



THE HIDDEN RESOURCE

Decarbonising Spain's Thermal Sector Through Industrial Waste Heat Recovery.
A Quantitative Analysis & Strategic Blueprint.

**We are importing what
we are already wasting.**

100 PJ

Annual recoverable industrial
waste heat

40.8%

Of Spain's residential thermal demand
this single resource could cover

0%

Current market penetration of district
heating in Spanish homes

Decentralised Dependency

80% of Spain's heating capacity relies on individual, fossil-fuelled building systems. This fragments demand and locks households into volatile global gas markets.



Invisible Outflows

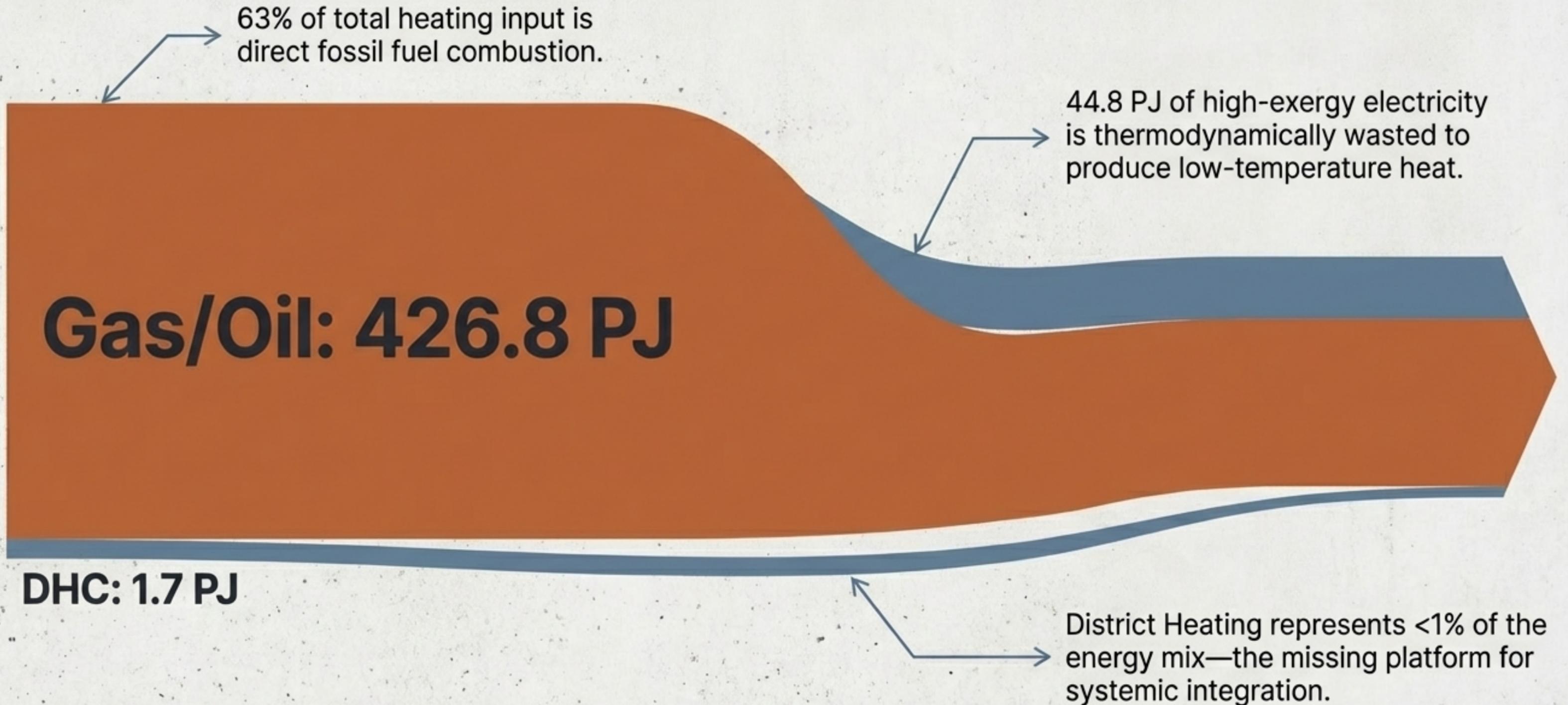
Spanish industry generates massive thermal energy released as an uncaptured byproduct, completely disconnected from the surrounding urban demand that desperately needs it.

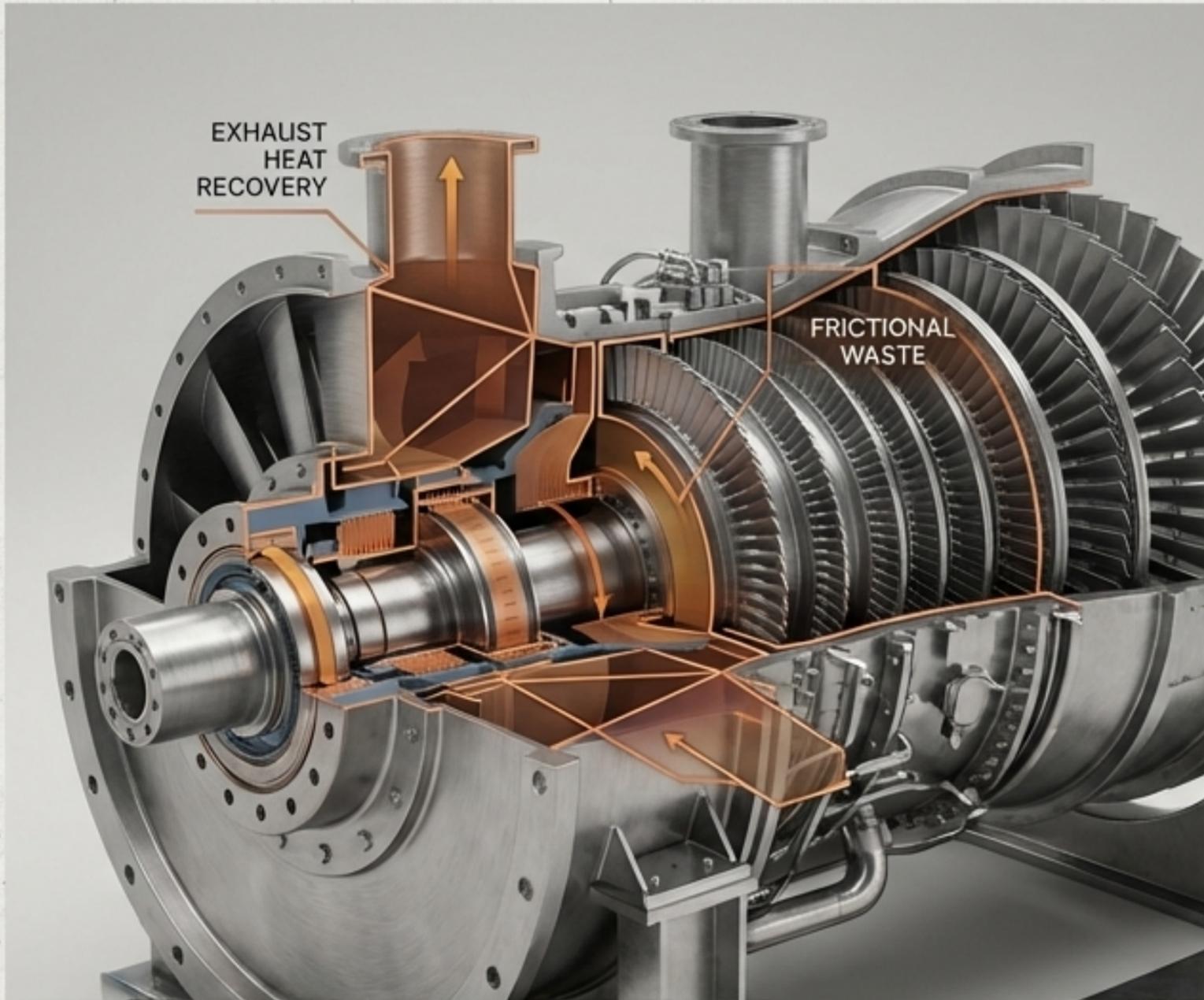


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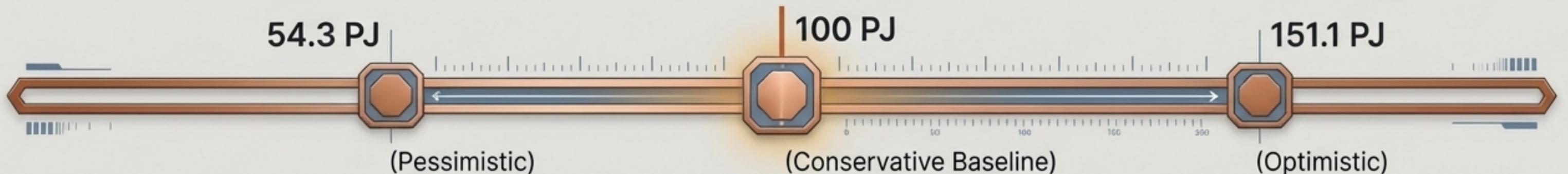
The Linear Thermal Pathway



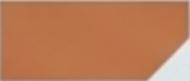
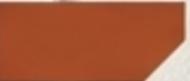
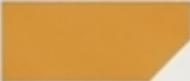
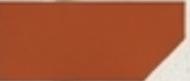


100 Petajoules of Untapped Energy.

Spain holds nearly 10% of the EU's technically available waste heat. This is not a marginal phenomenon, but a concentrated, plannable, and recoverable domestic energy asset.

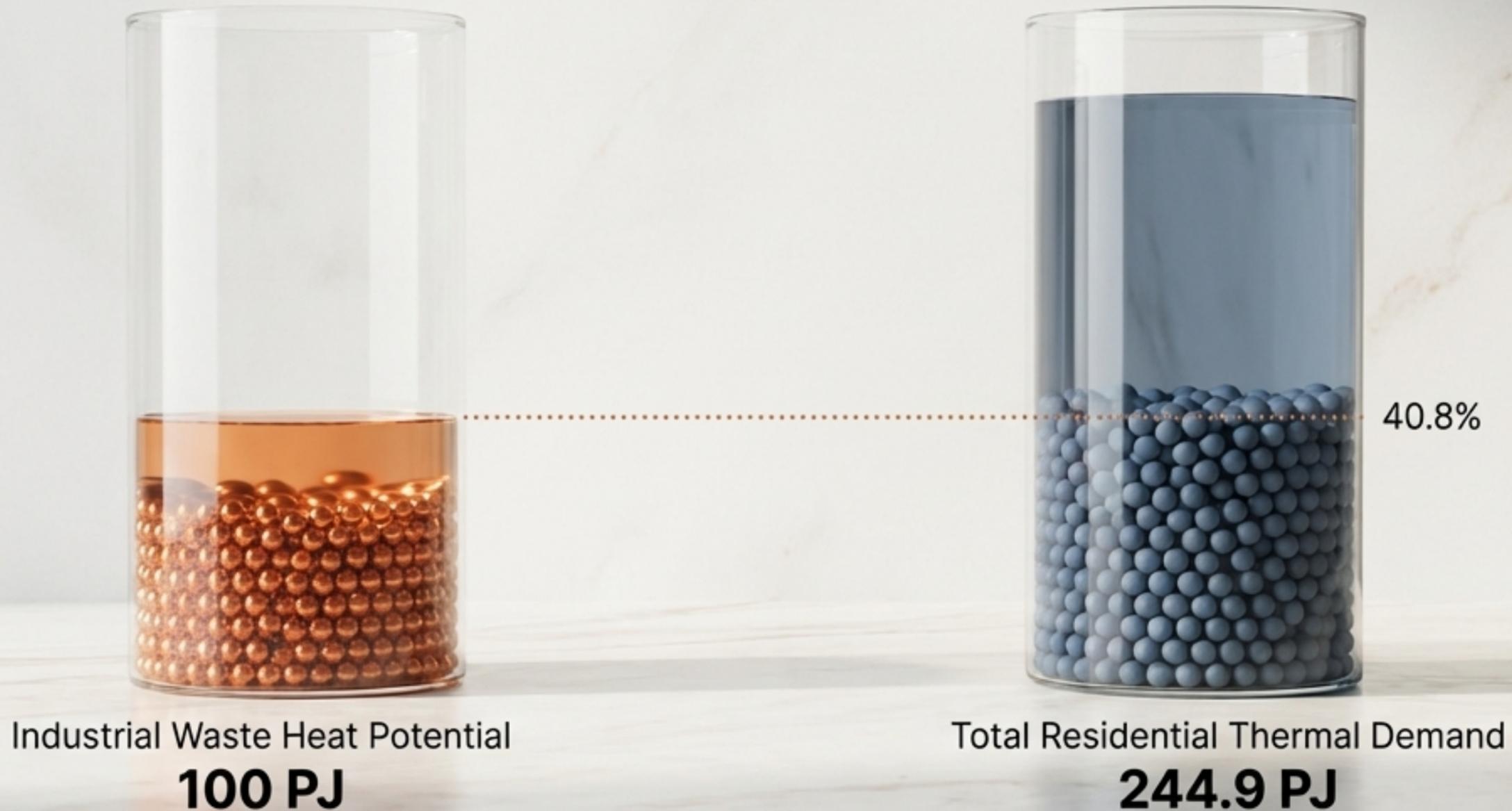


Where the Heat Lives: Sectoral Characterisation

	Low Temp (<200°C)	Medium Temp (200-500°C)	High Temp (>500°C)
Chemical/Petrochemical			
Petroleum Refining			
Cement/Minerals			
Metal Casting			
Paper/Pulp			

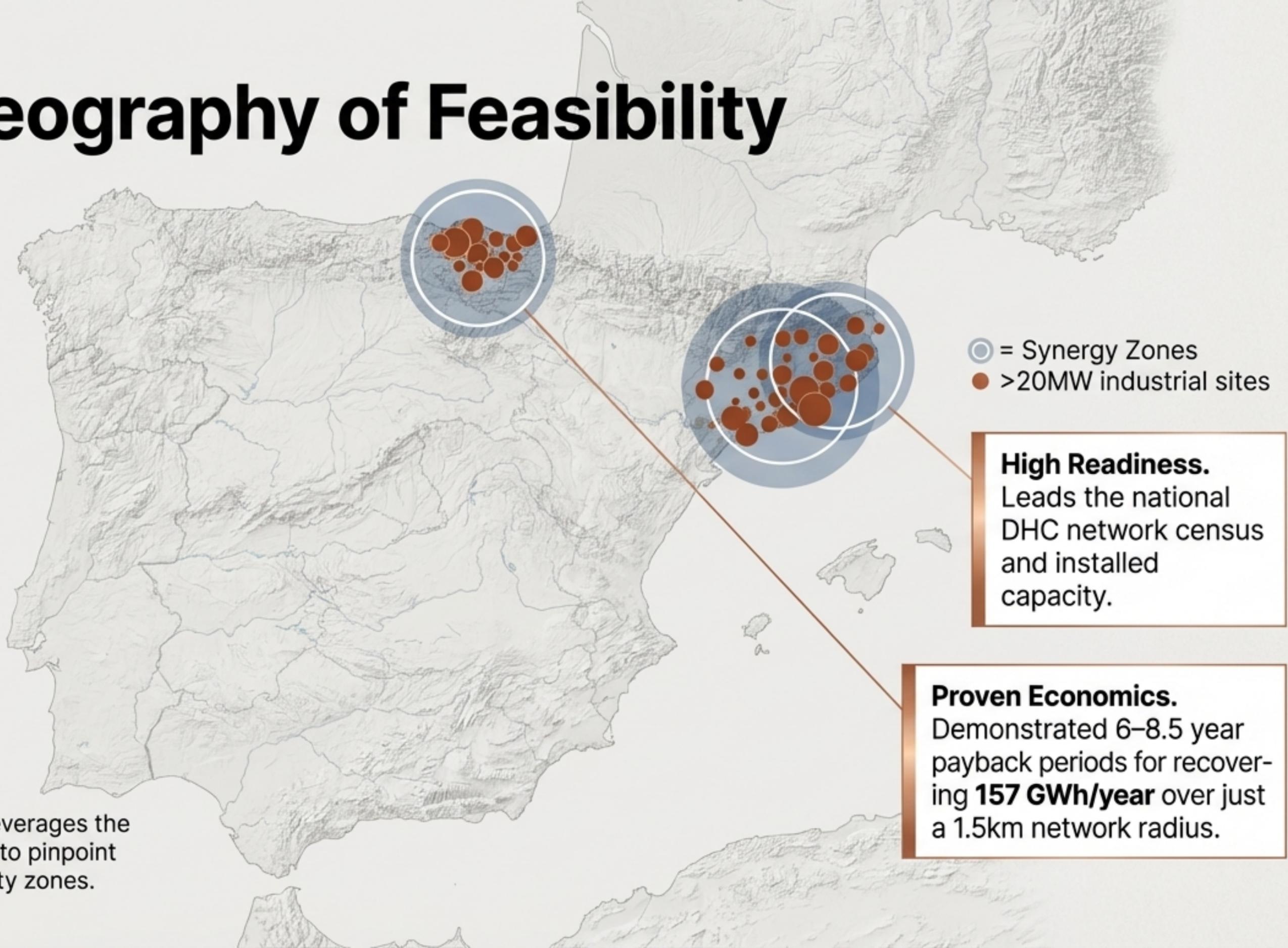
Immediate Compatibility: Over 33 PJ of low-grade heat is immediately compatible with modern District Heating—no high-temperature upgrading required.

The Scale of Displacement



Spain's industrial waste heat perfectly mirrors the thermal scale of its built environment. Harnessing this single resource displaces over 40% of residential heating demand in one systemic stroke.

The Geography of Feasibility



Strategic mapping leverages the IDAE Mapa de Calor to pinpoint 10km radius feasibility zones.

The Missing Link: 4th Generation DHC



Low Operating Temps (50-60°C).

Captures lower-grade industrial waste with maximal efficiency.

Minimal Heat Loss.

Advanced materials enable transport across 10km synergy zones.

Fuel Agnostic Grid.

Acts as an integrated thermal platform for waste heat, large-scale heat pumps, and solar thermal.

State Transformation Matrix

The Linear Liability



Import Fossil Fuel ↓ Burn at Individual Building ↓ Emit Carbon ↓ Discard Industrial Heat

Circular Industrial Symbiosis



Industrial Production → Capture Byproduct Heat → Distribute via DHC → Decarbonise Cities

Transforming a geographic environmental liability into a plannable, commercial national asset.

A Three-Pillar Roadmap



Mandate.

Foundational
Policy & Planning

Unlock.

Industrial Supply
Incentives

Deliver.

De-risking
Infrastructure



Pillar 1: Foundational Policy

Action:

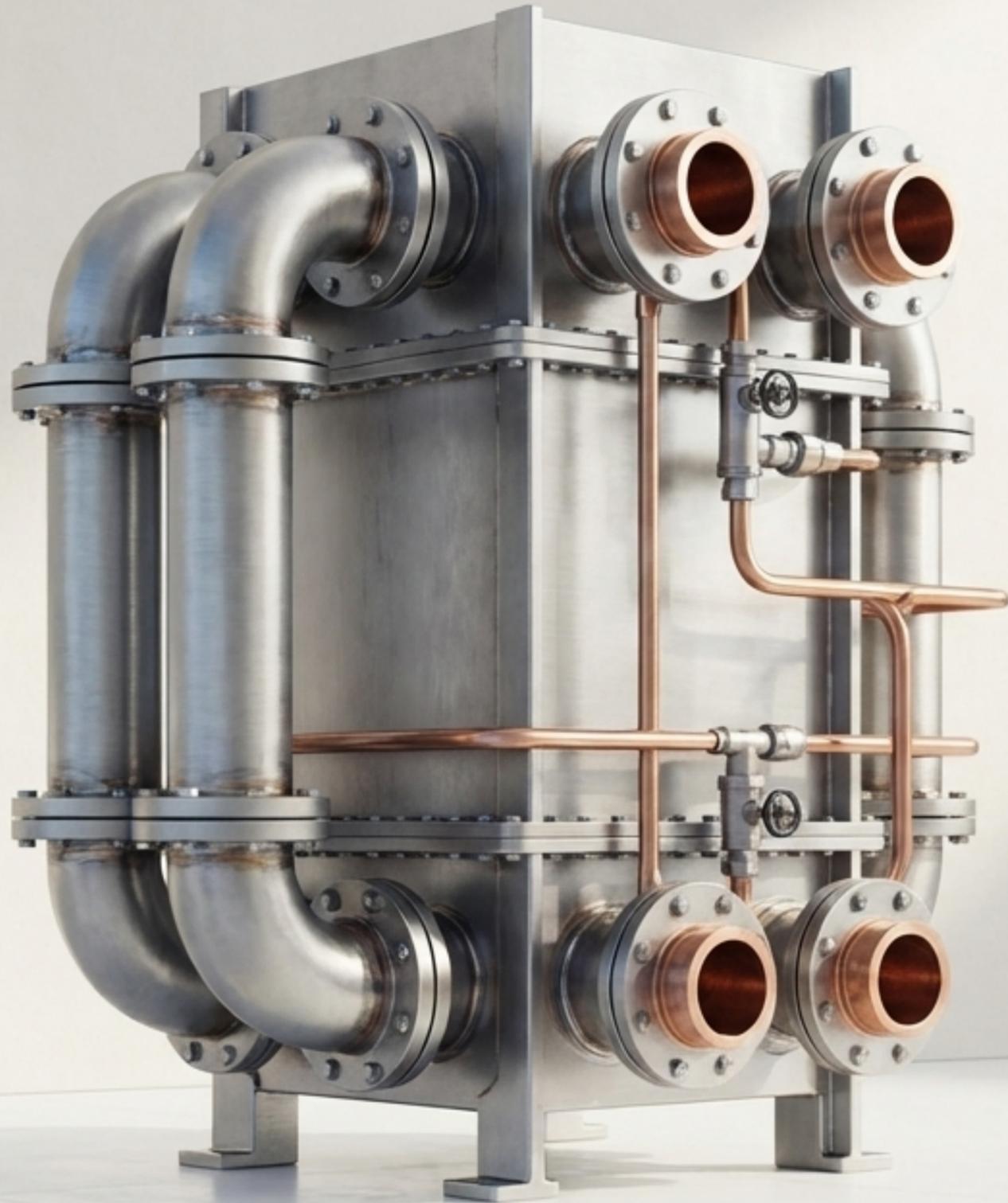
Transpose Article 25.6 of the recast EU Energy Efficiency Directive (EED).

Mechanism:

Mandate local heating & cooling plans for all municipalities with populations >45,000.

Requirement:

Municipalities must actively assess DHC potential, quantify industrial waste heat, and utilize the national IDAE Mapa de Calor as the single, mandatory source of truth.



Pillar 2: Unlocking Supply.

CAPEX: Co-Finance Equipment.

Utilise NextGenerationEU grants to subsidise industrial heat capture equipment (exchangers, pumps).

OPEX: Revenue Certainty.

Establish regulated, long-term Power Purchase Agreements (PPAs) for heat, guaranteeing industrial sellers a stable ROI.

Red Tape: Regulatory Fast-Tracking.

Remove administrative friction and exempt recovered heat from penalising energy taxes.

Pillar 3: Enabling Delivery.

Capital

Public-Private Partnerships (PPPs). Deploy state-backed loan guarantees and direct capital grants for strategic DHC network backbones.

Zoning

DHC Development Zones. Empower municipalities to mandate network connection for all new building developments within designated synergy zones.

Support

National One-Stop-Shop. Establish centralized technical and financial assistance to help municipalities navigate complex infrastructure procurement.

A Circular Energy Economy

Spain's thermal vulnerability is a choice. By transforming 100 PJ of wasted industrial heat into a national asset, Spain will decouple from global gas volatility, boost industrial competitiveness, and build the resilient thermal infrastructure of the 21st century.

The data is clear. The time for strategic action is now.

