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## GS 2 : INTERNATIONAL RELATIONS

THE HINDU PAGE : 5

# India co-sponsors resolution passed by UNSC against Iran

The resolution demands the 'immediate cessation of all attacks by the Islamic Republic of Iran' on GCC countries; India prioritises the safety of 'all civilians', says Ministry in wake of criticism over unbalanced responses on conflict in West Asia

**Sahasini Haidar**

NEW DELHI

India has prioritised the safety of "all civilians", the government said on Wednesday in an effort to deflect criticism that it had only condemned Iran's actions, and not those by the U.S. and Israel in the ongoing war in West Asia.

On Wednesday, India co-sponsored a Gulf Cooperation Council (GCC) resolution at the United Nations Security Council (UNSC) along with 134 countries that demanded the "immediate cessation of all attacks by the Islamic Republic of Iran" against GCC countries Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates, and Jordan. The resolution was passed with 13 UNSC members voting in favour while Russia and China abstained.

It condemned "any actions or threats by the Islamic Republic of Iran aimed at closing, obstructing, or otherwise interfering with international navigation through the Strait of Hormuz".

"The resolution reflects

The resolution reflects several of our positions. We have a large diaspora in the GCC countries, and their well-being and welfare are of utmost importance. The Gulf is also very important for our energy security needs

**RANDHIR JAISWAL**  
MEA spokesperson



several of our positions," said Ministry of External Affairs spokesperson Randhir Jaiswal at a weekly press briefing on Thursday.

"We have a large diaspora in the GCC countries, and their well-being and welfare are of utmost importance. The Gulf is also very important for our energy security needs," Mr. Jaiswal added, in references to about 10 million Indians who live and work in West Asia, and India's energy purchases from the region that make up about 50% of its crude oil and 90% of its liquefied petroleum gas (LPG) imports.

In contrast, there are about 9,000 Indians in Iran and India has discontinued its energy imports from Iran since 2019, under threat of U.S. sanc-

tions. The Indian support for the UNSC resolution comes on the heels of a number of statements by the Ministry condemning specific Iranian actions such as the attacks on various countries across the West Asian region, buildings in Dubai, Omani facilities and a Thai ship bound for India.

### U.S.-Israeli actions

However, India has not similarly condemned the attacks by the U.S. and Israel on Iran, in which an estimated 1,255 people have been killed, including Iran's Supreme Leader Ayatollah Ali Khamenei, his family and advisors; the sinking of Iranian ship *IRIS Dena* in the Indian Ocean that had been hosted for exercises by India; or the

bombing of a school in Mubin in which 150 schoolgirls are believed to have been killed. Nor has India or the GCC-led resolution spoken about Israel's strikes on Lebanon, where the government said more than 630 people have been killed, and 8,00,000 displaced from their homes.

To a question from *The Hindu* about the seemingly unbalanced responses, Mr. Jaiswal said that the MEA had issued statements, and External Affairs Minister S. Jaishankar had made *suo motu* statements in both Houses of Parliament that regretted the loss of lives.

"As far as the question of the schoolchildren is concerned... we have issued several statements on the ongoing conflict. We have underlined the need for prioritising the safety of all civilians. We regret the precious lives lost, and express our grief in that regard," Mr. Jaiswal said.

In the past few days, India's "silence" on U.S. and Israeli actions has come in for criticism from a number of senior former diplomats speaking to the media and at various public events.

"Diplomacy should recognise complexity, not reduce it to a single culprit," former Indian Foreign Secretary and former Ambassador to the U.S. Nirupama Menon Rao said on Thursday in a post referring to the Ministry of External Affairs statement, suggesting that India's sponsorship of the UN resolution would "endorse a narrative that begins the story with Iranian retaliation rather than the escalation that preceded it".

In an interview to news agency ANI, former Foreign Secretary Kanwal Sibal said India should have issued a statement condoling the death of Ayatollah Khamenei "to recognise that the head of state contrary to norms of international law has been politically assassinated".

Speaking about the March 4 submarine torpedo attack that sank the *IRIS Dena* "very close to India shores", former Foreign Secretary Shyam Saran said that India must assert itself in the face of U.S. actions. "Tactical subservience can easily result in strategic irrelevance," he added.

## GS 3 : SCIENCE AND TECHNOLOGY

## THE HINDU PAGE: 8

## Preparing India for a true innovation-led economy

India today presents a striking paradox in research, development, and innovation. Despite unprecedented government ambition, reflected in major funding commitments, regulatory reforms, and improving global innovation rankings, the country still continues to underperform on the fundamentals that drive innovation strength. Headlines suggest momentum, yet outcomes tell a more sobering story: low research and development (R&D) intensity, limited global technological influence, weak research-to-market translation, and persistently inadequate private-sector participation. While recent policy initiatives are necessary and welcome, India's innovation challenge is no longer one of intent but of execution. An examination of R&D expenditure, patent scale and quality, human capital gaps, and the weak bridge between research and entrepreneurship leads to an inevitable conclusion: meaningful transformation will require far deeper systemic change, particularly from the industry.

**A year that holds promise**

Following the Government of India's announcement of the ₹1,00,000 crore (approximately \$12 billion) Research, Development, and Innovation (RDI) Fund last year, 2026 has begun with much promise. In her ninth consecutive Union Budget speech, Finance Minister Nirmala Sitharaman reaffirmed the government's commitment to R&D through a ₹20,000 crore corpus for deep-tech startups, extended tax incentives, and investments in digital infrastructure. A near six-fold increase in funding for the flagship programme, Atal Tinkering Labs – from ₹500 crore to ₹3,200 crore – also highlights the focus on nurturing future innovators. The government's intent is clear: a Viksit Bharat powered by Yuva Shakti. But whether this translates into innovation outcomes will depend on how decisively industry responds.

These measures follow closely on the removal of the three-year existence requirement that had limited the access of deep-tech startups to schemes under the Department of Scientific and Industrial Research's Industrial R&D Promotion Programme. Late last year, the government also lifted the blanket ban on patenting inventions related to atomic energy. The Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India (SHANTI) Act, 2025 now allows patents for the "peaceful uses of nuclear energy and radiation", which opens the door for greater private-sector participation. Yet, as with other reforms, the real test will be whether industry invests enough to translate this openness into deployable technologies.

All these developments coincide with a significant improvement in India's ranking in the Global Innovation Index (GII). India now ranks

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Driving India's 'research, development, and innovation' story needs decisive private sector participation

38th among 139 economies in GII 2025, and patent filings have nearly doubled from under 59,000 in 2020-21 to over 1,10,000 in 2024-25. While domestic filings now account for about 62% of the total, this shift is both recent and policy-driven, underscoring that the underlying innovation base – particularly industry-led R&D – remains shallow. Although these indicators point in the right direction, there remain systematic and structural issues that keep India from real transformation in research, development, and innovation.

**The private sector's shortcomings**

R&D expenditure as a share of GDP – especially private-sector spending – is a key indicator of innovation readiness. India invests just 0.65% of its GDP in R&D, far below advanced economies and many peers (lowest among BRICS nations except for South Africa) including Singapore, Japan, and South Korea. In most innovation-leading economies, industry drives the most R&D spending. In India, however, the state still bears a disproportionate share, reflecting the private sector's limited appetite for long-term, high-risk innovation.

Similarly, India's patent filing numbers are impressive in isolation, but are a fraction of the over 1.8 million patent applications filed in China (1.6 million domestic filings) and significantly less than the 600,000 filed in the United States (2,70,000 domestic filings). This reflects the absence of sustained, high-risk R&D investment by India's private sector.

One way to assess innovation impact is by international patent filings, since inventors seek protection abroad only for commercially viable ideas. The number of Patent Cooperation Treaty (PCT) applications show India's global contribution: 4,547 in 2024, up 22% from 2023. While growth is strong, India remains far behind China (over 70,000), the U.S. (over 54,000), and Japan (over 48,000). Even Switzerland, which is a bit larger than Kerala, filed over 5,300 applications. These examples show that scale, and not just growth rate, drives global technological influence.

According to the GII 2025, India performs poorly on key human-capital indicators critical to innovation, ranking 95 in employment in knowledge-intensive sectors and 80 in the number of full-time equivalent researchers. The situation is more acute with respect to gender diversity, where India ranks 101 among 119 economies in the employment of women with advanced degrees, a weakness that matters given the strong correlation between diversity and innovation outcomes. While the government has acknowledged this gap and introduced initiatives such as Women's Instinct for Developing and Ushering in Scientific Heights and Innovations (WIDUSHI) and Women in Science and

Engineering (WISE)-KIRAN to improve women's participation in science and engineering, their impact remains to be seen. For now, the data underscore that India's innovation challenge is as much about talent inclusion and retention as it is about funding or policy intent.

**A faultline**

An attribute of India's development trajectory that is often quoted is the missing "large-scale, labour-intensive industrialisation" when compared to its east Asian peers leading to over-reliance on agriculture and services. Even India's so-called new age unicorns are built on abundance of labour (instant delivery platforms, for example) rather than deep, defensible, genuine R&D-led technological innovation. It is, therefore, reasonable to conclude that the absence of globally significant technologies of Indian origin stems not merely from historical policy choices but also from a sustained reluctance within the private sector to invest in deep, long-gestation R&D.

Innovation reaches its full impact only when research is anchored to enterprise, i.e., when ideas move successfully from laboratory to market. In India, this last step – the absence of industry-led commercialisation mechanisms affecting innovation remains the weakest in the Research, Development, and Innovation (RDI) chain. While universities and public research institutions generate growing scientific output, mechanisms for technology transfer, venture creation, and risk-capital alignment remain underdeveloped. High-technology entrepreneurship is inherently uncertain, capital-intensive, and requires long-gestation, demanding patient funding, strong intellectual property protection, and an ecosystem that tolerates failure. Countries that lead in innovation have built bridges between academia, industry, and finance. India's opportunity lies not just in increasing startup numbers but also in nurturing R&D-driven enterprises capable of creating globally competitive technologies.

India's private sector must now take up the baton and rise to the challenge of driving India's RDI story. There are visible green shoots in the commercial space sector with several successful start-ups demonstrating strong promise. Deep tech is another emerging area where the RDI fund set up by the government can be a game changer, provided industry positively embraces the opportunity and commits long-term capital. When the 6G standard is globally launched in the coming years, it will be telling how many Indian origin patents feature among the standard essential patents (SEP) list. The government has paved the way. But the question now is whether India's private sector R&D will race ahead.

*The views expressed are personal*

## GS 3: ECONOMY

## THE HINDU PAGE: 8

## Economic Survey promises, impact of new labour codes

India's new labour codes, with draft central rules released in December 2025, have been presented as a reform with transformative potential. The Economic Survey 2025-26 makes an optimistic case: these codes are expected to increase formalisation from 60.4% to 75.5%, generate 77 lakh jobs, reduce unemployment, boost female labour force participation and contribute 1.25% to GDP by 2029-30. These projections assume that simplifying compliance for firms will incentivise formalisation and expand registered employment.

However, over 80% of India's workers are in the informal sector, and they remain outside most of the labour code protections. The scale of informality is increasing. Firms, when given flexibility, tend to respond by shifting away from formal employment. Between 2011 and 2023, direct factory employment fell from 61% to 47%. Contract workers grew to 42% of the factory workforce. Regular employment in central public sector enterprises declined by 30,000 workers in 2024 alone, replaced by casual and contract workers (Public Enterprises Survey 2025). The organised sector, once associated with stable employment, is shrinking in India. And the new codes accelerate this by loosening regulatory definitions and protections, making it easier for firms to avoid permanent employment relationships.

### Formalisation illusion

A striking feature of the codes is how they respond to informality by raising the thresholds for protections. The Occupational Safety, Health and Working Conditions Code raises the definition of a "factory" from 10 workers to 20 (with power) and from 20 to 40 (without power), increases the contract labour threshold from 20 to 50 workers and raises the threshold for prior approval for lay-offs from 100 to 300 workers.

At the same time, the government expects these codes to increase formalisation. This rests



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The promises of reform cannot hide the realities in India's informal workforce

largely on expanding "fixed-term employment", that is, letting firms hire on short-term contracts instead of permanent jobs. Formal employment has historically meant job security, regular wages, social security and the ability for collective bargaining. Fixed-term employment offers some benefits under the codes, such as appointment letters and equal gratuity after one year, but undermines the key feature that distinguishes formal work from precarious work: job security.

### Grey areas

While the codes require platform companies to contribute 1%-2% of annual turnover for gig worker schemes, rules on how companies must contribute, benefit levels, coverage and claim details are all left to be "notified through subsequent schemes". The reskilling fund for retrenched workers follows the same pattern: employers must deposit 15 days' wages per worker. How to access these funds, who provides training and what skills are taught are unspecified. Like India's many cess and welfare funds, collection may happen, but utilisation may lag perpetually.

The Code on Wages creates a National Floor Wage and a National Minimum Wage but offers no clear methodology for setting either and how they will differ. The new rules make space for greater administrative discretion instead. Defenders of flexible labour markets often argue that minimum wages destroy jobs. The logic is that if you force employers to pay more than market rates, they will hire fewer workers. But decades of empirical research have shown that the job loss predictions consistently fail to materialise (Dube 2019). Higher wages reduce turnover costs for firms. And, when low paid workers get raises, they spend more on food, transport, housing and goods. The increased consumption boosts aggregate demand. In labour markets where employers often have substantial power to set wages below competitive levels,

minimum wages actually improve efficiency by reducing employer exploitation.

Further, the rebranding of labour inspectors as "Inspector-cum-Facilitators" might sound progressive, but when inspectors become facilitators helping employers comply, enforcement weakens. This is made explicit by allowing employers to compound serious violations such as wage theft or unpaid overtime by paying prescribed fines. If penalties are lower than compliance costs, breaking the law can become a rational business decision. This is particularly damaging in the informal sector. In the absence of unions, labour courts or workers' awareness of rights, labour inspectors could have been the only channel for redressal. Converting them to facilitators eliminates even this minimal accountability.

### There are many assumptions

The labour codes fail to confront what drives informality in the first place. It is not that regulations are too complex for firms to navigate but that informality is structurally profitable. While technology is automating routine jobs, the new platform jobs it is creating are bypassing employment relationships entirely.

The optimistic projections of the Economic Survey rest on assumptions that contradict many of the labour market realities. Making formal jobs more flexible will not lead to formalisation as long as informality remains cheaper and more profitable.

Lower compliance costs will also not create better jobs if firms respond by replacing permanent workers with contract workers. The numbers may eventually materialise, such as higher formalisation percentages, but they will measure changes in how firms account for workers, not improvements in how workers actually live.

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# GS 2: SOCIAL JUSTICE

## THE HINDU PAGE: 10

# Women's political participation in India

While the turnout of women voters has increased over the years, campaign participation still shows a clear gender gap. The disparity in Parliamentary representation also remains wide, reflecting limited candidature, party nominations, and constraints on political autonomy.

### FULL CONTEXT

Sanjay Kumar  
Vibha Attri

#### The story so far:

**W**omen's relationship with electoral politics has undergone a profound transformation over the past six decades. Women today vote in numbers nearly equal to men, and in several State elections, even surpass them. Yet this remarkable rise in participation has not translated proportionately into representation or power. The Indian case presents a striking paradox: electoral inclusion without structural equality.

#### Women as voters

In the decades after Independence, electoral participation showed clear gender disparities. Although women were formally included in the electoral process, their turnout remained significantly lower than that of men. In the 1967 Lok Sabha election, male turnout was 66.7 percent while female turnout was 55.5 percent—a gap of 11.2 percentage points (Chart 1). Similar disparities continued into the 1970s. In 1971, the gap widened slightly to 11.8 points. These patterns reflected structural constraints such as lower female literacy, restricted mobility, domestic responsibilities, and limited political outreach to women.

From the 1980s onward, the gap began to narrow steadily. By 2009 it had fallen to 4.4 percentage points. The most notable shift came in the last decade: in 2014 the gap dropped to 1.5 points, and in both 2019 and 2024 women voted at nearly the same rate as men.

A similar trend is evident in State Assembly elections between 1990 and 2025 (Chart 2). In the early 1990s, women's voter turnout was on average 4-5 percentage points lower than that of men. This gender gap narrowed steadily through the 2000s, falling to -1.8 percentage points during the 2005-07 elections and to -1 percentage point by 2008-10.

After 2011, the pattern reversed. Women began voting at slightly higher rates than men, with the average turnout gap turning positive at 1.13 percentage points during 2011-13 and widening to 2.82 percentage points in 2015-16. Although the margin moderated in subsequent years, it remained positive at 1.6 percentage points during 2020-25. Overall, the average gender turnout gap in State Assembly elections from 1990 to 2025 shows a clear long-term convergence, followed by a modest but sustained advantage in women's voter participation.

#### Electoral participation beyond voting

While voter turnout has approached parity, campaign-level participation continues to show a clear gender gap (Table 3). Across Lok Sabha elections from 2009 to 2024, men consistently report higher involvement in public political activities.

Women's participation in campaign activities has been gradually increasing, though a clear gender gap persists. Attendance at election meetings and rallies rose from 9 percent in 2009 to around 16 percent in recent elections, while men's participation has remained roughly double.

Similar patterns are visible in processions and door-to-door canvassing, where women's involvement increased

## Winds of change

The data for the charts were sourced from the Women and Politics study conducted by Lokniti-CSDS

Chart 1: The year-wise difference between male and female voter turnout between 1967 and 2024 Lok Sabha elections

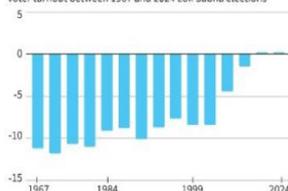


Chart 2: Average gender gap in State Assembly elections between 1990 and 2025

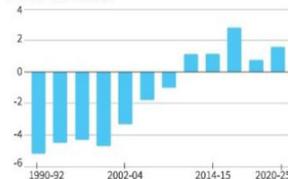


Table 3: Gender-wise participation in political activities over the years

Campaign activity	2009		2014		2019		2024	
	Women	Men	Women	Men	Women	Men	Women	Men
Election meetings/rallies	9%	28%	15%	34%	14%	29%	16%	31%
Participation in processions	5%	20%	6%	15%	8%	14%	11%	18%
Participation in door to door canvassing	6%	17%	6%	14%	7%	13%	11%	19%

from about 5-6 percent to 11 percent, yet still lagged behind men. These trends suggest that while women are becoming more visible in public political activities, but they have limited engagement in electoral campaigns.

A key factor limiting women's public political engagement is the need for family permission. The Lokniti-CSDS Survey on Women and Politics, conducted in 2019, shows that most women report requiring approval for activities such as attending rallies, candidate meetings, or campaigning. These constraints highlight that gender gaps in visible political participation are shaped not only by interest or capability but also by social and familial norms (Table 4).

#### From participation to representation

If women have achieved parity as voters, representation in Parliament tells a different story.

In the first Lok Sabha in 1952, only 22 women were elected. For decades, women's representation fluctuated at modest levels. Even in 1977, the number dropped to 19. A visible shift began only in the 21st century. The number of women MPs rose from 59 in 2009 to 62 in 2014, and then to a historic high of 78 in 2019, before declining slightly to 74 in 2024 (Chart 5).

Yet even at its peak, women constituted only about 14 percent of the Lok Sabha—far below their near 50 percent share of the electorate.

#### The nomination bottleneck

The representational gap becomes clearer when examining candidature. In 1957, only 45 women contested parliamentary



Table 4: The share of who said they needed permission to participate in select political activities (in %)

Activity	Need Permission Yes (%)
Attend a political rally	64
Attend a candidate meeting	62
Join a protest	63
Campaign for a candidate or party	61

Chart 5: Year-wise number of women MPs elected to the Lok Sabha

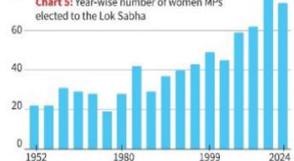
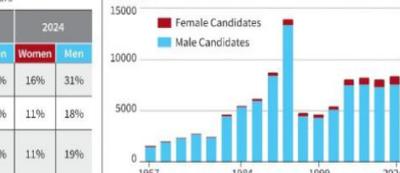


Chart 6: Gender-wise number of candidates in Lok Sabha elections



elections. By 1996, that number had risen sharply to 599. In recent elections, female candidature has continued to expand—668 women contested in 2014, 726 in 2019, and 800 in 2024 (Chart 6). However, these numbers must be viewed in context: male candidates still number in the thousands. Women remain a small minority among the total contestants.

Political parties often justify limited nominations by arguing that women are less "electable." Yet success rate data complicates this claim. In 1957, 49 percent of women candidates won compared to 33 percent of men (Chart 7). In 1962, women's success rate was 47 percent against 25 percent for men. Even in recent elections, women's success rates are comparable or slightly higher: in 2019, 11 percent of women candidates won, compared to 6 percent of men. In 2024, the success rates were 9 percent for women and 6 percent for men. These figures indicate that when women are given tickets, they are capable of winning.

#### Autonomy and political socialisation

Women's underrepresentation in legislatures reflects not only limited candidature and party nominations but also constraints on political autonomy and socialisation. While women now vote at near-parity with men, their decisions are not always independent. In 2014, 51 percent reported voting without advice, a figure that slightly declined to 50 percent by 2024.

These patterns are also reflected in women's attitudes toward political alignment within the family. A majority of women (52 percent) consider it important to share the same political views as their family (Chart 8)

Chart 7: Success rate of male and female candidates in Lok Sabha elections (in %)

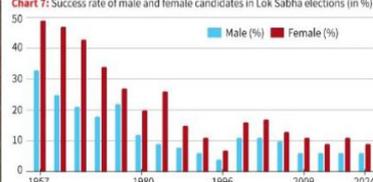


Chart 8: How women perceive having the same political views as their families (in %)

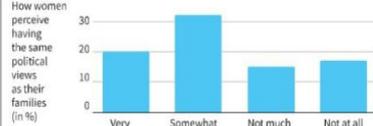
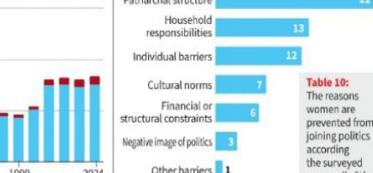


Table 9: The share of women who agree with the following statements about structural barriers (in %)

Statement	Agree (%)
Easier for woman with a political background to enter politics	58
Easier for woman from upper economic status to join politics compared to a woman from lower economic status	57
Parties routinely favour men over women, regardless of candidate merit	44
Voters are more likely to vote for men than women	44

Table 10: The reasons women are prevented from joining politics according to the surveyed women (in %)



Beyond family and social constraints, women also face systemic obstacles within political institutions. Many perceive that political opportunities are not equally accessible. Data from the Lokniti-CSDS study on women and politics show that 58 percent of women believe it is easier for a woman from a political family to enter politics, while 57 percent feel that women from higher economic backgrounds have an advantage. Nearly half (44 percent) think that political parties prefer men when allocating tickets, and a similar proportion believe that voters favour male candidates over female (Table 9).

#### Structural and social barriers

When asked about the broader challenges that shape women's political participation, women pointed to a range of structural and social factors. Patriarchal structures are the biggest obstacle, cited by 22 percent of women, followed by household responsibilities (13 percent) and individual-level constraints such as lack of confidence, awareness or experience (12 percent). Cultural norms (7 percent) and financial or structural constraints (6 percent) were also reported (Table 10).

While women now vote at near-parity, true power and representation remain limited. The passage of the Women's Reservation Bill provides a structural path to bridge this gap, but the challenge remains to ensure that women's participation translates into real authority and decision-making. (Sanjay Kumar is a Professor and Political Analyst. Vibha Attri is a Researcher working with Lokniti-CSDS. Views expressed by the authors are personal.)

## THE GIST

Post independence, electoral participation showed clear gender disparities. Although women were formally included in the electoral process, their turnout remained lower than that of men. From the 1980s onward, the gap began to narrow.

While voter turnout has approached parity, campaign-level participation continues to show a gender gap. Across Lok Sabha elections from 2009 to 2024, men report higher involvement in public political activities.

Representational gap in Parliament and State legislatures is prominent. Beyond family and social constraints, women also face systemic obstacles, with many perceiving that political opportunities are not equally accessible.

## GS 3: ENERGY

### THE HINDU PAGE: 11

# Electrifying industrial heat as a path to India's thermal independence

As the conflict between the United States and Iran intensifies, the Strait of Hormuz has become increasingly volatile, with India importing nearly half of its natural gas, the crisis signals the urgency of accelerating the electrification of industrial heat

**Yasudevan Mukunth**

In the industrial town of Morbi in Gujarat, the air usually hums with the roar of gas-fired kilns producing millions of square metres of ceramic tiles. Today, however, a quarter of those kilns are cold. Nearly a thousand kilometres away in Ludhiana, Punjab, the textile hubs that clothe a third of India are facing a similar paralysis. The reason is geopolitical.

As the conflict between the U.S. and Iran intensifies, the Strait of Hormuz, the world's most vital oil and gas artery, has turned into a gauntlet. India imports nearly half of its natural gas and immediately felt the pinch – rendered more painful by the Ministry of Petroleum and Natural Gas, slashing gas allocations to non-priority industrial sectors to just 65-80% of their contracted volumes.

#### The need for thermal independence

For the manufacturers in Morbi and Ludhiana who began experimenting with new energy models years ago, the present crisis must be a moment of validation as they accelerate towards concentrated solar thermal (CST) technology and the large-scale electrification of heat. For others, however, it can seem like an ultimatum to fast-track decarbonisation and, for India overall, a reminder that it needs thermal independence, i.e. a 'sovereign' source of heat, rather than just energy independence.

For decades, industrial heat has been synonymous with burning hydrocarbons like coal or gas. In Ludhiana's textile mills, for instance, large boilers burn gas to create steam used in dyeing and finishing. In Morbi, gas flames bake tiles at temperatures exceeding 1,000 °C.

Rooftop solar photovoltaic panels have become common but they are designed to produce electricity, not the raw, intense heat that industries demand, so this is

where CST has become relevant. While photovoltaics use semiconductors to convert renewable sunlight into a stream of electrons, CST uses precisely controlled mirrors to concentrate sunlight onto a receiver, where it heats a fluid like water or molten salt to up to 400 °C.

Most textile processes, including scouring and bleaching, require a temperature between 100 °C and 180 °C. By installing parabolic troughs on factory grounds or nearby land, these mills can generate pressurised steam directly from sunlight.

According to data from the Ministry of New and Renewable Energy, India has a CST potential of 15 GW. Adoption, however, remains low – but as gas prices have already tripled due to the war in West Asia, the payback period for a CST installation has already shrunk from seven years to less than three.

For more than a century, people at homes, engineers in laboratories, and industrial operators have burnt fuel to create hot air, then transfer that heat to a product even though it is highly inefficient. For instance, a gas boiler loses 20-30 percent of its energy just in the exhaust. The electrification of heat, on the other hand, replaces the flame with electromagnetic fields and plasma. For example, an induction stove passes an electric current through a coil, creating a magnetic field that generates heat directly inside the metal or in the material being processed. There is no intermediary substance like air or steam that takes away a part of the heat, so the efficiency rates of such heaters have been known to exceed 90 percent.

In Morbi, several forward-thinking ceramic units are also experimenting with plasma torches for their kilns. Here, gas is ionised to a state called plasma. Plasma torches also allow users to closely control their temperature, thus preventing under- or over-heating for different processes.

#### Infrastructural challenges

The bigger question, however, is whether India's grid is ready. If every factory in Ludhiana and Morbi switched to induction and plasma heating tomorrow, the power grid would likely collapse. This is because industrial heat currently accounts for around 25 percent of India's total energy consumption and shifting that load from gas pipes to electric wires would be an engineering challenge.

Most factories operate on a 24/7 cycle whereas solar and wind energy are intermittent, so in order to electrify heat for industry, India needs round-the-clock renewable power, which entails a large rollout of battery energy storage systems and pumped hydro storage. At present, India's storage capacity is in its infancy and without it, the grid is not in a position to sustain the large 'spikes' of energy that heavy industrial induction furnaces demand.

Second, local power grids in industrial clusters like Ludhiana are often ageing. High-capacity induction heating requires high-voltage substations and reinforced cabling for last mile supply. Asset-loading reports from DISCOMs (electricity distribution companies) in industrial clusters suggest that roughly a quarter to a third of distribution transformers can be critically loaded during peak hours, with little headroom for additional demand.

These constraints accentuate CST's advantage, especially as a source of heat that does not depend on the grid. By generating thermal energy on-site and storing it in insulated tanks, a factory can continue operating even at night without drawing a single watt from the national grid. Thermal storage is also much cheaper than lithium-ion battery storage.

To survive the LPG crisis and complete the transition to electrified heat, India needs a 'National Thermal Policy'. Its current subsidies focus heavily on electricity (photovoltaics in particular)

whereas there are few incentives for direct-heat technologies like CST. The government should consider providing the same production-linked incentives to CST mirror manufacturers that it gave to solar cell manufacturers. India also needs to reform the carbon market to allow factories in Morbi, say, to sell their 'avoided emissions' through the nascent Carbon Credit Trading Scheme and use the revenue to offset the high capital cost of electric kilns.

#### Global policy lessons

Industries can also benefit from hybrid solutions given the inherent advantages of being able to modernise without junking their existing infrastructure first. For example, a CST system can operate during the day, a small gas-based backup system can support peak loads, and induction coils can provide heat for precision processes. The 'Miraah' project in Oman offers a useful example: engineers integrated one of the world's largest concentrated solar thermal plants with an existing gas-fired industrial operation. Thus, solar energy generates steam in daytime, reducing gas consumption by nearly 80%, while the gas boilers were on standby, and for nighttime use.

The 'Solar Heat for Industrial Processes' initiatives in Spain have allowed the company Solatom to develop plug-and-play solar thermal units: pre-assembled, containerised mirror arrays that a factory can install on a roof or a small parking lot and connect directly to its existing steam network. Denmark reformed its energy market to support 'heat purchase agreements', whereby an external provider installs and maintains a CST or induction system and the factory simply buys the heat at a fixed rate, typically cheaper than gas. Such solutions substantially lower the engineering costs for new adopters.

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**'A DECLINE DESPITE RISING URBANISATION'**

**House panel sounds alarm as urban development budget hits five-year low**

**Damini Nath**  
New Delhi, March 12

A PARLIAMENTARY Standing Committee Thursday flagged the decreasing share of allocations for the Ministry of Housing and Urban Affairs (MoHUA) to the lowest in five years, at 1.6% of the 2026-2027 Budget Estimates (BE), at a time when urbanisation is increasing.

The Standing Committee on Housing and Urban Affairs, chaired by Magunta Sreenivasulu Reddy, presented its report on the Ministry of Housing and Urban Affairs' Demands for Grants (2026-2027) in the Lok Sabha Thursday.

The Committee noted that "despite increasing urbanisation and rising demand for housing, water supply, sanitation and urban transport, the Ministry's relative share in the Central Budget has declined and its projections are routinely curtailed at the approval stage except in FY 2025-26."

While the total outlay of the Union government has increased from Rs 39.44 lakh crore in 2022-2023 to Rs 53.47 lakh crore in 2026-2027, the Ministry's share has not increased proportionately, the report said. In fact, the Ministry's share has gone down from 1.94% of the Budget in 2022-2023 to 1.6% in 2026-2027 — the

**Urban development budget**

(Numbers in ₹)

Year	Budget Estimates	Revised Estimates	Actual expenditure
2022-23	76,549.46 cr	74,545.64 cr	74,107.67 cr
2023-24	76,431.60 cr	69,270.72 cr	68,796.61 cr
2024-25	82,576.57 cr	63,669.93 cr	53,258.86 cr
2025-26	96,777.00 cr	57,203.78 cr	40,967.62 cr*
2026-27	85,522.39 cr	--	--

\*As on Feb 20

lowest in five years.

"Further, against the projected outlay of Rs 97,644.51 crore for 2026-27, the approved Budget Estimate is Rs 85,522.39 crore, reflecting a reduction of Rs 12,122.12 crore (12.41%). The Committee also note that such reductions between projected outlay and approved Budget Estimates have been persistent over the years i.e. 22.82% in 2022-23, 11.52% in 2023-24 and 17.25% in 2024-25, with the only exception being the year 2025-26," the report said.

The Committee noted that persistent gaps between the projected outlay and the budget allocations were linked to the utilisation of funds. The committee said the gap between the BE, Revised Estimates (RE), and Actual Expenditure had

"widened significantly in recent years".

"While utilisation remained close to RE in 2022-23 and 2023-24, the position deteriorated in 2024-25 and 2025-26. In 2025-26, the BE of Rs 96,777 crore was sharply reduced at RE stage to Rs 57,203.78 crore (a reduction of nearly 40%). The actual expenditure as on 20.02.2026 stands at Rs 40,967.62 crore, which is only 71.62% of RE implying that nearly 28.38% of the revised allocation is to be spent in the last 39 days of the financial year," the report said.

The Committee recommended that the Ministry adopt a more realistic mechanism to come up with budget estimates and to present a time-bound plan for increasing its share in the Union Budget.

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### • DEFENCE

# China's 'border defence' villages and the challenges they pose

Amrita Nayak Dutta  
New Delhi, March 12

CHINA HAS constructed 72% of its 628 Xiaokang, or "well-off villages," near the Line of Actual Control (LAC) in northeastern states, with 90% in Arunachal Pradesh.

The details were revealed on Tuesday by Deputy Chief of the Army Staff (Strategy), Lieutenant General Rajiv Ghai. He added that many of these settlements are in areas contested between the two countries.

"Not to mention the Xiaokang project of about 600 odd villages across the northern borders. But more importantly, almost 72% of these 628 villages are across the northeastern states. That translates to about 450, and out of these, almost 90% are opposite the state of Arunachal Pradesh. No marks for guessing why that is so," he said.

"These border settlements, villages are definitely a challenge. They're coming up very rapidly. And many of these are in areas that are contested," he said.

### The villages

China has been constructing 628 such

Xiaokang or "well-off villages" along India's borders with the Tibet Autonomous Region for over five years now. These have been constructed all along the LAC, including the Ladakh and Arunachal Pradesh borders.

The structures include mostly double-storey, large and spacious buildings. The construction for most of these planned villages has already been completed, as per officials.

The exact purposes of these villages have remained unclear, but they were understood to be dual-use — civil and military — and have thus been a concern from a defence perspective. The strategic community looks at it as a way to assert Chinese claims over certain areas along the LAC.

The extent of the LAC has been a source of contention between the two countries for years. India considers it to be 3,488 km long, while China says it is around 2,000 km.

### Are they occupied?

While China had been constructing them aggressively since 2019, they remained vacant for a long time. However, since late 2023, Chinese nationals have started occupying several of these villages particularly

### 'Xiaokang' villages

• China has been constructing 628 such Xiaokang or 'well-off villages' along India's borders with the Tibet Autonomous Region for over five years now.

• Almost 72% of these 628 villages are located across India's northeastern states. And out of these, almost 90% are opposite Arunachal Pradesh.

across from Lohit Valley and the Tawang sector of Arunachal Pradesh. China has also been constructing infrastructure, including border villages, in Bhutanese territory.

### Law concerning these villages

A new law on China's land borders was brought into effect from January 1, 2022. The law was passed in 2021 by the Standing Committee of China's National People's Congress, for the "protection and exploitation of the country's land border areas".

China's official news agency Xinhua stated: "The law also stipulates that the state shall take measures to strengthen border defense, support economic and social development as well as opening-up in border areas, improve public services and infrastructure in such areas, encourage and support people's life and work there, and promote coordination between border defense and social, economic development in border areas". Thus, this border law covers the border defence villages programme.

### India's response

The Indian government announced the

Vibrant Villages Programme in 2022 to develop its border villages into modern villages with all amenities and as tourist attractions. The programme builds on the existing Border Area Development Programme under the Union Ministry of Home Affairs.

Under the programme, India plans to develop 663 border villages into modern villages in the first phase. Of them, at least 17 such border villages along the borders with China in Ladakh, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh, have been selected for development as a pilot project.

### Infrastructure push

China has been constantly building infrastructure all along the LAC, including near Arunachal Pradesh's Tawang region and the Siang Valley. This includes new roads and bridges.

India has also focused on strengthening its border infrastructure and improving forward connectivity with the construction of new roads, bridges, and helipads. There has also been a push to develop alternate routes to the LAC and improve inter-valley connectivity in the northeast.