



Where to start in energy policy and geopolitics?

A FEW FUNDAMENTALS NOTIONS

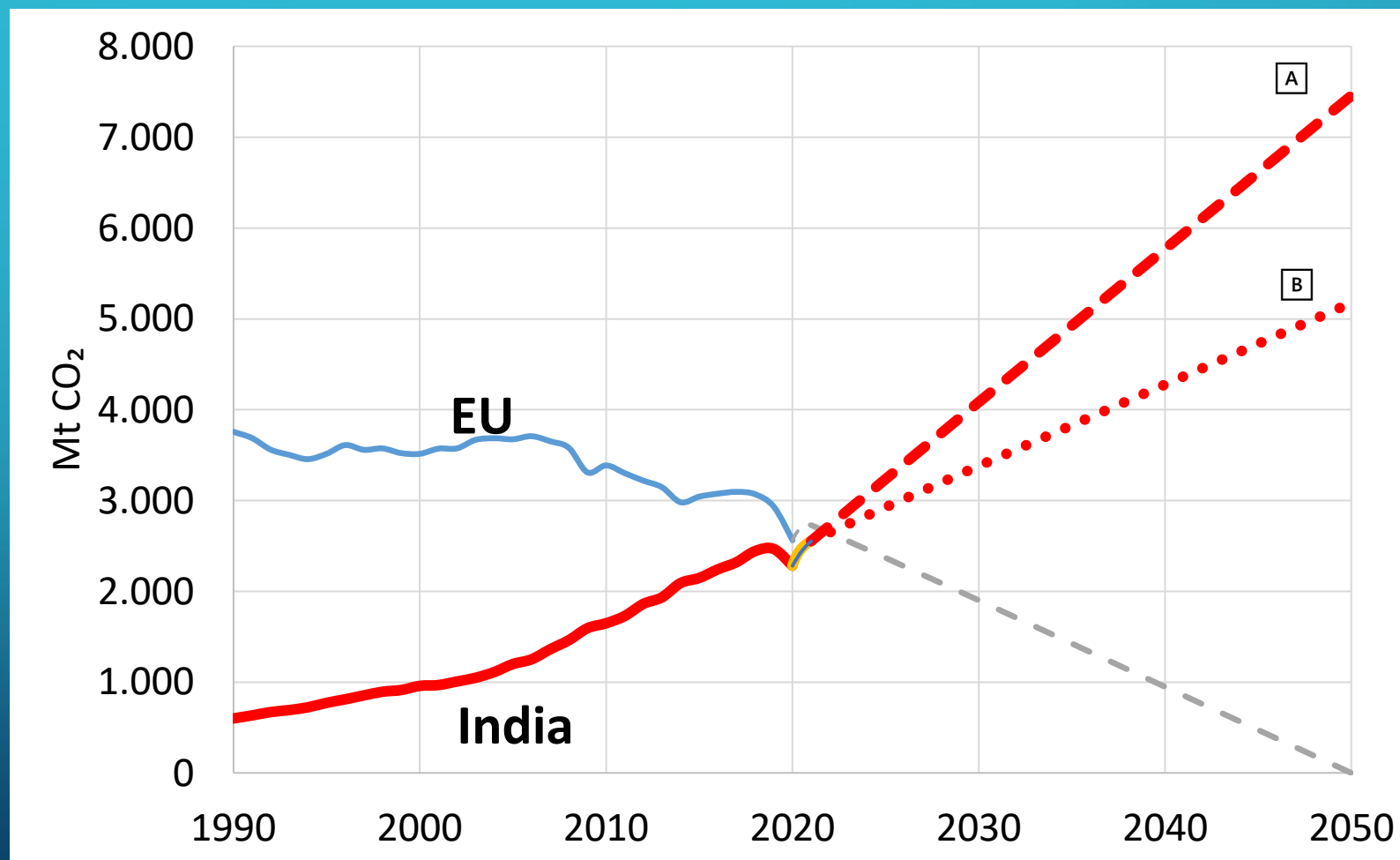
SAMUELE FURFARI

JOINT EPS-SIF INTERNATIONAL SCHOOL ON ENERGY
VARENNA, JULY 2023

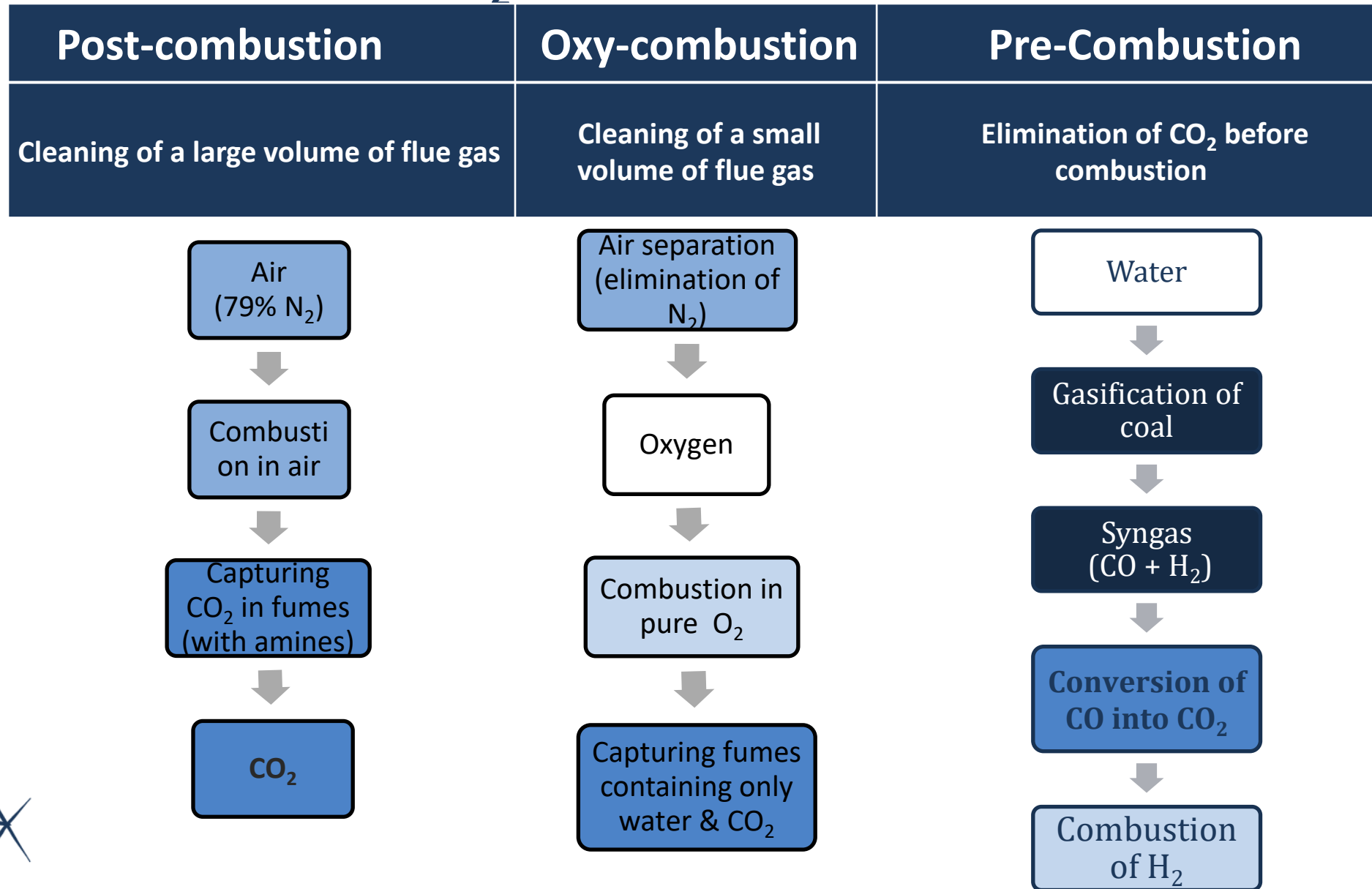
Credit: Glass painting by Fritz Wagner, "Komposition HG 1/15", 2015

EU and India CO₂ emissions.

Data up to 2020 from BP Statistical Review 2023. After 2020, the trend towards zero carbon in the EU and linear increase in India (B), reaching EU per capita emissions in 2050 (A).



Processes to eliminate CO₂ in combustion



Using the CO₂ ?

Oxydation (Combustion) of methane:



Reduction of CO₂ in methane



- Global reaction :



- Overall it is necessary to provide 802.88 kJ per mol of CH₄ formed (16 g) hence 50,180 kJ/kg CH₄

Reduction of CO₂ in methanol (with water as a source of hydrogen)

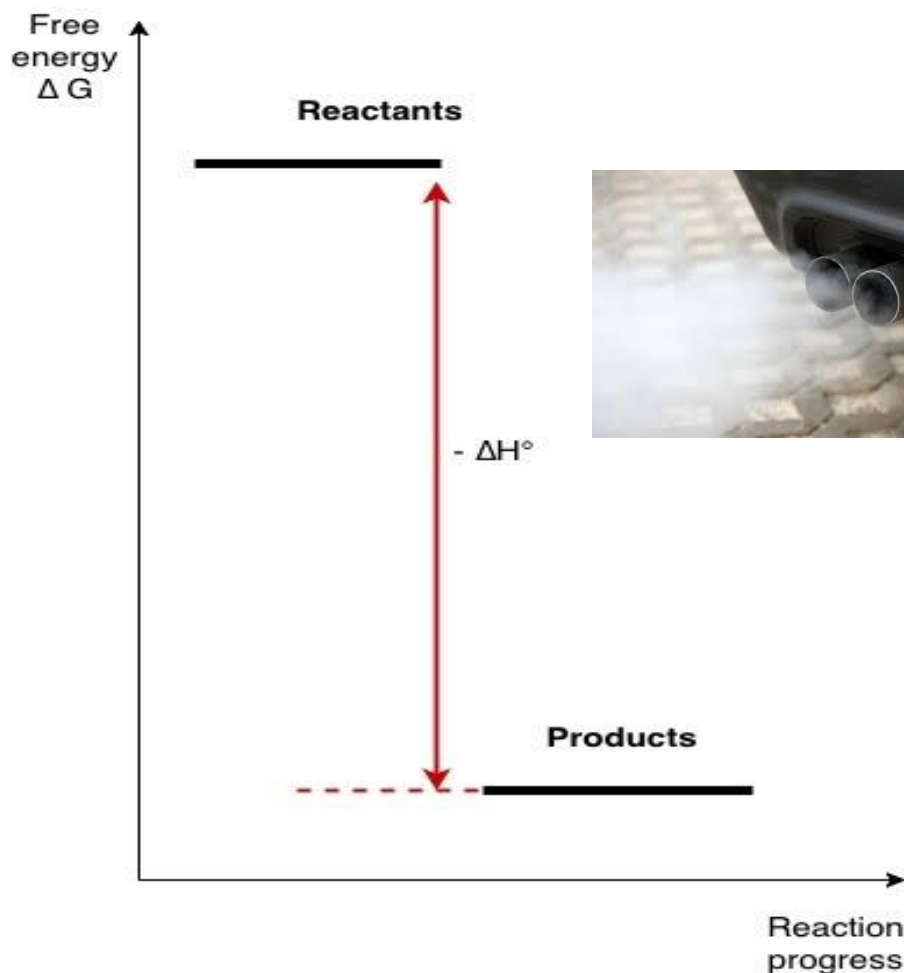


Global reaction:

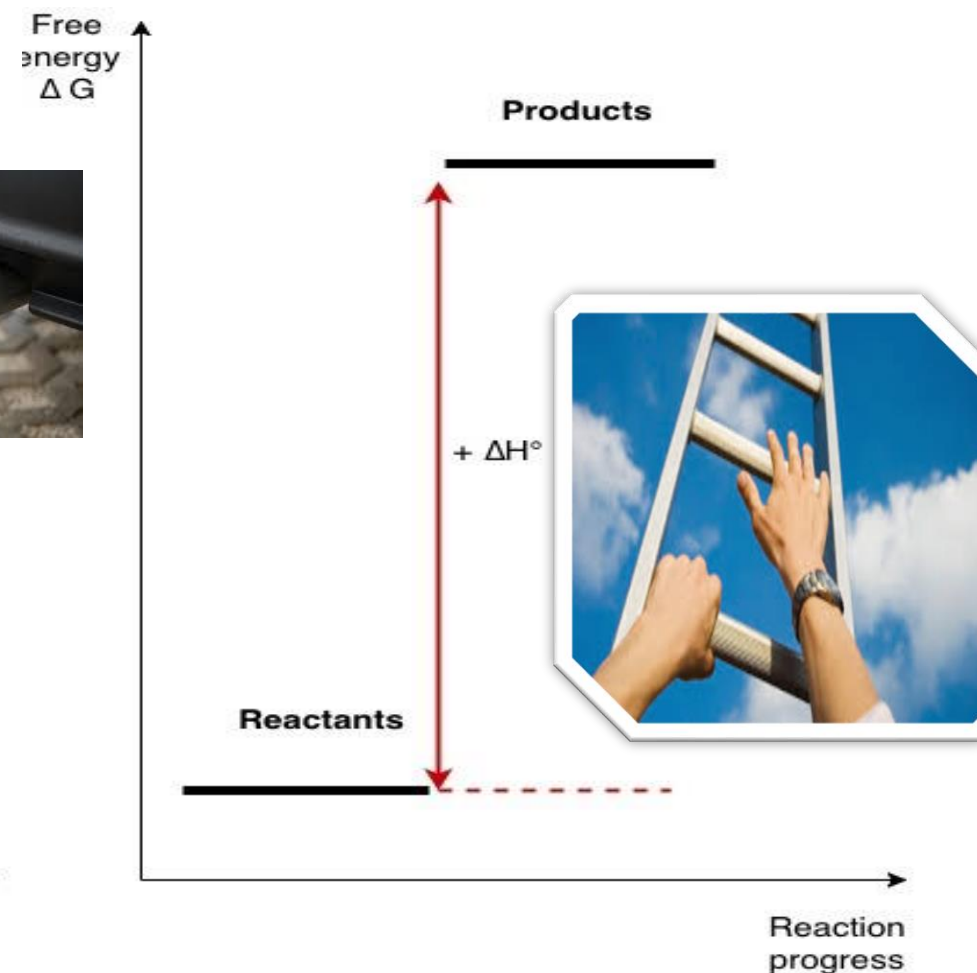


Overall it is necessary to provide 638.8 kJ per mol of CH₃OH formed or per mol of CO₂ transformed (it is less than for CH₄ production because carbon is less strongly "bound")

CO₂ : life exhaust pipe

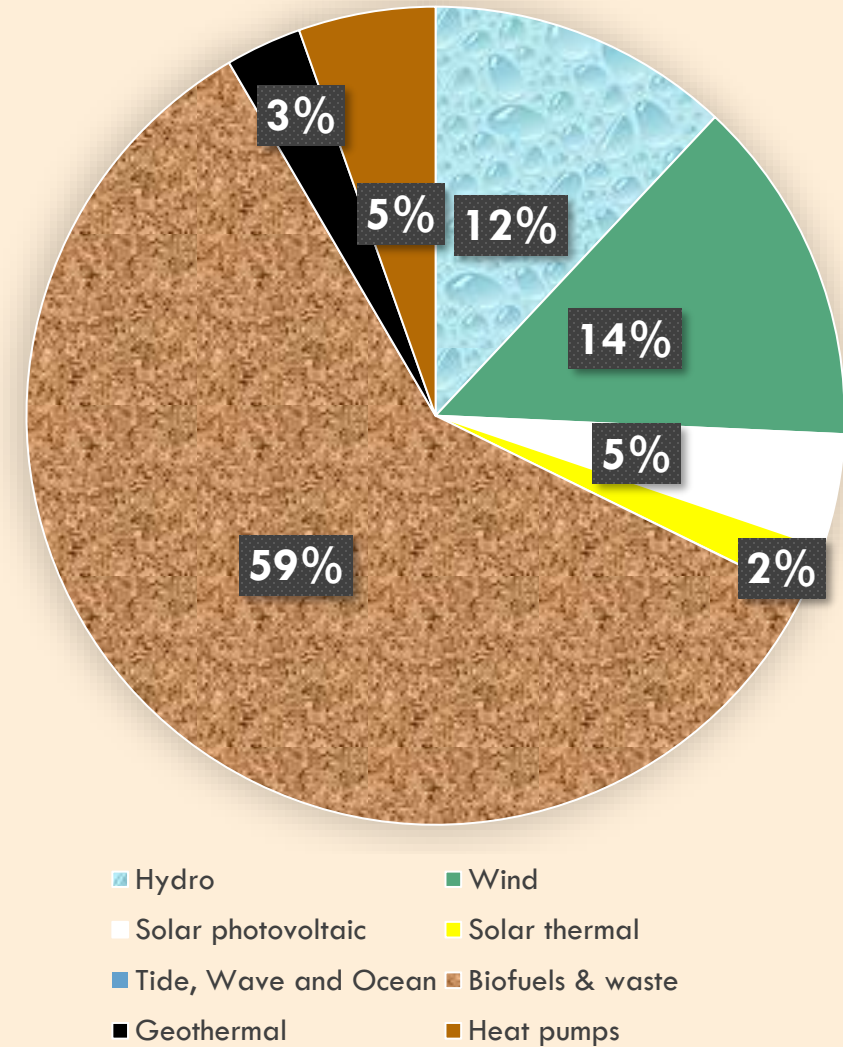
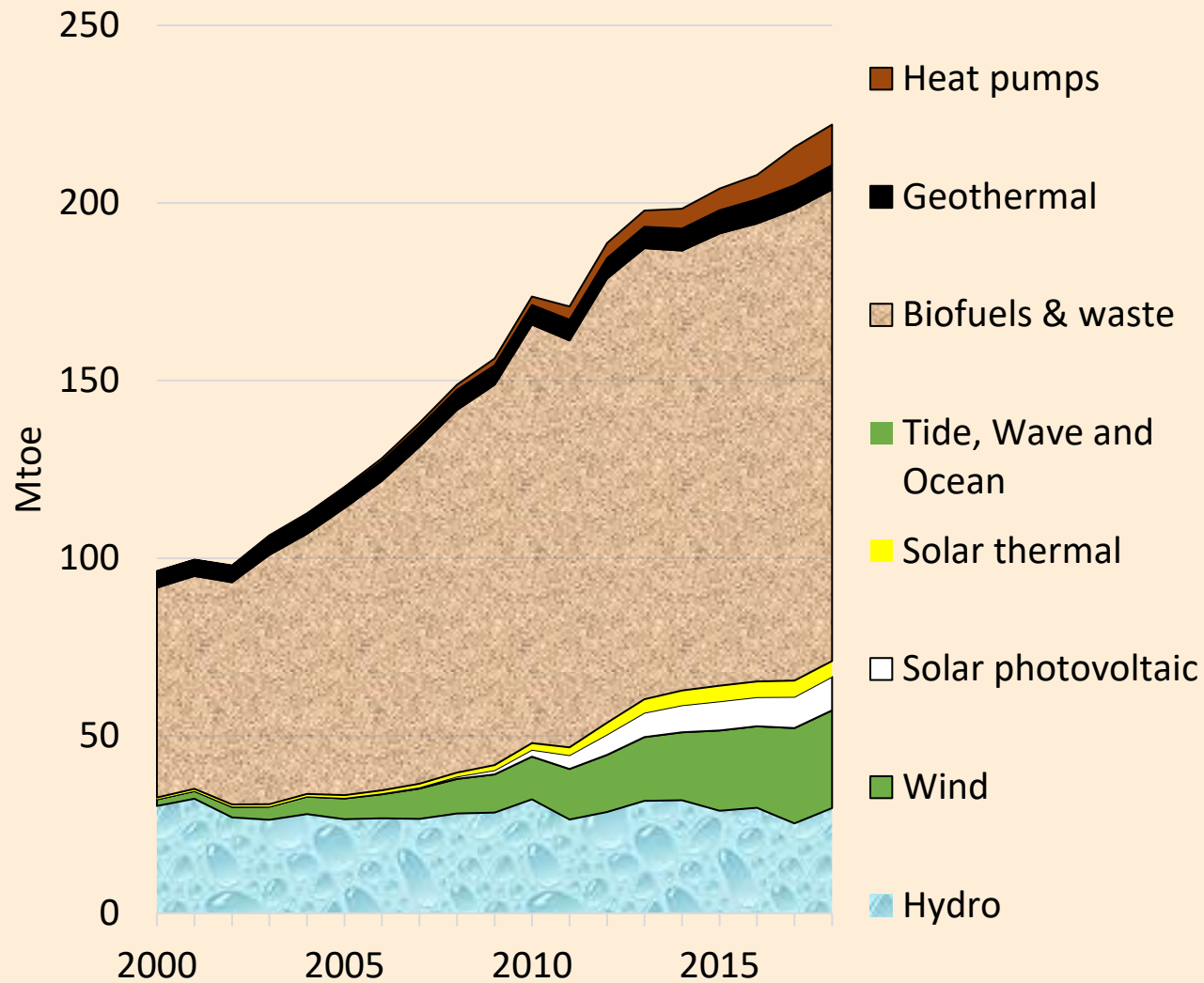


Products have less energy than reactants
Energy released (exothermic reaction)

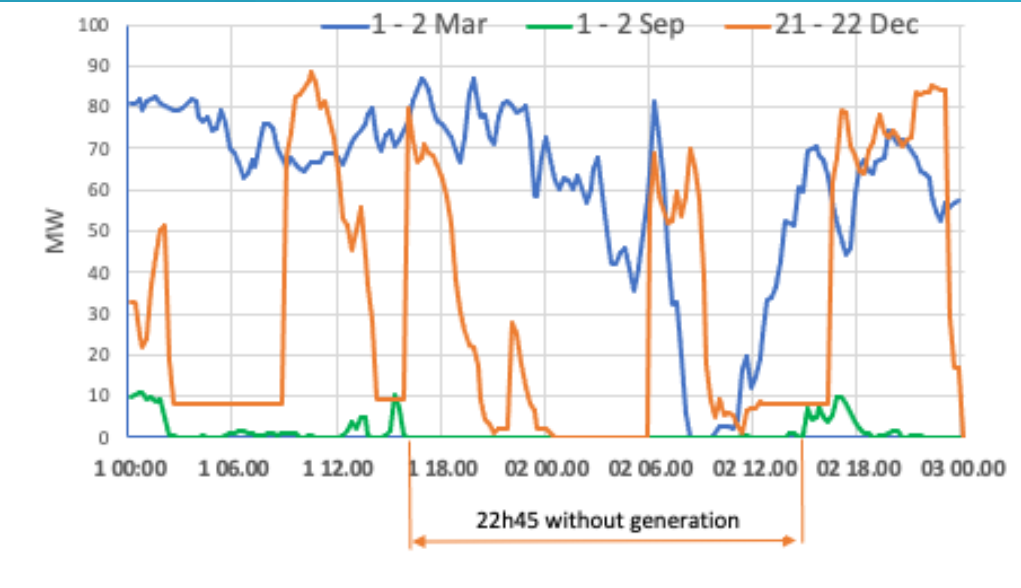
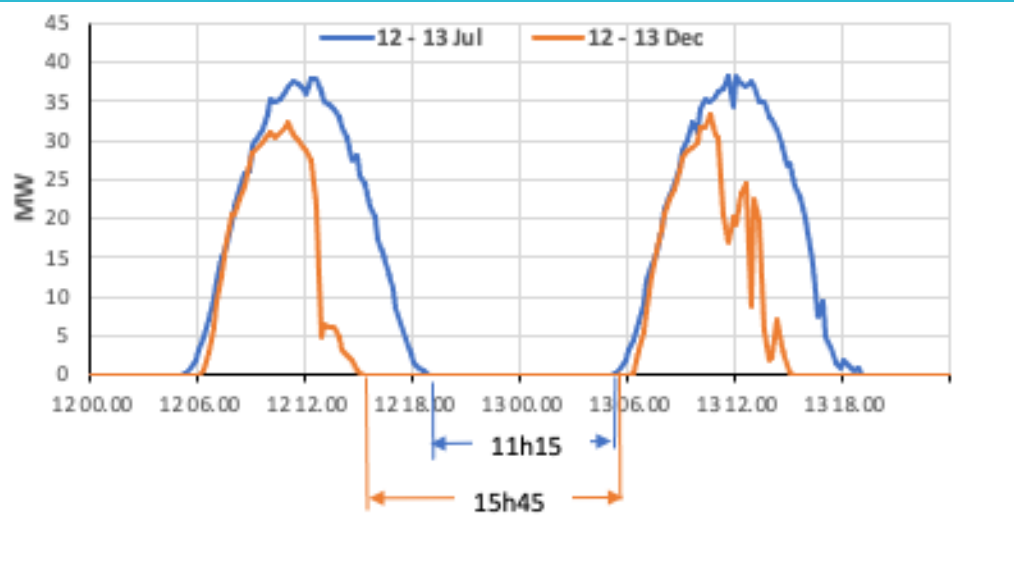


Products have more energy than reactants
Energy required (endothermic reaction)

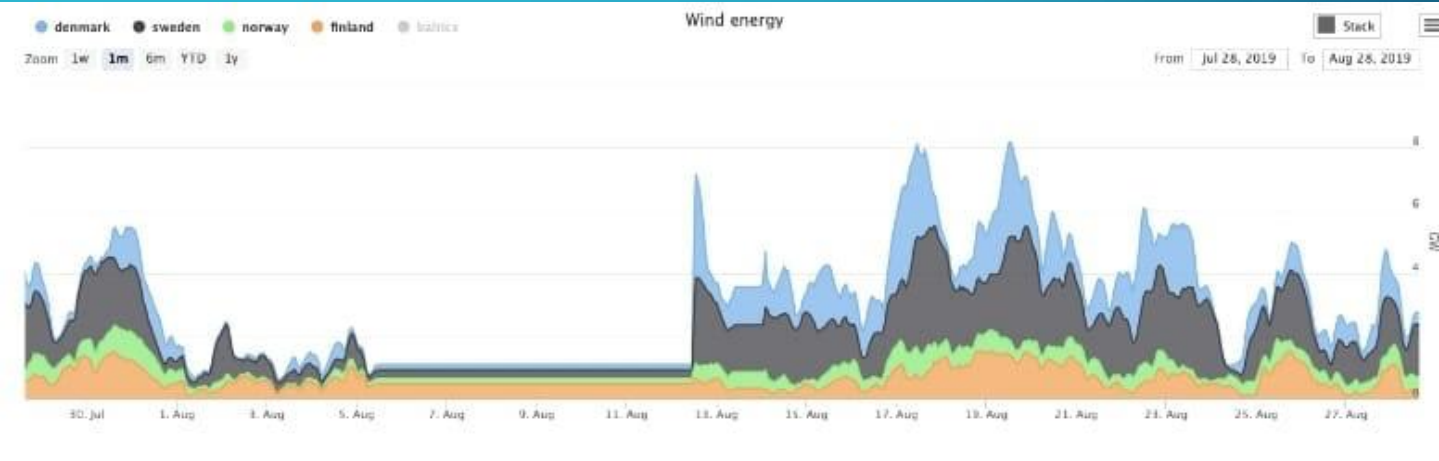
The renewable fuel mix reality in the EU



Intermittent and variable electricity generation or MW are not MWh

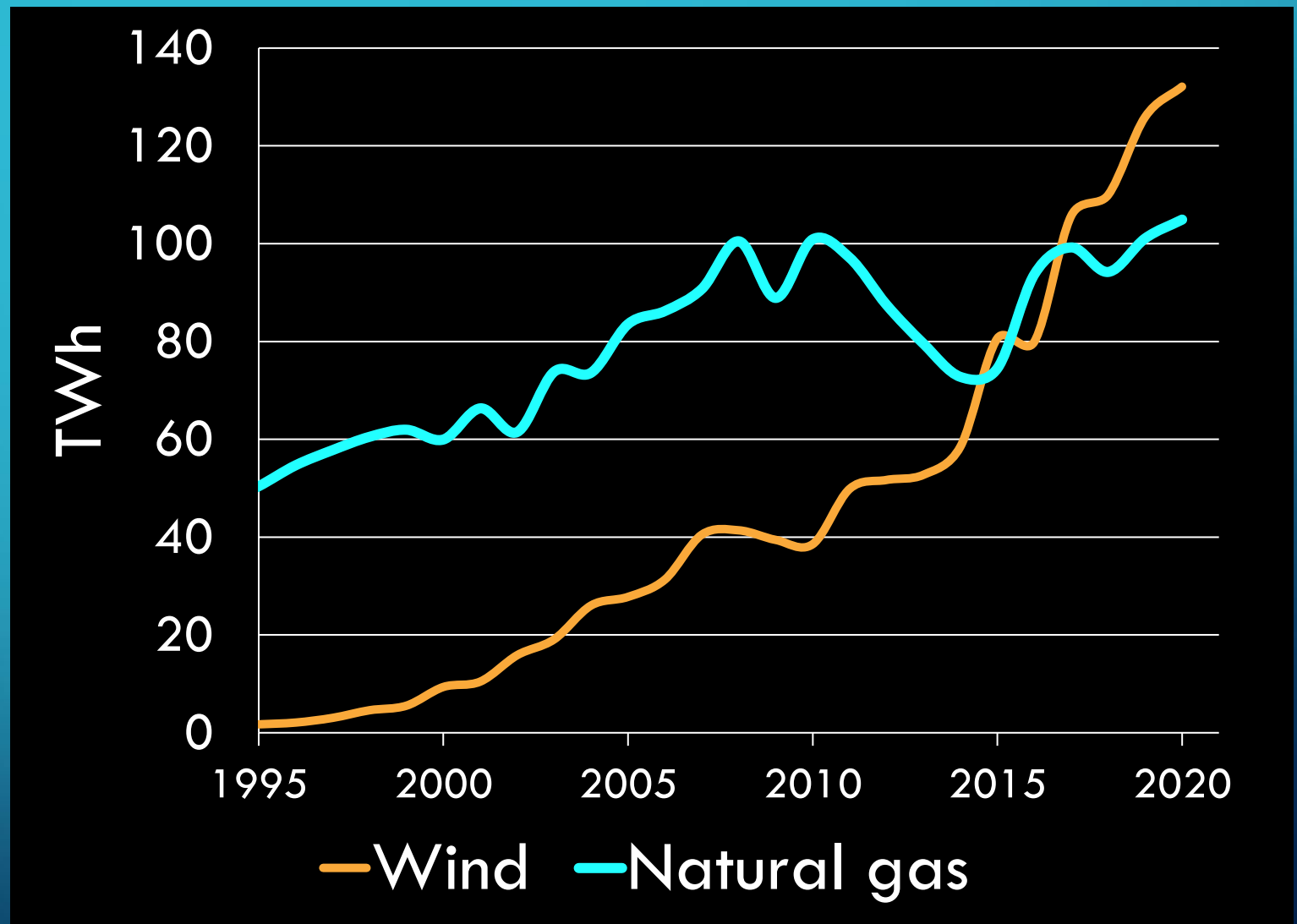


Average on 5 years	Wind	Solar
Load factor in the EU	23 %	11 %

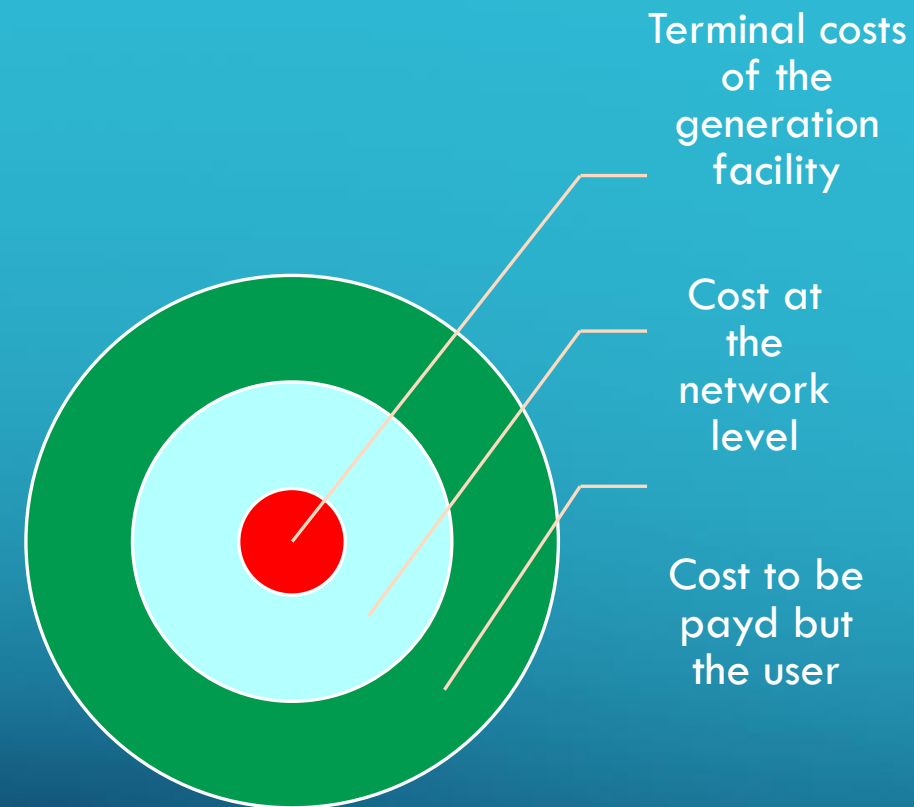


S. Furfari, and A. Clerici, “Green hydrogen: the crucial performance of electrolyzers fed by variable and intermittent renewable electricity,” Eur. Phys. J. Plus (2021) 136:509, Mai 2021

Electricity generation in Germany (Eurostat data)

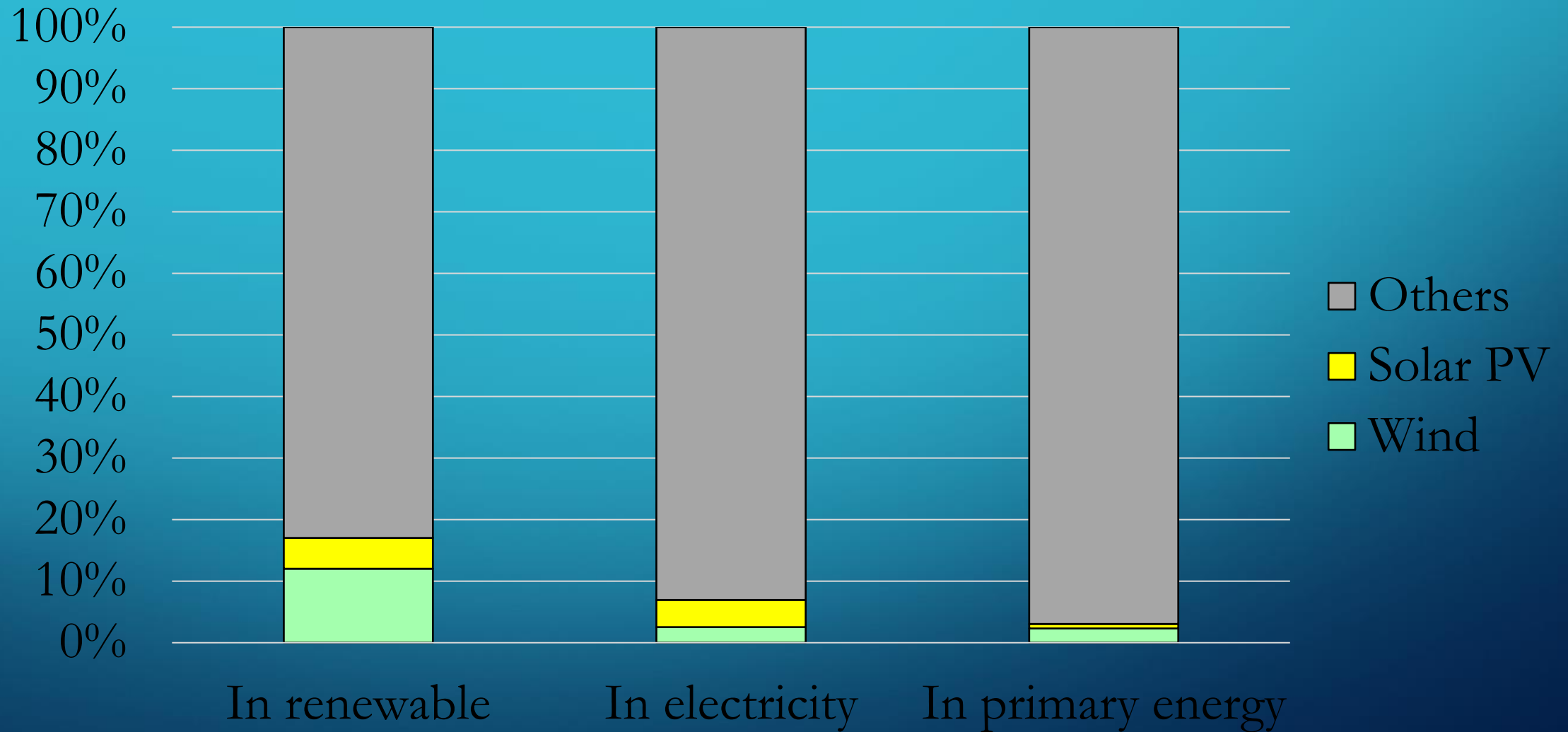


Impact of the network cost on electricity price



Domestic electricity prices for 100 kWh (euros) according to the percentage of renewable energy (solar and wind). Eurostat 2020 data

How important is wind power and solar energy?

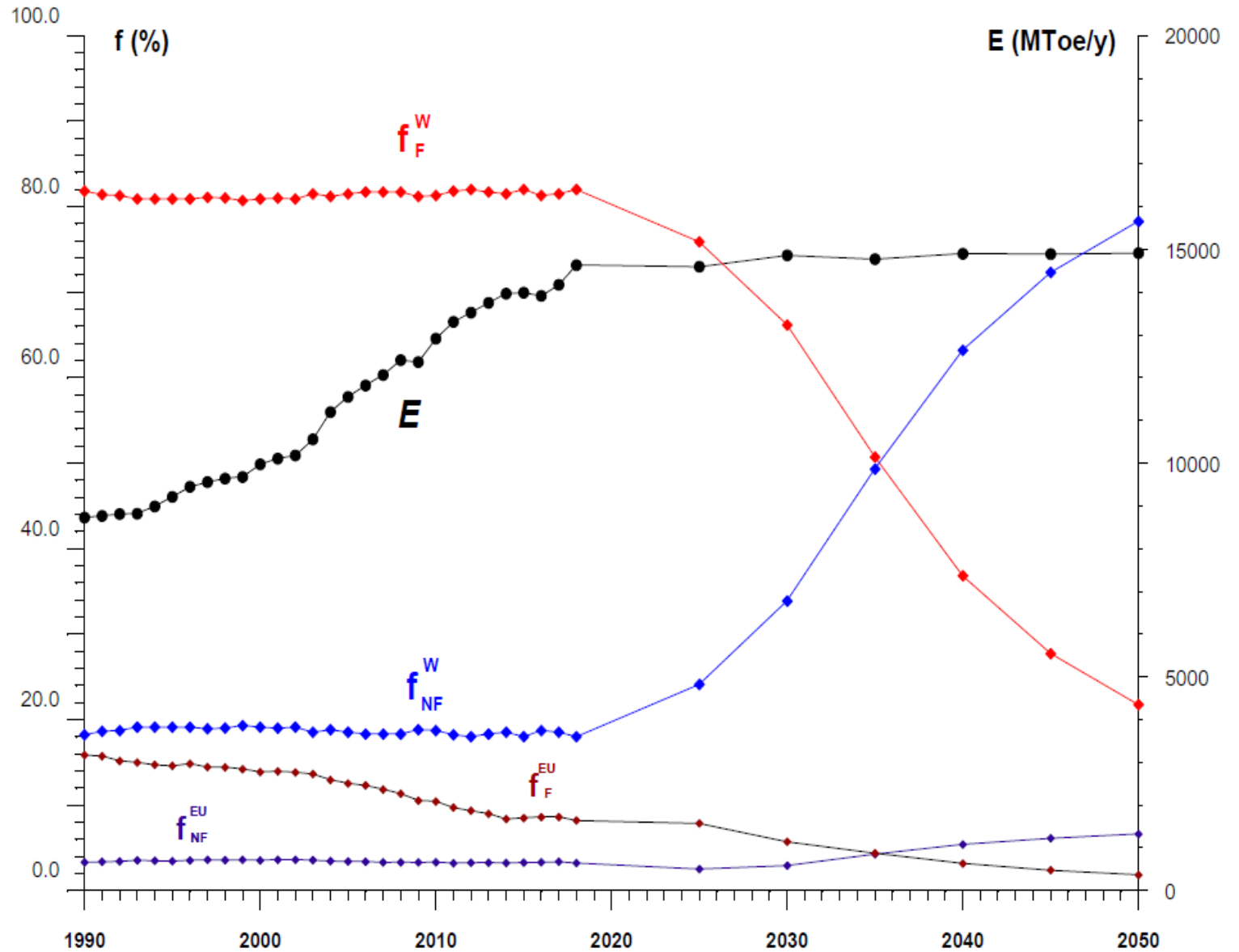


Is the European green deal achievable?

Samuel Furfari & Ernest Mund

The European Physical Journal Plus **136**, Article number: 1101 (2021) |

108 Accesses | 5 Altmetric | [Metrics](#)



OPINION | COMMENTARY

If You Want 'Renewable Energy,' Get Ready to Dig

Building one wind turbine requires 900 tons of steel, 2,500 tons of concrete and 45 tons of plastic.

WSJ | **OPINION**

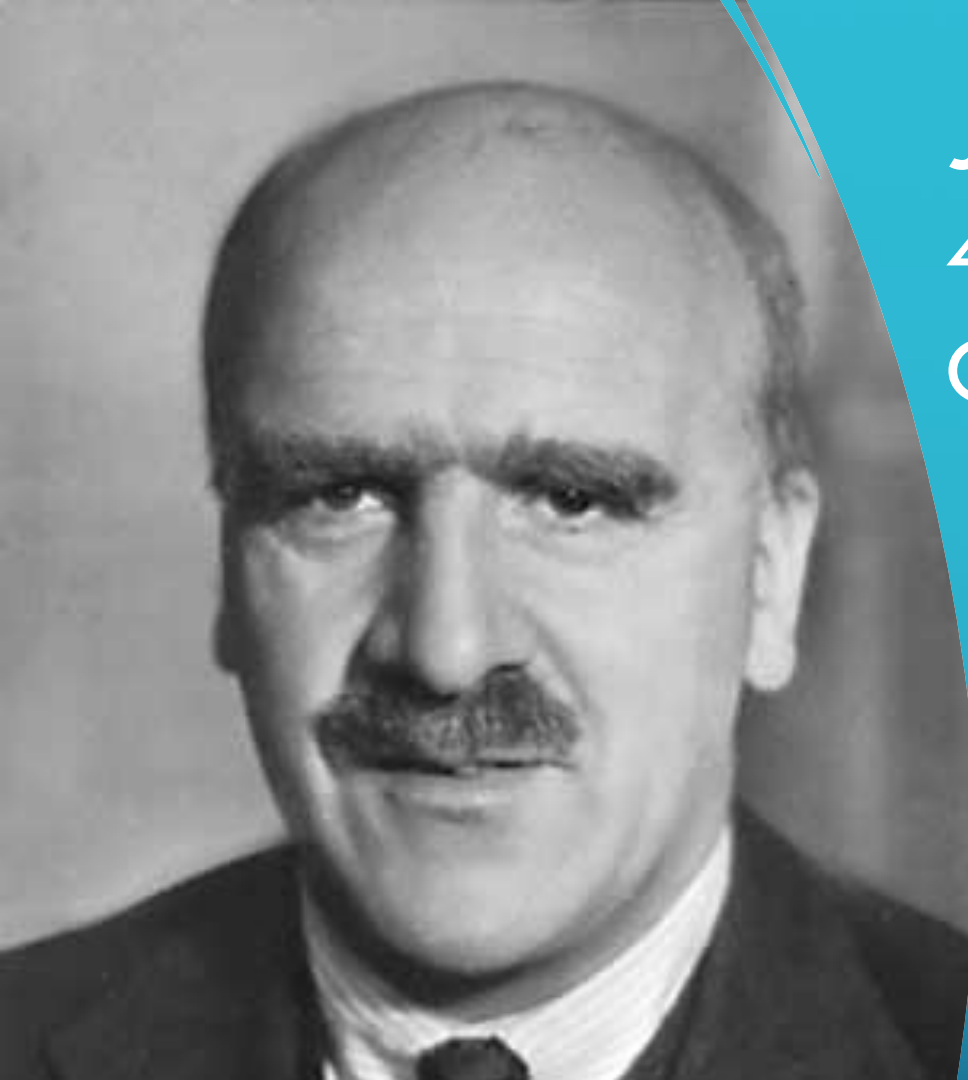
By Mark P. Mills

Aug. 5, 2019 6:48 pm ET



Garzweiler lignite
mine 2 May 2016
(© Samuel Furfari)





John Haldane
4 fév. 1923,
Cambridge Univ.



End of
coal



Wind
turbines



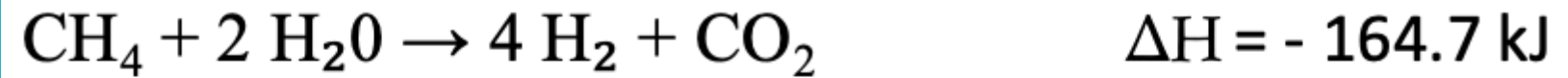
H₂

J.S. HALDANE
CH FRS
1860-1936
Physiologist
lived and conducted
experiments here
1891-1899

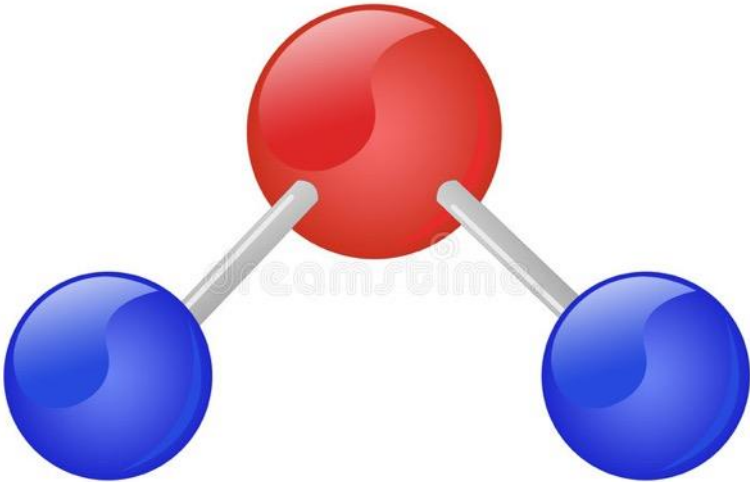
J.B.S. Haldane, in full **John Burdon Sanderson Haldane**, (born Nov. 5, 1892, Oxford, Oxfordshire, Eng.—died Dec. 1, 1964, Bhubaneswar, India), British geneticist, biometrician, physiologist, and popularizer of science who opened new paths of research in population genetics and evolution

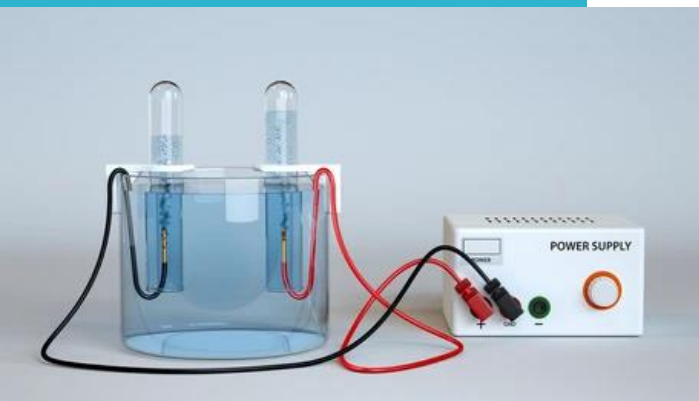


Why is hydrogen mass-produced by methane transformation?

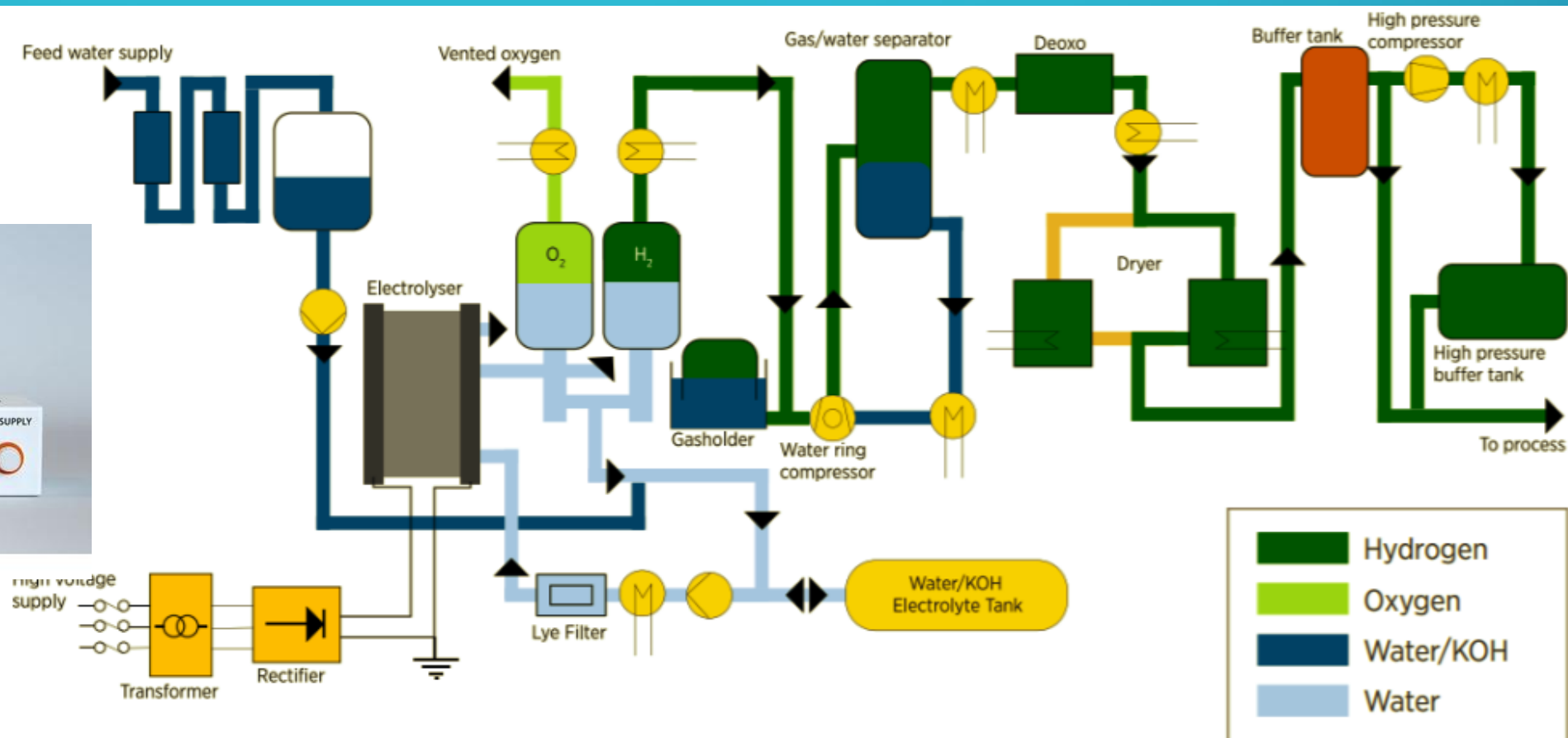


$$\frac{4 \times 285.8}{164.7} = 6.9$$





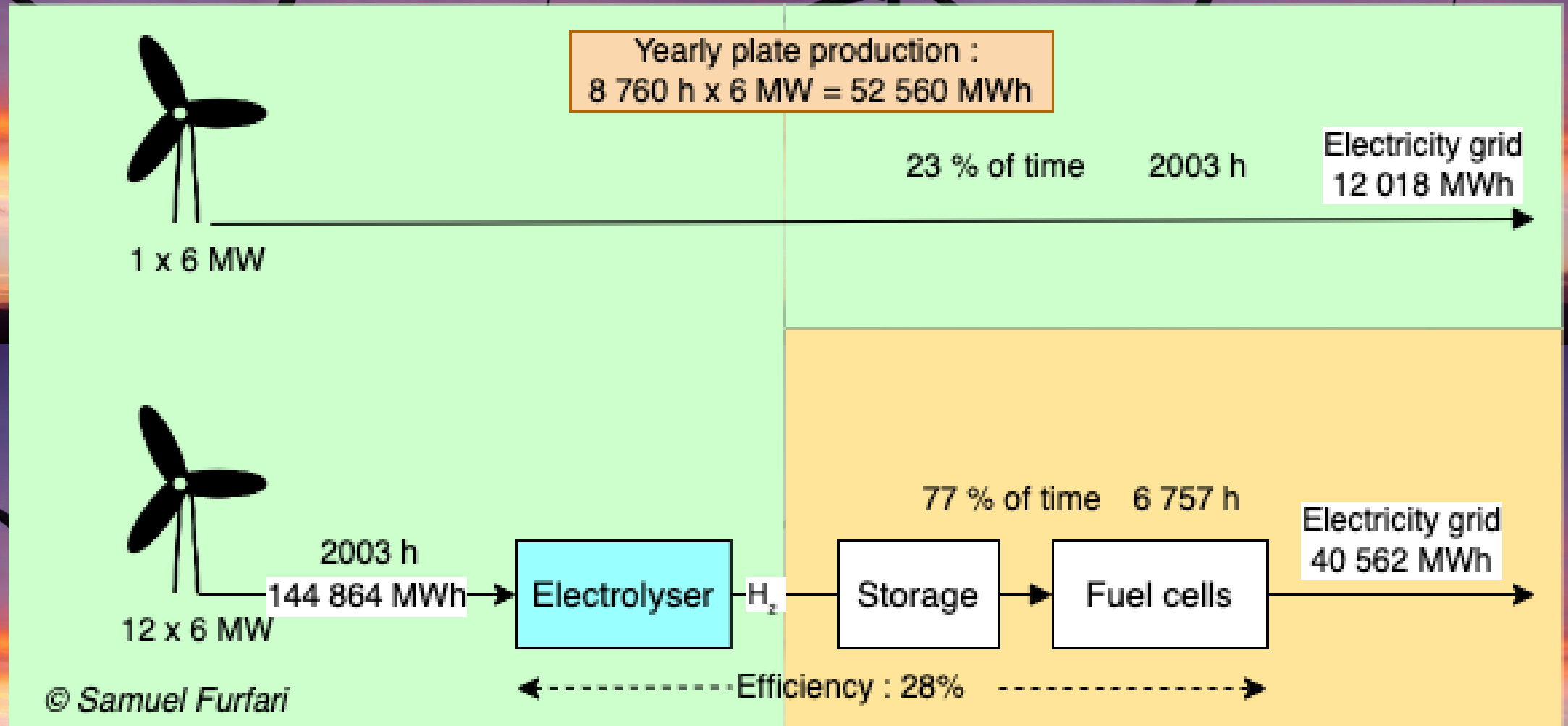
shutterstock.com · 1733387822



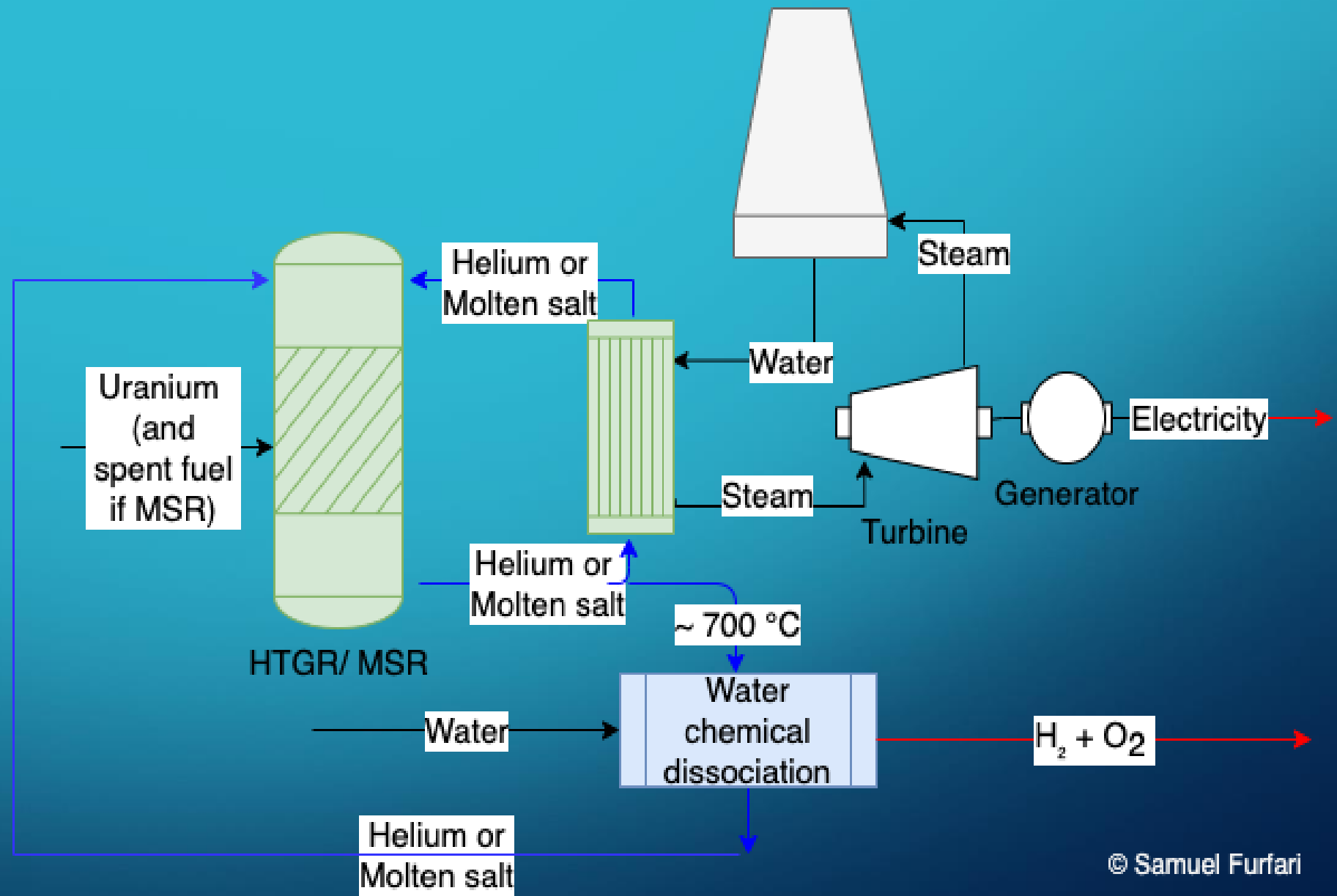
Note: This configuration is for a generic system and might not be representative of all existing manufacturers.

Based on IRENA analysis.

Hydrogen, the inefficient green gas



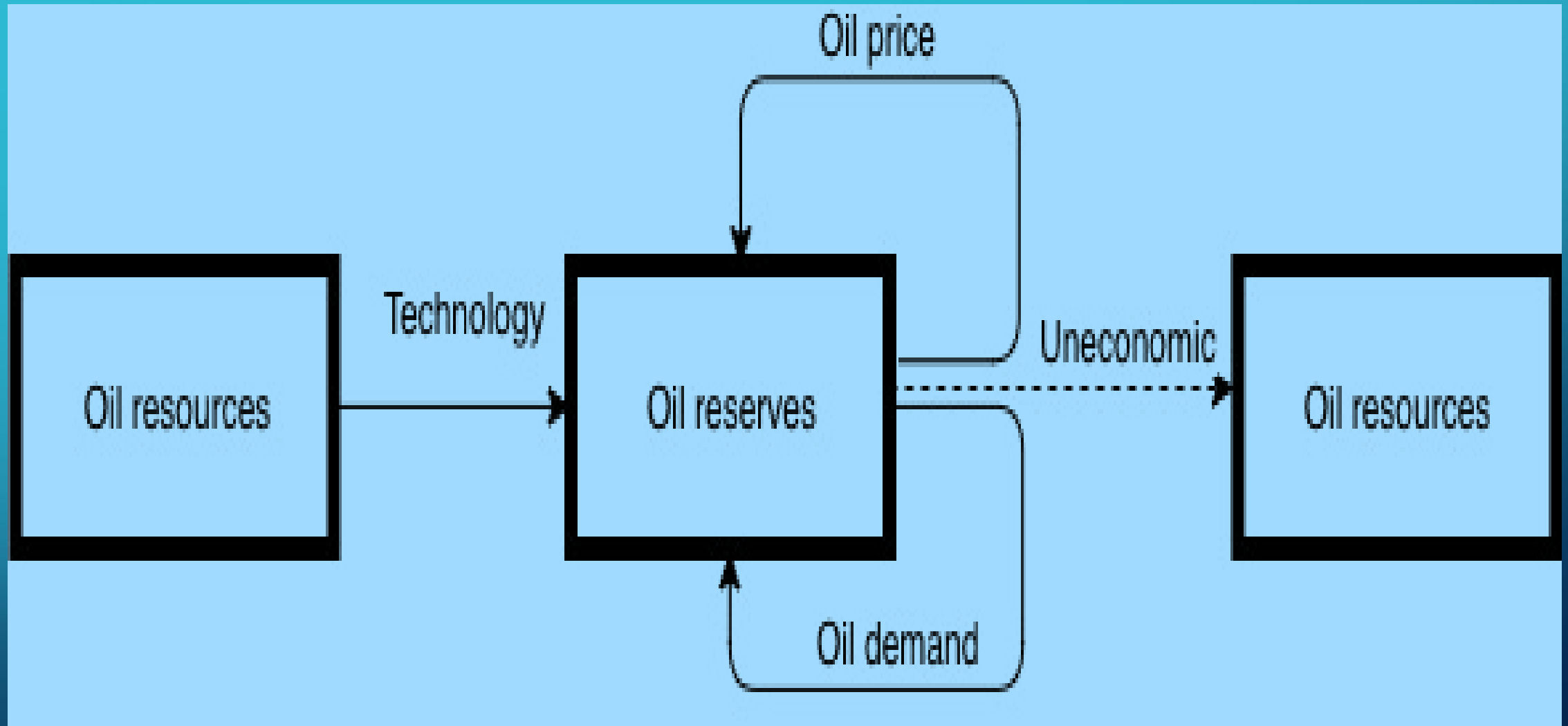
The future of hydrogen will depend on GEN IV nuclear power. In the meantime, we will continue to produce it from **methane**, a highly valuable **chemical resource**.



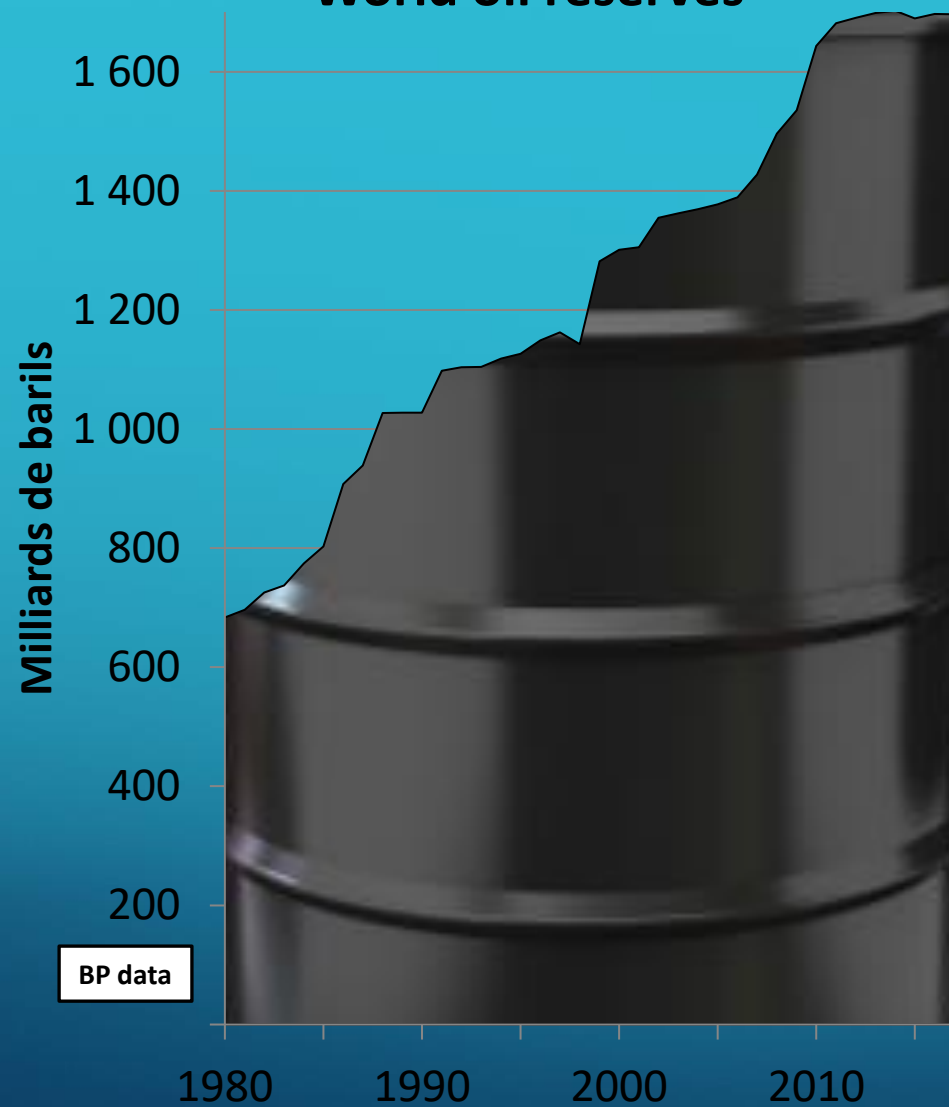
© Samuel Furfari

Resources and reserves



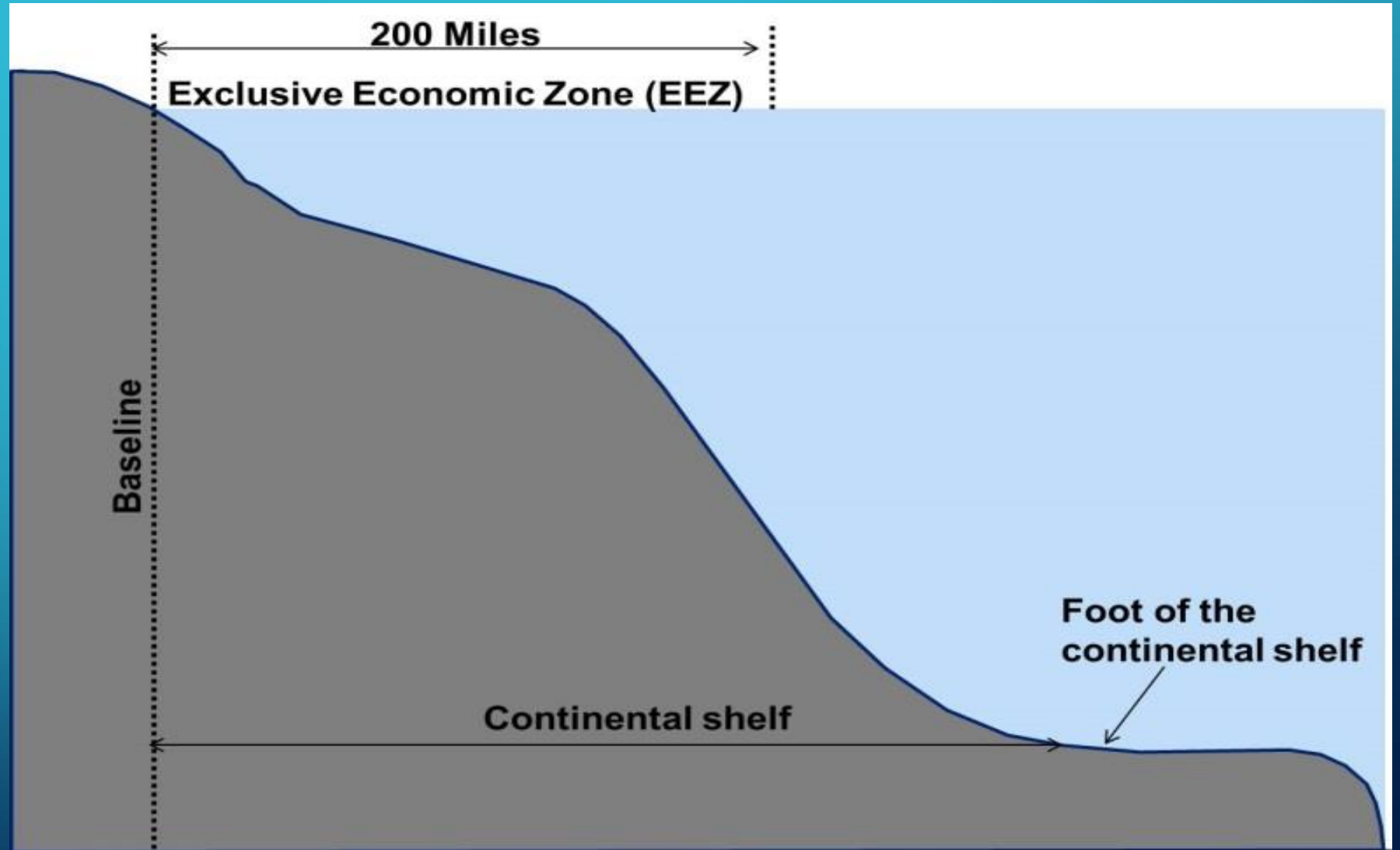
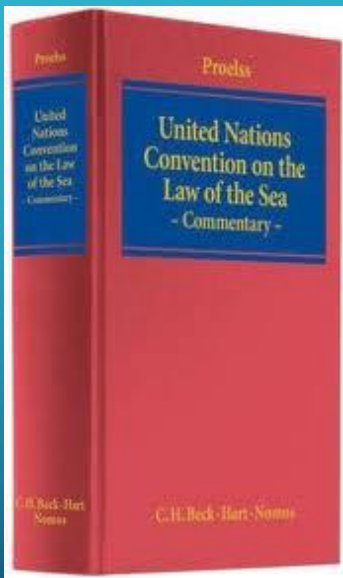


World oil reserves

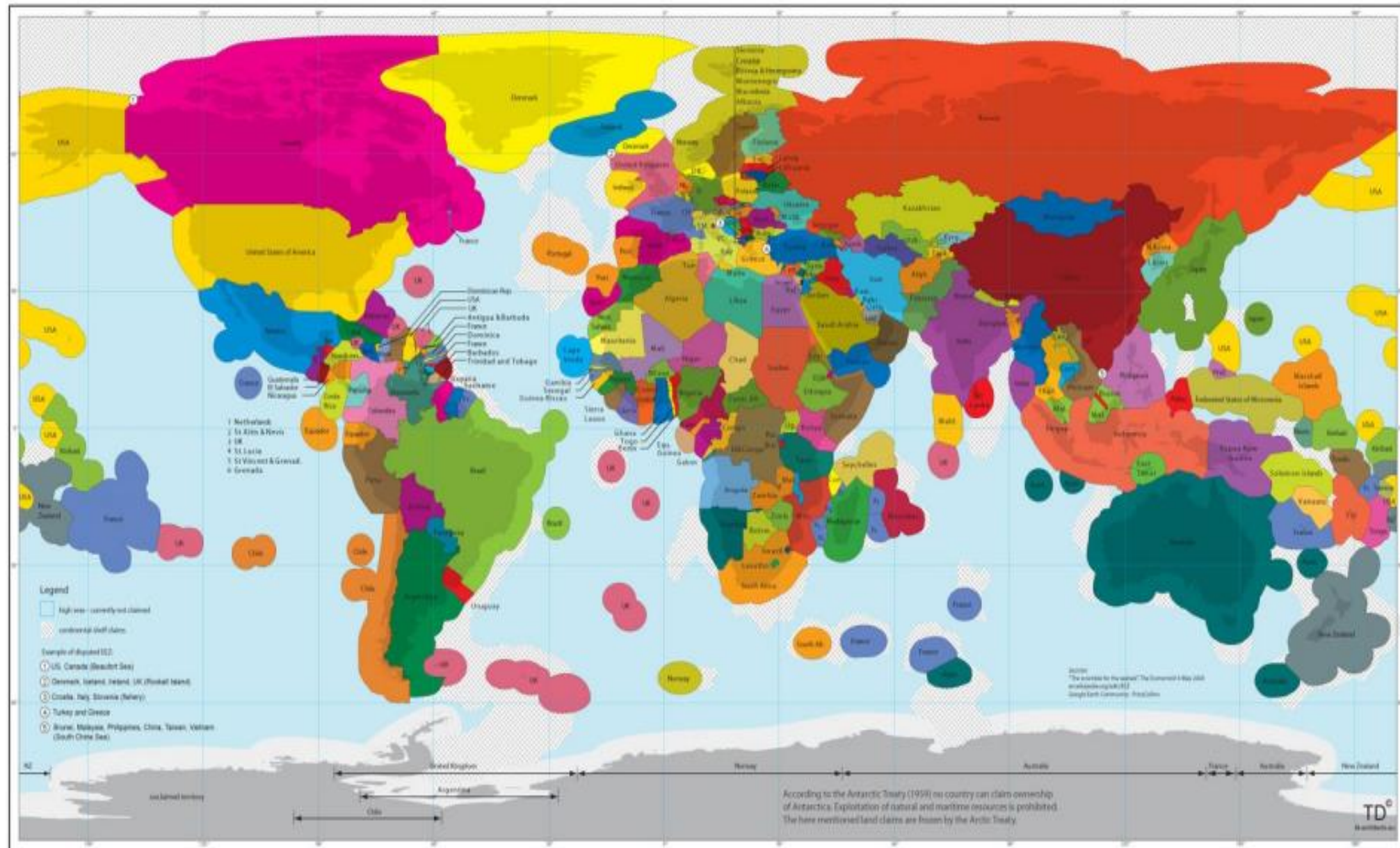


United Nations Convention on the Law of the Sea

UNCLOS
Montego Bay, 1982
Entered into force in 1994

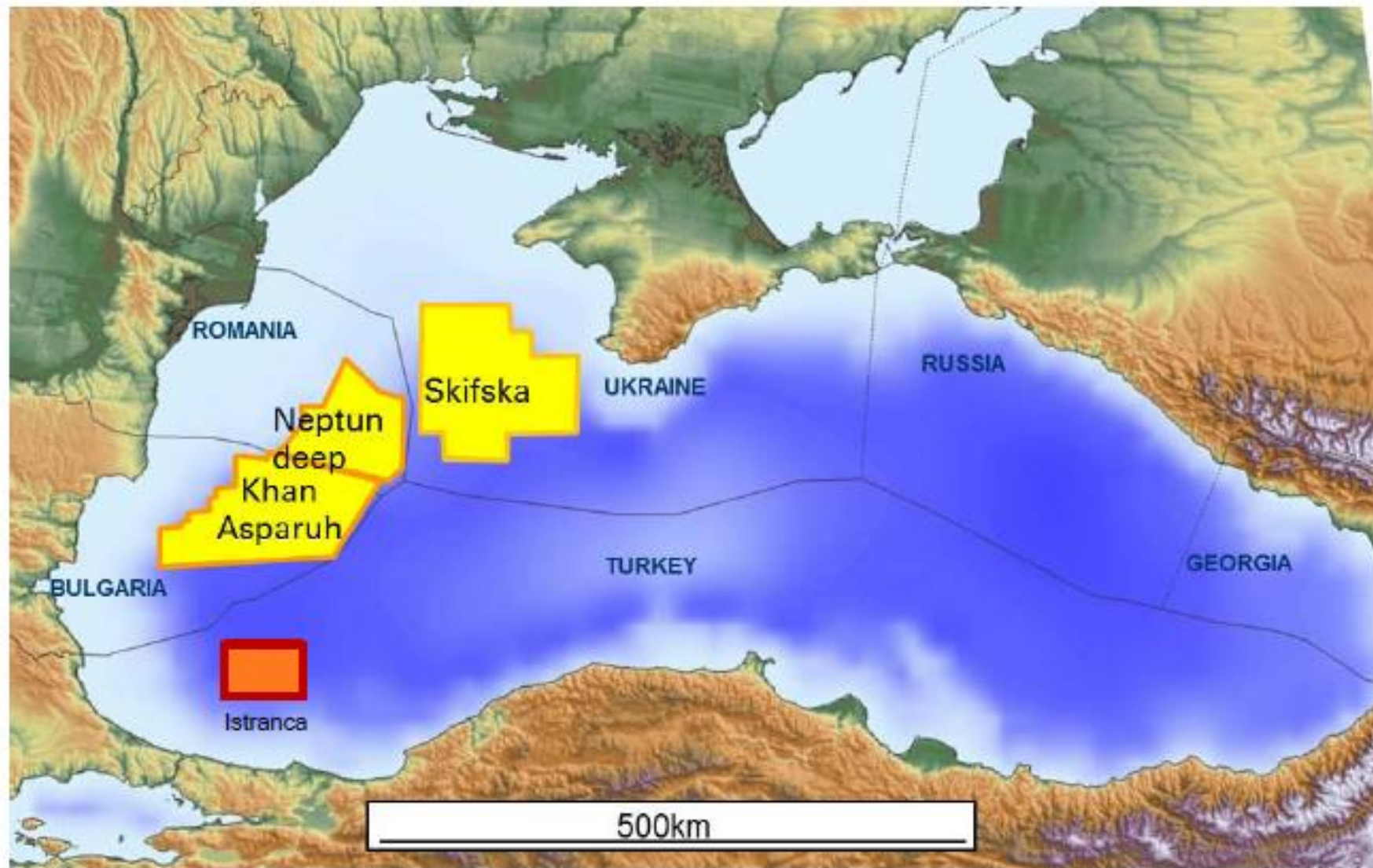


It gives coastal States rights they had not before



The new Europe



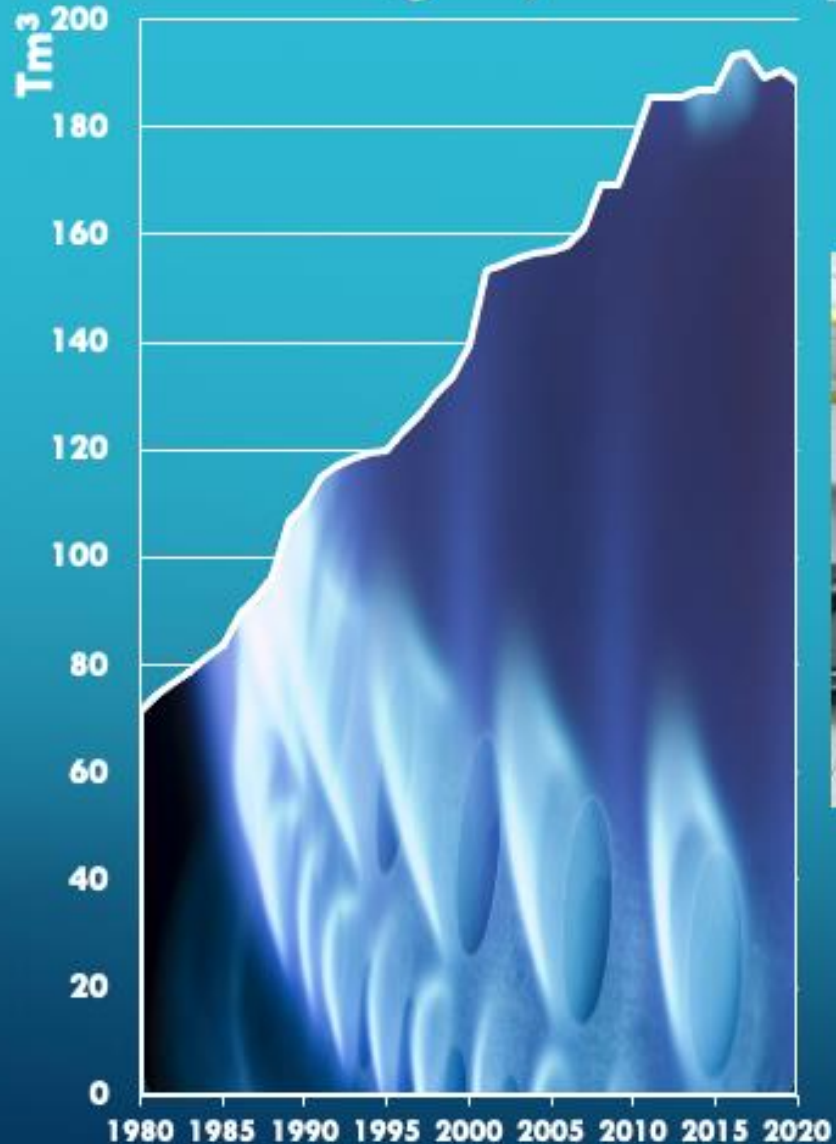


Blocks of OMV / OMV Petrom (Romania, Bulgaria, Ukraine)



Blocks of TPAO

Natural gas, the surprising energy

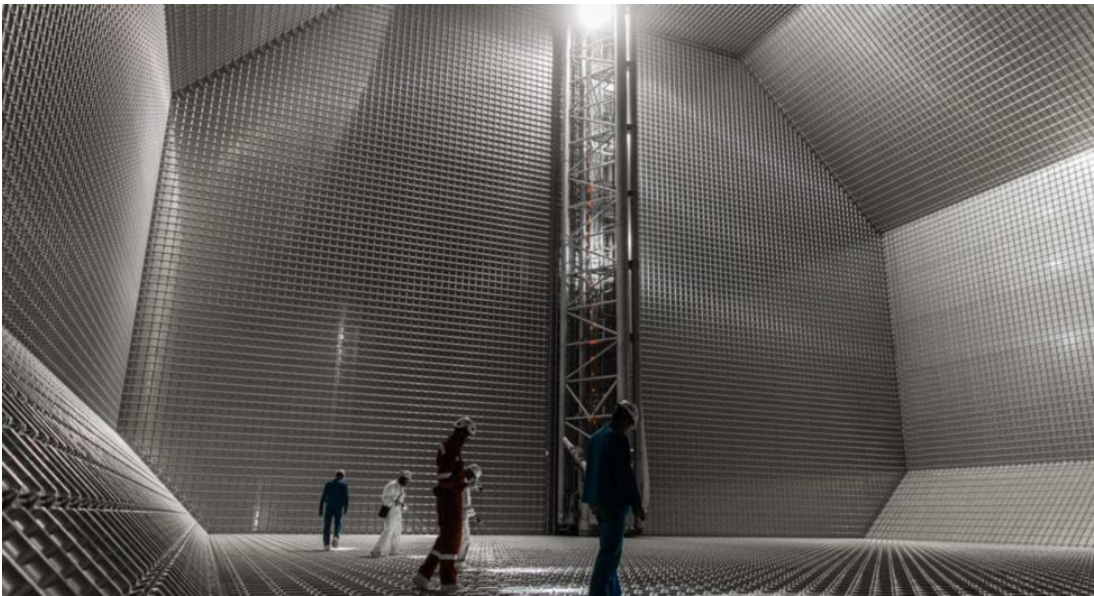


SAMUEL FURFARI

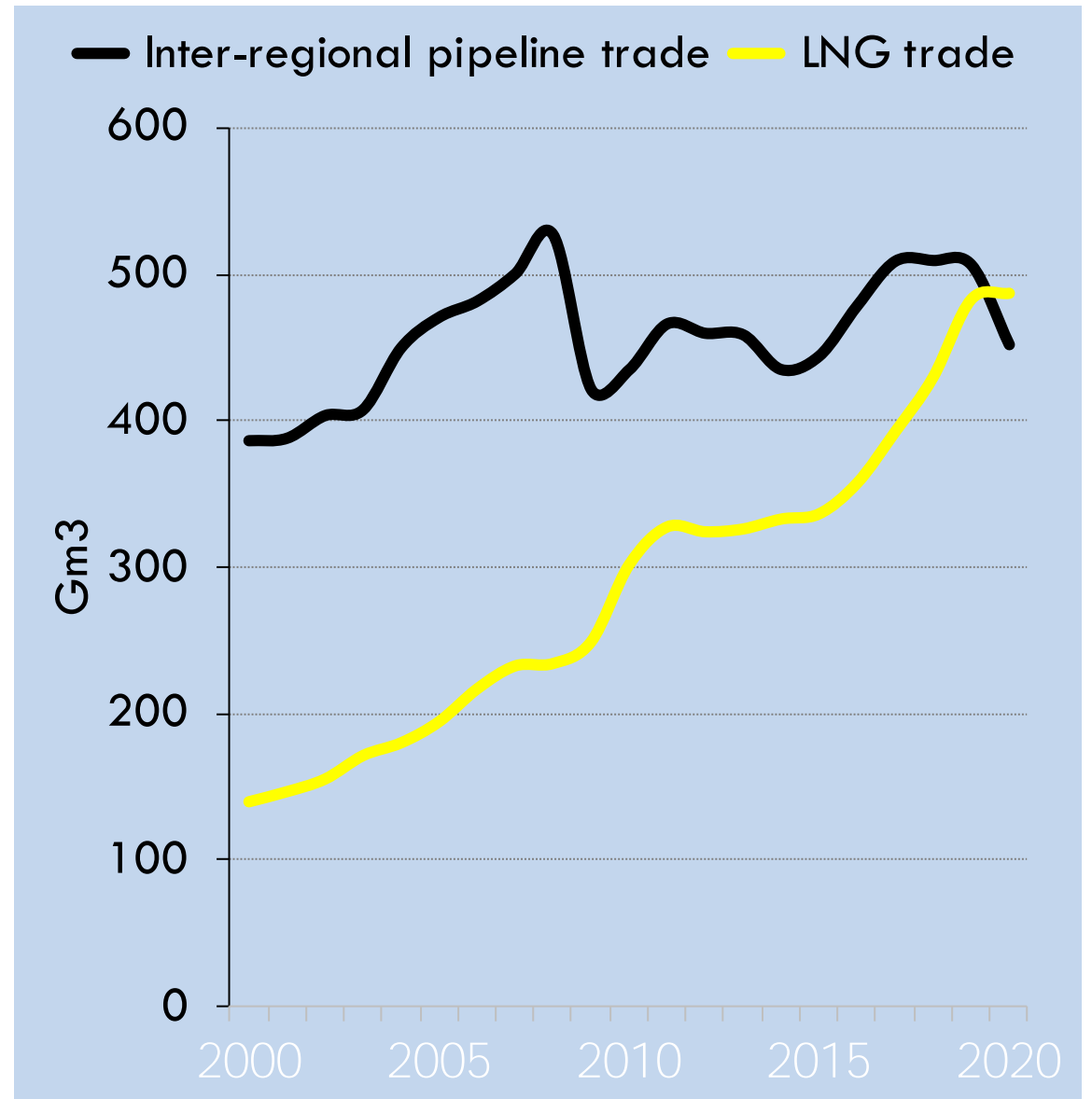


- Abundant
- Available
- Clean
- Affordable
- All uses

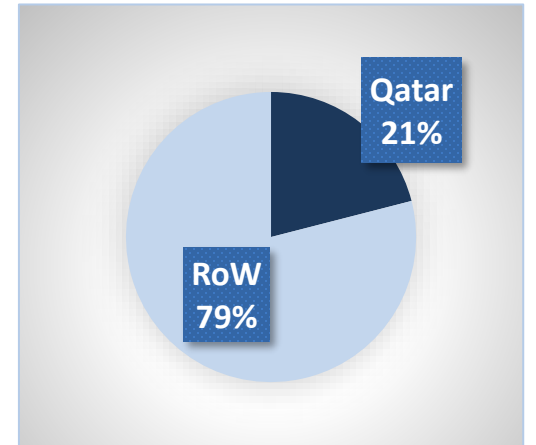
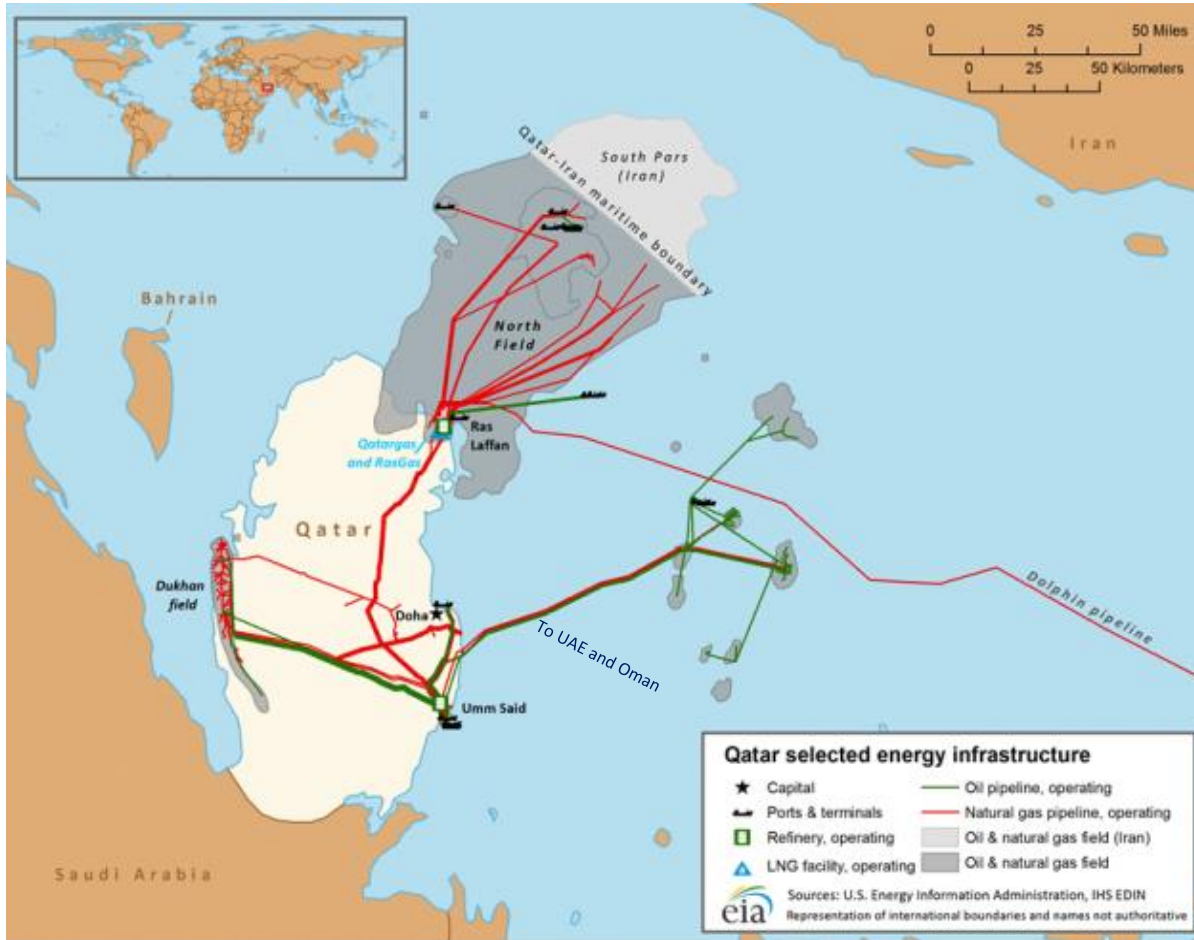
LNG trade has overtaken pipeline trade



Samuel Furfari

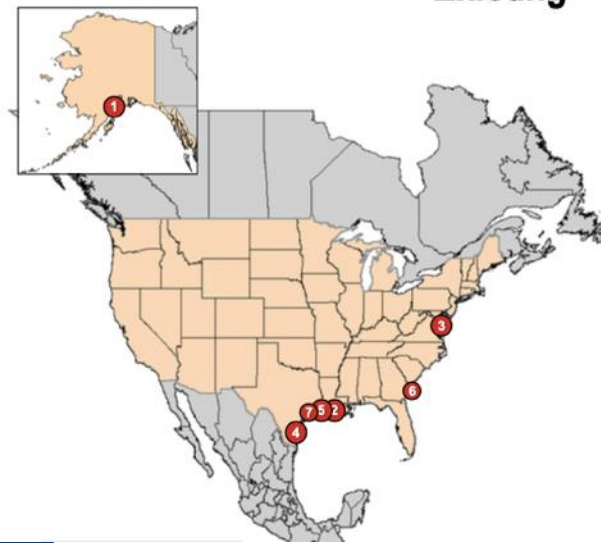


Qatar: Saudi Arabia of gas

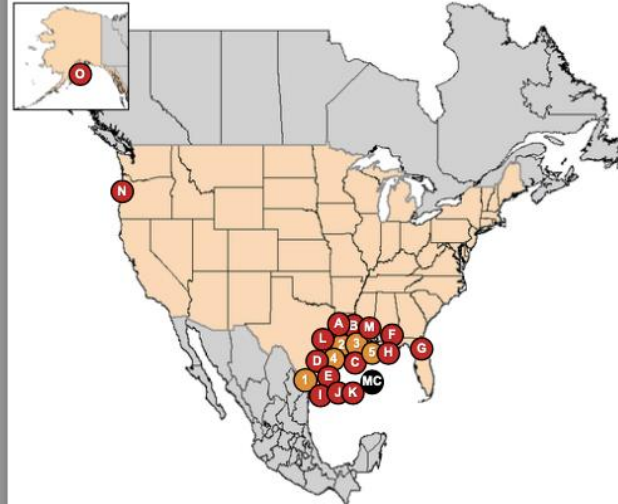


- Qatar is the world's 2nd largest exporter of liquefied natural gas (LNG)
- Reserves-production = 160 years of today exports

Existing



Approved, Not Yet Built



Export Terminal

UNITED STATES

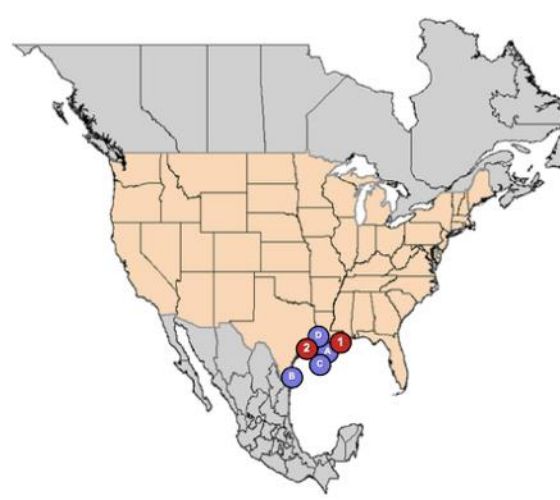
FERC – APPROVE

1. Corpus Christi, TX: 507
2. Sabine Pass, LA: 0
3. Cameron Parish, LA
4. Sabine Pass, TX: 2
5. Calcasieu Parish, LA

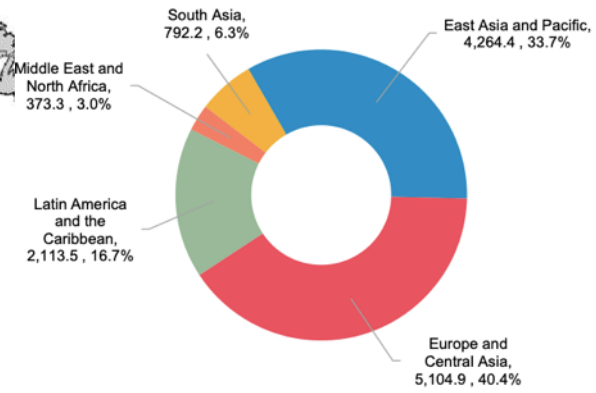
FERC – APPROVE

- A. Lake Charles, LA: 2
- B. Lake Charles, LA: 7
- C. Hackberry, LA: 1.4
- D. Port Arthur, TX: 1.8
- E. Freeport, TX: 0.72
- F. Pascagoula, MS: 1
- G. Jacksonville, FL: 0
- H. Plaquemines Parish, LA: 0.5
- I. Brownsville, TX: 0.5
- J. Brownsville, TX: 3.8
- K. Brownsville, TX: 0
- L. Corpus Christi, TX: 0
- M. Sabine Pass, LA: N
- N. Coos Bay, OR: 1.08
- O. Nikiski, AK: 2.63

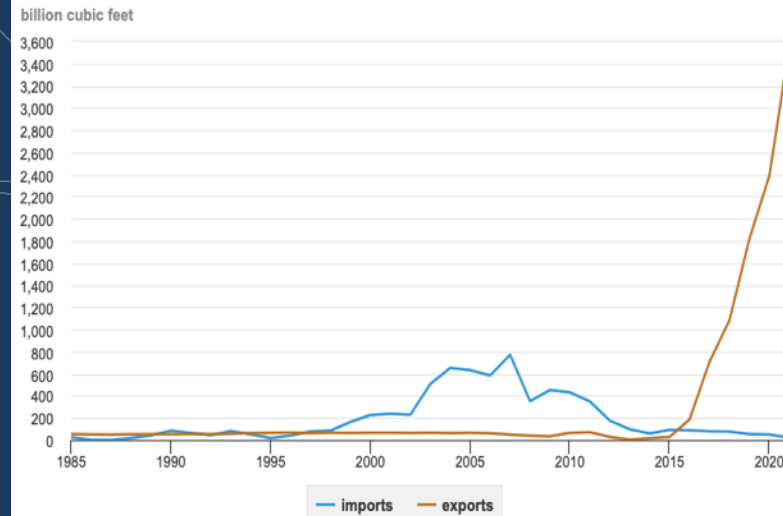
Proposed



1d. Domestically-Produced LNG Exported by Region
(Cumulative from February 2016 through September 2022)
(Bcf, %)



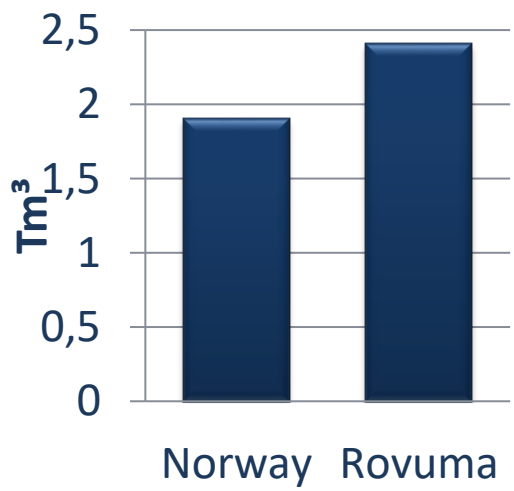
U.S. LNG imports and exports, 1985-2021



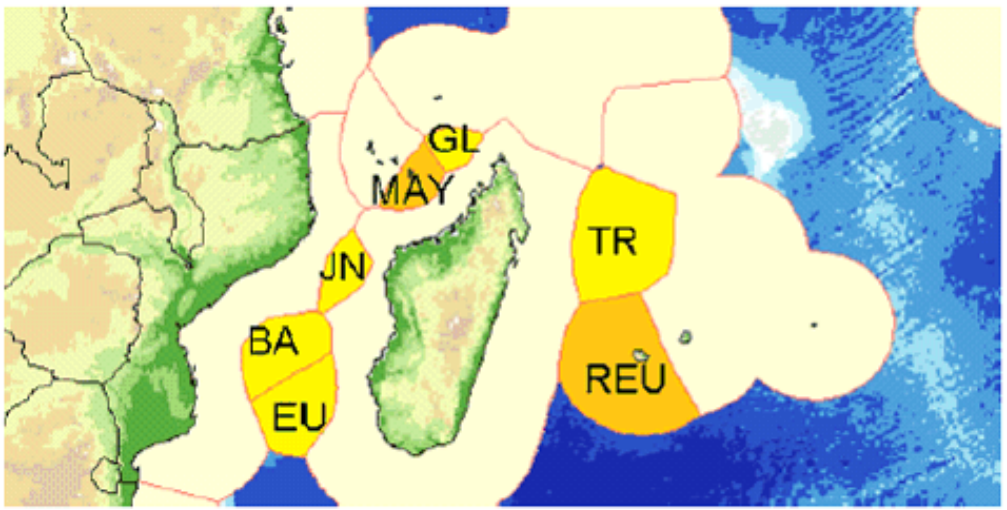
eia Data source: U.S. Energy Information Administration, *Natural Gas Monthly*, March 2021; data for 2021 are preliminary



Est Africa and gas potential



(M)
ZEE française de l'océan indien occidental



Source : Jérôme Dymont,
Institut de Physique du Globe de Paris, CNRS.

Abbonati subito!

Milano 6° (cambia)

ITALIA & MONDO

Venerdì • 21 Novembre 2014 • Aggiornato alle 22:25

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Renzi: «Dal Mozan 8 years i prossimi 30 anni». (M): la nostra scoperta più importante

20 luglio 2014 Commenti (3)

21/11/2014



Zohr, a great success for ENI and Egypt



Discovered in August 2015
850 billion m³



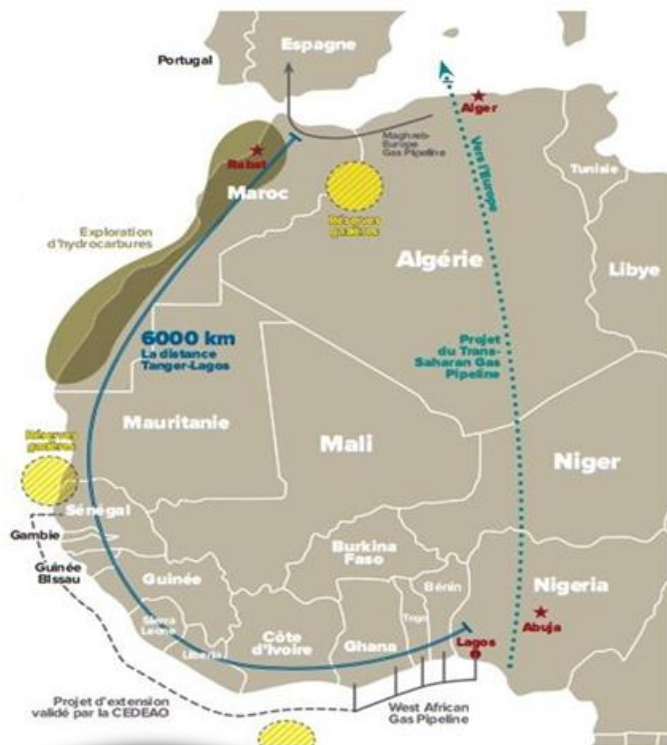
Inaugurated in January
2018

BP and Rosneft partners

Dal 2025 non ci servirà più il gas russo, ce lo promette l'Eni

24 Settembre 2022 In Cronaca, Da non perdere





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FPSO vessel for the bp-operated Greater Tortue Ahmeyim project successfully sets sail for project site

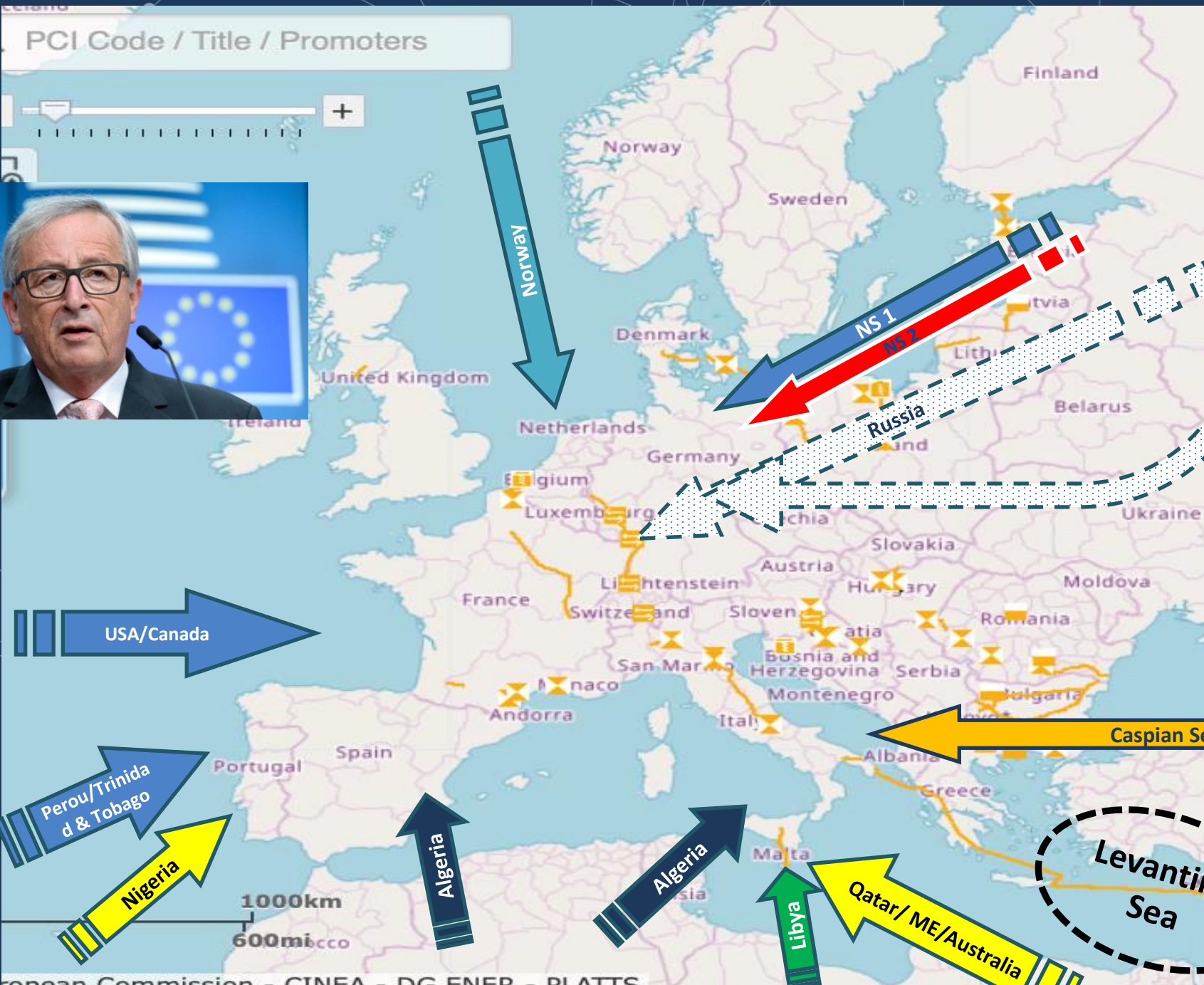
Release date: 23 January 2023



ESCP
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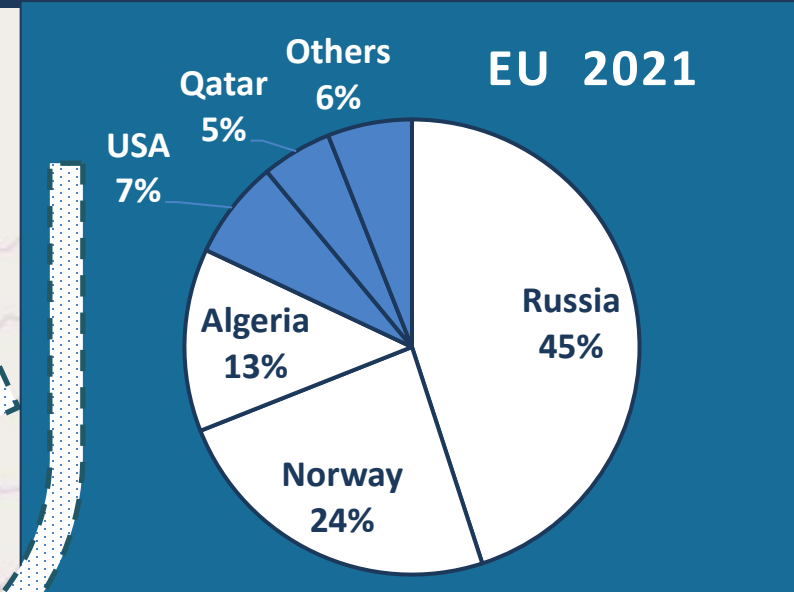
Samuel Furfari





PCI Code / Title / Promoters

+

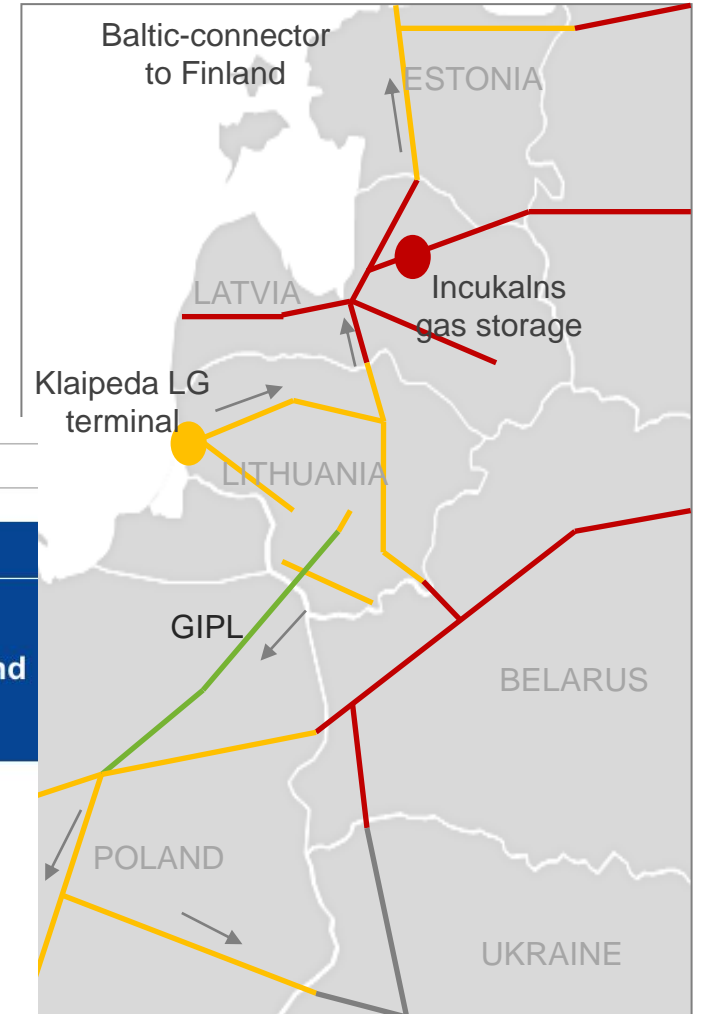




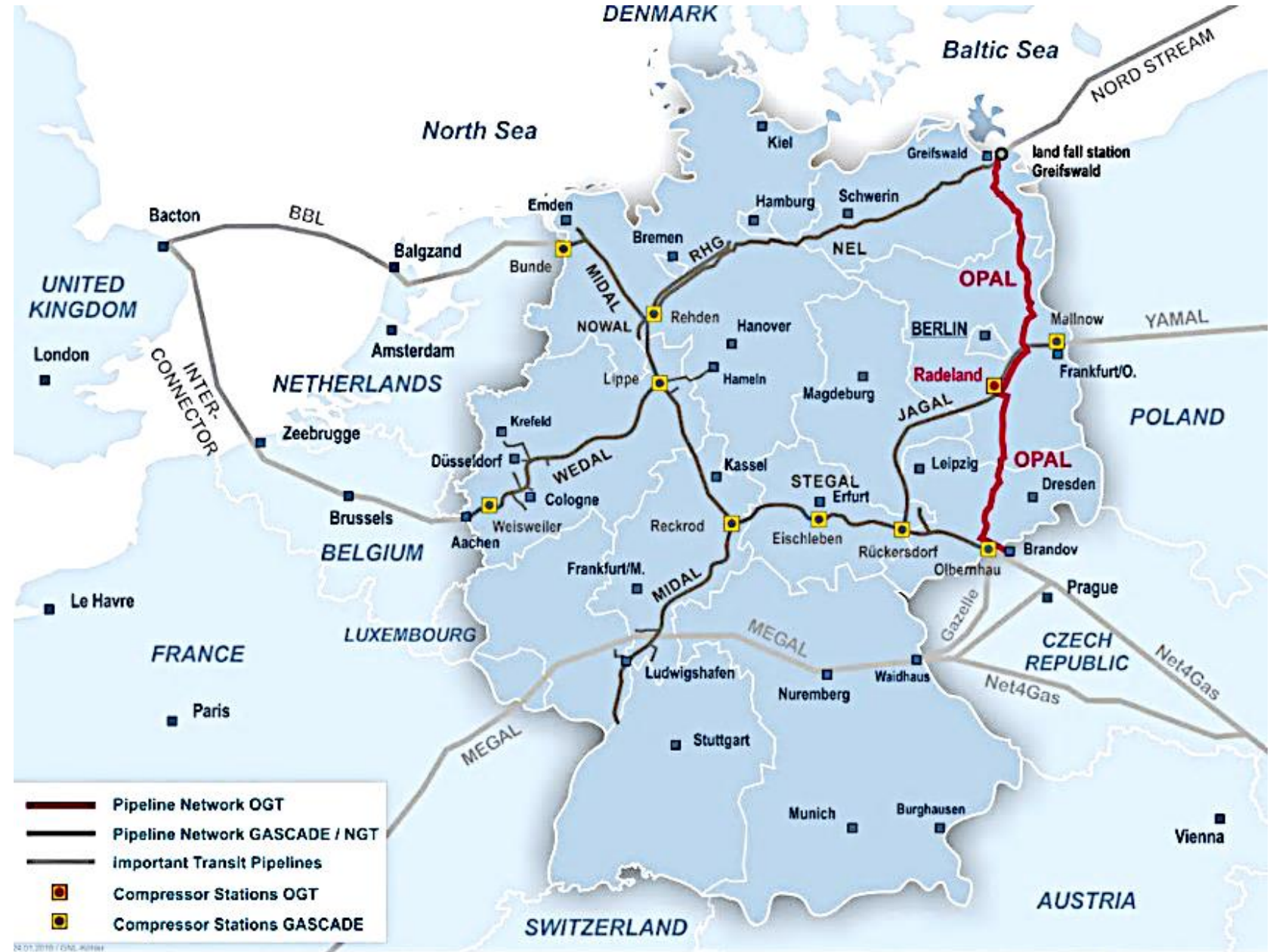
Home > News > Inauguration of gas interconnection between Poland and Lithuania

NEWS | 5 May 2022 | Brussels | Energy

Inauguration of gas interconnection between Poland and Lithuania



Germany as a gas hub in Northern Europe with the OPAL pipeline



Yamal LNG Project – 27 G\$ -27.3 Mt/y

Patrick
Pouyanné
TotalEnergy
CEO

Leonid
Mikhelson
Novatek
CEO



First LNG load on December 8,
2017, at the port of Sabetta



FINANCIAL TIMES

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Opinion **Inside Business**

Russia's LNG ambitions no longer a pipe dream

Novatek's Yamal project a watershed moment for the country's hydrocarbon industry

HENRY FOY

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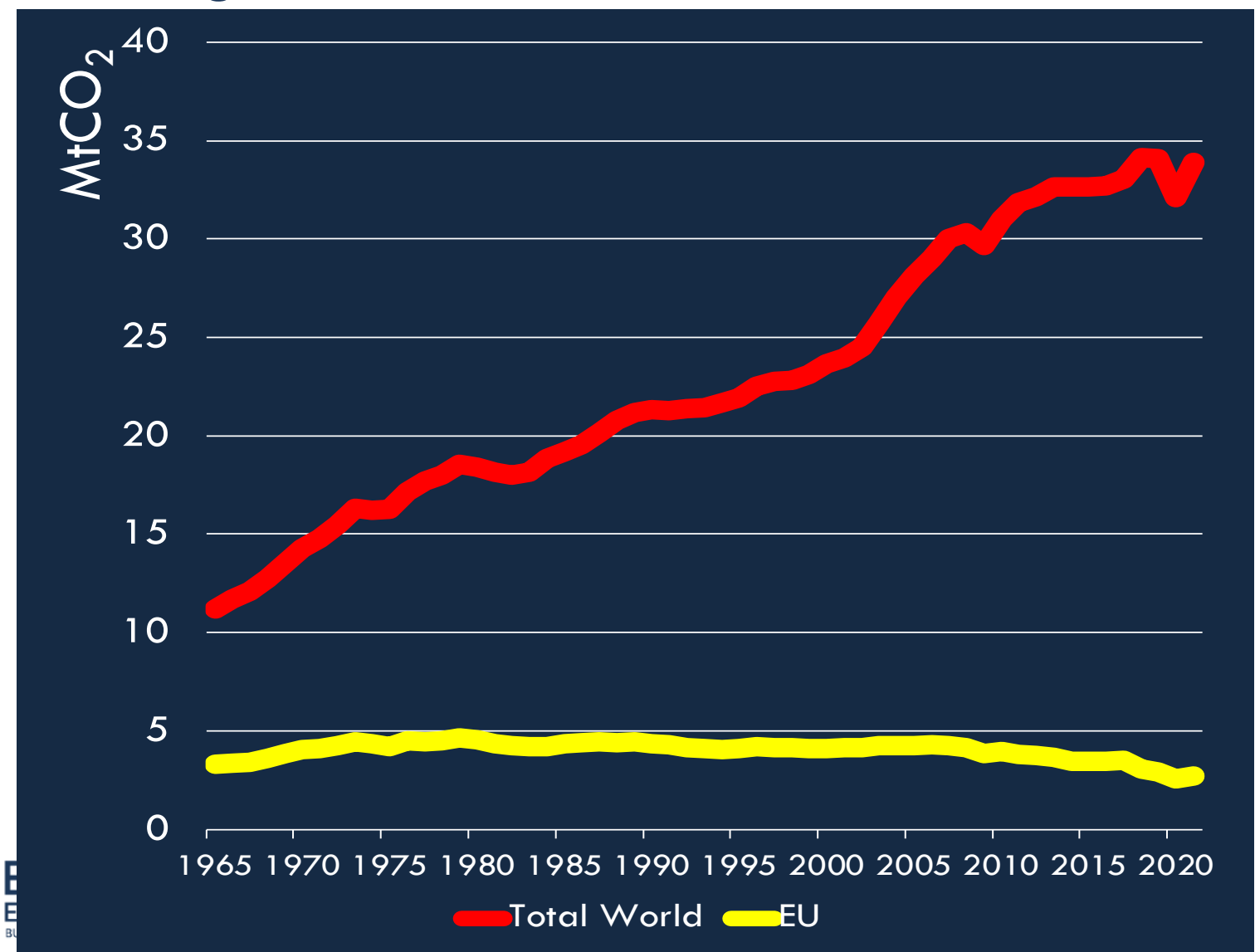
Henry Foy in Moscow DECEMBER 27 2017

10

How can LNG be exported from Yamal?



Trends in global and EU CO2 emissions



Party to the UNFCCC	Increase since adoption of the UNFCCC
World	+59
Latin America	+73
Africa	+93
Non-OECD	+134
Pakistan	+245
Indonesia	+265
India	+280
China	+311
Vietnam	+1380
EU	-23

Data : BP 2022

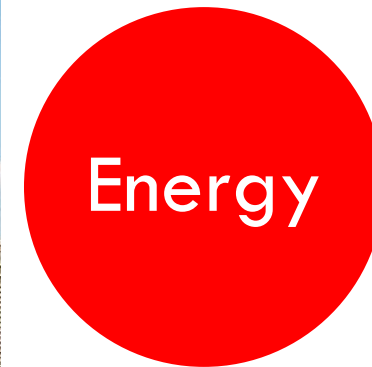
1,0 + 0,4
billion ↑



+ 8%/a
GDP



↑ Energy



Gas



Nu
c



Re
n



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The Bureau of Energy Resources (ENR) leads the Department of State's efforts to develop and execute international energy policy through diplomatic and programmatic engagement that promote a low-emissions future, energy security for the United States and our allies and partners, and economic prosperity through sustainable, affordable, and reliable energy access.



SENIOR BUREAU OFFICIAL AND
PRINCIPAL DEPUTY ASSISTANT
SECRETARY

Harry Kamian

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Westinghouse signs initial contract for Ukrainian AP1000s

22 November 2021



A contract signed by the Ukrainian nuclear operator Energoatom and US vendor Westinghouse will trigger the engineering and procurement of components for the first of several AP1000s planned for Ukraine. The country is planning as much as 11 GWe of new build by 2040.



Patrick Fragman (seated left) and Petro Kotin (seated right) sign on behalf of Westinghouse and Energoatom, respectively (Image: Energoatom)

	Oil (Gt)	Gas (Tm ³)	Coal (Mt)
Potential of the BRICS	84,4	70,6	494,441
No BRICS	160,0	117,5	579,667
World	244,4	188,1	1 074 108
% BRICS	35 %	38 %	46 %

Expansion

The challenge of the BRICS

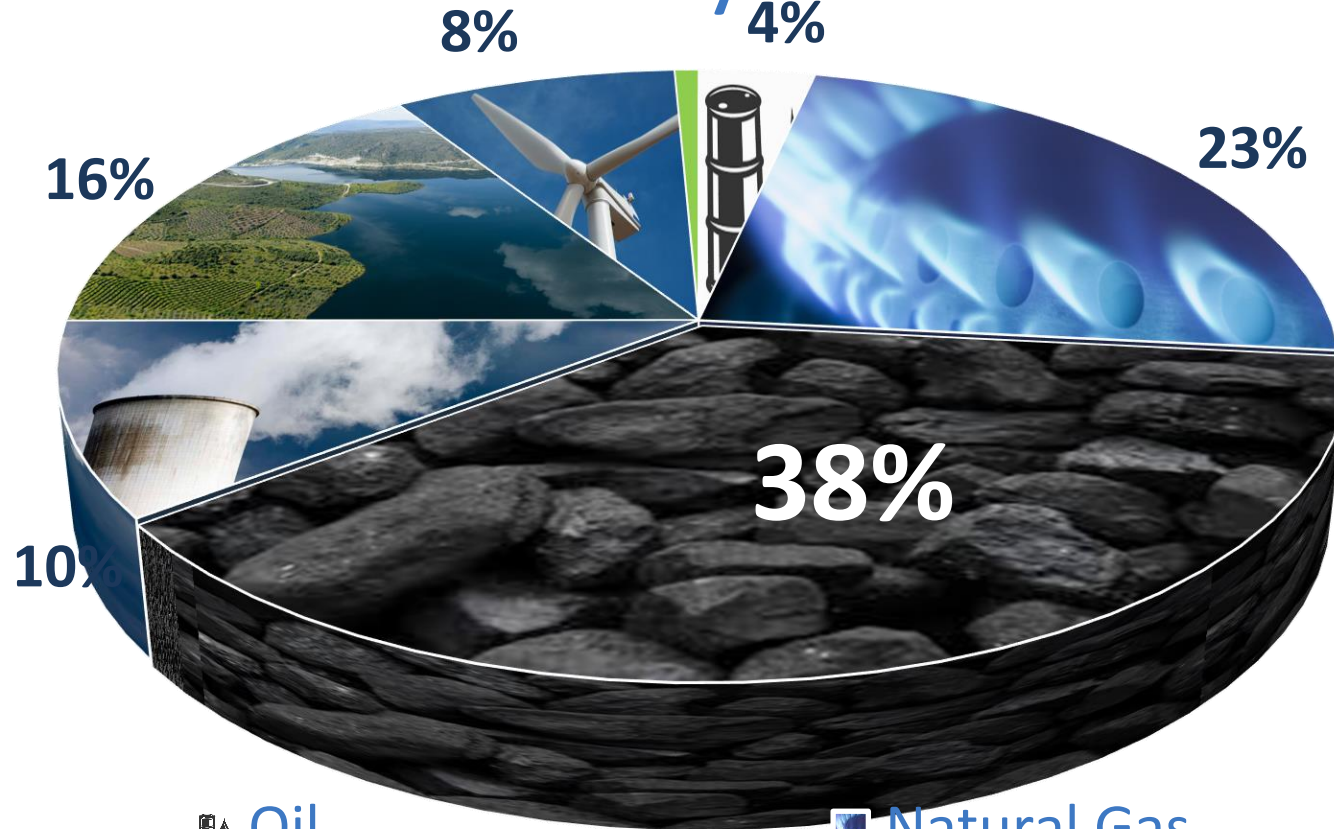


Sharm El Sheikh, 7 Nov. 2022



Coal ≈ electricity

Electricity-fuel mix



Oil



Coal



Hydro electric



Natural Gas



Nuclear energy



Renewables

ESCP
EUROPE
BUSINESS SCHOOL

Samuel Furfari

Scott Morrison backs coal wealth for decades to come



By David Crowe
January 20, 2021 — 8:12pm

Save Share A A A 218 View a



Scott Morrison, not only nuclear submarine





#ChamberNews #AEW2021

A Message from Nigerian Petroleum Minister on the future of the Oil and Gas Industry

1 443 vues • 17 sept. 2021

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Newsweek

Mon, Nov 14, 2022

Europe's Failure to Meet Its Climate Goals Should Not Be Africa's Problem | Opinion

YOWERI K. MUSEVENI, PRESIDENT OF UGANDA

ON 11/8/22 AT 7:00 AM EST



Russia-Ukraine War Not An 'Excuse' For 'Addiction' On Fossil Fuel: Al Gore



<https://www.newsweek.com/europes-failure-meet-its-climate-goals-should-not-africas-problem-opinion-1757502>



Sustainability Now



A Western Distraction from Climate Action

May 30, 2023 | ALI RASHID AL NUAIMI

In a dangerous diversion, members of the US Congress and the European Parliament have demanded the removal of Sultan Al Jaber as COP28 president-designate. But to have any hope of taking urgent action to address climate change and maintain economic growth, the world must not let political drama impede tangible and practical solutions.

ABU DHABI – It should be common knowledge by now that climate change is a complex problem with outsize consequences for the Global South. By

Worse still, the US and European legislators are advocating international intervention in a sovereign decision – the latest in a long line of Western efforts to dictate to Global South governments for domestic political gain.

Aramco, 12 July 2023, Kuala Lumpur



Asia and the Energy Future

BY THE ARABIAN SUN / 0 COMMENTS / 12 JULY 2023

Aramco's president and CEO Amin Nasser calls on Asian leaders to speak louder and more clearly about the regions unique priorities to help shape a new, pragmatic global energy transition approach, as Aramco doubles down on its Asia commitments.



“The same energy transition policies should not be applied to every nation. If they are, it will severely affect the competitiveness of those who are not at the same economic maturity level, which is the case for many in Asia.”

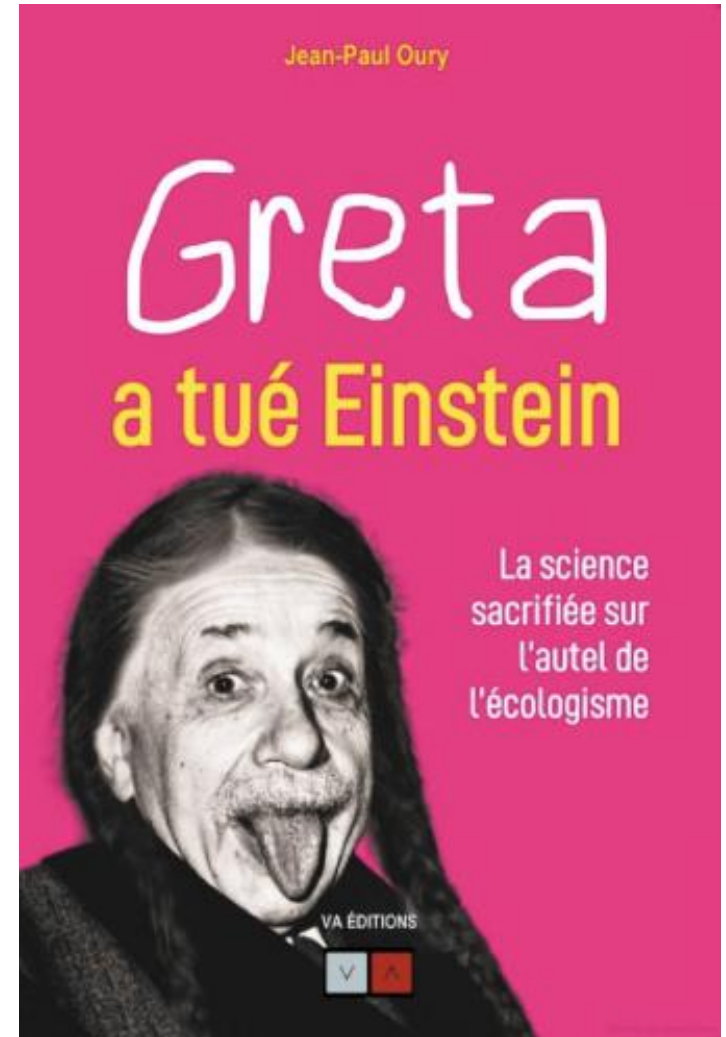
“So, in a century that is Asian, we know our future is Asia.”

— *Amin Nasser*



**JEAN-PAUL OURY :
"TOUS LES PROBLÈMES
VIENNENT D'UNE
LACUNE CRUELLE QUI
EST L'ABSENCE D'UNE
POLITIQUE
SCIENTIFIQUE
ALTERNATIVE À
L'ÉCOLOGISME."**

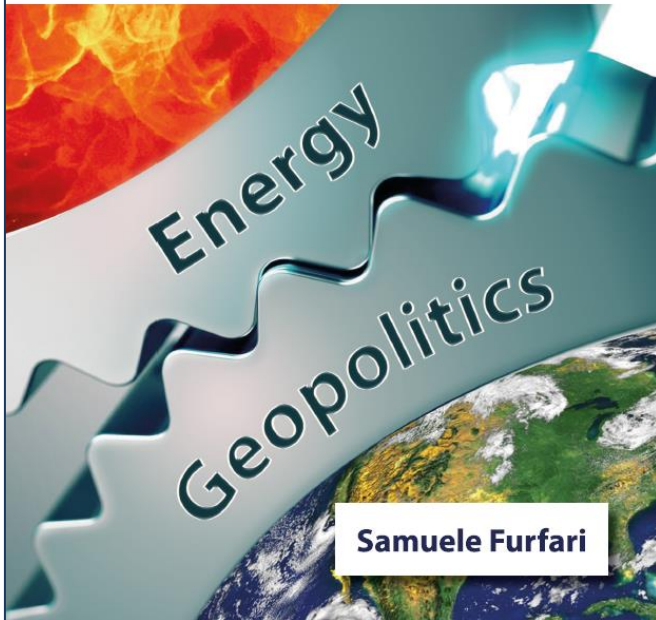
**All the problems
stem from a cruel
shortcoming,
which is the
absence of an
alternative
scientific policy to
ecologism.**



sfurfari@escp.eu

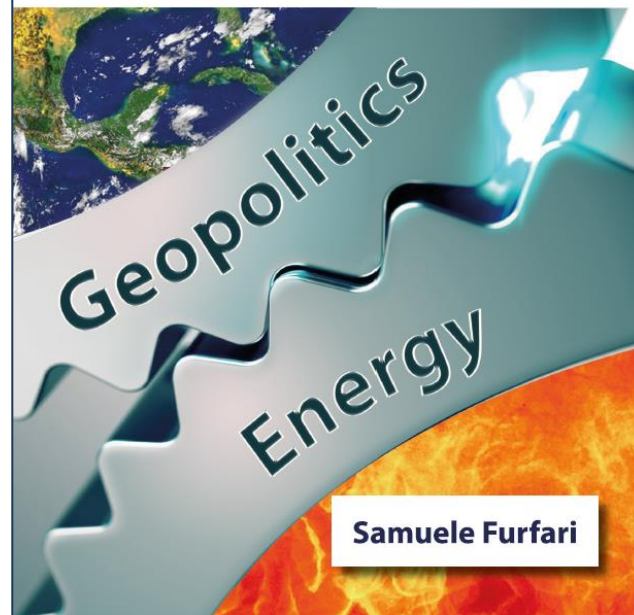
The changing world of energy and the geopolitical challenges

1. Understanding energy developments



The changing world of energy and the geopolitical challenges

2. Shifting Sands: The Geopolitics of Energy



Energy insecurity

The organised destruction of the EU's competitiveness

Samuel Furfari