When it comes to meeting climate goals, Hungary is one of the EU leaders. This is largely due to the structure of the Hungarian energy mix, in which nuclear energy plays a huge – and growing – role. Thanks to their position as a frontrunner in this EU priority area, Hungary retains a negotiating margin within the EU that allows it to pursue their multi-vector foreign and economic policy. Poland should be inspired by Hungarian solutions and the direction of its energy and environmental transformation, drawing on Hungary's experience also in the area of nuclear energy. At the same time, it should be kept in mind that Hungarian energy policy is still based on close cooperation with Russia, recognised unanimously by most other NATO and EU countries as a potential threat. Therefore, the enticement and strengthening of cooperation between Hungary and Poland must be separated from issues related to the applied technologies and focus on cooperation among industrial actors as well as regulatory, financial and organisational issues, which are key to the successful implementation of infrastructure projects, including nuclear projects.

For every independent and self-determining state in the world, energy generation sector is of uttermost strategic importance. It is a sector that is subservient to all others but, at the same time, allows for their existence and development.

Energy supply and consumption per capita correlates strongly with living standards[1] [2] and drives the economic development of regions[3] and countries[4] [5]. Accounting for the present trend driving electrification of new activity areas, such as individual transportation, and how much electric energy is required to apply the digital solutions that are becoming mainstream as well as the rising popularity of AI applications to perform tasks of increasing complexity, this relationship may only be strengthened.

For this very reason, the vast majority of countries strive to maximise their energy security, i.e. to guarantee their ability to meet domestic energy demand uninterruptedly and continuously, the elements of which are energy independence and diversification of generation sources.

Main EU limitations

The present EU energy policy is shaped by two key factors. The first is the requirement of decarbonisation, driving – through a system of charges and taxes – the need for modernisation in the form of resignation from generation technologies based on burning fossil fuels. The second is Russia's war with Ukraine, which has provided an additional incentive to accelerate and increase pressure for such defined modernisation. The

imposition of sanctions on the purchases of raw materials from Russia meant that energy dependence on coal, gas and oil – most of which before 2022 largely came from Russian suppliers in the EU market, had to be reduced. It also forced a move away from the use of Russian nuclear fuel in the European nuclear reactors, including reactors of Russian design, as well as freezing, sometimes abandoning[6], cooperation with the Russians on nuclear projects in Europe. Suffice it to say that WWER-type facilities operating in the Ukraine[7], the Czech Republic[8] or Slovakia[9] have all switched to American nuclear fuel produced in Sweden.

Hungary has not followed their European partners pursuing their own multi-vector foreign and economic policy instead. Hungary opted to minimise the risk of an escalation of the conflict in Ukraine by, among other things, consistently opposing the economic sanctions imposed on Russia. Moreover, in terms of economic sanctions, the Hungarian government managed to negotiate an exception: in exchange for the Hungarian vote in favour of sanctions on the import of the Russian natural gas[10], Hungary was given the green light to expand the Paks nuclear power plant in cooperation with Rosatom. Two new reactors of the III+ generations built in the VVER-1200 technology[11], will double the installed capacity of the plant. If one takes into account that the Paks NPP already covers more than 40% of the country's domestic electric energy demand, it becomes clear that the implementation of this project will give Hungary and its economy a huge boost of … energy. It is the flagship infrastructural project of Victor Orban's cabinet. More interestingly, the forward march of nuclear power in Hungary may not stop there. Plans to build another facility, an SMR reactor, also in cooperation with Russia are already taking shape[12].

The gap in starting positions

The Polish power generation may envy Hungary their results. The sector's GH emissions are well below the European average (181 gCO2/kWh in 2022 to 265 gCO2/kWh in 2022) and well below the Polish (681 gCO2/kWh in 2022)[13]. Hungary was also one of the first EU countries to commit to achieving net zero emissions by 2050, formulating its energy policy accordingly and aiming to achieve 90% of energy production from low-carbon sources (new nuclear and RES) by 2030[14]. Energy prices, both wholesale and retail, are also much lower in Hungary. This is not difficult though, given that prices in Poland are among the highest in the EU (next to Italy and Ireland), burdening Poland with the risk of losing foreign investment, among other things[15] [16].

The ease and speed with which Hungary hits the targets of the European energy and ecological transition, which are and which will remain one of the EU's highest priorities in

the coming years, gives Budapest a certain margin to use when negotiating other issues. Victor Orban's cabinet is obliquely making use of this margin by pursuing a multi-vector policy, which goes against the grain of the virtually unanimous European policy of economic and political ostracism towards Putin's Russia. The negotiated exception for the expansion of the Paks NPP is the best example.

The reason for the disparity between GH emissions from the Hungarian and the Polish energy sector as well as the glaring difference in energy prices becomes clear when one looks at the energy mix structure in both countries. The large share of nuclear power, biofuels and waste in the Hungarian energy mix has for years meant low dependence on natural gas, oil and coal, even if these still come from Russia. Such outcome is the result of a simple strategic decision taken by Hungary decades ago and analogous to that taken by France[17] in the 1970s . Faced with a lack of its own fossil fuel resources, Hungary decided to produce energy differently, taking advantage of developments in global nuclear technology.

The fundamental difference between a nuclear power plant – even if built by a Russian company using Russian technology – and imported fossil fuels is precisely this: a nuclear power plant will always produce energy on its site, supplying the host country's energy grid. Nuclear fuel can be safely accumulated and stored to create a stockpile sufficient to cover its needs for years to come. Nuclear fuel can also be purchased from a variety of suppliers without depending on any geographical direction. Meanwhile, fossil fuel power plants will stop producing energy when the fuel supply to its boiler runs out. Neither natural gas, coal nor oil can be stockpiled in quantities sufficient to keep the plants running for several years.

Nuclear power absent from the Polish energy mix

Nuclear power will only supply the Polish national grid in about a decade. The Polish Nuclear Power Programme provides for the construction of 9 GW of installed capacity in two locations[18]. However, a number of nuclear projects not covered by the PNPP and led by some local governments[19], joint-stock companies[20], private entities[21] and state-owned companies[22] alike, have sprung into existence in Poland. One of the projects provides for the construction of a full-scale nuclear reactor, the others foresee implementation of the entire range of SMR technologies offered by a number of potential suppliers, with GE-Hitachi's BWRX-300 technology being the black horse. Assuming that all of these projects are implemented, they will add a total of 12.5 GW of nuclear power to the Polish grid and, according to some estimates, there is still room for more in the Polish electric grid. The Hungarians are also planning to build a small SMR reactor, in cooperation with the Russians[23].

Approaches to nuclear power in Hungary and Poland

The Hungarian and the Polish approach to nuclear is – simultaneously – very similar and … very different.

Poland sold one of the reactors to be built in the unfinished Żarnowiec NPP to Hungary in 1992, after abandoning the Żarnowiec NPP project. It is still used as a training centre at the Paks NPP[24].

Both the authorities and the societies of both countries are clearly convinced of the legitimacy of nuclear energy in their energy mixes[25] [26].

However, there is also a fundamental difference in this regard: a difference between the pragmatic approach of the Hungarians, experienced in the implementation and operation of nuclear facilities, and the more idealistic rather than practical or factual approach of the Poles, inexperienced in the matter. In Poland, nuclear projects are still plagued by an inability to consistently implement commitments once made.

Room for cooperation

Both parties, Hungary and Poland, would benefit from cooperation between nuclear regulators, central administration units responsible for nuclear energy management as well as organisations implementing nuclear projects. However, such cooperation would require remaining at a technology-neutral level: Poland excludes the participation of Russian entities in nuclear projects on its territory and had made this decision for political reasons and due to national security concerns long before Russia's attack on Ukraine. From a strategic point of view, however, it would be valuable for the Polish side to become more familiar with Hungarian legal conditions as well as financial and organisational solutions applied to nuclear as this may help overcome thinking of nuclear projects as something too big for us to afford and too complicated to manage in Poland.

Such cooperation would also provide both partners with the opportunity to improve their competencies and develop their human capital in the nuclear field. Understanding and familiarising oneself with solutions applied in other countries of the region is valuable knowledge, which, due to certain similarities in social attitudes and conditions, political and organisational cultures, may find practical implications for project implementation.

Nuclear power, however, is about much more than building the reactor itself. Almost 80 Polish companies operate on the global nuclear power market as suppliers of various goods

and services[27]. Establishing contacts between these entities and those operating on the same market, but coming from Hungary, could be both a development impulse for the domestic industry in Budapest and Warsaw, and a way to broaden the pool of potential partners in the nuclear projects being implemented in both countries.

While Hungary is much further down the successful road to energy and ecological transition than Poland, thus a source of positive examples and inspiration, Hungary has much to gain by strengthening cooperation with Poland as its partner within regional organisations and within the EU, where both countries have common interests and socio-economic battles to win together.

Recommendations:

1. Establish and strengthen cooperation between central administration units responsible for nuclear power projects, nuclear regulators and organisations planning implementation and implementing nuclear projects in order to familiarise themselves with the organisational and financial solutions applied;
2. Create a cooperation platform for Hungarian and Polish industry representatives present on the global nuclear market in order to expand the pool of potential partners for nuclear projects in both countries and mutually support the development of national organisational and industrial capacities in this area;
3. Build and develop competencies of a pool of experts familiar with solutions applied by other countries in the region, a knowledge important due to similarities in social attitudes, political and organisational cultures;

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