Policy Brief
14/2024

NÁRODNÁ BANKA SLOVENSKA
EUROSYSTÉM

Greening the economy: Climate change and renewable energy adoption in CEE Countries

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In this policy brief, we look at the challenge of the transition to renewable energy in the Central and East European (CEE) countries. Europe is one of the fastest warming regions globally. Well-designed transition strategies towards renewable energy are important to counter this trend while ensuring price stability and fostering economic resilience. Our analysis reveals that renewable energy adoption was quite limited in the CEE countries over the last 20 years. Moreover, the results suggest that traditional financial institutions (banks) lag in supporting renewable energy. Countries with deeper capital markets tend to have higher amounts (shares?) of renewable energy. This brief thus advocates for blended financing mechanisms, i.e. a two-sided support of banks and capital markets, to increase and speed up the adoption of renewable energy sources.

- CEECs are disproportionately affected by climate change
- The transition to renewable energies helps to stabilize energy prices at lower levels
- Effective financing of renewable energy production requires a blend of bank financing and capital market funding
- Enhanced access to capital markets and financial innovation, is essential for mitigating climate risk
- Renewable energy adoption in CEECs can spur economic growth and high-tech innovation

Introduction

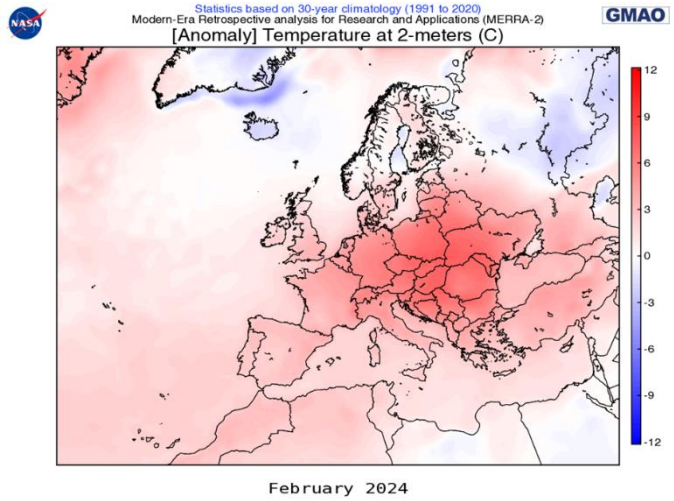
Climate risk translates into financial risk over the long term, calling for action by central banks, whose task is to secure stable and thus sustainable financial markets. Since the adoption of the Paris Climate Agreement in 2015, we have seen the first significant policy and financial initiatives enabling a sustainable energy future in the EU. These collectively aim to push economic and financial agents to support environmental sustainability. In parallel, the geopolitical landscape demands greater independence from fossil fuels to ensure long-term, sustainable economic development. This shift is not only necessary for environmental conservation but also for enhancing energy security, reducing geopolitical vulnerabilities, and fostering a resilient economy. The green transformation depends on the innovative capacity of companies and startups. Banks alone cannot provide the necessary capital because of the high capital requirements and potential investment risks (Mauderer, 2022). A balanced funding mix is therefore necessary to finance the green transformation.

In this policy brief, we follow up on the findings in Horky and Fidrmuc (2024), which demonstrate that deeper and more dynamic capital markets are positively associated with the consumption of renewable energy. Furthermore, the role of financial institutions in this process justifies more targeted policies supporting blended financing in renewable energy sources to mitigate investment risk. This analysis employs a cross-country perspective, with a particular focus on Central and Eastern European countries.

Climate Change in Central and Eastern Europe

Europe is identified as one of the fastest warming regions globally, a trend that is particularly pronounced in its continental areas (WMO, 2023). Climate change and hotter than usual summers directly affect consumer prices via affecting agricultural and economic activity (Kotz et al., 2023). Coastal regions have so far been somewhat shielded from extreme temperature increases thanks to the moderating influence of the sea. A visualization created using NASA's MERRA-2 tool for February 2024 illustrates these anomalies and is presented in Chart 1.

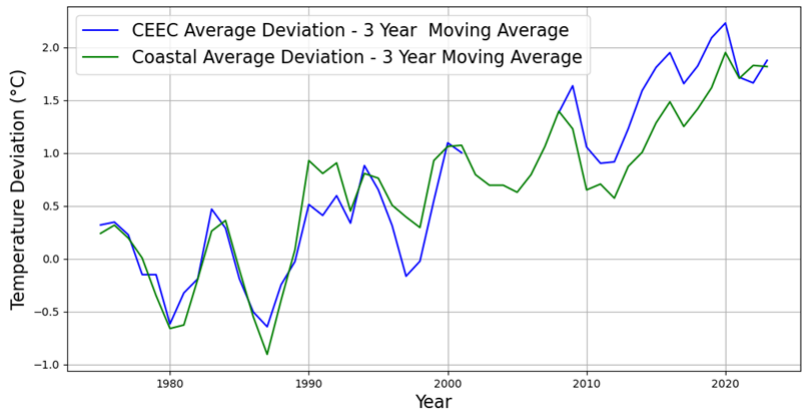
Chart 1
MERRA-2 temperature anomaly visualization for Europe



Source: MERRA2 - space-based observations of processes in the climate system). The visualization tool can be accessed via: https://fluid.nccs.nasa.gov/reanalysis/anomaly_merra2/
Notes: The figure shows the mean values of measured temperature for February 2024 minus their corresponding long-term mean values

This warming trend has accelerated since the 2000s, whereas prior deviations were not markedly different. To provide a longer-term perspective, we analyzed the average temperature deviations of several cities in Central and Eastern Europe and compared them with those of three major coastal cities[1]. The analysis presented in Chart 2 reveals a clear upward trend in temperatures across all cities examined, yet the increase is more pronounced for the cities within the CEEC region.

Chart 2
MERRA-2 temperature anomaly visualization for Europe



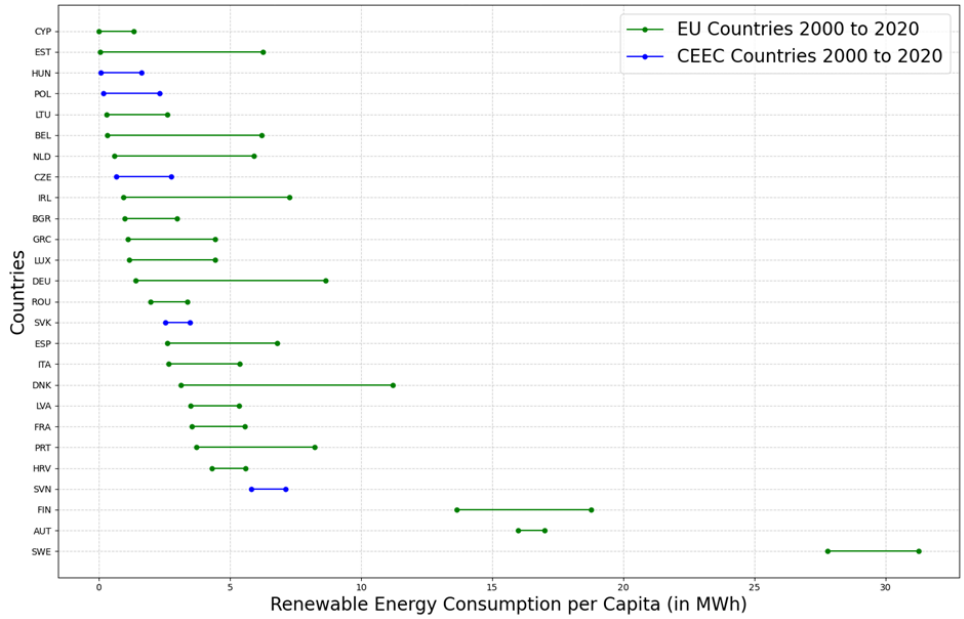
Source: We rely on annual historical average temperature data provided by Tutiempo Network, S.L., gathered from local weather stations. Notes: We calculate a long-term average temperature for each city from 1973 to 1990 and accordingly the temperature deviation for each city and each year from this long-term average. We aggregate these deviations to enable a comparison between the CEEC and the coastal cities.

[1] The cities in the CEEC are Bratislava, Kosice, Prag, Brno and Budapest, the coastal cities are Hamburg, Kopenhagen and Rennes.

Higher temperatures usually come with more frequent climate-related disasters, such as floods and droughts which directly affect consumer prices. Furthermore, it can be demonstrated that fossil fuels have significantly higher marginal costs than renewable energy sources, as evidenced by the merit order curve (Kremer et al., 2021)[2], and therefore have the propensity to significantly influence prices and inflation as well. It is shown, that energy prices are a major driver for cost-of-living development in European cities (Ingoglia et al., 2024). The transition towards renewable energy sources addresses both concerns: firstly, the global climate, which is particularly detrimental to continental regions; and secondly, it also serves as a vital economic strategy to stabilize prices and protect economies from the compound risks associated with energy price fluctuations. However, we find that the growth of renewable energy consumption[3] between 2000 and 2020 was rather low in the investigated CEECs compared to the rest of Europe as shown in Chart 3.

Chart 3

Development of renewable energy consumption (in MWh per capita) from 2000 to 2020



Source: Author's own calculations based on https://ourworldindata.org/grapher/per-capita-renewables

Notes: The graph depicts the change of renewable energy consumption per capita in European countries between 2000 and 2020

[2] An illustration of the merit order curve based on the research by Kremer et al. (2021) can be found in Chart 6 in the Appendix. The merit order curve reflects the order of the short-run marginal costs of energy/electricity production. As electricity is traded usually via day-ahead futures the sources with the lowest marginal costs are feed into the system first, followed by the next expensive ones and so on. Therefore, a higher share of renewables (i.e. low-marginal cost production) reduces and stabilizes electricity prices.

[3] Renewables in the used dataset include hydropower, wind, solar, geothermal, wave and tidal, and bioenergy, but not traditional biofuels. The primary energy we rely on in this research is measured using the "substitution method". This method is used for non-fossil sources of electricity (namely renewables and nuclear), and measures the amount of fossil fuels that would be required by thermal power stations to generate the same amount of non-fossil electricity. Data Source: Ritchie et al., 2023

Capital Markets, Financial Institutions and the green transformation

Renewable energies are associated with a certain degree of financial risk due to high investment costs in technologies and their future prospects being often ambiguous (Kim & Park, 2016). The research conducted by Horky & Fidrmuc (2024) suggests that a higher degree of financial development in terms of financial institutions reduces the amount of renewable energy consumption per capita. In contrast, the development of capital markets exerts an opposite effect. This is consistent with the argument that financial institutions, as providers of safe deposits and investments, tend to be risk averse. Their cautious approach stems from a responsibility to minimize losses and ensure the safety of customer deposits. The regulation of banks to ensure the stability of the financial system is of great importance, but it may impede the provision of capital to renewable energy business models.

Moreover, banks have well established relationships to their existing customers, also fossil energy producers. This additional layer might hinder the provision of capital to renewable energy producers. Capital markets are less constrained by such prudential considerations. Their openness to risk allows for greater investment in innovative but potentially volatile sectors, including green technologies. For these markets, behavioral factors play a significant role in shaping investment decisions. Notably, individual green preferences are increasingly influential. As Busato et al. (2023) posit, the concept of "green preferences" emerges from the understanding that environmental quality profoundly impacts consumers' environmental awareness. Individuals with strong preferences for a functioning environment are more likely to support, invest in, or purchase products and services from companies that prioritize sustainability, including renewable energies and green technologies.

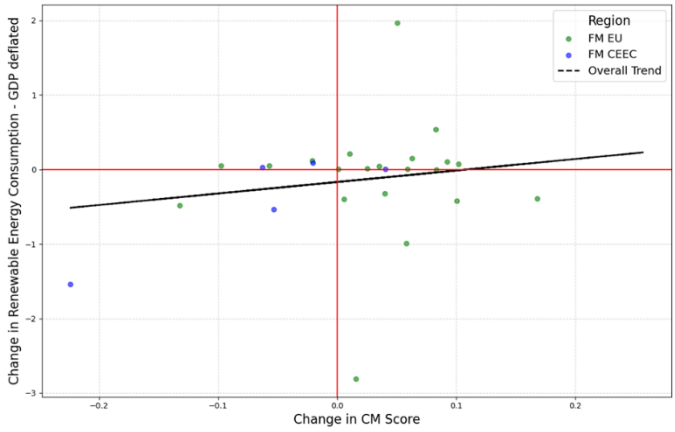
Existing data on the CEE countries confirm the story. We make use of the IMF scores[4] (Svirydzenka, 2016) as core measures to capture the impact of financial institutions and capital markets development on renewable energy consumption. Firstly, all 5 countries under investigation have a comparably low level of capital markets

[4] The overall IMF financial development indicator takes values between zero (0) and one (1). Compared to the traditional single indicators used as proxies for financial development (e.g., domestic credit to private sector), this indicator exhibits several advantages has a broader coverage and provides a multidimensional measure of financial development using eight financial variables. We use the subindices to measure financial institutions (FI) and capital markets (CM) each of which cover the depth and the accessibility of the financial institutions and markets.

development, with Slovakia showing the lowest values by a significant margin. The exact score values can be found in Chart 7 in the appendix. The following Charts 4 and 5 plot the change in capital markets, financial institutions respectively, development against the change in renewable energies consumption per capita[5].

Chart 4

Change in capital markets development vs. change in renewable energy consumption per capita (2000 – 2020)

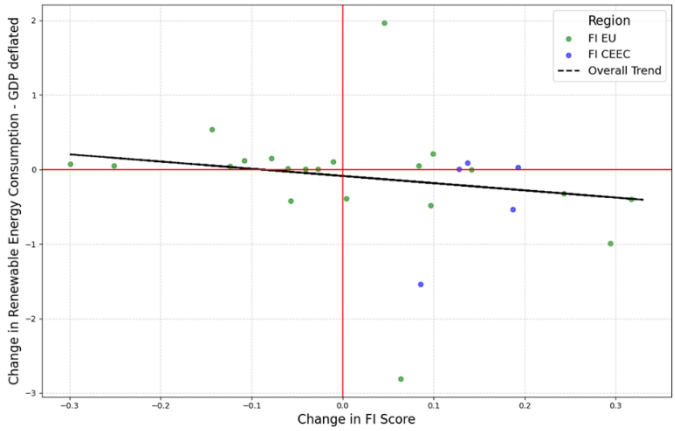


Source: Author's own calculations based in the IMF capital market development score and the renewable energy consumption per capita as taken from https://ourworldindata.org/grapher/per-capita-renewables

Notes: The graph shows the change in capital markets development and renewable energy consumption between 2000 and 2020 with a positive relationship. Outliers are not removed, however, Horky & Fidrmuc (2024) present robust econometric evidence for this relationship.

Chart 5

Change in financial institutions development vs. change in renewable energy consumption per capita (2000 – 2020)



Source: See, Chart 4.

Notes: The graph shows the change in financial institutions development and renewable energy consumption between 2000 and 2020 with a negative relationship. Outliers are not removed, however, Horky & Fidrmuc (2024) present robust econometric evidence for this relationship.

[5] As we compare countries of different size and economic development, we deflate the renewable energy consumption with the countries GDP to ensure better comparability. Furthermore, in this policy brief, we only present a short descriptive overview. The full econometric analysis can be found in the paper by Horky & Fidrmuc (2024)

The trend in capital markets development appears to be a significant bottleneck for the adoption of renewable energies. Our analysis indicates that, except for the Czech Republic, all CEECs under investigation have experienced a decline in capital markets development from 2000 to 2020. Among these, Slovenia has experienced the most pronounced decline across all European nations under investigation. In contrast, there has been a noticeable increase in the financial institutions sector development across all five countries. The overarching trends, depicted by the black line in our plots, remain consistent even after the introduction of several control variables and the application of a variety of panel data methodologies.[6].

Conclusions

CEE countries are disproportionately affected by the impact of climate change, resulting in more extreme weather events and potentially in price volatilities and increased inflation. Energy supply plays a special role as it is a core driver of cost of living in European cities. The adoption of renewable energy in this case not only addresses the world-wide issue of global warming but also mitigates directly region-specific turbulences of the climate change by having a moderating impact on energy prices.

Moreover, innovations in renewable technologies and associated research & development expenditures have a chance of creating complementary effects such as economic growth and the emergence of high-tech business models. Renewable energy production techniques are inherently high-tech advancements. By promoting and investing in such technologies, economies position themselves at the forefront of technological development. This potentially catalyzes the creation of new jobs and an innovative environment.

Ensuring the availability of blended financing sources, both bank- and capital-market based, is essential for accelerating the green transformation in CEECs. Only a combination of different financing sources can enable a robust support system for renewable energy projects. From a policy standpoint, banks need encouragement and regulatory frameworks that allow them to grant loans to renewable energy producers without increasing systemic risk. Simultaneously,

[6] The whole research including an overview of the methodologies applied can be found in Horky & Fidrmuc (2024).

strengthening access to capital markets is crucial for providing the necessary risk capital for renewable energy business models.

Finally, the development and fortification of capital markets in CEECs for enabling renewable energy business models is indispensable. It would be necessary to substantially increase the volume of capital markets and channel them towards innovative and renewable energy business models. For sure, the trend of the last years with a potential reducing capital markets development in the CEECs should be stopped for achieving the goal of promoting renewable energy sources. However, establishing capital markets is a lengthy strategic process associated with a lot of uncertainty.

The plan of the European Capital Markets Union (CMU) should help to increase capital market development in the CEE countries. CMU is a possibility to increase capital markets access but without the need of taking on country-individual steps. Furthermore, new financial instruments, regulated and traded on capital markets such as Catastrophe bonds and Green bonds offer innovative perspectives for investment in the green transformation and disaster risk management.

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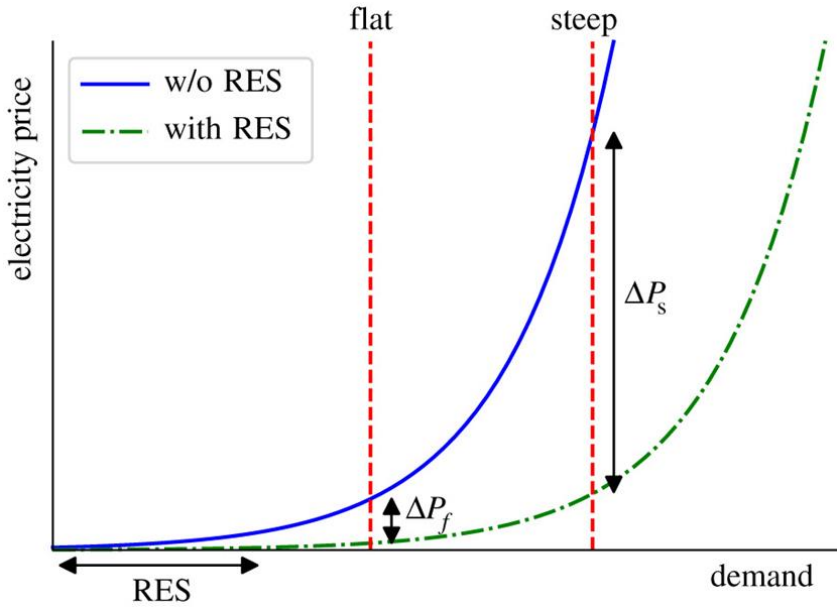
Appendix

Chart 6

Illustration of the merit order curve



Source: Kremer at al. (2021)

Notes: Merit order curve without (blue solid) and with (green dash-dotted) infeed from renewable energy sources (RES). As renewable energy sources have lower marginal costs than fossile energy sources, renewables excert a decreasing effect on electricity market prices.

Chart 7

Score values of financial institutions and capital market development for the CEECs

Country	Year	Financial institutions score	Capital markets score
CZE	2000	0.38	0.34
	2020	0.51	0.38
HUN	2000	0.38	0.40
	2020	0.52	0.38
POL	2000	0.31	0.45
	2020	0.50	0.38
SVK	2000	0.34	0.08
	2020	0.53	0.03
SVN	2000	0.46	0.34
	2020	0.55	0.11

Source: We use the IMF financial development index (Svirydzenka, 2016)

Notes: Values of financial institutions and capital markets development for the five CEECs in our data sample. It is visible, that the capital market score has decreased for most countries with partly extremely low values in 2020.