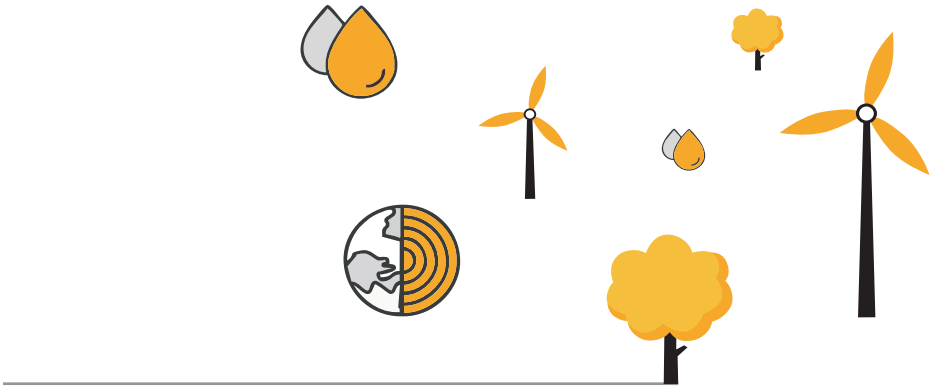
SAPI Slovenská asociácia fotovoltického priemyslu a OZE



Slovak Renewable Electricity Market Report 2022

Slovak Association of Photovoltaic Industry and RES (SAPI)

Slovak Renewable Electricity Market Report 2022

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EXECUTIVE SUMMARY

The Slovak Renewable Electricity Market Report 2022 maps out the current state of renewable energy sources used for electricity generation (RES-E) in Slovakia and introduces a set of projections on future development scenarios by 2030, 2050 respectively. It is centred around five types of RES-E – solar PV, hydropower, wind energy, geothermal energy, and bioenergy. The document introduces three scenarios, namely business as usual, NECP and zero-emissions target, each encompassing a unique dataset and trajectory. As of early 2023, Slovakia struggles with achieving both the targets approved in the final 2019 National Energy and Climate Plan (NECP) and milestones the country should strive for to reach its carbon-neutrality by 2050. With the exception of hydropower, each RES-E technology is underutilised and fails to be deployed in line with the introduced trajectories for harvesting renewable electricity. Should the key barriers hindering large-scale RES-E development persist, the recent growth rate will be insufficient to achieve either the NECP or the long-term zero-emission targets. In light of the above, Slovakia should aim to almost double the 2022 installed RES-E capacities by 2030 in order to be on track to reach its carbon neutrality by the middle of this century.

Content

Introduction

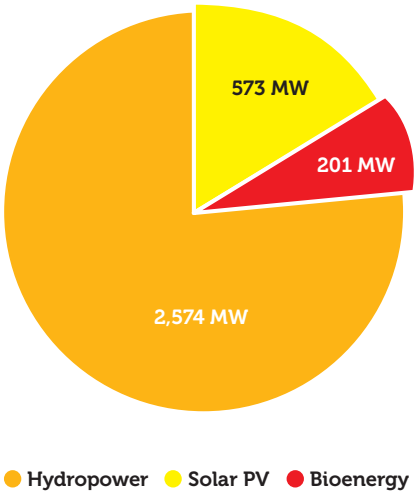
The document presents a quantitative description of the Slovak electricity market with a focus on five renewable technologies generating electricity (RES-E) with the potential, and a foreseen role, in the national energy market. Hence, it scrutinises the development of solar PV, hydropower, onshore wind power, geothermal energy, and bioenergy sources.

This market report serves as a pilot for a series of annual reports mapping the country's past development of RES-E and simultaneously forecasting the future market growth. It is to be based on annual progress reported for each technology.

In order to achieve carbon neutrality by 2050, certain milestones of total installed capacity need to be met for each RES-E technology. While 2050 is deemed the deadline by which the neutrality should be achieved, 2030 is generally viewed as a so-called milestone the majority of Slovakia's national policy documents of a strategic nature are tailored for. The national targets for 2030, however, need to have a clear outlook for 2050 to assure that should a certain trajectory be followed, the EU Member States will meet the installed capacity necessary for carbon neutrality.

At the end of 2022, hydropower represents more than three quarters (77%) of total renewable installed power, followed by solar PV being responsible for almost one fifth (17%), and bioenergy with a small share of 6%. There are only 3 MW of installed wind capacity and no existing geothermal plants generating electricity in Slovakia. Both RES-E technologies therefore hardly contribute to the Slovakia's renewable electricity mix as provided in Graph 1.

Graph 1: The shares of major technologies on total RES-E capacity in 2022



Source: OKTE; SIEA; ÚRSO (2023)

The current version of the National Energy and Climate Plan (NECP), approved by the Slovak Government in December 2019, projects milestones for these technologies by 2030. The installed RES-E capacities that are required to be on track towards carbon neutrality seem to be much higher than what the plan envisions. Moreover, the recent RES-E development does not indicate a trend that would likely result in the fulfilment of even the NECP targets.

The report scrutinises the past RES-E deployment since 2010 to provide context on the state of the market as of the end of 2022, as well as to present a starting point for possible future development across all technologies. The document presents an outlook based on three possible scenarios. Scenarios have been given the designations "business as usual", "NECP target", and "zero-emission scenario". Each scenario follows a different set of data and trajectories of development. Subsequently, differing end targets are reached in each scenario, with the year 2030 regarded as the major milestone and 2050 as the deadline for decarbonisation.

The datasets used to map the past market growth are not publicly available and were provided to SAPI for the purposes of this report by the Short-term electricity Market Operator (OKTE, a.s.), the Slovak Innovation and Energy Agency (SIEA), and the Regulatory Office for Network Industries (ÚRSO).

Business as usual

The business as usual (BAU) scenario utilises the data available for previous years to predict the future development of each RES-E technology. The scenario models a trajectory that may be expected should the past trends be followed. The predictions are modelled from the average increase of installed capacities in the period of last three calendar years (2020-22).

NECP target

The NECP target scenario applies figures provided by the 2019 NECP. In the document, the expected installed capacity for each RES-E technology has been projected for years 2021-30. Based on these agreed upon targets, the report predicts a trajectory beyond 2030 with the expected installed capacities should the NECP be followed. When calculating the NECP scenario pathway beyond 2030 (i.e., towards 2050), the predictions are modelled from the average increase of installed capacities for the last three calendar years included in the NECP (2028-30). The NECP scenario therefore presents the RES-E development under the conditition that the current NECP is followed until 2030 and this level of growth is maintained afterwards.

Zero-emission target

The referential basis for the zero-emission target scenario has been provided by the energy and emission modelling tool 2050 Pathways Explorer. The specification and calibration of the model, tailored for the Slovak electricity sector, as well as the analysis of the resulting data, is being provided by the Institute of Forecasting (IF) of the Slovak Academy of Sciences (SAS). The model takes into consideration the expected rise in electricity consumption and the subsequent increase in carbon emissions, including the rollout of new technologies to mitigate this increase, such as carbon capture and storage (CCS). Based on these conditions, it presents yearly targets that would put the Slovak electricity market on the trajectory towards carbon-neutrality by 2050.

The 2050 Pathways Explorer model does not include data for each RES-E technology. As the data on geothermal energy and bioenergy sources is so far unavailable, the trajectories for these scenarios cannot be projected.

Renewables development and outlook

Solar PV

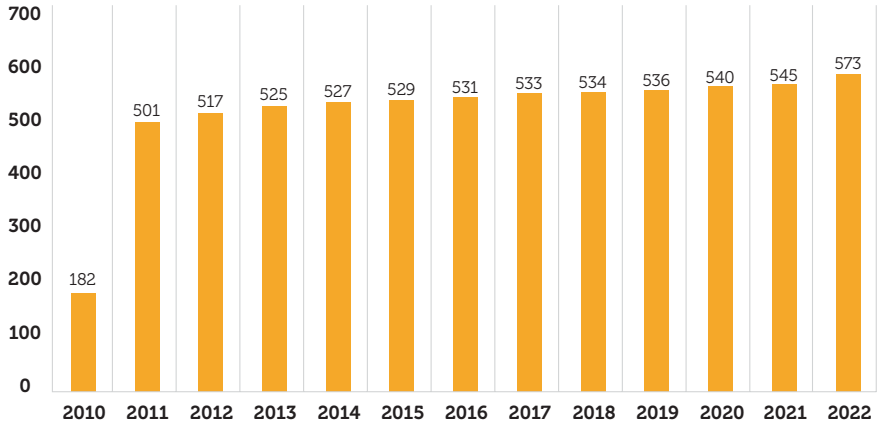
Past development

Similarly to other electricity generating technologies, development of solar PV was immensely affected by the eight-year long moratorium for grid connection (so-called stop state). Except for small-scale installations of up to 10 kW, the promising start of solar PV deployment, which began in 2010 and 2011, came to an almost complete halt in 2013 after three years of an upward trend. While the so-called solar boom was not as intensive as in some other Member States, for instance, in Czechia, the Slovak electricity market still experienced a rise of installed PV capacity by over 300 MW in a single year.

In 2022, the solar PV capacity rose by 28 MW, marking the highest annual increase since 2011 and setting the current installed capacity at 573 MW.

The past development of solar PV capacities is illustrated in Graph 2 provided below.

Graph 2: Installed capacity of solar PV plants – 2010-22 (MW)



Source: OKTE; SIEA; ÚRSO (2023)

The period of 2013-21 saw no significant capacities deployed, and the solar PV increased only marginally owing to small-scale installations for residential purposes. In view of the above, the stop state proved to be a major barrier in the further deployment of RES-E. In 2021, however, it was (partially) overcome, and a pathway towards new solar PV projects became less challenging, although not yet without barriers, but with newly introduced grid capacity limits set by the Slovakia's electricity transmission system operator (TSO) SEPS, a.s.

According to the report Rooftop Photovoltaic Energy Potential in Slovakia (2023), drafted for SAPI by Energiewerkstatt, Slovakia has a theoretical (realisable) rooftop PV potential of around 37 GW. To put this into perspective, only approximately 20% of this potential would need to be utilised to reach the overall zero-emission scenario target for 2050. It is worth noting that no ground-mounted plants are included in the calculations.

Future development scenarios

Business as usual

Slovakia has seen an increase in the installed capacity in the last three years. The increase between 2021 and 2022 especially pushes the BAU scenario curve significantly higher. Nevertheless, should the annual average growth rate from the period of 2020-2022 continue, the expected installed capacity in 2030 would be 672 MW – an overall increase of only 99 MW. By extent, the years leading up to 2050 would see only additional new 247 MW installed, amounting to the total capacity of 919 MW.

Notwithstanding the above, this scenario is prone to changes resulting from political and economic events. Soaring energy prices, new reserved capacities for renewables, and a few incentive schemes, among other factors, are likely to result in new large-scale solar PV plants being deployed in Slovakia, significantly increasing the installed capacity in coming years. Therefore, should the latest trend of increased installed capacities be followed, the curve might gradually continue to rise.

NECP target

The current Slovakia's NECP projects a solar PV target of 1,200 MW cumulatively installed in 2030. While the NECP does not specify the character of these capacities, it is to be assumed that both ground-mounted and rooftop PV will play a role in harvesting Slovakia's solar potential. The NECP anticipates a linear growth of new capacities as high as 100 MW annually. Should at least this trend be followed without increase, the projection would result in the overall 3,200 MW in 2050.

It is worth highlighting that the NECP was submitted to the European Commission (EC) in December 2019 when the development of solar energy was halted by the (full) connection moratorium. While the technological pathway still remains rather ambitious compared to the past development, there is the NECP revision ongoing as of early 2023 that might lead to an increased 2030 target for solar PV.

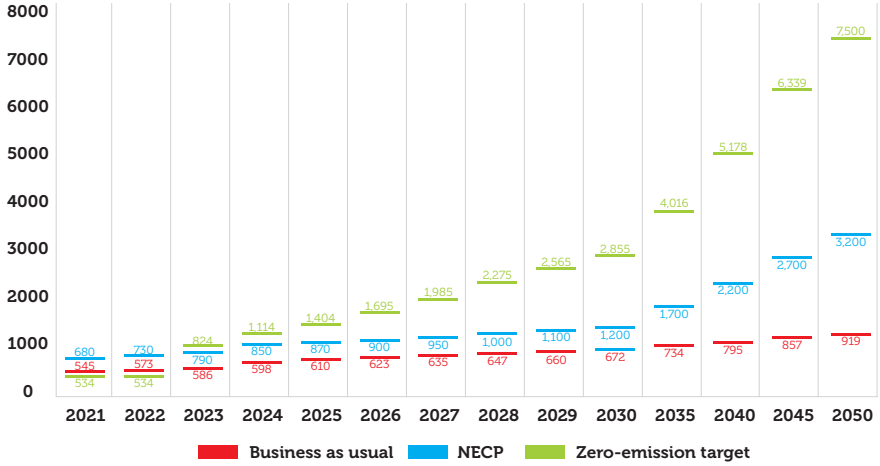
Zero-emission target

In line with the 2050 Pathways Explorer model, Slovakia should aim for the installed capacity of solar PV of at least 7,500 MW. This 2050 target would ensure that the country would fulfil its climate obligations, especially when it comes to ensuring its climate neutrality. In order to stay on track, Slovakia needs to implement the total of 2,855 MW in solar PV plants by 2030.

Hence, this scenario requires a clear action of the Slovak Government and a preparation of an enabling investment environment that would allow for a rise of new solar PV capacities.

The aforementioned future development scenarios for solar PV in Slovakia are illustrated in Graph 3 provided below.

Graph 3: Solar PV development scenarios – 2023-50 (MW)



Brief summary

There are stark differences in both the 2030 and the 2050 targets the aforesaid scenarios provide. Due to the past limited solar development, the projection based on the current market is rather pessimistic. Should the current trend be followed, only 919 MW of solar PV capacity will be reached by 2050. By comparison, the NECP expected this capacity to be reached by 2027 already. Nevertheless, the BAU scenario is most susceptible to changes with additional data, since the expected increase in new solar PV capacities might shift the curve closer to the NECP trajectory.

The NECP fails to meet the ambition Slovakia should strive for in the long run. As shown in the zero-emission scenario, Slovakia will need to implement at least 7,500 MW of solar PV installed in 2050 if it aims to reach its carbon-neutrality. This target – as well as the 2030 milestone target – is more than double of that set in the NECP.

- As of 2022, the installed capacity is 39 MW higher than the starting point projected for the year in the zero-emission scenario.
- The current installed capacity is 157 MW lower than the installed capacity the NECP projected for year 2022.
- To stay on the zero-emission scenario trajectory, the solar PV capacity needs to be increased by 251 MW by the end of 2023.

Hydropower

Past development

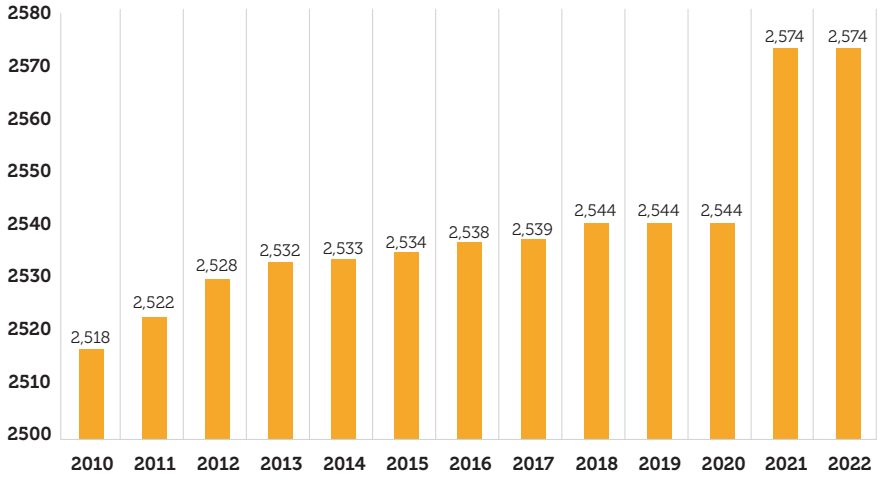
Hydropower has long been the RES-E of utmost importance in Slovakia as it plays a significant role not only in the RES sector, but in the overall electricity market. Over the last decade, Slovakia witnessed a gradual increase in the installed capacity of hydropower plants – mainly ones falling into the category of small hydropower plants (SHPPs) with lower installed capacity of up to 10 MW and micro-ones of up to 100 kW.

The total capacity of hydropower peaked at 2,574 MW in 2021. It, however, includes not only large hydropower dams and SHPPs, but also pumped-storage hydroelectricity storage systems (PSHs) mainly used for balancing the load demand.

The past development of hydropower capacities is illustrated in Graph 4 provided below.

Development of new hydropower projects has been almost ceased due to previous cases of bad example. Several SHPPs have not been projected and constructed in accordance with key EU directives on the protection of biotopes and environment. In 2014, a still ongoing infringement procedure has been started against Slovakia by the EU due to insufficient

Graph 4: Installed capacity of hydropower plants – 2010-22 (MW)



Source: OKTE; SIEA; ÚRSO (2023)

assessments of hydropower plants' impact on hydromorphology and biodiversity. As a result of that, permitting of new hydropower projects is subject to strict scrutiny from the Ministry of Environment (MŽP SR) and environmental NGOs, and a series of disputes over new SHPPs have emerged. In some cases, the Supreme Court of the Slovak Republic (NS SR) has revoked the approval and licensing of projected SHPPs, such as the ones located in *Žiar nad Hronom* and *Hronský Beňadik*.

Currently, there are only few projects in the pipeline. The largest of these is the new hydropower dam *Čunovo II*, with a planned capacity of 24 MW. Should the project be realised as projected, its construction should start by 2026. Additionally, it is expected that a few SHPPs each with capacity below 1 MW will enter the construction phase by 2030.

Future development scenarios

Business as usual

As such, new installed capacity will come from either new or modernised large dams and SHPPs. The capacity of PSHs totalling 916 MW is expected to remain constant in the following years.

While the installed capacity hovered at slightly over 2,500 MW throughout the last decade, we predict its slight rise in the upcoming years, should the BAU scenario be followed. With approximately 7 MW of added capacity annually, this would amount to 2,627 MW in 2030 and 2,761 MW installed in 2050.

NECP target

Thanks to the already existing installed capacity, the current NECP expects hydropower to play a major role in fulfilling the Slovakia's 2030 renewable energy targets, with its lion's share on electricity generation. As the NECP does not foresee new installed capacity in PSHs, all new hydropower projects are to be large dams and SHPPs.

The current 2030 target for hydropower stays at 2,671 MW. The NECP predicts a steady increase in the following years that, compared to other RES-E technologies, will be at a rather slower rate due to an already

relatively high installed capacity. Should the NECP be projected for year 2050 and the currently planned development be followed, Slovakia would record a total installed capacity of 2,691 MW, making it the second largest RES-E right after solar PV in the long run.

Zero-emission scenario

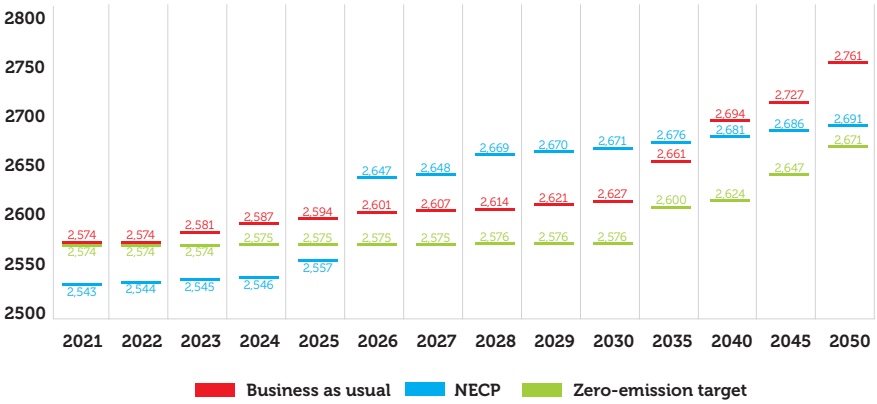
In line with the 2050 Pathways Explorer model, Slovakia should aim for the installed capacity of hydropower of at least 2,671 MW.

Nevertheless, the vast majority of projected development is expected to take place after 2030, with an overall increase of 95 MW until 2050. The milestone target for 2030 was almost achieved in 2022, with only 2 MW separating the country from the projected 2,576 MW.

Considering the projects that are expected to be implemented, it seems that the 2030 target will be achieved well before this year. This would give Slovakia an edge for further development, giving it the potential to reach the 2050 target much earlier.

The aforementioned future development scenarios for hydropower are illustrated in Graph 5 provided below.

Graph 5: Hydropower development scenarios – 2023-50 (MW)



Brief summary

Compared to other RES-E technologies, hydropower is a bit of an anomaly. First of all, the projected installed capacities for 2030 and 2050 are quite close to each other in all three scenarios. This can be attributed to the already relatively high installed capacity, meaning that the projected yearly increases are not so high as to create stark differences.

The main difference, however, is that the zero-emission scenario has the lowest projected capacities both in 2030 and 2050. Should either the current NECP or the current business model be followed, Slovakia would see more installed capacity in hydropower that it actually needs to reach carbon-neutrality by 2050. This expectation is dependent on development of other RES-E technologies, since the zero-emission scenario expects increased installed capacity in all potential sources – along with those that, currently, are either not utilised at all or used only to a limited extent.

- As of 2022, the installed capacity is equal to the starting point projected for the year in the zero-emission scenario.
- The current installed capacity is 20 MW higher than the installed capacity the NECP projected for year 2022.
- To stay on the zero-emission scenario trajectory, the hydropower capacity does not need to be increased by the end of 2023.

Wind power

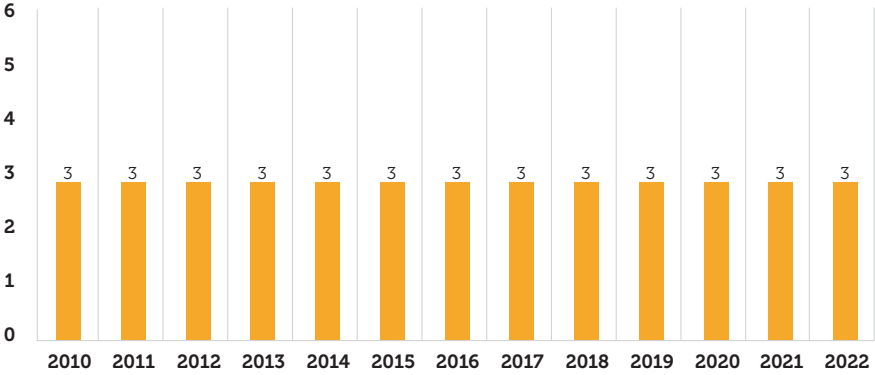
Past development

At the end of 2022, Slovakia has still only 3 MW of wind energy capacity installed. Such figure makes it a leader in non-utilising its vast wind energy potential in the EU-27, right after Malta. Thus, wind energy has an almost negligible share on Slovakia's overall electricity generated.

In total, there are 2 wind parks consisting of 5 plants harvesting wind energy in the country. The last constructed park, located in *Ostrý vrch (Myjava)* with the installed capacity of 0.5 MW, dates back to 2004. The wind park *Cerová* consisting of 4 wind turbines is the other one totalling

around 2.6 MW and commissioned one year earlier. It derives from the above that the curve of wind deployment has been "frozen" since then as partially illustrated in the Graph 6 provided below.

Graph 6: Installed capacity of wind plants – 2010-22 (MW)



Source: OKTE; SIEA; ÚRSO (2023)

Except for the aforesaid stop state, there is a wide array of further reasons why new development of wind plants has not kickstarted yet. In line with the Study of Wind Energy Deployment in Slovakia (2022) written by SAPI, the process of environmental impact assessment (EIA) is the barrier of utmost importance, referring to its non-existing limits (as of 0 kW) and unpredictability of such process accompanied by (no) deadlines for EIA scoping. However, among others, negative public perception of wind energy projects and missing land-use planning of municipalities should not be overlooked, too.

In line with another study, namely Study of Wind Energy Potential in Slovakia (2022) elaborated by Energiewerkstatt for SAPI, the country has excellent theoretical potential for wind harvesting. Despite several limits that apply to wind energy projects in Slovakia, it was estimated to roughly 168 GW extending over around 20% of the Slovakia's territory. Such data clearly shows that the reason why there is almost no wind power projects; it is not because of natural conditions, instead the current state has been predominantly driven by a set of legislative, regulatory, administrative, technical and other barriers.

Future development scenarios

Business as usual

In light of the above, if the past growth rate is strictly followed, there will be no new wind plants in the coming decades.

This is however highly likely not to materialise since there are a few wind energy projects in the pipeline as indicated by the EIA/SEA Information System operated by MŽP SR. In early 2023, the platform lists a total of 11 wind energy projects (composed of 69 wind turbines) with the overall installed capacity of 414 MW. The installed capacity ranges from 12 MW to 48 MW. As all of them are at the stage of EIA screening report and/or scoping, it is not possible to estimate the success ratio of their possible implementation at the moment.

NECP target

The 2019 NECP projects a wind power target of 500 MW installed by the end of this decade. Considering natural characteristics of the Slovakia's territory, all plants are to be clearly onshore.

The NECP anticipates a linear growth of new wind energy capacities amounting in average to 50 MW annually as of 2022 onwards. Should at least this trend be followed without increase, the projection would result in the overall 1,500 MW being installed in 2050.

It should be however highlighted that the NECP was submitted to the EC in December 2019 when the development of wind energy was halted by the (full) connection moratorium. While the technological pathway is highly ambitious compared to the past (non-)development, it is worth noting that the NECP revision is ongoing as of early 2023, which may also lead to an increased 2030 target for wind power.

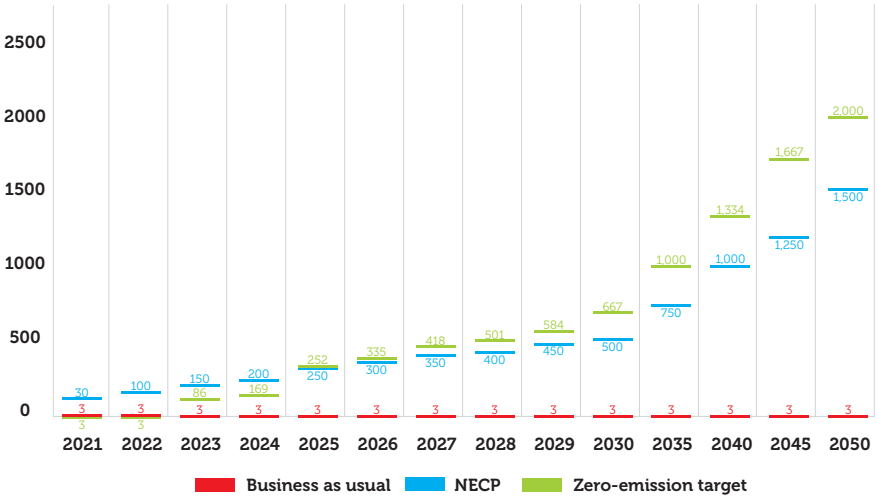
Zero-emission scenario

In line with the 2050 Pathways Explorer model, Slovakia should aim for the installed capacity of wind power of at least 2,000 MW by the middle of this century.

This 2050 target would ensure that the country would fulfil its climate obligations, especially when it comes to ensuring its climate neutrality. In order to stay on track, Slovakia needs to implement at least 667 MW in wind power plants by 2030. Considering the number of wind energy projects in the pipeline totalling 414 MW in early 2023, the target is considered achievable, if the above-mentioned major barriers are at least mitigated.

The aforementioned future development scenarios for wind energy are illustrated in Graph 7 provided below.

Graph 7: Wind power development scenarios – 2023-50 (MW)



Brief summary

Slovakia should build more wind plants as it has vast theoretical potential for wind harvesting. The figures provided above clearly show that Slovakia should make use of ongoing NECP update and aim for more wind power projects already by 2030.

Therefore, if the still persisting barriers are to be overcome or at least mitigated, the Slovak economy could benefit immensely from wind energy. In this context, it is worth highlighting that almost 90% of respondents under the Study of Wind Energy Deployment in Slovakia rated the quality of the investment environment, specifically for wind energy

projects in Slovakia, as very bad, or bad in mid-2022. If the unfavourable status quo shifts in a positive direction, the historical experience with of around 8-year lasting administrative and permit granting procedures, as well as no wind development is likely to be finally brough to an end.

- As of 2022, the installed capacity is equal to the starting point projected for the year in the zero-emission scenario.
- The current installed capacity is 97 MW lower than the NECP projected for year 2022.
- To reach the zero-emission scenario trajectory, the installed capacity needs to be increased by 83 MW by end of 2023.

Bioenergy

Past development

Bioenergy, as it is understood in this section, can come from two differing types of fuels – biogas, including biomethane, and solid biomass. When it comes to biogas, several sources can be used to produce it, such as sewage from water treatment plants, household waste, and waste produced in agriculture and farming industry. Solid biomass, on the other hand, includes wood, waste produced during its harvest and processing, and energy crops grown specifically for their high energy potential, such as maize and rapeseed. Solid biomass was critical in surpassing the Slovakia's overall renewable energy target for 2020.

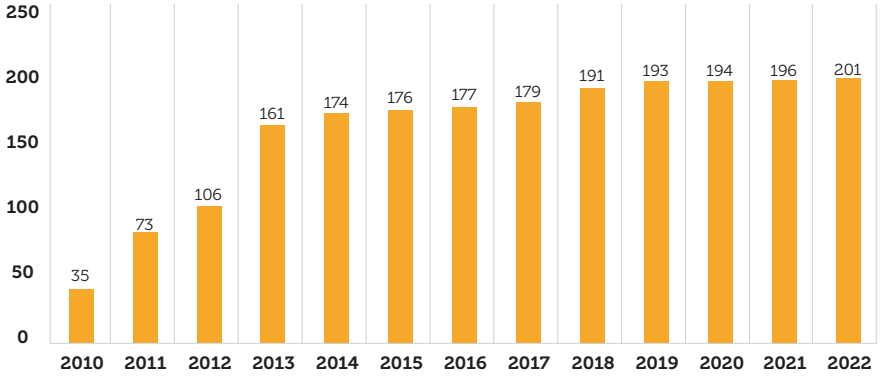
As of 2022, biomass and biogas account for 201 MW of installed capacity for electricity generation.

While the use of solid biomass ensured the country's success in its renewable energy mix, the development of biogas was hindered as much as the solar PV by the stop state for new projects. While in 2014, there were over 140 biogas stations, the moratorium led to no new biogas stations connected to the grid since then. As such, their number gradually fell. As of early 2023, there are only 76 biogas stations– a little over half of the stations in operation only 9 years ago.

Although the stop state was lifted in 2021, no new biogas stations have been connected to the grid yet and serve only for local usage. There are,

however, several new projects planned. These projects include new plants in *Leopoldov* and *Žiar nad Hronom*, and increasing capacity of the biomethane plant in *Jelšava*.

Graph 8: Installed capacity of bioenergy sources – 2010-2022 (MW)



Source: OKTE; SIEA; ÚRSO (2023)

Future development scenarios[1]

Business as usual

The gradual decommissioning of existing biogas stations has, despite the rise in biomass usage, slowed down the annual growth. Nevertheless, once the aforementioned projects are put into operation, their yield should contribute to further rise in the BAU development scenario.

If the BAU scenario is followed, the total installed capacity of 222 MW will be reached by 2030. Although the stop state has adversely affected the use of bioenergy in electricity generation, we expect the curve to remain on an upward trajectory in the upcoming years. Moreover, depending on a new regulatory framework and legislation, more biogas stations might be constructed, further pushing the curve upwards.

NECP target

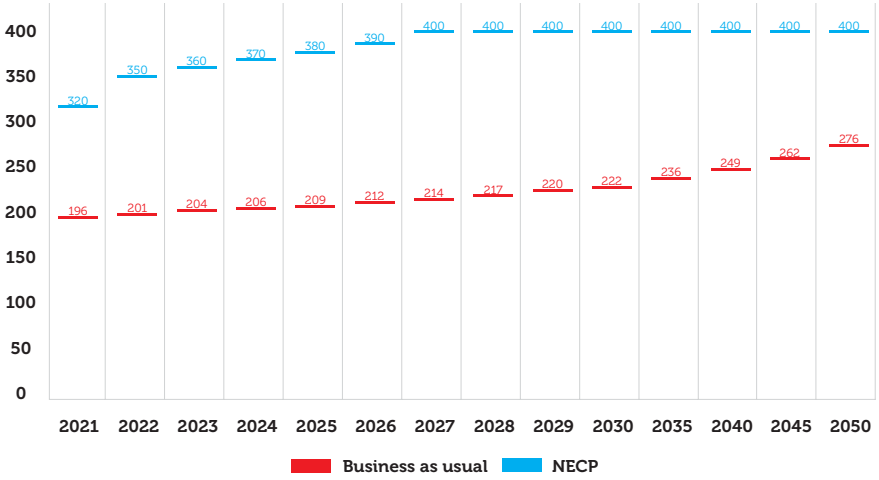
Solid biomass and biogas were included in the current NECP and together, they are expected to be the third most developed RES-E tech-

[1] The 2050 Pathways Explorer model does not currently include the data for geothermal power, thus the trajectory for the zero-emission scenario cannot be projected.

nology, behind hydropower and solar PV in 2030. Until then, Slovakia should have 400 MW of installed bioenergy capacity, evenly divided between solid biomass and biogas. According to the NECP, this milestone should be reached by 2027 already. Considering this, the projected installed capacity in 2050 would, according to our methodology, remain at 400 MW.

The available future development scenarios for bioenergy are illustrated in Graph 9 provided below.

Graph 9: Bioenergy development scenarios – 2023-50 (MW)



Brief summary

Due to the lack of data for the zero-emission scenario, we may only compare the current development with the NECP target. Nevertheless, even the NECP target seems to be impossible to achieve based on the previous development. Despite the fact that the trajectory in the NECP target scenario is projected as static from 2027 all the way to 2050, the current BAU trajectory shows us that the current rising trend would still not be sufficient to meet the 2030 NECP target.

- As of 2022, the installed capacity is 51 MW higher than starting point projected for the year in the zero-emission scenario.
- The current installed capacity is 149 MW lower than the installed capacity the NECP projected for year 2022.

Geothermal power

Past development

At the end of 2022, geothermal energy is not used in electricity production, but only to a limited degree for heat production and recreational use. This makes it the only RES-E technology in Slovakia without any installed capacity.

According to the Dionýz Štúr State Institute of Geology (2019), the Slovakia's overall (probable) geothermal potential is calculated at around 6,200 MWt.

The development of geothermal power is mainly hindered by very high costs required for both the exploratory digs and the actual construction of the geothermal pumps. Moreover, strict criteria associated with the EIA process increase the investment risk.

Future development scenarios[2]

Under the first scenario based solely on the past (non-)development of geothermal power capacities in Slovakia, the country will implement no new plants by 2050.

The 2019 NECP expects at least some use of geothermal power in electricity production. In line with the plan, 2024 should see a rise from zero installed capacity to 4 MW provided by the geothermal power plant in *Ďurkov* that is under development as of early 2023.

Considering the aforesaid potential the country offers, 4 MW is a low target to aim for. While it is highly probable that the project in *Ďurkov* will not be completed before 2026, any further delays that might lower the chances of the plant being constructed before 2030 should be avoided. Moreover, there are at least two other projects that can be finished before 2030 – the plants in *Prešov* and *Žiar nad Hronom*, both with the planned capacity of 20 MW.

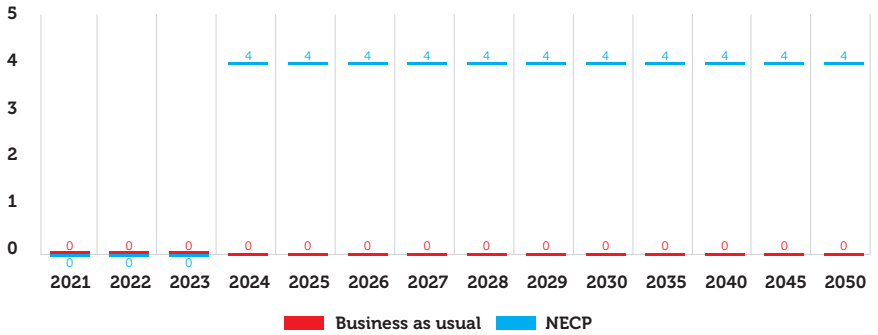
While there are other geothermal power plants currently projected, for example, in the city of *Kežmarok*, the potential of these wells, as well as

[2] The 2050 Pathways Explorer model does not currently include the data for geothermal power, thus the trajectory for the zero-emission scenario cannot be projected.

the timeframe when they might become operational, is so-far unknown.

The available future development scenarios for geothermal power are illustrated in Graph 10 provided below.

Graph 10: Geothermal power development scenarios – 2023-50 (MW)



- As of 2022, the installed capacity is equal to the starting point projected for the year in the zero-emission scenario.
- The current installed capacity is equal to the installed capacity the NECP projected for year 2022.

Conclusion

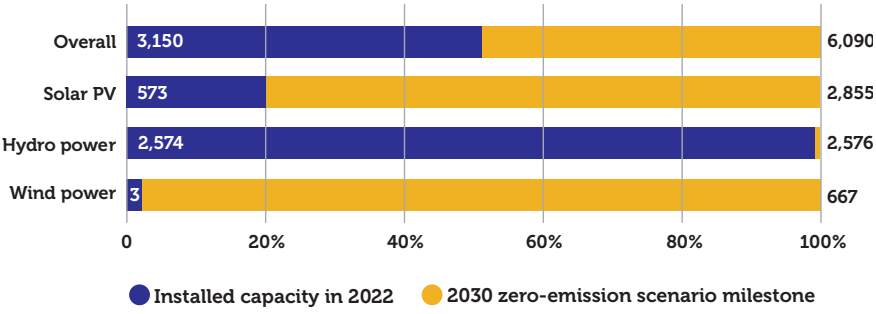
The projections provided show that the Slovak RES-E market is not yet on the track to reach either the 2030 NECP targets or the ones required for carbon-neutrality in 2050.

Despite the recent resurgence of solar PV and bioenergy, their current BAU trajectories indicate that, should the current trends be followed, these sources will meet neither the NECP nor – in the case of solar PV – the zero-emission 2030 targets. Furthermore, the absence of wind and geothermal power freezes their BAU trajectories. This is especially relevant for wind energy, since the gap between the current state at the end of 2022 and the target that should be reached widens annually.

Hydropower is the only RES-E that is currently above the 2022 zero-emission scenario target. The projection for hydropower predicts that the BAU trajectory will not fall below the zero-emission target trajectory until 2050. Nevertheless, the success of hydropower will be insufficient to meet the overall RES-E target for carbon-neutrality.

The graph below indicates the progress as of the end of 2022 for each RES-E technology under the zero-emission scenario targets towards 2030 milestones. As the modelling tool 2050 Pathways Explorer does not yet include data for geothermal energy and bioenergy, the milestones in the graph do not include these energy sources.

Graph 11: Progress as of 2022 towards the 2030 zero-emission scenario milestones (MW)



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