



**TATHASTU**  
Institute Of Civil Services

# DAILY CURRENT AFFAIRS

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[support@tathastuics.com](mailto:support@tathastuics.com)

HEAD OFFICE: 53/1, UPPER GROUND FLOOR, BADA BAZAR ROAD,  
OLD RAJINDER NAGAR, NEW DELHI-110060

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### A strategy fuelled by vision, powered by energy

#### Syllabus:

- **GS 3 – Indian Economy**

## *A strategy fuelled by vision, powered by energy*

**A** few days ago, India overtook Japan to become the world's fourth largest economy. Since 2014, under Prime Minister Narendra Modi's leadership, India's GDP has more than doubled to \$4.3 trillion in 2025. This is the result of a decade-long strategy centred on reforms, resilience and relentless pursuit of self-reliance.

India has not only become the world's fastest-growing major economy but is also a strategic force. The energy sector, integral to this rise, has undergone a structural transformation during the first year of Modi 3.0, building on 10 years of foundational change.

More importantly, India's growth rate of 6.7% in the last quarter places it on a fast trajectory that none of the other countries can remotely hope to achieve in the coming years.

#### Outlining an energy strategy

India is now the third largest energy and oil consumer, fourth-largest refiner, and fourth-largest LNG importer globally. With energy demand expected to grow two and a half times by 2047 and 25% of incremental global demand set to come from India, the road map is clear: energy security is development security.

The Modi government's energy strategy addresses the energy trilemma of availability, affordability, and sustainability through a four-pronged approach – diversification of sources and suppliers, expansion of domestic production, transition to renewables, and affordability. In the upstream oil and gas sector, India's exploration acreage has doubled from 8% in 2021 to 16% in 2025. With a goal of covering one million square kilometres by 2030, the government aims to unlock 42 billion tonnes of oil and oil-equivalent gas. This expansion has been enabled by landmark reforms such as the reduction of 'No-Go' areas by 99%, streamlined licensing through Open Acreage Licensing Policy (OALP) rounds, and attractive pricing incentives for new gas wells.

The revised gas pricing mechanism – linking prices to 10% of the Indian crude basket and offering a 20% premium for new wells – has enhanced gas availability for city gas networks and industrial usage. To reduce costs and accelerate monetisation, new revenue-sharing contracts allow shared infrastructure among Exploration and Production (E&P) players.

Technological and geophysical efforts have complemented policy reforms. The National Seismic Programme, Mission Anveshan, airborne gravity gradiometry (AGG) surveys, and continental shelf mapping have expanded data and exploration confidence, especially in frontier



**Hardeep S. Puri**  
is Union Minister of  
Petroleum and  
Natural Gas in the  
Government of India

basins such as the Andamans, the Mahanadi, and the Cauvery.

The Oil and Natural Gas Corporation Limited (ONGC) and Oil India have together made over 25 hydrocarbon discoveries across the Mumbai Offshore, Cambay, Mahanadi, and Assam basins in the last four years. Noteworthy among these are the Suryamani and Vajramani wells on the west coast offshore and the Utkal and Konark fields on the east coast deep waters. These discoveries add over 75 MMtoe (million metric tonnes of oil equivalent) and 2,700 MMSCM (million metric standard cubic metres) of gas to India's reserves.

Collaborations with global majors are bearing fruit. ONGC's partnership with bp is projected to boost output from Mumbai High by 44% for oil and 89% for gas. A data centre at the University of Houston now facilitates access to India's exploration datasets for international investors.

Downstream infrastructure has seen parallel expansion. India now operates 24,000 kilometres of product pipelines, nearly 96,000 retail outlets, and has significantly strengthened its strategic reserves and LPG storage. Over 67 million people visit petrol pumps daily, which is testimony to the scale and efficiency of India's fuel supply ecosystem.

India's city gas network has grown from 55 geographic areas in 2014 to 307 in 2025, with piped natural gas (PNG) connections up from 25 lakh to 1.5 crore and over 7,500 compressed natural gas (CNG) stations in operation. Unified pipeline tariffs and city gas expansions have ensured affordable access even in distant States.

#### The focus of the green strategy

Biofuels have emerged as a cornerstone of India's green strategy. Ethanol blending in petrol has surged from 1.5% in 2013 to 19.7% in 2025.

Blending quantities have expanded from 38 crore litres to 484 crore litres. This has saved 1.26 lakh crore in foreign exchange, reduced emissions by 643 lakh MT, and paid ₹1.79 lakh crore to distillers and over ₹1 lakh crore to farmers.

Feedstock diversification ranging from molasses to maize has created a robust ethanol ecosystem. Parallelly, the Sustainable Alternative Towards Affordable Transportation (SATAT) initiative has commissioned over 100 compressed biogas (CBG) plants and aims for a 5% CBG blending mandate by 2028. Central support for biomass procurement and CBG-pipeline connectivity is accelerating circular energy adoption.

Green hydrogen has been given a massive thrust with 8.62 lakh tonnes of production and 3,000 MW of electrolyser tenders awarded. Oil

public sector undertakings are leading from the front – Indian Oil Corporation Ltd. (IOCL) recently awarded a landmark 10 kilo-tonnes per annum (KTPA) green hydrogen tender to Larsen & Toubro for its Panipat refinery. Bharat Petroleum Corporation Limited (BPCL), Hindustan Petroleum Corporation Limited (HPCL), and GAIL India Limited are similarly progressing with large-scale hydrogen projects, while the Numaligarh Refinery Limited (NRL)'s green hydrogen unit in Assam is poised to become a first in the northeast.

India's natural gas pipeline network now spans over 25,000 km; it targets 33,000 km by 2030. Strategic pricing reforms and inclusion of gas in the 'No Cut' category for transport and domestic segments are ensuring supply stability. Gas production has increased steadily from 28.7 billion cubic metre (BCM) in 2020-21 to 36.4 BCM in 2023-24, with further growth projected.

No other country has so drastically altered its 'Systems' as India, as evinced by the Oilfields (Regulation and Development) Amendment Act 2024 which has enabled hybrid leases, allowing renewables alongside hydrocarbons. Discovered small fields (DSF) fields now operate under simplified contracts with minimal compliance burdens, unlocking marginal fields across basins. These sweeping policy reforms show that we are ready to tweak and do more to make India's upstream sector as competitive as any in the world.

Through PM Gati Shakti, the Ministry of Petroleum and Natural Gas has digitally mapped over one lakh assets and pipelines. Integration with the National Master Plan ensures real-time project visibility and synergy across ministries. Key projects such as the Indo-Nepal pipeline and Samruddhi Utility Corridor have benefited from route optimisation and cost savings of over ₹169 crore.

#### A consumer outlook

Affordability remains central. Despite global LPG prices rising by 58%, Pradhan Mantri Ujjwala Yojana (PMUY) beneficiaries pay ₹553 per cylinder, supported by targeted subsidies and compensation to oil companies. Fuel prices in India have been kept stable through excise cuts, insulating citizens from volatility seen in neighbouring countries.

Eleven years into the Prime Minister's transformative leadership, India's energy sector is no longer defined by anxiety. It is now marked by confidence, self-reliance and strategic foresight. Energy is not just a commodity. It is a catalyst for sovereignty, security and sustainable development.

India's energy sector can be defined in three words – confidence, self-reliance and strategic foresight

### Key points from article

- **Economic Growth and Energy Consumption:**
  - ◆ India is now the **third-largest energy and oil consumer**, **fourthlargest refiner**, and **fourth-largest LNG importer** globally.
  - ◆ The country's energy demand is expected to grow **2.5 times by 2047**, with India contributing to **25% of global incremental demand**.
- **Energy Trilemma and Government Strategy:**
  - ◆ The energy strategy addresses the **trilemma** of **availability, affordability, and sustainability**.
  - ◆ Focused on **diversification of sources, domestic production expansion, transition to renewables**, and ensuring **affordable energy**.
- **Oil and Gas Sector Developments:**
  - ◆ India's **exploration acreage** has doubled from **8% to 16% (2021-2025)**, with a target of covering **1 million square kilometers** by 2030.
  - ◆ Major **hydrocarbon discoveries** across multiple basins, adding **75 MMtoe of oil reserves** and **2,700 MMSCM of gas**.
  - ◆ Reforms like **Open Acreage Licensing Policy (OALP)** and **revised gas pricing mechanisms** have encouraged exploration and enhanced domestic gas supply.
- **Expansion of Energy Infrastructure:**
  - ◆ **City gas networks** have increased from **55 to 307 geographic areas (2014-2025)**, with **1.5 crore PNG connections** and **7,500 CNG stations**.
  - ◆ India now has **24,000 kilometers of product pipelines** and **96,000 retail outlets**.
  - ◆ **PM Gati Shakti** has digitally mapped over **1 lakh assets and pipelines**, optimizing project execution.
- **Renewable Energy Transition:**
  - ◆ **Biofuels:** Ethanol blending in petrol has surged from **1.5% (2013)** to **19.7% (2025)**, saving **₹1.26 lakh crore** in foreign exchange.
  - ◆ **Compressed Biogas (CBG):** Over **100 CBG plants** commissioned, with a target of **5% CBG blending mandate by 2028**.
  - ◆ **Green Hydrogen:** India has produced **8.62 lakh tonnes** and awarded **3,000 MW electrolyser tenders** to promote green hydrogen.
- **Strategic Developments in Gas Infrastructure:**
  - ◆ India's natural gas pipeline network has grown from **25,000 km to 33,000 km by 2030**, enhancing stability and ensuring supply security.





- **Affordability and Consumer Welfare:**

- ◆ Despite rising global LPG prices, the **Pradhan Mantri Ujjwala Yojana (PMUY)** keeps costs stable for beneficiaries at **₹553 per cylinder** through targeted subsidies.

## India-Australia defence ties beyond American shadows

### Syllabus:

- **GS 2 – International Relations**

## India-Australia defence ties beyond American shadows

**D**onald Trump's return to the White House has sent shockwaves through the global security landscape. With the North Atlantic Treaty Organization (NATO) being put on a burden-sharing timeline and Mr. Trump's cold transactional approach to security commitments worldwide, the Indo-Pacific too faces a pivotal moment. Yet, this represents a strategic opportunity for middle powers such as India and Australia to deepen their defence relationship.

#### An alignment of interests

Australia's strategic geography – bridging the Indian and Pacific Oceans with territories and military presence near Southeast Asia – complements India's maritime ambitions. The Australian Defence Force (ADF) is experienced in coalition operations and can effectively enable Indian military capabilities, as seen in the recently implemented air-to-air refuelling arrangement. Australia's established relationships with Pacific Island nations align with India's growing interests. Most importantly, both nations share concerns about China's assertiveness and a common vision for sovereign resilience and regional stability.

While Japan, South Korea, and Europe are all valuable partners for India, the New Delhi-Canberra defence relationship has quietly built bureaucratic muscles, which are skeletal in other relationships. Over the past decade, successive Australian Prime Ministers and India's Prime Minister Narendra Modi have elevated this partnership, with Canberra viewing New Delhi as a "top-tier security partner". This foundation now provides the perfect launch pad to navigate a world where American security guarantees appear increasingly conditional.

The bureaucratic muscles of the New Delhi-Canberra relationship include the Comprehensive Strategic Partnership (CSP) 2020 and the 2+2 ministerial dialogue launched in 2021 for high-level strategic coordination. Practical cooperation has advanced through arrangements such as the Mutual Logistics Support Agreement (MLSA), which streamlines logistical support during joint exercises and humanitarian missions, and the November 2024 Air-to-Air



**Gaurav Saini**  
is Co-founder, Council for Strategic and Defense Research



**Kim Heriot-Darragh**  
is Research Fellow, Australia India Institute

Australia's view of India being a 'top-tier security partner' can help navigate a world where U.S. security guarantees appear to be increasingly conditional

refuelling arrangement allowing the Royal Australian Air Force to extend the operational reach of Indian aircraft. Further, key military exercises—AUSTRAHIND (Army), AUSINDEX (Navy), and participation in multilateral exercises such as Pitch Black and Malabar, demonstrate a decade of careful relationship-building.

Neither New Delhi nor Canberra can be expected to fill the gap left by the United States alone. India remains tied to its continental predicament, with an active border dispute with China and both conventional and sub-conventional challenges from Pakistan. Similarly, Australia is undergoing substantive churn in the strategic imagination of its regional role, which involves a complete overhaul of its armed forces, acquisitions of new technologies under the AUKUS (Australia, the United Kingdom, and the U.S.), and increased outreach to smaller island states in its maritime geography.

Given all this, how can both sides ensure that they rise up to face challenges in the regional security architecture? Five aspects need immediate attention:

#### The focus areas

First, it is time to rebalance defence engagement beyond comfortable silos. While Navy-to-Navy cooperation has flourished, there is a need to break down service barriers. This could be achieved through joint military exercises that reflect real world operations, and moving towards a dedicated forum for joint staff talks. Further, both sides should work towards a major joint, combined exercise within the next decade – one that truly tests their collective capabilities.

Second, India's defence footprints in Canberra need to reflect the strategic importance of this relationship. It should consider upgrading its Defence Adviser (DA) position in Canberra to a one-star rank. Since this position has always been held by a Navy official, the addition of dedicated Army and Air Force personnel as assistants could help balance the service participation. Further, it needs to have dedicated people for its engagement with the Pacific Islands – work that is currently handled by the very efficient DA in Canberra.

Third, India needs to elevate ground-up ideas from working-level personnel. Too often, strategic dialogues become exercises in diplomatic niceties rather than forums for hard truths. Including more uniformed professionals with operational insights and creating spaces for classified discussions can generate fresh thinking that both nations need. Simple initiatives such as fellowships for staff college graduates or regular war-gaming exchanges would build the mutual understanding that underpins genuine cooperation.

Fourth, India should explore cooperation with Australia in the Maintenance, Repair and Overhaul (MRO) of naval vessels. New Delhi has successfully displayed its capabilities in this sector with active contracts with the U.S. and British navies. Further, exploring joint manufacturing and provision of patrol boats for small island security forces in the Indian Ocean Region and in the Pacific would again showcase the joint intentions and capabilities of the two sides. These aspects of cooperation in MRO and patrol boats may seem small, but their second and third-order impacts on exposure to each other's technologies and platforms can be immense.

#### An opportunity for MSMEs

Finally, defence industry collaboration demands a reset. Given that most of the bigger Original Equipment Manufacturers (OEMs) in Australia are field offices of European, East Asian, or American firms, Indian OEMs have preferred to deal directly with their main offices in these countries. Cooperation in the Micro, Small and Medium Enterprises (MSME) sector has been a missed opportunity. Defence and aerospace startups in both countries are at the forefront of cutting-edge technologies. Their outputs in components and dual-use technologies make them ideal to work with each other. Just like New Delhi, Canberra is also implementing an indigenisation programme in the defence sector. Therefore, there is potential to align the MSME sectors in both countries. To enable this, they could explore something similar to the U.S.-India INDUS X model.

### Key points from article

- **Evolution of India-Australia Defence Ties:**

- ◆ The **India-Australia defence relationship** has flourished over the past decade, underpinned by the **Comprehensive Strategic Partnership (CSP)** of 2020 and the **2+2 ministerial dialogue** launched in 2021.
- ◆ **Bilateral military cooperation** has grown through key exercises: **AUSTRAHIND (Army)**, **AUSINDEX (Navy)**, and multilateral exercises like **Pitch Black** and **Malabar**.
- ◆ **Air-to-air refuelling** arrangements between India and Australia help enhance the operational reach of Indian aircraft.





- **Strategic Geopolitical Positioning:**
  - ◆ Australia's **geographic location bridging the Indian and Pacific Oceans** complements India's maritime ambitions, especially in the Indo-Pacific.
  - ◆ Both countries share common concerns over **China's assertiveness** and aim for **regional stability and sovereign resilience**.
- **Enhancing Defence Cooperation:**
  - ◆ There is a **need to break down service barriers** and expand **joint military exercises** to improve real-world operational cooperation.
  - ◆ Proposals to **upgrade India's Defence Adviser position** in Canberra and establish more dedicated personnel for **Pacific Islands engagement**.
  - ◆ Push for creating **forums for joint staff talks** and fostering **operational insights** from uniformed professionals, which would improve mutual understanding and drive policy decisions.
- **Strategic Areas of Defence Cooperation:**
  - ◆ **Maintenance, Repair, and Overhaul (MRO)** cooperation, particularly for **naval vessels**, could deepen engagement in the **naval defence sector**.
  - ◆ India should explore **joint manufacturing** and provide **patrol boats** for small island nations in the **Indian Ocean Region (IOR)** and the Pacific, enhancing maritime security.
- **Strengthening Defence Industry Collaboration:**
  - ◆ The **MSME sector** in both countries represents an untapped area for **defence and aerospace collaboration**, particularly in **dualuse technologies and components**.
  - ◆ Both countries are committed to **indigenisation programmes** in defence, and further aligning these programmes could lead to more effective cooperation.
- **Regional Security and the Changing Global Landscape:**
  - ◆ The **changing global security dynamics**, especially under the uncertainty of **U.S. security commitments**, provide India and Australia an opportunity to take **independent yet complementary security actions**.
  - ◆ India and Australia are positioned as **middle powers** with shared goals of **regional stability, independence from external pressures, and securing their interests** in the Indo-Pacific.

**A ban, a split verdict and a health concern**

### Syllabus:

- **GS 3 – Environment & Ecology**



## A ban, a split verdict, and a health concern

**R**apeseed-mustard oil (hereafter 'mustard oil') is the third-largest edible oil consumed in India. Two executive and judicial decisions on mustard oil – one from 2021 and another from 2024 – have major public health implications, but have hardly received the public attention and scrutiny they deserve. In the first decision, the Food Safety and Standards Authority of India (FSSAI) prohibited the manufacturing and sale of blended mustard oil in India, effective from June 8, 2021. As per Indian food safety laws, selling an edible oil mixed with another edible oil is permitted, provided the proportion of an oil blended with another oil is within 20%. Reports suggest that FSSAI's ban decision was aimed at preventing the adulteration of mustard oil and boosting domestic mustard crop output. In the second, the Supreme Court ruled on July 23, 2024, against approval granted by the Central government for the environmental release of India's indigenously developed genetically modified (GM) mustard named Dhara Mustard Hybrid-II (DMH-II). A major ground on which one of the two judges pronounced a judgment against DMH-II was the insufficient assessment of the impact on human health of DMH-II. A common policy goal behind these two decisions was to protect the health of Indian mustard oil consumers. However, a closer look at the facts shows that this goal cannot be fully achieved through these two decisions.

### Erucic acid

The mustard oil extracted from the Indian mustard crop contains high levels of a unique fatty acid called erucic acid (40% to 54% of total fatty acid). This is significantly higher than the internationally accepted level of <5%. Mustard oil containing high erucic acid is considered undesirable for human consumption, particularly in



**Sthanu R Nair**

Professor of Economics, Indian Institute of Management Kozhikode. Views are personal

The erucic acid-reducing property of DMH-II and the associated health and economic benefits need to be factored in while deciding on the approval of the GM mustard crop

advanced countries such as the U.S., Canada, and Europe. Lab experiments demonstrated that animals fed with high erucic acid-containing mustard oil suffered from heart diseases, retarded growth, premature tissue death, and adverse changes to the liver, kidney, skeletal muscle, and adrenal glands. Though there is no conclusive evidence of a similar health impacts on humans, the stigma of the high erucic acid in mustard oil prevails in advanced economies. In those countries, the erucic acid content of mustard oil is strictly controlled by using canola oil for culinary purposes. Canola crop (oil), developed by Canada, contains less than 2% erucic acid content.

### Edible oil blending

Due to unfavourable climatic conditions, India has not succeeded in developing a high-yielding canola-quality mustard crop. Hence, the easiest way to reduce the high erucic acid content in mustard oil is to blend it with other edible oils. Several scientific studies have proved the lower presence of erucic acid in blended mustard oil. Also, since blended mustard oil is rich in unsaturated fatty acid, consuming it lowers LDL cholesterol and increases HDL cholesterol. One primary concern with edible oil blending is adulteration with artificial flavours and poisonous substances. A nationwide survey by FSSAI in August 2020 found that 24.21% of the 4,461 edible oil samples collected did not meet the quality parameters criteria. A maximum number of adulteration and contamination was found in mustard oil.

Instead of a ban, the sale of blended mustard oil can be allowed but in packaged/branded form with an explicit declaration regarding the oils that have been blended. The share of branded edible oil consumed in India is less than 30%. Strict implementation of the food safety and standards laws and strengthening of food safety infrastructure are also

essential in preventing adulteration. Since health is a State subject, the food safety administration at the State level has to play a vital role in this regard. As per industry sources, the proportion of other oils blended with mustard oil in India ranges from 5% to 50%. Though this does not conform with the law, which allows blending up to 20%, it has the unintended positive consequence of reducing the erucic acid content. Hence, the sale of blended mustard oil should not be banned entirely.

### GM mustard

Alternatively, the erucic acid content in Indian mustard oil can be reduced by cultivating the indigenous GM mustard crop DMH-II, which, apart from higher yield, has a lower erucic acid content (30-35%) compared to the traditional Indian mustard crops (40-54%). As a result, the oil extracted from DMH-II requires a lower quantity of other edible oils for blending to reduce erucic acid content. This, in turn, helps to reduce the imports of other edible oils. India is the world's largest importer of edible oils. Its edible oil import bill is pegged at \$20.56 billion by NITI Aayog.

Therefore, the erucic acid-reducing property of DMH-II and the associated health and economic benefits (in terms of reduced edible oil imports) need to be factored in by all the stakeholders while deciding on the approval of the GM mustard crop. The development of the indigenous DMH-II with a lower erucic acid content is by no means a notable achievement by Indian genetic scientists. After years of research, Canada and Europe have successfully introduced low-erucic acid traits into their rapeseed cultivars. Hence, plant breeding programmes aimed at reducing the erucic acid content in the mustard crop to an internationally accepted level of <5% should be given top priority in India's indigenous GM mustard crop development programmes.

## Key points from article

### • Mustard Oil in India and Health Concerns:

- ♦ **Mustard oil is the third-largest edible oil consumed in India, but it contains high levels of erucic acid (40% to 54%), a fatty acid considered harmful to human health, especially in advanced economies like the U.S., Canada, and Europe, where the acceptable level of erucic acid is below 5%.**
- ♦ **Animal studies** have shown that high levels of erucic acid can lead to **heart diseases, liver damage, and adverse changes in other organs.**
- ♦ Though **no conclusive evidence** exists on human health impacts, the **stigma** around high erucic acid content remains.



- **FSSAI's Ban on Blended Mustard Oil:**
  - ◆ **FSSAI's 2021 decision** prohibited the **manufacture and sale of blended mustard oil**, aiming to prevent **adulteration** and improve **domestic mustard crop output**.
  - ◆ **Blended mustard oil** reduces erucic acid content due to its combination with other oils, which lowers health risks associated with mustard oil.
  - ◆ **Concerns** arose over **adulteration** in mustard oil, as a national survey found **24.21% of edible oil samples** did not meet quality standards, with mustard oil being most adulterated.
  - ◆ Instead of banning blended mustard oil, the author suggests allowing its sale in **branded forms**, with clear labeling, and improving **food safety infrastructure** to reduce adulteration.
- **Genetically Modified Mustard – DMH-11:**
  - ◆ The **genetically modified (GM) mustard** variety, **Dhara Mustard Hybrid-11 (DMH-11)**, was developed to reduce erucic acid content and increase yield.
  - ◆ The **Supreme Court's 2024 ruling** on the approval of DMH-11 cited the insufficient **health impact assessment** as a major concern, halting its approval for **environmental release**.
  - ◆ DMH-11 has **lower erucic acid content** (30-35%) compared to traditional Indian mustard crops (40-54%), making it a promising solution for reducing health risks associated with mustard oil.
  - ◆ Additionally, GM mustard could reduce **India's reliance on edible oil imports**, which amount to a **\$20.56 billion import bill**.
- **Potential for Collaboration in GM Crop Development:**
  - ◆ The editorial suggests that India should prioritize **plant breeding programmes** aimed at further reducing **erucic acid levels** in mustard to meet **international health standards**.
  - ◆ The **long-term goal** should be to develop an **indigenous GM mustard crop** that lowers erucic acid while addressing the economic challenges posed by **edible oil imports**.
- **Alternative Solutions and Health Benefits:**
  - ◆ Blending mustard oil with other edible oils reduces erucic acid and improves the **health profile** of the oil, particularly in terms of **cholesterol balance** (lowering LDL and raising HDL).
  - ◆ **Blended mustard oil** is beneficial because of its **unsaturated fatty acid** content, which provides health benefits like lowering **LDL cholesterol**.
  - ◆ The editorial advocates for **branded blended mustard oil** with clear labeling to protect consumer health and ensure transparency in the oil blending process.
- **Alternative Solutions and Health Benefits:**
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## Ladakh gets new policies on quotas, domicile status

- ♦ The Ladakh Reservation (Amendment) Regulation, 2025 has been notified, which amends the Jammu and Kashmir Reservation Act, 2004:

1. The amendment increases government job reservations to 85% for resident Ladakhis.

# Ladakh gets new policies on quota, domicile status

Non-Ladakhis must stay in the Union Territory for 15 years to be considered domiciles; 80% of govt. jobs likely to be reserved for STs; a third of hill council seats to be reserved for women

Vijaita Singh  
NEW DELHI

**A**mid demands by Ladakhi civil society groups seeking "constitutional safeguards" for the region, the Centre on Tuesday notified new policies on reservation, languages, domiciles, and the composition of hill councils for Ladakh, which became a Union Territory in 2019.

The notifications pave the way for 85% reservation for resident Ladakhis in government jobs. For other residents – including children of Central government officials – to be considered "domiciles", they will have to show 15 years of continuous residence from October 31, 2019, Ladakh's foundation day.

In a first, a third of the

## Policy progress

Key events in the ongoing negotiations regarding Ladakh from 2023 to 2025

- **Jan. 3, 2023:** Committee forms to address Ladakh concerns
- **Nov. 30:** Committee is reconstituted with new members
- **March 4, 2024:** Talks between govt. and Ladakh leaders collapse
- **Oct. 6:** Activist Sonam Wangchuk begins fast

- **Oct. 21:** Govt. agrees to resume talks, fast ends
- **Dec. 3:** Committee meets with Leh and Kargil leaders
- **Jan. 15, 2025:** Follow-up meeting takes place in Delhi
- **May 27:** Domicile and reservation policy is hammered out



**Major demand:** Protests demanding Statehood for Ladakh have been continuing for the past few years. ANI

seats in hill councils have been reserved for women on a rotational basis. The official languages of the U.T. will be English, Hindi, Urdu, Bhoti, and Purgi.

President Droupadi Murmu notified the Union Territory of Ladakh Reservation (Amendment) Regulation, 2025, which amends the Jammu and

Kashmir Reservation Act, 2004 in Ladakh's context.

The new proviso, substituting a section in the 2004 Act which capped the reservation at 50%, said, "The total percentage of reservation shall in no case exceed 85%, excluding reservation for Economically Weaker Sections." Total reservation for government

jobs in the U.T. now stands at 95%, one of the highest in the country. Meghalaya has 85% reservation for Scheduled Castes/Tribes, and Arunachal Pradesh has an 80% quota for STs.

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2. Non-Ladakhis, including children of Central government employees, can only be considered domiciles if they show 15 years of continuous residence from Ladakh's foundation day, October 31, 2019.
3. One-third of the seats in the Ladakh Hill Council will be reserved for women on a rotational basis.
4. The official languages of Ladakh will include English, Hindi, Urdu, Bhoti, and Purgi.

## Kheer Bhawani Festival

- ♦ The Kheer Bhawani Festival, also called Mela Kheer Bhawani, is celebrated every year on *Jyestha Ashtami* by the Kashmiri Pandit community in Ganderbal district, Jammu and Kashmir.
- ♦ **Deity Worshipped:** The temple is dedicated to *Goddess Ragnya Devi*, an important deity in the Kashmiri Hindu tradition. Kheer Bhawani Festival

## Political leaders join Pandit devotees at Kheer Bhawani temple in Kashmir

Peerzada Ashiq  
SRINAGAR

Prominent Jammu and Kashmir leaders, including Farooq Abdullah of the National Conference (NC), Mehbooba Mufti of the Peoples Democratic Party (PDP), and Tariq Hameed Karra of the Congress, on Tuesday joined hundreds of Kashmiri Pandits in paying obeisance at the Mata Kheer Bhawani temple on the occasion of Jyestha Ashtami, amid a sense of unease and fear that was spread by the recent Pahalgam terror attack.

Mr. Abdullah, accompanied by his senior party colleagues, drove to Ganderbal district in central Kashmir in the morning, and joined devotees at the temple. "We took the bless-



Devotees perform rituals during the annual festival at the Kheer Bhawani Temple in Ganderbal district on Tuesday. IRAN NISSAR

ings of Mata Kheer Bhawani. We are living in harmony; we will be living in harmony. We sent a message of happiness," the NC president said.

Mingling with the Pandit devotees, mainly those who fled the Kashmir Valley in the face of militancy in the 1990s, Mr. Abdullah prayed that the Kheer Bha-

wani Mela (fair) would turn out to be a "starting point for displaced brothers and sisters to return and settle down in Kashmir again".

"Land and houses should be provided to Kashmiri Pandits. The government and the Centre should do the needful for their peaceful return. The situation is not the same as

when former Prime Minister Manmohan Singh ensured employment for thousands of Kashmiri Pandits by offering them government jobs in Kashmir for their peaceful return," Mr. Abdullah said.

Ms. Mufti joined the Pandit devotees in the visit to the shrine, and extended her wishes to the community on the occasion. She also paid floral tributes at the Kheer Bhawani temple pond, which is considered an auspicious ritual by the Pandit community.

The Kheer Bhawani Mela is the first major Hindu festival to take place in the Valley after the Pahalgam terror attack. The incident has cast its shadow on the fair, evident in the thin attendance when compared with that of 2024.



- ◆ **Largest Kashmiri Hindu Gathering:** It is the **biggest Hindu religious gathering** in the Kashmir Valley after the **Amarnath Yatra**.
- ◆ **Historical Legacy:** The temple structure was built by **Maharaja Pratap Singh** and later renovated by **Maharaja Hari Singh** in the early 1900s.
- ◆ **Ancient Mentions:** References to the site are found in **Kalhana's Rajtarangini**, **Bhriгу Samhita**, and **Abu'l-Fazl's Ain-i-Akbari**, which also mentions **flooding in Tula Mula**.

## Building Integrated Photovoltaics

### Syllabus :

#### ■ General Studies Paper 3- Science and Technology

##### BUILDING BLOCKS



GETTY IMAGES

## Building-Integrated Photovoltaics: converting buildings into solar assets

BIPV can turn entire buildings into power generators by integrating solar elements directly into architectural elements. While the initial costs may be high, by transforming conventional building components into energy-generating surfaces, BIPV can deliver long-term savings

Shantanu Roy

**W**ith an installed capacity of over 17 GW as of April 30, rooftop solar (RTS) is starting to play a significant role in India's renewable energy transition, especially in urban areas. However, its scalability is constrained by the limited availability of shadow-free rooftop spaces. Boosting solar adoption in densely populated cities therefore requires us to look beyond traditional rooftop-mounted solar systems and towards Building-Integrated Photovoltaics (BIPV).

##### What is BIPV?

BIPV can turn entire buildings into power generators by integrating solar elements directly into architectural elements.

It has two purposes: generating electricity and working as a structural part of a building. Unlike RTS systems, which are added to rooftops, BIPV systems are embedded into the building's architectural fabric, like in facades (the front exterior of a building), roofs, windows, and railings. They replace conventional construction materials such as glass, tiles, and cladding with solar alternatives.

While the initial costs may be high, by transforming conventional building components into energy-generating surfaces, BIPV can deliver long-term savings that help offset the capital costs.

##### How can BIPVs be incorporated?

Facades can host semi-transparent BIPV panels that serve as curtain walls or cladding, generating electricity while reducing entry of heat. Traditional roofing materials can be replaced with BIPV panels, allowing power generation without altering the building's structure.

Windows and skylights can also feature transparent or semi-transparent BIPV panels that allow natural light to enter while producing clean energy. Even

balconies, canopies, atriums, and shading devices can be designed to house solar elements, utilising structural features for energy generation without occupying additional space.

Because of their "stay out of sight" design, BIPVs can be used in residential apartments and commercial buildings as well as in public infrastructure such as railway stations, airports, and educational institutions. Their transparency, colours, sizes, and shapes can also be customised to suit particular aesthetic requirements.

##### BIPVs for India

The need for BIPVs stem from space constraints and the pressing obligation to pursue sustainable urban development. According to the 2016 Handbook of Urban Statistics published by the Ministry of Housing and Urban Affairs, India's urban population is projected to reach approximately 600 million by 2031 and 850 million by 2051.

In the high-rise buildings of India's populous cities, rooftop space is often insufficient to install RTS systems. Since BIPV can be integrated into various parts of a building's envelope, it can use available surfaces more efficiently.

For example, a 16-storey building with a 4,000 sq. ft. rooftop and 15,000 sq. ft. of facade area on each side can support an RTS system of only about 40 kW-peak (kWp) – but BIPV panels on just the south-facing facade could produce around 150 kWp.

Beyond high-rises, BIPVs can also be integrated into independent houses and in the balconies of homes whose residents don't have rooftop access. The latter is already popular in Germany, where solar panels have been installed on nearly 15 lakh balconies and manufacturers have estimated that a typical participating household could save up to 30% on its electricity bill.

##### What is the status of BIPVs in India?

The steady decline in solar technology

prices and a growing interest in sustainable and energy-efficient architecture is allowing BIPVs to gain momentum.

Today's India has some impressive BIPV installations. The Cris Datacenters building in Navi Mumbai has an 863-kWp system on its four facades. The Renewable Energy Museum in Kolkata, inaugurated in 2024, features a solar-powered dome made from over 2,000 integrated solar panels. The Jindal Steel & Power Ltd. facility in Angul, Odisha, hosts one of the largest BIPV installations in India. They have also been incorporated into railway stations in Vijayawada and Sahibabad.

These examples indicate BIPVs' ability to scale across public, commercial, and institutional buildings.

##### How can BIPV uptake be scaled up?

BIPV adoption in India has been limited by high initial costs, policy gaps, inadequate technical capacity, and reliance on imports.

Low awareness, lack of dedicated incentives, and absence of clear standards also push BIPV out of early building-design considerations.

In this milieu, Seco's dedicated incentive scheme is instructive: it subsidises up to 80% of installation costs, allowing BIPV into mainstream urban construction. India could look at expanding the existing solar schemes to offer higher incentives for BIPV, especially in space-constrained urban areas. In 2024, the Ministry of New and Renewable Energy issued operational guidelines for the PM Surya Ghar Muft Bijli Yojana, a scheme to install RTS systems in one crore households. The guidelines included BIPV in the scheme, allowing consumers to opt for it in case of limited rooftop space. BIPV installations in a residential segment qualify for a subsidy akin to that available for RTS systems: up to ₹78,000 for a 3-KW solar system. Similar schemes are required for

commercial and industrial segments.

Likewise, Europe's Energy Performance of Buildings Directive mandates the increased use of solar technologies in all new buildings and encourages innovative solutions like BIPV through clear regulatory guidance and minimum performance standards. India too can consider embedding BIPV provisions in its National Building Code, the Energy Conservation Building Code, and the Eco Nivwas Samhita.

Demonstrating BIPV through pilot projects in public infrastructure (via public-private partnerships) can improve visibility and catalyse wider acceptance. Boosting indigenous manufacturing through production-linked incentive schemes and targeted R&D alongside awareness programmes for architects, planners, and building developers will further strengthen the ecosystem.

Financial arrangements such as the Renewable Energy Service Company model and long-term power purchase agreements can help enhance project reliability and enable large-scale BIPV deployment.

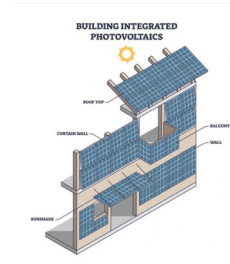
India can't rely solely on ground-mounted and rooftop systems to meet its goal to install 300 GW of solar capacity by 2030. Land-neutral solutions like BIPV need to be prioritised. The potential of BIPV for India's existing building stock is estimated to be 309 GW. According to the World Bank, nearly 70% of urban infrastructure needed for India to become a developed country by 2047 is yet to be built.

While this underscores the immense potential of BIPV to accelerate the nation's clean energy transition, actualising it demands robust policy support, design innovation, and a strong market push.

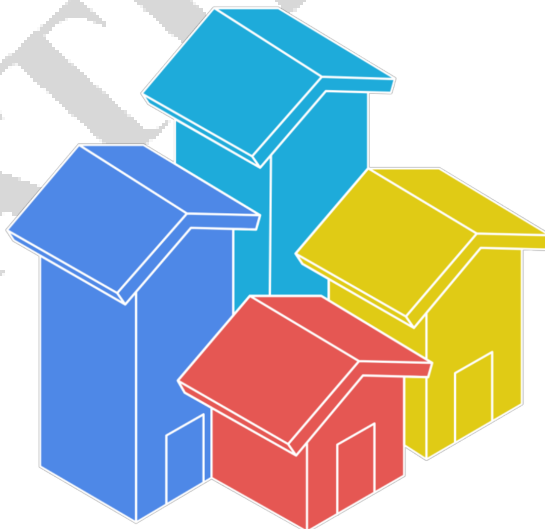
Shantanu Roy is Sector Coordinator, Renewables and Energy Conservation, at the Center for Study of Science, Technology and Policy (CSTEP), a research-based think tank.

## Building Integrated Photovoltaics

- ♦ Integrates solar energy generation directly into building components.
- ♦ Replaces conventional construction materials (like glass, tiles, cladding) with solar alternatives.
- ♦ Serves a dual purpose: energy generation + structural functionality.
- ♦ Installed in façades, roofs, windows, railings—unlike rooftop solar (RTS), which is mounted externally.
- **Why BIPV Matters for India**
  - ♦ Urban India is running out of shadow-free rooftops for solar panels.
  - ♦ Rising urban population: projected 600 million (2031) → 850 million (2051).
  - ♦ High-rise buildings have limited rooftop space but ample vertical façade area.
  - ♦ Example: 16-storey building: Rooftop (4,000 sq. ft): ~40 kWp potential South-facing façade (15,000 sq. ft): ~150 kWp with BIPV



### BIPV applications



- 1 Façades**  
Building exteriors generating solar power
- 2 Roofs**  
Solar panels replacing traditional roof tiles
- 3 Windows & Skylights**  
Transparent panels providing light and power
- 4 Balconies, canopies, shading devices**  
Unused spaces generating power



## Bacteria found at Rajgir hot spring lake shows antimicrobial activity

UPSC Prelims 2025

# Bacteria found at Rajgir hot spring lake shows antimicrobial activity

While scientists have determined that hot springs around the world are unexplored reservoirs of antibiotic-producing bacteria, the hot springs of India are not very well studied. driven by their putative value, researchers at the Vellore Institute of Technology in Tamil Nadu recently examined the Rajgir hot spring lake in Nalanda district

59. Consider the following statements :

- I. No virus can survive in ocean waters.
- II. No virus can infect bacteria.
- III. No virus can change the cellular transcriptional activity in host cells.

How many of the statements given above are correct?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Mohit Nikajle

**T**o live a cozy life on the earth, a temperature of around 25 to 30 degrees Celsius is ideal. But during a heat wave, where temperatures can cross 40 degrees Celsius, the consequences can be deadly. Humans and most complex multicellular organisms are not built to tolerate such heat.

That doesn't mean no living thing can, however.

Bacteria called thermophiles (meaning "heat lovers") have been known to tolerate 45 to 70 degrees Celsius of heat. Such a high temperature can give human skin third degree burns.

While such an environment may seem hellish to people, thermophilic bacteria see an opportunity. Places on the earth with temperatures like this - including hot springs, deep-sea thermal vents, and compost piles - offer a mineral-rich neighbourhood with relatively few competing life forms. To gain an edge, some thermophilic bacteria produce potent antibiotics as weapons to neutralise their competitors.

This is exactly why scientists have deemed hot springs around the world to be unexplored mines of antibiotic-producing bacteria. For example, thermophiles isolated from hot springs in the Air and Izan regions of Saudi Arabia have been found to produce a variety of potent antibiotics effective against gram-positive pathogenic bacteria.

The hot springs of India are not very well studied, however.

But driven by their putative value, researchers at the Vellore Institute of Technology (VIT) in Tamil Nadu examined the Rajgir hot spring lake in Nalanda district of Bihar. Their findings were published last month in the *Indian Journal of Microbiology*.

### Exploring microbial diversity

"People take holy baths in these hot spring lakes, thinking diseases can be relieved," K.V. Bhaskarao, professor at VIT and corresponding author of the study paper, said. "As a microbiologist, I know that along with the elements that are present in the water, some of the microorganisms can also be responsible for this so-called curative activity."

Studying which microbes are present in these hot spring lakes is challenging because researchers have to collect water and soil samples from a hot environment. At Rajgir, the temperature of the water can go up to 45 degrees Celsius, and the soil nearby can range between 43 and 45 degrees Celsius.

After collecting the samples, the researchers identified the



Representational image of a hot spring in Peru. The hot springs of India are not very well studied. PUBLIC DOMAIN

microorganisms present in them, for which they used 16S rRNA metagenomics. This technique relies on identifying the 16S rRNA gene, which is found in all microbes but has slight variations across species, thus helping scientists to identify bacteria accurately.

Researchers found many species of bacteria but one group that particularly caught their attention was the *Actinobacteria*, which made up 40-43% of the microbial diversity at the lake. Bacteria belonging to this group are known producers of antimicrobial compounds. Well-known drugs like streptomycin and tetracycline were first discovered as the products of *Actinobacteria*.

Hot springs studied till now showed very little diversity of *Actinobacteria*—sometimes it is less 20%—but in our study I saw them to be abundant at Rajgir," Aparna Kumari, a PhD scholar and first author of the study, said.

Discovering antibiotic-producing bacteria has become more pressing in the era of antimicrobial resistance—a silent epidemic fuelled by the unwarranted use of antibiotics. Bacteria have responded by developing ways to resist the drugs, reducing the latter's potency. One outcome is the rising cost of healthcare, since multiple antibiotics may be required to treat a single infection. The World Health Organisation has projected antimicrobial resistance will add up to \$1 trillion in healthcare costs worldwide by 2050.

Additionally, on average, pharmaceutical industries have been known to require a decade to bring novel antibiotics to the market, whereas

**The potential of thermophiles goes beyond antibiotics; they have applications across industries. The PCR test used to check for the COVID-19 virus needs an enzyme that was first found in a thermophile called *Thermus aquaticus***

bacteria develop resistance in much less time.

Thus, the discovery of any bacterium that can produce a potent antibiotic against pathogens is considered good news. Not all thermophiles produce antibiotics, however, and to find out which ones do, the VIT researchers conducted an antibacterial efficiency experiment.

They cultured the prospective bacteria with different pathogenic strains: *Escherichia coli*, *Salmonella typhimurium*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*. If the test bacteria could inhibit the growth of the pathogenic bacteria on a culture plate, it was confirmation that an antimicrobial compound was being produced. In this way, the team was able to identify seven strains of *Actinobacteria* that produced potent antimicrobials against several pathogens.

Going a step further, researchers aimed to isolate the specific antimicrobial compounds produced by these bacteria. In another paper published in *Chemical Papers*, an antimicrobial compound was successfully extracted from a bacterium identified as *Actinomyces* *bacterium* spp., obtained from the Rajgir hot spring.

(While the *Chemical Papers* study was published before the *Indian Journal of Microbiology* one, the work it describes came after.)

This bacterium produced a range of compounds. To isolate the one with antibacterial activity, the researchers used gas chromatography mass spectrometry, a sophisticated technique to separate compounds based on their chemical properties.

The compound was found to be diethyl phthalate, and it inhibited the growth of *Listeria monocytogenes*, a pathogenic bacterium that causes listeriosis, a fatal foodborne infection. This finding suggests that diethyl phthalate could potentially be developed as a drug against *L. monocytogenes* infections.

### Industrial, agricultural potential

The potential of thermophiles goes beyond antibiotics; they have many applications across industries. For example, the PCR test—widely in use during the COVID-19 pandemic to check for the virus's presence—requires an enzyme that was first found in a thermophile called *Thermus aquaticus*. A 2018 study in *Frontiers in Microbiology* by Banaras Hindu University researchers reported that a cocktail of bacteria from a hot spring in the Chamung area of Leh district has the ability to promote plant growth. Associate professor and the study's lead author Jay Prakash Verma said hot spring strains are effective for industrial and agricultural applications thanks to their heat-tolerant properties.

Mohit Nikajle is an IISc alumus and a science communicator based in Bengaluru. mohitnikajle234@gmail.com

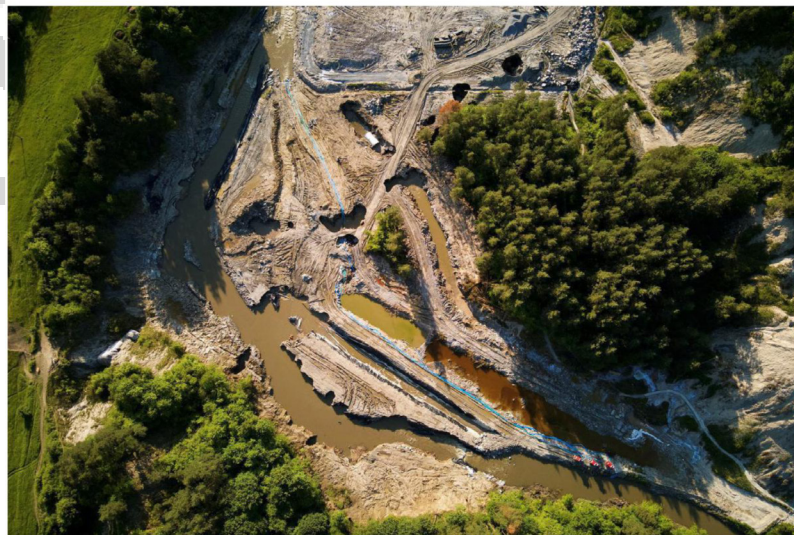
### THE GIST

Thermophiles can tolerate 45 to 70 degrees Celsius. Hot springs, deep-sea thermal vents, and compost piles offer a mineral-rich neighbourhood with few competing life forms. To gain an edge, some thermophilic bacteria produce potent antibiotics as weapons to neutralise competitors.

One group of bacteria, the *Actinobacteria*, makes up 40-43% of microbial diversity at Rajgir lake. These bacteria are known producers of antimicrobial compounds. Well-known drugs like streptomycin and tetracycline were first discovered as the products of *Actinobacteria*.

An antibacterial compound, diethyl phthalate, was extracted from the *Actinomyces* *bacterium* spp., which inhibits *Listeria monocytogenes*, a pathogenic bacterium that causes listeriosis, a fatal foodborne infection.

### BIG SHOT



This drone view shows the Corund river flooding portions of the Praid salt mine on June 2 and the gaping sink holes that have formed near the village of Praid in Romania. It is one of Europe's largest salt reserves and receives half a million tourists every year. REUTERS