

## Review of the «Global and Russian energy outlook up to 2040»

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### Abstract

The Global and Russian Energy Outlook up to 2040, prepared by the Energy Research Institute of the Russian Academy of Sciences and the Analytical Center for the Government of the Russian Federation, analyses the long-term changes in the main energy markets and thereby identifies the threats to the Russian economy and energy sector.

Research has shown that shifts in the global energy sector, especially in hydrocarbon markets (primarily the development of technologies for shale oil and gas extraction), will result in a slowdown of Russia's economy by one percentage point each year on average due to a decrease in energy exports comparison with the official projections. Owing to the lack of development of an institutional framework, an outdated tax system, low competition and low investment efficiency, Russia will be the most sensitive to fluctuations in global hydrocarbon markets among all major energy market players within the forecast period.

### Keywords:

scenario approach, optimization model, energy markets forecast, energy consumption, Russian energy sector.

### 1. Introduction

In recent years, the global energy sector has undergone significant changes: the global crisis has been accompanied by high price volatility for hydrocarbons; there has been a noticeable slowdown in demand and increased competition in the traditional Russian regional energy markets; and most importantly, new technologies have redrawn the international hydrocarbons trade in a direction unfavourable for Russia. To study the ongoing changes, the Energy Research Institute of the Russian Academy of Sciences (ERI RAS) has developed its own methodology for the long-term forecasting of global energy markets and in cooperation with the Analytical Center under the Government of the Russian

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Federation has prepared the "Global and Russian Energy Outlook up to 2040" (hereinafter referred to as Outlook 2013) [1].

## 2. The Purpose and Methodology of the Study

The main purpose of Outlook 2013 is the evaluation of the trends in the world's hydrocarbon markets (i.e., markets for the major energy resources exported by Russia), of their changes in view of anticipated technological breakthroughs and of the implications of these changes for Russia's energy sector and economy. Therefore, the authors developed the following:

- the baseline scenario for the world energy sector and fuel market development - primarily based on existing energy technologies;
- versions of the baseline scenario that would take place in the event of the success / failure of imminent technological breakthroughs in the production and consumption of hydrocarbons and their substitutes ("Shale Breakthrough", "Shale Failure", "Electromobile World", etc.);
- the forecasts of Russian energy development in view of transformations in global hydrocarbon markets and the assessment of their impact on the country's economy.

The novelty of the methodology used in Outlook 2013 lies not so much in the modelling of the production and consumption of certain energy resources. Instead, methodology mainly focusses on the modelling of the fossil fuels market conjuncture (liquid, gaseous and solid fuels) and prices, which seem to be more relevant given the radical transformation of global energy markets and increased competition between different energy sources.

The global scenarios were computed by the global energy markets forecasting block of SCANNER (ERI RAS modelling and information complex) [2], which includes models for energy consumption, liquid, gaseous and solid fuels markets, the electricity sector and the energy balances of the main countries and regions of the world. The equilibrium of production and consumption, as well as the equilibrium prices of fuels, were calculated for all regional fuel markets. An analysis of their sensitivity to changes for the most important resources and technological factors was performed, and the role of major market participants, especially Russian ones, was evaluated as well.

The results of the global outlook were used to make a detailed forecast of the development of the Russian economy and energy sector, enabling the assessment of the associated risks and prospects in the global context. Forecasts for the energy

and economic development of Russia relative to the baseline, as well as marginal “Shale Failure” and “Shale Breakthrough” scenarios, were made using the Russian energy sector forecasting block of SCANNER [2], with the assessment of their impacts on the country’s domestic demand, production, export of energy resources and consequences for the economy.

### 3. Study Results

The study reveals quite a modest forecast for global economic growth due to the impact of the global economic crisis, which, when accompanied by energy efficiency, leads to moderate energy consumption projections. According to Outlook 2013, the world’s consumption of primary energy would increase by only 40% (approximately 1.1% annually) from 2010 to 40, which is threefold lower than the average annual GDP growth and significantly slower than the energy consumption growth observed over the past 30 years (see Fig.1 and Fig.2).

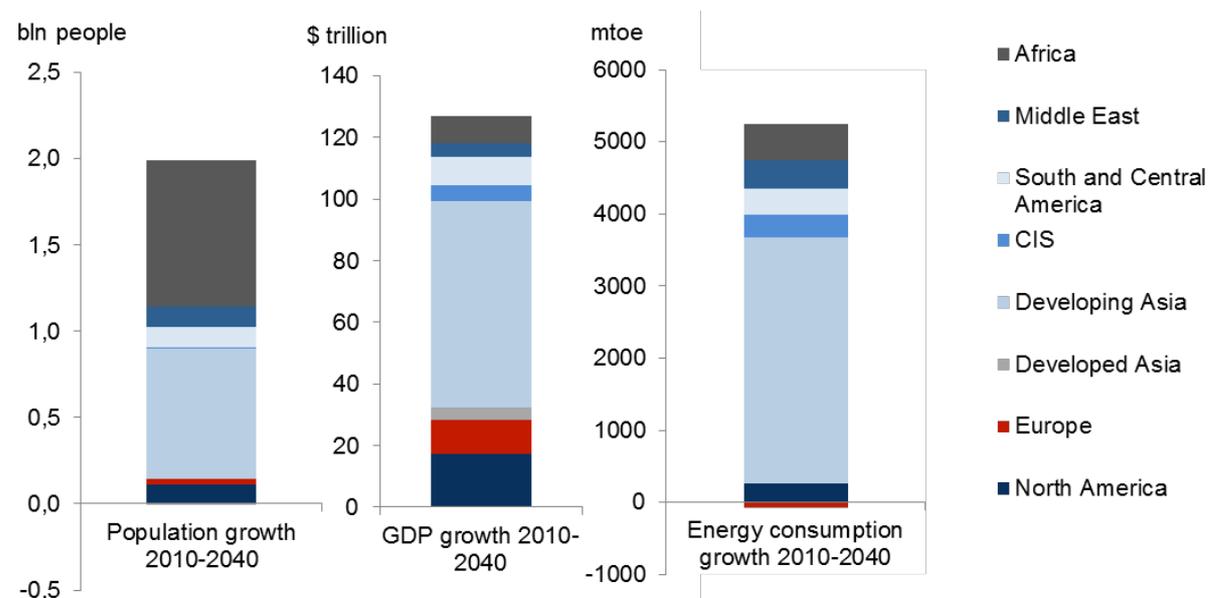


Fig.1. The world energy consumption and GDP

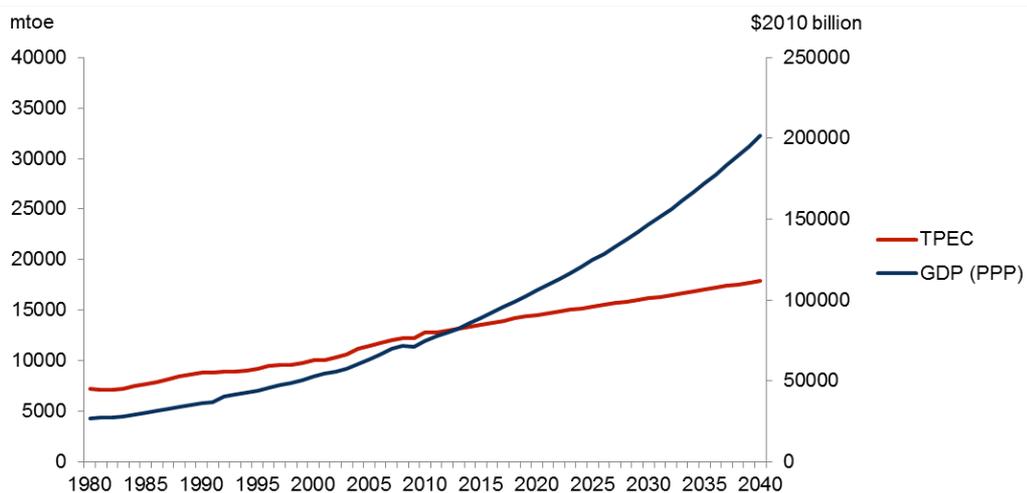


Fig.2. The world energy consumption and GDP

An important conclusion of the study is that hydrocarbons would remain the basis of the world's energy over the period under review: in 2040, their share will amount to 51.4% of the total primary energy consumption, which is not significantly different from the 53.6% share hydrocarbons constituted in 2010 (see Fig.3). At the same time, the structure of the world's energy consumption will become more diversified and balanced: the shares of fossil fuels will gradually level off (oil consumption will drop to 27% and coal to 25%, while gas consumption will increase to 25%), and they will be approached by other non-fossil sources (23% in total), thus strengthening inter-fuel competition and energy security. However, due to a slowdown in the economy, followed by tighter budget constraints, and, on the other hand, increased availability of hydrocarbons as a result of the shale revolution, the growth of non-hydrocarbon energy sources is expected to be slower than it was previously estimated. In fact, the shale revolution will postpone the danger of running out of economically viable oil and gas resources for another two or three decades, a danger that seemed so close 5-7 years ago (however, it will not prevent the decrease in oil shares from 32% to 27%). The absolute increase in consumption and the expansion of its niche in the fuel mix will be attributed to gas; thus, gas will be the most popular type of fuel over the next 30 years (although renewable energy sources will show a higher rate of consumption growth).

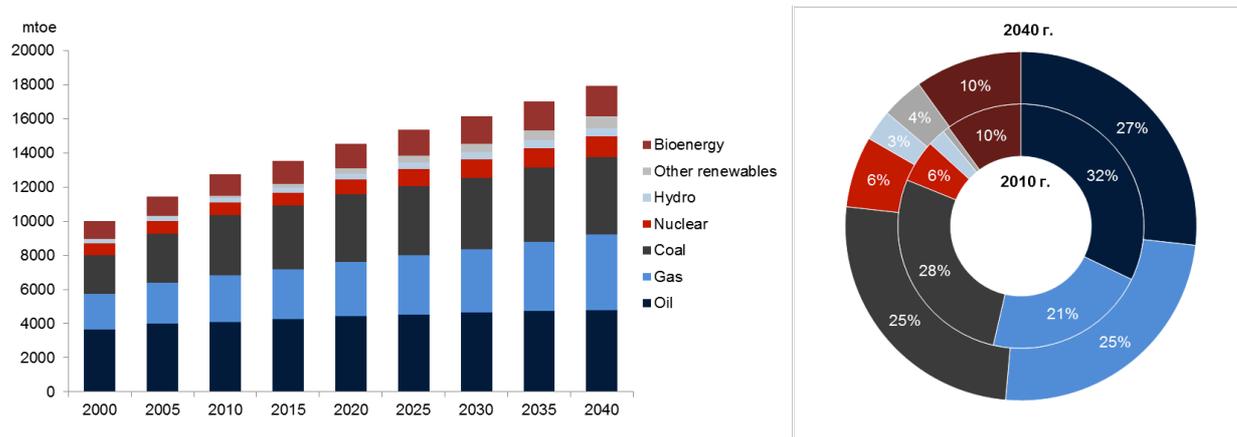


Fig.3. World primary energy consumption by fuel type in 2010 and 2040

The transformation of the world's energy markets will significantly alter the positions of the major global energy players. The pioneer of the shale revolution will receive the greatest benefits: within the next decades, the USA will gain energy independence, encouraged by low prices for hydrocarbons, which will boost the country's "new industrialisation". After 2030, owing to the development of shale oil production, the USA will already be able to cease oil imports from all countries except Canada and South America (i.e., the fields held in US companies' portfolios). Such strengthening of the USA's external position in the global oil market, coupled with its energy independence, could lead to serious geopolitical shifts. At the same time, research shows a drastic weakening of OPEC's market power: its ability to influence the price of oil will decrease to only \$[... -2 +7] / bbl in 2030 (see Fig.4).

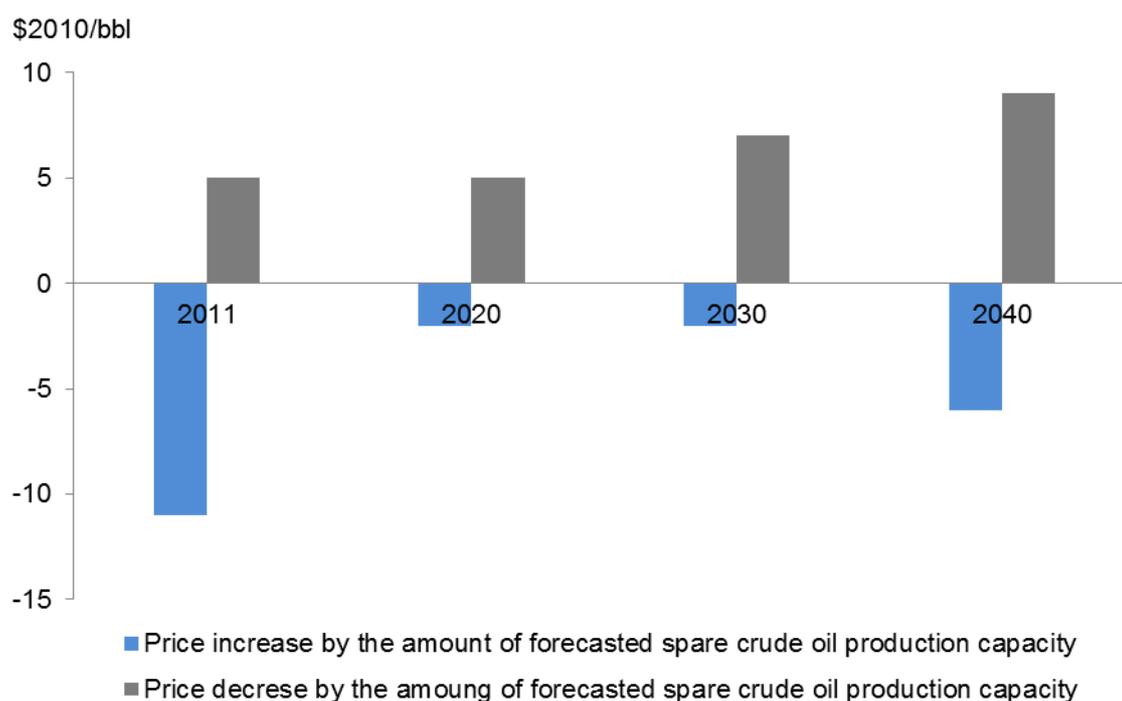


Fig.4. Changes in the balance price depending on OPEC policy, Baseline Scenario

As far as the international gas trade is concerned, it has already undergone significant changes under the effects of the USA shale gas production. Even as it remains an exclusively regional phenomenon, the shale revolution has led to the redistribution of LNG global flows. This effect will only be enhanced with the start of LNG exports from the USA and Canada in 2016-2018, which are likely to streamline to attractive Asia-Pacific markets first and, to a lesser extent, to the markets of Latin America and Europe as well. North America will have a complete gas self-sufficiency by reducing its dependence on any outside supplier, and at the same time, it will be able to contribute approximately 100 bcm of gas to the global LNG market, flexibly responding to the market situation and quickly redirecting supplies to the most profitable regional markets (see Fig.5). The USA and China (the country, which has its own large reserves of unconventional gas, and successfully carries out the policy of import diversification, builds the required infrastructure at a fast pace and enhances its position in other regions by national companies becoming engaged in the development of gas resources) will be the most influential participants in the gas market, on par with Russia.

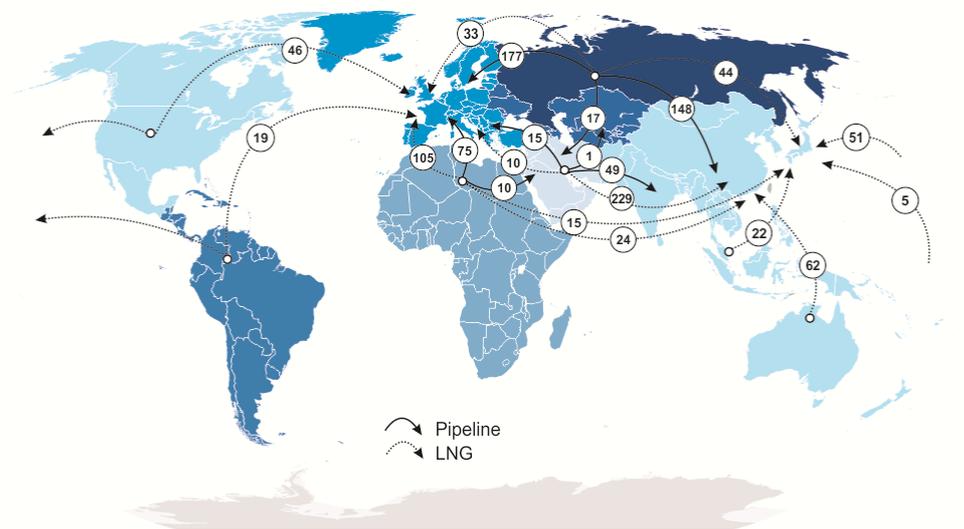


Fig.5. Inter-regional gas trade in 2040, Baseline Scenario, bcm

What is most important is that the United States will have the opportunity not only to carry out the large-scale export of oil and gas, but it will also be able to hold low prices on hydrocarbons for 2-3 years if it so desires. This could cause serious problems for Russia and the "weak" members of OPEC, which may create pre-conditions for a possible collapse of the organisation.

Russia will remain a key participant in the oil and gas markets, maintaining its leadership in gas production and export (although its export performance will be lower than the figures indicated in the official forecasts). However, Russia's bargaining position will weaken as investments in expensive projects that will be marginal for all export markets will make it vulnerable even to unsubstantial market fluctuations - it will be Russian gas and oil that will be pushed out of the market by cheaper suppliers.

An important objective of Outlook 2013 was to investigate the impact of technological breakthroughs on the situation faced by hydrocarbons markets. First, the effect of further breakthroughs in the technology of shale and tight oil and gas production (with lower production costs and low or zero water use) was assessed.

An analysis of oil and gas supply and demand curves (including those of unconventional sources) in this scenario revealed that there were no substantiated reasons for alarmist predictions of either too high or extremely low oil and gas prices. In fact, in all scenarios, ranging from the continued success to the possible failure of shale oil and gas production technologies, the equilibrium price of oil<sup>2</sup> up to 2040 does not fall of the range of \$100-130 (2010) per barrel (see Fig.6); gas prices remain highly differentiated in accordance with regional markets, with no signs of a strong decline.

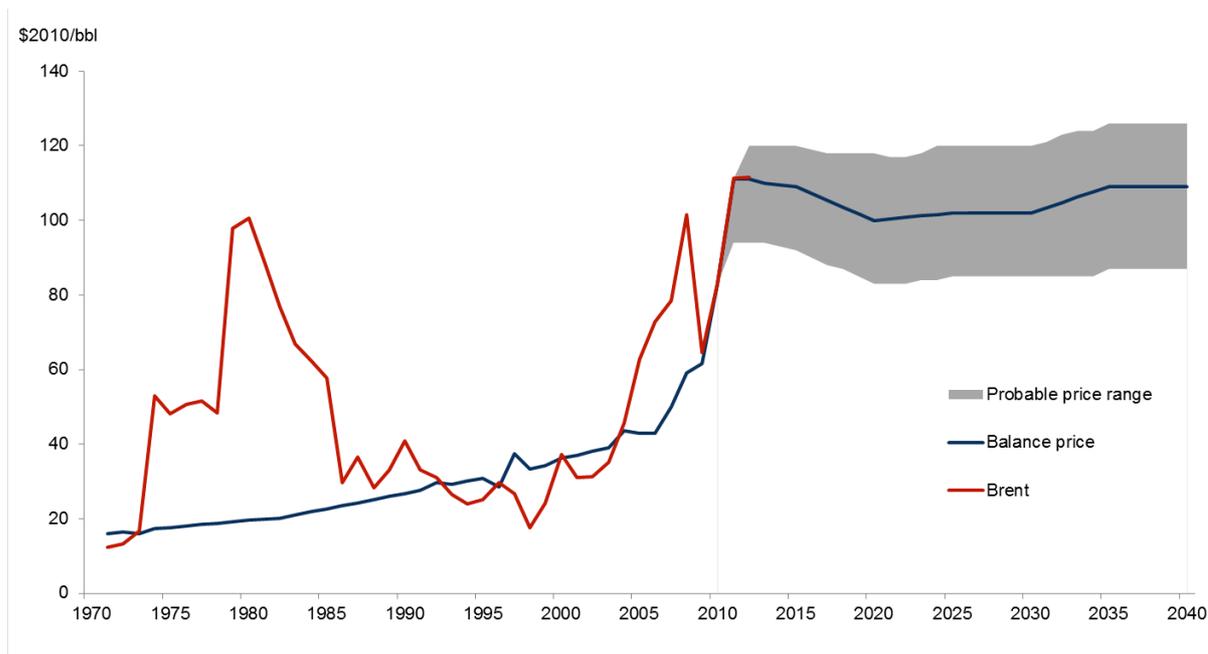


Fig.6. Projected price range of equilibrium oil prices

<sup>2</sup> The equilibrium price of oil is a price at which oil production in conventional and unconventional fields and the commercially viable options of oil substitution will satisfy demand in the particular year of the forecast period (factually reflecting the point of intersection of supply and demand).

However, the absence of a sharp fall in prices does not indicate that this “Shale Breakthrough” will be “safe” for traditional suppliers. The analysis shows that, although the oil and gas markets remain well balanced, the balance of leading players’ forces in these markets will change significantly. Some global players will gain more opportunities to influence, which for others will mean a loss of position.

In this scenario, the winners will be the USA, which will become the largest producer of hydrocarbons in the world, and China (by reducing the volume of imports in relation to the baseline scenario figures and owing to the development of its own shale deposits after 2020). The loser in this scenario will be primarily Europe. At low oil prices (relative to the baseline scenario), large amounts of European oil will be displaced from the market, the North Sea off-shore projects will not be put into operation, the attractiveness of renewable energy will decrease relative to that of hydrocarbon fuels and the dependence on imports will increase (See Fig.7 and Fig.8).

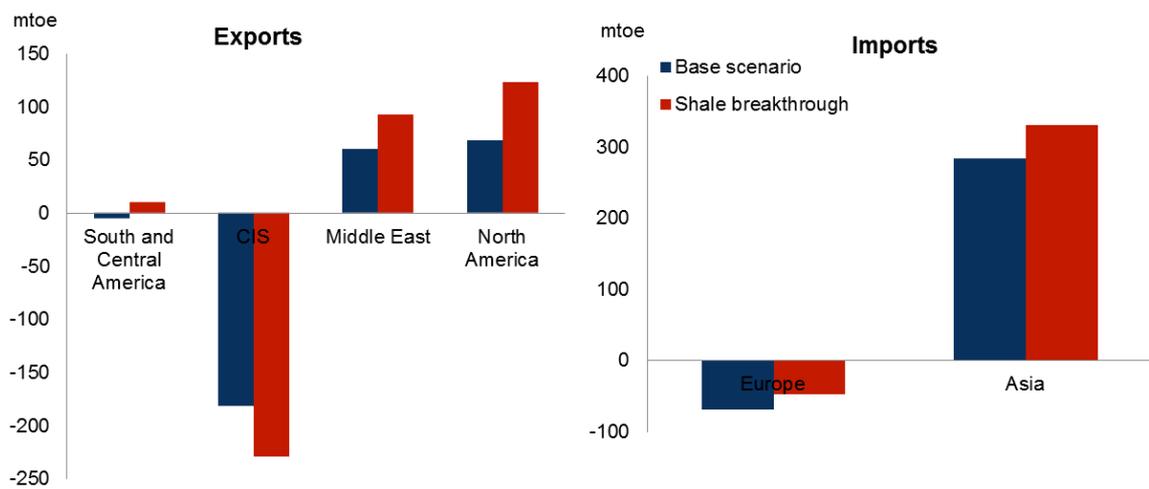


Fig.7. Changes of oil net export and import volumes in 2040 relative to 2010, Baseline and “Shale Breakthrough” Scenarios

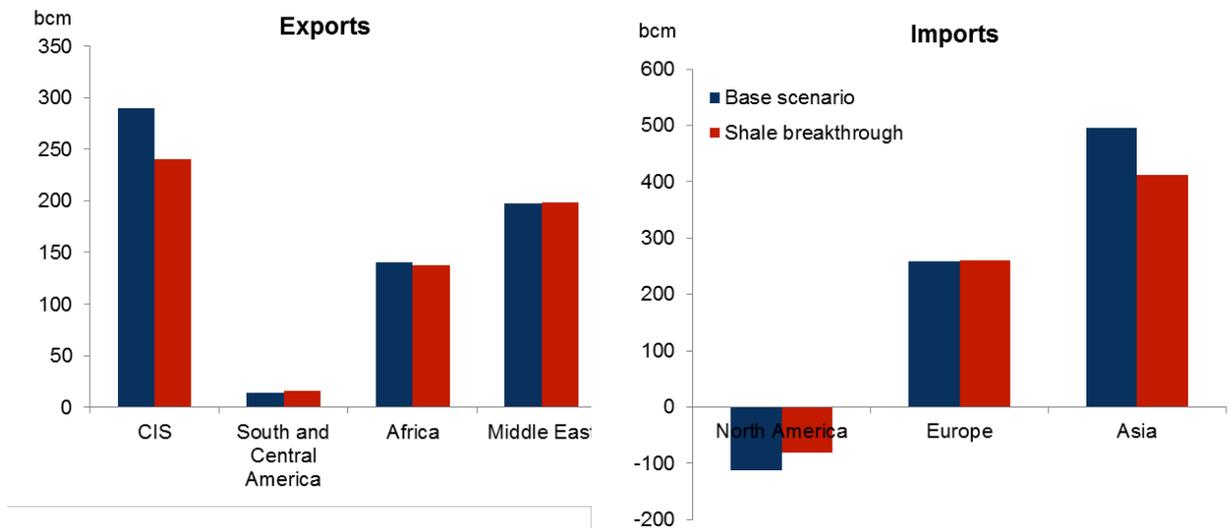


Fig.8. Changes of gas net export and import volumes in 2040 relative to 2010, Baseline and "Shale Breakthrough" Scenarios

A decrease in OPEC production and a reduction in OPEC's market share will be almost inevitable in this scenario between 2025 and 35. By 2040, the OPEC market niche will stabilise somewhat, but this scenario will almost completely deprive the cartel of the ability to influence the world price of oil at the midpoint of the forecast period.

CIS countries and Russia will be affected most of all in the "Shale Breakthrough" scenario. For Russia, this scenario will reduce the nation's oil production and exports by 50 mln tons by 2020, compared to the baseline scenario, and the export of Russian gas will drop by 70 bcm.

In addition to shale technologies, a large impact on hydrocarbon markets may give rise to other technological breakthroughs. Outlook 2013 primarily analyses the prospects for the replacement of petroleum-based fuels in the transport sector with gas, biofuel and electricity. In the long term, serious changes may cause the development of another type of unconventional gas, such as gas hydrates.

The analysis shows that Russia will become the most vulnerable exporting country in the case of almost any technological breakthroughs. Objectively favourable transformations in global energy markets, especially hydrocarbon markets, will generate additional risks to the Russian economy and energy sector. Outlook 2013 provides preliminary estimates of these effects on the country's economic growth due to a decrease in energy exports (see Fig.9). The calculations show a significant decrease in the volumes of Russian oil supplies, compared to

official Russian forecasts, that external markets would be able to absorb. According to the modelling results, Russia's position in the global market is moving towards that of a marginal supplier with the highest associated costs (for new fields and provinces) and with underutilised production potential. As a result, Russian exports of oil and petroleum products will decline by 25-30% after 2015, compared to the official forecast of the Russian Ministry of Economic Development (MED) [3], which implies that the annual loss will amount to \$100-150 bln of GDP and gas exports will decrease by 15-20%, a \$40-50 bln loss of GDP per year (see Fig.10). The country may lose another \$40-50 bln of GDP annually due to reduced oil and gas prices in the case of the "Shale Breakthrough" scenario.

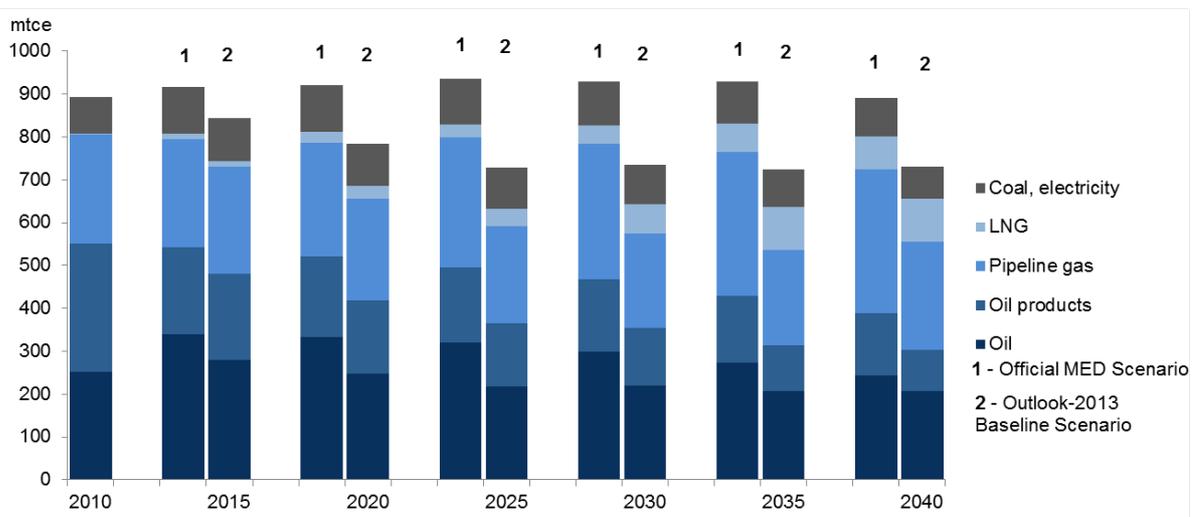


Fig.9. Energy resources exported from Russia by fuel type

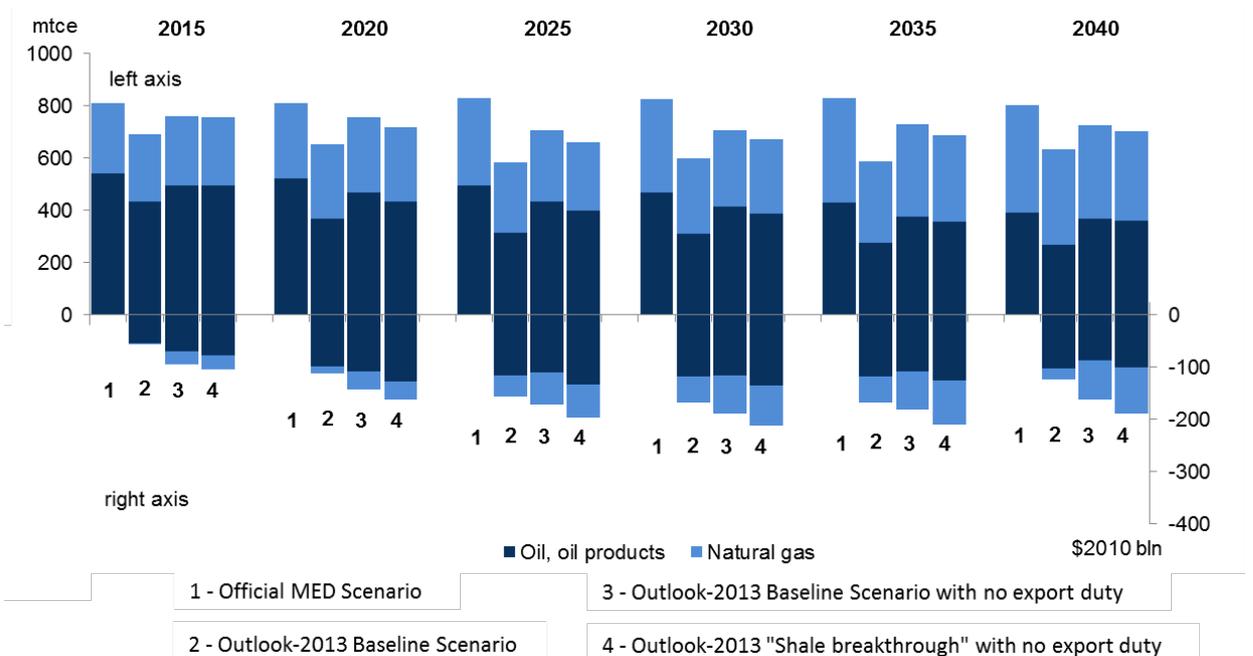


Fig.10. Energy export volumes (top) and decrease of its contribution to Russia's GDP (bottom) in the different scenarios of Outlook-2013

This decrease in revenues from gas exports and from oil sales will reduce the contribution of hydrocarbon exports to GDP by one-third. ERI RAS calculations show that strong multiplier effects typical for oil and gas industries and a decrease in the flow of foreign capital will significantly strengthen the impact of the export revenue recession and will slow down the development of the economy by one percentage point per year.

Thus, the conclusions of this research are quite alarming for Russia: in the future, the country will become the most sensitive to fluctuations in market conditions among all other major energy market players. The high costs of most energy projects (1.5-2.5 times greater than similar foreign figures), the lack of competition and an inadequate tax system will limit the competitiveness of Russian energy resources in global markets. Russia will face such severe restrictions in external energy markets for the first time. Therefore, the country's timely adaptation to these factors should be the most important task of Russian energy policy.

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