



WWF Polska

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Reference number assigned to the case by the Contracting Authority: RES/01/01/2021/OK

ANNEX 1a Concept of the publication

1. Concept of the publication – general remarks

Fundacja WWF Polska is seeking a Contractor that is ready to provide a publication in Polish and English, with an executive summary and presentation of its results in Polish and English, **on the optimisation of the electricity generation mix in Poland in order to achieve a high share of renewables by 2030, climate neutrality in the 2040s and an aspirational target of 100% renewables by 2050**. This should take into account the decarbonisation of other sectors such as heating and cooling, transportation, and industrial production and the expected rise in electricity demand connected with this process. The modelling should be optimised at realising the assumptions at the lowest possible cost per MWh of energy supplied.

The Contractor will present the results at least twice in Poland at its own expense, in the location stipulated by the Contracting Authority upon a minimum of two weeks' notice. The results might also be presented abroad, if agreed between the contractor and contractee¹.

The publication should consist of between thirty and sixty pages of A4 (excluding elements required in the final document, such as footnotes, the cover, the executive summary, and key recommendations) in a standard font and text layout.

A footnote must be provided in each instance in which facts and data are provided, stating the source of the data, including the name of the author, name of the publication, place and year of publication, page number, a link to online sources, and the date on which the source was obtained. The publication must include a bibliography, glossary, list of contents, and list of tables and charts.

Data from external sources that will be quoted in the publication must be based on academic literature, publications released by renowned consultancy firms and research institutions, or strategic documents and reports released by government institutions in Poland and elsewhere. The technological potential, examples, and expected costs must be based on literature that is as recent as possible.

As the publication, assumptions made in scenarios, boundaries, and findings (in the form of data given in tables and charts in .docx, .xlsx or online application format) and presentations on optimisation are covered by the scope of the contract, the proprietary rights to these goods will pass to the Contracting Authority upon completion of the contract.

The report, including the graphs, must be prepared in a neat editable manner: the text must be prepared in a text editor and graphs must be easily editable for a typesetter (e.g. as .xlsx files). The report must also

¹ If the pandemic situation will not allow (inter-)national travel and meetings, online meetings will be considered instead.



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undergo extensive proofreading in both languages. However, the typesetting of the report will be organised by Fundacja WWF Polska after the finalisation of the contract.

2. The publication layout:

- a summary with the **key findings and key recommendations** on 1 A4 page.
- **a summary for policymakers (approx. 5 pages of A4, including charts)**. The summary for policymakers should include:
 - a. information as to the context: max 1 page of A4,
 - b. description of the research issue: max 1 page of A4,
 - c. recommendations in the context of climate and energy policy – 1-2 pages of A4,
 - d. technological support for the recommendations concerning climate neutrality and renewables development: 1-2 pages of A4,
 - e. cost-based support for recommendations: 1-2 pages of A4,
 - f. recommendations on decisions needed according to the hypothesis that “an energy sector transformation represents a technological and economic opportunity for Poland”: 1-2 pages of A4.
- a brief description on the state of play of technologies, costs and legislation required for achieving the scenario’s results.
- arguments supporting the choice of the specific method of the energy system modelling.
- **a quantitative assessment of the scenario with its costs, savings, emissions, and potential gains from transformation of the sector, with regard to both energy generation, transmission, distribution, and storage in 2020-2050 with an impact of those projects on the price of energy for end users.**
- The environmental (non-climate related) aspects.
- recommendations for policymakers concerning decisions that must be made to set Poland in line with the scenario’s assumptions.

3. Substantive requirements:

The publication should refer to existing literature: energy models, decarbonisation scenarios and energy (storage) analysis. A selection of potential documents that the analysis might refer to or provide alternatives to is presented below:

- A review of modelling tools for energy and electricity systems with large shares of variable renewables²,
- Matching demand with supply at low cost in 139 countries among 20 world regions with 100% intermittent wind, water, and sunlight (WWS) for all purposes³,
- Krajowy Plan na rzecz energii i klimatu/National Energy and Climate Plan (KPEiK/NECP)⁴,

² <https://www.sciencedirect.com/science/article/pii/S1364032118305690>

³ <https://www.sciencedirect.com/science/article/abs/pii/S0960148118301526>

⁴ <https://www.gov.pl/web/klimat/minister-kurtyka-polityka-energetyczna-polski-do-2040-r-udziela-odpowiedzi-na-najwazniejsze-wyzwania-stojace-przed-polska-energetyka-w-najblizszych-dziesiecioleciach>



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- Scenarios of Low-emission energy sector for Poland and the EU until 2050⁵,
- The project of the Poland Energy Policy up until 2040⁶ (if a 'final' project will be presented, please refer to the latest version of the document),
- The 'low emission/climate neutral strategy' (the input into the EU Long Term Strategies if the document will be presented officially⁷,
- „Zmiana celów redukcyjnych oraz cen uprawnień do emisji wynikająca z komunikatu “EUROPEJSKI ZIELONY ŁĄD””⁸
- Neutralna klimatycznie Polska 2050, McKinsey⁹,
- “How to fill the coal gap? 43% RES by 2030?”¹⁰
- Other publications (from analyses about other countries or not envisaged when drawing up the tender enquiry).

The publication must refer to the “Available and future methods of energy storage” report made by the Warsaw University of Technology, commissioned by Fundacja WWF Polska¹¹ regarding energy storage cost curves.

Selection and arguments supporting the choice, of the appropriate method of fuel and energy system modelling

Building a model requires the use of methodology in the area of building mathematical models and their computer implementation. The publication must select and provide arguments for the choice of the appropriate method of fuel and energy system modelling and the prospects for changes in demand for electricity in Poland and how cost curves will develop and potential implementation of new production technologies and energy market analyses.

4. The Model's assumptions

- **must include an “aspirational scenario” for Poland:**
 - a. A **2030** coal phase-out date¹² and an aspirational goal of 50% of wind and solar power in the electricity generation mix;
 - b. A **2040** (nearly) net-zero electricity generation mix;
 - c. A **2050** (nearly)¹³ 100% RES electricity generation mix being compliant with environmental considerations and including massive energy storage solutions;
- must concern the Polish electricity generation market from a nation-wide perspective,
- must identify, quantitatively, the change in demand for energy in Poland or base information on this matter on existing studies and reports,

⁵ http://climatecake.pl/wp-content/uploads/2019/11/CAKE_energy-model_EU_low_emission_scenarios_paper_final.pdf

⁶ <https://www.gov.pl/web/aktywa-panstwowe/polityka-energetyczna-polski-do-2040-r-zapraszamy-do-konsultacji1>

⁷ https://ec.europa.eu/info/energy-climate-change-environment/overall-targets/long-term-strategies_pl

⁸ http://climatecake.pl/wp-content/uploads/2020/03/CAKE_Zmiana-cel%C3%B3w-redukcyjnych-i-cen-uprawn%C5%84-do-emisji-wynikaj%C4%85ca-z-komunikatu-Europejski-Zielony-%C5%81ad-1.pdf

⁹ <https://www.mckinsey.com/pl/our-insights/carbon-neutral-poland-2050>

¹⁰ <https://www.forum-energii.eu/en/analizy/jak-wypelnic-luke-weglowa>

¹¹ <https://www.wwf.pl/aktualnosci/report-energy-storage>

¹² To be discussed whether this will include CHP.

¹³ With the renewables shares going beyond modelings circulated in Poland up until December 2020. The contractor will strive for a fully 100% RES scenario.



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- must identify, quantitatively, the impact of implementation of energy storage and hydrogen technologies and the scope of each energy storage technology (particularly hydrogen, other synthetic fuels, pumped-hydro storage, electrochemical storage)
- must imply a decarbonisation of the whole economy, which will result in an increase of electricity demand due to, i.a. the electrification of transportation, heating or industrial processes. For these assumptions existing modelling and results can be used with a clear reference.
- must minimise the cost of implementing the scenario (per MWh)
- must state the calibration and analysis of sensitivity of the model,
- must consider limitations specified in '5. Additional assumptions'.

Further scenarios (or amendments to the 'Aspirational Scenario' mentioned above) will be discussed with the selected contractor depending on the challenges approached in fulfilling the aforementioned requirements. **Nevertheless, the document must analyse at least 3 scenarios, including a reference ('BAU') scenario.**

5. Additional assumptions

The 'aspirational scenario' must include the following assumptions:

1. the lowest possible share of biomass and biogas in the energy mix. The share of biomass should strictly exclude forest biomass obtained for energy purposes and biomass that can be used for production in the wood industry;
2. the role of biogas, taking into account the quantity of sustainable biogas, correlated with the amount of consumption of products of animal origin. As the energy system should be part of a climate-neutral economy, shifts in diets (less meat and dairy consumption) will be needed. Consequently, lower amounts of waste from animal origin might be available (e.g. manure).
3. No major import of biomass (only at a regional scale), with strictly excluded import from outside the EU.
4. A decreasing share of hydro power plants (the details will be discussed with the contractor, but should include the removal of selected major dams in Poland and a large share of small scale hydro power plants on a pathway towards 2050).
5. zero share of nuclear energy,
6. technological opportunities for energy storage, including new potential pumped hydro-storage plants on the area of lignite mines (details to be discussed with the contractor).
7. Optimisation of the electricity production mix at the lowest possible cost per MWh.
8. Flag concerns regarding spatial limitations for onshore and offshore wind power (with details to be discussed with the contractor).
9. **Additionally (at an extra expense, to be decided by the contractor – see Annex 2):** Present the cost differences of a scenario of energy self-sufficiency of Poland and unrestricted (technically feasible) import of electricity.

The report must:

- present the findings of a quantitative analysis conducted using a devised research tool and scenario-based analysis.
- analyse the findings about the values obtained for the reference scenario (BAU), and present the findings of model research in relation to the main aspirational scenario,
- include the attached initial data and final data in an editable format (such as excel),



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- describe the modelling methodology.

The costs of electricity production, installed capacities, electricity production (and/or demand), greenhouse gas emissions for the research scenarios must be presented in the form of charts and/or graphs making a clear comparison between the researched scenarios.

The report must depict the assumptions made about the price calculation, and LCOE and LCOS technologies, including energy storage technologies. The information concerning energy storage LCOS' must be based on the report "Available and future methods of energy storage"¹⁴, unless the authors obtain reliable cost curves for energy storage technologies indicating prices lower than those forecasted in the above-mentioned report. In this case, please provide two cost-frames (e.g. "low/high energy storage costs").

¹⁴ <https://www.wwf.pl/aktualnosci/report-energy-storage>