Abstract

“Long-term Strategy of the Russian Federation on the low-carbon development” is the key document in Russia for decarbonization of the economy [7]. It is at the draft stage and sets targets for reducing greenhouse gases emissions which are not enough to become carbon neutral by 2050. We have analyzed the Strategy and suggested 2 key target changes. The first target is to increase the share of nuclear and renewable energy in electricity generation mix to at least 70% by 2050. The second is to produce 50 ml tons of hydrogen by 2050 annually for both domestic consumption and export. These targets shall be achieved through 7 policy changes, including lowering legal barriers and promotion of renewables among the population. The combination of nuclear, renewable and hydrogen energy in future may totally replace fossil fuels from energy mix and build net zero economy.

Acknowledgment

The authors want to express their gratitude to Zhuravlev Pavel Vladimirovich (Vice-Rector – Head of the International Cooperation Department, Rosatom Technical Academy) and Fedorov Mikhail Igorevich (Head of the Nuclear Infrastructure Development Project Office, Rosatom Technical Academy) for consultations.

Proposal

Russia is joining the global trend for decarbonization of the economy. However, Russia has not set net-zero targets for its economy. For a short-term it pledged to significantly reduce its greenhouse gas emissions taking into account land use, land use change and forestry (LULUCF) by 30% compared to 1990 levels, as it is set by Nationally Determined Contribution to the Paris Agreement [2]. However, this target is almost achieved by now [10, 12].

For the long-term perspective, the comprehensive document on low-carbon development is still developing. In 2020 the draft of “Long-term Strategy of the Russian Federation on the low-carbon development” was published and it is
currently widely discussed [7]. Besides, other strategies and laws have been introduced to promote the low-carbon economy:

2. Roadmap for Hydrogen development to 2024 [5]
3. Energy strategy until 2035 [3]
5. Renewable energy sources capacity supply agreements [6]

We are going to analyze the Strategy on low-carbon development and suggest changes to it to foster the green future.

The Strategy on low-carbon development proposes 4 scenarios, but even the strictest scenario (“Intensive”) sets easily achievable targets compared to other countries. Its target is to decrease the emissions of GHG by 2050 to the level of 52% compared to 1990, whilst EU, USA, Canada plan to diminish them by 80-90% and become carbon neutral\(^1\). The summary of the Russian national indicators and targets is presented below [7, 13].

Table 1.

Actual data and targets of the Russian low-carbon Strategy

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>2020</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>GHG emissions, billion t</td>
<td>3.1</td>
<td>2.1</td>
<td>n/a</td>
</tr>
<tr>
<td>GHG emissions, billion t CO(_2)-eq (including absorption by LULUCF)</td>
<td>n/a</td>
<td>1.48 billion</td>
<td>1.619 billion</td>
</tr>
<tr>
<td>GHG emissions to 1990 level (including absorption by LULUCF)</td>
<td>n/a</td>
<td>47%</td>
<td>52%</td>
</tr>
<tr>
<td>Electricity generation, billion kW*h</td>
<td>1100</td>
<td>1080</td>
<td>1240</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electricity mix by generation:</th>
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<tbody>
<tr>
<td>Fossil Fuel</td>
<td>73%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>11%</td>
</tr>
<tr>
<td>Renewables</td>
<td>16%</td>
</tr>
</tbody>
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1 https://ec.europa.eu/clima/policies/strategies/2030_en


The draft of the Strategy lists 4 main methods of state support of low-carbon development:

1. increase in energy efficiency;
2. development of Renewable Energy Sources (RES) and other non-fossil fuel sources;
3. tax and financial incentives;
4. development of carbon capture technologies.

The Strategy highlights the high effectiveness of implemented energy saving technologies, at the same time it puts relatively low emphasis on RES and nuclear technologies. There is definitely a space for the development and investments in RES and nuclear technologies, which shall further help to reduce GHG emissions. We suggest 2 targets and 7 ways to foster the carbon neutrality.

1. Targets in share of RES and nuclear energy.

Currently nuclear energy constitutes circa 20% of electricity generation in Russia while the share of RES, including large hydroelectric power stations, is 18% [14].

We suggest to raise the share of nuclear energy to 30%. There is already a discussion to increase the share of nuclear energy to 25%, though the potential of the nuclear industry is high and promising technologies (small scale reactors, floating reactors, closed fuel cycle with fast neutron reactors) are around the corner and are capable of meeting changing demands of consumers [14]. We advise the following:

- Existing regulatory documents should be revised in order to reduce legal barriers for small scale and floating nuclear reactors. Russia has several projects in this sphere (Akademik Lomonosov floating power station, project of small scale NPP in Yakutia) which help to decarbonize remote areas.
• Creation of unified emissions trading and carbon certification systems. EU, Russia, China and other countries have introduced or planning to introduce their own certification systems. Countries should adopt the unified system for emissions trading and energy classification, and Russia should promote this initiative.

As far as RES (excluding large scale hydroelectric plants) are concerned their potential is even higher [8]. Earlier strategies promised that they would comprise 5% in installed capacity by 2024, but the newer Strategy offers this digit for 2050 [7, 11]. It is certainly a low target, which should be revised upward. Current state incentives are mainly applicable to large scale power stations. We advise to involve smaller companies and individuals in the use of RES by:

• lowering the interest rate for investments and loans for solar panels and wind turbines;
• promoting the investments in the development of smaller wind turbines and solar panels;
• raising public awareness through changes in school programs, special booklets at state service centers.

Implementation of current and proposed measures shall increase the share of RES in electricity mix to 40%.

2. Hydrogen target

Russian Energy strategy until 2035 determines that by 2035 Russia should export 2 ml ton of hydrogen annually [5]. Hydrogen is aimed for export and not for domestic consumption.

It is highly effective to use excessive power generated by nuclear power plants and RES for the production of hydrogen. The development of hydrogen technologies allows low-carbon power plants to operate at highest capacity factors generating both electricity and hydrogen. Such combination of nuclear energy, renewable
energy and hydrogen energy is proper solution to the future clean and reliable energy systems.

We suggest adding a target of 50 million tons of hydrogen produced annually by 2050 [16]. This hydrogen should come from RES and nuclear power plants. Hydrogen is also a good alternative to e-cars, as electric cars are not reliable in cold Russian climate.

A National Roadmap for hydrogen development to 2024 sets the first steps towards the hydrogen economy [5]. The following advice may also encourage the transition to hydrogen:

- State procurement of hydrogen cars for state services. This will support national manufacturing, development of technologies and guarantees the demand, which are needed for the industry at its first steps.
- Renovation of existing oil-filling station by adding equipment needed for e-cars and hydrogen vehicles.

Our measures combined with existing ones allow Russia to become carbon neutral and back up the economy.
List of abbreviations:

NPP - nuclear power plant
RES - renewable energy sources
GHG - greenhouse gases
LULUCF - land use, land use change and forestry
EU - European Union
USA - United States of America
1. The Federal Law “On emission control of greenhouse gases”
2. Nationally determined contribution of the Russian Federation to the Paris Agreement
3. Russian Energy strategy until 2035
4. Russian State program “Development of nuclear power industry”
5. Russian Roadmap for Hydrogen development to 2024
6. Renewable energy sources capacity supply agreements
7. Long-term Strategy of the Russian Federation on the low-carbon development (draft)
9. Russia Has Set an Ambitious Goal for Reducing Emissions by 2030, Michael Oshchepkov, 2021
15. The share of nuclear energy should reach 25% in Russian electricity mix by 2045, Strana Rosatom, 2021
16. Russian hydrogen energy development concept, the Government of the Russian Federation, 2021