
SYSTEM
EARTH
AIR
From emissions to opportunities
BUSINESS AND SOCIETY
Sustainable renewal of business, industry and society
WATER
Complex water adequacy and water treatment needs
ENERGY
Transition to carbon neutrality

BIO-CO2 USE AND REMOVAL 2024, HELSINKI 16.4.2024

WHERE THE BIOCCS IS GOING

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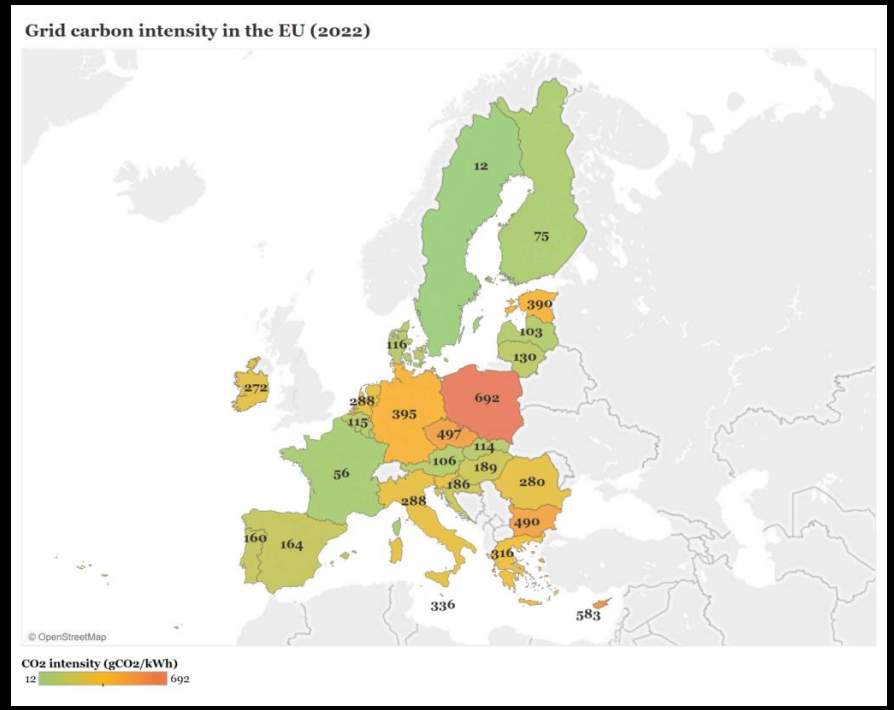
World has always changed and humans have survived

Whether we like or not the energy transition happens

- What is happening in Finland
- Why do we need carbon sinks
- What should be done post 2040
- What should be done with carbon

What is happening in Finland

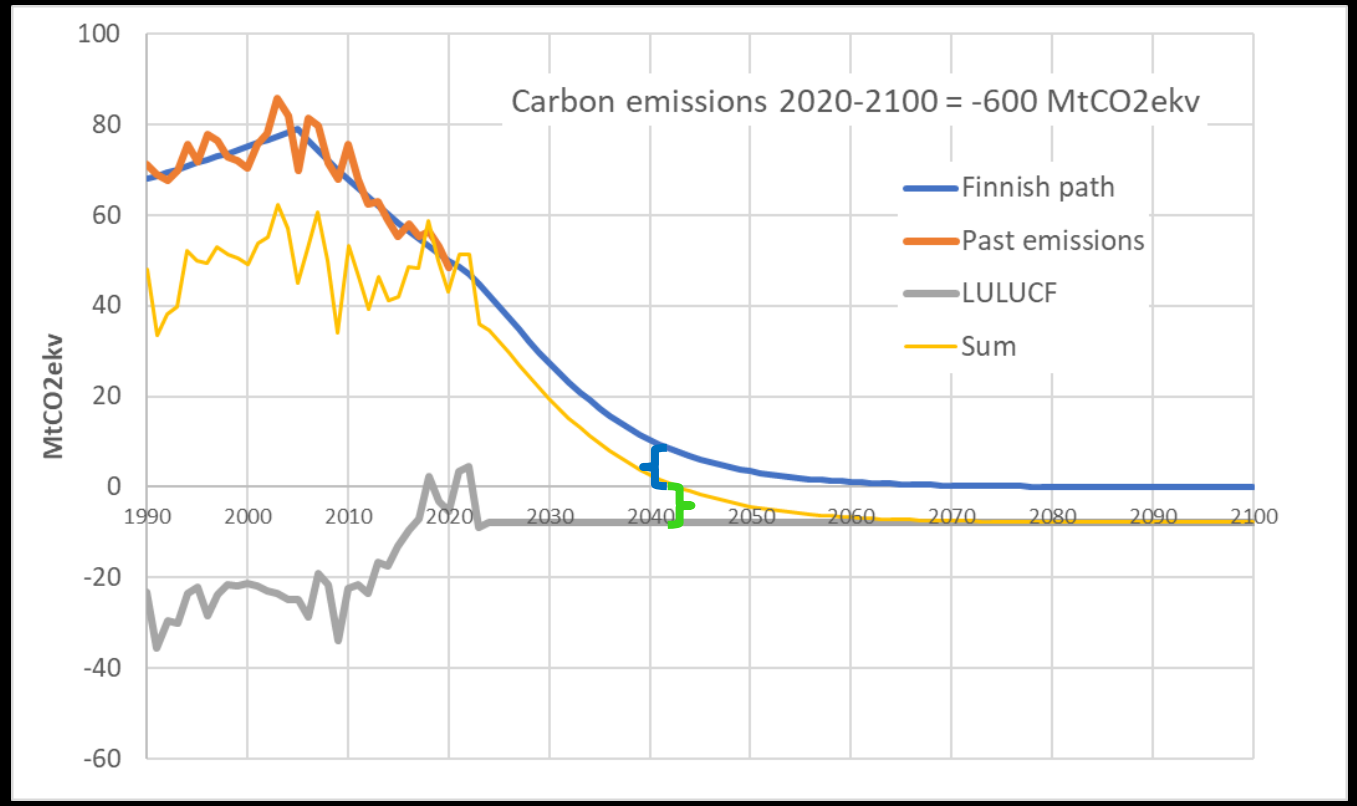
- Wind power will shortly generate a third of Finnish energy production
- Finnish electricity was ~33 gCO2/kWh in 2023
- Fast transfer to electric mobility
- End of coal and peat use for energy is here
- Finnish Industry to end fossil CO2
- Bioenergy, bioeconomy and BECCS are Finnish strengths
- First P2X investments; Tampere, Harjavalta,…
- ~2000 MW electric boiler capacity



Why do we need carbon sinks

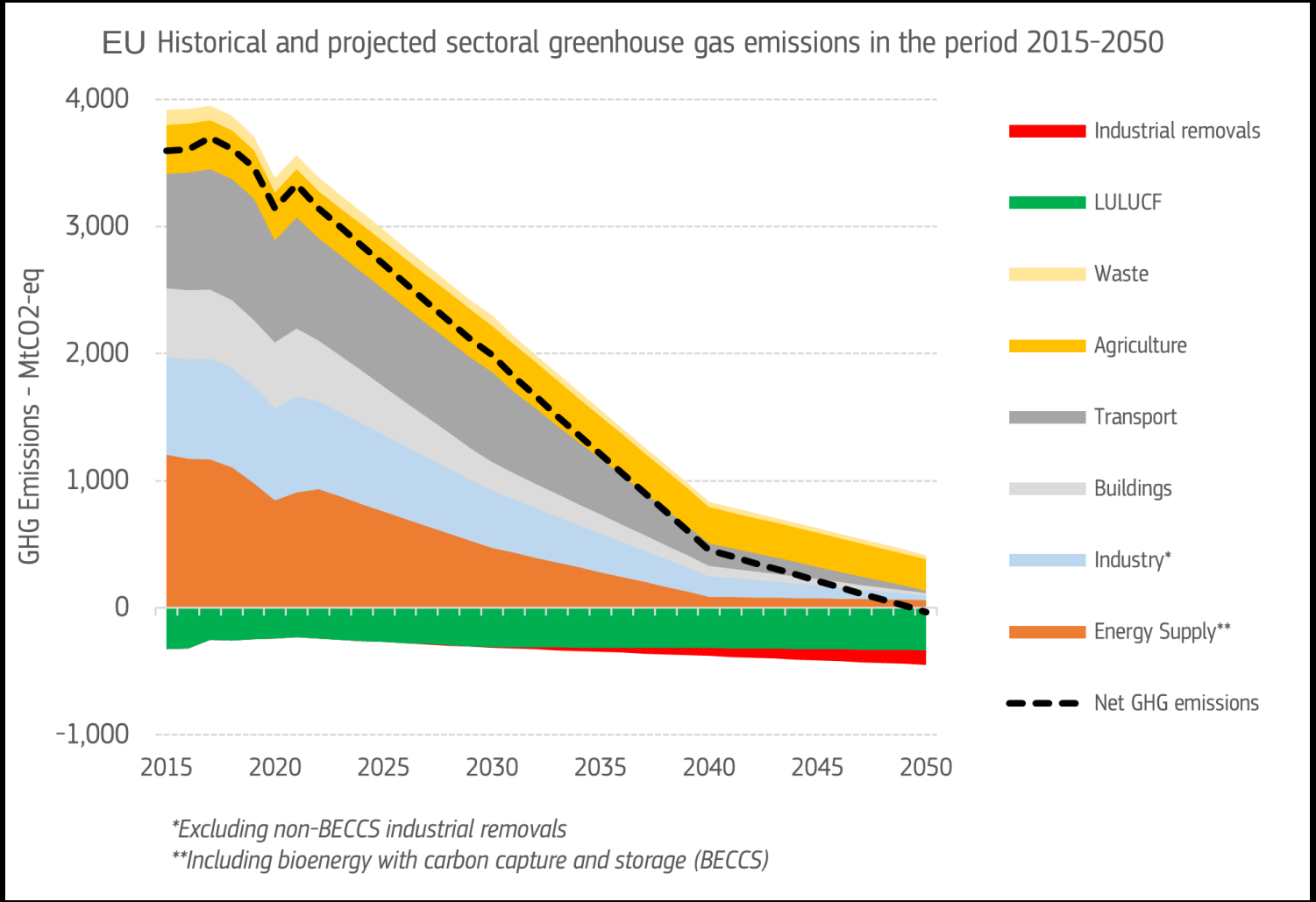
Carbon negative Finland by 2035

- National target, 2035 carbon neutrality, not yet sure
- Current trajectory ~2045 carbon neutrality without additional effort well before EU target
- LULUCF level in 2040 not yet clear due to recent changes in accounting*
- Large use of BECCS/BECCU not yet envisioned



*Additional 20 MtCO2e from about 5 Mha former peat lands

We have chosen not to end all fossil use?

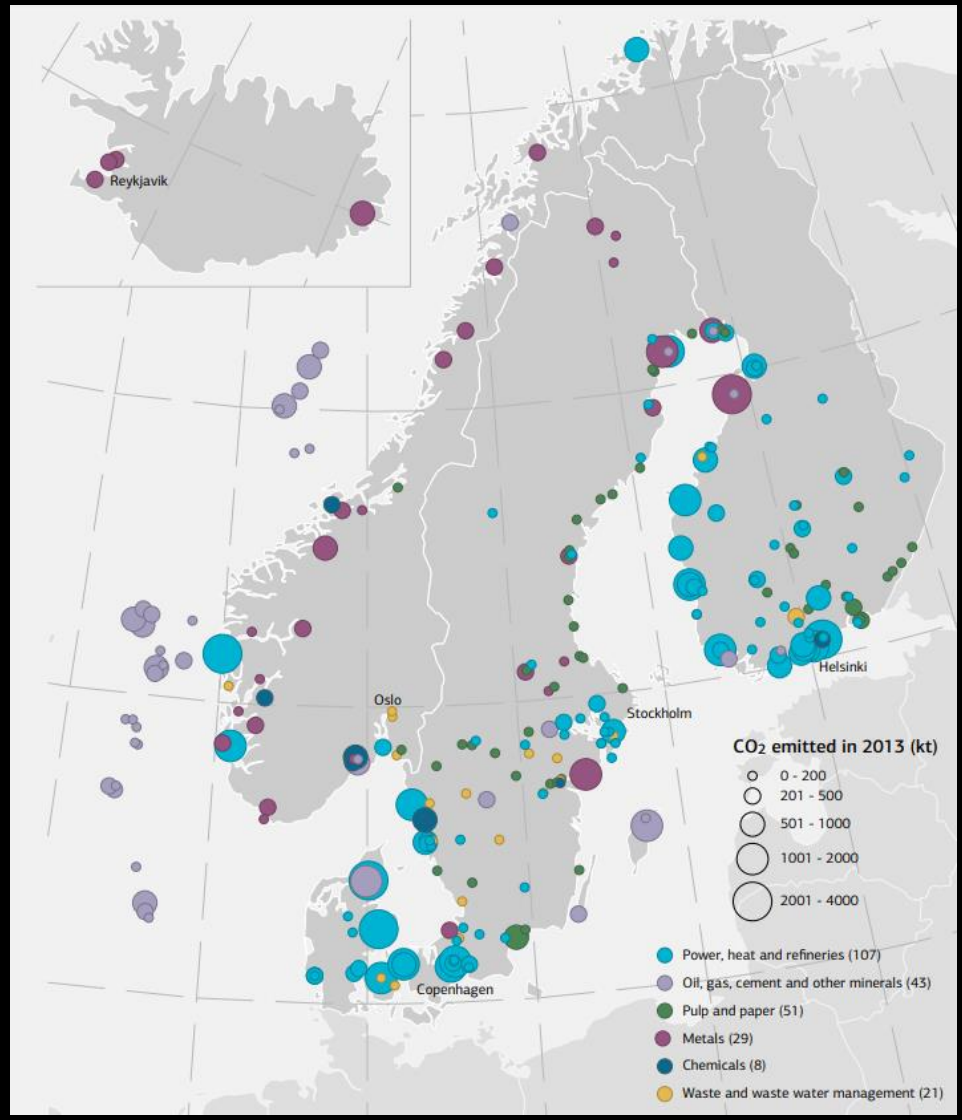


EU needs negative CO2 emissions to balance continuing fossil CO2 & agri

https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2040-climate-target_en

Nordic is poised to lead in carbon economy

- Large low carbon electricity
- Combined with large pulp and paper sector & CHP, large point sources
- BECCS in Nordics does not require additional biomass use
- Storage possibilities in Norway
- Nordics are poised to be a powerhouse of BECCS/BECCU



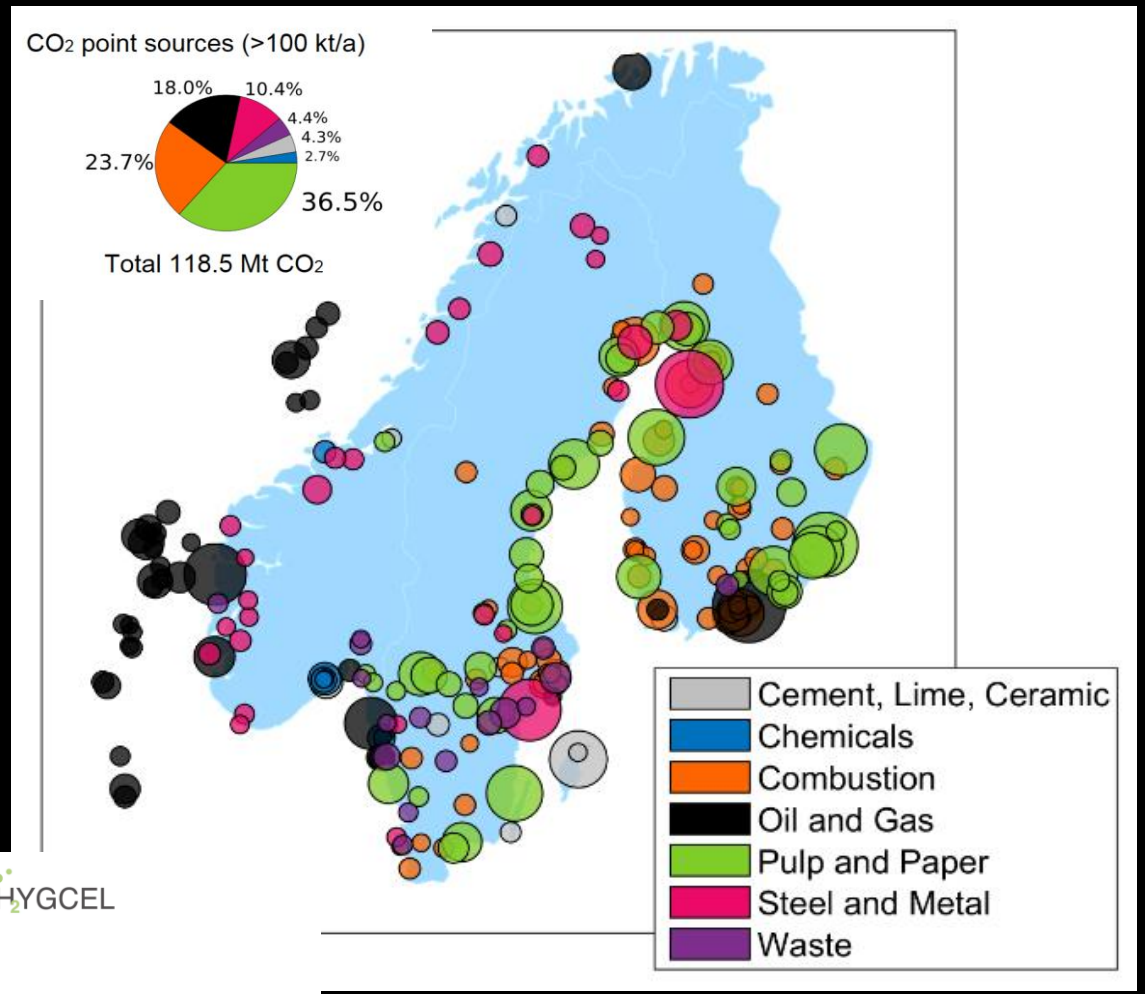
How will CC do after 2040

Role of CC after 2040

- Providing e-fuels to land transport, but will ”no combustion engines” kill all transport business
- Providing BECCS for required negative carbon removals, but who will pay?
- Providing carbon to chemicals and textiles, but fossil alternatives have still advantage

Where to use our carbon needs more thought

Will Nordics do BECCS, H2 or e-fuels?



HYGCEL – Hydrogen and Carbon Value Chains in Green Electrification

- Biogenic CO2 >50 MtCO2/a
- If 10 MtCO2/a to methanol
  - Electricity 9000 MW
  - Production 7.5 MtMeOH
- Value ~8 000 M€
- If 10 MtCO2/a BECCS
- Value ~1 000 M€
- If just hydrogen
  - Production 1.5 MtH2
- Value ~2 000 M€

THREADING-CO_2

Can we use CO2 to produce fibres

Textiles from CO2!

Replacing textiles from fossils

UANTWERP, FAIRBRICS, AIMPLAS, NALDEO, LUT LAPPEENRANTA, DIGIOTOUCH, TECNALIA, CIAOTECH, DITF, FAURECIA, NALDEO, SUREPURE, LTC

Funded by the European Union

HORIZON-CL4-2022-TWIN-TRANSITION-01-11: Valorisation of CO/CO2 streams into added-value products of market interest grant agreement N° 101092257.

Where to get the carbon for EU in 2050?

- EU needs 450 $MtCO_2$ carbon removal CCS
- In 2050 EU requires yearly 5000 TWh of e-fuels and e-chemicals[2] or ~300-1000 $MtCO_2$
- EU bioenergy use is ~1700 TWh[3] corresponding to ~600 $MtCO_2$
  - Direct use of forest biomass 263 Mm^3
- EU fellings 2022 were 532 Mm^3 corresponding to ~500 $MtCO_2$ from wood
- From current operations BECCS ~300 $MtCO_2$, where to get the rest?
- In addition, biomass is required for new buildings and high value end use e.g. lignin products and materials

[2]Ram et al., 2022, Accelerating the European renewable energy transition, Brussels.
[3]European commission, 2021, Brussels.

Carbon negative LUT in 2024

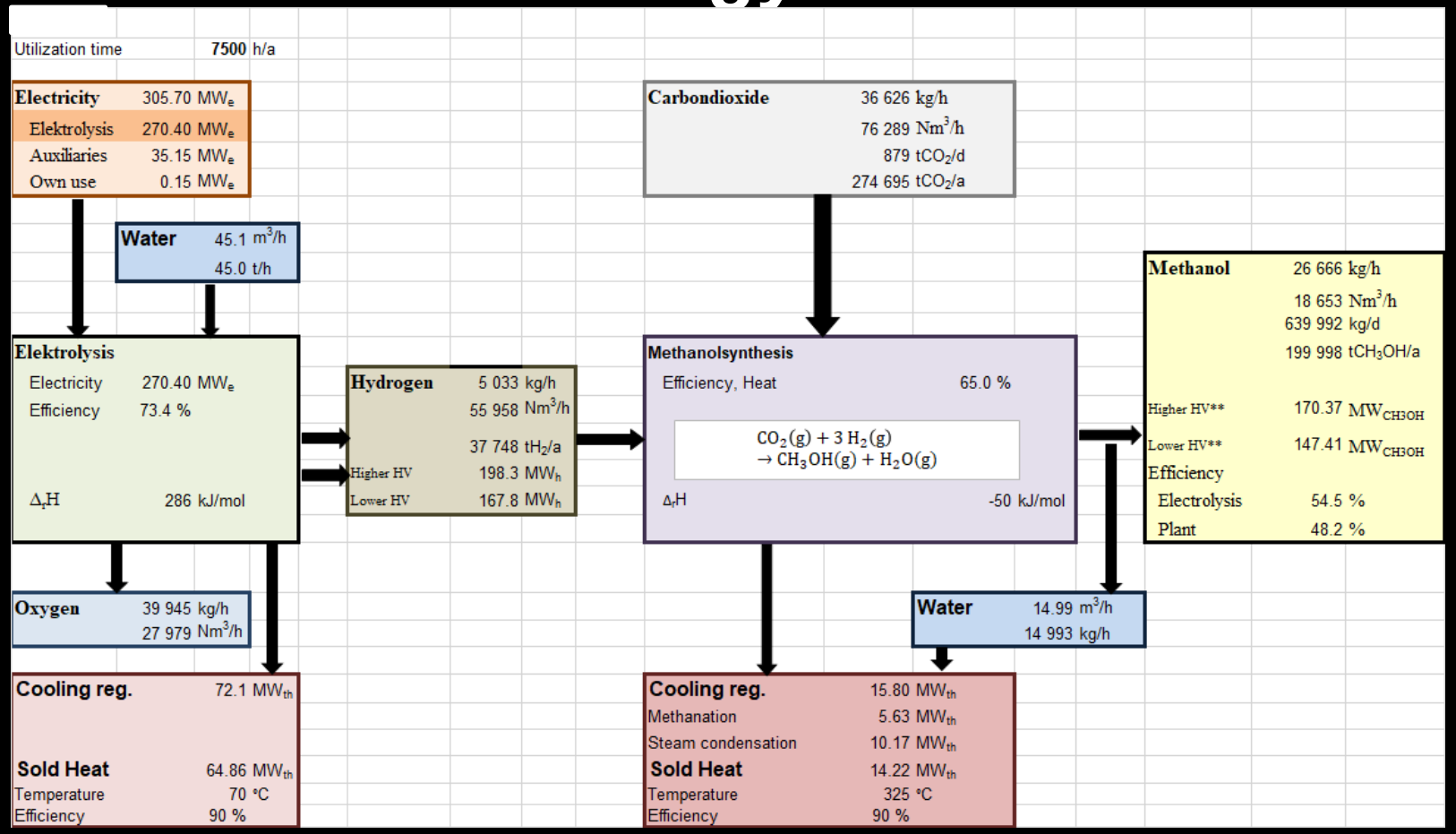
We aim to stop climate change – not merely adapt to it.

Kiitos


LUT
University

Build 100 units

Mass- and energybalance - 200 kt/a CH_3OH-plant



Sisään		
- sähkö	2 293 000	MWh/a
	2 293	GWh/a
- hiilidioksidi	275 000	tCO_2/a
- vesi	337 000	tH_2O/a
Ulos		
- metanoli	200 000	tCH_3OH/a
	1 106 000	MWh/a
- lämpö H1	486 000	GWh/a
- lämpö H2	107 000	GWh/a
- happi	300 000	tO_2/a
Investointi	339	M€

POHJOIS-KARJALA Maakuntaliitto