Renwable energy in Finland

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Finnish Energy

Finland – energy country without energy resources

- No fossil fuel resources (coal, gas or oil)
- High energy consumption per capita
  - Energy intensive industry (paper, chemicals, metals etc)
  - Cold climate, low population density
  - High standard of living
- Key elements of Finnish energy system
  - High energy efficiency in generation and in use
  - High use of domestic forestry related biomasses
  - Trust on and use of nuclear power
  - Increase of renewables and phase-out of fossils
  - Open, competitive Nordic energy markets
- As result also large energy technology sector & exports

Primary energy consumption
(per capita per year)

68 MWh

35 MWh

Electricity consumption
(per capita per year)

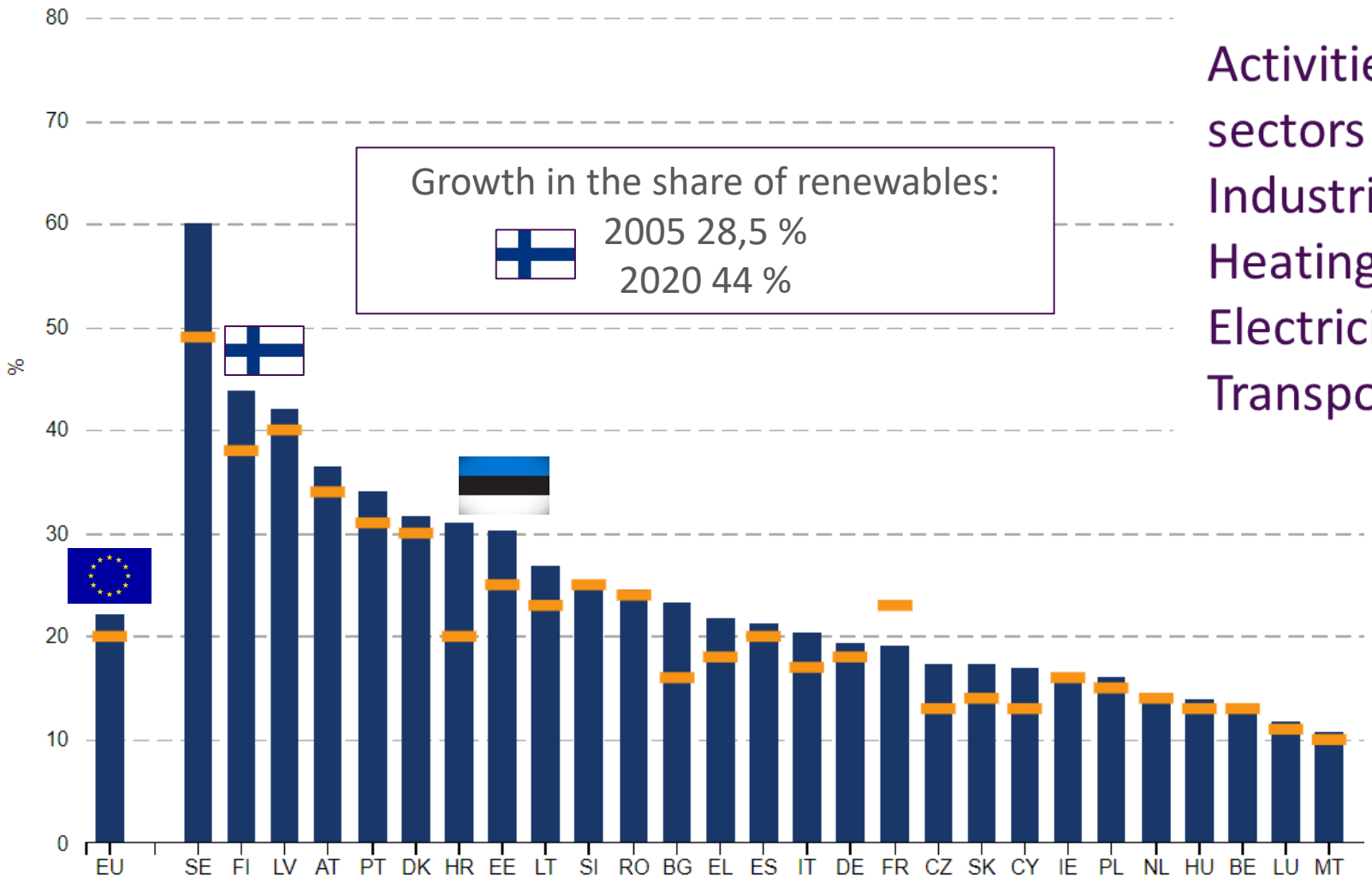
16 MWh

7 MWh

The focus in Finland´s energy policy has been in cost efficient reduction of greenhouse gas emissions, not in renewables

Share of renewables in total end use of energy in EU and member states 2020

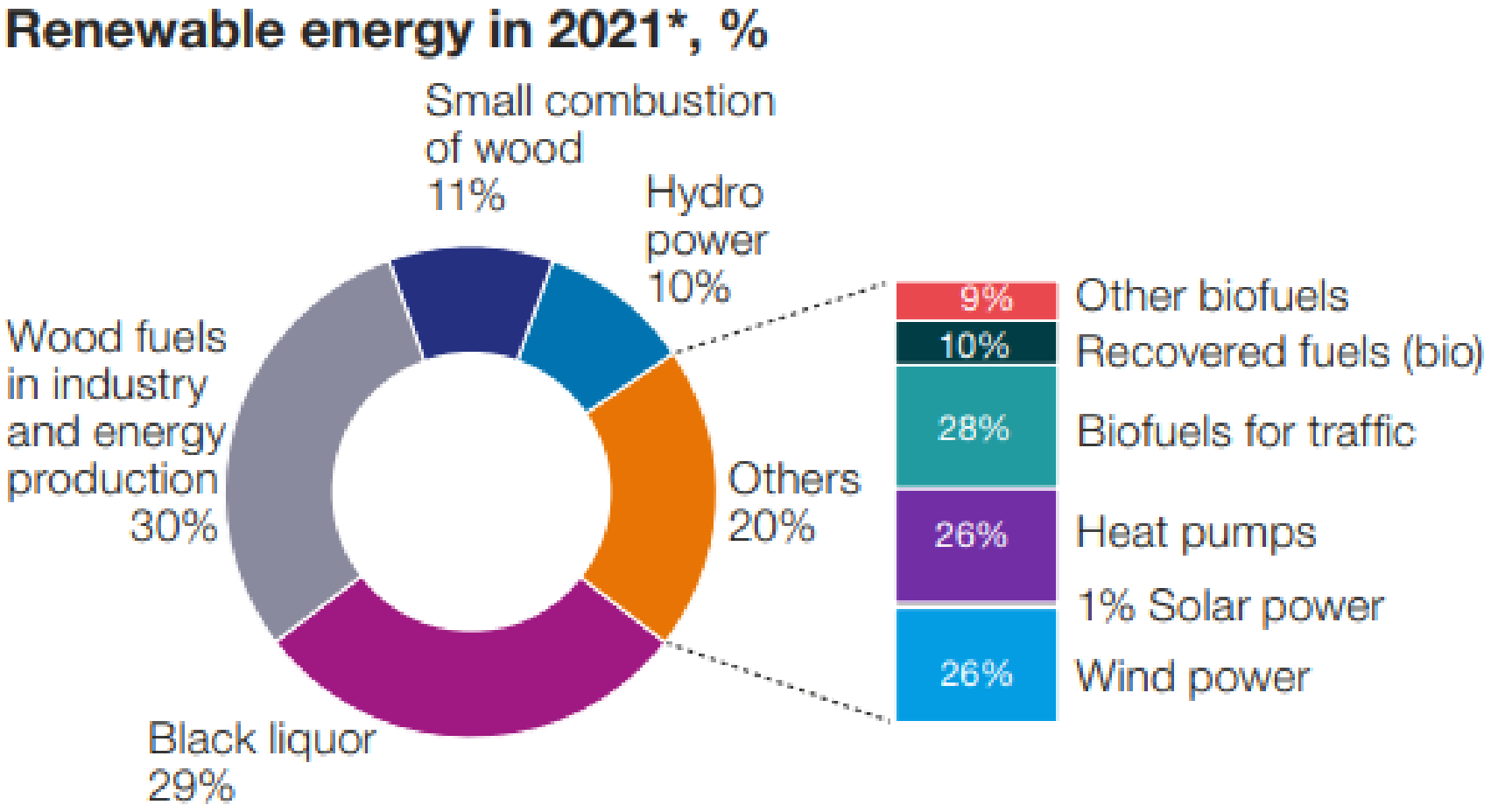
Finland´s announcement to EU on renewables in 2030: 51 %



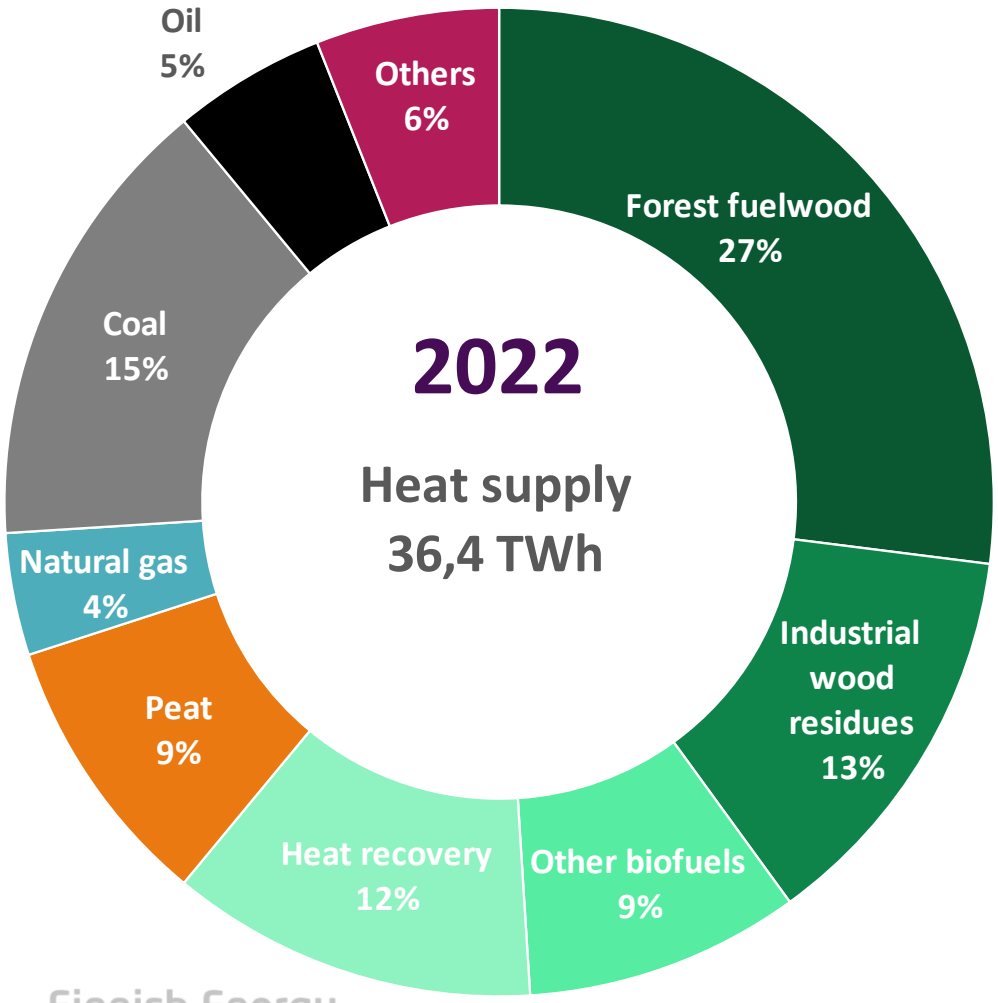
Activities in all sectors needed:
Industrial energy
Heating
Electricity
Transport fuels

Source: Eurostat

Renewable energy in Finland

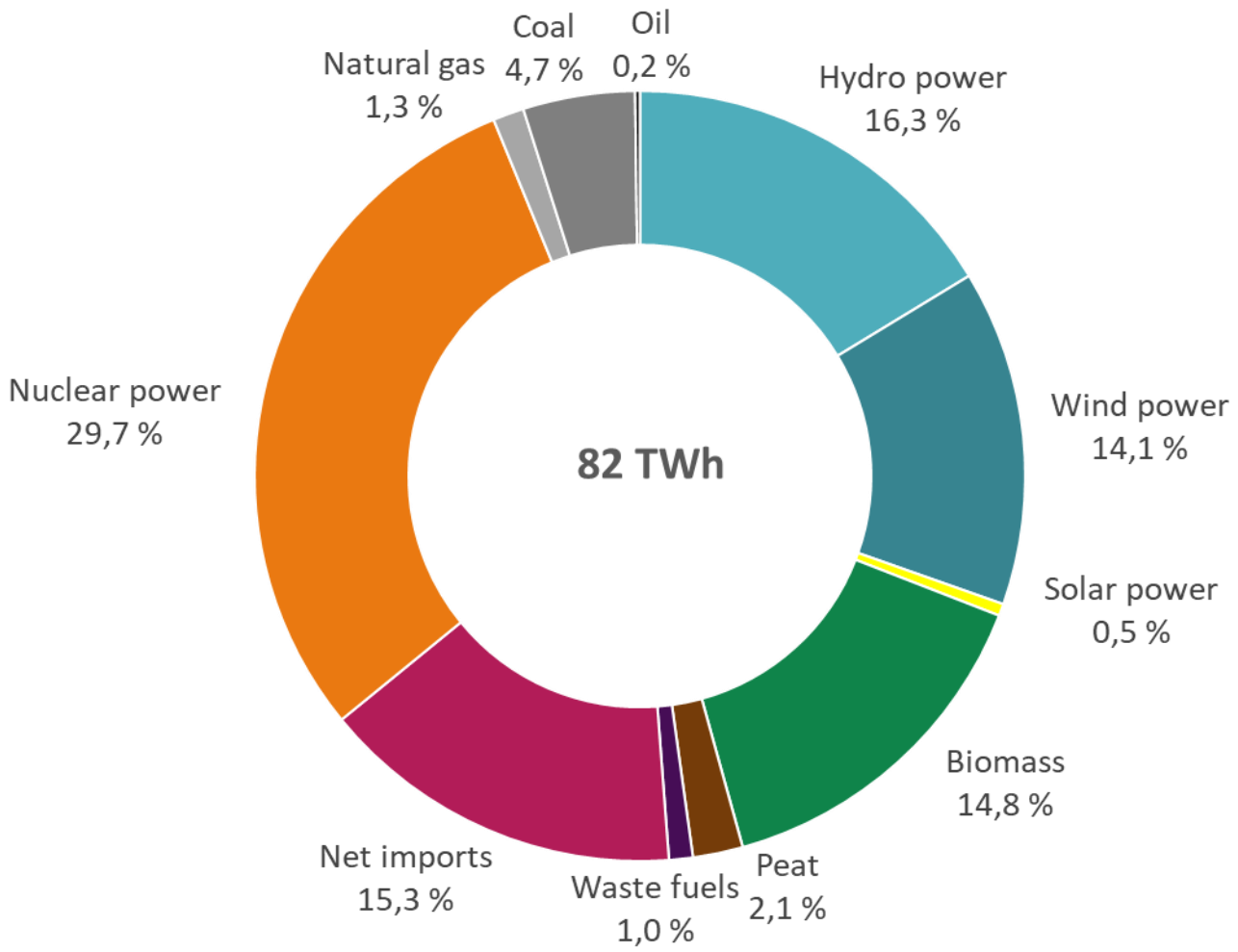


District heating – energy sources in Finland



- During last 10 years
  - Share of renewables has increased from 24 % to 49 % and heat recovery (waste heats) from 3 % to 12 %
- Coal will be phased out in next 2-3 years, latest by 2029 due to ban on coal in Finland.
- Electrical district heating (electric boilers) will be introduced and will be significant flexible users of wind power.

Electricity by energy source and net imports in Finland in 2022



Finland´s power generation 2022:

- Carbon neutral: 89 %
- Renewables 55 %
- CO2-emissions: 64 g/kWh$_e$

  (EU average around 270 g/kWh)

Power generation is developing fast

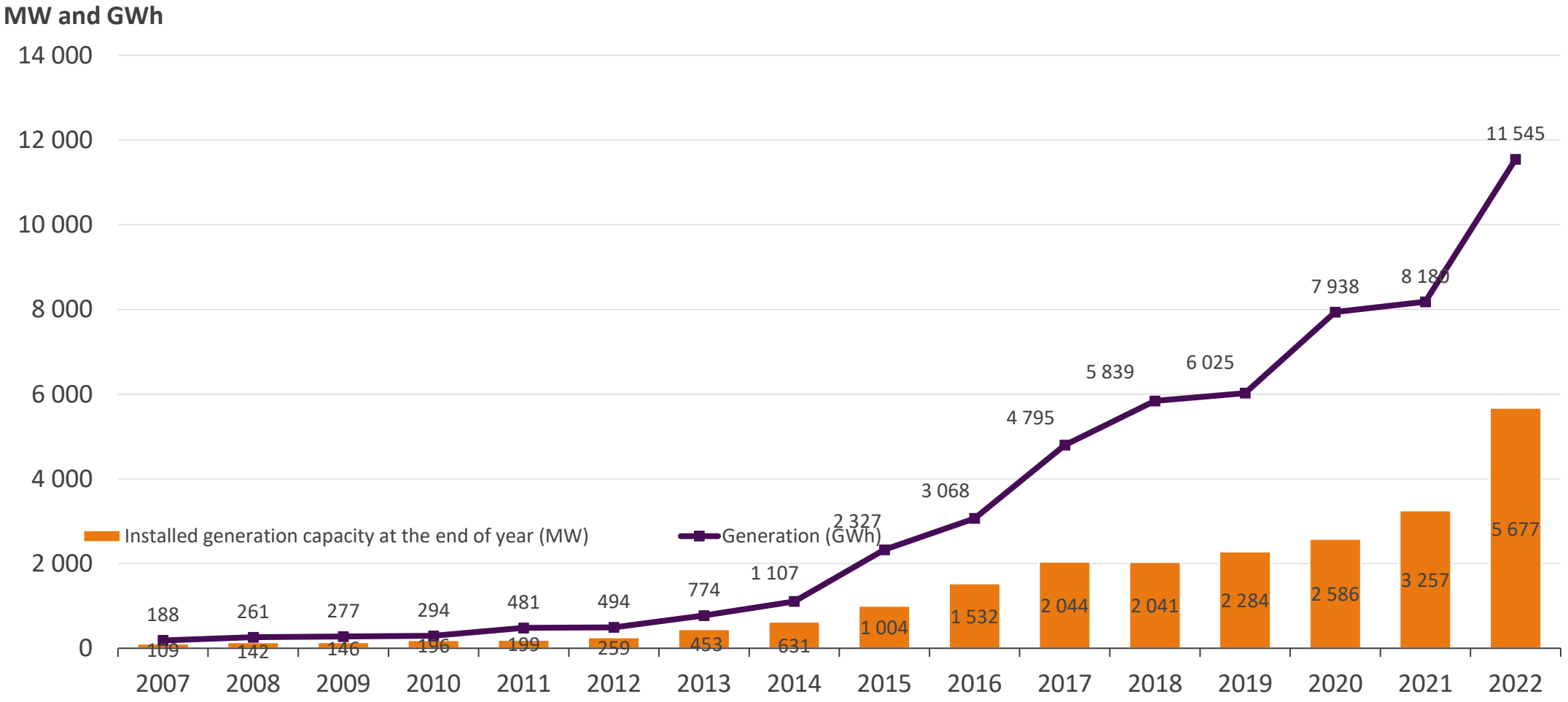
January – April 2023 (vs Jan-Apr 2022)

- Wind power increased from 14 % to 20 % (per consumption)
- Nuclear power increased from 28 % to 34 %
- Net imports decreased from 18 % to 5 %
- CO2 emissions fell from 68 g/kWh to 53 g/kWh (of generation)

In near future, 1000 – 2000 MW new wind power will be introduced annually

Wind power grows rapidly:

Capacity increased 76 percent and production 41 percent



Tremendous opportunities to increase wind and also solar

- Huge amount of wind and solar power projects
  - On-shore wind projects under development alone could double or triple Finnish power generation
  - Multiple off shore wind power projects
- Industrial scale solar power emerging this year

There is no single answer to
Why are companies investing in wind in Finland

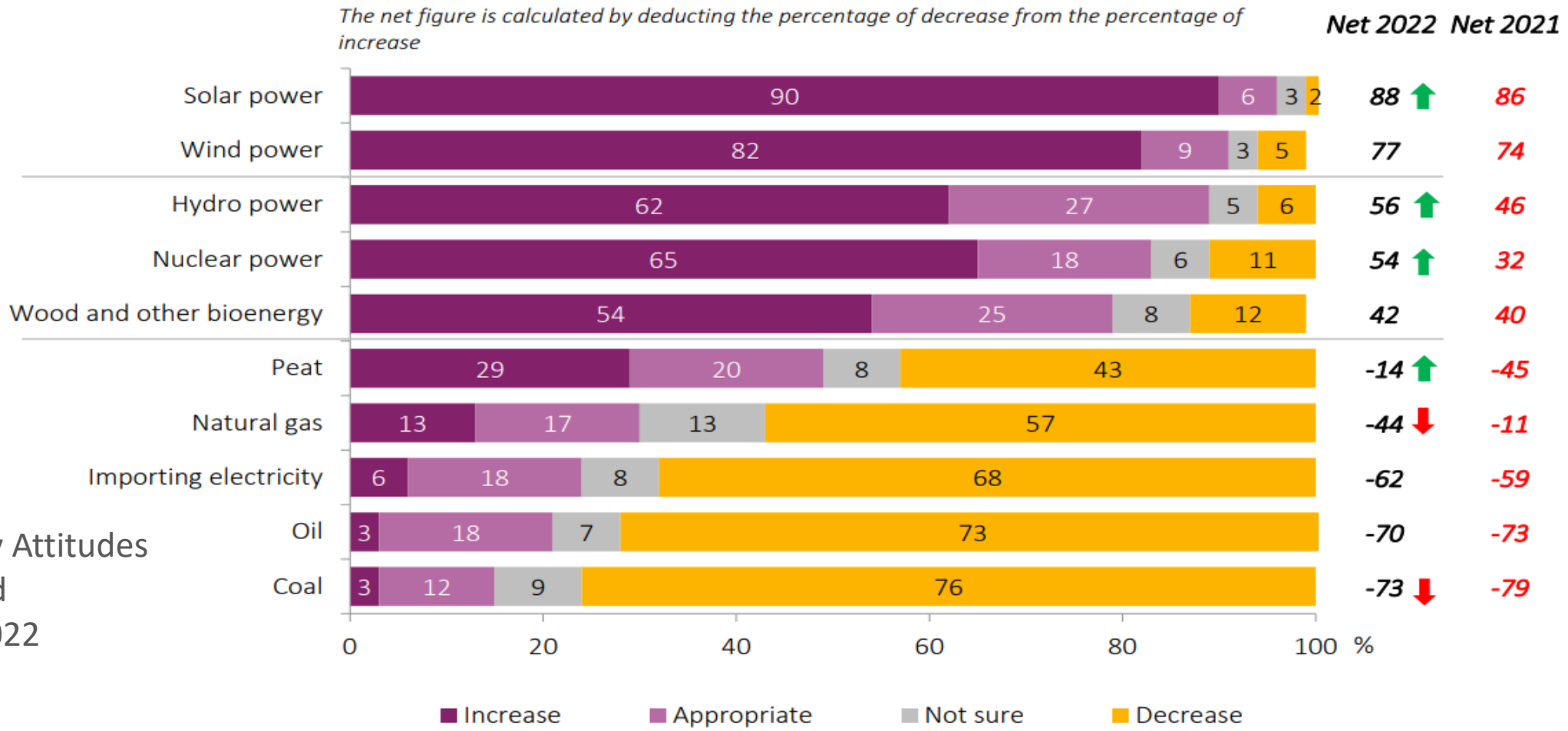
- Relatively good wind conditions
- Large land area with low population
- Municipalities actively want to have wind power
  - Real estate tax is municipal
- National grid enables investments
- No national subsidies or tenders – market is open for all investors
- Market has grown big enough for suppliers and subcontractors
- Customers want additional renewable electricity and are ready for PPA´s

People´s opinion on different energy sources for electricity generation

Suomalaisten energia-asenteet 2022

In which direction should our electricity generation be developed?

All respondents, n=1,000



Finnish Energy Attitudes
Poll conducted
14.10.-2.11.2022

Climate neutral energy system is possible and a great opportunity

Energiateollisuus