Action behind the words: Are legislators doing enough to address Europe's heating challenge?

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The political framework in Europe is beginning to recognize heat pump technology as part of the solution towards the Union's triple goal of GHG emission reduction, increased energy efficiency, and the use of renewable energy sources. However, political will to directly support the technology is limited, and so is the impact of policy on market growth. More action is needed to reap the full benefit of the technology.

Introduction

European policy makers have recently reconfirmed their commitment to reduce the demand for non-renewable energy sources, to improve energy efficiency, and to cut down greenhouse gas (GHG) emissions (Euractiv 2014a). Climate and energy policy should also result in reduced import dependency for energy, improved security of supply, affordability of energy and local employment.

For an impact in the market place, actions must follow words. Many stakeholders, among them the European Heat Pump Association, have called for truly ambitious, mandatory targets resulting in higher target values (30% renewable energy, 35 to 40% energy efficiency improvements), and an implementation trajectory that leaves no room for manoeuvre when working towards achieving them. This applies in particular to member states, as they are the key implementing actors.

Experience from the legislation set up around the currently active 2020 targets generates room for concern. Even though Commission representatives repeatedly stress that Europe is on track at least for the GHG and the RES targets for 2020 (Euractiv 2014b), EHPA's own analysis shows that both the renewables target and the energy efficiency target may be missed (Nowak 2013). This is particularly unnecessary, as heat pump technology would help to achieve all the goals mentioned in a cost-efficient manner. Providing direct support for heat pump technology as a matter of policy, by giving it "preferred technology" status, would make achieving the 2020, 2030 and 2050 targets much easier.

This article provides a condensed overview of the most important legislative acts (RES, EE, Ecodesign, the EPBD Directive and the F-Gas Regulation) affecting heat pump technology. It presents a brief analysis of the ways in which legislation both helps and hinders, and gives an overview of their effects on development of the heat pump markets in Europe. Finally, it discusses the status of the European heat pump market and the expected development of heat pump sales as a result of legislation.

Heat pump-related legislation in Europe

As a consequence of the 2020 targets, a number of legal instruments have been passed to contribute to target achievement. They address one or more target areas and apply to a range of system boundaries - from the product level, to member states, to Europe as a whole (see Table 1).

The Directive on promotion of the use of energy from renewable sources

The Directive on promotion of the use of energy from renewable sources (2009/28/EC) requires EU member states to significantly increase the contribution of renewable energies in their energy mix. Using a burden-sharing mechanism, all 28 member states shall collectively provide 20% of the Union’s final energy demand in 2020 from renewable energy sources (European Commission, 2009a).

While member states are free to choose the means to achieve their individual targets, the Directive sets up a common framework of mechanisms and guidelines that member states have to integrate into their legislation to ensure fulfilment of the obligation. This includes eligibility of measures, statistical transfers, joint projects, guarantees of origin, administrative procedures, information and training, and access to the electricity grid for energy from renewable energy sources.

With regards to heat pump technology this legislation was a milestone, as it not only augmented the definition of renewable energy sources (which previously only included geothermal energy) by aerothermal and hydrothermal energy, but also officially recognised heat pumps as a technology to use these sources.

At the start of the implementation phase, member states (MS) reported the expected contribution of heat pumps as part of their National

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1 This article is based on previous work presented at the 2014 IEA HPP international heat pump conference in Montréal, Canada. Thanks for original support goes to Pieter-Jan Cluyse and Pascal Westring.
### Table 1: Most important legislative instruments influencing the uptake of heat pump technology in Europe [Source: own]

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>Target area</th>
<th>System boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Regulation on Ecodesign for Heaters and Water Heaters</td>
<td>Energy efficiency</td>
<td>Product/System</td>
</tr>
<tr>
<td>2013</td>
<td>Regulation on energy labels for heaters and water heaters</td>
<td>Energy efficiency</td>
<td>Product/System</td>
</tr>
<tr>
<td>2014</td>
<td>F-Gas Regulation (review of 2006 regulation)</td>
<td>GHG emission</td>
<td>European Union / member state</td>
</tr>
<tr>
<td>2014</td>
<td>Green Public Procurement</td>
<td>Energy efficiency, Renewable energy</td>
<td>Product/System</td>
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Renewable Energy Action Plans (NREAPs). The accumulated MS targets for the contribution of air-, water- and ground-coupled heat pumps amounts to 141 TWh of renewable energy. However, this is barely 10% of the overall reduction target. Clearly, the potential of heat pumps was not recognised to the full extent in most countries.

While the 2013 update of the renewable energy action plan shows compliance with the development trajectory (European Commission, 2010a), a forecast of the European heat pump industry based on current sales numbers questions the possibility of achieving the 2020 target: sales and growth rates have been insufficient over the past three years and an annual growth rate considerably more than 10% p.a. over the next six years would be necessary to achieve the fairly unambitious heat pump targets. In consequence, policy makers must be more actively supportive of heat pumps to realise heat pumps’ contribution potential towards the use of renewables for heating and cooling.

**The recast of the Energy Performance of Buildings Directive**

The recast of the Energy Performance of Buildings Directive (2010/31/EU | EPBD) came into force in July 2010 (European Commission 2010c). It addresses the impact of buildings on Europe’s energy demand and in particular requires improvement of the energy performance of new and existing buildings within the European Union. The Directive sets minimum requirements on a framework for calculating the energy performance of buildings. The resulting method should be used to calculate the energy demand of buildings, building elements and technical building systems. It also requires an increase in the proportion of nearly Zero-Energy Buildings (nZEBs). Starting in 2021, all new buildings must be nZEBs, and energy renovation of existing buildings must be addressed by the member states.

A market drive is expected by making energy certification of buildings (including an inspection system for certification) mandatory, augmented by regular inspection of heating and air conditioning systems in buildings.

While heat pumps are barely mentioned in the Directive, they are major beneficiaries of its implementation. A much-improved energy standard, as currently observable in many member states, can quite often only be fulfilled with the installation of heat pumps. The concept of nearly zero-energy, using significant amounts of renewables produced on-site or nearby, can be seen as a requirement directly fulfilled by heat pumps connected to local photovoltaic systems.

Even though implementation of the EPBD was due by July 2012, the majority of member states has yet failed to implement it, with the Commission currently executing several infringement procedures.


The Ecodesign Directive establishes a framework for the setting of requirements for products with a major impact on energy consumption (European Commission 2009b). The requirements must meaningfully reduce the energy demand of each identified product group, and are minimum requirements that must be fulfilled in order to be able to bring the product to market.

The Energy Labelling Directive aims at the provision of end user-orientated information for different product categories. It is connected to the respective Ecodesign implementing act in those cases where the product covered is sold to end users. It consists of requirements for the product label
as well as for the technical information to be supplied with the product (European Commission, 2010b).

Implementing Measure on Ecodesign Requirements for Heaters and Combi-Heaters and Hot Water Heaters (ErP Lot 1 and Lot 2)

The regulations on the minimum Ecodesign requirements for heaters, combi-systems and hot water heaters apply to products and packages using gas, oil, solar thermal, aerothermal, hydrothermal or geothermal energy to provide heating, and/or hot water (European Commission 2009b). They include products with a thermal output of up to 400 kW capacity. They set minimum efficiency requirements based on primary energy efficiency (\( \eta_p \)). The \( \eta_p \) for heat pumps (with a PEF\(^2 \) of 2.5) will be calculated for a low- (35°C) and a high-temperature (55°C) heat delivery system. Efficiency of hot water production will be calculated based on a standard tapping cycle. The measure enables comparison of functionally equivalent products – heaters – based on primary energy efficiency as a single criterion. Once in place, a major effect towards products with higher efficiency – such as heat pumps - is expected.

The Energy Labelling regulation governs the information to be provided to end users as well as responsibilities of suppliers and dealers for the proper preparation and display thereof. The label should enable consumers to choose the more energy-efficient products. The energy label for heat pumps is mandatory for products with a thermal capacity of up to 70 kW. It will show the primary energy efficiency in a range from A++ to G from 2015, and in a range from A+++ to D from 2019 onwards, with A++ reserved for the most energy-efficient products. The package label will show the A++ class from the beginning; it will also show the thermal capacity per climate zone as well as information on the sound power. For Lot 2, the range will start with A+ to G (for heat pumps), and A+++ to G (for solar thermal water heaters), in 2015. In the case of combi-systems providing heating and hot water, a single unit will have two labels, indicating its heating and hot water production efficiency respectively (European Commission, 2013a; 2013b).

The Energy Efficiency Directive

The Energy Efficiency Directive (2012/27/EU l EED) aims at improving energy efficiency at member state level in order to achieve the non-binding EU-target of 20 % primary energy demand reduction by 2020 (European Commission 2012). Member states have to report their national energy efficiency targets and the measures to achieve them to the European Commission. The Directive encompases a number of targets that have to be achieved at the national level, such as:

- a renovation rate of 3 % per annum of all buildings (by floor area) owned and occupied by the central government;
- establishing national energy efficiency obligation schemes to achieve a reduction in energy demand of 1.5 % per year;
- adoption of policies which encourage the use of efficient heating and cooling systems (this is mainly aimed at co-generation, but does not exclude other technologies, such as heat pumps);
- encouraging the introduction of energy services;
- strategies to overcome the low renovation rate of residential and commercial buildings

The Directive is a compromise between member states, and it is estimated that its implementation will result in an approximate reduction of energy demand by 16 to 17 %. This means that it falls short of achieving the 20 % target. Member states have by now declared their energy savings targets and have handed in National Energy Efficiency Action Plans (NEEAPs) to the Commission. A first evaluation of the planned measures and their impact reveals that it will be a challenge to achieve even the 16 – 17 %. If the full assessment of the plans confirms this, mandatory energy efficiency targets will be discussed in 2014 and most likely such a shortcoming would increase the likelihood of adding a mandatory energy efficiency target for 2030, alongside a GHG reduction and renewables target.

F-gas Regulation

The Regulation on Fluorinated Gases (‘F-gases’ l 2014/517/EU) aims at reducing the amount of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6) placed on the internal market of the European Union. It is based on the general principle of avoiding the use of fluorinated gases in all cases where cost-effective and environmentally superior alternatives are available. If alternatives are not (yet) available, the Regulation aims at minimising losses in production, operation and at end-of-life of a product. Measures address leak-tightness and maintenance of equipment, labelling as well as training and certification of personnel.

The recast of the 2006 regulation came into force in May 2014. Its main element is a phase-down mechanism that reduces the amount of F-gases that can be placed on the EU market in 2030 by 79 % compared to the average emissions from 2009 to 2012 (European Commission 2014b). Consequently, refrigerants with a high Global Warming Potential (GWP), such as R404a, will most likely disappear from the market. However, R407a and R410 will be available and will be used due to their benefits of being energy-efficient, non-toxic and non-flammable. It will be a major task.

\(^2\) PEF = Primary Energy Factor: accounts for the energy losses of electricity generation and transport when comparing electricity use with other types of energy use in the building.

A value of 2.5 has been agreed upon as a European average. It will be used for the first five years of the regulation being in force.
for the industry to develop efficient systems using alternative refrigerants by 2030. This applies in particular to the development of necessary components. This development will have to include the training of professionals as well as an adjustment of building codes and standards. EHPA is calling on the Commission and member states to support the phase-down with additional funds for research and development in the area of low-GWP refrigerant heat pumps.

**Ecolabel and Green Public Procurement**

In order to support decision-makers on the private as well as on the administrative level, the EU uses the Ecolabel and Rules on Green Public Procurement. The latter are based on EU legislation on product policy (European Commission 2004a, 2004b).

The requirements for both the Ecolabel and GPP for hydronic heaters exceed the minimum requirements of Ecodesign and the Energy Label, and enhance them by additional criteria. The Ecolabel exists for different product groups. It has been introduced for heat pumps in 2007, and is currently valid until 30.10.2014 (European Commission 2007). An updated version applicable to all heaters using hydronic heat distribution systems has come into force in 2014 (European Commission 2014c). The Ecolabel takes a lifecycle perspective to calculate the weighted emissions per kWh of thermal energy and augments this value by additional requirements to prove the superior environmental performance of labelled products. Most heat pumps that are currently available fulfill the requirement of the Ecolabel, which proves their positive contribution to energy efficiency and the environment. However, due to the differing requirements for quality by different governments, the Ecolabel often fails to qualify for financial support. As such, its penetration in the market is still low.

In parallel with the Ecolabel, a set of guidelines on green public procure-

ment (GPP) was developed for heating systems. It aims at helping public authorities to make purchasing decisions for products with a reduced lifecycle environmental impact. GPP rules on heaters could play an important role in implementing the Energy Efficiency Directive on the administrative level.

However the voluntary nature of both measures, and the limited acceptance with regards to government support programmes, as well as the fact that many of the additional requirements are covered by other legislation, may hinder their positive impact on the development of the heat pump market.

**New framework conditions: The 2030 Climate and Energy Package**

EU decision-makers are currently discussing a follow-up of the 2020 targets. The new framework maintains the overarching aim of a secure, affordable and independent sustainable energy system providing local employment and mitigating climate change. After intense negotiation, stakeholders have agreed on the continuation of three mutually reinforcing targets for energy savings (via increased energy efficiency), more renewables and, in consequence, reduced GHG emissions.

At their autumn meeting, European heads of state will have to decide on the proposal made by the European Commission (European Commission 2014a) earlier this year. This means that Europe will aim to achieve a GHG reduction of 40 % by 2030 (based on 1990 levels), a 27 % share of renewable energy (based on the 2030 share of final energy) and at least a 30 % improvement in energy efficiency. Discussions are still in progress on how to implement targets that are mandatory at EU level in each member state: in particular under which governance mechanism non-compliance could be identified and resolved.

From a heat pump perspective, three mandatory targets will support the technology’s market development, as heat pumps are beneficial to achieving these targets and would thus be at the centre of fulfilling the requirements of related legislation.

**Impact of legislation on the market**

**Market status**

EHPA records HP sales data and market information since 1996. The number of countries covered has reached 21 in 2013.

A total of 771 245 heat pump units was sold in 2013 (+3 %). When integrating data since 1989, the aggregated sales number of heat pumps in Europe is close to 6.85 million units. Assuming a useful life of 20 years, the stock of units in operation is around 6.8 million units (see Table 2 and Figure 1).

<table>
<thead>
<tr>
<th>Year</th>
<th>Total EU-14</th>
<th>Total EU-21</th>
<th>Cumulative total 1989-2013</th>
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<tbody>
<tr>
<td>2005</td>
<td>446 037</td>
<td></td>
<td>1 015 607</td>
</tr>
<tr>
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<td>509 794</td>
<td></td>
<td>1 525 401</td>
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<td>589 118</td>
<td></td>
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<td>804 457</td>
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<td>2 918 976</td>
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<td>2009</td>
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<td>4 453 647</td>
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<td>5 262 238</td>
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<tr>
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<td>750 436</td>
<td>750 463</td>
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</tr>
<tr>
<td>2013</td>
<td>771 245</td>
<td>771 245</td>
<td>6 783 919</td>
</tr>
</tbody>
</table>

*Table 2: Heat pump sales in Europe, 2005 - 2013 [Source: EHPA]*
Topical article

Based on the 2013 data, the following trends can be observed:

Air is the dominant energy source for heat pumps. The majority of heat pumps sold are reversible air-air systems (51%) followed by air-water (18%) and ground-coupled units (13%). Exhaust air heat pumps are a small but growing segment (2%). The greatest growth is recorded for sanitary hot water units, with an increase of 29% from 2012 to 2013 and a share in total sales (2013) of 11% (see Figure 2).

Expected advancements in technology will make the already easy-to-install units more efficient and compact, integrating most of the necessary components. As well, new products are introduced in the market, providing efficient heat pump solutions for an increasing number of demand scenarios, namely the renovation segment and large building solutions, where a parallel demand for heating and cooling makes heat pumps particularly suitable. Air source units are cost-competitive in an investment perspective, and even more in an operations perspective. As such, they are preferred solutions for the performance and cost-aware consumer.

Sanitary hot water systems, which also use air as energy source, are the fastest growing sales segment. Their easy integration with existing heating system makes them an "entry-level heat pump". They enable the use of a minimum share of renewables (around 15%), as often requested by legislation.

The geothermal and hydrothermal installations segment shows a split picture. The number of large installations for commercial buildings, building blocks and district heating is increasing, with the latter often connected to bodies of water. The market for residential geothermal application sees a constant number of approx. 100,000 units. This is not expected to change, unless the cost of drilling can be reduced and the necessary administrative procedures to obtain a drilling permit are simplified.

Large heat pumps for commercial, industrial and district heating applications are becoming more popular, but not enough data exists for this important market segment.

The slight increase of 2% in the European market is spread unevenly across countries. In 2012, approx. half of the 21 observed markets grew, while the other half shrunk. In 2013, 10 out of 13 markets that have reported data show positive growth, most of them stronger than reported, from 2011 to 2012 (see figure 3).

The number of markets showing double-digit growth has decreased from 2012 to 2013, but some of the large markets, such as Germany, France and Sweden, have returned to the group of growth markets.
Figure 3: Growth rate of heat pumps sales in 21 European countries (in per cent), 2011-2012 and 2012-2013 [Source: EHPAI]

Looking at the available data for 2013 reveals that the Slovak Republic is leading the growth countries for a second time in a row followed by Poland, a market quickly becoming one of the major drivers of heat pump growth in Europe. In absolute terms, France is the growth leader with an additional 11,400 units, followed by Poland (+2,493) and Spain (+2,233).

As far as the benefits of the technologies towards achievement of the EU’s climate and energy targets are concerned, heat pumps continue to deliver the expected triple dividend in the form of also providing local employment as well as security and affordability of energy supply. As the market is growing, a slightly higher contribution to the different targets can be expected from sales in 2013.

The 771,245 units sold in 2013 added 20 GW of capacity to the market. They produced approx. 13 TWh of useful energy, and integrated 8.26 TWh of renewables in heating and cooling, at the same time avoiding 2.12 Mt of CO₂-equivalent emissions. An additional 4.83 TWh of primary energy was saved, resulting in a reduced final energy demand of 10.56 TWh, thus saving the end consumer money and making financial means available for other purposes.

In order to produce the 2013 sales volume and to maintain the installed stock, a total of 41,600 man-years were necessary. Obviously, real employment related to the heat pump market is larger, as not every employee works full-time on heat pumps only.

Impact of current legislation on markets

Current European legislation shows a clear focus on more energy efficiency, renewables and less GHG emissions. Overall guidance is provided by the RES-Directive and the EED, both being connected to a relevant 2020 target. GHG emission reduction is governed mainly by the EU Emission Trading System (EU-ETS), which covers 45% of all emissions. It is augmented by individual legislation such as the F-Gas Regulation, which addresses areas of high concern.

Heat pumps are part of the climate and energy legislation. The start can be seen in the recognition of heat pumps as an environmentally friendly technology by the Ecolabel for heat pumps in 2007. An enhanced definition of renewable energy in the RES Directive in 2009 changed the landscape for heat pumps, introducing air and water as renewable sources, and recognising heat pumps as a technology to use them.

The Energy Performance of Buildings Directive has probably had the greatest impact on market development of heat pumps up to today. Although the directive rarely mentions the technology, its impact on the selection of a building’s heating solution is huge. Stricter energy demand requirements lead to buildings with a lower relative energy footprint, a development that favours heat pumps for the equipment of the building - both new and renovated.

It is too early to determine the impact of the Ecodesign measure and the related energy label on heaters and hot water heaters, but industry is positive that the clear labelling of heat pumps as best-in-class technology will have a major impact in the market place. Due to the transition period, this effect will only become visible in the market from 2015 onwards. It is quite obvious, however, that manufacturers are currently using the transition period to align their product ranges to the requirements. While not yet visible, efficiency will be optimised.

Tools to guide and encourage customer demand, such as the Energy Label, the Ecolabel, and the Green Public Procurement rules are assisting the positive recognition of heat pump technology. All these instruments (should) have a positive effect on the further development and uptake of heat pumps in the European Union.

The implementation of the F-Gas phase-down, as agreed to in the F-Gas Regulation, will be a major chal-
lenge to the industry, as the search for, and development of, low-GWP alternatives and components for heat pump systems will impose considerable work on the industry’s research and development capacity.

A greater challenge may be presented by the different approaches towards heat pump support taken by the different member states. Instead of basing their incentive schemes for the technology on European legislation, such as the energy label, member states often opt for national, sometimes stricter, requirements for financial support. This interferes with the advantage of a single market, as it creates a more complex landscape of requirements, necessary tests and certificates. The approach rarely makes the final product or installed system any better, but renders its placing on the market more difficult, time-consuming and expensive.

The fact that incentives most often depend on government budgets makes them random, as they are stopped when budgets are used up. It can be argued that such schemes cannot only develop but also slow down and even destroy market development if not applied in a consistent, transparent and foreseeable manner.

**Is current legislation enough?**

Today’s legislation has been shaped around the 2020 targets. With only six years left until then, reaching the targets makes a sheer necessity of fast and comprehensive implementation of all EU legislation at member state level. Even this cannot be taken for granted, considering the fact that the Commission has issued notifications of non-implementation to a number of member states, both with regards to the EPBD and -most recently - with regard to the Energy Efficiency Directive.

Nevertheless, proper implementation would make achieving the current goals (and much more) easy, and this possibility makes opting for more ambitious targets on the EU and the member state level not a threat but an opportunity. Heat pumps are a key to open the door for governments to move towards a low-carbon economy in general and a low-carbon heating sector in particular.

Convincing decision-makers, in turn, is the key towards heat pump market growth. The purchase decision for a heating / hot water system depends largely on the relative price of the different alternatives. Unfortunately, decision-makers tend to focus on a comparison of the upfront investment cost, and rarely take the total lifetime cost of ownership of a product into consideration. This applies a disadvantage to heat pump technology, as the first costs are higher than those of comparable fossil alternatives.

Member states wanting to overcome this challenge can either help to reduce the cost for heat pump-based systems, or implement measures that increase the cost for the fossil fuel alternatives. In the first case, this would mean institutional or financial incentives for heat pumps, and the second would result in a burden on fossil fuels, for example via the introduction of a CO₂ tax or the integration of the heating sector into the emissions trading scheme.

Providing more support for heat pumps would speed up the decarbonisation of the heating sector. The comparison between heat pumps and the best available fossil fuel technology, a gas condensing boiler, reveals at least a 50% savings potential in heat pump emissions; and this saving is even higher when replacing oil or coal-fired systems.

In other words: governments that really want to address the heating sector can do so by giving a preference to heat pump-based systems. However, this requires much clearer decisions towards renewables and heat pumps for heating. The current business-as-usual approach will not be sufficient.

**Conclusion**

The current legal framework governing climate and energy explicitly and implicitly includes heat pumps as helping to achieve the targets.

Due to the long implementation cycles of legislation, the impact of the different legal measures on the markets is only partly beginning to show. The biggest impact currently observable results from the Energy Performance of Buildings Directive.

The Ecodesign regulation and the related energy label are too new to show any meaningful impact in the market place. They will influence sales from 2015 onwards.

The Energy Efficiency Directive is a strong tool, but it needs to be used. Once properly implemented in all member states, a strong impact on heat pump markets is expected.

The implementation of the F-Gas Regulation is critical. With its effect on the availability of F-gases, it is a major threat to the manufacturers of heat pumps, who now have to continue their normal development cycles in terms of unit design, functionality and efficiency (etc.), while at the same time having to integrate measures to reduce GHG emissions from refrigerants.

In conclusion: the foundation for a heat pump-friendly policy framework has been laid. Member states must now implement it swiftly and decisively in order to unleash heat pump technologies’ potential in achieving the climate and energy targets. A real policy change towards a low-carbon, energy-efficient heating (and cooling) sector requires more decisive action, addressing in particular the relative cost situation.

If such action is not taken, heat pump market development will have to continue largely on its own. This would be the slower development path. It would deprive Europe of an available solution towards many
pressing issues when it comes to renewables, energy efficiency and greenhouse gas emission, let alone the issue of affordability and security of energy supply.

The heat pump industry stands to support policy makers in their challenge towards a sustainable European energy system.

It is easy to like heat pump technology, but now we need action behind words.

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