# MONETIZAÇÃO DE GÁS NATURAL, DESCARBONIZAÇÃO E ELETRIFICAÇÃO

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Semana do Meio Ambiente 2022

# RESUMO DA APRESENTAÇÃO





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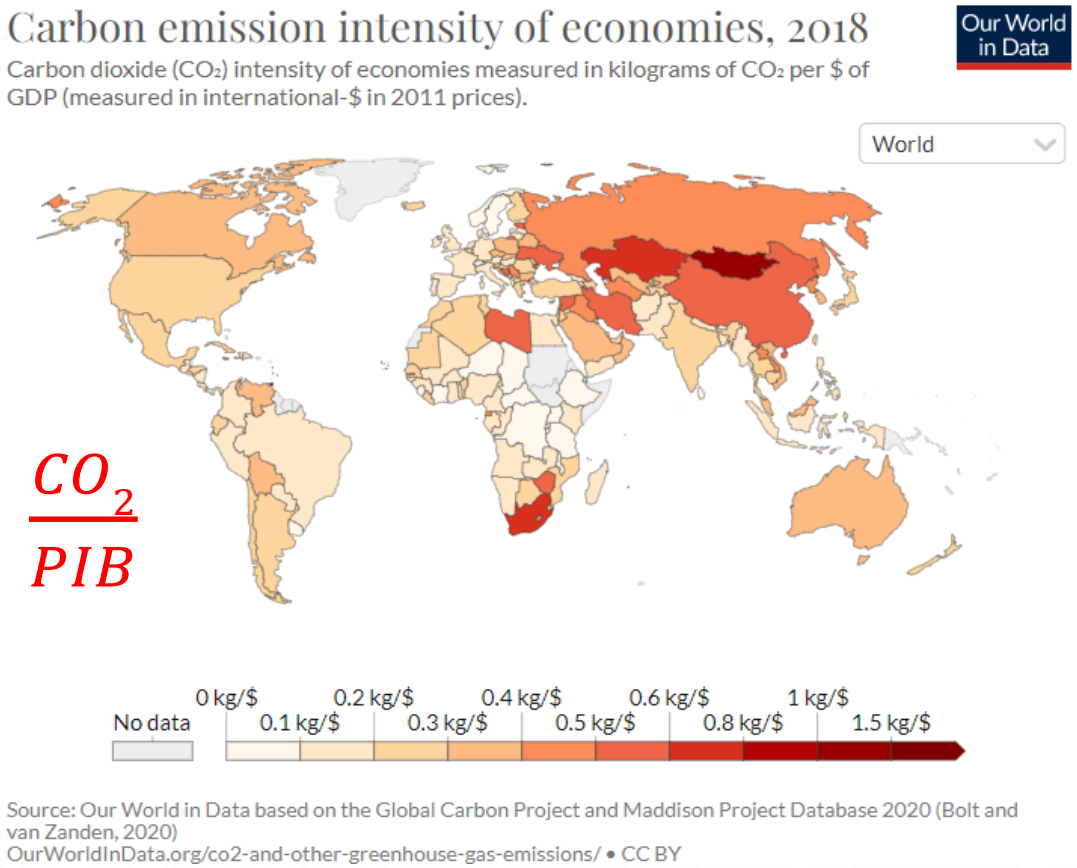
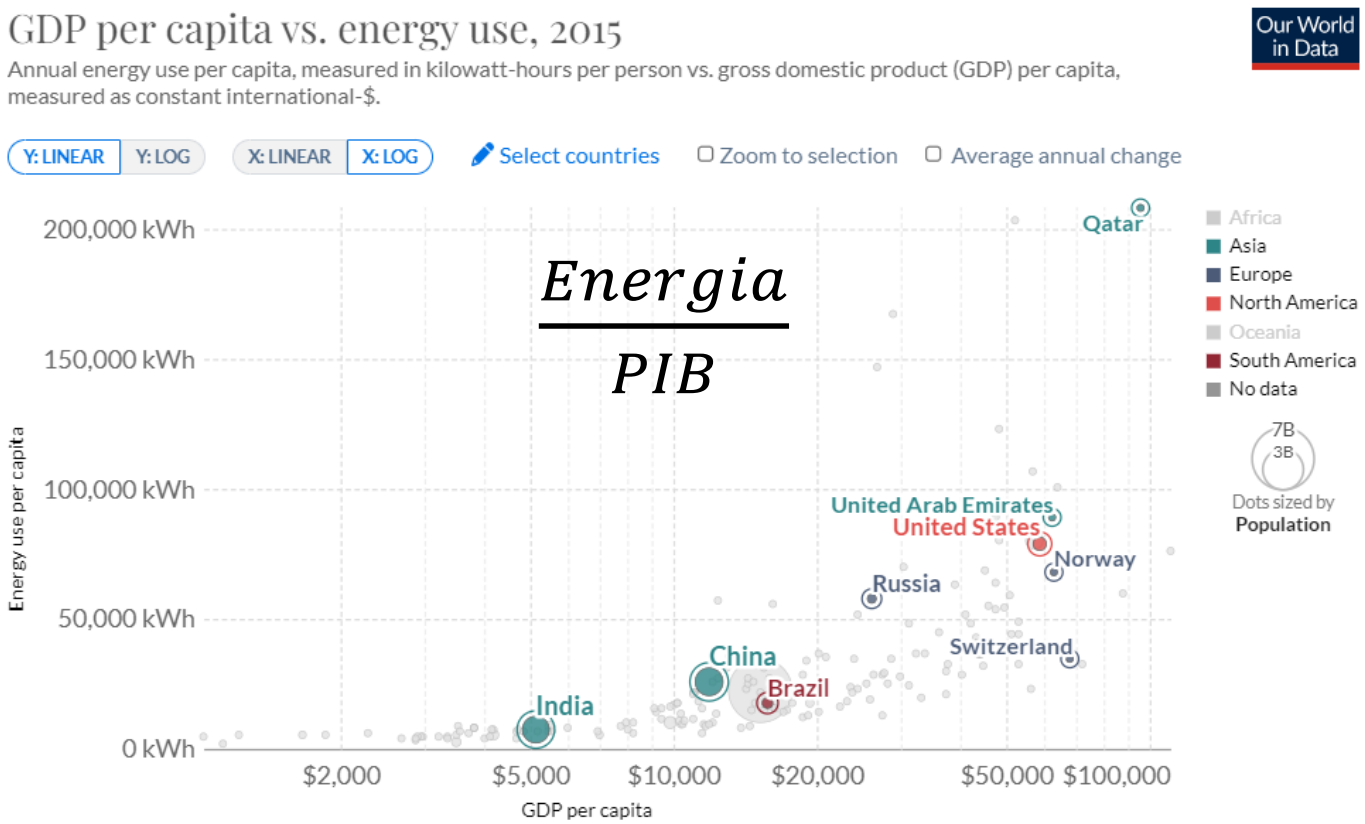
# GEORREFERÊNCIAS PARA A TRANSIÇÃO

# TRANSIÇÃO ← CLIMA NEXO $CO_2$ ← ENERGIA ← ECONOMIA




$$\frac{CO_2}{PIB}$$




$$\frac{Energia}{PIB}$$

*Intensidade de Carbono*

$$\frac{CO_2}{PIB} = \frac{Energia}{PIB} \times \frac{CO_2}{Energia}$$

*Intensidade de Energia*

*Intensidade de Carbono*

*Intensidade de Energia*

*MATRIZ ENERGÉTICA*

# GEOPOLÍTICA, NEXOS E TRANSIÇÃO ENERGÉTICA



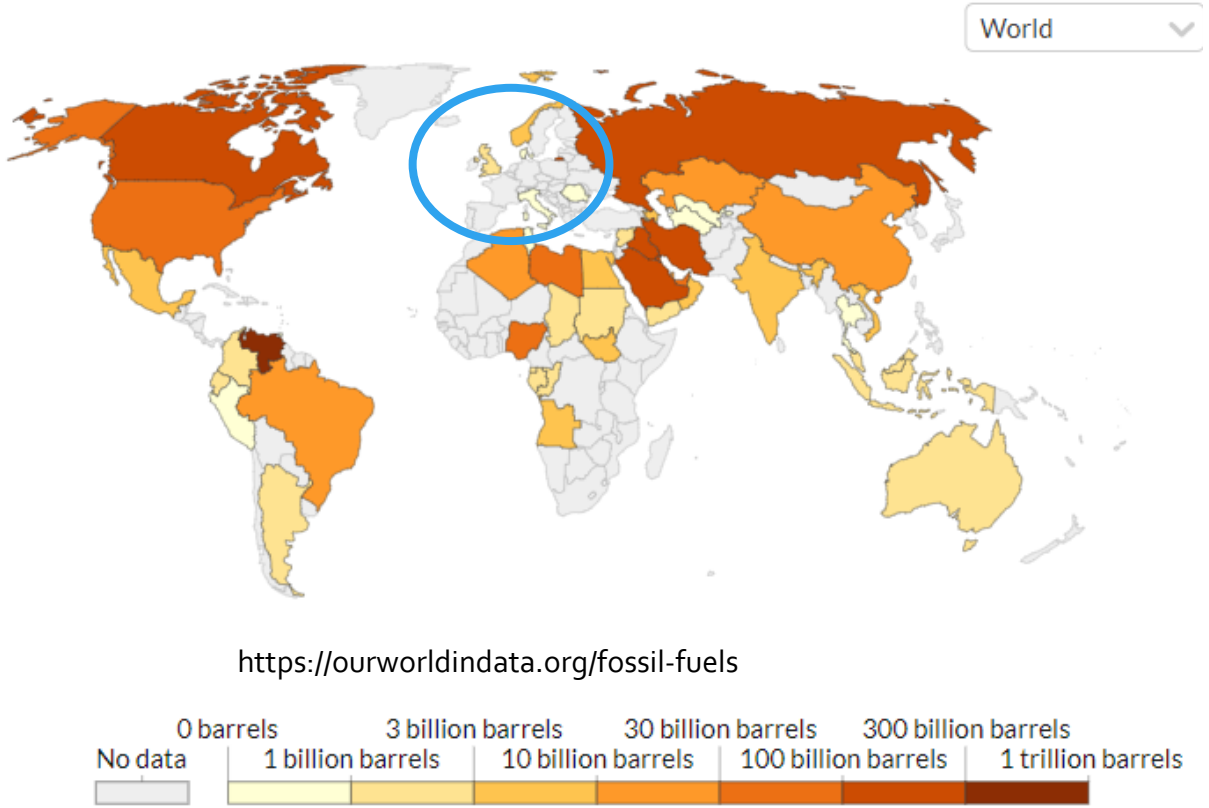


Our World in Data

## Oil reserves, 2020

Our World in Data

Shown is the total proven reserves of oil. This is oil that we know with reasonable certainty can be recovered in the future under existing economic and operating conditions. Proven reserves decrease when we extract oil, and increase as new resources are discovered or become economically viable to extract.



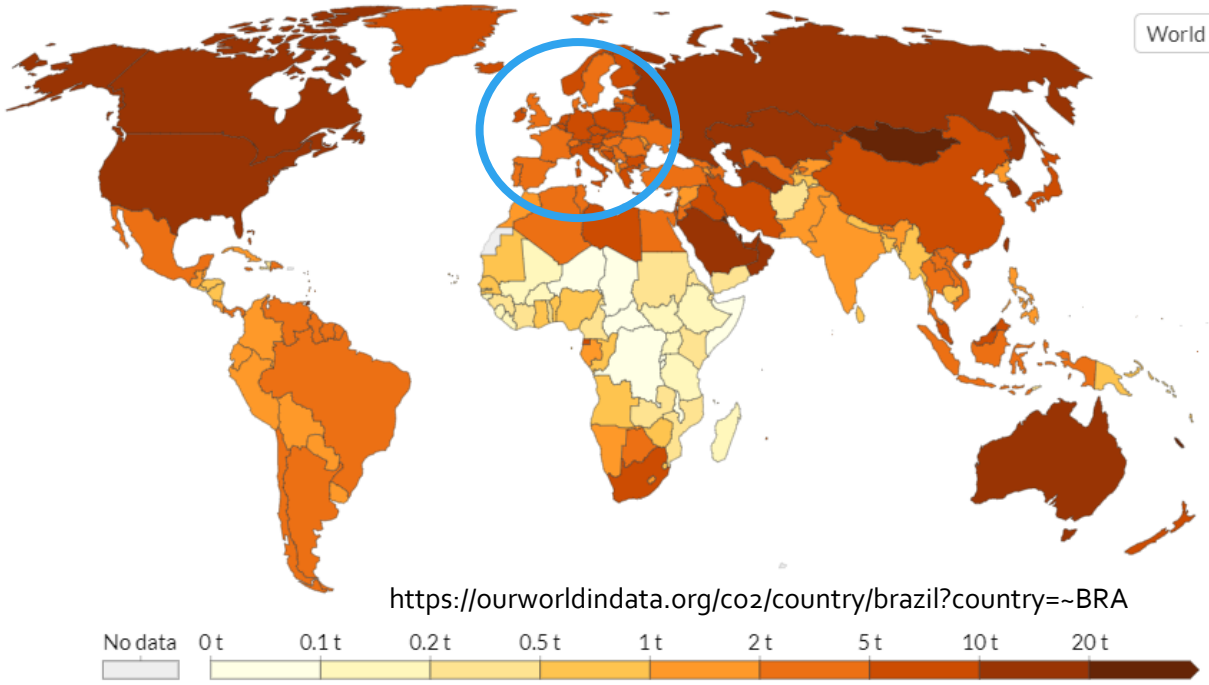

https://ourworldindata.org/fossil-fuels

Source: Statistical Review of World Energy - BP (2021)

OurWorldInData.org/energy • CC BY

## Per capita $CO_2$ emissions, 2020

Carbon dioxide ($CO_2$) emissions from the burning of fossil fuels for energy and cement production. Land use change is not included.




https://ourworldindata.org/co2/country/brazil?country=~BRA

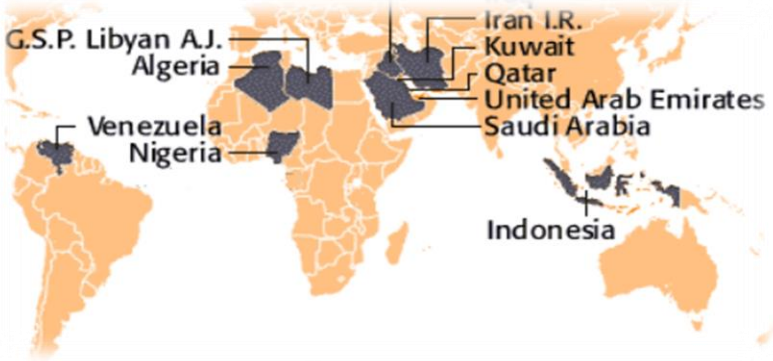
Source: Our World in Data based on the Global Carbon Project

OurWorldInData.org/co2-and-other-greenhouse-gas-emiss

# GIGA-RESERVAS

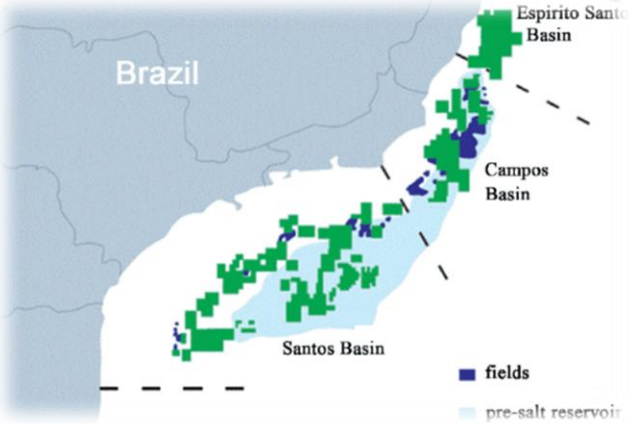
| Rank | Country | Barrels (bbl) |
|---|---|---|
| 1 | Venezuela | 298,400,000,000 |
| 2 | Saudi A. | 268,300,000,000 |
| 3 | Canada | 171,000,000,000 |
| 4 | Iran | 157,800,000,000 |
| 5 | Iraq | 144,200,000,000 |
| 6 | Kuwait | 104,000,000,000 |
| 7 | Russia | 103,200,000,000 |
| 8 | UAE | 97,800,000,000 |
| 9 | Libya | 48,360,000,000 |
| 10 | Nigeria | 37,070,000,000 |
| 11 | United States | 36,520,000,000 |
| 12 | Kazakhstan | 30,000,000,000 |
| 13 | Qatar | 25,240,000,000 |
| 14 | China | 24,650,000,000 |
| **15** | **Brazil** | **15,310,000,000** |
| 16 | Algeria | 12,200,000,000 |
| 17 | Guyana | 10,000,000,000 |
| 18 | Mexico | 9,812,000,000 |
| 19 | Angola | 9,011,000,000 |
| 20 | Ecuador | 8,832,000,000 |

https://oilnow.gy/featured/worlds-largest-oil-reserves-by-country/




24,24 bilhões de barris de reservas provadas + prováveis + possíveis (3P)

https://www.gov.br/anp/pt-br/canais_atendimento/imprensa/noticias-comunicados/reservas-provadas-de-petroleo-no-brasil-crescem-11-em-2021

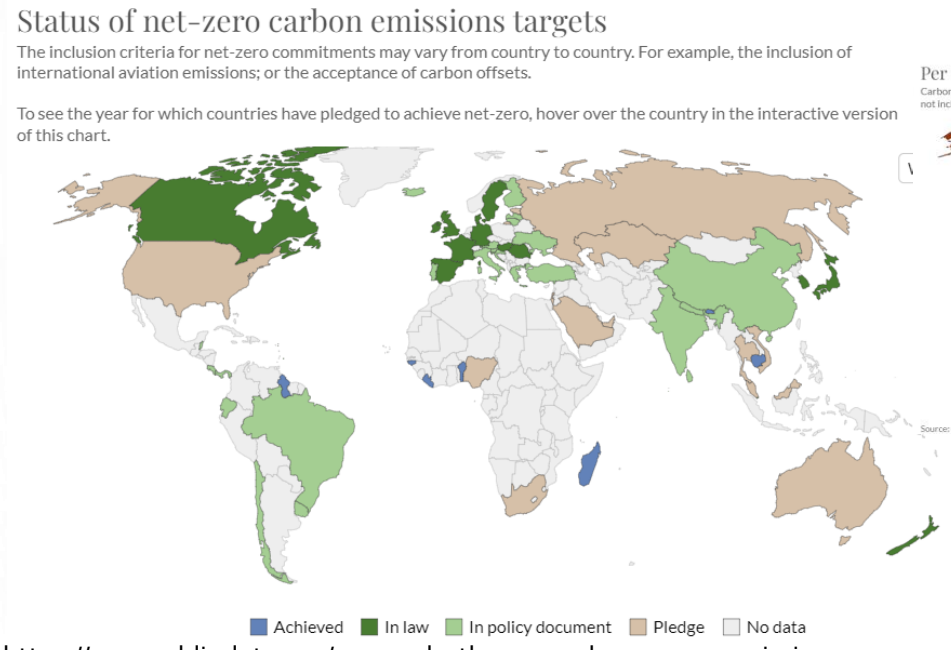



https://oilnow.gy/featured/petrobras-makes-new-oil-find-in-campos-basin/

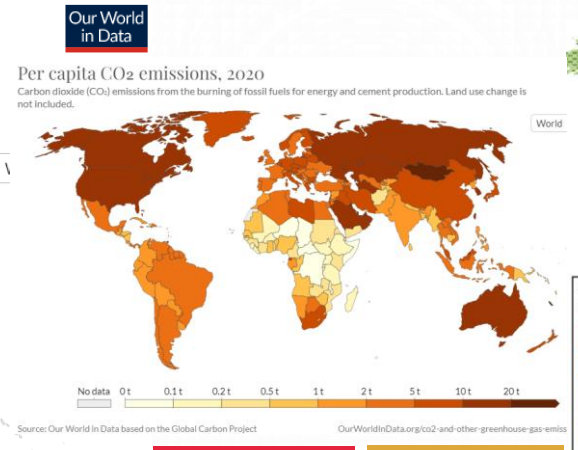
https://oilnow.gy/featured/brazil-to-increase-oil-production-by-300000-barrels-per-day-this-year-ami/

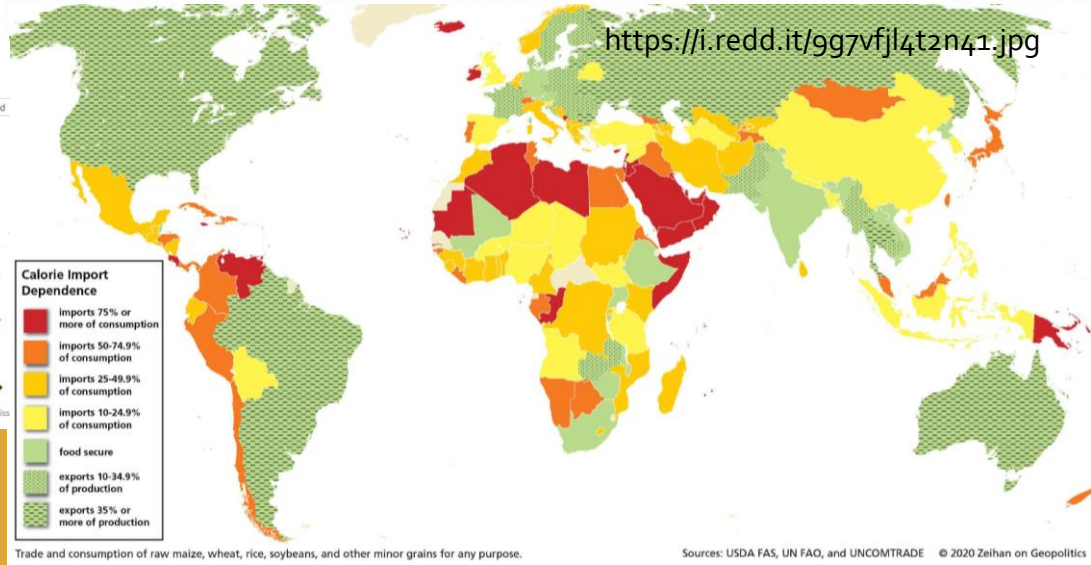

"DEZENAS DE BILHÕES DE BARRIS DE BARRIS DE ÓLEO E TRILHÕES DE PÉS CÚBICOS DE GÁS NATURAL."

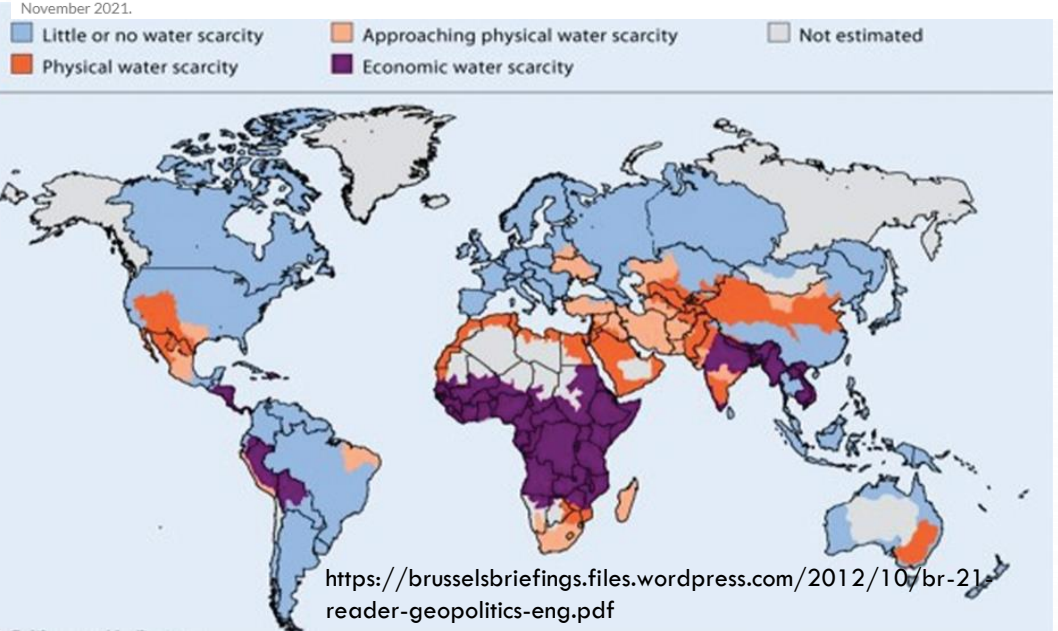
# GEOPOLÍTICA, NEXOS E TRANSIÇÃO ENERGÉTICA



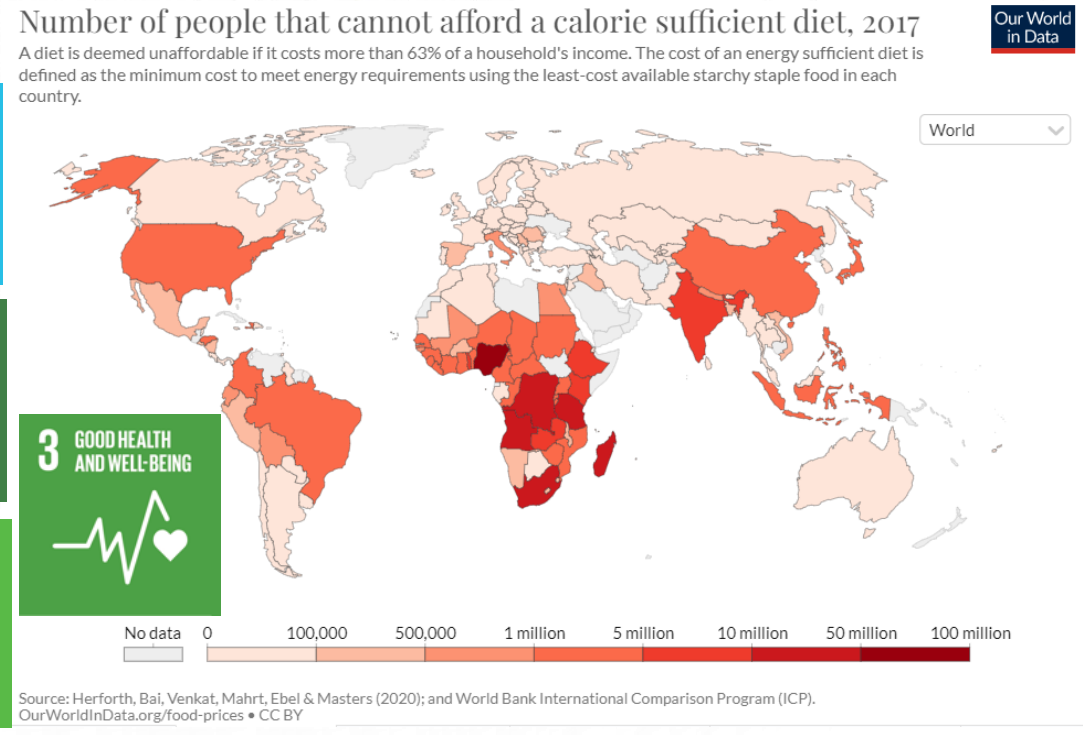

https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions



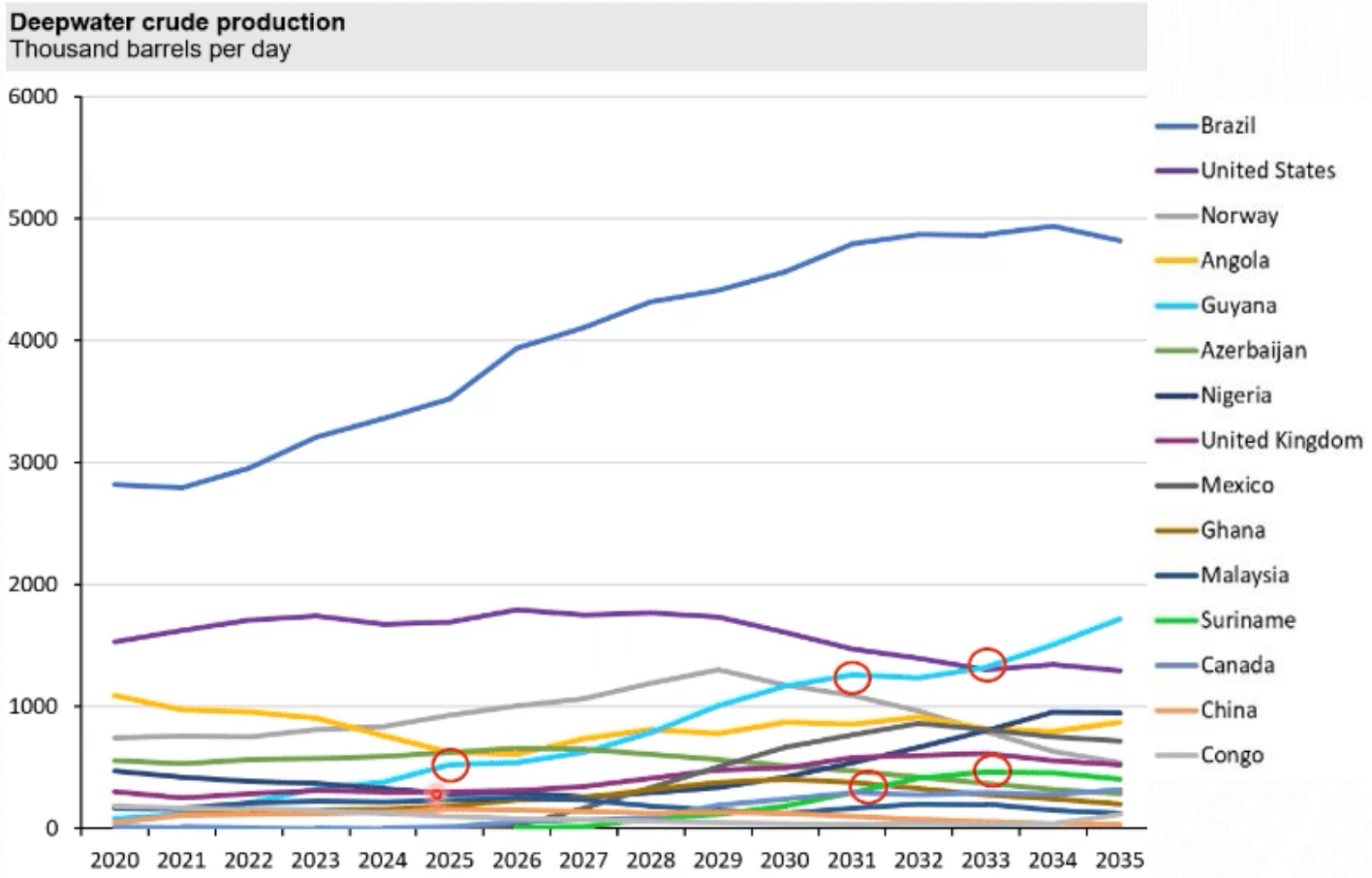




https://brusselsbriefings.files.wordpress.com/2012/10/br-21-reader-geopolitics-eng.pdf

# NEXO ECONOMIA – ENERGIA – CARBONO


https://www.arabnews.com/node/1997051/business-economy




https://oilnow.gy/featured/brazil-to-increase-oil-production-by-300000-barrels-per-day-this-year-ami/

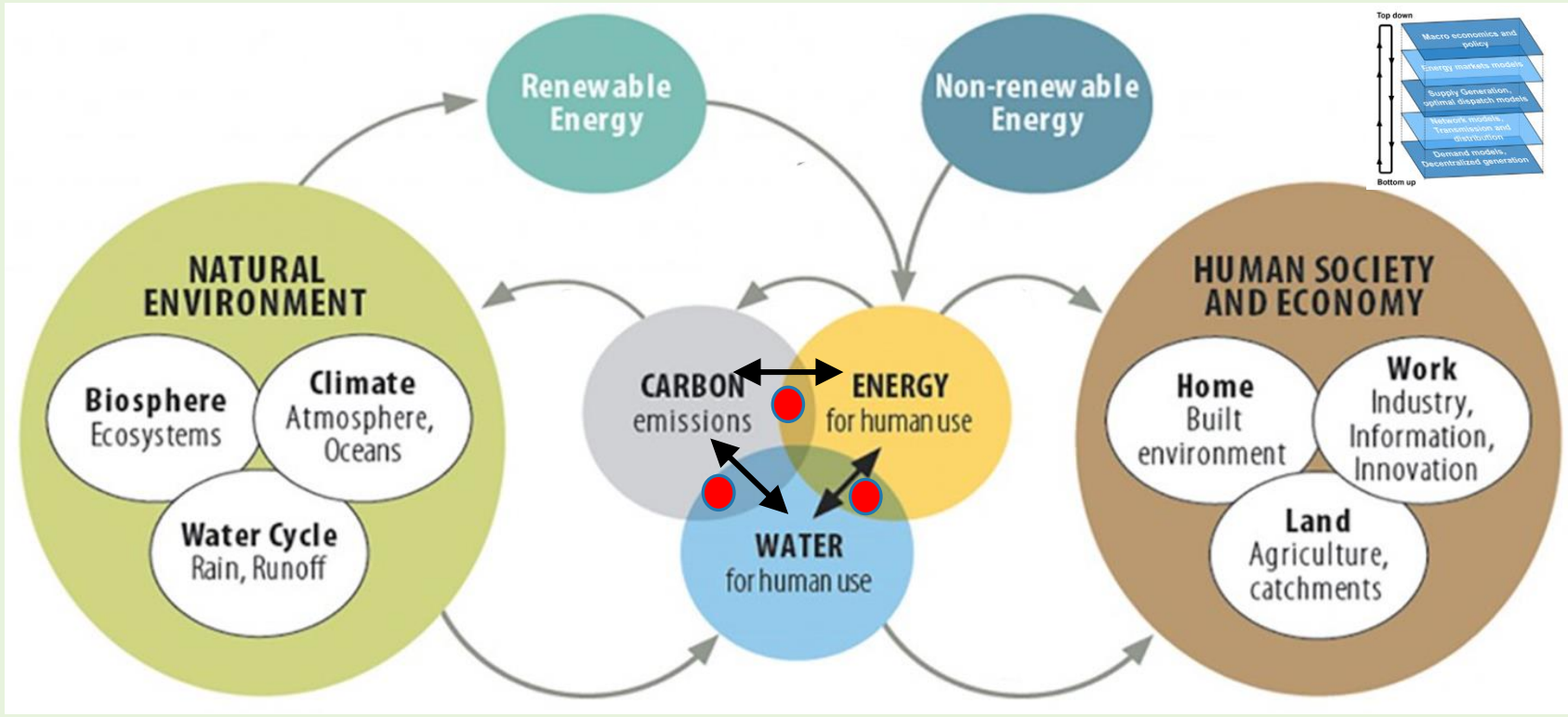
# VISÃO DA EXTENSÃO DE NEXOS


GEOPOLÍTICA DO PETRÓLEO

SEGURANÇA ENERGÉTICA

GEOPOLÍTICA DOS ALIMENTOS

SEGURANÇA HÍDRICA




NEXO ALIMENTO – ÁGUA – ENERGIA – CARBONO – ECONOMIA

$CO_2$ E MUDANÇAS CLIMÁTICAS

GEOPOLÍTICA ECONÔMICA

https://www.set-nav.eu/sites/default/files/common_files/publications/Nexus_story_and_modeling_ideas_paper.pdf

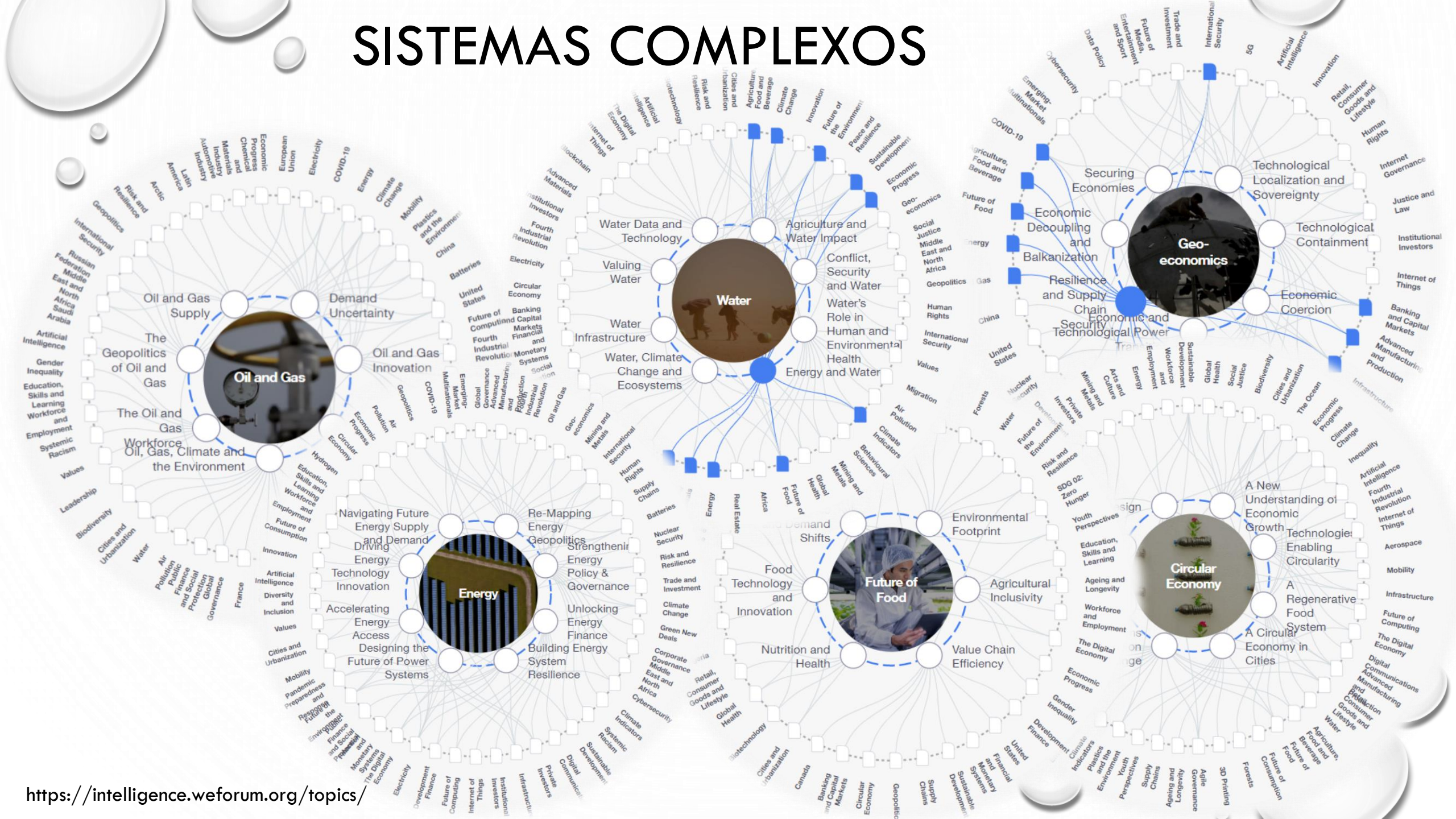
http://www.wec-nexus.ait.ac.th/

http://www.iags.org/geopolitics.html

**why societies choose to do what they do**

https://www.imf.org/Publications/fandd/issues/2020/06/political-economy-of-economic-policy-jeff-frieden

# SISTEMAS COMPLEXOS



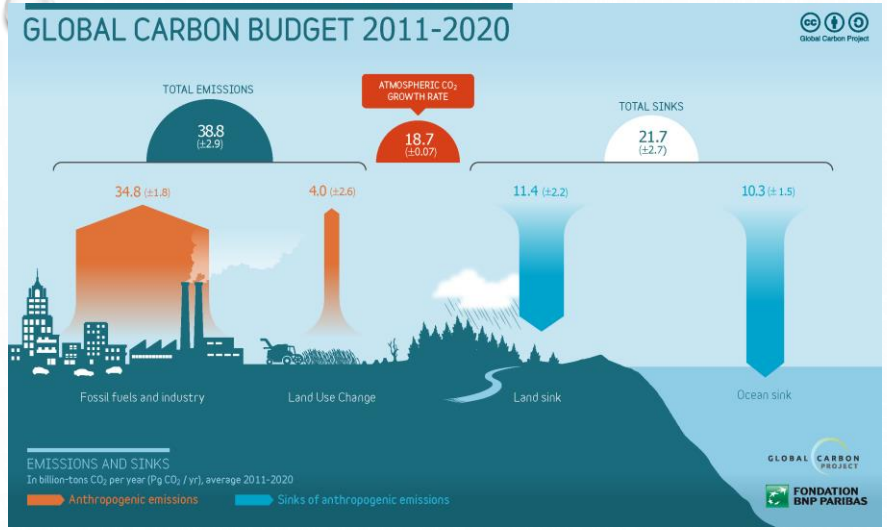

https://intelligence.weforum.org/topics/

# ORÇAMENTO DE CARBONO

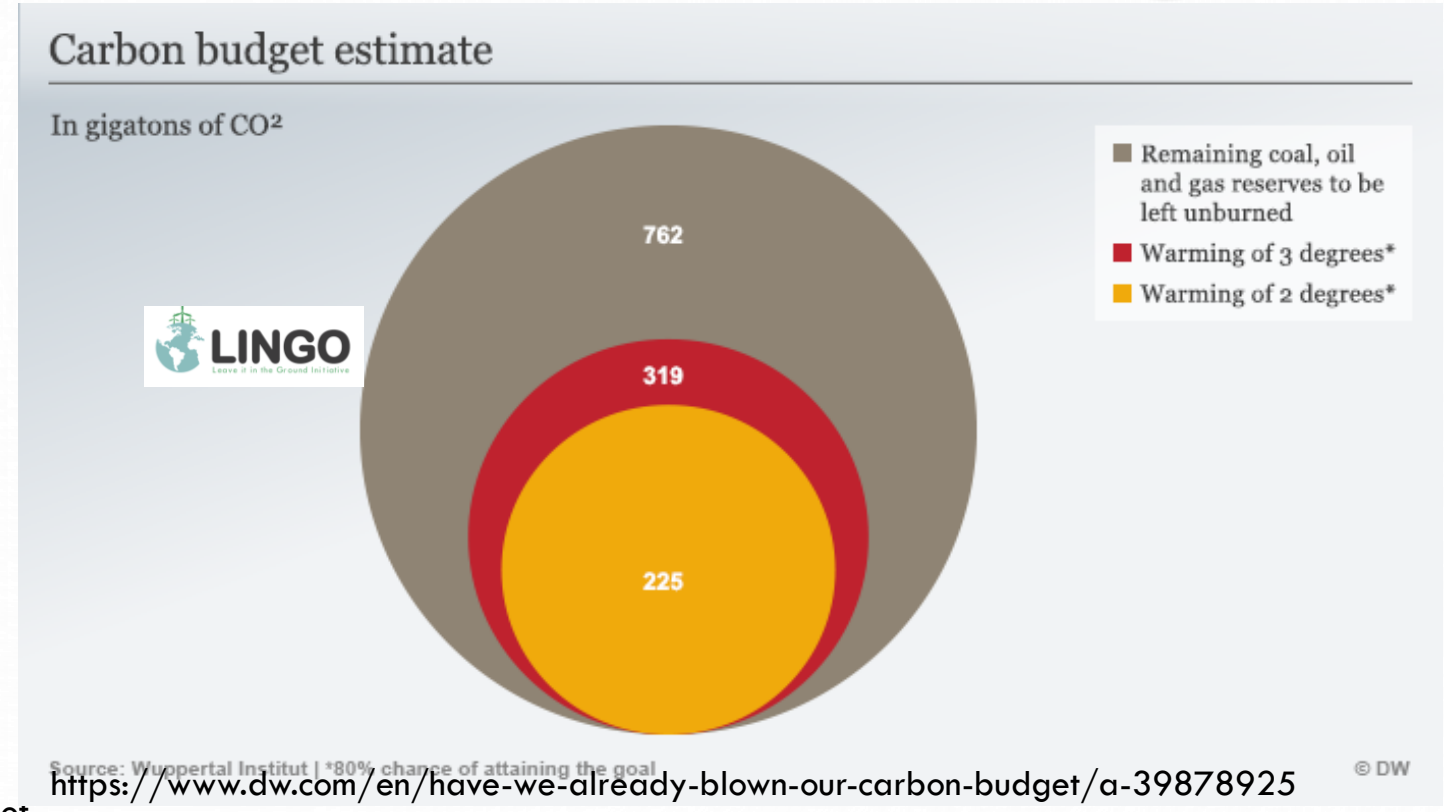




# ORÇAMENTO DE CARBONO




http://www.globalcarbonatlas.org/en/content/global-carbon-budget




https://www.dw.com/en/have-we-already-blown-our-carbon-budget/a-39878925

## INICIATIVAS DE MÉDIO E LONGO PRAZOS:

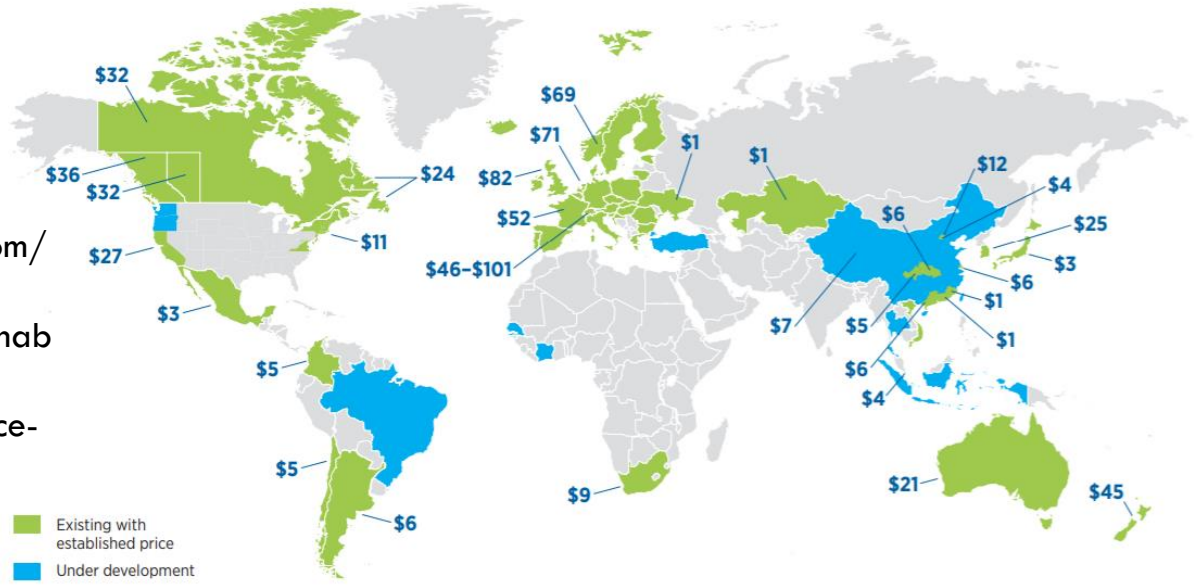
https://www.power-and-beyond.com/what-is-renewable-energy-definition-types-and-challenges-a-1027368/

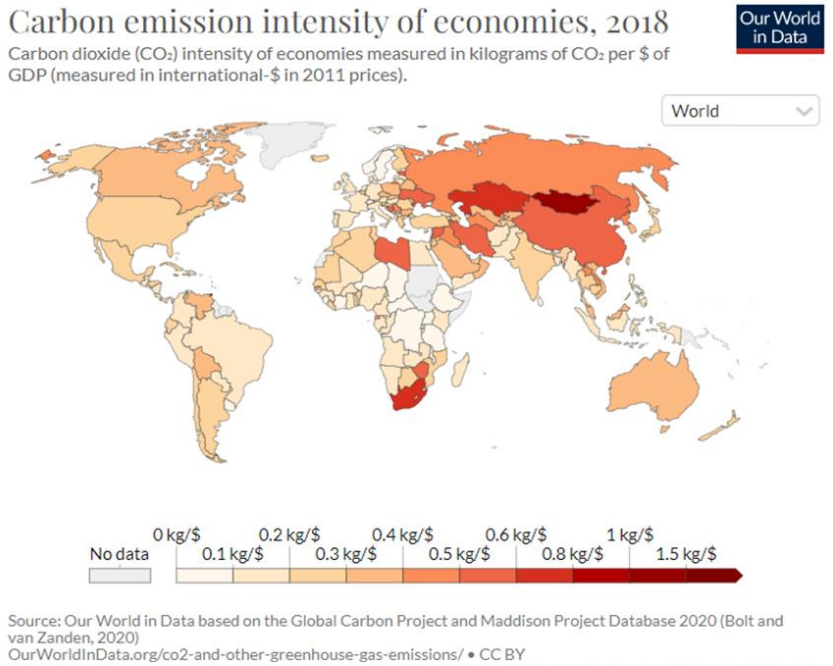
## TRANSIÇÃO (CURTO E MÉDIO PRAZOS):

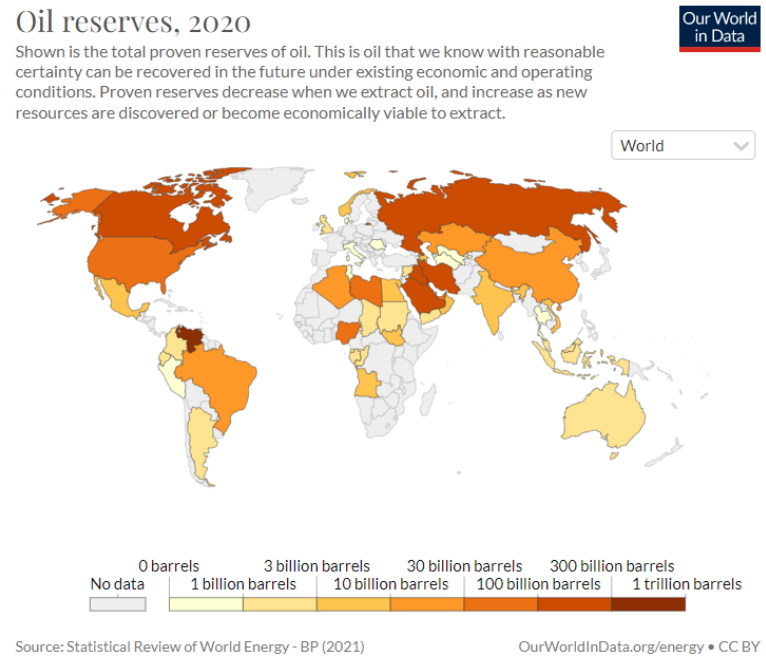
- ❑ Reduzir emissões com eficiência energética
- ❑ Aumentar Sumidouros antrópicos: CCS, CCU
- ❑ Expandir infraestrutura de geração e distribuição de energias renováveis.

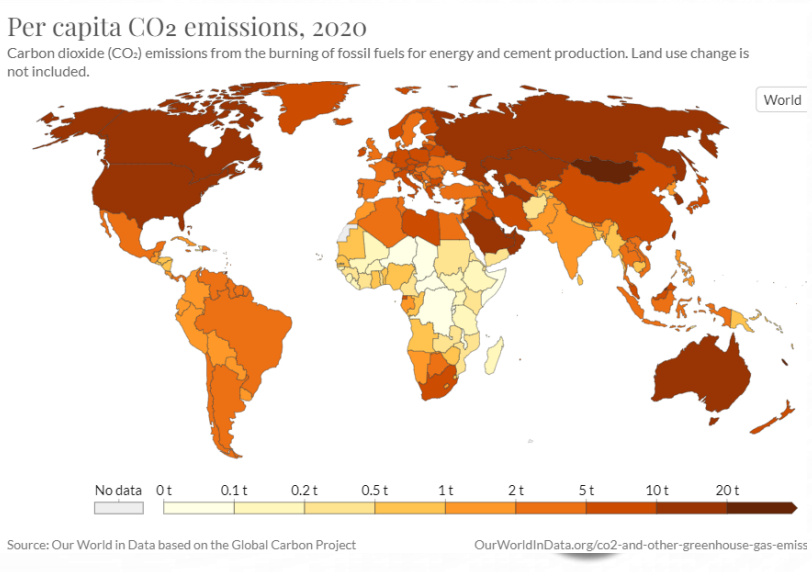
# PRECIFICAÇÃO DE CARBONO

https://www.chevron.com/-/media/chevron/sustainability/documents/2021-climate-change-resilience-report.pdf

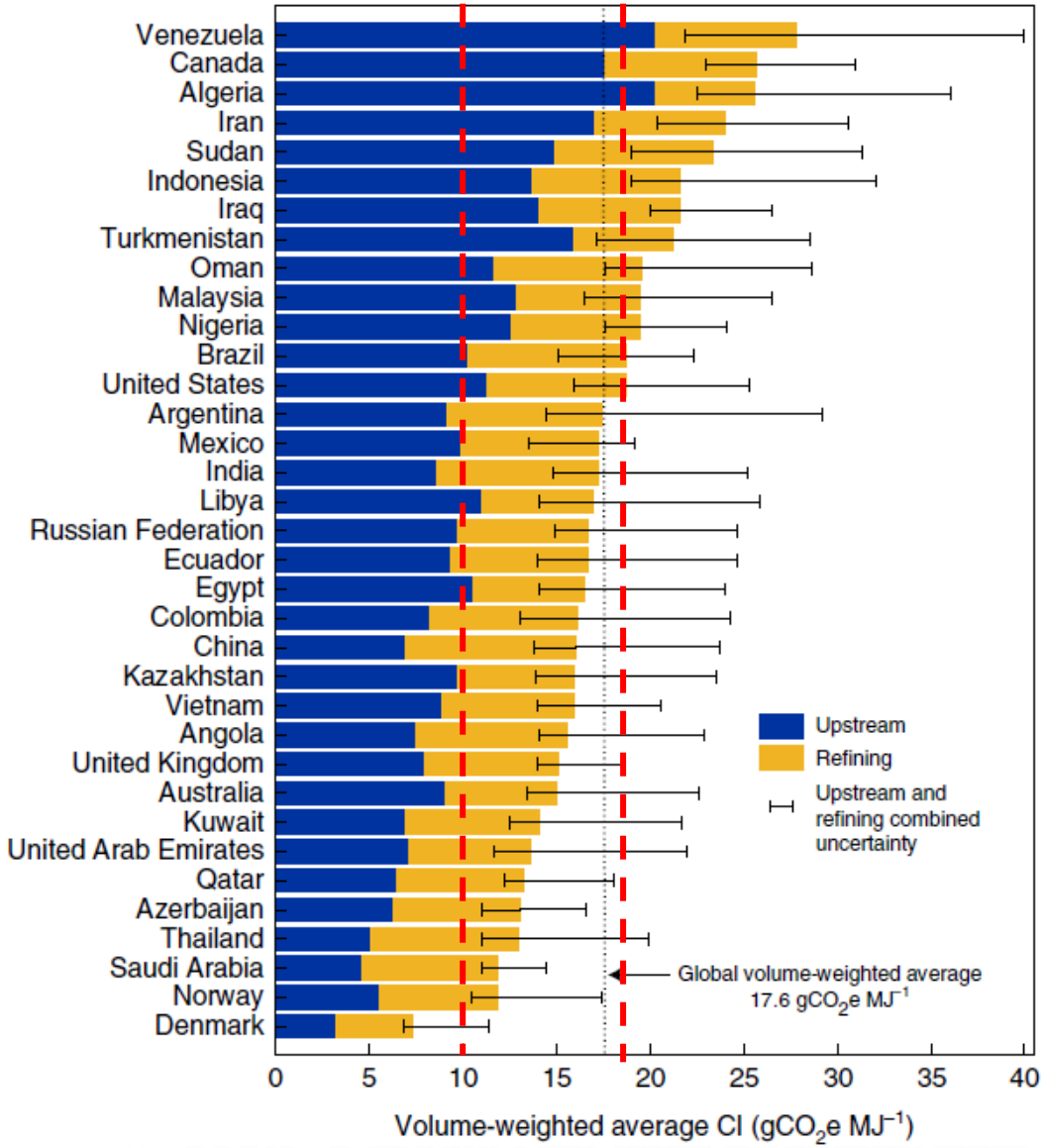


# EMISSÕES NO SETOR DE O&G




Nature Climate Change, https://doi.org/10.1038/s41558-020-0775-3

=> 1g CO2 / MJ = 6 kg $CO_2$ / bbl (1bbl ≡ 6000MJ)

O Brasil emite ~115 kg $CO_2$ / bbl
A média global de emissão é **105,6 kg $CO_2$ / bbl**.

Nature Climate Change, https://doi.org/10.1038/s41558-020-0775-3

Atualmente, a intensidade de carbono no E&P varia entre **20 e 30 kg $CO_2$ / bbl.**

Metas entre **6 kg CO2 / bbl** e **15 kg $CO_2$ / bbl** ao final da década.

https://www.udop.com.br/noticia/2021/11/25/o-que-as-petroleiras-estao-fazendo-para-descarbonizar-o-pre-saly.html

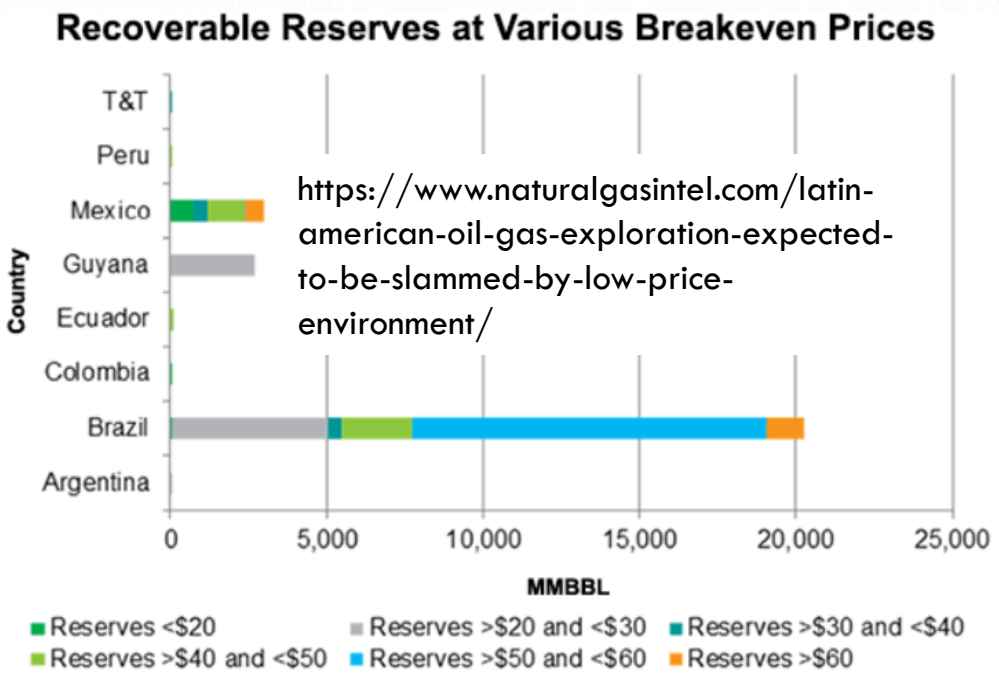
# QUEM TEM O&G TEM PRESSA

- Custo de Exploração do Pré-Sal: $5 / bbl
- Custo adicional de taxação de CO2: $40-$80 / tCO2

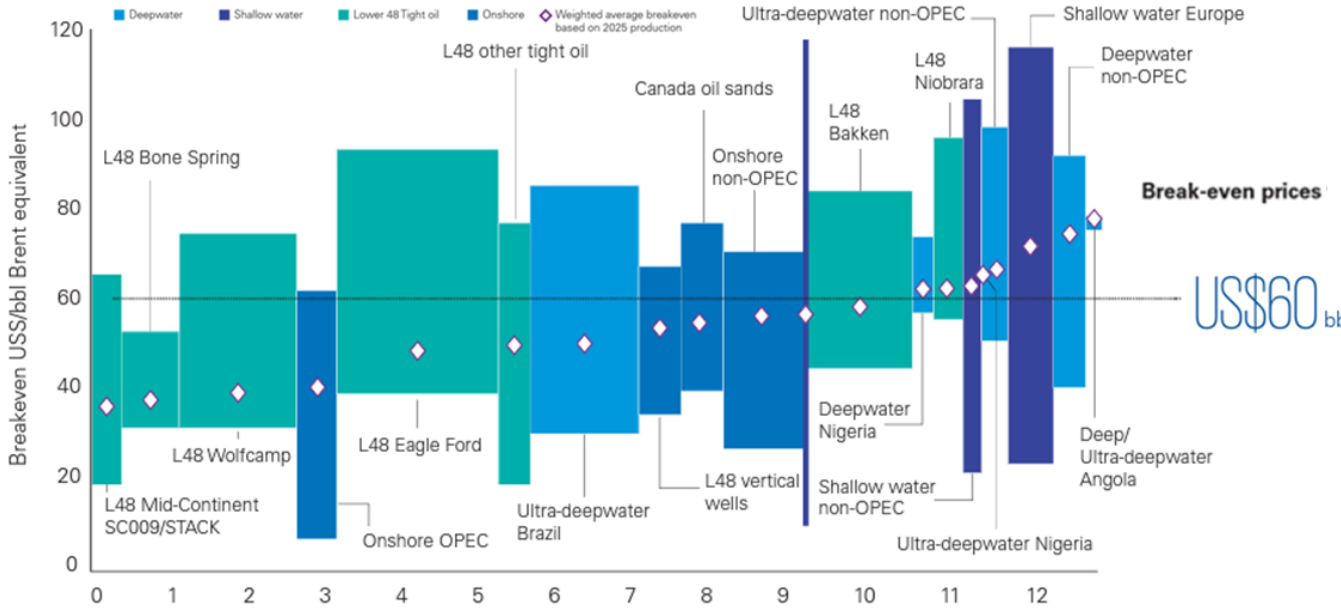

$$\frac{CO_2}{Energia}$$

INTENSIDADE DE CARBONO = **0.06 t CO2/bbl**
2,4 - 4,8 $ / bbl (aumento de 48%-96%)

INTENSIDADE DE CARBONO = **0.009 t CO2/bbl**
$0.36 - 0.70 $ / bbl (aumento de 7%-14%)

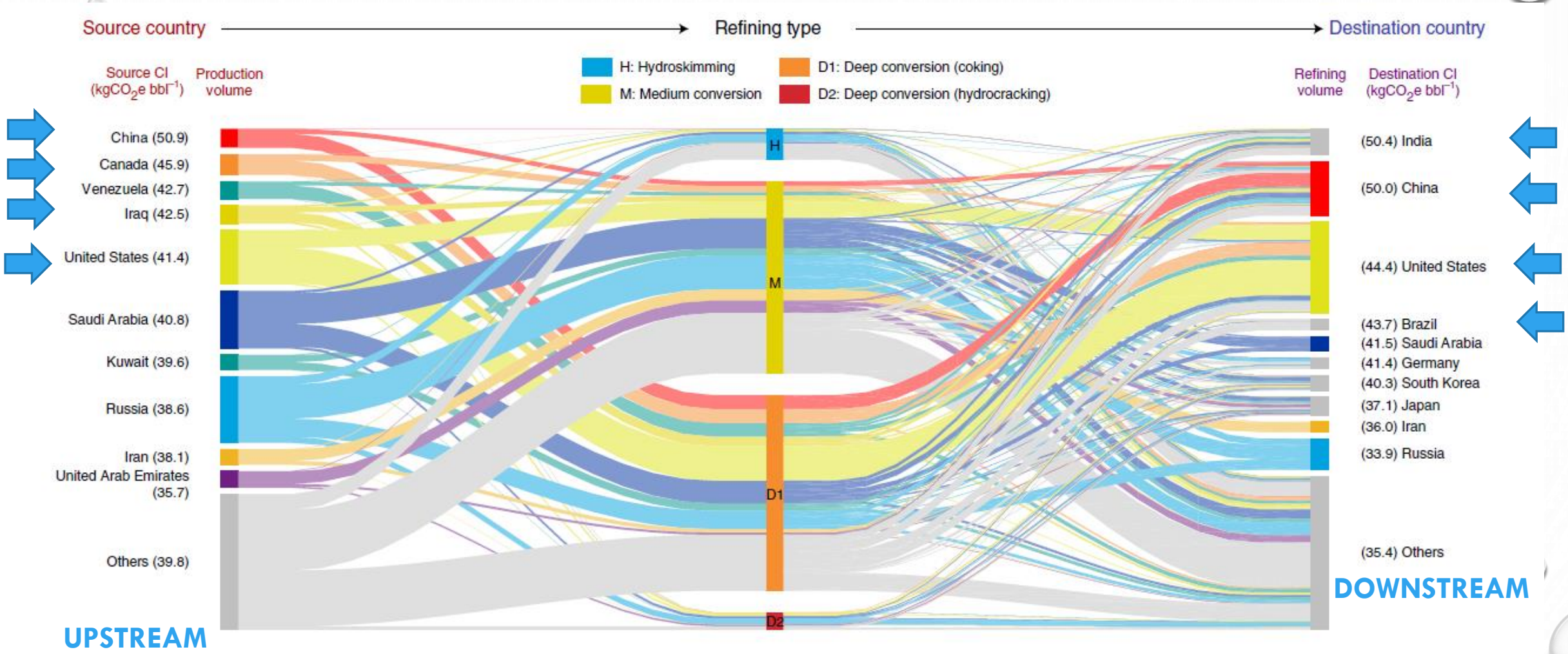



https://www.naturalgasintel.com/latin-american-oil-gas-exploration-expected-to-be-slammed-by-low-price-environment/



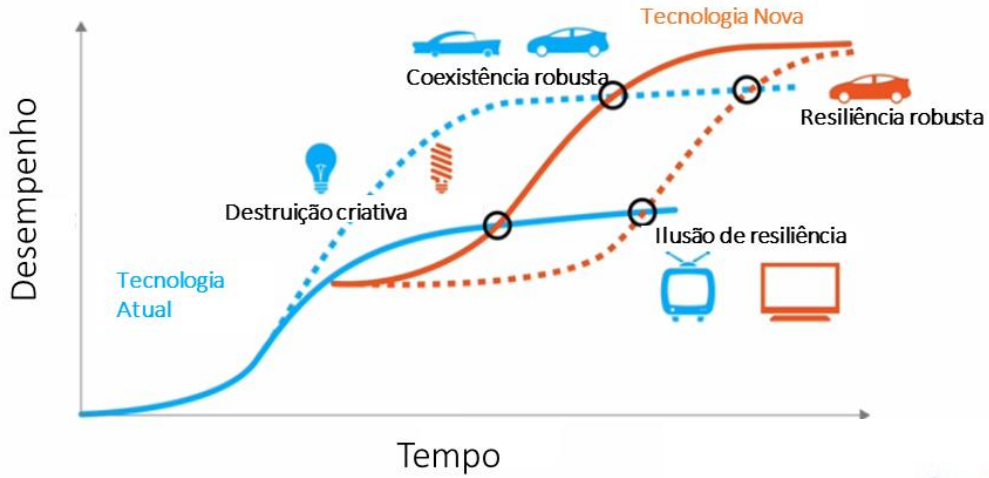

https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/12/delivering-long-term-value-in-e-and-p.pdf

# FLUXO GLOBAL DE PETRÓLEO

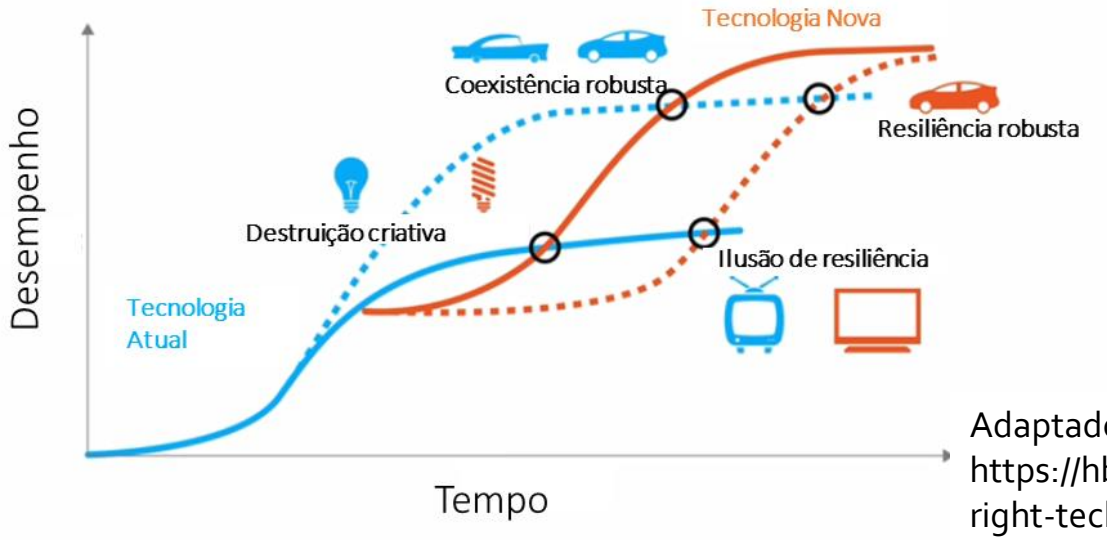



Nature Climate Change, https://doi.org/10.1038/s41558-020-0775-3

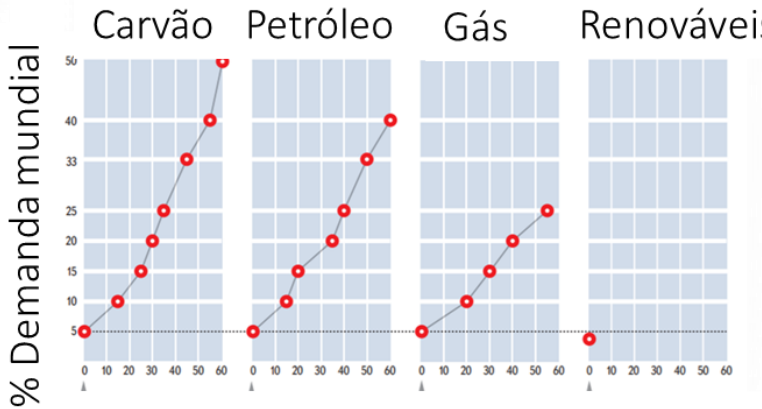
# TRANSIÇÃO DE TECNOLOGIAS




# TRANSIÇÃO REQUER TEMPO



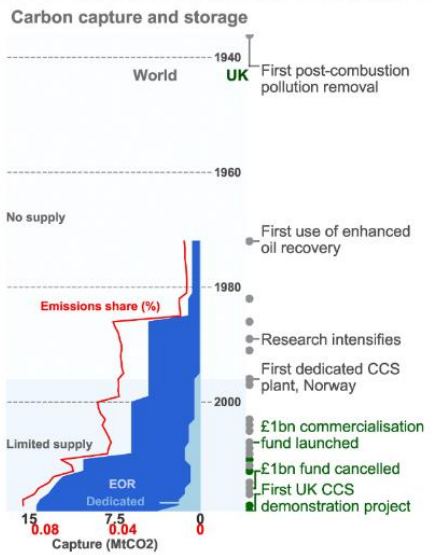

Adaptado de https://hbr.org/2016/11/right-tech-wrong-time

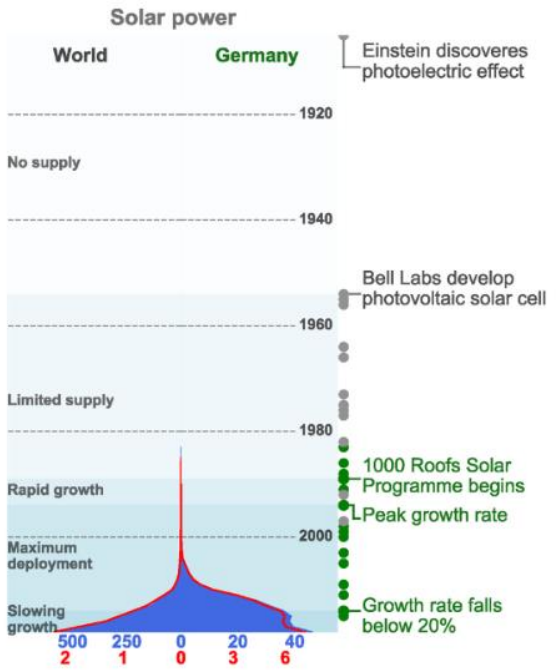


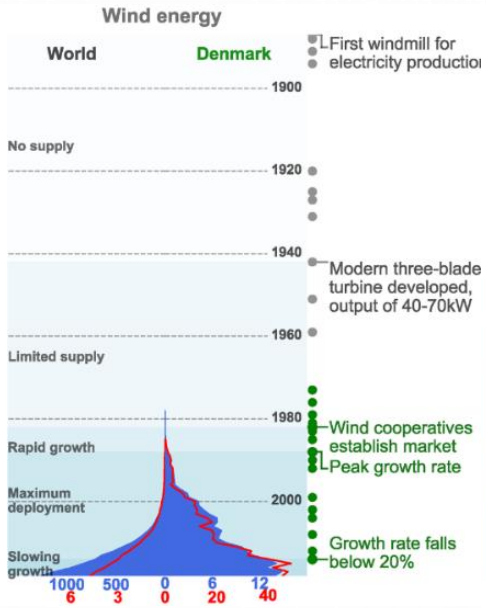

Anos após início de suprimento de 5% da demanda mundial

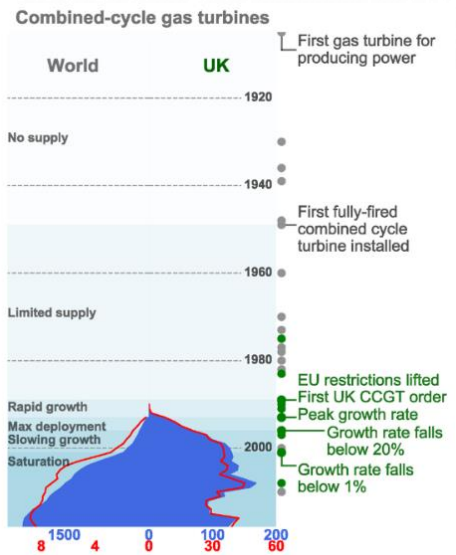
https://ourworldindata.org/how-long-before-we-run-out-of-fossil-fuels

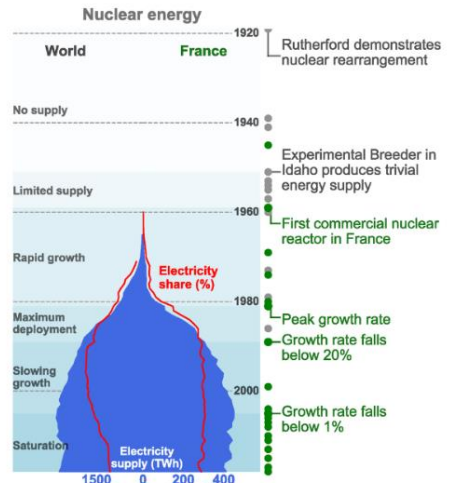

## Transições duram décadas!



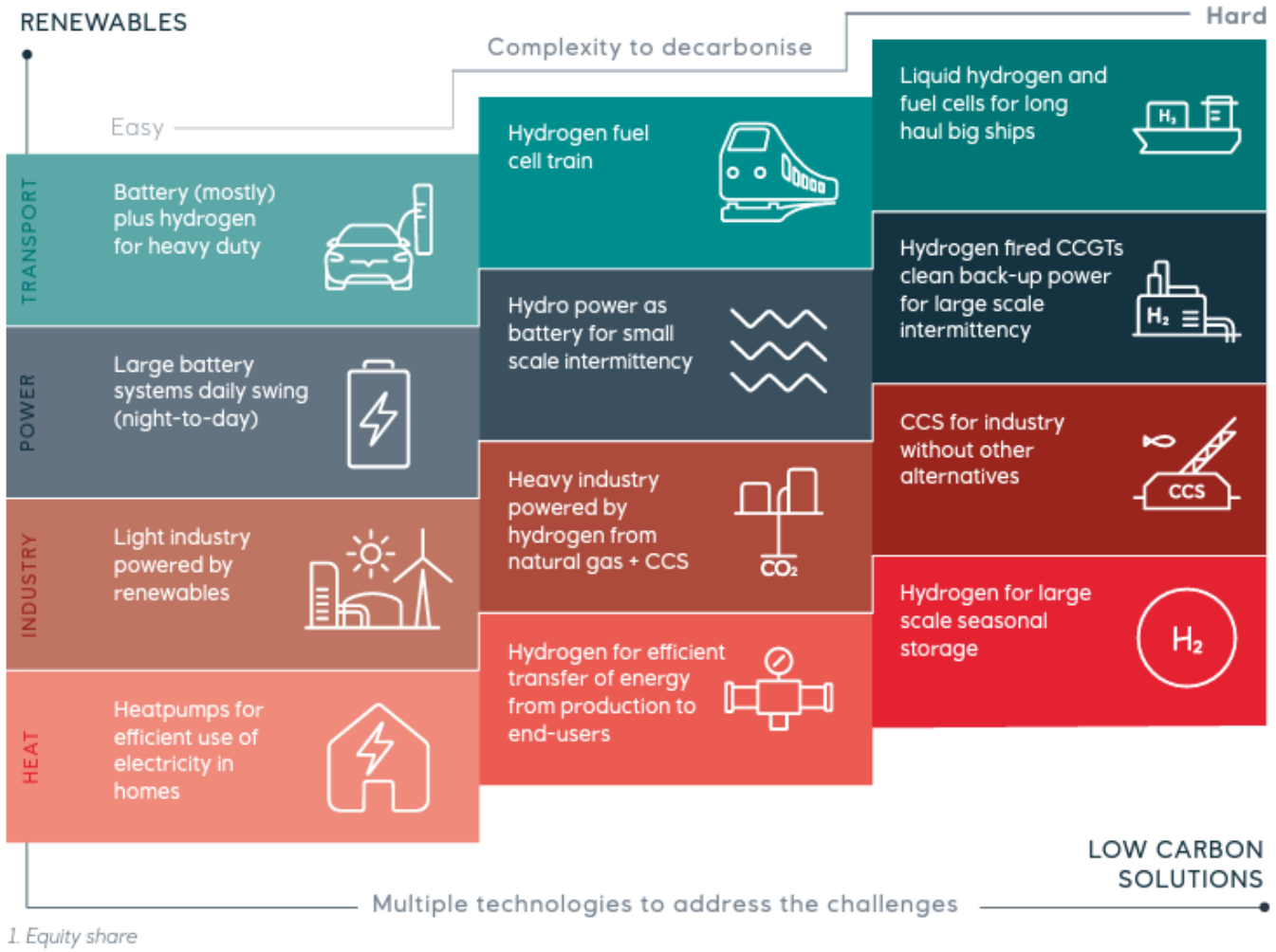



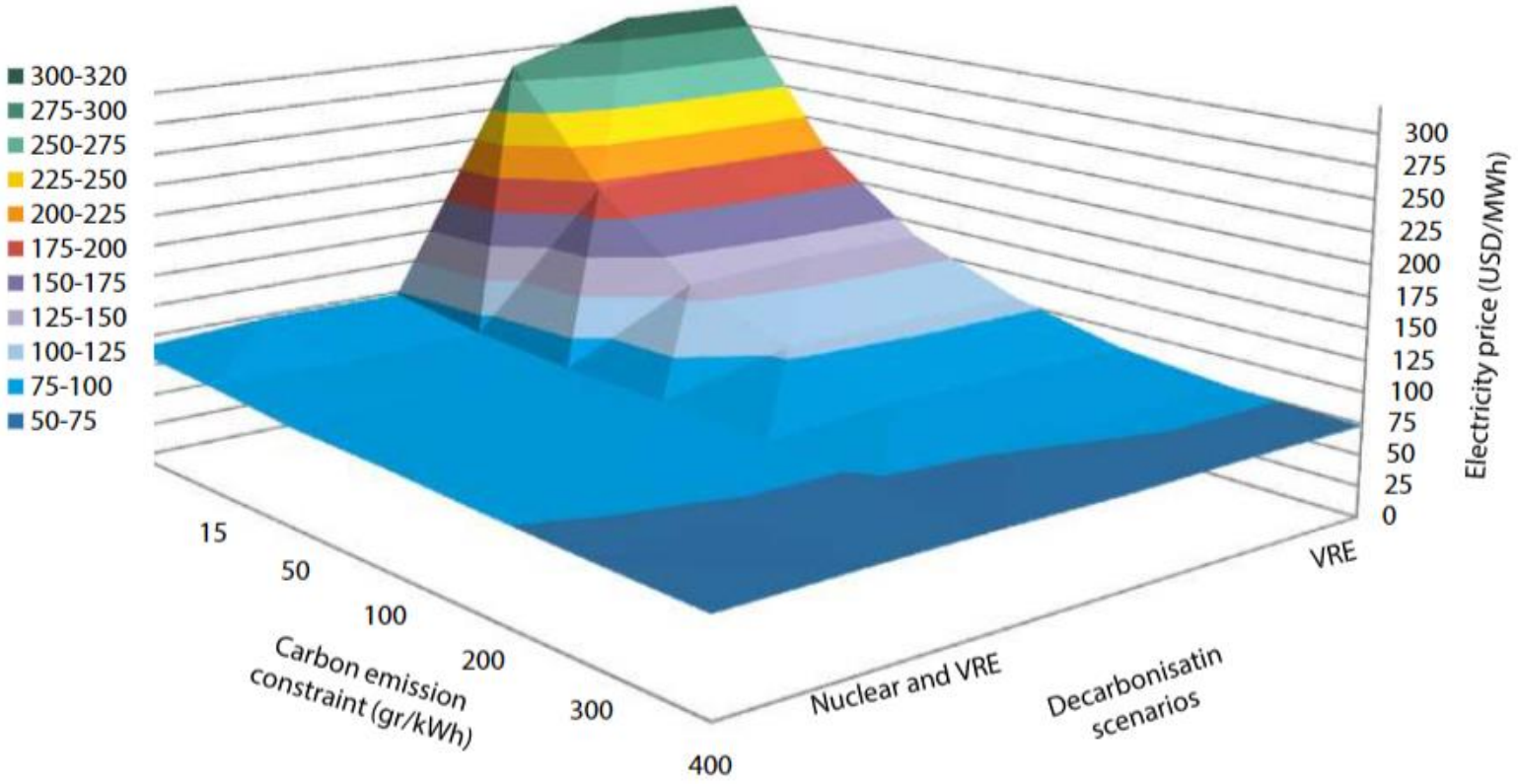

https://doi.org/10.1016/j.enpol.2021.112155

# AS METAS DE EMISSÃO E DIFICULDADES




https://cdn.sanity.io/files/h61q9gi9/global/6a64fb766c58f70ef37807deca2ee036a3f4096b.pdf?energy-transition-plan-2022-equinor.pdf

# OS CUSTOS DE DESCARBONIZAR A ELETRICIDADE

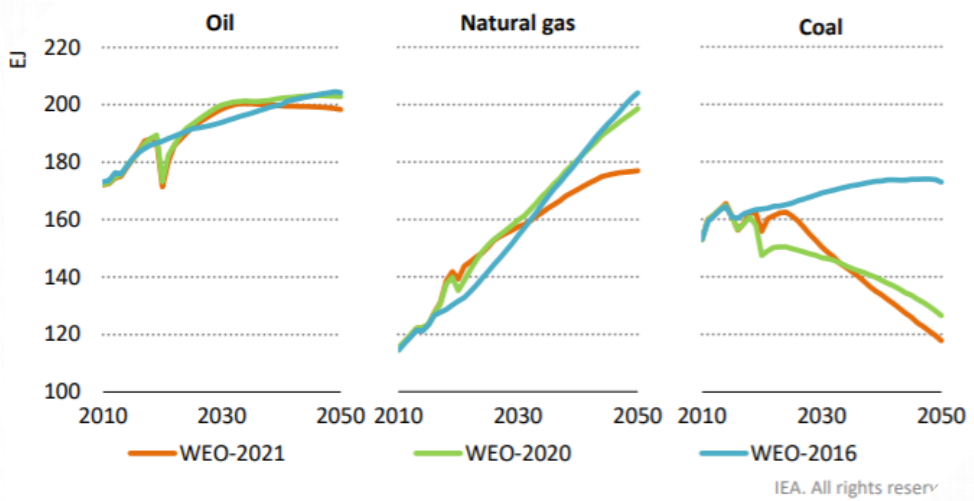



Os custos aumentam com metas mais restritivas às emissões de $CO_2$.

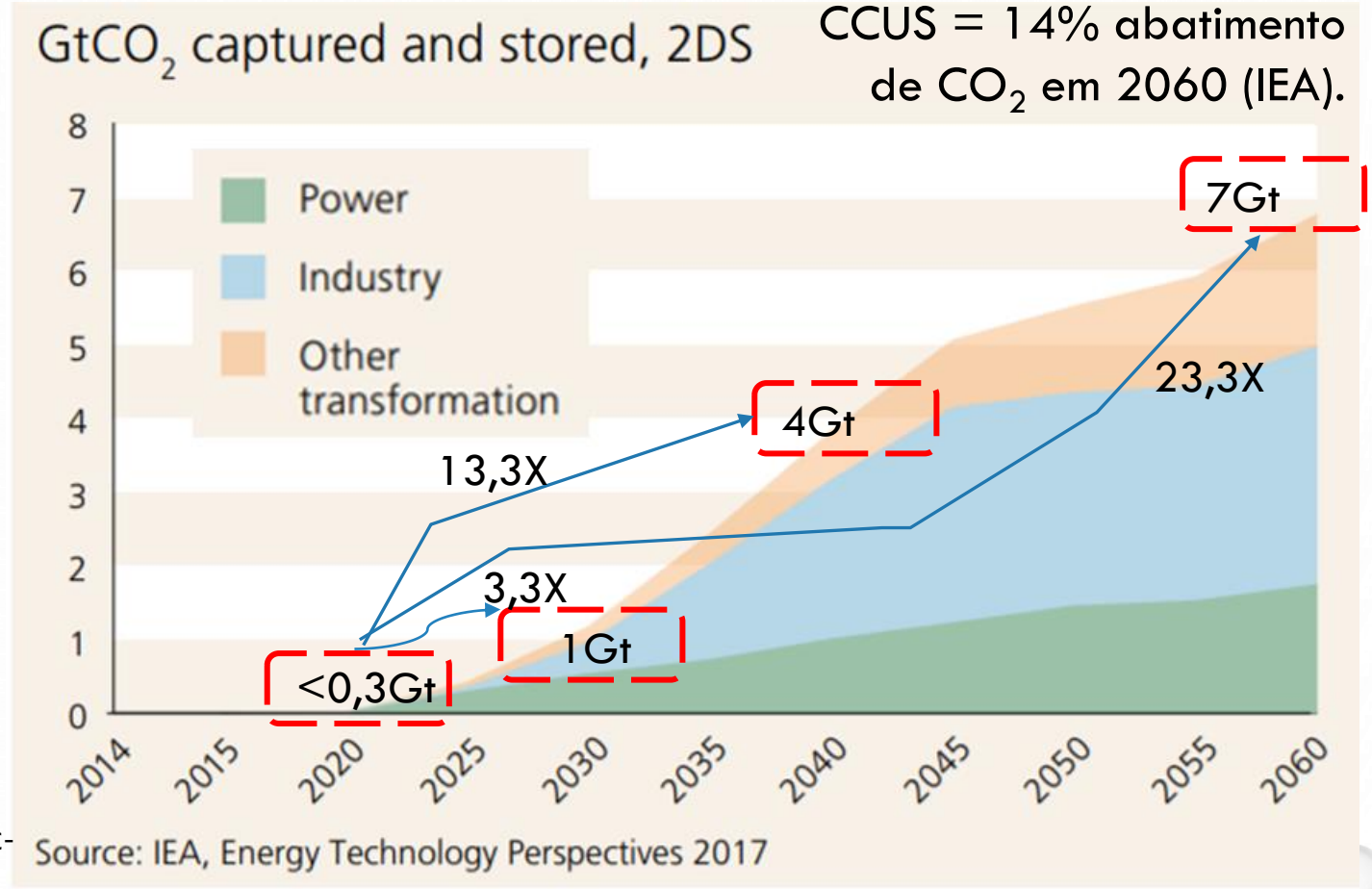
Diversidade de fontes reduz o custo total de energia.

https://read.oecd-ilibrary.org/nuclear-energy/the-costs-of-decarbonisation_9789264312180-en#page80

# AUMENTO DE ESCALA DE CCS É UM DESAFIO

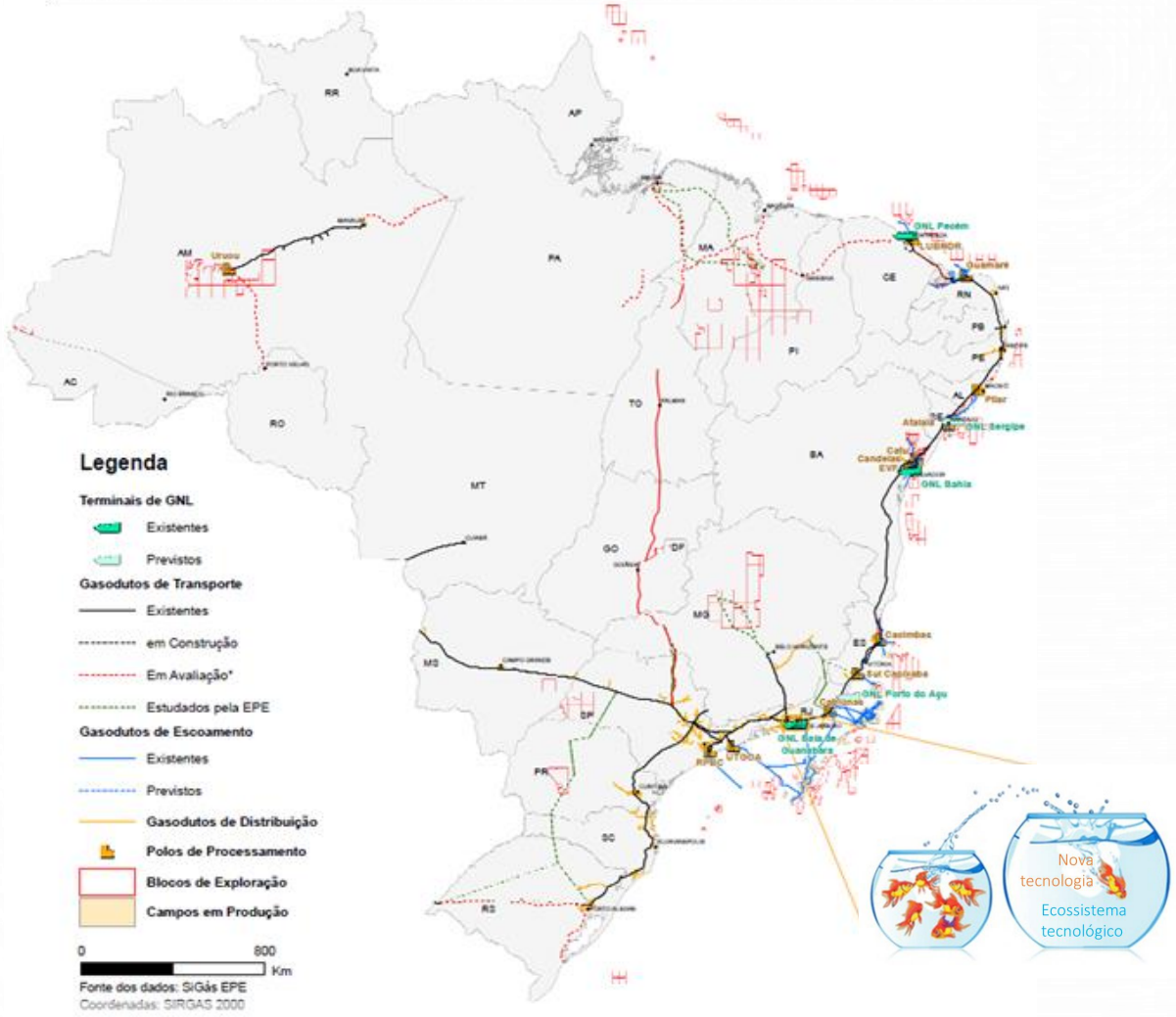



https://iea.blob.core.windows.net/assets/88decoc7-3a11-4d3b-99dc-8323ebfb388b/WorldEnergyOutlook2021.pdf




http://oilandgasclimateinitiative.com/wp-content/uploads/2017/10/OGCI-2017-Report.pdf

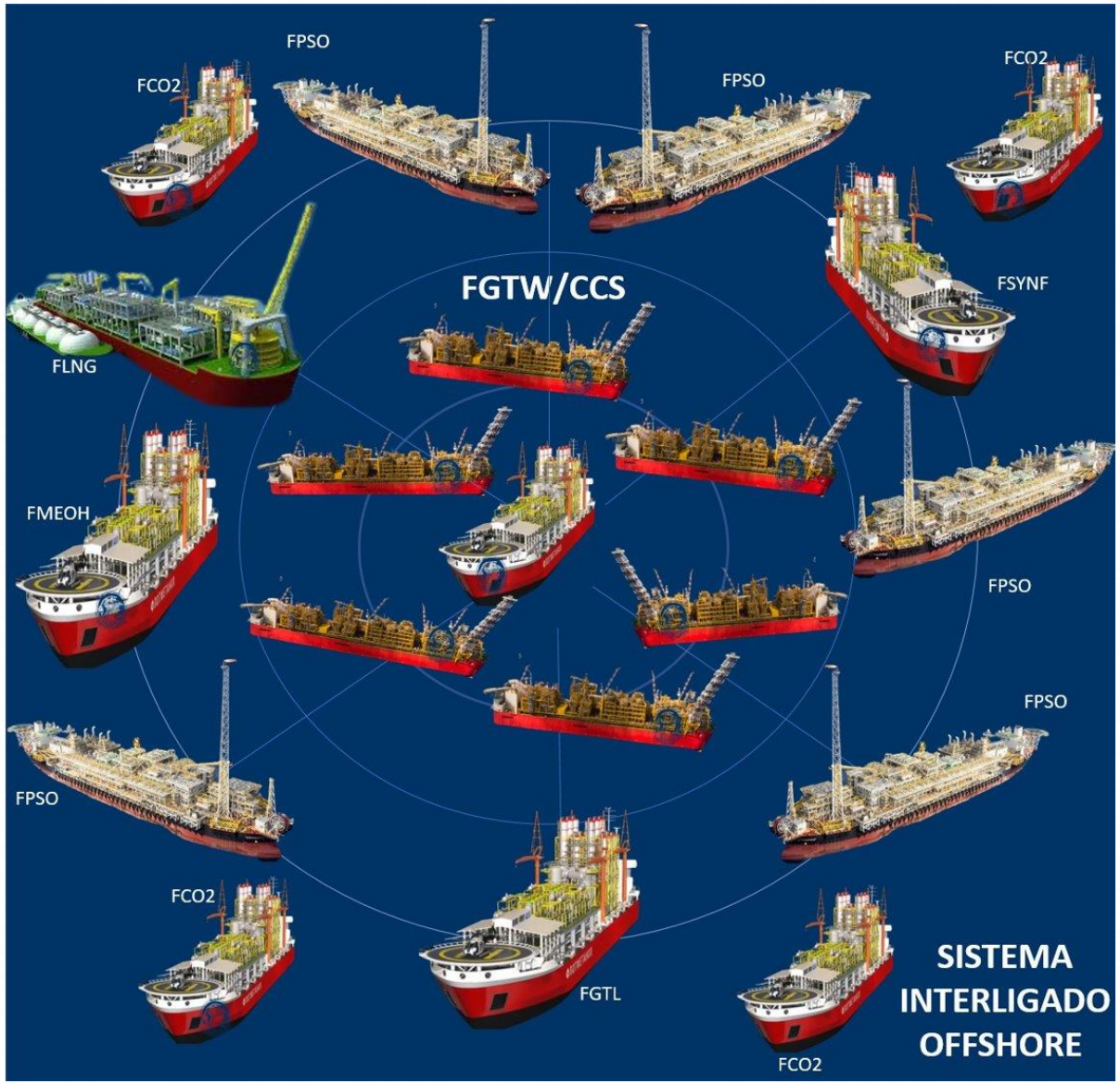
# ELETRIFICAÇÃO: TRANSPORTE DE MOLÉCULAS ($CH_4$) x ELÉTRONS




www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/publicacao-367/MAPA_Ao%20-%202019.pdf


https://gisepeprd2.epe.gov.br/WebMapEPE/

# Monetização NZE de Gás Natural



# REFLEXÕES FINAIS

# TRANSIÇÃO ENERGÉTICA

## *ESGWASHING*

https://www.infomoney.com.br › Colunistas

A pandemia do ESG-washing e sua letalidade - InfoMoney

**ESG-washing** é a prática de mostrar uma faceta ESG quando ela não existe em essência. Em bom português, seria o famoso “da porta pra fora”, ou “para inglês ver”.

https://ccbrasil.cc › blog › de-quem-e-a-culpa-pelo-esg...

De quem é a culpa pelo ESGwashing? – Capitalismo Consciente ...

Uma empresa pratica **ESGwashing**, por exemplo, quando seus esforços no universo verde não são proporcionais à grandeza de sua operação. Ou seja, ao anunciar ...

https://www.noticiasustentavel.com.br › esgwashing-co...

'ESGwashing': em comunicação não adianta parecer ESG ...

3 de dez. de 2021 — **'ESGwashing'**: em comunicação não adianta parecer ESG, precisa ser ESG, defende a jornalista Daniela Garcia em artigo sobre o tema.


## VALOR ECONÔMICO DA SUSTENTABILIDADE

SAVi Sustainable Asset Valuation