



Climate change, insurers, and fossil fuel companies a case for investment and collaboration

Kindly hosted by AIDA Association Internationale de Droit des Assurances

Starts at 3.30 pm London (10.30 am New York, 10.30pm Singapore)

Dr. Lars Schernikau | Germany/Singapore | HMS Bergbau AG – 28 July 2021



- Selection only -
Complete set of slides are
available upon request

Environmental Protection is Very Important

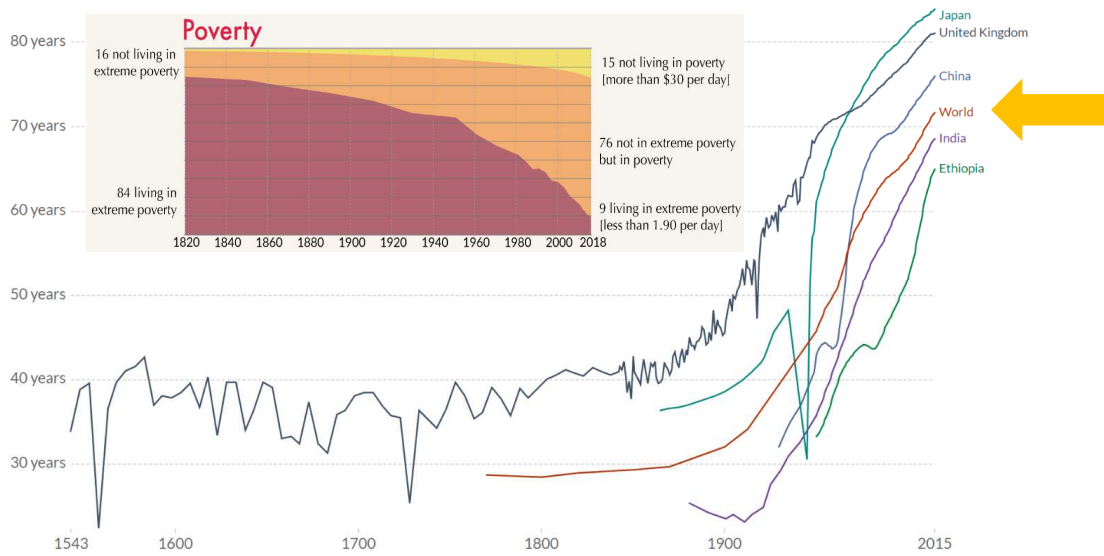
Today's Focus on the Environment is also Positive and Necessary

Schernikau
on Energy Policy



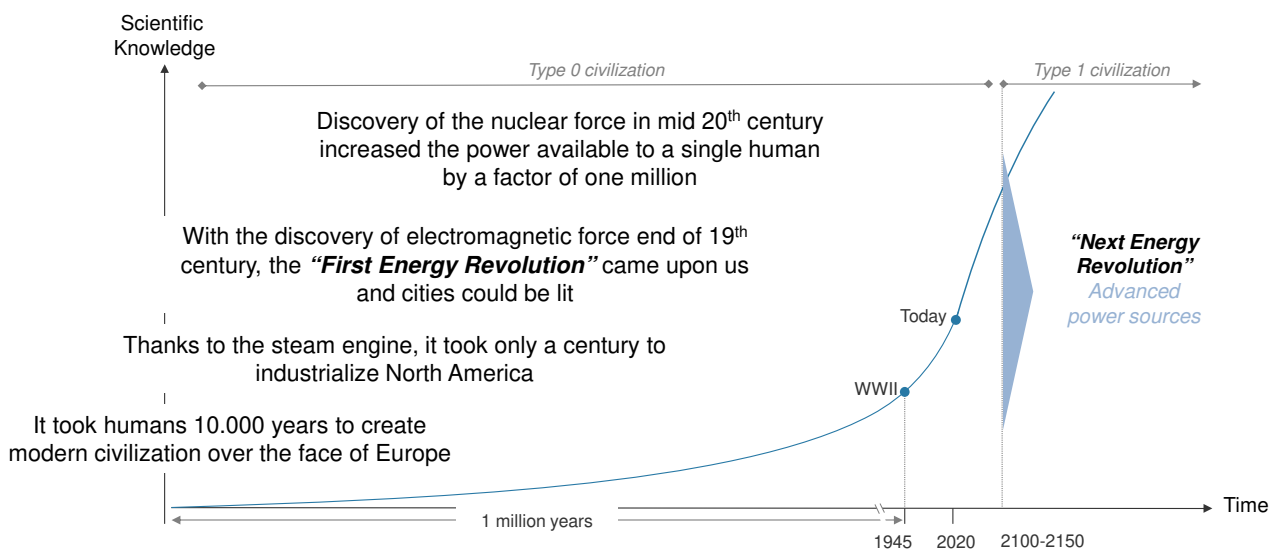
The issue of "Energy Transition & Decarbonization" is creating
fear and splitting/polarizing the world...
But, what we need is COLLABORATION and TOGETHERNESS

Life Expectancy 1543 to 2015
(at birth, if conditions wouldn't change throughout life)



Note: Shown is period life expectancy at birth, the average number of years a newborn would live if the pattern of mortality in the given year were to stay the same throughout its life
Source: Our World in Data. "OurWorldInData: Life Expectancy," July 2021. <https://ourworldindata.org/grapher/life-expectancy>.

Next Energy Revolution Will Be Reached Within the Next 150 Years



Humans have gained more knowledge since World War II than all the knowledge amassed in the previous 1 million⁽¹⁾ years

Note: A Type I civilization (also known as the planetary civilization) has the capacity to harness all the energy of its home planet, utilizing all the energy that reaches the planet (like solar) and all the energy it can produce (thermal, hydro, wind, etc); Type II civilization, also called a stellar civilization—can use and control energy at the scale of its planetary system

(1) Humans are likely to have developed over 1 million years ago, the Homo Sapien race is believed to have developed about 70,000 years ago
Source: Schernikau illustration, input from Michio Kaku's books

**Recommendation:
Check everything yourself**

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public any slides/recording
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PERSONAL DISCLAIMER:

I agree that

1. The world is warming
2. CO₂ is a greenhouse gas and contributes to warming
3. Humans contribute to global warming

no dispute

I care about the environment and our childrens' and planet's future

But I AM from the energy commodities industry, and love my job

dispute

I am biased and I will be critical

Content

*Schernikau
on Energy Policy*

Climate Change – Causes & Impacts

Understanding the Global Energy Landscape

Advantages & Disadvantages of Fossils Fuels vs. «Renewables»

Discussion on Environmental Protection: The Role of Fossil Fuel & Insurance Companies?

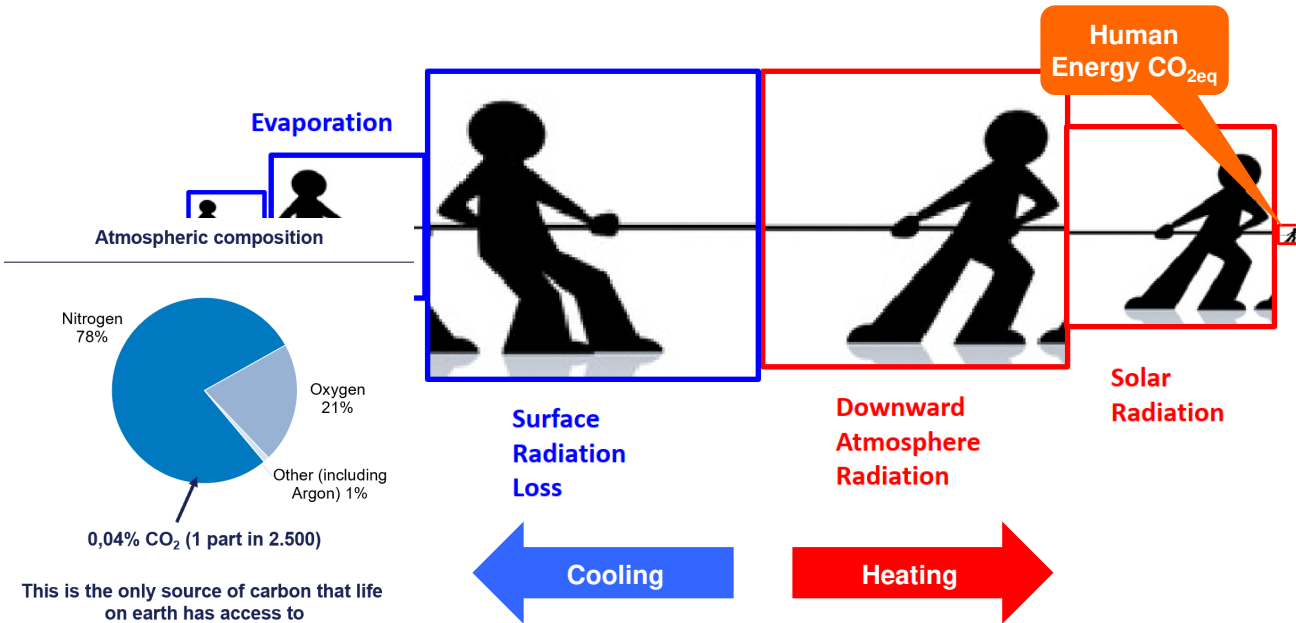
I will not cover:

- ***Politics, Scientific Consensus, Censoring, Critical Thinking in Education***
- ***Electric Vehicles, Nuclear, Geothermal, Hydro, Coal vs. Gas***
- ***Hydrogen, Batteries, Other energy storage ideas***
- ***Temperature histories, temperature measurements, and many other important topics***

Putting It Into Perspective
Temperature Comes from Energy

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no dispute



Source: Prof John Christy; Presentation Jan 2021

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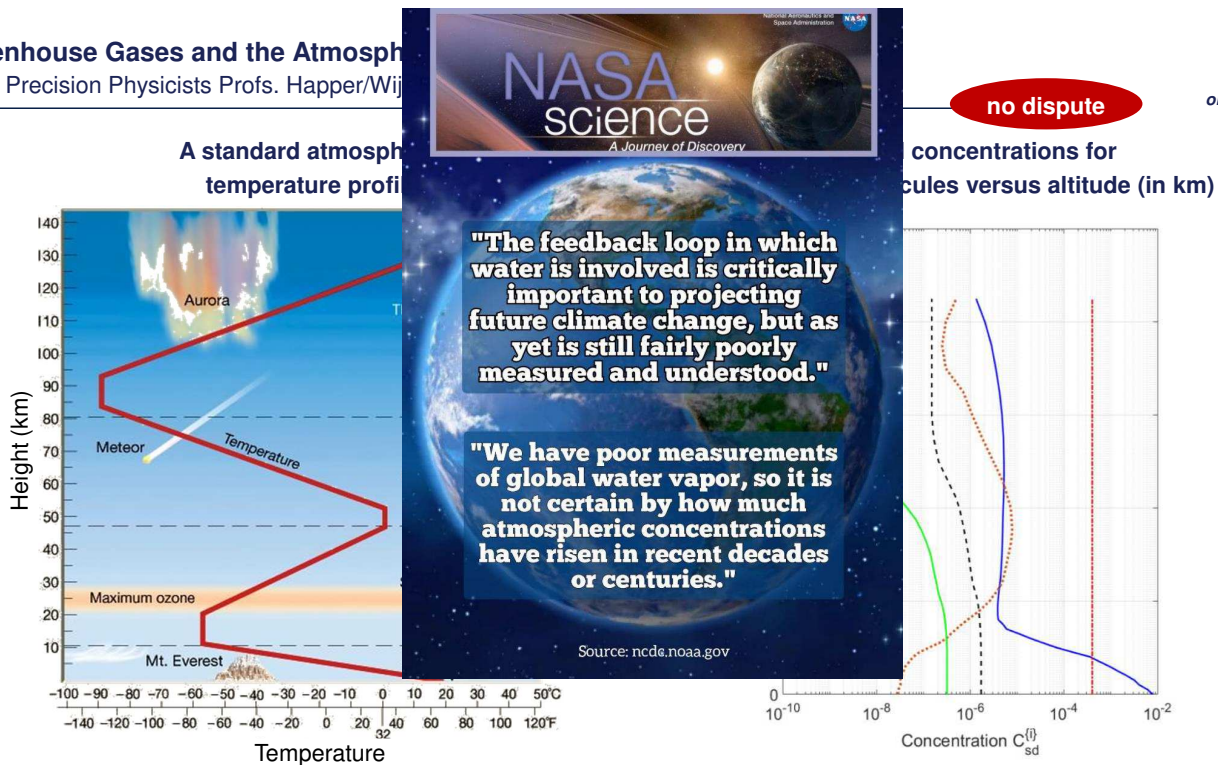
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Greenhouse Gases and the Atmosphere
From Precision Physicists Profs. Happer/Wijngaarden

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no dispute



Note 1: Figure Left. A standard atmospheric temperature profile[17], $T = T(z)$. The Earth's mean surface temperature is $T(0) = 288.7 \text{ K}$. Right. Standard concentrations[18], $C_i(z)$ for greenhouse molecules versus altitude z

Note 2: The water that makes up clouds is in liquid or ice form. Most of the water in clouds is in very small droplets. The droplets are so light they float in the air.

Sources: Wijngaarden/Happer Nov 2019/public Jun 2020; summarized here and in detail here; Arxiv

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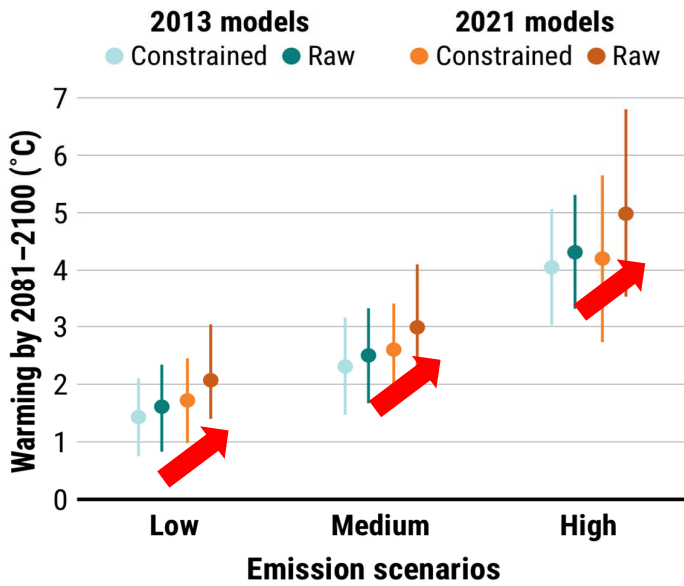
Page 7

U.N. climate panel confronts implausibly hot forecasts of future warming

ScienceMag.org July 2021

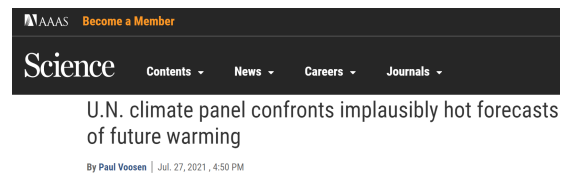
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Dispute?



“But as climate scientists face this alarming reality, the climate models that help them project the **future have grown a little too alarmist.**”

Many of the world’s leading models are now projecting warming rates that most scientists, including the modelmakers themselves, **believe are implausibly fast.**”



Sources: July 2021, [U.N. climate panel confronts implausibly hot forecasts of future warming | Science | AAAS \(sciencemag.org\)](https://www.sciencemag.org)

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Additional CO₂ Will Add Some (Insignificant) Energy to Atmosphere

Outgoing Energy from Earth

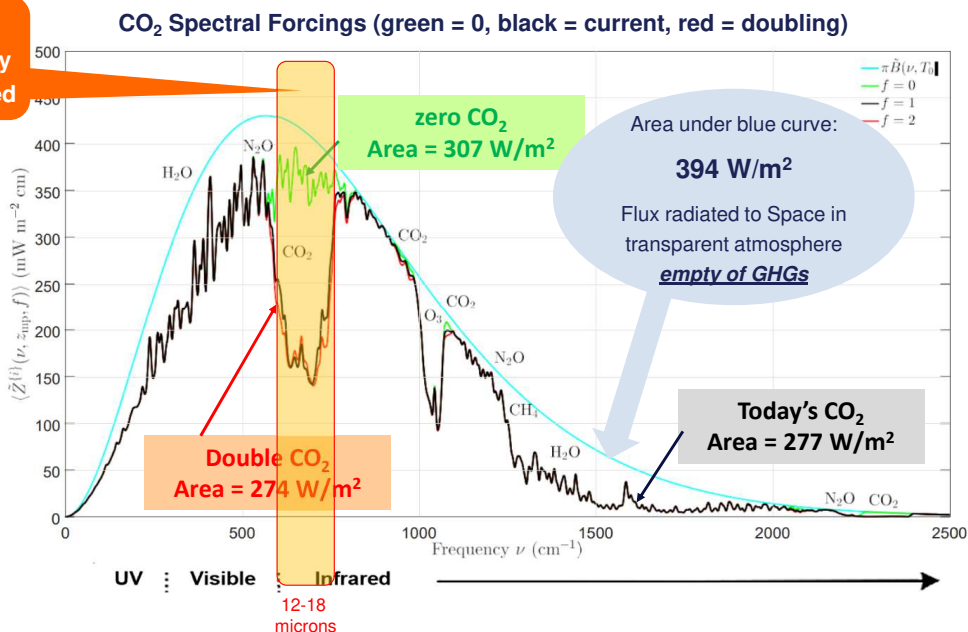
no dispute

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CO₂'s radiation absorption capacity essentially saturated

Earth's surface temperature:
today 15 °C

~38 °C warmer than without greenhouse gases
H₂O, CO₂, CH₄,
N₂O, O₃



Note 1: The area under the black, jagged curve is 227 W m⁻² and is the frequency-integrated flux at the top of the atmosphere of Fig. 3. The area under the Planck spectral intensity (the smooth blue curve) is 394 W m⁻². It is the flux, σT₀⁴, that would be radiated to space by a black surface at the temperature T₀ = 288.7 K for an atmosphere that contained no greenhouse gases and was transparent to thermal radiation.

Note 2: Figure 5: The spectral forcing at current levels of carbon dioxide, CO₂ (the black curve with f = 1), or if concentrations of carbon dioxide are doubled (the red curve with f = 2), or if all carbon dioxide is removed (the green curve with f = 0). See the caption of Fig. 4.

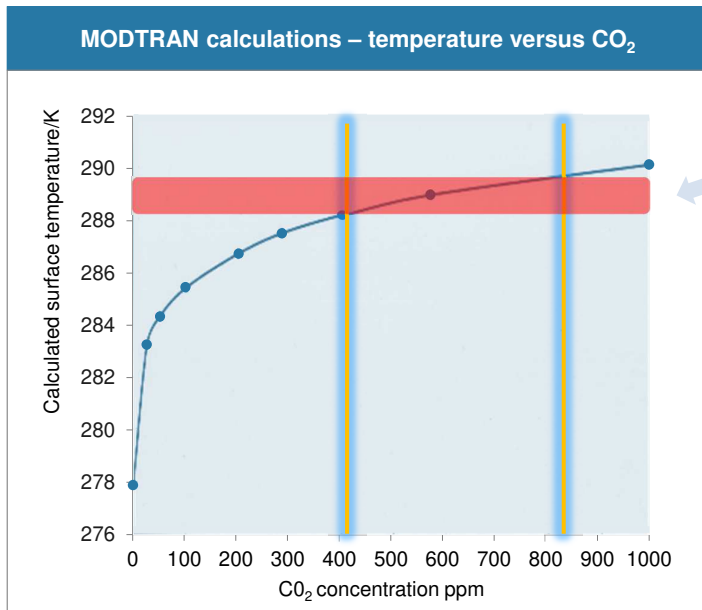
Sources: Wjringaarden/Happer Nov 2019; summarized [here](#) and in detail [here](#)

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no dispute



Climate Sensitivity

ECS - Equilibrium Climate Sensitivity

ECS is defined as the increase in global mean surface temperature (GMST) arising from a doubling of atmospheric equivalent CO₂, once the ocean has fully equilibrated. Changes would take in order of centuries.

TCR - Transient Climate Response

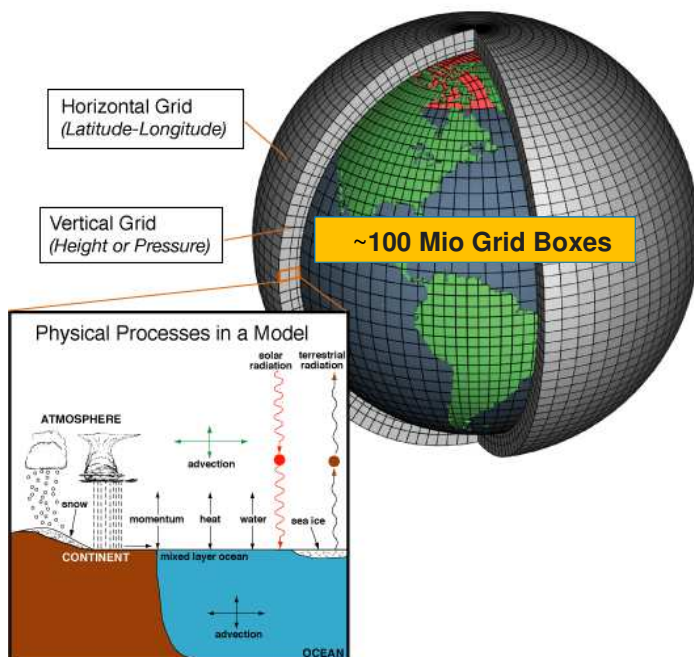
TCR is the increase in GMST, from a previous equilibrium state, when atmospheric CO₂ rises by 1% p.a. until it has doubled (taking 70 years).

It is lower than ECS since at the time of CO₂ doubling the ocean has not fully warmed up, which takes many centuries

Note: Wavenumber is the inverse of the wavelength; 12-18 microns wavelength = 550 – 830 wavenumber, there approx. range where CO₂ is affecting radiation
Sources: Modtran Simulation; publicly available, summarized Prof. Happer, Princeton 2017

Climate Models: Grid Across Atmosphere and Within Oceans

no dispute



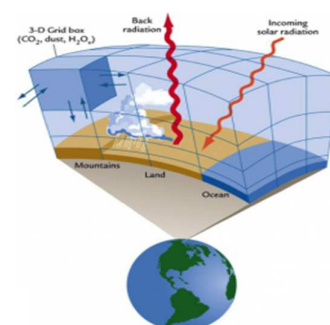
~1 Mio Grid Boxes for Atmosphere

- 10 to 20/50 layers of ~100 x 100 km boxes (some finer parts north down to 10km)
- more like pancakes; 1-4 km grid box height

~100 Mio Grid Boxes for Oceans

- ~10 x 10 km boxes

Models typically run in 30 min time steps



Note: at about 40 km atmospheric height the height of each box translates to about 1-4km
Source: NOAA AtmosphericModelSchematic.png | NOAA Climate.gov; Book Unsettled 2021, Prof Koonin, starting Page 79

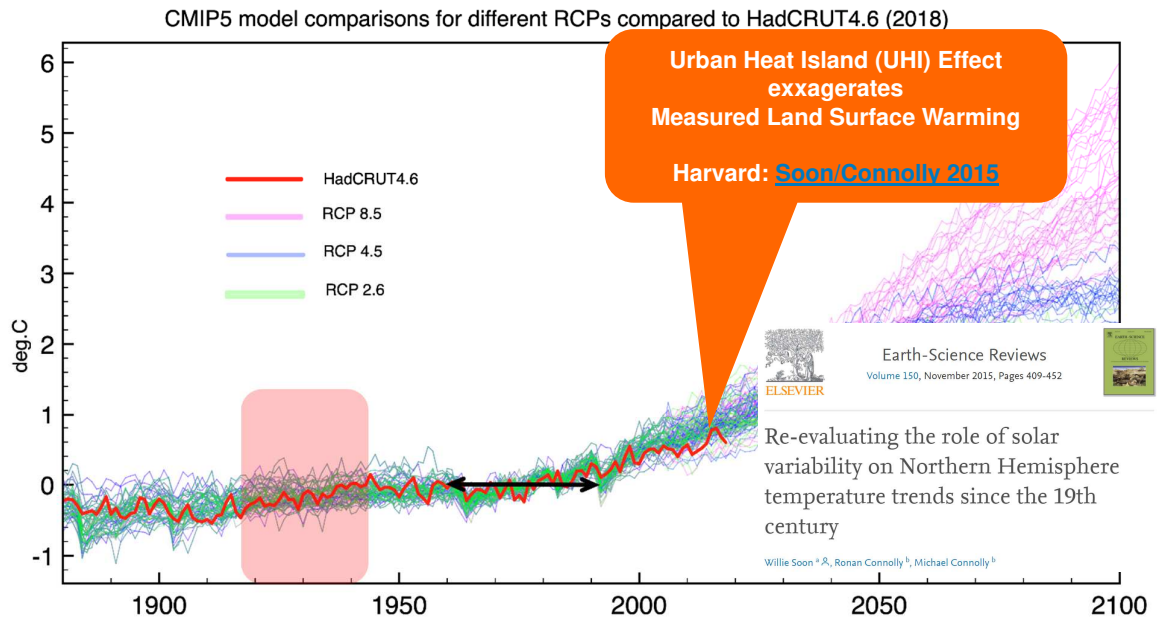
Surface Temperatures: Model Comparison Until 2100

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no dispute that there is
dispute amongst models

The model disagreement on global average surface temperature is large – a spread of 5+°C in 2100 and 2°C in 2050

Climate model tuning and parametrization ensures close match until present



Note 1: Spaghetti are individual annual model results for each RCP. Solid curves are model ensemble annual averages; HadCRUT4.6 compared to 41 models run with 3 widely different RCP forcing
 Note 2: Figure shows the result for HadCRUT4.6 compared to the CMIP5 model ensembles run with CO2 forcing levels from RCP8.5, RCP4.5, RCP2.4 and where anomalies use the same 30y normalization period. Actuals run even below the RCP2.6
 Source: Clive Best January 2019, downloaded [here](#).

Scenarios: Reality entirely outside of IPCC «Baseline»

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no dispute that IPCC uses
unrealistic «Baseline»

RCP - Representative Pathways (end of century radiative forcing W/m²)

RCP 2.6 is described "very stringent", requires CO₂ emissions start declining by 2020 and go to zero by 2100.

RCP 4.5 is described intermediate. Emissions peak around 2040, then decline.

RCP 8.5: emissions continue rise beyond 2100. Since AR5 described very unlikely, taken as the basis for worst-case climate change scenarios

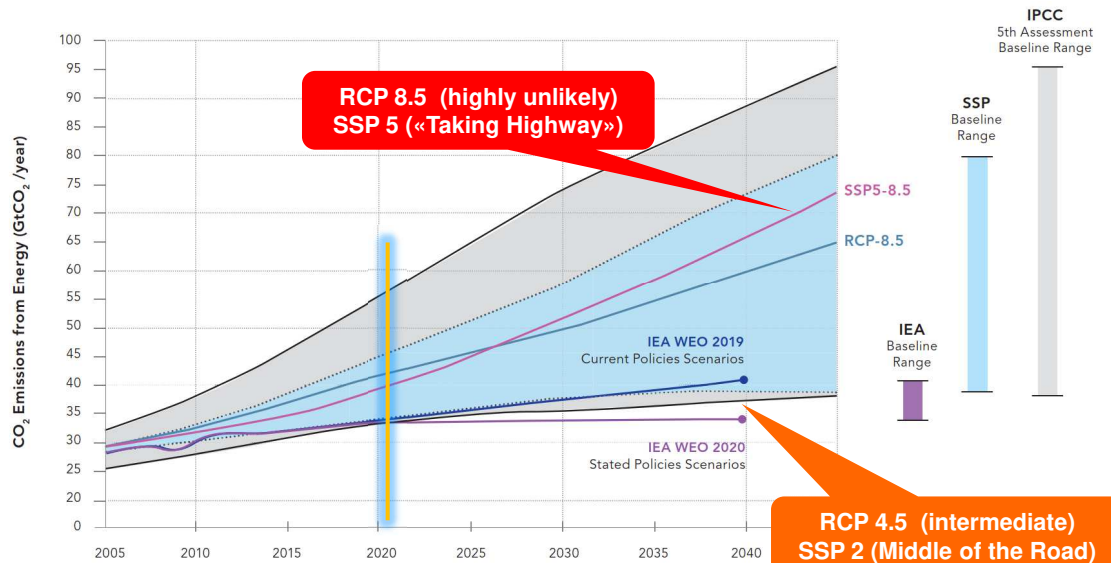
SSP - Shared Socioeconomic Pathways

SSP1 "Sustainability – Taking the Green Road"

SSP2 "Middle of the Road",
 SSP3 "Regional Rivalry – A Rocky Rd",
 SSP4 "Inequality – A Road Divided"

SSP5 Coal, Coal "Fossil-fueled Development – Taking the Highway"

IPCC BASELINE EMISSIONS SCENARIOS FROM 2005 TO 2040



Note: The range of fossil fuel baseline emissions projected by the International Energy Agency in 2019 and 2020 lie almost entirely outside the full range of baseline scenarios for the IPCC Fifth Assessment Report and the SSP scenarios shaping the IPCC Sixth Assessment Report.
 Source: Pielke, Roger, and Justin Ritchie. "Pielke: How Climate Scenarios Lost Touch With Reality," July 2021. <https://issues.org/climate-change-scenarios-lost-touch-reality-pielke-ritchie/>.

Scenar
8.5 Star

SSP3-7.0: Focus on Rivalry and national security
SSP1-2.6: Focus on Sustainability and well-being

Emissions grow steady for the whole century
Emissions peaked in 2019, net zero early 2080s

+ 4.3°C
(+ 2.8 – 7.2°C)

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± 0.0°C
(- 0.2°C – + 0.2°C)

Most plausible 2005-2040 emissions scenarios project less than 2.5 degrees C of warming by 2100

AUTHORS Contents lists available at ScienceDirect



Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss



+ 1.9°C
(+ 1.5 – 3.4°C)

2100

Distorting the view of our climate future: The misuse and abuse of climate pathways and scenarios

Roger Pielke Jr.^{a,*}, Justin Ritchie^b

^a University of Colorado Boulder, United States
^b University of British Columbia, Canada

“The Future isn’t what it used to be”
What do climate models use as input?

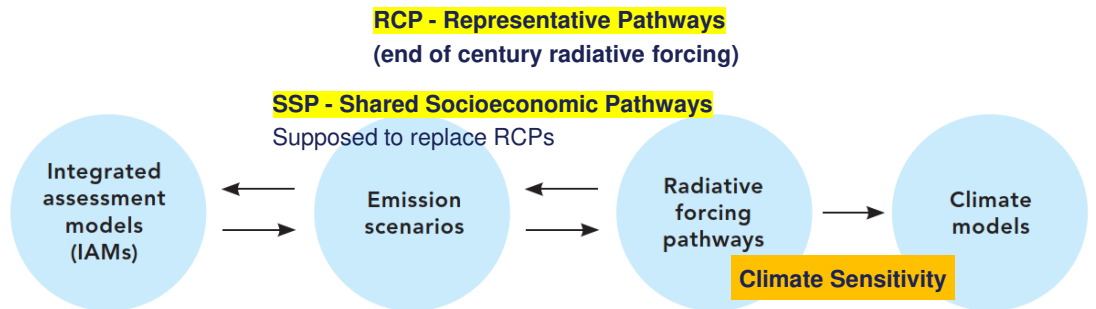
ROGER PIELKE JR. AND JUSTIN RITCHIE

How Climate Scenarios Lost Touch With Reality

A failure of self-correction in science has compromised climate science’s ability to provide plausible views of our collective future.

no dispute that IPCC uses unrealistic “Baseline”

- Socioeconomic variables**
- economic growth
 - population growth,
 - energy consumption,
 - changes in land use (farming, grazing, forestry, etc)
 - particulate pollution
 - And much more



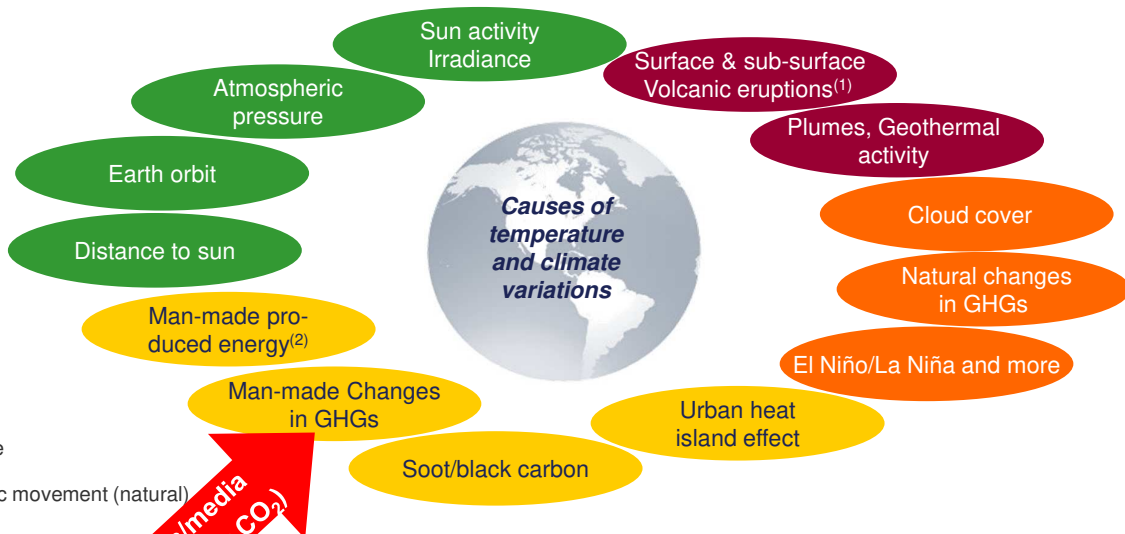
IPCC Baseline: 2021 6th Assessment

- RCP8.5: 2100 coal consumption per capita up 6x from today
- SSP5-8.5: coal surpass oil and EVs as dominant fuel for cars by 2100
- SSP1 (Green Road): global coal use doesn’t fall below current until after 2080
- By 2100: ~1.200 ppm CO₂ (2,8x of today)

RCP8.5 and its progeny SSP5-8.5 represent an obsolete and extreme vision of a coal-dominant future

What Causes Temperature and Climate Variations? We Are Not 100% Sure!

dispute



- Outer space
- Inner earth
- Atmospheric movement (natural)
- Man-made

The IPCC assumes essentially «net-zero» natural forcings

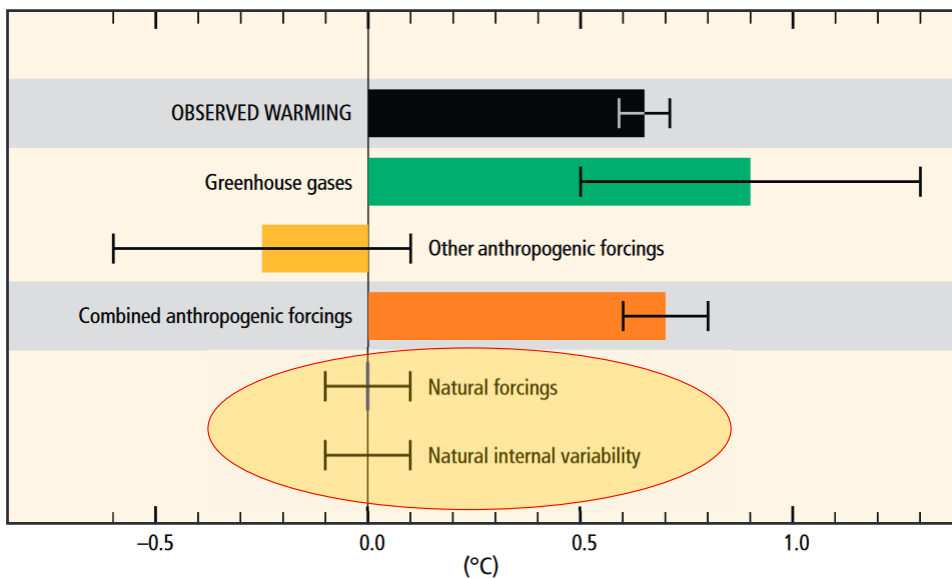
Politics/media
Focus (only CO₂)

(1) Probably 90% of all volcanos are below sea level and are rarely considered. Real carbon dioxide emissions from volcanos are underestimated as only active eruptions (only about 50-70 p.a.) are considered.
 (2) According to the law of conservation of energy, energy is ever lost, only converted. Any energy that humans generate (which does not come from the sun) and then utilize will always end up in heat radiation. This heat will either radiate back to space or warm the biosphere (not because of CO₂).
 Source: Schernikau analysis based on Soon 2005; s852; i342

IPCC AR5: Contributions to Observed 1951-2010 Surface Temperature Change

Essentially ZERO net natural forcing or internal variability

dispute



Note: Assessed likely ranges (whiskers) and their mid-points (bars) for warming trends over the 1951–2010 period from well-mixed greenhouse gases, other anthropogenic forcings (including the cooling effect of aerosols and the effect of land use change), combined anthropogenic forcings, natural forcings and natural internal climate variability (which is the element of climate variability that arises spontaneously within the climate system even in the absence of forcings). The observed surface temperature change is shown in black, with the 5 to 95% uncertainty range due to observational uncertainty. The attributed warming ranges (colours) are based on observations combined with climate model simulations, in order to estimate the contribution of an individual external forcing to the observed warming. The contribution from the combined anthropogenic forcings can be estimated with less uncertainty than the contributions from greenhouse gases and from other anthropogenic forcings separately. This is because these two contributions partially compensate, resulting in a combined signal that is better constrained by observations. (Figure 1.9)
 Source: "2014 AR5 SYR Synthesis Report: Climate Change 2014 — IPCC," 2014. <https://www.ipcc.ch/report/ar5/syr/>, Page 6

Cherry-picked data

Climate Change – Causes & Impacts

Understanding the Global Energy Landscape

Advantages & Disadvantages of Fossils Fuels vs. «Renewables»

Discussion on Environmental Protection: The Role of Fossil Fuel & Insurance Companies?



Claim: All Extreme Weather Is Getting Worse and it's Energy-CO₂ Fault

dispute

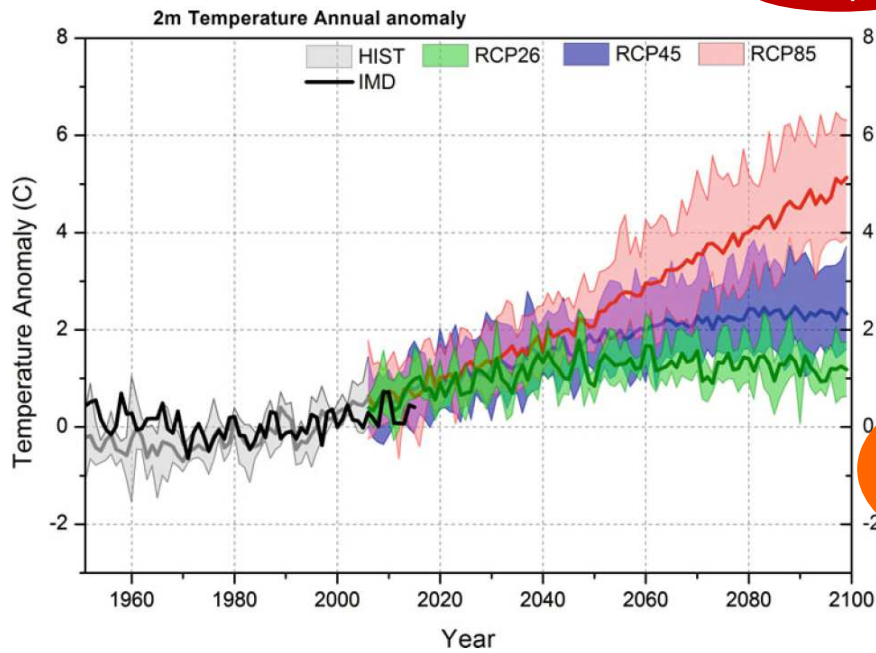


India's Temperatures Have Been Stable, Today Similar to 1950s...

... but Projections Using Unlikely IPCC RCP 8,5 or even RCP 4,5 Scenarios Make It Appear Alarming

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no dispute



India's Annual
Mean Surface Air
Temperatur in °C

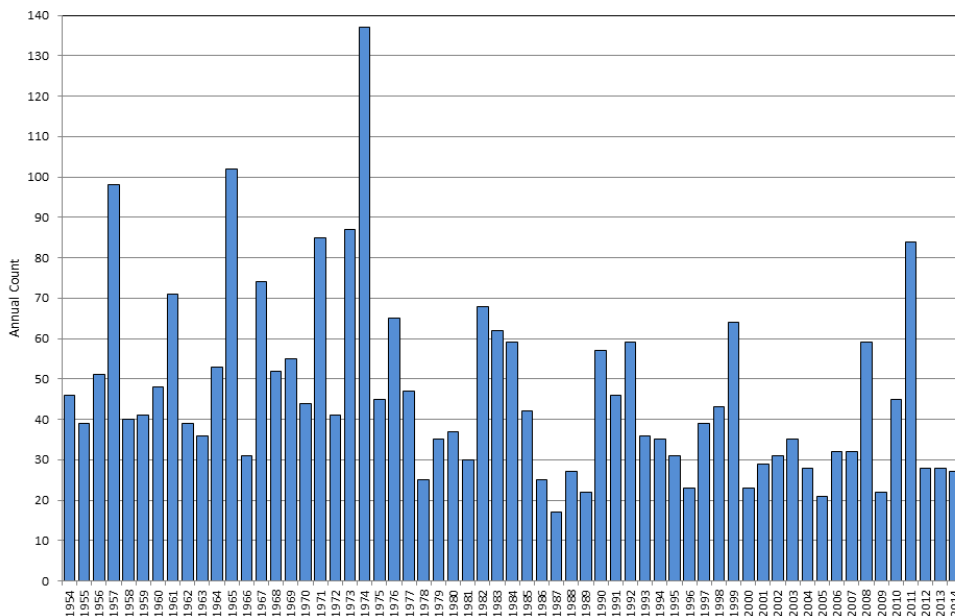
Note: Page 35, Fig 2.8: Time series of Indian annual mean surface air temperature (°C) anomalies (relative to 1976–2005) from CORDEX South Asia concentration-driven experiments. The multi-RCM ensemble mean (solid lines) and the minimum to maximum range of the individual RCMs (shading) based on the historical simulations during 1951–2005 (grey), and the downscaled future projections during 2006–2099 are shown for RCP2.6 (green), RCP4.5 (blue) and RCP8.5 (red) scenarios. The black line shows the observed anomalies during 1951–2015 based on IMD gridded station data
Source: Springer June 2020, Assessment of Climate Change over the Indian Region – Report of the Ministry of Earth Sciences (MoES) Government of India – available [here](#)

F3 Tornadoes

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US annual count of strong to violent tornadoes (F3+) 1954 to 2014

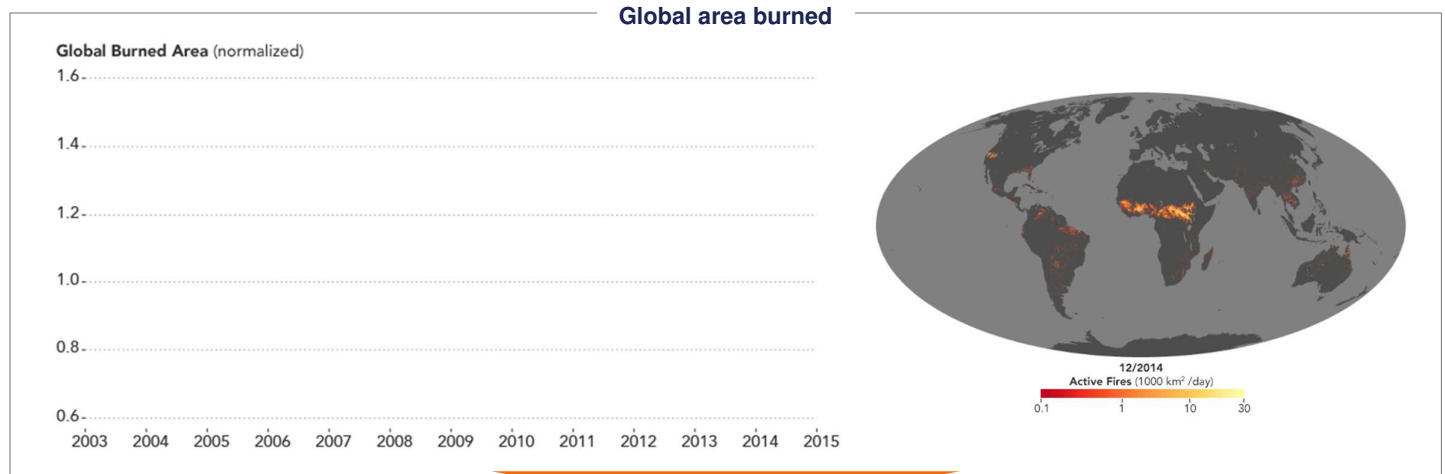


Source: NOAA, downloaded 1Jun2019 - <https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology/trends>

NASA: Total Number of Square Kilometers Burned Dropped by Roughly 25 Percent
Between 2003-2019

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“Even as the global burned area number has declined because of what is happening in savannas, we are seeing a significant increase in the intensity and reach of fires in the western United States because of climate change.”
(Randerson, University of California)

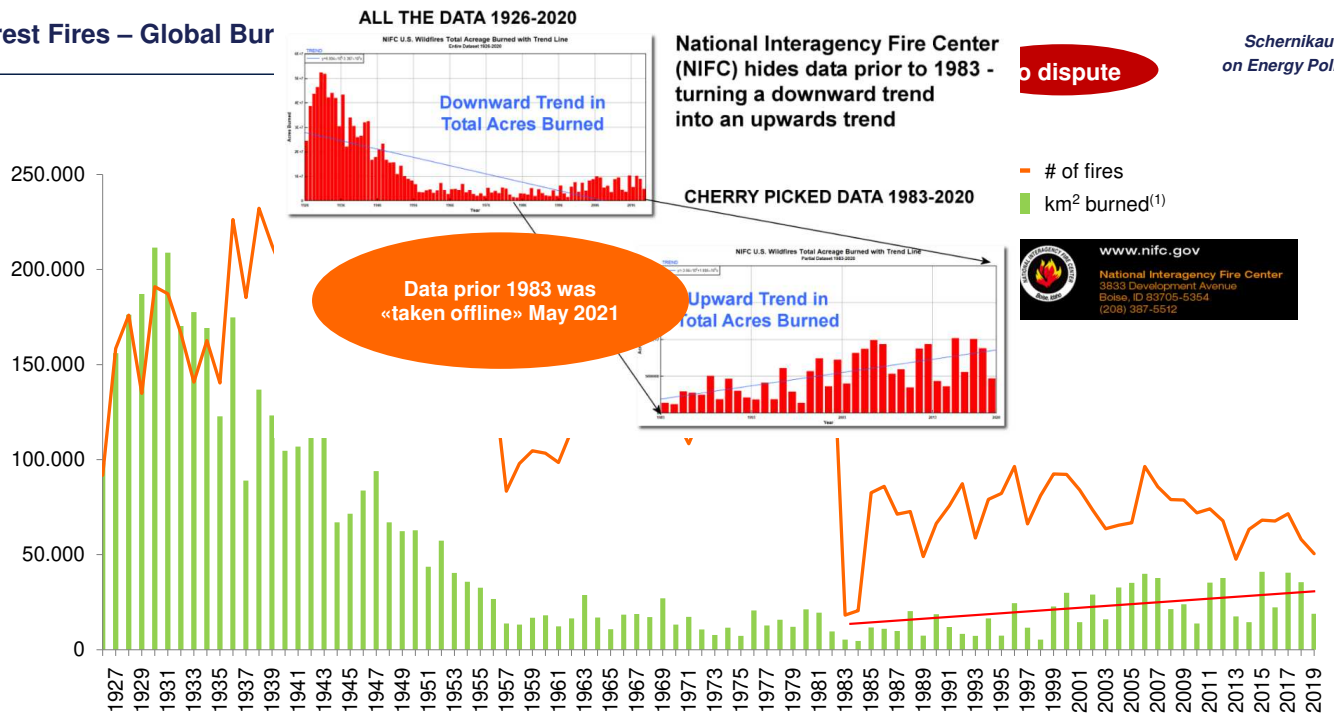
Sources: NASA Earth Observatory, written by Adam Voiland, downloaded from [nasa.gov](https://www.nasa.gov) [here](#) on 20 Sep 2020

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Forest Fires – Global Bur



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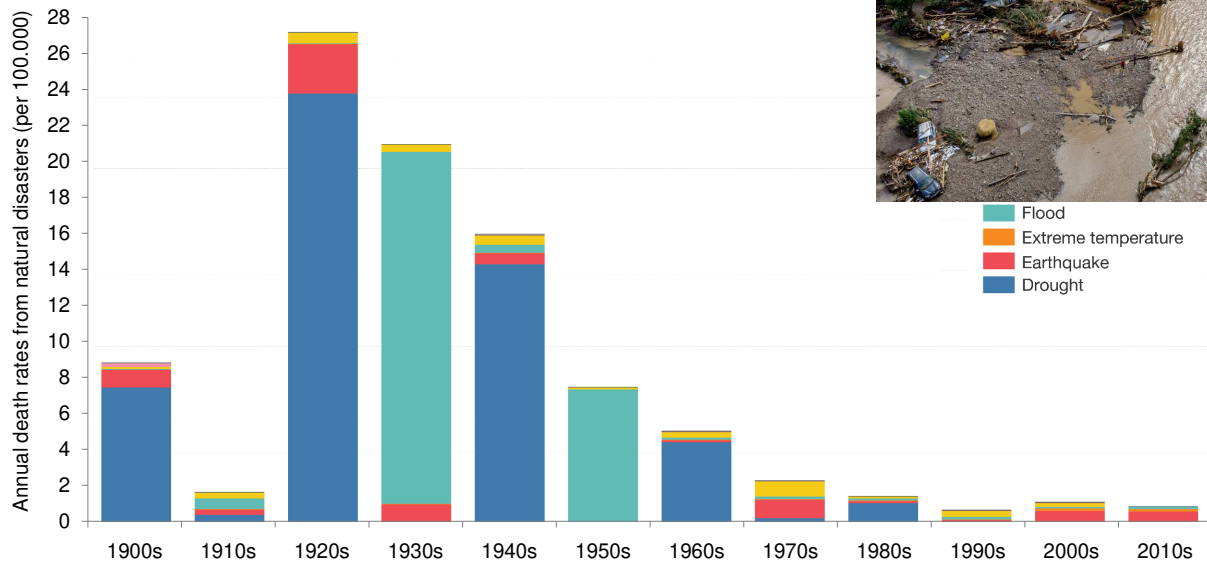
(1) Acres where converted to km², 1 acre = 0.00404686 km²; 1 km² = 247 acre
Notes: *2004 fires and acres do not include state lands for North Carolina; **Protected Federal lands in Alaska are included from 1959. All State, private and Federal lands in Alaska and Hawaii data are from 1960; ***Beginning in 1966, when Arizona entered the Cooperative Forest Fire Control Program, statistics became available for all 50 States.
Source: https://www.nifc.gov/fireinfo/fireinfo_stats_totalFires.html downloaded Mar 2020 (changed since then); change in NIFC data May 2021 [WUWT – NIFC Website change](#)

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Global Annual Death Rate from Natural Disasters by Decade



■ Flood
■ Extreme temperature
■ Earthquake
■ Drought

Note: Global death rate measured as the number of deaths per 100,000 of the world population. This is given as the annual average per decade (by decade 1900s to 2000s; and then six years from 2010-2015)
 Source: "OurWorldinData: Global-Annual-Death-Rate-from-Natural-Disasters-01.Png (13114x9476)," July 2021. <https://ourworldindata.org/uploads/2018/04/Global-annual-death-rate-from-natural-disasters-01.png>

Backup

Death from Flooding in Europe Drastically Declined

2018 Peer Reviewed Study (Delft University)

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no dispute

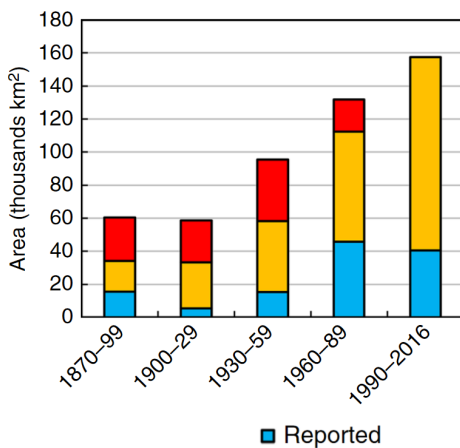
ARTICLE

DOI: 10.1038/s41467-018-04253-1 OPEN

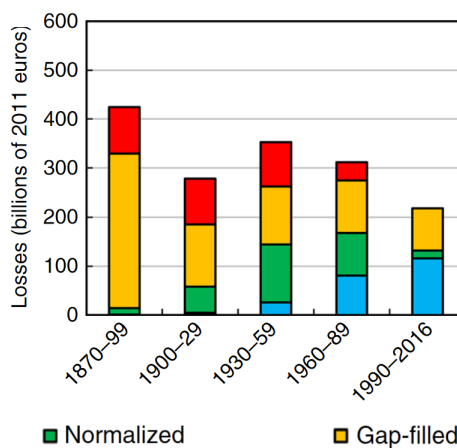
Trends in flood losses in Europe over the past 150 years

Dominik Paprotny^{1,2}, Antonia Sebastian^{1,3}, Oswaldo Morales-Nápoles¹ & Sebastiaan N. Jonkman¹

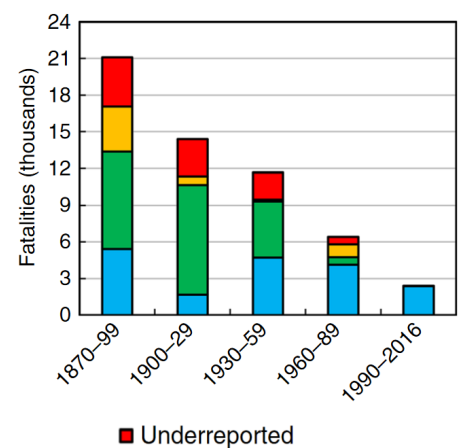
Area inundated



Financial value of losses with normalization by wealth



Fatalities



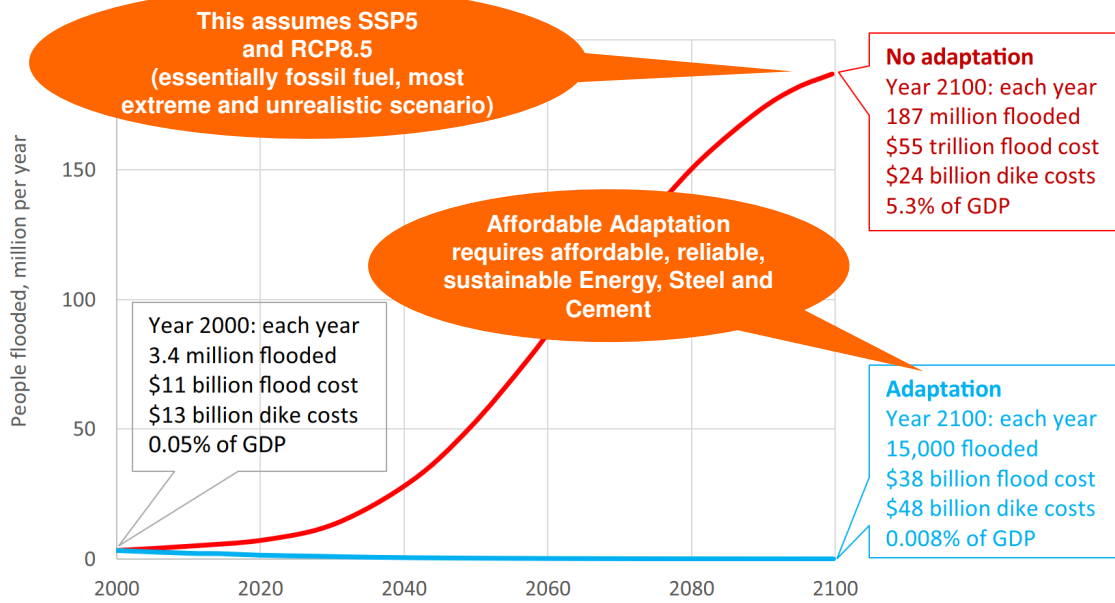
Source: Paprotny, Dominik, Antonia Sebastian, Oswaldo Morales-Nápoles, and Sebastiaan N. Jonkman. "Paprotny et al 2018: Trends in Flood Losses in Europe over the Past 150 Years." *Nature Communications* 9, no. 1 (May 2018): 1985. <https://doi.org/10.1038/s41467-018-04253-1>.

Flooding: Building Dams/Dikes Costs a Tiny Fraction of Trying to Decarbonize

Adaptation is the ONLY Logical Way Forward

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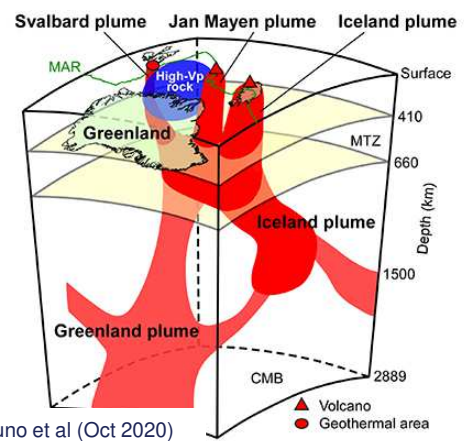
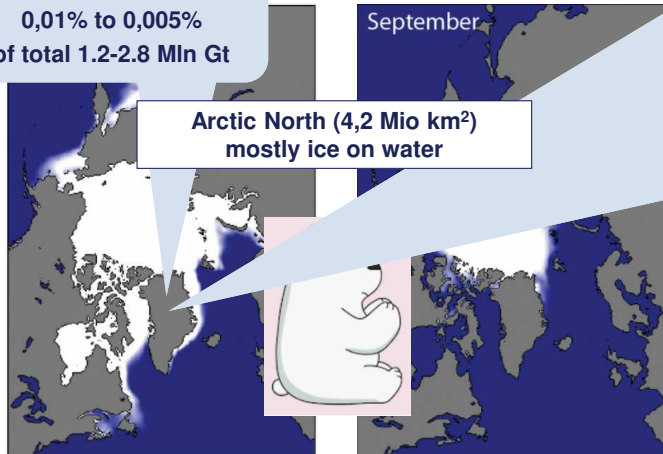
no dispute



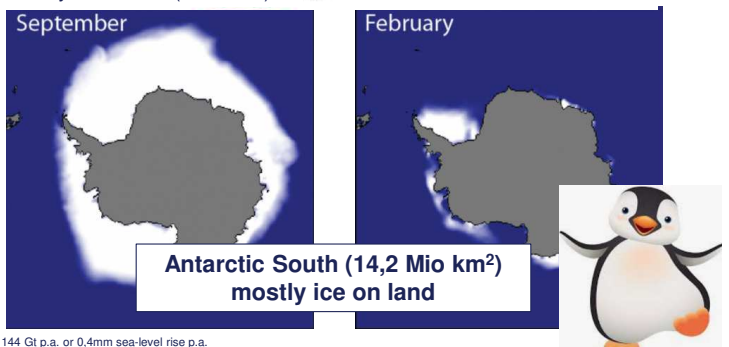
Note: Hinkel et al 2013 (here) much cited paper "Coastal flood damage and adaptation costs under 21st century sea-level rise" corresponds to these numbers, here Figure 2. Source: Lomborg 2020 (here); Fig. 8.; Million people flooded by coastal flooding from 2000–2100, using the fossil-fuel driven SSP5 scenario with the RCP8.5 climate scenario, essentially giving a high temperature increase and a sea level rise of 64 to 86 cm. The red line indicates no additional adaptation (dikes remain at the height of 2000). The blue line indicates adaptation, meaning investing in rising dikes both because of increasing sea levels and because of increasing incomes. Dike costs include both capital and additional maintenance cost. Percent is total cost of flood and dike costs. All costs in 2005 US\$, from (Hinkel et al., 2014, S4, S5 and S6). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Arctic (North) vs. Antarctic (South)

Loses ~145 Gt p.a.
0,01% to 0,005%
of total 1.2-2.8 Mln Gt



Toyokuno et al (Oct 2020)

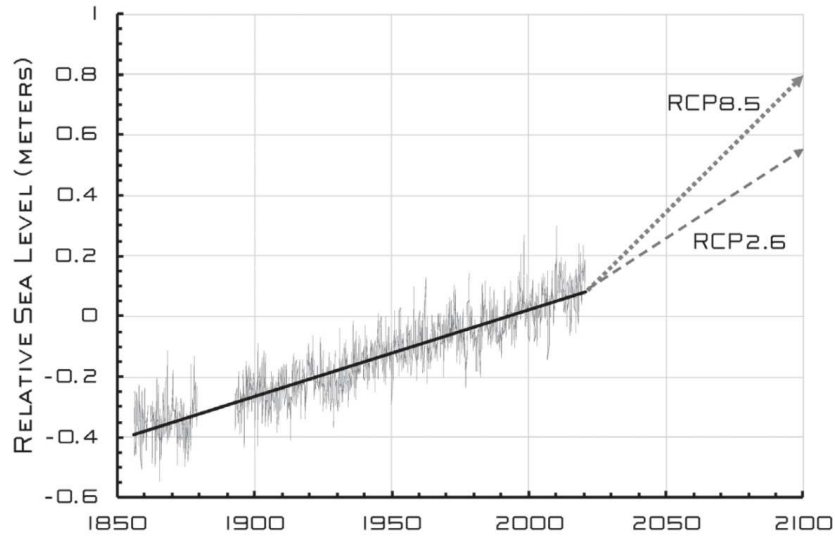


- The Antarctic (South) has been net decreasing sea levels by a minimal 0,04 mm per decade (peer reviewed study from 2017)

(1) of course some of the ice is ON Land – such as in Greenland – so there will be a minimal sea level increase. Greenland currently melts 144 Gt p.a. or 0,4mm sea-level rise p.a. Source: Lars Schernikau analysis and research; NSIDC, <https://nsidc.org/cryosphere/seaice/characteristics/difference.html>; Peer reviewed study Thomas et al. 2017 (Cambridge) "Regional Antarctic snow accumulation over the past 1000 years"; "Greenland Plume", Wiley Study Toyokuno et al (Oct 2020), link.

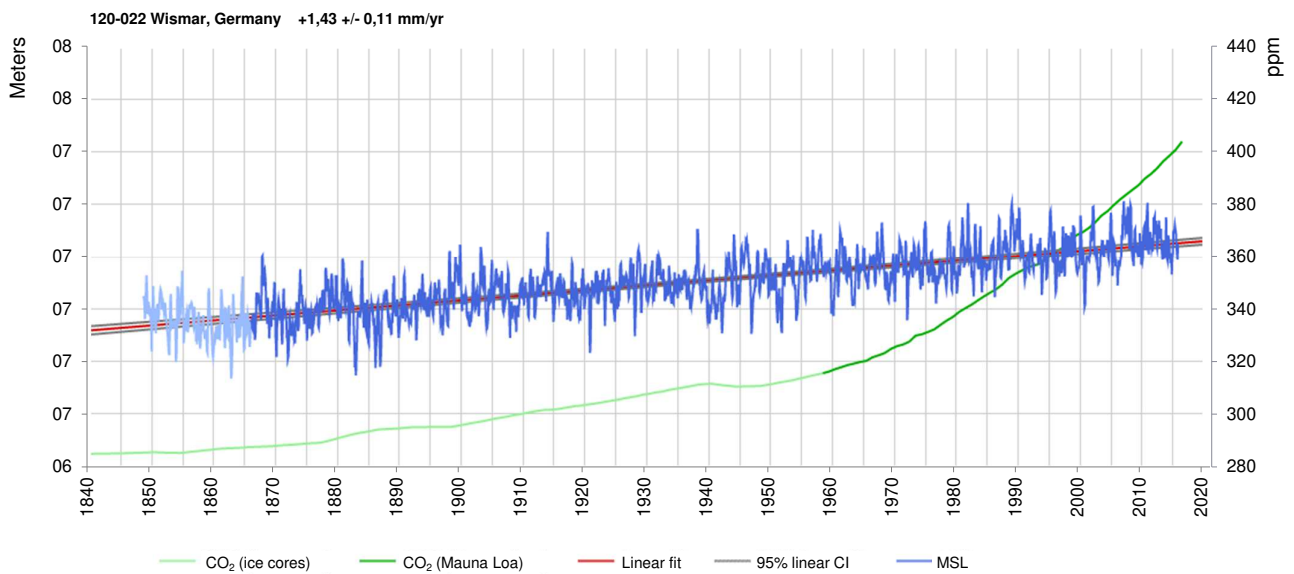
no dispute

SEA LEVEL AT THE BATTERY, NYC (1856–2020)



Note; Figure 8.7 Monthly mean sea level anomaly (after correction for the seasonal cycle) as measured since 1856 by the tide gauge at The Battery at the southern tip of Manhattan. The straight line shows the trend; the arrows show the average rise from 2020 to 2100 projected in AR5 under two different scenarios
 Source: Historical data from NOAA. "Relative Sea Level Trend 8518750 The Battery, New York."; projections from IPCC AR5 WGI Figure 13.23; Koonin, Steve. *Steve Koonin's New Book "Unsettled"* - Forbes Article, 2021. <https://www.forbes.com/sites/tilakdoshi/2021/04/30/lets-work-for-science-with-integrity-steve-koonins-new-book-unsettled/?sh=43376a342f38>.

no dispute

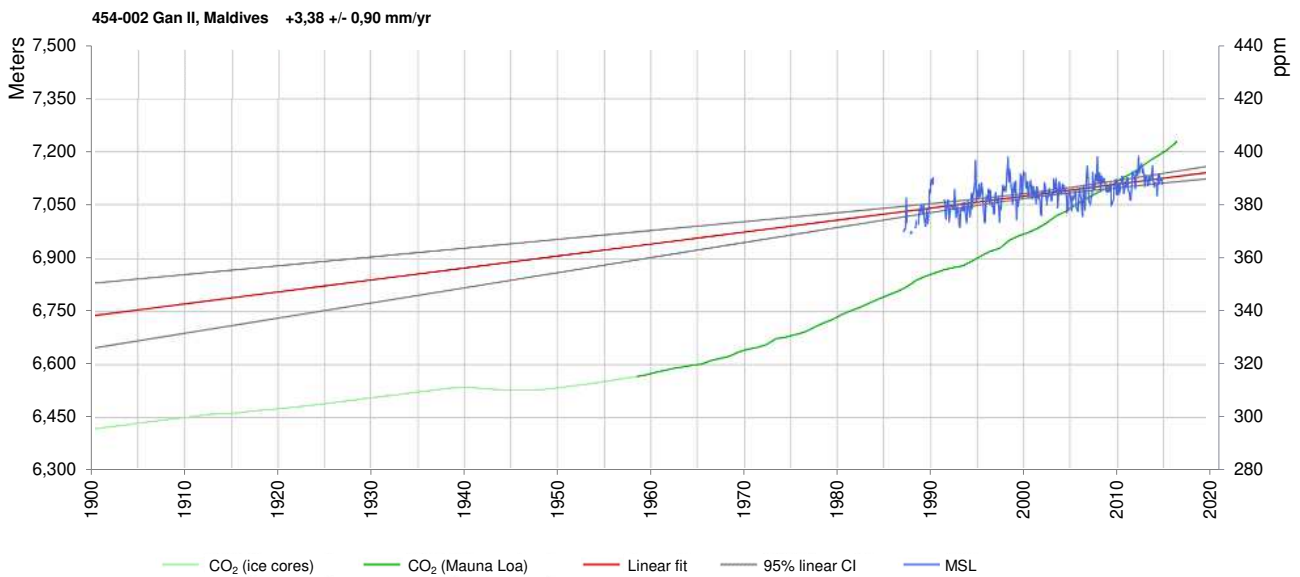


Sources: www.sealevel.info, based on PSMSL, NOAA, Expert Reviewer of IPCC Mr. David Burton

Maldives Sea-Level Data 1986-2015

no dispute

Schernikau
on Energy Policy



Sources: www.sealevel.info, based on PSMSL, NOAA, Expert Reviewer of IPCC Mr. David Burton

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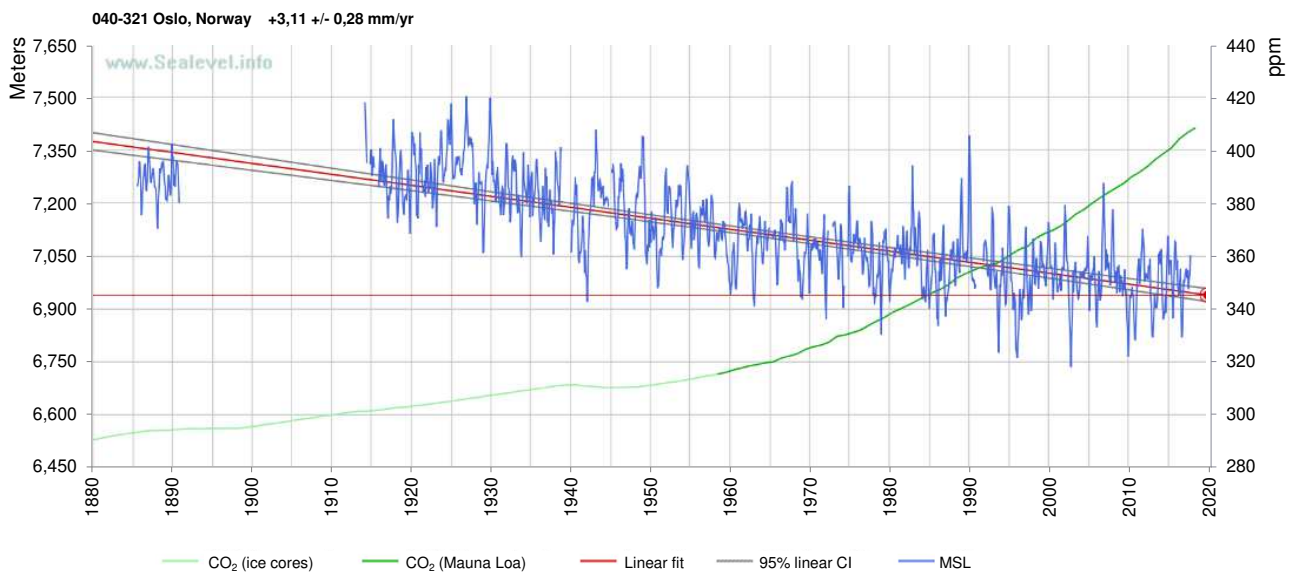
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Mean Sea Level at Oslo, Norway (1914 to 2017)

no dispute

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Note: The mean sea level (MSL) trend at Oslo, Norway is -3.11 mm/year with a 95% confidence interval of ± 0.28 mm/year, based on monthly mean sea level data from 1885/7 to 2017/12. That is equivalent to a change of -1.02 feet in 100 years. (R-squared = 0.445). The plot shows the monthly mean sea level without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents. By default, the long-term linear trend is also shown, in red, along with its 95% confidence interval. The plotted values are relative to the most recent Mean Sea Level datum established by NOAA CO-OPS.

Sources: www.sealevel.info, based on PSMSL, NOAA, Expert Reviewer of IPCC Mr. David Burton

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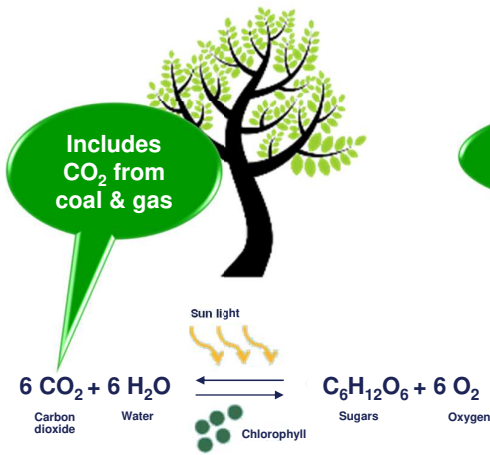
All Life on Earth Depends on One Single Formula

More CO₂ => More Life

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on Energy Policy

no dispute

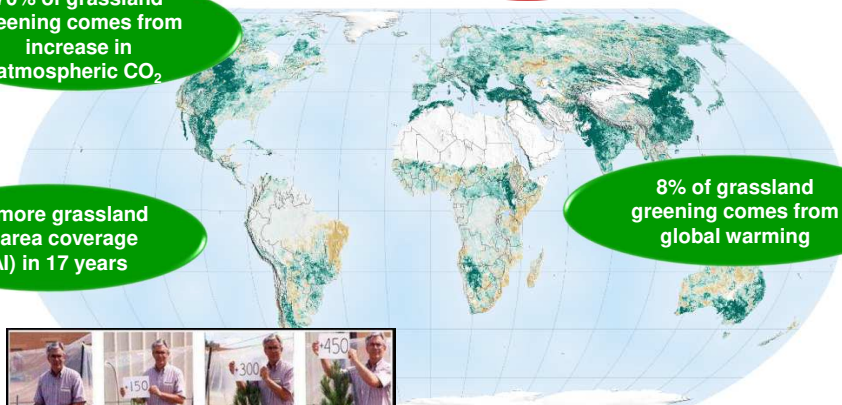
Photosynthesis



70% of grassland greening comes from increase in atmospheric CO₂

85% more grassland leaf area coverage (LAI) in 17 years

8% of grassland greening comes from global warming



The world needs to produce 60-70% more food by 2050

CO₂ is a key building block for life, not pollution ... but does contribute to slight warming

Note: The world is a greener place than it was 20 years ago, as shown on this map, where areas with the greatest increase in foliage are indicated in dark green. Data from a NASA instrument orbiting Earth aboard two satellites show that human activity in China and India dominate this greening of the planet.; Prof Craig Idso's [catalog of studies of the measured effects of varying CO2 levels on various crops](#)
Source: NASA Earth Observatory Sources; <https://www.nasa.gov/feature/ames/human-activity-in-china-and-india-dominates-the-greening-of-earth-nasa-study-shows>; right side: R.J.Donohue/CSIRO (June 2013) DOI, 10.1002/grl.50563

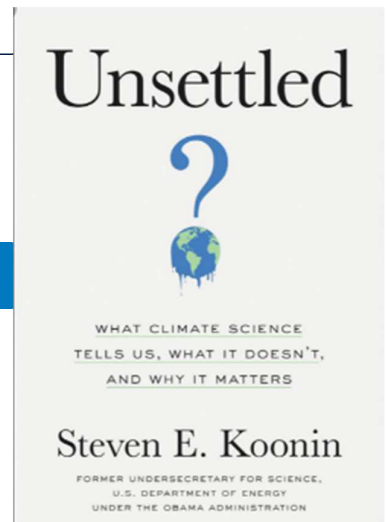
Content

Climate Change – Causes & Impacts

Understanding the Global Energy Landscape

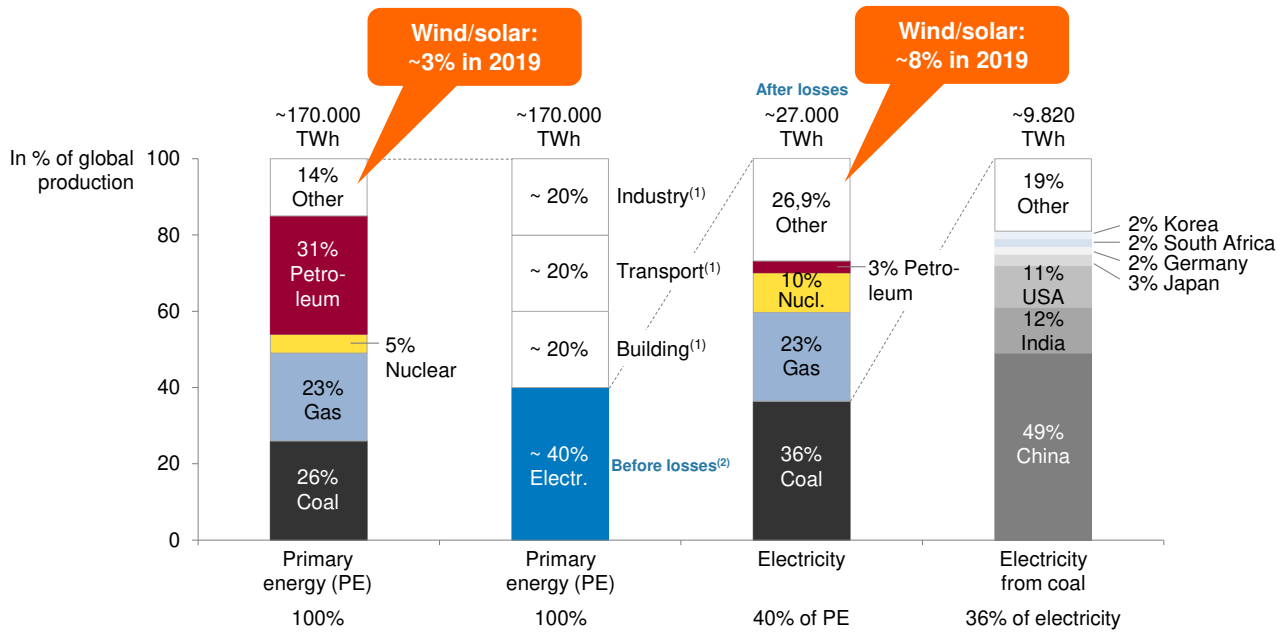
Advantages & Disadvantages of Fossils Fuels vs. «Renewables»

Discussion on Environmental Protection: The Role of Fossil Fuel & Insurance Companies?



Electricity: About 40% of Global Primary Energy

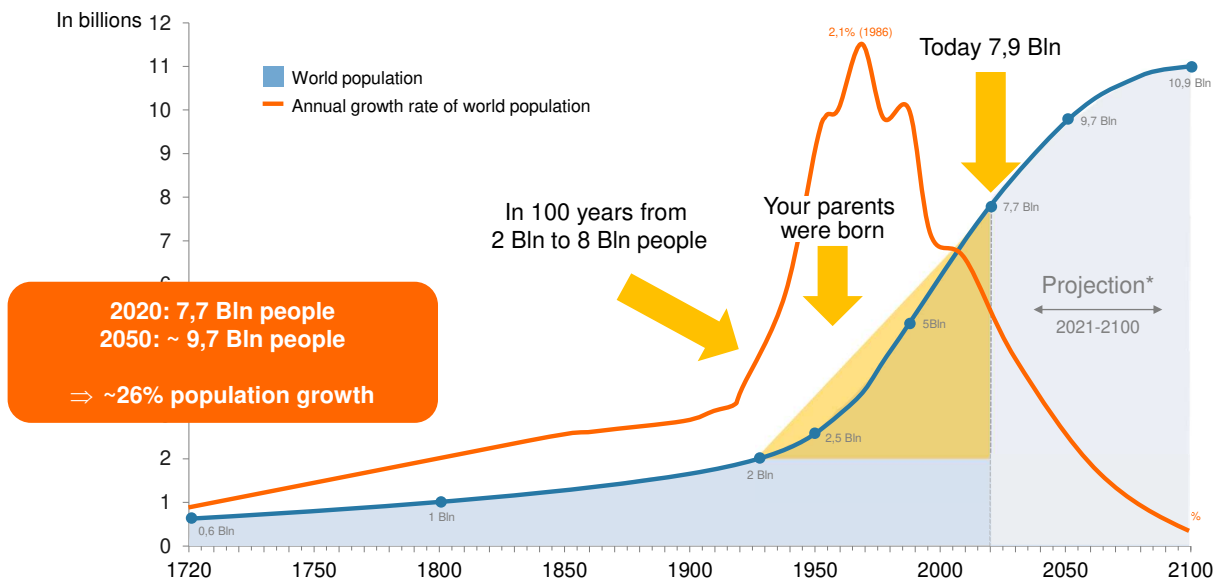
World's Primary and Electricity Energy Share 2019



(1) Only the portion of Industry/Transport/Building that is not included under electricity; (2) assumed worldwide net efficiency of about 33% for nuclear, 37% for coal, 42% for gas, assume avg. ~40% efficiency => 27.000TWh becomes 68.000 TWh or 40% of 170.000TWh
Sources: Schernikau analysis based on IEA Energy Technology Perspectives 2020 (link), BP Statistical Review of World Energy 2020 (link), see also World in Data

World Population Growth from 1700-2100

no dispute

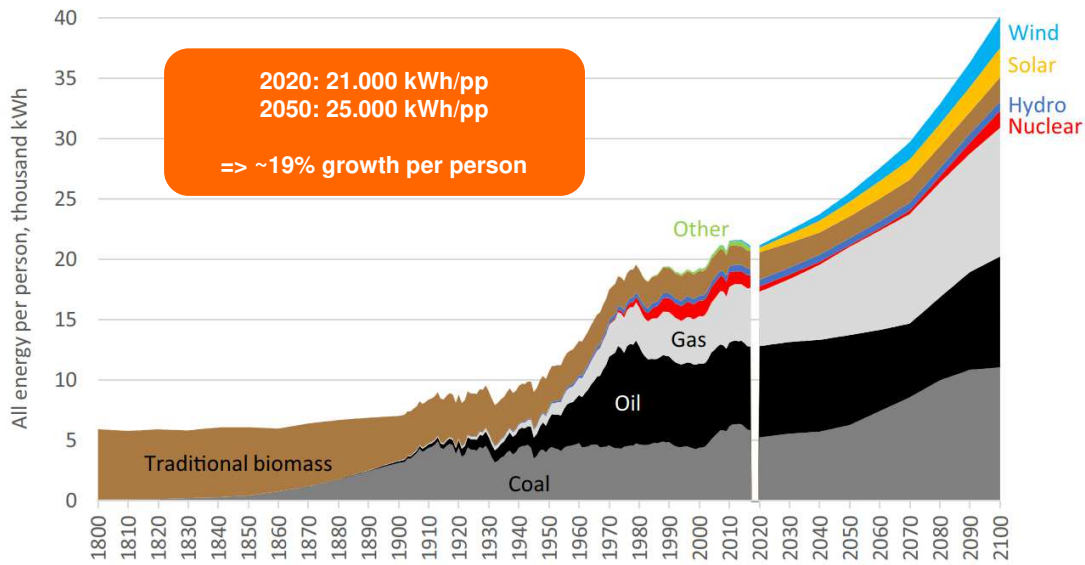


Sources: Data from 1750-2015 is taken from OurWorldInData.org series based on UN and HYDE. Projections for 2015-2100 are based on data from UN Population Division (2015) – UN Medium Fertility Variant.

Lomborg 2020: All Energy per Person Projected from 1800 to 2100

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on Energy Policy

no dispute?

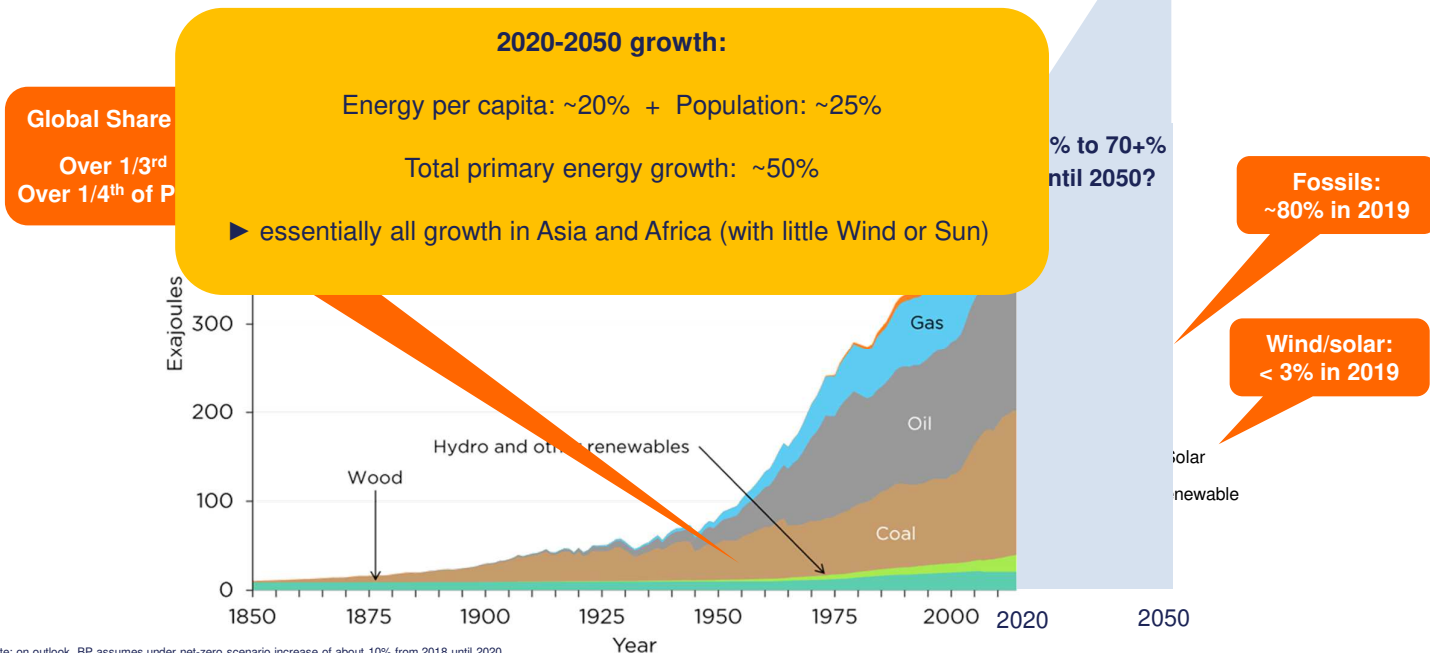


Source: Lomborg 2020 ([here](#)); Fig. 4; All energy (not just electricity) per person in the world, 1800–2100, TPES (total primary energy supply) measured in kWh, denoting natural gas with "gas." Historical data 1800–2017, SSP2 middle-of-the-road scenario for 2020–2100. 1800–1900 plus traditional biomass data up to 2017 from (Vaclav Smlil 2017, 240–41); see also (Fouquet 2009). 1900–1979 from (Benichou 2014; Etemad and Luciani 1991), 1971–2017 from (IEA 2018, 2019a), 2020–2100 SSP2 including population from (IIASA 2018; Riahi et al., 2017), global population 1800–2017 from (HYDE 2019; Roser and Ortiz-Ospina 2019). "Other" includes liquid biofuels, geothermal, solar thermal, modern biofuels, and waste. There are some minor discrepancies from the historical data to scenario data: SSP2 nuclear is inexplicably halved, SSP2 biomass seems to include all modern biofuels and possibly waste, and SSP2 solar is somewhat larger than IEA solar.

Is Life Without Fossils only Decades Away?...

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on Energy Policy

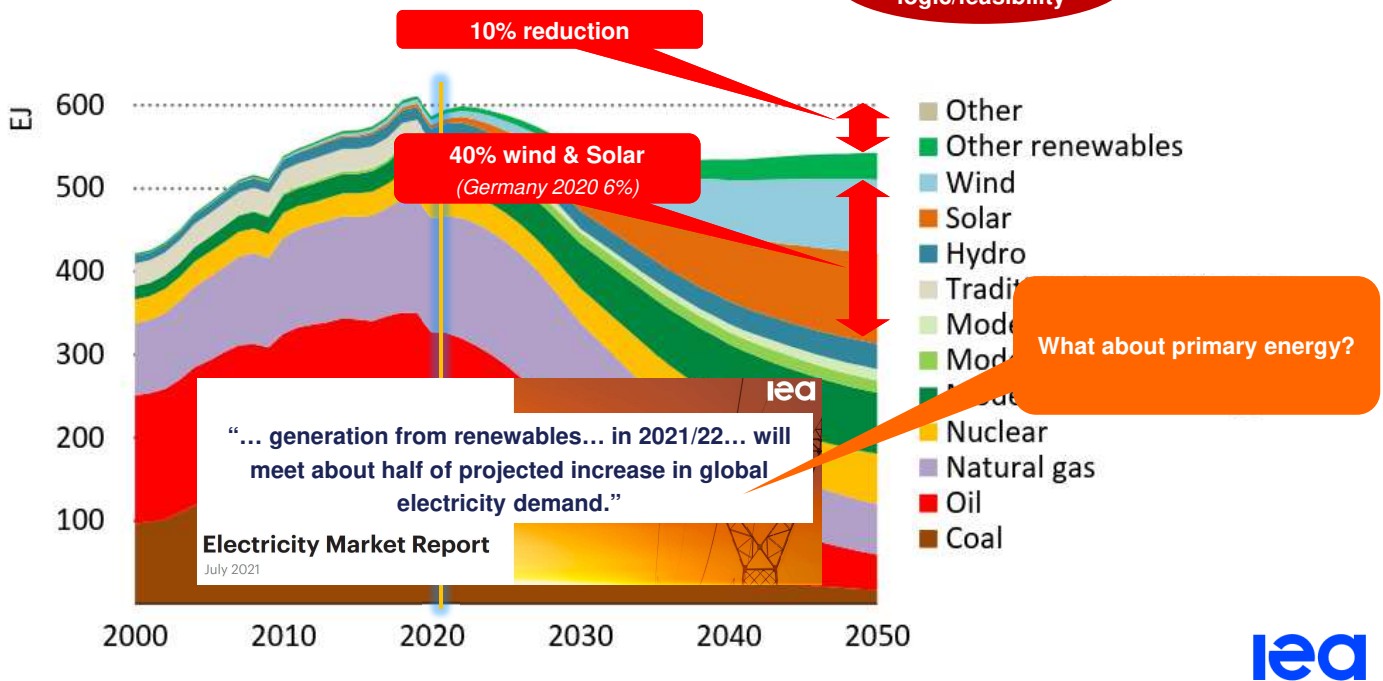
dispute



Note: on outlook, BP assumes under net-zero scenario increase of about 10% from 2018 until 2020

(1) Primary electricity converted by direct equivalent method.

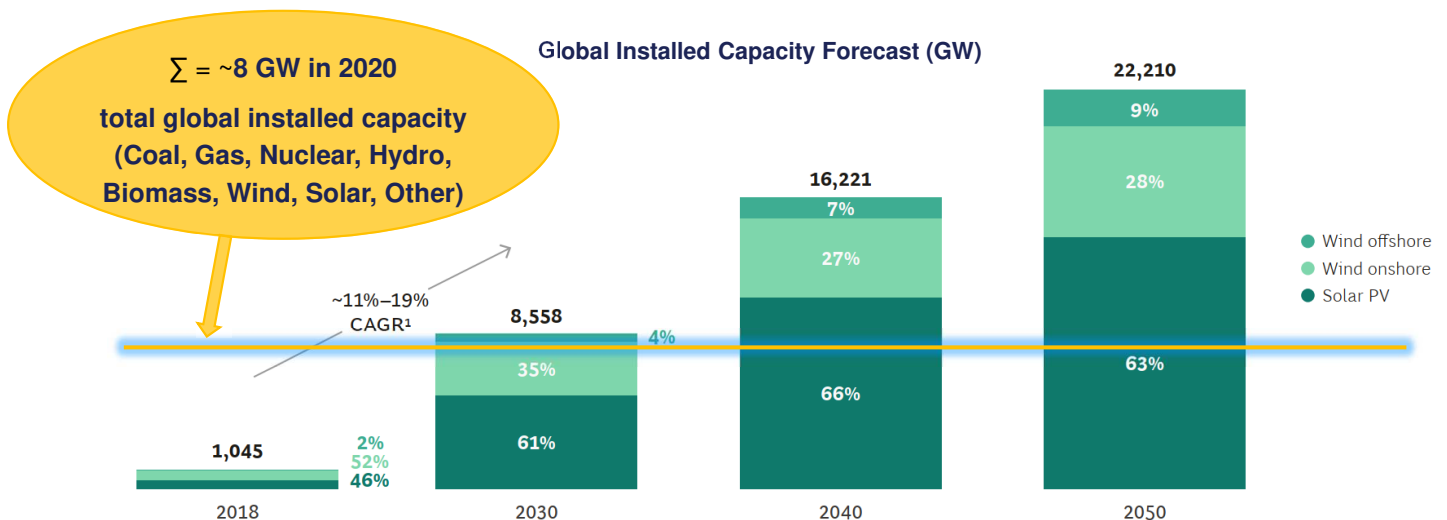
Source: Data compiled by J. David Hughes. Post-1965 data from BP, [Statistical Review of World Energy](#) (annual). Pre-1965 data from Arnulf Grubler, "Technology and Global Change: Data Appendix." (1998). EIA, IEA and BP outlook, [WorldEnergy.org](#)



Source: "IEA: Net Zero by 2050 – Analysis," May 2021. <https://www.iea.org/reports/net-zero-by-2050>, p57.

Global: Wind/Solar Capacity in 2050 to be almost 4x total (Fossil/Ren) today ...

... Demonstrates Dramatic Misconception about Energy-Densities and -Efficiencies



Note: PV = photovoltaics.

¹The range of the compound annual growth rate is based on the planned energy scenario vs. the 1.50C scenario.

Source: 2021 IRENA World Energy Transitions Outlook; BCG analysis.; "BCG: Mastering Scale in Renewables," June 2021. <https://www.bcg.com/publications/2021/maximizing-value-from-scale-renewable-energy>.

Climate Change – Causes & Impacts

Understanding the Global Energy Landscape

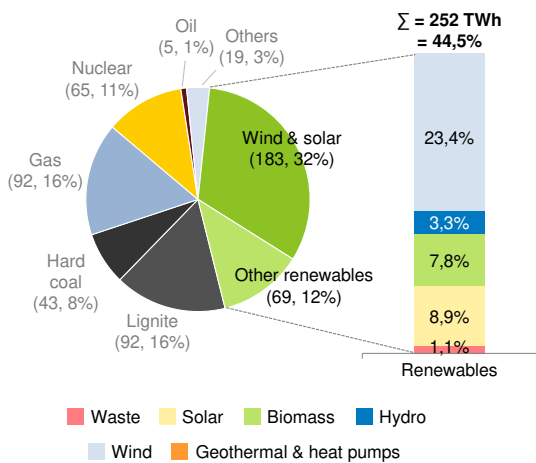
Advantages & Disadvantages of Fossil Fuels vs. «Renewables»

Discussion on Environmental Protection: The Role of Fossil Fuel & Insurance Companies?

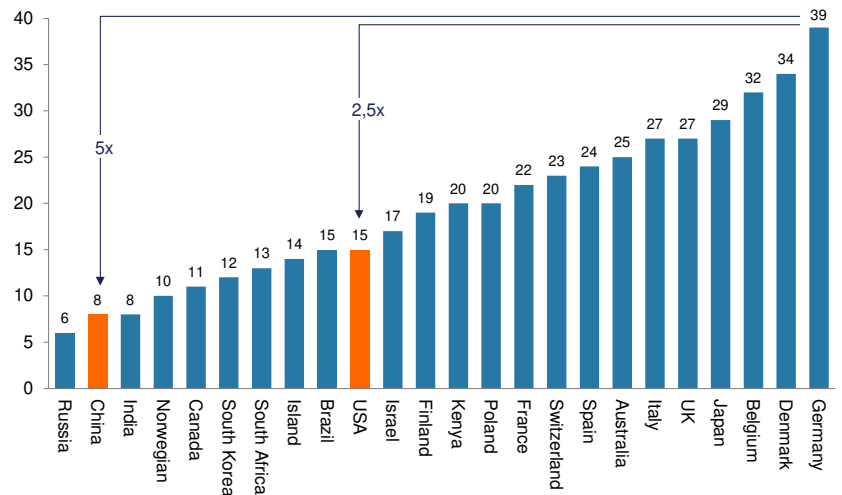
Germany Is Leading Electricity Price Worldwide

no dispute

German power production 2020 in TWh and %
Σ = 566 TWh



Consumer electricity prices worldwide by country in 2020 (US\$/kWh)



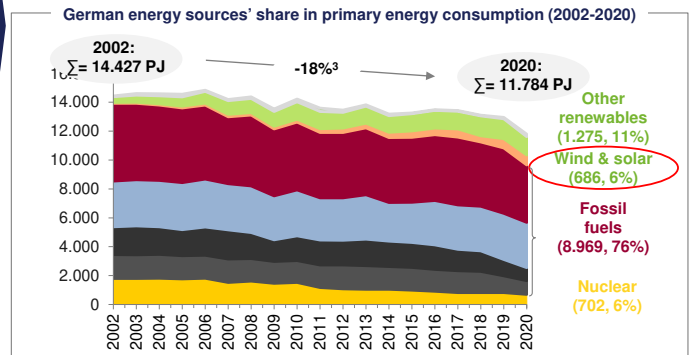
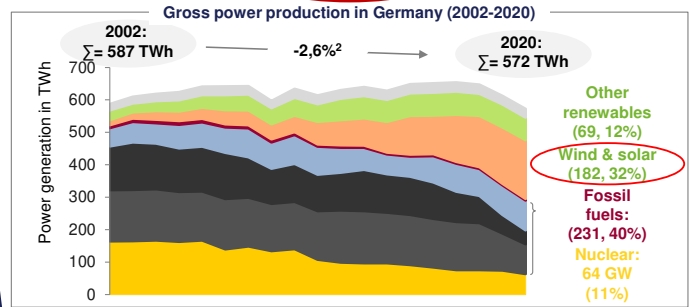
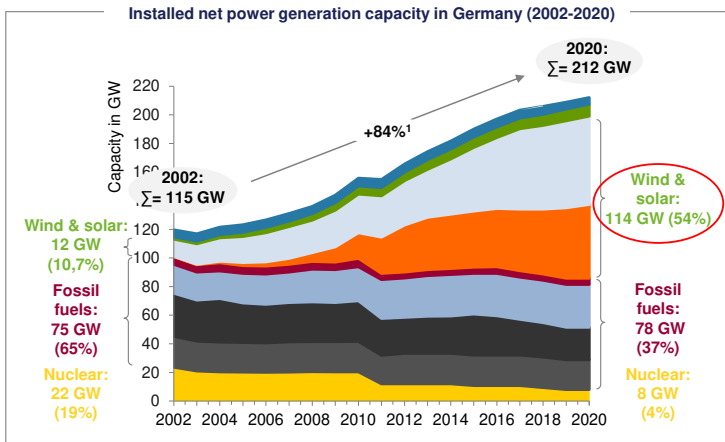
Note: This statistic shows electricity prices in selected countries worldwide excl VAT
Source: bdew annual report 2020 (BDEW Source PDF), Statista 2021 (Statista Link)

Germany: Renewable Installed Capacity vs. Power Generation and Primary Energy

Wind & Solar: 54% Capacity Gave Germany 32% Electricity and 6% Primary Energy

no dispute

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on Energy Policy



(1) CAGR: +3.46%; (2) CAGR: -0.14%; (3) CAGR -1.12%

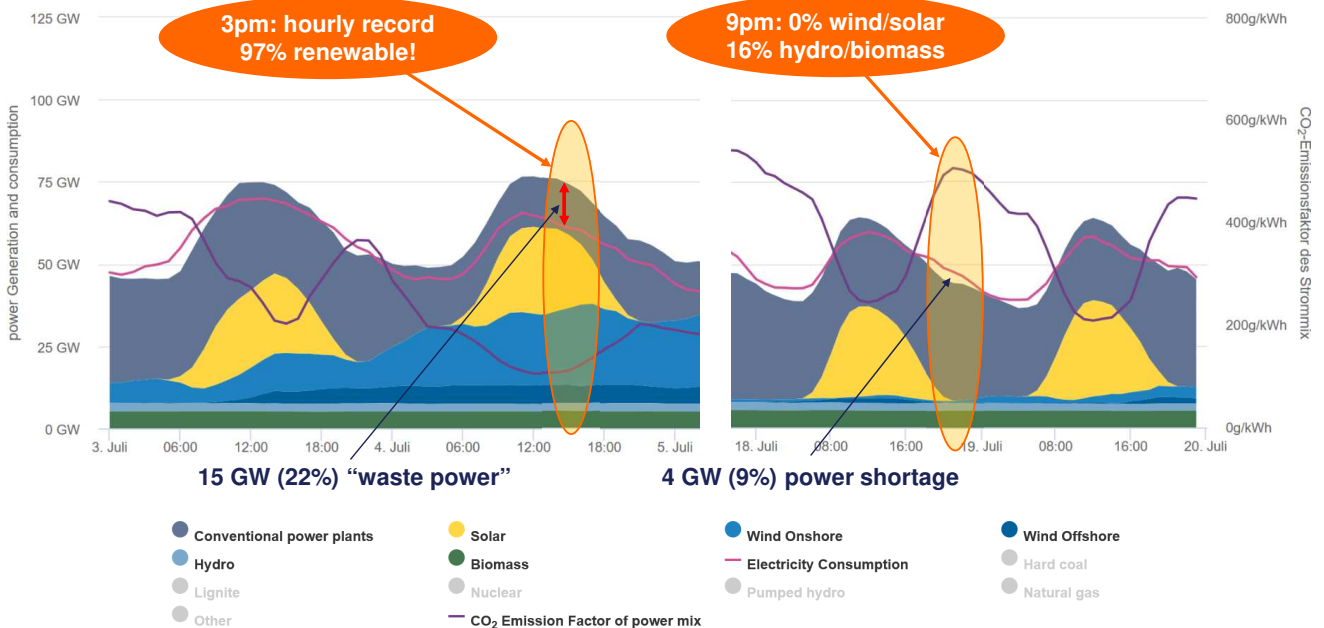
Sources: Schernikau Research and Analysis based on Fraunhofer Institute (link), and AG Energiebilanzen 2020 (https://ag-energiebilanzen.de/28-0-Zusatzinformationen.html%20und%20https://ag-energiebilanzen.de/10-0-Auswertungstabellen.html) and https://ag-energiebilanzen.de/6-0-Primarenergieverbrauch.html)

Germany: 4th of July 2020, "New Record" 97,2% Renewables

A Typical Period in Summer 2020 in Germany

no dispute

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on Energy Policy

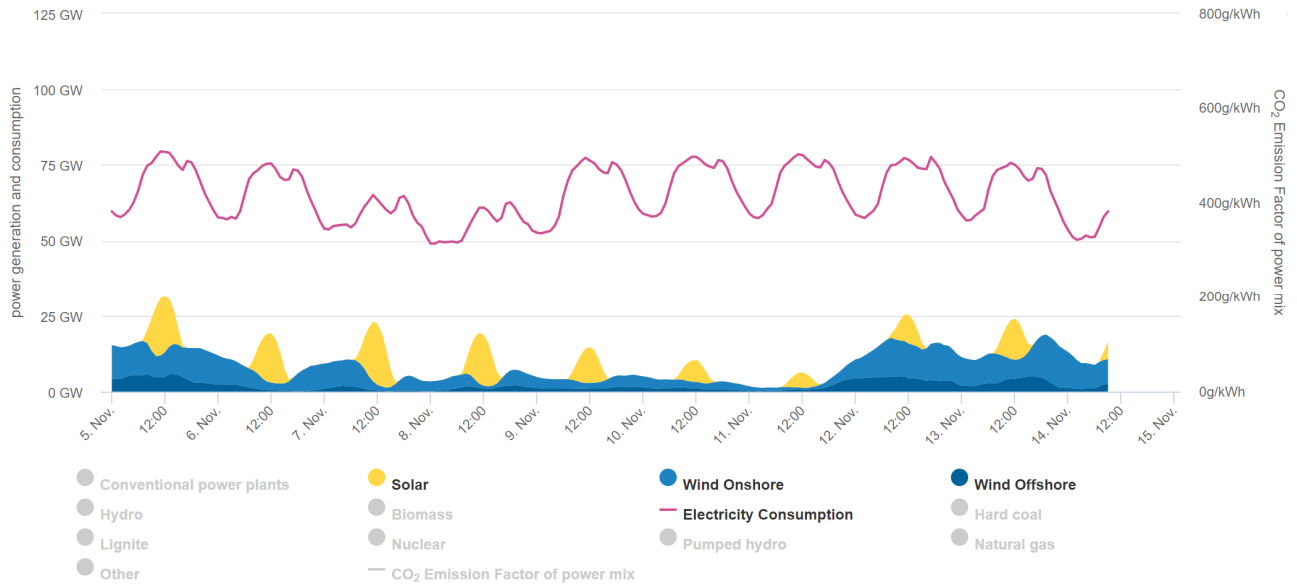


Source: Schernikau Analysis based on Agora Energiewende online, accessed 20 July 2020

Germany in Fall: Very Little Wind and Sun for 10 Days (2020 Data)

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no dispute



Source: Agora: <https://www.agora-energiemwende.de/en/service/recent-electricity-data/chart/power-generation/05.11.2020/14.11.2020/>

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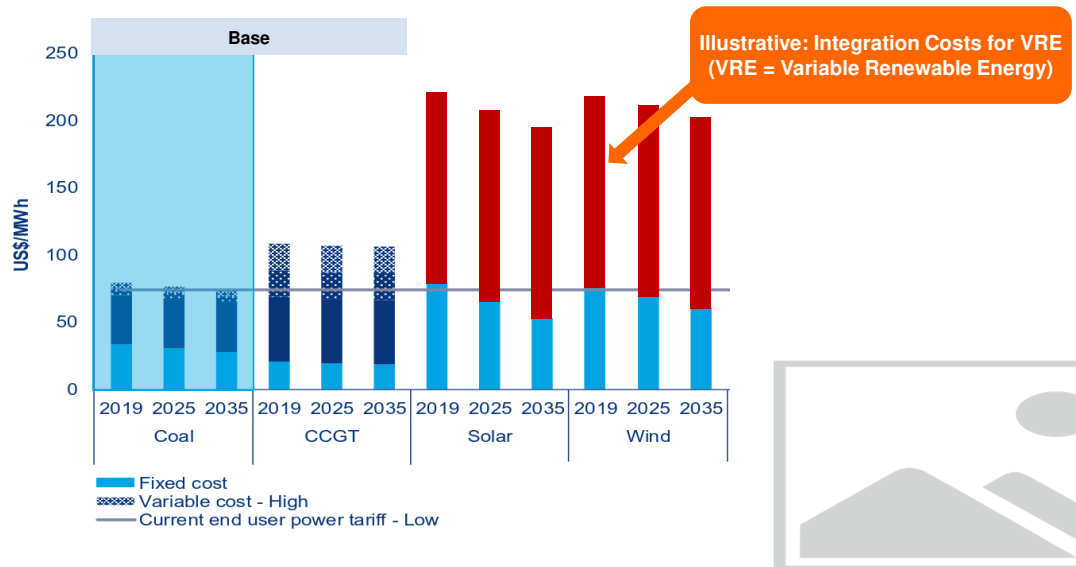
Understanding LCOE Is Crucial for New Builds.....

but Only for Comparing Apples with Apples (not for Comparing Renewables with Fossils)

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no dispute

Vietnam Levelized Cost Of Electricity (LCOE)



Source: 2019 Wood Mackenzie, GTM, MAKE

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IEA: Levelized Cost of Electricity (LCOE) & Value-Adjusted LCOE (VALCOE)

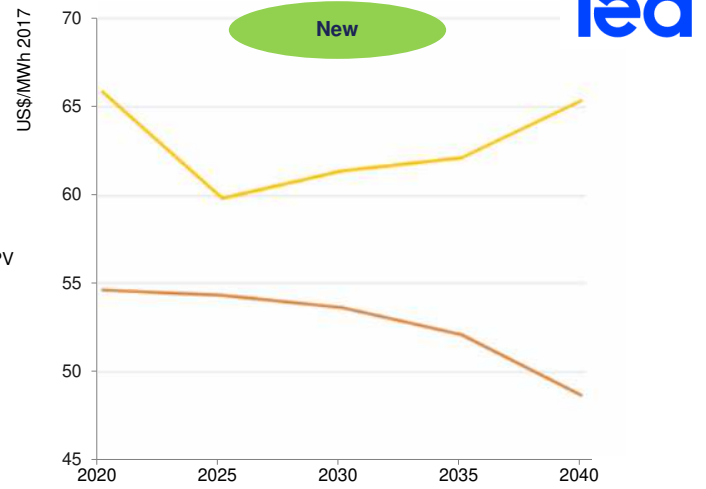
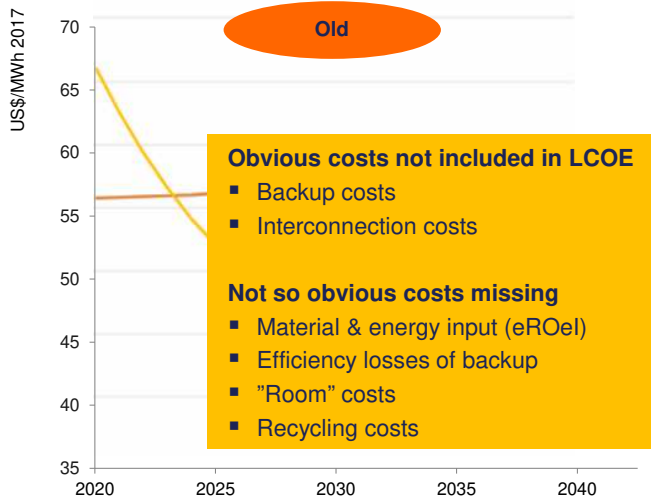
Solar PV and Coal-Fired Power Plants in India in the New Policies Scenario

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no dispute

LCOE

VALCOE



IEA Dec 2020: „The result of IEA’s value adjusted LCOE (VALCOE) metric show however, that the system value of variable renewables such as wind and solar decreases as their share in the power supply increases“

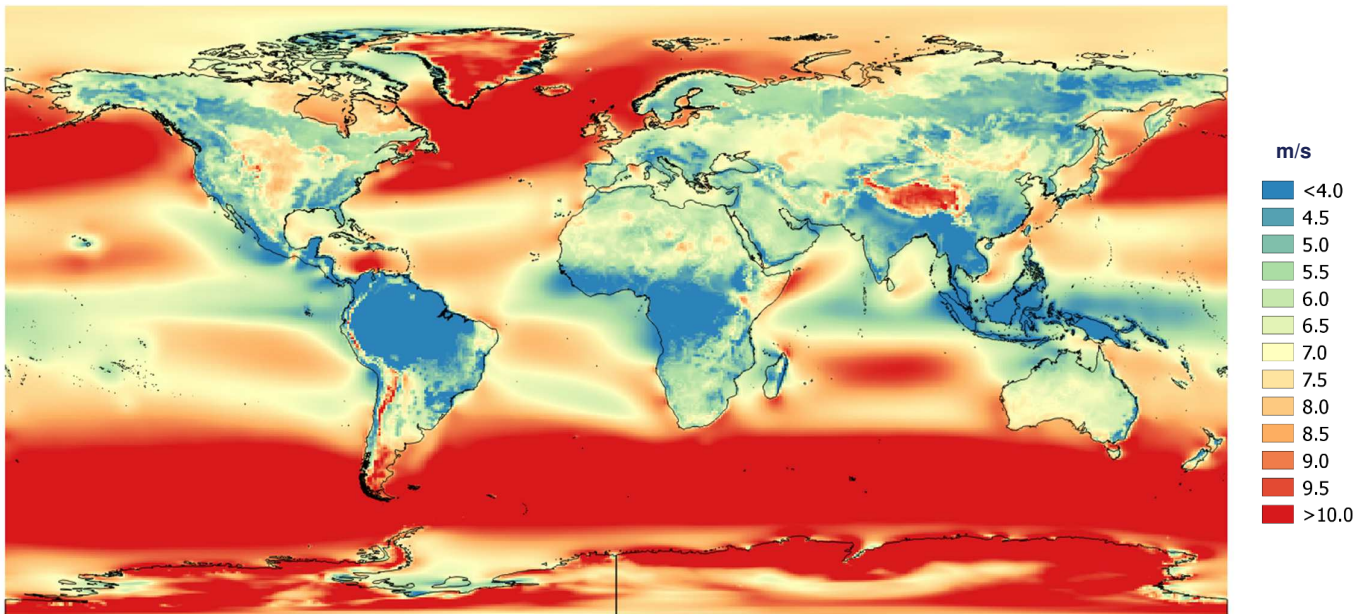
Source: IEA, WEO Analyst; February 12, 2019 by Brent Wanner, IEA original here [IEA.org](https://www.iea.org); "IEA: Projected Costs of Generating Electricity 2020 – Analysis," December 2020, <https://www.iea.org/reports/projected-costs-of-generating-electricity-2020>, p14
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Annual Wind Speeds at 100m Height

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no dispute

Mean wind speed at 100m from MERRA reanalysis (period 1979-2013)



Source: "Global Wind Atlas - Global Wind Map," June 2021, <http://science.globalwindatlas.info/datasets.html>.
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East and Southeast Asia not Suitable for Large-Scale Wind Deployment...

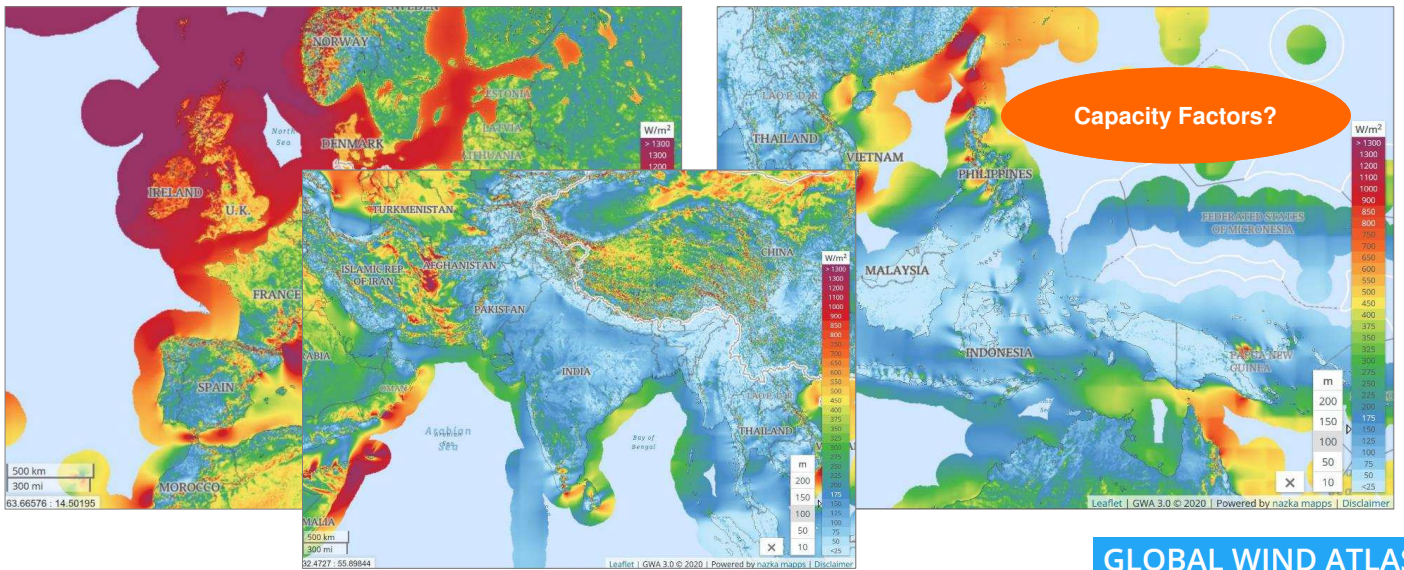
... Even if One Believes That Wind is a Viable Large-Scale Alternative to Conventional Energy

no dispute

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Wind energy density (Europe)

Wind energy density (Southeast Asia)

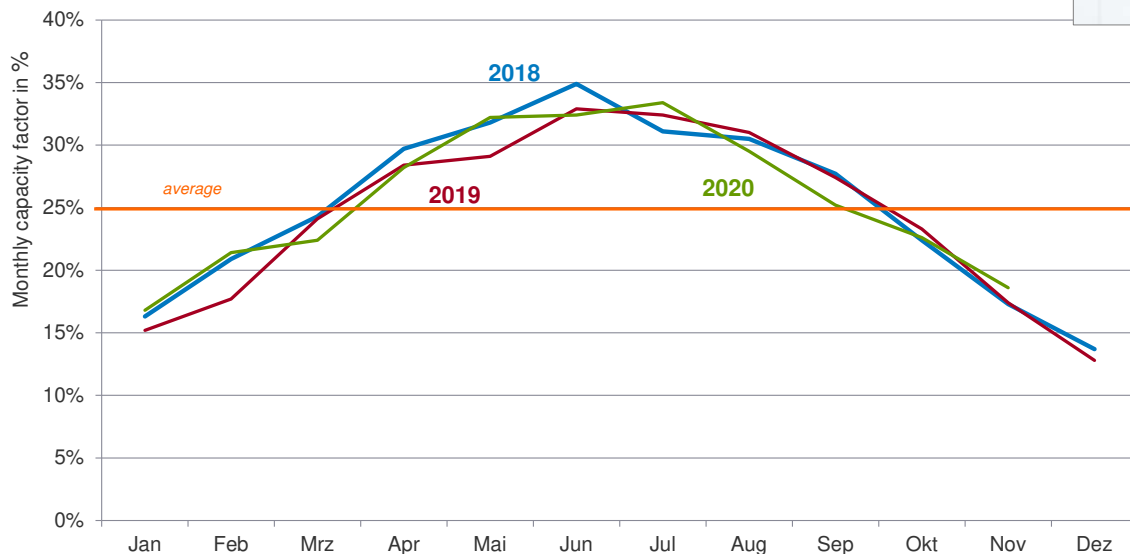


(1) "Weinand 2021: The Impact of Public Acceptance on Cost Efficiency and Environmental Sustainability in Decentralized Energy Systems." *Patterns*, June 2021, 100301. <https://doi.org/10.1016/j.patter.2021.100301>
Source: Global Wind Atlas, downloaded 24 April 2020 (setting Mean Power Density), www.globalwindatlas.info

California Solar Photovoltaic Capacity Factors 2018-2020

Capacity Factor = Avg. Power Output of a Technology Relative to Nameplate Capacity [W_{avg}/W_p]

no dispute



For comparison: global avg. Capacity Factor of installed Solar Capacity was 11-13% during 2008-2010¹

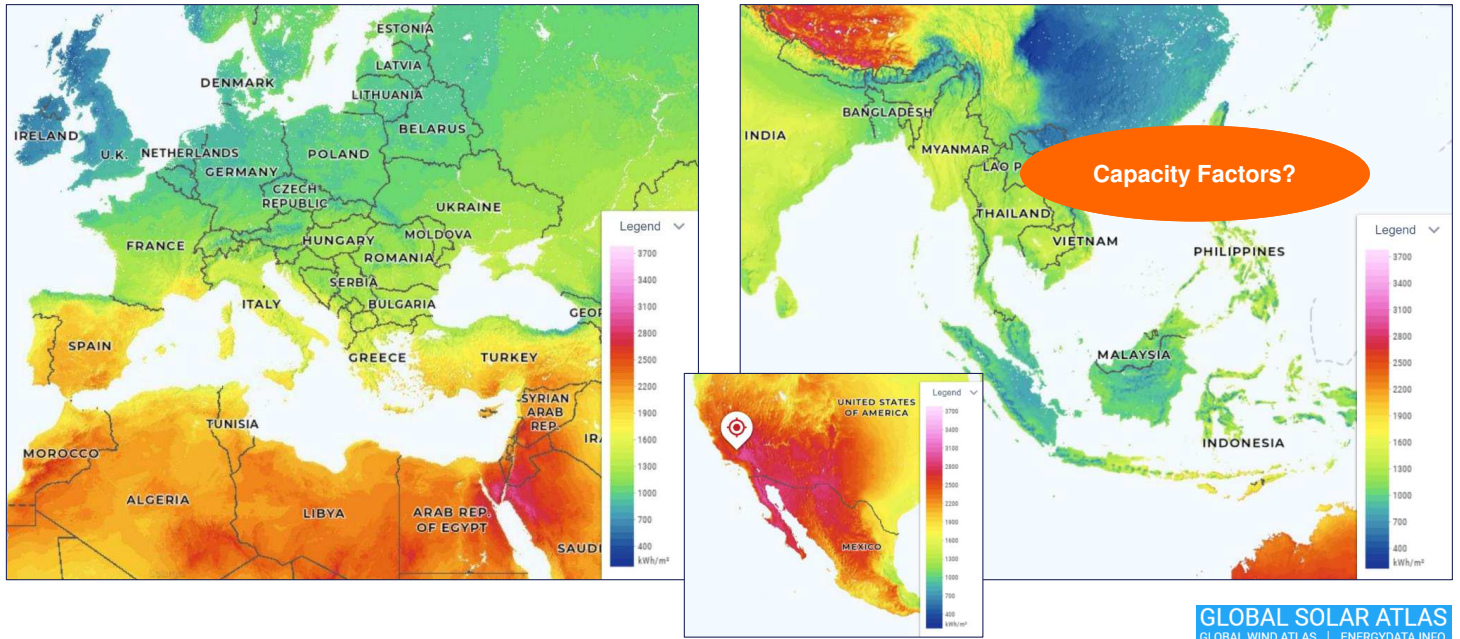
Note: Values for 2019 and prior years are final. Values for 2020 are preliminary. For 2020, only data from January to November is considered.
Source: EIA, accessed 3 Jan 2020 at this [link](http://www.eia.doe.gov); source for global average capacity factor is DOI: 10.1039 - Carbajales-Dales et al, Feb 2014 "Can we afford storage? A dynamic net energy analysis of renewable electricity generation supported by energy storage"

Solar Output Varies Worldwide – SEA not Suitable for Solar PV

Direct Normal Irradiation (kWh/m²)

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no dispute



Source: Global Solar Atlas, downloaded 17 Feb 2021, www.globalsolaratlas.info

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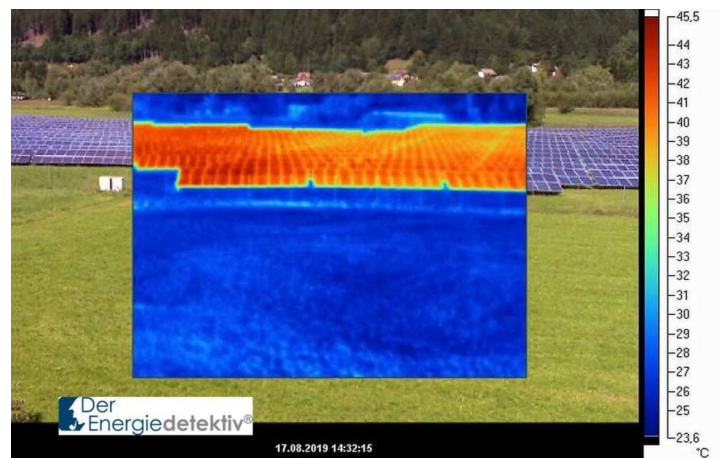
Why Solar Panels Increase Air Temperatures

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on Energy Policy

no dispute?

Natural cycle without solar panels

Effects of installing solar panels



Sunlight is supporting plant growth and plants support cooling

Sunlight is warming the atmosphere

Source: Schernikau research and analysis based on Dipl.-Ing. Jürgen A Weigl: Erwärmung durch Solaranlagen, Energiedetektiv, November 2020, [link](#)

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The bottlenecks which could constrain emission cuts

Dispute?

The Economist Subscribe Menu

Briefing
Jun 12th 2021 edition >

Growing „NIMBY“ Sentiment⁽¹⁾

The green revolution risks running short of minerals, money and places to build

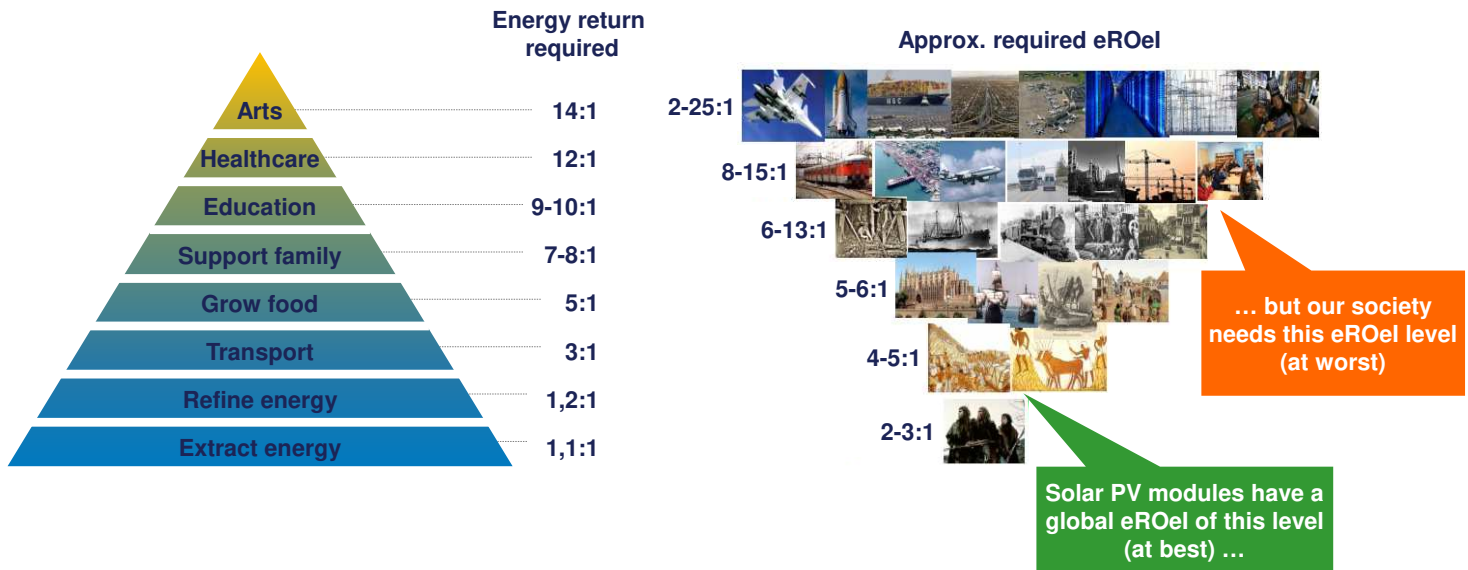


Jun 12th 2021

Note: NIMBY = Not in my Backyard;

Advanced Societies Require High energy-Return-On-energy-Invested (eROel)

no dispute



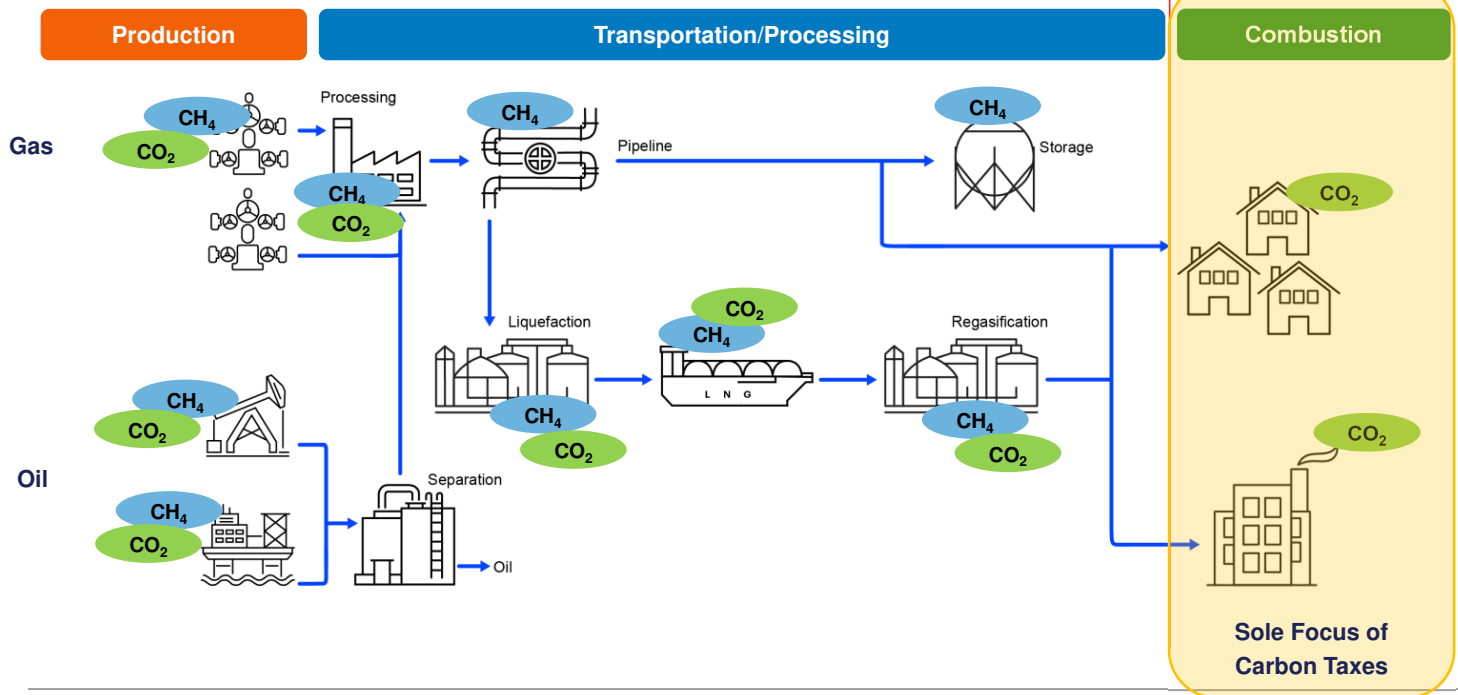
Source: Pedro A Prieto and Charles A S Hall: 'Spain's Photovoltaic Revolution: The Energy Return on Investment', Springer 2013, p7

LNG and PNG, Gas Chain and GHG Emissions

Distortions in Carbon Taxing

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no dispute



Content

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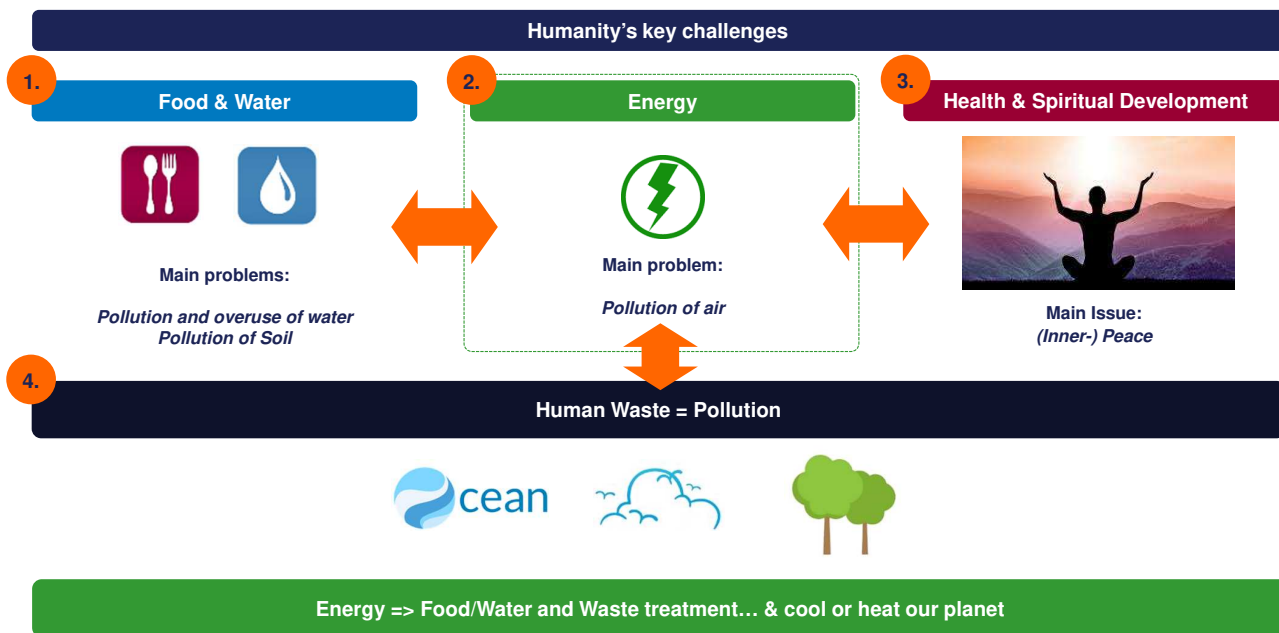
Climate Change – Causes & Impacts

Understanding the Global Energy Landscape

Advantages & Disadvantages of Fossil Fuels vs. «Renewables»

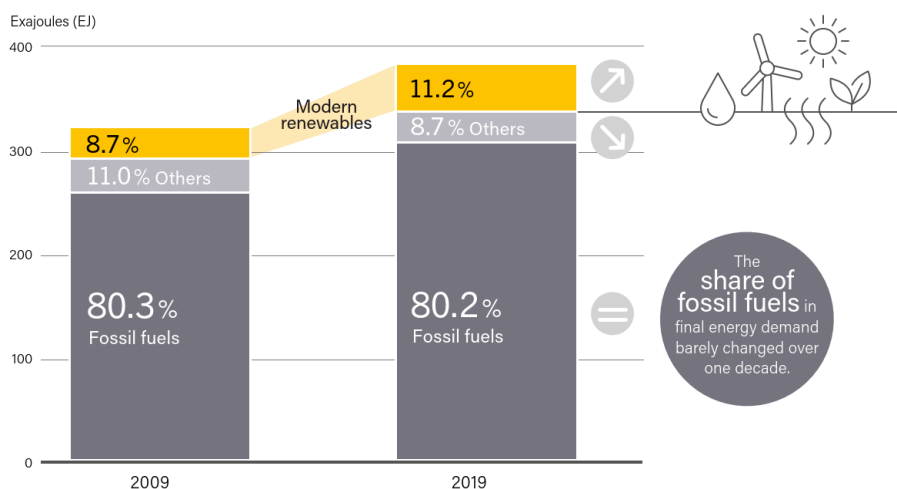
What Next?

Discussion on Environmental Protection: The Role of Fossil Fuel & Insurance Companies?



Backup

Investment – not Divestment – Is the Solution to a Cleaner Environment



If you have a problem,
what do you do?

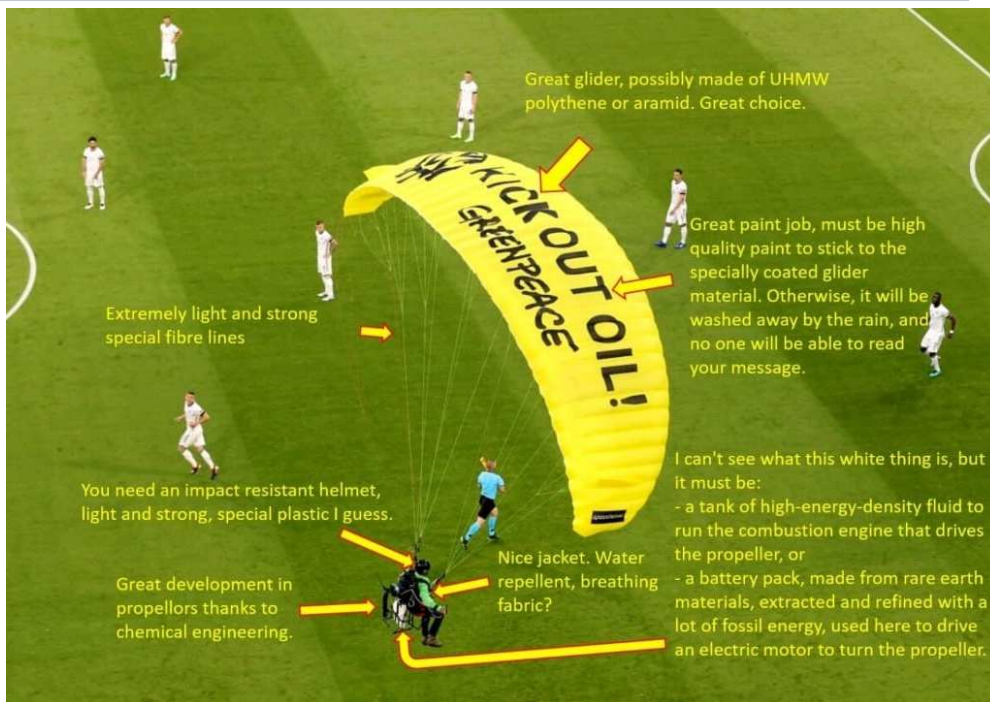
- a) Take money away from the problem = solution?
- b) Put money into the problem = solution?

Note: Totals may not add up due to rounding . This figure shows a comparison between two years across a 10-year span . The result of the economic recession in 2008 may have temporarily lowered the share of fossil fuels in total final energy consumption in 2009 . The share in 2008 was 80 .7% . Based on IEA data . Source: Secretariat, REN21. "REN21: Renewables Global Status Report." REN21 (blog), May 2021. <https://www.ren21.net/reports/global-status-report/>.

It Starts With Education...

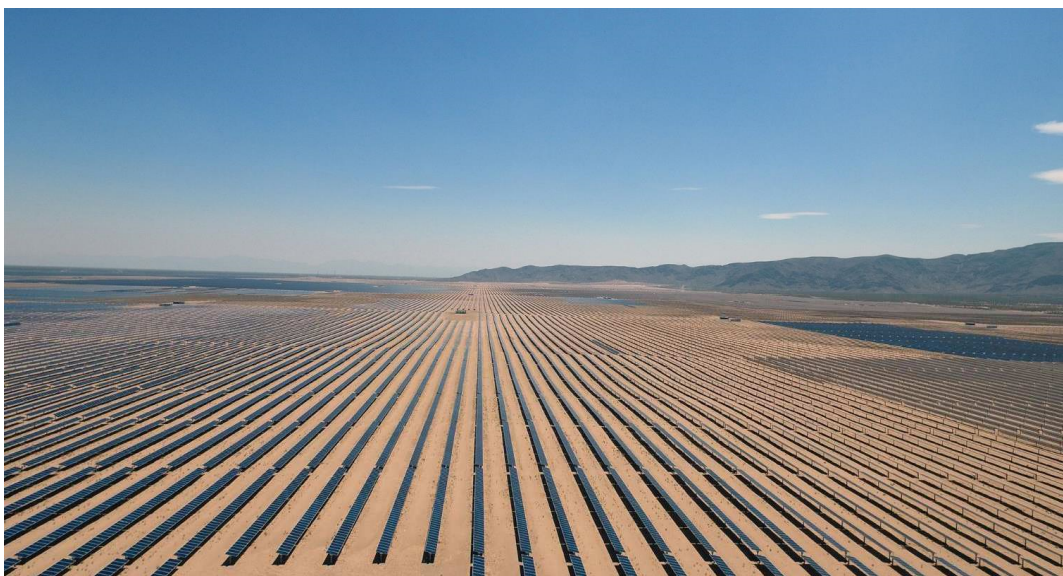
EM: Germany-France in Munich - June 2021

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What Happens to Solar in the Desert?

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What Happens to Solar in the Desert?

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Source: Twitter 6 April 2020; right downloaded [here](#)

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A Young Man Burning Electrical Wires to Recover Copper at Agbogbloshie, Ghana September 2019

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Source: Wikipedia Free License; downloaded [here](#)

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November 2020 in Germany



Source: 14 Nov 2020: Sebastian Böhme <https://twitter.com/SeBoehme/status/1327548634464968706>, top right [American Bird Conservancy](#), bottom right California [Wikipedia](#)

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Fragments of Wind Turbine Blades Await Burial at the Casper Regional Landfill in Wyoming

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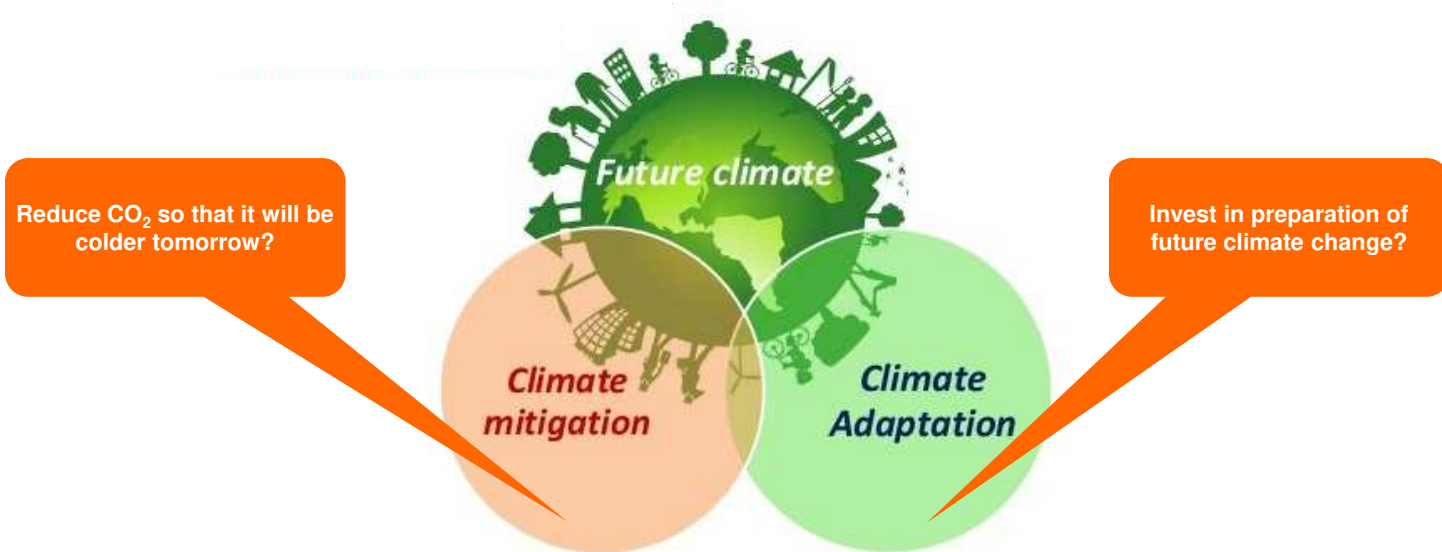


Source: left, Photo from 2011; [Eli Duke](#) from Portland, OR, USA, [Wikipedia](#); right, Photographer: Benjamin Rasmussen for Bloomberg Green; Feb 2020, Bloomberg Article [here](#)

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Source: [climate-change.jpg \(582x382\) \(greengoldbamboo.com\)](#)

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2020 Study confirms adverse effects of climate mitigation on poverty...

... but claims damages of climate change would be worse on poor

ENVIRONMENTAL RESEARCH LETTERS

LETTER • OPEN ACCESS

An assessment of the potential of using carbon tax revenue to tackle poverty

Shinichiro Fujimori^{1,2,3} , Tomoko Hasegawa^{2,4}  and Ken Oshiro¹ 

Published 11 November 2020 • © 2020 The Author(s). Published by IOP Publishing Ltd

[Environmental Research Letters, Volume 15, Number 11](#)

Citation Shinichiro Fujimori et al 2020 *Environ. Res. Lett.* **15** 114063

In addition to carbon tax revenue, carbon pricing has certain adverse side effects in terms of macroeconomic factors and household consumption. The global income loss associated with additional climate change mitigation costs could reach 2.0% in 2030 under the WB2C scenario and 1.5 C scenario shows similar trend by 2030 (figure 2(d)). Prices of goods, in particular energy and food, showed increases of 7.5% and 4.4%, respectively, which could have regressive effects on consumption levels of low-income households (figure 2(e)). The ultimate consequences of these price and income changes associated with

climate mitigation scenarios basically cause adverse side effects in poverty headcount, poverty gap, and poverty rates similarly. As the stronger the climate mitigation increases, the magnitude of the above-mentioned side effects gets larger. Taking an example of the WB2C scenario, poverty gap would increase by 23% compared with Baseline scenario (figure 2(f)). The poverty gap shifts from a baseline of 1.4% to 1.6% under WB2C. This number might appear large, but is small compared with the other uncertainties described below (e.g. socioeconomic uncertainty). Note that the ratio of the poverty gap to GDP for

each nation is not so much affected by the stringency of climate change mitigation (figure 2(h)). Importantly, the damage caused by climate change to the low-income class would be much larger than the average GDP changes and, thus, would be of more serious concern than the effects of climate change mitigation on poverty [9].

Source: Fujimori Oct 2020 Research [An assessment of the potential of using carbon tax revenue to tackle poverty - IOPscience](#)

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France: Temperature Dependent Power Demand Increases Until 2030 [EWI](#)

Dispute?

2030 PEAK POWER DEMAND IN NORTH-WEST EUROPE

Executive Summary



- 1 In North-West Europe, the 2030 power system would experience power interruptions of over 10% of demand during 100 to 250 hours, with economic cost of ~10 to 30 bn EUR

This challenge is receding in France there is

To study this scenario, we analyze the supply-demand gaps under TYNDP 2020-like supply scenarios and evaluate the associated costs.

- 1.1 In case of a cold winter, the 2030 supply-demand gap could reach ~35 to 70 GW, possibly leading to ~100 to 250 hours of Loss of Load and ~1.7 to 5.6 TWh of Energy Not Served

- 2 Our results show that by 2030, the risk of supply-demand gaps at peak time under cold temperatures increases.
- 6 By 2050, unless technologies such as long-term hydrogen storage provide additional solutions to bridge supply-demand gaps, the issue is likely to become more acute as electrification of end uses and intermittent renewable capacity further develop.

2030 Peak Power Demand in North-West Europe

Report (Final version) – September 2020

DTU International
Energy Report 2015



Energy systems integration for the transition to non-fossil energy systems

Edited by **Hans Hvidtfeldt Larsen** and **Leif Sønderberg Petersen**, DTU National Laboratory for Sustainable Energy

Chapter 2

Conclusions and recommendations

Finally, the Report points out that at local, regional, and global level, inadequately performing energy infrastructures may impose severe economic losses on society, reduce economic growth and even impair sustainable development. This field of energy research is still relatively young and is charged with challenges.

Source: Technical University of Denmark, DTU, International Energy Report 2015

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What Next for Insurers?

1: Stop insuring 80% of energy?

Focus only on new risks of «renewables» and Evs?

2: charge higher fees, allow developing nations to catch up?

Fund R&D until solution is found

«Biggest Concern for our Customers is Security of Supply»

What is needed is R&D to get to “New Energy Revolution” and Investment in (not Divestment from) Coal, Gas, Oil & Nuclear

Solve the Funding Crisis and looming Energy Crisis through concerted efforts of governments and private companies

Can the world afford to cease utilization of Oil, Coal, and Gas without having a viable alternative?

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THANK YOU

Please write t_hardy@btconnect.com for my contact details

I am available selectively for detailed (in person)
presentations/workshops

- Energy policy
- Science of climate change
- „Renewable“ vs conventional energy

Backup

12 Recommended Books That Warn Us of the Impacts of Human-Made Climate Change

Schernikau
on Energy Policy



12 Recommended Books that Warn us of Alarmism and Remind us to Stay Calm

Schernikau
on Energy Policy



Dispute on GWP

Umweltministerium
Flüssigerdgas ähnlich klimaschädlich wie Kohle
Nachrichtenagentur: Redaktion dts | 11.10.2020, 13:03 | 1067 | 0 | 0



Berlin (dts Nachrichtenagentur) ...
mittels Fracking gefördert wird, ...
klimaschädlicher als Pipelinegas aus ...
Stellungnahme des Bundesumweltministeriums ...
hervor, über welche das "Redaktionsnetzwerk Deutschland" ...
das Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit der Auftrassung, ...
dass Erdgas den emissionsintensiveren Einsatz von Kohle und Erdöl in einer ...
Übergangsphase auf dem Weg zur vollständigen Dekarbonisierung unserer ...
Energieversorgung ersetzen kann", heißt es in dem Bericht.

German government: Liquefied gas is as environmentally unfriendly as coal and oil

Send Print

**Global Warming Potential (IPCC):
CH₄ 84-87x higher than CO₂ over 20 years
(28-36x over 100 years)**

wallstreet:online

The Strategist .media

Source: Web Link and Link

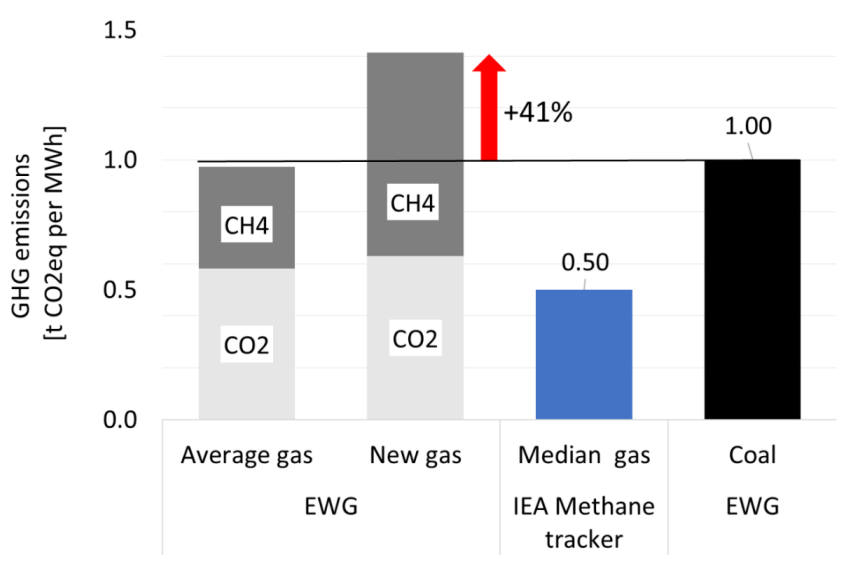
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dispute

Greenhouse gas emissions from fossil sources and additional emissions from the switch from coal to new natural gas



The Energy Watch Group (EWG)

- an independent, non-profit, non-partisan global network of scientists and parliamentarians.
- The network was established in 2006 by an international group of parliamentarians under the direction of the then-member of the German Parliament Hans-Josef Fell

Note: Greenhouse gas emissions from fossil sources and additional emissions from the switch from coal to new natural gas for electricity generation: Additional methane emissions more than offset any CO₂ savings. Source: Sep 2019 Natural Gas makes no Contribution to Climate Projections, download here energywatchgroup.org based on „Own calculation, IEA Methane tracker“

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Ocean corals may be more resilient against climate change than we thought



Climate change have placed the long-term health of the world's coral reefs in jeopardy.

Image: REUTERS/David Gray

Source: Jan 2021 WEF

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Scenarios: CO₂ Concentration with different «RCPs» and «SSPs»

RCP - Representative Pathways (end of century radiative forcing)

RCP 2.6 is described "very stringent", requires CO₂ emissions start declining by 2020 and go to zero by 2100.

RCP 4.5 is described intermediate. Emissions peak around 2040, then decline.

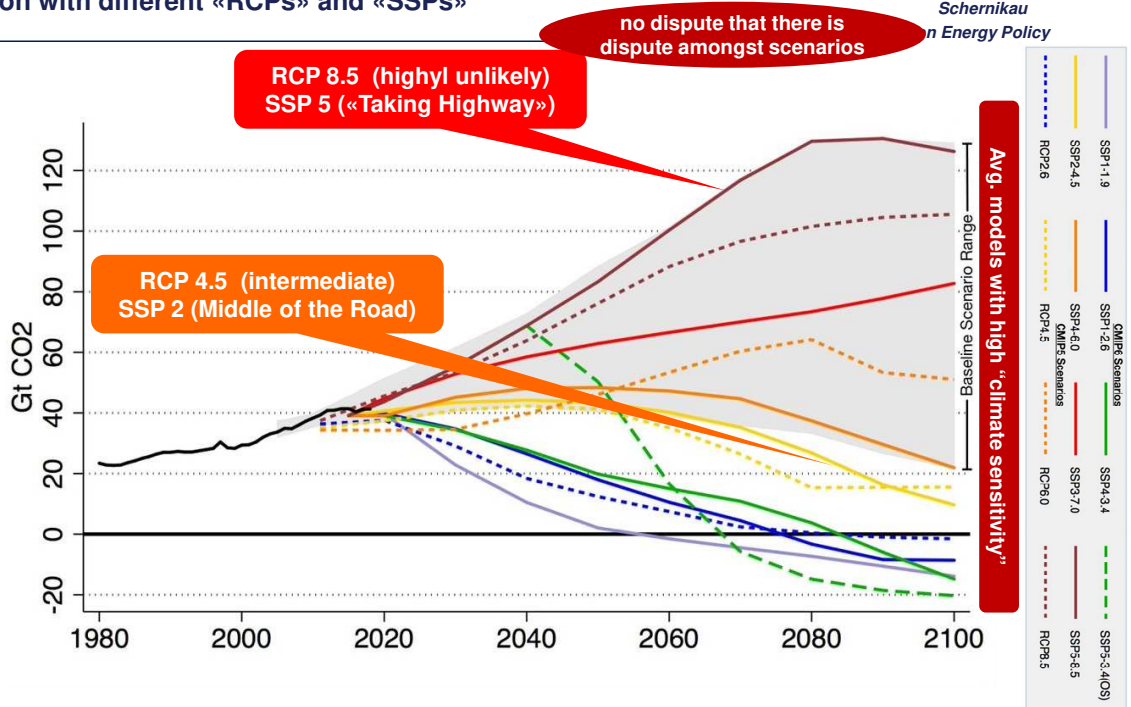
RCP 8.5: emissions continue rise beyond 2100. Since AR5 described very unlikely, taken as the basis for worst-case climate change scenarios

SSP - Shared Socioeconomic Pathways

SSP1 "Sustainability – Taking the Green Road"

SSP2 "Middle of the Road",
SSP3 "Regional Rivalry – A Rocky Rd",
SSP4 "Inequality – A Road Divided"

SSP5 "Fossil-fueled Development – Taking the Highway"



Note: The IPCC uses scenarios called "Representative Concentration Pathways" or RCPs to explore possible changes in future energy use, GHG and temperature; Going forward – as of the 6th assessment report in 2020 SSPs or "Shared Socioeconomic Pathways" are defined. These scenarios depend on which policies are enacted where and when
Source: [Zeke Hausfather on Twitter Oct 2019](#).

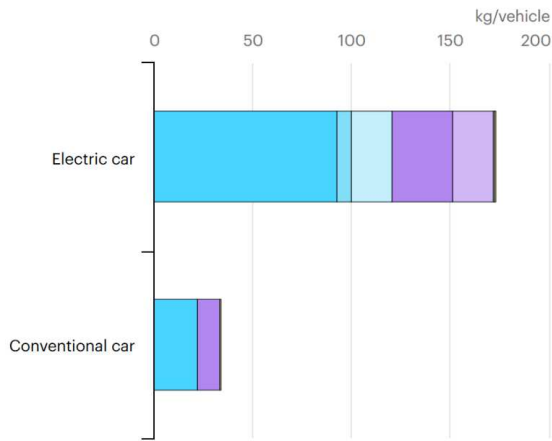
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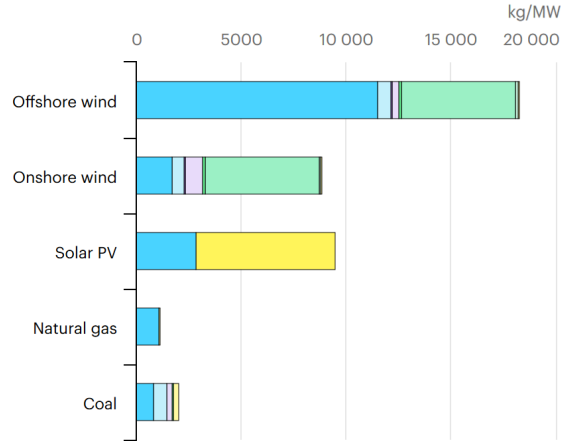
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Minerals used in selected transport technologies



Minerals used in selected power generation technologies



- Copper
- Lithium
- Nickel
- Manganese
- Cobalt
- Chromium
- Molybdenum
- Zinc
- Rare earths
- Silicon
- Others



Source: IEA May 2020 "Clean energy progress after the Covid-19 crisis will need reliable supplies of critical minerals" downloaded [here](#)

Blackouts in UK/France?
January 2021



MONTEL DE Ausgabe Nachrichten Analyse Marktdaten Veranstaltungen

French TSO issues power supply red alert for Friday

Strom VOR 15 STUNDEN

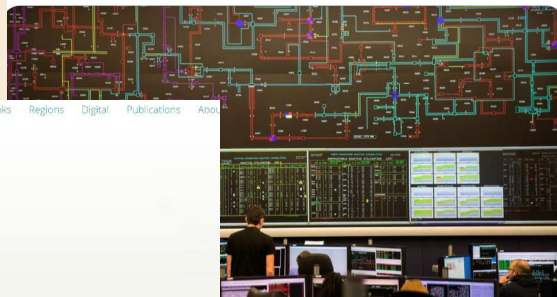
CHRIS EALES
07 Jan 2021
23:36 CET

(Montel) French grid operator RTE has issued a red alert for power supplies on Friday morning, urging people across the country to reduce consumption.

System split registered in the synchronous area of Continental Europe - Incident now resolved

Jan 8, 2021

The U.K. power grid is creaking and at risk of blackouts now that it's so reliant on renewable energy



Peaks at Risk of Blackouts

The synchronous area of Continental Europe was split into two separated grid regions between 14h05 CET and 15h08 CET when it was reconnected on 8 January 2021.

The U.K. power market is showing signs of strain. For the **fourth time this winter National Grid Plc warned** that the buffer needed to ensure security of supply and keep the lights on was too small.

While the U.K. has made swift progress on switching from fossil fuels to renewables, this is the downside to cleaning up its energy system. And, like Wednesday, when the wind doesn't blow, cold weather boosts demand and several nuclear plants are offline the grid operator is **left scrambling to avoid blackouts**

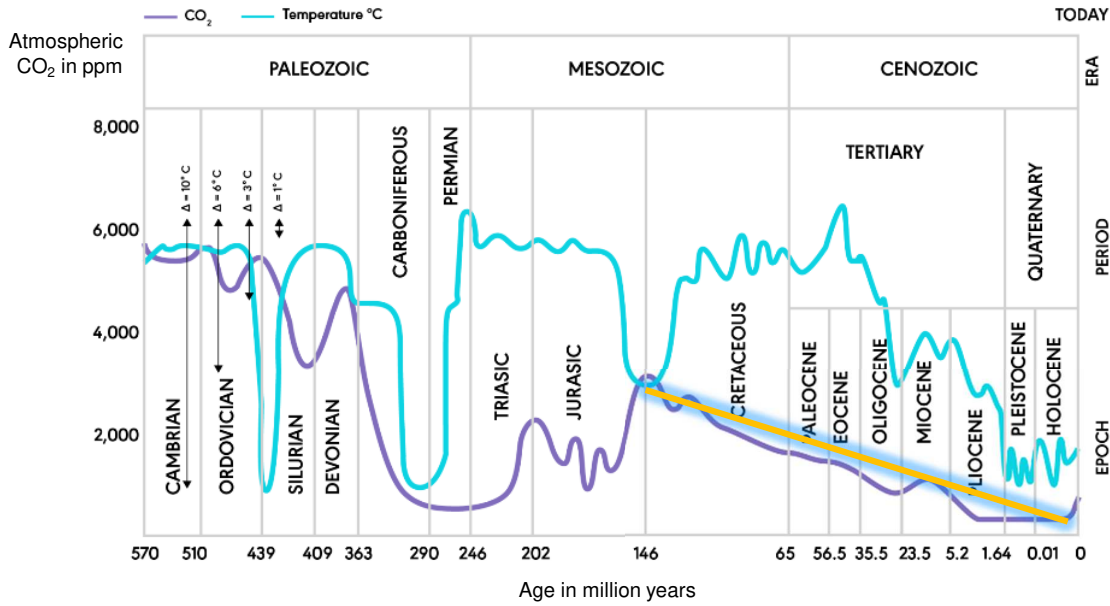
17:25 · 06.01.21 · [SocialFlow](#)

(Source: Bloomberg 6 Jan 2020, U.K. [Electricity Grid Creaks Under Repeated Winter Pressure - Bloomberg](#))

Global CO₂ Concentration & Temperatures Over Past 600 Million Years

no dispute

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on Energy Policy



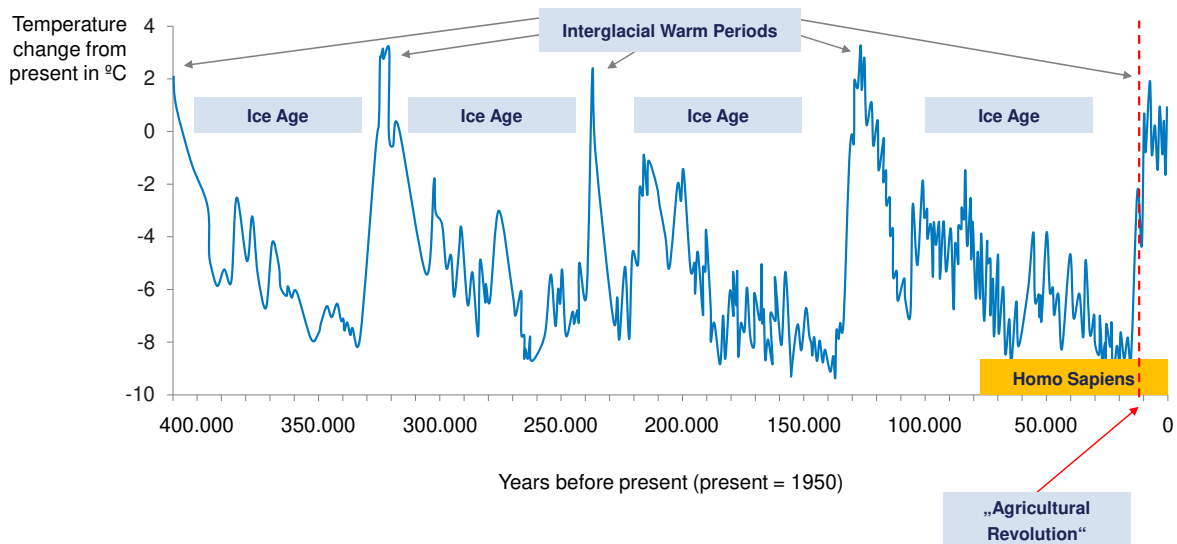
Note: Note both temperature and CO₂ are lower today than they have been during most of the era of modern life on Earth since the Cambrian Period. Also, note that CO₂ and temperature are not highly correlated, therefore this does not indicate a lock-step cause-effect relationship between the two parameters
Sources: Nasif Nahle. "Cycles of Global Climate Change." Biology Cabinet Journal Online, July 2009. http://www.biocab.org/Climate_Geologic_Timescale.html; Referencing C.R. Scotese, Analysis of the Temperature Oscillations in Geological Eras, 2002; W.F. Ruddiman, Earth's Climate: Past and Future, New York, NY: W.H. Freeman and Co., 2001; Mark Pagani et al., "Marked Decline in Atmospheric Carbon Dioxide Concentrations during the Paleocene." Science 309, no. 5734 (2005): 600-603.

We Are in the 5th Interglacial Warm Period of the Last 400,000 Years Which Has Lasted Unusually Long and Contributes to Higher CO₂ in the Atmosphere

no dispute

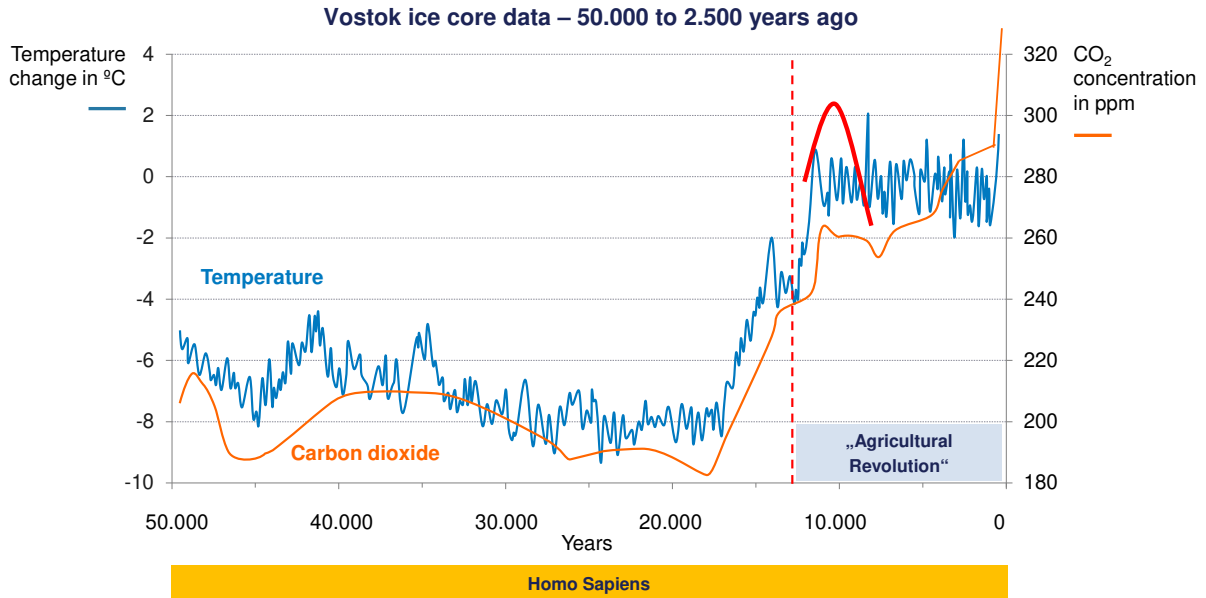
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Vostok ice core data – 400,000 years of temperature changes



Current Interglacial Warm Period Lasts far Longer than Previous Ones...
 ... and Is Basis for Human's Agricultural Revolution and Development

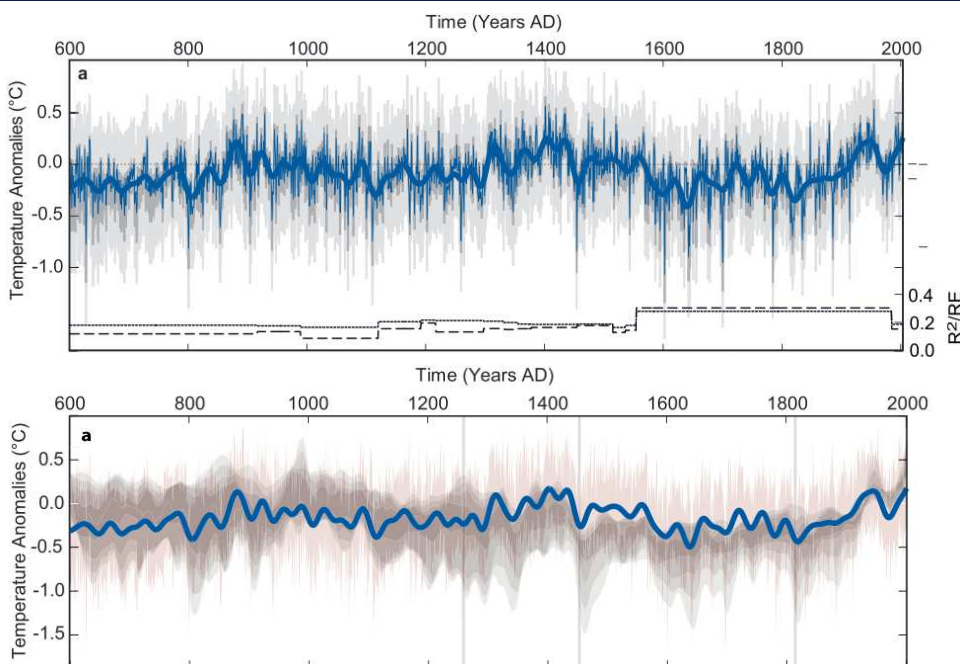
no dispute



Source: Schernikau analysis based on Cosmoquest.org; Joanne Nova. "The 800 year lag in CO2 after temperature – graphed." JoNova. <http://joannenova.com.au/global-warming-2/ice-core-graph/>

Peer Reviewed Study: New Tree Ring Data Revises View of IPCC of the Past 2,000 Years and Internal or Natural Variability of Temperatures

Dispute?



Historic temp anomalies below (compared to 1961-1990) and grey error bars.

- Notes: NH extratropical temperature reconstruction. (a) Nested June-July-August temperature reconstruction (blue) with combined uncertainty estimates derived from the calibration (dark grey) and sampling (light grey) errors. Anomalies with respect to 1961-1990. Bottom panel shows the time-varying explained variance (R²; dotted) and reduction of error statistic (RE; dashed) of differently replicated nests over the past 1400 years. All nests passed the 99% threshold of a red noise benchmarking exercise

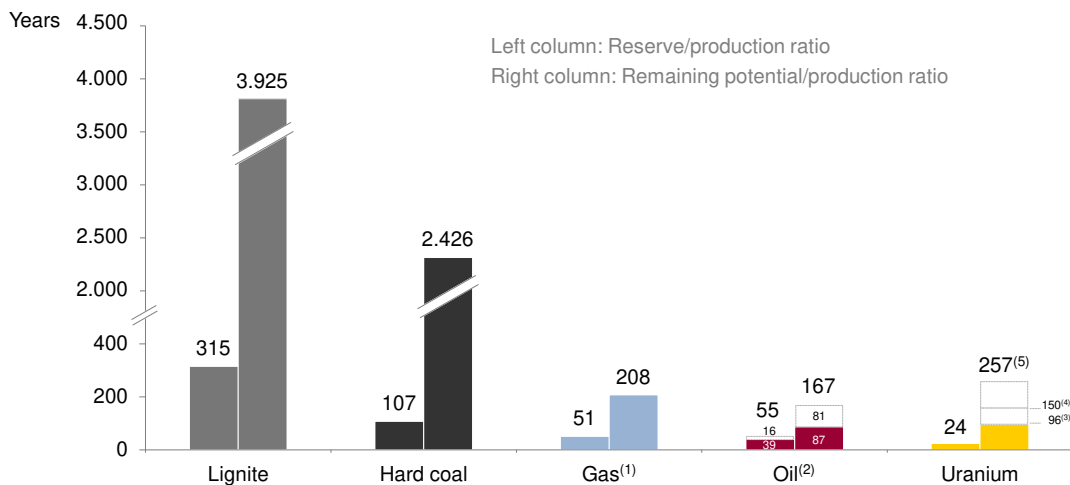
Historic temp anomalies below (compared to 1901-1976) and grey error bars.

- Notes: Comparison of Northern Hemispheric temperature reconstructions. (a) This study (blue) shown together with the distribution quantiles (grey shading) derived from 15 reconstructions assessed in the IPCC AR5 [Masson-Delmotte et al., 2013] after 30 year low pass filtering. Note that most reconstructions are scaled to annual mean temperature. Anomalies with respect to 1901-1976. Grey bars indicate major volcanic eruptions.

Source: Schneider et al 2015; Geophysical Research Letters; "Revising midlatitude summer temperatures back to A.D.600 based on a wood density network"

no dispute

Static range of energy fuels worldwide (production ratios) in 2018



(1) Shows conventional & unconventional gas total, reserve/production ratio for conventional gas: 48, for unconventional gas: 3; remaining potential/production ratio for conventional gas: 129, for unconventional gas: 79
 (2) Shows conventional & unconventional oil total, reserve/production ratio for conventional oil: 39, for unconventional oil: 16; remaining potential/production ratio for conventional oil: 87, for unconventional oil: 81
 (3) Remaining potential includes only economically recoverable resources, (4) Remaining potential includes all discovered resources, (5) Remaining potential includes discovered and undiscovered but assumed resources
 Note: 2018 data; reserves + resources = remaining potential; oil and gas include conventional & non-conventional reserves and resources
 Source: Schernikau analysis based BGR Energiestudie 2019 (https://www.bgr.bund.de/DE/Themen/Energie/Downloads/energiestudie_2019.pdf?__blob=publicationFile&v=10)

Backup

Tesla?

Dispute?

Even Tesla builds a Gas plant at its new 2021 Berlin Gigafactory



“The report also shows that Tesla intends to cover its energy requirements with both electricity and natural gas. In particular, natural gas is to be used for the energy-intensive melting process in the aluminum foundry and for the central heating and drying ovens in the paint shop”

Source: Electrive.com, exact link [here](#); also reported in Focus [here](#).