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The development of renewable energy in Russia: challenges and constraints

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List of abbreviations

BRICS – Brazil, Russia, India, China, South Africa

CIS – Commonwealth of Independent States

FDI – Foreign Direct Investments

IEA – International Energy Agency

IFC – International Finance Corporation

NGO – Non-Governmental Organization

TIC – Techno-Institutional Complex

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CHAPTER 1: Introduction

1.1. Background

More than 12% of Texas electricity (USA) is produced by the wind power. The world's largest wind farm, Roscoe Wind Farm, located in this state, generates almost 800 megawatt of energy (Dorosh, 2011; Wind energy, Texas). The world's two largest tidal barrages can be found in France and South Korea. The last one, Sihwa Lake Tidal Power Station, was introduced in 2011 and became the largest one with the generation capacity of 254 megawatt. It is said that this station can supply up to 500 000 households in a city (Dorosh, 2011; Advanced Technology Korea). The largest hydro power plants are located in China and at the border between Brazil and Paraguay with the general capacity of 22.4 and 14 gigawatt correspondingly. Even bigger plant, with a capacity of 39 gigawatt, is under construction in Democratic Republic of Congo (Dorosh, 2011).

These projects are just a tip of an iceberg which reflects that the whole world has been recently engaged into the developing of renewable energy sources. Renewable energy is the energy which is obtained from natural sources such as solar energy, wind power, hydropower, biomass energy and geothermal energy. In other words, renewable energy is energy obtained from continuous or repetitive currents of energy recurring in the natural environment (Twidell & Weir, 1986). Renewable energy sources are considered to have potential to provide energy with almost zero emissions of greenhouse gases and other air pollutants. They have been acknowledged as an alternative energy sources which can meet entire world's energy demand (Asif & Muneer, 2007).

In addition to large projects many small projects do exist. In 2012 total global investments into the renewable energy amounted USD 244 billion, while in 2004 investments spent on the renewable energy projects were equal only to USD 40 billion (REN21, 2013).

The development of renewable energy has been recently attracting a lot of attention on both national and international levels. It is seen as a solution to numerous problems which the whole world is facing nowadays. Renewable energy is considered as an essential input into the energy source diversification intended to decrease the dependence on fossil fuels, such as oil, coal and gas (Apergis & Payne, 2010). This issue becomes even more important in terms of the fossil fuels depletion and growing energy consumption, whereas renewable energy can become a key

answer to the sustainable development of modern societies in the future (Asif & Muneer, 2007; Dorian, Franssen & Simbeck, 2006). Moreover, renewable energy is associated with the opportunity to mitigate the destructing impact of the carbon dioxide (CO2) which stands behind the environmental pollution, climate change and global warming (Salim & Rafiq, 2012). In addition renewable energy represents one of the core means towards the energy security and perceived as an opportunity to enhance energy efficiency and sustainability (Resch et al., 2008). Therefore global environmental and security concerns, as well as certain countries interests in reducing their reliance on fossil fuels imports and usage, foster global interest in the development of renewable energy all over the world. According to the International Energy Agency (World Energy Outlook, 2007) renewable energy will be the fastest growing part of energy industry during the period of 2005 – 2030.

1.2. Research problem

"We should no longer burn our energy reserves"
"Alternative energy will sooner or later replace hydrocarbons"
— Medvedev D. A. [1]

"The only alternative to hydrocarbon fuels today is nuclear energy, other alternatives are foolish"
— Putin V.V. [2]

Some countries have already reached high shares of renewable energy sources in the total energy consumption. For instance, in 2011 the share of final energy from renewables in Sweden was equal to 48%, in Finland it was 33%, in France and Germany it reached almost 13% (REN 21, 2013). Nevertheless, they continue to set up new challenging goals for the future development of renewable energy. At the European level it was decided to satisfy 20% of the energy demand using renewable energy sources by 2020 (Resch et al., 2008), the government of France chose to

[1]Prime Minister of Russia, former Russian President; citation is taken from IFC Russia, 2011, p.7.

[2] Russian President; citation is taken from Ecozashita, 2013, p.6.

increase this share up to 23% and Denmark is planning to reach 35% by 2030 and even 100% by 2050.

For the emerging economies, like BRICS[3], the question of renewable energy is a special one. The demand for energy is rapidly increasing in these countries, while they still experience the same global problems as other countries do. No surprise that renewable energy is seen as one of the reasonable opportunities to meet energy needs and contribute to the solving of global problems. In 2012 36% of total global renewable power capacity (27% excluding hydropower) belonged to BRICS countries, with China and Brazil being among the world top-5 (REN21, 2013). China is successful in almost every type of renewable energy and it is a leader in hydropower and wind total installed capacity. Together with Brazil and India, it also possesses the largest non-hydro capacity. In addition, Brazil, India, China and South Africa are making a lot of effort in establishing new policies which will support renewable energy. According to REN21 (2013) they are the leading countries in the development of large-scale programs aimed to meet challenges of energy access and sustainability (p. 15).

However, much less can be said about the development of renewables in Russia. Except hydropower, where Russia holds the 5th place among top countries with the total capacity (year 2012), it can hardly been found any significant positive shifts among other types of renewables. While governments in many countries subsidize and support in different ways the development of renewable energy, in particular new policies and legal frameworks are issued, better investment conditions are created, the situation in Russia seems rather stagnant.

Russia's energy profile shows that it is locked in patterns common to Soviet period. The major part of its energy supply consists of conventional fossil fuels. Compared to their share in total energy the contribution of hydropower and nuclear energy is insignificant. Energy consumption and production in its turn is dominated by old factories and power plants; however, energy intensity is still one of the highest among the economies all over the world. Whereas during the recent years the understanding of energy, energy markets and energy security has been transformed, Russia's participation in it has been rather minor. Its role in alternative energy sources is really small, its influence is insignificant in solar power, wind or biofuels, in electric cars, battery research and smart grid (Gustafson, 2012). The utilization of renewable energy

[3] BRICS includes Brazil, Russia, India, China, South Africa

sources is mainly limited to the hydropower which generates approximately 155 TWh of electricity in Russia (REN21, 2013). According to Asif and Muneer (2007) hydropower accounts for 22% of total power-generated capacity (p. 1406).

Nevertheless, it has been mentioned by many scholars that Russia possesses a big potential of renewable energy sources and all of them can be effectively used in a particular sector of economy. For instance, the total wind potential of the country equals to 2000 – 3000 TWh per year, while the installed capacity accounts only for 16 MW with an average annual power generation of 12,8 KWh (Kulakov, 2011). The estimated potential area of solar collectors in Russia can be expanded up to 10 million m^2. Today, the area of installed solar thermal systems equals only to 15 thousand m^2 (Butuzov, 2011). Biomass is also seen as a perspective renewable energy source which has a great potential in Russia. However, according to Ministry of Agriculture the production capacity of ethanol fuel accounted 1.5 billion liters per year in 2005, but in 2008 less than 500 million liters were produced (mainly from wood waste and agricultural feedstock) (Matveev, 2011).

Meanwhile two thirds of the Russian territory with a population of 20 million people is not connected to the centralized electrical grid. It is the part of the country where the prices for fuel and energy are the highest. In addition, the majority of regions in Russia experiences power shortages and is in need of fuel and energy sources. Despite the fact that Russia is a country with the largest reserves of gas, it obtains almost 23% of world gas reserves, only 50% of urban and 35% of rural areas are actually supplied with gas (Popel, 2011).

In addition to local problems, Russia faces the global ones as well, such as climate change, fossil fuels depletion, high CO2 emissions, environment pollution etc. Nevertheless, it has been decided by the Russian government to slightly increase the share of renewable energy sources in the next few years. In particular, according to the resolution issued in 2009 on the Main Directions for the State Policy to Improve the Energy Efficiency of the Electricity Sector on the Basis of Renewable Energy Sources for the Period up to 2020, only 4.5% of the total produced electricity should be generated from renewables in 2020. However, as reported by IFC Russia in 2011 even an interim target of 1.5% has not been reached by 2010. While even the level of 4.5% has been considered too small in comparison to country's potentials, the target aim has been decreased down to 2.5% which is stated in the new Resolution (№ 321) issued by the Russian government in April 2014.

The barriers and obstacles which Russia meets on the way of the renewable energy sources development have been hardly highlighted or analyzed in details, studies have been concentrating mainly on future potentials and perspective of renewable energy sector. The most thorough research was made by IFC Russia in 2011. Besides the potentials of renewable energy sources in Russia, some barriers and challenges were specified, such as the availability of fossil fuels, high costs of renewables, technology underdevelopment etc. However, all of them are mainly focused on the economic and financial issues, while the political perspective is often omitted.

1.3. Research questions

The aim of the study is to identify and explore the possible obstacles and challenges which hamper the better development of renewables in Russia from the political perspective. The research questions will be as follows:

- Why is the development of renewable energy sources growing very slow in Russia?
- What barriers and obstacles prevent Russia from the higher pace development of this energy sector?

1.4. Theory and methodology summary

Three theories have been chosen to set the framework for the current study: globalization theory, techno-institutional lock-in and primary resource endowment.

Globalization theory sheds light on the current role of state in the world subject to globalization process and its importance towards the development of renewable energy sources. In addition, it explains the role of traditional energy sources in the modern integrated energy markets and possible barriers it can create on the way of the renewable energy development in Russia.

The theory of *techno-institutional lock-in* suggest the possible challenges that renewable energy industry faces in Russia from the viewpoint of established technological and institutional complex which activity is concentrated around the traditional energy sources and restrains the opportunities for alternative development directions in the energy sector.

Primary resource endowment theory suggests possible obstacles for renewable energy development from the standpoint of the initial availability and abundance/absence of different types of resources in the country under study, and its impact on the decisions made by local authorities.

The research is based on the case-study of Russian renewable energy policy. The methodological tools used for the research comprise literature review of scientific work and articles, legal documents and reports. In addition, semi-structured interviews have been conducted to give a better insight into the situation.

1.5. Organization of the study

Chapter 2 will be devoted to a theoretical framework for the study. It will give an insight to the three theories used for the current study, Globalization theory, Techno-Institutional lock-in and Primary resource endowments, and provide hypotheses for the research.

Chapter 3 will describe the methodology used in order to answer the research questions and test the hypotheses.

Chapter 4 provides findings and analysis for the first hypothesis driven from the Globalization theory. In particular, it will explore resources as an instrument used for geopolitical influence abroad and analyze how it can decrease the interest of the Russian government in renewables and therefore constrain the development of renewable energy sector.

The examination of techno-institutional lock-in in Russia as a constraining factor for the development of renewable energy is given in *Chapter 5*. It will analyze five elements of the techno-institutional complex established in the country in relation to renewables.

The impact of the availability and abundance of primary energy resources on the development of renewables in Russia is assessed in *Chapter 6.*

Chapter 7 presents conclusion, summary of the study and recommendations for further research.

CHAPTER 2: Theoretical framework

2.1. Introduction

Much attention has been brought to energy issues, climate change and CO_2 emissions all over the world. The role of renewables is significant in these questions. In many countries governments search for new opportunities to develop renewable energy sources, apply new policies and legal frameworks to support this branch. Having a great potential for renewables and need in satisfying its growing energy demand, Russia, unlike developed countries and other emerging economies, does not experience any significant advancement in this field.

In order to understand the barriers and challenges which can appear on the way to the increase in renewable energy sources share in Russian energy mix, several theories have been applied. The development of the renewable energy is a multidimensional and complex topic which can be analyzed and viewed from various angles and perspectives. It has been explored in terms of the technological advancement, political institutions and legal frameworks, sustainable development and environmental issues.

To analyze all the above mentioned aspects with regard to the research topic globalization theory has been applied. In addition, since the main focus of the paper is the activity of political institutions towards the development of renewable energy in Russia, the theory of techno-institutional lock-in is also introduced in this study. It will help to provide a more detailed insight into the current situation and identify possible obstacles in the development of renewable energy sources through the lens of the techno-institutional complex in Russia. The last but not the least theory used in this study is primary resource endowment theory, which presents some suggestions on how the availability and abundance of other energy sources in Russia can influence renewables in the country.

Each section in this chapter will describe one of the theories and their applicability to the development of renewables in Russia. The first section is devoted to the Globalization theory. The second one reveals the main idea behind the techno-institutional lock-in. The third section describes the primary resource endowment theory. Finally, the last section provides a short summary of hypothesis proposed in this paper based on these three theories.

2.2. Globalization theory

2.2.1. The process of globalization and its key features

The phenomenon of globalization has been widely discussed since 1980s. Despite the fact that globalization debate has been occurred for more than three decades, it is still hard to find one single definition that everyone would agree on. However, common specific features can be named.

Intertwined economic processes, increased capital flows among the countries, rapid pace of technology development, new level of interrelationship among countries, increased human mobility are usually indicated as the key attributes of globalization. In other words, the world once started to experience dissemination of different processes which took the form of interconnectedness and interdependence among the countries. As Speth (2003) has fairly admitted in his work, "globalization refers to the compression of the world and the tightening of all the linkages – economic, political, social, environmental – between developments here and events in far corners of the world" (p. 3). Globalization proves to be a multidimensional and ongoing process which restructures the existing economies, institutions and societies.

Globalization has changed the understanding of time and space, which Harvey (2000) reflected on as a "time – space compression". Rapid technological advancement and information revolution contributed to the increasing amounts of financial flows and trade, they decreased the time needed for these operations, made the communication faster and easier etc. These aspects became a ground for the creation of global markets, multinational corporations and international organizations. Levitt (1983) noted the emergence of global markets with the unprecedented magnitude of standardized products. Held and McGrew (2007) argued that global economy opened up and now included every part of the globe, and corporations started to perform internationally. Helliwell (2002) asserts that goods and services are freely and costlessly traded over space and borders (p. 15-16). "Globalization […] contributed to the progress of the world, through travel, trade, migration, spread of cultural influences, and dissemination of knowledge and understanding" (Sen, 2002, p. 6).

Therefore, the concept of globalization is rather multidimensional and broad involving various aspects of the modern world. Globalization theory, which came into view the same time

globalization concept started to be a hot topic, is of the similar nature. It covers all spheres of our lives, including politics, economics, social life, cultural life etc. To the benefit of the current study further attention will be mainly directed to the political and economic spheres, as they are seen as the key ones in answering the research questions defined in this paper.

2.2.2. Political and economic players in terms of globalization

Globalization theory depicts the changed roles of existing players and the emergence of new ones on the global arena. Depending on the proponents of a particular wave of globalization theory, globalists, skeptics or transformationalists, scholars present the current situation from different perspectives.

Globalization theorists talk a lot about the increased number and strengthened role of transnational corporations. Modern economy is penetrated by the transnational networks and global production networks which integrate national and local economies into a global one and in ways that have significant implications for their economic development (Dicken, 2011). Advocates of the globalist view consider that transnational corporations have become the central actors in the global economy, while governments started to accommodate to the forces of economic globalization (Held & McGrew, 2007). Nation-states lack the power and influence they had back in time, because now they have to adjust their policies to the needs of mobile capital (Martell, 2007). Proponents of other two waves, skeptics and transformationalists, consider that the role of transnational (or international companies as skeptics refer to them) corporations is exaggerated by the globalists; however, they still admit their significance in the modern world.

Another important concept in the globalization theory is the perception of the role of government in a globalized world. Opinions differ among the three waves of globalization theorists. Globalists consider that states have lost their power due to the transnational networks and creation of new international organizations. Transnational forces reduced the control of individual governments; states can no longer bear effective policies, resolve key problems or manage a broad range of public functions (Held & McGrew, 2007). Skeptics though argue that the role of states remain the same, they are still the only legitimate authority, they themselves or in international collaborations are able to regulate global economy and pursue their interests (Martell, 2007). The proponents of the most recent wave, transformationalists, on the other hand, consider the changed role of the state in the modern world. Advocates of this wave underline that

governments still have the power, but it has been changed due to the emergence of other significant actors on the global arena, such as transnational corporations and international organizations. In other words, the role of state has not been fully diminished, but rather reconstituted, and states have become more active in the modern world.

In relation to the energy industry, scholars have noticed a key role of the state throughout the history of the development of the energy sector. Every period dominated by the particular type of energy, such as wood, coal or oil, is characterized by specific actions of the governments. Transition from one source of energy to another was largely driven by the state (Moe, 2010). Considering the globalization period and new roles of state, there are all grounds to assume that governmental actions towards the energy sector affect the direction of its development. Therefore, if state does not put much effort to support and promote new sources of energy, including the renewable ones, they would not get a proper development, if not stagnate or even fail.

2.2.3. Globalization of energy markets

In the first section it has been mentioned that one of the key features of globalization is the creation of the global markets, the increased amounts of international investment flows and interconnected economic processes. Global economy experiences the intensifying integration of markets within and across the regions; economic activities become interlinked and interconnected (Held & McGrew, 2007).

Globalization affected the energy markets as well. They have become globally integrated and more open during the last decades. Harris (in Kugler & Frost, 2001) points out that though the globalization of market is a historical process, today it has become "unprecedented in its pace, range, and depth" due to more open access to resources, cross-border pipelines, business linkages, electric power grids etc.(p. 272).

This transformation has brought both opportunities and problems. On the one hand, energy became more accessible and low-priced, and it created conditions for the improvement of energy efficiencies and provided more opportunities for fuel substitution. Global energy market should generate necessary wealth, lower all kinds of barriers on the way of the financial flows and motivate governments to create good conditions in terms of needed policies. It should help to

create and diffuse appropriate technologies necessary for various types of energy development among the countries all over the world (Harris in Kugler & Frost, 2001; Harris in Brown, 2003).

On the other hand, deeper integration of energy markets puts countries into risks, since more interlinked energy markets present new security challenges. Countries become more dependent on each other through cross-investments, pipelines and electrical grids. The interdependence of energy markets is growing and the relationship among actors is evolving as well. While governments try to build relationships with countries suppliers of energy, the latter obtain more power on the global arena (Harris in Brown, 2003).

Contemporary global energy market is dominated by fossil fuels. Compared to them renewable energy markets are too small and off-grid and they still remain less integrated (REN21, 2013). Meanwhile, oil has become more than just an energy source. Morse (1999) argues that it is used also as a political instrument of the producing countries. He writes that "rather than keeping oil and politics on their separate tracks, the nations of the world have found ways to bind them together" (p. 1). In the context of globalization oil has become an instrument of foreign policy for the oil-export countries, a source of political power used through the global energy market.

According to Ehrenfeld (2005) it is cheap oil that enables globalization to flourish around the world (p. 320). He considers that renewable energy sources cannot replace cheap oil in the same magnitude. Though he underlines that countries need a public policy intervention into the fostering of investment programs which would motivate and help the development of renewable energy sources, he states that renewables cannot substitute oil "at the current rate of use" without any side effects. Ehrenfeld argues that renewable sources "can only power a nonglobalized civilization that consumes less energy" (p. 320).

Russia is known as one of the major oil- and gas-exporting countries. It is one of the key actors in the global energy market as well. Gidadhubli (2006) explored how energy has been used as an instrument of foreign policy for enhancing political objectives of the country. He admits that pipelines, destined for the transporting of oil and gas from Russia, have obtained geopolitical importance. In other words, national government uses energy markets in order to pursue its political interests across the countries. Renewable energy does not currently possess that kind of feature specific for fossil fuels energy markets. As renewable energy markets are small and take an insignificant share in a global energy market, it seems to be hard to use it as a political

instrument. Therefore, Russian government would probably put more interest into the traditional energy than renewable one as it gives more power to the state.

2.3. Techno- institutional lock-in

Unruh (2000, 2002) and Unruh and Carrillo-Hermosilla (2006), exploring the problem of global climate change, came up with a theory of techno-institutional lock-in. They argue that countries have become locked into fossil fuel-based technological systems and government institutions.

Technology has been playing a great role in the past decades, especially with regard to the usage of different energy sources. Due to technological advancement energy sources became cheap and widely distributed. However, technology itself is not the only key to the successful development. In addition, technological progress cannot be treated as if it happens automatically or appear by miracle. Sarewitz (2012) notes that it is the government who has always been the major investor and customer of new technologies. And the other way around, technological opportunities which can solve many problems may become an organizing tool to bring various political and institutional actors together.

Unruh (2000) actually says that existing technology and institutions can no longer be analyzed apart. Technological systems and institutions have become significantly interlinked and interconnected, and create together a so-called "techno-institutional complex" (TIC). This complex creates persistent intensive structures that affect further development and stability of the system.

TIC establishes and sustains certain standards, regulations, way of doing business etc. which are directed by particular interests of certain groups involved into this infrastructure. At some point of development TIC will find itself "locked-in". Unruh (2000) points out that once locked-in, techno-institutional complex can be hardly displaced. Thus, established TIC reduces the number of alternative technologies and options which could bring improvements and solve many problems (Unruh, 2000).

The process of globalization only worsens techno-institutional lock-in. It can be spread out to several countries or regions due to the easiness of technology transfer, established transportation systems and standards which are promoted by international organizations and multinational corporations operating across the globe (Unruh & Carrillo-Hermosilla, 2006).

Globalization theory points out that states are no longer the only major actors in the global politics and economy. Transnational corporations have recently become rather influential, especially if we consider energy sector. Today the majority of energy technology can be found in hands of TNCs. Moreover, the largest TNCs are actually engaged in the energy sector whose activity is based on oil and gas. According to Unruh's theory TNCs are a part of the techno-institutional complexes, who are mainly interested in supplying hydrocarbon-based technology packages and projects. In addition, this very power infrastructure is often funded and supported by government (Unruh & Carrillo-Hermosilla, 2006). As Eikeland and Sæverud (2007) point out if in a country can be found "strong and dominant internationally competitive national champions" engaged in the conventional energy industry and which operate worldwide, it is more likely that national governments will be more prudent towards the renewables, because new policies supporting alternative energy sources can foster the emergence of new competing energy industries (p. 23). Therefore, the established TIC in the country can easily block the development of the alternative technologies and energy sector.

In the case of Russia large TNCs, whose activities are mainly concentrated around oil and gas, will probably create barriers on the way of the alternative energy sources, such as renewables, unless they find an interest in them. Otherwise, countries will turn up in a "carbon lock-in", where the existing structure will resist any possible changes.

2.4. Primary resource endowment theory

This theory is based on the research made by Eikeland and Sæverud (2007) regarding the diffusion of renewable energy among European countries. They suggested that the success of renewable energy development and state interest in its promotion and support were dependent on the physical primary resource endowment in the country. In a situation when there can be found energy-related problems in a country, "the diffusion of renewable energy should rank high in the hierarchy of governmental priorities" (p. 23). And vice versa, if country possesses large amounts of conventional energy sources, such as oil or gas, and thus does not have major problems with energy, it is less likely that renewable energy industry will enlist support from the national government.

Obviously given resource endowments will differ from country to country. Therefore the setting does matter, as policies aimed to endorse the development of renewables are more likely to be found in a country with significant energy-related problems, while renewables in their turn are

considered by the national government as a solution. The availability of renewable energy sources also plays an important role, as it may become an additional advantage in favor of this particular industry and motivation for the government to develop stable policies (Eikeland & Sæverund, 2007; Moe, 2012).

The abundance of traditional energy sources in Russia, such as oil and gas, may therefore have an impact on the Russian authorities and local companies regarding their decisions made and initiatives taken towards the development of renewable energy in the country. In particular, as Russia is rich with traditional energy sources and has few immediate energy-related problems, it is more likely that the local government will show little interest in the development of renewables in the country.

2.5. Summary of hypotheses

This section gives a brief summary of hypothesis which stem from the theories described above.

H1: Renewable energy lacks political influence in a global energy market, so Russian government shows little interest to renewable energy industry.

H2: Established TIC in Russia blocks the development of renewable energy sources contributing to carbon lock-in.

H3: Due to the abundance of conventional energy sources (such as oil and gas) Russia has few immediate energy-related problems which gives little motive force for the dynamic development of renewables in the country.

CHAPTER 3: Methodology

3.1. *Introduction*

This chapter is devoted to the methodology chosen for the exploring of the research topic. First of all, it will be explained why qualitative approach has been chosen for the current research. Then the used sampling procedure will be described. The subsequent section reveals information about the types of the used data and its reliability and validity. After that some limitations of the study will be specified.

3.2. *Methodological approach*

"Sanity is not statistical"
— George Orwell, *1984*

In order to address research questions, the methodological approach should be chosen first. Normally, three types of approaches are distinguished: qualitative, quantitative and mixed. Quantitative research is concerned with the data that can be structured, represented numerically and thus statistically analyzed. To receive conclusions using quantitative methods in the research lots of information should be gathered and many cases explored. Since this approach is mainly based on numerical data and variables, it tends to ignore everyday context and any particular detail of a single case (Matthews & Ross, 2010; Bryman, 2012).

Qualitative approach is different from quantitative one in many ways. In a broad way this type of research is primarily based on words rather than on numbers. In social research qualitative methods are often associated with stories which represent experience, understanding and opinions of a particular person or group of people. However, sometimes qualitative research may be more positivist in its epistemological orientation, though still using no quantification. In other words, it can be more objective, rather than built on interpretations. Unlike quantitative approach, qualitative research is based on a relatively small number of cases which are analyzed in details. Therefore, the emphasis is made on knowledge in depth of a particular case in a specific context (Matthews & Ross, 2010; Bryman, 2012; Burnham, Lutz, Grant & Layton-Henry, 2008).

Mixed approach is a combination of qualitative and quantitative methods used in a way that is best for a single research. Though a mixed approach can give a more thorough and detailed analysis, a choice between either qualitative or quantitative is usually made due to time, money and opportunity limitations (Matthews & Ross, 2010).

It is the research questions and nature of data which should determine the type of approach to be chosen for the study (Matthews & Ross, 2010). In the current study numerical data and statistical analysis seem to be less of an interest unlike context-specific behavior and activities of actors involved into the development of renewable energy in Russia. The main aim of the research is to gain knowledge about the underlying reasons and grounds of the decisions made which restrain the growth of renewable energy sources. Therefore, qualitative approach appears to be the most appropriate for this study.

3.3. *Research design*

In order to address the research questions and also taking into account existing opportunities and different limiting factors, it has been decided to have a case study design. It gives the opportunity to make a detailed analysis of a single particular case. In addition, it is possible to gather different types of data within a case study.

The term "case" is usually associated either with a person, location or a particular situation. Thus, the unit of study may be an individual, a single community, an organization or a country. The emphasis in the case study is made on the intensive exploration of the given setting which provides in-depth understanding and knowledge about the case. However, case study usually has some boundaries, in order to make it clear what should be examined and what is not (Matthews & Ross, 2010; Bryman, 2012).

The current study explores the obstacles and challenges which may constrain a better development of renewable energy sources in Russia. To narrow down the potential wide range of deterrents, the main focus of the research has been given on the politics and policymaking around the renewable energy industry in that particular country.

3.4. *Sampling*

Due to limited time and resources a non-probability sampling has been chosen for this study. In particular two types of sampling were used: purposive and snowball.

Purposive sampling provides researcher with the opportunity to gather qualitative data which gives the information about respondents' experiences and perceptions. Though this type of sampling is not statistically representative, it enables the researcher to explore the problem in details and examine the research topic in-depth (Matthews & Ross, 2010).

In addition, elite interviewing was used. It implies that some of the respondents are treated as experts in the field of research. Elite interviewing can significantly contribute to the understanding of the research problem due to the high levels of knowledge and general intellectual and expressive abilities of the respondents (Burnham et al., 2008). In the current study respondents who have a vast experience and knowledge in the field of the renewable energy in Russia, but are not directly involved into the industry, are considered as experts. In particular, representatives of Bellona (Russian office) and IFC (International Financial Corporation) agreed to answer the questions regarding the research topic of this study.

Snowball sampling has also been applied since a few people were known in the beginning and there was an opportunity to reach them. They were interviewed in the first place and asked to suggest other persons to talk to on the same topic and provide their contacts.

3.5. *Data*

Both primary and secondary sources were used for the research. Primary data is gathered by the researcher using data collection tools designed specifically for the particular study. Secondary data reflects information and analysis that have been produced by other researchers (Matthews & Ross, 2010). Primary sources for the current research comprise semi-structured interviews, while secondary data comes from legal documents and reports provided by organizations such as IFC.

3.5.1. Semi-structured interviews

Interview is a widely used data collection tool in the social research. In qualitative approach two main types of interviews are usually specified: unstructured and semi-structured. While both of them provide quite a freedom and flexibility in conducting the interview, the unstructured interview implies the minimum of questions from the interviewer (Bryman, 2012). I assume that semi-structured interview is the most appropriate data collection tool for the current study, because it allows the interviewer to stick to a certain list of topics and questions and at the same time be flexible with regard to the responses provided by the interviewees.

Semi-structured interviews were conducted via Skype since all the interviewees were located in different countries, mainly in Russia. During the majority of interviews web camera was used, which gave the opportunity to simulate face-to-face interaction. However, some respondents had problems with internet connection, so some interviews were conducted without image streaming.

Interview guide designed specifically for the current research was used. Interviews were conducted either in Russian or in English. Voice recorder was used in all the cases.

3.5.2. Secondary data

First of all, the literature review of scientific articles and other scientific work related to the development of renewable energy in Russia was made. Legal documents issued by the Russian authorities with regard to renewable energy in the country were analyzed and used for the current study. In addition, various internet sources were taken into account, because a lot of changes with regard to the development of renewables in Russia happened recently, which have not been reflected in any scientific work yet.

3.6. *Validity and reliability*

The data that is gathered by the researcher should apply to certain standards and criteria. They guarantee the high quality of the research. In particular these standards ensure that data can be operated, and it is possible to draw truthful conclusions and receive results which represent the reality, and thus get correct answers to the research questions. One of the most important standards is validity. According to Matthews and Ross (2010) “as social researchers we need to find ways of collecting data that ensure that the data closely reflects the reality it represents” (p. 53). In addition, data itself, data collection and analysis should be consistent, or, in other words, they have to be reliable.

In the current study those two standards were certainly applied. However, some issues which turned up during the primary data collection should be pointed out. First of all, some interviewees represented big organizations which could have had their own position towards the existing situation with renewables in Russia. Thus, those interviewees could have provided me with the official answer rather than give a more critical view. In addition, some respondents refused to answer some of the questions due to the confidentiality of the information needed to answer those questions.

3.7. *Limitations*

Though every researcher tries to explore his/her question as thoroughly as possible, the study is usually subject to some limitations, and so is the current study.

First of all, I had limited time to conduct the interviews. Secondly, all my respondents were located abroad, so it was impossible for me to organize face-to-face communication, but rather use e-mails, Skype and phone. Sometimes it was hard to reach my interviewees and get an on-line appointment.

The results of the study are based on the interviews with a small number of participants, so it can hardly be generalized across the given settings.

The data and analysis presented in the current study do not include recently joined Crimea to the Russian Federation. Despite the fact that the world community has not approved Crimea as a part of Russia yet, it is considered as an official territory of Russia by the local government. Therefore, future statistics for the whole country might be adjusted given a new area, which may result in another data and findings different from the current ones.

CHAPTER 4: Globalization of energy markets: using energy sources as geopolitical influence abroad

4.1. Introduction

Due to the process of globalization countries all over the world have become interlinked and interconnected in many ways. Globalization of energy markets is one of these processes we can take notice of. Local energy markets started to integrate into a global one and influence each other, while local governments received the opportunity to impact other countries using energy sources as an instrument of foreign policy for enhancing political objectives of the country. Since global energy markets are dominated by fossil fuels, it has been suggested that Russian government would pursue the further development of conventional energy sources as they enables it with geopolitical influence, rather than give support to renewables which have a small and insignificant share in the global energy market and barely can be used as an instrument in world politics.

The following sections will explore traditional energy sources as political instruments used by the Russian government in the context of globalized energy markets and examine how renewable energy sources are different from oil and gas in terms of geopolitical influence in the world.

4.1. Oil and gas as instruments to pursue Russian political goals

The process of globalization has recently broadened the integration of domestic energy markets opening up a lot of opportunities and, at the same time, strengthening the mutual interdependence. Oil and gas have become the main traded energy sources. Harris (2001) notes that fossil fuels have been traded internationally for years and oil producers have been important multinational corporations; however, these days energy market globalization have become "unprecedented in its pace, range, and depth" (p. 272). Almost the whole world becomes involved into a globalized energy market, not without an active participation of the Russian Federation.

In 2000 Russia receives its new president, Vladimir Putin. He comes with a new political vision, new aims and targets, different from the ones of his predecessor. After the period of stagnancy in 1990s, Putin decides to rebuild Russia as strong and powerful country both politically and economically. He chose two main sectors as driving force of the development, one of which

became the energy sector. During the next 5-7 years Russia managed to reach a twofold increase in oil and gas production (Gidadhubli, 2007).

Despite the fact that oil and gas prices experienced significant rise the same years, it was not only economic wealth and maximizing economic gain pursued by the government. One of the main targets brought by Putin was to regain country's power position in the world (Gidadhubli, 2006). As energy markets were becoming more and more integrated, energy itself turned to be an opportunity and an instrument for geopolitical influence abroad and enhancing Russia's ambitions on a global scale (Gustafson, 2012).

Putin has noticed that *"the role of the country on international energy markets determines, in many ways, its geopolitical influence"* (Kupchinski, 2009). Therefore, energy soon became a strategic sector where state started to regain its control, so it could promote its geopolitical interests. Putin adopted a policy implying partially renationalization of the economy, restricting the role of private sector; in addition, state also started to acquire foreign shares in Russian companies operating in energy sector. Some measures were too critical and condemned by the rest of the world, like the case of Yukos[4] which gave birth to a new state-owned oil giant, Rosneft.

There are many examples of how energy was used then to pursue Russia's political objectives abroad. With the help of state-owned TNCs Russian government established economic and political ties through the pipelines. Russia gained control over the infrastructure of the neighbor countries which were used for oil and gas exports to European market (Gidadhubli, 2006).

In addition, state-owned TNCs acquired assets in former Soviet republics, like Kazakhstan, Turkmenistan, Azerbaijan, Belarus, and other foreign countries, as Hungary, Algeria, Venezuela etc. through investments made to energy sector including energy infrastructure. Moreover, some of the central Asian states became dependent on Russia as they were connected to the pipelines passing through Russia and thus the latter could control the exports of oil and gas made by these countries (Gidadhubli, 2006, 2007).

[4] Yukos was one of the largest privately-owned Russian oil companies. In 2006 it was declared bankrupt while its CEO was in prison for tax evasions. The majority of assets ultimately passed to Rosneft what made it one of the largest oil companies in Russia. Many scholars admit that this case was created intentionally in order to demonstrate the power of state.

Therefore, Russia obtained a significant leverage represented by energy sources. Gidadhubli (2007, 2006) points out that Russia often used oil and gas exports as favoring instruments for countries which were politically aligned, and punishing ones for countries opposed to Russia. For instance, in 2006 Gazprom increased the prices for gas exported to Ukraine from USD 50 to USD 230 in order "to punish" it for the Orange Revolution, which was considered as anti-Russian leaning of the country. While the price for gas supplied to Belarus was even less than USD 47.

Even today Russia continues to establish new oil and gas linkages with foreign countries and expand its influence through energy markets. For instance, in May 2014 Gazprom signed a gas supply contract with China. The 30-year deal implies gas supply through Russian pipelines in the amount of 38 billion cubic meters, and investments into exploration and construction of some of the pipelines (Gazprom, 2014).

Thus, it has been for a decade that Russian government develop fossil fuels energy sector. State has been prioritizing oil and gas since they enable the government to gain political power abroad and influence the political and economic situation in foreign countries. Traditional energy sources are successfully used as geopolitical weapons and instruments in globalized energy markets, and contribute to the reputation of Russia as energy superpower. Therefore, the main interest of the government is paid to that energy sector accompanied by huge support and incentives for future development.

4.2. Does renewable energy represent an alternative instrument for Russian foreign policy?

Renewable energy has always been opposed to conventional energy sources in many ways. Unlike fossil fuels, it is a source of unlimited resource endowments; it is cleaner and environment friendly. There are still debates among the scholars if renewables are able to completely substitute fossil fuels as an energy source, comparing technological and economic potentials of both alternatives.

However, as it has been mentioned in the previous section, fossil fuels are used not only as sources of energy, but also represent an important instrument of the state in international politics. For Russia it is one of the main reasons why government prioritizes this energy sector among the others. Therefore, if it starts to consider renewables as an alternative to traditional energy sources, they should not only be technologically and economically feasible, but also have the

same influence and weight in international politics as fossil fuels do. And vice versa, if renewables are unable to provide the government with power and contribute to Russia's development as an energy superpower on a global arena, it is most likely that local government will not be interested in rapid growth of this energy sector.

While oil and gas have been associated mainly with the globalization of markets, their increased interconnectedness and liberalization of markets, renewables have become a hot topic in terms of energy security and energy independence (Ehrenfeld, 2005). Renewable energy has become one of the key solutions to mitigate energy security risks. While oil and gas are binding the countries into a single energy market penetrated by pipelines providing exporting countries with power and influence, renewable energy is considered as an opposite instrument intended to provide countries with independence in energy-related issues and to become less vulnerable to the political impact of countries-exporters of energy.

In addition, renewable energy markets are not as developed as energy markets involving fossil fuels, and their size is almost incomparable to traditional energy markets. Barely any renewable energy source is used for exports. According to REN21 (2013), in recent years there has been an increase in international trade of wood pellets, biodiesel and ethanol; however, the amount is really small in comparison to oil and gas, that it can hardly provide a country with any political influence through these energy sources.

It is also a common knowledge that not only exports of energy sources are used as means of political influence. One of the significant ways to impact foreign countries' markets and politics is foreign direct investments (FDI). In REN21 (2013) it is stated that global investment trend into renewable energy decreased in 2012 by 12% in comparison to 2011. The lack of investments into the renewable energy sector shows that nowadays governments do not consider it as a tool of political influence.

Due to the fact that renewable energy, as an alternative to traditional energy sources, is unable to be a geopolitical instrument today and provide country with power abroad, it seems unlikely that Russia would stop supporting the ties built up and sustained through conventional energy sources and address its main attention to renewables. It would rather continue to use and support conventional energy market that contributes to state's influence in the world.

4.3. Conclusion

This chapter has explored the role of fossil fuels as strategic weapon used by Russian government in foreign politics and questioned if renewables can substitute traditional energy sources as a geopolitical instrument.

Globalization of energy markets has been used as an opportunity to regain Russia's power position in the world, while oil and gas has become an instrument in the hands of Russian government to pursue its political ambitions on a global scale. To become an energy superpower Russia has been steadily building up connections and ties with other countries through energy companies, producing oil and gas and exporting them to other countries using Russian pipelines. Through using this network of pipelines Russia has been able to enhance its goals in the world politics and establish its geoeconomic and geopolitical role.

Renewable energy sources in their turn prove to lack this "power" component which makes them unattractive for the state. On contrary, they are associated with energy security which is supposed to be reached by any country through the process of becoming independent of other countries supplying energy or energy sources to them.

Despite the fact that renewable energy experiences a steady development in the world, it has not yet reached the same size and production volumes as oil and gas, to enable countries with geopolitical power and influence. As the political aspect of energy source is one of the decisive factors for the Russian government to consider it as a priority, renewable energy does not get any significant support from the local government.

CHAPTER 5: Techno-institutional lock-in as a restraining factor of the renewable energy development in Russia

5.1. Introduction

The current part of the study explores the techno-institutional complex established in Russia and its impact on the renewable energy development. According to the TIC theory, brought up in Chapter 2, it might be one of the restraining factors which hinder the development of renewables in Russia, since it is "carbon locked-in" and tends to support the existing system blocking all other alternatives.

In the following sections the TIC framework will be applied to the case of renewable energy in Russia. It implies several elements, such as technological, institutional, industrial, organizational and social systems. Therefore, next sections will be broken down in accordance to each element and evaluate the current situation with renewables in Russia.

5.2. Technological element

The development of technologies necessary for the use of renewables is slow in Russia and is behind the level of other countries. Though there can be found some successful breakthroughs, like the production of wood pellets, many of them are targeted for export and are not used inside the country (Popel, 2011).

Recent legal documents issued by the Russian government (Decree "On incentive mechanism" No. 449; Resolution No. 861-p) have set up fixed targets in relation to domestic content requirement[5], a certain share of components and technologies used should be locally manufactured, that is planned to be used in renewable energy industry. In other words, those power generating plants which are going to produce energy based on the renewable energy sources must have a certain share of technology produced on the territory of the Russian Federation. The degree of domestic content requirement varies for every type of renewable energy, for example, in wind power and small hydropower it should be equal to 65% by 2020

[5] In Russian documents referred as localization of the technology production

and in solar energy it should reach 70% by 2020. If they fail to reach those targets, penalty coefficients will be applied.

Theoretically it is seen as a driving force to develop local technologies for the renewable energy sources. However, as it has been already mentioned, the level of technological development in relation to renewables is low in Russia and today the majority of necessary technological equipment is imported. Sergeev Y., one of the respondents for this study, says that *"It is impossible to reach a target of 70% when you lack the capacity for the production"*. Therefore, in reality it is more likely that such restrictions in using foreign technologies will hinder the development of renewable energy in the country. So far it has already become one of the obstacles for some small hydropower to take part in the annual tender for the right to receive financial compensation from the state and agreement for the power delivery (Vakhrusheva, 2013).

The equipment now used in electricity sector in Russia is rather old and outdated; the majority of it was implemented 20, 30 or even 50 years ago, which draws us back to Soviet times (Ecozashita, 2013). But today, when we talk about renewables we usually consider new and innovative technologies. It may create significant problems, since new technologies might be inconsistent with the old equipment used throughout Russia. In addition, the existing system has been working with the same structure for more than several decades, while innovative technologies require changes, which more likely to cause administrative and organizational problems.

5.3. Institutional element

According to Unruh's theory institutional element includes such key actors as government, ministries and departments, which influence certain industry, in this case it is renewable energy industry. Legal framework and government policy interventions are also considered as an important part of this TIC element.

Government plays a great role in the development of renewable energy industry in Russia. It creates the initiation and directions for the future development and set up targets that should be achieved. *"Government must develop support mechanism that will enable Russia to achieve targets, because everything depends on the target and the target is set up by the government"* says Boute A (legal expert, International Finance Corporation). Sergeev Y. in his turn admits that

"Everything depends on the political will. Nothing will happen if not the directive from the upper (federal) level". In addition, all the experts with whom I have conducted interviews noticed that before 2007, when it was announced on the top level that Russia should pay attention to the renewable energy sector and start to make progress in this field, nothing had been done at all since 1990s. In May 2014 at the St. Petersburg International Economic Forum Putin clearly outlined the attitude of the government towards the future development of energy sources in Russia saying that *"Both we and you fully understand that total energy consumption will be increasing at least in the next 30 years; however, the structure of consumed primary energy sources will not change. Therefore, we will pay a lot of attention to hydrocarbon production and the development of nuclear power"(Kireeva, 2014).*

There is no separate ministry which would have performed government administration just in the renewable energy sector. Renewables are under consideration of Ministry of Energy of the Russian Federation. In fact, until the year 2007, it was engaged mainly in the development of conventional energy sources, such as oil, gas and coal. However, today it is a key organization on the federal level that defines the future development of renewable energy in the country.

Local authorities on a regional level should be also regarded as influential actors in renewable energy industry. They have the right to elaborate their own programs, which will support renewables in their region, and implement them. All respondents, when asked about regional authorities, have specified that their interest in renewables is quite important and has a great impact on the development. Vakhrusheva K., for example, has noticed that *"a lot depends on the regional authorities; if they are interested in renewable energy and want to develop this industry, it is always possible to find ways to do it"*.

There can be named just a few regions which are seen to be really active and showing interest in the development of renewables. Based on interviews and news covering the achievements in renewables, I would distinguish the following regions: Belgorod, Murmansk, Tomsk and Kaluga regions. Some would also specify Leningrad, Nizhny Novgorod, Arkhangelsk and Chelyabinsk regions (see e.g. Ecozashita, 2013). There could be probably named a few more, since there are no generally accepted criteria yet; however, this number will hardly exceed 10-15, while the total

number of regions in Russia is 83[6]. That shows that the majority of regions prefer to concentrate on the conventional energy sources.

It should be noted that there is no law on renewable energy in Russia. Draft law has been discussed in Ministry of Energy for several years now, but no real action in order to pass that law has been done. The term "renewable energy" was officially adopted and reflected only in 2007 in the amendment to the existing law No. 35-FZ "On Electric Power". It provides the explanation what should be considered as renewable energy and gives a full list of renewable energy sources. This law required to elaborate the key directions of the government policy with regard to energy efficiency with the use of renewables and introduced shares of energy produced by renewable energy sources in the balance of production and consumption of energy per year.

Next important legal document, Resolution No. 1-p, was issued in 2009, which set up the targets of the renewable energy development up to 2020. It was determined to reach the share of renewable energy sources in the electricity production up to 4.5% (excluding large hydropower with more than 25 MW) by 2020. In addition, some incentives and enabling measures were reflected in that document, such as attracting additional investments, providing support to small entities, mechanisms of additional help using the financial sources of the state budget.

During the period of 2009 – 2013 different attempts to regulate somehow the sphere of renewables were made[7]; however, they did not bring any visible results and the share of renewable energy sources remained almost the same. In May 2013 a new Decree No. 449 and Resolution No. 861-p were adopted. They determined the renewable energy support mechanism for the wholesale electricity market, defined the expected amount of electricity produced with the use of renewable energy sources and the share of domestic content requirement.

The most recent changes in the regulation of the renewable energy sector were reflected in the Decree No. 321, issued in April 2014. This document is interesting for several reasons. First of all, it has another target rate that should be achieved by 2020 different from the one fixed in Resolution 1-p. While in 2009 legal document it was stated that the share of renewables in

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[6] This number excludes Crimea and Sevastopol, which have been considered by Russian legislation as two new regions of the Russian Federation since March 2014

[7] e.g. Decree No. 823 "On schemes and programs of potential development in electric power industry" , 2009; Decree No. 1178 "On pricing of regulated prices (tariffs) in electric power industry", 2011.

electricity production should reach 4.5%, the new Decree announces the figure of 2.5%. It is hard to trace the reasons why the target was reduced and where it comes from. Secondly, as Boute A. fairly admits, that brings uncertainty into the situation. Theoretically, all the mechanisms and support schemes should be elaborated with regard to the target rates, and if they are changed, it becomes unclear what the real intention of the government is. In addition, this Decree defines the amount of financial support to the development and utilization of different types of energy sources. As all types of energy sources are subsidized in Russia, it may clearly show the priorities of the government. While oil industry receives RUR 1.3 billion (approx. USD 37.5 million), coal industry gets RUR 18.3 billion (approx. USD 526.7 million), renewable energy industry will only receive RUR 190 million (approx. USD 5.4 million).

5.4. Industrial element

The renewable energy industry is represented mainly by small companies. According to Vakhrusheva *"renewable energy market is very small in Russia. All CEOs know each other and the number of companies do not exceed 100"*. They exist in the system dominated by conventional energy sources and barely carry any weight in the politics around energy industry in general, and renewables in particular.

Russian energy industry is mainly represented by large companies, whose main activity is based on fossil fuels. Many of them are transnational corporations with a wide network all over the globe. Take for example Gazprom, Lukoil, Rosneft, Zarubezhneft or Transneft. In addition, the majority of energy companies are state-owned. In the list presented above only one company is privately owned (Lukoil), while others have state shares in their capital. Therefore, the activity of these companies mirror the priorities of the government and no doubt that TNCs itself have a significant role in political decisions. Nevertheless, in both cases the interests of small companies might be discriminated.

It should be fairly admitted that recently large energy TNCs started to show interest in renewable energy industry. Gazprom conducts research in relation to the utilization of renewable energy sources in terms of the energy saving and energy efficiency program (Gazprom, Terms and programs for energy saving). Lukoil has now three large and one small hydropower plants in Russia. It has acquired wind power plants in Bulgaria and started to build a new one in Romania in 2013. Some solar panels have been installed at Lukoil's gas stations in Bulgaria, Serbia and Russia (Lukoil, Renewable energy). However, the number of such projects is really small and a

lot of them are located outside Russia. Renewables are considered by these energy companies as a side business, not the main activity. Therefore, some experts have doubts about the seriousness of if the intention of such big companies to develop renewables. At some point it may appear to be only the intention to create a "green" reputation for the company, rather than a true aspiration to develop renewable energy industry. Nevertheless, it will be only possible to say for sure in a couple of years depending on whether those companies continue to carry out the research in renewables and increase the capacity based on the renewable energy sources.

5.5. Organizational element

Companies working with renewable energy sources experience numerous organizational and administrative problems inside the country.

First of all, the level of bureaucracy is very high. Lots of procedures should be complied and many instances overcome. For example, in order to get the facility validated, companies should follow the certain procedures. Despite the fact that it has regulatory and legal framework, in reality this process can take up to the whole year. And without this validation company has no right to set specific tariffs (Ecozashita, 2013).

It is always hard for firms using renewables to get connected to the unified energy system in Russia. It belongs to one company[8], which has its own requirements for technical connection, its own regulations and standards, and in addition, it has its own plans for further expanding. So it is usually problematic for small companies to become a part of this system. The situation may be worsened by the lobbying of bigger companies, which produce energy from hydrocarbons or using nuclear sources. Moreover, connecting to the grid is rather an expensive process, since quite often additional grid to the nearest distribution center needed to be built and a company has to pay for that. In addition, plan for the connection to the grid should be approved by the company-owner of the grid (Vakhrusheva, interview).

Another significant challenge is to agree on the area for construction. There are some examples when projects were stopped due to that obstacle. OAO Rushydro was planning to contribute into the development of small hydropower in the northwestern part of the country. They faced

[8] OAO Rosseti; more often it is possible to hear the name Federal Grid Company of Unified Eneegy Systems, which is a subsidiary of OAO Rosseti

significant problems during the negotiation of the needed area where small hydro would have been located. The same situation happened to the offshore wind park in Kronshtadt. There was a strong intention to build one there; however, the area for the construction has not been agreed on eventually. Neither of these projects was carried out due to that organizational problem.

5.6. Social element

NGOs have become truly active and influential actors in recent years, whether it concerns renewables or other spheres. Besides being successful on the political arena, these organizations also try to bring knowledge to people, get their attention to specific problems and opportunities, provide help etc. A lot of NGOs work with renewable energy in many countries.

However, in Russia NGOs is not really a common phenomenon. It is hard to perform and obtain significant influence for these organizations inside the country. Moreover, if those organizations receive money from abroad and provide any suggestion about the amendments to laws, it can be seen as an attempt to influence local politics from abroad (Vakhrusheva, interview).

In relation to renewable energy development there can be named just two main NGOs operating in the Russian Federation and which have some influence in this field; these are Bellona and Greenpeace.

People's ignorance in the sphere of renewable energy should be really high in Russia[9]. Hardly anyone thinks about the origins of electricity he/she gets at home, work, etc. Mass media eagerly covers the news about the conventional energy sources, but it is rather hard to come across any information about renewables in a daily life. People are used to live in a country where fossil fuels are considered as the main component of the national economy and where "Gazprom is a national treasure"[10]. The majority of population lacks knowledge about renewables and unaware about the opportunities they may provide.

[9] The author suggests additional research to be done to get more accurate data

[10] Official advertisement of the largest Russian TNC operating in gas industry

5.7. Conclusion

This section has explored the five elements of the TIC in Russia: technological, institutional, industrial, organizational and social; and evaluated the role of renewables in that complex.

Every element of the Russian TIC seems to be organized around the conventional energy sources and represent five types of "carbon lock-in". Technology used for the production of energy that comes from fossil fuels has been already used for several decades; it has its established standards and characteristics applied in every region of the country. There is no clear and stable legal framework that would have been regulating renewable energy industry; government shows its inconsistency in decisions towards renewables by changing targets and issuing contradictory legal documents, while showing its priorities to the development of the conventional energy sources. Though there can be found some shifts in the regions, where local authorities show high interest in renewables, the majority still prefer to exist inside the well-known hydrocarbon-dominated system. The activity of large energy TNCs, who represent the major part of the energy market in Russia, is based on fossil fuels, while renewables continue to be just a side business, if a company has an interest in them at all. Small companies engaged in renewable energy industry in their turn face many organizational and administrative challenges operating in the system dominated by large energy TNCs. In addition, the consumer demand in renewables is rather low due to ignorance of Russian population in this field. People continue to live in a country which is dominated by conventional energy sources without having enough knowledge about other options.

Together all five elements constitute a whole TIC of the country, which thus finds itself in a "carbon lock-in" situation. Renewables today exist in that system and companies pursuing renewable energy sources have to overcome challenges created by it. The problems faced by renewable energy industry, which have been described in this chapter, reflect the way how fossil fuel-based energy system resist to the adoption of renewable energy sources and to any changes that should follow. Every obstacle, therefore, constrains the further development of renewables and sustains the lock-in of the existing TIC in Russia.

CHAPTER 6: The availability of energy sources and its influence on the renewable energy development in Russia

6.1. Introduction

This chapter analyses the challenges on the way of the renewable energy development in Russia from the perspective of primary resource endowment theory, which was presented in Chapter 2. It says that the availability of energy sources has a direct influence on the success of the development of a specific type of energy. In particular, it has been suggested that due to the abundance of conventional energy sources (such as oil and gas) Russia has few immediate energy-related problems which gives little motive force for the dynamic development of renewables in the country.

The following sections will shed light upon the conventional and renewable energy sources endowments in the country and present the existing energy problems in the Russian Federation.

6.2. The structure of the energy sector in Russia

The major share in the Russian energy mix belongs to fossil fuels, such as natural gas, oil and coal. Russia is the top-leading country in the world with a high share of gas in its total primary energy supply. Taking into account significant shares of oil and coal, fossil fuels make up more than 90% of total primary energy supply in Russia. Nuclear power accounts for 6%, hydropower accounts for 2%, while other renewables together stand for only 1% (Figure 1).

The electricity generation mix looks the same. It is dominated by the fossil fuels, large hydropower and nuclear power. The share of renewable energy sources excluding hydropower accounts for less than 1% (IFC Russia, 2011). Total installed capacity of power generating plants and power stations does not exceed 2 200 MW. Only 8.5 billion kWh of electric energy is produced with the use of renewable energy sources (Decree № 1-p, 2009).

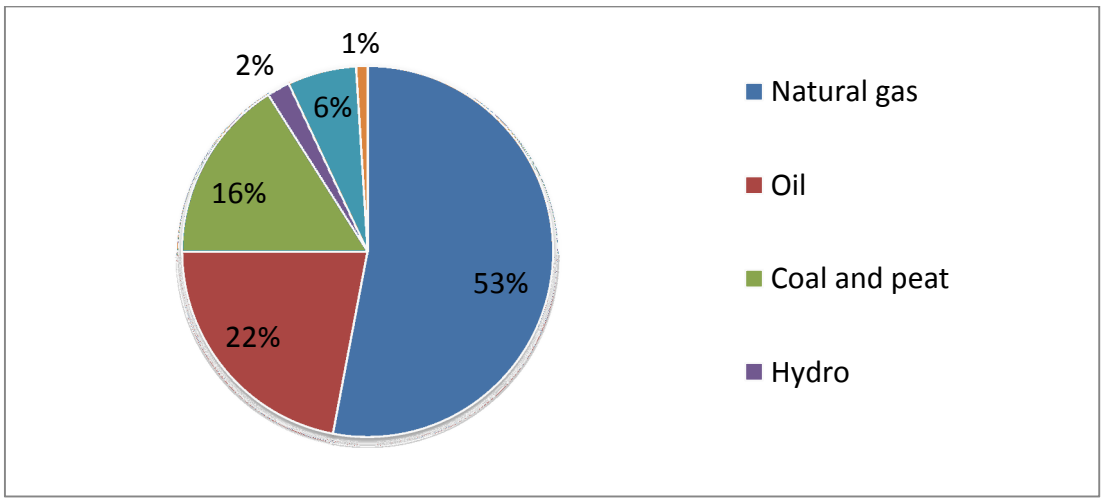

Figure 1. Total primary energy supply in Russia, 2011. (Source: IRENA, Renewable energy country profile: Russian Federation)

Russian Federation ranks first in natural gas reserves (23% of the total world reserves), with the total proved recoverable reserves accounting for 47 570 bcm. Gas production in both Russia and the CIS countries accounts for 25% of the total world amount. Russia ranks second in coal reserves (19% of the total world reserves) with total of proved recoverable reserves equals to 157 010 million tonnes (World Energy Council, 2013). The amount of oil reserves places the Russian Federation 7th among other countries (4-5% of total world reserves).

Around two thirds of all conventional energy sources are exported abroad: 45% is sold in its original form, 13% in the form of energy-intensive products and 6% is energy used for the transportation of energy across the country and abroad. Almost 80% of oil is also used as an export. Together oil and gas industries constitute 17% of the Russian GDP and more than 40% of the consolidated budget of the country (Popel, 2011).

Gustafson (2012) writes that "Russia's present oil wealth is inherited", and it is actually inherited from Soviet times. It was the Soviet Union which stimulated the exploration of the mineral base of the country and encouraged mapping of its natural resources. Supported by the well-organized knowledge base, including schools of geology and engineering, development of techniques for exploration, it was natural for Russia to turn into the oil industry after the 1990s crisis. At that time Russian companies concentrated their activities in the same region that was successful and profitable during the Soviet period, in West Siberia. Therefore, companies did not have to build or create anything from scratch, but rather use heritage from Soviet Union (Gustafson, 2012).

6.3. Renewable energy sources endowment in Russia

However, hydrocarbons and mineral deposits are not the only available energy sources in Russia. Due to a vast territory, good variety of landscapes and climate conditions, Russia possesses a great range of renewable energy sources. It has been repeatedly mentioned by many scholars, international organizations and media that the potential of renewables in Russia is rather high. According to the report prepared by Ecozashita (2013), technical capacity of the renewable energy sources in Russia is five times higher than the annual consumption of primary energy resources. However, renewable energy resource endowment differs with every specific type of energy and region of the country.

Next subsections will give an overview over the resource endowment of the main renewable energy types in Russia.

6.3.1. Wind power

Wind power is characterized as a perspective energy source in Russia. The total technical potential is estimated around 2000 – 3000 TWh, among which 200 – 300 billion kWh are considered as economically feasible.

To develop this capacity the construction of wind parks with a total capacity of 100 – 150 GW is needed that would require 1% of the whole territory. In 2011 total installed capacity was equal to 16 MW (Kulakov, 2011).

Today many projects for the construction of wind parks are developed, some of them are planned to be launched during the next 5-6 years. The distribution of wind farms throughout the territory of Russia can be seen in Figure 2.

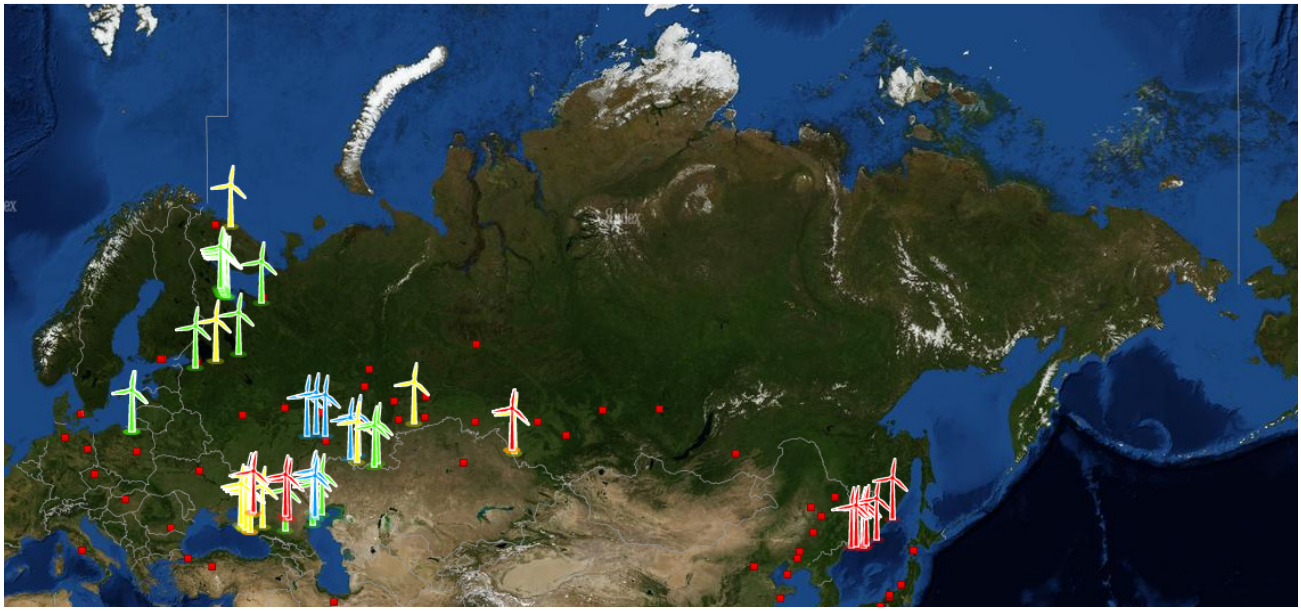

Figure 2. Map of Wind projects in Russia[11] (Source: Russian Association of Wind Power Energy (RAWI))

6.3.2. Solar energy

Russia possesses a huge potential in solar energy. Due to its large territory size and location, solar radiation varies considerably from region to region, from 810 kWh/m^2 per year in remote northern areas to 1400 kWh/m^2 per year in southern areas. Seasonal variations also influence the level of solar radiation in Russia. While in January it can be as low as 1.69 kWh/m^2, in July it can reach 11.41 kWh/m^2 per day (State information system on energy saving and energy efficiency).

[11] Interactive map is available at http://rawi.ru/map.php

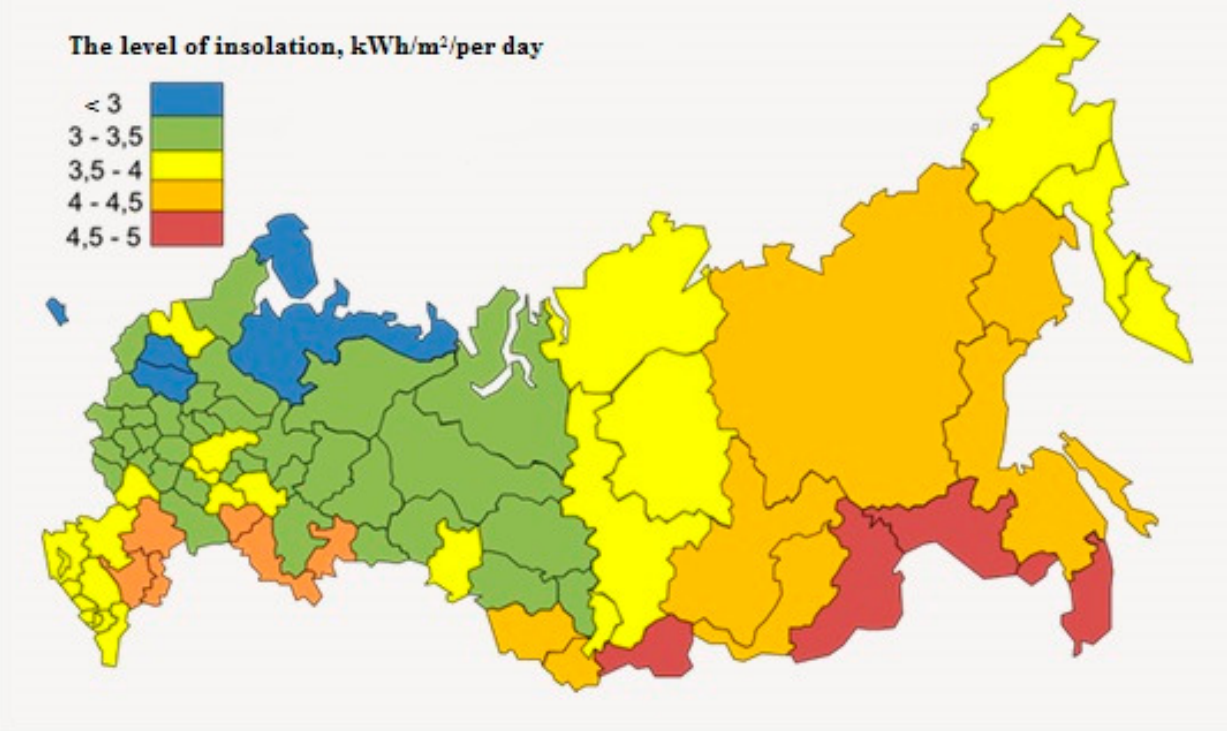

Figure 3. Solar energy potential in Russia. (Source: State information system on energy saving and energy efficiency)

The most perspective regions are Krasnodar region, Yakutia, Buryatia, Khabarovsk and Primorsk regions (see Figure 3). In many regions, especially in the southern part, the amount of sunny days may reach 300 (Chuykov, n.d.). The area in Russia which can be used for the installation of solar collectors is estimated to be 10 million sq.m. (Butuzov, 2011).

According to different estimations, the total installed capacity of solar energy generation equals to aprrox. 5 MW, the majority of which is located at small households. The largest solar power plant has been launched in Belgorod region with a capacity of 100 kW (State information system on energy saving and energy efficiency).

6.3.3. Small hydropower

Hydropower energy sector is a big one in Russia. According to REN21 (2013) Russia ranks 5th in total capacity of hydropower as of end-2012 and possesses 4.6% of global hydropower capacity. Total theoretical potential of hydropower is around 2295 TWh/yr, of which 852 TWh/yr are economically feasible. The most of hydropower potential is concentrated in Asian

regions (Siberia and the Far East). Hydro power generation was equal to 19% of total electricity generation in 2011 (World Energy Council, 2013).

However, in Russia large hydropower plants with capacity exceeding 25 MW are not considered as renewable energy sources. Only small hydropower plants fall into this category. Technically feasible potential of small hydropower plants is estimated around 382 TWh/yr ("Small hydropower in Russia", 2008). Small hydropower plants can be installed at small rivers, streams, elevation changes with water spillovers, therefore, the number of regions where small hydropower can be used is greater in comparison to large hydropower.

6.3.4. Bioenergy

Total potential of bioenergy in Russia is estimated around 433.9 GW, of which 119.8 GW is technically feasible and 64.1 GW is economically feasible (Russian Energy Agency, 2012).

There are many types of bioenergy, sometimes it is even hard to define what should be considered by bioenergy. However, experts specify the following potential types in Russia:

- organic waste from agro-industrial complex (up to 74.3 GW);
- organic waste from timber industry;
- waste in cities;
- peat;
- wood pellets;
- biogas.

The last two types are considered as the most potential ones as they do not differ with the region, unlike the other types of bioenergy (Russian Energy Agency, 2012).

Short summary of renewable energy resource endowments is presented in Table 1.

Table 1. Summary of the main types of renewable energy potential in Russia

	Total potential capacity	**Economically feasible potential**	**IRENA's assessment of RE resources***
Wind power	2000-3000 TWh/yr	200-300 billion kWh/yr	High
Solar energy	territory of 10 million sq.m		Medium
Hydropower **- small hydropower**	2295 TWh/yr 382 TWh/yr	852 TWh/yr n.a.	High
Bioenergy	119.8 GW	64.1 GW	High

**Source: IRENA, Russian Profile, 2012*

6.4. Energy-related problems in Russia

Resource endowment theory says that the success of renewable energy sources development depends largely on the energy-related problems present in the country. The larger problems are the higher is the motivation of the local authorities to solve them using renewable energy sources. So, does Russia have any immediate energy problems?

Popel (2011) points out that almost two thirds of the Russian territory is outside the centralized power supply (Figure 4). Considering that Russia ranks first in the world with an area of 17 098 246 km^2 this number reaches almost 11 500 000 km^2 and seems immense. As usual these regions also have the highest prices for fuel and energy.

However, much of the territory in Russia is sparsely populated. Therefore, if we have a look at the same parameter relatively to the population, then we see that only 15-20 million of people lack access to the centralized power supply. It means that with a total population of 143.5 million, only 10-13% of Russia's population are not electrified. It is significantly below the share of the population in Africa which has no access to electricity and which equals to 57%, and the same index in India which equals 25% (World Energy Outlook, n.d.). The world average level of the population lacking access to electricity is around 18% which also makes the Russian rate below that figure.

In addition, many regions in Russia are subject to power shortages and are in need of fuel and energy supply.

Figure 4. Energy supply on the territory of the Russian Federation. (Source: Popel, 2011)

Popel (2011) also underlines that only half of all the cities and 35% of rural localities are supplied by and have access to centralized gas supply. According to the most recent data provided by Gazprom (Gasification, 2014), in 2013 these numbers were equal to 70.9% and 54% for cities and rural areas correspondingly, with an average rate of 65.3% across the country.

6.5. Analysis and conclusion

The aim of this chapter was to analyze the primary resource endowments of the Russian Federation and to trace their influence on the development of the renewables in the country. The pre-given theory has formed the expectation that the abundance of conventional energy sources and absence of immediate energy-related problems in the country might restrain the development of renewables in Russia.

Information about the traditional energy resources endowment shows that Russia is indeed rich with fossil fuels. It is among top leader countries with huge oil, coal and gas reserves. During the Soviet times the majority of reserves have been explored and necessary infrastructure created. Therefore, even after Soviet Union collapsed it was easy for companies to catch up and organize their work around conventional resources.

On the other hand Russia has no less potential in renewable energy sources. Due to its vast territory and diverse climate, almost all the types of renewables potentially have even more energy capacity than conventional energy sources. However, the need in them is not that big to initiate the fast development of renewable energy sector. Regions which have enough energy based on conventional types, wonder where to use additional energy that would have been produced by renewables (Sergeev Y., interview) The number of regions that lacks power supply is steadily decreasing every year with the help of traditional energy sources. For instance, Gazprom regularly develops and adopts regional gasification programs for the future periods of time (1-2 year plans). The company finances the construction of pipelines in energy-deficit regions and delivering gas to population (Gazprom, Gasification). Traditional energy sources such as gas are preferred even though it might be more efficient to use autonomous power plants using renewable energy sources for supplying remote areas instead of developing a vast pipeline network.

It does not mean that energy-related problems which Russia experience these days are insignificant. However, they do not seem urgent and immediate, and are seen to be solved by the traditional types of energy. Therefore, the abundance of conventional energy resources and absence of immediate problems with energy gives little motivation for the government to put much effort and attention into the renewable energy industry, and rather provides grounds to continue with the conventional energy sources. In this regard, Vakhrusheva K. admitted that: *"Renewable energy industry is not going to be taken seriously until hydrocarbon is depleted"*.

CHAPTER 7: Conclusion

Recently, many countries have been noticed in developing renewable energy sources, and their local governments pursuing various supporting programs to foster that development. However, in Russia this energy sector seems to be stagnant and not developing, unlike the rest of the world. Therefore, the aim of the study was to analyze possible problems and constraints that hinder the development of renewables in the Russian Federation.

The research questions of the current study were as follows:

- Why is the development of renewable energy sources growing very slow in Russia?
- What barriers and obstacles prevent Russia from the higher pace development of this energy sector?

The theoretical framework for the study has been formed based on three theories: Globalization theory, Techno-institutional lock-in and Primary resource endowment theory. Since the development of renewable energy is truly a multidimensional process, the research has been narrowed down mainly to the political, technological and social aspects in order to give a better insight into the problem. Theories created a framework for the formulating of the three hypotheses which would provide with answers to the above mentioned research questions:

H1: Renewable energy lacks political influence in a global energy market, so Russian government shows little interest to renewable energy industry.

H2: Established TIC in Russia blocks the development of renewable energy sources contributing to carbon lock-in.

H3: Due to the abundance of conventional energy sources (such as oil and gas) Russia has few immediate energy-related problems which gives little motive force for the dynamic development of renewables in the country.

To test these hypotheses a qualitative research has been conducted based on primary (semi-structured interviews) and secondary (available reports, policies, legal documents etc.) data.

One of the main benefits of the study is that it explores the development of renewable energy in Russia from the political, technological and social aspects as a single system influencing the

development of this energy sector, rather than consider them separately. That helps to look at the problem from different perspectives and see how the whole system of those aspects affects the development of renewable energy sector. Thus, it provides a more adequate and comprehensive analysis of the contemporary development stage of renewables in Russia and reflects the complexity of problems and challenges it faces nowadays.

7.1. Summary of the findings

Collected data has confirmed all the three hypotheses which were formulated for the present study. Each hypothesis presents a part of the answer to the first research question and highlight causes which slow down development of the renewable energy in Russia. While the second hypothesis reveals particular obstacles which the development of renewable energy in Russia faces and therefore provides the answer to the second research question. The following part of the subsection will summarize these findings.

Why is the development of renewable energy sources growing very slow in Russia?

One of the reasons explaining the slow development of renewables in Russia is that renewable energy sources are unable to provide Russian government with political power abroad, unlike fossil fuels, such as oil and gas. Available data has shown that since Putin became the president of Russia in 2000, the government had decided to regain power and influence on a global arena, which was lost after the collapse of Soviet Union, through developing energy sector based on fossil fuels. During those days energy markets experienced the process of integration due to globalization, so oil and gas had been chosen by the state as a geopolitical instrument influencing other countries through the highly interlinked and interconnected energy markets. That was one of the key grounds why the state started to intensively support tradition energy sector of the country promoting its development inside the country and abroad. Oil and gas were no longer just energy resources which provided country with economic wealth and prosperity. They became geopolitical "weapons" in the hands of the Russian government.

When renewable energy was checked for that geopolitical component, it turned out that renewables do not possess this feature nowadays, at least at the current level of the world's renewable energy development. Renewable energy market is too small to use it as a political instrument to influence foreign countries, export volumes of renewables are insignificant and global investments into this energy sector are not that high and decreased during the last year. In

addition, renewable energy has been always opposed to fossil fuels and considered as one of the key solutions to energy security which will make countries less dependent on each other. Therefore, renewables cannot be used as geopolitical instrument by the Russian government, and thus do not receive any considerable support from it, and that significantly slows down the development of renewable energy sector.

Another factor that hinders the development of renewable energy in Russia is that its techno-institutional complex has been carbon locked-in, according to the Unruh's (2000) terminology, and thus creates barriers for any alternative energy sources and resists to any changes they might bring to the established system. The current study presented the analysis of five core elements which constitute techno-institutional complex with regard to the Russian Federation. These components are technological, institutional, industrial, organizational and social. Each of them proved to be carbon locked-in and which restrains the development of renewable energy in Russia.

Technological system is locked-in with old technologies and standards favoring conventional energy sources and leaving renewables in the background. *Institutional* lock-in is represented by departments and organizations which were specially created to regulate traditional energy sources, while no specific organizations that would have promoted renewables are established. *Industrial* complex is locked-in due to the fact that energy sector is mainly represented by large energy TNCs whose activities are based around fossil fuels and who pursue their own interests with regard to conventional energy while renewables stays as a side business at best. All procedures and measures developed by the Russian government and local authorities are aimed at traditional energy sector which creates *organizational* lock-in. The high level of bureaucracy makes it even harder for renewable energy to succeed. Last but not the least is the general level of ignorance among Russian population about other types of energy sources different from oil, gas or coal. Therefore, *social* lock-in also hinders the higher pace development of renewables.

Next factor which give the answer to the research question is the abundance of traditional energy sources, like oil and gas, and the absence of urgent energy-related problems. Findings show that Russia is rich with both conventional and renewable energy sources and have a huge potential in developing both of them. However, the traditional energy sector received a good heritage from the Soviet times which made it easier for companies to organize their activities involving fossil fuels. In addition, present energy-related problems in Russia do not seem urgent and are steadily

solved by conventional energy sources. Therefore, there is no immediate need to develop renewable energy sector in Russia.

What barriers and obstacles prevent Russia from the higher pace development of renewable energy sector?

The examination of Russian TIC and the role of renewables in that complex provided the most profound findings with regard to barriers which prevent Russia from the rapid development of this energy sector. Every type of carbon lock-in in TIC, technological, institutional, industrial, organizational and social, creates its own obstacles for the development of renewables in the country.

During the analysis of the findings it was found out that companies promoting renewable energy have problems with integrating their technologies with the old ones dominated in the energy sector. The level of domestic content requirement also creates a problem for renewable energy companies since this industry is not ready to reach such high levels set up by the government. Those barriers are the consequences of technological lock-in present in Russia.

Investigation of the institutional aspect of Russian TIC showed a poor legal framework which creates unattractive conditions for the development of renewables in Russia. In addition, inconsistency among the decisions made by government towards renewables make the situation even more unclear and complicated for renewable energy business.

As an effect of industrial lock-in in Russia, it has been found that the renewable energy market in Russia is mainly represented by small companies, who have little political influence and have to consider the activities of large energy TNCs, what makes small companies dependent on their decisions.

From organizational aspect, these small companies usually have a lot of administrative problems and have to bear with long bureaucratic processes in many aspects of their activities.

Another obstacle which was discovered during the analysis of the social part of TIC in Russia is the reduced demand for renewables due to the low knowledge level about the renewable energy sources among the population in Russia.

7.2. Recommendations for further research

In general, academic literature lacks information and research with regard to the development of renewable energy sources in Russia. Studies on this topic have been shadowed by the ones about the conventional energy sources, so any research about renewables in Russia would have been of great value.

Every type of renewable energy in Russia has its potentials and perspectives; they differ with the region and require different measures for support and promotion. While the current study has explored all renewables as a whole energy sector, it would have been interesting to examine any particular type of renewable energy in Russia separately and in-depth. Every single type of renewable energy is peculiar in its own way and challenges and constraints for their development may vary.

Regarding the present topic of the study, it would have been of interest to analyze and compare the barriers and constrains that experience small and large companies involved into renewable energy sector. It has been pointed out in the current study, that small companies have problems of a different kind than that of the large ones. Therefore, a deeper research with a focus on small and large companies is needed in that case.

The last but not the least suggestion for the further research is to examine in details the consumer market of the renewable energy sector. It has been specified that the ignorance of Russian population on the topic of renewables is probably high and may become a significant constraint for the development of this energy sector. However, a more thorough research based on recent data should be conducted.

List of Respondents

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