



## Annex 42

### Heat Pumps in Smart Grids

#### Market status summary per country

Appendix to the Final report

Operating Agent: The Netherlands

# Market overview

*Summary tables from country reports*

## **ABSTRACT**

This appendix provides an overview of the smart heat pump market status in each participating country in Annex 42.

## Table of contents

1	Introduction	4
2	AT – Austria	4
3	CH – Switzerland	5
4	DE – Germany	6
5	DK – Denmark	7
6	FR – France	8
7	KR – South Korea	9
8	NL – The Netherlands	10
9	UK – United Kingdom	11
10	US – United States	12

## 1 Introduction

This report presents an overview of market characteristics for each participating country in Annex 42. For details on the choice of differentiators, see the main report. Specific details on the market situation in each country can be found in the individual full country reports, also included with this document.

## 2 AT – Austria

<i>Differentiator</i>	<i>Austria characteristics</i>
 Drivers	<ul style="list-style-type: none"> <li>● Austria is already well underway to realise its 2020 goal of 34% renewable energy use. To accommodate the increasing RES-share, flexible smart grids could play an important role.</li> <li>● The main challenge is expected to arise within the next 5 – 10. Presently, part of the RES can still be exported to neighbouring countries.</li> </ul>
 Potential size	<ul style="list-style-type: none"> <li>● HPs have increasing market share, but still very small in total domestic heating.</li> <li>● Potential size is large, but a large part of buildings is expected to be using biomass-based systems towards 2050.</li> </ul>
 Buildings	<ul style="list-style-type: none"> <li>● A high potential for refurbishments, which potentially provides good changes for HP implementation.</li> <li>● Almost ¾ of houses is privately owned.</li> </ul>
 Prices	<ul style="list-style-type: none"> <li>● Consumer electricity and gas prices approximately follow European averages, implying a E-to-G ratio around 3. HPs with a SPF of at least 3 will outperform traditional boilers.</li> <li>● Around 1/3 of E- and G-prizes are potentially flexible.</li> <li>● No flexible tariffs available.</li> </ul>
 End-user	<ul style="list-style-type: none"> <li>● End-users not much interested in HPs.</li> <li>● Customers not used to flexible / changing tariffs.</li> <li>● No useful control strategies available, since social challenges are not ‘translated’ into financial incentives.</li> </ul>

### 3 CH – Switzerland

<i>Differentiator</i>	<i>Switzerland characteristics</i>
 Drivers	<ul style="list-style-type: none"> <li>• Primary driver is the increasing renewable generation (avoiding/delaying high voltage grid upgrade – expected to be 6bn Swiss francs by 2020).</li> <li>• Not an immediate challenge - 2030 is the key policy milestone</li> </ul>
 Potential size	<ul style="list-style-type: none"> <li>• HP big market share compared to other countries. &gt;200k HP installed in total, 20k/yr. (out of a domestic heating market of ~50k/yr.).</li> <li>• Dominantly hydronic HP, mix of UFH and radiators, storage tanks common</li> </ul>
 Buildings	<ul style="list-style-type: none"> <li>• 36% SFHs built pre-1960, and almost half of all dwellings pre-1960 - slightly lower share of old buildings than in DE, FR, significantly lower share of old buildings than UK.</li> </ul>
 Prices	<ul style="list-style-type: none"> <li>• Gas/electricity price ratio more positive for HPs than in UK, NL etc., and the incumbent technology is oil rather than gas, so economic proposition for HPs is strong.</li> </ul>
 End-user	<ul style="list-style-type: none"> <li>• End-users more used to HP, and HP tariffs with regular shut-down periods widespread.</li> <li>• Still some perception challenges, but Switzerland is further ahead than much of Europe</li> </ul>

## 4 DE – Germany

<i>Differentiator</i>	<i>Germany characteristics</i>
 Drivers	<ul style="list-style-type: none"> <li>● Balancing supply and demand, and reducing the need for grid upgrade investments.</li> <li>● A challenge in the medium term (5-10 years)</li> </ul>
 Potential size	<ul style="list-style-type: none"> <li>● Approximately 450,000 space heating HPs installed at the end of 2011 (&gt;5.3GWth and approx. 1.7GWel). Annual HP installs near 10% of heating installs (relatively high share relative to Europe).</li> <li>● Relatively high share of underfloor heating</li> <li>● Incentive to install a buffer storage capacity of at least 30l/kW – and the use of buffer storage tanks is more common in Germany than in e.g. UK or France.</li> </ul>
 Buildings	<ul style="list-style-type: none"> <li>● Half of the buildings have been built before 1969 - insulation levels in most of the old building stock very low and demand is high. Less than 5% of the building stock is reaching the ENEV2009 building regulations (80-90kWh/(m<sup>2</sup>*a).</li> <li>● Single and double-family buildings (with more physical space for HPs and storage than multi-family homes) account for almost half of the total dwellings in Germany.</li> <li>● New build market of 113,300 residential building completions, half of which single family homes – with HPs taking around 30% share.</li> </ul>
 Prices	<ul style="list-style-type: none"> <li>● Strong increase in natural gas and heating oil prices has supported HP growth in the past, but this trend has been reversed since 2008, with the ratio between electricity and gas having reached &gt;4 in 2013 – outlook for HP proposition not so positive.</li> <li>● HP tariffs are available in many areas, which are cheaper than the standard tariff. The tariff enables the utility to shut down the HP for up to 3 times a day for a max. of 2 hours (each time) via ripple control.</li> <li>● Flexible tariffs are required by law, but there's a lack of infrastructure (smart meters) to implement them. Smart meter rollout currently held up by doubts about their economic efficiency -&gt; flexible tariffs several years away.</li> </ul>
 End-user	<ul style="list-style-type: none"> <li>● Relatively constant heat needed.</li> <li>● High proportion of owner occupiers</li> </ul>

## 5 DK – Denmark

<i>Differentiator</i>	<i>Denmark characteristics</i>
 <i>Drivers</i>	<ul style="list-style-type: none"> <li>Increasing renewable generation around 37,6 % of the electrical consumption was produced by wind turbines in 2016 and it will increase to 50 % in 2020.</li> <li>The challenges regarding balancing the production and the high voltage grid are expected between 2020 and 2025.</li> </ul>
 <i>Potential size</i>	<ul style="list-style-type: none"> <li>Stable HP market with the 5th highest penetration in Europe – The policy aim for HPs is to become the primary heating technology in non-district heating areas.</li> <li>Air/air HP and hydronic HP (air/water GSHP), usually for radiators 55 °C or underfloor heating are most common.</li> </ul>
 <i>Buildings</i>	<ul style="list-style-type: none"> <li>The building stock has a relative good thermal quality, 56 % of the SFH are built after 1960, and most of the buildings have been refurbished since the 1980 with extra insulation at least double glazing.</li> <li>Most of the buildings with an energy label are scored between C and E with D as the most common marking.</li> <li>This means that the buildings typically have a good potential for flexibility.</li> </ul>
 <i>Prices</i>	<ul style="list-style-type: none"> <li>HP a good proposition against oil, gas prices are still competitive.</li> <li>The biggest challenge in Denmark is the very high fixed tax on electricity meaning that the potential flexible part of the price is very small.</li> </ul>
 <i>End-user</i>	<ul style="list-style-type: none"> <li>Relatively constant heat needed</li> <li>HP still a new technology so end-user perception still a challenge</li> <li>More demonstration projects than anywhere else in Europe testing the use of HP for demand side flexibility</li> </ul>

## 6 FR – France

<i>Differentiator</i>	<i>France characteristics</i>
 <i>Drivers</i>	<ul style="list-style-type: none"> <li>Managing increased net demand variability due to uptake of renewables and strong, decrease/shift winter peak demand</li> <li>An immediate challenge in some regions.</li> </ul>
 <i>Potential size</i>	<ul style="list-style-type: none"> <li>Biggest European HP market in terms of annual installs - currently approx. 315k HPs installed (2012), and strong growth expected, with HPs &gt;10% of annual heating installs.</li> <li>Large hydronic HP market, with radiators &amp; underfloor heating. Air/air also common (un south).</li> <li>Smaller storage tanks than in e.g. Germany, and less use of buffers (greater dominance of inverter-driven modulating HP).</li> </ul>
 <i>Buildings</i>	<ul style="list-style-type: none"> <li>52% of single-family homes are pre-1975 (32% before 1949). &gt; rather old building stock</li> <li>Large new build market of approximately 300,000-350,000 dwellings per year (~50% single family) – HPs expected to be primary new build technology, should be positive for flexibility.</li> </ul>
 <i>Prices</i>	<ul style="list-style-type: none"> <li>Overall relatively low energy prices, electricity compares favourably to gas (ratio of less than 2, even without considering the gas boiler efficiency).</li> <li>Taxes only account for approximately 33% of the total costs, -&gt; there's room for savings on both energy costs (33% of price) and network charges (last 33%).</li> <li>No intra-day flexible tariffs, but day/night exists, as well as "all day" flexible tariff (3 different day tariffs, with a predefined number of days in each tariff band)</li> </ul>
 <i>End-user</i>	<ul style="list-style-type: none"> <li>Information not available on end-user usage patterns</li> <li>Experience with "simple" flexible tariffs positive</li> <li>~60% owner-occupiers</li> </ul>

## 7 KR – South Korea

<i>Differentiator</i>	<i>South Korea characteristics</i>
 <i>Drivers</i>	<ul style="list-style-type: none"> <li>● Maintaining capacity margins / balancing supply &amp; demand</li> <li>● An immediate challenge (black-outs already a problem).</li> </ul>
 <i>Potential size</i>	<ul style="list-style-type: none"> <li>● HP account for 10% of HVAC market, and are mainly installed in the commercial, i.e. non-residential, sector.</li> <li>● HPs are mainly air/air, primarily for cooling, though growth of reversible HP for heating also expected</li> <li>● It is a challenge for HPs to compete with gas (which is available in 72% of all buildings; &gt;90% in cities), and with low cost electric heating mat (low efficiency but 10% of cost of a HP).</li> <li>● High temperature (50-60 degrees C) underfloor heating is the norm, &amp; culture of supplying this from gas boilers, not HPs.</li> </ul>
 <i>Buildings</i>	<ul style="list-style-type: none"> <li>● Majority of existing buildings built since 1980s – relatively newer than in Europe, relatively well insulated</li> </ul>
 <i>Prices</i>	<ul style="list-style-type: none"> <li>● Low price differential v gas and electricity (electricity only 25% higher than gas) – should technically be good for HP, but due to very low energy prices in general, there is a low incentive to switch fuel for running cost savings.</li> <li>● Cumulative electricity tariffs where user is charged more per kWh if they consume more – discouraging for HPs.</li> <li>● No flexible tariffs but some day/night tariffs.</li> </ul>
 <i>End-user</i>	<ul style="list-style-type: none"> <li>● constant heat need – but culture of using gas boiler for heating, not HP (HP air/air for cooling)</li> <li>● little experience of 3<sup>rd</sup> party control</li> <li>● ~50% of total building stock is rented properties, and &gt;50% multifamily houses / multiplex – end-user has no choice on heating system.</li> </ul>

## 8 NL – The Netherlands

<i>Differentiator</i>	<i>Netherlands characteristics</i>
 <i>Drivers</i>	<ul style="list-style-type: none"> <li>Managing distribution grid congestion</li> <li>An issue within the next 5-10 years</li> </ul>
 <i>Potential size</i>	<ul style="list-style-type: none"> <li>Currently 178,000 HPs installed (in total) in NL, &lt;15,000/year compared with 350,000 boilers/year.</li> <li>Mainly hydronic HP - 79% water/water, 15% a/w and 6% hybrids, heat distribution systems mainly radiators and underfloor heating.</li> <li>All HPs [except hybrids] have a DHW storage tank installed – but standard boilers in NL do not have storage.</li> </ul>
 <i>Buildings</i>	<ul style="list-style-type: none"> <li>Building stock is in relatively good shape, but relatively old houses, built during the 50s and 60s, form the bulk of the stock.</li> <li>New-built houses have good thermal quality, but there are hardly any incentives for home owners to assess or improve the energy quality of existing buildings.</li> <li>Space is a pressing problem, especially within the city centres. High real estate prices per m<sup>2</sup> floor area severely limit the space that is available for heating installations.</li> </ul>
 <i>Prices</i>	<ul style="list-style-type: none"> <li>A low share (approximately a third) of the electricity cost is potentially “flexible”.</li> <li>Energy prices levels are in favour of gas, but gas prices have risen much more than electricity prices over last 10 years.</li> <li>Day/night tariffs are available but low value to customers – do not encourage change in consumption.</li> </ul>
 <i>End-user</i>	<ul style="list-style-type: none"> <li>Mainly constant temperature</li> <li>Approx. half of the buildings are owner-occupied</li> </ul>

## 9 UK – United Kingdom

<i>Differentiator</i>	<i>UK characteristics</i>
 <i>Drivers</i>	<ul style="list-style-type: none"> <li>Reducing distribution grid congestion (particularly winter peak and daily peaks, driven by the expected HP market growth)</li> <li>An issue within the next 5-10years (post 10 yrs., supply/demand issue become a greater driver)</li> </ul>
 <i>Potential size</i>	<ul style="list-style-type: none"> <li>20k HP/yr., projected to at least triple to 2020. But severe competition from gas boilers (HPs account for just 1% of annual heating market which is 1.5 million per year)</li> <li>Predominantly hydronic HP (A/W) &amp; radiators (usually high temperature, up to 80 degrees C)</li> <li>Storage tanks installed with HPs, but heating market dominated by (and trend increasingly towards) combi gas boilers with no storage.</li> </ul>
 <i>Buildings</i>	<ul style="list-style-type: none"> <li>Most buildings pre-1960, poor insulation, low thermal mass</li> <li>Average home size smaller in UK than rest of Europe</li> <li>Off-gas &amp; rural homes have space (land area and storage tanks), but increasing trend for replacing with combi boilers, removing storage</li> </ul>
 <i>Prices</i>	<ul style="list-style-type: none"> <li>Elec prices &gt;3 x price of gas, so HP only compete against oil.</li> <li>Limited availability of non-flat tariffs (day/night available in limited regions).</li> <li>An “expectation” that flexible tariffs will come but not in short term &amp; timetable not clear</li> </ul>
 <i>End-user</i>	<ul style="list-style-type: none"> <li>Heating systems used for “bursts” of heat, not constant – not good for flexibility (but also a result of the building types)</li> <li>Little experience of 3<sup>rd</sup> party control of HPs – CLNR project only. Some experience with electric storage heating in limited regions</li> <li>High proportion owned properties &amp; social housing</li> </ul>

## 10 US – United States

<i>Differentiator</i>	<i>US characteristics</i>
 <i>Drivers</i>	<ul style="list-style-type: none"> <li>• Security of supply is the biggest issue, leading to relatively long history of demand response in the US</li> <li>• An immediate challenge</li> </ul>
 <i>Potential size</i>	<ul style="list-style-type: none"> <li>• Large HP market with high growth rate – but most HP are air/air.</li> <li>• There is already some experience of capturing limited flexibility from air/air HPs.</li> <li>• Small proportion of ground-source HP offer greater kW demand levelling flexibility potential (this market mainly in northern areas and comparable in size to the largest European HP markets).</li> <li>• Storage not common as central air distribution dominates for both air/air HPs and GSHPs. A small emerging market for domestic hot water HPs with integrated storage.</li> </ul>
 <i>Buildings</i>	<ul style="list-style-type: none"> <li>• Aging building stock, with high energy demand</li> <li>• Large buildings</li> <li>• Not easy for capturing flexibility from HP.</li> </ul>
 <i>Prices</i>	<ul style="list-style-type: none"> <li>• Gas price a third of the price of electricity</li> <li>• Several flexible tariffs available in some regions, and though take-up is low, there is significantly more experience than Europe.</li> </ul>
 <i>End-user</i>	<ul style="list-style-type: none"> <li>• Demand response more widespread in US so customers more used to “concept” – though questions around their response to demand response with the HP.</li> <li>• High proportion owned properties</li> </ul>





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