Geothermal potential in the European heating market

Executive summary

September 2026

green therma

Executive summary

	Key findings	Comment
1	***Heat is Europe's largest energy-service demand (53%) and the largest emitter (60%), yet lacks a clear decarbonization pathway***	• Heat accounts for 53% of European energy-service demand, roughly 5,300 TWh p.a., in addition heat stands for 60% of GHG emissions, equaling ~1400 Mt p.a. • Services like work and electric services sees clear decarbonization pathways through clean molecules and clean electrons. Heat does not.
2	***Geothermal offers the most efficient source of energy to heat, while being independent of non-EU imports of commodities or technology***	• Geothermal is the most efficient way to generate heat. While alternatives carry 5-40% conversion losses, geothermal has none. In contrast to alternatives, there are no reliance on non-EU commodities or technology such as biomass feedstock or mass manufactured energy assets.
3	***Heat4Ever™ avoids historical failure modes of geothermal energy. Through risk reduction it may unlock geothermal scalability***	• The closed-loop design removes binary resource risk, as no water reservoir is needed and uncertainty narrows from resource existence to exact temperature. • With no contact between fluid and geology, the system avoids reservoir management risks, induced seismicity, and contamination.
4	***Green Therma delivers a standardized & independent solution, building upon O&G legacy, enabling a new energy infrastructure asset class***	• Energy technologies scale on independent decision-making and value-chain standardization. Onshore wind shows how a single utility counterpart, bankability and a standardized asset class enable adoption. • Heat4Ever shares these attributes and is positioned to replicate that adoption path, while high barriers to entry, from the O&G sector reduce commoditization risk, seen in comparable energy technologies.
5	***Green Therma targets competitive heat pricing within the district heating baseload and midload segments***	• Levelized cost of heat are comparable to alternative technologies, but sensitive to discount rate. Baseload can be delivered at ~50 EUR/MWh[1], midload at ~60.[1] • Other decision criteria like resource dependency and reliability will likely be the decisive factor. Green Therma proves to be the least resource dependent and emitting alternative.
6	***Green Therma suited to target ~25 GW of capacity until 2050, with ~17x upside potential in both district heating and industry***	• In industry, Food & Beverages is the expected market entry, potentially unlocking 10 GW before 2050. • In district heating, Germany and Austria are considered the most promising markets with ~1000 networks found to be Green Therma suitable. Representing ~700 MW yearly add-ons towards 2030.
7	***Heat markets are fundamentally different from power markets, with higher appetite for reliability & long term investments***	• The power market is an open, spot-dominated market with optionality to import during shortfalls, historically it has therefore rewarded flexibility and low OPEX. • The heat market is locked, with no import fallback and volumes secured under long-term contracts, hence it rewards reliability, higher CAPEX is justifiable when dependable delivery is guaranteed.

1) At 4% real discount rate (6.1% nominal @ 2% inflation), capex 7 EUR/W, full assumptions on separate slide.

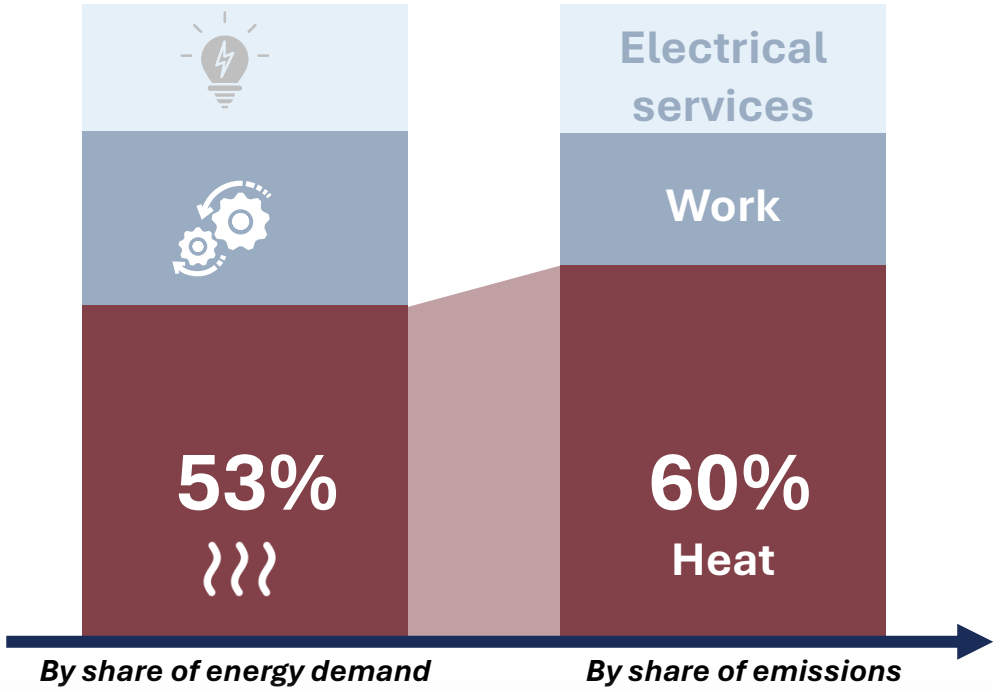
Source: Rystad Energy research and analysis

Geothermal for heat is one of Europe's highest-impact decarbonization levers

Heat demands 53% of energy and emits 60% of emissions in Europe. Solving heat is critical...

... geothermal for heat to the rescue, while also offering a relief in a tight decarbonization market

Energy service demand in Europe 2025



Pathway to decarbonization

*Decarbonize the **power markets**...* → *... and consume **clean electrons**...*

*... then **fuel** the residual...* → *... by consuming **clean molecules***

There is a tug of war for clean electrons and clean molecules in Europe

Demand will be captured by the highest paying consumers

While supply is heavily dependent on imports of both fuels and power assets

Green Therma is viable to serve up to ~75% of European heat

Geothermal heat bypasses these constraints

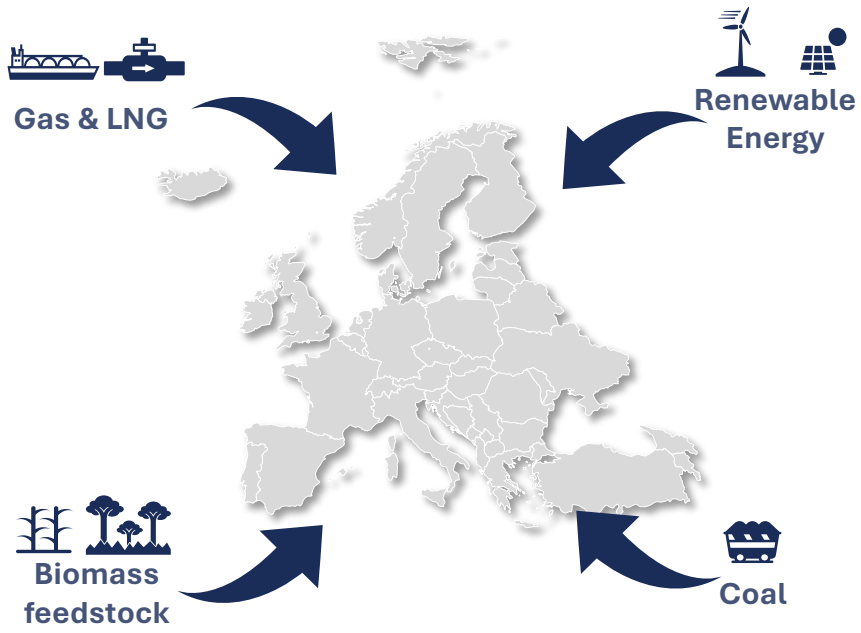
Source: Rystad Energy research and analysis

Geothermal heat is unique because of no dependency and no efficiency loss

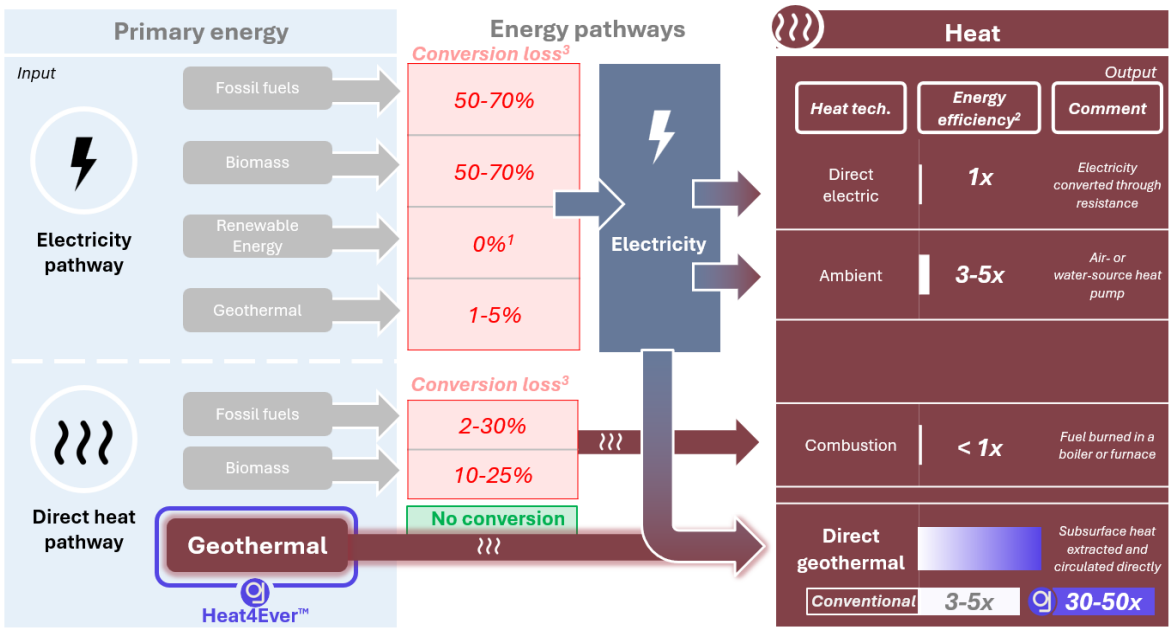
From an energy reliability perspective, Europe is too dependent on imports to solve for heat...

... and from an energy efficiency perspective, no heat source beats geothermal

Import dynamics for European heat



Key pathways from primary energy to heat

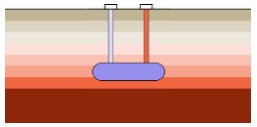
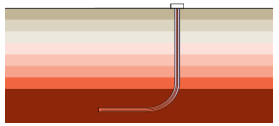


Independent energy source, with a European supply chain

The most energy efficient source of heat generation

1) Wind and solar do have physical capture losses, but standard energy accounting normally defines their primary energy at the electricity-generation point. 2) Useful heat delivered per unit of purchased energy. Indicative performance: direct electric ~1x; ambient heat pump ~3–5x; combustion ~0.75–0.95x; direct geothermal ~30–50x auxiliary electricity input.
3) Conversion loss from primary energy to electricity, or from fuel to useful heat.
Source: Rystad Energy research and analysis

But traditional geothermal comes with limitations and concerns

The main issues with traditional geothermal...	Hydrothermal 	... to be tackled by Green Therma	Green Therma 
Geographical flexibility	**Geographically limited** *Needs hot, permeable water reservoir*		**More geographically flexible** *Only requires sufficient temperature at depth, no reservoir needed*
Repeatability	**Bespoke engineering projects** *Reservoir-dependent materials and equipment*		**Standardized solution** *Containerized topside and patented DualVac™ pipes. No site-dependency impacting use of specialized chemicals/wellheads*
Exploration risk	**Binary well success risk** Committing *to drilling before resource is confirmed*		**Avoids binary well success risk** *High temperature is known to exist. Some risk of exact temperature and MW output*
Operational predictability	**Significant operational concerns** *Scaling, reservoir risks (pressure, flow). Typically also significant power price exposure*		**Prevents reservoir risk and power price dependency** *Enclosed fluid avoids the typical reservoir- and chemical risks. Minimal power price exposure*
Environmental intrusiveness	**Seismicity and leakage risk** *Risks of seismicity from water reinjection has blocked proposed projects. Freshwater contamination is also a concern*		**Closed loop avoids reservoir water injection** *Minimal impact on the surroundings after the well is constructed. No contact between geology and fluid*

Green Therma aims to tackle key limitations and concerns with traditional geothermal

Source: Rystad Energy research and analysis; Industry interviews

Green Therma offers comparable cost with a built-in hedge against fuel and power prices

Heat4Ever™ can deliver at comparable cost levels...

... with attractive non-economic attributes

Pre-tax LCOH in Germany ex. subsidies, construction year 2026[1]
EUR/MWh

Baseload LCOH

~30%

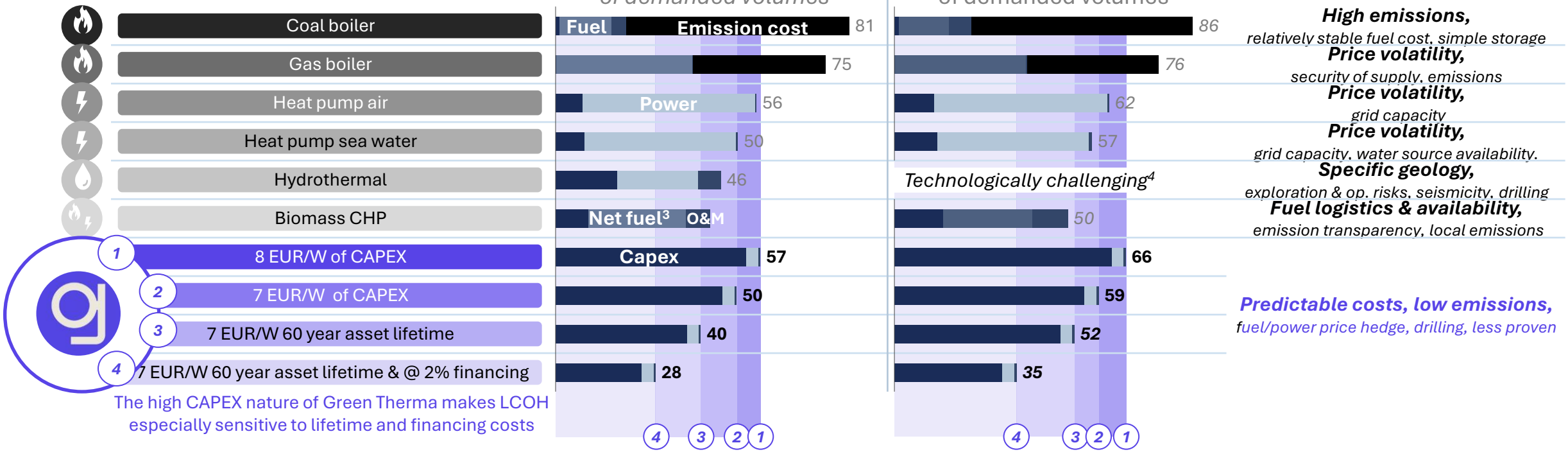
of demanded volumes[2]

Midload LCOH

~60%

of demanded volumes[2]

Non-economic factors



High emissions,
relatively stable fuel cost, simple storage

Price volatility,
security of supply, emissions

Price volatility,
grid capacity

Price volatility,
grid capacity, water source availability.

Specific geology,
exploration & op. risks, seismicity, drilling

Fuel logistics & availability,
emission transparency, local emissions

Predictable costs, low emissions,
fuel/power price hedge, drilling, less proven

1) Using real discount rates throughout. Green Therma estimates on own capex. Assumption overview on separate slide. 2) In energy terms. Remainder is peakload, which is less relevant. 3) Fuel cost net of electricity sales. 4) Risks scaling, casing damage, and permanent reservoir output loss.
Source: Rystad Energy research and analysis

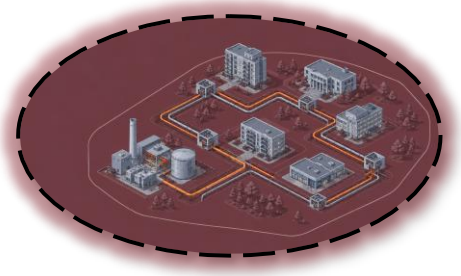
RystadEnergy

Heat markets are fundamentally different from power markets, with higher appetite for reliability

The power and heat markets operate under fundamentally different dynamics...

... where the power market rewards optionality and low OPEX, the heat market rewards reliability.

Power markets	Heat markets
Open market, with optionality to import expensive short term power	Locked market, with no optionality to import heat given shortfall



Optionality favored

Short term market dominates

Technologies delivering low OPEX as led decarbonizing the power markets

Reliability favored

Long term contracts dominates

Technologies delivering reliable heat at a predictable cost should be favored. The heat market has yet to see an obvious contender.

Source: Rystad Energy research and analysis

Green Therma delivers a standardized & independent solution set to unlock geothermal scalability

Solar, batteries, and now onshore wind have shown that independence and standardization is key for scalability...

... Heat4Ever™ is in large showing comparable attributes to onshore wind

Learnings from disruptive energy technologies: ***Independent*** decision-making and ***standardization*** across the value chain

	Onshore wind	Green Therma
Independence	***Moderately independent***	***Moderately independent***
	Infrastructure in place, the grid. One main point of conviction, the power utility	*Infrastructure in place, district heating. One main point of conviction, the heating utility*
Screening	***Transparent bankability assessment***	***Transparent bankability assessment***
	Standardized and transparent screening metrics → *Transparent bankability*	*Standardized and transparent screening metrics* → *Transparent bankability*
Supply chain	***Standardized energy asset class***	***Standardized energy asset class***

Green Therma may be the core technology provider unlocking scalability in geothermal

8 Source: Rystad Energy research and analysis

RystadEnergy

Leveraging the existing O&G ecosystem is both the path to scale and the barrier against rivals

Building on partnerships and specialized knowledge from Oil and Gas...

Partnerships

With robust suppliers and well execution leaders...

slb, Halliburton, Tenaris, Baker Hughes, NABORS, HALLIBURTON

Existing equipment & technology

...decades of oil & gas technology innovation...

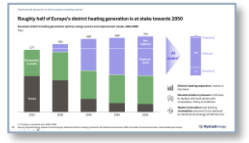
O&G sector looking to pivot

... and a massive existing supply chain to tap into with vast experience, workforce and budgets into renewables

... are both acceleration enablers and barriers against commoditization

Rapid scaling

Experienced team & partners needed for claiming the decarbonization wave in heat...



Competitive edge

... building robust supply chains and with commitment from industry leaders...

Difficult to commoditize

... while building customer trust not replicable or possible to commoditize, protecting margins

Sweet spot between standardization and bespoke projects ensures a scalable solution with protected margins

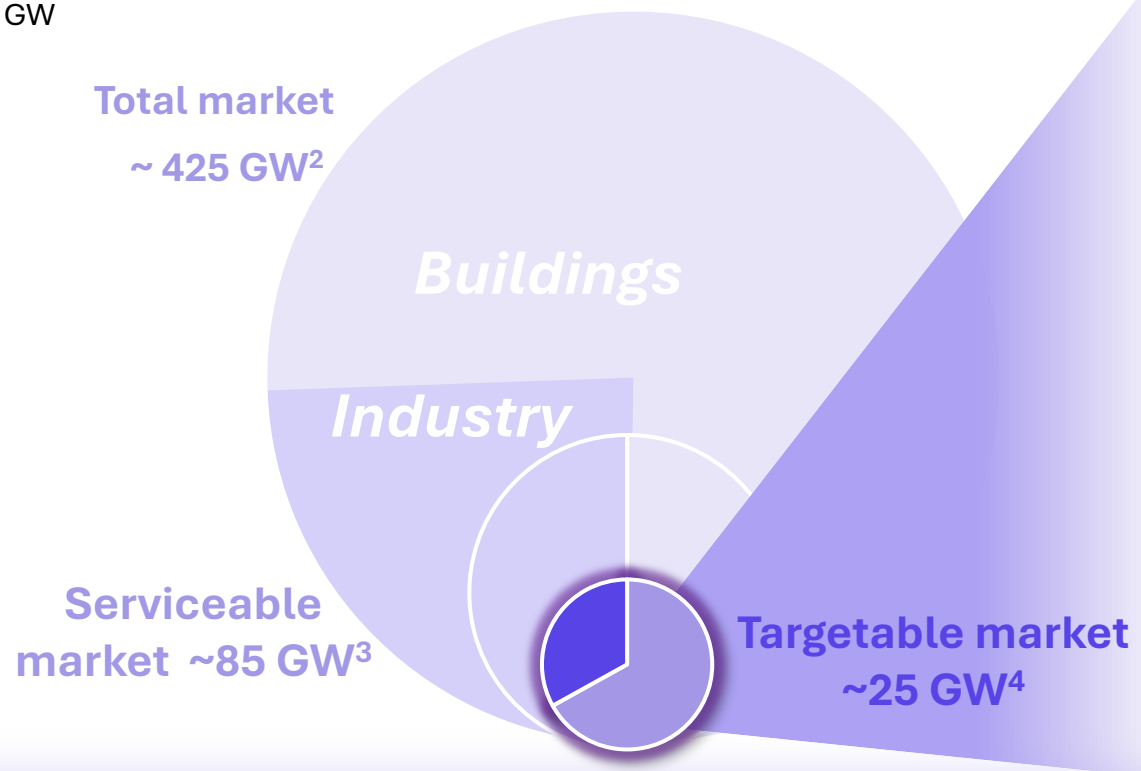
Source: Rystad Energy research and analysis; Industry interviews

A ~425 GW market shift puts ~25 GW within Green Therma's reach by 2050, and it starts now

Screening ~9,000 EU heating networks plus industry narrows a ~425 GW total market to ~25 GW targetable by 2050…

Market sizing Green Therma potential towards 2050[1]

GW



… the shift is underway: 1400 networks already pass screening, with yearly heat needs of 700 MW towards 2030

~1400

networks where Green Therma holds a comparative advantage

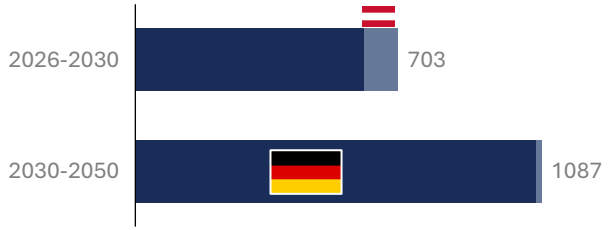
~1000 of them are in Germany and Austria

~10 GW

targetable in industrial heat by 2050. Food and beverage signals early adoption

~700 MW

yearly additions at stake in top 3 countries towards 2030



35 cities

evaluated and considered good fit for Green Therma

1) The market size assumes Green Therma to deliver at 98% utilization for all purposes and applications in TAM for simplicity. Viable utilization grades are assessed for targetable market.2) TAM captures all European heat demand technically viable for Green Therma. 3) SAM captures share of TAM that will be replaced with new heat source towards 2050 given policy targets for respective countries. 4) Targetable market captures share of SAM believed for Green Therma to win based on competitive advantage for respective volumes based on network characteristics before 2050.

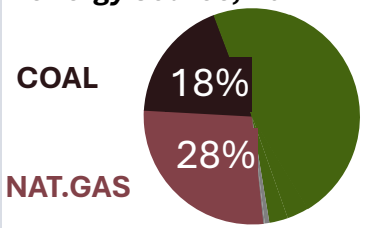
Source: Rystad Energy research and analysis; EnergyDemand Cube; EU; Eurostat

Potential of ~61 Mt CO2e avoided annually by 2050, on par with Ireland's total emissions today

	Unit	District heating	Industrial	Total
Rystad Energy targetable market before 2050	***In capacity (GW)***	15	10	25
	In Energy (TWh)	129	86	215
Potential replacements of coal and natural gas in district heating and low process industrials		**Coal**	**Natural gas**	
	Share of energy mix	18%	28%	
	Share of replaced energy	39%	61%	
	Replaced energy (TWh)	84	131	215
Emissions reduced by replacements before 2050	***IPP emission intensity (tCO2/MWh fuel)***	0.341	0.202	
	Efficiency	0.9	0.9	
	Total avoided MtCO2/yr	***32***	***29***	***61***

Targetable market towards 2050 ~25 GW

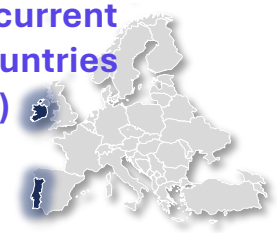
European district heating by energy source, 2024



61

Mt CO2e/year avoided in 2050

Comparable to current emissions of countries like Ireland (~60) or Portugal (~50)



Annual 2050 snapshot, not cumulative. Assumes 25 GW geothermal (15 GW district heating, 10 GW industrial) displacing gas and coal boilers at the current European heat mix (28%/18%), IPCC 2006 fuel emission factors and 90% boiler efficiency. Load factor 98%

Source: Rystad Energy research and analysis

We are an independent research and energy intelligence company, equipping clients with data, insights and education that power better decision-making.

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