

Global Trends in Clean Energy and Transportation

The Hawthorn Club

Virtual Global Thought Leadership Series

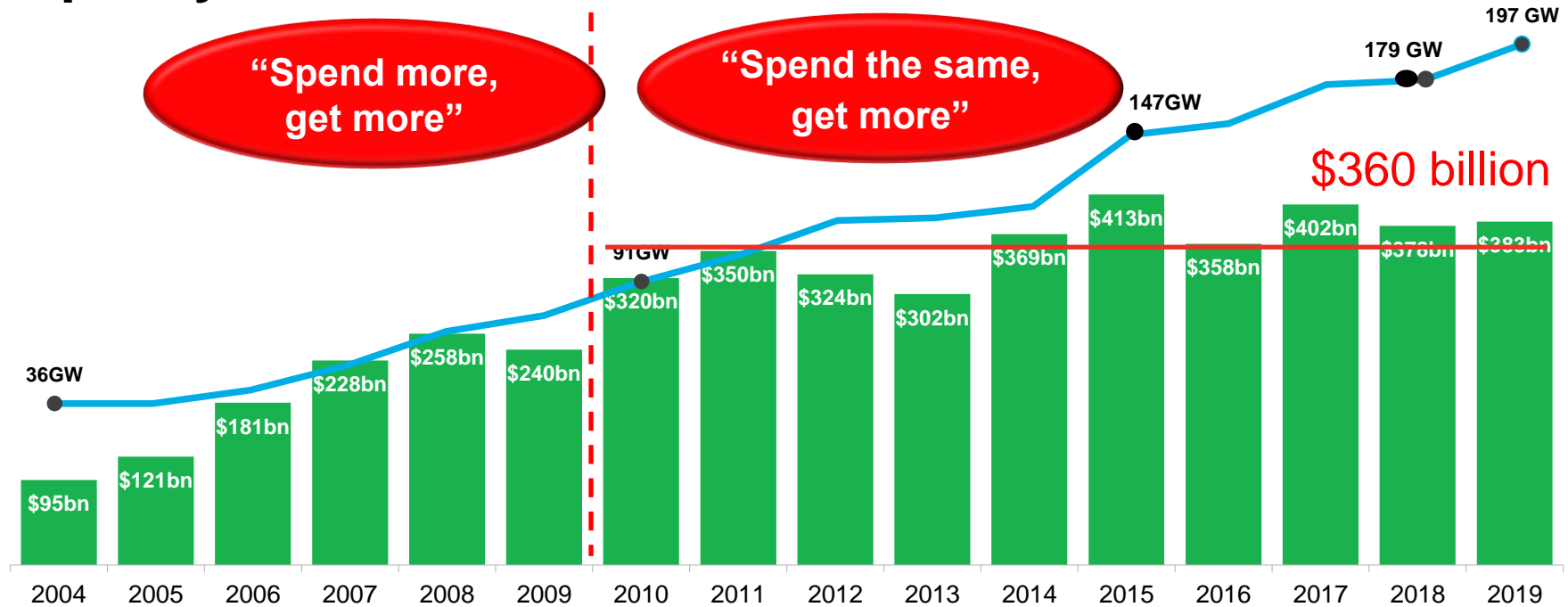
The Interweb, 23 June 2020

Michael Liebreich

Founder and CEO

Liebreich Associates

Global clean energy investment and capacity installations 2004 – 2019



Note: Total values include estimates for undisclosed deals. Includes corporate and government R&D, and spending for digital energy and energy storage projects (not reported in quarterly statistics). Includes large hydro.

Source: BNEF, IRENA

Unsubsidised clean energy world records 2016

Solar PV



Country: Chile
Bidder: Solarpack
Signed: August 2016
Construction: 2019

US\$ 2.91 c/kWh

Onshore wind



Country: Morocco
Bidder: Enel Green Power
Signed: 2016
Construction: 2018

US\$ 3.0 c/kWh

Offshore wind



Country: Denmark
Bidder: Vattenfall
Signed: 2016
Construction: 2022

US\$ 5.3 c/kWh

Note: images are illustrative only

Source: Various manufacturers and project developers

Unsubsidised clean energy world records 2018

Solar PV



Country: Mexico
Bidder: Enel
Signed: Nov 2017
Construction: 2018

US\$ 1.97 c/kWh

Onshore wind



Country: Mexico
Bidder: Neoen
Signed: Nov 2017
Construction: 2019

US\$ 1.77 c/kWh

Offshore wind



Country: Denmark
Bidder: Vattenfall
Signed: 2016
Construction: 2022

US\$ 5.3 c/kWh

Note: images are illustrative only

Source: Various manufacturers and project developers

Unsubsidised clean energy world records 2019

Solar PV



Country: UAE
Bidder: ACWA
Signed: October 2019
Construction: 2021

US\$ 1.69 c/kWh

Onshore wind



Country: Mexico
Bidder: Neoen
Signed: Nov 2017
Construction: 2019

US\$ 1.77 c/kWh

Offshore wind



Country: Germany
Bidder: Dong/ENBW
Signed: 2016
Construction: 2024

US\$ 4.9 c/kWh

Note: images are illustrative only

Source: Various manufacturers and project developers

Unsubsidised clean energy world records 2020

Solar PV



Country: Qatar
Bidder: Total/Marubeni
Signed: Jan 2020
Construction: 2021-2022

US\$ 1.57 c/kWh

Onshore wind



Country: Mexico
Bidder: Neoen
Signed: Nov 2017
Construction: 2019

US\$ 1.77 c/kWh

Offshore wind



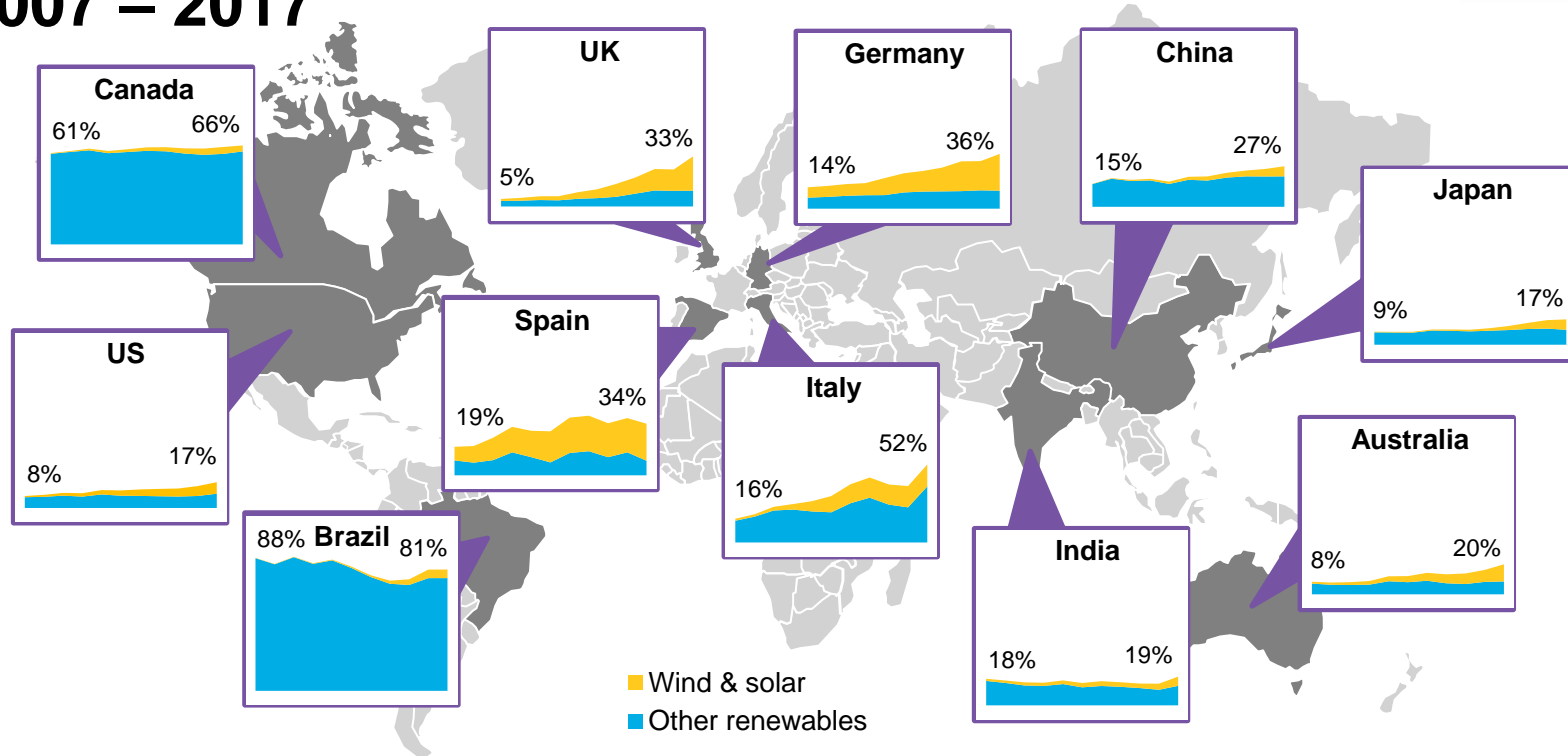
Country: Germany
Bidder: Dong/ENBW
Signed: 2016
Construction: 2024

US\$ 4.9 c/kWh

Note: images are illustrative only

Source: Various manufacturers and project developers

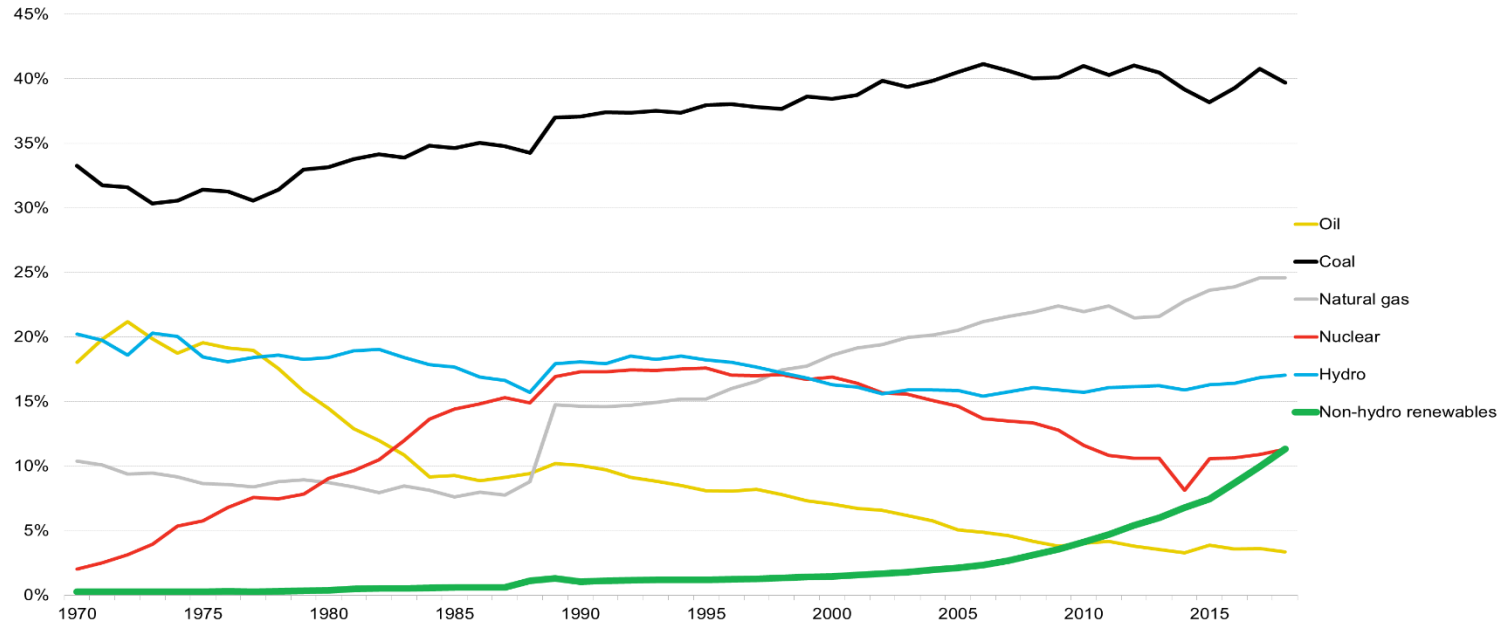
RE proportion of power generation 2007 – 2017



Note: Calculated as GWh renewable production / GWh consumption

Source: Liebreich Associates; BNEF; BP

Global share of power generation by source 1971 - 2019



Source: Liebreich Associates, IEA, BP, World Bank

Wind and solar are not taking over the world

“

Today, solar and wind make up just 0.8% of global energy. In a quarter century, solar and wind will produce less than 4% of global energy

”

*Bjørn Lomborg
visiting professor at the Copenhagen Business School
President of the Copenhagen Consensus Center
4 February 2018*



Image: Lomborg.com

Trump on US coal

July 2017

“

And you know all the people that were saying the mining jobs? Well we picked up 45,000 mining jobs in a very short period of time.

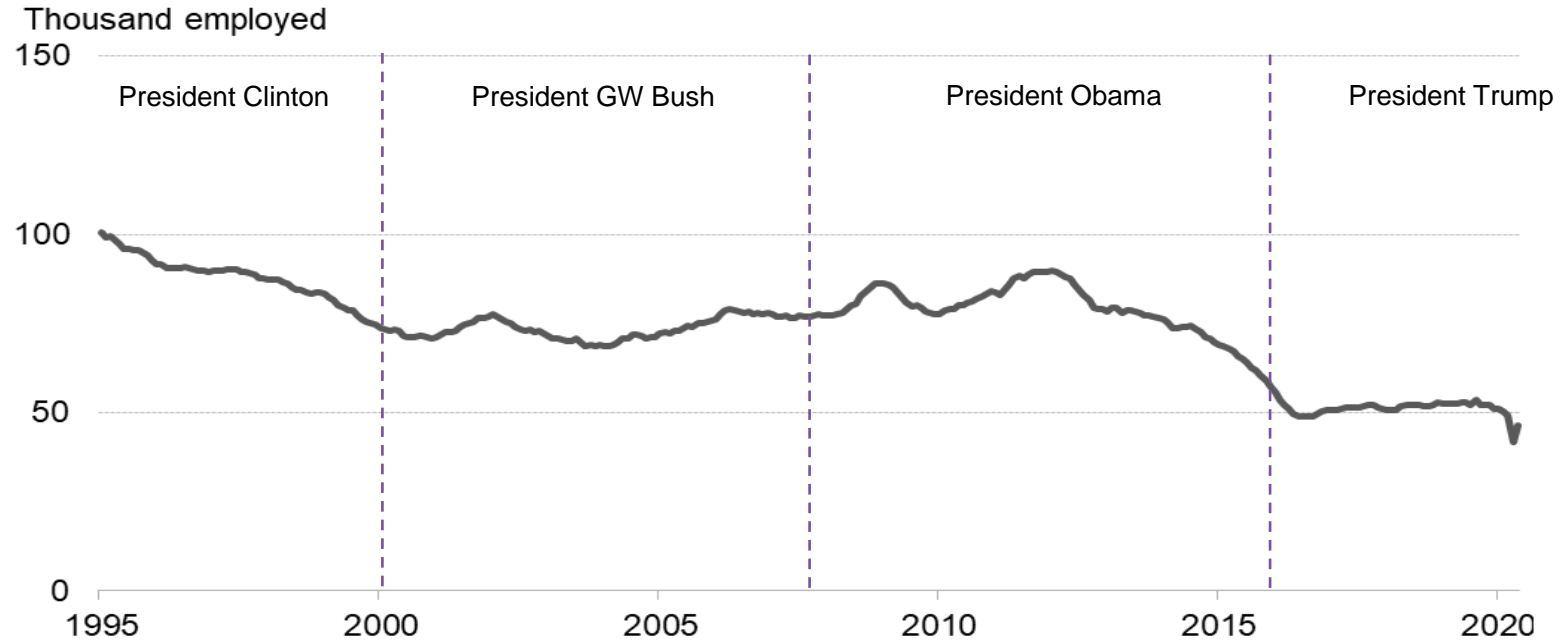
”

*Donald Trump
US President*



Image: Mark Lyons/Getty Images

Fact-checking – US coal mining monthly employment Jan 1995 – May 2020

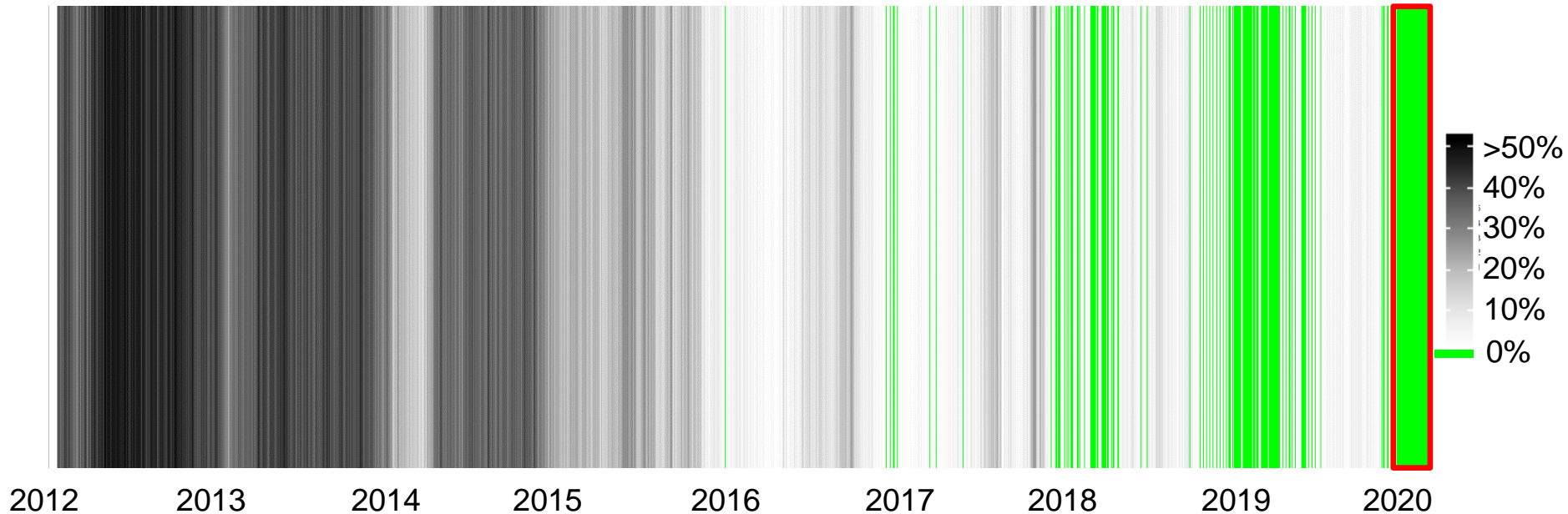


Source: U.S. Bureau of Labor Statistics

UK daily coal share 2012 – 2020

Liebreich
Associates

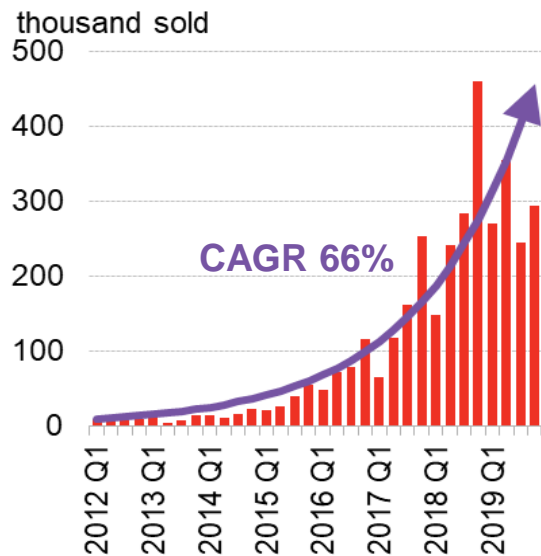
67 days, 22 hours
and 55 minutes
without coal



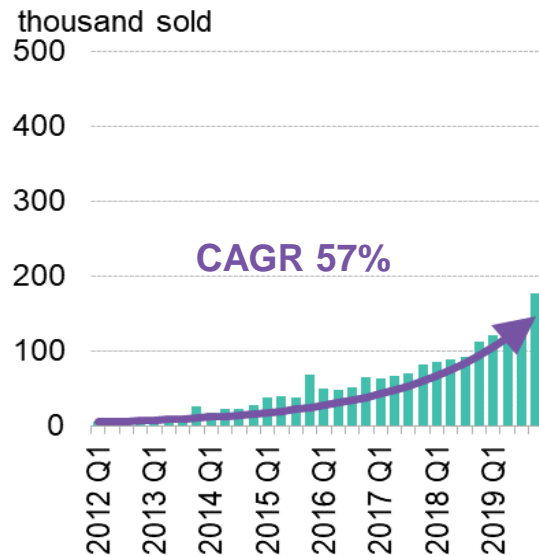
Source: Gridwatch.uk, Liebreich Associates

Quarterly EV sales by region Q1 2012 – Q4 2019

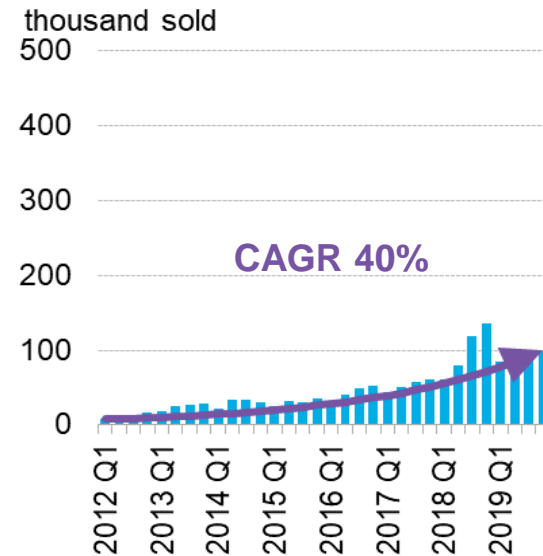
APAC



EMEA



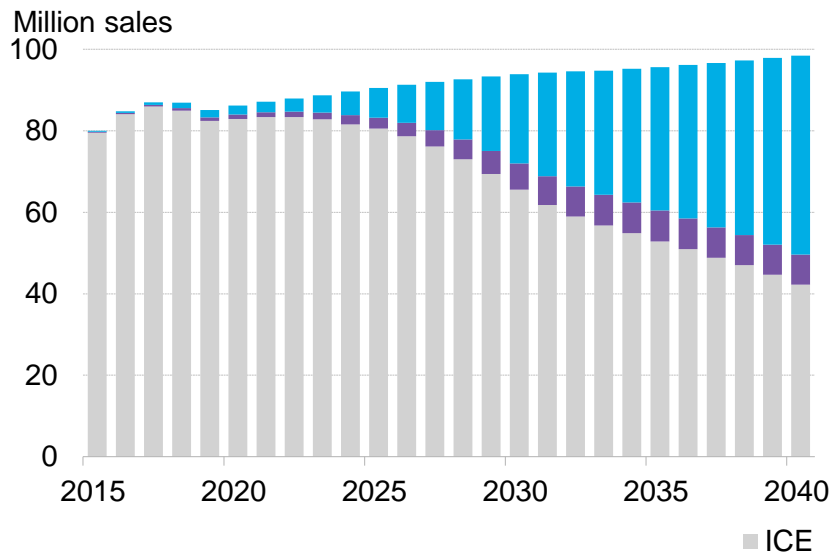
AMER



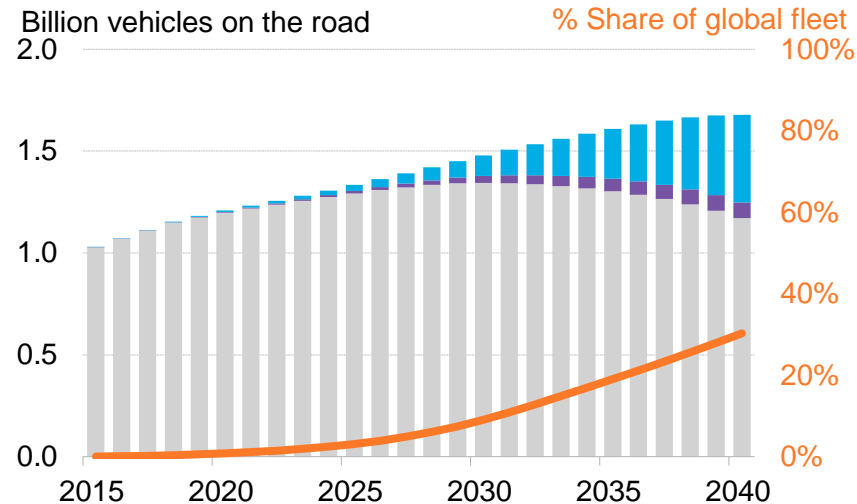
Source: BNEF

BNEF electric vehicle outlook to 2040

Annual global passenger vehicle sales



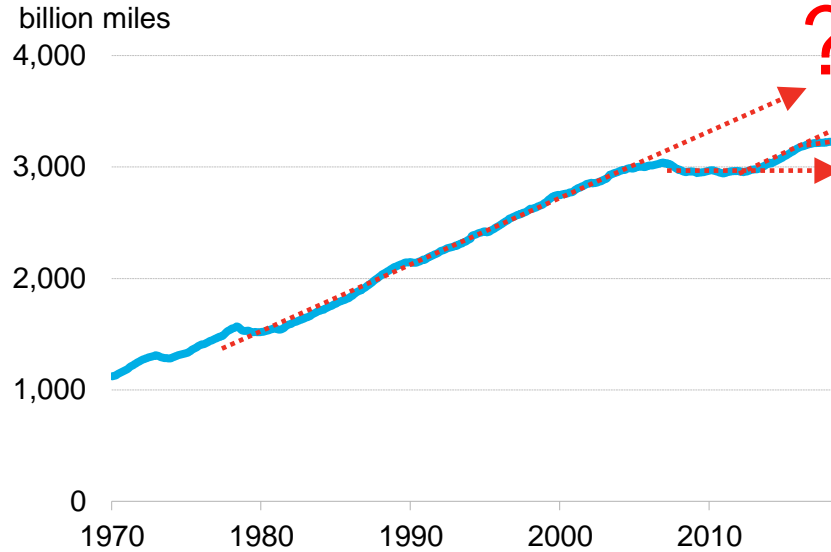
Global passenger vehicle fleet



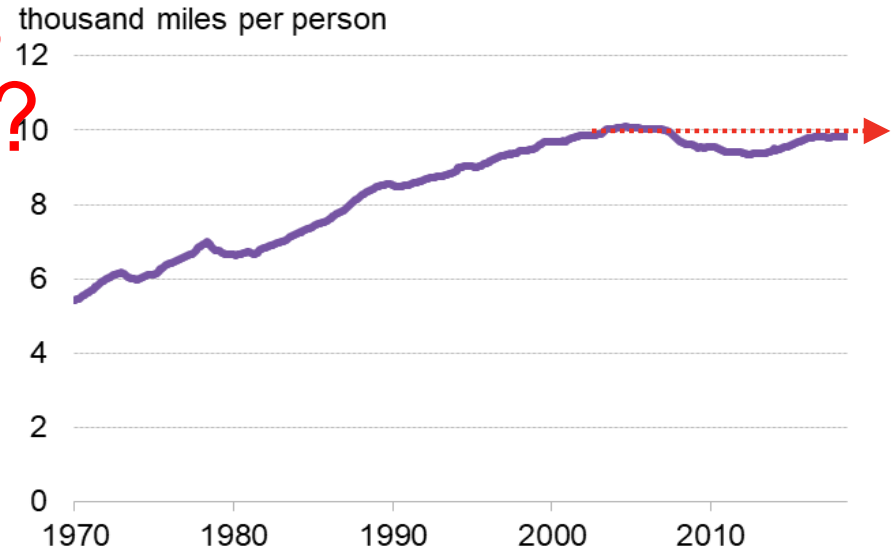
Source: BNEF EVO 2019

US transportation trends 1970 – 2019

Vehicle miles travelled



Vehicle miles travelled per person



Note: Miles reported as moving 12 month average; data up to June 2019

Source: Liebreich Associates; FRED

Innovation in heat is cool

Liebreich
Associates



Images: Naked Energy; Climeon; Danfoss; SaltX; Sonnen; Radbot; Optiwatt; PassivSystems; Sunamp; Solidpower



The world must achieve
greenhouse gas neutrality
some time in the second half of
the century



*Paris Agreement
December 2015*



Image: UNFCCC

Beyond the Three-Third World

Shipping/air/freight



Manufacturing



Chemicals



Agriculture



Heat

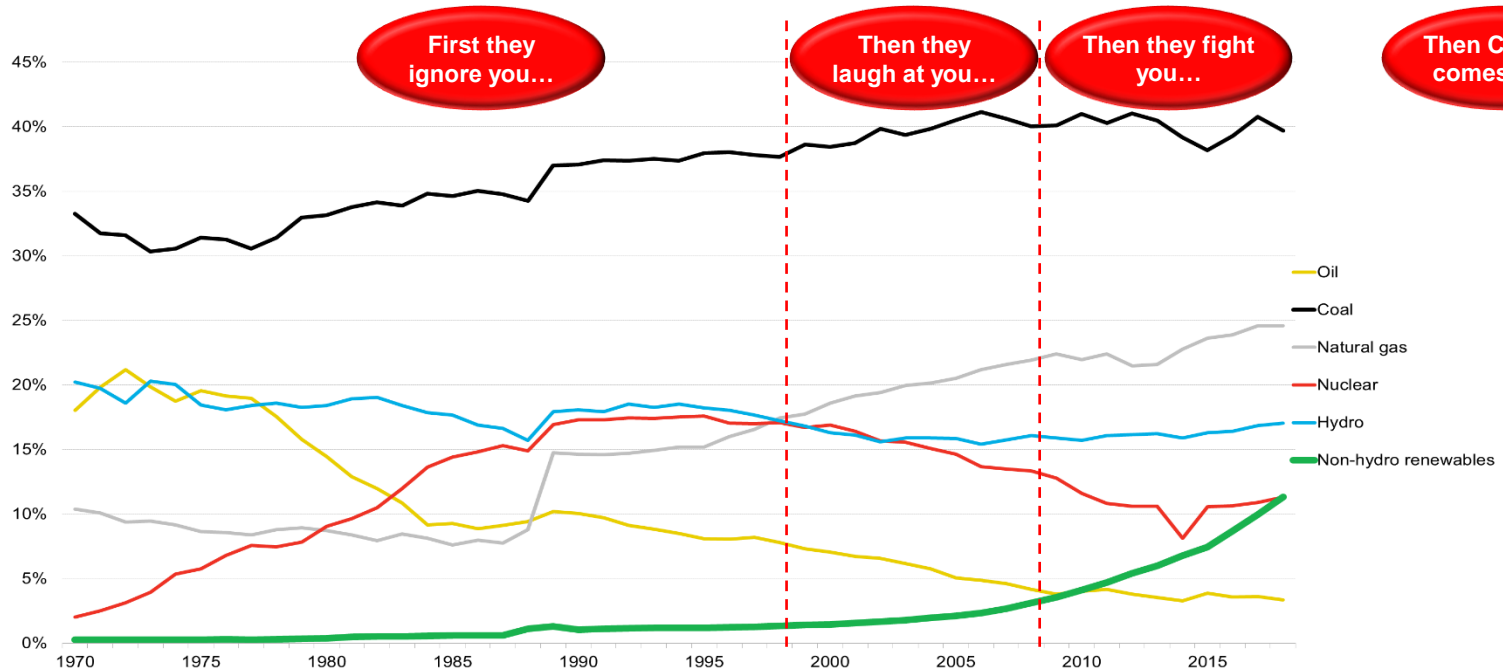


Energy access



Images: Bloomberg New Energy Finance, Tesla, Wallpaper Mania, Cleantecnica; Wikipedia Commons

Global share of power generation by source 1971 - 2019

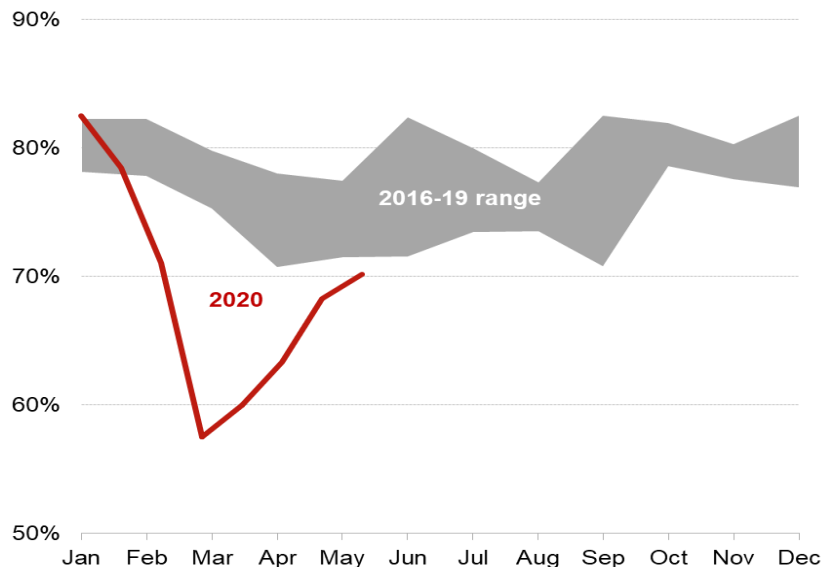


Source: Liebreich Associates, IEA, BP, World Bank

Chinese energy companies during the pandemic

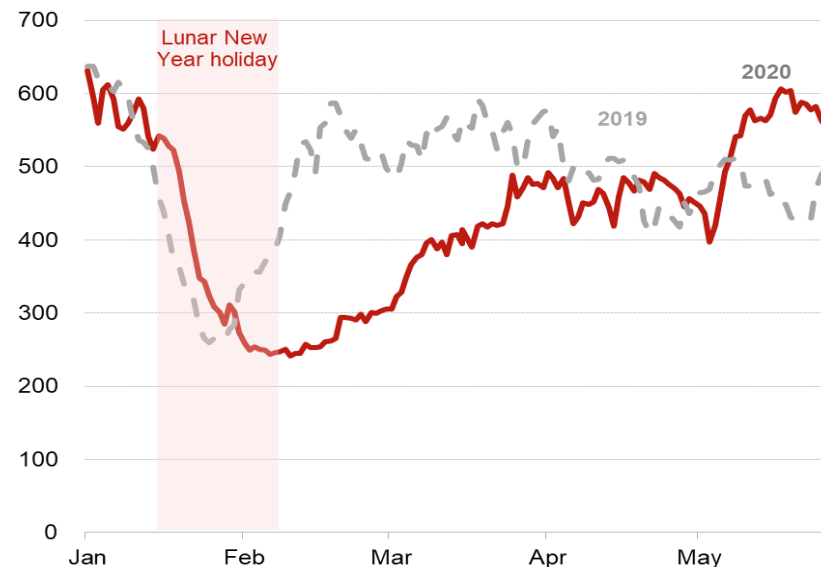
China state refiners run rates

State-owned refiners aggregate utilization rate



Major power generators coal consumption

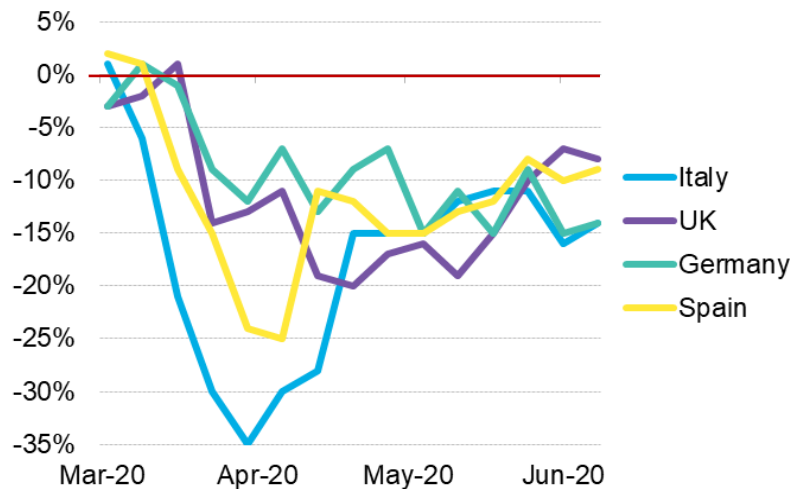
Thousand metric tons



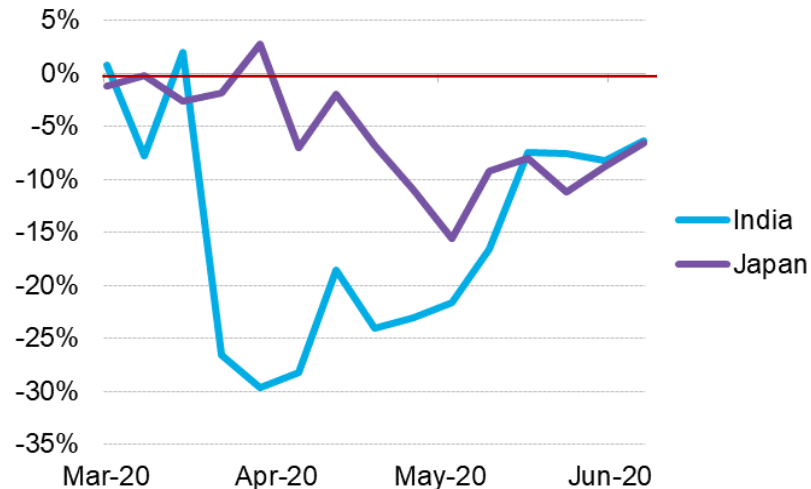
BloombergNEF, China Coal Transportation and Distribution Association

Electricity demand in Europe and in Asia

Europe



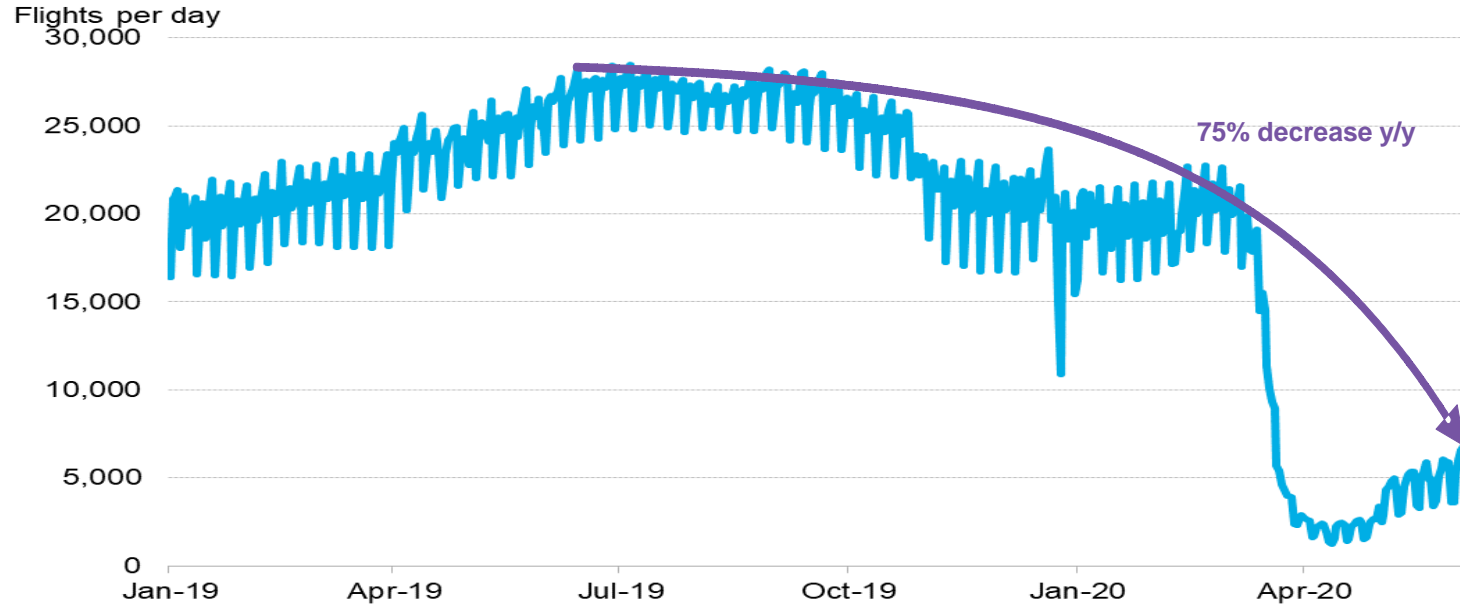
Asia



Note: average daily electricity load from each week in 2020 with the corresponding week from 2019 for peak hours (08:00-18:00). Percentages are adjusted for differences in temperature..

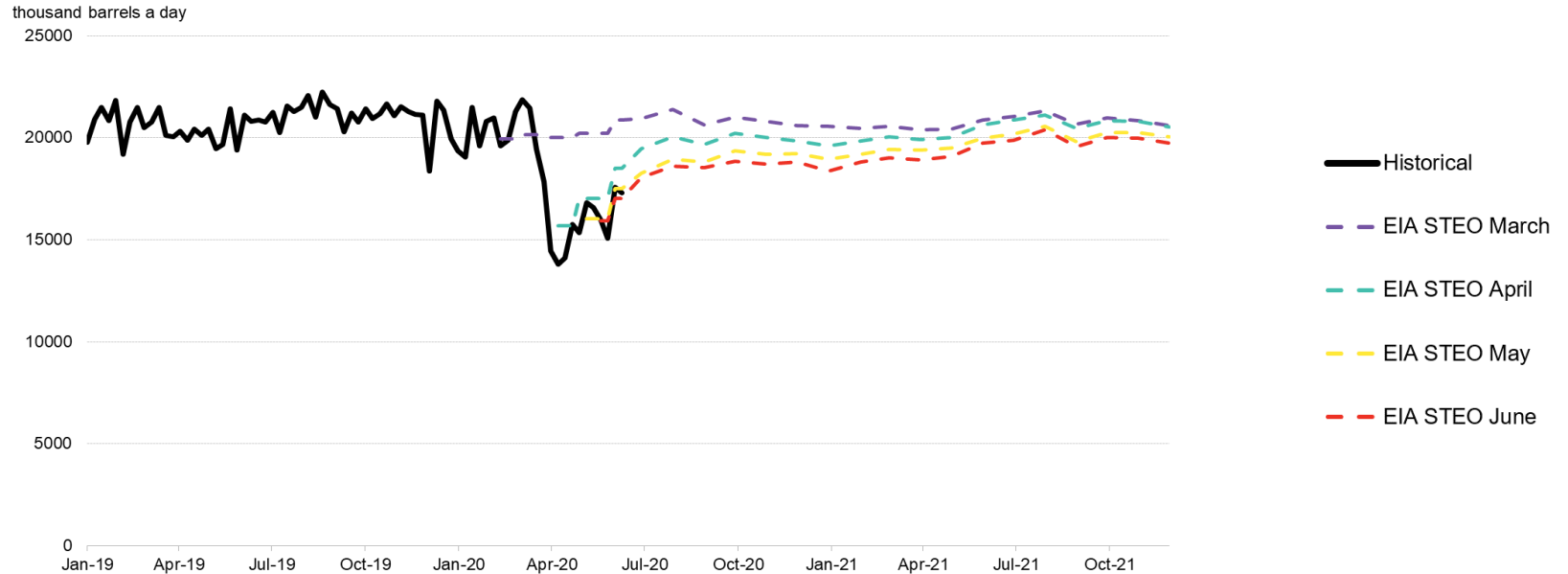
Source: Bruegel

Flights in Europe 2019-2020



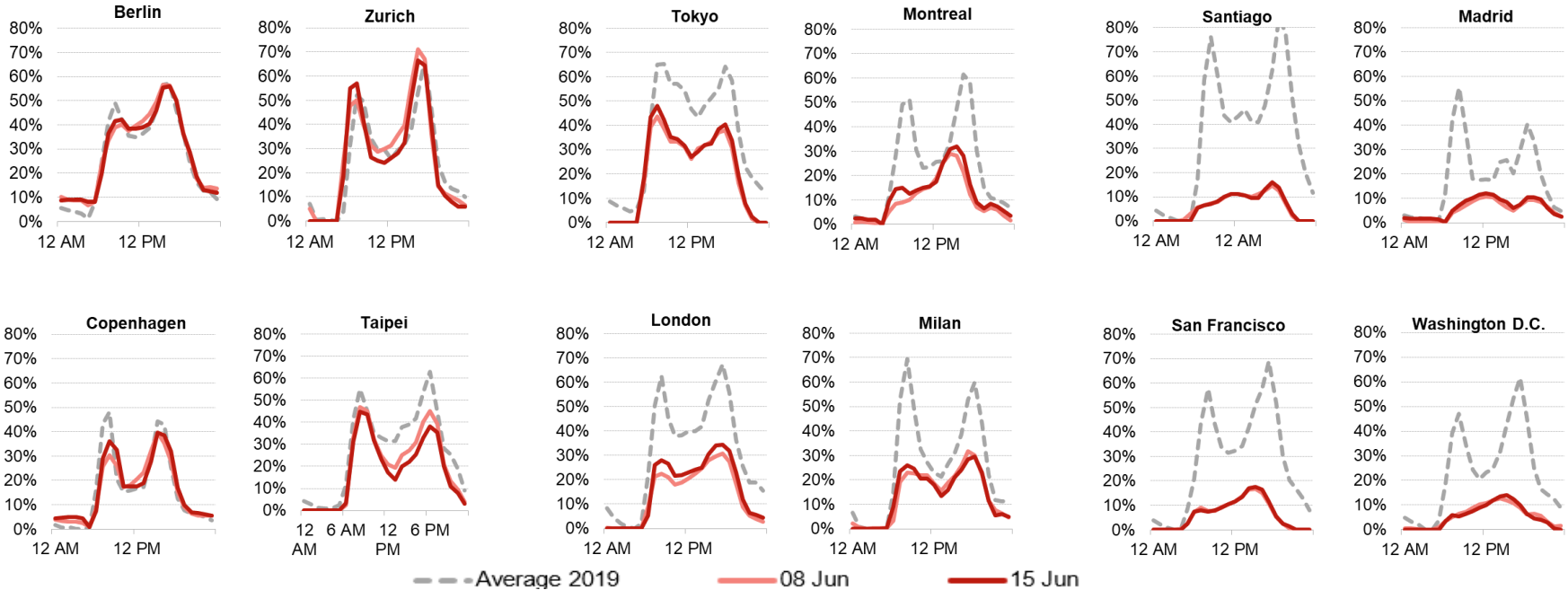
Source: Eurocontrol

US oil demand



Source: EIA

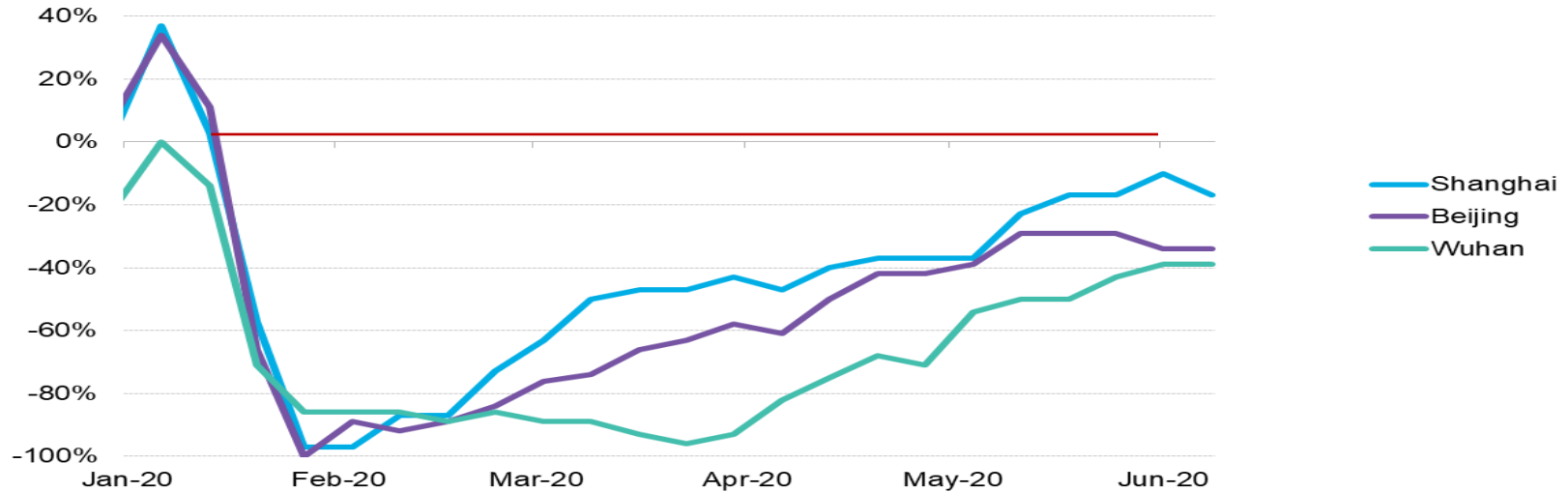
Road congestion in selected cities



Note: TomTom Congestion Index data

Source: BloombergNEF, TomTom

Congestion levels in selected Chinese cities



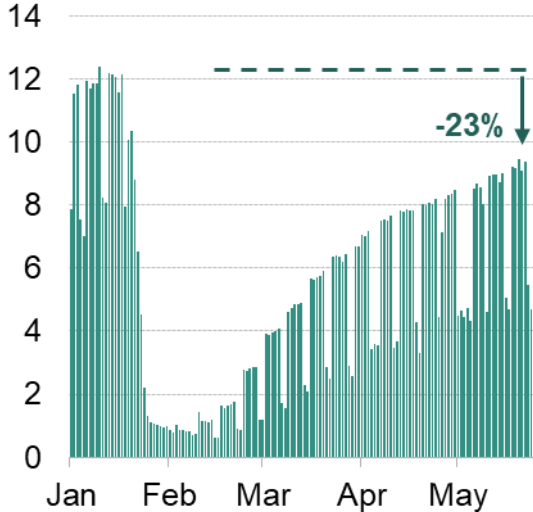
Note: Weekly averages. Figures are percentages of an equivalent week in 2019

Source: TomTom Index

Daily subway passenger numbers in selected Chinese cities

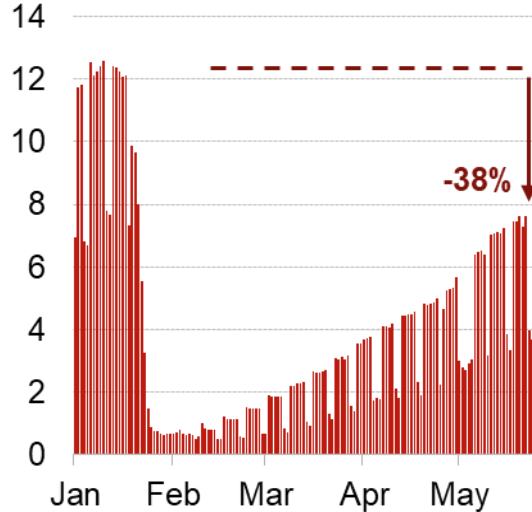
Shanghai

Million passengers



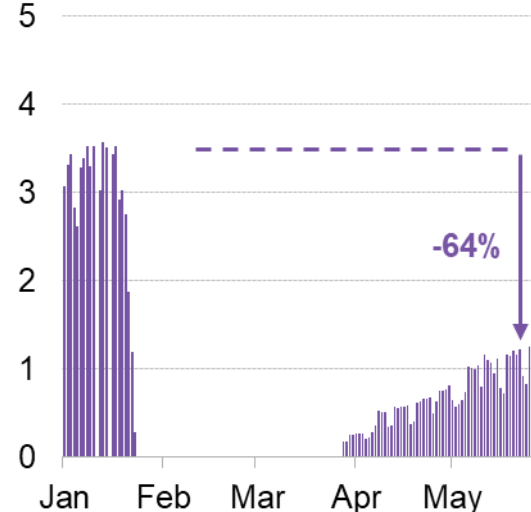
Beijing

Million passengers



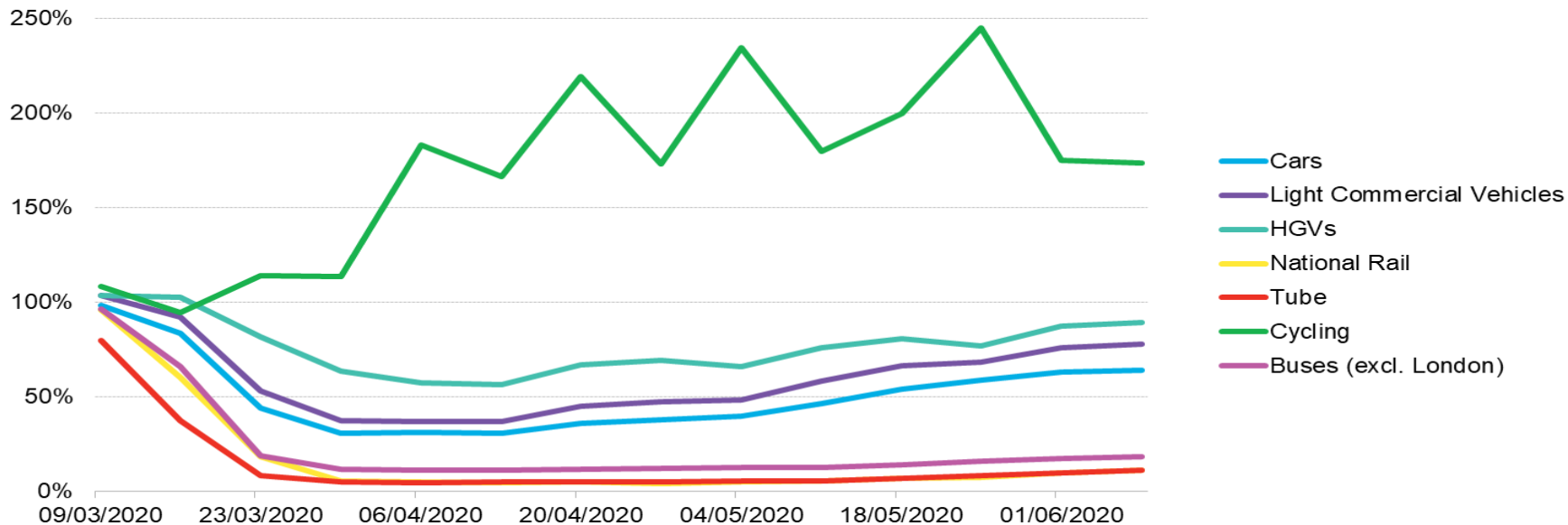
Wuhan

Million passengers



Source: BloombergNEF, local transport authorities

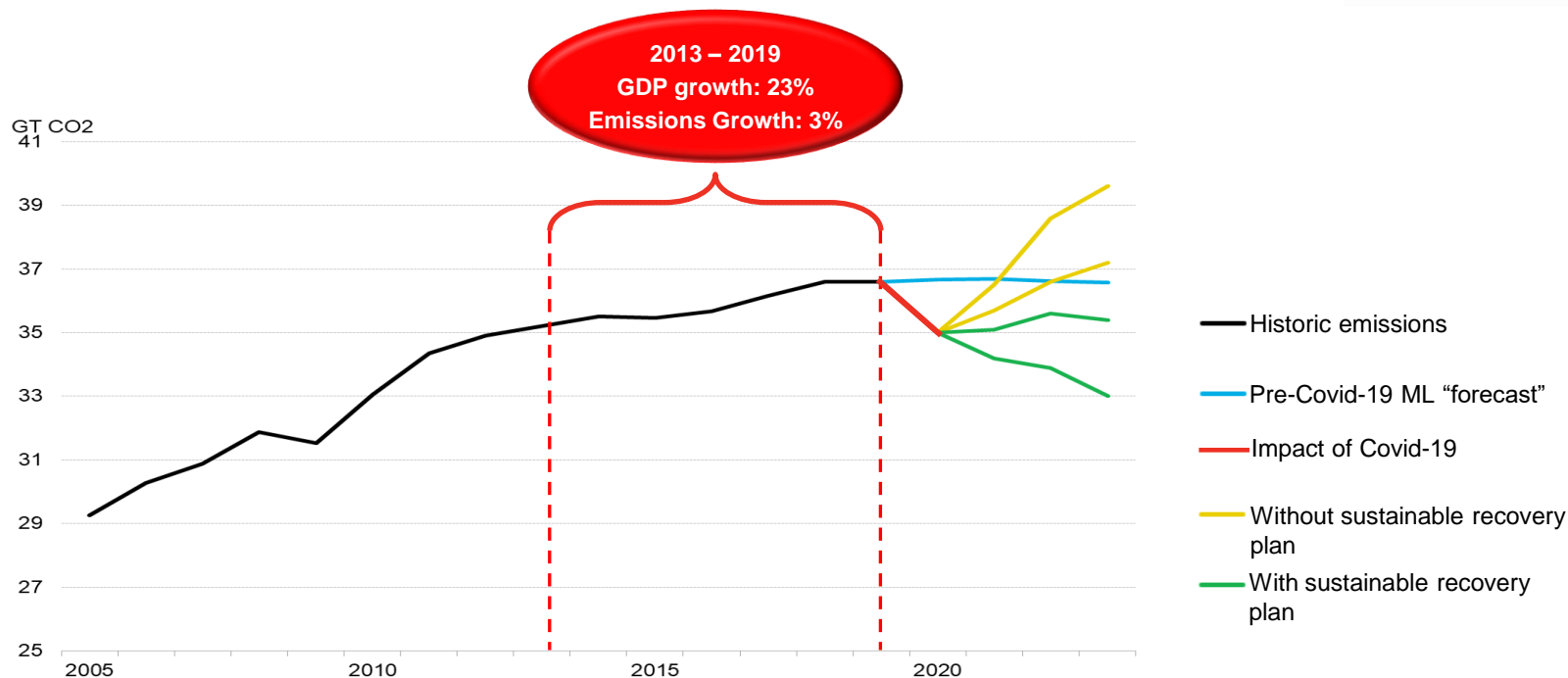
Use of transport modes in the UK compared to 2019



Note: Weekly averages. Figures are percentages of an equivalent week in 2019

Source: Department for Transport

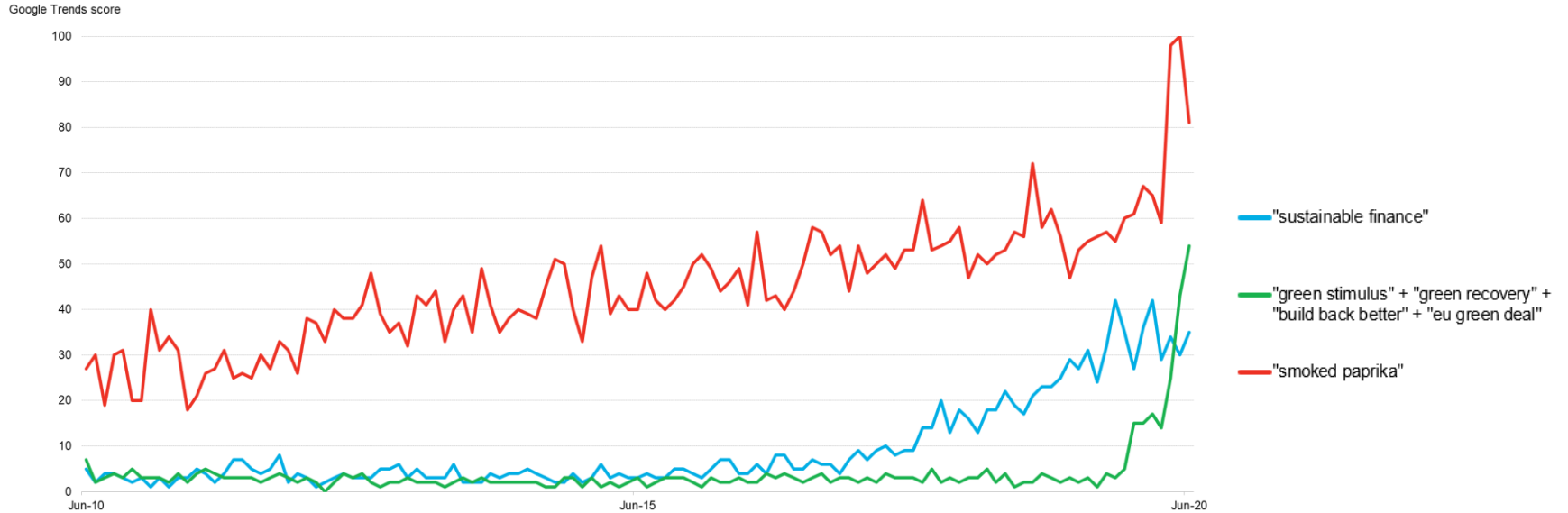
Covid-19 emissions scenarios



Note: Data for 2020 provisional

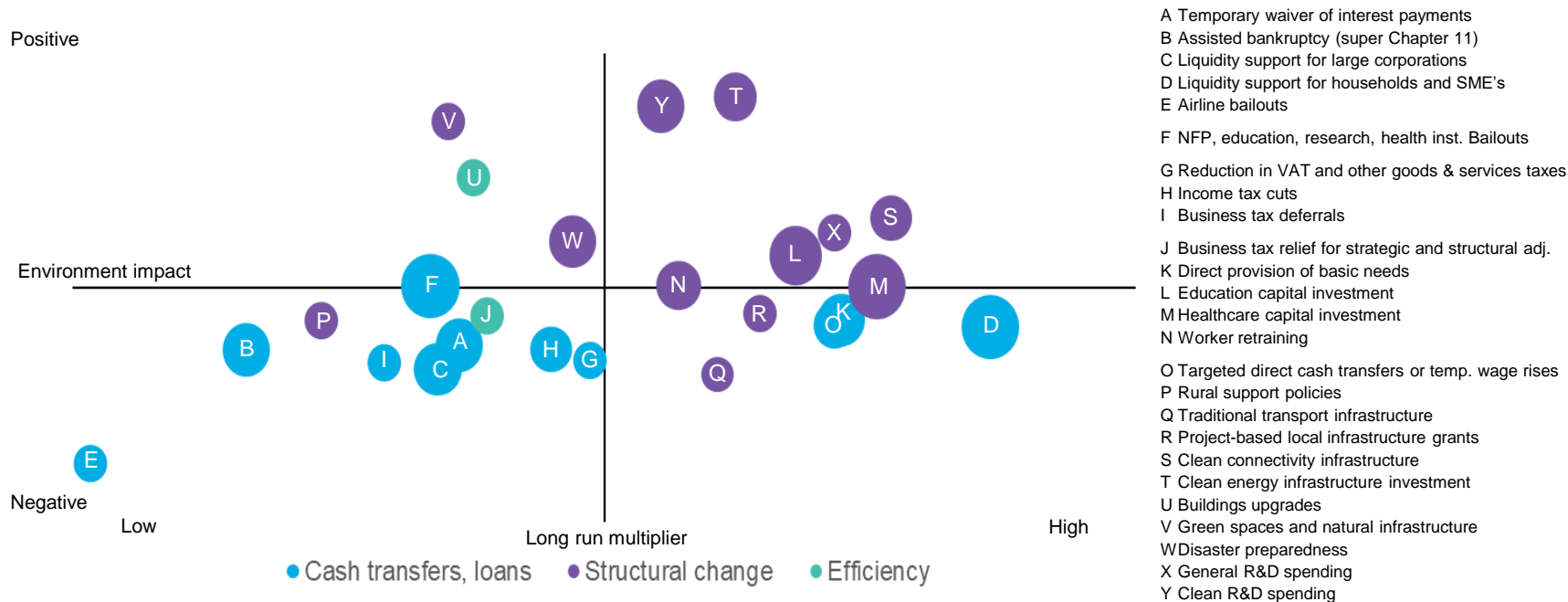
Source: Liebreich Associates, IEA

Google trends



Source: Liebreich Associates, Google Trends

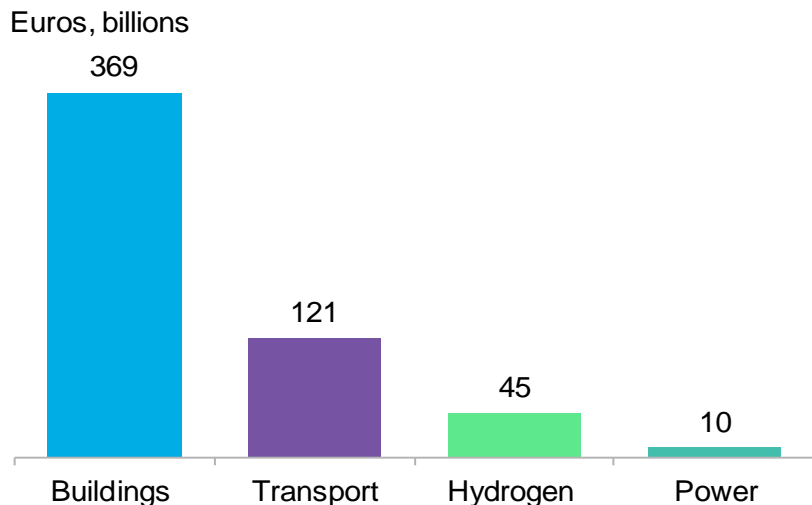
Survey of Fiscal Recovery Policies



Source: Cameron Hepburn et al.

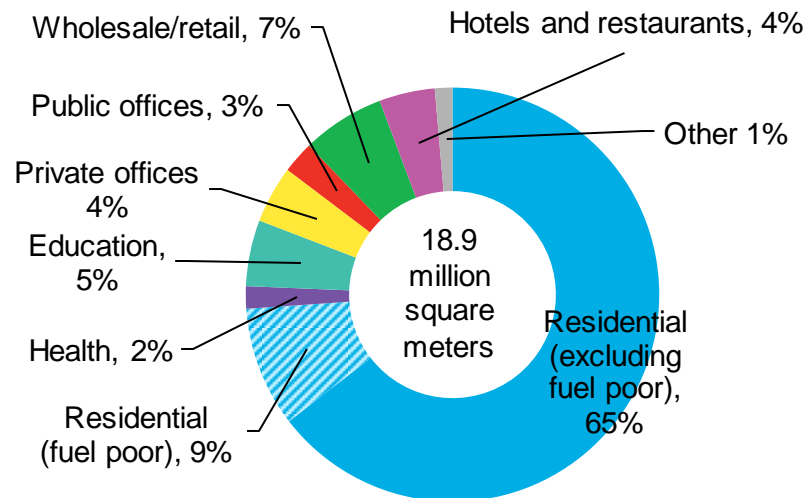
Buildings: the epicenter of green recovery

Total budgetary contributions of the EU's green recovery plan by sector



Source: Euractiv, BloombergNEF. Note: Assumes 4 years for the duration of measures that extend for the recovery period of Next Generation EU proposals.

EU-27 building floor space by sector



Source: Euractiv, BloombergNEF. Note: In 2018, 7.6% of European households were unable to keep their homes adequately warm. This represents approximately 9% of total building floor area. Floor space estimates are from 2013.

Global Commission for Urgent Action on Energy Efficiency's recommendations

Prioritise cross-cutting energy efficiency action for its economic, social and environmental benefits

Act to unlock efficiency's job creation potential

Create greater demand for energy efficiency solutions

Focus on finance in the wider context of scaling up action

Leverage digital innovation to enhance system-wide efficiency

The public sector should lead by example

Engage all parts of society

Leverage behavioural insights for more effective policy

Strengthen international collaboration

Raise global energy efficiency ambition

Thanks!

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