Energy vision of environmental associations until 2035

We live in an era of great challenges and opportunities. Due to the environmental and climate crisis, more sustainable energy solutions are being sought around the world. Estonia must keep pace with these changes, because, in addition to crises, the country is also guided in its decisions by the environmental policy of the European Union, the fall in oil prices and several other factors. As a small, energetic and flexible country, Estonia has the opportunity to be a leader here, but this requires a bold plan and action.

Unfortunately, the state does not yet have a clear and comprehensive understanding of how to reduce the amount of oil shale energy consumption and what energy solutions can be used instead. In the energy vision, we offer our image of the future of the Estonian energy sector until 2035 in order to support and encourage decision-makers, communities, energy producers and other stakeholders, both at the local and at the national levels.

The global and the Estonian energy scenarios (5) are usually based on default assumptions that consumption will increase by 50% over the next few decades, technological innovations will neutralize the impact of production and consumption on the environment, and the state-owned companies and other large companies will continue to be key players in the energy sector.

Recent research suggests that these assumptions are unrealistic. For instance, greenhouse gas emissions are associated with the volume of energy consumption, which means that if the energy consumption increases, the emissions will increase as well (6-9). In addition, in the context of growing energy consumption, the demand for raw materials for power plants and cars will grow more than their extraction in the coming decades (10-12). Thus, abandoning fossil fuels and overcoming the climate crisis will be unattainable in the context of constant absolute growth in energy consumption, but it will become more realistic as the production and consumption of energy decreases (13-14). However, on the contrary of what the popular belief is, this should not lead to a decrease in social welfare (15).

We want the Estonian state to think of transition plans and to make smart and sustainable choices that should be based on the latest research and on adequate assumptions. In our opinion, in the future, Estonia will use renewable and sustainable energy. Renewable and sustainable energy is generated using different technologies, produced by different producers in different regions of Estonia, and can be stored smartly. The transition to new solutions is convenient for stakeholders, it includes citizens through energy cooperatives and is fair to society and the environment. Based on the latest scientific assessments and experience from other countries, we have formulated goals and solutions that Estonia should strive for over the next 15 years.

1. Energy comes from 100% renewable and sustainable sources

According to the forecasts about the near future, world's leading scientists (16) exclude the use of solid (oil shale), liquid (shale oil) and gaseous (natural gas) fossil fuels, wood combustion and nuclear energy. In the future, energy will only be produced from renewable and sustainable sources, which means that they can be used on a large scale for a very long time.

Renewable and sustainable sources include, among others, wind and solar energy, which are also the cheapest and safest energy sources (17). However, the placement of wind and solar power plants should be based on rigorous environmental impact studies, including field studies. Stations should not be located in close proximity to protected natural sites such as squirrel habitats or important routes.

They should also not be located near protected natural species such as birds of prey, water birds, bats, and seals. When locating stations, preference should be given to multipurpose land uses or locations where there is no competition for space with other land uses, such as rooftops and closed quarries. After the construction of a wind or solar park, biodiversity in the park must be restored, and its existence must be supported by regular maintenance.

The potential of hydropower in Estonia is low because the terrain is flat and the current is weak, moreover, the construction of stations can dramatically reduce the number of many species of fish in the rivers. Based on the principle of sustainable biomass, the use of wood in energy production is acceptable only if there are wood residues from logging and wood processing or from conservation work in pastures. Consequently, mass burning of wood is not a sustainable solution because it causes significant damage to forest biological diversity and does not contribute to overcoming the climate crisis, so reducing deforestation is likely to be inevitable. At the same time, Estonia has a relatively large surplus of herbaceous biomass, both due to the maintenance of meadows protected by natural heritage and to pastures that simply remain open, so it would be wise to use them more efficiently.

2. Using intelligent storage and consumption management solutions

The problem of uncontrolled wind and solar energy can be solved with storage technologies and smarter consumption management. Energy storage should be based on pumped storage, thermal and hydrogen technologies (18-19). In Estonia, mines that lag behind the oil shale industry, or other areas that use the new Zero Terrain technology (20), are also suitable for the construction of pumped storage power plants. Fuel and hydrogen storage can be used as an alternative to today's carbon-intensive heavy industry and transportation solutions. It should be remembered that hydrogen is not an energy source, but an energy carrier.

Therefore, only hydrogen obtained from renewable electricity will help to overcome the climate crisis. The production of hydrogen from fossil electricity or natural gas is a dead-end road that is often accompanied by greenhouse gas leaks and only exacerbates dependence on fossil fuels. In addition to energy storage, attention needs to be paid to managing short-term consumption in virtual power plants, which will help to better integrate renewable energy sources into the grid and cover energy needs during periods of peak consumption.

3. Energy production and consumption are significantly reduced due to energy savings

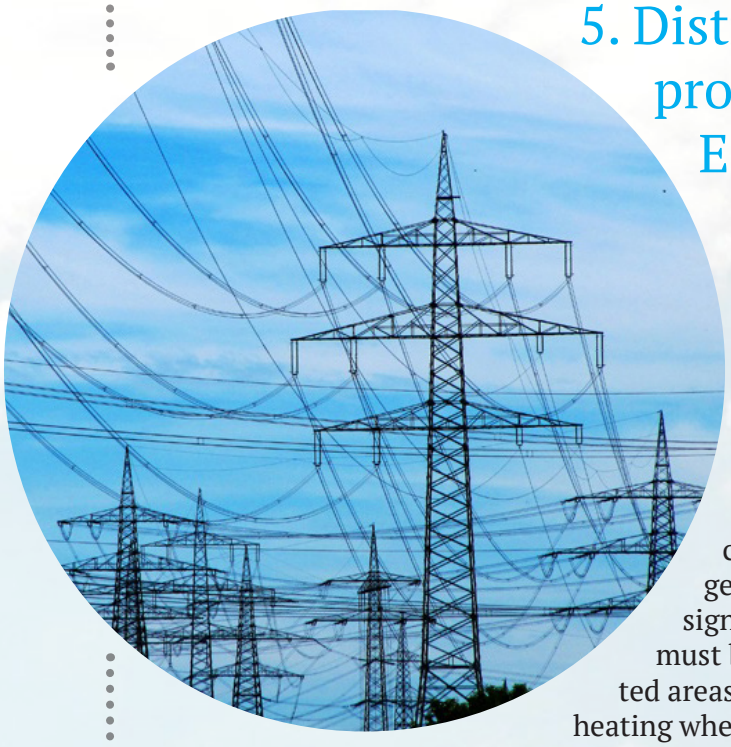
According to scientists, in order to avoid the catastrophic consequences of climate change, the production and consumption of energy in developed countries must be reduced by at least 40% (21-22). It is necessary to reduce energy consumption, especially in heavy industry and transport, where the transition to renewable fuels is especially difficult and can lead to new serious environmental problems (23).

Reducing production and consumption must be based on both efficiency gains through the development of new technologies and energy savings. However, efficiency savings alone are not enough, since they often have the opposite effect: efficiency gains increase energy production and consumption, making it more affordable (24-26). Savings on efficiency also have clear thermodynamic limits and have already been achieved in a number of technologies.

Much more attention should be paid to reducing consumption by saving energy, which means that the unnecessary energy use should be eliminated. Once consumption has been reduced, fully distributed renewable energy production and close network connections between regions and countries will be sufficient to ensure security of supply.

4. Social well-being is supported by energy savings

Instead of increasing production and consumption, the goal should be to obtain the energy that society needs in order to be able to function. In countries with a large ecological footprint, such as Estonia, it is possible to significantly reduce energy consumption thanks to the efficiency and energy savings, which will not harm the public welfare (15, 22). For an average person, this will not bring significant changes, since the biggest share of excess energy consumption are energy-intensive luxury goods and services (27). Abandoning them will still mean that people will have access to all modern conveniences, such as a warm and bright room, internet access and essential household appliances, as well as access to all basic utilities (15, 28). Avoiding energy-intensive luxury goods will also reduce the number of working hours that accumulate due to overproduction, giving people much more free time, for example, to improve knowledge that will benefit both them and their community (22). Of course, what the society is ready to give up must be agreed in a democratic way.



5. Distributed and diversified production spreads throughout Estonia

The transition to renewable energy sources inevitably leads to the decentralization of electricity production. This means that most of the production stations are scattered all over Estonia and more and more electricity is being consumed as close to the production site as possible.

Distributed generation reduces network losses and increases the flexibility of production and consumption. To provide large-scale distributed generation, the existing electrical network needs to be significantly modernized and the capacity of its parts must be increased. For district heating in densely populated areas, preference should be given to centralized district heating whereas in sparsely populated areas it is better to use heat pumps (29, 30). However, this is the case if the heat supply is based on wind and solar energy or on sustainable biomass and if it allows cogeneration of heat and electricity from waste heat.

6. Through cooperative production, citizens are involved from the very beginning

The cheapness and availability of renewable energy, as well as the possibility of its distributed generation, open the way for new participants in the electricity market. These include the energy cooperatives that are increasingly emerging in Europe (31–33) and which are created and owned by the local people.

The experience of other countries has shown that cooperative forms of ownership can provide the right balance between the interests of local authorities, communities and developers of renewable energy sources (34). This will increase independence from monopolies, add value to their house and accelerate the transition to renewable energy. The time has come to create energy cooperatives, as EU legislation has recently become more favorable for cogeneration (35). Among other things, this makes it possible for the state to democratize the electricity market and provide additional funding for the Green Revolution (36).

7. Given the urgency of the climate crisis, special attention will be paid to technologies that are already in use

In the context of the Green Revolution, several other options were discussed, such as building a nuclear power plant, as well as capturing and storing or using carbon. The development of new clean technologies is welcome, but as climate change mitigation needs to be tackled decisively in the next decade, it is necessary to invest in existing solutions.

Capturing and storing or using carbon is only permissible if the technology chosen is economically viable and climate neutral throughout its life cycle, which is not the case with existing technologies (37). The government should not support the oil shale industry, especially if it is doing so with the aim to make expensive and unreliable carbon capture technologies profitable for the industry. The construction of the currently planned generation III + nuclear power plant in Estonia is excluded, since it would lead to serious safety risks such as radioactive waste and accidents, moreover, the construction of a nuclear power plant of this kind would depend on outdated or untested technologies, it would be extremely costly for the state budget and it would not provide a fast enough solution to the climate crisis (38). Until proven safe and reusable, fourth generation nuclear power plants are built around the world, it will be impossible to speak about their suitability.

8. The transition to renewable energy is fair and democratic

Overall, there is a risk that the achievement of the climate targets will lead to a range of social and environmental problems. In Estonia, it is worth, first of all, to pay attention to the future of those people whose social and economic well-being is still largely dependent on the oil shale industry.

The transition to renewable energy must be ambitious, but fair, well thought and gradual, and only in this way it can secure a favorable future for the most vulnerable people. To this end, we can learn from the experience of many other regions which have gone through a fair transition (39). At the same time, during the transition period, one should not forget about the fair treatment of mineral resources and nature. Rare earths and minerals used in renewable energy and electric vehicle components are currently mined mainly in several developing countries, but due to the growing demand, the European Union has allowed mines to expand widely across its territory (40). In the context of growing global energy consumption, the demand for raw materials is growing faster than it will be possible to extract it in the coming decades (10–12). It is important to focus on reducing production and consumption, because otherwise we will create more and more environmental problems.

The energy vision has been written by the Estonian Green Movement, the Estonian Fund for Nature, the Baltic Environmental Forum, the Estonian Ornithological Society, the Center for Environmental Law, the NGO Lääneranik, the Nõmme Tee Society, the Heritage Conservation Association, the Tartu Student Nature Conservancy, the Estonian Student Environment Sorex.

References

1. Ripple, W. J., Wolf, C., Newsome, T. M., Galetti, M., Alamgir, M., Crist, E., ... & 15,364 scientist signatories from 184 countries. (2017). World scientists' warning to humanity: A second notice. BioScience, 67(12), 1026-1028.
2. Ripple, W., Wolf, C., Newsome, T., Barnard, P., Moomaw, W., & Grandcolas, P. (2019). World scientists' warning of a climate emergency. BioScience.
3. Weyhenmeyer, G. jt. (2020). A warning on climate and the risk of societal collapse. Guardian. https://www.theguardian.com/environment/2020/dec/06/a-warning-on-climate-and-the-risk-of-societal-collapse.
4. Wiedmann, T., Lenzen, M., Keyßer, L. T., & Steinberger, J. K. (2020). Scientists' warning on affluence. Nature Communications, 11(1), 1-10.
5. 5. Broughel, A. E. (2020). Globaalsed energeetika valdkonna stsenaariumid: kas rohepöördel on lootust?. Arenguseire Keskuse konverents „Teistmoodi tulevik". https://youtu.be/lcNOD3HPR2Q.
6. Hickel, J., & Kallis, G. (2020). Is green growth possible?. New Political Economy, 25(4), 469-486.
7. Parrique, T., Barth, J., Briens, F., Kerschner, C., Kraus-Polk, A., Kuokkanen, A., & Spangenberg, J. H. (2019). Decoupling debunked. Evidence and arguments against green growth as a sole strategy for sustainability. European Environmental Bureau.
8. Schröder, E., & Storm, S. (2020). Economic growth and carbon emissions: The road to "hothouse Earth" is paved with good intentions. International Journal of Political Economy, 49(2), 153-173.
9. Ward, J. D., Sutton, P. C., Werner, A. D., Costanza, R., Mohr, S. H., & Simmons, C. T. (2016). Is decoupling GDP growth from environmental impact possible?. PloS one, 11(10
10. Giurco, D., Dominish, E., Florin, N., Watari, T., & McLellan, B. (2019). Requirements for minerals and metals for 100% renewable scenarios. Achieving the Paris Climate Agreement Goals: Global and Regional 100% Renewable Energy Scenarios with Non-Energy GHG Pathways for +1.5C and +2C, 437–457.
11. Moreau, V., Dos Reis, P., & Vuille, F. (2019). Enough Metals? Resource Constraints to Supply a Fully Renewable Energy System. Resources, 8(1), 29.
12. Sonter, L. J., Dade, M. C., Watson, J. E., & Valenta, R. K. (2020). Renewable energy production will exacerbate mining threats to biodiversity. Nature Communications, 11(1), 1-6.
13. Floyd, J., Alexander, S., Lenzen, M., Moriarty, P., Palmer, G., Chandra-Shekeran, S., ... & Keyßer, L. (2020). Energy descent as a post-carbon transition scenario: How 'knowledge humility' reshapes energy futures for post-normal times. Futures, 122, 1-14
14. Grubler, A., Wilson, C., Bento, N., Boza-Kiss, B., Krey, V., McCollum, D. L., ... & Cullen, J. (2018). A low energy demand scenario for meeting the 1.5 C target and sustainable development goals without negative emission technologies. Nature Energy, 3(6), 515-527.
15. Millward-Hopkins, J., Steinberger, J. K., Rao, N. D., & Oswald, Y. (2020). Providing decent living with minimum energy: A global scenario. Global Environmental Change, 65.
16. Jacobson, M. Z. (2020). 100% Clean, Renewable Energy and Storage for Everything. Cambridge University Press.
17. REN21 (2020). Renewables 2020 Global Status Report. https://www.ren21.net/wp-content/uploads/2019/05/gsr_2020_full_report_en.pdf.
18. Trainer, T. (2017). Some problems in storing renewable energy. Energy Policy, 110, 386-393.
19. Trainer, T. (2018). Estimating the EROI of whole systems for 100% renewable electricity supply capable of dealing with intermittency. Energy Policy, 1-19. 648-653.
20. Energiasalv (2020). Zero Terrain. https://energiasalv.ee/zeroterrain/.
21. Hickel, J. (2019). Is it possible to achieve a good life for all within planetary boundaries? Third World Quarterly, 40(1), 18-35.
22. Trainer, T., & Alexander, S. (2019). The simpler way: envisioning a sustainable society in an age of limits. real-world economics review, 247-260.
23. de Blas, I., Mediavilla, M., Capellán-Pérez, I., & Duce, C. (2020). The limits of transport decarbonization under the current growth paradigm. Energy Strategy Reviews, 32.
24. Brockway, P. E., Saunders, H., Heun, M. K., Foxon, T. J., Steinberger, J. K., Barrett, J. R., & Sorrell, S. (2017). Energy rebound as a potential threat to a low-carbon future: Findings from a new exergy-based national-level rebound approach. Energies, 10(1), 51.
25. Shove, E. (2018). What is wrong with energy efficiency?. Building Research & Information, 46(7), 779-789.
26. Sorrell, S. (2009). Jevons' Paradox revisited: The evidence for backfire from improved energy efficiency. Energy Policy, 37(4), 1456-1469.
27. UNEP (2020). Emissions Gap Report 2020. https://www.unenvironment.org/emissions-gap-report-2020.
28. Rao, N. D., Min, J., & Mastrucci, A. (2019). Energy requirements for decent living in India, Brazil and South Africa. Nature Energy, 4(12), 1025-1032.
29. Connolly, D., Lund, H., Mathiesen, B. V., Werner, S., Möller, B., Persson, U., ... & Nielsen, S. (2014). Heat Roadmap Europe: Combining district heating with heat savings to decarbonise the EU energy system. Energy Policy, 65, 475-489.
30. Lund, H., Möller, B., Mathiesen, B. V., & Dyrelund, A. (2010). The role of district heating in future renewable energy systems. Energy, 35(3), 1381-1390.
31. Gorroño-Albizu, L., Sperling, K., & Djørup, S. (2019). The past, present and uncertain future of community energy in Denmark: Critically reviewing and conceptualising citizen ownership. Energy Research & Social Science, 57, 1-12.
32. Seyfang, G., Park, J. J., & Smith, A. (2013). A thousand flowers blooming? An examination of community energy in the UK. Energy Policy, 61, 977-989.
33. Van Der Schoor, T., & Scholtens, B. (2015). Power to the people: Local community initiatives and the transition to sustainable energy. Renewable and Sustainable Energy Reviews, 43, 666-675.
34. Warren, C. R., & McFadyen, M. (2010). Does community ownership affect public attitudes to wind energy? A case study from south-west Scotland. Land Use Policy, 27(2), 204-213.
35. Lowitzsch, J., Hoicka, C. E., & Van Tulder, F. J. (2020). Renewable energy communities under the 2019 European Clean Energy Package–Governance model for the energy clusters of the future?. Renewable and Sustainable Energy Reviews, 122.
36. de Brauwer, C. P. S., & Cohen, J. J. (2020). Analysing the potential of citizen-financed community renewable energy to drive Europe's low-carbon energy transition. Renewable and Sustainable Energy Reviews, 133.
37. Sekera, J., & Lichtenberger, A. (2020). Assessing Carbon Capture: Public Policy, Science, and Societal Need. Biophysical Economics and Sustainability, 5(3), 1-28.
38. Eesti Roheline Liikumine (2020). Ülevaade tuumaenergia riskidest. http://roheline.ee/uudised/uudis/2020/11/26/ulevaade-tuumaenergia-riskidest/.
39. WWF (2020). Just Transition to climate neutrality: Doing right by the regions. https://regionsbeyondcoal.eu/wp-content/uploads/2020/03/WWF_Just-Transition-to-Climate-Neutrality.pdf.
40. European Commission (2020). Commission announces actions to make Europe's raw materials supply more secure and sustainable. https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1542.

Picture credit: background picture Pexels/Pixaby.com; 1. PIRO4D/Pixaby.com; 2. sweetlouise/Pixaby.com; 3. vaxomatic, 4. Freepik.com; 5. Rainer Sturm/pixelio.de; 6. Freepik.com; 7. Freepik.com