

HEATING UP



**THE DATA BEHIND THE
DEBATE ON GREEN HOMES**



A NEW NARRATIVE

The green agenda is a major driver of change in the built environment, with political will and societal need disrupting a conventionally mature segment of the international economy.

This change is often slow moving, but the energy insecurity seen as a result of the war in Ukraine has shifted government policy and household behaviour, highlighting how fossil fuel-dependent Europe continues to be and how much change is needed on the path to net zero.

In the UK and Europe, domestic carbon emissions represent around a fifth of total emissions, meaning decarbonising homes is high on the agenda. To date, many of the policies surrounding the reduction of domestic carbon focus on swapping out gas-powered boilers for cleaner, greener alternatives. However, CIL's research reveals a more dynamic picture, with no single answer for delivering meaningful change across Europe.

Instead, the optimal solution varies based on the underlying infrastructure and differences in power generation at a country-level. Ultimately, reaching net zero requires an overhaul of the central grid towards renewable and nuclear energy, rather than consumer change alone.

Available technologies, including heat pumps and electric systems, are not yet a practical mass substitute for gas boilers and are either

prohibitively expensive or do not materially reduce emissions for most households. Indeed, in countries, such as Germany and Poland, which have particularly carbon-intensive power generation at the grid level, gas boilers remain more carbon efficient than electric alternatives. The most immediately effective change comes through better insulation and heat recovery, yet almost all governments shy away from the politically unpopular move of forcing private homeowners to insulate.

In this piece, CIL explores the challenges faced on the journey to decarbonising Europe's homes, and how current narratives overlook the complexity of the options available. We examine the challenge of heat pumps being a poor mass substitute for gas combi boilers and consider electric systems as an alternative. We outline our research exploring both the financial and environmental effects of moving to an electric alternative across Europe and what else needs to be done to reach net zero.

AT A GLANCE

- There is no single pan-European answer to decarbonisation but multiple solutions, which vary based on existing infrastructure.
- Available domestic technologies are not yet enough, with heat pumps only part of the answer and a weak cost/benefit case for the mass replacement of combi gas boilers.
- Electric systems can, in some cases, produce more total CO₂ and result in higher running costs; hydrogen boilers remain a long way off.
- The most effective available change comes through insulation and heat recovery in the near term.
- Ultimately, net zero will require a central grid overhaul towards renewables and nuclear. This will take significant capex and intergenerational political will to realise.

METHODOLOGY

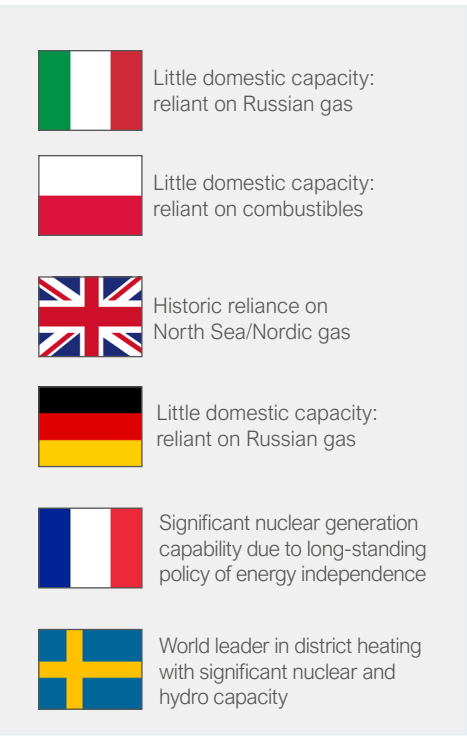
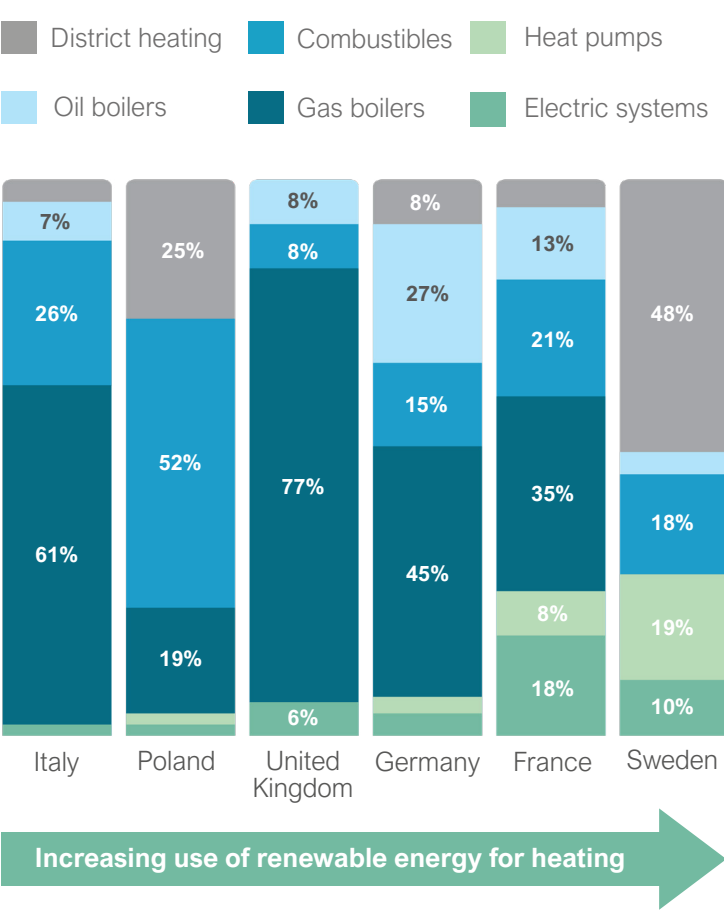


- Our views draw on CIL's recent work in the sector, including 100+ conversations with industry participants and 1,000+ consumers and tradespeople surveyed internationally.
- The modelling presented in this paper is underpinned by BRG data, which we use to estimate running costs under various energy mix, price, and heating system scenarios.
- Utility cost data is based on H2 2021 and carbon emissions statistics are from July 2022 for consistent comparison, taking annual average household consumption by geography.

ENERGY MIX MATTERS

A country’s path to decarbonisation is determined by its energy mix. Due to the huge difference in grid infrastructure across Europe, there is no one-size-fits-all solution.

Energy Mix: Central Heating & Water
% of kwh



The mix of domestic heating systems is related to a country’s energy generation capacity and energy policy.

Gas boilers and combustibles still represent the majority of Europe’s domestic heating infrastructure. Gas boilers are difficult to swap out in most settings, and the significant presence of combustibles shows how far Europe has to go on the path to net zero.

The mix of different heating systems is a result of a country’s energy sources. With 41% of its energy coming from the North Sea gas reserves,

the UK lags behind many of its European counterparts and is still highly dependent on gas boilers, while France generates 42% of its energy mix from nuclear, and therefore has more optionality when it comes to electric. Sweden is a clear green leader.

As a result of these different energy mixes, countries will need to rely on different technologies and approaches to decarbonise and will do so at different rates. In short, there is no single answer to going green internationally.

Heat pumps are not the whole solution.

While often lauded as a mass solution, heat pumps are only part of the story. Heat pumps are inherently green and can be cheap to run once installed. However, installation costs can be prohibitive at 5-15x more than a gas boiler. Unlike combi boilers, heat pumps fail to provide instant heat from a small unit. They are not a suitable like-for-like replacement in most domestic settings and present challenges in areas of high building density.

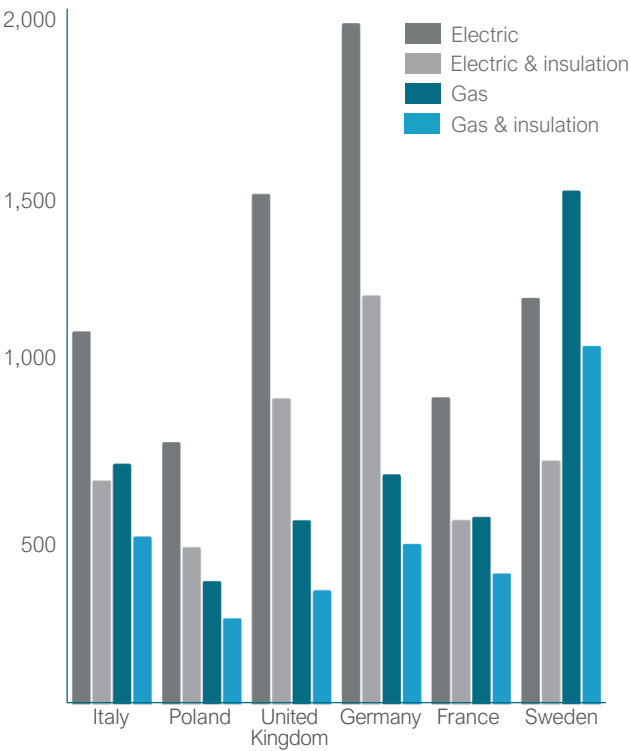
Electric boilers are not always greener.

There is no mass, electric-based replacement for gas boilers without an overhaul of grid power. Instead, carbon emissions and consumer cost can be reduced more effectively and immediately through better insulating of the housing stock. It is politically difficult to regulate retrofitted measures for existing homes.

Adding insulation to a home with a gas boiler is better value for the European consumer than using an electric boiler, with or without insulation.

Household running costs by system type and with potential savings from insulation

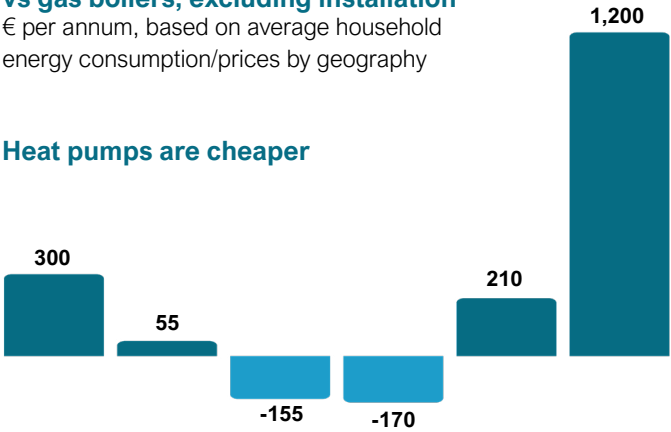
€ per annum, based on average household energy consumption/prices by geography



Net cost comparison of using heat pumps vs gas boilers, excluding installation¹

€ per annum, based on average household energy consumption/prices by geography

Heat pumps are cheaper



Heat pumps are more expensive

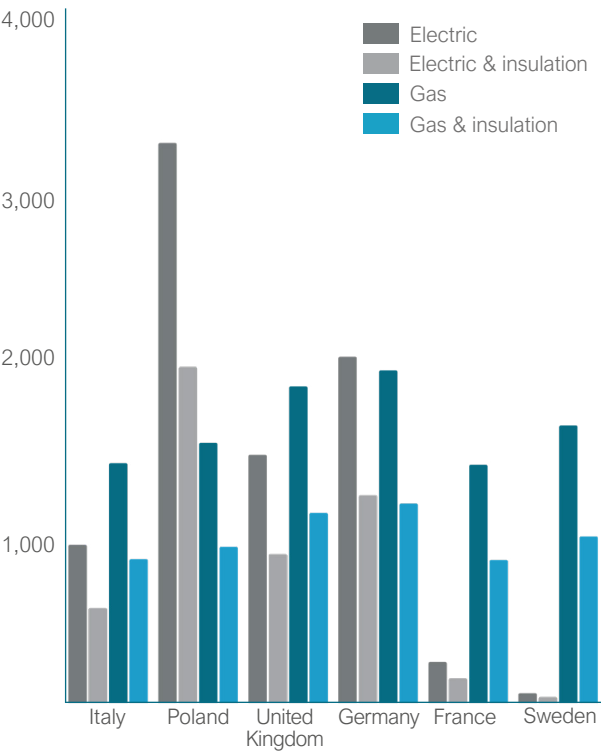
Italy Poland United Kingdom Germany France Sweden

¹ The difference in average annualised installation cost between heat pumps and gas boilers is ~€900.

Given the underlying grid, adoption of electric alone is not always net positive for carbon emissions, but there is always a case for better insulation.

Household carbon emissions by system type and with potential savings from insulation

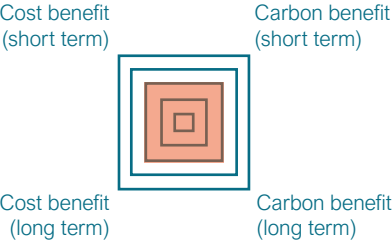
kg of CO₂ per annum, based on average household energy consumption by geography



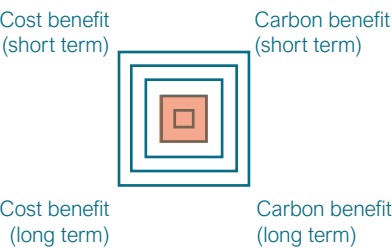
GREEN INITIATIVES SCORING

CIL's Green Initiatives Scoring demonstrates the near-term effects at a household level of better insulation and the longer-term advantages of decarbonising grid power generation.

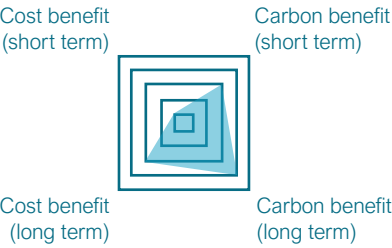
INSULATION & HEAT RECOVERY



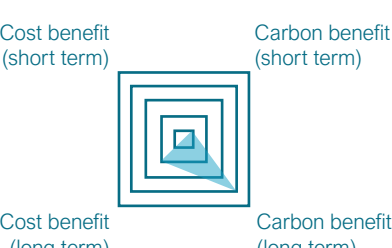
SMART DEVICE ADOPTION



HEAT PUMPS



ELECTRIC HEATING SYSTEMS



SHORT TERM (2020s)

The highest impact initiatives for reducing CO₂ emissions and household spend will be to continue with mature technologies, driven by regulations.

Improve home efficiency: Decreasing heat leakage can reduce household emissions by up to ~40%. Installation services, incentivisation schemes and support for less well-off households require further work.

Encourage smart device adoption: While governments will continue to mandate basic smart technology, consumer adoption of smart devices will also improve energy efficiency.

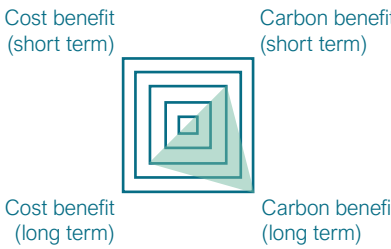
MEDIUM TERM (2020s-2030s)

The medium term will see a shift towards available greener technologies while genuine net zero solutions are developed and grid power generation is overhauled.

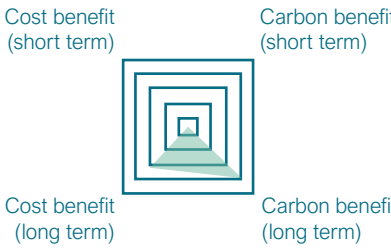
Extend use of heat pumps: Installation costs need to decrease ~50% to compete with gas and electric boilers. In some geographies, heat pumps are more expensive to run than gas boilers (even with 3x efficiency savings), suggesting more cheap electric capacity is needed before these are viable.

Expand use of electric boilers: During the early 2020s, electric boilers will remain unattractive due to high running costs, but adoption will be driven by regulation once home insulation has improved.

GRID OVERHAUL



HYDROGEN OR OTHER NEW BOILERS



LONG TERM (2040s-2050s)

International government support will be required in the long term to directly fund and commercialise new technologies, likely through sponsored research, public investment and tax reliefs.

Transform grid power generation: Growing political pressure will continue to drive governments to develop renewable, nuclear and other non-fossil fuel power generation internationally.

Commercialise hydrogen boilers: Existing gas infrastructure could be repurposed for carrying hydrogen, although hydrogen-ready boilers are still in development and their commercial model is yet unproven.

Other new technologies: There are many unknown and emergent technologies that could replace current domestic heating systems.

Embracing better energy efficiency in the form of usage, insulation and heat recovery will be key to meeting 2030 targets. Higher utility prices are already beginning to change consumer behaviour in the near term. In the longer term, however, overhauling how grid power is generated and commercialising new technologies (such as hydrogen power) are the only ways to reach net zero by 2050.

GET IN TOUCH

To discuss any of the points raised in this paper, please get in touch.



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