Transitioning to a climate-neutral electricity generation in Estonia

Frequently asked questions

<table>
<tr><th>Question</th><th>Answer</th></tr>
<tr><td>1. To reach 2030 objectives will renewables auctions be enough?</td><td>Across the pathways examined, after the outcome of the completed and planned renewable auctions has been considered, there is still a gap of between 2.7 GWh and 7 GWh of renewable electricity missing. This amount of additional generation is unlikely to come forward without dedicated support because investors are not willing to take on the full market risk. Risk reduction instruments, such as extending state guarantees and public co-investing/sharing risks, are possible actions to increase private investment.</td></tr>
<tr><td>2. Based on current knowledge and modelling results would it be feasible and secure to invest in Nuclear power?</td><td>Relying on nuclear is a too risky strategy, as nuclear is exposed to several risks, mostly related to public perception and to the challenges with the technology (nuclear projects have historically been subject to long delays and cost overruns). Stakeholder opposition is not related to the technology per se, but is influenced by the example of other countries in Europe that have recently attempted to develop new nuclear power plants (UK, France, Finland). In the three cases, the project is substantially delayed, several times more expensive than initially planned, and in two out of three cases required support from the taxpayers or the consumer. Even in the most promising scenario, nuclear electricity is unlikely to be available before mid to late 2030s, so the scenario is not recommended even if modelled electricity prices in 2050 are the lowest. Concerning the latter point, the sensitivity analysis showed that the scenario results in terms of electricity prices are not robust, as a change in generation from nuclear sees prices increase.</td></tr>
<tr><td>3. From which source we will get electricity after 10 years in cold and dark winter night?</td><td>Nights are not the time of the day with the highest consumption, this happens usually during evening time. The answer to the question depends on the scenario, but in general in the mid 2030s, generation when solar is unavailable will come from:

Any dispatchable capacity (oil shale, biomass, gas, hydro)
Wind energy and interconnectors (imports)
Batteries (in some scenarios biogas or pumped hydro) will fill any capacity gap

For example in the two most highly recommended pathways the following mix is envisioned in 2030, against an estimated peak power requirement of 2 200MW:

RES-Storage: Total capacity: 7.1 GW, of which 48% is dispatchable power, 16% excluding batteries. Dispatchable capacity provides 24% of annual generation. Main technologies are Offshore Wind 1 000MW, Solar 1 249MW, Onshore Wind 1 479MW, 2 235MW Batteries. Generation: 3.9 TWh onshore wind, 3.5 TWh offshore wind, 2.2 TWh Oil shale, 1.4 TWh solar. This provides 105% of the annual net domestic requirement, allowing for net exports over the year.
AT: Total capacity: 5.6 GW, of which 46% is dispatchable power, 17% excluding batteries. Dispatchable capacity provides 29% of annual generation. Main technologies are Solar 1 507MW, Onshore Wind 1 479MW, 1 607MW Batteries. Generation: 3.8 TWh onshore wind, 1.7 TWh Oil shale, 1.8 TWh solar. This provides 70% of the annual net domestic requirement, the gap met through imports.
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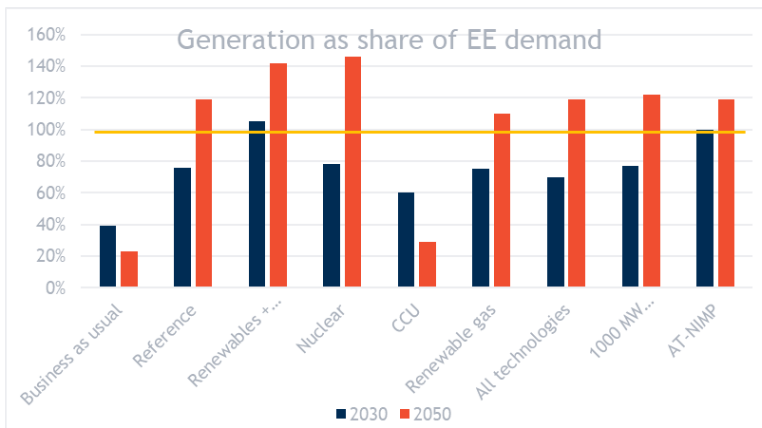
	• In all pathways there is a base of dispatchable capacity, primarily the oil shale facilities (676MW in 2030) which are later fuelled by biomass, but also small dedicated biomass plants (101MW), Fossil gas capacity (70MW in 2030 in most pathways), Hydro (8MW), Biogas (20MW) and waste (19MW). Few of these smaller contributors can be upscaled economically. The largest potential is with fossil gas, but this is contradictory to the climate neutral goal. In the long term Nuclear could also be used.
4. Is it necessary to keep certain amount of local capacity MW for security of power supply and how much?	• One of the no-regret actions, recommended in most scenarios, is to develop a new flexibility strategy aimed at incentivizing the deployment of batteries and other flexibility technologies. The strategy should consider alternative to the current approach (strategic reserve) so that investors see a clear business case in investing in batteries. However, suddenly removing reserve capacity may create substantial risk and excessive price spikes. Therefore, the withdrawal of reserve capacity should be dependent on the deployment of batteries and non-dispatchable sources. • In the long term, the most cost-effective solution is having well-functioning and transparent flexibility market, open to demand response and to installations based in other countries.
5. Which is a fluctuation and change of dependency from import in different pathways?	All scenarios considered excluding the CCU pathway deploy enough capacity to generate over 100% of electricity demand. The RES+Storage and AT NIMP pathways are the only ones that reach this by 2030. 
6. Will it be feasible to have off-shore wind parks already in 2025-2030 and what is necessary to do for that (supporting)?	While 2025 is highly unlikely, 2030 is feasible, as long three priority actions are carried out in the very short term: • Review of the planning process (single application procedure) • Support developers with the baseline studies to be carried out. For example, the Government could carry out Geological and Archeological desktop studies, Geotechnical and Geophysical field studies, seabed mobility studies, wind resources and LCOE assessments and make these studies available to potential bidders in renewable auctions . A similar action has already been undertaken as part of the ELWIND project. • Definition of a technology-specific price support mechanism (e.g. price floor/ feed-in premium)

	The completion of the relevant elements of the offshore grid (an initiative of Baltic and Nordic TSOs) will be an additional step that would greatly increases the chances of offshore wind being in place by 2030.
7. Is there a straight correlation between CO_2 price and investments to renewables (does higher CO_2 price bring more investments)?	It is not the CO_2 price per se, but the expectation of a high-CO_2 prices in the medium-long term, sufficiently high to keep wholesale price from fossil plants above their LCOE. However, other considerations will also be important, in particular: • expectations concerning future incentive schemes, that may cannibalize revenue (e.g., the more wind farm in the future, the lower the wholesale price when wind is the marginal generator; • expectations on the use of the strategic reserve, which would limit temporary high prices that may benefit renewables; • whether a price support system is in place.
8. How realistic would it be to use CCU in Estonia and what are necessary additional technologies, costs etc. for that?	Retrofitting CCU to Auvere and TG11, as assumed in the CCU pathway, is feasible for a cost of around €1 billion. The required technologies are the capture equipment to be installed during refurbishment operations, together with other technologies required as part of the chosen process. However, such an investment would have negative returns unless other outlets for CO_2 are found, e.g. a storage site outside Estonia.
9. What would be necessary actions to be in compliance with Fit 55?	Fit for 55 does not require any specific actions, but it requires a certain amount of CO_2 emissions reductions. All pathways examined reach this objective, which means that all actions in support of renewable technologies should be put in place to ensure these come forward (review of the planning and approval process; PPAs; risk-reduction instruments; incentives for households and SMEs). The broader question for policymakers is how much extra weight (if any) should the power sector bear in reducing total national emissions. Typically as one of the easier sectors to decarbonize it is asked to do more than difficult sectors such as agriculture or transport. All pathways produce emissions reductions far in excess of the 55% reduction, i.e. 95% reductions by 2030, creating potential to offset slower reductions in other sectors. All pathways also significantly exceed the share of renewable energy goals (i.e. all pathways >70% RES in 2030, compared to 40% target).
10. Which pathways and action plans would be the best to reach climate neutrality based on prognosis of CO2 reduction and measures related?	All pathway emissions are significantly lower than the Fit-for-55 trajectory. The CCU pathway has the lowest emissions, however, this pathway generates the least electricity - significantly lower than the electricity requirements. All pathways are modelled to achieve net zero by 2050, using direct air capture technologies to deal with any small remaining emissions as needed.
11. Which would be the spatial distribution of capacities and their impacts in every pathway?	Modelling in all pathways suggests additional onshore wind capacity should be deployed as follows in all pathways by 2030: Lääne Eesti 850 MW; Põhja-Eesti, Kesk-Eesti and Kirde Eesti: each 100 MW, Lõuna-Eesti, no additional wind capacity added. This deployment requires an estimated land use of around 230-460 km^2 (or less than 1% of the total land area in Estonia) Offshore wind capacity is modelled to be added in proximity to Lääne Eesti.
12. How much (what would be the range) do we need to bring investments with help of support funding and/or abroad loans (in GWh and euros) in addition to renewables actions (these	While renewable auctions provide operational support to renewable generation, they do not finance the construction of the wind or solar farms. This means that finance for these will also have to come from investors.

actions are financed from renewables tax of consumers)?

EUR million by 2050	Generation investment	Transmission investment
Renewables + storage	11,040	355
Nuclear	9,338	230
CCU	3,065	135
Renewable gas	8,942	141
All technologies	6,972	155
No net imports	8,075	135
1000 MW dispatchable capacity	7,623	155

According to the technology and transmission investment, support funding from the EU and other institutional investors will be available. For example, to help with the deployment of CCU, interconnectors, large flexibility and storage projects.

13. Which are financial institutions and their main conditions (project size by euros and duration, location, international cooperation etc.) to get investment loans or support as well as needs and possibilities for successful application process?

There are several options both for public sector initiatives and private developers. The more suitable institution and product depends on the need and type of project. Details are available in Deliverable 7 report, Annex D.

14. Which are the basic and most important steps, actions/measures to shorten project timelines for new renewable capacities as well as storages.

The three main steps identified are:

- **Review the planning process and identify steps that can be streamlined/shorted (action 1A):**
  - Update the legal framework surrounding the approval process for renewable energy installations, including the creation of a single approval procedure and single contact point beginning with large projects (e.g. offshore wind energy farms) but with the aim to extend to all applications. The contact point will coordinate inputs from other relevant authorities.
  - Establish maximum allowable time-limits for all stages of the planning process, including the approval of the environmental impact assessment;
  - Set up a group of sectoral experts, national defense and representatives from the civil society to resolve conflicts concerning proposed development sites for wind and solar energy. Options should be considered whether such a group could play a formal role in the appeal process. This role could be assigned to a newly formed energy Agency.
- **Provide more administrative resources to LAs in charge of approving projects (action 1B)**
  - Dedicate additional human and financial resources at national level (e.g. experts, commission studies, prioritization in approval processes) to support projects of national interest. The Government should define a set of criteria that identify projects of national interest, according to the overall strategic direction chosen. The overall project size (capacity) and its contribution to the energy and climate targets and security of energy supply (electricity system stability, independence from imported fossil fuels) should be major

	criteria; in this context wind energy farms and nuclear and conventional power plants could be considered as projects of national interest. See below (Institutional Reform) the suggested action concerning a new agency and the role it could play in respect to these projects. o Support local administrations with additional resources to timely deal with project proposals. Solutions may include: ▪ Providing additional budget; ▪ Providing experts (secondments); ▪ Providing tools to facilitate the process; • **Carry out a series of other supporting actions (Action 1C)** o Make the inclusion of new promising renewable energy production areas mandatory in local statutory, thematic and special plans, and link payments from the local government equalization fund to this requirement. This action should have a short-term conclusion (i.e., max by end of 2023); o If, following the previous action, the number of sites identified is not sufficient, a new spatial plan will be defined at national level. Further studies should be carried out to quantify this with more precision according to the selected scenario; o Create possibilities for municipalities to benefit from renewable energy investments in their jurisdictions. This could take the form of profit/revenue sharing with municipalities, co-financing via local authorities or energy communities, or direct purchase contracts; o Options should be explored to increase the areas that can be used for onshore wind energy projects. These options should consider brownfield and greyfield sites (e.g. previously developed areas, underdeveloped industrial parks), combined use (e.g. in industrial areas, co-location with other infrastructure) and options to locate alternative onshore wind turbine designs, such as bladeless wind turbines.
15. What are the most important measures and costs related to different stake holders?	**Review of the planning process** The cost of the measure depends on several factors (extent of the review and pathway), but the main impact of his measure is the additional staff costs, either at central or local level. The cost will be borne by central and local government. **Renewables support** The cost of this measure depends on future electricity prices, and it would affect consumers bills (the cost will be borne by all consumers according to their tariffs and consumption). Estimated cost in 2030 range between 0 (in case of persistently high energy prices) and €209 million per year. **Electricity system balancing** The cost of setting up a balancing market are low compared to its benefits, and would be paid by market participants via market fee. The initial investment would be made by the system operator, and passed to consumers via energy bills as part of the RAB model. **Transmission network reinforcement** Additional investment costs have been estimated to vary between €135 million and €355 million depending on the scenario (total costs up to 2050). The cost will be borne by the TSO (or by private investors in the case of private assets) and recovered either via network fees to consumers or via electricity wholesale cost in the case of private assets.

16. What are the main steps and actions to break down local opposition to new installations, how to motivate local people (best practices from other countries) and rise ability to understand importance of new units? There is going on a process regulating local benefit from renewables, would it be enough?	To reduce local opposition, it will not be sufficient to increase local benefits. The action plan proposes a series of coordinated measures to ensure local communities feel more part of the transition and directly benefit from it: • One-stop shops • Energy communities • Providing financial advantages to local administrations that are more proactive in identifying suitable areas • Identifying mechanisms for local communities to directly benefit from installations in their proximity
17. Which are necessary investments (costs) to speed up transmission developments for renewables, storage, DSM etc.?	The modelling analysis returns the following interventions: • Lääne-Eesti and Latvia: according to the pathway, are necessary up to 332 MW of interconnection capacity by 2030 and between 600 MW and 1200 MW by 2050. Total investment cost up to 2050 vary between €135 million and €266 million depending on the scenario • Lääne-Eesti and Põhja-Eesti: 377 MW of transmission capacity by 2050, for a total investment of €89 million
18. Based on which technologies would the necessary dispatchable capacity be most cost effective?	The modelling did not require a specific level of dispatchable capacity, demand is satisfied in all pathways either via domestic production or imports. Setting a necessary level of dispatchable capacity is a strategic decision. However, differences between the pathways are relatively small in the percentage of dispatchable % of total capacity, with around 40% in 2030 increasing to 45% in 2040 and around 50% in 2050. With the biomass-fuelled oil shale and batteries (by far) providing the largest part of this capacity. The RES+storage (batteries), nuclear (nuclear) and AT-NIMP (fossil gas, nuclear) have the highest dispatchable capacity percentage by 2050 (full results are available in Annex to the Action plan report, Deliverable 7).
19. Based on which sources and technologies is covered our security of supply in cold winter period in 2030 and 2050 and to realize that which actions we should take?	The scenarios modelled ensure that demand is met at all time, although quite often this will be via batteries. The scenarios with lowest dispatchable capacity are more reliant on imports, but in general the expected amount of batteries will fill the gap.
20. What would be the most realistic pathway considering public costs and state taxes, risks and impacts to SKP, income tax etc.?	Across the seven potential scenarios examined, the *All technologies* and the *Renewable + Storage (offshore wind)* scenario are the pathways that appear to offer the best combination of benefits, costs, risks and feasibility. The *RES + Storage* scenario scores positively concerning security of supply, limit to fossil fuel use, socio-economic impacts and CO_2 emissions, but its high costs are the key challenge. Refer to **Error! Reference source not found.** for the synthetic score and the Annex for the underlying justification for the scores.