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Exploring the implications of Russian Energy Strategy project for oil refining sector

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ABSTRACT

Downstream is historically a problematic sector of Russian petroleum industry, suffering from many issues: low efficiency, import dependence and inferior products quality. In an effort to combat these problems, a large-scale modernization and renovation program has been initiated in 2011 resulting in over 35 billion US$ investments up to date, yet still many challenges remain. Russian government identifies development of hydrocarbon refining as one of the priorities of the country's strategic development, and as such has included several goals as a part of the Energy Strategy of Russia up to 2035 project to serve as guidelines for the industry.

In our research we have explored the implications and adequacy of these goals. Using the developed modeling tool, we composed a long term forecast of petroleum products output and investment up to 2035. The calculation show, that a full-scale renovation of the sector to meet the advanced global standards would require over 90 billion US$ of additional investment. The goals set by the Energy Strategy project were found to be lacking in several key areas. We propose adjusting the goals to include additional target indicators and put extra emphasis on the cooperation between government and companies, both domestic and international.

1. Introduction

For many years Russian Federation has been a major player in the global liquid fuels markets, as one of the world leaders in crude oil production and refining, as well as petroleum products exports. However, for a long period of time Russian petroleum industry had a pronounced leaning towards the upstream sector and crude exports; with the downstream receiving only a fraction of attention and investment. It was only in the early 2010's that the sector received proper attention. Yet, oil refining in Russia is still lagging behind in efficiency, which is reflected in several key qualitative parameters: Nelson Complexity Index[1] (Johnston, 1996); share of straight-run products in the refinery output[2]; production of high-quality motor fuels per ton of refined feedstock.[3] The further development of the downstream sector is one of the priorities of Russian energy policy, established by the Energy Strategy of Russia up to 2035 project[4] (Minenergo of Russia, 2017a).

This article aims to pinpoint the main challenges faced by the Russian downstream sector; conduct the analysis of goals set by the Energy Strategy Project to overcome these challenges and work out recommendations for improvement of Russian strategical approaches in the field of oil refining. For the sake of this research a long term forecast of major industrial and economic indicators of the downstream sector up to 2035 was composed with the use of the SCANER model complex developed by ERI RAS (Makarov, 2011). The modeling approach, presented in the study has shown its validity over the course of development of ERI RAS Global and Russian energy outlooks (Makarov et al., 2014, 2016) and may be adopted for analysis of other petroleum refining countries, first and foremost the Eurasian Economic Union, as the authors have already conducted an in-depth analysis of key technological and economic parameters of oil refining in the region (Kapustin and Grushevenko, 2017). The forecast will help evaluate the changes in the industry, the dynamics of domestic fuel balance and the industry's export potential.

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[1] The Nelson Index complexity index to quantify the relative cost of components that make up a refinery. It is a pure cost index that provides a relative measure of the construction costs of a particular refinery based on its crude and upgrading capacity and, by extension, the technological level of a given refinery.

[2] Straight-run distillation products (gasoline fraction, naphtha, light gasoil) and residues (vacuum gasoil, fuel oil).

[3] First and foremost, high-octane gasoline and low-sulfur diesel fuel of advanced environmental classes.

[4] Henceforth referred to as Energy Strategy Project.

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Table 1
The plans for refineries modernization and their current status.
Source: Compiled by the authors based on: Qadripartite agreements; Oil companies' plans; Ministry of Energy reports; dataset by KORTES (2013).

Petroleum refining processes	Existing capacity in 2011, million tons/year	The sum of planned additional capacities by 2020, million tons/year	The degree of plans implementation in 2017
Upgrading processes	**56,35**	**51,9**	**44%**
Catalytic cracking	22,4	11,5	49%
Hydrocracking	8,3	40,4	23%
Visbreaking	18,13	Not included in the Agreements	
Coking	7,52	Not included in the Agreements	
Conversion processes	**94,75**	**70**	**26%**
Gasoil hydrotreating	55,0	44,8	26%
Catalytic reforming	30,85	7,2	24%
Isomerization	6,1	7,1	35%
Naphtha hydrotreating	1,3	8,5	17%
Alkylation	1,3	1,9	24%
Oxygenation	0,2	0,5	0,70%
Total	**151,1**	**121,9**	**34%**

2. Background

2.1. Analysis of the recent developments and current state of the Russian downstream sector

The annual cumulative crude processing capacity in Russia exceeds 300 million tones, made up by 32 major[5] as well as over 50 smaller refineries. Yet, despite the sheer volume of installed capacity, the downstream sector can hardly be characterized as advanced, as it is troubled by many persistent issues. In this chapter we will identify the most pressing strategic challenges for the sector as well as the recent developments.

Undoubtedly the most significant of hurdles for the downstream sector is the poor technological outfit of Russian refineries. This is illustrated by a relatively low average Nelson Complexity Index of 5.5. To put in perspective, according to data from the Oil & Gas Journal survey (OGJ, 2017) the global average is around 6, while the technically sophisticated USA downstream sector's average exceeds 11 (EIA, 2017). This causes many setbacks, with the most prominent being a disproportionally large share of fuel oil and straight-run products in the balance of Russian refineries and, consequently, a fairly tight supply-demand balance for high-octane gasoline.

Steady gasoline supply is one of the important factors for economic development and social stability and shortages of this important fuel were referred to as "nonsense for Russia" by then prime-minister Vladimir Putin in 2011 (BBC Russian, 2011). Thus, over the years, the Russian government has taken a number of fiscal and administrative measures, to ensure sector's development.

Since the mid 2000-s Russia has witnessed a considerable increase in the volumes of crude oil refining, from 207 million tons in 2005–290 million tons in 2014. Apart from the growing domestic market, this growth was largely supported by a system of tax incentives in the form of reduced customs duties for oil products in relation to crude oil (SKOLKOVO Energy Centre, 2013). The aim of these incentives was to secure investment into the downstream sector by providing increased refining margins and financial resources for the oil companies. Yet the ultimate effect of this policy was the rapid development of a very specific segment of oil refining: primitive splitting of oil into straight-run distillates with their subsequent export. Despite these half-products' low value, such activities were profitable due to the difference in export duties. This way, the growth of domestic oil refining had little to none effect on production of high-quality motor fuels and the sector's technological development, as up until 2014 Russia experienced gasoline crises (Kapustin and Grushevenko, 2016).

In 2014 a major reform of the hydrocarbon taxing system has been initiated, known as "tax maneuver". A part of this reform was the elimination of incentives to export fuel oil and straight-run oil products. The duty on fuel oil ("mazut" in Russian classification) was equated with duty on crude; the duties on naphtha and high-sulfur diesel were also raised substantially (Gazprom Neft, 2017). The downstream sector reacted with a steady decline in refining volumes in 2015 and 2016, and several of refining companies have reported a major drop in profitability (Ivashenko and Zorina, 2017; Podobedova, 2015). Yet still, the new system maintains incentives for complex refineries as the duties on motor gasoline and diesel were even reduced.

To compensate for tax incentive policy, which has shown dubious effectiveness, the Russian government has demonstrated a more direct approach to ensuring the refining sector development. It came in the form of Quadripartite Agreements between oil companies, FAS (Federal Antimonopoly Service), Rosstandart (Federal Agency on Technical Regulating and Metrology) and Rostechnadzor (Federal Environmental, Industrial and Nuclear Supervision Service). Signed in 2011, these agreements, that included most of the major oil companies, contained detailed plans for massive refineries modernization up to the year 2020, which were developed as a joint effort of the government and the companies. Moreover, the oil companies were legally bound to carry out their refinery modernization plans while public authorities were tasked with monitoring the execution and punishing non-compliance (Kapustin and Osipova, 2015).

The plans were extremely ambitious, amounting to almost doubling the total secondary processes capacity of Russian refineries. As of 2017, the Quadripartite Agreements enjoyed relative success, as more than 32 billion $ have been invested in refineries modernization and over 60 refining units have been built and reconstructed (Novak, 2016). Yet these capacities make up only a third of the initial projects (Table 1). The underfulfillment of plans can be attributed to the following factors:

- The plans, compiled during the hydrocarbon price boom were inherently overreaching;
- Excessive focus on production of diesel fuel on the background of struggling domestic demand and shrinking export niches in Europe;
- Unfavorable prices for oil and petroleum products in 2014–2016, and the economic crisis in Russia.

As things stand, it is almost certain that the modernization plans will not be carried out in their entirety by 2020.

The other major challenge for Russian refineries is a high level of import dependence. The most prominent is the dependence on external supply of catalysts for petroleum refining. Minenergo (2015) evaluated the extent of this dependence for the key catalytic refining processes (Table 2).

We estimate current overall annual consumption of catalysts in

[5] With annual crude refining capacity in excess of 2 million tons.