Center for energy efficiency XXI (CENEf -XXI)

Assessment of the *Low Carbon Social and Economic Development Strategy for the Russian Federation to 2050*

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Slow carbon

Low carbon

No carbon

Moscow, December 2021 r.

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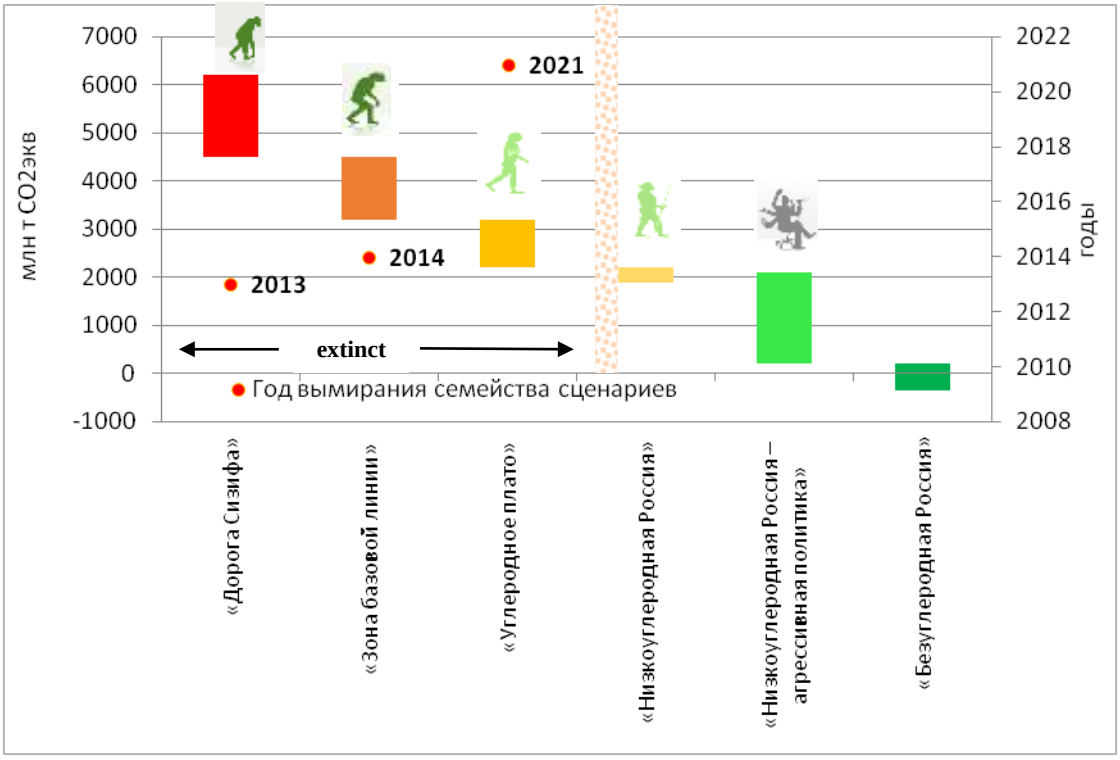
1 Evolution of the Russian government's mitigation commitments and projections

In October 2021, Russia set a carbon neutrality target for 2060. In 2009 in Copenhagen, Russia made a commitment to maintain its 2020 GHG emission at no more than 75% of the 1990 level. In 2015 in Paris, Russia made a commitment to keep its GHG emission at 70-75% of the 1990 level until 2030. Presidential Decree No. 666 of November 4, 2020, requires that the emission be no more than 70% of the 1990 level until 2030. Low Carbon Social and Economic Development Strategy of the Russian Federation to 2050 mandates Russia's net GHG emission go down by 80% from the 1990 level and by 60% from the 2019 level in 2050. This is the only Russia's strategic document with a time horizon to 2050. This evolution of commitments mostly follows the evolution of GHG emission pathways visions (Figure 1.1).

Figure 1 Evolution-driven GHG emission projections families



Sources: CENEf-XXI.

There is an over three decades' history of long-term GHG emission projecting in Russia. Knowledge accumulation, methods and models improvement, more adequate economic growth assumptions, and deployment of cutting-edge low carbon technologies result in the extinction of all families of scenarios with high GHG emission estimates for 2050. So far, all zero carbon scenarios in Russia imply manifold increase in LULUCF absorption.

The family of scenarios should grow. This requires:

- the development of carbon neutrality scenarios;
- the recognition of the need for a deep economic modernization and of the unfeasibility of rapid economic growth assosoated with the Baseline and Conservative scenarios that are based on the continuation of outdated raw materials export model;
- transition from excessive reliance on CO_2 absorption by forests to an even distribution of mitigation efforts across all sectors;

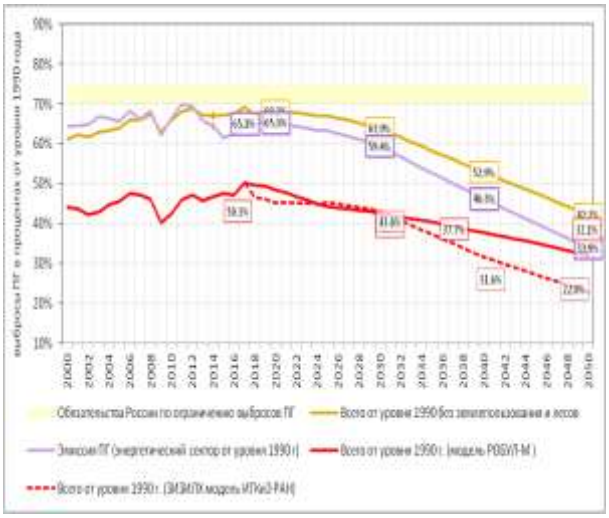
- a more complete incorporation into the models of technological and cost aspects of low carbon transition in all key sectors with an account of the economy of scale and learning effects;
- assessment of the impact of larger-scale hydrogen and CCUS deployment;
- a larger focus on reducing emissions from non-energy sources (industrial processes, agriculture, and waste).

2 Evolution of the draft LTS between 2019 and 2021

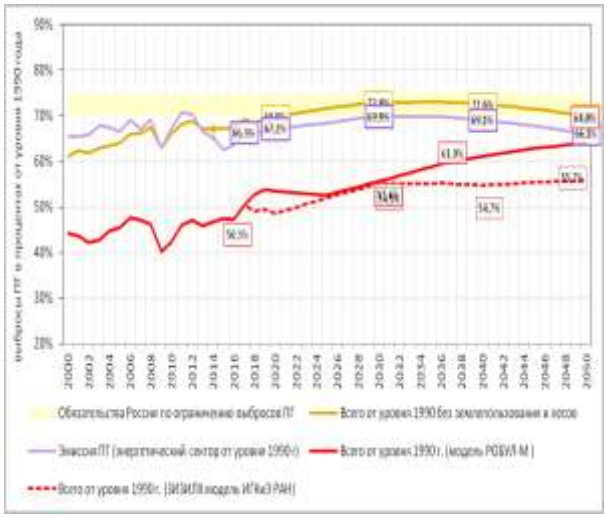
According to the Paris Agreement, which was ratified by the RF government, the country was expected to develop and submit a long-term low carbon strategy (LTS) in Glasgow, that was initially scheduled for November 2020. The RF Ministry of Economic Development, which is responsible for climate mitigation policies, announced a tender to prepare background materials for the LTS. The tender was won by CENEf-XXI. In November 2019, CENEf-XXI developed a very detailed, 1,000 page-long report, that included background materials for each sector and provided an integrated picture. As required by the TOR, this report included 4 scenarios: Baseline, NDC, Energy Efficiency, and 1.5ºC (see Figure 2). All of the scenarios were based on the official long-term economic projections by the RF Ministry of Economic Development (to 2036) and sectorial strategies (to 2030-2035) that had been adopted by that time. However, beyond 2036, CENEf-XXI had to develop its own economic projections to 2050. This was the first ever draft Russian official document with a time horizon to 2050. In the 1.5ºC scenario, net GHG emissions were down to 23-34% of the 1990 level, depending on the net LULUCF sinks uncertainty.

At a very early stage of drafting the LTS, the RF Ministry of Economic Development rejected the 1.5ºC scenario fearing that other ministries / agencies and large companies will not approve it. The government decided to develop its first draft LTS based on the requirement to keep the emission below 70% of the 1990 level, as mandated by President Decree No. 666 of 04.11.2020. It was in excess of CENEf-XXI's energy efficiency scenario to allow for a larger emission by 2030 before it starts declining by 2050. Two scenarios shown in red dotted lines in Figure 3 were titled *No Policies* and *Inertial*, the black one is the *Baseline*, and the green one is the *Paradigm shift*. It is very likely that, if Glasgow had not been postponed, an LTS similar to this draft would have been officially adopted in 2020.

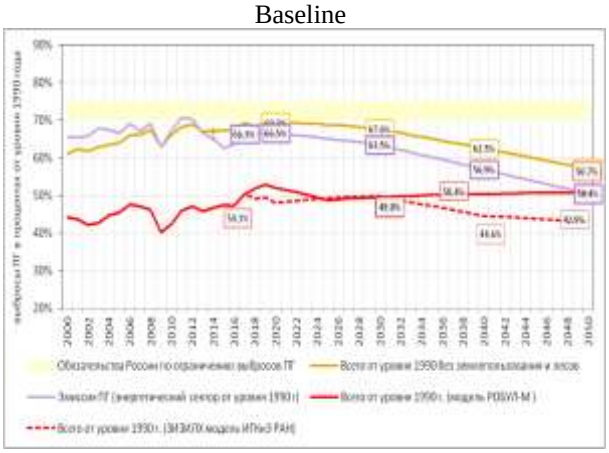
Figure 2 GHG emission trajectories compared to the 1990 level in the four scenarios included in the background materials



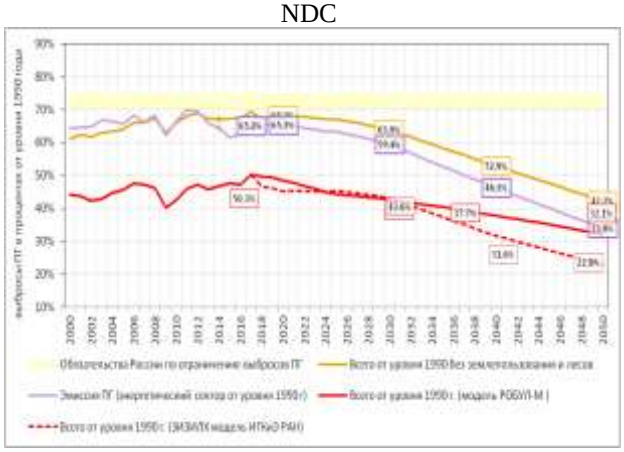
Baseline



NDC



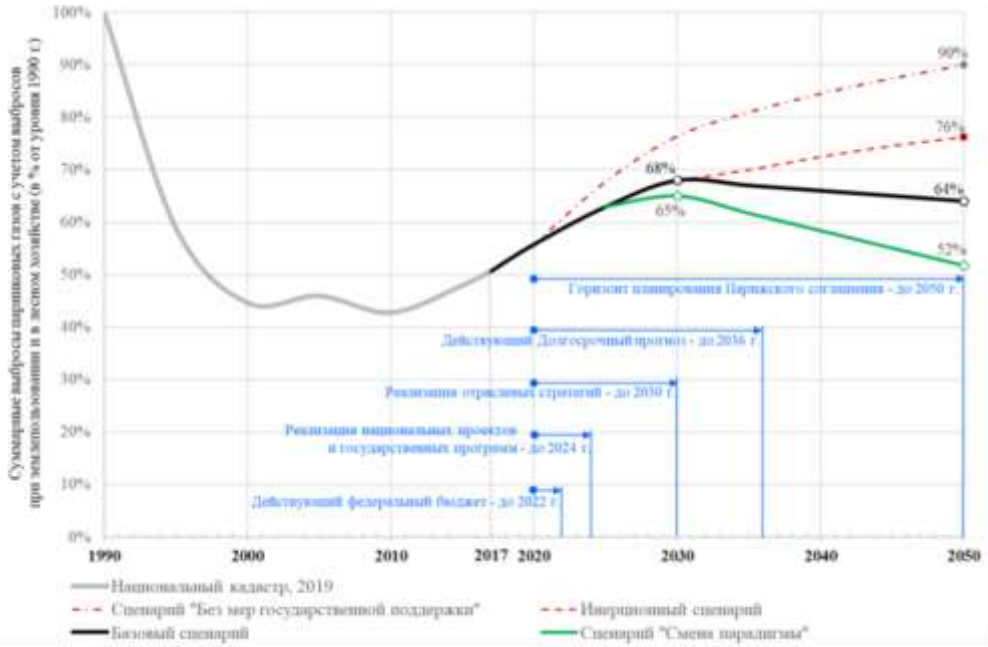
Energy Efficiency



1.5ºC

Source: Bashmakov I.A. Russian low carbon development strategy. *Voprosy Ekonomiki*. 2020;(7):51-74. (In Russ.) https://doi.org/10.32609/0042-8736-2020-7-51-74

Figure 3 GHG emission trajectories compared to the 1990 level as shown in the first draft LTS (February 2020)



Source: RF Ministry of Economic Development. Mid-2020 draft LTS.

By summer 2020, it became clear that COP-26 would be postponed for one year, and so the work on the RF LTS continued. Through the whole LTS development and approval process, three heads of the Energy Efficiency Department of the RF Ministry of Economic Development were appointed and gone. In late 2020 – early 2021, the Institute of Economic Projections of the Russian Academy of Science (IEP RAS) was selected to continue the work on LTS. The problem was that IEP RAS's leading experts (A. Shirov and B. Porfiriev) hold very conservative views on the mitigation policies in Russia, which they have clearly expressed in a number of articles and presentations, including the one, which was sort of a basis for further LTS development.[1] Some quotes from this paper are given below:

> "Implementation of the so-called aggressive scenario to halt global temperature growth at any cost within 1.5°C as compared to the pre-industrial era is unacceptable to Russia from socioeconomic perspective given its leading to lowering the average annual GDP growth rate by 1.8 percentage points by 2050. In addition, tough measures to reduce GHG emissions involve energy costs skyrocketing to unprecedented levels – from the current 13% of the GDP to 30% of the GDP by 2040. Such a burden would hardly be compatible with economic growth or, in any case, provide for the economic growth's providing for improvement of the communities' standard of living. Russia needs the long-term development strategy with low GHG emissions level focused on improving the quality of living, modernizing and increasing the competitiveness of the national economy".
>
> "The core impediment to sustainable development of Russia is not a high level of the GHG emissions, but economic stagnation".
>
> "Action priorities in the area of the GHG sinking should involve improvement of the LULUCF sector potential by promoting sound natural resources management policy and voluntary projects to increase carbon sink and reservoir capacity of the forest and wetland ecosystems".
>
> "Action priorities to reduce GHG emissions assume the imperative and expediency of economic stimulating of the structural change in the energy sector that involves production and technological chains within the country and do not provide for excessive price growth. Such change includes increasing use of natural gas (as the most "clean" fossil fuel) and nuclear energy (given Russia's leading position in the nuclear technology area), as well as cogeneration of electricity and heat. Pronounced increase in using renewables, energy storage systems and electric vehicles should be acceptable only if production of these is successfully localized and costs are reduced. Sustainable economic growth is a prerequisite for intensifying energy efficiency improvement as it involves modernization of the production facilities and using available and competitive industrial capacities. Specific measures targeted at energy savings will be inefficient given economic stagnation. A reasonable (smart) scenario of the Russia long-term economic development with the low GHG emissions level should comply with the principles above and its driving force propelled by structural and technological modernization of the economy that fully involves economic potential of the energy resource and power sector. The implementation of this development scenario would allow Russia to comply with the Paris Agreement national commitments while ensuring economic growth at the pace not yielding to that of the global average."

Sad about this story was that many government officials and the business community would rely on this paper which supports the position that mitigation activities in Russia will undermine its economic development. Under the project with ECF CENEf-XXI started controversy with IEP

[1] Porfir'ev B., Shirov A., Kolpakov A. Strategiya nizkouglerodnogo razvitiya: perspektivy dlya ehkonomiki Rossii. Mirovaya ehkonomika i mezhdunarodnye otnosheniya. 2020. T. 64, № 9. S. 15-25 [Low-Carbon Development Strategy: Prospects for the Russian Economy. *Mirovaya ekonomika i mezhdunarodnye otnosheniya*, 2020, vol. 64, No 9, pp. 15-25.] https://doi.org/10.20542/0131-2227-2020-64-9-15-25.

RAS and developed the following paper: I. Bashmakov. *Low Carbon Development and Economic Growth* (in Russian), which initially was uploaded to CENEf-XXI's website and later published in the journal "Neftegazovaya vertikal" (Oil and gas vertical), No. 19-20, 2021. Going point by point, this paper proved, that both assumptions and conclusions by IEP RAS were either not valid or erroneous. In April 2021, this paper was sent out to three assistants to President Putin to convince them that the idea of GHG mitigation undermining the economic growth was wrong. As a result, the RP President's Administration attempted to promote RF carbon neutrality pledge, but only resulted with Russia's commitment for cumulative 2021-2050 GHG emission below that in the EU.

A workshop *Russia's Long-Term Low Carbon Development Strategy* held on March 15, 2021, by CENEf-XXI under the project with ECF was designed to discuss (1) how we can attain the transition of Russia's economy and society towards sustainable development; (2) what are the key directions and the immediate measures for Russia's long-term low carbon transformation; (3) how is the development of Russia's Long-Term Low Carbon Strategy to 2050 going. CENEf-XXI, IEP RAS, and other Russian and foreign think tanks and also government officials were invited to discuss the LTS and to clearly outline their positions towards the LTS.

By the end of August 2021, another draft LTS was released by the RF Ministry of Economic Development and included four scenarios that built on the IEP RAS's philosophy, and even the names of the scenarios (Figure 4) showed that those were quite close to the ones described in IEP RAS's paper *Low-Carbon Development Strategy: Prospects for the Russian Economy*. By that time, President Putin had already announced Russia's commitment for a cumulative 2021-2050 emission below that in the EU.

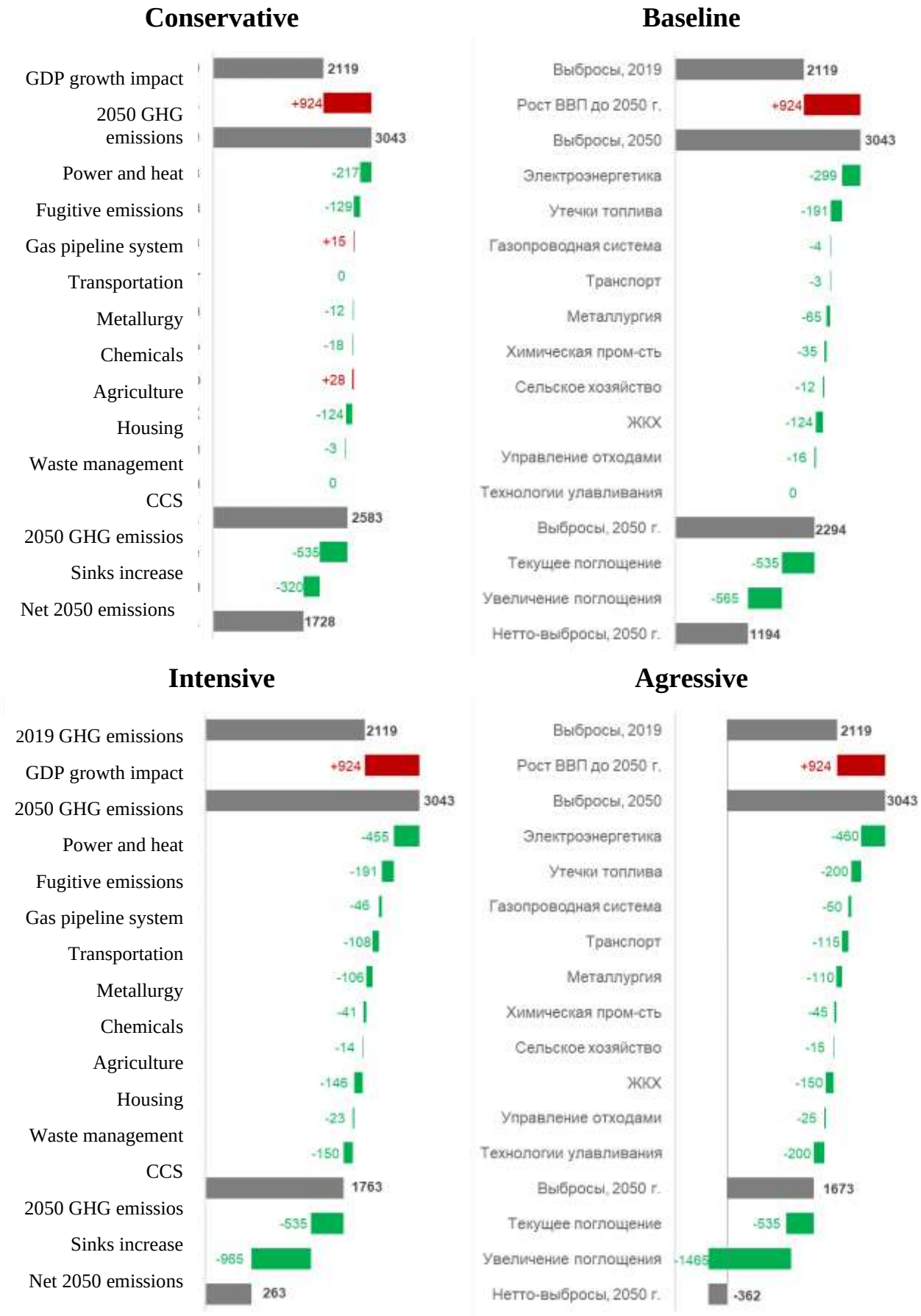
This draft was very disappointing. Anatoly Chubais, Special Representative of the RF President for Relations with International Organisations to Achieve Sustainable Development Goals, invited Igor Bashmakov and Oleg Pluzhnikov to provide their comments on this draft. The comments (*I.A. Bashmakov and O.B. Pluzhnikov. A risky strategy of developing a low-carbon Strategy. Review of the Low carbon social and economic development strategy of the Russian Federation to 2050)* were developed and widely disseminated, including to the RF President's Administration, ministries and agencies, the expert community, mass media and general public (https://cenef-xxi.ru). The key points of criticism were as follows:

1. The draft Strategy lacks clear guidelines and targets. Like in many other Strategies, the text of this document is compiled in a most general form, without clear guidelines, roadmaps, or descriptions of specific mechanisms.

2. In the Baseline Scenario, GHG emissions in 2050 in all sectors, except LULUCF, are 8% up from the 2019 level, and net emissions are 25% down amounting to 39% of the 1990 level. GHG emissions grow in many sectors (industry, transport, agriculture, waste), and decline only in the energy sector, housing and services. Such evolution can hardly be called "low carbon development". The proposed list of regulatory measures will in fact preserve Russia's current situation for the next 30 years.

3. What exactly is the Strategy? The goal is to reduce net emissions to 1,194 million tons CO_2eq. The main set of measures is aimed to increase the absorption by 565 million tons CO_2eq. Other means to be used towards this goal are formulated in a most general form, lack a clear description of measures to launch them and assess their effectiveness. Emissions grow in many sectors. The measures proposed in the Strategy "are designed to help keep the rise in global average temperature well below 2 degrees Celsius". It is unclear, how the baseline scenario, assuming an increase in greenhouse gas emissions by 2050, will contribute to achieving this goal.

Figure 4 2050 GHG emissions in four scenarios of the August 2021 draft LTS



Source: RF Ministry of Economic Development. August 2021 draft LTS.

4. An important point is the assessment of the emissions increase resulting from the economic growth. The authors of the Strategy have made a number of inadequate assumptions. For example, it was assumed that in any scenario Russia's GDP growth can accelerate from 0.9% in 2011-2020 to more than 3% in 2021-2050 and will outpace global GDP growth. It is unclear why GDP growth rates do not correlate with the economic growth model chosen in different scenarios. The authors of the Strategy, however, point out that "the preservation of the export-raw material model of development and its exhaustion" pose a threat to Russia's economic growth. This means that GDP growth rates in the Conservative and Baseline scenarios, which are based on this model, should be lower. Additional investments and rejection of the raw materials export-oriented economic model in the Intensive and Aggressive scenarios should accelerate economic growth. Because in all the four scenarios Russia's economy grows at a rate higher than the global average, and the macroeconomic stability is maintained, the question is, why select the baseline scenario, which assumes an increase, rather than a reduction in GHG emissions.

5. The Strategy indicates, that the Baseline Scenario was selected for the implementation, because it provides for lower cumulative net GHG emission of the Russian Federation to 2050 compared to that of the European Union. However it is not clear, why other scenarios, which provide depper emission reductions, were not selected for the implementation.

6. The main driver towards "low greenhouse gas emissions development" in the Strategy is an increase in GHG uptake by Russian forests and swamps. Without this increase, GHG emissions are 8% up in the Baseline Scenario. Only a significant increase in absorption – by 565 million CO_2eq. by 2050, which is twice the level of absorption in 2019 (535 million t CO_2eq.) – allows to reduce net GHG emissions in the Baseline scenario. Another maneuver indicated by the Strategy is the revision of the methodology for accounting for existing sinks. This methodology does not exist yet, but there are high risks that it will not, unlike the currently used methodology, be recognized by the IPCC and the UNFCCC. That is, the entire "absorbing" part of the Strategy is based on very shaky grounds of individual unverified estimates and the methodology revision expectations.

7. Renewable energy development is globally recognized as a key direction for a low-carbon economy. Development of low- and zero-carbon energy sources is included in the draft Strategy. At the same time, there are no renewable energy sources in the Baseline Scenario, and they are only mentioned in the unfeasible Intensive Scenario.

8. As a general comment, what's the point of developing so many scenarios, if only one is proposed for implementation? The other three are not supported by the Strategy.

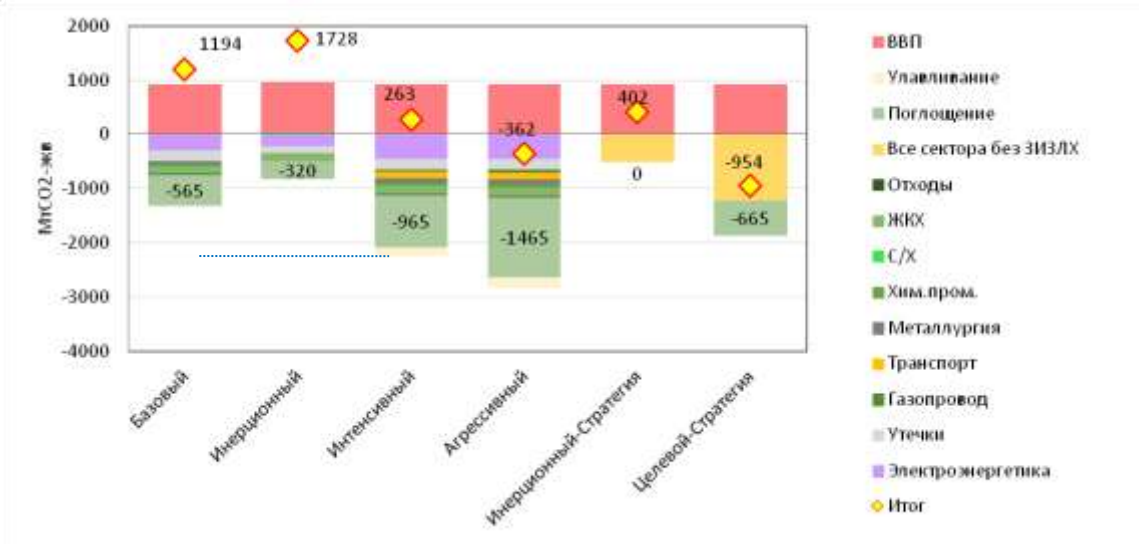
9. It is important to substantially revise the draft Strategy to:

   - Increase the ambition of GHG emission reduction commitments (in the draft, growth relative to 2019 is often called a decrease).
   - Reduce the general descriptive part. Shift the focus to the sectors and give more attention to the technological aspects of low-carbon modernization of the Russian economy.
   - Evaluate the scenarios and explain the choice of the low-carbon trajectory.
   - Justify additional regulations and draw up roadmaps for their application by sectors.
   - Recognize the need for modernization and the impossibility of economic growth based on the existing raw materials export model and linking assumptions on the economic growth and the chosen model of economic development with GHG emission trajectories.

- Reduce the reliance on LULUCF sinks in the Strategy.

The *Aggressive* scenario provides the first ever projection with a negative emission in 2050 (Figure 5). Increased absorption by Russian forests and swamps is the key driver for low carbon development. In each following scenario of the draft *Strategy*, additional 75-80% reduction in net emissions originates from the incremental sinks. However, the hoped-for sector may become the main factor for net GHG emission growth. The ROBUL model runs suggest that, if the current trends persist, in the baseline scenario the sink will turn into a source of some 56 mln tons CO_2eq. by 2050, or that the absorption will drop to 277 million tons CO2eq. The Institute of Global Climate and Ecology of the Russian Academy of Science argues that the absorption will remain at 475-565 million tons of CO_{2eq}.[2] However, the Strategy assumes a huge (1,465 million tons CO_2eq.) increase in the LULUCF sector. Even in the *Conservative* scenario, sinks grow by 320 million tons CO_2eq. According to the Russian national GHG inventory, sinks peaked in 2010 at 710 million tons CO_2eq, and have been on a declining trend since. Therefore, it would have been logical to assume a further reduction in the *Conservative* scenario.

Figure 5 Changes in GHG emission and absorption over 2019-2050 in the latest draft and the final text of the Low Carbon Social and Economic Development Strategy of the Russian Federation to 2050



Source: the latest draft Low Carbon Social and Economic Development Strategy for the Russian Federation to 2050; actual version of the Low Carbon Social and Economic Development Strategy for the Russian Federation to 2050 adopted by the RF Government Decree No. 3052-r of October 29, 2021.

Only a significant increase in carbon sinks (by 565 million tons CO2eq.) by 2050 to more than double the 2019 level (535 million tons CO2eq.) allows for a reduction in net GHG emission in this scenario. None of the scenarios with exsessive reliance on very high estimates of the absorption potential, should serve the basis for the *Strategy*, unless carefully verified.

Another maneuver highlighted is the revision of the accounting methods for the current CO2 sinks in LULUCF. Albeit no new methodology has been developed yet, there is a high risk that, unlike the one in place, it will not be recognized by the IPCC and UNFCCC. Perhaps the authors of the *Strategy* hope that new estimates – that between 1998 and 2014 managed Russian forests absorbed 354 million tC per year on average, which is, according to Schepaschenko et al. (2021), 47% above the estimates used in the National Inventory Report – will be officially recognized. It

[2] See Bashmakov I.A. Russian low carbon development strategy. *Voprosy Ekonomiki*. 2020;(7):51-74. (In Russ.) https://doi.org/10.32609/0042-8736-2020-7-51-74

is not clear, how evenly the estimated average increments are distributed over the years, and if the annual data shows any stable trend.

In fact, the scenarios show an "abandoned" Russia, which is left by its population. If GHG absorption by forests in 2019 (630 million tons) is 47% up, it will equal 926 million tCO_2/year. If net absorption in the LULUCF sector is to reach 2,000 million tCO_2/year, it should grow up by 1,465 million tCO_2. According to Romanovskaya et al. (2019), the absorption potential of the Russian LULUCF can be estimated at 545–940 $MtCO_2$eq./year. No potential can ever be implemented to a full extent. According to Roslesinforg, a forest planted on 2.5 ha should grow up to be 10 years old, before it can absorb 1 tC (3.7 tCO_2). In other words, the absorption ratio is 1 tCO_2/0.68 ha/year. Schepaschenko et al. (2021) point out, that a 0.56 ha mature forest with the current species/age structure can absorb 1 tC (i.e. 1 tCO_2/0.15 ha/year). The *Baseline* scenario requires that forests be planted in 85-382 million ha, which is a substantial part, if not all, of the agricultural land, plus perhaps a part of other land. If additional 1,465 million tCO_2eq are to be absorbed by 2050 (*Aggressive* scenario), 220-1,000 million ha need to be planted by 2040. For information: according to Rosstat, Russia's total land is 1,712 million ha; agricultural land occupies 222 million ha, forest land is 871 million ha, and other land is 393 million ha. In other words, the level of absorption required in the *Aggressive* scenario can be attained, if all agricultural land is replaced with forests, even if only 0.56 ha is needed to capture 1 tC.

The draft *Strategy* was based on very shaky grounds of sample estimates and the methodology revision expectations. Government documents should not build on such unreliable basis**.** This is the most vulnerable part of the daft *Strategy*, because if such extremely high assessment appears to be overestimated, the whole *Strategy* concept will collapse. The risk associated with the *Baseline* scenario involves a 500-1,000 million tCO_2eq. smaller, than projected, absorption. Since the *Strategy* assumes moderate decarbonization efforts in other sectors, there is a substantial risk that the overall goal of achieving lower total emission in Russia, compared to the EU, will not be attained. And other sectors should not be forgotten. CENEf-XXI's estimates show that if we want to get an effect equal to that from heat- and electricity savings delivered by energy efficiency renovation of apartment buildings in Kemerovo, we should plant forest on an area 16-50 times the size of total land occupied by the Kemerovo municipality. And this goes for each Russian city. If we also want to achieve the effect equal to GHG emission reductions yielded by energy efficiency improvements in other sectors (energy, industry, transport), the area to be allocated for forest planting will grow several times.

The *Strategy* cannot build on hopes for emissions reduction or sinks growth in just one sector. Other sectors can also offer a substantial GHG mitigation potential. After a harsh criticism the absorption estimates for the LULUCF sector were substantially revised in the final version of the Strategy.

In parallel with the LTS drafting, there were two processes, which largely influence the attitude of the government and the business community to climate mitigation activities in Russia:

- Discussion of the threats posed by CBAM and the Green Deal for Russian exporters and pressure from the business community on the government to ensure protection from CBAM;[3] large Russian businesses started developing their own carbon neutrality strategies to 2050;
- More countries, including China and the USA, were coming up with their carbon neutrality pledges, fearing the geographical and product extension of CBAM mechanisms.

These developments resulted in Russia's commitment to achieve carbon neutrality no later than 2060, as announced by the RF President on October 13, 2021, at the Russian Energy Week

[3] Bashmakov I. et al., 2021a: *CBAM: Implications for the Russian economy. Center for Energy Efficiency - XXI Moscow*. Moscow, Russia, 22 pp. Workshop *Carbon Border Adjustment Mechanism (CBAM): what are the possible effects for Russia's economy?*. CENEf-XXI for ECF, July 26, 2021.

Plenary session. This means that the RF President's Administration position finally evolved in the direction initially discussed in April 2021. This pledge was not included in the LTS which is limited to 2050, but the LTS was revised and its rhetoric shifted noticeably.

In early October 2021, the RF Ministry of Economic Development released a new draft LTS. The final LTS text (Low Carbon Social and Economic Development Strategy of the Russian Federation to 2050) was approved by the EXECUTIVE ORDER No. 3052-r October 29, 2021 (see Annex 1).

3 Main elements of Russia's LTS

Russia's LTS includes 6 sections:

I. Analysis of the international context

II. Conservative scenario

III. Target (intensive) scenario

IV. Measures to implement the Strategy

V. Strategy monitoring and implementation mechanisms

VI. Strategy implementation indicators

Two scenarios are considered: Conservative scenario and Target (intensive) scenario. In the latter, GHG emission in 2050 is only 14% below that in 2019, while sinks more than double bringing net GHG emissions to 60% below the 2019 level and 80% below the 1990 level. The 2050 GHG emission is slightly above the August 2021 draft Intensive scenario (Figure 4) and well above CENEf-XXI Energy Efficiency and 1.5°C scenarios (Figure 2), while sinks increment by 2050 is down from 965 mln tCO2eq. in the August draft to 665 mln tCO2eq. in the final LTS version. However, sinks increment still contributes 70% to the net GHG emission reduction in 2019-2050.

Таблица 3.1 Target (intensive) scenario GHG emission indicators (mln tCO_2eq)

	1990	2019	2030	2030		2050	2050	
				to 2019	to 1990		to 2019	to 1990
GHG emissions	3,159	2,119	2,212	+4%	-30%	1,830	-14%	-42%
GHG sinks	-73	-535	-539	+0,7%	+738%	-1,200	+124%	1,644%
Net GHG emissions	3,086	1,584	1,673	+5,6%	-56%	630	-60%	-80%

Source: Low Carbon Social and Economic Development Strategy for the Russian Federation to 2050 was approved by EXECUTIVE ORDER No. 3052-r October 29, 2021.

Despite assumed growth in net GHG emissions in 2019-2030 by 5.6%, 2030 net emission is 56% below the 1990 level. This is as much as the EU's pledge in its strategy "Fit 55". Therefore, the LTS narrative may be as following: keep -55% from 1990 net GHG emission to 2030 and -80% to 2050 mostly by increasing LULUCF sinks.

LTS text was modified to better reflect the need to launch climate policies and low carbon technological options. These qualitative statements are not sufficiently incorporated in the LTS GHG emission indicators.

4 Overall assessment

The international factors driving the LTS development and approval included concerns about the competiveness and external markets, political agenda, attractiveness for foreign investments, including under Article 6 type of projects.

Previous mitigation commitment was set by the RF President Decree No. 666 of 04.11.2020 to keep 2030 emission below 70% of the 1990 level. The recommended LTS Intensive (target) scenario brings net GHG below 20% of the 1990 level. Increased absorption capacity of forests and other ecosystems is to contribute 70% to this target.

The LTS time horizon is to 2050, but nevertheless it says very carefully that moving along the Intensive (target) scenario leads to carbon neutrality by 2060. This commitment was announced by President Putin on October 13 at the Russian Energy Week Plenary session. No research looking beyond 2050 has been taken so far in Russia to support this announced commitment. The LTS is the first strategic document with a time horzon to 2050. All of the earlier strategies only looked to 2030-2035. This means, that while the other strategies are to be revised, they have to accommodate for the LTS provisions.

Two scenarios are presented in the LTS to illustrate what mitigation policies can bring and to show different pathways. Both cover all sectors, all GHGs emissions and sinks. The Conservative scenario was developed to set a stage and background for the innovative one. Moving along the Conservative scenario does not allow for a transition, even in any distant future, to the carbon neutrality pathway.

In the previous versions of LTS, low carbon transitions were directly associated with a slowing down economic growth. The rhetoric of the adopted LTS is very much in contrast with such negative statements. For the first time an official government climate document states that a low carbon transition will accelerate, rather than slow down economic growth. This means, that the low carbon transition costs are manageable and the multiple benefits contribute to GDP growth.

Intensive (target) scenario was developed to keep net 2030 GHG emissions at 56% below the 1990 level, and net 2050 emission at 80% below the 1990 level to pave the road to carbon neutrality to 2060. For the first time, the LTS considers a possibility to use carbon pricing policy instruments in Russia along with other incentives to combat GHG emissions growth. Certain international conditions are required for Russia to switch to the Intensive (target) scenario. It is stated that Russia may be moving slower, if these conditions are not in place.

Nearly all key and most frequently used cross-sectoral and sectoral specific policies and technologies are considered. In Russia, a focus is put on the technologies which are well-deployed and develloped (nuclear, CHP, hydrogen) or allow for the use of traditional resources (for example, coal with CCS). Nearly all major technologies for low carbon scenarios are listed in the LTS.

Increasing sinks in the LULUCF sector is number one mitigation option in the LTS. In some projections by Russian think tanks, sinks in LULUCF continue to decline to 2050, as forests mature, and also affected by large wildfires. This declining trend has been observed since 2010. In the LTS, however, LULUCF has to first compensate this decline and then more than double the sinks to absorb additional 665 mln t CO_2eq. by 2050. Very intensive activities are required to attain this target.

LTS control and monitoring process will rely on three types of documents: *Strategy implementation roadmap, Federal implementation plan* (development is under way), *and regional implementation plans*, as well as *State report* to be annually submitted by the RF Ministry of economic development (see below).

There as a very limited number of indicators by sectors of technologies uptake in the LTS. The *Federal LTS implementation plan* will have to elaborate these. Some of activities indentified in this Plan will be developed in January 2022 and many positions are scheduled to be implemented

the first quarter of 2022, while others later, in 2022-2024, because such development requires additional analytical and political efforts.

5 Detailed assessment

5.1 Analysis of the international context

This section of the LTS describes the drivers for LTS development:

> Carbon regulation mechanisms that are emerging in a number of jurisdictions are an important factor determining the competitiveness in the carbon intensive markets. The potential extension of such mechanisms to the international trade may confront the law of the World Trade Organization and the UN Framework Convention.
>
> There are plans to introduce a variety of bans on the sale (use) of carbon intense products in order to protect domestic markets.
>
> Supranational measures aimed to regulate, or curb the growth of, greenhouse gas emissions are also taken within the mandate of international organizations and supranational associations.
>
> Various initiatives are currently being considered under the OECD and on other international platforms to develop multilateral mechanisms for climate regulation. Since 2021, the Russian Federation has taken part in the OECD's International Programme for Action on Climate.
>
> Given the international significance of the climate agenda, the need to ensure energy transition, reduce greenhouse gas emissions, as well as the wide scope of the global climate policies, which pose additional threats to the Russian economy, it is of paramount importance to develop incentives and conditions for re-directing financial flows to finance the country's sustainable environmental, social, and economic development and for the adaptation of financial market actors to the new risks associated with the transition to a sustainable economy, including a low carbon economy.
>
> It is important to ensure compliance of the Russian approaches to the identification and verification of sustainable, including 'green', projects with the international standards. Transition projects taxonomy, which focuses on projects with a high environmental impact, has an important role to play in carbon-intense sectors. When in place, a set of criteria and a verification system for sustainable and transition 'green' projects would help substantially expand the range of potential investors in such projects, provide access to a cheaper financing, avoid the risks of erroneous earmarking of products as 'green', and add maximum transparency to the new financial tools market.
>
> Because new industrial technologies are developing and approaching the thermodynamic thresholds of energy efficiency, it is becoming increasingly important to improve the efficiency of materials use and to increase the scale of their reuse.

The international factors driving the LTS development and approval include concerns about the competiveness and external markets, political agenda, attractiveness for foreign investments, including under Article 6 type of projects

5.2 LTS goals and coverage

This section of the LTS describes LTS goals and coverage as follows:

> The Strategy outlines measures aimed to reduce greenhouse gas emissions to 70% below the 1990 level with a maximum account of the absorption potential of forests and other ecosystems and in line with a sustainable and balanced social and economic development of the Russian Federation. It also identifies low carbon development pathways and measures to 2050.

This statement reflects the requirement of the RF President decree No. 666 of 04.11.2020 to keep the 2030 emission below 70% of the 1990 level without setting a new target to 2050, which in

the Target (intensive) scenario is below 20% of the 1990 level. It also points out the LTS emphasis on a larger absorption potential of forests and other ecosystems as the main mitigation option.

> The Strategy is primarily tailored to attain a goal specified in the presidential address to the Federal Assembly of the Russian Federation of April 21, 2021: to reduce between 2021 and 2050 the accumulated net GHG emission in the Russian Federation to a value lower than that in the European Union to help hold global average temperature rise well below 2°C above pre-industrial levels, and to make effort to limit the temperature rise to 1.5°C.

This statement was not adjusted to the commitment announced by the Russian President at the Russian Energy Week plenary session on October 13 to achieve carbon neutrality no later than 2060. The reason is that no research looking beyond 2050 has been taken so far in Russia to support this announced commitment.

> The Strategy is a strategic planning document of the Russian Federation. It is a cross-industry document and it provides a basis for the integration of national GHG mitigation policies in other strategic planning documents of the Russian Federation; social and economic development strategies of the regions and republics of the Russian Federation; planning and strategic documents of state-owned corporations, national companies, and public non-profit organizations. The Strategy outlines the Russian economy's adaptation pathways under the global energy transition and determines the target setting in sectorial and regional adaptation plans.

Russian LTS is the first strategic document with the time horizon to 2050. All other strategies were to 2030-2035. This means, that while the other strategies are to be revised, they have to accommodate for the LTS provisions.

> The Strategy covers the sectors of economy and public administration which are anthropogenic GHG sources or sinks, and includes two scenarios for Russia's social and economic development – conservative and intensive – which differ in the level of technological development, structural change (shifts) in the economy, absorption potential of natural GHG sinks, and other effects.

Two scenarios are presented in the LTS to illustrate what mitigation policies can bring and to show different pathways. Both cover all sectors all GHGs emissions and sinks.

5.3 Macroeconimic implications

In earlier LTS versions low carbon transitions were directly associated with a slowing down economic growth. The rhetorics of the adopted LTS is very much in contrast with such negative statements:

> Russia's economic goal for 2030, which is to be achieved through the structural national policies, is to attain sustainable growth at a rate higher than the global average (i.e. at least 3% growth) while maintaining macroeconomic stability. The development scenarios differ in their approaches to the adaptation of the Russian economy to the global energy transition.

This is a very optimistic statement, for it is unlikely that average GDP growth rates in Russia will reach 3% per year in 2021-2050.

> With the global energy transition, the conservative scenario assumes a decrease in the energy exports from 2030 onwards (2.8% in real prices over 2031-2050 on average), which will hardly be compensated by an increase in the non-energy exports. With an account of the growing imports, net export dynamics will be the greatest restraining factor for the GDP, which will be growing annually at 1.5% over 2031-2050 on average, and by the end of the projection horizon the growth rate will go down to about 1%.
>
> In view of the above, domestic demand will also show just a moderate growth with real disposable income increasing at 1.2% per year on average, and investment in fixed assets at 1.9% per year.

The measures outlined in the target (intensive) scenario will accelerate positive structural shifts to 2050 and help increase the share of 'post-industrial' sectors by 11.8 percentage points compared to 2020 (+4.9 percentage points compared to the conservative scenario).

The target (intensive) scenario describes a more moderate, than in the conservative scenario, decrease in energy exports from 2030 onwards (-2.1 percent in constant prices annually between 2031 and 2050), including through the re-orientation to production of high added value products and measures to improve the competitiveness of Russian energy exports in the international markets. Non-energy exports are expected to grow at 4.4 percent annually. Stable economic growth will be determined by an accelerated growth of investments in fixed assets (3,7 percent annually) and of disposable income (2.5 percent annually). Annual economic growth in this scenario will be 3% between 2031 and 2050. In the long-term, the economic growth rate will somewhat decrease (to about 2.8 percent by 2050), including due to the slowdown in the global growth, yet it will still remain above the global average.

At the same time, growing investment in the decarbonization of the energy sector may raise domestic power prices.

For the first time an official government climate document states that a low carbon transition will accelerate, rather than sllo down, economic growth. It is a very important achievement for those who have been promoting this idea for a long time.

Total investments in the reduction of net emission will be on average 1 percent of GDP over 2022-2030 and 1.5-2 percent of GDP over 2031-2050. The multiplier effects of the investments will have additional positive impacts on the economic growth. Additional GDP growth to 2050 resulting from the investments will be 25 percent above the investments made.

This means, that the low carbon transition costs are manageable and the multiple benefits add to GDP growth. They bring multiple benefits as stated below in the text quoted from the LTS.

The target (intensive) scenario allows for the following positive effects:

- sustainable economic growth at a rate higher than the global average; a high level of technological development and competitiveness of the Russian economy;
- emergence and development of new industrial sectors (including hydrogen energy and electric transport), new highly productive jobs;
- better investment attractiveness of Russian enterprises and economy, fast investment growth;
- growing Russian exports and increasing share in the global domestic product;
- access to the global markets of sustainable finance;
- maintaining the employment level; growing disposable income;
- improved environment and the ecological well-being;
- introduction of the circular economy principles;
- carbon intensity reduction by more than 2 times to reach the level of the leading economies;
- participation of the Russian Federation in the global climate agenda provides incentives for external trade; substantial contribution to the global climate mitigation efforts;
- meeting the commitments of the Russian Federation under the Paris Agreement and UNFCCC;
- implementation of the target (intensive) scenario would help the Russian Federation balance anthropogenic GHG emissions and absorption no later than 2060.

The last statement is the only place in LTS which shows very carefully the announced carbon neutrality pledge to 2060.

5.4 Conservative (inertial) scenario

The Conservative (inertial) scenario was developed to set a stage and background for the innovative one. It does include moderate efforts to control GHG emissions.

The conservative scenario sets out to achieve the national goals and to implement sectorial strategic planning decisions. However, it does not consider any additional measures that might yield GHG reductions as a direct or indirect effect.

The conservative scenario does not provide for the carbon neutrality on the planning horizon.

The Conservative scenario does not allow for a transition, even in any distant future, to the carbon neutrality pathway.

GHG mitigation measures as integrated in the conservative scenario do not provide sufficient incentives for the low carbon transition, because they do not include any mechanisms to encourage corresponding activities on the national scale and by institutional investors, such as tuning the financial flows to the low carbon development and climate change resilience pathways.

In … the conservative scenario, economic development pathways incur the following substantial risks:

- declining public revenues resulting from a drop in energy exports;
- decreasing share in the global gross domestic product, lagging behind in the technological race;
- exhausting the potential for the development model based on the exports of raw materials; lagging behind in the development and deployment of promising technologies (including 'green' technologies) that incur materials uptake reduction and improve energy efficiency;
- worse conditions for debt financing, poor investment, capital outflow;
- potential risks of human resources outflow; poor employment indicators;
- only moderate increase in disposable income.

In view of the above, the conservative scenario is not considered as the target one. In order to attain the goal specified in the Presidential Address to the Federal Assembly on April 21, 2021, and to minimize the above risks, it is proposed to consider the intensive scenario as the target one.

5.5 Target (intensive) scenario

The Intensive (target) scenario was developed to keep net 2030 GHG emissions at 56% below the 1990 level, and net 2050 emission at 80% below the 1990 level to pave the road to carbon neutrality to 2060.

The intensive scenario includes additional decarbonization measures for the economic sectors and an increase in the absorption potential of managed ecosystems. This scenario views the global energy transition as one factor that can improve the competitiveness of the Russian economy on the global scale. On the Strategy's horizon, carbon intensity of Russia's gross domestic product drops 1.5-fold and will be above the global average by 2020.

The target (intensive) scenario links the goals of the international GHG mitigation agenda with Russia's economic potential for the low carbon transition and domestic social and economic interests. The key parameters of the infrastructure renewal to 2024-2026 as specified in the Strategy have been identified and integrated in national programmes and projects. Additional GHG mitigation measures as included in the target (intensive) scenario were selected based on the ROI criteria.

The target (intensive) scenario includes technical regulation policies and finance and tax policies, which aim to reduce anthropogenic GHG emissions, as an additional driver for the technical renewal of the economy. The selection of the above policies (for example, carbon pricing, GHG emission allowances, regulations requiring mandatory deployment of, and incentives for, low carbon

technologies and high energy and resource efficiency, adjustment of the mineral extraction tax and other taxes and charges, etc.) for the most inefficient, carbon intense sectors will be based on the assessment of the social and economic effects of these policies and the results of pilot emission control projects in some of the Russian republics and regions.

The above statements for the fist time consider a possibility to use carbon pricing policy instruments in Russia along with other incentives to combat GHG emission growth. Potential toolkit is further developed in the statement below.

> Green certificates are another GHG regulation tool, which has an important role to play in the implementation of the target (intensive) scenario. They certify the rights which arise from the positive environmental and social effects achieved during energy production, namely, emission and waste reduction and mitigation of harm to the environment and human health.

The statement below specifies certain international conditions for Russia to switch to the Intensive (target) scenario. It is stated that Russia may be moving slower, than required by the LTS, as long as these conditions are not in place.

> The target (intensive) scenario was developed based on the assumption that the following arrangements will be made by the parties to the Paris Agreement:
>
> - each country will be free to set its own emission reduction pathway and its nationally determined contribution;
> - the measures taken will be technologically neutral (i.e. the reductions and absorptions, including from nuclear and hydro projects, will not be discriminated);
> - the need to improve the carbon absorption potential of managed ecosystems will be mutually recognized;
> - Russian climate regulations will be in line with the international standards, including the taxonomy, green certificates, and green projects verification;
> - the level of ambition of nationally determined contributions under the Paris Agreement can increase based on the development of green financing, which provides a basis for the implementation of green projects and for investment in low carbon development and adaptation to climate change (sanctions should be waived on these activities);
> - the mechanisms of Article 6 of the Paris Agreement provide for the universal rules of the allocation of carbon credits for voluntary climate projects and of other GHG reduction units in compliance with the international standards. Such non-discriminatory conditions would allow for the implementation of the most efficient climate projects and maintain stable demand for carbon credits.
> - It is recommended that the target (intensive) scenario be used as the basis for the Strategy implementation.

5.6 Policies and technologies in the target (intensive) scenario

In the statement below, Russia sets technological priorities for combating climate change. The emphasis is put on those where Russia hold leading positions (nuclear, CHP, hydrogen) or which allow for the use of traditional resources (like coal with CCS). Nearly all major technologies included worldwide in low carbon scenarios are listed in the LTS.

> Technologies to reduce the carbon footprint of the coal-fired generation in place will be used. Pro-active digitalization and electrification in economic sectors will be under way. Hydrogen technologies will be deployed in the iron and steel and chemical industries. Combined-cycle, nuclear, hydro and renewable power generation will be developed, GHG reduction potential will be increasingly used in the coal-fired energy sector, including through a complete transition to the best available technologies, support for innovative and climate efficient coal combustion

technologies, large-scale replacement of inefficient boilers with cogeneration units, providing incentives for the development and deployment of CCUS. The growing power demand will be met through low carbon combined-cycle power generation and nuclear, hydro, and renewable generation.

The following key instruments will be used to reduce greenhouse gas emissions:

- In the power sector, cutting-edge technologies are to be introduced; combined-cycle power generation, nuclear, hydro and renewable energy should be developed; large-scale implementation of the GHG reduction potential in the coal-fired power generation is required, including through a complete transition to the best available technologies, support for innovative and climate friendly coal combustion technologies, large-scale replacement of inefficient boilers with cogeneration units and CCUS equipment. Key change in the power generation structure is expected in 2031-2050;
- Reduction of fugitive emissions associated with GHG leaks from industrial processes and fossil fuel transportation. It is also anticipated that GHG capture, storage and use technologies will be deployed;
- In the transport sector, we should see transition to electric turbines and to comprehensive electrification of transport and development of the charging infrastructure;
- In carbon intense sectors, low carbon and energy efficiency technologies are to be deployed. The implementation mechanism should be based on the development of a regulatory basis to incentivize the deployment of low carbon and resource/energy efficiency technologies (GHG emission or resource/energy efficiency indicators may be specified in the BAT handbooks) and on the revision of the currently used BAT handbooks. In the iron and steel and chemical industries, resource/energy efficiency technologies should be deployed, and the uptake of low carbon technologies, including GHG sequestration and hydrogen technologies, should be increased;
- In the housing and utility sector and in housing construction, it is expected that heat- and cold-supply efficiency will be improved, and new buildings will be of high energy efficiency categories (A or A+ classes). One instrument to achieve this is to assign energy efficiency classes at the construction stage, including with an account of energy efficient glazing. Dilapidated and inefficient residential buildings should be retired and replaced;
- In agriculture, approaches to soil fertilization should be optimized (for example, through the use of fertilizers with a slow release of nitrogen), and site-specific crop management should be developed. It is anticipated, that the best available technologies will be deployed in the agricultural sector;
- Resource conservation technologies will be deployed in the industrial and household waste management.

5.7 Sinks expansion in the Target (intensive) scenario

Increasing sinks in the LULUCF sector is number one mitigation option in the LTS. The LTS states:

> The target (intensive) scenario anticipates growth in the absorption potential of managed ecosystems in the forest sector from the current 535 million tons CO2eq. to 1,200 million tons CO2eq.
>
> The target (intensive) scenario anticipates overall absorption growth to 665 million tons CO2eq. as the most likely target to ensure compliance with the international standards of measures implemented in the Russian Federation to protect and improve the quality of GHG sinks and reservoirs.
>
> The target (intensive) scenario describes eventual introduction of low carbon and energy efficiency technologies to 2030, which involves insignificant emission increase associated with a

stable economic growth. From 2031 onwards, the scale of technologies deployment will allow it to reverse this trend and proceed to the emission decline phase. The measures included in the target (intensive) scenario will help decrease gross emission by 910 million tons of CO2eq. by 2050 compared to the BAU scenario. Increased absorption will yield an additional effect of up to 665 million tons of CO2eq. by 2050.

In other words, in 2050 the target (intensive) scenario will yield 60 percent net GHG emission reduction from the 2019 level and 80% reduction from the 1990 level. This would help progressively increase the level of ambition of Russia's nationally determined contributions to the goals of the Paris Agreement (on condition that the Russian carbon regulation, sustainable projects criteria, and absorption by managed ecosystems comply with the international standards).

In some projections by Russian think tanks, sinks in LULUCF continue to decline, as forests mature, and also affected by large wildfires. This declining trend has been observed since 2010. In the LTS, LULUCF has to first compensate this decline and then more than double the sinks to absorb additional 665 mln t CO_2eq. by 2050. Very intensive activities are required to attain this target.

5.8 Sectorial policies in the target (intensive) scenario

Nearly all key and most frequently used cross-sectoral and sectoral specific policies and technologies are considered in the LTS. This list was largely borrowed from CENEf-XXI's November 2019 report with background materials.

The following measures need to be implemented under the target (intensive) scenario:

- cross-sectoral:
    - financial and tax policies to incentivize the reduction of anthropogenic GHG emissions in highly inefficient, carbon intense sectors. These policies should be identified with an account of results obtained by setting special legislative regimes in individual regions and republics of the Russian Federation;
    - setting up a national system to promote sustainable development and GHG emissions reduction under the mechanisms of Article 6 of the Paris Agreement;
    - development of public non-financial reporting of companies; improving energy and ecological efficiency in economic sectors;
    - revision of information and technical handbooks on the best available technologies to account for energy/resource efficiency parameters; technology switch to the best available low carbon and zero-impact technologies;
    - government support for the introduction of, and scaling up, low- and no-carbon technologies;
    - larger-scale use of secondary energy resources, waste recycling in industrial processes, including for process and energy use;
    - setting industry-wide goals for low carbon transition and ensuring they are met;
    - incentives for the use of secondary energy resources in the production of goods;
    - revision of fiscal, customs, and budgeting policies to account for the low carbon development challenges;
    - accounting for GHG balance impacts provided by public spending and investments;
    - development of sustainable, including 'green', financing; adopting industry-wide and regional climate change resilience and adaptation plans and energy transition roadmaps;
    - support for, and dissemination of, CCUS technologies;

- in the energy sector:
  - partial replacement of coal generation plants with low- or no-carbon units; growth in no-carbon power generation; reduction in the emissions from the coal plants in place through the deployment of new technologies;
  - larger-scale recovery of associated petroleum gas;
  - development of hydrogen exports based on fossil fuel hydrogen production and on low-carbon hydrogen to penetrate the international hydrogen markets and develop relevant technologies through the launch of commercial hydrogen plants; setting up hydrogen production complexes; creation of hydrogen supply chains to the international and domestic markets; increasing the share of hydrogen in the exports structure;
  - reduction in energy and resource consumption, application of energy efficiency technologies (combined-cycle gas units; combined heat and power generation), timely decommissioning or modernization of worn out or obsolete equipment; improving insulation; reduction of power and heat distribution losses;
  - development of distributed generation (including in off-grid power systems) while maintaining the reliability of power supply;
  - creation of additional power generation sources to reduce power transmission losses;
  - substantial increase in renewable power generation while meeting the local manufacturing content requirements of the Russian Federation for equipment production and the environmental responsibility principles, including for rare earth metals mining;
  - disclosure of information on power generation and power footprint to the customers;
  - recovery of some types of waste (including non-recyclable waste) for energy use;
  - introduction of innovative resource/energy efficiency technologies for solid fossil fuel production, refinery, processing, and transport;
- in construction and housing&utility sectors:
  - tough energy efficiency requirements for new residential, public, and industrial buildings (A and A+ classes) to cut energy demand and increase the efficiency of energy use;
  - demolition of worn out and inefficient residential and public buildings;
  - energy efficiency renovation of the existing buildings with district heating or individual boilers, domestic hot water supply and space heating systems; replacement of electric appliances and lighting systems with more efficient models; introduction of smart energy controls under commercial projects;
  - recycling of solid fuel combustion waste from energy facilities (ash and slug, furnace and coal dust), including through the use for the construction of buildings and roads, recultivation of land, and revitalization of damaged territories (recultivation of open cast mines and quarries);
  - incentives for the installation of renewable energy units at buildings (solar collectors for hot water supply, PV panels for electricity generation, heat pumps, flat- or house-level waste heat recovery units, food disposal units to process waste into biogas, etc.);
  - improving the efficiency of heat- and cold supply systems, including through loss reduction and low-grade heat recovery;
- in transport:
  - large-scale change in the structure of passenger- and cargo turnover in favour of less carbon intense vehicles;

- deployment of new, energy efficient vehicles; large-scale electrification and gasification of public transport; conversion of automobiles to hybrid engines; incentives for the use of zero-carbon and zero-pollution vehicles; incentives for the use of public transport;
- construction of gas- and electric charge infrastructure for various transport categories; providing simple access to low carbon fuel for vehicles;
- lower natural gas consumption for energy generation; improving energy efficiency of industrial processes; loss reduction;
- deployment of new transport and information control technologies; development and introduction of smart monitoring and management technologies in the transport sector;
- development of transport infrastructure and logistics for transport flows management, better traffic capacity, and higher average speed;

- in the industrial sector:
  - improvement of iron ore materials quality, physical and technical parameters of coke; use of metallized raw materials and hot fuel-rich gases;
  - improving energy/resource efficiency of the iron and steel industry and non-ferrous metallurgy; increasing the share of electric steel production and DRI; switch from natural gas to hydrogen (requires additional research and a special infrastructure); increasing the share of primary aluminium produced on the second generation electrolysers with pre-baked anodes (300 KA or more); conversion to the inert anode technology (requires additional research); maximum use of recycled water;
  - improving the efficiency of feedstock and raw materials use; improving energy efficiency of processes, including energy and heat generation; the use of secondary resources under the circular economy concept; incentives for technical research to increase the life cycle of equipment for the purpose of reducing the demand for material and energy resources to produce new equipment; minimization of product failures;
  - development and deployment of carbon dioxide and methane capture, storage, and use technologies, and development of the relevant infrastructure, engineering and production of equipment that allows for GHG emission reductions through carbon and methane capture and use;
  - development of new energy resources, including hydrogen, green ammonia, biodiesel from wood to be used in diesel engines and biomethane for the gas infrastructure; the use of new energy resources, including hydrogen and biodiesel;
  - development of a full-scale production of components for automobile electric charging stations and gas filling compressor stations;
  - improving energy/resource efficiency of chemical plants; deployment of new processes and catalyzers which, inter alia, reduce emissions from chemical production, improve the selectivity, and also allow for the processes to go under lower temperatures and pressures, which helps reduce energy consumption; restructuring of the fuel balance to convert to fuels that produce less GHG from combustion; reduction of nitrogen oxide consumption for nitric acid production;
  - reduction of ‘wet’ cement production; switch from fossil fuel to alternative fuels which produce less GHG emission; using secondary resources for process needs (the use of secondary resources, such as ash from thermal power plants, iron and steel slag, as raw materials reduce specific heat consumption for clinker production and GHG emission from limestone decomposition);
  - development of an energy equipment recycling system to ensure recycling of ferrous and non-ferrous metals; this partially meets primary metals demand and thus mitigates environmental impacts by reducing minerals production and relevant energy consumption;

- in household and industrial waste management:
    - transition to a circular economy to minimize waste, incentivize the use of secondary resources and waste and/or waste components as process feedstock for many economic sectors; development of the 'extended responsibility' institute for the producers and importers of goods and packaging;
    - separate waste collection and accumulation, including for organic waste;
    - better uptake of landfill gas collection technologies and landfill gas use for energy needs; maximum possible recycling of organic waste to be used as feedstock, including for commercial compost, biogas, or feed and feed additives for livestock and aquaculture;
- in agriculture and forestry:
    - larger-scale use of mineral fertilizers with slow release of nutrients and of fertilizers with nitrification inhibitors which dissolve and release nitrogen slower than conventional nitrogen fertilizers; compliance with fertilizers application standards and terms; revision of the fertilization practices;
    - differentiated application of agrochemicals on cultivated land; development of 'crop-specific' agriculture (best available technologies uptake in the agricultural sector); satellite remote sensing for soil and crops monitoring);
    - application of the cutting-edge agronomical methods (regenerative technologies) to enhance crops yield and promote crop residue carbon absorption;
    - erosion control and field protection measures;
    - increasing the productivity of livestock; development of targeted breeding to help breed livestock with lower methane emissions;
    - production of biofuel in livestock husbandry and crop production; deployment of biogas units for organic waste processing;
    - promoting carbon accumulation in agricultural land;
    - watering of previously drained bogs, including to prevent peat fires; ensuring fire safety; bogs water balance management;
    - improving the efficiency of forest management; improving forests protection;
    - enhancing sanitary safety in forests and combating pest outbreaks;
    - implementation of climate projects to develop forestry infrastructure; care for forest plantations to improve carbon absorption potential of forests;
    - improving the efficiency of fire protection in forests to prevent wildfires; setting up regional aviation centers for wildfire protection; increasing the aircraft fleet to detect and monitor wildfires; increasing the staff of airborne fire alert service;
    - increasing the reforestation area;
    - creation of a forest selection and seed-growing network for the cultivation of planting material in Russia's regions and republics; incentives for the creation of high-value plantations.

5.9 LTS control and monitoring

LTS control and monitoring process will rely on three types of documents: *Strategy implementation roadmap*, *Federal implementation plan* (development is under way), *and regional implementation plans*, as well as *State report* to be annually submitted by the RF Ministry of economic development.

For the purpose of monitoring the progress towards the Strategy implementation the Russian Government will adopt a *Strategy implementation roadmap*, which will include economy-wide, sectorial, and other measures to attain the specified targets. The roadmap will integrate high priority Strategy implementation measures for the entire economy and separately for the energy sector, construction and housing&utility sector, transport, industry, household and industrial waste management, agriculture, and forestry.

The roadmap will include measures that can yield the highest social and economic effect and result in a substantial reduction of GHG emission (increase in absorption) on the national scale. The measures can help remove current administrative barriers, create a new legislative basis to promote investment in low carbon business and minimize the risks for the energy, food, economic, and overall national security.

On the regional level, the Strategy is implemented, inter alia, through the agreements that are signed between the RF Ministry of economic development and executive bodies of Russian regions and republics and include *regional implementation plans*.

Control over the Strategy implementation will be exercised by estimating current performance indicators and by monitoring the implementation of measures included in the *implementation plan*.

The results of the Strategy implementation monitoring, including information on the actual and projected performance indicators, will be submitted by the RF Ministry of economic development to the RF Government in the form of a *state report* and uploaded to the official website of the RF Ministry of economic development.

The results of the Strategy monitoring will also be included in international reports submitted by the Russian Federation under UNFCCC and the Paris Agreement.

The provisions of the Strategy will be updated as and when necessary, including as required by revisions of the nationally determined contribution. The global stock taking in compliance with Article 14 of the Paris Agreement will serve the informational basis for updating the Strategy and the nationally determined contribution.

5.10 The Strategy indicators

The Strategy implementation progress will be assessed using the following indicators:

- overall and sector-wide GHG emissions; energy production and efficiency;
- energy efficiency indicators by sectors; carbon intensity of the economy;
- the involvement of national agencies and industries in the Strategy implementation;
- the volume and effectiveness of investments in GHG emission reduction and absorption enhancement.

The list and quantification of the indicators may be verified based on the results of the Strategy implementation control, the adoption of new and verification of the existing industry-wide strategic planning documents and the indicators that shape Russia's nationally determined contributions under the Paris Agreement.

However, in the LTS only total GHG emissions and removals are shown.

ANNEX 1

GOVERNMENT OF THE RUSSIAN FEDERATION

EXECUTIVE ORDER

October 29, 2021, No. 3052-r

MOSCOW

Pursuant to Presidential Decree No. 666 “On greenhouse gas emissions reduction” dated November 4, 2020, it is required that:

1. The attached Low Carbon Social and Economic Development Strategy for the Russian Federation to 2050 (hereinafter referred to as “the Strategy”) be adopted.

2. Federal executive agencies abide by the Strategy for the development and implementation of sectorial strategic planning documents, national programmes (subprogrammes) of the Russian Federation, and other strategic planning documents.

3. Federal executive agencies which, on behalf of the Russian Federation, act as the owners of the property of federal state unitary enterprises, integrate measures aimed to ensure low carbon development of the Russian Federation in the action plans of the said enterprises, and by March 30, 2022, forward verified action plans of federal state unitary enterprises to the RF Ministry of Economy.

4. It is recommended that:

executive agencies of regions and republics of the Russian Federation and local governments abide by the Strategy for the development and implementation of regional programmes (subprogrammes) and other documents;

state corporations, State company “Russian Highways”, and joint stock companies partially owned by the state integrate measures aimed to ensure low carbon development of the Russian Federation in their strategies and by March 30, 2022, forward their verified strategies to the RF Ministry of Economy.

5. It is required that the RF Ministry of Economy ensure:

preparation and annual submission, no later than November 30 of the year following the reporting year, to the RF Government of a progress report on the Strategy implementation, including an assessment of progress towards the goals and targets of the Strategy, and a verification of the long-term GHG emission projection;

development, within 6 months, in cooperation with national agencies and organizations concerned, of an action plan to implement the Strategy and submission thereof to the RF Government.

Chairman of the Government of
the Russian Federation M. Mishustin