

Tavoitteena hiilineutraalius – energian isot trendit ISY syyskokous 19.11.2020 Antti Arasto



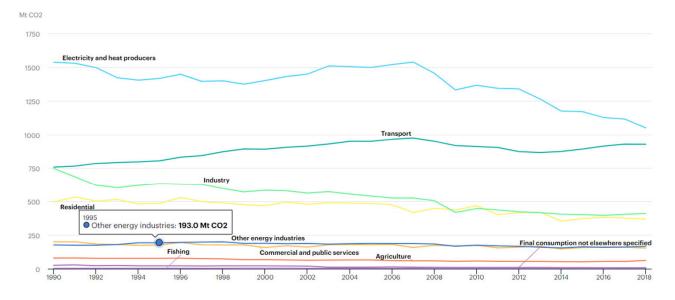
Decarbonising primary energy is the key to combat climate change.

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It is the physical world that matters in this context d Greenhouse Gas Emissions in 2005 44,153 MtCO₂ eq. Sector W. Tota End Use/Activity Gas Road 10.5% ansportation 14.3% Air Rail, Ship, & Other Transport 2.5% Residential Buildings 10.2% 7 U Elect y & Heat 24.9% Commercial Buildings 6.3% £ Unallocated Fuel Combustion 3.8% ш Iron & Steel 4.0% Carbon Dioxide (CO₂) 77% Z Other P 8.6% L Combu Chemicals 4.1% 5.0% Cement 14.7% Industr 7.0% Other Industry T&D Losses 2.2% Fugitiv Emissions 4.0% Oil/Gas Extraction, Refining 6.4% & Processing Indust cesses 4.3% (tropics only) Deforestation 11.3% HFCs, PFCs, Lan Jse Change* 12.2% Afforestation -0.4% SF6 1% Harvest/Management 1.3% Agricultural Energ 1.4% Vethane H₄) 15% 5.2% Agriculture Soils 13.8% iculture Livestock & Manure 5.4% Rice Culti Other Agr Nitrou. (N₂O) S WORLD RESOURCES INSTITUTE

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Electricity generation is decarbonisong faster than other sectors



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

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CO2 emissions by sector EU-28 (IEA)

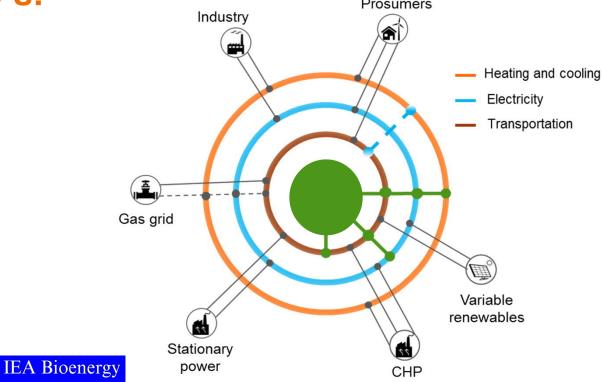
Changing roles, market drivers and business models

- 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

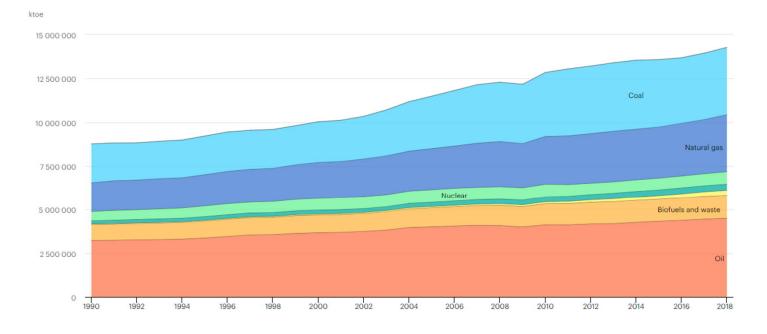


Solar and wind energy resources and associated levelised cost of electricity [Langer, Energy market transformation from energy optimized to capacity optimized system, 16.8.2016, Helsinki]

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



Total world energy supply

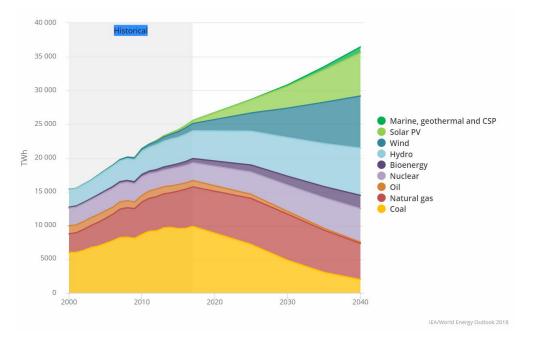


IEA 2020

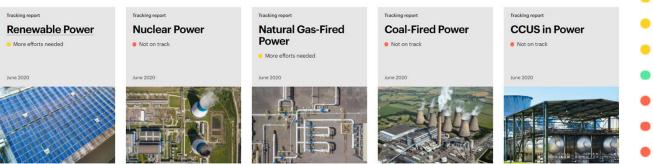
Coal
Natural gas
Nuclear
Hydro
Wind, solar, etc.
Biofuels and waste
Oil
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Sustainable Development Scenario (SDS)



Tracking clean energy progress



Overview

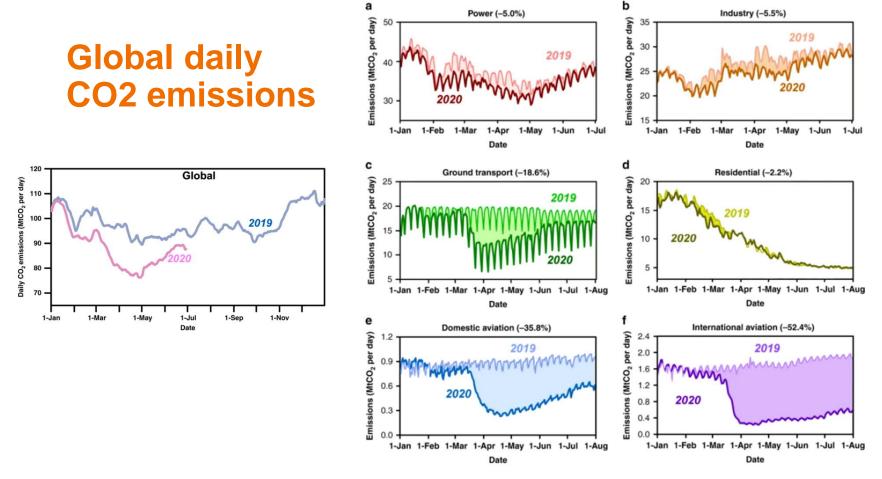
- Renewable power
- Solar PV
- Onshore wind
- Offshore wind
- Hydropower
- Bioenergy power generation
- Concentrating solar power (CSP)
- Geothermal
- Ocean power
- Nuclear power
- Natural gas-fired power
- Coal-fired power
- CCUS in power

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



Covid-19

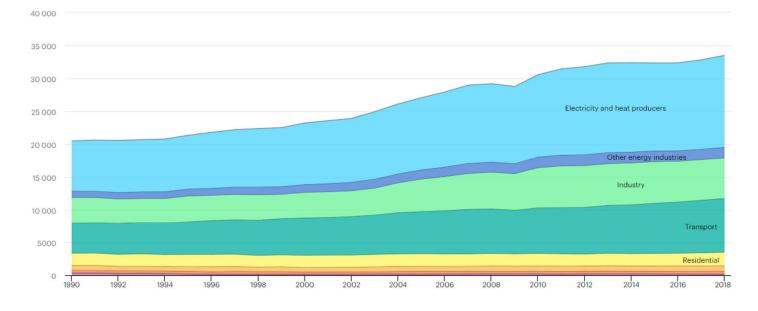
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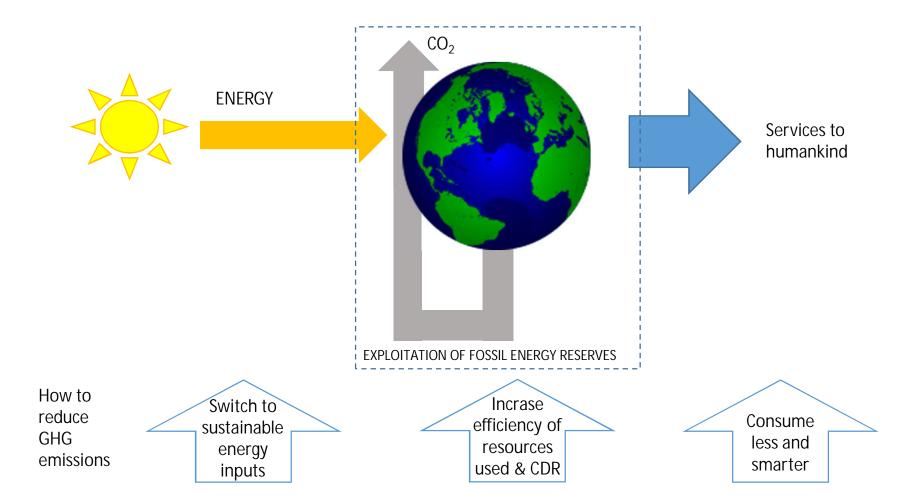
Liu, Z., Ciais, P., Deng, Z. *et al.* Near-real-time monitoring of global CO₂ emissions reveals the effects of the COVID-19 pandemic. *Nat Commun* 11, 5172 (2020). https://doi.org/10.1038/s41467-020-18922-7

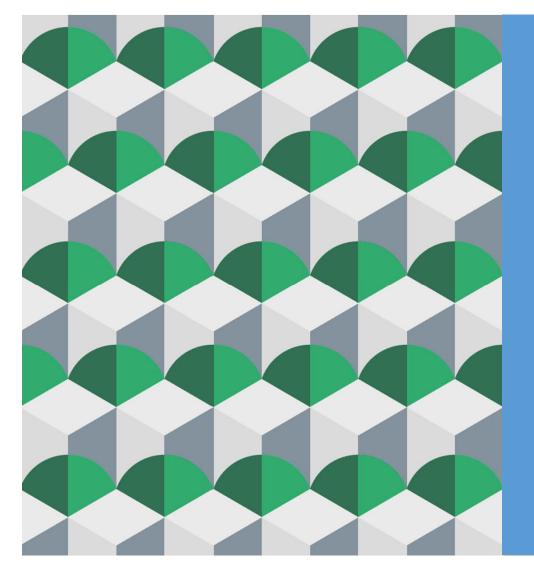
Global CO2 emissions by sector



IEA 2020

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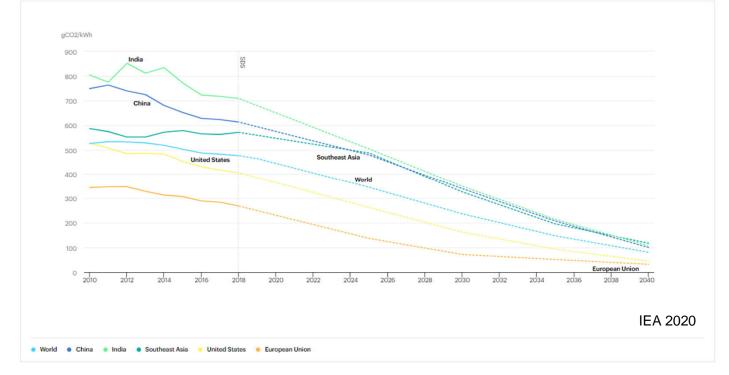




Role of electricity

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Carbon intencity 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

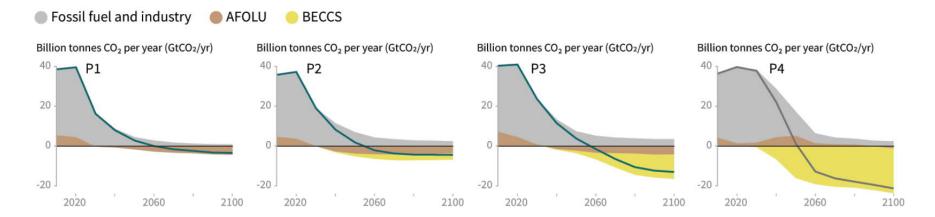
- Can be produced from a wide variety of resources
- Can be used in a wide range of applications



P2X?



All pathways use Carbon Dioxide Removal (CDR)!



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

IPCC SR15

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Conclusions

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





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