

100% renewable energy

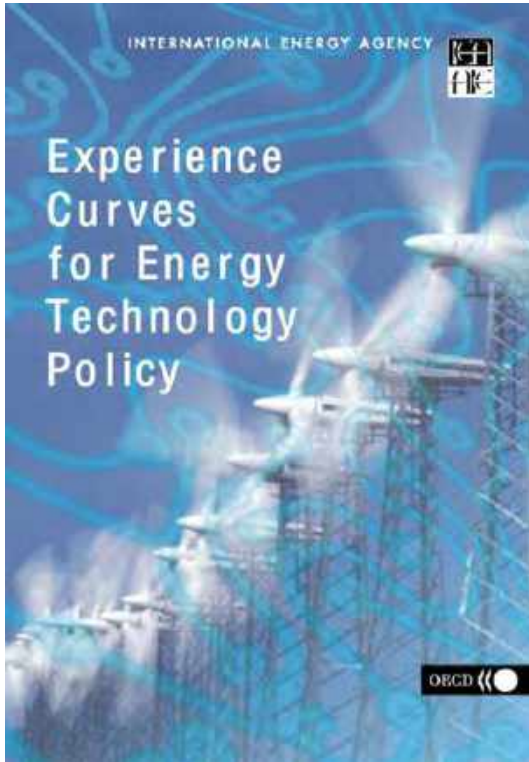
– not just electricity.

2023-08-31

Tomas Kåberger

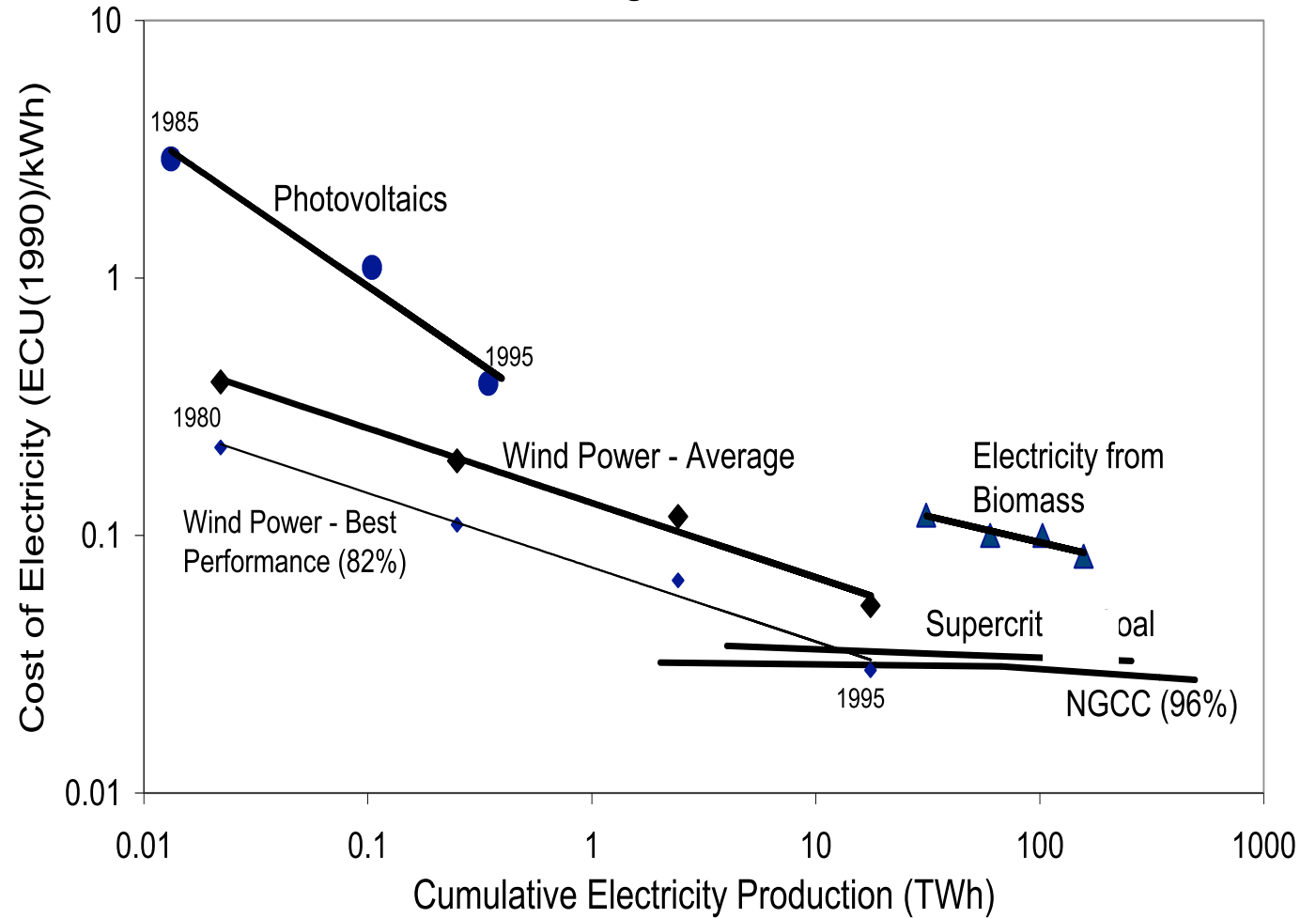
*professor Chalmers University of Technology
Executive Board Chair of Renewable Energy Institute, Tokyo*

Industrial learning by experience

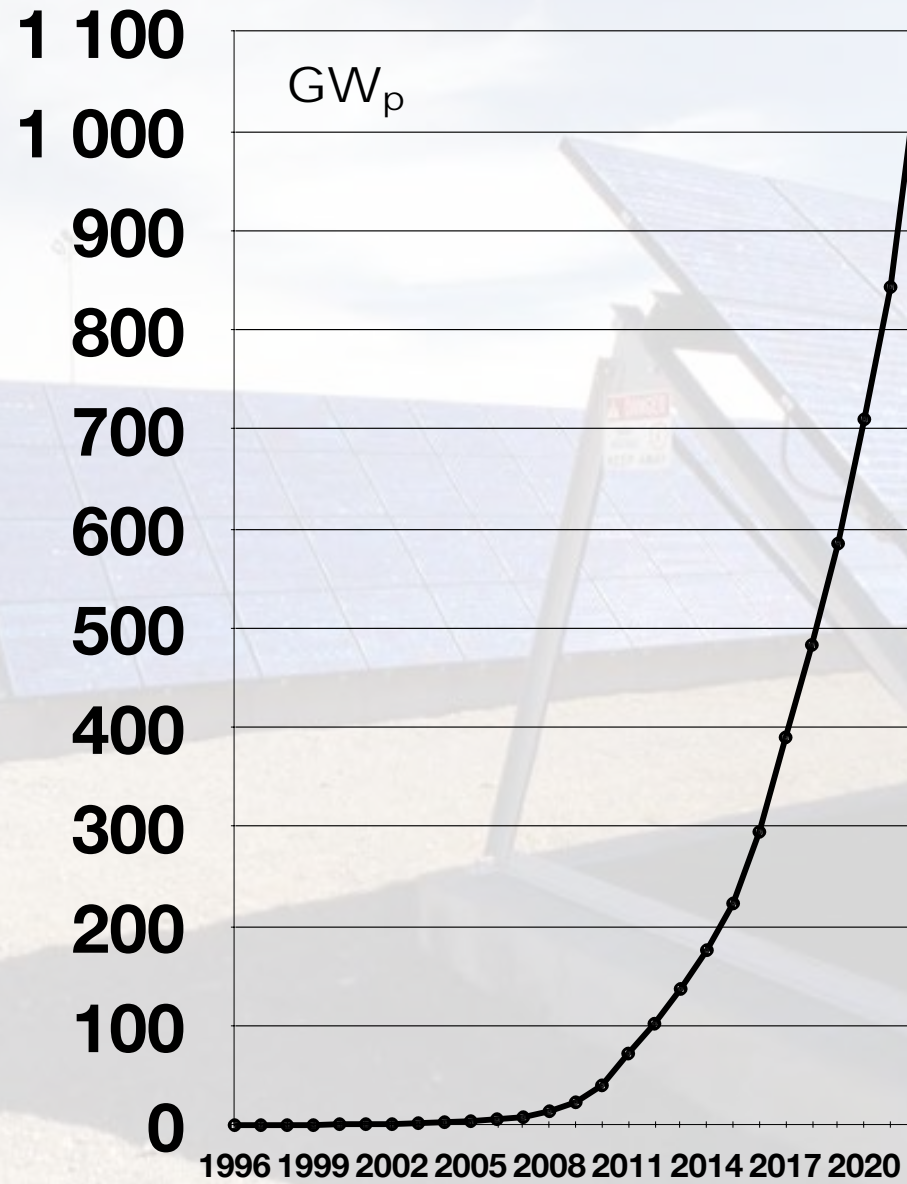


Prof. Clas-Otto Wene, Chalmers Univ. of Technology, 2000

Electric Technologies in EU 1980-1995

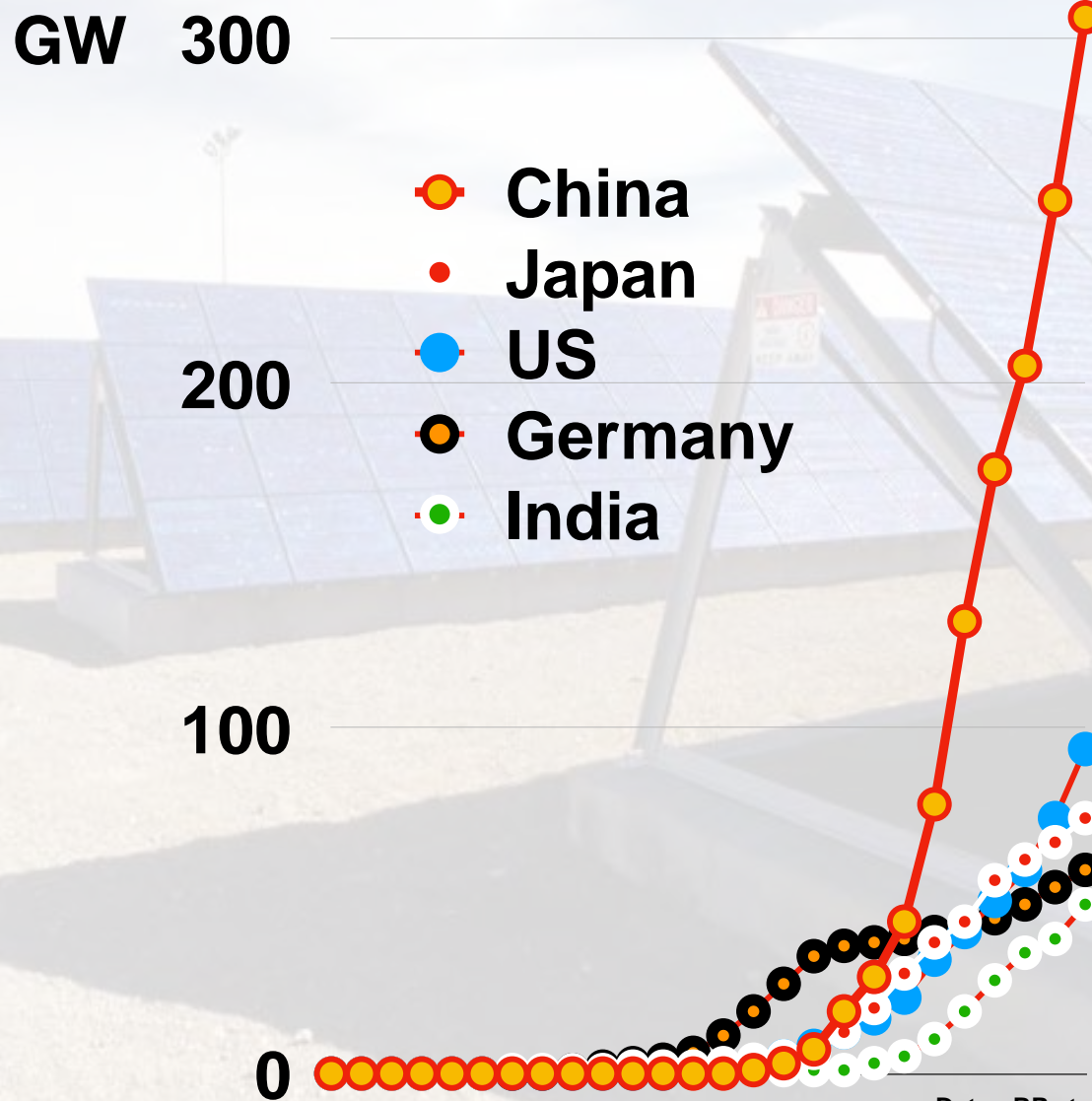


Global solar PV capacity 1996-2022



Data: BP statistical review, IRENA, 2022 "inspired estimate"

Solar PV- capacity leading countries. 1996-2021



Data: BP statistical review of world energy, IRENA



Tremendously Low 4.8¢/kWh Solar Price In Peru, Unsubsidized

February 25th, 2016 by [Guest Contributor](#)

Peru recently awarded 185 megawatts (MW) of new solar photovoltaic (PV) contracts in a renewable energy solicitation, at record-low prices for a nation not offering any tax breaks for such development.

Of the 185 MW of new project capacity, 144 MW relates to a bid [from Enel Green Power](#) at \$47.98/MWh (megawatt-hours); and 40 MW relates to a bid from Enersur at \$48.50/MWh.

Notably, the projects aren't expected to be built until 2017 — when solar PV prices are expected to be notably lower, hence the lower bids and contracts.

According to the press release from Peru's Supervisory Agency for Energy and Mines (Osinermin), the Enel Green Power contract is for the provision of 415 gigawatt-hours (GWh) of electricity a year from the company's planned Rubi solar PV project at the aforementioned price of \$47.98/MWh. The Enersur contract is for the provision of 108 GWh of electricity a year from the planned Intipampa solar PV project at \$48.50/MWh.

Delivery of electricity from the projects is currently set to begin by the end of 2018 — if the terms of the contracts are to be met.

Along with the above-mentioned solar energy projects, 3 wind energy projects were awarded contracts following the recent solicitation. Contract prices for these projects ranges from \$36.84–37.83/MWh. In addition, a number of hydroelectric and biomass projects were awarded contracts as well.

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Dubai Gets Record-Low Bid Of 2.99¢/kWh For 800 MW Solar PV Project

May 2nd, 2016 by [Saurabh Mahapatra](#)

Dubai Electricity and Water Authority has received yet another record-breaking bid for expansion of the iconic Mohammed bin Rashid Al Maktoum Solar Park, the lowest solar price bid in history, for an 800 MW solar PV project that expands on 213 MW.

Cheapest Solar on Record Offered as Abu Dhabi Expands Renewables

Photographer: SeongJoon Cho/Bloomberg

Abu Dhabi

by Anthony Dipaola
@A_Dipaola17

offer at 2.42 cents a kilowatt-hour

September 19, 2016 – 8:13 PM CEST
Updated on September 20, 2016 – 8:14 AM CEST

- ▶ Utility Adwea gets power offer at 2.42 cents a kilowatt-hour
- ▶ JinkoSolar makes lowest bid with offers still being evaluated

Two companies offered to build the cheapest solar power plant on record in Abu Dhabi, reflecting declining costs for photovoltaic cells and cheaper financing for clean-energy projects.

Government-owned Abu Dhabi Water & Electricity Authority received a record-low bid of 2.42 cents a kilowatt-hour for power from a planned facility in the Persian Gulf sheikhdom, state-run Emirates News Agency said. The utility on Monday opened six bids to build a solar plant capable of generating at least 350 megawatts, the agency said. JinkoSolar Holding Co. of China and Japan's Marubeni Corp. made the lowest joint offer, according to an official from the Middle East Solar Energy Industry Association, who asked not to be identified citing policy.

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Dubai Electricity
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by Anthony Dipaola
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September 19, 2016 - 8:13 P
Updated on September 20,

- Utility Adwea
- JinkoSolar r



Neoen just placed the lowest solar bid Mexico has seen to date.

Prices for solar in Mexico's latest auction may not have set a new world record, but have raised eyebrows among analysts nevertheless.

Average solar prices were in the \$20 per megawatt-hour range, said GTM Research Americas solar analyst Manan Parikh. "I was surprised the average cost of solar broke the thirties because I thought the prices would stabilize more, given that the commissioning date is still only two and a half years out," he said.

Global solar developer Neoen secured the lowest solar bid, at \$19.18 per megawatt-hour -- which represents the lowest solar price seen in Latin America to date.

GTm originally reported that Mitsui-Trina secured the lowest bid. However, a review of the

gtm:
A Wood Mackenzie Business

SOLAR PROJECTS

Mexican Solar Sets a Record Low Price for Latin America

Mexico's latest energy auction didn't set a world record, but confirms a trend toward ultra low-cost PV worldwide.

JASON DEIGN | NOVEMBER 29, 2017



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Winners, projects, prices of Portugal's record PV auction

The Portuguese government has published the final results and a list of all projects selected in the procurement exercise. French IPP Akuo is the developer behind the record bid of €0.0147/kWh, which was for one of three projects it won in the auction. The second- and third-lowest winning bids were €0.01637/kWh and €0.0171/kWh, while the highest was €0.03116/kWh. Overall, the authorities allocated 1.15 GW of solar in the oversubscribed auction, down from initial plans for around 1.4 GW.

AUGUST 9, 2019 EMILIANO BELLINI

MARKETS UTILITY-SCALE PV PORTUGAL



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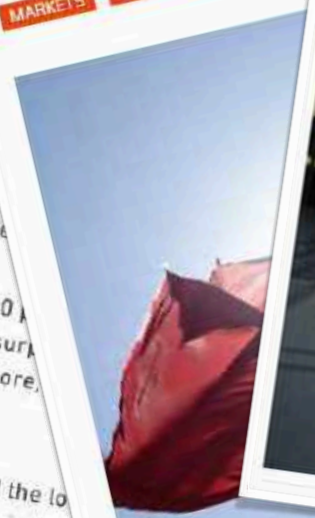
Neoen just placed the lowest solar price...

Winners, projects, Portugal's record

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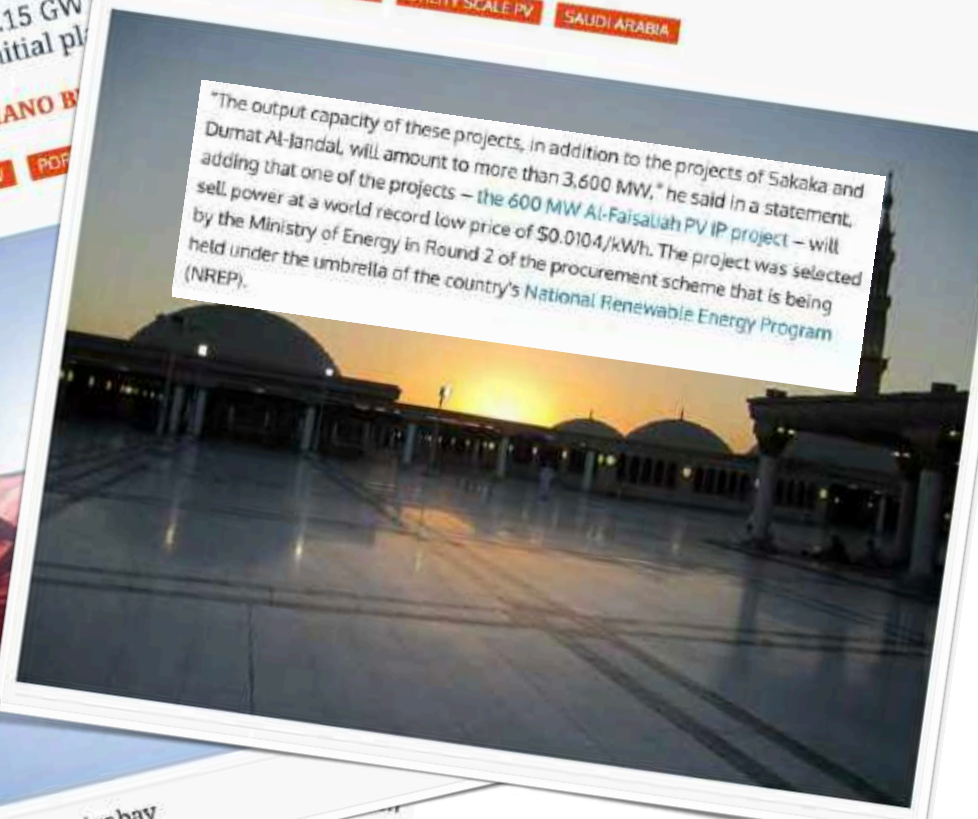
Saudi Arabia's second PV tender draws world record low bid of \$.0104/kW

The record low price was offered for the 600 MW Al-Faisaliah PV IP pro
which competed in the second round of the country's procurement sche
for renewable energies.

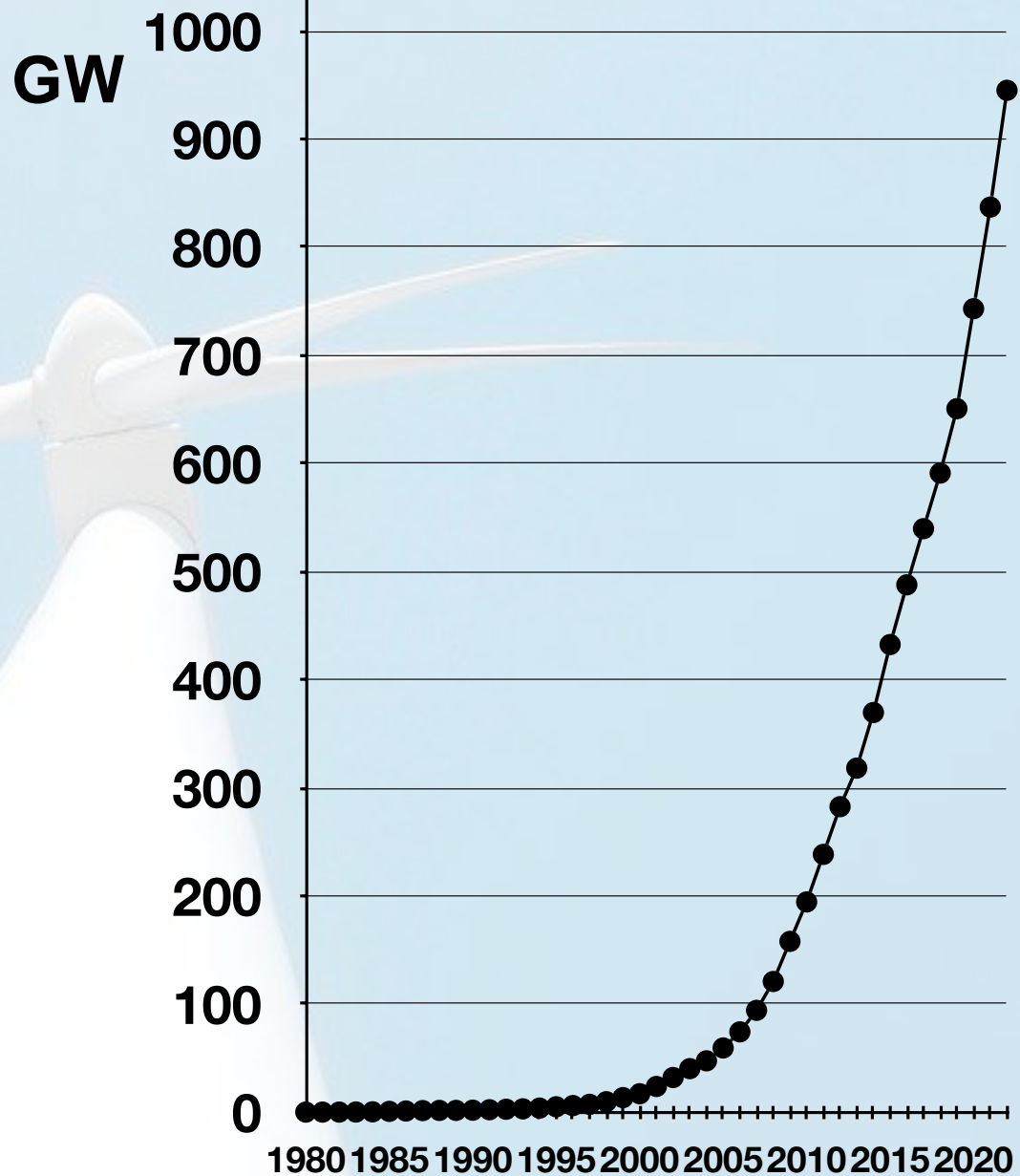
APRIL 8, 2021 EMILIANO BELLINI

MARKETS MARKETS & POLICY UTILITY SCALE PV SAUDI ARABIA

"The output capacity of these projects, in addition to the projects of Sakaka and
Dumat Al-Jandal, will amount to more than 3,600 MW," he said in a statement,
adding that one of the projects - the 600 MW Al-Faisaliah PV IP project - will
sell power at a world record low price of \$0.0104/kWh. The project was selected
by the Ministry of Energy in Round 2 of the procurement scheme that is being
held under the umbrella of the country's National Renewable Energy Program
(NREP).

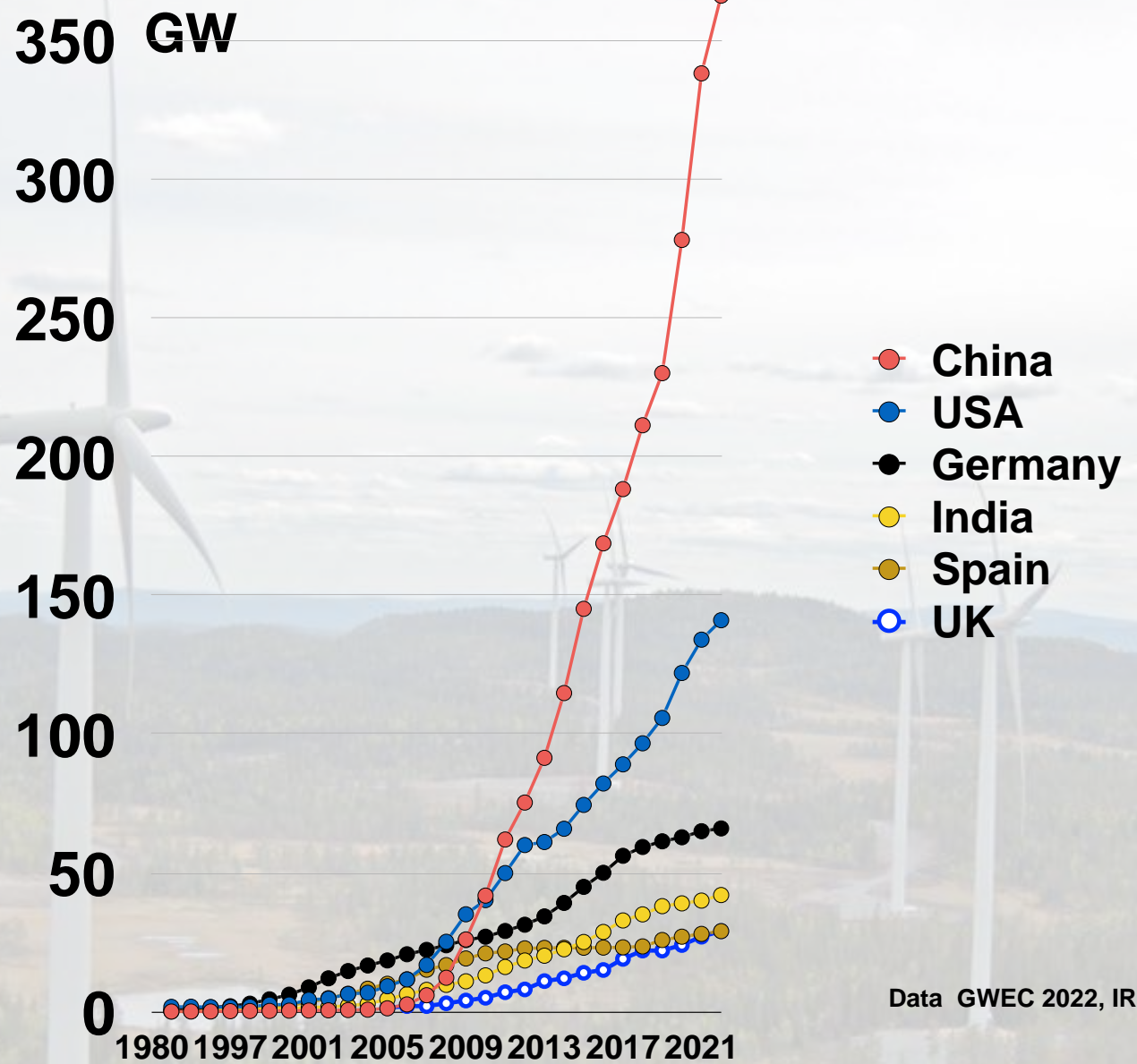


Global Wind power capacity 1980-2022



Data: GWEC, 2023

Wind power capacity leading countries 1980-2022



Data GWEC 2022, IRENA, 2023

New low for wind energy costs: Morocco tender averages \$US30/MWh

14

By Giles Parkinson on 17 January 2016

The north African country of Morocco has achieved a new low for wind energy costs, securing average bids of just \$US30/MWh from its tender for 850MW tender of large-scale wind energy projects, with the lowest at around \$US25/MWh.

Print

The pricing – revealed by its energy ministry at a ministerial round table at the International Renewable Energy summit in Abu Dhabi on Saturday – sets a new low for wind energy pricing in the world, and is boosted by the remarkable wind energy resource sourced from Atlantic trade winds, and some concessional finance.

Abderrahim El Hafidi, vice minister of energy and environment, described the result as “extraordinary” and “amazing” and said it pointed to a “real revolution” in the means of producing energy. Some bids in the US have been in and around \$US25/MWh, although these have been boosted by a 30 per cent production tax credit.



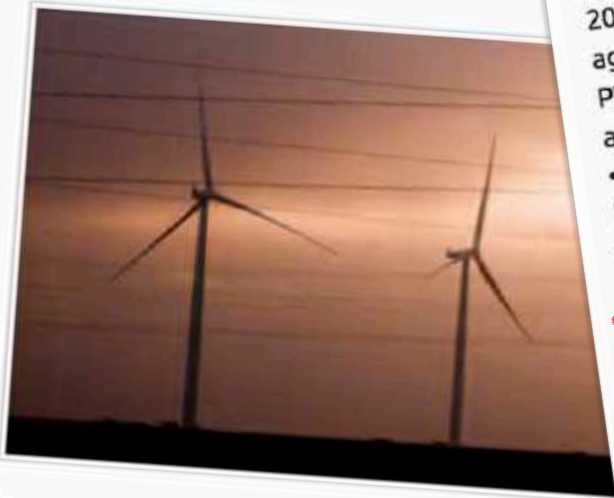
New low for wind energy costs: Morocco tender averages \$US30/MWh

By Giles Parkinson on 17 January 2016

The north African country of Morocco has secured average bids of just \$US30/MWh from scale wind energy projects, with the lowest at

The pricing – revealed by its energy ministry at an Energy summit in Abu Dhabi on Saturday – is boosted by the remarkable wind energy resources and concessional finance.

Abderrahim El Hafidi, vice minister of energy and electricity, called the results “amazing” and said it pointed to a “real revolution” in the sector. He said the US have been in and around \$US25/MWh, although the production tax credit.



Enel sets a new world wind record in Mexico, below \$18/MWh

November 29, 2017 [Paul Dvorak](#): 0 Comments

This Flash Note from [Make Consulting](#) examines the results of Mexico's third long-term power auction held in November 2017. The note evaluates the event and its bidding within the context of previous auction rounds in Mexico as well as within the Latin American region. It analyses the dynamics that contributed to Enel's record low bidding and posits dynamics that favor low bidding in the Mexican market.

Key points:

- Mexico hosted a long-term power auction in November 2017 which awarded offtake agreements to wind power and PV projects totaling 5.5 TWh of annual production
- Enel submitted four successful bids for wind power sites with the lowest reaching \$17.70/MWh
- In total, the auction awarded PPAs to 2 GW of new project sites, including 689 MW of new wind power sites which are due online in 2020



Offshore wind costs hit record low ★

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Published on 06/07/2016, 10:57am

Two 350MW arrays in the Netherlands will supply power at €87/MWh, beating the next cheapest project by miles

By [Megan Darby](#)

Dong Energy has set a record low price for offshore wind power in a winning bid to build two arrays off the coast of the Netherlands.

The Danish company committed to supply electricity at €72.70/MWh (US\$80.40), not including transmission costs. The cables will add about €14/MWh, experts say.

That beats an industry goal of bringing costs below €100/MWh by 2020. The closest any rival had previously come was €103/MWh by Vattenfall in Denmark last year.

“It was a result that was well beyond anyone’s expectations,” said Oliver Joy, spokesperson for the European Wind Energy Association.

Offshore wind record low

New record for cheapest offshore wind farm



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Published on 06/07/2016, 10:57am

Two 350MW arrays in the power at €87/MWh, beat by miles

By Megan Darby

Dong Energy has set a wind power in a winning bid on the coast of the Netherlands



The costs of offshore wind have fallen significantly in recent years
CREDIT: BLOOMBERG

The Danish company came in at €72.70/MWh (US\$80.40) per MWh, beating previous industry costs. The cables will be laid in 2017.

By **Emily Gosden**, ENERGY EDITOR

14 SEPTEMBER 2016 - 7:35AM

That beats an industry target of €100/MWh by 2020. The previous record came was €103/MWh in 2015.

The cost of building offshore wind farms has fallen to a new low, with Sweden's Vattenfall winning contracts to build two projects in Danish waters for just over €60 (£51) per megawatt-hour (MWh).

"It was a result that exceeded expectations," said a spokesman for European Wind Energy Association.

Offshore wind record low

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By Megan Darby

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That beats an industry target of €100/MWh by 2020. The previous record came was €103/MWh in 2015.

"It was a result that exceeded expectations," said a spokesman for European Wind Energy Association.

New record for cheapest offshore wind farm



7.33 AM CET / 9-Nov-2016 / Vattenfall (STO:ONOT)



The costs of offshore wind power have fallen to a new low, with Vattenfall winning a tender for a 600 MW farm in the Baltic Sea. CREDIT: BLOOMBERG

By Emily Gosden
14 SEPTEMBER 2016

The cost of building offshore wind farms has fallen to a new low, with Vattenfall winning a tender for a 600 MW farm in the Baltic Sea. The winning bid was €49.9 per MWh, which is among the lowest costs in the world for offshore wind power.

Vattenfall wins tender to build the largest wind farm in the Nordics

Today, Vattenfall has won the tender to build Danish Kriegers Flak, a 600 MW offshore wind farm in the Baltic Sea. The winning bid was EUR 49.9 per MWh, which is among the lowest costs in the world for offshore wind power.

"The announcement is an essential milestone for our ambition to increase our production of renewable power. We are already the second largest offshore player globally. The winning bid of EUR 49,9 per MWh proves that Vattenfall is highly competitive and brings down the costs for renewable energy", says Magnus Hall, CEO Vattenfall.

Kriegers Flak will be Denmark's largest offshore wind farm and can supply 600,000 Danish households with renewable energy – corresponding to 23 percent of all households in Denmark. Vattenfall's investment in Kriegers Flak will be EUR 1.1 – 1.3 billion, pending a final investment decision.

"This is exciting news. I'm very proud of our people in the Wind organisation who once again delivered a winning bid. Vattenfall has won the three latest offshore wind tenders in Denmark; Horns Rev 3, Danish Near Shore and Kriegers Flak, equivalent to the energy consumption of 55 percent of the Danish households", says Gunnar Groebler, Head of Vattenfall Wind.



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

Scandinavia's largest offshore wind farm inaugurated



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.

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Published on 06/07/2016

Two 350MW arra
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By Megan Darb

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First Subsidy-Free Offshore Wind Deal In German Offshore Wind Auction, DONG Energy & EnBW Win Big

April 14th, 2017 by [Joshua S Hill](#)



Germany's first competitive auction for offshore wind projects has not only delivered an average bid price that was "far below expectations" according to the Bundesnetzagentur, but also included what is likely one of the world's first subsidy-free offshore wind projects.

First Sub Wind De Wind A EnBW

April 14th, 2017

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NETHERLANDS

Vattenfall awarded Dutch zero-subsidy site

19 March 2018 by David Weston, [Be the first to comment](#)

NETHERLANDS: Developer Vattenfall has been granted the licence to build the 700MW Hollandse Kust Zuid offshore wind project in the latest Dutch offshore tender round, without subsidy.



Vattenfall, through its Dutch subsidiary Nuon, built Egmond aan Zee, the Netherland's first offshore wind project

The site, located 22.2km off the Dutch coast, will require €1.5 billion in investment from Vattenfall, the developer said. It comprises two 350MW projects and due online in 2022.

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19 March 2018 by

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NEWS • WIND • 5 JULY 2021 • 2 MIN

Vattenfall starts construction of offshore wind farm Hollandse Kust Zuid



The construction of the 1.5GW Hollandse Kust Zuid offshore wind farm has started. The first vessel transporting foundations to the construction site departed today. Over the next two years, the world's first subsidy-free offshore wind farm will be built off the Dutch coast. The fossil-free energy generated by the wind farm will benefit both households, businesses and industrial partners.

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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.

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.

Figure: Danish Energy Agency.

1. December 2021

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

Thor Wind Farm I/S has won the concession to build Thor Farm. This is the first time a tendering procedure has been used for offshore wind energy in Denmark without aid. When the winner is expected to pay DKK 2.8 bn. to the Danish state over the next 20 years.

News

Supply

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Wind farms to pay back £660m under CfD scheme amid high gas prices

By Molly Lempriere



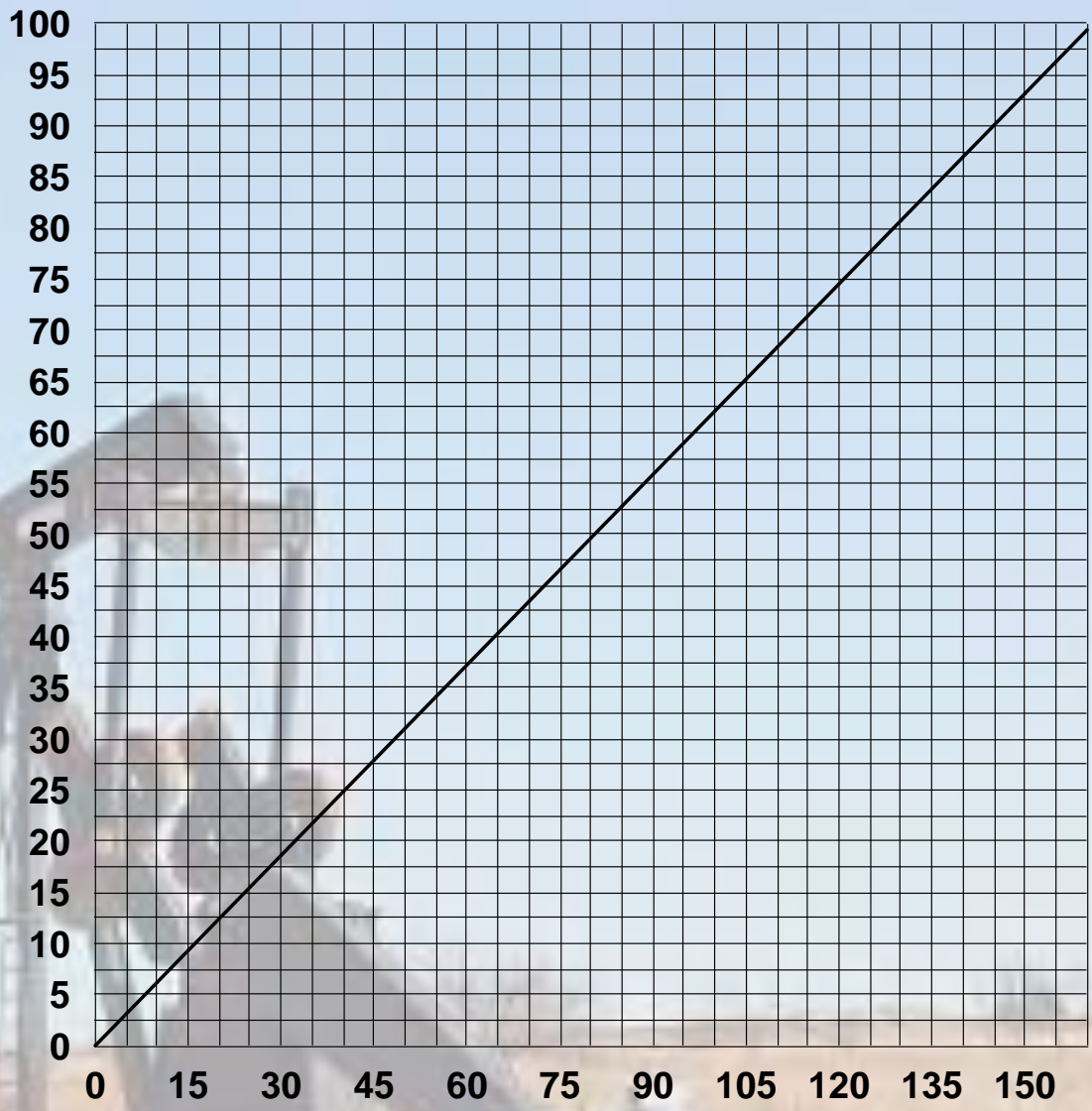
Octopus Energy Generation to invest £15 billion in offshore wind by 2030. Image: Pexels NC.

Wind farms are expected to pay back £660 million under the Contracts for Difference (CfD) scheme amid the current energy crisis.

According to new analysis from the Energy and Climate Intelligence Unit (ECIU), between October 2021 to April 2023 wind farms are expected to pay...

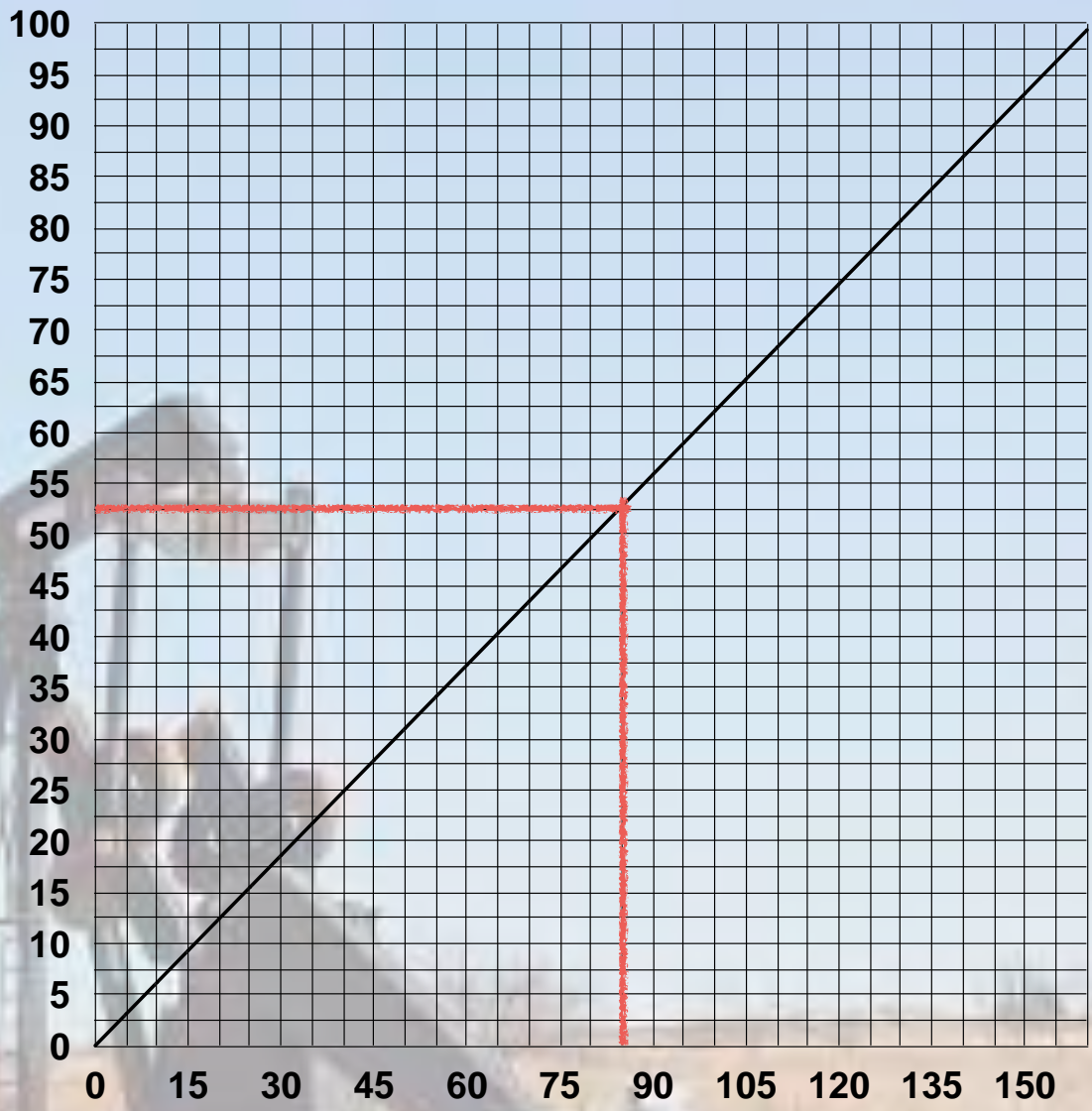


USD/MWh



Crude oil, USD/bbl

USD/MWh




Crude oil, USD/bbl

Norway: Plug-In Car Sales Nears 85% Share In June 2021



Jul 05, 2021 at 12:56pm ET

How Did Shenzhen, China Build World's Largest Electric Bus Fleet?

by  [Lu Lu](#), [Lulu Xue](#) and Weimin Zhou - April 04, 2018

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Diesel buses—and the choking smog they spew—are a common sight in most cities. But not in Shenzhen, China.


The southeastern city, which connects Hong Kong to mainland China, **announced** at the end of last year that all of its **16,359** buses had gone electric. The city's buses are the world's first 100 percent electrified bus fleet, and its largest—bigger than New York's, Los Angeles's, New Jersey's, Chicago's and Toronto's electric bus fleets **combined**.



Electric buses have replaced diesel ones in Shenzhen, China. Photo by Lu Lu/WRI China

How Did Shanghai Electric Buses

by  Lu Lu, Lulu

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The southeast
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Jul 05, 2012

World's Largest

Electromobility

Setting a Course for Carbon-Free Shipping

<http://www.siemens.com/innovation/en/home/>



In conjunction with Fjellstrand, a Norwegian shipyard, Siemens has developed the technology for the world's first electrically-powered car ferry. The fact that the electric ship, which will enter service in 2015, causes no carbon dioxide emissions is in part due to the electricity mix in Norway.


As silently as a crocodile, the white giant approaches the shore. It opens its "mouth," which is several meters across. Suddenly the silence is broken by the roar of engines as a stream of trucks and people emerge from the opening. Odd Moen, an engineer who is responsible for ship solution sales at Siemens Norway, smiles. If everything goes as planned, this vision of an electrically-powered ferry sailing across Norway's fjords will become a reality at the beginning of 2015. Making hardly a sound and producing absolutely no emissions, it will be the first and only ferry of its kind in the world.

A Century of Battery-Powered Service

For more than 100 years, there have been battery-powered submarines that run solely on electricity.

 Text Size

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 1 October 2014


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How Did Shanghai Electric Buses

by  Lu Lu, Lulu

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Jul 05, 202

Electromobility
Setting a Cou

ABB powers world's largest emission-free electric ferries

Tue 21 Jun 2016 by Paul Fanning

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Tycho Brahe – along with Aurora – will operate completely on battery power between Helsingør (Denmark) and Helsingborg

[Learn More](#)

In conjunction with Fjellst
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AIRBUS PUTS ELECTRIC E-FAN TRAINER INTO PRODUCTION IN PAU


by Dave Calderwood May 1, 2015

Airbus is to put its two-seat E-Fan powered by electric motors into serial production in Pau, France. Construction on a new plant will start in 2016 and Airbus has set a target for entry into-service for the E-Fan 2.0 of the end of 2017 or beginning of 2018.

Norwa

How Did Sh Electric Bus

by  Lu Lu, Lulu

 Comments

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Electromobility
Setting a Cou

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Tue 21 Jun 20

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A Century of Battery-Powered Serv

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AIRBUS PUTS EL

 Dave Calderwood

Airbus is to put its tw
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into-service for the E-

Sustainable Business

United Airlines to buy 100, 19- seat electric planes from Heart Aerospace

2 minute read

Allison Lampert



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



Sydney and Paris, 27 July 2022

Neoen and Tesla deliver innovative inertia services at Hornsdale Power Reserve big battery in Australia

- Neoen's 150 MW / 193.5 MWh battery storage facility Hornsdale Power Reserve (HPR) in South Australia has secured approval from the Australian Energy Market Operator (AEMO) to deliver inertia services to Australia's National Electricity Market
- HPR is the first big battery in the world to deliver grid-scale inertia services, thanks to Tesla's pioneering Virtual Machine Mode technology
- Batteries now have the capacity to provide these services at scale, as gas and coal fired generators have traditionally done
- It comes after two years of extensive trials and intensive collaboration with Tesla, AEMO and ElectraNet, supported by the South Australian Government, ARENA and CEFC
- The arrival of this capability paves the way for AEMO's stated vision of 100% instantaneous renewable penetration by 2025

Neoen (ISIN: FR0011675362, Ticker: NEOEN), one of the world's leading producers of exclusively renewable energy, has successfully implemented Tesla's Virtual Machine Mode (VMM) at its 150 MW / 193.5 MWh Hornsdale Power Reserve (HPR), Australia's second largest lithium-ion battery. HPR has secured approval from AEMO for its grid-forming inverters to start delivering inertia services into the South Australian grid.

A minimum level of inertia, in conjunction with frequency control services, is needed both during normal operation of the electricity network and after major disturbances. Inertia has traditionally been provided by gas or coal fired generators. The closing of thermal power plants and increasing volumes of renewable energy are resulting in inertia shortfalls in the grid, a serious network issue that batteries are now able to overcome. In addressing these challenges, this innovative solution represents a breakthrough of global significance.

South Aus battery sa stabiliza

A new report ana
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DECEMBER 5,

ENERGY STORAGE

NEOEN

Sydney and Paris, 27 July 2022

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UTILITY DIVE

BRIEF

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

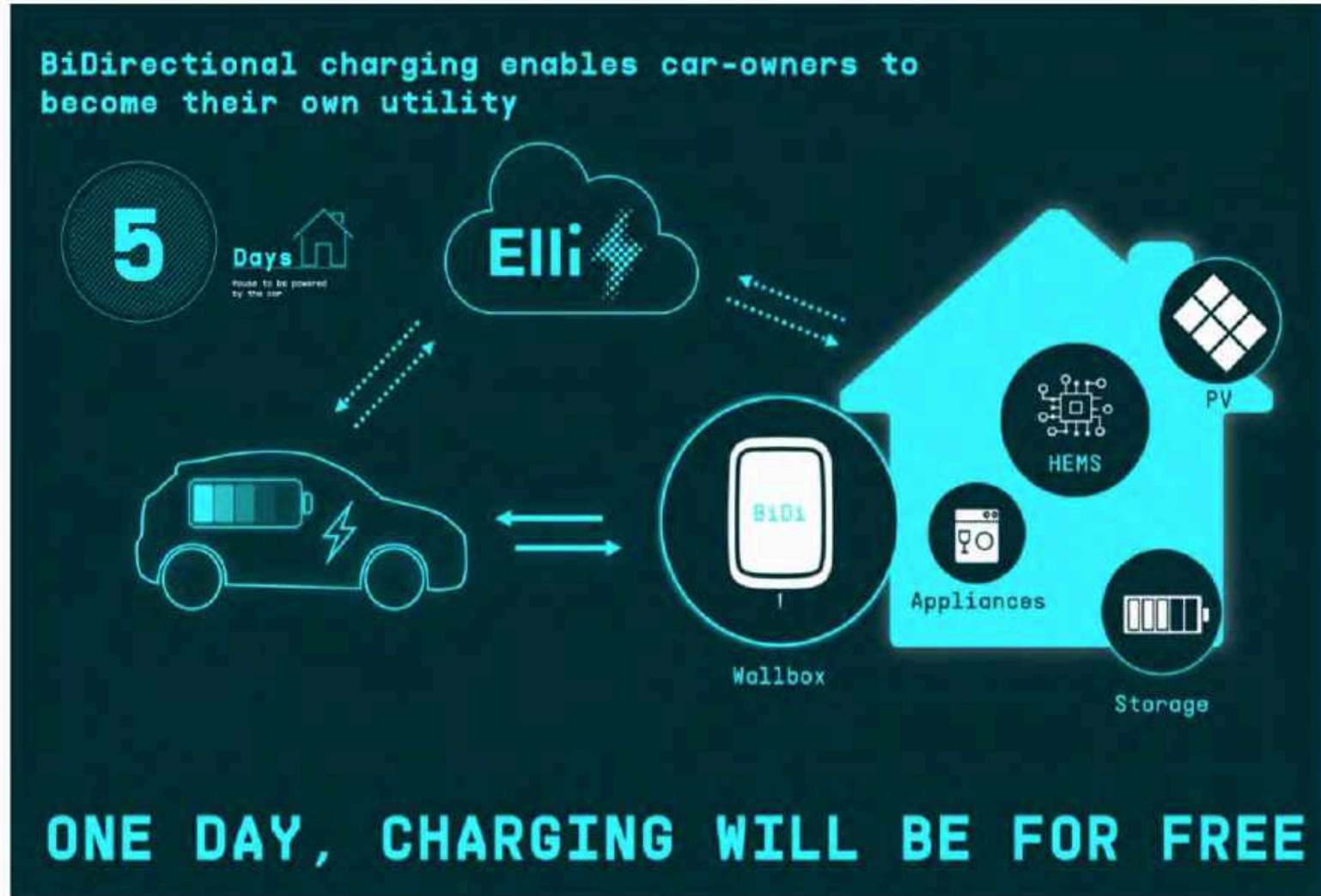
By Gavin Bade

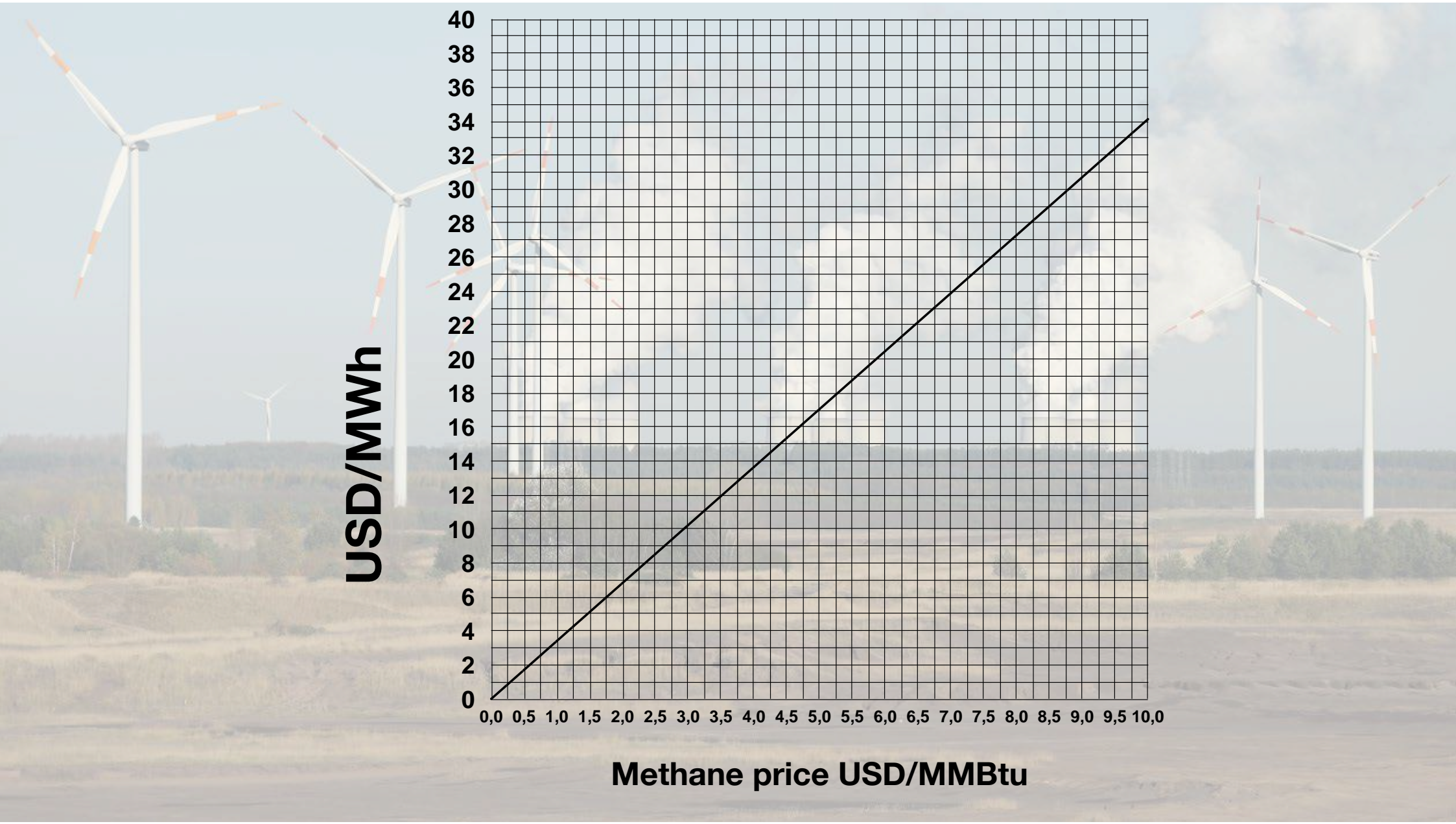
Published Nov. 9, 2018

Dive Brief:

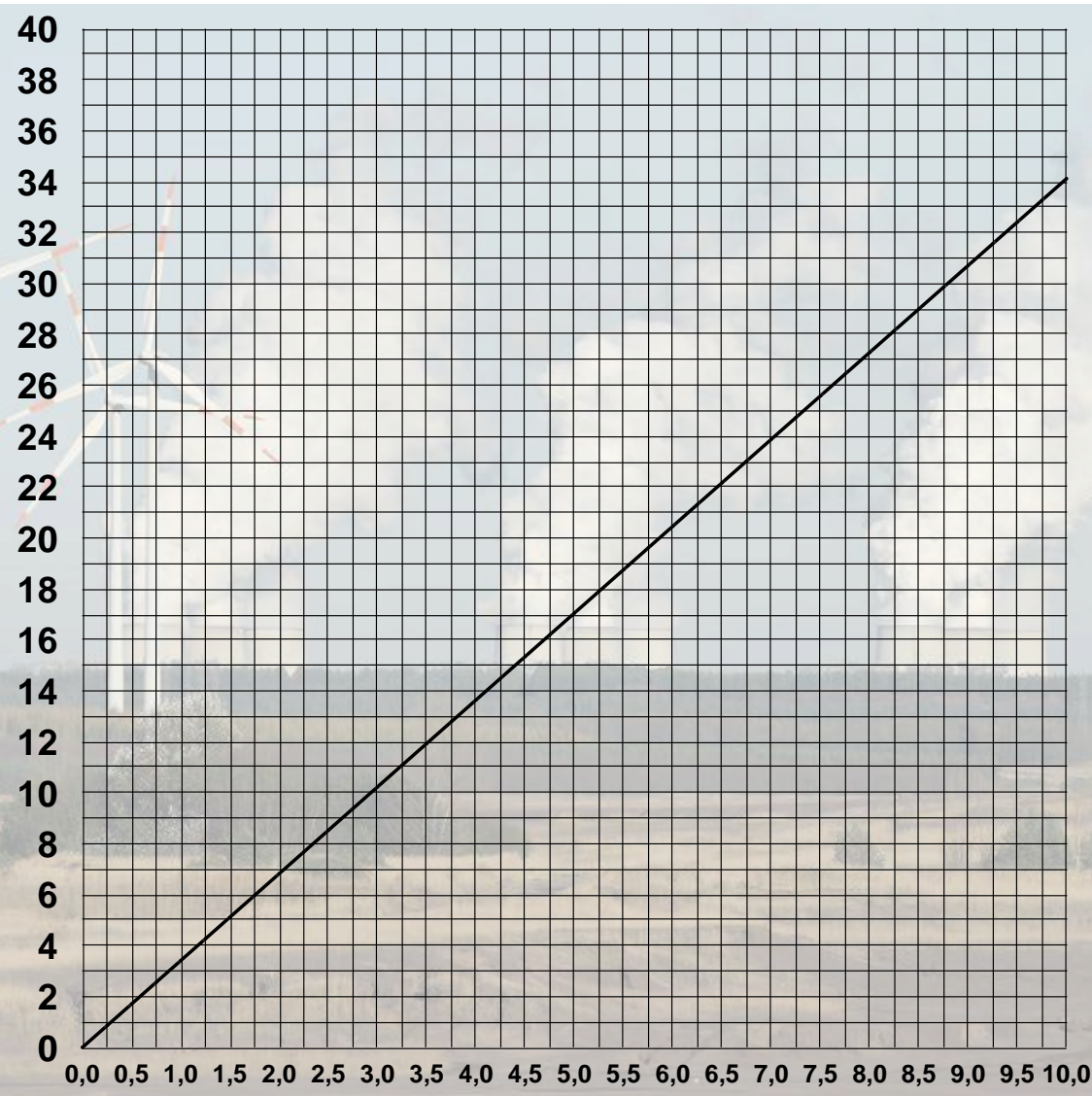
- The California Public Utilities Commission on Thursday approved four energy storage projects for Pacific Gas & Electric (PG&E) to replace retiring gas generators, including two batteries that would be the largest in the world.

V2G standard on BEV:s from 2022



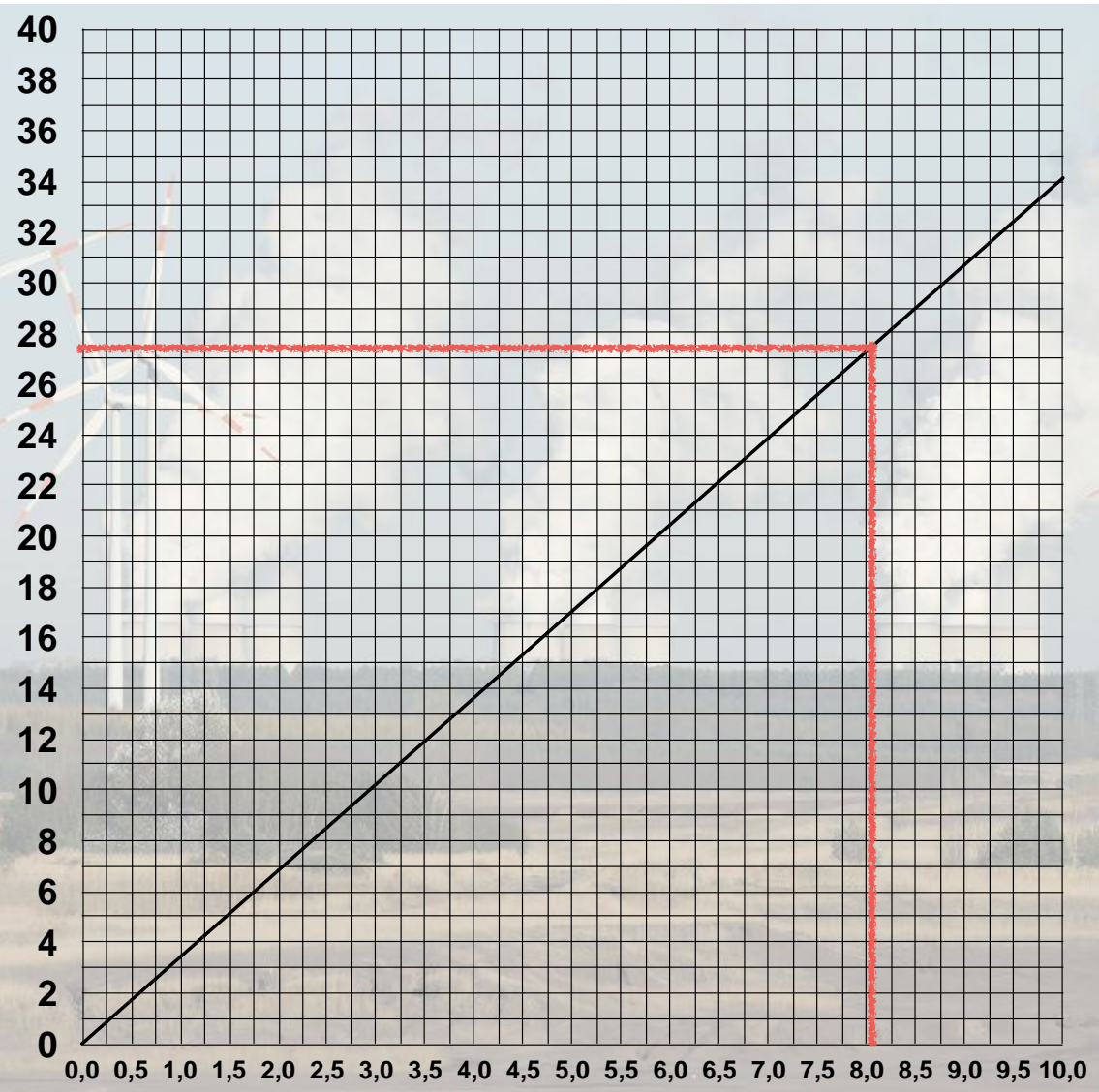


USD/MWh



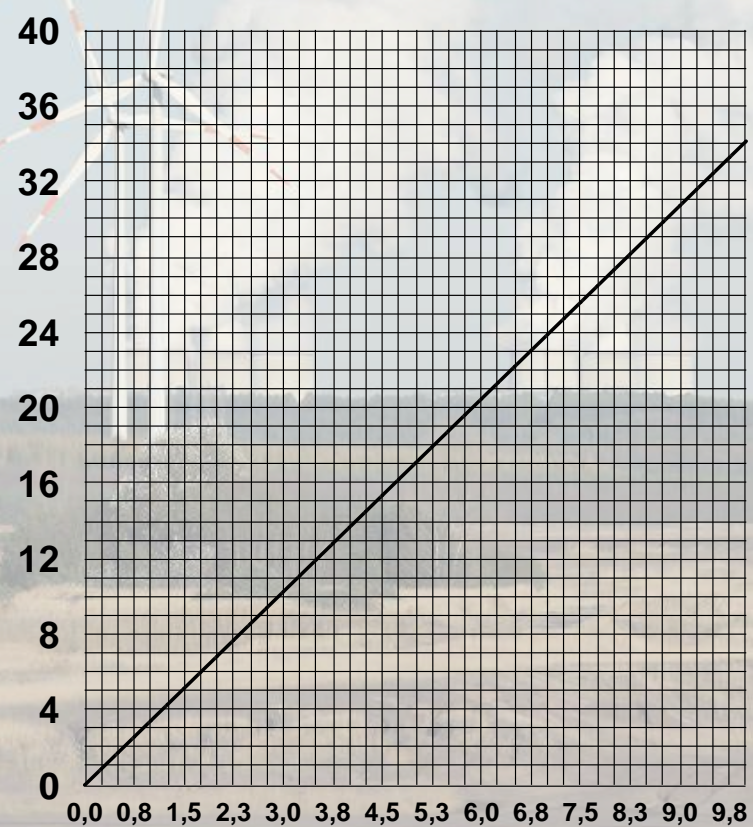
Methane price USD/MMBtu

USD/MWh



Methane price USD/MMBtu

USD/MWh



Methane price USD/MMBtu

News

ADNOC And TAQA Forms Joint Venture For 30 GW Renewable Energy By 2030

By Pooja Chandak - 17th November 2021



99 0


ADNOC and Abu Dhabi National Energy Company PJSC (TAQA) launches a new global renewable energy and green hydrogen venture in the presence of His Highness Sheikh Khaled bin Mohamed bin Zayed Al Nahyan, Member of the Abu Dhabi Executive Council, Chairman of the Abu Dhabi Executive Office, and Chairman of the Executive Committee of the Board of Directors of Abu Dhabi National Oil Company (ADNOC).


Abu Dhabi's two energy giants will create a clean energy powerhouse, with a total generating capacity of at least 30 Gigawatts (GW) of renewable energy by 2030, that will position Abu Dhabi and the United Arab Emirates (UAE) at the forefront of the energy transition and further advance its global leadership role in green hydrogen. The new strategic partnership will focus on domestic and international renewable energy and waste-to-energy projects as well as the production, processing and storage of hydrogen and ancillary activities. The new partnership will leverage ADNOC's energy and hydrogen capabilities and TAQA's renewables expertise, with bold aspirations for significant local and international growth.


Commending both companies for their visionary partnership, H.H. Sheikh Khaled bin Mohamed bin Zayed emphasized how the UAE continues to proactively advance practical solutions and capitalize on opportunities to secure a lower carbon future as the nation works to achieve its 'Net-Zero by 2050 Strategic Initiative'.

Portugal Pledges Cheap Green Hydrogen to EU Partners

Published on 24 September 2020 by Vanessa Drazem and Joao Liria

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- Country says it'll make the fuel for less than \$4 a kilogram
- Sines project set to be part of a hydrogen industrial cluster

Portugal said it can produce hydrogen made from renewable energy at one of the lowest prices in the western world.

The country will be able to produce the fuel for below 3.50 euros (\$4) per kilogram by the end of next year, according to Joao Galamba, Portugal's Secretary of State for Energy. That's well below the price for hydrogen production seen in most western countries, according to BloombergNEF.

Spain positions itself to be Europe's green hydrogen hub

By EuroEFE

📅 25 maj 2021



More than €1.5 billion from Spain's €70 billion recovery plan will be invested in the green hydrogen sector over the next three years. [EFE/Ismael Herrero]

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Portug Hydro

Published on 24 May

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4) per kilogram by the end of next
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European Energy helps Lego bricks go green

Danish renewables and PtX player will supply e-methanol for plastics production from its Kassø facility from 2024

[Image: European Energy]

20 April 2023 Other News

RELATED STORIES



European Energy orders Stiesdal electrolyser

27 MARCH 2023

European Energy has entered into an agreement with Lego, as well as medical products producer Novo Nordisk, to deliver e-methanol to reduce fossil fuels in the companies' plastics production processes.

The e-methanol will be produced at European Energy's PtX facilities in Kassø, in Aabenraa, Denmark.

The production of e-methanol will be based on renewable energy from wind and solar plants which is first used to produce green hydrogen via electrolysis, before further processing into e-methanol, which also requires biogenic CO₂.



European Energy helps Lego bricks go green

Danish renewables and PtX player will supply e-methanol for plastics production from 2025

20 April 2023 Other News

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European Energy orders Stiesdal electrolyser

27 MARCH 2023

European Energy has entered into an agreement with plastics producer Novo Nordisk, to deliver e-methanol for the companies' plastics production process from 2025.

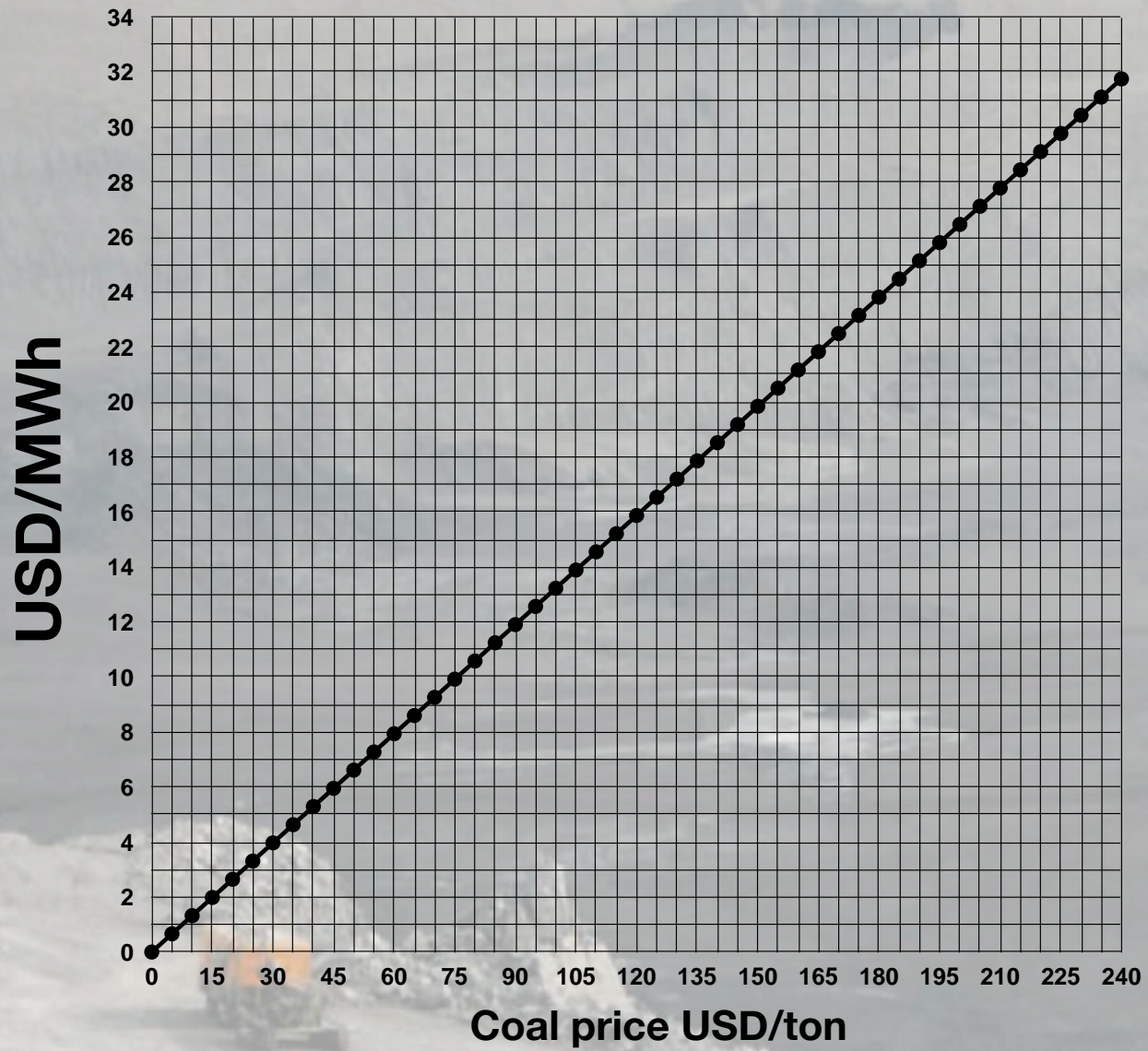
The e-methanol will be produced at European Energy's PtX plant in Aabenraa, Denmark.

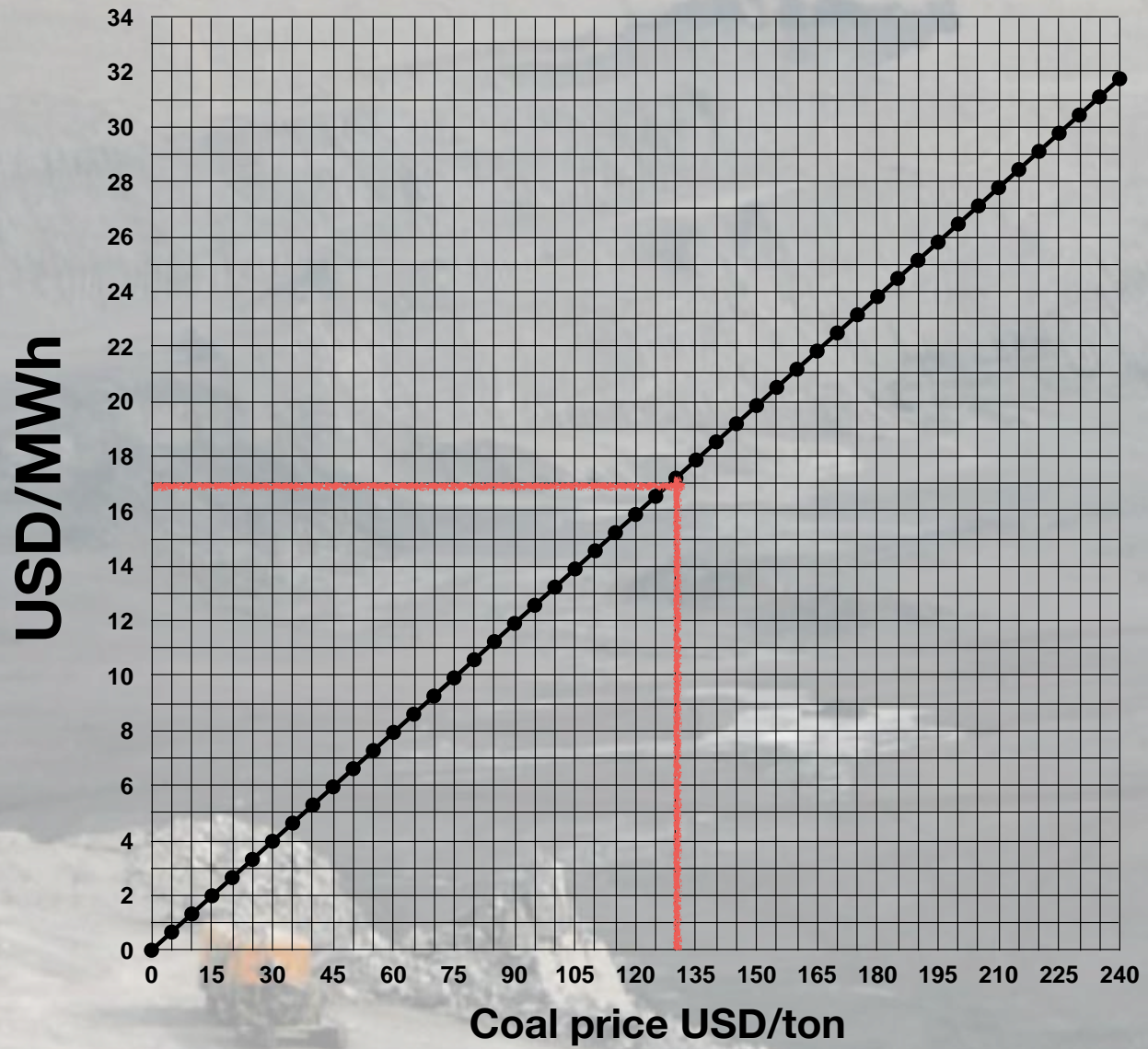
The production of e-methanol will be based on wind and solar plants which is first used to produce hydrogen before further processing into e-methanol.

Liquid Wind today announces that Ørsted will acquire full ownership of FlagshipONE, the Swedish green electrofuel plant previously co-owned by Liquid Wind and Ørsted. Located in Örnsköldsvik, FlagshipONE is Europe's largest green electrofuel facility that has reached a final investment decision.



Bild: Illustration av FlagshipONE, Örnsköldsviks kommun. Liquid Wind och Ørsted







A joint venture between SSAB, LKAB and Vattenfall

2021-06-21

HYBRIT: SSAB, LKAB and Vattenfall first in the world with hydrogen-reduced sponge iron

SSAB, LKAB and Vattenfall have now produced the world's first hydrogen-reduced sponge iron at a pilot scale. The technological breakthrough in the HYBRIT initiative captures around 90% of emissions in conjunction with steelmaking and is a decisive step on the road to fossil-free steel.

The HYBRIT pilot plant in Luleå, Sweden has completed test production of sponge iron and demonstrates that it is possible to use fossil-free hydrogen gas to reduce iron ore instead of using coal and coke to remove the oxygen. Production has been continuous and of good quality. Around 100 tonnes have been made so far. This is the first time ever that hydrogen made with fossil-free electricity has been used in the direct reduction of iron ore at a pilot scale. The goal in principle is to eliminate carbon dioxide emissions from the steelmaking process by using only fossil-free feedstock and fossil-free energy in all parts of the value chain.

The world's first fossil-free steel ready for delivery

AUGUST 18, 2021 15:00 CEST

6 MIN READ

SSAB has now produced the world's first fossil-free steel and delivered it to a customer. The trial delivery is an important step on the way to a completely fossil-free value chain for iron- and steelmaking and a milestone in the HYBRIT partnership between SSAB, LKAB and Vattenfall.



In July, SSAB Oxelösund rolled the first steel produced using HYBRIT technology, i.e., reduced by 100% fossil-free hydrogen instead of coal and coke, with good results. The steel is now being delivered to the first customer, the Volvo Group.

"The first fossil-free steel in the world is not only a breakthrough for SSAB, it represents proof that it's possible to make the transition and significantly reduce the global carbon footprint of the steel industry. We hope that this will inspire others to also want to speed up the green transition," says Martin Lindqvist, President and CEO of SSAB.

2021-06-21

HYBRIT: SSAB hydrogen-reduced

SSAB, LKAB and Vattenfall... a pilot scale. The technology... emissions in conjunction

The HYBRIT pilot plant demonstrates that it is possible to produce 100 tonnes of steel per day using electricity instead of coal and coke to reduce emissions. The technology has been developed and fossil-free energy in all parts of the value chain.

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 result of the 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 Construction Equipment's facility in Braås, Sweden. "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," 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.



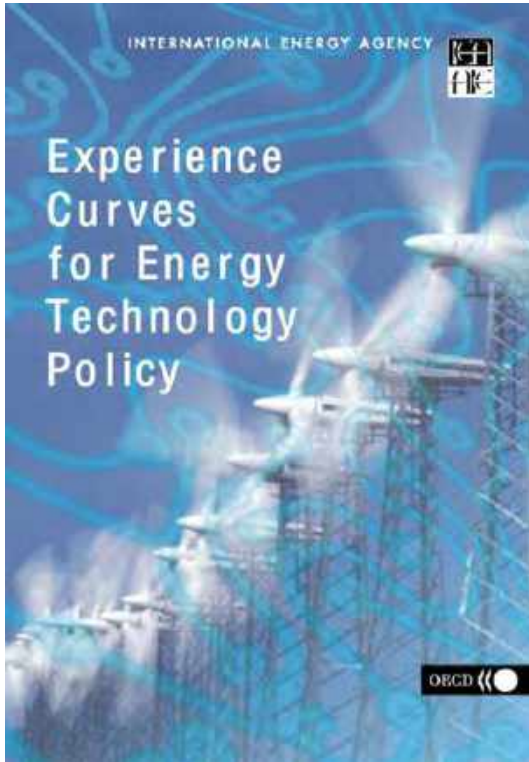
2021-06-21

HYBRIT: SSAB and Vattenfall produce hydrogen-reduced steel

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

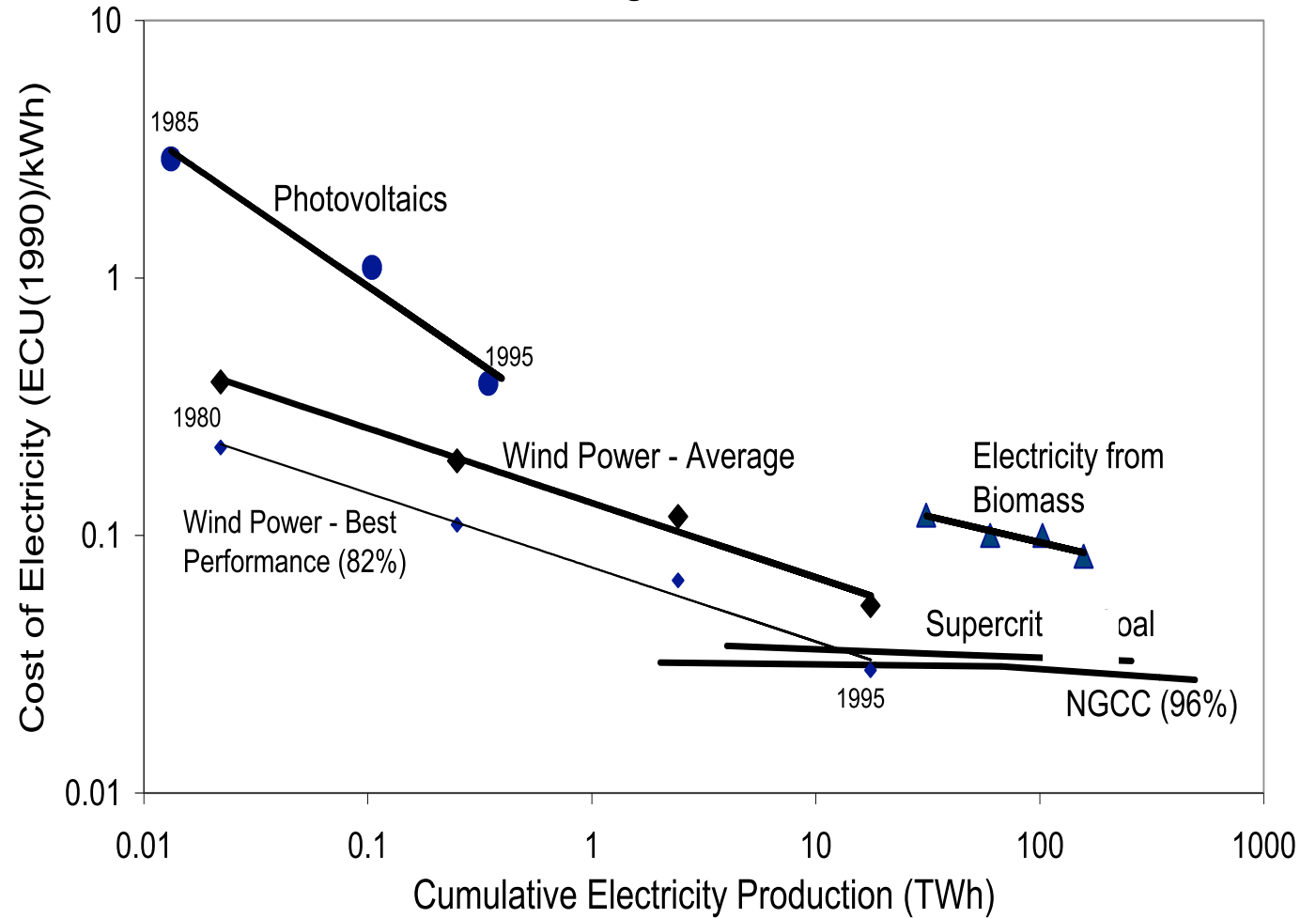
The HYBRIT pilot plant demonstrates that it is possible to produce steel without coal and coke to reduce CO2 emissions. 100 tonnes have been produced and the technology has been tested. The use of electricity has been tested and it is possible to eliminate carbon dioxide emissions and fossil-free energy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

Industrial learning by experience

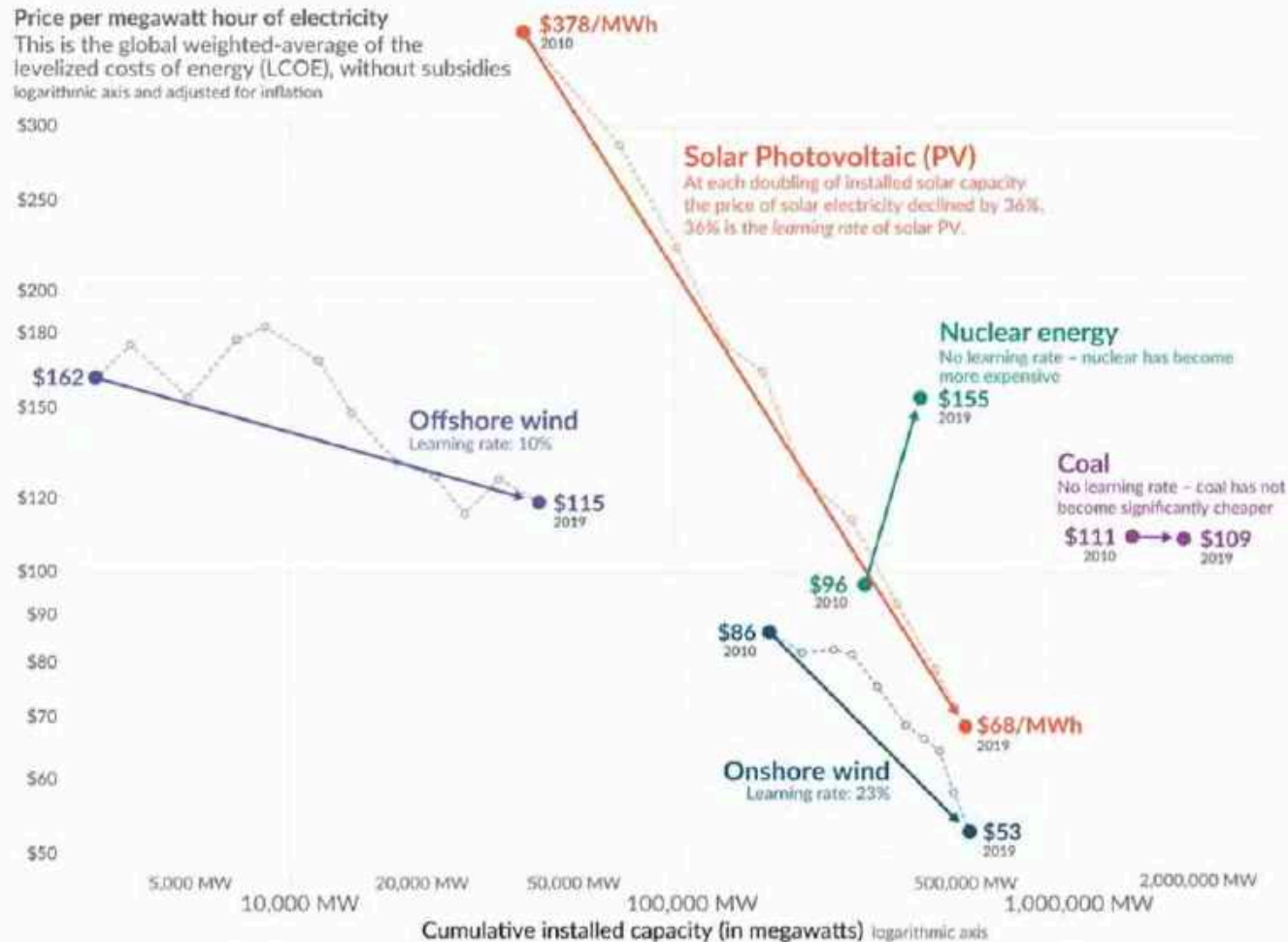


Prof. Clas-Otto Wene, Chalmers Univ. of Technology, 2000

Electric Technologies in EU 1980-1995



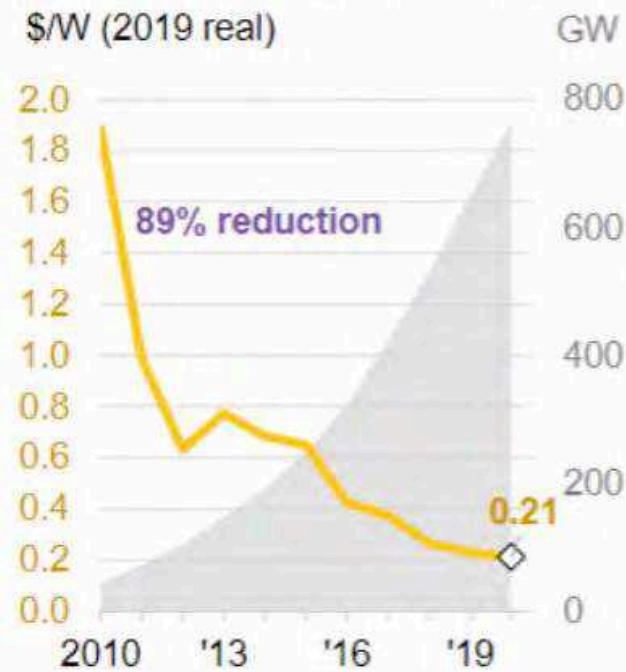
Electricity from renewables became cheaper as we increased capacity – electricity from nuclear and coal did not



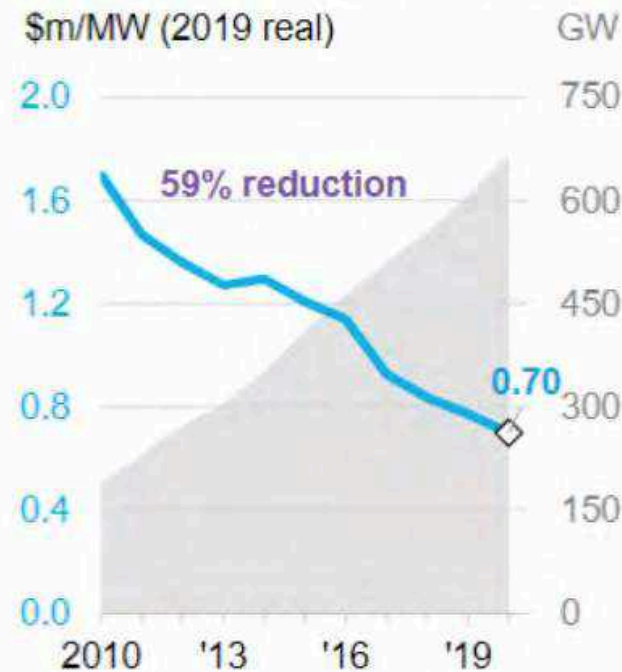
Source: IRENA 2020 for all data on renewable sources; Lazard for the price of electricity from nuclear and coal – IAEA for nuclear capacity and Global Energy Monitor for coal capacity. Gas is not shown because the price between gas peaker and combined cycles differs significantly, and global data on the capacity of each of these sources is not available. The price of electricity from gas has fallen over this decade, but over the longer run it is not following a learning curve.

Innovation and scale impacts on renewable technologies

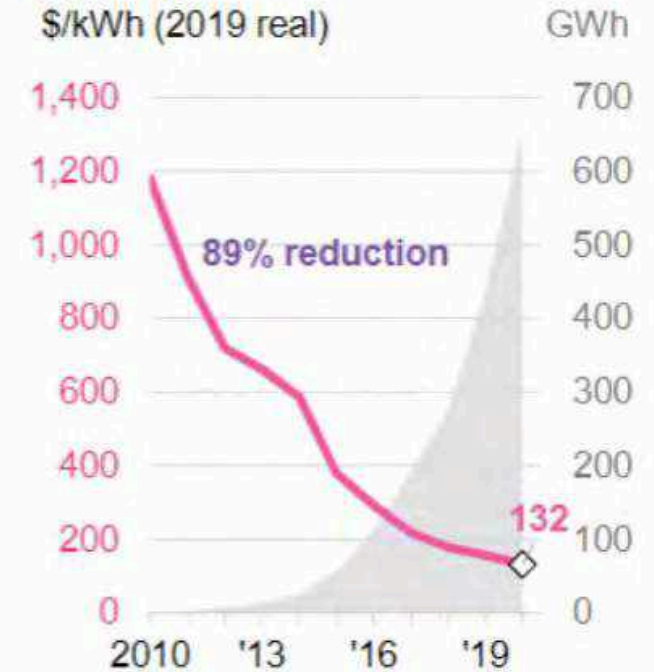
PV module price and cumulative installed capacity



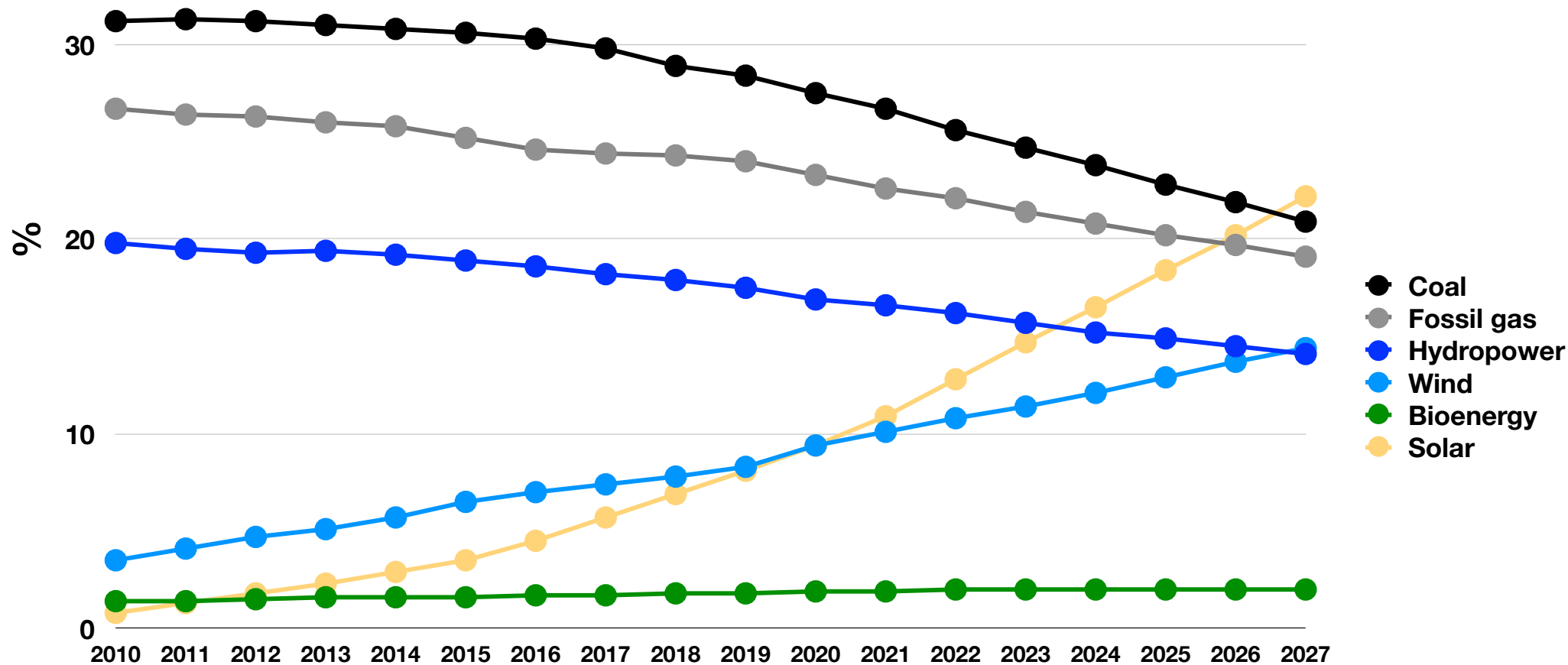
Onshore wind turbine price and cumulative installed capacity



Li-ion battery pack price and demand



Source: BloombergNEF.



IEA, Share of cumulative power capacity by technology, 2010-2027, IEA, Paris <https://www.iea.org/data-and-statistics/charts/share-of-cumulative-power-capacity-by-technology-2010-2027>, IEA. Licence: CC BY 4.0

100% renewable energy
– easier than just 100% RES electricity.
2023-08-31

Tomas Kåberger

professor Chalmers University of Technology
Executive Board Chair of Renewable Energy Institute, Tokyo