

The heat transition

Lessons from other Northern European countries on decarbonising heating

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Navigating Economic Change
Lessons from abroad and history

Navigating Economic Change

As the UK is buffeted by the economic shocks and challenges of the 2020s, The Economy 2030 Inquiry, a collaboration between the Resolution Foundation and the Centre for Economic Performance at the London School of Economics (LSE), funded by the Nuffield Foundation, is publishing a series of essays examining how policy makers from a range of advanced economies, including the UK in the recent past, have managed periods of disruptive economic change. As we seek to reformulate the UK's economic strategy for new times it is vital that we learn the lessons of these comparative and historic perspectives.

Some consider the trajectory of a national economy following a major shock – for instance, Germany after unification, New Zealand after the UK joined the European Community, Estonia post-USSR and the UK during the tumultuous 1980s. Others examine the experience of particular cities – for instance a group of post-industrial ‘turn-around cities’ - or the adjustment of key features of a national economic system, such as Danish ‘flexicurity’. Together they offer a powerful and timely set of insights on the successes and failures of economic policy makers in the face of economic shocks and structural change. The essays are written by a range of leading economists and national experts and reflect the views of the authors rather than those of the Resolution Foundation, the LSE or The Economy 2030 Inquiry.

They have been commissioned and edited by Gavin Kelly (Chair of the Resolution Foundation and member of the Economy 2030 steering group) and Richard Davies (Professor at University of Bristol and fellow at the LSE's Centre for Economic Performance).

Note on this essay: Renée Bruel contributed to this essay in a personal capacity and not as part of her role with the European Climate Foundation.

The Economy 2030 Inquiry

The Economy 2030 Inquiry is a collaboration between the Resolution Foundation and the Centre for Economic Performance at the London School of Economics, funded by the Nuffield Foundation. The Inquiry's subject matter is the nature, scale, and context for the economic change facing the UK during the 2020s. Its goal is not just to describe the change that Covid-19, Brexit, the Net Zero transition and technology will bring, but to help the country and its policy makers better understand and navigate it against a backdrop of low productivity and high inequality. To achieve these aims the Inquiry is leading a two-year national conversation on the future of the UK economy, bridging rigorous research, public involvement and concrete proposals. The work of the Inquiry will be brought together in a final report in 2023 that will set out a renewed economic strategy for the UK to enable the country to successfully navigate the decade ahead, with proposals to drive strong, sustainable and equitable growth, and significant improvements to people's living standards and well-being.

Introduction

Over the last decade, there have been substantial reductions in greenhouse gas (GHG) emissions in the power and transport sectors both in the UK and overseas, as countries work towards achieving net zero by 2050 at the latest. The UK is at the vanguard internationally when it comes to decarbonising its power sector, and uptake of Electric Vehicles (EVs) is picking up pace. But progress on decarbonising buildings has been very slow.

Energy used for purposes of heating and cooling accounts for around 50 per cent of total final energy consumption. Of this, almost half is consumed for heating buildings.¹ In the UK, fossil fuels account for over 90 per cent of the energy used in heating, almost all of which is gas. As such, it will be impossible to meet legally binding climate targets without moving to low carbon ways of heating buildings. Despite the scale and urgency of this challenge, the UK is lagging on its own targets and is behind its international peers. Making progress on domestic heating is now the central challenge, both in cutting carbon emissions and in responding to the energy-driven cost of living crisis.²

The UK government assumes that carbon emissions from homes need to drop by at least 47 per cent by 2035.³ A reduction of this scale in such a short amount of time has not been achieved before. Sluggish progress over recent decades, with emissions from buildings falling by just 18 per cent since 1990, highlights the scale of this challenge.

The need to decarbonise heating has taken on a new sense of urgency in recent months as a result of the energy price and security crisis, exacerbated by the invasion of Ukraine. At the time of writing, the UK Government has focussed on interventions to protect households from the sharpest impact of rising prices, with far less focus on transitioning away from fossil fuels and improving energy efficiency.

Even before the current crisis, the UK government had begun to set out an approach to decarbonise heating and buildings, with the launch of its Heat and Buildings Strategy. This sets out the Government's high-level approach – one largely based on regulations and market interventions – but it does not provide a detailed plan that will allow the UK to meet its ultimate net zero goals or its interim carbon budgets. As the UK embarks on what must be a major decade of policy change and delivery in this area, this chapter considers what lessons can be learnt from other European countries that are further along in their heating transition.

The structure of this chapter is as follows. First, we describe the UK context for heating decarbonisation, including reductions in emissions achieved to-date, the main technology options available, and the emerging policy mix. Second, in order to identify approaches that were successful elsewhere, we provide a selective overview of international experience including the Netherlands, Sweden, Denmark and Norway. Third, we provide an analysis of what lessons these countries offer the UK. Finally, we conclude with some policy directions for the UK.

1 IEA, [Renewables 2021: Analysis and forecast to 2026](#), December 2021.

2 This is covered in the UK context here: A Anis-Alavi et al., [Hitting a brick wall: How the UK can upgrade its housing stock to reduce energy bills and cut carbon](#), The Resolution Foundation, December 2022.

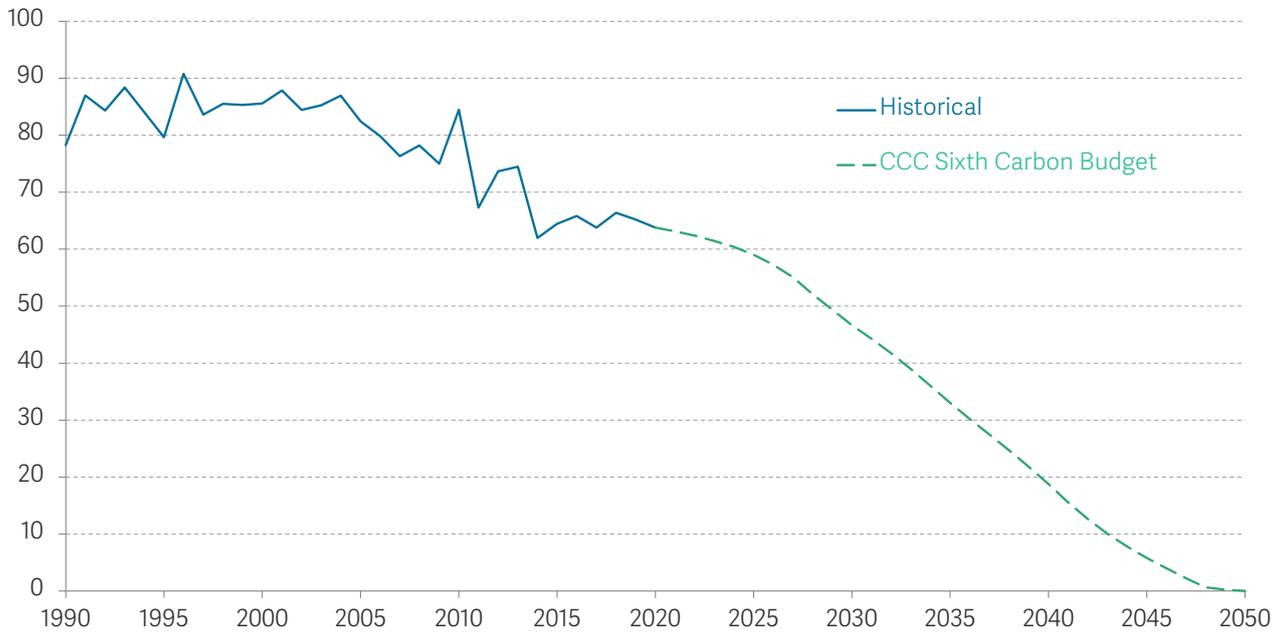
3 Department for Business, Energy & Industrial Strategy, [Net Zero Strategy: Build back greener](#), October 2021.

Heating makes up a large share of the UK’s carbon footprint

The heating of buildings is a major contributor to the UK’s greenhouse gas emissions, accounting for 23 per cent of total emissions, with home heating alone comparable to the carbon emissions of all petrol and diesel cars on UK roads.⁴ Meeting the UK’s net zero emissions target, therefore, will only be possible by complete decarbonisation of the building stock (see Figure 1). GHG emissions from buildings have fallen by 18 per cent since 1990, but much of this was driven by regulations that mandated that all new boilers installed after 1995 had to be efficient condensing models.⁵ Nearly 30 years later, however, there is a vanishingly small number of inefficient boilers left in the country, meaning this policy has run out of road.⁶

FIGURE 1: Emissions from residential buildings need to fall much more rapidly than they have done in the past

Direct metric tonnes of CO₂ emissions from residential buildings



SOURCE: CCC, Sixth Carbon Budget, December 2020.

The vast majority of homes in England are still heated using fossil fuels, with 86 per cent relying on gas and 4 per cent oil.⁷ Ignoring wood burners, fewer than 500,000 homes are currently equipped with some form of low-carbon heating system.⁸ As a result, only about 5 per cent of the UK’s total heat demand in buildings is currently met by low carbon sources.

Progress on decarbonising heating has been too slow in the UK

Progress on making homes in the UK more energy efficient has ground to a near-complete halt in recent years, with the installation of loft and wall insulation in 2021 at just 4 per cent of the peak levels seen in 2012 (when home insulation was a major government priority), and well short

⁴ Department for Business, Energy & Industrial Strategy, [Net Zero Strategy: Build back greener](#), October 2021; Department for Business, Energy & Industrial Strategy, [Provisional UK greenhouse gas emissions national statistics](#), March 2021.

⁵ Committee on Climate Change, [Net Zero: Technical Report](#), 2019.

⁶ J Rosenow et al., [The remaining potential for energy savings in UK households](#), Energy Policy 121, pp. 542-552, October 2018.

⁷ Ministry of Housing, Communities & Local Government, [English Housing Survey: Energy report 2019-20](#), July 2021.

⁸ Committee on Climate Change, [UK housing: Fit for the future?](#), February 2019.

of that required to meet 2050 targets.⁹ This is despite the large benefits to the climate, as well as to household finances, of faster progress being made. One quarter of the energy consumed by households could be cost-effectively saved by 2035.¹⁰

Nor is the replacement of fossil fuel-based heating systems with carbon-free heating technologies happening fast enough. In 2021, the UK installed just 54,000 heat pumps (of which 33,000 were in existing homes), while the financial year ending April 2021 saw almost 1.8 million gas boilers sold.¹¹ The UK lags behind comparable European countries, with 2021 seeing 537,000 heat pump sales in France, 382,000 in Italy and 177,000 in Germany.¹²

Part of the UK's under-performance in this area is a product of the unique challenges it faces. For example, the country has an unusually old housing stock; the age of a building is the biggest single driver of its energy efficiency, so this contributes to the UK having some of the most inefficient housing in Europe.^{13 14} At the same time, the UK places a heavy reliance on gas, exploiting large domestic reserves in the North Sea – and making the most of relatively (until recently) cheap gas prices.¹⁵ Gas is very much embedded in the national policy outlook: one recent strategy to reduce fuel poverty in the UK has been to connect “off-grid” properties to the gas networks and to fit fossil gas boilers.¹⁶ More widely, low-income households in the UK are on average poorer than low-income households in other (affluent) Western European economies, which makes the question of affordability and paying for the transition all the more contentious and complex.¹⁷ Yet there is no scope for delay: almost all of the UK's 29 million homes will require upgrading by 2050 (either in terms of building efficiency, heating systems or both). That corresponds to about 1 million homes per year, or more than 19,000 homes per week.

In Box 1 we provide a summary of the ways in which policy has, so far, held back the domestic heat transition in the UK.

9 J Rosenow et al., [The pathway to net zero heating in the UK](#), UK Energy Research Centre, October 2020.

10 J Rosenow et al., [The remaining potential for energy savings in UK households](#), Energy Policy 121, pp. 542-552, October 2018.

11 Climate Change Committee, [2022 Progress Report to Parliament](#). Heating and Hot Water Industry Council, [Boilers bounce back as consumers invest in home renovation](#), May 2021.

12 European Heat Pump Association, [Record growth for Europe's heat pump market in 2021](#), July 2022.

13 ONS, [Age of the property is the biggest single factor in energy efficiency of homes](#), January 2022.

14 K MacLean et al., [Managing heat system decarbonisation: Comparing the impacts and costs of transitions in heat infrastructure](#), Imperial College Centre for Energy Policy and Technology, April 2016.

15 S Arapostathis et al., [Governing transitions: Cases and insights from two periods in the history of the UK gas industry](#), Energy Policy 52, pp. 25–44, January 2013.

16 Ofgem, [Fuel Poor Network Extension Scheme \(FPNES\) Governance Document](#), February 2021.

17 A Corlett, F Odamtten & L Try, [The Living Standards Audit 2022](#), Resolution Foundation, July 2022.

BOX 1: Policy failure has held back the domestic heating transition in the UK

For the past decade, UK households could receive support through the Renewable Heat Incentive (RHI) policy to install carbon heating. The RHI offered quarterly subsidy payments to households to recoup the initial outlay over seven years, and was available for heat pumps, biomass boilers and solar thermal.

Deployment of heat pumps via the RHI fell below expectations, with predictions that the scheme would deliver just 22 per cent of planned renewable heat installations (across domestic and non-domestic buildings).¹⁸ It was estimated in the RHI would support 491,000 heat pumps by the original end of the scheme in April 2021.¹⁹ By August 2021, however, only 71,517 heat pumps had been accredited.²⁰ Low uptake was explained by the reliance on (cheaper) natural gas for heating, and limited access for households lacking initial funds.

Government policies have actively supported the installation and use of high carbon heat sources. For example, the Energy Company Obligation (ECO) scheme subsidises new boiler installations in fuel-poor households, locking them in to high carbon heat for another 15-20 years (the typical condensing boiler lifetime). The absence of regulations, such as the now-announced 2035 ban on boiler sales and installations, failed to signal change was needed. As such, industry neither developed new technologies, nor did the workforce start to gain knowledge of low-carbon heating systems that could be passed on to the public.

UK clean heat uptake was also impeded by policy decisions that increased the operating costs of electrified heat. Placing levies on electricity bills to pay for environmental and social policies (done so to ensure all 'paid their way', as around one-in-six British homes are not on the gas grid) and the lack of effective carbon pricing both mean that the price of gas is lower than it should be, and the price of electricity higher.

The UK government has made some initial attempts to regulate existing buildings. From 2018, landlords in the private rented sector have been prohibited to let their properties if it is of very low energy performance. Since these introductions the share of very poorly insulated rentals has fallen.²¹

The current Government has announced major reforms to decarbonise heating. The 2020 Energy White Paper and 2021 Heat and Buildings Strategy offered some much-needed ambition, policies and pledges after years of inaction. The papers outlined a combination of regulation, subsidy, tax changes and market-based mechanisms to drive the uptake of clean heat. The Autumn Budget 2022 committed £6 billion of additional funding up to 2028 to upgrade the energy efficiency of the country's homes. There is, however, little details on exactly what this will include, and it will only come into place from 2025.

¹⁸ National Audit Office, [Low-carbon heating of homes and businesses and the Renewable Heat Incentive](#), February 2018.

¹⁹ Department of Energy and Climate Change, [Renewable Heat Incentive – Domestic: Impact Assessment](#), July 2013.

²⁰ Department for Business, Energy & Industrial Strategy, [RHI monthly deployment data](#), August 2021.

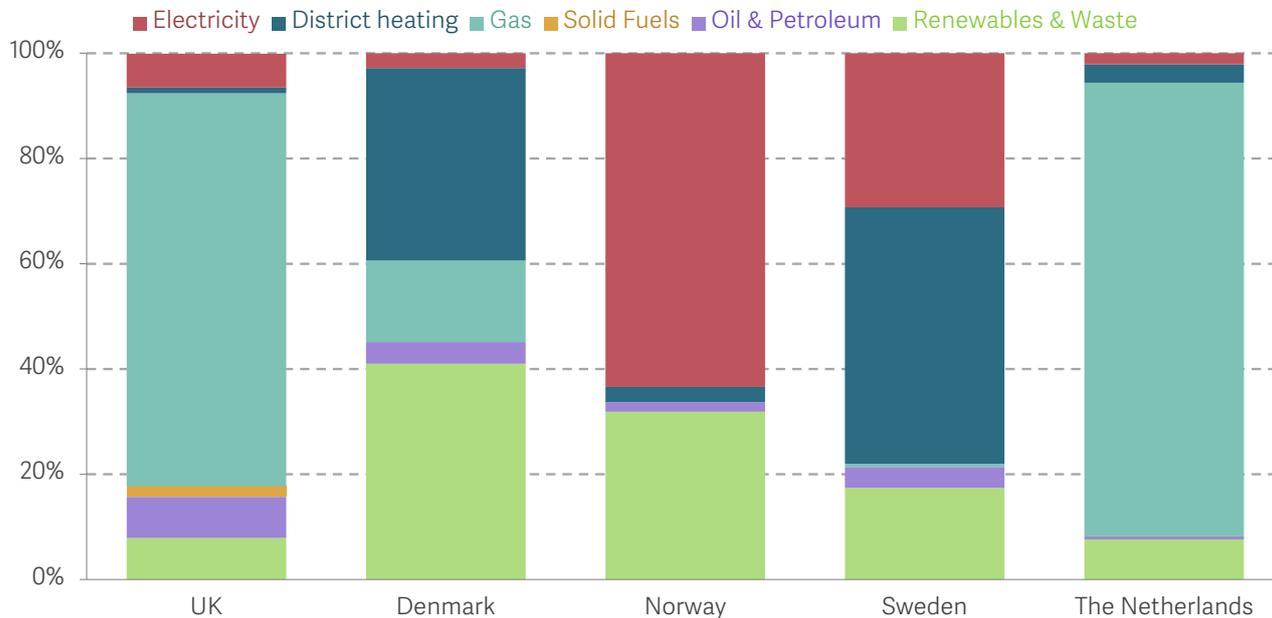
²¹ A Anis-Alavi et al., [Hitting a brick wall: How the UK can upgrade its housing stock to reduce energy bills and cut carbon](#), The Resolution Foundation, December 2022.

To gain an insight into learnings and best practices that can be utilised by UK policy makers, we next explore the experience of comparable European countries.

The heating mix and net zero transition in comparable European countries

The transition to decarbonise heating may seem daunting, and to some even unrealistic, but this is not the first major heat transition that countries in Europe have gone through at pace. Both the UK and the Netherlands switched from coal to gas heating in less than 15 years around the 1960s and, as Figure 2 shows, both countries still have a very high share of domestic heating provided by gas. The Netherlands, however, leads the UK in terms of ambition in getting off gas, with a political will to accelerate this transition following a number of earthquakes near the Groningen gas field in the early 2010s.

FIGURE 2: Domestic heat supply by source: 2018



SOURCE: Eurostat.

In contrast, Norway, Sweden and Denmark have largely transitioned directly from fossil fuel to renewable-based heating. The main driver for these countries was the oil crisis in the 1970s, which led to fossil-fuel shortages and a realisation of vulnerability (a similar situation to the one we face today as a result of the Russian invasion of Ukraine). This led to a widely supported goal to become independent from fossil fuel imports. Despite changes in political parties over time, this has been a constant focus in national energy policies in these countries – and explains why gas and oil make up a low share of heating fuels in all three countries.

In addition to political attitudes, there are significant differences between these countries and the UK in terms of the technology used to heat homes. Over 60 per cent of houses in Denmark are connected to district heating; in Sweden, district heating provides around 90 per cent of the heat demand in multi-family buildings and almost 60 per cent of total heat demand across all buildings.²² Heat pumps – the route most likely to be taken in the UK – are more common too, with 20 per cent of Swedish homes warmed by heat pumps. The Nordic nations do, however, rely on biomass heating more than

²² District heating systems distribute heat or cooling across a defined area from a single source. This removes the need for individual boilers or heaters in every home or building.

comparable nations; although technically low carbon (despite producing emissions at source), this does have significant sustainability issues.

In the next section of this chapter, we describe the main policies and approaches in the countries mentioned that have enabled, and will continue to support, the switch to renewable-based heating. While these countries have not all followed the same path to decarbonise heating, common approaches can be identified and lessons learnt.

Stop the problem getting larger: no new buildings should be on the gas grid

The largest and most challenging part of decarbonising homes is addressing the existing housing stock, but we still need energy efficient new buildings. Even though new buildings in European countries usually only increase the number of homes by around 1 per cent per year, a ban on connecting new homes to the gas grid is a clear first step to prevent the problem becoming worse. Building standards and regulations across the continent mean that energy demand, and therefore energy costs, for new properties is much lower, although in many instances (especially in the UK) they could be lower still.

Current policy, however, means the majority of new UK homes continue to be connected to the gas grid. In fact, it isn't until 2025 that new building regulations will mandate the installation of clean heat, by which time several hundred thousand new gas-heated homes will have likely have been built. This 2025 date itself represents a significant delay on proposals set to tighten regulations on new homes that were cancelled in 2016, just months before they were due to come into effect. Other European countries made this shift years ago.

Denmark, for example, introduced a ban on oil and gas heating in new buildings in 2013, adding to a ban on resistance heating (one of the most inefficient ways of keeping warm) that came into effect in 1998. As a result, the uptake of district heating, which was considered the most important low-carbon heating technology, increased rapidly. Similarly, Norway introduced a ban on the use of fossil fuels in new buildings and major renovations in 2017, with a complete ban on the use of oil boilers coming into force in 2020 (as oil was the only carbon-based fuel used for heating in Norway, this effectively meant a ban on all fossil fuel heating).²³ The Netherlands, which, as discussed above, has a similar heating energy and technology mix to the UK, has had such a ban in place since mid-2018 – some seven years before the UK.²⁴

Municipalities leading the way

In several of the countries discussed, local government is playing an important role in the transition to low-carbon heating, which should not be surprising given heat supply and demand are very local issues. This is especially the case in countries where district heating (homes heated from a collective source) is central to the transition. The involvement of local governments does, however, require a clear legal mandate, local policy tools, expertise and sufficient capacity. This is, so far at least, lacking in the UK – even if the Scottish government is considering a more locally led approach.

²³ Agora Energy, [Decarbonising heating in Buildings](#), November 2021.

²⁴ Omgevingsweb, [Gasvrije nieuwbouw vanaf 1 juli 2018: wat is de wetswijziging en wat zijn de implicaties voor lopende nieuwbouwprojecten?](#), July 2018.

In 1979, Denmark adopted the first Heating Supply Law, which required municipalities to map current and expected future heating demand, priorities for different heating technologies, and identify if neighbourhoods were suitable for district heating. As a result, the share of district heating grew from 20 to 40 per cent between 1972 and 1990, and with it came an increase in the use of gas for district heating. From 1982 onwards, municipalities could require new and existing buildings to connect to the public district heating network or gas supply. This provision was introduced to ensure that investments made in district heating infrastructure would be profitable; reducing the distance that heat needed to travel, particularly in high-density neighbourhoods.

Municipalities today are still the key actors in district heating in Denmark, although they are supported by the Danish Energy Agency, and are responsible for updating municipal heating plans and approving new heating projects. Since there is no 'opt out' of district heating, price regulation and protection of consumers is well-established. The large district heating networks are owned by energy companies, while smaller networks are owned either by municipalities or by consumer-owned cooperatives.

Even in the gas-dominated Netherlands, municipalities are expected to drive the transition to sustainable heating. Local areas have been tasked with developing local Heat Transition Plans that set out how and when each neighbourhood in their municipality can be offered alternative sources of heating before 2050. These plans are developed with housing associations, Distribution System Operators, home-owner associations and local citizens, and had to be submitted before the end of 2021. A support programme and subsidies are available both for developing plans and their implementation.

There is some evidence of a locally-led approach in the UK, albeit on a far smaller scale. Local Authority Delivery (LAD) schemes have in recent years seen some progress on both home insulation and clean heat, including targeting support at lower-income households. However, both levels of ambition and funding remain significantly lower than in comparable EU nations. The use of district heating is also increasing, concentrated in high-density housing in urban areas, albeit currently unregulated and not offering consumers particularly good value for money.

A tax system that supports the transition

Tax design can play an important role in the transition. Taxes, for example, have an impact on the profitability and attractiveness of different fuel options. In the UK there are currently no carbon taxes applied to gas burnt in the home, whereas electricity is taxed via the Emissions Trading Scheme and Carbon Price floor, and carries the majority of levies that fund environmental and social schemes. This framework means that costs are added to a lower carbon fuel rather than one associated with higher emissions.

At least fifteen countries in Europe have put a carbon price on heating and/or transport fuels. These carbon taxes vary in scale and size, with Sweden having the highest carbon price in the world while the Polish carbon tax is effectively zero.²⁵ Sweden's CO₂ tax was introduced in 1991. The general public broadly accepts the tax, which has gradually increased to incentivise the energy transition. Since its introduction it has increased from 250 Swedish kronor (SEK) per tonne of CO₂ (£20 per tonne) to SEK

²⁵ L Sunderland et al, [Equity in the Energy Transition: Who pays and who benefits?](#), Regulatory Assistance Project, May 2020.

1200 per tonne in 2022 (£97 per tonne). This is significantly higher than the carbon tax for heating in Norway which was also introduced in 1991 and reached €50.80 per tonne by 2019 (£45.40 per tonne). In both countries, these taxes have been the main drivers of the decarbonisation of domestic heating.

Rather than a carbon tax, since 2020 the Netherlands has introduced a gradual shift in the energy tax burden from electricity to natural gas for households, in order to strengthen the business case for electrified heating. The energy tax on gas is now set at 44 cent per m³ (2 cents higher than in 2021) whereas the tax on electricity is 8 cents per kWh (almost 7 cents/kWh lower than in 2021). Additional funds raised via this tax shift will be returned to households via a tax reduction and a lower energy tax rate for the first bracket for electricity.

In its 2020 Energy White Paper, the UK Government outlined its intention to expand the UK Emissions Trading Scheme (ETS) so that it covers new sectors, potentially including domestic heating. At the time of writing, however, no progress has been made.

Subsidies that reduce the costs of investment

As well as tax incentives, governments that have advanced further than the UK in the heating transition have also relied on subsidies for the upfront investment costs involved in insulation or changing heating technologies.

The Norwegian government started providing subsidies to encourage the switch to electric heating (heat pumps) and district heating in the early 2000s. The subsidies amounted to on average 25 per cent of the investment costs of renewable based heating and 45 per cent of the investment costs of renewable based district heating. This support could also be combined with a subsidy to remove oil boilers and oil tanks. A combination of these subsidies, high fossil fuel taxes, low electricity rates and a ban on the use of oil heating for buildings from 2020 led to nearly 1.5 million heat pumps being sold by 2020 (in a country with less than 2.6 million dwellings). The subsidy scheme, partly as a result of other measures mentioned earlier, became so popular that the government decided to end it in 2021.

A range of subsidies also exist in Sweden. Investment grants for solar technology to heat rooms and water have been made available since 2000. And since 2005, grants have been offered to convert domestic heating systems, in the form of investment subsidies and tax deductions on the costs of labour involved in installing a heat pump (up to 50 per cent of labour costs). However, these subsidies have not been made available on a continued basis, and the resulting stop-go effect has led to booms and busts in the installation of heat pumps. The high fossil fuel taxes, and tax deductions for the costs of labour, are considered to have had more of an effect on uptake than the investment subsidies.²⁶

The subsidy programme available in the Netherlands for heat pumps, solar thermal boilers, and insulation has not been large enough to make a significant impact with the total amount available annually almost always spent before the end of the year. Despite a subsidy of about 20 per cent of investment costs, as well as low interest loans, the total impact has been very limited so far, and by far the largest growth in heat pumps has been in new buildings.

²⁶ R Hanna & R Gross, [Best practice in heat decarbonisation policy: A review of the international experience of policies to promote the uptake of low-carbon heat supply](#), Working Paper, UKERC, December 2016.

The new government in the Netherlands (since January 2022) has set up a new Climate and Transition fund of around €35 billion until 2030, from which subsidies for heat pumps, the national insulation programme, new nuclear power plants, carbon capture and storage (CCS), renewable energy, and other climate change mitigation measures will be paid. The largest share of approximately €22 billion will be made available to support the transition of the industry. This fund will be separate from the national budget and will therefore have a limited impact on the national debt.

The new government has significantly increased the subsidies for heat pumps and insulation, with a 'national insulation programme' of €4 billion, and a €900 million subsidy programme for (hybrid) heat pumps, both until 2030. The subsidy per heat pump has increased from 20 to 30 per cent from 2022 onwards. Vulnerable households in badly insulated buildings will receive additional support. In addition, subsidies for the currently unprofitable district heating network business cases will also become available.

As an attempted post-Covid stimulus, the UK Government introduced new subsidies for clean heat and energy efficiency through the Green Homes Grant. Despite widespread public interest, however, onerous conditions for both applicants and tradespeople meant that only a fraction of targeted upgrades – 47,500 homes compared to a goal of 600,000 – were made. 2022 saw the launch of a new subsidy scheme, the Boiler Upgrade Scheme, offering up to £5,000 toward the cost of a new heat pump. However, limited funding means this is only expected to subsidise 90,000 heat pumps over three years – or less than the number currently installed annually even without subsidies.

Regulation of heating systems and energy efficiency of buildings

Many governments, including the UK Government, already make use of regulation to mandate the heating technology that home owners install. In the UK, as discussed above, the installation of new gas boilers will not be permitted in any homes after 2035, and in new homes from 2025. In stark contrast, from 2026 all households in the Netherlands will no longer be able to replace gas boilers with anything other than a heat pump or a hybrid heat pump (a combination of a gas boiler and a heat pump, whereby the gas boiler is only used on the coldest days of the year). An EU-wide move to phase out fossil-only boilers by 2029 has been mooted, although this is still some way from being adopted as a binding regulation.

But it is primarily in relation to building energy efficiency that regulations have been deployed in other European countries. Making progress on this front is crucial to the heat transition as clean heat systems will then be able to operate more efficiently and at lower cost.

Regulations on energy efficiency have been used in Denmark since 1961, with the requirements ratcheting up over time. The next phase will see every homeowner that still has a gas connection being contacted by the Government before the end of 2022 to consider how they will transition to clean heat. It is expected that around 50 per cent of these houses will be able to connect to a district heating network, and the other 50 per cent will have to switch to a heat pump. This increased ambition will see its remaining 400,000 gas-heated homes switch to renewable-based heating by 2030.

As far back as 2009, Sweden's 'Integrated Climate and Energy Policy' (ICEP) introduced the goal of increasing energy efficiency in buildings by 20 per cent in 2020 and 50 per cent in 2050. Supporting these targets, Sweden's building code energy requirements are very rigorous for both new builds and

renovations. These regulations have supplemented the key role that taxes on energy and CO₂ have played in reducing GHG emissions from heating.

Regulation has also played a role in the Netherlands where a minimum energy performance standard for commercial buildings (EPC C by 2023) and social rental (average EPC B by 2021) was introduced in 2012. This has led to an increase in renovation activity in both commercial buildings as well as in the social rental sector. Renting out poorly insulated properties will no longer be allowed from 2030 in both the social and private sectors. The social rented sector will receive support to upgrade their building stock.

In addition, in 2021, the Dutch government introduced an 'Insulation Standard' to be added to the energy label of buildings. This indicates if the building is 'gas-free ready' – that is, it indicates if it has a decent level of insulation. Although the standard is not very high, and is currently only a communication instrument for home-owners, it is expected to have an impact on property values (evidence shows that houses with a higher EPC are sold for a higher price) and it will be evaluated and potentially strengthened in 2025.

As well as incoming sales regulations, the UK has been making increased use of regulation to drive energy efficiency, albeit at a slower pace, and with weaker standards, compared to some of its European peers. For example, since 2018 privately rented properties have needed an EPC rating of E or higher, a minimum expected to be tightened to EPC C in the coming years.

Lessons for the UK

The UK government is significantly behind other countries in North Western Europe in decarbonising its building stock. It will have to move at pace to develop and implement a policy agenda spanning regulation for both new and existing buildings, tax reform, financial support for households and the creation of a stable long-term policy framework that instils confidence among consumers, investors, local authorities, and providers. The examples provided in this chapter show that with a mix of strong policies implemented consistently over time rapid change can happen.

What lessons, then, can be drawn from experiences in Sweden, Denmark, Norway and the Netherlands?

Clearly a long-term policy framework is essential. The UK's stop-start approach to policy stands out compared with comparator countries, and although widely referred to as a reason for slow progress, it remains the key issue policy makers need to put right.

Firm targets are necessary but not sufficient. Having recently set much-needed emissions targets and pathways to decarbonise homes, the UK is now in a good position to give industry and households some much needed confidence. Announcements about regulation, subsidies or tax changes will all fail to drive change if families and firms do not have confidence that they will endure.

The Government should be looking to employ all the levers it has available to it (tax, subsidy, regulation, R&D support and market-making) in a complementary manner. And this is where lessons from overseas come in.

It is widely acknowledged that the UK's tax system is not aligned with the move to net zero emissions, with a clear mismatch between its stated targets and its policy stance when it comes to the taxation

of fuels. Taking insight from countries such as Sweden, where widespread carbon taxes are long-established at levels sufficient to change behaviour, the UK should look to align its tax system with the imperative of net zero. The distributional impacts of introducing a carbon tax, especially during a cost of living crisis, would need to be carefully considered.

As discussed, UK subsidy schemes are available, but they remain short term and limited in ambition: current policies will not deliver the Government's goal of installing 600,000 heat pumps per year by 2028. As such, more generous and more targeted subsidy support should be made available – particularly in light of the impacts of high energy prices on lower-income households following Russia's invasion of Ukraine. Matching the generosity and length of subsidy schemes with Government targets would give households more confidence that, when ready to move to clean heat, support will be available.

Stronger regulation has clearly borne fruit in other countries. The lesson is that these regulations must be dependable. Taking new homes as an example, for a few weeks in 2020 it was suggested that new regulations would be brought in by 2023, instead of 2025 as previously billed – before reverting to the original date. Countries where regulations have driven change have not suffered from such indecision and uncertainty.

Finally, the UK is set to continue its market-led approach by imposing mandates on boiler manufacturers, so that a certain percentage of sales have to be low-carbon heating systems. This represents a different approach to that utilised in other countries, but there are precedents of using such a policy in other sectors, such as the car industry. Mandates on boiler manufacturers should be used in conjunction with other methods that have been proven to work, such as rebalancing taxes and levies on heating energy.

Perhaps, above all, the heat transition cannot happen without improving the energy efficiency of houses. More efficient homes will be cheaper to heat (and cool), require smaller heating systems and use less heating fuel.²⁷ Improving the energy efficiency of buildings can be achieved through long-standing financial support programmes and minimum energy performance standards, again, as seen in numerous other countries, as well as building codes which impose stricter energy performance requirements over time.²⁸

Alongside the 'harder' policy and regulatory measures described above, 'softer' interventions which improve consumer awareness, enhance technical standards, spread best practice and strengthen supply chains are also essential.

Finally, there is the role of municipalities. We have described the key role municipalities have played in both Denmark and the Netherlands in leading the transition away from gas heating. This requires a mandate and capacity in local government that is currently not present in the UK. The UK currently has a rather centralised government system with limited powers for local administrations. This means that, for now at least, the national government will have to take the lead in the urgent challenge of moving to a fully decarbonised building stock.

²⁷ J Rosenow & R Lowes, [Heating without the hot air: Principles for smart heat electrification](#), Regulatory Assistance Project, March 2020.

²⁸ L Sunderland & Santini, [Next steps for MEPS: Designing minimum energy performance standards for European buildings](#), Regulatory Assistance Project, June 2021.

Navigating economic change: lessons from abroad and history

As the UK is buffeted by the economic shocks and challenges of the 2020s, The Economy 2030 Inquiry, a collaboration between the Resolution Foundation and the Centre for Economic Performance at the London School of Economics (LSE), funded by the Nuffield Foundation, is publishing a series of essays examining how policy makers from a range of advanced economies, including the UK in the recent past, have managed periods of disruptive economic change. As we seek to reformulate the UK's economic strategy for new times it is vital that we learn the lessons of these comparative and historic perspectives.

Some consider the trajectory of a national economy following a major shock – for instance, Germany after unification, New Zealand after the UK joined the European Community, Estonia post-USSR and the UK during the tumultuous 1980s. Others examine the experience of particular cities – for instance a group of post-industrial ‘turn-around cities’ - or the adjustment of key features of a national economic system, such as Danish ‘flexicurity’. Together they offer a powerful and timely set of insights on the successes and failures of economic policy makers in the face of economic shocks and structural change.

The essays are written by a range of leading economists and national experts and reflect the views of the authors rather than those of the Resolution Foundation, the LSE or The Economy 2030 Inquiry.

They have been commissioned and edited by Gavin Kelly (Chair of the Resolution Foundation and member of the Economy 2030 steering group) and Richard Davies (Professor at University of Bristol and fellow at the LSE's Centre for Economic Performance).