Role of carbon free energy in transition to climate neutral society

Aalto Energy Forum
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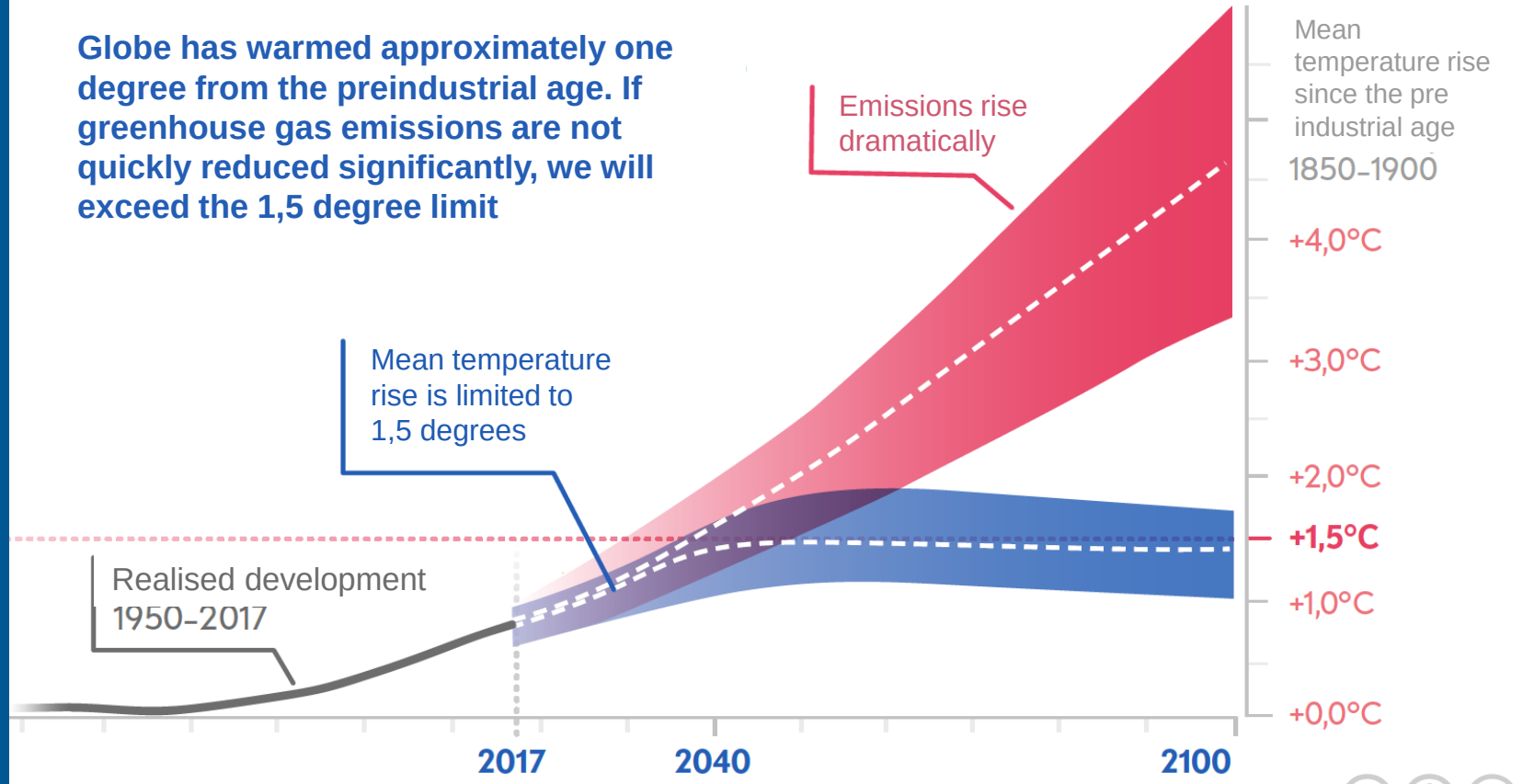
Decarbonising primary energy is the key to combat climate change.

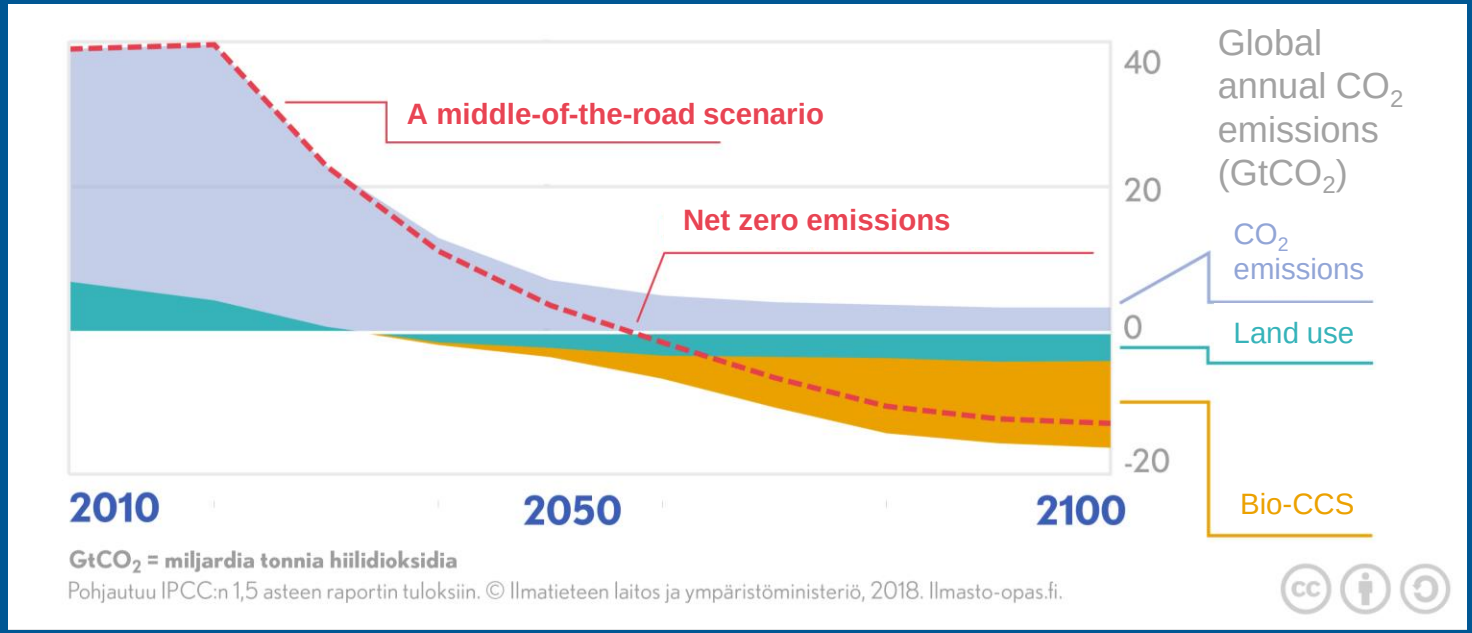
Climate change 101

Globe has warmed approximately one degree from the preindustrial age. If greenhouse gas emissions are not quickly reduced significantly, we will exceed the 1,5 degree limit



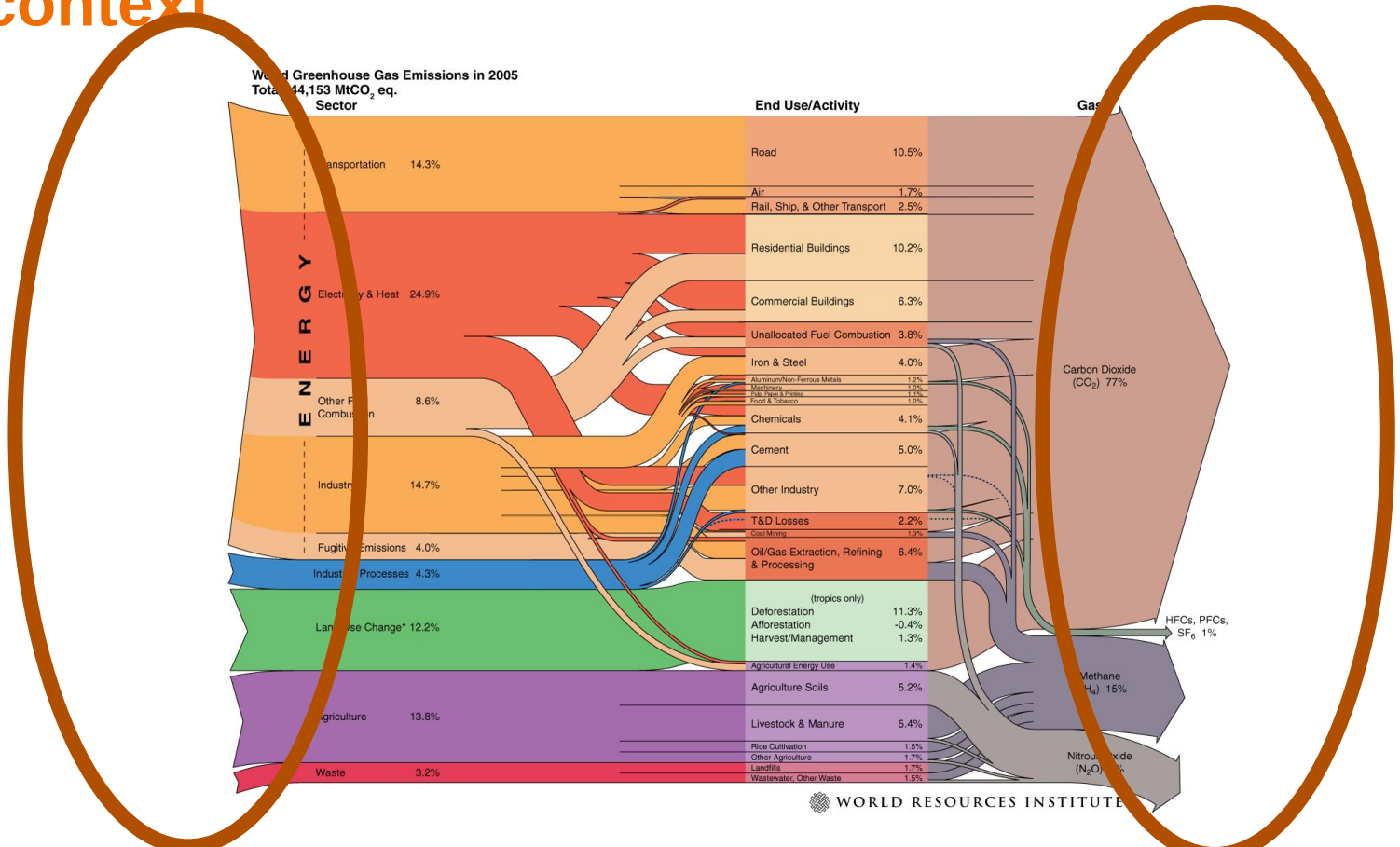
Pohjautuu IPCC:n 1,5 asteen raportin tuloksiin. © Ilmatieteen laitos ja ympäristöministeriö, 2018. Ilmasto-opas.fi.

In order to limit the global warming to below 2dg level NET ZERO emissions should be reached by mid century

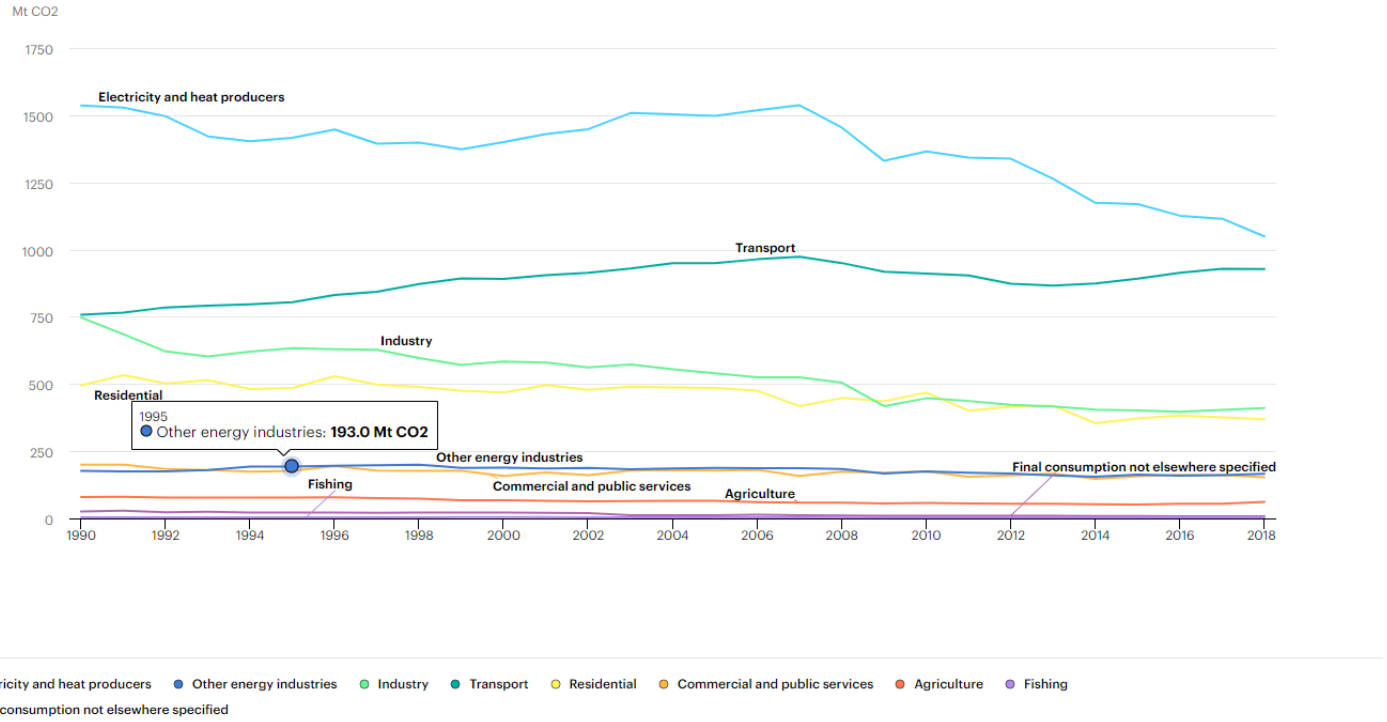


What's up CO_2?

It is the physical world that matters in this context



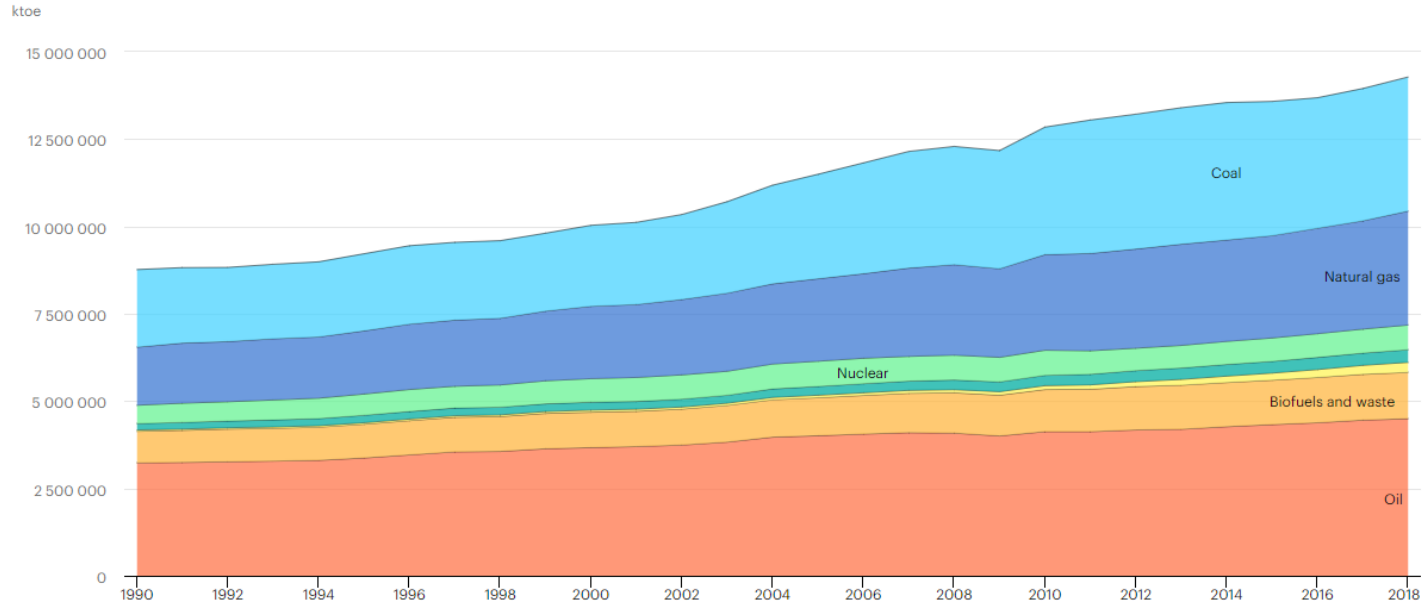
Electricity generation is decarbonisong faster than other sectors



CO2 emissions by sector EU-28 (IEA)

Systemic approach to CO_2 mitigation and what to do

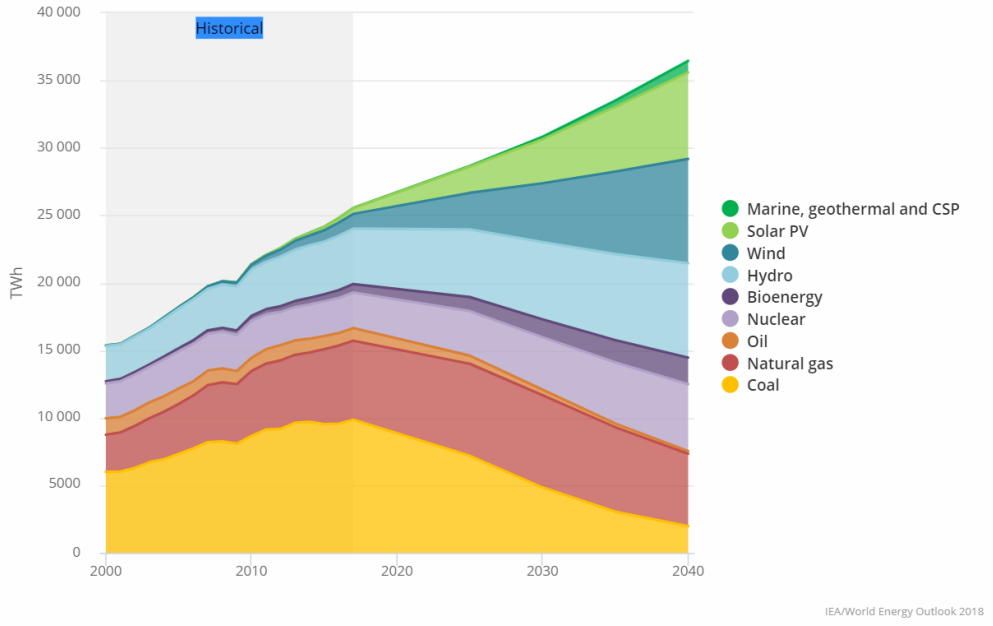
Total world energy supply



IEA 2020

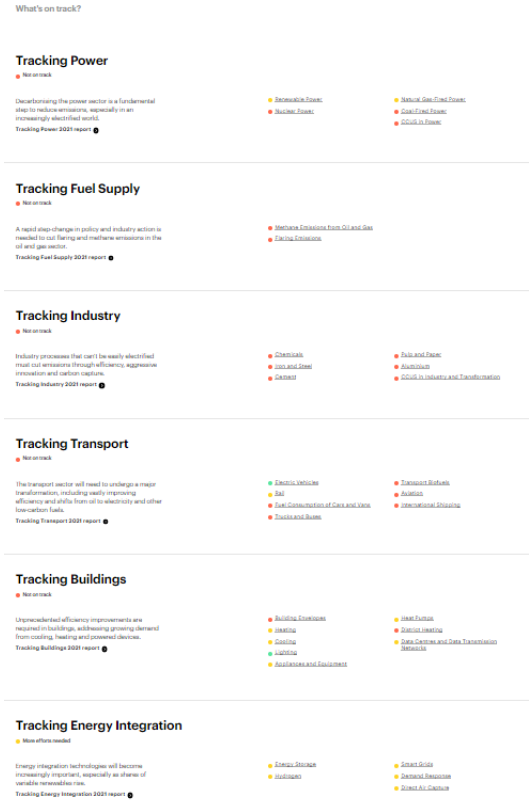
Coal Natural gas Nuclear Hydro Wind, solar, etc. Biofuels and waste Oil

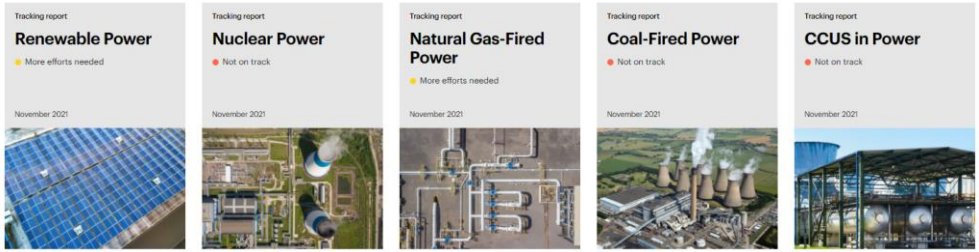
Sustainable Development Scenario (SDS)



Sustainable Development Scenario (SDS)
Outlines an integrated approach to achieving internationally agreed objectives on climate change, air quality and universal access to modern energy.

Tracking clean energy progress

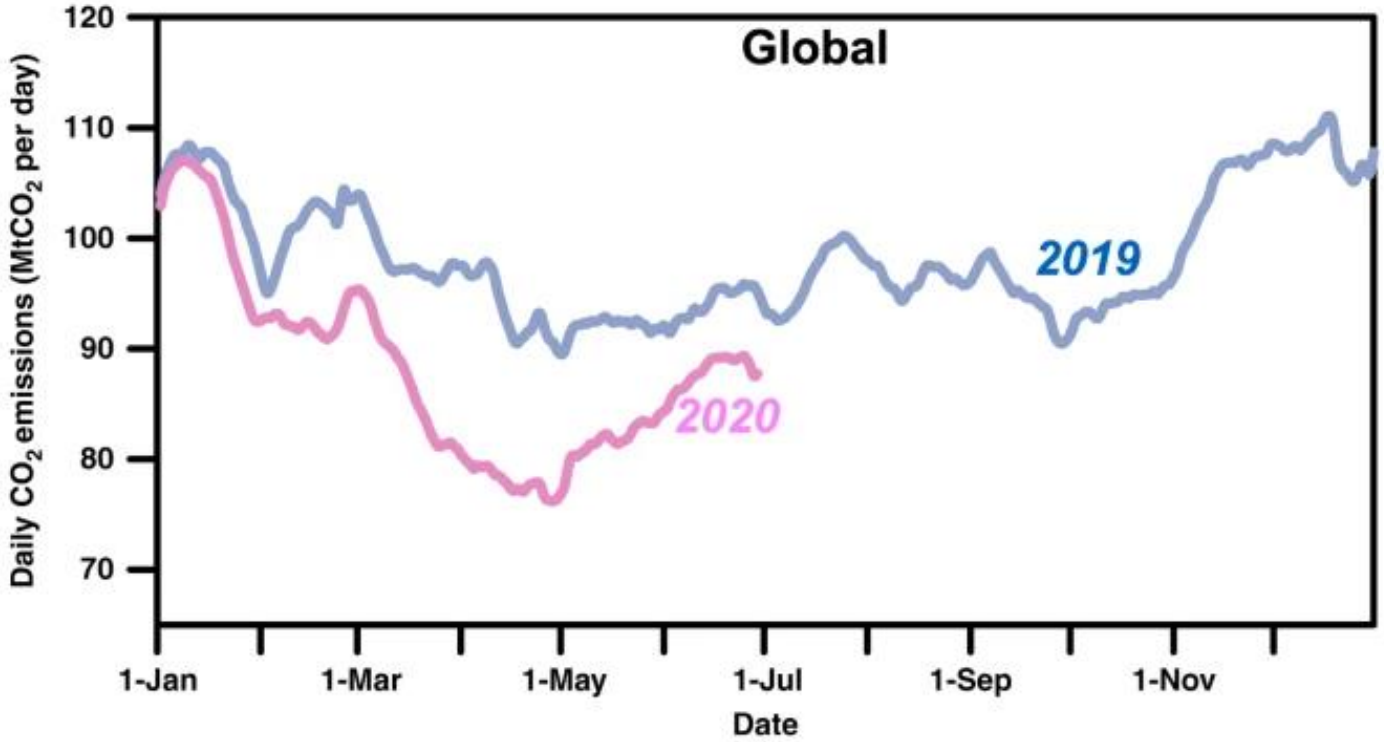




https://www.iea.org/topics/tracking-clean-energy-progress

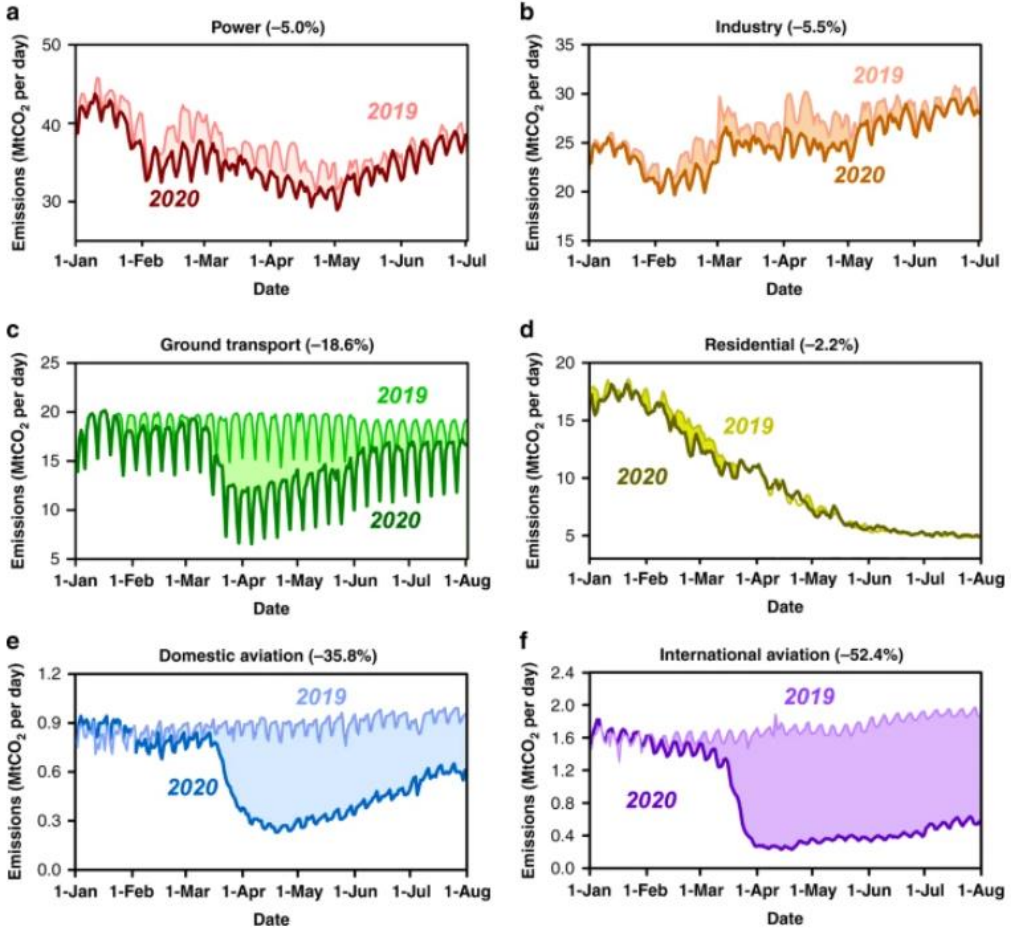
Covid-19

Effects of COVID-19 on global CO2 emissions



Liu, Z., Ciais, P., Deng, Z. *et al.* Near-real-time monitoring of global CO_2 emissions reveals the effects of the COVID-19 pandemic. *Nat Commun* 11, 5172 (2020). https://doi.org/10.1038/s41467-020-18922-7

Global daily CO2 emissions



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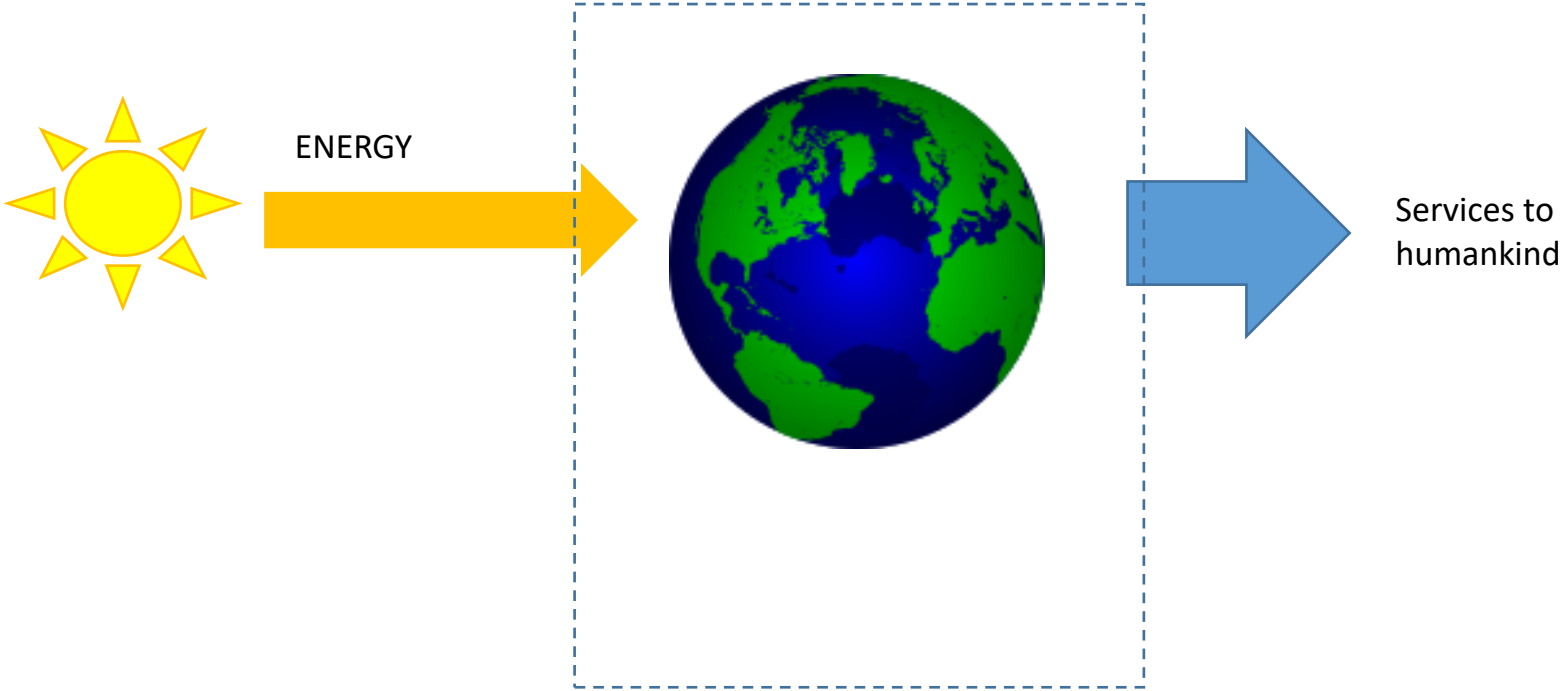
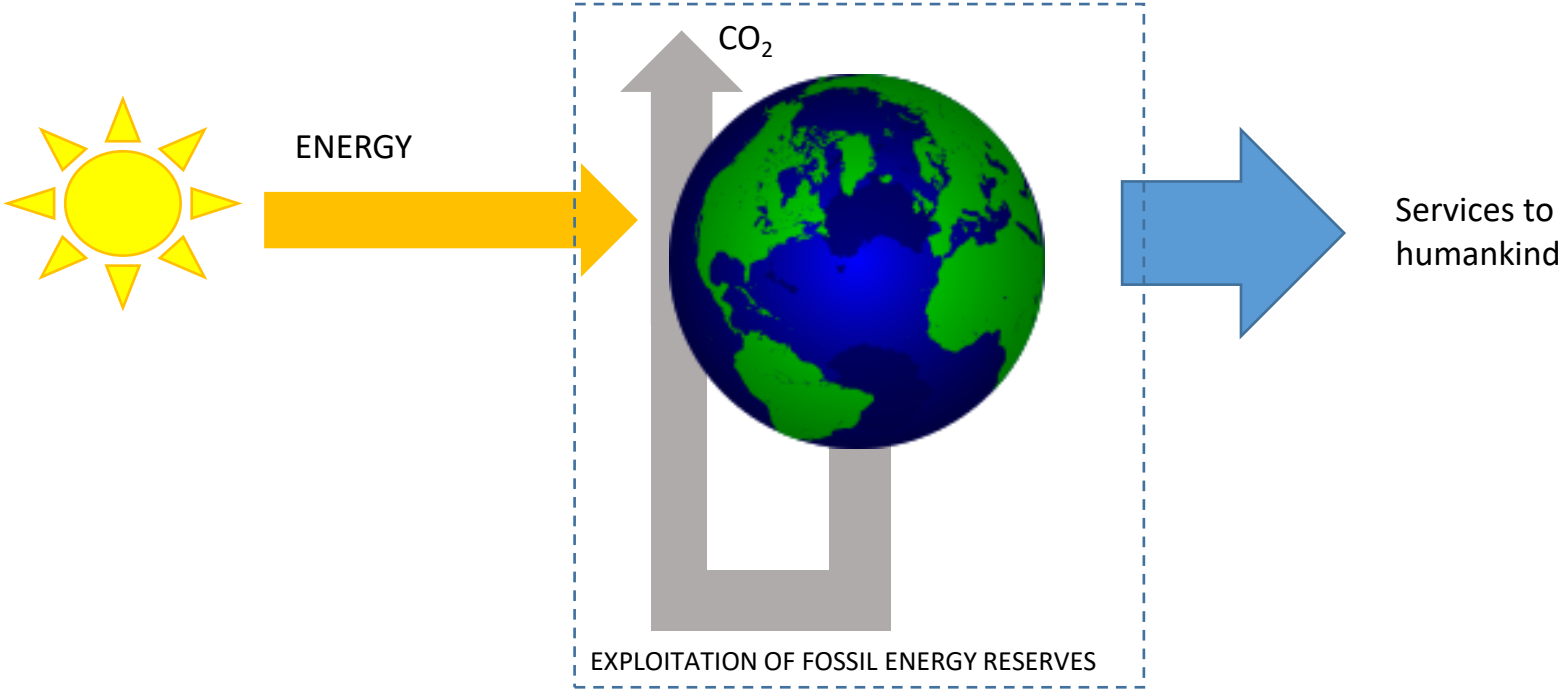
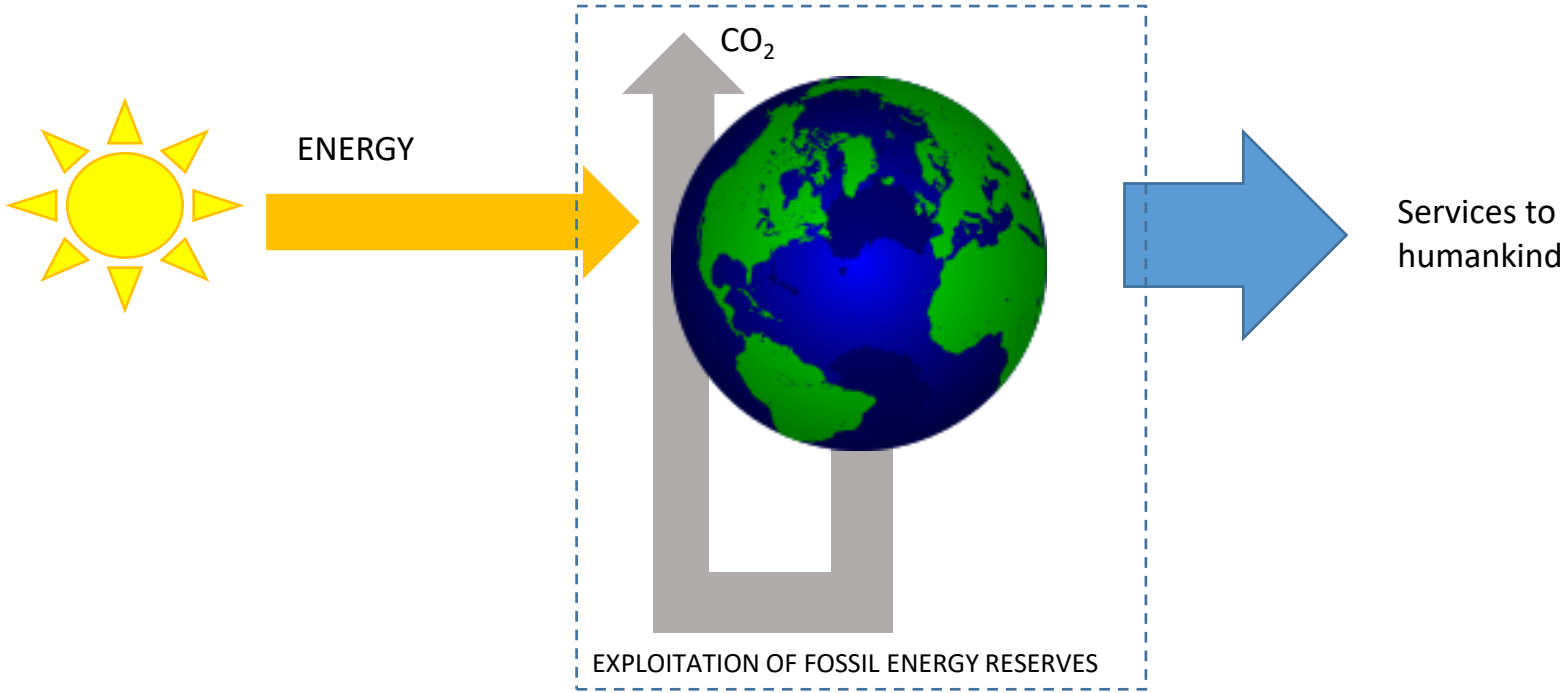

ENERGY
Services to
humankind


CO_2
ENERGY
Services to humankind
EXPLOITATION OF FOSSIL ENERGY RESERVES



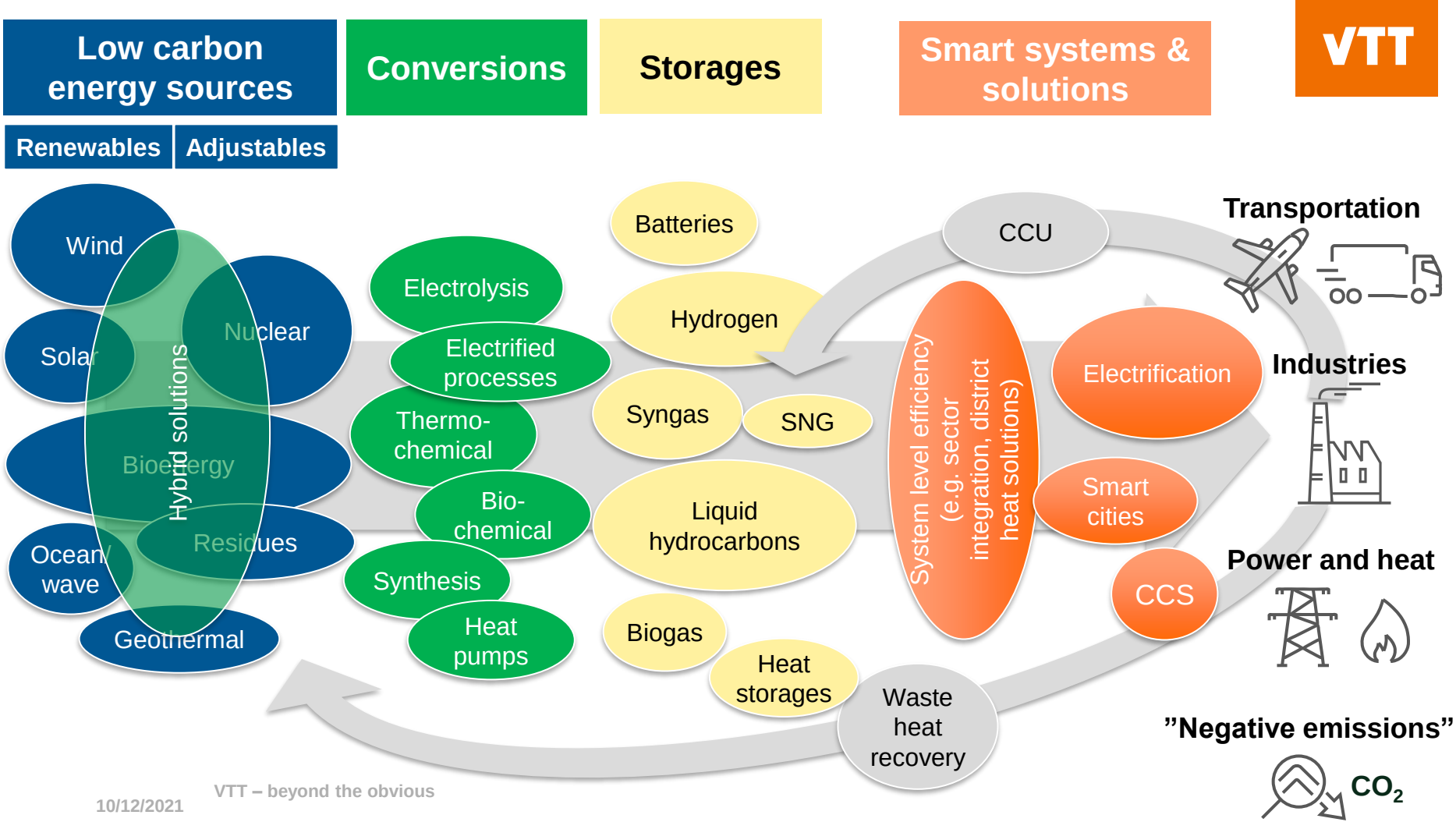
How to reduce GHG emissions

Switch to sustainable energy inputs

Increase efficiency of resources used & CDR

Consume less and smarter

Solutions


Low carbon energy sources
Conversions
Storages
Smart systems & solutions
VTT
Renewables
Adjustables
Wind
Solar
Nuclear
Hybrid solutions
Bioenergy
Residues
Ocean/ wave
Geothermal
Electrolysis
Electrified processes
Thermo-chemical
Bio-chemical
Synthesis
Heat pumps
Batteries
Hydrogen
Syngas
SNG
Liquid hydrocarbons
Biogas
Heat storages
Waste heat recovery
CCU
System level efficiency (e.g. sector integration, district heat solutions)
Electrification
Smart cities
CCS
Transportation
Industries
Power and heat
”Negative emissions”
CO_2

Conclusions

- Decarbonisation of primary energy
- Decarbonisation of primary energy and systemic change

- Energy carriers to enable penetration of low carbon electricity to hard to decarbonize parts of the system
- Carbon dioxide removal

- Decarbonisation of primary energy

VTT

beyond
the obvious

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