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INDIA'S FOUNDRY CHEMICALS INDUSTRY POISED FOR EXPANSION; BUT IMPORT DEPENDENCE, ESG RULES WEIGH HEAVY

Madhumita Mookerji

As India prepares for a major up-cycle in casting production, the foundry chemicals and fluxes ecosystem is gearing up for a steady decade-long expansion. Yet, the sector remains vulnerable to supply chain shocks, inconsistent raw material quality and escalating environmental compliance demands. With global buyers diversifying beyond China and domestic foundries seeking higher-grade consumables, the industry's next phase will hinge on raw material access, R&D investment and policy intervention

Limited domestic availability of key inputs like zircon, graphite and phenolic resins exposes sector to global volatility

Technology upgrades, China+1 shift, govt schemes may strengthen competitive edge

Foundry chemicals and fluxes are among the most critical consumables required in producing castings. These inputs influence casting integrity, surface finish, mould/core stability and metal flow characteristics, making them indispensable to production across automotive, heavy engineering, thermal power, wind power, general machinery as well as Defence applications.

The current market size of the Indian foundry chemicals industry is pegged at around INR 1,500-2,000 crore annually and is expected to register a minimum 6% y-o-y growth over the next decade, tracking the projected expansion in both domestic and export castings production. Industry players note that this growth estimate may even be conservative, given the upcoming capex cycles in railways, non-ferrous auto components (especially electric vehicles), and infrastructure.

"The key assumptions for the said growth is attributed to the growth predicted for the Indian foundry industry—both ferrous and non-ferrous—over the next one decade," said an industry source. Globally, demand for high-precision cast components for renewable energy (wind, solar) and new-energy vehicles (EVs, hybrids) is expected to boost consumption of advanced binders, riser sleeves, coatings and fluxes.

Key challenges for foundry chemical manufacturers

1) Gaps in domestic raw material availability: A central challenge continues to be the limited domestic availability of core raw materials required for manufacturing foundry chemicals. Most producers remain dependent on imports for mission-critical materials.
Indian foundry units depend upon several chemicals and reagents. These include:

Low-ash coal - mostly imported from **Indonesia** and **Australia**

Zircon sand - sourced from **Australia/South Africa**, but recent supply tightening from South Africa has increased price swings

Ferro alloys - primarily imported from China

Solvents - procured from oil-producing countries

Phenol, formaldehyde, and furfuryl alcohol - largely procured from China, making costs vulnerable due to exposure to **China's** energy policies and domestic environmental curbs

Graphite and refractory clays - where India has moderate availability, but quality inconsistency pushes buyers toward imports

2) Import dependence: Solvents, dispersants, deflocculants, high-purity zircon and specialty additives continue to be import-dominated due to limited domestic technology and product development.

3) Fragmented domestic supply chain: Domestic supply chains remain fragmented and do not form a significant portion of total requirements. India does have zircon deposits in coastal regions like Kerala and Odisha, but commercial exploitation is limited due to mining restrictions, environmental sensitivity and inadequate processing infrastructure. The same applies to specialty additives and advanced resins, where domestic R&D is still catching up.

4) Inconsistent quality of raw materials: Variability in the quality of raw materials such as refractories, resins, graphite and clays leads to inconsistent performance, affecting mould strength, coating quality and final casting rejection rates.

5) Price volatility & supply chain disruptions: These include factors like -

Port congestion and vessel delays which increase lead times

Freight rate volatility which affects landed costs

Oil price fluctuations directly impact solvent-based coatings and binders

China's environmental controls influence global supply of phenolic resins, affecting Indian prices

6) Quality standardisation and testing challenges: The absence of unified national standards for coatings, binders and fluxes creates variability in formulations. Different foundries prescribe custom viscosity, solid content, ignition loss and rheology parameters, making mass standardisation difficult. Some industry bodies have pushed for AIS (Automotive Industry Standards)-type benchmarks for foundry chemicals, but adoption remains slow.

7) Competitiveness in exports: Indian producers benefit from lower labour and operational costs, enabling competitive pricing in the Middle East, Southeast Asia, and emerging African foundry hubs. Exported products typically fall under HSN 38241000 and 38249900. However, Indian exporters face stiff competition from Chinese and Turkish players, especially in high-purity zircon coatings and advanced chromite-based systems.

Policy measures and incentives needed

Industry stakeholders emphasise the following interventions:

Concessional or zero duty on essential raw materials like zircon, graphite and special additives not produced in India

Duty-free import of testing, environmental control and automation equipment under the EPCG scheme

Streamlining raw material availability via:
- Forward contracts or government-facilitated bulk procurement of zircon
- Incentives for domestic resin and binder R&D

The Advanced Authorisation Scheme (AAS) and Export Promotion Capital Goods (EPCG) policy remain vital for exporters, enabling zero-duty import of capital goods.

Under the Remission of Duties and Taxes on Exported Products (RoDTEP) scheme, exporters receive refunds for embedded duties not reimbursed elsewhere.
Special economic zones (SEZs) and export-oriented units (EOUs) offer long-term incentives, including duty-free imports and tax benefits.

Several manufacturers expect the upcoming chemical industry policies to emphasise on:

- Indigenous specialty chemical clusters
- Technology tie-ups
- Import substitution incentives
- Environmental compliance financing for SMEs

Environmental regulations and sustainability needs

Compliance with sustainability norms constitutes a significant cost driver — especially for SMEs and family-run foundry chemical operations.

Required investments include:

- Effluent treatment plants
- Volatile Organic Compounds (VOC) emission mitigation systems
- Dust collectors and air pollution control devices
- Hazardous waste storage, monitoring and fire safety facilities
- Energy-efficient process upgrades
- Certifications such as ISO 14001, REACH (for exports), and Responsible Care

These measures increase upfront capital cost but ultimately help meet global customer requirements, especially in Europe and the US, where OEMs increasingly seek low-VOC, water-based coatings and sustainable binder systems.

Growth enablers

- India's castings production is expected to exceed 20 million tonnes by 2025, with long-term growth supported by railways, automotive, EVs, and renewable energy components.
- The rise of ductile iron castings for wind and hydro power will drive consumption of specialised coatings, riser sleeves, inoculants and fluxes.
- The China+1 shift is prompting global buyers to diversify sourcing of foundry consumables, benefiting Indian manufacturers who can offer customised formulations.

The shift toward water-based and low-VOC formulations is another major growth area, particularly for exporters.

Industry innovations and future direction

Sources in Shamlax Meta-Chem, a key

producer of foundry chemicals and fluxes, said the company is developing specialised products such as:

Colour-changing coatings (both water- and solvent-based) for mould and core applications, enabling instant visual confirmation of drying

Advanced coatings for high-pressure die casting (HPDC) and EV aluminium components

Specialised fluxes for ductile iron and windmill castings

Low-VOC and odour-controlled binder systems to meet global ESG requirements

"With inhouse R&D and technical capabilities, we aim to provide customised solutions for both domestic and global foundries," a company source said.
Industry insiders add that India is seeing growing interest in:
3D-printed sand moulds, requiring next-generation binder chemistry

Nanotechnology-based coatings for improved thermal resistance

Automated application systems for consistent coating thickness

Bio-based binders derived from agricultural waste (future potential, currently at pilot

TECHNOLOGY EMERGING AS PIVOT OF INDIAN FOUNDRIES' TRANSFORMATION

Madhumita Mookerji

Key castings companies are now scripting a Defence sector story where self-reliance is the watchword. From warship propellers and missile casings to lightweight aluminium armour and deep-sea exploration modules, foundries are exploring terrains less travelled so far, aided by government facilitation

Cutting edge defence tech on foundry radar

Quality, high precision are key focus areas

The Indian foundry industry, long seen as the backbone of traditional manufacturing, is undergoing a quiet but powerful transformation. Shedding the run-of-the-mill character, foundry items are now being incorporated in high-profile products ranging from warship propellers and missile casings to lightweight aluminium armour and deep-sea exploration modules. India's foundry engineers and metallurgists are now scripting a new story - where technology is not just a support tool but the strategic heart of India's foundry ecosystem. And, Defence is one area where cutting-edge technology is the key.

DRDO focusing on transfer-of-technology model

Take the DRDO model, which is one of collaboration and facilitation, and involves developing a material in-house, demonstrating it, and then hand-holding industry in scaling up production. This transfer-of-technology (ToT) model has been evolving since the 1990s -- turning research

prototypes into commercial successes. Yet, a DRDO source cautioned that true self-reliance demands more than mere “know-how”. “We must also own the know-why,” he insisted, because, “without understanding the science behind the technology, co-development cannot happen.”

To bridge that gap, the government has identified key technologies in its Department of Industrial Policy & Promotion (DIPP) and Directorate of Industry Interface & Technology Management, (DIITM) frameworks, while the “DRDO-industry-academia” partnership aims to guide companies through innovation pathways and access to the Technology Development Fund (TDF).

The Naval Materials Research Laboratory (NMRL), under DRDO, develops high-end welding materials for surface ships and submarine hulls where quality is key. Every innovation begins - and ends - with foundry-grade alloy steel castings.

The very fact that around 76% of the INS Vikrant aircraft carrier is manufactured with domestically manufactured components highlights how far indigenous capabilities have come.

Speaking on import substitution, a senior scientist at NMRL said transfer of technology is a key aspect of DRDO and necessary for a prototype to get realized. “We take tech from foreign vendors... But we never learn the 'know-why' part because the foreign vendor will never give that to us. But we impress upon them to give the 'know-why', otherwise, the next stage of co-development cannot happen. So know-why should be embedded in the technology,” he insisted.

Make in India versus self-reliance

A foundry industry official drew an important distinction between Make in India and Atmanirbhar Bharat. “The former is about manufacturing. But true self-reliance means owning the intellectual property, the design, and being ready for future demand,” he said. As India eyes developed-nation status by 2047, the message is clear: India needs to be future-ready with a focus on complex, high-quality castings, not just volumes.

India's mineral richness, many feel is not the challenge - technology is. A source at L&T

Special Steels & Heavy Forgings dwelt on the company's relentless pursuit of scale and precision at its Hazira plant in Gujarat - a site that houses India's largest and heaviest forgings. “Whatever we make is for the strategic sector -- from critical naval forgings to heavy components for missiles and reactors,” the source observed.

“We lacked the technology to make titanium forgings. So now, we're building a manned submersible vehicle that will dive 6 km below the seabed - the first in India - to explore minerals,” the source informed.

For him, technology is as much about people, process, and plant. “A process that works in one foundry may not in another,” he explained. “Every parameter must be measured to the nth level. Only then do you get a product that performs right every time,” he insisted.

Adani's integrated approach to Defence tech

Representing the new-age Defence manufacturing mind-set, Adani Defence & Aerospace entered the ecosystem just seven years ago but has already acquired and scaled up multiple facilities - including PLR Systems, a small arms manufacturer, and a greenfield ammunition and missile integration complex in Kanpur.

“Phase one, for small calibre ammunition, is complete. Large calibre production started very recently, and by January 2027, we will begin medium calibre manufacturing,” a company official said.

Backed by Adani's financial strength and global collaborations - from Israel to France and Australia - the group's strategy involves scouting proven technologies globally, indigenising them, and delivering tailor-made systems for the Indian Armed Forces. Working closely with DRDO on multiple missile development programmes, the company's focus is on “delivery and co-development -- building capability, not just capacity”, the source emphasised.

Navy's indigenisation wave

India's ship-building sector is transforming today and how! Adding a strategic perspective, a high-ranking naval official informed that, today, about 50 naval platforms are in various stages of construction - a major leap in indigenisation. Each ship, he pointed out, requires INR 30-40 crore worth of components from foundries - from propellers to engine blocks.

However, MSMEs often find navigating the Defence supply chain difficult. However, some practical steps can be followed: 1) register with a shipyard, 2) enlist with DGQA (which certifies naval equipment), and connect directly with the Warship Design Bureau to showcase foundry capabilities. The naval official urged foundries to invest in R&D, given that “foundry technologies are

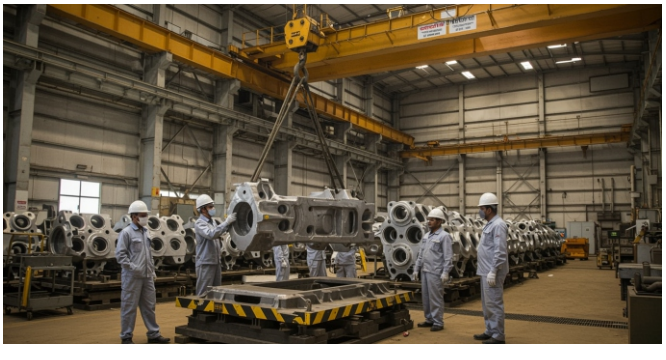
changing rapidly". On exports, the official noted a new proactive push: "Earlier, industry had to find markets on its own. Now, Defence exports are a national mission, supported by Indian embassies worldwide."

Taural's aluminium leap: From import dependence to global benchmark

A global benchmark in aluminium sand casting, Taural made headlines when it indigenised a critical 180-kg aluminium component for the Sarath tank - earlier imported from Russia - within just six months, during the pandemic.

"Aluminium casting was once an ignored field in India," recalled Bharat Gite who leads Taural. "But today, every sector - Defence, naval, energy, railways - is turning to aluminium for its light weight, durability, and recyclability," he emphasised.

Calling aluminium "the most sustainable metal," he cited examples like crash barriers, which, though expensive, offer superior rebound strength and longevity compared to steel.



What once required imported ingots is now being met domestically by major producers like Vedanta and Hindalco, who are customising alloys for Defence and transport sectors.

The ESG imperative

Officials at **JS Auto Cast Foundry India** brought in the perspective of digital transformation. As part of the Kalyani Group, JS Auto Cast supplies iron castings for Defence, automotive, renewable, and wind sectors.

"Our vision rests on nine principles - from safety and ESG to technology, digitisation, and innovation," a company source said. "Quality must be the same for domestic and global markets, and product development cycles must be faster. That's how Indian foundries can benchmark themselves globally," the

Outlook

A clear narrative emerges. Technology is the alloy that binds India's foundry industry to its Defence ambitions. Innovation is no longer optional - it is an imperative. The ecosystem is aligning. Transfer-of-technology, R&D collaborations, industry's process discipline, and the government's funding mechanisms are collectively forging a path to true Atmanirbhar Bharat. Indeed, India's foundries are not just melting metal but shaping the future of national resilience through technology.

WILL POWER TARIFFS & RENEWABLES RECAST FOUNDRY COMPETITIVENESS?

By Madhumita Mookerji

Power has a 15-30% share in Indian foundries' input costs. Units typically seek uniform tariff patterns and a reduction in electricity costs. While tariff uniformity may not always be possible, a long-term reduction in costs is viable through renewable energy sources. However, challenges remain as initial installation costs are high. The Ministry of Power, on its part, has advocated specified renewable consumption obligation (RCO) from 1st April 2024 to various categories of consumers. Foundry Frontier takes a look

Will rising power costs push Indian foundries toward renewables and policy reforms?

Power typically accounts for 15-30% of the total cost of production for Indian foundries and it varies by process and automation levels. Power costs have been known to be increasing by 4-8% per annum, depending on region, fuel prices, and grid tariffs, with diesel/gas back-up systems also contributing to the volatility in energy costs. Reinforcing the importance of addressing power-related issues, a past President of The Institute of Indian Foundrymen (IIF), had also urged in a session at the recently-concluded IIF Eastern Regional Conference – EASCON 2025-26, “Foundries are hugely power-intensive. Around 20% of our costs are energy. I have been advocating this issue for the last few years...”

How do foundries source their power?

Large units often source from captive coal-based thermal power plants or do open access power procurement. But many are increasingly exploring group captive solar/wind sources, especially in states with favourable policies (eg, Gujarat, Maharashtra, and Tamil Nadu). In fact, these three states are known to be driving India's renewable energy (RE) sector with policy-driven growth.

MSME units primarily depend on grid power (discoms) and diesel gensets for back-up.

Tariff disparity?

What foundry units in India are looking for is a viable and level playing field in terms of power tariffs. But is thermal power always available at a unified level? In West Bengal, for instance, many find some disparity between the power tariffs enjoyed in the DVC area and that in Howrah. "Howrah and Kolkata together export around 32,000 tonnes of castings which is a substantial figure and there should be a power tariff uniformity. Power should be made available at competitive rates," insisted a Kolkata-based foundry source.

Sources rued that within West Bengal, there is a disparity between the rates offered by the discoms. For instance, Howrah, which is regarded as the epicentre of industry in Bengal by many, and where large parts are serviced by the West Bengal State Electricity Distribution Company Limited (WBSEDCL), power costs are higher by 13% compared to say the Durgapur region, which is also served by DVC - a competitor to the former.

This disparity was also pointed out at the recently-concluded EASCON 2025-26. When asked, sources in the state power department responded that this is a "policy matter".

"It is true that consumers in the DVC area are getting more benefits. This is a policy matter with our state government. We can discuss the matter later and provide better

benefits to others as well," a WBSEDCL official stated at the EASCON.

How can power costs be reduced?

Another important area that foundries are looking at is a reduction in their power costs. A key route through which power costs can be reduced is renewables. The Ministry of Power (MoP), through the Bureau of Energy Efficiency, it may be recalled, had mandated a certain percentage of electricity consumption from renewable energy sources. The MoP, vide its Gazette Notification dated 20th October, 2023, had specified renewable consumption obligation (RCO) from 1st April 2024 to various categories of consumers, including designated consumers (DCs) operating captive power plants (CPPs) and procuring

power through open access (OA). Thus, by 2024-25, the RCO percentage to be met was 29.91%, followed by 33.01% in 2025-26

Minimum percentage of electricity consumption from renewable energy sources maandated by govt

Financial year	RCO (%)
2024-25	29.91
2025-26	33.01
2026-27	35.95
2027-28	38.81
2028-29	41.36
2029-30	43.33

and which is to be expanded to a sizeable 43.33% by 2029-30.

"An additional investment helps one to get into a niche market and beat competition," emphasised a Delhi-based foundry source. However, few MSMEs have renewable installations due to capital cost issues.

Govt order can protect units from rising power costs

"Yes, partially, if implemented strategically," a source said, adding: "Renewables (solar/wind) can offer long-term price certainty, especially via group captive power purchase agreements (PPAs) and open access procurement."

"The capital investment burden may be high upfront but the levelised cost of electricity (LCOE) from solar/wind is already lower than grid or diesel over 10-15 years," said another source.

Also, if a foundry unit is part of a steel value chain, ie, forging, semi-finished steel components, then the cost of renewables can also get reduced.

Cost implications for foundries (new renewable energy set-up vs power exchanges) options:

(**a) Setting up a captive RE plant (for instance, solar on rooftops or ground)**: Capex is heavy here but offers long-term savings. It requires land, permits, storage, and technical support.

(b) Buying RE power via power exchange/open access/renewable energy certificates (RECs): This is an operating expenses (OPEX)-based model, more suited for MSMEs. It needs regulatory permissions (state load despatch centre {SLDC}, open access (OA) charges, wheeling etc.
The estimated investment is INR 3.5-4.5 crore/megawatt (MW) for solar (captive). Buying RE via exchange could be 20-30% cheaper per unit than thermal over time.

Outlook

MSMEs will require policy support (eg, viability gap funding, interest subsidies, RE transition grants etc). Larger units could use internal accruals or RE PPAs with developers.

Rising power costs will remain a structural pressure point for Indian foundries, especially MSMEs that depend heavily on grid power and diesel back-up. Policy clarity on tariff uniformity and open-access charges will be critical to restoring competitiveness in key clusters. Renewable energy adoption is set to accelerate, driven by RCO mandates and the promise of long-term cost stability. However, high upfront capital costs will slow MSME participation unless targeted fiscal support is extended. Larger, integrated units are likely to move faster, using renewables as both a cost hedge and a strategic differentiator.

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