

Portugal's 5.1 TWh Hidden Asset

A Blueprint for a Circular
Thermal Economy

A Systemic Market Failure

82.7 TWh Total Thermal Demand (2015)

54.2% Fossil Fuel Dependency

District Heating supplies exactly **0.0%** of residential heat demand.

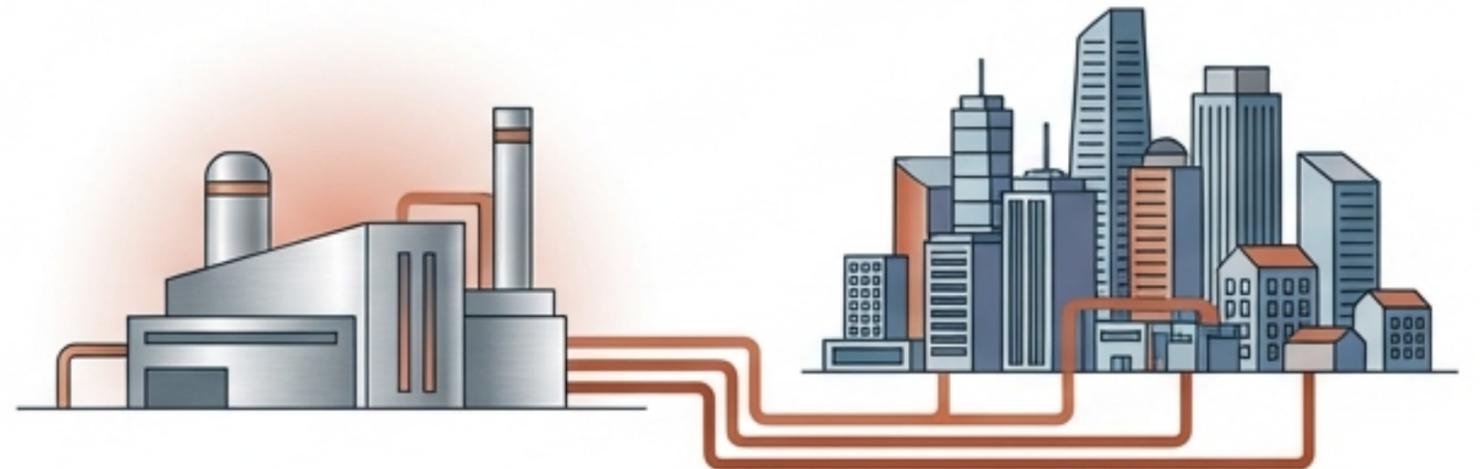


An Indigenous Energy Reserve

5.1 TWh / year

of technically recoverable industrial waste heat.

Equal to the **entire hot water demand of Portugal's residential and tertiary sectors combined**. Treating this waste as a sovereign asset offers a **cost-effective decarbonisation pathway**.



The Catalyst: The 2023 Recast Energy Efficiency Directive (EED)

The Mandate: Article 25.6 introduces a legally binding obligation for regional and local authorities to prepare local heating and cooling plans for municipalities with >45,000 inhabitants.

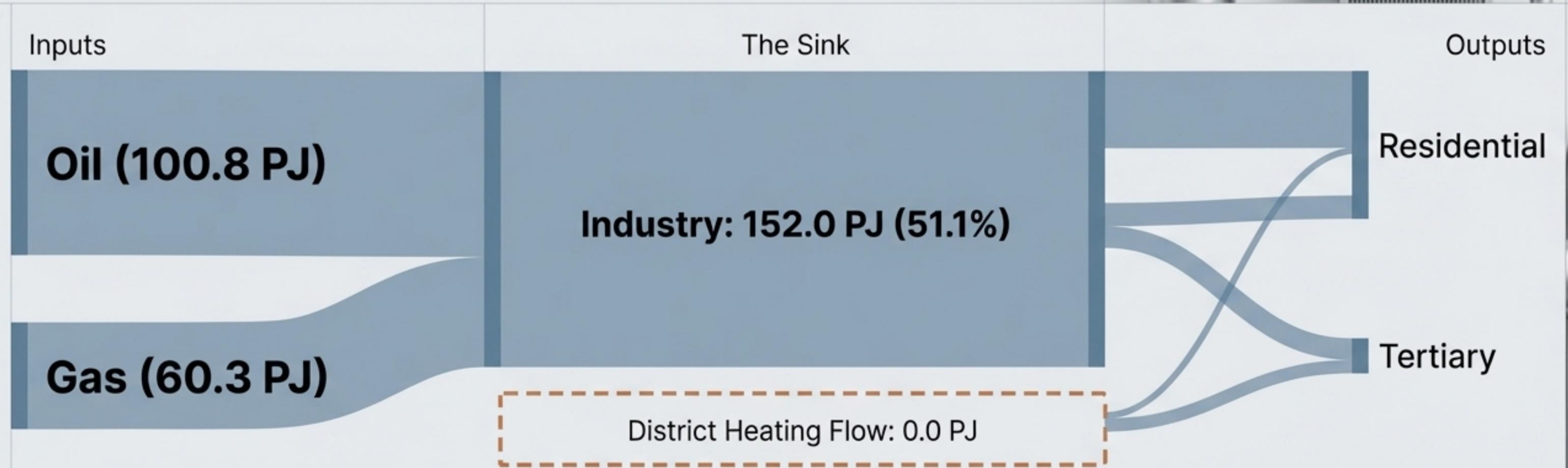
The Paradigm Shift: Moves energy policy from abstract national targets to granular, spatial, place-based planning.

Deadline: Full transposition by September 2025



PORTUGAL: No legal framework in place

The Linear Energy Baseline: 297.6 PJ of Decentralised Combustion



Millions of unintegrated, individual boilers lock the nation into high carbon costs and geopolitical price volatility.

A background image of industrial machinery, featuring a large metal heat exchanger or condenser with multiple horizontal tubes and a complex piping system with various valves and fittings. The scene is brightly lit, suggesting an indoor industrial facility.

Reframing 'Waste' to 'Asset'

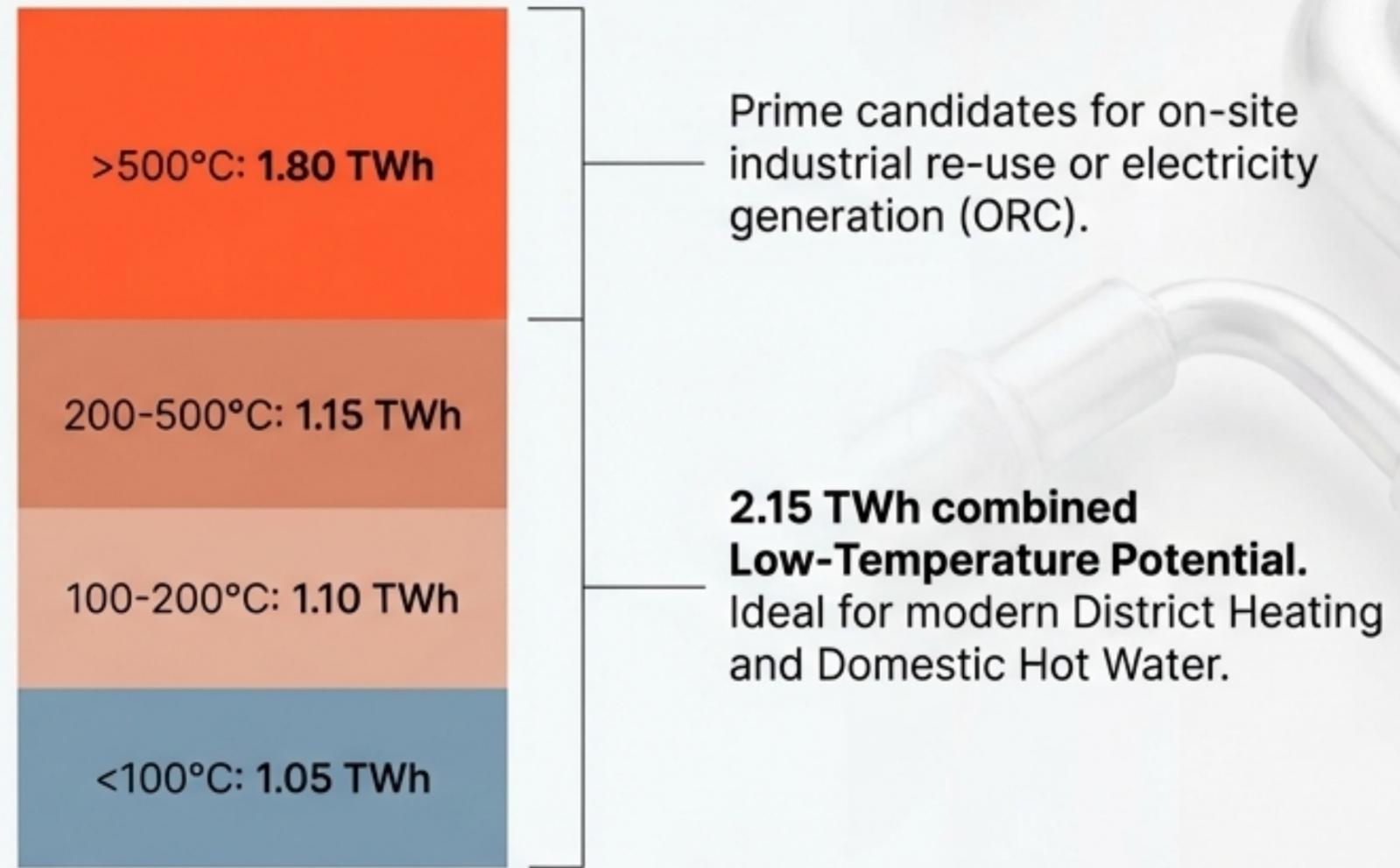
5.1 TWh / year

Calculated using the rigorous Pan-European Thermal Atlas (PETA) methodology and sector-specific Waste Heat Fractions.

Represents approximately 18.4 PJ of technically available, indigenous secondary energy.

This resource is predictable, quantifiable, and immune to international fuel market shocks.

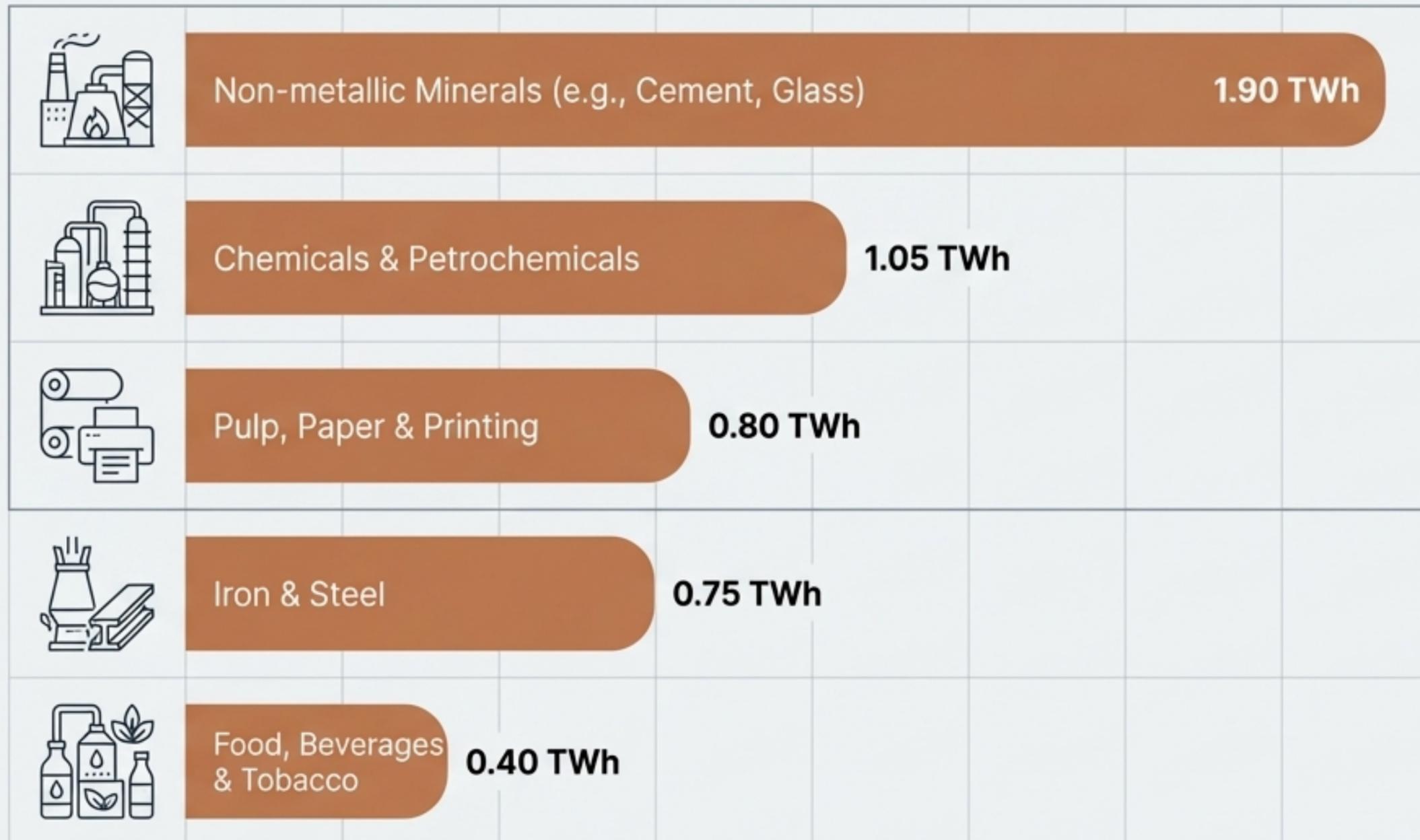
Precision Matching: Temperature Grades Dictate Viability



Thermal Stratification Pillar

Almost half the national potential sits below 200°C—perfectly matched for supplying the built environment via insulated thermal networks.

The Source Profile: Identifying Prime Targets



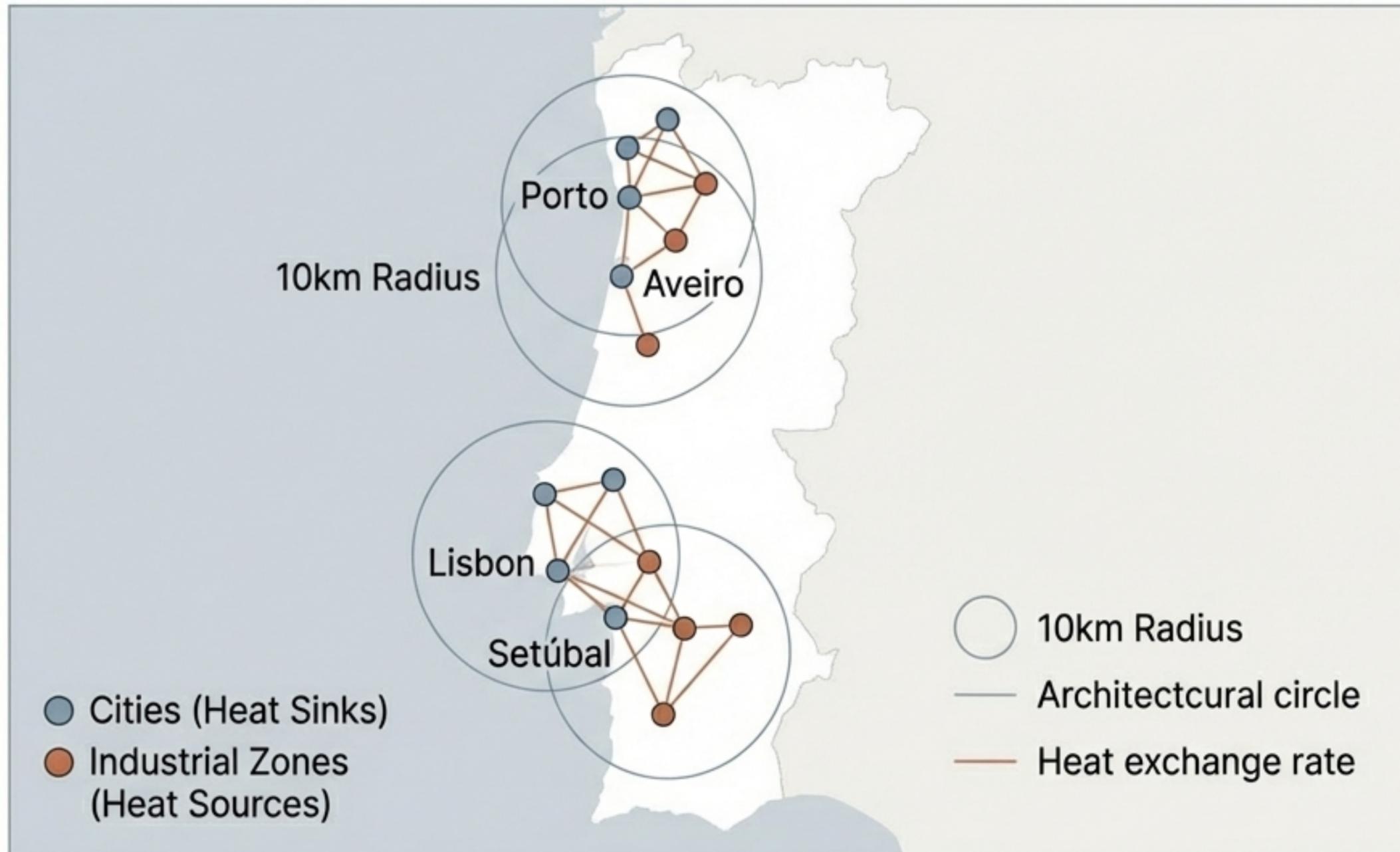
Strategic Focus: Non-metallic minerals, chemicals, and paper account for nearly 75% of the total available thermal resource. These heavy industries represent the priority anchor points for early-stage urban-ran-industrial symbiosis projects.

Bridging the Gap: 22.2% Hot Water Coverage Potential

CATEGORY	DEMAND VS SUPPLY	COVERAGE
Residential Hot Water	Demand = 7.0 TWh Supply Pool = 2.15 TWh 	30.7%
Tertiary Hot Water	Demand = 2.7 TWh Supply Pool = 2.15 TWh 	79.6%
Aggregated Hot Water	Demand = 9.7 TWh Supply Pool = 2.15 TWh 	22.2%

Takeaway: The 2.15 TWh of low-temperature waste heat is not a niche contribution. If harnessed, it represents a direct, technologically proven substitute for one-fifth of the nation's building hot water needs, bypassing fossil fuels entirely.

The Geographical Symbiosis: Mapping the 10km Feasibility Zone



The 10km Rule

Heat cannot be transported economically over vast distances. The viability of district heating relies on the PETA-established '10km rule'—the maximum viable distance between a source and a sink.

The Portuguese Advantage

Major emitters in cement, chemicals, and paper are naturally co-located near dense population centres along the coastal corridor. This presents immediate 'low-hanging fruit' for synergy regions.

The 4-Pillar Policy Architecture

Pillar 1: Governance & Mandates

Transpose EED Article 25.6;
Create a National Competence Center under DGE.

Pillar 2: Financial De-risking

Establish a multi-annual "Heat Fund" providing >80% coverage for early-stage planning and feasibility.

Pillar 3: Data & Zoning

Mandate waste heat audits for heavy industry; implement strict strategic energy zoning.

Pillar 4: Capacity Building

Fund municipal GIS and energy modelling training; foster public-private-industrial partnerships.

Engineering the Market: Mandates & Capital



The “Competence Center” Model

- Instead of overburdening municipalities, a DGE-led centre provides standardized methodologies and calculation tools (mirroring successful models in Germany and Denmark).



The “Heat Fund” Imperative

- District Heating is fundamentally CAPEX-heavy. To break the 10-year stagnation, a national fund (co-financed by EU) must provide long-term visibility. Subsidising >80% of planning costs ensures high-quality, investable spatial plans.



Visibility & Protection: Data Audits and Energy Zoning

Step 1: Unlocking the Data

Mandate periodic, standardized waste heat audits for all energy-intensive industries.

Feed temperature and volume data directly into a centralized municipal database.

Step 2: Strategic Energy Zoning

Local H&C Plans carry legal weight. In zones designated optimal for District Heating, implement a presumption AGAINST the expansion of natural gas networks.

The Result

Eliminates parallel infrastructure competition and provides absolute regulatory certainty for DHC investors.

Realising the Circular Thermal Economy

The transition is not hindered by technology, but by regulatory will. By creating a framework that connects urban demand with industrial supply, Portugal can turn 5.1 TWh of atmospheric waste into a sovereign competitive advantage.

- 1. Energy Security:** Drastic reduction in exposure to volatile, imported fossil fuels.
- 2. Industrial Competitiveness:** New revenue streams for heavy industry.
- 3. Urban Decarbonisation:** Secure, affordable, low-carbon heat for millions of citizens.

