

# Heat pumps and global residential heating

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# **Research question**

How would heat pump adoption in the residential sector affect total and peak electricity demand globally and for individual countries?





# **Our Findings**

Peak electricity demand would be 4-6 times higher than average demand. This is a major barrier to high uptake of heat pumps, given the huge costs involved.

# **Results: heating energy need**

90% of global residential heating need comes from 27

#### Method

We developed a model of global heating energy.

This geographical model uses historical population-weighted temperature data, and assumptions about heating energy use and the efficiency of heat pumps to give peak instantaneous demand, calculated at three-hourly time steps.



countries – all in the Northern hemisphere.

Heating energy need is dominated China - almost 40% of global total.

Together the EU-28 countries account for 14.9% of global heating demand, with the top five countries being Germany (3.1%), the UK (1.8%), Poland (1.7%), France (1.5%), Italy (1.3%).

Country	% global heating demand
China	39.2
<b>Russian Federation</b>	9.8
United States	6.6
Germany	3.1
Japan	2.9
India	2.8
Pakistan	2.1
Ukraine	2.1
United Kingdom	1.8
Iran	1.7

#### **Results: peak and mean demand**

Globally, 100% heat pump adoption would require 11% of current world electricity & increase peak demand by 65%.

# **Step 2**: calculate residential heating need

The UK relationship between degree days and heating need is assumed for all countries.

# **Step 3**: calculate electricity demand



For the UK, 100% adoption of heat pumps would increase national electricity demand by 25%, and peak electricity demand by 65%. The peak: mean heating ratio is 4.1 and would change from the current total electricity peak: mean ratio from 1.58 to 2.11.

	UK	EU-28	China	World - no grid	World - with grid
Mean electricity demand (GW)	9.1	81.3	232	582	582
Peak electricity demand (GW)	37.6	499	1172	3353	2325
Peak electricity if 95% heating demand met (GW)	24.2	260	793	2029	1774
Ratio Peak: Mean	4.1	6.1	5.0	5.7	4.0

#### **Discussion: reducing the peak: mean ratio**

There are several options for reducing the peak: mean ratio, but even with these it remains a huge challenge.

One option is to install gas or biomass systems in parallel with electric heat pumps, to be used at times of high electricity demand (so-called hybrid systems). As our modelling showed, international interconnection should be able to help reduce peak demand. A more radical option is simply not to meet peak projected demand, and to assume people will accept lower indoor temperatures.



# **Further questions**

Does the peak issue set a limit on the percentage of residential heating demand that can be met by heat pumps, and if so, what is it?



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