Energy Bill REVOLUTION

Association for the Conservation of Energy

Westgate House
2a Prebend Street
London N1 8PT

020 7359 8000
sarah@ukace.org

Energy efficiency and excess winter deaths: Comparing the UK and Sweden

November 2013

1 Introduction

David Cameron pledged in February 2013 that he wanted the UK to become "the most energy efficient country in Europe"[1]. However, at present the UK is the 'cold man of Europe', with very high levels of fuel poverty and poorly insulated homes. In contrast, Sweden has well-insulated homes, meaning that its people suffer less from fuel poverty and excess winter deaths – even though they face higher energy prices and colder winters.

"Stockholm in winter". Credit: sumodaz, RGBStock

Malmo, Sweden. Credit: City of Malmo[2]

[1] http://www.ukace.org/2013/02/david-camerons-speech-at-the-launch-of-deccs-energy-efficiency-mission/
[2] Source: http://buildipedia.com

Earlier this year, a report[3] by ACE Research for the Energy Bill Revolution compared fuel poverty and energy efficiency in the UK to 15 other European countries. The UK was ranked either the worst, or among the worst, on energy poverty, affordability of heating, efficiency of homes and excess winter deaths. This is despite the fact that it has amongst the lowest energy prices in Europe and relatively high household incomes compared to the other countries. The report showed that the poor energy efficiency of our housing stock is one of the main causes of these problems.

This briefing looks in more detail at the UK's performance relative to Sweden, which is generally seen as representing the best practice in Europe on these energy issues, and has a similar income level to the UK. Table 1 summarises the key findings on a range of indicators, and what these mean.

Table 1: Overview of key findings for the UK and Sweden

Indicator	UK	Sweden	What does this mean?
Excess winter deaths as a proportion of all deaths (%)	4.61	3.76	High winter death rates are often linked with fuel poverty. Compared to Sweden, the UK has a 23% higher rate of excess deaths in the winter despite the fact the UK has much milder winters than Sweden.
Proportion unable to afford to heat their home adequately (%)	6.5	1.6	The share of people who cannot afford to heat their home is four times higher in the UK than in Sweden
Proportion spending a considerable share of expenditure on energy (%)	19.2	11.2	The share of households who must spend a lot of their budget on energy is 70% higher in the UK than in Sweden.
Approximate price per unit of most common type of heating[4] (p/kwh)	5.6	9	Swedes use different types of heating to Britons. However, in general, Swedes pay a higher price for each unit of energy for heating. This means prices are not the cause of the UK's poor performance on the measures above.
Real adjusted gross disposable income of households per capita (£)	18,900	19,000	The UK has almost the same household income as Sweden. This means income is unlikely to be the main cause of the UK's poor performance.
Proportion living in homes in a poor condition (%)	15.9	8.4	The UK's share of people living in leaky homes is almost twice as high as Sweden's. This is likely to be a cause of the UK's poor performance.
Average U value of walls (W/m^2K)	1.16	0.35	The UK's homes lose three times more heat than Sweden's because they are poorly insulated. This is likely to be a major cause of the UK's poor performance.

[3] http://www.ukace.org/2013/03/fact-file-the-cold-man-of-europe/

[4] For the UK, the most common type of heating is gas heating, and for Sweden it is for district heating. To enable a fair comparison, we have converted the unit price of gas (4.5p) into a price per unit of "useful heat". For details, please see Appendix 1.

The example of Sweden provides a clear illustration of what improving the housing stock would mean for the UK - cutting fuel poverty, reducing excess winter deaths and making energy more affordable. The Energy Bill Revolution is calling for the carbon tax every household pays via their bills to be used to make UK homes highly energy efficient, prioritising the homes of the fuel poor. There is enough carbon tax revenue from the Emissions Trading Scheme and the Carbon Price Floor to end fuel poverty and significantly reduce carbon emissions and energy bills. This investment in homes is also one of the best ways to generate growth and jobs in the UK economy.

2 Background: comparing the UK and Sweden

If we are going to compare energy issues in the two countries, it is important to understand some of their basic similarities and differences. Figure 1 shows the two countries' locations.

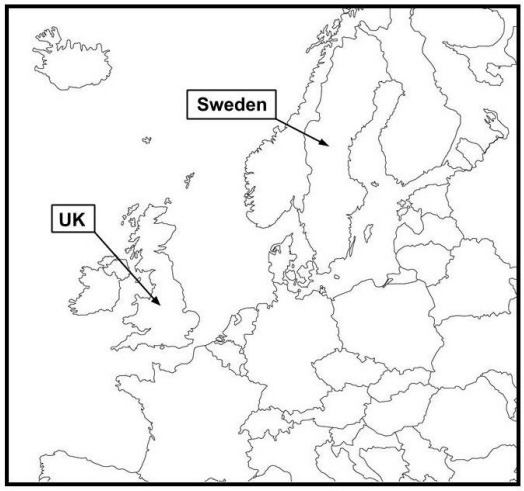


Figure 1: Locations of Sweden and the UK

2.1 Climate

In central and southern Sweden, summer temperatures are similar to those in England, but winters are colder and very snowy, with the sea often freezing over. In the rest of Sweden, temperatures are much colder, with long, severe winters and some areas where the snow never melts[5]. As an illustration, Table 2 shows January temperatures in the two capital cities, with Stockholm being much colder than London.

Table 2: January temperatures in London and Stockholm, from BBC weather[6]

	January average minimum daily temperature (°C)	January average maximum daily temperature (°C)
London	2	6
Stockholm	-5	-1

So Sweden has much colder winters than the UK, and we might expect Swedes to have more difficulty keeping warm than Britons.

[5] Source: The Met Office: http://www.metoffice.gov.uk/weather/europe/sweden_past.html
[6] Source: http://www.bbc.co.uk/weather

2.2 Income

Another important consideration, if we are to compare the two countries, is their incomes. People in Sweden and the UK have very similar incomes. The average disposable income in the UK is £18,900. This is very slightly lower than in Sweden, where it is £19,000[7]. So there is no reason to think that differences in income would lead one country's citizens to struggle more with heating costs.

3 Results

In this section we consider the differences in fuel poverty and excess winter deaths between the two countries, and their possible explanations.

3.1 Excess winter deaths and affordable warmth

First, we investigate the issues of affordable warmth and excess winter mortality in the UK and Sweden. In a working paper in late 2010[8], the European Commission calculated how many households in each country were spending a considerable share of their expenditure on energy (based on a pre-determined threshold). Those spending over this threshold were classed as being in energy poverty. On this basis the UK has 19% of households in energy poverty[9], while Sweden has only 11%.

Another indicator is whether people can afford to heat their homes adequately[10]. The European Commission Statistics on Income and Living Conditions (SILC) survey (2011) asked householders whether they could afford to adequately heat their home. 6.5% of UK householders said they cannot afford to keep their home warm. In contrast, in Sweden, the figure was only 1.6%.

Another important issue is excess winter mortality. This refers to the number of additional deaths in the winter months compared to the rest of the year, and is a problem associated with fuel poverty. Table 3 shows the number of excess winter deaths was much higher in the UK in 2011-12, but this is because the UK's population is greater, and so the total number of deaths is higher. For a fairer comparison, we can look at excess winter deaths as a proportion of all deaths. This shows that in Sweden, 3.8% of all deaths were excess winter deaths, while in the UK the figure was 4.6%[11], which is 23% higher.

Table 3: Excess Winter Deaths (EWDs) for 2011-2012[12]

	Excess winter deaths (EWDs)	Total deaths	Proportion of deaths that are EWDs (%)
Sweden	3,385	89,959	3.76
UK	25,535	554,156	4.61

[7] We use 2011 'real adjusted gross disposable income of households per capita' from Eurostat (this is the latest data available). This is based on income before housing costs, because data on income after housing costs were not available.
[8] EC, 2010
[9] In fact, out of all 27 Member States, the UK ranks second from bottom according to this measure.
[10] It is important to note that 'adequately' warm is a subjective measure of an expectation of comfort which undoubtedly varies from country to country. People may also have different understandings of what it means to "afford" their heating.
[11] The ONS also has a method for calculating an Excess Winter Mortality Index (EWMI) that enables comparisons of this problem across different areas. Applying this method shows that the UK in 2010/2011 had an EWMI of 14.5%. In contrast, Sweden had an EWMI of only 11.7%.
[12] Data from Eurostat, 2013

It should be noted that this method does not take account of the specific climatic conditions in the countries in that year. However, it appears that Sweden has fewer excess winter deaths as a proportion of all deaths, despite the fact that Sweden experiences far colder winters.

Across all the measures the UK performs worse than Sweden, with more UK residents spending large amounts of their budget on energy and struggling to afford heating. The links between cold homes and negative health impacts are now well known, so this lack of affordable warmth is likely to contribute to the UK's higher rate of excess deaths in winter. This raises an important question: why are UK residents suffering more than Swedes in terms of energy poverty and its impacts?

3.2 Energy prices

It might be assumed that UK residents are struggling to keep warm because of high energy prices. Whilst it is true that retail gas and electricity prices have seen significant increases in the last few years, the UK still has relatively low energy prices compared to other European countries.

In the UK, the main source of energy for heating is gas, and DECC's Quarterly Energy Prices Update[13] shows that Great Britain's average gas price is 4.5p per unit. To compare this to the costs of other heating sources we can convert it to a cost per unit of useful heat (see Appendix 1) – this gives a cost of 5.6 p per unit. Average UK domestic gas prices, including taxes, are the second lowest in the EU15. Swedes do not use gas as a main source of heating; their main sources are district heating, electricity and biomass. The average unit cost of district heating in Sweden is approximately 9p and the average unit cost of biomass is around 6 – 7p[14].

DECC's Quarterly Energy Prices update states that in 2012, average UK domestic electricity prices, including taxes, were the fifth lowest in the EU 15, at 14p per unit. DECC state that in Sweden, the figure is very slightly higher, and the Swedish Energy Agency states that the average unit cost of electric heating for a house is around 16p[15]. Further details about heating in Sweden can be found in Appendix 1.

These facts make the data presented here so far all the more significant – UK residents struggle more than Swedes to afford their heating bills, and have higher levels of energy poverty and excess winter deaths, despite facing **lower** energy prices. We already know that the two countries have similar incomes. So to understand the reasons for the observed differences between Sweden and the UK, we must compare the energy efficiency of homes in the two countries.

3.3 Quality of homes

To find out why the UK performs worse than Sweden in terms of heating affordability and energy poverty, we need to consider the state of the buildings people live in. With the available data, there are two main ways this can be measured. First, we can examine the number of householders living in a dwelling with a 'leaking roof, damp walls, floors or foundation, or rot in the window frames or floor' using the answers provided by households to the SILC survey (2011). These sub-standard homes may be hard to keep warm, and can present a health risk to occupants[16]. Sweden has 8.4% of people living in these leaky homes, while the UK has a much higher rate of 15.9%.

A second indicator of housing quality is the U value of walls. A U value is a measure of how much heat is lost through a building's fabric, with low values representing less heat loss (i.e. more efficient walls).

[13] DECC, 2013
[14] Swedish Energy Agency, 2012
[15] Swedish Energy Agency, 2012
[16] It is common practice in the UK to consider issues such as mould, condensation and damp as indicators of possible fuel poverty.

The UK's walls currently have an average U-value of 1.16 (which, for comparison, is similar to that of a modern double glazed window). In contrast, Sweden has an average of 0.35 (which is around the value of an insulated cavity wall)[17]. So Swedish walls are typically over **three times more efficient** than British walls. Or, to put it another way, a British wall typically loses three times more heat than a Swedish wall[18].

Together, these data suggest that the UK's buildings perform badly in terms of energy efficiency. The poor state of our buildings is a key reason why so many UK people cannot afford their heating, and are at risk of cold homes, fuel poverty, and negative impacts on their health and wellbeing.

4 Conclusions

This analysis shows that the share of people who cannot afford to heat their home is **four times higher** in the UK than in Sweden. The share of households in energy poverty is **70% higher** in the UK than in Sweden. These shocking facts may explain why the UK has higher rates of excess deaths in the winter than Sweden.

This is all the more worrying when we consider the fact that the UK's energy prices are amongst the very lowest in Europe (including taxes), with Swedes paying higher energy prices, despite having similar average household incomes. At the same time, Swedes face much colder and more severe winters.

So, if energy prices and incomes are not the main cause of the problem, we must consider the state of the housing stock. The UK's share of people living in leaky homes is **almost twice as high** as Sweden's, and our walls lose **three times** as much heat. To a considerable extent, the UK's problems of fuel poverty are explained by the inefficiency and poor state of repair of our homes. Further evidence of these links is provided by the cases of other Scandinavian countries, as outlined in Appendix 2.

The case of Sweden suggests that energy efficient buildings can make warmth affordable, even when energy prices are high and winters are cold. This example provides a clear illustration of what improving the housing stock would mean for the UK - cutting fuel poverty, reducing excess winter deaths and making energy more affordable for everyone.

These findings confirm that the political, social, environmental and economic opportunities available in making our housing stock one of the most efficient in Europe are very real – as already shown in work by Cambridge Econometrics and Verco (2012) and Camco (2012).

Recycling carbon revenues to make homes highly energy efficient is the best way to bring down household energy bills and the best long term solution to end fuel poverty. It is also the most cost effective way to reduce carbon emissions and one of the best ways for the UK to generate jobs and growth.

[17] The average U values are derived from the Building Performance Institute Europe's Data Hub for the Energy Performance of Buildings (BPIE 2013). This contains data on the average U value of walls for single family dwellings built in different periods. This has been combined with data on the amount of floor-space in dwellings built in each period to calculate a weighted average U value for each country's single family dwelling stock.

[18] To reflect the fact that each country's climate is different (with colder climates necessitating lower U values) we also considered the 'optimal' wall U value for buildings in the UK and Sweden. Each optimum was calculated to reflect the most cost-efficient standard for buildings in each country to make their contribution to the EU's 2050 climate goals. Sweden is much closer to achieving its optimal U value. See 'The Cold Man of Europe' report for more details.

Bibliography

BPIE. 2013. "Data Hub for the Energy Performance of Buildings." *Data Hub for the Energy Performance of Buildings*. http://www.buildingsdata.eu/.

Cambridge Econometrics, and Verco. 2012. *Jobs, Growth and Warmer Homes - Evaluating the Economic Stimulus of Investing in Energy Efficiency Measures in Fuel Poor Homes*. London: Consumer Focus. http://www.consumerfocus.org.uk/files/2012/11/Jobs-growth-and-warmer-homes-November-2012.pdf.

Camco. 2012. *Energy Bill Revolution Campaign Report*. London: Transform UK, The co-operative and Consumer Focus. http://www.energybillrevolution.org/wp-content/uploads/2012/02/Energy-Bill-Revolution_full-report.pdf.

Cameron, David. 2013. "David Cameron's Speech at the Launch of DECC's Energy Efficiency Mission." *Association for the Conservation of Energy*. http://www.ukace.org/2013/02/david-camerons-speech-at-the-launch-of-deccs-energy-efficiency-mission/.

DECC 2013. *Quarterly Energy Prices*. London: Department of Energy & Climate Change. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244580/qep_sep_13.pdf

EC. 2010. *Commission Staff Working Paper: An Energy Policy for Consumers*. Brussels: European Commission. http://ec.europa.eu/energy/gas_electricity/doc/forum_citizen_energy/sec(2010)1407.pdf.

Eurostat. 2013. "European Union Statistics on Income and Living Conditions." *Eurostat*. http://epp.eurostat.ec.europa.eu/portal/page/portal/income_social_inclusion_living_conditions/data/database.

Healy, J. D. 2003. "Excess Winter Mortality in Europe: a Cross Country Analysis Identifying Key Risk Factors." *Journal of Epidemiology and Community Health*: 784–789.

Swedish Energy Agency, 2012. "Energy in Sweden 2012". http://www.energimyndigheten.se/Global/Engelska/Facts%20and%20figures/Energy_in_sweden_2012.pdf

Appendix 1: Heating in Sweden

In Britain, gas is the main fuel used for heating, and so gas price is a good indicator of the heating costs people face. However, natural gas supplies less than 3% of Sweden's final energy demand (including heating in residential buildings). Therefore, the price of gas in Sweden is not representative of Swedish heating fuel prices.

This Appendix explains how we can compare heating costs in Sweden to those in Britain, and shows that heating costs in Sweden are higher.

1. Fuels used for heating in Sweden[19]

In 2010, for space heating and domestic hot water production, 35.7TWh was used in houses (57%) and 27.2 TWh in apartment buildings (43%).

Houses (2010)[20]:

- Electricity is the commonest form of energy carrier for space heating and domestic hot water production in houses: 16 TWh
- Biomass: 12 TWh
- District heating: 6 TWh
- Oil: 1.3 TWh

Apartment buildings (2010)[21]:

- District heating is the commonest form of energy carrier for space heating and domestic hot water production in apartment buildings: 25 TWh
- 1 TWh: electric heating
- 0.4 TWh: oil heating

This shows that the most important residential heating fuels are: district heating (31 TWh; heat plants predominantly use biomass or waste to generate district heat); electricity (17 TWh) and biomass.

2. Costs of heating in Sweden

District heating costs

District heating costs vary depending on region and fuel used in heat plants. In 2011, Luleå had the country's lowest average district heating price for apartment buildings of 44.1 öre per kWh (around 5p), while Hammarö had the highest price at 97.1 öre per kWh (around 11p)[22]. We have not been able to access data on all regions and the average price. However, the graph below from the Swedish Energy Agency suggests the average figure was 9 pence in 2011.

[19] Data in this section is from Swedish Energy Agency (2012)
[20] Figures don't quite add up to 35.7 TWh due to lesser fuels being omitted from source
[21] Figures don't quite add up to 27.2 TWh due to lesser fuels being omitted from source
[22] Swedish Energy Agency (2012)

Electricity costs

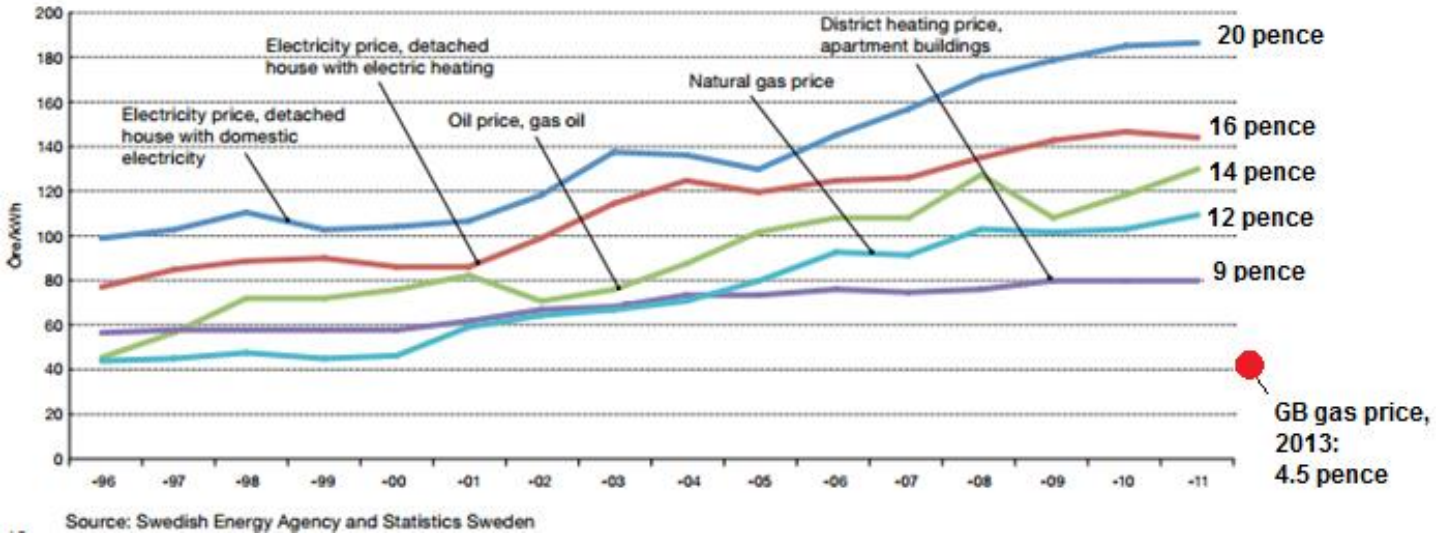
Sweden's electricity price for domestic consumers is €0.136 (around 11p) *without* taxes (Eurostat, 2013 data)[23]. The Swedish Energy Agency graph (which includes taxes, below) suggests a higher figure (red line indicates price of electricity used for heating) – approximately 16p.

Biomass costs

The price of pellets, including taxes, for domestic customers in April 2012 was 55–65 öre per kWh for customers purchasing by the sack-load (around 7p), and 48–58 öre per kWh for those buying in bulk (around 6p).[24]

3. Summary

The graph[25] below shows prices for different fuel types in Sweden since 1996 (including taxes). The key thing to note is the end point of each line, where the cost in pence is shown. (These data only go up to 2011).



Sweden's high gas price is not especially relevant to the true cost of heating in Sweden, but gas actually costs less per unit than electricity (red line) and oil (green line) used for heating. District heating is the most prevalent form of heating. Other than biomass, it is the lowest cost per unit heating fuel. It is important to note that its price is that of delivered heat (whereas our gas price measures the cost of the fuel, before it is converted into useful heat[26]). Nevertheless, in useful heat terms, the most prevalent heating fuel in Sweden in 2011 is significantly more expensive than the most common heating fuel in Britain in 2013.

[23] This indicator presents electricity prices charged to final consumers. Electricity prices for household consumers are defined as follows: Average national price in Euro per kWh without taxes applicable for the first semester of each year for medium size household consumers.
[24] Swedish Energy Agency (2012)
[25] Swedish Energy Agency (2012), graph shows energy prices in the residential and service sector.
[26] Assuming a typical conversion efficiency of gas into useful heat of 80%, the cost per kWh of useful heat comes out as 5.6p (4.5p divided by 0.8).

Swedes who heat their homes with biomass, and can buy in bulk, could pay a price for heating fuel in 2012 that was 33% higher than the GB gas price[27] is in 2013. However, biomass accounts for less heating in Sweden than district heating or electric heating, both of which have higher unit prices (around 9 pence for district heating and over 16 pence for electric heating in a house).

This means that we can say that Swedes pay much higher prices for heating than people in the UK. This supports the argument that energy efficiency in Sweden may be the main reason for that country's better performance in terms of fuel poverty.

Appendix 2: Other Scandinavian countries

Table 4 summarises key data for three Scandinavian countries and the UK. All these measures are explained in more detail in Section 3, above. Some data for Norway is not available.

Table 4: Summary of data for Scandinavian countries and the UK

Country	Proportion who say they cannot afford adequate heat[28] (%)	Proportion in leaky home[29] (%)	Average U value of walls[30] (W/m^2K)	Proportion in energy poverty[31] (%)	Proportion of deaths that are EWDs[32] (%)
Norway	1.2	7.6	-	-	2.46
Sweden	1.6	8.4	0.35	11.2	3.76
Finland	1.8	5.7	0.37	13.0	1.98
UK	6.5	15.9	1.16	19.2	4.61

This shows that the UK's share of people who cannot afford to keep their home warm is **more than three times higher** than Finland's and **more than five times higher** than Norway's. The UK's share of households in energy poverty is **nearly 50% more** than Finland's.

The share of people living in a leaky home is **nearly three times higher** in the UK than in Finland, and **over twice as high** as in Norway. The UK's walls lose **over three times** more heat than Finland's.

These facts may help explain why the rate of excess winter deaths in the UK is **more than double** Finland's rate, and **87% higher** than Norway's rate.

This difference in excess winter mortality has been established by research over several decades. For example, a study in 1996 found: "*The relative excess winter mortality is approximately twice as high in*

[27] DECC's latest Quarterly Energy Prices show the Great Britain average gas unit price, including taxes, is 4.5p.
[28] Eurostat, data from 2011 (latest available)
[29] Eurostat, data from 2011 (latest available)
[30] See earlier footnote on U-values (note 16)
[31] EC, 2010
[32] Eurostat, data from 2011 (latest available)

the UK compared with the Scandinavian countries. ….excess winter mortality (December–March) in England and Wales was …markedly higher than in Norway" [33].

Another study, in 2007, found that: "*Paradoxically, relative seasonal variation in mortality appears lowest in countries with cold winters, such as Russia, Norway and Canada and is higher in Britain, Israel and Portugal where winters are milder*"[34].

Together, all these facts provide further evidence of the links between poor building quality, energy poverty and excess winter deaths, and of the benefits the UK could gain by following Scandinavia's example in investing in the efficiency of homes.

33 Laake and Sverre (1996): http://ageing.oxfordjournals.org/content/25/5/343.short
34 Davie et al. (2007): http://www.biomedcentral.com/1471-2458/7/263/