

# The 21-Petajoule Pivot

Integrating Industrial  
Waste Heat to  
Decarbonise Poland's  
District Heating Sector.

A Quantitative Analysis  
& Policy Blueprint.



# A heating sector defined by scale and an entrenched reliance on solid fossil fuels.

Demand:

**408 PJ**

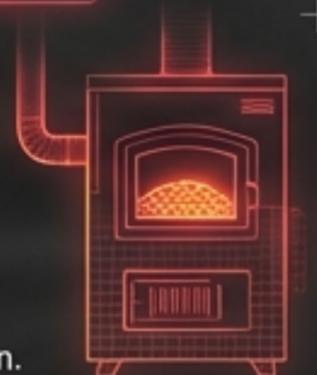
Total 2023 final energy consumption for heat.



Reliance:

**20.61%**

Share of residential energy from solid fossil fuels—the highest in the European Union.



The Mandate:

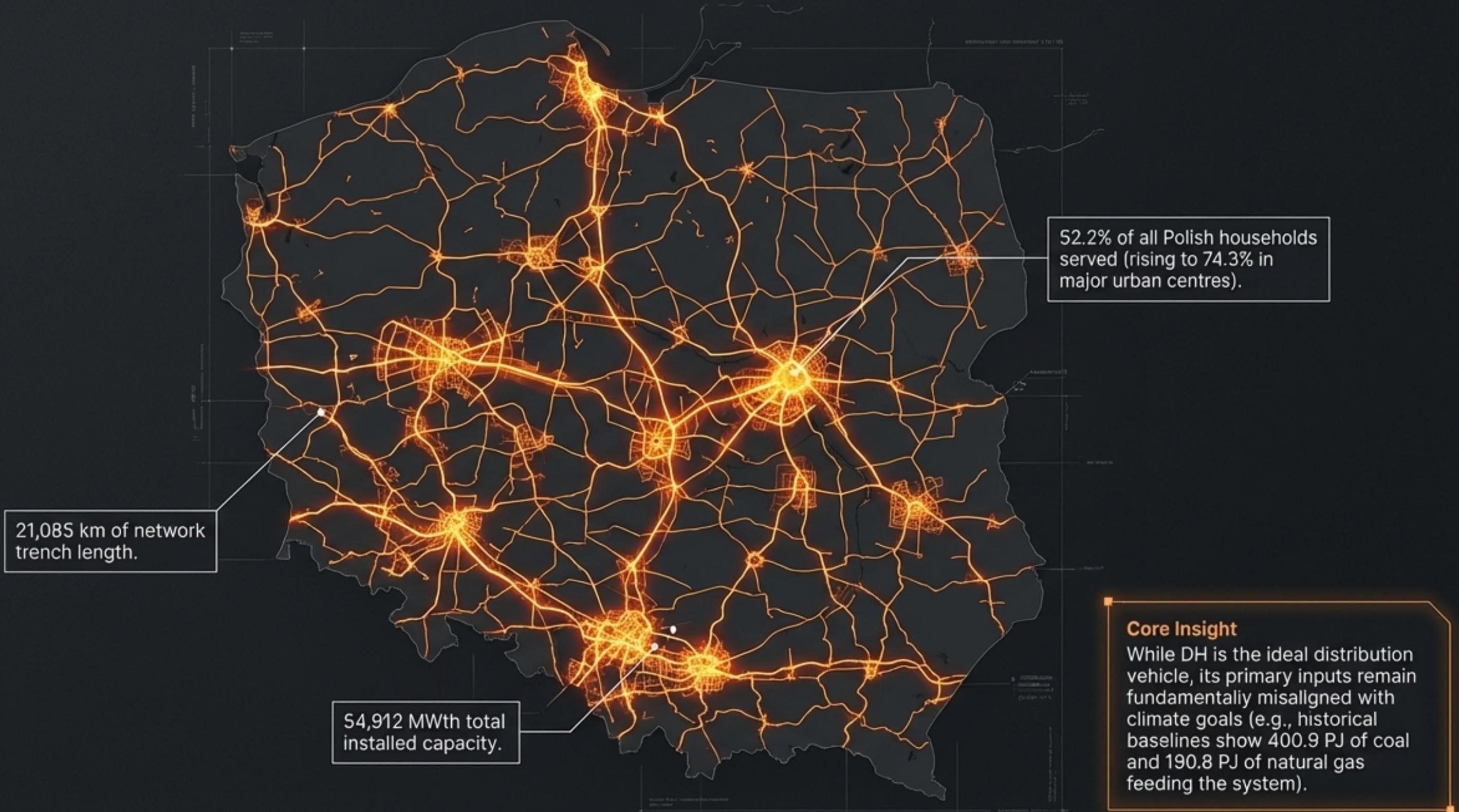
**61% → 22%**

The NECP mandated drop in coal's energy production share between 2023 and 2040.

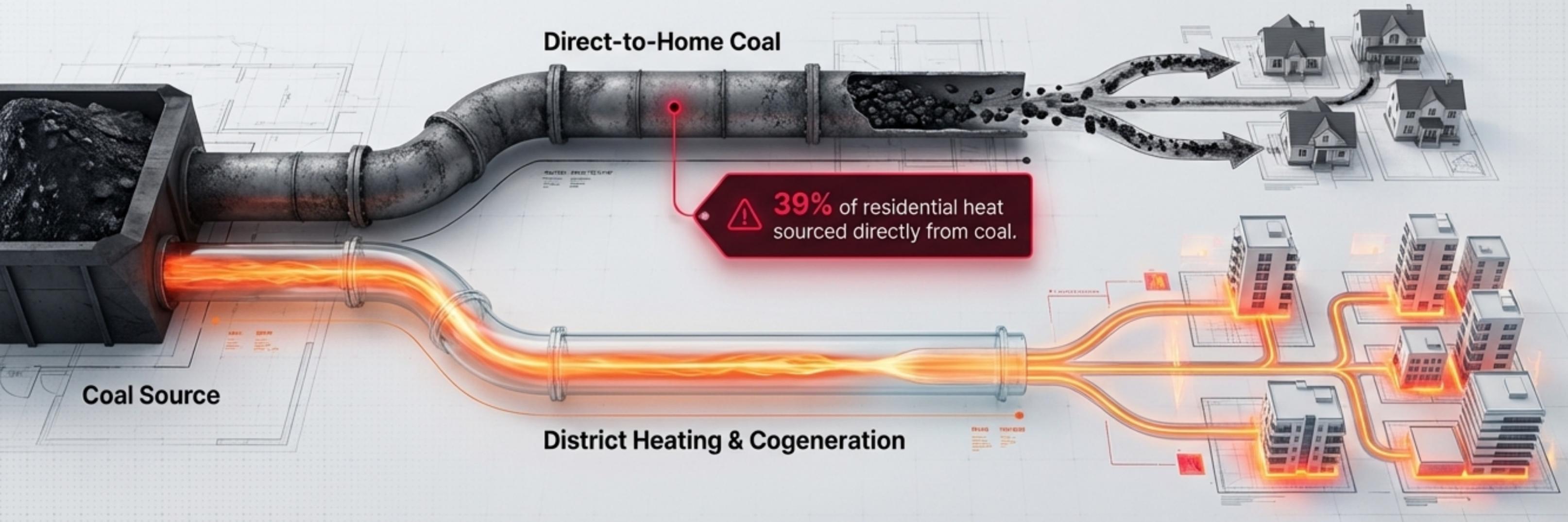


The impending coal phase-out creates a massive thermal deficit. Poland must replace its primary heating fuel rapidly without compromising energy security or economic stability.

# The district heating network is the single most powerful lever for national decarbonisation.

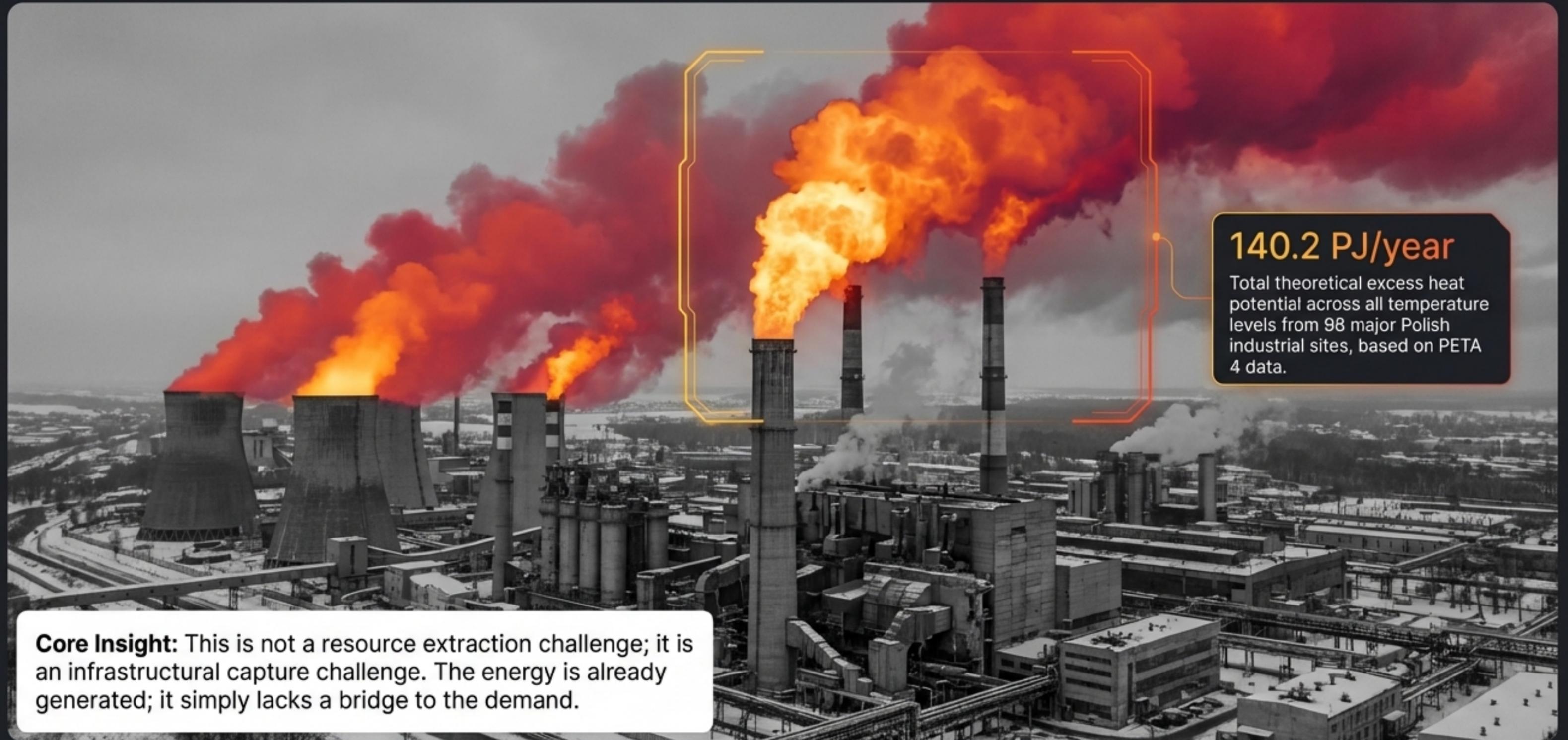


# The greatest systemic inefficiency is the bypass of the district heating network.



Expanding the DH network to displace individual coal boilers is critical. However, achieving this requires a massive influx of zero-carbon fuel to ensure the expanded network is actually clean.

98 industrial sites are venting a massive reservoir of zero-carbon thermal energy.



**140.2 PJ/year**  
Total theoretical excess heat potential across all temperature levels from 98 major Polish industrial sites, based on PETA 4 data.

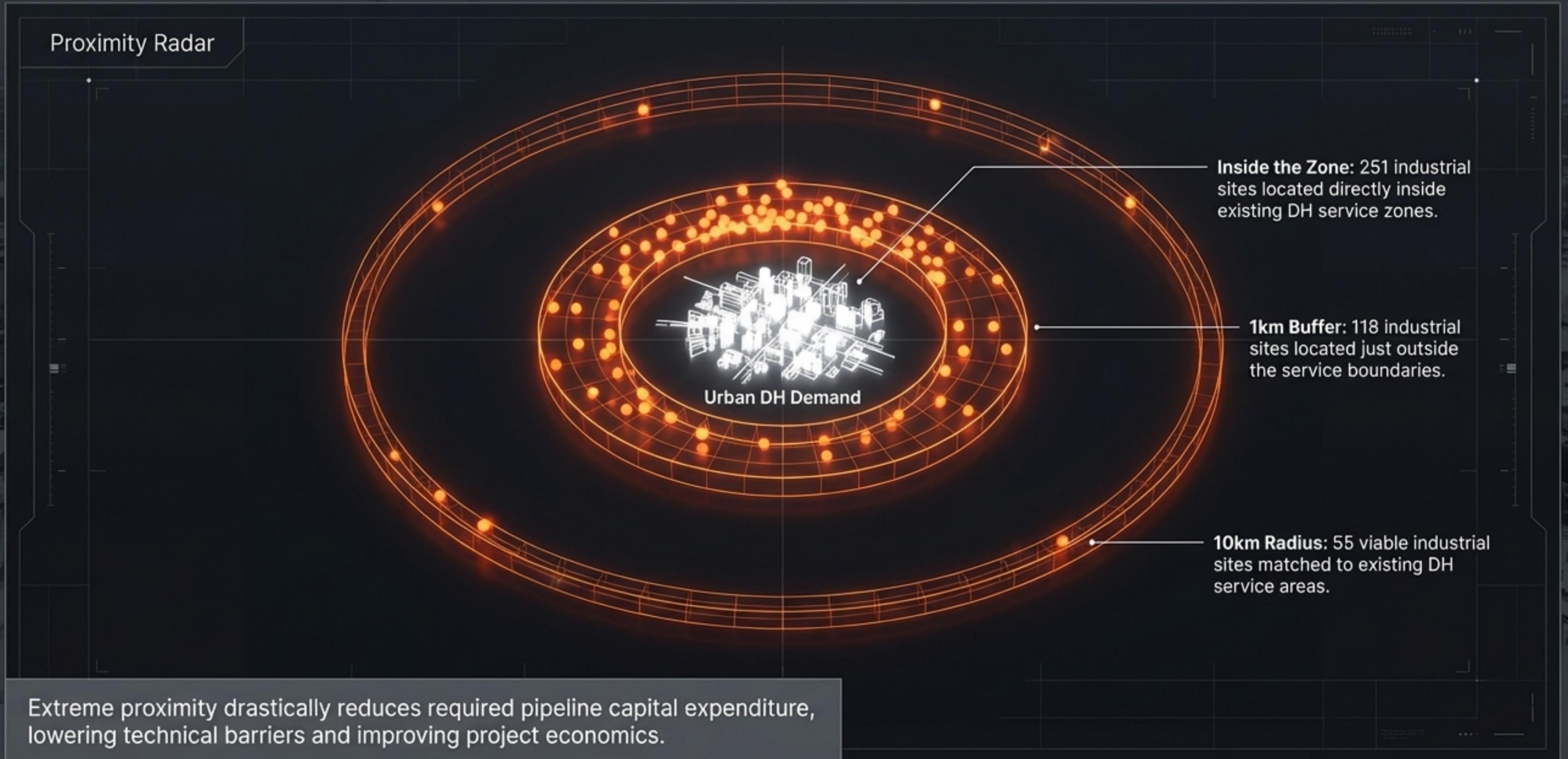
**Core Insight:** This is not a resource extraction challenge; it is an infrastructural capture challenge. The energy is already generated; it simply lacks a bridge to the demand.

# Stratifying the total potential: Temperature dictates the technological pathway.

Temperature Level	Total Potential (98 sites)	Technology Required	Injection Viability
Level 3 (>95°C)	<b>35.9 PJ/year</b>	Direct Heat Exchanger	High (Direct injection into existing high-temp DH networks).
Level 2 (>55°C)	<b>40.5 PJ/year</b>	Large-Scale Heat Pumps	Medium (Suitable for low-temp DH or requires upgrading).
Level 1 (>25°C)	<b>63.8 PJ/year</b>	Advanced Heat Pumps	Low (Requires significant upgrading before injection).

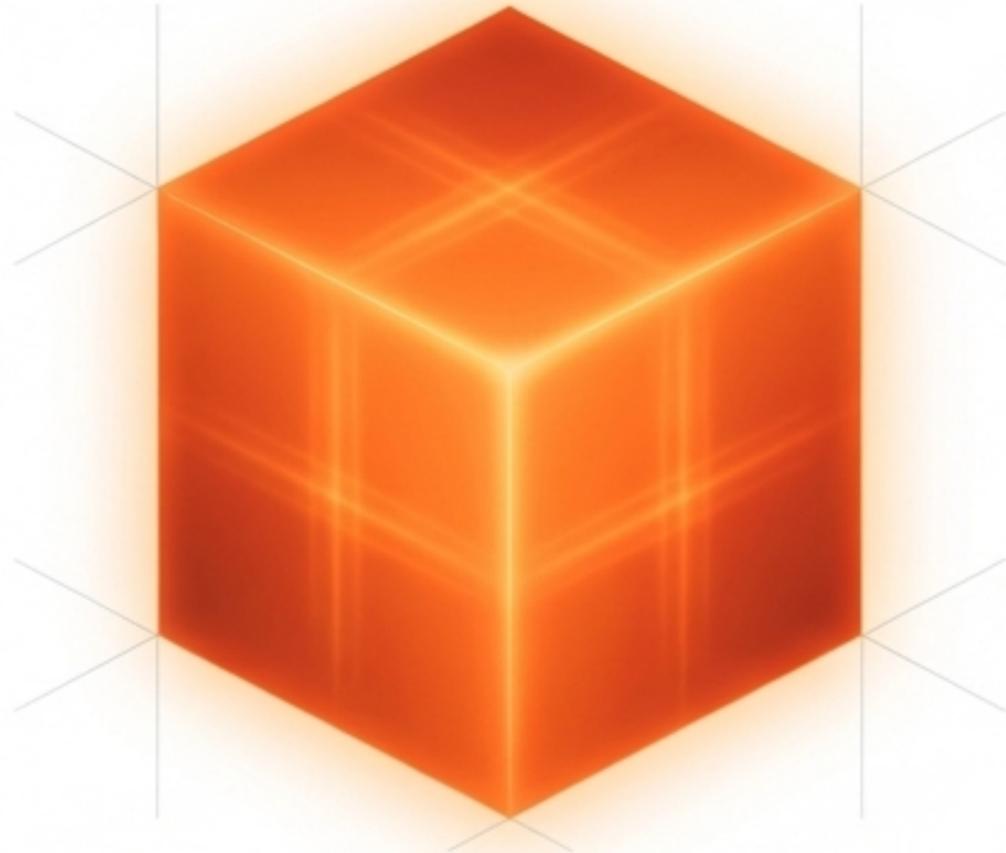
High-grade (>95°C) heat represents the most immediate, low-friction integration opportunity, requiring minimal technological upgrading.

The spatial barrier is an illusion: the heat is perfectly co-located with urban demand.



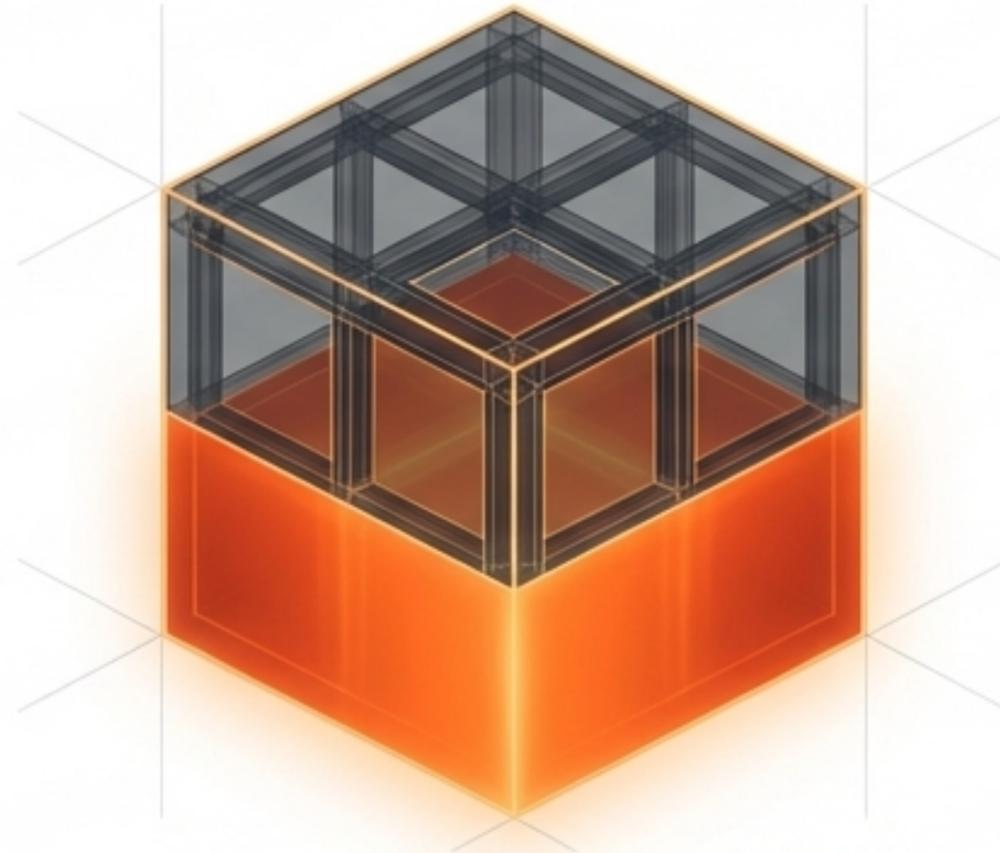
## 21.3 Petajoules: A highly concentrated, cost-effective baseload supply.

5.2% of National Demand



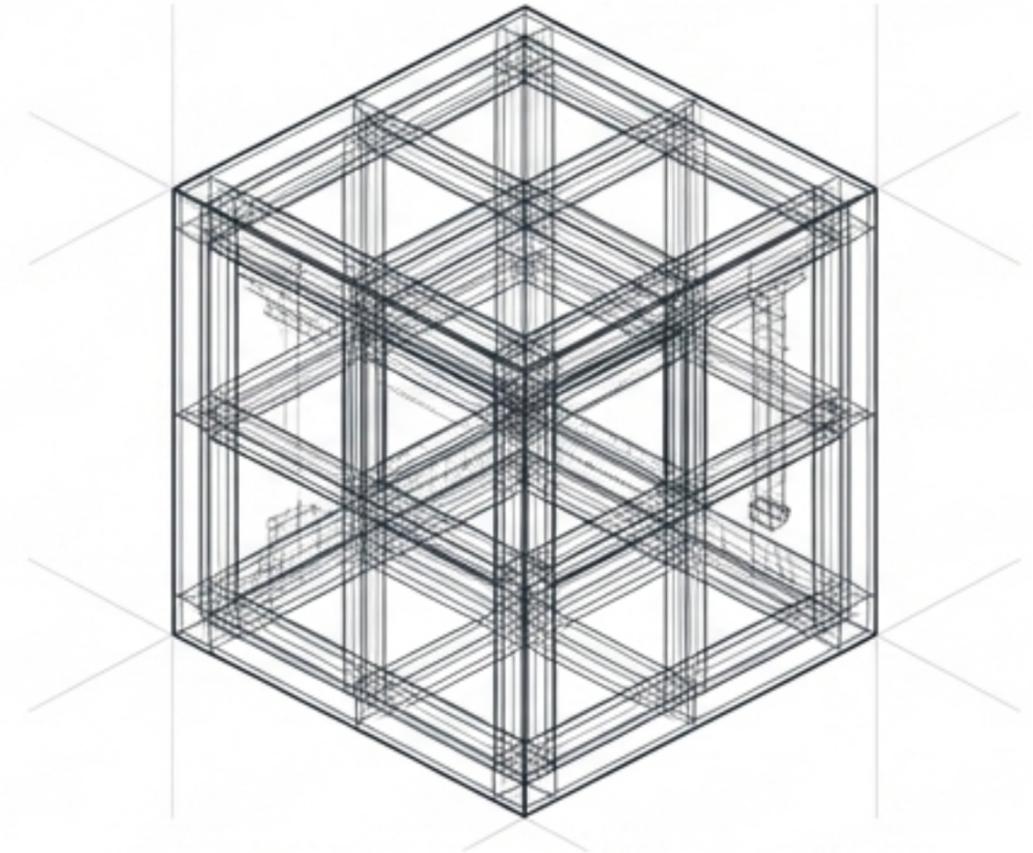
21.3 PJ of  $>95^{\circ}\text{C}$  heat from 55 nearby sites covers 5.2% of Poland's total 408 PJ national heat consumption

14.5% of DH Supply



This single resource could cover 14.5% of the entire District Heating sector's needs.

1.17 Million Tonnes



The annual CO<sub>2</sub> abatement achieved by displacing fossil-fuel-based heat (based on an average factor of 55 t/TJ).

While 4.3% of local demand in specific zones seems modest, it provides a highly reliable, zero-carbon anchor for local transition away from imported fossil fuels.

# The First-Mover Tension: Efficiency vs. Urban Decarbonisation

## Maximum On-Site Recovery

Industry keeps the heat

**9.89 PJ/year**

available for DH.

## Current On-Site Recovery

Industry sells the heat

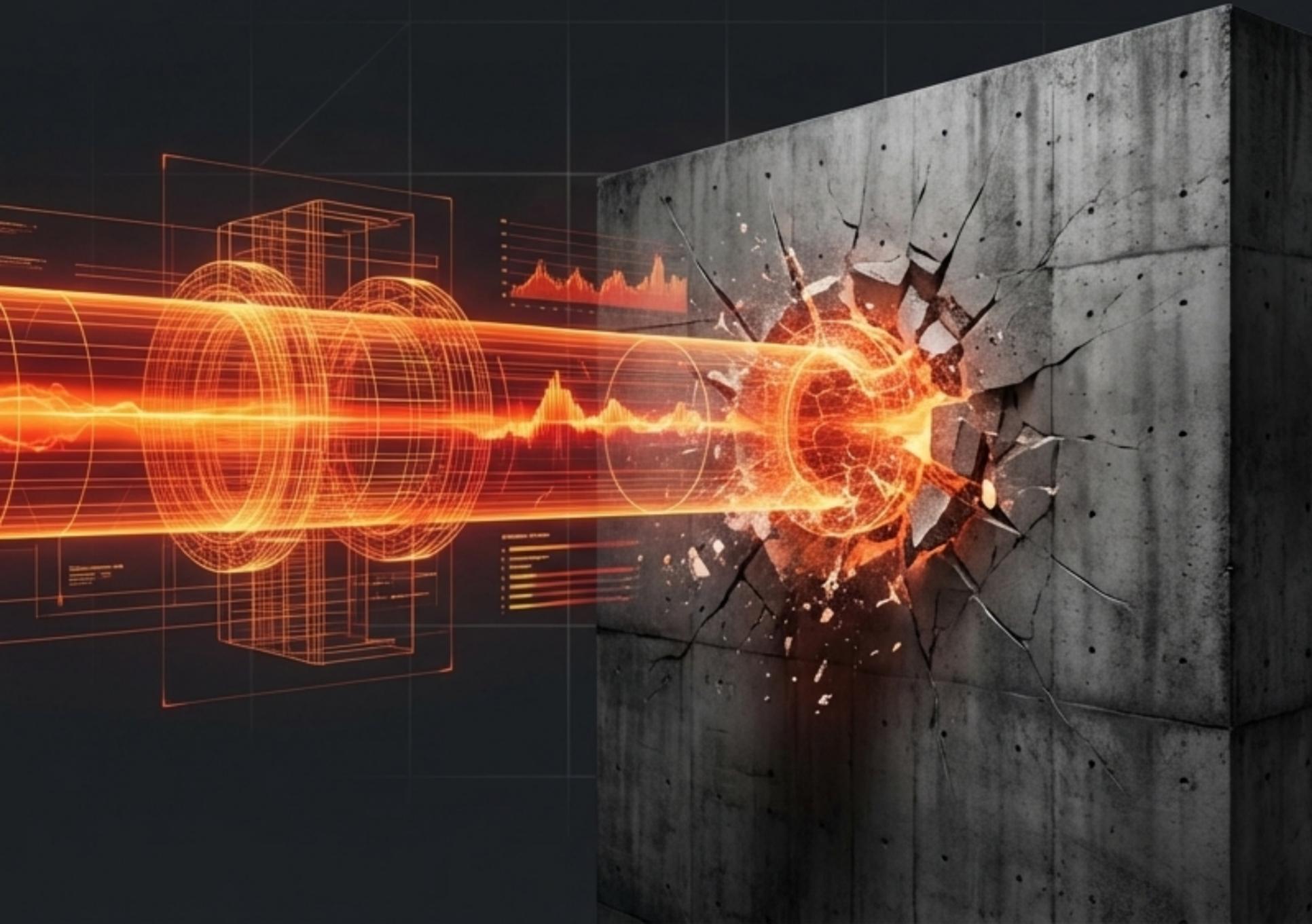
**21.29 PJ/year**

available for DH.

**Explanatory Text:** If industries implement Best Available Technologies to reuse heat on-site, the viable high-temp potential plummets by more than half (from 21.29 to 9.89 PJ).

**Core Insight:** Without clear policy hierarchies, industrial efficiency targets compete directly with urban decarbonisation for the same thermal energy.

# Regulatory inertia and tariff structures actively lock in fossil fuel dependence



**Tariff Approval Trap:** The national system limits the justification of costs for modernising and extending the DH network.

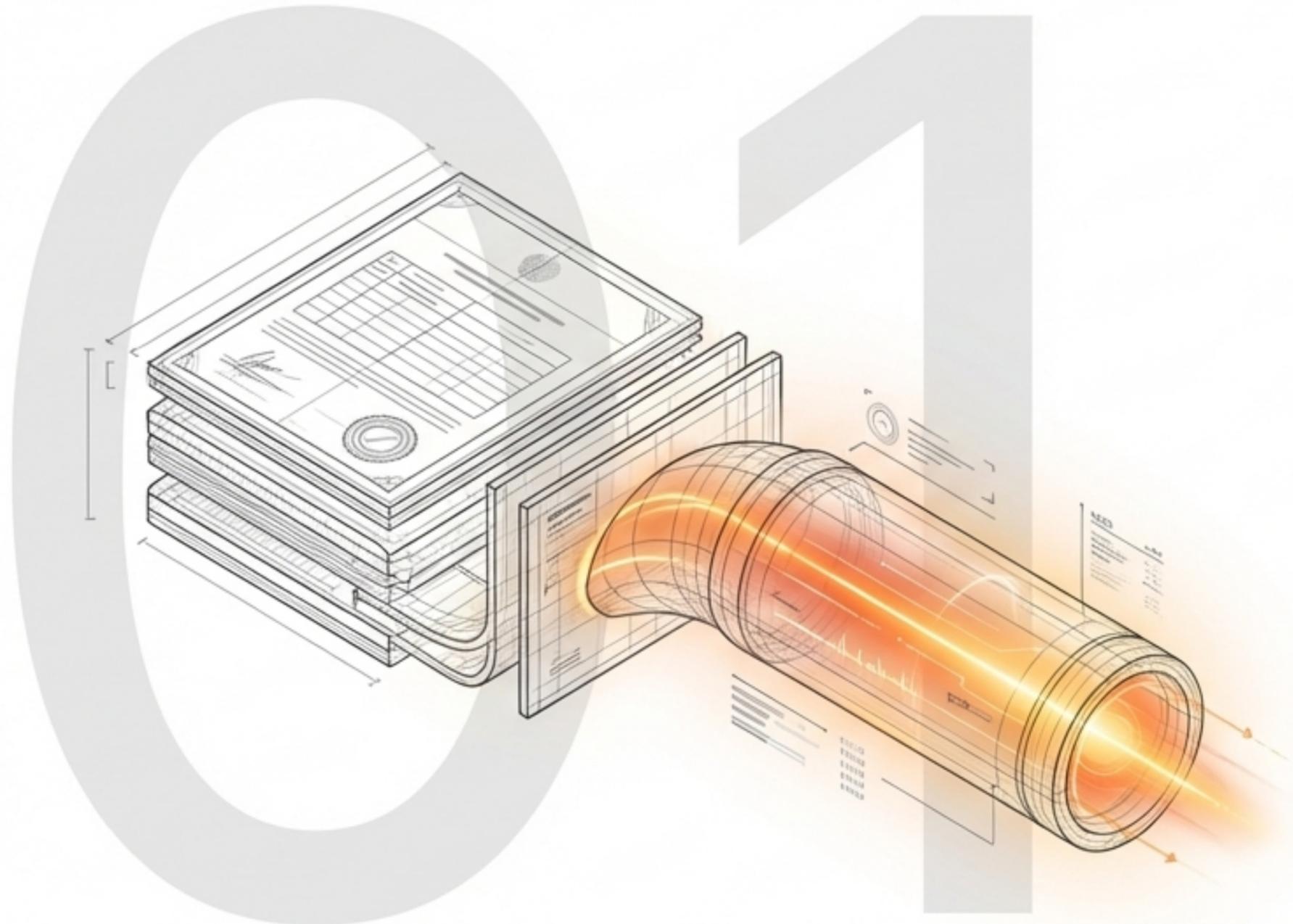


**Financial Prohibitions:** Necessary investments in efficiency and multi-source heat integration are rendered economically unviable.



**The Efficiency Gap:** As a result of this framework, only ~20% of Polish heating companies currently meet the EU definition of an "efficient system."

# Pillar 01: Fundamental tariff reform and spatial planning alignment



## 1. Overhaul the Tariff System

Allow DH operators to include new connection pipelines in their regulated asset base. Establish long-term pricing mechanisms to guarantee ROI for industrial sellers.

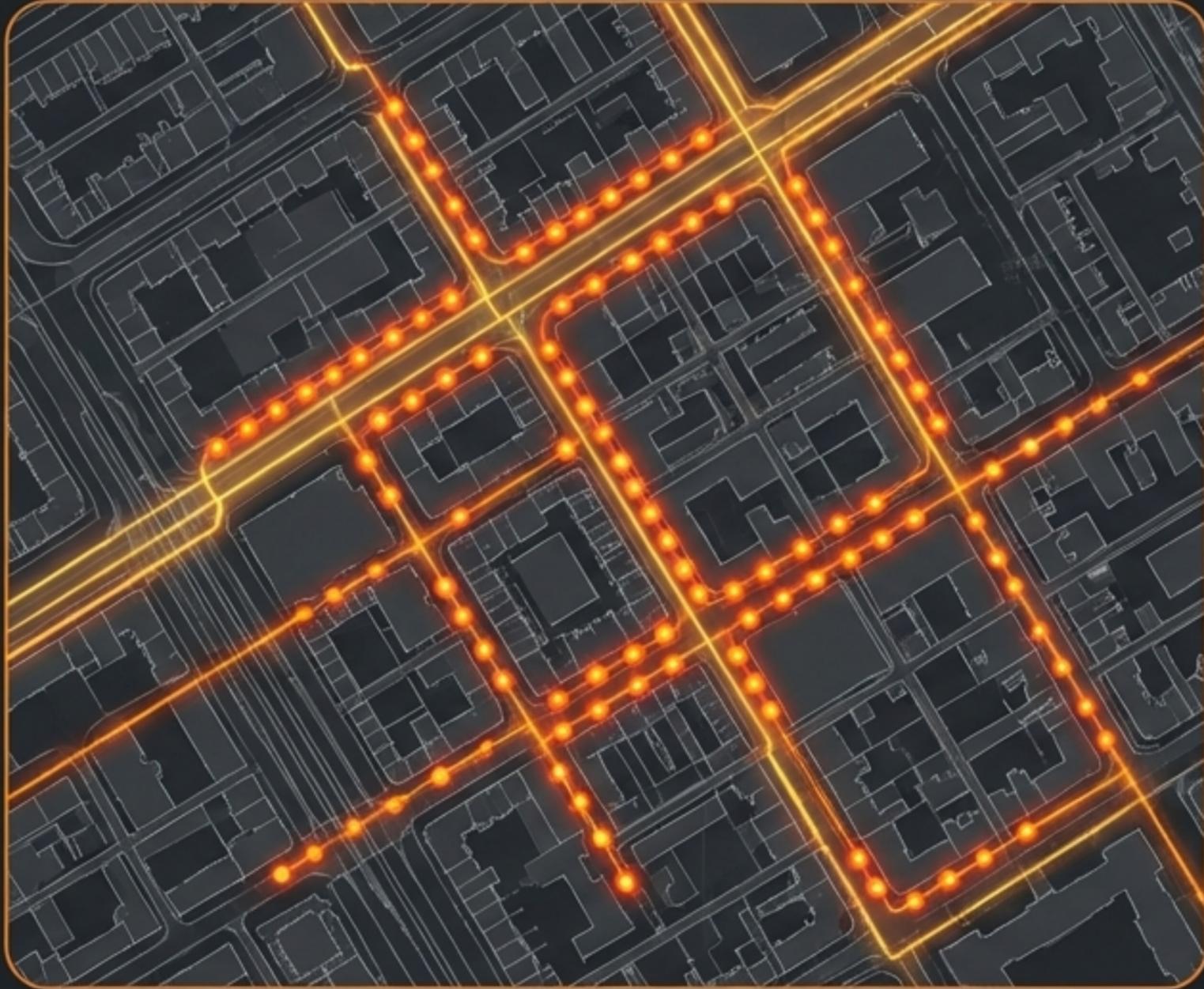
## 2. Mandate Local Heat Planning

Close the implementation gap for the EU EED (Sept 2025 deadline). Integrate industrial zones directly into municipal heating plans.

## 3. Establish a "Right of First Offer"

Require industries within a viable radius to offer excess heat to local DH operators before investing in major on-site recovery projects, prioritising the highest societal value.

# Pillar 02: De-risking physical infrastructure to capture 'inside the zone' wins



## 1. National Waste Heat Infrastructure Fund

Create a targeted financial vehicle blending grants and low-interest loans, capitalising on REPowerEU, the Modernisation Fund, and the Just Transition Fund.

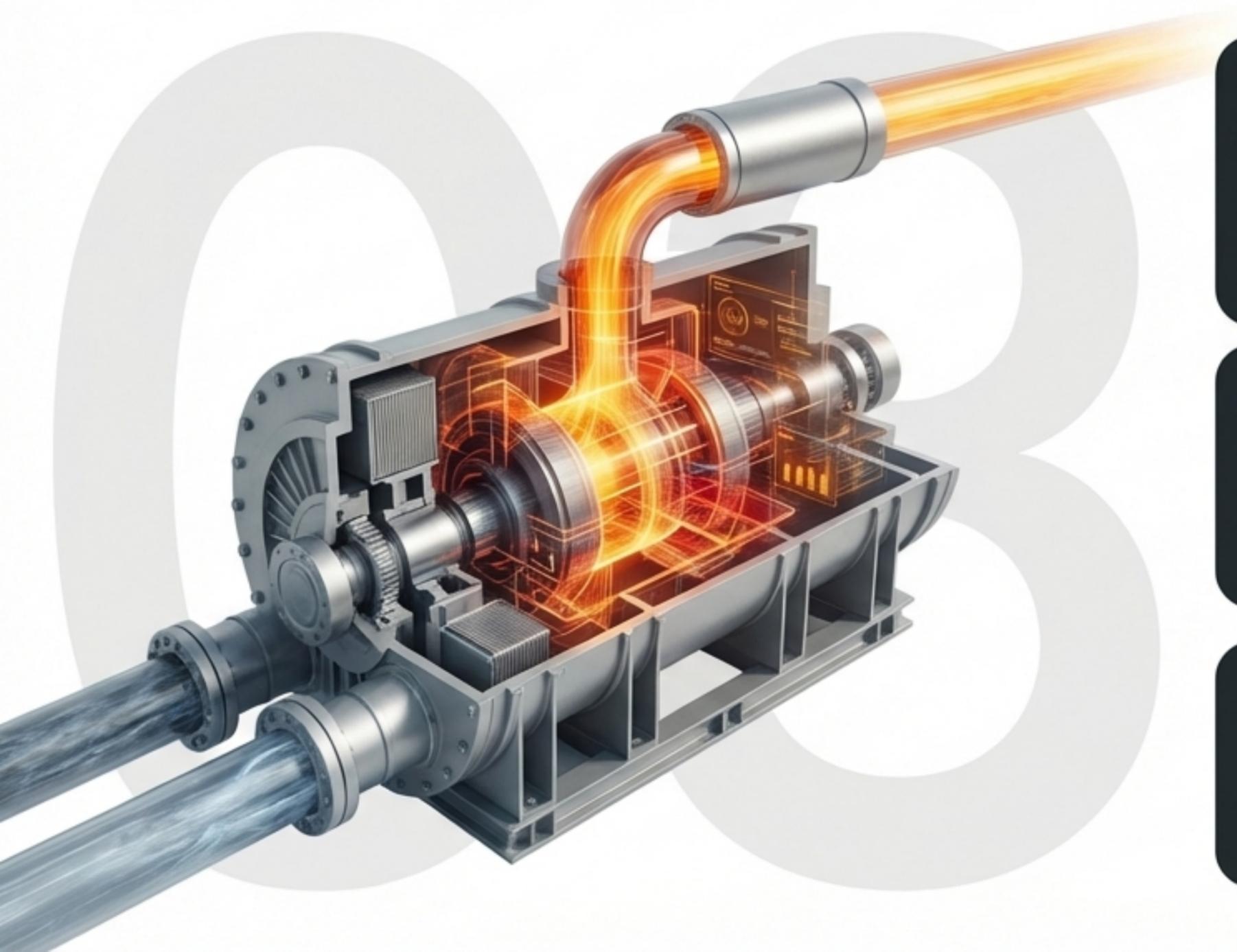
## 2. Prioritise 'Inside the Zone' Fast-Tracking

Direct initial funding and administrative fast-tracking exclusively to the 251 industrial sites located directly inside existing DH zones.

## 3. Lower Technical Risk

These specific projects offer the highest return on investment and the fastest path to delivering tangible, politically visible results.

# Pillar 03: Expanding the resource pool through technological modernization



- 1. Large-Scale Heat Pump Deployment:** Unlock the 24.6 PJ ( $>55^{\circ}\text{C}$ ) and 41.8 PJ ( $>25^{\circ}\text{C}$ ) reserves via a dedicated national support scheme for industrial-grade heat pumps, aligning directly with NECP goals.
- 2. Transition to 4<sup>th</sup> Generation Networks:** Incentivise the modernisation of existing high-temperature DH networks into low-temperature systems.
- 3. Future-Proofing:** This transition fundamentally expands the pool of usable waste heat sources and curtails network heat losses.

# An interdependent framework for a resilient thermal ecosystem.



The 21.3 PJ opportunity cannot be unlocked in isolation. Tariff reform (Policy) provides the business case. The National Fund (Infrastructure) provides the capital to build the bridge. Heat pumps and 4<sup>th</sup> Gen networks (Technology) expand the viable resource pool. Without all three, the heat remains stranded.

# Transforming an environmental liability into a strategic geopolitical asset.

