

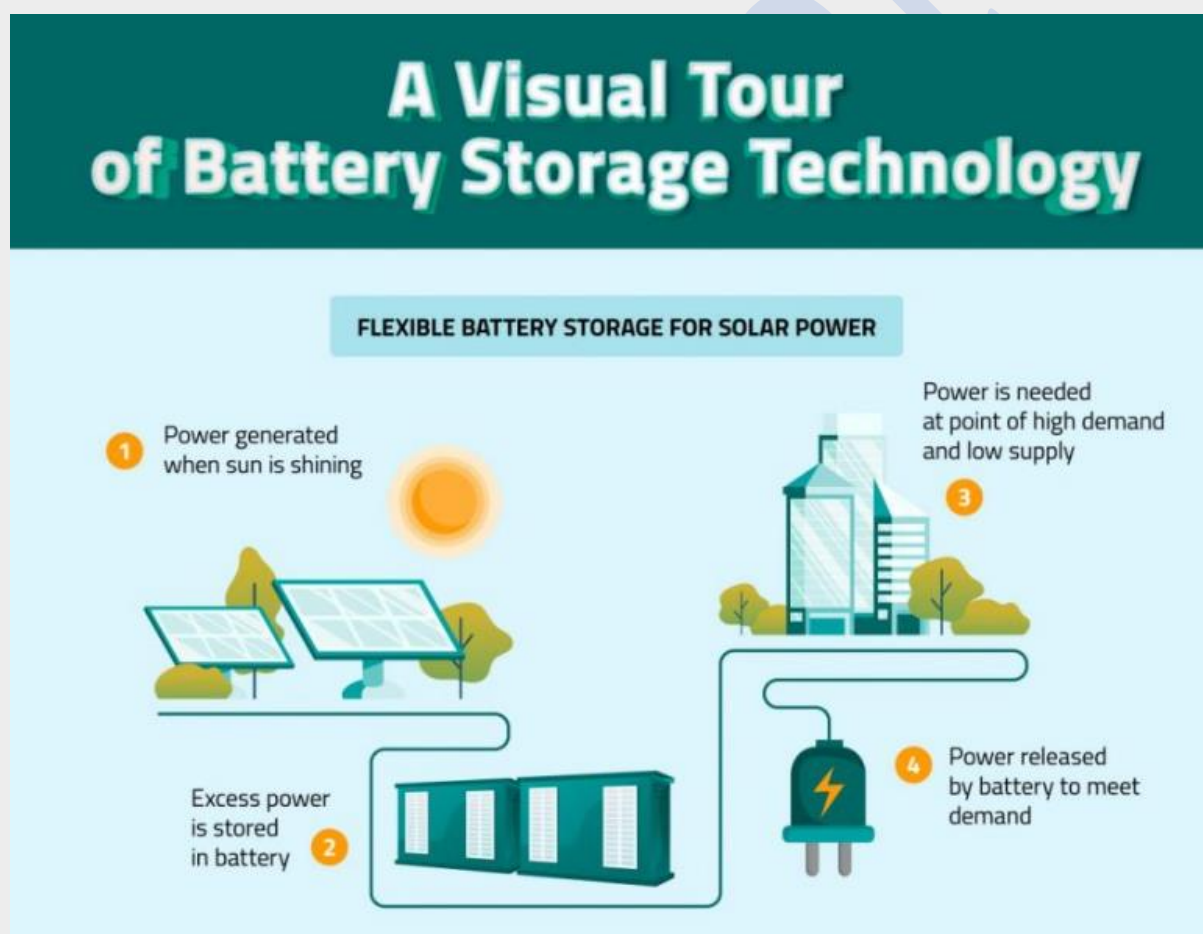
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1. Why battery storage is essential for a renewables-heavy electricity grid

Introduction

With India targeting to have half of its electric power capacity come from renewables by 2030, the resilience and stability of its power grid have never been more critical. Renewables, while essential for a sustainable future, come with their own set of challenges.



Foremost among these is the inherent variability of renewable energy sources like wind and solar. Unlike traditional energy sources that provide a consistent and predictable output, renewable energy generation fluctuates based on weather conditions, posing a risk to grid stability. The electricity grid, thus, needs to be equipped with additional flexibility that will allow power generation to be ramped up or down based on demand.

To this end, a separate market for grid-flexible resources, called the ancillary services market, will have to be set up. Such markets exist in all geographies where the share of renewable energy in the grid has breached the 15-20% mark (renewables make up roughly 10% of India's energy portfolio at the moment).

Ancillary Services

In absence of infrastructure that can store electricity in large amounts, it must be produced as it is used. The electricity grid responds to shifting demand to continuously generate and route electricity to where it is needed the most.

This is all fine when it comes to traditional energy sources, with their consistent and predictable output. However, fluctuations in scheduled dispatches of electricity generated from renewables could have an error of 3-5%. For an installed renewables capacity of 500 GW (as India plans to achieve by 2030), a 3% error would amount to a supply reduction of 15 GW, enough to cause a severe imbalance in the grid.

Ancillary services provide quick, real-time adjustments to balance supply and demand of power. There are three kinds of ancillary services:

- Primary services respond to fluctuations in real-time (less than a second), which makes them the most relevant in addressing imbalances in renewables-heavy grids. They can only be provided via hydroelectricity, and battery storage (more on that later).
- Secondary services respond to fluctuations within 10-15 minutes. These comprise gas-based capacities.
- Tertiary services take about 20-30 minutes to respond, and comprise thermal power plants, including the coal-fired plants that remain in use in India.

The Covid Example

To illustrate just how these services would work, it will be useful to recall the evening of April 5, 2020 during the first Covid-19 lockdown. Prime Minister Narendra Modi had called for a switching off of lights at 9 pm for 9 minutes. This led to a sudden load reduction of almost 15 GW at 9 pm, and a subsequent increase in load at 9.09 pm.

A Power System Operation Corporation Ltd (POSOCO) report published after the event outlined how the grid was managed. The load reduction was carried out in a phased manner, a few minutes before 9 pm by reducing power generation from thermal, gas, and hydel sources by about 11 GW. At 9.10 pm, hydropower stations were ramped up to supply approximately 17.5 GW, enough to handle the sudden surge in demand.

The unique characteristic of hydropower — the ability to instantly ramp up or down — was crucial in this regard. Gas and thermal power stations require 8-20 minutes to do the same. The only other resource with similar characteristics as hydropower in this regard is battery storage.

This is more so because unlike in the Covid-19 event, which was meticulously planned for in advance, real life situations may not serve any advance notice. For the 9 minute long event, POSOCO had assumed full control of hydropower resources in advance, effectively removing it from the energy market and operating it independently.

Need for Battery Storage

The deployment of Battery Energy Storage Systems (BESS) within the ancillary services market will be crucial as India's grid becomes more renewables-heavy. This is because BESS is the fastest in responding to grid contingencies, and can transition from standby to full power in under a second. It can provide essential services such as frequency control, voltage regulation, congestion relief, peak shaving, power smoothing, and peak capacity support, making it an invaluable asset in the modern grid.

The Global Energy Alliance for People and Planet (GEAPP) partnered with BSES Rajdhani Power Limited (BRPL) and IndiGrid to launch India's first commercial-scale BESS pilot in New Delhi earlier this year. This 20MW/40MWh project (which can provide up to 20 MW of power for two hours) is designed to provide reliable power access to over 12,000 low-income consumers in Delhi.

The Central Electricity Regulatory Commission has identified the need for 4 GW of such capacities to ensure grid flexibility and stability. By 2031-32, India has estimated a storage requirement of 73.93 GW, a majority of which is expected to come from BESS.

Relevance: GS Prelims & Mains Paper III; Science & Technology

Source: Indian Express

2. Elon Musk-owned X to resume ops in Brazil: why did Brazil Supreme Court order shutdown?

Introduction

A protest of a Brazilian Supreme Court decision that banned the social network X from operating in the country, in São Paulo, Sept. 7, 2024. Brazil's Supreme Court said that Elon Musk's social network could return in the country after a monthlong ban because the company had complied with the court's orders.

Brazil's Supreme Court Orders X to Pay Fines for Service Resumption



Brazil's Supreme Court recently revoked a ban on X (formerly Twitter) after the Elon Musk-owned company agreed to comply with its order. This comes over a month after X services were suspended in Brazil following the apex court's order on August 30.

Justice Alexandre de Moraes, in his order, authorised the "immediate return" of X to the country after the site paid fines totalling 28 million reais (\$5.1m) and agreed to appoint a local representative, as required by Brazilian law. This development follows a months-long feud between Musk and Moraes.

Musk's beef with the judge

The order to ban X in Brazil came after a 24-hour deadline imposed by the Supreme Court on X to name a representative in Brazil passed on August 29. This came weeks after X claimed Justice Alexandre de Moraes had threatened its former legal representative with arrest if the platform did not comply with orders to block some accounts. The representative later resigned. Earlier this year, Justice Moraes ordered X to block accounts allegedly spreading disinformation. This has been a longstanding concern in Brazil.

However, on April 7, X's Global Government Affairs complained of being forced to block "certain popular accounts in Brazil" for unknown reasons, and Musk called for the impeachment of Justice Moraes. He has since targeted the judge repeatedly, and called him "the dictator of Brazil".

On August 30, the GGA account said it "would not comply with his (Justice Moraes') illegal orders to censor his political opponents...we will publish all of Judge de Moraes' illegal demands and all related court filings in the interest of transparency".

Musk has claimed to be a "free speech absolutist", saying governments instructing the blocking of accounts infringes on people's free speech rights. But X has complied with some government requests earlier, like in the case of India. Musk was also accused of hypocrisy and silencing his critics when the X accounts of several journalists were suspended in January.

Justice Alexandre de Moraes said on April 7 that Musk was waging a "disinformation campaign". He referenced Musk's actions in his order, saying, "The flagrant conduct of obstruction of Brazilian justice, incitement of crime, the public threat of disobedience of court orders and future lack of cooperation from the platform are facts that disrespect the sovereignty of Brazil."

Who is Justice Alexandre de Moraes?

Justice Moraes oversaw the case against former right-wing Brazilian President Jair Bolsonaro (2019-2022), over the January 8, 2023 riots in Brasilia. Bolsonaro's supporters entered and attacked government buildings, a week after socialist President Luiz Inacio Lula da Silva was sworn in after winning the 2022 elections. Musk has been a great supporter of Bolsonaro, who called him a "true legend of freedom".

Many right-wing Brazilians see de Moraes as a biased judge. In 2022, he ordered a temporary ban on the messaging app Telegram for not complying with an investigation into neo-Nazi chat groups. However, a federal court later lifted the restriction, saying a ban was "not reasonable" for the freedom of communication for other users.

The judge's recent orders have come under wider scrutiny. For instance, he set a daily fine of 50,000 reais (\$8,900) for people or companies using virtual private networks or VPNs to access X. According to The New York Times, Justice de Moraes also imposed a fine of \$3 million on Musk and froze the assets of Starlink, Musk's satellite internet service. In defiance, Musk told Brazil's telecom agency that Starlink would not block access to X.

The ban on X followed the French government's arrest of Telegram CEO Pavel Durov, over crimes like child pornography on the app. Telegram said it was "absurd" to hold Durov responsible, bringing forth the tensions between governments and tech giants over regulations on speech.

President da Silva's government has supported the judge. Solicitor General Jorge Messias earlier said in a post on X, "We cannot live in a society in which billionaires domiciled abroad have control of social networks and put themselves in a position to violate the rule of law, failing to comply with court orders and threatening our authorities."

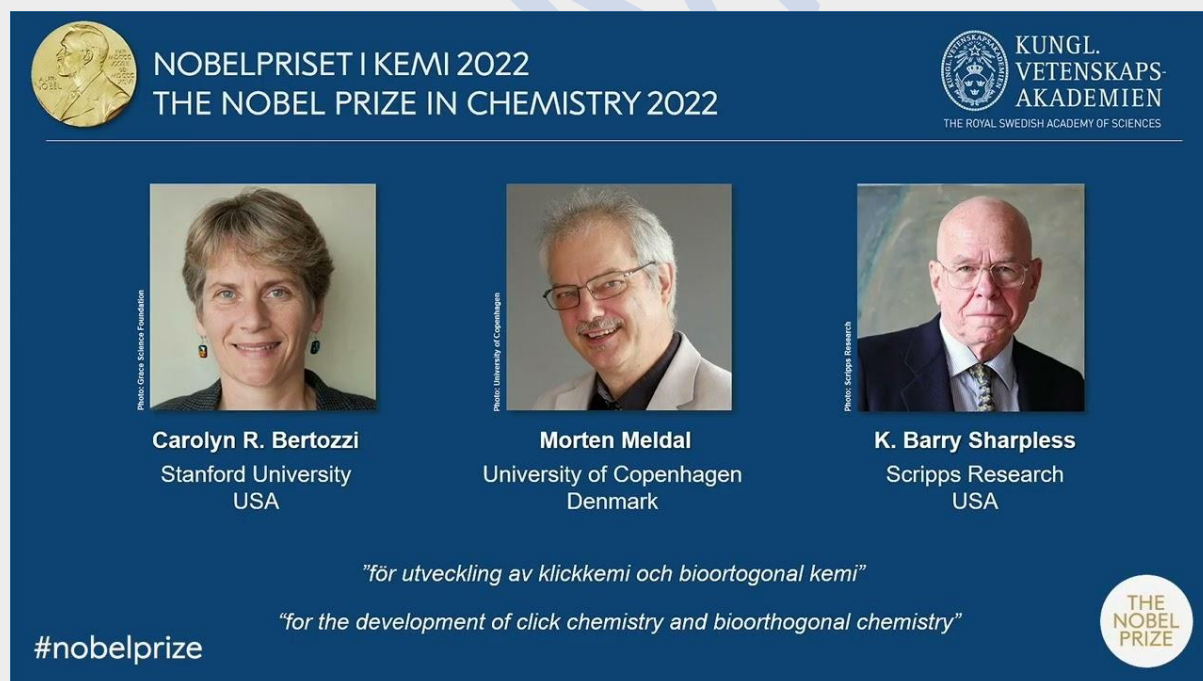
Relevance: GS Prelims & Mains Paper II; International Issues

Source: Indian Express

3. Chemistry Nobel 2024 out: What exactly have the winners done, why it matters

Introduction

2024 Nobel Prize in Chemistry: The Nobel Prize in Chemistry 2024 has been awarded to David Baker, Demis Hassabis and John M Jumper. While Baker (62), who works at the University of Washington, Seattle, won "for computational protein design", the American Jumper (39) and Briton Hassabis (48), who both work at Google DeepMind, were honoured for "protein structure prediction".



The graphic is a blue rectangular banner for the Nobel Prize in Chemistry 2022. At the top left is a gold Nobel medal. To its right, the text reads "NOBELPRISET I KEMI 2022" and "THE NOBEL PRIZE IN CHEMISTRY 2022". On the top right is the logo of the Kungliga Vetenskapsakademien (The Royal Swedish Academy of Sciences). Below the title, three portraits of the winners are shown in a row. Each portrait is accompanied by the winner's name and affiliation. Below the portraits is the award citation in Swedish and English. At the bottom left is the hashtag #nobelprize, and at the bottom right is a circular logo that says "THE NOBEL PRIZE".

NOBELPRISET I KEMI 2022
THE NOBEL PRIZE IN CHEMISTRY 2022

Carolyn R. Bertozzi
Stanford University
USA

Morten Meldal
University of Copenhagen
Denmark

K. Barry Sharpless
Scripps Research
USA

"för utveckling av klickkemi och bioortogonal kemi"
"for the development of click chemistry and bioorthogonal chemistry"

#nobelprize

THE NOBEL PRIZE

The Chemistry Nobel is the third to be announced, and combines work on cell proteins and Artificial Intelligence, which won the Nobels for Medicine and Physics respectively this year.

What exactly have Baker, Hassabis and Jumper done, and why is it important? We explain.

First, why is work on proteins important?

Proteins are fundamental to almost all biological processes, or as the Nobel Prize website poetically says, to “the exuberant chemistry of life”. In human bodies, for example, the protein haemoglobin transports oxygen, insulin helps absorption of glucose from blood, etc. Thus, anything that impacts protein production can have consequences for human health.

Given their central importance, proteins have been extensively studied for a long time. There was even a competition about predicting protein structures running from 1994 (called Critical Assessment of Protein Structure Prediction, or CASP), which ended only after Jumper’s contributions to Hassabis’s work helped them win it decisively in 2020. Baker, separately, had participated in the competition in 1998.

What did Jumper and Hassabis do?

Proteins are built from 20 amino acids, joined into long strings. As the Nobel Prize website explains, the “string of amino acids twists and folds into a distinct – sometimes unique – three-dimensional structure. This structure is what gives proteins their function.”

In the 1960s, Christian Anfinsen, an American scientist, got a protein structure to unfold and fold itself. He found that the protein assumed exactly the same shape every time, and realised that this shape is determined by its sequence of amino acids.

This created an exciting possibility: “if chemists know a protein’s amino acid sequence, they should be able to predict the protein’s three-dimensional structure,” the Nobel website says. This prediction eluded scientists for a long time.

Hassabis, meanwhile, had been working in the field of AI, and had co-founded DeepMind, which built AI models for boardgames and was later sold to Google. In 2018, he entered the CASP. His team built an AI model called AlphaFold, which displayed around 60 per cent accuracy in predicting protein structures. While impressive at the time, this accuracy rate was not good enough. Research on AlphaFold continued, but saw a breakthrough only after Jumper joined Google DeepMind.

And what did Baker do?

Baker developed Rosetta, a software to predict protein structures.

“Baker made his debut in the CASP competition in 1998 using Rosetta and, in comparison to other participants, it did really well. This success led to a new idea – that David Baker’s team could use the software in reverse. Instead of entering amino acid sequences in Rosetta and getting protein structures out, they should be able to enter a desired protein structure and obtain suggestions for its amino acid sequence, which would allow them to create entirely new proteins,” the Nobel website says.

Baker and his team succeeded, and today, a variety of new proteins with various functions can be created in labs.

Why is their work important?

As the Nobel website says, “That we can now so easily visualise the structure of these small molecular machines is mind boggling; it allows us to better understand how life functions,

including why some diseases develop, how antibiotic resistance occurs or why some microbes can decompose plastic.”

“The ability to create proteins that are loaded with new functions is just as astounding. This can lead to new nanomaterials, targeted pharmaceuticals, more rapid development of vaccines, minimal sensors and a greener chemical industry – to name just a few applications that are for the greatest benefit of humankind,” the website adds.

Relevance: GS Prelims & Mains Paper III; Science & Technology

Source: Indian Express

4. What is fortified rice? Why did Centre extend initiative for its distribution in schemes

Introduction

The Union Cabinet recently extended the universal supply of fortified rice in all central government schemes providing free food grain under the National Food Security Act, 2011, in its present form, until December 2028.

In a briefing on the Cabinet decision, Union Information and Broadcasting Minister Ashwini Vaishnaw said that the aim of this was to “address anaemia and micro-nutrients deficiency”.

The Cabinet Committee on Economic Affairs (CCEA), in April 2022, had decided to implement the rice fortification initiative throughout the country in a phased manner by March 2024. All three planned phases have now been successfully completed, with the target of universal coverage achieved by March 2024, an official statement following the Cabinet announcement said.

What is rice fortification, and why is it needed?

The Food Safety and Standards Authority of India (FSSAI), country’s top food regulator, defines fortification as “deliberately increasing the content of essential micronutrients in a food so as to improve the nutritional quality of food and to provide public health benefit with minimal risk to health”.

India has very high levels of malnutrition among women and children.

According to the Food Ministry, every second woman in the country is anaemic, and every third child is stunted.

“According to the National Family Health Survey (NFHS-5) conducted between 2019 and 2021, anaemia remains a widespread issue in India, affecting children, women, and men across various age groups and income levels. Besides iron deficiency, other vitamin and mineral deficiencies, such as Vitamin B12 and folic acid, also persist, impacting the overall health and productivity of the population,” the aforementioned government statement said.

Fortification of food is considered to be one of the most suitable methods to combat malnutrition. Rice is one of India’s staple foods, which is consumed by about two-thirds of the

population. Per capita rice consumption in India is 6.8 kg per month. Fortifying rice with micronutrients is an option to supplement the diet of the poor.

What is the process by which rice is fortified?

Various technologies, such as coating, dusting, and 'extrusion', are available to add micronutrients to regular rice. The last mentioned technology involves the production of fortified rice kernels (FRKs) from a mixture using an 'extruder' machine. It is considered to be the best technology for India.

Dry rice flour is mixed with a premix of micronutrients, and water is added to this mixture, which is then passed through a twin-screw extruder with heating zones. Kernels similar in shape and size to rice are produced, which, as per Ministry of Consumer Affairs, Food and Public Distribution guidelines, must "resemble the normal milled rice as closely as possible".

The kernels are dried, cooled, and packaged. FRK has a shelf life of at least 12 months. The kernels are blended with regular rice to produce fortified rice. Under the Ministry's guidelines, 10 g of FRK must be blended with 1 kg of regular rice.



According to FSSAI norms, 1 kg of fortified rice will contain the following: iron (28 mg-42.5 mg), folic acid (75-125 microgram), and vitamin B-12 (0.75-1.25 microgram).

Rice may also be fortified with zinc (10 mg-15 mg), vitamin A (500-750 microgram RE), vitamin B-1 (1 mg-1.5 mg), vitamin B-2 (1.25 mg-1.75 mg), vitamin B-3 (12.5 mg-20 mg) and vitamin B-6 (1.5 mg-2.5 mg) per kg.

How is fortified rice cooked and eaten?

It is no different from the way any rice is cooked and eaten. The rice needs to be cleaned and washed in the normal way before cooking. After cooking, fortified rice retains the same physical properties and micronutrient levels as it had before cooking.

Fortified rice is packed in jute bags with the logo ('+F') and the line "Fortified with Iron, Folic Acid, and Vitamin B12".

How has the fortification initiative fared so far?

In his Independence Day speech in 2015, Prime Minister Narendra Modi announced that rice distributed under various central government schemes like the Public Distribution System (PDS) and Mid-Day Meal Scheme in schools, would be fortified by 2024. In April 2022, the Centre cleared a phase-wise plan to implement the rice fortification initiative.

Phase 1 had already been implemented when the Centre's plan was cleared. It saw two programmes — Integrated Child Development Services and PM POSHAN — covered by March 2022.

Phase 2 extended the supply of fortified rice to PDS and other welfare schemes in 112 Aspirational Districts in 27 states, and 291 high stunting burden districts by March 2023.

Phase 3 saw all remaining districts in the country get covered under the initiative by March 2024.

The cost of rice fortification is around Rs 2,700 crore per annum — less than 2% of India's annual total food subsidy bill. Since the 2019-20 fiscal year through March 31, 2024, approximately 406 lakh metric tonnes (LMT) of fortified rice have been distributed through the PDS, the government said in a statement issued in July this year.

As per officials, there are 925 fortified rice manufacturers in the country, with a capacity of 111 LMT per annum. FRK produced by these manufacturers are sent to India's 21,000-odd rice mills for blending. Installed blenders in these mills have a monthly capacity to produce 223 LMT of fortified rice.

According to Vaishnav, the Centre has invested Rs 11,000 crore for developing the fortified rice supply chain in India.

Relevance: GS Prelims & Mains Paper III; Science & Technology

Source: PIB