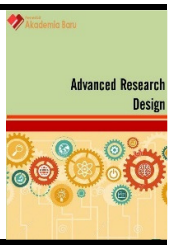
Penerbit Akademia Baru

Journal of Advanced Research Design

Journal homepage: www.akademiabaru.com/ard.html
ISSN: 2289-7984



Global Energy Security and Eastern Europe: A Review

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ARTICLE INFO

Article history:
Received 18 January 2018
Received in revised form 22 March 2018
Accepted 28 March 2018
Available online 9 June 2018

ABSTRACT

In this recent years, energy security has been actively studied. European vitality security challenges have changed significantly in the previous 20 years. From one viewpoint, the current strains amongst Russia and the EU are undermining heir verifiable organization on vitality; on the other, profound changes in the vitality scene at the worldwide level, activated by innovative advances and major geo-political changes, are driving the EU to revaluate its vitality security system. The point of this paper is to talk about Eastern Europe vitality security in a changing worldwide. Furthermore, this paper will give a review on the energy market and the energy security strategy in Eastern Europe country.

Keywords:
Global energy security, Eastern Europe (EU), Russia and the EU, vitality security, energy security strategy in EU.

1. Introduction

Globalization become one of the factor for the energy demand to increase. As the demand increase, higher supply of energy is required. This rapid globalization then leads to rapid depletion of energy resources [1]. Energy security can be defined as uninterrupted physical availability of energy sources at an affordable price to meet future energy demand [2,3]. Energy security can be in term of source availability, consumer affordability and environmental sustainability for energy development [4]. Concerns over energy security have raised worries about the reliability of electrical power supply due to blackout happened in United States and also shortages of electrical power in developing countries [5]. Energy is important in order to keep the economics of the country to run smoothly [6]. Mostly the important goal of energy policy for many importers countries in the world is security of supply whilst energy exporters seek for security of demand and fair price [7,8]. The inequality in energy source distribution among the country had raised insecurity among the country for the energy

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availability in the future [8-10]. The country without energy resources will depend greatly on the country with resources.

European EU nations purchase the greater part of their vitality from non-EU sources [11,12]. Since interest for vitality is developing in the EU, reliance on remote providers will increment after some time. A large number of the vitality imports begin from flimsy districts and providers related with a considerable danger of supply interruption, which puts European nations under genuine weight [13]. Excessive gas dependency on Russian gas take toll on security risk for European Union where Eastern Europe becoming one the key battlegrounds of the energy game [14,15]. Crisis between Russian and Ukraine in 2009 raised concern for European Union energy security of supply [16]. This concern eventually causing policy maker to revise the internal and external dimension of the European Union energy security strategy [17]. European Union mostly depend on Russia for its energy supply source as Russia abundant in source. This factor eventually makes Russia among the big energy market player in Eastern Europe [18,19].

Eastern Europe is part of eastern side of European continent[20]. Geographically, among the country that consider in the eastern part of Europe is Belarus, Ukraine, Russia and Georgia [21]. The Nord Stream pipeline built on the bottom of the Baltic Sea is designed to transport gas from Russia directly to Germany and then further to other EU countries effectively bypassing countries of Central and Eastern Europe who are faced with losing transit fees as a significant source of their revenues [15,22].

This paper will give a review on global energy security focussing on Eastern Europe. Eastern Europe as the transit country and also as the customer in the gas transport plays a role in the policy maker of energy security. Focussing on Eastern Europe, this paper will give a review on the energy market at Eastern Europe. In addition, this paper also will discuss about the energy security strategy for the Belarus, Ukraine, Russia, and Georgia.

2. Energy Market of Eastern European

A state of transition in energy market is currently undergoing in the states in Eastern Europe – East Germany, Hungary, Poland, Bulgaria, Czechoslovakia and Romania. This one of many aspects signify their overall transition from previously communism to a more liberal economic and political systems. The developments in future energy sectors in Eastern Europe as well as the Soviet Union will significantly impact the energy market developments and world oil, as these countries collectively are the world's largest oil and gas producers and the second largest energy consumers [19].

The Central European and the Soviet Union states, which also known as The East Bloc, until recently were as a group of nearly self-sufficient in energy. These countries were connected to the world due to their net exports of coal, oil and gas, whereby another direction of the trade flow was minimal. Until this day, there was a complementary relationship established among the six Eastern European countries and the Soviet Union. The Eastern European countries have imported 1.6 million of barrels per day (mbd) of oil in 1988, where the huge majority of this amount, roughly around 1.5 mbd, were imported from the Soviet Union. The Soviet Union has exported 3.1 mbd of oil in total. Meanwhile, the remaining half of these exports went mainly in the Western Europe, to the OECD countries. These exports of Soviet crude oil were primarily piped to the bloc countries through export pipelines (to Poland and East Germany, built in the 1960s, and to Czechoslovakia and Hungary, built in the 1970s). The contract was against Rubles which were cheaper and easier to earn than hard currency, as its terms permitted the Eastern European countries the capability to possible buy Soviet crude oil at favorable conditions. Previously, the Soviet Union repudiated policies to increase crude

exports at these terms, and it cut down deliveries to Eastern Europe in 1988. In the future, the hard currency payments requested by the Soviet Union will increase to a larger share [19].

As for the current energy market, the national energy markets full integration into a global EU internal electricity energy market, which was targeted in 2014, imposed a great challenge for the power markets of the European. These days, East-Central Europe countries have currently considered as recent power markets and are not fully known by the occidental market players. On the other hand, among other possible repercussions, the establishment of this single European energy market, provide them a more significant part in comprehending the evolution of European power prices [23]. Meanwhile, in other markets, various determining factors contribute to the price formation and they are relatively different according to countries depending on their resources, neighboring countries and others too numerous to mention [23].

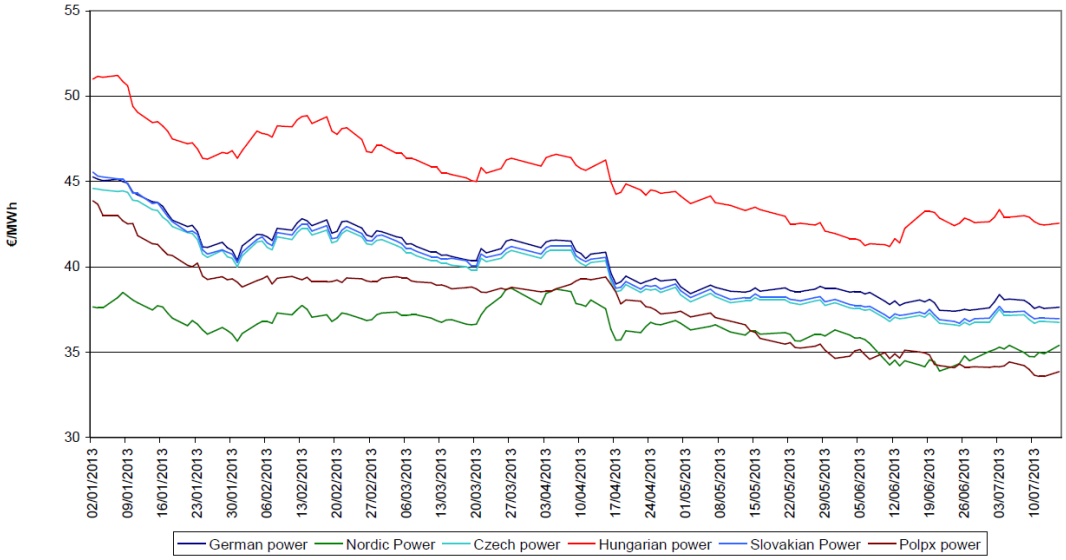


Fig. 1. Calendar 2014 contracts in Central Eastern Europe, Germany and Nordic countries in 2013 [23]

According to the above graph, "Calendar 2014" contract evolves in a similar way in the six CEE countries (Czech Hungary, Republic, Romania, Poland, Slovenia, and Slovakia). All of the markets are collectively on backwardation, shown in the graph. This trend signify a higher production and a lower renewable consumption in Europe in general – not specified to East-Central Europe.

If all of the contracts are linked, this correlation is notably brazen for the Czech and Slovakian contracts. These two neighboring countries have strictly the similar evolution according to the "Calendar 2014" contracts, and both of these two countries follow the German contract. Since the beginning of the year, the three contracts have settled in a 0.5€ range. Furthermore, most of the times, the day-ahead of Czech and Slovakian are equal (graph below) [2,3].

From the graph above, due to partly high taxes, the evolution of the Hungarian contract is at a higher level than the Czech and Slovakian contract, although they have the same evolution (the correlation between the Czech and Hungarian Calendar is 0.971). Meanwhile, Poland gains advantage from the lowest electricity prices in the Northern Europe, resulting this country, among all CEE countries, to have the cheapest Calendar 2014. There are however, many factors which can explain the particularities of each CEE countries [2,4,5].

In term of renewable energy, the policy strong differs from one CEE country to another. Slovenia, Slovakia, and Romania have reached the EU goal of a having total 20% of renewable share in their

energy mix. This accomplishment is strongly contributed by their high hydraulic productions [3,5]. Poland, the Czech Republic and Hungary however, contrarily, are struggling to implement their energetic transition [19]. For the past few years, Hungary has made a tremendous improvement, aided by the governmental subventions. It has launched and developed its own biomass and wind production but still far and a lot more efforts required in order to reach the EU goals [2,3].

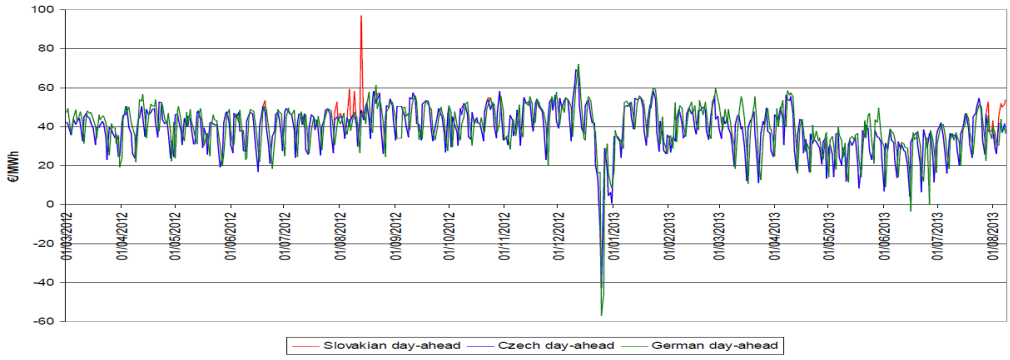


Fig. 2. Czech, Slovakian and German day-ahead since March 2012 [23]

Meanwhile, the Czech Republic, which targeting a 13% of renewable energy in its energy mix by 2020, has already reached to its maximum hydraulic capacities. The country is not geologically and environmentally favorable to develop its renewables production. It does not have abundance of areas with good wind conditions to sustain its wind farms. Poland, on the other hand, is reluctant to develop its renewable energy. In 2011, the country has only 7% of renewable energy share in the total power generation, whereby the majority of it comes from cogeneration. Poland is openly unwilling to change this trend and preferring on slowing the EU climate negotiations by rejecting all quantitative targets, as per what it similarly did with the EU "Carbone 2050" March 2012 plan [14, 19, 23, 24].

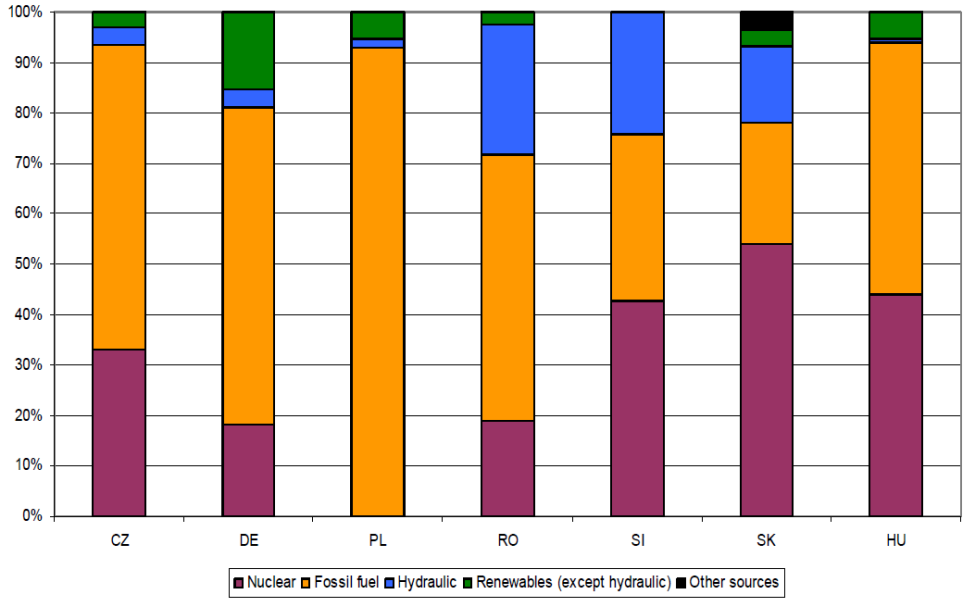


Fig. 3. Mix energetic in CEE in 2011 [23]

3. Belarus Energy Security Strategy

Belarus is a landlocked country surrounded by the Russian Federation, Ukraine, Lithuania, Poland and Latvia. At the end of the World War 1, the Soviet troops has occupied Belarus and since then, the state had been incorporated as part of the USSR under the name of Belarusian Soviet Socialist Republic in the year 1919. At the end of the Russo-Polish war, the state has been divided two region and not until 1939, that the Soviet troops has manage to recover part of the land. Belarus since then, has been independent state in the year 1990 that marks the end of the Soviet regime for almost 60 years. It is on July 1990, that the Republic of Belarus had been established as part of the former Russian commonwealth nations. In the year, the elected President of Belarus that goes by the name Alexander Yukashenko has manage to secure the post in the first ever national general election and continue to do so for the next four terms until the year 2016 [26]. After gaining independence, Republic of Belarus has managed to apprehend and control its economic performance and since then, in the year 1996 steadily growing economic status has boost the GDP of the state due to the orientation of its economic framework towards the social axis that are favourable by both the Russian and the EU to invest due to the quality of the Belarusian good and an increase in the labour productivity.

Generally, the Belarusian energy sector rely heavily upon hydrocarbon sources of fuel such oil, coal and natural gases especially the natural gases that compose of 66% of the total amount of source to generate 97.1% of energy production and other relevant sector. The natural gas supply is use heavily on the heat production purposes and the electricity production. It is estimated that about 80% of Belarus centralized heating station utilize natural gases and about 95% of the country electricity production rely heavily upon natural gases as the main primary fuel supply. The table below represent the energy balance of the Republic of Belarus in 2008.

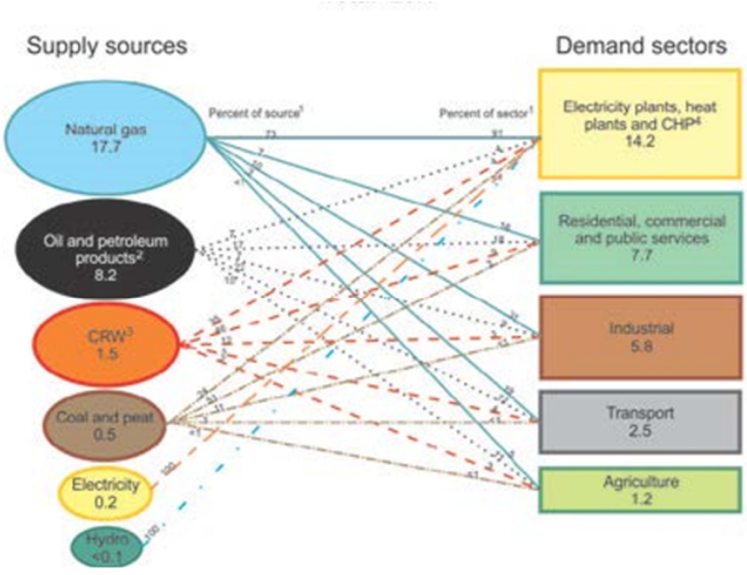


Fig. 4. Energy balance of the Belarusian primary energy flow by sources and their respective sector in 2008[26]

From the above figure, the energy deliverance and supply of Belarus state must have increased dramatically over the years due to the improving economic condition and the recently established

independent and sustainable energy security policy. As described before, the natural gases supply are exclusively coming from the Russia side through Gazprom's Yamal-Europe gas pipelines signifying the hegemonic control of the Russian over the state's energy security issues. Amid the monopolization of the Russian's private owned government company the Gazprom, over the natural gases supply to the entire Eastern European region, the Belarusian parliament has agreed to constitute a focus energy policy strategy in which to deliver greater energy independence for the former USSR satellite state. The seven focus area are [27]

1) Energy independence
2) Diversification of energy resources and suppliers, decreasing the share of dominating energy supplier from 90% in 2015 to 70% in 2035.
3) Reliability of energy supply, reservation and processing of fuel and energy resources.
4) Increasing the energy efficiency of the end consumption of fuel and energy resources through the introduction of the new technologies and materials in the manufacturing and the services centre, construction and housing, reduction of the energy intensity of GDP of approximately 37% by 2035 from the level of 2010.
5) Economic and energy efficiency of energy generation and distribution.
6) Affordability of the fuel and energy resources for consumer, elimination of the cross subsidization of the electricity and heat tariffs.
7) Integration over the global energy system, development of the international cooperation with the Eurasian Economic Union, the EU and the leading energy organizations such as the International Energy Agency and the International Uranium Enrichment Centre

The initiator of the focus energy policy became more relevant after three big crisis that involve the forceful restructuring of the Belarus energy market by the Russian. Starting in 2004, the failure to adapt the Union idea between the former satellite state and the Russia under the proposed Federation concept has caused the Gazprom to double the natural gas prices has forced the Belarus to increase the tariffs and taxes of the Russian military based in the Belarusian soil. The, Belarus response not only failed miserably but also, caused the Russian to take non-compromise action by completely stopping the gas delivery by the Gazprom. Even so, another Russian private company goes by the name "Trans Nafta" have agreed to support the Belarus energy demand during the crisis alleviating the heavy damage done to the Belarus energy market[26]. However, the support Belarus received was only for a short while when the "Trans Nafta" have orientated their company objective from the business domain to the political one. The company suddenly refused to provide any means of energy supply to the Belarus state citing that, an abundant amount of natural gas supply has already been taken by the Belarusian side and no new contracts has been signed between the two parties. The energy crisis seems to spiral down severely until President Lucashenko of Belarus reached a diplomatic solution with the Kremlin few days later. The second energy crisis that take place in the year 2006/2007 saw another Russian dominion over the Eastern European energy market. In 2006, the Gazprom without any consents or agreement with their clients has approved to increase the prices for the natural gases supply for every post-soviet states by doubling the amount from the original value. Luckily, only the Belarus state that is successfully maintaining its price value near the market value. Even so at the beginning of the 2007, the next wave of price increase started to emerge.

The Gazprom suggested that the Belarusian needed to pay an amount of USD 200 per tonne forcing the Belarus state to renegotiate again their term with the Russian. The Gazprom exclusively stated that the lowest they can go for the Belarus state is USD 105 and no longer below than the minimum value. However for the Belarus, the highest value they could pay is around USD 75 per tonne contradicting the Russian expectations. In order to dissolve the problems, under the one sided

agreement, the Belarus agreed to pay to the Russian for over USD 100 per tonne of natural gas supply invoking Russian aim to control the eastern energy market. Based on this agreement, Vladimir Putin outlined a strategy for the Russia that: "Russian will not give up taking control of the pipelines infrastructure in the former territory of the Soviet Unions". In the latest series of energy crisis that take place in the year 2010, The Kremlin disagreed with the Belarus initiative to diversify its energy policy citing that it will increase the vulnerability of the Russian energy market dominion due to the presence of the another strong political power. During the time, the Belarus state aims to include new energy key player in the region by inviting investor from Iran, Venezuela, and even Ukraine to provide sustainable energy import. The Kremlin respond in this context, by increasing the price tariffs of the export duties towards the crude oil prices and other important commodities for the people. By doing so, the Belarus is being pressurized by the external power prompting major shift in their energy security framework.

Even after the energy crisis of 2004, a new approached regarding the risk of reducing their energy security risk has been clearly defined in a clear cut manner. Energy crisis in this sense can be defined as the shortage of fuel and energy resources, taking into account the ratio of prices and domestic demand, which can be paid in the absence of the possibility of finding an alternative in the short term. By the year 2005, the Belarus Security Council has already agreed that energy security issue along with the rural development planned has been assigned as the top objective of the government policy. Both issue, has been prioritized firstly to combat social backwardness and energy dependence market in the Republic of Belarus. From the time it was proposed, the Belarus concept of the energy security has been greatly modified several times depending on the state of relation with its neighbouring countries. However, the issue of the energy security never clearly made it to the political domain of the Belarus government forcing the idea to never undergo any powerful reformation that involves any legal actions. Even so, a series of strategic documents has been emerging since the introduction of a more liberal energy market in the region since 2004 itself.

For the Belarusian government, energy security is defining as maximum high level of certainty of fuel and energy resources supply for the sustainable socio-economic development, meeting all the criteria of energy independence and political autonomy and to minimization of damage in case of the emergency. The Belarusian government believe that self-sufficiency concept should be strong enough to no longer rely and being dependent on the external sources at the same time, have the capabilities to deliver alternative energy supply when needed. The philosophy of protectionism has been adapted inside the definition of the energy security in order to provide a solid framework that protect the overall energy interest of the Belarus people. In order to achieve the focus energy policy that promote independency, several key factors are very important to be implemented which are[28],

1) Energy resources needed to be deliver at a reasonable prices that are affordable by the people at an economically reasonable prices yet, will help reduce the risk of the possibility of another energy crisis in the state.
2) The need of an existence of a long term agreement between any lateral parties to ensure continuous supply of energy resources and their implementation parallel to the guided criteria with respect to the economic and ecological reasonability.
3) The diversification of the raw material by 20 percent.
4) Economical usage of the energy resources

The key factors will serve as the guidelines tools for the Republic of Belarus to determine the best possible impact of the energy diversification policy. It will function as a setting criteria to describe the best possible condition in which the country could obtain by implementing those policies.

On the other hand, besides achieving the self – sufficiency state of a country, the Republic of Belarus also encourage its public in reorienting their economy structure to be less dependent towards high intensity energy demand added that with the outdated and weak production assets. In other words, the government encourage its people to be more reasonable in energy demand by optimizing the amount of energy use in the industry that only produce product that could support large growth of the Belarus economic structures. In terms of the energy intensity for industrialization utilization, the Republic of Belarus hold a high value if compared with the other European countries. The table below shows the energy intensity between the European countries:

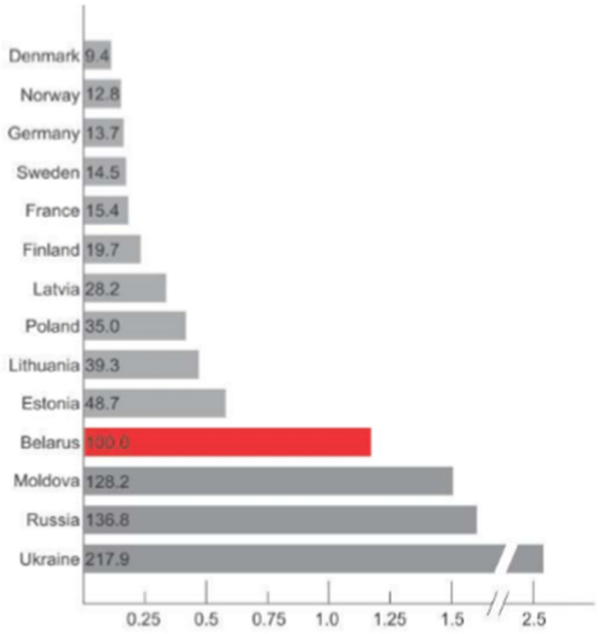


Fig. 5. Energy intensity comparison between the European countries in 2008[26]

Currently as the Russia play a key role in providing a subsidized natural gas supply to the Belarus, the economic productivity of the state has been steadily increasing even so, the changing global game of technological development adding the need to remain competitive, a new structure of economic strategy needed to be adapted to remain relevant, optimize and sustainable that is a function of the political strategy and environmental concern. Thus, both parameters should orientated the Republic of Belarus economic model to be more efficient and productivity and yet, consuming less energy intensity and the search for the new economic growth should also be incorporated energy security considerations. Table 1 shows the Belarus state target objective by the year 2020 using the energy independence policy.

Moreover, as the Republic of Belarus itself do not have significant source of fossil fuels reserve, this implies that the government needed to restructure their energy market by diversifying and introducing energy generation method to include solar, wind , water and even the nuclear energy. Besides that, to secure their political strength and sovereignty, the government also encourage the usage of natural domestic resources such as peat, straw, wood, secondary energy resources and even biogas to produce electrical energy. Such method will help maintain ecological security and sustainable development of the Republic. Currently, the domestic dependent energy sources has

started to replace the import energy sources in the energy balance sheet to secure the energy demand. The initiative is expected to replace 2.4 billion metre cubic of imported natural gas supply from the Russia thus, reducing the energy dependency towards them. In addition to that, Belarus also had cooperated with Iran in a joint-venture scheme to develop a natural gas and crude oil field located in Joifer. This strategy would allow greater dilution of the Russian influence in the region and secure energy supply for the Republic of Belarus[29]. Moreover, Belarus also has started to be more cooperative with the European Union by imitating their energy diversification policy for the purpose to scar out the Russian hegemonic control. Republic of Belarus even supported for the development of Liquid Natural Gas pipelines across Poland and Lithuania for the same purpose. Another method of energy diversification adapted by the Republic of Belarus is the introduction of the nuclear power. Even though this strategy would only encourage the Russian to intervene in their energy market through Rosatom nevertheless, an agreement has been made on 2011 that provide a solid cooperative framework between the Russian and the Republic of Belarus to developed nuclear technology for the peaceful purposes. In that agreement, the Russian agreed to provide 90% of loan to the Belarus as the initial heat cost of building two unit of 1194MWe of nuclear power plant. The nuclear power plant is expected to be operated in the year 2018 and 2020.

Table 1
Belarus target energy policy [26]

Factor	Target for 2009 (Percentage)	Target for 2015 (Percentage)	Target for 2020 (Percentage)
Reducing the energy intensity of GDP compared to 2005	24.8	50	60
The share of domestic energy sources in the balance	20.3	28-30	32-34
The share of natural gas in the energy consumption	71.8	64	55
The share of the dominant supplier in the final energy	82.3	70-71	57-64
Ensuring the store capacity of gas represented in days	61.2	78.9	118

The Republic of Belarus, even though Kremlin demonstrate a series of risk in propagating severe political issue in terms of energy security yet for them, Russia will still be a relevant strategic partner in terms of energy supplier and provider. As said by the President Lukashenka, “They (Russia) are our traditional market we buy and will buy energy from here. Stepwise however, our countries should increase the volume of the supplies via other route. We should fly, as they said in Belarus “On two wings” “[26].

4. Ukraine Energy Security Strategies

Since the February Revolution of 1917 that saw the rising power of the Ukrainian people against the USSR (United Soviet Socialist Republic), the country had undergone several political turbulences that would only solidify the Russian interest in the region. Under the agreement of the Belavesha

Accords between the USSR and the satellite states in the mid-1970s, the diplomatic movement will force the official dissolution of the USSR regime and the establishment of the fully independence commonwealth state including Ukraine[30]. Even so, the agreement made by the former President of Ukraine Leonid Kravchuk along with Boris Yeltsin of USSR and with Stanislav Shushkevich of Republic of Belarus, has failed to remove the Russian hegemonic influence across the eastern region including the Ukraine from interfering with their political climate. Rather, the agreement will mark the shift of Ukrainian energy policies to be more dependent towards the Russians rather than the E.U (European Union) in supplying important amount of fuel to meet the energy demand of the Ukrainian's. Until today the political crisis that involve the annexation of Crimea through the Russian clandestine policy have bring the countries spiralling down into an all-out civil war period in which until today, no political solution has ever been succeeded in unifying the ongoing political struggle between the pro-Russian or the pro-Europeans. From the perspective of the energy security, the Ukraine has import an abundant amount of coal and natural gas from the Russia for electricity generation purpose. Even so if the condition is to be compared with the other Eastern European countries, relatively Ukraine are the least dependent towards the Russian energy supply that only generate about 55% from the total electricity generation. The table below summarize the 2011 data of the Ukraine energy dependency percentage towards various source of fuels,

Table 2
Data of Ukraine energy share 2010[28]

Source	Consumption	Imports	TPES share	Electricity Generation share
Crude Oil	14.2 Mt*	55%*	7.2%	0.3%
Natural Gas	64.6 bcm	69%	37%	9.5%
Coal (all types)	64.1 Mt	20%	32.8%	38.2%
RES	-	-	2.1%	5.7%**
Nuclear Energy	-	-	18.7%	46.3%

* 2010 data
** Hydro stands for 5.6% of Electricity Generation Share
Note: 2011 data

Even so in terms of energy consumptions, the Ukraine still holds the record between the Eastern Europeans countries likewise, 12.4 Mt of crude oil and 64.6 bcm of natural gas alone are needed to generate annual electricity for 2011 only [31]. Thus, the Ukraine have high dependency of importing energy from the non-domestic sources to ensure sustainability of its energy security. In terms of crude oil, the energy source are imported from the several trunk-pipelines that connect the Russian federations and the Ukraine located at the places called Druzhba and Prydniprovski in the Russian soil. However, the current ongoing political conflict of the Crimea annexation from the Ukraine has forced only one of the refineries facilities called Kremenchuk refinery out of seven unit to still be fully functional at the time. The collateral damage from the ongoing civil conflict has put the stress effect towards the economic line causing severe social unrest and uncertainty in terms of the energy security issue. The table below represent the percentage contribution and ownership of each refinery facilities available in the Ukraine:

Table 3
Data of Ukraine energy infrastructure ownership 2010[27]

Refinery	Owner	Capacity
Odessa	VTB Bank OAO	2,8 / 3,9
Lysychansk	TNK-BP	7,2 / 16,0
Kherson	Continuum Group	? / 7,1
Kremenchuk	Privat Group (57 %), Naftogaz of Ukraine (43 %)	8,0 / 18,6
Drohobych	Privat Group (75 %), Naftogaz of Ukraine (25 %)	2,0 / 3,3
Nadvirna	Privat Group (74 %), Naftogaz of Ukraine (26 %)	2,2 / 4,0
Shebelinka	UkrGazVydobuvannia	1,0 / 1,2
Note: capacity in Mt/y; first figure is technical (maximal available) capacity, the second is installed capacity		

Even so, Ukraine also have their own several natural gas supply line originating from the natural gas fields of Dashava in the west and Krestihe and Shebelinka in the east. From these sources, the Ukraine could generate 31% of its energy demand domestically without relying on any external parties. At the same time, current finding also suggest that the existence of the unexplored oil field located at the region of the Azos and the Black Sea could become a major potential in driving the domestic energy industry. Moreover, it is also suggest that a new natural gas field could exist in the Ukrainian soil untapped and unexplored which could provide an amount of 11.5 Tcm far exceeding current value of the energy demand. In order to remove the shackle of Ukrainians energy security from the dominant control of the Russian's Gazprom, the energy diversification policy has been highlighted to preserve the influence of the government towards its people and to maintain its sovereignty of directing the orientation of the national energy security framework from the influence of any form of clandestine movement. To further reduce the Russian hegemonic control, the Ukraine government have agreed to allow the Chinese people from the People Republic of China, to invest heavily in the development of natural gas supplies as part of the diversification policy of the energy sector. This in turns over time, will generate friendly competitive environment between the Russian and the China private investor to win the contract and trust of the Ukrainian people.

At the same time, the strategy will help the Ukraine to pressure the Gazprom to sell the natural gas at a more affordable and competitive prices. Moreover, the Ukraine government had already signed an amount of USD 3.65 billion with the China Development Bank to assist in the financial sector of building quality facilities for the exploration and distribution of the natural gases. Besides that, other types of power plant such as coal and nuclear have been extensively facilitate either to improve their lifetime extension or by building a new set of power plant facilities. In terms of nuclear power, the Ukraine government have generated an amount of 46.3% of power production from the nuclear sources that makes it one of the most important energy generation technology in the region. Currently, a number of 15 units of energy generator in four operating nuclear power plant has helped produced an amount of 13835 MWe annually for the Ukrainian's. All the power plant facility in the Ukraine are government own facilities under the operational team directed by the National Nuclear Energy Generating Company headed by the Ministry of Coal and Energy Industry of the Ukraine. Yet in the midst of current political crisis, the energy demand of the Ukraine has undergo a series of fluctuation trajectory that alter the significance of the energy industry. If less demand is provided by

the people, the energy industry might suffer a setback in terms of overproduction of energy supply by the external parties which may heighten the cost of electricity generation of the Ukraine people due to the less return of investment but high initial capital cost. Albeit that, over time, the energy industry demand has risen again due to the reduction of the political tension between different axis of believe of the Ukrainian people. The table below shows the energy demand pattern of the Ukraine people from the year 2013 which is the starting period of the Crimea annexation into Russian territory[30]

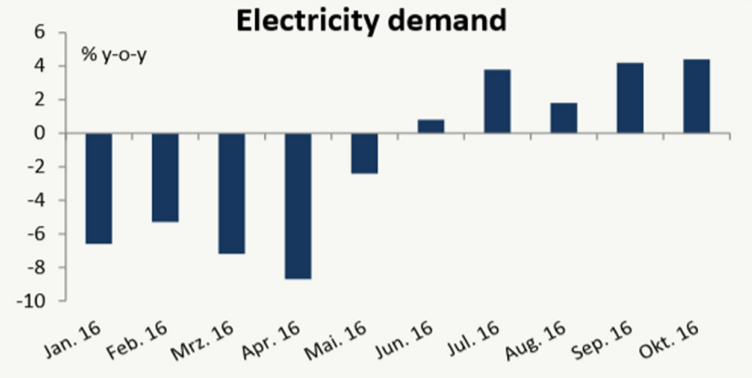


Fig. 6. Ukraine electricity demand 2013[27]

The sectoral situation of the Ukraine have been deteriorating for the last five years owing to the civil conflict that have been driven by the Russia presence. The rising prices of the imported natural gas supply, the reduction of the transit volume of natural gas that coming into the Ukraine and degradation of the large network of pipelines materials have place a sheer strain towards the Ukraine stability. Moreover, the recent crisis between the Russia and the Ukraine regarding the Crime state has altered fundamentally the bilateral relation between the two countries. Currently, with the rising energy demand, the Ukraine need to spend 8% of its GDP annually on energy import only to par with the demand consumption. Such order, has limit the leverage power of the Ukraine against its neighbour especially the Russia causing the later to seek political dominion in the former region. Such condition already been favoured by the Gazprom since it already has exerted its full economic and political dominance to achieve the minimum strategic goal for the Russia. In 2015, Russia supply 29.4% of the EU natural gas, 25.8% of the solid fuel supply and 27.7% of the oil imported from the former. All of the different energy supply given to the European Union must pass through the transit countries whereby, a third of Russia energy supply is passing through the Ukraine. It is believed the dependency of the Russian towards the Ukraine as a transit countries have provide a space of political leverage for the later one. Even so, the advantages give to the Ukraine would not last longer should two network pipeline which are the Nord Stream 2 and the Turkish Pipelines completely constructed. Both the newly constructed pipelines will degrade the Ukraine position as an important transit countries of energy supply which will limit its political leverage in the region and also along with the other European countries. Such condition would also place constraint on the amount of natural gas supply that are coming from the western world to the Ukraine. This will provide an advantages for the Russia to sell natural gas at a higher prices to the Ukraine even though the business is conducted in a competitive market environment due to the lack of equal competition parties among the energy suppliers. The picture shows the planning for the Nord Stream 2 pipelines:

Fig. 7. Image of Nord Stream 2[27]

Thus, in order for the Ukraine to still remain important and relevant within the region and for the purpose to regulate the natural gas prices, a new set of economic model which focus more on the integrated economic system needed to be adapted within the Ukraine economic framework. On August 2017, the Ukraine adapted the newly oriented economic model that will their energy security strategy through the homogenous relation with the European Union (EU). The newly adapted energy security strategy will bolster greater security in terms of energy production, supply and consumption adding up with the important energy criteria of energy efficiency, renewable technology development and the market integration with the other European Union countries. This strategy has been divided and planned in three phase's implementation: from 2020 to 2025 and 2035. At the initial stage, the most important achievement is the energy market reformation that needed to take place entirely within the energy market of the Ukraine by the year 2020. The reformation of market in this perspective, refers to the development and utilization of Ukraine's own domestic energy supply such as natural gas and coal to be used for the energy sector production and other relevant industries. Coal market in the Ukraine is expected to be developed maturely and flourished under the newly adapted energy security policy and several already established coal mining facility would also undergo reformation in terms of organizational arrangement and the economic directions for the market to be more competitive and relevant. The Ukraine government are seeking control of any form of private energy company to orientate their company direction par to the new energy security policy. Moreover by 2020, 8% of the total energy production of the Ukraine will be delivered in forms of renewable energy sources such as solar and wind power to compliance with the Ukraine commitment towards preserving the natural condition of the environment.

The second stage of the plan which will take place in the year probably 2025, will focus more towards the complete integration process of the Ukrainian Electricity system with the European Network of Transmission System Operator (ENTSO-E)[31].Such strategy will provide the Ukraine with

a powerful allies that could secure their energy security interest which is independency from the Russian influence. Other than that, it will provide the country a strong political motivation to maintain the utilization of the Ukraine as the transit countries in the region to undo the Gazprom spreading influence by the construction of the vast network pipelines that by passing the state. Moreover, the plan also aims to attract a group of elite investor from the European Union to help rebuild the Ukraine energy market and to liberalize its economy from the grasp of the Russian state control. By doing so, the Gazprom will no longer be the only major key supplier of the natural resources but also, other private company will start to sprout in the region which will place a heavy competition condition with the former. The formation of newly private or government own company, will pressurize all the parties to reduce the process of its natural gas supply at a more competitive level which is very beneficial for the country that consume it such as the Ukraine itself. The new investment also would provide adequate liquidity for the Ukraine to develop new energy infrastructure, to launch the new power generating sources that could replace the old power generation technology to boost energy efficiency and to improve the efficiency of district heating utilities to combat winter climate. It is also expected that by the year 2025, even the energy sources for the heating purpose will be utilize through the domestic productions.

The last stage of the planning that are expected to take place in the year 2035 or earlier will be, for the Ukraine to launch a national greenhouse gas trading system whereby taxes will be charge upon any company that surpasses the limit of Ukraine environmental control standard. At the same time, the objective to decrease the pollution and diversify energy production using the renewable energy sources will be highly recommended to accommodate about 25% of the total energy productions[32]. The market integration with the European Union would not only bring positive imparts in terms of economy perspective but also, deliver better and quality power generation technology by following the European standard. Moreover during all the proposed stages, initiative of adapting towards the nuclear technology would also be non-negligible as the later will help decarbonize of the Ukraine energy supply. To achieve all of the planning phase, Ukraine's national policy on the national integration required full reformed based on the previous agreed EU-Ukraine Association Agreement and the Treaty Establishing the Energy Community. The legal agreement not only will help the Ukraine to establish a solid integration policy but also, would transfer European Union positive value, practices and experiences to the region energy market that has undergo stagnant for quite number of years. Cooperation with the European counterpart would provide strength for the Ukraine to overcome all of the difficulty lies ahead and to become a fully functional integrated system within the framework of the EU energy sector which proven to be beneficial for both sides. The EU-Ukraine Association Agreement aims at providing the cooperative result focusing upon "the enhancement of the energy security of both side, competitiveness and sustainability".

The agreement also encourages for both side to promote the economic growth and making progress towards full market integrations. The integration would be possible to promote the unification of the technical ability and capacity of both regions in developing natural gas infrastructures, Ukrainian natural gas storage hub and other related infrastructure that are strong and reliable, which would solidify the effort of both sides to reduce energy security risk under the Gazprom strong political dominance and at the same time, creating a competitive market environment. The integration of the Ukraine power network with the ENTSO-E would potentially increase the export of the energy supply to the Ukraine by 18-20 billion kilowatt hours[31] thus, dramatically reducing the dependency of energy supply by the Gazprom. Both side also had agreed that the agreement would provide a deadlock mechanisms for both parties to ensure commitment and efficient energy services. Therefore, if one of the side fail to fulfil the obligations of the respective agreement criteria then, the efficiency of the cooperation will be decreasing dramatically resulting in

great economic loss for both side. The only stumble block between the cooperation of the European Union and the Ukraine is the construction of the Nord Stream 2. Thus in this respect, to strengthen the agreement, the European Union will provide full support for the Ukraine by acknowledging the Ukraine as an important transit countries to secure the energy interest of both parties. Furthermore to exacerbate the effect of mutual cooperation, the European Union itself will continuously be in a state of demanding energy supply from the Russia through the Ukraine. It is a clear cut political interest whereby both sides are trying to secure their energy interest through the suppression of the Gazprom influences by recognized ruling mechanisms which provide strong political motivation that will significantly increase the positive impact of the mutually beneficial agreement between both sides.

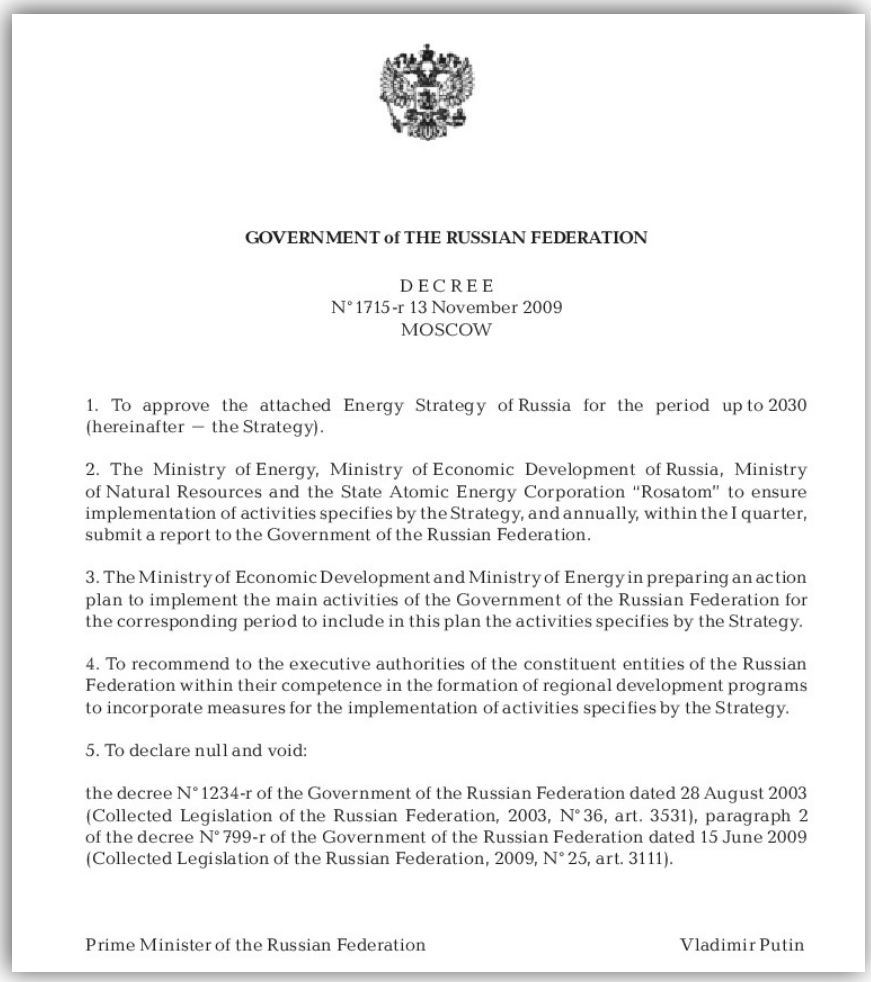
5. Energy Security Strategy of Russia

As we know, the production and consumption of energy resources is very important for the world. Russia is one of the country that rich with energy resources. This rich country is the fourth world producer of electricity as third largest generator of nuclear power, third producer and second world exporter of crude oil, fourth producer and first world exporter of refined petroleum products, second producer and first exporter of natural gas [33]. Russia also is in the top ten countries by proved reserves crude oil as the producer and largest proved reserves of natural gas. Fuel and Energy Complex (FEC) of Russia is not only important in Russian economy sector but also most important in global energy market even beyond doubt. In 2012, share of Russian FEC in both GDP and Russian producing industry was coarsely 30%, about 51.7% share in tax revenues to the republic's financial plan and 65.9% share in export incomes [34]. Crude oil industry fortifies 20.2%, natural gas industry also secures 6.6% and followed by coal and electricity industry of 29.7% share of FEC in GDP. Even in the export revenues, crude oil industry share is the most secured (approximately 50% of total export) which followed by natural gas industry (roughly 14.4%) and also the rest by electricity and coal industry.

FEC of Russia comprises of crude oil-extracting and petroleum refining industry, nuclear power, natural gas and coal industry, fossil fuel industry, pipelines, grids and other transmission infrastructure. Russian FEC not only providing country's demand but also preserving energy security and its competitiveness on the global market for the last several decades. FEC are functioning as supplying the economy with energy in the following mandate: the production of primary energy resources and their transportation and transformation, as well as the supply of gas, electricity, heat, and oil products to end trades [35]. Furthermore, FEC is vital for preceding Russian Federation economic stability where its role developed due to a variety interference on the way of development of Russian economy, occasional instability, and general unpredictability. State of FEC in Russia expresses internal stability and geopolitical potential of Russia in the region.

Russia has its own energy policy where the objective is to capitalize on the effective use of natural energy resources and the prospective of the energy sector to withstand economic growth, enhance the population value of life and stimulate strengthening of foreign economic positions of the country [35]. Whereas executing the Energy Strategy of Russia for the period up to 2020, approved by Decree N° 1234-r of the Government of the Russian Federation (Figure 8) the validity of most of its key provisions was confirmed by the actual development of the country's energy sector even underneath conditions of abrupt modifications of foreign and domestic factors determining the major operating parameters of the Russian fuel and energy complex. Energy Strategy of Russia for 2020 also specified that the document should be amended where necessary at least once in 5 years. The Strategy extends the time period up to 2030 with new goals and priorities for the country development. The main

objective of the Strategy is to set up innovative and efficient energy sector in Russia meeting the energy needs of a growing economy, as well as the foreign economic interests of the country and ensuring the necessary contribution to the country's social-oriented and innovative development.



GOVERNMENT of THE RUSSIAN FEDERATION

DECREE
N° 1715-r 13 November 2009
MOSCOW

1. To approve the attached Energy Strategy of Russia for the period up to 2030 (hereinafter – the Strategy).

2. The Ministry of Energy, Ministry of Economic Development of Russia, Ministry of Natural Resources and the State Atomic Energy Corporation "Rosatom" to ensure implementation of activities specifies by the Strategy, and annually, within the I quarter, submit a report to the Government of the Russian Federation.

3. The Ministry of Economic Development and Ministry of Energy in preparing an action plan to implement the main activities of the Government of the Russian Federation for the corresponding period to include in this plan the activities specifies by the Strategy.

4. To recommend to the executive authorities of the constituent entities of the Russian Federation within their competence in the formation of regional development programs to incorporate measures for the implementation of activities specifies by the Strategy.

5. To declare null and void:

the decree N° 1234-r of the Government of the Russian Federation dated 28 August 2003 (Collected Legislation of the Russian Federation, 2003, N° 36, art. 3531), paragraph 2 of the decree N° 799-r of the Government of the Russian Federation dated 15 June 2009 (Collected Legislation of the Russian Federation, 2009, N° 25, art. 3111).

Prime Minister of the Russian Federation Vladimir Putin

Fig. 8. Decree N° 1234-r of the Government of the Russian Federation [33]

The purpose of the Energy Strategy 2020 (ES-2020) was - the most effective use of natural resources and ability of energy sector for the determinations of sustainable economic growth, upgrading of quality of life, and promotion of the country's global interests [35]. As stated in ES-2020: "Russia has meaningful resources of energy and effective fuel-energy complex, which is a foundation for financial system development, tool for leading internal and external politics. Role of the country on the world's energy markets largely determines its geopolitical impact. Energy sector provides vitality of all areas of countrywide economy in various methods determines formation of main financial and economic indicators of the country" [35]. As suggested in the strategy, Russian energy industry is vital for further growth and improvement of quality of life. ES-2020 set the main goal: define methods to achieve a contemporary state of energy complex, and growth of competition capacity of its products and services on a worldwide market [35].

November 13, 2009, second Energy Strategy was approved, for the period till 2030 [36]. ES-2030 merely saved the old prophecy: the goal was to maximize consumption and surge of effectiveness of

energy complex in order to sustain economic growth, improve the quality of life and enhance the country's global function. ES-2030 also shaped new priorities of development of energy industry in frames of transition of Russian economy to an innovational development, – the vision that was introduced as part of a Concept of a Long-Term Socio-Economic Development of Russia till 2020 approved a year before ES-2030 was approved. The Concept determined the strategic goal of Russia as formation of qualitatively brand new Russia that complies with a profile of a global chief in the twenty first century [37]. The need for innovations collectively with growing targets of the country was determined by many factors: comparative strengthening of socioeconomic quality of Russian national economy, world financial crisis, developing ambivalence towards Russia on the global political arena, exploration of Arctic, reformation of military, further - Gas Exporting Countries Forum was officially established in Moscow and first summit of BRIC was carried out in Yekaterinburg [37]. Trade of accents in the vision on the role of energy industry in Russia from ES-2020 to ES-2030 was in numerous techniques an expected transition for the once to be one of the utmost powers of the world that fell into a detrimental revolutionary reorganization. The country got out of the entire chaos of 1990th, gained power and by the end of first decade of the twenty first century appeared to be a completely different power.

February 17, 2014, Analytical Center for the Government of the Russian Federation together with Ministry of Energy of Russian Federation (MoE) and Russian Union of Industrialists and Entrepreneurs organized first public forum deliberating Energy Strategy 2035 (ES-2035) where the project was virtually unanimously acclaimed. As of March 2015, Minister of Energy announced that it is planned that corrected ES-2035 will be considered by the government summer 2015 to discuss energy strategy of Russia till 2035. Project ES-2035 brings revolution even though ES-2030 had a small points made about necessity to giving up FEC as a main industry in Russia. The main idea of ES-2030 is FEC must be an engine for development of nation's economy and upgrade to stimulating infrastructure for development of Russian economy [35].

A. Energy Strategy 2020 (ES-2020)

There are some assumption of expectation from ES-2020 where GDP evolution times 3.3 by 2020 compared to 2000 rate, evolution of investments in capital assets times 7, high world prices for Urals crude oil (up to 30 usd/barrel) and natural gas (138 usd/1000 cubic meter), GDP per person 179.2 thousand rubbles/person and share of FEC in Russian industry would be 19.8% versus 29.5% in 2000. Enthusiastic scenario was based on effective implementation of economic reforms, liberalization of market, effectiveness of energy industry, favorable trade relationships with different nations and successful integration with World Trade Organization that would allow favorable keys of transit and transportation issues for energy industry. The significance of formation of a unified energy transit infrastructure in bordering regions of Europe and Asia was mentioned in the ES-2020. The scenario was characterized by the high level of energy effectiveness and rapid downsizing of energy intensity.

Worst case scenario of ES-2020 presumed complete and speedy-paced recognition of economic reforms, in conditions of unwanted external circumstances, oriented towards rapid diversification of economy and reducing social burden for the budget. In other words, adverse combination of internal and external conditions (to begin with - low oil prices and demand for assets) would dictate the need to perform bulk of reforms that would "lead to negative economic growth rates and social anxiety in first years. However it would allow to free economy from burdens of reforms in future [38]. ES-2020 predicted to obtain following basic results which decreasing energy intensity to GDP and growth of energy effectiveness (energy intensity would decrease from 22% in 2000 to 13-15% in 2020). Internal demand for primary fuel and energy resources would be absolutely satisfied, in the identical time fuel and energy expenditures per person would moderately grow against faster growing personal

income. Every year FEC revenues would develop with aid of 1.5 by 2010, with accumulated tax increased by 1/3. Export of energy resources would develop about 45-64% by 2020, which might fulfill sustainability of country's balance of payments, and strengthen its economic state and influence.

B. Energy Strategy 2030 (ES-2030)

ES-2030 confirmed that most of the errands posed by ES-2020 have been brought to action. The mechanisms of energy policy such as electrical power reform, liberalization of electrical power market, reform of nuclear power, advent of favorable tax environment in energy industry and realization of infrastructure projects that enforce development of country's energy industry were executed [39]. Though the final qualitative effects of the primary stage of strategy's implementation were not accomplished. Explicitly those results comprise formation of a basis for a sustainable development of energy industry such as formation of authorized statutes, introduction of fair competitive market, finalizing energy efficiency reorganization for concerning industries, and most significantly the transformation of FEC leading role back to its natural feature as an effective and stable supplier of fuel energy resources for the desires of the economy and population. Major changes in basic economic indicators had happened in 2008 [40]:

- Urals crude oil price raised from 27 USD/barrel in 2000 to 94 USD/barrel in 2008, which exceed predictions by 4.
- Fuel and energy resources exportation raised 1.6 times from 2000 to 2008, exceeding the expectations of ES2020 by 9.6%;
- GDP propagated 65% from 2000 to 2008, which was an 11% deviation from ES-2020
- Actual surplus of extraction and production of fuel and energy resources was 26% compared to 2000 – 2.6 deviation from projections
- Internal demand for fuel and energy resource propagated 10% compared to 2000 – 5% deviation from projections (as explained by the worldwide economic crisis).

ES-2030 above all pointed out a aim of making innovational and effective energy industry that among everything else secures innovational development of the country, determines necessity for raising effectiveness of the industry, favorable institutional environment, national economy's integration into world energy exchange in particular further integration in European and Asian space and modernization and renewal of energy industry infrastructure [39]. By the time ES-2020 was due for an update, the global crisis changed expectations of original strategy. In 20082009 developers of ES-2030 admitted that specific route for innovational development and accomplishment of focal goals possibly exchange. The hypothesis about relations between national economy and energy industry of the updated strategy determined by the decrease of dependence of national economy on energy industry which will be evaluated as decreases in following indicators by 2030 in comparison to 2005 [35]:

i. Share of fuel and energy complex in GDP and its share in export – not less than by 1.7;
ii. Share of fuel and energy resources in GDP – more that by 3 times;
iii. Share of capital investments in FEC in percentages to GDP – not less than by 1.4, and its share in the total capital investments – more than by 2;
iv. Energy intensity in GDP – more than by 2, electricity intensity in GDP – not less than by 1.6.

In the same time, it was stated that in frames of ES-2030 the role of FEC is vital for significant strategic tasks of the country's development. Building of recent energy infrastructure could be also vital for development of Siberia and Far East regions. ES-2030 complements to the list of the expected effects mentioning significance of transition to a sustainable innovational manner of development:

i. Required development of energy industry infrastructure to increase efficiency of the industry;

ii. Russia must grow to be a regional leader in energy security of Eurasia by excellently influencing price policy on regional market making it predictable and stable, complete integration with Eurasian energy transit system, securing export-import relationship through an active communication;
iii. Russian energy industry should be completely renewed – it should be fresh, high technological, operative, and sustainable, and should not only rely on resources, but also on human capital and innovational potential;
iv. Provision of energy security for Russian Federation and all its regions;
v. Exploration of new regions.

In the light of necessity for larger corrections in energy strategy than expected, ES-2030 proposed 3 stages, different from what was presumed in ES-2020 [39]:

i. First stage – retrieval from crisis and formation of nuts and bolts for new economy, exploration of chances that exist during crisis for qualitative renewal and modernization of the industry. This stage is characterized via renewal of infrastructure and static production assets, including finishing in advance started most important projects, exploration of territories and areas in phrases of further development of infrastructure, accomplishment of basic market and legal tools and system of governmental regulation in energy industry. The times frames for ending of the second stage would be conditioned by the duration and strength of the crisis.
ii. Second stage – transition to innovational development and formation of infrastructure of latest economy system. The main emphasis of the stage would be elevating energy performance in FEC as the result of the first stage modernization of constant production/capital assets and finishing legal frameworks and institutional reformation, realization of projects in East Siberia, Far East, Arctic, and Yamal. Starting of innovational renewal of FEC, it was expected that FEC would give in its positions as a frontrunner account of national budget in favor of innovational sources of growth.
iii. Third stage – stage of innovational economy development. The stage would be characterized by the new technology and transition to energy of future. Third stage was alleged to be finalized by 2030.

6. Energy Security of Georgia

The economic policy issues of Georgia has been controlled by the German Economic Team Georgia (GET Georgia) which advices the government and state authorities concerning the issues [41]. Any issues that appear will be discussed and presented to the high-level decision maker during the regular meetings. Under the TRANSFORM programme, this body will be financed by the German Federal Ministry of Economic Affair and also its successor. Securing the energy supplies play an important role for public and their private life. This is because energy affect the production factor of all sectors such as for lighting, heating, transportation, cooking and other basic needs [42]. Hence, any shortage even if for several seconds can lead to gigantic effect to the surrounding people, the affected industry and also might affect the country itself.

Georgia is located in a geopolitically sensitive area which makes the energy security to be important and not to under estimate the energy supply from foreign countries. The most memorable disaster which yet to be solved was during January 2006 that causes explosion of the Russian gas pipeline and electricity transmission line to Georgia [43]. The disaster leads to the potential economic cost of one-off supply disruption and also the political cost of non-stop threats. This is why GET

Georgia needs to minimize the probability of any energy supply disruptions from occurring by taking variety measures.

Georgia have a strong average fuel mix which comes from the local production as well as the energy produce by import sources. 35% of the total energy production comes from local production which mainly produced from biomass and hydropower. This makes the overall energy consumption for Georgia relatively low at 790 ktoe.

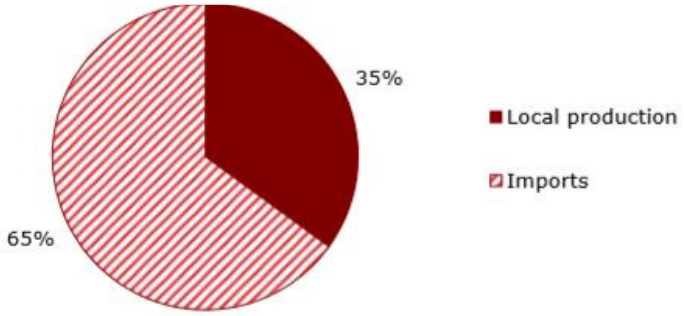


Fig. 9. Energy balance for Georgia in 2012[44]

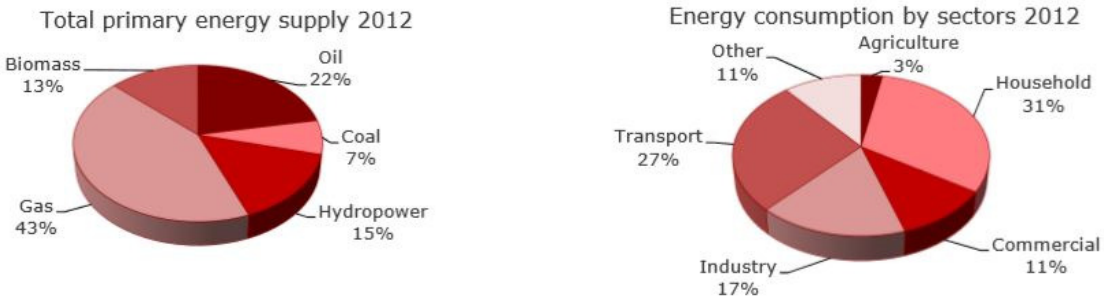


Fig. 10. Energy supply and consumption in 2012[44]

Georgia is an electricity exporter and the infrastructure at the Black Sea Ports give the easy access to oil and coal for the country[45]. The good relationship towards the neighbouring countries help Georgia to compensate the failure of major domestic generation assets. Georgia also getting a stable gas supply from Azerbaijan which consist of 43% of the country energy mix. Azerbaijan has a difficulty to stop from supplying gas to Georgia because the country is an important route for Azeri gas. Even if there will be political based of supply disruption from Azerbaijan, Georgia can rely on Russia to bring the import gas to Armenia and also Turkey which technically has the capability to transport the supply to Georgia. This shows that the supply for Georgia is really strong and can be easily maintained if any unwanted scenario happened.

However, a well secured supply of energy is not a well-defined concept. This is because it is only a first approximation that the total consumption of a certain type of fuel that was imported from a single country. It is well known that most of fuels and supplies are partially exchangeable which means that an over-pessimistic picture can be provided from current import shares. Moreover, important details such as the weather and seasonal pattern can results in different exchange rate. So, the true factor that affect the outcome of energy supply pattern are the projected fast growth of

natural gas for fuel mix, the vulnerability of critical infrastructure for gas, and lastly the compliance with European regulations [46].

7. Challenges due to increase of gas consumption

Natural gas is the most commonly used in producing electricity as this source is one of the best energy carrier because of the versatility, clean and also easily accessible characteristic. This makes Georgia heavily depend on this source which currently supply by Azerbaijan and will be increasing by double of its current amount by 2030. The drastic increase of the demand in natural gas can be easily fulfil by Azerbaijan since the South Caucasus pipeline that was built in May 2006[47]. This pipeline can transport up to 8.8 bn cubic meters (bcm) per year and it is also planned to be extended up to 25 bcm in foreseen future.

Table 4
Energy balance in million cubic meter (mcm)[44]

	Today	2020	Potential
Consumption	2,200	2,900	
Domestic production	0	0	0
Total Import	2,200	2,900	
- AZE	2,200	2,900	20,000
- ARM (IRN)	0	0	2,500[5]
- RU	0	0	8,500[6]
- TUR	0	0	Potential reverse flows
Storage	0	0	300-700

The table above shows the variety of main suppliers for Georgia energy supply, the routes of transportation, and also the amount of fuels that is transported. Currently and in 2020, the main supplier for Georgia supply is Azerbaijan but in 2030, there is potential for Georgia to have more than 1 main supplier which will be depend on Armenia, Russia, and turkey which increase the energy imports from 43% to 62% by 2030. The import dependency was predicted to be increase up to 77% compare to previous percentage which is 65%[48].

Table 5 Gas consumption forecast in ktoe [44]

	2014	2015	2020	2025	2030
Natural Gas	1,806	1,896	2,420	3,089	3,942

The next issue will be the dependency on gas is unevenly distributed over the year. Since the hydropower is the main energy source for Georgia during summer, there is almost no natural gas that will be consumed during this season. But during winter where most of the hydro reservoirs are completely frozen, the energy will be produce by natural gas again especially for heating purpose[49]. The Table 3 above shows the specific detail and its prediction for future consumption of natural gas.

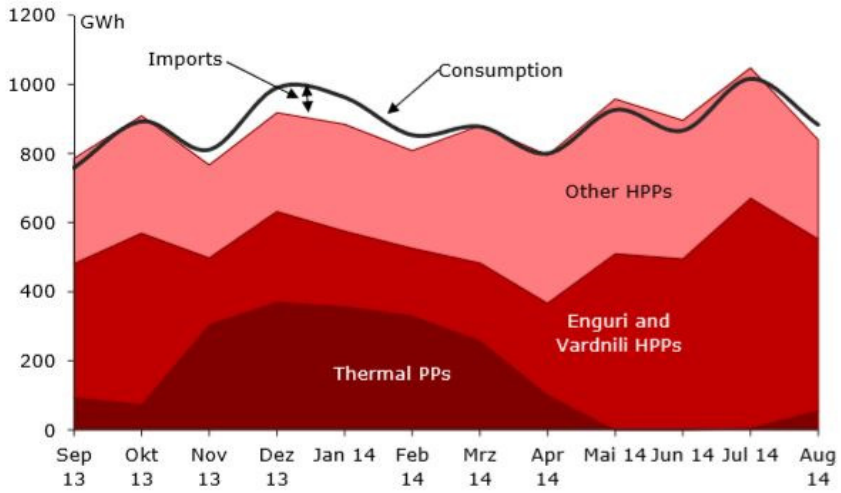


Fig. 11. electricity balance by supply sources from September 2012 to August 2013 [44]

Figure 11 shows the electricity balance by supply sources. In this time length, it is limited that the supplies from Azerbaijan at 12.5 mcm/f which is difficult to be compensate. In this case, Russia can easily provide the requested amount of supply to Georgia and Armenia on short notice via the existing 1200 mm and 700 mm pipelines [50].

In a nut shell, Georgia should vary their source income by not only depend mostly on the supply of natural gas from Azerbaijan but also they need to find an alternative energy mix which can be helpful in any unwanted event. This cause Georgia to be in short-term gas supply risk such as demand curtailment ability, mitigated by strategic gas storage, and also the duel fuel ability for thermal power plants and heating system. For fulfilling the growing demand, the long-term energy supply disruptions could be by establishing sufficient alternative supply routes which will be coming from Russia, Armenia or the turkey.

8. Conclusion

In the nut shell, energy supply is a very important issue to be constantly organized in order to maintain the supply at affordable price to meet the future energy demand. In order for the countries to get their supplies demand, they need to have their supplier which can fulfil demand throughout the year. Most of the country has their own fixed supplier such as Georgia gets supplies mainly from Azerbaijan and they use energy mix rather than solely depend on only one type of source to produce the certain amount of energy. As for this country, the supply will be transport through pipeline in black sea port non-stop throughout the year regardless of the seasonal changes including winter. Every country has their own backup supplier in order to make sure that their supplies does not run

out such as Georgia has Russia, turkey, and Armenia to back up their energy sources supplies in the event if their agreement with current supplier disrupted.

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