Terms of Reference for an analytical research on economic costs of energy transition in Ukraine

Project: Renewable energy discourse support

Project no: 20-6-100/12421033

1. Background information

The Heinrich Boll Foundation is a non-governmental, resource-based organization that promotes a democratic agenda and changes public discourse with a view to green democratic development. The Foundation is part of the Green Political Movement of Germany and the EU. Since 2017 one of the key priorities of the Foundation's work in Ukraine is to promote just energy transition from fossil and nuclear energy to renewable energy sources towards socio-ecological transformation.

Ukraine's power sector is going through a crisis. After an opening of a liberalized market in July 2019, the market power of incumbent players, including mostly privately-owned coal generation, has not been addressed. The market integration of renewable energy is limited by inefficiencies in the market design. The stability of the RES sector is threatened by a set of political decisions that lead to significant debts accumulated and not much desire to keep investments flowing into renewables. Most of conversation around renewables in Ukraine boil down to "expensive feed-in tariffs" and excessive financial burden for consumers. However, the hidden costs of fossil-fuel generation are not mentioned or analyzed. Coal sector has been historically a source of corruption, inefficient use of public finance and an instrument to manipulate political decisions in favor of fossil-fuel generation.

Ukraine is now facing a social and political dilemma whether to keep the cost low and limit the development of renewables or to create conditions for further electricity market liberalization, invest into the energy transition and phase-out coal. The comprehensive analysis should help politicians and the Ukrainian society to understand the long-term costs and benefits of the energy transition and enhance the dialogue.

2. Objective of the assignment

The objective of this assignment is to provide macroeconomic analysis of costs and benefits of transitioning the **electricity production** from coal generation to renewables in Ukraine.

3. Tasks and scope of work

The scope of works for the contractor envisages the economic modelling based on the methodology, preliminary described in the Annex 1 to this Terms of Reference. The modelling should compare 2 scenarios to show economic costs and benefits for energy transition:

1. Reference scenario;
2. Transition scenario.

The contractor will be supported by the local expert, hired independently by the Foundation, to facilitate the data collection and providing an insight into the Ukrainian energy sector. Based on the above-outlined tasks, and respectively implemented, the contractor is expected to implement next tasks:

1. Prepare a methodology for the economic analysis and approve it with the Client.

2. Collect and verify input data for economic modelling together with the local expert and the Client, in consultations with Ukrainian stakeholders. The basic set of input data for 2 modelling scenarios is formulated by Client in an Annex 1 to this ToR.

3. Provide modelling and communicate intermediate results to Client. Adjust the input data and modelling if necessary.

4. Verify results of the modelling and agree them with the Client.

5. Prepare final report.

6. Participate in public presentation of the results.

The timeline is subject to discussion between the Client and potential Contractor, but the final report with description of results should be provided not later than March 31st 2021. The shorter proposed timeframe of task fulfillment would be an asset for potential Contractor in case of other equal criteria.

4. Deliverables/Outputs

Deliverables should include the following:

- Detailed description of the methodology used for the analysis and modelling (in electronic form);
- Datasets with inputs used for the analysis and modelling (in electronic form);
- The final report with the results, in English and/or Ukrainian (in electronic form);
- The short presentation for the public event, based on the report results (in electronic form);
- The public event - presentation of the results, together with the Foundation representative and the local expert (online participation, travel to Ukraine is not foreseen due to COVID-19 restrictions).

5. Reporting

The Contractor is responsible to report in English and/or Ukrainian by providing draft deliverables one week before estimated deadline (agreed later with selected Contractor) to responsible program coordinator at the Heinrich Boell Foundation.

6. Public use of deliverables

All research results and reports are intellectual property of the Foundation. The Contractor can use outputs of this assignment for own further activities as well as present them publicly but with mentioning "the research is implemented with support of the Heinrich Boell Foundation, Kyiv-Ukraine Office". The further use and presentation of the research results beyond the scope of this assignment should be prior agreed with the responsible program coordinator at the Heinrich Boell Foundation. Written presentations should include logo of the Heinrich Boell Foundation, Kyiv-Ukraine Office.

7. Timeframe of the contract

The signing of the contract and start of activities is expected for September 21st 2020. The assignment is expected to be finalized **not later than March 31st, 2021.** All activities, ultimate timeframes and implementation details are subject to discussion and will be clarified in the contract after negotiations with the selected Contractor.

8. Place of assignment:

- At the location of the Contractor; no travel foreseen.

9. Financial proposal

The proposal from potential Contractor should include a shortly described proposed methodology for the analysis, the estimated timeline and total budget for the assignment. Deadline for the proposal submission is August 31st, 2020. The written proposal should be sent to oksana.aliieva@ua.boell.org. Successful applicant will be informed by September 4th, 2020.

Annex 1 to the Terms of Reference for an analytical research on economic costs of energy transition in Ukraine

Modelling methodology and basic input assumptions proposed by the Client

The economic analysis covers modelling of 2 scenarios in the Ukrainian power sector development and respective socio-economic effects and GHG emissions. The key aim of the analysis is to estimate the real cost, both direct and hidden, of keeping business as usual and continuing support of the coal industry and compare it to the costs and benefits of the transition to renewable energy in the electricity sector. The optimal pathway to targets set out for 2030 and its cost-benefit analysis should be presented.

The scenarios and the underlying assumptions set out by the Client here are not subject to change and represent the Fund's vision. The presented methodology describes a Client's preliminary vision for the analysis and is subject to change based on offers and suggestions from the Contractor.

Modelling period: 2021-end of 2030 (10 years).

Scenario 1. Reference scenario. The Ukrainian energy mix in terms of installed capacities does not change in the next 10 years. Existing power plants continue to operate, additions to the RES capacity are minimal and include existing projects' pipeline until 2022 and insignificant additions during 2022-2030.

Scenario 2. Transition scenario. New RES capacities are deployed to replace coal generation. New cost-effective non fossil-based balancing and reserve capacities are deployed alongside to ensure flexibility enough to integrate additional renewables. Only existing non-coal capacities are used to provide balancing and reserves. The Transition scenario minimises the total GHG emissions of the system.

Closure of coal-fired thermal plants triggers the decrease of demand for coal, which forces closure of coal mines in Ukraine. Coal mines with the highest costs are closed first. Supply sources with the lowest cost have priority. E.g. if imported coal is cheaper than locally extracted, the latter is not subsidised and produced. All employed in the coal value-chain, regardless of ownership, receive welfare benefits from the state.

Key target parameters for 2030

Parameter	Reference scenario	Transition scenario
RES share in electricity production (incl. big hydro)	13% (based on Energy Strategy of Ukraine until 2035)	to be determined in the analysis
Coal share in electricity production	as today	<5%
GHG emissions of the system	based on the modelling	minimum achievable
CO2 tax	as today + inflation increase	calculated at the level required to achieve scenario targets

Underlying relevant assumptions

- Currency of the modelling - EUR.
- Macroeconomic, demographic, energy consumption, technology and fuel price projections for both scenarios are gathered and formulated by the Contractor in close collaboration with the local expert.
- Ukrainian occupied territories of Crimea, parts of Donetsk and Luhansk oblasts are not covered by research.
- Reference scenario includes assumption that new RES capacity additions if any are primarily utility scale solar PV and wind with current ratios of local equipment/components utilization, with minor penetration of rooftop solar and other Distributed Energy Resources (DERs). For Transition scenario RES and new energy capacities equipment is partially imported (50%) and another part is internally produced. This figure should be clarified with appropriate stakeholders and could be adjusted. For Transition scenario significant penetration of DERs is proposed as well for self-consumption (this assumption could be adjusted depending on methodology proposed by the Contractor).

- Existing nuclear and hydro capacity remains constant and operational throughout the modelling period. No new investments into nuclear and big hydro is considered for this analysis.
- No new investments are made into fossil-fuel generation for this analysis. New fossil-fuel generation is not considered as a balancing capacity option. Only existing non-coal (e.g. steam-gas units) are allowed.
- Demand for heat, covered by existing CHP park, is exogenous and remains relatively stable until 2030 in Reference Scenario. In Transition Scenario demand for space heating could be reduced due to growing penetration of DERs, while existing coal- and gas-fired CHPs are replaced by co-generation powered by renewable energy. This assumption could be discussed with contractor and adjusted depending on modelling methodology.

Methodology proposed for modelling:

- Cost-benefit analysis of social welfare and macroeconomic effect between Scenarios.
- Copper-plate power system dispatch optimization modelling. The model should optimise the investment decisions based on the least-cost approach, based on the constraints presented in this ToR.
- The modelling takes into account balancing and reserve requirements.
- RES that are considered by model: solar, wind, biomass and biogas. Optimal mix is proposed by the modelling.
- Value-chains covered in the analysis:
  - For coal-fired power plants: extraction – enrichment – transportation – generation.
  - For RES (including balancing and storage): development (including IT support) - production of components – construction – generation.
- CAPEX of new projects should account for distribution into local and imported components. E.g. for PV projects, CAPEX distribution is 50-50. Distribution figures are to be proposed by the Contractor based on available market data.

Economic parameters to be investigated should include but not limited to the next outputs:

Power system:

- Total system costs (absolute and per MWh) in each year.
- RES integration cost (incl. balancing costs and utilization effect).
- Power generation mix in each year.

Power sector and value-chains-specific economics:

- Demand for coal, natural gas and other CO2-emitting fossil fuels. (Demand for coal, gas and other CO2 intensive sources)
- RES support costs
- List of coal mines left operating and numbers of people employed.

Effect on public finance:

- Public spending on state coal mines decommissioning and subsequent maintenance.
- Net effect on taxes (VAT, income tax, ecological tax, social security taxes).
- Social welfare benefits payable by the state to dismissed coal-sector workers.
- Subsidies for state-owned coal mines to maintain operational profitability.

Macroeconomic effect:

- Total investments required, both for new capacities and decommissioning costs (TPPs and mines separately).
- Total effect on GDP, including effect on net export.
- Employment and net effect on jobs across the analysed value-chains.

Environmental effect:

- Power system-specific GHG emissions in each year.
- GHG emissions attributable to respective value-chains.

Factors that may be neglected:

- Geographical distribution of RES capacities.
- Grid costs of RES integration (assuming copper-plate approach for the power system modelling).
- In Reference scenario only generation-side flexibility is assumed. In Transition scenario demand side-flexibility is assumed proportional to DER penetration.
- Ukraine's power system trading zones UA-IPS (mainland) and UA-BEI (Burshtyn energy island) are combined.
- No cross-border trading is modelled, no ENTSO-e integration is achieved during the model horizon.
- Electricity market prices are not modelled.