EC commitment towards CO2 reduction

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European Commission
DG Research and Innovation

3rd EU Conference on Supercritical CO2 (sCO2) Power Systems

18-19 September 2019, Paris (France)

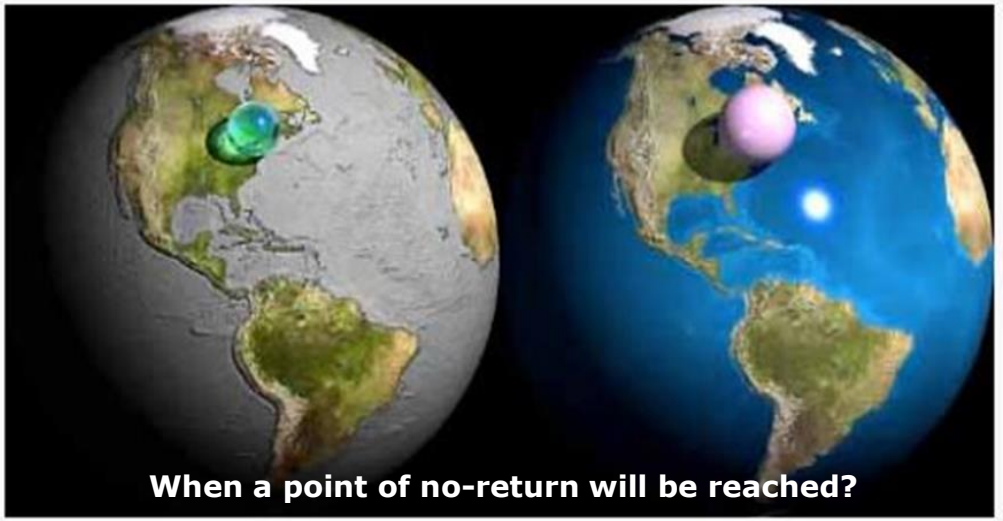
Future generations will suffer because of our mistakes/ delays in facing climate changes' consequences

A pilot struggles to combat the deadly fires in Portugal this summer. Major wildfires are expected to increase in Europe

The JRC study shows that, unless global warming is curbed as a matter of urgency and appropriate adaptation measures are taken, **about 350 million Europeans could be exposed to harmful climate extremes on an annual basis by the end of this century with a 50-times increase in fatalities compared with 2018 data**

Two-thirds of Europeans affected by extreme weather by 2100
New JRC study raises the alarm

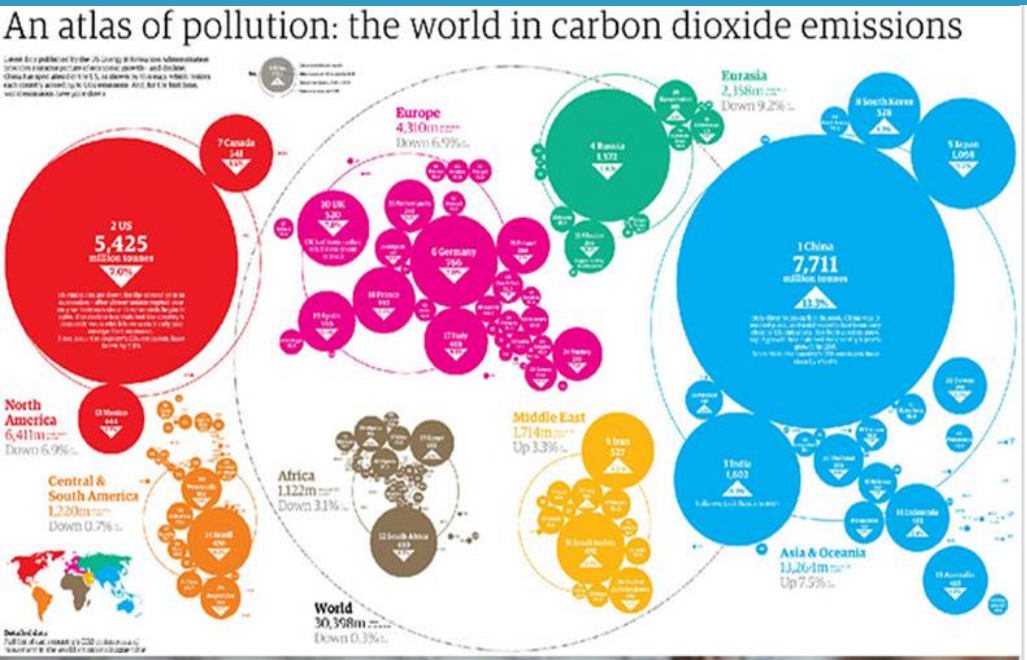
Cliff edge effect: climate changes are not expected to have a "linear trend"



When a point of no-return will be reached?

This image shows the volume of all the world's water if put in the form of a sphere (green) and the volume of the atmosphere (pink) if the air were all at sea-level pressure. *(Credit: Adam Nieman, Science Photo Library)*

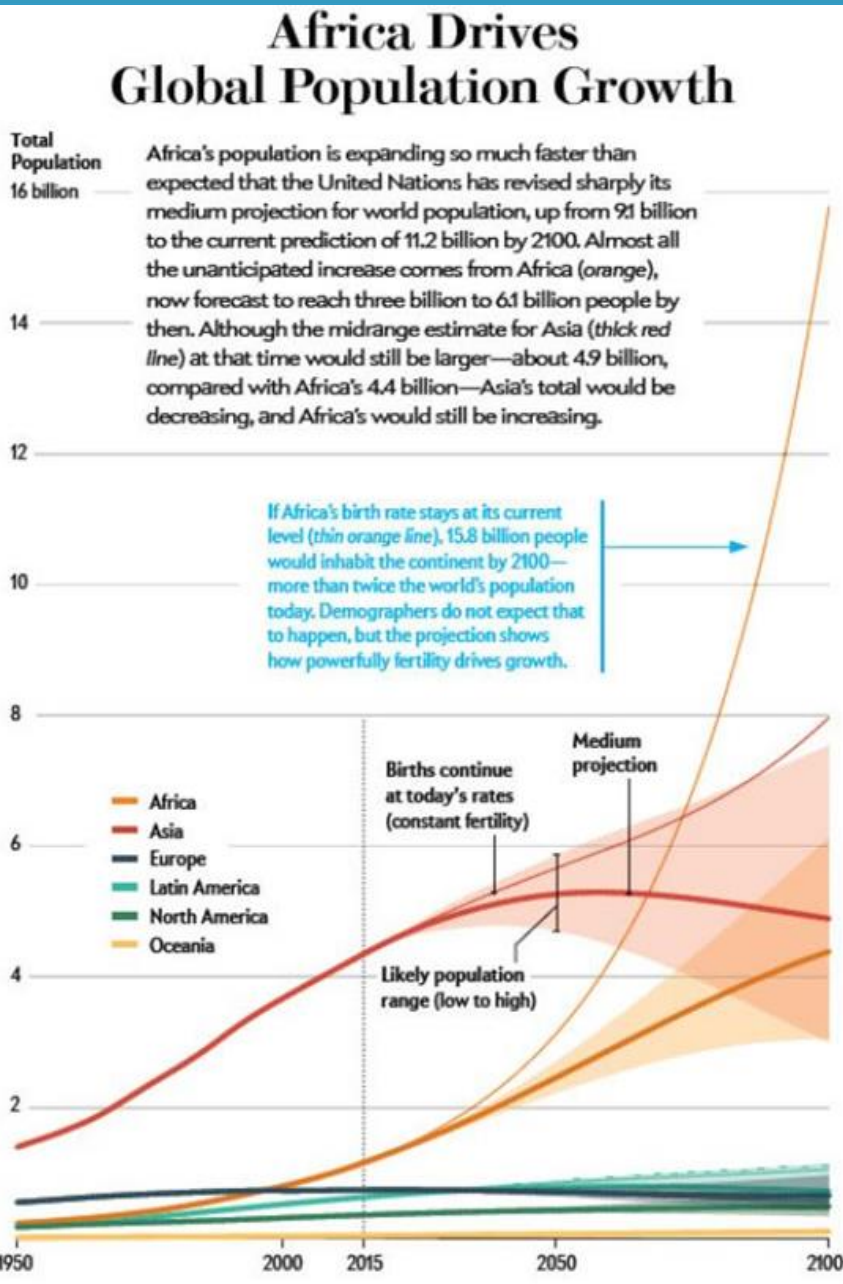
World population, energy demand and environmental impact



- by 2030 Nigeria will have the same population of Europe
- by 2050 world population will almost double
- by 2100 Africa's population will equal the one of the rest of the world

CREDIT: JONATHAN TORGOVNIK *Getty Images*

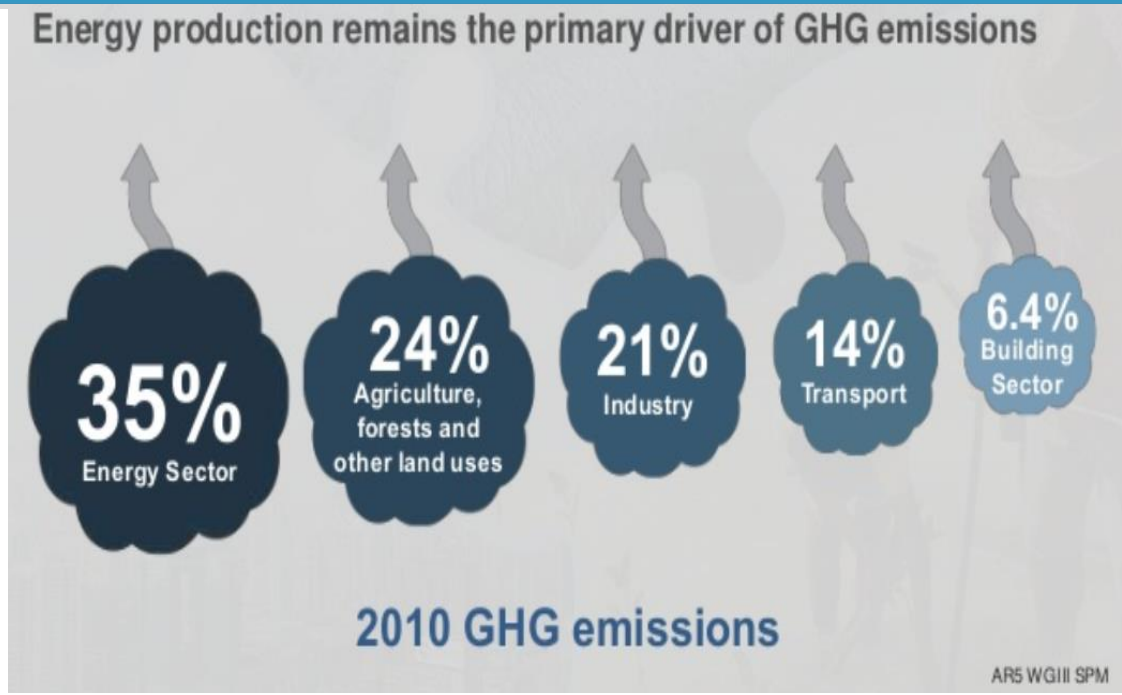
Counselor from Marie Stopes International educates women gathered at a hospital in Rabai, Kenya, about family-planning options, including emergency contraception.



Energy (not GDP) is synonym of progress… but today's energy is still synonym of CO2 emissions

In the last 20 years, maximum temperatures have steadily increased in line with CO2 releases

Globally in 2018, humans produced over 42 billion tons of CO2 (https://www.atag.org/facts-figures.html)



Energy & industry

- 25 billion tons of CO2 are released each year (about 75 % of today's electricity is generated by burning fossil fuels: coal, oil and gas) from power plants and industry

Transport

- Road transport: in the EU, 852.3 million tons of CO2 were emitted in 2015, constituting more than 70 % of emissions from all modes of transport (EU vehicles cover the distance Earth-Sun 22.000 times/year)
https://egvi.eu/who-we-are/the-european-green-vehicles-initiative-egvi-cppp/
- Planes: Worldwide, commercial flights produced 895 million tonnes of CO2 in 2018 (115000 flights per day) constituting about 12% of emissions from all modes of transport

CO2 emissions and climate change – a global challenge

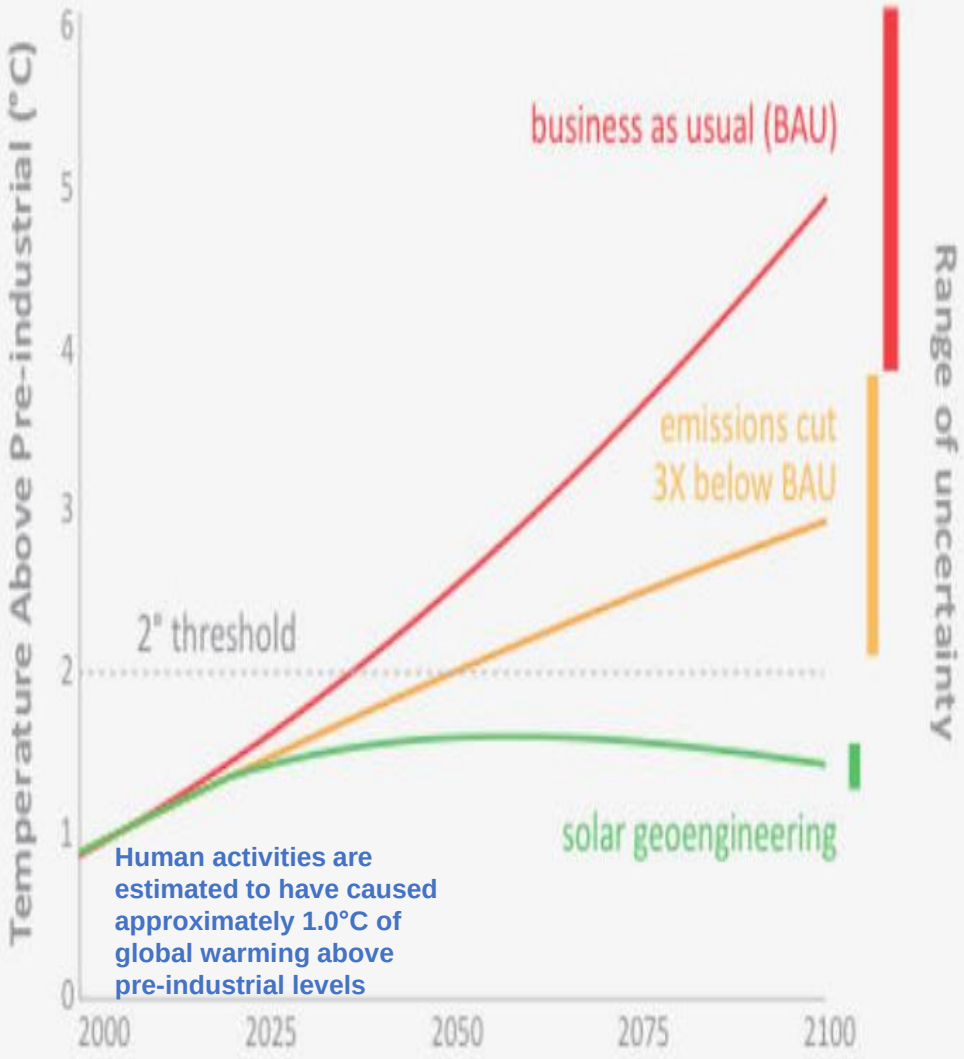
A resilient **Energy Union** with a forward-looking climate change policy

To stop global warming, EU leaders decided in 2014 to:

- reduce greenhouse gas emissions by 40 % by 2030, compared to 1990
- raise the share of renewable energy to 27 % by 2030
- increase energy efficiency by 27 % by 2030

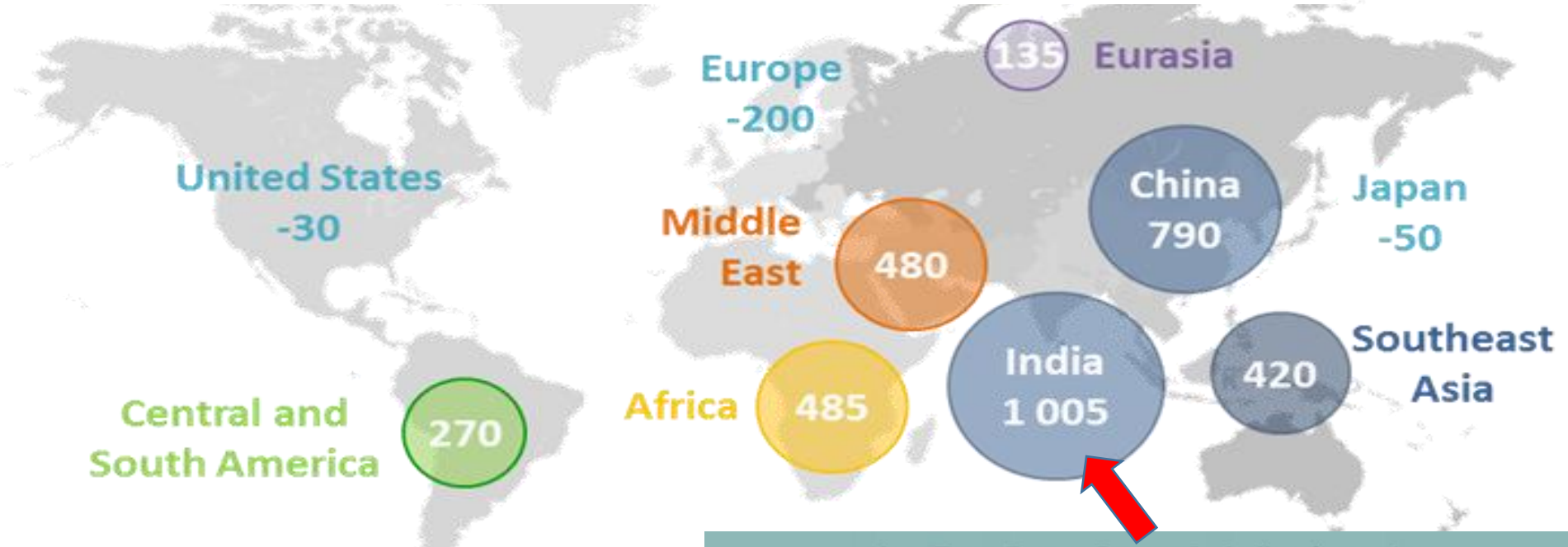
Reminder: the European Commission does not promote the use of specific energy sources (matter of Member States' initiative)

Climate change is a global threat: Europe alone cannot stop it



Trends of energy consumptions (2016-2040)

Changes in energy demand, 2016-40 (Mtoe)

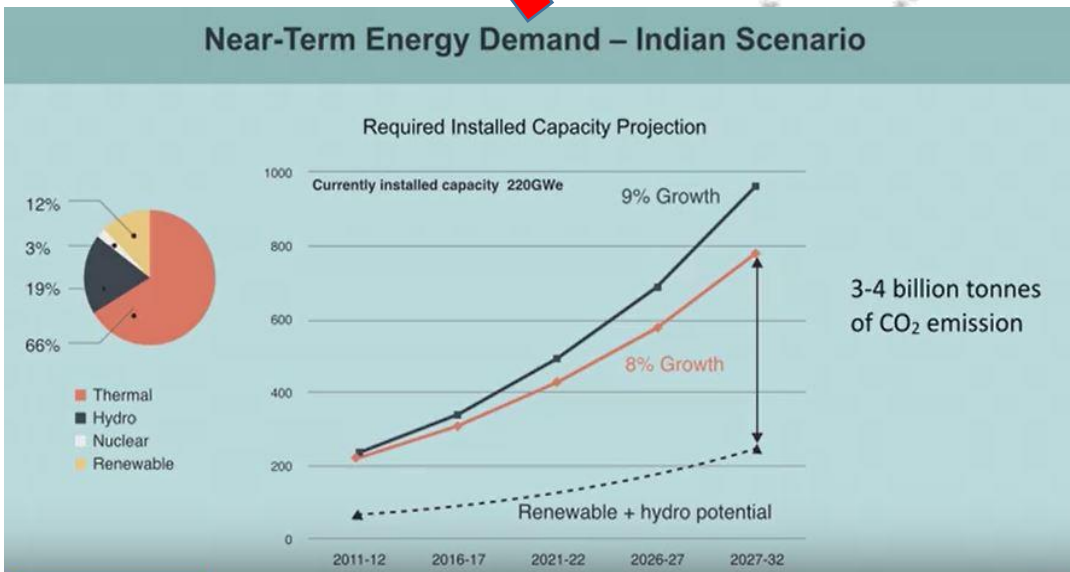


China:

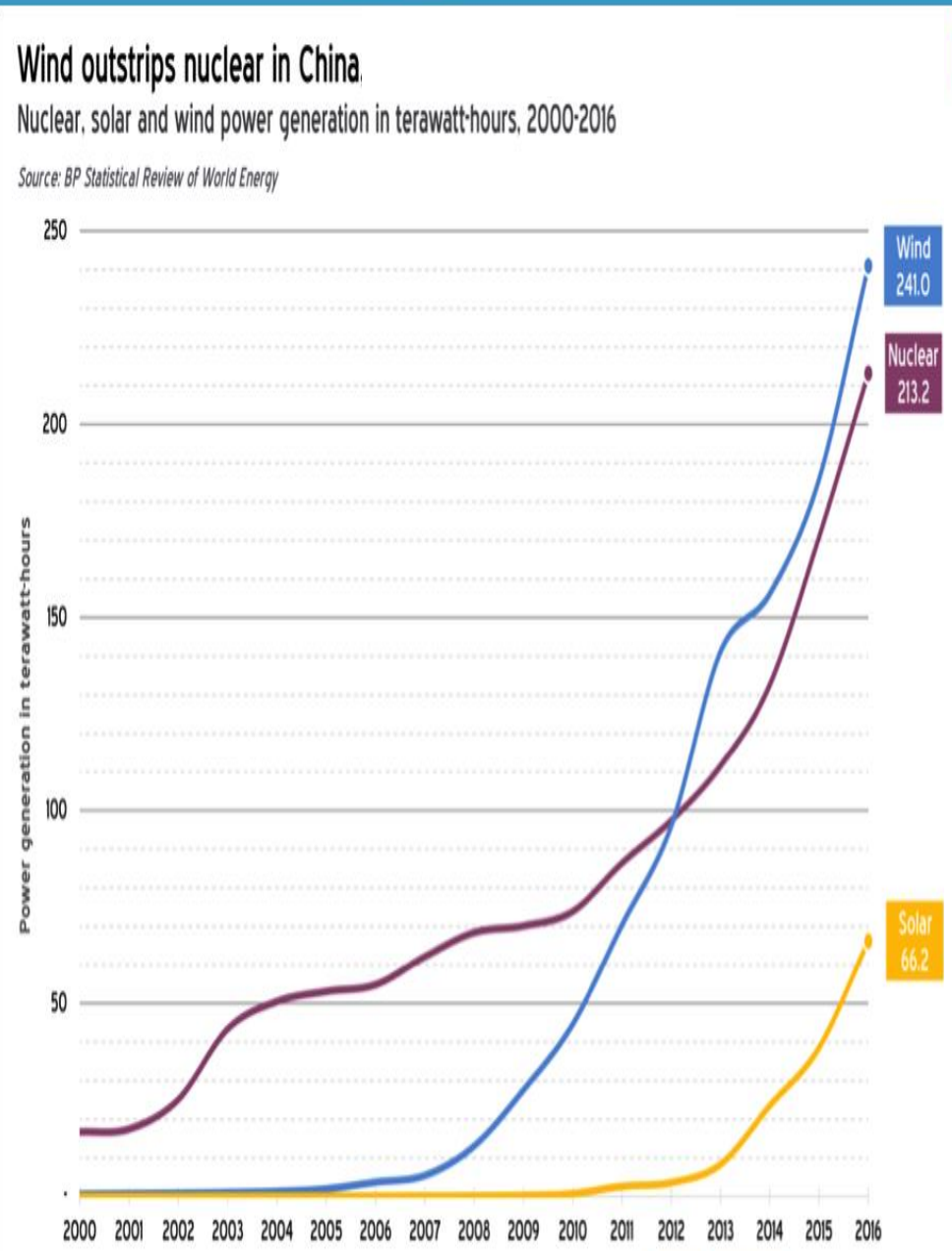
-Fossil-fueled electricity in 2015 (predominantly from coal): 73%

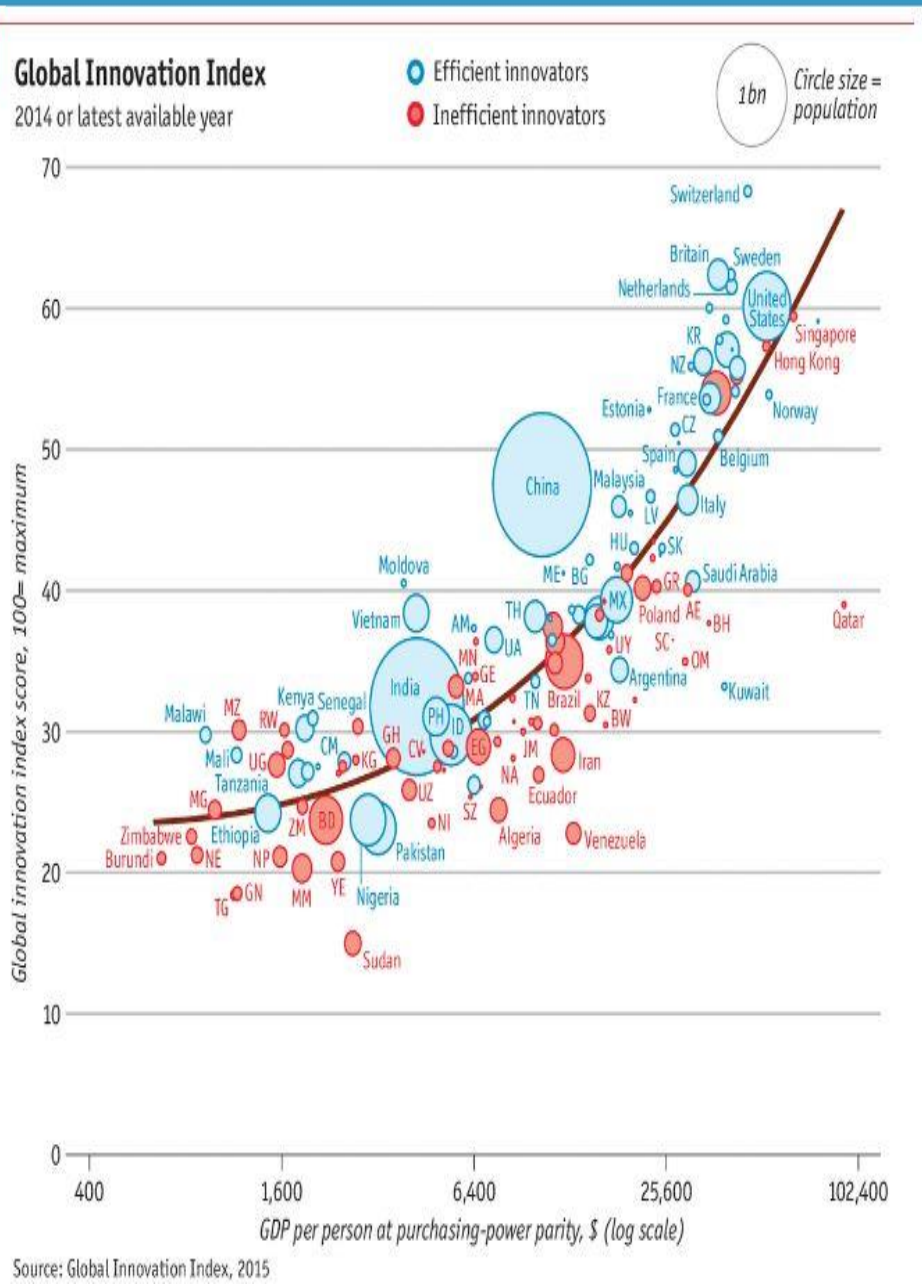
-Low-carbon sources (including nuclear) meet 45% of increase in global demand (wind 9.1% installed capacity delivered 4% in 2016)

-Nuclear capacity will double in a decade (10% in 2030)

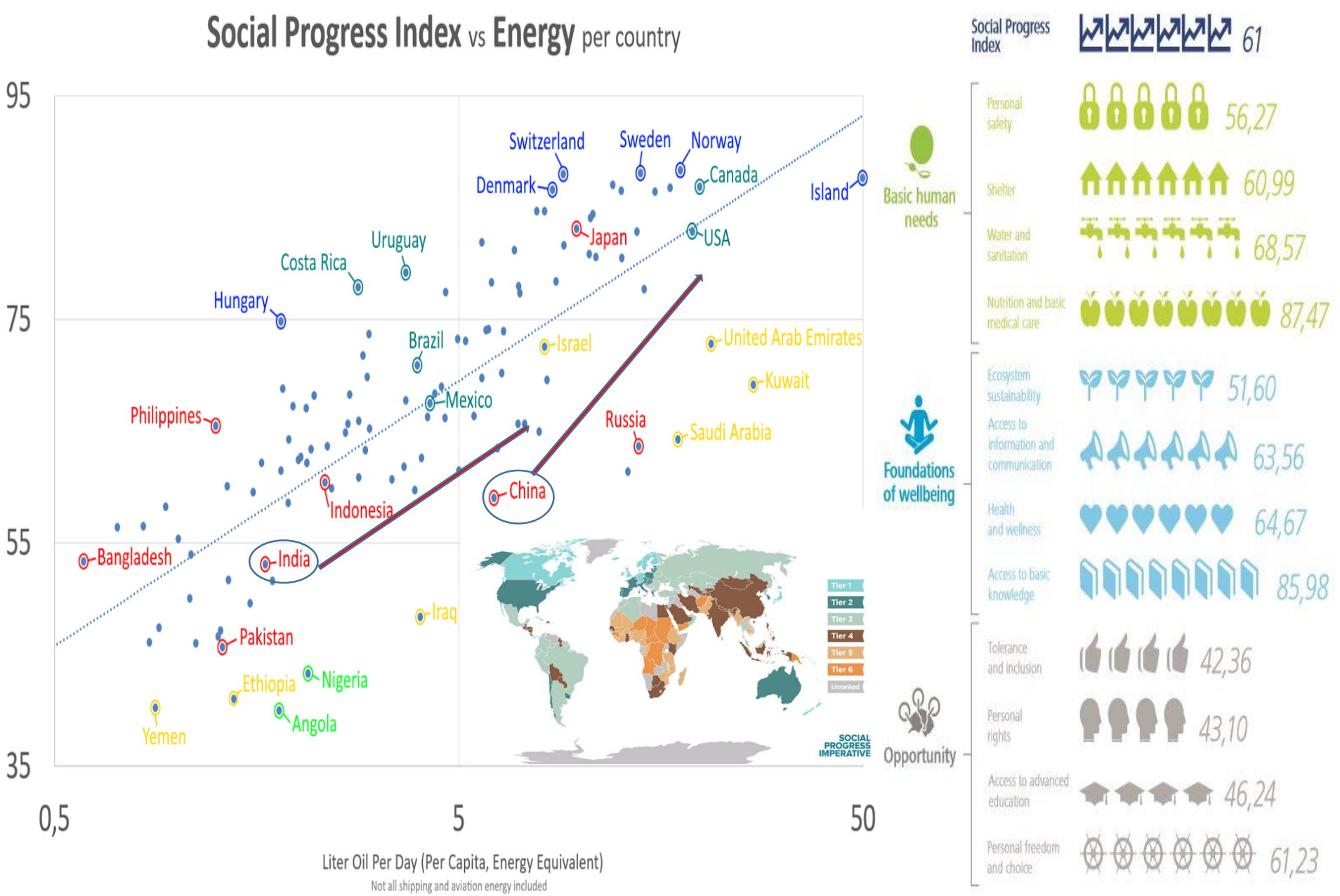


"Clean energies" in China and energy systems' performance (capacity factors)



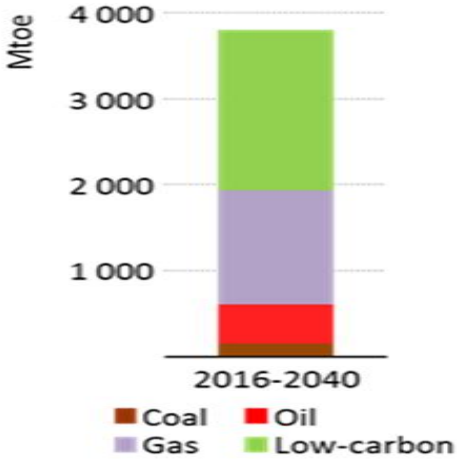


Energy is an indicator of wealth: the SPI (Social Progress Index)



Reducing worldwide climate risks? A long way to go

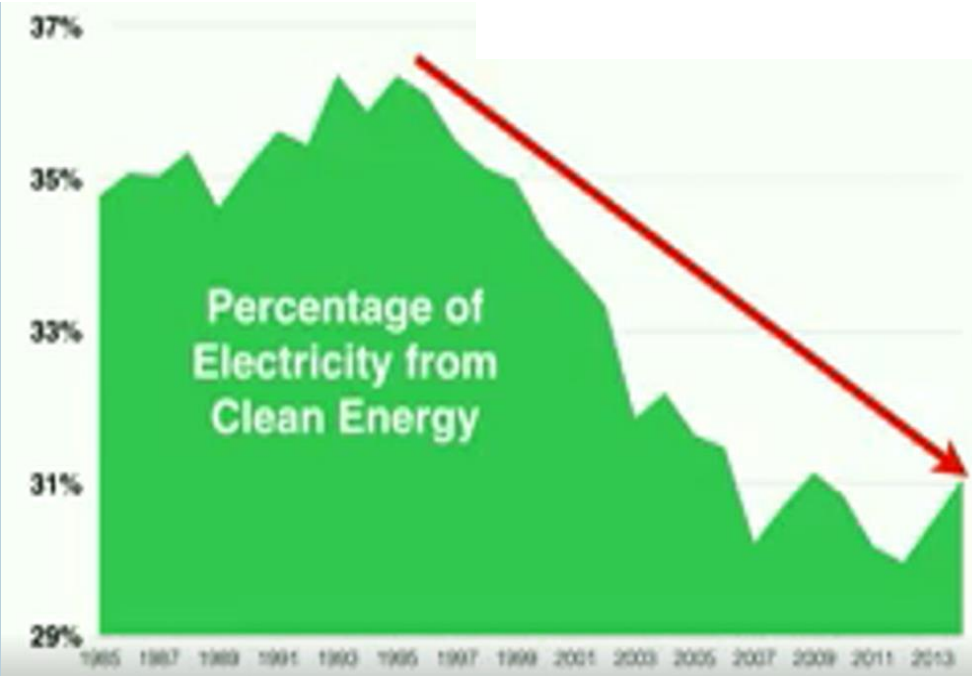
Forecasted changes in worldwide energy demand 2016-40

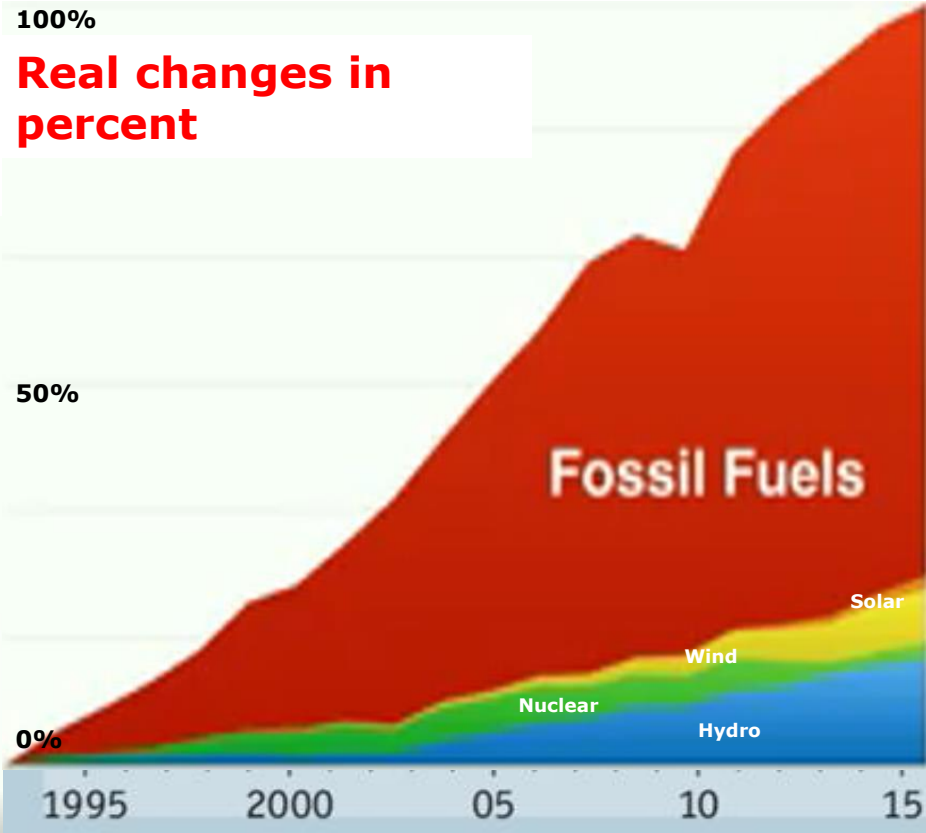


From 2000 to 2017, the world consumption of coal (in Mtoe/year) increased 14 times more than the increase of solar, and 6 times more than the increase of wind

https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review/bp-stats-review-2018-full-report.pdf

In the last 10 years the nuclear share has decreased by 7 % (solar and wind has increased by 3.8 %) worldwide





Today's negative effects of renewables on electricity costs and CO2 emissions

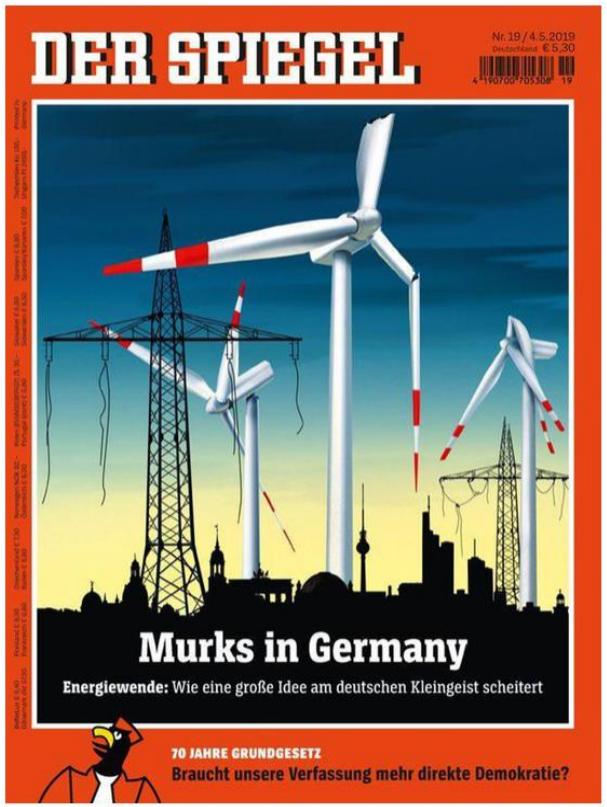
- Financial effect (California ISO): Every year more Californian consumers have solar cells. As a result, every year electricity demand during the day falls, and revenue falls accordingly

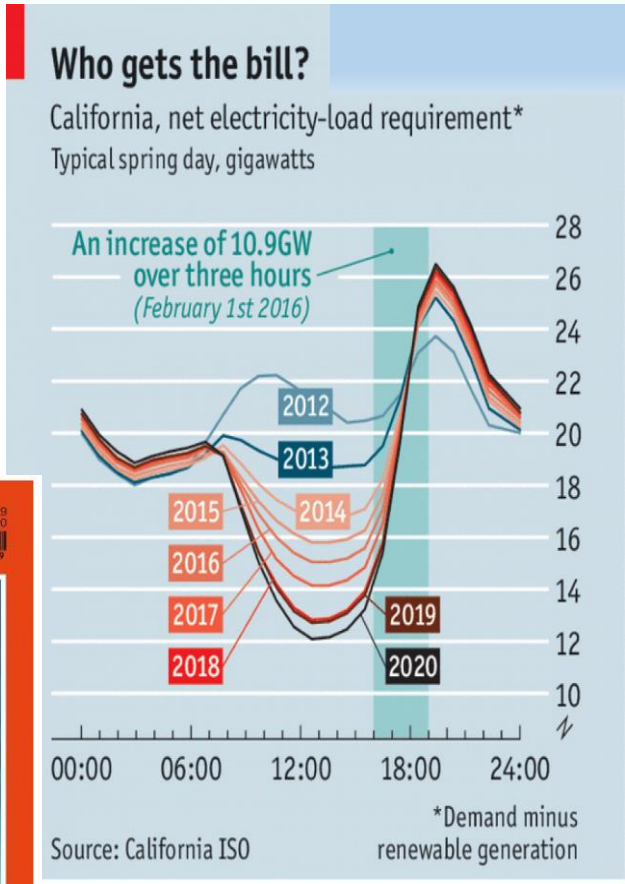
Similar effects are seen in Germany, where there are now 1.4 million PV users—mostly domestic. It is one of the reasons—subsidies are another—why domestic electricity prices have stayed high while wholesale prices have fallen (reducing incentives to further investments)

When fewer people rely on the grid, there are also fewer left to share the costs

Experts forecast many more cuts from the grid: the more customers generate their own electricity, the more utilities have to raise prices to the customers that remain, which makes them more likely to leave the grid in turn

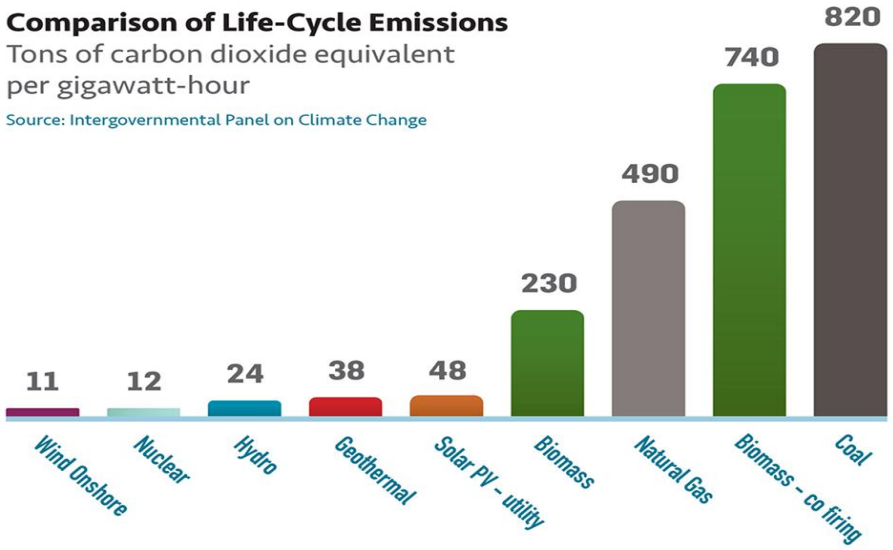
- Intermittency effect: solar and wind require almost an equivalent installed capacity from different energy systems (therefore solar and wind would paradoxically maintain CO2 emissions in countries with no nuclear in the energy mix)

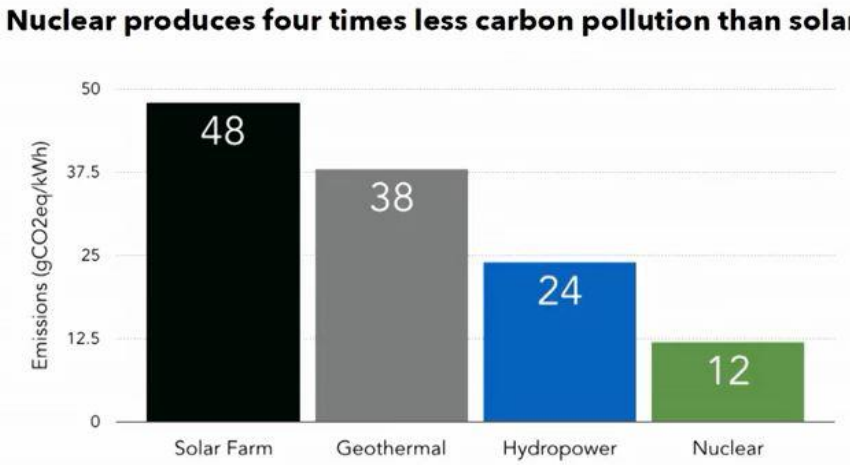




The duck: the icon describing the effect that domestic renewables have on the demand for grid electricity, and thus on the revenues of utilities

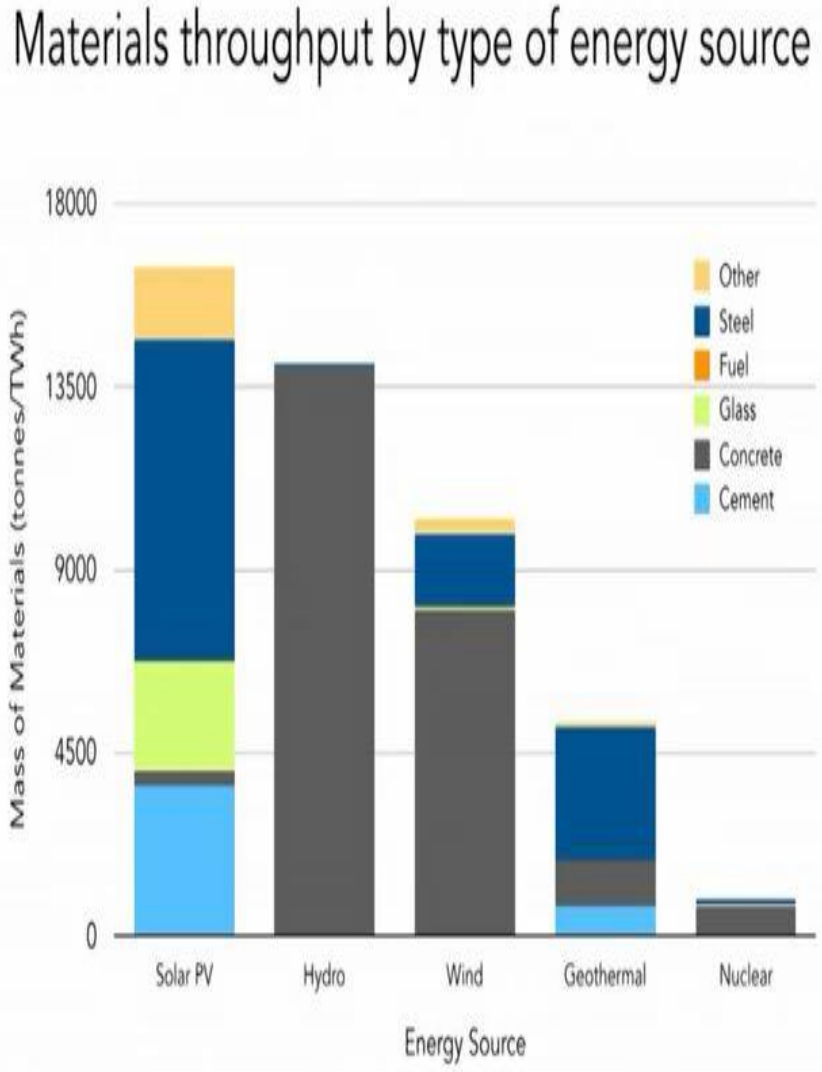
A comparison of CO2 emissions and waste/hazardous materials generated by type of energy source





Source: Intergovernmental Panel on Climate Change (IPCC) 2014

Annex III Table A III.2 :: Schlömer S., T. Bruckner, L. Fulton, E. Hertwich, A. McKinnon, D. Perczyk, J. Roy, R. Schaeffer, R. Sims, P. Smith, and R. Wiser, 2014. "Annex III: Technology-specific cost and performance parameters." In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

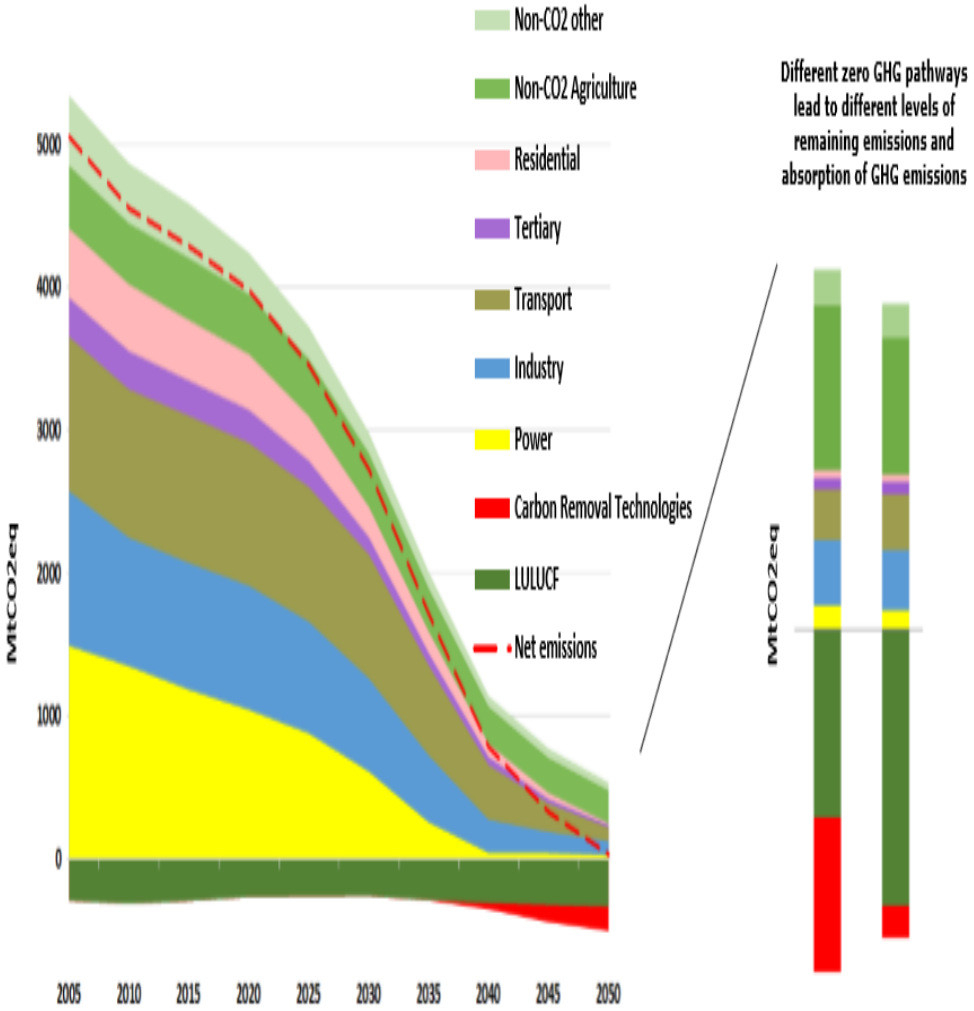


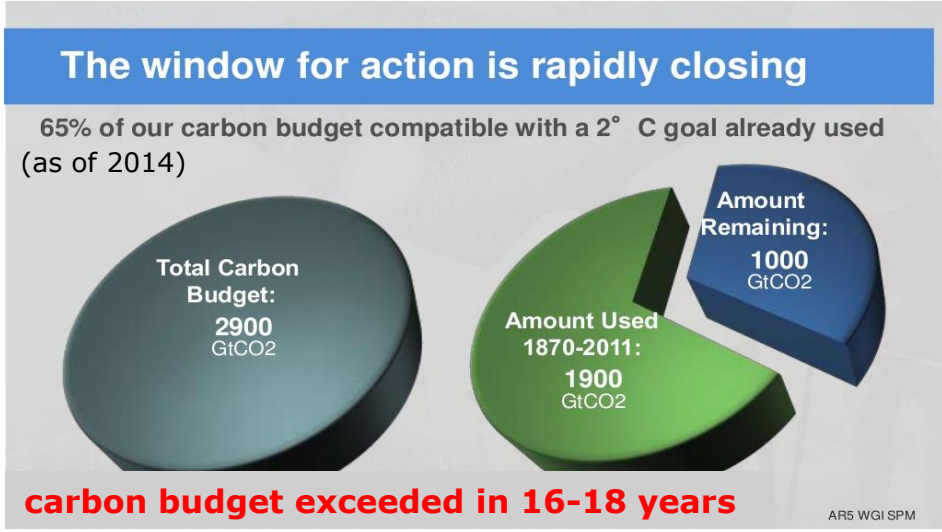
Sources: DOE Quadrennial Technology Review, Table 10.

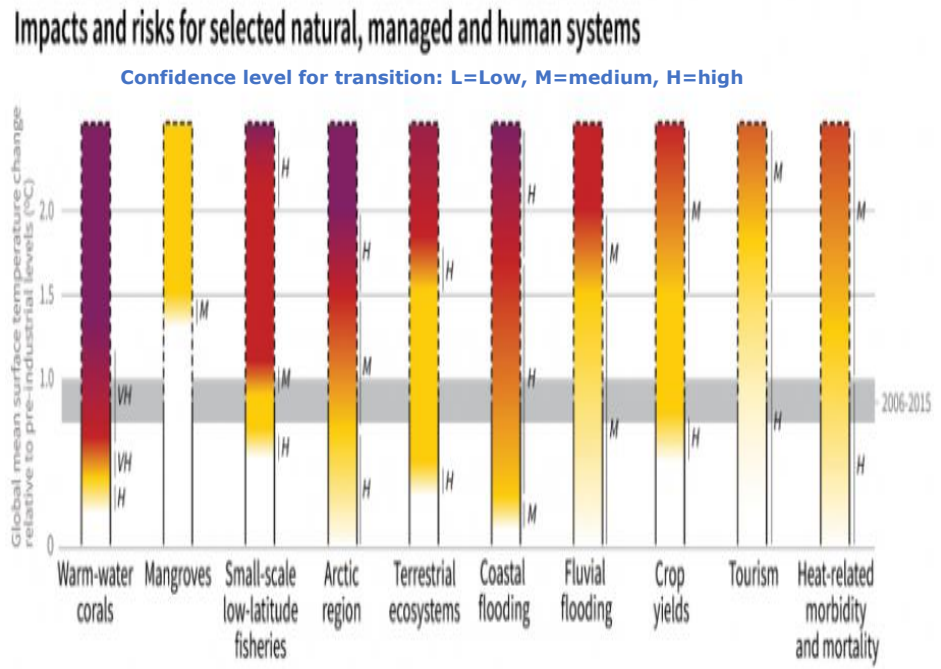
Murray, R.L. and Holbert, K.E. 2015. Nuclear energy: an introduction to the concepts, systems, and applications of nuclear processes (7th ed.). Elsevier.

IPCC's eight scenarios towards a climate neutral net Zero GHG emissions https://www.ipcc.ch/sr15/chapter/spm/

IPCC at COP21: "on the basis of a continuation of current technological and societal development, compliance with climate objectives will require a six-fold increase in global nuclear capabilities by 2050"





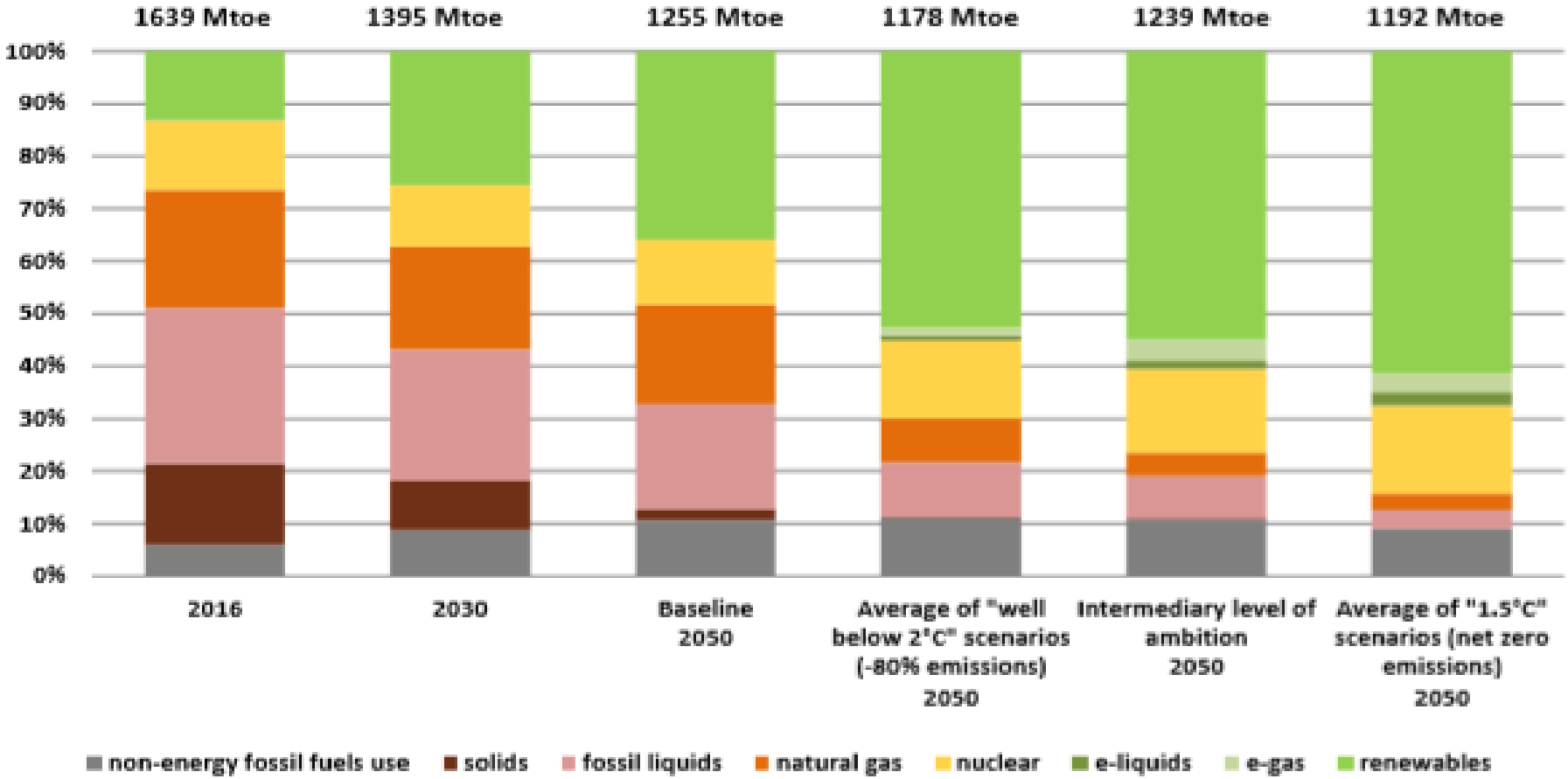


NB: bars represent the emissions and absorptions in 2050 of the 7th and 8th scenarios (which include all low-carbon energy systems as well as CCU, CCS, highly-circular economy and improved land use sink): https://ec.europa.eu/transparency/regdoc/rep/1/2018/EN/COM-2018-773-F1-EN-MAIN-PART-1.PDF

A clean planet for all:
EC Communication COM(2018) 773 final

By 2050 more than 80% of EU electricity will be coming from renewable energy sources together with a nuclear power share of 15% (95% carbon-free energies)

Forecasts of EU total energy consumption (with four 2050 scenarios)



https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/2050-long-term-strategy

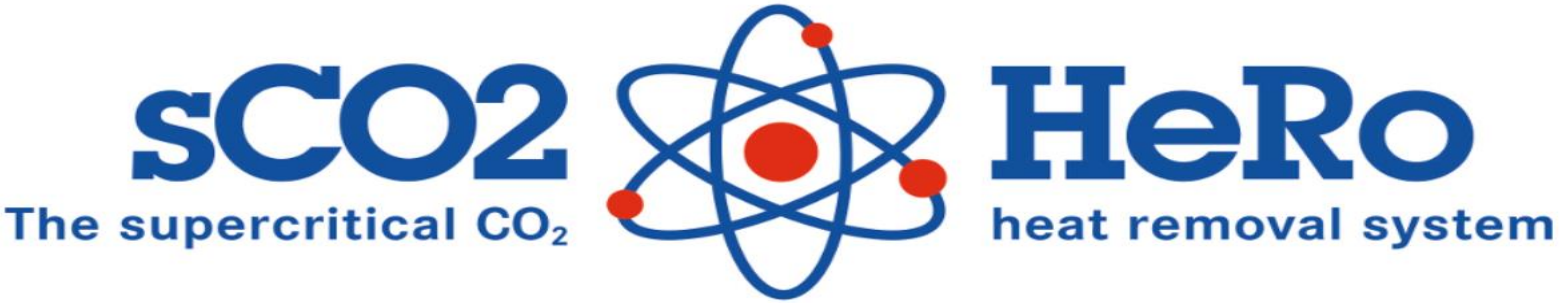
EURATOM project sCO2-4-NPP

EURATOM has the mission to guarantee and improve the safety of nuclear installations which are part of the energy mix of sovereign EU member countries

- EURATOM, through the Work Programs implemented by DG RTD, put in place a "shared" strategy aiming at a viable and safe use of nuclear energy in those EU countries which intend to benefit from this energy source

The sCO2-4-NPP project (building on the good results of previous sCO2-HeRo) aims at reaching a final TRL 5 (up to TRL 7 for specific components), i.e. an industrial application to guarantee no need of emergency evacuation plans around the nuclear plant

(success story: Solving the core cooling problem for safer nuclear energy https://ec.europa.eu/research/infocentre/article_en.cfm?artid=50334)

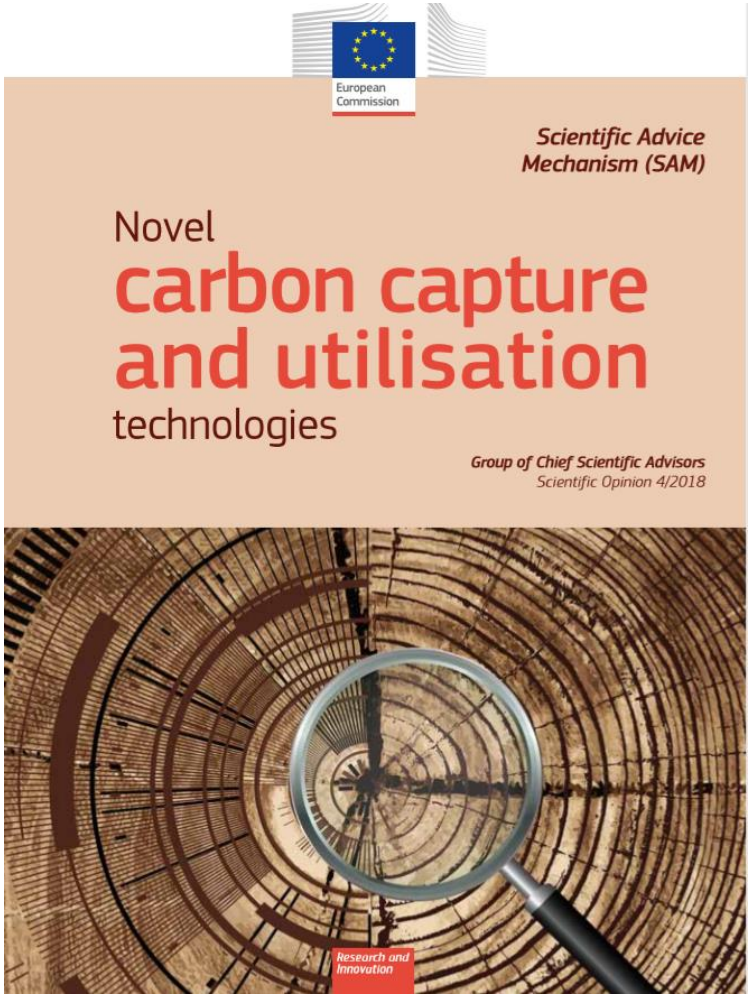


Carbon Capture Utilisation (CCU) and Storage (CCS): the opinion of the SAM (EC Scientific Advisory chanism)

Scientific advice based on existing research on the climate mitigation potential of CCU/CCS technologies to inform future policy decisions:
https://ec.europa.eu/research/sam/index.cfm?pg=hlg

1) Under what circumstances CCU for production of fuels, chemicals and materials can deliver climate benefits and what are their total climate mitigation potential in the mid- and long-run?

2) How can the climate mitigation potential of CO_2 incorporated in products such as fuels, chemicals and materials be accounted for considering that the CO_2 will remain bound for different periods of time and then may be released in the atmosphere?



Studies on the feasibility of CCU technologies

- Study by DG Research and Innovation: "Pathways to sustainable industries" -Energy Efficiency and CO_2 utilisation https://ec.europa.eu/info/research-and-innovation/strategy/policy-support/p4p_en#p4p_sustainable

- Work carried out by Prof. A. Bardow and Mr. D. Green: Low-carbon process industries through energy efficiency and carbon dioxide utilisation

- The study focussed on a total sample of 546 projects and assessed 61 projects related to CO_2 utilisation (from FP7 and mainly Horizon 2020 for a total EU contribution in excess to 240 Million Euro)
- Relatively lower TRLs for CCU in comparison to EE (average TRL 3.8 while for EE was 5.3)

MSs-driven initiatives on CCU: Phoenix

The **Phoenix** initiative was launched on the 22nd of Feb 2018 at the European Industry Days 2018 in Brussels:
http://www.phoenix-co2-valorisation.eu/

Wide agreement across MSs on the benefits that could arise from a major integrated European initiative on CO_2 utilisation

Discussions led to a core group of MSs (France, Germany, the Netherlands) working towards building such an initiative and complementing the EU R&I efforts in the field (with a strong public and private commitment)

Horizon 2020: Prize for CO2 Reuse

- To accelerate innovation in CO_2 utilisation technologies
- To contribute to climate mitigation
- To increase transparency about technology readiness, barriers, costs, environmental performance and innovation needs

  - Prize: 1.500.000 euro
  - Deadline submission of applications: 2Q 2019
  - Award of the prize: 4Q 2019
  - Horizon Prizes: https://ec.europa.eu/research/horizonprize/
  - DG Climate Action: http://ec.europa.eu/clima/

Carbon capture and geological storage (CCS)

CCS is a technique for trapping CO2 emitted from sources such as power plants

The NER 300 programme: a funding programme for demonstration of CCS and RES (innovative renewable energy technology)
Budgeted with the sale of 300 million "emission allowances" from the New Entrants' Reserve (NER) of the EU emissions trading system

NER 300: -Two calls for proposals in 2012 and 2014 with EUR 2.1 billion granted to 38 RES and 1 CCS projects (projects are under implementation)

The Commission's proposal for a "2030 climate and energy policy framework" acknowledges the role of CCS in reaching the EU's long-term emissions reduction goal

High cost a barrier to uptake
the cost of capture and storage remains an important barrier to the take-up of CCS
The capture component is an expensive part of the process: as flue gas from coal or gas-fired power plants contains relatively low concentrations of CO2 (10-12% for coal and around 3-6% for gas) the amount of energy needed to capture the gas makes the process costly

Duration of CO2 segregation
the 2005 Special Report on CCS by the Intergovernmental Panel on Climate Change (IPCC) concluded that appropriately selected and managed geological reservoirs are 'very likely' to retain over 99% of the sequestered CO2 for longer than 100 years and 'likely' to retain 99% of it for longer than 1000 years

H2020 SPIRE instrument: Sustainable Industry through Resource and Energy Efficiency

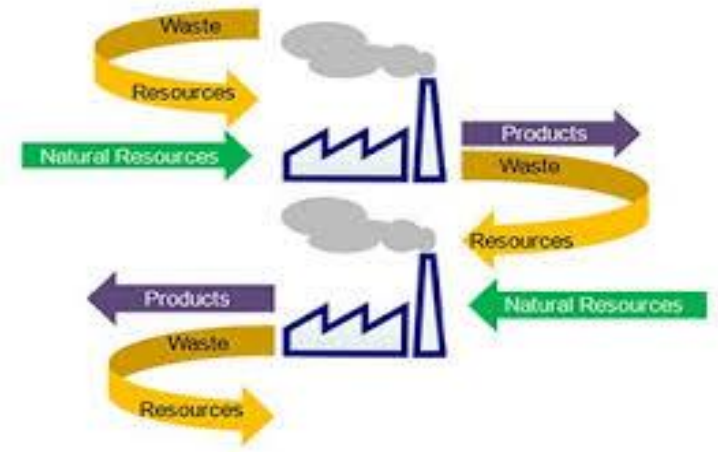
SPIRE is a Public-Private Partnership initiative (900 MEuro for the period 2014-2020)

- Supporting development and demonstration of CCU as well as industrial symbiosis
- Strong drive to move towards a zero waste circular economy in Europe as well as to move to climate neutrality by 2050 in line with Paris agreement COP 21
- Enhance competitiveness of industry and resilience of European economy by decreasing reliance on imports of fossil fuels

https://www.spire2030.eu/projects/our-spire-projects

SPIRE CO_2 related Projects

- MefCO2: Methanol production from CO_2 waste streams
- FreSME: Similar to MefCO2 but using steel off gases
- RECODE: CO_2 for produce cement and cement additives
- Carbon4PUR: Polyuretanes production from waste CO_2
- ICO2CHEM: Hydrocarbons (waxes) production from waste CO_2
- OCEAN: Electrochemical conversion of CO_2 to oxalixc acid
- CO2EXIDE: Electrochemical production of Ethilene Oxide from C
- CarbonNext: CSA study on viable alternative industrial carbon feedstocks including CO_2



Biotech CO_2 Projects

- ENGICOIN: CO_2 exploitation in waste treatment
- BIOCONCO2: CO_2 from steel, to chemicals and plastics
- BioRECO2VER: CO_2 to chemicals

Cross-Cutting Call: Competitive, Low Carbon and Circular Industries (205.5 M€)

Nanotechnologies, Advanced Materials, Biotechnology, and Advanced Manufacturing and Processing (NMBP)	**Budgets**
1. NMBP - ERA-NET on materials, supporting the circular economy and sustainable-development-goals 2. NMBP - Materials life cycle sustainability analysis (RIA) 3. SPIRE - Tapping into the potential of Industrial Symbiosis (IA) 4. SPIRE - Near zero discharge for fresh water used by industry (IA) 5. SPIRE - Mineral waste, by-products and recycled material as feed for high volume production (IA)	**118.5 M€**
6. Develop, implement and assess a circular economy oriented product information management system for complex products from cradle to cradle (IA) 7. Raw materials innovation for the circular economy (IA): processing and refining of primary and/or secondary raw materials; recycling of raw materials from end-of-life products & buildings; advanced sorting systems for high-performance recycling of complex end-of-life products, sustainable metallurgical processes 8. Raw materials policy support actions for the circular economy: Expert network on Critical Raw Materials (CSA)	**58 M€**
9. Low carbon industrial production using CCUS (IA) 10. Industrial (Waste) Heat-to-Power conversion (IA)	**29 M€**

Cross-Cutting Call tentative deadlines: Competitive, Low Carbon and Circular Industries (205.5 M€)

Portfolio rationale -design and demonstration of:

- profitable and sustainable (circular) value chains of materials, products and services
- novel sourcing and value-added destinations for non-product outputs between industrial facilities (industrial symbiosis)

Portfolio approach -clustering activities for:

- continuous dialogue and exchange of good practices between all actors involved
- transfer of knowledge to identify technological and non-technological barriers
- coordinated deliverables and joint dissemination or exploitation activities

Topics (Type of Action)	Budgets (EUR million)	Deadlines
	2020	
Opening: 27 Jun 2019		
CE-NMBP-41-2020 (ERA-NET-Cofund)	15.00	13 Feb 2020
CE-NMBP-42-2020 (RIA)	6.00	
CE-SC5-08-2020 (CSA)	3.00	
CE-SPIRE-01-2020 (IA) CE-SPIRE-07-2020 (IA) CE-SPIRE-09-2020 (IA)	97.50	
CE-SC5-07-2020 (IA)	40.00	13 Feb 2020 (First Stage) 03 Sep 2020 (Second Stage)
CE-SC5-31-2020 (IA)	15.00	
Opening: 01 May 2020		
LC-SC3-CC-9-2020 (IA)	14.00	01 Sep 2020
LC-SC3-NZE-5-2020 (IA)	15.00	
Overall indicative budget	205.50	

DG CLIMA: Innovation Fund

First tool to implement Long-Term EU Strategy on GHG reduction

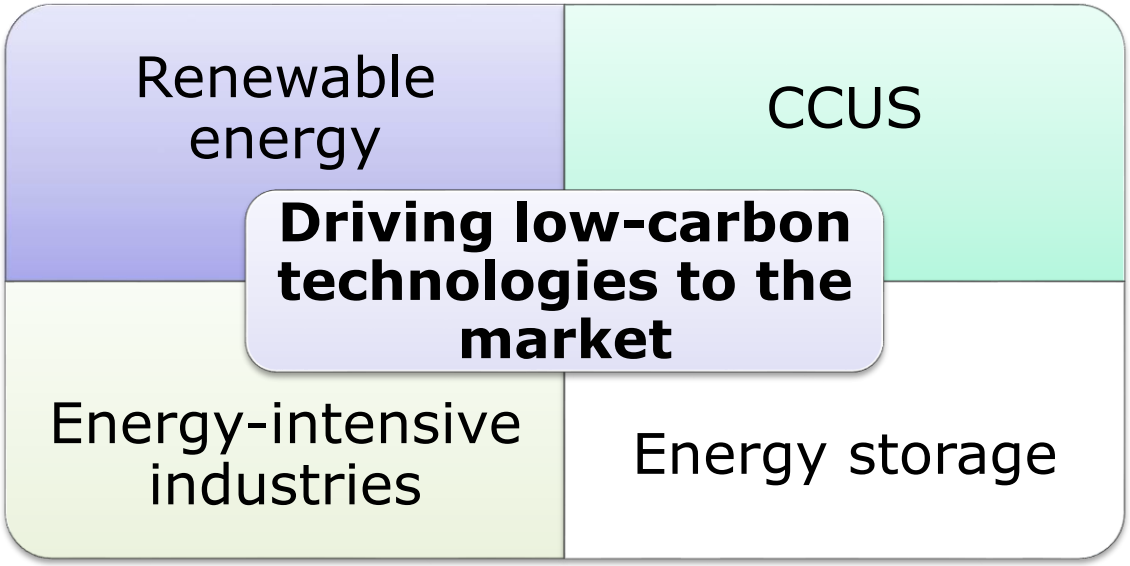
Driving low-carbon technologies to the market

(high TRL)

Regulatory Framework adopted on 26 February 2019

selection criteria

- Greenhouse gas emissions avoidance
- Degree of innovation
- Project maturity
- Scalability
- Cost efficiency



Key features of the Innovation Fund

Volume of at least EUR 10 billion at current carbon prices

Support of up to 60% of additional costs related to innovative technology

First call expected for 2020 and regular calls up to 2030

Financed from the revenues of the EU Emissions Trading System

Support of additional capital and operating costs (up to 10 years)

Comprehensive selection criteria and project development assistance

The IF will develop synergies with a broad set of instruments for R&I (e.g. HE) and deployment (e.g. the European Structural and Investment Funds, ESIF and MSs funding) to increase reach and impact

INNOVATION FUND

Driving clean innovative technologies towards the market

First call for projects in 2020

€10 billion to invest up to 2030 in EU's climate neutral future

Avoid emissions and boost competitiveness

Supporting innovation in:

- Energy intensive industries
- Renewables
- Energy storage
- Carbon capture, use and storage

Funded by: EU Emissions Trading System

https://ec.europa.eu/clima/policies/innovation-fund_en

#InnovationFund

European Commission

Strategic Planning for Horizon Europe: current public consultation

#HorizonEU

Please join us, if you can

Website:
https://ec.europa.eu/info/research-and-innovation/events/upcoming-events/european-research-and-innovation-days_en

End May
Strategic Plan ready for public consultation

24-26 Sept
European R&I Days

Nov/Dec
Final version – Strategic Plan
Commission endorsement

2020
Work Programme drafting,
Preparation for programme launch

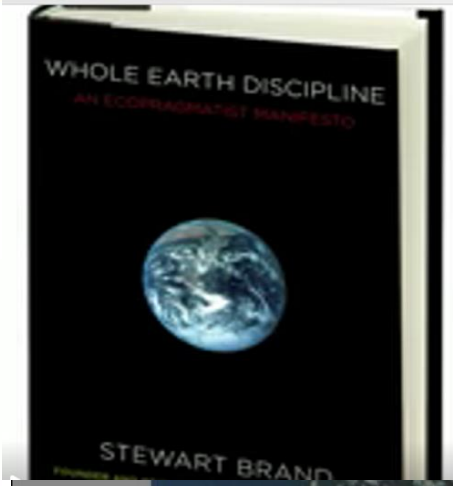
By end October
Finalisation of co-design with stakeholders and citizen
New version of Orientations towards the Strategic Plan

June-Sept
Public consultation
Citizens and stakeholders

Ongoing
Cross-cluster alignment, refinement

Your turn, your opinion

New ideas: is solar geoengineering necessary? What are the risks of solar radiation management (SRM)?



Cities are green.

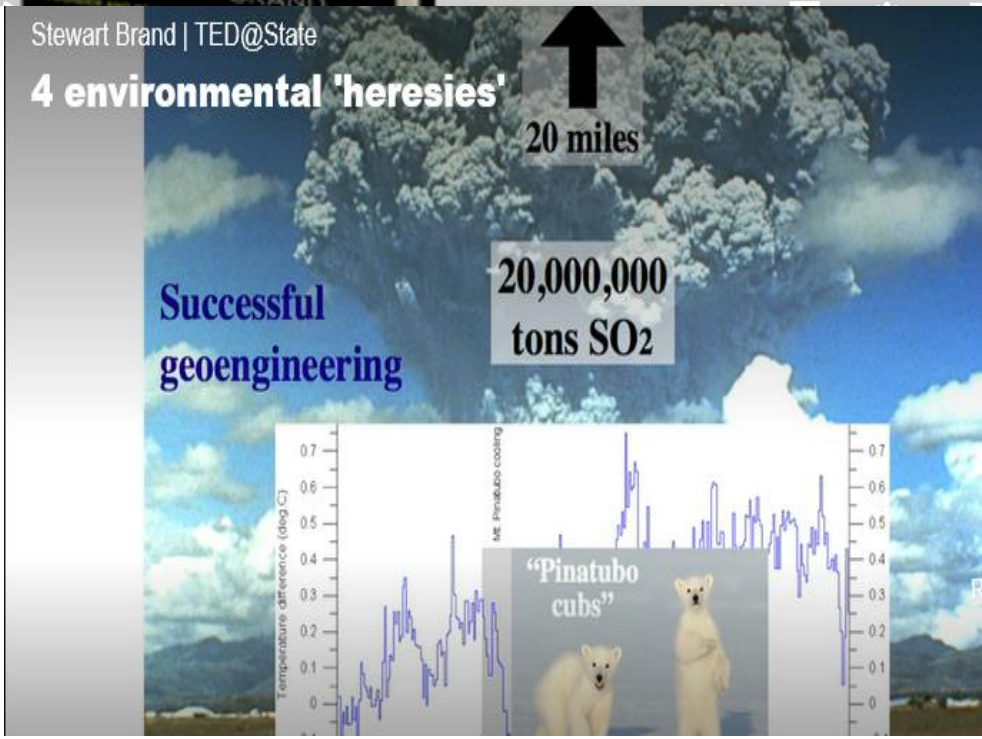
Nuclear power is green.

Genetic engineering is green.

Geoengineering is probably necessary.

Baseload electricity

	US	World
1. Fossil fuels (coal and gas)	71.4%	66.1%
2. Hydro	6.5%	16.1%
3. Nuclear	19.3%	15.7%
4. Space solar?		



https://www.ted.com/talks/stewart_brand_proclaims_4_environmental_heresies#t-96304

Conclusions

- To reach net-zero GHG emissions an effective low-carbon energy mix should be used
- Horizon 2020 is providing a strong support to CCU, CCS, RES as well as circular waste technologies through the PPP SPIRE instrument (0.9 billion €), the NER 300 (2.1 billion €) and a further cross-cutting call on "Competitive, Low carbon, Circular industries" (0.2 billion €)
- Next FP HE (2021-2027) will include many intervention areas potentially suitable to support R&I activities in the CO2 utilisation domain: a public consultation is under way
- The EC is developing instruments to integrate R&I to initiatives at MSs level (e.g. Phoenix) to accelerate the commercial deployment of novel technologies: the « innovation fund » will provide 10 billion € for low carbon technologies
- The scientific community has the duty to respond to the climate challenges of the 21st century: through the creation of influential networks/experts' groups there is the need of a holistic strategy to "fight the technocratic paradigm which dominate economic and political life"

THANK YOU !


TRUST


LEARNING
EDUCATION
DEVELOPMENT
TRAINING


SERVICE
TRUST
LOYALTY
SATISFACTION
VALUE
COMMUNICATION


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS