By Gábor Papp

Geopolitical turmoil hand in hand with accelerating green transition had challenged European countries unprecedented. Poland has its unique position within these global circumstances, since coal production and consumption is still an important factor in the country's energy mix. At the same time both renewables and nuclear energy pose as a valuable substitution with their inherent advantages and disadvantages. One of the key aspects is the potential upcoming changes related to Poland's supply chains in the upcoming years to which the country must prepare. Hungary with its experiences regarding nuclear power could be an exceptional partner for Poland to achieve its goals.

Introduction

The Russian-Ukrainian war has brought the question of energy again into the centre of attention. Within a short time, the EU had come up with the Versailles Declaration[1] which had already contained the issue of energy. Then in the framework of the REPowerEU Plan[2] the EU had declared to reduce its dependence from Russian fossil fuels and accelerating clean transition. However, not much has been told so far about nuclear energy in the framework of this strategy. However, some recent events like the creation of the Nuclear Alliance in 2023 or the first Nuclear Energy Summit held in Brussels in March 2024 may foreshadow that some changes would about to arrive.

Even though nuclear energy has several advantages (like emission-free electricity, long-term reliable operation, system stability[3] and being not or at least far less affected by weather conditions like solar or wind energy production) the possible increase in both interest and demand could have led to consequences which may pose challenges like buildout and/or improvement of electricity grids, deployment of new technologies or the transformation of supply chains.

Polish nuclear energy aspirations

Green transition aspirations and recent geopolitical events like the Russian-Ukrainian war and the tensions around the Red Sea pose unprecedented challenges for European countries in term of energy security. Poland has a unique situation between these countries since it is the biggest hard coal consumer accounting for more than 40% of the EU-s overall consumption[4]. Even though both Poland's hard coal production and electricity production from coal had dropped, the latter by a record amount in 2023, hard coal was still accounted

for 61% of Poland's electricity production[5]. To decrease and replace this quantity by other resources is probably Poland biggest chance and challenge at the same time from the energetic point of view, since renewables and nuclear energy are both come up as a potential substitute with their respective advantages and difficulties.

According to the latest related document the Energy Policy of Poland Until 2040 adopted in 2021, "The first unit … of the first nuclear power plant is scheduled to be commissioned in 2033. In the following years, five more units are planned to be commissioned at intervals of 2-3 years"[6]. Related technology and provider was not explicitly appointed in the document, but currently, from the announcement of prime minister Mateusz Morawiecki by October 2022 it seems that Poland's first nuclear reactors going to be Westinghouse's AP1000 models. Constructions are destined to start in 2026 in the Pomerania province[7].

Renewables…

Renewables are also being an important part of the cited document for enhancing energy security and by generating economic competitiveness in the long run since "the use of RES will result in the decrease in the wholesale prices of energy, as well as the reduction of costs accompanying the emission of pollutants"[8]. Power generation from renewables hit a record high percentage in Poland in 2023 accounted for 27% of total production[9]. More than half of this was produced by onshore wind power, while photovoltaics was responsible for 25%[10]. Photovoltaics deployment had been accelerated during the last years[11] while significant offshore wind power infrastructures planned to be installed as early as 2026[12].

… and their challenges

The growing share of renewables within electricity production is a welcome change from the climate point of view, however, further increase of RES accompanied with the appearance of nuclear energy would pose a significant challenge to Polish energy systems by the early 2030s to which the country must prepare in advance. According to Forum Energii's report „over 90% of offshore wind turbine components installed in Europe in 2019 were manufactured on our continent"[13]. While this number may look pleasant first, it has to be noted that the market of permanent magnet's which are essential to these infrastructures is heavily dominated by Chine just like the rare earth market itself from which dysprosium, neodymium, praseodymium, and terbium are essential components of these magnets.Even though Europe has quite a good market share on the different levels of the global supply chains regarding wind power infrastructures face to face with China for example compared to photovoltaics,[14] China's overall dominance on both sectors should implicate that growing need and therefore growing deployment of renewables comes sooner

or later with higher Chinese influences as well. From this latest point of view deploying nuclear energy could be a tool for mitigate further Chinese influence as well, whereas, as it stands, nuclear technology and infrastructure will be provided by a friendly country or at least not by a systemic rival just like the EU refers to China[15].

At the same time parallel use of renewables and nuclear for energy production could pose some internal systemic challenge for example related to economy and raw materials. According to World Nuclear Association "The integration of intermittent renewables with conventional base-load generation is a major challenge facing policymakers in the EU…"[16]. One of the key aspects is related to wholesale market prices. "At high levels of renewable generation … the nuclear capacity factor is reduced and the volatility of wholesale prices greatly increases whilst the average wholesale price level falls. The increased penetration of intermittent renewables thereby greatly reduces the financial viability of nuclear generation in wholesale markets where intermittent renewable energy capacity is significant"[17].

Moreover, serious grid expansions – which looks to be the case in Poland in the future – need raw materials as well, especially copper. Poland is the biggest copper producer within the EU[18], but it is still an open question whether the country would be able to meet its growing demand internally or copper import would rise which may lead to growing raw material dependency as well.

What makes the whole question even more complicated is the question of Small Nuclear Reactors (SMR's). Thanks to its many advantages[19] and the fact that the technology has not economically scaled up yet, there can be observed a kind of rush between actors to become one of the early providers and parallelly with this, investigations are ongoing in many countries for mapping the chance of the technology's implementation. From this point of view, it is an important development that in 2023, ORLEN Synthos Green Energy managed to reach an agreement for joint investment in developing SMR technology with American and Canadian companies[20]. Not only because Poland may be able to deploy a fleet of SMRs in the future but also because the country would gain valuable experiences and therefore could potentially become an important actor of this sector in the future, which in turn may bear European wide impacts.

Finally, by applying nuclear energy, uranium supply and nuclear waste management are also factors and further aspects of supply chains which are need to be considered. Lastly, another aspect which has to be taken into account is the social acceptance of nuclear energy. Even though that according to the findings, public support is quite high[21] in Poland recently, the country has no experience regarding the coexistence of (local) society

and nearby nuclear power plant. Here comes the territory where Hungary could serve as an exceptional partner to share its own experience about this, since in the region of Paks local communities and the power plant live in a prosperous coexistence since more than 40 years[22]. This coexistence was also highlighted recently in a podium discussion by Hungary's Minister of Foreign Affairs and Trade Péter Szijjártó[23].

Recommendations:

1. Boost R+D joint activities between Poland and Hungary. This could not only mutually beneficial from the scientific point of view, but also may have the potential to strengthen the overall relation between the countries resulting in a kind of spillover effect.
2. Since the Hungarian city of Paks is a good example of how local society and nuclear power infrastructures could beneficially coexist, these experiences may worth to be channelled into study tours or other initiatives from which Hungary and Poland could mutually profit. Even though already existing technologies in Hungary and previsioned ones in Poland are different and of course there are many confidential issues related to these subjects too, from one hand some good practises could be potentially learnt from Hungary while from the other hand Polish SMR updates could provide valuable information to Hungary too.
3. Both countries need to consider the restructuring or the evolving of the old-new supply chains and treat these changes as a matter of geopolitics. Meanwhile, supply chains could also provide a field of cooperation for Poland and Hungary on bilateral and multilateral level as well.

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