Analysis of the prospects and risks of cooperaction between Russia and the Visegrad Four countries.

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Abstract

The paper gives an overview of potential V4 energy demand scenarios and their implication on Russian exports to the region. Despite the respective EU policies, the CEE region still copes with inherent sectoral path dependency problems, the spread of low-carbon technologies face major administrative and financial hurdles. In this environment Russia may shift local decision maker attitudes by various ways, promoting nuclear and fossil agenda. At the same time radical validation of climate policy considerations may even increase external dependence in the short and medium run. The current study analyses these diverse factors and tries to rearrange the current mental interrelations between new technologies and Russian dependence.

Analysis

Introduction

For Russian energy and in particular Russian foreign energy policy, the Visegrad region has lost much of it pecularities in the last couple of years. The combined energy demand represents only 11.2% (2016) of the EU energy consumption. Given the much higher domestic sufficiency ratios in the region, V4 has even a much lower share in total EU energy imports. As far as oil import patterns regarded, this sector has integrated into the common European space the fastest and Russian imports are made on a market basis, with little regional specifics. The events since 2009 on the natural gas markets demonstrated, that contractual patterns follow the mainstream European trends, even if with time gaps and imperfections. The political attitude towards Russian energy and Russia as such has also

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became fragmented. Russian fears from early 2000s of having a regional "*cordon saniteire*" and consequently building up some sort of energy transit barrier, remained unfounded. Even if local politics are often interlaced with energy markets, there is no single regional pattern and the relations vary widely country-by-country. While some elements of Soviet legacy have remained and can be maintained, especially as far as the nuclear industry regarded, the Visegrad region has been transformed into the Eastern corner of the EU markets. A bit more politicized, old-fashioned, more reliant on Russian molecules, but predominantly functioning on the European basis.

Thus it is important to overview, whether Russia's future expectations regarding the European energy demand trends are valid in the case of the Visegrad region. Russia has been long skeptical about the progress of renewables, believed that EU countries will have to turn back to nuclear or natural gas in the longer run. This very much resonated with the local Eastern European sentiments, especially in the Visegrad countries, where solar and wind has long been perceived as expensive, unreliable and insufficient to cover incremental needs. These attitudes provided some overlaps in common understanding between Russia and Visegrad countries. Nonetheless, these beliefs seems to be fading away on both sides. Russian energy policy makers recently have started to reconsider their skeptical attitudes and take into account the possibility of a longer, more sustainable penetration of new energy technologies with their implications. At the same time many Visegrad countries became more silent in their former criticism of renewables and started to gradually turn to these new forms of fuels.

Russia and especially Gazprom puts much of its market hopes on European depletion trends and narrowing competition within the continent. While these expectations are primarily based on the North Sea and Dutch depletion trends, internal decrease within the other, including Eastern European countries may also provide better marketing opportunities in the future. Nonetheless, it is not evident, that incremental demand will be imported from Russia. Political and energy diversification considerations, better interconnectivity and emerging gas hubs, new sources as US LNG or Romanian Black-sea gas complicate the prognosis for Gazprom.

Nonetheless, in some other regards the Visegrad region has a huge potential for Russia. Given the low import ratio and the still relatively high GDP growth of the region, the potential for incremental import is bigger than in developed Western countries. This is the more true, since much of the region's self-sufficiency is based on coal and nuclear capacities. As far as the former regarded, its demand has been falling the steepest in the EU, several European countries, more recently Slovakia and Hungary decided to decommission their coal-fired power plants. Climate policies may force out one of the pillar

of local electricity generation, while the question of substitution may remain open, if solar and wind potential does not develop accordingly. In the nuclear field, the total regional fleet will have to be decommissioned until 2040. This seems to be an easy-win for Russia: few Western alternatives remained for new nuclear bloc constructions, while swaps to other fuels offer an even bigger generation gap for the future. It is reasonable to say, that V4 countries guarantee a higher depletion trajectory than the rest of the EU and despite policy considerations Russia, still has the best chances to take the bigger chunk of the incremental import market.

The following study attempts to overview these trends from a Russian angle. The work represents an unique effort to understand and analyze local Visegrad energy developments by a Russian expert and give an external insight into the problem.

Annotation of the first part of the research

The report covers the energy sectors of the Visegrad countries (also called the Visegrad Four, V4) - Poland, the Czech Republic, the Slovak Republic and Hungary. The goal is to overview the current and future structure of energy balances of the V4 countries and assess their potential role for Russia's energy export.

In order to do this, the study makes the following steps:

• Analysis of the structure of energy balances and current trends in Visegrad energy consumption.

• Formation of scenarios (highlighting key alternatives).

• Construction of an inertial scenario for the development of energy consumption up to 2040 and an estimation of CO2 emissions according to this scenario.

• Assessing the role of V4 countries for Russia as a major supplier.

Description of the research intent

The energy balance of the Visegrad Four (V4) countries is currently dominated by nuclear energy (except Poland), coal and natural gas. Among renewable sources, only biomass and waste are massively applied. The development of modern renewable energy sources (wind and solar) is at an early stage and is characterized by the soft commitments from the governments and local regulators.

In recent years, the global energy industry has begun a technological revolution, which is in transition to a new energy model - increasing the share of renewable energy (it becomes competitive without subsidies), increasing the role of distributed systems (smart grids and storage devices), mass

introduction of energy efficient technologies in consumption of energy and fuel. The second major factor in the development of the global energy industry is the emerging climate governance, which, following the Paris Climate Agreement, should be implemented at the level of individual countries.

This report aims to make an assessment on the inertial development of energy consumption of the Visegrad countries and consequently make some observations on the cooperation with Russia in the field of energy supplies.

The study is supposed to simulate the forecast energy balances of V4 countries. First, these results shall serve as a basis for further study of the economic and technological competitiveness of different energy technologies and fuels in the V4 countries and make an assessment on the optimal future energy balances. Second, these results of the forecast may be used as an assessment of the role of V4 countries for Russian energy export and the share of Russia in imports to these countries.

The second part of the study proposes to assess the economic, technological and political risks of implementing different scenarios. The economic and technological risks may be evaluated on base of prognoses of energy balances.

To assess political risks, interaction with experts from V4 countries is planned using the in-depth interview method. Russia is the largest supplier of either coal or natural gas (and has the potential to significantly increase gas supplies, especially taking into account the expected reformation of the gas industry in Russia), as well as a major player in the construction of new and operation of existing nuclear power plants. Accordingly, it is important to assess the limits of the possible cooperation between V4 countries and Russia and the related risks involved.

Description of the model and approach.

In order to forecast the demand for energy resources (ER), we use a “bottom-up” simulation model (for more details[1]). It works in three interrelated stages.

1. First, the energy demand is determined in five sectors of the final consumption - population, industry, transport, chemical sector, other types (these are mainly services). For this, various regression, imitation, and scenario parameters and ratios are used. Basically, the curves of specific consumption of each energy resource in each sector are used, which are multiplied by the corresponding parameter of the perspective dynamics of the sector (i.e. projected values of

[1] Proceedings of the Energy Seminar of ECFOR RAS Semikashev V.V., Kolpakov A.Yu. Construction of agreed scenarios of world production, consumption and oil prices. (ECFOR RAS). March 29, 2016

population, value added in sectors of the economy, number of car fleet). Also, hypotheses of the evolution of the energy consumption structure with the replacement of less modern ER by more progressive ones - natural gas, electricity, biomass / biofuel[2] (as a carbon-free source) are actively used, and sector specificity is taken into account.

In total, this determines the final consumption of the ER, which consists of the consumption of either transformed and processed ER (heat and electricity, oil products) or primary ER (coal, oil, natural gas, biomass and waste).

2. At the second stage, it is calculated how much primary ERs are needed for the production of transformed and processed ERs that were evaluated at the first stage. Emphasis is put on power plants and boilers.

First, an electric power balance is formed taking into account losses and own needs, import and export (as shares of total consumption and production respectively), and an estimate of the supply of thermal energy from power plants is given. Then, for the generated value of the total electricity production, the need for fuel is estimated by setting the generation structure and the efficiency dynamics.

The structure of generation is the most important parameter for the development of the energy sectors of V4 countries. This parameter gives the highest variety of forecast results. Therefore, alternative scenarios will be formed primarily on the basis of this parameter. In addition, this sector is modeled for each country (input and output indicators are balanced) in different ways. This will be discussed in more detail when describing countries.

Next, the structure of heat energy production is formed. The total amount of heat produced is derived from the total heat demand of the final sectors, taking into account losses. From total production it is essential to subtract heat production at the EPS (obtained a step earlier). Next, the structure of generation is set.

The sectors of oil refining and own needs of the fuel and energy complex are proposed in a simplified form - losses of oil products, oil, coal and natural gas for various refining and transfer processes are estimated.

3. At the third stage, the total demand for primary ERs (as the sum of final consumption and costs in the transformation and processing sector), import and export parameters, as well as own production of primary ERs in each country is determined.

[2] Used here as synonyms

For each V4 country, a modification of the model is developed, as well as various ways of balancing energy balances and highlighting key parameters.

We also note three features of the forecast at this stage.

Due to the limited time and size of the report, the consumption of motor fuel by transport and the sphere of oil refining are reviewed to a lesser extent and based on inertia. In the next research, this issue will be considered taking into account the alternatives for the development of these sectors (the emergence of electric vehicles, the introduction of restrictions in the field of fuel policy, as well as the influence of other revolutionary factors).

Cooperation with Russia in the sphere of oil and oil products supply is not considered. These are fairly competitive markets with easy and cheap switching between different suppliers or consumers, what reduces the importance of dependence on a particular supplier as a part of energy security analysis.

Analysis and forecast of the Polish energy balance

Poland is the largest country of the Visegrad Group. With a population of 38.4 million people its total energy consumption is a little bit less than 100 million toe. This equals about 2.5 toe per person annually.

The structure of the energy balance is rather simple and, it can be said, rectilinear (Table 1). It is formed on the basis of domestic coal production. In 2015, it constituted 80% in the balance of power plant fuels and 50% in total primary energy consumption — competing with much smaller proportions of imported oil and gas. Coal is also the main fuel for boiler houses - 90% (of total energy consumption) and the population - 32%. The volume of its consumption in industry is significant - 24% and it also forms a major fuel even in the service sector with its 13% share.

Poland's energy dependence is based on imported gas and oil - just over a third of primary consumption. At the same time, about 10% of the mined coal is exported. There are no significant electricity flows with neighboring countries.

Table 1. Simplified energy balance of Poland, 2015, mln. toe.

	Coal	Gas	Oil	Petroleum	Renewables, except biomass	Biomass	Electricity	Heat	Total
Primary Energy Production	**53,9**	**3,7**	**0,9**	**0,0**	**1,2**	**8,0**	**0,0**	**0,0**	**67,7**

Net exports (-) / imports (+)	-5,5	10,1	25,7	-3,3	0,0	0,4	0,0	0,0	27,2
Primary Energy Consumption	**48,3**	**13,8**	**26,6**	**-3,3**	**1,2**	**8,3**	**0,0**	**0,0**	**94,9**
Power stations	32,8	1,2	0,0	0,4	1,1	2,4	-14,1	-4,4	19,4
Boiler rooms	2,5	0,2	0,0	0,0	0,0	0,0	0,0	-2,3	0,5
Oil refining	0,0	0,0	28,1	-27,5	0,0	0,0	0,0	0,0	0,6
Losses and other transformations	1,8	1,7	-1,4	1,9	0,0	0,0	3,1	1,3	8,3
Final consumption	**11,3**	**10,6**	**0,0**	**21,8**	**0,1**	**5,9**	**11,0**	**5,5**	**66,2**
Industry	3,4	3,2	0,0	0,6	0,0	1,9	4,3	0,7	14,1
Transport	0,0	0,4	0,0	15,2	0,0	0,8	0,3	0,0	16,6
Residental	6,2	3,2	0,0	0,6	0,1	2,5	2,4	3,9	18,8
Other sectors	1,6	1,7	0,0	2,1	0,0	0,7	4,0	0,9	11,1
Industrial use as a raw material	0,1	2,1	0,0	3,3	0,0	0,0	0,0	0,0	5,5

For the period 1990-2015 coal was rather actively replaced by more environmentally friendly fuels. Growth in biomass production and consumption exceeded 4 times - from 2 to 8 million toe. Consumption of natural gas increased by 1% annually, up to 14 million toe. Even the new generation renewable energy sources (solar and wind) have appeared in the country, currently they represent about 1 million toe in total energy production. In the former case, solar panels are used primarily by households and often their production does not enter the power grid.

As a result, the share of coal in the balance of ES fuels decreased from 97% to 81%, while the share of wind electricity increased to 7%, the share of biomass to 6%, and natural gas to 4%. Shares of petroleum products and other renewable energy fluctuate around 1%.

While Poland has significant internal crude oil and natural gas reserves, it has to rely on imports extensively. Natural gas is mainly used directly for heating and industrial purposes (by 3.2 million toe among the population and in industry, 2.2 million toe in the chemical industry) and not in the generation sector.

In the baseline scenario, a moderate growth of the economy and energy consumption is assumed. Biomass consumption is expected to grow by the highest pace. In Poland it represents an energy source, which is easy to obtain (is available and inexpensive), does not lead to CO2 emissions, and does not lead to energy dependence from external suppliers and increases diversification by fuel types in the energy balance. The structure of consumed ER is shown in Fig. 1 (energy balance) and Fig. 2 (fuel balance for power stations).

As a result, CO2 emissions are determined by a combination of factors — a reduction in the high coal emissions, an increase in oil and gas consumption, which can be described as fuels with an average CO2 emission level and an increase in carbon-free (in terms of CO2 balance) biomass. In the scenario presented, there is no reduction in CO2 emissions. They slightly increase in the first decade of the forecast, and then by 2040 they return to the level of 2015 - 280 million tons of CO2.

Consumption of oil and petroleum products remains only in the transport and chemical sectors. At the same time, we note that in the case of a scenario of active development of electric vehicles, the load on the coal power industry in Poland will only increase, while CO2 emissions will be increased.

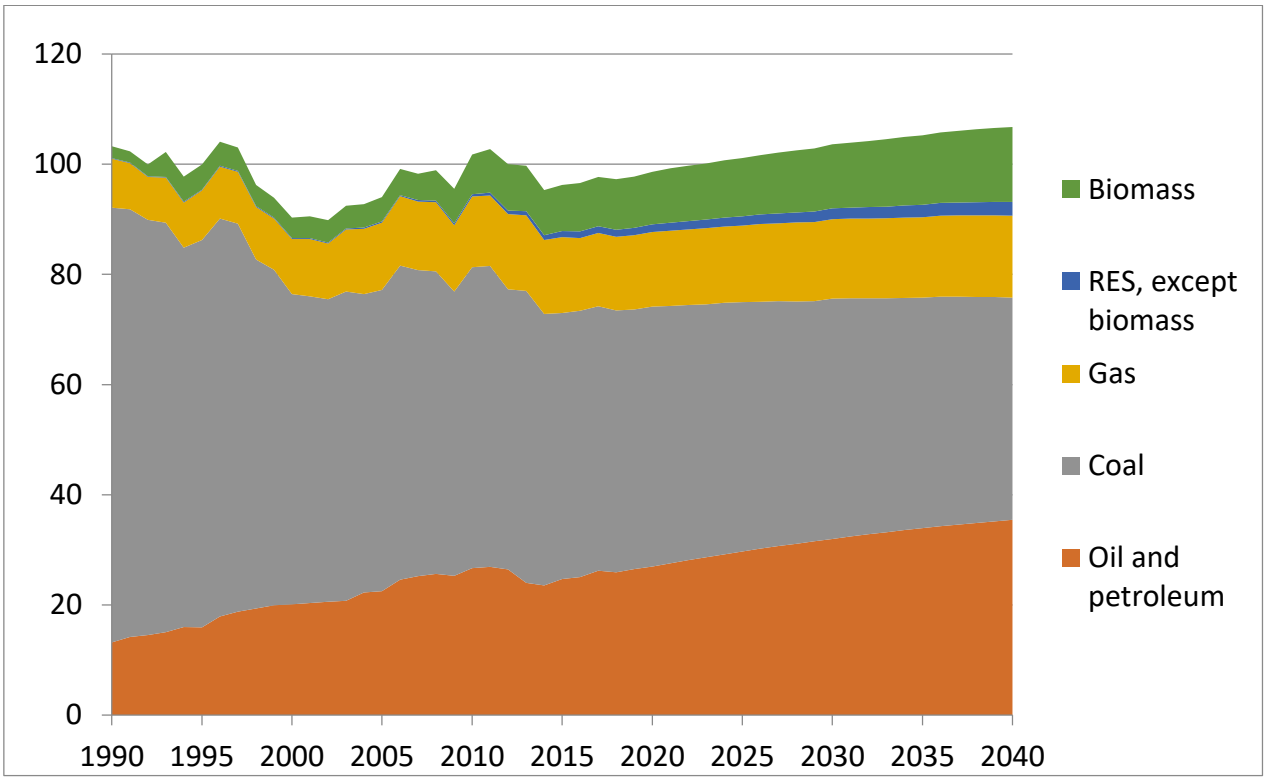

Fig. 1. Structure of total consumption of primary ER, mln.toe

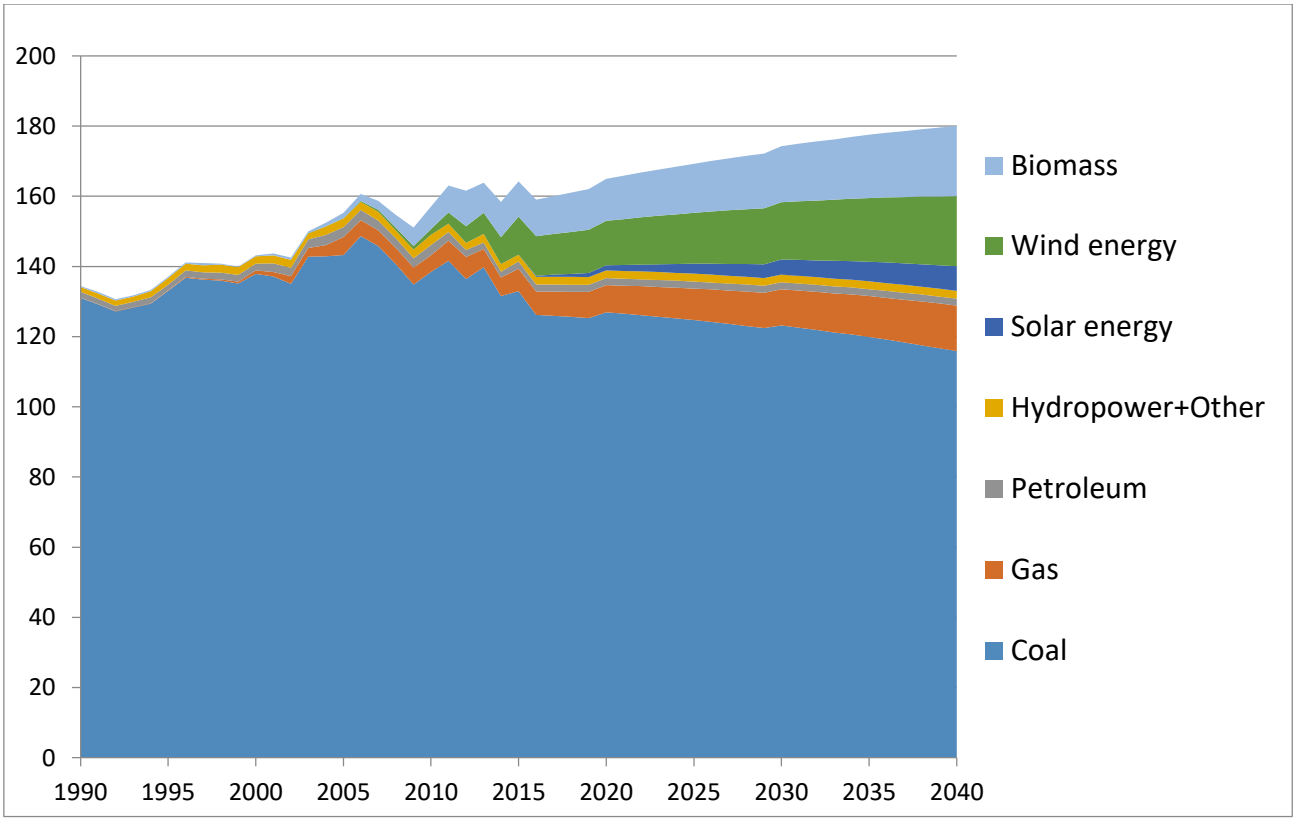

Fig. 2. Structure of electricity generation by types of fuel, billion kWh.

According to Gazprom, in 2015, 8.9 bcm of Russian gas, or 7.6 million toe, were delivered to Poland. This represents three quarter of the total imports of natural gas and 55% of its consumption. Accordingly, putting aside oil imports and looking only on the other segments of the energy balance, the dependence indicator on Russia remains below 10%.

Presented in Figure 1 variant of the scenario forecast of energy consumption in Poland, while maintaining Russia's share in the structure of gas imports, Russian gas supplies may be about 8.5–9 million toe by 2040.

Analysis and forecast of Czech energy balance

In the Czech Republic energy consumption per person is about 4 toe (total primary energy consumption is 42 million toe with 10.5 million people). Imports account for only a third of total energy consumption - this is exclusively oil and natural gas. Gas is mainly used directly - almost 80% of the total consumption in the country (apparently, mainly for heat supply, to a lesser extent as raw

materials for industrial use), and less than 20% goes to the energy sector (at the power plants and boilers).

The Czech Republic also exports electricity. Its net export position is based on competitively priced coal and nuclear generation. In 2015, exports amounted to 15% of the total electricity balance, but in some years it went even above 20%.

The Czech Republic produces coal domestically, a small amount of which is exported - approximately 5-10% of the total coal production. In the past the share of exports reached 20% and shows currently a declining trend, may fall below 10% in the coming years.

Czech electricity supply is based on coal and nuclear power plants, which account for over 85% of total generation. As for the other sources, biomass is the most significant, which in 2015 amounted to 6% in the balance of fuel for power plants. Generation from biomass began to grow only in the last decade. The other types of generation in the total account for less than 10%, including gas power plants, which make up only 2.5-3%.

Table 2. Simplified energy balance of the Czech Republic, 2015, mln.toe.

	Coal	Gas	Oil	Petroleum	NPP	RES, except biomass	Biomass	Electricity	Heat	Total
Primary Energy Production	**17,1**	**0,2**	**0,2**	**0,0**	**7,0**	**0,416**	**4,1**	**0,0**	**0,0**	**29,1**
Net exports (-) / imports (+)	-0,5	6,3	7,2	1,2	0,0	0,000	0,0	-1,1	0,0	13,1
Primary Energy Consumption	**16,6**	**6,5**	**7,4**	**1,2**	**7,0**	**0,416**	**4,1**	**-1,1**	**0,0**	**42,2**
Power stations	12,1	0,6	0,0	0,0	7,0	0,399	1,2	-7,1	-2,3	11,9
Boiler rooms	0,1	0,5	0,0	0,0	0,0	0,000	0,0	0,0	-0,6	0,1
Oil refining	0,0	0,0	7,5	-7,5	0,0	0,000	0,0	0,0	0,0	0,0
Losses and other transformations	2,1	0,2	-0,1	0,3	0,00	-0,001	0,00	1,3	0,8	4,7
Final consumption	**2,3**	**5,1**	**0,0**	**8,3**	**0,0**	**0,018**	**2,9**	**4,7**	**2,1**	**25,5**

Industry	1,0	2,1	0,0	0,3	0,0	0,0	0,7	1,9	0,6	6,6
Transport	0,0	0,1	0,0	5,6	0,0	0,0	0,3	0,1	0,0	6,1
Residental	0,8	1,8	0,0	0,0	0,0	0,0	1,8	1,2	1,0	6,7
Other sectors	0,0	1,1	0,0	0,4	0,0	0,0	0,2	1,4	0,4	3,5
Industrial use as a raw material	1,1	2,1	0,0	6,8	0,0	0,0	1,0	2,1	0,6	13,7

For the period 1990-2015 coal consumption was quite actively forced out. In final consumption (industry, chemistry, population, services and transport) its share decreased by five times. At the same time in power generation and heat supply, parallel to the increasing demand on generation, there was only a slight decrease in consumption. In contrast to coal, biomass consumption has increased. The growth came from the main segments of final consumption, here it increased by more than 2 times in the last decade, up to 4 million tons. In the power industry, biomass burning multiplied by 6 times between 2005 and 2015, up to 5 million tons.

The forecasted dynamics of the Czech energy balance is presented in Figure 3. This trend is primarily driven by trends of decreasing consumption. Thus, the inflection point of final electricity consumption growth coincide with the peak of total energy demand.

The second group of factors is the structure of electricity generation and the strategy of energy exports. In the presented forecast, there is a growth in the production of electricity on emission-free sources: 50% of biomass, twofold growth of solar energy and more than threefold increase in wind energy production. Against the background of stagnating electricity consumption, it leads to a 40% reduction in coal consumption.

Electricity production at nuclear power plants will be at the same level throughout the forecasted period.

The Temelin nuclear power plant (2 GW of generating capacity based on 2 Russian VVER-1000 reactors) will be operational until the end of the forecasted period. The Dukovany station (4 VVER-440 units) is older. There are possible scenarios for closing all or part of the blocks, building new power units (both at this site and at the Temelin nuclear power plant) or extending the license and extending their lifetime until 2035–2040.

The Czech Republic has been considering the construction of new nuclear power units at sites of existing power plants[3]. In the inertial scenario, it is assumed that the existing capacity will work until 2040. This, against the background of a reduction in the total generation, leads to an increase in the share of NPPs in total electricity generation from 32% to 38%.

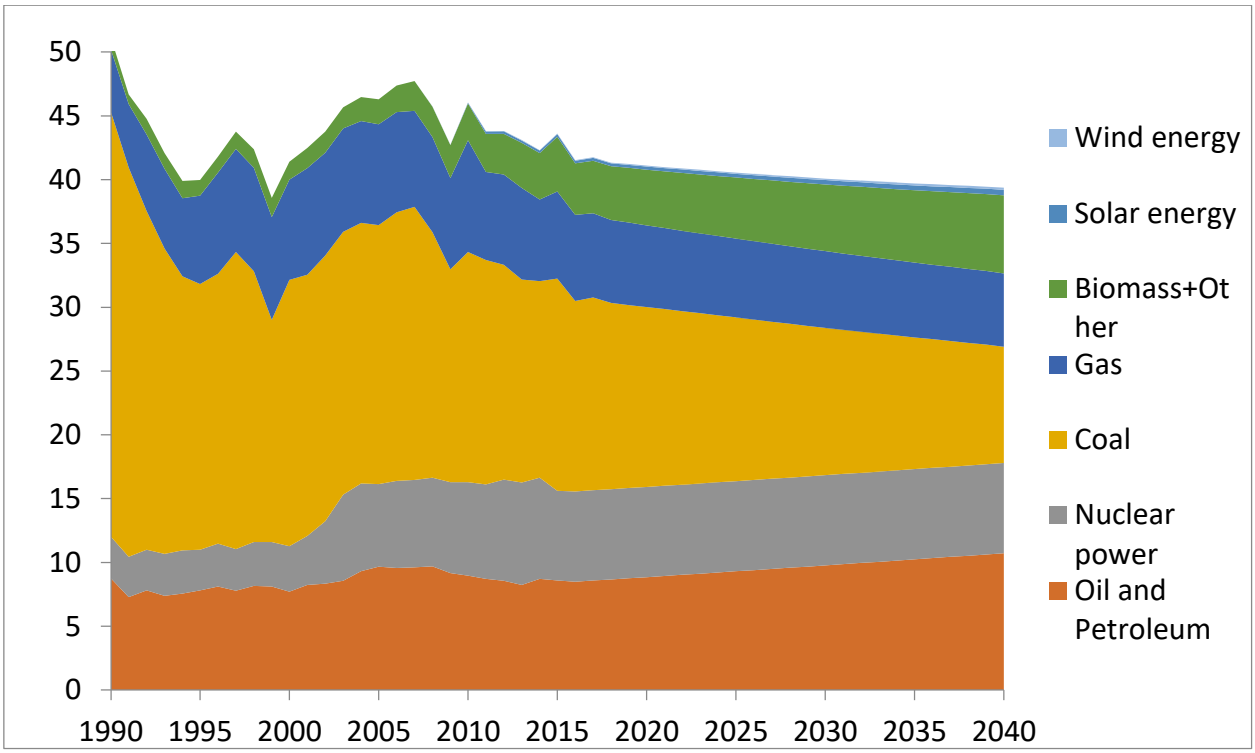

Figure 3. Structure of total consumption of primary ER in the Czech Republic, mln.toe.

Two nuclear power plants are supplied with fuel from Russia (through TVEL). However, the optionality from the technological point of view is present, suppliers from other countries may manufacture the fuel cells. This means an indirect (mild dependence) on Russia with a volume of approximately one third of the total electricity generation in the country.

According to Gazprom, in 2015, 4.2 bcm of Russian gas, or 3.6 million toe, were delivered to the Czech Republic. This represents just over half of total import and consumption of natural gas (own production is minimal, almost all gas consumed is imported). In terms of the dependence of all energy consumption on Russia, with the exception of oil, the dependency ratio remains less than 10%. As in the forecasted period, gas consumption growth is not foreseen, there will be no growth in dependence on Russia in the period up to 2040.

[3] https://ria.ru/atomtec/20160322/1394420482.html

The total dependence of the Czech power supply on energy supplies from Russia does not exceed 25% of the total consumption of primary ERs.

Analysis and forecast of the Hungarian energy balance

Hungary consumed around 25 million toe primary energy with an annual energy intensity of 2.5 toe per capita for its less than 10 million population.

Natural gas (with a share around 30%) and electricity (around 15%) dominate in the final consumption. The burning of biomass represents 10%, while district heating also provided another 5%.

Table 3. Simplified energy balance of Hungary, 2015, mln. toe.

	Coal	Gas	Oil	Petroleum	RES, except biomass	Biomass	Electricity	Heat	Total
Primary Energy Production	**1,5**	**1,4**	**0,9**	**4,1**	**0,3**	**3,1**	**0,0**	**0,0**	**11,3**
Net exports (-) / imports (+)	0,8	6,1	6,0	0,0	0,0	-0,2	1,2	0,0	13,9
Primary Energy Consumption	**2,4**	**7,5**	**6,9**	**4,1**	**0,3**	**2,9**	**1,2**	**0,0**	**25,2**
Power stations	1,6	1,1	0,0	4,1	0,1	0,7	-2,6	-0,5	4,5
Boiler rooms	0,1	0,6	0,0	0,0	0,1	0,1	0,0	-0,7	0,1
Oil refining	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Losses and other transformations	0,4	0,1	0,3	0,0	0,0	0,0	0,7	0,3	1,8
Final consumption	**0,3**	**5,7**	**6,5**	**0,0**	**0,1**	**2,2**	**3,1**	**1,0**	**18,9**
Industry	0,2	1,3	0,6	0,0	0,0	0,2	1,3	0,4	4,0
Transport	0,0	0,0	3,9	0,0	0,0	0,2	0,1	0,0	4,2
Residental	0,1	2,6	0,1	0,0	0,0	1,8	0,9	0,5	6,0
Other sectors	0,0	1,4	0,4	0,0	0,1	0,0	0,8	0,1	2,8
Industrial use as a raw material	0,0	0,4	1,5	0,0	0,0	0,0	0,0	0,0	2,0

Domestic production constitutes around 40% of total energy demand (11 mln toe), which has three major components:

- internal mining of lignite, oil and gas – 4 mln toe;
- electricity generation at the Paks nuclear power plant (four VVER blocs with 500 MWh each) – four mln toe primary energy;
- three mln toe biomass and waste.

Import composes of the following categories:

- 0.8 mln toe coal – around one-third of total domestic demand;
- six mln toe oil – around 80% of total demand;
- six mln toe natural gas – almost 90% of total demand;
- 1.2 mln toe (around 16 billion kWh) electricity, which constitutes around one-third of total domestic consumption.

The high proportion of oil and gas imports represent the main fields of dependence. In the electricity field the nuclear generation covers 40% of local demand, while the rest of the power plants are mainly gas-fired. Under low electricity prices and potentially high gas import prices these capacities remain idle and are substituted by imports. Consequently in 2015 the share of imports constitute 30%.

Hungary strives for developing biomass and waste utilization. The electricity generation from these fuels increased more than 20 times between 2000 and 2015, reaching 2.3 billion kWh, or 8% of total electricity supply. At the same time solar and wind generation is relatively weak, mainly remains on the level of pilot projects or early development.

Hungary also plans to expand its existing nuclear fleet by two new units (1200 MW capacity each) at Paks. This would double the nuclear component in the national balance as early as by 2026-27, potentially later.

Accordingly the Hungarian development of electricity sector is based on the following three components:

- expanding the nuclear fleet;
- continuing electricity imports;
- balancing these with alternatives:
    - gas-fired generation or
    - renewables from biomass or solar and wind prospectively.

In the baseline scenario we calculate with the construction of the two new Paks nuclear units around 2026-27. Furthermore, generation from renewables significantly increase, up to 25% of the electricity balance. This means that biomass and waste utilization doubles, wind production grows by four times, while solar generation exceeds 10% of total supply. Gas generation may provide balancing needs (Figure 4), and import of electricity may decrease or even cease (Figure 5).

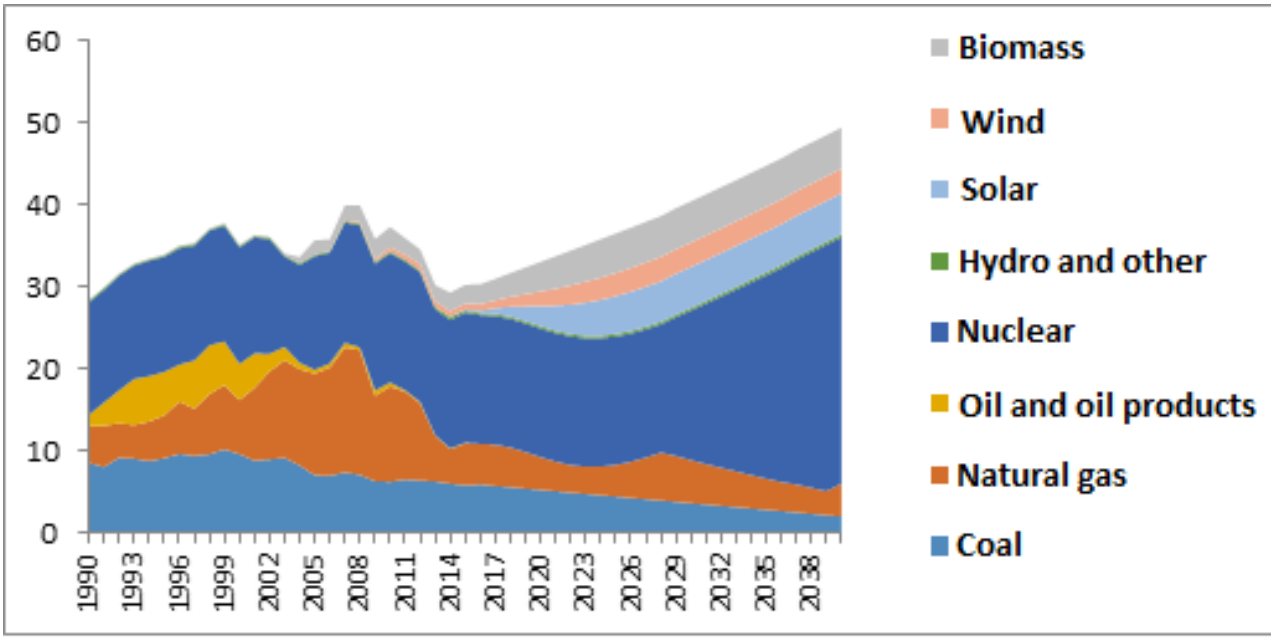

Figure 4. Structure of electricity generation in Hungary, billion kWh

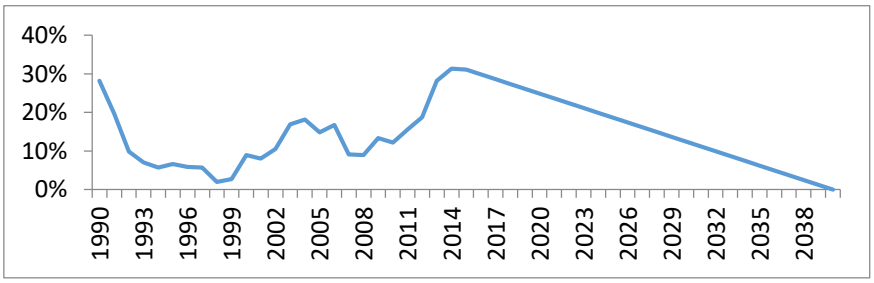

Figure 5. The share of electricity imports in total consumption in Hungary, %

Accordingly to this baseline trajectory, the total growth of primary energy consumption until 2040 constitute around 20% (Figure 6), while the totoal GHG emission equals 43-44 mln tonnes. This

later target can be met despite of considerable increase in oil demand (by 40%) by cutting coal demand and stagnating use of natural gas.

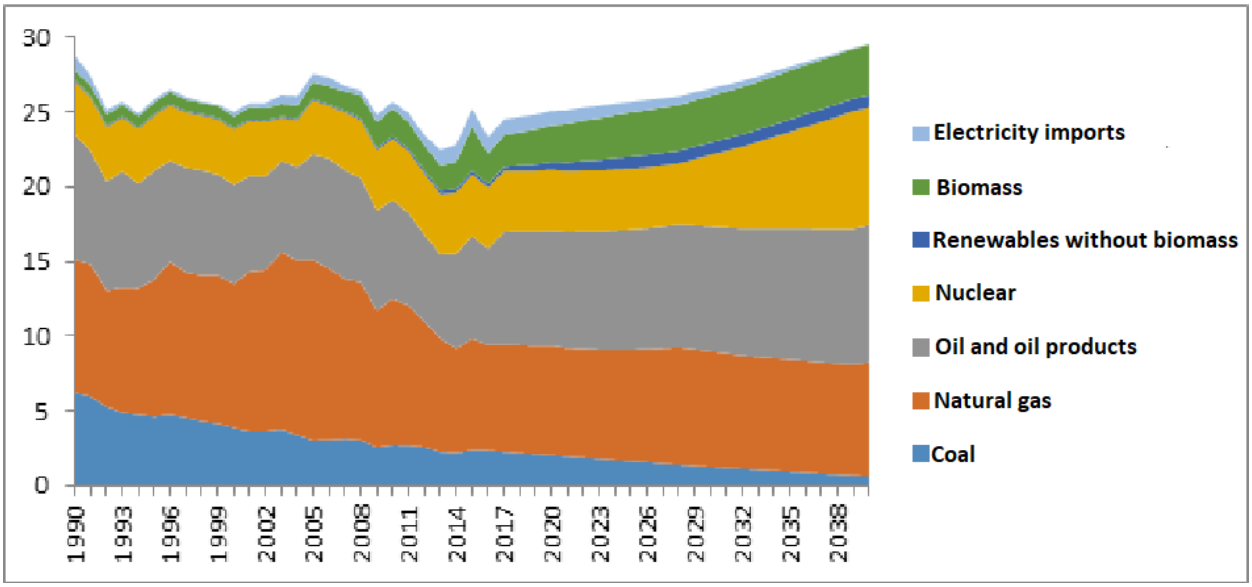

Figure 6. Figure 3. Structure of total consumption of primary ER in the Czech Republic, mln.toe.

According to Gazprom statistics, 5.9 bcm Russian gas was delivered to Hungary in 2015. This represents 80% of total imports and two-third of total consumption. Consequently the dependence ration from Russia with the exclusion of oil stands around 20%.

In the presented scenario renewables are actively developed while gas demand stagnates. Keeping in mind the construction of interconnectors and the ongoing development of European gas markets, it is reasonable to expect, that Hungary will not increase its dependence on Russia further, rather decreases it.

Analysis and forecast of the Slovak energy balance

Slovakia has the lowest consumption of energy, around 16.4 mln toe in 2015. At the same time on a per capita level (3 toe per capita annualy) it demand exceeds Poland and Hungary.

In the total primary balance, 25-25% falls on oil and nuclear supply, while 20-20% on gas and coal, 8.5% on biomass. High coal import levels, around 80% of total demand, distinguish Slovakia from the other V4 countries.

Table 4. Simplified energy balance of Slovakia, 2015, mln. toe.

	Coal	Gas	Oil and oil products	Nuclear	Renewables	Biomass	Electricity	Heat	Total

					except biomass				
Primary Energy Production	**0,5**	**0,1**	**0,2**	**4,0**	**0,4**	**1,4**	**0,0**	**0,0**	**6,6**
Net exports (-) / imports (+)	2,8	3,8	3,0	0,0	0,0	0,0	0,2	0,0	9,8
Primary energy Consumption	**3,3**	**3,9**	**3,3**	**4,0**	**0,4**	**1,4**	**0,2**	**0,0**	**16,4**
Power stations	1,0	0,4	0,2	4,0	0,4	0,5	-2,3	-0,6	3,6
Boiler rooms	0,0	0,3	0,0	0,0	0,0	0,1	0,0	-0,3	0,0
Oil refining	0,0	0,0	-0,2	0,0	0,0	0,0	0,0	0,0	-0,2
Losses and other transformations	1,4	0,3	0,5	0,0	0,0	0,0	0,4	0,2	2,8
Final consumption	**0,9**	**2,9**	**2,7**	**0,0**	**0,0**	**0,8**	**2,1**	**0,6**	**10,0**
Industry	0,7	0,8	0,2	0,0	0,0	0,6	1,0	0,2	3,4
Transport	0,0	0,1	1,9	0,0	0,0	0,1	0,1	0,0	2,2
Residential	0,0	1,1	0,0	0,0	0,0	0,0	0,4	0,5	2,0
Other sectors	0,1	0,5	0,1	0,0	0,0	0,1	0,6	0,0	1,5
Industrial use as a raw material	0,0	0,4	0,6	0,0	0,0	0,0	0,0	0,0	1,0

According to Gazprom statistics, 8.3 bcm Russian gas was delivered to Slovakia, signaling an 80% dependency ratio. At the same time total dependence with the exclusion of oil remain relatively low, around 20%, as in the case of Hungary.

Slovakia recently efficiently diversifies its gas imports, using the interconnectors and contractual diversity within the country. Thus independently from the high import ratio from Russia, Slovak economy may weather off potential supply cuts much better, than in 2009.