Project 68 | **Industrial High-Temperature Heat Pumps**

https://heatpumpingtechnologies.org/project68/

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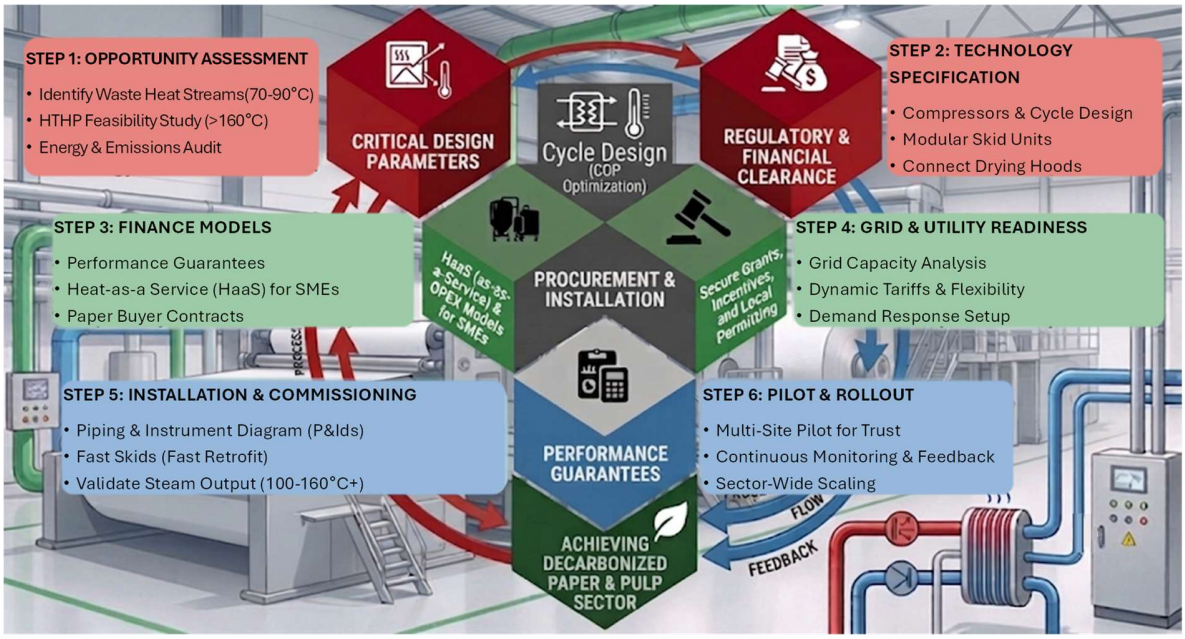
Task 2 – Sector Collaboration: From Barriers to Opportunities: Sector-Specific Stakeholder Perspectives on Industrial Heat Pump Uptake

[Paper & Pulp Sector]

The Paper and Pulp sector is the most promising industrial sub-sector for adopting high-temperature heat pumps (HTHPs). Its primary energy consuming process, drying, aligns well with the supply temperatures provided by HTHPs. Unlike other industries, this sector operates under a two-tier architecture: consolidated multinationals manage raw materials upstream, while smaller regional players handle specialized conversion downstream. Consequently, a two-track strategy combining collaboration between global and local companies is necessary for the effective deployment of HTHP technology.



Stakeholder map: Industrial HTHP in Paper & Pulp

Sector Landscape

Following factors influence and shape heat pump adoption and deployment potential within the paper & pulp sector.

- **Sector Organization:** Large upstream pulp producers have the capital for heat pump investments, but downstream SME converters face tight margins and need financial certainty to commit to high upfront costs.
- **Energy Prices & Tariffs:** High electricity rates paired with low fossil fuel costs undermine heat pump economics, requiring high-temperature heat pumps to maintain high efficiency (COP) to offset power tariffs and peak demand changes during continuous 24/7 operation.
- **Infrastructure:** Paper mills offer ideal waste heat recovery from humid drying hood exhaust and hot condensate, but shifting massive drying loads to high-temperature heat pumps requires major electrical grid upgrades and a low-emission grid to deliver true net carbon reductions.
- **Cultural & Economic Aspects:** Continuous 24/7 manufacturing makes risk-averse mills reject technology with potential downtime. Furthermore, typical heat pump payback periods exceed strict corporate hurdles of under five years, compounded by a tendency to view heat integration as custom engineering rather than standard upgrades.

All information were provided by the supplier without third-party validation. The information was provided as an indicative basis and may be different in final installations depending on application specific parameters.

- **Industrial End Users**: Mills demand 24/7 continuous heat or steam with zero unscheduled downtime. Expect short paybacks and need compact, skid-mounted units to fit tight legacy footprints.
- **Technology Suppliers**: Suppliers are focused on scaling large-capacity high-temperature heat pumps, sourcing robust high-pressure compressors with natural refrigerants, and delivering modular, turn-key packages.
- **Engineering Consultants & Planners**: Experts perform pinch analyses, dynamic thermal simulations, and steam loop redesigns to integrate high-temperature heat pumps without disturbing overall mill energy balances.
- **Utility & Energy Providers**: Grid operators must deliver capacity upgrades for large-scale electrification while offering flexible, time-of-use tariffs that enable heat pumps to function as active demand response assets.
- **Public Authorities & Regulators**: Policy makers manage safety frameworks for low-GWP refrigerants, streamline permitting processes, and provide direct CAPEX subsidies or grants to help bridge the heat pump commercial viability gap.
- **Research Institutions**: R&D centers lead the development of next-generation high-temperature cycles and refrigerants, deploying full-scale pilot projects to rigorously validate performance and build industry trust.

Stakeholder Analysis: Barriers & Opportunities

This stakeholder analysis breaks down the primary market and technical hurdles hindering high-temperature heat pump (HTHP) deployment in the paper and pulp sector, pairing each barrier with a targeted solution and responsible stakeholder.

Paper & Pulp High-Temperature Heat Pump (HTHP) Deployment Framework

Barrier	Opportunity & Solution	Stakeholder
High CAPEX & Long Payback	Shift upfront costs to OPEX using heat as a service and grants.	Financing & Investors
Downtime Risks & Tight Space	Deploy pre-fabricated compact skid units with output guarantees.	Industrial End-Users & Brands
Complex Thermal Retrofits	Pre-validate waste heat loops via upfront pinch analysis and simulation	Engineering Consultants & Planners
High Power Rates & Grid Limits	Adopt dynamic time-of use tariffs and fast-track grid connections.	Utilities & Grid Operators
Not Enough Track Records	Mass-Produce modular compressors and prove performance in real-world pilots.	Technology Suppliers & R&D
Slow Permitting & Cheap Gas	Fast track low-GWP refrigerant permits and mandate carbon pricing.	Regulatory & Public Authorities

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Stakeholder Strategic Interests

Shared Challenges

- Spark Spread Risk: Unfavorable ratios between high electricity tariffs and inexpensive fossil fuels directly undermine the economic payback periods of industrial heat pump installations.
- Downtime Hesitancy: Continuous 24/7 manufacturing environments require strict, uninterrupted operational reliability, creating an inherent operational bottleneck for integrating new thermal technology.
- Capital Gap: The higher capital expenditure and longer payback horizons of high-temperature heat pumps frequently conflict with strict short-term corporate budget hurdles and liquidity metrics.

Collaboration Areas

- Upfront Pinch Analysis: Consultants, mill engineers, and suppliers mapping waste heat loops before equipment specification.
- Flexible Grid Integration: Mill operators and utilities co-designing dynamic power usage to lower energy costs during peak hours.
- Co-Funded Pilots: R&D institutions, OEMs, and early-adopter mills sharing capital risk to publish validated performance data.

Required Innovations

- Business: OPEX/Heat-as-a-Service models paired with third-party uptime guarantees.
- Policy: Fast-track permitting for natural refrigerants alongside carbon tax mandates.
- Technology: Standardized skid-mounted HTHPs designed for minimal retrofit downtime.

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