

Is the number of global natural disasters increasing?

(A proposal for the EPS Energy group position paper)



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Research Article

Is the number of global natural disasters increasing?

Gianluca Alimonti & Luigi Mariani 

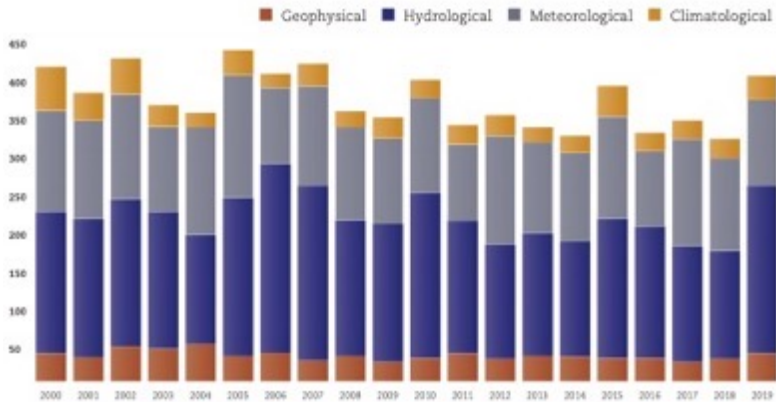
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- Do we need an energy or an ecological transition?
- Proposal for an EU energy transition



Why this study?

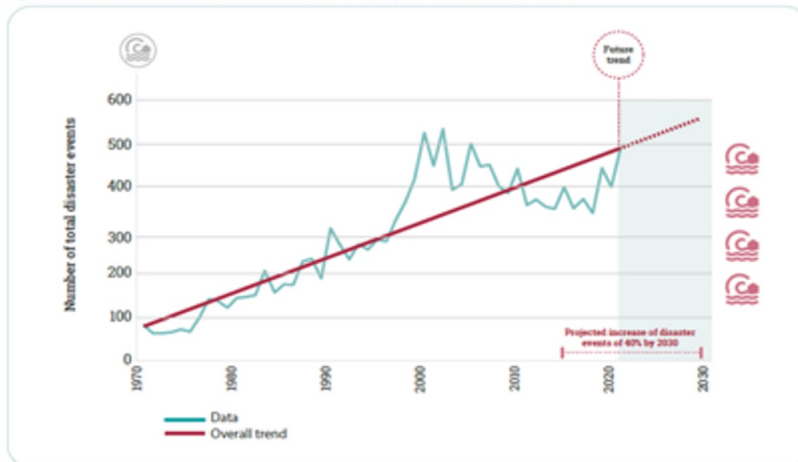
The number of disasters by disaster sub-groups per year (2000-2019)



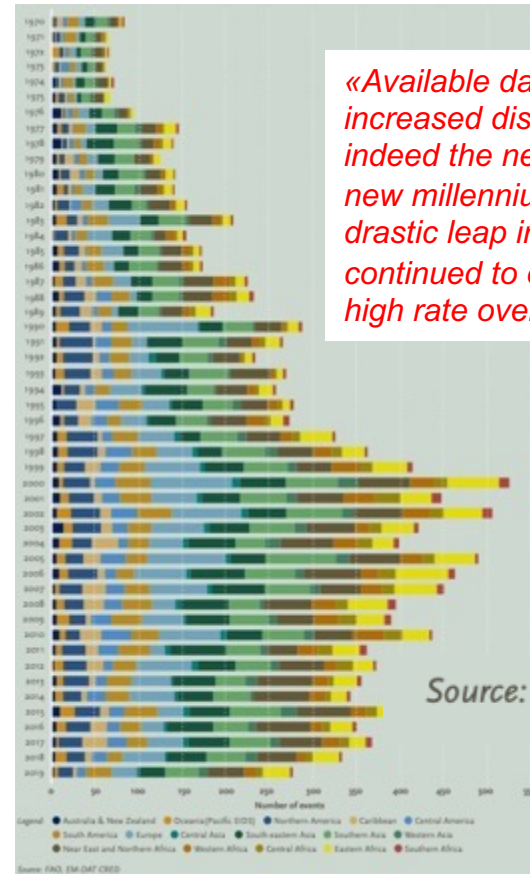
“This report focuses primarily on the staggering rise in climate-related disasters over the last twenty years”

Source: The human cost of disasters: an overview of the last 20 years (2000-2019) UNDRR (UN Office for Disaster Risk Reduction)

Figure S.1. Number of disaster events 1970–2020 and projected increase 2021–2030



Source: United Nations Office for Disaster Risk Reduction (UNDRR) analysis based on the International Disaster Database (EM-DAT; CRED, 2021)



«Available data shows that increased disaster occurrence is indeed the new normal.... With the new millennium, disasters took a drastic leap in frequency and have continued to occur at a consistently high rate over the past 20 years”.

Source: FAO, EM-DAT CRED

Source: «The impact of disasters and crises on agriculture and food security». FAO 2021

«If current trends continue, the number of disasters per year globally may increase from around 400 in 2015 to 560 per year by 2030 – a projected increase of 40% during the lifetime of the Sendai Framework»

Source: GAR Report, UNDRR 2022

Data source: EM-DAT



The international disaster database used in this work is EM-DAT (Emergency Events Database), created by CRED (Centre for Research on the Epidemiology of Disasters) in 1988 with initial support from the World Health Organization and the Belgian government. **This is the only publicly available global disaster database with about 26,000 events from 1900 to the present, and it is widely cited.**

At least one of the following criteria must be met for a new event to be added to the database:

- 10 or more deaths;
- 100 or more people affected/injured/homeless;
- declaration of a state of emergency and/or request for international assistance.

In EM-DAT two main groups of disasters are distinguished: **natural disasters and technological disasters** (industrial or transport accidents). **Our work deals only with natural disasters**, and in EM-DAT this category is divided into 6 subgroups: biological, geophysical, climatological, hydrological, meteorological and extraterrestrial disasters.

Extreme events Vs natural disasters

Miami Beach, Then and Now



Source: Roger Pielke, Jr., *The Climate Fix: What Scientists and Politicians Won't Tell You About Global Warming*, 171.

The same hurricane that would cause deaths and serious damage today, probably would not be recorded in EM-DAT if it had struck in 1925

Extreme events in IPCC AR6

Table 12.12 | Emergence of CIDs in different time periods, as assessed in this section. The colour corresponds to the confidence of the region with the highest confidence: white cells indicate where evidence is lacking or the signal is not present, leading to overall *low confidence* of an emerging signal.

extreme events

Climatic Impact-driver Type	Climatic Impact-driver Category	Already Emerged in Historical Period	Emerging by 2050 at Least for RCP8.5/SSP5-8.5		Emerging Between 2050 and 2100 for at Least RC8.5/SSP5-8.5	
Heat and Cold	Mean air temperature	1				
	Extreme heat	2	3			
	Cold spell	4	5			
	Frost					
Wet and Dry	Mean precipitation		6	7		
	River flood					
	Heavy precipitation and pluvial flood				8	
	Landslide					
	Aridity					
	Hydrological drought					
	Agricultural and ecological drought					
	Fire weather					
Wind	Mean wind speed					
	Severe wind storm					
	Tropical cyclone					
	Sand and dust storm					
Snow and Ice	Snow, glacier and ice sheet		9		10	
	Permafrost					
	Lake, river and sea ice	11				
	Heavy snowfall and ice storm					
	Hail					
	Snow avalanche					
Coastal	Relative sea level		12			
	Coastal flood					
	Coastal erosion					
Open Ocean	Mean ocean temperature					
	Marine heatwave					
	Ocean acidity					
	Ocean salinity	13				
	Dissolved oxygen	14				
Other	Air pollution weather					
	Atmospheric CO ₂ at surface					
	Radiation at surface					

What is observed today

Extreme events in IPCC AR6

No evidence, except for heat waves (increasing) and cold waves (decreasing).
Deaths caused by cold waves are about 10 times those caused by heat waves.

[https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196\(21\)00081-4/fulltext](https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(21)00081-4/fulltext)

Climatic Impact-driver Type	Climatic Impact-driver Category	Already Emerged in Historical Period
Heat and Cold	Mean air temperature	1
	Extreme heat	2
	Cold spell	4
	Frost	
Wet and Dry	Mean precipitation	
	River flood	
	Heavy precipitation and pluvial flood	
	Landslide	
	Aridity	
	Hydrological drought	
	Agricultural and ecological drought	
	Fire weather	
Wind	Mean wind speed	
	Severe wind storm	
	Tropical cyclone	
	Sand and dust storm	

Also, some media outlets have recently adopted and promoted terms and phrases stronger than the more neutral ‘climate change’ and ‘global warming’, including ‘climate crisis’, ‘global heating’, and ‘climate emergency’. Google searches on those terms, and on ‘climate action’, increased 20-fold in 2019, when large social movements such as School Strikes for Climate gained worldwide attention”
[Source IPCC, AR6 WG1, p. 173].

High confidence of decrease

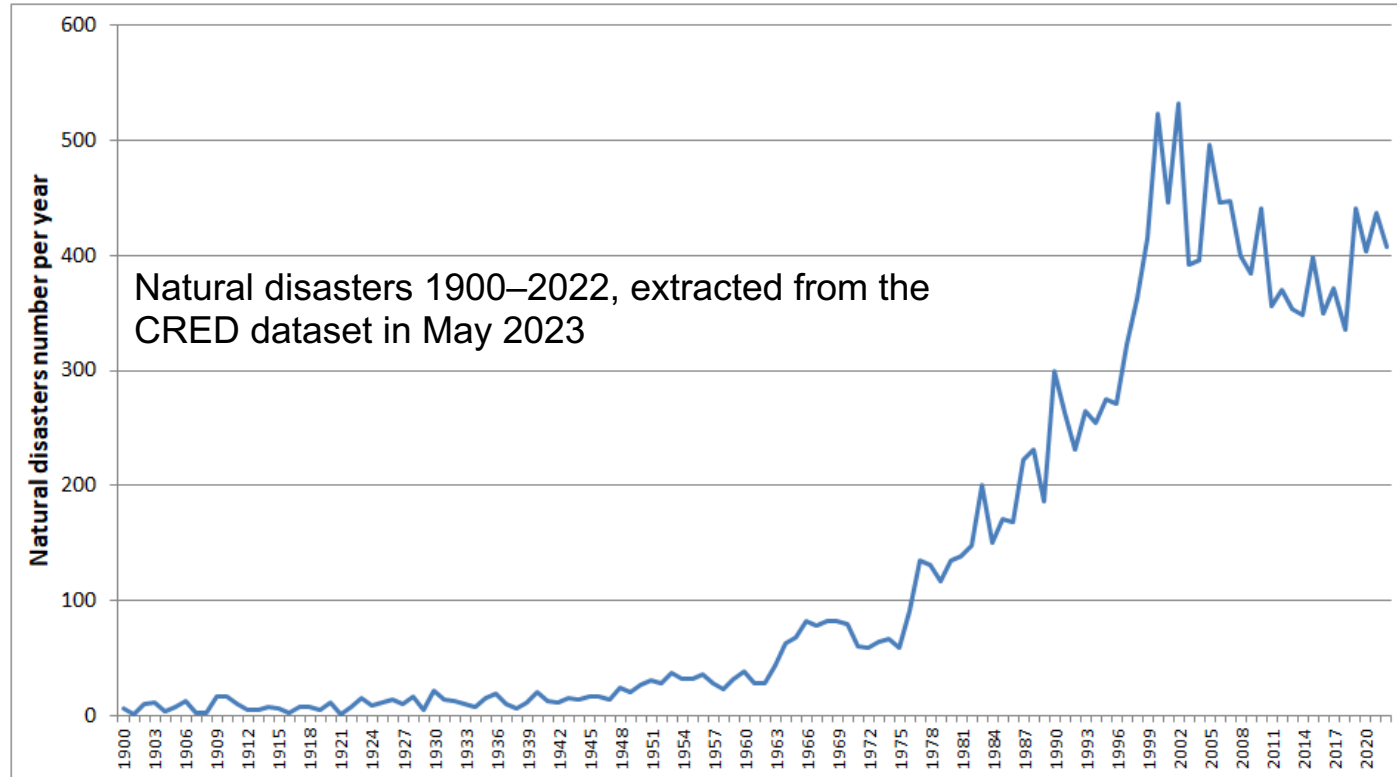
Medium confidence of decrease

Low confidence in direction of change

Medium confidence of increase

High confidence of increase

EM-DAT Natural disasters since 1900



Guha-Sapir, CRED Director, et al. (2004) wrote that their time series (figure above with data up to 2003) “might lead one to believe that disasters occur more frequently today than in the beginning of the century. However, reaching such a conclusion based only on this graph would be incorrect. *In fact, what the figure is really showing is the evolution of the registration of natural disaster events over time*”.

Guha-Sapir, D, Hargitt, D, & Hoyois, P. (2004). Thirty years of natural disasters 1974-2003: the numbers, Presses Universitaires de Louvain. <https://www.emdat.be/thirty-years-natural-disasters-1974-2003-numbers>

Warnings from CRED

Again in 2008, CRED wrote (Scheuren, 2008):

*“Indeed, justifying the upward trend in hydro-meteorological disaster occurrence and impacts essentially through climate change would be misleading. ... **one major contributor to the increase in disasters occurrence over the last decades is the constantly improving diffusion and accuracy of disaster related information”.***

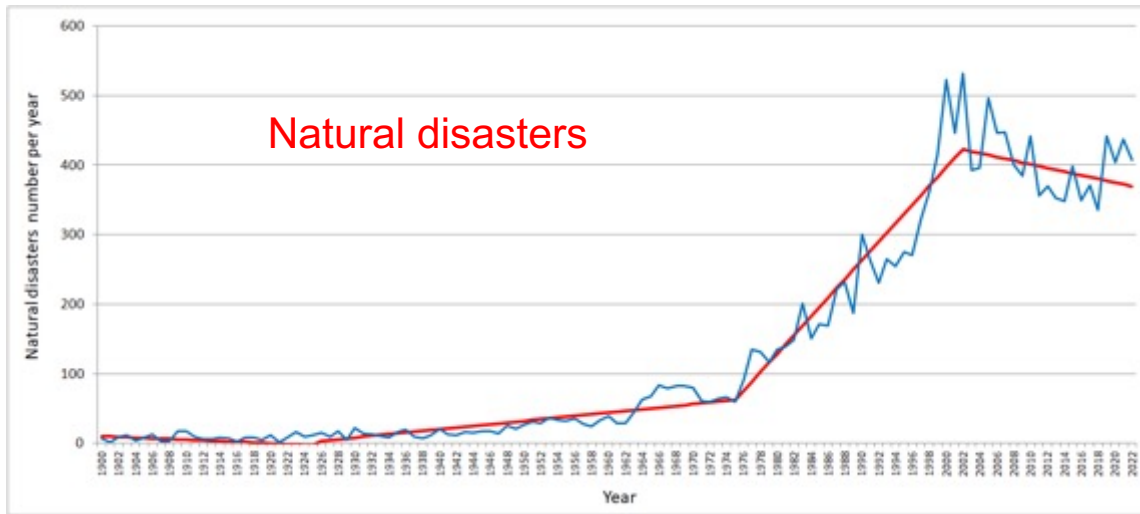
Scheuren, J-M., Le Polain, O., Below, R., Guha-Sapir, D., & Ponserre, S. (2008). Annual disaster statistical review: Numbers and trends. <https://www.cred.be/node/316>

These considerations have also been repeated in more recent times when a 2015 CRED report (CRED, 2015) mentioned:

*“The volume and quality of data about natural disasters increased enormously after 1960 when the US’s OFDA (Office of U.S. Foreign Disaster Assistance) actively began to collect information about these events. The arrival of CRED in 1973 further improved data recording while the development of global telecommunications and the media, plus increased humanitarian funding and reinforced international cooperation also contributed to better reporting of disasters. **Thus part of the apparent increase in the frequency of disasters in the past half-century is, no doubt, due to improved recording”.***

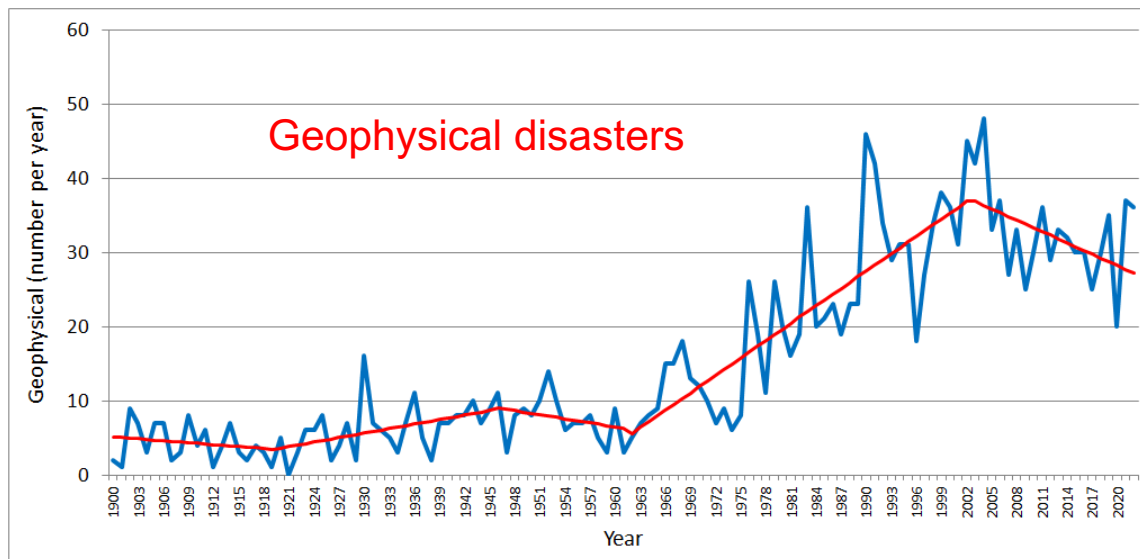
CRED. (2015). The human cost of natural disasters: A global perspective. http://www.cred.be/sites/default/files/The_Human_Cost_of_Natural_Disasters_CRED.pdf.

Disasters trend



Linear piecewise best fit analysis with the request of a minimal **10% trend change at breakpoint** and a low pass filter of 10-15 years.

After a period of substantial stability, a significant growth was observed around the mid-1970s, identifiable with the significant improvement in disaster reporting. **This growth stops around the beginning of the 21st century, when the reporting can be considered reliable as stated in several CRED reports.**



A flat trend is expected for geophysical disasters originating from earthquakes, volcanic activity or dry mass movements are not sensitive to climate variations and: **an increase in geophysical disasters could be explained only by a better reporting.**

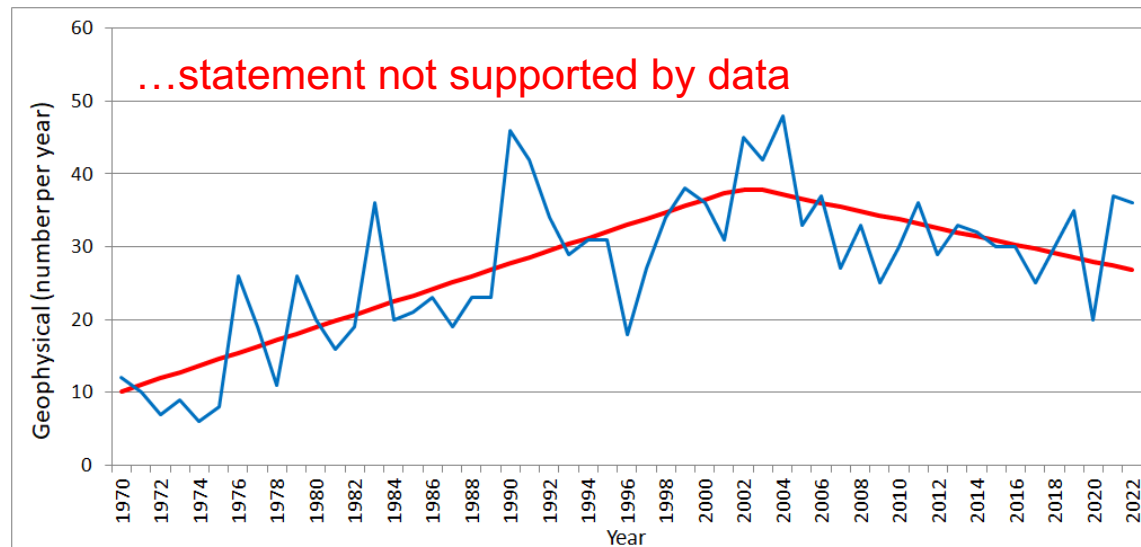
The breakpoint at the beginning of the 21st century overlaps with the breakpoint identified by the analysis of all natural disasters and agrees with the assessments expressed by CRED.

...therefore:

The claim that the increase in natural disasters recorded in EM-DAT in the late 20th century is largely, if not completely, caused by better reporting and not by an increase in actual events is supported by three lines of independent evidence:

1. several CRED reports (Guha-Sapir et al., 2004; Scheuren et al., 2008; CRED, 2015);
2. best fit analysis which detected an important breakpoint and even a change in the trend of natural disasters at the beginning of the 21st century, in agreement with what was written and justified in point 1;

While the average rate of geophysical disasters, such as earthquakes, landslides and mass movements, remained fairly stable over time, other disaster types have radically increased since the 1970s. Source FAO: The impact of disasters and crises on agriculture and food security, 2021



...therefore:

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CRED, September 2023: Technologies and initiatives can be considered responsible for the dominant trend observed. Therefore, it is challenging to infer insight into the actual drivers of disasters such as climate change, population growth, or disaster risk management. **Accordingly, excluding pre-2000 data from trend analyses based on EM-DAT is strongly recommended.**

<https://doc.emdat.be/docs/known-issues-and-limitations/specific-biases/>

Conclusions (on natural disasters)

The statement that we are facing an increasing trend of natural disasters, as claimed in three official reports by UNDRR and FAO on the basis of the EM-DAT dataset, has been checked. **Our, conclusion, in agreement with CRED, is that the claims presented in the reports are not supported by data and that natural disasters are decreasing since the beginning of the XXI century.**

Moreover, as supported by IPCC, there is no evidence of climate extreme events variations, except for heat waves (increasing) and cold waves (decreasing). Nevertheless....



Climate Crisis Heading into ‘Uncharted Territories of Destruction, Urges Leaders to Heed United in Science Alarming Report

Floods, droughts, heatwaves, extreme storms and wildfires are going from bad to worse, breaking records with ever alarming frequency. Heatwaves in Europe. Colossal floods in Pakistan. Prolonged and severe droughts in China, the Horn of Africa and the United States....**The number of weather, climate and water-related disasters has increased by a factor of five over the past 50 years.**

<https://press.un.org/en/2022/sgsm21450.doc.htm>

Guterres: ‘The era of global warming has ended, the era of global boiling has arrived’

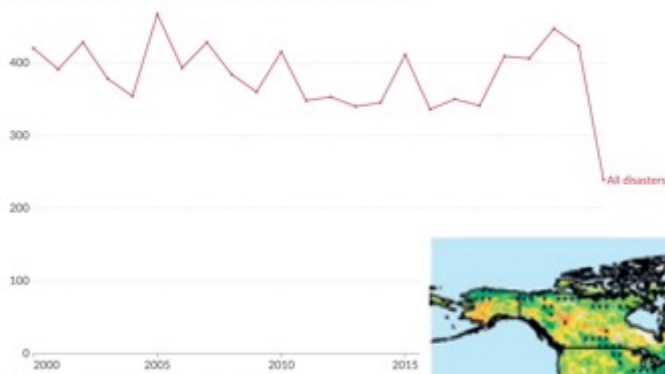
July, 2023 <https://news.sky.com/video/antonio-guterres-the-era-of-global-warming-has-ended-the-era-of-global-boiling-has-arrived-12928654>

**Conclusion: we must be leaving in two different worlds!
...let’s go back to our world:**

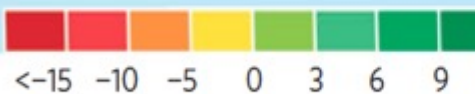
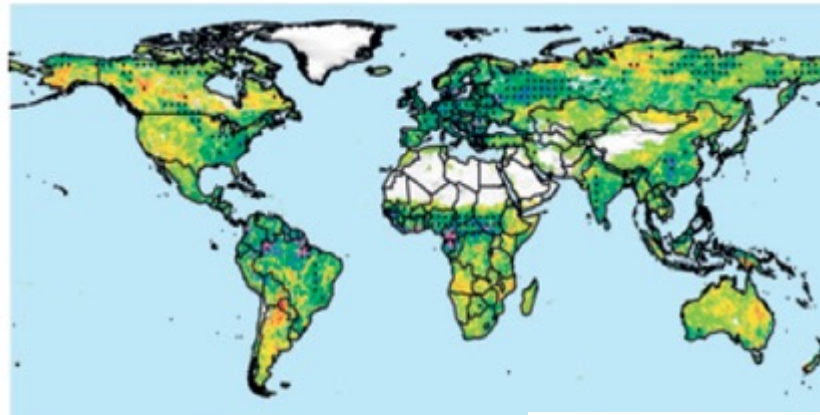
Energy or ecological transition?

Number of recorded natural disaster events, 2000 to 2023

The number of global reported natural disaster events in any given year. Note that this largely reflects increases in data reporting, and should not be used to assess the total number of events.

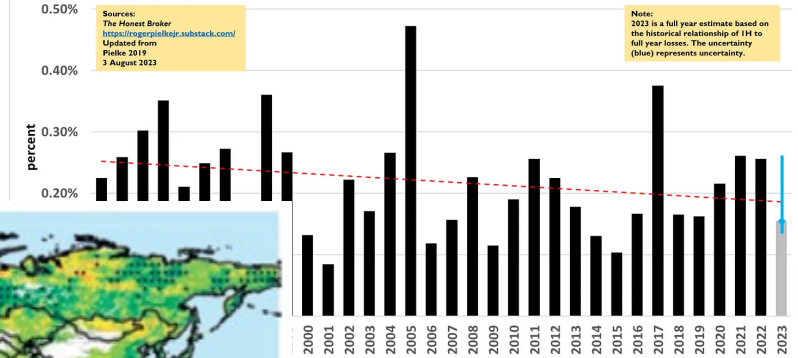


Data source: EM-DAT, CRED / UCLouvain (2023)
Note: Data includes disasters recorded up to September 2023.



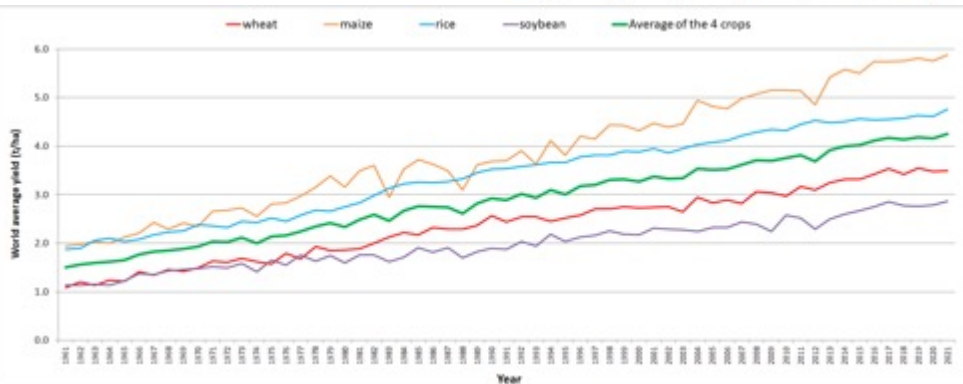
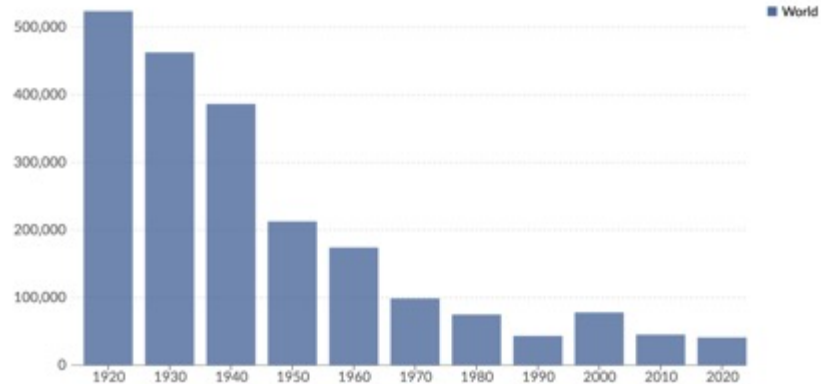
Global Weather Losses as Percent of Global GDP: 1990-2023

(Sources: Munich Re, World Bank & updated from Pielke 2019)



Decadal average: Annual number of deaths from disasters

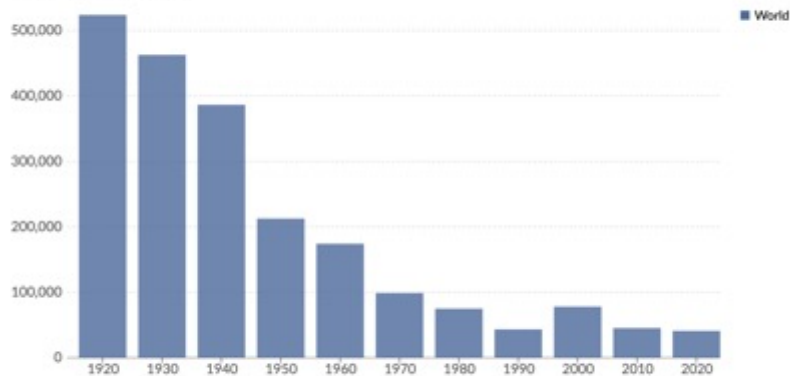
Disasters include all geophysical, meteorological and climate events including earthquakes, volcanic activity, landslides, drought, wildfires, storms, and flooding. Decadal figures are measured as the annual average over the subsequent ten-year period.



Speaking of health impacts...

Decadal average: Annual number of deaths from disasters

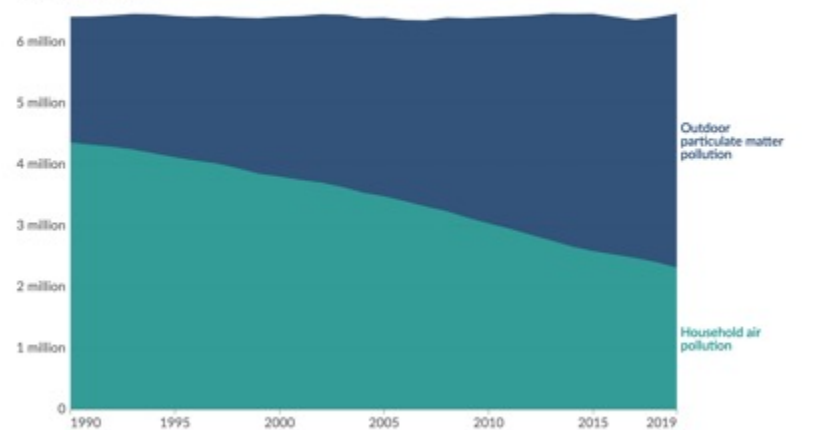
Disasters include all geophysical, meteorological and climate events including earthquakes, volcanic activity, landslides, drought, wildfires, storms, and flooding. Decadal figures are measured as the annual average over the subsequent ten-year period.



Data source: Our World in Data based on EM-DAT, CRED / UCLouvain, Brussels, Belgium - www.emdat.be (D. Guha-Sapir)
Note: Decadal figures are measured as the annual average over the subsequent ten-year period. This means figures for '1900' represent the average from 1900 to 1909; '1910' is the average from 1910 to 1919 etc. Data includes disasters recorded up to September 2023.
CC BY

Deaths from household and outdoor air pollution, World

Total number of deaths from household and outdoor particulate matter air pollution per year. Household pollution-related deaths result from the use of solid fuels (crop wastes, dung, firewood, charcoal and coal) for cooking and heating.



Data source: IHME, Global Burden of Disease (2019)

OurWorldInData.org/air-pollution | CC BY

Deaths caused by air pollution are more than two orders of magnitude larger than those caused by natural disasters

EU Energy Policies

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN COUNCIL
AND THE EUROPEAN PARLIAMENT Brussels, 10.1.2007
AN ENERGY POLICY FOR EUROPE COM(2007) 1 final

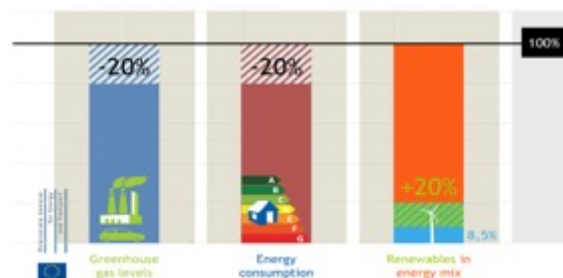
"To these ends, the ministers have agreed on the following objectives:... putting more abundant energy at a cheaper price at the disposal of the European economies...". The Messina declaration, 1955 (ground of EEC)

The Energy Challenges:

- Sustainability
- Security of Supply
- Competitiveness



Targets (or tools):



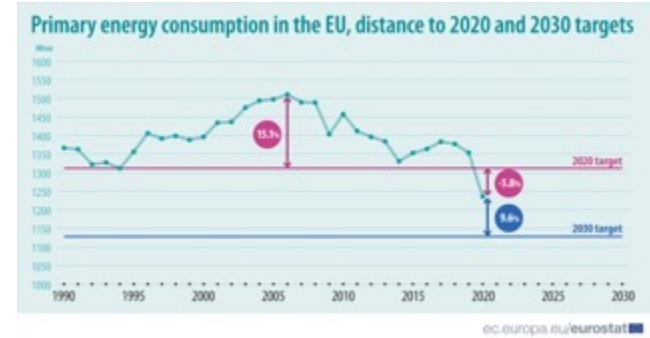
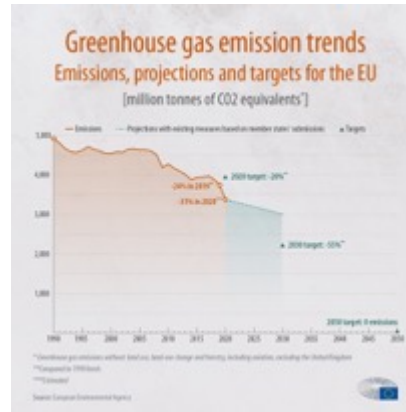
Sustainability: Energy accounts for 80% of all greenhouse gas (GHG) emission in the EU; it is at the root of climate change and most air pollution.

Security of Supply: Europe is becoming increasingly dependent on imported hydrocarbons. With "business as usual" the EU's energy import dependence will jump from 50% of total EU energy consumption today to 65% in 2030. ...This carries political and economic risks. The pressure on global energy resources is intense.

Competitiveness: The EU is becoming increasingly exposed to the effects of price volatility and price rises on international energy markets and the consequences of the progressive concentration of hydrocarbons reserves in few hands.

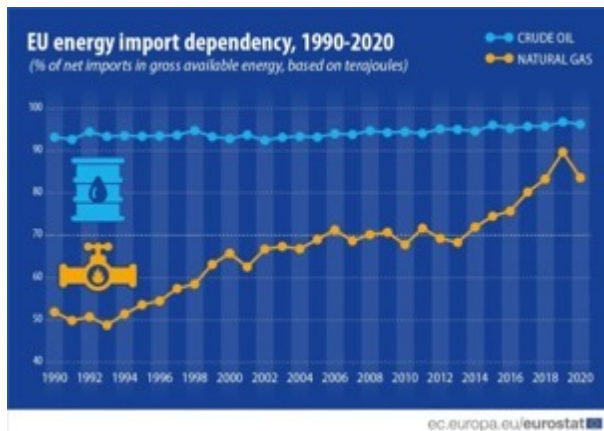
Source: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52007DC0001>

Targets reached...

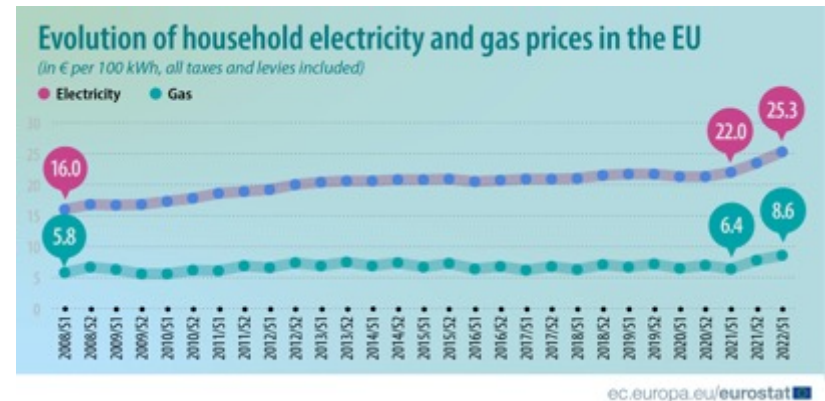


...but what about the challenges?

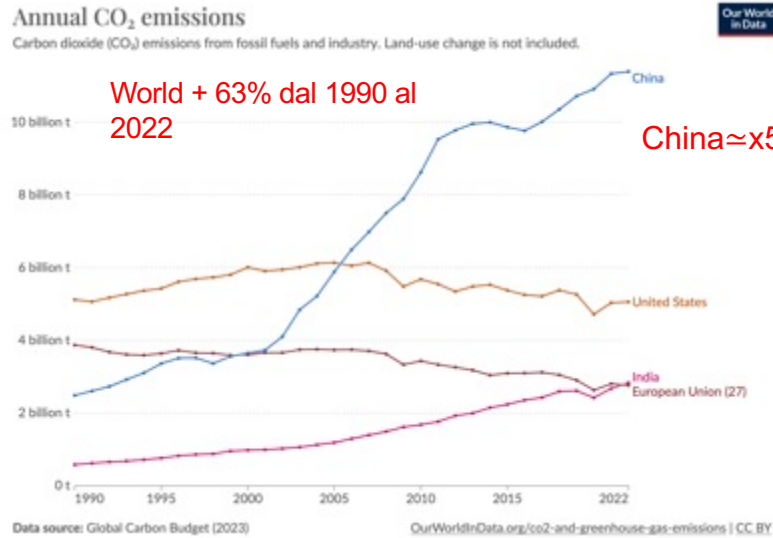
Security of Supply



Competitiveness



Sustainability (decarbonization)?...



1990
in tonnes

- World 22.75 billion t

1990

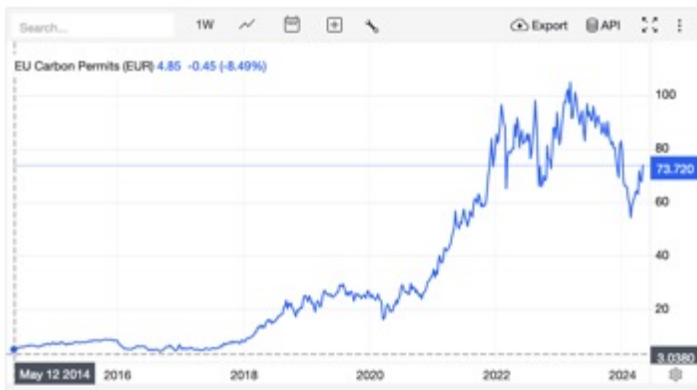
- United States 22.51%
- European Union (27) 17.01%
- China 10.92%
- India 2.54%

2022
in tonnes

- World 37.15 billion t

2022

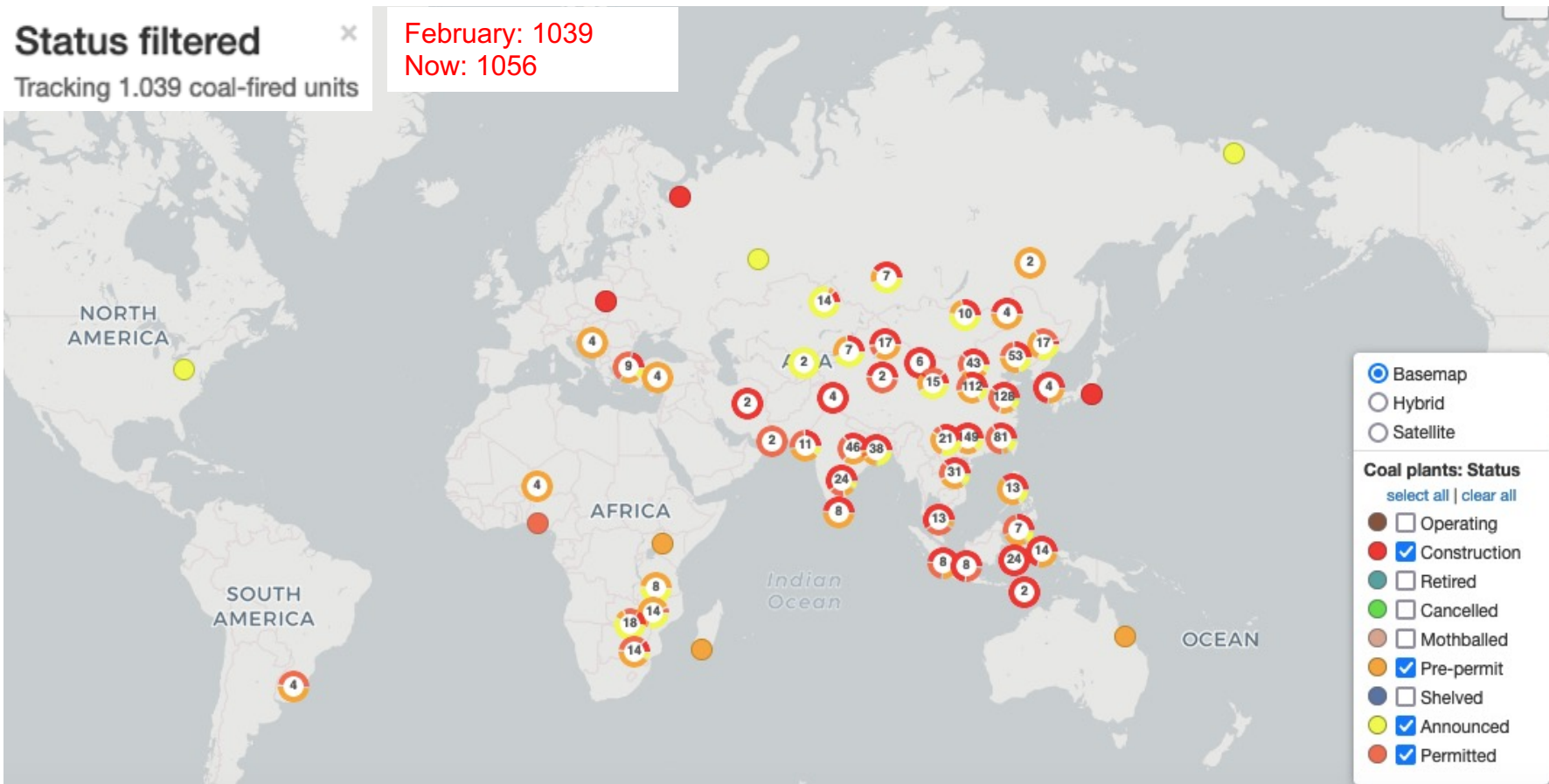
- China 30.68%
- United States 13.61%
- India 7.62%
- European Union (27) 7.43%



Relocation of energy-intensive industries
(Security of Supply? Competitiveness?)

<https://tradingeconomics.com/commodity/carbon>

Planned coal plants



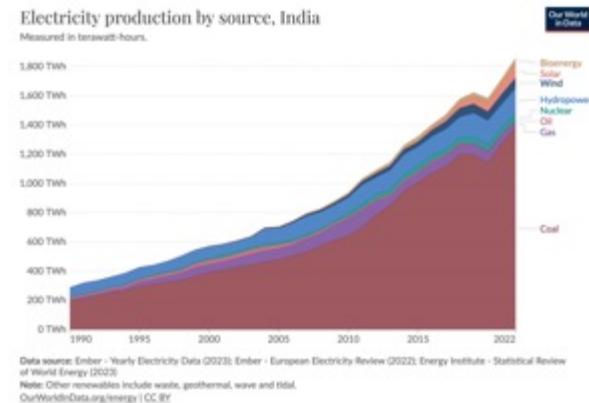
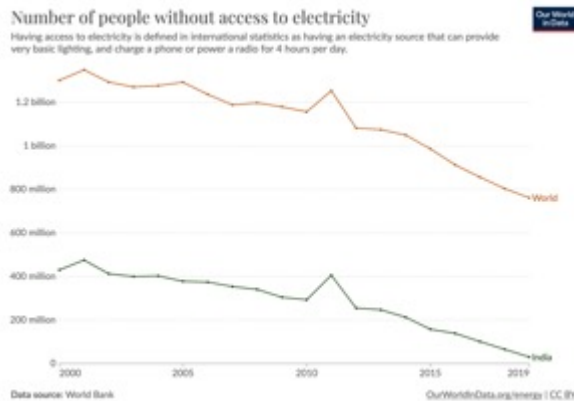
<https://globalenergymonitor.org/projects/global-coal-plant-tracker/tracker/>

Future of global emissions?

What is China doing?

China must achieve carbon neutrality in a progressive and orderly manner, **without ever forgetting energy security**. Achieving climate goals must be based on our availability of energy and resources. **We must decarbonize "by following the principle of creating the new before destroying the old"**. Therefore, China will also have to **focus on clean and efficient use of coal**. Xi Jinping at the twentieth congress of the CPC, Oct. 2022

What is India doing?



What is EU doing?

EU 2030 emission reduction target is -55% and the 2040 goal is -90%

What EU energy strategy?

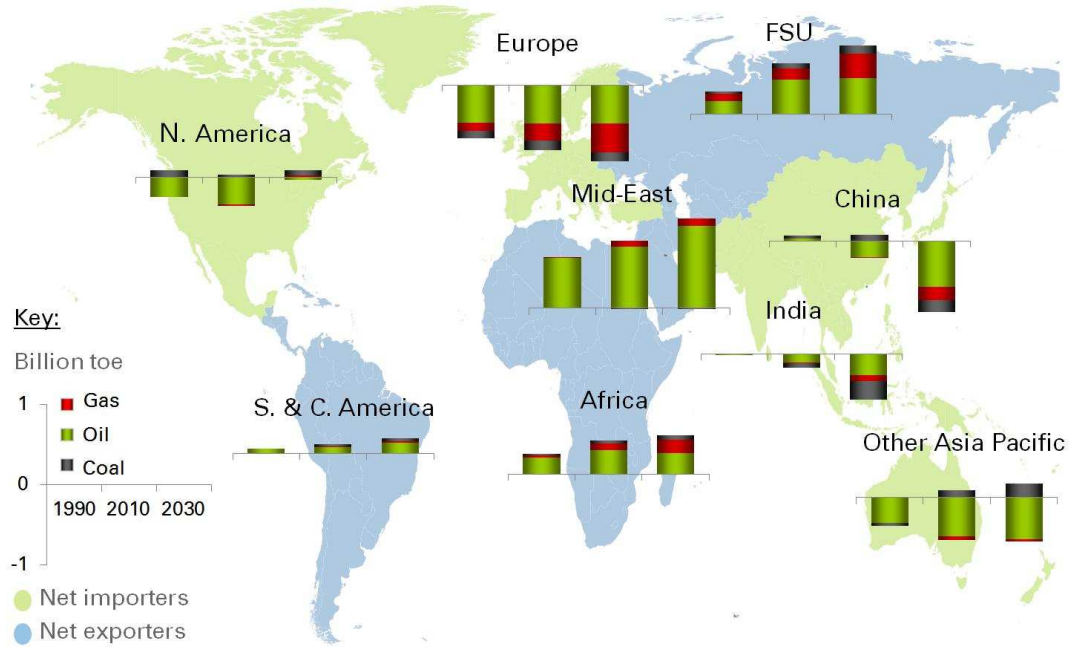
The Energy Challenges:

- Sustainability
- Security of Supply
- Competitiveness

Trade Balances May See Significant Change Due to Resources and Demand Growth
– Creating A New Energy Security Paradigm?



<https://www.imf.org/external/datamapper/datasets/WEO>



Energy Outlook 2030

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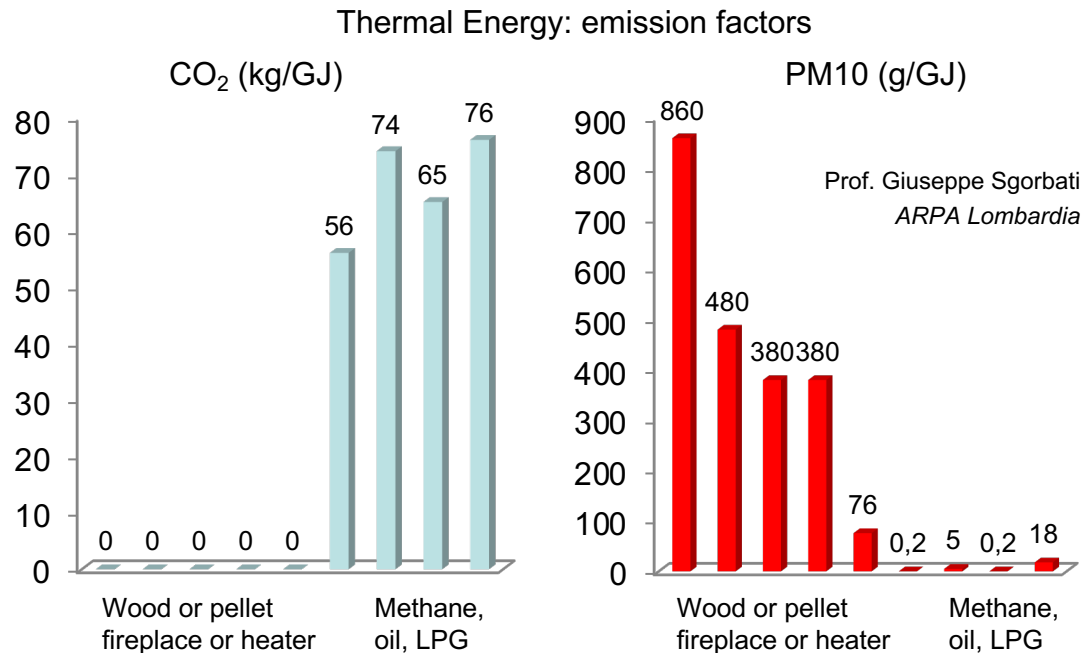
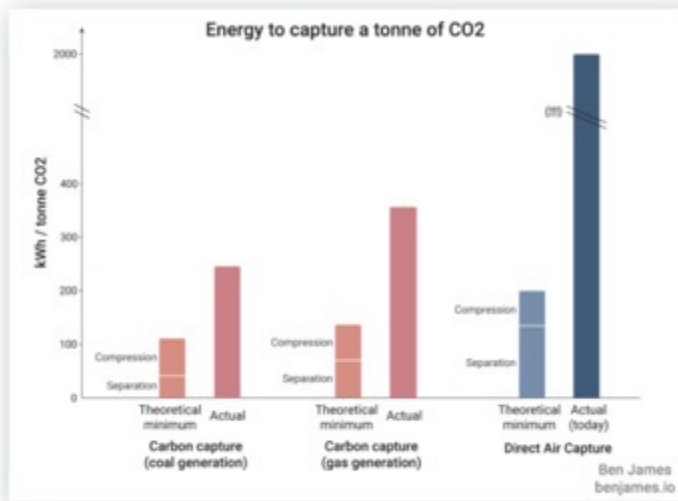
© BP 2012

EU has valid reasons to develop RES and increase energy efficiency, but putting decarbonisation as an urgent priority when the rest of the world follows other paths risks to cost a lot and to be useless for the environment

Decarbonization may be harmful (to the other challenges)

CCS: lower efficiency and higher EE costs
Security of Supply? Competitiveness?

Pollution Vs Decarbonization
Sustainability?



Grid stability: with an increasing VRES penetration, grid stability would be much better guaranteed by a few small gas-fired power plants rather than by huge and expensive battery parks.
The -90% emission reduction target may prevent a deeper VRES penetration.

Proposal for an EPS-Energy Group Position Paper

There is no need for a global and urgent ecological transition; EU needs an energy transition. A pragmatic approach to energy policy drops the timelines and emissions targets, in favor of accelerating energy innovation. The goal is abundant, secure, reliable, cheap & clean energy: resources should be evaluated for abundance, reliability, lifecycle costs and environmental impacts.

- **Define a single target for “sustainable” energy sources** (cost competitive, with no/limited environment-human impact and a long time span)
- **Efficiency not as a target but used according to cost/benefit evaluations** (heating house by solar or heat pumps Vs thermal insulation)
- **Dismiss the emission reduction target** (that may even be harmful to the sustainable energy sources target. Ironically, attempts to reduce emissions are exacerbating energy poverty and unreliability, which increases emergency risk.)

Without focusing on CO₂ emissions, odds are that this strategy will lead to cleaner energy by the end of the 21st century than by urgently attempting to replace fossil fuels.

Thank you for your attention



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