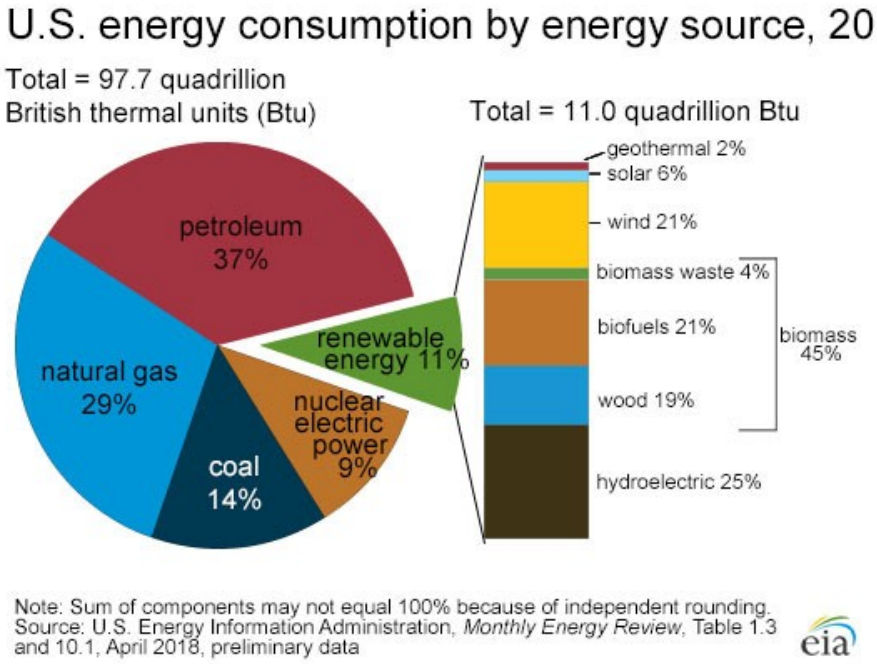
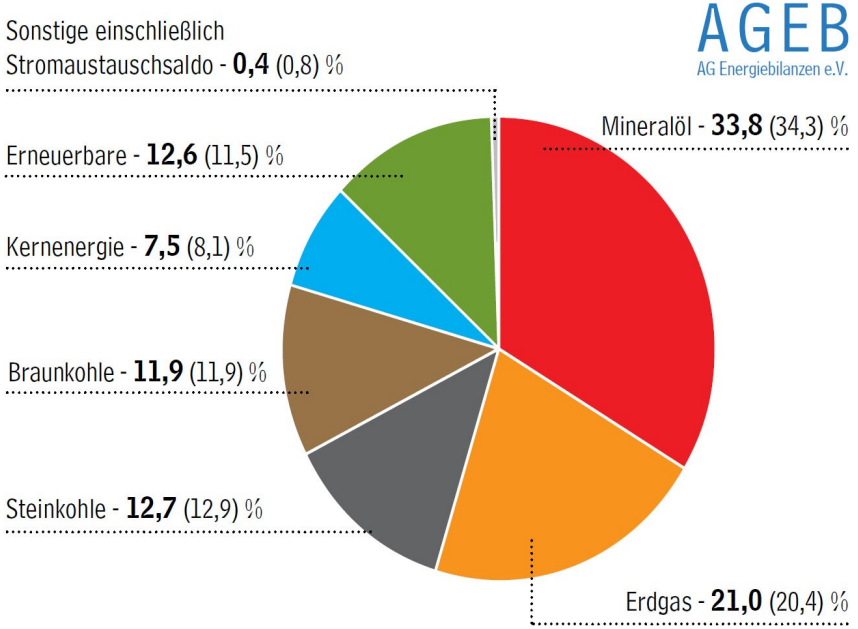
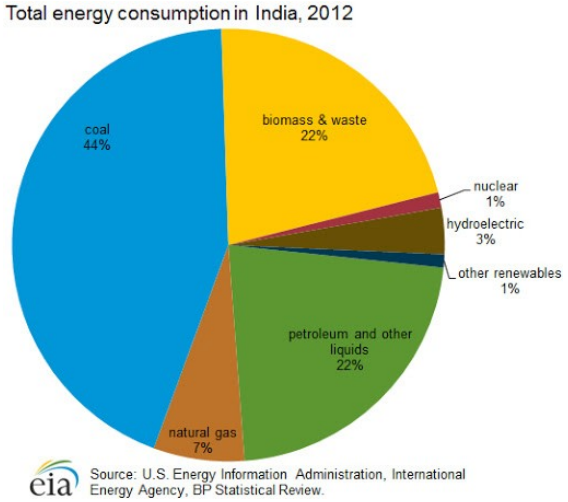
Challenges for Future Energy Concepts

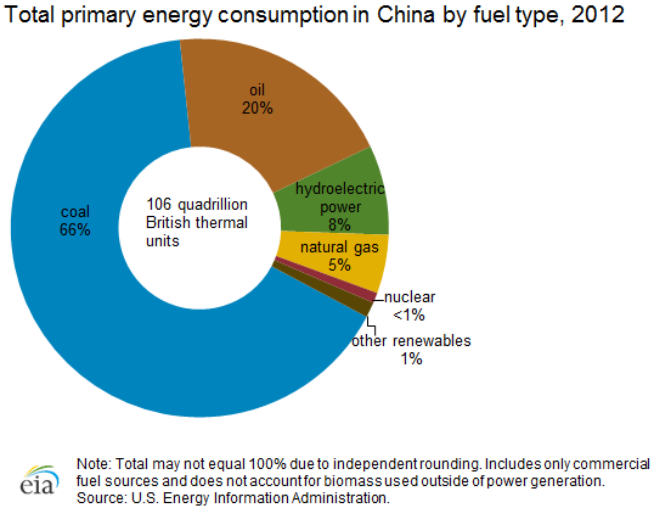
Alexander Auer

Energy “Production” and “Usage”









Impact of Fossils on the Environment

Impact of Fossils on the Environment

- Pollution of environment
- Uneven distribution of resources on the globe
- Greenhouse effect

A note on pollution

In Germany after WW2 the economy recovered due to coal mining and steel production – the consequence was substantial air pollution and *acid rain*.

The same development is currently being observed in China:

Fotoarchiv Ruhr Museum

www.welt.de/regionales/koeln/article109230668/Koks-und-Cola-das-Ruhrgebiet-ganz-irre-modern.html#cs-zgbdc5-66kumkik49jg9gyice6-original-jpg.jpg

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https://www.ubz-stmk.at/fileadmin/ubz/upload/Materialien/Stundenbilder/Gesundheit/Luft/Gesundheit_Luft_US_2019_Saurer_Regen-Waldsterben.pdf

https://chinapower.csis.org/air-quality/ and World Bank's World Development Indicators (WDI) dataset. Abbreviations: PM 2.5 , particulate matter with a diameter of 2.5 micrometers or less; WHO, World Health Organization.

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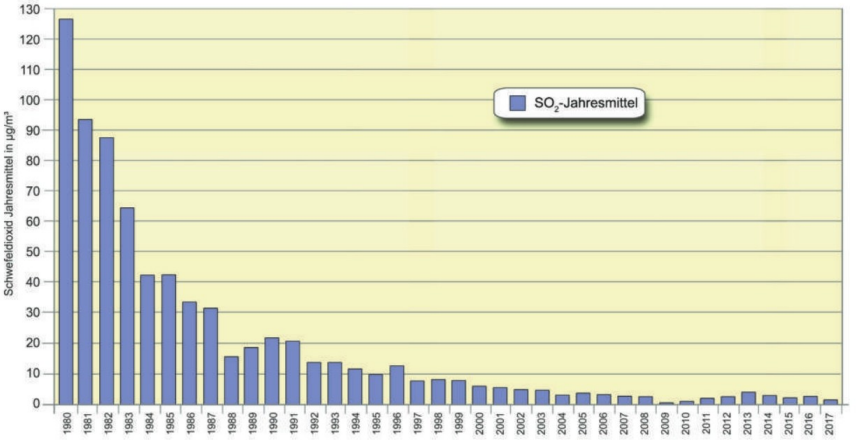

Abb. 3: Jahresmittelwerte von Schwefeldioxid (SO_2) an der Station Graz-Nord von 1980 bis 2017 (Quelle: Land Steiermark)

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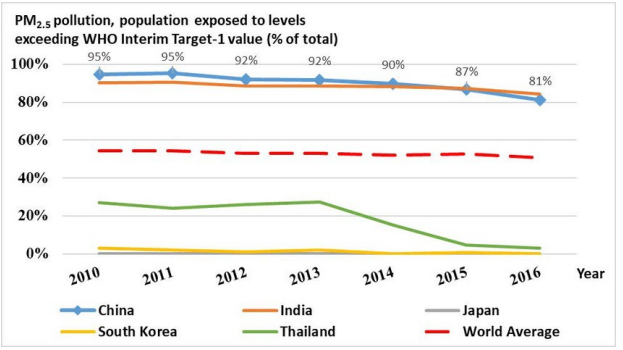

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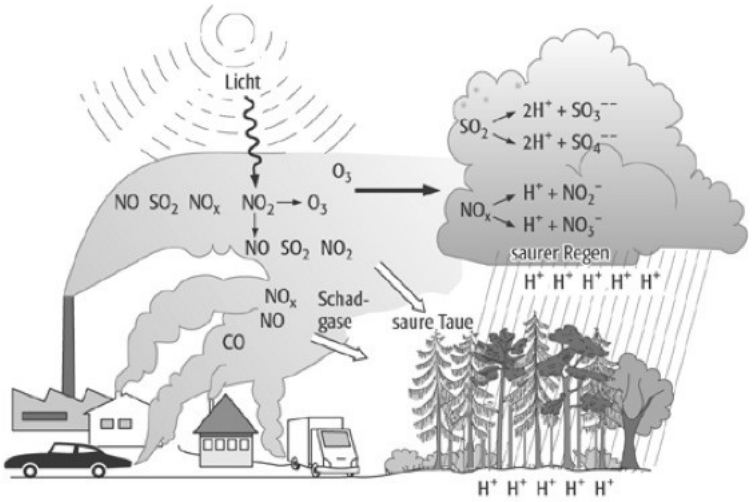
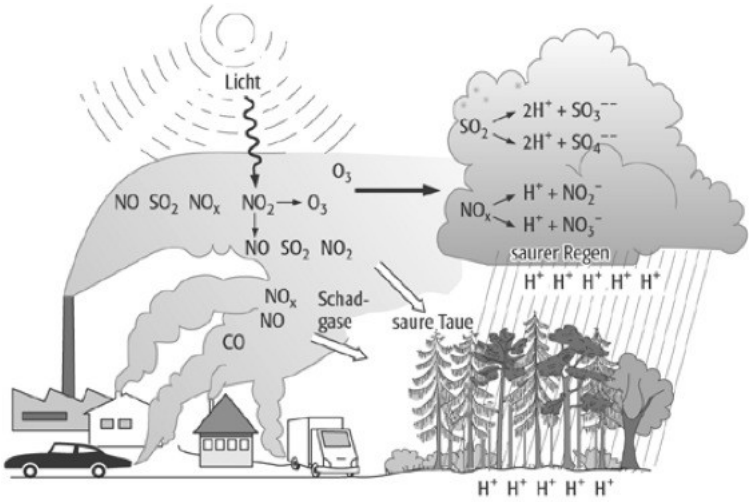
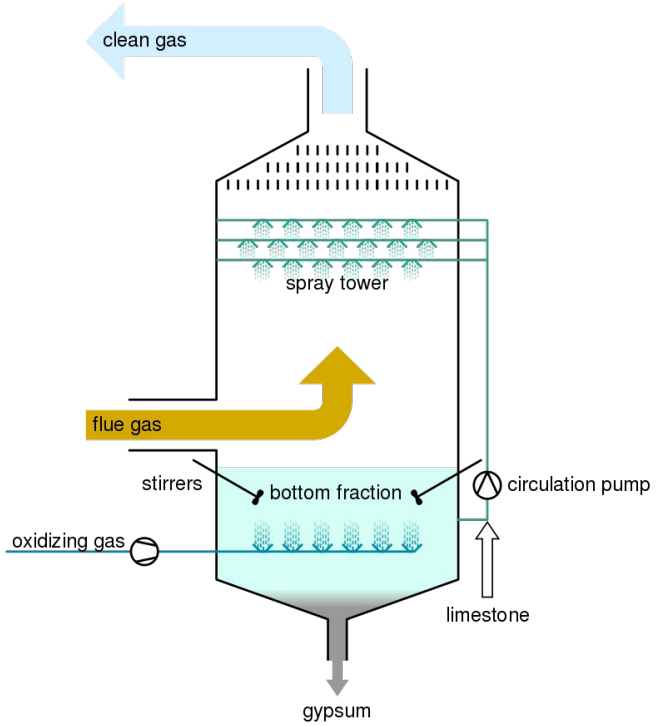


www.spektrum.de/lexikon/geographie/saurer-regen/6905
https://en.wikipedia.org/wiki/Flue-gas_desulfurization

A note on pollution





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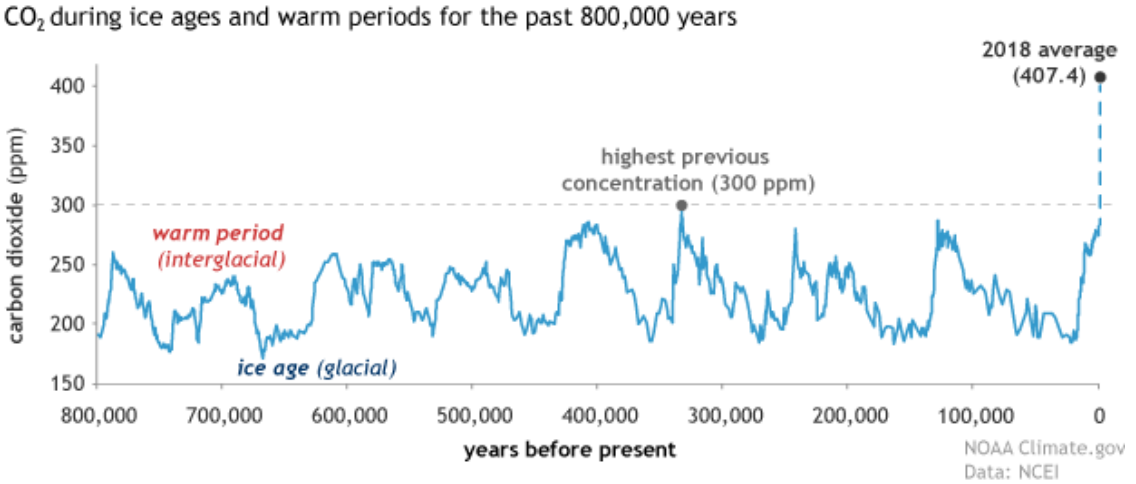
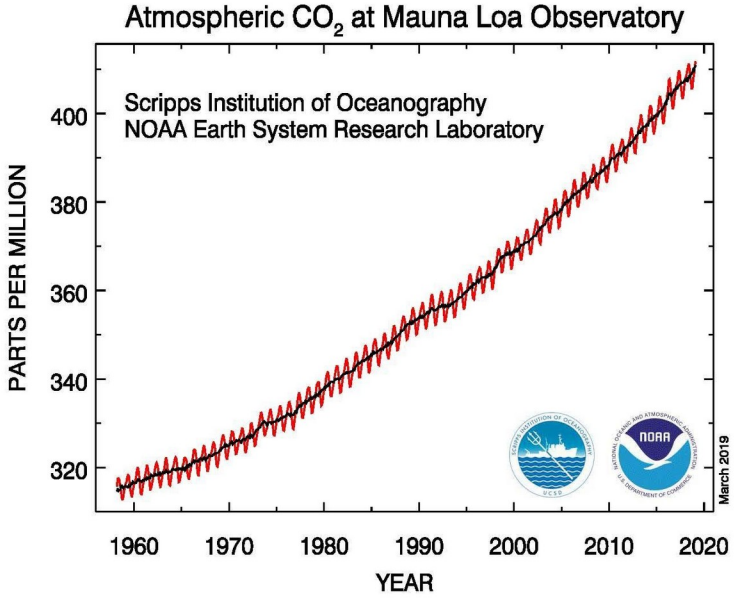
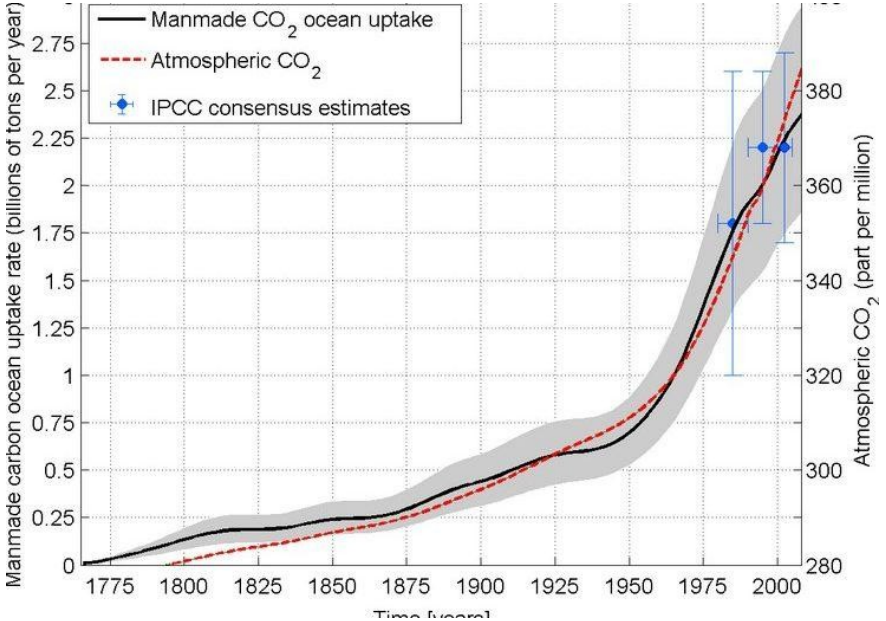
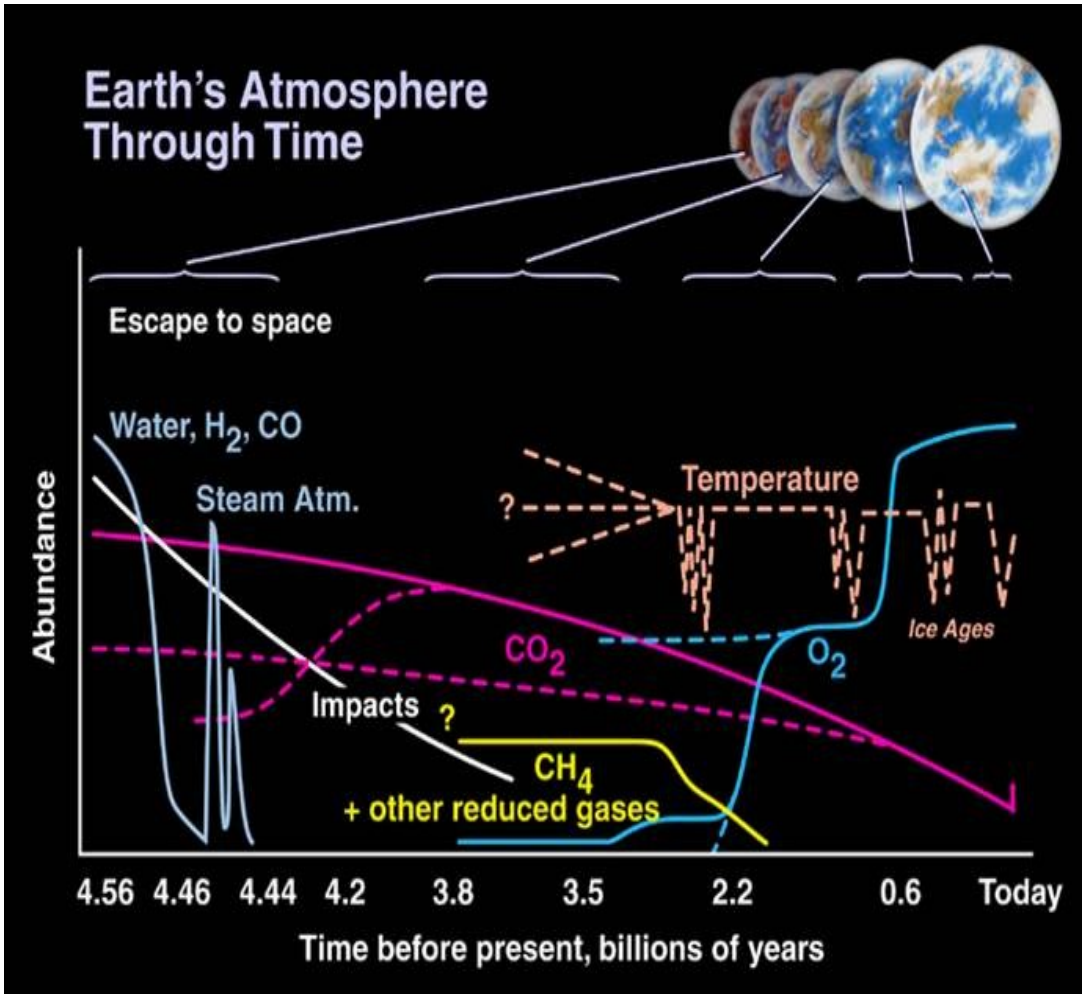
Greenhouse Effect







The History of Earth's Atmosphere



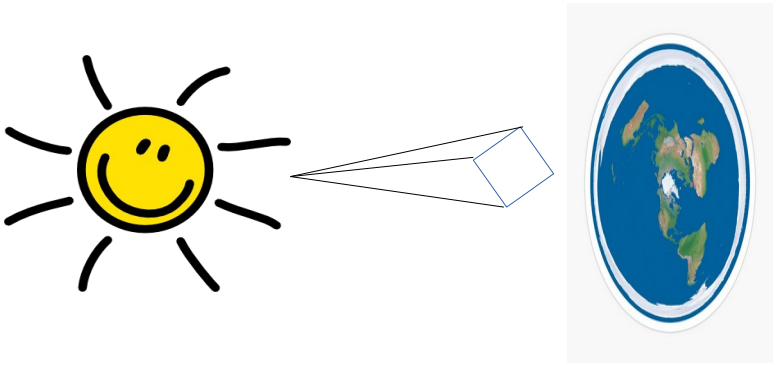
Energy Abundance

Earth's radius: 6.38×10^6 m

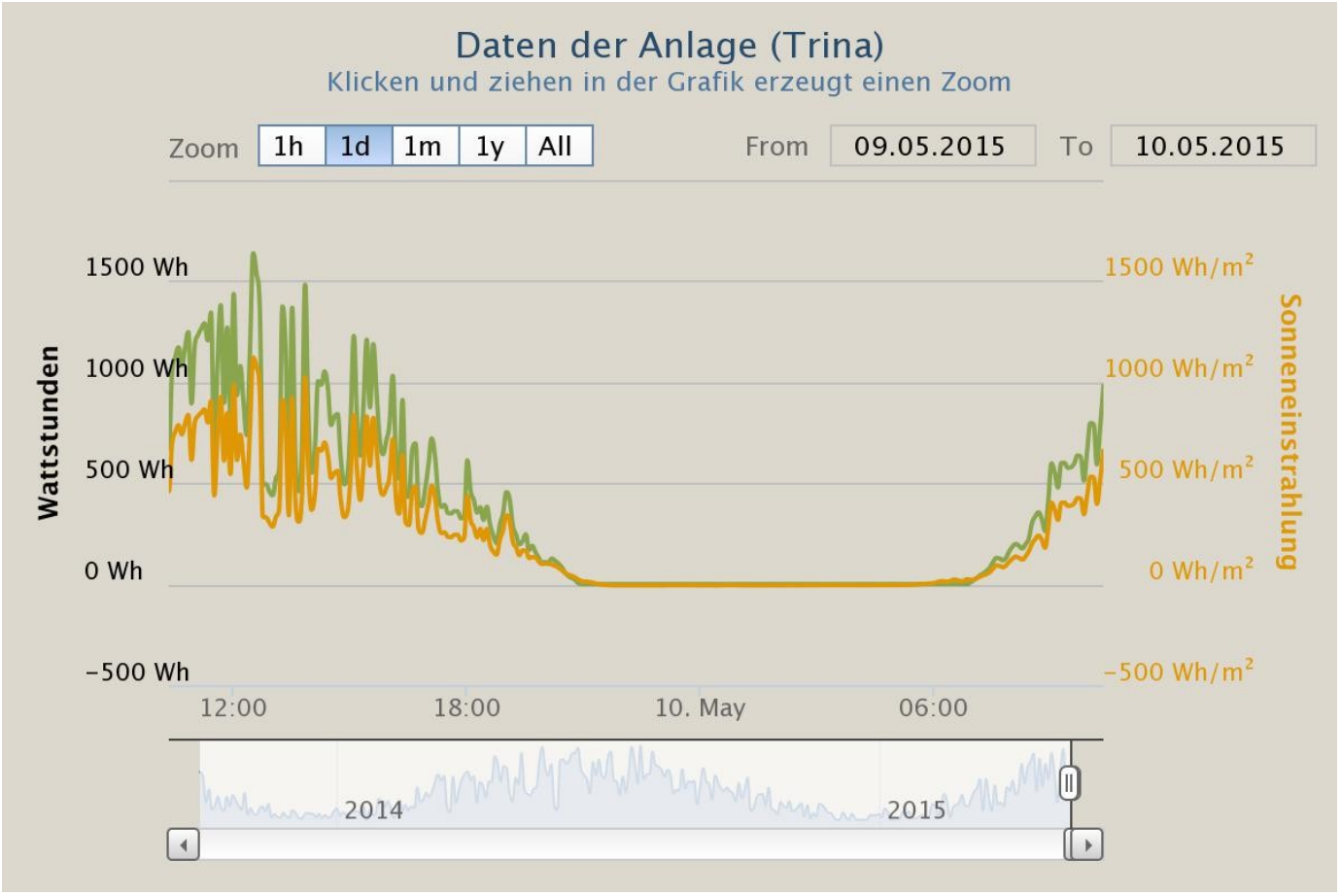
Irradiation of the sun: 1000 W/m^2
(1kWh/m^2 in one hour)

Mankind's power consumption:
50.000 TW/year = 5×10^{13} kW/year

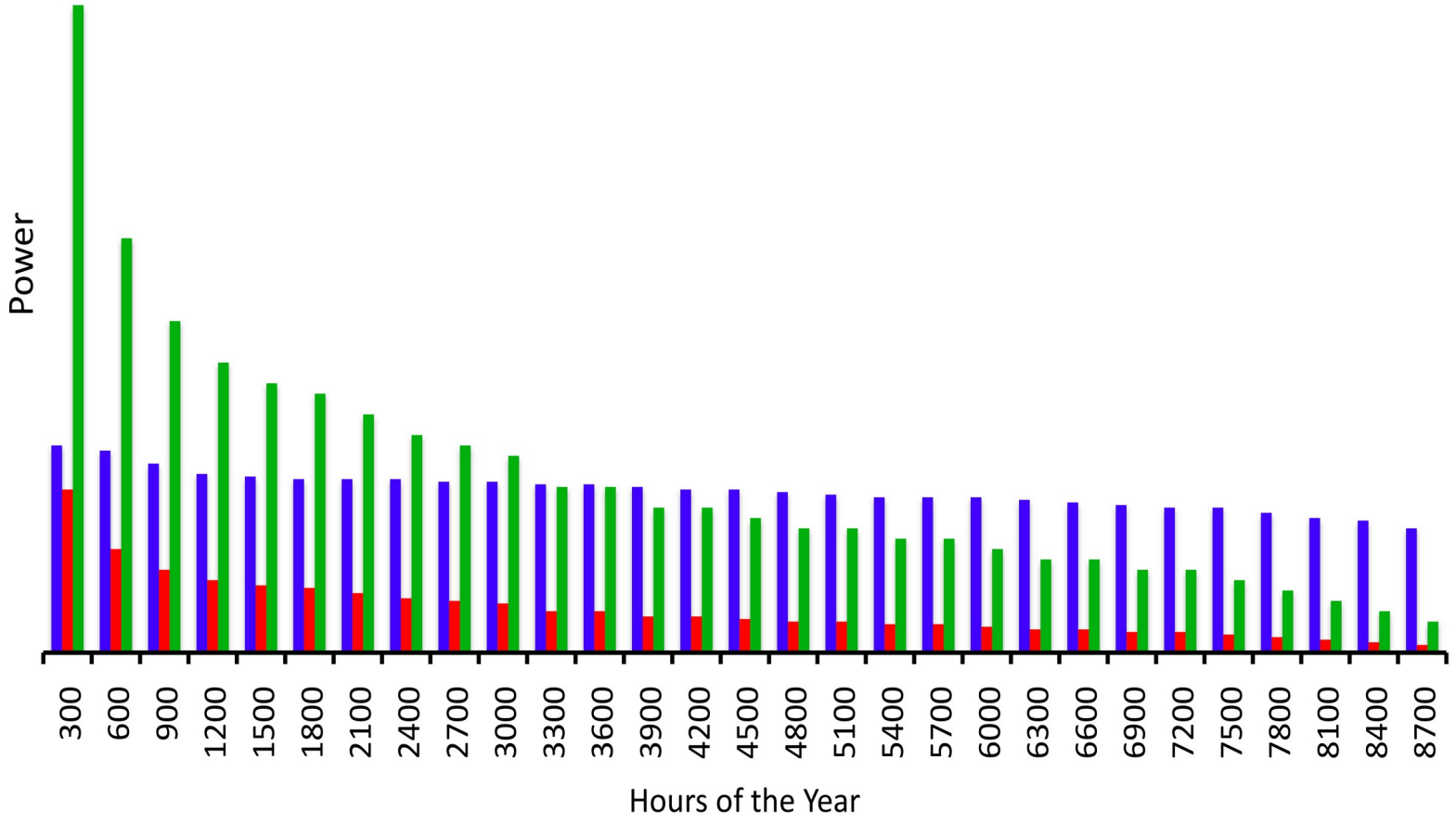
Three hours of sun
is enough energy
to supply our society with
power for a whole year !



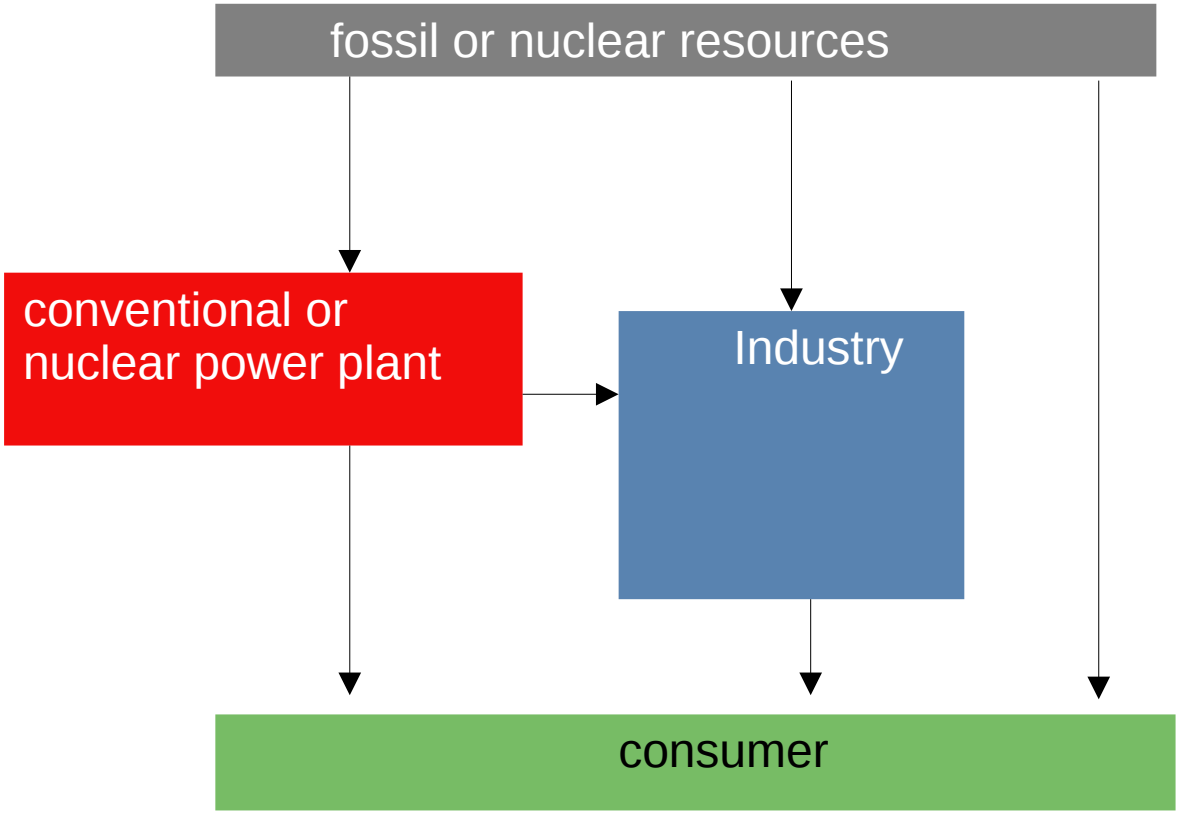
A Key Feature of Renewables..



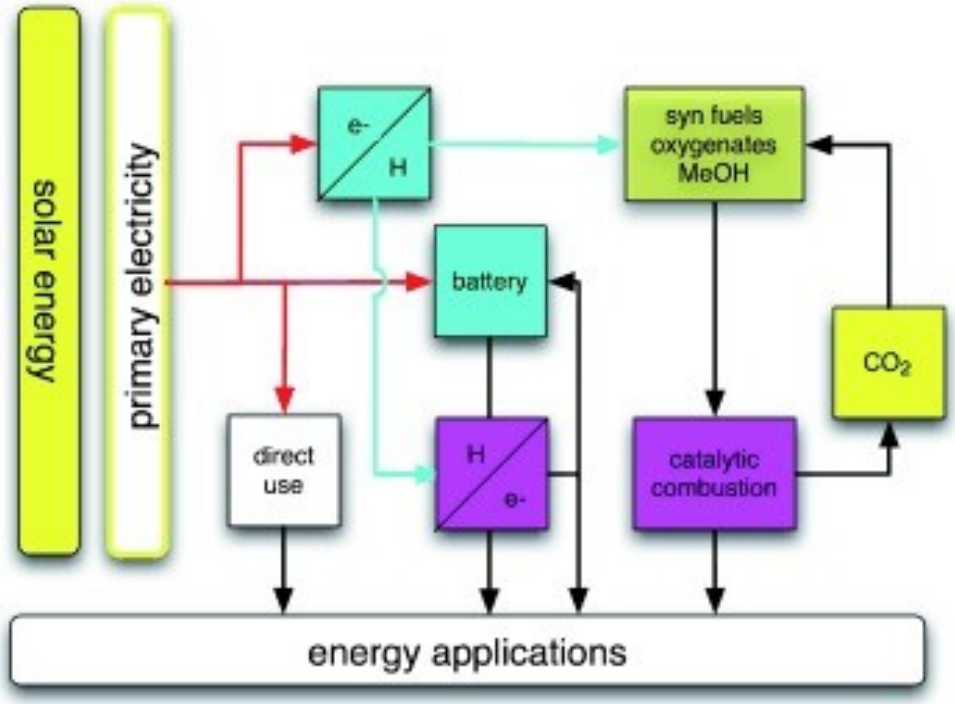
Demand and Supply with Renewables

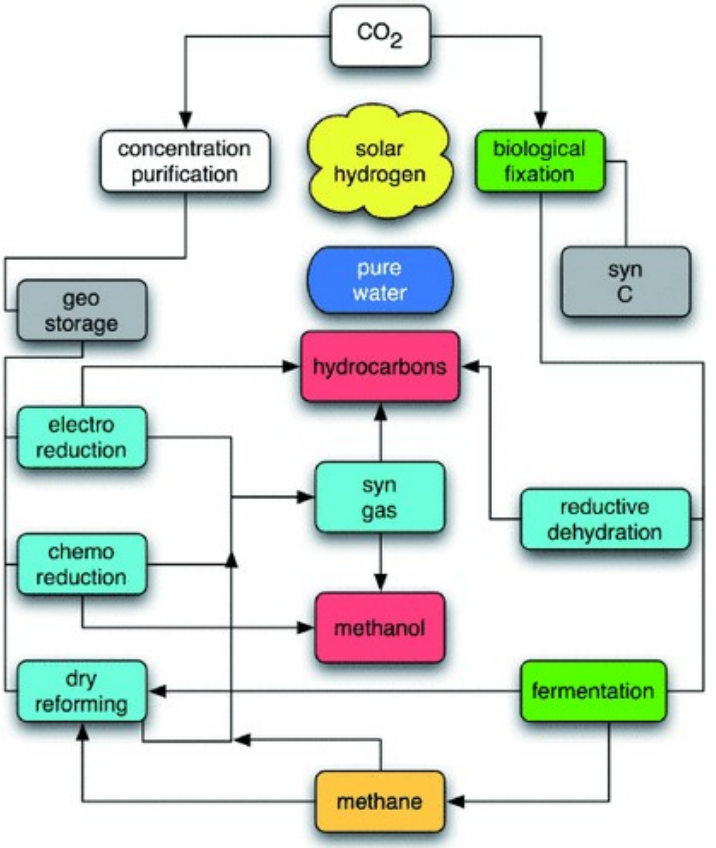


Current Energy Systems



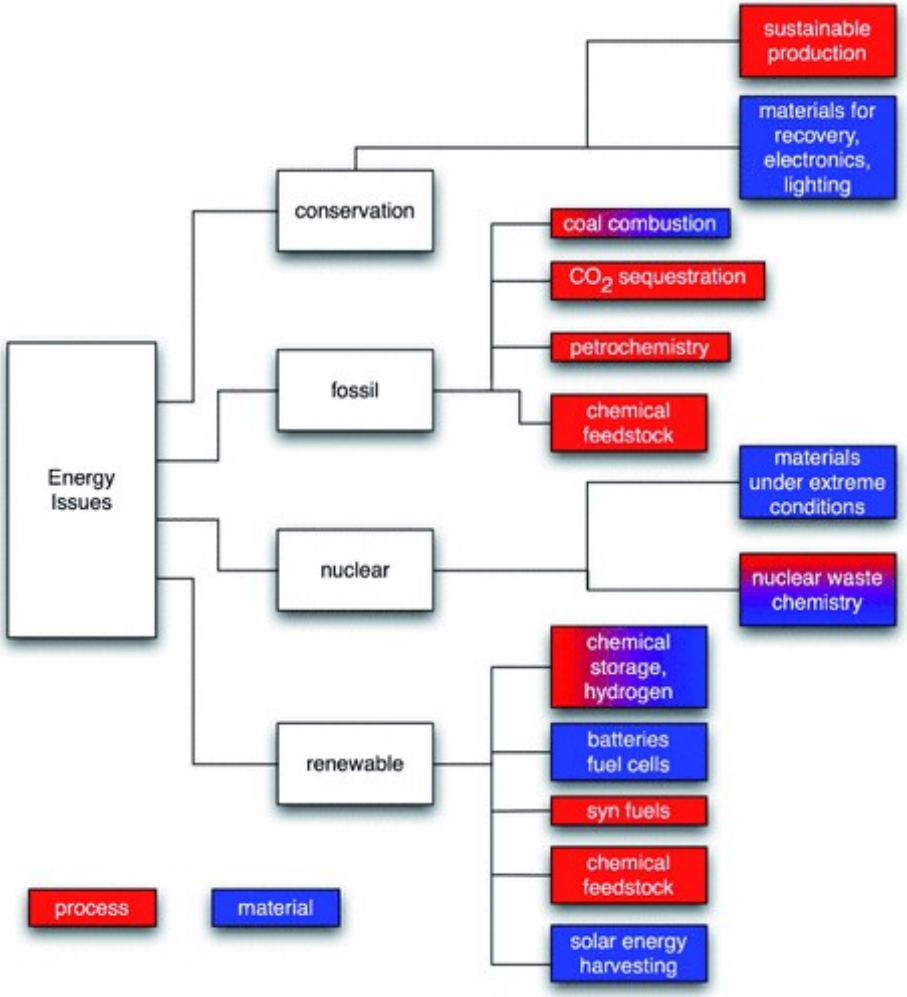
Future Energy Systems

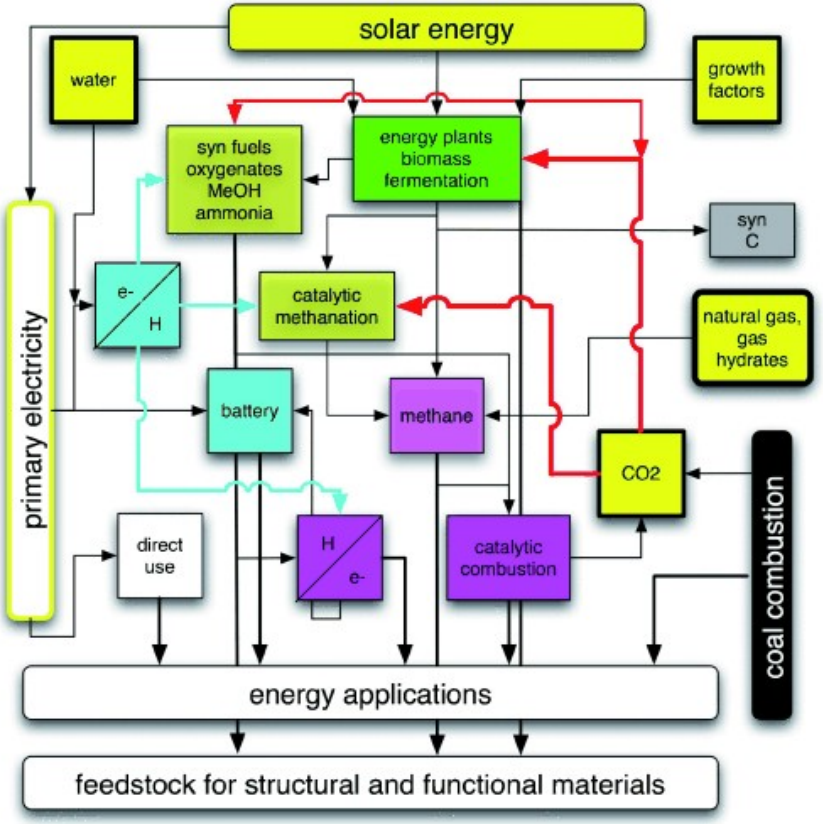




https://chemistry-europe.onlinelibrary.wiley.com/doi/full/10.1002/cssc.200900183?utm=&utm_source=researcher_app

Future Energy Systems





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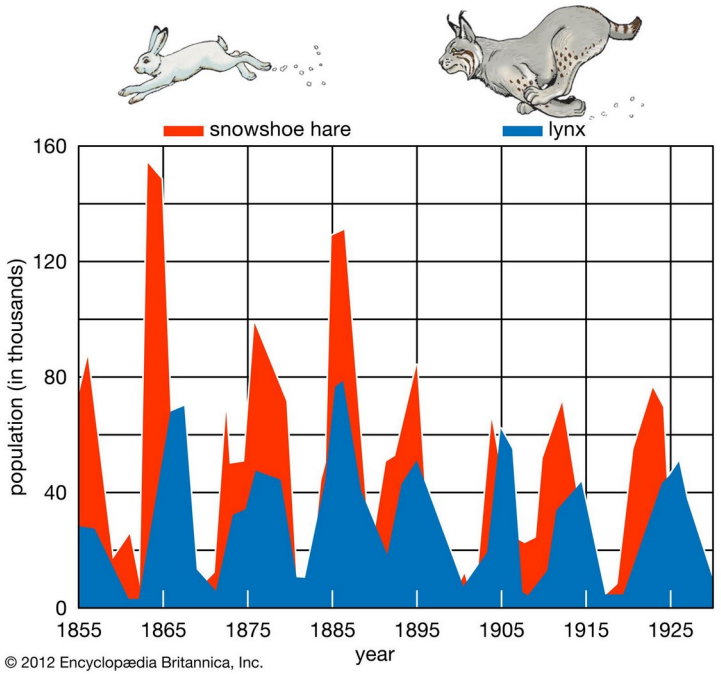
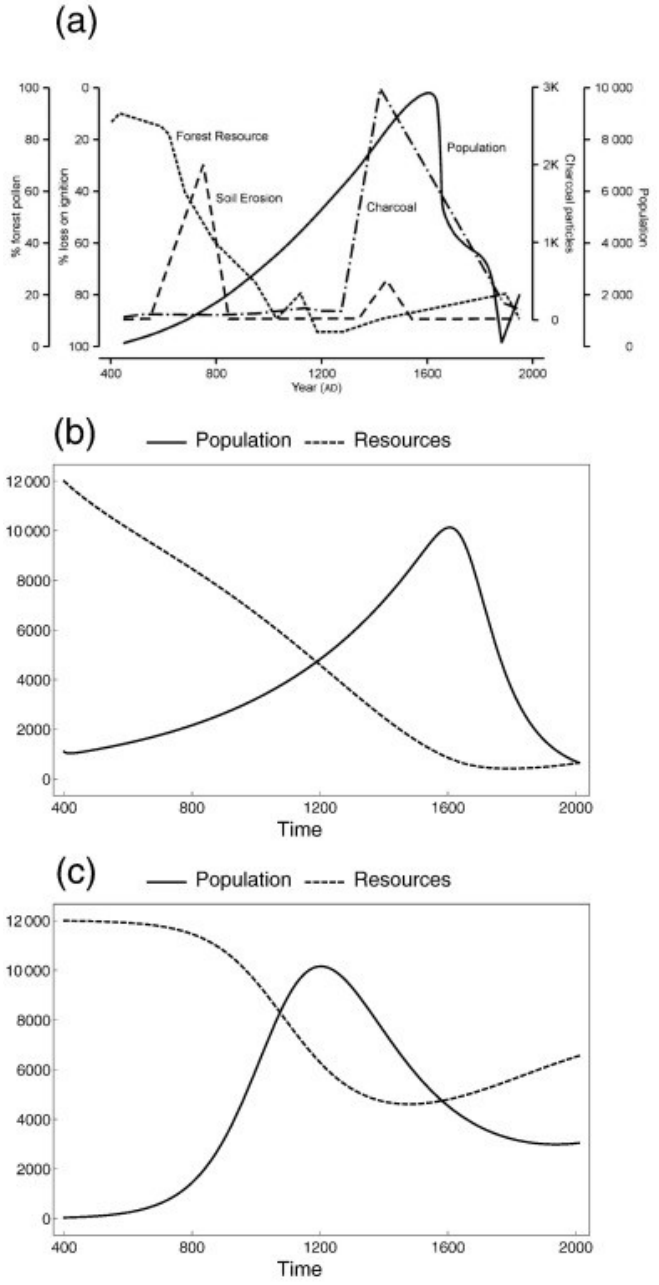
The Dynamics of Change





Key Take-Home Messages

- Understand the components and magnitudes of the current energy economy
- Learn how to read and understand the numbers associated with energy systems
- Study the technology of a future energy economy

- ***Learn to focus on the details, be able to think about the bigger picture***

Note that we are material scientists, not politicians, economists or technicians !

The Course

- ***The big picture***: Read the book by D. MacKay "*sustainable energy without the hot air*" and familiarize youself with his scientific approach to arguments and numbers
- ***Focus on details***: Study the topic assigned to you and prepare a 20min talk according to the description

- Final oral exam – focus on MacKay Book and your topic, but mind the key take-home messages I mentioned above ….