DEVELOPMENT OF THE FUEL AND ENERGY COMPLEX IN CONNECTION WITH THE ADOPTION OF THE DECARBONIZATION LAW (ON THE EXAMPLE OF AUSTRALIA)

Dr. Svetlana Punanova
Oil and Gas Research Institute of the Russian Academy of Sciences, Russia

ABSTRACT

The article, based on the current informational material, provides an overview of the mineral resource complex of Australia and the ways of its development in modern conditions. Modern requirements for the development of the fuel and economic complex of countries are caused by new challenges in connection with the need to follow the Paris Convention on Climate Change and the installation on decarbonization – a significant reduction and then a complete rejection of CO_2 emissions from the combustion of hydrocarbons. The work shows that the process of "greening" Australia provides for the creation and implementation of a completely new paradigm for the development of the fuel and energy complex. This is a complete rejection of the extraction and use of coal, an increase in gas production in compliance with environmental requirements, the development and implementation of new technologies, the expansion of gas storage facilities and a network of pipelines, as well as the parallel development and introduction of renewable energy sources.

Keywords: *Australia, fuel and energy complex, climate change, decarbonization, renewable energy sources*

INTRODUCTION

The Paris Agreement under the Framework Convention on Climate Change) was adopted on December 12, 2015 following the 21st conference of the United Nations Framework Convention on Climate Change (UNFCCC; 1992) in Paris. It was supported by all 197 members of the UNFCCC (193 UN member states, as well as Palestine, Niue, Cook Islands and the EU).

Decarbonizing the economy of the energy system is the reduction of CO_2 emissions per unit of energy generated (kg/barrel). The decision to minimize carbon dioxide emissions into the atmosphere during the development and production of hydrocarbon raw materials predetermines the need for the adoption of a new paradigm for the development of the fuel and energy complex in modern conditions. And this means a balanced and scientifically grounded combination of all types of energy raw materials. Australia, being a country with a low energy base (it has an insignificant resource of petroleum hydrocarbons, only 0.3% of the world's reserves), at the government level is taking on new challenges in connection with the doctrine of climate change. Develops and implements new global perestroika

processes of updating the complex so that the country feels confident and self-sufficient in the near future and in the future.

In the history of the exploitation of various types of fossil fuels from the 19th century to the 21st century, the energy priorities of industrial development have repeatedly changed (Fig. 1) [1].

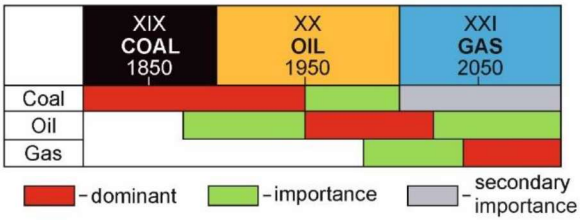

Fig. 1. *Epochs (eras) of domination (domination) of various types of fossil fuels in the world fuel and energy complex [1]*

Of all types of energy fuel, natural gas is the best type of natural resource for a number of reasons, in particular - environmental. Natural gas is becoming the means that contributes to the achievement of energy security, the growth of industrial production, the development of innovations, and the improvement of the environmental situation. Moreover, it is the environmental characteristics of natural gas as a fuel that are one of the main arguments in favor of its acquiring a key role in the global energy sector of the current century. Compared to other types of fossil fuels, natural gas emits a very significant amount of heat per unit weight, but at the same time it pollutes the atmosphere to a much lesser extent with combustion products [2].

RESULTS AND DISCUSSION

Overview of Australia's Energy Resources and the Direction of Their Development in Relation to Industry Decarbonization

Government and business structures of Australia, embarking on the path of the Paris agreements and in solidarity with the decision of the European Union on decarbonization, are taking tough measures to reconstruct their existing energy complex [3], [4], [5]. These actions go in three directions:

- complete rejection of the extraction and use of coal;
- developing and increasing gas production in compliance with environmental restrictions and expanding the construction of gas storage facilities and a network of pipelines for the domestic and foreign markets;
- powerful development of renewable energy sources based on wind, water and various modifications of solar panels.

There is a transition from a centralized system of large fossil fuels (mainly coal) to a decentralized system of widely dispersed, relatively small renewable sources in the form of wind and solar generators. And if by 2020 the energy produced by coal-fired power plants still remained high (although there is a noticeable decrease in the use of the most environmentally harmful brown coal) with a significant increase in renewable energy sources (Fig. 2), then over the next 15 years it is planned to further close two-thirds of all generating capacities of power plants working on coal [3], [4] (Fig. 3).

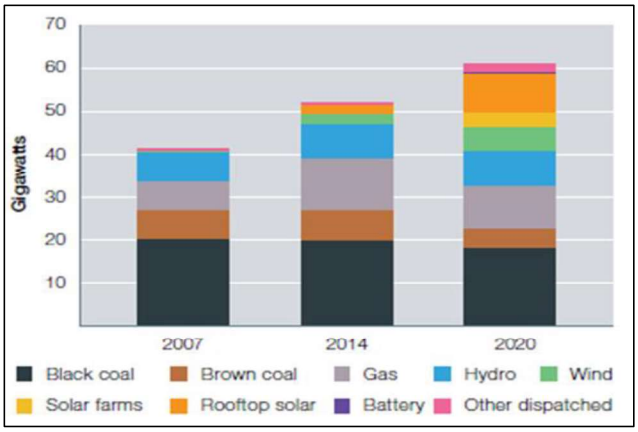

Fig. 2. *Changes in the energy sector: coal, brown coal, gas, water, wind, solar panels and other energy sources [3]*

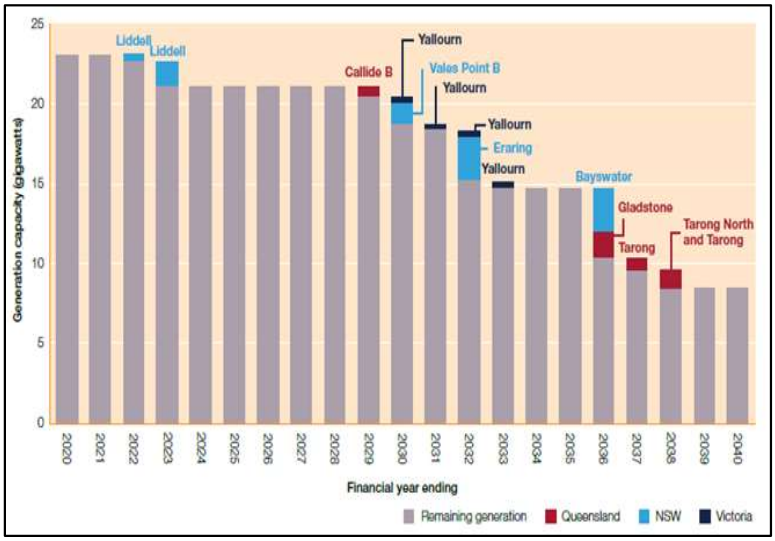

Fig. 3. *Schedule of planned reduction of coal generators in various states by 2040 (gray - residual capacity) [3]*

The first oil in Australia was discovered by a French expedition in shale rocks near Sydney in 1802. However, commercial exploitation of this field began only in

1865. The second was the discovery in 1885 of a similar Naguin field (Queensland), and the third (1886) – Salt Creek in South Australia. The beginning of commercial oil development on the island of Tasmania dates back to 1901, and in 1920 the first gas condensate well was launched in the same area on the island of Bruni. In 1907, the first offshore oil well was drilled in Albany Harbor (the drilling rig was on the shore, and the trunk went into the water) [6], [7].

A significant number of large and small proven and inferred oil and gas basins have now been identified on the continent. Thus, in the middle and eastern parts there is a vast Central Australian Basin associated with the foothill trough of the Late Paleozoic folded structures that frame the Australian Shield from the east. In this fold system in the southeast of the continent, there is a small intermontane South Australian Basin, otherwise called Gippsland, and a number of others. Australia currently holds about 0.3% of the world's hydrocarbon reserves. Most of Australia's identified hydrocarbon resources are condensate and liquefied natural gas (LNG) associated with the giant offshore gas fields in the Brouse, Carnarvon and Bonaparte basins. In addition, oil accumulations have been identified in the basins of the Perth, Canning, Amadeus, Cooper rivers (Eromanga, Bowen Surat, Otway, Bass and Gippsland oil and gas basins).

As of December 2018, oil production in Australia is 283 663 barrels/day. For comparison, the USA produces 10 961 718, Russia – 10 527 370, and Saudi Arabia – 10 058 000. The country exports 214 355 and imports 360 899 (in the same dimensions). At the same time, 51% of imported refined gasoline comes from oil refineries in Singapore, 18% from South Korea, 12% from Japan and other countries. The main proven oil reserves are located in the Gippsland oil and gas fields and nearby offshore oil fields in the Bass Strait, 65-80 km from the coast. In total, this area currently provides about 40% of oil production in Australia [8].

Australia has significant gas reserves, with gas being the third-largest energy resource after coal and uranium. Fourteen basins are gas-bearing, located both onshore and offshore (Fig. 4). The main types of gas produced in Australia are conventional natural gas and gas from coal seams. Advances in extraction techniques have improved the commercial prospects for the recovery of other forms of unconventional gas, including shale gas and gas in sandstones and tight gas carbonate reservoirs.

In Eastern Australia, almost 70 percent of the gas produced is converted into LNG for export, mainly to Asia. The remainder is sold on the domestic market. Some of the gas is stored in depleted gas fields or storage tanks. Gas sold to domestic consumers is transported from production sites to major demand centres or hubs through powerful pipelines. The lines are wide bore and high pressure to optimize lifting capacity. They supply gas for the power plants of large industrial and commercial customers, as well as for power supply companies that sell gas to their customers.

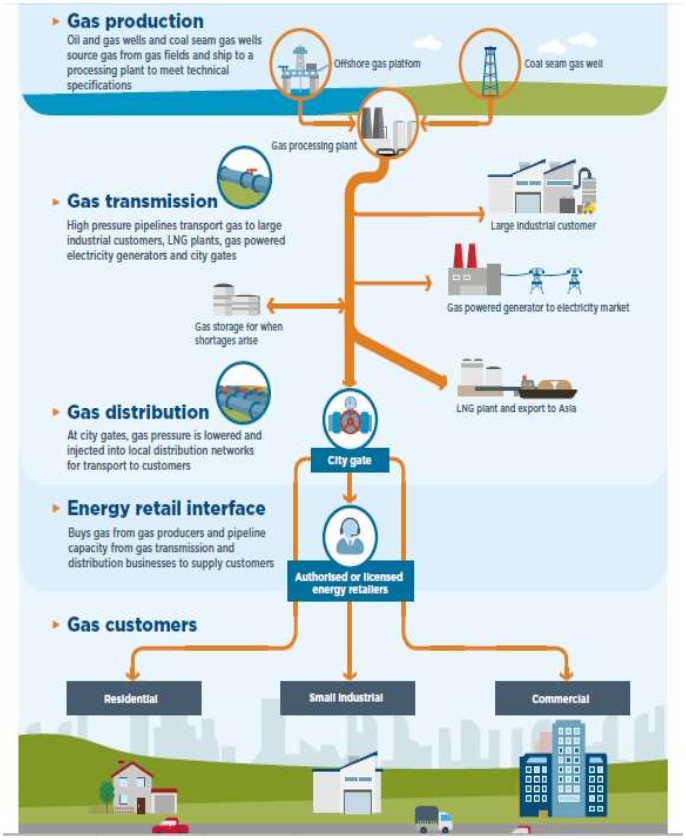

Fig. 4. *Gas supply chain [3]*

The energy market in Eastern Australia (Fig. 5) (practically all states: Queensland, New South Wales, Victoria, South Australia, Tasmania) is connected by main gas pipelines and supplies gas from the basins to industrial consumers in large settlements. The main production basins are the Bowen Surat Basin in Queensland, the Cooper Basin in northeastern South Australia and three basins off the coast of Victoria, the largest of which is the Gippsland Basin. Gas has become the main export industry in Eastern Australia. The industry has transformed the eastern gas market and has given producers the choice of exporting gas or selling it domestically. By 2018, about 61% of Australian gas production in the Eastern States was exported. When competing with overseas customers, prices in the domestic market increased. Higher gas prices are also affecting electricity markets, which have become more reliant on gas-fired generation following the closure of several coal-fired generators in 2016 and 2017 [9], [10], [11].

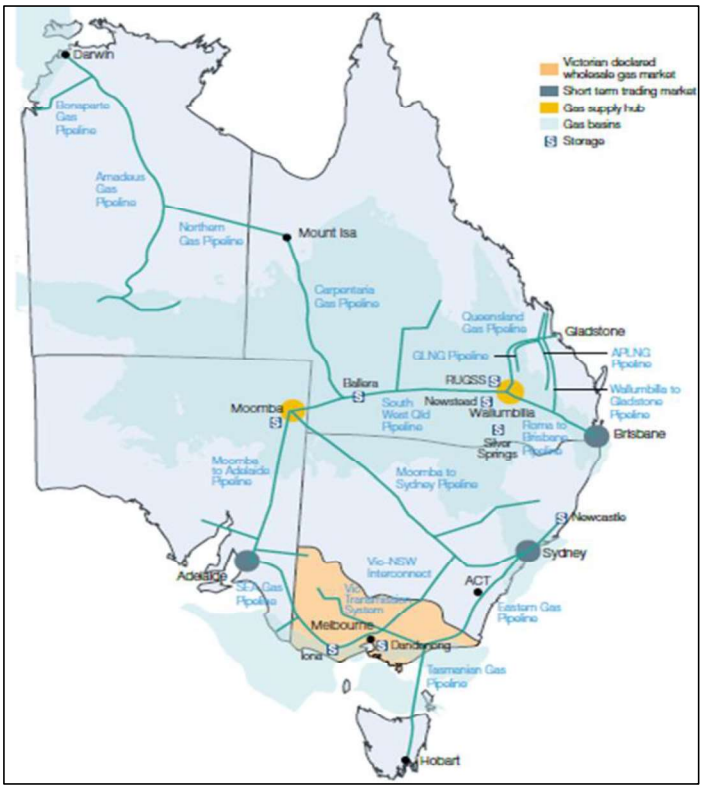

Fig. 5. *Eastern Gas basins, markets, major pipelines and storage (Eastern Australia) [3]*

CONCLUSION

Based on the example of the Australian fuel and energy complex, the article analyzes new challenges and global restructuring processes of the complex renewal, taken at the government level in connection with the decision of the European Union on decarbonization. These measures are being taken so that the country, having a not so high energy base, an insignificant resource of petroleum hydrocarbons (0.3% of world reserves), feels confident and self-sufficient in the near future and in the future. The decarbonization strategy must be well substantiated and calculated, supported by significant investments of budgetary and private capital with the involvement of a wide range of scientific research.

In Russia, such a scheme for changing the fuel and energy complex is planned for the near future (Fig. 6) [12].

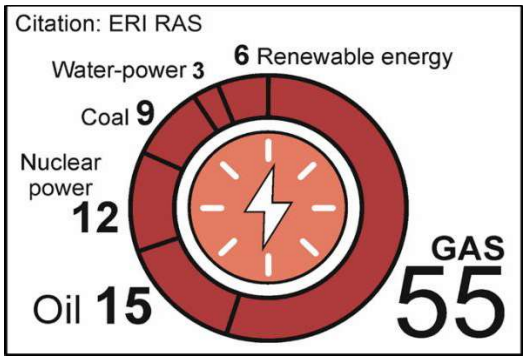

Fig. 6. *Forecast of the structure of primary energy consumption in Russia in 2040, % [12]*

Some ill-considered and politicized approach in making such global decisions leads to environmental and natural disasters. This is exactly what happened in the USA in the state of Texas in February 2021 (Fig. 7) Most of the state lost power during the historic "winter storm" [13], [14].

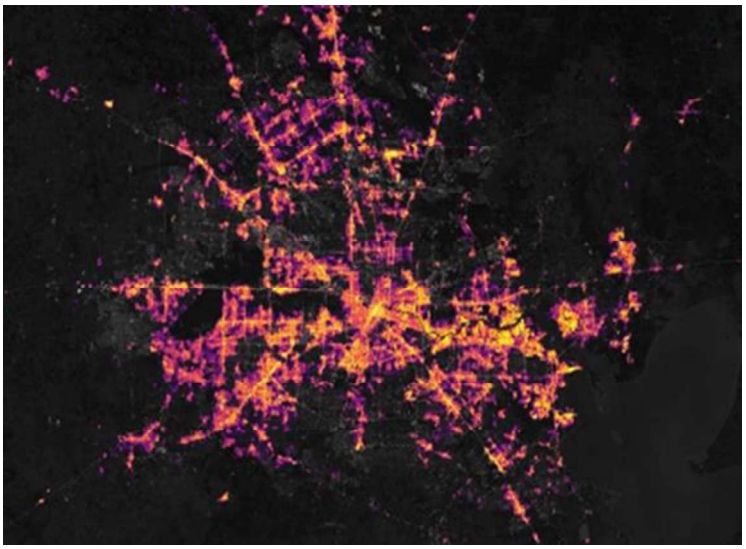

Fig. 7. *A partial blackout in Houston is captured Tuesday by a NASA satellite. Much of the state lost power during a historic winter storm (Credit: NASA [13])*

According to Emily Grubert [15], a professor of energy systems at the Georgia Institute of Technology, “The reason for this disaster stems from the fact that the country is seeking to make two energy transitions at the same time. One is the move from dirtier power plants to cleaner ones, and the other is an attempt to electrify buildings and cars that used to run on oil and gas”.

The main thing is to find a balance: not to underestimate the role of hydrocarbons and not to be late in the search for new technologies for generating energy [12].

In conclusion, it is worth citing the statement of Nikolai **Fyodorov,** a Russian religious thinker and philosopher (1826-1903): "A civilization that exploits, but does not restore, cannot have any other result than the approach of its own end."

ACKNOWLEDGEMENTS

This work was written as part of a state assignment on the topic of "Development of the Scientific and Methodological Foundations of the Search for Large Accumulations of Hydrocarbons in Nonstructural Traps of a Combined Type within the Platform Oil and Gas Basins."

REFERENCES

[1] Skorobogatov V.A. A new paradigm for the development of the energy complex of Russia in the first half of the XXI century. Neftegaz. RU, v. 89, issue 5, pp 80-89, 2019.

[2] http://www.pro-gas.ru/ecolog/ecol_full/

[3] State of the Energy Market Australian Energy Regulator. Melbourne, Victoria 3000. First published by the Australian Competition and Consumer Commission 2020, 281 p. © Commonwealth of Australia 2020. www.aer.gov.au

[4] Quarterly energy dynamics. AEMO Q4, February, 2020.

[5] Newcastle gas terminal given critical status. NSW Government, Media release, August, 2019.

[6] Krajushkin V.A., Klochko V.P., Guseva E.E., Maslyak V.A. Progress in oil and gas exploration on the continental slopes of Australia and New Zealand. Geology and Mineral Resources of the World Ocean, issue 1, pp 88-102, 2012.

[7] Punanova S.A. On some priority directions of development of the oil and gas complex. Materials Int. scientific and practical conf. "On a new paradigm for the development of oil and gas geology." Kazan, Ikhlas, 2020, pp 170-174.

[8] https://theconversation.com/australia-imports-almost-all-of-its-oil-and-there-are-pitfalls-all-over-the-globe-97070)

[9] Gas inquiry 2017–2025. Interim report, ACCC, January 2020, February 2020, 29 p.

[10] Australian LNG projects. APPEA, web page, available at: www.appea.com.au/oil-gas-explained/operation/australian-lng-projects/. 2020.

[11] Department of Industry, Innovation and Science, Resources and energy quarterly, Energy Quest, Energy quarterly, March, 2020.

[12] Rossiyskaya Gazeta: Special Issue Energetic. December 22, 2020, issue 8342 (rg.ru) https://cdnimg.rg.ru/pril/fascicle/4/20/09/42009-1608570690.pdf

[13] Storrow B. Why the Deep Freeze Caused Texas to Lose Power Issues with natural gas supplies and the grid's isolation both factored in to the massive. E&E News. Scientificamerican. February 18, 2021. https://www.scientificamerican.com /article/why-the-deep-freeze-caused-texas-to-lose-power/

[15] https://thebell.io/idealnyj-shtorm-ili-proval-alternativnoj-energetiki-tri-prichiny-energeticheskogo-krizisa-v-ssha, 2021.

[16] Grubert E. http://emilygrubert.org/