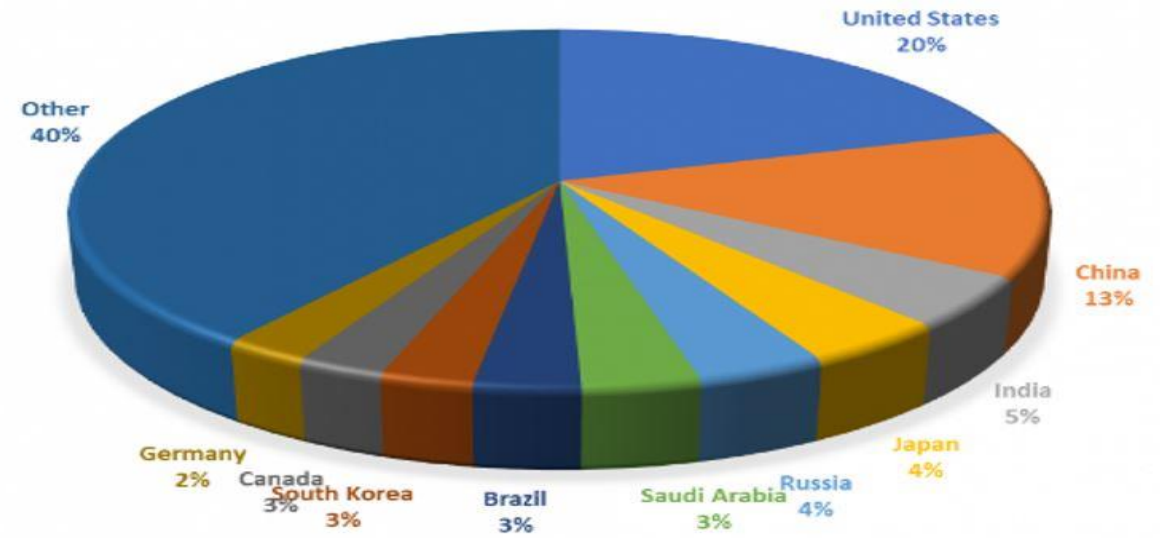
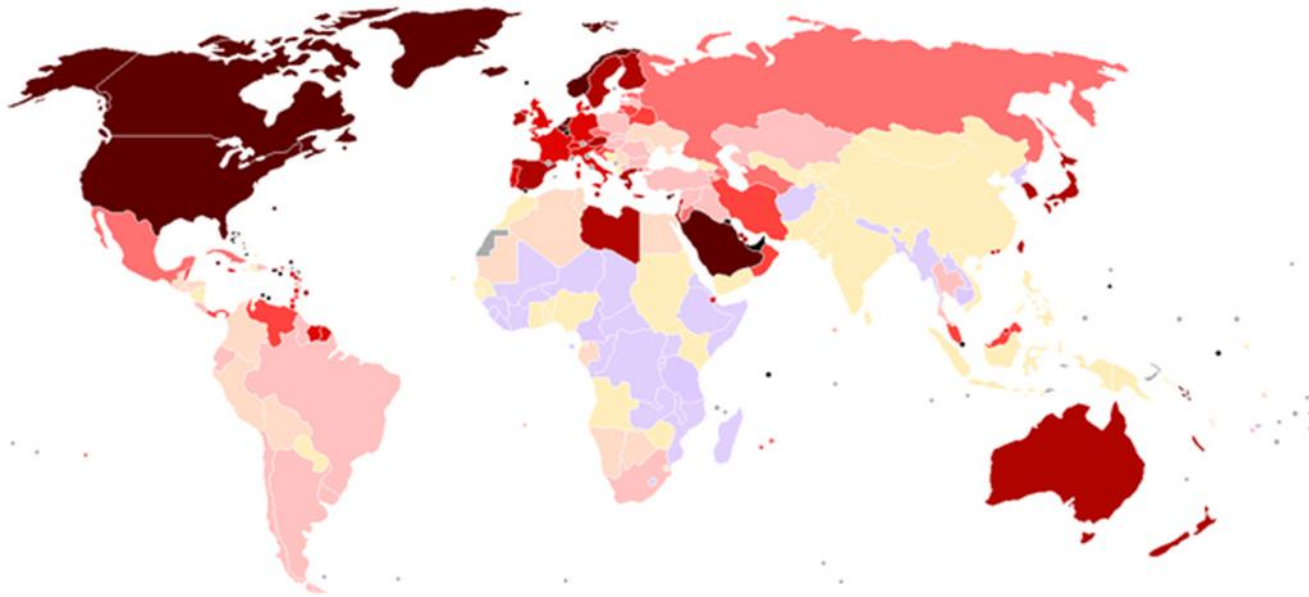


Human Impact On The Environment



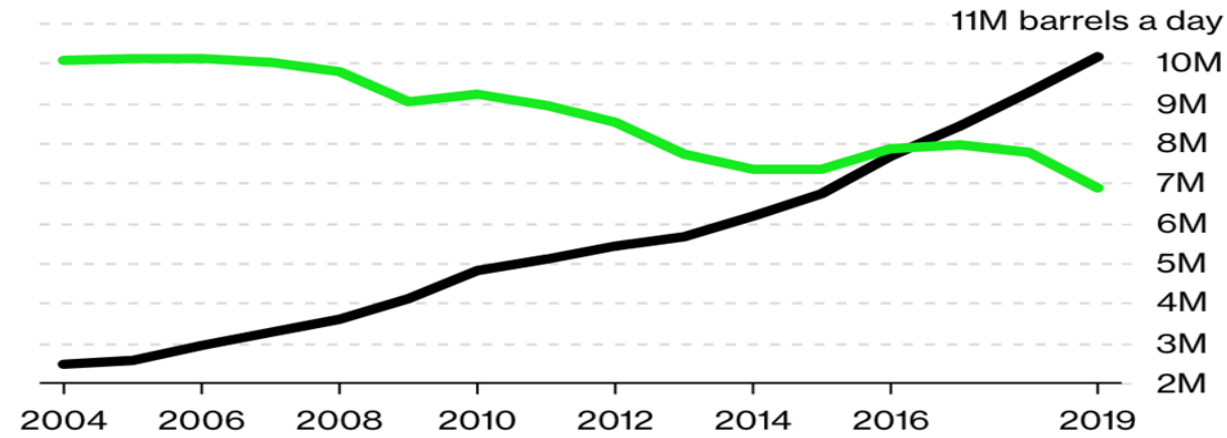


Rank	Country/Region	Oil consumption (bbl /day)	Year
-	World (incl biofuels)	100,100,000	2019
1	United States	19,400,000	2019
-	European Union	15,000,000	2017
2	China	14,056,000	2019

Oil Import Kings

China shipped in more oil last year than the U.S. did at its peak in 2005

▬ China oil imports
 ▬ U.S. oil imports



Source: China Customs, U.S. Energy Information Administration
 Note: 2019 U.S. data is through Oct. 31

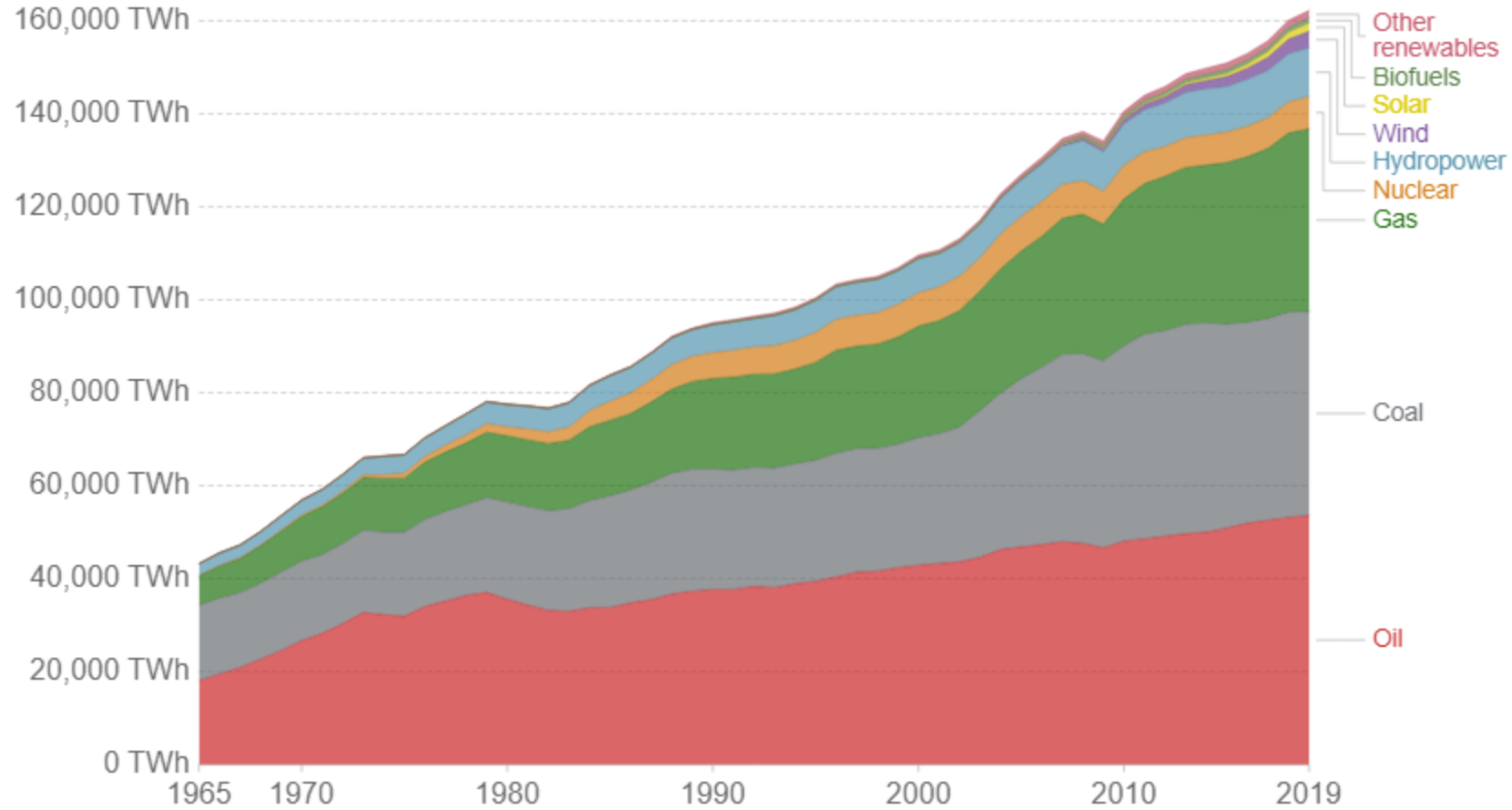
Human Impact On The Environment



Energy consumption by source, World



Primary energy consumption is measured in terawatt-hours (TWh). Here an inefficiency factor (the 'substitution' method) has been applied for fossil fuels, meaning the shares by each energy source give a better approximation of final energy consumption.



Source: BP Statistical Review of World Energy
Note: 'Other renewables' includes geothermal, biomass and waste energy.

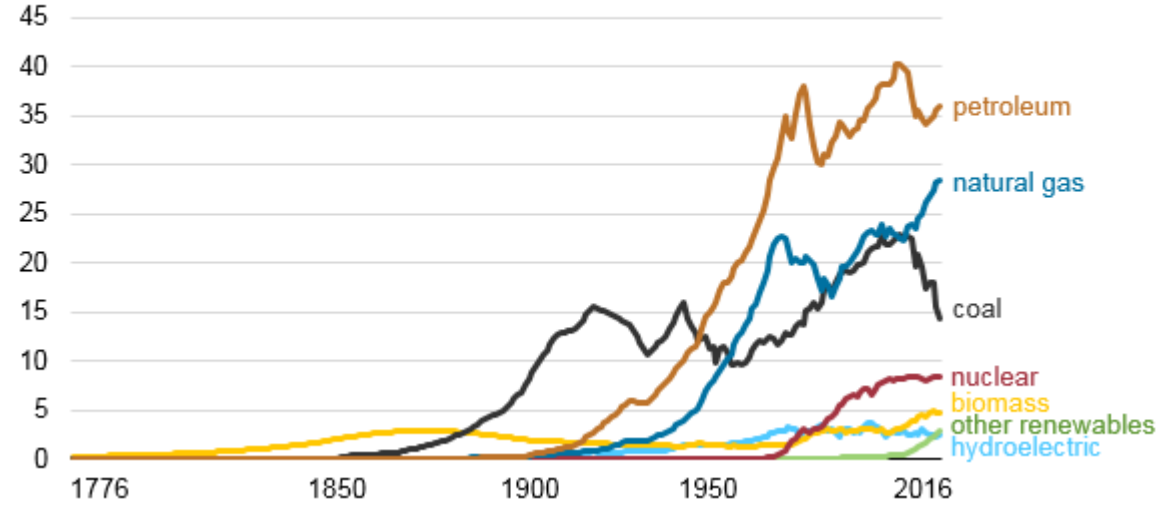
OurWorldInData.org/energy • CC BY

Human Impact On The Environment

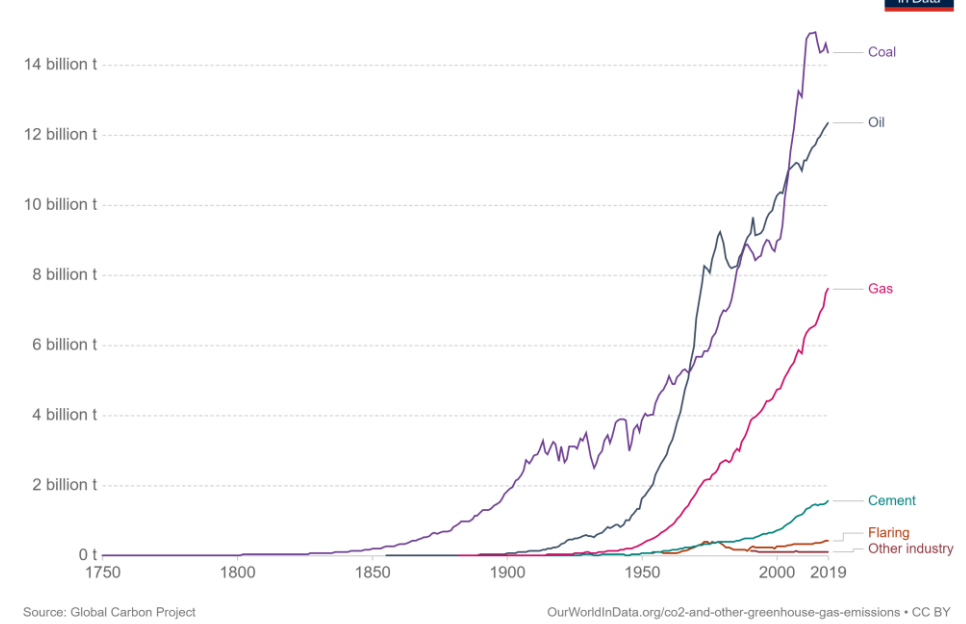


Energy consumption in the United States (1776-2016)

quadrillion British thermal units

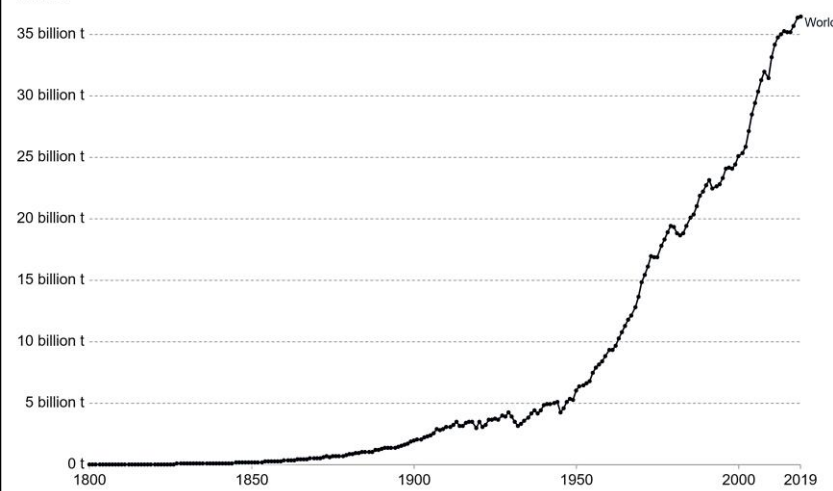


CO2 emissions by fuel, World



Annual CO2 emissions

Carbon dioxide (CO₂) emissions from the burning of fossil fuels for energy and cement production. Land use change is not included.



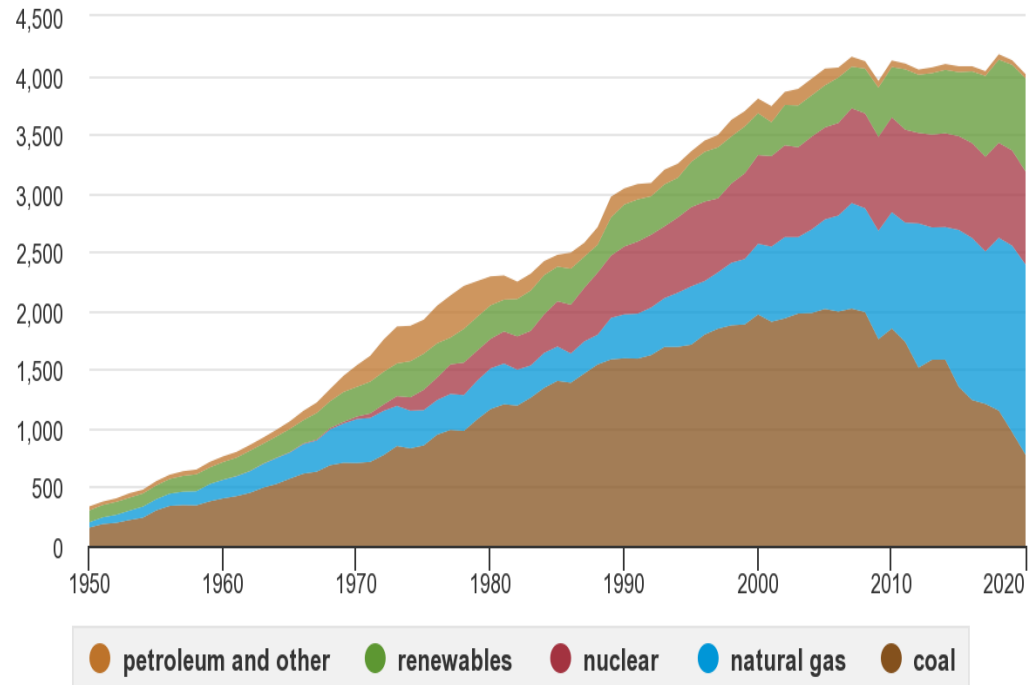
Source: Global Carbon Project; Carbon Dioxide Information Analysis Centre (CDIAC) OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY
Note: CO₂ emissions are measured on a production basis, meaning they do not correct for emissions embedded in traded goods.

Human Impact On The Environment



U.S. electricity generation by major energy source, 1950-2020

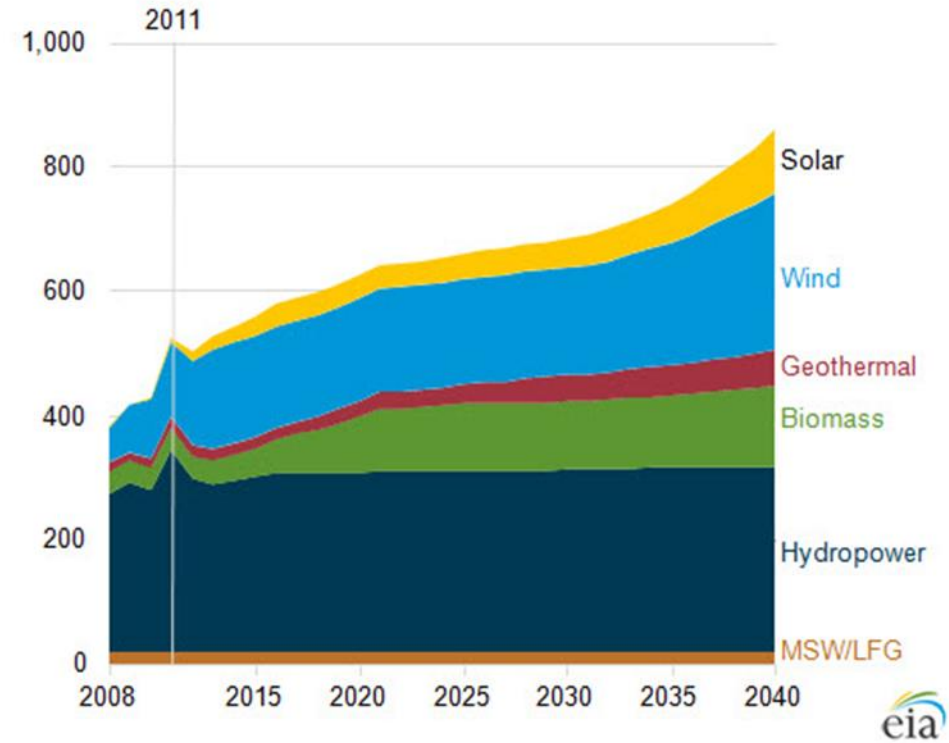
billion kilowatthours



Note: Electricity generation from utility-scale facilities.

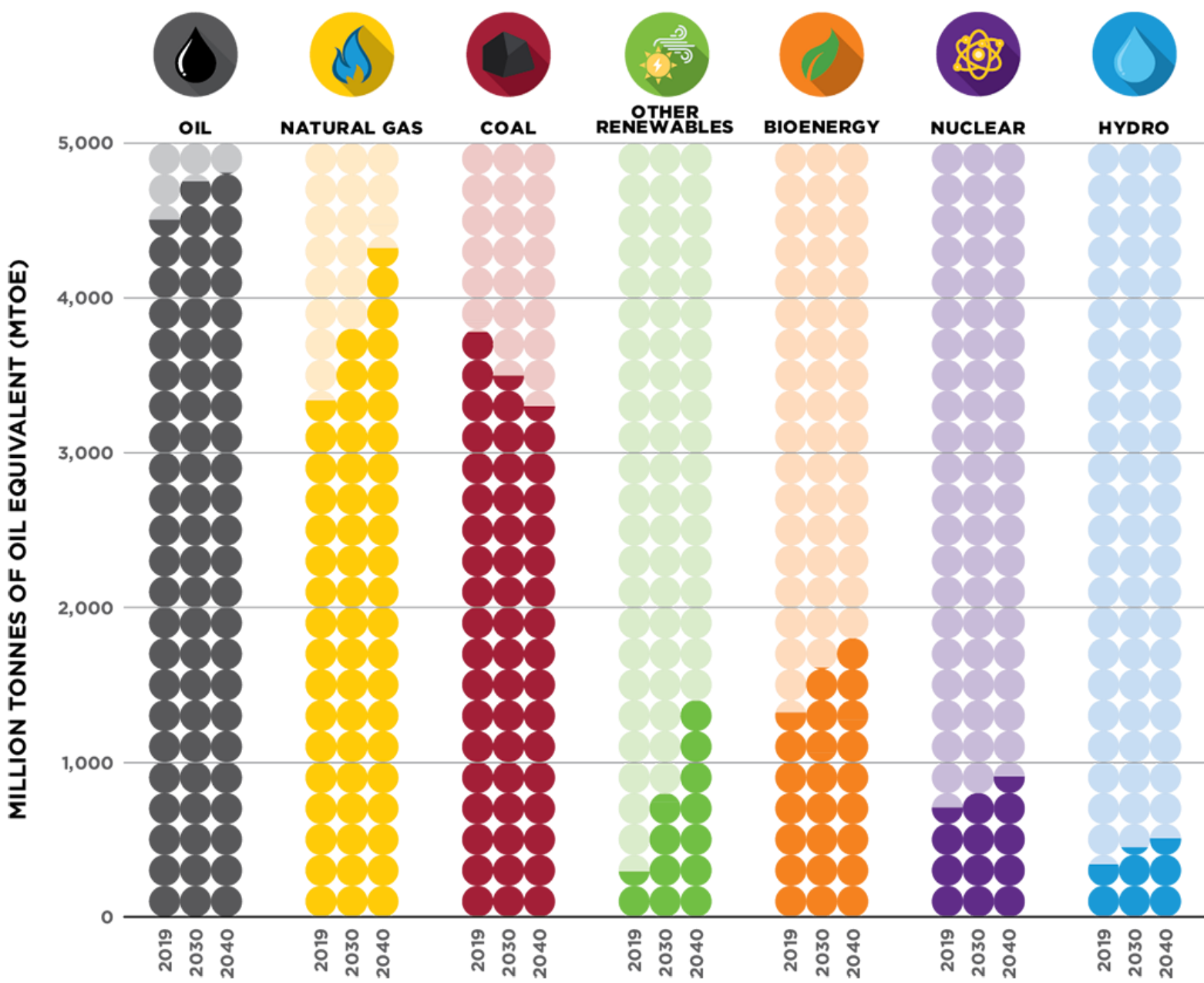
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 7.2a, January 2021 and *Electric Power Monthly*, February 2021, preliminary data for 2020

Figure 83. Renewable electricity generation by type, including end-use generation, 2008-2040 (billion kilowatthours)



eia

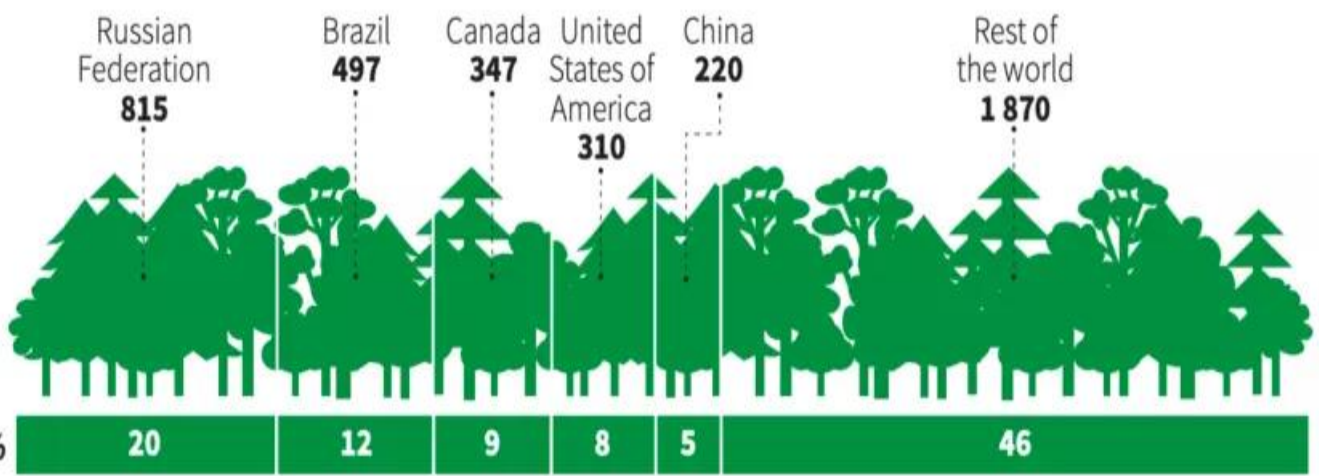




Human Impact On The Environment



Top five countries for forest area, 2020 (million ha)

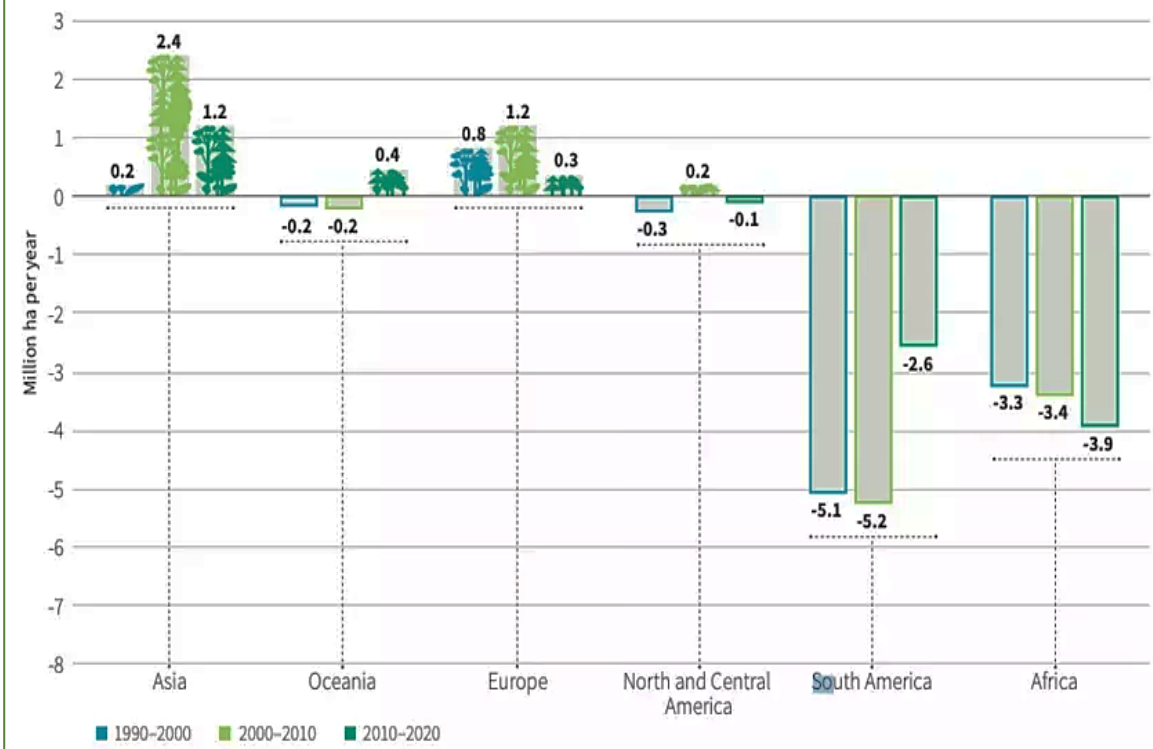


There are estimated 3.04 Trillion trees all over the world

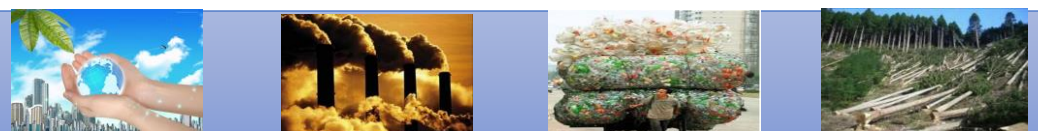
Annual rate of forest expansion and deforestation, 1990–2020



Annual forest area net change, by decade and region, 1990–2020



Human Impact On The Environment





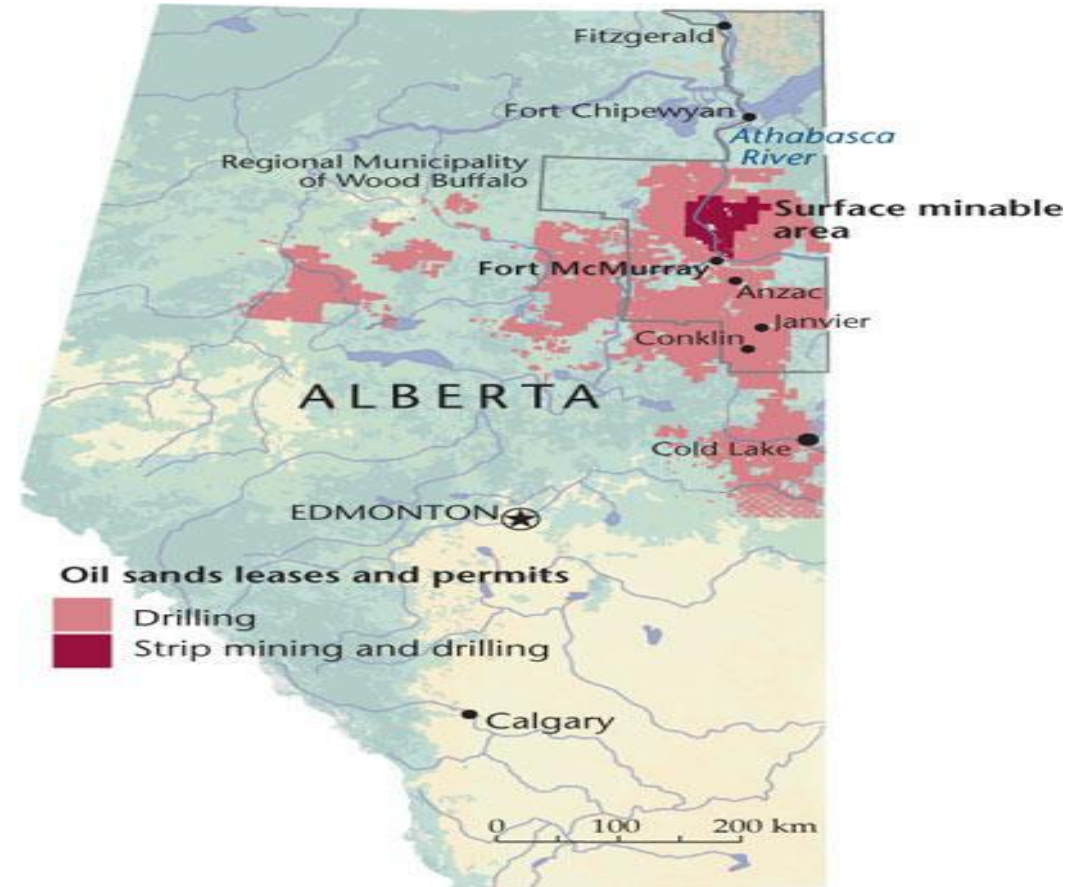
Human Impact On The Environment





Two tones

McMurray, Alberta use the world's largest trucks and shovels (machinery) to recover bitumen. **About two tones of oil sands must be dug up, moved and processed to produce one barrel of oil.**



Human Impact On The Environment





Recent development

Climate Summit. 4/22/2021
40 countries. Promise to cut the emission by 50%

Return of USA to Parise Accord

- Green Saudi Arabia 3/27/2021

- 10,000,000,000



- Green Middle East 3/27/2021

- 40,000,000,000



- Iraq signing for five solar electricity generation.

The State of the Paris Agreement

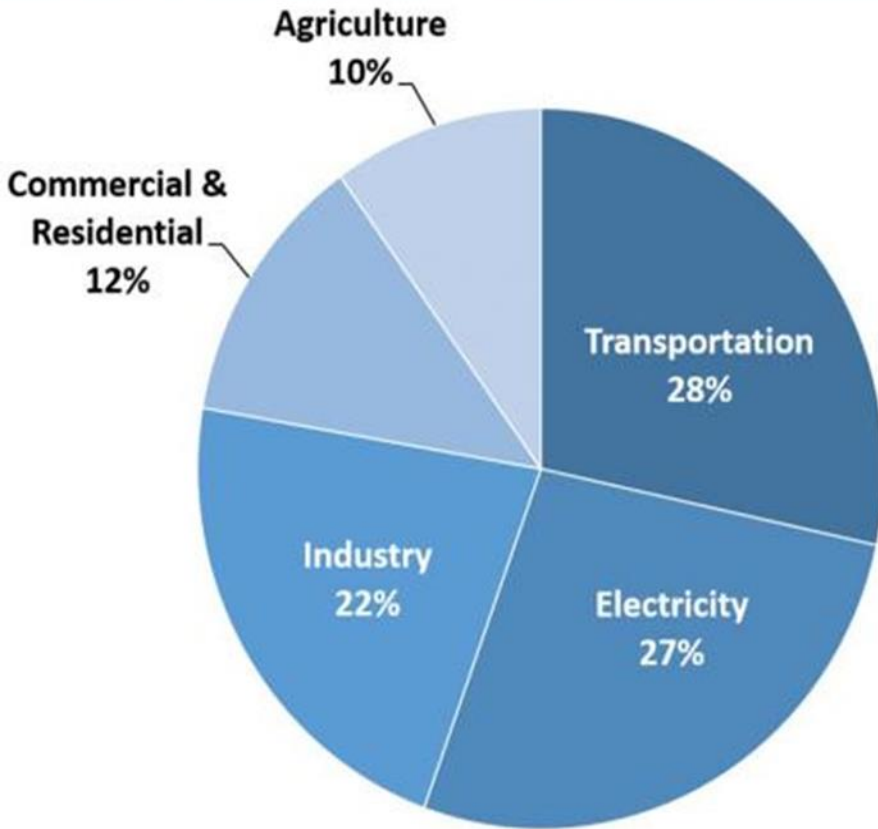
Countries by their participation in the Paris Agreement (as of Nov 5, 2019)



Human Impact On The Environment



Total U.S. Greenhouse Gas Emissions by Economic Sector in 2018



Total Emissions in 2018 = 6,677 Million Metric Tons of CO₂ equivalent. Percentages may not add up to 100% due to independent rounding.

Five cheap ways to remove CO₂ from the atmosphere

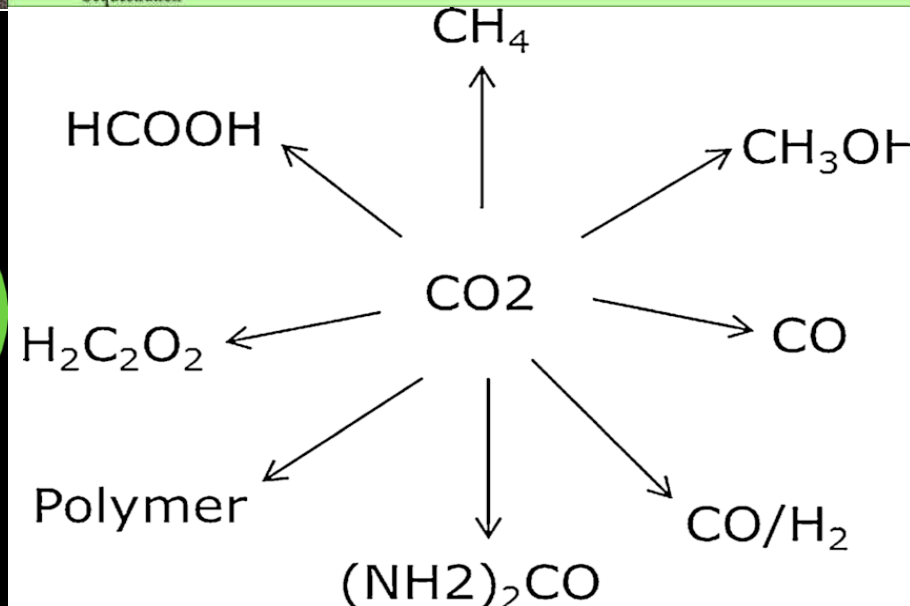
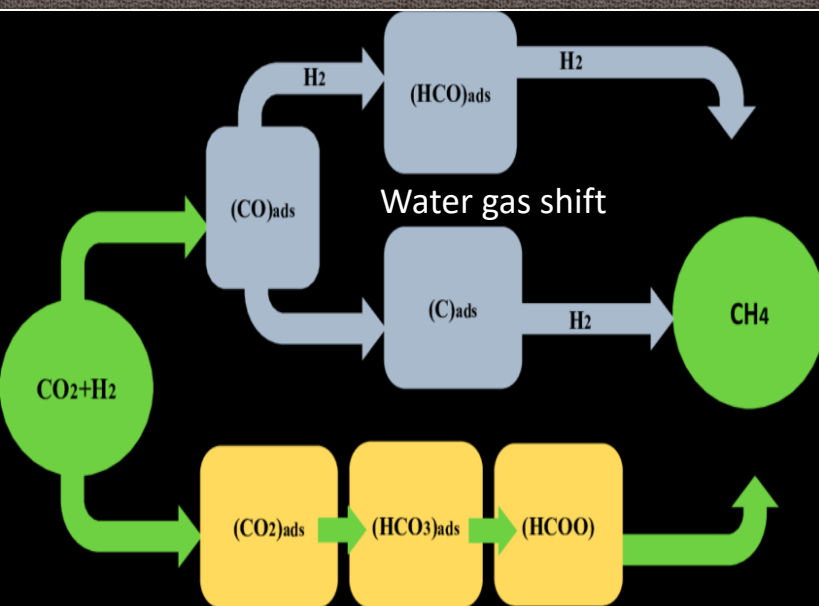
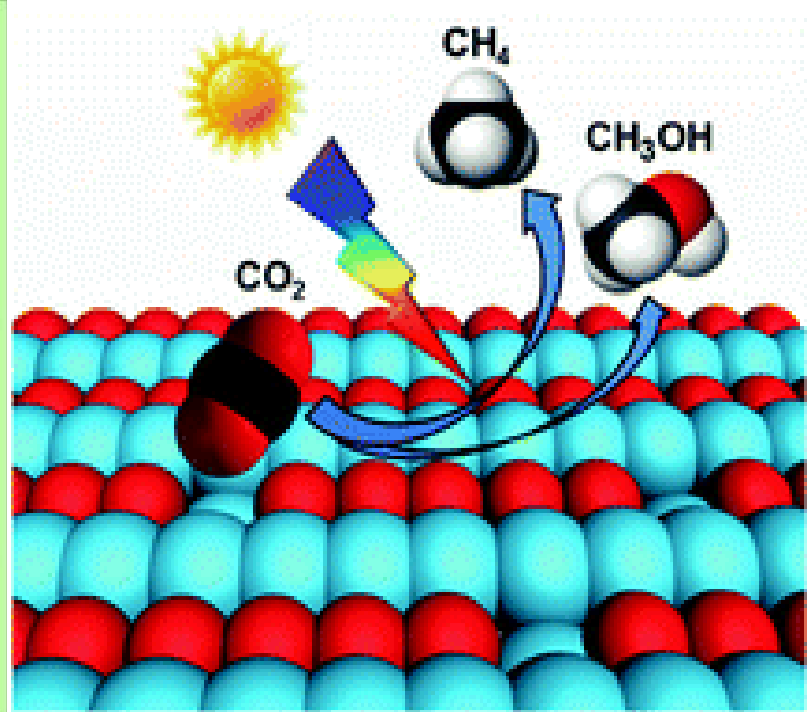
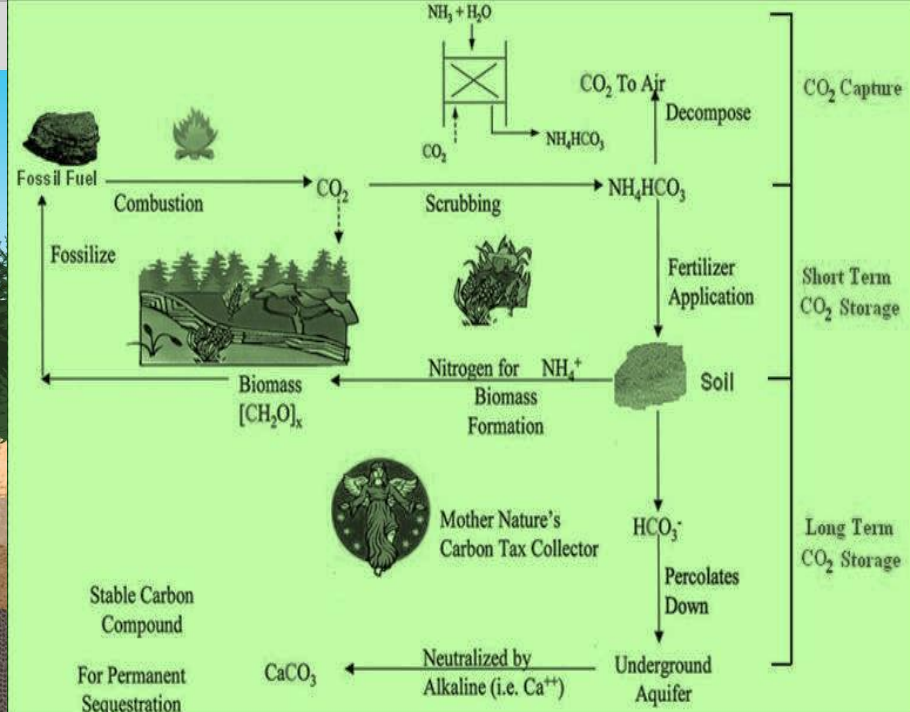
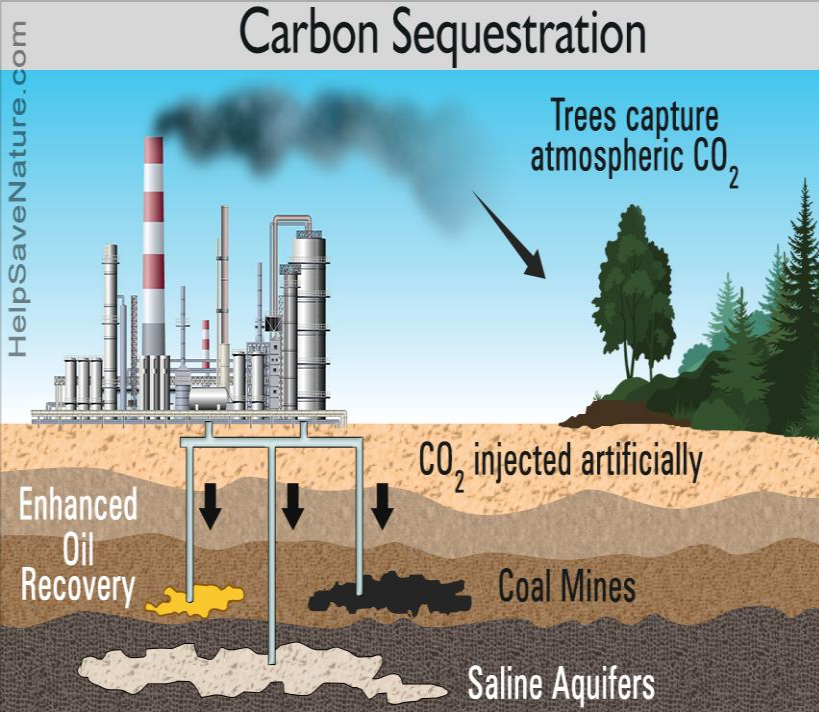
- 1- Planting trees
- 2- Forest management
- 3- Agricultural practices
- 4- Biomass energy with carbon capture and storage
- 5- Drive less



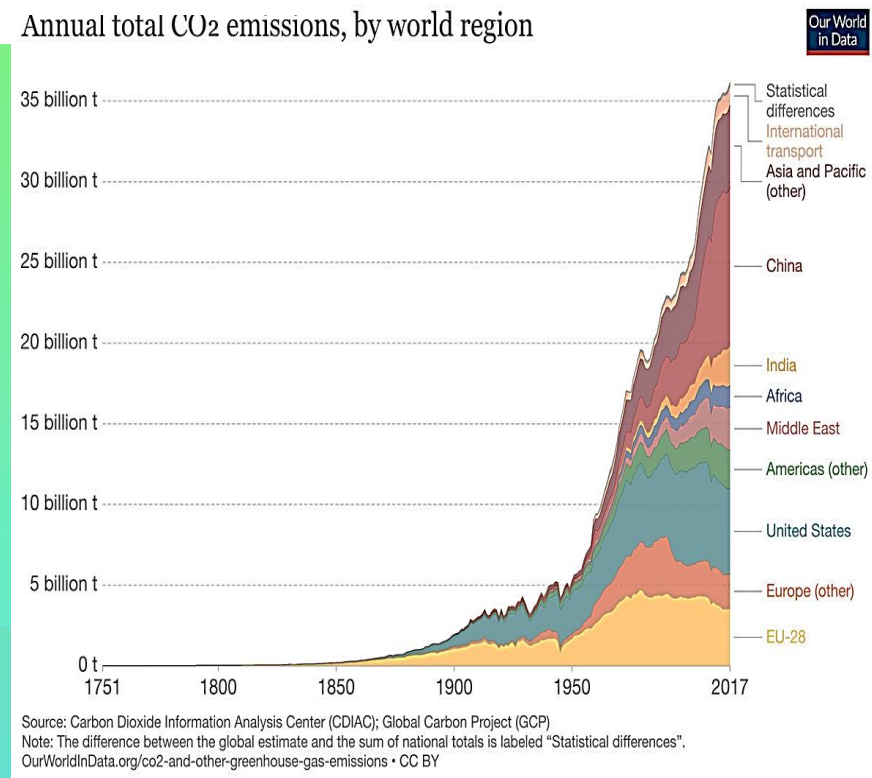
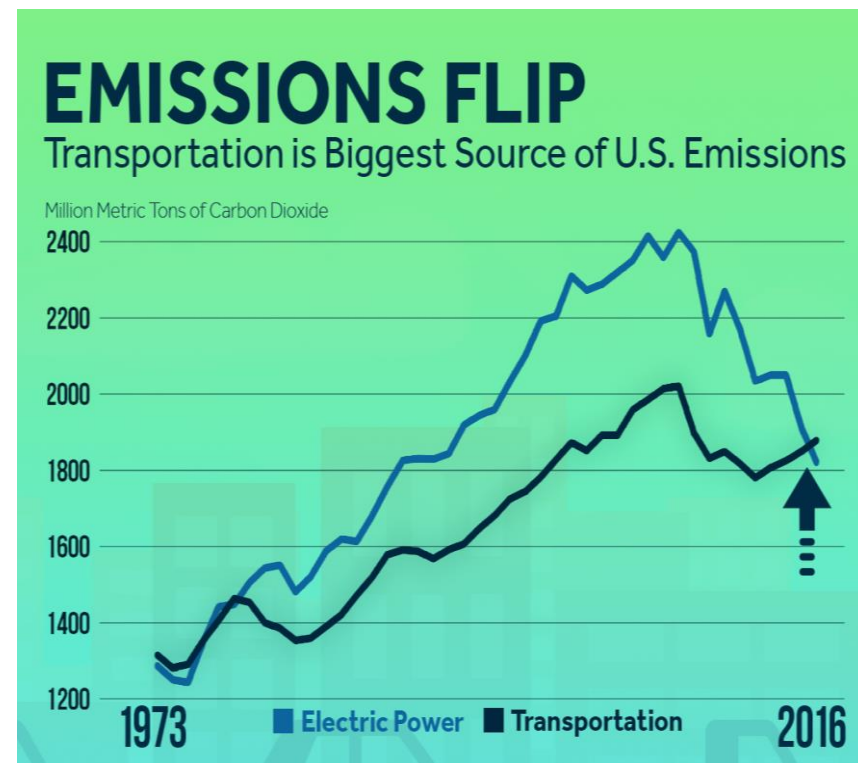
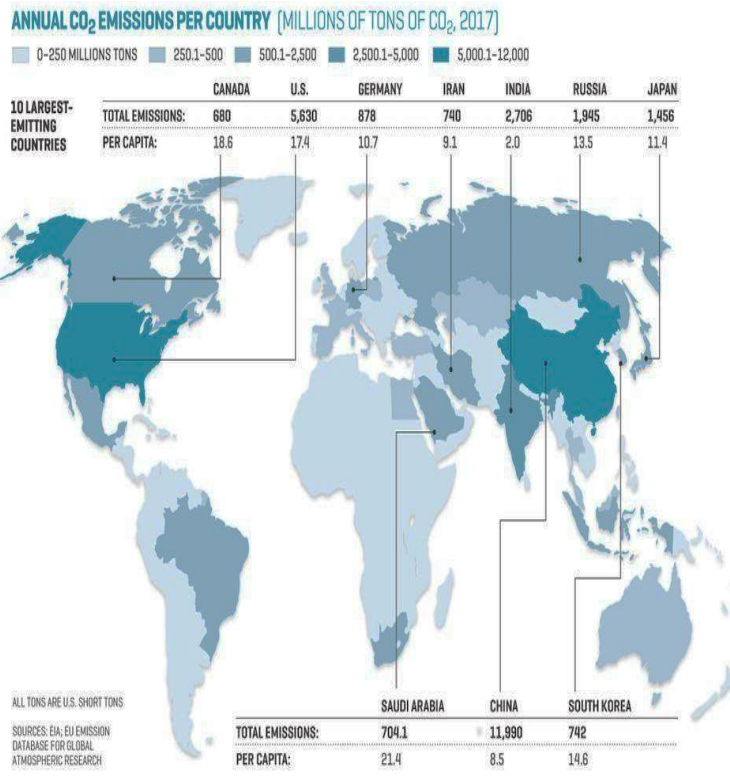
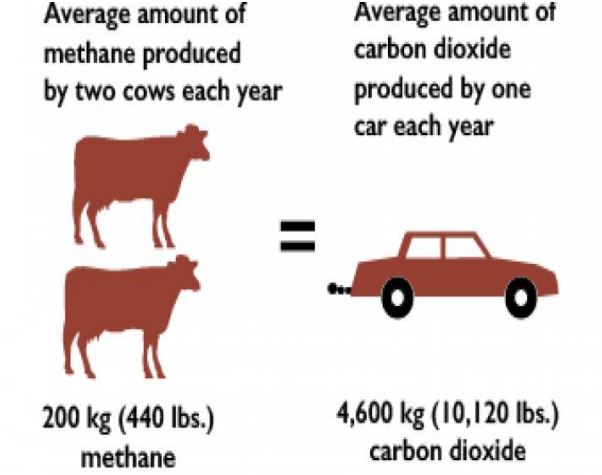
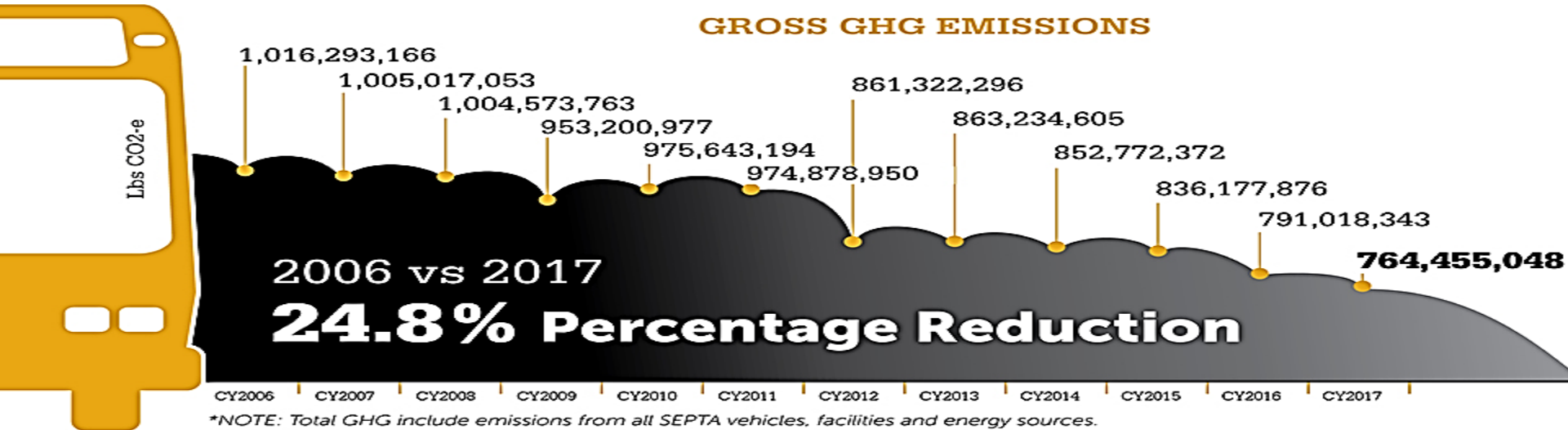
Carbon sequestration or carbon dioxide removal (CDR) is the long-term removal, capture or sequestration of carbon dioxide from the atmosphere to slow or reverse atmospheric CO₂ pollution and to mitigate or reverse global warming.

Fugitive Emission



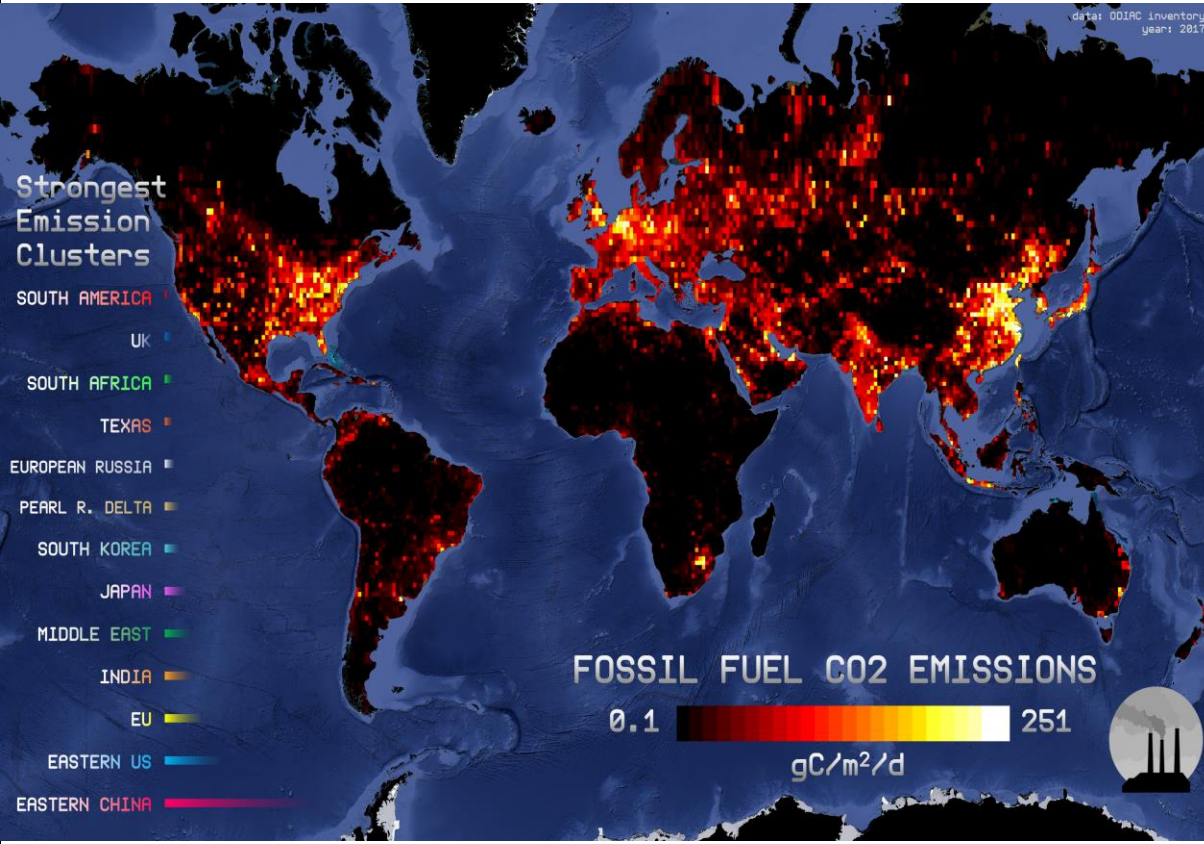
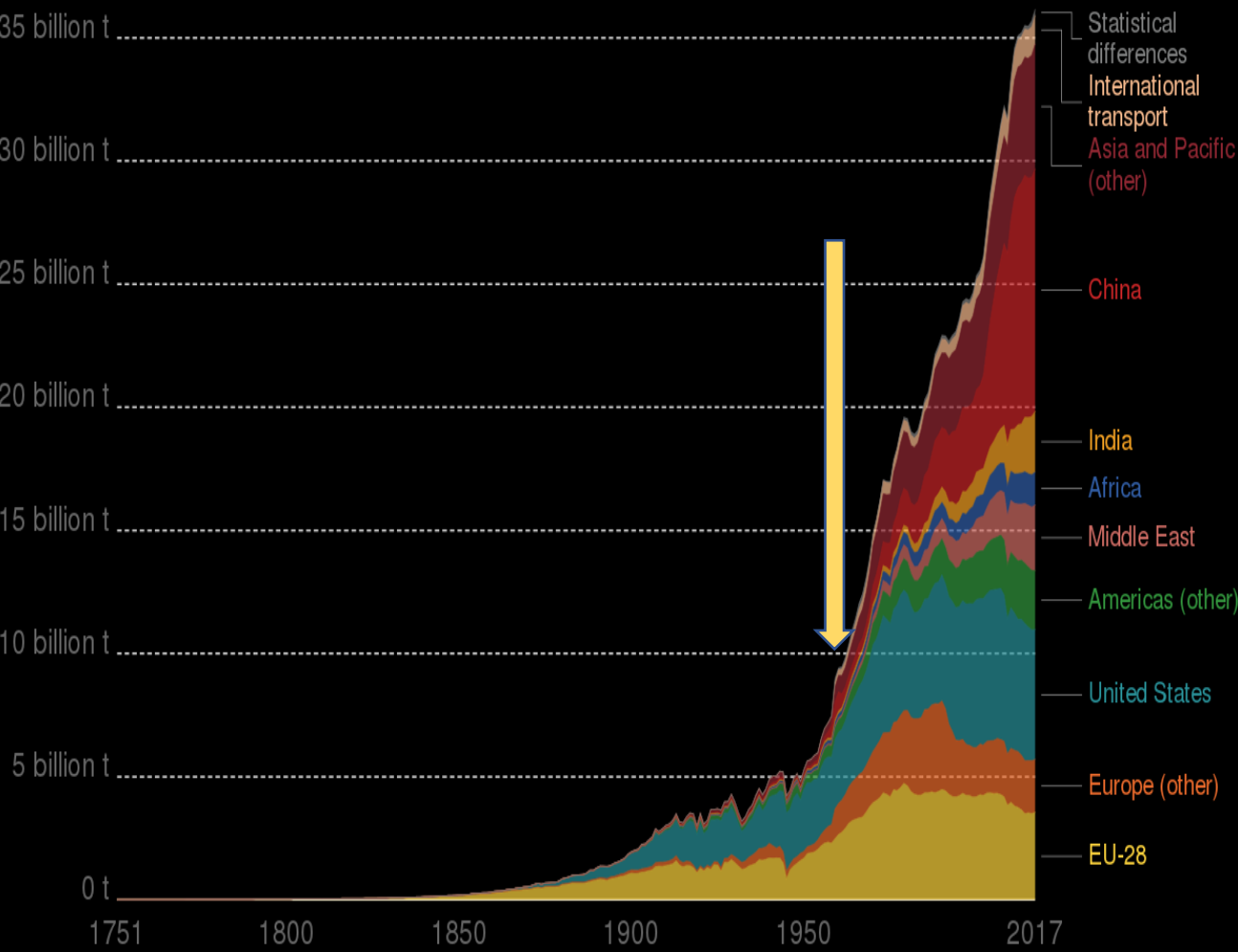


Human Impact On The Environment



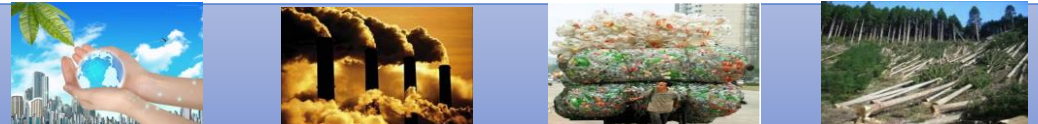
Annual total CO₂ emissions, by world region

Our World
in Data



Source: Carbon Dioxide Information Analysis Center (CDIAC); Global Carbon Project (GCP)
 Note: "Statistical differences" notes the discrepancy between estimated global emissions and the sum of all national and international transport emissions.

Human Impact On The Environment



1- Wind



2- Hydropower



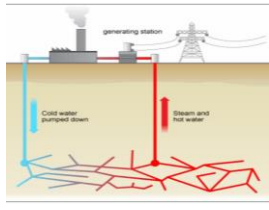
3- Solar



4- Renewable fuel



5- Geothermal



6- Hydrogen



6- Nuclear



Renewable
ENERGY SOLUTION

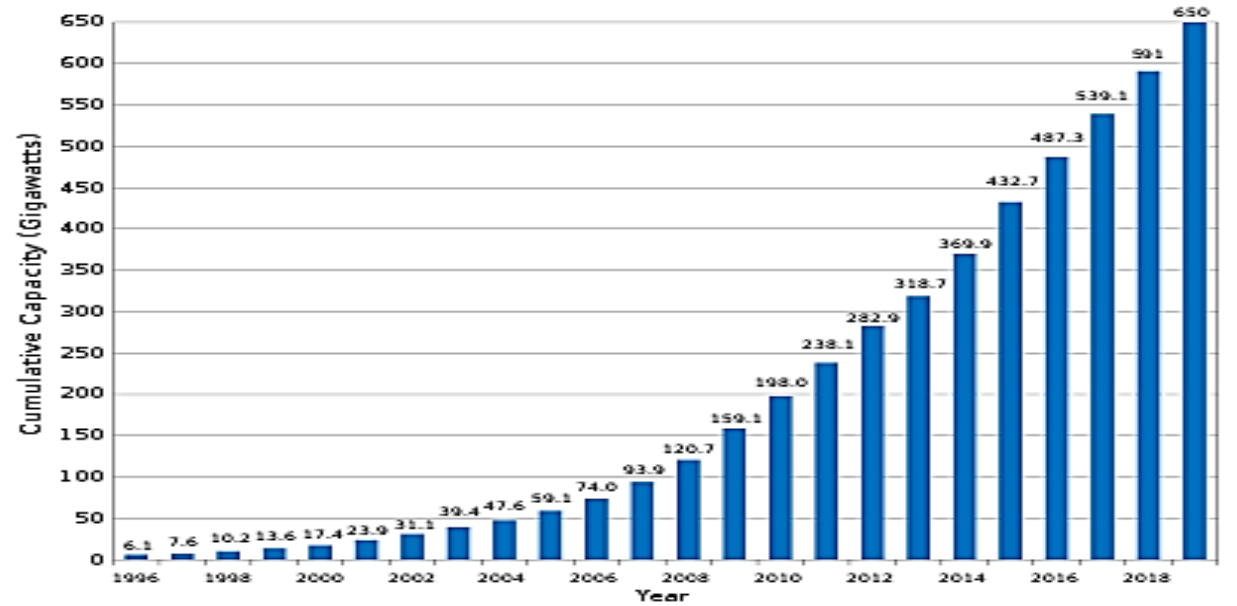
Human Impact On The Environment



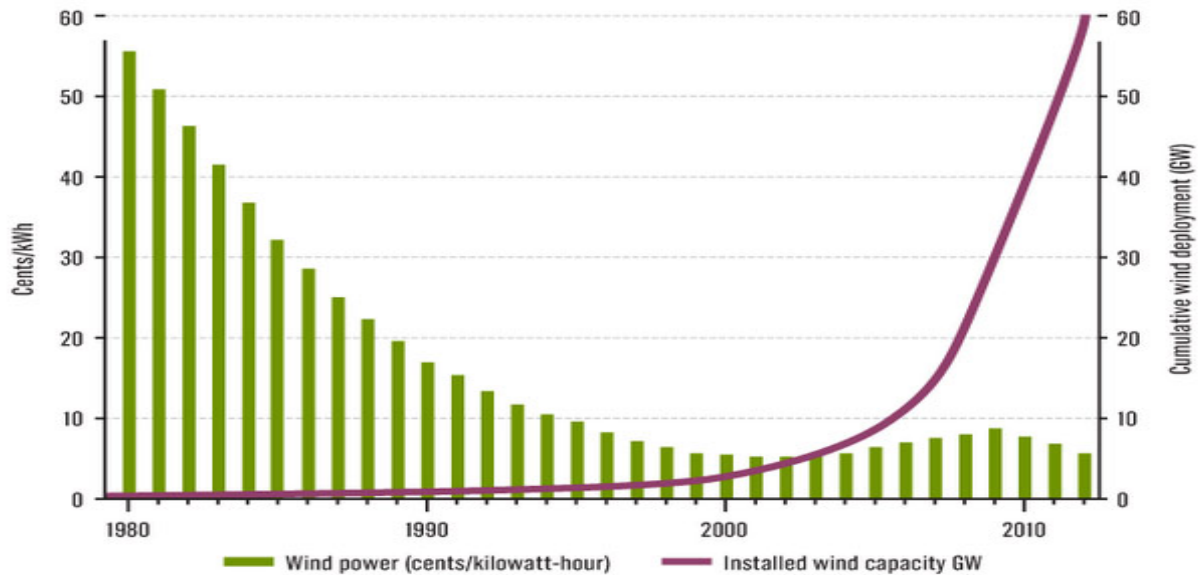


Five of the ten largest wind farms in the world are operated in the US. Two offshore wind farms have made the list, while the remaining eight are onshore.

Global Wind Power Cumulative Capacity (Data: GWEC)

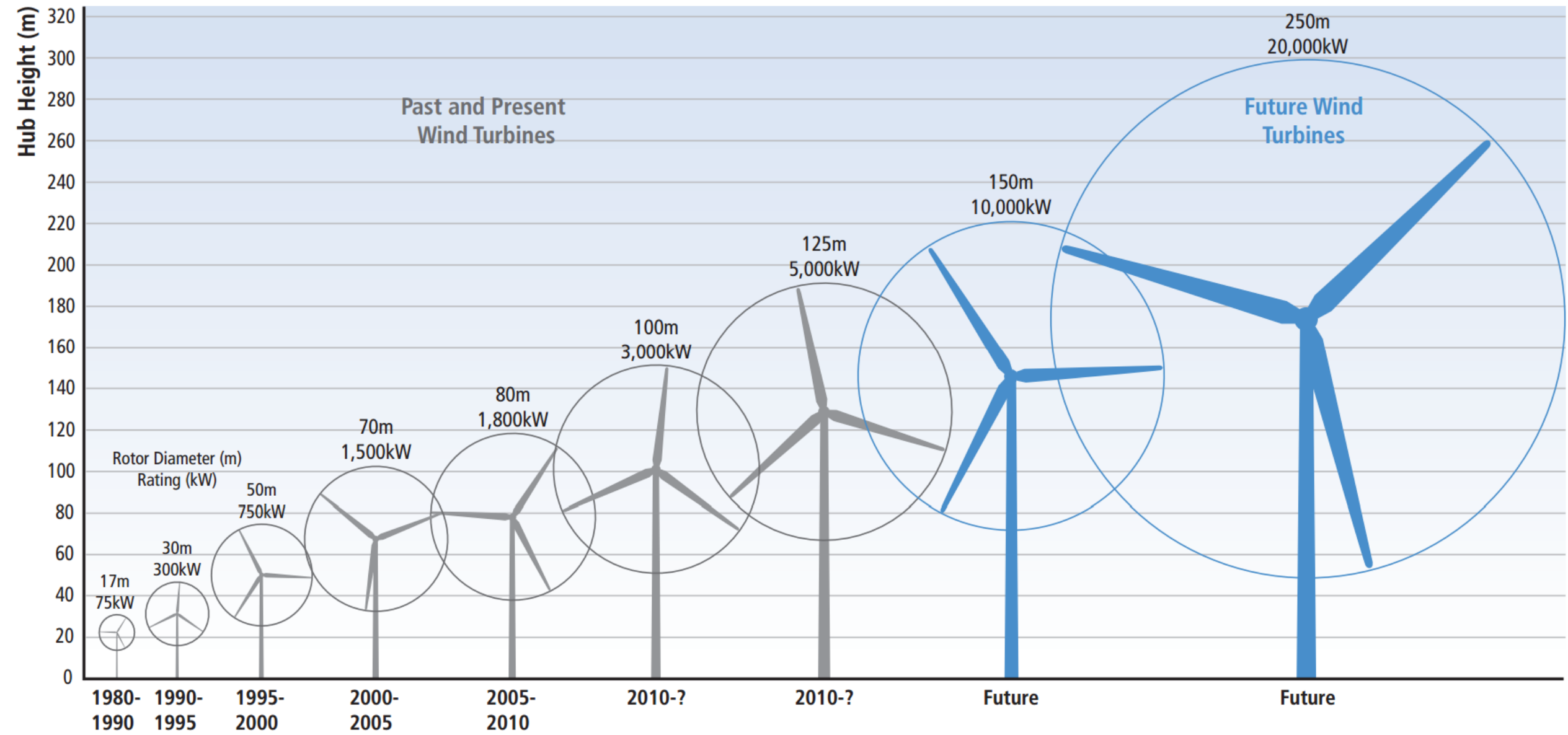


Deployment and cost for US land-based wind 1980-2012

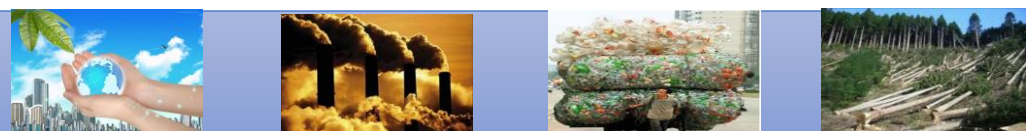


Human Impact On The Environment





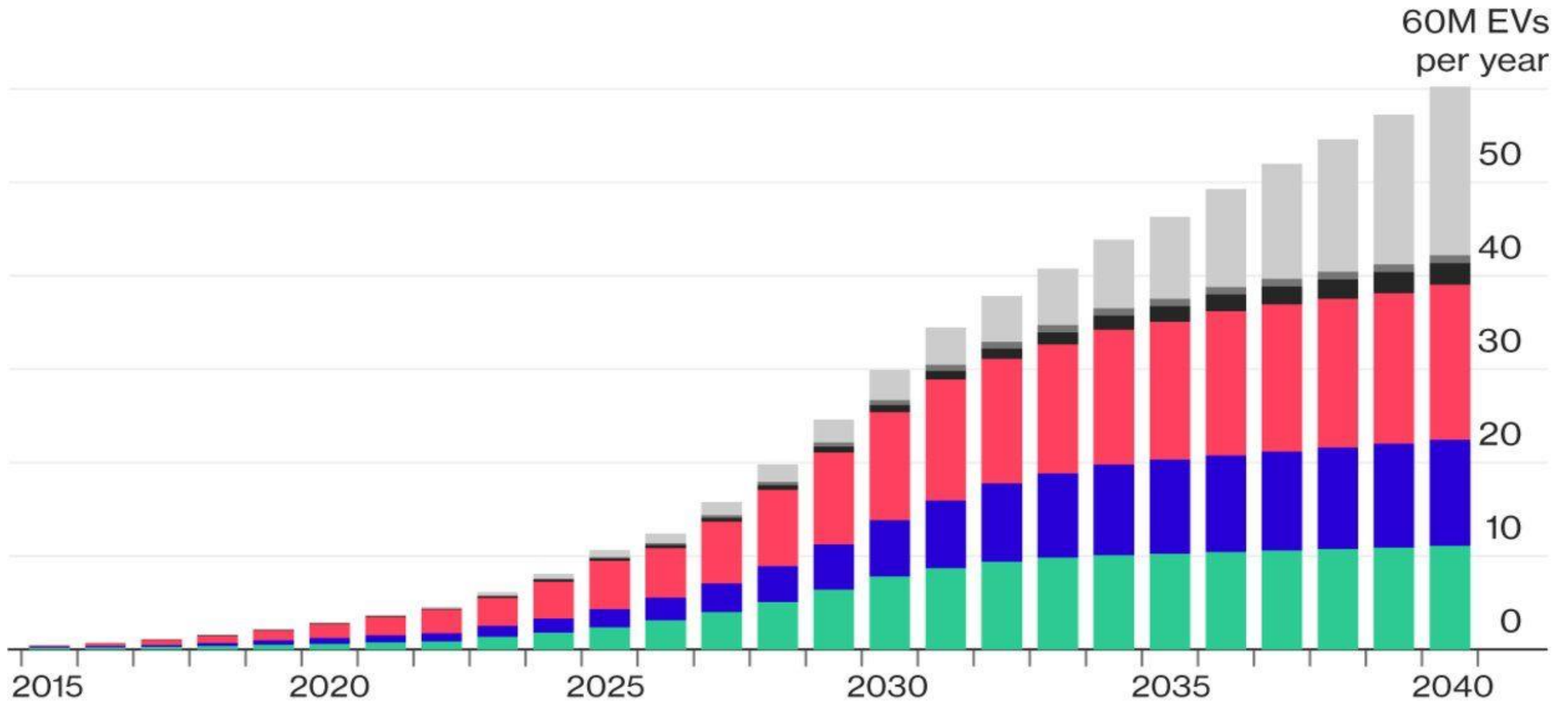
Human Impact On The Environment



Global Electric-Car Revolution Set to Take Off

China set to lead EV market

Europe U.S. China Japan South Korea Rest of World



Source: Bloomberg New Energy Finance

Bloomberg

Human Impact On The Environment





The Three Gorges Dam in Hubei, China, has the world's largest instantaneous generating capacity (**22,500 MW**), with the Itaipu Dam in Paraguay/Brazil in second place (**14,000 MW**).

Iraq Hydroelectric

Name	Location	Capacity (MW)
Adhaim Dam	Saladin Governorate	27
Darbandikhan Dam	Sulaymaniyah Governorate	249
Dukan Dam	Sulaymaniyah Governorate	400
Haditha Dam	Al Anbar Governorate	660
Hemrin Dam	Diyala Governorate	50
Samarra Barrage	Salah ad Din Governorate	84
Mosul Dam	Nineveh Governorate	1,052
Mosul Dam Regulator	Nineveh Governorate	62
TOTAL		2,584

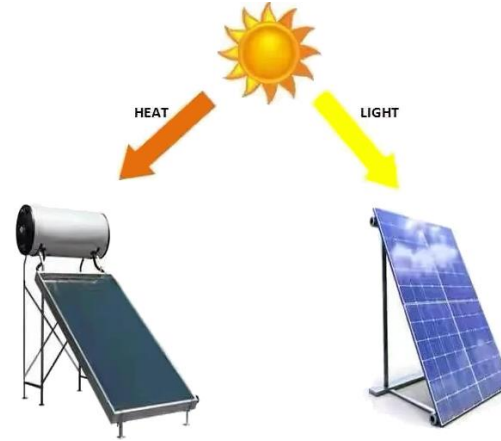


Human Impact On The Environment



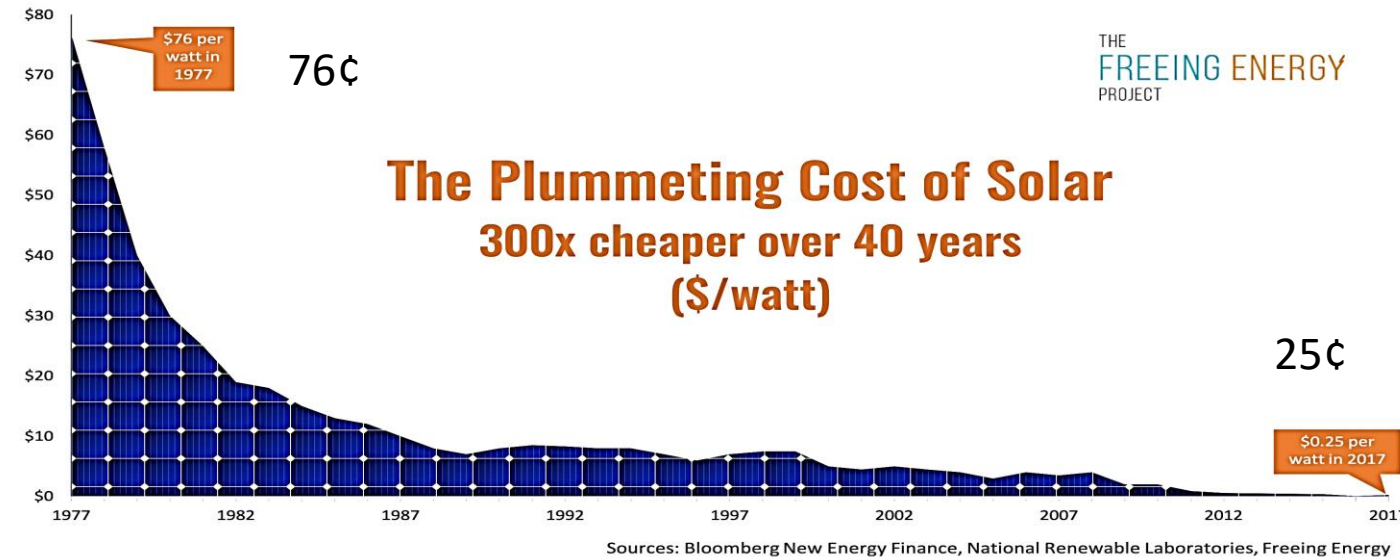


Solar thermal technology, which captures the sun's heat. This heat is used directly or converted into mechanical energy and in turn electricity, known as concentrated solar power



Photovoltaic solar technology, which directly converts sunlight into electricity using panels made of semiconductor cells.

More recent cost of KW/H
 Portugal 1.32 ¢
 Saudi Arabia 1.04¢

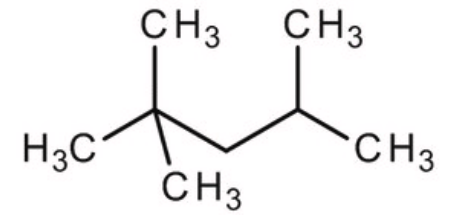
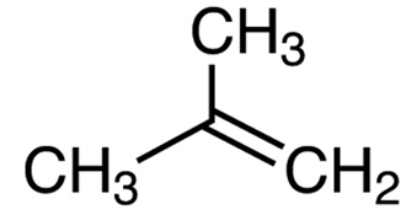
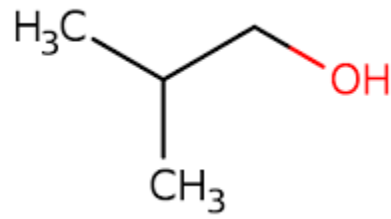


Human Impact On The Environment





Glucose



solar energy

Photosynthesis

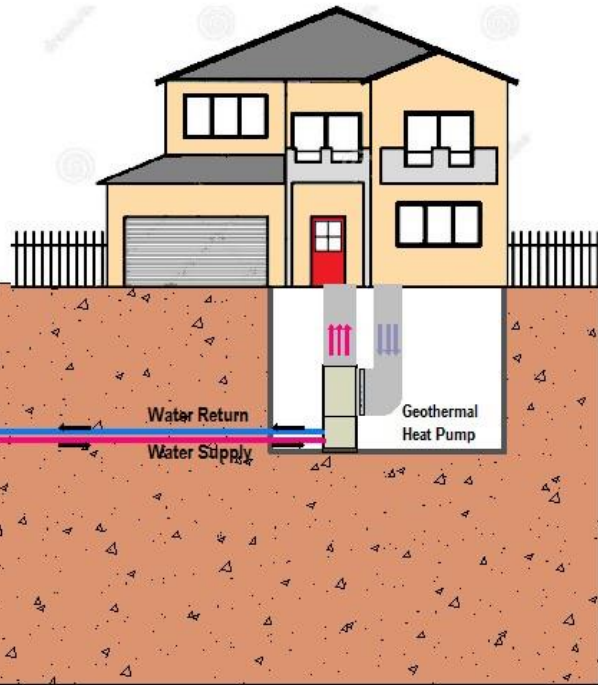


Human Impact On The Environment



Closed Loop System

In heating mode, heat from the ground is absorbed by the water which circulates through the heat pump, which transfers that heat to the house and the cooler water returns to the ground to absorb more heat.



Geothermal power is power generated by geothermal energy. Technologies in use include **dry steam power stations**, **flash steam power stations**, and **binary cycle power stations**. Geothermal electricity generation is currently used in 26 countries, while geothermal heating is in use in 70 countries.

As of 2015, worldwide geothermal power capacity amounts to **12.8 gigawatts (GW)**, of which 28 percent or **3,548 megawatts (MW)** are installed in the **United States**.

Countries generating more than **15 percent** of their electricity from geothermal sources include **El Salvador, Kenya, the Philippines, Iceland, New Zealand, and Costa Rico**.

Human Impact On The Environment



Types of Hydrogen

Grey hydrogen

Split natural gas into CO_2 and hydrogen

CO_2 emitted in the atmosphere

Blue hydrogen

Split natural gas into CO_2 and hydrogen
Residual gasses also in H-vision scope

CO_2 stored or re-used

Green hydrogen

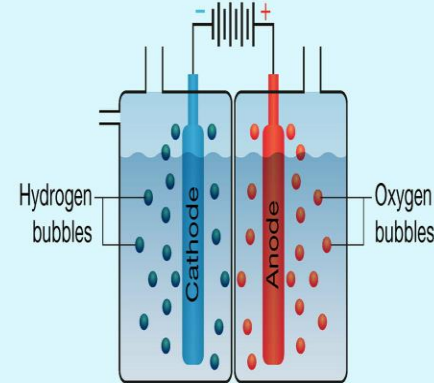
Split water into hydrogen by electrolysis powered by wind and sun

No CO_2 emitted



Designing a novel catalyst for splitting water molecules

Electrolysis of water can be used as a renewable source of energy, but this process requires an **overpotential**.

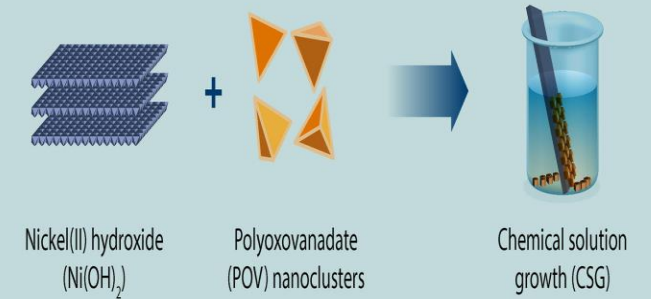


Catalysts like non-precious metal oxides/hydroxides can enhance electrolysis via engineering morphological/electrochemical properties, but are...

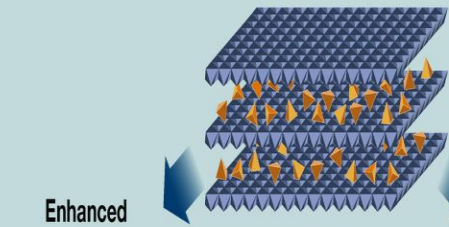


Novel catalysts made with common materials are desired.

Synthesis of a novel catalyst



Intercalation of $\text{Ni}(\text{OH})_2$ layers with POV nanoclusters.



Enhanced morphological and electrical properties.

Potential use of CSG method for production of Li-ion Batteries and Biosensors.

Excellent catalyst for electrolysis.

Two-Dimensional Layered Hydroxide Nanoporous Nanohybrids Pillared with Zero-Dimensional Polyoxovanadate Nanoclusters for Enhanced Water Oxidation Catalysis

Gunjakar et al. (2018)

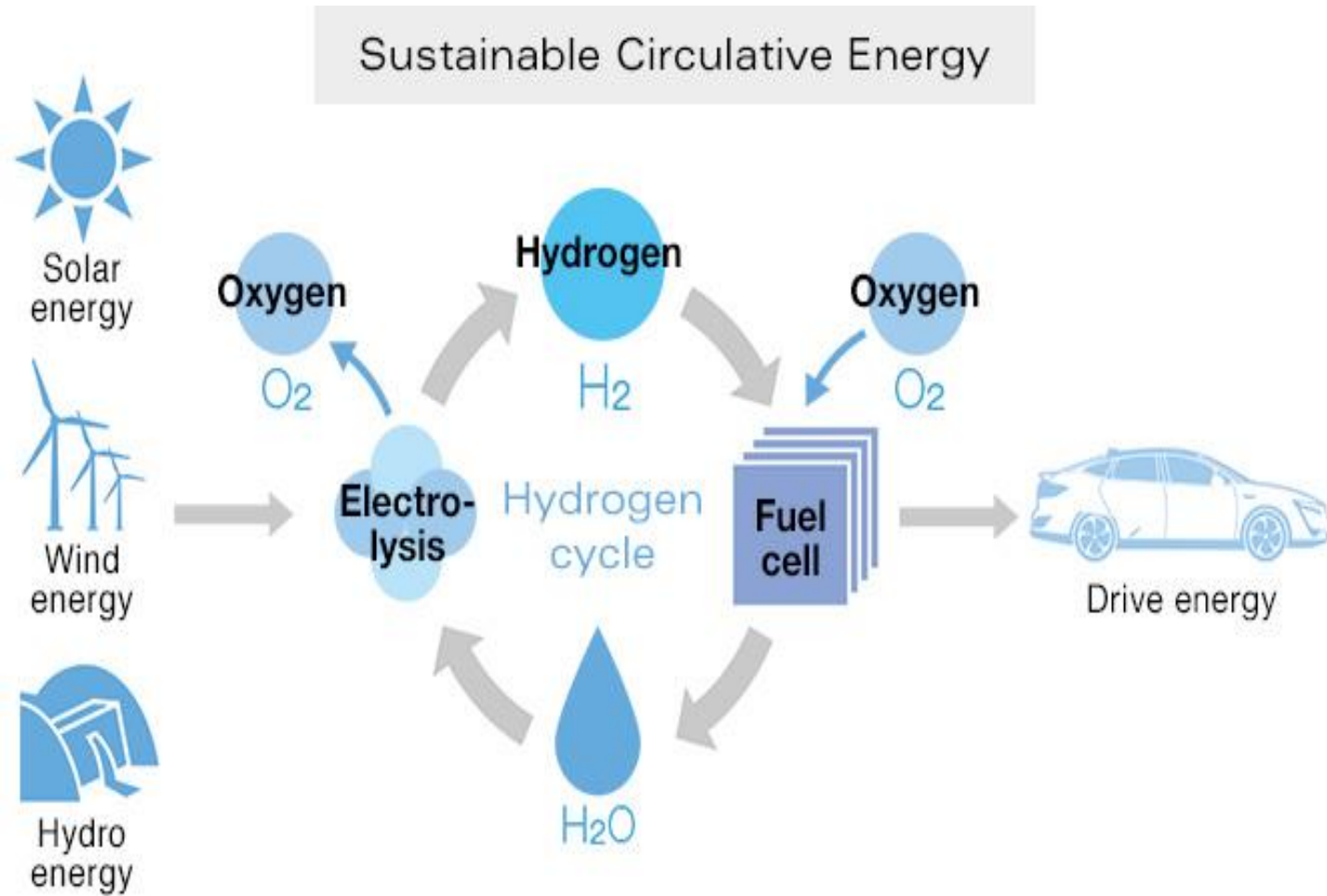
Journal: Small DOI: 10.1002/smll.201703481



Human Impact On The Environment

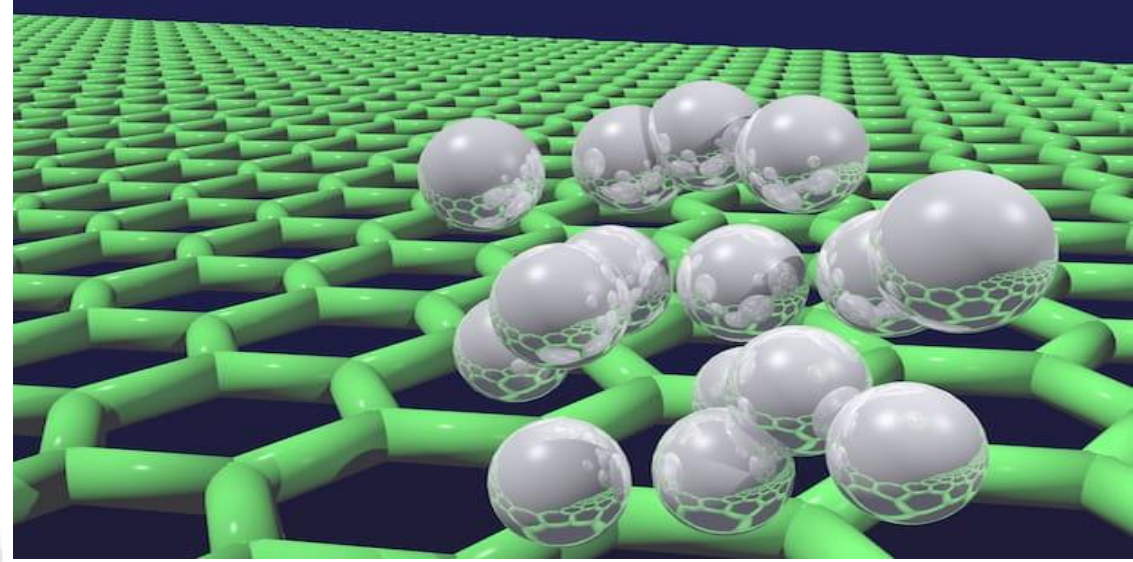


The Future



\$5 Bn Green Hydrogen Project to Come up in Saudi Arabia

650 million kg



Energix Energy is moving forward with plans to build a **\$5.4 billion** facility off the coast of Brazil called Base One. And that's news because the company claims that Base One **will be the world's biggest** individual CO2 reducer by generating more than **600 million kg** of green hydrogen per year by the time it's fully operational in 2025.

Human Impact On The Environment





Human Impact On The Environment

