The economic implications of phasing out coal in Ukraine by 2030

Executive Summary

Research for “The economic implications of phasing out coal in Ukraine by 2030” was conducted in October 2020 - April 2021 by Aurora Energy Research on initiative and with financial support of the Heinrich Böll Foundation, Kyiv Office – Ukraine. The idea of the study is to compare economic implications of two different scenarios of power sector development, one of which assumes phasing out coal for electricity production by 2030. This report summarizes methodology used, major assumptions and key results, such as hypothetical power mix under both scenarios and corresponding economic implications (influence on job places, taxes, macroeconomic parameters, etc.).

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Executive Summary: The economic implications of phasing out coal in Ukraine

The coal sector has been an integral part of the Ukrainian electricity system for decades. But infrastructure and plants are approaching the end of their technical lifetime, and investments in the electricity sector are necessary, independent of the future composition of the power sector.

This study explores how this window of opportunity could be used to phase out coal in Ukraine and transition to a cleaner power mix for the future. We present a potential coal phase-out by 2030, reducing coal generation over the decade, while investing in new renewable power generation. Overall, the study shows the following:

> **A coal phase-out is not only technically feasible, it also creates economic opportunities and new jobs, while reducing the inefficient subsidy payment.**

As the current coal industry of Ukraine is projected to accumulate losses of more than a billion Euro over the next decade, a coal phase-out can reduce the burden on the state budget while simultaneously creating new jobs in the renewables industry.
The study is designed to span a 'solution space', assessing the economic impacts of an ambitious coal phase-out plan in contrast to a continuation of the status quo.

> **Reflecting about Ukrainian energy transition is in line with global developments.**

In line with their climate targets, multiple countries have announced to phase out coal-fired power generation in order to decarbonise their electricity systems. As it stands, 20 of the 27 EU member states have announced to phase out coal from their electricity mix or are already coal-free. Additionally, previous very coal dependent countries like Canada, Chile or the UK have taken concrete measures to close down their national coal plant fleet.

These announcements stem not only from climate concerns. Phasing out coal has shown to curb local pollution in NO_2, SO_2 and particulate matter which affect respiratory health. Also, economic costs associated with ongoing coal production have in many cases proven higher than building new, renewable generation capacities. Overall, the decision to phase out coal from the electricity system is part of an ongoing transition of the energy system observed across a wide range of countries.

Old, central generation is replaced by decentral, clean energy sources that operate more flexible. These globally observed developments are also mirrored in the Ukrainian discussion, with the country committing to the Paris Agreement and targeting net-zero emissions by 2060. And like in many other countries, the Ukrainian power sector is in need of modernisation.

Other studies have shown that a coal phase-out in Ukraine is technically possible. Already with the currently available technologies, enough energy is available to supply demand at all times. This study complements these analyses by complimenting detailed power sector modelling with an assessment of the economic impacts. We analyse how a feasible pathway could look like and what the impact on the state budget and the wider economy would be. Along with the coal phase-out by 2030, the study looks at the cost of decommissioning of coal mines and associated welfare payments for affected groups of workers to accompany the transition of the energy sector.

For this purpose, we have modelled a transition scenario (TRA) with a linear closure of all 17 GW coal capacity in Ukraine between 2020 and 2030. In parallel, renewable capacities in the scenario almost triple compared to current capacities, amounting to 35 GW of wind, hydro power, biomass and photovoltaic capacity in 2030. Other capacities like nuclear are held constant or altered according to current announcements for closure or commissioning. Transition scenario is compared to a business-as-usual scenario (BAU). This scenario takes into account recent announcements as well as renewable energy sources (RES) build-out as incentivised by current policies. This only amounts to a 1.5-fold increase of current capacities (see also Figure i).

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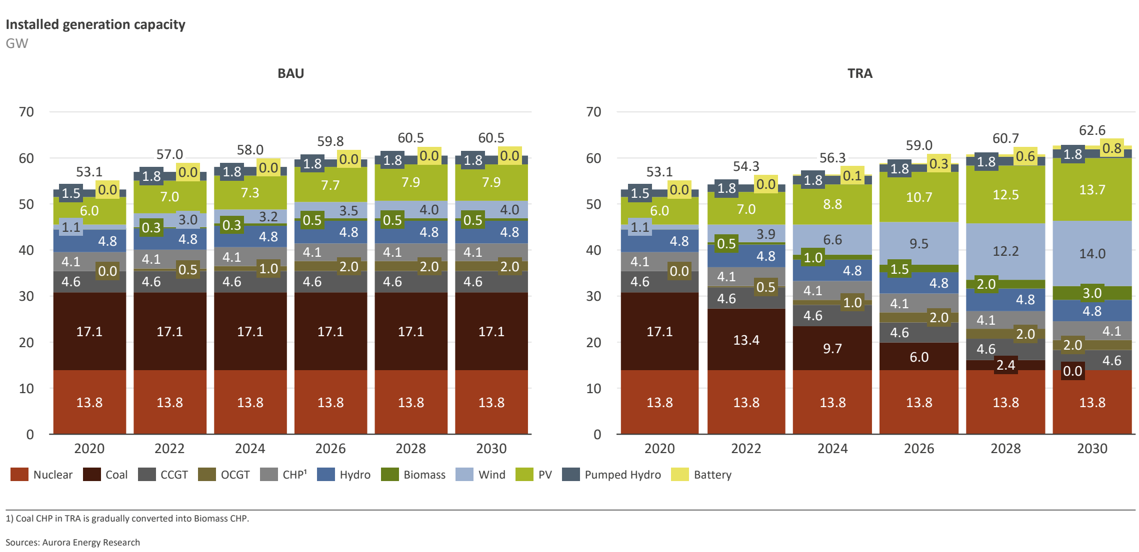

Figure i.: Power generation capacities in BAU and TRA

In a second step, the study analyses macro-economic implications of this trajectory. Estimating the direct costs for the operation and closure of mines and coal power plants as well as indirect costs for compensation of affected actors as well as effects on job creation in emerging industries. Thirdly, the study also considers changes to the state budget, e.g. by an altered tax income (Figure v). In a last step, with the help of a CGE model, the study looks at the macro-economic spill-over effects of the energy transition and how GDP and individual sectors are impacted by the ambitious policy approach.

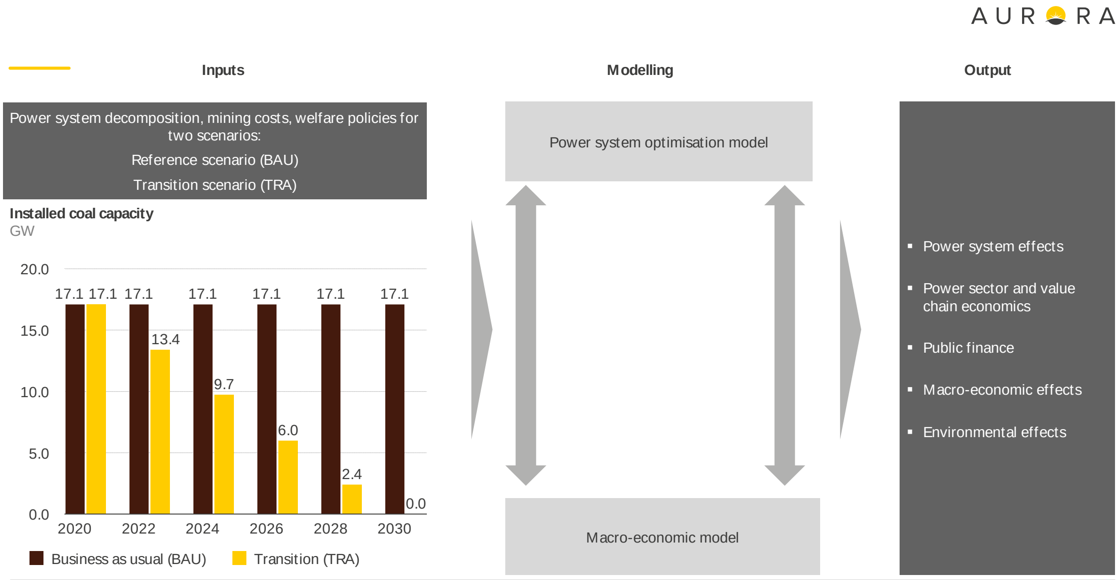

Figure ii.: Approach of the study

With this design, the study aims to show potential benefits and solutions as well as inform policy makers on aspects that have to be considered when planning a further transition of the power sector. Factors that should be considered when steering a process towards coal phase-out as well as drivers for costs and potential revenue streams become visible.

When taking a closer look on the power system modelling, two conclusions are central:

> **Stable electricity supply can be guaranteed while reaching a renewable share of > 50% of power generation in 2030.**

In the power sector, the assessment shows that security of supply can be guaranteed while phasing out coal. We modelled power generation on an hourly basis and see renewables taking an increasing share (see also Figure iii).

Coal generation decreases from 28% (or 40 TWh) to less than 20 TWh in the mid-twenties until its phase-out in 2030. Renewables take an increasing share in the electricity mix. In 2030, they generate more than 83 TWh, making up more than half of the total electricity mix. Generation from wind contributes the largest of all renewable sources. From 3.3 TWh in 2020, it increases to 29 TWh in 2026 and 42 TWh by 2030, making up 25% of the total generation mix. PV almost triples its share from 4% to 11% in 2030. This corresponds to an increase of over 12 TWh, from 6.2 TWh in 2020 to 18.6 TWh in 2030. By 2030, biomass generates almost 14 TWh of electricity, increasing from 1 TWh in 2020 to around 7 TWh in the middle of the decade. In the transition scenario, we also see that gas capacities are being relied on significantly more to provide the needed flexibility. Almost 9 TWh are generated by gas in 2030 in total. Notably, the old gas-powered steam turbines replace coal in mid-peak load. This points toward the second main conclusion from the analysis of the power system:

Figure iii.: Power generation mix in BAU and TRA

Flexibility not capacity adequacy is the key challenge for the Ukrainian power system.

Currently, Ukraine has more capacity installed than it actually needs to fill its power demand. Today, there is not a single hour where 70% or more of coal capacity are used, and there are gas plants that do not need see any economic incentives to dispatch at all. This means that more than 30% of coal plants (or more than 5GW) could be phased out without any consequences for security of supply.

Our modelling has shown however that capacities that can balance intermittent generation from renewables are important. Nuclear plants with their technical limitations and the old age in Ukraine are mostly inadequate to provide this flexibility, which is why biomass, pumped hydro storage and batteries need to play an increasingly important role in a high renewable system. Here the question needs to be discussed how this flexibility can be ensured in the future in the most economical way.

Broadening the view from the power sector to its repercussions on the Ukrainian economy, five aspects deserve special mentioning.

Firstly, the analysis finds that the current operation of coal mines is hugely unprofitable.

More than a billion Euro would be necessary to sustain the state-owned coal mines in the coming 10 years.

State-owned coal mines register losses of up to 230 € per ton of coal extracted. Shutting down these mines reduces mine-related costs by 35% for the state, even when accounting for decommissioning costs of these mines and compensation for workforce.

From mining companies’ data, we assess that around 55 000 jobs in mining and power generation will be lost.

While 55 000 jobs will be lost with phasing out coal, the energy transition also creates the potential for up to 160 000 new jobs.

Photovoltaic, wind and biomass power generation assets can also be produced in Ukraine. This would create new jobs (see Figure iv).

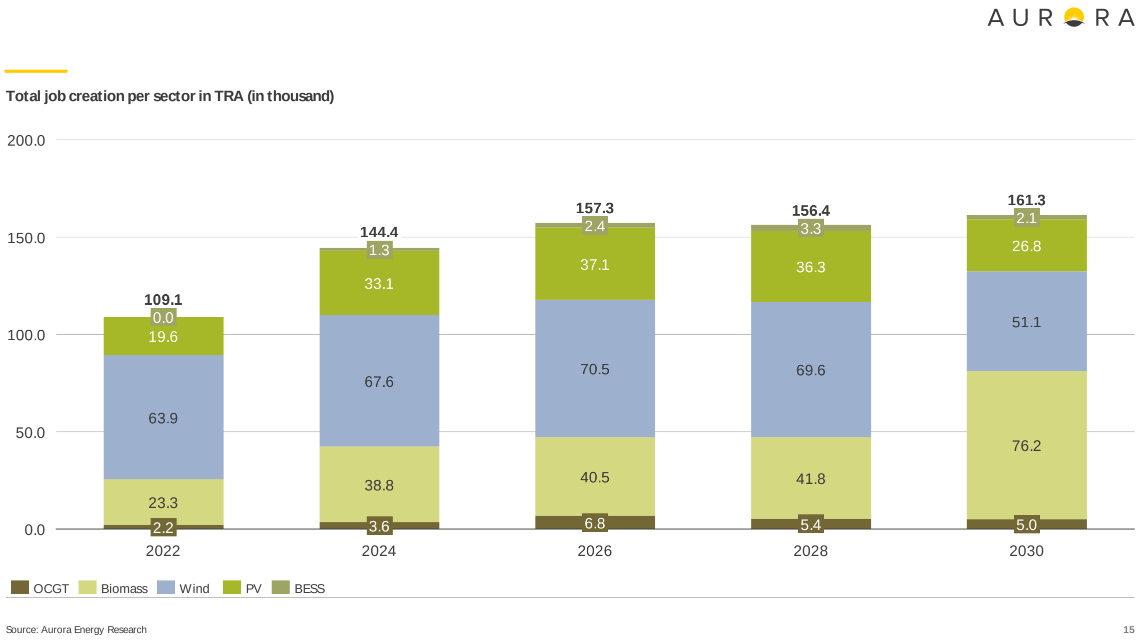

Figure iv.: Job creation in TRA

Changes in employment have implications for the state budget: The creation of new jobs impacts the state revenue via the income tax. We further analysed economic impacts of the energy transition on four components to the state budget: Income tax, social security tax, value-added tax (VAT) and carbon tax:

The transition scenario has a positive impact on public budgets, creating >50% higher tax revenues over the coming 10 years.

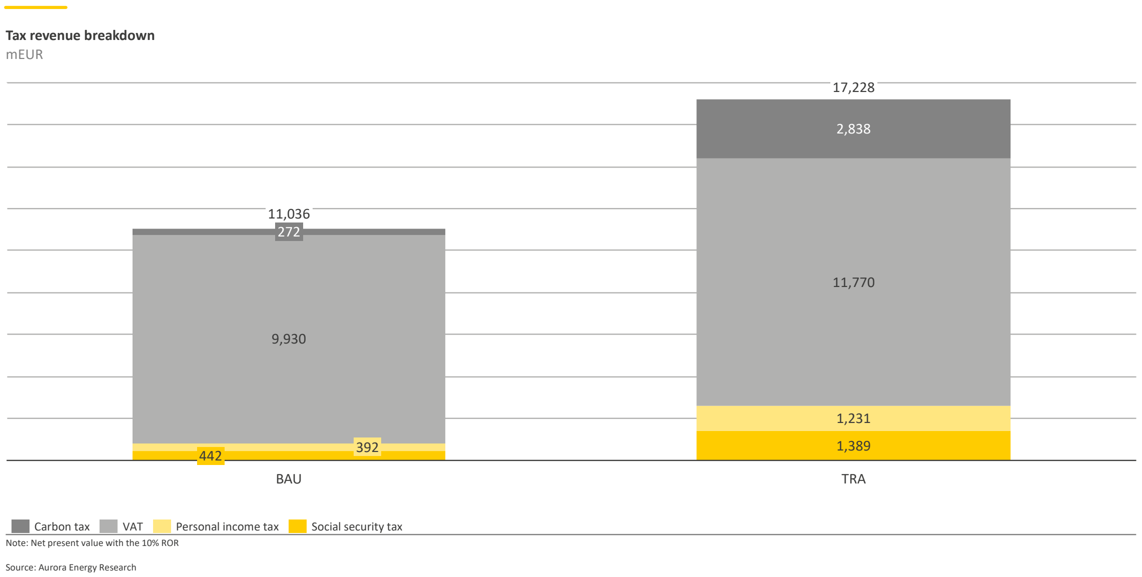

Figure v.: Net present value of tax revenues in BAU and TRA

The transition and build-out of new generation assets requires investments and creates additional cost. Looking at the total system cost over the next decade, the analysis show:

The energy transition leads to higher power sector cost of on average EUR 1.6 bn.

Here it is noteworthy that new investments in the sector are necessary under any circumstances in the medium and that an accelerated transition can help to target these replacements. The additional investments made have the potential to create jobs and stimulate economic growth (see Figure vii for an overview of investment needs).

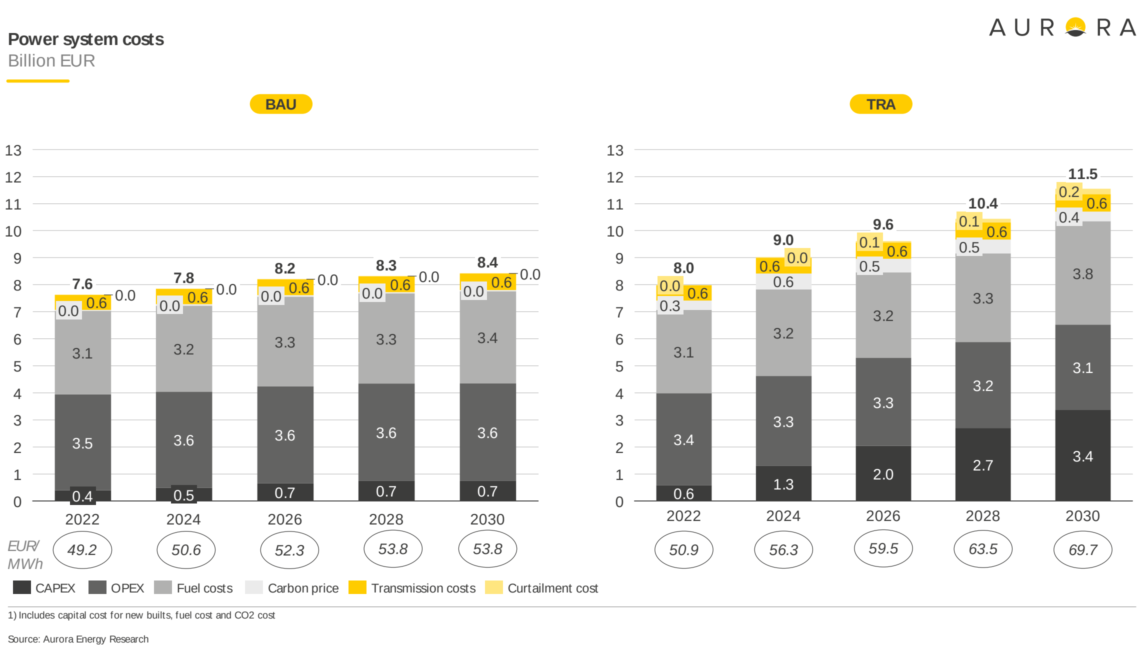

Figure vi.: Power system costs

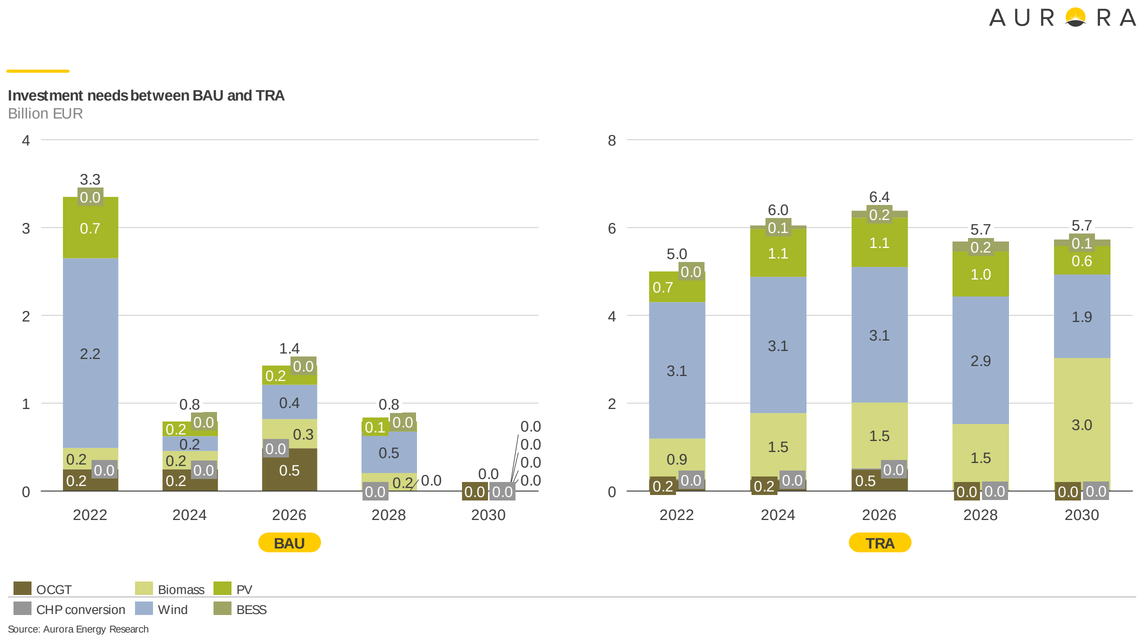

Figure vii.: Investment needs under BAU and TRA

Lastly, the study assesses the wider macroeconomic impacts of the transition scenario (via a CGE model).

The analysis shows that the TRA scenario through the mobilised investments has a positive effect on gross domestic product (GDP). In comparison to the 2018 equilibrium, the analysis shows for TRA in 2030 that direct investment amounts to +12 % GDP and induces a total GDP growth of 15% (second-order effects of 3%). In comparison, direct investments under BAU amount to 2% of GDP, inducing a 3% growth (second-order effect of 1%).

These findings suggest that the positive direct impacts can cause further positive spill-over effects in the wider economy (also see Figure viii). The assessment of the impacts on individual sectors shows that certain sectors benefit, while others are negatively affected.

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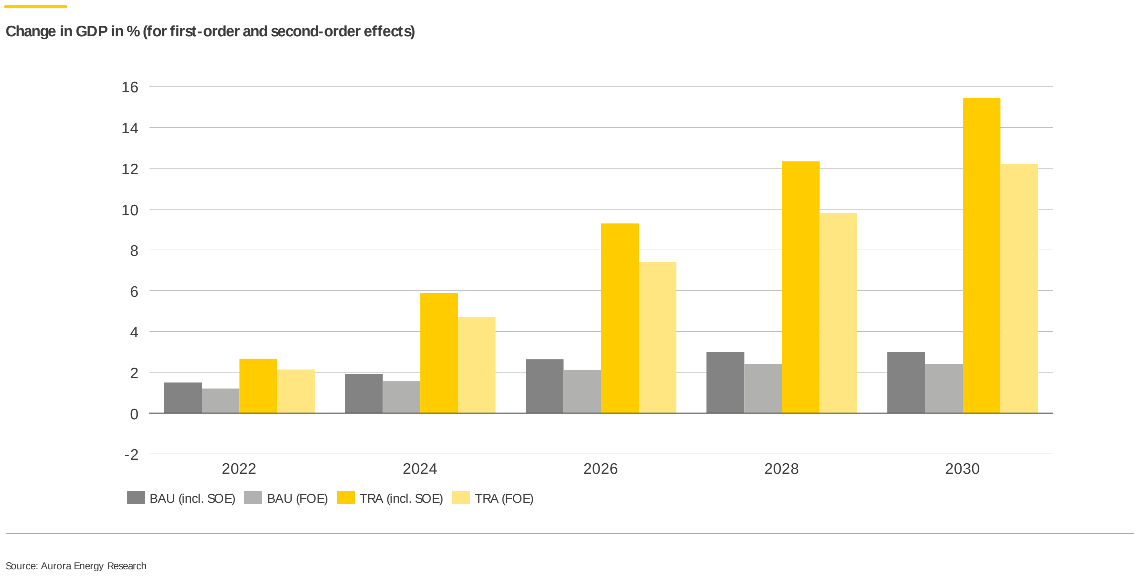

Figure viii.: Impact on GDP in % of first-order (FOE) and second-order effects (SOE)

Key policy considerations

The investment necessity in the Ukrainian electricity sector opens a window of opportunity to steer the decarbonisation of the power sector, induce economic growth and create new job opportunities.

There are **six key policy areas** that need to be considered:

1. How can a **decarbonised power sector** in Ukraine look like? How can flexibility be ensured?
2. How can **investments** into the renewables and flexible asset be attracted?
3. What is the political economic behind the energy transition? Who are the **key actors** in the process that can facilitate change?
4. Which **processes** can facilitate the energy transition? What are formats (e.g. expert commissions, stakeholder consultations etc.) that enable this transition?

5. How can a **just transition** be designed? How can structurally affected regions and workers be best supported? How can vulnerable households be protected against rising power prices?
6. What **industrial policy** can complement the energy transition? Which existing sectors are negatively impacted by the transition process and might need support, what emerging industries can be attracted and build up for the future?

The complete report "The economic implications of phasing out coal in Ukraine by 2030" is available by the link

shorturl.at/anruD