

Tavoitteena hiilineutraalius – energian isot trendit

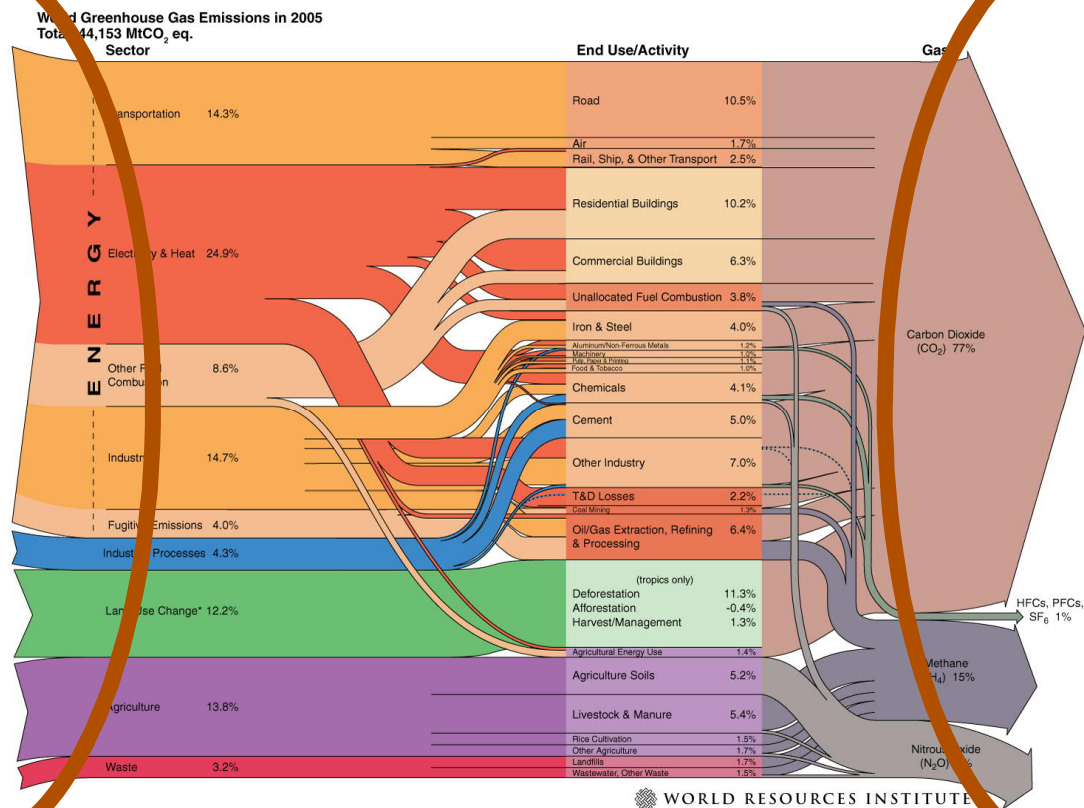
ISY syyskokous 19.11.2020

Antti Arasto

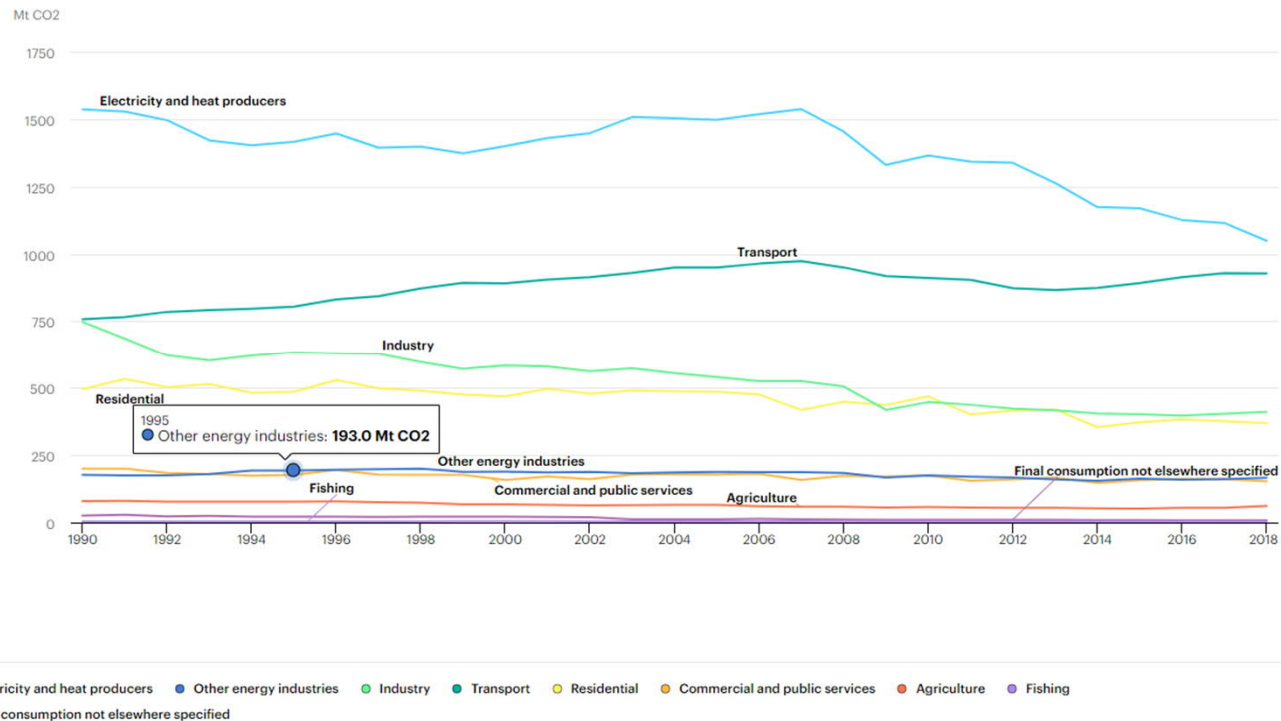
*Decarbonising primary energy
is the key to combat climate
change.*



It is the physical world that matters in this context

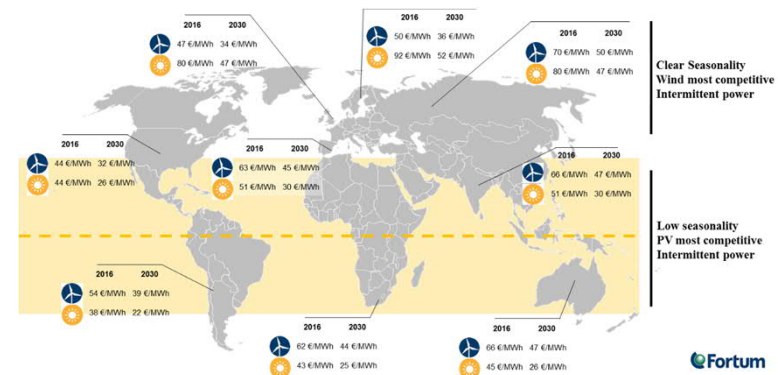


Electricity generation is decarbonising faster than other sectors



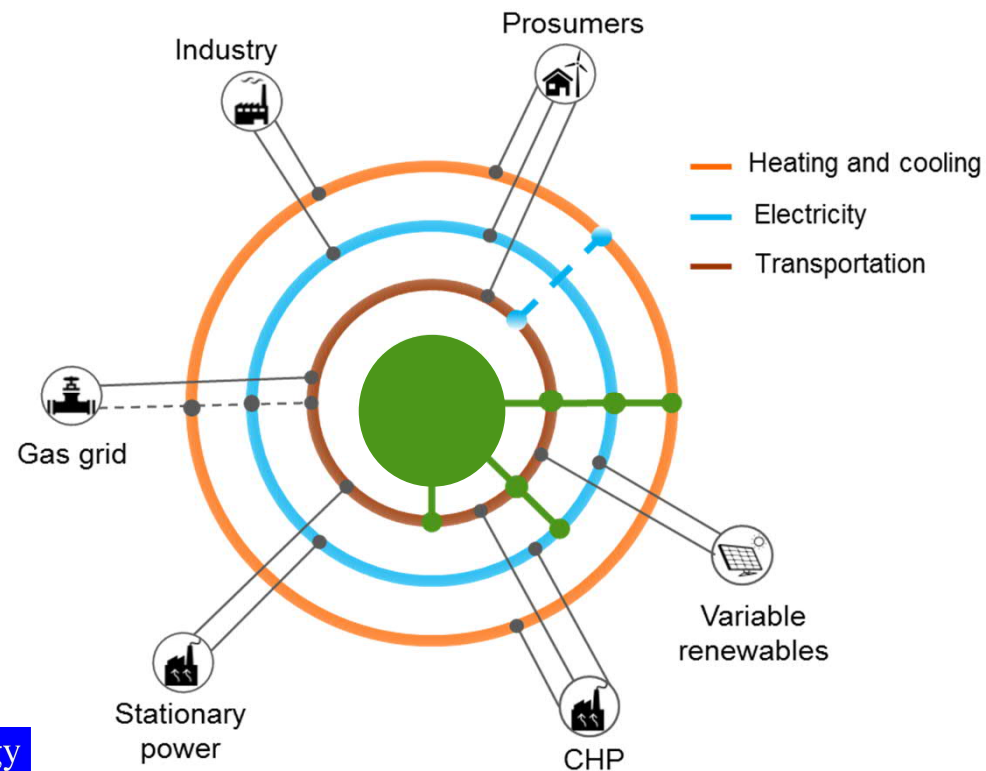
Changing roles, market drivers and business models

- In Europe, 2030 targets and renewable, solar and wind electricity penetration drives market change
- Electrification and price formation change the role of consumables and grids and earning logics will drive change and create new business models

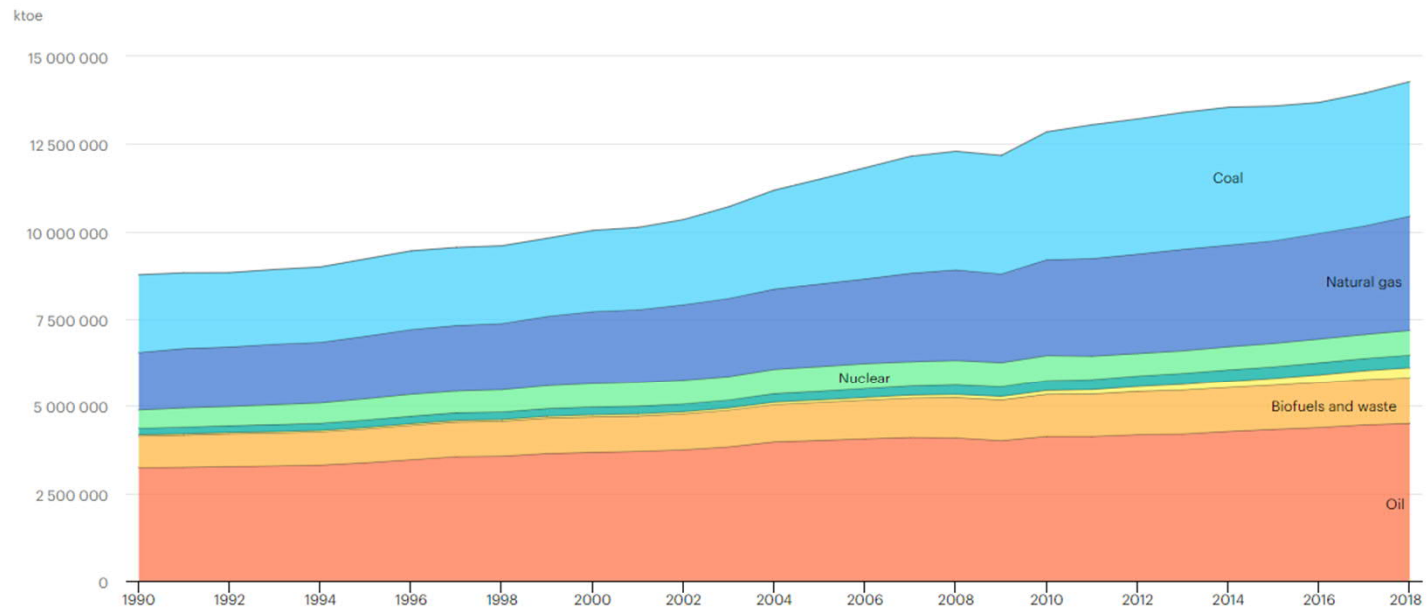


Solar and wind energy resources and associated levelised cost of electricity [Langer, Energy market transformation from energy optimized to capacity optimized system, 16.8.2016, Helsinki]

Energy system will be significantly more distributed, interconnected and more flexible than today's!



Total world energy supply

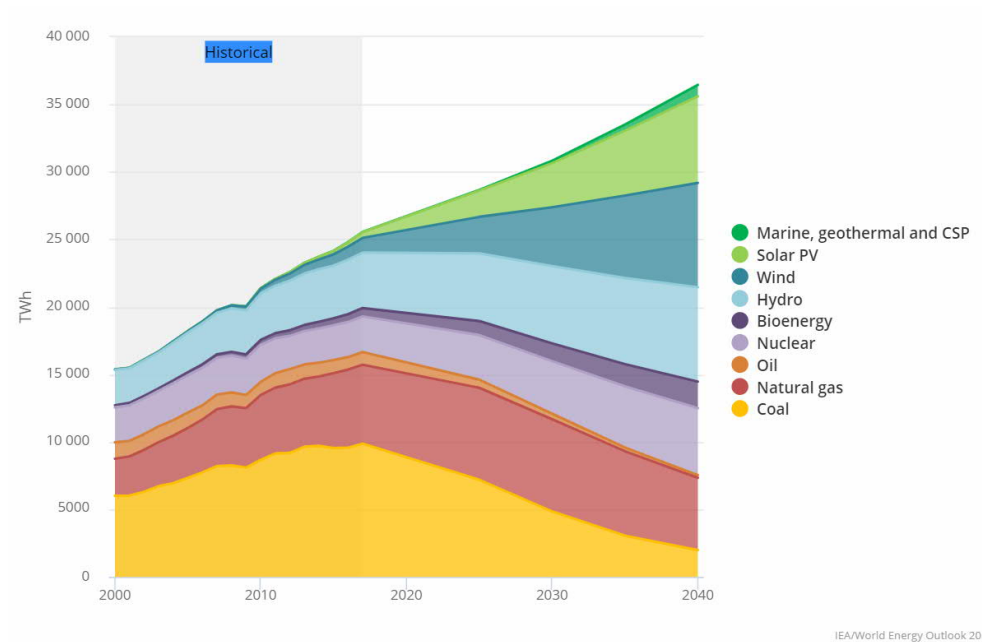


IEA 2020

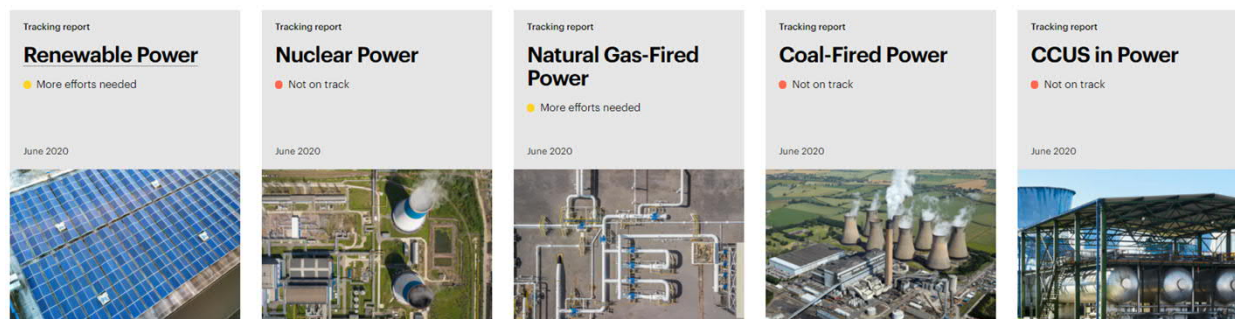
● Coal ● Natural gas ● Nuclear ● Hydro ● Wind, solar, etc. ● Biofuels and waste ● Oil

19/11/2020 VTT – beyond the obvious

Sustainable Development Scenario (SDS)



Tracking clean energy progress



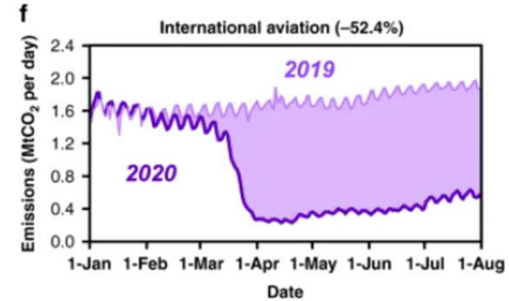
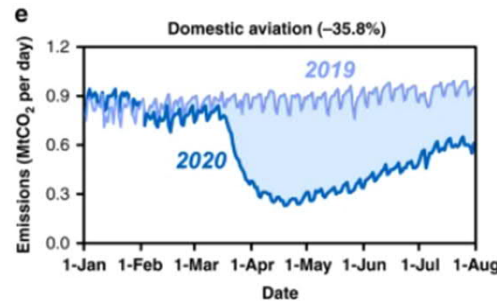
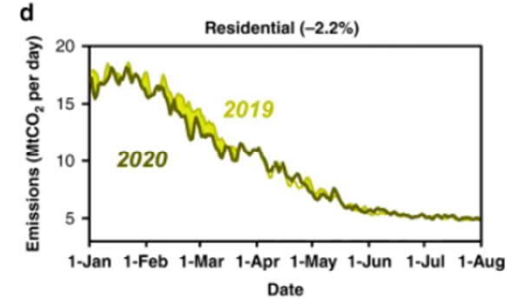
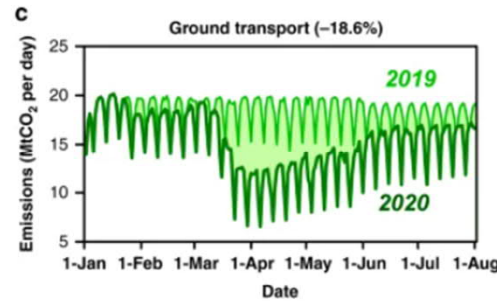
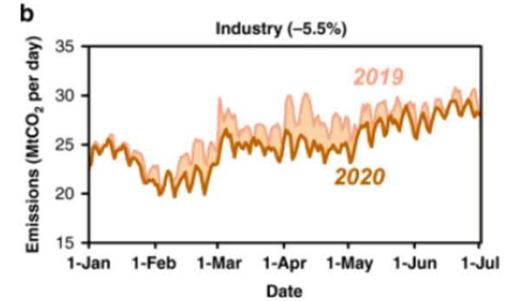
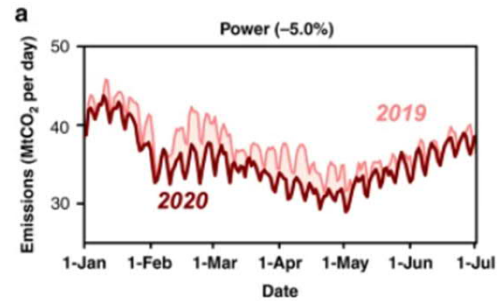
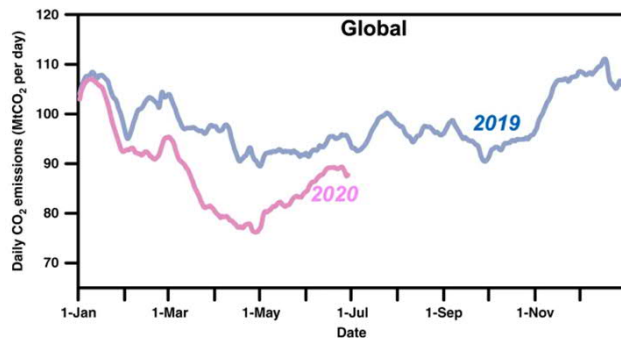
Overview

- Renewable power
- Solar PV
- Onshore wind
- Offshore wind
- Hydropower
- Bioenergy power generation
- Concentrating solar power (CSP)
- Geothermal
- Ocean power
- Nuclear power
- Natural gas-fired power
- Coal-fired power
- CCUS in power

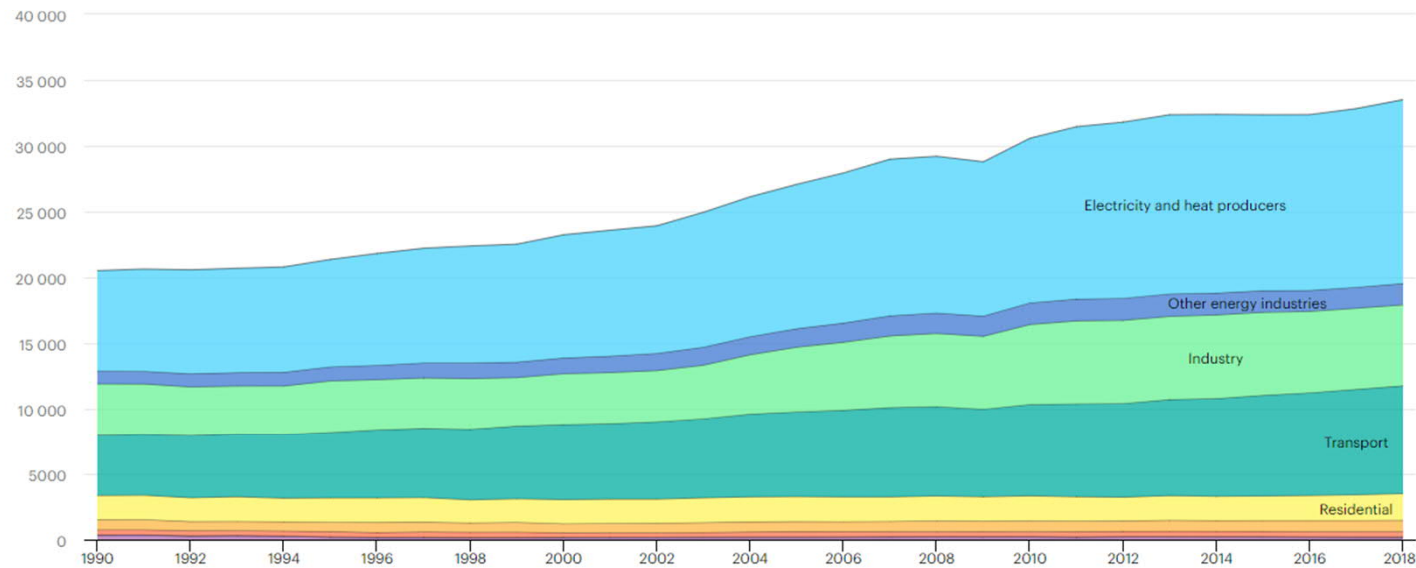
Covid-19

19/11/2020 VTT – beyond the obvious

Global daily CO₂ emissions

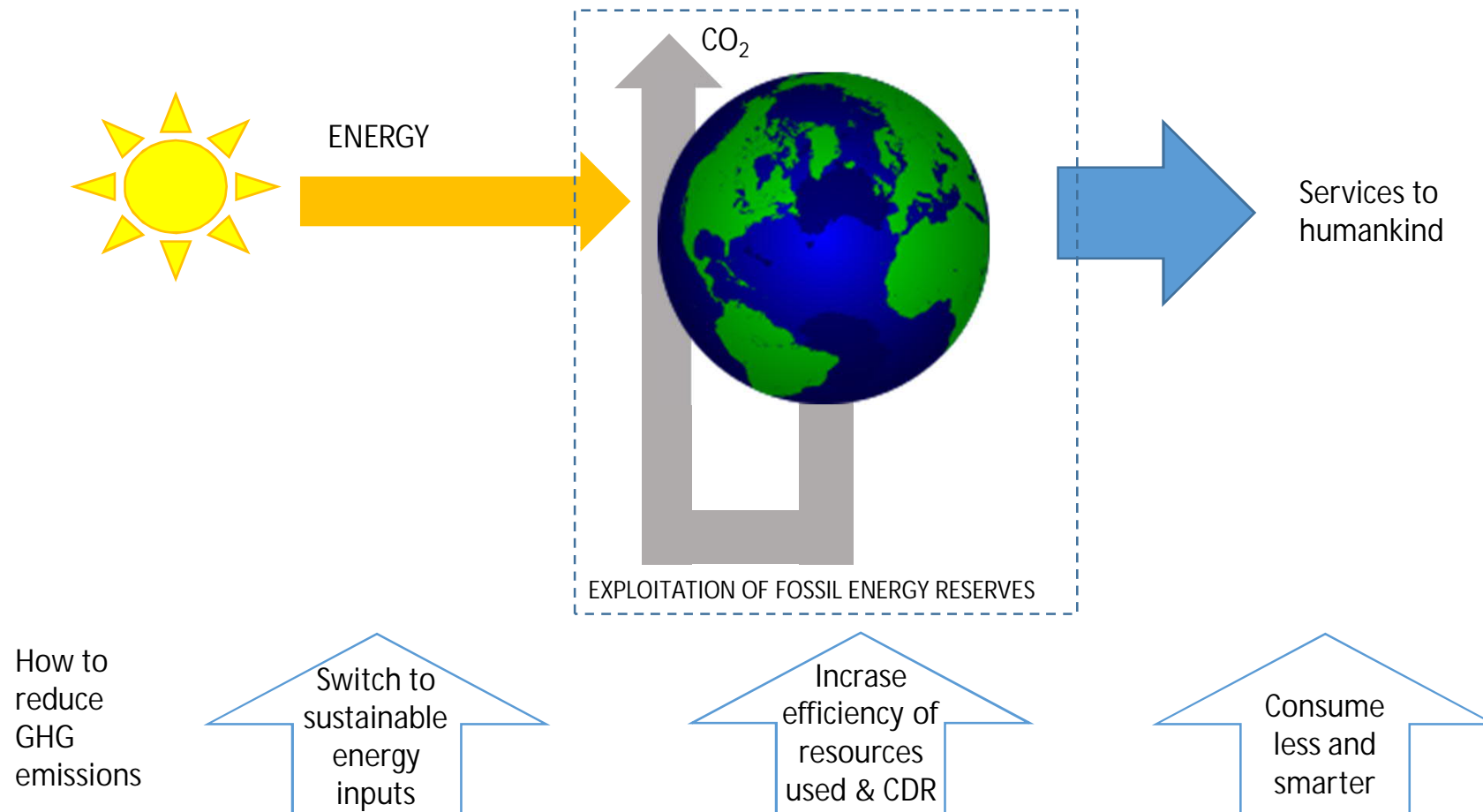


Global CO2 emissions by sector



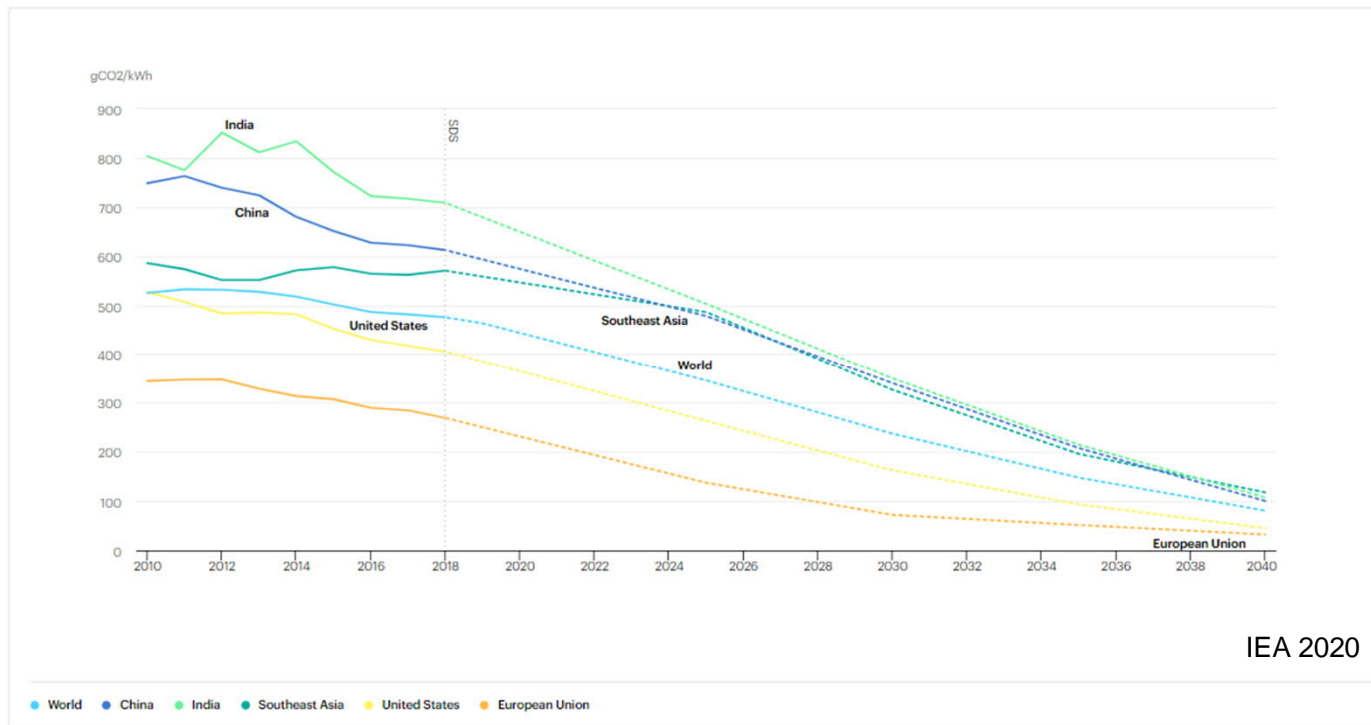
IEA 2020

Electricity and heat producers
Other energy industries
Industry
Transport
Residential
Commercial and public services
Agriculture
Fishing
Final consumption not elsewhere specified



Role of electricity

Carbon intensity of electricity generation in Sustainable Development Scenario



Electrification is the fast track to decarbonise



Hydrogen (in the) economy

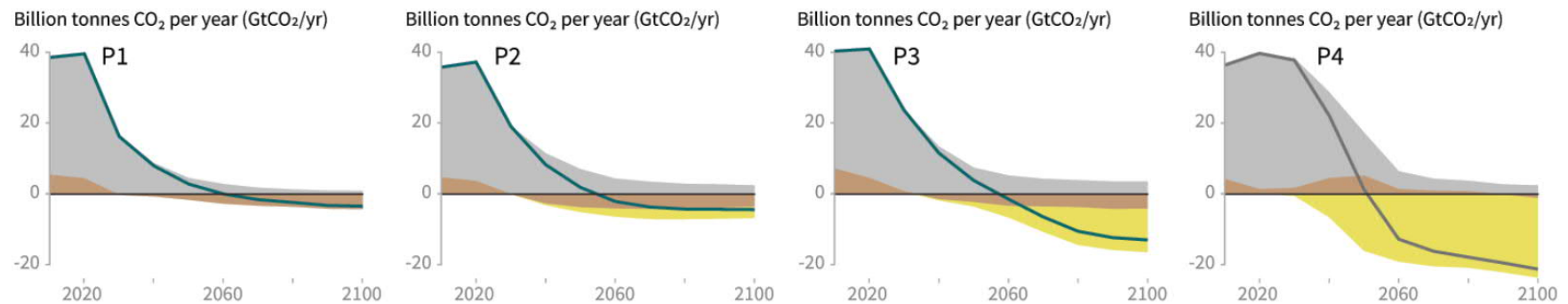
- A vision of a large-scale switch to using hydrogen as an energy carrier
- Eternal "magic bullet" in energy scenarios
- Main advantage is its versatility
 - Can be produced from a wide variety of resources
 - Can be used in a wide range of applications

P2X?



All pathways use Carbon Dioxide Removal (CDR)!

● Fossil fuel and industry ● AFOLU ● BECCS



The more emission reductions are delayed, the more CO₂ removal from the atmosphere is needed

IPCC SR15

Conclusions

- Decarbonisation of primary energy
- Decarbonisation of primary energy and systemic change
- We already have all the technical tools to do the decarbonisation
- Energy carriers to enable penetration of low carbon electricity to hard to decarbonize parts of the system
- Decarbonisation of primary energy

bey⁰nd

the obvious

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