

Beyond The Boiler

An Action Agenda For Scaling Industrial Heat Electrification in India

Key findings and an action agenda from field research across Perundurai, Tamil Nadu and Surat, Gujarat, two of India's largest textile wet-processing clusters.

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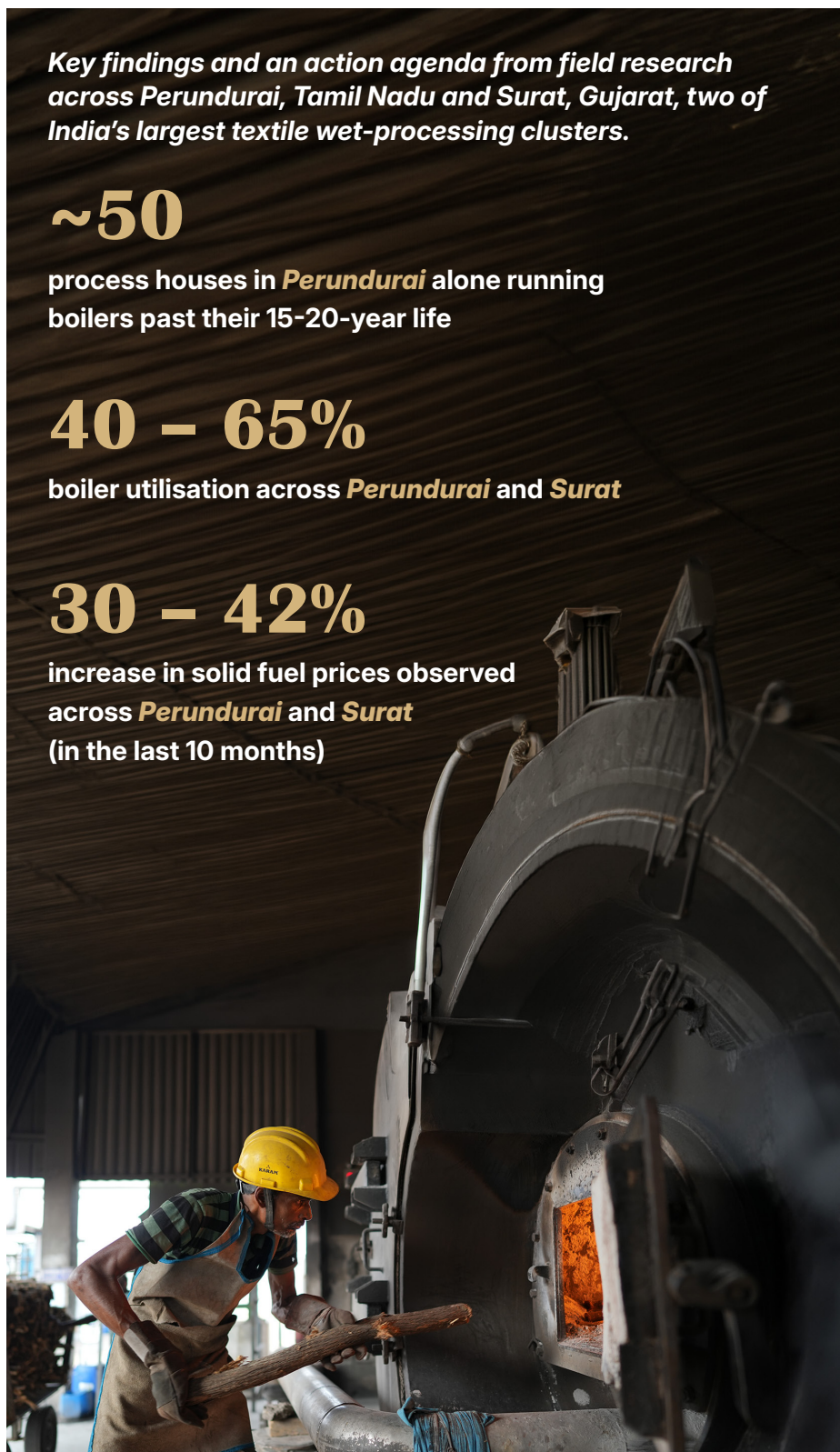
process houses in **Perundurai** alone running boilers past their 15-20-year life

40 – 65%

boiler utilisation across **Perundurai** and **Surat**

30 – 42%

increase in solid fuel prices observed across **Perundurai** and **Surat** (in the last 10 months)



Rising fuel price uncertainty, stricter buyer sustainability requirements, and a wave of ageing thermal equipment are converging at the same time. For many manufacturers, the next boiler or thermal system replacement will shape energy costs and emissions for the next 15–25 years. Replacing ageing combustion equipment with electric alternatives, rather than locking in another fossil fuel system, offers a strategic opportunity to improve competitiveness while reducing long-term carbon exposure.

A practical starting point for decarbonising textile manufacturing is wet processing, which accounts for the largest share of thermal energy demand and fuel consumption. Optimising thermal systems at this stage by better matching equipment to process temperature requirements, addressing oversized and underutilised heating systems, recovering waste heat, and adopting electric technologies such as heat pumps can unlock significant efficiency gains and cost savings as part of a broader transition.

Beyond improving efficiency, these investments reduce exposure to volatile fossil fuel markets, simplify operations by lowering fuel handling and maintenance requirements, and help manufacturers meet growing buyer expectations around low-carbon production, traceability and resilient supply chains.

**This moment presents
an opportunity to rethink
industrial heat systems
altogether not just from an
emission lens but also from a
socio-economic perspective.**

The Economics of Industrial Heat are Changing

Levelised Cost of Steam (LCoS) comparisons show that steam costs are influenced by several independent factors, including fuel quality, operating hours, system utilisation, equipment efficiency, electricity tariffs and access to low-cost renewable power.

At electricity tariffs of around

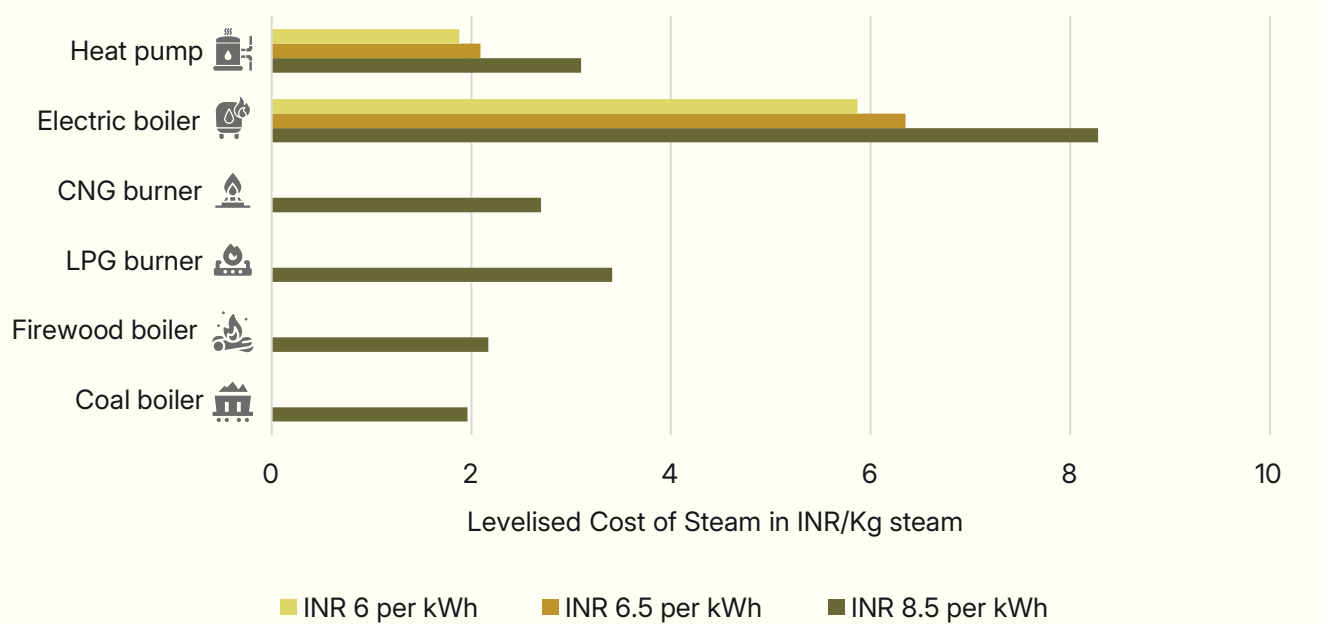
INR 6/kWh

industrial heat pumps can become the most cost-effective option for many low- and medium-temperature applications, outperforming coal, firewood, furnace oil and natural gas while reducing exposure to fuel price volatility and growing sustainability and traceability requirements.

Unlike conventional combustion systems, the economics of electrified heating technologies are highly sensitive to proper system sizing and process integration. Their competitiveness improves considerably in applications dominated by low- and medium-temperature heat, where waste heat streams can be recovered, simultaneous heating and cooling loads coexist, and high-capacity utilisation can

be maintained. The comparative LCoS estimates presented below illustrate the range of heating costs associated with different fuel and technology pathways and underscore the importance of affordable renewable electricity in improving the economics of electrification. Heat pump already makes economic sense when compared with LPG.

Levelised Cost of Steam for Different Electrification Technologies





What will Determine the Pace of Industrial Heat Electrification

Most industrial decarbonisation technologies have existed for years. Yet despite their availability, they haven't achieved scale. That's because industrial heat electrification is not a technical transition; it's a systems transition.

It runs from electricity network planning to heat demand optimisation, steam integration, need-based (cluster-level) thermal infrastructure design, targeted policy incentives and finally, the actual investment and skilled workforce to implement it. At every stage, progress depends on policy, technology, finance, infrastructure and markets reinforcing one another and not operating in isolation. Scale only comes when these conditions align together.



A Once in a Generation Replacement Opportunity

Many textile units are approaching major equipment replacement cycles. This creates a rare opportunity to redesign thermal infrastructure rather than locking in another two decades of combustion-based systems. Greenfield facilities can adopt electrified heating by design, while existing plants can transition in phases through process integration and waste heat recovery.



Better Data Enables Better Investment

Successful electrification starts with understanding how heat is used. Most MSMEs lack process-level data on steam flows, temperatures and equipment utilisation, making it difficult to optimise systems, recover waste heat or size technologies appropriately. Better thermal data is the foundation for better investment decisions and stronger business cases.



Business Models need to Evolve alongside Technology

High upfront costs, limited access to finance and technology risks continue to constrain investment, particularly for MSMEs. Service-based models such as Heat-as-a-Service, equipment leasing and ESCO-led delivery can reduce capital barriers and make electrification more accessible.



An Enabling Ecosystem is Essential

Scaling industrial heat electrification depends on an enabling ecosystem. Affordable renewable electricity, demonstration projects, coordinated technology supply chains, supportive policies, and stronger alignment between brands and suppliers are essential to build confidence and reduce investment risk across the value chain.



The Benefits Extend Beyond Decarbonisation

Cleaner thermal systems can improve energy security, reduce operational complexity and maintenance, enhance worker health and air quality, and support greater integration of renewable electricity thereby strengthening the long-term competitiveness and resilience of India's textile manufacturing sector.

Action Agenda for Electrification of Industrial Heating in Textile Manufacturing

Scaling industrial heat electrification requires coordinated action across four enabling areas: Grid Planning, Electricity Market Reform, Technical Assistance & Technology Deployment, and Policy, Investment & Manufacturing Ecosystem. The following actions outline how different stakeholders can help create the conditions for scale.

For MSMEs/Clusters

Conduct baseline assessments and prioritize knowledge sharing

- ◆ **Build the business case.** Map process heat and assess feasibility to identify cost-effective electrification opportunities.
- ◆ **Align investment with replacement cycles.** Replace ageing boilers with cleaner thermal systems instead of fossil-fuel reinvestment.
- ◆ **Optimise before electrifying.** Improve efficiency through process integration, condensate recovery and waste heat utilisation.
- ◆ **Amplify knowledge exchange.** Connect industry, technology providers and financiers to accelerate learning and adoption.

For Policymakers

Provide the policy push for electrification and create the enabling conditions

- ◆ **Strengthen industrial ecosystems.** Develop cluster roadmaps, domestic manufacturing and skilled workforce for electrification
- ◆ **Plan for clean industrial heat electrification.** Integrate industrial heat into long-term grid and renewable energy planning
- ◆ **Improve access to affordable renewable electricity.** Enable affordable clean power through open access, tariffs and streamlined approvals
- ◆ **Align policy with industrial investment cycles.** Incentivise electrification during boiler replacement and new industrial investments

For Manufacturers/Innovators

Accelerate technology availability and adoption

- ◆ **Boost local production.** Expand local production of heat pumps, thermal storage, and key components.
- ◆ **Develop solutions fit for textile manufacturing.** Develop modular technologies suited to textile process temperatures and operating conditions.
- ◆ **Demonstrate performance at scale.** Scale pilots to validate performance, economics and system integration under Indian conditions.

For Other Ecosystem Players

(Impact Investors, Philanthropies, Escos, etc.)
Drive early adoption

- ◆ **Create an enabling investment environment.** Support demonstrations and policies that de-risk industrial electrification investments.
- ◆ **Back innovative delivery models.** Pilot Heat-as-a-Service, leasing and ESCO models for MSME adoption.
- ◆ **Facilitate collaboration across the value chain.** Foster partnerships across industry, finance, EPCs, academia, and technology providers.



Planning Your Next Boiler?

Scan to take the 2-minute electrification readiness assessment

