



PEP2040 scrutinized by Forum Energii

Comments and recommendations on Poland's Energy Policy until 2040

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Key remarks

- There are many risks associated with the scenario proposed in **PEP2040**, which may threaten Poland's energy security:
 - The risk of power shortages in the system after switching off lignite power plants and highly probable delay in the implementation of the nuclear energy project.
 - The risk of a large increase in wholesale electricity prices due to lack of cost optimization, which may result in deterioration of the competitiveness of the Polish economy in Europe.
 - The risk of excessively growing electricity imports to Poland due to significant price differences.
- The document makes no reference to jointly agreed EU energy and climate goals. **PEP2040** should specify a correspondingly higher contribution by Poland towards the reduction of CO₂ emissions resulting from the development of RES and improvement of energy efficiency. The analyses of Forum Energii indicate that it is possible, even without nuclear power.
- **PEP2040** fails to take into account the upcoming changes on the EU energy market as introduced by, among other things, the so-called Winter Package ("Clean Energy for All Europeans") and network codes.
 - When it comes to the energy market, it is necessary to prioritize the improvement of the power system flexibility, which will enhance the security of supply and will reduce the costs of the power system in the long term.
 - There is no reference to the strategy for building the internal energy market. The obligation to do so is stipulated in the Treaty on the Functioning of the European Union. Unlocking the potential of existing interconnectors and their expansion can significantly reduce costs of the Polish power system.
- The 2040 perspective is too short for the state Energy Policy. The planning horizon in the European Union is 2050.
- **PEP2040** fails to address the issue of cost-effectiveness. Without providing any reason, it is proposed to withdraw from onshore wind, even though it is the cheapest source of renewable energy. At the same time, the project to build nuclear power plants is still maintained, despite the fact that it is a very expensive option of energy supply.
- Electricity demand growth forecasts have not been justified in **PEP2040** and fail to reflect the plans for electrification of the heating sector and transport.
- **PEP2040** fails to address the heating sector in an adequate manner, especially considering the scale of challenges related to the improvement of air quality.
- Generally, **PEP2040** overlooks trends related to new technologies, e.g. energy storage, a new role for consumers, growing importance of distributed energy.

Given the risks associated with the scenario proposed in **PEP2040**, we decided to present an alternative scenario.

Comparison of the alternative scenario and the PEP2040 scenario

The **alternative scenario** is based on the following assumptions:

- Electricity production from lignite to decrease even before 2030 – the deposits are depleting faster than assumed in **PEP2040**.
- The share of hard coal is decreasing faster than assumed in **PEP2040**.
- Nuclear power plants are not built.
- Offshore wind energy is implemented at the level of **PEP2040**.
- In the alternative scenario, we assume cross-border transmission, because Poland has connections with neighbouring countries and we already import and export electricity.
- Although the demand for electricity in **PEP2040** is too high, we have adopted the same level in the alternative scenario in order to compare the results.
- We have extrapolated production capacities up to 2050 for the **PEP2040** scenario.

As a result of cost optimization, the electricity market model added:

- Gas units
- PV
- Onshore wind

Table 1. Comparison of **PEP2040 scenario** and the **alternative scenario**:

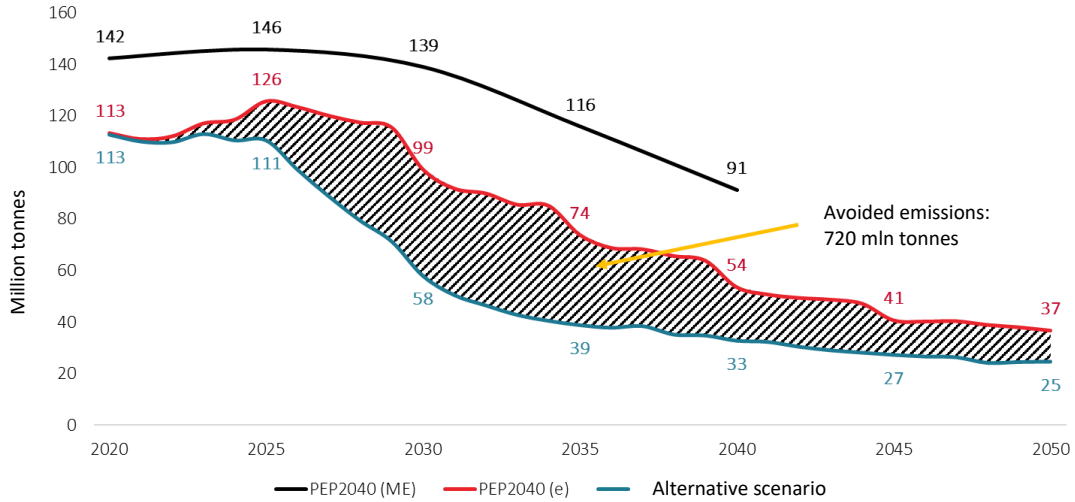
Main model parameters	PEP2040	Alternative scenario
Prices of fuels and CO ₂	Until 2021, <i>futures</i> contracts concluded in the fourth quarter of 2018; "New Policies" scenario IEA, WEO 2018.	
Nuclear power	Launch of the first unit in 2033; 7.5 GW in total after 2040	Without nuclear power
Lignite	Replacement of lignite with nuclear energy. To remain: <ul style="list-style-type: none"> • 2030: 7.5 GW • 2040: 1.5 GW 	Phasing out of lignite in accordance with the expected depletion of exploited deposits. To remain: <ul style="list-style-type: none"> • 2030: 2 GW • 2040: 0.5 GW

Hard coal	Units currently under construction, maintenance of CHP at 6 GW, withdrawal of old units <ul style="list-style-type: none"> • 2030: 18.5 GW (3.7 GW currently under construction) • 2040: 12 GW 	Units modernized and included in the capacity market <ul style="list-style-type: none"> • 2030: 13 GW • 2040: 7 GW • 2050: 4 GW (only units constructed after 2018)
Gas	<ul style="list-style-type: none"> • 2030: 6 GW • 2040: 10 GW 	According to cost optimization, mainly CHP: <ul style="list-style-type: none"> • 2030: 16 GW • 2040: 20 GW
RES	In 2040: <ul style="list-style-type: none"> • PV 20 GW • Offshore 10 GW • No new investments in onshore; phase-out until 2045 	In 2040: <ul style="list-style-type: none"> • PV 20 GW + cost optimization • Offshore 10 GW • Onshore 24 GW (cost optimization)
Demand for electricity	Average increase by 1.7%, i.e. up to 230 TWh in 2040 in accordance with the PEP2040 assumptions, among other things, due to the increase of GDP, e-mobility etc. adopted by the Ministry of Energy.	

Source: Ministry of Energy, *Conclusions from prognostic analyses for the energy sector* – Annex 1 to Polish Energy Policy up to 2040 (**PEP2040**), Warsaw 2018; Forum Energii.

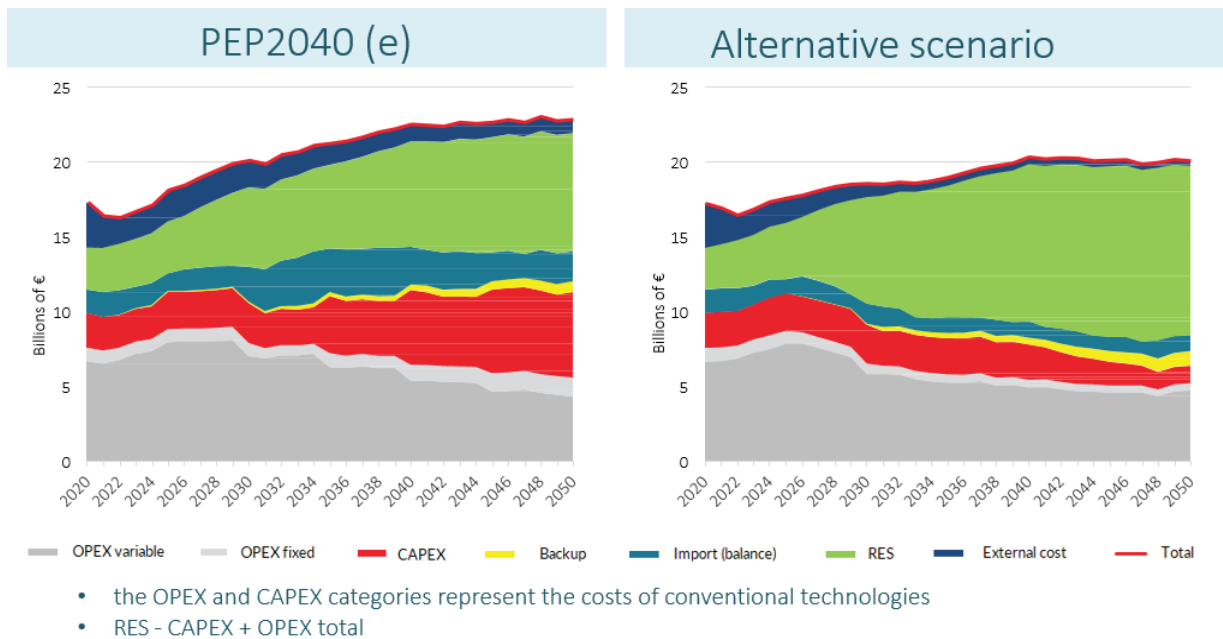
In the analyses, we assumed cross-border transmission resulting from price conditions. For comparison purposes, not only the alternative scenario, but also **PEP2040** takes into account the possibility of import when it is profitable. For this reason, modelling results, and consequently CO₂ emissions, wholesale electricity prices as well as fuel consumption in the scenario consistent with the Ministry of Energy's assumptions, differ from the results presented in **PEP2040** – they are more favourable. Such a scenario with energy policy assumptions is referred to below as **PEP2040 (e)**. The key differences between the scenarios are presented in the following figures.

Figure 1. Comparison of the level of emission reduction from the energy sector – scenarios: **PEP2040** (according to the Ministry of Energy), **PEP2040 (e)** and **alternative scenario**



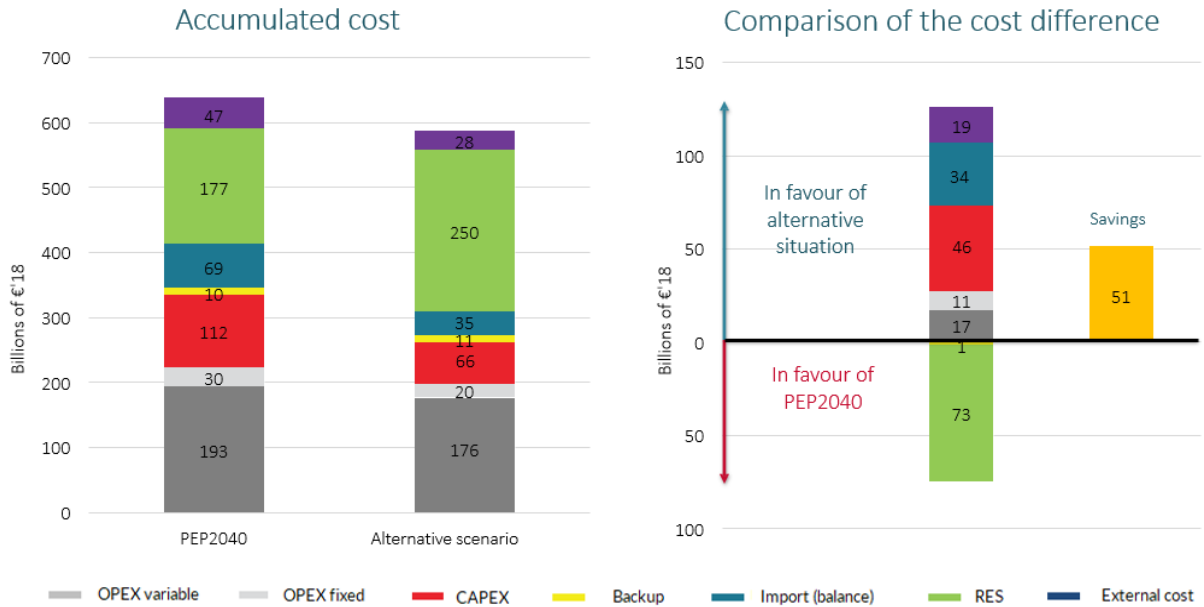
Source: prepared by Forum Energii, Enervis.

Figure 2. Total electricity production costs according to **PEP2040 (e)** scenario and **alternative scenario**



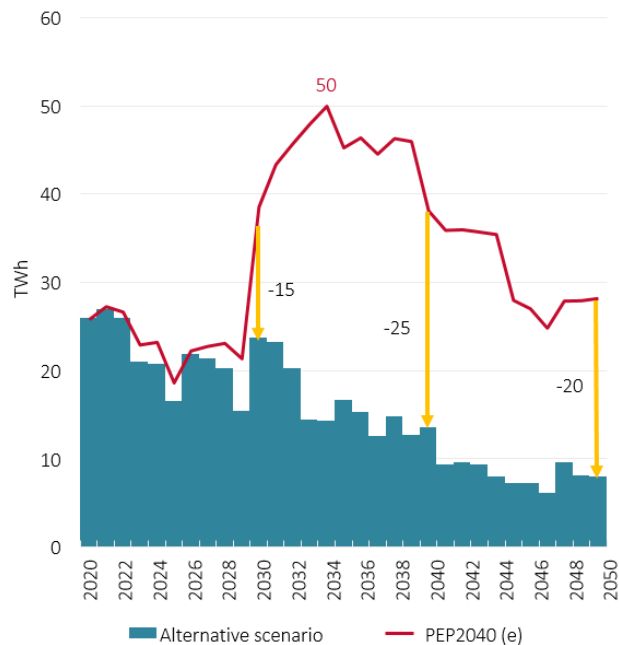
Source: prepared by Forum Energii, Enervis.

Figure 3. Accumulated costs of electricity production (2018-2050) according to **PEP2040 (e)** scenario and **alternative scenario**



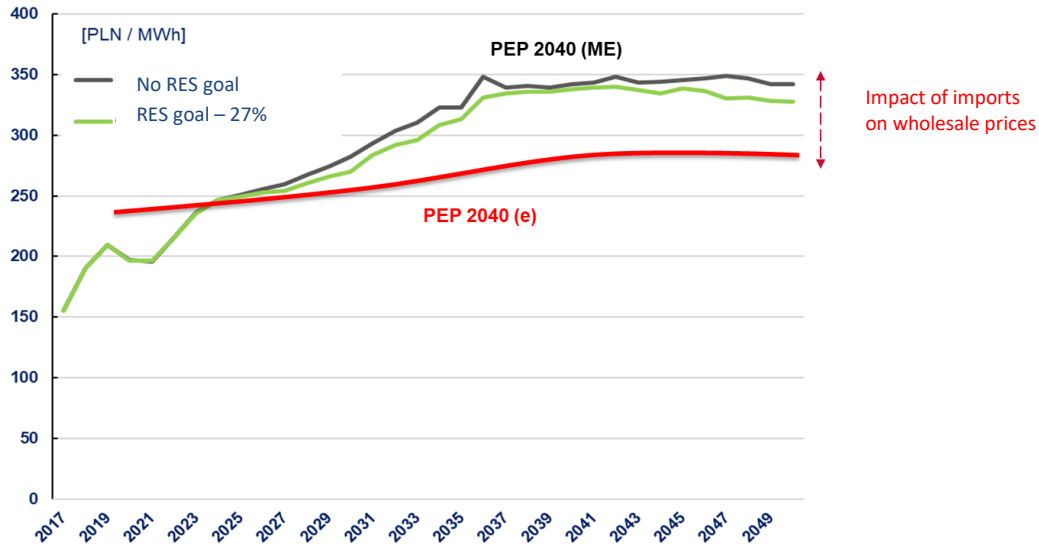
Source: prepared by Forum Energii, Enervis.

Figure 4. Electricity imports according to **PEP2040 (e)** and **alternative scenario**



Source: prepared by Forum Energii, Enervis.

Figure 5. Comparison of the level of wholesale electricity prices – scenarios: **PEP2040** (according to the Ministry of Energy), **PEP2040 (e)** and **alternative scenario**



Source: Ministry of Energy forecasts; prepared by Forum Energii, Enervis.

Detailed comments on PEP2040

1. There is no reference to joint EU energy and climate goals and the perspective is too short.
 - **PEP2040** fails to make reference to Poland's EU commitments with regard to energy and climate policy – both up to 2030 and 2050. The goals for 2030 were negotiated by Poland as part of the Winter Package.
 - By the end of 2018, Poland was required to present a draft national energy and climate plan, and its final version and low-carbon strategy up to 2050 should be forwarded to the European Commission by January 2020 at the latest. Without taking into account the EU assumptions, the **PEP2040** project will soon become obsolete and the Polish government will not be prepared to negotiate new EU goals for 2050.
 - Consistency with the EU law is important not only for the proper transposition of law. It is also vital to prepare the state for the absorption of EU funds in the new financial perspective. After 2020, the link between the funds to be spent and the implementation of the EU climate and energy policy will be even stronger. Due to the lack of strategic investments and plan of their spending, funds for these very goals may become unavailable or limited for Poland.

RECOMMENDATIONS

- **PEP2040** should specify a correspondingly higher Poland's contribution to the implementation of joint EU goals for the reduction of greenhouse gas emissions.
- When determining the contribution, the development of RES and improvement of energy efficiency should also be taken into account – at the level resulting from the adopted Winter Package.
- It is necessary to set goals in the 2050 horizon.

2. The potential for reducing CO₂ emissions is greater

- The potential for reducing CO₂ emissions in 2030 is larger than 30% presented in **PEP2040**.
- In the scenario without nuclear power, Poland (only in the power industry, including CHP plants) can reduce emissions by more than 29% in relation to the level assumed in **PEP2040 (e)**, which is confirmed by the result of the *alternative scenario* analysis.
- **PEP2040** fails to address energy efficiency and RES in a sufficient manner.
- **PEP2040** should take into account cross-border connections. As a result, the potential for reducing emissions in electricity would be higher.
- **PEP2040** fails to notice the entire heat supply area in a comprehensive manner, focusing on heating systems. On the other hand, the heating sector is responsible for as much as 60 million tonnes of CO₂ emissions (ETS and non-ETS). Consequently, the potential for reducing emissions from the heating sector was overlooked in **PEP2040**.

RECOMMENDATIONS

- **PEP2040** should set more ambitious emission reduction goals.
- Cross-border connections should be included in the plan to cover future electricity demand.
- The potential of energy efficiency and RES in emission reduction should be taken into account.

3. There is no reference to the planned changes on the energy market resulting from the Winter Package

- **PEP2040** makes no reference to the functioning of the energy market and its organization is crucial to ensure the cost-effective reconstruction of the Polish energy sector. It fails to address the issue of the locational market, which is being considered in Poland.
- **PEP2040** fails to take into account most of the changes on the European energy market, including those introduced by the Winter Package:
 - The need to adapt the national power market to the requirements specified in the regulation on the internal energy market. On 19 December, a compromise was reached, which prejudices that the public aid for units emitting more than 550 grams of CO₂ per kWh will not be allowed after 1 July 2025. Thus, at the end of 2024, payments in favour of generators producing electricity from coal, who in 2021-2024 will benefit from one-year contracts, will end in Poland, and at the end of 2025, payments will also stop for those who (in the first auction) obtained a 5-year support for modernization. This means a sharp drop in the revenues of some generators and possible economic shutdown of generating units.
 - The problems of old units may aggravate future requirements for the best available techniques (BREF conclusions). Currently planned modernizations (adaptations to the

BREF conclusions that will be applicable in August 2021) will not allow for their fulfilment. However, PEP fails to assume in the analyses that such costs will have to be incurred.

RECOMMENDATIONS

- The principles for the functioning of the energy market in the future should be presented. The reform should be targeted to increase the flexibility of the power system and its market valuation. Along with the development of digitization, cheap RES and storage technologies, the national power system should be prepared for increased dynamics of supply fluctuations. The flexibility of the system is already considered crucial, and its increase is supported by the EU regulations – network codes and Winter Package (e.g. activation of new services in the distribution network). The key activities that should be included in PEP are as follows:
 - Increased flexibility of conventional power plants.
 - Supporting demand flexibility. Poland has had its first, promising experience with demand side response (DSR). It is necessary to keep developing this mechanism in a consistent manner and include its role in the state energy policy.
 - Planning joint development of sectors (so-called sector coupling) – electrification of the heating sector and transport will facilitate the management of surplus energy and support in balancing the system.
 - Development of short-term markets. Variable RES can support system stability, e.g. by providing system services.
 - Development of a strategy for improving the liquidity of the Polish power exchange and preparation of the Polish market for the increase in competition in the EU dimension.
 - Analysing the impact of introducing the locational pricing.
 - Defining the future role of a consumer in the new energy market model. It is necessary to rebuild the market in such a way as to ensure the transfer of the price signal from the wholesale market to the retail one.

4. When proposing the energy mix, there is no cost-effectiveness approach

- When selecting the future energy mix, in addition to strategic goals for the state, the capital expenditure criterion (CAPEX) and the criterion of minimizing the total costs of NPS activities should be taken into account. Only the cost-optimal mix will allow for reducing the growth of electricity prices. One should also recognize that, only accumulated investment outlays (PLN 400 billion up to 2040) were presented in **PEP2040** and there is no information on the assumed levelized cost of electricity (electricity production) of various sources.
- For unknown reasons, the cheapest RES technology – onshore wind farms – is eliminated from the power system.
- **PEP2040** fails to allow for estimating the total costs of transition of the Polish power industry, nor how it will translate into electricity prices for recipients.
- The comparative scenario in **PEP2040**, i.e. with no RES goal, was based on unrealistic assumptions, including the fact that no expenditures for the construction of six new generating units (including the very expensive Ostrołęka power plant), expenditures for the construction of RES in 2018-2020, or the costs of future adaptations to subsequent BREF environmental requirements were taken into account. First, it causes deliberate distortion of the analysis and

artificial reduction of the scenario costs without an obligatory RES goal. Secondly, it is not clear whether the PEP baseline scenario was also developed in such a simplified way. Therefore, the estimates of the costs of energy transition are of great concern.

RECOMMENDATIONS

- When selecting the future energy mix, the criterion of minimizing the total costs of NPS activities should be taken into account. Only this approach will minimize burdens for recipients. The costs of the system transition should be considered in the 2050 horizon. All costs should be taken into account, i.e. those resulting also from the EU environmental and climate policy. They should not be selected on a discretionary basis.
- It is necessary to account for development in the mix, instead of excluding onshore wind farms (see below).
- The proposed *alternative scenario* allows for minimizing the total costs of transition of the Polish power industry, with a more effective fulfilment of the EU goals.

5. The assumptions of RES in PEP2040 fail to spot their real potential

- **PEP2040** includes offshore wind energy. This is a good starting point, although the potential of this technology is, in our opinion, greater in the long term.
- It is significant that **PEP2040** notices the importance of solar energy. PV will improve the security of the Polish energy system in summer when the demand for electricity increases, and conventional power plants experience cooling challenges. However, PV is to be developed too slowly, and, above all, too late in the proposed scenario. The analyses of Forum Energii indicate that the installed capacity may reach 10 GW already in 2026 (in comparison to 2030 in PEP). Withdrawal from onshore wind energy in the perspective of the next years is incomprehensible. No arguments justifying this decision were given. The inclusion of wind energy in the energy balance is economically justified. In 2030, Poland could have about 16 GW of wind capacity on land and gradually increase it up to 24 GW. As it results from **PEP2040** Poland intends to achieve the 21% RES goal in 2030. Such a level would be sufficient if the EU goal of 27% was adopted (as estimated by the European Commission in 2016¹). In the end, however, last-year RES directive assumes a 32% share of RES in 2030. This is another argument for the lack of consistency of the energy policy project with the EU regulations being implemented.

RECOMMENDATIONS

- The development of PV should be faster. There is no justification for introducing PV only after 2023. Already now, the transmission system operator should have 3-4 GW of PV capacity due to the summer peaks.

¹ Cf. European Commission, "Impact Assessment. Accompanying the document Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast), SWD(2016) 418 final, Brussels, 30.11.2016. https://ec.europa.eu/energy/sites/ener/files/documents/1_en_impact_assessment_part1_v4_418.pdf

- It is necessary to propose new rules for the functioning of the energy market in the future, so as to reward flexibility and, consequently, enable a greater integration of variable sources (see above).
- Integration of distributed sources, improvement of international cooperation conditions on electricity markets as well as search for synergies resulting from the electrification of the heating sector and transport, which may also support the integration of RES, should be included in grid development plans (which also requires modernization due to its age).

6. The risk of a large adequacy gap in the energy system after 2030

- At the end of the decade, lignite power plants will be closed down in Poland. The low probability of introducing nuclear energy at this time means that Poland will face a serious threat to the security of electricity supply.
- The nuclear power development plan has existed for 10 years (Resolution No. 4/2009 of the Council of Ministers of 13 January 2009 on actions taken in the field of nuclear power development). The basic elements of the Polish nuclear power program are still missing: the financing model (in accordance with the EU public aid principles), the current plan of action and location.
- Regardless of the advantages of this technology, specific risks should be taken into account. In the final effect, such large and capital-intensive investments are more expensive than the budget assumes and are delivered with delays. Capital expenditures included in PEP (PLN 20 million/MW, i.e. EUR 4.67 million/MW²) are already underestimated.
- Both the date of commissioning the first unit and the rate of delivering the next units should be assessed as unrealistic.
- It is necessary to pay attention to the fact that if nuclear energy is included in the mix, we will become dependent on the import of nuclear fuel and on the technology supplier.
- No progress in the implementation of the nuclear power plant may have serious negative consequences for the Polish energy sector:
 - Threat to energy security – even if the first nuclear power plant is built in 2033, it will not replace the lignite being phased-out.
 - Simulated construction of the nuclear power plant can block the development of offshore wind farms due to network congestion.
 - Nuclear power requires an advanced financing model involving many credit institutions. The high cost of capital (long payback period, the risk of regulatory changes affecting project costs, etc.) can affect the costs and availability of funding for other investments.
 - If nuclear power plants are not built or their implementation is significantly delayed, Poland will not achieve the CO₂ reduction goals after 2030. Since the nuclear power is treated as a RES alternative, goals for renewable sources are already underestimated (27% in 2030 and 33% in 2040).
- **PEP2040** has shown that lignite can be replaced with nuclear power after 2030³. In our opinion, too optimistic plans for lignite extraction have been presented. As it results from **PEP2040** the

² For example, they are expected to amount to 5.5 million EUR/MW for the Hungarian Paks NPP.

³ As it can be read in PEP “The optimization model included the possibility of building the first nuclear unit with 1.4 GW in 2033 (due to the capacity gap preventing the cover of growth of power demand).”

installed capacity and production of these sources will not have changed by 2030. Lignite will be gradually withdrawn as late as about 2035. In fact, the available resources will end before 2030 due to high production and costs of CO₂. Lack of economic justification for the reconstruction of opencast lignite mine in Złoczewo (too long distances for transport of coal) will determine that particular units of Bełchatów power plant will be closed earlier, even at the end of 2020s.

- **PEP2040** seems to notice that closing the units in Bełchatów requires a strategy for their replacement, because Bełchatów appears among potential locations for a nuclear plant. So far, Bełchatów has not been mentioned among the three preferred locations (Choczewo, Lubiatowo-Kopalino, Żarnowiec), where location and environmental studies were conducted. The Polish Nuclear Power Program has not been updated in this scope. This is a big change that requires advanced preparation works.
- If we fail at timing the replacement of energy sources in the Polish power system, there will be an over 9 GW adequacy gap. It will pose a threat to energy supply security. **PEP2040** fails to notice this problem or to suggest any alternative solutions.

RECOMMENDATIONS

- It is necessary to rationalize the expectations regarding the costs and the time horizon for a nuclear power plant in Poland to be built, which is about 15 years from the moment the construction decision is taken.
- An emergency scenario should be prepared for a situation in which nuclear power plants will not be able to replace lignite power plants.
- The assumptions regarding shutting down lignite power plants should be made more realistic, i.e. earlier than after 2030.

7. High demand for electricity was not justified

- **PEP2040** lacks a reference to the potential of energy efficiency, and it is the cheapest and most effective method of reducing CO₂ costs and emissions.
- In the case of power industry, the efficiency improvement was only considered declaratively and in relation to the supply side.
- A high demand for electricity and capacity is expected (1.5% and 1.3% respectively), which is further increased with the development of electric cars and heat pumps (forecasts are 1.7% increase in energy demand and 1.6% in capacity demand).
- The forecasts of PSE⁴ assume that the increase in electricity demand will be within the range of 1.2-1.6% per year in 2018-2027. In **PEP2040** according to the Ministry of Energy, it will be 1.9% in the decade of the 2020s. In the analysis of Forum Energii entitled *Polish Energy Sector 2050. 4 scenarios*, we assumed this factor at 1.4% per year. In 2050, electricity production would be at the level of 220 TWh, whereas according to PEP it will amount to 230.1 TWh already in 2040.

⁴Polskie Sieci Elektroenergetyczne, *Development plan in the scope of current and future electricity demand for 2018-2027*, January 2018.

- Overestimation of electricity demand results in the need to ensure higher production capacities, which significantly increases the costs of functioning of the power system.

RECOMMENDATIONS

- Forecasts of electricity and power demand should be re-analysed. They should be based on the combination of growth factors such as development of electric transport and electrification of heating, but above all, on limiting demand: improvement of energy efficiency, DSR, energy efficiency in buildings and demographic changes in Poland.
- The opportunities resulting from the integration of the heating sector and transport with the energy sector should be taken into account.
- The potential of cross-border transmission and the ability to cover the peak demand with energy imports should be taken considered.
- If the high demand for electricity is maintained in 2040, this should be reflected in the entire energy policy, e.g. coincide with the plans for electrification of heating, transport and other sectors of the economy.

8. The future of hard coal

- With regard to earlier announcements, declarations regarding coal energy were verified in **PEP2040**. Excluding cogeneration, a 50% share of coal will be already reached in 2030, and not 20 years later as it was announced by the Ministry of Energy.
- PEP assumed that the currently working coal units are mostly adapted to future environmental requirements. As part of the capacity market, operating units acquired funds to carry out the necessary modernizations, thanks to which they will meet the requirements of the BREF conclusions adopted in 2017.
- Due to the introduction of a limitation to support coal units emitting more than 550 g, it will not be possible to continue this support mechanism in the future.
- As it is realistic to assume further tightening of the BREF environmental protection and emission requirements, it may turn out that, despite current investments and high costs, in a few years some units will not be able to function on the energy market without a support system.
- Since after 2025 support of coal-fired power plants as part of the capacity market will be very limited, it may turn out that coal-fired power plants will not survive without the support, so the perspective of their functioning is shorter than **PEP2040** assumes.
- PEP failed to assume tightening of environmental requirements after 2020, and it can be expected to happen. What is more, the outlays for the nearest (in relation to unit which are not centrally dispatched) as well as subsequent modernizations were overlooked in the comparative analyses. It artificially underestimates the cost of the scenario with a higher share of coal.
- According to our analyses, the share of coal in electricity generation will be around 20-25% in 2050. However, in the case of absence of limitations on cross-border transmission, this share will reduce the volume of imported, cheaper electricity.
- Maintenance of the share of hard coal in the energy balance will require high modernization outlays as well as import of the resources. PEP should consider both issues, because they will result in a different assessment of the mix development scenario proposed by the Ministry.

- In **PEP2040**, forecasts for the national hard coal balance were not presented. It was assumed that coal consumption would be high and stable until the end of the 2030s, (around 35 million tonnes per year, and 30 million tonnes at the end of the decade of 2030s). Considering consumption in the heating sector, there is a risk that demand will not be met by domestic production. **PEP2040** cannot ignore such an important issue as a growing dependence on hard coal imports. Insufficient domestic production will have a negative impact on energy security. PEP fails to refer to the ban on public aid for mines, which became applicable in 2019 after a long transition period. This is more and more limiting the possibility of support for mining.

RECOMMENDATIONS

- An optional scenario assuming a smaller share of coal in the future should be developed.
- It is necessary to specify a strategy and order of shutdown of individual generating units, as well as a plan to replace them with other sources.
- A support strategy for coal units, which will not be able to participate in the capacity market after 2025, should be prepared.

9. Unrealistic assumption of zero electricity imports

- The assumption regarding the construction of a common energy market results from the TFEU. The aim of its formation is to limit the increase in electricity costs by increasing competition, price convergence in the EU, increasing the security of supply and reducing CO₂ emissions.
- **PEP2040** fails to include cross-border electricity flows, which, in our opinion, is incorrect for a few reasons:
 - The internal energy market in the EU is developing and gradually integrating.
 - In the long term, it can be assumed that the problems of unplanned power flows will be solved, which will improve the predictability of supplies and will increase trade in electricity.
 - Assuming the autarchy, Poland will face electricity prices higher than prices in other UE countries.
 - It was assumed that the interconnection capacity should be at least 10% in relation to the installed capacity of the system at the UE level. Moreover, the already agreed Regulation on the internal electricity market (Winter Package) contains provisions requiring maximum transmission capacity for market participants (provisions indicate as much as 70% or 75%) and prohibiting their reduction due to internal problems.
- Current Polish experience shows that cross-border connections have a significant role in ensuring generation adequacy.
- According to analyses in **PEP2040** scenario, Poland imports significantly more electricity than in the alternative scenario – Poland will become a net importer of electricity in the future. The wholesale price has a direct influence on this phenomenon. The volume of electricity imports could be reduced in the future (even by half in comparison to **PEP2040**). The condition is a similar production structure in Poland and in the neighbouring countries.

RECOMMENDATIONS

- **PEP2040** should include the real level of electricity imports and exports.
- When planning the future energy mix, it is necessary to consider the production structure in neighbouring countries, because it will have a great impact on energy prices and flow directions.

10. There is no comprehensive approach to the problem of the area of heat supply

- In **PEP2040**, the heating sector is perceived only through the prism of system heat. This is too narrow a perspective, because system heat is only responsible for covering around 1/3 of the country's heat needs. Heat flux generated in buildings, supplied from individual heat sources and industrial heat flux, were overlooked. Narrowing the analysis perspective limits the effectiveness of **PEP2040** in the implementation of the assumed strategies.
- It was assumed in **PEP2040** that the development of RES is needed only to reduce the impact of the power industry and heating sector on climate. The beneficial effects of RES development on improving the country's fuel balance and air quality were overlooked. The area of heat supply is responsible for about 40% of the entire national energy flux. Maximizing the use of energy from RES and improving energy efficiency on the heat consumers' end should be one of the pillars of the policy of improving the country's energy security.
- In **PEP2040**, too little emphasis is placed on the efficient use of available biomass. It is necessary to strive for using biomass in processes of high energy efficiency, i.e. in cogeneration and heating units.
- **PEP2040** lacks the adoption of the CO₂ reduction goal for the heat supply area. This blocks the development of a decarbonisation strategy of the heating and cooling sector in accordance with the EU policy and the national policy of reducing dependence on the import of fuels for heating and energy purposes.
- **PEP2040** fails to indicate the end date of the process of abandoning the combustion of solid fuels in buildings heated with individual heat sources. The lack of a more detailed schedule hinders the possibility of improving air quality in Poland for the next ten years. In consequence, enterprises producing heating devices and investors implementing new construction projects will find it impossible to take adaptive measures. The risk of increasing future costs of adaptation to stricter environmental policies is also growing.
- **PEP2040** overlooks any benefits from the development of cogeneration and no assumption was made to maximize the use of available heat flux for electricity production with this method. No benefits for the National Power System from the development of gas cogeneration are identified, either. It was assumed that the increase in the capacity of gas cogeneration units will be only 1.4 GWe, and in the area of coal cogeneration units, the capacity will remain at the level of 5.5 GWe. This assumption concerning coal units appears in contradiction with the dominant practice of the CHP sector, and also implies a loss of about 4 GWe of additional capacity for the NPS – if the existing coal units (with 5.5 GWe capacity) were replaced with gas fired units (9.5 GWe), with the same heat generation.
- **PEP2040** fails to see the benefits from the integration of the heat supply sector with NPS. The flexible heating sector can effectively stabilize the operation of the NPS through the use of

energy accumulation, as well as thanks to the operation of flexible cogeneration units and heat pumps operated by the TSO or DSO.

RECOMMENDATIONS

- The energy policy should set goals and strategy for the heating sector. The heating sector is not only system heat, but also heating in individual buildings.
- A detailed schedule of actions should be developed in a separate document, *A Strategy for the Heating Sector up to 2050*, to which **PEP2040** should refer.
- The goal of primary energy reduction of buildings should be set for 2040 (2050). The goal of this reduction should result from the increase in the share of RES in the area of heat supply and improvement of the energy efficiency of buildings. Guidelines should also be prepared for a separate government document on the strategy for modernization of buildings and improvement of energy efficiency.
- Biomass is a valuable local fuel. The limitation of biomass utilization in new large condensing units above 20 MWe should be introduced, and bidding mechanisms to stimulate the construction of cogeneration units for biomass and biogas should be effectively used.
- The goal of full decarbonisation of the heating sector by 2050 should be adopted, which will contribute to the improvement of air quality in Poland and to the improvement of the fuel balance.
- The goal of abandoning the combustion of solid fuels in newly built buildings with a two-year grace period from the date of adoption of **PEP2040** should be adopted, and in the case of existing buildings, the replacement of solid fuel heat sources should be completed by 2035.
- Higher cogeneration development goals should be introduced, which will allow for a better use of the heat flux and doubling the current level of the installed electric capacity.
- **PEP2040** overlooks the benefits of connecting the heating sector with the NPS, and hence the consequences of the electrification of the heating sector and its potential in stabilizing the operation of the PPS.