Strategic Policy Priorities for Renewable Heating and Cooling in Europe

Work Package 5

- Strategic policy recommendations for RHC in Europe

Deliverable number: (D.5.1)

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1. EXECUTIVE SUMMARY

With current legislative framework and market conditions across the EU, it is very difficult for renewable heating and cooling (RES-HC) installations, such as biomass, solar thermal, geothermal and heat pumps, to compete with installations using conventional fuels. However, these solutions are necessary if we want to decarbonise the heating and cooling sector that represents 50% of EU's total energy consumption.

In order to allow RES-HC to become competitive and deploy substantially on the heating and cooling markets, a number of policies need to be established to drive consumers' choices towards renewable solutions and financial tools need to be efficiently set up to support this uptake.

This paper starts with summarizing the main barriers to RES-HC deployment, which have been identified in the framework of the project, including through a survey among final consumers to understand consumers' key purchasing criteria, information about "willingness to pay" and main rejection reasons.

Four main barriers have been identified:

- Lack of strategic priorities and governance
- Persistent market failures
- Poor awareness, quality and engagement
- The financing challenge

Then, the paper addresses the identified barriers with policy recommendations at EU, national and local levels. Given the multi-level governance of the EU and the need to establish a set of mutually supportive policies, the paper is proposing a wide-range of policy options that should be leading to a greater deployment of RES-HC installations. These policies are mutually supportive and policy action should be taken at all levels to ensure an effective and sustainable uptake of RES-HC solutions.

This will lead not only to an effective decarbonisation of the H&C sector but also to the development of a local and innovative industry creating growth and jobs within EU borders and improve EU's energy dependency by replacing the use of imported oil and gas with indigenous and renewable sources of energy.

The policy recommendations that are summarized in table at the end of this document cover different aspects:

First, it addresses the overall strategic priorities that needs to be established in the first place to give a clear and coherent signal to markets and drive consumers/local authorities choices towards cleaner solutions in the H&C sector. This includes the establishment of well-defined long-term objectives and roadmaps as well as of specific policies including favourable building codes and improving modelling and reporting in this sector.

Second, the paper looks at establishing a fair market for RES-HC and addressing market failures by phasing out fossil fuels subsidies and putting a price on carbon to reflect the real cost to the society resulting from the use of fossil fuels in heating installations. RES-HC should in addition be promoted with well-established and transparent support schemes, to reward their renewable and clean aspects. Key success factor for RES-HC support schemes have been developed in the framework of this project and can be found on the project website (www.front-rhc.eu).

Third, the paper develops recommendations on how to increase awareness about RES-HC solutions with communication campaigns and streamlined information and administrative procedures linked to subsidies. It also highlights the role of professionals such as installers and architects in enhancing the benefits of these installations by qualtitative installations leading to better performing installations.

Finally, the paper looks at addressing the financing issue. RES-HC solutions often face higher investment costs and need therefore to be financially supported for a substantial uptake. Support schemes should be well designed and information about it better disseminated. Other solutions such as innovative financing tools or demand aggregation are also analysed.

These recommendations address EU, national and local policy-makers and should lead to a substantial uptake of RES-HC solutions in the H&C sector.

2. INTRODUCTION

The Renewable Energy (RES) Directive[1] establishes the enabling policy framework for the deployment of renewable energy for the decade 2010-2020. The development of RES share in the total EU energy mix, together with a decrease of total EU energy demand have been identified as 'no regret options' to reach EU 2050 decarbonisation objectives, a 80% to 95% reduction in GHG emissions compared to 1990 levels.

On 12th December 2015, in Paris, 177 countries have committed to reducing their greenhouse gas emissions to keep temperature rise well below 2 degrees Celsius. EU Member States have committed and will have to deliver GHG emission reductions covering their entire energy systems including: electricity, heating, cooling and transport sectors. The heating and cooling sector represents almost 50% of EU total final energy consumption and offers therefore great opportunities to decarbonize the entire energy system.

The FROnT project intends to advance the penetration of renewable heating and cooling (RES-HC/RHC) technologies by providing a better understanding of how to deploy renewable heat and

[1] Directive 2009/28/EC of the European Parliament and Council of 23 April 2009

cooling technologies in the market. In pursuit of this goal, it is important to understand the main barriers that are currently hampering the deployment of RES-HC installations and analyse how to possibly overcome them. The project proposes a set of short and long-term policy recommendations to address these barriers.

Economists tell us that the most efficient way to internalise negative externalities or costs of energy conversion would be through taxation or a cap and trade system (e.g. the EU Emissions Trading System). Yet, they also recognise that this adjustment alone may not be sufficient to develop the wide range of technologies at the necessary speed needed to decarbonise the economy by mid-century (Linares et.al, 2013). Furthermore, lessons learnt from the deployment of renewable electricity generation has highlighted the multiple policy instruments which are required to address the full range of barriers preventing uptake of renewable energy technologies.

The FROnT project aims to identify the main barriers to the deployment of RES-HC and then address these barriers with a set of policy recommendations. Since multiple instruments are required and given the multi-level nature of EU governance, this paper is addressing EU, national and local policy-makers by proposing a series of policy actions that could be added up in order to guarantee an uptake of RES H&C options and ensure the decarbonisation of EU entire energy system.

Due to the decentralised nature of the heating and cooling sector, the local dimension is central in addressing this sector with adapted options, considering local specificities and resources available.

3. BARRIERS IDENTIFIED

In the framework of the project, a survey to identify end-users' decision making factors for heating and cooling (H&C) systems in the five participating European countries (Netherlands, Poland, Portugal, Spain and UK) has been undertaken. It allowed identifying key purchasing criteria, information about "willingness to pay", including environmental and social parameters and main rejection reasons[2].

Two of the main barriers to the deployment of RES-HC identified by the survey on end-user side are, still, the poor consumer awareness on the availability of RES-HC technologies and the higher initial investment cost compared to fossil installations and the financing difficulties linked to it.

[2] The survey results can be found on FROnT website http://www.front-rhc.eu/library/ D.4.1 – European Report: Key Decision Factors.

- **Poor awareness, quality and engagement**: the survey shows that awareness of all RES technologies, and especially the benefits they provide to the consumers and the society is very low in all sectors: residential, non-residential and industrial sectors. This, together with the sometimes-necessary structural changes and the need of approval by neighbours or managers, represents an important barrier to the deployment of RES-HC technologies. This poor awareness is also a reality among European and national policy-makers and represents similarly an important barrier as RES-HC technologies are often not properly identified when policy making and therefore not properly incentivized.
  Furthermore, RES-HC installations not properly installed or not properly used are underperforming and their benefits are therefore not maximised. This is not creating a positive image for these solutions that should be properly installed (quality control) and regularly maintained (performance assurance).

- **The financing challenge**: RES-HC technologies' investment cost might be higher than traditional fossil fuel equipment. Even if the total economic savings throughout the lifetime of the RES-HC equipment is greater than the fossil equipment, this higher initial cost is a true barrier and represents the main rejection reason for RES-HC technologies, at least in the residential sector.

In addition, project partners have identified two additional barriers on the supply side of RES-HC installations: the lack of strategic priorities in EU and national policy-making and unfair market conditions.

- **Lack of strategic priorities and governance**: Inconsistencies can be noticed between different pieces of current legislation but also between short and long-term objectives. This reflects a lack of overall long-term strategy with short and long-term priorities. It is translated into counter-productive legislation, leading to lack of stability and trust that are hampering the deployment of renewables.

- **Persistent market failures**: it is currently impossible to compare the cost of fossil and RES installations, as long as, in most Member States, fossil-based heating appliances (e.g. condensing gas and oil boilers) remain heavily subsidized and while fossil fuel prices are still regulated and the carbon not substantially priced. A valid cost-efficient approach requires a pre-existing state of perfect competition. This is not the case today. It is therefore a real challenge for RES-HC technologies – that are consistent with EU climate objectives – to develop and deploy in such an unfair market. In that respect, EU institutions are encouraged to work on a new heat market design, complementing the work on the power and gas markets.

The FROnT surveys revealed a number of additional barriers impacting upon increased deployment of RES-HC technologies, covering both technical and perceived consumer obstacles. However, for the purposes of this paper, the project consortium have decided to focus on these four key barriers considered as the most important ones.
The following section will propose policy recommendations to EU, national or local policy-makers to overcome these barriers.

4. POLICY RECOMMENDATIONS TO OVERCOME IDENTIFIED BARRIERS

4.1 STRATEGIC PRIORITIES AND GOVERNANCE

4.1.1 DEVELOP A LONG-TERM DECARBONISATION ROADMAP, INCLUDING PLANS AND MILESTONES FOR 2030 AND 2050

The EU has set itself a long-term objective of reducing greenhouse gas emissions by 80-95% when compared to 1990 levels by 2050. The Energy Roadmap 2050 explores the transition of the energy system in ways that would be compatible with this greenhouse gas reductions target while also increasing competitiveness and security of supply.

To achieve these goals, significant investments need to be made in renewable energy, energy efficiency and grid infrastructure. Investments in H&C infrastructure are made for a period ranging from 15 years for individual heating systems to 60 years for larger plants and infrastructure. For this reason, policies that create a stable business climate and promote investments in the decarbonisation of the H&C sector through energy efficiency and fuel switch to renewables must begin today and be finalised by 2050. It is therefore crucial to ensure consistency of current and upcoming legislation with long-term objectives.

In its 2011 study "Deploying Renewables: Best future policy practice", the International Energy Agency advices policy-makers to adjust priorities and instruments as renewables' deployment grows, taking a dynamic approach in the different phases of inception, take-off, and consolidation. Widespread diffusion, therefore, requires time and effort.

National, regional, and local governments have an important role to play in ensuring our common long-term objectives are met. National long-term strategies with short, medium and long-term plans[3] should be developed, including strong measures and financing mechanisms available. So as to ensure the effectiveness and the implementation of such national plans, a strong reporting and monitoring system is encouraged, with reliable data collected. Benchmarks should be established by Member States to ensure a fair and transparent delivery of national and EU objectives.

In order to reach EU's 2030 climate and energy objectives[4], the European institutions (Commission, Parliament, and Member States) are developing a standardised template for national climate and energy plans to ensure consistency and comparability among Member States' progress towards the target of at least 27% and allow for proper monitoring. The template should build upon existing renewable energy national plans and preserve reporting on trajectories and policy developments per sector, type of renewable energy sources and enabling technologies.

[3] As France, Germany, the UK and Italy have done under the DDPP scheme. More information available at: http://deepdecarbonization.org/

[4] These objectives are still discussed in EU institutions. Council Meeting of October 2014 agreed on a 27% EU-binding target for renewables.

Measures to prevent gaps between the collective obligation of the EU and Member States' plans (gap-avoiders) and then instruments to fill such gaps (gap-filling instruments) should include:

- Ambitious minimum requirements for renewables in Nearly Zero Energy Buildings, to be covered including through sustainable district heating and smart thermal networks, and other measures to increase renewable heating and cooling consumption in existing buildings and industry;

- Conditionality in the allocation of existing EU funds and adapting public deficit accounting rules (exemptions for investments in RES);

It is only with clear and transparent short, medium and long-term milestones that we will reach our 2050 objectives and honour our COP21 commitments to keep temperature rise well below 2 degrees Celsius.

EU recommendations:

- ✓ Ensure **consistency** of current and upcoming legislation with long-term climate and energy objectives
- ✓ Provide **uniform and binding templates** for national climate and energy plans
- ✓ Propose a **strong governance** system with ambitious mechanisms to incentivise Member States to develop renewables

National, regional and local recommendations:

- ✓ Develop **long-term strategies** with short, medium and long-term plans including strong measures and financing mechanisms

4.1.2 DEVELOP CONSISTENT AND MUTUALLY SUPPORTIVE LEGISLATION

Consistency among short and long-term objectives is crucial. Consistency across the different political objectives (energy efficiency, development of RES and GHG emissions reduction) is also important for policy objectives to be delivered in an effective manner. As pointed out by the 2016 IRENA report "Renewable energy in cities" (p. 13) "it is important to avoid investment in marginally more efficient technologies, so as not to create a "technology lock-in". For example, replacing an old oil-fired boiler with one that is slightly more efficient (instead of a significantly more efficient heat pump) can inhibit efficiency improvements for many years, given the long lifetime of the equipment".

The European institutions are revising the EU legislative framework to reach EU 2030 and 2050 climate and energy objectives, in 2016, the "year of delivery". This includes the revisions of existing

sectoral legislations, such as the Renewable Energy Directive (RES-D), the Energy Performance of Building Directive (EPBD), the Energy Efficiency Directive (EED) and the adoption of new instruments such as the Smart Finance for Smart Buildings Initiative, etc. This simultaneous work allows policy-makers to use all tools available to deliver in a consistent manner and avoid ambiguous and inconsistent legislation. As an example, the European Commission recommendation to phase out fossil fuel subsidies in the Heating and Cooling Strategy on one hand and its green light to finance gas infrastructure with taxpayers' money in the LNG Strategy on the other hand is not reflecting a consistent policy-making.

The same happens under the Energy Efficiency Directive Article 7, Member States have the obligation to set up an energy efficiency obligation scheme that ensure that energy distributors achieve an energy savings target (1.5% of the annual energy sales to final consumers or equivalent measures). From the analysis of the National Energy Efficiency Action Plans it is possible to observe that several Member States have implemented Article 7 of the EED also through significant subsidies to small-scale fossil-based heating technology, e.g. condensing gas and oil boilers. Such subsidies are in practice slowing down the market uptake of renewables in the heat sector, thereby contradicting the objective of RES Directive and offsetting the good provisions already available therein.

In the post-2020 framework, policy-makers should avoid provisions that are locking-in technologies non-compatible with the decarbonisation objective and that hampers the development of renewable energy technologies, especially in the heating and cooling sector. In the case of Article 7 of the EED, eligible savings should be clarified so as to avoid that energy efficiency legislation is interpreted in a way that would allow subsidies for any fossil fuel technologies.

For an effective and smooth implementation of EU's climate and energy targets, it is of utmost importance that the European Commission (and the co-legislators) have a horizontal overview of the revised legislations to avoid inconsistent and unproductive measures slowing down reaching our long-term climate and energy objectives in a cost-effective manner.

On the contrary, the various EU policies should rather reinforce each other. According to the IEE 'RES-H Policy' project recommendations, policy makers need to consider the potential of reinforcement of policy instruments when creating policy. In fact, there is considerable evidence that a single instrument may not be sufficient to provide the different kinds of support that technologies at different stages of technological maturity and deployment require and that more effective renewable energy policy outcomes can be gained from combining different instruments.

EU and national recommendations:

- ✓ Ensure that any future legislation is **coherent** and does not lead to inconsistencies
- ✓ Avoid **lock-in** and investments in technologies non-compatible with the decarbonisation objective or the achievement of EU RES targets

4.1.3 UNDERSTAND THE NEED TO PURSUE FULL DECARBONISATION OF THE BUILDING SECTOR AND SUPPORT RD&I, TO DECARBONISE THE H&C SECTOR AS A WHOLE

Almost 50% of EU final energy consumption is used in the heating and cooling (H&C) sector. Only 17.7% of this energy is produced by renewable sources of energy. More needs to be done to reach the defined EU decarbonisation objectives.
Buildings are the first consumers of H&C. In some colder climate zones, space heating can account for more than 80% of H&C consumption.

It is important to understand the potential that lies in the building sector to decarbonise the H&C sector as a whole. Indeed, RES-HC technologies such as efficient heat pumps, solar thermal, biomass and geothermal installations are today mature and available to deliver. Fully decarbonising the building sector is technically feasible today. Political will and market conditions are rather missing.

When decarbonising the building sector, it is crucial to reduce energy demand of buildings through energy efficiency measures and simultaneously increase the share of renewable energy sources in the remaining energy consumption. This will allow maximising energy efficiency and RES synergies and decarbonise the building sector cost-effectively.

But the challenge of decarbonising the H&C sector lies in some areas where RES-HC technologies cannot deliver yet due to current technical limitations. This is the case in some industrial sectors with complex and high-temperature thermal processes where fossil fuels will be residually required in the mid-term.

RD&I in renewable heat technologies is needed to reduce costs, enhance system performance and facilitate the integration of RES-HC into existing and future infrastructure. It is also needed to increase the temperature level and cover additional industrial sectors.

The EU should continue supporting technological development not only as it will be necessary to decarbonise our economies, but also to ensure that Europe retains its status as a world leader in manufacturing and design, reinforcing one of its main competitive strengths. It is also important to fight against energy poverty and provide stability to heat supply by protecting consumers against fluctuations in energy prices. More attention should be paid to the energy system as a whole, to system integration, to the development of smart thermal grids and to new industrial processes able to decarbonise the non-ETS sectors.

EU and national recommendations:

- ✓ Understand the potential that lies in the **building sector** to decarbonise the H&C sector as a whole and carry out consequent policies
- ✓ Exploit **synergies** between **energy efficiency** measures and deployment of **renewable** heat technologies in building renovation projects
- ✓ Continue investing in **RD&I** to speed-up the development and deployment of renewable thermal technologies able to decarbonise the remaining part of the H&C sector

4.1.4 DEVELOP POLICIES TO TRIGGER RENOVATION OF EXISTING BUILDINGS

As mentioned previously, decarbonising the building sector is today technically feasible. However, it is a challenge as 99% of the total building stock are existing buildings and 70% of them are privately-owned. The EU H&C Strategy acknowledges that owners generally fail to undertake cost-efficient renovations because they lack awareness of the benefits, lack advice on the technical possibilities, face split incentives (for instance in multi-apartment buildings) and have financial constraints. The tenant – landlord dilemma is also to be tackled as important shares of houses are rental housing. A political push is needed to trigger renovation of these buildings.

Almost half of the EU's buildings have individual boilers installed before 1992, with efficiency of 60% or less. 22% of individual gas boilers, 34% of direct electric heaters, 47% of oil boilers and 58% of coal boilers are older than their technical lifetime. Modernising and replacing the old stock of individual heating installations with modern and renewable installations is a must but is also very challenging due to the structure of ownership.

Therefore, setting long term (2050) national refurbishment strategies with minimum requirements in terms of primary energy and with some form of financial support available may be an effective way forward. Minimum requirements could be established following a cost-optimal approach taking into account age, climate, end-use etc. Such a provision would mean a need for a mechanism triggering renovation cycles by 2050 that promotes only the most efficient technologies using renewable energy (for example, for individual appliances, linking support schemes with eco-design requirements and eco-labelling). This provision could be set under the Energy Efficiency Directive (EED).

France has taken this path with the French Grenelle Law (Article 5) that imposes an energy renovation plan for housing. The plan includes all the policies and measures adopted by the government to reduce the total energy consumption of existing building stock by 38% by 2020. To do so, the government has set the objective to renovate 400 000 dwellings each year starting in 2013.

National recommendation:

- ✓ Set **long-term national refurbishment strategies** with mechanisms triggering renovation cycles by 2050

4.1.5 DEVELOP FAVOURABLE BUILDING CODES

According to the 2009 RES Directive Article 13.4, Member States should, in their building regulations and codes or by other means with equivalent effect, require the use of minimum levels of energy from renewable sources in new buildings. Member States shall permit those minimum levels to be

fulfilled, inter alia, through district heating and cooling produced using a significant proportion of renewable energy sources.

In view of the revision of the RES Directive, this provision should be reinforced by making a link with the Nearly Zero-Energy Buildings (NZEB) concept for new buildings in the Energy Performance of Buildings Directive (EPBD). In fact, the EPBD establishes the obligation for Member States to ensure that by 31 December 2020, all new buildings are NZEB. According to that same Directive, 'nearly zero-energy building' or NZEB means a building that has a very high energy performance. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby. Looking at Member States implementation of this provision, the majority of Member States have already translated this obligation into minimum requirements of RES in buildings.

Extending the "very significant amount" to a gradually increasing "minimum requirement" would ensure that NZEB are really compatible with decarbonisation objectives.

This requirement would have an important market impact. As it has been demonstrated in this project, one of the major barriers to RES-HC deployment is the lack of awareness and information on RES-HC technologies. By setting a RES obligation in new buildings (which is a niche market, compared to the large market composed of the existing stock of buildings), awareness amongst professionals is indirectly triggered through the creation of a dedicated market for RES-HC. Professionals will have to adapt/train themselves if they want to have work on this new market.
This will set the tone and kick-start larger deployment of RES-HC in existing building stock, where it is much more difficult to impose such a burden on building owners. In fact, this measure will not be too burdensome for private owners as it is optimising the initial investment cost in the whole price of construction/deep renovation.

In the NZEB definition of the Energy Performance of Buildings Directive (EPBD), policy-makers should extend the "very significant amount of RES" to an **increasing "minimum requirement of RES" in new buildings**. As an alternative, the definition of NZEB should include a CO2 emissions indicator.

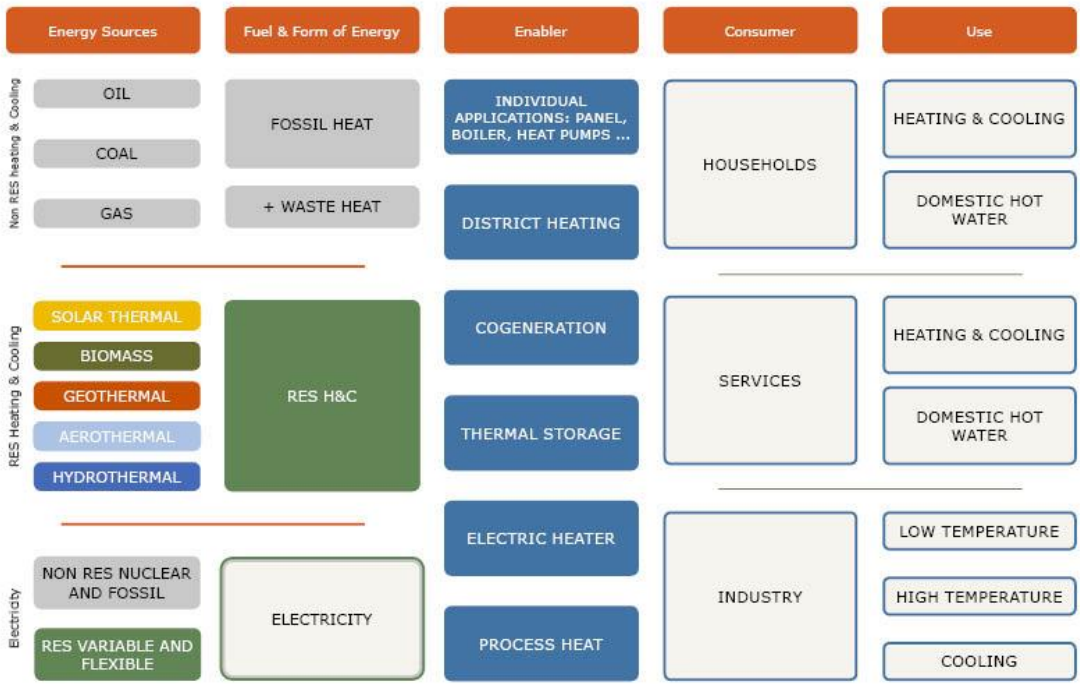
4.1.6 IMPROVE THE PARAMETERS OF THE MODELLING USED FOR PROJECTIONS OF HEATING AND COOLING

The 2030 climate and energy objectives and targets are based on a thorough economic analysis that measures how to cost-effectively achieve decarbonisation by 2050, using model based decision support tools. Modelling tools are crucial to allow policy makers understand the short, medium and long term implication of their policy choices.

The challenge is to model the future energy systems with increasing complexity and overlapping policies. Against this background, a thorough analysis of the heating and cooling sector, at least comparable with the one carried out for the electricity sector, is still missing. Yet, the modelling used in the impact assessment accompanying the European Commission Energy Roadmap 2050[5] fails to go beyond electricity and to provide a significant outline of heating and cooling. Indeed, the Commission published all the results of the modelling for electricity as well as for transport but only distributed heat/steam numbers have been disclosed. RES H&C figures have only been reported in relative terms and the total heating and cooling demand is completely omitted.

A mapping covering all dimensions of this complex sector, illustrated in the figure below, with a sufficient consideration of the energy sources would improve the Energy Roadmap and help identifying potential decarbonisation solutions in the building sector.

MAP OF THE HEATING AND COOLING SECTOR



[5] https://ec.europa.eu/energy/en/topics/energy-strategy/2050-energy-strategy

Energy models should also identify and take into account new technological trends and look more in details into the non-ETS sectors. A complete assessment of economic and societal benefits would also be useful as it would highlight not only the environmental benefits of the different policy options but also their impact in terms of economic growth, job creation, energy dependency, energy poverty, etc.

EU and national recommendations:

- ✓ Develop a **throughout and transparent analysis** of the heating and cooling sector
- ✓ Carry out a **complete assessment** of environmental, economic, societal and political benefits of policy options when doing impact assessment

4.1.7 ESTABLISH EU-WIDE DEFINITION AND METHODOLOGIES TO TAKE COOLING INTO ACCOUNT IN BUILDING CODES, NATIONAL STATISTICS AND SUPPORT SCHEMES

Although not visible in statistics, demand for cooling is on the rise everywhere in Europe, especially in the industrial sector. Today, cooling from renewable energy technologies is often neither recognised in legislation nor captured in statistics. And when renewable cooling is calculated on the national level, this is not accounted at EU level[6]. In the revised RES Directive, for instance, there is a need to develop a definition and a methodology to take into account renewable cooling.

EU recommendations:

- ✓ Assess the impact of recognition of RES cooling on national RES targets
- ✓ **Develop an EU-wide definition and a methodology** to take into account **renewable cooling**

National, regional, and local recommendation:

- ✓ Improve collection of **statistics on heating and cooling appliances, including from RES**

[6] This is the case in the Netherlands, where 1.8 PJ of renewable cooling from ATES systems is accounted at national, but not at EU level. Source: FROnT conference "HOW TO MAKE THE EU NUMBER ONE IN RENEWABLE HEATING & COOLING", 15 June 2016, Brussels

4.2 MARKET CONDITIONS

4.2.1 PHASE OUT FOSSIL FUELS

If EU Member States want to achieve their long-term energy and climate objectives (80-95% GHG emissions reduction by 2050), fossil fuels will have to be phased out. A three-step approach is recommended for the heating and cooling sector:

- Stop direct and indirect subsidies to fossil fuels and deregulate prices
- Ban fossil fuels in new buildings
- Phase out fossil fuels in existing buildings

Stop direct and indirect subsidies to fossil fuels

The European Commission study on *Subsidies and costs for EU energy*[7] shows that in 2012, the total value of public interventions in energy (excluding transport) in the EU-28 is € 122 billion. Interventions to support renewable energy sources only accounts for € 41 billion. This, again, reflects inconsistency in EU legislation and may hamper the EU from reaching its decarbonisation objectives.

As an example, the European Council conclusions of 22 May 2013 are urging Member States to phase-out fossil fuel subsidies and to focus incentives on non-fossil fuel based heating and cooling systems. At the same time, new fossil fuel energy production (including the second largest fossil-fuel power station in the world: Belchatow lignite-fired power station in Poland) are subsidised under the ETS Directive (Article 10c) on the name of modernising electricity generation in certain member states. Same situation takes place, as mentioned above, under the Energy Efficiency Directive (EED). Individual fossil fuels condensing boilers are subsidised on the name of energy efficiency.
The Council conclusion to phase-out fossil fuels subsidies should prevail and consistency across EU legislation is the only way forward if we want to reach our long-term decarbonisation goals. The European institutions are currently revising a large set of legislation. It is the appropriate time to analyse the consistency of these legislations across the board and ensure direct and indirect subsidies are gradually and completely phased-out. In order to carry out a consistent approach in the phasing out of fossil fuels, the decarbonisation of the heating and cooling sector must also take into account the CO_2 content of electricity-driven heating appliances. The process of decarbonisation of the electricity and of the heating and cooling sectors must therefore run in parallel to avoid the replacement of carbon intensive fossil fuels for heating with carbon intensive or inefficient electric heaters.
Vulnerable consumers should be part of the energy transition, and deserve special attention. Different support levels to switch to green heating and cooling solutions, adjusted according to the income level of households should be established, in order to address energy poverty cost-efficiently.

[7] https://ec.europa.eu/energy/sites/ener/files/documents/ECOFYS%202014%20Subsidies%20and%20costs%20of%20EU%20energy_11_Nov.pdf

An alternative option would be to develop public-private energy services companies (ESCOs) to help vulnerable consumers reduce their energy bills thanks to energy savings measures and renewable systems.

Phase out fossil fuels in buildings

Policies are necessary to foster the energy transition. A combination of 'carrots' (financial supports) and 'sticks' (clear and ambitious regulations) seems the most promising strategy to achieve a decarbonised energy system. This would ensure a coherent regulatory framework and provide investment security for the private sector.

As the "stick", legislation forcing a gradual phase out of fossil fuel heating installations should be put in place in each Member States. It could start with new buildings where it is easier to integrate a RES-HC installation in the design phase of the house and where the cost of the installation is diluted in the whole construction cost. Then it could be equally applied to existing buildings with a long-term renovation strategy.

Example of Denmark: Denmark is the first country to have put in place a consistent policy and ban fossil-based installations. Since 2013, the installation of oil-fired boilers and natural gas heating is banned in new buildings in Denmark. Since 2016, the Danes have also banned the installation of new oil-fired boilers in existing buildings in areas where district heating or natural gas is available. This was supported by the Danish government with 42 million DKK (5.6 million Euro) from 2012 to 2015. The Danes have understood that the heat sector is a crucial pillar for an energy transition where most costs are saved and major contributions are made for climate protection. They also understood that it will create green growth and employment in the next decade, while also preserving the competitiveness of traditional enterprises. Oil and gas are increasingly expensive and have a significant share of CO_2 emissions especially in buildings.[8]

EU and national recommendation:

- ✓ Analyse consistency among legislations and ensure direct and indirect **subsidies to fossil fuels are phased-out in time**

National recommendation:

- ✓ Set up a strategy to **phase out fossil fuel** heating installations in time.

[8] http://www.power-to-the-people.net/2013/02/new-best-policy-denmark-introduces-the-brake-on-heating-costs/

4.2.2 INTERNALISE NEGATIVE EXTERNALITIES FROM FOSSIL FUELS

The EU Emission Trading System (ETS) covers combustion installations with a rated thermal input above 20 MW. In addition, emissions from production of electricity (12%) used in heating is also regulated under the EU ETS. The total heat supply which is covered by the EU ETS is estimated to be around 25% of the total heat supply. However, as the EU ETS is hampered by systemically low carbon prices, the negative externalities of this portion of the heat supply cannot be considered as fully covered. The rest of the energy use in the heating sector falling to the non-ETS sector is generated by natural gas (44%), petroleum products (17%), coal (3%), and renewables (11%)[9].
Because in sectors outside ETS, negative externalities created by the use of fossil fuels are not internalized and create a burden for the society, the 'Polluters Pays Principle' should be adopted in sectors outside ETS through the introduction of a carbon tax or other levies.

This system would have the advantage to put pressure on the polluting sectors. Indeed, CO_2 emissions having a price, it will indirectly support all other alternatives, including energy efficiency and switch to renewable energy.
Because economic actors will have to bear the cost of their CO_2 emissions, they will be incentivised to switch to cleaner fuels. Fossil fuels will become more expensive, making renewable options much more competitive in comparison.
This system would also progressively limit the need for direct financial support. The clean energy sector will therefore become a market-oriented competitive sector, which offers economically viable solutions for operators willing to avoid paying taxes on their polluting activities.

Ideally, a carbon tax should be established at EU level: since 1990 and due to the unanimity rule at the Council level, several attempts have failed and it is very unlikely that such a common taxation system will be introduced in the near future.

Therefore, the introduction of national carbon taxation systems in sectors outside ETS (including buildings and small industries), should be introduced on the national level.

Here are some features for an effective tax introduction:

- Level of the tax: it is important that the level of the tax is high enough to incentivize users to switch to a clean option rather than paying the tax. As it has been seen in most Member States currently having a carbon tax in place (France, Ireland, Sweden, Denmark, etc.) it can be introduced at a low level and increase with time. One of the main issues with introducing a carbon tax is public acceptance and impacts on the markets. By starting at a low level, it allows a smooth adaptation over time for users and markets.
- Communication: As mentioned above, one of the main barriers to the introduction of a carbon tax is public but also political acceptance. It is therefore essential to build a good communication around it and take the opportunity to communicate on CO_2 emissions and its harmful

[9] Inclusion of the heating sector in the EU ETS - Finnish Energy Industries, GreenStream Network Ltd Final report 2015-06-30 SS-20150302, http://energia.fi/sites/default/files/dokumentit/ajankohtaista/Uutiset/gs_ets_heating_report_2015.pdf

consequences. The word "tax" should also be avoided as it inherently creates a rejection reaction.

- Revenue of a carbon tax: It is important that the revenues of the tax compensate somehow the extra burden for households (tax shift, like in Belgium), address the issue of energy poverty (like in France) or are used to create an energy transition fund for RES and EE (like in Switzerland). This should also be extensively communicated to people to foster their acceptance.
- Address sensitive target groups: Small industries (not covered by the ETS) should be granted a special treatment, with lower carbon tax, not to hurt national companies' competitiveness. Vulnerable consumers should also be granted the same treatment, or even be exempted from paying the tax.

National recommendation:

- ✓ **Introduce a carbon tax** in sectors outside ETS

4.2.3 ESTABLISH OFF-BUDGET FUNDS FROM CARBON PRICING INSTRUMENTS

Under the ETS Directive (DIRECTIVE 2003/87/EC), *Member States shall determine the use of revenues generated from the auctioning of allowances. At least 50 % of the revenues generated from the auctioning of […], should be used for one or more of the following:*
[…] (b) to develop renewable energies to meet the commitment of the Community to using 20 % renewable energies by 2020, as well as to develop other technologies contributing to the transition to a safe and sustainable low-carbon economy and to help meet the commitment of the Community to increase energy efficiency by 20 % by 2020;
[…] (g) to finance research and development in energy efficiency and clean technologies in the sectors covered by this Directive; […]

This recommendation is not legally binding, resulting in some Member States benefiting from additional auction allowances while not spending their auctioning revenues on transitioning to a low carbon future.

The 2013 European Commission's "Guidance for the design of renewables support schemes" recommends off-budget financing to avoid fiscal impacts and uncertainty. This can be done by financing the support scheme through a levy on gas consumption as it happens already in most of the support schemes for renewable electricity. An alternative way to move off-budget and provide stability is found in Switzerland, where the 10-year long Buildings Programme is to a large extend financed through a carbon tax.

National recommendations:

- ✓ Use **ETS or carbon tax revenues in RES and EE projects**, in line with EU long-term climate and energy objectives
- ✓ Move support scheme programmes **off-budget** to provide stability

4.3 AWARENESS, QUALITY AND ENGAGEMENT

4.3.1 DISSEMINATE INFORMATION ON RES-HC TECHNOLOGIES AVAILABLE THROUGH COMMUNICATION CAMPAIGNS TARGETING PROFESSIONALS, CONSUMERS AND CITIZENS AND PROMOTE ENERGY LABELLING

In order to address the lack of awareness, there is a need to reinforce the Renewable Energy legislation and starting with fostering better implementation by Member States.

According to current RES legislation, Member States shall ensure that information on support measures and on benefits, costs and energy efficiency of equipment is available, and that with the participation of local authorities, member states shall develop information, awareness raising, guidance or training programmes.

Education can also play an important role in raising awareness. Local authorities should be incentivized to organize communication and educational campaigns, considering local specificities and available resources.

Another way to inform and empower end-consumers is to promote clear and efficient energy labelling on heating systems. The granting of support should be conditional to the best performing heating systems. Member States should implement energy labelling requirements and make sure clear and harmonised labels give sufficient information to inform end-consumers choices. It is important in this respect that the revised legislation sends signal that would boost the purchase of renewable solutions over any fossil fuel based – albeit efficient – systems.

National recommendations:

- ✓ Improve **implementation** of RES Directive Article 14 and develop **information, awareness raising, guidance or training programmes**
- ✓ Foster clear and harmonized **energy labelling requirements** that would boost the purchase of renewable solutions over any fossil fuel based – albeit efficient – systems

4.3.2 IMPROVE QUALITY OF THE TRAINING, QUALIFICATION AND ENGAGEMENT OF PROFESSIONALS

Lack of trained professionals (architects, installers and builders) has been mentioned as one of the challenges and barriers in the implementation of the EU Heating and Cooling Strategy. Training of professionals was referred to as one of the tools for the improvement of the strategy objectives in the building sector.

In order to increase professionals' awareness on RES-HC installations, and indirectly end-consumers' awareness, the number of installers trained and the quality of these trainings should be largely improved. RES-HC technologies being new and innovative technologies, a qualitative installation is crucial to maximise its economic and environmental benefit, building therefore a positive reputation for the technology.

In order to do so, the RES Directive referring to certification and qualification schemes should be reinforced and better implemented by member states: *Member States shall ensure that certification schemes or equivalent qualification schemes become or are available by 31 December 2012 for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems, shallow geothermal systems and heat pumps.*
It is recommended to promote systems such as qualification, training, labelling and all other systems contributing to the attestation of professional competences over certification schemes that might be too burdensome for installers that are predominantly craftsmen and SMEs.

Imposing certification to installers of renewable equipment might have an opposite side-effect of diminishing the supply of renewable energy equipment in buildings due to the extra burden imposed. We rather recommend creating a market for RES-HC technologies, through a set of policy measures and building codes and a principle of mutual recognition between EU member states, that would incentivise installers to get voluntarily trained to supply a growing demand for RES-HC installations.

National recommendation:

- ✓ Improve **implementation of RES Directive Article 14.3** and promote systems that fosters professionals' competence

4.3.3 STREAMLINE ADMINISTRATIVE PROCEDURES RELATED TO SUPPORT SCHEMES

The most important features of a support scheme to be efficient are the stability and clarity of the scheme as well as its application rules.
Information about available support schemes should be easily found and understood by end consumers. For example, a list of clear eligibility criteria and installations should be established. The information and documents required should be kept simple. Digital (online) applications should be promoted. Good information on all (national, regional or local) support schemes requirements and technical conditions should be made available on a single portal/website (one stop-shop)

For some markets, there is also a clear need to create some sort of registration mechanism for professionals and installations that can be solicited under the support scheme. The registration will allow the consumers to register their complaints and someone to attend to their claims and ensure that they are resolved. Registration of complaints empowers consumers to participate in demand response, thus saving them money through getting services from recommended experts who will install and manage the installation in the best performing conditions. With such a structure in place, it is expected that the consumer confidence in the technology will likely improve.
Consumers will have a reliable source not only to identify the installer closer to their area of residence but also to have access to a list of installers who have no outstanding claims from clients. It will allow the production of reliable indicators such as typical maintenance cost, cost per installed power, cost per thermal heat generated, time duration per maintenance act and per RES-HC options, and components most likely to be substituted per RES-HC technology. This information can be available to help consumer select heating/cooling option. The acquired information will also help deterred practices of over-selling, since reliable and structured information will be available for any potential RES-HC buyer.

National recommendation:

- ✓ Make sure **support schemes** are **stable** and their application rules **clear and easily found**

4.3.4 IMPROVE VISIBILITY THROUGH ENERGY PERFORMANCE CERTIFICATES OF BUILDINGS (EPCs)

Today, EPCs of existing buildings have to include future measures to be incorporated in the building in order to improve energy efficiency. In addition to that and in order to improve end-consumers' awareness on their heating systems, EPC should also have the obligation to highlight, on the front page, the environmental impact (CO_2 emissions) of the building, as well as the shares of the different energy sources/technologies used. This would not only improve end-consumers' awareness on their

own heating system, but also incentivise them to increase the share of RES to improve the energy performance of their building.

This should also be accompanied by the obligation to include on EPCs the investment and operating/life-cycle costs, as well as a brief profitability analysis linked to the future measure(s). This would bring a positive competition among heating systems that should decrease, in the medium to long-term, the cost of RES-HC solutions.

Among the schemes analysed by the project, the UK´s RHI domestic scheme is the only one to consider 'Energy Performance Certificate' to identify the heat demand of the property. The German region of Baden-Wuerttemberg has successfully implemented a system where EPCs include renovation roadmaps, with tailored advice to owners and investors on how to improve the energy performance of their buildings. France and the region of Flanders in Belgium are developing similar concepts.

National recommendation:

- ✓ Improve the **visibility of RES** and of thze building's environmental impact on **EPCs**

4.3.5 ENGAGE STAKEHOLDERS IN DIALOGUE WHEN DEFINING POLICY

Energy dialogues should take place with stakeholders and consumers representatives about the long-term climate and energy objectives (2050?) and how to reach these objectives. This should result in concrete long-term policies and actions, designed and shared by all stakeholders.

Example: The Dutch Energy Dialogue
The energy dialogue is an initiative of the Dutch Minister of Economic Affairs. Between April and July 2016, more than 125 meetings were organised by 72 organisations and in which over 3000 people discussed about the Dutch use and supply of energy in the future. Entrepreneurs, scientists, civilians, NGO's and other stakeholders expressed their ideas and discussed about the preferred energy situation in 2050.
A junior energy dialogue also took place in primary schools and through on-line debates.
The opening meetings were about sustainable heating and cooling in residential and non-residential buildings, sustainable heating and cooling in industry and the use of waste heat and sustainable transport and electricity. New technologies, business models, collective heat supply, energy efficiency and the role of (natural) gas in the energy transition were discussed.

The outcomes of the energy dialogue will be used in the long-term energy policy/ energy agenda for a transition towards a sustainable energy solution in the Netherlands (low CO_2, safe, reliable, affordable energy system).

National, regional, and local recommendation:

- ✓ **Engage stakeholders in dialogue** when defining long-term climate and energy objectives

4.3.6 PROMOTE DISTRICT HEATING (DH) AND THE USE OF RES IN DH AND BLOCK HEATING (2-3 HOUSES)

Today around 85% of DH systems run on fossil fuels. There is a need to set (increasing) minimum shares of renewables for existing district heating. This could be integrated in the framework of refurbishment and upgrading works. This obligation could be fulfilled with existing and future funding opportunities.
As good examples, France and Sweden have engaged in switching their DH to renewable fuels and have today important share of their DH that is heated with RES-HC. This has been possible in France thanks to a well-functioning support scheme, mainly investment aid (Fond Chaleur) and in Sweden, mainly thanks to an efficient carbon tax.

Building on these examples, one can say that establishing efficient support scheme to help financing the switch, or set an effective carbon tax are useful to help deploy RES-HC in DH. It is also crucial to engage local authorities and stakeholders and increase their awareness of the RES-HC options available.

In addition, it is crucial not to interpret building codes (including for NZEB), like if the building were an energy island. It is important to fully consider renewables used in DH in the energy performance of buildings and to leave the doors open to "renewable energy produced nearby", i.e. from district heating, especially considering that in historic buildings and city centres there are technical constraints for deep renovation and the installation of on-site renewable technologies. In this regard, renewable energy used in district heating should be taken into account as it is an easy way to decarbonise the buildings sector in a cost-efficient way and avoid locking-in conventional technologies using fossil fuels.

Hungary has understood the crucial role of DH by setting up a *District Heating Development Action Plan* in 2015-2016, as part of the National Energy Strategy. The Action Plan emphasizes the role of renewables – especially biomass and geothermal – in modernizing the Hungarian DH sector. The Action Plan that is expected to be launched in September 2016[10].

[10] Regulatory frameworks for geothermal district heating: A review of existing Practices, Angelino et al. https://www.geothermal-energy.org/pdf/IGAstandard/EGC/2016/EGC2016-P-LA-308.pdf?

EU and National recommendation:

- ✓ Promote efficient district heating (DH) and set **minimum shares of RES** for new and existing DH.

4.4 FINANCING

4.4.1 UNDERSTAND THE NEED TO FINANCE RES-HC SOLUTIONS UNTIL THE MARKET CONDITIONS HAVE BEEN FIXED

It is very difficult to compare the real cost of renewable and fossil installations with today's market conditions. The unfair market conditions are analysed above in the section dedicated to overcome market conditions issues.

However, it is crucial to understand that RES-HC technologies today are still dependent on state support not only because these technologies are not yet widely deployed and have not reach economies of scale capable of bringing costs drastically down, but also because they compete with fossil fuels technologies that are heavily subsidised.

According to IEA's latest estimates[11], fossil-fuel consumption subsidies worldwide amounted to $493 billion in 2014, with subsidies to oil products representing over half of the total. Those subsidies were over four-times the value of subsidies to renewable energy. In that context, one can easily understand the financing challenge faced by RES-HC technologies industry and the financial public support they deserve.

In addition, the European Commission estimates the value of the negative externalities associated with the use of fossils fuels roughly three times as high as actual government support for fossil fuels. Fixing these unfair market conditions would definitely help RES-HC solutions to be widely deployed to not only reduce our GHG emissions but also reduce state budget linked to health and mitigation solutions.

EU and National recommendation:

- ✓ **Support RES** solutions until **fair market conditions** are established

[11] International Energy Agency, World Energy Outlook, Energy subsidies, http://www.worldenergyoutlook.org/resources/energysubsidies/

4.4.2 ESTABLISH WELL-DESIGNED SUPPORT SCHEMES AVAILABLE FOR RES-HC TO REDUCE COSTS AND FOSTER COST-EFFICIENT DEPLOYMENT OF RES-HC

Since they are financed by public money, it is even more crucial that financial support to RES are efficient and cost-effective.

A series of elements of design have been retained and analysed in the framework of this project, and a manual of good practices has been developed[12].

First of all, it is essential to understand that RES-HC technologies and RES-HC users are manifold and a "one-size fits all" approach, in terms of policy or support, would not be the most effective. A combination of different support policies and financial instruments should be promoted according to technologies' stage of maturity (risk) and technical characteristics as well as the maturity of the market in which they are promoted.

In addition, one of the most important element is the stability of the scheme that should run at least 5 years. Stop and go policies should be avoided as they irrevocably undermine investors' confidence. Another way to improve the stability of a scheme is to move off-budget, through for example a levy on gas consumption, to avoid fiscal impacts and uncertainty linked to political mandates, as it has been described above.

Finally, in a bid to improve the overall scheme's accountability and transparency there is a need to undertake periodic evaluation to track whether targets are being met. A communication of the gains and success of the support scheme needs to be done to help policy makers and the public understand the distributional impact of a scheme, both in terms of costs and environmental performance. Particular attention should be paid on the fuel poor and other vulnerable groups

Good practices identified by the projects that could be replicated can be found on the project website[13].

National recommendation:

- ✓ Establish **well-designed support schemes** for RES-HC

[12] It can be found on the FROnT project website: http://www.front-rhc.eu/

[13] http://www.front-rhc.eu/

4.4.3 INCREASE AWARENESS OF EXISTING SUPPORT AND FINANCING OPPORTUNITIES

It is often difficult to have a clear picture of what kind of support or financing opportunities exist at national/regional/local level. We recommend therefore to:

- Improve RES-Legal website in order to have an updated platform covering all financing opportunities in all Member States, with relevant information on how to access those opportunities on a standardized and comparable way across Member States.

- Disseminate the revamped platform with communication and awareness campaigns.

EU, national and local recommendation:

- ✓ Improve **awareness** of existing **support and financing opportunities**

4.4.4 HAVE APPROPRIATE AND STREAMLINED ADMINISTRATIVE PROCEDURES RELATED TO PERMITTING/AUTHORISATION FOR ALL RES TECHNOLOGIES

The administrative and thereby financial burden linked to licensing and authorisation is, in some countries, still significant and represent an important barrier to investment in some RES-HC solutions.

Article 13 of the RES Directive requires Member States to streamline and rationalise the administrative procedures and to clearly define and coordinate the respective responsibilities of national, regional and local administrative bodies. Besides, timetables for determining planning and building applications should be transparent: comprehensive information and assistance to applicants should be made available at the appropriate administrative level. Furthermore, it specifically requires taking into account the particularities of individual technologies and encourages the practice of 'simple notification' for smaller projects. However, simplified notifications for small projects are only in place for a very limited number of countries. Article 13 should therefore be strengthened and better implemented by Member States.

In addition, in many countries an appropriate licencing/authorisation regime for emerging technologies is not yet in place. New EU-wide technology-specific guidelines and concerted actions should fill this gap. In order to streamline administrative procedures, a 'one-stop-shop', the online application system, and the practice of simple notification should be in place.

EU recommendation:

- ✓ **Strengthen Article 13.1 of RES Directive** and work on **concerted action** with national and regional governments

National recommendation:

- ✓ **Streamline administrative procedures**

4.4.5 PROMOTE DEMAND AGGREGATION AT LOCAL LEVEL

The H&C sector is mostly a decentralised sector. As such, this brings specific challenges in its decarbonisation, as well as opportunities. While some Member States (mainly Northern and Eastern European countries) have traditions of district heating to supply heating to households, most Member States rely on individual heating appliances for heating buildings. While the decision to switch a centralised system to RES only involve a couple of people (local authorities) that have a negotiation advantage due to the size of the project, it is a greater challenge to convince each building/apartment owner to make the switch.

Aggregating individual installations demand through local authorities or consumer organisations could not only have a positive impact on the price of the RES-HC installation thanks to group purchase, but also provide technical advices to maximise the economic and environmental benefits of the installation. It can also play the role of a consumers' awareness campaign.

Therefore, it is recommended to:

- ✓ Better involve consumers' associations as stakeholders of awareness campaigns, in order to promote their leadership in group purchasing practices.
- ✓ Disseminate best practices of local authorities group purchasing, through dedicated platforms in cooperation with local representatives such as the Covenant of Mayors as an example.

Local recommendation:

- ✓ Push for **demand aggregation** (through consumers' organisations or dedicated regional agencies)

4.4.6 RAISE THE INVOLVEMENT OF PRIVATE FINANCIAL INSTITUTIONS TO DEVELOP NEW FINANCIAL TOOLS

Return on investment over time in RES should attract private investors (banks, funds, insurance companies). It is essential to increase investors' confidence in RES-HC projects. This requires adequate data and information of the sector on the financial attractiveness of RES for H&C. Best practices should also be exchanged and promoted, highlighting the profitability and return of investment of projects.

The public sector, such as local authorities, can play an important leverage effect to attract private financing but can also, by acting as a financial organism, be a good example for private institutions. It goes beyond simply implementing a system of grants or assistance for energy improvements and involve creating a real service for users in the building renovation sector.

As an example, the Ile-de-France region (France) has set up a truly public service, acting as a One-stop shop, backed by SEM Energies Posit'if, aimed at advising, supporting and helping fund a private individual's home energy improvements.
Energies POSIT'IF is a public private company used by French local authorities to manage urban development projects particularly energy related projects. It aims at increasing the number of energy retrofits in the Ile-de-France region by providing comprehensive technical services (energy advice, retrofits and energy performance guarantees) and third party financing to thermally upgrade multiunit buildings[14].

The European Commission has also set up an initiative called "Smart Financing for Smart Buildings Initiative", in the framework of the Energy Performance of Buildings Directive (EPBD). The initiative aims at connecting the financing community with the energy efficiency project developers, by promoting projects aggregation, de-risking, and improved understanding of energy efficiency in the financing community. This initiative should seize the opportunities coming from a combined approach between RES-HC and energy efficiency in terms of financing, and promote such synergies to accelerate the decarbonisation of the heating and cooling sector.

EU and national recommendation:

- ✓ Act as **leverage** to attract **private financing**

[14] Intelligent Energy Europe funding from Mobilising Local Energy Investments (MLEI PDA) was used for the initial project development phase. More details at: http://www.energiespositif.fr/

5. SUMMARY TABLE

Strategic priorities and governance	Market conditions	Awareness, quality and engagement	Financing
Develop a long-term decarbonisation roadmap, including plans and milestones for 2030 and 2050	Phase out fossil fuels	Disseminate information on RES-HC technologies available through communication campaigns targeting professionals, consumers and citizens, and promoting energy labelling	Understand the need to finance RES-HC solutions until the market conditions have been fixed
Develop consistent and mutually supportive legislation	Internalise negative externalities from fossil fuels	Improve quality of the training, qualification and engagement of professionals	Establish well-designed support schemes available for RES-HC to reduce costs and foster cost-efficient deployment of RES-HC
Pursue full decarbonisation of the building sector and support RD&I	Establish off-budget funds from carbon pricing mechanisms	Streamline administrative procedures related to support schemes	Increase awareness of existing support and financing opportunities
Develop policies to trigger renovation of existing buildings		Improve visibility through energy performance certificates of buildings (EPCs)	Have appropriate and streamlined administrative procedures related to permitting/authorisation for all RES technologies
Develop favourable building codes		Engage stakeholders in dialogue when defining policy	Promote demand aggregation at local level
Improve the parameters of the modelling used for projections of heating and cooling		Promote district heating and the use of RES in DH, and block heating	Raise the involvement of private financial institutions to develop new financial tools
Establish EU-wide definition and methodologies to take cooling into account in building codes, national statistics, and support schemes			

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7. CONCLUSIONS

On 12 December 2015, in Paris, 177 countries have committed to reducing their greenhouse gas emissions to keep temperature rise well below 2 degrees Celsius. EU Member States have committed and will have to deliver GHG emission reductions covering their entire energy system, including the electricity, heating and cooling and transport sectors.

The heating and cooling sector represents almost 50% of our energy consumption and is therefore key to decarbonise our entire energy system.

Renewable technologies such as geothermal, solar thermal, biomass and heat pumps, are today mature and available as solutions to decarbonise the H&C sector.

Important barriers on the demand and supply sides exists however and are hampering the deployment of RES-HC. On the consumers' side, the main barriers identified are the lack of awareness and financing difficulties. On the manufacturer of RES-HC installations side, unfair market conditions and lack of stable and coherent supportive policy framework have been identified as main barriers.

This paper gives a set of policy recommendations to be taken at EU, national and local levels in order to allow further deploying RES-HC solutions. Energy being a shared competence between EU and national levels, a combination of supportive policies at supra, national and local level are needed to effectively decarbonise the H&C sector and reach our mid/long-term climate and energy objectives.
In order to support the deployment of RES-HC solutions, two important things are needed:

- **a stable and coherent legislative framework**. Stability over years will ensure investors' confidence while coherence will guarantee climate and energy objectives are met in a most cost-effective and straightforward manner. Policies aiming at supporting RES-HC solutions are needed in markets where the negative externalities of fossil fuels are not internalized and the carbon not (or not enough) priced.

- **Technology and market specific support schemes.** EU markets and RES technologies have different maturity levels. Therefore, a one-size-fits-all approach would not address the specificities of each technology or market and would jeopardise developing the right range of RES technologies needed to decarbonise completely our energy system. In a market still dominated by subsidies to fossil fuels, effective support schemes to RES are needed to increase their competitiveness and accelerate their deployment.

This paper also emphasises on the importance of the **building sector**, representing almost 30% of our total energy consumption, to decarbonise our energy system and gives recommendations to foster a switch to RES heating appliances in existing and new buildings. It stresses the importance of architects and installers in increasing awareness among final consumers. In addition, the paper highlights the necessity to develop long-term decarbonisation roadmaps, with clear and coherent national plans and milestones for 2030, 2040 and 2050.

More information about the project can be found at www.front-rhc.eu .

Co-funded by the Intelligent Energy Europe Programme of the European Union