

Structural shifts will shape Ukraine's energy and climate future
- Lessons from the EU accession of Poland and Romania

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Introduction

Predicting future energy demand and emission must be based on assumptions how the Ukrainian economy will develop, and what critical uncertainties are.¹ A sensible assessment of future energy demand and emissions trajectories is crucial for policy-choices and investment decisions.

In the current situation such predictions are incredibly difficult. But for Ukraine's preferred scenario – relatively speedy accession to the EU – we have some historic experience on the economic implications.

As demonstrated by newer members such as Poland and Romania, accession to the EU has not only sped up economic growth, it has also profoundly changed the economic model of the acceding countries. In this paper we use these two examples, the largest two countries in Central and Eastern Europe, to illustrate similar structural shifts that could be in store for Ukraine and their associated implications for the country's energy demand and emissions.

Poland has been one of the world's greatest economic success stories over the last three decades. Early economic reforms and macroeconomic stabilisation, the subsequent reforms in the run-up to the EU accession in 2004 and the increasing integration into the single market have led to a profound transformation of the Polish economy.

Romania's economic reforms have been arguably less rapid and far-reaching, but its accession to the EU in 2007 has contributed to a profound transformation of the economy. Both country cases illustrate how intensive and stable economic growth has been underpinned by profound changes in the sectoral composition of the economy, increasing FDI inflow to certain industries, radical changes in export industries and structural shifts in the availability and cost of key factors of production.

For Ukraine, we argue that an EU accession scenario would imply very different structures of energy demand and emissions than a non-EU scenario. Hence, modelling exercises of the emissions and the energy sector of Ukraine should consider an EU accession scenario that reflects these structural shifts.

We will illustrate how key economic variables have structurally changed in Romania and Poland during their pre- and post-accession process – and briefly suggest the implications of corresponding shifts for Ukraine's energy demand and emissions.

¹ One example is the National Energy and Climate Plan (NECP) that is due to be submitted in summer 2024.

1 Executive summary of Poland, Romania and Ukraine

The geographical location, natural resources, and demographics of the three countries analysed in this paper played an important role in the macroeconomic trends prevailing since the beginning of the economic transition. In particular, these factors determined their traditional competitive advantages and development of the main sectors of the national economy. Further transition in line with the EU integration of these countries also resulted in shifting of many of the traditional industries and lower reliance on the domestic resources. However, the strong presence of mining of the traditional resources still characterised Poland, Romania and Ukraine in 2020. The population trends and countries' size are no less important for understanding the national specific aspects of the economic development of these countries.

The different size of the population may not also correlate with the number of labour forces (2020)

	Romania	Poland	Ukraine
Population	19.265.250	37.899.070	44.132.049
Labour force	8.908.333	18.245.536	20.585.937

Source: World Bank (2023f)

Having the biggest population among the three countries in 2020, the available labour force in Ukraine was only slightly higher than in Poland and represented less than the half of the total population. While the amount of the labour force was around the half of the total population in Poland and Romania in 2020.

Ukraine preserves a significantly higher share of the agriculture lands compared to Poland and Romania (2020)

	Romania	Poland	Ukraine
Territory (sq km)	238.397	312.679	603.700
Agricultural lands (as % to total area)	56.7	48.1	71.3

Source: World Bank (2023g)

Being historically known as the 'breadbasket' of Europe and being the biggest country in Europe, Ukraine preserves an extremely high share of the agricultural lands compared to its EU neighbours - exceeding 70%. This high share of agricultural lands in Ukraine is largely explained by the geographical conditions and one of the most fertile soils in the world. On the other hand, this also relates to a slow structural transition of the Ukrainian economy, which still heavily relies on agriculture: e.g., the share of the agricultural lands in Poland and Romania also exceeded 60% and the beginning of their transition in 1990s, but then sharply dropped to the level of 50 - 55% in the 2000s (based on the World Bank data).

The three countries preserve their Europe's and global leadership in some important mining areas

The significant role of the mining industries is another important feature of Poland, Romania and Ukraine. Thus, before the Russian full-scale invasion of 2022, Ukraine was among top 10 countries in the world producing iron, as well as top 5 European gas producers, also having a significant production of steam and coking coal. At the same time, Poland remained among the main European lignite and steam coal producers, while having a much lower level of iron production. Eventually, Romania maintained an important share of the domestic gas and petroleum production having a possibility to satisfy the majority of the domestic needs.

	Romania (2020)	Poland (2020)	Ukraine (2020)
Iron (tones)	565.000	8.000	49.274.000
Aluminium (tones)	271.307	N/A	N/A
Lignite (tones)	15.030.906	52.355.510	1.843
Coking coal (tones)	N/A	12.584.820	6.434.800
Steam coal (tones)	N/A	42.111.970	17.733.500
Petroleum (tones)	3.457.000	858.030	2.430.800
Gas (mn cubic meters)	8.914	4.860	20.183
Uranium (tones)	N/A	N/A	877

Source: International Organizing Committee for the World Mining Congress (2023)

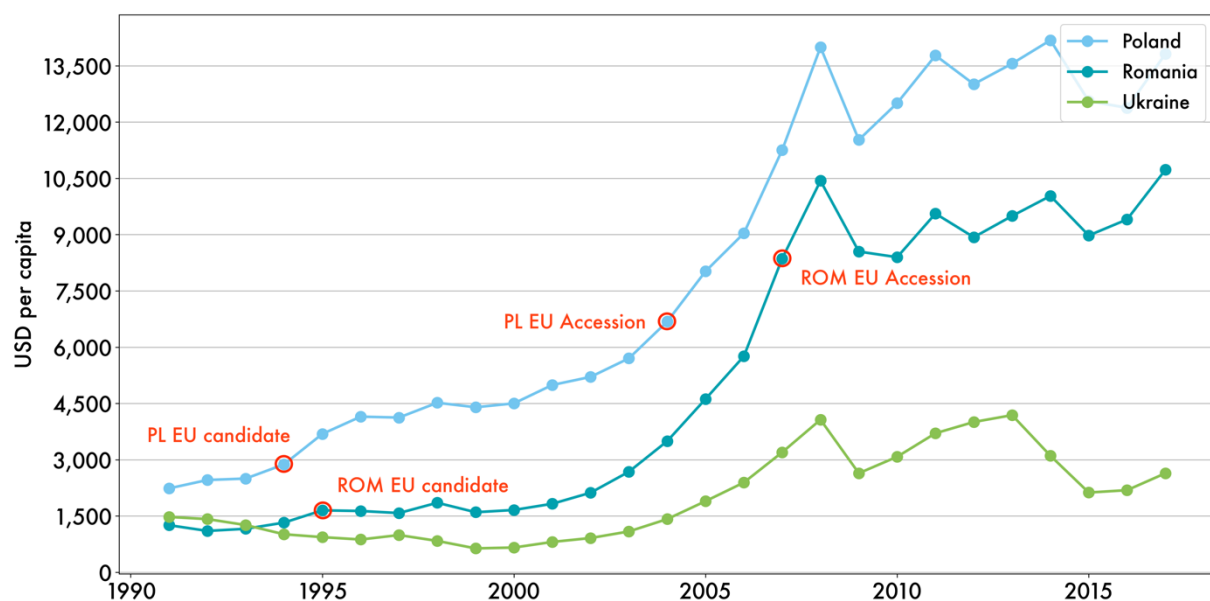
The presence of certain mining industries is another legacy of the period preceding the EU Integration of the countries analysed in the paper. Creating important comparative advantages for their economies in the previous years, the traditional mining industries may also face additional challenges in the current green transition of the national economies on their way of ensuring long-term competitiveness. In particular, the issues of carbon intensity of such industries and possible social implications in their transition deserve the special attention.

2 Macroeconomic developments

Fast growth in Poland and Romania also proved relatively resilient in times of crisis

Both Poland and Romania experienced several important spikes in GDP growth associated with their EU accession efforts and integration into the EU market. Recessions in both countries were fairly short-lived and followed by rapid recoveries. Many analysts argue that structural reforms in the run-up to EU accession and the integration into the EU internal market drove the dynamic economic development observed. GDP growth in Ukraine followed a slower, more linear trajectory before the 2008-2009 financial crisis and a much deeper recession afterwards. Recovery has also been much slower in Ukraine.

Figure 1: Nominal GDP per capita (in USD)²



Source: (World Bank, 2023b)

Some implications for Ukrainian energy demand and emissions:

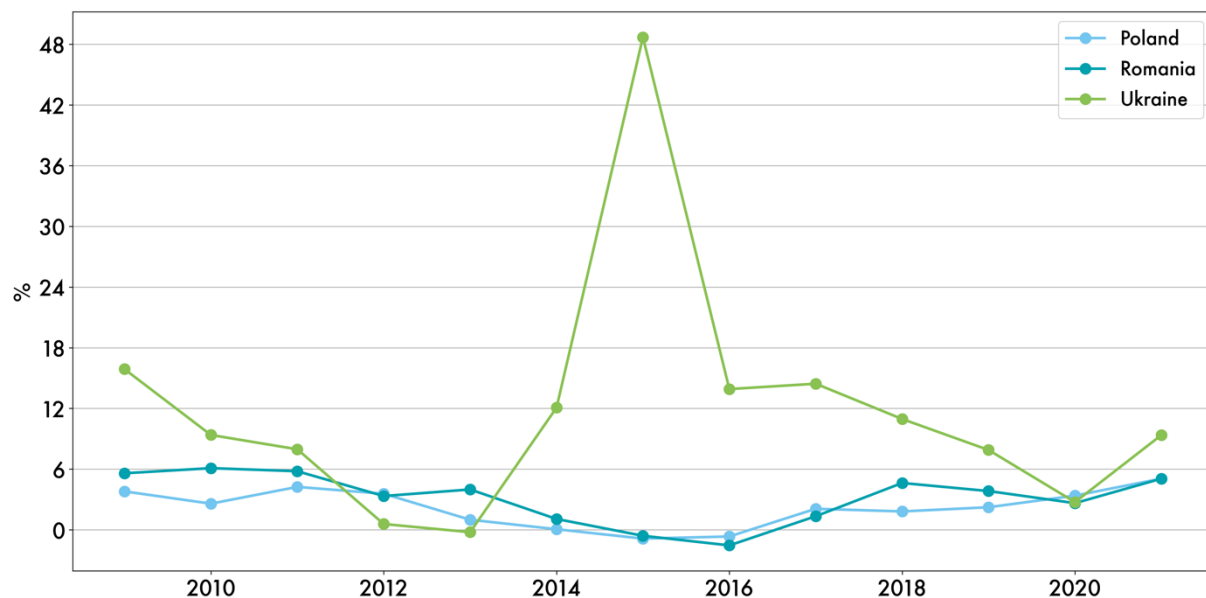
- Very steep sustained economic growth is a possible scenario.
- Modernisation and structural change (see section 2) are needed to contain energy demand and emissions in this scenario.

² The graph demonstrates the nominal GDP per capita of Poland, Romania and Ukraine. Alternatively, the graph can also be presented in GDP PPP values. The general trend and spread between the countries will not significantly change if the PPP values are selected. At the same time, choosing the PPP values may result in a slightly lower accuracy of the numbers due to various approaches to PPP calculation.

Calming of inflation in Poland and Romania ensured forward-looking economic decisions

Thanks to macroeconomic stabilisation policies and growth, Romania and Poland have calmed inflation to a predictable rate of no more than 5% over the last decade. The Copenhagen criterion on ‘economic stability’ has likely provided an important anchor for expectations. Both Poland and Romania are not currently members of the Euro-zone but expected to join it in the upcoming years. With joining the Eurozone, the control over the inflation in these countries will also be a subject of the common European Central Bank's monetary policy.

Figure 2: Inflation rate (in %)



Source: (World Bank, 2023d)

Meanwhile, the inflation rate in Ukraine has been unstable most of the time, reaching record highs in 2015 and still fluctuating substantially during the subsequent ‘stabilisation’. This instability is largely explained by the high volatility and low level of development of financial markets in Ukraine, the high degree of exposure to external factors and the relatively late transition to inflation targeting by the Central Bank (2016).

Some implications for Ukrainian energy demand and emissions:

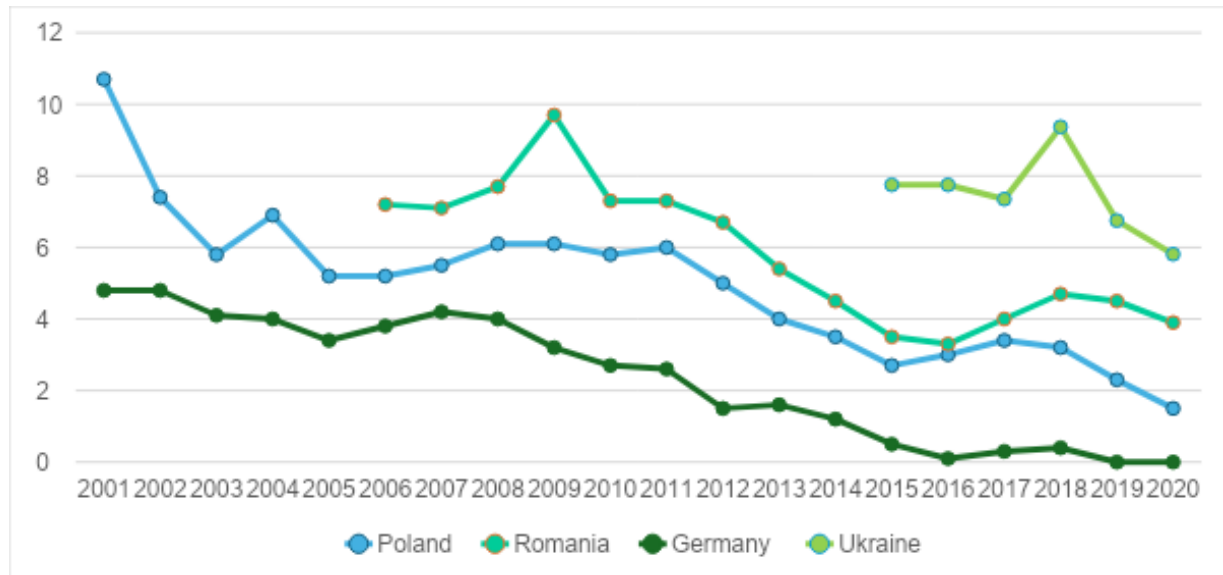
- Predictable inflation will allow more forward-looking decision-making (clearer how relative prices are going to develop).
- Better targeting of investments to sectors of future scarcity.
- The stabilisation in inflation is likely to result in better economic efficiency.

Sharp decline in the cost of capital in Poland and Romania during and after accession

The cost of capital in Poland and Romania has fallen sharply on several occasions since the 2000s, as can be seen from the interest rate on the countries' government bonds. The decline in the cost of capital also coincides with the progress made by Poland and Romania in their credit ratings (reaching BBB and A levels), which are still slightly higher than those of the most advanced EU economies (e.g., Germany).

The interest rate of Ukrainian long-term government bonds remains approx. 2 times higher than in Poland and Romania, which could change radically if macroeconomic stabilisation and growth are achieved.

Figure 3: Yield of long-term government bonds (in %)



Source: (OECD, 2023b; Ministry of Finance, 2024)

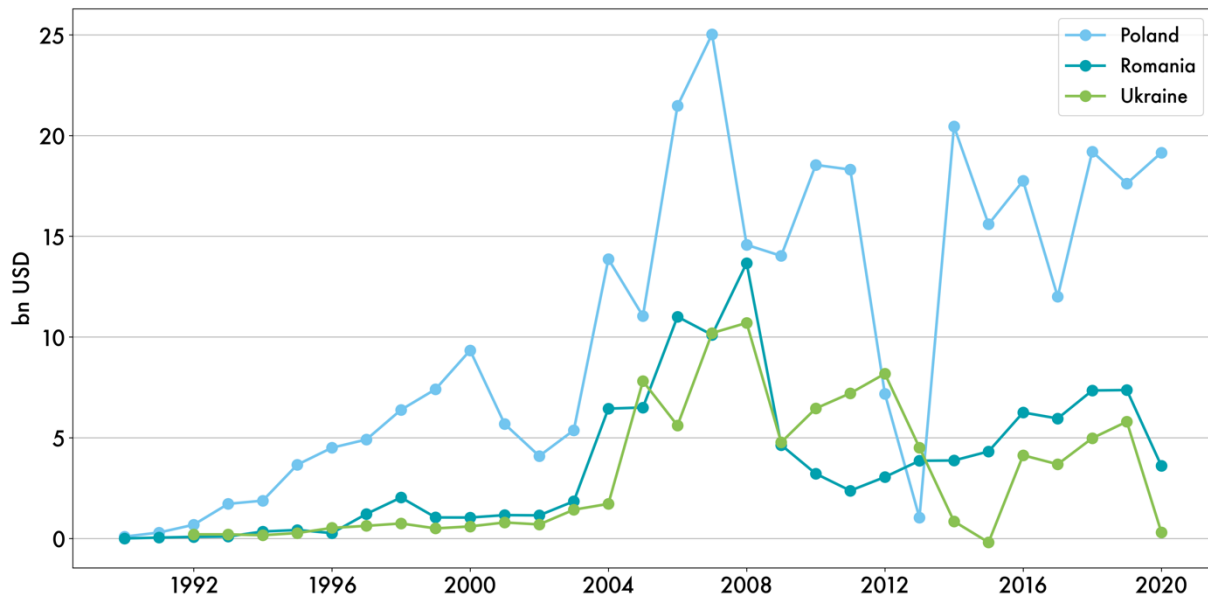
Some implications for Ukrainian energy demand and emissions:

With lower capital costs, all long-term solutions become relatively cheaper. This typically helps clean solutions.

Lower capital costs favour CAPEX-intensive technologies over OPEX intensive solutions (i.e., nuclear, RES, EV, energy efficiency relatively benefit from lower capital cost; while gas/coal/hydrogen plants etc. may lose attractiveness).

Foreign direct investment increased in Poland and Romania leading up to EU accession, stabilising afterwards

Figure 4: Foreign direct investment, net inflows (in bn USD)

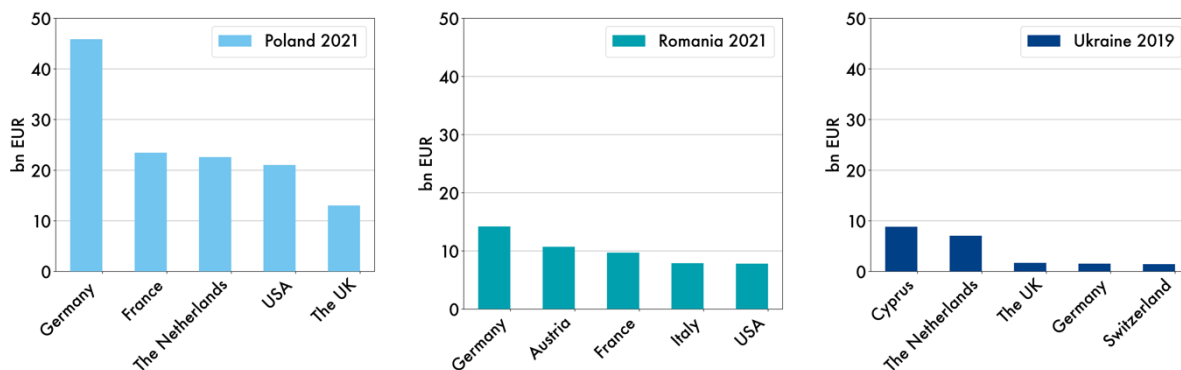


Source: (World Bank, 2023a)

Poland and Romania experienced a sharp increase in FDI that underpinned the intense economic transformation and integration into the EU.

FDI in Ukraine also shows a non-linear trend, with several sharp increases during the period of economic growth in the mid-2000s and the post-recession recovery. In general, the examples show that FDI inflows can both increase and decrease, with the EU integration factor, the implementation of necessary reforms and the external demand for the national product playing a crucial role.

Figure 5: FDI by origin (in mn EUR)



Source: (European Central Bank, 2023; Narodowy Bank Polski, 2023; National Bank of Romania, 2022; Ukrstat, 2020)

The main sources of FDI differ substantially between Ukraine, which receives much of its FDI inflows from Cyprus and the Netherlands, which are likely to be off-shore havens for Ukrainian (or Russian) money; and Romania and Poland, which receive most of their FDI from the major economies of Europe and the USA.

The Ukrainian data are therefore quite tricky: they make it very difficult to identify the real origin of the sources of FDI, may lead to an overestimation of FDI (as some of it is domestic money) and show the lack of interest of the large EU economies in investing in Ukraine.

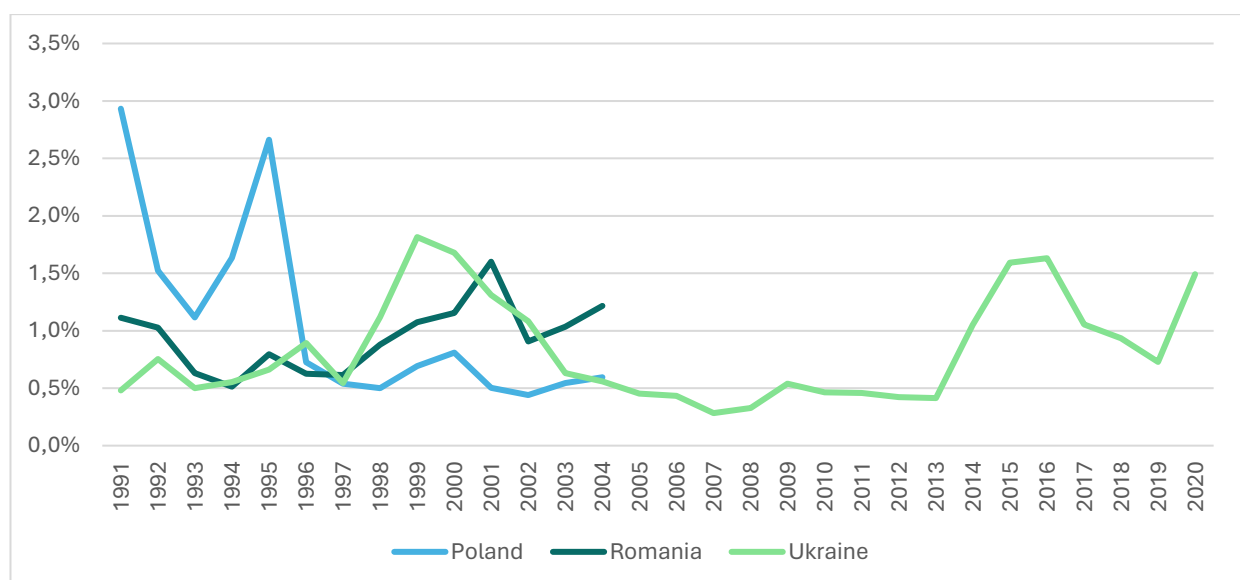
Some implications for Ukrainian energy demand and emissions:

- Structural FDI inflow implies knowledge transfer (higher TFP).
- More FDI reduces domestic consumption-investment trade-offs, allowing for an increase in both.
- Investment from the technologically advanced countries of the EU may relocate the production of new technologies to Ukraine.
- Lowering the share of off-shore jurisdiction in investment to Ukraine can bring a more constant and stable investment flow.

Alongside with FDI, Poland, Romania and Ukraine received a significant development aid in their transition

Given the challenges that transitional post-socialist economies face on their way to market economy, international financial institutions have been actively providing monetary support to offset the economic shocks and ensure financial stability of the countries. The data provided by the World Bank (until 2004 for Poland and Romania) indicates the willingness of large donors to provide a stable support, where the intensity of reforms can lead to a bigger assistance from international financial corporations, as it was in the case of Poland in the early period of the reforms. At the same time, the data reveals that Poland, Romania and Ukraine received approximately similar amounts of international aid (as ratio to their GDP) in a pre-accession period. After the beginning of the Russian full-scale invasion, the aid to Ukraine has increased dramatically (previously certain increase also took place in 2014 – 2015 following the annexation of Crimea and war in Donbas), but this is explained by the extraordinary situation related to the support amidst active warfare, which is not a typical tendency for the region.

Figure 6 International development aid as the % to GDP



Source: (World Bank, 2023h)

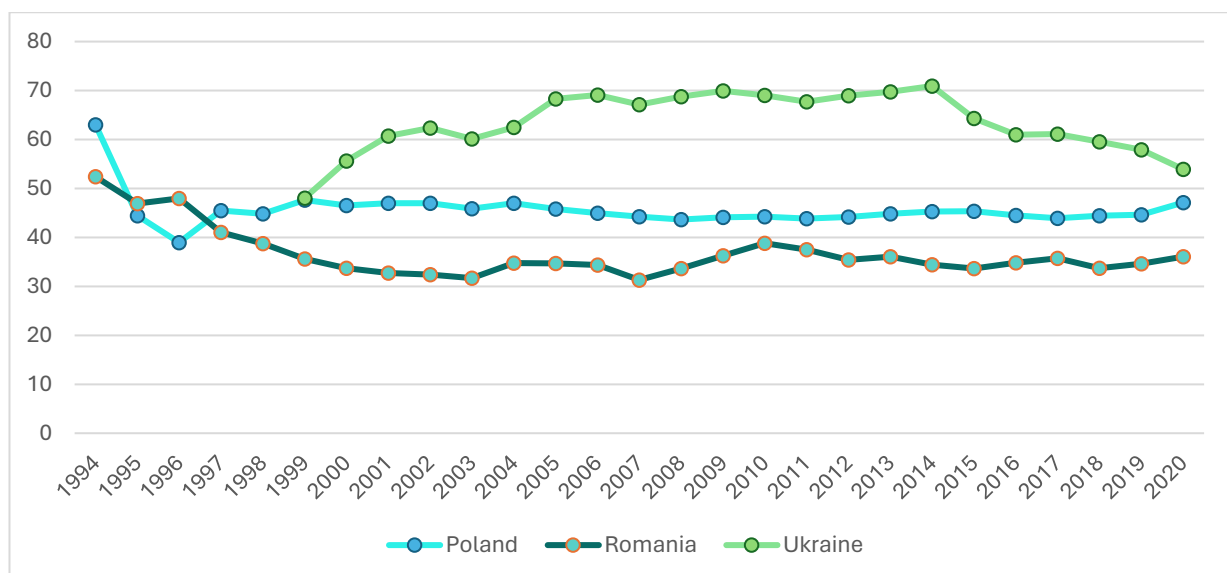
Some implications for Ukrainian energy demand and emissions:

- Development and other monetary aid is likely to ensure the support in the period of important climate reforms and transformations of the Ukrainian economy.
- A specific aid for climate transition can also be expected to support the particular reforms and modernization activities.
- The quality of post-war reconstruction and reforms in Ukraine may result in an increase of international support.

Ukrainian economy remained heavily subsidised compared to Poland and Romania before 2022

The level of subsidies as the ratio to overall government spending indicates the degree to which the national economy relies on budgetary support to keep the main industries and sectors running. The high share of subsidies spending often signals the need to bail-out many sectors that cannot efficiently function under free market conditions. This issue becomes especially problematic for the post-socialist transitional economies, where the national industries faced significant demand reduction and extreme pressure from the foreign rivalries. The chart below demonstrates that both Poland and Romania shifted from the significant (more than 50-60%) budgetary spending on subsidies to a more moderate and stable rate of less than 50%. At the same time, Ukraine had significantly increased the subsidisation of its economy in the late 1990s and until 2014, reaching the level of more than 70%. The beginning of the reforms under EU Association Agreement, improvements in budget discipline and losing some industries after 2014 resulted in lowering the share of subsidies in government spending, which, however, remained visibly higher compared to Poland and Romania before the Russian full-scale invasion of 2022.

Figure 7 Subsidies and other transfers as % of expense

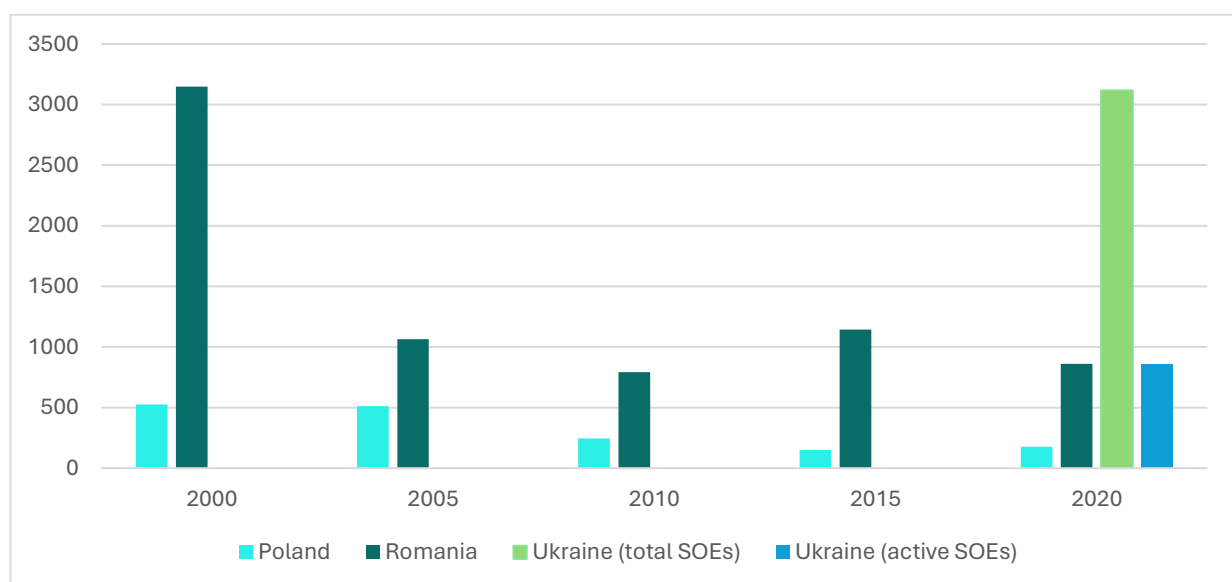


Source: (World Bank, 2023i)

A more precise outlook of the state sector of economy partly explains this tendency. In particular, Ukraine maintained a significantly bigger number of state-owned enterprises (SOEs) compared to Poland and Romania

before the beginning of the Russian full-scale invasion. Unlike Poland, which has been operating a limited number of SOEs since the massive privatisation and corporate governance reform in 1990s - early 2000s, or even Romania, which still has a pretty large state sector, the Ukrainian government has been traditionally operating an extremely extensive number of SOEs exceeding 3000 enterprises. Only a part of them (approx. 850) are still active with an even smaller number of profitable ones, but the remaining more than 2000 SOEs still create a significant pressure on the budget in terms of maintaining the assets. One can expect the significant reduction of the number of SOEs in Ukraine due to the privatisation process and optimization of state assets needed for the successful EU accession, moreover, the Ministry of Economy of Ukraine already announced such plans.³

Figure 8 The number of SOEs in Poland, Romania and Ukraine



Source: (Statistics Poland, 2005,2010,2015,2020; Romanian Fiscal Council, 2011, 2016, 2020; International Monetary Fund, 2019; LIGA.net, 2024)

Some implications for Ukrainian energy demand and emissions:

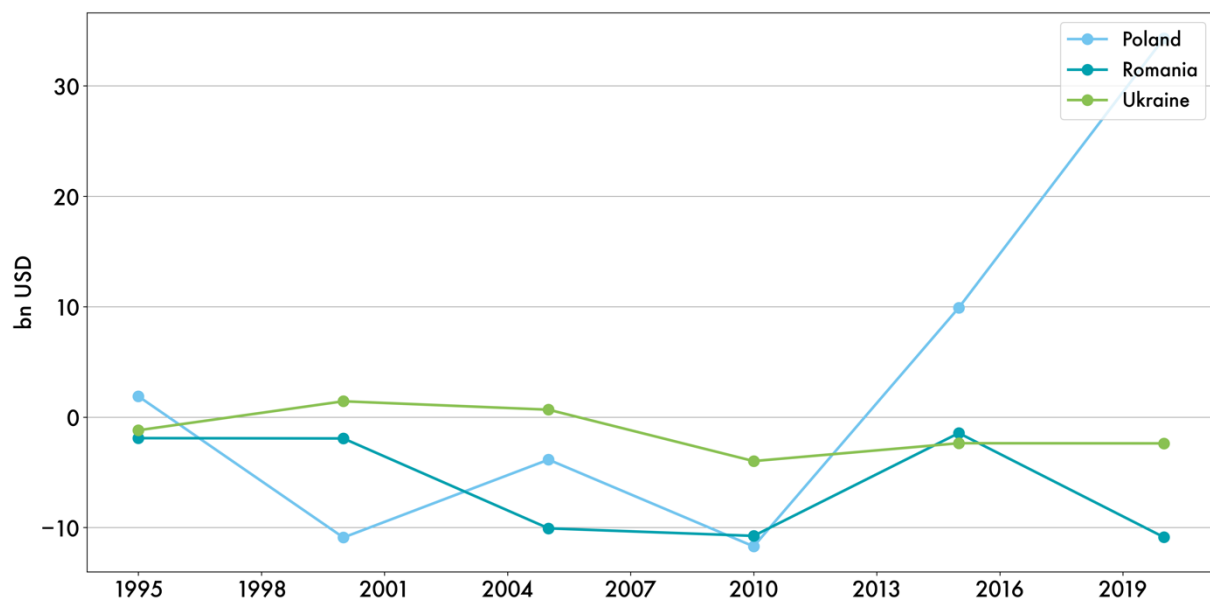
- With the general reduction of the burden on the state budget of Ukraine, some important activities related to climate transition may still be needed.
- In particular, the allowed state aid allocated under EU rules for CAPEX investment in new facilities of energy generation and other green projects may concern such subsidies.
- The decrease of the number of SOEs will also result in lower costs for keeping the industries running and ensuring coverage of their operation costs.
- At the same time, additional support is likely to be needed for the transition of coal regions and other areas affected by carbon-intensive industries, as well as people working in such industries in Ukraine.

³ <https://projects.liga.net/reform-of-corporate-management-of-state-property-eng/>

Increased consumption led to trade balance deficit in Poland and Romania

Strong consumption growth during the accession process led to a negative trade balance in Poland and Romania. After 2012, Poland started to generate a substantial trade surplus. Ukraine's macroeconomic situation did not allow it to afford a substantial trade deficit in order to simultaneously grow investments and consumption.

Figure 9: Net trade in goods and service (in bn USD)



Source: (World Bank, 2023e)

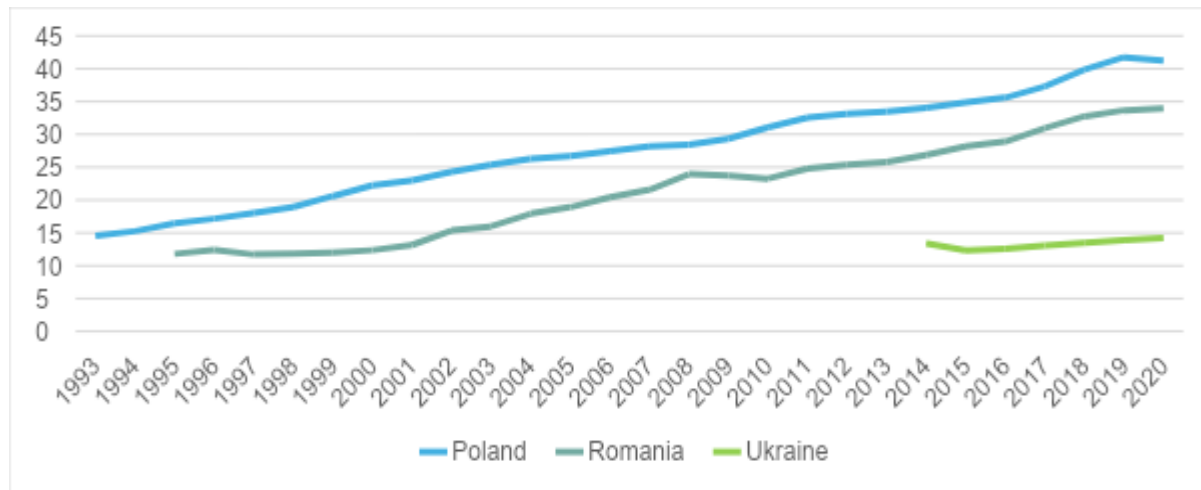
Some implications for Ukrainian energy demand and emissions:

- Imports of essential goods and services will likely increase in the future.
- This might also replace some of the energy-intensive industries in Ukraine.

Labour productivity sped up as GDP increased in Poland and Romania

Labour productivity, estimated as the unit of GDP produced per hour worked in the country (by the total labour force), has risen sharply in Poland and Romania in line with their strong GDP growth. Ukraine's current much lower level of labour productivity needs to increase substantially to support economic growth.

Figure 10: Labour productivity (in USD per hour)



Source: (Ministry of Justice - Ukraine, n.d.; OECD, 2024; International Labour Organization, 2024) and some own calculations

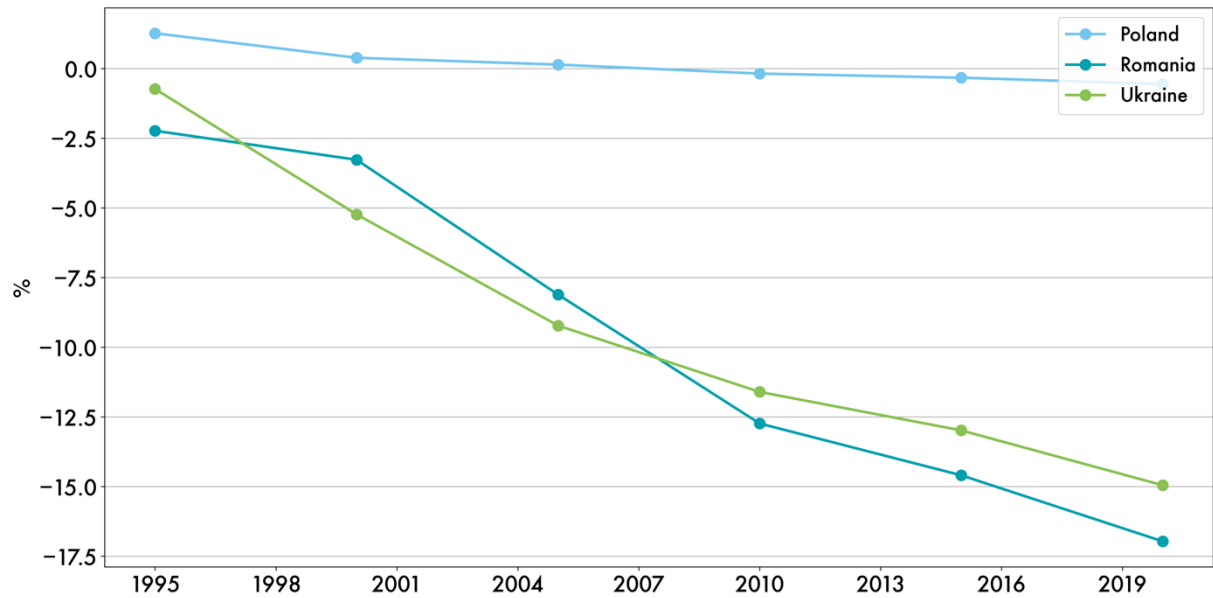
Some implications for Ukrainian energy demand and emissions:

- Labour productivity is a key determinant of potential output.
- Decoupling GDP from population dynamics will be crucial for Ukraine’s economic development.

Poland and Romania show very different population dynamics

Poland has so far managed to maintain its population level despite increasingly low fertility rates (2021: 1.3) as less than 10% of the population emigrated, while Romania has been gradually losing population since the 1990s due to significant emigration, while fertility rates somewhat stabilised (2021: 1.8). In Ukraine, before the war, most population losses were a result of very low fertility rates (2019: 1.1) with emigration more limited than the other two countries. The war has changed this drastically.

Figure 11: Deviation from 1990 population level (in %)



Source: Own calculation based on (UN Data, 2022)

Some implications for Ukrainian energy demand and emissions:

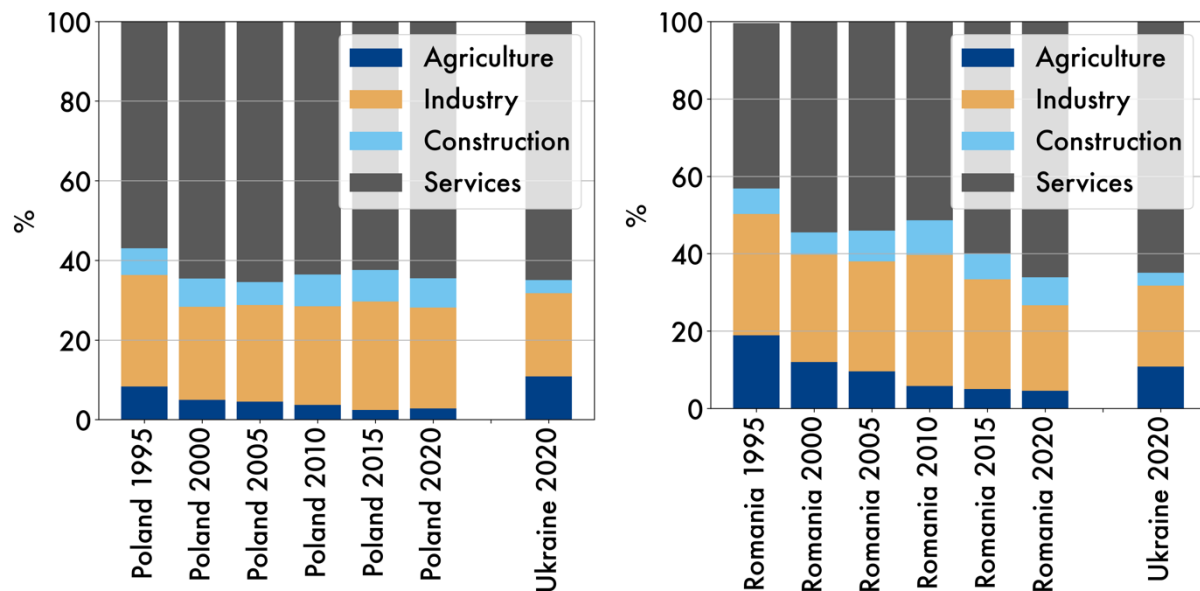
- Persistent loss of population (migration, war and demographic echo) will be a major challenge for Ukraine.
- It might drastically reduce economic activity and population energy consumption, and hence overall energy consumption and aggregate emissions.
- The age and skill structure of the Ukrainians that stay in the country will be an important determinant of the country's future economic development.

3 Sectoral shifts

Agriculture and industry lose their share to services in Poland and Romania

The cases of Poland and Romania show that both countries experienced a dramatic shift in sectoral economic development, i.e., the decline in the share of agriculture and industry in the structure of their economies, which was largely replaced by the rapid growth of services.

Figure 12: Share of the main sectors in total value added (in %)



Source: Own calculation based on (Romania National Institute of Statistics, 2024; Statistics Poland, 2023; Ukrstat, 2023b)

The example of Ukraine also demonstrates the strong growth of the role of services in the economy, which is already at the level of Romania and Poland, while the country maintains a much higher share of agriculture.

Some implications for Ukrainian energy demand and emissions:

- In terms of value-added shares, Ukraine does not look very different from PL or RO.
- The main difference is the substantially larger share of agriculture.
- As the transition continues, the agricultural sector may shrink in the structure of the economy, while the services sector may grow even more than in PL and RO, leading to lower emissions.

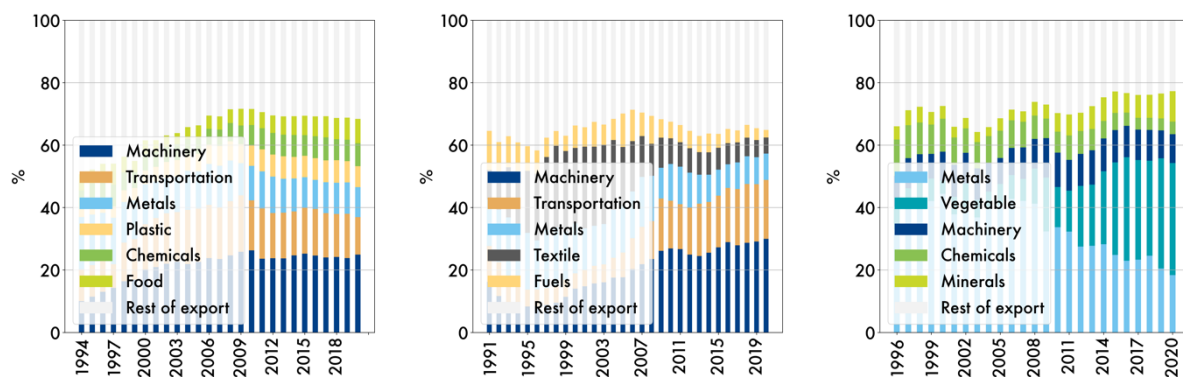
Shifts in export structure towards higher value products

The share of machinery and transport services in Poland’s exports increased significantly in the early stages of its economic transition (1994-2001). Later, this trend became more linear, with another sharp increase in machinery in 2009-2010. Together with the increasing role of machinery and transport, Poland’s export structure has become more diversified over time.

The case of Romania was different from that of Poland before it joined the EU. In particular, Romania’s exports shifted significantly from the growth of metals and textiles in the early stages to a sharp increase in machinery later on. With EU accession and the post-2009 financial crisis transformation, the traditional export sectors shrunk to a minimal level, having been completely overtaken by machinery and transport services. Thus, the Romanian case shows that economic transition combined with EU integration led to a sharp restructuring of exports with the decline of traditional industries and an increasing share of machinery and services.

The transition of Ukrainian exports is visibly different from these two cases, where a significant share of metals has been replaced by agriculture since the 2009 financial crisis with a sharp decline in machinery exports. The shifts in Ukrainian exports were mostly driven by external factors (e.g. shifts in external demand) rather than by domestic transitions and integration into the new markets.

Figure 13: Share of the main export sectors (in %)



Source: (World Bank, 2022)

Some implications for Ukrainian energy demand and emissions:

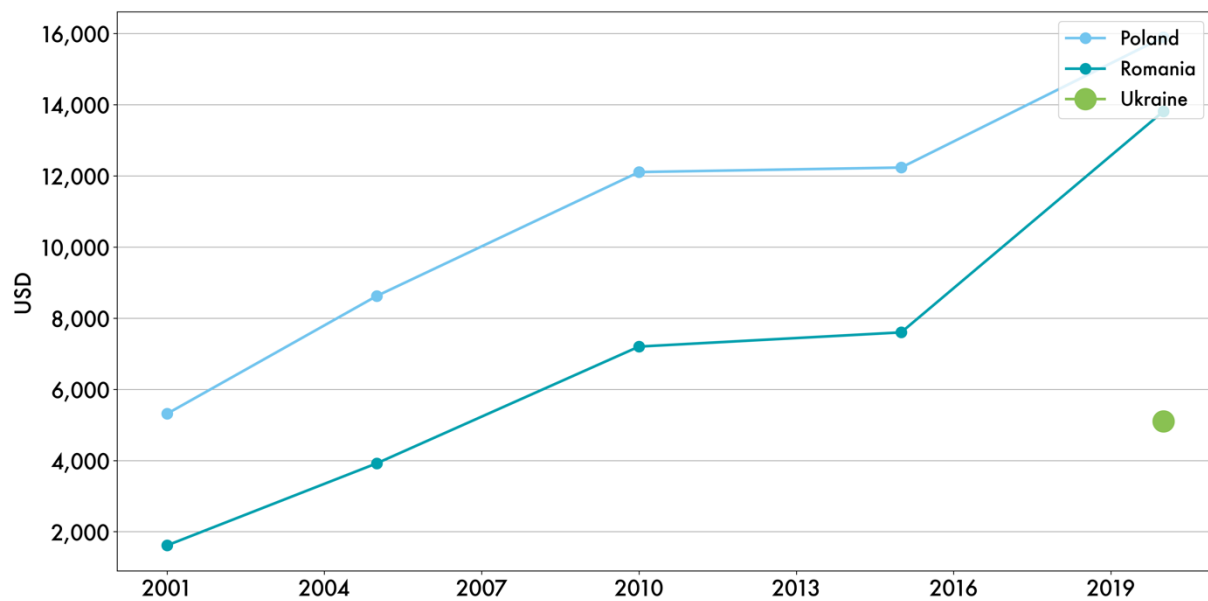
- Moving to more high-value-added products might allow a decoupling of growth from emissions.
- This might also mitigate the outsized role of agricultural products. Energy consumption is also likely to fall as more high-tech sectors develop rapidly.

4 Consumption tendencies

Economic growth is likely to lead to a significant improvement in social and economic conditions, which will also influence consumers' behaviour.

Sharp increase in real wages as a result of intensive economic growth in Poland and Romania

Figure 14: Annual average gross wages (in USD)



Source: (OECD, 2023a; Pension Fund of Ukraine, 2020)

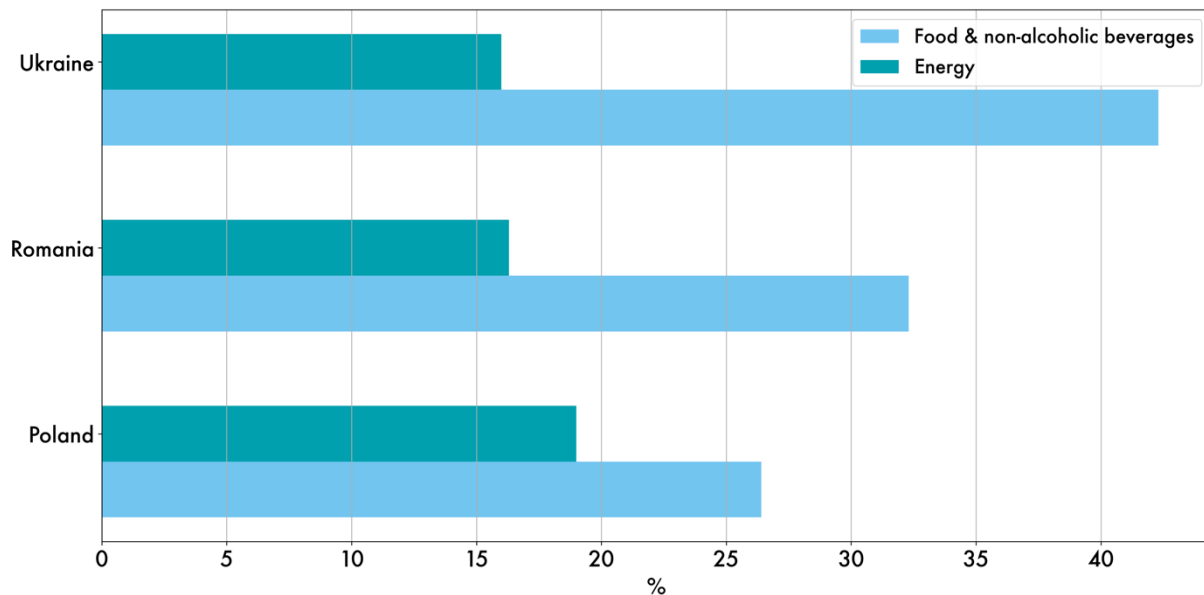
Real wages in Poland and Romania have shown clear stable growth over the last decade with some especially fast increases in the 2004–2010 and 2015–2020 periods. The corresponding indicator for Ukraine in 2020 has lagged well behind the Polish and Romanian pace (around 2.5 to 3 times lower), as it can be seen from the comparative chart above.

Some implications for Ukrainian energy demand and emissions:

- An increase in average income can provide households with more resources for energy efficiency measures.
- The likely increase in consumption may not result in a significant uptake in emissions as the production of goods and services grows more innovative and efficient.

Lower share of spending on food and energy post-economic transition in Poland and Romania

Figure 15: Share of households expenses for 2021 (in %)



Source: (National Institute of Statistics Romania, 2022; Statistics Poland, 2022; Ukrstat, 2022)

As seen in the graph above, Ukrainian households as of 2021 still spend 10–15% more of their income on food than their Polish and Romanian counterparts, while spending about the same proportion on energy and utilities. If social and economic conditions improve rapidly in Ukraine, households are likely to experience an increase in personal income. This should lead to shifts in expenditure, with a lower share of income spent on food and energy. At the same time, the liberalisation of energy prices in the post-war period may lead to price increases and shifts in the share of income spent on energy.

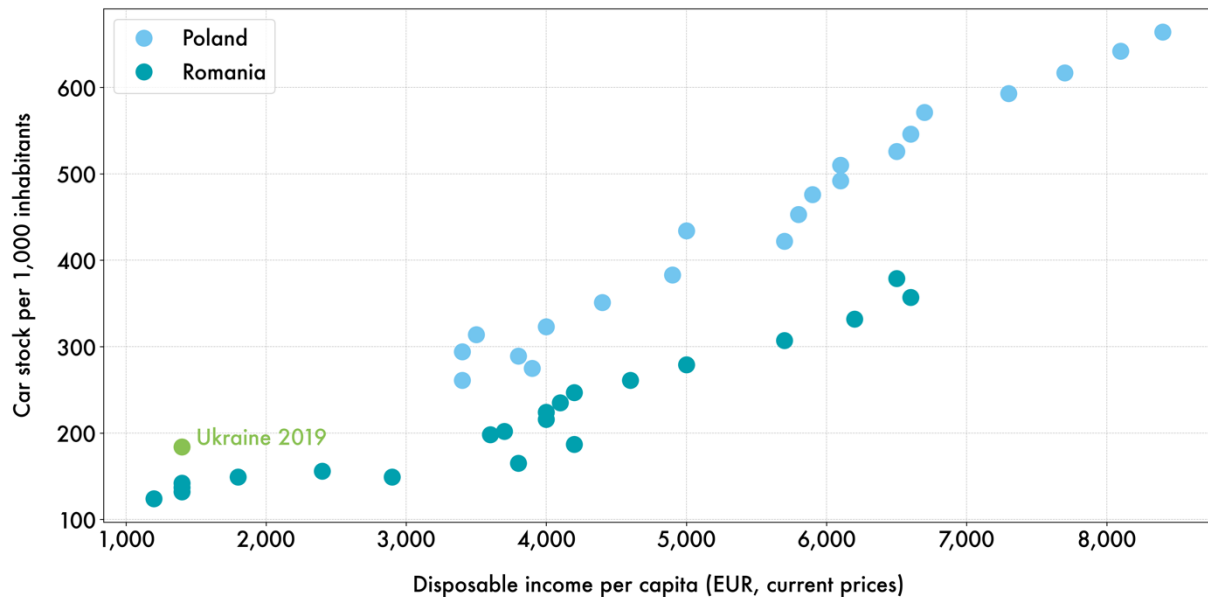
Some implications for Ukrainian energy demand and emissions:

- Households that can lower the share of their expenses on basic needs (e.g., food) will be able to invest more in energy efficiency measures.
- A potential increase in energy and utility prices will be no less important in stimulating energy efficiency.

Car ownership increased with rising income in Poland and Romania

The increase in vehicle ownership is another phenomenon that is likely to occur as household income rises. In Poland and Romania, a sharp rise in car stock took place when the disposable income per capita exceeded the 4,000 Euro threshold.

Figure 16: Car stock per 1,000 inhabitants based on average income



Source: Own calculation based on (Eurostat, 2023b, 2023c; Helgi Library, 2020)

Some implications for Ukrainian energy demand and emissions:

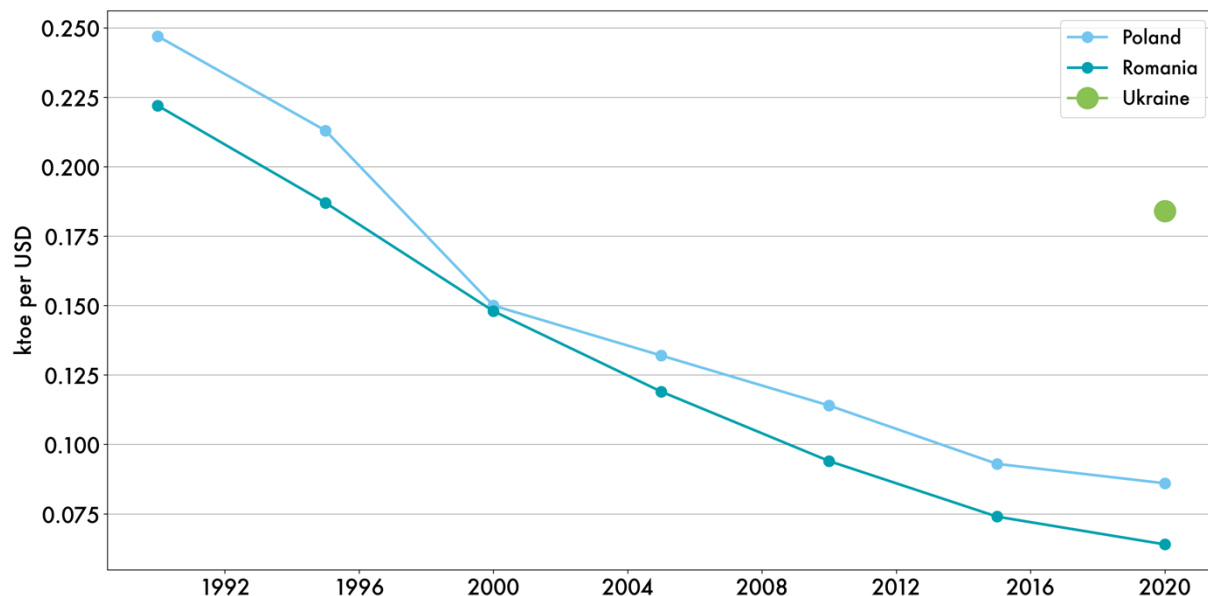
- A higher share of car emissions might occur at the beginning of Ukraine's economic transition as ownership increases. This can be later mitigated by a sustainable public transportation system.
- Eventually, car emissions are likely to see a sharp drop as higher income allows people to replace old cars and shift to electric vehicles.

5 Energy efficiency and climate trends

Faster economic growth led to lower energy intensity in Poland and Romania

A shift in consumption and key sectors of the economy is likely to result in a faster decrease in the energy intensity of GDP. Poland and Romania demonstrated a significant decline in energy intensity already during the first decade of their transitions, followed by a more linear trend afterward. The energy intensity of GDP in Ukraine remains visibly higher, however, the situation may radically change in the fast-growing scenario.

Figure 17: Energy intensity of GDP (ktoe per USD, 2015 prices)



Source: (Enerdata, 2023)

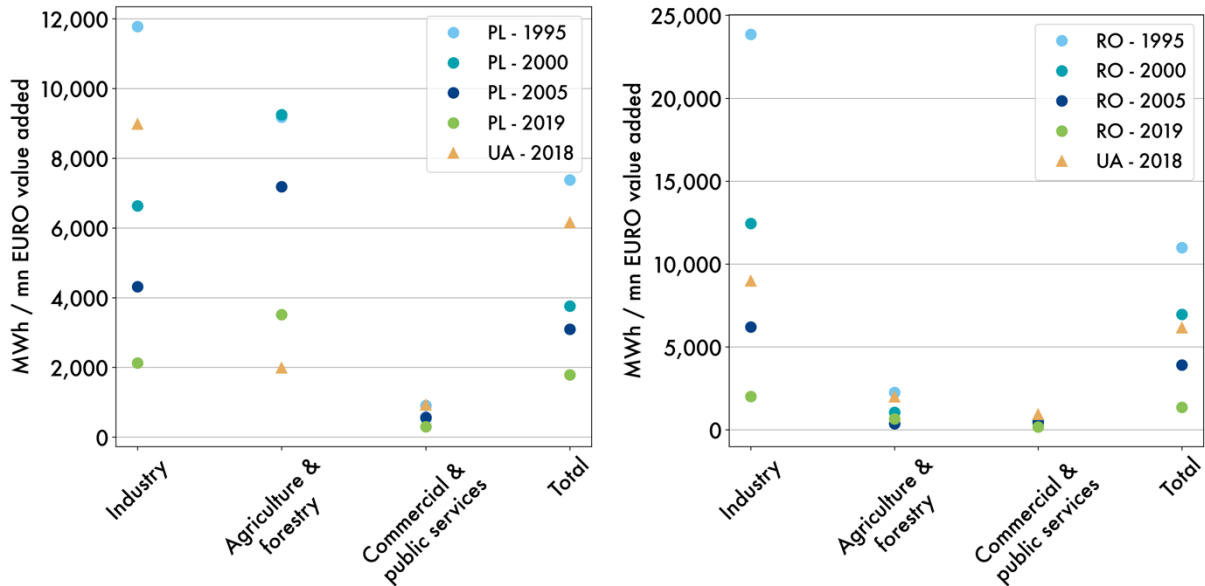
Some implications for Ukrainian energy demand and emissions:

- Strong GDP growth in the future will not lead to an equivalent increase in energy intensity.
- The decoupling of growth from emissions will be visible in Ukraine's economic growth as energy efficiency improves.

Industrial energy intensity improved faster than other sectors in Poland and Romania

Driven by sectoral shifts and energy efficiency improvements, the energy intensity of Polish industry improved drastically from 12,000 MWh per million euro in 1995 to about 2000 in 2019 bringing down the energy intensity of the whole economy along with it.

Figure 18: Energy consumption per unit of value added (MWh/ m EUR)



Source: Own calculation based on (Eurostat, 2023a, 2024)

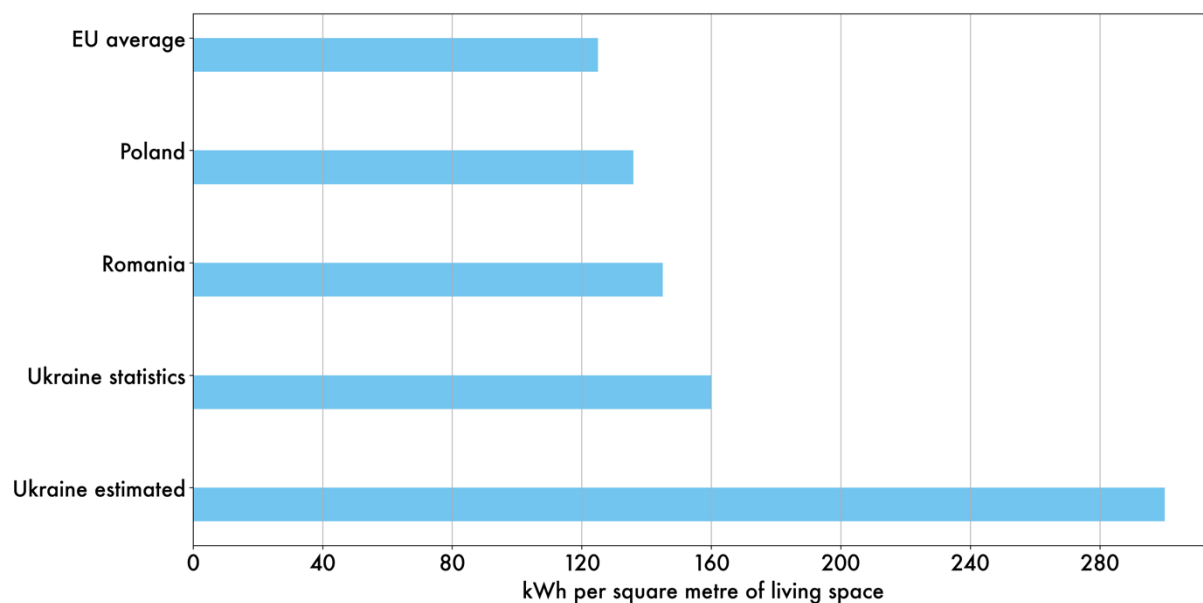
Some implications for Ukrainian energy demand and emissions:

- Improvements in energy efficiency and sectoral shifts will drastically change the energy consumption outlook for Ukraine as a whole.
- Accordingly, emission intensity will drop.

Households consume less energy as the economy successfully transforms

Energy consumption in Ukrainian households is likely to draw closer to the EU’s much lower average, following a similar trend to Poland and Romania. Calculating average household consumption using energy balance data provided by the State Statistics of Ukraine may be misleading, as limited data is available on heating in private houses not connected to the gas networks or central heating, which still represent a significant share of the Ukrainian housing sector (around 40%). Because of this dissonance in tracked data, it is possible to assume that the actual consumption is closer to 300 kWh per 1 sq.m., which is significantly higher than EU average consumption or consumption in Romania or Poland.

Figure 19: Households energy consumption 2020 (kWh per 1 sq. meter living space)



Source: (Cabinet of Ministers of Ukraine, 2014; European Environment Agency, 2015; Ukrstat, 2021, 2023a)

Some implications for Ukrainian energy demand and emissions:

- The households’ energy consumption is likely to reach the EU average with Ukraine’s transition.
- Switching to new solutions and sustainable electrification of heating is also likely to bring the better outcome for statistics.

6 Summary

The analysis provided in this paper allowed pointing out important aspects of the macroeconomic transition of Poland and Romania that are likely to have non-linear trajectories in the case of the active EU Integration of the transitional economies. Such aspects are likely to be extremely important in the case of the further EU Integration of Ukraine and should be considered in developing modelling assumptions. The main findings from the cases of transformation of Poland and Romania are summarized in the table below. It is assumed that similar trends will occur in Ukraine when integrating with the EU.

Indicator	The impact of the transition	The impact on emissions and energy intensity
GDP growth	Is likely to intensify significantly with EU integration and slowdown in some periods (e.g., post-recession).	Fast GDP growth may increase emissions and energy consumption for a limited period but decrease in the long-run (due to technological transition).
Inflation rate	Inflation is likely to reach a low and predictable pace with macroeconomic stabilisation.	This will support the transition to low carbon production.
The cost of capital	A significant reduction of the interest rate of the governmental bonds can provide better access to capital.	Will support the CAPEX-intensive investment where many new energy technologies can benefit.
FDI inflow	May intensify in the periods of rapid economic growth and then stabilise later on.	Is likely to support the transition to new industries and services bringing the transition to a low carbon economy.
FDI origin and sectors	The investment from EU states is mainly directed towards manufacturing, high-tech industries, real estate and service.	Can stimulate higher utilisation of new green technologies in line with the tendencies in the majority of the EU economies.
Trade balance	The negative trade balance is likely to be the outcome of the economic transition, given the growing consumption.	May bring the higher standards of energy saving and technological solutions leading to low carbon transition.
Productivity of labour	The sharp growth in productivity of labour can occur with the growth in GDP and modernization of the economy.	Can lead to involving less personnel in producing goods and services with the efficiency increase.
Population dynamics	Usually have a linear trend, which is unlikely to promptly change even with the economic growth.	Preservation of the higher share of skilled workers can contribute to the transition towards better efficiency and lower emission.

Shifts in the sectors of economy	The agriculture sector is likely to shrink significantly with the increase of service sector and shifts in industry focused on the transition to high-value, export-oriented added production	Is likely to bring another positive shift in efficiency and emission reduction.
Consumption trends	Lower share of basic products in the total households spending, increase in the number vehicles and better savings by the population.	May lead to certain increase of car emissions at the beginning, mitigated later by utilising less emission and energy intensive technologies.
Energy intensity of economy and households	Lower energy intensity due to modernization and efficiency gains, while households consumption is likely to decrease to EU average level.	Similar shifts can be expected for Ukraine with the transition of economy.

7 Expert & Stakeholder notes

The remarks, notes and comments provided here by experts as well as policymakers and social stakeholders familiar with the topic reflect their individual opinions. Typically, they are based on a "final draft" version of the document.

Name, institution

Notes & comments

8 Conclusion

Sharp structural shifts will set the scene for developments in energy demand and carbon emissions in the next decade - they will likely dominate the effects of energy and climate policy choices. In particular, the expected sharp periods of GDP growth are not likely to lead to the subsequent steady increase in emissions, unlike during the Industrial Revolution. Instead, the growth is likely to be decoupled from emission rate.

Another outcome of the transition will be a period of considerable uncertainty. Many trends that used to be linear in the past are likely to become less stable. For instance, shifts in consumption may lead to a more volatile trading balance, some sectors of the economy may lose their share in the overall structure (e.g., agriculture) and the industrial sector may change towards the decline of traditional spheres and the emergence of new manufacturing. At the same time, the transition is likely to bring a lot of rapid improvements in the macroeconomic trends that were previously unstable in Ukraine, such as the cost of capital, inflation, labour productivity and FDI inflows from the EU.

A "persistent-structures-scenario" is inconsistent with a credible pathway to EU accession. Successful EU integration will require adjusting Ukrainian exports to the demand trends in the EU market, where higher technological standards, better efficiency and lower levels of carbon intensity prevail. This, in turn, will accelerate structural changes in the sectors of the Ukrainian economy outlined above, and result in the contraction of many traditional industries, stimulating the introduction of new technologies and higher valued-added production; thus, reducing the carbon intensity of the economy and stimulating energy efficiency. Maintaining the pre-war economic structure will not allow Ukraine to proceed with the successful transition.

A "Poland-scenario" might be a useful sensitivity test for assessing how robust predictions are, while "Romania-scenario" might strengthen the hypothesis on prevailing of the same tendencies even in the case of a slower transition. The two country cases analysed above differ in terms of the speed of transition, with the Romanian economy having reached the same level as Poland in most indicators only in the last decade. The Romanian case demonstrates that the presence of similar factors of EU integration can lead to similar results, albeit with a different timeframe. As such, the Polish case can provide a possible reference for a Ukrainian scenario with fast, post-war growth and its implications for the climate, while the case of Romania is still relevant as a reference for a scenario of slower EU integration and transition.

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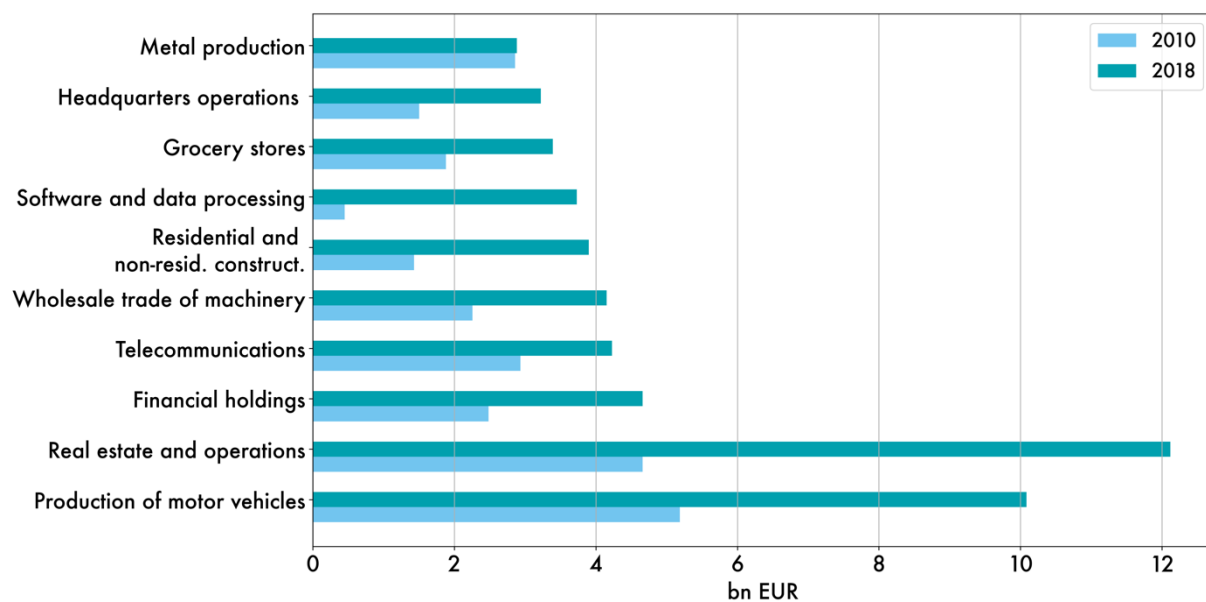
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Annex

FDI by sector

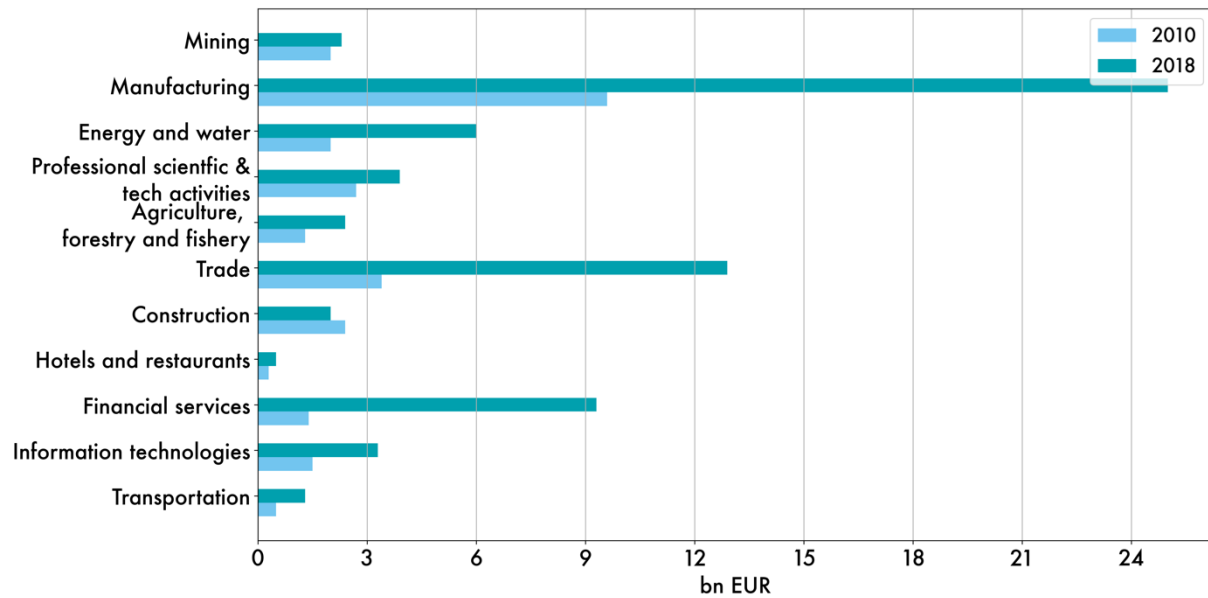
The FDI inflow to certain industries also demonstrates that new industries began dominating in the national economy attracting more capital in the transitional countries. In the case of Poland, the investment in real estate and certain areas of manufacturing (i.e., the production of motor vehicles) became the key areas in recent decade. At the same time, many new industries have been also acquiring a significant share, including the software which had grown by more than 140% in 2010 – 2018. In the case of Romania, manufacturing became the key are of investment in 2010 – 2018 growing by 30% in this period. The trade and construction sectors became another important area of investment in the country. Similarly to Poland, some traditional sector, e.g., mining, has not experienced the significant Increase investment in the same time. The outlook of the FDI inflow to Ukraine demonstrates that together with the higher share of investment in services (e.g., trade), real estate and manufacturing, the inflow to the traditional sectors, e.g., mining, had also been among the key areas in the pre-war period.

Figure 20: FDI stock in Poland (in mn EUR)



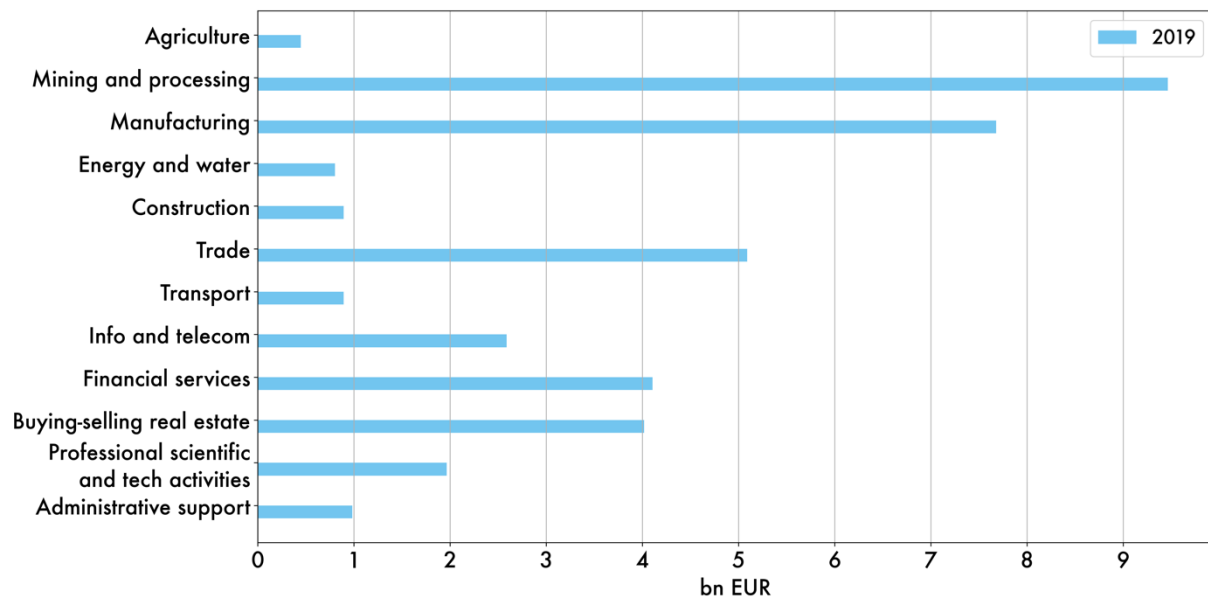
Source: (American Chamber of Commerce in Poland, 2020)

Figure 21: FDI stock in Romania (in mn EUR)



Source: (National Bank of Romania, 2019)

Figure 22: FDI stock in Ukraine (in mn EUR)



Source: (Ukrstat, 2020)

Some implications for Ukrainian energy demand and emissions:

- Shifting to the new machinery is likely to bring new technologies to Ukraine, also bringing more efficiency.
- The intensive investment in real estate may also bring additional energy efficiency in building in Ukraine.