The increased relevance of climate regulation issues in the context of a record increase in the level of greenhouse gases in the atmosphere has become a catalyst for the development of decarbonization and the implementation of programs aimed at reducing carbon dioxide emissions in many sectors of the economy. The world energy sector and hydrogen energy as one of the directions of its development are no exception.

The global demand for hydrogen energy sources is largely due to the inclusion of this area in national development programs. For 2020, the state of development of hydrogen initiatives is observed both in individual states (Fig. 1): on the territory of the EU countries, the USA, Brazil, China, Japan, Korea, Australia, Saudi Arabia, South Africa (for more information, see the Appendix), and and at the intergovernmental level, such as the Hydrogen council or H2 Mobility.

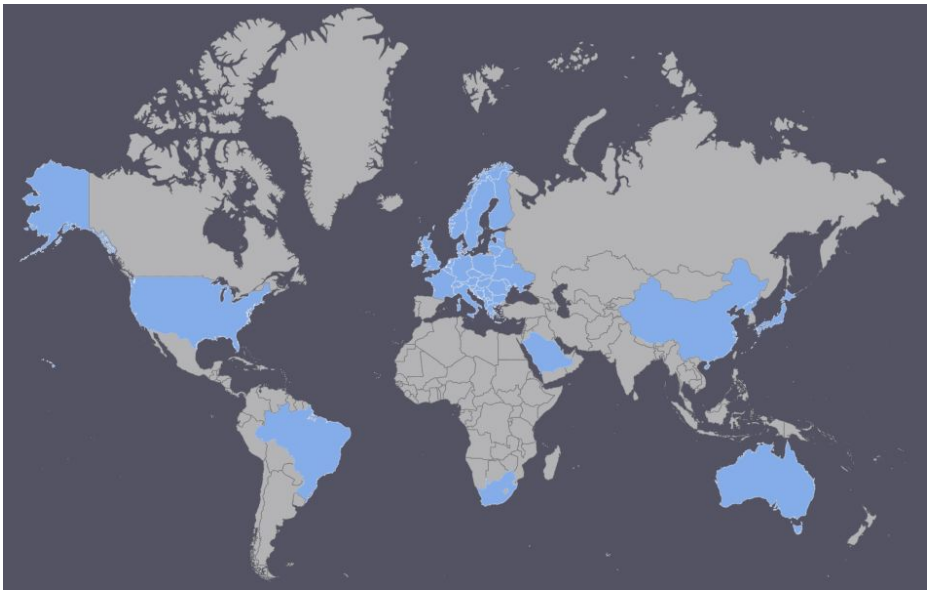

Figure: 1. Implementation by countries of programs to support hydrogen energy

The use of hydrogen as an energy source is not a fundamentally new solution: in a number of countries, existing types of fuel include a hydrogen component and related infrastructure solutions are being developed. However, a further increase in the share of low-carbon fuels will require additional investments in the development of technologies associated with its transportation over long distances and reducing the associated costs.

An unambiguous answer to the question of the development of hydrogen energy in Russia has not yet emerged. On the one hand, this is due to the smaller volume of national projects for decarbonization of the Russian energy sector in comparison with the maintenance and development of projects in the hydrocarbon and nuclear markets. On the other hand, Russia has a great resource potential for the development of hydrogen energy and a partially suitable infrastructure for its transportation. In such a situation, with the adoption and comprehensive support at the state level of the strategy for the development of the Russian hydrogen market, the volume of its production can reach significant levels on

a global scale. However, the assessment of the possible impact of the development of hydrogen energy in Russia on the competitiveness of the national energy industry remains open.

The research carried out on the initiative of “Avtopromimport” of the Higher School of Economics in cooperation with representatives of the State Corporation Rosatom was aimed at identifying the factors of competitiveness of hydrogen energy. As the basis of the methodological apparatus, a family of three-circuit ICC models for assessing and forecasting competitiveness was used. The results obtained allowed us to formulate the following conclusions:

- the most significant factor in the economically effective development of hydrogen energy in the Russian Federation is the compliance of the technologies used for hydrogen production with the requirements determined by its foreign consumers and, first of all, the scientific and technical justification for classifying hydrogen obtained at nuclear power facilities as "green" energy sources;
- an additional factor in the development of Russian hydrogen generation is a set of regulatory and legal framework, regulations for the production, storage and operation of hydrogen, as well as safety standards in this area.

As a result of the study, it was concluded that it is advisable to actively develop hydrogen energy in the Russian Federation exclusively within the framework of the implementation of a comprehensive program for its regulation, carried out in close contact between state institutions and international organizations, representatives of business, science and education, as well as in the mode of constant monitoring of the achievement of target indicators of industry competitiveness.

Appendix

Countries	Development prospects of the direction
EU countries	- Development of a decarbonization strategy and increasing the proportion of hydrogen to 24% of the final volume of energy consumption; - Obtaining hydrogen energy on the basis of other renewable energy sources: solar and wind energy; - Development of programs within the European Clean Hydrogen Alliance.
USA	- Implementation of pilot projects in the framework of electrolysis production of hydrogen at nuclear power plants.
China	- Creation of about 1 million vehicles on hydrogen fuel within a decade.
Japan	- Transition of the country's economy to a hydrogen strategy; - Increasing the share of hydrogen imports and exports of hydrogen fuel cell vehicles.
Korea	- Implementation of projects within the framework of roadmaps in the field of hydrogen economy; - Leadership in the production of fuel cells;

	- Import of hydrogen and export of fuel cell vehicles and fuel cells for power plants; - Adoption of hydrogen legislation in 2020.
Australia	- Pilot projects in the field of hydrogen energy; - Adoption of the National Hydrogen Strategy 2019; - Development of the export direction of hydrogen energy.
Saudi Arabia	- Development of prospects for the construction of hydrogen refueling stations.
South Africa	- Inclusion of vehicles on hydrogen fuel in the Public Transport Development Strategy.
Brazil	- Inclusion of the hydrogen direction in the Scientific, technological and innovative development plan of the country.