

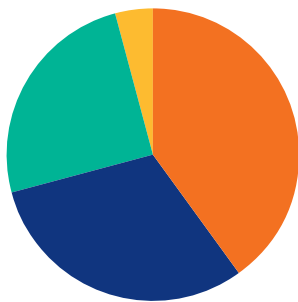
Replacing oil boilers with air-source heat pumps: household economics and system-wide impacts

Background

Around 700,000 homes in Ireland use oil as their primary space and hot water heating fuel. Given the need to reduce our reliance on imported, green-house gas producing fossil fuels, options for achieving reductions in these homes need to be considered as a priority. Homeowners can reduce emissions and lower their ongoing energy bills by improving household energy efficiency and/or by changing how their heat requirements are met.

This study focusses on the potential impacts of a long term transition to heat pumps as an alternative energy source to oil. The household level economic considerations of a move away from oil are estimated as well as the system-wide impacts of a large scale switch. Heat pumps offer an opportunity to reduce greenhouse gas emissions in the heat sector while increasing renewable heat production, thereby contributing to meeting Ireland's EU obligations in relation to greenhouse gas emissions and renewable heat.

Ireland's residential heat sector (2013)



2,283 ktoe

1.6 MILLION HOMES

● Oil	40%
● Gas	31%
● Solid Fuels	25%
● Renewables	4%
Biomass:	1.6%
Solar:	0.8%
Heat-pumps:	1.6%

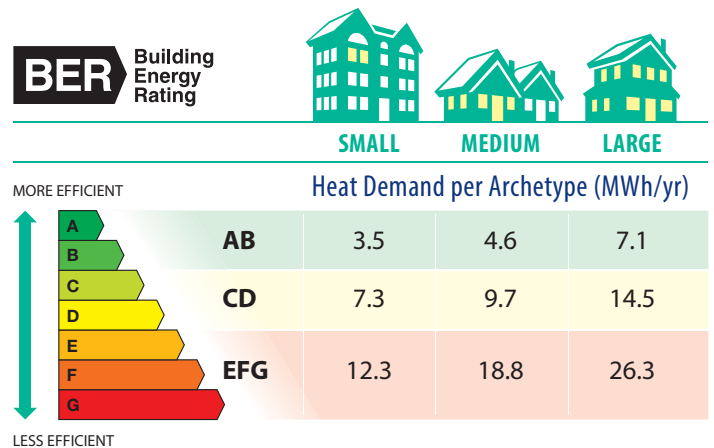
- The figure shows the primary energy share of each fuel type used for heating the 1.6 million homes in Ireland (2013), including energy used to generate the electricity used.
- This contributed 29% of 2013 energy related emissions not covered under the emissions trading scheme (ETS) in Ireland by producing approximately 6.2 million tonnes of CO₂.
- In 2013, 89% of all primary energy used in Ireland was imported. 100% of oil used was imported.

Methodology

To investigate the impact of replacing oil-fired central heating systems with heat pumps, dwellings were separated into different types based on building type and energy efficiency.

- Dwelling types – flat/apartment (small), terrace (medium), or semi-detached/detached (large).
- Energy efficiency – Based on building energy rating (BER) set as three categories: A or B (AB), C or D (CD), or E, F or G (EFG).

This results in nine archetypes constructed to represent dwellings in Ireland with oil-fired central heating systems.



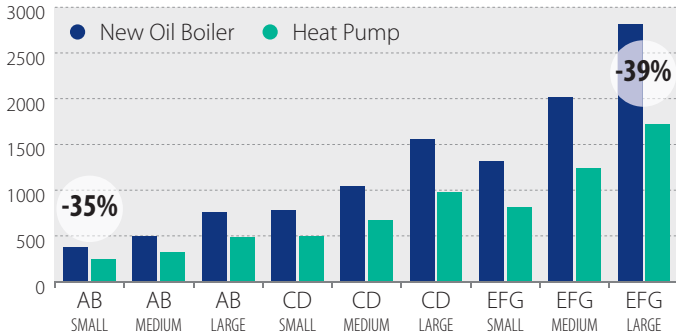
The results compare ongoing heating costs and capital costs when replacing an oil-fired heating system in a dwelling with an air-source heat pump. Heat pumps are not as efficient when outside temperatures are extremely low, or when they are used to boost internal temperatures from a cold starting point. The results include the impact of using an auxiliary heating source (electric immersion) installed together with the heat pump at these times.

Consumer level impacts

Annual Heating Costs

When using an air-source heat pump instead of an oil boiler, annual household heating bills can be reduced by 35% - 39% per household depending on dwelling type and efficiency. The overall trend shows dwellings with low energy efficiency performance (BER E,F,G) spend more on heating compared to the same dwelling type with high energy efficiency performance (BER A, B).

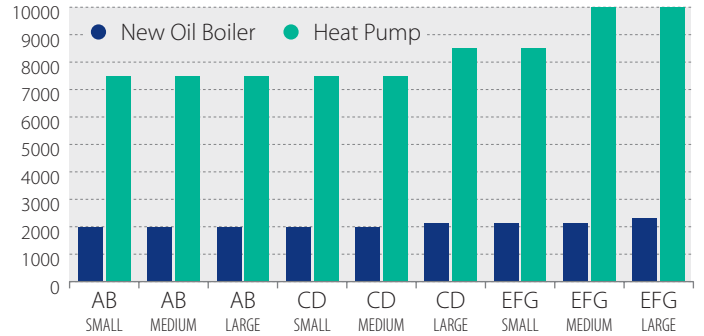
ANNUAL HEATING BILL PER DWELLING (€) (BASED ON AVERAGE 2014 FUEL PRICES)



Installation cost and simple payback

The capital cost of purchasing and installing a heat pump is larger than a replacement oil boiler and increases with higher heating demand as larger units are required.

INSTALLATION COST PER DWELLING (€)



Air-Source Heat Pump Simple Payback (years)

AB SMALL	AB MEDIUM	AB LARGE	CD SMALL	CD MEDIUM	CD LARGE	EFG SMALL	EFG MEDIUM	EFG LARGE
41.6	33.2	19.8	19.6	14.9	11.0	12.5	10.2	7.0

461,000 dwellings in Ireland are in these categories with an estimated simple payback of 11 years or less.

Building Fabric First

The most cost effective way for most householders to reduce ongoing energy bills is by investing in building fabric upgrades e.g. upgrades to roof and wall insulation, draught proofing, changing to triple glazed windows etc. From a policy perspective consideration of the costs and benefits of improvement to building fabric need to be compared to those estimated for a shift to a broad scale roll-out of heat pumps.

System-wide impacts of broad-scale change

The need for large scale technological change will be a necessary step if we are to achieve our long term decarbonisation goals i.e. to 2030 and 2050. In that context the system-wide impacts of converting all 700,000 dwellings in Ireland from oil-fired heating systems to heat pumps have been estimated.

Experience shows that householders tend to require very short payback times on new energy investments – less than 7 years in most cases. Policy intervention is likely to be required to drive any large scale shift to heat pumps over the long term.

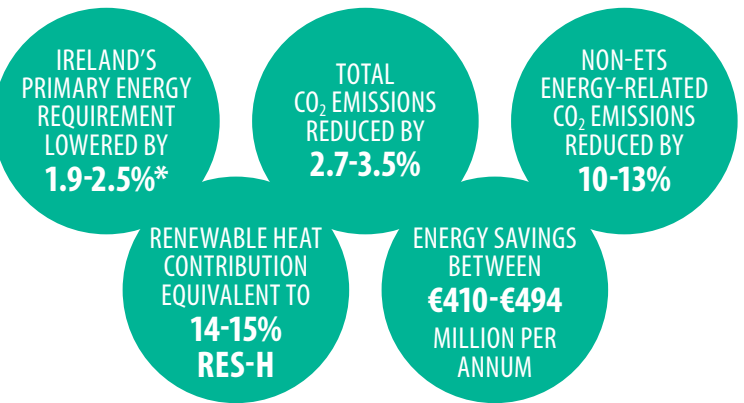
* All reductions are compared to 2013 values.

Key considerations for householders

Heat pumps must be appropriately sized and installed by qualified experts in suitable buildings.

The availability of night-rate electricity has a significant effect on the cost savings and payback of the technology.

Fabric upgrades such as insulation, triple glazing and draught proofing should be considered first as a lower cost way to reduce energy bills. Such upgrades should happen in advance of fitting a new heat pump to ensure the pump is correctly sized.



Key considerations for policy makers

Further development of standard recommendations on the installation, sizing and operation of heat pumps to ensure their optimal performance.

The impacts on the electricity system from additional demand.

The interaction of supports for demand reduction (energy efficiency) and energy supply side alternative such as heat pumps.