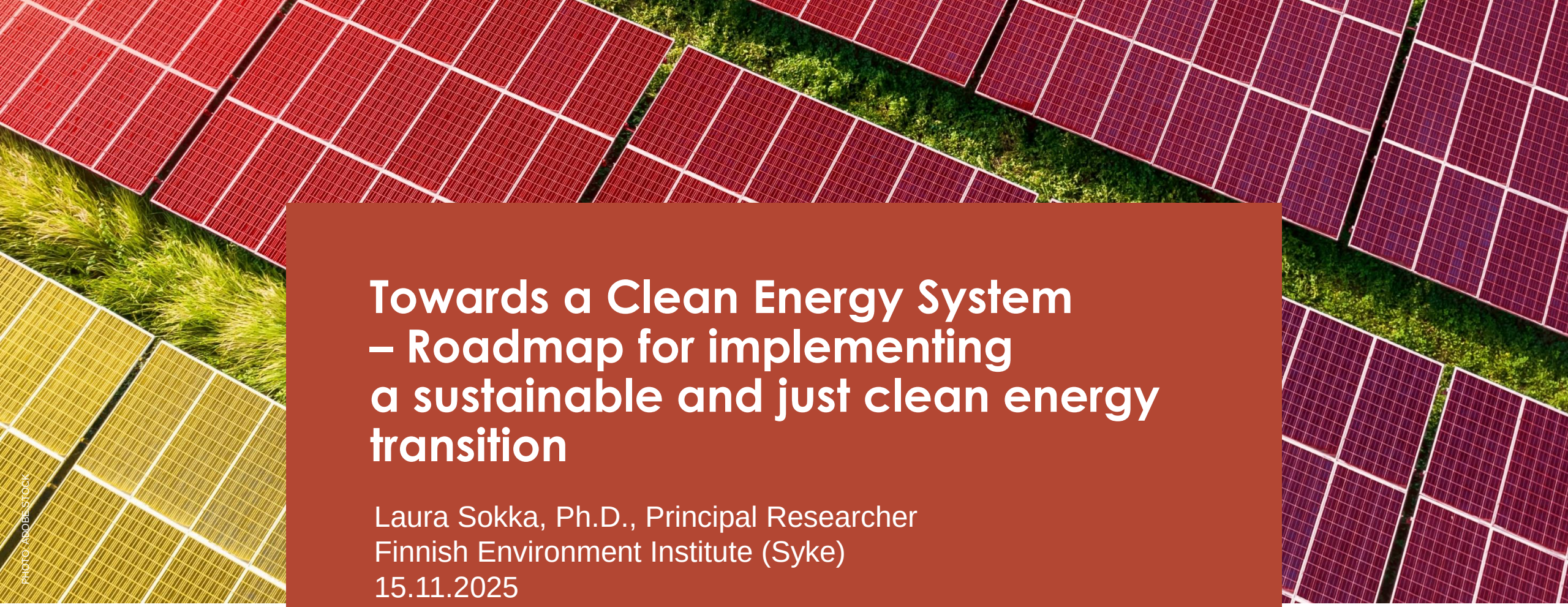

PHOTO: ADOBE_STOCK

Towards a Clean Energy System – Roadmap for implementing a sustainable and just clean energy transition

Laura Sokka, Ph.D., Principal Researcher
Finnish Environment Institute (Syke)
15.11.2025

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Programme

- **Laura Sokka, Finnish Environment Institute:** Towards a Clean Energy System - Roadmap for implementing a sustainable and just clean energy transition
- Comments by
  - **Anne Højer Simonsen**, Deputy Director, Climate, Green transition and Energy, Danish Industry
  - **Silva Paananen**, Counsellor, Trade and Investment at Ministry for Foreign Affairs of Finland

Transition to a climate neutral economy

The urgency of climate change requires a rapid transition to a clean energy system.

Moreover, the transition may also contribute to several other strategic objectives, including

- improving energy security and the resilience of the energy system.
- reducing air pollution,
- enhancing economic growth and employment,
- reducing energy costs,
- improving public health,
- promoting technological innovations,
- reducing environmental loads

In order to keep to the principles of sustainable development, the transition should not cause significant harm to the environment, nature or people.

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Some background on Finland, and the Finnish energy system

- Finland is located in Northern Europe with sparse population and long distances.
- Over three fourths of the land area, corresponding to 23.1 million hectares, are covered by forests.
- Finland has a relatively specific role in energy security as it is a small country next to Russia with no fossil energy resources of its own.
- Previously, the Russian imports of fossil fuels played an important role, with peat, nuclear power and renewable energy sources, mainly hydropower and wood, having large contribution as well.
- While biomass plays a major role in energy production, at the same time the role of the LULUCF sector has been crucial in achieving the carbon neutrality, a national aim by 2035.

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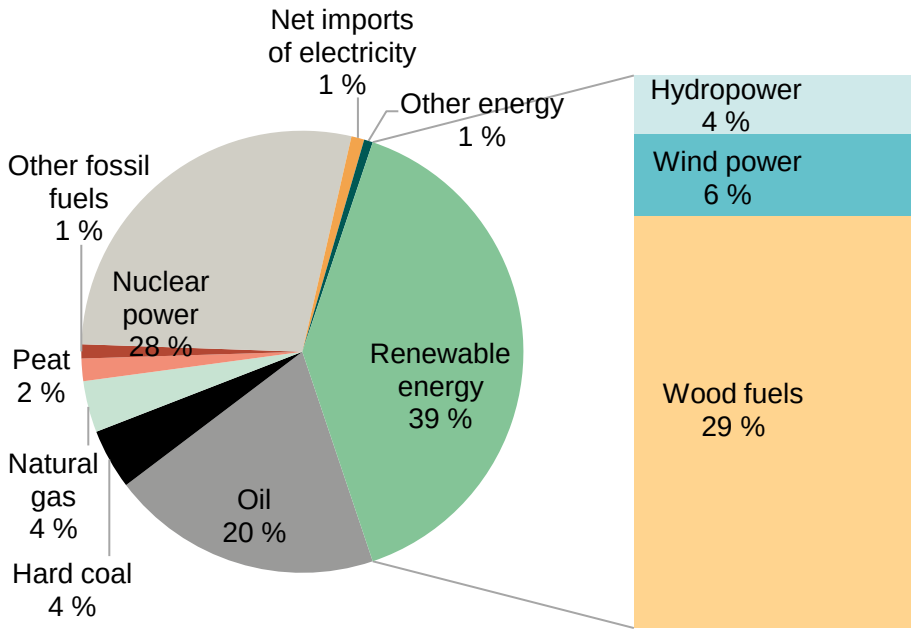
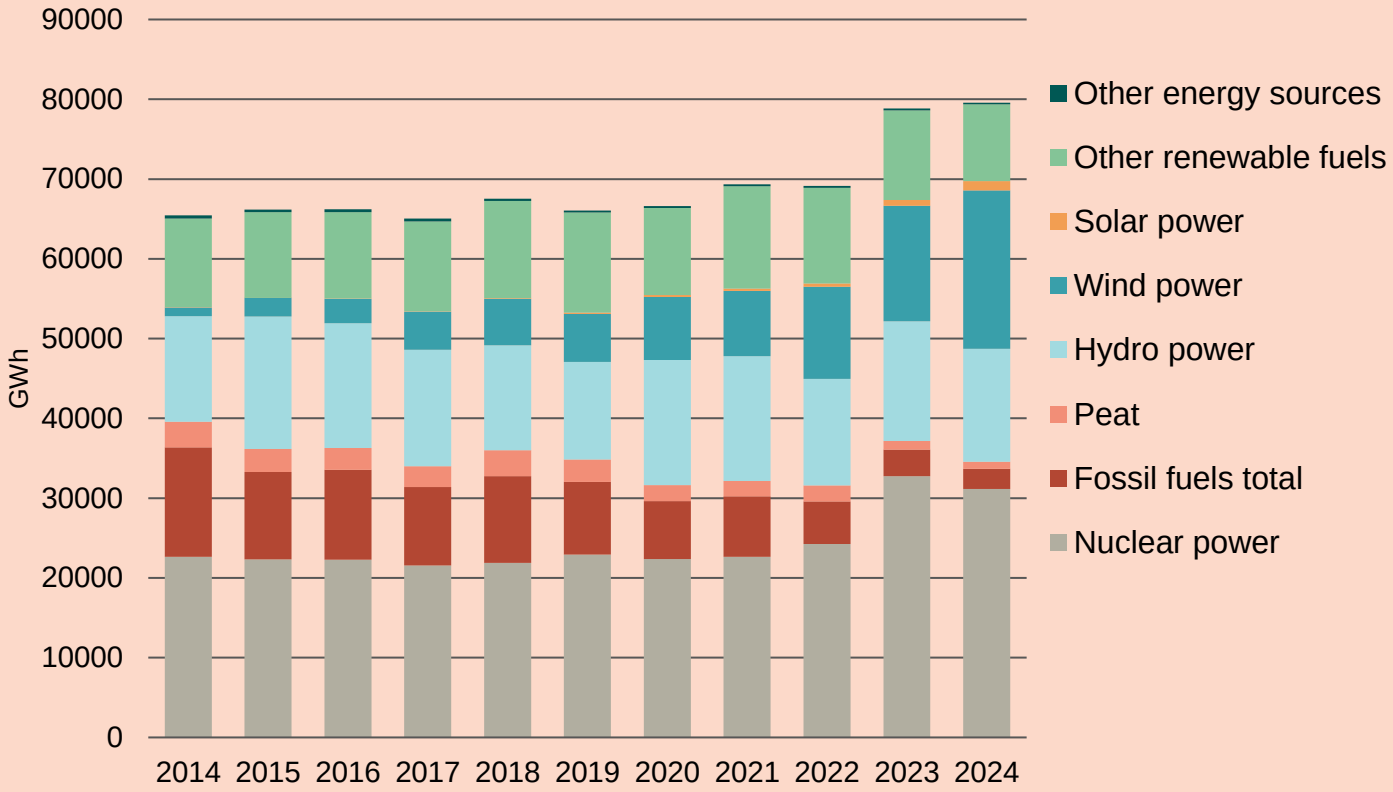
Energy and electricity production in Finland

Total energy consumption by energy source



Source: Official Statistics of Finland (OSF): Production of electricity and heat [online publication]. ISSN=1798-5099. Helsinki: Statistics Finland [Referenced: 6.11.2025]. Access method: https://stat.fi/en/statistics/salatuo

Supply of electricity by energy source by year



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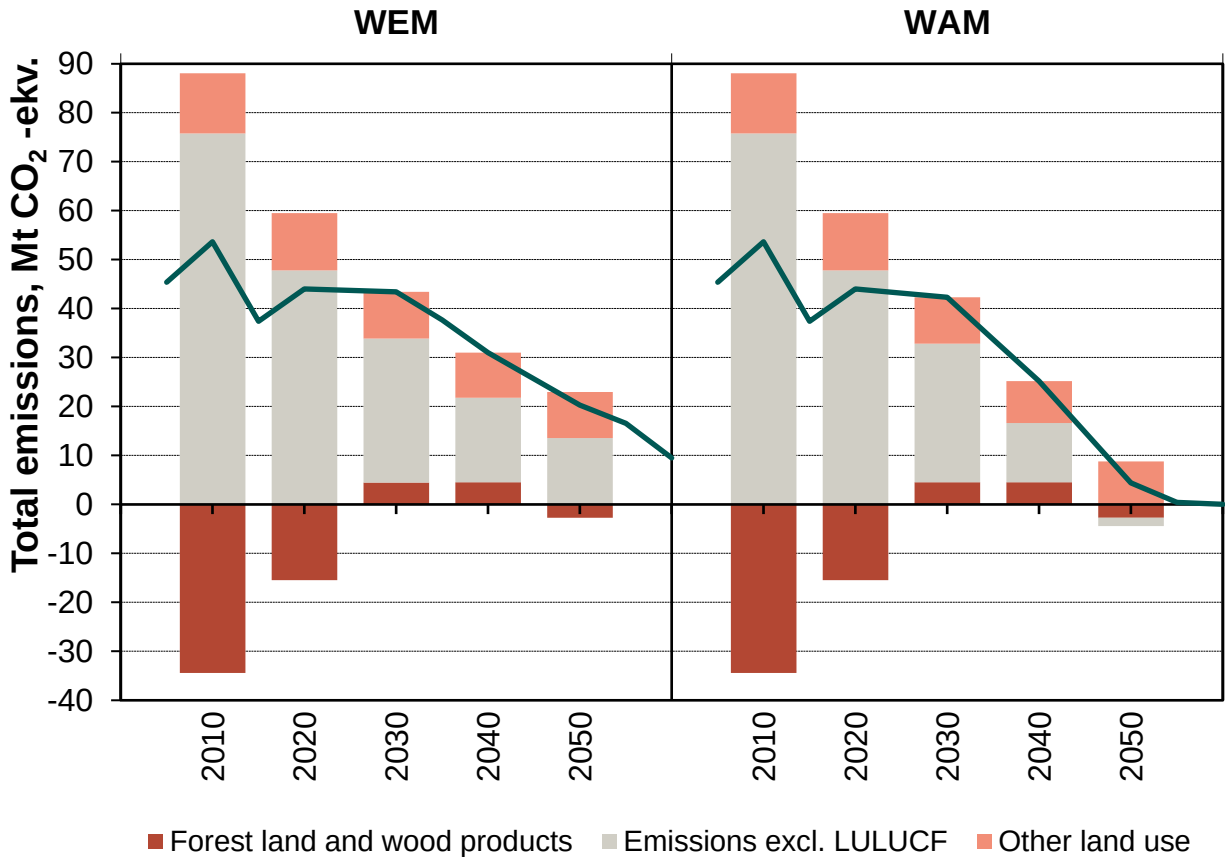
Expected development of GHG emissions in Finland (incl. LULUCF)

- While the emission targets are ambitious, and the fossil emissions are decreasing as planned, emissions from the LULUCF sector have been growing.
- LULUCF has turned from sink to a source of greenhouse gas emissions.
- This is due to increased harvesting, higher CO2 emissions from peat forest soils and the depletion of the carbon sink in mineral forest soil.



Source: Koljonen et al. 2025. https://doi.org/10.32040/2242-122X.2025.T442

WEM = With Existing Measures, WAM = With Additional Measures

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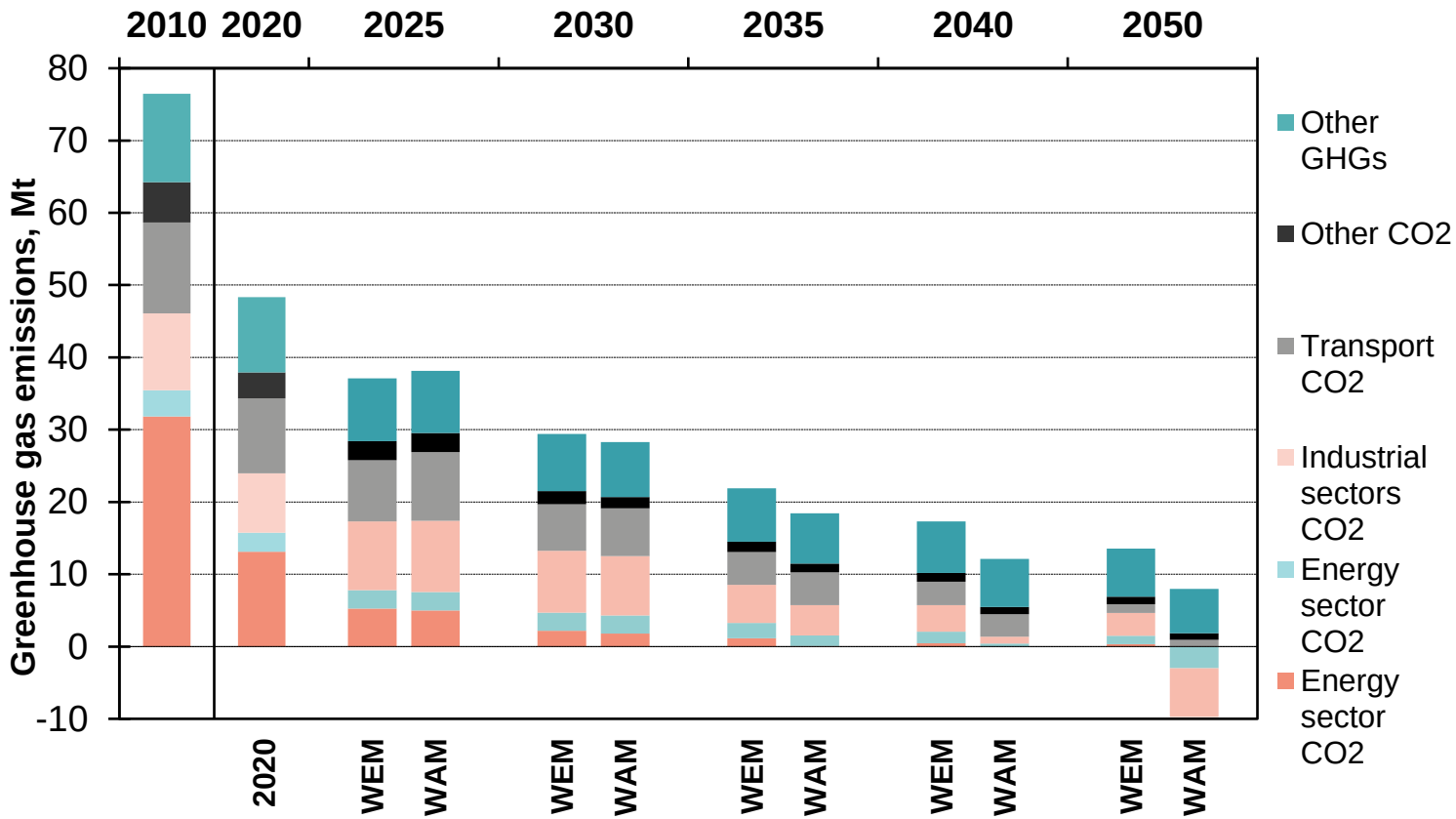
Expected development of GHG emissions (excl. LULUCF) by sector

- Fossil emissions are expected to continue decreasing.
- Present policy visible in 2025.
- CCUS technologies in the later decades.
- Energy sector



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Development of a clean energy system

- In Finland, in cooperation with VTT Technical Research Centre of Finland Ltd. and Geological Survey of Finland (GTK), w have been running a large research project ”Towards a Clean Energy System – REPower-CEST”.
- It provides a comprehensive view of the solutions, impacts, implementation challenges and opportunities of a clean energy system replacing fossil fuels.
- A sustainable and just transition to a clean energy system requires that the transition does not cause significant harm to the environment, nature or people.
- In the project, researchers and experts produce information, tools and service concepts needed to analyse, manage and solve the challenges and risks related to the environmental, economic and social dimensions of the clean energy transition.
- The aim has been to develop a roadmap based on a broad knowledge base for implementing a sustainable and fair clean energy transition in Finland by 2035.

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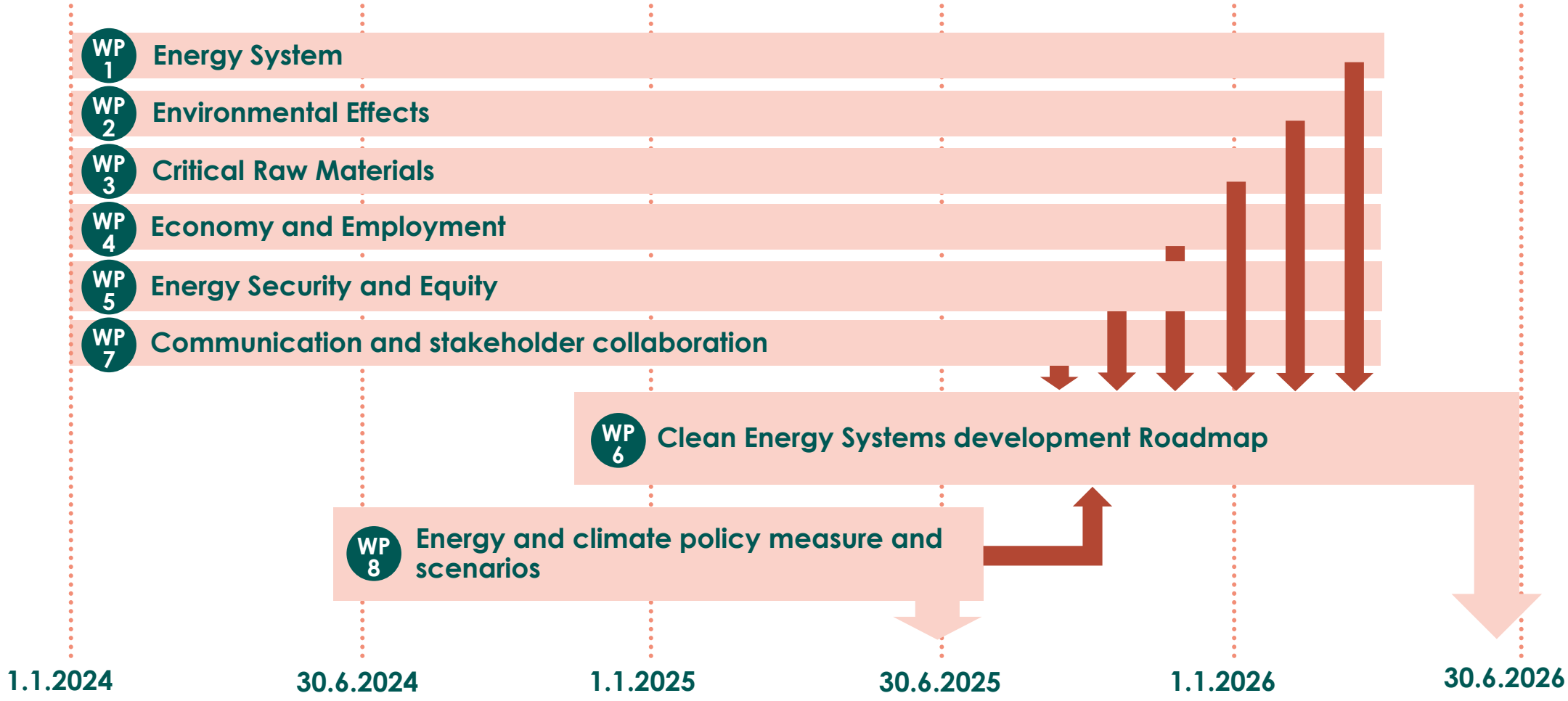
Timeline and structure of the project



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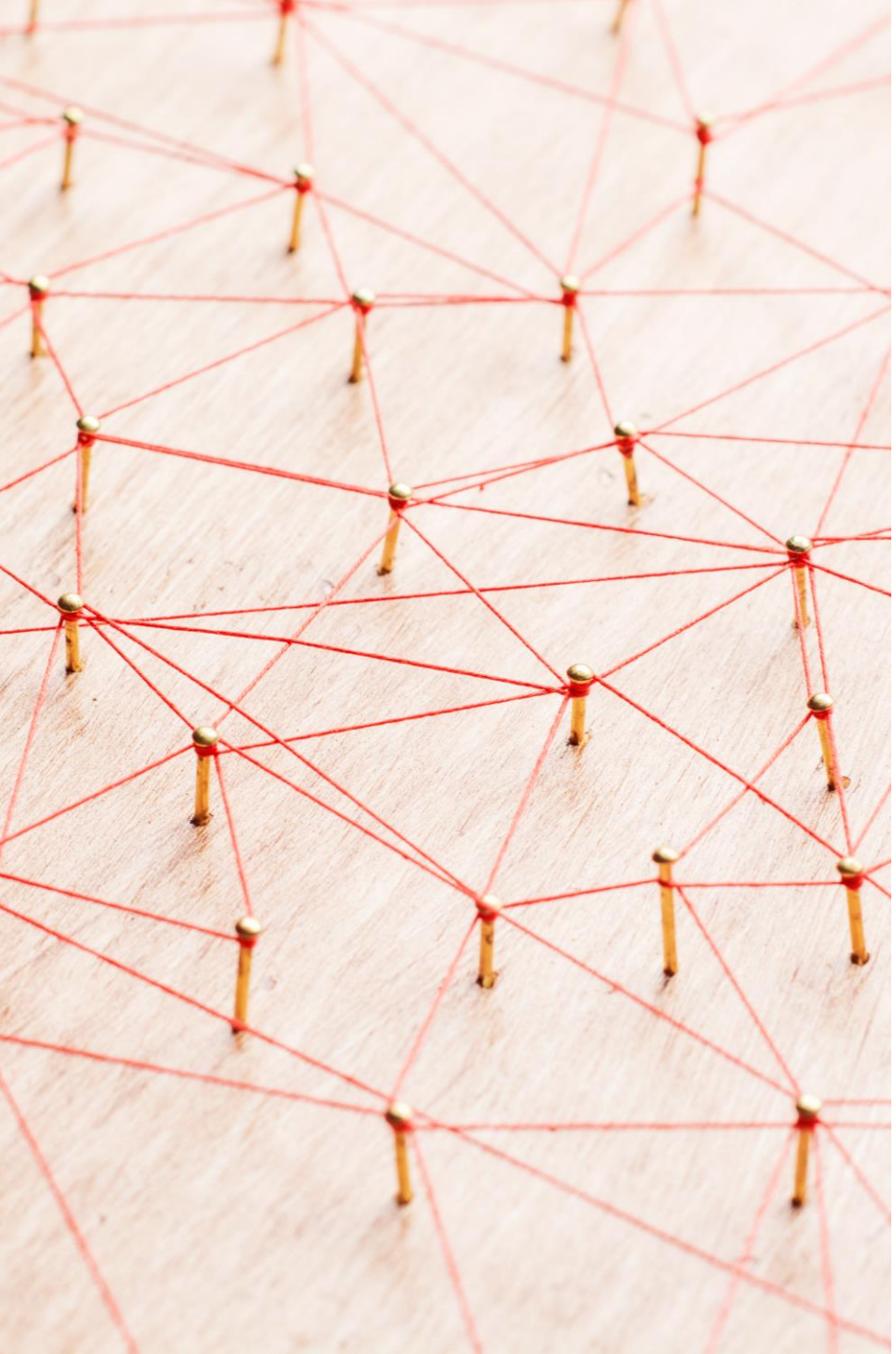

Structure of the clean energy transition roadmap

- Vision
- Drivers
- Present situation 2025
- Change 2025-2055
- Target state in 2055
- Viewpoints: Energy system, climate and other environmental impacts, resouce consumption, including critical raw materials, economy and employment, energy security and justice.

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Vision: Finland achieves a sustainable and secure energy system

- Efficiency, renewablity, low emissions , resilience, just transition, circular economy
- Achievement of climate targets.
- DNSH principle, ecological and social sustainability
- Sustainable development as an overarching political principle
- Information based decision-making, acceptability
- Fair distribution of costs and benefits
- Attractive environment for investments

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Drivers of the clean energy transition

- Different factors driving the transition:
  - Political
  - Economic
  - Social
  - Technological
  - Environmental
- These factors do not represent desired or aimed futures but likely developments based on present knowledge, observed trends or expert estimations.
- Drivers form a realistic framework for the development of the clean energy transition in 2025-2055.
- Possibilities for a change have been included.

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Present status of the clean energy transition in Finland

- Fossil emissions decreased but challenges particularly in heavy vehicle traffic, heating and industrial emissions
- Bottlenecks in energy transmission and distribution infrastructure
- Uncertainties in the operational environment
- Companies, communities and research organisations have increased cooperation
- From the point of view of social and regional justice there are both challenges and opportunities
- Biodiversity impacts resulting from renewable energy investment
- Coherent strategic direction seems to be missing

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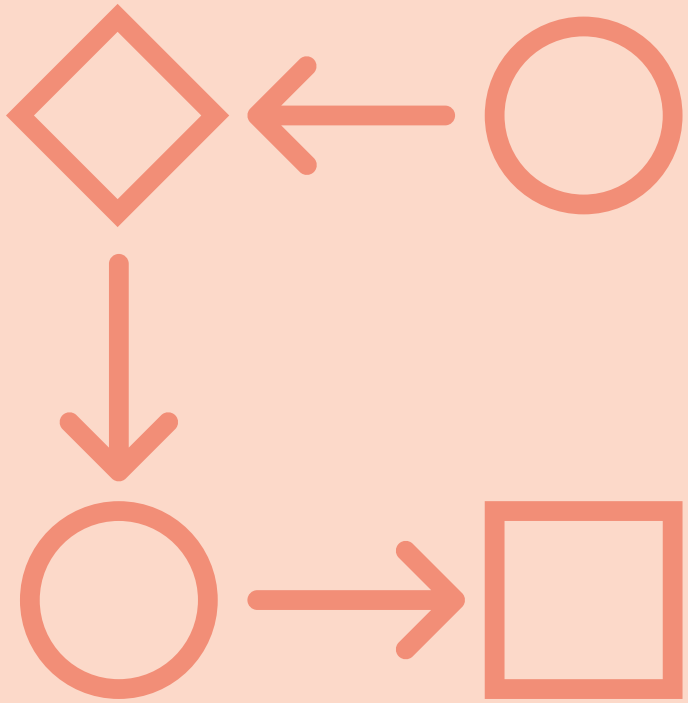

Transition to a clean energy system in 2025-2055

- Gradual development of the energy system towards low-emission, flexible, and resource efficient system where environmental, ecoomic and social targets can be achieved simultaneously.
- In 2025–2035 emphasis is in strenghtening the basis of the energy system, and widening of the technological selection.
- In 2035–2045 emphasis moves to energy system integration and development of the market structure.
- In 2045–2055 the energy system is a diverse and flexible entity where different production and storage technologies complement one another.

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Goal state of the clean energy system in 2055

- By 2055 Finland has achieved a stable, resilient and low-emission energy system, which acts as the basis of the sustainable society.
- Building of the energy system has been done by minimising nature damages and considering social justice.
- Efficient integration and its guidance.
- Circular economy, material efficiency, sustainable utilisation of renewable resources.
- Ecological and social sustainability.
- Resilience.
- Appraisal of clean energy.

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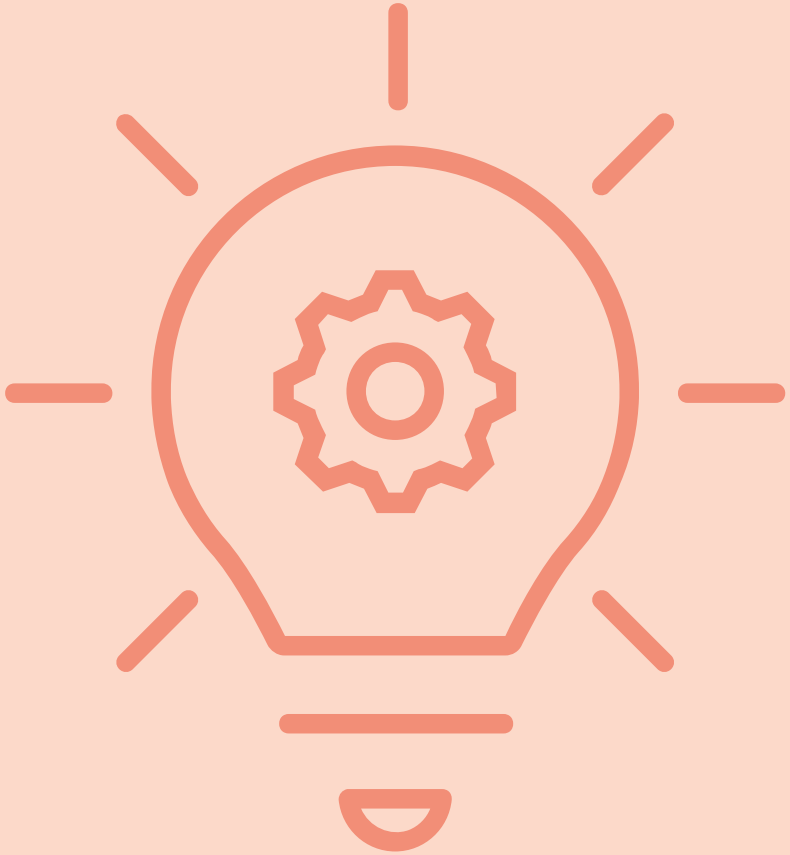

Lessons learned and conclusions

- Vision and roadmap building aid in finding the attempted end point.
- Goes beyond invidual scenarios.
- Roadmap defines the concrete steps towards the targeted change.
- It collects together views of the central social actors.
- Includes a vision, targets and concrete actions.
- Thereby it creates common willingness and understanding of how to move towards the aimed vision (climate neutral, sustainable energy system, achieved through just transition).

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Next: Commentary speeches

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Silva Paananen

Counsellor of Trade and Investment

Ministry for Foreign Affairs of Finland

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Finlands miljöcentral
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Anne Højer Simonsen

Deputy Director, Climate,

Green transition and Energy, Danish Industry

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Thank you!

Finnish Environment Institute at Finland Pavilion at the UN COP30 climate change conference: www.syke.fi/en/cop30

Towards a Clean Energy System – REPower-CEST - Hiilineutraalisuomi

laura.sokka@syke.fi

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