

Pro Nukes, anti Wind... why?

Salzburg
2022-10-04

Tomas Kåberger

*professor Chalmers university högskola
Executive Board Chair of Renewable Energy Institute, Tokyo*

Russia's export dependency

- **World's largest net-exporter of oil and fossil gas**
- **Together with the "CIS" countries more than half of uranium mining**
- **All new reactor contractions in the world outside China since 2019**
- **...and 4 in China**

EUs import dependency

- >90% of oil and uranium
- >80% of fossil gas
- >30% of coal

From Russia:

≈1/2 gas and coal

≈1/4 of oil and nuclear fuels

US strategy in Mars:

- Short term: Sell from strategic oil reserves
- A year: Increase domestic oil and gas extraction
- Immediately for the long term: Energy efficiency, electrification of transport, heating and industry
- *"I am going to use the Defense Production Act to secure supply chains for the critical materials that go into batteries for electric vehicles and the storage of renewable energy : lithium , graphite, nickel and so much more."*



<https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/03/31/remarks-by-president-biden-on-actions-to-lower-gas-prices-at-the-pump-for-american-families/>

REPOWER EU TO CUT OUR DEPENDENCE ON RUSSIAN GAS



More rooftop solar panels, heat pumps and energy savings to reduce our dependence on fossil fuels, making our homes and buildings more energy efficient.



Speeding up renewables permitting to minimise the time for roll-out of renewable projects and grid infrastructure improvements.



Decarbonising Industry by accelerating the switch to electrification and renewable hydrogen and enhancing our low-carbon manufacturing capabilities.



Doubling the EU ambition for biomethane to produce 35 bcm per year by 2030, in particular from agricultural waste and residues.



Diversifying gas supplies and working with international partners to move away from Russian gas, and investing in the necessary infrastructure.



A Hydrogen Accelerator to develop infrastructure, storage facilities and ports, and replace demand for Russian gas with additional 10 mt of imported renewable hydrogen from diverse sources and additional 5 mt of domestic renewable hydrogen.



Europe and the world need to draw the right lessons from today's natural gas crisis

Published on January 13, 2022



Fatih Birol [in](#)

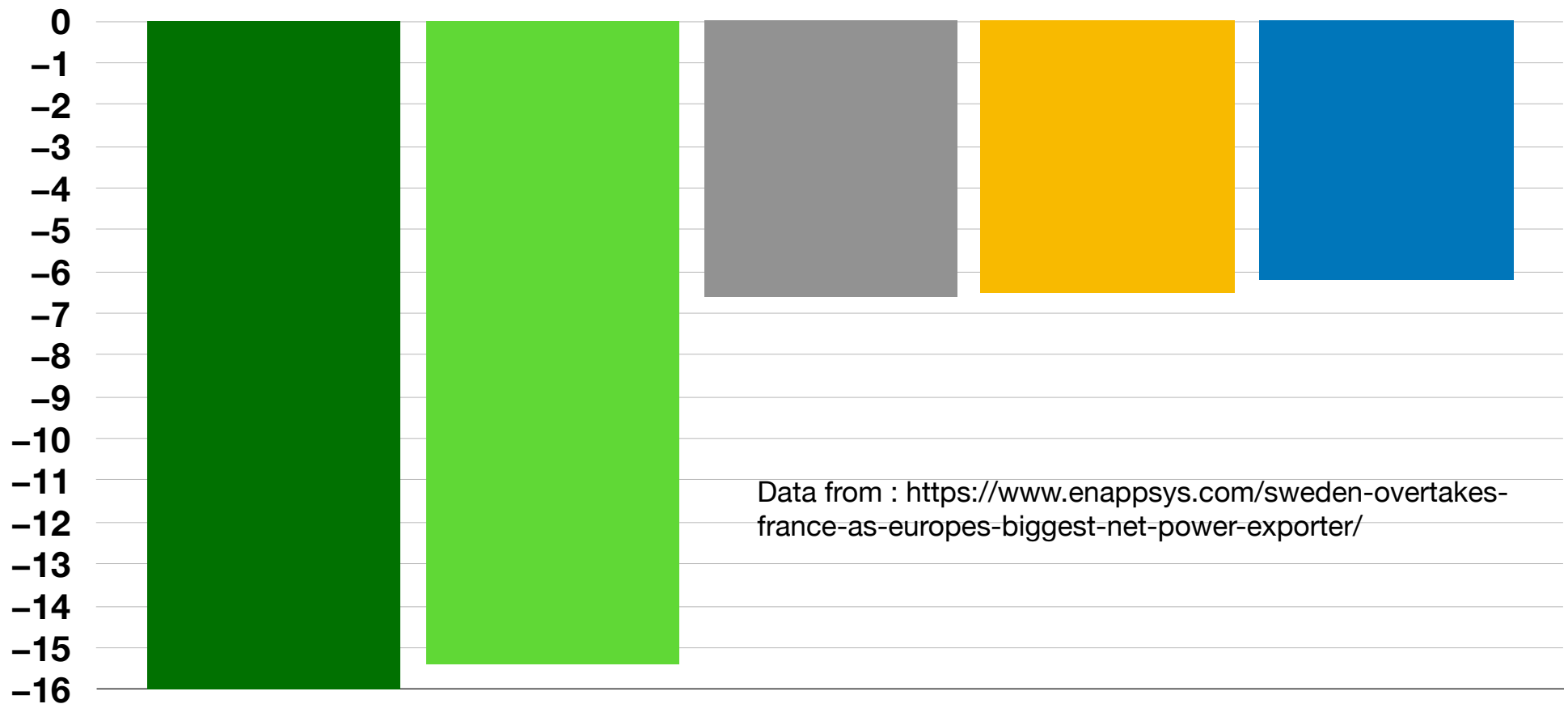
Executive Director at International Energy Agency (IEA)

Unfortunately, we are once again seeing claims that volatility in gas and electricity markets is the result of the clean energy transition. These assertions are misleading to say the least. **This is not a renewables or a clean energy crisis; this is a natural gas market crisis.**

We see strong elements of 'artificial tightness' in European gas markets, which appears to be due to the behaviour of Russia's state-controlled gas supplier. Russia has reduced its exports to Europe by 25% in the fourth quarter of 2021 compared with the same period in 2020 – and by 22% compared with its 2019 levels.

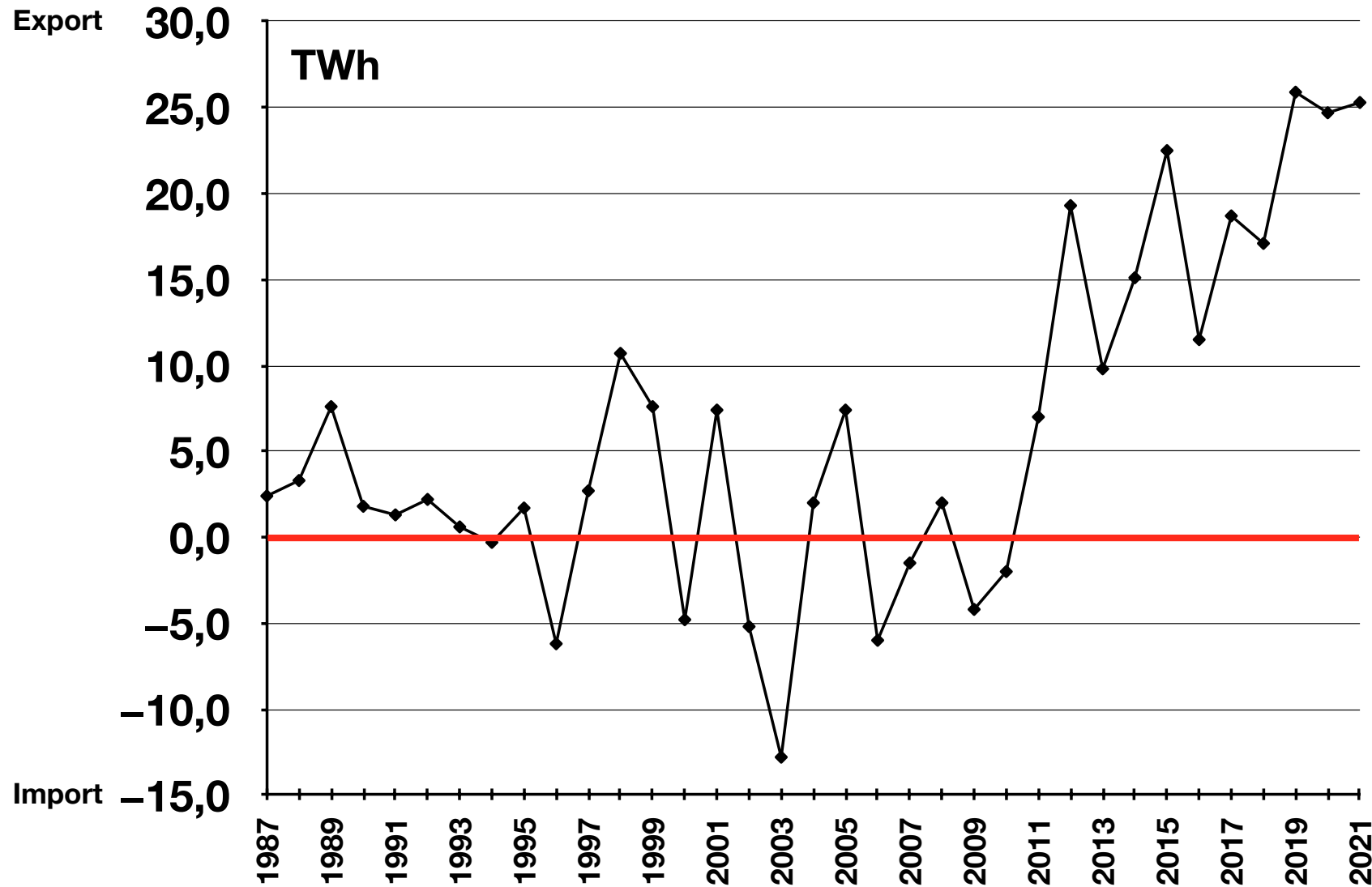
Net export H1 2022

■ Sweden ■ Germany ■ Bulgaria ■ Spain ■ Norway



Sweden net exchange 1987-2021

● 33,5 TWh senaste 52 veckorna



Källa: Energiföretagen

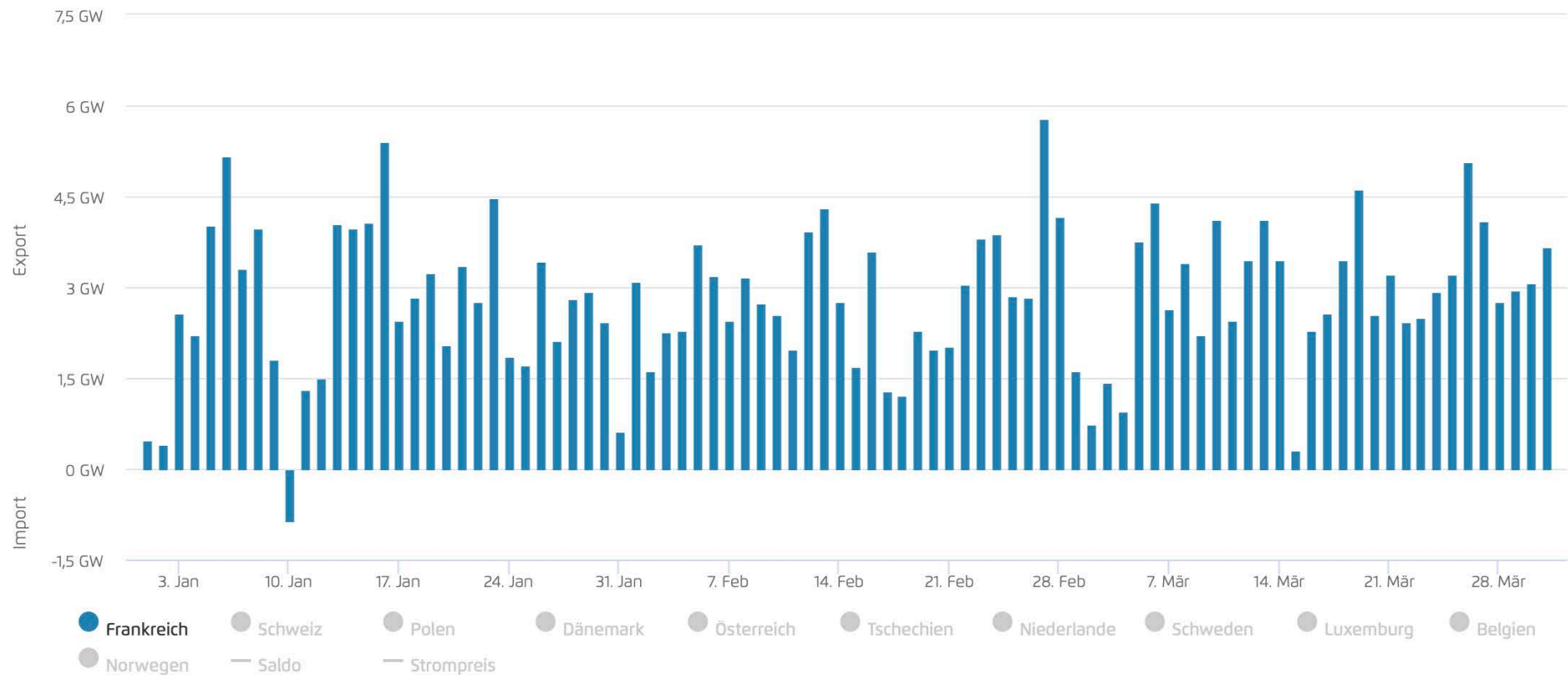
Sweden annual electricity trade, net, 2021



Data från: <https://www.svk.se/om-kraftsystemet/kraftsystemdata/elstatistik/>

Germany's daily net-export to France Q1 2022

Strom-Import/Export





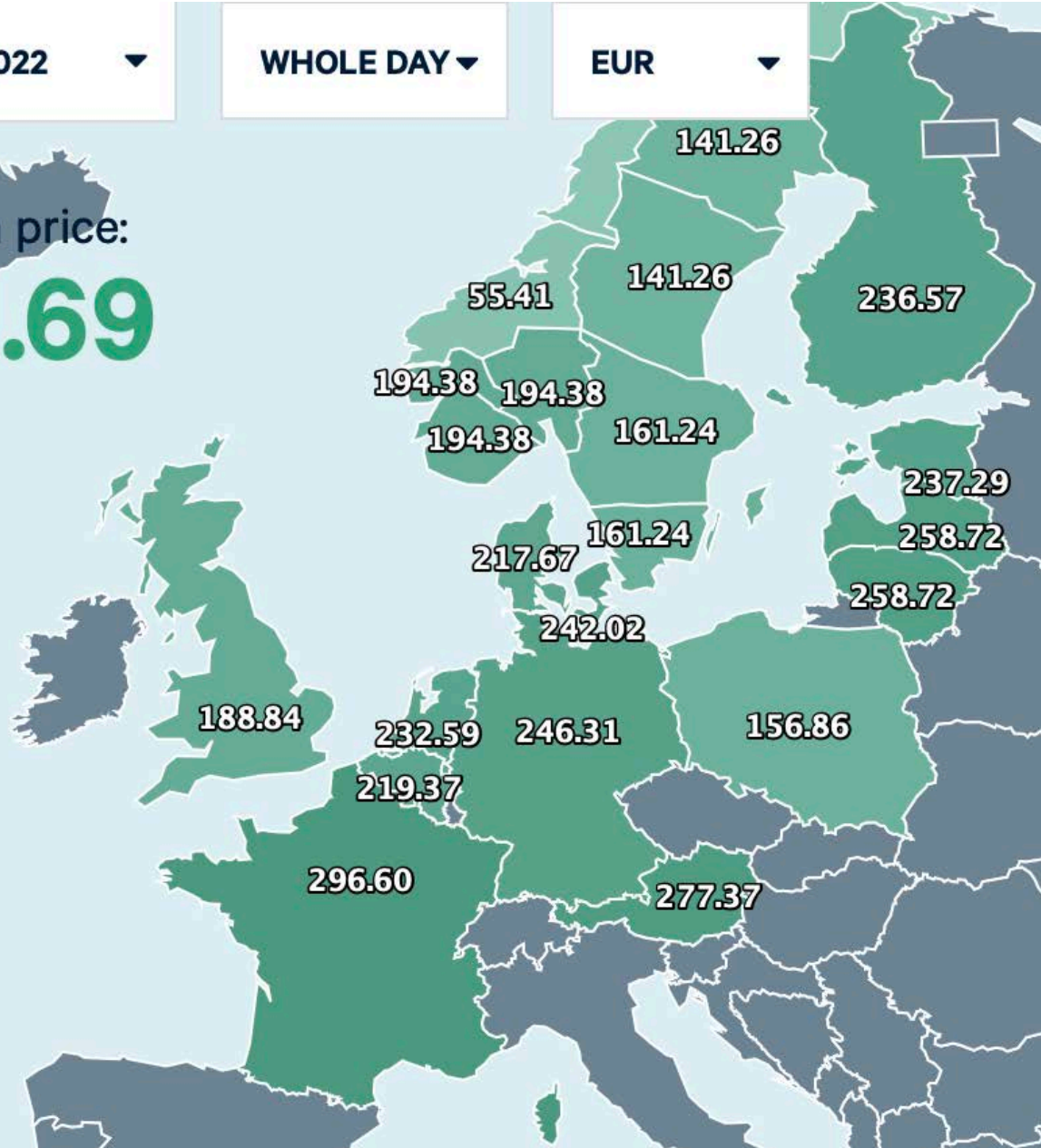
04 OCTOBER 2022

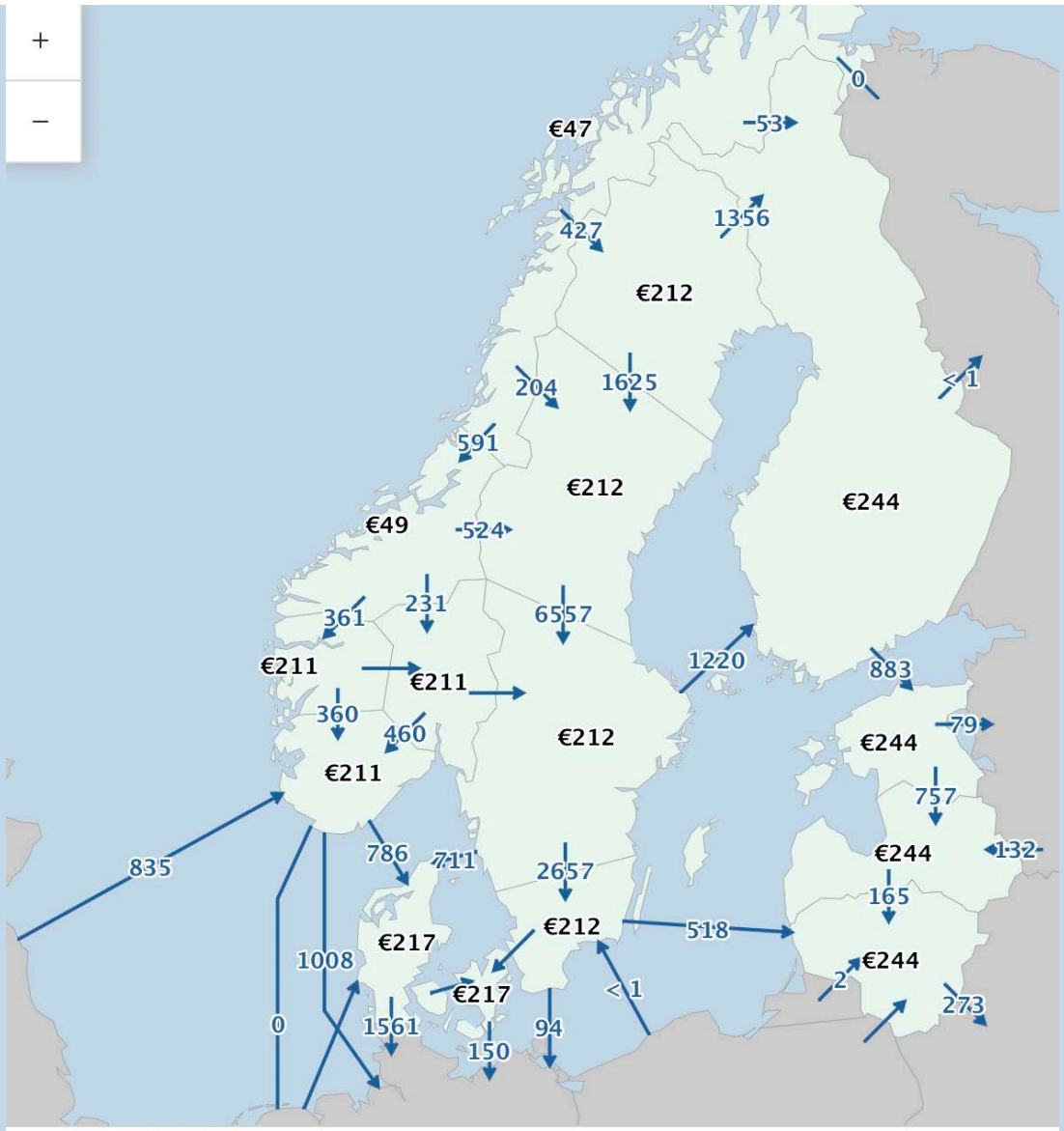
WHOLE DAY

EUR

System price:

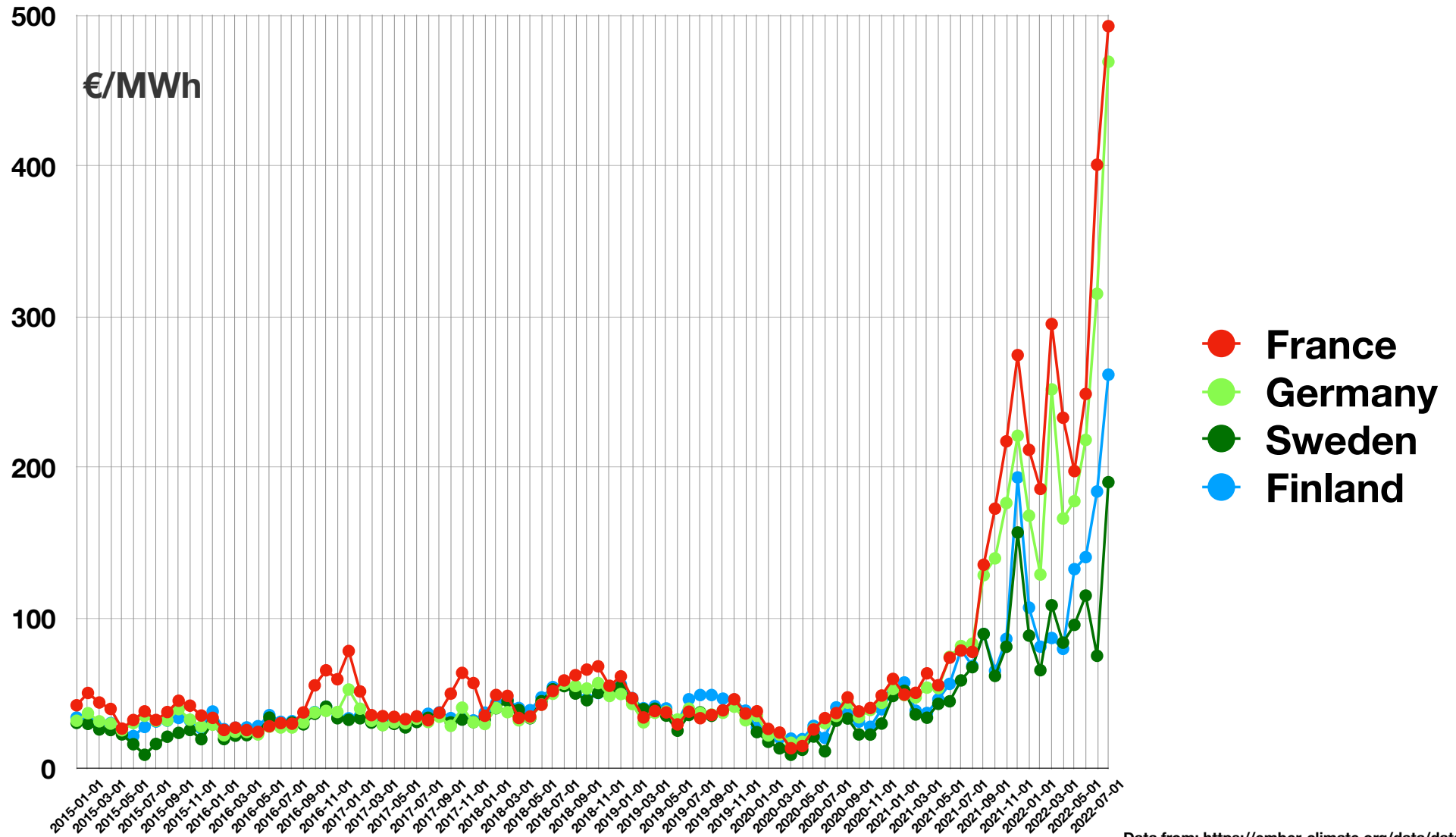
151.69





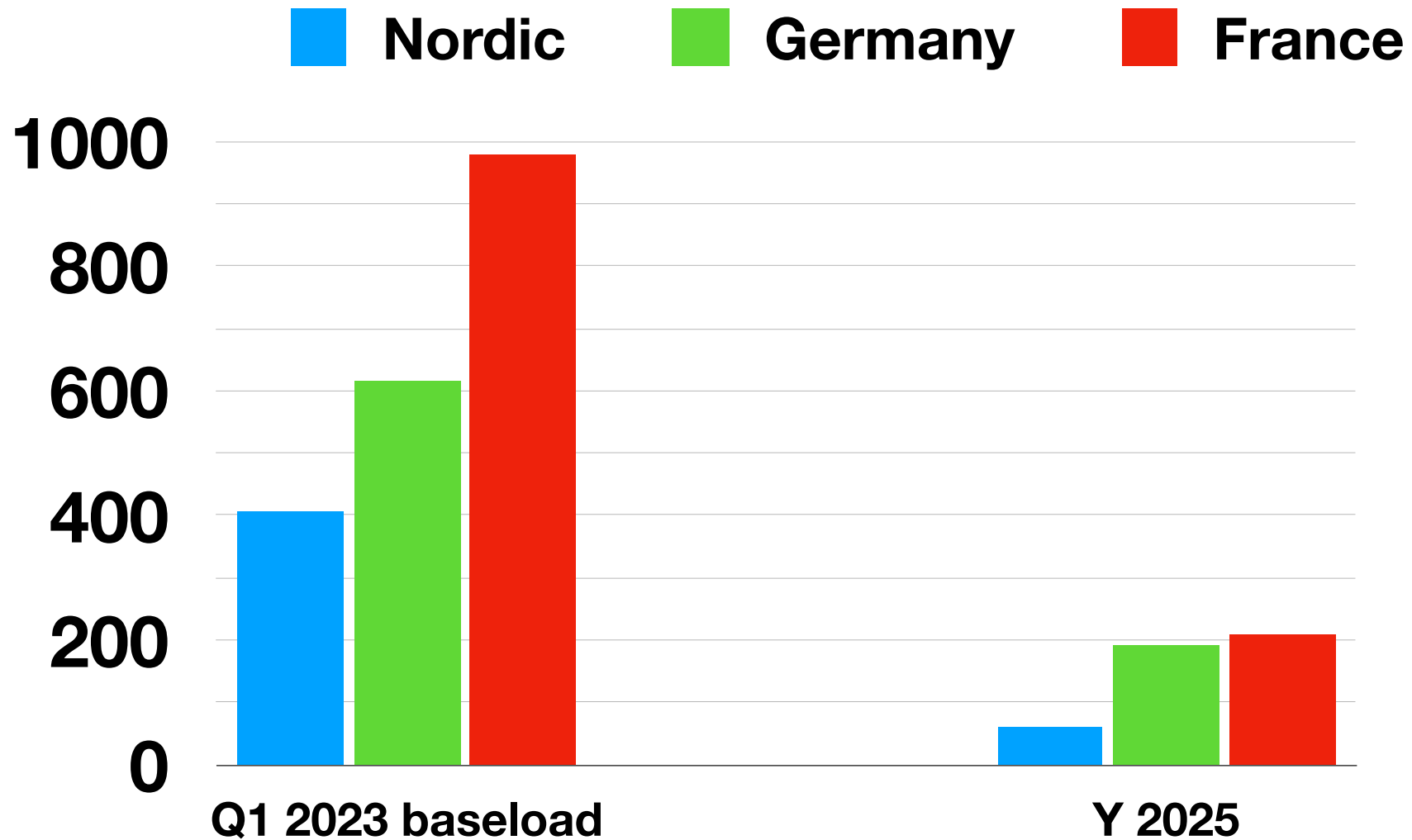
Shows prices for: 2022-10-04 11:00
Shows flows for: 2022-10-04 11:00

Monthly average electricity prices 2015 - august 2022



Data from: <https://ember-climate.org/data/data-tools/europe-power-prices/>

Future Prices €/MWh as of 2022-09-27

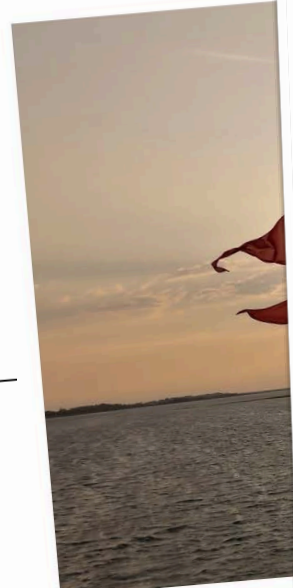


Business: Another 50 Germany subsidizes Be E Denmark

By Brian Pa
6 februari 2
German PV asset man
company Greengo hav
project.

MAY 28, 2020 RALPH D
▶ EnBW 1
▶ Park w.

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Unsubsidized solar is
Image: Kirstinsfotos/PIXAWAY

EnBW builds and unsubsidized so announces plan

German utility EnBW plans to bu
Germany, while Italian oil compa
600 MW PV project portfolio.

DECEMBER 7, 2020 SANDRA ENKE
MARKETS MARKETS & POLICY GERMANY



nd NIEUWS • GELOOF • OPINIE • MENSEN • CULTUUR

Vattenfall wil eerste subsidievrije zonnepark op land bouwen

Energiebedrijf Vattenfall wil een subsidievrij zonnepark gaan bouwen in Almere. Het zou het eerste zonnepark op land zijn in Nederland waarbij geen gebruik wordt gemaakt van overheidsgeld. Vattenfall bouwt ook al het eerste subsidievrije windmolenpark op zee.

anp 16 november 2021, 15:28

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INNOVATION FOR SUSTAINABILITY

Agriv Prod



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News • Science



an Energy ure

ll farmers, save water,

y Haley Mast



NEWS

China set to double solar installations to 108GW this year, claims NEA

By Carrie Xiao
May 31, 2022

Grids, Operations & Maintenance, Power Plants, Projects

Asia & Oceania, Central & East Asia

Facebook Twitter LinkedIn Reddit Email

LATEST

PV Talks: PVEL's Tristan Erion-Lorico on 2022's solar module performance trends

FEATURES, INTERVIEWS

India installed solar capacity surpasses 50GW, with another 70GW+ in the pipeline or bidding phase

NEWS

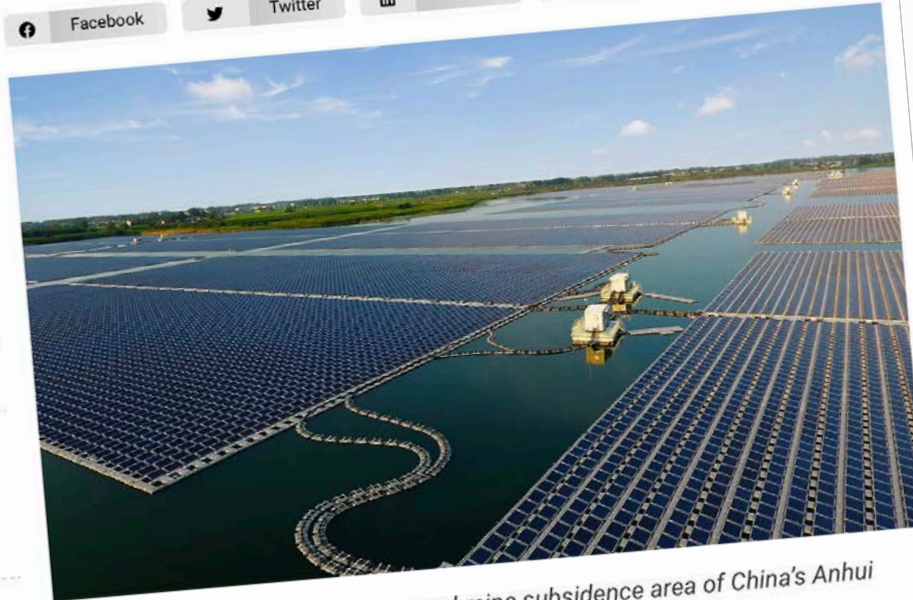
Renewables action vital to counter 'apocalyptic' Australian power prices

NEWS

China set to double solar installations to 108GW this year, claims NEA

NEWS

Solar wins 166MW in latest Brazilian renewables auction

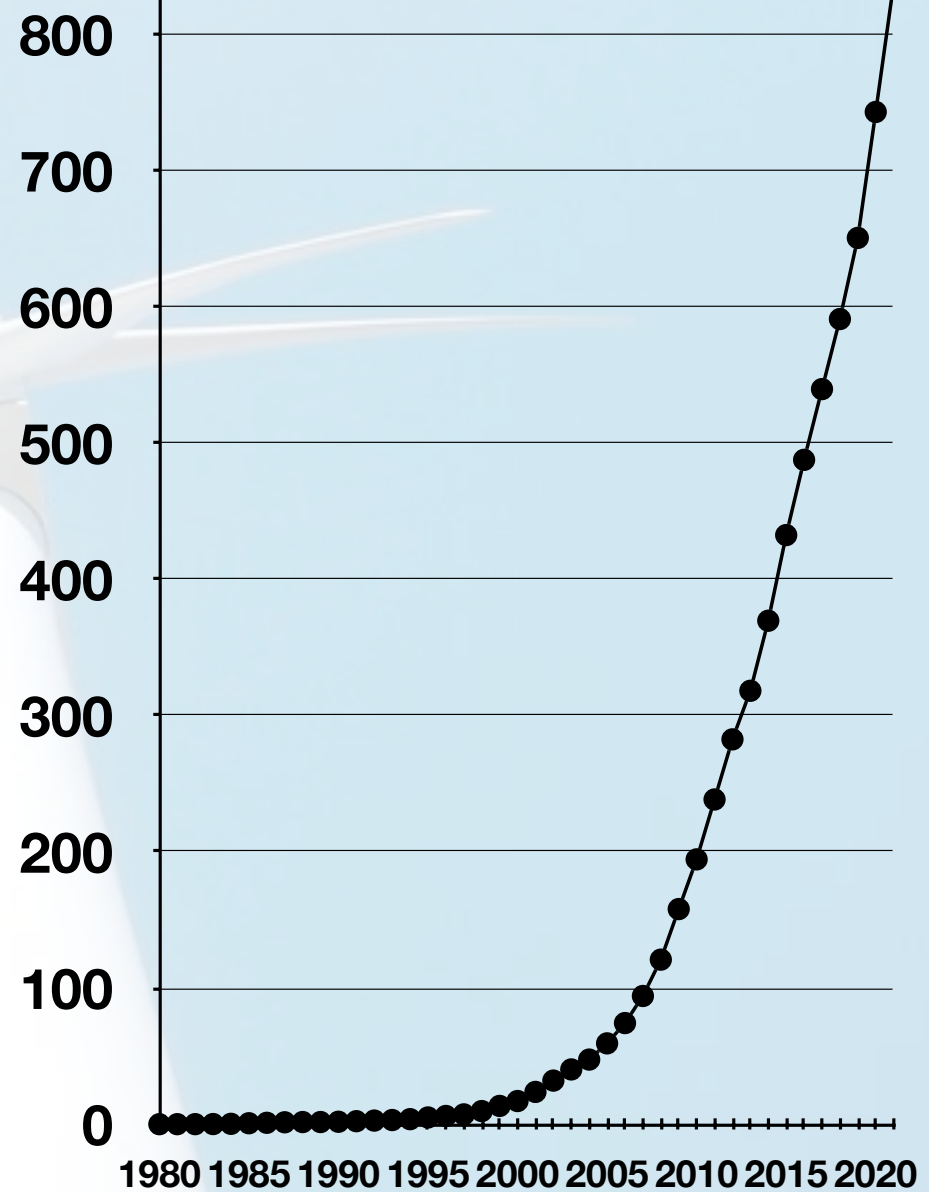


A 102MW floating PV project in a coal mine subsidence area of China's Anhui Province. Image: Sungrow Floating.

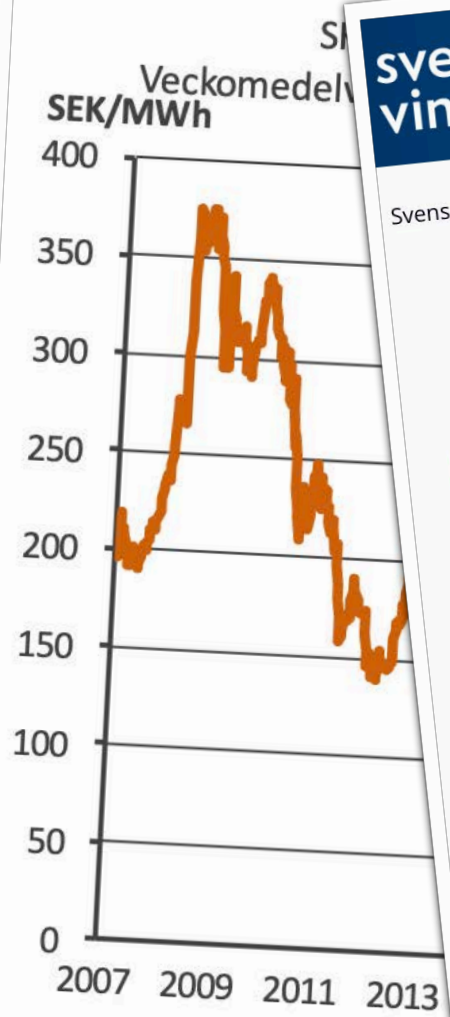
China expects to install up to 108GW of solar this year, nearly double the capacity it installed last year.

Global Wind power capacity 1980-2021

GW



Data: GWEC, 2022



Svensk Vindenergi / Pressmeddelande / Rekordstor installation av vindkraft pressar elpriserna

2022-02-08
PRESSMEDDELANDE

Rekordstor installation av vindkraft pressar elpriserna

Det fjärde kvartalet 2021 installerades mer vindkraft än något kvartal tidigare, visar ny statistik från Svensk Vindenergi. Över 1 gigawatt, GW, togs i drift. Det kan jämföras med att det i början av fjolåret fanns totalt 10 GW vindkraft i Sverige. Under helåret togs totalt 2 GW ny vindkraft i drift. De stora installationerna bidrar till att vindkraften producerar rekordmycket el och pressar elpriserna i hela landet.

Statistik om vindkraftens utbyggnad fjärde kvartalet 2021

- Att addera över 1 gigawatt under ett kvartal är häpnadsväckande mycket. De rekordstora installationerna visar att det finns fantastisk kompetens hos de tiotusentals människor som jobbar med att bygga vindkraften, komponenterna och infrastrukturen som behövs i Sverige, säger Daniel Kulin, ansvarig för marknadsfrågor på Svensk Vindenergi.

PRESS RELEASE • WIND • 6 SEPTEMBER 2021, 14:00 CET • 2 MIN

Scandinavia's largest offshore wind farm inaugurated

SHARE



isa en meny

2.mp4

60 X

His Royal Highness the Crown Prince of Denmark, together with Danish Minister for Industry, Business and Financial Affairs, Simon Kollerup, has inaugurated Vattenfall's new offshore wind farm Kriegers Flak. The wind farm is Scandinavia's largest and will increase Danish wind power production by 16 per cent.

Offshore w
record low

1k
Shares



Published on 06/07/2016

Two 350MW arra
power at €87/MW
by miles

By Megan Darb

Dong Energy l
wind power i
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The Danish c
€72.70/MW
costs. The c

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"It was
expectations,
European Wind Ener

First Sub Wind De Wind A EnBW

April 14th, 2017

Germany's
average b
also included

NETHERLANDS

Vattenfall

19 March 2018 by

NETHERLANDS
Hollandse Kust Zuid
without subsid



Vattenfall, through its Dutch s

The site, located 22.2k
from Vattenfall, the de
2022.



Vatt
offsh

VATTENFALL

NEWS • WIND • 2 AUGUST 2022 • 1 MIN

First power from offshore wind farm Hollandse Kust Zuid delivered



The first power from Hollandse Kust Zuid wind farm
has been successfully delivered to the Dutch
electricity grid.

benefit both
industrial partners.



Energistyrelsen



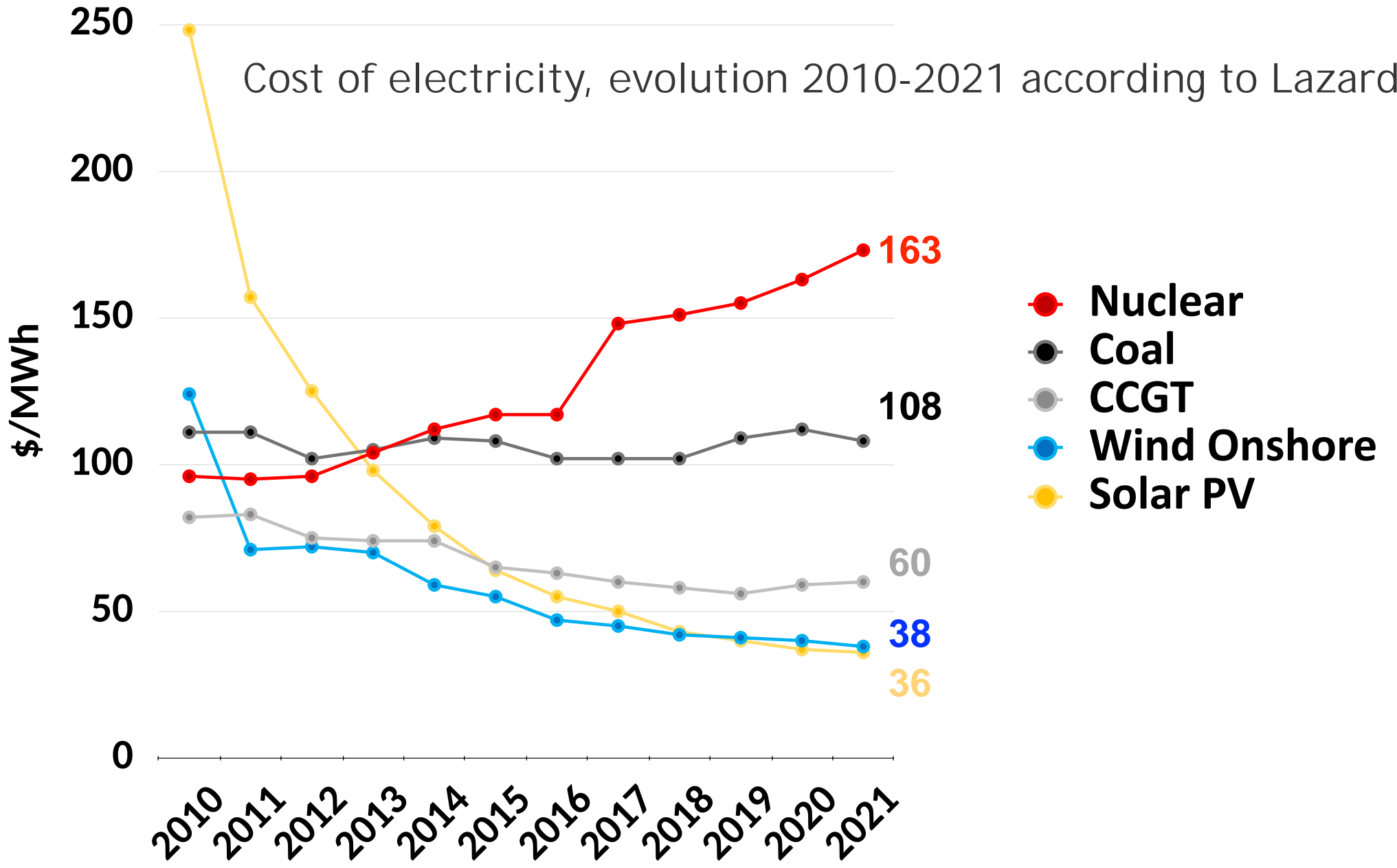
Figure: Danish Energy Agency.

1. December 2021

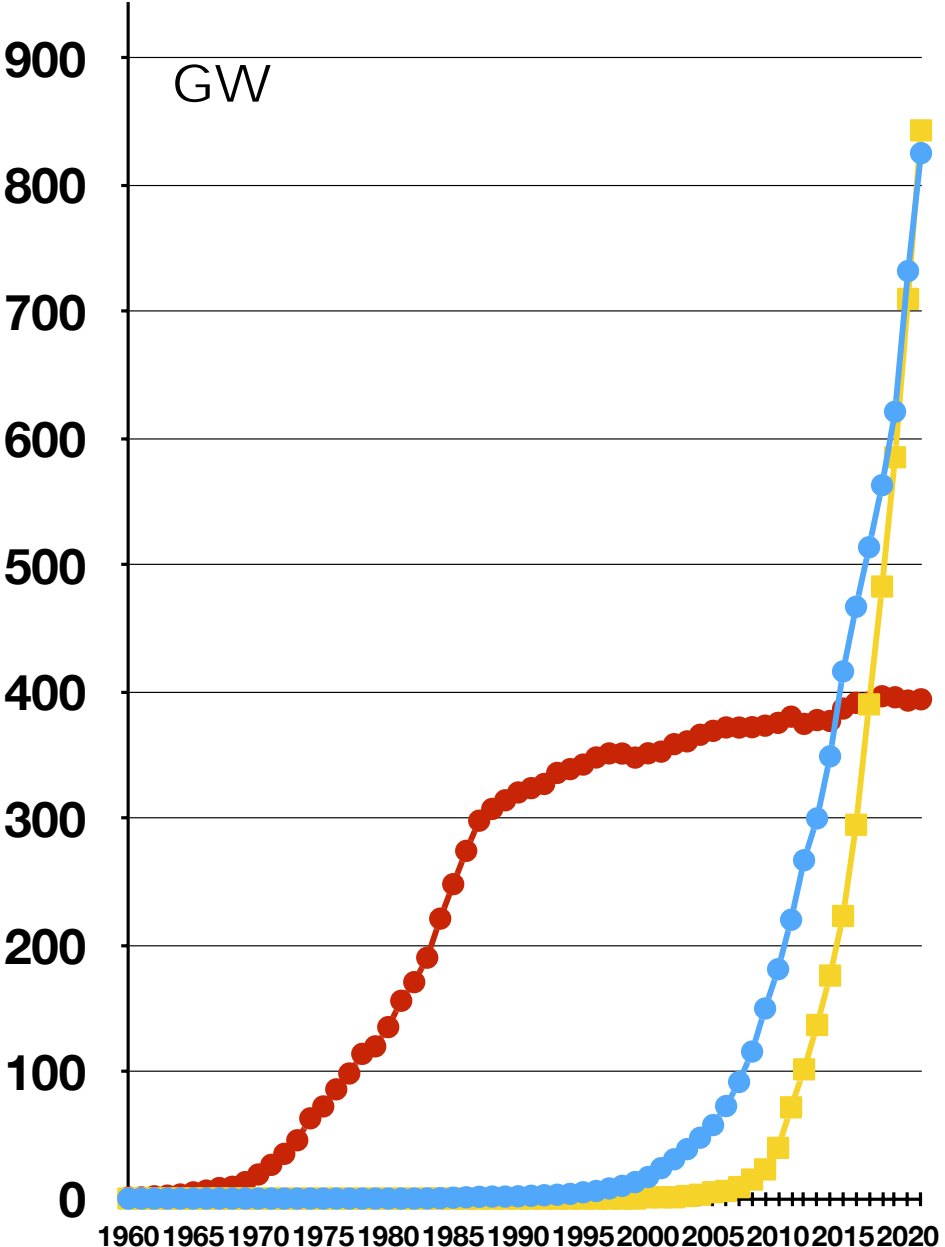
Thor Wind Farm I/S to build Thor Offshore Wind Farm following a historically low bid price

Thor Wind Farm I/S has won the concession to build Thor Offshore Wind Farm. This is the first time a tendering procedure has been completed for offshore wind energy in Denmark without aid. When power is produced, the winner is expected to pay DKK 2.8 bn. to the Danish state within just a few years.

Cost of electricity, evolution 2010-2021 according to Lazard



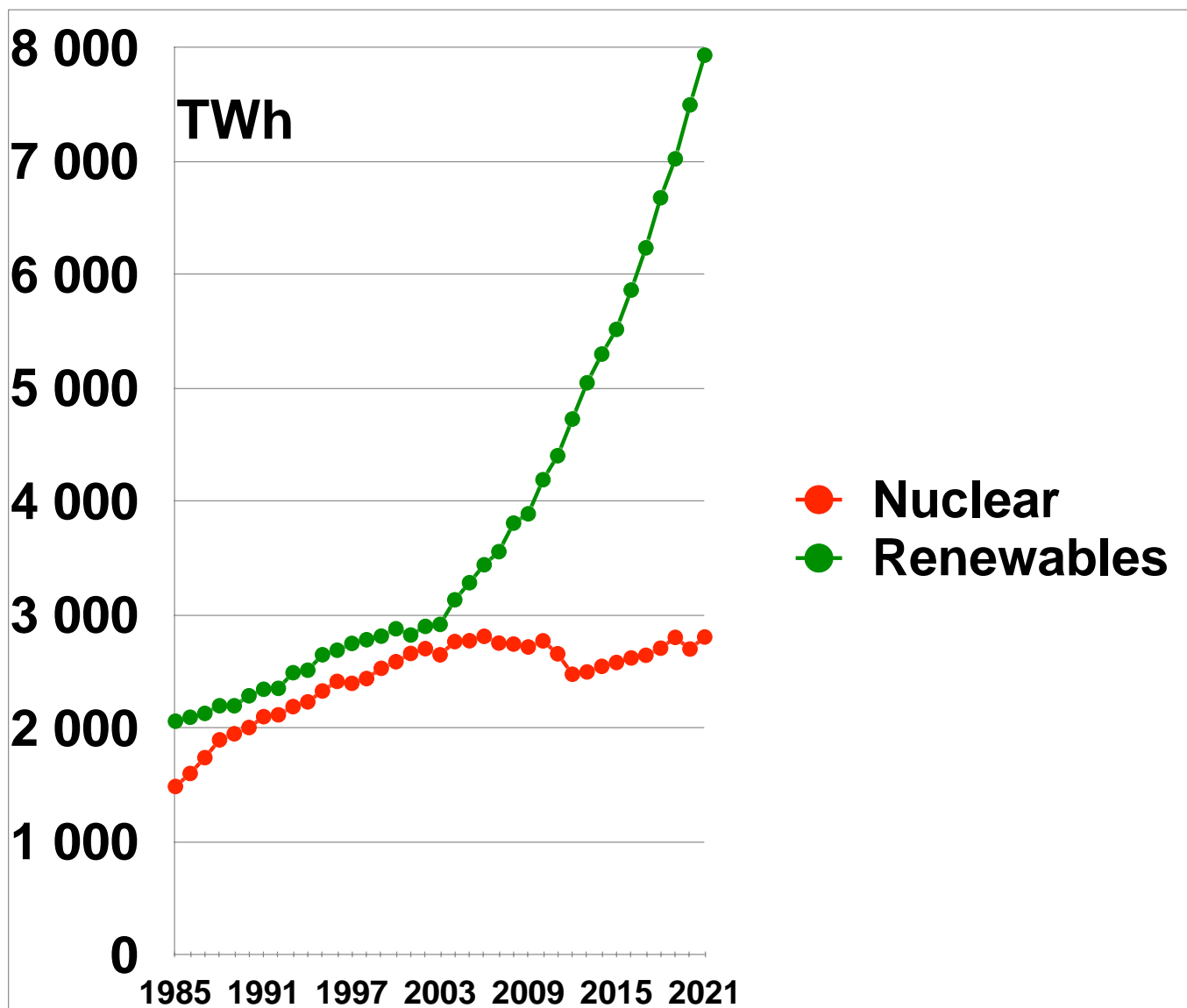
Global power capacity 1960-2021



- Wind
- Solar
- Nuclear

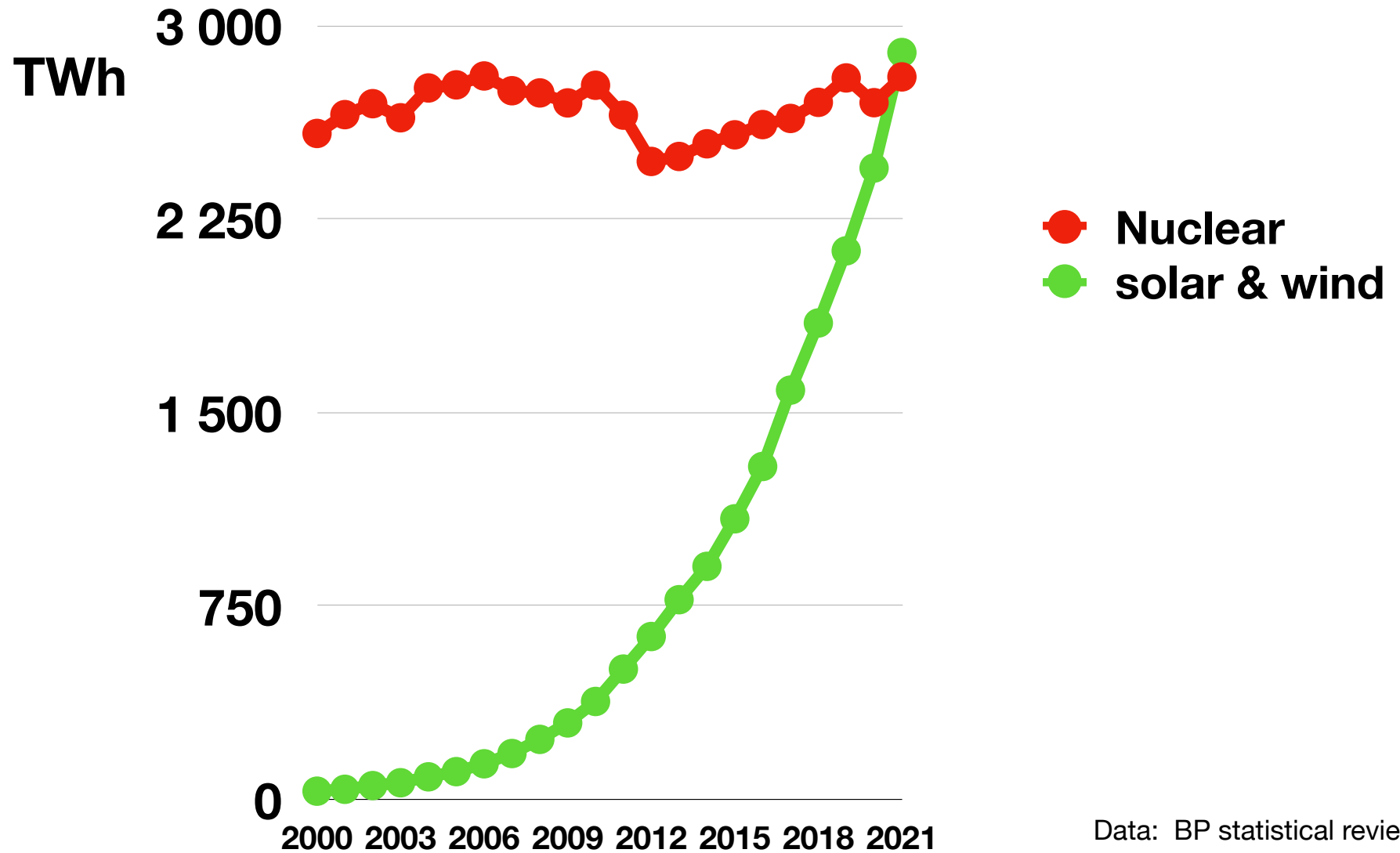
Data: BP, IAEA

Non-fossil electricity generation globally, 1985-2021



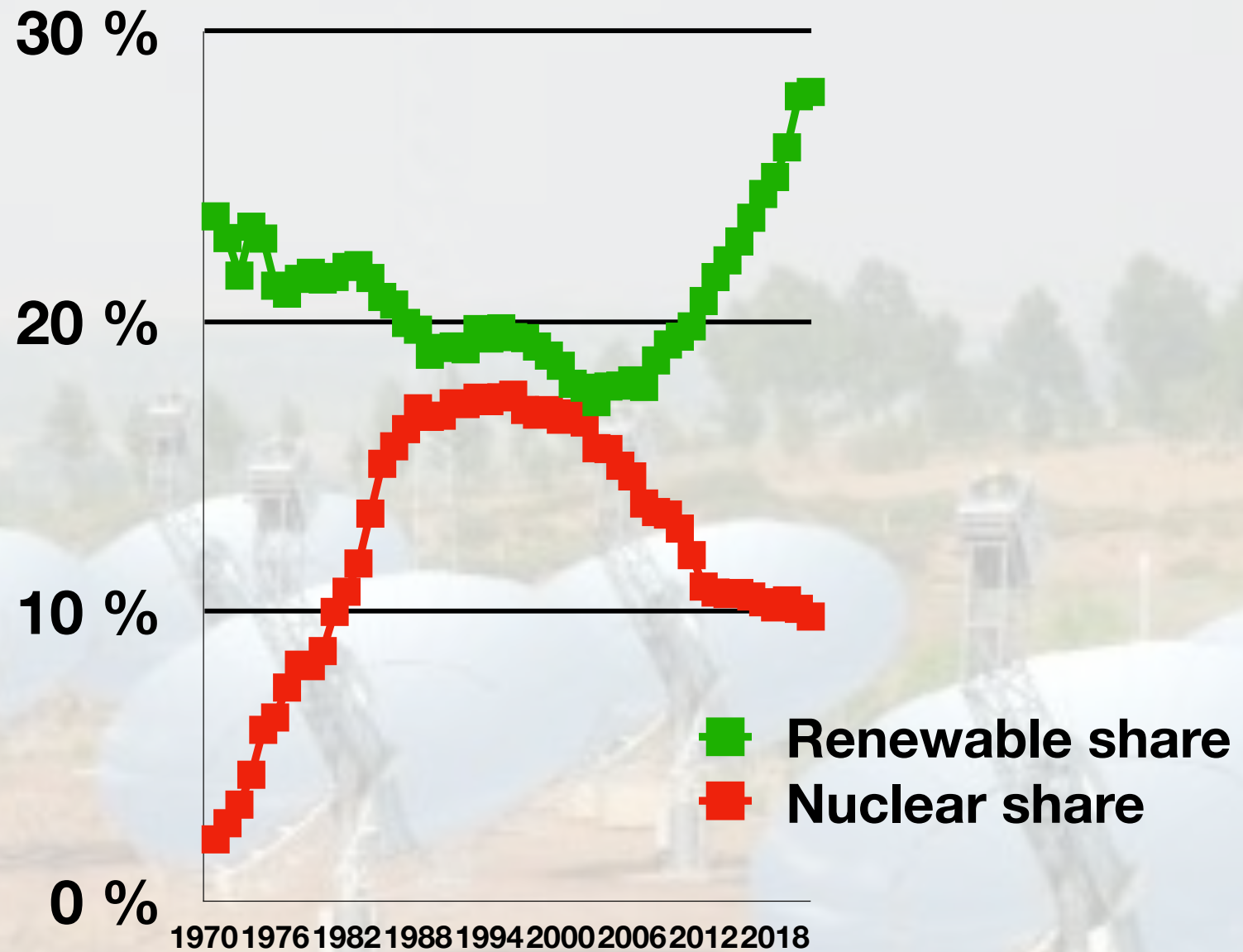
Data: BP Statistical Review 2022

Global non-fossil electricity production 2000-2021



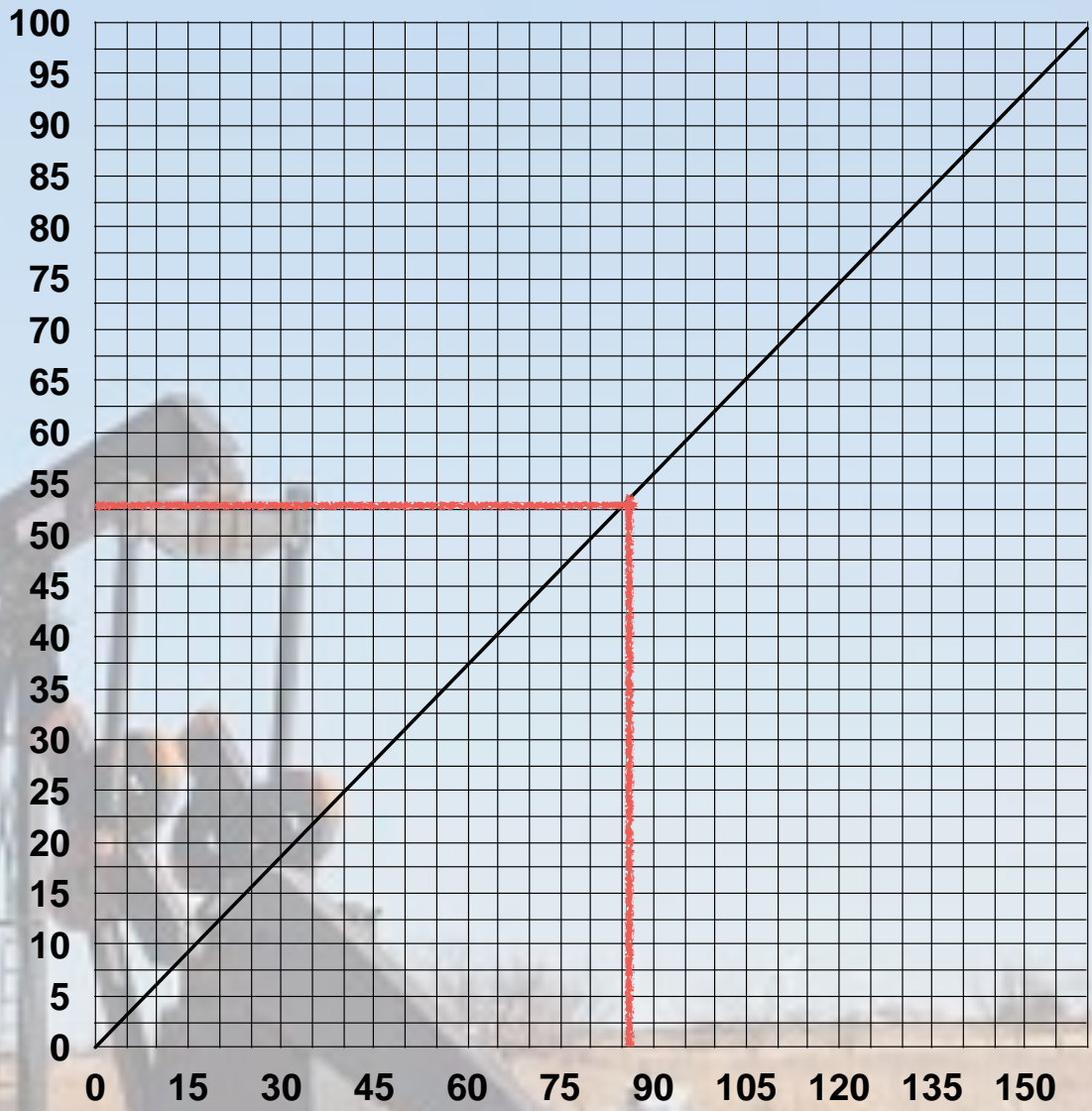
Data: BP statistical review 2022

Non-fossil electricity share of total production 1971-2021



Data: 1970-1984: IEA
1985-2021 BP statistical review 2022

USD/MWh



Crude oil, USD/bbl

South Australia's Tesla big battery saves \$40 million in grid stabilization costs

A new report analyzing the world's largest lithium-ion battery's performance in the first year of operation shows the Hornsdale Power Reserve has delivered on high expectations of its performance and market impact. It has helped stabilize the grid, avoid outages and reduce system costs, as well as triggered a surge in uptake of similar fast response systems across Australia.

DECEMBER 5, 2018 **MARIJA MAISCH**

ENERGY STORAGE

HIGHLIGHTS

UTILITY SCALE STORAGE

AUSTRALIA



 UTILITY DIVE

BRIEF

Storage will replace 3 California gas plants as PG&E nabs approval for world's largest batteries

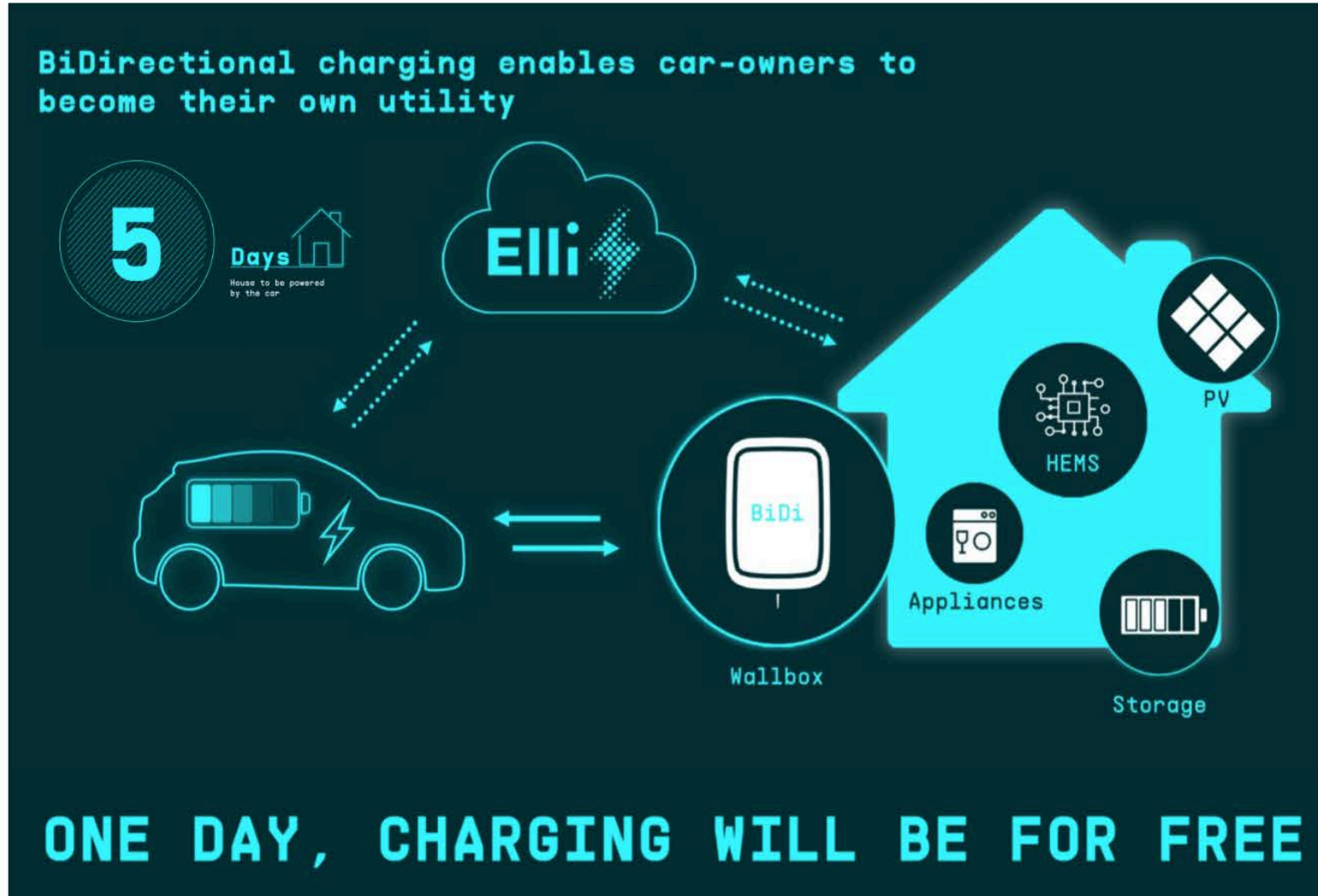
By Gavin Bade

Published Nov. 9, 2018

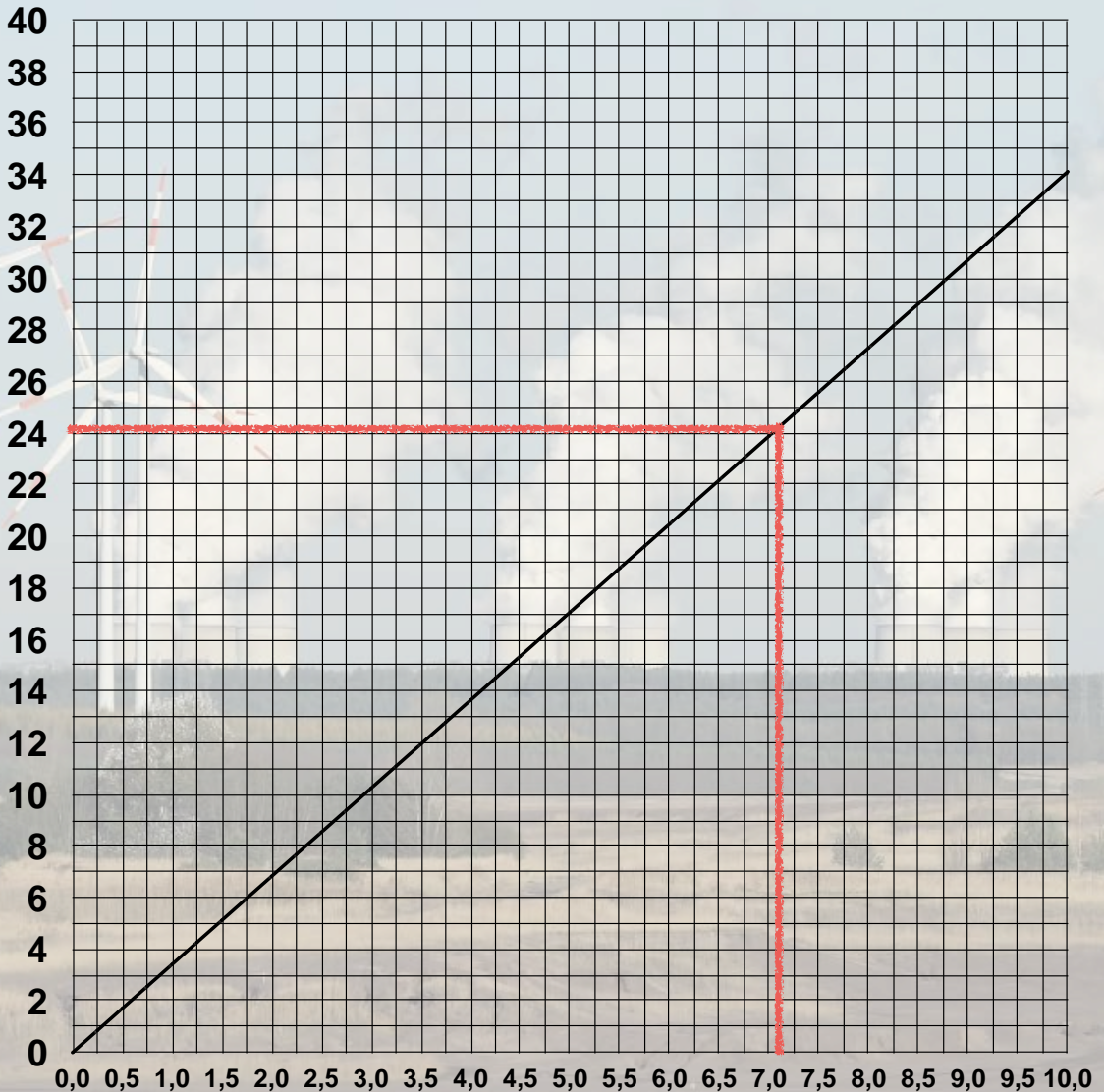
Dive Brief:

- The California Public Utilities Commission on Thursday approved four energy storage projects for Pacific Gas & Electric (PG&E) to replace retiring gas generators, including two batteries that would be the largest in the world.

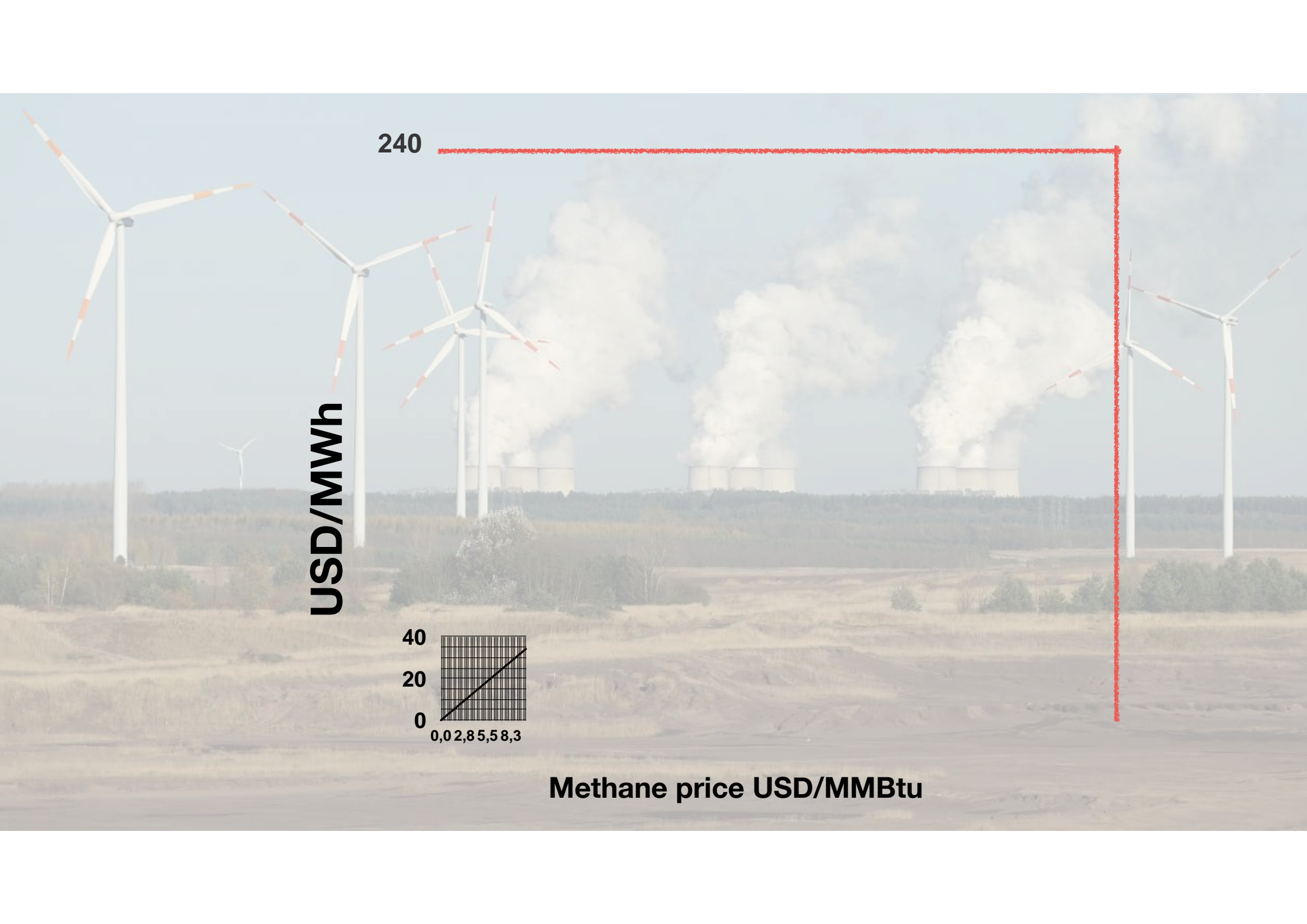
V2G standard on BEV:s from 2022



USD/MWh

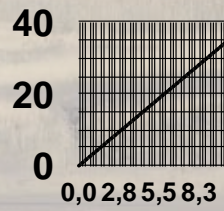


Methane price USD/MMBtu

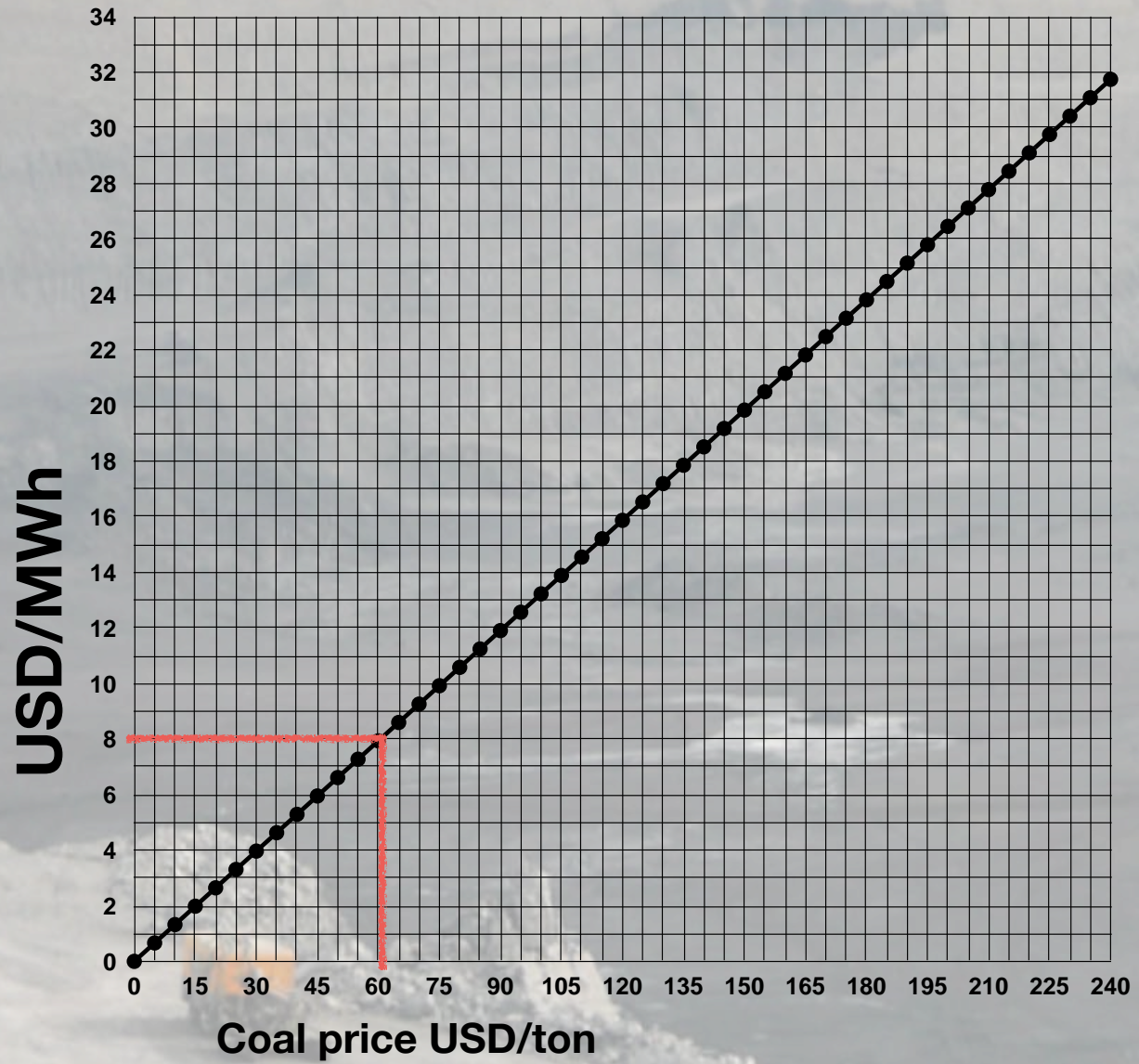


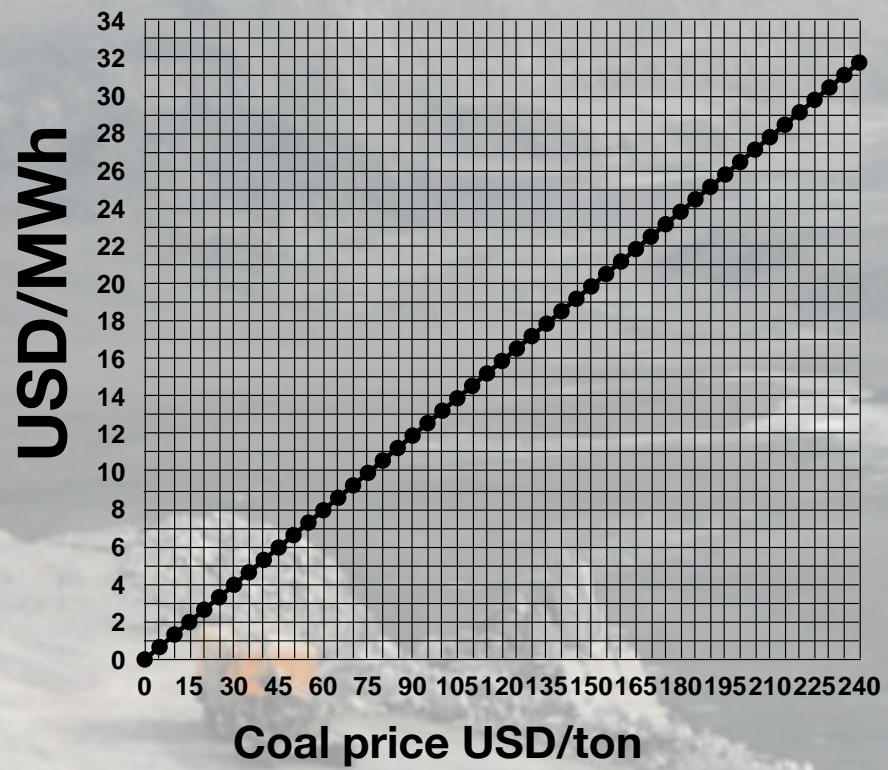
240

USD/MWh



Methane price USD/MMBtu





HYBRIT

▶▶▶ FOSSIL-FREE STEEL

Articles

The world's first fossil-free steel

AUGUST 18, 2021 15:00 CEST

SSAB has now produced the world's first fossil-free steel, an important step on the way to a completely fossil-free steel. This is a HYBRIT partnership between SSAB, LKAB and Vattenfall.



In July, SSAB Oxelösund rolled the first steel produced using hydrogen instead of coal and coke, with good results. The steel is now being delivered to Volvo Group. "The first fossil-free steel in the world is not only a breakthrough, it also significantly reduce the global carbon footprint of the steel industry and is a key step in the green transition," says Martin Lindqvist, President and CEO of SSAB.

■ Press release

VOLVO LAUNCHES WORLD'S FIRST VEHICLE USING FOSSIL-FREE STEEL

10/13/2021

By Press Information

Volvo Group is proud to reveal the world's first vehicle made of fossil-free steel from SSAB – made in Volvo Construction Equipment's facility in Braås, Sweden. During today's green steel collaboration event, it was announced that more vehicles will follow in 2022 in what will be a series of concept vehicles and components using fossil-free steel from SSAB.



2021-06-21

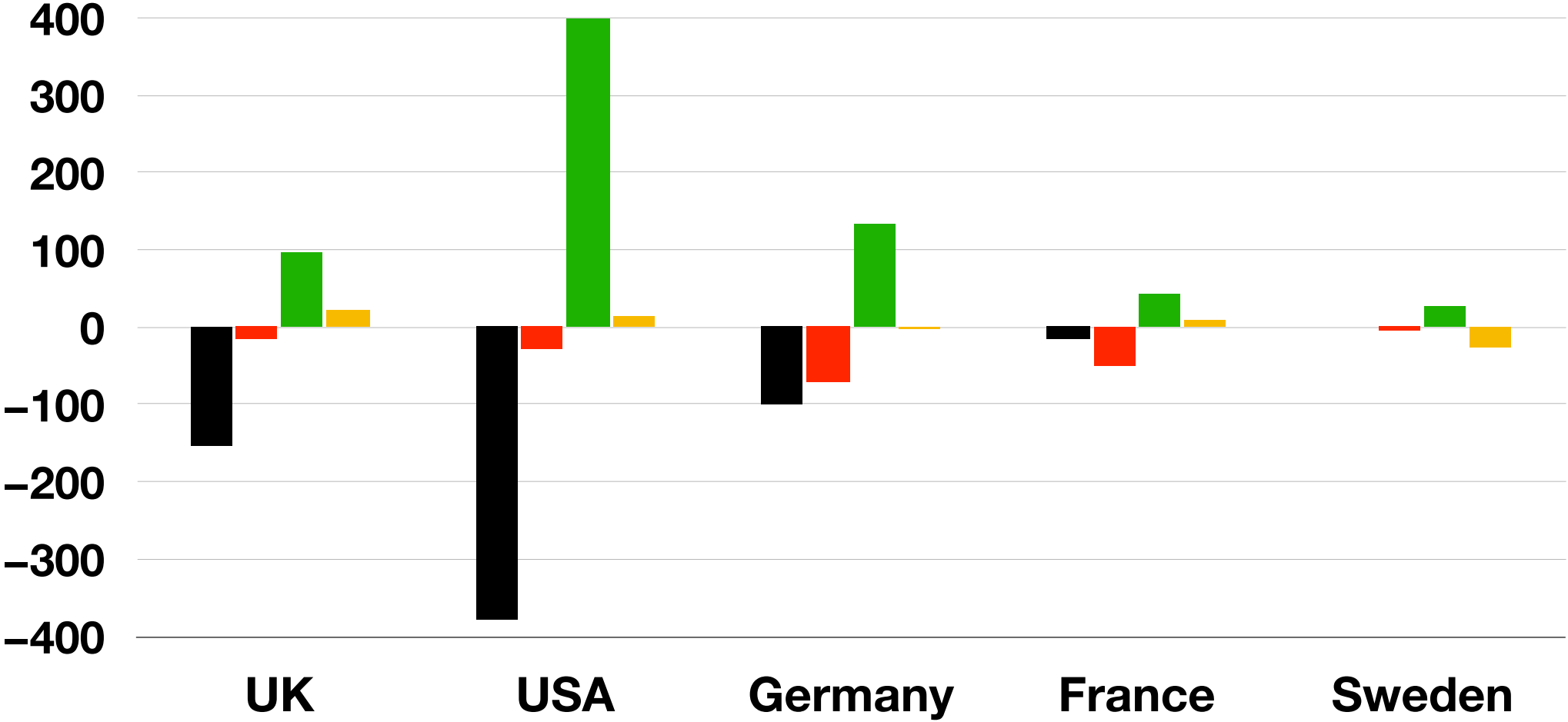
HYBRIT: SSAB and Vattenfall produce hydrogen-reduced steel

SSAB, LKAB and Vattenfall have produced the world's first fossil-free steel at a pilot scale. The technology uses hydrogen instead of coal and coke, resulting in significantly lower CO2 emissions in conjunction with fossil-free energy.

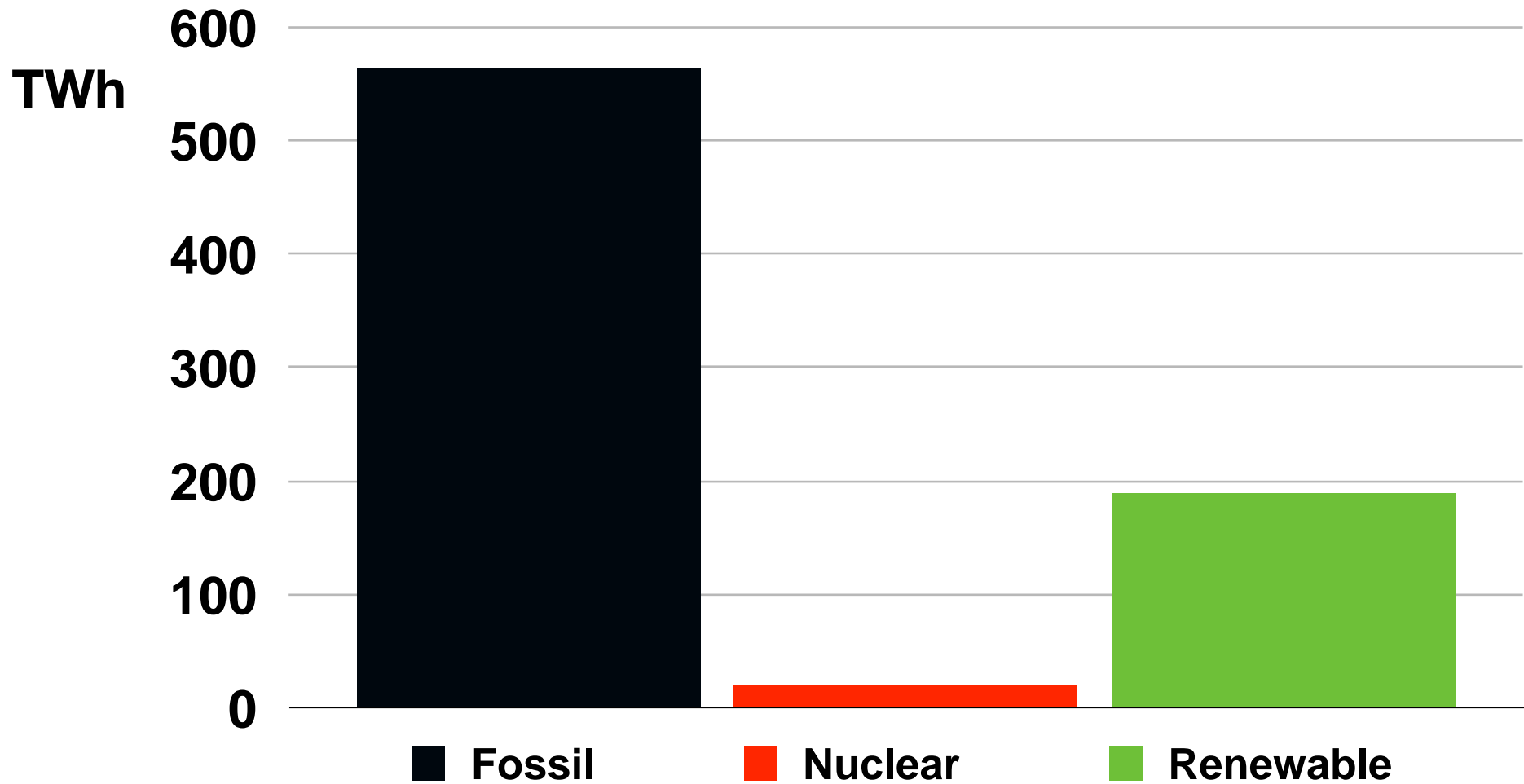
The HYBRIT pilot plant demonstrates that it is possible to produce steel without coal and coke to reduce CO2 emissions. 100 tonnes have been produced and the electricity has been generated from fossil-free energy to eliminate carbon dioxide emissions and fossil-free energy in all parts of the value chain.

Change in electricity supply 2021-2010, TWh

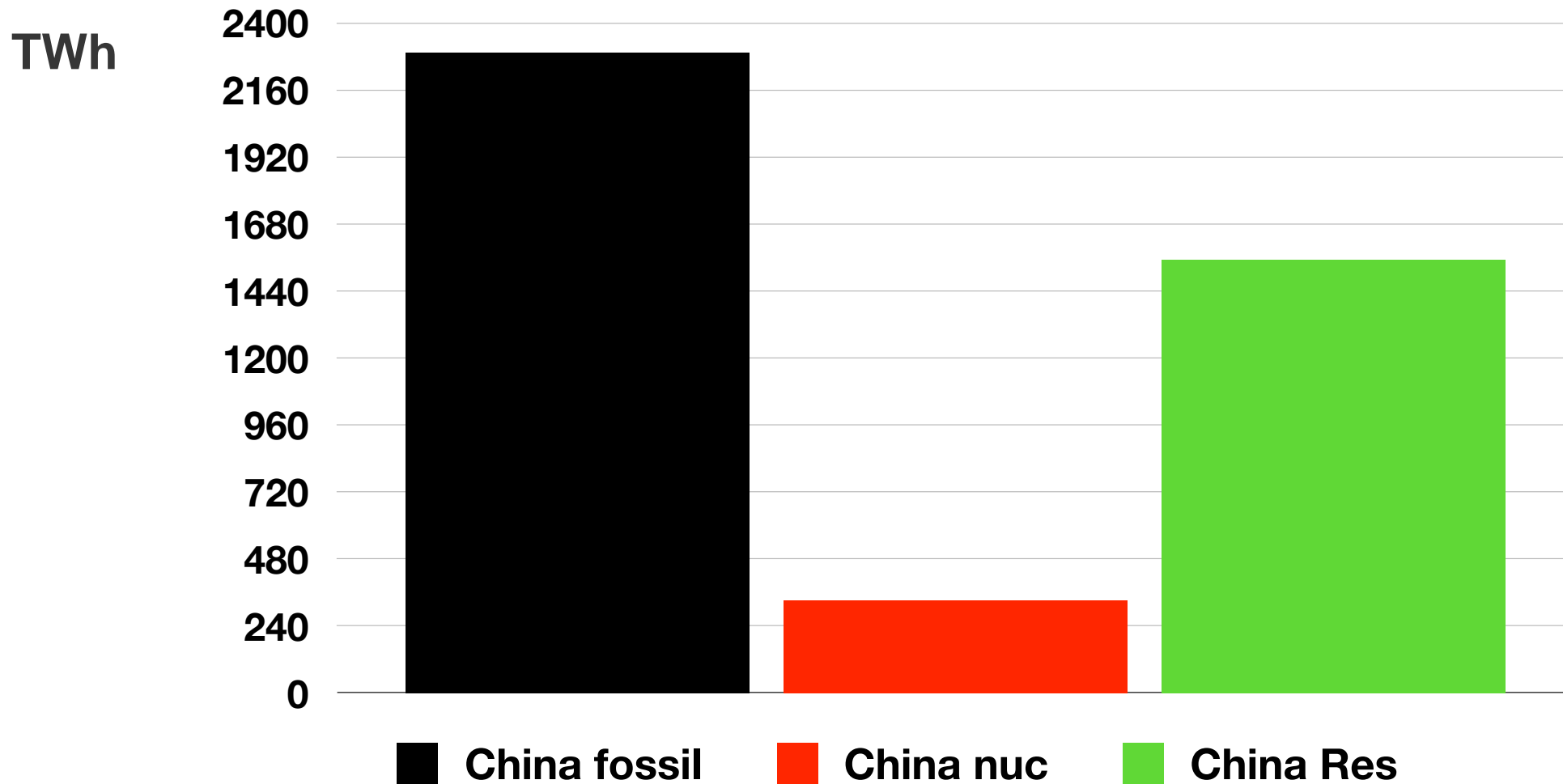
Fossil **Nuclear** **Renewables** **Import**



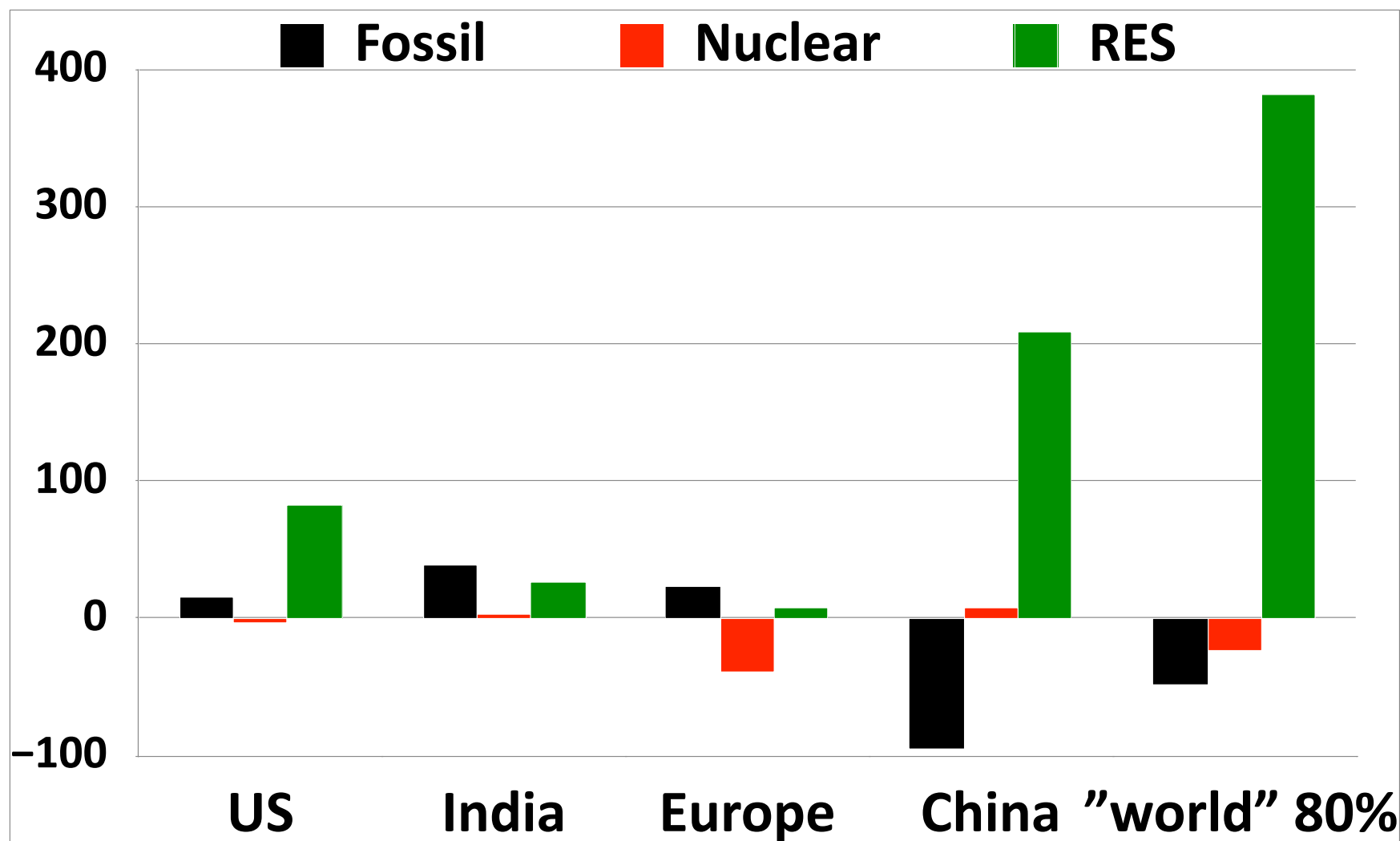
Indias Electricity 2021-2010



China Electricity 2021-2010



Change in electricity generation H1 2022-H1 2021

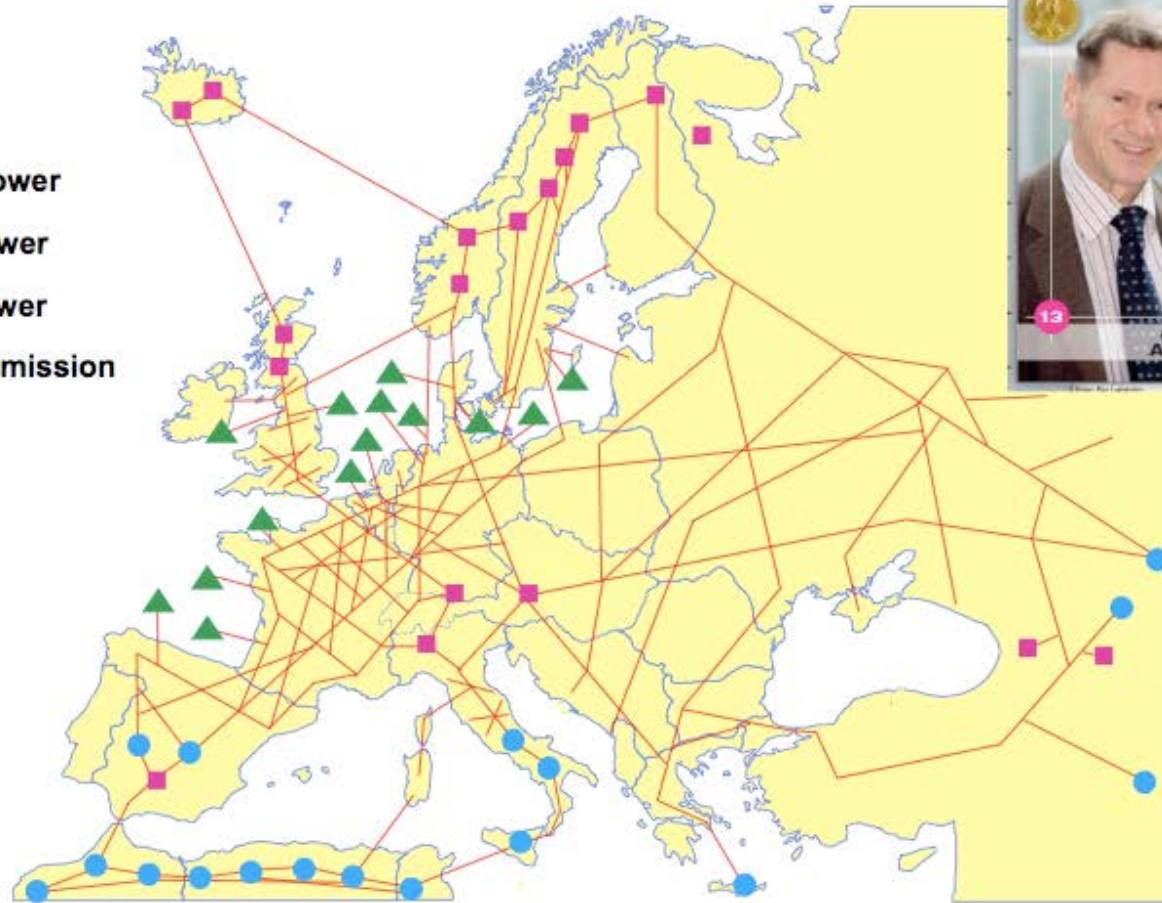


Data from
IEA, sep 2022

Vision for renewable power system 1992

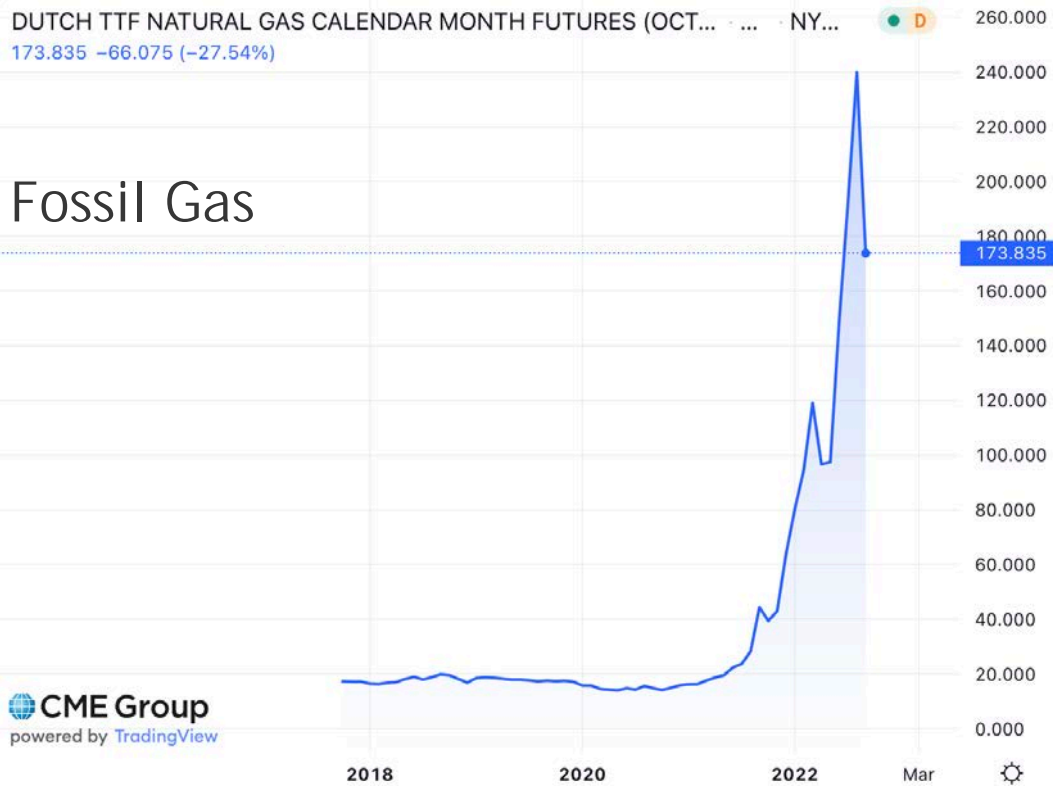
- Hydro power
- Solar power
- ▲ Wind power
- DC transmission

Solar 700 GW
Wind 300 GW
Hydro 200 GW
Storage 1000 TWh
...and lots of cables!!

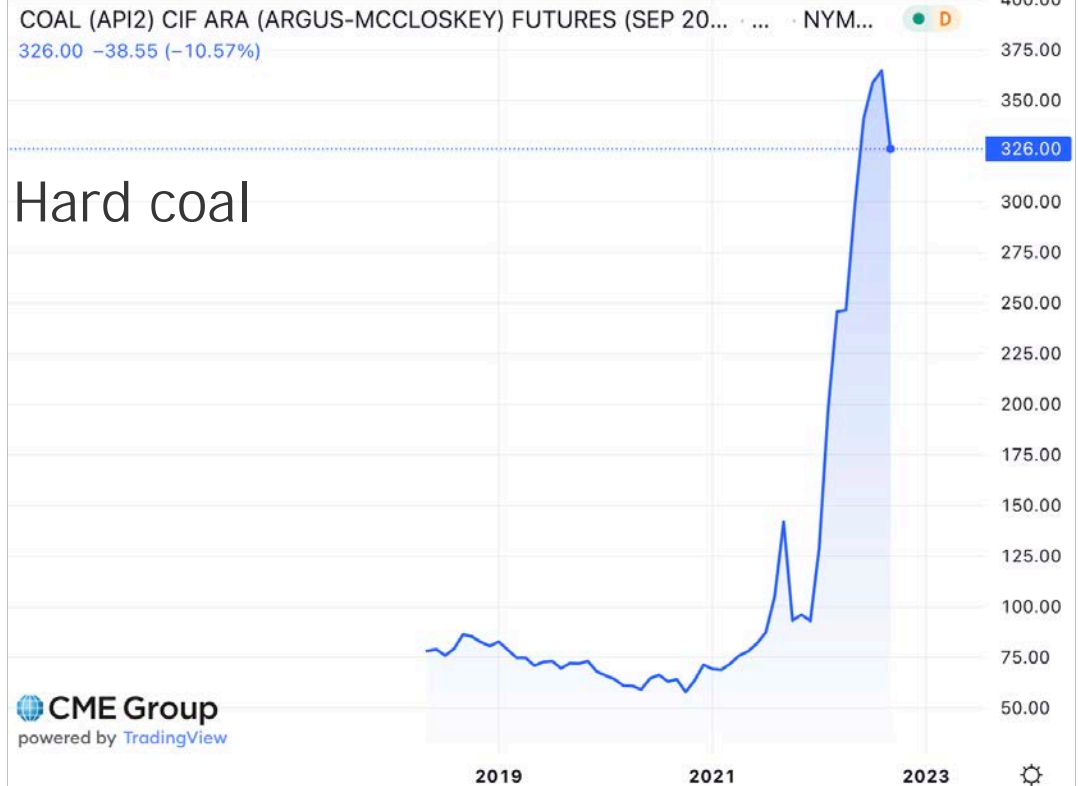


Fossil fuel crisis

€/MWh



USD/ton



BRENT CRUDE OIL FUTURES (NOV 2022) · 1M · NYMEX

● D 86.27 -9.37 (-9.80%)

Vol 0

Crude oil

USD/fat



 **CME Group**
powered by TradingView

2015

2017

2019

2021

2023

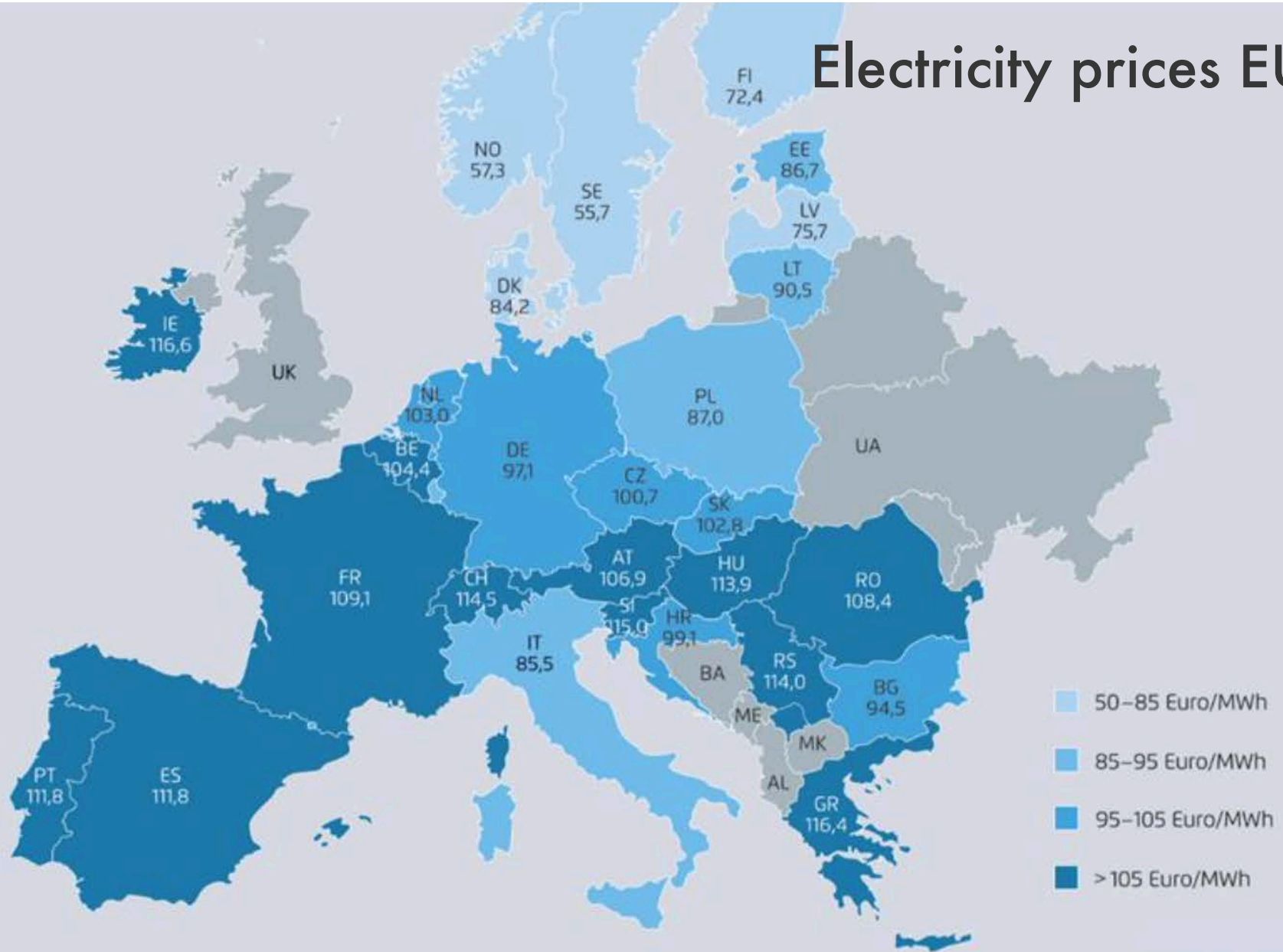


Elåret 2021. Från rekordlågt till rekordhøgt elpris

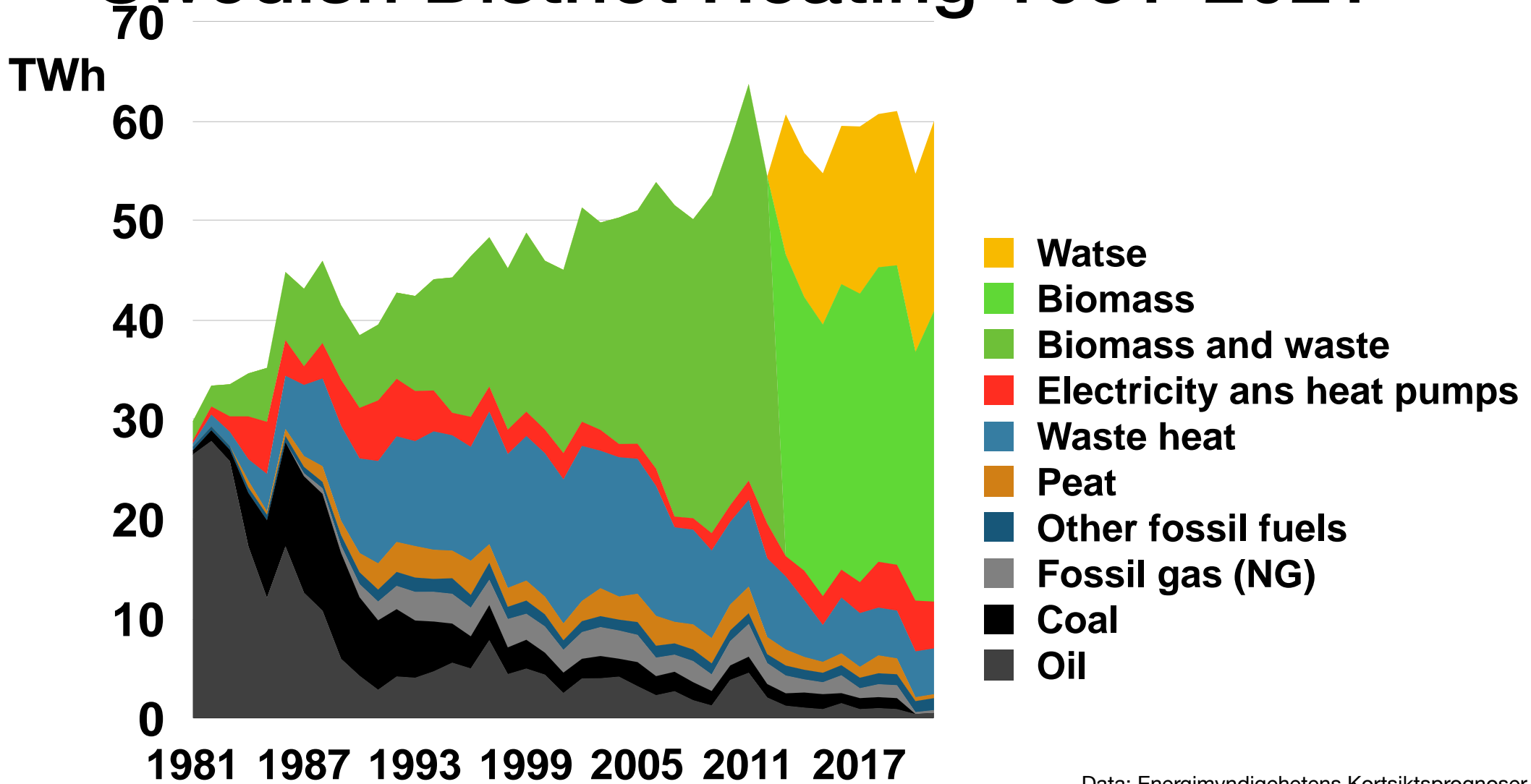
Publicerat av: [Eva Rydegran](#) · 31 december 2021

PRESSMEDDELANDE 21-12-31. Det genomsnittliga systempriset på elborsen Nord Pool Spot blev 63 øre/kWh år 2021, en økning med 52 øre jämfört med 2020, motsvarande 554 procent. Storleksordningen för kraftslagen är densamma som tidigare år, där vattenkraften står för 43 procent av den totala elproduktionen, kärnkraft 30 procent, vindkraft 17 procent och kraftvärme 9 procent. Solkraften står än så länge bara för en procent men växer kraftigt.

Electricity prices EU 2021

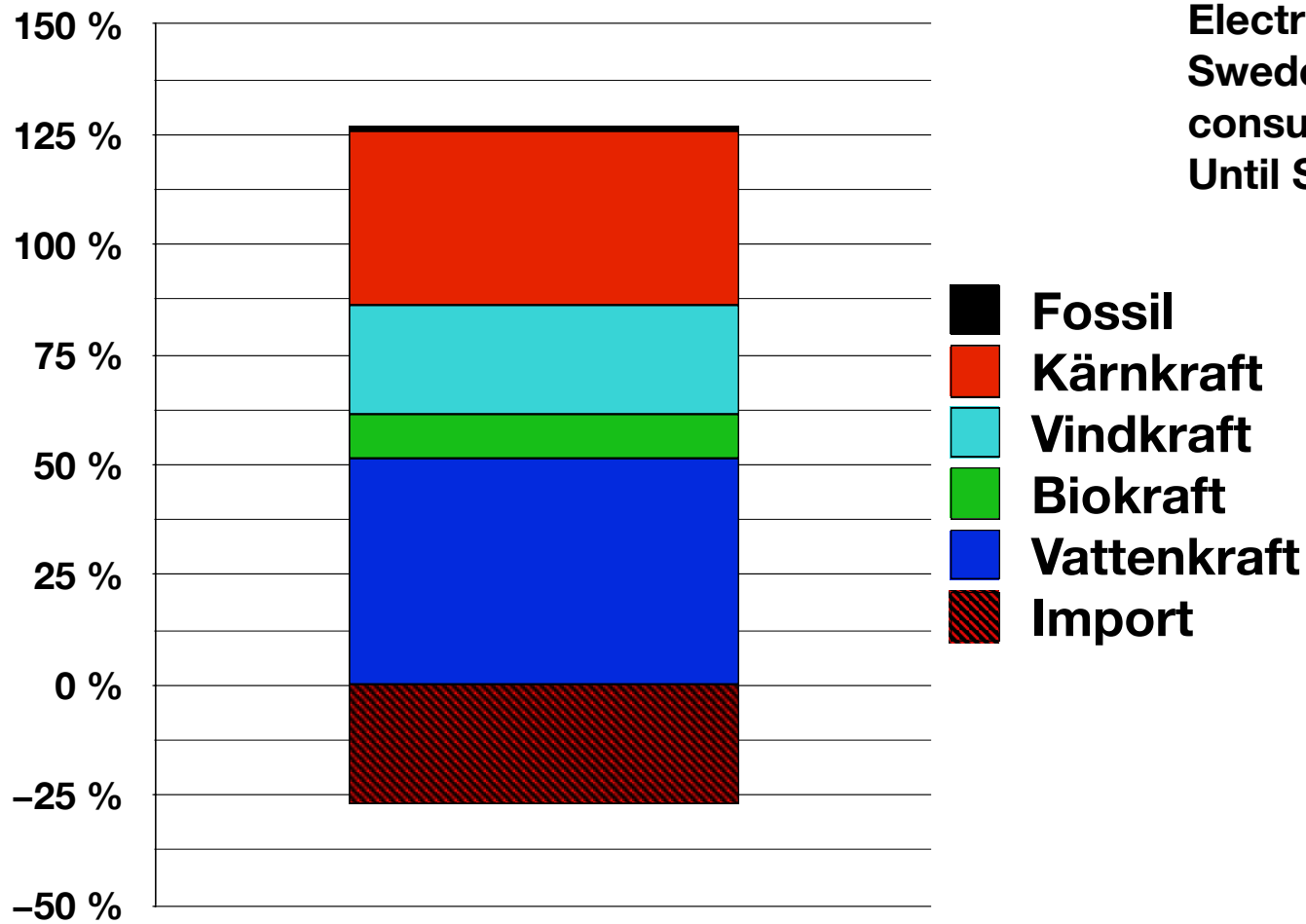


Swedish District Heating 1981-2021



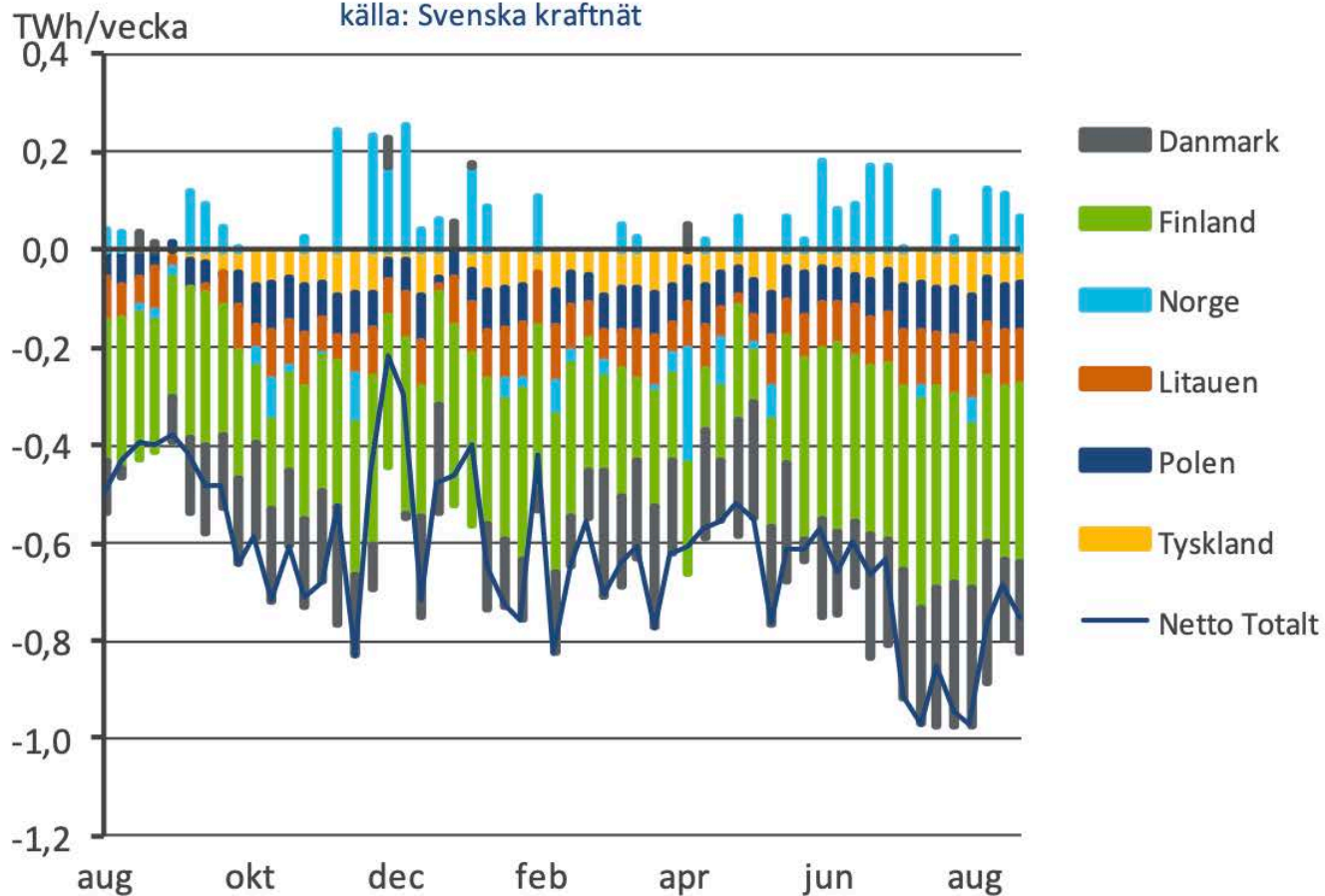
Data: Energimyndighetens Kortsiktsprognoser

Electricity production in Sweden 2022 in percent of consumption Until Sep 18

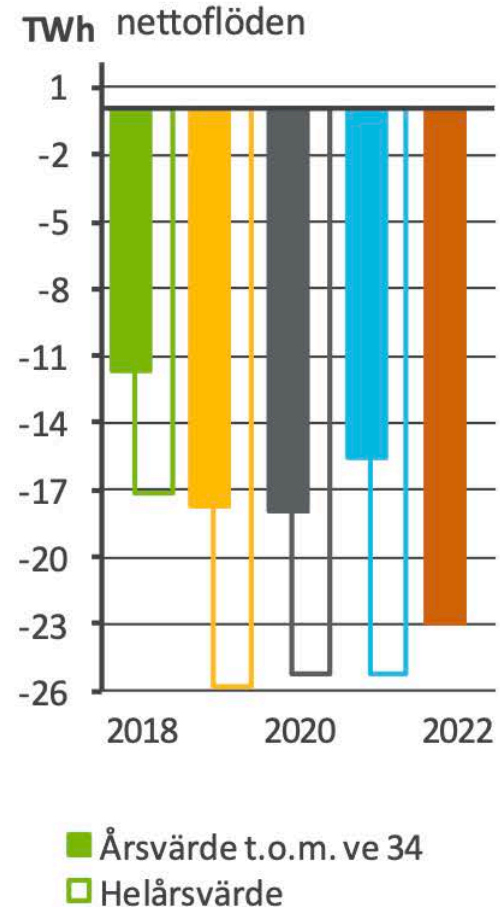


Netto kraftflöden till och från Sverige

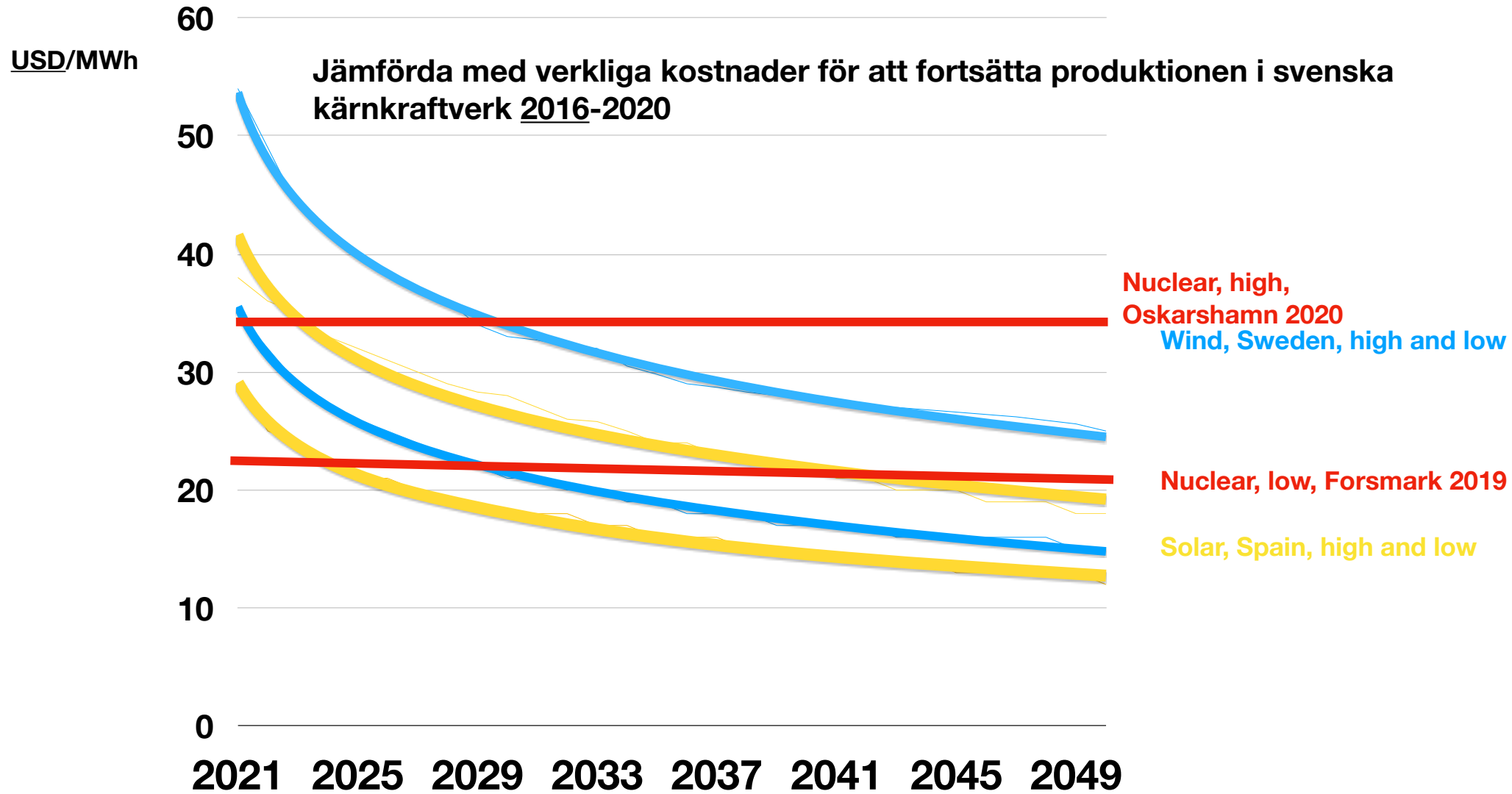
källa: Svenska kraftnät



Totala ackumulerade nettoflöden



Bloomberg kostnadsprognoser

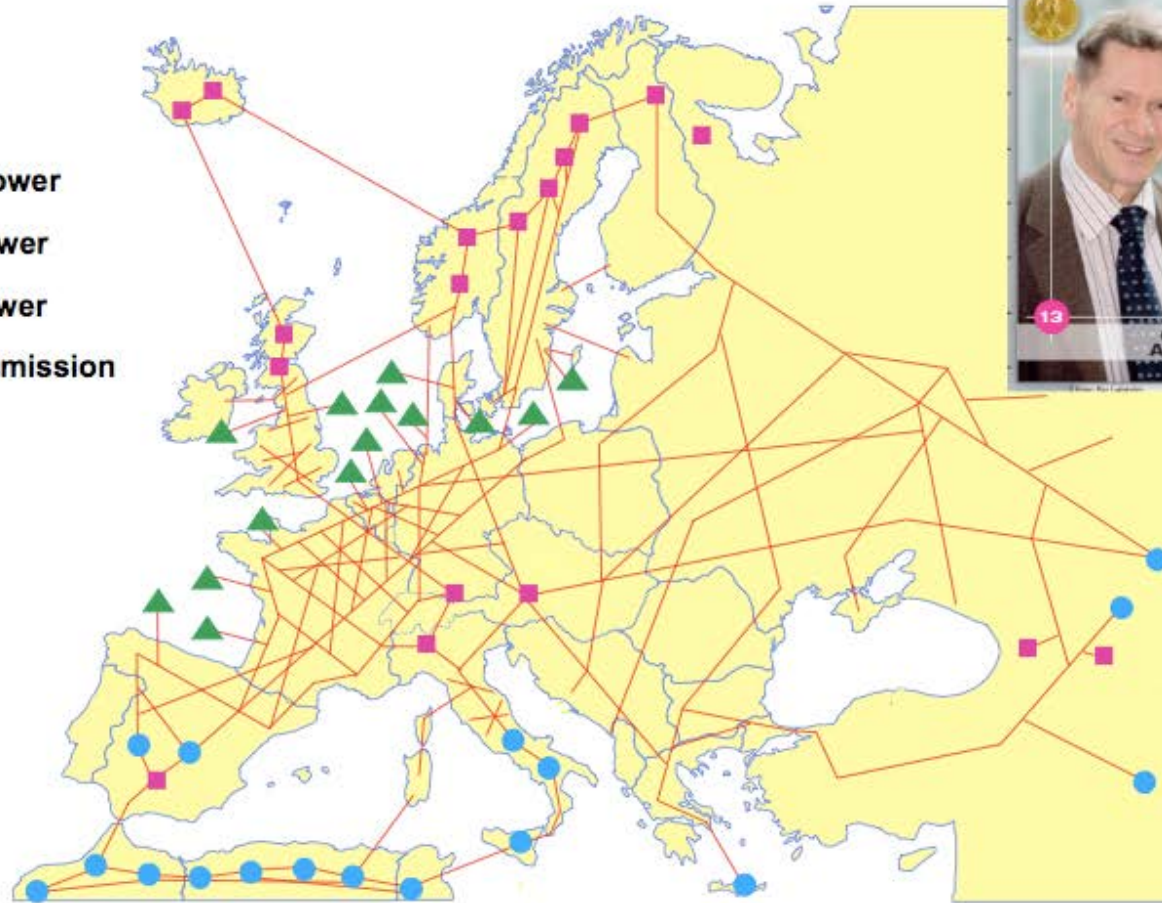


Data från Bloombergs betaldatabas, resp offentliga årsredovisningar från kärnkraftverken

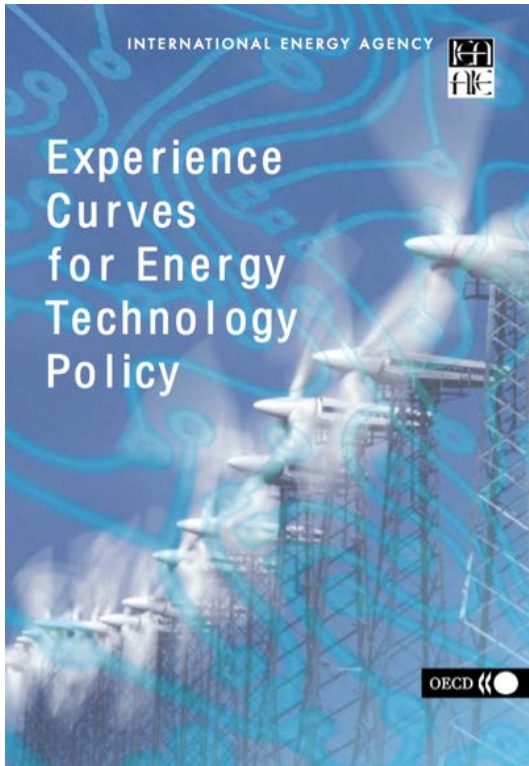
Vision for renewable power system 1992

- Hydro power
- Solar power
- ▲ Wind power
- DC transmission

Solar 700 GW
Wind 300 GW
Hydro 200 GW
Storage 1000 TWh
...and lots of cables!!



Industrial learning by experience



Prof. Clas-Otto Wene, Chalmers Univ. of Technology, 2000

Electric Technologies in EU 1980-1995

