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Long road from policy targets to building performance

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Abstract

Following the Paris Climate Agreement in December 2015, policies adopted by all countries will increasingly aim to curb CO_2 emission levels. Policies translated into legislation, and various market support schemes will influence choices made by designers, contractors and building owners. Based on research carried out by BSRIA, this paper argues that it is time for all stakeholders in the process of building construction, including policy makers, manufacturers, architects, contractors and end users, to forge a holistic response to solving the problems of underperforming buildings.
Product-only related approaches, adopted by many countries, do not always deliver durable performance improvements, or raise the overall efficiency of a building.
The trend towards integrating renewable energy systems tends to increase the use of metering and controls, leading to a high level of system complexity. For such systems to deliver the promise of lower CO_2 emissions and to operate in a lean and energy-efficient way, a much higher level of knowledge, awareness and cooperation is needed on the part of all project stakeholders.

Keywords – policy goals; market developments; operational performance

Introduction

Mounting scientific evidence and a growing number of natural disasters occurring around the world are increasingly translating into global, regional and national targets for reducing GHG emissions.

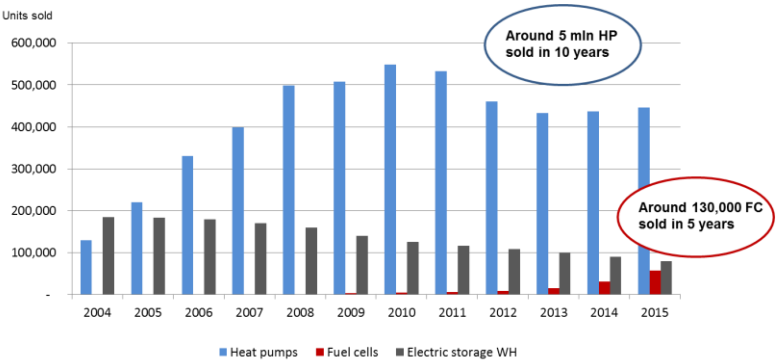
Worldwide, policies, regulations and support schemes are being introduced which should pave the way towards achieving the targets. Policies represent a strong driver for markets but the full extent of their impact can only be experienced if they look further than supporting a technology or product alone.

1. Policies' impact on market developments

In the last five years we have witnessed the release of different measures, in form of regulations or support mechanisms, across the world. Their impact on the markets has usually been strong but their effect in terms of meeting targets has varied from case to case. Sometimes, as in case of Japan, policy measures have resulted in marked technology shifts, setting things on a path towards meeting environmental targets.

As shown in Figure 1 below, within 10 years, heat pumps have effectively displaced electric storage water heaters in Japan and have become the mainstream product in both the new build and in the renovation market.

Figure 1. Sales of heat pumps, electric storage water heaters & fuel cells, Japan, 2004-2015



Source: BSRIA

The above success can be attributed to three **Cs**:
Cooperation / Coordination / Communication

and encompass the following **key points**:

- Clear policy goals,
- Transparent and continuous financial support,
- Partnership with manufacturers and the deployment chain,
- Coordinated action to spread awareness among consumers.

Following the successful introduction of the residential heat pumps to the Japanese market, the "three C" approach is now being deployed to accelerate the uptake of fuel cells, a technology that the Japanese government considers crucial to its policy of ensuring continuous and safe energy provision.

Despite the fact that fuel cell technology has been commercialised only recently (2009) and that the fuel cell products initially introduced were very expensive, sales supported by generous subsidies, the involvement of utilities and the powerful ENE-FARM recognition program have boosted the market to over 130 thousand units in the last five years (Figure 1).

Positive market developments have prompted manufacturers to intensify R&D activities and 2015 saw the introduction of new, smaller, more efficient and more affordable residential units, offsetting the gradual decrease in the government's financial support per unit.

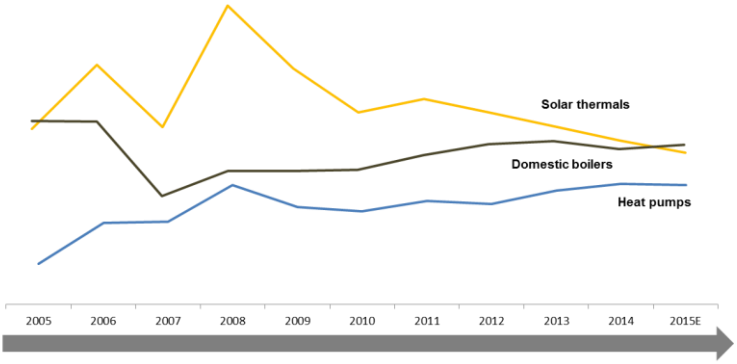
Such a comprehensive approach has, however, been an exception, as most governments restrict their involvement to the introduction of financial support mechanisms for specific products and stop short of creating the right environment for their deployment.

Particularly in the EU where, following the Kyoto protocol, an impressive set of overarching environmental goals has been adopted, we have witnessed the introduction of various financial mechanisms to support renewable-energy based heating products.

This product-based approach has been successful initially as far as market developments in some countries are concerned.

In Germany, where solar thermal installations have been subject to financial subsidies from an early stage, the market doubled in size between 2005 and 2008, reaching a figure of 2 million square metres sold (see Figure 2.) However analysed from a longer term perspective the story is far from being a reason for satisfaction.

Figure 2. Sales trends for solar thermals, heat pumps and domestic boilers in Germany, volume, 2005 - 2015



Source: BSRIA

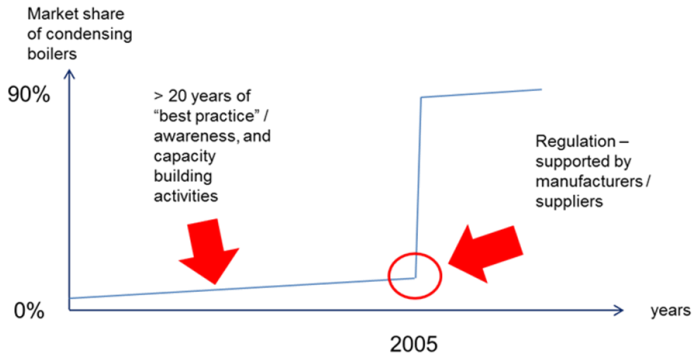
Generous incentives offered by the government fuelled a rush towards the product that was purely financially driven. A lack of understanding and experience on the part of both end-users and installers and the even more glaring absence of any comprehensive view of the role this technology is to play in the broader policy context have made the sales vulnerable to purely commercial factors. The big rises and falls visible in the chart represented in Figure 2 (above) relate to two major factors: availability of incentives that have been subject to the government's "stop / go" decisions and on the state of the energy market (including prices of fossil fuels).

A continuous downward trend seen in the market for solar thermals from 2011 onwards has been caused by the impact of the government's new energy policy that provided generous feed-in-tariffs for sales of photovoltaic (PV) systems causing a market boom followed quickly by significant decreases in the end-user price of PV systems. While this worked very well for PV systems it has caused problems for the solar thermal market.

One government policy has interfered with another. Households invested in attractive renewable electricity generation, while continuing to use traditional boilers for heating, as reflected in the sales trend for domestic boilers, shown in Figure 2 above.

In terms of regulatory approach, the UK should be quoted as an example of successful government intervention. As early as in 2005 the UK government introduced mandatory sales of condensing boilers for installations in households, new and existing. The domestic boiler market had become 95% condensing within 3 years (See Figure 3) while the commercial segment (where no such regulation has been in place) has been lagging behind - an 80% share of condensing technology for commercial boilers only being achieved in 2014.

Figure 3. Share of condensing technology among domestic boilers in the UK

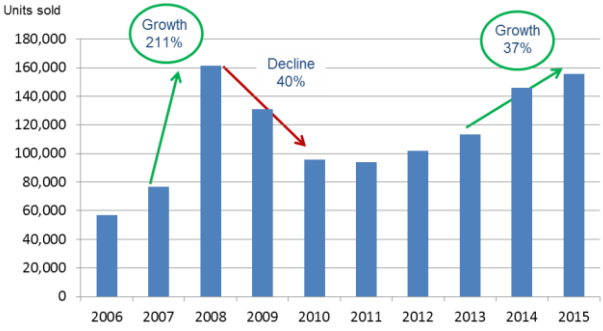


Source: BSRIA

Does this represent a big "success story"? It would appear so, but in fact, a significant proportion of installed condensing boilers do not condense, as the return temperature in the system is too high. The policy regulated the product but did not go further to ensure its performance lived up to expectations when installed in an actual heating system.

Since 2008, air-to-water heat pumps have been recognised as a renewable energy source in the EU. Developments on the French heat pump market (Figure 4.) illustrate clearly how support for a product that comes without consideration of the wider market background, including the level of the know-how down the value chain, can fail the goal it is pursuing.

Figure 4. French heat pump market sales, 2006 – 2015



Source: BSRIA

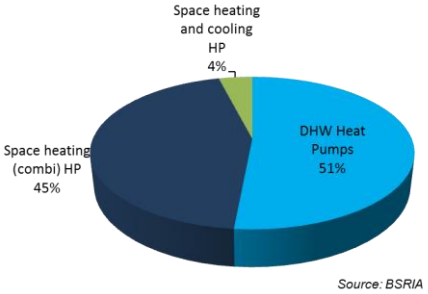
Increases in the tax credit incentive to up to 50% and spiralling fossil fuel prices combined with low electricity prices for residential consumers have created a favourable environment for growth in the market and sales of heat pumps tripled between 2006 and 2008 (Figure 4).

Suitable or not, heat pumps have been recommended by installers who saw them as an easy source of higher revenue. However a lack of professional knowledge about the product and its operational requirements resulted in faulty installations and disillusioned customers; this bad image stuck to the heat pumps and the market fell by 40% between 2008 and 2010 (Figure 4.).

Recovery has been slow - in the last two years the market has posted significant growth though this has been achieved thanks mainly to the popularity of domestic hot water heat pumps, which are easy to install, less costly than heating heat pumps and supported by a an attractive level of tax credit.

In 2015 this type of unit accounted for 51% of the French hydronic heat pump market (Figure 5) while in 2008, when the market was at its highest, this product accounted for a share of just 4%.

Figure 5. French hydronic heat pump market, sales by type of heat pump, 2015



A similar development has been observed on the UK market, albeit on a smaller scale. A survey carried out by the UK Energy Saving Trust in 2010, following the first wave of heat pump installations supported by the initial incentive scheme, revealed poor performance results for many installed products.

Nevertheless, the Survey represented a step in the right direction.

Monitoring of the efficiency, and hence the effectiveness of new technologies that have been installed represents a major step towards eventual success.

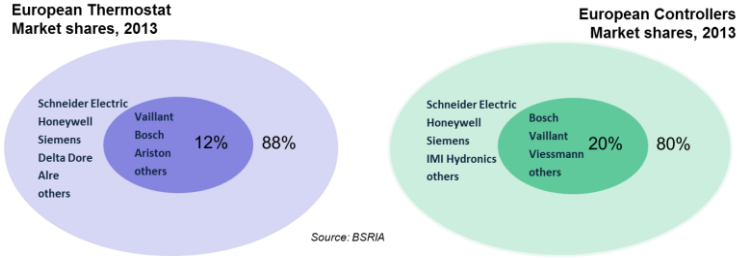
The European Directive for ErP has recognised this to a certain extent by introducing efficiency label for products sold as well as for the systems installed in the buildings.

The adoption of the ErP Directive and even more so the promotion of energy efficiency as independent energy source, have both emphasised the positive role of the energy efficiency. Consequently, controls have also been promoted as a way of improving this.

Advanced technologies are available to measure, control and manage the energy used in buildings. Specialised companies develop control devices and systems to enhance the performance of buildings and manufacturers of HVAC products integrate their products with these systems but sometimes also develop their own control devices to enhance the efficiency of their products and systems.

The share of large heating companies in the European thermostat market reached 12% in 2013, while in the same year their share in the European system controllers market accounted for 20%. (Figure 6.)

Figure 6. European Thermostat and System Controllers market shares, volume, 2013

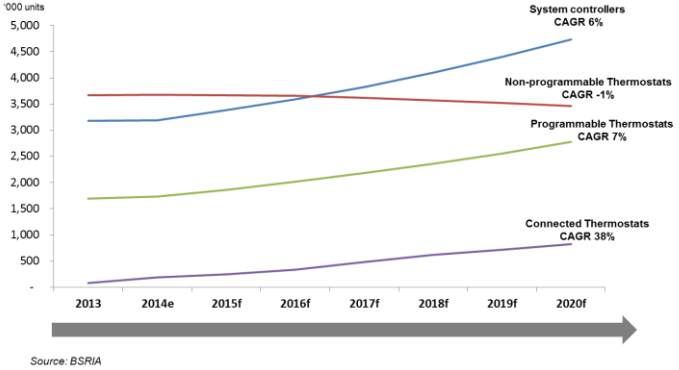


Controls are generally considered as the most cost-effective way of achieving a good level of energy efficiency for both products and systems hence their growth in popularity at all levels of the value chain in the construction environment.

Architects and system designers, contractors and end user are embracing controls by choice or simply by default (when integrated controls are delivered with a product or a chosen system). The general rush towards connected technologies prompted by the global availability of smart phones gives the uptake of HVAC controls another dimension.

The trend has already been confirmed in the main European markets by the growth in the sales of connected thermostats, expected to reach 38% compound growth, the highest by far for all control products, between 2013 and 2020 as shown on Figure 7 below.

Figure 7. Sales trend for System controllers and Thermostats based on data for UK, Germany, France, Italy & Poland



Source: BSRIA

The impact that controls have on the performance of buildings is in reality currently a long way from what could be expected.

A performance check carried out under Carbon Trust mentoring on UK buildings that were awarded grants for renewables between 2006 and 2010 discovered that the buildings were:

- Feature-packed with many unmanageably complex controls and with a BMS but often not functioning correctly;
- Still not finished or commissioned at the time of handover;
- Showing energy consumption over 3 times Part L compliance calculations;
- Fitted with LZC technologies that were often risky, fragile and bolted on to a fundamentally dysfunctional building.

The lack of a holistic approach to the building's HVAC system can result in a situation where one set of controls is in effect working against another as happened in one of the cases analysed, where controls managing the operation of the ventilation system were working against the controls operating the underfloor heating system. This occurred because the overarching BMS could not manage them both as communication protocols were not compatible.

Controls are soon to become the focus of the revised EPBD, hence policy makers will start covering them with regulations and incentive programs. Lessons should be learned from previous experience so that controls and integrated HVAC systems that they manage can achieve their full potential.

BSRIA therefore recommends that:

- It is not enough to oblige manufacturers to provide efficient products;
- It is not enough to prompt designers, contractors and customers to choose efficient products and controls;
- It is necessary to ensure high quality installation and commissioning;
- It is necessary to ensure that the system performs to specification after it has been installed;
- It is necessary that the building's operators and users can understand and operate the systems they are given.

Last but not least, qualitative mechanisms of support should be considered. They should focus on the responsibility to "deliver on the promise" meaning that the building should not only be equipped with efficient, smart technologies but that its operation should reflect the benefits that these technologies are capable of providing.

Australia has implemented the highly successful NABERS program where an Energy Commitment Agreement plays a crucial role; The US is at the initial stage of making the "Performance Contract" work.

Europe's plans to cut CO_2 emissions should focus as much on the promotion of efficient technologies, large and small, as on effective implementation programs where operational reality is at least as important as compliance with regulations and laws.

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