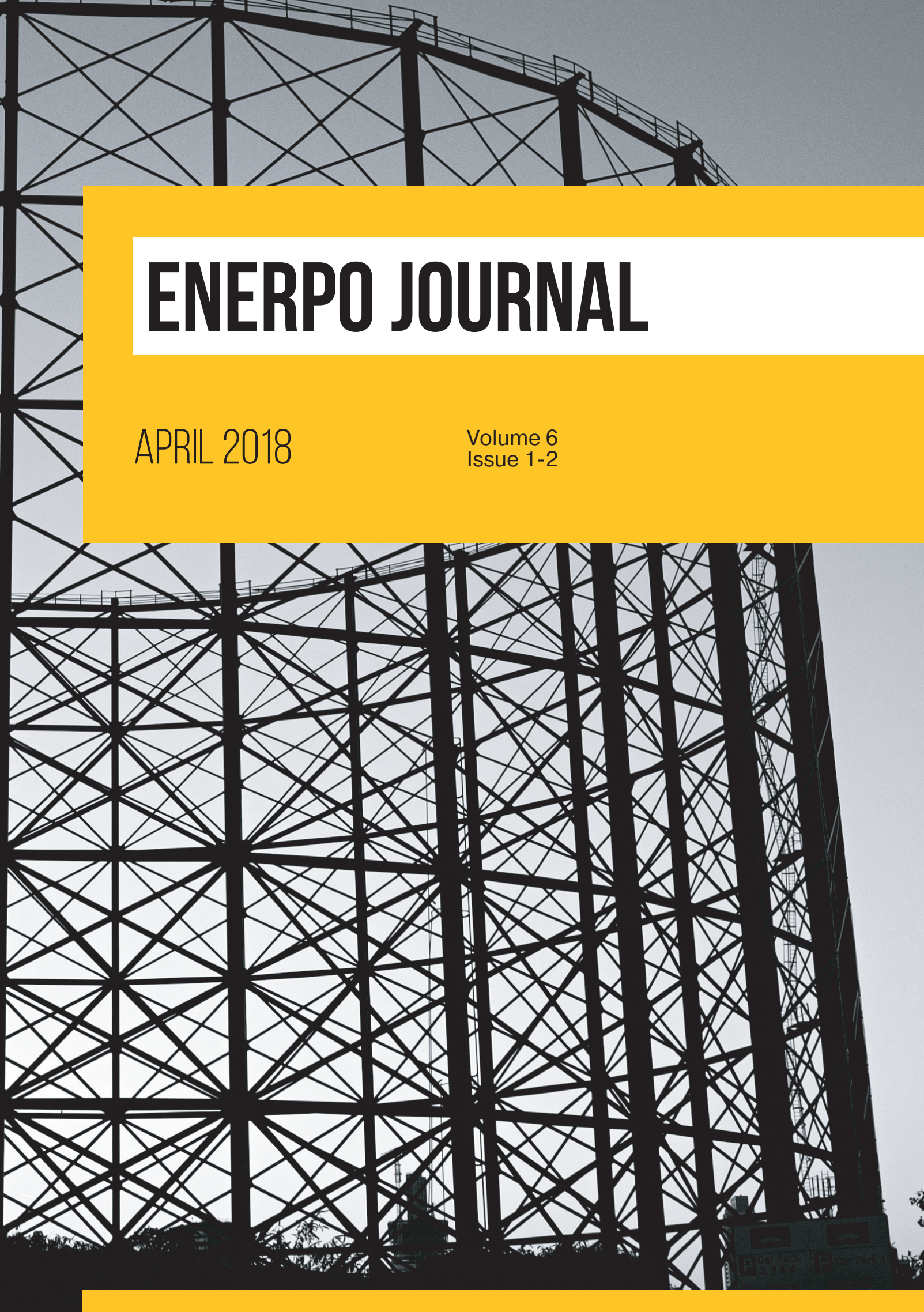

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ENERPO Research Center

EUROPEAN UNIVERSITY AT ST. PETERSBURG

The European University at St. Petersburg, being one of the first independent universities in post-Soviet Russia, has retained its freedom from state and corporate interests since its founding in 1994. Today EUSP seeks to continue its contribution to independent research by hosting ENERPO Research Center under its auspices. The goal of this Center is to provide a balanced analysis of the energy challenges faced by governments and companies worldwide, with a specific focus on Russia's role in global energy markets.

ENERPO Research Center will also enable domestic stakeholders to compare their experiences with international practice in the spheres of energy efficiency and sustainable development. The main purpose is to facilitate a more informed approach to the development and utilisation of energy resources in a 'greener' world. We strive to contribute to a better understanding of challenges faced by traditional energy systems, and our expertise will help policymakers and companies to navigate the quickly evolving energy landscape.

ENERPO Research Center creates educational programs on sustainable development, inclusive of the Paris Climate Agreement and Russia's obligations in environmental protection and climate change.

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MAIN ACTIVITIES IN 2017-2018:

- EUSP joined the Russian Climate Partnership. This important step means that ENERPO RC will join its expertise and efforts in creating a balanced economy with the leaders of Russian business who strive to move toward cleaner energy sources and lowering the environmental effect of the business activities.
- ENERPO RC published the Practical guide on energy efficient projects implementation. The guide analyses the projects in Russia's North-Western region.
- ENERPO RC Executive Director spoke at COP 23. During a roundtable in the Russian pavilion, Maxim Titov reported on green financing instruments in Russia.
- ENERPO RC started cooperation with UNECE. Main areas of cooperation that commenced in 2017 include energy efficiency and low-carbon development.
- The Presidential Grant was awarded for the implementation of the project: "Interactive Learning Platform of the Russian Arctic: People and Infrastructure". The application was prepared jointly by ENERPO Research Center, Center for Science and Technology Studies (STS Center), Center for Arctic Social Studies.
- Clean Energy Award was launched. The contest aimed at drawing attention to the sustainable development issues, and its results were announced at the second international Clean Energy Forum.

RESEARCH AREAS:

- Strategic policy development and advocacy for energy efficiency and clean energy;
- Climate change and the strengthening of Russia's position in the international climate agenda, in relation to international security and the environmentally-sensitive Arctic region;
- Development of green financial instruments, promotion of sustainable development best practices, and introduction of international standards for environmental and social risk management.

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CLIMATE CONFERENCE IN BONN: AN INSIDER'S VIEW

Maxim Titov

Abstract

The 23rd Conference of Parties of the United Nations Framework Convention on Climate Change (COP 23) took place in Bonn, Germany, in October 2017. Maxim Titov, Executive Director of the ENERPO Research Center, was one of the many high-level attendees of the conference. In order to gain some insider's view of the conference, we met with Titov to talk about his takeaways and general experience. Interview was conducted by Irina Mironova.

Key words: COP23, Paris Climate Agreement, INDCs, Russia's climate policy

ENERPO JOURNAL: What were the main tasks that the conference in Bonn set out to do? What did participants do during the conference? It was expected that the mechanisms of implementation of the Paris Agreement would be further developed. Did this materialize?

MAXIM TITOV: There were three levels of activities during the conference.

Firstly, there was the formal level of elaborating on the mechanisms of the Paris Agreement. The rules for this are expected to be finalized next year in Poland. The experts were working on these rules during the COP 23 meeting. The work done now was mostly on the methods of measuring emission levels, and other topics as well.

The second level of the conference was practical. Some very interested delegations attended the event. For example, the representatives of groups strongly affected by climate change were present – I am talking about indigenous people as well as several island states of the Pacific Ocean. In particular, I am talking about Fiji, which was actually chairing the conference (it was due to logistical reasons that the conference itself was held in Germany despite Fiji's chairmanship). Also, there were a few very active delegations from American cities to make a statement: 'despite the fact that the US is quitting the Paris Agreement, we are still on board and will pursue our commitment'.

The third level consisted of a bulk of events, or maybe it's better to call them 'happenings'. For example, there was an anti-coal activity with posters in front of the main entrance of the conference expo and where the presenters' faces were covered with coal powder: they reminded the visitors of the fact that the closest coal-fired power plant was only located some 50 km away from the conference site. Their message was also that before hosting the event, Germany could have stopped coal-fired electricity generation, which Germany did not do.

Concerning Russia's participation; this year Russia was very active, and its presence was much more noticeable than during previous years. Russia's pavilion was probably not the most noticeable, but activities were taking place there continuously, broadcasting what climate-related activities are undertaken in our country.

ENERPO JOURNAL: So what are these Russian activities related to the climate change?

MAXIM TITOV: Let me begin answering your question by describing the set-out. In Bonn, there were two large halls overall: one with the official programme and presentations of high representatives (Presidents etc), and another one with national pavilions where the agenda was determined by the countries themselves. In the large hall with national pavilions, people could stroll between the stands and decide whether the 'happenings' were interesting enough for them to stay for a bit longer. The most prominent and noticeable in my view were the zones created by India, Indonesia, France, Great Britain and Germany. These five pavilions demonstrated that these countries really do have something to present in terms of climate change mitigation and related developments. I did not see China's pavilion at all in that hall, which was rather surprising, given the fact that this country does a lot in terms of climate change mitigation, and its activities have world-wide implications. From a psychological point of view, the best solution was French pavilion: it was an open amphitheater, and when walking by, visitors were instantly engaged in what was going on there (unlike the case of India, where you had to open the door to enter, so you had to really decide to go there and make extra effort to enter). Germany's pavilion was also open and it was possible to sit down there. So the task of any pavilion was not only to present what the country has to present, but also in a way to keep attention of the visitors.

Russia's pavilion in that sense was a more 'old-school' one:a closed room with chairs and a stage and there was

usually some panel discussion going on. There was also a closed section for negotiations. The Russian pavilion had theme days: one day was devoted to natural gas, one day devoted to nuclear energy, and one day devoted to hydro. Russia's position throughout the forum was that the use of natural gas, large-scale hydro and nuclear power generation is the most consistent way to prevent a further increase of global temperatures by means of decreasing greenhouse gas emissions. While I did not manage to attend nuclear team's presentation, I heard of some protests against it.

There was also a series of events organized by Rusal *[Russia's largest aluminum company, ed.]* at the Russian pavilion. It started with the presentation of Alexander Bedritsky, the Special Envoy of the President of Russia for Climate Affairs. He presented Russia's official approach: that we adhere to the climate change mitigation efforts and that it is very important for Russia. At the same time, there are certain considerations which are a source of disagreement between some of the counterparts and which prevented Russia from acceding to the Paris Climate Agreement.

Another aspect that Bedritsky mentioned, and that I found very interesting, is green financing, with his focus being on Russia's participation in international programs for green investment. As a result of the financial sanctions, which are affecting some of the largest banks, those banks cannot participate in programs of green financing. Some international organisations that worked with Russia before no longer do that. This is important, because these projects do not only concern Russia; for example, in the projects of the Global Environment Facility, Russia acts as a donor. The message was that even though there are political reasons for certain measures taken against Russia, these measures must not concern environment and climate change issues, because this is our common planet.

Further, Rusal organized a very informative programme. They invited scientists, who are researching the development of coral riffs in the Pacific Ocean; these riffs are diminishing as a result of global warming and these researchers presented photographic evidence of that. Furthermore, representatives from Rusal itself also presented about a new type of aluminium, the production process of one tonne of which emits several times less emissions than usual. As I understood, one of the energy inputs in the process of production is hydro power, which makes it much cleaner than when coal-fired power generation is used. As a result, when end products are analysed, this should be taken in consideration: in the previous steps of the value chain, less emissions were emitted, which makes the end product cleaner as well. In fact, end product producers should pay attention to the carbon impact of the materials that they are using. I also presented during this session with the Review of Green Financing prepared by the ENERPO Research Center. The audience was not very large, but there were a lot of questions.

Besides the Rusal session, there was a round table chaired by Gazprom. One of the main ideas here was that Europe uses too much coal in its power generation. By finalizing Nord Stream 2, Gazprom would help Europe to replace coal-fired generation with natural gas. If all coal is replaced by natural gas in the power generation, this would significantly decrease emission levels in Europe.

ENERPO JOURNAL: Was there any progress in defining the mechanisms of the Paris Climate Agreement? How can this progress be assessed? How would it be possible to monitor compliance with countries' own Intended Nationally Determined Contributions (INDCs), which they started to submit after the Paris Agreement came into force?

MAXIM TITOV: Experts have analysed the figures submitted so far in the form of INDCs, and it was reported that these figures are insufficient to reach climate change mitigation targets. Every country submitted a roadmap which it considered to be realistic in the current conditions, but overall if we sum up these roadmaps, they fall short of reaching the limit of global warming by 2°C (by 2100 relative to the pre-industrial level, which is considered to be a commonly accepted target today in order to avoid irreversible effects on the planet). Therefore, the INDCs themselves have to become more ambitious.

However, compliance mechanisms are essentially voluntary. It is not possible, for example, to expel a country from the UN for falling short of reaching its INDC targets. It is a voluntary mechanism and the basic idea is that all participants should find it possible to adhere to it. The most important question now is how to make it plausible for all participants while also making it more ambitious.

Developed countries should provide assistance to the developing nations. The fast-developing countries are responsible for large amounts of emissions, while the risk of their growth slowing down is not very high, while they cannot cope effectively with the emissions increase. The largest amount of electricity is generated at coal-fired power plants. These developing countries are declaring their willingness to participate in emission cutting initiatives, but essentially, they are lacking the necessary funds.

ENERPO JOURNAL: What about the role of Russia in the process?

MAXIM TITOV: Procedures to meet the goals are being negotiated, and the Russian delegation is participating in these negotiations. It is a question what Russia's influence on the decisions could realistically be, however; in the light of its non-ratified status, the Russian delegation might lack the right of vote. In any case, according to the economists' reports, both options for Russia (the Paris Agreement ratification versus non-ratification) have certain negative effects, or downsides.

The consequences for Russia are not necessarily in the realm of climate change: as one of the countries dependent

on exports of hydrocarbons, Russia might find itself in a difficult position when demand for hydrocarbons starts to decrease, and the country has to compete with other suppliers of coal, oil and natural gas. The share of oil and gas in Russia's exports earning is declining. However, if by the time the need for hydrocarbon imports declines Russia is still heavily dependent on these earnings, this creates a whole new level of problems. This is not linked to climate per se, but has rather serious economic implications.

Another conclusion from Bonn is that it's not the first time that important developments are taking place in Russia, and that we understand the trends as well as the direction we need to take. However, Russia is often unable to demonstrate its understanding and developments to the international community. To put it simply, the PR is not good. In this context, I found it rather surprising to be present at the climate conference and see our nuclear energy industry being advertised. It is commonly accepted that nuclear energy is not part of the 'clean energy solution'. Even if it is present in energy balance of a country, it is not put in the avant guard at the climate conferences and in my opinion, it was not justified from the point of view of smart PR to put such a focus on it. It seems more adequate to put more stress on the development of renewables, such as for example solar stations in the far north, distributed generation with the use of wind generators and research in hydro generation. Of course, nuclear energy is very important in Russia's energy mix, but I find it a big question whether it should be put in such a bright spotlight at climate conferences.

Maxim Titov

Executive Director of the ENERPO Research Center. Maxim is a climate finance professional with 12 years of experience managing projects at the International Finance Corporation (World Bank Group) in Eastern Europe, Central Asia, the Middle East and North Africa. He has a successful track record designing climate finance programs for financial institutions, trainings for bankers, effective advocacy and public policy, marketing and communication campaigns. Most recently, Maxim served as Project Manager to undertake a market assessment of the clean energy sector in Jordan with the Global Green Growth Institute.

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NATURAL GAS HUBS IN THE ASIA PACIFIC REGION: A BI-PRODUCT OF NATIONAL GAS MARKET DEVELOPMENTS?

Jinsok Sung, Irina Mironova

Abstract

The Asia Pacific is the one of the largest natural gas consuming and importing regions in the world. Nevertheless, domestic markets in the Asia Pacific are at an earlier stage of liberalization than the North American and European markets; the Japanese, Chinese and South Korean natural gas markets have been liberalized gradually. Recently these countries have accelerated energy market reforms as a result of various challenges each county is facing. In accordance with energy market reforms and the increasing volume of liquefied natural gas (LNG) trading in the Asia Pacific region, three countries – Singapore, Japan and China – are working towards establishing LNG hubs.

Key words: LNG, natural gas hub, Asia Pacific markets

The price of natural gas is one of the most fundamental features of the market. The price is crucial for ensuring that natural gas resources are effectively developed and distributed; it provides a signal to producers about the need/opportunity to invest in upstream development, and it provides a signal to the consumer about the competitiveness of natural gas against other fuels. It is generally perceived that a market exchange provides the most consistent way of price discovery in the natural gas market. Importantly, all currently functioning natural gas trading hubs (spots where deals are attributed), such as Henry Hub in the US, TTF in the Netherlands, and NBP in the UK, all developed based on physical pipeline infrastructure. At present, there is no single platform that deals purely with liquefied natural gas (LNG) trading. This makes the future development of the Asia Pacific market a very interesting case, which potentially can bring about a fundamental change in natural gas trading on a global scale.

Natural gas trade in the Asia Pacific region is characterized by large volume of consumption and high dependency on imports. But what makes it essentially different from the North American or European market is the dominance of LNG trade flows compared to the volume of natural gas traded by pipeline. This has both geographical and historical reasons: while in some cases building pipelines is not viable because of the distance (for example, to bring gas from Algeria to Japan), in others this is due to political reasons (for example, between Russia and South Korea via the territory of DPRK). The basic instrument of natural gas trade in the region is bilateral long-term contracts, which were concluded by major Asian players such as Japan, South Korea and Taiwan for periods of up to 20-30 years, the prices of which are largely indexed to crude oil prices. This mechanism prevails in the regional natural gas trade today.

Market changes observed in Japan, China and South Korea demonstrate the increase of importance of competitive mechanisms on the national levels. This may well have spillover effect on the regional market and lead to the formation of a regional gas trading hub. In this article, we will look at four countries in the East Asian region (Japan, China, South Korea and Singapore), their roles and the possible benefits in the creation of a natural gas hub.

NATURAL GAS MARKET REFORMS IN EAST ASIA: A BRIEF UPDATE

The year 2017 marked an important turn in national developments in natural gas markets in the Asia Pacific Region: Japan saw its next stages in market liberalization in natural gas, electricity and heating sectors and China might have crossed the watershed between import parity netback pricing and market pricing while Korea announced its ambitions to break up monopolies in the natural gas and electricity sectors. Below we will have a look at the details of these developments and examine whether these changes bear the potential to transform the structure of the regional gas market.

Natural gas market reform in Japan

Japan is one of the largest importers of natural gas and the largest buyer of LNG in the global market, with nearly 100% import dependency. Infrastructure and the natural gas transportation system in Japan traditionally belonged to vertically integrated private energy companies. Regional monopolies were allowed to prevent multiple investments. As a result, natural gas transportation systems of different prefectures are not well connected to each other. The problem exists in various sectors, including in natural gas and electricity. This created some serious problems after the disaster at the Fukushima nuclear power plant (NPP) in 2011,after which the nuclear sector of the country was put on hold to undergo

2017	Liberalization of the natural gas retail market 1. Expand retail competition to the residential sector in 2017, opening a new market 2. Revise business license categories under the Gas Business Act in line with full retail competition: LNG terminals (notification), general gas pipeline services (permission), specified gas pipeline services (notification), and retailers (registration) 3. Ensure third-party access to LNG terminals
2022	Unbundling the gas pipeline service sector

Table 1. Japan's Gas Business Act summary

Source: International Energy Agency (IEA) and Ministry of Economy, Trade and Industry Japan (METI)[3]

	Liberalized sector	Regulated sector
Annual consumption	>100 000 m³	<100 000 m³
Market volume	¥1,7 trillion (= $14,2 billion, €12,6 billion)	¥2,4 trillion (= $20 billion, €17,8 billion)
Type of customers	Large factories / buildings Medium factories / buildings Small factories	Small shops Residential customers
Number of contracts	0,1 million	Residential customers: 24,7 million Small shops and offices: 1,2 million
Share of total gas supply	64%	36%

Table 2. Liberalized and regulated segments of the gas market before the adoption of the Gas Business Act

Source: adapted from METI

safety checks. Regions facing electricity shortages could not receive adequate amounts of neither natural gas not electricity from adjacent provinces. The imports of fossil fuels, including LNG, increased substantially, while this coincided with a period of historically high prices for oil and LNG. As a result, energy market reforms were accelerated[1]. Energy market reforms in Japan aim to overcome the disconnectedness of the networks as well as to promote new business models for energy companies.

Directions for the natural gas sector development were summarized in the Gas Business Act (see Table 1) and include: ensuring security of supplies; decoupling gas prices from the oil price and ensuring the lowest possible rates; expanding the areas serviced by gas companies through greater diversity of retail choices for gas companies and pricing plans for gas consumers; diversifying the uses for natural gas.

Before this liberalization of the natural gas retail market, it was divided into two sectors: the liberalized sector and regulated sector. Consumers had the right to choose suppliers if their consumption exceeded 100 000 cubic meters per year. If annual consumption was less than 100 000 cubic meters per year, the regulated tariff was applied (see Table 2). With the implementation of the Gas Business Act, the regulated sector now became fully competitive. [4]

The reforms in the natural gas sector are part of an overall energy sector liberalization effort. The developments across natural gas, electricity, heat sectors and in the field of regulatory oversight are all part of a wider energy retail market reform Roadmap (see Table 3).

In our view, these significant changes in the energy sector in Japan may have serious regional implications. One particular reason is that liberalization of the gas market also concerns the LNG sector. Besides access to the pipeline infrastructure, the government plans to facilitate access to LNG import terminals and other LNG infrastructure as well. Companies only need to officially notify the regulator at the beginning of their activities and receive permission. As of 2017, 37 business entities (mainly electricity generating companies) have been registered as new gas retailers and have started launching their gas retail business. In 2022, the pipeline sectors are to be legally unbundled from their manufacturing or retail gas business sectors. [7]

1 *Agency for Natural Resources and Energy Japan, 2015. Energy market reform in Japan. Available at: <http://www.enecho.meti.go.jp/en/category/electricity_and_gas/energy_system_reform/> [Accessed 29 April 2018].*

Ministry of Economy, Trade and Industry Japan, 2013. Electricity system reform. Available at: <http://www.meti.go.jp/english/policy/energy_environment/electricity_system_reform/outline.html> [Accessed 29 April 2018].

2 *Agency for Natural Resources and Energy Japan, 2015.*

3 *International Energy Agency, 2013. Developing a Natural Gas Trading Hub in Asia. [pdf] Available at: <https://www.iea.org/publications/freepublications/publication/AsianGasHub_FINAL_WEB.pdf> [Accessed 29 April 2018]. Ministry of Economy, Trade and Industry Japan, 2015. Bill for the act for partial revision of the electricity business act and other related acts (outline). [pdf] available at: <http://www.meti.go.jp/english/press/2015/pdf/0303_02a.pdf> [Accessed 29 April 2018].*

4 *Ministry of Economy, Trade and Industry Japan, 2015. Bill for the Act for Partial Revision of the Electricity Business Act and Other Related acts (outline).*

5 *Ministry of Economy, Trade and Industry Japan, 2015.*

7 *Matsuo, T., Fujimoto, Y., 2017. Energy Market Reform and Surveillance Commission in Japan. The Icer Chronicle. Available at: <http://icer-regulators.net/article/energy-market-reform-and-surveillance-commission-in-japan/> [Accessed 29 April 2018].*

	2015	2016	2017	2020	2022
Natural gas			Full retail competition		Legal unbundling of the pipeline sector (targeting largest companies)
Electricity	Establishing the Organization for Cross-regional coordination of transmission operators	Full retail competition		Legal unbundling of transmission and distribution segments	
Heat		Full liberalization			
Regulation	Establishing a new regulatory authority (electricity-related services)	Adding gas and heating services to the list of responsibilities of this authority			

Table 3. Roadmap of the energy retail market reform in Japan

Source: Adapted from Masato Sasaki[6]

What this means for the regional and global LNG market is that more Japanese companies will refer to the spot market in order to meet their obligations in the domestic market as they gain access to both infrastructure and customers. This explains the overall interest of Japanese companies towards more flexible conditions for natural gas procurement (including less rigid terms of long-term contracts[8] as well as a fully functioning regional gas trading hub for spot deals and hedging operations). But this reform does not yet provide sufficient basis for creating such natural gas trading hub in Japan itself.

NATURAL GAS MARKET REFORM IN CHINA

China is one of the most prominent players in the natural gas market: not only did it overtake South Korea as the second largest importer of LNG in 2017, but it is also actively expanding its pipeline imports. Due to the nature of China's gas import strategy (a 'compass' of gas import routes connects the country with Central Asia, Southeast Asia, world LNG markets and potentially Russia) and its sheer size, developments in this market carry the potential of China taking on an integrator's role in the Asian natural gas market.

As of 2018, China's natural gas market looks closest to actually realizing a natural gas trading hub, but the situation in the natural has market of this country was certainly not like this before. Until 2011, the market was largely regulated, with the government setting the levels of wellhead prices as well as the prices for end users (for clarification of various types of prices, see Figure 1).

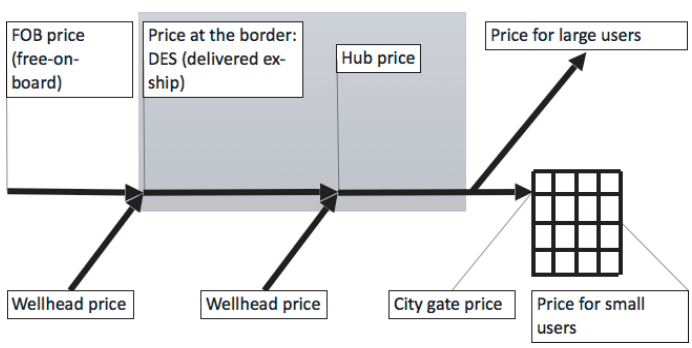

Figure 1. Types of natural gas prices along the supply chain

Terms and abbreviations:
Wellhead price: natural gas price, which reflects the cost of production.
FOB (Free-on-Board) price: LNG price at the loading port, which reflects the cost of production, processing and transport to the LNG terminal, as well as liquefaction fee. The FOB price does not include transportation in LNG cargo, insurance and regasification.
DES (Delivered ex-ship) price: LNG price at the receiving port, which includes the cost of the LNG as well as that of transportation to the terminal. Recently, the abbreviation DAT (Delivered at Terminal) is used to reflect the same term.
Hub price: price of natural gas at the hub, or a designated point of custody transfer.
City gate price: price of natural gas at the entry of municipal distribution system, which usually reflects the cost of production and transportation all the way to the city or is regulated by the authorities to reflect the price of competing fuels and/or the purchasing capacity of large and small users in any given municipality.

Source: International Gas Union[9]

6 Sasaki, M., 2018. Japan's gas policy focusing on LNG strategy, Tokyo: CWC Japan LNG Gas Summit

8 D In 2015, Chubu and Tepco joined their efforts to create 'Japan's Energy for a New Era' (JERA) in order to achieve greater flexibility in natural gas trade while maintaining security of supply. As of 2018, CNOOC and Kogas are collaborating with JERA in developing upstream assets across the world, creating LNG transport fleet, developing trading operations and negotiation new contracts without the destination clauses.November 2016]

9 International Gas Union, 2011. Wholesale Gas Price Formation: A Global Review of Drivers and Regional Trends. P. 8.

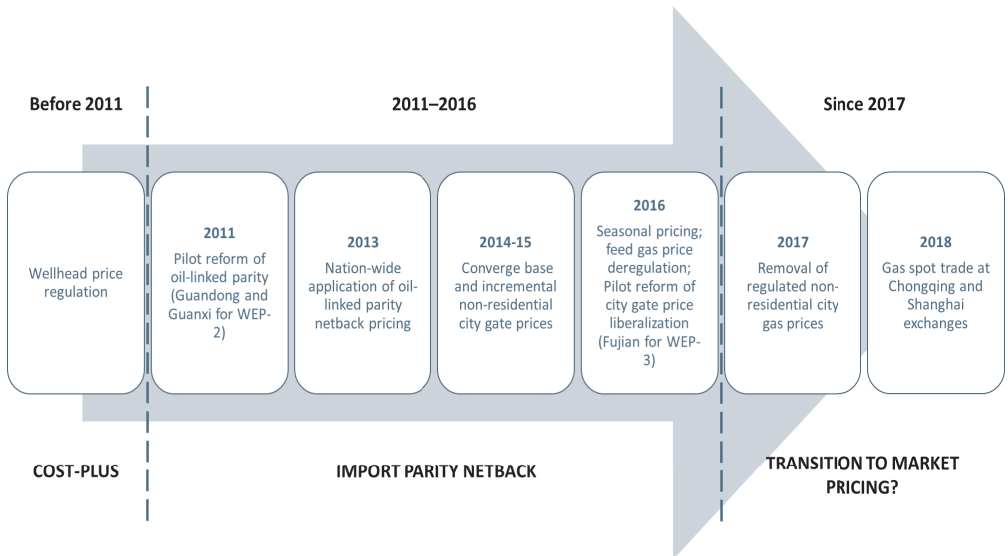

Figure 2. Natural gas pricing reform in China: Chronology

Source: Adapted from SIA Energy[16]

This system was not productive: gas companies would experience significant difficulties because of the gap between international LNG prices and domestic prices. A low level of domestic prices also inhibited natural gas exploration and production efforts domestically. Overall, the regulated gas pricing system created obstacles to the expansion of natural gas within China's energy mix, which has become imperative ever since the PRC took a path toward cutting emission levels.

Fundamental changes have been introduced in the gas sector in China this decade. Since 2011, China makes consistent steps to move away from price regulation (or cost-plus principle) toward market-based pricing.

In December 2011, the National Development and Reform Commission (NDRC) introduced pilot netback pricing in the Guangdong and Guangxi provinces.[10] The system was applied to the industrial, transportation and electricity sector. Maximum gas prices at the city gate in these provinces became linked to the mazut and LPG price imported in Shanghai by a ratio of 60:40 with a discount of 10% whilst the weighed purchasing capability of citizens in each region was also taken into account.[11]

The next step was undertaken in July 2013, when the NDRC announced a two-tiered city-gate price system for 29 provinces. Prices in the municipalities were defined by a base demand and the price of incremental gas volumes.[12] Natural gas consumption exceeding the 2012 level was classified as the 'incremental volume'.

The price of natural gas consumption beyond the 'base demand' was indexed to the import price of mazut and LPG in Shanghai at a ratio of 60:40 with a discount of 15%. The price in each region was weighed by the transportation costs from Shanghai and the purchasing power in each region.[13] Therefore, in each region, the price ceiling and the base demand price were at a different level. In 2015, the NDRC announced that China officially ended its two-tier gas pricing system. The 'incremental' city-gate prices were cut and the factual city-gate prices were raised in every province in order for the two different gas prices to converge. [14]

In 2017, the NDRC announced a new stage in its natural gas market reform: regulation of non-residential city gate price is now to be removed. Gas companies are encouraged to gradually split sales and pipeline businesses to promote a market-based pricing mechanism and the government is only to step in when abnormal price fluctuations occur.[15] Finally, at the end of 2017, it was announced that the creation of a Chinese gas index is one of the priorities, and there are two exchanges now trading natural gas: Shanghai and Chongqing. These developments suggest that the Chinese natural gas market moves toward a principally new stage in its development. As summarized below (Figure 2), the movement is logically geared towards the market pricing of natural gas.

10 China National Development and Reform Commission

11 Petelin, E., 2016. Как реформа ценообразования на природный газ повлияет на газовый сектор Китая. Center of Energy Policy Analysis of Higher Schools of Economics. [pdf] Available at: <https://www.hse.ru/data/2016/12/21/1112026807/Gas%20Price%20Reform%20in%20China.pdf> [Accessed 29 April 2018].

12 Incremental volume – in excess of 2012 volumes for non-residential sectors linked to LPG and fuel-oil import prices. IEA, 2014. The Asian quest for LNG in a globalizing market. [pdf] Available at: <https://www.iea.org/publications/freepublications/publication/PartnerCountrySeriesTheAsianQuestforLNGinaGlobalisingMarket.pdf> [Accessed 29 April 2018].

13 Petelin, E., 2016. Как реформа на ценообразования на природный газ повлияет на газовый сектор Китая.

14 Sino Oil and Gas limited, 2015. China officially ended its two-tier gas pricing system. Available at: <http://www.sino-oilgas.hk/html/news_industry_o.php?id=298694> [Accessed 29 April 2018].

15 China Daily, 2017. China unveils market reform for oil and gas industry, [online] 22 May. Available at: <http://www.chinadaily.com.cn/china/2017-05/22/content_29437500.htm> [Accessed 29 April 2018].

16 Li Y., 2017. China's LNG Demand & Reform Outlook, Beijing. SIA Energy. Available at: <http://www.oilandgascouncil.com/sites/default/files/files/YAO%20LI%20-%20SIA%20ENERGY_0.pdf> [Accessed 29 April 2018].

What will be the outcomes for the regional and global gas markets? Firstly, it is important to mention that China has created a set of pre-conditions for competitive price discovery (removal of regulated prices). Secondly, China is currently making steps to launch a gas price index. If such an index earns the trust of outside players, it may serve as the regional index as well. Therefore, changes in the national gas market of China can have a transformative influence on the regional gas market structure.

Energy market and state energy company reform in South Korea

Together with Japan and China, South Korea is one of the largest players in the LNG market, and until 2017 it was the second largest importer of LNG after Japan, until overtaken by China. The natural gas market of the Republic of Korea is characterized by the monopolistic role of the national champion, Korea Gas Corporation (Kogas) but currently, the natural gas market in Korea is also experiencing some changes.

In 2016, the government of the Republic of Korea declared a reform of state gas and electricity companies, affecting of the state monopolies Korea Gas Corporation (Kogas) and Korea Electric Power Corporation (Kepco). Traditionally, Kogas was the sole seller of natural gas in the wholesale market and in addition to that, Kogas has always been the largest importer of LNG in the country, being responsible for over 90% of all LNG imports.

Companies in the electricity and industrial sector, such as Posco, GS Energy, SK E&S, Korea Midland Power (Komipo) and S-Oil, could import LNG only for their own consumption.
The ineffectiveness of these state companies in the natural gas and electricity sector led to an increase of corporate debt however, which eventually motivated the government to begin with reforms. The liberalization of the electricity and gas markets was part of these reforms; the government opened the door for private companies to the market. New legislation will facilitate the import of LNG by private companies as well as the use of gas pipelines and access to gas storage and LNG terminals owned by Kogas.

The liberalization of the gas market is aimed at strengthening competition in the gas and electricity market. However, it will take some time: private companies will gain access to the wholesale market only after 2025 (see Table 4), while

Natural gas market reform	New legislation allows companies other than Kogas to import LNG and to use gas storages and gas pipelines. However, liberalization of natural gas market is planned only after 2025.
Electricity market reform	Liberalization of the electricity retail market. Private companies other than the state monopoly, Korea Electric Power Corporation (Kepco) can sell electricity. Creation of a new market and business model.

Table 4. State energy company reform in Korea

Source: Ministry of Trade Industry and Energy of Korea[17]

Kogas has large contracted volumes of LNG under long-term contracts all the way until 2024. Moreover, the timetable of the liberalization of the electricity retail market is not yet announced.

There is a possibility that in 2019, a fundamentally different approach will prevail in Korea's energy policy however. In January 2019, the new edition of the "National Energy Master Plan" (which is updated every five years) will be published. The National Energy Master Plan is a comprehensive document that covers all energy sectors, and systematically links and coordinates energy-related plans from a macro perspective. The expectation of a new focus in energy policy comes from the fact that the newly elected administration puts more emphasis on the promotion of clean energy sources such as renewables. The administration also stresses the need to decrease consumption of coal and increase the role of natural gas. Gradual retirement of nuclear plants is another factor in the policy change; permissions for new generating capacity are not being granted, while the existing licenses are not being renewed. Overall, it is expected that 'green energy' will be the beneficiary of the new energy policy in Korea and in line with that, it is expected that natural gas will be heavily used as a cleaner ('bridging') fuel on the road to the renewables era.[18] This potential change in the reforms puts the pricing of natural gas and electricity at the center of the reform.

Currently, the prices for both natural gas and electricity are regulated. They are linked to the import price of the fuel and the exchange rate. There are no plans yet to change the pricing system; therefore, liberalization of the natural gas and electricity markets in Korea will remain at a relatively low level for a longer time due to the lack of retail and wholesale market competition and absence of unbundling in the midstream sector.[19] The situation looks similar to that of Japan, with only one difference: in Korea, the role of the monopolist players is stronger, which makes market liberalization something more of a long-term, and quite distant perspective. At the same time, it is important to mention that Korean companies share the newly founded Japan's Energy for a New Era's (JERA) – an innovative energy company with a focus on LNG and trade-liberalization – aspirations toward more flexible conditions for natural gas trade. However and also similarly to Japan, despite these priorities, the gas market does not yet provide basis for the creation of a natural gas trading hub.[20]

17 Ministry of Trade Industry and Energy Korea, 2016. Reform of State Organization at Energy, Environment, Education sectors. Available at: <http://www.motie.go.kr/motie/ne/presse/press2/bbs/bbsView.do?bbs_seq_n=158304&bbs_cd_n=81> [Accessed 29 April 2018].

18 Ministry of Trade Industry and Energy Korea, 2014. Korea Energy Master Plan - outlook & policies to 2035. Available at: <http://www.motie.go.kr/common/download.do?fid=bbs&bbs_cd_n=72&bbs_seq_n=209286&file_seq_n=2> [Accessed 29 April 2018].

19 Ministry of Trade, Industry and Energy of Republic Korea, 2016. Reform of State Organizations at Energy, Environment and Education Sectors.

20 Sung, Jinsok., 2017. Азия в поисках хаба. Нефтегазовая Вертикаль.11, 68-70. Available at: <http://www.ngv.ru/magazines/article/aziya-v-poiskakh-khaba/?sphrase_id=137112> [Accessed 29 April 2018].

NATURAL GAS HUBS AND EXCHANGES IN THE ASIA PACIFIC REGION

As we saw earlier, all of the three of the major gas-consuming Northeast Asian countries are working on restructuring their natural gas sectors as part of wider energy sector reform agendas focused on overcoming domestic issues. In Japan, the main problem is the lack of connectivity between the regions and the lack of competition. In China, the cost-plus pricing approach used to create problems for the expansion of domestic gas production and undermined international activities of the Chinese companies because of the gap between lower domestic prices and higher LNG prices, while the role of natural gas in the energy sector overall remained insufficient to help China reach its emission reduction targets. The Republic of Korea tries to reform the natural gas sector led by the state corporations.

In all of the cases, we see definitive interest toward finding a regional price index. The motivations behind this interest are two-fold. Firstly, all three importers are interested in a price index that would be independent of the oil price movement. Secondly, it is important for LNG buyers to be able to purchase natural gas from the spot market to cover seasonal peaks and other unforeseeable peaks in demand. A liquid regional natural gas trading hub providing a price index as well as the opportunity to conclude spot deals and hedge risks would be a solution to both of these motivations.

However, despite the fact that prominent players are interested in the possibility to purchase gas from a hub within the region, the viability of setting up such a hub is rather limited. Below we will review the hub launching potential in three jurisdictions: Singapore, Japan, and China.

Singapore

Singapore is already one of major oil trading and financial hubs in the world. It is also located on route of a significant part of the LNG deliveries to the Asia Pacific region (those that originate in the Middle East have to pass through the Malacca strait). It is quite logical that if LNG importers want to find a spot convenient to attribute their deals to, Singapore serves as very handy choice due to its geographical location and trading infrastructure. Moreover, existing energy trading companies and financial institutes in Singapore provide a favorable business environment for the development of a natural gas hub. The Singapore Exchange (SGX), which has been serving as a trading platform for a number of commodities since 1999, started spot LNG trades on a platform called Sling (abbreviation of SGX LNG Index Group) in 2014[21]. The Sling spot LNG price index has three categories: Singapore Sling FOB[22], Northeast Asia Sling DES[23] and Dubai/Kuwait/India Sling DES.[24]

21 Carlson, D., Yu, C., Lunt, A., 2016 Creating an Asian Market for LNG – Introduction to FOB Singapore SGX LNG Index Group ('SLInG'). SGX.

22 Singapore FOB – price 'Free on Board' at Singaporean port.

23 North East Asia DES – price in Japan, China and South Korea.

24 DKI DES – price 'Delivery ex-ship' in Dubai, Kuwait and India.

At the SGX, bilateral over-the-counter trades are conducted and cleared by the SGX. LNG futures and swap deals at the SGX are tied to Sling spot price index.

However, the volume of trades on the SGX is relatively small[25], while Japan and China are working on launching their own exchanges instead of trading in Singapore.

Japan

In 2016, the Japanese government officially announced a policy of de-linking the LNG price from crude oil prices in favor of an LNG pricing mechanism, based on the Japan Over-the-Counter-Exchange (JOE), which was established in Tokyo in 2014. JOE aims to be an international platform for LNG trade by the early 2020s. Originally, it was a joint company of the Tokyo Commodity Exchange (TOCOM, 60%) and the Singaporean group GINGA (40%) but since April 2017, JOE has become a 100% subsidiary of TOCOM.[26] At the time of creation, JOE did not have a lot of support from Japanese companies, since these had enough long-term contracts to supply their customers and therefore, trading activity has thus far been low. Indeed, the first deal was concluded in July 2015, which was more than a year after the establishment of platform.[27] In April 2017, JOE launched physical and cash-settled swap contracts based on the JKM DES (Japan Korea Marker, a price assessment published by Platts; DES stands for 'delivery-ex-ship').[28]

Japan faces the problem of a high degree of contracted demand on its way to introducing a gas trading hub. An active entrance to the spot LNG market was caused by the Fukushima accident. Currently however, in the context of nuclear power plants re-start, the only way to change prevailing pricing mechanisms for natural gas is to negotiate a shift from JCC indexation to alternative formulas within the already existing long-term contracts.[29] Overall, Japan so far does not use spot indexation itself as a result of the share of long-term contracts in overall demand as well as the absence of adequate local indices. Therefore, the chances of Japan providing a regional benchmark in the future are rather low.

China

Many consider China to be the most prospective candidate for the role of Asian LNG hub thanks to its considerable

25 Inajima, T., Stapczynski, S., 2016. Bloomberg, [online] 25 January. SGX seeks to break LNG's link to oil with Singapore SLInG. Available at: <https://www.bloomberg.com/news/articles/2016-01-25/sgx-seeks-to-break-lng-s-price-link-to-oil-with-singapore-sling> [Accessed 29 April 2018].

26 Hamada, T., 2016. Need for Reliable Benchmark Price and Hedging Market for Asian LNG Market. Tokyo OTC Exchange.

27 Hamada, T., 2016. Need for Reliable Benchmark Price and Hedging Market for Asian LNG Market.

28 Tokyo Commodity Exchange, 2017. TOCOM Announces Launch of New LNG Contracts on JOE. Available at: < http://www.tocom.or.jp/news/2017/20170403-2.html > [Accessed 29 April 2018].

29 Rogers H., Stern J., 2014. Challenges to JCC Pricing in Asian LNG Markets. Oxford Institute for Energy Studies.

volume of indigenous natural gas production and its diverse import sources such as LNG and pipeline imports.

China houses the very first platform in the Asia-Pacific region that started trading LNG: the Shanghai Petroleum Exchange (SPEX). It was established in 2006 by several Chinese state oil companies (CNPC, Sinopec, CNOOC) and originally facilitated the trading of crude oil and petroleum products. SPEX started to trade LNG and LPG in 2010, but these trades have continuously lacked liquidity.

Despite being the first, SPEX is not the only exchange in China dealing with energy products. Pipeline gas, LNG and oil products are also traded at the Shanghai Petroleum and Natural Gas Exchange (SHPGX). SHPGX was formed within the framework of a strategic alliance between Xinhua News Agency and the NDRC, thus its status among Chinese exchanges is rather special because of the state support. The SHPGX was officially launched in November 2016, after 16 months of trial operations. During the first 10 months of operation, the volume of pipeline gas trading reached 15.4 bcm, whilst LNG trades reached 1.32 bcm.[30] The trading volume of natural gas (including both physical and cash-settled contracts) reached 50 bcm in 2017.[31] These figures indicate that the SHPGX has the potential to become the most liquid natural gas exchange in Asia and this trading platform does indeed seek to position itself as China's main natural gas trading hub, similar to Henry Hub in the US or the NBP in the UK. There is also a potential of becoming the single most important natural gas trading platform in the Asia-Pacific region.[32] However, it now it has a potential competitor in Chongqing.

The Chongqing natural gas trading exchange is the newest city of Chongqing is located in the province of Sichuan, where the largest shale gas production site in China is located. Also, the province is connected by a pipeline with Myanmar and potentially with LNG routes bypassing the Malacca strait, through a regasification plant under construction in Myanmar and an already functioning pipeline. Trunk pipelines from Central Asia also reach this province. The Chongqing natural gas exchange was created in 2017, and its functioning is targeted at the creation of a Chinese natural gas price index that would have regional prominence and help to create a proper price benchmark.

Overall, China's potential of hosting a natural gas trading hub is stronger than that of Japan. Given the higher volumes and strong continuous increase in gas demand in China, there is every reason to assume that at least one of the hubs developing there now has the potential to become the most liquid hub in Asia, which would be reliable for market participants from outside China as well.

Republic of Korea

South Korea does not aspire to be a global or regional LNG hub or exchange. Even if it had such ambitions, at the moment, it does not look likely that they could be realized. A low level of liberalization of the domestic natural gas market and a lack of competition in the wholesale market hinder the establishment of a natural gas hub. Kogas is the sole seller in the wholesale market and the existence of such a monopolist does not allow for any kind of competition and deprives the country of any chances to create a hub or exchange.

The best candidate?

In all of the potential hubs discussed above (and summarized in Table 5), there is a problem in terms of a lack of liquidity. Essentially, this means that it is not easy to conclude the sales-and-purchase agreements. But it has to be stressed that this is not unique for the Asia Pacific region: LNG trade is also less liquid than pipeline network–based deals in other regions. Asian Pacific players are conducting a unique experiment, and its outcome in the form of shaping a hub will have global implications. In this regard, China has a relative advantage over Japan and Singapore because of the following factors:

1. All of the potential hubs in China have both LNG and pipeline supplies;
2. The trade volume of the Chinese market is the largest out of all the countries in the Asia Pacific region;
3. The government makes consistent steps to liberalize the market and introduce competitive pricing;
4. The pipeline network in this country is integrated and connects different regions not only inside China, but also across Asia (including Central and Southeast Asia).

30 China Daily, 2016. Shanghai Petroleum and Natural Gas Exchange launched in Lujiazui, [online] 30 November 2016. Available at: <http://www.chinadaily.com.cn/m/shanghai/lujiazui/2016-11/30/content_27530028.htm> [Accessed 29 April 2018].

31 Chen, G., 2017. Exploration and Challenge of Natural Gas Trading in China. United States Association for Energy Economists.

32 Lin, D., Goh, B, 2016. Reuters, [online] 26 November. China launches commodity trading center in Shanghai, eyes Asia gas hub. Available at: <http://www.reuters.com/article/us-china-gas-idUSKBN13L07T> [Accessed 29 April 2018].

Kumagai, T., 2016. Platts, [online] 22 November. Tocom, Platts sign MoU to develop Japan oil products, Asia LNG benchmarks. Available at: <https://www.platts.com/latest-news/natural-gas/tokyo/tocom-platts-sign-mou-to-develop-japan-oil-products-26602412 [Accessed 29 April 2018].

Mevlut, K., 2015. China Daily, [online] 3 July. Shanghai oil & gas exchange starts operations. Available at: <http://www.chinadaily.com.cn/m/shanghai/lujiazui/2015-07/03/content_21170225.htm> [Accessed 29 April 2018].

Osamu, T., 2015. Reuters, [online] 31 July. Japan exchange says first LNG forward deal done, [online] Available at: <http://uk.reuters.com/article/japan-lng-trade-idUKL3N10B30820150731 > [Accessed 29 April 2018].

Lefebvre, B., 2014. ICIS, [online] 17 September. Liquidity issues loom large for Japanese TOCOM LNG market. Available at: <http://www.icis.com/resources/news/2014/09/17/9821540/corrected-liquidity-issues-loom-large-for-japanese-tocom-lng-market/> [Accessed 29 April 2018].

33 Aizhu C., Gloystein H. China's Chongqing gas exchange aims to be Asia price benchmark. Reuters, [online] 28 February 2018. Available at: <https://www.reuters.com/article/china-gas-exchange/rpt-chinas-chongqing-gas-exchange-aims-to-be-asia-price-benchmark-idUSL4N1OT29Z> [Accessed 29 April 2018].

	Exchange/hub (founders)	Traded items	Year of launch
Singapore	SGX – Energy Market Company (subsidiary of SGX – 100%)	Singapore Sling (Singapore LNG Index Group) FOB North Asia Sling DES (Korea Japan China Taiwan) Dubai/Kuwait/India Sling DES	SGX 1999 SLING 2015
Japan	JOE (Japan Over the Counter Exchange) TOCOM (100%)	Physical/LNG (OTC – bilateral settlement) Physical/LNG (JKM-differential/OTC – bilateral settlement) JKM Swap (financial – cash settled) contract (OTC – cleared by CME) DES Japan Swap (OTC – cleared by CME)	TOCOM 1984 JOE 2014
China	SPEX (Shanghai Petroleum Exchange) Shenergy, Petro China, Sinopec, CNOOC, Sinochem	LNG/LPG	SPEX 2006 (LNG/LPG – 2010)
	SHPGX Xinhua News Agency, Petro China, Sinopec, CNOOC, Shenergy Group, Beijing Gas Group, ENN Group, Hong Kong and China Gas Co., Ltd. (Towngas), China Gas Holdings Limited and China Huaneng Group.	LNG, pipeline gas, oil products	SHPGX Beginning of trial period 2015 Official launch 2016
	Chongqing natural gas trading exchange		2018

Table 5. Natural gas trading platforms in Asia Pacific region

Source: Reuters, Platts, ICIS, China Daily, Neftegazovaya Vertikal

CONCLUSION

Three Northeast Asian countries, Japan, China and the Republic of Korea, are the world's leading importers of LNG. All three countries have transformed their domestic natural gas markets in order to have more competition. Their national efforts may well have a spillover effect on the regional market, since it is important for LNG buyers to move away from oil indexation toward a pricing principle that would reflect market conditions in the natural gas market (instead of the oil market). This naturally creates the demand for the launch of a regional natural gas trading hub. In this context, gas exchanges have been launched in Singapore, Japan and China. When looking at these exchanges, we can conclude the following:

Japanese companies have large volumes contracted and because of that they have not been able to engage in trading at the newly created hub in Japan. LNG buyers plan to get rid of oil price indexation in long-term contracts, so a functioning hub that provides a price benchmark (whether in Japan or in another location in the Asia Pacific region) is definitely within their interest.

Singapore meanwhile seeks to become the center of physical trades of LNG at the regional and global level. Its position as an established oil trading hub and the existence of a high number of energy companies and financial institutions in the country can help to strengthen its position as an LNG trading center.

China has several potential hubs. One of them is the Shanghai Petroleum Gas Exchange (SHPGX), which aims to position itself as the main natural gas hub in China, and later to become an international platform for the pricing of hydrocarbon resources in the Asia Pacific Region. Initial results show that the SHPGX is producing more positive results than other exchanges in the region. Another potential hub is the Chongqing Natural Gas Trading Exchange, which is a newly created entity with large ambitions and potential as well. Many consider that China is the most prospective candidate for the role of becoming an Asian gas hub thanks to its considerable volume of indigenous natural gas production and its diverse import sources such as LNG and pipeline imports.

Lack of liquidity is a characteristic of all the potential hubs discussed in this paper. It should be noted, however, that there is no other place in the world where LNG trading is more active than in the Asia Pacific region but that there is not enough trading activity to support LNG hubs in the global market overall. This is due to the difficulties of transportation and storage related to this fuel; the large capital investments required in LNG infrastructure restricts the number of market participants. Therefore, it can take more time for the LNG market to develop compared to the oil market, for example, and the path to a liquid and reliable LNG trading hub is complicated and unpredictable. However, thanks to a number of advantages of natural gas (such as being the cleaner fossil fuel and its price-competitiveness as a transportation fuel), LNG trading activities will continue to grow, and the role of LNG hubs will strengthen over time.

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BOOK REVIEW

RENEWABLE ENERGY SOURCES IN THE ISOLATED COMMUNITIES OF THE RUSSIAN ARCTIC

Hilma Salonen

Abstract

Hilma Salonen, visiting researcher from the Helsinki University, reviews the book: Renewable Energy Sources in the Isolated Communities of the Russian Arctic (Возобновляемые источники энергии в изолированных населенных пунктах Российской Арктики). Authors: Berdin, V. H., Kokorin A.O., Yulkin, G.M., Yulkin, M.A. (Бердин В.Х., Кокорин А.О., Юлкин Г.М., Юлкин М.А.). Publisher: WWF, 2017. 80 pp.

Key words: Renewable energy sources, distributed generation, Russian Arctic

Far-flung, sparsely populated settlements of the Russian Arctic have, since the Soviet times, received energy deliveries via the so-called Northern Delivery system. The deliveries travel distances of thousands of kilometers, often in conditions where roads are in such a condition that using waterways and ice roads is the only option. It may thus take from several months to even 1.5 years for these shipments to reach their destination. These difficulties raise the price of fuel considerably, so that the share of transport expenses in the fuel cost can be as big as 70%, and the deliveries are only possible with the help of heavy subsidies. To complicate the situation further, the deliveries are under increasing pressure as the effects of climate change warm up the Arctic, melt ice roads and prolong the thaw period.

The report that we are reviewing, published by WFF and written by V. Berdin, A. Kokorin and G. Yulkin and M. Yulkin, concentrates on evaluating current solutions to the challenges posed by the distances in the Far North through the increased use of renewable energy as well as on identifying the regions where and technologies with which these challenges might be overcome in the future. The writers of the report have succeeded in meticulously mapping the past efforts and current potential for future projects in each region of the Russian Arctic. The cities of Murmansk and Arkhangelsk, and the autonomous districts of the Nenets, Yamalo-Nenets and Chukotka, Taimyr, Sakha and Kamchatka are examined separately in detail, with special attention to their resources and projects of wind energy and solar power. In most regions, these resources, especially when combined with diesel generators, have the best potential to provide solutions to the problem of energy supply in the far-flung small settlements. These energy sources can be installed on a small scale in a range of locations and help to ease the problem of storage of typical fuels used in those areas.

The report takes the effort to illustrate both the limits of the central grid, the geographical dimensions of local renewable resources and the location of the settlements with the help of maps. In general, the wind power potential is highest along the coasts of the Arctic Ocean, while the prospects of solar power stand out mainly in Sakha and parts of Kamchatka. As for the centralized power grid, it is very limited especially in eastern Siberia and the Far East, concentrating around the bigger urban settlements and excluding vast areas of sparsely populated land and its industries. While some settlements dependent on the Northern Delivery system are already mixing energy from wind turbines and solar panels with that of diesel generators, Arctic conditions pose a lot of challenges to this. For example, in locations where the winds are especially strong, e.g. in Tiksi, several pilot projects have failed as the equipment has been blown over. Therefore, the best results have been achieved under 'intermediate' conditions, for example in Murmansk and Kamchatka, where the winds are strong but the overall climate is milder. To complicate the issue further, the current legislation requires wind energy equipment to be at least partially manufactured or assembled in Russia, limiting the possibilities to utilize foreign technology and expertise.

Thus far, most regions have experimented with small wind energy installments. The republic of Sakha is a notable exception due to its large potential for solar power, and Kamchatka for its geothermal sources and plans for hydropower dams in the region's smallest rivers. Utilizing tidal power is also a theoretical possibility in many regions, although not in near future. The problem common to all regions is that the current maintenance problems of the central grid networks require more attention than the needs of the remote settlements. The report concludes that many actors in the field are waiting for successful examples from pilot projects in other regions, whose example could be then copied.

The republic of Sakha has been a frontrunner in the field because of good cooperation between the regional government and private energy companies in developing pilot projects previously. The conditions for wind energy

Illustration: Batagay solar power plant, the largest solar power plant north of the Polar circle. Capacity: 1 MW. Area size: 4.2 hectares. Equipment: Suntech STP300-24/Ve. Temperature range: max. +40°C, min. -45°C.

Source: Petr Okoneshnikov, ysia.ru

might be more favorable in Murmansk, where the winds are strong and the overall climate milder, but the motivation to develop renewable energy is diminished by the fact that 99% of the population lives within the reach of the centralized power network. In some regions such as Taimyr, only 64% live in urban settlements and thus the need to update the isolated energy supply becomes much more pressing. Unfortunately, the energy company RAO Energy East, owning most companies responsible of the power stations of Eastern Siberia and Far East, has been suffering from financial difficulties lately and is thus concentrating on only the most necessary maintenance work. Although balancing imported fuels with renewables would save money and fuel, the savings are not yet big enough to motivate regional leaders to make them a priority. In addition, the poor state of the power network should be considered before any major changes in the fuel mix take place, but the problem is that the electricity tariffs are already too high. In other words, for the time being, only a long-term investor such as the state is a viable option for developing the use of renewables.

The report recommends more flexible solutions to be considered in order to overcome both the financial and maintenance problems and gain long-lasting results. Especially combined wind-diesel units are seen as a way to ensure sufficient energy reserves while also decreasing the need for imported fuel and coal. These types of innovations also seem to be more exciting for investors. The report also stresses the need for a more efficient fuel economy, which would entail replacing many outdated diesel generators with new, energy-efficient ones that could also be connected with wind or solar generators. Also here, the greatest progress thus far has happened in Sakha. In addition, it is suggested that the requirement for localized production of renewable equipment could be loosened regarding these type of pilot projects and that a targeted subsidies system should be implemented to meet the targets. There are successful examples of solar power and combined wind-diesel units in a larger scale from Sakha and Murmansk, albeit in connection with the centralized grid and not within isolated energy systems. On this basis, and with adequate funding, it may be possible to develop them further, according to the report.

In this report, Berdin et al. succeed well in presenting the realities facing new renewable energy projects in the Russian Arctic, from the geographic and environmental as well as the financial point of view. In their analysis, it becomes clear that the situation cannot be solved with a simple solution. Instead, several problems, such as the poor condition of the central power network and the lack of investors for renewable energy projects, are connected to each other. On the other hand, the report also notes that the actions of the Russian state should strive to be more consistent and practical-minded. Despite the special attention given to the role of renewable energy in the isolated regions of the Arctic, a detailed support program is still lacking. In order to push for real progress in the field, a common effort between all stakeholders is required. Another obstacle in the way of renewables as a standardized power source in the Far North is that ecological reasons do not seem to motivate the regional decision-makers or local residents, so they cannot offer these solutions a competitive edge.

Although the report is quite comprehensive, a critical note must be made. Considering the complexity of the situation, it would have been useful to get more concrete information regarding other actors potentially interested in developing local renewable sources, such as gas and oil companies or mining companies. Regarding the increasing effect of global warming on the Northern delivery system, it would also have been useful to see more maps depicting the complicated delivery routes in order to better estimate its future challenges. However, the report gives a good basis for future research on the subject by opening up several possible growth points to be examined.

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OIL PRICE SHOCKS AND ECONOMIC GROWTH: THE EVIDENCE FROM KYRGYZSTAN

Alan Mamatov

Abstract

Starting from the second half of the 20th century, many researchers have focused their attention on the increasing influence of oil price shocks on global economic performance. However, the current stock of empirical literature significantly lacks research on developing oil importing economies from the post-Soviet region. The purpose of this paper is to empirically analyze the essence of the relationship between oil price shocks and economic growth in the specific case of the Kyrgyz Republic. Following an in-depth analysis of the macroeconomic structure of the country, it will be demonstrated that despite of the oil importing status of the Kyrgyz Republic, abrupt increases in crude oil prices may benefit the pace of its economic growth in the long-term, whereas abrupt decreases may not induce any visible impact.

Key words: Oil prices, price shocks, economic growth, Kyrgyzstan

For the last forty years, many researches have been devoting their attention to the increasing role of oil price fluctuations in global economic performance. Existing empirical inquiries can be characterized in accordance with the economies under consideration: oil importing and oil exporting. In turn, empirical results related to the impact of oil price fluctuations or shocks on real economic activity are found to be different in those two categories of countries.

Logically, an oil price increase should benefit oil exporters, but not oil importers, whereas an oil price decrease must positively impact oil importers, and not oil exporters. However, in reality the causal nexus might have a different essence. For instance, oil importing countries can absorb unfavorable effects of a negative oil price shock in light of different oil dependency pattern, different policies implemented, and different transmission mechanisms.[1]

The ways oil price fluctuations can affect the macroeconomic activity of developing oil importers pertain to both the supply and demand side of the economy. The aggregate supply side can be considered through the potential effect on the private production sector. For instance, if the price for crude oil (basic input) increases, it would lead to increase in production costs, which in turn lowers output. Assuming that a significant part of its gross domestic product (GDP) consists of an energy-intensive sector, a positive oil price shock would then decrease the overall welfare of the economy (ceteris paribus), i.e. reduce the pace of economic growth.[2]

In contrast to the supply side, an oil price increase might affect aggregate demand by altering the overall levels of consumption and investment. For an oil importing economy, it would cause consumption levels to fall as a result of a decrease in real disposable income. Investment levels would then be affected through the decreasing profitability of firms, which would make them less attractive from an investors' perspective.[3]

Moreover, oil price shocks may alter currency exchange markets and the inflation rate, which would lead to indirect effects on real economic activity. The exchange rate (floating regime) might also absorb negative effects of oil price shocks, incidentally boosting indirect effects. Moreover, Central Banks may induce a tighter monetary policy to offset inflation, which could potentially lead to a change in the lending interest rate. The bottom line is that the overall economic activity of a developing oil importer would likely slow down after a sudden increase of the oil price.[4]

However, for certain small oil importing economies, there is a possibility that positive oil price shocks could induce an opposite effect on real economic activity. The reason for that might be the composition of GDP, the geographical position of the country, close economic relations with big oil exporting economies, or the influence of remittances on aggregate demand.

Additionally, results of certain inquiries conclude that the impact of oil price fluctuations on economic growth cannot be described via the conventional way of linear and symmetric specification. [5]

In contrast to most studies, which are generally focused on developed economies, the present research will assess the effects of oil price shocks on economic growth in the specific case of the small oil importing economy of the Kyrgyz Republic. In analyzing the dynamic interactions between oil price shocks and economic growth, special attention will be paid to the influx of remittances as a major transmission channel for indirect effects of abrupt oil price fluctuations.

1 Jiménez-Rodríguez, R., 2009. Oil Price Shocks and Real GDP Growth: Testing for Non-linearity. Applied Economics. 37(2). [Accessed 05 April 2016].

2 EconPort, 2015. Supply and Demand Shocks. [pdf] Available at: <http://www.econport.org/content/handbook/Equilibrium/shocks.html> [Accessed 1 April 2016].

3 EconPort, 2015. Supply and Demand Shocks.

4 Jiménez-Rodríguez, R., 2009. Oil Price Shocks and Real GDP Growth: Testing for Non-linearity.

5 Idem.

Specifically, a multivariate vector autoregression (VAR) analysis will be applied on a monthly time series data set (covering the period from January 2005 until December 2015) to enlighten the way oil price changes might impact the real economic activity of the Kyrgyz Republic.

THE STRUCTURE OF THE ECONOMY OF THE KYRGYZ REPUBLIC AND ITS POTENTIAL RESPONSE TO OIL PRICE SHOCKS

The Kyrgyz Republic (or Kyrgyzstan) is a developing, landlocked economy in Central Asia. Prior to its independence in 1991, Kyrgyzstan was a part of the Soviet Union, an alliance which significantly determined its development also after the Soviet Union's collapse. Currently, Kyrgyzstan is considered to be a low-middle income country, with the gross national income (GNI) per capita equaling to 1,170 U.S. dollars (2015).[6]

After the end of the Soviet Union era, Kyrgyzstan suffered considerably from a large contraction in industrial output, a diminishing standard of living, and an overall recessionary pattern of national economy. The government tried to implement several neo-liberal reforms to smooth the transition from a centrally-planned to a free market-oriented type of economy. Among others, the government of Kyrgyzstan supported the mass privatization of state-owned enterprises, a rapid integration into international trade system, and a complete deregulation of the economy.[7]

The economy of the country was steadily developing until the national revolution of of 2005, which significantly diminished the growth capacity of the country, as well as its investment attractiveness. Five years later in 2010, Kyrgyzstan suffered from another political upheaval and national turmoil, which further worsened its development potential.[8]

From an international trade perspective, Kyrgyzstan, as a landlocked economy, is heavily dependent upon the trade relations with its closest neighbors, i.e. the Russian Federation, Kazakhstan, and China. |And indeed, for the last years, Kyrgyzstan's major import sources have been China, Russian, and Kazakhstan with the most imported products being various textiles, refined petroleum, machinery and equipment. [9]

In the meantime, the countries to which it exports most are Switzerland, Kazakhstan and Russia. The largest amount oa trade with Switzerland occurs because of the internal gold production. Concurrently, the prime exported products were precious metals, together with various textiles, agricultural products, and other ferrous metals. [10]

Addressing the composition of the GDP of the country for the last seven years directly, it is reasonable to state that the GDP of Kyrgyzstan has been heavily dominated by the service sector. In particular for the period of 2009-2015, the share of the service sector in the GDP of Kyrgyzstan was, on average, equal to 47 percent, while in 2015 it reached its peak value of 50 percent.

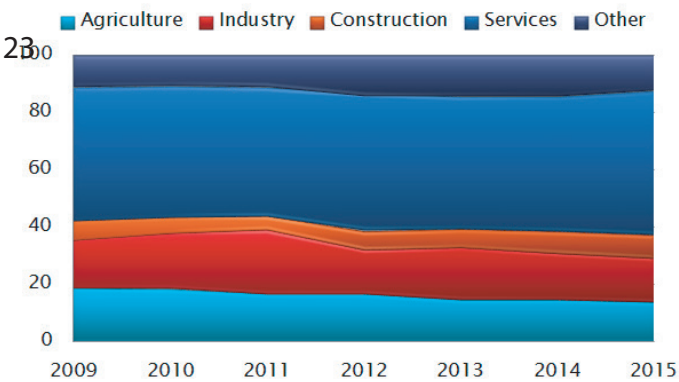


Figure 1: The GDP structure of the economy of the Kyrgyz Republic, 2009-2015

Source: Ministry of Economy of the Kyrgyz Republic, 2016. Sotsyal'no-ekonomicheskoe razvitie Kyrgyzskoy Respubliki. [online] Available at: <http://mineconom.gov.kg/index.php?Itemid=159&lang=ru> [Accessed 1 June 2016].

The second largest sector for the same period was the industrial sector, which on average accounted for 18 percent of the country's GDP, whereas the third largest sector was the agricultural sector, which, on average, made up 16 percent of the GDP. Finally, the last sector of significance was the construction sector, which accounted for about 7 percent of the GDP. The graphical information on the changes in the composition of Kyrgyzstan's GDP for the period of 2009-2015 is presented in Figure 1 (see above).

Furthermore, it is necessary to mention the huge role that international remittances have in influencing macroeconomic performance of the Kyrgyz Republic. The population of Kyrgyzstan has experienced a massive external labor migration, since the beginning of 2000s. External labor migration was primarily determined by the low living standards and lack of job opportunities in Kyrgyzstan, as well as by the rapid economic expansion in neighboring Kazakhstan and Russia.
Hence, Kyrgyzstan became the second largest remittance-receiving country in the world, where the remittances strongly determined the economic well-being and the quality of life of the majority of the population. The major part of remittances comes from labor migrants working in either Russia or Kazakhstan.

6 *The World Bank, 2014. Kyrgyz Republic: Overview. [online] Available at: <http://www.worldbank.org/en/country/kyrgyzrepublic/overview> [Accessed 22 June 2016].*

7 *Central Intelligence Agency, 2015. The World Factbook: Kyrgyzstan. [online] Available at: <https://www.cia.gov/library/publications/the-world-factbook/geos/kg.html> [Accessed 24 June 2016].*

8 *Central Intelligence Agency, 2015. The World Factbook: Kyrgyzstan.*

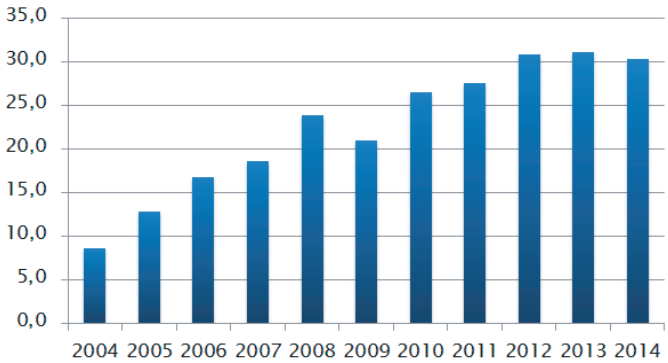
9 *The Observatory of Economic Complexity, 2014. Kyrgyzstan. [online] Available at: <http://atlas.media.mit.edu/en/profile/country/kgz/>*

10 *The Observatory of Economic Complexity, 2014. Kyrgyzstan. [online]*

11 *Ministry of Economy of the Kyrgyz Republic, 2016. Sotsial'no-ekonomicheskoe razvitie Kyrgyzkoy Respubliki. [online]*

12 *Akmoldoev, K. and Budaichieva, A., 2012. The Impact of Remittances on Kyrgyzstan Economy. [pdf] Available at: <http://avekon.org/papers/534.pdf> [Accessed 25 June 2016].*

13 *Budaichieva, A., 2012. The Impact of Remittances on Kyrgyzstan Economy.*



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Source: Ministry of Economy of the Kyrgyz Republic, 2016. Sotsyal'no-ekonomicheskoe razvitie Kyrgyzskoy Respubliki. [online] Available at: <http://mine-

Specifically, for the recent decade, the average value of remittances as a share of the GDP was equal to 22.5 percent, reaching its paramount value of 31 percent in 2013. More detailed information on the changes in the value of personal remittances as a share of Kyrgyzstan's GDP is presented in the Chart 2 above.

The strong role of personal remittances, as well as the firm trade relations with Russia and Kazakhstan (both are considered pure oil exporting economies), might significantly alter the way crude oil price shocks would affect the real economic activity in the Kyrgyz Republic.

Taking into consideration the structure of the economy of Kyrgyzstan, its GDP composition, geographical constraints, close economic ties with Russia and Kazakhstan, and huge influx of remittances from aforesaid countries, the transmission mechanisms through which oil price shocks might impact the economic growth of Kyrgyzstan might drastically differ from what would be considered from conventional perspective.

For example, an abrupt decrease of the oil price might not directly benefit the real economic activity in the Kyrgyz Republic due to the country's GDP structure, which is heavily dominated by the service sector. The service sector is usually regarded as considerably less energy-intensive than light or heavy industries.

Furthermore, a sudden decrease in the crude oil price should negatively impact the real economic activity of Kyrgyzstan's close neighbors, i.e. Russia and Kazakhstan, due to their oil exporting nature. A Curtail in real economic activity of Russia and Kazakhstan, in turn, would diminish the aggregate amount of remittances that flows to Kyrgyzstan from its labor migrants. That, of course, would induce a significant negative demand shock to Kyrgyzstan's population that heavily relies upon personal remittances.

Moreover, an adverse impact of an abrupt decrease in crude oil price on the economic growth of Russia and Kazakhstan might entail a negative growth spillover effects on the economy of Kyrgyzstan, due to the country's landlocked nature[14]. The overall outcome should thus be an indirect slowdown of real economic activity in the Kyrgyz Republic, resulted from a negative oil price shock.

In case of a positive oil price shock, the sequence of events might take an opposite nature: the economies of Russia and Kazakhstan would benefit from a sudden increase in crude oil prices, while the economy of Kyrgyzstan might not suffer a lot, due to the composition of the country's GDP.

Economic expansion in Russia and Kazakhstan would possibly increase the influx of remittances from Kyrgyzstan's labor migrants, as well as enhance the positive growth spillover effects. The aggregate outcome would then be an indirect enhancement of the real economic activity in the Kyrgyz Republic, resulting from a positive oil price shock.

THE EMPIRICAL ANALYSIS

In order to empirically examine and verify the nature of the relationship between oil price shocks and the economic growth of Kyrgyzstan, as well as to determine the role of remittances in the aforesaid interaction, the vector autoregression (VAR) analysis was chosen to be employed.

Christopher A. Sims firstly proposed the multivariate VAR methodology in the context of structural macroeconomic analysis. The VAR approach introduced by Sims allowed the investigation of the stochastic behavior of macroeconomic indicators in the framework of the dynamic systems, alleviating common constraints on parameters.[15]

The system of VAR equations is commonly represented in the Moving Average form, ensuring applicability of the impulse response functions and forecast error variance decomposition analyses:[16]

$$Y_t = \eta + \sum_{j=0}^{\infty} \Omega_j \varepsilon_{t-j}$$

$$\eta = (I_n - \sum_{j=1}^{p} \Theta_j)^{-1} c$$

Where:

$Y_t - (6 \times 1)$ vector of the variables of interest;

Ω_j – identity matrix;

I_n – identity matrix;

η – the mean of the process;,

Θ_j – the j^{th} matrix of autoregressive coefficients of the dimesion $(6 \times 6)$for $j = 1,2, \dots, p$;

$c = (c_1 \dots c_6)' - (6 \times 1)$ intercept vector of the VAR model;

$\varepsilon_t - (6 \times 1)$ vector of reduced – form residuals.

14 Faye, M. L., McArthur J.W., Sachs J.D. and Snow T., 2004. The Challenges Facing Landlocked Developing Countries. [pdf] Available at: http://www.unmillenniumproject.org/documents/JHD051P003TP.pdf [Accessed 26 June 2016].

15 Sims, C. A., 1980. Macroeconomics and Reality. [pdf] Available at: http://www.jstor.org.ldb.osceacademy.kg:3020/stable/pdf/1912017.pdf [Accessed 25 October 2016].

16 Jiménez-Rodríguez and Sánchez, 2004. Oil Price Shocks and Real GDP Growth. Empirical Evidence From Some OECD Countries. [pdf] Available at : https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp362.pdf?b35d2a5fd0bae52378b274ce13a956c4 [Accessed 25 October 2016].

The set of variables were chosen upon the works of previous scholars. Specifically, the description of the model and the key variables were borrowed from the work of Jiménez-Rodríguez and Sánchez,[17] with the inclusion of the appropriate modifications necessary to test the proposed hypothesis.

In particular, the model incorporates three key variables of interest: crude oil prices, the real GDP of the Kyrgyz Republic, and the monthly influx of remittances. These are included in order to examine the previously mentioned hypothesis and trace the impact of shocks in the crude oil price on the real GDP of Kyrgyzstan and inflow of remittances.

The crude oil price variable is represented by the monthly changes in the Brent spot crude oil price, taken as U.S. dollars per barrel. The spot price for Brent crude oil is considered to be one of the leading global benchmark prices of crude oil, and was extensively used by researchers previously.[18]

The real GDP of Kyrgyzstan is used as a proxy for economic growth, while remittances are added to control for the crucial transmission mechanism, through which changes in crude oil prices might induce demand shock to the economy of Kyrgyzstan (both real GDP and remittances are expressed in natural logarithms, the first differencing of which allows to perceive variables in terms of growth rates).

Moreover, there are several additional control variables that are included to the model to account for other potential transmission mechanisms.[19] Kyrgyzstan's net imports of energy products are added to control for trade distortions that may arise from sudden changes in crude oil prices for instance.

As was mentioned previously, Kyrgyzstan is a landlocked economy, implying a strong dependence upon the trade relations with close geographical neighbors. The Russian Federation and the Republic of Kazakhstan, the largest economic partners of the Kyrgyz Republic and its closest neighbors, are quite sensitive to the sudden hikes in oil prices, due to the oil-exporting nature of their economies.

Thus, oil price fluctuations might impact the real economic activity of Kyrgyzstan through negative or positive growth spillover effects. In turn, it is likely to be translated through changes in net imports of energy products of the Kyrgyz Republic, due to the oil-importing nature of Kyrgyzstan's economy.

Additionally, the real effective exchange rate and the inflation rate are added to the system in order to control for other crucial transmission channels through which oil price fluctuations might indirectly impact the economic growth of Kyrgyzstan.[20]

Lastly, the crude oil price variable will further be transformed into two separate variables in order to capture the potential non-linear relationship between oil price shocks and real GDP of the Kyrgyz Republic. Particularly, the asymmetric transformation of the oil price variable will have the following form:[21]

$$\text{OilPrices}^{+}_{t} = \begin{cases} \text{OilPrices}_t \;\; if \;\; \text{OilPrices}_t > 0 \\ 0 \;\; otherwise \end{cases} \qquad \text{Positive change}$$

$$\text{OilPrices}^{-}_{t} = \begin{cases} \text{OilPrices}_t \;\; if \;\; \text{OilPrices}_t < 0 \\ 0 \;\; otherwise \end{cases} \qquad \text{Negative change}$$

The data sample on each variable is comprised of monthly data and covers the period from January 2005 to December 2015. The total number of observations is equal to 132.

The data points on real GDP and the inflation rate originate from the official archives of the National Statistical Committee of the Kyrgyz Republic. The real GDP is measured in millions of soms (the domestic currency of Kyrgyzstan) and adjusted for the monthly inflation rate.

The data points on the monthly influx of remittances, the real effective exchange rate, and the net imports of energy products come from the online statistical database of the National Bank of the Kyrgyz Republic (the subsection named "external sector of the economy" contains the data on the aforesaid variables).[22] The data on the Brent spot crude oil price originates from the database of the U.S. Energy Information Administration (the section named "Spot Prices for Crude Oil and Petroleum Products").

In particular, monthly influx of remittances and net imports of energy products are represented in millions of the U.S. dollars. For the real effective exchange rate the base period is the year of 2010. Moreover, the real effective exchange rate is adjusted to the basket of ten significant foreign currencies, among which the U.S. dollar, the euro , the Russian ruble, the Kazakhstani tenge, the Chinese yuan, the Japanese Yen, the Turkish lira, and other regional foreign currencies.

As previously stated, five out of six variables were transformed to the natural logarithmic form to be able to produce inference in terms of elasticities. The inflation rate was not transformed to the natural logarithms, due to the fact that it was already represented in the form of percentage changes in the CPI.

It has to be noted that several statistical procedures were performed on each variable from the chosen data set, in

17 Idem.

18 Idem.

19 Idem.

20 Idem.

21 Idem.

22 National Bank of the Kyrgyz Republic, 2015. Statistics: External Sector of the Economy. [online] Available at: <http://nbkr.kg/index.jsp?lang=ENG> [Accessed 26 October 2016].

order to ensure stationarity of the stochastic processes and eliminate the possibility of co-integration among time series variables.

In particular, augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) unit root tests were performed on each variable of the model. Under each testing procedure it was verified that variables of the proposed model are first difference-stationary variables or integrated of order one, implying that first differencing is sufficient to achieve stationarity of the stochastic processes.

The potential presence of co-integration among stochastic variables was tested through the Søren Johansen's (1995) test for co-integration.[23] The results of the test clearly indicated the absence of co-integration among tested variables, thus solidifying the validity of the proposed VAR model.

Finally, the likely occurrence of residual autocorrelation was verified through the Lagrange-multiplied test, which demonstrated no autocorrelation in residuals for constructed model, whereas the lag-order selection statistics was based upon the Akaike information criterion.

THE MACROECONOMIC EFFECTS OF OIL PRICE SHOCKS

Based upon the previously established VAR methodology, it is possible to extend the verification of the proposed hypothesis through the impulse-response functions (IRFs) analysis.
In particular, the present study relies on the results of cumulative IRFs, which allow tracing the accumulated response of a certain endogenous variable to a unit exogenous shock in another endogenous variable within the dynamic system of VAR equations.[24] The vertical axis in each IRF graph represents a percentage change in a response variable. The horizontal axis, in turn, displays the time path of a response variable, where each step equals one month. Shaded areas represent two standard error bands of the 95 percent confidence interval.

To justify the application of the IRFs analysis, the series of the Granger-causality Wald tests were implemented. Formally, "a variable X is said to Granger-cause a variable Y if, given the past values of Y, past values of X are useful for predicting Y".[25]

The results from the Granger-causality Wald tests determined that in a model with positive oil price changes, the real GDP is Granger-caused by both positive oil price changes and remittances. The remittances variable, in turn, was Granger-caused only by positive oil price fluctuations.

Thus, for the first model it is necessary to analyze the impact of one percent of positive oil price shock induced on the response paths of the real GDP and remittances variables. Additionally, it is possible to trace the impact of one percent positive shock in the influx of remittances induced on the real GDP.

Figure 3 demonstrates the accumulated response of Kyrgyzstan's real GDP to one percent positive oil price shock. As one may observe from the graph, the first reaction of Kyrgyzstan's real GDP to a sudden change in oil price is negative.

Particularly, in one month after the shock, the real GDP of the Kyrgyz Republic would decrease by approximately 0.182 percent. This negative pattern would remain until the fourth month, and the decrease in real GDP in four months after the shock would be equal to approximately 0.025 percent.

Yet, after the fourth month, the real GDP exhibits a steady positive growth pattern. Specifically, in six months after the positive oil price shock, the real GDP of Kyrgyzstan would increase by about 0.311 percent. In ten months after the one percent positive oil price shock, the accumulated effect is even more pronounced, indicating the increase in real GDP of Kyrgyzstan by about 0.501 percent.

After tenth months, the cumulative impact of positive oil price shock on the real GDP of Kyrgyzstan would drastically diminish, implying that the effect eventually dies out. In twelve months, the one percent positive oil price shock would induce only 0.204 percent amplification in the real GDP of the Kyrgyz Republic.

Figure 4 indicates the impulse-response path of the influx of remittances variable to one percent positive oil price shock. As one may observe from the graph below, a positive oil price shock induces a steady increase in the influx of remittances to the Kyrgyz Republic.

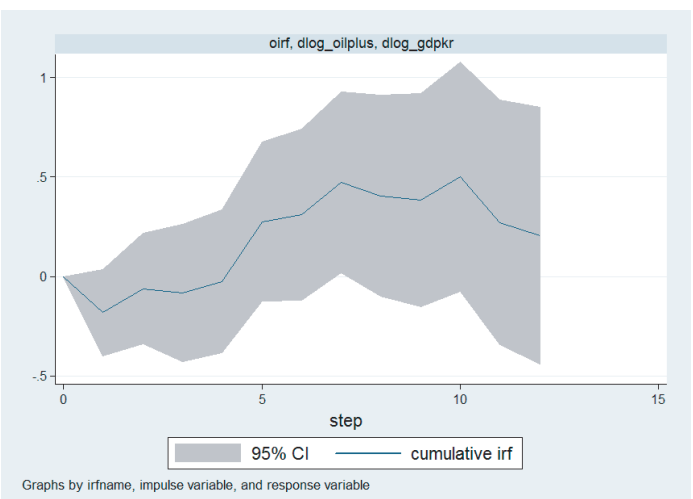

Figure 3: Accumulated impulse-response path of the real GDP of the Kyrgyz Republic to one percent positive oil price shock

23 StataCorp, n.d. Estimate the cointegrating rank of a VECM. [pdf] Available at: <http://www.stata.com/manuals13/tsvecrank.pdf> [Accessed 27 October 2016].

24 StataCorp, n.d. Create and analyze IRFs, dynamic-multiplier functions, and FEVDs. [pdf]

25 Idem.

In particular, one month after the shock, the remittances' inflow would increase by about 0.183 percent. With a minor decrease in a third month, the influx of remittances demonstrates a firm upward trend up until the fourth month. After the fourth month, the effect of a shock eventually stabilizes, indicating a permanent nature of the induced impact.

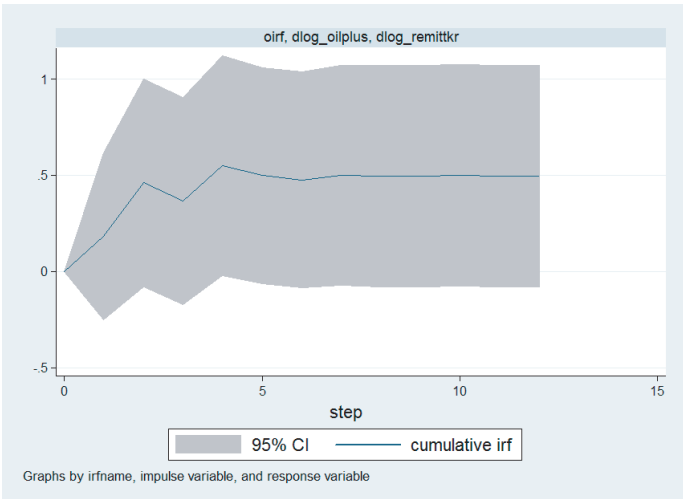

Figure 4: Accumulated impulse-response path of the influx of remittances to one percent positive oil price shock

Finally, Figure 5 represents the accumulated response of Kyrgyzstan's real GDP to one percent positive shock in the influx of remittances. As one may observe from the graph below, initially the real GDP responds positively to the sudden increase in the remittances' inflow. In particular, one month after the shock the real GDP of Kyrgyzstan would sharply increase by about 0.087 percent.

However, after the first month, the accumulated impulse-response path of the real GDP demonstrates a steadily diminishing pattern, indicating that the impact of one percent shock in remittances induce a rather short-run nature.

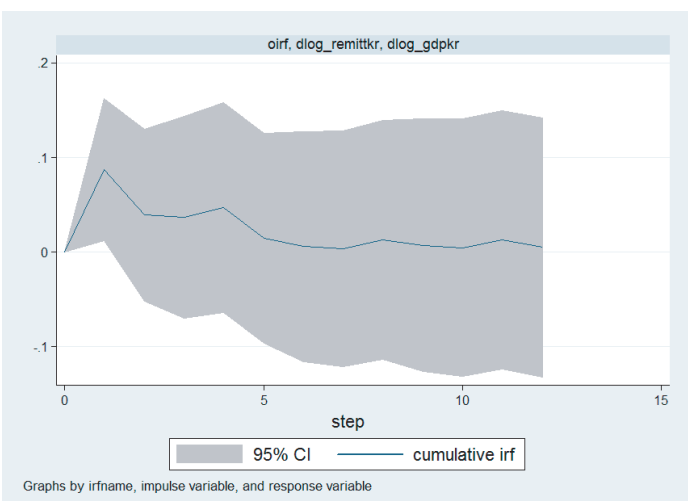

Figure 5: Accumulated impulse-response path of the real GDP of the Kyrgyz Republic to one percent positive shock in the influx of remittances

In three months after the shock, the real GDP would increase only by about 0.037 percent, while in six months after the shock, the positive impact of an increase in remittances is almost negligent, equaling to a 0.006 percent amplification in the real GDP of the Kyrgyz Republic. In one year after the shock, the accumulated effect eventually disappears.

Considering the model with negative oil price changes, the Granger-causality Wald tests revealed that neither remittances nor negative oil price fluctuations Granger-cause changes in the real GDP of the Kyrgyz Republic. Thus, construction and interpretation of the corresponding cumulative IRFs cannot be implemented, due to the absence of any visible causal relationship among the aforesaid variables.

However, it was revealed that the influx of remittances is Granger-caused by the negative oil price changes, and thus is sensitive to them. Below, Figure 6 represents the accumulated impulse-response path of remittances to a one percent negative oil price shock. It is evident that the nature of the impact induced by the shock on the influx of remittances bears a transitory nature.

Specifically, in one month after the shock, the influx of remittances would decrease approximately by 0.066 percent. However, after the first month, the accumulated effect rapidly dies out, indicating that negative oil price shock would impact remittances only in the short-run.

In six months after the shock, the influx of remittances would decrease by about 0.017 percent, whereas in twelve months the impact would be even more negligent, equaling approximately to 0.013 percent decrease in remittances' inflow.

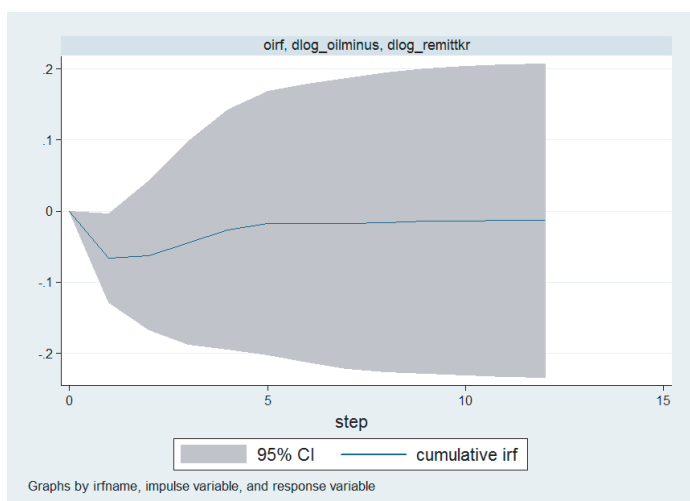

Figure 6: Accumulated impulse-response path of the influx of remittances to one percent negative oil price shock

Impulse Variable – Response Variable	T = 1	T = 6	T = 9	T = 12
$\Delta lnOIL_t^+ - \Delta lnGDP_t$	-0.182	0.311	0.383	0.204
$\Delta lnOIL_t^+ - \Delta lnREMITT_t$	0.183	0.477	0.496	0.496
$\Delta lnREMITT_t - \Delta lnGDP_t$	0.087	0.006	0.007	0.005
$\Delta lnOIL_t^- - \Delta lnREMITT_t$	-0.066	-0.017	-0.014	-0.013

Figure 7: Accumulated response elasticities

Impulse Variable – Response Variable	T = 1	T = 6	T = 9	T = 12
$\Delta lnOIL_t^+ - \Delta lnGDP_t$	-0.178	0.309	0.380	0.202
$\Delta lnOIL_t^+ - \Delta lnREMITT_t$	0.180	0.475	0.493	0.492
$\Delta lnREMITT_t - \Delta lnGDP_t$	0.077	0.005	0.005	0.004
$\Delta lnOIL_t^- - \Delta lnREMITT_t$	-0.065	-0.017	-0.014	-0.012

Figure 8: Accumulated response elasticities after order readjustment

To summarize the results from the cumulative IRF analysis presented above, Figure 7 demonstrates the response statistics for each of the above-mentioned graphs. The first column of Figure 7 indicates the pair of impulse and response variables, whereas the first row highlights the corresponding time path. The internal part of Figure 7 is filled with the response elasticities, i.e. the percentage of change in the response variable caused by a one percent shock in impulse variable. As was previously mentioned, the dynamic system of VAR equations and the behavior of cumulative IRFs are sensitive to the specific order of the variables within each equation. Thus, as a robustness check for the proposed model and obtained results, it was decided to change the order of the variables within the dynamic system of VAR equations, further checking how a readjustment of variables would alter the behavior of the cumulative IRFs.

Figure 8 above summarizes the response elasticities for both models after an order readjustment was applied. As one may observe, the response elasticities have not demonstrated significant changes, preserving a similar trend of the response path. The similarity of the obtained results demonstrates an overall validity of the model and cumulative IRFs.

CONCLUSION

The peculiarities of the interaction between oil price shocks and economic growth cannot be considered insufficiently explored topics; there are numerous empirical inquiries devoted to the issue, covering different countries in various time periods, even taking into account the possibility of non-linear relationship.

Yet, there is still a shortage of empirical investigations on how the economic growth pattern of small oil importing economies from the post-Soviet region would react to a sudden change in the crude oil price.

The objective of the present study was to empirically explore how the economic growth in the Kyrgyz Republic would react to an unexpected oil price shock. The economy of the country incorporates a number of particular internal characteristics, i.e. the specific structure of the GDP, an unfavorable geographical position, and a strong economic influence from huge oil exporting economies. This, in turn, might completely transform the conventional way of how the small oil importing economy of the Kyrgyz Republic might react to abrupt fluctuations in crude oil prices.

Relying on the dynamic multivariate VAR methodology with corresponding derivation of Granger-causality Wald tests and cumulative impulse-response functions, it was revealed that only positive oil price shocks induce an effect on the real GDP of the Kyrgyz Republic.
Specifically, an immediate reaction of Kyrgyzstan's real GDP to an abrupt oil price increase is negative. This fact does not support previously stated argument that economic growth of the Kyrgyz Republic should immediately benefit from a sudden hike in oil prices.

Our finding can be explained by the underestimation of the oil importing nature of Kyrgyzstan's economy. Whereas service sector reserves the largest share of Kyrgyzstan's GDP, industrial, agricultural and construction sectors are still dependent upon the supplies of energy products, and thus are sensitive to sudden fluctuations in crude oil prices.

However, in the long-term, the real GDP of the Kyrgyz Republic demonstrated an upwardly increasing pattern, proving that an abrupt increase in the oil price might benefit the real economic activity in Kyrgyzstan, yet not immediately and directly.

On the other hand, we found an absence of causality in terms of the effect of negative oil price shocks on the real GDP of the Kyrgyz Republic. The result was unexpected, as it was believed that negative oil price shocks should indirectly deteriorate the real economic activity of a small oil importing economy.

The acquired result might be explained by the overestimated roles of remittances, growth spillover effects and negative oil price fluctuations, as determinant factors of changes in the real GDP of the Kyrgyz Republic.

It has to be noted that the current empirical study incorporates a number of limitations, mostly with respect to the collected sample of time series data. Yet, despite of the existing limitations, the findings from the present research can be used for further investigations, as well as for the macroeconomic policymaking purposes

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COMMENTARY

LONG-TERM HONEYMOON BETWEEN RUSSIA AND THE OPEC: TOO EARLY TO EXPECT?

Nikolay Kozhanov

Abstract

Recent statements by Saudi Prince Mohammad bin Salman that OPEC is considering the signing of a long-term agreement with Russia and other non-OPEC members that would allow for controlling prices at the international oil market for the next ten to twenty years have created a lot of rumors on Russia's readiness to form a solid, long-term alliance with the Cartel. At the same time, Moscow prefers to be very cautious when discussing the future of Russian-OPEC / Russian-Saudi cooperation in the hydrocarbon market. This article looks at the rationale behind Russia's cooperation with Saudi Arabia and OPEC.

Key words: Russia, Saudi Arabia, OPEC, OPEC+, ROPEC, oil price

Recent statements by Saudi Prince Mohammad bin Salman that OPEC is considering the signing of a long-term agreement with Russia and other non-OPEC members that would allow for controlling prices at the international oil market for the next ten to twenty years[1] have created a lot of rumors on Russia's readiness to form a solid, long-term alliance with the Cartel (ROPEC?).[2] Currently, Moscow is already participating in the so-called OPEC+ agreement that was signed between OPEC members and some non-OPEC countries. This document implies that, till the end of 2018, these states will impose limits on domestic oil production in order to stabilize the situation on the international oil market.

So far, the OPEC+ agreement managed to achieve at least some goals it set and has boosted the growth of oil prices.[3] Nevertheless, Moscow prefers to be very cautious when discussing the future of Russian-OPEC/Russian-Saudi cooperation in the hydrocarbon market. Thus, when commenting on Mohammad bin Salman's statements, Kremlin's spokesman Dmitry Peskov only argued that Russia, indeed, has a diverse and multilevel dialogue with the Saudis on different issues including the development of the oil sector. [4]Yet, he avoided discussing the idea of a long-term agreement itself. In reality, the future of the oil pact between Russia and the OPEC is still unclear, not in the least because of potential contradictions between Moscow and Riyadh. While believing in the necessity to cooperate and control the oil market, each of the two countries sees the prospects of this control in a slightly different way. Thus, Russian experts interviewed by media site Al Monitor believe that the Kingdom does not have any set oil price's maximum through which Riyadh would prefer to stop the oil price growth. Or, at least, the Saudi price maximum is much higher than that of set by Russia (approximately 70 dollars per barrel). Consequently, it is expected that Riyadh will strive for as high oil prices as possible in order to facilitate the future IPO of Saudi Aramco, to fund Saudi economic reforms and to finance Mohammad bin Salman's adventures in Yemen.

Yet, Moscow is more after keeping oil prices in 50-70 dollars corridor. However, Saudi efforts might push them beyond 70 dollars. This is not in the interests of Russian oil producers as higher oil prices would strengthen their rivals in those countries that have not joined the OPEC+ deal. Another reason for Russian oil producers to be concerned on the Saudi attempts to mull for higher oil prices is that a price of oil above 70 dollars will not bring much profit to them. As argued by Russian market analysts, the additional income generated by high oil prices will be consumed by additional taxes and excise duties imposed by the government. As stated by oil experts interviewed by Al Monitor, under the current legislation, the oil companies will be able to maximize their output only through the increase in oil production with oil prices staying in the corridor of 50-60 dollars.

In general, Russian business seems to be against any further obligations with regard to the decrease in oil output beyond 2018. And there are some reasons for this. First of all, when joining the OPEC+, Moscow definitely lost its free-rider status, which allowed it to profit from OPEC actions aimed at increasing oil prices without being a member of the OPEC or having binding agreements with this cartel. Secondly, most of those factors that affect the international oil prices are not in the area of the OPEC+ influence (such as oil consumption in India and China or oil production in the US). Consequently, it does not make sense to work with the organization if it can't fully affect the situation in the market.

1 *RBC, 2018. Эр-Рияд рассказал о возможной десятилетней сделке ОПЕК и России [Riyadh discussed the possible 10 year deal between OPEC and Russia]. [online] Available at: <https://www.rbc.ru/rbcfreenews/5aba91cd9a7947bcb3e997ba> [Accessed 30 April 2018]*

2 *Sobolev A., 2018. Саудовская Аравия и Россия готовят долгосрочный пакт о контроле поставок нефти [Saudi Arabia and Russia are working on a long-term pact on oil supply controls]. [online] Available at: <https://news.ru/den-gi/neftyanaya-druzhba/> [Accessed 30 April 2018]*

3 *Gazeta.ru, 2018. Новак отметил позитивную роль соглашения ОПЕК+ [Novak noted the positive role of OPEC+ agreement]. [online] Available at: <https://www.gazeta.ru/business/news/2018/03/29/n_11349596.shtml?updated> [Accessed 30 April 2018]*

4 *Gazeta.ru, 2018. Песков прокомментировал предложение о подписании соглашения ОПЕК+ на 20 лет [Peskov commented on the proposal to sign OPEC+ agreement for 20 years]. [online] Available at: <https://www.gazeta.ru/business/news/2018/03/28/n_11343955.shtml?updated> [Accessed 30 April 2018]*

Thirdly, the extension of the oil production limits imposed by the OPEC+ agreement beyond 2018 will definitely backfire in relation to the plans of Russian corporations to put new oil-fields on-line.[5] Thus, on 23 March, Lukoil presented its new development strategy that implies an annual growth of production by 1 percent until 2027. Rosneft's plans imply a 2 percent growth of production annually until 2022, whereas Tatneft plans 2.4 percent of annual growth in oil production until 2025.

Apart from this, Russian business and market analysts believe that the OPEC+ deal is becoming too fragile and dependent on external factors.[6] Thus, they are convinced that some of the participants of the deal such as Iran, Libya, Nigeria, Iraq and, potentially, even Venezuela might either violate the OPEC+ agreement or even leave the deal in order to return the share of the market they previously lost due to a number of reasons (US sanctions, civil war, ISIS, economic and political crisis, etc.). Under these circumstances, it will be hard to secure the effective influence of the OPEC+ deal on the oil market should it be extended in one form or another.

The Kremlin does not share the critical views of Russian corporations on the OPEC+ deal and high oil prices. This is quite understandable: higher oil prices will ensure higher incomes in the Russian budget. Yet, given the current system of informal power structures in Russia, where the heads of oil corporations are also politically influential figures, the Kremlin can't ignore the opinion of the oil sector. Under these circumstances Moscow will be cautious when considering the Saudi idea to impose further limits on oil production. Thus, the director of the Russian Fund of National Energy Security, Konstantin Simonov, predicts that in order to extend Russian participation in the OPEC+ deal, Moscow will need either to provide further perks to oil companies or to change the system of taxation after 2018[7]. So far, the Russian leadership is getting more inclined not to extend its participation in the OPEC+ deal after 2018 and start the process of the gradual exit from the agreement as soon as the oil market is stabilized (for Russia this means that global commercial oil reserves will decrease until the five-year average). The latter is expected to happen by August – September 2018. In other words, since October 2018, Moscow might declare that it wants to disengage from the deal with the practical implementation of this decision after January 2019.

However, this still does not mean that the Russian leadership has taken the final decision on its participation in the OPEC+. So far, Russian officials have not made any clear statements in this regard. Moreover, they reserved certain space for maneuver by arguing that everything is possible.[8] There is still a chance that Moscow will stay the part of the deal, but it will demand less strict conditions for itself. The Kremlin is not interested in complete cutting of its relations with the OPEC as this will backfire in its dialogue with Saudi Arabia. However, Moscow also does not want to be a part of a fully-fledged consortium[9] that, on the one hand, is able to affect the international oil prices, but, at the same time, is also able to limit Russia's rights to determine its own volumes of oil exports and production. Under these circumstances, Moscow is after establishing a consultative ground for the members of the OPEC+ after 2018 that would allow them to discuss emerging challenges and potential investments projects. The decisions of this body are not going to be obligatory for its participants. Yet, it is not clear whether Saudi Arabia and other participants of the OPEC+ will support this idea: a forum format will not be able to affect the behavior of the market. Instead, they will probably be insisting on the formation of a new cartel which, in turn, is not in the Russian interests.

5 Finam, 2018. *Новое предложение от ОПЕК заставит российских нефтяников пересмотреть свои планы [New OPEC proposal will force Russian oil companies to review their plans]. [online] Available at: <https://www.finam.ru/analysis/marketnews/novoe-predlozhenie-ot-opek-zastavit-rossiiyskix-neftyanikov-peresmotret-svoi-plany-20180328-12400/> [Accessed 30 April 2018]*

6 Tikhonov S., 2018. *Будущие горизонты формата ОПЕК+ [Future horisons of the OPEC+ format]. [online] Available at: <http://www.ngv.ru/magazines/article/budushchie-gorizonty-formata-opek/> [Accessed 30 April 2018]*

7 Tikhonov S., 2018. *Будущие горизонты формата ОПЕК+ [Future horisons of the OPEC+ format].*

8 RBC, 2018. *Эр-Рияд рассказал о возможной десятилетней сделке ОПЕК и России [Riyadh discussed the possible 10 year deal between OPEC and Russia].*

9 TASS, 2018. *Первый замминистра энергетики РФ: Россия не рассматривает вступление в ОПЕК [Russia does not consider joining OPEC] [online] Available at: <http://tass.ru/ekonomika/5012710> [Accessed 30 April 2018]*

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FINLAND'S RENEWABLE ENERGY POLICY AS A FACTOR OF RUSSIAN-FINNISH ECONOMIC COOPERATION

Sergey Sutyrin, Serafima Khatkevich

Abstract

The energy sector is one of the areas of Russian-Finnish economic cooperation. Russia has been the major natural gas supplier to Finland as well as the main petroleum oil and coal exporter. In addition, Russia and Finland are bounded by common trade and investment interests in nuclear power engineering, wind power, wood biofuels and electricity. Nowadays, environmental protection affects the structure of trade in energy resources. The aim of this paper is to estimate when and how bilateral trade and investment cooperation in energy can change, and what are the consequences resulting from the energy transition in Finland for the Russian economy. The authors conclude that on the one hand, Russia's exports of traditional hydrocarbons will suffer. On the other hand, there are prospects for cooperation beyond traditional hydrocarbons, namely wood fuel and nuclear power. The paper also discusses the prospects for Russian-Finnish cooperation in natural gas, wind and hydropower, as well as partnership in the Arctic region.

Key words: Finland's fuel and energy complex, Russian-Finnish economic cooperation, Paris Agreement, renewable energy sources

The energy sector is a strategic area for Russian-Finnish economic and technological cooperation. Since the Soviet times, Russia has been the major natural gas supplier to Finland as well as the main petroleum and coal supplier. Furthermore, in 2015, the commercial export of electricity from Russia was upgraded into bilateral trade with the launch of Finnish electricity exports to Russia. However, Finland has remained a net importer of electricity from Russia. The monetary value of energy trade between Russia and Finland peaked in 2008, and has decreased since then began decreasing, in particular, because of the decline in the price of energy resources.[1] Nevertheless, in the first half of 2016, the share of Russian supplies in Finland's imports was 65 percent.[2] In addition, these two neighboring countries have common investment interests not only in above mentioned industries but also in nuclear, hydro- and wind power engineering.

In 2016, Finland ratified the Paris Agreement and began to implement its national Clean Technology Programme. In order to meet the conditions of the Agreement, Finland has to substitute traditional energy sources with renewable ones. This article focuses on the consequences of changes in the structure of energy consumption by sources in Finland for Russian-Finnish trade and investment cooperation in the energy sector. The article is structured as follows. First, a summary of Paris Agreement`s goals is given, including the peculiarities of its implementation in Finland, differences from Kyoto Protocol, and a description of the current situation in the energy industry in Finland. Second, we examine the influence of the international agreement under United Nations Framework Convention on Climate Change (UNFCCC) on Russian-Finnish economic relations with regard to oil, coal and natural gas as traditional energy sources. Third, the effects of the agreement on bilateral trade and investment cooperation in relation to non-hydrocarbon energy sources, such as biofuels, wind and hydropower, nuclear power are considered. Finally, the report concludes with recommendations for further areas of Russian-Finnish cooperation in the energy sector.

IMPLEMENTATION OF CLEAN TECHNOLOGY PROGRAMME UNDER THE PARIS AGREEMENT IN FINLAND

Environmental concerns started to affect the structure of trade in energy resources. Finland has played an active role in climate policy on international, European and national levels, consistently fulfilled rules and directives, and instituted programmes designed to eliminate emissions of greenhouse gases (GHG), primarily carbon dioxide (CO_2). Under the Kyoto Protocol, an international agreement on declining CO_2 emissions in industrially developed countries,[3] Finland has become one of the pioneers in implementing energy efficiency technologies inside and outside the country and in international trade in emission quotas.[4] When the Kyoto Protocol entered into force in 2005, Russian and Finnish Ministers agreed on cooperation in the

1 *Statistics Finland, 2017. Energy prices [online] Available at: <http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__ene__ehk/020_ehk_tau_102_en.px/?rxid=cab5b9a3-aa08-4b5b-a2fa-081d351aabb3> [Accessed 21 August 2017]*

2 *tatistics Finland, 2017. Total energy consumption fell by 4 percent in January to March [online] Available at: <http://www.stat.fi/til/ehk/2017/01/ehk_2017_01_2017-06-21_tie_001_en.html> [Accessed 21 August 2017]*

3 *United Nations Climate Change, 2017. Kyoto Protocol [online] Available at: <http://unfccc.int/kyoto_protocol/items/2830.php> [Accessed 23 August 2017]*

4 *Гасик, Т. Финляндия и реализация Киотского протокола. Venäjän Kauppatie, [online] Available at: <http://www.kauppatie.com/2005/09-2005/3.htm> [Accessed 23 August 2017]*

energy sector within the framework of the Protocol. Finland has always played an important role in the Russian-EU Energy Dialogue, which was launched in 2000. Since then, Finland has worked to diversify its energy structure, and has shown interest in the development of new transport routes. For instance, the Nord Stream project – a gas pipeline that provided significant security and increased independence in energy sector for the whole Europe – was originally a joint Russian-Finnish project, developed between Gazprom and Neste/Fortum, under the name 'The North European Gas Pipeline'. [5]

In accordance with Kyoto mechanisms, countries had an opportunity to meet the conditions by undertaking projects abroad. Finnish enterprises used this chance. For example, in 2011 Finnish energy company, Fortum, participated in seven projects in Russia that were expected to reduce greenhouse emissions by 3.5 million tonnes of CO_2 during 2009-2012. These projects included the construction of an additional generation unit at a combined heat and power plant in Tyumen, and the reconstruction of the Nevsky hydropower plant.[6] Likewise, there were some projects in nuclear energy, such as assisted safety activities in nuclear power plants at Kola and Sosnovy Bor, or studies on the replacement of electricity generation capacities in the North-West Russia.[7]

In 2016, the Finnish government ratified the Paris Agreement with its goal to "limit the temperature increase to 1.5°C above pre-industrial level".[8] According to the new UNFCCC international agreement, Finland should accomplish 60 percent emission reductions by 2030 and 130 percent below 1990 levels by 2050.[9] That is stricter than the previous target – 80–95 percent by 2050.[10] In order to achieve these targets, the Finnish government has accelerated the transition from traditional hydrocarbon energy sources (oil, coal, and natural gas) to renewable ones (wind, solar and hydropower, biofuels including wood). Therefore, Finland is going to increase the share of renewable energy sources in total energy consumption to 50 percent by 2020 and to phase out coal from Finland's total

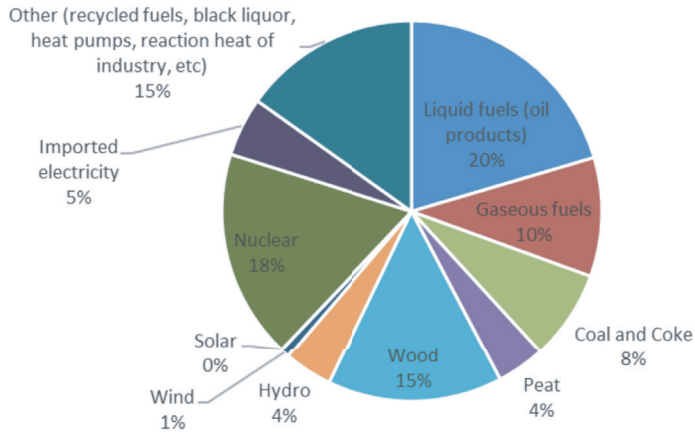

Figure 1. Finland's total energy consumption by source, 2016

Source: Statistics Finland[12]

energy consumption to 50 percent by 2020 and to phase out coal from Finland's total primary energy consumption and cut oil use by a quarter by 2030.[11]

As presented in Figure 1, in 2016, the share of renewable sources in Finland (wind, solar, hydro and wood fuel) was around 20 percent. To achieve the goals of increasing their share to 50%, the clean technology programme implementation requires an investment of €80 million by 2030.[13] In 2017, the share of renewables is forecasted to be five percent higher than in 2016.[14]

Wood plays an essential role in this process. According to Cleantech Finland, 75 percent of all renewable energy sources are wood fuels. This is also supported by Finland Statistics data. Some statistics even demonstrate that since 2011 wood has been prevailing over oil in consumption structure (Figure 2), and Finland has been increasing the volume of its imports of this solid biofuel. Besides, there are more than 10 projects in the Finnish wind power energysector currently under development, with the largest project having a capacity of over 400 MW.[15] The use of renewable energy will be accompanied by the limitation of coal, oil and natural gas consumption, as well as by cutting

5 Aalto, P., 2008, The EU-Russian Energy Dialogue. Europe's Future Energy Security, Hampshire: Ashgate

6 Fortum, 2017. Russia approved two Fortum Joint Implementation projects [online] Available at: <https://www.fortum.com/en/mediaroom/pages/russia-approved-two-fortum-joint-implementation-projects.aspx> [Accessed 23 August 2017]

7 Lausala, T., Valkonen. L., 2000, Proceedings of the Joint Energy Workshop for North West Russia, St. Petersburg, 7-8th October, 1999, Copenhagen: TemaNord

8 United Nations Climate Change, 2017. Paris Agreement [online] Available at: <http://unfccc.int/paris_agreement/items/9485.php> [Accessed 23 August 2017]

9 SITRA, 2016. Technical Report What does the Paris Climate Agreement mean for Finland and the European Union? [pdf] Available at: <http://climateanalytics.org/files/ca_paris_agreement_finland_eu.pdf> [Accessed 23 August 2017]

10 Ministry of the Environment, Ministry of Agriculture and Forestry and Ministry of Employment and the Economy, 2015. Finnish climate policy – towards a low-carbon and energy-efficient future. [pdf] Available at: <https://ilmasto-opas.fi/ilocms-portlet/article/8a54c390-fed4-42da-a2c2-4bab74993ebd/r/b844a8fb-f69d-4c20-a506-cf17ac9f5a9e/suomen_ilmastopolitiikka_rgb_en.pdf> [Accessed 23 August 2017]

11 Aalto University, 2017. Implications of Finland's plan to ban coal and cutting oil use [online] Available at: <http://www.aalto.fi/en/current/news/2017-06-02-005/> [Accessed 24 August 2017]

12 Statistics Finland, 2017. Total energy consumption by source [online] Available at: <http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__ene__ehk/> [Accessed 24 August 2017]

13 Ecostate, 2017. Finland to provide EUR 80 million investment aid to renewables [online] Available at: <http://www.ecoestate.tv/en/News/econews/index.php?ELEMENT_ID=2092> [Accessed 25 August 2017]

14 CleanTech Finland, 2017. New record for renewable energy production in Finland [online] Available at: <http://www.cleantechfinland.com/-/new-record-for-renewable-energy-production-in-finland> [Accessed 25 August 2017]

15 Bergmann, 2017. Finland invests in Wind Energy. An overview [online] Available at: <http://www.bergmann.fi/e/article/wind_investments> [Accessed 25 August 2017]

net imports of electricity despite the overall increase in energy consumption. Reduction of the share of traditional energy sources is expected to be some 15 percent by 2030. Therefore, there is an opportunity to ramp up nuclear power energy as well.

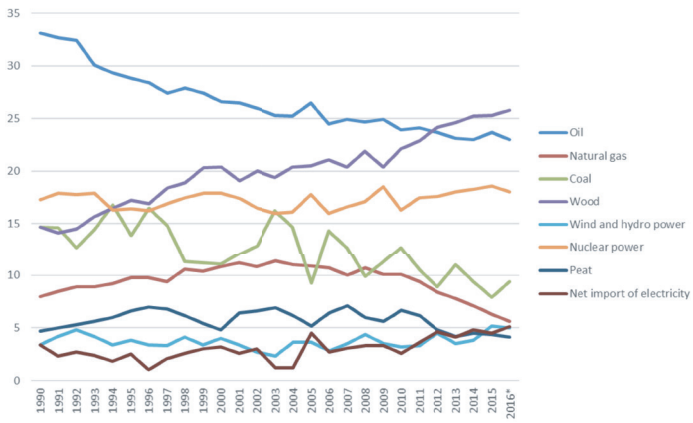

Figure 2. Energy consumption in Finland by source, 1990-2016, %

Source: Statistics Finland

There are two opportunities for Finland to reach the targets under the Paris Agreement: (1) realization of eco projects inside the country, and (2) investment in the reduction of CO_2 emissions abroad. The latter approach is considered to be less costly and, consequently, economically and technologically beneficial for Finland. Finland has accumulated considerable knowledge and experience in energy efficiency technologies, which can be sold.[16] However, in this article we will consider only internal alterations in the energy sector in Finland that can affect Russian-Finnish energy cooperation.

According to the Ministry of Environment of Finland, the majority of GHG emissions are generated by heat and electricity generation (35 percent), transportation (19 percent) and industrial production and construction (14 percent) – in total, 68 percent. Remaining emissions are generated by the heating of buildings, agriculture, fishing and forestry industries, industrial processes and the waste sector.[17] Thus, priority areas for eradication of harmful emissions by introducing clean technologies could be predicted with a relatively high level of certainty. In addition to the substitution of traditional sources, we could assume an energy consumption increase in Finland following the decline in consumption in 2010s (Figure 3) Let us suppose a stable consumption in the short-run, instead of the exponential trend built on the graph. Then there will be a growth in renewable energy use at least by 15 percent by 2020. At the same time, Finland can increase its usage of other low-carbon sources, such as nuclear power.

16 *SITRA, 2016. Technical Report What does the Paris Climate Agreement mean for Finland and the European Union? http://climateanalytics.org/files/ca_paris_agreement_finland_eu.pdf*

17 *Ministry of the Environment, Ministry of Agriculture and Forestry and Ministry of Employment and the Economy, 2015. Finnish climate policy – towards a low-carbon and energy-efficient future https://ilmasto-opas.fi/ilocms-portlet/article/8a54c390-fed4-42da-a2c2-4bab74993ebd/r/b844a8fb-f69d-4c20-a506-cf17ac9f5a9e/suomen_ilmastopolitiikka_rgb_en.pdf*

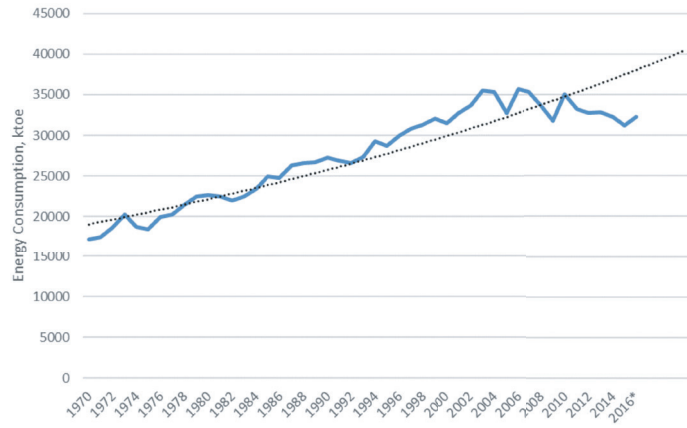

Figure 3. Energy Consumption in Finland, 1970-2016

Source: Statistics Finland

Implementation of these goals will obviously have an impact on related sectors of the Russian economy and consequences can be ambiguous. From the one hand, a decrease in hydrocarbon consumption in Finland will cause the decline in this rea of Russian-Finnish cooperation. From the other hand, in contrast to losses caused by declining trade in traditional energy sources, Russia could develop international trade cooperation in renewable energy.

CONSEQUENCES FOR RUSSIAN-FINNISH TRADE IN TRADITIONAL ENERGY SOURCES

Oil Sector

Russian coal and oil exports are likely to suffer from the transition to renewable sources in Finland. The oil sector that had been taking leading position in Finland's total primary energy consumption until 2012, despite the fact that from 1973 to 2016 this share declined from 60.8 percent to 23 percent.[18] During this period, Finland's oil consumption decreased by 39.7 percent and since 1990 by 17.8 percent. If in 2016 consumption was equal to 7.4 mtoe, then by 2030 this volume should be reduced by 25 percent to 5.2 mtoe.

According to Finland Statistics, in 2016 the country imported 11 million tonnes of crude oil, at a cost of 3.1 billion euros.[19] International Trade Centre Statistics reported somewhat different data with an import volume of more than 12 million tonnes and a value of 3.8 billion U.S. dollars.[20] It is interesting to mention that from 1990 to 2016, total oil imports grew by 35.4 percent in volume terms, despite the

18 *Statistics Finland, 2017. Energy supply and consumption [online] Available at: <http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__ene__ehk/020_ehk_tau_102_en.px/?rxid=cab5b9a3-aa08-4b5b-a2fa-081d351aabb3> [Accessed 21 August 2017]*

19 *Statistics Finland, 2017. Energy supply and consumption*

20 *International Trade Centre, 2017. Bilateral trade between Finland and World [online] Available at: <http://www.trademap.org/Bilateral_TS.aspx?nvpm=1|246||000||2709|||4|1|1|1|2|1|1|1|1|1> [Accessed 23 August 2017]*

fact that from the beginning of 2010s this figure began to decrease. In 2016, Russia exported almost 10 million tonnes of crude oil to Finland, and accounted for 88.64 percent of the volume (87.2 percent of the value)[21] of Finnish oil imports. Since 1990, the volume of imported oil has increased by around 10 times.[22] Already in 1997, Russia ousted the main oil exporters Norway and United Kingdom from the top positions and gained a share of 34.5 percent of Finnish oil imports. Crude oil is still the undisputed leader among all energy sources imported by Finland from Russia.

It is possible to assume that the implementation of Finland`s energy strategy will lead to the scaling down of oil imports by a quarter by 2030. If we suppose the annual steady diminution, the total import should be cut by around 6 percent in volume terms by 2020 (ceteris paribus). However, the share of Russia has been increasing and, as we mentioned above, reached 88.64 percent. Hence, the import from Russia could decline by less than 6 percent and could attain 9.4 m tonnes in 2020.[23] Besides, we can take into account that around 60 percent[24] of imported oil is refined and exported to other countries as motor and aviation gasoline or jet fuel,[25] and only the remaining 40 percent is consumed within the country.

Consequently, oil imports from Russia could be reduced by 2.4 percent to 9.73 million tonnes. Notwithstanding, both these figures are higher than ones in 2014 or 2015 (Figure 4). So, it should not be a dramatic fall in trade, but the real consequences are nevertheless not obvious and straightforward. On the one hand, imports from Russia could rise due to the attractive price of Russian oil and well-established transportation processes. On the other hand, negative influence may be exerted if Finland – as a country having no domestic oil production – decides to minimize dependence on Russian energy resources by increasing imports from Norway or other countries.

Nowadays, net exporters of energy resources (in particular, crude oil) are experiencing difficulties caused by the fall in prices since 2014. Despite the increase of total oil imports in volume terms due to declining oil prices (Figure 5b), the corresponding figure in value terms has been declining (Figure 5a). The is one interesting feature: in 2016, Russian oil export increased by 1.5 percent in value while Brent price was diminishing. Finnish crude oil imports from Russia increased by 18.3 percent in volume and declined by 22.2 percent from other countries, leading to an increase in total import by 11.7 percent. A part of oil supplies from

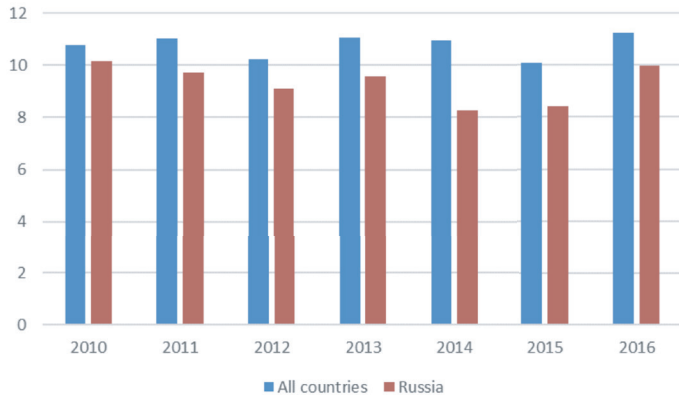

Figure 4. Finnish crude oil imports, million tonnes

Source: Statistics Finland[12]

Kazakhstan, Algeria and Angola was substituted with Russian oil. Due to the fact that the consumption of oil in Finland was almost unchanged compared to the previous year, we could assume that Finland saw an increase in oil-refining activities, and the export of refined oil products. For instance, in 2016, Finland's exports of aviation fuel increased by 25.5 percent.

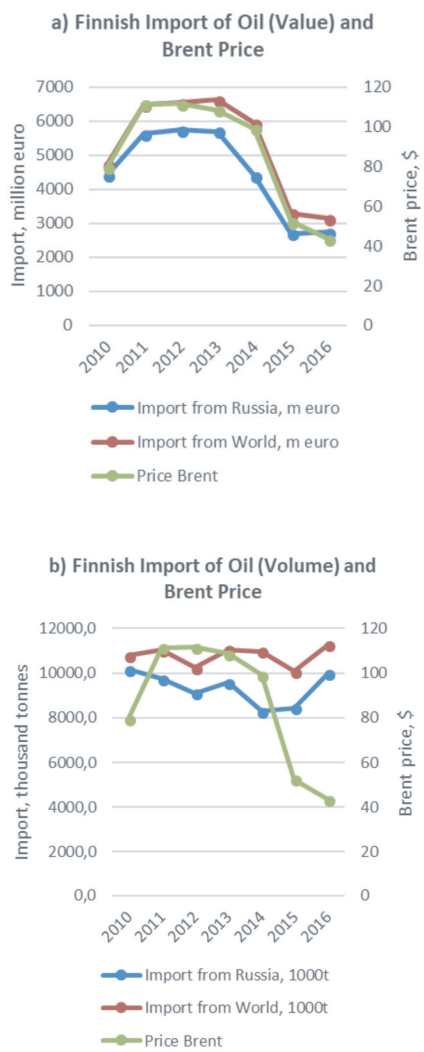

Figure 5. Finland's oil imports and Brent price

Source: Statistics Finland, Statista

21 Statistics Finland, 2017. Finland Statistics http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__ene__ehk/030_ehk_tau_103_en.px/table/tableViewLayout1/?rxid=cab5b9a3-aa08-4b5b-a2fa-081d351aabb3

22 Comtrade.org, 2017. [online] Available at: <https://comtrade.un.org/data/> [Accessed 23 August 2017]

23 Calculated by the authors according to Statistics Finland, 2017.

24 Calculated by the authors according to Statistics Finland, 2017. We assume that motor or aviation gasoline imported in Finland were not reexported to other countries because there are no related statistical data in ITC or Comtrade proved this fact.

25 Statistics Finland, 2017.

Oil price remains a serious problem for Russian oil exports: some forecasts show only 1 U.S. dollar per barrel increase in 2018,[26] while others expect 57.5 dollars per barrel by 2020.[27] A more encouraging forecast for oil price from McKinsey Energy Insights expects oil prices to reach around 60-70 dollars per barrel.[28] At the same time, we can reckon negative price changes because of projected prevalence of oil supply over demand in 2018.[29] The price of Urals oil is linked to Brent, usually with a discount of 1-2 dollars. According to Sergey Pikin, Director of Energy Development Fund, there is a possibility to increase Russia`s share in the value of Finnish import by around 1-2 percent through improving oil quality.[30] But this would also mean increase in the price of Urals, bringing it to the same level as BRENT. Such situation might not be very good for the prospects of Russia keeping its market share in the Finnish market: when the prices of Russian and Norwegian oil level up, Russia can lose Finnish market. It is considered that relatively low price is an advantage of Urals.

We could assume another threat – it is reasonable for Finland to start buying Saudi Arabian oil that is cheaper because of more competitive Saudi pricing.[31] Likewise, Saudi Arabia is planning to set a hub in Poland to capture the markets of Germany and Eastern Europe, in addition to its supplies to the rest of Western Europe. In the case of Saudi oil taking over the market share in Finland, it seems feasible for Russia to redirect trade to Eastern countries, for example, to China, considering that the share of Finland in total Russian oil export is around 3–4 percent. Year-on-year China has increased its share by 2.5–3 percent that equals to Finnish one.[32] In the light of this, it is expected by Energy Ministry that Russia will send up to 30 percent of crude oil exports to Asia by 2020 and thereby diversify markets from the West.[33]

26 U.S. Energy Information Administration, 2017. Short-term energy outlook. [online] Available at: <https://www.eia.gov/outlooks/steo/report/prices.cfm> [Accessed 26 August 2017]

27 DiChristopher, T., 2017. Oil prices will be stuck below $60 through 2020, Credit Suisse forecasts. CNBC, [online] 24 July Available at: <http://www.cnbc.com/2017/07/24/oil-prices-below-60-through-2020.html> [Accessed 27 August 2017]

28 World Oil, 2017. McKinsey Energy Insights releases Global Oil Supply and Demand Outlook to 2030, 19 April. [online] Available at: <http://www.worldoil.com/news/2017/4/19/mckinsey-energy-insights-releases-global-oil-supply-and-demand-outlook-to-2030> [Accessed 22 August 2017]

29 U.S. Energy Information Administration, 2017. Short-term energy outlook.

30 Топалов, А., 2016. Нефть Brent на грани смерти. Газета.ru, [online] 22 January. Available at: <https://www.gazeta.ru/business/2016/01/19/8029535.shtml> [Accessed 22 August 2017]

31 Mazneva, E., Wilkin, S., 2017. Saudi Aramco Cuts Oil Pricing for Europe Where Russia Dominates. Bloomberg, 6 April. [online] Available at: < https://www.bloomberg.com/news/articles/2017-04-05/saudi-aramco-lowers-some-crude-pricing-for-asia-raises-for-u-s> [Accessed 22 August 2017]

32 Comtrade.org, 2017.

33 S&P Global, 2015. Russia sees 30% of crude oil exports heading to Asia by 2020, 4 September. [online] Available at: <https://www.platts.com/latest-news/oil/moscow/russia-sees-30-of-crude-oil-exports-heading-to-26200666> [Accessed 22 August 2017]

Coal Industry

Coal industry is vital for Finland`s heat and power plants. Three-quarters of heat and around one-third of electricity in Finland is produced at combined heat and power plants, which utilise fuels such as coal. Coal-fired power plants are highly important for stable heat and electricity supply, especially when additional electricity is required during cold and dry years, that see reduced hydroelectric power production. Hydro and wind power provides about 5 percent of total energy consumption.[34] Consequently, imports of coal also depend on the rainfall or winter severity in Finland. According to Finnish Coal Info, the difference in imported volume of coal could be up to three times: for example, from 9 million tonnes in a dry year to less than 3 million tonnes in a rainy year.

Prospects for the coal industry are quite straightforward: without any doubt, the sector will suffer from the climate change mitigation plans, which suggest complete coal phase out in Finland, despite its important role in the heating industry. By 2030, Russia is expected to lose this market completely. Until the mid-2000s the share of coal in total energy consumption in Finland was around 15 percent, and only since 2004 has it began falling. In 2015, it reached 7.9 percent, but in 2016 increased to 9.4 percent and returned to the 2014 level that equals to 3 mtoe. According to Finland Statistics, the large annual change was primarily due to the record low use of hard coal in 2015. The profitability of hard coal was weakened by the distinct decline in the wholesale price of electricity in the Nordic electricity exchange. As a result, domestic production of electricity was replaced with imports.

In 2016, Russia exported to Finland 133.2 million euros worth of coal [35]– equal to 1.07 percent of total Russian coal exports.[36] It is worth mentioning that since 2009, when the share of Finland in Russian coal exports was 5.23 percent, this figure has been declining. In comparison with shares of Asian countries – Republic of Korea (15.8 percent of Russian export), Japan (12.8 percent), and European countries – the Netherlands (4.9 percent) or Germany (4.6 percent), the percentage of Finland was not very significant.[37] According to the Finland Statistics, Russia`s share in Finnish coal import was 52.5 percent while the share in steam coal import was equal to 87.2 percent and in coking coal import was 20.3 percent. So, Finland is more dependent on Russian export of coal than Russia on Finnish import.

According to the "Global Coal Mining to 2020" report, "the global coal market will likely have shifted from its reliance on China and export-based countries having stagnating production. The one exception to this will be India, which will continue to increase in coal consumption driving

34 Finnish Coal Info, 2017. Coal in Finland. [online] Available at: <https://hiilitieto.fi/en/hiilitietoa/hiili-suomessa/> [Accessed 24 August 2017]

35 Finland Statistics, 2017.

36 Comtrade.org, 2017.

37 Comtrade.org, 2017.

both domestic production and import demand growth."[38] In 2016, India took thirteenth place among all coal importers from Russia. That is why it is reasonable to develop energy cooperation with India to avoid stagnation in Russia's coal industry. At the same time, there are various forecasts for coal prices. The World Bank forecasts the price around 55 dollars per tonne in 2018 and slight increase thereafter. The IMF`s forecast is more positive: their experts predict 76.2 dollars per tonne in 2017. [39] In comparison with average coal price in 2016 of 66 dollars per tonne,[40] realization of the latter forecast will be beneficial for Russia, who provides around 12 percent of world coal exports.

Natural Gas

Natural gas, the cleanest fossil fuel, could become a substitute for oil and coal. Finland is already highly dependent on Russia for natural gas imports. According to Finland Statistics, Russia is the only supplier of natural gas to Finland. The import dropped by 34 percent in volume terms for last four years; the drop in value was three-fold because of the fall in prices of this energy source. As shown in the graph below (Figure 6), these imports correlated with the volume of heat and power generated by natural gas in Finland. This means that functioning of natural gas power plants in Finland depends on import from Russia. The continuation of such dependence can have two consequences: Finland could minimize Russia`s share in natural gas imports and/or reject usage of natural gas in heat and electricity generation on the whole. Alternatively, according to the National Emergency Supply Agency of Finland, this dependence has been exaggerated because the share of natural gas in total energy consumption structure that is around 5-6 percent can be substituted "with other fuels without great difficulty". [41]

Between 2010 and 2016, consumption of energy generated by natural gas had been falling and reached 1.8 mtoe. Furthermore, the share of this source in energy consumption has been decreasing rapidly: from the maximum 11.4 percent in 2003 to a minimum of 5.6 percent in 2016 that was almost equal to the share of wind and hydropower.[42] This decline notwithstanding, we would like to believe that the cooperation could liven up with regard to new policy, but

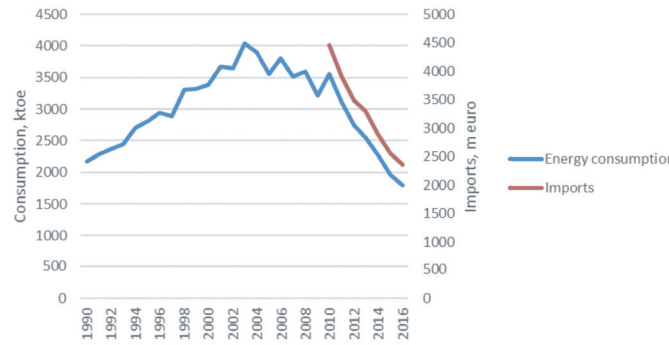

Figure 6. Consumption of gas-fired electricity and Finnish imports

Source: Statistics Finland[12]

there are some serious pitfalls for the future Russia-Finland partnership because of increasing competition from other countries and other types of energy sources.

On 11 May 2017, the Finnish Government gave to the Parliament a proposal concerning a Natural Gas Market Act and certain related acts such as Act on Separating the Activities of the Natural Gas Transmission Network Operator, Act Amending the Act on the Control of the Electricity and Natural Gas Market and others. With this Act Finnish natural gas market will be opened for competition between Russia, the USA with its liquefied natural gas, the Baltic States, Poland and other countries of Central Europe in 2020. According to the Ministry of Economic Affairs and Employment, the natural gas transmission network of the operators will be separated from the production and sale of natural gas using the effective unbundling model in the EU Directive on the internal market for natural gas[43]. Additionally, within this Act special regulation on prices is abolished to provide price competitiveness. However, Russian natural gas is cheaper than European one, e.g. price in British hub NBP was 22 percent higher in 2016.[44] So, it is not obligatory that other suppliers of gas will be less costly. And probably Finland will continue purchasing Russian natural gas.

Nevertheless, construction of the Balticconnector gas pipeline between Finland and Estonia is developing rapidly. Realization of this project can be harmful for Russian trade in gas in 2020s. The EU is interested in detaching Finland from Russian gas insomuch that invested 75 percent of this project; the rest was paid by Finland and Estonia. LNG will be used to fill this corridor, and Finland will have an opportunity to return redundant gas. This is the real substitute for Russian gas especially due to LNG market

38 Hobbs, H., 2016. Global Trends in coal to 2020. World Coal, [online] 14 January. Available at: <https://www.worldcoal.com/special-reports/14012016/global-trends-in-coal-to-2020-52/> [Accessed 25 August 2017]

39 Knoema, 2017. Coal Prices Forecast: Long Term 2018 to 2030. [online] Available at: <http://knoema.ru/xfakeuc/coal-prices-forecast-long-term-2017-to-2030-data-and-charts> [Accessed 25 August 2017]

40 Statista, 2017. Thermal coal prices from 2003 to the third quarter of 2017. [online] Available at: <https://www.statista.com/statistics/214236/thermal-coal-prices-since-2003/> [Accessed 25 August 2017]

41 Huhtanen, J., 2015. Energy dependence on Russia has been exaggerated. Helsinki Times. [online] 1 November. Available at: <http://www.helsinkitimes.fi/finland/finland-news/domestic/13594-energy-dependence-on-russia-has-been-exaggerated.html> [Accessed 25 August 2017]

42 Statistics Finland, 2017

43 Ministry of Economic Affairs and Employment of Finland, 2017. Law proposal: natural gas market opened for competition in 2020. [online] Available at: <http://tem.fi/en/article/-/asset_publisher/lakiesitys-maakaasumarkkinat-avataan-kilpailulle-vuonna-2020> [Accessed 24 August 2017]

44 Ткачев, И., 2016. «Газпром» начал продавать газ в Европе на 20% дешевле рынка. РБК. [online] 9 June. Available at: <http://www.rbc.ru/economics/09/06/2016/575973bc9a7947c723a9d3ae> [Accessed 24 August 2017]

growth by 12 percent year-on-year. [45]

However, LNG is a more expensive option: both Qatari and US LNG is more expensive than Russian gas[46] (in Poland they call it "diversification fee").[47] In reality, Lithuania paid 250 dollars per thousand cubic meters[48] of LNG while the average price of Russian natural gas in Europe was 167 dollars / thousand cubic meters[49] in the previous year.

At the same time as Finland is engaged in the construction of Balticconector, Russia is constructing Nord Stream 2 in cooperation with European giants such as Royal Dutch Shell, Austria`s OMV, France`s Engie and Germany's Uniper and Wintershall. This pipeline is aimed to connect Russia and Germany bypassing Ukraine. Part of the pipeline bypasses territorial waters of Finland, and the permission for construction was granted in April 2018.

One should take under consideration that the USA is trying to impose price competition by implementing new sanctions against Russia but this time they affect not only Russian interests but also the interests of European countries. Now it is still a question whether Finland will replace Russian gas with American LNG substitute. Actually, Russia can compete with the USA even in LNG supplies to Finland. In 2016, the proportion of LNG in gas exports from Russia was 8.1 percent, this gas is exported only to the Asia Pacific countries and India.[50] In 2015, the International Gas Union recognized Russia as the most effective producer of LNG. [51]The Ministry of energy expects that Russia will augment its presence on the world LNG market to 13 percent by 2025 (to 15-20 percent according to the Novatek forecast) from its current 4-5 percent.[52] It can come true due to the launch of Yamal LNG supplies on the spot market in 2017 and start of deliveries under long-term contracts in 2018.[53]

Finally, in accordance with Finland`s gas company Gasum, even now natural gas can be replaced by Finnish 100 percent renewable biogas that is upgraded to a composition corresponding to natural gas.[54] This type of fuel absolutely falls under Paris Agreement, but Finns need time to carry out the substitution policy mentioned above. Even under the most pessimistic scenario, if Finland substitutes all Russian gas, Russia will lose 1.7 percent of its total gas exports – that is the share of total exports accounted for by Finnish consumers in 2016. [55]

This challenge is a chance for Russia to strengthen cooperation with Finland non-hydrocarbons sector, particularly renewables.

CONSEQUENCES FOR RUSSIAN-FINNISH TRADE BEYOND MAJOR HYDROCARBONS

Wood Industry

Wood industry seems to be the most promising sphere for the development of Finnish-Russian trade cooperation. In 2016, the percentage of wood in the energy consumption structure of Finland was 15 percent, which is higher than in 1990.[56] It seems possible to augment renewable sources share partially by increasing wood fuel use by 2020. Based on previous growth rates of forest sources consumption, we could assume growth of wood biofuels in energy consumption by 8–12 percent by 2020.

Russian exports of forest resources to Finland mainly consist of roundwood, fuelwood, sawnwood, plywood, and paper. The share of Russian supplies in Finnish wood pellet imports has been going up and in 2016 reached 90.7 percent by value (4.9 million euro) and 97.8 percent by volume. On the contrary, the share in other wood fuel imports fluctuated during 2010s and achieve 52.2 percent in value and 69.6 percent in volume. With the share of Russia unchanged the Finnish import can ramp up by

45 Pagni, J., 2017. The Finland-Estonia gas pipeline is a 'high-level project for the EU' – breaking the dependency on Russia. Business Insider Nordic. [online] 24 May. Available at: <http://nordic.businessinsider.com/the-finland-estonia-gas-pipeline-is-a-high-level-project-for-the-eu--breaking-the-dependency-on-russia-and-connecting-finland-with-the-continental-market-2017-5/> [Accessed 24 August 2017]

46 Мануков, С., 2017. Сможет ли американский газ конкурировать с российским в Европе? Expert Online. [online] Available at: <http://expert.ru/2017/06/19/smozhet-li-amerikanskij-gaz-konkurirovat-s-rossijskim-v-evrope/> [Accessed 24 August 2017]

47 Топалов, А., 2016. Польша отказывается от российского газа. Газета.ru. [online] 31 May. Available at: <https://www.gazeta.ru/business/2016/05/31/8273639.shtml> [Accessed 24 August 2017]

48 EurAsia Daily, 2017. Литва получит СПГ из США: цены на газ в стране уже в 1,5 раза выше польских, [online] 27 June. Available at: https://eadaily.com/ru/news/2017/06/27/litva-poluchit-spg-iz-ssha-ceny-na-gaz-v-strane-uzhe-v-15-raza-vyshe-polskih> [Accessed 24 August 2017]

49 Алексеева, Н., Цегоев, В., 2017. Надавили на газ: почему Европа сопротивляется экспансии американского СПГ. RT. [online] 5 July. Available at: https://russian.rt.com/world/article/405829-gaz-evropa-ssha-spg> [Accessed 24 August 2017]

50 Ministry of Energy of RF, 2017. Производство и поставки сжиженного природного газа (СПГ). [online] Available at: <https://minenergo.gov.ru/node/4853> [Accessed 24 August 2017]

51 Погосян, А., 2015. Производство сжиженного газа России объявлено самым эффективным. Известия. [online] 20 July. Available at: <https://iz.ru/news/588969> [Accessed 24 August 2017]

52 VostocKCapital, 2017. Сжиженный природный газ в мире и России: текущее состояние и перспективы развития. online] Available at: <https://www.vostockcapital.com/spg/szhizhennyiy-prirodnyiy-gaz-v-mire-rossii-tekushhee-sostoyanie-perspektivyi-razvitiya/> [Accessed 24 August 2017]

53 S&P Global, 2017. Russian Yamal LNG to sell first 2017 LNG cargoes on spot market, 30 March. [online] Available at: < https://www.platts.ru/latest-news/shipping/sabetta-yamalpeninsula/russian-yamal-lng-to-sell-first-2017-lng-cargoes-26699065> [Accessed 24 August 2017]

54 Gasum, 2017. Use of natural gas in Finland. [online] Available at: <https://www.gasum.com/en/About-gas/natural-gas-and-lng/Use-of-natural-gas-in-Finland/> [Accessed 24 August 2017]

55 Comtrade.org, 2017

56 Statistics Finland, 2017

57 Statistics Finland, 2017

10–12 percent by 2020. It is highly important for Russian exporters because Finland accounted for 36.9 percent of Russia's wood fuels export in 2016 and, in contrast to many other sectors, we could argue that Russia depends on Finnish importers and biofuels expansion.

For Russia as an exporter, the price of wood – in particular of wood pellets – is very important, especially now when the market is low. According to the Wood Pellet Association of Canada, "the buildup of production capacity based on demand forecasts from a few years ago has resulted in a current state of excess supply; spot market prices for industrial wood pellets have hit historical lows. New demand, combined with growth in the Japan and South Korea, will soak up the current excess capacity and is expected to bring spot prices back into line with the long-term averages" that are 162.87 dollars.[58] Another determinant of demand growth is the transition from traditional energy sources to renewable ones in all countries that ratified Paris Agreement, including Finland. In accordance with this forecast and the current spot price of 112.76 dollars in December 2016, there should be an increase in price by 44.4 percent by 2020.

In addition to trade, one should not ignore technological and investment cooperation. Finland is a pioneer and global leader in the deployment of efficient forestry technologies. The Natural Resources Institute of Finland has been developing up-to-date approaches to gather forest bioeconomy information for the Russian market. It is a combination of three methods: pictures by drones, satellite images and sample plot measurements. This appears to be extremely significant in conditions when roads are poor or totally absent and when up-to-date data on forest sources is available for less than 10 percent of Russia's forest area. For Finland as a country dependent on Russian wood resources, it also would be beneficial to obtain more information about Russia's forest area.[59] Also, the Institute launched an information service that focuses on forest policy and legislation, raw material procurements, sustainable forestry and bioenergy in Russia, Baltic and Eastern European countries.[60]

Besides, many Finnish companies in forest industry such as Stora Enso, UPM, Metsa, have run businesses in wood processing in different parts of Russia. The Finnish forest industry has invested more than 1 billion euros,[61] mostly in northwestern territories, by leasing forests, developing infrastructure and, of course, by establishing subsidiaries and mills.

Peat Fuel

Finland has substantial reserves of peat, which may be considered as a biofuel as well (although it does take hundreds of years for it to form). In certain years the share of peat in heat and electricity generation was rather high. During most of the period under review, the contribution of peat was higher than that of hydro- and wind power. At the moment, this fuel provides 4–5 percent of electricity and 15 percent of heat.[62]

Until the end of the XXth century, peat was classified as a fossil fuel and greenhouse gas emissions from combustion of peat were taken into account in the calculations of the International Panel for Climate Change. Countries with developed peat industries and significant roles of this fuel in heat and electricity generation, including Finland and Sweden, strongly disagreed with this decision. They based their critique on the fact that peat is a renewable source and there is an opportunity to produce biomass on cut-over peatlands.

The Finnish Ministry of Trade and Industry released a report "The Role of Peat in Finnish Greenhouse Gas Balance" produced by three internationally-recognized climate change and peatland experts from Finland, the UK and the USA.[63] In this report, they defined peat as a slowly renewable biomass fuel non-belonging neither to fossil fuels nor to biofuels. Only in 2000 peat was recognized as a biofuel when the European Parliament amended Article 21 of the Council Directive on the promotion of electricity from renewable energy sources in the international electricity market by adding peat to the list of renewable energy sources.[64] Though the fate of the amendment is unknown for the present, because at the time of writing the decision-making process was unfinished. In fact, in 2009, the EU Directive on the promotion of the use of energy from renewable sources – Article 7 Part 5 – stated: "Biofuels and bioliquids … shall not be made from raw material obtained from land that was peatland, unless evidence is provided that the cultivation and harvesting of that raw material does not involve drainage of previously undrained soil". In 2016, the European Commission proposed a revision of the

58 *Wood Pellet, 2017. Global pellet market outlook in 2017. [online] Available at: <https://www.pellet.org/wpac-news/global-pellet-market-outlook-in-2017> [Accessed 28 August 2017]*

59 *Luke. Natural Resources Institute Finland, 2017. A new solution for the management of up-to-date forest resource information in Russia. [online] Available at: <https://www.luke.fi/en/news/a-new-solution-for-the-management-of-up-to-date-forest-resource-information-in-russia/> [Accessed 28 August 2017]*

60 *Luke. Natural Resources Institute Finland, 2017. Forestry in Russia and Eastern Europe. [online] Available at: <https://www.luke.fi/en/natural-resources/forest/forestry-in-russia-and-eastern-europe/> [Accessed 28 August 2017]*

61 *Finnish Forest Industries, 2017. The Finnish Forest Industry Develops the Forest Sector in Northwest Russia. [online] Available at: <https://www.forestindustries.fi/in-focus/forests-and-wood-supply/the-finnish-forest-industry-develops-the-forest-sector-in-northwest-russia/> [Accessed 28 August 2017]*

62 *Пятый элемент, 2017. Торф: хорошо забытое старое. [online] Available at: <https://5thelement.ru/articledetail.php/?ELEMENT_ID=1207> [Accessed 29 August 2017]*

63 *International Nuclear Information System, 2017. The role of peat in Finnish greenhouse gas balances. [online] Available at: <https://inis.iaea.org/search/search.aspx?orig_q=RN:32001740> [Accessed 29 August 2017]*

64 *International Peatland Society, 2017. Peat as an Energy Resource. [online] Available at: <http://www.peatsociety.org/peatlands-and-peat/peat-energy-resource> [Accessed 29 August 2017]*

Renewable Energy Directive, which made the protection of peatland even stricter".[65]

During the 2010s, the usage of peat in Finland`s heat and electricity generation has been decreasing year-on-year. However, we suppose that Finns will not refuse peat completely because they have implemented a process of co-combustion of peat and wood. It had been found out that 'the chemical properties of wood fuel alone may cause certain problems in boilers'.[66] They started burning peat together with wood to reduce corrosion in the superheater tubes and to manage Sulphur Dioxide (SO_2) emissions. Thus, an increase of effectiveness of wood biomass utilization in heat and power plants is dependent on the use of peat as well. Besides, it is reasonable to have alternative fuels to maintain security of supply.

Despite the high domestic reserves of peat, Finland purchases this fuel abroad. Peat import from Russia has been increasing and in 2016 reached almost a half of total Finnish peat import (0.6 million euros) while Finland`s share in Russian peat export is 7.1 percent.[67] At the same time, trade in peat is not a major sphere for Russian-Finnish cooperation neither in terms of value, nor in terms of volume, if compared to oil or wood procurements. In 2016, Finns paid 1.3 million euros for imports of 45.7 thousand tonnes of peat. [68] This is a meager part, less than 1 percent, of total peat consumption in Finland, where annually about 6.5 million tonnes of peat is burned.[69]

Nuclear Power

The second applicant for replacing oil and coal is nuclear power, especially in light of the fact that Finland is going to build its fifth nuclear power plant (NPP), Hanhikivi-1, in cooperation with Russia. Although there has been a lot of debate over whether to include nuclear energy in the list of renewable energy sources or not, and both parties had strong arguments, there is still no conventional wisdom on this topic.[70] In any case, in our view, nuclear energy can be included in the list of clean low-carbon sources of energy.

Russian-Finnish nuclear energy partnership has started already in the Soviet period. Loviisa NPP – the first one in Finland – was constructed in 1977. It was a unique project: for the first time in history, Western countries and the Soviet Union worked together in the field of nuclear energy technologies. The degree of Finland`s participation was around 50 percent. The Soviet Union supplied the VVER-440 reactors, turbines, generators, and other components. Safety, automation and control systems were produced in the Western countries.[71]

In 2013, Rusatom Overseas, the international division of the State Corporation Rosatom, and Fennovoima, Finland`s nuclear power company, signed a contract for the construction of the Hanhikivi-1 NPP. The plant will be equipped with 1.200MW AES-2006 pressurized water reactor designed by Gidropress, a subsidiary of Rosatom.[72] It is estimated that this plant will provide 10 percent of energy consumption in Finland by 2024.[73] In 2014, Finland and Russia signed a new intergovernmental agreement on nuclear energy cooperation that was a prerequisite to transporting the reactor to the Hanhikivi-1 NPP. The agreement includes provisions related to nuclear energy research, energy safety, and radiation protection.[74]

In January 2015, the Russian government added the Hanhikivi-1 NPP project to the list of self-supporting infrastructure projects co-financed by the National Welfare Fund (NWF). The maximum amount of NWF funds allocated for its implementation is a ruble equivalent of 2.4 billion euros, but no more than 150 billion rubles. Russia owns 34 percent of the venture. The economic effect of the project Hanhikivi-1 NPP for Russia is expected to be 17.5 billion euros. The Russian budget is anticipated to receive over 3 billion euros in taxes that exceeds investments of 2.5 billion euros.[75] Approval of the project documentation by the Finnish Radiation and Nuclear Safety Authority STUK is a precondition for obtaining a license for the construction of the Hanhikivi-1 NPP. Earlier it was reported that Fennovoima plans to obtain a safety assessment and building permit to begin construction of the nuclear power plant in 2018.

This project is beneficial for many associated industries of Russian, Finnish and European parties. For example, in 2013, the Russian nuclear fuel company TVEL signed ten-year contract for the nuclear fuel supply, management and design with Fennovoima worth 450 million euros

65 European Commission, 2017. Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast). [online] Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016PC0767R%2801%29> [Accessed 29 August 2017]

66 International Peatland Society, 2017. Peat as an Energy Resource.

67 Comtrade.org, 2017.

68 Statistics Finland, 2017.

69 Пятый элемент, 2017. Торф: хорошо забытое старое.

70 Chowdhury, N., 2012. Is Nuclear Energy Renewable Energy? Stanford University. [online] 22 March. Available at: <http://large.stanford.edu/courses/2012/ph241/chowdhury2/> [Accessed 29 August 2017]

71 Fortum, 2017. Loviisa nuclear power plant. [online] Available at: <https://www.fortum.com/en/energy-production/nuclear-power/loviisanpp/history/pages/default.aspx> [Accessed 25 August 2017]

72 Power Technology, 2017. Hanhikivi 1 Nuclear Power Plant. [online] Available at: <http://www.power-technology.com/projects/hanhikivi-1-nuclear-power-plant/> [Accessed 25 August 2017]

73 РИА Новости, 2017. Заказчик АЭС "Ханхикиви-1" в Финляндии назвал текущий приоритет для проекта. [online] 7 April. Available at: <https://ria.ru/atomtec/20170407/1491782530.html> [Accessed 25 August 2017]

74 World Nuclear News, 2014. Russia, Finland agree on more cooperation. [online] 26 February. Available at: <http://www.world-nuclear-news.org/NP-Russia-Finland-agree-on-more-cooperation-2602144.html> [Accessed 25 August 2017]

75 РИА Новости, 2017. Заказчик АЭС "Ханхикиви-1" в Финляндии назвал текущий приоритет для проекта.

and will ship TVS-2006 fuel cartridges for the first core. Atomproekt developed the design and licensing documentation for the project. Suomen Maastorakentajat Oy was awarded a 5 million euro contract by Fennovoima to improve local infrastructure by constructing the Hanhikivi-1 access road, the water supply piping and domestic wastewater sewer for the plant site. The German company Siemens was hired for the electrification of the construction site.[76]

In general, trade in nuclear technology is an important field of cooperation. There was no constant trend in the value of Finnish imports of nuclear fuel, the figures were fluctuated around 93 million euros and in 2016 reached 89 million euros. Around 38–40 percent (54 percent in 2013) of Finnish import is accounted for by Russia; the main competitors are Germany and Sweden that account for 30 percent and 32 percent, respectively. Thanks to the new nuclear power plant, Finland will increase the import of nuclear fuel at least by a quarter because no uranium is currently mined. Germany is going to phase out nuclear power plants by 2022 while all uranium mines had already been closed.[77] It can either lead to substitution of German nuclear fuel with Russian fuel, or the German share can be divided between several countries.

Cooperation in Wind Power Sector

Russia developed a national programme with a goal of increasing the share of renewable energy sources in electricity production to 4.5 percent by 2020.[78] Russia could achieve 11 percent of renewable energy by 2030, according to new findings by the International Renewable Energy Agency.[79] Finland, as a main player in renewable energy market, began developing wind power projects in Russia as a part of Russian government programme. At the end of 2015, the Russian Rusnano and the Finnish Fortum signed a preliminary agreement to run a consortium for the construction of wind farms. Finland`s party invested 65 million euros in building wind power capacity of 35 MW in the Ulyanovsk oblast.[80] According to the Bloomberg data, Fortum`s long-term plan is to build approximately 500 MW of wind power generation capacity in Russia within the he agreement with Rusnano.[81] Therefore, the share of Finland in Russian wind power production will be roughly 15 percent by 2024 when Russia achieves wind power generation capacity of 3.6 GW.[82] We can expand the initiative of partnership between Russia and Finland to the new field. It can substitute or complete current investment cooperation in construction of thermal power plants because Fortum finished all related projects in Russia in 2016. [83]

Trade in Electricity

Another potential area for trade cooperation is electricity. Finland has been increasing the percent of import of electricity in energy consumption that reached 5.1 percent in 2016. It can be reasonable to continue this trend if Finland is not ready for a full substitution of traditional energy resources under its Governmental programme on climate change. The share of Russia in Finnish import of electricity is 20 percent while the main provider is Sweden. This cooperation became bilateral in 2015, when Finland exported electricity to Russia for the first time after signing an agreement on bidirectional trade between Fingrid and the Russian national grid.[84] Beforehand it was not widespread, but in 2017 Russia started the biggest-ever auction to purchase 1.9 GW of clean electricity. Finland won this tender competing with Italian Enel that won two wind power projects.[85]

Russian-Finnish economic cooperation in Arctic

The other facet of Russian-Finnish economic cooperation is Arctic energy cooperation. Russia and Norway are the main markets for Finnish Arctic energy expertise. Finland provides them with energy-efficiency projects such as modernized transmission lines, decentralized generation of electricity, geothermal heat and electricity generation. Close collaboration was started in maritime technologies and shipbuilding as well as in clean technologies and mining industry.[86] Finland`s Strategy in the Arctic Region highlights

76 6 Power Technology, 2017. Hanhikivi 1 Nuclear Power Plant.

77 Staudenmaier, R., 2017. Germany's nuclear phase-out explained. DW. [online] 15 June. Available at: <http://www.dw.com/en/germanys-nuclear-phase-out-explained/a-39171204> [Accessed 25 August 2017]

78 Lagerwey, 2017. Lagerwey technology used to power up Russian wind industry. [online] Available at: <https://www.lagerwey.com/blog/2017/06/19/lagerwey-technology-used-to-power-up-russian-wind-industry/> [Accessed 27 August 2017]

79 REVE, 2017. Russia has abundance of all renewable energy sources which can be scaled up to fuel economic growth. [online] 6 April. Available at: <https://www.evwind.es/2017/04/06/russia-has-abundance-of-all-renewable-energy-sources-which-can-be-scaled-up-to-fuel-economic-growth/59327> [Accessed 27 August 2017]

80 Bigot, S., 2016. A 60 MW wind farm in Northern Russia by 2020. Eurasia Network. [online] 14 December. Available at: <https://eurasianetwork.wordpress.com/2016/12/14/first-offshore-wind-farm-in-russian-waters/> [Accessed 27 August 2017]

81 Bierman, S., Hirtenstein, A., 2017. Russia Starts Largest Renewable Energy Auction in Bid for Jobs. Bloomberg. [online] 29 May. Available at: <https://www.bloomberg.com/news/articles/2017-05-29/russia-starts-largest-renewable-energy-auction-in-bid-for-jobs> [Accessed 27 August 2017]

82 Lagerwey, 2017. Lagerwey technology used to power up Russian wind industry.

83 Fortum, 2017. Fortum in Russia. [online] Available at: <https://www.fortum.com/countries/ru/about/oao-fortum/pages/default.aspx> [Accessed 27 August 2017]

84 Fingrid, 2017.First-ever electricity transmission from Finland to Russia. [online] Available at: <http://www.fingrid.fi/en/news/announcements/Pages/First-time-ever-electricity-transmission-from-Finland-to-Russia-7th-June-2015.aspx> [Accessed 27 August 2017]

85 Bierman, S., Hirtenstein, A., 2017. Russia Starts Largest Renewable Energy Auction in Bid for Jobs.

86 Prime Minister's Office Finland, 2013. Finland's Strategy for the Arctic Region 2013. [pdf] Available at: <http://vnk.fi/documents/10616/334509/Arktinen+strategia+2013+en.pdf/6b6fb723-40ec-4c17-b286-5b5910fbecf4> [Accessed 29 August 2017]

the importance of the oil and gas resources of the Arctic for energy supplies in Europe. The hydrocarbon reserves of the Barents Sea and the process of their development are of great interest to Finnish companies even with the current Programme on climate change. Their goal is to participate in large projects, such as Shtokman, as subcontractors and enter the international level of developing deposits beyond the Arctic Circle. Bilateral Russian-Finnish cooperation in the joint development of hydrocarbon reserves was greatly influenced by the agreement on the division of the so-called "grey zone" in the Barents Sea, when the maritime border between Russia and Norway was confirmed. Finns expect to receive significant economic and financial results from participation in the development of this zone.[87] In 2017, The Academy of Finland and the Russian Foundation for Basic Research have launched a call for joint projects in the field of Arctic research on climate change and related ecosystem adaptation.[88]

CONCLUDING REMARKS AND RECOMMENDATIONS

Despite the growth in renewable energy use in Finland, the main purchased sources in Russian-Finnish trade are crude oil and natural gas, while the values of biofuels are relatively low. Under the terms of Paris Agreement and national climate change programme, sooner or later Finland will decrease the share of fossil fuels in energy (heat and electricity) production as well as its import of such sources. It means that Russia should further develop its cooperation with Finland in clean and bio technologies in energy sector. Otherwise, by 2030 or by 2050, Russia will lose its positions in Finnish fossil fuel market while not gaining stability in its renewable resources market.

For instance, it could be cooperation in the field of forestry. For this purpose, Finnish-Russian Working Group on Sustainable Forestry Development works out projects in bioenergy and discusses forest policy in Finland and Russia.[89] In addition, we would recommend paying more attention to the evaluation of project results by certain criteria in order to draw accurate conclusions.

Nuclear energy has always been a promising sphere for Russian-Finnish investment and trade cooperation. The Hanhikivi-1 NPP is going to be constructed in Finland by Russian and Finnish companies by 2024. That is why we can affirm that cooperation within this sector will continue. It is possible to say the same about partnership in the wind power sector, due to long-term joint projects currently being realized in Russia.

Furthermore, we would like to mention that even if Finland does not accumulate a significant share in Russia's export of traditional energy sources, the ratification of the Paris Agreement on climate change by almost all of Russia's trade partners could lead to dramatic fall in Russia's overall exports of carbon-based energy sources (coal, oil, and natural gas). Thus, in order to minimize the risks associated with these trends, Russia should develop renewable sources and related economic partnerships, first of all, improving bioenergy technologies on the national level.

87 *Российский Центр освоения Арктики, 2017. Стратегия Финляндии в освоении Арктики. [online] Available at: <http://arctic-rf.ru/news/mejdunarodnaya_deyatelnost/strategiya-finlyandii-v-osvoenii-arktiki> [Accessed 29 August 2017]*

88 *Suomen Akatemia, 2017. Academy of Finland and Russian Foundation for Basic Research launch call in Arctic research. [online] Available at: <https://www.aka.fi/en/research-and-science-policy/academy-programmes/current-programmes/arctic-academy-programme/ajankohtaista/academy-of-finland-and-the-russian-foundation-for-basic-research-launch-a-call-in-the-field-of-arctic-research/> [Accessed 29 August 2017]*

89 *Northern Research Institute Of Forestry, 2015. Russian-Finnish Cooperation in the Field of Forestry. [online] Available at: <http://www.sevniilh-arh.ru/en/news/index.php?ELEMENT_ID=320> [Accessed 29 August 2017]*

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CLEAN ENERGY FORUM 2017

Russian Economy, Energy and Environment: How to Find A Balance for Sustainable Development?

• **Nikita Lomagin,** Vice-Rector for GR, European University at Saint Petersburg

"The main aim of the Clean Energy Forum is to discuss low-carbon development paths of the Russian economy. We see our Forum as a permanent platform for dialogue of all interested parties. At the Clean Energy Forum 2017, we spoke about the ways to minimize harmful environmental impact while developing economically in a sustainable way. Having signed the Paris Climate Agreement (albeit without ratifying it yet), Russia undertakes responsibilities and obligations which will have to be respected. It is our understanding that the technical solutions concerning resource saving and emissions reduction is not the main difficulty in the realization of 'green' projects. It is the mechanism of achieving managerial solutions that represents a much bigger challenge. We work toward solving this challenge both in our daily activities at the ENERPO RC, as well as within the framework of the Clean Energy Forum."

LIST OF SPEAKERS

(in order of appearance)

• **Nikolay Vakhtin,** Rector, European University at St. Petersburg (welcome speech)

• **Hans Wesseling,** Consul-General of the Kingdom of the Netherlands (welcome speech)

• **Oleg Pluzhnikov,** Business Russia

• **Branko Milicevic,** Economic Affairs Officer, United Nations Economic Commission for Europe (UNECE)

• **Sergey Vakulenko,** Head of Strategy and Innovations, Gazpromneft

• **Igor Bashmakov, Director,** Center for Energy Efficiency (CENEF)

• **Jan-Jaap Aué,** Hanze University of Applied Sciences

• **Vitaly Bekker,** Project Manager at UNDP

• **Mikhail Yulkin,** Head of the Climate Change Working Group, Russian Union of Industrialists and Entrepreneurs (RSPP)

• **Alexander Bychkov,** Director General, RUSS-INVEST

• **Tim Heitling,** Partner, Baker&McKenzie

• **Mikhail Davydov,** Senior Analyst, Standard&Poors

• **Iya Gordeeva,** Audit Energo Group

• **Maxim Titov,** European University at St. Petersburg

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