From Energy Market Fundamentals to EPIC Research Frontiers

EP Innovation Centre

Date 11/09/2024

Who am I?

linkedin.com/in/martin-miškuf

Experience

Head of Analytics and Model Development London Branch
EP Commodities, a.s. · Full-time
Apr 2022 - Present · 1 yr 11 mos
London, England, United Kingdom

EP Commodities specializes in the trading of energy commodities, transit and storage capacities. We deal with transactions in natural gas, power, emissions allowances, coal and structural products like spreads acr ...see more

Developer
Gazprom Marketing & Trading
Aug 2018 - Mar 2022 · 3 yrs 8 mos
London, United Kingdom

Developer, Data & Analytics, Gazprom Marketing & Trading, London, United Kingdom
Main responsibilities:... ...see more

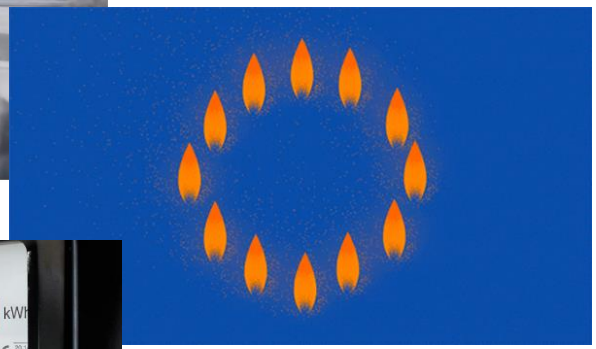
Ph.D. Student
The Technical University of Košice
Sep 2014 - Jun 2018 · 3 yrs 10 mos
Košice, Slovakia

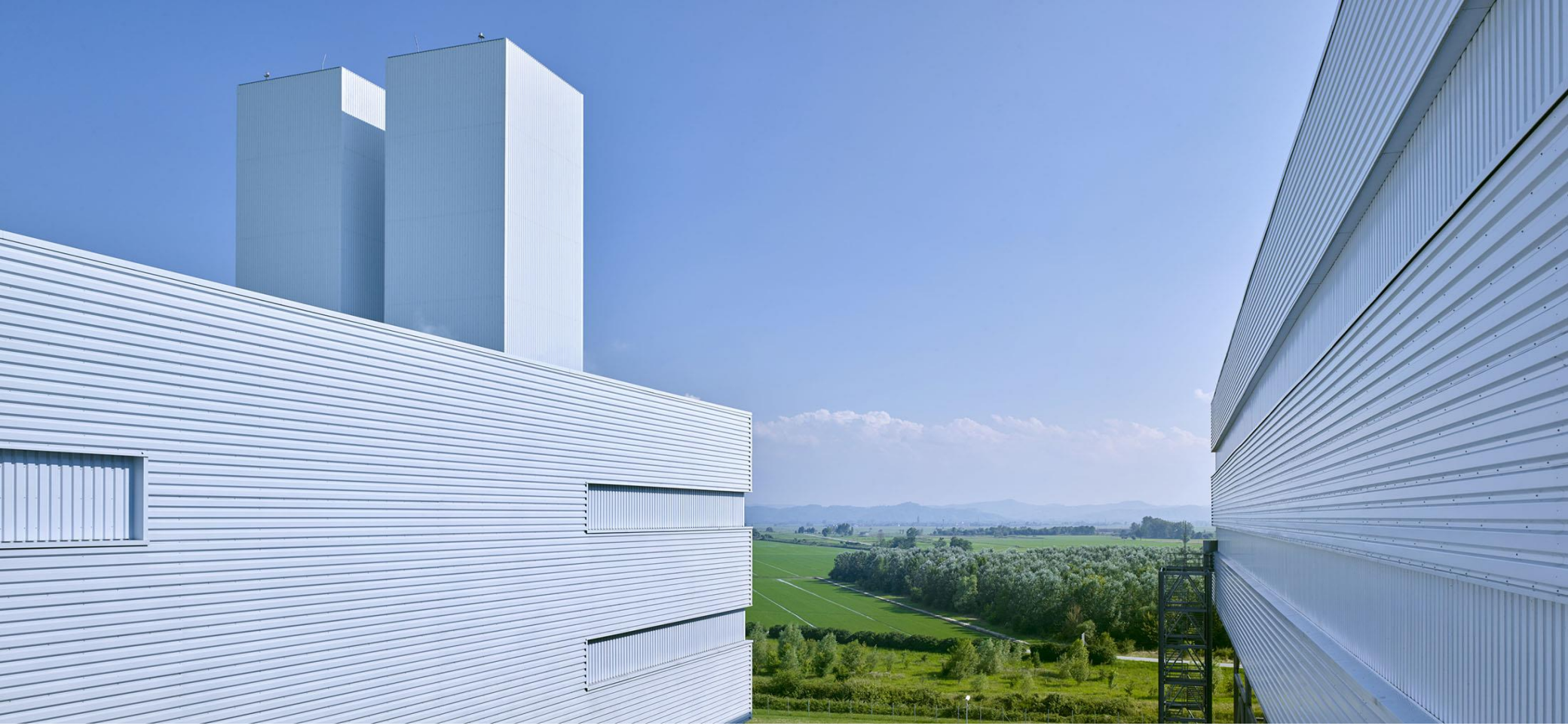
The team of Intelligent Cybernetics Systems, Department of Cybernetics and Artificial Intelligence, Faculty of electrical engineering and informatics... ...see more

Department of Cybernetics and Artificial Intelligence
stránka Katedry Kybernetiky a Umelej Inteligencie na TU Košice

Agenda

- Dynamics and Challenges in the Energy Market
  - Role of natural gas in the energy mix
  - Changing balancing mechanisms
  - Geopolitics and energy security concerns
- Trends, Problems & **EPIC** research gaps
  - Emerging technologies and problems
  - **EPIC** research gaps and university cooperation
- Q&A Session





Dynamics and Challenges in the Energy Market

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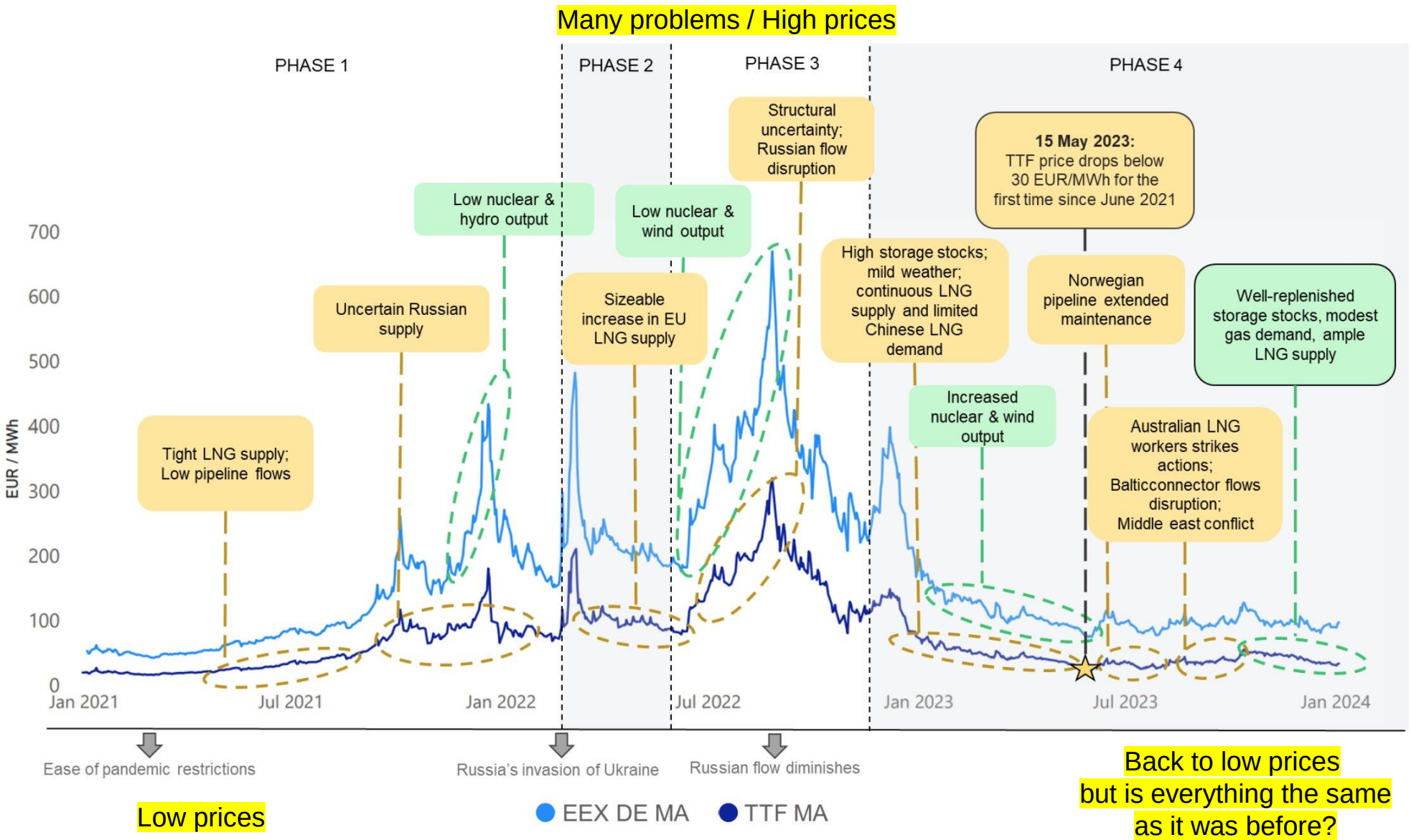
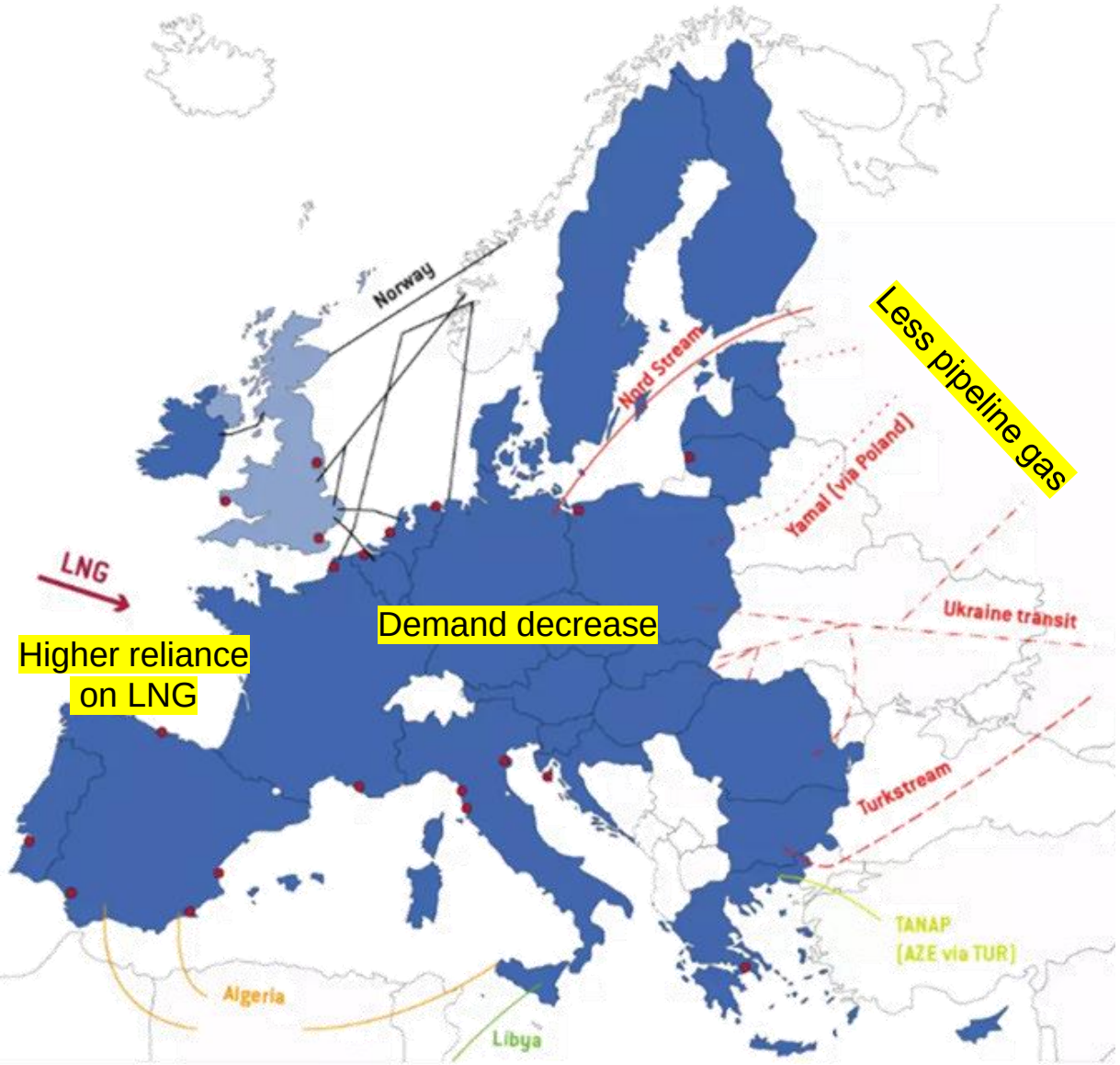
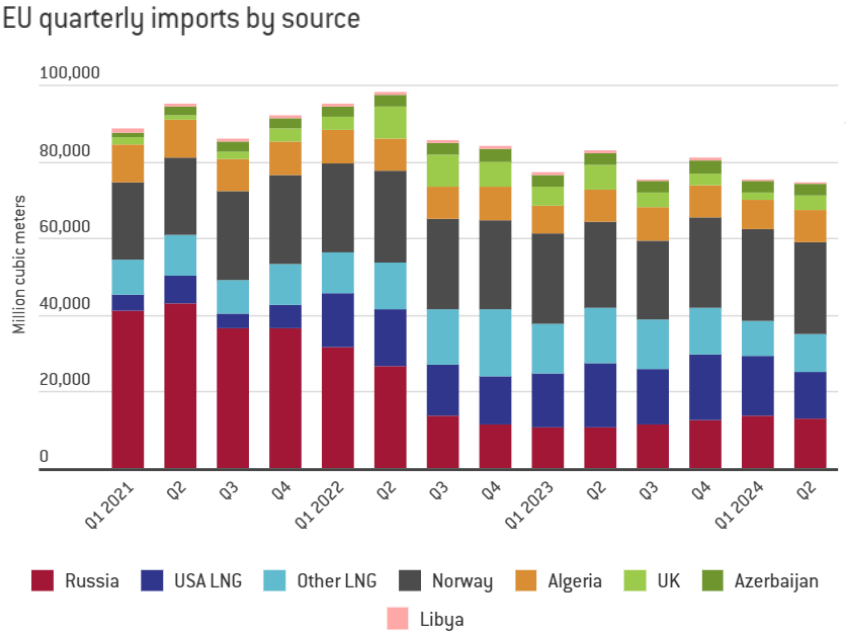
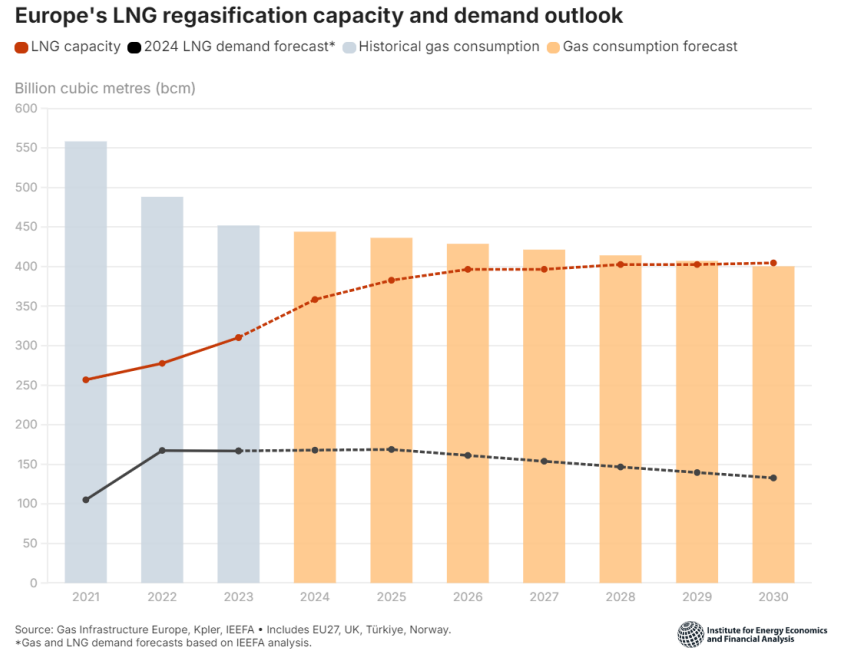
Dynamics and Challenges in the Energy Market



Changes in the EU Supply and Demand

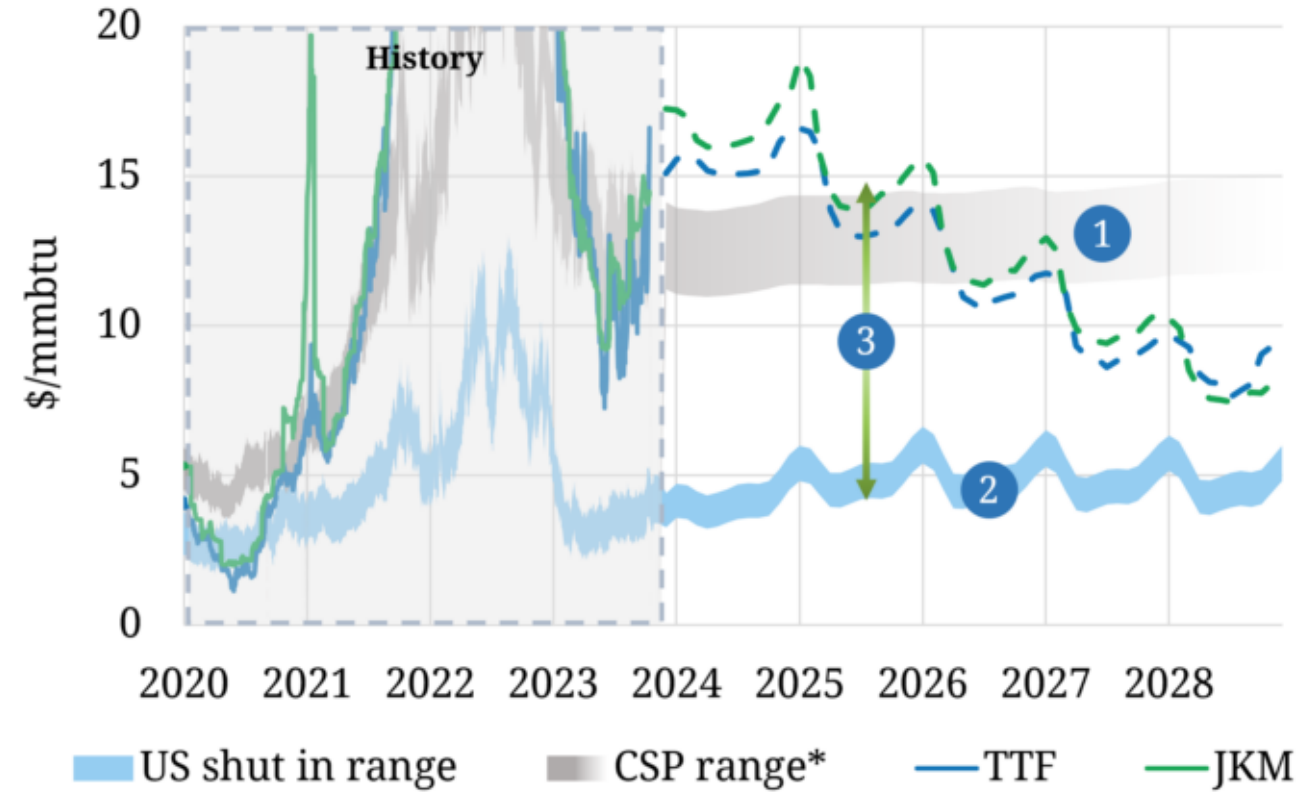






https://www.bruegel.org/dataset/european-natural-gas-imports
https://ieefa.org/european-lng-tracker

EU Balancing Mechanism: from Fuel switching to JKM-TTF spread



1. EU switching range links gas to coal & CO2 prices; impact diminishes into 2030s as coal closes

2. US SRMC dynamic range driven by HH & shipping costs; provides key global price support

3. Asian LNG demand response key source of flex across all price levels (and growing in importance as (i) Asian spot procurement increases (ii) European CTGS channel shrinks)

**Indicative switching channel for 50-52 % efficient gas plants vs 38-45% efficient coal plants*

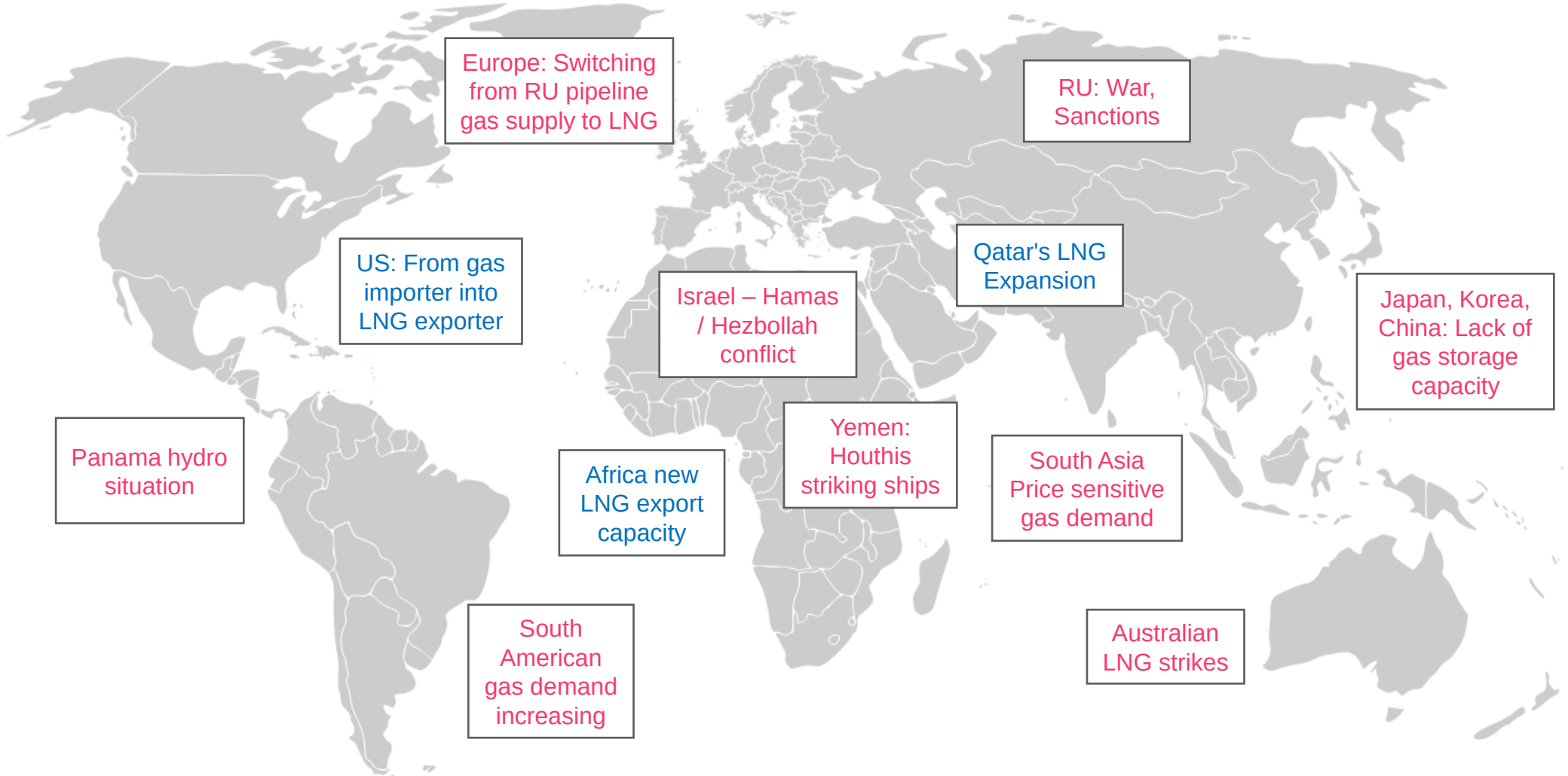
Thanks to **RES and supply changes** ratio between gas and power moves is changing
Used to be: **Power price = 2 * Gas price + 0.4 * Carbon price**

The **coal and lignite phaseout** will reduce thermal / **fuel switching capacity**.
EU is now more reliant on LNG, with the **JKM-TTF** price spread becoming a key balancing mechanism.

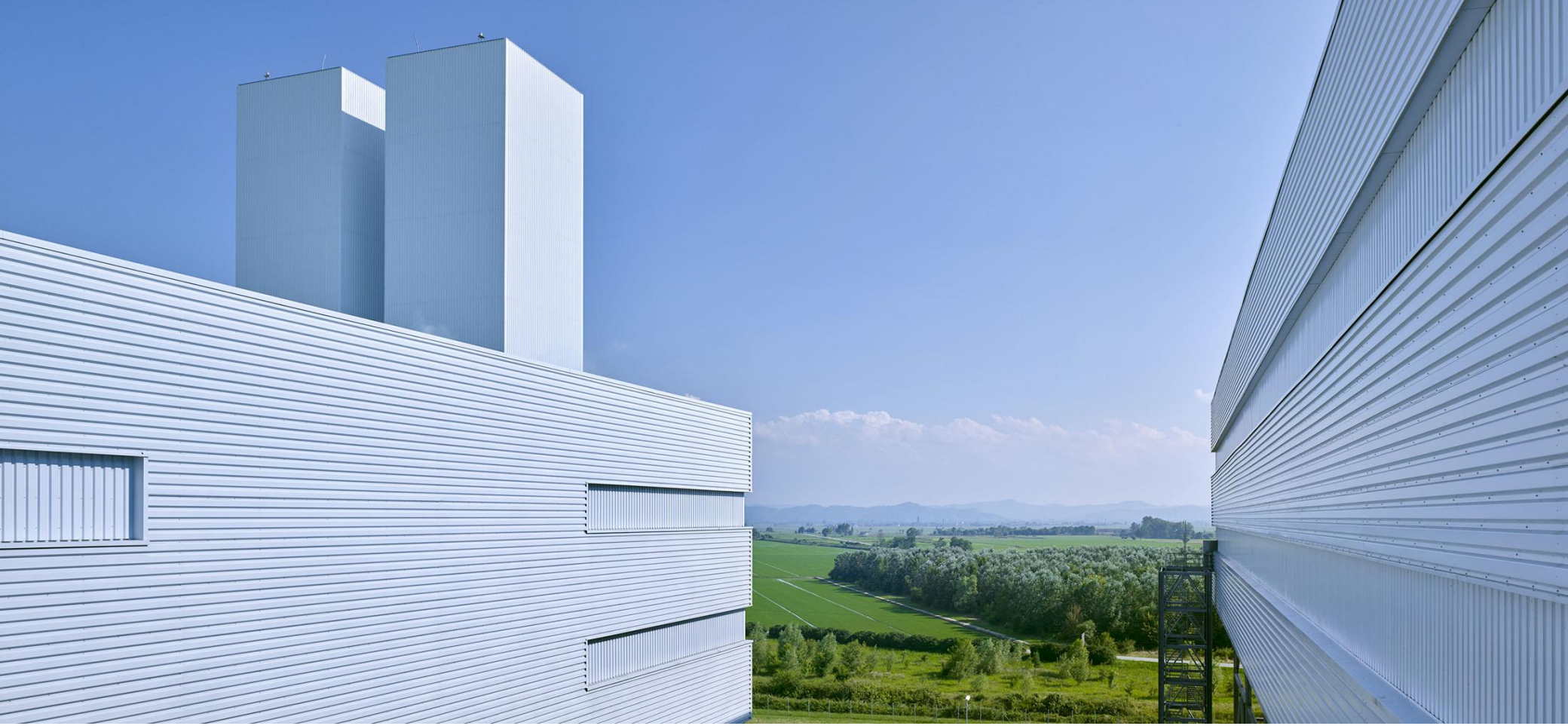
https://timera-energy.com/blog/what-is-setting-global-gas-prices/
https://timera-energy.com/blog/asian-demand-flex-is-setting-global-gas-prices/

The Influence of Geopolitics on Energy Markets

Pipeline gas generally results in lower price volatility.
Increased reliance on LNG can cause price fluctuations of tens of percent in a single day.
Higher volatility may lead to unpredictable energy costs, impacting demand for consumers, industries, and the power sector.



https://www.ice.com/insights/energy/the-globalization-of-natural-gas-gains-momentum



Trends, Problems & EPIC research gaps

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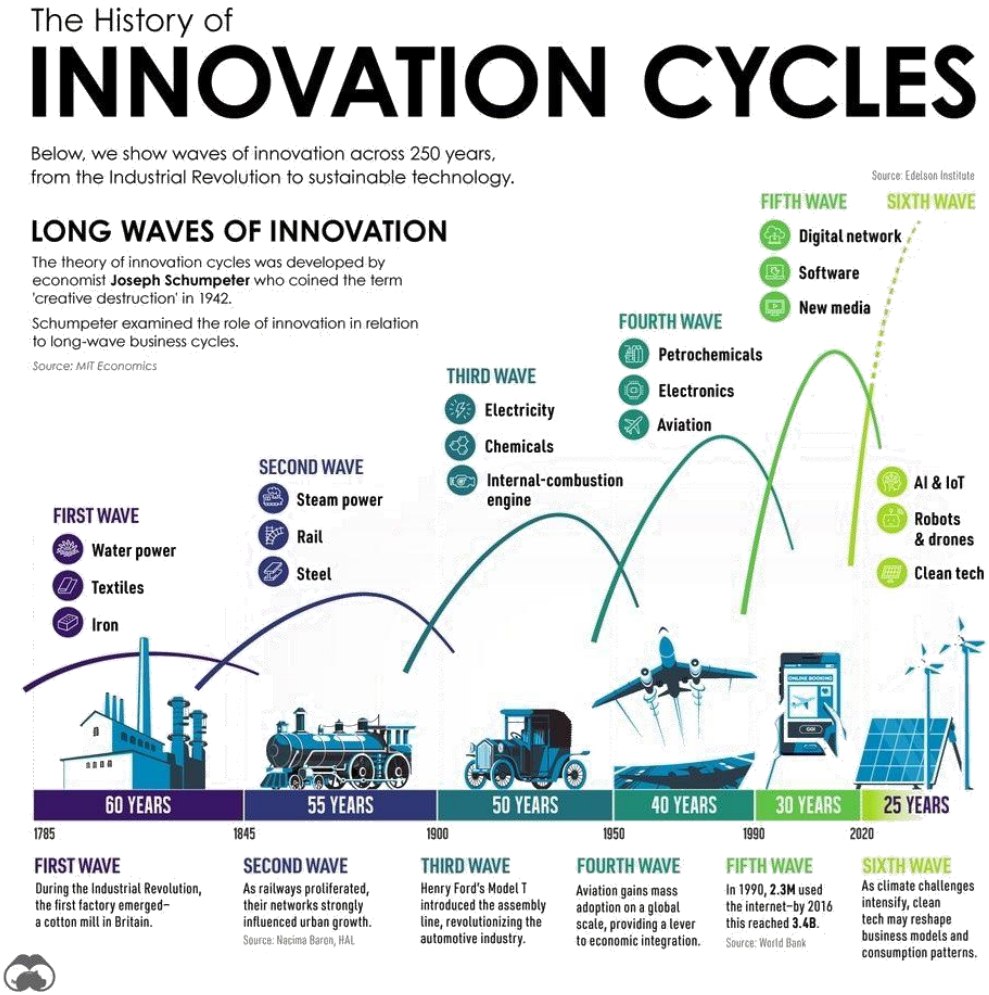
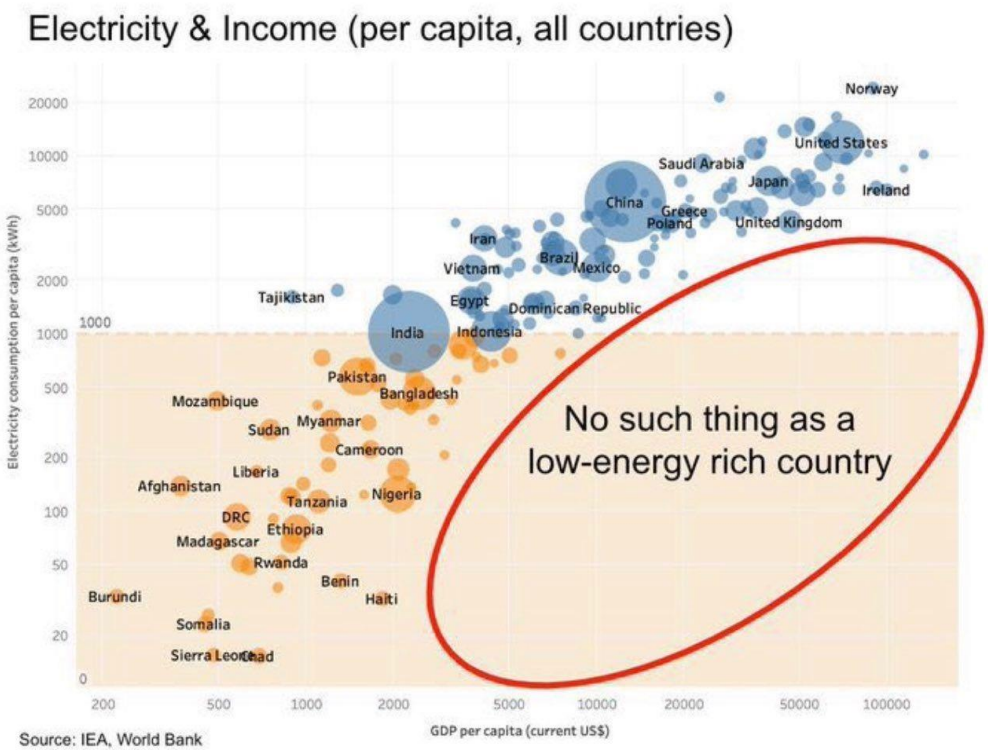
Importance of Energy for Innovation

Will we be able to change our behavior and meet our energy needs?





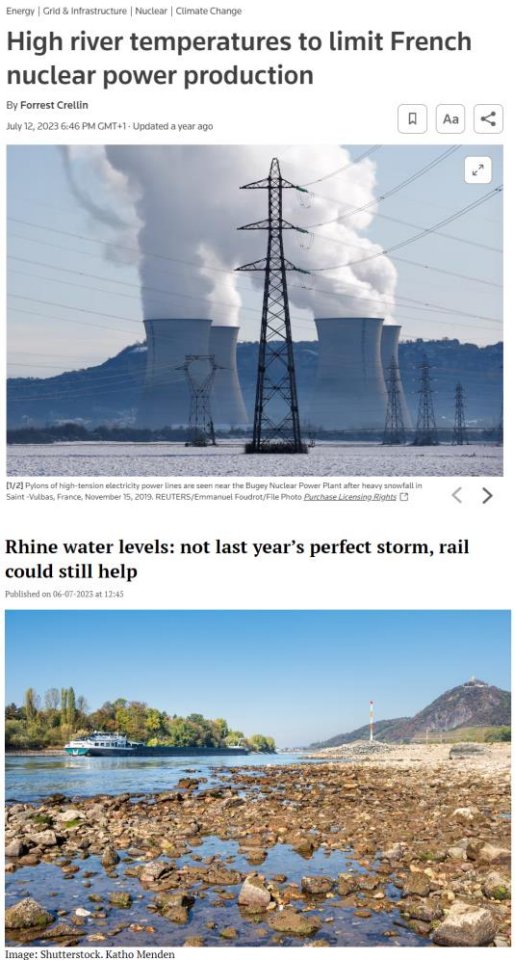
https://www.visualcapitalist.com/the-history-of-innovation-cycles/

Climate change

Affecting both the supply and demand sides

Supply: Hot weather leads to reduced thermal production, weather extremes causing unpredictable output.

Demand: Warmer winters reduce heating demand, while hot summers increase cooling demand



Energy | Grid & Infrastructure | Nuclear | Climate Change

High river temperatures to limit French nuclear power production

By Forrest Crellin

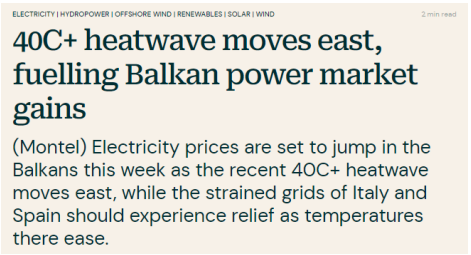
July 12, 2023 6:46 PM GMT+1 · Updated a year ago

[1/2] Pylons of high-tension electricity power lines are seen near the Bugey Nuclear Power Plant after heavy snowfall in Saint -Vulbas, France, November 15, 2019. REUTERS/Emmanuel Foudrot/File Photo Purchase Licensing Rights

Rhine water levels: not last year's perfect storm, rail could still help

Published on 06-07-2023 at 12:45

Image: Shutterstock. Katho Menden

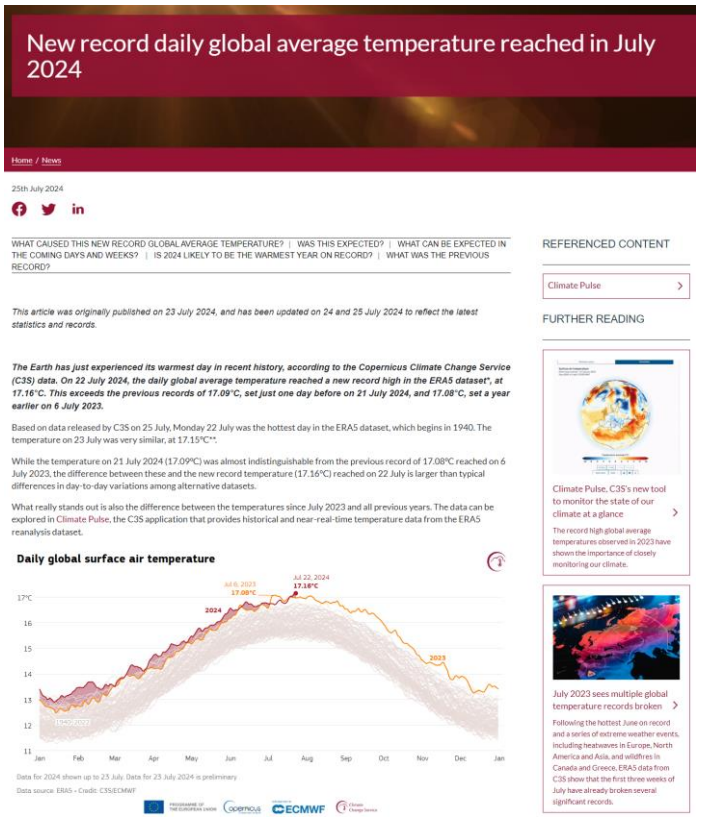


ELECTRICITY | HYDROPOWER | OFFSHORE WIND | RENEWABLES | SOLAR | WIND

2 min read

40C+ heatwave moves east, fuelling Balkan power market gains

(Montel) Electricity prices are set to jump in the Balkans this week as the recent 40C+ heatwave moves east, while the strained grids of Italy and Spain should experience relief as temperatures there ease.



New record daily global average temperature reached in July 2024

Home / News

25th July 2024

WHAT CAUSED THIS NEW RECORD GLOBAL AVERAGE TEMPERATURE? | WAS THIS EXPECTED? | WHAT CAN BE EXPECTED IN THE COMING DAYS AND WEEKS? | IS 2024 LIKELY TO BE THE WARMEST YEAR ON RECORD? | WHAT WAS THE PREVIOUS RECORD?

This article was originally published on 23 July 2024, and has been updated on 24 and 25 July 2024 to reflect the latest statistics and records.

The Earth has just experienced its warmest day in recent history, according to the Copernicus Climate Change Service (C3S) data. On 22 July 2024, the daily global average temperature reached a new record high in the ERA5 dataset*, at 17.16°C. This exceeds the previous records of 17.09°C, set just one day before on 21 July 2024, and 17.08°C, set a year earlier on 6 July 2023.

Based on data released by C3S on 25 July, Monday 22 July was the hottest day in the ERA5 dataset, which begins in 1940. The temperature on 23 July was very similar, at 17.15°C*.

While the temperature on 21 July 2024 (17.09°C) was almost indistinguishable from the previous record of 17.08°C reached on 6 July 2023, the difference between these and the new record temperature (17.16°C) reached on 22 July is larger than typical differences in day-to-day variations among alternative datasets.

What really stands out is also the difference between the temperatures since July 2023 and all previous years. The data can be explored in Climate Pulse, the C3S application that provides historical and near-real-time temperature data from the ERA5 reanalysis dataset.

Daily global surface air temperature

Data for 2024 shown up to 25 July. Data for 23 July 2024 is preliminary

Data source: ERA5 - Credit: C3S/ECMWF

REFERENCED CONTENT

Climate Pulse

FURTHER READING

Climate Pulse, C3S's new tool to monitor the state of our climate at a glance

The record high global average temperatures observed in 2023 have shown the importance of closely monitoring our climate.

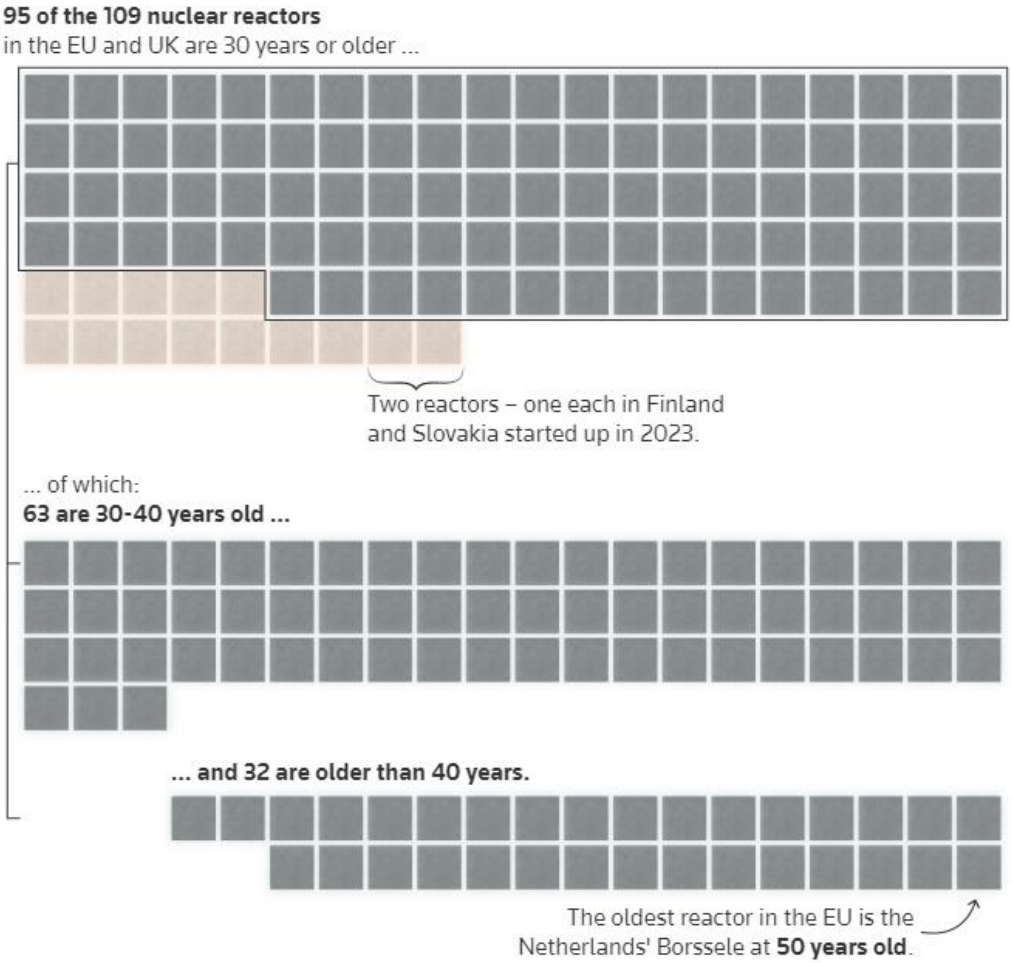
July 2023 sees multiple global temperature records broken

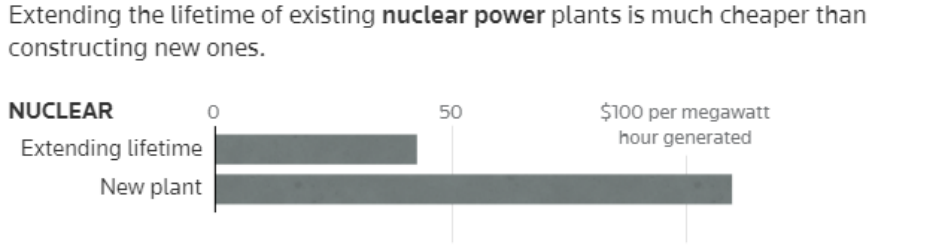
Following the hottest June on record and a series of extreme weather events, including heatwaves in Europe, North America and Asia, and wildfires in Canada and Greece, ERA5 data from C3S show that the first three weeks of July have already broken several significant records.

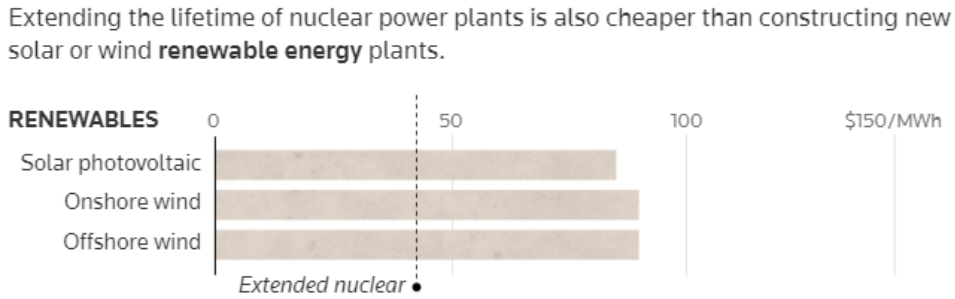
https://montelnews.com/topics/electricity
https://www.reuters.com/business/energy/
https://climate.copernicus.eu

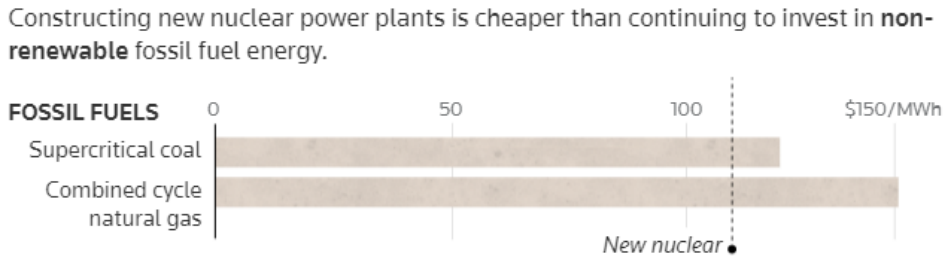
EU The Nuclear Aged

Old nuclear = higher risk / unexpected maintenance => volatile / higher prices?
Is there any near-term solution? Emerging technologies (SMR, etc.), policies / price guaranties





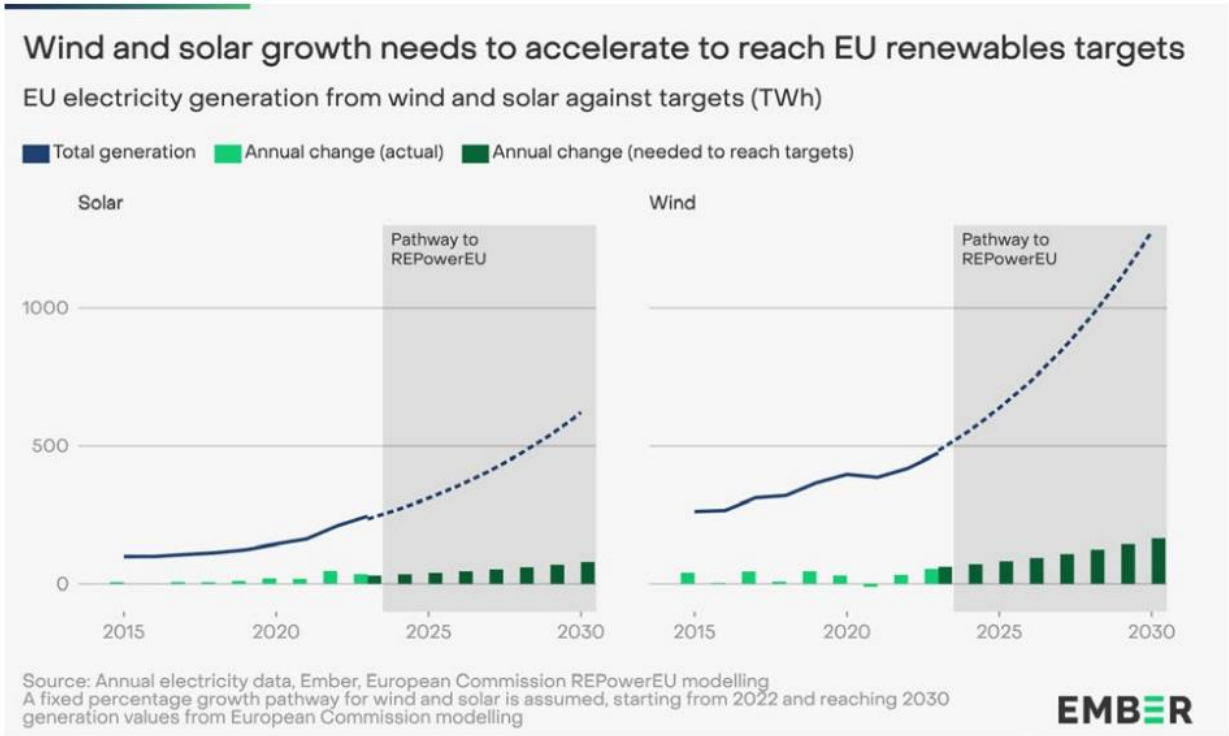




https://www.reuters.com/graphics/EUROPE-ENERGY/NUCLEARPOWER/gdvzwweqkpw/

Benefits and Challenges of Renewable Power Generation

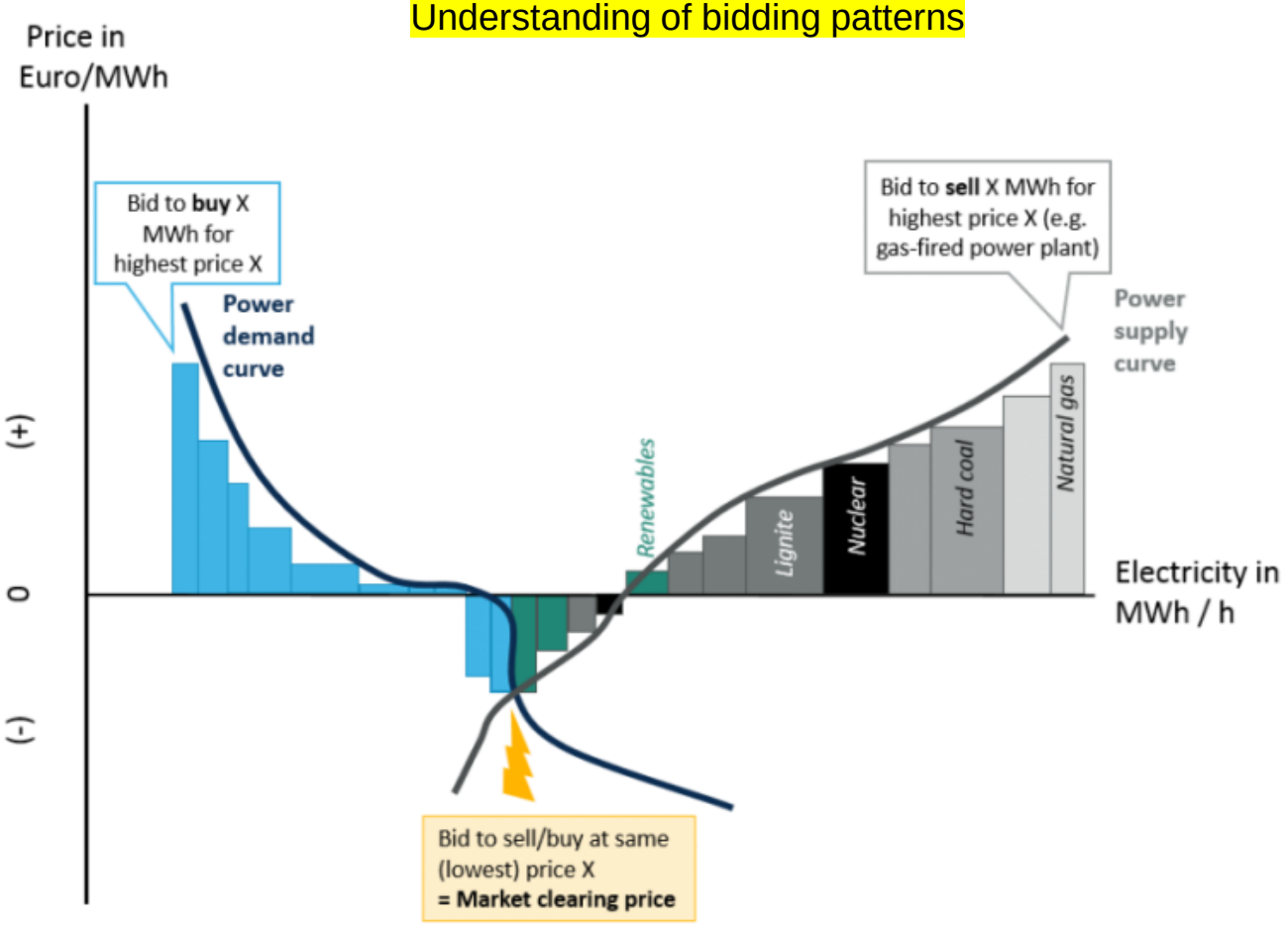
Life expectancy of RES 20 years
Policies to incentivize reasonable renewable growth
Supply chain issues (China major producer), hard to recycle

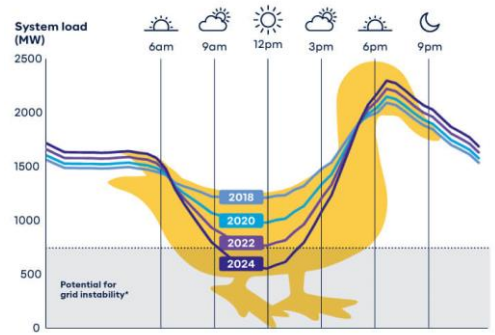


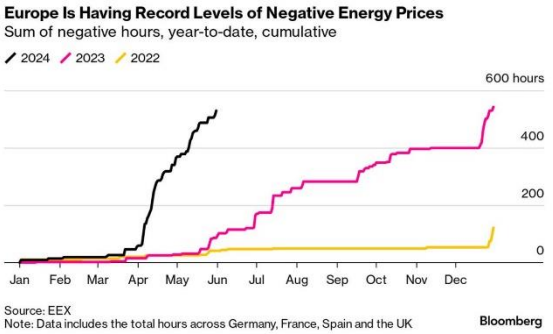
https://ember-climate.org/insights/research/european-electricity-review-2024/

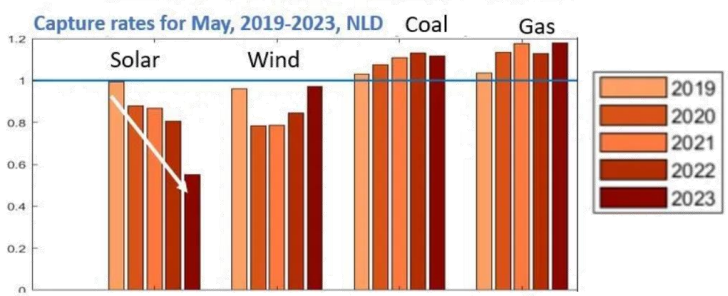
Duck Curve, Negative Pricing, Capture Rates, and Market Cannibalization

The supply side is changing, but the **demand** side remains **notoriously inflexible.**
Impact of policies on the inefficient energy market pricing
Understanding of bidding patterns





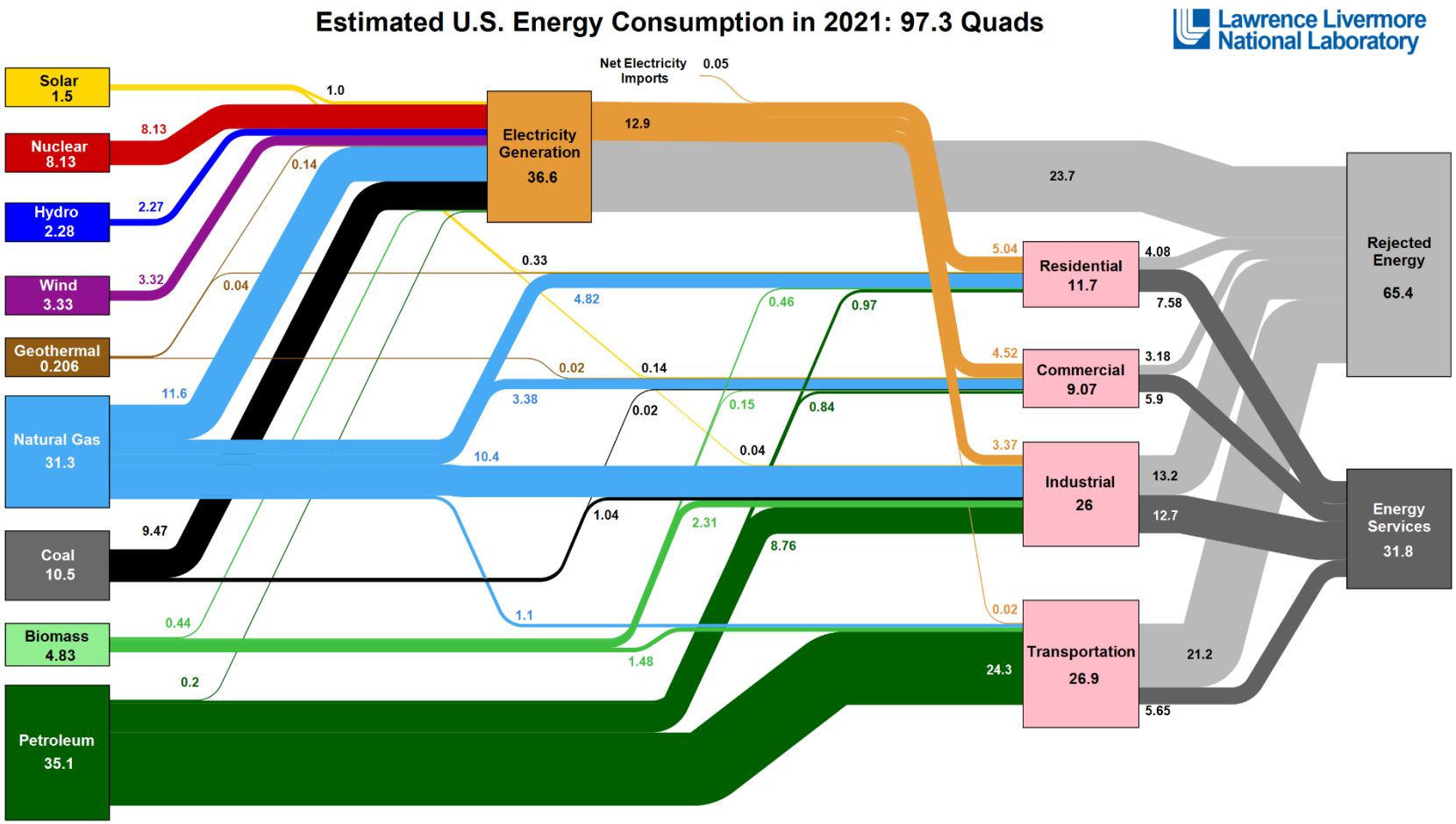




Duck curve: https://www.synergy.net.au/Blog/2021/10/Everything-you-need-to-know-about-the-Duck-Curve
Negative pricing: https://www.cleanenergywire.org/factsheets/why-power-prices-turn-negative
Solar cannibalization: https://gemenergyanalytics.substack.com/p/solar-cannibalization-more-details
EU needs more integrated electricity markets: https://www.bruegel.org/policy-brief/unity-power-power-unity-why-eu-needs-more-integrated-electricity-markets

Energy Transition: Rejected Energy

We only need to replace one-third of our current fossil fuel usage.

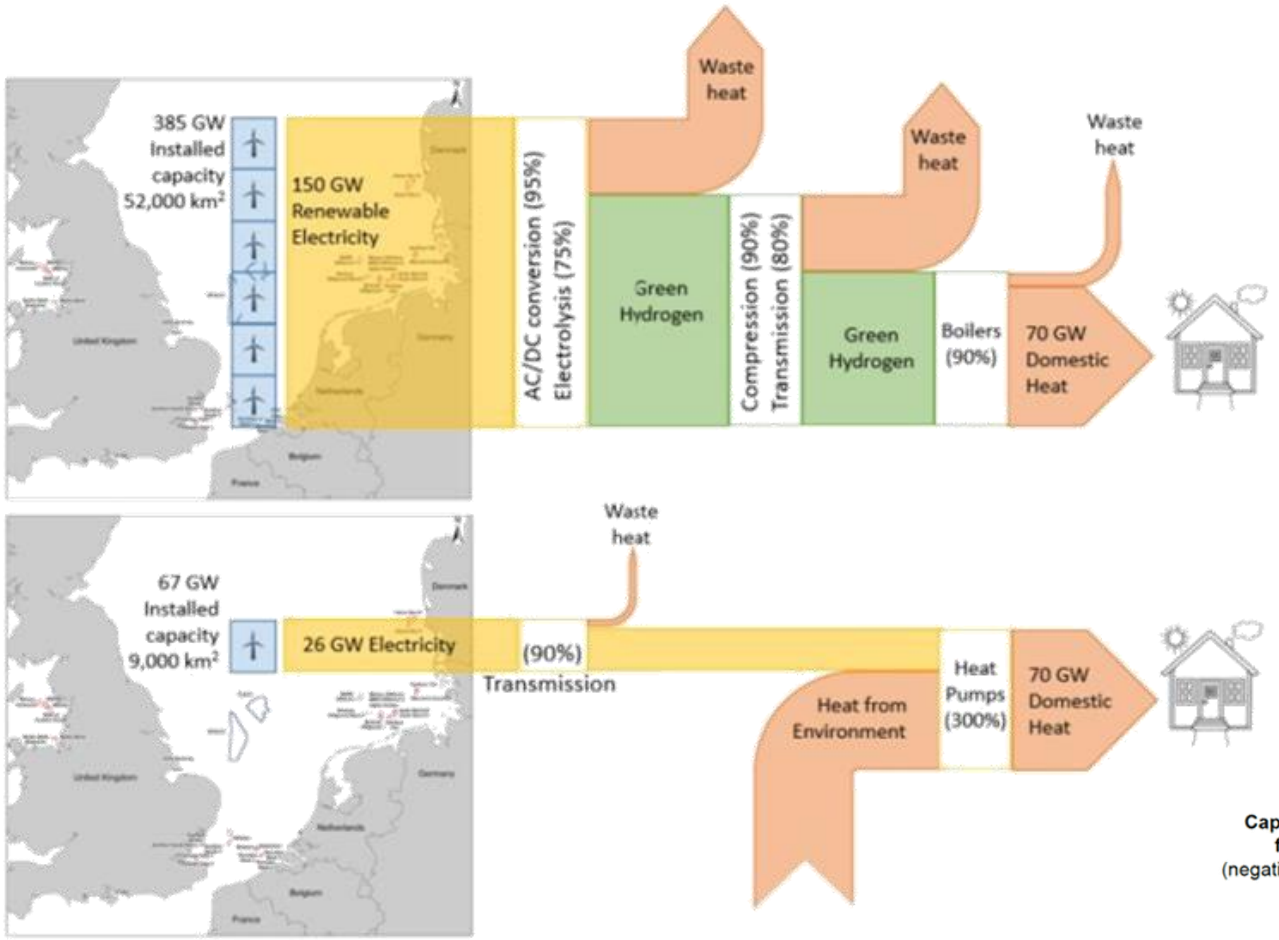


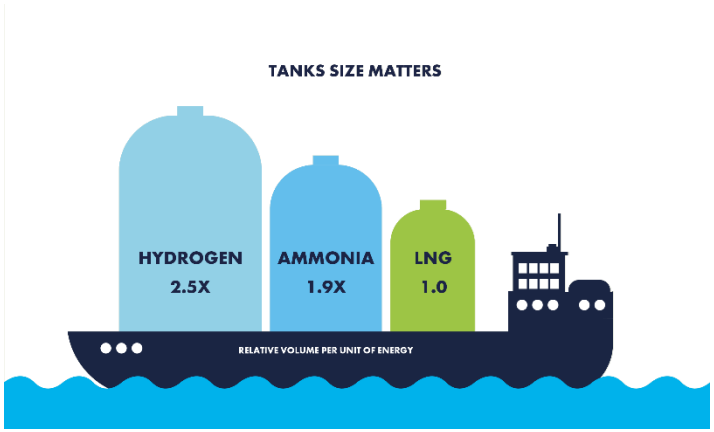
Source: LLNL March, 2022. Data is based on DOE/EIA MER (2021). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant heat rate. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential sector, 65% for the commercial sector, 21% for the transportation sector and 49% for the industrial sector, which was updated in 2017 to reflect DOE's analysis of manufacturing. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

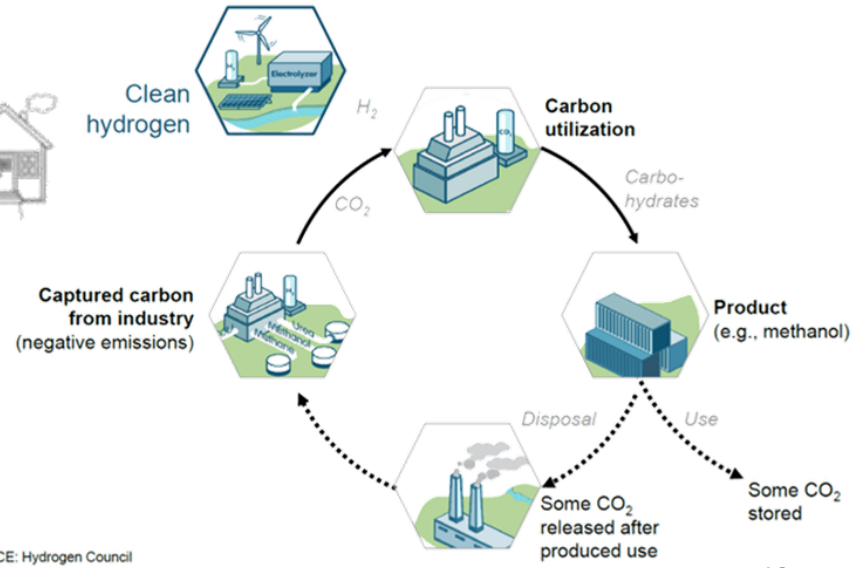
https://youtu.be/EVJkq4iu7bk?si=Fot9iH2LtSCxGhwQ

New Technologies: Heath pumps, Hydrogen and future trends

We are changing the supply side – will we be able to change the demand side as well?
If not / not quick enough, how can we store excess energy for times when we need it?"



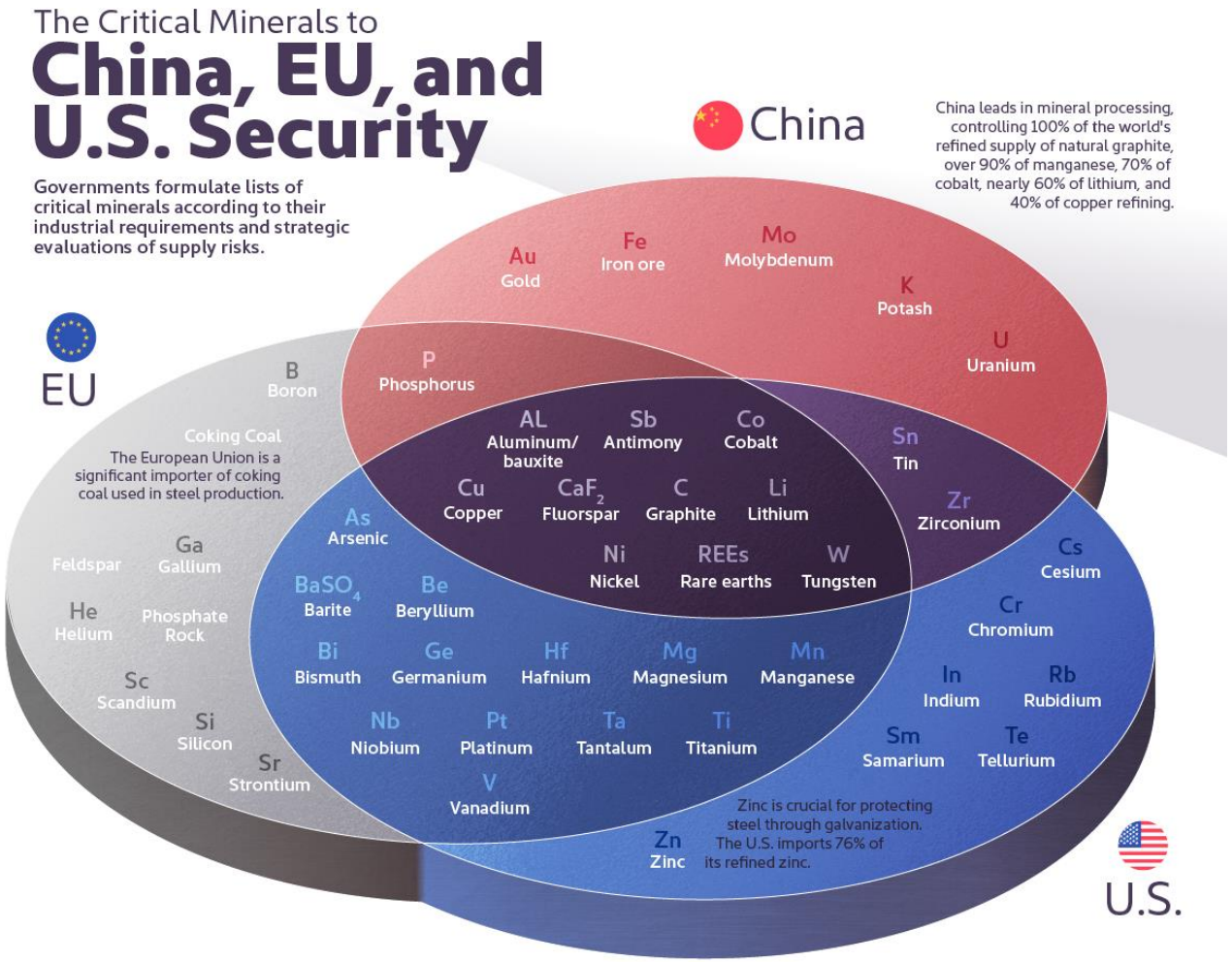




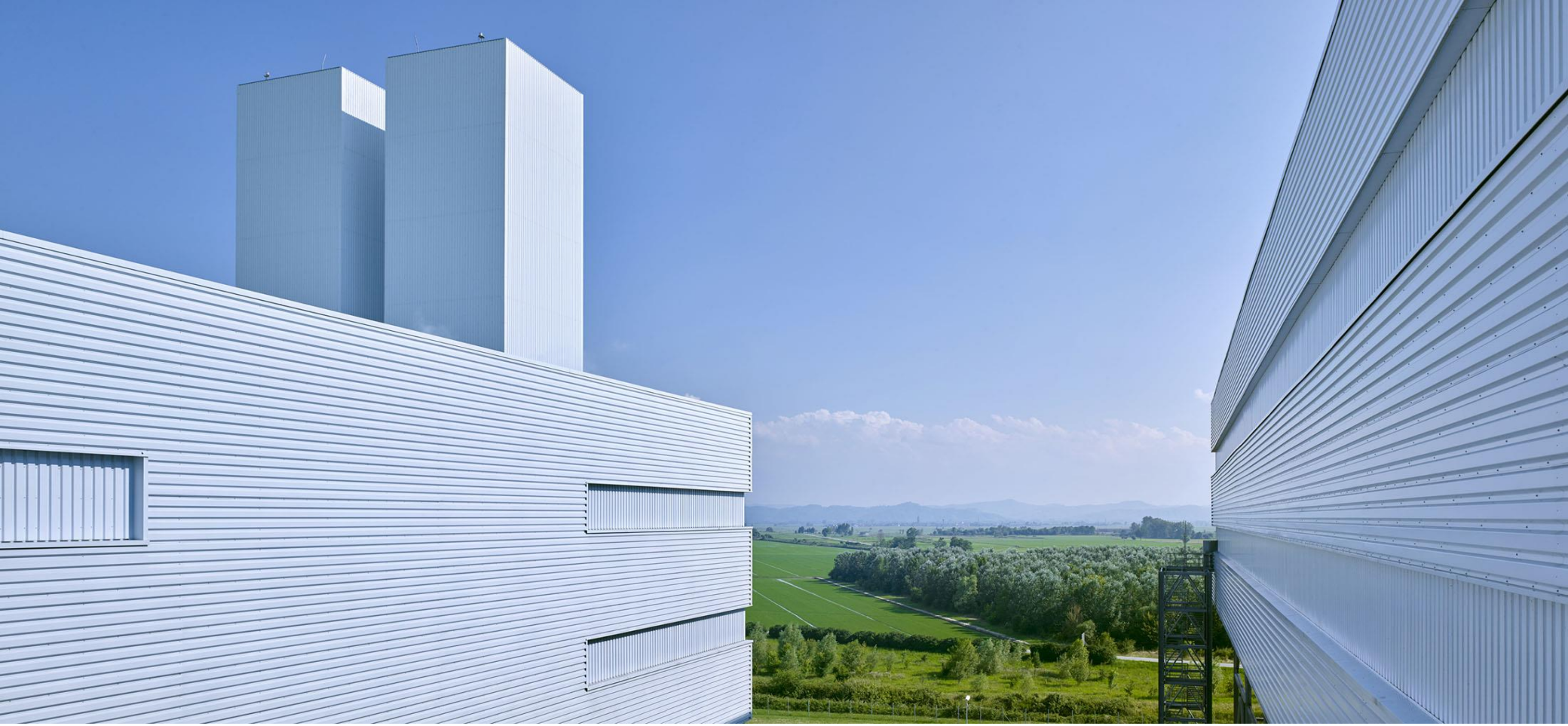
SOURCE: Hydrogen Council

Energy Transition: Critical Minerals and Geopolitics

To meet net zero targets, **we need China**. Same way as we needed RU gas to keep low gas prices.
In case of conflicts (for example Taiwan) **implications will be much worse** compared to RU-UA war.



https://www.whitecase.com/insight-our-thinking/geopolitics-and-decarbonization-mining-metals-sector
https://www.visualcapitalist.com/the-critical-minerals-to-china-eu-and-u-s-national-security/



How to start:
From lectures through courses to EPIC research

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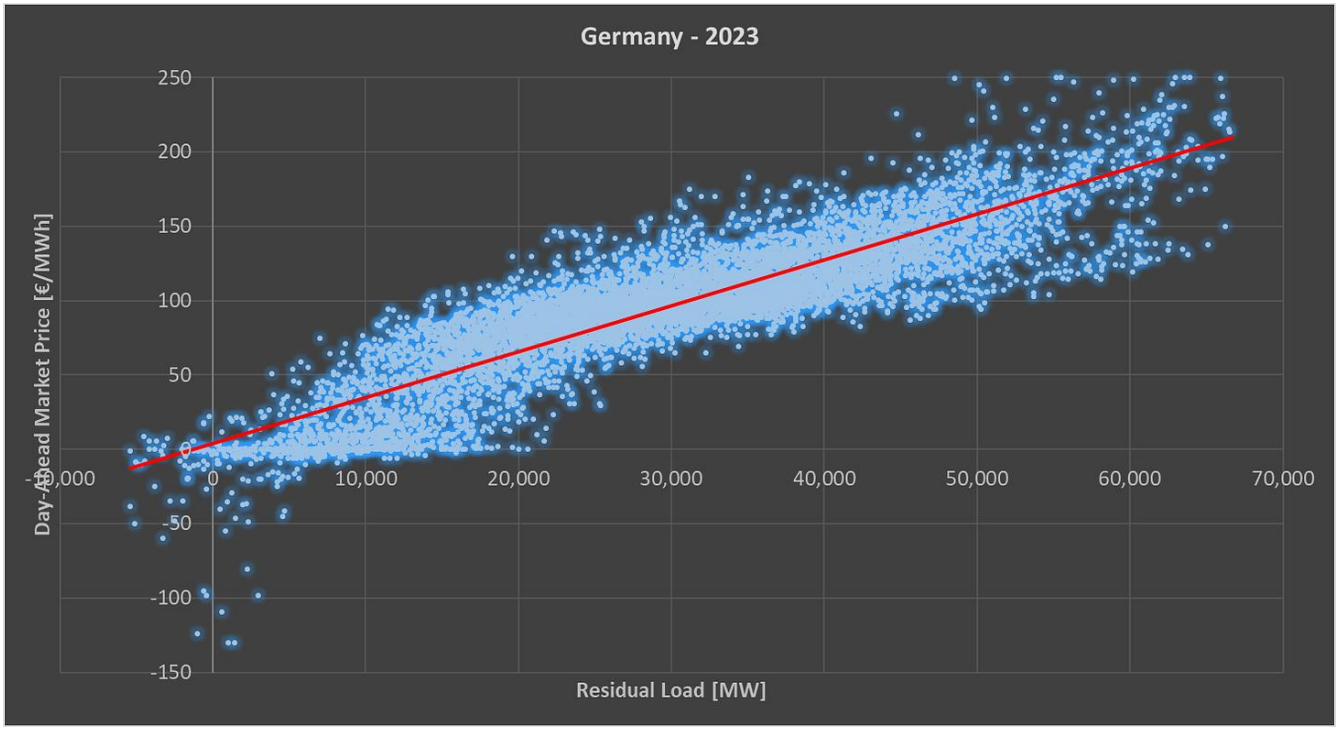
You don't need much to get started

Add data analytics to your study programmes
Make the most from transparency platform
Understanding power price, future changes and their impact on future power prices



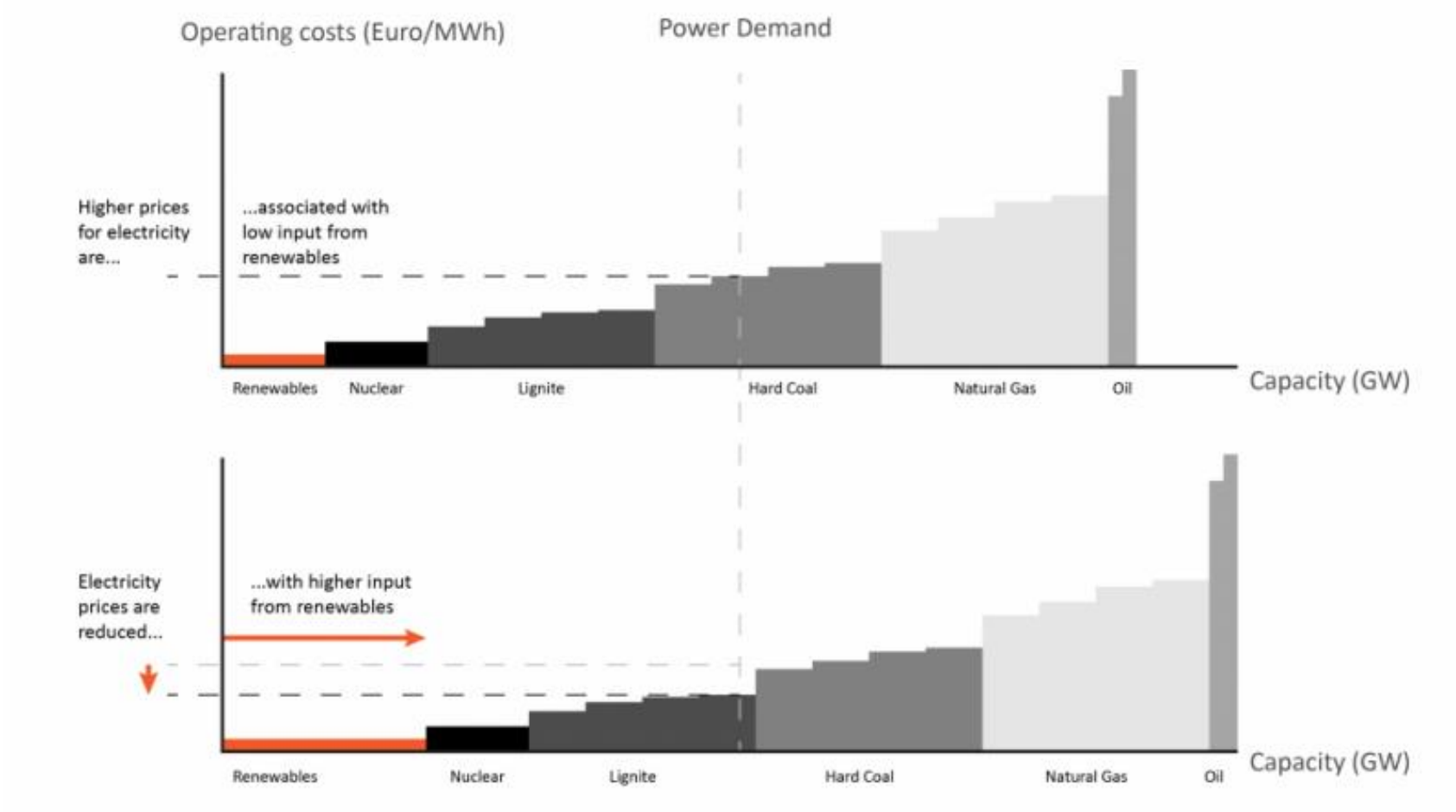
Demand – (Wind + Solar) = Residual Load

You have **more than enough data** to start, you can **also ask for university data licenses**
Data services: Energy Charts (free), Commodity Essentials, EnapSys, Kpler, Volue, etc.
Research terminals: Refinitiv Workspace, Bloomberg terminal, etc.

Many blogs describing recent market events, pricing: https://gemenergyanalytics.substack.com/
Free source of data: https://**www.energy-charts.info**/charts/power/chart.htm?l=en&c=DE

Learn how to model things the way we do in business

Stack model (Merit order) - Better way to model non-linear relation ship between supply and demand



Build your own model, ask big market players for university cooperation (Aurora, Genscape, Plexos, etc.)

EUPHEMIA algorithm
https://energy.ec.europa.eu/data-and-analysis/energy-modelling/metis_en
https://energy.ec.europa.eu/publications/metis-1-scripts-and-data_en

Energy Security Framework

BIG PICTURE - How to shape your research to be more interesting for business, EU projects

How to adapt to new market conditions on Supply and Demand side?

More interconnected / volatile market

Supply

- Driver
  - Geopolitics – Energy Security
  - Environment – Net Zero Policies
  - Investment Policies (CFD, PPA, etc.)
  - Emission Policies (ETS, Carbon taxes, etc.)
- Increase
  - Adding more renewables
    - Balancing with no sun, wind, rain
    - Exporting / storing when there is a lot
  - Grid stability
    - Interconnector capacity
    - Grid inertia, RES not directly connected
- Decrease
  - Ageing conventional powerplants
  - Decommissioning thermal generation
  - Cannibalization effect / bidding strategies
  - Negative pricing / inefficient market

Demand

- Driver
  - How much consumers can afford to pay?
  - Price guarantees
- Sectors
  - Residential (LDZ)
    - Delayed response to heating season
    - Climate change / cooling demand increase
  - Power
    - Fuel switching model
    - Less hours where thermal is setting price
    - Changes in underlying commodities and their impact on power prices
  - Industrial
    - Demand reduction = Lower tax income for EU
    - High energy prices = industry relocating production outside of EU
    - EU introducing Carbon import tax

EP Innovation Centre - TECHNICOM

- **Enhancing Education and Research Quality**: Collaboration aims to elevate the quality of education and research at TUKE and other universities through innovative initiatives.
- **Skill Development in Commodity Market**: Provides a unique opportunity for students and researchers to acquire valuable skills in commodity market analysis and trading, fostering practical knowledge alongside academic learning.
- **Centre of Excellence - TECHNICOM Office**: TUKE hosts a Centre of Excellence where talented students can access the TECHNICOM office, equipped with excellent hardware and resources for hands-on learning.
- **Opportunities for Exposure**: Students and researchers have the chance to visit trading offices in Europe and the UK, gaining exposure to real-world trading environments and networking opportunities.
- **Empowering Talent**: The collaboration empowers talented students and researchers to excel by providing them with resources, mentorship, and opportunities to thrive in the field of commodities trading and analytics.
- **Interested? Contact us for more information.**
  - DEE: marek.pavlik@tuke.sk, roman.cimbala@tuke.sk
  - DCAI: erik.kajati@tuke.sk, iveta.zolotova@tuke.sk
  - martin.miskuf@epcommodities.cz

In May 2023, the research and innovation center EPIC was inaugurated within the TECHNICOM facility

Captivating snapshots of university students exploring our London office in September 2023.

EPH – Energeticky a Průmyslový Holding

Flexible Power Generation

One of Europe's leading producers of energy from traditional sources

Read more

Renewables

Producer of energy from a balanced mix of renewable energy sources

Read more

Gas and Power Distribution

Key strategic gas infrastructure operator & relevant power distributor in Slovakia

Read more

Gas Transmission

Operator of an important gas corridor in Slovakia connected to all neighbouring countries

Read more

Gas Storage

A major operator of natural gas storage capacity in the region of Slovakia, Czech Republic and Austria.

Read more

Heat Infra

A major supplier of heat in the Czech Republic, serving residential and commercial customers in major regional cities

Read more

Performance 2023			
24.2 bn EUR	3.6 bn EUR	28.9 bn EUR	
Revenues	EBITDA	Total assets	
36.1 TWh	6.0 TWh	45.5 TWh	64.3 TWh
Power production	Power distribution	Gas distribution	Gas Storage capacity

https://www.epholding.cz/en/
EPH H1 2023 Results Presentation – updated

Thank you - Q&A and some useful links

- LinkedIn
  - Lion Hirth (Prof. energy study programme in DE): https://www.linkedin.com/in/lionhirth/
  - Gabriele Martinelli (Reuters power): https://www.linkedin.com/in/gabriele-martinelli-10bb1819/
  - Joachim Gessner (Bloomberg News): https://www.linkedin.com/in/joachimgessner/
  - Tom Marzec-Manser (ICIS Gas): https://www.linkedin.com/in/tom-marzec-manser/
  - Matthew Jones (ICIS Power): https://www.linkedin.com/in/matthew-jones-5a25862a/
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  - Stefan Feuchtinger (Emissions): https://www.linkedin.com/in/steffeuchtinger/
- EMBER: https://ember-climate.org/insights/
  - European Electricity Review 2024: https://ember-climate.org/insights/research/european-electricity-review-2024/
- BRUEGEL: https://www.bruegel.org/keyword/energy
  - European natural gas imports: https://www.bruegel.org/dataset/european-natural-gas-imports
  - Europe's under-the-radar industrial policy: https://www.bruegel.org/policy-brief/europes-under-radar-industrial-policy-intervention-electricity-pricing
- IEA reports https://www.iea.org/analysis?type=report
  - Electricity 2024: https://www.iea.org/reports/electricity-2024
  - Gas Market Report, Q1-2024 : https://www.iea.org/reports/gas-market-report-q1-2024
- Oxford Institute for Energy Studies: https://www.oxfordenergy.org/publication-topic/energy-insight/#
- Gas - ENTSOG: https://gasdashboard.entsog.eu/
- Power / Electricity - ENTSOE: https://transparency.entsoe.eu/