Evaluation of building projects under the Intelligent Energy Europe II Programme

Executive Summary

Written by ICF
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Intelligent Energy Europe (IEE) Programme

The EU’s Intelligent Energy Europe (IEE) Programme typically supported projects which sought to overcome non-technical (informational, behavioural, institutional and financial) barriers to the uptake, implementation and replication of innovative sustainable energy solutions. The IEE Programme operated for more than a decade – IEE I ran from 2003 to 2006 and IEE II from 2007 to 2013. The type of activities funded under IEE are now funded under the Horizon 2020 (H2020) Framework Programme, which supports research, demonstration and efforts to improve the market uptake of energy-efficient technologies.

A key rationale for the EU to support the funding of buildings projects is to provide important insights and learning to help influence both EU and Member State policy makers in producing more effective policies. IEE project outcomes have also contributed to the delivery of sustainable, secure and competitively priced energy for Europe.

This study evaluated 63 IEE II buildings projects including two Concerted Actions on EPBD

This evaluation\(^1\) covers 63 buildings-related projects under the IEE II Programme (hereafter referred to as the “IEE II Buildings Projects\(^5\)”), including two Concerted Actions on the Energy Performance of Buildings Directive (CA EPBD II & III). The target groups within the scope of this evaluation were project coordinators, project consortia members (project partners), final beneficiaries (end-users of project outputs) as well as relevant national or EU level buildings-related associations.

Over €72m was allocated to these 63 building-related projects including Concerted Actions, representing 16% of the entire IEE II funding.

\(^{1}\) The evaluation forms part of a rolling programme of evaluations, whereby different cohorts of projects within the IEE II programme are allocated by EASME for an evaluation. Other completed evaluations have covered Sustainable Energy Communities, the BUILD UP Skills initiative and the Mobilising Local Energy Investment (MLEI) initiative. The Concerted Actions are also planned to be the subject of a separate evaluation.
Nearly three quarters of projects fell in the €1m to €2m size range and almost 20% of projects had a total budget of over €2m.

Partners in buildings projects covered the EU28 and beyond.

The study tasks followed the main flow of the Programme, i.e. from determining key EU energy policy support needs, through understanding the development of Calls for Proposals, which in turn generated a list of funded projects which were analysed.

Around three quarters of the buildings projects had finished by the time of the evaluation. The analysis of this information, together with high-level stakeholder insights and interviews and surveys with project coordinators, partners and final beneficiaries, culminated in a list of recommendations for focal areas of future EU support programmes.

Thematic focus of the IEE II Buildings Projects

The figure below presents a consolidated view of the 61 building-related projects according to project themes (with each project potentially covering more than one thematic area). The most common project themes were in the areas of nearly-zero energy buildings (including passive house design and implementation) and renewable energy use.

Note that smart meters were not covered under the scope of buildings projects in this evaluation. Two projects made reference to coverage of smart meters in their activities.
Both the CA EPBD II and III worked on the entire EPBD implementation and hence covered most of these topics.

**What are stakeholders saying about the Programme?**

"The soft approaches are essential as they are the ‘glue’ that makes the technologies ‘stick’ and ensure they are actually deliverable."

"We have seen real progress within the Calls and significant improvement since the original IEE through to H2020."

"At policy level, the IEE Programme was very useful as it stimulated the introduction of technical, social and economic ideas. The main limitation was the realisation, as the Programme progressed, that it was not going to be enough, as the problems to overcome are so large and varied, especially at regional level."

"IEE was close to market and broader in approach, FP7 was R&D focused and very specific technology-wise. We feel that H2020 has taken a step backwards in that it is not looking at the closer to market activities as much anymore."

**Relevance**

There is consistent evidence to indicate that the Programme overall was highly successful in responding to the needs, problems and challenges of the building sector in implementing EU energy policy objectives, in particular to support the energy efficiency target for 2020. The seven buildings-related Calls in IEE II were structured to support the implementation of the EPBD, EED (and the Directives it repealed) and RESD requirements related to buildings. Call priorities were very well correlated with requirements and implementation timelines of EU energy policies; and 95% of Coordinators who responded confirmed that the Programme had responded well to the needs, problems and challenges of the building sector. Earlier calls, from 2007 to 2009, for example, prioritised the strengthening of EPBD and RESD requirements, as well as training and capacity building. The 2010 Call had a strong emphasis on the RESD, including the promotion of large-scale renewables. Overall, all Calls focused on building-related priorities aligned with EPBD requirements. The emphasis of each Call changed year-by-year, although sometimes only with small modifications. For example, the

"Non-technical barriers are the single biggest challenge in the market – as they are the main reasons why energy efficiency technologies are not implemented. The IEA Market reports show that if all cost effective Best Available Technologies (BAT) were fully implemented, savings in excess of 80% could be achieved."

International Energy Agency (IEA)
Programme focused on low-energy buildings throughout the funding period, starting with passive buildings in earlier Calls (i.e. 2008 to 2009) and progressing to support Nearly-Zero Energy Buildings (NZEBs) in later Calls (i.e. 2011 to 2013). Furthermore an emphasis on the up-skilling of the building workforce was consistently applied throughout the earlier phase of the Programme (i.e. 2007 to 2010), while in later years, from 2011 to 2013, this priority was turned into a dedicated initiative, BUILD UP Skills.³

The Calls collectively provided a substantial opportunity for stakeholders working in the built environment to test out innovative approaches and solutions to the policy challenges set by these Directives.

Projects targeted a diversity of stakeholders, from policy makers and regulatory officials (at EU, Member State, regional and local level), professionals (architects, engineers, trainers, real estate agents) to building end-users (including tenant associations, social housing organisations and building managers). The corresponding needs, problems and challenges were also wide-ranging. The most common theme addressed was information barriers (experienced by policy makers, investors, real estate professionals), followed by awareness raising amongst building users.

Outstanding design of many projects enabled them to be highly relevant with overarching energy policy objectives and responsive to key needs and challenges of stakeholders in the sector. Projects were both relevant and coherent with EED, EPBD and RESD policy objectives, as well as to each Call’s core objectives and priorities. Most Call priorities (42 out of 46) were met by funded projects, with nearly a third of projects (19) addressing more than one Call priority. Priorities related to NZEBs yielded the most funded projects (18), followed by efforts to encourage the uptake of Energy Performance Certificate (EPC) recommendations (14). The single gap in coverage, occurring only in the later years of the Programme, was with respect to renewable energy sourced district heating and cooling solutions. Interviews with around 20 project coordinators indicated that nearly all believed that their projects managed to respond to the needs, problems and challenges of the building sector in implementing EU energy policy objectives. This perception of coordinators is further validated by final beneficiaries of projects, 94% of whom when surveyed, believed that their project's objectives were aligned with their organisation’s needs.

Impact, Effectiveness and efficiency

Projects were very successful in delivering their intended outputs, with the majority (90%)⁴ able to deliver them to a great extent, and, in some cases, exceeding their initial targets. Projects were complex and generated multiple outputs which, in many cases, cannot be aggregated. Project coordinators interviewed expressed that their project has been successful, with most implemented and delivered as planned.

Since 2009, projects were required to establish, monitor and report Common Performance Indicators (CPIs). In total, CPI data reported by a sample of projects was

³ The IEE II programme was broad. If there is a lack of coverage in certain priorities for the buildings projects, then it may well be covered by other areas of the IEE II Programme. This was not explored in this evaluation.

⁴ Based on a review of 42 completed Final Reports.
considered. If it is assumed that the remaining non-reporting projects had a similar impact per euro spent, the total impact of the IEE II building projects at the point of project closure can be estimated to be:

- Over 540,000 TOE of annual primary energy savings
- Over 450,000 TOE of annual renewable energy generated
- Over 2 million tonnes of annual CO₂ reduced
- Over €6 billion invested in sustainable energy solutions

Cost-effectiveness data from buildings projects shows the Programme is generating outstanding value for money.

There is evidence for lasting impacts from a number of projects, although there is no monitoring mechanism. Consortium partners have an important role to play in this regard since they may help to sustain and replicate outputs. Evidence gathered from interviews shows that the most successful projects had strong support and buy-in from the coordinator and partner institutions. The ability to engage parties not directly involved in the project, to help with sustaining and replicating approaches initiated by the project, is also critical to long-term impacts and success. Moreover, projects that have shown most long-lasting impacts, following project completion, were those that had been very focused on outputs with commercial viability and value.

The evaluation identified 19 projects (nearly half the projects which had closed by the time this report was prepared) which demonstrated clear evidence that intended impacts were being achieved beyond the lifetime of the project. Two thirds of all projects (40) declared that their project contributed to improving the evidence base in support of energy- and building-related policy formulation. Some contributed directly to the evidence base, i.e. the project was designed with the main intention of improving the evidence base or supporting tools in policy formulation. In other cases, projects contributed indirectly to policy formulation, i.e. the indirect/unintended impacts of the project provided an evidence base which helped policy makers. Nine prominent examples of projects making clear contributions to buildings energy policy making at either EU, national or local level are described below:

QUALICheck identified issues, gaps in compliance and best practices related to improving the quality of Energy Performance Certificates (EPCs). It developed a strong evidence base in depicting the “situation on the ground”. Project outputs continue to be discussed amongst public authorities and key stakeholders, in terms of future policy recommendations. Moreover, project participants indicated that QUALICheck contributed to the 2017 revision of the EPBD.

EPISCOPE, TABULA, ENTRANZE, and ZEBRA2020 have contributed to the knowledge and data inputs which are supporting the development of the EU Building Stock Observatory. In particular, EPISCOPE served to understand the data availability of renovation data: “without the project, BPIE would not have been able to advise the Commission on the Observatory”. This initiative serves as one of the main tools in monitoring the energy performance of buildings across Europe, providing support to policy making. For instance, the example buildings from TABULA have

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5 This evaluation took into account CPI data from 22 projects. Remaining projects were not included for various reasons, including: (i) they were not required to monitor their CPIs as they were approved before the 2010 call; (ii) they had not yet published their final achieved CPIs at the time of the analysis, either because they were still on-going or else had closed very recently, or; (iii) they were considered as not representative, in particular due to extraordinarily high figures.
been used in CA EPBD II to support the cost optimality calculations for buildings, while the recommendations set out by ENTRANZE have enriched the discussions leading to the 2017 revision of the EPBD.

iSERV was designed to demonstrate the ability of automatic HVAC system monitoring to reduce actual energy use. As a complementary support to on-site inspections, iSERV uses monitoring to identify inefficiencies in the operation of HVAC systems and report them, with useful feedback, to building managers/users. The project provided a further evidence base for the current revision of the EPBD.

Cool Roofs provided a strong evidence base in highlighting the effectiveness of this new technology. It has enabled the enhancement of Cool Roofs policies, particularly, in France, Greece and Italy. As a result of the project, the European Cool Roofs Council (ECRC), established under the project, entered into discussion with CEN to develop a Cool Roofs standard for the European market.

PassREg aimed to trigger the implementation of NZEBs through the Passive House concept throughout the EU by raising awareness, delivering training and establishing networks. In the Netherlands, policy makers have benefited from the project and the national legal framework for buildings has been revised in line with the project recommendations.

InstallRES established training courses for the qualification of trainers and the certification of installers of renewable energy systems in buildings. In Bulgaria, for example, from 2013 it has been mandatory that any solar PV system is installed by a certified installer registered the certificates issued by the VHSE (Vocational High School of Electronics “John Atanov”), one of the project partners, thereby greatly enhancing the overall calibre of the solar PV installation supply side.

Sustainability

80% of projects (49) reported having some form of self-sustaining mechanism6 in place to ensure results continued beyond the project closure. Two suitable mechanisms that have been developed by the projects to ensure continuity are the development of a self-sustaining institution or network of stakeholders and the development of final project outputs that are further exploited after project closure. Within the 63 projects, more than half (32) noted that at least one institution had taken ownership of their project outputs after project closure, of which at least 16 projects reported that these institutions were external to the projects. Furthermore, at least 14 buildings projects have generated tools and/or databases which can potentially be further exploited after project closure, helping address data and information gaps for key stakeholders, such as policy makers and financial institutions.

6 These mechanisms include reference material or online database, active network of stakeholders and adoption of best practice, certification mechanisms and strategies.
Projects that focused on awareness raising and offering support on energy efficiency and renewable energy measures seemed to have a high sustainable impact among final beneficiaries. The vast majority of respondents (29 out of 36) have implemented or plan to implement building energy performance measures after their participation in the project. Most final beneficiaries (17 out of 21) that had been trained were also encouraged to replicate the training in future opportunities after project closure, and over half of respondents already had.

Coherence

The coherence of IEE II buildings projects is demonstrated through the interaction of many project partners with other EU-funded projects. The R&D Framework Programme 6 and/or 7 and INTERREG were EU programmes most cited by respondents. Prior involvement of project partners with other EU-funded projects had often led to increased efficacy of building projects under IEE II.

Amongst final beneficiaries, nearly all respondents (89%) — who overall had been involved in 40 out of 49 buildings projects that responded — felt the projects were highly coherent with other European and national interventions and policies.

EU exchange meeting and webinars have had a positive impact for more than 70% of those taking part in such meetings. Most coordinators and partners felt that interactions with other projects contributed to their own project being more successful; and over 60% of coordinators and partners who said their project benefitted from interaction with other projects had participated in EU exchange meetings or webinars.

CA EPBD II and III

CA EPBD II and III participants were satisfied with the initiative, and saw much added value in the opportunity for collaboration and policy coordination, through information and experience exchange. Most participants who responded felt that CA EPBD has, at least to some extent, both led to more effective policies for building energy performance in their countries as well as helping countries achieve a common view on solutions to EPBD policy challenges. The main topic that CA EPBD tackled most effectively was the demonstration and deployment of NZEBs. Another major body of work covered Energy Performance Certificates.

CA EPBD II and III played an important role in facilitating Member States’ implementation of building energy policies in line with the EPBD, as well as in promoting harmonised policies across the EU. One of the main challenges to be tackled in the future is to reach out to a wider range of stakeholders, without compromising the already established ‘trusted’ environment where policy makers and advisors can express openly and in confidence their ideas and concerns.

Overall, CA EPBD II and III made a good start towards establishing improved collaboration with other Concerted Actions (i.e. CA EED and CA RESD). Even though the collaboration with other CAs was not an explicit objective of the CA EPBD until CA EPBD IV started (2015-2018), several cross-CA meetings did take place. A few joint working groups were also established during CA EPBD II and II, including a working group to support the development of roadmaps for the renovation of existing public buildings. Looking ahead, there are untapped opportunities for collaboration, and these should be tackled under CA EPBD IV.

The Concerted Action on EPBD was launched in 2005 as a joint initiative of EU Member States and the European Commission. It acts as a forum to help Member State representatives of the EU Member States and Norway to transpose and implement the EPBD. The initiative is now currently into its fourth phase (2015-2018).

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\(^7\) Renovation Roadmaps were a requirement under CA EED, but were also relevant for the CA EPBD.
Lessons learned for improving project effectiveness

The following lessons are based on a comprehensive review of final project reports, backed by consultations with project coordinators and partners:

- Coordinators and partners that are genuinely invested in core thematic areas leads to successful teams, and projects with lasting impact;
- Careful project design and planning enables successful delivery and long-term benefits. This includes effective identification of market challenges/gaps/improvement opportunities, working with a realistic budget and objectives;
- Effective and early engagement of partners at proposal stage is crucial. Partners play a vital role in ensuring that the project objectives are aligned to the local context;
- Regional diversity is a key added value of IEE. To ensure optimal impact, regional differences must be accounted for from the project outset. This includes acknowledging diverse challenges and outlining tailored strategies to face them;
- National Advisory Committees can play a pivotal role in getting to know, and facilitating more effective working within local markets; and
- Efficient communication with EASME Project Advisers is important to aid project delivery.

Persistent market challenges which EU support could address

Persistent market challenges were scoped out using project partner, final beneficiary and high-level stakeholder responses. A set of common themes were raised by stakeholders, including:

- **There is a need to improve policy coherence and enforcement at national and regional level.** This involves a stronger joined-up thinking between national and regional public bodies, as well as local authorities who have a key role to play. Verification of compliance with the rules in place and enforcement, e.g. related to the energy efficiency norms in the buildings code and EPC need to be re-enforced.

- **A number of challenges inhibit the renovation – including deep renovation – of the existing building stock across Europe.** Nearly all parties consulted agree that there should be a greater focus on fostering the deep renovation of buildings renovation, e.g. towards NZEB standards. However, there is a lack of drivers for energy renovation of the buildings stock. The cost implications, and hence obtaining appropriate financing, remain a particular challenge for deep building renovation and the drive towards achieving NZEBs. The intrusive implications of deep renovation also continue to be a major hindrance to greater uptake. Substantial data gaps on building stock still remain for entrepreneurs, policy makers and financial institutions.

- **Awareness among building owners and occupiers remain a persistent challenge.** Low consumer priority of energy efficiency inhibits energy efficiency renovations. Consumers are much more concerned about other issues, such as aesthetics and available floor space, which outweigh the importance of building energy performance. Consumers are also faced with a challenging task of selecting the right provider because of a fragmented and disorganised supply chain. In addition, there are opportunities to further exploit existing building energy management systems by improving their operation.

- **Improving the soft and hard skills of builders and installers to enhance build quality and boost energy efficiency renovations.** Much has been done already (within IEE I and the BUILD UP Skills initiative) to identify and fill skills gaps, but further work remains. A slow uptake of innovation and neglect of clean technologies if they require long pay-back periods hinder progress. Furthermore, builders are often either self-employed or work in micro enterprises. Both types of employment have very limited time availability for training due to the loss of income.

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8 Soft skills refer to the ability of building sector workers to interact, advice and communicate effectively with building end users and consumers. Hard skills refer to the technical ability to install or deliver the relevant energy efficiency solution, including design, installation, operation, maintenance and digital capabilities.
Enhancing the building’s role in a smart environment is a new challenge. The increasing digitalisation of building infrastructure and integration of Information and Communication Technology (ICT) is changing the market at an unprecedented rate. However, smart solutions are dependent on wider infrastructure provision. Potential delays in deploying smart buildings could occur where the smart infrastructure is not yet available. Buildings are expected to play a vital role in future decentralised renewable energy generation and energy storage, but this will require close cooperation with energy utilities, Distribution System Operators and regulators. Finally, privacy and data protection issues have gained importance and can come in conflict with energy monitoring.

Financial barriers remain a key barrier for consumers wishing to integrate sustainable energy technologies into buildings. High upfront costs and a lack of direct access to finance remains a key hurdle in the uptake of energy efficiency and renewable energy solutions. Furthermore, financial institutions find little incentive in supporting the uptake of clean technologies in buildings, since they do not yet take into account the benefits of energy savings, for example in terms of reduced operational costs or increased asset values.

Recommendations

The recommendations are based upon: the evaluation findings (desktop research, survey inputs and stakeholder interviews); gaps within IEE II; lessons learned; insights of parallel initiatives (namely MLEI\(^9\) and BUILDUP Skills); the transition from IEE II to H2020; and the buildings-related topics of the first H2020 work programmes. Recommendations are structured into two main categories: recommendations on the content of future EU support Programmes; and recommendations on the process of future support Programme design and management. A third set of recommendations relate to the CA EPBD and what could be taken forward in CA EPBD Phase V (after 2018).

Content-related recommendations for future Programmes

<table>
<thead>
<tr>
<th>Improving policy coherence and enforcement at national or regional level</th>
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<tbody>
<tr>
<td><strong>Recommendation #1</strong></td>
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<table>
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<tr>
<th>Fostering deep renovation of existing building stock</th>
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<tbody>
<tr>
<td><strong>Recommendation #2</strong></td>
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<td><strong>Recommendation #3</strong></td>
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<tr>
<td><strong>Recommendation #4</strong></td>
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\(^9\) The ability of buildings and wider infrastructure (such as decentralised energy generation, storage assets, electric vehicle charging points) to respond dynamically (using interconnected sensors, smart meters, building management systems and ICT) to interact to create both improved building efficiencies as well as larger system energy savings and financial efficiencies.

\(^10\) MLEI: Mobilising Local Energy Investment

\(^11\) Mainstream renovation refers to residential renovations that are usually triggered by lifestyle changes, aesthetics, floor space usage, etc. (i.e. triggered by non-energy needs). Many of these drivers also apply to the commercial & public sector.
### Enabling informed choices for building owners, users and financial institutions

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Description</th>
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<tbody>
<tr>
<td>Recommendation #5</td>
<td>Enable informed choices and investment decisions with better access to reliable and up-to-date information and support robust accreditation systems of service providers to build clients' trust.</td>
</tr>
<tr>
<td>Recommendation #6</td>
<td>Promote non-energy and lifestyle benefits from building energy renovations in order to convince owners and tenants.</td>
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### Enhancing the building’s role in a smart environment

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Description</th>
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<tbody>
<tr>
<td>Recommendation #7</td>
<td>Support wider adaptation of buildings in a smart environment.</td>
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<tr>
<td>Recommendation #8</td>
<td>Promote the wider exploitation of data and ‘big data’ to unlock the full potential of smart solutions for in building usage, in order to benefit potential end-users such as demand response aggregators.</td>
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<tr>
<td>Recommendation #9</td>
<td>Develop and promote solutions to overcome privacy and data security concerns.</td>
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</table>

### Improving soft and hard skills of builders and installers

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<tr>
<th>Recommendation</th>
<th>Description</th>
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<tbody>
<tr>
<td>Recommendation #10</td>
<td>Increase efforts to improve the ‘soft’ skillsets of builders and installers to enable them to act as energy efficiency champions to consumers.</td>
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<tr>
<td>Recommendation #11</td>
<td>Allow project budgets to compensate self-employed building workers and micro-enterprises for their time in attending training sessions.</td>
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<tr>
<td>Recommendation #12</td>
<td>Develop effective mechanisms or supporting tools to enable better enforcement of ‘as built’ quality compared with design specifications (to help address the design-performance gap).</td>
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### Process related recommendations for future Programmes

<table>
<thead>
<tr>
<th>Process Recommendation</th>
<th>Description</th>
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<tbody>
<tr>
<td>Process Recommendation #1</td>
<td>Reinforce a stronger emphasis on achievement of longer-term impacts.</td>
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<tr>
<td>Process Recommendation #2</td>
<td>Reinforce stronger requirements for participants to demonstrate an understanding of local/regional challenges.</td>
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<tr>
<td>Process Recommendation #3</td>
<td>An innovative approach and monitoring frameworks are required to strengthen the reporting of SMART indicators in order to quantify impacts more accurately.</td>
</tr>
<tr>
<td>Process Recommendation #4</td>
<td>In order to encourage the most innovative projects, Call topics could be formulated to remain broad and challenge-based so that they do not restrict projects.</td>
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</table>

### Recommendations for Phase V of the CA EPBD

The following areas for improvement to both the strategic process and content in Phase V of the CA EPBD were identified based on the feedback from CA EPBD interviewees.

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12 In particular, a stakeholder from the Association of European Heating Industry (EHI) noted that: “A key non-technical barrier remains how to convince consumers and installers to move to next generation technologies and not simply replace like-for-like”.

13 SMART – Specific, Measurable, Accepted, Realistic, Time-dependent
<table>
<thead>
<tr>
<th>Recommendation #1</th>
<th>Several major technical topics should be given more emphasis in Phase V:</th>
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<tbody>
<tr>
<td>CA EPBD</td>
<td>■ Enhancement of the building's role in: energy storage; Demand Side Management (DSM); and, smart cities;</td>
</tr>
<tr>
<td>Recommendation #2</td>
<td>■ Automation and smartness; and,</td>
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<tr>
<td></td>
<td>■ Small-scale renewables generation in buildings.</td>
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<tr>
<td>Recommendation #2</td>
<td>A number of process-related recommendations could be pursued in Phase V:</td>
</tr>
<tr>
<td></td>
<td>■ There appears to be an opportunity to share insights from the CA EPBD in open public meetings to improve its knowledge sharing and thereby help to accelerate the communication of results and data;</td>
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<td></td>
<td>■ While ministerial representatives do attend CA EPBD plenary sessions when key decisions are being taken, there is scope for more decision-maker involvement, through tailored sessions, which should help to enhance the communication of key messages;</td>
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<td></td>
<td>■ Regional governments could be encouraged to participate in the CA EPBD to help sub-national policy implementation; and,</td>
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<tr>
<td></td>
<td>■ Greater time should be given over to cover popular themes under the EPBD during Plenary meetings, in order to enable as many stakeholders as possible to attend.</td>
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