



IEA Bioenergy
Technology Collaboration Programme



Trends of bioenergy in the member countries of IEA Bioenergy

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EUBCE 2022 (online) - 12 May 2022

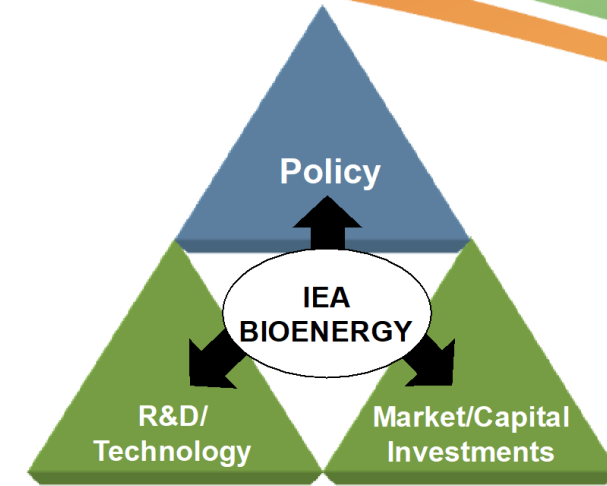
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Technology Collaboration Programme

by **iea**

IEA Bioenergy

Technology Collaboration Programme (TCP), functioning within a framework created by the International Energy Agency (IEA)



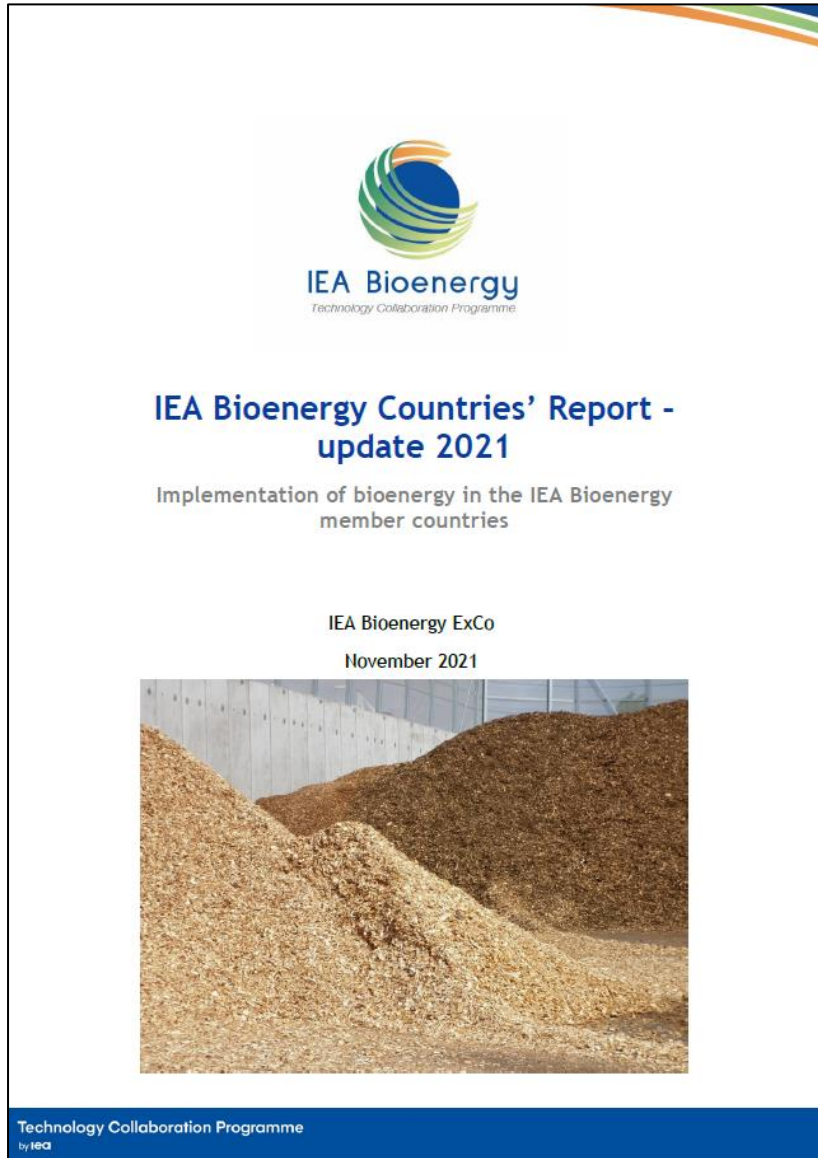
Goal:

- International **collaboration** and **info exchange** on bioenergy research, technology development, demonstration, and policy analysis
- Facilitate the commercialization and market deployment of sustainable bioenergy systems = **climate positive, environmentally sound, socially acceptable** and **cost-competitive** (incl. external costs)

26 members: 15 European countries + EC, US, CND, BR, India, China, Japan, Korea, AUS, NZ, SAfr

Work programme carried out through **Tasks** and **Special Projects**, covering the full value chain from feedstock to final energy product => collect, summarize and report scientific evidence in the wide field of bioenergy.

IEA Bioenergy Countries report 2021



- Published in November 2021 (summary reports & individual country reports) - available at <https://www.ieabioenergy.com/blog/publications/2021-country-reports/>
- Analysis of IEA Bioenergy member countries/regions
 - Evolution of energy system and the role of bioenergy since 2000
 - Based on IEA World Energy Balances database (*detailed data up to 2019*)
 - Most data expressed per capita for comparability
 - Input policy framework from country representatives

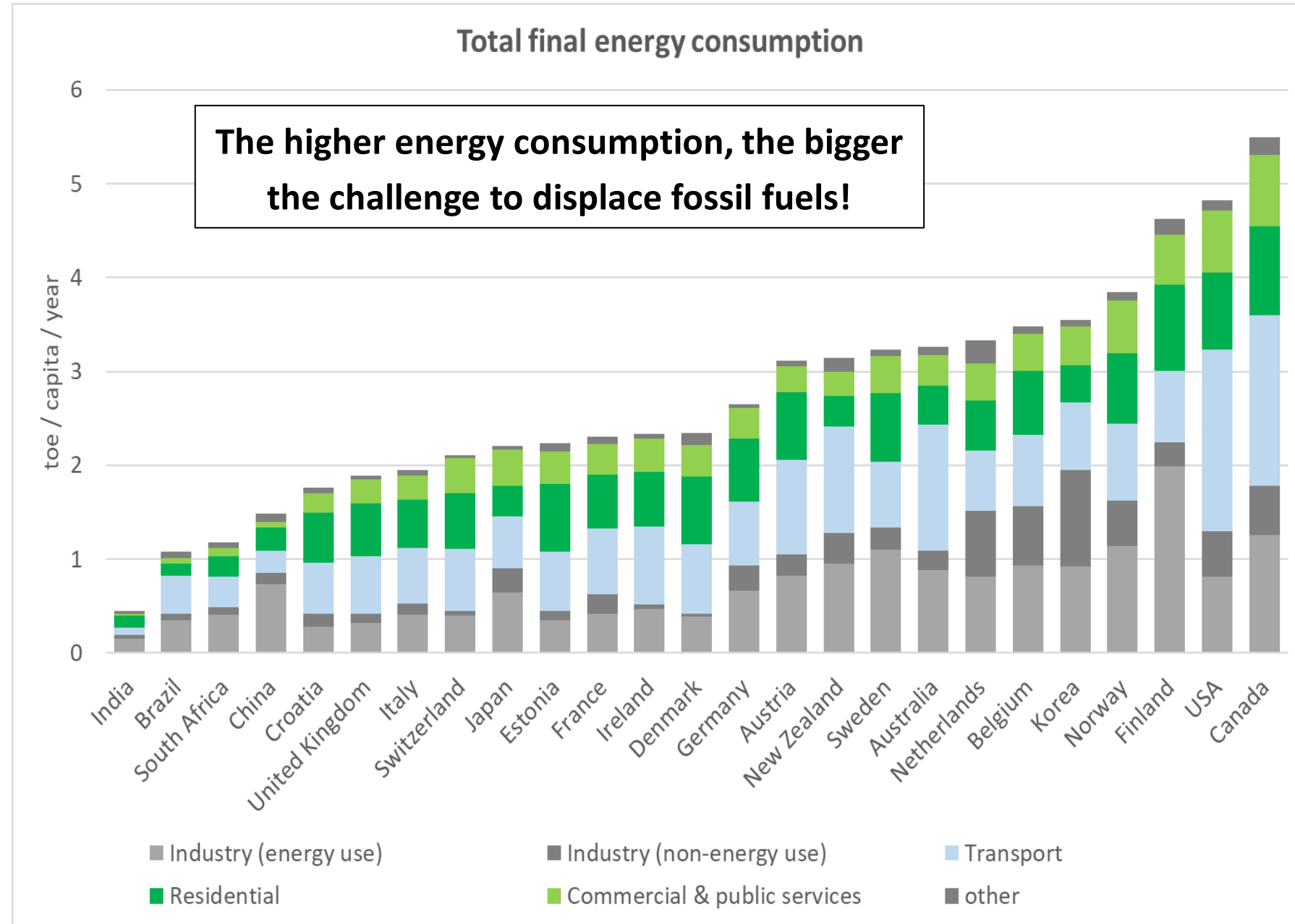
Countries have specific background/specificities

Main factors:

- Economy /GDP
- Presence of energy-intensive industries
- Transport distances, vehicle fleet & roll public transport
- Climatic circumstances

Specific circumstances per country for biomass production & other renewables

(e.g. population density, forest vs agricultural area, growth conditions, topography, ...)

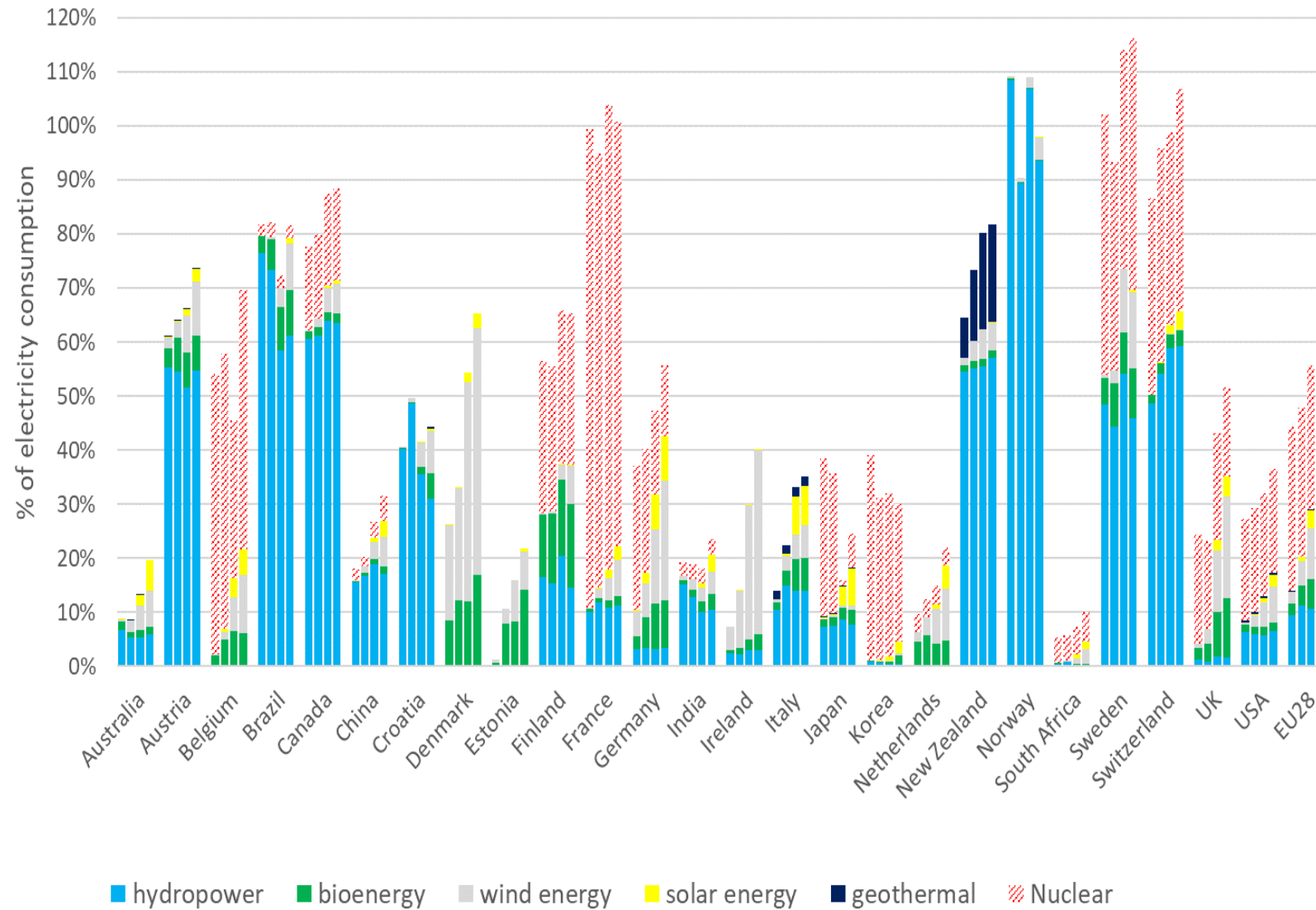


Electricity



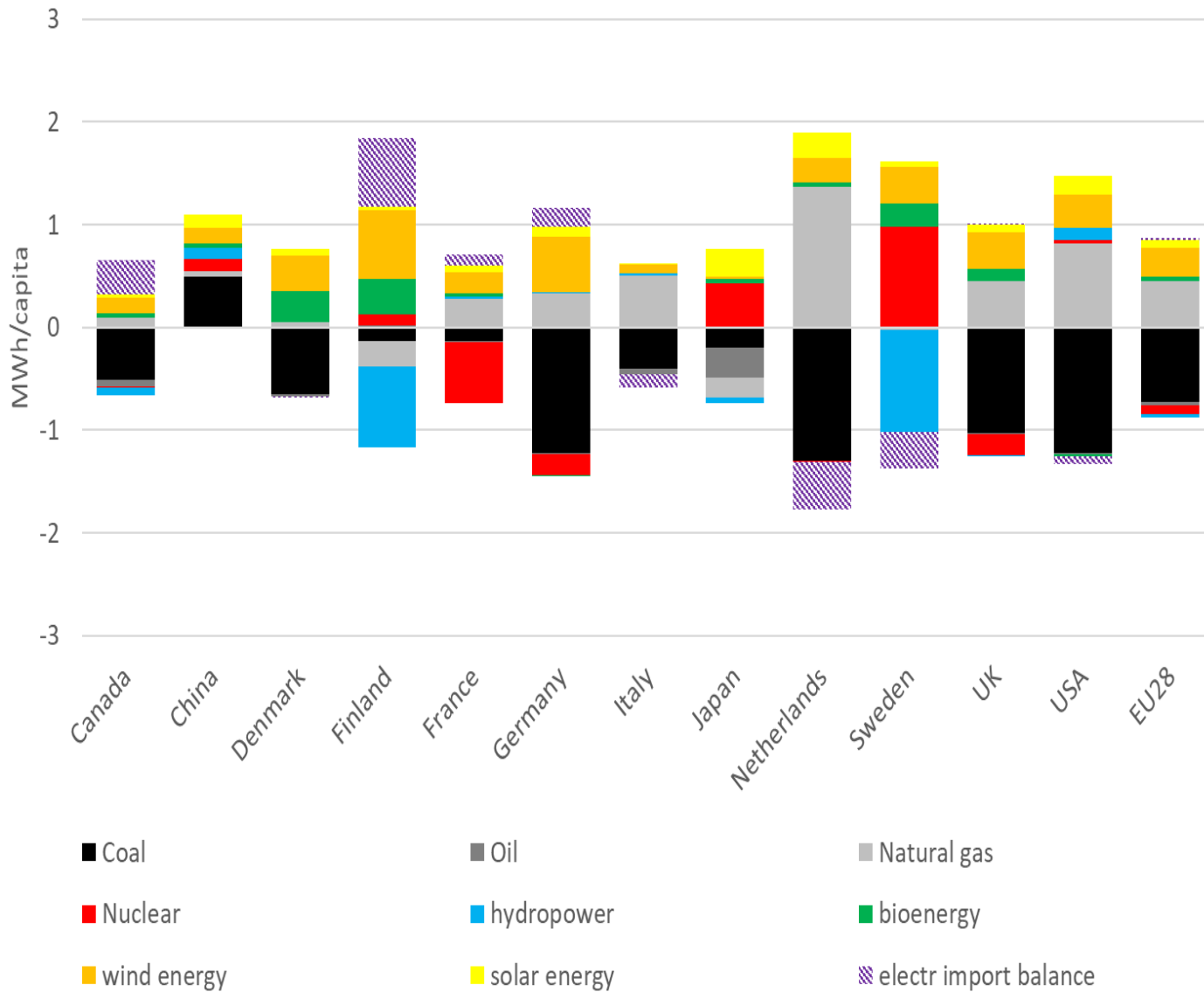
Picture: ONE (Only Natural Energy)

Share of low-carbon electricity (2005-2010-2015-2019)



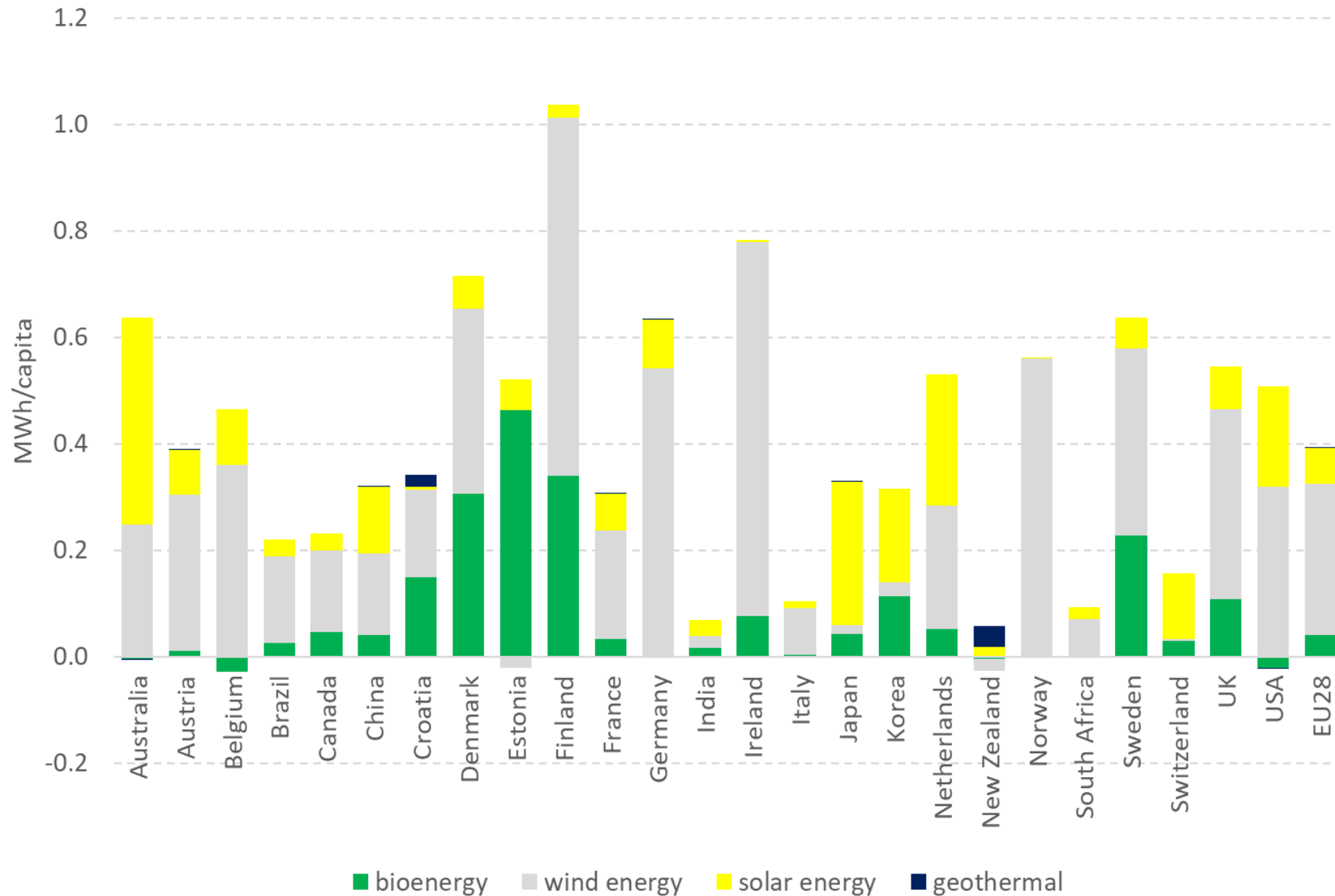
- Some countries have high basis of hydro-power (linked to topography)
 - >50% in NO, CN, BR, CH, NZ, SE, AT
 - important factor for renewable power
- Some have substantial amount of nuclear
 - >25% in FR, BE, SE, CH, FI, KR
- Wind power:
 - >20% in DK, IE, DE
- Geothermal:
 - >15% in NZ
- Biopower
 - >10% in DK, FI, UK
- Solar:
 - >5% in DE, IT, JP, AU
- Biopower in EU28:
 - 54% solid biomass
 - 32% biogas
 - 12% renewable MSW
 - 3% bioliquids

Increase/decrease of electricity output between 2015 and 2019



- Most regions had a **strong decrease of coal power** (except China, India)
- **Compensated by**
 - Increase in renewable power
 - Increase in natural gas (increase often bigger than renewables!)

Increase of renewable electricity output between 2015 and 2019



- Main growth in wind, followed by solar and biopower
- Biopower particularly growing in Scandinavian countries (in CHPs)
- Main support renewable power:
 - Feed-in tariffs
 - Obligations with green power certificates
 - Tender systems, with contracts for difference

Heating fuels & distributed heat

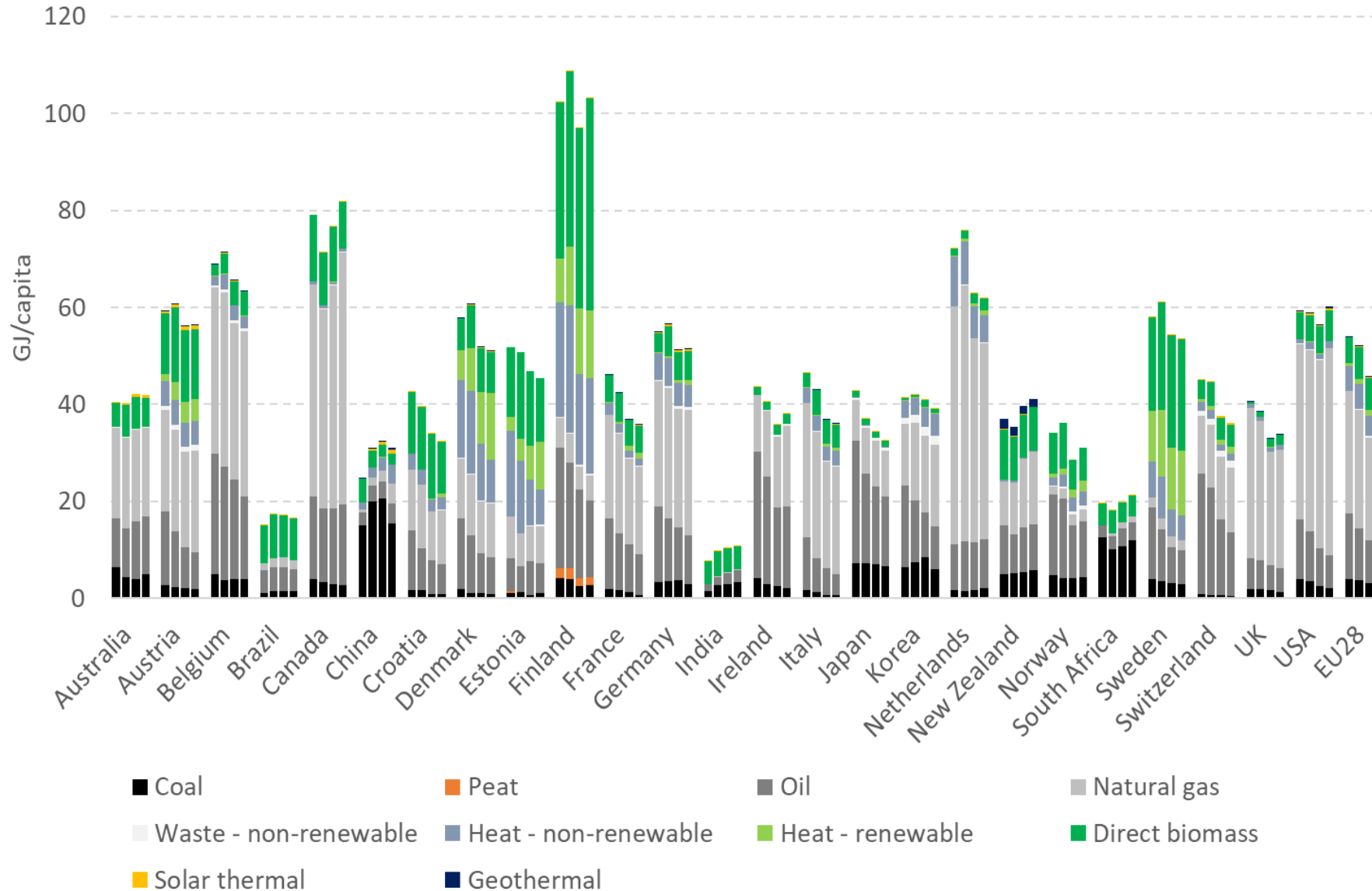
(use of electricity for heating not included)



Picture: GEMCO Energy

Heating fuels & distributed heat (residential, services, industry)

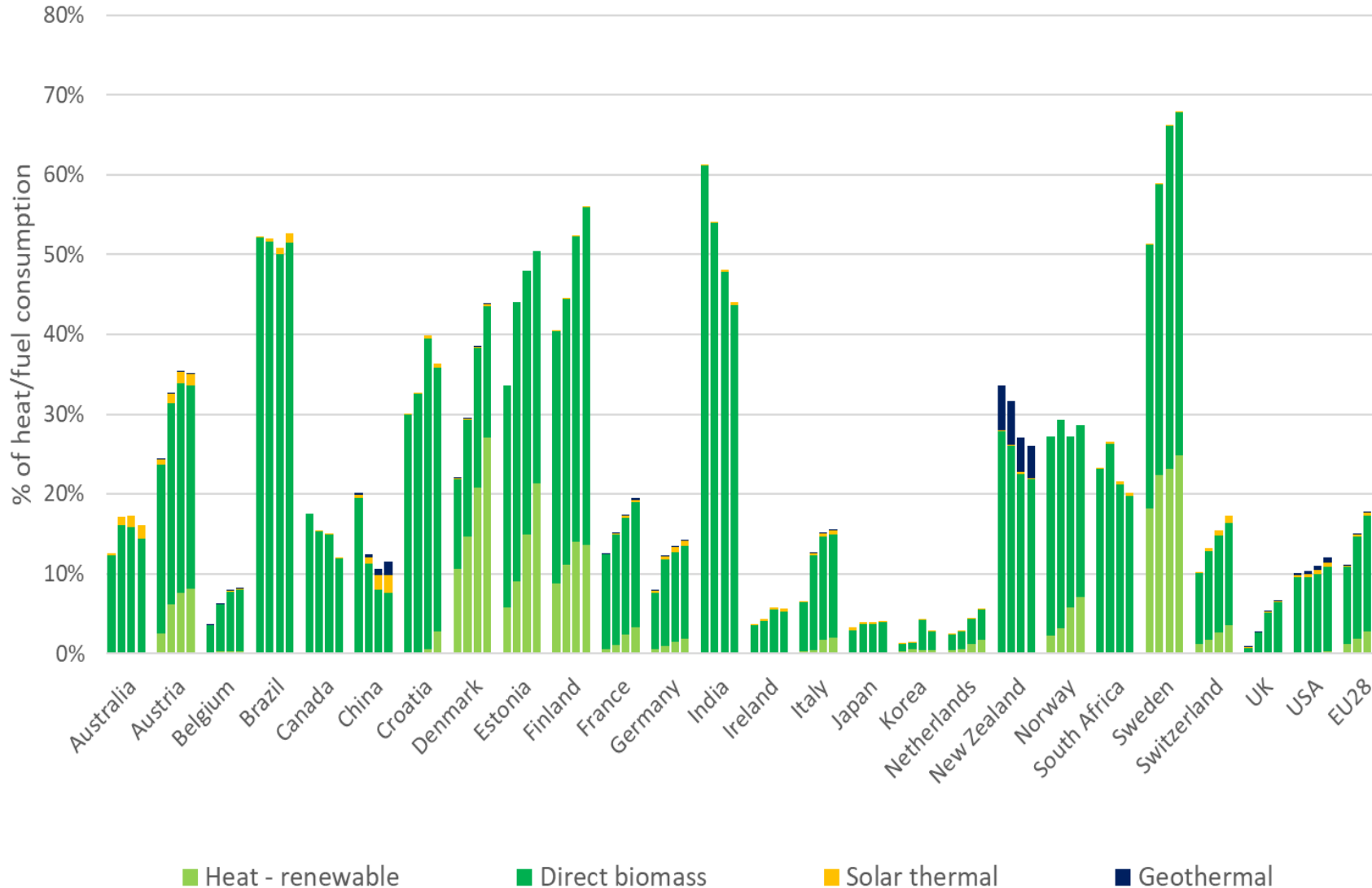
Heat/fuel consumption (2005-2010-2015-2019)



- In most countries heat depends for 80-95% on fossil fuels
 - Decreasing role for heating oil
 - increasing role for natural gas
- Strong role of district heating in Scandinavian countries
- Bioenergy is dominant type of renewable heat (direct & through distributed heat)

Heating fuels & distributed heat

Renewable heat/fuels (2005-2010-2015-2019)



- Increasing role of biomass for district heating in Scandinavian countries
=> *replacing fossil fuels*
 - Mostly in CHP mode (co-producing power)
- Traditional biomass decreasing in China, India
- Main support renewable heat:
 - subsidies for renewable heat projects
 - support for domestic renewable heat instalment
 - CO₂ tax on fossil fuels (in industry and for district heating)

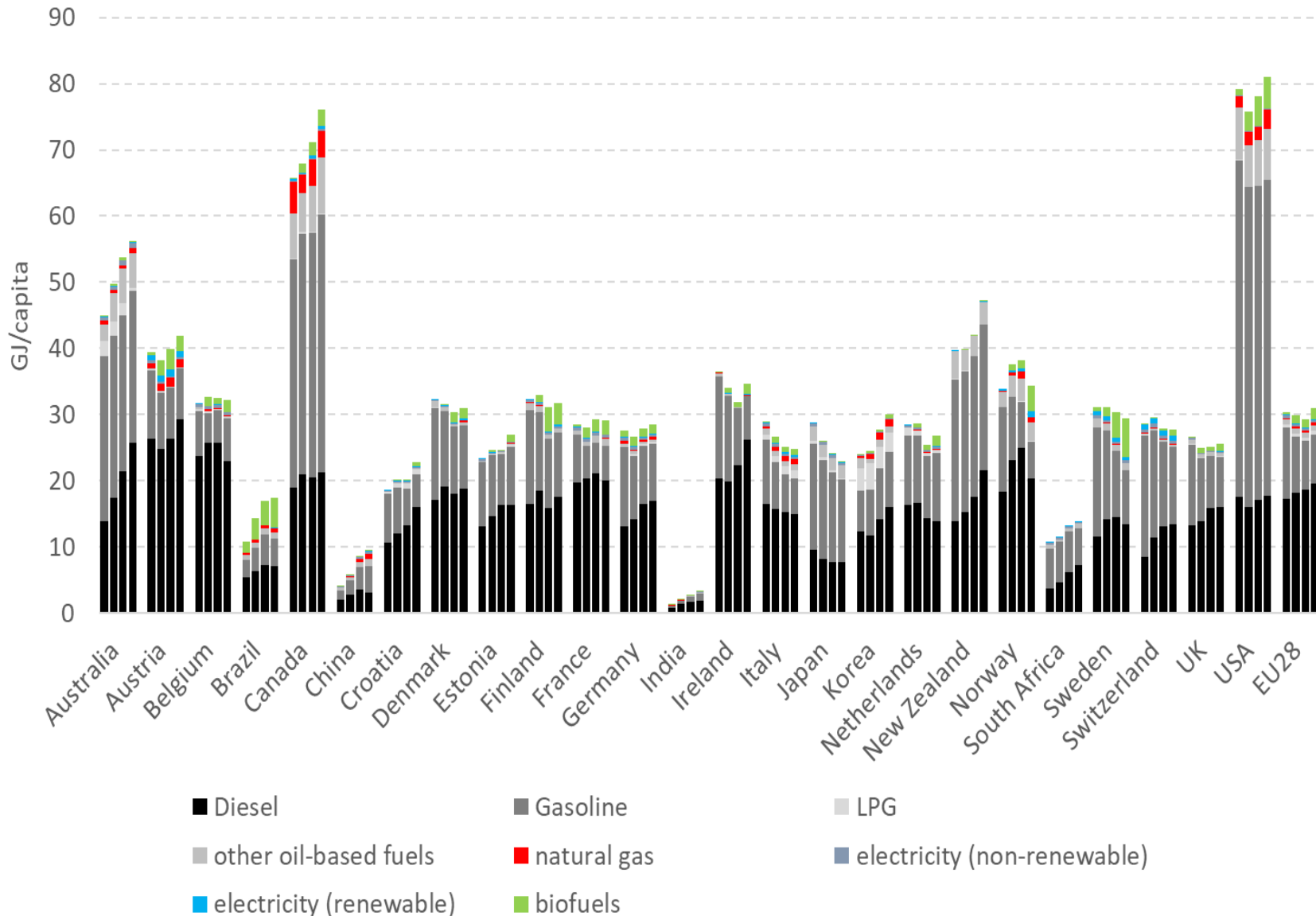
Transport



Source: ecoenergy-consulting.com

Overall transport

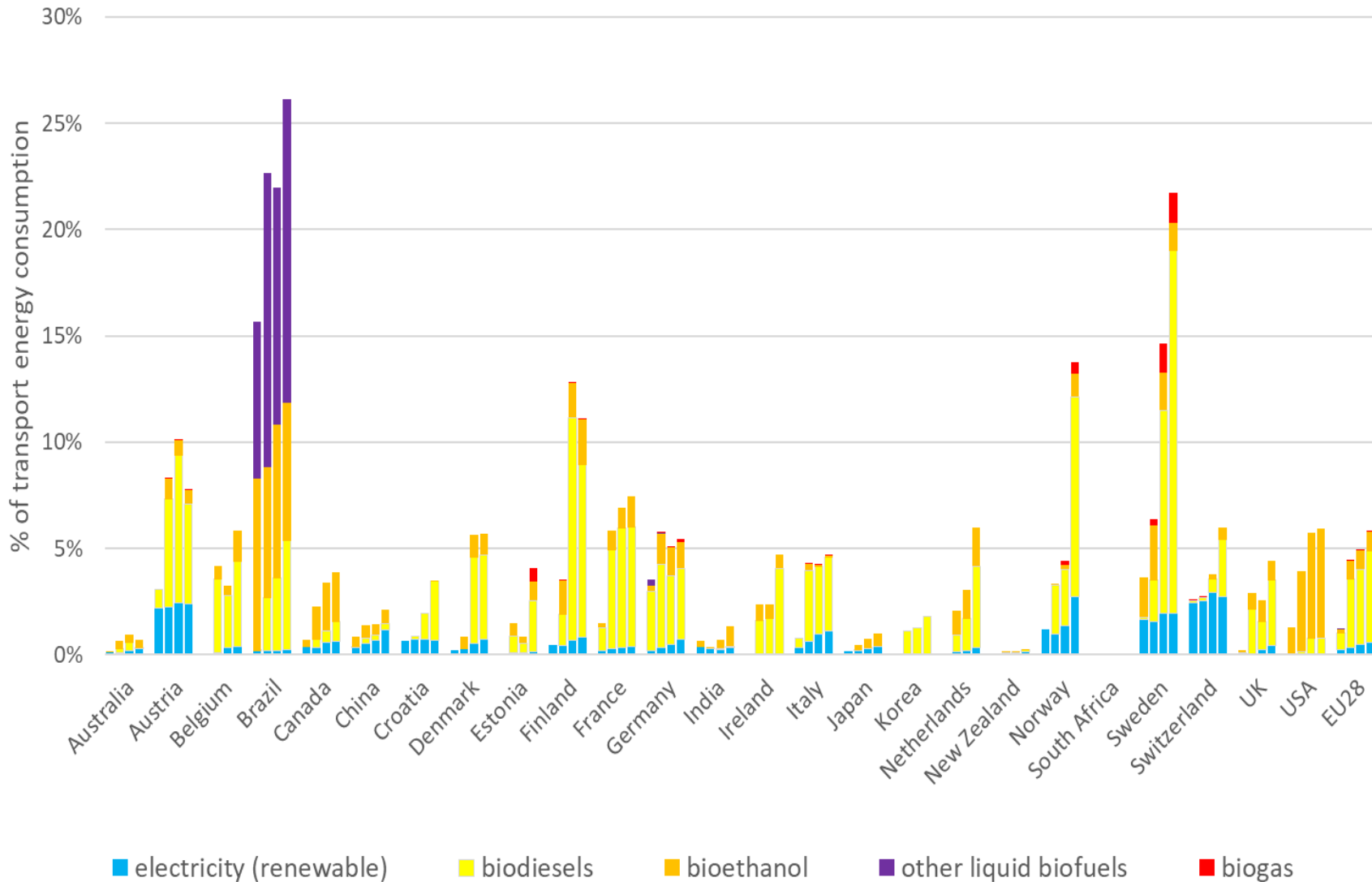
Transport energy consumption (2005-2010-2015-2019)



- Fossil fuels still >95% in most countries
- Very high transport fuel consumption in North America
 - Related to distances, types of vehicles (& fuel economy standards), state of public transport
- Diesel dominant in Europe (and still increasing)
 - => higher focus for biodiesel
- Gasoline dominant in Americas
 - => higher focus on bioethanol

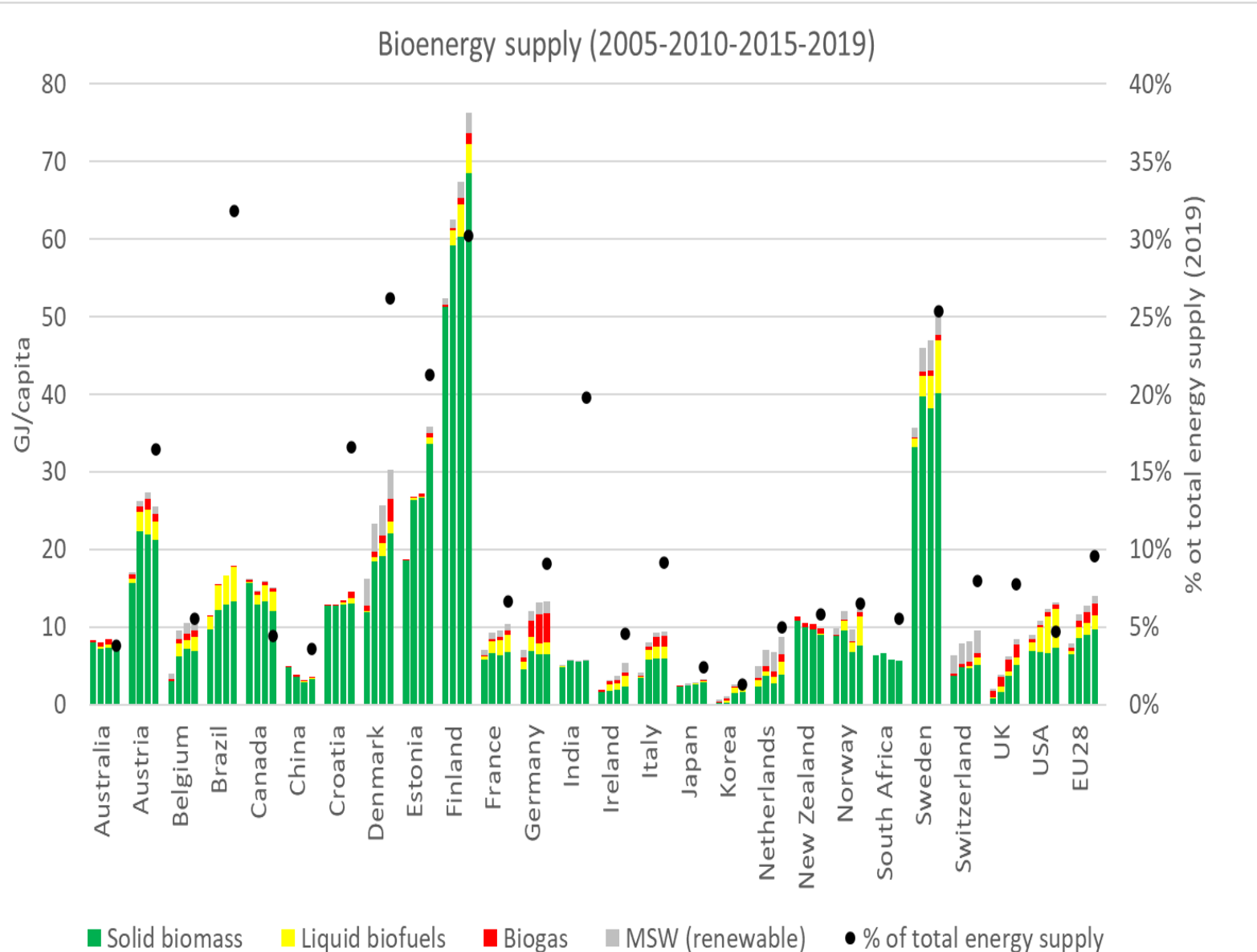
Renewables in transport

Share of renewable energy in transport (2005-2010-2015-2019)



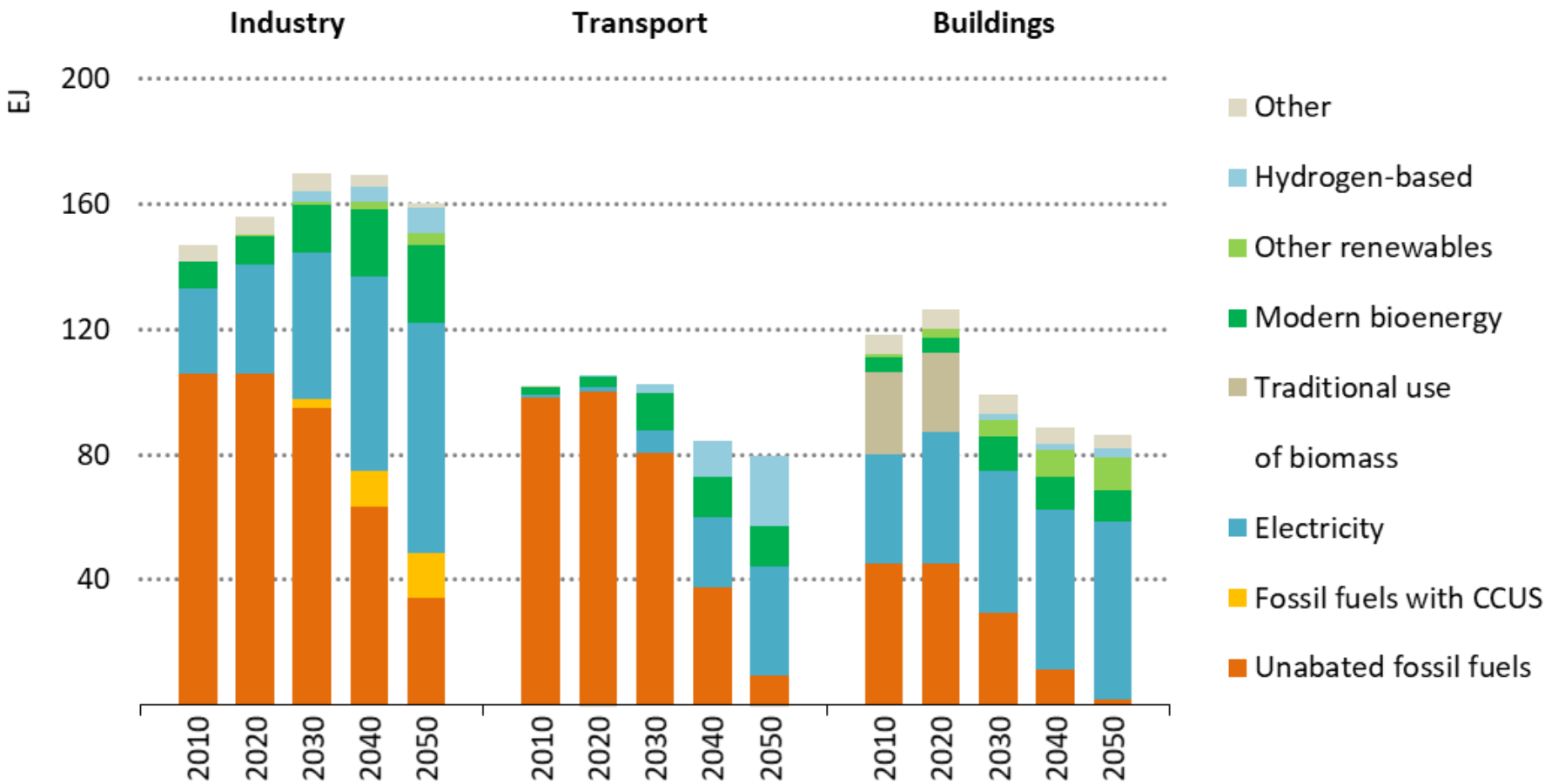
- Brazil and Sweden already achieved >20% renewable energy in transport
- Most other countries between 4-6% (*excl. double countings!*)
- Distribution biodiesels /bioethanol follows diesel/gasoline distribution in most countries
- Renewable electricity so far modest roll (*mostly still through rail*)
- Main support systems:
 - Tax incentives
 - Blend obligations
 - LCFS (carbon intensity based)
 - Support for electric vehicles

Overall supply of bioenergy



- Role of bioenergy typically between 5 and 25% of total energy supply (>25% in BR, FI, DK, SE)
- Solid biomass (for heat & power) still most important
 - forest residues, processing residues, agri residues, post-consumer wood waste, ...
 - mostly in countries with high domestic forest area
 - some countries rely on imports => strong sustainability criteria
- Liquid biofuels most for transport - rising again, with increased focus on waste/residues as feedstock
- Biogas still most used for CHP; increasing trend to upgrade to biomethane & inject in gas grid
- Renewable MSW links to stage of waste management development (advanced in North & West Europe)

Future prospects for bioenergy? - IEA Net Zero Emissions by 2050 scenario



2050 role bioenergy:

- 15% of industry energy use (mainly high temperature heat)
- 16% of transport energy use
- 10% of energy use in buildings (traditional use of biomass to phase out)
- 5% of electricity production (total electricity x 2.5)
- Negative emissions through BECCS of 1.3 billion tons CO₂
 - 45% in biofuel production
 - 40% in power production
 - rest in heavy industry

There is a wholesale shift away from unabated fossil fuel use to electricity, renewables, hydrogen and hydrogen-based fuels, modern bioenergy and CCUS in end-use sectors

Conclusions

- Fossil fuels (coal, oil, gas) still dominating in most countries' energy mix, particularly for transport fuels and heat
- In 2015-2019 period: coal decreased (except in developing countries) => compensated by increase in natural gas (!) and renewables
- Bioenergy >50% of renewable energy supply (*except in countries with elevated levels of hydropower*)
- Bioenergy is versatile => plays a role in the three main energy sectors: electricity, fuel/heat consumption and transport energy
 - Growth in renewable power most in wind (and solar); role biopower is modest (but opportunities in CHP operation & for grid stabilisation)
 - Bioenergy is dominant type of renewable heat. Important growth prospects for industry heat, and to replace fossil fuels in district heating.
 - Transport still largely fossil (hardly going down). Biofuels are the main renewable in transport. Increasing electrification (mainly for road transport) will shift the use of biofuels to difficult-to-electrify sectors (e.g. aviation). But electrification takes a few decades; mind legacy fleet!

Thanks for your attention!

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