Energy system modelling to support national energy and climate policy making in Finland

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Over the past decade VTT has had a central role to support ministries and Governments in Finland in their energy and climate policy making

Impact assessments of new policies and measures for medium-term policy making:

Energy and Climate Strategies (EIS)

Medium-Term Climate Plans (KAISU)

Reporting NECPs* for the EC

Creating pathways and scenarios for Long-Term Climate Plans (LTS)

Reporting LTS for the EC

Fullfilling the Climate Act requirements

Support for updating the national Climate Act reform

Alternative climate goals for 2030, 2040, 2050 and climate neutrality target

Support for implementation of government programmes and national strategies

Bioeconomy strategy
Circular economy strategy

Excise tax reforms

*National Energy and Climate Plans (NECPs) outline actions and policies to achieve 2030 climate and energy targets

Government programmes, Climate Act and EU regulation set the guidelines

PMI J. Sipilä
2015-2019

- Energy & Climate Str.
- KAISU1
- 1st NECP to EC
- Excise tax updates

PMI S. Marin
2019-2023

- Climate & Energy Str.
- KAISU2
- Update of Climate Act
- 1st LTS to EC
- Update of Bioeconomy Strategy
- Roadmap for Excise tax renewals

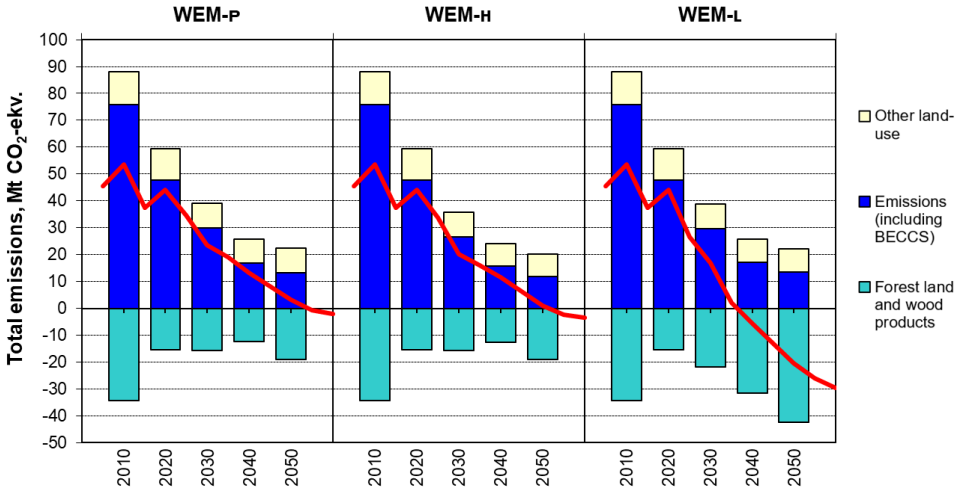
PMI P. Orpo
2023-2027

- Energy & Climate Str.
- KAISU3
- LTS based on Climate Act requirements
- 2nd NECP to EC

Content and Methods of the Assessments for policy impact assessments

- Typically modelled and analysed by several national research organisations.
- Formulation of scenarios With Exsisting Measures (**WEM**, e.g. reference scenario) and With Additional Measures (**WAM**, e.g. policy scenario)

Lessons learnt: increased challenges to define WEM pathway, which should include both national and EU level policies and measures implemented.



Source: Koljonen et al. (2024)
https://urn.fi/URN:ISBN:978-952-383-219-0

Modelling framework:
All the models are soft-linked to calculate the developments of energy, emissions and economy

Sectoral models:
- Buildings and construction (FineBuild)
- Road (ELIISA), rail (RAILI) and sea (MEERI) transport
- Work machines (TYKO)
- Municipal and biowaste
- F-gases
- Agricultural (DREMFIA)
- Forestry (MELA)

Integrated Assessment Models
- Energy system (TIMES-VTT)
- National Economy (FINAGE)
- Regional Economy (REFINAGE)

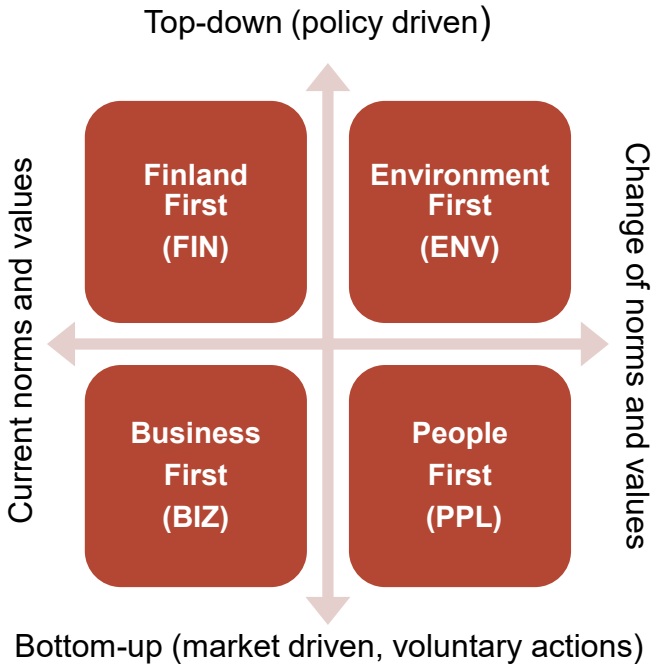
Land-use models
- Yasso07 for agricultural land
- LULUCF modelling for land use emissions and sinks

Lessons learnt: increased complexity to fulfill increased reporting requirements for several ministries and EC has made the modelling framework heavy to run

Content and methods to study long-term developments (LTS)

- **Participatory scenario planning** to engage stakeholders
- **Citizen surveys** to study current capabilities, opportunities, and motivation and to assess potentials for behaviour change
- Analysis of sectoral **low carbon roadmaps** by industry and commerce.
- Quantitative **modelling** of **alternative scenarios**
- **Qualitative assessments** on environment, people, health, security etc.

Using foresight methods to create alternative pathways is very useful but takes time



P	Political	Political factors are government, trade and tax policies, general political issues, changes in leadership, regulation, and political trends.
E	Economic	Economic factors may include inflation, interest rates, exchange rates, economic growth and unemployment levels.
S	Social	Social factors are cultural trends and patterns in society. They may include lifestyle trends, age distribution, and consumer behavior.
T	Technological	Technological factors may include technological advancements and developments, innovation and scientific breakthroughs.
E	Environmental	Environmental factors may include climate change, environmental regulations, waste management policies and consumer environmental awareness.

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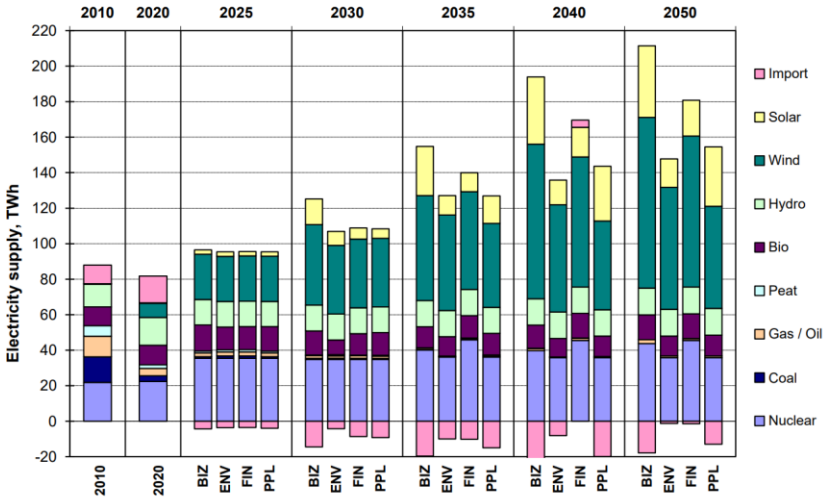
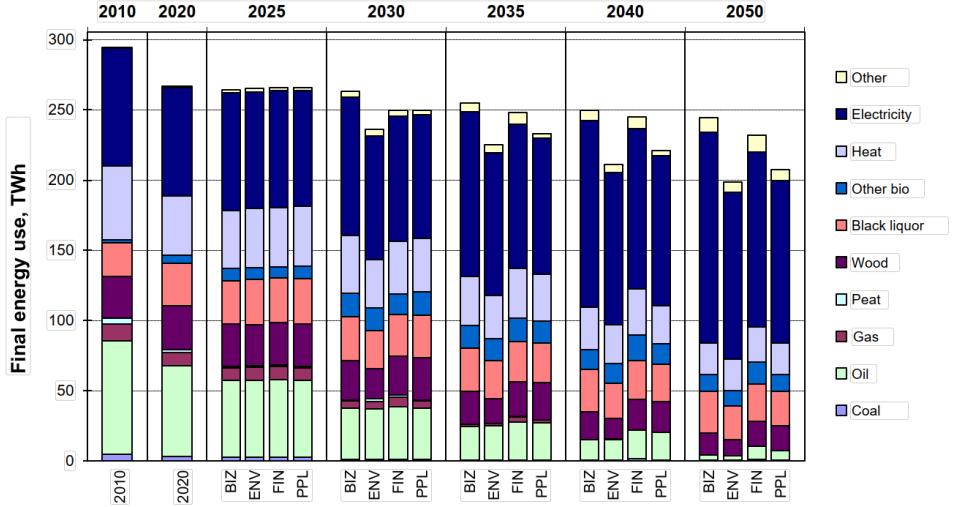
Energy system modelling is at the core of quantitative analysis of alternative pathways





Source: TIMES-VTT modelling by A. Lehtilä in Koljonen et al. (2025)
https://publications.vtt.fi/pdf/technology/2025/T443.pdf

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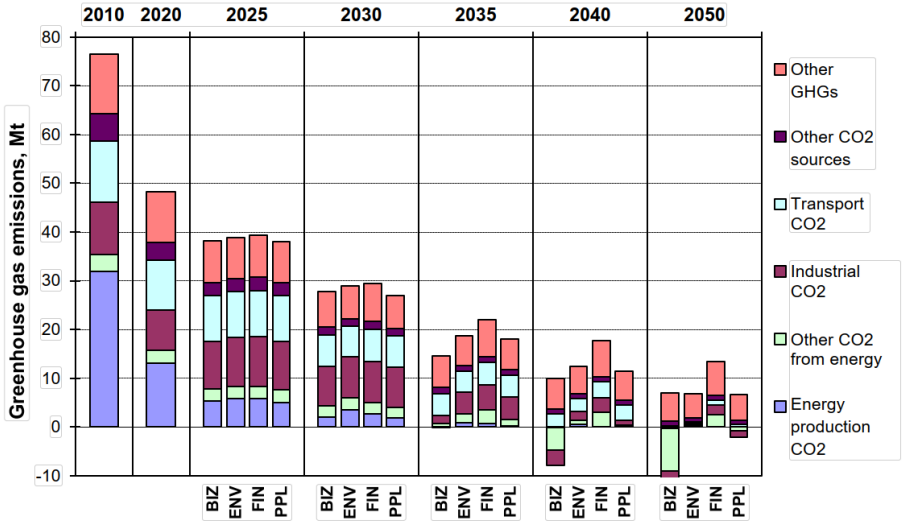
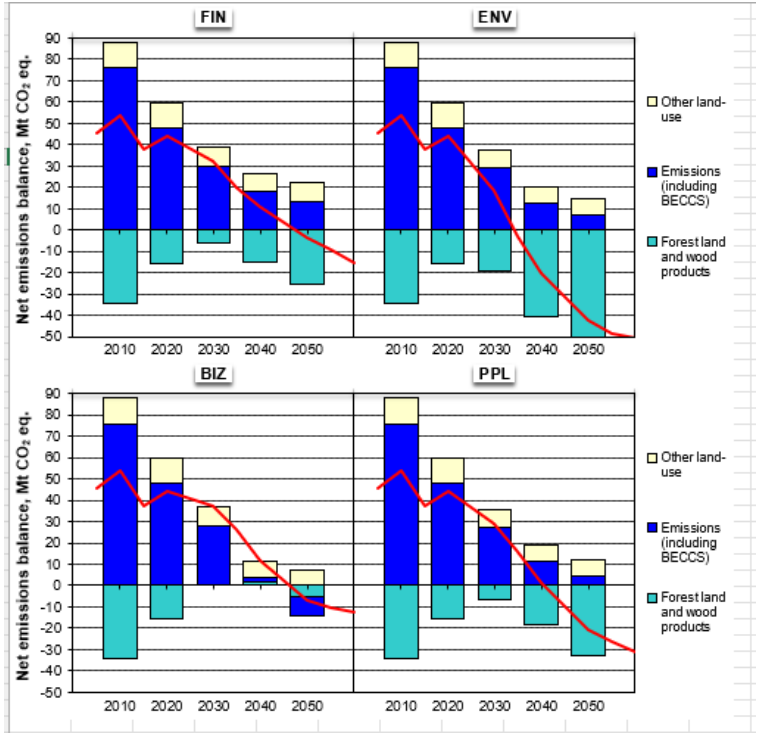
… but analysing climate neutrality is hard …





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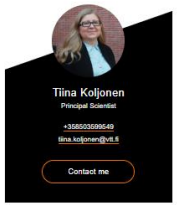
… and communicating about the complex results with high uncertainty is even harder …

Carbon neutrality is still achievable for Finland – immediate and decisive action on clean technology and land use is needed

News, Press release 27.10.2025 13:00 EET

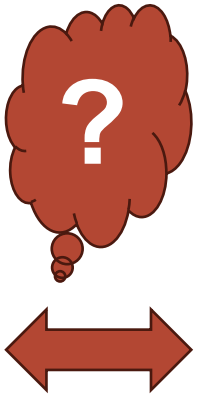


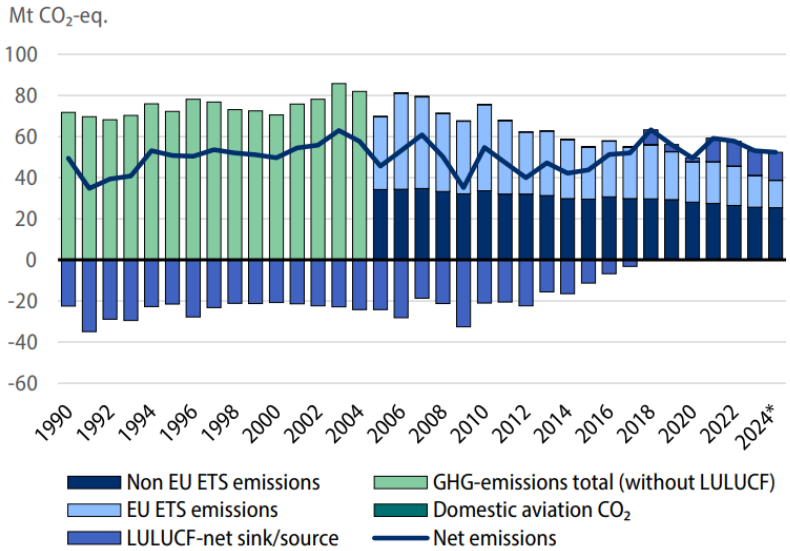
New long-term climate scenarios demonstrate that Finland is positioned well to achieve carbon neutrality after 2040 and become carbon negative by mid-century. Reaching this goal requires strengthening both technologically and naturally produced carbon sinks. A report by VTT Technical Research Centre of Finland, the Finnish Environment Institute (SYKE), the Natural Resources Institute Finland (Luke), and the Geological Survey of Finland GTK also reveals that citizens and companies alike are highly committed to achieving climate targets.

Read the summary

- Finland can achieve carbon neutrality after 2040 and carbon negativity by mid-century, but this requires all emission sectors to actively contribute, especially addressing challenges in the land use sector.
- Net-negative solutions are crucial, combining emission reductions with enhanced natural and technical carbon sinks, yet the deployment of technologies like CCS has been hampered by high costs and policy limitations.
- A clear long-term vision and committed policy support are needed to drive investments in low-carbon solutions and ensure fairness in the transition across different socioeconomic groups.

This summary is written by AI and checked by a human.





Source: Annual Climate Report 2025, Ministry of Environment

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During the last ten years each Government has had their own targets and critical points

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2023-2027

EU's 2030 policies

- Increase the share of RES to 55% and self-sufficiency in energy supply to 50%. => phase-out of coal by 2029.
- Challenge to achieve the non-ETS (i.e. ESR) GHG reduction target of 39% by 2030.

EU's FitFor55 package

- Update of Climate act with new climate neutrality target by 2035.
- Fair transition.
- Sectoral Low Carbon Roadmaps by industry and commerce.
- Non-ETS (i.e. ESR) target of 50% by 2030.

RePower EU

- Phase-out of all the Russian energy and raw-materials.
- New challenges with LULUCF => strong motivation for BECCS.
- Minimize the impacts on citizens => contradicting policies compared with climate targets.

Conclusions – relevance

- TIMES-VTT Energy system modelling soft-linked with other models has provided a foundation for **national energy and climate policies**, targets, and strategies.
- Policy impact assessments have been instrumental in the preparation and updating of **legislative and strategic** processes.
- Guidance for investment and **innovation policy**.
- Informing and **reporting** Finland's contribution **to EU's** policies.
- Monitoring and evaluation **of policy effectiveness**.

Conclusions - recommendations

Increased complexity and uncertainties of future increase the complexity of scenario planning, including modelling.	• Communication of results requires great **simplification**
Each Government has its own programme and agenda, also EU's policies can change in between.	• You need to **be prepared** for changes, even radical ones
Integration of Social, Economic, and Environmental Dimensions.	• **Participatory scenario planning** and **citizen engagement** to move beyond techno-economic towards socio-economic

beyond

the obvious

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