Energy transition:
Energy revolution in the Visegrad Four countries

Analytical Report – V4 CARE ARSEC project (supported by the International Visegrad Fund)

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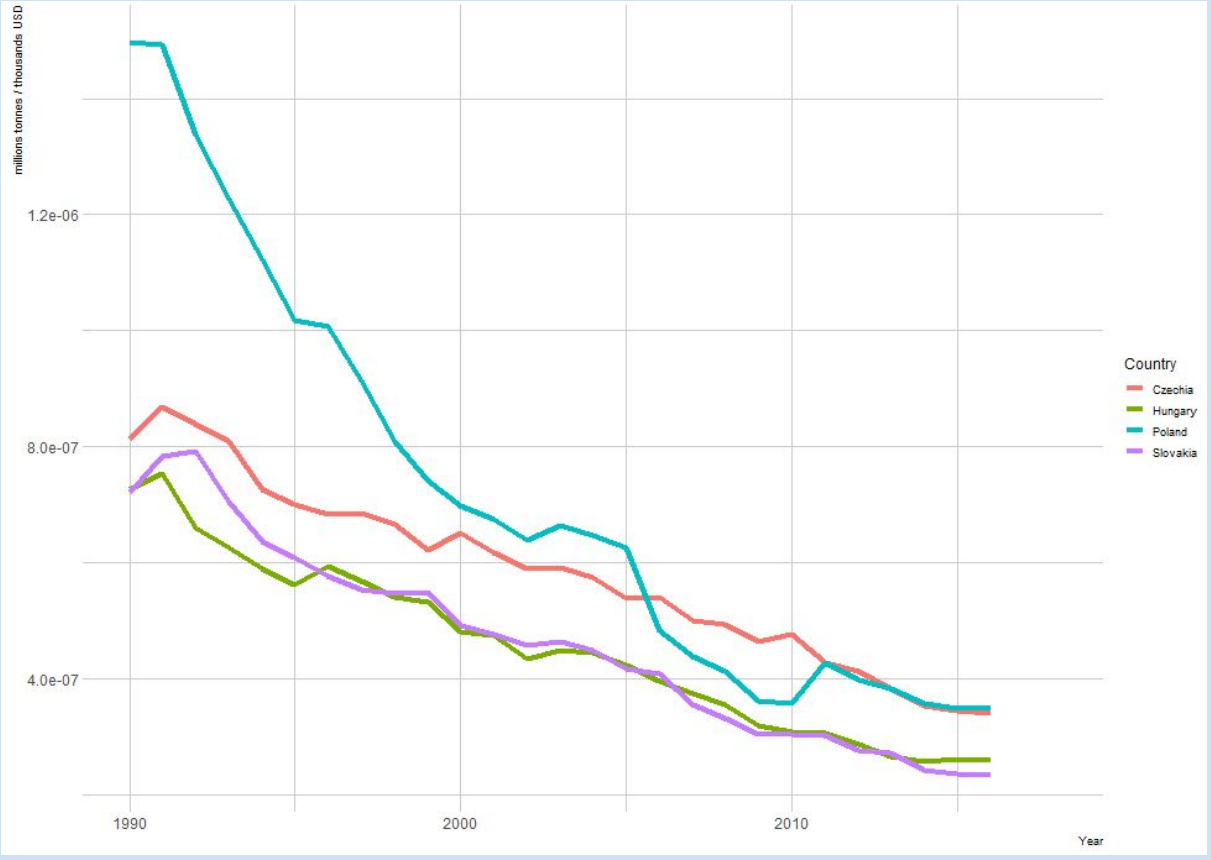
Visegrad Four (V4) countries have undergone series of changes in the energy sector since the fall of the Communist regime. These countries embarked on the way of market reforms and restructuring of their economies. At the same time, they were able to maintain growing GDP, while increasing their energy efficiency and decreasing the greenhouse gas (GHG) emissions. However, emission decrease is attributed mainly to the closure of heavy industry, as it is the case of the former Czechoslovakia and not because of introduction of effective policies. The structure of the energy mix of the V4 countries is path-dependent, heavily influenced by the communist period. V4 countries are dependent of imported and domestic fossil fuels, especially coal in the Czech Republic and Poland and natural gas and oil in the whole V4. Three countries (the Czech Republic, Hungary and Slovakia) inherited also nuclear sector that continues to be the key in low-carbon electricity sector. Poland plans to join the nuclear club as well and is planning to develop its first nuclear power plant by mid 2030s. From the point of view of the renewable energy sources (RES), V4 countries opt for their traditional sources (biomass and hydro), while the penetration of wind and solar energy is rather modest and the countries are not even close to the EU targets (see below).

Figure 1: GHG emissions in the Visegrad Group countries per GDP



Source: Eurostat/Global Arena Research Institute

The accession of V4 countries into the EU influenced also their energy sector. Despite the fact that each country is responsible for its own energy mix, as agreed in the 2009 Lisbon Treaty, the countries decided to develop a set of measures that will lead to gradual decarbonisation of their economies. The EU and its policies respond to the climate change, making the Union the most important driver of clean energy and decarbonisation within the V4. EU energy and climate policies has been merging together since the introduction of the

2020 Climate and Energy Package (European Council, 2007). The so-called 2020 energy and climate package was approved by the European Council in 2008 and sets three crucial targets: a 20% reduction in GHG emissions compared to the 1990 level, increasing the share of renewables in gross final energy consumption to 20%, and a 20% improvement in energy efficiency (see Table 1). These targets were further enacted in EU legislation. However, there were also several concerns expressed by few Central and Eastern European countries, among them also the V4 countries, over the level of ambitions, as they were (are) in different economic situation as their Western counterparts.

Table 1: EU decarbonisation targets

	2020	2030	2030 (revised)
Share of RES in gross final energy consumption	20%	27%	32%
Energy efficiency improvement	20%	27%	32.5%
GHG emission reduction	20%	40%	55%

Source: Authors based on European Council data

The European Commission introduced also the Energy Roadmap 2050 in 2011 affirming its ambitious strategy for climate and energy policy and set the long-term goal of reducing greenhouse gas emissions to 80–95% compared to the 1990 level by 2050. As can be seen in the Table 2, the 2020 package was further changed and developed with the 2030 Climate and Energy Framework adopted by the European Council in 2014 (European Council, 2014) and the goals were even further increased in 2018. In September 2020, the Commission proposed further increase of the 2030 GHG reduction target to 55% of the 1990 level (European Commission, 2020); this goal was adopted in December 2020 by the member states.

Table 2: V4 decarbonisation targets

	2020 target	2030 target (draft)	EC evaluation	2030 target (final)
Share of RES				
Czech Republic	13%	20,80%	23%	22%
Hungary	13%	20%	23%	21%
Poland	15%	21%	25%	21-23%
Slovakia	14%	18%	24%	19.2%
GHG emission reduction				
Czech Republic	-9%	-14%	low	-14%
Hungary	-10%	-7%	very low	-7%
Poland	-14%	-7%	modest	-7%
Slovakia	-13%	-12%	low	-12%
Energy efficiency				
Czech Republic	25,3 Mtoe	41,3 Mtoe	neutral	41,3 Mtoe
Hungary	18,2 Mtoe	27 Mtoe	neutral	N/A
Poland	71,6 Mtoe	90,9 Mtoe	neutral	91,3 Mtoe
Slovakia	9,2 Mtoe	16,2 Mtoe	ambitious	15,7 Mtoe

Source: Authors based on the European Council data and National Energy and Climate Plans

In Visegrad countries energy security has been an important issue since the 2009 gas crisis. It is not surprising then that the idea of the Energy Union has started in this region, by the then

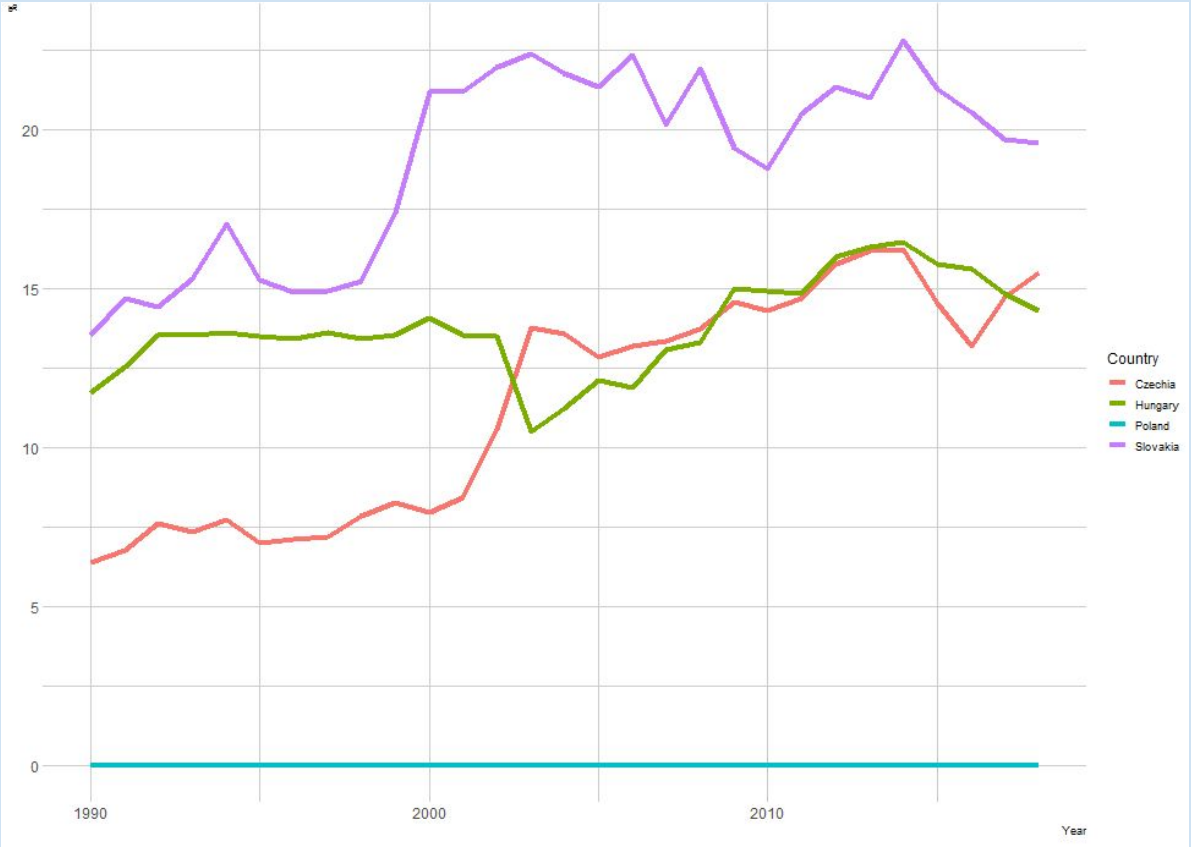
Polish Prime Minister Donald Tusk. But the Energy Union did not focus solely on energy security issues, but it became an umbrella project for the whole energy policy decarbonisation (see Table 3). Energy Union introduced two important policies – legislative initiative *Clean energy for all Europeans* and *the Governance Regulation* (2018/1999.) The main legislative package proposed by the Commission under the *Clean Energy for all Europeans* initiative, was introduced in 2016 and consisted of eight legislative proposals and underlined the Commission's increased interest in climate issues within the energy area (European Commission, 2017). Within the Regulation all member states had to deliver their National Energy and Climate Plans by the end of 2018. These were evaluated by the European Commission and then member states had to deliver their revised versions. This process is very unique in energy governance and pushes countries to deliver decarbonisation policies.

Table 3: Five dimensions of the Energy Union

Energy security	Diversifying sources of energy and ensuring energy security through solidarity and cooperation
Internal energy market	Enabling the free flow of energy through the EU through adequate infrastructure and without technical or regulatory barriers
Energy efficiency	Improved energy efficiency will reduce dependence on energy imports, lower emissions, and drive job creation and growth
Decarbonisation	The EU is committed to the Paris Agreement and to retaining its leadership in the area of renewable energy
Research, innovation and competitiveness	Supporting breakthroughs in low-carbon and clean energy technologies by prioritising research and innovation to drive the energy transition and improve competitiveness.

Source: European Commission (2015)

Figure 2: Share of nuclear energy in the Visegrad Group (in %)



Source: Eurostat/Global Arena Research Institute

As can be seen in Figure 2, the Visegrad countries relies mainly on nuclear energy to secure low-carbon electricity production. It is a vital issue also for Poland that at the moment does not have a nuclear power plant, but plans to develop a nuclear programme by mid-2030s. Other V4 countries, that have nuclear power plants are further expanding their nuclear facilities. Although the share of nuclear is energy is among the highest in the EU, the V4 countries plan to further increase this share. Slovakia is finalising two reactors (Mochovce 3 and 4), Hungary has been in the preparational phase for Paks 2 NPP since 2014 and the Czech Republic is obtaining permits for new reactors in Dukovany and Temelín. Nuclear energy will remain central in low-carbon energy production for all V4 countries. But as the experience from (not only) this region shows, the costs of the building new plants, nuclear fuel management, and especially decommissioning of the old facilities are high. In case of Slovak reactor V1 in Jaslovské Bohunice decommissioning costs are estimated to 1.2 billion eur (TASR, 2019).

The EU has agreed on the long-term goal of keeping the increase in global average temperature to below 2°C and, if possible, 1.5 °C, of the pre-industrial level by the ratification of the Paris Climate Agreement. The document was ratified by the EU in 2016 and it also enhances the EU's commitments set out in the 2030 framework (European Council, 2019). New challenges in energy and climate policy are ahead with the introduction of A European Green Deal under the Ursula von der Leyen Commission aiming to reach climate neutrality by 2050. This goal was originally opposed by all V4 countries, however, Slovakia supported it in June 2019 and the Czech Republic and Hungary supported it in December 2019. When the countries reached the final agreement, Poland was the only country that remained in the opposition. Climate Law ensuring the 2050 climate neutrality objective will also be incorporated into the EU legislation. However, due to the outbreak of the Covid-19 pandemic the process was slowed down and the law has not been introduced

yet. As the Table 4 shows, the targets of Green Deal are not climate and energy specific, but encompass all aspects of economy and society.

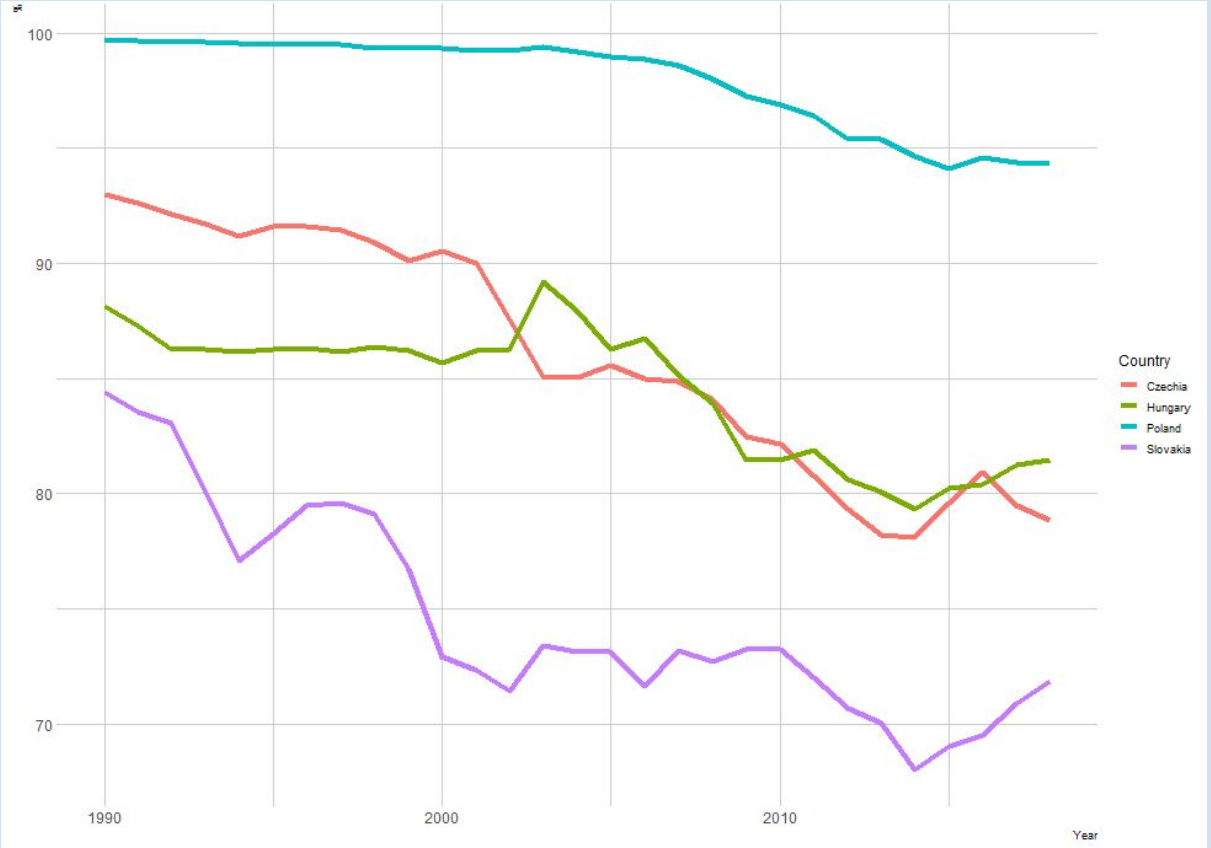
Table 4: Policy areas of the European Green Deal

Policy area	**Main goal**
Biodiversity	Measures to protect fragile ecosystems
From Farm to Fork	Ways to ensure sustainable food systems
Sustainable agriculture	Sustainability in EU agriculture and rural areas thanks to the common agricultural policy (CAP)
Clean energy	Opportunities for alternative, cleaner sources of energy
Sustainable industry	Ways to ensure sustainable environmentally respectful production cycles
Building and renovating	The need for a cleaner construction sector
Sustainable mobility	Promoting more sustainable means of transport
Eliminating pollution	Measures to cut pollution rapidly and efficiently
Climate action	Making the EU climate neutral by 2050

Source: European Commission (2019)

Figure 3 illustrated the complexity of decarbonisation within the Visegrad countries, especially Poland that relies heavily on coal. The Czech Republic is also coal-dependent country, lignite-fired power plants in Slovakia and Hungary will be phase-out soon, so decarbonisation in these two countries will be less problematic (although far from not problematic at all). From this point of view it is important to mention the Initiative for Coal Regions in Transition launched by the European Commission in 2017. It is a non-legislative part of the *Clean energy for all Europeans* package aiming to mitigate the social consequences of the transition of coal regions in all V4 countries. (but also in other coal regions of the EU). There is also a problem connected to use of fossil fuels in V4 countries, air pollution, particularly emissions (PM10) and (PM2.5) that remains a serious challenge. This is mainly because of the inefficient combustion techniques for domestic heating and increasing individual transport (old diesel and petroleum cars), as well as ineffective policy designs (such as missing clear goals for air quality, which has been changing very slowly only recently).

Figure 3: Share of fossil fuels in the Visegrad Group (in %)



Source: Eurostat/Global Arena Research Institute

Table 5: Overview of the milestones of EU energy and climate policies

Policy / Strategy	**Date**
2020 Climate and Energy Package	2007
Europe 2020: A Strategy for Smart, Sustainable, and Inclusive Growth	2009
Energy Roadmap 2050	2011
2030 Climate and Energy Framework	2014
Energy Union	2015
Paris Agreement	2016
Clean energy for all Europeans	2016
National Energy and Climate Plan (draft)	2018
Green Deal	2019
National Energy and Climate Plan (final)	2019

Source: Authors based on European Commission data

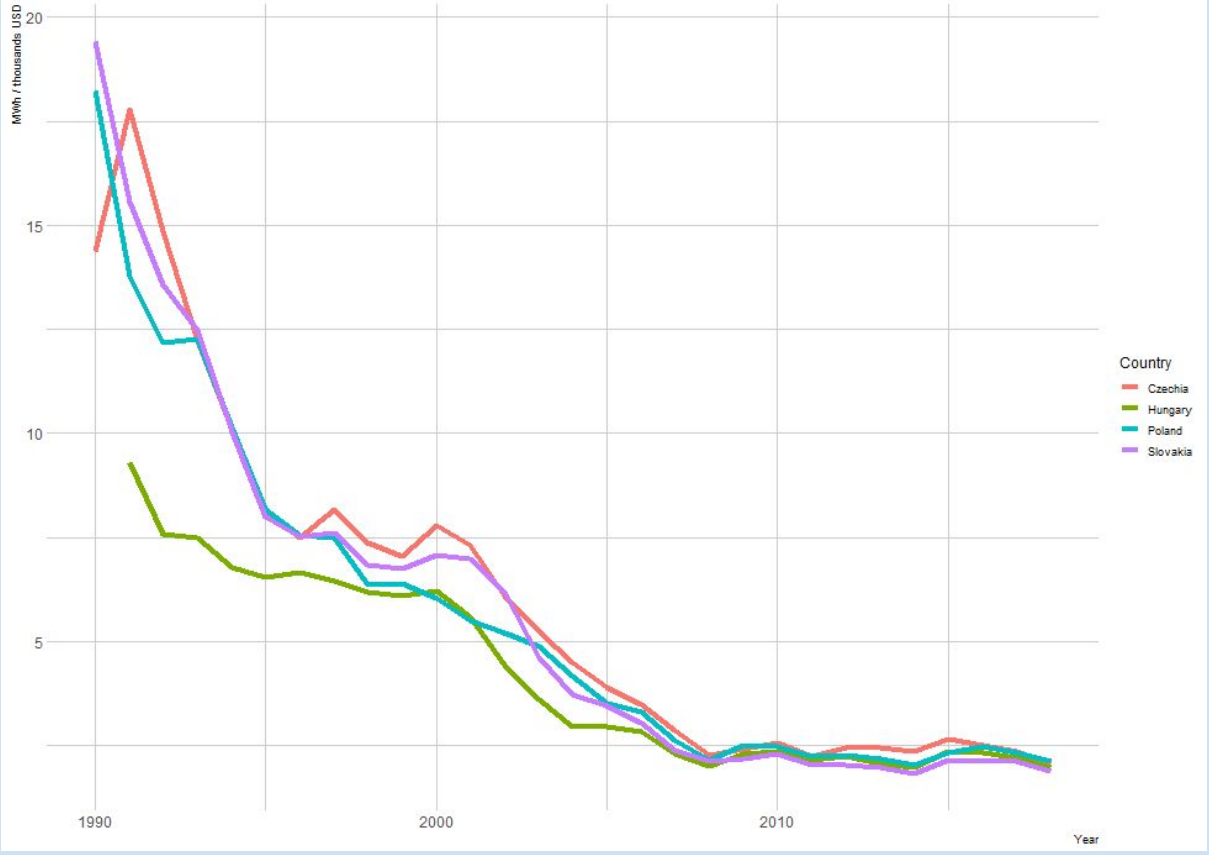
Energy efficiency

All four countries of the Visegrad Group show a significant improvement of energy efficiency since 1990. As Figure 4 shows, all of them suffered from low energy efficiency in 1990 – this was caused by a communist legacy of their economies (except of Hungary) being focused on heavy industry (in the Slovak case there was also significant military industry). With this industry being uncompetitive in the free market, shortly after the collapse of the Communist regimes and command economy connected to Comecon (The Council for Mutual

Economic Assistance) providing demand for heavy industry from the Visegrad Group countries, this section of economy experienced fast downturn. This had many negative consequences, however, in the area of energy and climate policy also several positive ones.

Besides sharp increase of energy efficiency (i.e. decrease of consumption per unit of gross domestic product (GDP) as show in Figure 4) there was also a connected sharp decrease of greenhouse gasses (GHG) emissions (see below). 1990s were characterised by a very sharp decrease of energy intensity (Slovakia started at 19.4 MWh per 1000 USD, Poland at 18.2) and although the process was halted in the second half of the decade in all four countries (around 7 MWh per 1000 USD), it was re-started in the 2000s as a result of these countries' involvement in EU's programmes. Second half of 2010 saw stabilisation of energy efficiency (at the level around 2 MWh per 1000 USD) as all the cheaper measures have been taken and the more expensive ones, that would further increase energy efficiency are more difficult to implement.

Figure 4: Primary energy consumption in the Visegrad Group countries per 1000 USD of gross domestic product



Source: Eurostat/Global Arena Research Institute

A different development has been recorded also when it comes to energy efficiency in per capita terms. While GDP has experienced sharp increase in all four Visegrad Group countries following the end of the Communist regimes, the number of inhabitants and the overall energy consumption has not changed that much. What has changed were the distribution of consumption – heavy industry and other sectors of economy with low energy efficiency were replaced by services and other sectors with higher energy efficiency. Here (see Figure 5) we can observe difference between the four analysed countries –the effect of heavy industry dismantling from early 1990s in the Czech Republic and Slovakia is quite visible in these two cases. Poland and Hungary were not that focused on heavy industry during the communist era

and therefore their consumption in per capita terms stayed very similar. What we can observe here are the consequences of 2009 economic crisis as well as different economic development during the 1990s. For example, we can observe the consequences of economic reforms in the Czech Republic in the 1990s that were followed by sharp recovery connected to increase of energy consumption.

While in the case of the Czech Republic and Slovakia we can observe a decrease of energy consumption in per capita terms between 1990 and 2018 (from 56.2 and 46.8 to 47.5 and 36.4 MWh per capita respectively), in the case of Hungary and Poland the difference in the structure of their economies (in the case of Poland also huge domestic market and less opened economy) and positive economic development during the three decades caused in the case of Poland actually an increase in consumption from 31.6 in 1990 to 32.7 MWh per capita in 2018 and in case of Hungary only minimal decrease from 32.7 to 32.0 MWh per capita in this period.

Figure 5: Primary energy consumption in the Visegrad Group countries per capita

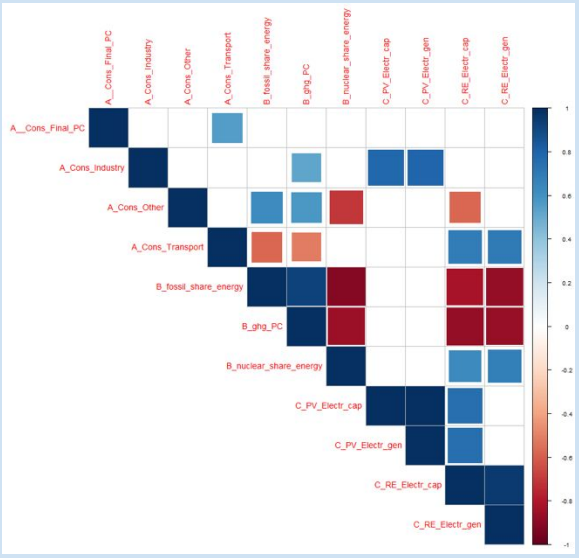
Source: Eurostat/Global Arena Research Institute

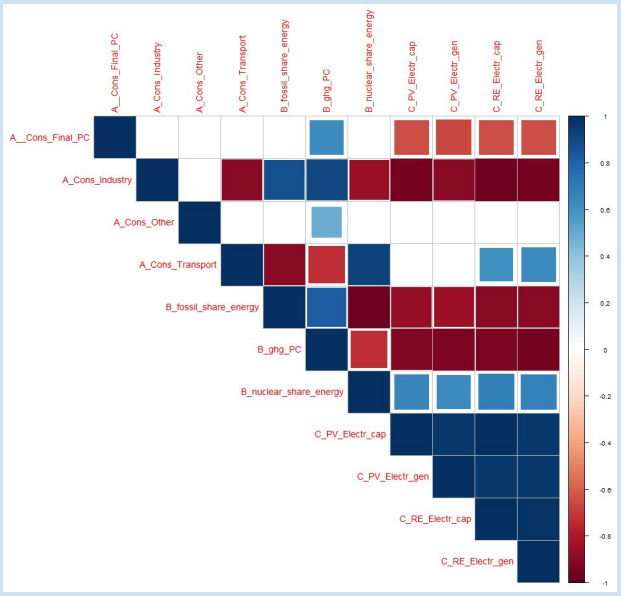
Correlation matrixes

The following section presents correlation matrixes between 11 energy and climate variables in each of the Visegrad Four countries what allows a comparison between these cases. Red squares present negative (-1) correlation between variables, blue squares present positive correlation (+1). These are all correlation with statistical significance, if there is no significance, there is no colour – i.e. the square is empty (white). The less strong is the correlation, the lighter the colour is (light red or light blue) and the smaller the square is.

Matrix 1: The Czech Republic

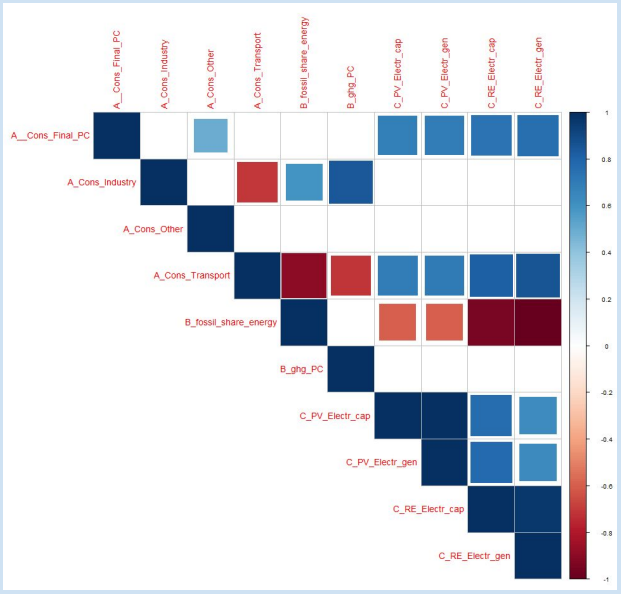
Matrix 2: Hungary

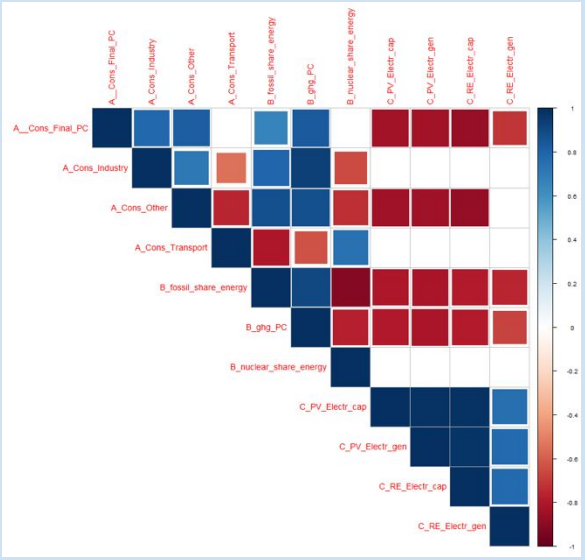




Matrix 3: Poland

Matrix 4: Slovakia





Source: Global Arena Research Institute

As we can see from the matrixes, the two representing the Czech Republic and Slovakia (Matrixes 1 and 4) are more similar to each other than to the other two. This can be linked to the historical legacy in the form of a common state (the Czechoslovakia) during the duration of which the infrastructural foundations of current energy systems of these two countries were made. For example, gas and oil pipelines were build, nuclear power plants were developed and nuclear industries (including research, training, engineering, etc.) were created. There are, however, still differences between these two. While in the Slovak case there is no link between energy consumption in industry sector and renewable sources of energy, there is a negative correlation between these two in the Czech case. In both countries there is a negative correlation between employment of renewables and final energy consumption per capita – in the period when the share of renewables in energy mix grew, the consumption of energy per capita decreased. This link is stronger in the Slovak case (the squares are darker red).

The other two matrixes (2 and 3) show much less connection between individual variables, both positive and negative. In the case of Hungary is an interesting connection between a growth of energy consumption in industry and increase of installed capacity and production of photovoltaic energy. However, both growths could be explained by a third variable as photovoltaic energy has a preferential access to the grid what means that the whole increase of production in photovoltaic power plants is consumed by the economy (including growing industrial sector). The Matrix 2 shows also a link between fossil fuels and nuclear – with the latter replacing the former (there is a negative correlation between these two). We can see a similar development in the Czech Republic and Slovakia. Also, production of GHG negatively correlates to the share of renewables and share of fossil fuels in energy mix.

Interestingly enough, this is case only for renewables as whole – when it comes to photovoltaic power plants, the correlation with GHG production and share of coal is not statistically significant. Decrease of GHG is also connected in all three countries with nuclear technology to a share of this type of energy in energy mix. In the Polish case, the increase of renewables (in general and also photovoltaic) is connected to increase of energy consumption in per capita terms.

Literature

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