

Pathway to Climate Neutrality: the Role of Nuclear Energy

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Ministry of Economic Affairs
and Employment of Finland

Themes



- Programme of the Finnish Government and the implementation of carbon neutrality target 2035
- The role of nuclear energy in overall energy and climate transition
- Priorities of the Finnish Presidency of the EU Council: climate neutrality of the EU by 2050



Programme of Prime Minister Antti Rinne's Government: Carbon neutrality by 2035



The Government will work to ensure that **Finland** is carbon neutral by 2035 and carbon negative soon after that. We will do this by accelerating emissions reduction measures and strengthening carbon sinks.

The Government is committed to reforming the climate policies of the **European Union** and Finland so that we can do our part to limit the global mean temperature increase to 1.5 degrees Celsius. Finland aims to develop the EU's long-term climate measures so that the EU can achieve carbon neutrality before 2050. This means tightening the emissions reduction obligation for 2030 to at least 55 per cent below the 1990 emissions level.



Starting points

In the long run, sustainable growth and climate policy are not in conflict

- However, the path and timing of transition are crucial regarding the costs involved
- Low-carbon solutions face growing demand globally

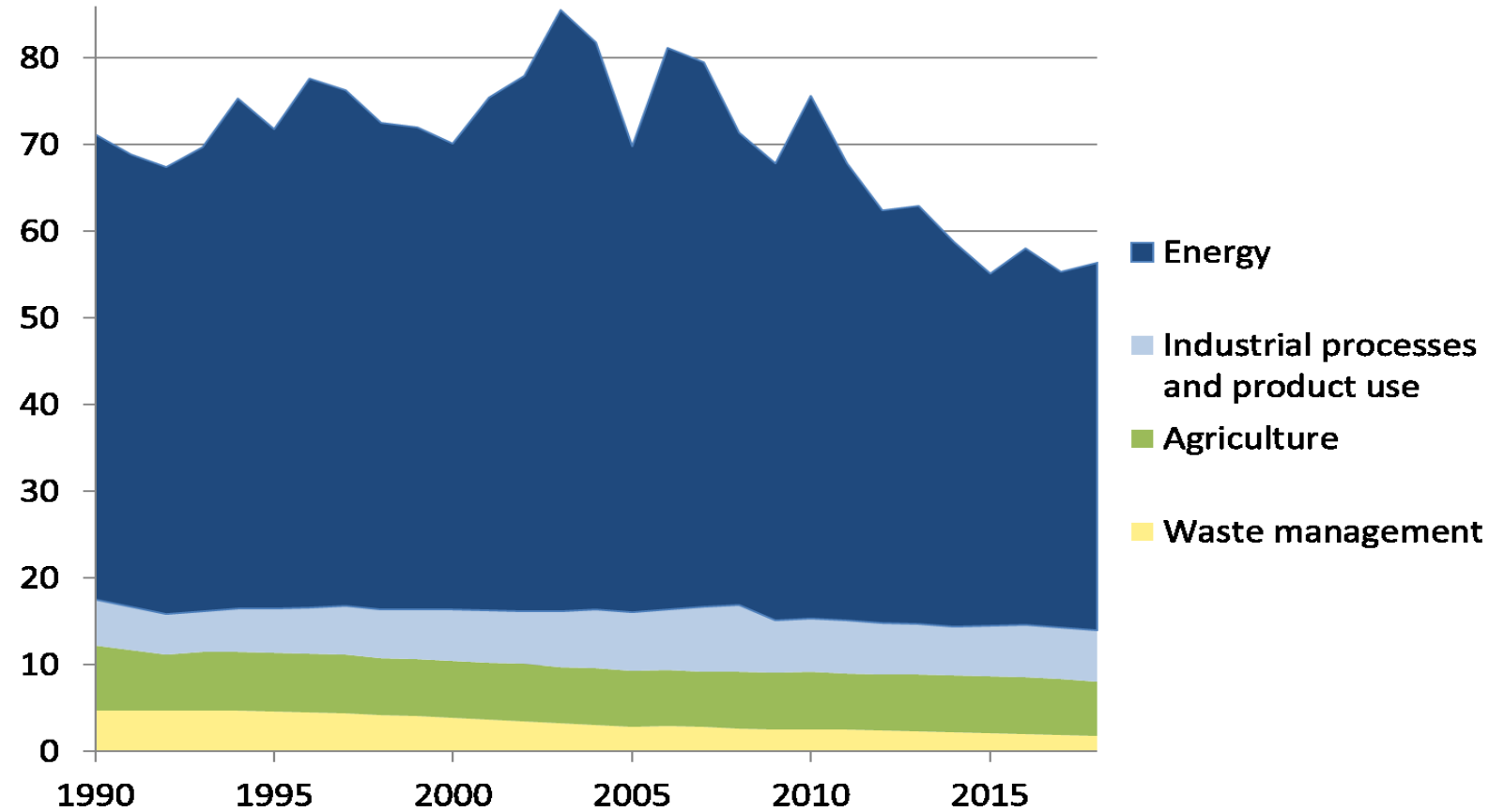
We need predictable, long-term energy and climate policies for the necessary investments to take place

- Energy and climate policies are clearly interlinked: about 75% of greenhouse gas emissions are energy use related
- Investments are long-term (for decades)
- Capital investors assess thoroughly regulatory and market risks
- Energy and climate policies must be based on best available data and best estimates of future development

Greenhouse gas emissions by sector 1990 – 2018*



Mt CO2 ekv.

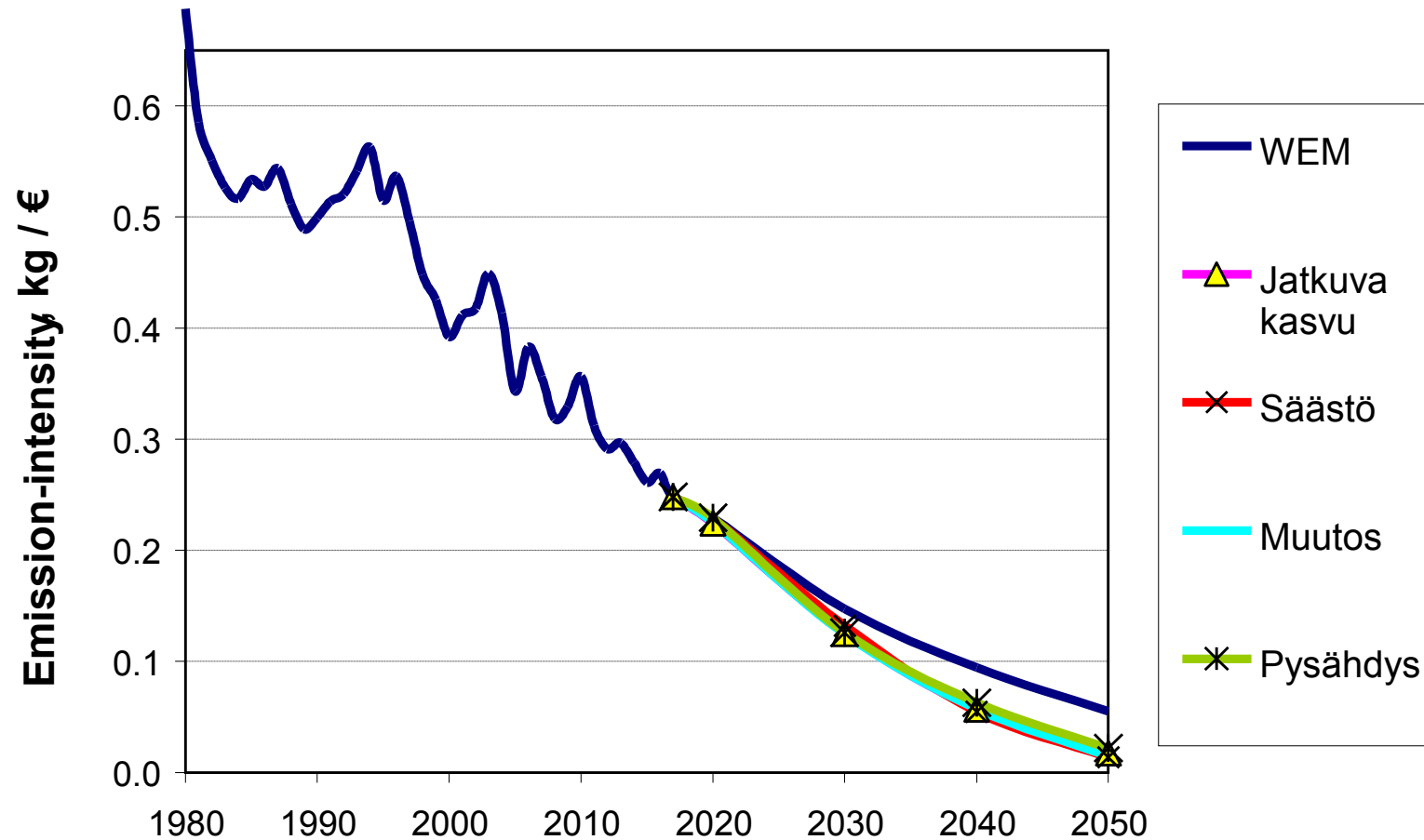


Source: Statistics Finland, * 2018 proxy estimate

The Finnish economy is less and less emission-intensive



- At the same time, the marginal cost of cutting GHG emissions becomes higher

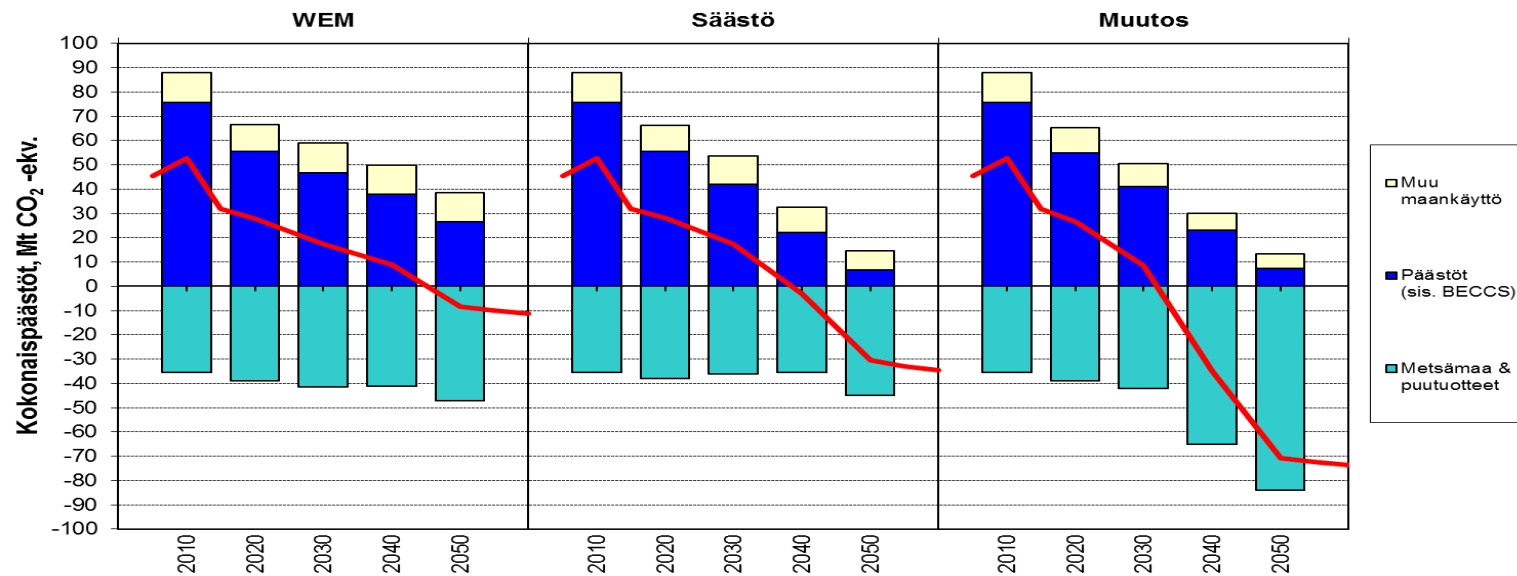


Source: Päästöintensiteetin kehitys 1980–2050 (PITKO-selvitys, 28.2.2019 s. 94)

According to the existing studies, Finland might become carbon neutral by 2040 (PITKO by VTT and SYKE)



- Wood harvests & carbon sink development as a key issue. "Muutos" scenario is based on 65 Mm³/a wood harvests, other scenarios on 80 Mm³/a.
- The speed of industrial transition, technological development etc.? (many scenarios)



Source: PITKO-selvitys 28.2.2019, sivu 92

Longer run: emissions can be cut 85-90% by 2050



- Marginal costs increase sharply when close to 90% decrease
- Global development of cost-effective and commercialised technologies is decisive in many ways
 - BECCS (bioenergy carbon capture and storage) development is a key factor
- Finnish electricity production is already 80% emission-free and soon more due to Olkiluoto 3 nuclear power plant unit starting production in 2020
- The whole energy production can be made practically carbon-neutral
- The most challenging sectors to decarbonise:
 - Agriculture
 - Cement production
 - Crude oil refineries

How to achieve carbon neutrality by 2035?



Strategic level:

- In the long term, the essential task is to minimise the use of fossil fuels and to develop carbon sinks.
- To start with, we need better understanding on cost-effective roads towards 2035. PITKO study is updated during autumn. The most relevant issue is how to accelerate decarbonisation even further cost-effectively and taking into consideration the potential speed of technological development.
- Energy-intensive sectors like steel, forest and chemical industry are in focal role, especially regarding the costs and economic effects of low-carbon transition. Agriculture and transport are equally important.
- Updates are needed for final integrated National Energy and Climate Plan (NECP) and national Long-term Strategy which will be provided to the European Commission by the end of 2019.
- Accordingly, national strategies will be updated in 2020/2021.

How to achieve carbon neutrality by 2035?



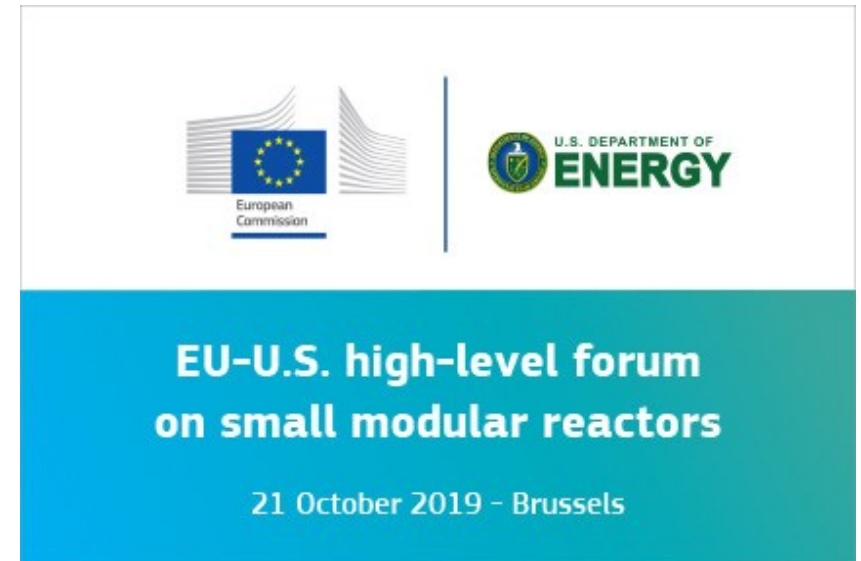
Tools:

- In general, regulation, subsidies and taxation should promote transition to low-carbon economy. Due to EU obligations, there is a need to focus now on Effort Sharing Sector, especially transport.
- According to the Government Programme, there will be a specific focus on energy taxation, sectoral low-carbon roadmaps, biogas programme etc.
- Operating aid is decreased, and stronger focus will be on innovation financing.
- EU instruments, especially Emissions Trading System, are essential instruments in transition.
- Low-carbon energy technologies need to be developed (R&D&I, deployment) in all fronts. Smart as well as resource-efficient solutions are important. Sector integration (sector coupling) is necessary for flexibility.
- Well-functioning energy markets and operating environment in general play a big role.

The role of nuclear energy in future energy and climate policies



- **Nuclear energy is an essential part of the solution**
 - We need all kinds of low-carbon technologies and cost-effective solutions to reach climate neutrality
- **Energy markets will evolve fast in the transition**
 - Overall electrification, incl. industries
 - Intermittent renewable production requires flexibility
 - The role of base-load power?
 - Decarbonising the heating sector in many ways
 - Possibility to use Small Modular Reactors?
 - Economics and regulation?
- **In the longer run, competitiveness is the issue**
 - In Finland, wind power is the most economical electricity source
 - Large, "tailor-made" projects will lose competitiveness
 - Modularity, standardisation etc. without compromising safety and reliability



Nuclear power: 2,800 MWe, 22 TWh/a, 25% of demand With Olkiluoto 3, 4,400 MWe



Total electricity consumption in Finland 87 TWh

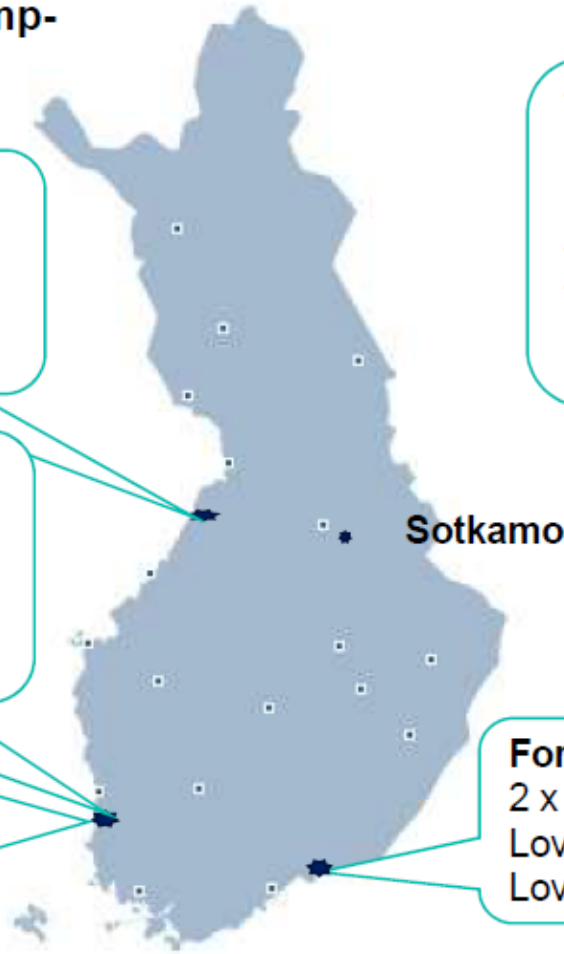
Fennovoima, Hanhikivi:
Hanhikivi 1 (FH1)
AES2006 1200 MW
In licensing

TVO, Olkiluoto:
2 x BWR 890 MW (net)
Olkiluoto 1 (1978) 7 TWh
Olkiluoto 2 (1981) 7 TWh
Olkiluoto 3 (2020) – 1600 MW

Posiva, Olkiluoto:
Spent nuclear fuel repository,
under construction
(2016)

Fortum, Loviisa:
2 x PWR 505 MW (net)
Loviisa 1 (1977) 4 TWh
Loviisa 2 (1980) 4 TWh

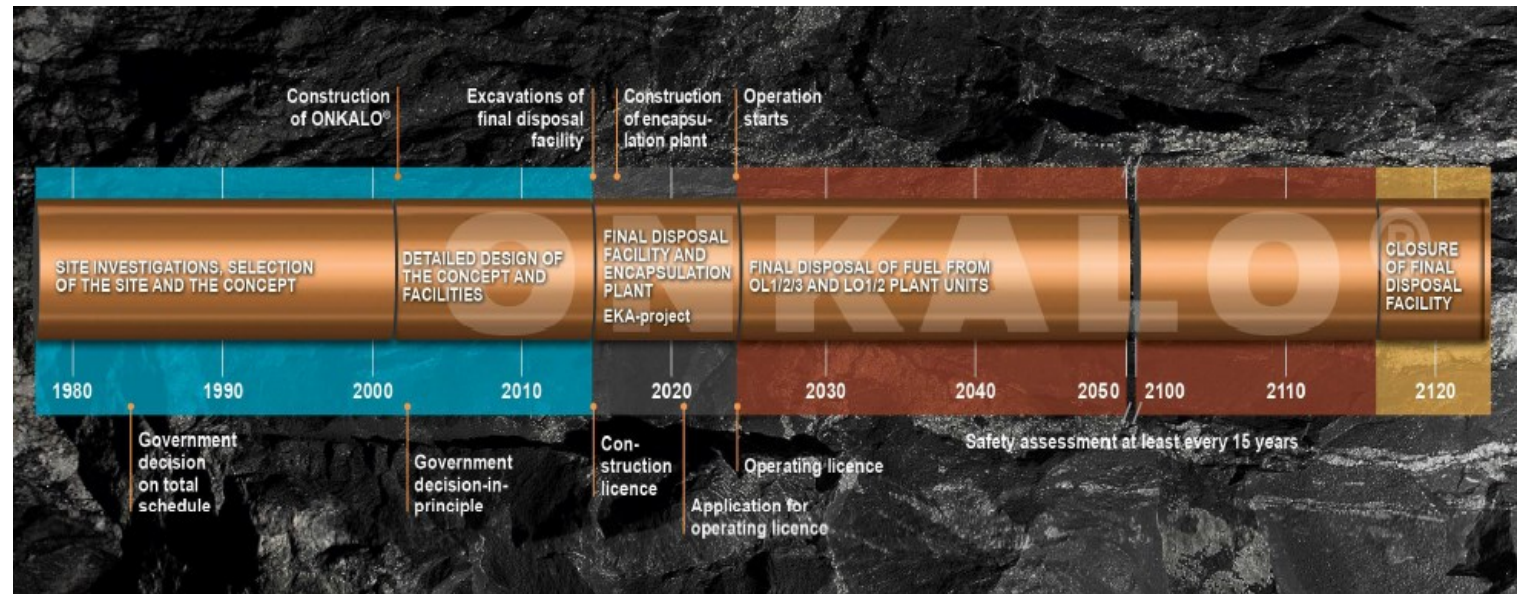
- Fuel: no front-end facilities, potential uranium recovery from a nickel mine (Terrafame Oy, Sotkamo)
- No reprocessing of spent fuel
- Ban to import/export nuclear waste (since 1994).





Challenges for legislation and regulation

- In Finland, a clear need to update legislation for many reasons
 - The Nuclear Energy Act is from 1988 and requires updating
- Licencing procedures: streamlining
- New technologies
 - E.g. SMRs
- Nuclear spent fuel and waste management issues (Posiva final disposal repository being constructed)
- Other nuclear material issues
- Working group on legislation
 - 10/2019 – 6/2020
 - Legislative proposals later on

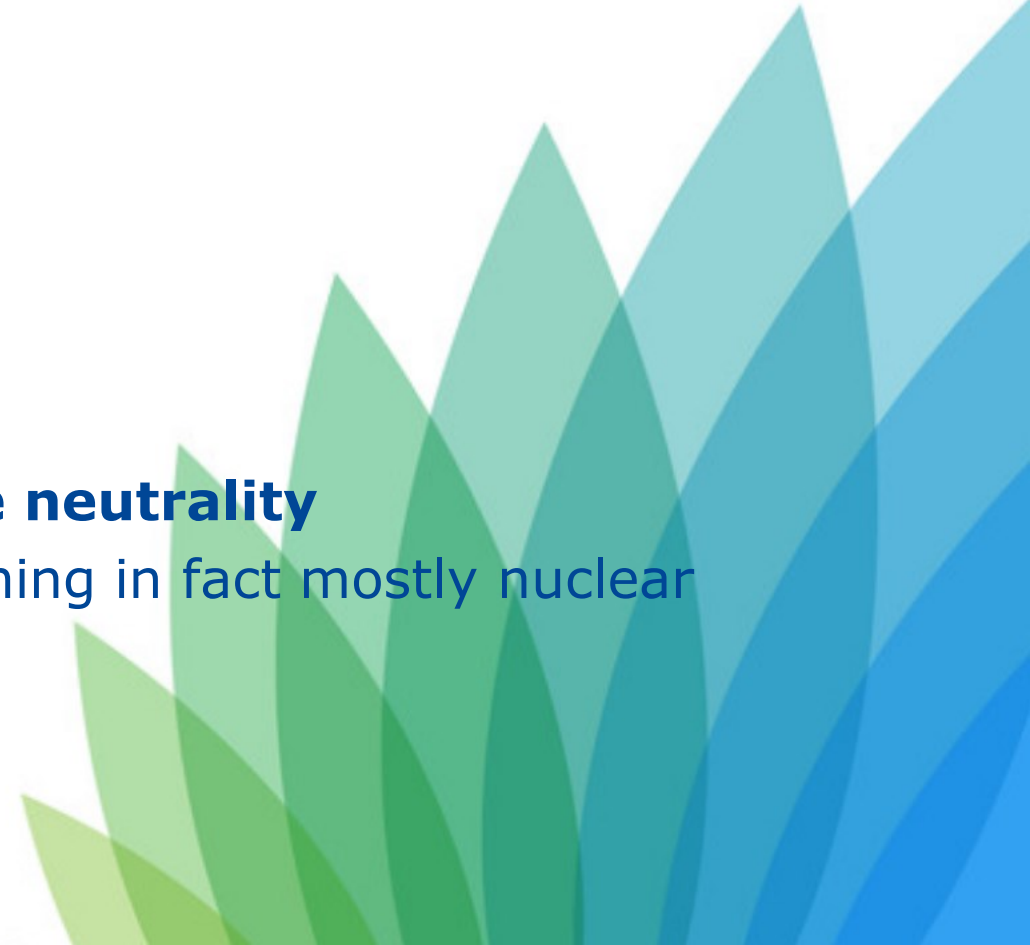


Finnish Presidency of the EU Council in the field of energy

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ENERGY COUNCIL – THE AGENDA

- The overall goal: Long-term strategy (LTS) **making the EU climate neutral by 2050**
- Implementation of the **Energy Union**
 - Energy security
 - Internal energy market
 - Energy efficiency
 - Decarbonisation, renewables
 - Research, development and innovation
- Draft **National Energy and Climate Plans**
- **Innovative technologies promoting climate neutrality**
- The issue of “**technology-neutrality**”, concerning in fact mostly nuclear energy
 - Rules on sustainable financing
 - EU financing



KEY DATES

- Energy Council, 24 September 2019, Brussels
 - National Energy and Climate Plans
 - Beyond 2030: National Long-term strategies
 - Innovative energy technologies
- SET-Plan Conference, 13-15 November 2019, Helsinki
 - Strategic energy technologies
 - Research and innovation in the energy sector to enhance European industrial leadership
- Energy Council, 4 December 2019, Brussels
 - Agenda will reflect Finnish Presidency priorities
 - Ursula von der Leyen's Commission in place?; Green Deal and other priorities related to energy and climate policy



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