An aerial photograph of a city, likely Amsterdam, showing a mix of traditional European architecture and modern industrial infrastructure. In the foreground, there are rows of colorful, multi-story buildings along a canal. In the middle ground, a large industrial facility with several tall cooling towers and smokestacks is visible, emitting white steam. To the right, a large cargo ship is docked at a pier. The background shows more of the city and a body of water under a hazy sky.

Unlocking the Thermal Dividend

Industrial Waste Heat as the Cornerstone of the Dutch Energy Transition

A Strategic Briefing for National Policymakers and Energy Stakeholders

93%

Residential heat demand supplied by natural gas in 2013.

4%

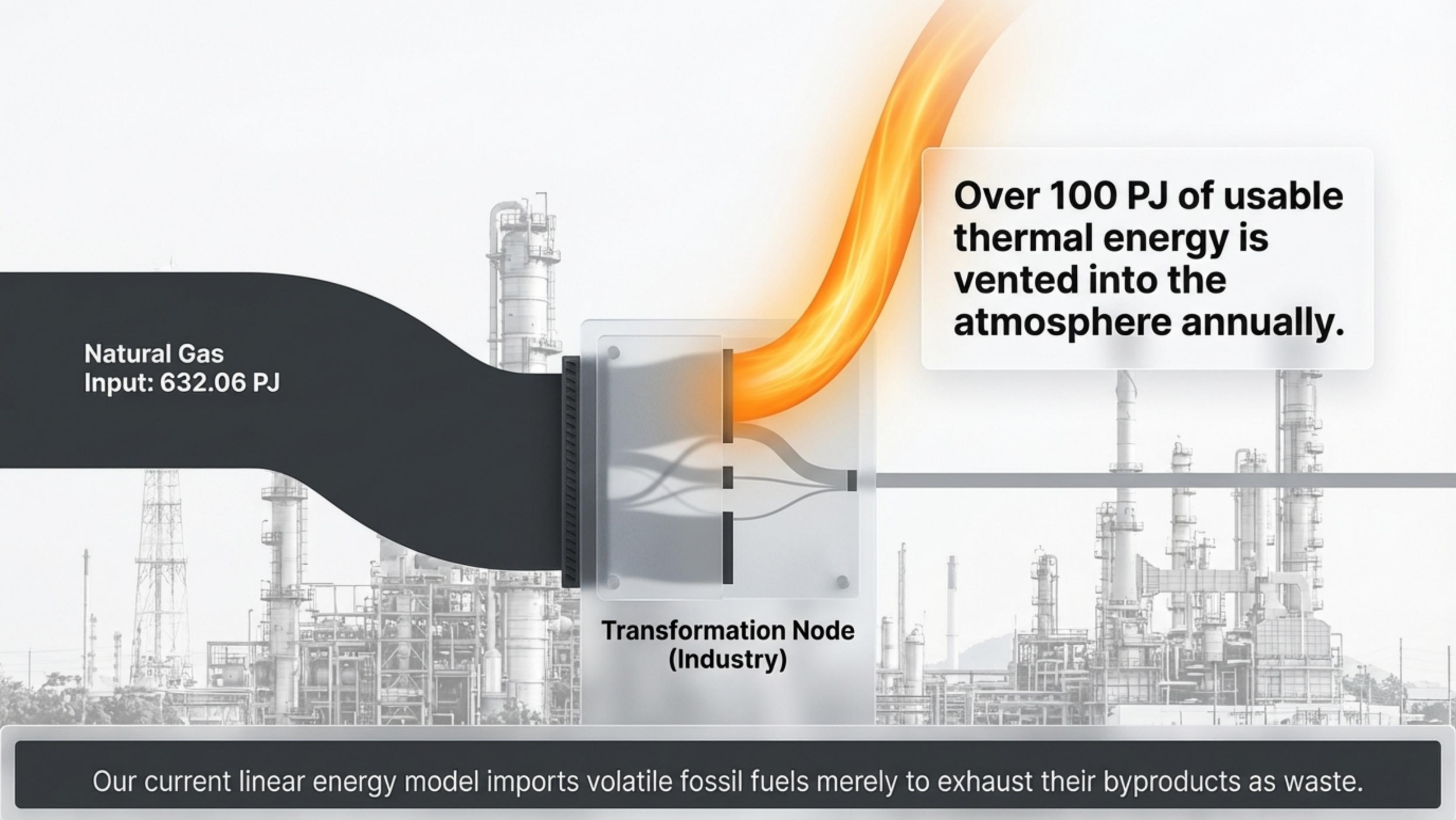
Market share of collective district heating.

1.5 Million

Homes mandated to transition off gas by 2030.



The legacy of Groningen has created unparalleled infrastructural path dependency. Phasing out natural gas requires dismantling a century-old socio-technical lock-in.



The diagram illustrates the energy flow in an industrial transformation node. On the left, a thick black wavy arrow represents the input of natural gas, labeled 'Natural Gas Input: 632.06 PJ'. This arrow enters a central grey box labeled 'Transformation Node (Industry)'. Inside this box, a stylized flame is shown. From the right side of the box, a thick orange wavy arrow curves upwards, representing the output of usable thermal energy. Below the orange arrow, a thin grey horizontal line extends to the right, representing a byproduct or waste stream. The background of the entire image is a faded photograph of an industrial refinery or chemical plant with various towers and pipes.

Natural Gas
Input: 632.06 PJ

Over 100 PJ of usable thermal energy is vented into the atmosphere annually.

**Transformation Node
(Industry)**

Our current linear energy model imports volatile fossil fuels merely to exhaust their byproducts as waste.

The Legislative Leader

Transitievisie Warmte: Mandatory municipal heat programmes.

WGIW Law (2024): Legal authority to force neighbourhood gas decommissioning.

EED Readiness: 1 of only 3 EU states fully ready for transposition.

The Implementation Laggard

Sweden

23 EUR/GJ

Germany

38 EUR/GJ

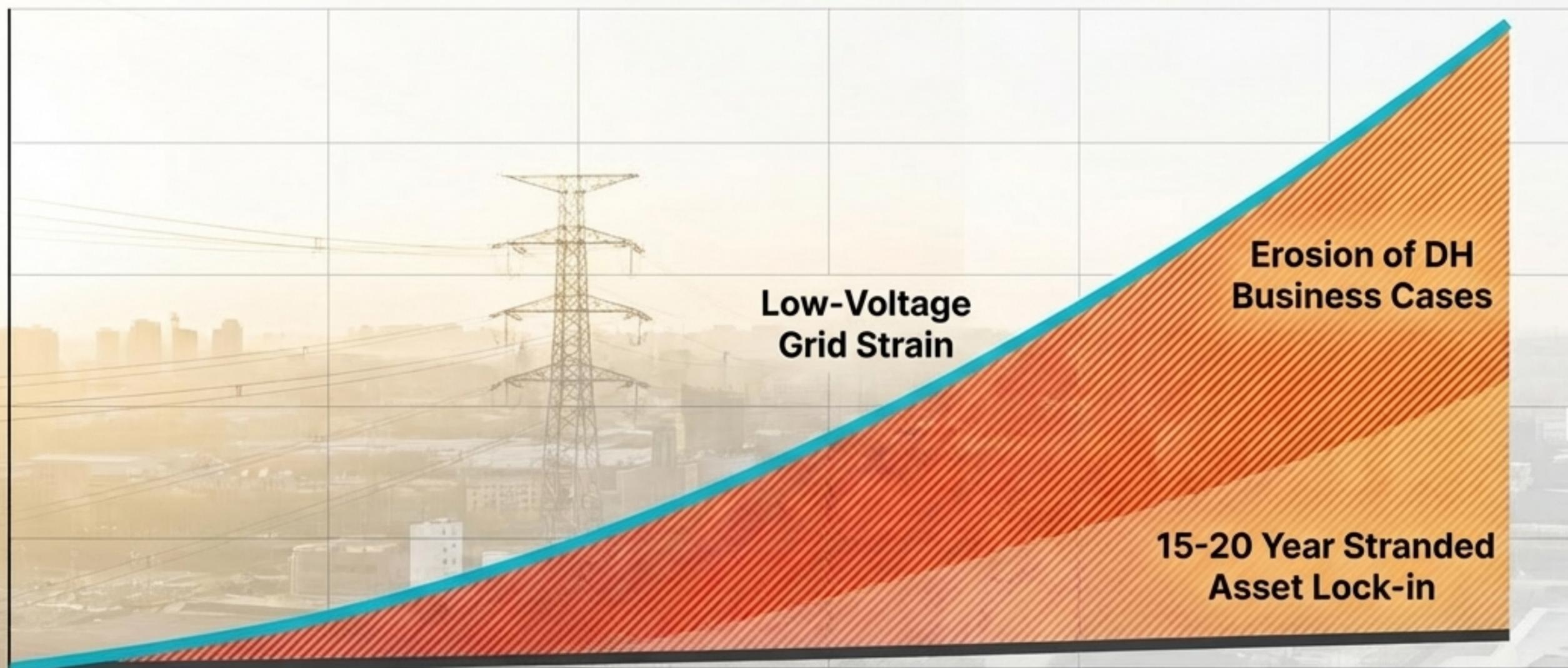
The Netherlands

66 EUR/GJ

Average integral heating tariffs (2023)

Advanced planning architectures are failing to translate into physical infrastructure due to crippling market distortions and exorbitant capital costs.

The Collision Course



Individual Electric Heat Pumps
(752k units by 2024)

District Heating Market Share (~4%)

Uncoordinated market forces are systematically eroding the viability of collective decarbonisation pathways in dense urban cores.

Row Titles	Individual Electric Heat Pumps	Collective District Heating
Capital Intensity	Consumer-borne	High Upfront Institutional
Grid Impact (Electricity)	Severe strain in dense areas	Minimal / Grid-balancing capable
Spatial Suitability	Suburban / Rural	High-Density Urban / Industrial proximity
Adoption Pace	Rapid / Market-driven	Slow / Coordination-heavy

Individual heat pumps win on speed, but fail on grid impact in dense areas. Central intervention is required to deploy collective solutions where systemically necessary.

A detailed view of an industrial plant with numerous silver pipes, walkways, and large cylindrical tanks under a clear sky.

100+ Petajoules

Total Potential:
127.4 PJ/year

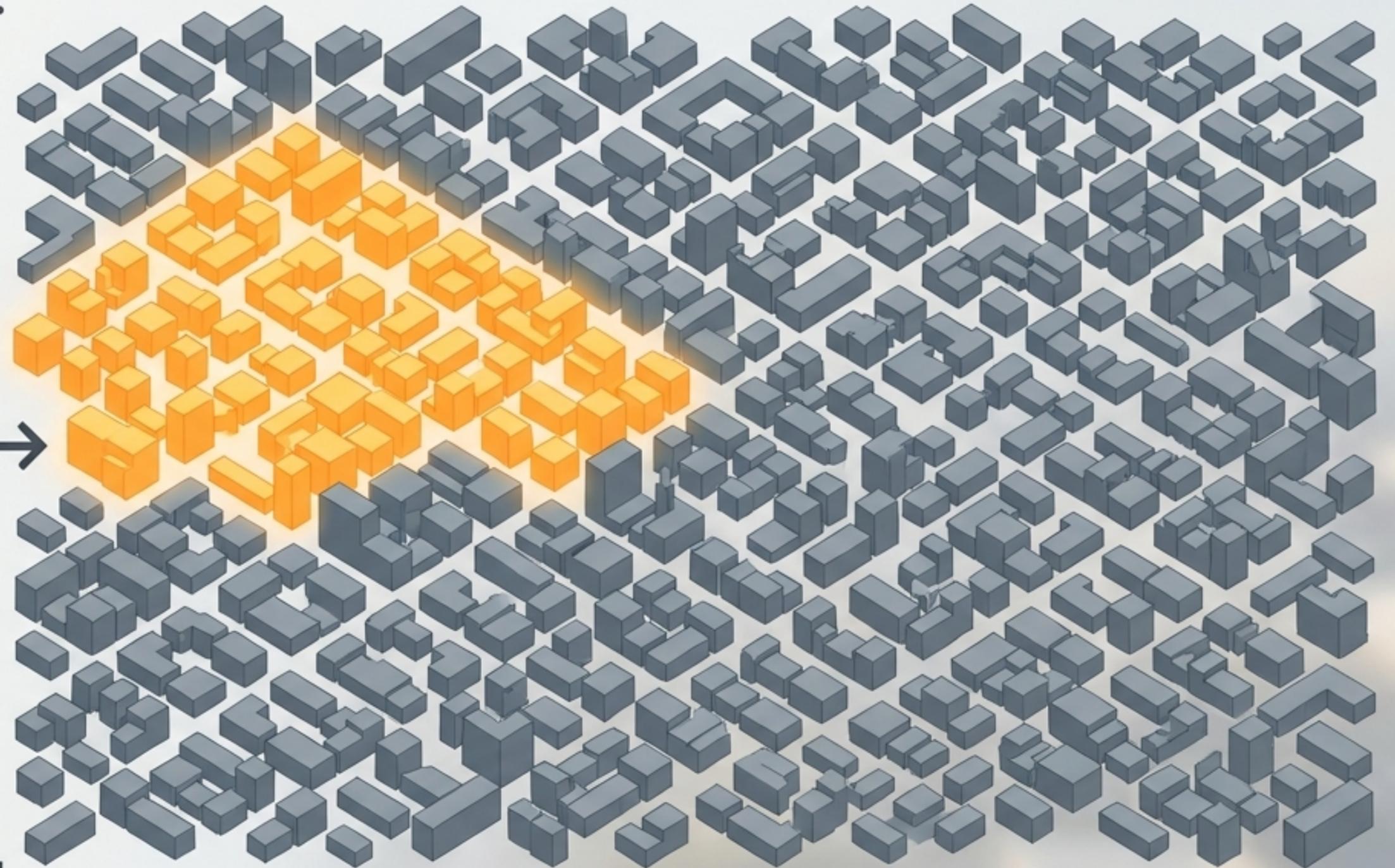
**Technically Usable
Supply:** 57 to 70
PJ/year

Distance: 98% of major
industrial sites are
within 10 km of urban
heat demand

Industrial waste heat is a stranded domestic asset capable of shielding the Dutch economy from global energy volatility.

**Total Built
Environment
Demand:
525 PJ**

**Usable Supply:
57-70 PJ**



The thermal dividend possesses the technical potential to satisfy 13% of the entire Dutch built environment's heat demand—equivalent to permanently decarbonising 1.2 million households.

Industrial Sector	Low-Grade Heat (<100°C)	Medium-Grade Heat (100-400°C)	High-Grade Heat (>400°C)	Total Potential
Oil Refineries	10.0	12.6	6.0	28.6
Chemicals	12.0	10.0	5.0	27.0
Iron & Steel	2.0	5.0	8.0	15.0
Waste Incineration	3.0	11.9	0.0	14.9
Data Centres	9.9	0.0	0.0	9.9
Hydrogen Production	10.0	10.0	5.0	25.0
Total	51.9 PJ	51.5 PJ	24.0 PJ	127.4 PJ

Over 80% of the available thermal dividend exists in the low-to-medium temperature grades—perfectly aligning with modern district heating requirements.



Tech Cyan

30°C Low-Grade
Waste

Clean Electricity Input

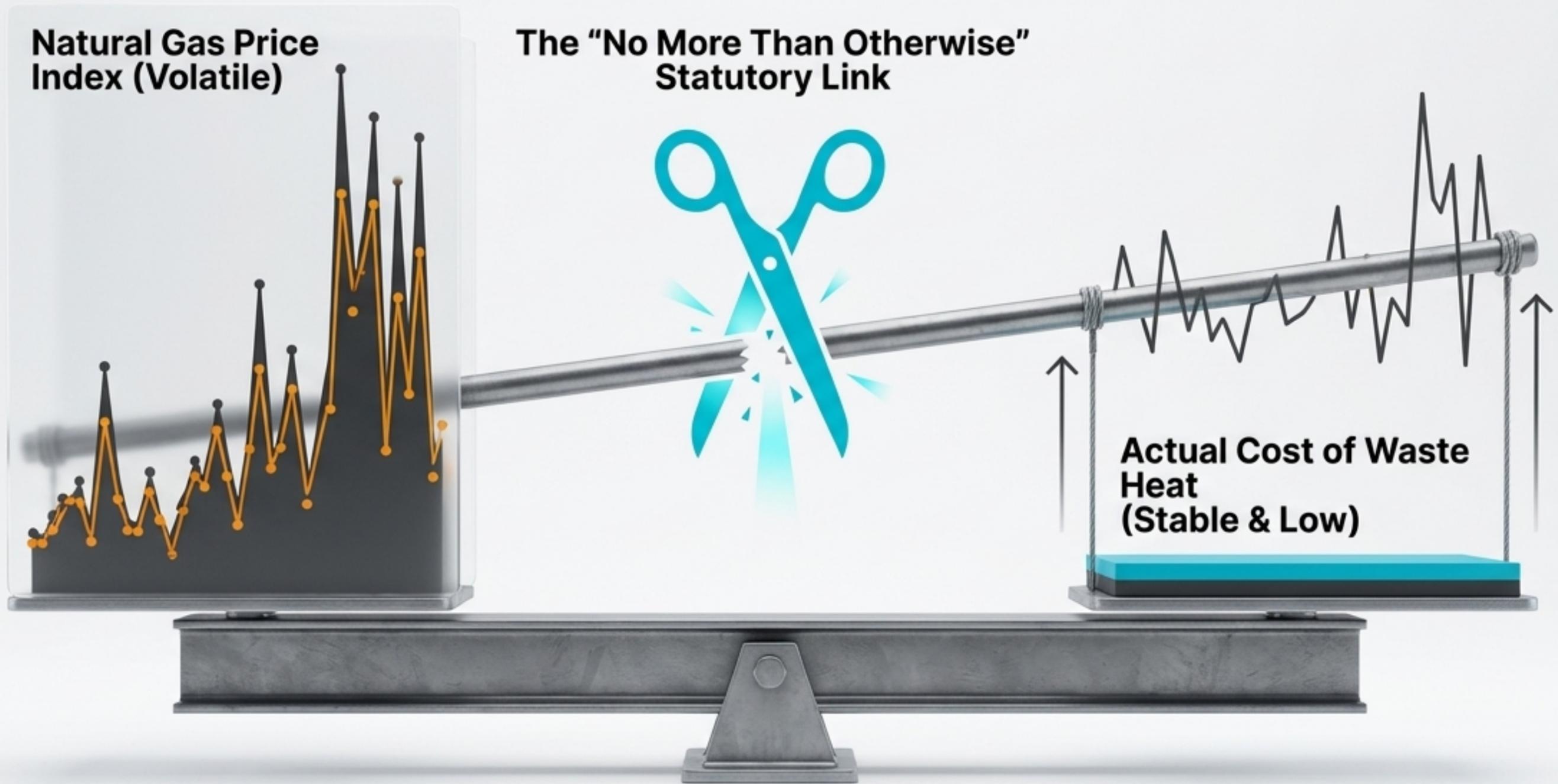


Thermal Amber

60-70°C High-Value
Residential Heat



Modern large-scale heat pumps transform previously useless low-grade industrial exhaust into premium, grid-ready thermal energy.



Decoupling district heating tariffs from volatile fossil fuel markets is the single most critical market reform required to unlock consumer adoption.

A coordinated triad of financial de-risking, market reform, and spatial governance is required to bridge the implementation gap.



Pillar 1: Infrastructure De-risking

Implement Regulated Asset Base (RAB) models and national loan guarantees to lower the cost of capital for DHC networks.



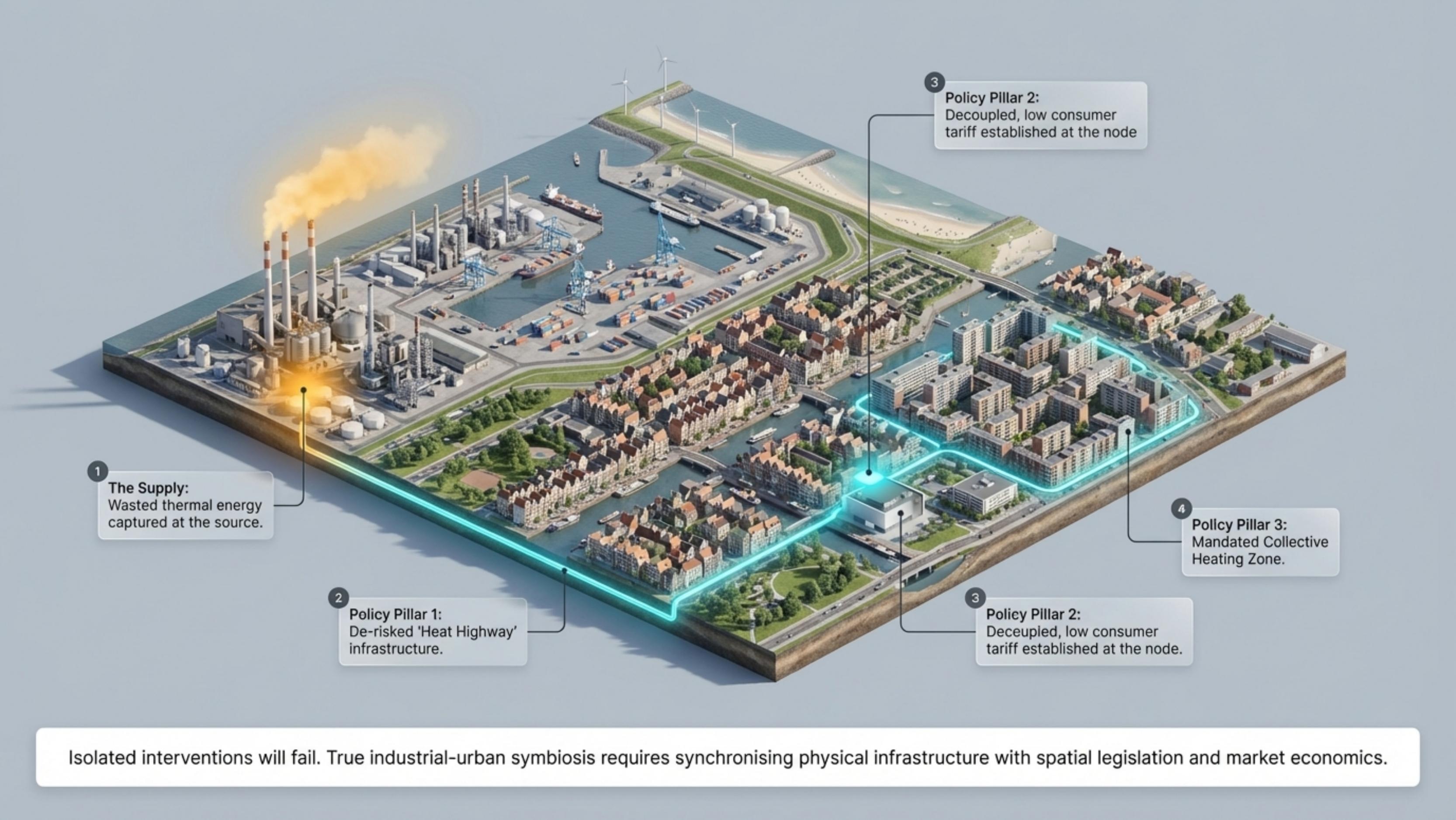
Pillar 2: Market & Regulatory Reform

Sever the gas-price link and legally mandate major industrial emitters to offer viable waste heat to network operators.



Pillar 3: Strategic Spatial Zoning

Mandate municipal Heat Programmes to designate exclusive, high-density zones for collective heating, phasing out individual pump subsidies in these areas.

A 3D isometric diagram illustrating industrial-urban symbiosis. On the left, an industrial facility with smokestacks and a power plant is shown. A glowing cyan line represents a 'Heat Highway' infrastructure connecting the industrial site to a residential urban area on the right. The urban area features various building types, including multi-story apartment blocks and smaller houses. A central node in the urban area is highlighted with a glowing cyan circle. Callout boxes with numbers 1 through 4 are connected to different parts of the diagram: 1 points to the industrial source, 2 points to the 'Heat Highway' infrastructure, 3 points to two different nodes in the urban area, and 4 points to a specific residential zone.

1 The Supply:
Wasted thermal energy captured at the source.

2 Policy Pillar 1:
De-risked 'Heat Highway'
infrastructure.

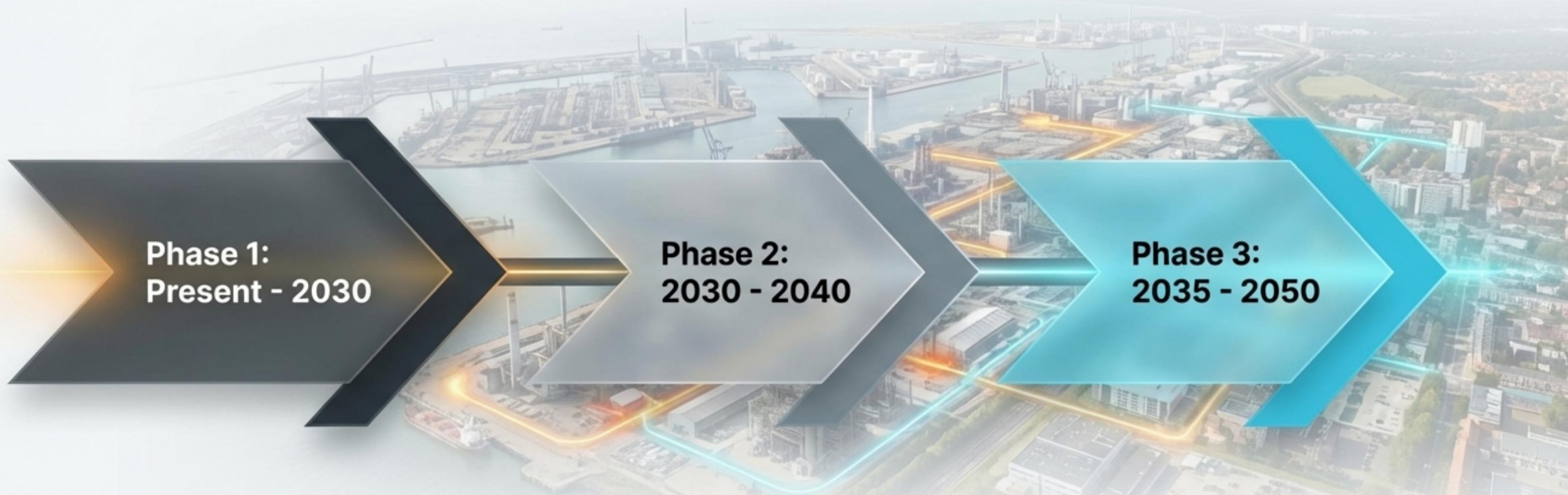
3 Policy Pillar 2:
Decoupled, low consumer
tariff established at the node

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Decoupled, low consumer
tariff established at the node.

4 Policy Pillar 3:
Mandated Collective
Heating Zone.

Isolated interventions will fail. True industrial-urban symbiosis requires synchronising physical infrastructure with spatial legislation and market economics.

A phased spatial rollout prioritises immediate high-yield anchor projects before scaling to an interconnected national thermal grid.



Anchor Projects

Focus on immediate high-yield clusters: Port of Rotterdam, Tata Steel, Chemelot. Establish foundational local networks.

Inter-regional Heat Highways

Construct transmission pipelines connecting major industrial sources to non-industrial cities, creating a national thermal market.

Low-Temp Integration

Network densification. Connect diffuse 4G/5G sources (data centres, wastewater) to the primary backbone.

The Netherlands must transition from a century of linear fossil extraction to a future of circular thermal circulation.

By treating industrial waste heat as a cornerstone asset rather than an environmental byproduct, we can insulate our economy, decarbonise our built environment, and pioneer a definitive model for urban-industrial **symbiosis**.