
ORDEM
DOS
ENGENHEIROS
2013
ANO OE
ENERGIA E
CLIMA

Energia no Mundo

Desafios

João Francisco Fernandes
Escola Superior de Tecnologia de Setúbal
Instituto Politécnico de Setúbal – Polytecnic University

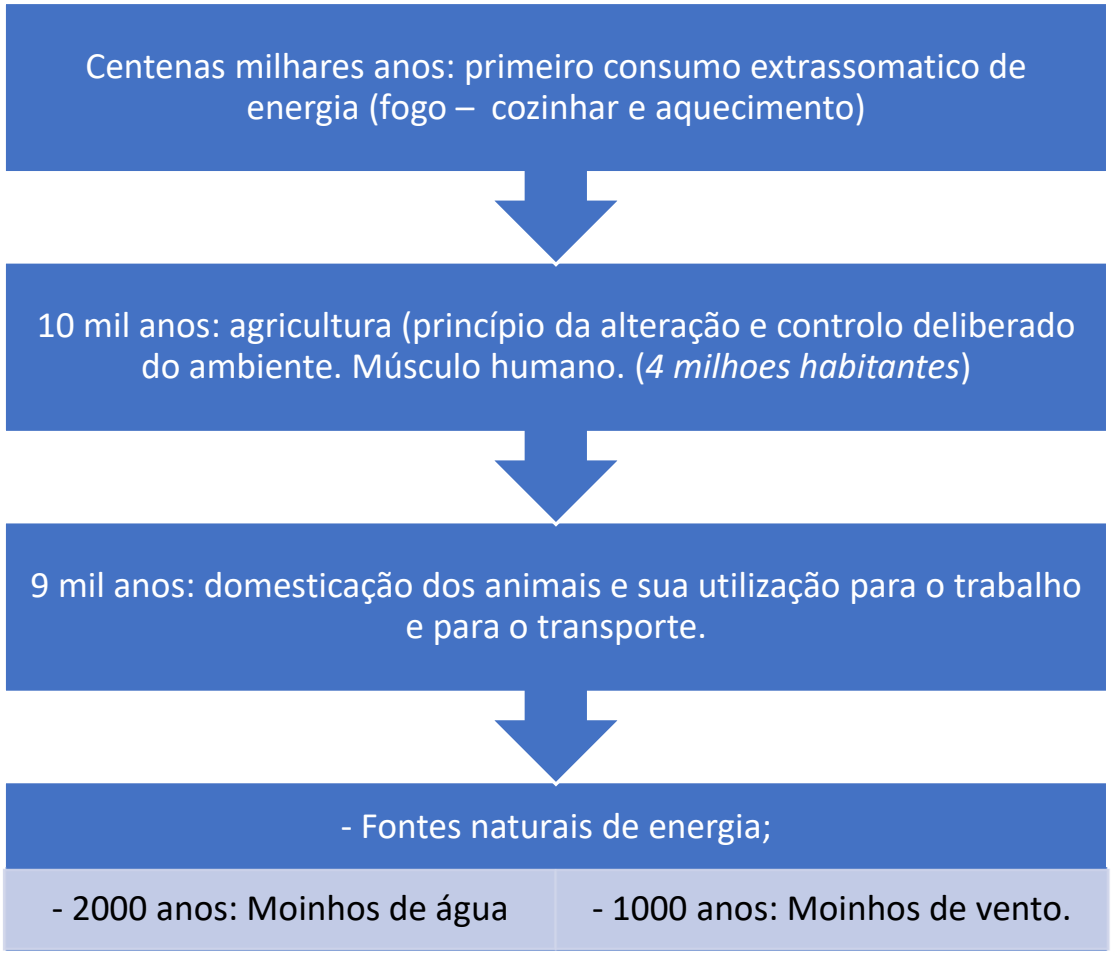
ORDEM DOS ENGENHEIROS

ANO OE ENERGIA E CLIMA

Emissões e alterações climáticas

Preços da Energia

Uso da energia ao longo da história humana I



até 1600: energia térmica proveniente combustíveis vegetais, energia mecânica proveniente de pessoas e animais.

Depois de 1600: utilização crescente do carvão fossil (Inglaterra))

1700 primeiros motores a vapor em minas de carvão (combustão de carvão)

1800: combustível vegetal representa 98% da produção de calor e iluminação. Pessoas e animais 90% da energia mecânica.

1900: metade da energia mecânica: motores a vapor (carvão), noras e turbinas hídricas, moinhos de vento, turbinas a vapor e motores de combustão interna.

Em 1950: combustíveis fósseis 3/4 energia primária, motores de combustão representam 80% energia mecânica

1800: 1 bilião de habitantes (0.05 GJ per capita)

1900: 1.6 biliões (2.7 GJ per capita)

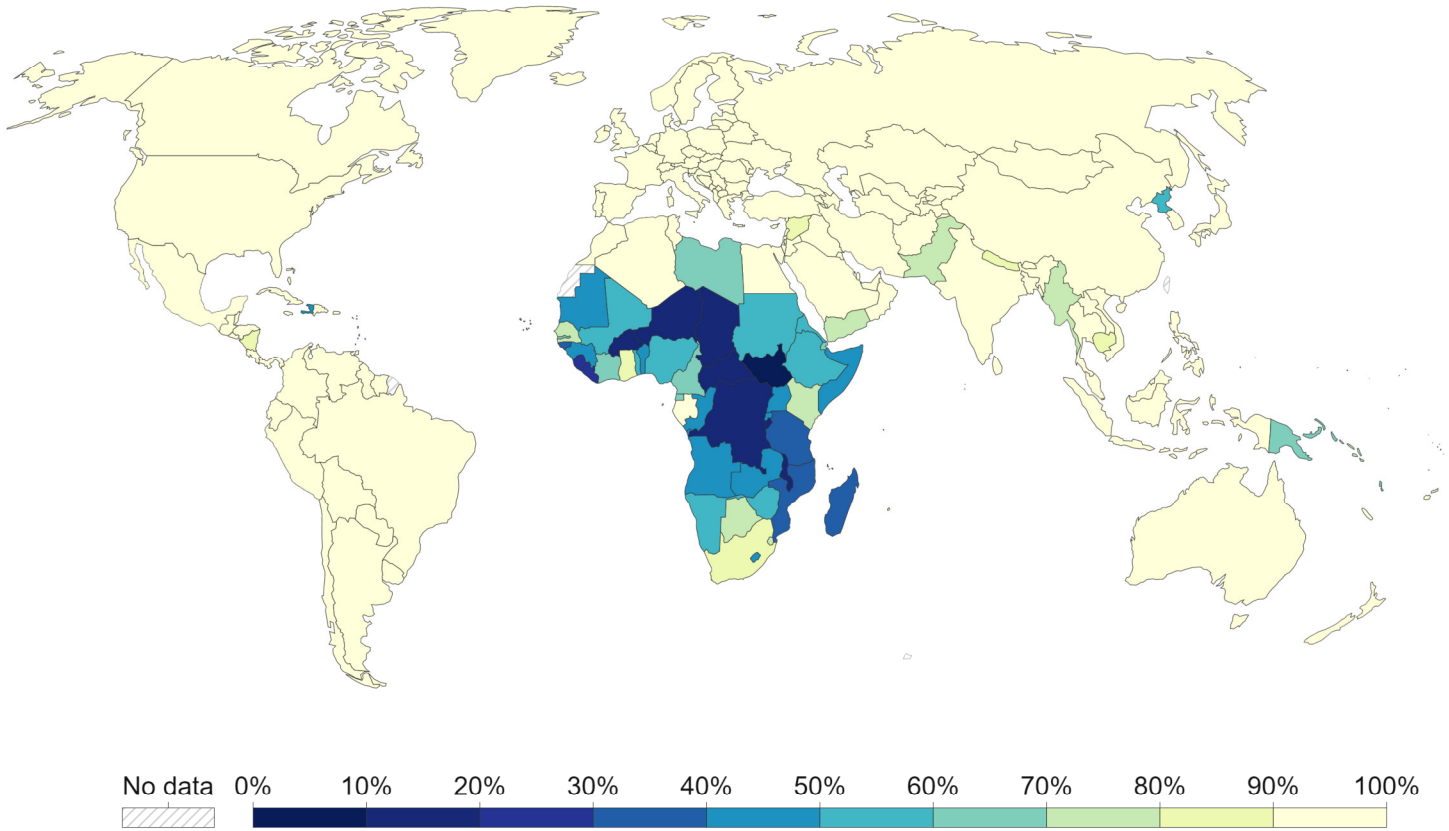
2000: 6.1 biliões (28 GJ per capita), (mas EUA 150 GJ, Japao 80 GJ, China 50GJ)

Conclusão 1:

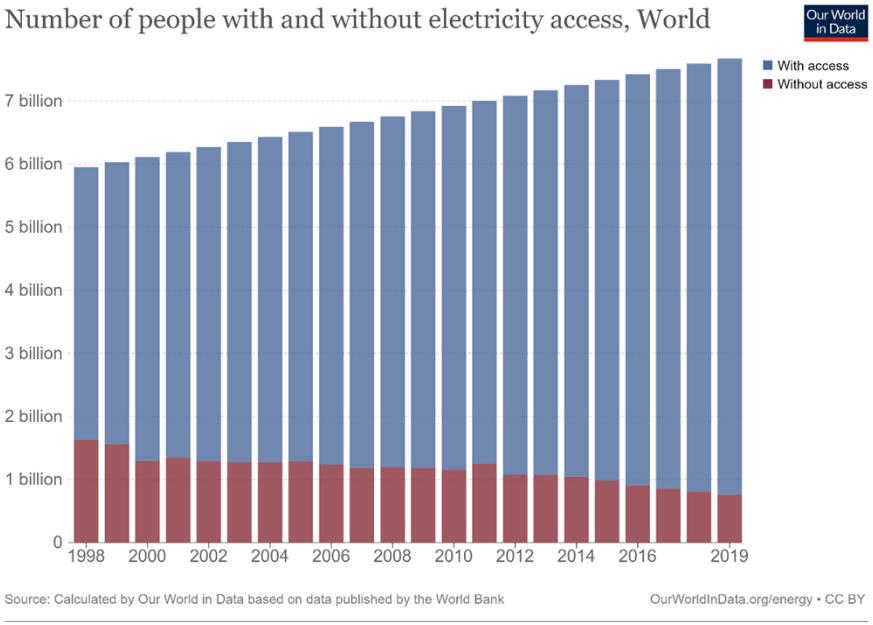
O progresso social, económico e tecnológico dos últimos 300 anos, e em particular, nos últimos 100 anos não tem qualquer equivalente histórico, e fez-se alicerçado na energia.

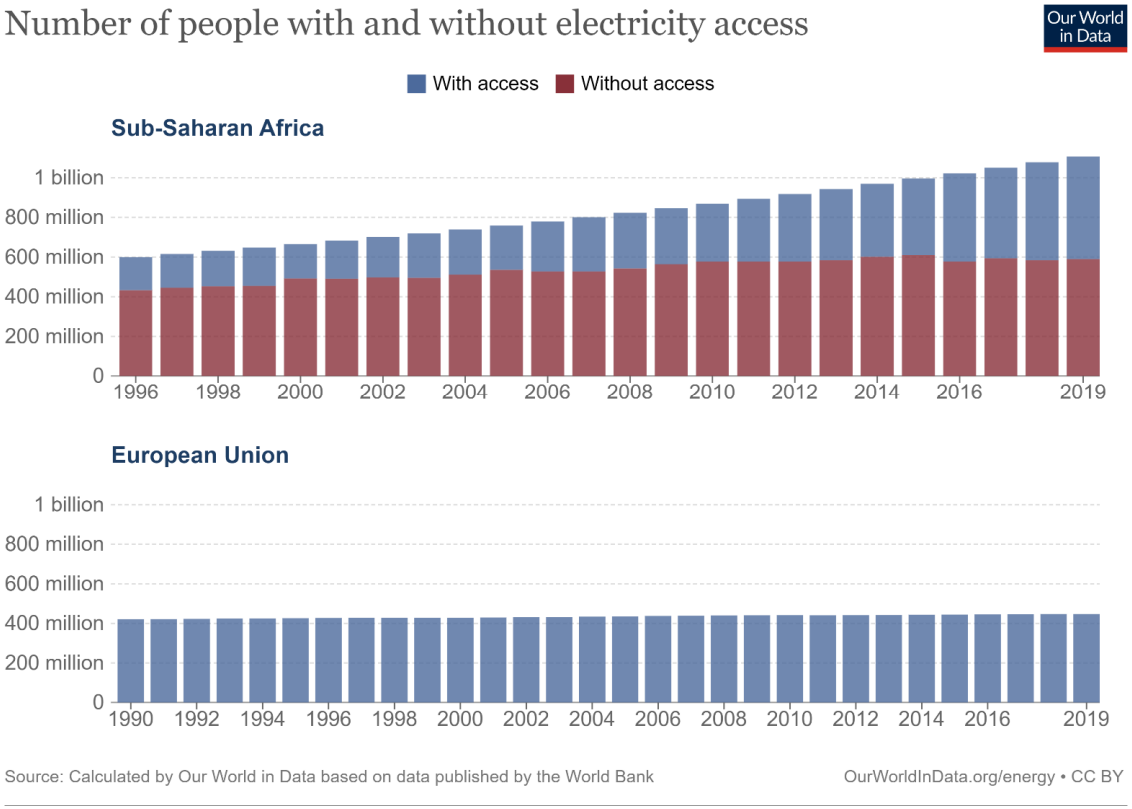
Electricity access, 2020

Share of the population with access to electricity. The definition used in international statistics adopts a very low cutoff for what it means to 'have access to electricity'. It is defined as having an electricity source that can provide very basic lighting, and charge a phone or power a radio for 4 hours per day.



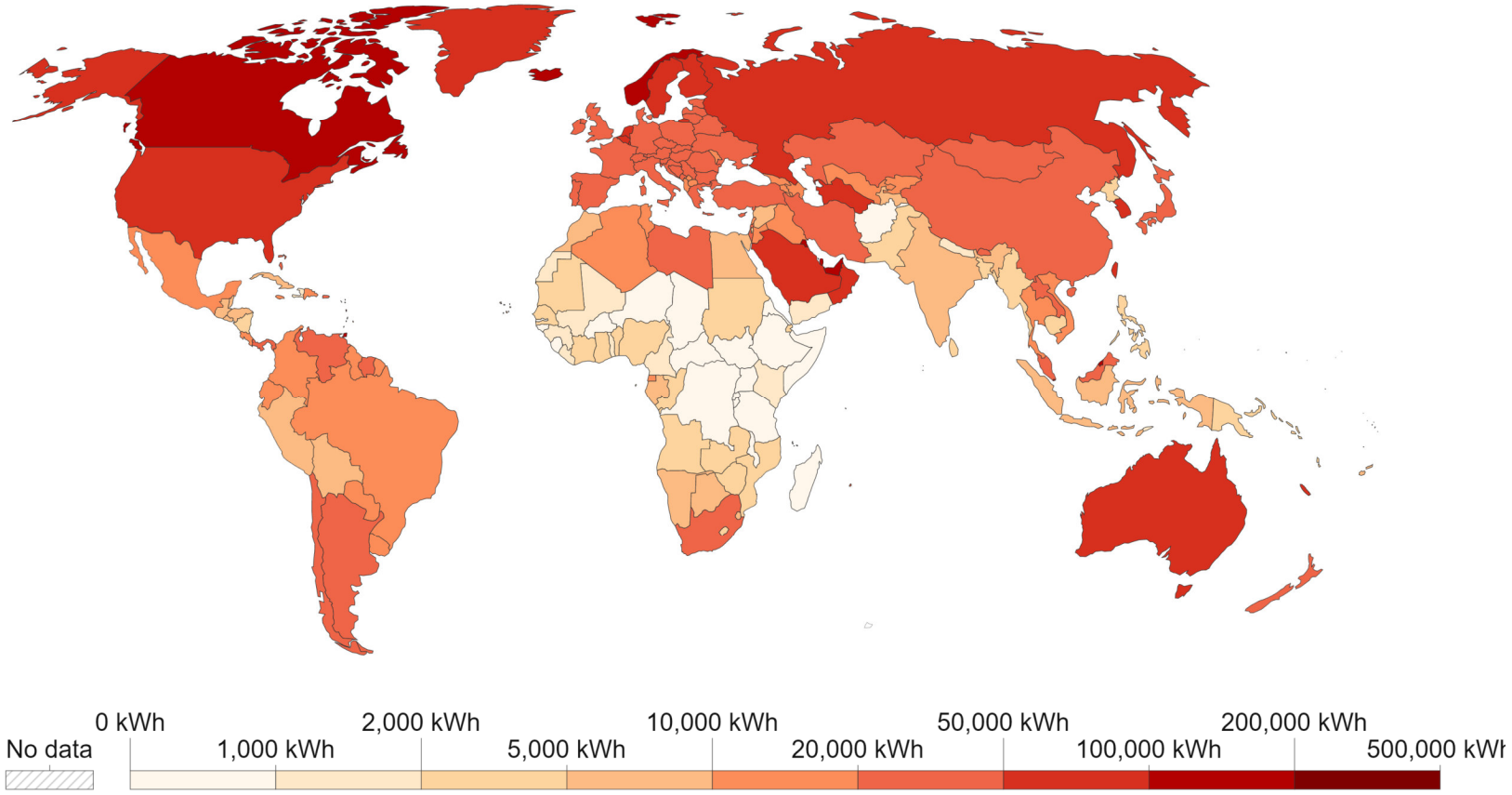
Source: World Bank


Number of people with and without electricity access, World
Our World in Data
With access
Without access
7 billion
6 billion
5 billion
4 billion
3 billion
2 billion
1 billion
0
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2019
Source: Calculated by Our World in Data based on data published by the World Bank
OurWorldInData.org/energy • CC BY


Number of people with and without electricity access
Our World in Data
With access
Without access
Sub-Saharan Africa
1 billion
800 million
600 million
400 million
200 million
0
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2019
European Union
1 billion
800 million
600 million
400 million
200 million
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2019
Source: Calculated by Our World in Data based on data published by the World Bank
OurWorldInData.org/energy • CC BY

Energy use per person, 2021

Energy use not only includes electricity, but also other areas of consumption including transport, heating and cooking.



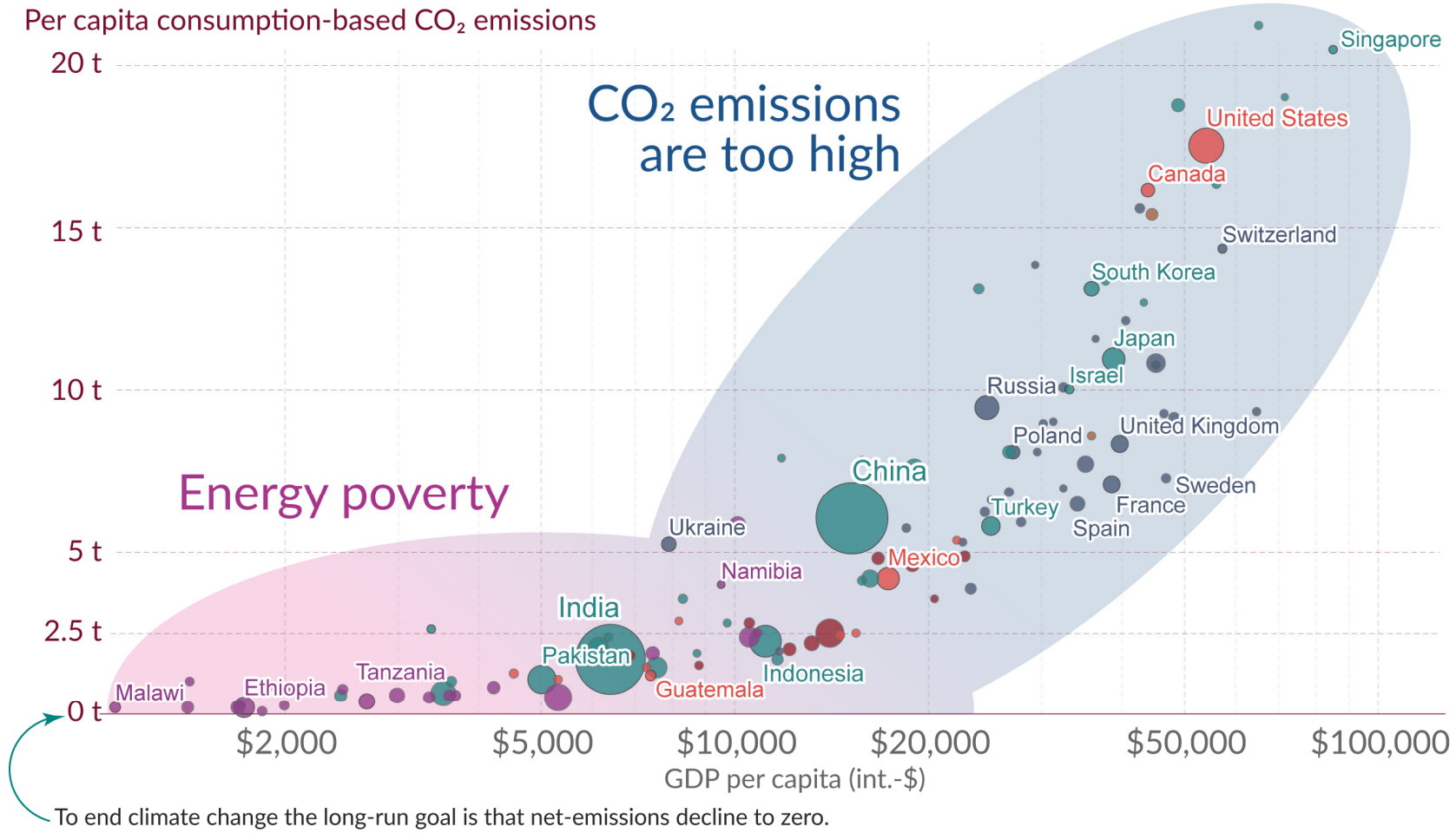
Source: Our World in Data based on BP & Shift Data Portal

OurWorldInData.org/energy • CC BY

Note: Energy refers to primary energy – the energy input before the transformation to forms of energy for end-use (such as electricity or petrol for transport).

CO_2 emissions per capita vs GDP per capita

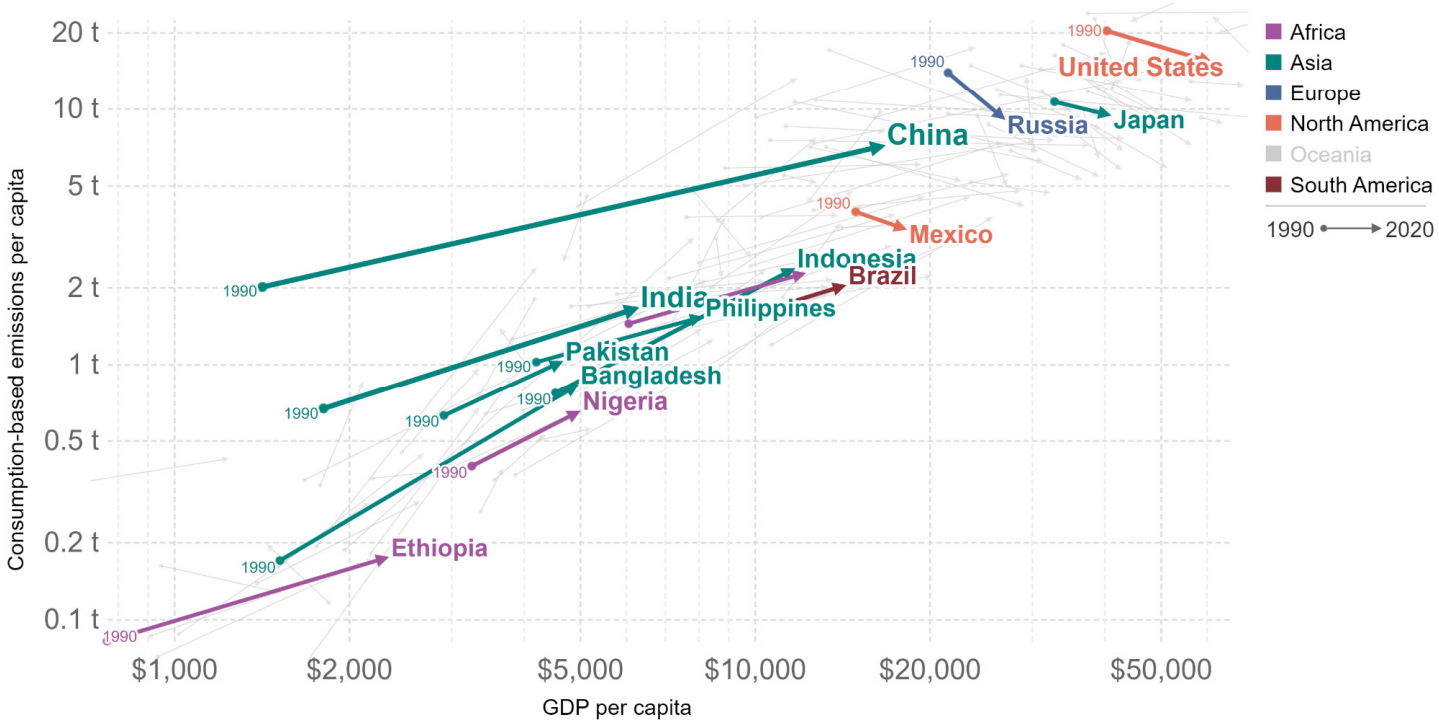
Our World in Data



Data for 2017: Global Carbon Project, UN Population, and World Bank.

Consumption-based CO_2 emissions per capita vs GDP per capita, 1990 to 2020

– Consumption-based emissions[1] are national emissions that have been adjusted for trade. It's production-based emissions minus emissions embedded in exports, plus emissions embedded in imports.
– GDP per capita is adjusted for price differences between countries (PPP) and over time (inflation).



Source: Our World in Data based on the Global Carbon Project; Data compiled from multiple sources by World Bank
OurWorldInData.org/co2-and-greenhouse-gas-emissions • CC BY

1. Consumption-based emissions: Consumption-based emissions are national or regional emissions that have been adjusted for trade. They are calculated as domestic (or 'production-based' emissions) emissions minus the emissions generated in the production of goods and services that are exported to other countries or regions, plus emissions from the production of goods and services that are imported. Consumption-based emissions = Production-based – Exported + Imported emissions

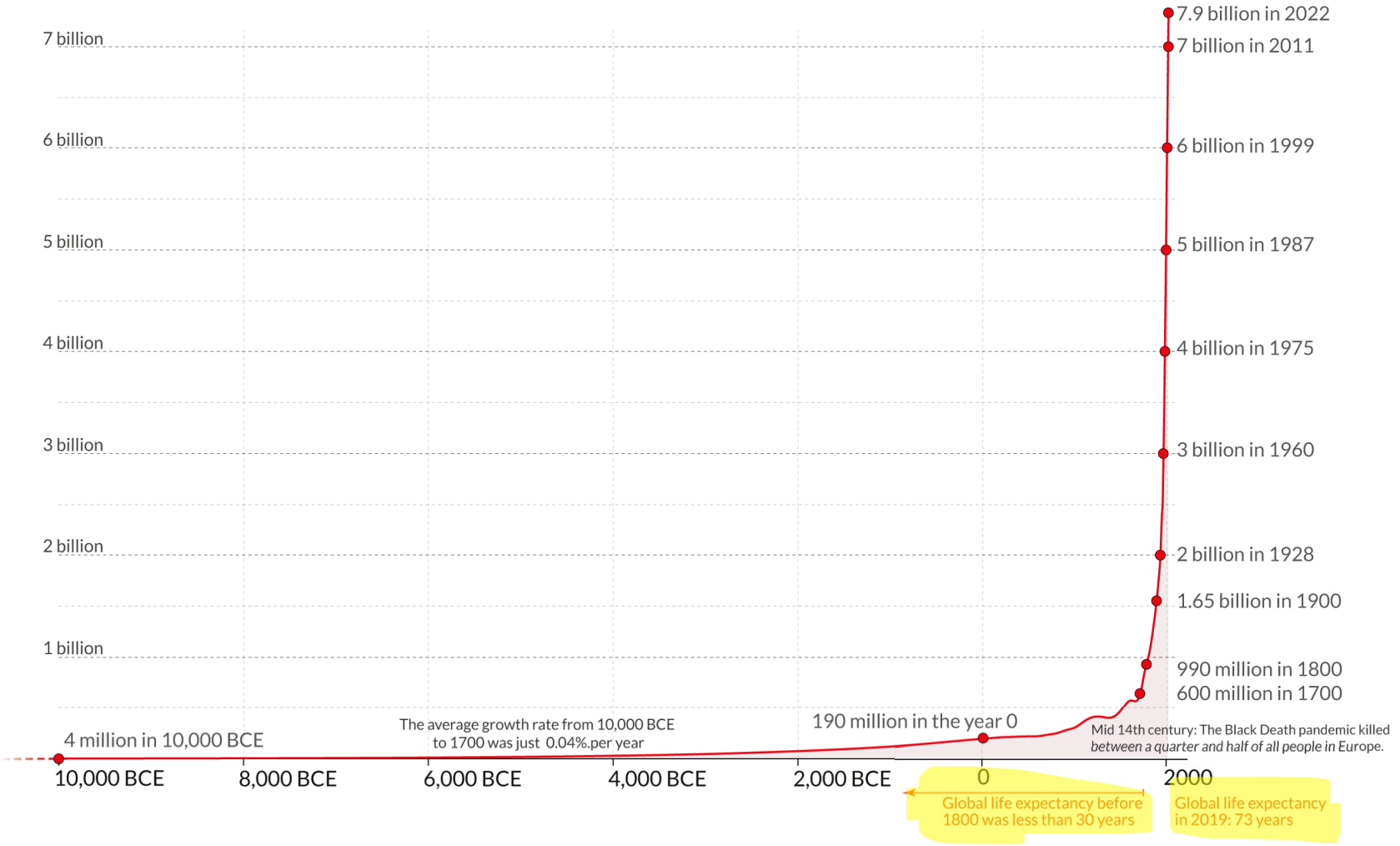
Conclusão 2:

A correção das desigualdades no mundo pressionará fortemente o aumento do consumo de energia.

Our World in Data

The size of the world population over the last 12.000 years

Demographers expect rapid population growth to end by the end of the 21st century. The UN demographers expect a population of about 11 billion in 2100.

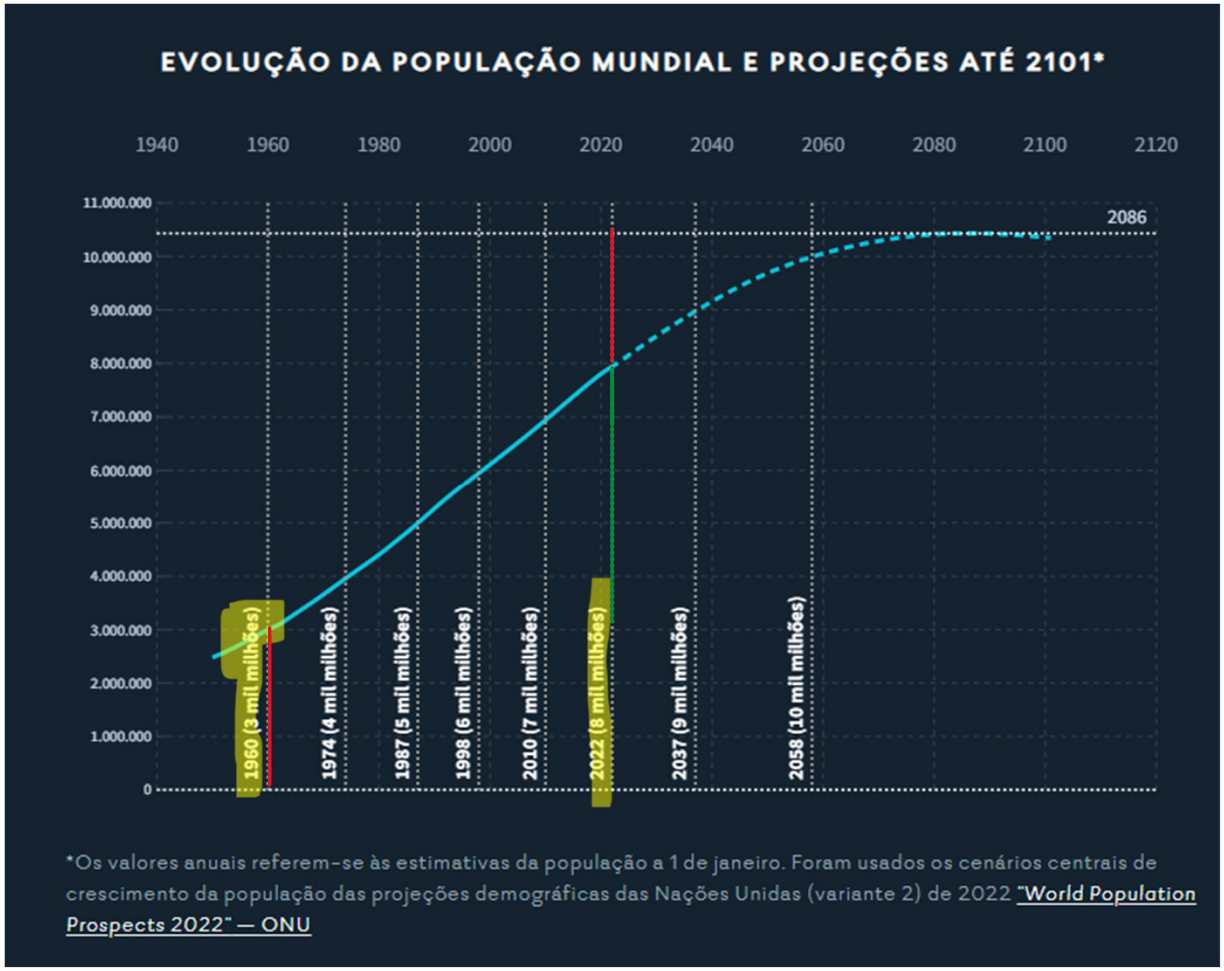


Based on estimates by the History Database of the Global Environment (HYDE) and the United Nations. On OurWorldinData.org you can download the annual data.

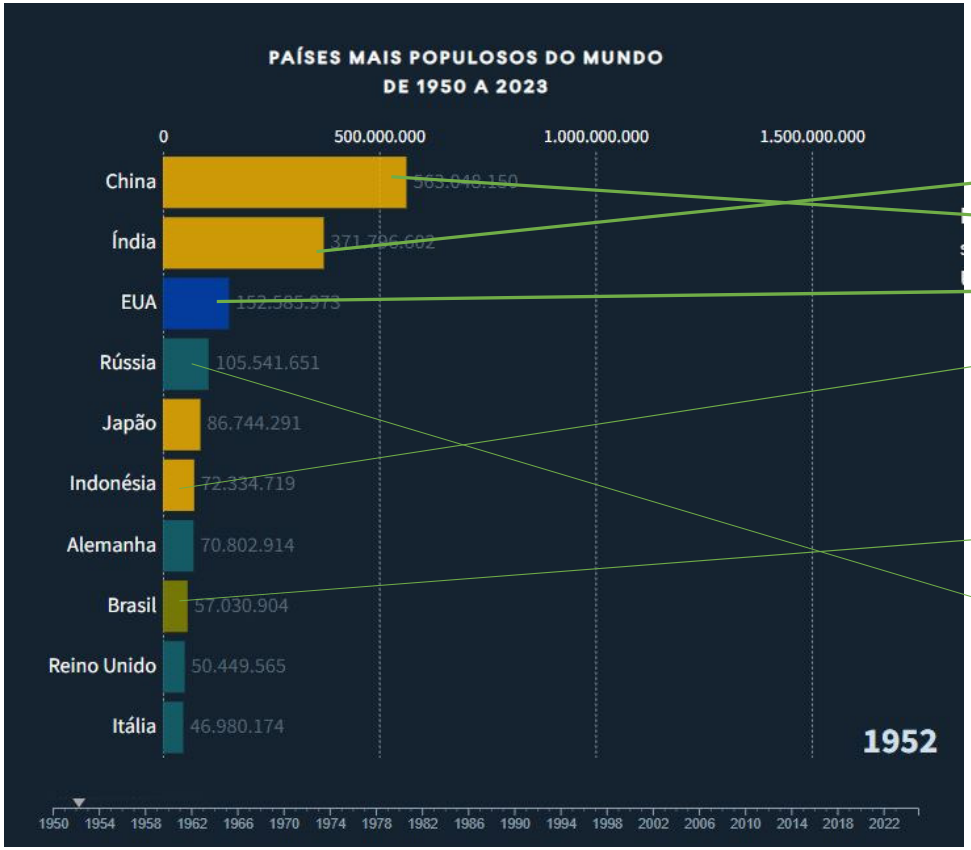
3 mil milhões em
12 mil anos

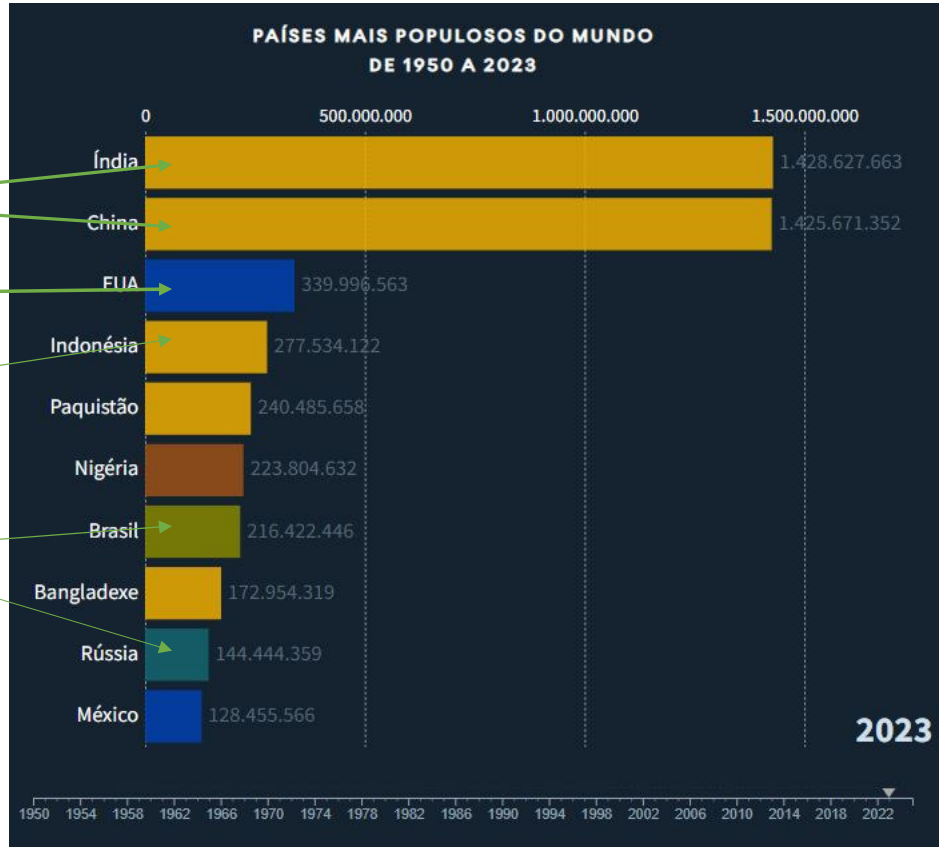
5 mil milhões em
60 anos

2 mil milhões em
40 anos



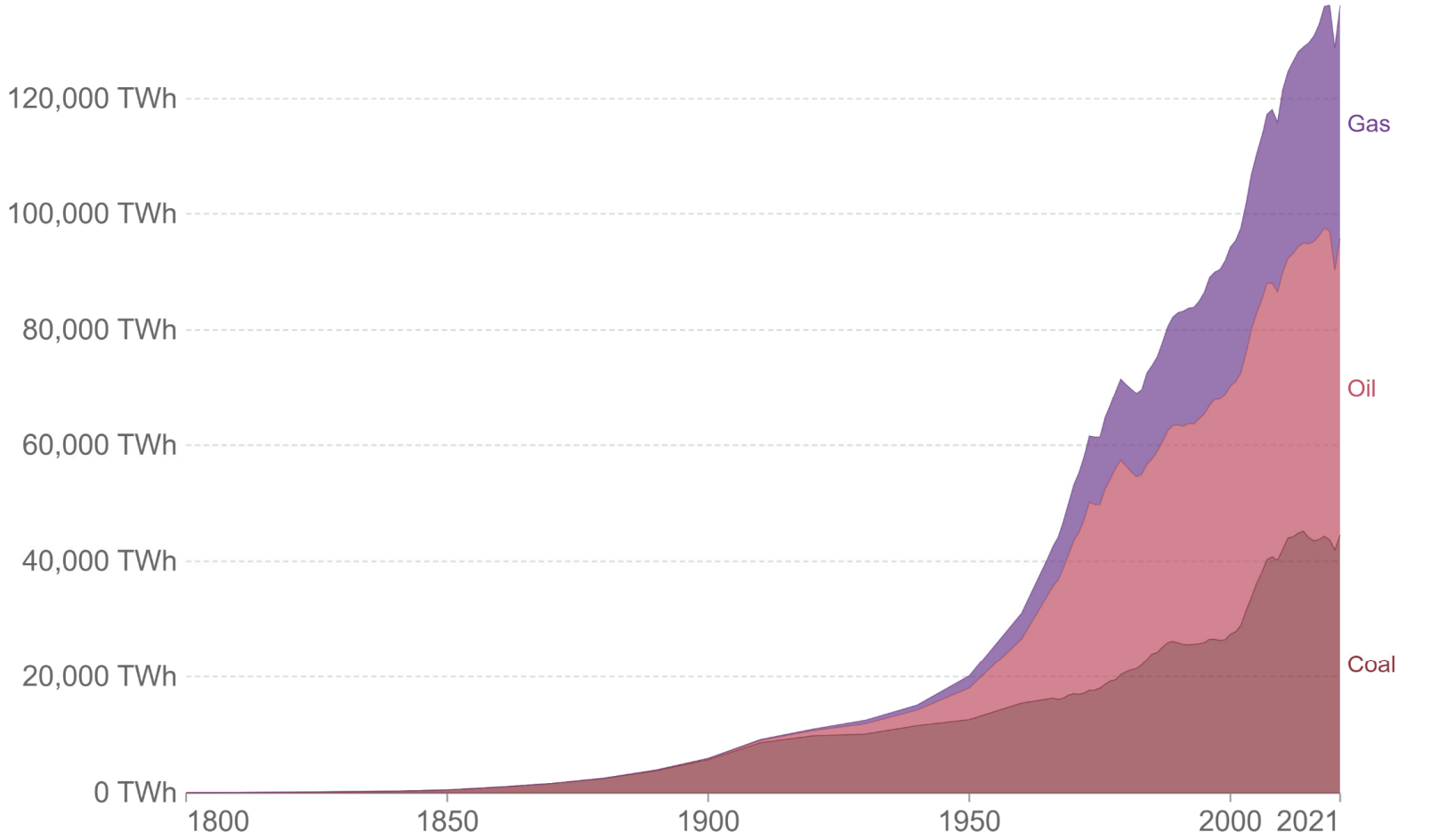
Países mais populosos do mundo de 1950 a 2023





Global fossil fuel consumption

Global primary energy consumption by fossil fuel source, measured in terawatt-hours (TWh).



Source: Our World in Data based on Vaclav Smil (2017) and BP Statistical Review of World Energy

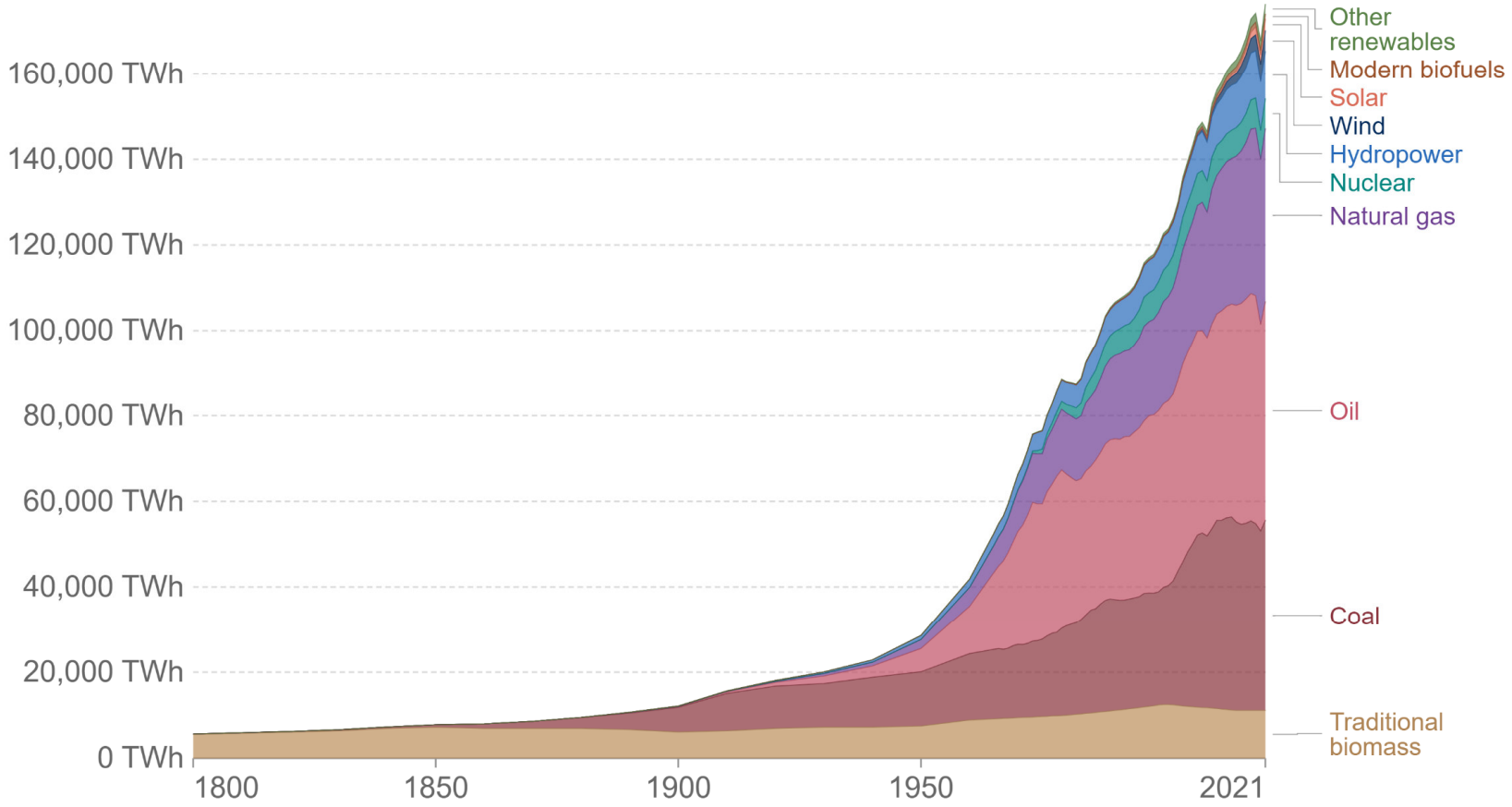
Conclusão 3:

À explosão demográfica correspondeu o respetivo mais que proporcional consumo de energia.

O crescimento da população (+25%) nos próximos 40 anos pressionará fortemente o aumento do consumo de energia.

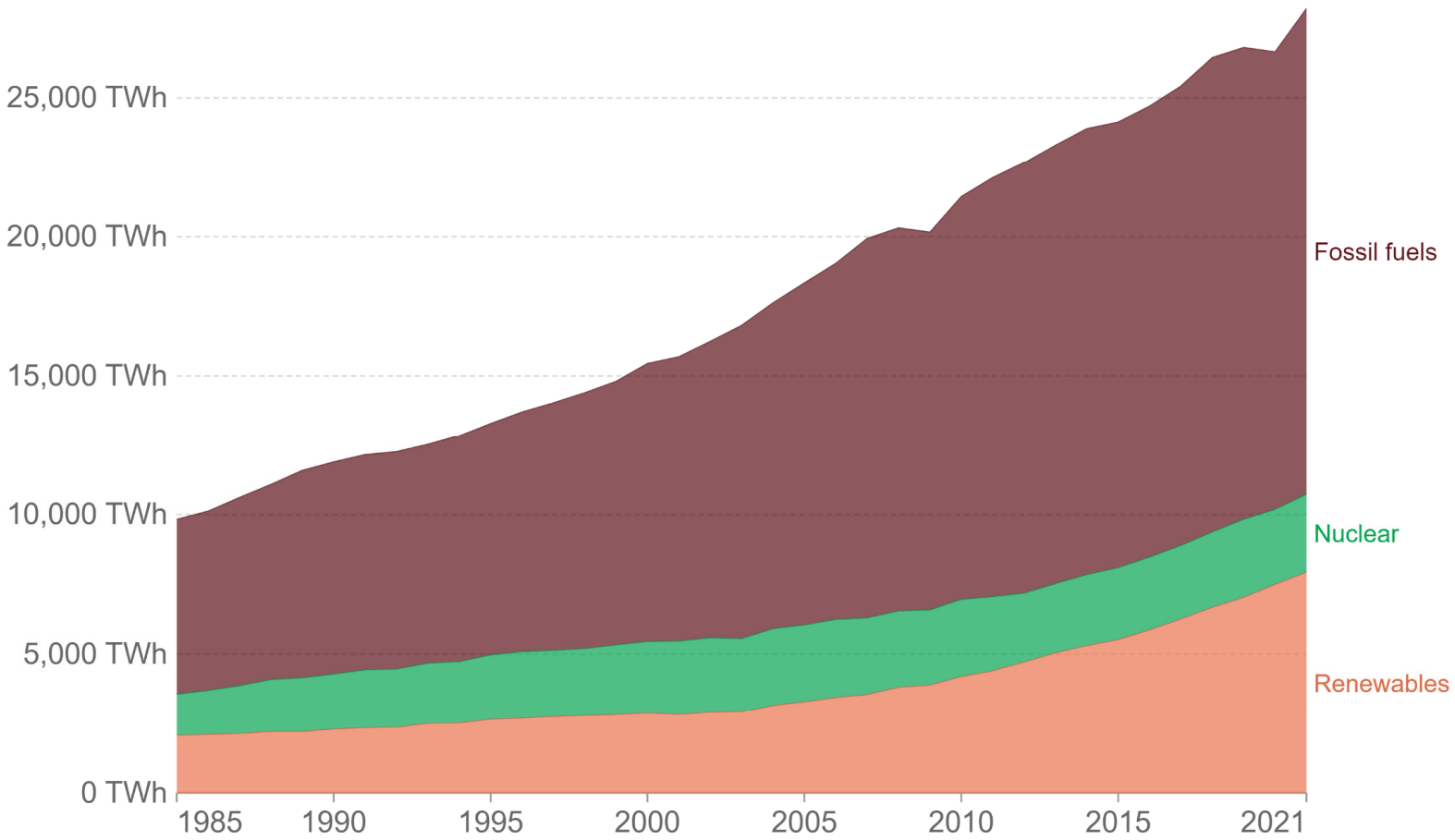
Global primary energy consumption by source

Primary energy is calculated based on the 'substitution method' which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels.



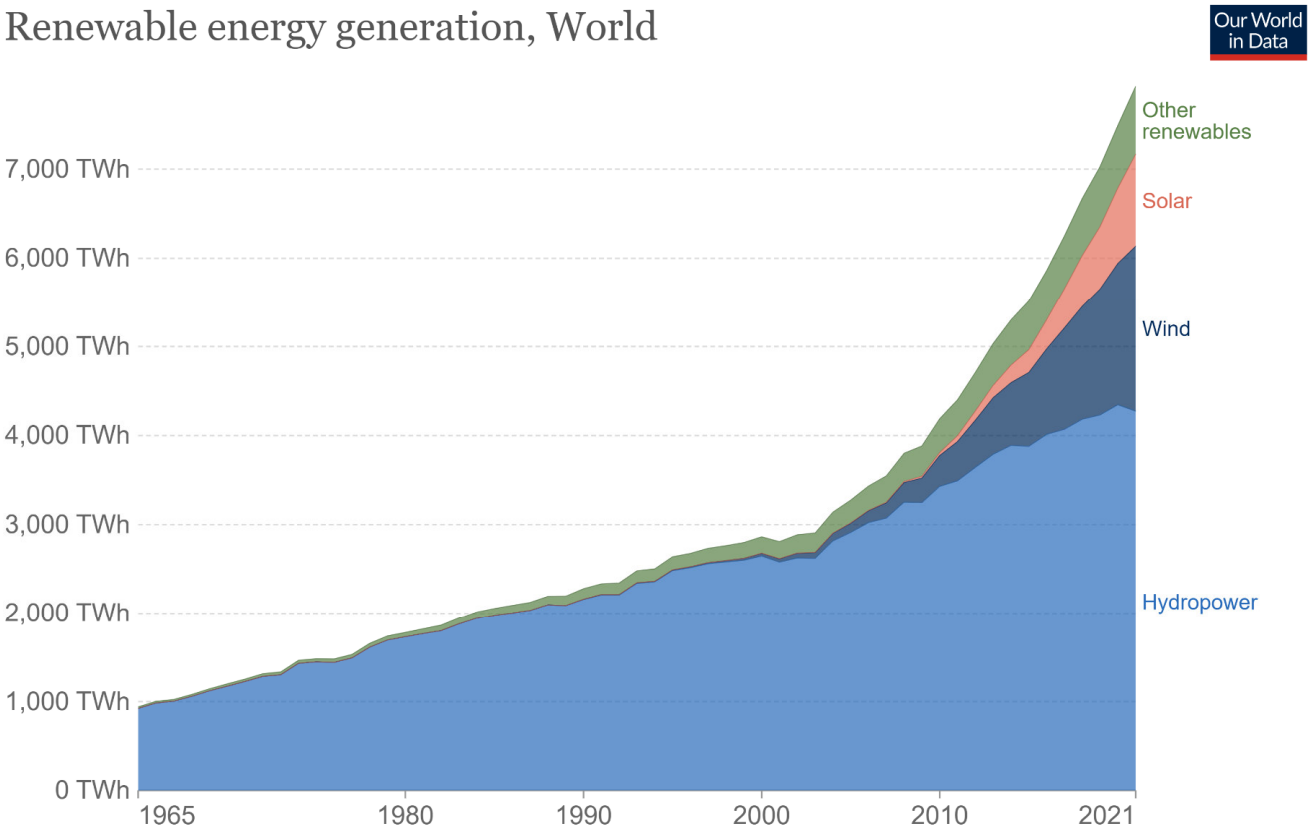
Source: Our World in Data based on Vaclav Smil (2017) and BP Statistical Review of World Energy

Electricity production from fossil fuels, nuclear and renewables, World



Source: Our World in Data based on BP Statistical Review of World Energy (2022); Our World in Data based on Ember's Global Electricity Review (2022); Our World in Data based on Ember's European Electricity Review (2022)

Renewable energy generation, World



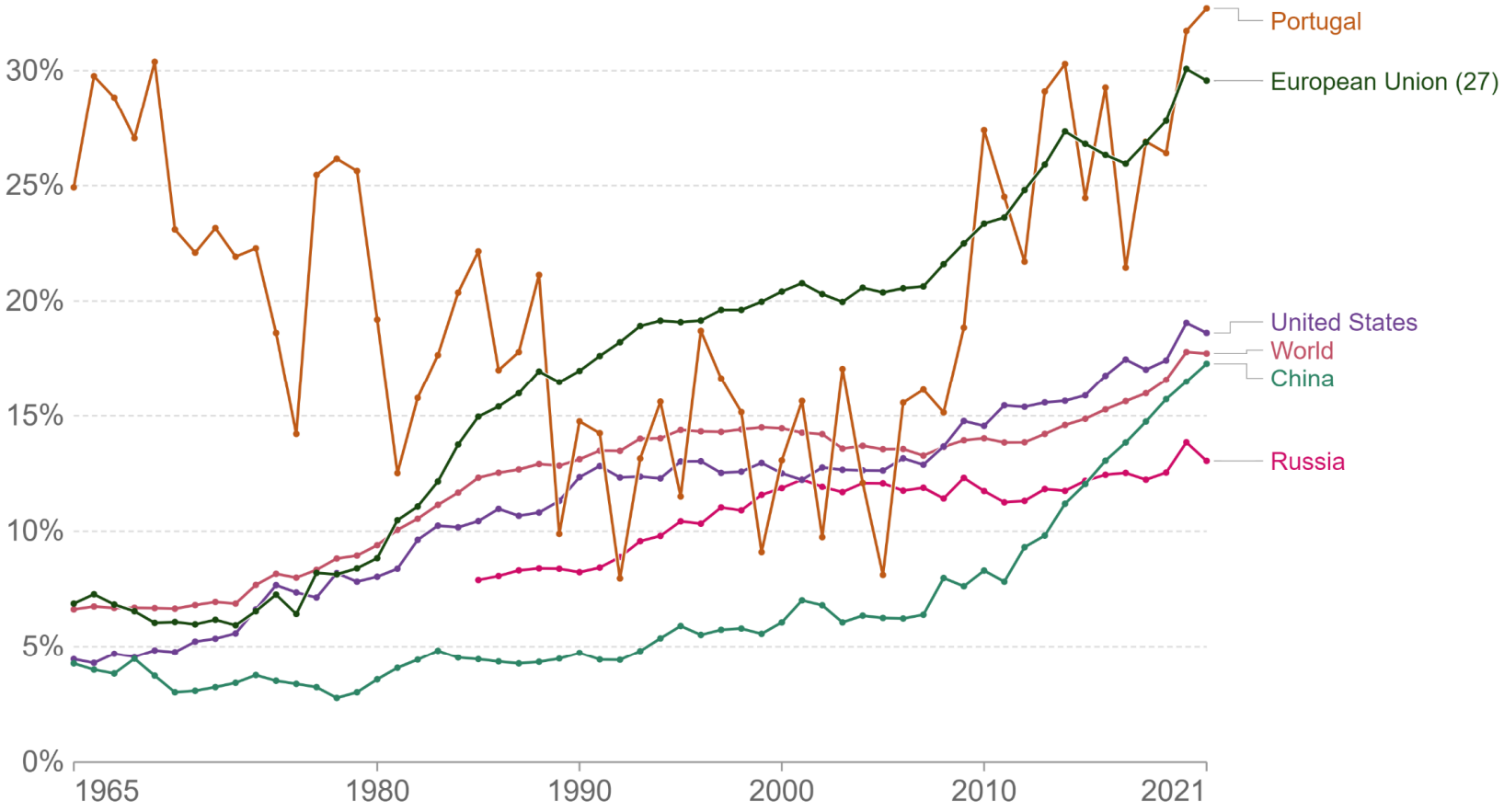
Source: Statistical Review of World Energy - BP (2022)

OurWorldInData.org/renewable-energy • CC BY

Note: 'Other renewables' refers to renewable sources including geothermal, biomass, waste, wave and tidal. Traditional biomass is not included.

Share of primary energy from low-carbon sources

Low-carbon energy is defined as the sum of nuclear and renewable sources. Renewable sources include hydropower, solar, wind, geothermal, wave and tidal and bioenergy. Traditional biofuels are not included.



Source: Our World in Data based on BP Statistical Review of World Energy (2022)

OurWorldInData.org/energy • CC BY

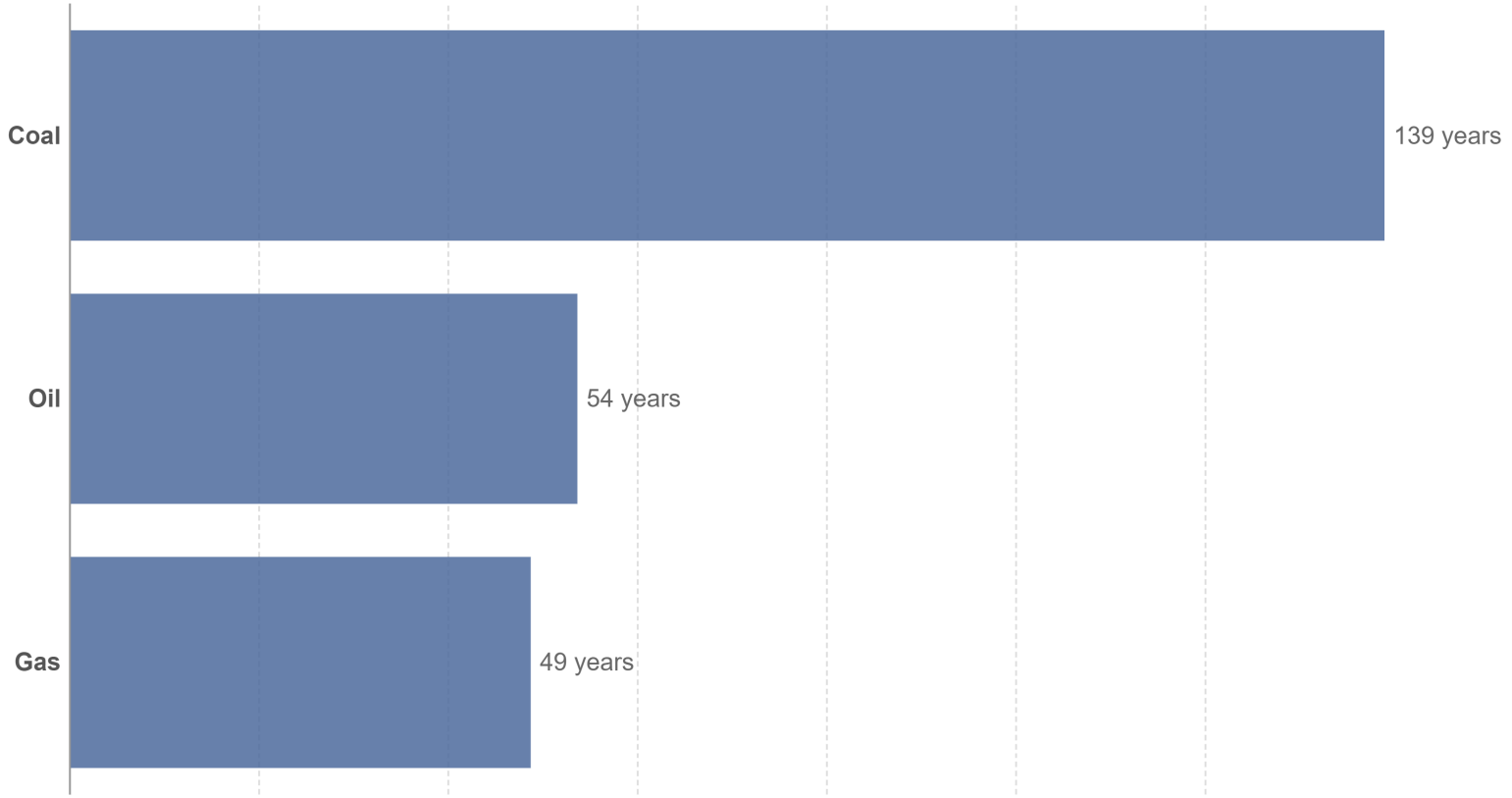
Note: Primary energy is calculated using the 'substitution method', which accounts for the energy production inefficiencies of fossil fuels.

Conclusão 4:

As energias renováveis não têm ainda expressão significativa no mundo, embora na União Europeia e, em particular, em Portugal tenham já algum peso.

Years of fossil fuel reserves left, 2020

Years of global coal, oil and natural gas left, reported as the reserves-to-product (R/P) ratio which measures the number of years of production left based on known reserves and present annual production levels. Note that these values can change with time based on the discovery of new reserves, and changes in annual production.

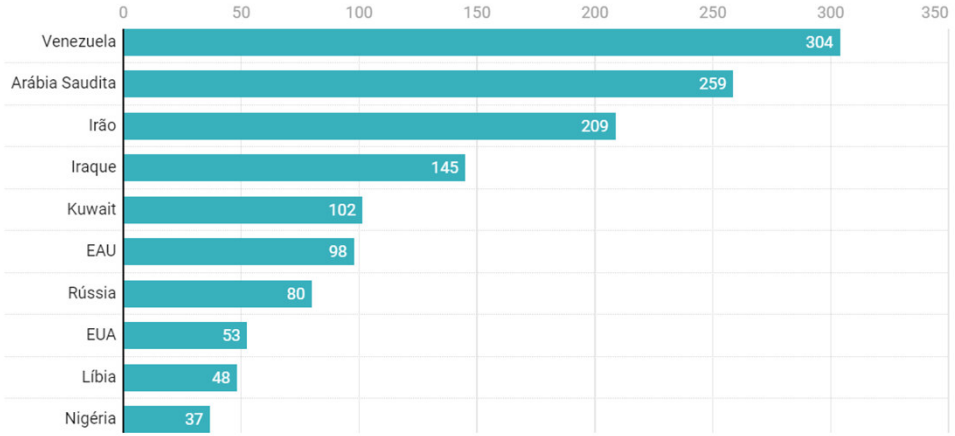


Source: BP Statistical Review of World Energy

Produtores

DE PETRÓLEO

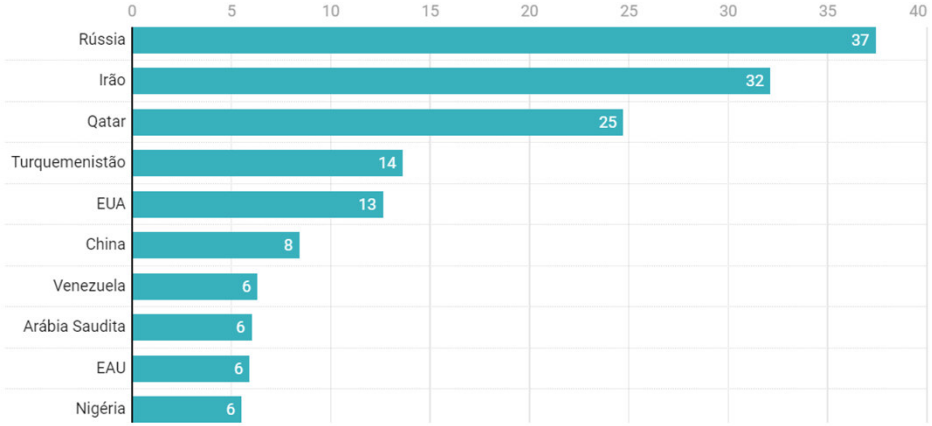
Em milhões de barris (1 barril=42 galões=159 litros), 2019



Fonte: OPEC Annual Statistical Bulletin 2020 • Criado com Datawrapper

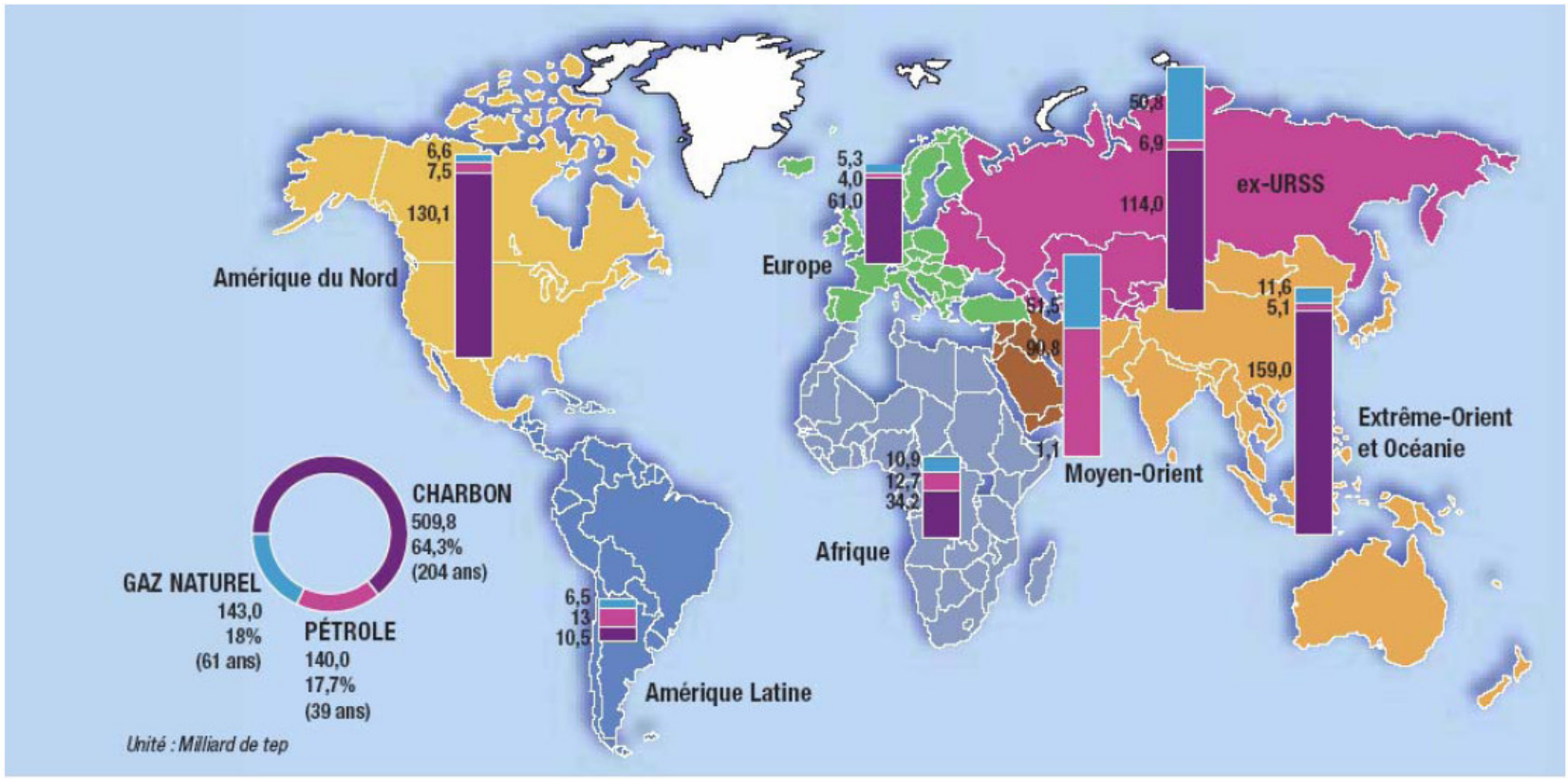
DE GÁS NATURAL

Em triliões de m3, 2020

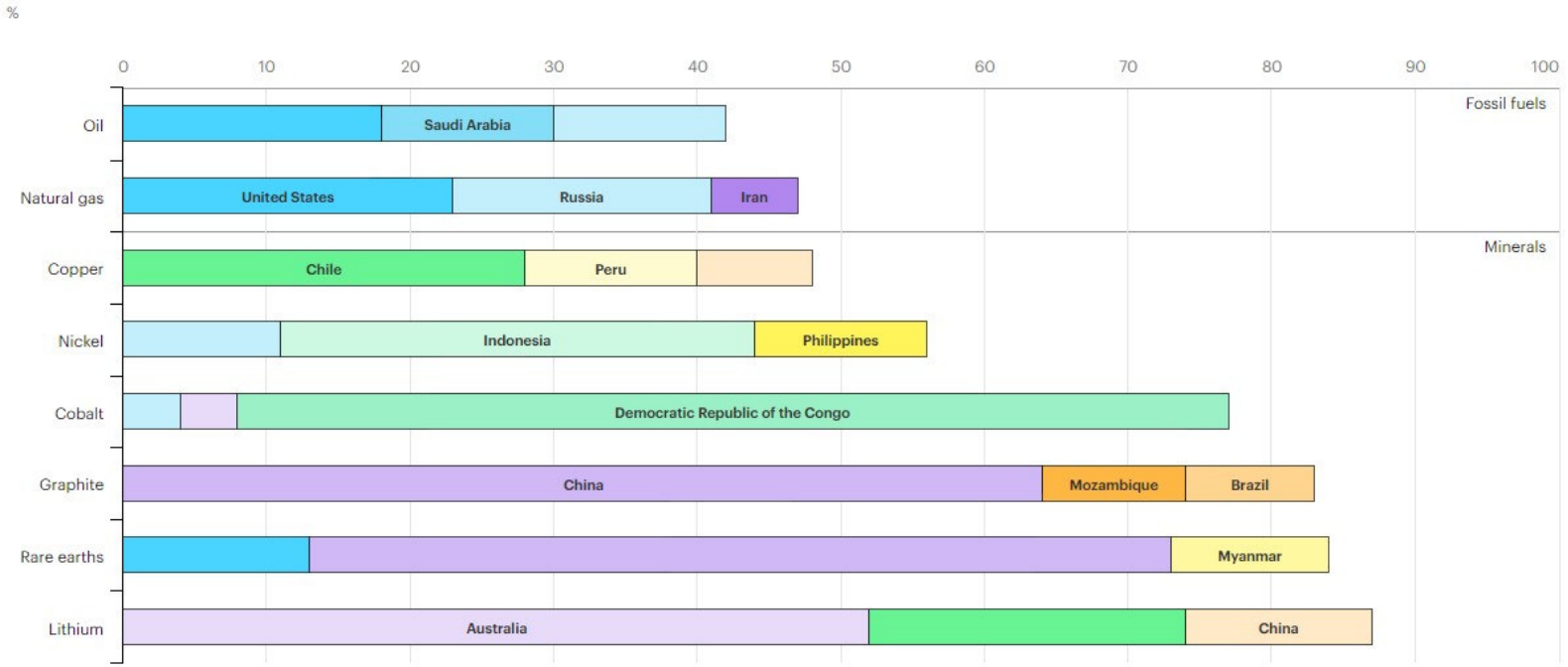


Fonte: BP Statistical Review of World Energy • Criado com Datawrapper

Localização reservas mundiais de combustíveis fosseis

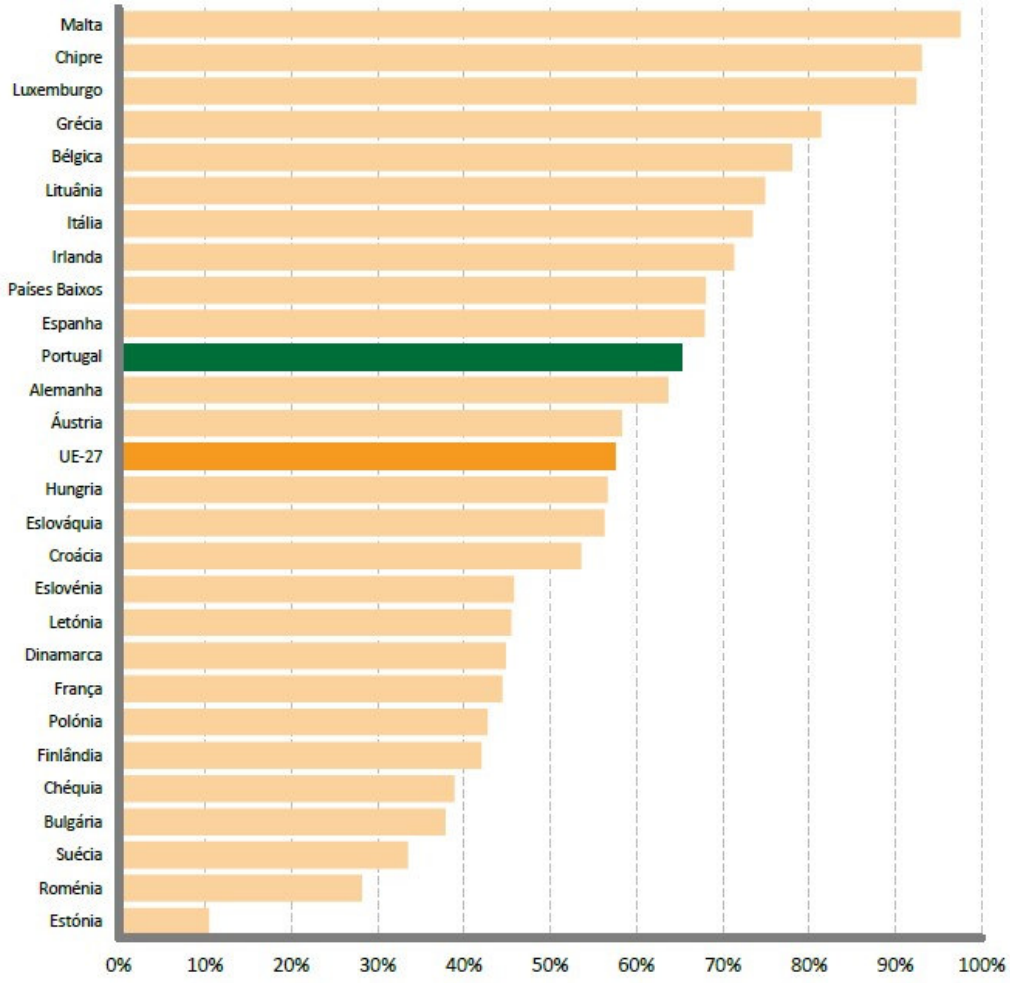


Sources : Conseil Mondial de l'Energie, BP et Ministère de l'Économie et des Finances (DGEMP).



United States Saudi Arabia Russia Iran China Australia Chile Democratic Republic of the Congo Indonesia Philippines Myanmar Peru Mozambique Brazil China

Dependência Energética (2020)

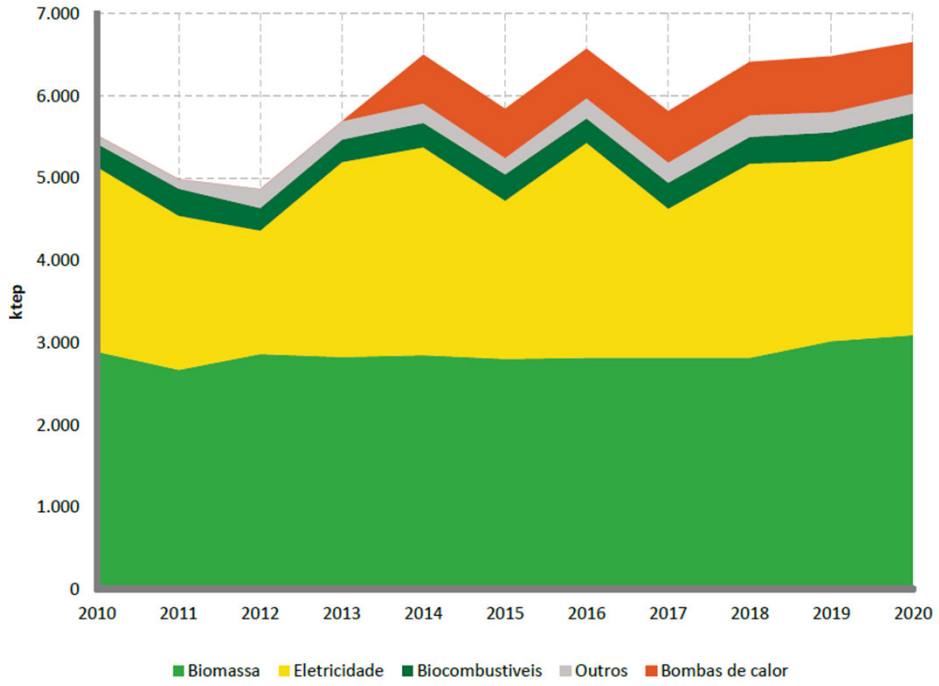


Fonte: Eurostat

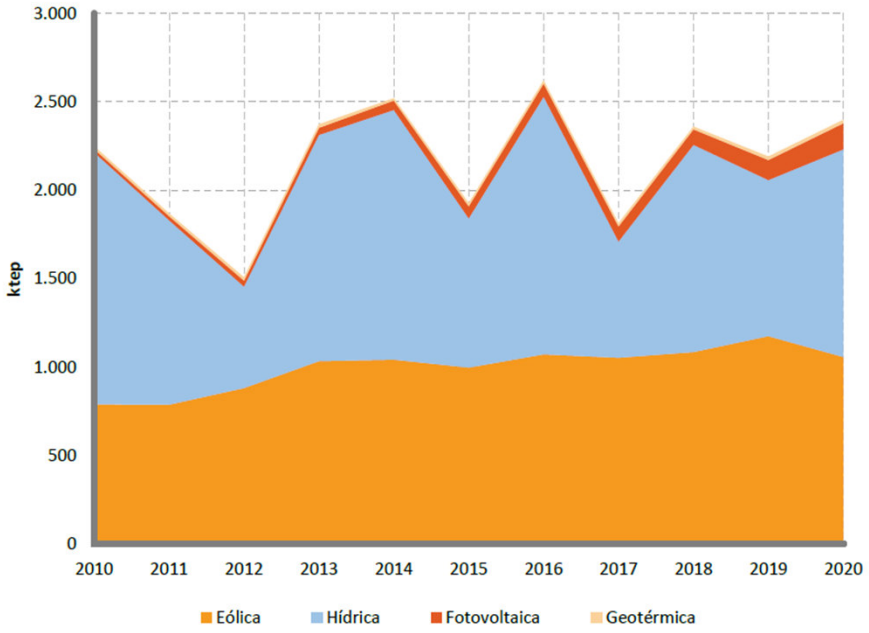
Conclusão 5:

A independência energética das democracias é uma garantia fundamental de paz, bem estar e sustentabilidade.

Produção doméstica (recursos endógenos)



Energia



Eletricidade

Conclusão 6:

No país do sol, o solar térmico e, sobretudo, o fotovoltaico não tem expressão.

Futuro:

- Ajudar o mundo desigual a desenvolver-se com menos energia e com mais renováveis.
- Reduzir e eliminar emissões CO2
  - Maximizar Eficiência Energética (edifícios -pobreza/ineficiência-, indústria, transportes)
  - Maximizar Energia Renovável (Biomassa, Eólicas off-shore, fotovoltaico – edificios, industria-, armazenagem, hidrogénio verde).

OBRIGADO

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joao.francisco@estsetubal.ips.pt