6 The policy instruments of European front-runners: effective for saving energy in existing dwellings?

Abstract

Existing dwellings receive frequent attention in climate change policy given the wealth of cost-effective, but un-exploited, energy saving potential within their walls. Policy attention also recognises the need for instruments that can navigate around barriers and maximise opportunities to achieve deep carbon reductions. However, there is a lack of evidence and knowledge about the instruments that can boast of success. In response to this knowledge gap, the instruments that form the main policy response to reduce energy consumed for space and water heating in existing dwellings in several front-runner European countries are assessed. Aims are to include, and to go beyond, an understanding of effectiveness based on reported reductions in CO_2 emissions and/or monetary savings on energy bills. Effectiveness is also judged on the basis of how instruments reflect policy instrument and energy policy concepts drawn from literature. Results show that the instruments that define action of front-runners differ significantly. Front-runners fail to reconcile all the identified concepts in their main instruments but some feature strongly. In this regard, selected countries established their main instruments over two decades ago, reflecting the concept of long-term instrument development and support. However, few front-runners adequately monitor and evaluate instruments to illuminate cause and effect. Front-runners struggle to diversify their core instrument approaches to capture 'hard to reach households' such as the private rental sector and lower-income households. The divergence in the instruments that form the main policy response of front-runners allows for the characteristics of a range of instruments to be analysed including regulations, information tools, taxes and incentives.

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§ 6.1 Introduction

The unparalleled energy saving potential of existing dwellings is widely established (BPIE 2011; McKinsey and Company, 2009; Schröder et al., 2011; Ürge-Vorsatz et al., 2007). However, evidence of policy instruments that tap into this potential is much less publicised. While building regulations form the instrument of choice for new build, an equivalent type of 'keystone' instrument for existing dwellings is less observable. Instead, the traditional approach to energy saving in existing dwellings revolves around economic incentives and information tools with numerous reports highlighting scope for improvement (Boardman, 2007; Höhne et al., 2009; WBCSD, 2009). Moreover, according to the European Commission (2011), market and regulatory failures are causes for the EU falling short on progress towards the 2020[13] energy efficiency target. This casts the spotlight on, inter alia, the types of instruments charged with meeting this target.

To gain greater knowledge of the type of instruments associated with success in meeting climate change targets for existing dwellings, a comparative study of several front-runner countries, Denmark, Germany, Sweden and the UK, was carried out. Countries were chosen based on their classification as front-runners according to literature. The instruments that define the main national action to existing dwellings were drawn from documentary sources and confirmed with national experts. Research objectives are to: (1) identify and characterise instruments considered as effective and (2) identify if and how energy policy and instrument design and evaluation concepts are reflected in instruments. Therefore, 'effectiveness' of instruments is interpreted as both the documented results of goal achievement and the extent to which instruments deal with aspects unique to this policy domain.

Literature from comparative public policy was used to structure research for the first objective (Rose, 2001). This literature provided guidance on how to choose cases for comparative study. Document analysis was carried out to characterise instruments reported as effective. To meet the second objective, the main instrument(s) used by front-runners were assessed against concepts from literature. Results from document analysis and instrument assessments based on concepts were verified with national experts (See Appendix 4).

A fundamental goal of this research was to deepen understanding of the content, mechanisms and scope of policy instruments. This responds to a research gap, 'the

13 European Union Member States are committed to 2020 targets: obligatory 20 % reduction in greenhouse gas emissions and 20 % increase in energy from renewable sources and an indicative 20 % improvement in energy efficiency.

purpose of almost all evaluations [i]s to measure the energy savings and cost... As a result, there has been almost no discussion in the global literature on energy efficiency about general principles ...' (Fairey and Goldstein, 2006, p. 8–64). Moreover, the purpose of many best practice studies appears to be describing the instruments of other jurisdictions as if the interest is replication. Using concepts from literature is an effort to go beyond traditional cost-efficient and cost-effective evaluations by searching for how instruments tackle, or fail to tackle, salient issues in this policy domain.

§ 6.2 Approach

§ 6.2.1 Policy instruments and data collection

Taking policy instruments as a variable for analysis receives support from a range of public policy commentators (Bemelmans-Videc et al., 1998; Eliadis et al., 2005; Linder and Peters, 1989; Howlett, 2010). Policy instruments can be defined as the concrete and specified operational forms of intervention by public authorities (Bemelmans-Videc et al., 1998, p. 4). Instruments are viewed as the means of overcoming market barriers or in terms of effect on the target group. Commentators, including Schneider and Ingram (1990) and Salamon (2002), discuss instruments in terms of influence on behaviour. In this way, an instrument can be conceived as the means 'to get people to do things they otherwise would not have done or it enables them to do things they might not have done otherwise' (Schneider and Ingram, 1990, p. 510).

To isolate tools for analysis, the instruments of front-runners were screened from a range of sources including comparative studies (e.g. Hamilton et al., 2010), National Energy Efficiency Action Plans (NEEAPs) (required by the European Energy Services Directive), assessments/reviews of NEEAPs (EEW, 2009; EC, 2009) and country reviews by the International Energy Agency (IEA). Instruments identified as defining action were isolated for deeper analysis. Sources used for the in-depth analysis included EU project reports and evaluations, national evaluations and peer- reviewed articles. It was decided to limit the study to the instruments that really define policy attention to existing dwellings for a number of reasons. Considering that there is a wide range of instruments in operation in different countries, a choice was made between seeking breadth or depth. What is more, it was discovered that there is often not enough data to fully characterise and assess the full range of instruments. It was further decided to limit the study to instruments aimed at reducing energy consumed

for space and water heating as this makes up approximately 70 % of residential energy use) (Itard and Meijer, 2008). The instruments analysed as part of research presented here are listed in Table 6.1.

	ECONOMIC INCENTIVES	ECONOMIC DISINCENTIVES	REGULATIONS	INFORMATION TOOLS
Denmark			Building Regulations	EPC
Germany	KfW loans & subsidies			
Sweden	Subsidies	Energy & CO_2 taxes		Local Energy Advisors
UK	Supplier Obligations			

TABLE 6.1 Instruments considered to dominate action in front-runner countries

It is emphasised that the instruments listed in Table 6.1 are not unique to any particular front-runner. Denmark also operates a Supplier Obligation, and many countries operate incentives and loan schemes, taxes and information tools. Under the requirements of the Energy Performance of Buildings Directive, all Member States have minimum requirements for major renovation and a requirement that the EPC is issued for dwellings during construction, sale and rental. However, some countries invest more in a particular instrument, state that the majority of energy savings are expected from certain instruments or implement instruments in a unique way. It is these instruments that form the focus of this study.

To verify and expand data obtained from secondary sources, national experts from the selected front-runners were sent questions relating to the characterisation of the policy instrument approach and results for each assessment concept (see Appendix 4). Phone interviews were held with experts from each front-runner case during Autumn/Winter 2011 to discuss results and finalise conclusions. Email correspondence formed an additional source of information for Germany, Sweden and the UK.

§ 6.2.2 Comparing and selecting countries

Comparing and learning from other jurisdictions is well established in policy analysis (Dolowitz and Marsh, 2000; James and Lodge, 2003). Comparing the instruments used by front-runners forms an evidence-based means of developing ideas and provides a window to possibilities, otherwise hidden by institutions, cultures and social structures (Rose, 2001). This window is considered especially useful in cases where the same instruments are used in many countries but appear to excel in some.

To identify front-runners, academic and policy documents on environmental policy in general and energy policy in the building sector in particular were examined (for example, Jordan and Lenschow, 2000; Liefferink and Andersen, 1998; EC, 2009; EEW, 2009). A review of instruments in operation in front-runner countries was conducted before: Denmark, Germany, Sweden and UK were selected for comparison. Front-runner countries are viewed as a fruitful base for learning and are defined as countries that set regulatory trends in policy fields (Jänicke, 2005, p. 130).

§ 6.2.3 Assessment concepts

Literature on policy instruments, policy design and evaluation, energy policy, market transformation and diffusion illuminate a range of concepts that can be used as a normative guide for assessing instruments. These are listed below and further elaborated:

- Instrument combination
- Long term framework
- Incentivising/obligating balance
- Target group differentiation
- Primacy to energy efficiency
- Whole house approach
- Energy sufficiency

  - *An instrument combination* is based on policy instrument literature and theories such as smart regulation which state that instruments should be chosen to interact and to maximise strengths and offset weaknesses of individual tools (Howlett, 2004; Gunningham et al., 1998; cited in Howlett, 2010). Furthermore, in terms of energy efficiency policy, multiple barriers require the combined effect of the instruments (WBCSD, 2009). Gunningham et al. (1998) discuss combinations as being negative and neutral. In the context of this analysis, the instruments considered to form the main action towards existing dwellings are assessed in terms of whether they form a strategic combination with other instruments.

  - *Long-term framework* is based on market transformation and diffusion theory and is considered necessary to 'embed' energy efficiency, transform the market and allow support for higher levels of energy efficiency (Fairey and Goldstein, 2006). A key factor considered necessary for market transformation is that long-term funding or supportive regulatory policies, but ideally both, are supported and sustained in effort over time until the market can sustain itself without public funding (Fuller et al., 2010). In the context of this research, the longevity

of instruments in terms of how long they have been active and the future planning of instruments is assessed.

- *An incentivising and obligating* balance follows the notion that policy should represent a 'give-and-take strategy', that a restrictive instrument should be combined with a stimulative one (cited in Bemelmans-Videc et al., 1998). In the context of this research, the instruments that dominate action in front-runners will be examined in terms of whether such a dynamic is evident.

- *Target group differentiation* is based on the idea that the target group represents a range of diversity differentiated by, inter alia, income level, housing quality, knowledge and awareness and potential to innovate. Two particularly 'hard to reach groups' in this domain are lower-income households and the private rental sector who face barriers of upfront investment and the split incentive, respectively (Boardman, 2007). As a result, bespoke instruments or mechanisms within instruments are required to reach these groups. Added to the barriers particular to these groups is that dwellings in these categories are frequently of the lowest energy efficiency which heightens the need for deliberate targeting. In the context of this research, the extent to which the dominant instruments account for this diversity, and if not what alternative instruments are used, is examined.

- *Primacy to energy efficiency* is based on the notion that the most energy-efficient and cost-effective approach is to provide an energy-efficient built envelope which dictates further requirements in terms of heating and cooling installations (Rovers, 2008; ECEEE, 2010). Whether the instruments that dominant action in the chosen front-runners follow an approach to energy saving that gives primacy to energy efficiency will be examined, for example, is an efficient building envelope a condition for a subsidy for a micro-generation technology?

- *A whole house approach* is receiving increasing popularisation given the ambition of climate change policies. Ambitious targets lead to arguments that instruments supporting single energy performance measures will be ineffective. Instead deep renovation drawing on a complete range of energy-saving measures is required (Mlecnik et al., 2010; Hamilton et al., 2010). This is especially the case when long-range targets to 2050 are discussed, in which case it is expected that emissions from the building sector will have to be reduced by 90% (BPIE, 2011, p. 99). When analysing the instruments of front-runners, whether they work towards single measures or whole house renovation will be examined.

– *Energy sufficiency* is interpreted as the desired end point of policy instruments, which is interpreted as a reduction in absolute energy use. However, often the implementation of an instrument or adoption of an energy saving measure by a householder is considered the end point (Wilhite and Norgard, 2003). Therefore, effective monitoring and evaluation of instruments and intended outputs are critical components to link cause and effect and to ensure instruments are sufficient for goals. This is especially necessary considering that energy use at household level and actual effects of energy-saving measures on household energy use remain imperfectly understood (Guerra Santin, 2010). This concept will be applied to the assessment that follows by examining whether the instruments of front-runners are associated with monitoring and evaluation programmes.

§ 6.3 Policy instruments of front-runners

The instruments considered to dominate national/federal policy action for existing private dwellings are presented here. Based on secondary sources, instruments are characterised in terms of content and effects. Drawing on secondary sources and using interviews and correspondence with national experts the dominant instrument approaches are assessed against the seven assessment concepts listed below:

– Instrument combination
– Long term framework
– Incentivising/obligating balance
– Target group differentiation
– Primacy to energy efficiency
– Whole house approach
– Energy sufficiency

If a concept is considered to be partly represented by the main instrument approach, it is assessed as weak; if a concept is explicit in policy documentation relating to the instrument, it is assessed as moderate and if a concept is made explicit and has associated results, it is assessed as strong. The assessment of all countries is displayed in Fig. 6.1.

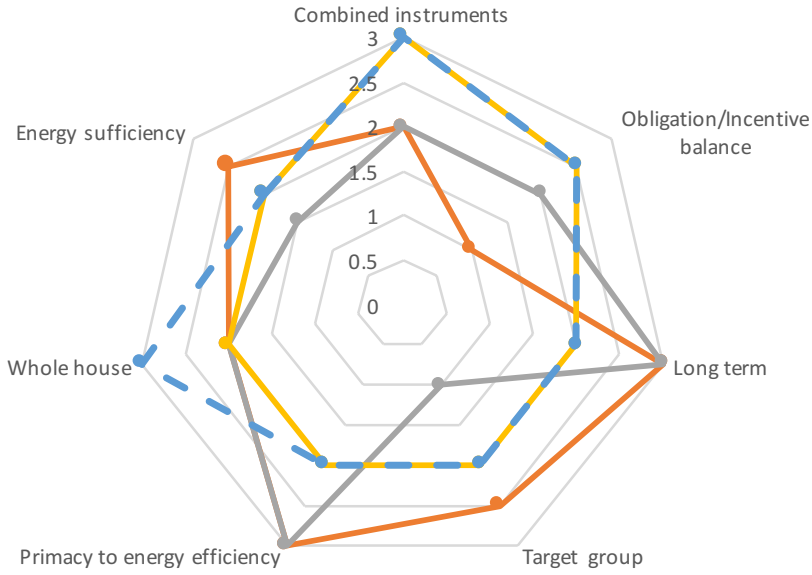

FIGURE 6.1 Assessment chart.
Scores: 0: absent; .5 transitional; 1: weak (concept partly represented); 2: moderate (concept explicit in policy documentation);3: strong (concept explicit with results)

§ 6.3.1 Denmark

§ 6.3.1.1 Policy background

Danish 2020 climate change goals include a 30% reduction in greenhouse gas emissions, 30% share of renewables and a 4% reduction in energy consumption from 2006 levels (DMCE, 2011, p. 8). A long-term goal is fossil fuel independence by 2050 with a ban on installing oil heaters in existing dwellings from 2017 forming part of this action (ibid). Taxes on energy and CO_2 emissions play a role in reducing energy consumption (Togeby et al., 2009). In the future, simultaneous strengthening of regulations for building components and obligations on energy companies are likely to play a greater role (DMCE, 2011). Strengthening of building regulations for renovation and installation replacement and improved functioning of the Energy Performance Certificate (EPC) form the current central instrument responses for existing dwellings (Hamilton et al., 2010; DMTE, 2005). It is planned that this approach will lead to a saving of 25% of current energy use compared to 2005 regulations (Hamilton et al., 2010, p. 49). It is these two instruments that form the focus of this assessment.

§ 6.3.1.2 Building regulations

Content The 2010 Building Regulations issue a comprehensive suite of component u value requirements required during conversion, or alteration of individual building components (DMEBA, 2010). Given that most countries typically issue regulations for existing dwellings during 'major' renovation, this can be considered more ambitious than the norm. Requirements respect a definition of cost effectiveness based on a calculation[14], which means that the energy-saving measure must pay for itself within 75 % of its expected lifetime (DMEBA, 2010, p. 136). As well as these 'non-major' renovation requirements, building regulations follow the definition of major renovation recommended in the EPBD[15]. In the case of single-family houses, regulations during major renovation only apply to the part of the building undergoing renovation; for all other cases, regulations apply to the complete building. A link with the EPC is evident as the measures considered cost-effective during renovation as well as outside renovation activity are listed therein.

Effects Research identifies a considerable potential for renovation such that 30–35% of energy used for heating could be saved offering a reasonable payback time (Gram-Hanssen and Christensen, 2011). Whether this effect is reached is not precisely known due to a lack of monitoring and evaluation. Although a large-scale evaluation was conducted of the national energy efficiency portfolio in 2008, building regulations and the impact on existing dwellings do not appear to have been included. Expert opinion and secondary sources note that while impacts are not attributed to regulations with high precision, the opinion is that they have a strong market effect especially in terms of the development of innovative products (Hamilton et al., 2010).

§ 6.3.1.3 Energy Performance Certificates

Content EPCs were introduced to Denmark in 1997 predating their introduction through the Energy Performance of Buildings Directive (EPBD) and exceeding directive requirements in ambition (Togeby et al., 2009). For example, EPCs are valid for 5 years instead of 10 required by the EPBD. Additionally, recommendations in EPCs follow two trajectories: immediately feasible measures and measures feasible during a major renovation.

14 Measures are considered cost-effective if annual saving multi plied by the lifetime divided by the investment is greater than 1.33 (DMEBA 2010, p. 136)

15 ".. building works on the building envelope or installations which effect more than 25 % of the building envelope, or whose value is higher than 25 % of the value of the latest public property valuation, excluding the value of the plot" (DMEBA 2010, p. 140).

The EPC in Denmark has suffered from well documented implementation issues. In 2007–2008, it was estimated that 50–60 % of properties sold had EPCs (cited in Gram-Hanssen and Christensen 2011, p. 12/13). Although mandatory, EPCs were not associated with any particular promotion campaigns perpetuating a situation of low awareness (Joosen and Zegers, 2006). Empirical research demonstrates the importance of building and sustaining a good reputation in the energy certification system (Gram-Hanssen et al., 2007). However, a feeling that EPCs were too expensive and unreliable was pervasive (Joosen and Zegers, 2006). Negative media attention created scepticism among the public, with, for example, EPC recommendations considered as 'copy and paste' efforts (Gram-Hanssen et al., 2007). Furthermore, key stakeholders such as estate agents were said to have been unsupportive of implementation (Laustsen and Lorenzen, 2003).

Effect Research on the effects of EPCs is at best inconclusive. One study found that EPCs had an impact on investment priorities with more technically demanding improvements conducted on dwellings with EPCs than those without (Laustsen and Lorenzen, 2003). Analysing impact in terms of actual energy use showed that dwellings with EPCs did not demonstrate reduction in gas use over dwellings without but whether renovation work had taken place was not factored in (Kjærbye, 2008). In terms of an effect on property marketability, 38 % of a sample of Danish householders who received an EPC considered it important or very important in making an offer (Adjei et al., 2011, p. A264). Meanwhile, 11 % used the EPC during price negotiation (ibid).

The comprehensive evaluation of the national energy efficiency portfolio in 2008 concluded that the EPC was not cost-effective (Togeby et al., 2009). This conclusion was based on aspects such as the €650 cost for the EPC often for householders not interested or ready to receive the information (ibid) and supported by data from the Kjærbye (2008) study stating that gas use between dwellings with an EPC and without was undifferentiated.

§ 6.3.1.4 Assessment concepts

The *policy instrument combination* concept is charted as 'moderate' in Fig. 6.1. Combined instrument action exists between the EPC and building regulations with, for example, EPCs required after major renovation. Nevertheless, these instruments do not form a powerful positive combination especially considering the EPC, for a large part of the housing sector, does not seem to guarantee energy savings. Using the typology of interactions of Gunningham et al. (1998), the combination could be considered neutral.

The *obligating/incentivising balance* is also judged as 'moderate'. While obligations are considered strong with component requirements even for 'non-major' renovation, this concept is weakened by the absence of an incentivising balance. According to a national expert, this may change in the future with proposals for incentives like green loans in response to the 2050 Energy Strategy.

Clear and strong elements of a *long-term strategy* are in place with a mandatory EPC introduced in 1997 and a clear role for existing dwellings in building regulations. The dominant instruments are grounded in legislation securing their persistence. The 2050 Energy Strategy provides a long-term view giving preparation time to the market. As a result, the long-term concept is plotted as 'strong'. As can be expected from instruments rooted in the transaction and renovation processes, there is no *differentiation of the target group*. Furthermore, according to a national expert, there are currently no complementary instruments used for 'hard to reach' groups. As a result, this concept is plotted as 'weak' in Fig. 6.1.

Danish support of component level requirements in building regulations demonstrates that thermal performance of the building envelope is central. As a result, *primacy to energy efficiency* is plotted as 'strong'. However, building regulations and the EPC focus on a single measure-based approach. During an expert interview, it was noted that promotion of the *whole house perspective* takes place but it remains a major challenge to integrate it into an instrument while respecting the economic capability of householders. As a result, the whole house concept is charted as 'moderate'.

Whether energy consumption is actually reduced because of instruments is touched upon in evaluations but not consistently monitored. While a comprehensive evaluation of instruments was conducted in 2008, it was based largely on cost effectiveness. It remains that instruments lack clear and consistent monitoring frameworks to prove cause and effect. Although this cause–effect precision is lacking, a national expert reported correlation between building regulations and energy consumption reduction as strong. As precision is lacking about whether instruments directly lead to expected savings the concept of energy sufficiency is plotted as 'moderate'.

§ 6.3.2 Germany

§ 6.3.2.1 Policy background

Germany's climate change targets include a 40% reduction of GHG emissions with a 1990 baseline, 20% reduction in primary energy consumption and building heating energy use with a 2008 baseline and an 18 % share of renewable energy generation by 2020 (OECD/IEA, 2008). To meet targets, an estimated 20 million dwellings require renovation by 2020 (KfW Bankengruppe, 2010). In response, one estimate is that the thermal retrofit rate will have to increase from 0.8 to 2% per year (Neuhoff et al., 2011, p. 3). A range of instruments are in place to reach these targets; however, the dominant policy instrument for existing dwellings is the economic incentive programme operated by the federal development bank Kreditanstalt für Wiederaufbau (KfW) (Rosenow, 2011). KfW loans and grants are coordinated with federal incentives for energy advice and building regulations (Energy Savings Ordinance, EnEV) and are specifically geared to bring existing dwellings in line with, or beyond, new build standards. Alongside this, the EnEV issues component-based regulations during the renovation trigger as well as general retrofit stipulations, for example, insulating un-insulated heating pipes (Engelund-Thomsen et al., 2009). Furthermore, EnEV contains an option of meeting 140% of the energy requirement of new build instead of component requirements during renovation. This comes close to a form of energy performance standard for existing dwellings.

§ 6.3.2.2 KfW incentives

Content Since 1996 KfW loans have targeted energy efficiency in pre-1979 buildings (Korytarova, 2006, p. 7). According to a national expert, funding has traditionally been announced on an annual basis although from 2011 funding was secured at €1.5 billion annually until 2014. Terms and conditions of loans are viewed as highly attractive; they are long term, pre-payment is possible without extra charges and combination with other incentives is possible (Hamilton et al., 2010). In 2011, interest rates were approximately 2.30–2.85% depending on the contract period (Rosenow, 2011, p. 264) approximately 1 to 2% lower than contemporary market rates.

Five levels of loans are available for the 'KfW Efficiency House' standard. The most ambitious is KfW Efficiency House 55 which represents 55% of the maximum primary energy requirement as specified by regulations for new build (KfW Bankengruppe, 2011). Repayment bonuses form an additional strong incentive; for example, 12.5%

is taken off a loan if KfW Efficiency House 70 is achieved (ibid). KfW incentives offer considerable subsidisation of energy based retrofit. Neuhoff et al. (2011, p. 8) found that one third of the incremental costs to reach new build standard are subsidised and one half if 55% of the standard is reached. In the event that a particular level cannot be achieved, financing is available for single energy saving measures.

Effects The KfW programme has achieved some impressive results. Since 2006, approximately 2.2 million tons of CO_2 emissions have been saved annually with 188 million € saved on household bills (Hamilton et al., 2010, p. 62). From 1990 to 2006, CO_2 emissions from existing dwellings were reduced by 24%, a reduction largely attributed to the KfW programmes (cited in Schröder et al., 2011, p. 10). However, whether free rider and rebound effects are reflected in these figures is not mentioned. Furthermore, doubt about whether incentives are adequate to reach the 20 million dwellings requiring retrofit by 2020 has been aired (Hamilton et al., 2010; Schröder et al., 2011). Previous years have witnessed approximately 230,000 dwellings per annum being reached by KfW financing (cited in ibid, p. 68) lower than expected to reach the 2020 target. While there is doubt in terms of scope, few appear to question the ambition of this instrument. According to a national expert in the first half of 2011, almost 40% of loans for the 'KfW Efficiency House' were for renovations pledging to go beyond new build requirements. The cost effectiveness of this ambition, however, has been questioned. Galvin (2010) argues that achieving the lower standards offered by the KfW programme is considerably more cost-effective in terms of energy saved per euro invested and in terms of return on investment over the lifetime of renovations than reaching for the higher standards.

§ 6.3.2.3 Assessment concepts

In terms of the first concept of a combined instrument approach, the synergistic relationship with KfW incentives stimulating renovation beyond minimum building regulations is plotted as 'strong' in Fig. 6.1. The second concept of an *obligating/ incentivising balance* is considered 'moderate to strong' given that building regulations not only issue requirements during the renovation trigger but also issue general retrofit requirements for some components with incentives available to reach these through KfW loans for individual measures.

The *long-term framework* concept is listed as 'moderate', although in operation since 1996 there is some uncertainty about funding beyond 2014. Funding has been typically announced annually although currently there is guaranteed funding until 2014. However, Rosenow (2011) highlights the vulnerability of this instrument to political change noting for example that budgetary constraints reduced funding in 2010.

The *target group differentiation* concept is plotted as 'moderate' as the often marginalized private rental sector is reached, but uncertainty remains about whether lower income groups are reached. Private homeowners are the main recipients of KfW loans at 41% with private landlords at approximately 33%, figures that generally reflect the tenure division (KfW Bankengruppe, 2011). According to a national expert, repayment bonuses are considered an incentive for sub-groups such as private landlords. The comparatively high supply of private rental dwellings also results in competition between private landlords which may explain how this tenure group is motivated to improve energy efficiency (Schröder et al., 2011). Less obvious are participation rates of lower-income householders. Fuel poverty is not a strong policy discussion point in Germany (Rosenow, 2011). According to a national expert, KfW do not request and/or collect data on income profiles. This is because loans relate to the energy performance potential of the building and not the financial capacity of the applicant. However, Galvin (2010) notes in his study that the substantial investment required by householders to meet ambitious standards precludes the participation of lower income householders.

Primacy to energy efficiency is recorded as 'moderate'. While a holistic approach to energy performance with a starting point of energy efficiency is explicitly supported by the different KfW Efficiency House levels support for single measures within KfW does not depend on a building envelope thermal standard. Meanwhile, the whole house approach is considered 'strong' as it is explicit in the KfW Efficiency House levels. While single measures are supported with KfW finance, this is in response to economic difficulties of reaching KfW Efficiency House levels in some dwellings. Moreover, applicants following the 'Efficiency House' approach receive more generous funding than those following the single measure approach (Schröder et al., 2011).

The *energy sufficiency* concept is plotted as 'moderate' given some uncertainty about actual versus theoretical savings. A number of evaluations show that energy savings have been achieved with the KfW scheme (see Rosenow, 2011). A national expert confirmed that recipients of KfW incentives must confirm that measures have been carried out but actual energy consumption is not monitored.

§ 6.3.3 Sweden

§ 6.3.3.1 Policy background

The IEA described Sweden's energy policies as 'sound and sustainable' (OECD/IEA, 2008, p. 27) with an objective of reducing energy consumption per unit of heated area in homes by 20% by 2020 and 50% by 2050 with a 1995 baseline (Ministry of Sustainable Development, 2006). Sweden is frequently promoted as a model country in terms of decoupling economic growth from environmental degradation (Fouche, 2008). A key role in this reduction is attributed to a decentralised energy supply focused on conversion of electric and oil-fired boilers to district heating, heat pumps and biofuel-fired boilers. In addition, district heating has changed from fossil fuels to biofuels with increased heat recovery from waste (Ministry of Sustainable Development, 2006). This reflects a typical focus in Swedish energy policy on supply side issues (Khan, 2006; Kiss and Neij, 2011). Alongside accolades, commentators note complacency in Swedish policy which they see as a reaction to CO_2 emissions being considerably lower than European counterparts (McCormick and Neij, 2009).

The 2011 National Energy Efficiency Action Plan states that the "task of government policy is to identify and eliminate 'market failures', principally externalities and a lack of information" (SOU 2011, p. 8). This is reflected in the two policy instruments that, on the basis of literature review and expert interview, are considered to characterise Sweden's approach to energy performance improvement in existing dwellings: economic tools-subsidies and taxes and information tools -local energy advisors

§ 6.3.3.2 Economic tools

Overview Economic incentives have played a consistent role in Swedish residential energy policy since the 1970s and are primarily developed to support new technology or systems (McCormick and Neij, 2009). From 1977 to 2010, 16 national economic incentives are reported and 1994 appears to be the only year that some form of incentive was not in place (cited in ibid, 2009, p. 9–10). Incentives from the 1970s to the turn of the century typically focused on insulation measures and ran for 1 to 2 years (ibid). From 2000, incentives focused on supporting conversion to more sustainable energy sources in particular to biofuel boilers, heat pumps, solar heating systems and district heating (ibid). More recent incentives operate over longer time frames—3–5 years. Incentives manifest as grants and tax exemptions and commonly cover 30% of investment costs (ibid). Current incentives (2011) include a 50% tax relief on renovation work for properties

older than 5 years and a subsidy for solar heating systems (SOU, 2011). While the tax relief programme covers energy performance work, the main intended effect is to reduce black market labour. Reaction to problems in the construction sector as opposed to proactive energy conservation is said to underpin many subsidies 'when unemployment disappeared so did the support schemes' (cited in Sprei et al., 2006). Two taxes work towards reducing or influencing more sustainable energy use in Swedish households (Nair et al., 2011). An energy tax based on per unit use and a CO_2 tax based on carbon content with biofuels and peat exempt (ibid). It is aimed that the CO_2 tax contributes to the three goals of greenhouse gas reduction, increase in renewable energy generation and energy efficiency (SOU, 2011). Since its introduction in 1991, the CO_2 tax has increased fourfold from €27 to €100/ton CO_2 in 2001 (Nair et al., 2011, p. 7–472).

Effects Unfortunately, incentives have been associated with little in the way of strategic evaluation (McCormick and Neij, 2009). A survey of householder perceptions of instrument effectiveness conducted by Nair et al. (2011) found that subsidies and tax deductions were considered most effective. These were followed by energy labelling of products and the energy tax. Meanwhile, only 23% of respondents considered the CO_2 tax as effective (ibid, p. 7–472). While energy end users may not consider the CO_2 tax effective, in wider policy terms it is considered positively as having contributed to more efficient use of energy and having influenced the choice of heating systems (cited in Mc-Cormick and Neij, 2009) particularly the increased use of biomass in district heating systems (Johansson, 2000).

An interesting effect of economic tools is the synergetic effect, 'where two instruments enhance each other's effects' (Gunningham et al., 1998, p. 16). Subsidies for conversion of energy supply and the CO_2 tax have created such synergy. Between 2006 and 2010 householders with resistance heaters were eligible for an incentive to install water filled radiators if they concomitantly converted to district heating or installed a heat pump or equipment covering 70% of the heat demand using biomass as a fuel (Joelsson and Gustavsson, 2008). Further leverage was the CO_2 tax with its rate directly related to carbon content of fuel and with an exemption for biomass.

Another synergetic effect is observable with subsidies and technological procurement. Improving the commercialisation of newly developed energy efficient technologies has formed an important facet of Swedish energy policy since the 1990s (Högberg, 2007; McCormick and Neij, 2009). The Swedish Energy Agency sets up partnering deals with buyer groups to promote design innovation in energy performance technologies. Heating and control systems, domestic hot water systems, ventilation and energy efficient windows have been particular areas of attention (McCormick and Neij, 2009). Procurement policy is a key factor for Sweden having one of the world's most mature heat pump markets and for the development of highly efficient windows (Kiss and Neij, 2011). Kiss and Neij (2011, p. 9) note that best available technology for windows

improved from 1.8 W/m² K in the 1970s to 0.7–0.6 W/m² K in 2010 while in the same period the market share of energy efficient windows increased from 20% in 1970 (average U value of 2.0 W/m² K) to 80–85% in 2010 (average U value of 1.3–1.2 W/m² K). The authors see several instruments as important to diffusion including economic and information tools (ibid).

§ 6.3.3.3 Local energy advisors

Overview Energy policy in Sweden reflects a 'long tradition of mass schooling' and 'a strong belief in information campaigns and the ability to change through learning (cited in Löfström and Palm, 2008). 'The measures to increase energy efficiency are focused on policy instruments that support the efficiency that occurs spontaneously in society and that are adjusted to market mechanisms, especially actions to spread information and knowledge' (Högberg, 2007, p. 6). Among the longest running information instruments is national support for Local Energy Advisors (LEAs).

Central government has funded municipal energy advisors since the 1970s (with a hiatus between 1986 and 1998) (Mahapatra et al., 2011, p. 1). Municipalities have the option of requesting state support for the employment of an advisor and all 290 municipalities avail of this (SOU, 2011). Owners of single-family dwellings form the main target group (cited in ibid). The aim is to disseminate objective information concerning environmentally friendly energy supply and more efficient energy use to the public. Commonly, LEAs support other tools, namely by providing information on economic incentives.

Effects Reportedly municipal energy advisors reach approximately 200,000 individuals a year. With a population of approximately 9.2 million (Hamilton et al., 2010, p. 103), this translates to just over 2 % of the population seeking energy advice annually. Reportedly the programme is weakened by the low use (McCormick and Neij, 2009; Mahapatra et al., 2011). In a survey on effectiveness from an end user's point of view, 30% stated that LEAs encouraged them to adopt energy efficiency measures (Nair et al., 2011). Two separate research projects show that 50 and 35% of respondents were aware of LEAs (cited in Mahapatra et al., 2011).

On a positive side, the instrument is considered to function as a positive complement to other instruments (ibid). Research by Palm (2010) found that energy advisors represented a good way to reach households but recommended that a more active and differentiated approach to targeting households should be developed. Furthermore, Palm (2010) found that homeowners frequently contacted LEAs to receive confirmation that their decision was correct in terms of energy performance works. Information on subsidies is another frequently stated reason for contact (Mahapatra et al., 2011).

§ 6.3.3.4 Assessment concepts

The *combined instrument concept* is recorded as 'strong' for Sweden. The promotion of energy efficiency technology, the provisions of subsidies for over three decades (which of late focus on more sustainable energy supply through district heating, solar heating systems and/or heat pumps), taxes and information provision suggests a careful and positive mix of policy instruments. This instrument mix has also benefitted from a strong starting position: a long history of stringent building regulations (with among the world's highest standards for insulation components) and a low carbon energy portfolio (with electricity from nuclear and hydropower forming the highest percentage for space heating) (Hamilton et al., 2010, p. 104).

Instrument mixes, in the past at least, have not necessarily balanced between *obligating/incentivising* but more aptly between dis-incentivising/incentivising. This is most evident during energy supply conversion efforts with subsidies for renewable based heating supply and taxes based on carbon content. Though not strictly obligating/incentivising, the mechanism behind this concept is in evidence and is therefore plotted as 'moderate to strong' in Fig. 6.1.

Dominant instruments have operated over long time frames, for instance, the Local Energy Advisor scheme and subsidies for energy saving began in the 1970s and have operated almost consistently since that time. Meanwhile, procurement of energy efficient technologies and taxes were introduced in the 1990s. Some criticism surrounds the 'stop start' nature of subsidies and the underlying goals of subsidies being focused on assisting the construction industry rather than fuelling a strong and focused energy policy. Less clear is what future instruments will resemble especially those charged with reaching 2050 targets. According to expert interviewees building regulations during renovation will likely play a much more important role in the future. As a result of uncertainty in the future framework, the *long-term* concept is plotted as 'moderate' in Fig. 6.1.

Policy documentation states that the aim of policy instruments is to harness naturally occurring efforts to improve energy efficiency. This suggests that the *target group is undifferentiated*. According to a national expert, the split incentive is recognised as an issue but the private rental sector is not targeted in a unique way with national instruments. Similar to some other front-runners, fuel poverty is not considered an issue in Sweden; therefore, according to a national expert, designing instruments to reach lower-income households is not a policy consideration. As most economic instruments focus on reducing cost price (by 30%) or issuing tax credits, it could be assumed that lower-income householders are less likely to participate (see Stern et al., 1986). The concept of target group differentiation is plotted as 'moderate' because sub-groups such as lower-income households are considered less in need of policy attention due to social equity considerations but reaching the private rental sector remains an issue.

Economic incentives in the 1980s and 1990s focused on improving the thermal envelope giving *primacy to energy efficiency*. Moreover, the benefits of early and strict building regulations are reflected in the existing stock. With average consumption per floor area for heating, hot water and electrical appliances at 146 kWh/m² in 1990–1995 Sweden reached a level over a decade ago that other European countries are still striving towards (OECD/IEA, 2008). However, commentators mention stagnation of energy efficiency policy since the 1990s (Nässén and Holmberg, 2005). More recent instruments demonstrate a strong focus on supply side energy policy. According to a national expert, the subsidy for solar heating active in 2011 did not depend on the energy efficiency of the property. Moreover, a recent study reported that only 15% of all cost-efficient measures in the building sector are likely to be carried out (Persson et al., 2009, p. 75). Similarly, a national expert stated that primacy to energy efficiency is high on the agenda but is lost in implementation. Given the strong baseline position in terms of energy efficiency, but the apparent current lopsided focus on supply, primacy to energy efficiency is plotted as 'moderate'.

Based on similar reasoning as with the primacy to energy efficiency concept, attention to the *whole house* concept is plotted as 'moderate'. A national expert reported that while 2020 targets for energy efficiency are on track, achievements are pushing 2050 targets further away as householders are carrying out the easier measures making deeper retrofit less cost-effective. Despite this, there is evidence that major property purchaser groups in Sweden have developed renovation concepts based on the whole house approach. While they remain voluntary, according to a national expert, they are said to represent a large group. According to national experts, improving the detail and focus of evaluation efforts is considered necessary and as a result *energy sufficiency* is plotted as 'moderate'.

§ 6.3.4 UK

§ 6.3.4.1 Policy background

The UK has one of the strongest policy backgrounds of the studied cases with the Climate Change Act issuing a statutory obligation to reduce CO_2 emissions by 80% by 2050 on 1990 levels (Ofgem, 2011, p. 2). Alongside this is a statutory obligation to eradicate fuel poverty by 2016 (HCCLGC, 2008, p. 16). Challenges associated with improving existing dwellings are heavily publicised. Over 40% of the stock contains 'hard to treat' features such as solid wall construction (BRE, 2008, p. 1). Furthermore, fuel poverty affects approximately 2.4 million households (HCCLGC, 2008, p. 16).

Some unique instruments poised to enter the policy landscape answer the need for innovative policy responses. The 'Green Deal', an innovative financing 'pay as you save' arrangement attached to properties instead of owners/occupants, is due in 2012. A proposed Renewable Heat Incentive, to be introduced alongside the Green Deal, will be the first feed-in-tariff system supporting heat generation in Europe (DECC, 2010a). The Energy Act 2011 contains provisions that will make it unlawful to privately rent out properties below an EPC rating of E (DECC, 2011).

Current action towards energy saving in existing dwellings is the much applauded Supplier Obligation (SO)—the Carbon Emissions Reduction Target (CERT) (Höhne et al., 2009). This is a legal obligation on electricity and gas suppliers to achieve carbon emissions reduction targets in the household sector (Ofgem, 2011). In its current phase, CERT operates from 2008 to 2012 with expected lifetime CO_2 emissions reduction of 293Mt (ibid, p.1).

§ 6.3.4.2 CERT

Content CERT has operated in the UK since 1994 and applies to household gas and electricity suppliers with 250,000 plus customers (DECC, 2009; Rosenow, 2012). Suppliers receive a carbon reduction target based on their customer base. A predetermined carbon score is attached to energy performance measures approximately 40% of which must be achieved in priority groups such as low income households (DECC, 2010b). Under a separate obligation—the Community Energy Saving Programme (CESP)—suppliers must meet specific targets in defined low-income areas and adopt a whole house approach in meeting these targets (ibid). The enforcement body, Ofgem, has powers to penalise energy suppliers for non-compliance (Ofgem, 2011). The cost of CERT is funded through increases in customer bills (DECC, 2010b).

Effect CERT is viewed extensively as a success in terms of suppliers achieving their set targets and societal cost benefits (Ofgem, 2011; Lees, 2008). Suppliers spent approximately €2 billion as part of CERT from 2002 to 2008 (Rosenow, 2011, p. 266). Meanwhile, DECC (2010a, p. 6) state that over 7.5 million dwellings have been subject to full or part subsidy measures giving an annual saving of £45 on household energy bills. During the 2005–2008, phase costs to consumers amounted to approximately £7 per fuel per year and £5 for low income groups (DECC 2009, p. 7). In terms of the fuel poverty objective, Lees (2008, p. 5) notes that in the 2005–2008 cycle, over 1.1 million low income households were assisted with fuel switching and insulation.

However, CERT is not without its criticisms; a repeated one is the focus on 'low hanging fruit' (HCCLGC, 2008). Negative media attention highlighted mass unsolicited mail

outs of light bulbs with lighting accounting for over 25% of carbon considered saved by CERT's third year (Ofgem 2011, p. 1). Independent evaluations have proposed that the whole house approach be adopted and critique the 'lost opportunities' in dwellings receiving 'some' improvement (Lees, 2008).

Whether CERT reaches across tenure groups is another point for attention with acceptance that the private rental sector and hard to treat dwellings are unlikely to benefit (DECC, 2010a). Reinforcing this is that the private rented sector comprises the greatest proportion of hard-to-treat dwellings at 50% (BRE, 2008, p. 1). Parag and Darby (2009) view an issue with CERT to be the passivity introduced to householders, arguing that they are not motivated in psychological, social or economic ways to reduce energy demand.

While the SO has won praise for the integration of social objectives, with 40% of measures targeted to priority groups, this also forms a source of contention. It is argued that all households contribute through bill increases but not all receive measures, as a result, higher-income households receiving measures are receiving subsidies from lower-income groups if they too are not receiving measures (OECD/IEA, 2008). Some energy suppliers claim that if the primary aim of CERT is carbon reduction, then allocating a disproportionate amount of resources to lower-income groups—the lowest energy consumers—is counter intuitive (cited in HCCLGC, 2008). The argument from these dissenting voices is that fuel poverty is better tackled through direct policies (OECD/IEA, 2008).

§ 6.3.4.3 Assessment concepts

Multiple and innovative tools are in place or poised to tackle existing dwellings, but as yet they do not form a strategic combination. Therefore, the *combined instrument* concept is plotted as 'moderate'. The *obligating/incentivising* concept is considered 'weak' considering that householders are entirely incentivised to carry out energy-saving measures. CERT shows the strength of a *long-term approach* with short-term cycles for targets with the result that improvements and adjustments are made and certainty is offered to stakeholders. As a result, this concept is plotted as 'strong'.

CERT and its preceding versions have deliberately differentiated attention with a special focus on vulnerable households such as lower-income groups and pensioners. It is acknowledged that CERT fails to reach the private rental sector. This group will be targeted through the Green Deal and in the future through legislation making it unlawful to rent out EPC rated properties lower than E. Given that CERT does much for sub-groups but does not completely *differentiate the target group*, this concept is plotted as 'moderate to strong' in Fig. 6.1.

Although, at macro policy level, energy efficiency and renewable energy policy in the UK is often criticised for poor integration (Warren et al., 2011), at the level of CERT *primacy to energy efficiency* is considered 'strong'. This concept was incidentally supported by the plucking of low hanging fruit, and the importance of improving energy efficiency is apparent with the recent amendment to CERT which requires that 68% of investment be dedicated to insulation (DECC 2010b). Moreover, it is reported by a national expert that micro-generation measures performed under CERT are only approved if they are conducted in a dwelling that is efficiently insulated. Meanwhile, increasing attention to the notion of *whole house* retrofit is evident in CESP, which obliges energy suppliers to meet targets in low-income areas using this approach. Nonetheless, it is not yet the status quo and is therefore plotted as 'moderate'.

Energy sufficiency is considered 'moderate to strong' as according to a national expert while actual energy savings after implementation of energy saving measures are not measured, savings are calculated theoretically when suppliers have closed the scheme. Moreover, progress is tracked with regular publications and evaluations (Ofgem, 2011).

§ 6.4 Effective for reaching energy savings in existing dwellings?

A research objective was to identify and characterise the instruments that are considered to dominate policy action for existing dwellings in Denmark, Germany, the UK and Sweden. It emerged that the instruments dominating the action of front-runners differ remarkably. The German approach is characterised as mainly subsidising but at a highly ambitious level, the Danish approach with making tough demands at natural moments like renovation, the Swedish approach with subsidising and taxing with a long-term view of converting energy supply towards renewable sources and the UK approach with obligating energy suppliers and using their 'outreach' capacity to reach energy end users. While this makes comparing the effectiveness and efficiency of the different approaches difficult, it provides rich data into how the various energy policy and policy instrument concepts are managed.

Countries studied here demonstrate why they are at the forefront of policy action for existing dwellings in Europe. Denmark and Sweden offer glimpses of a future of fossil free energy use in existing dwelling, with Denmark initiating a phase out of oil boilers in this decade and with consistent efforts in Sweden to convert to renewable energy supply sources. The main aim of German federal level incentives is to bring existing dwellings in line with or beyond new build standards. Meanwhile, the UK set their policy commitments as legal obligations giving the issue of energy saving in existing dwelling a permanent place on the agenda.

A second objective was to identify whether and how energy policy and instrument design concepts are reflected in instruments. Analysis of front-runners confirms that they have been embedding existing dwellings in long-term policy frameworks for some time. Some of the most prevalent instruments discussed here—the EPC in Denmark, KfW incentives in Germany, taxes and procurement in Sweden and Supplier Obligations in the UK-were introduced in some form in the 1990s. With some exceptions, there is certainty that instruments, as they exist now, will persist in similar form into the future.

However, a long-term framework alone is not enough to embed energy efficiency to the extent aimed for. All front-runners report complexities with achieving ample ambition in energy saving and high participation from households. Achieving a balance between ambition and participation proves elusive with the UK achieving high participation but with criticisms of prolific distribution of low-level single measures like efficient light bulbs. Meanwhile, the German approach is the opposite, achieving less participation but high ambition. Interestingly, the German and UK approaches are said to achieve similar energy savings although at higher cost for the German approach (Rosenow, 2011).

Front-runners also show vulnerability to some of the more complex aspects of developing instruments in this policy domain. One of these is how the diverse groups that form the denizens of existing dwellings are reached. The UK comes to the fore with an obligatory focus on lower income households and proposals to 'remove' the worse rated private rental dwellings in the future if 'softer' measures fail. However, other front-runners are more silent on this front, which, inter alia, questions the equitability of instruments such as government subsidies.

Infusing the core instrument approaches with a whole house perspective and integrating energy efficiency and renewable energy ambitions remain as challenges for all front-runners. The German approach, with support for single measures as an alternative to an ambitious retrofit, shows understanding that the latter is not always possible or profitable. Similarly, in Denmark, the ideal of whole house retrofit is supported but the difficult reality of integrating this into instruments accepted. Meanwhile, primacy to energy efficiency is fused with the dominant approaches of the UK and Denmark but falters with German and Sweden cases.

A recurring theme is that little is known about the direct and indirect effects of many instruments. Few instruments are designed alongside monitoring and evaluation programmes that can link them to effects. Instead, implementation of the instrument alone is often considered sufficient. A pertinent example in this regard is the introduction of the EPC throughout Europe, mirroring the Danish instrument. At its introduction, the EPC in Denmark was an innovative instrument with a logical theory of closing the information gap on the energy efficiency of properties during transaction.

Yet evidence of the effectiveness of the instrument in Denmark had not been amassed when it entered into the European legislation. Now that evidence has been gathered, its strength, at creating a more informed and discerning buyers/renters' market, is questionable. The persistent failure to track instruments hinders an understanding of instruments most suited to this policy domain.

§ 6.5 Conclusions

The aim of this study was to explore evidence-based examples of effective instruments designed to improve energy performance in existing dwellings. Front-runners were identified as a source of learning. Only the instruments that are considered to dominate policy action were analysed. As well as searching for effectiveness in terms of reported reduction of CO_2 emissions, this study sought to identify how instruments overcome barriers and exploit opportunities by assessing them according to a number of prominent concepts from energy policy and policy instrument literature.

Ambitious climate change targets mean that policy action must excel across a range of policy instruments. The instruments that lead action in front-runners cover a range from which some lessons can be drawn. Lessons include using performance-based incentives to push the boundaries of ambition (Germany), the creative use of instrument combinations to steer towards ambitious targets or alternative energy sources (Sweden), the use of stakeholders that can reach the target group en masse (UK) and the role of regulations whether defining standards or eliminating fossil fuel-based technologies (UK and Denmark).

However, even the instruments that rate among Europe's most ambitious are not considered adequate by many commentators, either because they are not intensive enough or because the complementary instruments are undeveloped. Instruments struggle to integrate concepts like 'primacy to energy efficiency' and 'whole house', which could be expected as commonplace in response to climate change targets. A combination of tougher obligations, stronger incentives and more creative use of instruments appear as prerequisites if existing dwellings are to play their assigned role in climate change policy. A crucial and related lesson revolves around confidence in information about progress to climate change targets. Even some of Europe's front-runners have yet to develop adequate monitoring and evaluation programs that prove and link their instruments with impact.

An interesting avenue for further research would be a collaborative study with several front-runners to study in depth how instrument packages operate. Alongside this, deeper understanding of dwelling owner/occupants and the role of instruments in their decision making could fill research gaps. An additional research avenue could be cross policy comparative learning to identify ways in which challenges such as balancing participation with ambition have been managed in other sectors.

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