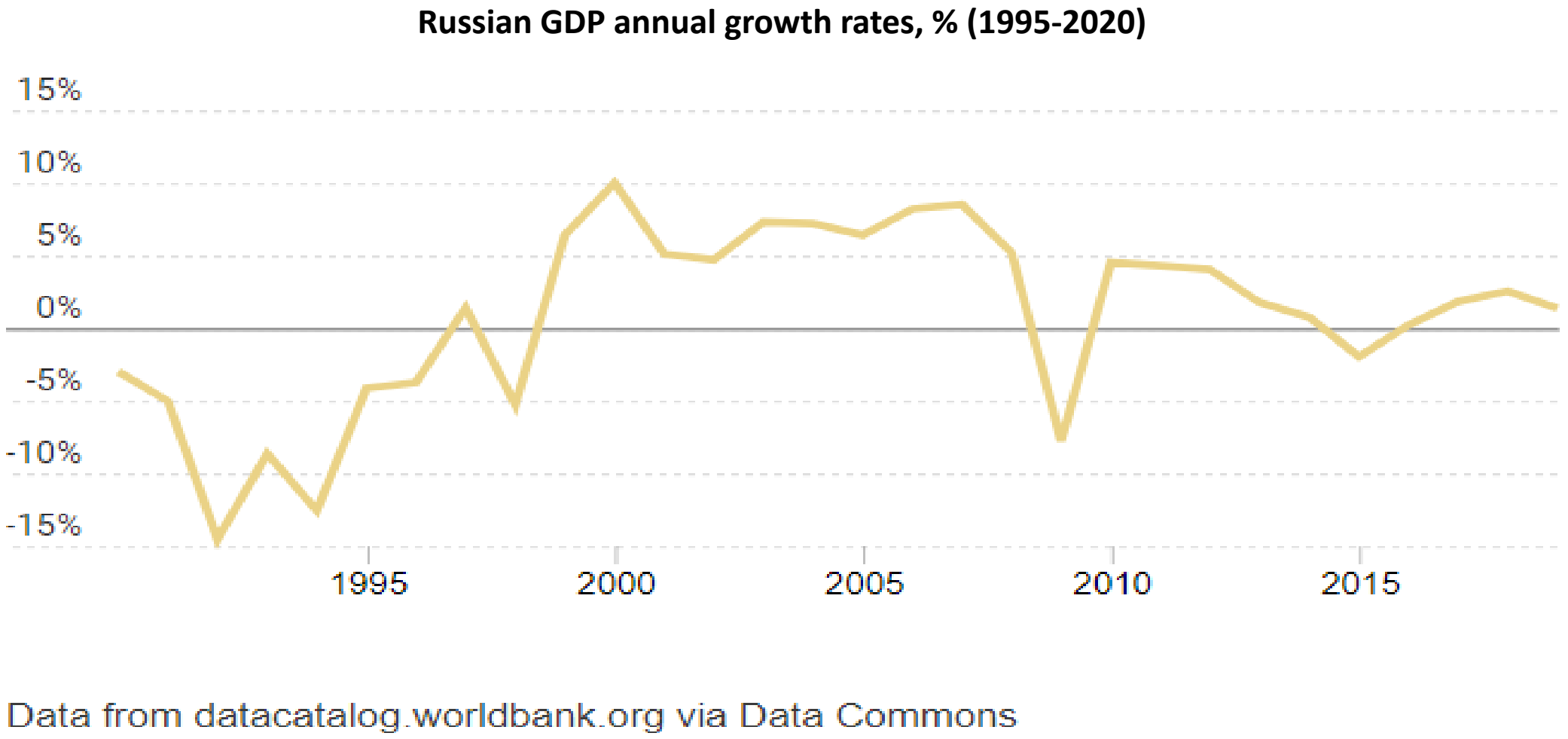
- Growing share of RES limits the demand growth for fossil fuels, thus resulting in lower than expected export volumes for hydrocarbons.
- CBAM introduction as a part of the carbon taxation mechanism might become a long-term source of instability for economies relying on fossil fuels.
- Banks and financial institutions are assessing climate risks and becoming more reluctant to provide financing for fossil fuel projects.

Russia's energy resource export outlook



Source: Russian Academy of Science ERI, Moscow School of Management SKOLKOVO, HSE

After high growth rates in 2010-ies, now Russia`s GDP expectations are revised downwards to nearly flat



Energy Strategy-2035:

focus on energy exports increase (especially to Asian Pacific markets) - by 15-46% by 2035 from the level of 2018

Hydrogen export goals:

0,2 MT by 2024

2 MT by 2035

(=0,7% of total Russian energy exports)

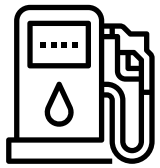
(H2 ‘origin’ is not mentioned, as well as domestic H2 market KPIs)

+20-86%

coal export growth (planned)

+47-98%

natural gas + LNG export growth (planned)



+80-110%

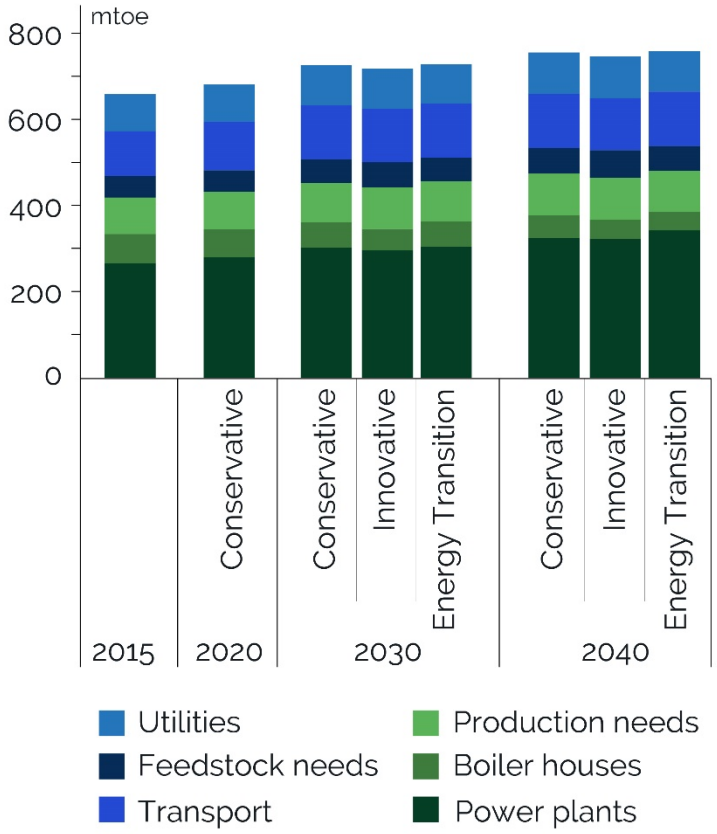
gasoline + diesel export growth (planned)

+85% **growth in Asia-Pacific market** share of total Russian energy exports **(planned)**

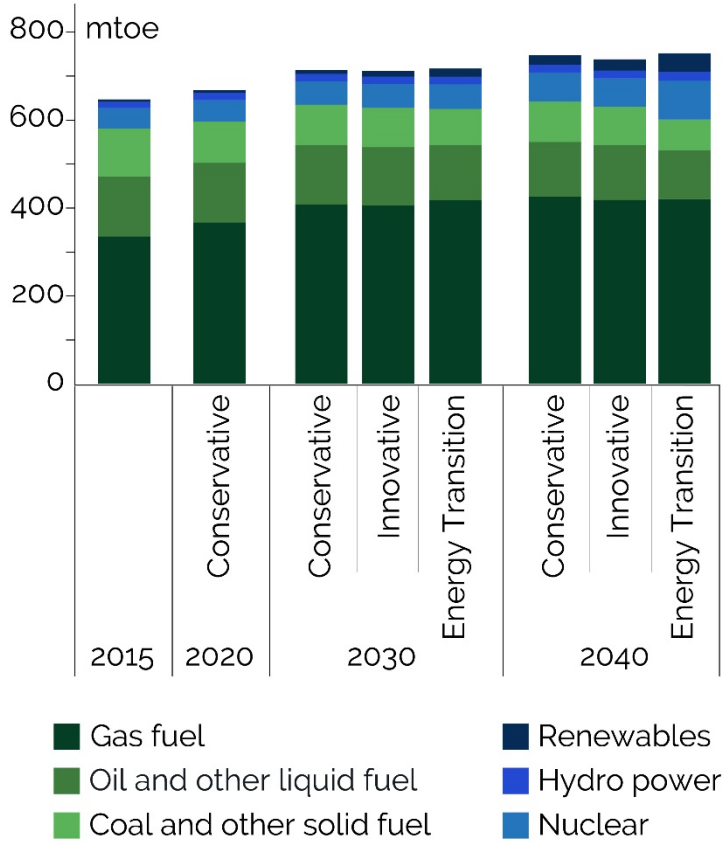
Source: Energy Strategy of Russia (adopted in June 2020)

Primary energy consumption and energy mix unlikely to change significantly before 2040

PRIMARY ENERGY CONSUMPTION BY SECTOR



PRIMARY ENERGY CONSUMPTION BY SOURCE



Natural gas remains the main energy source – and the most affordable one

Wind & solar electricity will stand for 2-2,5% in electricity mix by 2035 – no incentives for storage

Source: ERIRAS-SKOLKOVO Energy Outlook (2019)

Russian climate policy:
focus on maintaining of achieved GHG emission reduction level

-30%
by 2030

National Determined Contribution of Russia (including LULUCF compared to 1990)

-50%

GHG emissions level already achieved in 2017 (including LULUCF compared to 1990)

Most likely, long-term emission goals (by 2030 & 50) could be achieved without active efforts

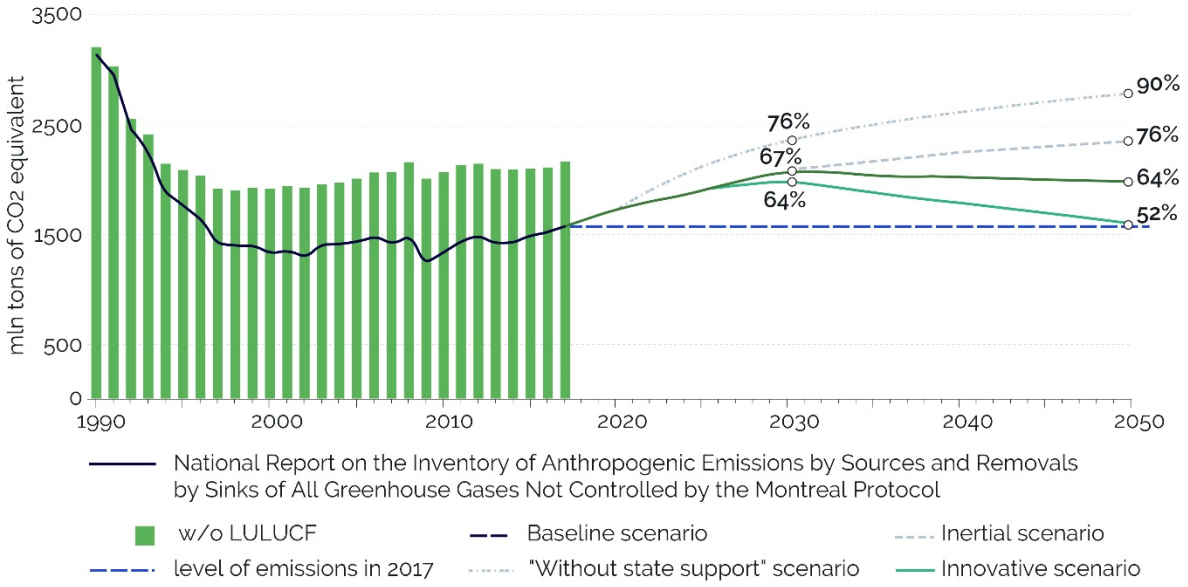
Energy efficiency improvement is considered as the main tool of GHG emissions management

Carbon pricing is not considered in strategy so far

Significant changes in energy mix are not in the agenda

Anthropogenic GHG emissions targets in Russia are planned at the same level by 2050 as in 2017 (best case)

Anthropogenic GHG emissions (including and excluding LULUCF) in Russia from 1990 until 2017 (current data) and from 2017 until 2050 (outlook according to the Low Carbon Development Strategy draft).



Source: SKOLKOVO Energy Centre analysis

GHG emission regulation elements

Element	Document	Document status
Long-term goal of Russian Federation GHG emissions	Decree of the President 666 dated Nov. 4, 2020	**Approved.** The national target for emissions of from the level of 1990 by 2030 has been set.
The strategy of social and economic development	Long-term development strategy of the Russian Federation with low GHG emissions by 2050	**In progress.** The draft Strategy was submitted by Ministry of Economic Development to the in March 2020. Expected to be approved in 2021.
Introduction of the national regulation GHG emissions	Federal Law “On Limiting Emissions”	**In progress.** The draft law includes vocabulary, obligation to monitor GHG emissions and for voluntary climate projects. Expected to be in 2021.

Source: SKOLKOVO Energy Centre analysis

Sakhalin carbon regulation experiment

- Is considered in addition to new federal law “On Limiting GHG Emissions” – in the form of separate federal law draft.
- Status: discussions. Adoption is expected in 2021.
- Goals: achieving carbon neutrality by 2025-2026 in Sakhalin Region and development of regulatory mechanisms for GHG emissions and sinks.
- All companies which emit >50,000 tCO2e per year (2022-2023) and >20,000 tCO2e per year (2023-2026) will participate in the experiment.
- Carbon pricing is discussed (about US$2/tCO2).
- GHG emissions reduction potential is 33,2% by 2026 (from the level of 2019).

Source: SKOLKOVO Energy Centre analysis

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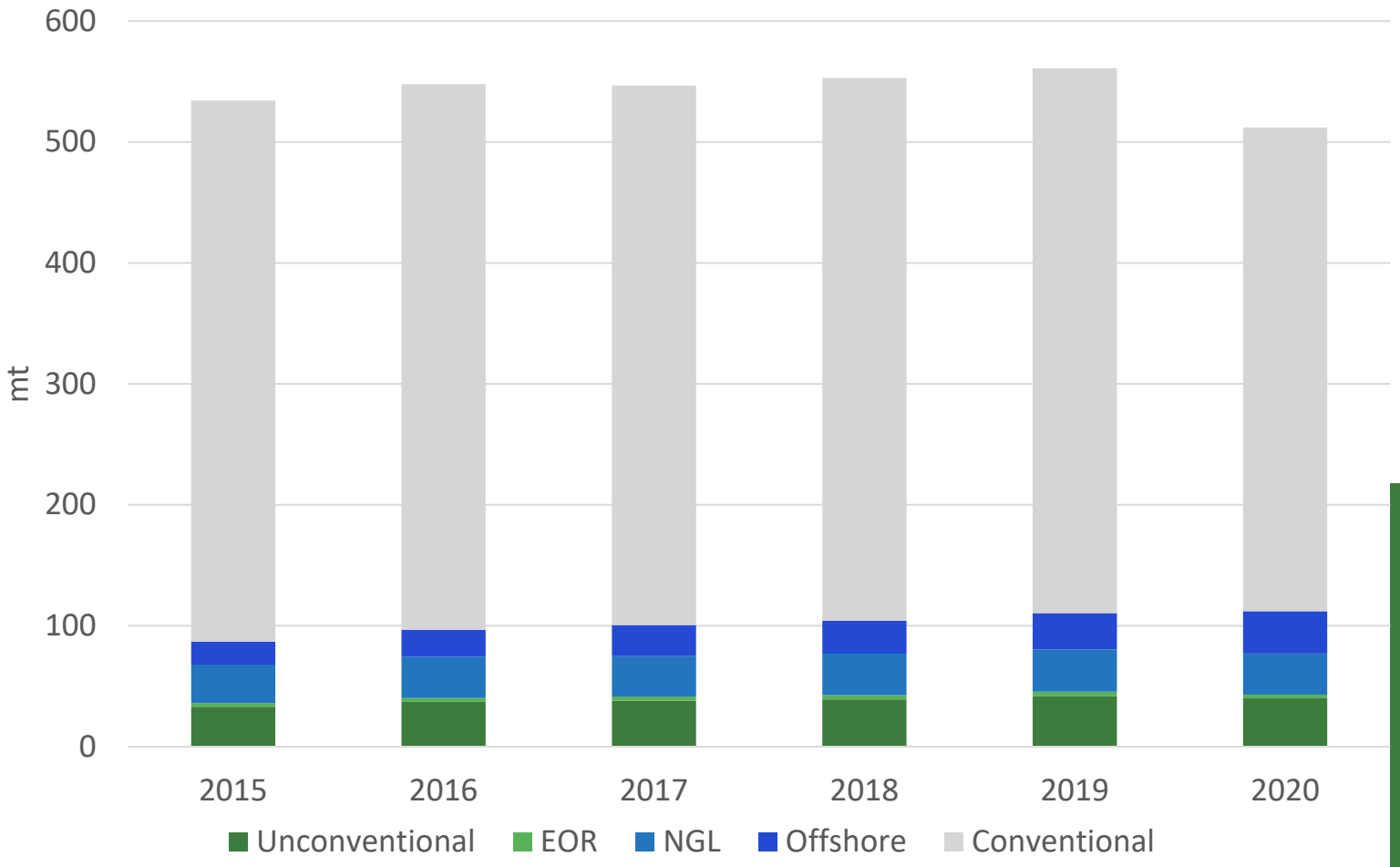
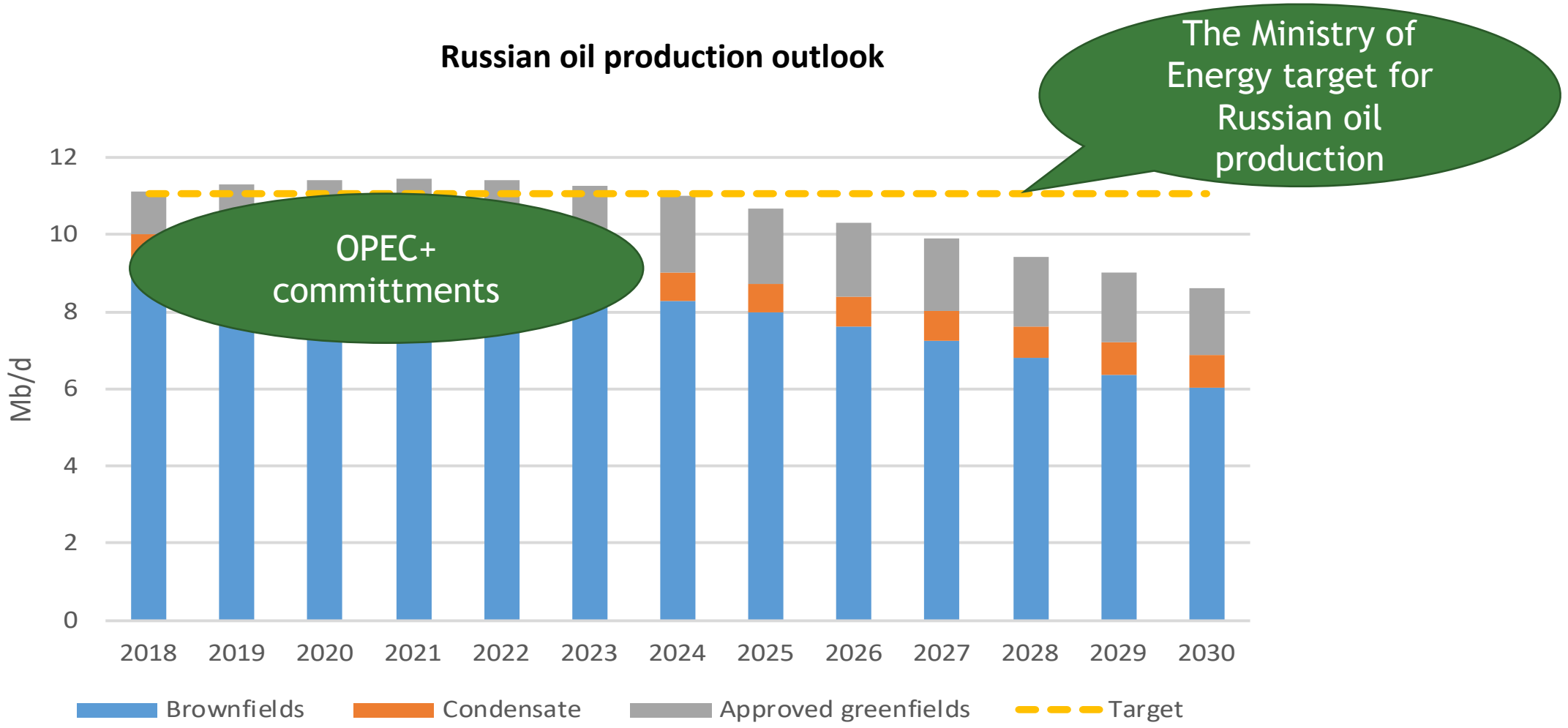
Oil production structure in Russia



OPEC + deal became a significant limitation for the Russian oil production growth

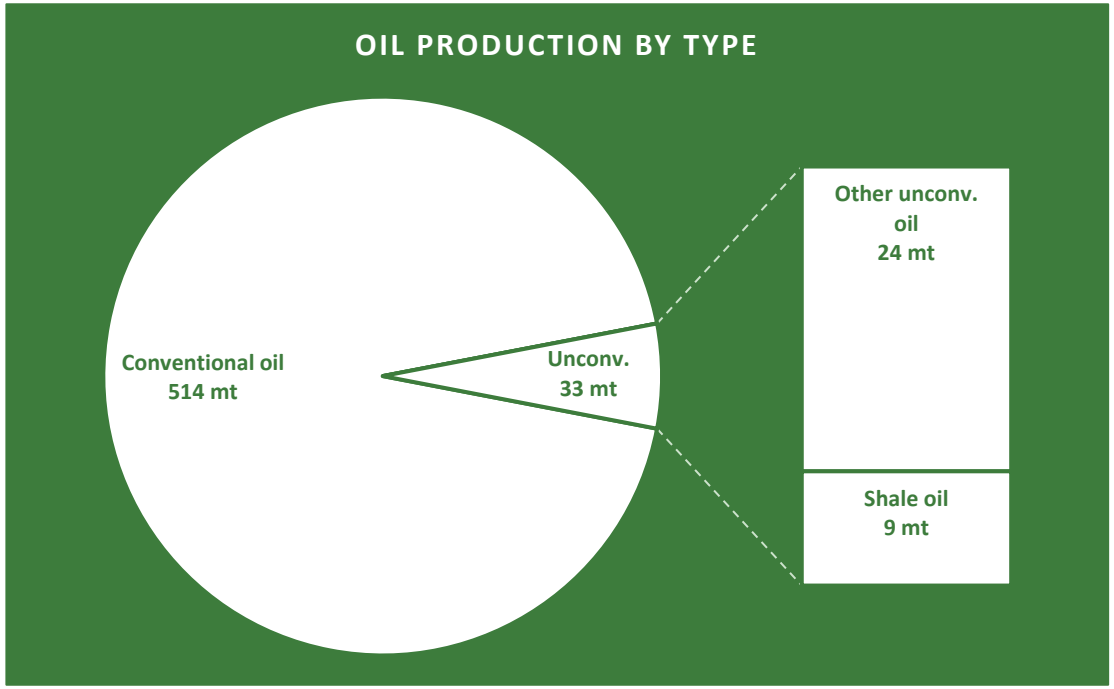
Source: CDU TEC, Energy Centre estimation

Russian oil production is expected to stagnate due to the OPEC+ deal and natural depletion

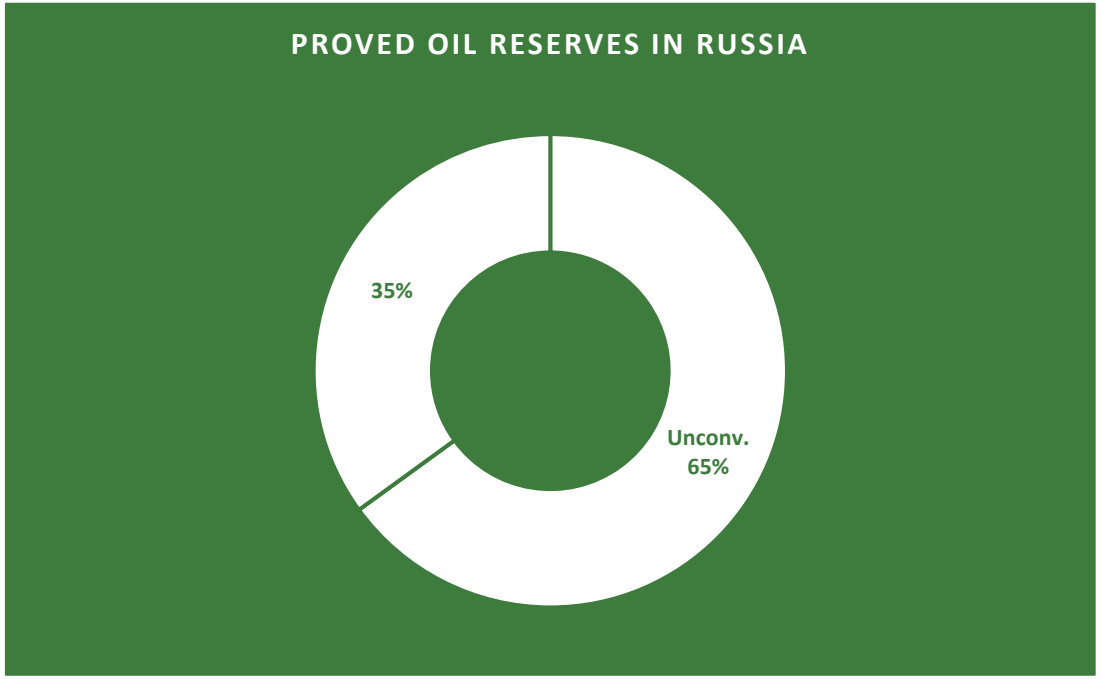


Source: Energy Center SKOLKOVO

In the long-term importance of unconventional oil will increase



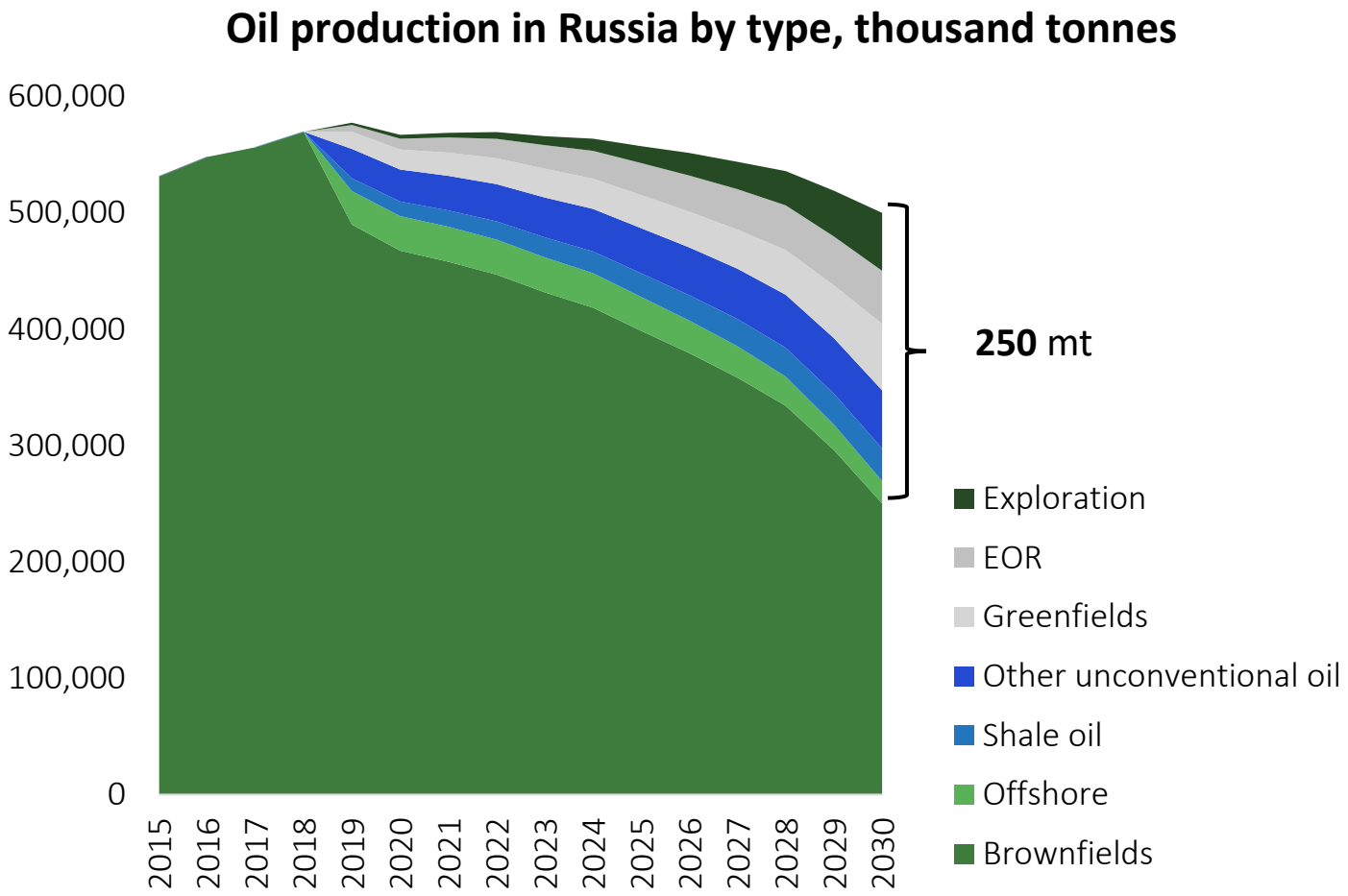
Source: The Ministry of Energy of the Russian Federation, company data, SKOLKOVO Energy Centre



Source: The Ministry of Energy of the Russian Federation, State Reserves Committee

! Development of unconventional reserves associated with stimulating the creation of technologies and equipment (in particular for hydraulic fracturing)

Maintaining oil production in Russia will require new technologies and tax incentives



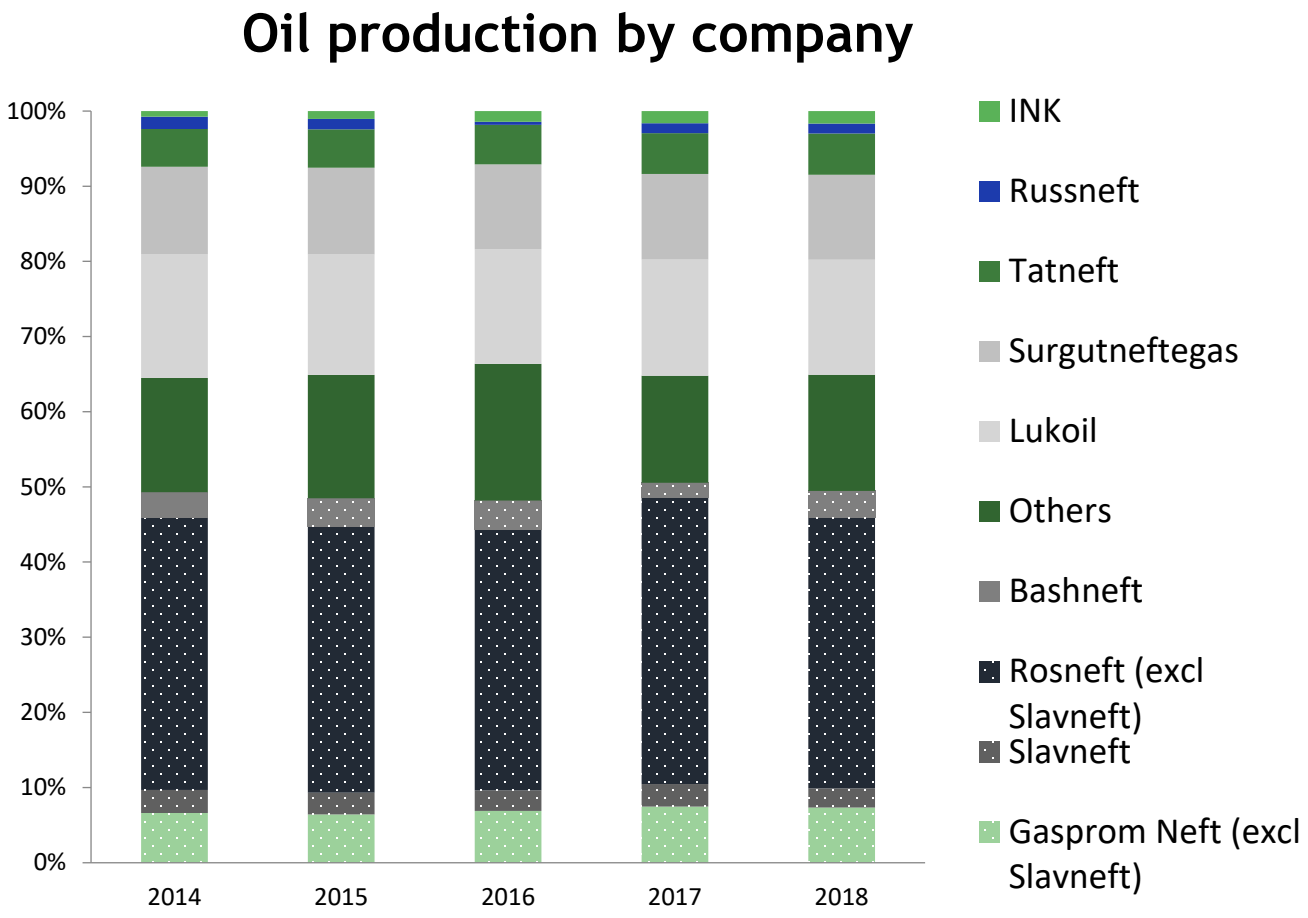
Source: The Ministry of Energy of the Russian Federation, company data, SKOLKOVO Energy Centre

By 2030:

- ✓ **500 MT** – oil production
- ✓ **250 MT** – brownfields
- ✓ **50%** of production due to new technologies
- ✓ **Unconventional oil and EOR** unprofitable without tax breaks

! To maintain the volume of oil production it is necessary to reallocate the rent between the state and oil companies

Recent trends in the Russian oil sector



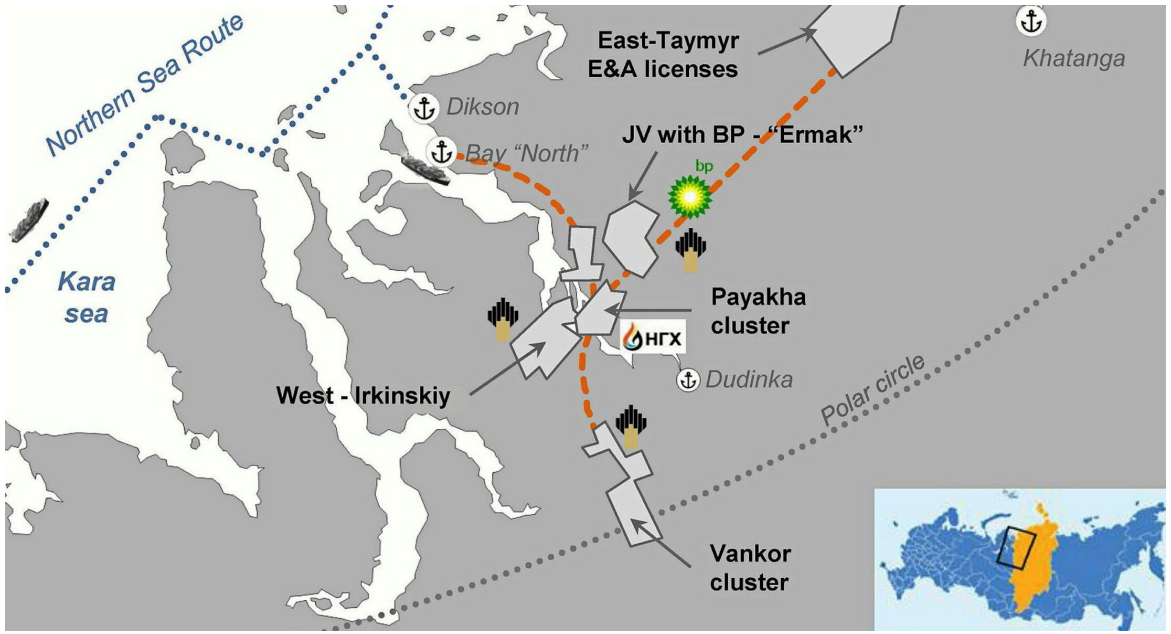
Source: Energy Center SKOLKOVO

- Consolidation under the state control (informal since 2020)
- Deterioration of the resource base (recent analyses of the Accounts Chamber of the Russian Federation)
- High interest to the Arctic projects
- Sanctions and import replacement
- Digitalization speeded up by COVID-19

Russian oil companies went planning for 20-30% CAPEX reductions

- Rosneft 25% CAPEX reduction in 2020 (compared to the initial plan), mainly in the upstream.
- Gazprom Neft not more than 20% CAPEX reduction.
- LUKOIL ~20% Capex cut.
- Tatneft redirects investments in 2020 from upstream to refineries and petrochemicals.
- SIBUR 30% CAPEX reduction (mainly due to the postponement of smaller projects).

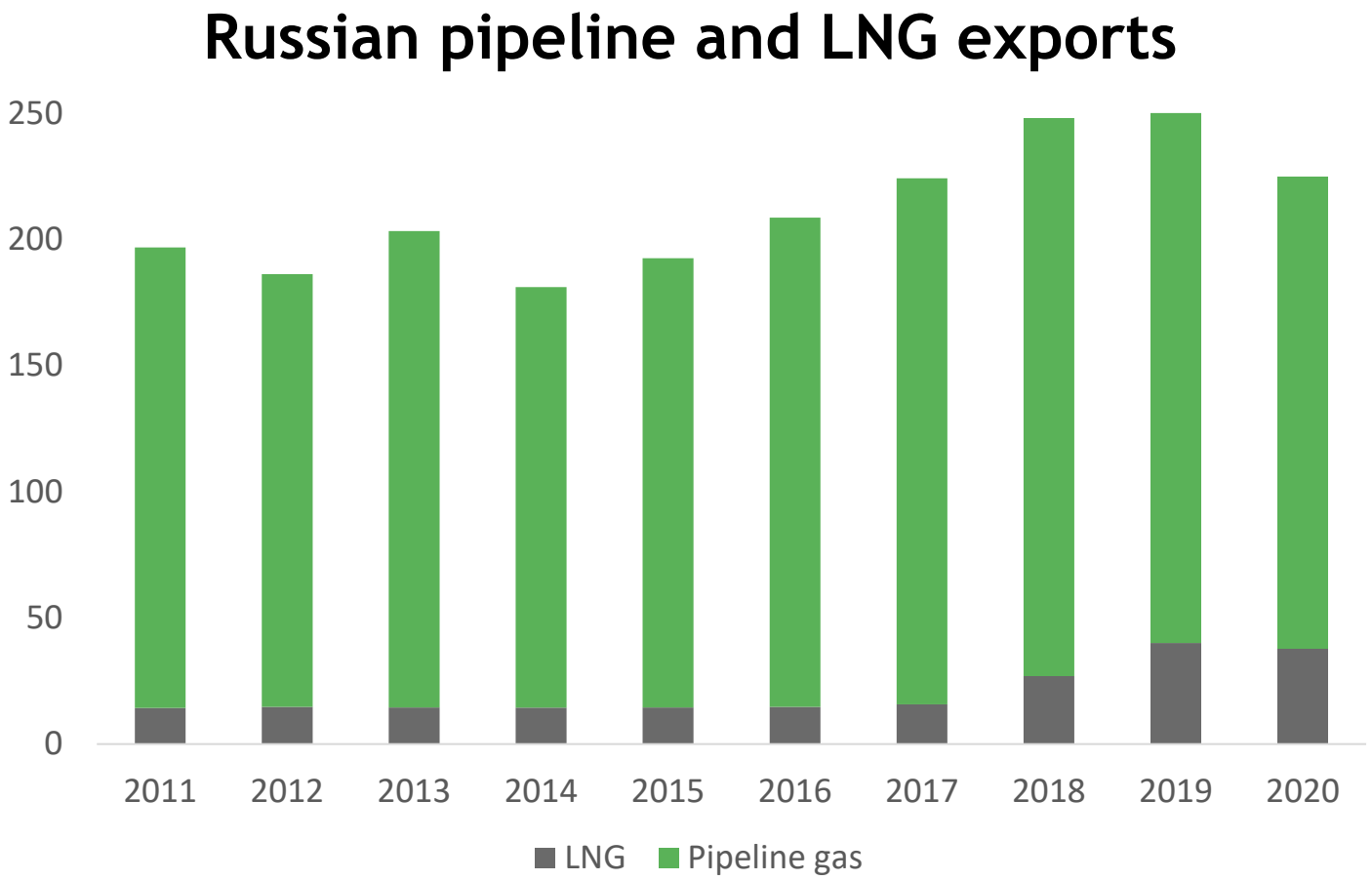
However, Rosneft has launched Vostok oil project



- The growth potential of Vostok Oil production:
- in 2024 - 25 MT
- in 2027 - 50 MT
- by 2030 - 115 MT

Breakeven prices: $35-$40 per bbl
Total investment in the project: 10 trillion rubles

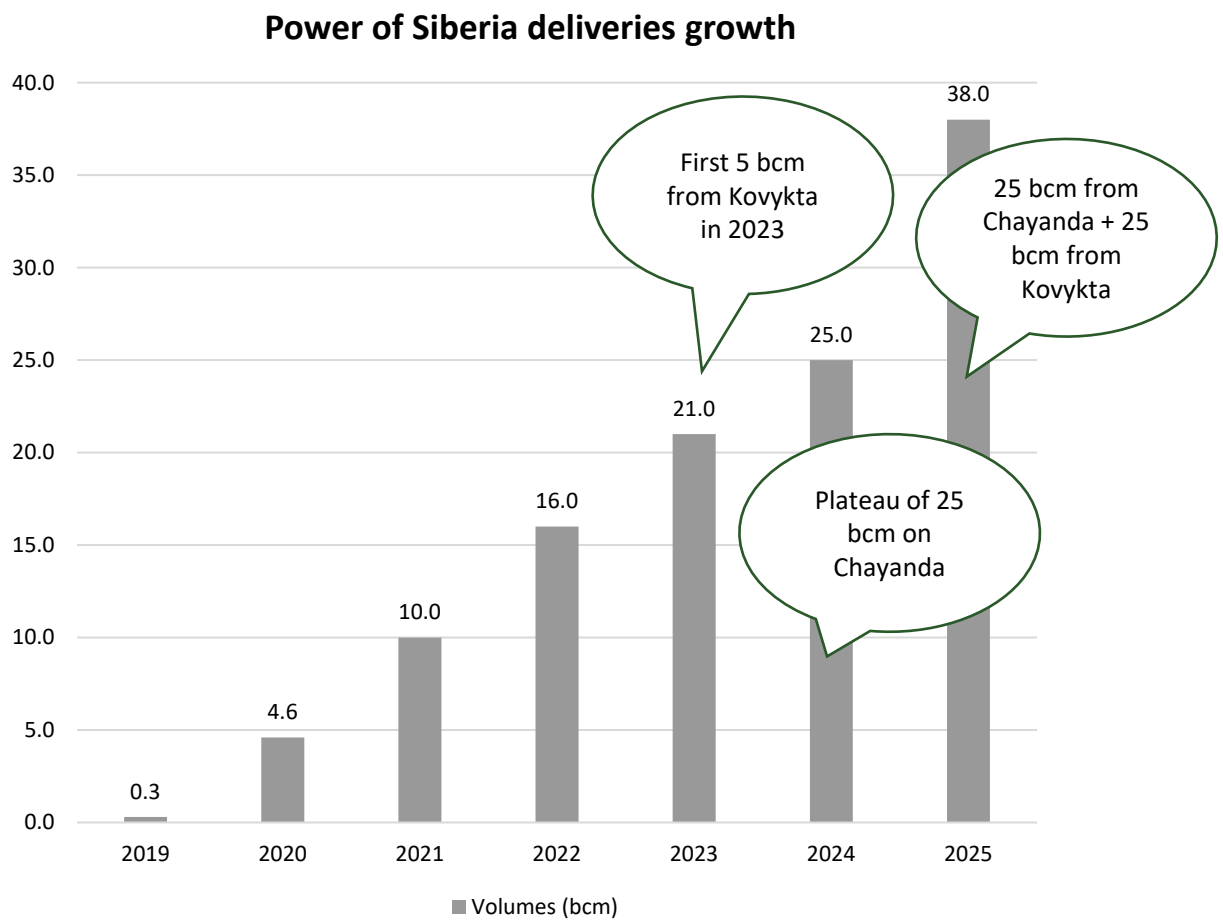
Russian natural gas and LNG export trends



- Predominantly a pipeline gas supplier with only one operating large-scale LNG plant on Sakhalin Island until 2017, Russia started paying more attention to LNG after the successful launch of Yamal LNG plant in Dec 2017.
- The share of LNG in Russia's total gas exports reached more than 15% in 2019.
- It is forecast to be even higher in 2020, since pipeline gas exports to Europe have been hit by COVID-19 pandemic and consequent demand drop…

Source: Russia's Energy Ministry, Customs, author's estimates for 2020

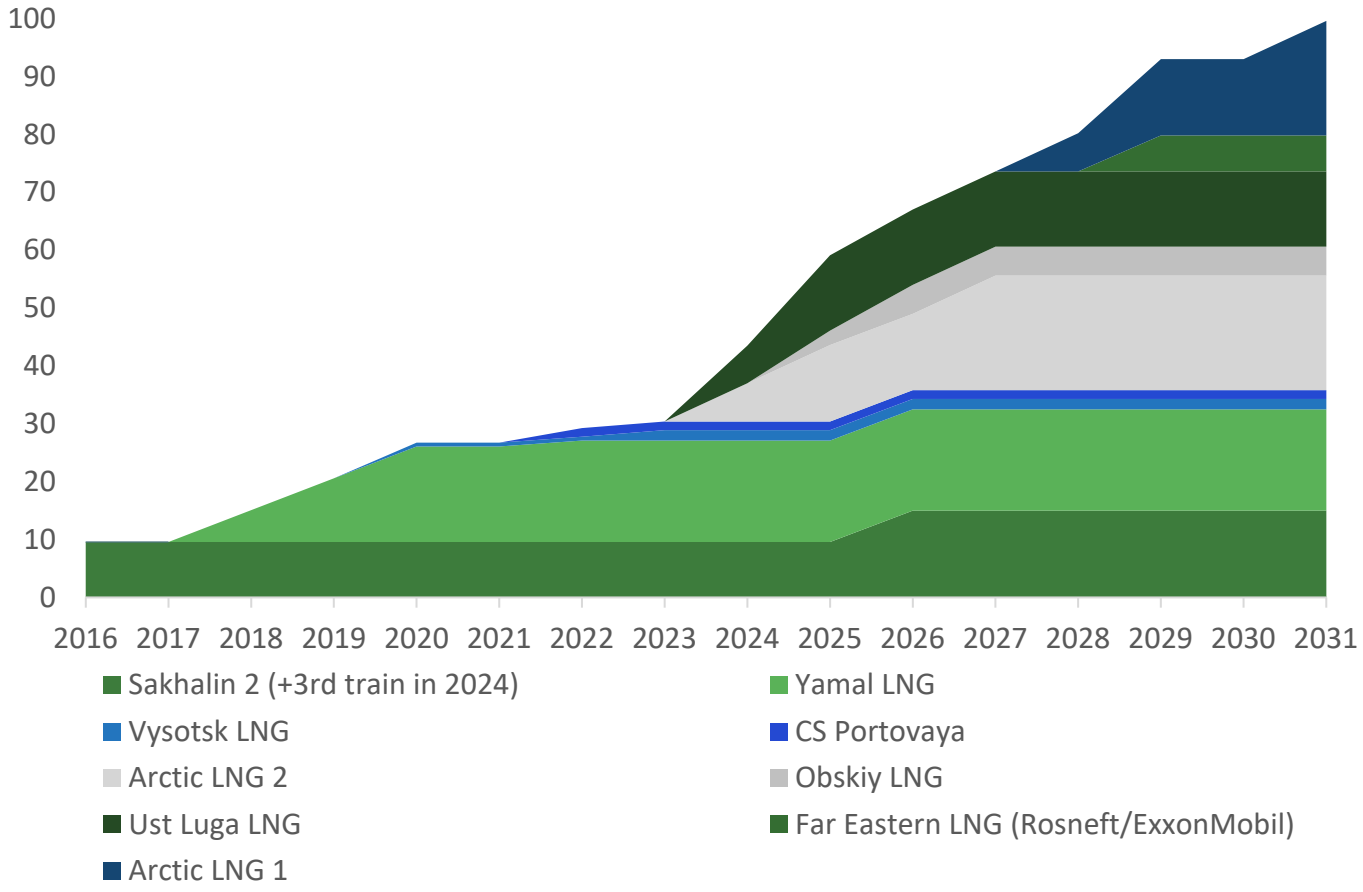
Russia’s export pipelines to Europe almost built, plans for new pipelines to China



- Nord-Stream 2 saga almost finished. First string completed, less than 100 km left for the second line.
- TurkStream was utilized by 73% in Q1 2021, utilization will grow once European section is fully completed.
- Power of Siberia increases export volumes; 8.5 bcm planned for 2021.
- Amur GPP 77% ready; once launched will allow for ‘cleaner’ composition of gas exported to China.
- Power of Siberia 2 discussion is ongoing. The planned route will go through Krasnoyarsk, Ulaanbaatar to finish in Central China. If built gas from Western Siberia will be exported not only westwards but also eastwards.
- Power of Siberia 2 will have a capacity of up to 50 bcma.
- Power of Siberia 2 feasibility study is ongoing. Gazoprovod Soyuz Vostok company registered in Mongolia.

Russian gas production will be driven by LNG plans

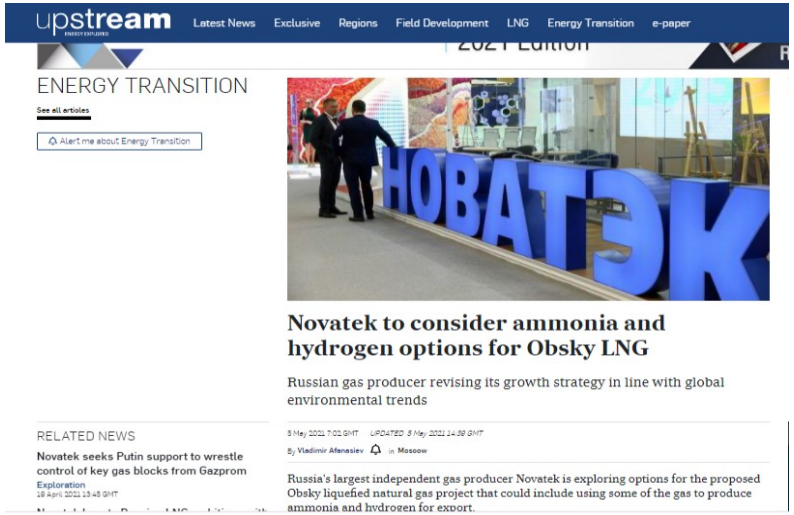
Russian LNG nameplate capacity (announced projects)



Source: SKOLKOVO Energy Center

- By early 2030s, Russia can increase its LNG export capacity up to 100 MTPA at projects that have already been announced.
- Novatek is expected to be the dominant supplier with 70 MT production foreseen in the 2030 corporate strategy. Arctic LNG 2 39% ready as of Q1 2021.
- At the same time, the Russian state Energy Strategy 2035 envisages 80-140 MT LNG production by 2035…
- COVID-19 pandemic and the market downfall will delay the process of new FIDs but long-term commitments may well remain in place.

Gas exports transformation. Discussion has started.



- First carbon-neutral LNG cargoes already exported from Russia (carbon offsets were used).
- Novatek is studying the possibilities to produce ammonia and hydrogen, with carbon capture and storage (CCS) technology. The company plans to use hydrogen as a fuel mix with natural gas. Works with Baker Hughes and Siemens to achieve this goal.
- Two fields supporting the proposed Obskiy LNG plant are already at advanced stages, Novatek looks presently at different opportunities to monetize this resource base, particularly a gas chemistry project at Sabetta to produce “blue” ammonia. Novatek may internally decide to move forward with this project in 2021 with a potential FID decision in 2022.
- Gazprom has proposed a hydrogen production facility in Germany. Company plans to accumulate own technological competencies (methane pyrolysis) in the field of hydrogen production.
- Russia’s gas export strategy envisages 2 MT of H2 exports in 2035.

Russian oil and gas companies' long-term targets for GHG emissions reduction

Company	Target	Target Year	Base Year	Reduction, %
Gazprom	Specific GHG emissions from natural gas transportation, total CO_2e per billion m^3 per km	2024	2018	3.8%
Gazprom Neft	No published GHG emissions reduction targets			
Zarubezhneft	No published GHG emissions reduction targets			
Irkutsk Oil Company	No published GHG emissions reduction targets			
LUKOIL	Official long-term targets are being expanded. The company is reportedly targeting carbon neutrality by 2050.			
NOVATEK	GHG emissions per unit of production in the Upstream segment	2030	2019	6%
	Methane emissions per unit of production in the Production, Processing and LNG segments	2030	2019	4%
	GHG emissions per ton of LNG produced	2030	2019	5%
Rosneft	Carbon intensity in upstream sector	2035	2019	30%
	Methane emissions intensity	2035		0.25%
Russneft	No published GHG emissions reduction targets			
Sakhalin Energy	No published GHG emissions reduction targets			
Sibur	Specific GHG emissions from gas processing	2025	2018	5%
	Specific GHG emissions from petrochemistry	2025	2018	15%
Surgutneftegaz	No published GHG emissions reduction targets			
Tatneft	Carbon intensity	2025	2019	10%
		2030	2019	20%
	*strategic target: carbon neutrality by 2050			

Source: Energy Center, Moscow School of Management SKOLKOVO.

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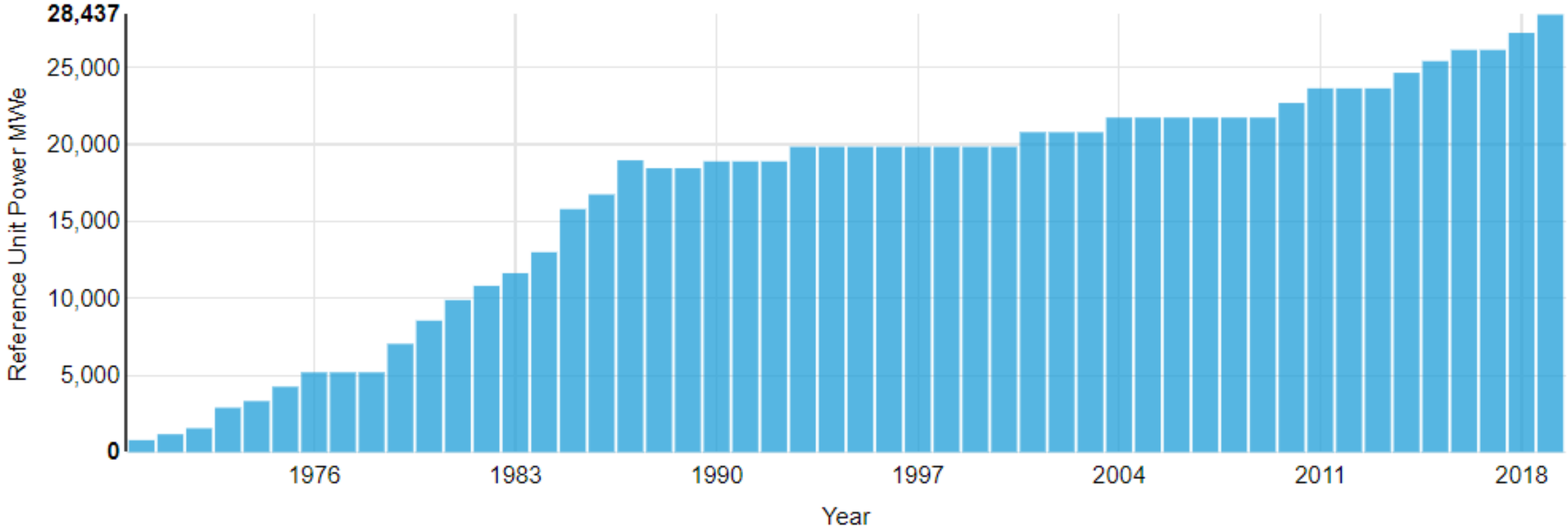
Russia remains committed to nuclear energy

Russian operable nuclear capacity



Nuclear plants in Russia

- General overview
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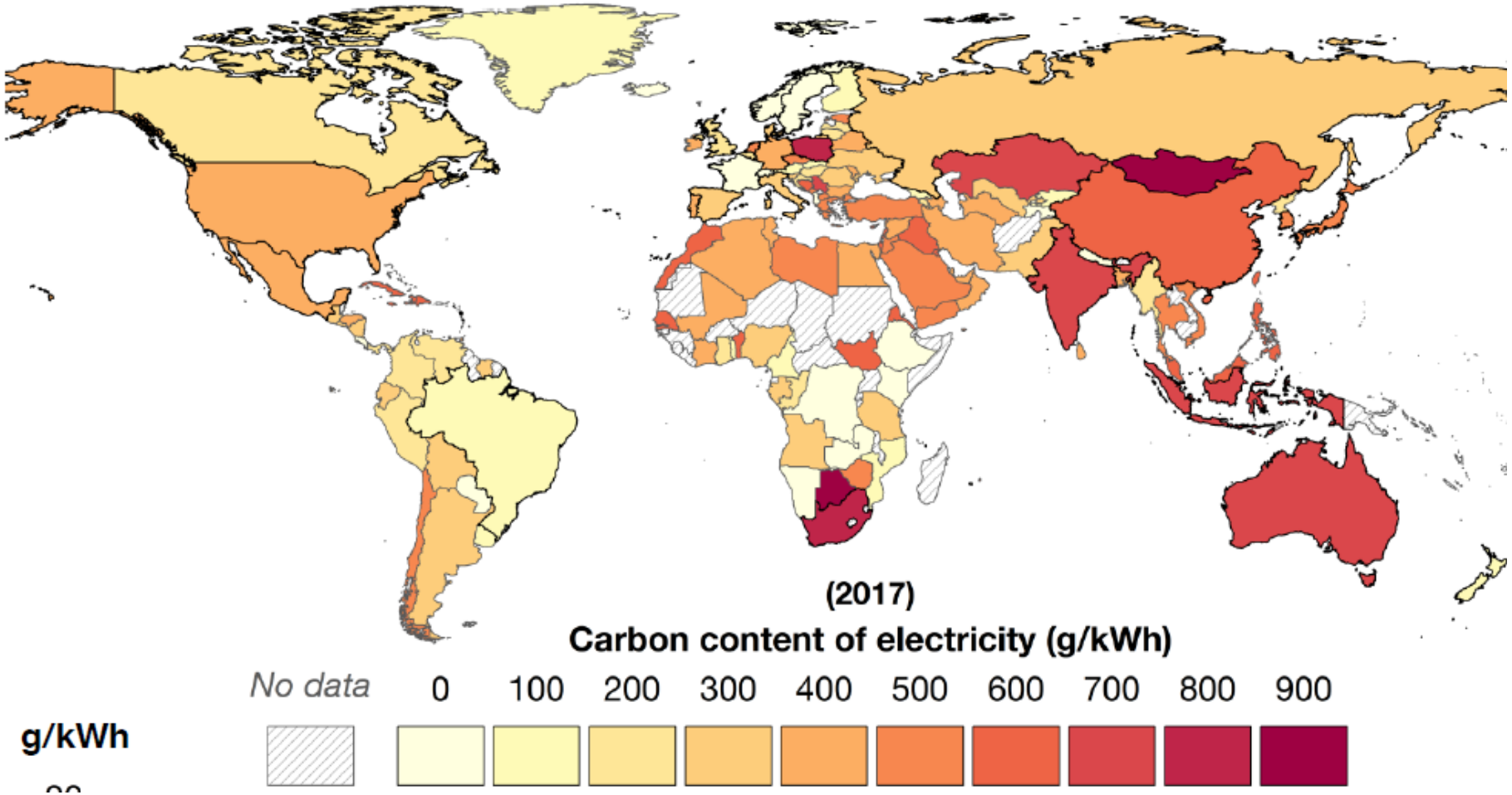
Decarbonization is not high on the national agenda



- Carbon content is less than in USA, China, Australia, India, Japan, Germany…
- Carbon regulation is only beginning to evolve.
- Skepticism prevails among stakeholders.

Source: Staffell et all, (2018). Energy Revolution: Global Outlook

Current status of the main elements of the GHG emission regulation system

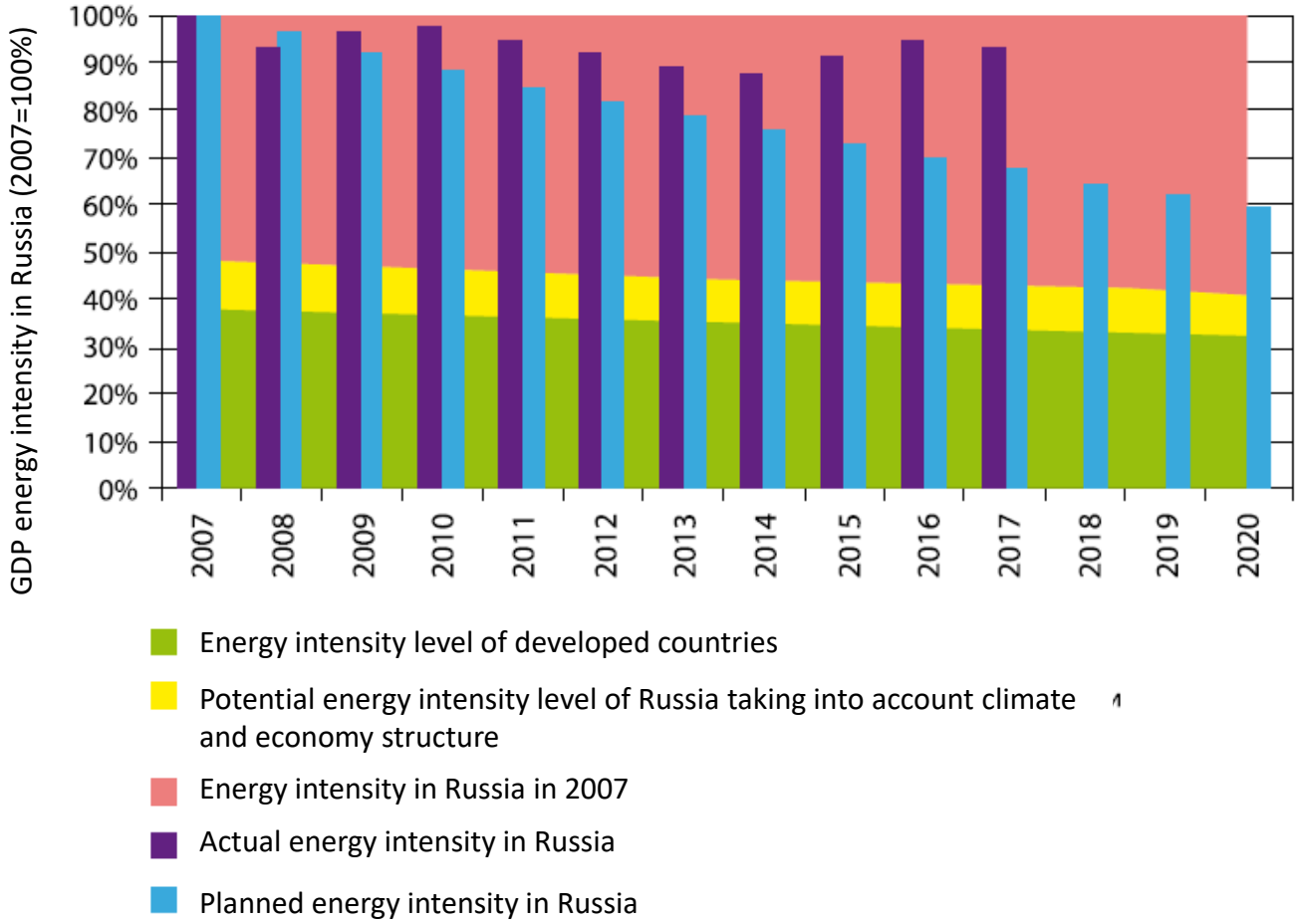
Element of the of GHG emission regulation	Document	Document status
Long-term goal of the Russian Federation for GHG emissions.	Decree of the President of the Russian Federation No. 666 dated November 4, 2020	Approved. The national target for emissions of 70% from the level of 1990 by 2030 has been set. Therewith, in 2017, emissions amounted to 50.7% of the level of 1990.
The strategy of social and economic development	Long-term development strategy of the Russian Federations with low GHG emissions by 2050	In progress. The draft Strategy was submitted by the Ministry of Economic Development to the Government in March 2020. Obviously, this Strategy will be adjusted before approval, taking into account the Presidential Decree No. 666 dated November 4, 2020. Expected to be approved in 2021.
Introduction of the national regulation on GHG emissions.	Federal Law “On Limiting GHG Emissions”	In progress. The draft law has been submitted to the State Duma. It conceptually corresponds to Presidential Decree No. 666 dated November 4, 2020. It includes vocabulary, obligation to monitor GHG emissions and mechanism for voluntary climate projects. No regulation is introduced as such, since it is not required to achieve the national goal by 2030. Expected to be approved in 2021.

Source: Energy Center, Moscow School of Management SKOLKOVO.

What could be Russia`s stakes in the energy transition?

- ✓ **Energy efficiency**
- ✓ **Renewables** (solar, wind, tidal, biomass – biomethane, pellets, small hydro), including potential export projects (Arctic wind, Yakutia solar + DC transmission)
- ✓ **Nuclear** (next generation reactors on fast neutrons)
- ✓ **Natural gas** replacing oil in transportation (maritime, road), LNG leadership
- ✓ **Hydrogen (blue, green, yellow, turquoise)**
- ✓ **CCUS** (including CO2-EOR)
- ✓ **Offsets** (including reforestation/ natural sinks investment projects)

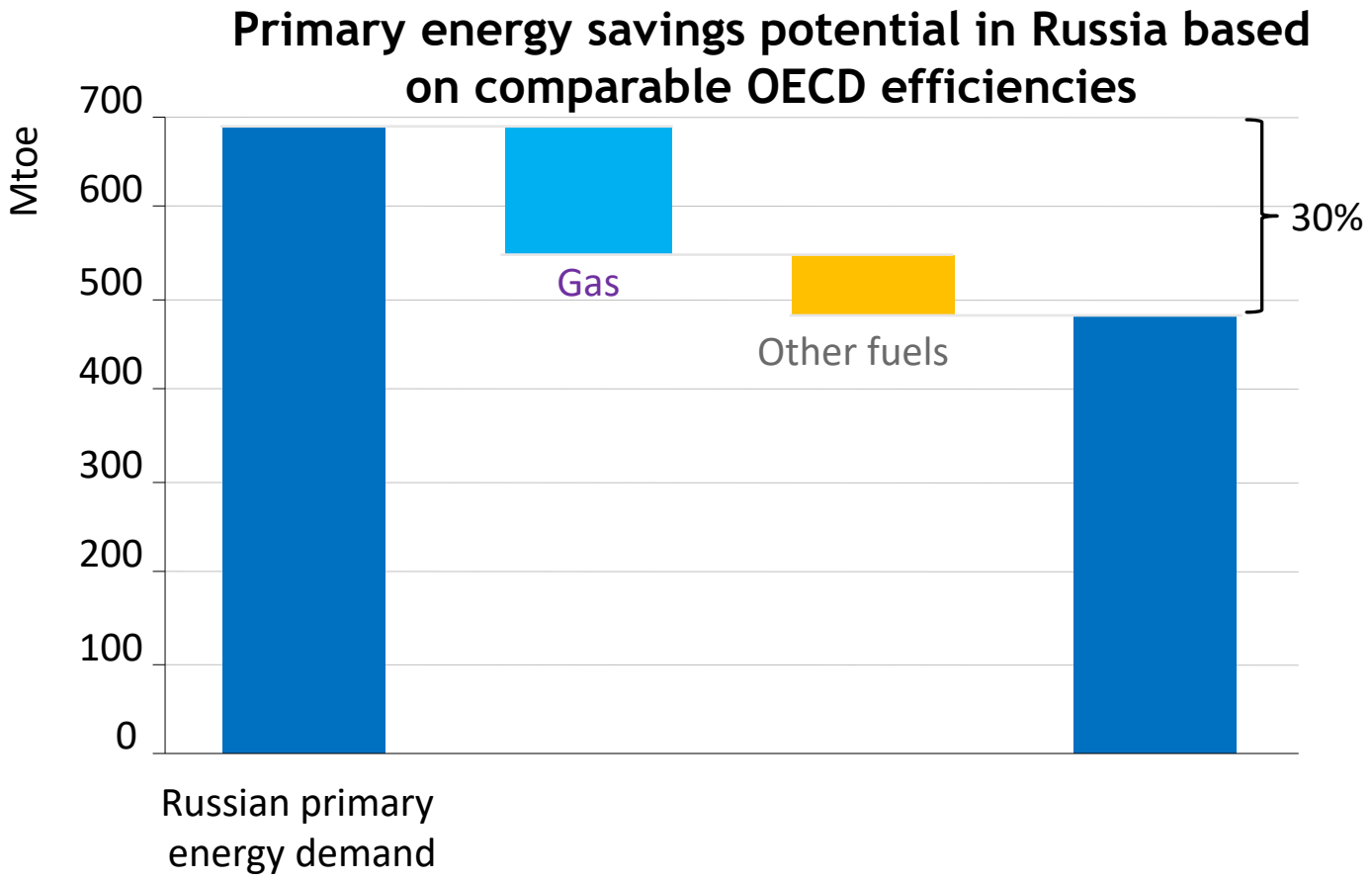
Energy intensity is still high with no sustainable decline



- Initial energy efficiency target set in 2008 was to reach 40% decline in GDP energy intensity by 2020.
- Substantial federal budget subsidies were allocated but very limited change occurred.
- Initial target was significantly scaled down to 9.41% and federal funding discontinued.
- GDP energy intensity in Russia in 2017 is only 10% lower 2007 level.

Source: Igor Bashmakov, 2018

Russia has huge energy efficiency potential: energy consumption could be decreased by 30%



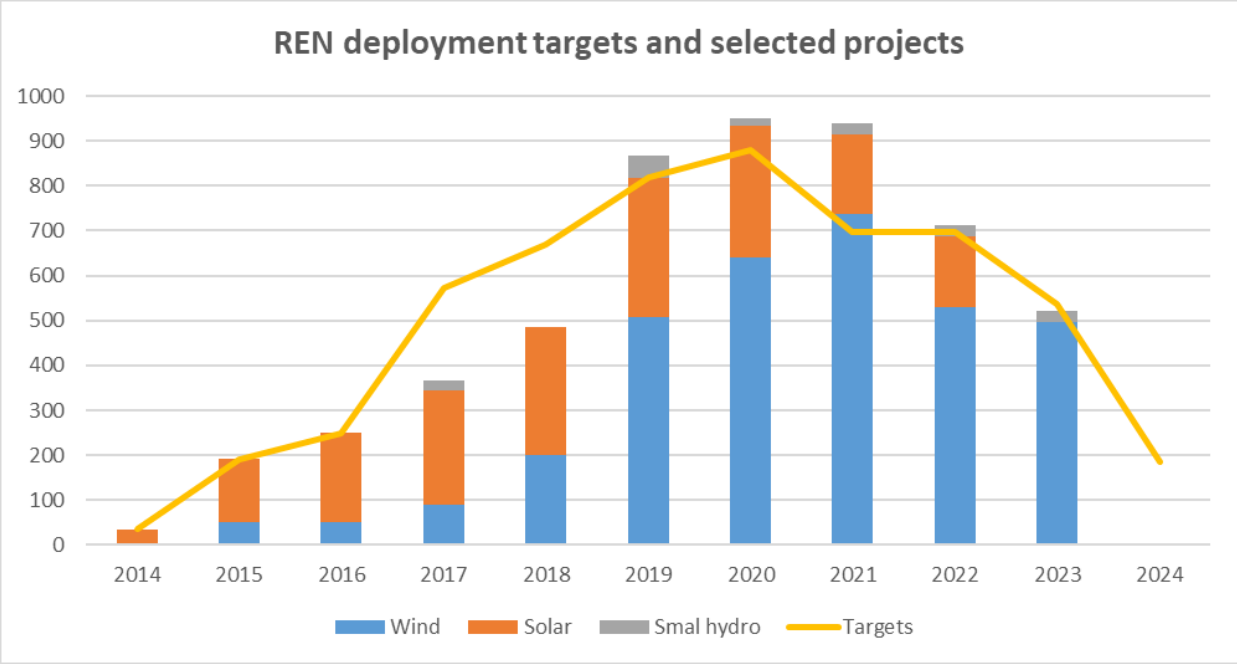
Source: WEO 2011. IEA.

Main obstacles for energy efficiency in Russia:

- Administrative barriers and lack of regulation, granting guaranties of the investment return
- Lack of cheap long-term loans for energy-efficient projects that are accessible to smaller market participants
- Low prices of energy

BUT THE PRIZE IS HUGE!

First wave of renewable support was successful but continuation is not clear

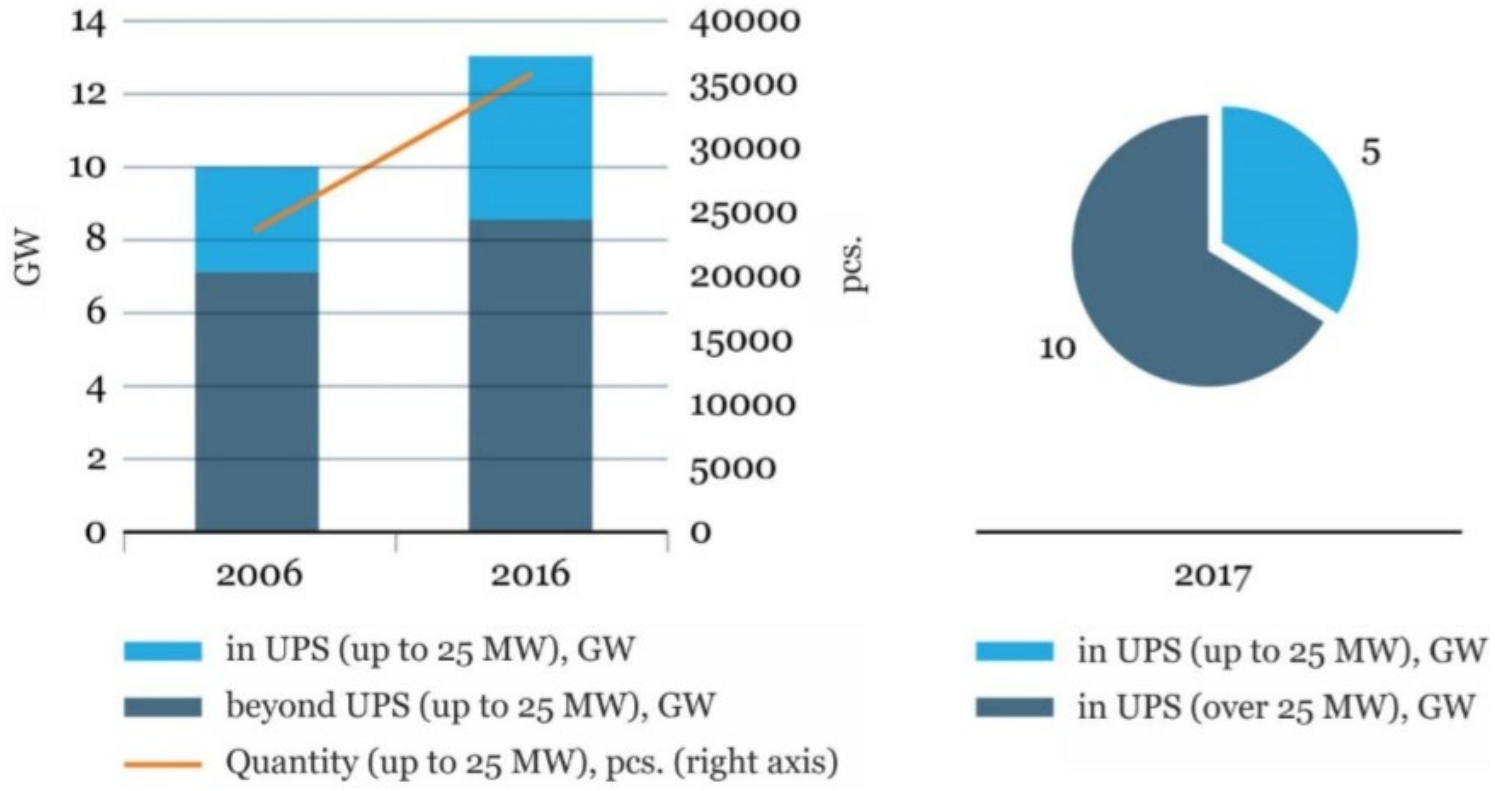


Source: System Operator of UES of Russia

- Initial target for REN's share in generation was set in 2009 - 4.5% by 2020 (later shifted to 2024).
- Support mechanism launched in May of 2013 (similar to Capacity supply agreements used earlier for thermal plants).
- 5.5 GW of renewable capacity will be supported under this program up to 2024 (61% wind, 32% solar and 7% small hydro).
- 96% of this quota has been already auctioned with Rosatom, Fortum and Enel taking majority of contracts.
- Average capex dropped 2-2.5 times while minimum bids in 2018 were below $1K per kW.

Distributed generation is an important part of the Russian power system …

Capacity and number of distributed generation plants in Russia

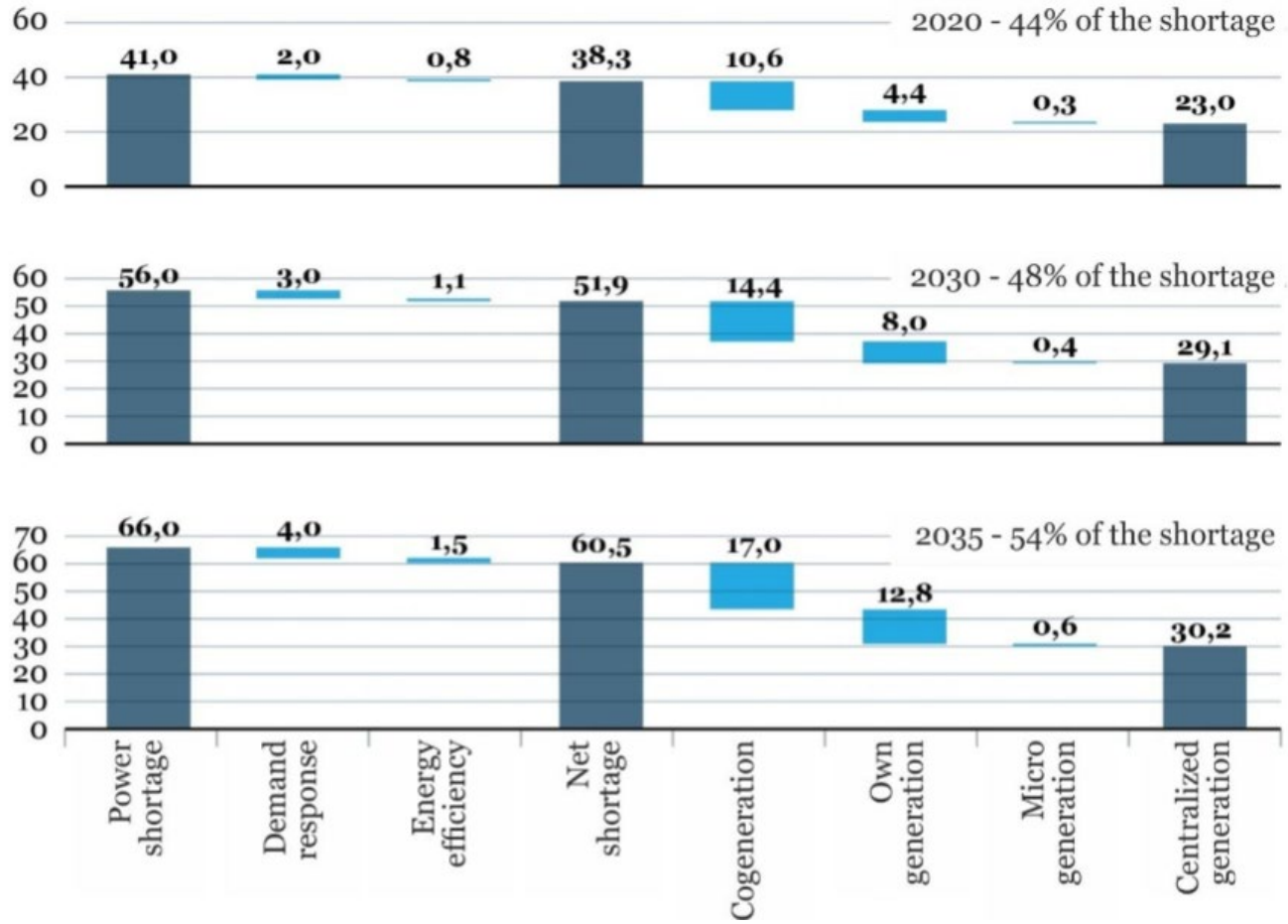


Capacity of distributed generation in Russia can be estimated at about 23-24 GW (~9% of total capacity)

Source: Rosstat, McKinsey & Company

… with significant potential for development

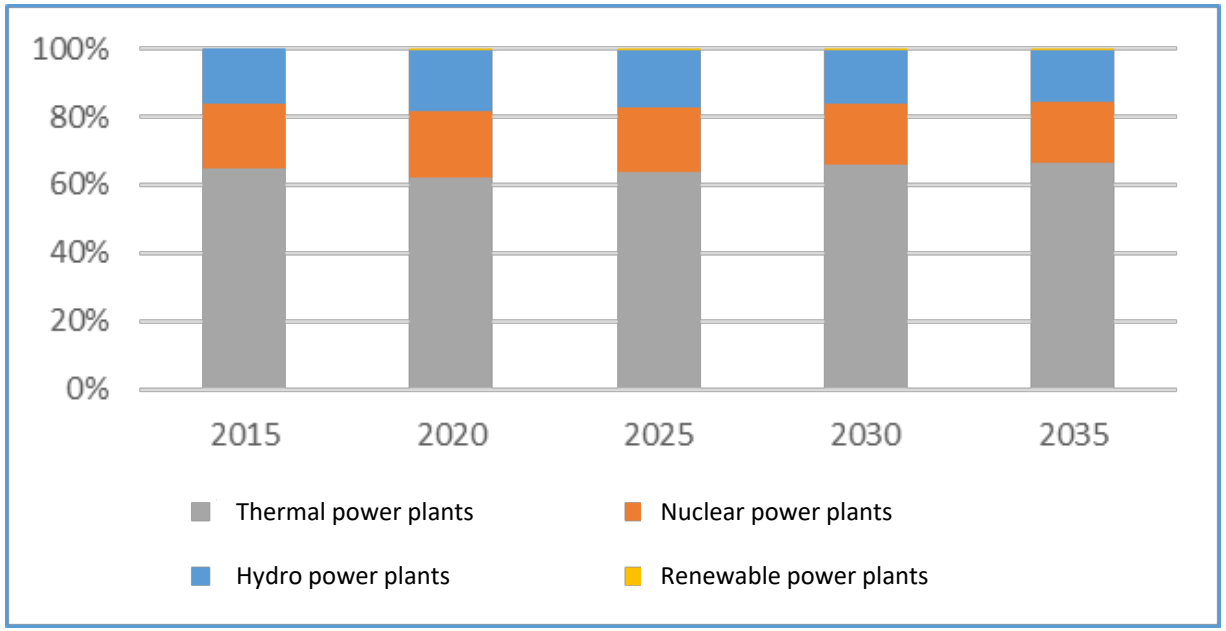
DER potential in UPS for the period 2020-2035, GW



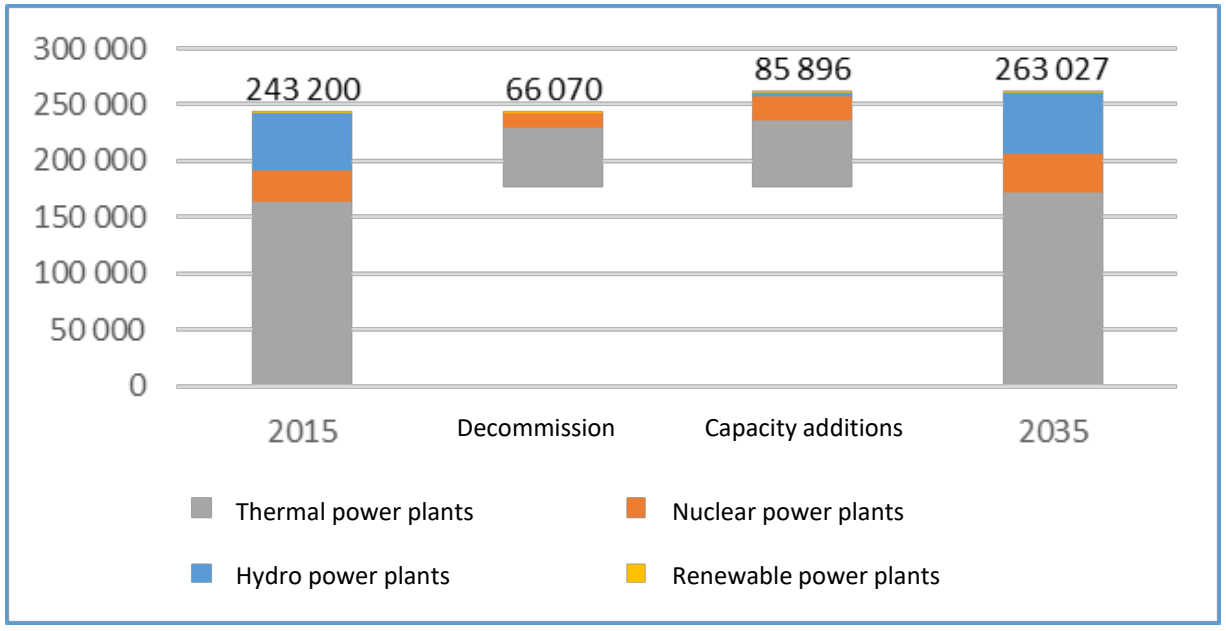
Source: SKOLKOVO Energy Center

Russian long-term energy plan – still “Business as Usual”

Electricity generation in centrally supplied zone

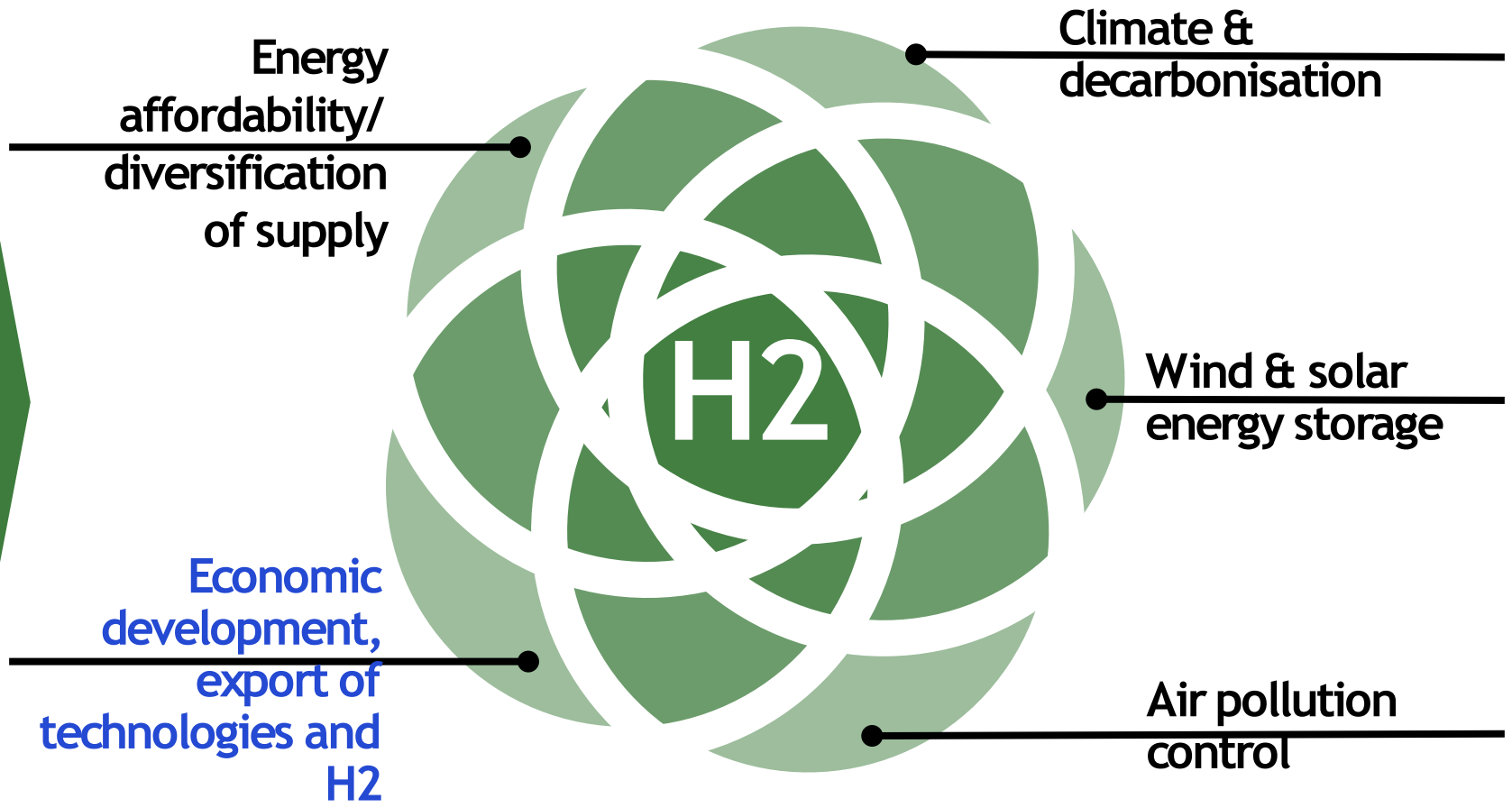


Installed capacity dynamics in centrally supplied zone (WM)

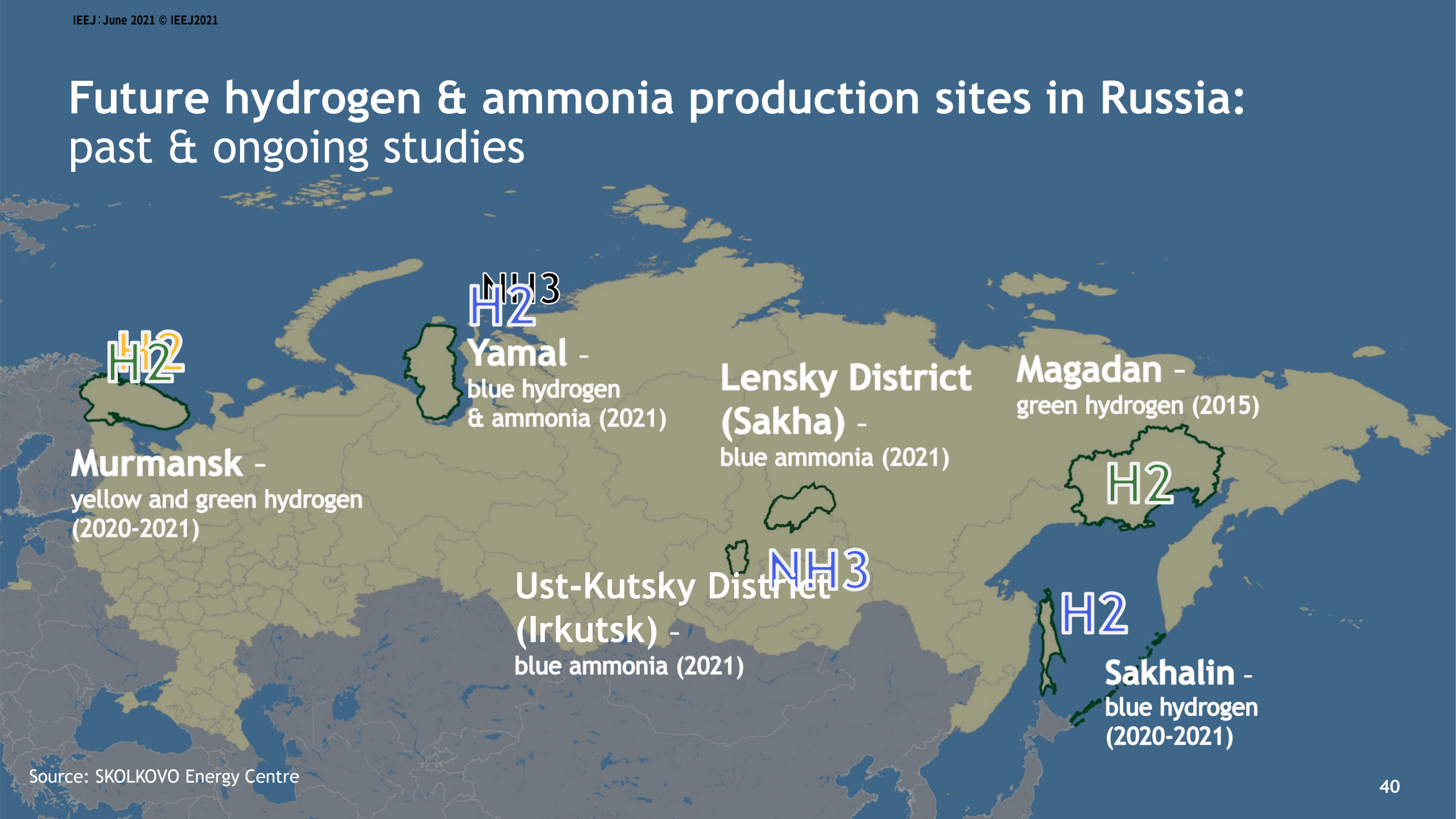


Source: Power Facility Arrangement Master Plan of Russia up to 2035

Common incentives for hydrogen development on the policy level

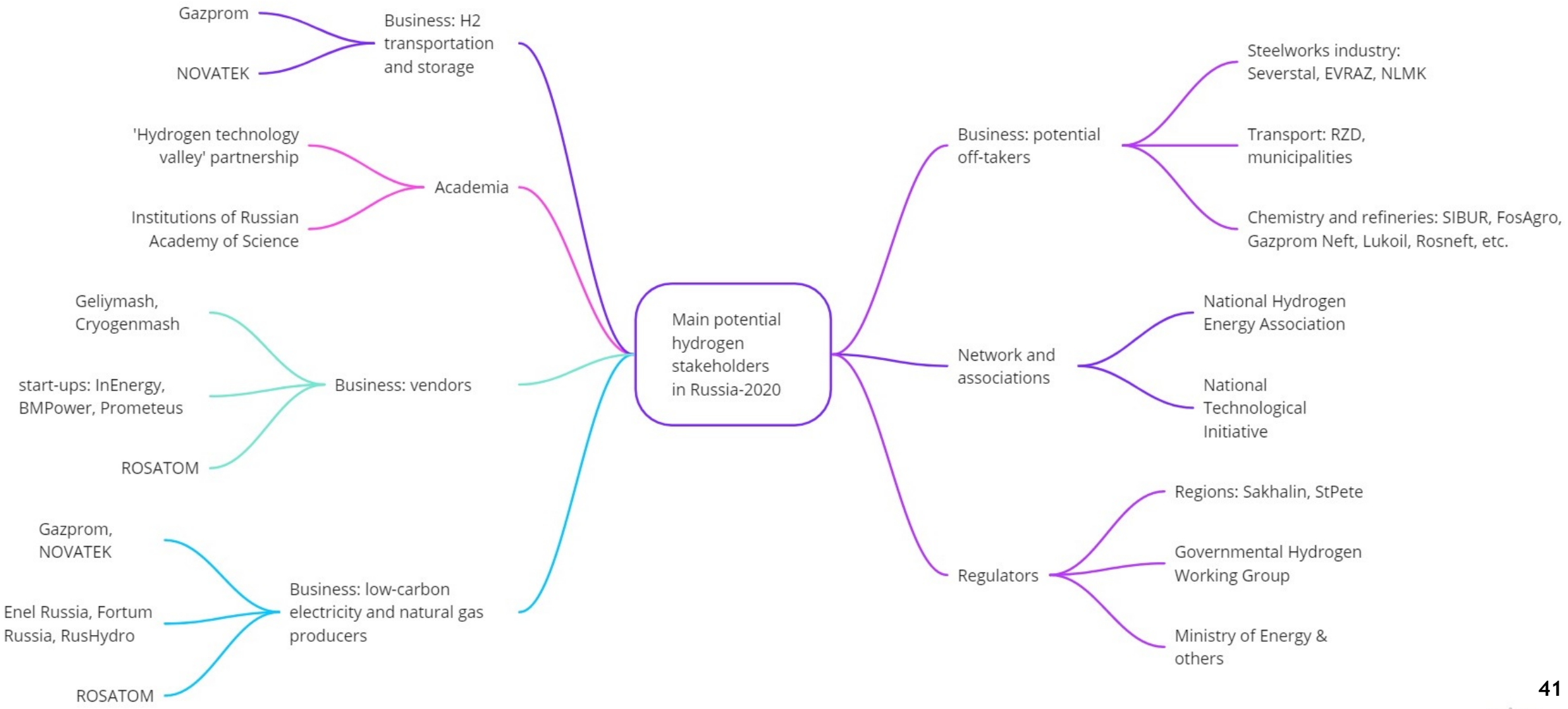


Future hydrogen & ammonia production sites in Russia: past & ongoing studies

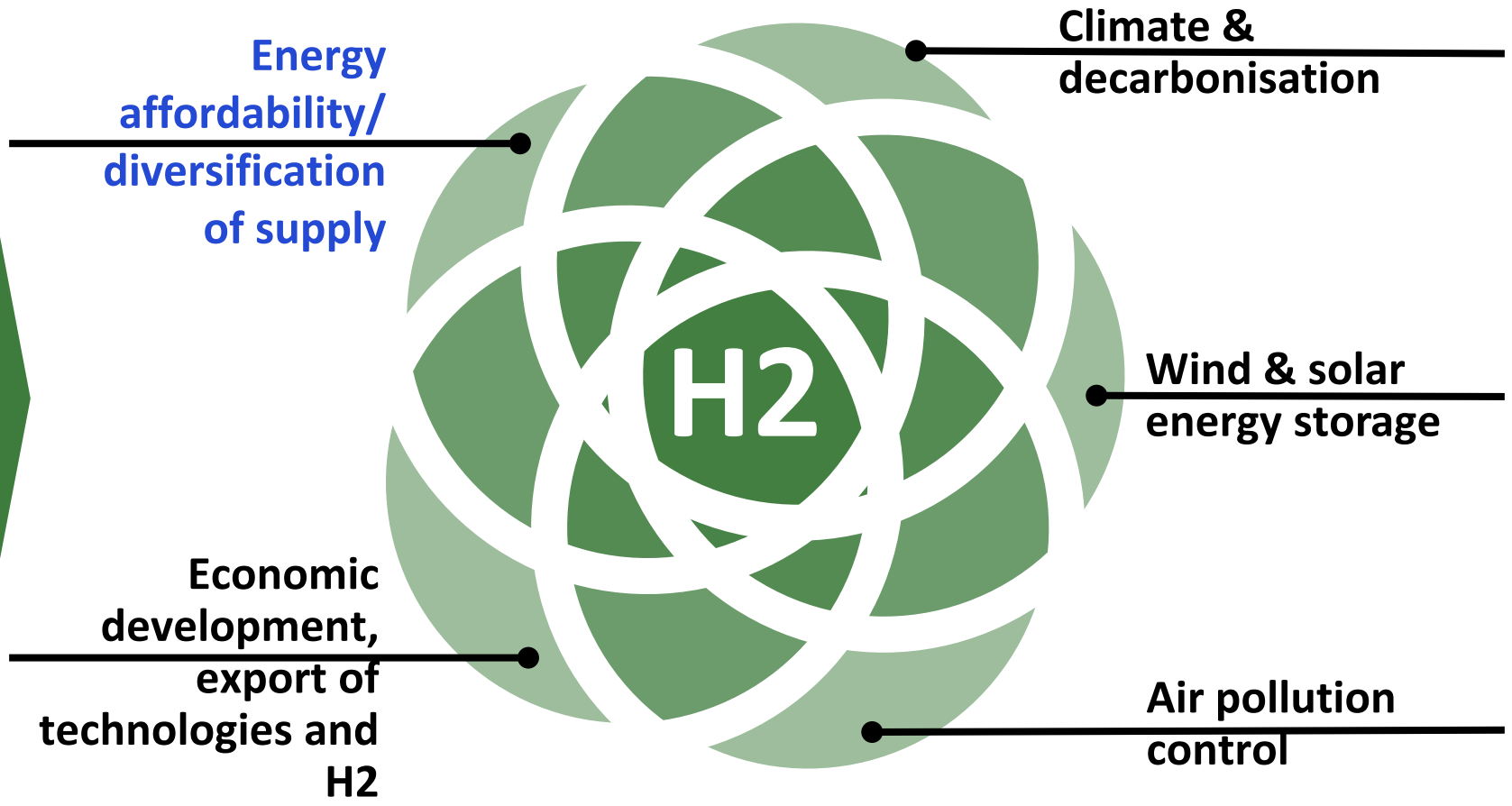


Source: SKOLKOVO Energy Centre

Russian academia and industry stakeholders could bring added value to H2 strategy towards economy growth

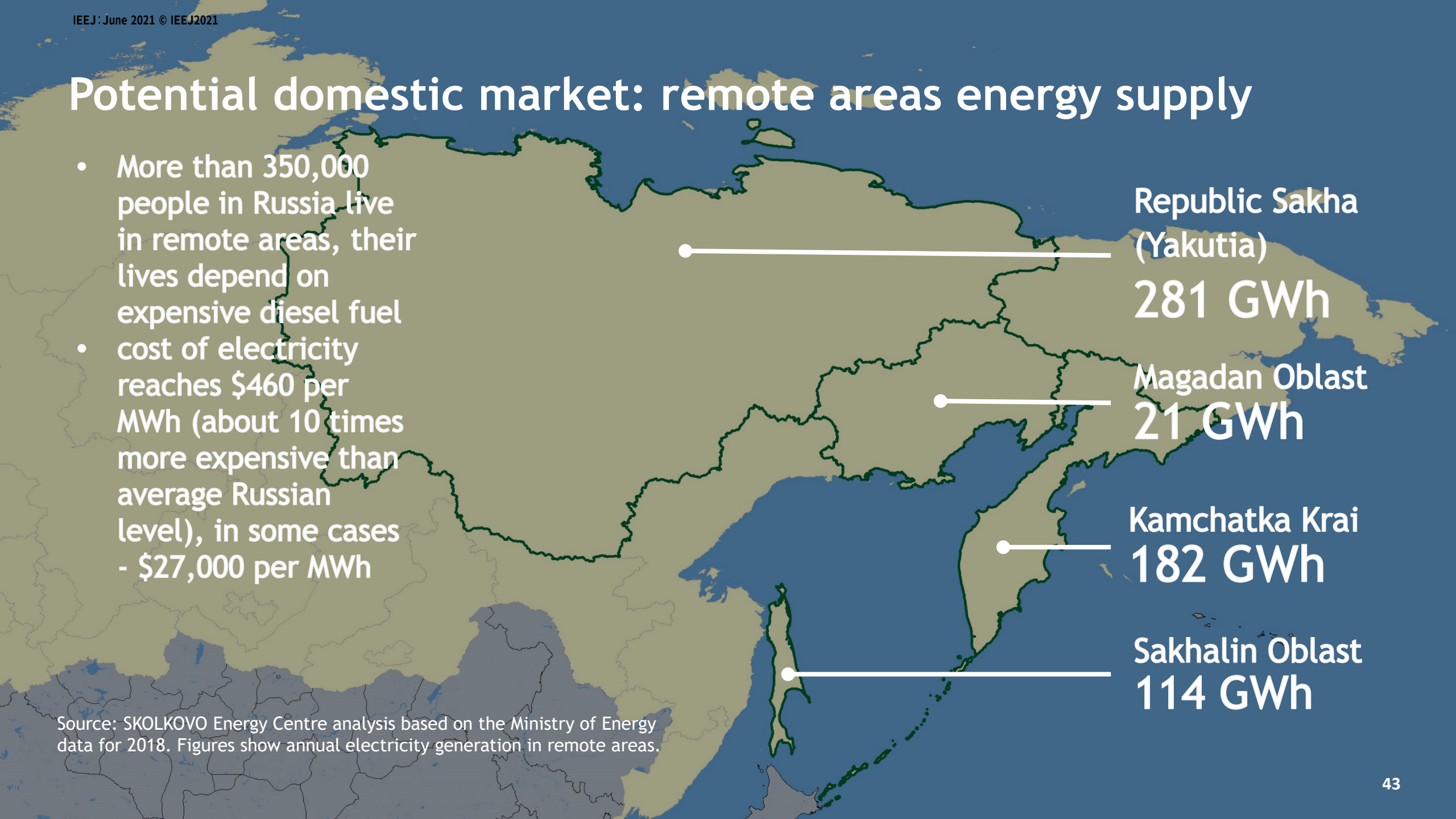


Common incentives for hydrogen development on the policy level



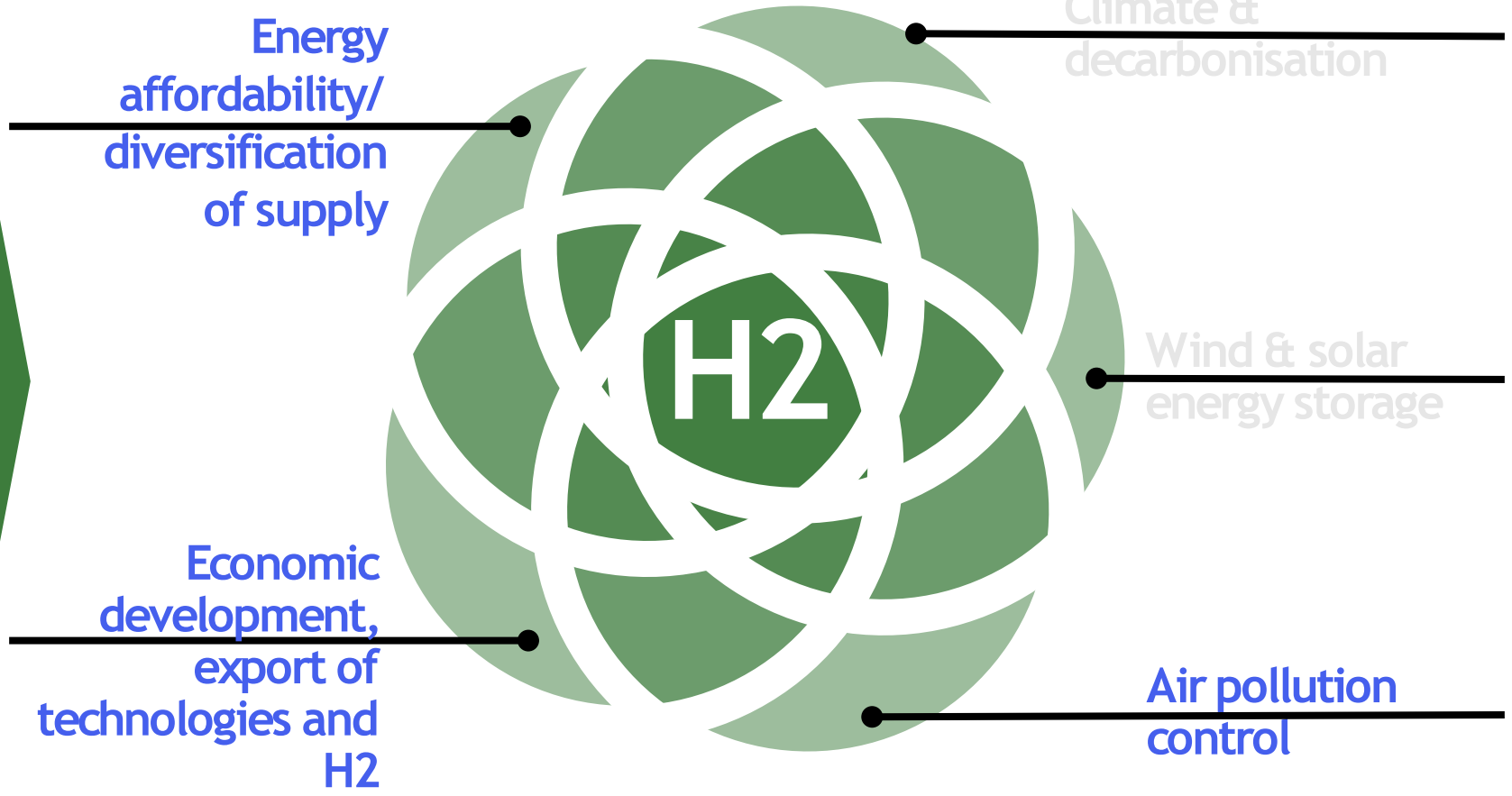
Potential domestic market: remote areas energy supply

- More than 350,000 people in Russia live in remote areas, their lives depend on expensive diesel fuel
- cost of electricity reaches $460 per MWh (about 10 times more expensive than average Russian level), in some cases - $27,000 per MWh



Source: SKOLKOVO Energy Centre analysis based on the Ministry of Energy data for 2018. Figures show annual electricity generation in remote areas.

Only three incentives for hydrogen are in place in Russia

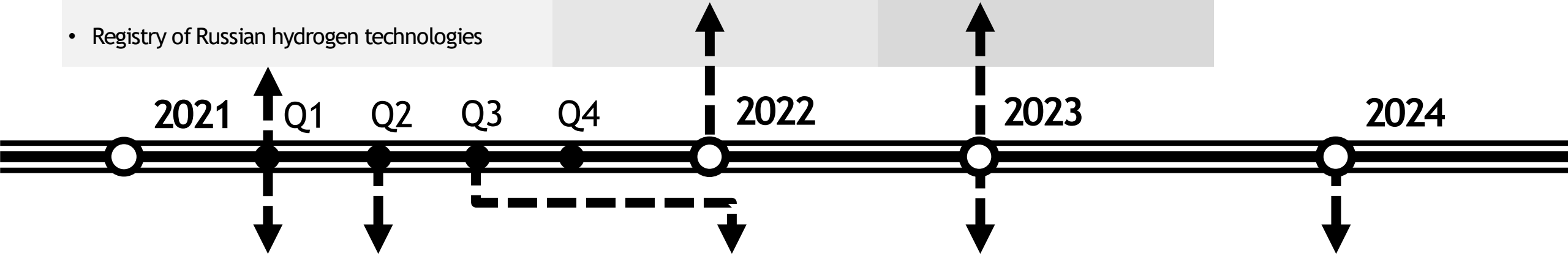


H2 action plan: milestones

To be published

- Hydrogen energy development master-plan
- Interdepartmental working group led by the Deputy Prime Minister
- Registry of Russian hydrogen technologies
- Methodology for assessing the life cycle of hydrogen production methods
- Methodology for the classification of hydrogen by GHG emissions level

Source: SKOLKOVO Energy Centre analysis based on Hydrogen Energy Action Plan (adopted in October 2020)



- measures of state support for pilots
- hydrogen certification
- hydrogen export support measures
- technical regulation
- international cooperation
- measures to support domestic H2 demand
- proposals for clusters, landfills, engineering centers

Intergovernmental closed discussions

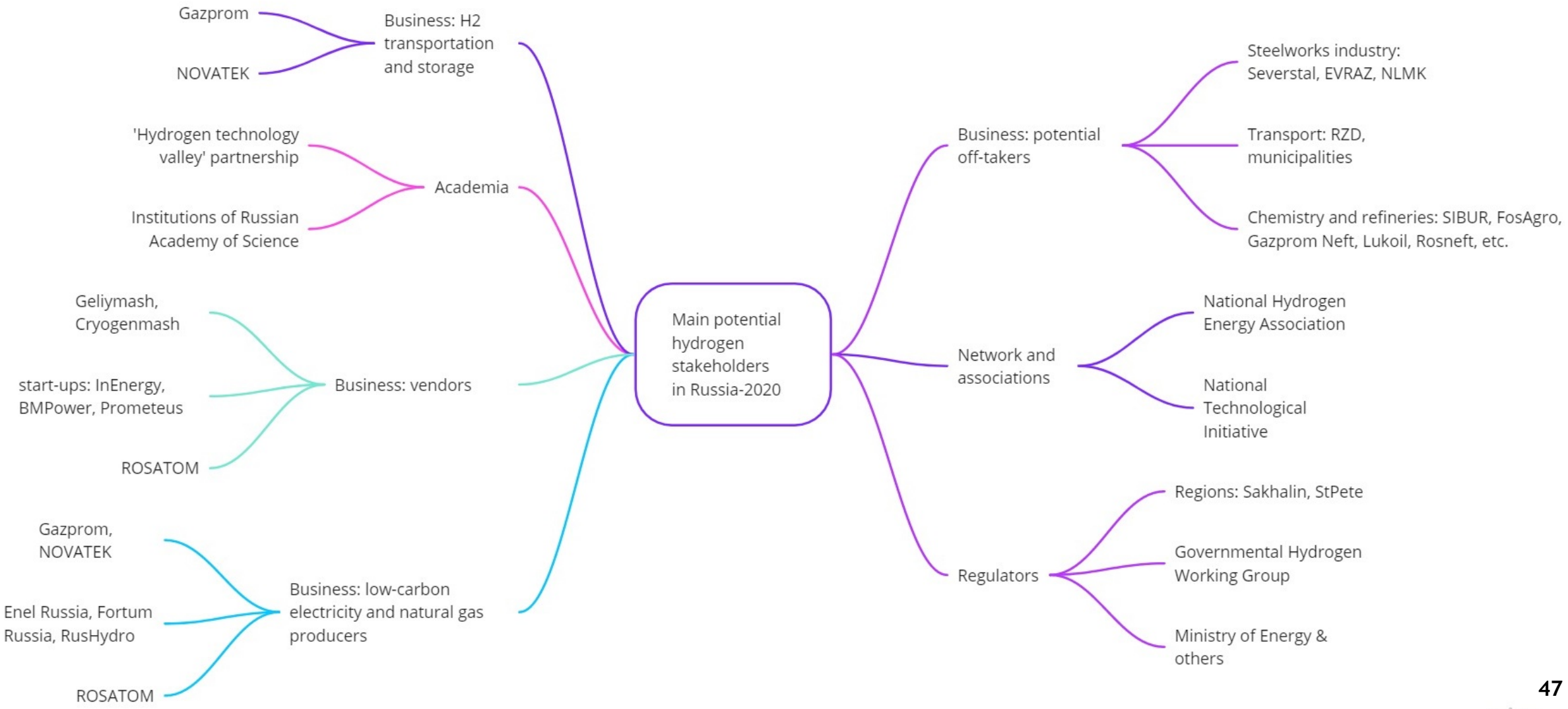
- low carbon hydrogen production (particularly in the gas industry)
- pilot electrolyzer on nuclear power plant site
- tests of gas turbine on methane-hydrogen fuel
- hydrogen train prototype

Major target pilots

Questions for forthcoming Russian H2 strategy

- Hydrogen export goals: how to make export-oriented projects feasible, if domestic H2 demand is limited up to zero?
- National CO2 pricing – is this necessary to boost domestic hydrogen demand?
- Air pollution standards - will tightening them help the FCEV deployment and how will it affect outdated car owners?
- ‘Local content’ requirements for imported technologies: reaching hydrogen export goals VS boosting Russian-based vendors
- Japan, Korea Rep., China declared carbon neutrality targets - does Russia's energy export strategy take this into account? Can hydrogen export serve as response to this threat and how to ensure its global competitiveness?

Key stakeholders in hydrogen



Q&A: ready to answer your questions!

Contact: report@tky.ieej.or.jp