UNIVERSITY OF BELGRADE
FACULTY OF POLITICAL SCIENCES

Regional Master's Programme in Peace Studies

MASTER'S THESIS
The role of energy resources in sustainable human development

Academic supervisor:
Nemanja Džuverović

Student:
Svetlana Tyutyunnikova
527/2016

Belgrade, 2019

Contents

Abbreviations **3**

Introduction **4**

1. Theoretical framework **7**

1.1. Energy resources and their role in modern world **7**

1.2. Conflict and peace framework of energy resources development **15**

1.3. Sustainable development and sustainable peace agenda **18**

2. Empirical evidence **23**

2.1. Sustainable development assessment and energy resources **23**

2.1.1. Access to electricity 26

2.1.2. Climate action and renewable energy sources 29

2.1.3 Energy efficiency 38

2.2. Role of energy sector for geopolitics, conflict and peace **41**

2.2.1 Natural resource impact on social institutions: resource curse 41

2.2.2. Role of energy in conflict and peace 44

2.2.3. Globalization and cooperation: role of multinational corporations 49

3. Discussion **52**

3.1. New opportunities and potential of energy sector transition and transformation **52**

3.2. Risks and open questions of further energy sector development **57**

Conclusion **60**

References **61**

Abbreviations

ANSI Adjusted Net Savings Index

B4P Business for Peace

CCS Carbon Capture and Storage

GDP Gross Domestic Product

GWP Global Warming Potential

FDI Foreign Direct Investments

FNR Fast Neutron Reactor

IAEA International Atomic Energy Agency

IEA International Energy Agency

IEP Institute for Economics and Peace

IRENA International Renewable Energy Agency

LNG Liquefied natural gas

MNC Multinational Corporation

NGO Non-Governmental Organization

OECD Organization for Economic Co-operation and Development

RES Renewable Energy Sources

SDG Sustainable Development Goals

SNA System of National Accounts

UN United Nations

UNCTAD United Nations Conference on Trade and Development

Introduction

Of all the problems of reconciling growth within planetary boundaries none is more urgent and none is more complicated than the challenge of energy. This thesis is considering the current global trends in energy sector as ones of the main drivers of human development from different perspectives. On the one hand, tendency to limit CO2 emissions and search for accessible alternative energy resources aim to prevent climate change and preserve nature; on the other hand, given significant dependence of economic growth from energy consumption, nowadays humankind is unable to decouple human development from energy use and material footprint.

The current situation and trends in global energy production and use are presented in order to formulate possible solutions for achieving goals of sustainable human development in terms of energy resource system transition and transformation.

The work also raises the issue of geopolitical impact of development and distribution of energy resources in the world today and in foreseen future, and its role in global peace as a part of development agenda. Prevention of global conflicts comes down to adequate resolution of current contradictions of planetary size. In my thesis, I wanted to present the connections between global energy resource trends and global problems they cause or solve, and advocate the importance of new ways of action according to current trends of sustainable development.

Changes in energy resources exploration, conversion and consumption affect local and international economy, while economic growth is believed to be a driver and a consolidating factor in sustainable peace (Bailey et al, 2015). While the economic benefits of energy resources development are explicit and observable, there are also huge implicit geopolitical, social and other interdependent effects. For example, energy companies can influence unstable regions through foreign direct investments and play either conflict-boosting or mediating role. While in the past substantial number of conflicts related to unequal energy distribution took place, real opportunities for applying the strategy of business for peace lie in this field. Government policies, international cooperation standards and corporate business strategies reflect current trends in energy sector: shift from traditional fossil fuels to renewables, price volatility and energy security, restrictions related to climate change. It means that energy transition and transformation has extraordinary opportunities to contribute to human development agenda and peacebuilding on both local and world levels.

The purpose of this thesis is to assess the role of current trends in energy resources production and consumption system and to investigate the transformative potential of this business sector for development agenda and peace using comparative case and data analysis. The main research question of this paper is how current trends in energy sector, such as shift from traditional fossil fuels to renewables, energy efficiency growth and restrictions related to climate change, are

affecting sustainable human development and peace.

For research purposes, quantitative analysis of official statistics and data was used to depict the level of realization of sustainable development goals related to energy together with current trends in energy resources exploration, distribution and use worldwide. For data sources World Bank, International Energy Agency and other statistic databases were used, as well as the official business reports on energy development. Comparative method showed interdependence between energy sector operations and economic development, political situation and social tensions in particular regions. The secondary analysis of data collected by other researchers and case studies available in academic literature was also important for this work and presented new linkages through the amount of academic data and case studies on these topics.

Theoretical framework is divided into three main parts: first one is devoted to energy resources production and use in modern world; second part is related to energy in geopolitical framework; third part describes sustainable development agenda. In the first part the history and modern era of energy consumption and use are shown, together with different scholars' views on future forecast of world energy sector development. The theories were compared with assumptions based on International Energy Agency and certain extractive companies' reports, which show modern trends in the industry in accordance with current technical limitations. The problem of energy resources production and its relations with other global problems of our time is also reflected in the first part of theoretical framework, as well as the common academic knowledge in this field.

The second part gives a review of recent research devoted to conflict and peace framework od energy resources development. Works of various authors are presented covering the topic of natural resource relation with conflict, peace and institutional stability of countries.

The third part is dedicated to sustainable development agenda. It gives a brief outlook to the creation of Sustainable Development Goals (SDGs), their academic basis, implementation and current progress assessment worldwide. The particular attention is paid to sustaining peace as a part of the agenda and interdependence between peace and development.

Empirical section contains the research on influence of energy resources on sustainable human development shown by indicators used for sustainability measurement and the role of energy sector for geopolitics, conflict and peace. The first section presents global trends in achieving development goals related to energy and their role for sustainability and prosperity of nations. The second section addresses the geopolitical processes related to energy sector trends, such as the resource curse paradox, globalization and cooperation in the field. Particular attention is paid to energy resources influence on conflict and peace, as well as their potential for peacebuilding.

In discussion section new opportunities and potential of energy sector transition and transformation are presented based on the research conducted as well as risks and open questions of current strategies in energy sector in terms of sustainable development.

Work limitations refer mostly to the evidence base. Several main sustainability and energy development indicators were presented and analyzed, but there are risks of making generalizations out of the data and cases presented without taking into consideration all circumstances of energy sector operations in particular country or region. There are also methodological questions of causality, temporality and attribution, especially regarding the cases on energy sector influence on conflict and peace.

Taking into consideration the limitations, this paper is aimed to present the energy development case from different perspectives and therefore provide knowledge scope and useful insights for further research.

1. Theoretical framework

1.1. Energy resources and their role in modern world

By global problems of our time we understand those affecting the interests of all mankind, threatening the existence of civilization and requiring adequate resolution of current contradictions of planetary size. Global problems endanger the very existence of mankind and require joint efforts of governments and people of all countries for their solution. The list of global problems could be reduced to approximately ten universally accepted problems with slight variation: ecological, energy, food and demographic problems, the North-South problem, the problem of urbanization, the accumulation of nuclear weapons stocks, the problems of new diseases and antisocial phenomena (organized crime, drug trafficking, etc.) and international terrorism (Panina 2005: p.100). There are no clear boundaries between the indicated problems, since they are all closely interrelated.

Phenomenal scientific and technological progress of mankind in the twentieth century sharply raised the problem of resources and energy sources in particular. In a broad sense resources are understood as the whole surrounding world. In practice, the concept of resources includes those substances and forces of nature that can be used by society on its current stage of development. The size of the planet has its limitations, the life of stars, including the Sun, is not eternal, so, all resources are obviously limited.

Resources are central to nearly every major problem, challenge and opportunity the world faces today. Be it for peace and security, climate change, jobs or increasing incomes, access to major resources for all is essential. The core of human development is directly dependent on material use.

The history of the invention of latest energy conversion ways, mastering its newest sources and, ultimately, the energy consumption growth is a history of civilization itself. At the moment when a person learned how to make fire and use it for cooking and heating own dwellings, the first energy consumption boost occurred, while the main sources were firewood and muscular human strength. The invention of wheel, creation of various tools, blacksmith production development are associated with the subsequent fundamental step towards further energy use growth. A particularly significant increase in global energy consumption took place in the last 200 years due to the beginning of the industrial era. A human from industrialized society consumes 100 times more energy and lives 4 times longer than the primitive man (Makarov, Grigoryev, 2016).

In today's world, the energy is the foundation of development of basic industries determining the public production progress and shows substantial development rates. At the same time, energy sector is one of the sources of unfavorable effects on the environment and humans. It affects the

atmosphere (oxygen consumption, gas, water and hard particles emissions), hydrosphere (water consumption, creation of artificial reservoirs, discharges of polluted and heated water, watery waste), biosphere (emissions of toxic substances) and lithosphere (consumption of fossil fuels, landscape change).

But over the last quarter century, significant changes have occurred in the global energy industry, primarily due to the transition from extensive development and energy euphoria to efficiency and economy based energy policy. The energy crises of 1973 and 1979, the gradual stabilization of fossil fuel reserves and the increasing cost for their production, the desire to reduce the economic dependence resulting from energy export and it's influence on political volatility in the world led to these changes (Makarov, Grigoryev, 2016). Furthermore, there is a growing awareness regarding possible threat of large-scale consequences of energy development and concern about the increasing degradation of living standards due to increased environmental pressure at the local and regional levels (acid rains, air and water pollution, thermal pollution, etc.).

As we speak for today, there are concerns that global energy system may fail to meet the expectations and hopes set out on it. The escalation of the conflict in the Middle East, a region remaining single major supplier of inexpensive oil, recalls the most tense situations for global energy that have arisen after the oil shocks of the 1970s. The situation between Russia and Ukraine brought back to the agenda the issue of gas supply continuity. The nuclear power industry, to which some countries assign a strategic role in ensuring their energy security, expects an uncertain future.

In modern globalized world with rapid population growth and 3 billion people expected to reach middle class in the next 20 years energy resource question is highly important and urgent (Dobbs et al, 2011). The research by McKinsey Global Institute "Resource Revolution: Meeting the world's energy, materials, food, and water needs" claims that the world could be entering a new era of challenging energy resources extraction and highly volatile prices. It says that meeting future demand would require a large expansion of supply, while additional efforts would be necessary to address climate change and universal access to energy (Dobbs et al, 2011). Consumption is being the main driver of growing global material use, while the markets of major resources are highly volatile, demand is soaring and supply is getting more complicated and expensive with some available resources being depleted. For example, in case of energy resources with the notable exception of natural gas and renewable energy, new sources of supply are often found in abandoned locations, hard to recover and have lower resource base, which makes new oil projects mostly smaller than they were in the past, and up to two times more expensive (Dobbs et al, 2011).

Part of the researchers and economists all over the world are being skeptical about the

possibility of successful achievement of sustainability of energy supply and use in the near future. Gail Tverberg, researcher and the author of "Our Finite World" blog, focuses on the current energy consumption trends and limitations and their interconnections with the world economy. She writes a lot about the oil shortage and its impact. According to her theory, having enough energy is highly important in order to sustain economic system. So the problem of energy resources is not only qualitative (some sources are more polluting, some are less), but also quantitative as resource depletion and market changes threaten the very core of economic system and human development itself (Tverberg, 2017). She is being mostly skeptical about the future of world energy, predicting difficulties in energy supply, high and volatile prices and further dependence on traditional fossil fuels. According to Gail Tverberg's research (Tverberg, 2019), current economy is way too dependent on energy consumption per capita, and under conditions of growing world population and development the problem is expected to become even deeper. The author also doesn't believe in possibility of revolutionary transition from fossil fuels and ability of renewable sources to make a significant contribution to future energy supply.

Vaclav Smil presents similar theory in his books. Smil gives a critical overview of popular myths about the future of global energy and proposes reasonable and sound long-term solutions to current energy challenges (Smil, 2010). As coal, oil, and natural gas still supplies most of the world's primary energy, Smil is giving skeptical view on possibility of promised rapid and massive transition to clean and renewable sources. Some of the common myths the author is deconstructing are the following: glorious future of electric cars, imminent peak of crude oil extraction, exaggerated potential for liquid biofuels, contributions to be made by wind-powered electricity generation, etc.

The aggravation of the energy recourse problem is often connected with the activities of the Western civilization. In the US energy consumption was measured six times higher than the world average and 30 times higher than in developing countries (Panina, 2005). If developing countries managed to achieve the growth of mineral resources consumption to the level of the US, then currently developed oil reserves would be exhausted in 7 years, natural gas - in 5 years, coal - in 18 years (Panina, 2005). These calculations are used to show that it is impossible to bring the level of "golden billion" closer to the population of developing countries, at least in the foreseeable future.

But if we look at the current trends and prognoses on energy future and the role of fossil fuels in it, the picture is not that dark. According to the International Energy Agency (International Energy Agency, 2018), by 2040 global energy demand will increase by 37%, while population and economy growth will be less energy consuming than before. Due to pricing signals, energy policy and structural shifts in the global economy towards a larger share of the services and light

industry sectors, basically the growth scenarios of global energy demand will noticeably slow down — from over 2% per year in the last two decades to 1% in the year after 2025. The global distribution of energy demand will change dramatically: on the one hand, stagnation in Europe, Japan, Korea and North America, on the other hand — rapid growth in Asia, where 60% of world demand will concentrate, as well as in Africa, the Middle East and Latin America. The beginning of the 2030s, when China is expected to become the globally largest consumer of oil, having overtaken the USA, where oil consumption will fall to a level unprecedented for several decades, will become a milestone. From now on, India, Southeast Asia, the Middle East and part of sub-Saharan Africa will be the main drivers of global energy demand growth.

By 2040, oil, gas, coal and low-carbon energy sources are predicted to be part of the world energy market. International Energy Agency is not expecting problems with lack of resources, but there will be other issues. Although using regulation and market mechanisms, the share of fossil fuels in the demand of primary energy types could reduce to three-quarters by 2040, it will be impossible to stop the growth of carbon dioxide (CO2) emissions in the energy sector – it will rise by 20%.

The natural gas demand will increase by more than half — this is the fastest growth rate among fossil fuels. Some protection against the supply risk will be provided by a more flexible global liquefied natural gas (LNG) trade. By IEA prognosis, China and the Middle East will be the main demand growth regions and in OECD countries gas will become the main fuel in the energy balance by 2030. Unlike oil, gas production is expected to increase almost everywhere (with the exception of Europe), while unconventional resources will account for almost 60% of global supply growth.

Coal reserves are believed to be huge, there are no problems with its production, but in the future, the measures to control pollution and reduce CO2 emissions will potentially limit demand for it. Global coal demand is expected grow by 15% by 2040, but almost two thirds of this growth will be in the coming decade. Coal demand in China will reach a plateau of just over 50% of total global consumption, and then begin to decline after 2030. Demand for coal will also decline in OECD countries, including the US, where the use of coal for power generation will decrease more than one third. India will overtake the US and become the second largest market in the world by 2020, and shortly thereafter it will overtake China as the largest coal importer. The current low coal prices put pressure on manufacturers globally, forcing to reduce mining costs, but high-cost mines closure and increased demand are projected to lead to higher prices to attract new investment in this sector. By 2040, China, India, Indonesia and Australia will account for more than 70% of world coal production, highlighting the importance of the Asian region in coal markets. The implementation of highly efficient technologies at coal-fired power stations, as well as longer-

term CO2 capture and storage technologies, can be effective measures to ensure a smooth transition towards low-carbon energy, avoiding production to be shut down before the investment returns.

In numerous countries, especially in the transport sector, there is a rising interest in energy efficiency measures. Since three quarters of the global automotive market is now subject to technical fuel consumption standards, even though the fleet of cars and trucks is predicted to more than double by 2040, according to IEA forecasts, the oil demand in transport sector will increase by only a quarter. Therefore, by 2040, the energy efficiency improvement would make it possible to avoid “excess” demand of 23 million barrels of oil per day, which is more than today's production of both Saudi Arabia and Russia put together. The savings in the gas sector due to the use of new technologies in the electric power and industry will amount to 940 billion cubic meters, i.e., more than today's production in all of North America.

To conclude with, the latest findings and prognoses till 2040 made by International Energy Agency, major trends are the following:

1. global energy demand growth is expected to slow down with a structural shift to developing countries
2. share of traditional fossil fuels in total energy mix is going to decrease
3. production of coal, which is currently the most polluting source, is expected to reach its plateau and slowly go down afterwards
4. oil demand is going to continue with a slight increase
5. major growth is predicted for natural gas – the most environmentally friendly source among traditional fuels
6. preventing growth of CO2 emissions in the energy sector is the only major problem which is not expected to be solved by presented trends

The ecological problem is acute and well-known to be closely interconnected with traditional energy resources extraction and use. Its essence lies in the fact that the environment (nature) is becoming less suitable for life as a result of man's technological activities. Pollution of water, land and air in the late XX - early XXI centuries has become so high that thousands of species of animals and plants have already extinct and keep disappearing on annual basis.

Smoke and dust pollute air and lead to pulmonary diseases, acid rains, deforestation and greenhouse effect (temperature increase of the atmosphere and the earth's surface due to the increased concentration of carbon dioxide in the air). Contamination of the aquatic environment leads to the loss of marine and river flora and fauna, the multiplication of pathogens. The quantity of drinking water in all countries is rapidly declining (Panina, 2005).

The resource use and environmental problems are exacerbated by rapid urbanization.

Urbanization is the process of increasing the number of urban settlements, leading to the growth and development of cities. Urbanization is a powerful factor that boost material use and energy consumption and transforms the environment, atmosphere, vegetation, soil, terrain, hydrographic network, groundwater and even climate. Overcrowded cities with high population density (Barcelona - 70 thousand people per 1 square km, Paris - 30 thousand people per 1 square km, some parts of Hong Kong - even 1.5 million per 1 square km, etc.) harshly affect people, cause stresses, provoke manifestation of mental illness, worsen human health in general (Panina, 2005). Inevitable accidents at industrial facilities affect the more people the higher the population density is in a particular locality. And the larger the city, the stronger its impact on nature and people is.

The total area of the urbanized territory of the Earth at the end of the XX century amounted to more than 4.69 million square km. It is expected that by 2070 it will reach 19 million square km, which is 12% of the whole land area and more than 20% of the land area suitable for human life (Panina, 2005. This can dramatically rise material footprint of nations and worsen the state of the biosphere.

There is no general consensus on how to solve environmental problems caused by energy resource exploitation. Some researchers believe that the further development of science and technology will overcome negative trends. Others believe that it is necessary to change the model of global economy and to move towards sustainable development based on the preservation of the world's major balances (environmental, energy, demographic) under the system of fair international relations.

A number of energy reports issued by environmental panels and international consulting firms present comprehensive overviews on environmental side of the global energy problem and its possible future. For example, United Nations Environmental Panel Report named “Global Material Flows and Resource Productivity” is focused on one of the most essential challenges of modern human society in order to sustain environmental and climate balance - decoupling material use and related environmental impacts from economic growth. For example, it says that in order to be successful, decoupling efforts need to go beyond simple efficiency gains that arise from maturing economies (United Nations Environmental Programme, 2016).

Economist and environmentalist Jeffrey Sachs devotes substantial part of his research to energy resources as the key driver of economic success, to the problem of their depletion and environmental harm the traditional fossil fuels cause. He advocates the importance of green finance in renewable energy, particularly nuclear, as well as in new technologies and carbon capture and storage (Sachs et al, 2019). The author believes in transformative potential of moving away from fossil fuels and major transition to low-carbon economy, though the challenges in this sphere are of a huge scale. Emissions per unit of energy should be the main factor to be decreased

in order to stop climate change and avoid catastrophic consequences. Still, the economist believes in the future of zero-carbon electricity from non-fossil fuel sources and importance of global electrification.

The ideas of Prof. Sachs could be confirmed by figures provided by IEA report in that light. Electric energy is the fastest growing energy market and contributes most to reducing fossil fuels in the global energy balance. In view of the expected electricity demand growth, about 7,200 gigawatts of generating capacity, including replacement of decommissioned power plants by 2040 (about 40% of current capacity) will need to be built (International Energy Agency, 2018). By 2040 in many countries the steady growth in the use of renewable energy sources will increase their share in global electricity production to one third of the total generation. Adequate pricing signals will be necessary to ensure timely investments in new thermal power plants, which, along with investments in renewable energy sources, will ensure the power grid reliability. Market reforms or changes in the electricity pricing principles will be required in some cases. The move towards more capital-intensive technologies and higher prices for fossil fuels will lead to higher average electricity supply costs and prices for final consumers in much of the world. However, improving end-use energy efficiency will help reduce the share of household's electricity costs.

Renewable energy technologies being one of the most important components of low-carbon energy resources are expected to continue growing rapidly around the world through subsidies. By 2040, due to the rapid cost reduction and ongoing state support, IEA expects renewable energy sources to account for almost half of the electricity production increase, while the use of biofuels will increase almost threefold and will amount to 4.6 million barrels per day, and the use of renewable energy sources for heat generation will more than double. The share of renewable energy sources in electricity production will increase most of all in OECD countries, reaching 37%, and their growth will be equal to the net increase in electricity supply in these countries. Meanwhile, renewable energy generation will more than double in non-OECD countries, led by China, India, Latin America and Africa. Wind power will account for the lion's share of energy generation growth from renewable sources (34%), followed by hydropower (30%) and solar energy (18%). Since the share of wind and solar energy use in the world's energy balance will increase fourfold, their integration from both technical and market perspective will present more complex issues. In the countries of the European Union, the wind energy use will reach 20% of the total electricity production, while in Japan the solar energy use in the summer period will be 37% of the peak demand.

Nuclear power is expected to remain an integral part of national energy strategies even in countries with progressive drawdown of nuclear power plants that are looking for a replacement of them. In the main IEA scenario, nuclear power capacity will grow by almost 60%. But the share

of nuclear energy in global electricity production, which reached its maximum almost two decades ago, will increase by only one percentage point and will be 12%. This growth model reflects a problem for all types of new thermal capacity in competitive energy markets, along with more specific economic, technical and political complex issues for the nuclear energy. Nuclear power grows mainly in countries with regulated prices and government support for this sector.

The properties of nuclear power are quite attractive for several countries that do not abandon it, despite the complex issues that the sector currently faces. Nuclear power plants help to improve the reliability of the power system in regions where the power system includes generating capacities of various types. For energy-importing countries, this may reduce dependence on foreign supplies and limit the impact of fluctuations in the energy costs in international markets.

Atomic energy provides one of the few opportunities for large-scale measures to reduce carbon dioxide emissions, as it can serve as a basic part of the power grid. According to the IEA report, since 1971 the atomic energy use have averted the release of about 56 gigabytes of CO2 into the atmosphere corresponding to almost two years of total global emissions of pollutants at the current level. The average costs required to reduce emissions into the atmosphere through the new atomic facilities implementation depend on the energy balance characteristics and the requirements for the acquisition of fuel types being used.

Public concern about nuclear power must be taken into account. Based on experience in recent years, the public opinion can be decisive in the nuclear energy future. The main concern is the reactors' safety operation, the proper handling of radioactive waste and the prevention of the nuclear weapons proliferation. In this situation, confidence in the competence and independence of the regulatory authorities is necessary. This is especially important with the growing nuclear power industry: in the main IEA scenario, the number of countries with nuclear power will grow from 31 to 36, taking into account also countries that will abandon atomic energy by 2040. The total amount of spent nuclear fuel will double and amount to more than 700 thousand tons during projection period. Meanwhile, no country has permanent structures for the dumping of long-lived and highly radioactive waste produced by industrial reactors. All countries that produced radioactive waste need to develop the plans for location of permanent disposal sites.

Unfortunately, there are a lot of populist narratives together with greenwashing tendencies as far as energy sector potential transformation is concerned. Willing to present the popular view on necessity of switching to renewables and avoiding traditional fossil fuels, media, politicians, environmentalists and even some scientists are caught into trap of unrealistic ideas and misconceptions regarding energy. But, according to current figures, the transition to low-carbon energy system is possible, taking into consideration both economical and environmental challenges. Rational scientific approach and critical thinking, free from exaggerated claims and

impossible promises, are the only ways to develop and implement constructive and sound policies for the future.

1.2. Conflict and peace framework of energy resources development

Energy resources are not only the basis of economic development, they are also known to have direct and indirect influence on geopolitics, conflict and peace. Recent academic works related to the field confirm the extremely important role of energy for global political scene. Michael Klare, a scholar in peace and security, devotes his works to the humanity race for scarce resources in conditions of growing demand and dwindling supplies, predicting widespread instability all over the world, especially in areas with long-standing territorial disputes (Klare, 2012). The author claims, that access to the main resources, especially energy carriers, will become the reason for most of the conflicts in the forthcoming period, that will take the form of so-called "resource wars". He argues, that only changing global consumption patterns might be the salvation for current situation in energy resource geopolitics.

Other researchers also provide the evidence of resources impact on political instability and intra- and interstate conflicts. The research by Michael Ross (Ross, 2015) provides the examination of the political effects of resource abundance, especially on quality of institutions, government accountability, and possibility of of civil war. By providing an exhaustive literature review, the author argues there is strong evidence that one particular type of energy source – petroleum – has the following common effects: 1) It increases the durability of authoritarian regimes. The evidence presents the relation between higher levels of oil wealth and authoritarian regimes, as well as their contribution to this regime stability and durability. The reason for these effect is a so-called rentier mechanism, when a state gets all or big part of national revenues coming from the local resources rent to external parties. 2) It increases certain types of corruption. Although this relationship is difficult to prove due to measurability lacks, there are still well designed subnational studies that offered compelling evidence that resource windfalls have led to heightened corruption. 3) It helps to trigger violent conflict in low- and middle-income countries. Although cross-national correlation between oil and civil conflict remains debatable, there are studies incorporating subnational data reporting a strong link between oil and conflict onsets, particularly when they focus on low- and middle-income countries. The effect is often pronounced in the territory of marginalized ethnic groups, as well as it could be called the recent phenomena, emerging after the 1970s.

Another review on energy resources role for interstate and intrastate armed conflict was conducted by Koubi Vally and other researchers for Journal for Peace Research (Koubi et al, 2014). Their article provided an abundant literature review of interlinkages between natural

resources, including non-renewable and renewable ones, and intra- and interstate conflicts, their duration and intensity. The work presents both theoretical arguments and empirical findings that resource wealth rather than deficit is likely to be associated with conflict. While this was expected for non-renewable resources, it came as a surprise for renewable ones. From existing literature, it is also concluded that natural resource wealth is part of a complex set of factors that can create conditions for a region or state to an armed conflict. Therefore, the article proposes the necessity of further research with more data on resource abundance and conflict potential, including state, regional and interstate levels and analyzing issues of endogeneity and interaction of different factors inside the relation of conflict and resources.

The effect of major oil and other mineral discoveries on interstate armed conflict in Africa was explored by Rabah Arezki, Sambit Bhattacharyya and Nemera Mamo (Arezki et al, 2015). The analysis is using data on discoveries during the period from 1946 to 2008 and presents different view on resource-conflict relation. The paper's key original contributions are using a geocoded dataset of resource discovery at the grid level and using grid level data on conflict in Africa. Africa is commonly known as one of the main locations where conflict on a natural resource base is present. But the research established no substantial casual evidence that natural resources trigger conflict in Africa. Even more, according to the collected data, resource discovery can significantly reduce the likelihood of conflict onset up to ten years after resource discovery. The other argument related to the national character of the resource-conflict link is challenged. The results of the model remain the same at both local and national levels, as well as with applying other factors such as type of conflict, resource deposit size or quality of institutes.

The similar conclusions are given in research by Christa Brunnschweiler and Erwin Bulte. They explored the relationship between resources and civil war in nine 5-year periods between 1960–2004, where it is commonly considered that natural resources tend to magnify the risk of civil war (Brunnschweiler, Bulte, 2009). The authors make two contributions. First, they focus on the causal link between resources and conflicts, where they focus solely on the onset of the conflict, not its duration or intensity. Second, they take into account resource abundance and whether it influences conflict directly or indirectly. They overall include the following resources: subsoil assets (fuel and non-fuel minerals), cropland, pastureland, timber and nontimber forest resources, and protected natural areas. They find evidence of a link between resource wealth and the onset of conflict, demonstrating that it runs opposite to the common perspective: Resource abundance can lower the probability of conflict, and particularly of the onset of a major conflict, because of the effect of growing incomes. Moreover, it is discovered that conflict torn only societies, that are dependant on resource extraction. Therefore, economic diversification and low dependence on natural resources are the essential components of development and peace.

Another different outlook on the resource influence on conflict possibility was published in the Journal of peace research by Matthias Basedau and Lay Jann (Basedau, Jahn, 2009). Looking at the usual evidence of the resource-conflict link, the authors set and later confirm two hypotheses to determine why some oil-producing countries are spared from violence and others are not. First, they claim high per capita revenues from oil allow governments to avoid conflict. Second, they further test the "rentier state" theory and find that oil-rich countries usually keep peace by several following policies: large-scale resource distribution, substantial security spending and relatively better governmental institutions. The research claims that distinguishing between resource wealth and resource dependence is highly important, especially in peace-related terms. The resource wealth itself in per capita terms does not effect internal stability, while the dependence could be the reason for problems. Countries oil-rich in per capita terms do not show common presence of internal violence despite the fact of resource dependency. The governments use resource revenues in order to sustain internal peace by large investments in security apparatus together with resource and income distribution in the country. Huge spending is required from countries rich in oil per capita to apply the mentioned policies, so maintaining peace in such circumstances is rather costly.

The alternative view on oil and conflict relations was also presented by Anca Cotet and Kevin Tsui based on cross-country evidence (Cotet, Tsui, 2003). Their paper re-examines the oil fuels-war hypothesis and provides an analysis of the impact of oil abundance on conflicts. Unlike other literature, they use other ways to measure oil abundance and conflict. The former is observed through oil production rather than oil rent, while the latter is observed not only by onsets of wars, but also coup attempts, irregular leader transitions and military spending. The data covers 103 countries over a long period of time between 1930 and 2003. As the main contribution, they find oil abundance does not cause any of their measures of violent challenges to the state. However, they do find that oil abundance significantly affects military spending, but only among nondemocratic countries. This is justified by the leadership style of oil-rich dictators, who are predicted to run more repressive (nondemocratic) regimes in order to successfully deter political challengers. As a secondary storyline, by using a quasi-experimental analysis, they show that results on statistical association between oil reserves and civil war from previous studies can be refuted by simply controlling for country fixed effects.

To crown it all, presented academic articles and research show that energy resources as one of the main primary commodities and economically valuable assets have a significant role in global geopolitics. At the same time, cross-country evidence presents different results of this influence, depending on institutional stability, political regime and rent distribution mechanisms. According to various research, resource abundance may be the fuel for intra- and interstate conflicts, or, on the contrary, spare the country from internal disputes and maintain peace. Anyhow, taking into

consideration all mentioned assumptions, it could be concluded that transformation of natural energy resources exploitation and use is inevitable in short-to-medium term period. This transformation is highly important to meet the needs of growing human population together with maintaining subtle environmental balance on Earth and peace between nations.

1.3. Sustainable development and sustainable peace agenda

The formulation of global problems, including resource problem, was rather abstract and was only reflected in the works of several scientists such as V. I. Vernadsky, who was a pioneer in the environmental sciences, recognized the ways biological processes affect the atmosphere and also mentioned the role of discovery of new energy sources such as nuclear in global human activity (Vernadsky, 2012). Then, in the second part of 20th century, these topics gained proper attention.

In 1972 the famous report for The club of Rome's Project on the Predicament of Mankind named "Limits to growth" was published by the group of researchers (Donella H. Meadows et al, 1972). It was based on the computer simulation of exponential economic and population growth with a finite supply of resources. The model used 5 variables, such as population, food production, industrialization, pollution, and consumption of non-renewable natural resources, to create three basic scenarios of further human development, two of which predicted collapse and unprecedented consequences for mankind. These scenarios were based on continuing historical production and consumption tendencies and predicted rapid and uncontrollable decrease both in industrial capacities and world population in the end of 21th century. The only scenario that contained a message of hope was the one that proposed altering current growth trends in order to achieve global equilibrium and environmental and ecological sustainability. The possibility of achieving stabilized world outcome was also predicted to be highly dependent on how soon the humanity will stand on changes track.

The report was met with criticism and rejection by both politicians and economists, as was the whole idea of existence of world limitations. But by the beginning of the 21st century more and more leading economists and academics, such as Simmons (2000), Parenti (2012) and Turner and Alexander (2014) admitted the ideas presented in the "Limits to growth" report together with the fact, that simply ignoring these insights for 30 years may now have even worsen consequences for mankind.

Nowadays more and more researchers are devoting their work to global problem of limited resources and humanity track to sustainable development. One of the profound and comprehensive work was done by the influential economist Jeffrey Sachs (Sachs, 2015). In his book complex interactions between economic, social and environmental systems are examined, as well as the

possible holistic pathways and problem solving approaches are presented. Together with giving the holistic framework to the problem of global resources limitations, Sachs presents interconnections with other global issues of our civilization and gives a normative and ethical view of the world today and tomorrow on it's path to inclusive and sustainable growth. Sachs also argues that solutions are feasible and affordable, despite strong opposition by vested interests and the inaction of governments.

Sustainable development is development in which the needs of current generations are met without compromising the ability of future generations to meet their own needs. This basic formulation first appeared in 1987 in the "Our Common Future" report. This report was prepared by the UN Commission on Environment and Development, commonly known as the Brundtland Commission for its leader Gro Harlem Brundtland, a political and public figure from Norway, who made a great contribution to promoting the concept of sustainable development and international cooperation to achieve it. It is the formulation of the Brundtland Commission that contains the key idea of sustainable development - viewed as a balance between generations.

In this broad interpretation, the concept of sustainable development served as the ideological basis for adopting first the Millennium Development Goals (MDGs) in 2000, and then after MDG's success - for the 2030 Agenda for Sustainable Development in 2015. The latter document, drafted under the UN, contains the Sustainable Development Goals for the period from 2015 to 2030. The SDGs determine the main problems that humanity faces and underlines the necessity of combating them, but unlike MDGs they are universal and apply to all countries, address the root causes of global problems and focused on means of implementation. The Sustainable Development Goals include a set of more than 170 tasks in different fields, combined into 17 goals - from overcoming poverty and ending hunger to ensuring gender equality and urgent action to combat climate change. The 17 goals are formulated in a broad sense, then each of them is specified through a large set of different indicators.

At the same time, the document does not stipulate the way in which they are to be achieved. International institutions have neither the means nor the authority to resolve these problems. A significant part of funding can only be provided at national level. The goals of sustainable development are a statement of problems and their priority. The next stage should be to determine the direction of action and the specific tools for achieving solutions, which is already being gradually implemented by each country separately.

The achievement of the Sustainable Development Goals requires the joint efforts of governments, the private sector, civil society and all people of the Earth. The goals are not legally binding. It is expected that countries will act responsibly and create their own national mechanisms in order to achieve the 17 goals. The sustainable development agenda is a plan of a universal,

comprehensive and transformative nature. Sustainable development goals are global, but at the same time take into account the specifics of different countries. All goals are interrelated, so the efforts to achieve them should be comprehensive.

The most difficult situation in terms of problems of sustainable development is found in poor countries: countries in sub-Saharan Africa, Central and South Asia, especially in India, where most of the world's poor people are now concentrated. At the same time, the Sustainable Development Goals are a global initiative. All countries of the world participate in discussing them and developing common approaches. The developed countries are also actively involved in this process, for example, through participation in the financing of international institutions that are engaged in solving these problems.

The key international organization financing the achievement of the Sustainable Development Goals is the World Bank. The projects funded by the World Bank are aimed at overcoming the problems of poverty, low development of infrastructure, poor access to water and energy resources, etc. More specialized organizations also exist. For example, the Global Environment Facility, which focuses on financing projects addressing environmental issues. The Green Climate Fund is currently being created within the framework of the United Nations Framework Convention on Climate Change, which will be engaged in financing the efforts to adapt to climate change and reduce greenhouse gas emissions in poor countries. The European Bank for Reconstruction and Development, the Asian Development Bank, the African Development Bank are engaged in financing the solution of infrastructural, energy and poverty-related problems in regional context.

The 2030 Agenda for Sustainable Development is a long-term plan for large-scale transformations, which includes interrelated and inseparable goals and objectives in the field of sustainable development. Each year the UN provides the Sustainable Development Goals report which gives an overview of the current results on achieving the targets, presenting progressive and weak areas to date. In 2019 the report demonstrated profound progress and positive trends in several critical areas, such as for example extreme poverty reduction, decrease in child mortality rates and increase in people’s access to electricity (United Nations, 2019).

As for Sustainable Development Goal 7 directly related to energy, the UN announce quite encouraging results. According to the report data, the access to electricity is increasing, renewable sources are gaining larger share in total energy mix and energy efficiency improvement is continuing. Between the areas that need more attention there are access to clean cooking technologies, electrification of sub-Saharan Africa and expanding the spheres of using renewables (United Nations, 2019).

At the same time, the Goal 13 related to environmental protection and climate change remain the most vulnerable area with little progress so far. Greenhouse gas concentration levels, especially carbon dioxide, continue to climb, as well as ocean acidity and sea levels. The global mean temperature beats records each year and in 2018 it was approximately 1°C above the pre-industrial baseline (United Nations, 2019). The effects of these trends are evident worldwide, causing land deterioration, flora and fauna extinction and other catastrophic consequences with little time left to reverse or at least stop these changes. They also affect poor part of the globe the most, leading to food shortages, hunger, and potential displacement from uninhabitable land. The climate change requires fast and profound transitions in global economy, industrial systems and, particularly, energy system. With all concerns mentioned, the report presents existing opportunities for further progress using interlinkages and synergy among Sustainable Development Goals. For example, reducing CO2 emissions would substantially influence prosperity and health of people, developing new infrastructure and increasing sustainability of cities.

Progress in achieving development goals, climate and energy in particular, also affects conflicts and peace across the globe. The 2030 Agenda contains not only the SGD's, but also the Resolutions on the UN's peacebuilding architecture, that recognizes strong connections and mutual reinforcement between development, security and peace (United Nations, 2016). Among the SDG's the Goal 16 is devoted to peace, justice and strong institutions, and according to the UN progress report there were no substantial advances during the recent years in this area (United Nations, 2019). Sustainable development and sustainable peace are two intertwining concepts, and one is always the integral part for the other. The Sustainable Development Goals are promising to leave no one behind, especially addressing the most vulnerable part of the population. Nowadays half of the world's extremely poor people live in fragile and conflict-affected regions, and SDG's are embraced as the part of the solution of these complex conditions and peacebuilding process (Martinez-Soliman, Fernandez-Taranco, 2017).

Johan Galtung identified two types of peace: negative peace, which is the simple absence of violence and war, and positive peace – as an integration of human society (Galtung, 1964). Positive peace includes prevention of all 3 tops of Galtung's violence triangle – direct violence, as well as cultural and structural violence (Galtung, 1969). According to Galtung's Violence Triangle, cultural and structural violence cause direct violence, and the direct violence has roots which are cultural and structural. However, violence can start at any corner in the direct-structural-cultural violence triangle and it can be easily transmitted to the other corners (Galtung, 1969). And in context of sustainable development and its correlations with peace, structural violence would be the most important factor. Structural violence lies in the core of social and economic institutions,

and directly affects wellbeing and prosperity of nations. In that context, peace could be named a key component of development.

The Institute for Economics and Peace identified Eight Pillar's of Positive Peace – specific factors, describing favorable economic, political and social conditions, that lead to positive peace (Institute for Economics and Peace, 2016). Among them there are equitable resource distribution, sound business environment, high levels of human capital and others, strongly connected with sustainable development agenda. According to the IEP report, these factors are able to generate preconditions for peace, as well as serve as the tools for peacebuilding in conflict-affected areas. In this way sustainable development and economic growth agenda could even be called the major basis for peacebuilding. The core to the successful future society, living in peace and wealth, is the effective resource base with reasonable distribution and minimum harm to the environment. This is particularly true for energy resources production and use. Energy security and access for all, together with eliminating hunger and poverty, providing clean drinking water and sanitary conditions, building sustainable cities with useful infrastructure are the minimum basis to the better world we are striving to create. And with a world being a safer and friendlier place there will be probably less reason for conflict and aggression, while reduced inequalities will lower tensions in society.

Activities of UN agencies on conflict resolution and ensuring peace are distributed to different levels and directions, and 2030 Agenda is an important part of them. They usually overlap, affect one another and work synergistically, while sustainable development of energy sector is one of the core issues in this field.

2. Empirical evidence

2.1. Sustainable development assessment and energy resources

With so many expectations put on the future of sustainable human development track, the main question is whether these goals are reachable and to what limit. The 2030 Agenda offers a wide range of indicators that measure success in achieving the Sustainable Development Goals. By assessing them in conjunction and combining them into different groups, it is possible to composite a large number of different complex indicators.

The successful achievement of SDG's requires adequate indicators for development. Some of the typical shortcomings of modern social stereotypes in the world are the absolution of economic growth and its traditional indicators. It is necessary to change how the vast majority of politicians and scientists view the very problem of development. Countries need a steady increase in the welfare of the population, which is a completely different idea of socio-economic development. It includes not only economic growth, but also investments in human capital and preservation of environment, which means complex approach to wellbeing of people and nature.

An example of an inadequate indicator, from the point of view of sustainability of development, is the classic and most widespread indicator in the world - GDP. It represents a generalized assessment of progress of the currently dominant economic model, based on the SNA (System of National Accounts), adopted by the UN in 1952. The overwhelming majority of countries still measure the success of their development using this indicator. However, for countries with large natural capital, GDP growth at the expense of the primary resources sector may be ambiguous. The easiest way to achieve this growth is by over-exploitation of energy deposits, forests, land, etc.

Currently, the UN Statistical Commission has developed new approaches to making the SNA greener, allowing to go beyond the traditional concept of GDP by internalizing the external costs (externalities) of economic activity associated with negative impacts on ecosystems and public health, which means including the costs of the harm caused by economic activity in the progress indicator.

In the practice of international organizations and many countries, the following complex indicators of sustainable development are widespread: human development index, ecological footprint and adjusted net savings. The human development index, in addition to the income indicator, also includes the indicators reflecting the level of education and life expectancy, thus highlighting the social aspect of sustainable development. In terms of environmental sustainability, the ecological footprint indicator is used – it shows the area of productive land and aquatic ecosystems that are necessary to produce everything that humanity consumes, given that it restores all ecosystems that were harmed by economic activity. At the moment, the ecological footprint of

humanity exceeds the area of the planet Earth, which means that humanity is developing unsustainably (Global Footprint Network, 2019).

Apparently, the most developed and having a good statistical base and calculation possibilities at the national and regional levels, is the World Bank's Adjusted Net Savings Index – ANSI. From the point of view of sustainable development, the amendment of the traditional indicator of gross savings is fundamentally important - depletion of natural capital (primarily energy resources), and the damage from environmental pollution, including the effects on human health, are deducted from them. "Anti-raw material" orientation of ANSI is obvious - the exploitation of natural resources decreases this indicator, and, unlike GDP, it takes into account the human and natural dimension of economic growth. The indicator includes net savings adjusted for consumption of natural capital, depletion of resources and damage from pollution, to which the investments in human capital are added.

An important advantage of adjusted net savings as an integral indicator of sustainable development is its annual calculation for all countries of the world and its publication in World Bank Indicators “World Development Indicators”. This indicator is already used by some countries as an official indicator at the macro level.

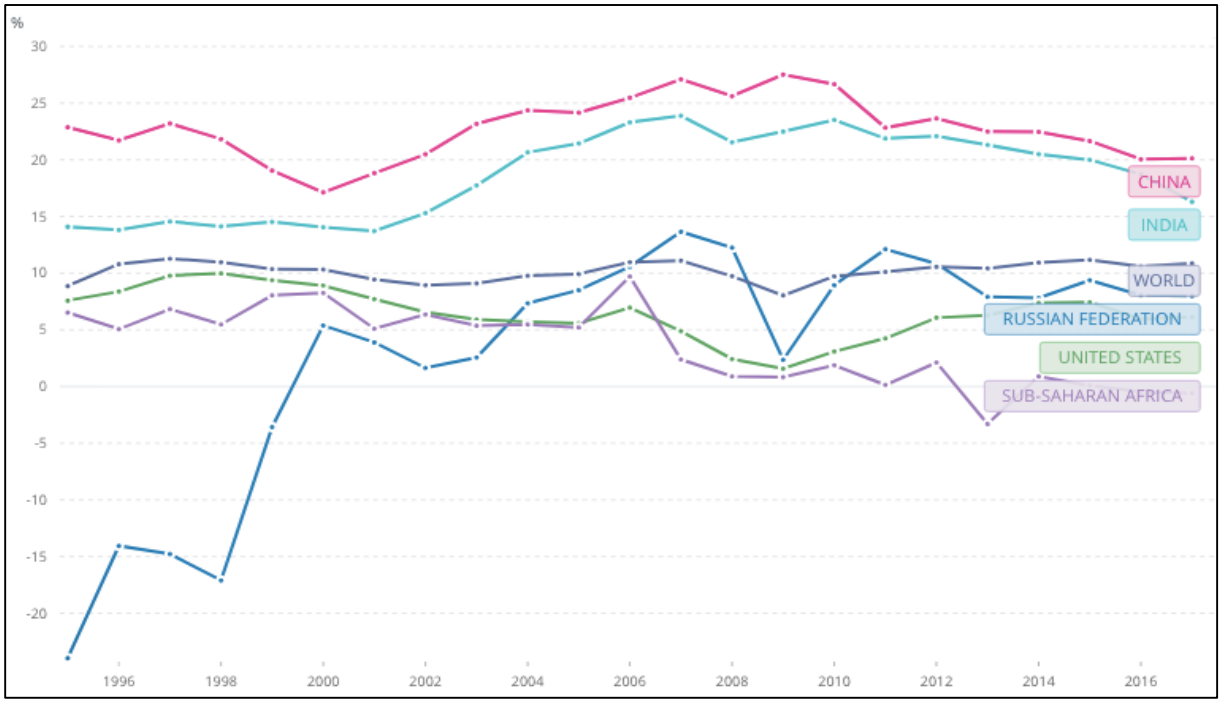

Figure 1. Adjusted net savings, including particulate emission damage (% of GNI). World Bank Open Data.

If we look at the data presented on the graph (Fig. 1), the world average trend of adjusted net savings is keeping practically the same level for 20 years with smaller drops and rises. As the world GDP is constantly growing and investments in human capital are mostly on a rise as health

and education levels across the world are improving, it could be supposed that there is a substantial negative influence of resource depletion and environmental damage. For example, in Russia in the pre-crisis years, against the backdrop of huge GDP, ANSI was often negative largely due to the depletion of energy resources. China and India after 2010 also show negative trend, while their economies are developing with high growth rates. Sub-Saharan Africa's adjusted net savings are in the decline, while only the United States is showing steady increase after 2008. At the same time, it cannot be said that there is a single complex indicator, by looking at which the economists could concur on whether humanity is developing steadily or not. This is due to the fact that the very concept of sustainable development is extremely broad and heterogeneous. The influence of different factors included into complex indicators makes it impossible to assess strong and weak areas of development progress in particular region and shows just the global trend. For further analytics it is important to assess indicators related to the specific field of research.

Energy sector progress is playing an important role in assessing development, as it affects not only economic growth, but also natural and human capital of regions. According to SDG number 7, the main energy-related goal is to ensure access to affordable, clean, reliable, sustainable and modern energy for all. It implies several main tasks planned under the goal. The first one is to provide all people with access to electricity, second one – to increase the share of renewable energy sources in total energy consumption, and the third – to double the global energy efficiency indicators. Another goal directly related to global energy resource system is Goal 13 – climate action.

To assess the influence of energy sector trends on sustainable development particular indicators should be taken. Out of the wide variety of the World Bank Data the following may be suitable:

1. Access to electricity (% of population)
2. Alternative and nuclear energy (% of total energy use)
3. Energy use (kg of oil equivalent) per $1000 GDP
4. CO2 emissions (metric tons per capita)

Each of the chosen indicators relates to the particular Sustainable Development Goal and the task and presents the progress in the process of their completion. Looking at single specific indicators instead of integrated ones makes the data presented more applicable to analyze the particular areas of energy sector progress and its influence on overall sustainable development with minimum risk of evidence base because of the complexity of factors included in each integrated indicator.

The dynamics of changes in the mentioned indicators is shown by the following block of countries: The United States, The Russian Federation, China, India and Sub-Saharan Africa group of

countries, and the data is also compared with the world average. The chosen cases represent developed economies (The US), major world emerging economies with different geopolitical situation and development stages (The Russian Federation, China, India) and underdeveloped regions (sub-Saharan Africa). They are also the main world energy consumers and at the same time regions with profound energy resource base, which is important for the research topic. The cases represent illustrations and examples for each energy related development assessment.

2.1.1. Access to electricity

Recently the World Bank circulated a report that addresses the situation around electricity usage around the globe (World Bank, 2019). The key figure that draws attention is as follows: 1 billion people (or about 13% of the world's population) still have no access to domestic power consumption. The document notes that the crushing majority of them (about 87%) are rural residents. Sub-Saharan Africa suffers from the most severe electricity shortage. Another two challenging regions are Central and South Asia, while most developed countries (like the US) have reached the 100% level long from now (Fig. 2).

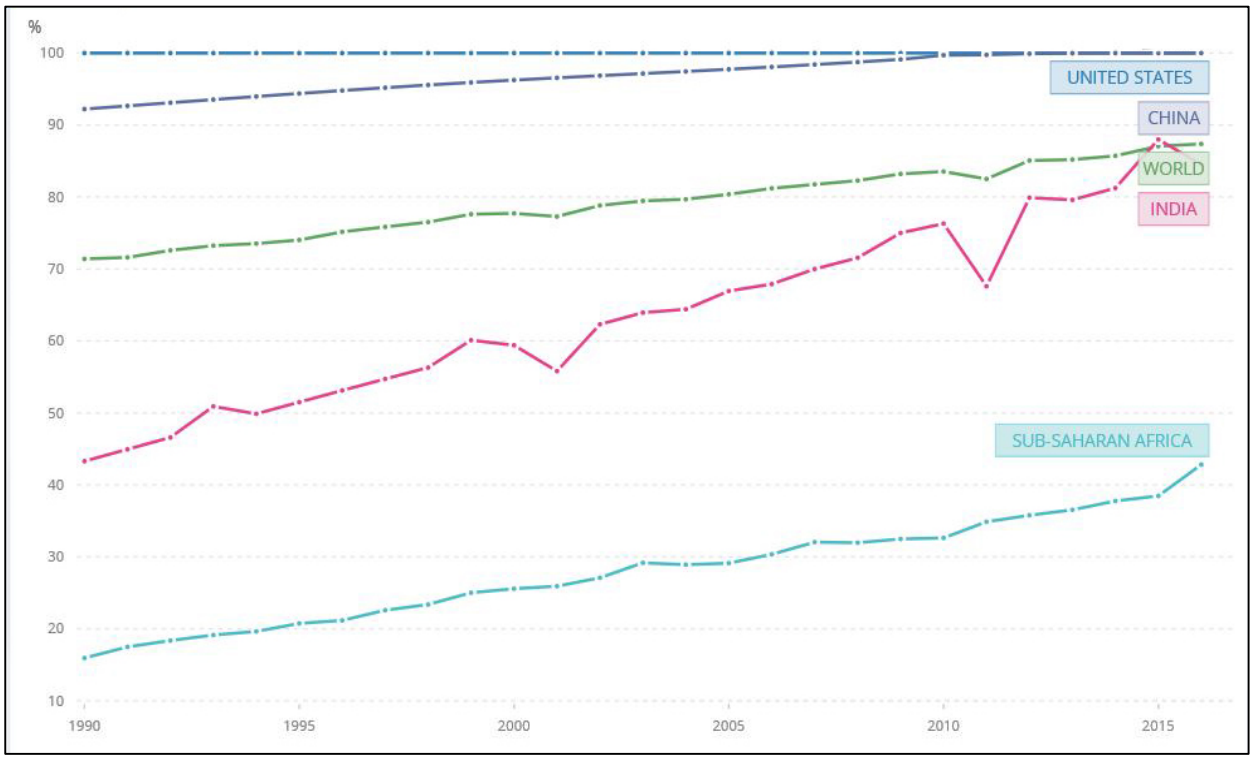

Figure 2. Access to electricity (% of population). World Bank Open Data.

However, the World Bank notes a positive trend towards a decrease in the number of people that have to live with no access to electricity. As the report says, the electrification rate has been demonstrating a marked increase since 2010. If this trend continues, the World Bank estimates that by 2030 just around 670 million people will remain without any access to electricity. The

document also notes that tens of millions of people receive electricity via home systems based on solar energy conversion. These panels often form even small power grids. However, the list of such pioneering countries where this practice exists is extremely limited.

The population without access to modern energy lives in conditions of the worst energy deficit. According to IEA (International Energy Agency, 2018), about 620 million people living on the African continent sub-Saharan, have no access to electricity, and for those with access, the power supply is often unreliable and expensive. About 730 million people living in this region use solid biomass for cooking on primitive devices causing indoor air pollution leading to 600,000 early deaths in Africa each year. About 13% of the world's population lives in sub-Saharan Africa, but this region consumes only 4% of the world's energy supply (more than half of which comes from solid biomass). The region is energy-rich, but the resources mostly used on a very limited scale. Over the past five years, almost 30% of the world's discoveries of oil and gas deposits accounted for this region, which is also rich with renewable energy sources, especially solar, hydropower, wind and geothermal.

The subcontinent's energy system is expected to develop rapidly in the following period, but many problems will be addressed only partially. By 2040, the economy is expected to quadruple, the population – to almost double, and the demand for energy – to grow by about 80% (IEA, 2018). Generating capacity will also quadruple, and nearly half of this growth are expected come from renewable energy sources, which could play an increasingly important role in small and isolated electrical systems in rural areas. In total, about a billion people will have access to electricity by 2040, however, more than half a billion people will still not. Production volumes in Nigeria, Angola and many smaller local manufacturers show that this region will remain an important source of oil exports, despite an increase in domestic demand. The region will also become an important participant in the gas market, as the development of large deposits on the coast of Mozambique and Tanzania will complement the increasing production volumes in Nigeria and other countries.

The energy sector in the region can make a greater contribution to increasing well-being. In the "African century" scenario presented by the International Energy Agency, the introduction of reforms were proposed to increase the GDP of sub-Saharan Africa by further 30% by 2040. A modern integrated energy system will allow more efficient use of resources and provide energy to a large part of the population in the poorest regions of sub-Saharan Africa. Focused programs for energy sector development are needed to make the twenty-first century truly the "African century".

The World Bank particularly mentions in its report India's progress on the issue of electricity access, with about 30 million people annually adding to the number of electricity consumers in this country (World Bank, 2019). India ranks fourth in terms of overall energy consumption after

China, the USA and Russia, but it's energy system is especially interesting because, unlike many others, it is still in formation period. Over 22% of country's population have no energy access, while the government plans to have the country fully electrified by 2030 (World Bank, 2019). At the same time, technical losses in electric power transmission remain strikingly high, and underdeveloped energy system is imposing two-percent GDP loss annually.

In terms of population, India and China are equally enormous countries - China's population is 1.36 billion people, India's – 1.26. Economic growth rates, however, are far from being similar. For the last 25 years, both countries have demonstrated fair growth rates and upgrades in various forms. Nevertheless, in the last 15 years China has been showing an almost unparalleled growth rate hardly anyone can match. In addition, energy access has been the primary economic driver for it, as strong correlation between GDP growth and energy consumption are typical for early industrialization stages. Even though in China, and in India to a lesser extent, energy consumption has increased in the last 25 years, per-capita energy consumption in both countries is much less than in other industrially developed countries. China consumes much more energy than India does for various reasons. To begin with, China is almost entirely electrified, which not only means power access to most citizens but also to enterprises, factories and plants. This scale of manufacture requires considerable energy resources. At the same time, most China's power is still generated in coal-fired power plants. Coal has been the driver of Chinese economy and, according to forecasts, it will remain the major energy resource. This is particularly important as achieving one target of 2030 Agenda for sustainable development could possibly have negative impact on other ones. In case of China – achieving electrification rates goes along with increasing environmental damage by using the most polluting fuel.

There are a number of obstacles that require special consideration and search for compromise. Firstly, all countries are at different levels of development in terms of available energy capacities, technological solutions and infrastructure accessibility. Regional associations could become instrumental in narrowing the gap between countries by exchanging ideas and elaborating a common action plan. Secondly, implementation of all other Sustainable Development Goals might call for increased energy supplies, which can further complicate attainment of the Goal 7. For instance, the Goal 2 of 2030 Agenda addresses eradication of hunger, however, around 3 billion of people use traditional biomass or coal to prepare their food damaging both their health and environment. It is therefore crucial to create conditions for "clean" food preparation. Population increase will also fuel the need in clean energy. Meeting the growing energy demand will require the increase of the share of renewable energy sources in global energy mix, growth of investments in "clean" power sources and constant focus on social and economic

context of any given region. At the same time, states have to demonstrate political will to achieve a unified solution that is environmentally friendly, economically viable and socially equitable.

Access to energy could be called one of the basic needs and predispositions for any kind of development in modern world. But in the light of sustainability agenda, the means of achieving this goal are very important. The growth of electrification and energy consumption in near future will bring series of interlinked effects on natural and human capital of regions, particularly the developing ones. That is why, together with access to energy, the other 2 targets included in Sustainable Development Goal 7 should gain proper attention: increasing the share of renewable energy sources in total fuel mix and energy efficiency.

2.1.2. Climate action and renewable energy sources

Environmental factor is one of the major ones in general sustainability assessment. Therefore, impact of energy on criteria of sustainable development should always be considered in terms of efficient use of natural resources and limiting negative environmental impacts. Resource efficiency of any energy source can be estimated based on the total amount of resources, their availability and exhaustion, intensity of energy released, the extent of water and land use. Environmental impact is primarily associated with emissions of greenhouse gases and air pollutants and global warming effect related to them.

The global average temperatures of the Earth's surface are increasing, the precipitation volumes and their place and time distribution are changing, the warming of the oceans and increasing sea levels are observed, extreme weather and climate events are becoming more frequent. In 2015, for the first time in modern history, the average temperature of the planet was exceeded by more than 1°C compared to the XIX century, when observations of the global temperature dynamics began, and now the warming trend is continuing (Kokorin, 2017). Therefore, the target to provide humanity with safe, reliable and affordable energy necessary for further socio-economic development is inevitably linked with a sharp reduction in greenhouse gas emissions.

The Kyoto Protocol was the first international agreement on market principles of nature conservation, reducing greenhouse gas emissions and solving the problem of climate change. The Protocol was ratified by most of the signing countries, with exception of the US and Canada, but after the first commitment period expired, several more countries withdrawn their participation in the second round (including Russia, Japan and New Zealand). The next step was the results of the UN World Conference in Paris in December 2015. In contrast to the Kyoto Protocol, not only developed countries and countries with economies in transition, but all countries, regardless of the degree of their economic development, undertake emission reduction commitments. The 2030

Agenda includes Goal 13 – climate action, which aims to prevent climate change and it's consequences all over the globe. And energy resource production and use play a central role in all the international agreements and targets mentioned.

As it is known, all organic energy sources emit large amount of greenhouse gases and air pollutants. Intergovernmental Panel on Climate Change for determining exposure greenhouse gases on global warming used the so-called global warming potential (GWP) in the Kyoto Protocol. Global Warming Potential is a parameter that numerically determines the heating effect of a certain greenhouse gas molecule relative to the CO2 molecule. The effect of the emission is estimated for a certain period of time. Carbon dioxide (CO2) was adopted as a reference, while all greenhouse gases and pollutants bring significant harm to the environment and humankind. Among the energy sources, coal accounts for the highest emissions (gram quantity of CO2 equivalent per 1 kWh produced electricity). If we take this as 100%, then oil accounts for approximately 84%, natural gas - almost half (47%) of coal emissions, while the contribution of other sources is negligible (Fig. 3).

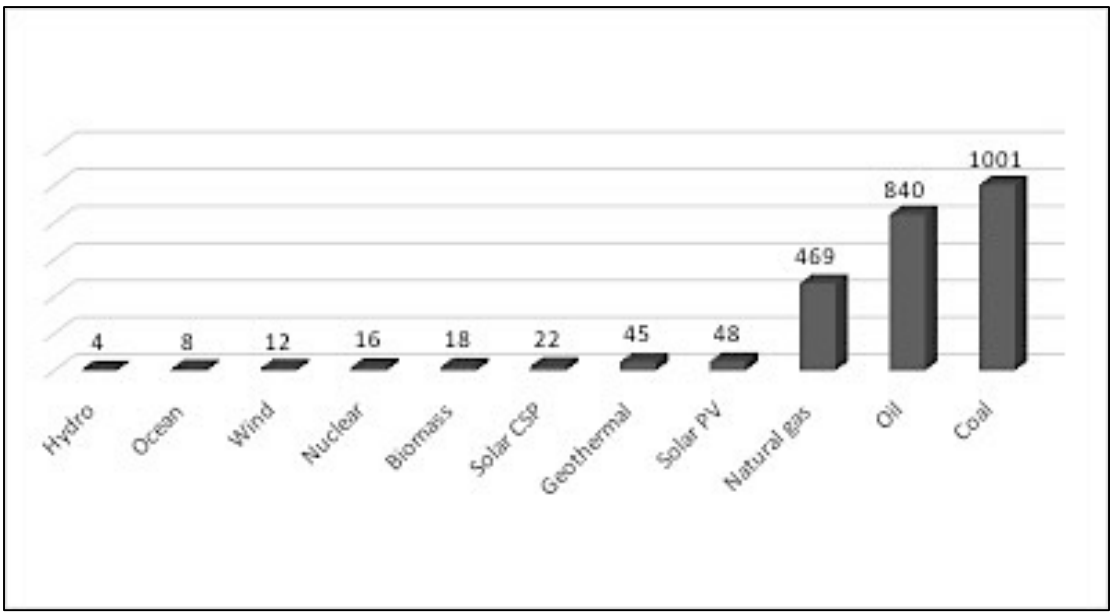

Figure 3. Specific greenhouse gas emissions (g CO2 eq / kWh) for various energy sources in electricity generation.(Zhiznin&Timokhin, 2017).

According to the data, CO2 emissions per capita continue to grow on the world level, particularly because the activity of developing countries, though developed countries such as US has shown substantial decrease during the last decade (Fig. 4).

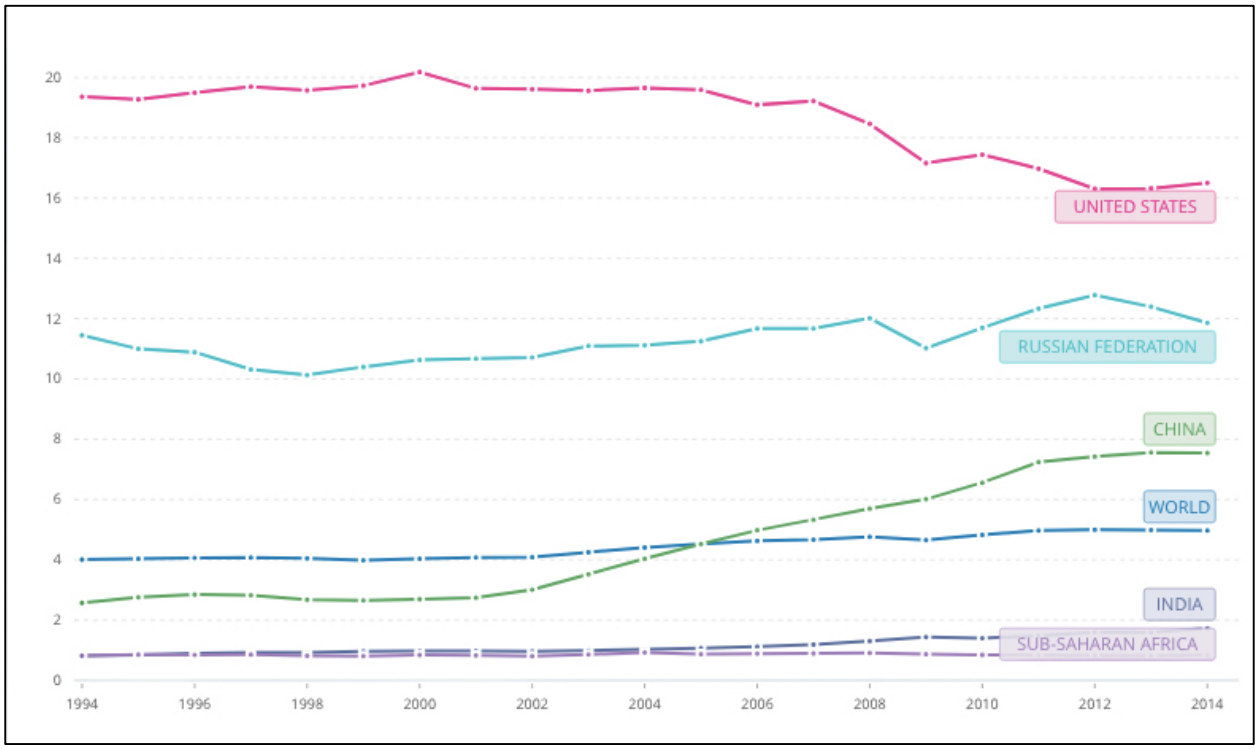

Figure 4. CO2 emissions (metric tons per capita). World Bank Open Data.

In the developed countries, formulation and adoption of energy strategies closely relates to the implementation of goals of sustainable development, eco-friendly economy, and environmental protection. This connection is obvious when progressive trends in the world economy development are considered. In June 2012 in Rio de Janeiro, the largest UN conference (Rio + 20) of the XXI century took place, and actually summed up the results of twenty-year attempts of mankind to change the traditional model of development and switch to a new model which enables the transition to sustainable development. The strengthening of environmental restrictions has led to realization of necessity to form a new type of economic development in the world, to develop a new “green” course of the economy. Important features of "green" economy are dedicated to energy. The term "low carbon" economy has become widespread. "Green" economy is often viewed in the context of global climate change, which is also largely connected to the combustion of fossil fuels and related effects from it. More frequently, "green" innovations are discussed, which mean new technology with minimal impact on the environment (renewable energy sources, electric transport, biofuels, etc.). The global crisis has also been one of the contributors to the formation of “green” economy. Many states are actively developing anti-crisis programs in which the environmental component takes up a significant place.

Firstly the signs of new “green” economy were seen mostly in developed countries, where prosperity did not have to be compensated by an increase in environmental risks, deficit of natural resources and environmental pollution due to modern technological solutions and post-industrial

stage of development. But nowadays, alongside the developed countries, environmental priorities are beginning to play an increasingly important role in countries where for longer time the interests of environmental protection have been subordinated to economic growth. A typical example of this is the change in the policy of China, a country with the second-largest economy of the world and a difficult environmental situation.

Shifting from traditional fossil fuels to renewable energy sources (RES) is one of the target of SDG 7. The interest in these energy sources in the world has been steadily growing. They have acquired significance not only in the field of environment and energy and already make a substantial contribution to the global energy balance. Among the features of RES are their virtually unlimited sources that are constantly being replenished and significantly exceed the foreseeable needs of humanity. In addition, renewable energy sources practically do not cause the pollution of the environment, which means that they do not change the Earth's heat balance. Unlike oil, gas or coal, renewable energy sources are relatively evenly distributed over countries and regions, therefore their development can be considered as energy and geopolitical security factor (Zhiznin, Timokhov, 2017).

With the goal of reducing greenhouse gas emissions, many countries actively promote the use of renewable energy sources using subsidies and legislative directives that give them priority. Several countries, such as Sweden and Denmark, have even announced that their goal is to replace all or most existing power plants with renewable energy sources. The world index of alternative and nuclear energy % of total energy use has shown an unprecedented boost over the last years (Fig. 5). The USA is one of the successful examples of RES use growth, despite the fact that Trump's administration announced the revival of coal industry and further investments in traditional fuels. According to the Federal Energy Regulatory Commission, in April 2019 the overall installed capacity of renewable energy resources in the USA for the first time exceeded the coal-fired generating capacity (Forbes, 2019). The gap between coal and RES is predicted to increase further in the coming years, but despite the triumph against the coal, RES has not yet succeeded in becoming the USA's main energy source. Though the percentages of RES participation in total fuel mix in India and China are still low, the growth rates presented by the World Bank are giving hope, especially in case of China, that announced particular policy in emissions reduction by using alternative energy. Over the past few years, China has become a world leader in the clean energy production, overtaking the world in the production of compact fluorescent lamps, solar water heaters, solar photovoltaic panels and wind turbines. Notably, China's clean energy growth reflects a strong and increasing commitment by the government to diversify its energy-intensive economy, reduce environmental problems and prevent massive import of energy carriers. Sub-Saharan Africa due to its underdevelopment is still showing mostly

local progress in this area. In Russian Federation coal, oil and gas still make up the majority of all produced primary energy. Apart from large hydropower plants, the share of RES in electricity production are pretty low. This could be explained by large deposits of organic fossil fuels in this country together with economic dependence on the resource base.

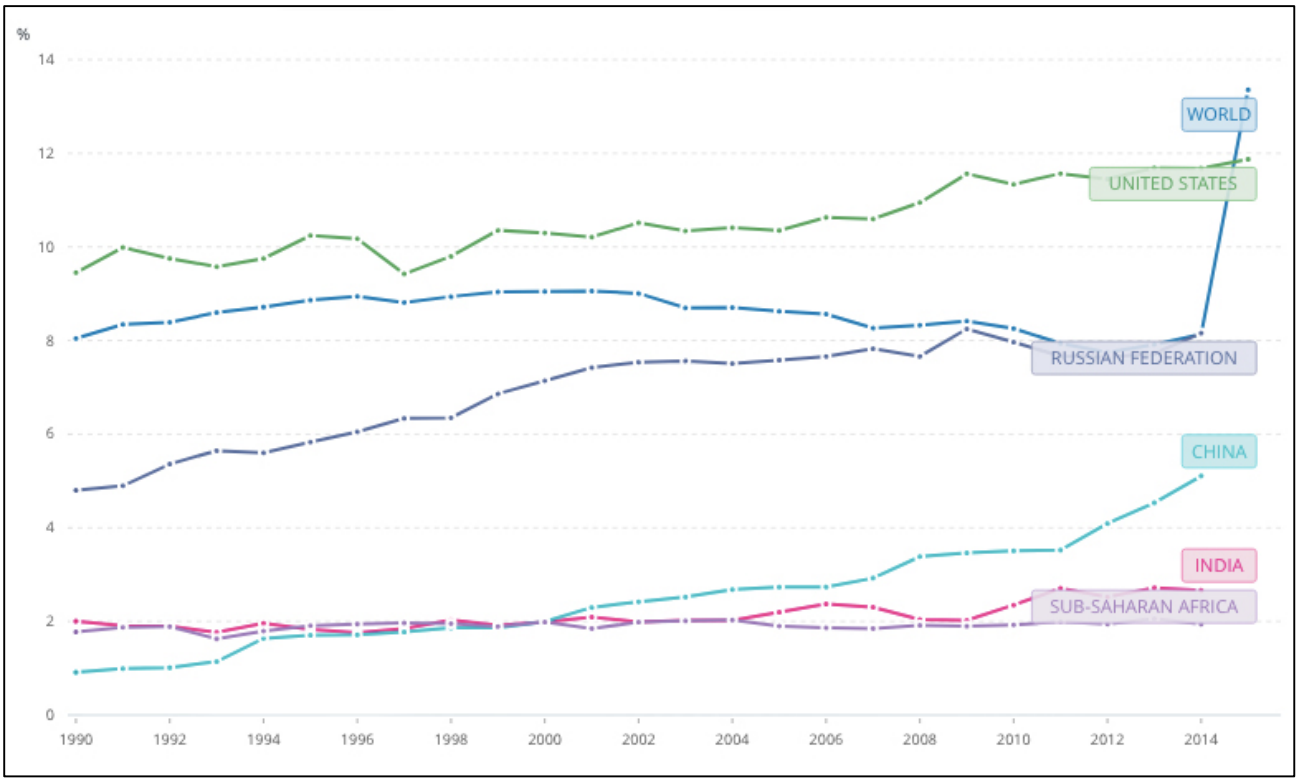

Figure 5. Alternative and nuclear energy (% of total energy use). World Bank Open Data.

It is important to note that in conditions of fuel competition, the organic energy resources still have the advantages. This manner of obtaining energy, in which the world's leading energy companies are involved, is more rewarding than using clean technologies. In this regard, economic efficiency and existing limitations of renewable sources should be taken into account when assessing their potential for sustainability development. Different kinds of RES have different issues that may boost or narrow their future role in global energy mix.

First of all, it should be noted that some renewable sources, such as solar and wind, by their very nature are characterized by instability and discontinuity of action. When used as a basic source at peak capacity, backup power sources or energy storage are needed, which is very expensive. So, in 2015 the cost of energy storage in the most popular lithium-ion batteries was still very high, despite the general trend of the reduction of storage costs (World Nuclear Association, 2016).

Wind power stations, depending on their location, produce 20-40% of their top capacity during one-year period (Union for the Co-ordination of Transmission of Electricity, 2016). The

remaining 60–80% of energy should be provided by backup stations. Solar photovoltaic output could be also very unstable, especially during the winter months. To provide the necessary energy potential, the wind power and solar installations should often be increased by many times, which could not be possible. However, there are days when neither wind nor solar installations produce significant amounts of electricity, so backup generators are needed.

To compensate for intermittent sources instability, backup power is used. In most cases it is generated at conventional power stations by burning fossil fuels, mostly natural gas, which requires additional investments both for generation and transmission of energy. Nevertheless, it is much cheaper than storing energy.

Considering the greenhouse activity of methane, CO2 emissions of gas stations and leakage of natural gas during the transportation, it is accounted that renewable energy source plants with gas backup capacities could potentially have higher emissions of greenhouse gases than autonomous coal stations equal power (Zhiznin, Timokhov, 2017).

Regarding wind and solar power plants, it is important to note that a distinction should be made between the cost of 1 kWh excluding various overhead costs (prime cost) and the cost of 1 kWh in a system connected to the electrical network. In the first case, it is made by wind or solar installation and is immediately consumed or stored, and in the second case, it is necessary to take into account investments in reserve capacity and transmission of electric power. Difference between these two indicators can be significant - so the cost of 1 kWh delivered to the network in most cases is several times that of the prime cost (Zhiznin, Timokhov, 2017).

Another important consideration is that that electrical energy is produced and consumed simultaneously, therefore the stability and frequency of the network are its main characteristics; they must be maintained within strict tolerances. Intermittent energy interferes with the network and degrades its reliability, especially if the installed capacity of intermittent sources is a significant percentage of the total network capacity. Experience shows that energy supply in unreliable electrical networks can have serious economic and social consequences in the form of prolonged power outages in large urban areas.

To sum it up, this means that the combination of an intermittent power source and its backup power plant in current circumstances are not achieving economic competitiveness, even in conditions of wind and solar energy prime cost decline. Though it can be efficiently used for local power supply in geographically isolated regions that do not have access to large electrical networks.

Nuclear energy is the other option for alternative energy production. Uranium is used as the main resource in the nuclear power industry. Nuclear Energy Agency of the OECD and the International Atomic Energy Agency (IAEA) calculated the common uranium resource base.

Reasonable estimates of resources that can be extracted at a price up to $260/kg U, amounted to 7.6 million tons (Nuclear Energy Agency, International Atomic Energy Agency, 2018). These reserves of global nuclear power will last for about 120 years.

In addition to uranium as a nuclear fuel, thorium can be used, the reserves of which are more evenly and widely distributed across continents. In the future, it will also be possible to extract uranium from seawater. This could be the potential for ensuring global energy security and stability.

Unlike other fuel cycles (coal, oil, gas) uranium fuel can be recycled and reused in fast neutron nuclear reactors (FNR-reactors). The introduction of such reactors can have a revolutionary impact on the future of nuclear power and allow to significantly expand its resource base and make the nuclear industry self-sufficient.

Indeed, FNR reactors produce significantly more energy per kilogram of uranium and have greater efficiency compared to conventional thermal reactors (Zhiznin, Timokhov, 2017). This allows to have very high uranium mining prices. In addition, newly built FNR reactors can use reprocessed fuel from existing reactors, as well as burn most of the most dangerous highly radioactive elements, while reducing the amount of radioactive waste. Currently the main limitations of FNR reactors remain high capital costs and limited experience in their operation. There are two such reactors in the world so far, both in Russia.

In the long term (by about the middle of the 21st century), thermonuclear power plants may appear, which will significantly surpass resource, environmental and many other characteristics of nuclear fission reactors. All of this would ultimately fully meet the global energy needs.

The advantages of nuclear power include its economic competitiveness. This is shown by the example of France, where the cost of electricity on the market is one of the lowest in the world. After the oil crisis of 1973, for two decades, this country began to receive most of the electrical energy previously obtained from fossil fuels at nuclear power plants. At present in the French energy balance about 75% is accounted for nuclear power generation (Zhiznin, Timokhov, 2017). An important additional advantage of this was the reduction of greenhouse gas emissions per capita. In France, they are among the lowest among industrialized countries. Also, greenhouse gas emissions are many times lower than emissions in countries that do not have nuclear power plants and that use fossil fuels (Australia, Denmark, Switzerland, Sweden, and several others).

Ecological aspects of nuclear power are the following: studies have shown that nuclear power causes least pollution to the environment (Kharecha et al, 2013). It is a well-known fact that nuclear power plants do not emit CO2. Every year, 441 worldwide operating nuclear power plants prevent emissions of more than 2 billion tons of CO2. In contrast, coal plants produce about 30 billion tons of CO2 per year. In addition, air pollution and dispersion of pollutants and toxic

substances cause negative consequences for human health. It is important to note that nuclear power plants emit less radioactive substances and other harmful impurities into the atmosphere than coal stations do. The products of coal combustion contain oxides of carbon, nitrogen and sulfur, carcinogenic and mutagenic substances. Coal ash mainly consists of hazardous oxides of silicon, aluminum, iron, calcium, magnesium, titanium, sodium, potassium, arsenic, mercury and sulfur, as well as uranium and thorium (Zhiznin, Timokhov, 2017).

Uranium mining has the most harmful impact on the environment associated with nuclear power. However, the need for it will decline sharply after fast reactors become commercially available, which can be expected in the coming decades.

Newly developed methods of disposing used nuclear fuel could dramatically reduce radiation hazards, as well as the volume of waste that should be stored in isolation from the environment. This waste will be disposed in an inert form, that is, in the form of ceramic or solid substances that will not be leached into the environment for a thousand years. At the same time, a large amount of solid and gaseous waste from coal stations (including mercury and heavy metals) remain toxic to humans and the environment.

The central question of nuclear power future is its safety. Nuclear power is recognized as one of the safest energy technologies in terms of fatal health effects, despite three major nuclear accidents that occurred on Three Mile Island in the USA, the Chernobyl nuclear power plant in the USSR/Ukraine and Fukushima in Japan. Of these three, only the accident at the Chernobyl nuclear power plant caused the deaths of people who were directly exposed to high doses of radiation at the first stage of the emergency cleaning operation. Nevertheless, the death toll was then less than 100, which is relatively small compared to the number of annual deaths in the coal and oil and gas industries (Kharecha et al, 2013). It is important to note that the number affected by radiation sickness, radioactive contamination, etc. as a result of the consequences of three accidents at nuclear power plants is much higher, but there is no exact data. Still, global average mortality rates per billion kWh, according to the World Health Organization (WHO), were: 100 — coal generation, 36 — oil, 24 — biofuel/biomass, 4 — natural gas, 1.4 — hydropower, 0.44 — solar energy, 0.15 —wind and 0.04 — for the nuclear industry (World Health Organization, 2016).

The accidents at the Chernobyl nuclear power plant and Fukushima caused radioactive contamination of vast areas of land and the need to evacuate the population. However, in both cases, the bulk of the evacuated areas had radiation levels below the normal background level in many regions around the world. It should be noted that land pollution is not limited to severe nuclear accidents, similar events occur in the chemical industry, where pollutants often become extremely dangerous.

An indicator of the high level of safety of a new generation of nuclear facilities is that

specialized systems will limit the consequences and duration of an emergency. Advanced technology is focused on passive safety, and not on actively operated engineering systems that require external influence.

Nuclear power is also associated with the problem of potential leakage of materials used for weapons. Most countries have signed the Treaty on the Non-Proliferation of Nuclear Weapons, obliging them to refrain from the production of weapon materials and atomic weapons. The main task of the IAEA is to verify compliance by member states with the Treaty on the Non-Proliferation of Nuclear Weapons. There are four states that haven't signed the Treaty - India, Pakistan, Israel and South Sudan, and one that has announced withdrawal – North Korea. Out of them, India and Pakistan are known to use uranium for power production and at the same time have disclosed their nuclear weapon programs.

It is important to note that nuclear energy is not limited to the generation of electricity. It can equally well be used to solve such important tasks as desalination of water, obtaining ecologically pure hydrogen in the required quantities, in transport, during heating of rooms, removing carbon from CO2, creating synthetic liquid fuel and etc.

Nuclear power, hydropower and renewable energy today could be the most important means to solve both energy and climate problems. CO2 emissions avoided by using nuclear, hydro, and renewable energy from 1970 to 2010, are estimated at about 1/3 of global emissions (International Atomic Energy Agency, 2015). Thus, the role of clean technologies (nuclear, hydropower and renewable energy sources) in achieving the goals of the 2030 Agenda for Sustainable Development, the Kyoto Protocol and the UN Paris Agreement on Climate Change is very significant. Their advantages are that they are minimally involved in the creation of the greenhouse effect. Therefore, these energy technologies need to be developed further, taking into consideration existing limitations.

In general, it is obvious that the environmental factor is becoming world-wide increasingly important priority for the formation of a new economy, modernization and technological renewal. The implementation of the new "green" course implies a reduction in the use of non-renewable resources for the production of electricity, for the sake of investments in renewable energy and energy efficiency. Realization of energy and climate priorities would automatically mean an abrupt reduction in environmental pressure due to the close correlation between the quantities of consumed energy, use of natural resources, greenhouse gas emissions and the amount of pollution. All this means that in the coming decades the most progressive countries will have an economy with a new, innovative and technological basis, the most important characteristic of which will be the minimum impact on the environment. The developing economies should follow as they are expected to produce the major load of energy demand in the forthcoming period.

2.1.3 Energy efficiency

The third target to reach in terms of SDG 7 is to double the global energy efficiency indicators, based on the amount of primary energy used for GDP growth. This task is also connected with the SDG number 12 – responsible consumption and production, which calls for rational development and use of natural resources for economic growth.

Energy efficiency means rational use of energy resources by utilizing less amounts to ensure the same level of energy supplied for buildings or manufacturing processes. It also means achieving economically viable usage of energy at the current level of technological development level and in compliance with the environmental protection requirements. In contrast to energy saving and conservation which is mainly aimed at reducing energy consumption, energy efficiency means useful output of energy. Energy efficiency provide the following benefits - for population: significantly cut utility costs; for countries: saved resources as well as enhanced performance, production and competitive power; for ecology: reduced greenhouse gas emissions into atmosphere; for energy companies: reduced fuel costs and unreasonable construction cost; for manufacturers: reduced output prime cost, and many other direct and indirect benefits.

Nowadays an increasing number of states treat energy efficiency, ecology and energy security as top priorities within their energy policies, resulting in their decreased dependence on hydrocarbons. All this inevitably leads to a global shift in the global energy structure, with no revolutionary breakthroughs, but based on the evolutionary development and improvement of technologies already available.

The advantageous effect (in monetary terms) per unit of energy resource consumed, i.e. the energy productivity indicator, serves as the most obvious indicator of the economy energy efficiency. Scientific researches and official statistics sometimes employ a reverse indicator, GDP energy intensity, that reflects the amount of energy resource per unit of useful effect (Fig, 6). According to the graph, it can be concluded that the general tendency in the world is growing energy efficiency. Since 2005, the basis of the Chinese government state policy has been efforts in energy conservation and energy efficiency improvement. To achieve these goals, administrative, legal and economic actions were made. During the first three years of the plan, China reduced energy expenditures per unit of GDP by slightly more than 10 percent, resulting in savings of 290 million tons of oil equivalent and reduced the country's greenhouse gas emissions by 750 million tons of carbon dioxide equivalent (IEA, 2019). This level of efficiency growth rate is very high in comparison with world average. Current challenges for China in this area progress include an imperfect market management policy, as well as a lack of energy conservation potential. The government of India in 2009 also adopted the “National Plan of Action for the Effective Use

of Energy and Environmental Protection", which aims to the energy efficiency improvement by 20% by 2020 and reducing the energy intensity of economy. Though the efficiency growth rates are lower than China's, the index of energy use per 1000$ GDP in India is pretty low for the emerging market and even below the world average. The USA economy is showing stable decrease in energy intensity due to the technological progress. In Russian Federation energy intensity rates are the highest out of the presented countries, which could be connected with economic dependence on primary resource base. Sub-Saharan Africa is also quite above world average, as the most countries in the block are on their early development stage.

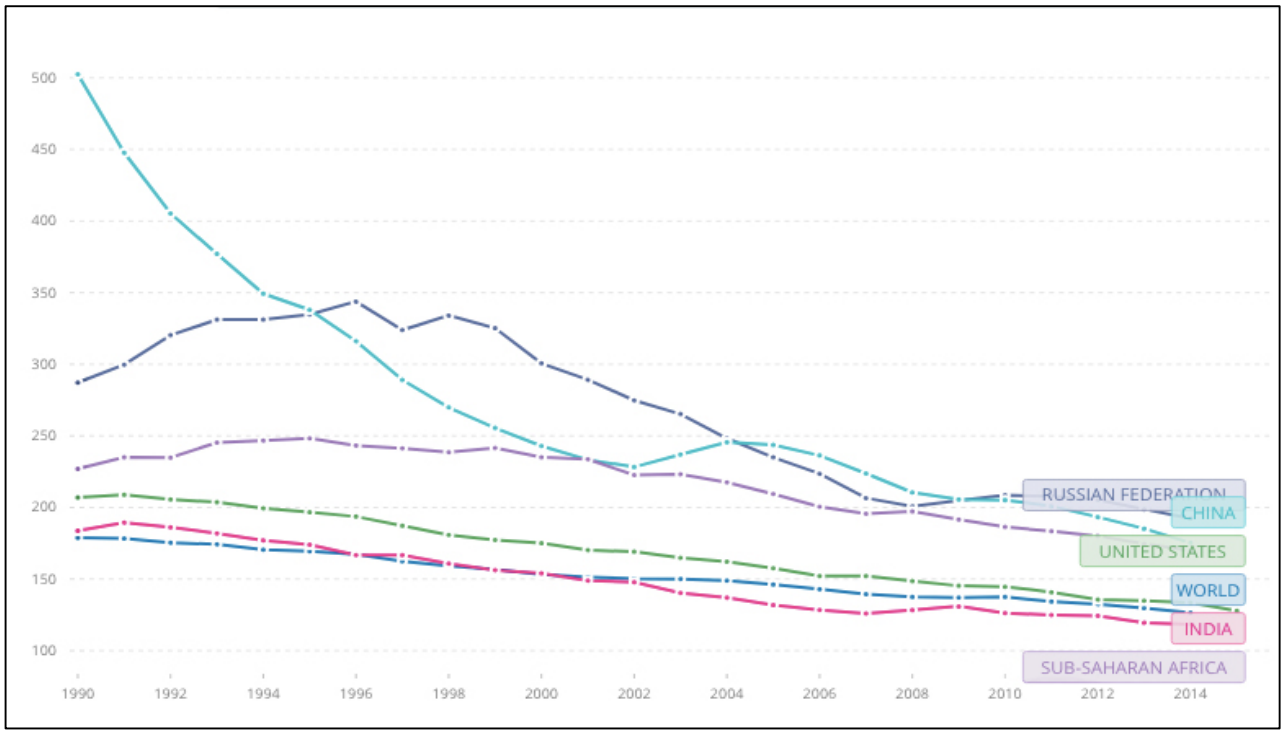

Figure 6. Energy use (kg of oil equivalent) per $1,000 GDP (constant 2011 PPP). World Bank Open Data.

The early development stage of rapid national population growth is usually followed by advanced growth of energy consumption and economy industrialization. Later, the growth of per capita GDP production outpaces the growth of energy consumption, which is related to the post-industrial economy coming into being and the expanding share of less energy-intensive service sector within it (Makarov, 2016). This objective pattern leads to a fundamental difference in the level and dynamics of primary energy consumption per capita in developed and developing countries. In the latter, per capita energy consumption grows as their well-being increases, while developed countries have already passed their peak of per capita energy consumption. Given the outrunning population growth, there might be a situation where developing countries will not be able to significantly increase their per capita energy consumption, i.e. they will face the problem of energy poverty. That is why energy efficiency is extremely important for emerging markets. It can also be said that energy efficiency improvement programs should better focus more on

increasing of the useful effect being the result of energy consumption, rather than reducing of the consumption volume (energy saving).

To crown it all, improving energy efficiency has always been a determining factor in energy development and will further play even more important role in global energy policy. The world is entering a new stage of energy sector development, when the decades of continuous energy consumption growth were for the first time followed by a gap between economic upturn and energy consumption growth. In many of the most economically and technologically advanced countries (OECD members), primary energy consumption has stabilized, and in some (some European states and Japan) it has already started to gradually decline. The global progress in the area of energy efficiency is also promising, as all major countries and regions are already demonstrating the trend of GDP energy intensity reduction. Energy efficiency increase do not require revolutionary technological changes and provides the possibility of covering growing energy demand with currently available resources, which makes it even more valuable. Globalization also contributes to unification of technologies used and equalization of economies' energy intensity levels (Babkin, 2013). This is extremely important for achieving the Sustainable Development Goals, as actions on energy efficiency directly influence on decoupling economic growth from resource use and creating new sustainable and green economic model.

2.2. Role of energy sector for geopolitics, conflict and peace

Role of energy resources are not limited to economic and environmental influence on global human development. On the contrary, their availability, quantities and quality are strongly connected with social and political agenda and sustainable development goals, linked with peace and partnership, such as Goal 16 - Peace, justice and strong institutions and Goal 17 - Partnership for the goals.

Nowadays energy becomes an increasingly important element of geopolitics that defines the nature and character of international relations. It could be the reason behind grave political tensions and intra- and interstate conflicts. Limited availability of energy resources, infrastructure and cutting-edge technologies poses serious threat to economic viability and public security of many countries. A dual process emerges - energy is used as a geopolitical tool and political interests exert an increasing impact on energy development.

2.2.1 Natural resource impact on social institutions: resource curse

One of the main issues that make energy resources so important is their unequal distribution all over the world. The geographical distribution of resources, particularly organic ones, is the key to understanding of energy geopolitics, its relationship with the territory and disputes between countries regarding mineral and energy resources, i.e. power and political influence globally. Scarcity of hydrocarbon resources in some countries could be the reason for underdevelopment, import dependency and economic instability. But this correlation is not linear at all – sometimes resource-rich countries get in the trap of underdevelopment while having all natural predispositions for economic growth, which is called the “resource curse”.

The term “resource curse” was introduced in 1993 by a geographer and economist Richard M. Auty to describe the global phenomenon: unprecedented drop of living standards in oil exporting countries in 1970-1980s in the time of crude oil price peak (Auty, 1993). Along with this phenomenon, many countries dependent on export of raw materials were failing to achieve sustainable and stable economic development since global prices for natural resources were exposed to major fluctuations.

The slowing development of resource-rich countries was first brought to light in intercountry research by J. Sachs and A. Warner (Sachs, Warner, 1995). The authors pointed out that this deceleration was entirely in keeping with the results of historic analysis of economic growth: in XVII century, resource-poor Netherlands overtook Spain rich in precious metals, in late XIX - early XX century Japan outstripped Russia. The research results confirmed the negative relationship between resource abundance and low economic growth rates, taking into consideration all other variables important for economic development.

The “resource curse” hypothesis in its traditional understanding states that countries with abundance of natural resources – oil, gas, coal, non-ferrous metals - typically show slower development pace than similar economies with scarcer resources. All others being equal, resource-rich countries are bound to develop faster than others do; however, in practice, growth pace of resource-abundant economies can be both considerably higher and lower compared with growth rates of similar economies without the resource cushion. Still, the latest history shows that none of the countries making a leap from developing to developed economies in the last 60 years (Japan, South Korea, Taiwan, Singapore, Hong Kong) possesses significant natural resources.

An essential channel of the resource curse is negative impact of the resource abundance on the quality of institutions, especially when it comes to traditional energy resources like fossil fuels. From this perspective, profits from extraction and development soar so rapidly that it becomes more profitable to invest in rent revenue distribution than in production activity. Influence peddling, unfair competition and corruption thrive with negative consequences to growth. The possible model demonstrates that in countries with bad institutes abundant resources have negative impact on prosperity, while in ones with good institutes the impact is positive. If rent income is high and rent-oriented activity (interest peddling, corruption, seizure of property) is tolerated, it makes more economic sense for investors to invest in rent acquisition; if such practices are not tolerated and deemed too risky, investors will be more inclined to invest in production. In the former case, investments will be useless for the society, in the latter – they will contribute to growth acceleration (Polterovich, 2007a).

The experience of developed countries also confirms the hypothesis arguing that the resource curse is a primary threat for countries with politically weak institutions: for them, a change in the business environment does not result in deterioration of political institutions. Norway, one of the hydrocarbon-richest countries, has channeled additional revenue coming from oil export to increase expenditure in education and create a stabilization fund. But since resources were discovered after the country had established and sustained its political and economic institutes, the resource abundance did not impair the growth rate. Norway remains one of the resource-richest countries and relies its economy on production and export of oil. The opposite example is Venezuela, which, despite of the proven oil reserves, slid into the resource curse and economic crisis due to weak political and social institutions and mismanagement of the resources.

Abundance of natural resources impacts both economic development of countries and their political systems. The political regime of resource-rich countries tends to be less democratic than in other countries. To explain this relation, it is important to understand why abundant resources contribute to and promote fragility of democracy.

Three major reasons for sustainability of autocracy in resource-rich countries could be indicated. Firstly, a dictator can channel the revenue from natural resources to finance defense and law enforcement agencies that will reinforce dictator's power and suppress opposition. Secondly, this revenue provides means for a dictator to implement populist policy, for example, lower taxes and finance social programs (above the economically viable level) thus winning support of masses and undermining the appeal of the opposition. Thirdly, the "social capital" accumulation effects have their role to play, too. The countries with dominating extracting industries that rely on relatively simple technologies have a small share of highly skilled workforce. Consequently, the civil society in these countries develops slowly, and their demand for democratic institutions is relatively low.

Taking the above-mentioned into account, it may be concluded that principal symptoms of the resource curse include suppression of tradable sectors by resource-based and non-tradable ones; shrinking production volume in the context of increasing prices for resources; flourishing corruption, unfair competition and fragility of democracy.

Nigeria is a bright example of the resource curse. Country's oil industry generated a huge 350 billion USD profit from 1970 to 2000. The financial policy dictated that revenue from natural resources was directed at poorly manageable ambitious projects that went on hold when the financing source ran dry. Around 4,500 projects of this kind were suspended in Nigeria in late 1990s. At the same time, 70% of population lived in absolute poverty (Polterovich, 2007b).

Countries with mature institutions derive benefits from natural wealth and channel the revenue to develop other industries. Oil-rich Norway, a country with highest UN's human development index, is often cited as an example of successful victory over resource curse. The period with growing oil prices did not show any change in the share of export in GDP, whereas the share of oil export in the structure of overall Norwegian export rose dramatically. Oil sector displaced more innovation-intensive tradable sector. In 1970-1980, crude production in Norway increase sevenfold. At the same time, Norwegian living standards did not decline, and country's democracy did not suffer any tragic consequences. It is only natural to assume that firm state control over country's oil wealth can be a rational policy choice only for countries with underdeveloped market. Norway nationalized oil production after discoveries in 1970s and forwards 80% of oil revenues to public budget (Polterovich, 2007a). Not only had Norway been able to steer clear of the resource curse, it also overtook all its neighbors in terms GDP per capita (in purchasing power adjusted dollars) and is coming close to the USA. In context of new trends in energy sector development, it is worth mentioning that Norway meets the largest part of its own electricity demand by hydropower, making it possible to export most of oil. Due to hydropower,

with the lowest cost of electricity generated, Norway is able to maintain the average electricity cost for the population at a sufficiently low level.

Energy resource wealth may be the curse but not necessarily. The methods countries use to overcome the resource curse in terms of energy resources include firm state control over oil and gas revenues; redistribution of oil and gas revenues; financing social peace and supporting domestic companies and active promotion of growth of non-energy industries. Still success of the presented methods is highly dependent on local conditions and stakeholders involved.

2.2.2. Role of energy in conflict and peace

Energy's new resource and technological base makes impossible to neglect its role as an important geopolitical factor. At the same time, one of the preconditions for transition to sustainable development of humanity and building "new energy civilization" is making sure that energy is not used as a factor for resolving regional and international political conflicts.

In the meantime, lack of resources repeatedly has been one of the major factors contributing to armed conflicts in the Middle East, North and Sub-Saharan Africa and other regions. Fight for natural resources goes a long way back: it has been a reason for numerous conflicts all over the world. Environmental changes pose new questions about availability of natural resources and control over them. Growing resource scarcity may lead to enforced public controls over key energy resources thus sparking geopolitical tensions between states. The amplified connection between security and resources becomes more and more pronounced. There are several reasons for that: scarcity of resources followed by strengthening economies of developing countries and climate change.

Under conditions of depletion of natural energy resources, developed countries are trying to seize control over strategically important raw materials and fossil fuels, which inevitably exacerbates the contradictions of rich and poor, North and South, and cause all range of social tensions, leading to intra- and international conflicts and threatening peace. For example, political and economic effects of FDI in energy sector and unequal access to resource rents may arguably increase the risk of conflict, as resource discoveries create expectations of jobs and prosperity among populations (Bailey et al, 2015). Growing demand for energy sources for increasingly populated nations and economic systems brings up an issue of how suitable, reliable and available energy reserves are. This situation may put additional strain on relations between countries competing for limited resources and lead to interstate conflicts. Even without conflicts, the rivalry for depleting energy reserves contains risk to increasing tensions, internal conflicts and terrorism.

International community is currently calling for a common definition of conflict resources - natural resources, that could be potential catalysts or drivers of conflict. Philippe Le Billon, well-

known scholar on this subject, defines traditional fossil fuels as one of the major conflict resources, as their exploitation, trade and control over them may contribute to armed conflict and lead to so-called "resource wars" (Le Billon, 2005). Countries, dependent on critical or highly valuable resources, are usually vulnerable in economic and political terms, which can result in various forms of conflicts, from internal to large-scale regional disputes. Such countries may leverage weapon and precision technology transfer securing political and military alliances as incentives for forging strategic relations with energy producing states. This process takes place for example in Middle Asia, where China, Russia and the USA compete for access to and control over regional gas and oil reserves. Based on current assumptions, it is possible to assume that several regions, such as Africa, especially sub-Saharan region, Middle East and Middle Asia, have predispositions to be involved in energy conflicts. At the same time, Russia, which is already the leading world producer of natural gas, claims it's territorial control over half of the Arctic hydrocarbons reserves. This might give the country enormous strategic superiority and escalate the potential disputes with the USA, Canada, Denmark and Norway, also interested in their position in the Arctic.

Current trends in the energy sector give hope for changes in terms of conflict potential of resource control and distribution. The International Renewable Energy Agency (IRENA) provided the analysis of the impact of the renewable energy technologies on political and economic relations between countries (International Renewable Energy Agency, 2018). The main conclusion of the analysis is that with the growth of share of renewable energy resources in total fuel mix and electricity production will inevitably lead to economic changes within countries and the redistribution of global political influence. Countries that already use RES and continue to invest in the development of new technologies associated with them will benefit. Underdeveloped countries without own hydrocarbon fuel sources will be able to improve their economic situation, since RES are available globally, and the decreasing cost of technologies for converting hydrocarbons into energy will make it possible to gain long-awaited energy independence. Predictably, large exporters of oil and gas, such as Russia, the Middle East, North Africa and others could have a hard time. Hydrocarbon exports averages around 25 % of budgets of these states. Potential decline in hydrocarbon demand and existing reserves will lead to economic recession unless these countries adapt economy to new energy realities.

The global energy transition caused by RES can reduce the geopolitical tensions associated with the distribution of traditional energy resources and enhance cooperation between countries. At the same time, renewable energy sources use can help to reduce environmental pressure of human activities, improve people's health due to less air and water pollution and create new jobs and other economic benefits. Energy system transformation may help to mitigate social, economic and environmental problems, which are often one of the main causes of geopolitical instability and

conflict. Therefore, energy transition has potential to create preconditions for sustaining peace.

At the same time, natural resource management is claimed to be an important integral factor for post-conflict environment and peacebuilding. This is particularly true for energy resources because of their role as a primary commodity for population and their high value for economic development at the same time. The Untited Nations Environmental Programme published a report in support for Peacebuilding Commission, where they addressed not only the potential contribution of natural resources to the outbreak of conflict and during the conflict, but also their potential role in peacebuilding (Untited Nations Environmental Programme, 2009). The report presents three possible ways how natural resource management could contribute to peacebuilding: by supporting economic recovery, developing sustainable livelihoods and contributing to dialogue and cooperation. Natural resource management has to be addressed first of all by governments and international organizations, but the impact of business community is also crucial. There is a potential for energy companies, especially extractive ones, to reduce negative effects of their actions and even develop strategies that help consolidate peace in fragile contexts.

There is a relatively new field of academic research named Business for Peace (B4P), which looks for potential peace-positive influence of business activities. The main assumption of business for peace scholarship, from the United Nations Global Compact B4P initiative (United Nations Global Compact, 2013) to research by John Forrer and John R. Katsos (Forrer and Katsos, 2015) or Jason Miklian and Peer Schouten (Miklian, Schouten, 2019), is that businesses contribute to economic growth, state revenues and people's income, which create the conditions for sustainable peace. So-called "peace-dividends" – promise of economic contribution and further development - prevent deepening of the conflict, make the conflict "costs" higher and encourage dialogue between parties by providing common constructive goals with clear benefits for everyone. This indirect influence is the most common way for energy companies to contribute to peace by staying in it's core field of activities. There are also possibilities for businesses to participate in peacebuilding more actively, for example by taking the mediation role or sponsoring political processes. The problem here is that mostly businesses do not have required skills, knowledge or human resources to engage in sensitive processes of reconciliation and peacebuilding itself. That is why such engagement usually takes the form of private-public partnership with NGO's or other organizations, experienced in conflict resolution. For example, in case of Azerbaijan and Armenia, with initiative of International Alert meetings with representatives of local businesses and international organizations were organized in order to address conflict-related concerns (Sweetman, 2009).

Large-scale extractive industries, such as oil or gas exploration and production companies, are believed to have the widest transformative potential in post-conflict and fragile regions. They

attract foreign direct investments so important for regions emerging from conflict and at the same time do not require developed local markets and business environment.

Good example here gives Myanmar case, where investment in the extractive industries accelerated almost overnight: FDI commitments in 2010/11 were at least 30 times greater than the average for the previous two decades (Bailey et al, 2015). Since 2011 the country is undergoing the transition period after protracted internal conflict started in 1948 and led to country's political and market isolation. The transition period includes democratic reforms and wider engagement in international diplomatic and trade relations. Myanmar is a resource-rich country, particularly with natural gas, with many deposits still unexplored. Therefore, it is very attractive to FDI in extractive sector, and many projects were launched since then. There are such projects as Shwe offshore gas field developed by South Korea's Daewoo International in conjunction with the military-linked Myanmar Oil and Gas Enterprise, or the Kyaukphyu–Yunnan gas pipeline infrastructure, in which China National Petroleum Company invested more than 2,5 billion dollars (Natural Resource Governance Institute, 2015). Donor agencies, such as Asian Development Bank and UN Development Programme, as well as the Australian and UK governments, also take part in capacity-building projects and extractive governance. Together with investments, different stakeholders also provide the country with frameworks for international development and standards and thus contribute to sustaining peace after emerging from conflict and support new democratic institutions.

The main risk associated with large-scale investments in energy resources extraction and production in fragile contexts is that the country in transition might not have enough capacity and institutional strength to manage the sector and revenues and to control resource rent and possible malversations. This may potentially undermine the contribution of energy sector to economic growth of the country and therefore to peacebuilding agenda.

In any case, potential resource development in post-conflict region presents mutual interest for parties in conflict and therefore may encourage peace dialogue between them. The case of Qatar and Bahrain dispute over the Hawar islands and other territories might be good example of this possibility. Since 1930's two countries had maritime dispute over the islands, still being British colonies at that time, which was escalated several times to military tensions and almost led to war during 1980's. The beginning of the conflict was directly influenced by started oil and gas exploration in that area, but during the whole period there was no proof of any commercially significant deposits. After hydrocarbon reserves beneath the islands were confirmed by Bahrain in 1980's and followed unsuccessful negotiations between countries, the case was brought to the International Court of Justice in 1991. In 2001 the Court granted Bahrain the Hawar Islands (excluding the Janan Island), Qit'at Jaradah, and Fasht Al Azm, while Qatar received Zubarah,

Fasht Dibal, and the Janan Island (Wiegand, 2012). Both countries began exploration on granted territories, but only Qatar received substantial material benefits from large-scale commercial exploitation of it's hydrocarbon reserves. Still, the ruling over the territories has never been questioned afterwards. This case may suggest that the confirmation of energy resource reserves can convince parties to stand on track of resolving protracted boundary dispute in order to receive the possibility of resource exploitation on the conflict territories.

Presented cases, of course, depend a lot on the context and can never be the universal recipe for conflict resolution process. But they still confirm the hypothesis that promise of economic benefits and development opportunities provided by energy resource exploration and production may become consolidating factor for sustainable peace. Energy companies' activities and investments in that field could be the catalyst for economic recovery in post-conflict regions, especially because often primary sector has the major share in economies of such regions and do not require additional infrastructure or local market development. They can also enhance dialogue between separated groups providing shared economic interests and therefore preventing conflict to relapse.

In terms of energy sector current trends and transformation, it is important to access the potential role of renewable energy sources in peacebuilding. Isobel Edwards in her research not only claims that RES development reduces the risks of conflicts related to energy extraction and environmental stress, but also names it a potential peacebuilding tool (Edwards, 2018). Using decentralized renewable sources for securing energy supply may help to establish sustainable livelihood in post-conflict region, free from political issues and competition over resource control. It also doesn't require high-cost infrastructure and bring benefits to local community instead of the income center of large-scale projects. The good example here could be the Sudan case, where scarce water supply used to cause conflicts between and within communities. Also, the affected regions were often located far from national electrical grid and had minimal centralized energy supply. The natural resource conflict was successfully managed by the United Nations Development Programme by installing solar powered water pumps in 6 states of the country, providing steady water supply for local communities and reducing tensions over primary commodities access (United Nations Development Programme, 2017). Except for peace, this solution also contributed to other SDG's achievement, including Goal 7. Solar powered pumps provide clean energy supply that has no negative environmental effect in comparison with diesel-powered pumps, as well as they do not require additional operational costs dependent on fuel prices. This solution ensures community development together with creating preconditions for sustaining peace.

To crown it all, the opportunities for peace contribution exists through the different activities

of energy sector from large-scale extractive projects to local decentralized alternative power supply. Traditional organic fuels production can influence economic recovery by massive direct investments in primary sector. With the right revenue management and institutional support such projects can provide profound basis for economic stability in post-conflict regions. At the same time, promise of income and new jobs can enhance dialogue and cooperation between parties on the shared interests' basis. As for decentralized small projects, mostly associated with renewables, their influence is mostly in avoiding conflict resources use and providing energy security for fragile regions. Though such projects can not handle the base load on a country level, they empower local communities and support their economic circulation. Decentralized renewable projects are also in compliance with sustainability agenda and environmental protection.

Related to energy SDG 7 and its targets, presented in the first part of empirical section are closely connected to sustaining peace by creating preconditions for it. Providing access to clean and affordable energy for everyone reduces the risks of conflicts on the basis of resource scarcity and environmental stress. Transition to another types of energy sources contributes to more equal distribution of commodities and power across the globe. Energy efficiency gives opportunity to achieving these goals with existing resources. Equal opportunities in terms of energy access create preconditions for economic development and structural basis for positive peace.

2.2.3. Globalization and cooperation: role of multinational corporations

Globalization processes connected with both revolutionary technological changes and globalized economic factors go hand in hand with intensive increase of energy consumption and convergence of per capita energy consumption in developed and especially developing countries. It intensifies the problem of satisfying ever-growing need in energy and decreasing the environmental impact of energy production, transportation and usage.

The principal problem facing the global energy in the next fifty to one hundred years is predicted to be the search for reliable and solid source of raw materials supply. For example, the global power industry has to address the challenge of limited supply of relatively inexpensive sources of fossil fuel and transition to new resource base. From the geopolitical standpoint, the global community and countries have to work towards shifting from economic growth domination to building a long-term policy aimed at sustainable development. Achieving sustainable development goals will call for long-term investments, including direct foreign investment in major sectors, notably in developing countries. The required investments encompass sustainable energy, infrastructure and transport, as well as information and communication technologies. Public sector must receive a clear mandate to work towards these tasks.

To build the necessary momentum, every country has to hold regular progress reviews of 2030 Agenda involving civil society, business community and representatives of various stakeholders. At the regional level, countries exchange experience and resolve common weak points. At the international level, UN, within annual High-level Political Forum on sustainable development, measures global progress, identifies gaps and emerging issues and comes up with corrective proposals.

Through the international cooperation governments can work on mutual policies and exchange technologies and knowledge in order to provide energy security and up-to-date development. But no substantial progress in this field can be done without conscious action of business itself. Energy sector is characterized by high capital investments, which make energy producing and extractive companies become important actors on local and global political scene. They could be either national energy producers or multinational corporations, but anyway they usually have big influence and capital control.

Over the recent decades the activity of multinational corporations has drawn lots of attention of both academic researchers and global society. In modern globalized world their role in international economy as the non-state actors became highly important and rather controversial. Multinational corporation is commonly defined as a corporate organization that owns or controls production of goods or services in two or more countries other than their home country (Drucker, 1997). Colonization were actually often maintained through these early international corporations, when they were exploiting colonial countries resources and population for gaining profit and development for home country. Some modern critics, like Michael Parenti (Parenti, 2011) and Abayome Azikiwe (Azikiwe, 2014), view the actions of MNCs nowadays through neocolonial context, mentioning similar patterns of their behavior: unequal wealth distribution between home and host countries and exploitation of cheap labor and resource extraction. After national companies, MNC's are the other major players in global energy resource sector.

As independent none-state actors multinational corporations nowadays play one of the leading roles in globalized economy and are often named the main representatives of globalization itself. With all the risks involved national governments still make efforts to attract foreign direct investments (FDI). In order to benefit from MNCs, states mediate relationships with corporations and ways of their regulation. This process is described by obsolescing bargaining model, when the corporation seek more profit from its investment and the government seek increase in economic development. One of the crucial factors are whether the MNCs suppress local firms or provide them with development opportunities and encourage competition. The most successful examples show that supportive relations between MNCs, local governments and local business may provide benefits from multinationals activities for all parties involved.

Positive impact of MNCs on sustainable human development can be reached with the right policy, especially in the energy sector. First of all, MNCs provide FDI to less developed countries, which is essential for their economic growth. The most beneficial are so called "greenfield" investments, when the corporation directly invest into production facilities in the host country. Secondly, there is transfer of management and professional skills and technological advances. Local business can inherit these advantages from MNCs and implement them in their own operation, upgrading their capacities and becoming more competitive on the local and global economic scene. Thirdly, there are trickle down effects to related industries and service providers, as well as the infrastructure improvement. Corporate responsibility projects, usually provided by MNCs, contribute to local communities as well. The last but not the least are the direct benefits to the government financial system, which include oil and gas rent, increase in tax revenue and improving balance of payments with added benefit of FDI.

To sum it up, energy multinational corporations are complex and diverse actors of modern globalized world and their impact on development cannot be reduced to simple pro or contra approaches. Their influence is never only of economical character, but also of political, social and cultural. They are never entirely responsible for the development success or failure of national states. As mentioned in the UNCTAD report (United Nations Conference on Trade and Development, 1999), multinational corporations "can only provide access to tangible and intangible assets and catalyze domestic investment and capabilities". This catalytic role is though highly valuable and should be well used. Foreign direct investments itself are extremely favorable for host countries economies, especially for the developing countries with weak budgets. And instead of blaming MNCs for underdevelopment of the periphery it could be productive to work on relationships between corporations, nation states and international community in order to boost development impact and reduce negative side effects of their activities. Multinationals are single important actors of globalization and their role will inevitably grow through the following years.

Globalization trends make it highly important for further development of energy sector to set up dialogue, partnership and unite actions of governments, business and other stakeholders. Forging partnership relations between governments, private sector, civil society and people on a global, regional and local level is a mandatory precondition for achieving the sustainable development goals, especially in the field of energy. Common vision and common goals serving interests of humanity and the planet must be the foundation of these relations.

3. Discussion

3.1. New opportunities and potential of energy sector transition and transformation

Together with the problems that humanity has to resolve, presented data shows the existing opportunities and potential as well. Energy sector transition and transformation should become the basis of the global shift to sustainable human development and new economic model.

The priority task of sustainable development is often defined as providing energy sources, especially electricity, to the world's population who still do not have access to it. In the final document “The Future We Want” of the United Nations Conference on Sustainable Development (also known as Rio+20), that took place in 2012, energy sector plays a central role: it recognizes the extremely important role that energy plays in the process of development, since access to modern sustainable energy services contributes to the eradication of poverty, saving human lives and improving their health, and also helps ensure that the basic needs of people are met (International Atomic Energy Agency, 2013).

Development of new technologies in the energy industry is one of the main drivers of change, as it determines the ways energy is produced, distributed, and consumed. Taking into account that innovation and modernization cycles in the power industry tend to last longer, it can be assumed that technologies available today will go commercial by 2050. With the increase in cost efficiency, the implementation of various low-carbon power technologies could speed up, which will significantly influence the power sector development. Companies worldwide are trying to reduce equipment costs and improve efficiency, which promotes the use of new technologies and makes them more common and competitive in the market. Furthermore, new providers emerge with new technologies, which further strengthens the competition and drives prices down. Due to such developments, renewable energy is becoming less expensive and more competitive compared to conventional technologies. New technologies could be the revolutionary solution to the main Sustainable Development Goals related to energy, by ensuring universal access, cleaner production with less environmental effect and efficient use of existing resources.

Since traditional fossil fuels still have the major part in global fuel mix and transition to alternative sources is only on it’s way, intelligent technology and advanced solutions are very important for this sphere. The conjuncture of oil prices stimulates significant changes in the oil and gas industry and forces difficult decisions to be made. The existing algorithms are critically evaluated, new approaches are sought to respond to the market dynamics of supply and demand, to solve environmental problems and to reduce the costs associated with the development of innovative energy sources. These challenges encourage major industrial players to seek technological innovations to keep costs low and at the same time improve the safety, reliability and efficiency of all processes - from the drilling site to the refinery. Sustainable development

depends on the use of the right technologies - those that will help reduce the company's capital costs and operating costs, as well as improve corporate environmental performance and safety.

Due to tightening emission limits oil production growth could be expected to be moderate. Experts have different opinions as for when the demand will reach its peak. For example, Royal Dutch Shell and Statoil forecast this to happen by late 2020s or 2030s, whereas the International Energy Agency (IEA) expects oil demand to keep growing until 2040. The development of alternative transport fuels, such as gas and biofuel, will hold this growth, taking into account the tightening emission standards, active use of electric vehicles, and the development of the relevant infrastructure. While transportation is extremely important for trade and regional development, the access to oil and its efficient use will be required in the forthcoming period.

Gas still remains one of the main energy sources. Taking into account the gradual shift towards cleaner energy sources worldwide, gas consumption could be expected to increase further. Moreover, gas has a big potential to remain the key primary energy source due to the shale gas technology that has proved to be effective both financially and technologically. This is particularly true for North America, where this technology is developing rapidly. Innovations in the area of natural gas could provide cleaner solution for base load of many emerging markets, expected to grow their energy demand in the following years.

Despite the still significant coal reserves, there now seems to be a global consensus that further development of this technology makes little sense both from the financial and from the environmental standpoint. Thus, the role of coal in most regions will most likely weaken. The global coal market is shifting towards the less developed regions of Asia and South Africa, where coal will remain the dominating fuel for decades to come. For environmental reasons, new coal projects attract less and less investments. Many countries implement carbon capture and storage (CCS) technologies on existing facilities. Such technologies are quite effective in reducing CO2 emissions, so several European countries, North America and other regions have started initiatives supporting the spread of CCS. However, the use of CCS is still associated with some issues, including the price uncertainty and the lack of infrastructure for transportation of the captured CO2. Further investments, infrastructure and development of regulation mechanisms are needed before the CCS technology can grow any further. This technology could be of particular importance for achieving sustainability of regions, where economy is still highly dependent on coal, such as China.

Renewable energy sources and their further development are going to play an important role for sustainable development, first of all because of their virtually unlimited available amounts and relatively even distribution over countries and regions, unlike traditional fossil fuels. Because of this RES can be perceived as both energy and geopolitical security factor. The importance of clean

technologies for achieving the goals related to climate change is even more significant, as they do not cause pollution and are minimally involved in the creation of the greenhouse effect. At the same time, it is important to note that in conditions of fuel competition, the organic energy resources still have economic advantages and are able to take the base load of electricity generation. Reducing costs of energy production from renewables is the major opportunity for massive development of environmental friendly energy solutions. The changes are now obvious in power generation, as the major reduction in the price of photovoltaic solar power and (to a lesser extent) of wind power has caused a surge in investments into renewables. Over the last 15 years, the standard value of solar power has decreased by 57%, and may reduce by another 59% in the future. Wind energy generated on and off-shore has reduced in price by 12 and 15% respectively, which may become 26 and 35% by 2025 (Skolkovo, 2018). Another crucial technology for RES development is power accumulation and smart grids that ensure efficient management of electricity supply and transmission. These technologies will enable wider use of intermittent generation facilities, such as wind and solar power units. The trend is universal, so it is safe to assume that both solar and wind power industries will continue growing, covering a larger part of the ever-growing demand than they do now. Small hydro turbines are also growing in popularity. This niche technology may be quite impactful on the local level, especially in the growing markets.

Nuclear power remains the only carbonless energy source that can cover the base load on the current level of technological development. Low cost of material in the overall generation cost ensures high predictability in the long term and economic competitiveness. Such issues as safety, long construction cycles, and need for large investments are becoming increasingly manageable. In the next years, a number of small module reactors are expected to come into operation, as well as several reactors of the new generation that are able to use the spent fuel accumulated in the past. These two types of reactors may be used to create multiple small nuclear plants that produce cheap electricity without CO2 emissions. The role of nuclear power could be the most important for global sustainable development and access to clean and affordable energy all over the globe with the right international policies applied to the field. The biggest driver of change in the power industry, however, will not be the development of individual technologies, but rather their convergence and efficiency. For example, the implementation of digital technologies creates new opportunities in power transmission and management and offers new solutions across the entire value creation chain, from electricity generation to client relations. Smart meters, consumption management systems, automatic demand response, and micro grids will shape the market and the power system in general. The development of power storage solutions will determine the degree of user autonomy. Internet of things and smart houses, on the other hand, might change user lifestyles, electricity demand, and energy efficiency. The development of technologies drives

changes that will transform multiple industries. For example, smart transportation systems use sensors and technologies that optimize routes and enable effective energy consumption. As technologies develop, they become cheaper, more available, and more common. Electric vehicles have become a reality. In 2016, the total number of electric cars exceeded two million and will surely keep growing, which will significantly change power demand in the transportation sector (Skolkovo, 2018). One more important factor that has immense energy efficiency potential is the new generation of materials. This includes light construction materials instead of heavy steel in vehicle manufacturing. This creates space to install additional emission control devices, electronic and other equipment (which is particularly important for hybrid and electric vehicles that charge from the grid) to reduce costs and achieve maximal energy efficiency.

Energy efficiency provide various kinds of direct and indirect benefits for national governments, population, businesses and international communities. They include resource saving, reducing ecological footprint, greenhouse gas emissions, and air and water pollution, thus improving health of people, together with reducing utility and fuel costs and enhancing economic competitiveness. The tendency of stabilizing primary energy consumption and GDP energy intensity reduction in different countries and regions is very promising. With contribution of globalization and unification of technological development between regions this tendency can be soon spread even to actively developing markets alongside with developed countries, as environmental priorities are beginning to play an increasingly important role everywhere. Innovations and the development and spreading of digital and power technologies will determine what the global energy market will look like. They will also drive changes in the developing countries, accelerating market growth and prompting the shift from conventional technologies towards new ones.

The possible assumption is that some energy sector transition scenarios may be associated with rapid transformation of energy markets, implementation of new technologies, and their convergence with other tools, whereas in other scenarios the development will be driven by the modernization of the current technologies and optimization of energy systems as such. This will be determined by regulation and supporting mechanisms, as well as by the consumer interest in using new and innovative technologies. The speed at which innovations are implemented in different scenarios will also depend on the relevant competitive ability of renewable power sources compared to mineral fuel and nuclear power in terms technology and costs, and on the availability of investments and openness of economies to sharing innovations.

To crown it all, environmental factor, changing of traditional fuel mix and energy efficiency are becoming world-wide tendencies and increasingly important priorities for the formation of a new development course, modernization and technological renewal. All these factors are

extremely important for decoupling economic growth from energy consumption and for creating new sustainable economic model.

As well as energy resource scarcity may hold some regions back in their development, energy resource wealth may also be the curse, but not necessary. There are different methods that can be used to overcome the resource curse, confirmed by the best examples of highly developed countries, such as Norway. The curse is usually linked with traditional fossil fuels as oil and gas, and first of all can be decreased by changing the fuel mix and focusing on alternative renewable sources. Still, traditional organic fuels play the major role in energy production, so the other methods for overcoming the resource curse are first of all strengthening the institutions, firm control over oil and gas revenues and their distribution, as well as financing non-energy domestic industries and social peace.

Transition from conventional energy resources to renewable ones and global energy market shift will definitely have a deep influence on geopolitics. Today extraction businesses play crucial role on both local and global political scenes due to the crude dependence of economics. In terms of growing potential of non-conventional energy resources technological progress may become more important competition factor. Renewable resources are more equally distributed across the globe, which will give the underdeveloped regions opportunity to get out of economic dependency and develop their own energy supply basis. This may lead not only to economic growth, but to the change in political power distribution across the globe.

One of the most inspiring opportunities for energy sector positive participation in peacebuilding agenda is the new field of academic research named Business for Peace. The link between energy resource exploration and possible conflicts on that basis could be not inevitable, taking into consideration presented potential of extractive companies to reduce negative effects of their actions and develop strategies that help consolidate peace in fragile contexts.

Large-scale projects in form of foreign direct investments and activities of multinational corporations in fuel extractive field are believed to have transformative potential in post-conflict and fragile regions, attracting substantial funds and not requiring developed infrastructure and local markets at the same time, which is extremely important for countries emerging from conflict. They could contribute to economic growth and provide conflict parties with mutual interests, so-called “peace-dividends”. Staying in their core filed of activities and keeping profitable, energy companies can still create conditions for sustainable peace and developing opportunities.

Innovative approach and technological improvements in the field of energy sector have potential to provide preconditions to achieving the Sustainable Development Goals related to energy, as well as other dependent areas. Positive shifts in energy extraction, production,

distribution and use are crucial for economic growth, natural and human capital of countries, as well as for sustaining peace and international cooperation.

3.2. Risks and open questions of further energy sector development

For millennia, energy had not played an essential role in international relations and global politics. The state of things changes dramatically in XX century. As capacities grew and the structure of anthropogenic energy became more complex, the energy resources in use became of increasingly high quality. Energy moved to the forefront of the world geopolitics due to the following key factors: growth of energy demand, unequal distribution of oil and gas reserves throughout the planet, increasing differences among countries in terms of availability of own resources, dependence of numerous economies on prices of oil and gas resources, reliance on external energy supplies, etc.. All these factors influence sustainable human development and create challenges to achieving its goals.

Characteristic of the forthcoming development period of global energy markets are rooted in deep transformation, increased demand of emerging markets and sharpening of competition – both direct competition in a number of markets (e.g., the market of liquefied natural gas) and interfuel competition (e.g. traditional fuels vs. renewables). Modern energy markets are exposed to fluctuations more than ever before. Recently, there was a considerable increase in uncertainties and risks in long-term development of global markets due to the impact of technological development on crude resource price. This trend is not aligned with sustainable development principles and endanger global energy security. It also brings about further difficulties in large project implementation requiring in-depth collaboration. Opportunities for minimization of these risks primarily include: concentration of global intellectual and financial resources; development of new production, extraction, transportation and utilization technologies of energy resources; environmental awareness and action (Mastepanov, 2015). Intensified international energy cooperation is necessary to address these issues and contribute to global energy security.

Sustainable human development is largely dependent on ensuring global energy security. It is a complex concept including political, economic and technogenic energy security. Nowadays there are substantial amount of risks that may create obstacles to achieving all above-mentioned. The core principle of global energy security comes into collision with the common aspirations of countries to rely on their own resources, even if they are more expensive. For example, the United States plans to return to old oil fields and to start developing new ones located in the Arctic National Reserve or on remote shelves, which entails unnecessarily high costs. Hereby, energetic independence takes precedence over energy security. National resources are turned into powerful geopolitical weapon. Markets are dominated by national energy companies, which block access to

domestic resources to independent producers. These tendencies create additional trade constrains and at the same time political risks. Stability of energy producing states is of great importance for ensuring energy security. It might be threatened by energy resources exploration and extraction in increasingly difficult conditions, difficulties with transportation and environmental damage.

The problem of lack of knowledge on the resource reserves is even more important than the problem of limited resources. Currently, experts do not know the exact amount of oil reserves. Especially little data exists on the Arab countries, due to the fact that they used to overstate the quantity of their resources in order to increase production and export quotas. Analysts cannot accurately predict the peak of world oil production (Hubbert peak). The USA passed back in 1970, then the extraction fell by almost half. The energy supplying countries try to retain state control over national resources. But this strategy is often ineffective. However, attempts by the importing countries to solve the problem of energy security on their own are also doomed to fail. One of the main features of the global energy security problem lies in the fact that unilateral actions of states do not lead to positive results. Joint efforts of all parties interested in solving this problem are required.

To create conditions for sustainable human development, new concept of global energy security should be developed with the following priorities: energy conservation, the use of environmentally friendly technologies in the extraction, transportation and combustion of fuel, the growing use of renewable energy sources and the preservation of significant volumes of natural resources for future generations (Mazur, 2008).

At the same time, effective usage of renewable energy sources and unconventional hydrocarbons does more than simply growing total energy sources. These will have a major impact on development of global energy markets, change the balance of power and traditional country split into energy exporters and importers. This development may bring about sharpening competition not only between various sources of oil and gas but also between the regions of their origin. Shale revolution, in particular, along with similar technological, technical and economic innovations, will undoubtedly aggravate competition in international oil and gas markets threatening to shrink or outright close down several of them for imported energy resources. After the global crisis of 2008, the world entered the era of turbulence, and saw increasing risks across the entire spectrum of economic decisions, including those related to the search for a new model of economic development. The future of the entire global economy and global energy in particular could be largely determined by the following factors and trends: counterweighing globalization and regionalization, the threat of energy deficit, the end of hydrocarbon era, evolution of innovative non-hydrocarbon energy, etc. (Mastepanov, Shafranik, 2014). All mentioned may become serious obstacles on the human path to sustainability.

Limited availability of energy resources, infrastructure and cutting-edge technologies could make energy resources the possible reason for political tensions and even one of the major factors contributing to armed conflicts. A dual process emerges - energy is used as a geopolitical tool and political interests exert an increasing impact on energy development.

For energy producing regions it is important to overcome the main symptoms of the resource curse, such as suppression of other economic sectors by resource-based ones, unfair competition, corruption and fragility of institutes and democracy. Similar risks may be applied to large-scale investments in energy resources extraction and production in fragile contexts and regions emerging from conflicts. Post-conflict regions and countries in transition might not have enough capacity and institutional strength to manage the sector and revenues and to control resource rent and possible malversations. Fragile institutions and political system prevents effective distribution of resource rents and therefore the possibility of economic development and creating conditions for sustainable peace.

To sum it up, long term priority of the global energy strategy should be minimization of economic, social and environmental risks to create conditions of achieving sustainable human development in the forthcoming period. Most of these risks are interdependent and systematic. International community's response to emerging problems and challenges should take the form of qualitative evolution and quantitative expansion of international cooperation in the area of energy. Only this approach could add sustainability to the energy sector development and the entire global economy. The challenges facing humanity today represent new opportunities to adequately resolve them and respond to them.

Conclusion

The current thesis gives a wide overview on modern trends in energy sector and evidence of their influence on sustainable human development agenda and peace. The contribution of this thesis is that it focuses on the central role of energy for human civilization itself and presents deep interdependence of main development goals and current global energy strategy. Provided data also shows the potential of energy business to contribute to global peace by creating economic and social conditions for it.

Earth population is growing, and with it the need for electricity. In order to provide a reliable power supply, four main tasks related with energy should be accomplished: ensuring continuous supply of energy and its availability to end-users, shift to renewable and safe sources, energy efficiency and environmental safety. For the sustainable development of the energy system, it is necessary to introduce changes throughout the entire chain of energy conversion, starting with the use of different fuels for its production and transmission and ending with the optimization of consumption.

Trends in energy production and consumption and industrial changes affect human lives on macro- and microeconomic levels, as well as whole institutions of society. On global level satisfying energy needs of civilization and providing energy security is impossible without international partnership and mutual strategy of nations. However, cooperation is often dismissed with intra- and interstate tension and conflicts rooted in unequal resource distribution and massive capital investments needed for production of energy. According to collected data, influence of access to energy sources is not that predictable. Development of renewables puts expectations on energy sources redistribution as a boosting factor for economic growth and political independence of underdeveloped regions. Moreover, energy resource development has potential for peace-positive influence in fragile and post-conflict contexts. Investments in energy projects may encourage dialogue between stakeholders, provide “peace dividends” and significantly increase the cost of conflict, creating conditions for sustainable peace.

The results of the current thesis could be useful for reviewing the wider picture of current trends in energy sector and their explicit and implicit influence on sustainability of world economy and peace agenda. It also outlines the bottlenecks of contemporary global energy strategy together with potential opportunities for further development.

References

Arezki R., Bhattacharyya S., Mamo N. (2015): Resource Discovery and Conflict in Africa: What Do the Data Show? CSAE Working Paper Series 2015-14, Centre for the Study of African Economies, University of Oxford.

Azikiwe, A. (2014): "Burkina Faso: Masses Rise Up Against Neo-Colonial Rule." Global Research. Centre for Research on Globalization. Available on https://www.globalresearch.ca/burkina-faso-masses-rise-up-against-neo-colonial-rule/5411706

Auty R. M. (1993): Sustaining Development in Mineral Economies: The Resource Curse Thesis. London: Routledge.

Babkin A., Novikov A (2013): Teoreticheskie aspekty i tendentsii globalizatsii ekonomiki, Globalizatsiia ekonomiki i razvitie promyshlennosti: teoriia i praktika, pp. 33—59.

Bailey, Ford, Brown, Bradley (2015): Investing in Stability. Can Extractive-Sector Development Help Build Peace? Chatam House, The Royal Institute of International Affairs.

Bannon I., Collier P. (2003): Natural resources and violent conflict: options and actions. World Bank.

Basedau, M., Jahn, L. (2009): Resource curse or rentier peace? The ambiguous effects of oil wealth and oil dependence on violent conflict. Journal of peace research, 46(6): 757-776.

British Petroleum (2017): Statistical Review of World Energy. Available on: http://www.bp.com/content/dam/bp/pdf/energy-economics/energy- outlook-2017/bp-energy-outlook-2017.pdf

British Petroleum (2019): BP Energy Outlook. 2019 Edition. Available on https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019.pdf.

Brunnschweiler, C., Bulte, E. (2009): Natural resources and violent conflict: resource abundance, dependence, and the onset of civil wars. Oxford economic papers, 61(4): 651-674.

Chatham House (2014): Resource development in fragile and conflict-affected states: can it promote peace? Workshop Summary. Available on: http://www.chathamhouse.org/event/resource-development-fragile-and-conflict-affected-states-can-it-promote-peace.

Collier P. (2003): Natural Resources, Development and Conflict: Channels of causation and Policy Inteventions. WorldBank.

Collier, P. (2006): Post-Conflict Economic Recovery – A paper for the International Peace Academy. Department of Economics, Oxford University. Available on: http://users.ox.ac.uk/~econpco/research/pdfs/ IPA-PostConflictEconomicRecovery.pdf.

Conciliation Resources (2012): New Ways to End Old Wars. Available on: http://www.c-r.org/resources/seminar- report-new-ways-end-old-wars.

Cotet, A., Tsui, K. (2003): Oil and conflict: what does the cross country evidence really show?

American Economic Journal: Macroeconomics, 5(1): 49-80.

D+C, development and cooperation (2015): Dossier about emerging-market multinationals, Available on https://www.dandc.eu/en/briefings/multinational-corporations-emerging-markets-are-forces-be-reckoned-long-term.

Damania, R., Bulte, E. (2003): Resources for Sale: Corruption, Democracy and the Natural Resource Curse. Univ. of Adelaide. Available on https://www.adelaide.edu.au/cies/papers/.

Dobbs, Oppenheim, Thompson, Brinkman, Zornes (2011): Resource Revolution: Meeting the world's energy, materials, food, and water needs. McKinsey Global Institute.

Drucker (1997): The Global Economy and the Nation State. Council on Foreign relations.

Edwards, I., (2018). The role of decentralized renewable energy in peacebuilding. Quaker United Nations Office, Geneva. Available on: https://quno.org/sites/default/files/resources/QUNO_Role%20of%20DRE%20in%20Peacebuilding_FINAL%20WEB.pdf

ExxonMobil (2018): 2018 Outlook for Energy: A View to 2040. Available on https://corporate.exxonmobil.com/en/~/media/Global/Files/outlook-for-energy/2018-Outlook-for-Energy.pdf.

Forbes (2019): U.S. Renewable Power Capacity Surpasses Coal For The First Time. Available on: https://www.forbes.com/sites/rrapier/2019/06/10/u-s-renewable-power-capacity-surpasses-coal-for-the-first-time/#56655b41655b

Forrer J., Katsos J. (2015): Business and Peace in the Buffer Condition. Academy of Management Perspectives. Available on: https://www.researchgate.net/publication/287150216_Business_and_Peace_in_the_Buffer_Condition

Galtung, J. (1964): An Editorial. Journal of Peace Research. 1(1).

Galtung, Johan (1969). "Violence, Peace and Peace Research". Journal of Peace Research. 6.

Global Footprint Network (2019): Open Data Platform. Available on https://data.footprintnetwork.org

Gurgiev S. (2008): The economy of "the resource curse". Economic issues. No4.

Gylfason, T. (2000): Natural resources, education and economic development. CEPR Discussion Paper 2594.

Haslam, Schafer, Beaudet (2009): Introduction to International Development. Approaches, Actors, and Issues, Oxford University Press.

Hawken, P., Lovins, A., Hunter, L. (2000): Natural Capitalism: Creating the Next Industrial Revolution. US Green Building Council; 1st edition.

International Atomic Energy Agency (2015): Contribution to Avoided GHG Emissions. Climate

Change and Nuclear Power 2015. Vienna, p 122.

International Atomic Energy Agency (2013): Energy and sustainable development. IAEA Bulletin 54-1. Available on: http://www.iaea.org/Publications/Magazines/Bulletin/Bull541/Russian/Bull54_1_Mar2013_ru.pdf.

Institute for Economics and Peace (2016): Positive Peace report 2016. Available on http://visionofhumanity.org/app/uploads/2017/02/Positive-Peace-Report-2016.pdf

International Energy Agency (2018): World Energy Outlook. Available on https://www.iea.org/weo2018/.

International Petroleum Industry Environmental Conservation Association (2008): Guide to Operating in Areas of Conflict for the Oil and Gas Industry. Available on: http://www.ipieca.org/publication/guide-operating-areas-conflict-oil-and-gas-industry.

International Renewable Energy Agency (2018): Global Energy Transformation. A roadmap to 2050. Available on: https://www.irena.org//media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_Report_GET_2018.pdf

Kharecha P. A., Hansen J. E. (2013): Prevented Mortality and Greenhouse Gas Emissions from Historical and Projected Nuclear Power. Environmental Science & Technology, Available on: http://pubs.acs.org.

Klare, M. (2012): The Race for What's Left: The Global Scramble for the World's Last Resources. Metropolitan Books.

Kokorin A. O. (2017): The Paris of the UN Climate Agreement: The Present and Future Impact on the Economies of Russia and Other Countries. Available on: http://www.imemo.ru/files/File/ru/conf/2016/11022016/11022016-PRZ-COCK.pdf.

Koubi, V., Spilker, G., Bohmelt, T., Bernauer, T. (2013): Do natural resources matter for interstate and intrastate armed conflict? Journal of Peace Research 51.2: 227-243.

Le Billon P. (2006): Fuelling War: Natural Resources and Armed Conflicts, Adelphi Paper 373, IISS & Routledge.

Lee, B., Preston, F., Kooroshy, J., Bailey, R. and Lahn, G. (2013): Resources Futures. London: Chatham House. Available on: http://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy,%20Environment%20and%20Development/1212r_resourcesfutures.pdf.

Makarov A., Grigorev L. (2016): Prognoz razvitiia energetiki mira i Rossii. INEI RAN—ATs pri Pravitel'stve RF. Moscow.

Martinez-Soliman, M., Fernandez-Taranco, O. (2017): Sustainable development and sustaining

peace: Two sides of the same coin. United Nations Development Programme. Available on https://www.undp.org/content/undp/en/home/blog/2017/7/20/Sustainable-development-and-sustaining-peace-Two-sides-of-the-same-coin.html

Mastepanov A. (2015): Energetic situation in the context of new challenges and geopolitical realities. Presentation on the Third Russian-German Conference "Through innovation to energy efficiency", Berlin.

Mastepanov A., Shafranik Y. (2014): Russia's energy: selecting development path under new conditions. Energy policy, issue 5, 2014, pp. 21 – 31.

Mazur I. (2008): Global energy security. Age of globalization. № 1-2008, p. 57-69. Available on: https://www.socionauki.ru/journal/articles/129825/

Meadows, D. H., Meadows, D. L., Randers, Behrens, W.W.III (1972): The Limits to Growth. A report for The club of Rome's Project on the Predicament of Mankind. Potomac Associates - Universe Books.

Medard Gabel and Henry Bruner (2003): An Atlas of the Multinational Corporation. The Press.

Miklian J., Schouten P. (2019): Broadening 'business', widening 'peace': a new research agenda on business and peace-building. Conflict, Security & Development journal. Available on: https://www.tandfonline.com/doi/full/10.1080/14678802.2019.1561612

Natural Resource Governance Institute, (2015): Myanmar. Available on: http://www.resourcegovernance.org/ countries/asia-pacific/myanmar/overview.

Nelson, J. (2000): The Business of Peace: The private sector as a partner in conflict prevention and resolution. London: The Prince of Wales Business Leaders Forum, International Alert, Council on Economic Priorities. Available on: http://www.international-alert.org/sites/default/files/publications/The%20 Business%20of%20Peace.pdf.

Nuclear Energy Agency, International Atomic Energy Agency (2018): Uranium 2018: Resources, production and demand. Available on: https://www.oecd-nea.org/ndd/pubs/2018/7413-uranium-2018.pdf.

OECD Nuclear Energy Agency (2000): Nuclear Energy in a Sustainable Development Perspective. Available on: http://www.oecd- nea.org/ndd/docs/2000/nddsustdev.pdf.

Oetzel, J., Getz, K. and Ladek, S. (2007): The role of multinational enterprises in responding to violent conflict: a conceptual model and framework for research. American Business Law Journal, Vol. 44, No 2, pp. 331–58. Available on: http://auapps.american.edu/~oetzelj/ABLJ,MNEsandConflict.pdf.

Panina, N.V. (2005): Global conflicts of new and newest time. Moscow, ID 06117.

Parenti, C. (2012): "The Limits to Growth": A Book That Launched a Movement. The Nation. Available on https://www.thenation.com/article/limits-growth-book-launched-movement/.

Parenti, M. (2011): The Face of Imperialism. New York: Paradigm Publishers.

Polterovich, V. (2007a): Mechanisms of “the resource curse” and economic policy // Economic issues. No 6.

Polterovich, V. (2007b): Democratization and economic growth. Social sciences and modern times. No 2.

Ratne,r B., Meinzen-Dick, R., May, C., Haglund, E. (2013): Resource conflict, collective action, and resilience: an analytical framework. International Journal of the Commons 7.1: 183-208.

Ross, M. (2015): What have we learned about the resource curse? Annual Review of Political Science 18: 239-259.

Sachs, J.D., Warner, A.M. (1995): Natural resource abundance and economic growth. Available on https://ideas.repec.org/p/nbr/nberwo/5398.html

Sachs, J. D. (2015): The Age of Sustainable Development. Columbia University Press.

Sachs, J. D. (2018a): Energy for the Common Good. Available on https://www.project-syndicate.org/commentary/climate-change-pope-ecumenical-patriarch-by-jeffrey-d-sachs-2018-06.

Sachs, J. D. (2018b): China’s Bold Energy Vision. Available on https://www.project-syndicate.org/commentary/china-global-renewable-energy-grid-by-jeffrey-d-sachs-2018-04.

Sachs, J. D., Woo W.T., Yoshino N., Taghizadeh-Hesary F. (2019): Handbook of Green Finance. Asian Development Bank Institute. Available on https://link.springer.com/referenceworkentry/10.1007%2F978-981-13-0227-5_13

Simmons, M. (2000): Revisiting The Limits to Growth: Could the Club of Rome Have Been Correct After All? Available on https://www.resilience.org/stories/2000-09-29/revisiting-limits-growth-could-club-rome-have-been-correct-after-all-part-one/.

Skolkovo (2018): New sight on energy future: development scenario till 2050. Available on: https://iems.skolkovo.ru/downloads/documents/SKOLKOVO_IEMS/Research_Reports/SKOLKOVO_IEMS_Research_2018-03-19_ru.pdf

Smil, V. (2010): Energy Myths and Realities: Bringing Science to the Energy Policy Debate. AEI Press; First edition.

Smil, V. (2017): Energy and Civilization: A History. The MIT Press.

Stijns, J.P. (2006): Natural resource abundance and human capital accumulation. World Development. Available on https://www.sciencedirect.com/science/article/abs/pii/S0305750X06000453?via%3Dihub

Sweetman, D. (2009): Business, Conflict Resolution and Peacebuilding. Contributions from the private sector to address violent conflict. Routledge. Available on: https://www.taylorfrancis.com/books/9780203875704

Tverberg, G. (2015): There is too much of almost everything. Business Insider. Available on https://www.businessinsider.com/there-is-too-much-of-almost-everything-2015-5.

Tverberg, G. (2016): How researchers could miss the real energy story. Available on https://ourfiniteworld.com/2016/10/27/how-researchers-could-miss-the-real-energy-story.

Tverberg, G. (2017): Why 100% Renewable Energy Is Just A Dream. Available on https://oilprice.com/Alternative-Energy/Renewable-Energy/Why-100-Renewable-Energy-Is-Just-A-Dream.

Tverberg, G. (2019): The true feasibility of moving away from fossil fuels. Available on https://ourfiniteworld.com/2019/04/09/the-true-feasibility-of-moving-away-from-fossil-fuels/

Turner, G., Alexander, C. (2014): Limits to Growth was right. New research shows we're nearing collapse. The Gueardian. Available on https://www.theguardian.com/commentisfree/2014/sep/02/limits-to-growth-was-right-new-research-shows-were-nearing-collapse.

Vernadsky,V. (2012): Biosphere and noosphere. Moscow, Iris-press.

United Nations (2016): 0/262. Review of the United Nations peacebuilding architecture. Resolution adopted by the General Assembly on 27 April 2016. Available on https://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/70/262

United Nations (2019): The Sustainable Development Goals Report. Available on https://www.un.org/sustainabledevelopment/progress-report.

United Nations Development Programme, (2017). Renewable Energy Serves as a Peacebuilding Catalyst in Sudan. UNDP Press Center, June 18 2017. Available on: http://www.sd.undp.org/content/sudan/en/home/presscenter/articles/2017/06/18/renewable-energy-serves-as-a-peacebuilding-catalyst-in-sudan-.html

United Nations Environment Programme (2016): Global Material Flows and Resource Productivity, report. Available on http://www.resourcepanel.org/reports/global-material-flows-and-resource-productivity-database-link.

United Nations Global Compact (2009): Business for peace. Available on: https://www.unglobalcompact.org/take-action/action/peace

United Nations Conference on Trade and Development (1999): World investment report.

Union for the Co-ordination of Transmission of Electricity (2016): Integrating Wind Power in the European Power Systems — Prerequisites for Successful and Organic Growth. Union for the Coordination of Transmission of Electricity (UCTE). Available on: http://UCTE-integratingwindpower.pdf.

Wiegand, K. E. (2012): Bahrain, Qatar, and the Hawar Islands: Resolution of a Gulf Territorial Dispute, Middle East Journal, Vol. 66, No 1, pp. 79–96.

World Nuclear Assosiation (2016): Electricity Storage at Utility Scale. Renewable Energy and Electricity. Available on: http://www.world-nuclear.org/ information-library/energy-and-the-environment/renewable-energy-and-electricity.aspx

World Bank (2019): More People Have Access to Electricity Than Ever Before, but World Is Falling Short of Sustainable Energy Goals. Press release. Available on https://www.worldbank.org/en/news/press-release/2019/05/22/tracking-sdg7-the-energy-progress-report-2019.

World Bank Open Data. Available on https://data.worldbank.org/.

World Health Organization (2016): Ambient Air Pollution: A global assessment of exposure and burden of disease.

Yergin, D. (1993): The Prize: The Epic Quest for Oil, Money, & Power. Free Press

Zhiznin S., Timokhov V. (2017): Impact of energy on sustainable development. World economics and international relations, vol. 61, No. 11, p. 34-42.