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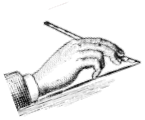

# IMPORTANT

# EDITORIAL HIGHLIGHTS


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# GS 2: INTERNATIONAL RELATIONS

# INDIAN EXPRESS PAGE: 10

# In Delhi's support for Arab Gulf, a return of the Bombay school of thought

RAJA MANDALA
C RAJA MOHAN

WHETHER THE Iran war escalates into a more devastating confrontation or cools into a diplomatic mode this week, one fact is now beyond dispute: The Gulf has moved decisively to the very top of India's strategic priorities. Geography alone should have made this happen long ago. The Gulf is not a distant theatre; it is India's immediate neighbourhood, separated only by a narrow stretch of water and tied to the Subcontinent through deep economic, social, and security ties. India's approach to the current war suggests that Delhi will no longer treat the Gulf as a peripheral region.

The Gulf's new centrality also revives an older debate in modern India's strategic imagination — the contest between the so-called "Bombay School" and "Ludhiana School". The terms may sound strange to contemporary ears, but they capture two enduring ways of thinking about India's geopolitics.

The story begins in the late 18th century, when the British Raj, newly ascendant in the Subcontinent, confronted a dramatic external shock: Napoleon's conquest of Egypt in 1798. His ambitions in the eastern Mediterranean and the Middle East exposed the vulnerability of the Indian empire's western approaches. The result was the birth of the "Great Game", the prolonged contest between Britain and its European rivals for influence across the territorial arc from the Levant to the Hindu Kush. Out of this crucible emerged two distinct strategic visions. Both saw the need for defending India well beyond its territorial borders. They diverged on questions of geographic focus and policy instruments.

The Bombay School, shaped by the commercial dynamism of the emerging Parsi and Gujarati capitalists operating in the space created by the empire in western India and the Arabian Sea, saw India's security beginning at sea. Its leading figures — John Malcolm and Mountstuart Elphinstone — viewed Persia and Arabia as the natural outer ring of India's defence.

Their instincts were outward-looking and maritime. Malcolm's early 19th-century missions to Tehran sought to anchor Persia in a British-Indian orbit through diplomacy and trade. Elphinstone, as governor of Bombay, expanded the East India Company's naval presence in the Persian Gulf and concluded security arrangements with the Arab coastal principalities — the entities that would later become the Trucial States. For the Bombay School, the key to India's security lay in controlling sea lanes, shaping littoral politics, and projecting influence across the Gulf. Ports, commerce, and naval power were its natural instruments.

The Ludhiana School — where the East India Company agents were located before gaining full control of the Punjab — was continental in orientation. Figures such as Henry Lawrence, John Lawrence, and Claude Wade operated in a world shaped by tribal politics, feudal forces, and shifting alliances in the effort to prevent European penetration through Central Asia and Afghanistan. For them, Afghanistan was the lynchpin. The defence of India required forward fortifications, tribal militias, and political manipulation in the highlands beyond the Indus.

> The Bombay School saw India's security beginning at sea. Its leading figures — John Malcolm and Mountstuart Elphinstone — viewed Persia and Arabia as the natural outer ring of India's defence

The First Anglo-Afghan War (1839–42) was the decisive collision between these two schools. The Ludhiana School prevailed in policy, pushing the Raj into Kabul to install a friendly ruler. The catastrophic retreat from Afghanistan vindicated the Bombay School's scepticism about continental adventures. Yet the Ludhiana logic proved resilient. As the Raj consolidated the Punjab and fretted about Russian expansion, the Ludhiana School entrenched itself.

After 1947, Pakistan inherited this tradition. Its quest for "strategic depth", the search for a protectorate in Afghanistan, its reliance on tribal proxies, and its entanglement with extremist forces all flowed from the Ludhiana worldview. Rawalpindi's neglect of Karachi — once a vital node of the Bombay Presidency's maritime universe — reflected the same landlocked worldview. It was only China's rise and its maritime ambitions that put Pakistan's coastline back on the strategic map.

Independent India, too, drifted toward the Ludhiana mindset. Partition created new land borders with Pakistan that had to be defended. Delhi's socialist turn diminished the role of trade, ports, and maritime strategy. The three great port cities — Bombay, Calcutta, and Madras — ceded primacy to a land-centric capital.

Economic reforms in the 1990s and the new focus on trade put the maritime world back in the reckoning. But the persistent demands of contested land borders kept Delhi's strategic gaze fixed on the continent. It was the rapid rise of the oil-rich Gulf — and the massive flows of labour, remittances, energy, and capital — that gave unacknowledged heft to the Bombay School.

Today, nearly 9 million Indian workers, nearly $50 billion in annual remittances, and critical energy and logistics dependencies tie India inextricably to the Gulf. The region has become a vital extension of India's economic and social space. Revolutionary Iran's confrontational politics after 1979 limited Delhi's engagement with Tehran, but the Arab Gulf steadily assumed the centrality that Persia once held for Malcolm and Elphinstone.

The revival of the Bombay School does not mean India can ignore the challenges on its northwestern marches. The enduring hostility with Pakistan remains real. The task for Delhi is not to choose between maritime and continental imperatives but to integrate them — to anchor maritime India firmly in the Gulf while maintaining credible military deterrence on the land frontier.

Meanwhile, the rise of political moderation and economic openness in Arabia stands in sharp contrast to Iran's oppressive theocracy and Pakistan's persistent use of religious extremism and violent proxies to destabilise India. In subtle but significant ways, the Arab Gulf's positive political evolution offers India a counterweight to the destabilising impulses emanating from Pakistan and Iran. Delhi's strong support for the Arab Gulf in the current war is, in essence, about the return of the Bombay School.

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# GS 1: MODERN HISTORY

# INDIAN EXPRESS PAGE: 10

# Phule's life and thought, a constitutional project

ANURAG BHASKAR

AS WE mark the beginning of the bicentenary year of Mahatma Jotirao Phule, born on April 11, 1827, he is rightly remembered as a social reformer, educator, fierce critic of caste, and pioneer of women's education. Yet, to stop there is to miss the deeper significance of his work. Phule's life and thought can be understood as a constitutional project. Even if it did not produce a legal text, it reimagined the foundations of social order on the principles of equality, dignity, and the redistribution of power.

Born into a Shudra community, Phule experienced firsthand the injustices of a graded society. Yet, what transformed experience into critique was his encounter with new intellectual resources. Reading English classic texts furnished him with a vocabulary through which he could begin to articulate claims of rights, equality, and justice. A transformational moment was his engagement with Thomas Paine's *Rights of Man* in 1847.

Paine wrote that every individual possesses certain natural rights due to "his existence", and certain civil rights for "being a member of society". Paine also understood a constitution as a foundational structure of political power. A constitution is a "body of elements" containing the principles on which government is organised, with the ultimate purpose of promoting "the general happiness". Phule's subsequent interventions aimed at promoting the rights of all through institutional and structural efforts: The establishment of schools for women and oppressed castes, the opening of public wells to those deemed "untouchable", and advocacy for widow remarriage alongside a critique of child marriage.

Phule was also a keen observer of global constitutional developments. In his seminal work *Gulamgiri* (Slavery), 1873, he situated the struggle against caste oppression within a transnational history of emancipation. In the preface, Phule referred to the abolition of slavery in the US and dedicated the book to "the good people of the United States, as a token of admiration for their sublime disinterested and self-sacrificing devotion" against slavery, "and with an earnest desire that my countrymen may take their noble example as their guide in the emancipation of their Sudra brethren from the trammels of Brahmin thraldom". This positioned Phule as one of the earliest Indian thinkers to envision constitutional responses to the oppression of marginalised communities.

His focus on equality and equitable measures is also evident in his submissions to the Education Commission of 1882. Phule argued for compulsory primary education up to the age of 12. He insisted that higher education must be within the reach of all, and proposed targeted government scholarships for those communities "amongst whom education has made no progress", alongside "more liberal" and proactive measures to advance women's education.

Phule's constitutional imagination extended to the material conditions of labour and agrarian life. In *Shetkaryacha Asud* (Cultivator's Whipcord, 1883), he exposed how caste domination operates within the agrarian economy. The Shudra farmer, he wrote, is so burdened by exploitation and deprivation that even the possibility of sending his children to school is foreclosed. At the same time, he directed sharp criticism at colonial administrators, observing that White officers had neither the time nor the inclination to inquire into the conditions of the cultivators.

What emerges from Phule's writings and interventions is a deeper insight: That social hierarchy, economic exploitation, and state indifference are mutually reinforcing. He identified the failure of governance to respond to systemic injustice. In doing so, he implicitly called for a reordering of state priorities to focus on the lived conditions of the most vulnerable.

Phule passed away in 1890, but his ideas continued to inform India's evolving constitutional imagination. B R Ambedkar drew upon his vision of social transformation and gave it concrete expression in constitutional guarantees. Phule's bicentenary places upon us a renewed responsibility to confront the continuing challenges of inequality.

What emerges from Phule's writings and interventions is a deeper insight: That social hierarchy, economic exploitation, and state indifference are mutually reinforcing

*Bhaskar is the author of* The Foresighted Ambedkar: Ideas That Shaped Indian Constitutional Discourse

# GS 3: ENERGY

# INDIAN EXPRESS PAGE: 15

• ENERGY

# Kalpakkam: 'Critical' step in 3-stage nuclear programme

**The Kalpakkam fast breeder reactor has attained criticality, a big part of the second stage of the programme. The next step is thorium reactors**

ANIL SASI

INDIA IS among the few countries with considerable experience in developing nuclear technologies. This includes mastery over pressurised heavy water reactor (PHWR) technology — reactors that use natural uranium as fuel and heavy water (deuterium oxide) as a coolant and moderator.

These reactors now comprise the bulk of India's installed nuclear power capacity of 8,180 megawatt electric (MWe), alongside some imported light water reactor units.

Two other technologies are a work-in-progress: fast breeder reactors (FBRs) and a longstanding project aiming to fabricate thorium-based nuclear reactors.

These three technologies — PHWRs, FBRs and thorium reactors — progressing in a series, make up India's ambitious three-stage nuclear power programme. This programme envisages a pathway to utilising India's abundant thorium reserves to generate electricity.

On Monday, India took a major step towards completing the vital second stage — its first indigenous FBR, at Kalpakkam in Tamil Nadu, attained criticality.

Going critical means the initiation of a self-sustaining nuclear fission reaction that will eventually lead to full power generation. It is a key milestone indicating that the reactor core is functioning as designed and that each fission event in the core now releases a sufficient number of neutrons to sustain an ongoing series of reactions.

This major step came after the 500-MWe FBR's "core loading" — or the process of placing nuclear fuel assemblies inside the core — was completed in March 2024.

The Kalpakkam reactor will initially use uranium-plutonium mixed oxide (MOX) fuel, with a "blanket" of a uranium isotope (U-238) around the fuel core that will undergo nuclear transmutation to produce more fuel — hence the name "breeder".

Nuclear transmutation involves the conversion of a chemical element or isotope into another chemical element, with the numbers of protons or neutrons in the nucleus of the atom undergoing a change.

## *The three stages*

The first stage in India's nuclear programme entails the setting up of PHWRs and associated fuel cycle facilities, which is currently in progress. The India-US civil nuclear deal opened the doors for India to buy uranium for its domestic reactors, increasing the pace of its PHWR programme.

The second stage involves deploying FBRs at scale. FBRs are designed to produce more fuel than they consume. The "higher breeding" is desired so that the rate at which power capacity can grow would be higher.

FBRs enable the potential to harness the energy of natural uranium by over 60 times through multiple recycles. These breeder reactors are also crucial for enlarging the inventory of plutonium — produced after the first stage PHWRs — so that a much larger irradiation capacity to produce an isotope of uranium (U-233) at scale for use in the three-stage programme can be built up.

For this, at an appropriate stage, the FBRs would need to be loaded with thorium (Th-232) as the blanket material that would be converted to U-233. With sufficient inventory and production capacity for U-233 having built up, the move onto the third stage can then happen.

Thus, FBRs are a key link between the first and third stages of the programme.

## *Second-stage plans*

India's FBR programme began in 1985 with the operationalisation of a 13.5MWe Fast Breeder Test Reactor.

The 500-MWe prototype Kalpakkam FBR, indigenously designed and built, is now in an advanced stage of commissioning. Besides the Kalpakkam FBR, India plans to construct six more FBRs with a capacity of 600MWe each. Two of these six reactors are planned to be constructed at the site adjacent to the prototype FBR, and another site will be identified to build four more reactors, according to an expert committee report of the Vivekananda International Foundation.

Successive governments have nurtured the FBR project as a step towards India developing comprehensive capabilities that span the entire nuclear fuel cycle, by which electricity is produced from uranium in nuclear power reactors. In 2003, when Atal Bihari Vajpayee was prime minister, the Bharatiya Nabhikiya Vidyut Nigam Ltd or BHAVINI was incorporated to build and operate what was then India's most advanced nuclear reactor, the prototype FBR. The project was expected to be completed by September 2010, but was delayed due to technological challenges. The last set of approvals had revised the completion target to October 2022.

Once commissioned, India will be the second country after Russia to have a commercial operating FBR. China has a small programme on fast breeders; programmes in countries such as Japan, France, and the US were shut down amid safety concerns.

The Department of Atomic Energy aims to increase nuclear power capacity to 22,400 MWe by 2032. It has approved the construction of 10 new PHWRs in "fleet mode", in which a plant is expected to be built in five years from the first pouring of concrete.

## *Key for third stage*

The second stage leads to the third phase where thorium can be used as the main fuel. The three stages, in this process, involve the conversion of "fertile material" (which is not fissionable by thermal neutrons) into fissile material.

For example, U-238, the dominant isotope of uranium, is a fertile material that cannot by itself make the reactor achieve criticality, and has to be converted to fissile plutonium (Pu-239) in a reactor.

The spent fuel from thermal reactors contains Pu-239, which is most efficiently burnt in a fast reactor or FBR.

Thorium-bearing monazite too, is a fertile material that has to be converted to the fissile U-233. India has adopted a "closed fuel cycle" approach, which involves the reprocessing of spent fuel to separate the useful Pu-239 and U-233 isotopes from U-238 and Th-232. To multiply the fissile inventory and to gradually work towards establishing a higher power base, it is key to ultimately use thorium in the third stage of the programme.

The FBR is clearly being seen as an important milestone for getting to the third stage, clearing the way for the full utilisation of the country's thorium. Transitioning to thorium-based nuclear power generation in India is vital for securing energy independence, which requires building sufficient inventory of fissile U-233 through irradiation of thorium in thermal or fast nuclear reactors of relevant capacity, according to nuclear scientist Anil Kakodkar.

Now that India is able to build a large PHWR capacity with imported uranium (as fuel), the country has the possibility of using this reactor capacity for conversion of thorium to fissile uranium through irradiation of thorium along with HALEU (a fuel variant called high assay, low enriched uranium) in the country's indigenous PHWRs at scale, he told *The Indian Express*.

This enables the launch of the thorium phase (the third phase of India's three-stage nuclear programme) earlier than envisaged, without having to wait for build up of required FBR capacity that comprises the second stage.

A file photo of the Kalpakkam Nuclear Complex. IAEA/WIKIMEDIA COMMONS

### Setting the stage

Once the Kalpakkam project is commissioned, India will be the second country after Russia to have a commercial operating FBR

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China has a small FBR programme. Programmes in countries such as Japan, France, and US were shut down amid safety concerns

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# GS 3: ENVIRONMNT

# THE HINDU PAGE : 9

# On India's updated climate pledges

India's announcement of its revised Nationally Determined Contributions (NDCs) to the Paris Agreement prompts scrutiny of its existing climate mitigation actions and the need to factor in the country's developmental costs alongside those of meeting its climate commitments

FULL CONTEXT

T. Jayaraman

India's announcement of its revised Nationally Determined Contributions (NDCs) to the Paris Agreement – the term applied to the mitigation and other climate action targets that countries voluntarily commit to under the agreement – represents a considered step forward when India's energy and development policies are encountering serious headwinds. It is clear that the government has opted for continuity and incremental advance with respect to India's earlier NDCs. It is also clearly confident that its commitments will nevertheless be more than adequate in relation to its equitable share of global climate action, in keeping with climate justice and within its expected commitments as a developing nation.

**Three climate goals**

As the press communique after the Cabinet approval of the updated NDCs noted, there are three specific enhancements that have been committed. The first is an increase in the reduction of emissions intensity of its GDP, from 45% below 2005 levels by 2030 to 47% below 2005 levels by 2035. The second is ensuring that 60% of installed capacity for power generation is from non-fossil fuel sources, while the third is the enhancement of forest and tree cover carbon sinks to 3.5 – 4 billion tonnes of carbon dioxide equivalent above 2005 levels.

India's climate policies are best understood in the context of its structural constraints as a lower middle income developing country, that determine its available choices for climate action. Over the last three decades, these constraints have not substantially changed, which is also why India continues to insist on the relevance of the United Nations Framework Convention on Climate Change (UNFCCC). But apart from these, given the structure of the Paris Agreement that requires renewed and enhanced commitments to climate mitigation every five years, short-term considerations have also begun to have a considerable weight in the formulation of the NDCs. The rapid deterioration of the global environment for climate action over the last year has undoubtedly brought this issue to the fore.

**Enthusiasm for climate action**

Structural constraints have not, however, dampened enthusiasm for climate action in India, both at the level of the Centre and the State governments. There is a considerable range of activities designed to set India on the path to low-carbon development, drawing significant public and private sector efforts and resources, including electric vehicles, enhancement of energy efficiency, promotion and deployment of non-fossil fuel sources of electricity generation, new technologies such as green hydrogen and more recently, the active promotion of carbon capture and storage efforts.

But given India's developmental levels today, it is clearly premature for India to convert all such efforts into the significantly more onerous and accountable commitments that are the NDCs, the progress towards which is to be reported every two years in the Biennial Transparency Report (BTR) to the UNFCCC.

A section of global and domestic public opinion has raised the issue of the adequacy of India's NDCs relative to a global temperature goal of 1.5 degree warming above pre-industrial levels (the more ambitious part of the Paris Agreement's goals). Some have downplayed the new targets, one commentator going so far as to call it "a walk in the park". Others call for increased generation from renewables as the metric and not installed capacity. Even some sections of opinion that have welcomed the NDCs, appear nevertheless to be uncertain on whether these new commitments are genuinely the best that India can make at this time.

A drone view of solar panels and the NTPC (National Thermal Power Corporation) power plant in Solapur, Maharashtra. REUTERS

**The cost of going green**

All the above variants of the "India can (must) do more argument" ignore some critical realities that contextualise India's climate actions. Given that India's natural energy source is overwhelmingly coal, it is inaccurate to view improvements in emissions efficiency of GDP and the corresponding bending of its emissions trajectory as a "natural" corollary of India's growth story. Priority to electricity from renewable sources comes with significant costs, including backing down readily available and often cheaper or comparably priced coal-based thermal power, further tilting a playing field that privileges renewable energy to sustain our climate commitments.

Renewable energy (RE) projects including utility scale battery storage have begun to make their appearance in India's power sector. But the corresponding scaling up of India's battery storage capacity, required for ensuring the stability of generation even from the proposed 2030 RE targets will run into a few trillion rupees at least. Part of such expansion would have to be funded by the government, deploying resources that would have been utilised in other sectors. At the very least, the deployment of such large scale battery systems is not immediately feasible. The most globally widespread option of energy storage in reverse pumped hydropower systems, has very limited scope in India at present. Additionally, environmental concerns, and water needs for competing uses such as irrigation, as well as the regulatory challenges faced by all large hydro projects are likely to preclude any rapid expansion.

Optimistic RE projections, not only in India but even globally, have run into the lack of transmission capacity and the challenges of grid balancing, with the associated costs often omitted when referring to the cost-effectiveness of RE power.

Since, for India, coal is the mainstay of power generation when solar and wind cease, unlike the large-scale gas and hydro available elsewhere, the full utilisation of the available RE capacity will inevitably have to be "curtailed", while adding to the operation and maintenance costs for thermal power operated in this cyclical fashion. These add further to the true cost that India bears for the pursuit of its climate commitments.

Improving energy efficiency in other sectors is also being pursued vigorously, including the introduction of mandatory emissions intensity targets in key industries. The early ramp up of electric vehicles, while the jump from BSIV to BSVI vehicle emissions standards was just coming into place, was another leap-frog moment, whose cost to the economy must not be underestimated. Since the 26th Conference of Parties of the United Nations Framework on Climate Change at Glasgow, every Central government budget has seen a range of initiatives and resource commitment across various aspects of climate mitigation. Indeed, a major knowledge gap today is that while future costs of increased mitigation action are routinely calculated, the cost burden attached to India's mitigation initiatives undertaken so far, in the absence of any significant climate finance, have yet to be estimated in a reliable manner.

**Accounting for India's developmental future**

At a more over-arching level, India's mitigation challenge cannot be based on a simple extrapolation of the current structural features and trends of its economy.

India's developmental future needs room for further large-scale growth in manufacturing and industry, expansion in the provision of goods and services to its population at adequate levels beyond the minimum, and an urban transition that has only just begun. In this context, the "India can do more" arguments that rely on such extrapolation of economic trends and the persistence of current structural features, miss the urgent need to hedge India's developmental future.

India cannot commit its NDCs to preserving the Paris Agreement goal of limiting global temperature increase to 1.5 degrees above pre-industrial levels, when the goal is rapidly slipping out of reach. This a trend that India cannot reverse, given that its per capita emissions are a third of the global average. Even otherwise, under the voluntary emissions reduction NDCs of the Paris Agreement, the benefits of India's reduction in emissions below any business-as-usual baseline, are distributed primarily to the big emitters globally, due to their inadequate efforts, and proportionately less to India, especially when the largest historical emitter has walked out of all climate treaties and seeks to dismantle climate action both at home and abroad.

India's climate commitments have to be strategic and circumspect, while its NDCs are formulated in informed self-awareness of its, to use the language of the Paris Agreement, "national circumstances."

*(T. Jayaraman is with the National Institute of Advanced Studies, Bengaluru. Views expressed are personal.)*

## THE GIST

- India's climate policies are best understood in the context of its structural constraints as a lower middle-income developing country, which shape its choices for climate action.
- The country has implemented several decarbonisation initiatives, including electric vehicles, deployment of non-fossil fuel power sources, and technologies such as green hydrogen.
- However, India needs room for further large-scale growth in manufacturing and industry, which must be factored in alongside the future costs of its climate commitments.

# GS 3: SPACE

# THE HINDU PAGE : 6

# Energy from space

**Q: What is space-based solar power?**

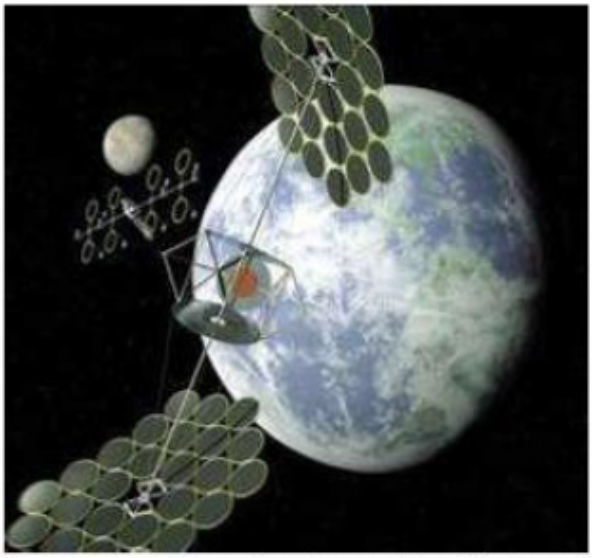
**A:** The Shimizu Corporation in Japan has proposed a belt of power plants sitting along the moon's equator, which is 11,000 km long, called the "Lunar Ring". According to the company's plans, robots can build this mega-structure from lunar soil. The facilities will collect solar energy from the sun and beam it to the earth as microwaves.

If space-based solar power sounds like science fiction, it is exactly that. The concept involves launching large arrays of satellites to collect sunlight 24/7, and beaming the energy to the earth as microwave radiation. The corporation's plans are slightly different — they involve facilities on the lunar surface rather than in earth orbit — but otherwise involve the same physics.

Unfortunately for supporters of the idea, there are daunting hurdles.

The cost of space-based solar is staggering. Even if rocket launch prices drop significantly, engineers must still transport thousands of tonnes of hardware into orbit (or the moon). Building a single functional power plant is an unprecedented logistical feat. Once operational, the system must beam power through the atmosphere, a process that will lose significant energy as heat.

In orbit, a single collision with space debris could cripple a billion-dollar array, turning it into junk. Maintenance will also be extremely expensive on the moon.



A conceptual illustration of a satellite collecting solar energy in earth orbit and beaming it down as microwaves. NASA

Terrestrial solar and battery storage are also getting cheaper and more efficient every year, making it hard to justify a complex and risky orbital or lunar facility. For now, space-based solar remains an idea trapped in poor economics.

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