Title: Full steam ahead for heat pumps?
The impact of Europe's climate and energy policy revisited

European climate and policy is (still) governed by the overarching goal to reduce the demand for non-renewable energy sources and to cut down greenhouse gas (GHG) emissions. As a side effect, it should result in lower import dependency for energy, better security of supply, affordability and local employment.

Even though Europe usually does not favour any technology, it is surprising that the heat pump technology - being beneficial to all these goals in a cost efficient manner - has not been given an exemption and been picked as a preferred technology.

The current paper provides an overview of the most important legislative acts (RES, EE, Ecodesign and EPBD Directive as well as the F-Gas regulation) in their effect on heat pump technology in Europe. It analyses mutual reinforcing as well as contradicting parts of the legislation and provides an outlook on their effects for the development of the heat pump markets in Europe.

A critical perspective will be provided on the heavily discussed need of one or several new targets for the period from 2020 to 2050.

The article shows that heat pumps are recognised or even specifically included in most of Europe's legislative acts. Yet, for a swift market update more ambitious political support including consistent implementation across regional boundaries is necessary.

That means that, in the overarching perspective until 2030, heat pumps would benefit from mandatory targets on energy efficiency, renewables and GHG emission reduction.

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1 INTRODUCTION

Europe's climate and energy is in transition. The much quoted 20-20-20 targets for energy efficiency, renewable energy sources and greenhouse gas (GHG) emission reduction apply to 2020 and the discussion on new targets for the period until 2030 is in full swing. For the long-term perspective until 2050 at least a GHG reduction target of 80- 95% of emissions compared to 1990 has been agreed upon.

2 HEAT PUMP RELATED LEGISLATION IN EUROPE

In terms of legislation a number of legal acts were implemented addressing different levels of the energy system and focus on different system boundaries - from the European level to the product/system level (see Table 1)

Table 1: Most important legislative acts influencing the uptake of heat pump technology in Europe (Source: own)

Year	Name	Focus
2009	Renewable Energy Sources Directive (RES Directive)	European Union / Member State
2010	Energy Performance of Buildings Directive (EPBD)	Building
2009	Ecodesign for Energy related Products-Framework Directive (ErP)	Product/system
2009	Energylabelling Directive	Product/System
2010	Energy Efficiency Directive (EED)	European Union / Member State
2013	Regulation on Ecodesign for heaters and water heaters	Product/System
2013	Regulation on the energylabel for heaters and water heaters	Product/System
2014	F-Gas Regulation (review of 2006 regulation)	European Union / Member State
2014	Ecolabel Framework Directive with the Ecolabel for heat pumps, for hydronic heating systems and for office buildings.	Product/System
2014	Green Public Procurement	Product/System

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

The Directive on the promotion of the use of energy from renewable sources, often referred to as 'RES Directive', requires EU Member States to significantly increase the contribution of renewable energies to 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 transpose into their legislation to ensure the 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 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. 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 to achieve the 2020 target: sales and growth rates have been insufficient over the past three years and a growth rate by far exceeding 10% p.a. for the upcoming six years would be necessary to achieve the rather unambitious heat pump targets. In consequence policy makers must be more actively supporting heat pumps to unleash the heat pump contribution potential towards the use of renewables for heating and cooling.

2.2 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 requires in particular the 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 of the share of nearly Zero-Energy Buildings (nZEBs). Starting in 2019 and 2021 all new public and private buildings shall be NZEBs and the energetic renovation of existing buildings shall be addressed by the Member States.

A market drive is expected by making energy certification of buildings (incl. a control system thereof) 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-increased 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 requirement directly fulfilled by heat pumps connected to local photovoltaic systems.

Even though the 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.

2.3 The Ecodesign for Energy-related Products Framework Directive and the Energylabeling Directive

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 shall 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. Product groups are identified via assessment reports. As nearly 50% of EU’s final energy consumption is used for heating purposes, the heating sector was identified as most important. The regulation to identify the minimum performance criteria and the related calculation method (ErP Lot 1 and Lot 2) eventually came into force in September 2013 - after more than 7 years of discussion.

The Energylabeling 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 the end-user. It consists of requirements on the product label as well as on the technical information to be supplied with the product. (European Commission, 2010b)

Implementing measure on Ecodesign requirements for heaters and combi-heaters (ErP Lot 1 and Lot 2)

The regulations on the minimum Ecodesign requirements for heaters, combi-systems and hot water heaters applies to products and packages using gas, oil, solar thermal, aerothermal, hydrothermal and geothermal energy to provide heating, and/or hot water (European Commission 2009b). It includes products with a thermal output of up to 400 kW capacity. It sets minimum efficiency requirements based on primary energy efficiency (*eta s*). The *eta s* for heat pumps (with a PEF[1] of 2,5) will be calculated on a low (35°C) and a high temperature (55°C) heat emitter system. Efficiency of hot water production will be calculated based on a standard tapping cycle. **The measure enables the comparison of functionally equivalent products – heaters – based on primary energy efficiency as a single criterion.**

The **Energylabeling regulation** governs the information to be provided to end users as well as responsibilities of suppliers and dealers on the proper preparation and display thereof. The label should enable the 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 70kW. 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+++ being reserved to the most energy efficient products. The so-called 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).

2.4 The Energy Efficiency Directive

The Energy Efficiency Directive (2012/27/EU | EED) aims at improving energy efficiency on the 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 encompasses a number of targets that have to be achieved on the national level, such as

- the 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;

[1] 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.

- adopt 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);
- encourage 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 approximately a reduction of energy demand by 16 to 17%. Thus 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 help adding a mandatory energy efficiency target for 2030, alongside a GHG reduction and renewables target.

2.5 F-gas Regulation

The regulation on fluorinated gases ('F-gases') 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 to avoid 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 the 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 will most likely come 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 2014c). 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 and non-toxic and inflammable. It will be the major task for the industry until 2030 to develop suitable alternatives on the refrigerant level as well as the necessary components and systems. This development will have to include the training of professionals as well as an adjustment of building codes and standards.

2.6 Ecolabel and Green public procurement

In order to support decision makers on the private as well as on an administrative level, the EU uses the labelling and rules on green public procurement. The latter are based on the 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 Energylabel 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 water-based (using hydronic heat distribution systems) heaters systems will finally come into force in 2014. The Ecolabel takes a

lifecycle perspective to calculate the weighted emissions per kWh thermal energy and augments this value by additional requirements to proof the labelled products their superior environmental performance. Most heat pumps that are currently available fulfil the requirement of the Ecolabel, which proofs their positive contribution to energy efficiency and the environment. Due to the differing requests on quality by different governments the Ecolabel is often not accepted for financial support. As such, its penetration in the market is still low.

Parallel to the Ecolabel a set of guidelines on green public procurement (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 may hinder their positive impact on the development of the heat pump market.

3 MUTUAL IMPACT OF LEGISLATION

The presented summary of European legislation shows a clear focus towards 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 like the F-gas regulation, as to address areas of high concern.

EPBD and Ecodesign Directives work in the same way: they set requirements for sectors and product groups that have been identified to be heavy users of energy with a considerable savings potential. In case of the ErP implementing measures on heaters, water heaters and combi-systems, the need to maintain a single European market for this product group requires a quick implementation. The regulation is immediately applicable in all MS. Tools to guide and encourage customer demand, like the Ecolabel, Green Public Procurement rules and national approaches are supplementing these mandatory minimum requirements. All these instruments (should) have a positive effect on the further development and uptake of heat pumps in the European Union.

At the same time, these measures are often used as the basis for incentive schemes although MS rarely use a European approach as a prerequisite for financial support. They rather opt for different, sometimes also stricter requirements. This results in a more complex landscape of required tests and certificates that do not necessarily make the final product or installed system better, but render its placing on the market more difficult and more expensive. In addition, availability of incentives is often random as they depend on government budgets. 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.

In sum: while most of the relevant pieces of legislation augment each other in their positive impact on heat pump technology, more support is necessary from the government level, i.e. European legislation must be implemented without further delay and should be augmented positively, rather than hindered by national or other European legislation.

An example where a systematic overall perspective is lacking is the challenge related to the reduction of F-gas emission. While the EU regulation foresees a phase-down agreed by the Member States, some countries like Spain and Denmark have introduced additional measures: an F-gas tax as well as a maximum charge per refrigerant. With the EU regulation in place, the additional cost for taxing the refrigeration puts a double burden on the users - with likely a limited additional impact. However this approach makes heat pumps slightly more expensive and increases the investment cost advantage of fossil fuel-based systems. A level playing field would at least require the introduction of a CO_2 tax parallel to the F-gas tax. This approach is taken by Ireland, where both types of emissions are taxed.

Another example of added complexity is the new Ecolabel for water based heaters. While it takes a lifecycle emission perspective by setting a requirement for the weighted average emission per kWh of thermal energy, it does not stop there. Among the additional criteria added, one applies a requirement on the maximum GWP value of the refrigerant used by heat pumps. As the GWP value is also a factor in the TEWI method, that is employed to calculate the emission per $kWh_{thermal}$, it sets a double burden on a specific technology. Keeping in mind that emission of heating systems is largest in the operation phase and mainly results from the fuel used. Thus the additional criterion may be justifiable from an ecological perspective, yet its impact towards a total overall emission reduction is questionable.

Cases like the one documented can be detrimental to the market penetration of heat pump systems. 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. In other words: every fossil fuel boiler sold instead of a properly designed heat pump system increases GHG emissions (Nowak 2014).

Preferably, such a limitation can be overcome by introducing a lifecycle focus. Ironically this development can be observed in both pieces of legislation just used to show a critical development: the revision of the Ecolabel and the F-gas regulation. The Ecolabel for hydronic heating systems uses a weighted TEWI value (emission per $kW_{thermal\ energy}$) – while the F-gas regulation uses the emission equivalent of 10 tonnes of CO_2 as a comparison factor (European Commission, 2014c). This approach points in the right direction and will hopefully replace a ‘single factor’-approach in the future.

With this positive assessment in mind, it is even more important to stress that the background for a stronger heat pump development has been set on the EU level. It is now paramount that Member States implement the different Directives properly and define national goals and measures contributing to the 2020 and 2030 energy and climate targets.

It has often been claimed that a level playing field for all technologies should be prepared. This could be achieved by evaluating the different technologies and energy sources with regards to their contribution to the targets. Such an approach should include a positive acknowledgement of those technologies providing a specific benefit in terms of the use of renewables, the reduction of energy demand and GHG emissions. No further support should be granted to the use of fossil fuels, especially not if this support is of financial nature and thus actually distorts the comparability of systems. Similarly, a strong mandatory set of three targets will serve as future guidance of investment and decision making processes, both for the individual or other stakeholders. This will be discuss briefly in the next chapter.

4 IS A SINGLE GHG TARGET SUFFICIENT TO ACHIEVE THE SET OF TARGETS?

The on-going debate on the EU climate and energy package 2030 must be viewed in the framework of existing legislation, which again is a direct result of the EU goals set towards 2050. The original strategy aimed at providing a secure, affordable and independent sustainable energy system providing local employment and mitigating climate change. It was believed that three, mutually reinforcing targets on energy savings (via increased energy efficiency), more renewables and in consequence less GHG emissions were necessary to achieve this target. In principle, this has not changed.

The debate on targets beyond 2020 takes place in light of the 2050 energy roadmap. It started in March 2013 with the Commission Green Paper on the 2030 targets, and continued with European parliaments own initiative report and the Commission Communication on the same topic in early 2014. While the European Parliament (European Parliament 2014b) supports the need for three binding targets and has specifically acknowledged the importance of heating and cooling to achieve them, the Commission document was far from visionary. In the light of a difficult economic environment the European Commission (European Commission 2014a) stressed the need for affordable targets and presented a rather obvious GHG reduction target of 40% by 2030 (based on 1990 levels) augmented by a rather weak European renewables target of 27% (based on the 2030 share of final energy) and no energy efficiency target. This is somewhat surprising as it ignores the Commission's own background documents, which often identified energy efficiency as a "no regrets"-option (e.g. in its Horizon 2020 programme). Furthermore, the Energy Roadmap 2050 (European Commission 2011) and other documents argue that a high renewable target is the most cost-efficient option.

The currently observed risk of not meeting the energy efficiency target shows the importance of a mandatory requirement. The Commissions background document towards the 2050 roadmap reveals that a limitation to a GHG and a renewables target only will in fact have a negative impact towards the EUs GDP. This could be overcome by a third ambitious and mandatory energy efficiency target, which will reduce total energy demand and thus make the targeted GHG and the RES target shares easier to achieve.

Providing answers to the question of whether or not to set a mandatory energy efficiency target will be a main focus of advocacy work in Brussels this summer. From a Member State perspective it will have to be discussed based on the results of the evaluation of the National Energy Efficiency Action Plans (NEAAPs), which are due this quarter. Informed sources believe that a mandatory European energy efficiency target is very likely and will be part of the 2030 strategy.

The current lack thereof is explained by a missing uniform opinion on energy efficiency on the Member State level. In spring, MS were still struggling with achieving the tentative target under the 2020 goals and refused to set the next target without a proper evaluation of action undertaken within the energy efficiency Directive. Thus it will first have to be discussed, how to achieve the still indicative energy efficiency target until 2020. Once this is settled, the timeframe until 2030 can be addressed.

As Member States will be the first to suffer form insecurity of energy supply and increasing prices from fossil fuel imports, it should be in their interest to set ambitious mandatory targets and honour contribution towards their achievement. A target range

of 25% to 40% until 2030 is deemed likely to be discussed and agreed upon over the summer, latest at the fall meeting of the European Council.

From a heat pump perspective, an additional target would be supportive to the technology's market development, as it would both trigger product investments as well as uptake by consumers. At the same time it could open a contribution potential via the use of abundant waste heat.

5 CONCLUSION

The current legal framework governing climate and energy targets explicitly and implicitly includes heat pumps. The technology is recognised as supportive towards these targets.

It is however too early to conclude that this is enough to give a green light for a fast and robust development of heat pump markets, as obstacles still exist in administrative requirements and a lack of implementation is observable on different pieces of legislation on the Member States level. As such, current policy signals more or less "*drive slowly"* rather than "*blow full steam ahead"*.

Stakeholders have to continue their advocacy work towards a full recognition of the heat pump potential towards the 2030 and 2050 climate and energy targets. This includes both the industry and legislators. They have sufficient evidence to trust much more in the technologies potential and thus should streamline and ease administrative measures to encourage its use. If properly implemented in all applicable areas, todays cities could become future heat pump cities. A business-as-usual approach or even a reduction of ambition is certainly not enough to achieve this.

6 REFERENCES

EUROSTAT (2011): Accounting for renewable energy from heat pumps – A framework proposal Renewable Energy Statistics Working Party 2011, working document, download: http://circa.europa.eu/Public/irc/dsis/chpwg/library?l=/renewable_statistics_1&vm=detailed&sb=Title)

European Commission (2004a): Directive 2004/17/EC coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors. OJ L 134, p. 1-113 of 30.4.2004.

European Commission (2004b): Directive 2004/18/EC on the coordination of procedures for the award of public work contracts, public supply contracts and public service contracts. OJ L 134, p. 114-176 of 30.4.2004.

European Commission (2006): Regulation 842/2006 on certain fluorinated greenhouse gases. OJ L 161, p. 1-11 of 14.6.2006.

European Commission (2007): Commission Decision establishing the ecological criteria for the award of the Community eco-label to electrically driven gas driven or gas absorption heat pumps. OJ L 301, p 14 - 25 of 20.11.2007.

European Commission (2009a): Directive 2009/28/EC on the promotion of the use of energy from renewable sources. OJ L 140, p. 16-62 of 5.6.2009.

European Commission (2009b): Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-related products (recast). OJ L 285, p. 10-35 of 31.10.2009.

European Commission (2010a): Renewable energy transparency platform. http://ec.europa.eu/energy/renewables/transparency_platform/transparency_platform_en.htm

European Commission (2010b): Directive 2010/30/EU on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products OJ L153, p. 1-21 of 18.6.2010.

European Commission (2010c): Directive 2010/31/EU on the energy performance of buildings. OJ L 153, p. 13-35 of 18.6.2010: Directive 2010/31/EU.

European Commission (2011): Commission Communication: Energy Roadmap 2050 (COM/2011/0885 final).

European Commission (2012): Directive 2012/27/EU on energy efficiency. OJ L 315, p. 1-56 of 14.11.2012.

European Commission (2013a): Commission Delegated Regulation 811/2013 supplementing Directive 2010/30/EU with regard to the energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device OJ L 239, p. 1 - 82 of 6.9.2013.

European Commission (2013b): Commission Delegated Regulation 812/2013 supplementing Directive 2010/30/EU with regard to the energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device OJ L 239, p. 83 - 135 of 6.9.2013.

European Commission (2013c): Regulation 813/2013 implementing Directive 2009/125/EC with regard to ecodesign requirements for space heaters and combination heaters OJ L 239, p. 136 - 161 of 6.9.2013.

European Commission (2013d): Regulation 814/2013 implementing Directive 2009/125/EC with regard to ecodesign requirements for space heaters and combination heaters OJ L 239, p. 162- 183 of 6.9.2013.

European Commission (2014a): Commission communication: A policy framework for climate and energy in the period from 2020 to 2030 (COM/2014/015 final).

European Parliament (2014b): Resolution of 5.2.2014 on a 2030 framework for climate and energy policies (P7_TA(2014)0094).

European Parliament (2014c): Proposal for a Regulation No (EU) No. …/2014 of the European Parliament and of the Council on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 (A7-0240/0).

Nowak, T. (2010): Future cities = heat pump cities. Presentation at the European Sustainable energy week, Brussels. 23.3.2010.

Nowak, T. (2010): The CO_2 reduction potential heat pumps. Internal document, Brussels.

Nowak, T.; Demeersman-Jagancacova, S.; Westring, P. (2014): European Heat Pump market and statistics report 2014 (data preview, final version forthcoming). Brussels.