The European Union’s programme for India

Clean Energy Cooperation with India (CECI): Legal and policy support to the development and implementation of energy efficiency legislation for the building sector in India (ACE: E^2)

Specific Contract: FWC No. PI / 2015 / 368-474

State Action Plans for the EPBD and their implementation – including roadmaps to ‘Nearly Zero Energy Buildings’ (NZEB)

EU EXPERIENCE ON EPBD - POSITION PAPER

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A project implemented by EXERGIA S.A., member
of SACO Consortium, in collaboration with PwC India

FOREWORD

This position paper has been developed by the project "Clean Energy Cooperation with India (CECI): Legal and policy support to the development and implementation of energy efficiency legislation for the building sector in India ("ACE:E^2"[1])".

The ACE: E^2 project is financed by the European Union and managed by the Delegation of the European Union to India. It is carried out as part of the Framework Contract COM 2011 Lot 1 (Europeaid/129783) by EXERGIA S.A., member of SACO Consortium, in collaboration with PricewaterhouseCoopers (PwC) India, under the Specific Contract: FWC No. PI / 2015 / 368-474 signed between the Delegation of the European Union to India (EUD) and SACO on December 18th, 2015.

The contents of this paper are, however, the sole responsibility of the contractor and can in no way be taken to reflect the views of any particular individual or institution, including the European Union, the Delegation of the European Union to India, and the Bureau of Energy Efficiency (BEE) in India.

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[1] ACE: E^2 – Adoption, Compliance, Enforcement – Energy Efficiency

ABBREVIATIONS

ACE: E2	Acronym of the project (Adoption, Compliance, Enforcement – Energy Efficiency)
BIM	Building Information Modelling
BEE	Bureau of Energy Efficiency
BPIE	Building Performance Institute Europe
CECI	Clean Energy Cooperation with India
CEN	European Standards Body
CPD	Continuing Professional Development
CPS	Competent Persons Schemes
EED	Energy Efficiency Directive
EUD	European Union to India
EED	Energy Efficiency Directive
EP	Energy Performance
EPC	Energy Performance Certificate
IEE	Intelligent Energy for Europe
ICT	Information and Communication Technology
IEE	Intelligent Energy for Europe
NZEB	Nearly Zero Energy Buildings
RIA	Regulatory Impact Assessment
SBEM	Simplified Building Energy Model

Contents

Table of Figures

1 SUMMARY

The EU Energy Performance of Buildings Directive[2], or EPBD, was published in 2002 and formally came into force in 2003 across all EU Member States. Legal transposition and practical implementation across Europe mainly took place between 2006 and 2009. The Directive was 'recast' in 2010[3], with various reinforcing amendments which were implemented since 2011.

The approaches and experiences of EU Member States in implementing the various requirements in the EPBD have varied widely. This position paper therefore selects and highlights what are considered to be among the best practice approaches, levels of ambition, systems and experiences implemented in particular EU Member States in relation to the provisions of the EPBD most relevant to building energy code (ECBC) implementation in India. These relate to their governance, action planning, consultations, legal adoption, technical methodologies and systems development, capacity building, administrative systems development, certification, enforcement, promotion and incentivisation.

The paper is centred around two key planning tools, and their implementation at Member State level – namely Action Plans adopted in 2004- 2006 in relation to the provisions in the original EPBD, and the 'Nearly Zero Energy Buildings' (NZEB) Roadmaps first published in 2012- 2015 to meet a requirement in the recast EPBD. It indicates the nature and sequence of the tasks, responsibilities and relative timetables contained within these plans and summarises the main features of their implementation.

It is not the intent of this position paper to comprehensively address all aspects of the EPBD Action Plan implementation. Rather, it provides an overview and foretaste of aspects of the implementation process that are considered most relevant to implementation of the ECBC in India, with reference to a sample of good practice examples from the EU. Fuller details on those various key steps and good practice elements of Action Plan implementation will be elaborated in the position papers to follow in this series.

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[2] Directive 2002/91/EC of the European Parliament and Council, on the energy performance of buildings.

[3] Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast)

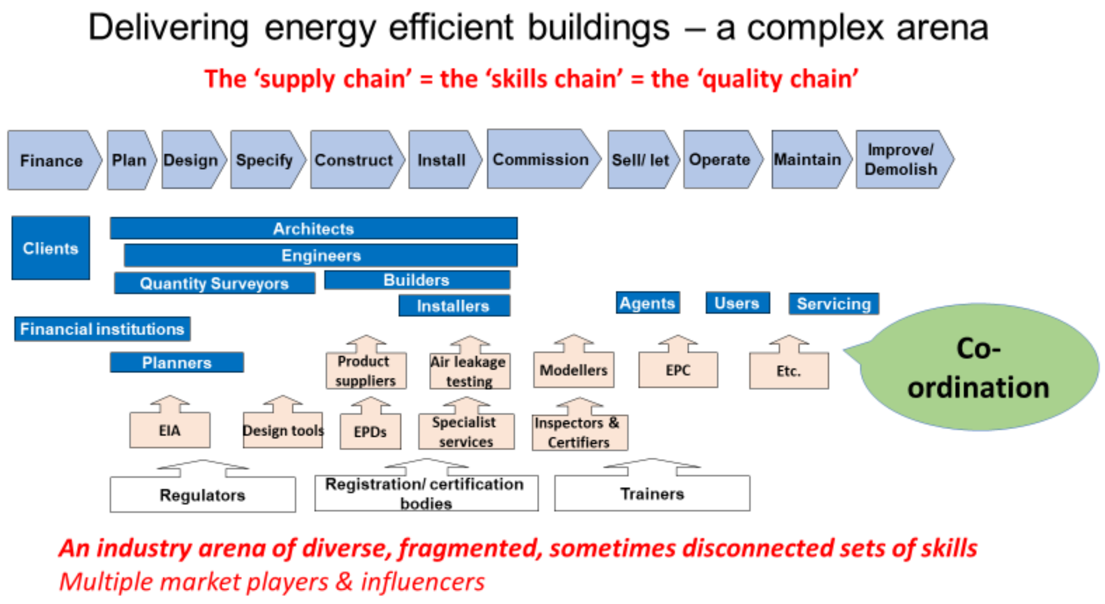
2 CONTEXT AND CHALLENGE OF EPBD IMPLEMENTATION

2.1 Legal and market context for transposing and implementing the EPBD

Once issued by the EU, a Directive is required to become law in all Member States, by a process called legal 'transposition' (which is similar to the 'notification' process applicable to the ECBC in India). However, many of the Articles or provisions within a Directive can be open to flexible interpretation, so that the form of legal transposition can vary between Member States. This is the case with aspects of the EPBD, which leaves detailed implementation and adaptation to Member State authorities, taking account of national and regional/ local conditions. Moreover, while almost all EU Member States already had reasonably well-established building codes and energy performance standards (in some cases extending back to the 1950s) prior to the EPBD, these involved a variety of legal configurations and differing scopes of coverage and levels of stringency in those standards.

It was therefore inevitable that variations would arise between Member States in their detailed implementation of the energy performance (EP) requirements to meet their obligations under the Directive. But there has also been considerable common ground between Member States in the shared challenge of consulting, communicating and co-ordinating with the key stakeholders and sectoral interests in the building industry. The complexity and fragmentation of the industry arena and the respective roles of these common market, facilitative and regulatory players in planning, delivering and operating buildings with good energy performance is shown schematically in Figure 1. As shown in the diagram, this 'supply chain' can also be regarded as the 'skills chain', 'compliance chain' or 'quality chain' and an understanding of the respective roles is important to achieving compliance and establishing a suitable enforcement regime.

Figure 2-1 Schematic of positions and roles of market, regulatory and facilitative parties in the building industry supply chain



2.2 Key requirements of the EPBD

For clarity, this description combines the key requirements of the original EPBD and recast EPBD.

The primary aims of the EPBD were to drive the building sector towards more ambitious energy efficiency standards, to make energy use in buildings more transparent and widely understood, and to increase the use of renewable energy sources. The EPBD had three sets of key requirements, whereby each Member State must:

1. Adopt an official energy performance calculation methodology that accords with the common general framework methodology specified in an Annex to the Directive. The scope of the technical parameters to be covered is set out in this Annex. This is aimed at encouraging a broadly common 'currency' or 'language' based on an integrated and relatively holistic scope of thermal and electrical energy usage. But it still allows flexibility regarding the detail of the methodology in individual Member States.
2. Set mandatory minimum requirements for the energy performance of new buildings and major renovations, using the above technical methodology. This mandated a performance-based approach (rather than specifications of component requirements). Energy efficiency requirements must be formulated as an overall performance criterion, covering the main thermal and electrical energy uses, expressed in terms of - normally primary (fossil fuel) - energy consumption (and possibly CO_2 emissions) per annum per m^2 of gross floor area. As a dynamic process, these requirements (plus requirements for retrofitting of building elements) must

be reviewed at least every five years, using a ‘cost optimal’ method based on a Life Cycle Analysis to inform the technical standards. They are compounded by a requirement for Member States to establish ‘Nearly Zero Energy Buildings’ (NZEB) as mandatory for all new buildings by the end of 2020 and for new buildings owned and occupied by public authorities by the beginning of 2019, and to publish national NZEB roadmaps including intermediate targets for 2015.

3. Establish and implement a system of energy performance certification (EPC) mandatory for all residential and tertiary sector (offices, shops, hotels, public buildings etc.) buildings4 at the point of construction, offer for sale or rental, and also using the above methodology. It applies to both new and existing buildings. This is aimed at making energy performance a visible market factor influencing purchase and rental choices – including mandatory use of EPCs in property advertisements. This system involves publishing an energy label for each applicable building, typically on a scale from ‘A’ to ‘G’. EPCs were required to be carried out by independent qualified assessors (or ‘experts’). Placing a greater emphasis on enforcement, the recast EPBD required Member States to establish independent recording and quality control systems for EPCs, and to ensure that ‘penalties provided for [infringements against national provisions] must be effective, proportionate and dissuasive’.

[The EPBD also required many public buildings to display EPCs in an accessible location and introduced regular inspections of heating and air conditioning systems. But these provisions are not covered in this Position Paper as they are not immediately relevant to the circumstances of the ECBC in India.]

The Directive was followed by a requirement within the associated EU Energy Efficiency Directive (EED)[5] to establish national strategies for mobilising investment in energy efficient renovation of the existing building stock.

In support of the above three sets of requirements, the EU Commission mandated the European Standards Body CEN to develop a suite of EN standards in order to encourage more harmonised technical and economic approaches across Member States.

The original Directive permitted Member States to phase in the requirements, particularly for EPCs, over a period of up to 3 years in order to allow time for sufficient number of qualified assessors to be trained and available.

It is important to note that, unlike other EU energy directives, the EPBD has been essentially an actions-based rather than targets-based in the specification of its requirements. It has certainly been intended that delivery of its actions will make a significant contribution to meeting EU energy policy targets for 2020 (through its role in ‘National Energy Efficiency Action Plans’), but compliance of a Member State with the

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[4] Except special cases, such as heritage buildings, religious buildings and buildings with very low energy use.

[5] Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency

Directive will be verified in the first instance by evidence of delivery on its various required actions under the Directive.

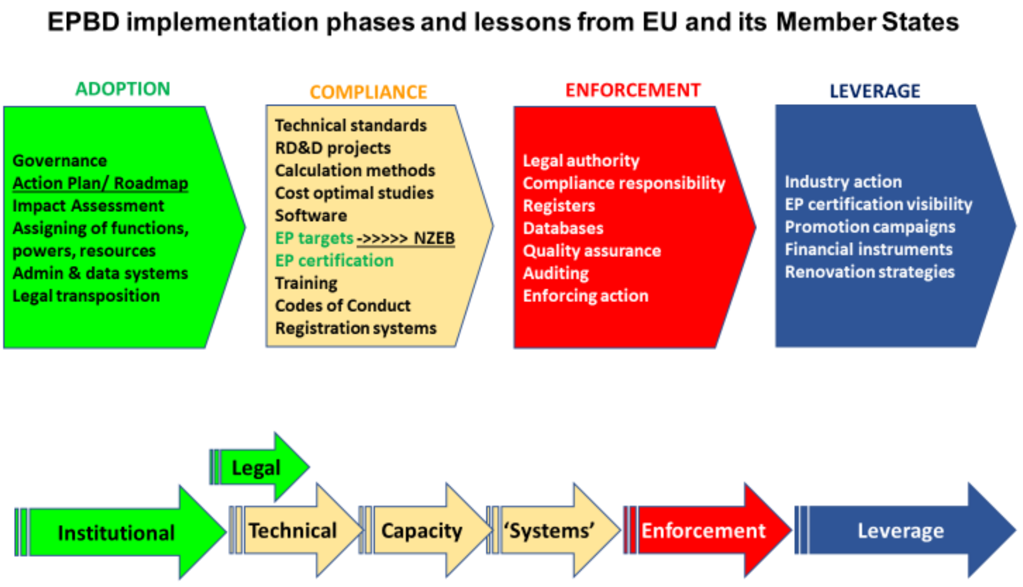
2.3 EPBD implementation: A four stage process

The multiple requirements of the EPBD, some of which were familiar to some EU Member States, but many of which were new to several Member States, posed a significant challenge to meet the requirements of the Directive within the specified timescales. A well co-ordinated approach was necessary for success.

Figure 2-2 is a schematic overview of key activities required to be delivered. These are grouped into four blocks, which in broad terms are logically sequential. While the EPBD and ECBC are not identical in their obligations, for clarity with respect to the ECBC implementation process in India the first three blocks in the diagram have been presented and labelled in a way that broadly aligns with the framework prescribed for the ACE:E^2 project itself. The four blocks accordingly consist of Adoption > Compliance > Enforcement > Leverage. The latter is a supplement to the 'Adoption > Compliance > Enforcement' concept in order to indicate actions which were aimed at amplifying the effectiveness and impact of the EPBD.

While the blocks of activities are shown sequentially for the purposes of this narrative, in reality it will be seen in the illustrative Gantt chart below that many of the processes of technical, administrative and legislative implementation of EP requirements and establishment and operation of EPC systems were carried out in parallel.

Figure 2-2 Primarry blocks of tasks necessary for implementation and effectiveness of the EPBD



2.4 Focus and limitation of this Position Paper

Within its limited page numbers, this position paper cannot comprehensively address all aspects of the EPBD implementation. Its aim is to provide a flavour and foretaste of aspects of EPBD implementation process that are considered most relevant to implementation of the ECBC in India. Fuller details on those various key steps and best practice elements of implementation will be elaborated in the position papers to follow in this series.

The paper is centred around two key planning tools, and their implementation – namely Action Plans adopted in 2004-2006 in relation to the provisions in the original EPBD, and the 'Nearly Zero Energy Buildings' (NZEB) Roadmaps first published in 2012-2015 to meet a requirement in the recast EPBD. These two actions are underlined in Figure 2-2.

The action groups listed in Figure 2 are now described in turn. In each case a summary is given of what are considered to be good practice approaches, systems or experiences.

3 ADOPTION

Co-ordination, master planning, task actioning, legal enactment

3.1 Institutional arrangements at Member State level

In EU Member States there were already established traditions of building energy codes being under the aegis of Ministries of Construction (or similar). So in general, the enactment of legal requirements in relation to building energy codes tended to be the responsibility of Ministries of Construction (or similar), while new types of requirements such as inspections of technical systems tended to be the responsibility of Ministries of Energy (or similar). The situation with requirements in relation to EPCs was variable, with such requirements being enacted by either of these Ministries. In the majority of Member States, the development and administration of calculation software and EPCs was assigned to national energy efficiency agencies, who were assigned the necessary functions and powers under the new legislation.

The assignment of responsibilities for legal enforcement of compliance with the building codes did not usually change relative to the previously established systems for building codes in general – which were often local authorities. The role of such authorities was sometimes confined to clerical type review of documentation plus sample inspections, and the training of their personnel did not always extend to the technical methodologies.

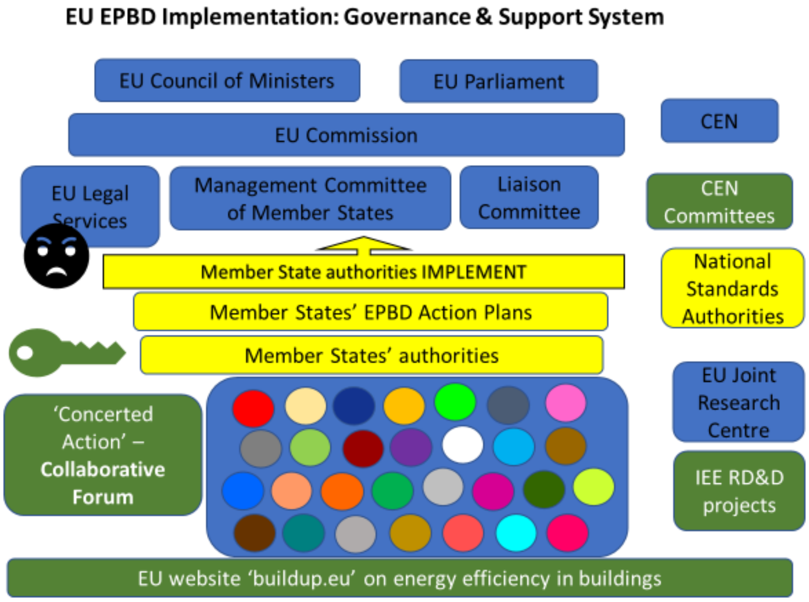
Good practice: Several Member States established co-ordination or steering committees from the above Ministries and agencies. In a number of cases, these committees developed and published national implementation plans. For example, in Ireland, this was a small steering committee consisting of senior officials from the two key Ministries, chaired by the lead Ministry responsible for construction policy and EPBD adoption, and with the secretariat being provided by the national energy authority. These short lines of communication enabled work to proceed at an efficient pace. The steering committee developed its key planning document in the form of a Draft Action Plan which was issued to all stakeholder groups as part of an initial national communication campaign (including a series of roadshow meetings) and feedback submissions were invited, on which basis elements of the plan were amended and strengthened.

In contrast, the EPBD steering committee included not only the Ministries and agencies but extended to a range of stakeholders. However, importantly, a small central sub-group, headed by the lead Ministry, drafted the key planning documents for EPBD implementation.

3.2 Overall governance at EU level and links to Member State level

The overall institutional and governance system at EU level, and its relationship with Member State institutional arrangements for EPBD implementation, was outlined in Position Paper 1 and is shown in Figure 3-1. The Member State authorities and their roles are represented in yellow while the most significant EU resources assisting implementation are represented in green.

Figure 3-1 Institutional and governance structures to enable EPBD implementation



Aimed at efficient and coordinated approaches, at both Member State and EU levels.

The respective bodies and their roles are as follows:

- The relevant Member State authorities. As indicated above, these are typically a combination of Ministries responsible for Construction, for Energy and a supporting national energy agency – responsible for developing and overseeing an action plan for implementing the Directive and enforcing its requirements. (This can potentially form part of the National Energy Efficiency Action Plan separately required by the Energy Efficiency Directive). These authorities also participate in the above Management Committee, and typically have established their own national coordinating committee/s and consultative fora for stakeholders.
- The European Standards body, CEN, was mandated by the EU Commission to develop or update a suite of approximately 50 standards to support implementation of the Directive and encourage more harmonised technical requirements. These standards ranged from the holistic calculation of energy performance, to requirements for energy certification and inspection of technical systems, to the

specification and performance of building elements, components and equipment. Several technical committees were involved.

- The National Standards Authorities are members of CEN and responsible for the process of adopting EN standards as national standards. Many of these standards allow for 'localisation' of requirements to take account of national and/or regional climate and technical conditions. While EN standards automatically become national standards and are aimed at encouraging legal adoption for the purposes of the EPBD, the resultant national standards are not obligatory on the national authorities.
- In addition to operating a competitive research, development, demonstration (RD&D) programme, the EU Commission operated a support programme entitled 'Intelligent Energy for Europe' (IEE) to tackle barriers and assist market deployment. These programmes supported projects in the fields of improving technologies, tools, skills development, market analysis, databases, market awareness initiatives and financial initiatives, and generated useful insights, findings and case examples.
- The EU Commission funded the development and ongoing enhancement of a wide ranging website covering all aspects of energy efficiency in buildings from policy level (e.g. national reports on EPBD implementation) to practical case studies on various technology and market issues.

Collaborative forum for shared learning between Member States

Energy performance competencies and improvement trends over time can vary significantly from Member State to Member State. This reflects differing historical experiences, institutional systems, climate, tools, skills and overall state of market development with regard to energy efficiency.

- A collaborative project supported by the EU Commission, entitled the EPBD Concerted Action, has played an important role in assisting Member States with implementing the Directive. It has provided a confidential forum (and confidential website) through which representatives from Member State authorities could systematically explore options for implementing the various requirements, sharing approaches, challenges, achievements and best practices. These forums typically met three to four times per year and also included working groups, study tours and webinars. This has produced much valuable information to Member State authorities, agencies, planners and market stakeholders on the practical implementation of the EPBD[6].

3.3 Guiding principles in EPBD implementation

Good practice: In approaching the planning of EPBD implementation in an EU Member State, the following is an example of best practice guiding principles that were adopted in

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[6] https://www.epbd-ca.eu/

one Member State. Ultimately, the practical implementation ought to achieve a pragmatic balance between these principles.

Practicality: The technical services should be deliverable through the channels of existing professional and trade expertise. They should require a moderate level of training and upskilling of service providers with prior foundational skills. They should be geographically accessible, entail quick turnaround services at acceptable cost, and not retard normal market activity. The information and advice produced by service providers should be sufficient to enable building owners and energy consumers to exercise informed choices and avoid excessive detail.

Clarity: From the building owner or consumer perspective, the delivered information, its purpose and value should be clear. From the technical service provider perspective, the procedures and tools should be easily understood and as simple as possible to apply. Information and Communication Technology (ICT) systems should be exploited to achieve user friendliness in the process and results, underpinned by appropriately powerful technical resources and reliable administrative support systems.

Consistency: The measures should be of credible quality and value. Relative or comparative accuracy of the information provided is the goal, sufficient to enable informed choices by building owners and consumers. Results should be repeatable to an acceptable tolerance. Details of the technical methodologies being applied should also be transparent to inspection by specialists and regulators. The procedures must be underpinned by robust training, validation of tools and skills, quality assurance, and ongoing data and other technical support. The administration systems, engaging best practice in ICT systems, should co-ordinate and maintain these functions.

Cost efficiency: Related to all the above, services should be provided at as competitive a cost as possible, while complying with the obligations of the EPBD. They should seek to minimise the burden of time or complexity on either the service user or provider.

3.4 Action Plan elements: tasks, responsibilities and timetable

Once the governance and institutional arrangements are in place, there is a logical sequence of developmental tasks to be carried out in order to implement the full set of obligations set in the Directive. Consistent with the outline in

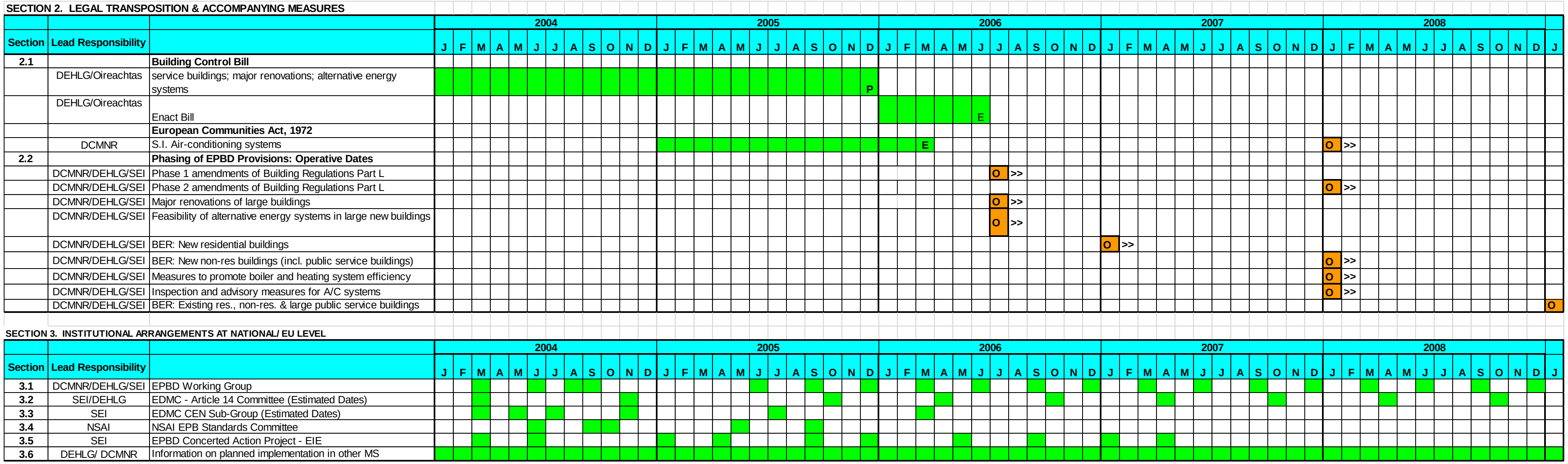
Figure 3-2 above, these tasks can be broadly grouped as legislative, technical, administrative and communications. Engaging and consulting with stakeholders.

Good practice: An example in Ireland's action plan of an overall timetable, in this case covering the period 2004 – 2009, is detailed in the Gantt chart of Figure 4. It contains many inter-dependencies between tasks and considerable technical research and administrative systems development work was required to be complete in order to enable practical implementation of the Directive in its entirety. This plan is an example of a phased introduction of EP requirements and EPCs, to allow development of the necessary technical and administrative infrastructure and prepare the market. This was necessary to allow methodology and software development, and for sufficient numbers of suitably qualified professionals to be trained in the new methodologies, performance criteria and compliance procedures. In this case, phasing took place over three years, firstly applying to new residential buildings, then new non-residential buildings and finally existing buildings (where EPCs were required when offered for sale or rental).

Any such plan contains uncertainties arising from the interdependent relationships between different sets of tasks, and from issues that may possibly emerge in the course of investigation and development. The need is therefore to obtain a pragmatic balance in terms of meeting the obligations set out in the EPBD according to the principles outlined above. Its aim is to provide a roadmap to implementing the Directive in a manner that is not just formally complete but is ultimately successful in its impact. This continues to be a work in progress, with a particular challenge applying with the requirement to establish and operate robust enforcement systems for compliance checking and quality assurance of EP requirements and EPCs.

Good practice: The process of preparing and consulting on a well-formulated Action Plan is in itself a good practice action.

Figure 3-2 Segment of EPBD Action Plan Gantt Chart covering legal transposition, accompanying measures and institutional arrangements



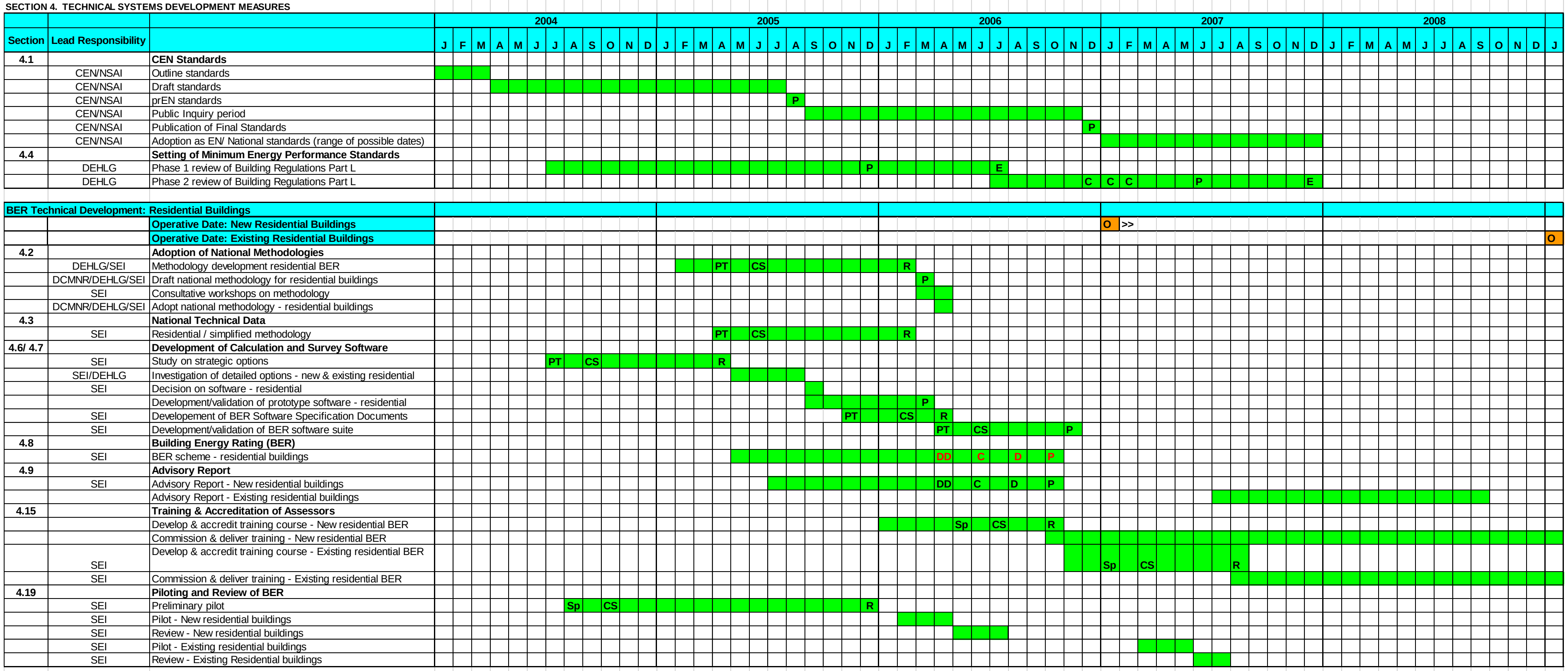
SECTION 2. LEGAL TRANSPOSITION & ACCOMPANYING MEASURES

Section	Lead Responsibility	
2.1		**Building Control Bill**
	DEHLG/Oireachtas	service buildings; major renovations; alternative energy systems
	DEHLG/Oireachtas	Enact Bill
		European Communities Act, 1972
	DCMNR	S.I. Air-conditioning systems
2.2		**Phasing of EPBD Provisions: Operative Dates**
	DCMNR/DEHLG/SEI	Phase 1 amendments of Building Regulations Part L
	DCMNR/DEHLG/SEI	Phase 2 amendments of Building Regulations Part L
	DCMNR/DEHLG/SEI	Major renovations of large buildings
	DCMNR/DEHLG/SEI	Feasibility of alternative energy systems in large new buildings
	DCMNR/DEHLG/SEI	BER: New residential buildings
	DCMNR/DEHLG/SEI	BER: New non-res buildings (incl. public service buildings)
	DCMNR/DEHLG/SEI	Measures to promote boiler and heating system efficiency
	DCMNR/DEHLG/SEI	Inspection and advisory measures for A/C systems
	DCMNR/DEHLG/SEI	BER: Existing res., non-res. & large public service buildings

SECTION 3. INSTITUTIONAL ARRANGEMENTS AT NATIONAL/ EU LEVEL

Section	Lead Responsibility	
3.1	DCMNR/DEHLG/SEI	EPBD Working Group
3.2	SEI/DEHLG	EDMC - Article 14 Committee (Estimated Dates)
3.3	SEI	EDMC CEN Sub-Group (Estimated Dates)
3.4	NSAI	NSAI EPB Standards Committee
3.5	SEI	EPBD Concerted Action Project - EIE
3.6	DEHLG/ DCMNR	Information on planned implementation in other MS

Figure 3-3 Segment of EPBD Action Plan Gantt Chart covering delivery of technical systems development actions



SECTION 4. TECHNICAL SYSTEMS DEVELOPMENT MEASURES

Section	Lead Responsibility		2004												2005												2006												2007												2008												
			J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J
4.1		**CEN Standards**																																																												
	CEN/NSAI	Outline standards	🟩	🟩	🟩																																																										
	CEN/NSAI	Draft standards				🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩																																										
	CEN/NSAI	prEN standards																				P																																									
	CEN/NSAI	Public Inquiry period																					🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩																										
	CEN/NSAI	Publication of Final Standards																																						P																									
	CEN/NSAI	Adoption as EN/ National standards (range of possible dates)																																							🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩													
4.4		**Setting of Minimum Energy Performance Standards**																																																												
	DEHLG	Phase 1 review of Building Regulations Part L							🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	P	🟩	🟩	🟩	🟩	🟩	🟩	E																														
	DEHLG	Phase 2 review of Building Regulations Part L																															🟩	🟩	🟩	🟩	🟩	C	C	C	🟩	🟩	🟩	P	🟩	🟩	🟩	🟩	🟩	E													
BER Technical Development: Residential Buildings																																																															
		Operative Date: New Residential Buildings																																							O	>>																								
		Operative Date: Existing Residential Buildings																																																													O
4.2		**Adoption of National Methodologies**																																																												
	DEHLG/SEI	Methodology development residential BER														🟩	🟩	PT	🟩	CS	🟩	🟩	🟩	🟩	🟩	🟩	🟩	R																																		
	DCMNR/DEHLG/SEI	Draft national methodology for residential buildings																												P																																		
	SEI	Consultative workshops on methodology																												🟩	🟩																																	
	DCMNR/DEHLG/SEI	Adopt national methodology - residential buildings																													🟩																																	
4.3		**National Technical Data**																																																												
	SEI	Residential / simplified methodology																PT	🟩	CS	🟩	🟩	🟩	🟩	🟩	🟩	🟩	R																																		
4.6/ 4.7		**Development of Calculation and Survey Software**																																																												
	SEI	Study on strategic options							PT	🟩	CS	🟩	🟩	🟩	🟩	🟩	🟩	R																																														
	SEI/DEHLG	Investigation of detailed options - new & existing residential																	🟩	🟩	🟩	🟩																																										
	SEI	Decision on software - residential																					🟩																																										
		Development/validation of prototype software - residential																					🟩	🟩	🟩	🟩	🟩	🟩	P																																				
	SEI	Developement of BER Software Specification Documents																							PT	🟩	🟩	CS	🟩	R																																				
	SEI	Development/validation of BER software suite																													PT	🟩	CS	🟩	🟩	🟩	🟩	P																										
4.8		**Building Energy Rating (BER)**																																																												
	SEI	BER scheme - residential buildings																	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	DD	🟩	C	🟩	D	🟩	P																														
4.9		**Advisory Report**																																																												
	SEI	Advisory Report - New residential buildings																			🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	DD	🟩	C	🟩	D	🟩	P																														
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4.15		**Training & Accreditation of Assessors**																																																												
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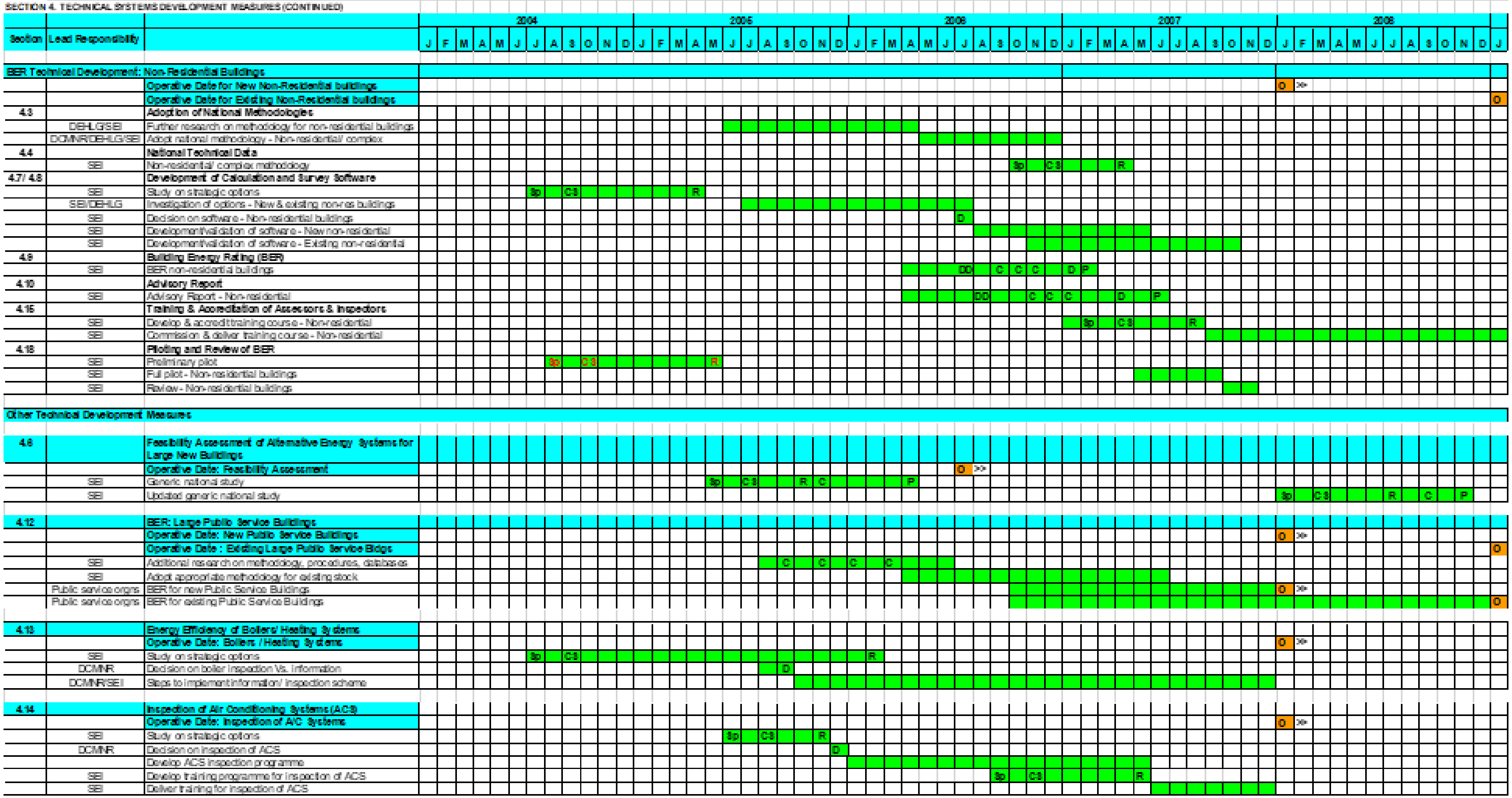
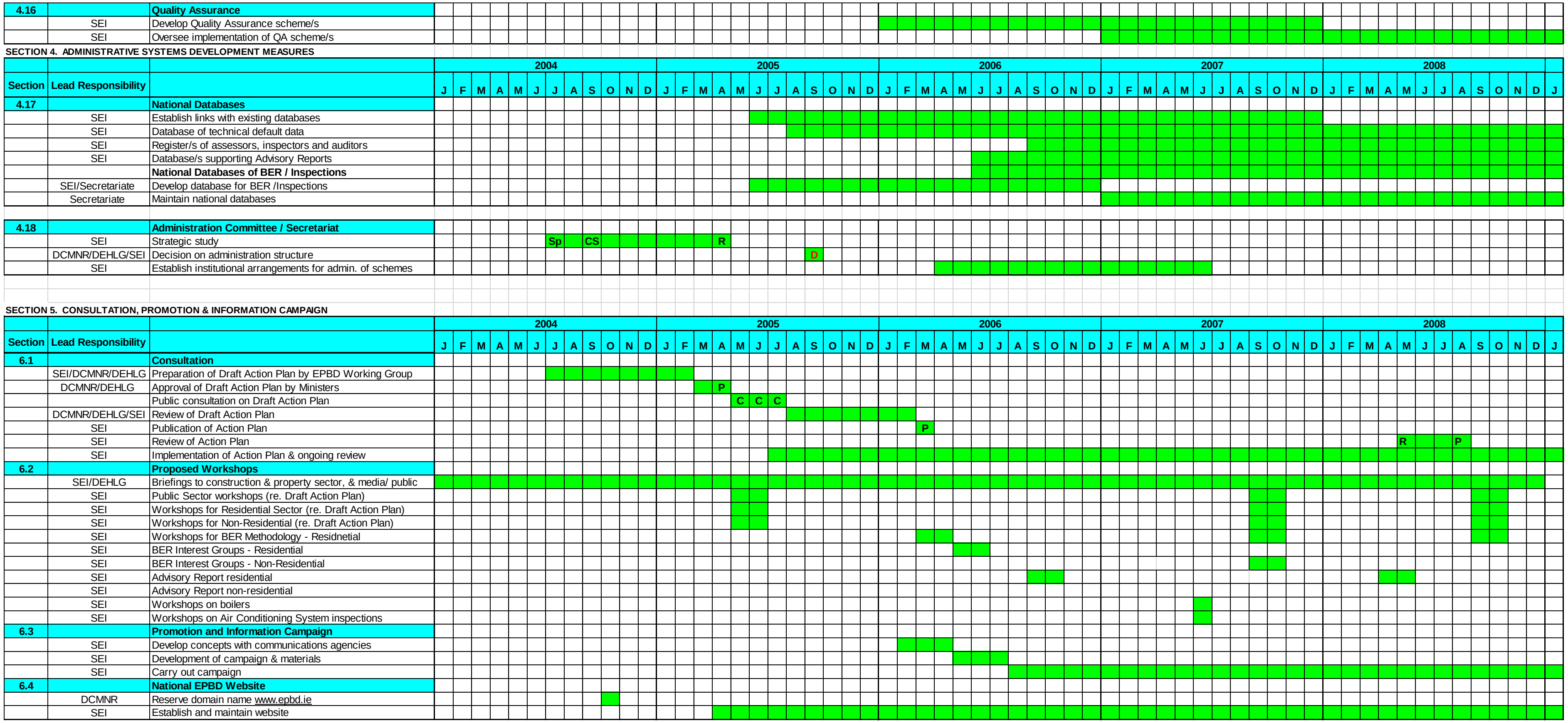
		Commission & deliver training - New residential BER																																		🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
	SEI	Develop & accredit training course - Existing residential BER																																			🟩	🟩	Sp	🟩	CS	🟩	🟩	🟩	🟩	R																		
	SEI	Commission & deliver training - Existing residential BER																																												🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
4.19		**Piloting and Review of BER**																																																												
	SEI	Preliminary pilot								Sp	🟩	CS	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	R																																								
	SEI	Pilot - New residential buildings																											🟩	🟩	🟩																																			
	SEI	Review - New residential buildings																														🟩	🟩	🟩																																
	SEI	Pilot - Existing residential buildings																																									🟩	🟩	🟩																					
	SEI	Review - Existing Residential buildings																																												🟩	🟩																				



SECTION 4. TECHNICAL SYSTEMS DEVELOPMENT MEASURES (CONTINUED)

Section	Lead Responsibility	
BER Technical Development: Non-Residential Buildings		
		Operative Date for New Non-Residential buildings
		Operative Date for Existing Non-Residential buildings
4.3		**Adoption of National Methodologies**
	DEHLG/SEI	Further research on methodology for non-residential buildings
	DCMNR/DEHLG/SEI	Adopt national methodology - Non-residential/ complex
4.4		**National Technical Data**
	SEI	Non-residential/ complex methodology
4.7/ 4.8		**Development of Calculation and Survey Software**
	SEI	Study on strategic options
	SEI/DEHLG	Investigation of options - New & existing non-res buildings
	SEI	Decision on software - Non-residential buildings
	SEI	Development/validation of software - New non-residential
	SEI	Development/validation of software - Existing non-residential
4.9		**Building Energy Rating (BER)**
	SEI	BER non-residential buildings
4.10		**Advisory Report**
	SEI	Advisory Report - Non-residential
4.15		**Training & Accreditation of Assessors & Inspectors**
	SEI	Develop & accredit training course - Non-residential
	SEI	Commission & deliver training course - Non-residential
4.18		**Piloting and Review of BER**
	SEI	Preliminary pilot
	SEI	Full pilot - Non-residential buildings
	SEI	Review - Non-residential buildings
Other Technical Development Measures		
4.6		Feasibility Assessment of Alternative Energy Systems for Large New Buildings
		Operative Date: Feasibility Assessment
	SEI	Generic national study
	SEI	Updated generic national study
4.12		BER: Large Public Service Buildings
		Operative Date: New Public Service Buildings
		Operative Date : Existing Large Public Service Bldgs
	SEI	Additional research on methodology, procedures, databases
	SEI	Adopt appropriate methodology for existing stock
	Public service orgns	BER for new Public Service Buildings
	Public service orgns	BER for existing Public Service Buildings
4.13		Energy Efficiency of Boilers/ Heating Systems
		Operative Date: Boilers / Heating Systems
	SEI	Study on strategic options
	DCMNR	Decision on boiler inspection Vs. Information
	DCMNR/SEI	Steps to implement information/ inspection scheme
4.14		Inspection of Air Conditioning Systems (ACS)
		Operative Date: Inspection of A/C Systems
	SEI	Study on strategic options
	DCMNR	Decision on inspection of ACS
		Develop ACS inspection programme
	SEI	Develop training programme for inspection of ACS
	SEI	Deliver training for inspection of ACS

Figure 3-4 Segment of EPBD Action Plan Gantt Chart covering delivery of administrative system development, consultation, promotional and information actions



4.16		**Quality Assurance**																																																												
	SEI	Develop Quality Assurance scheme/s																									🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩													
	SEI	Oversee implementation of QA scheme/s																																					🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩

SECTION 4. ADMINISTRATIVE SYSTEMS DEVELOPMENT MEASURES

			2004												2005												2006												2007												2008												
Section	**Lead Responsibility**		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J
4.17		**National Databases**																																																												
	SEI	Establish links with existing databases																		🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩													
	SEI	Database of technical default data																				🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
	SEI	Register/s of assessors, inspectors and auditors																																	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
	SEI	Database/s supporting Advisory Reports																														🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
		National Databases of BER / Inspections																														🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
	SEI/Secretariate	Develop database for BER /Inspections																		🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩																											
	Secretariate	Maintain national databases																																					🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
4.18		**Administration Committee / Secretariat**																																																												
	SEI	Strategic study							Sp	🟩	CS	🟩	🟩	🟩	🟩	🟩	🟩	R																																												
	DCMNR/DEHLG/SEI	Decision on administration structure																							D																																					
	SEI	Establish institutional arrangements for admin. of schemes																													🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩																			

SECTION 5. CONSULTATION, PROMOTION & INFORMATION CAMPAIGN

			2004												2005												2006												2007												2008												
Section	**Lead Responsibility**		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J
6.1		**Consultation**																																																												
	SEI/DCMNR/DEHLG	Preparation of Draft Action Plan by EPBD Working Group							🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩																																													
	DCMNR/DEHLG	Approval of Draft Action Plan by Ministers															🟩	P																																												
		Public consultation on Draft Action Plan																	C	C	C																																									
	DCMNR/DEHLG/SEI	Review of Draft Action Plan																				🟩	🟩	🟩	🟩	🟩	🟩	🟩																																			
	SEI	Publication of Action Plan																											P																																	
	SEI	Review of Action Plan																																																				R	🟩	🟩	P					
	SEI	Implementation of Action Plan & ongoing review																			🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
6.2		**Proposed Workshops**																																																												
	SEI/DEHLG	Briefings to construction & property sector, & media/ public	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	
	SEI	Public Sector workshops (re. Draft Action Plan)																	🟩	🟩																													🟩	🟩													🟩	🟩			
	SEI	Workshops for Residential Sector (re. Draft Action Plan)																	🟩	🟩																													🟩	🟩													🟩	🟩			
	SEI	Workshops for Non-Residential (re. Draft Action Plan)																	🟩	🟩																													🟩	🟩													🟩	🟩			
	SEI	Workshops for BER Methodology - Residnetial																											🟩	🟩																			🟩	🟩													🟩	🟩			
	SEI	BER Interest Groups - Residential																													🟩	🟩																																	
	SEI	BER Interest Groups - Non-Residential																																															🟩	🟩																	
	SEI	Advisory Report residential																																	🟩	🟩																				🟩	🟩								
	SEI	Advisory Report non-residential																																																												
	SEI	Workshops on boilers																																										🟩																			
	SEI	Workshops on Air Conditioning System inspections																																										🟩																			
6.3		**Promotion and Information Campaign**																																																												
	SEI	Develop concepts with communications agencies																										🟩	🟩	🟩																																		
	SEI	Development of campaign & materials																													🟩	🟩	🟩																															
	SEI	Carry out campaign																																🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
6.4		**National EPBD Website**																																																												
	DCMNR	Reserve domain name www.epbd.ie										🟩																																																			
	SEI	Establish and maintain website																🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩

3.5 Stakeholder and wider public consultation and information campaigns

Starting with the Action Plan, consultation with interested parties should b carried out throughout the development, piloting and implementation phases for each aspect of the EPBD. The aim of the consultation process is to secure the understanding, co-operation and participation of key actors and influencers in the property sector, including the following categories:

- Representative bodies in the construction industry (builders and suppliers)
- Representative bodies among building professionals
- Local authorities as the bodies responsible for building control enforcement functions
- Energy specialists including Local Energy Agencies and software providers
- Standards, certification and accreditation bodies
- Educational, Training and Research bodies
- Energy services utilities and representative bodies
- Energy user and consumer groups – for both the residential and non-residential sectors
- Financial Institutions
- Property owners and facilities management organisations.

Good practice: In Ireland a series of **workshops** / 'road shows' was held on a regional basis to inform interested parties on the progress regarding the implementation of the EPBD and to obtain feedback. A comprehensive promotional and information campaign, including newspaper and journal articles and TV and radio advertising was undertaken in order to inform the above organisations and the general public, particularly in relation to the new obligations and benefits of energy performance certification (EPC). The campaign included design/print, advertising, press events and indirect marketing initiatives particularly with key market players. Over the period 2004-2009 Irish authorities organised or participated in a total of over 200 information sharing events on various aspects of the EPBD implementation, with a combined total attendance of over 25,000 people (Ireland's population is 4.5 million). In order to provide live access to the full community of interests in relation to news, reference material, discussion / consultation documents and other information, a dedicated national EPBD website (www.epbd.ie) was established.

3.6 Regulatory Impact Assessment (RIA)

In the case of proposals for new legislation in EU countries it is a common practice that the national 'business case' is required to be prepared for approval by Government, particularly by the Ministry responsible for Finance. This has typically taken the form of a 'regulatory impact assessment' (RIA) and has applied in many EU Member States to both the cases of new, re-designed building codes incorporating strengthened EP requirements and the introduction of new requirements for EPCs. The RIA document typically outlines the purpose, policy context, implementation options, impacts, costs and benefits, and enforcement responsibilities and issues. Traditionally the cost-benefit assessment may have been applied either payback or life cycle analysis (LCA). However, the EPBD's mandatory requirement for cost optimal studies in the review of building energy codes has led to all such cost-benefit analysis now being on an LCA type basis.

3.7 Developing and enacting the transposing legislation

(to be detailed in Position Paper 3)

The legislative instruments used by EU Member States to transpose the EPBD requirements have varied according to pre-existing legislative frameworks and traditions in relation to building codes, energy legislation and adoption of EU legislation. Further details will be given in Position Paper 3. However, a typical experience has been for the first draft outline of legislation to be prepared by the Ministries and/or agencies in the EPBD steering group and a cycle of successive drafts consulted and amended further. Following this, the proposed texts are submitted to the Government's legal services (e.g. attorney general, parliamentary draughtsman) for review prior to finalisation and submission to either the Minister and Parliamentary Committee (and possibly full Parliament) for enactment. In the latter case, the finalisation of the legislation is subject to the normal debating and voting processes. However, any amendments must avoid conflicting with any of the mandatory requirements in the Directive. The duration of the overall process has been at least 6 to 9 months.

Key elements in the legislation include: definitions, connections to previous legislation, assignment of obligations on building owners or their agents, assignment of functions and powers in administration and enforcement, registration of qualified persons or organisations, specification of procedures for compliance, key reference documents and penalty systems. Typically legislation has been developed on a national basis, but in a small number of cases it has been also on a regional basis. In general, administrative oversight of the EP and EPC requirements has been assigned to a Ministry or energy agency and the enforcement powers have been assigned to local authorities.

An associated important need is for Government to authorise the financial and human resourcing of the assigned authorities to enable the development and operation of the necessary administrative and enforcement processes and associated IT systems, and to enable ongoing promotion and development.

Good practice: The pace of transposition varied considerably between different EU Member States. Countries such as Denmark, Portugal and Ireland enacted the legislation in 2006, and provided the necessary resources, while in a small number of countries these essential processes were not complete by 2010. The main challenges related to the new EPC concept and its administration. It is beneficial if the Member State already has a relatively standardised legal procedure pertaining to the transposition of EU directives. Because of the flexibility afforded in such directives, it is recommended that the legislation or its accompanying guidance documentation is rather explicit in prescribing the technical requirements and the procedures for ensuring compliance.

In several countries, the legislation was accompanied by development and publication of technical guidance documents and other support documents, e.g. codes of practice, databases of product performance (boilers, HVAC, motors, lighting, etc.), guidance documents on solar, external insulation certification. This may possibly extend to include new developments such as databases pertaining to the EU Construction Products Regulations, Environmental Product Declarations, etc.

Member States that had failed to meet their transposition deadlines were threatened with infringement proceedings by the EU legal services. Ultimately, the transposition process was completed for all countries.

4 COMPLIANCE

Capacity building: technical tools, skills and systems development

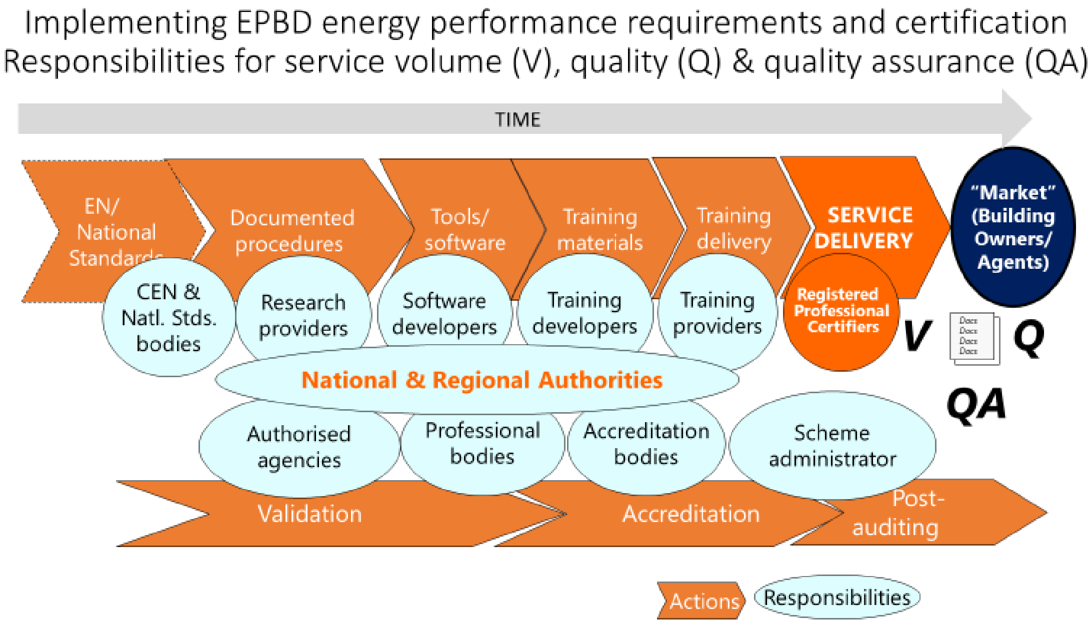
4.1 Overview of technical systems development

Prior to bringing new EP and EPC requirements into effect, it was necessary to ensure that three sets of conditions were established:

- Volume (V): Adequate numbers of relevant competent professionals are active in order to meet market demand and ensure healthy competition in the market;
- Quality (Q): These professionals are of adequate quality (competence);
- Quality Assurance (QA): Adequate quality assurance and administrative systems are in place to co-ordinate and oversee, on an ongoing basis, the reliable operation of these services.

These requirements cannot be considered in isolation and are dependent on completion of a series of prerequisite tasks, as follows. An overview of the individual sets of tasks and players required to establish EP and EPC compliance services in the marketplace, and their interrelationships in contributing to meeting the V-Q-QA conditions, is given schematically in Figure 4-1

Figure 4-1 Sequence of tasks and responsible parties for delivery of an EP compliance and certification service to meet volume, quality and quality assurance requirements.



This shows the integrated sequence of tasks that must be put in place ahead of establishing these services. The tasks shown as block arrows constitute a chain of dependencies, with the delivery of any individual task being dependent on the preceding task in the chain being complete. For example, in relation to the upper (V, Q) supply line, the presence of adequate numbers of qualified EP assessors demands that training has been delivered; this in turn demands that a training syllabus has been put in place, which in turn depends on the development and validation of the software to enable the application of the core methodology. The parties associated with these sets of tasks are shown as ovals. A similar sequential interdependency applies to the lower (QA) supply line.

Substantial progress has also been required on these tasks in order to allow integrated administration systems be developed and tested, including on-line systems for lodgement of evidence documentation on EP compliance to a central database, and consequent data management and quality assurance procedures.

As indicated previously, the scale and complexity of the work involved has necessitated an incremental, phased approach to implementing the individual requirements of the EPBD over time, in the manner allowed by the Directive. An example of the segmentation of these provisions and the proposed schedule of tasks leading to complete implementation was given in the Gantt chart of

Figure 3-2.

4.2 Role of EN standards

(to be detailed in Position Paper 4)

A key underlying factor in relation to the compliant implementation of the provisions in respect of EP requirements, and their application to new and existing buildings, and to EPCs, was the establishment of an official methodology (or other accepted methodologies) for the calculation of energy performance in buildings. Traditionally, there have been variations between EU countries in the technical scope of coverage (of energy use for heating, cooling, hot water, lighting etc.) and the form or grade of energy used in the performance criterion (useful, delivered or primary). However, the EPBD and associated development of European Standards (EN) led to the most comprehensive coverage, namely all major energy end uses and primary (fossil fuel) energy use, normally expressed in term of kWh per m^2 (and possibly also kg of CO_2 per m^2).

Recognising this and other technical needs under the Directive, and to encourage Member States to adopt a harmonised approach as far as possible, the EU Commission mandated and funded the European Standards Organisation[ε] (CEN) to prepare a hierarchical suite of supporting standards. National standards authorities in Europe are all members of CEN. The original aim was to have all relevant standards available as drafts for consultation in sufficient time to allow their adoption by Member State authorities, most of which had declared a receptiveness to using the new standards. However, the development process took considerably longer than intended, and the standards were also generally not in a practical form suitable for direct application by building specifiers and required considerable national input before they could be used operationally. Moreover, the core EP calculation standards were flexible in allowing annual, monthly or dynamic simulation model calculations. Therefore all the Member States committed to meeting their deadlines from the original EPBD were obliged to proceed with choosing or developing national methodologies for EP assessment advance of publication of the new EN standards. This included reviewing and adapting methods already in use in their own and other countries. A new mandate was issued to CEN by the EU Commission in relation to the recast EPBD and ultimately over the period 2012-2017 an extensive suite of standards was completed. Some of this work included collaboration between CEN and ISO and was published under the aegis of the ISO 52000 series. The modular structure of the suite is conceptually illustrated in Figure 6, showing the approach to integrating the various groups of standards

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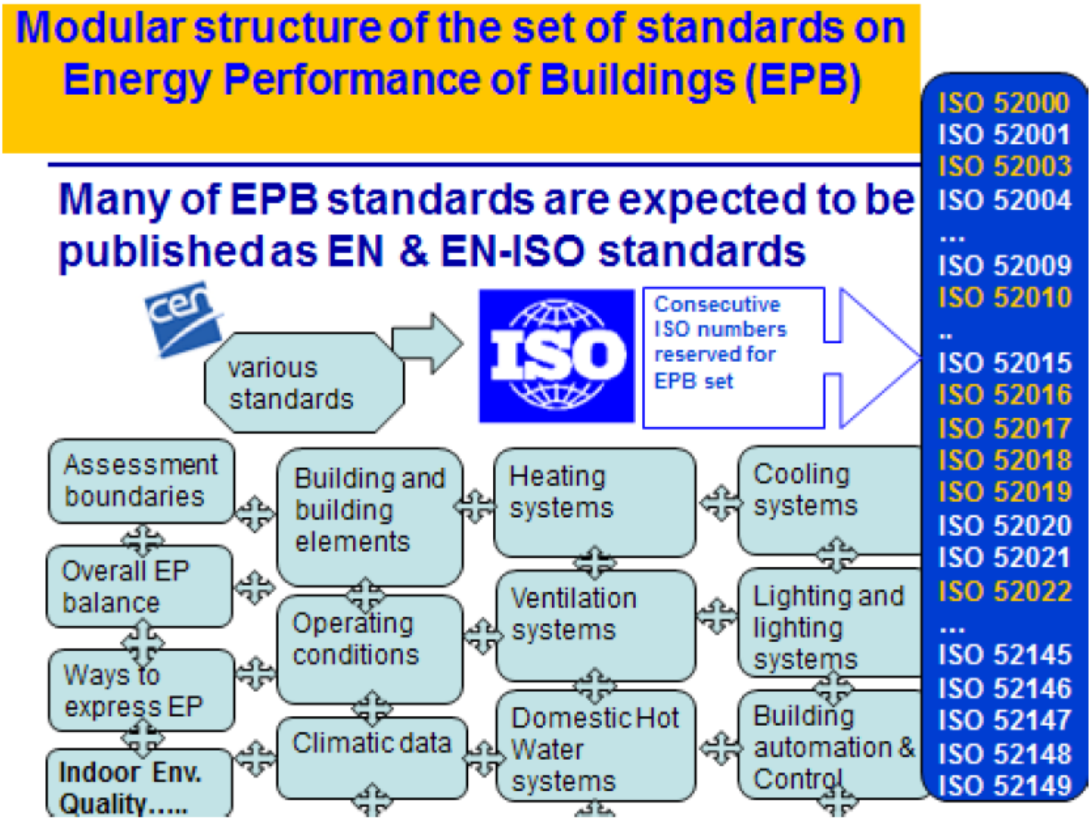
[ε] Formally known as "Comité Européen de Normalisation" (CEN) or the "European Committee for Standardisation".

pertaining to the various components and sub-systems contributing to overall energy performance.

Figure 4-2 Modular structure of European standards on energy performance of buildings



Overall, the new series is expected to help accelerate progress in energy efficiency, utilizing new building materials, technology and approaches to building design, construction and management. This includes novel concepts in the fields of thermal insulation, windows/ glazing, heating, cooling, lighting, ventilation, domestic hot-water systems, building automation and control, and renewable energy sources. It can be expected to lead to a gradual adaptation of existing methodologies as further refinements may be required to meet the needs generated following the adoption of NZEB performance standards. More details will be given in Position Paper 4.

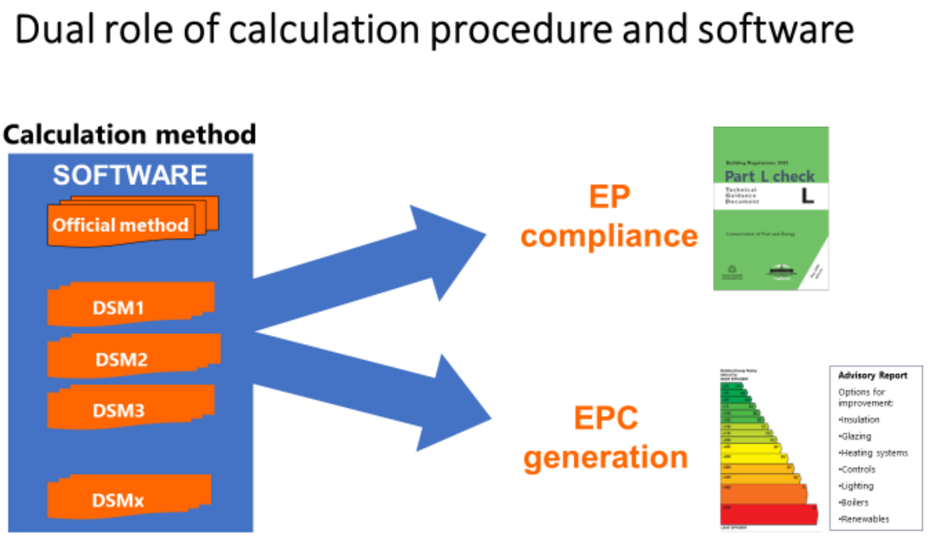
4.3 Calculation methodologies

The EN standards are not in themselves a full EP calculation methodology. In general, each national methodology for calculating and demonstrating compliance with EP requirements is the outcome of a series of modelling studies, and involves a calculation engine incorporating various algorithms, all of which are aligned to the relevant EN standards. It is typically embedded in a user-friendly software. The newly adopted methodologies varied in scope and complexity across Member States. Generally, different methodologies were used for residential buildings (sometimes also between apartments and single homes) and for other buildings, but in a small number of countries a common universal methodology was used. All methodologies used an overall energy performance indicator, covering the main thermal and electrical uses, and expressed as annual kWh of either final energy or primary energy per m^2 of gross floor area.

Whether inn assessing a building design or existing building, the concept of a 'reference' or notional building has been employed. The calculation is first performed on such a notional building with the same (or a standard) geometry as the building being assessed, but with 'reference' characteristics for its energy features based on good practice standards at a particular date (for example 2006). The same calculation is then carried out on the proposed or actual building and the key indicator from the assessment is the ratio of the performance of the actual building versus that of the reference building.

Good practice: Deriving from the terms of the Directive, the methodologies adopted in all Member States had a dual purpose, providing a common calculation engine for demonstrating compliance with the EP requirements and for producing EPCs, as shown in Figure 3-3. The calculation method permits either the official national methodology, or alternatives in the form of validated dynamic simulation models (DSMs). This dual role provides consistency and efficiency benefits both to building professionals and to regulatory authorities.

Figure 4-3 Dual role of calculation methodology in demonstrating EP compliance and generating EPCs



Good practice: Several EU countries have used a methodology and software called 'Simplified Building Energy Model' (SBEM), which was developed in the UK but also applied in adapted form (allowing for differn climatic and other libraries of data) in Cyprus, Malta, Ireland and some other States, to enable EP assessment of non-residential buildings. This is an example of a degree of harmonisation or convergence between EU Member States.

In most EU countries, a broadly similar national methodology and associated software has likewise been developed by the relevant national energy agency.

4.4 Software

Associated with the methodologies, officially recognised software tools were developed or adapted from existing tools. These also served as an important medium for training of designers, specifiers and EPC assessors in order to meet the relevant professional service delivery requirements to comply with the Directive. In most EU countries, for residential buildings and relatively simple non-residential buildings an official national method, typically based on monthly calculations, was adopted as freeware available to registered professionals (and in some cases to the general public). This covered most buildings but most countries also provided the option of validated commercial dynamic simulation methods to cater better for more complex buildings.

Good practice: Software tools have been developed in all EU Member States to support qualified persons in producing and issuing EPCs. Such development would typically entail a pilot trialling and review phase. There is a mix of software being produced by either the central or regional authority, or private companies. The number of available software packages varies between countries. In 20 EU countries the uniform and reliable interpretation and implementation of the calculation procedure of the software is assured by an accreditation process. This also usually includes an automatic quality check of the input data or a digital data protocol. Accreditation can either be organized at government level (such as in Poland, Malta, UK or Italy) or by a voluntary commitment of the private software suppliers (such as in Germany). Official validation of the calculation methods used in the software packages by a central authority is designed to build customer confidence and ensuring consistency and accuracy in the results.

Where software is not accredited, there can be doubts about the consistency and robustness of EPCs, and about consumer confidence in the EPC information.

Good practice: Piloting and review: In Ireland, for both residential and non-residential buildings, once the draft national methodologies had been agreed and the associated software developed and validated to a sufficiently advanced stage, and an early cohort of EP assessors were trained, the calculation and survey methodologies were piloted by means of a commissioned study by the national energy agency in order to identify any issues and difficulties. This enabled corrective adjustments to be made and reduce the risks of errors or difficulties in the use of the methodologies, software and administration system.

4.5 RD&D projects

(to be detailed in Position Paper 7)

The EU Commission operates a competitive research, development, demonstration (RD&D) programme, in which leading manufacturers of construction products and equipment have participated and collaborated for the purposes of developing more energy efficient products and service solutions. This contributes to the capacity of the market to respond actively to meet or surpass the requirements of the EPBD and other policies. The Commission has also operated a support programme entitled 'Intelligent Energy for Europe' (IEE) to tackle barriers and assist market deployment of energy efficiency. These programmes supported projects in the fields of improving technologies, tools, skills development, market analysis, databases, market awareness initiatives and financial initiatives, and generated useful insights, findings and case examples.

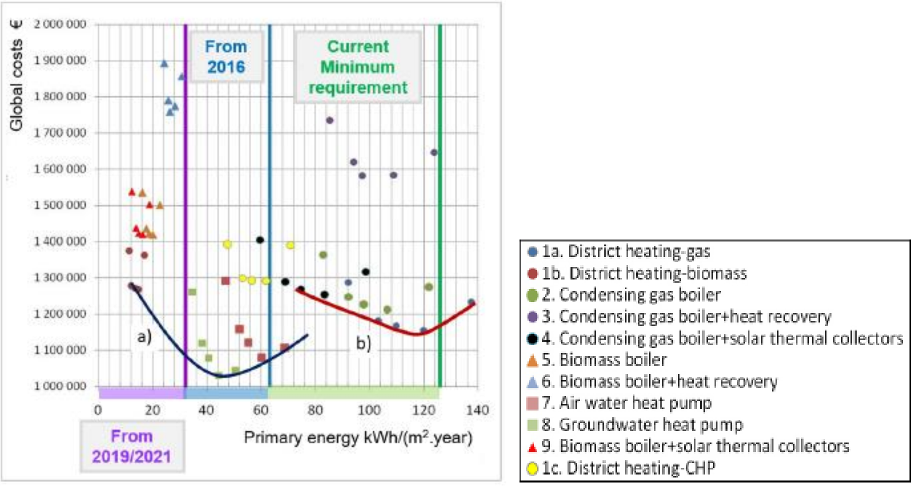
Many EU Member States also commissioned national studies and pilot projects for a similar purpose, aimed at informing the design of the EPBD implementation systems and their effectiveness.

4.6 Cost optimal methodology and studies

The recast EPBD introduced the concept of cost optimality when setting the EP requirements in Member States. The cost optimal level is 'the energy performance which leads to the lower cost during the estimated lifecycle'. This methodology introduced a long term life cycle (c. 30 years) approach to assessing the appropriate standards of performance to be set in the building code both for buildings as a whole and for their individual elements. The EU Commission issued guidelines in 2011 which were to be applied by Member States in their first new reviews of EP standards on the basis of this framework methodology, to be completed by 2013.

An example of the application of the concept is shown in Figure 8, with energy intensity on the X axis and cost intensity (life cycle cost) shown on the Y axis. In applying this process, different construction traditions, materials, climates and economic conditions have led to a rather variable set of energy performance standards across EU Member States. However, overall this new framework methodology has provided a new impetus to the significant improvement of energy performance standards across Europe.

Figure 4-4 Example of results from cost optimal analysis of costs and primary energy use in block of flats for different heating sources



Good practice: Figure 3-4 is an example of part of such an analysis in Slovakia showing the progression of proposed EP standards from the then current requirements level, the intermediate target requirement for 2016 and the indicative NZEB level for 2020. It shows two results curves: a blue curve (a) for heat pump and biomass solutions and a red curve (b) for heat sources that are feasible for all locations. This not only shows the wide range of life cycle (global) costs for different fuel options but reflects a policy commitment to a pathway leading to adoption of NZEB performance standards by 2019/ 2021.

In the Netherlands the cost-optimality methodology is considered to be a useful tool for communicating with stakeholders about the costs associated with the proposed regulation, and to gauge the political will for implementing the measures based on the associated costs.

4.7 EP targets: Setting of energy performance requirements – primary energy and emissions

Arising from application of the cost optimal methodology, the majority of Member States reviewed their existing EP requirements and either introduced more stringent requirements than applied pre-2015 or confirmed that they are already in accordance with cost-optimal levels. In all cases a format of requirement was adopted whereby a maximum permissible energy intensity was specified for different categories of building, expressed as kWh/m^2 per year of either final energy or primary energy. (In a number of countries a maximum permissible carbon or CO_2 intensity was also adopted.) A minimum level of renewable energy contribution was also adopted in some countries, e.g. regions of Austria and Spain. For non-residential buildings and sometimes for residential buildings, determination of compliance involved such an energy or carbon indicator being compared with that of a notional or ‘reference’ building of a defined geometry and technical specification. In several EU countries, the performance requirement is supplemented by minimum requirements (or backstop values or criteria) for individual elements or components of the building. This encourages a ‘fabric first’ approach to building design and specification, rather than for example relying on renewable energy to compensate for inappropriate design of the building envelope.

A degree of flexibility in the methodology framework, plus differences in energy prices, construction costs and climate between different countries led to a variety of findings and consequential actions. Countries have tended to be slower in applying the findings of their cost optimal studies to the building renovation segment of the market. It is likely that differences in levels of national policy commitment and ambition have also tended to influence the interpretation of actions arising from the cost optimal study findings.

This process is directly linked to the NZEB roadmapping process described below, given that intermediate targets were required for 2015 on the path to NZEB by 2019-2021.

Good practice: France has established a progressive performance based code that has been adapted to the different regions of the country. The code requires buildings to demonstrate compliance with the maximum allowed primary energy consumption, the ’Cepmax’ coefficient. This coefficient represents the maximum consumption of primary energy that considers thermal envelope components and most energy consuming systems including HVAC, hot water, lighting, heat recovery and auxiliary systems. The code also includes requirements for mandatory renewable energy, computer simulations, air-tightness testing for residential buildings and bio-climatic design considerations, all of which are integral to a holistic approach.

The Denmark building code is fully performance based and sets a total value in absolute energy use based on size and function of the building. The code addresses all thermal envelope requirements and energy-using efficiency standards in the calculation, including heating, cooling, ventilation, hot water, lighting (only non-residential), heat recovery and conversion and distribution losses. Studies have verified the effectiveness of these regulations. Austria, Finland and the Netherlands have similarly progressive performance based approaches.

Overall, despite the variations, there has been a progression in EP requirements being accelerated by the EPBD in building codes across EU Member States.

4.8 EP certification

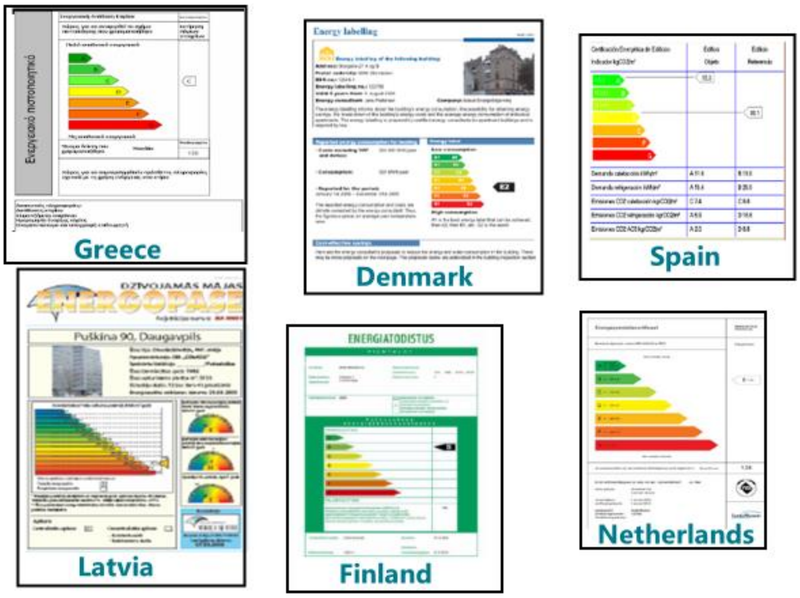
The new concept of mandatory EPCs at the point of construction, or offer for sale or rental, has required an extensive set of actions to be implemented in order to establish an effective system. (Hence the value of a well-coordinated action plan.) In the good practice cases, the process typically included the following, with differences in detailed analyses and EPC system design between residential and non-residential buildings:

- Finalisation of the EP calculation methodology and software.
- Carrying out a series of modelling and benchmarking studies.
- Development of the format and designing of the scale of the EPC label.
- Specification and organisation of training, with timelines to ensure adequate numbers of qualified design professionals and EPC assessors.
- Development of Codes of Practice or Codes of Conduct.
- Establishment of registers of EPC assessors.
- Design and establishment of EPC databases/ registers for on-line lodgement of EPCs.
- Development of a quality assurance regime with associated disciplinary and complaints procedures.
- Website development.
- A major communication and promotional campaign for the construction industry, politicians and the general public.
- Ongoing helpdesks for EPC assessors, building owners and the general public.

In general, for new buildings and buildings for sale or rental, the EPC was based on a calculated 'asset rating' rather than an 'operational' or measured energy use rating, to allow like-with-like comparison between competing properties. While the fundamental concept of an EPC with a scale from A to G was commonly applied across the EU, individual Member States took different aesthetic and functional approaches to the design of the EPC. These may work well within the individual States but do not facilitate interpretation between different States.

Good practice: In general, EU Member States adopted an EPC scale running in bands from A (best) to G (worst), sometimes with subdivisions. This had similar appearance in different countries (see Figure 9), guided by an EN standard, but different levels of stringency were applied in different countries, for example in relation to the level of performance that would receive an 'A' rating. It is recommended that the scale allows sufficient 'headroom' for future regulatory upgrading on the pathway to NZEB standards, and in good practice cases the existing regulatory standard for new buildings was set at a 'C' rating or on the boundary between 'B' and 'C', as guided by the EN standard. It is regrettable that some placed basic compliance with current regulations as having an 'A' rating (possibly under pressure from some construction industry interests), as this would then require A+ and A++ ratings in the future, and also weakening the market visibility signal and level of ambition for energy renovation of the existing building stock.

Figure 4-5 Some examples of the variety of design formats for Energy Performance Certificates (EPCs) in Europe



4.9 Databases of EP compliance and EP certificates

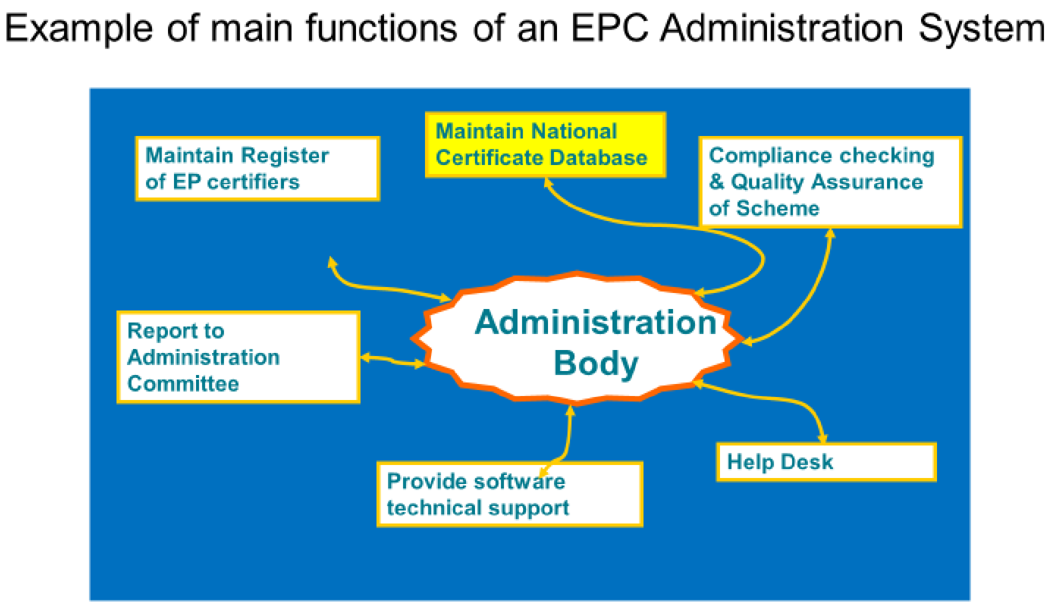
(to be detailed in Position Paper 9)

Generally, the underlying databases, and compliance and enforcement functions, in relation to EP requirements for new buildings or major renovations and in relation to mandatory EPCs for newly completed or existing buildings coming to market are not unified. Enforcement of both is usually a legal function of building control authorities (commonly local or municipal authorities). However, evidence of compliance with EP requirements is commonly lodged to a building control system database whereas the output data (and desirably also input data) for EPCs are typically lodged to a separate EPC database operated by the EPC scheme administrator (for example an energy agency). The lodgement, assignment of unique identifier and any payment process can be enabled by the design of an on-line system of access to the database which is restricted to registered professionals.

Good practice: A number of EU Member States (Portugal, Denmark, Ireland, Belgium-Flanders and others) have now established mandatory registers/ databases of qualified EPC assessors and of EPCs, whereby EPC assessors were required to lodge their EPCs to a central database. These are secure fully integrated systems which have entailed significant investment in robust ICT systems, but this has brought considerable strategic benefit and provided a monitoring resource and a basis for systematic quality assurance. Its automated features enable major operational efficiencies. Some further functionalities associated with such a database as part of the EPC administration system are shown in Figure 10. These can include registration of EP/ EPC assessors, link with calculation tools and on-line validation of EPCs. In relation to new buildings in particular, similar functionalities could apply to a building control database to serve as a compliance monitoring resource to the enforcement authorities in relation to the EP requirements (and indeed other building code requirements).

While a growing number of Member States have taken the step of establishing central databases for EPCs, not all have strong functionality, but the best examples allow access for enforcement authorities, researchers and policy makers, on an anonymised basis, to enable quality assurance strategies and inform national and regional plans for energy efficient renovation of the existing building stock. EU guidelines have been produced in relation to sampling of EPCs for quality assurance and associated enforcement purposes, and there appears to be a growing adoption of these guidelines, but significant progress still remains to be made in this regard.

Figure 4-6 Some functionalities of an EPC administration system associated with key databases



Fuller details on associated workflows and document flows will be given in Position Paper 9.

4.10 Training & examination

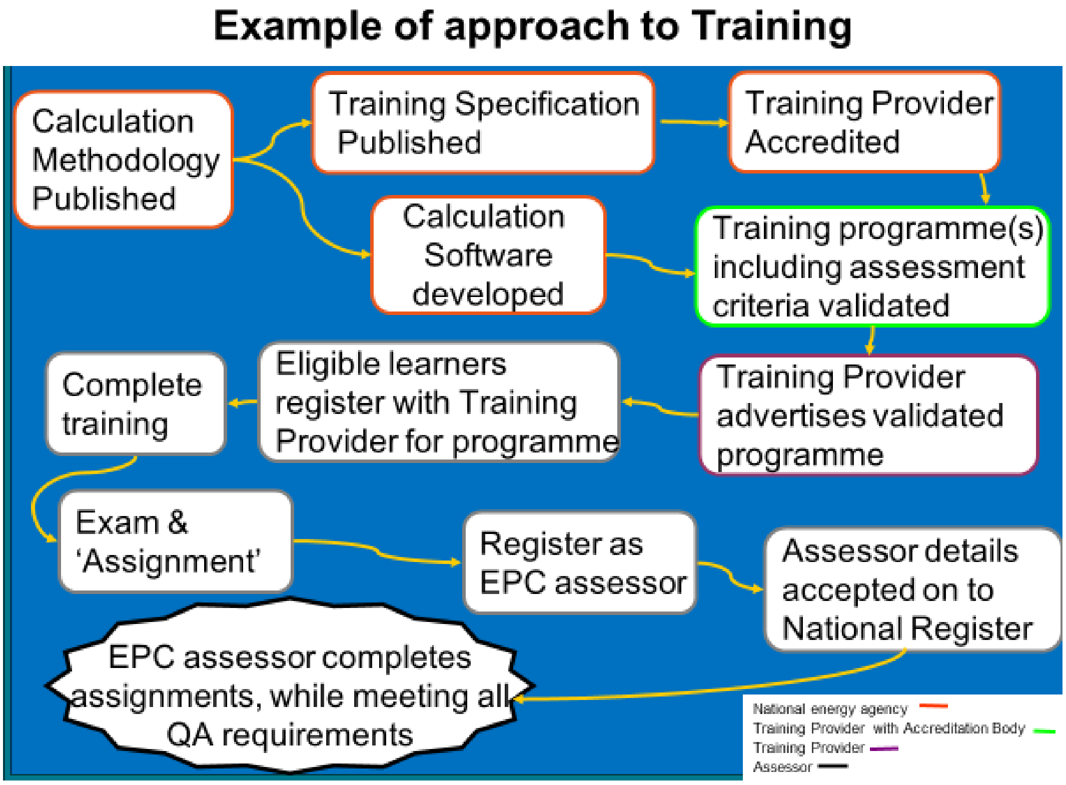
(to be detailed in Position Paper 5)

Good practice: An example of a series of steps involved in establishing a training and accreditation pathway to registration as an EPC assessor or EP competent professional is shown in Figure 11. Planning and design of this system and the levels of time and finance resources required on the part of trainees involves an appropriate balance between the criteria of V, Q and QA. Training delivery was often preceded by a 'train the trainers' course given by the national energy agency, software developer, academic or other specialists to training providers. These providers were typically subject to national training accreditation authorities. Prior to this, the national EPBD implementation authorities (typically the energy agency) would develop a training specification covering learning outcomes, minimum prior education/ industry experience requirements for trainees, credentials of individual trainers, curriculum content, tools and learning methods (e.g. including practical assignments). Curriculum content would cover the EP calculation software, accompanying manuals, understanding of regulations and procedures for lodgement of documents to the applicable databases. More than 16 Member States have prescribed requirements of this nature.

Compulsory training courses have been organised in at least 15 Member States. Volume delivery of training by the training providers has been typically of short duration (perhaps 2 days plus follow up) and in several cases were delivered on-line. Costs of training have varied, but on-line training was highly time-efficient for both trainers and trainees. Providers of training to building professionals (architects, engineers, surveyors, architectural technicians) varied between different Member States, but included a mix of academic institutions, professional bodies, software providers (for example of approved dynamic simulation models) and other commercial training providers. Training was frequently concluded with an examination in order to qualify for registration as a 'competent person'. In a number of cases, such examinations involved multiple choice questions. In a small number of countries, including Belgium (Flanders) and Ireland, a central State examination was established by the oversight authority.

Persons who pass the examination and who commit to complying with a Code of Practice/ Conduct (see further below) are then eligible to be licensed to work as a certified EP professional. In up to 19 Member States, it has been necessary to maintain continuing professional development (CPD) and to pass the examination periodically (e.g. every two years) in order to retain their license and remain on the register of certified professionals.

Figure 4-7 Overview of steps in establishing and delivering EP or EPC assessor training courses



With reference to Figure 1 above, the actual energy performance of a building depends strongly on the quality of execution on site of the design and specification. In turn this depends strongly on the qualifications and skills of blue-collar workers. For this reason a major strategic initiative carried out in multiple EU Member States under the EU 'Intelligent Energy for Europe' programme, entitled '**BUILD UP Skills'** has aimed to boost education and training of craftsmen, on-site construction workers and technical systems installers in the building sector. This is important for meeting progressively higher EP levels in new and renovation building, and particularly to meet the challenges of delivering NZEB. In this regard, each participating Member State is committed to producing a National Roadmap for training.

Good practice: Building element replacement in the UK: The UK has established 'competent persons schemes' (CPS) in order to ensure building elements retrofit and replacements, as well as small extensions, comply with the EP requirements in place. Under this scheme a building owner interested in performing such interventions will hire a competent person in order to implement and self-certify the works. Such schemes aim to enhance compliance, through promoting training and skills in the industry while minimising costs to industry, authorities and the building owner. The competent person must be part of a relevant CPS, such as the British Board of Agrément or the British Standards Institution. The certification issued by the competent person will be among the documents required if the building / building unit is subsequently sold or rented.

4.11 Codes of Conduct

Some Member States have published Codes of Practice to which technically qualified persons have been required to commit before being registered by the relevant registration body (architectural, engineering or surveying institutions, or national energy agency). These codes are focussed on ensuring an EP assessment service which is conducted in a professionally competent, independent manner. The product of this service will be the EP or EPC records and their lodgement on the national database. Delivery of a high quality service by active EP assessors is essential to the establishment and maintenance of public confidence in the quality of the buildings and of their certification, and to stimulating a positive response by way of improved energy specifications by building owners, developers and other investors.

4.12 Licensing and registration systems

On the basis of the steps outlined above, persons who have shown themselves to be technically competent and committed to providing their services according to the relevant Code of Practice/ Conduct are then eligible to proceed to be entered on a register as licensed to practice as a certified EP professional. This may involve payment of a registration fee. The register may be operated by a national energy agency. However, in some EU Member States, the system may choose to avail of existing registration infrastructure, whereby registration bodies for architects and engineers may list thus registered professionals in a specialist sub-category (such as ‘energy efficiency professional’ or similar) of their membership.

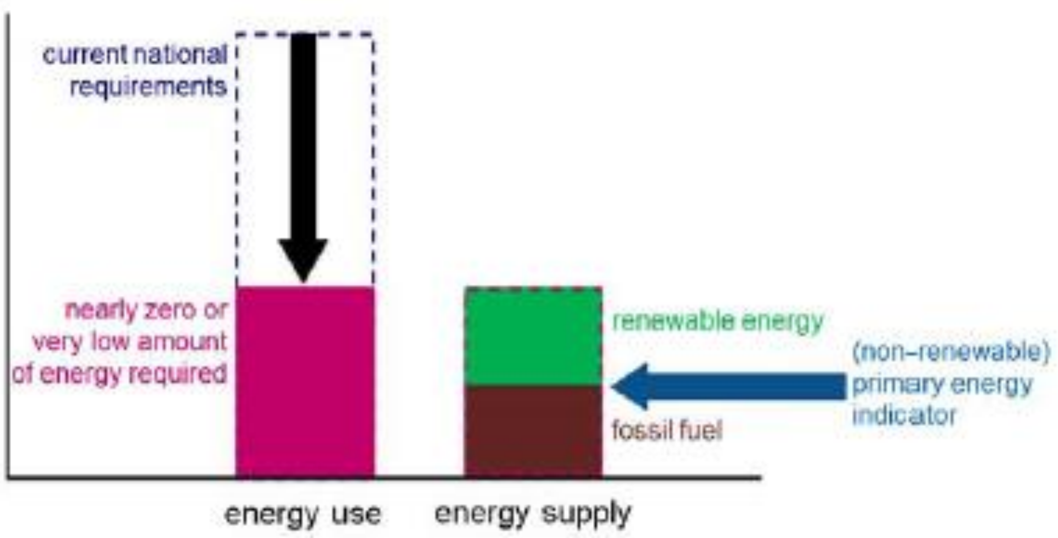
Good practice: In relation to databases or registers of EP compliance data, EPC data and support documentation, the lodgement of such data by the certified professional outlined may be accompanied by an automatic fee ro levy to the body administering the register. In the case of one country with a comprehensive register of EPCs this revenue is used to support a number of functions: staff resources in the scheme administration agency, ongoing development of the software tools and systems both technical and administrative, a help desk for both EPC certified professionals (which can include newsletters, FAQs and workshops) and for the general public, quality assurance resources, and promotion of the EPC scheme through advertising campaigns. This therefore comprises a largely cost neutral business model.

4.13 The roadmap to NZEB

The recast EPBD requires Member States to ensure that all new buildings by 31 December 2020 and all new buildings occupied and owned by public authorities by 1 January 2019 are NZEBs. They are also required to draw up national plans or ‘roadmaps’ for increasing the number of NZEBs, with the public sector showing exemplary leadership.

A NZEB is defined as a building that has a 'very high' energy performance. The nearly zero or very low amount of energy required should be covered 'to a very significant extent' by energy from renewable sources, including energy from renewable sources produced on-site or 'nearby'. It should also be without adversely affecting comfort, health and indoor air quality. The concept is illustrated in Figure 4-8

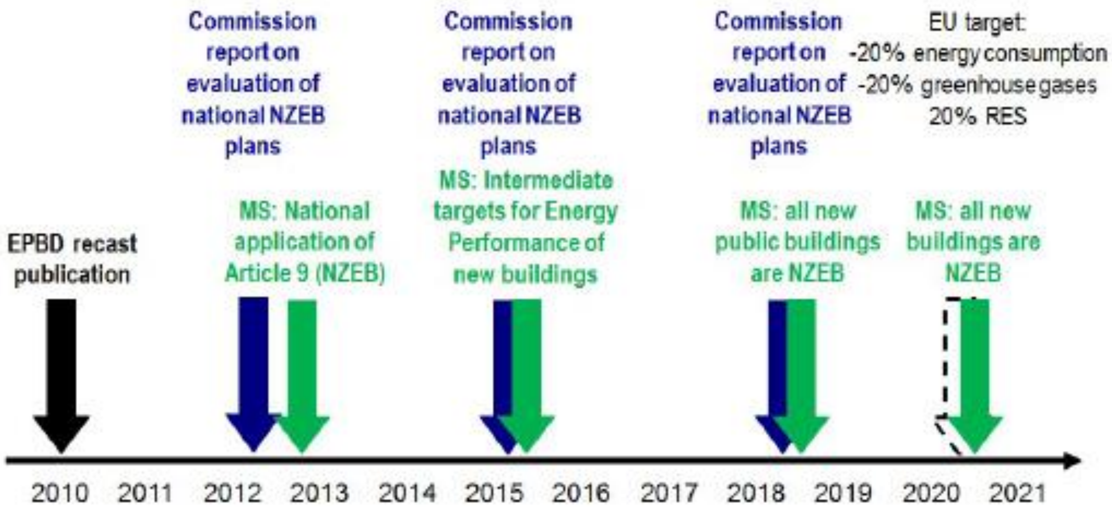
Figure 4-8 Graphical representation of the NZEB definition



The roadmap timeline, showing interim milestones for compliance and for associated EU Commission monitoring reports on progress, are shown in Figure 4-9.

Figure 4-9 Timeline for compliance with the EPBD requirements for road mapping to NZEB

(EU Commission resources shown in blue, Member State obligations shown in green)

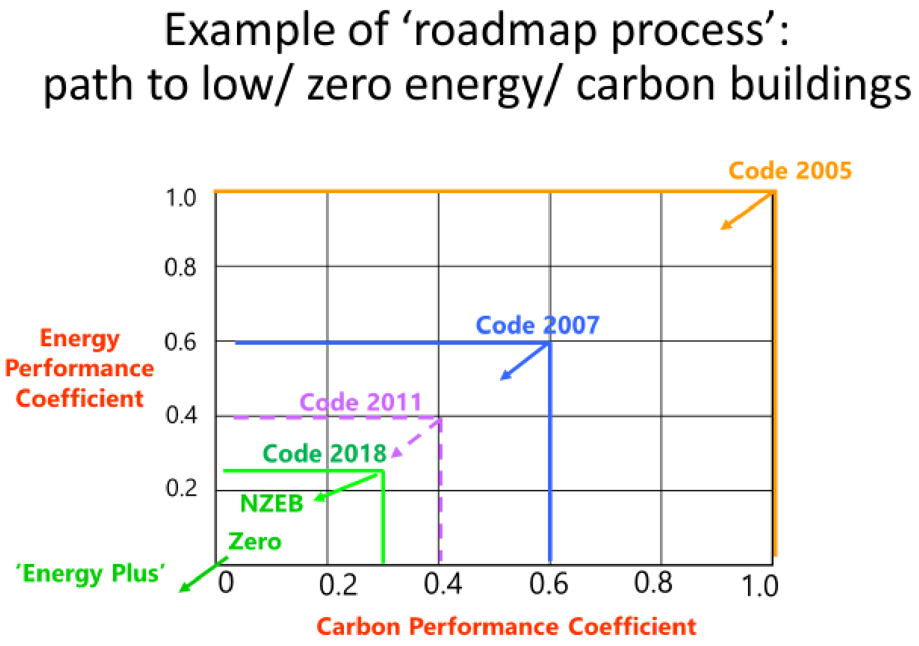


26 Member States had submitted national plans/ roadmaps to the Commission by 2014 and 27 had introduced measures to promote energy efficiency renovation to 'deep' or NZEB levels.

Not all were necessarily satisfactory in all details, but the very preparation of such plans was a positive process in policy commitment. Particular challenges arose in relation to NZEB definitions in the context of the wide variety of building types and practical requirements and procedures for the variety of potential renewable energy sources, plus the variety of site limitations vis a vis available and suitable renewable energy sources. To assist coherence across Member States, the EU Commission issued guideline targets according to building type and climate. In addition to these issues, Member State roadmaps took account of the emerging new EN standards, the findings of the cost-optimal studies, and distinguished between new and existing buildings and between commercial and public sector buildings. They also included existing or proposed awareness raising activities, education and training, R&D projects, pilot demonstration projects and financial support schemes. This process is already having a visible impact in driving the uptake of renewable energy technologies such as heat pumps and solar (photovoltaics and thermal).

In terms of levels of ambition, clear structure and frequent review processes, the strongest performing countries tended to be those which had long traditions of building energy codes. These included Denmark, the Netherlands, Sweden, France and Germany. Figure 14 illustrates the progressive improvement process in energy and carbon performance standards for new buildings in Ireland, leading to NZEB. In general however, for techno-economic reasons, the NZEB targets set for renovation were less ambitious than for new buildings, which is significant given the scale, age and endurance of the stock of existing buildings in Europe.

Figure 4-10 Example of graduated 'roadmap' process to NZEB for Ireland

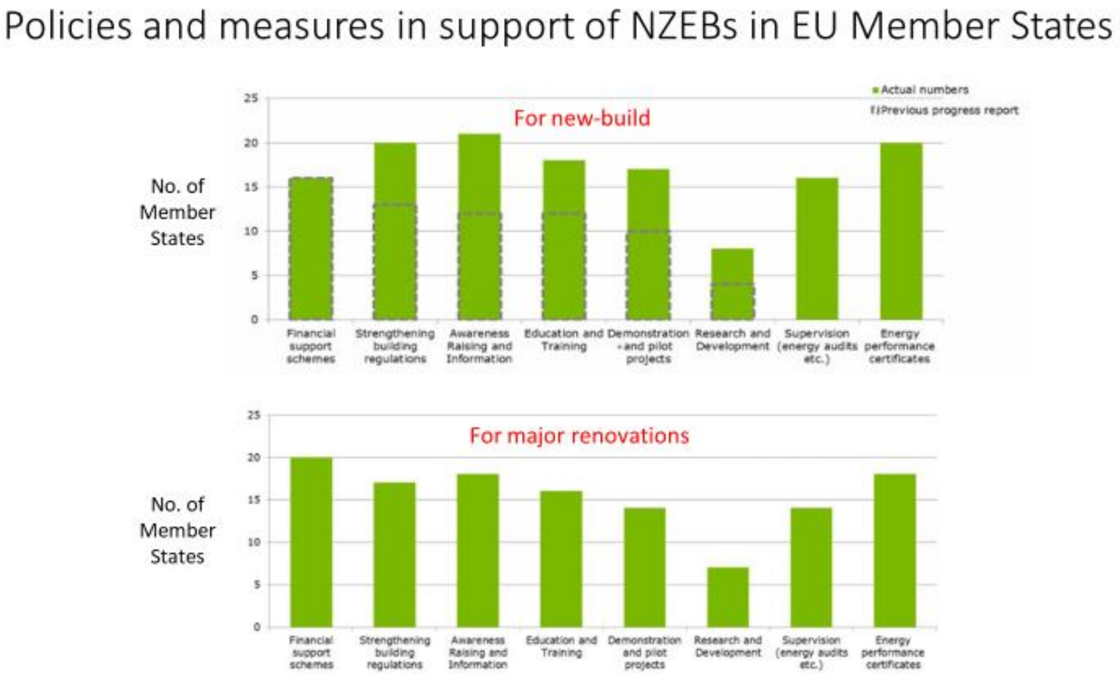


Good practice: Denmark is a good example of a clear and ambitious definition. It defines NZEB as having an annual primary energy intensity of no more than 20 kWh/m^2 for dwellings and no more than 25 kWh/m^2 for other dwellings, representing a 75% reduction in energy intensity since 2006. Austria is another example of a definition in terms of kWh/m^2 and represents an improvement in performance of at least 50% relative to the requirements in 2012. Additionally, several countries set transmission loss and ventilation loss requirements for NZEBs or minimum efficiencies for building services equipment and systems. A good definition would also include a reference to specified minimum indoor comfort requirements.

Denmark has incorporated definitions of future low-energy classes for many years to come and this has been a great success in helping industry to achieve future targets and to create a strong domestic supply chain. In 2010, definitions of Low-energy Class 2015 and Building Class 2020 were set, preparing Danish industry for future requirements almost 10 years in advance of when they will be enforced. This allows Danish industry to adapt their products to new standards. This regulatory clarity and stability is one reason why new very energy-efficient components are mainstream today on the market, and provides a healthy climate for long term investment in high quality low energy buildings.

This strengthening of performance requirements must be supported by targeted and timely outreach to key stakeholders to ensure market demand. Supporting policy packages, ongoing training, awareness raising and incentive schemes are all significant in activating the market to achieve the more ambitious performance targets that are roadmapped. In this context, EPC certification and labelling can clearly define classes that exceed the minimum standards for energy efficiency and encourage developers to go beyond the minimum EP requirements set in the code. Encouragingly, Figure 15 shows the number of EU countries that have adopted a strong range of such supporting instruments.

Figure 4-11 Profile of policies and measures being applied by EU Member States in support of NZEB



5 ENFORCEMENT

Verifying compliance, ensuring effectiveness

(to be detailed in Position Paper 8)

5.1 Context, compliance mechanism, and legal authority for enforcement

In EU Member States the EP requirements of the EPBD have usually been either embedded into existing building regulations requirements, or are applied and enforced through a stand-alone piece of building energy code legislation/regulation, separate to other building control obligations. When integrated into overall building regulations the compliance tends to be subject to the same authorities, compliance checking systems, and penalty frameworks as infringements related to safety or other environmental building requirements. Here the industry is likely to be more accustomed to meeting such requirements, which could be expected to lead to higher compliance rates (provided the other building requirements are already observed and complied with). However, officers responsible for checking compliance with other aspects of buildings may not always have the right level of experience and expertise to adequately assess compliance with energy-related requirements. In such cases, an independent EP system can enable separate compliance checking and enforcement practices to be developed. Effectively this is so with the stand-alone form of building energy code.

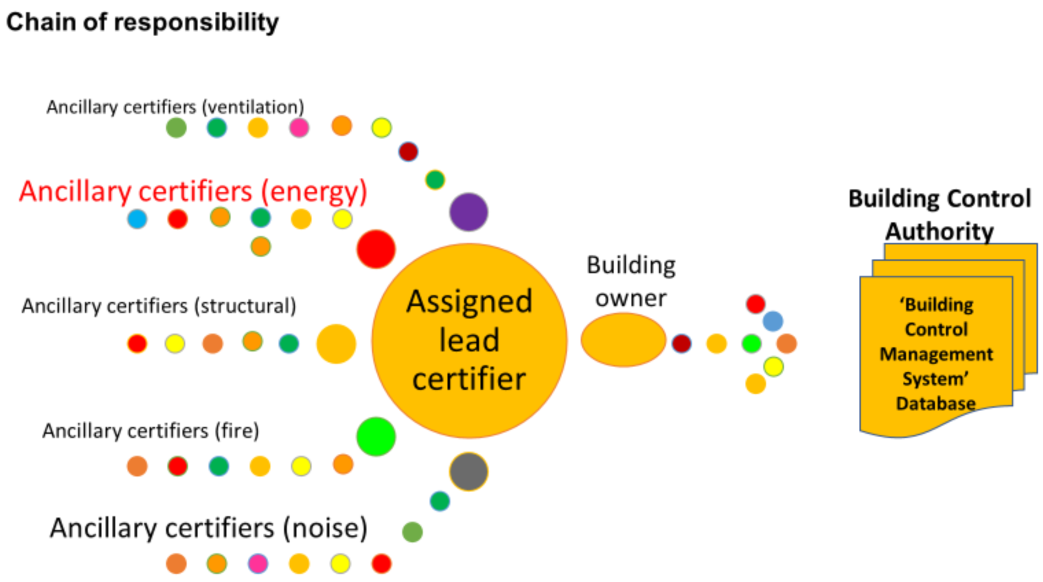
About half of Member States had established compliance and control systems for their building regulations for more than 30 years, and about half of such States had introduced such systems in the past 15 years, coinciding with the EPBD. The control function is commonly assigned to local/ municipal authorities. With the new concept of the EPC, the enforcement authorities for EP requirements compliance have often also been assigned responsibility for monitoring compliance in relation to evidence of the EPCs being produced and used in advertisements. However, in relation to compliance in terms of the quality/ veracity of the EPCs the responsibility has normally been assigned to an official energy in which case good liaison between these two authorities is an important requirement of the enforcement process.

5.2 Responsibility for compliance

In the case of both EP and EPC requirements for new buildings and renovations, most fundamentally the building owner has the legal responsibility for compliance. In practice, this responsibility is then contractually delegated by the building owner to a registered competent building professional, typically an architect or engineer, who is in the role of ‘lead certifier’. In turn, a chain of ancillary specialist certifiers will have responsibility for certifying compliance with individual aspects of the building code – structural integrity, fire etc. as well as specialist elements within the energy performance (thermal modelling, air leakage testing, etc.). For new buildings this is usually an extension of the design service provided by such professionals. In turn, the In the case of EPCs for either new or existing buildings the responsibility for procuring (and displaying) an EPC is with the building owner or their (selling or rental) agent, and is usually assigned to an energy professional who is registered to carry out EPC assessments – and is subject to the quality assurance (QA) regime operated by the EPC authority. The engaged professionals will be required to have appropriate insurances, including professional indemnity insurance. In some Member States, ensuring that an EPC is available in sale or rental transactions has been addressed by lawyers being required to have this documentation in their search list before closing the contract.

Good practice: Figure 16 illustrates an indicative chain of responsibilities that would typically apply to the certification of compliance with EP requirements, showing the roles of the building owner, lead certifier and branches of ancillary or auxiliary specialist certifiers. This results in a chain of documentary evidence the full detail of which may be obliged to be retained by the lead certifier and with either complete or distilled records from such evidence being lodged to a central database operated by the building control authority. This provides a clear chain of accountability and a clear path to be pursued by the enforcement authorities when carrying out audit inspections.

Figure 5-1 Schematic example of a chain of responsibility for certifying compliance



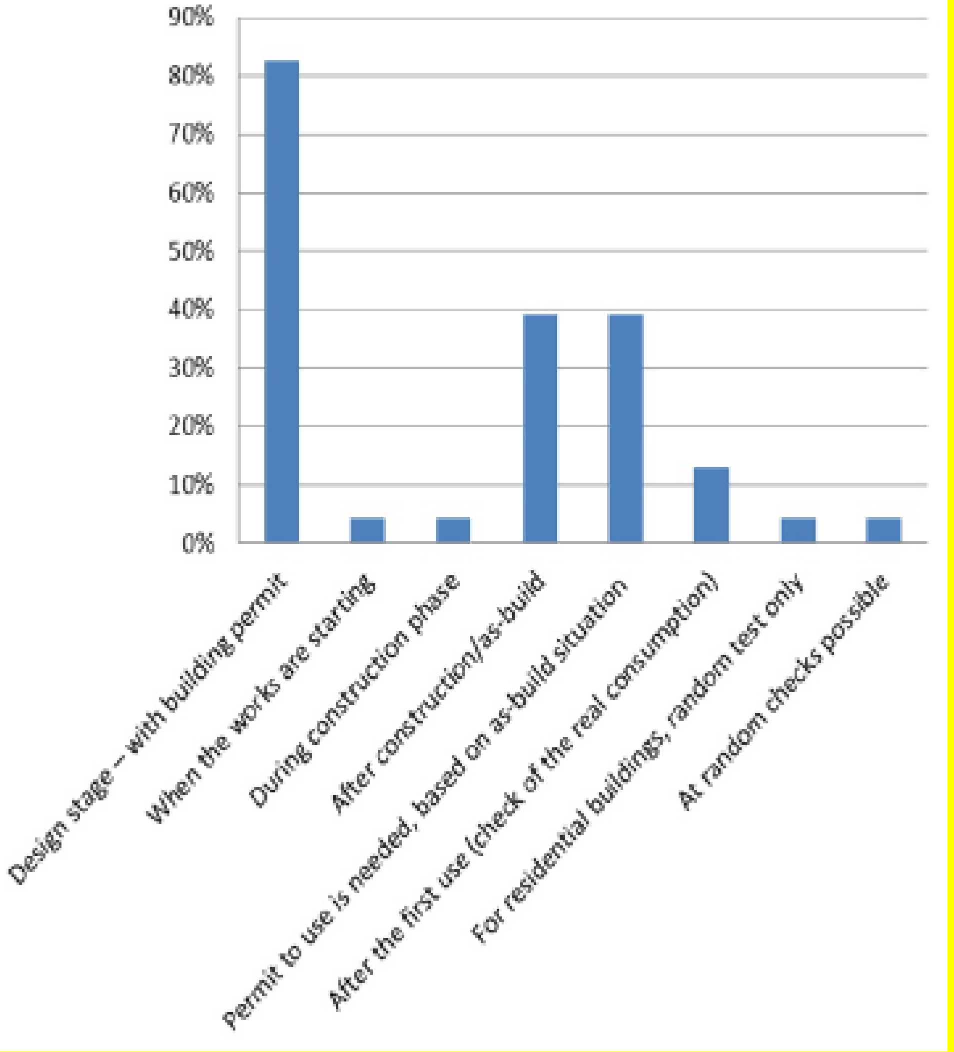
Such central databases are a key monitoring resource for the enforcement authorities in guiding the day to day planning and operation of their auditing and inspection regimes.

For the lodgement of EPCs to a central database a simpler chain of responsibility applies, and can be seen as a subset of the chain shown in Figure 16. However, in most EU Member States the databases and associated administration systems for EP and EPC requirements have not been (yet) unified. The detailed data from such a unified or coordinated approach is likely to be a valuable tool for assessing the level of compliance and in the QA strategies.

5.3 Systems for monitoring and verifying compliance – QA strategies

There is wide variation across the EU in the scope and detail of the administrative systems used to monitor and verify compliance with both EP and EPC requirements. In 12 Member States, the systems have only been introduced since 2013. Compliance with EP requirements is checked at different stages of the building process in different Member States, in some cases with compliance being checked several times during the building process (Figure 17). These checks can relate to whole buildings or to components, e.g. U-values, thermal bridges, air infiltration, system efficiency, overall performance, etc., and authorities may choose to check different elements at different stages. In the case of new buildings, an often significant feature in the control strategy is a requirement that compliance is certified before a permit is issued to either commence building or, on completion, to occupy and use the building. It should be appreciated that a building that was originally compliant at the design stage may subsequently be found to be non-compliant in its execution, through on-site inspection at an interim or completion stage.

Figure 5-2 Most EU countries check for aspects of compliance on more than one occasion.



In a small number of EU countries, EP requirements for all buildings are checked by or on behalf of the enforcement authority. In the model shown in Figure 16, it is the lead certifier that performs the final check. For practical resource reasons a sampling regime is applied in most countries. This can be a combination of targeted and random sampling. Targeting can be on the basis of various risk considerations – such as the scale or complexity of the project, past performance of the project team, etc.
Compliance data availability is higher for new buildings than for major renovations or for upgrade and replacement of individual building elements.

In a proportion of the countries which have established an EPC database, a similar sampling concept applies to the QA regime. This may be augmented by upstream verification features within the EP calculation software, helping EPC assessors to avoid data input errors before submitting the file to the database. Some strategies combine a mix of desk/ documentation audits, inspection of the premises/ files of the certifier and a site visit accompanying the EPC assessor. These combined approaches are aimed at the enforcement authority deploying resources effectively to achieve a culture of awareness, vigilance and compliance in the market. The Directive specifies a sampling rate for EPC quality purposes, which can in some cases equate to a rate of less than 1% per annum of the number of EPCs generated each year.

5.4 Databases and registers

It is already clear from earlier observations in the Compliance section of this paper that central databases are an essential platform for enabling a systematic monitoring, verification, QA and reporting system to be operated by the enforcement authorities, to confirm the extent to which both EP and EPC requirements are being achieved.

Good practice: For example in the case of Flanders (Belgium), data on buildings which had been subject to penalty fines for non-compliance was stored in a database. The level and categories of non-compliance could then be estimated on the basis of the penalty formula applied. This allowed the enforcement authority to map and address key aspects of non-compliance.

5.5 Compliance levels

In a study for the EU Commission, the EP monitoring, verification and QA regimes were classified as being either high or very high 'strength' in 15 Member States. However, this also means that a substantial proportion of Member States are not considered to have fully robust verification regimes. This diminishes the reliability of the reported compliance rates in those latter countries. Compliance rates for EPC provision and quality across the EU are less clear, but the experience with those Member States with good EPC databases is that after initial difficulties compliance rates are improving.

Good practice: The same study indicated that the levels of overall compliance are influenced by the scope and ambition of EP requirements, the penalty framework and the support structures. It indicated an overall compliance rate in the region of 85% across Member States. These are adjusted rates taking account of the 'strength' of the verification regimes, but were still subject to some uncertainties. For those countries which did not set ambitious EP requirements in their building code it may be relatively easy to achieve high compliance rates so this has less energy saving value than high compliance rates in countries with more ambitious EP targets. The real prospect of penalties appears to be an influence and good compliance is more likely to be achieved where financial and technical support systems are in place. Such systems are important where EP regulations have been introduced relatively recently and the industry and compliance bodies are still building capacity.

5.6 Penalty framework

The EPBD requires Member States to establish "effective, proportionate and dissuasive" penalties for infringements, there is no specific requirement for applying these penalties. A penalty framework can encompass financial penalties (fines) as well as sanctions and warnings. In several Member States, regardless of the formal penalty framework, most building owners comply because a building will not be granted a permit to occupy/use unless it is compliant with the EP requirements. This is a highly effective sanction and generally considered preferable to financial sanctions because of the human resources, time delays and cost that would be associated with bringing cases of fines to court. In a small number of Member States, for poor quality EPCs a penalty points system applies to the EPC professional assessor and lead to a requirement to issue a correct EPC to the client, and the prospect of suspension for repeat offences.

Good practice: In Belgium, over one hundred real estate agencies were checked by authorities at random in 2013-14 to confirm the existence of EPC indicators in property display material in real estate agency shops or on their internet sites. At the end of 2014, the first administrative fine was issued, with a focus on agencies that have repeatedly been non-compliant. Similarly, in Portugal a fine system was established to penalise real estate agencies which did not advertise properties' energy performance. As a result, the number of EPCs issued for existing buildings nearly tripled.

Rather than creating a penal and alienating culture, a common approach adopted in many countries has been for authorities respond to frequent causes of non-compliance by prioritising these issues for re=training of building professionals and trades, for example through website FAQs, guidance notes, site visits, workshops, webinars and CPD events. In many cases, professional and trade bodies and associations have been active in contributing to this constructive remedial approach.

6 LEVERAGE

Stimulating visibility, awareness, accelerating market normalisation, impact

Reference has been made above to policy support interventions aimed at assisting the process of EPBD compliance. However, it is possible to extend the ambition and impact further and, for example, reference has also been made to countries which have adopted pro-active national policies with such ambitions, which has assisted their building products and energy services sectors in gaining innovative and competitive advantage. This is particularly clear with regard to the NZEB roadmapping, but equally applies to other aspects of the Directive, which is seen as an evolving and ever strengthening policy instrument on the journey to a society that is served by ever more efficient and cleaner sources of energy.

6.1 Promotion, knowledge sharing and good practice guidance

(to be detailed in Position Paper 11)

Reference was made in the Adoption section regarding the importance of a sustained multi-channel campaign of promotion to create and maintain awareness of EP and EPC requirements and benefits to stakeholders and stimulate a market appetite for more energy efficient buildings. Within those stakeholders, such a campaign should be accompanied by knowledge sharing and guidance initiatives specifically directed at key actors such as designers and specifiers, builders, materials and equipment technicians, site supervisors and building control inspectors. Several such initiatives may be driven from within the industry itself and not require resourcing by the authorities.

Good practice: In Portugal, the Fund for Energy Efficiency has provided incentives for certified dwellings to increase their energy efficiency. Portugal's and Ireland's national energy agencies have also undertaken information campaigns, offering technical support on their websites, where there are FAQ sections. Brochures and other marketing pieces have been aimed at raising awareness of the general population and real estate agencies towards the importance of the EPCs. These include the creation of online portals inviting users to estimate their approximate annual energy consumption by inputting some relatively simple data (These portals are used for promotional purposes only).

6.2 Market visibility of EPCs

(to be detailed in Position Paper 9)

While the compliance and enforcement pattern around Europe is variable, the introduction of EPCs for building construction, sale or rental is playing a growing role in informing building owners, potential buyers and tenants about their choices in relation to energy performance of buildings.

With the EPBD obligations in relation to EPCs in property advertisements, adopted in 26 Member States, energy efficiency is becoming a visible market factor, influencing demand for more energy efficient buildings. This is expected to increase their market value, on which evidence is already emerging from research studies, and also provide a market driver to stimulate building owners to renovate their buildings. Figure 6-1 shows an example of such an advertisement.

Figure 6-1 Example of a property advertisement containing an EPC rating

6.3 Role of industry

(to be detailed in Position Paper 6)

In general, the overall supply chain of the building industry in Europe has been supportive of EPBD implementation. Within the EU, there has been a history of building energy codes embedded in regulation and for developers this has tended to result in increased costs initially. However, as such codes create a level playing field in the market they do not distort competition, and the societal rationale is clear in the same way as applies to health and safety regulations. Moreover, history has shown that such regulation drives industry adaptiveness and innovation, from the level of the product manufacturer/ supplier (through R&D) to developer/ builder and, and for countries such as Denmark it has gained several of their companies competitive advantage in international markets.

At both national and EU level a number of energy efficient product and equipment manufacturing associations have participated in R&D programmes, developed new product solutions (in which ICT technologies are playing an increasingly influential role), taken initiatives on training the workforce and indeed often have campaigned for even more ambitious EP requirements than have been adopted by Member States under the Directive.

Good practice: In Ireland, energy efficiency had come to be seen by some builders of new homes as providing them with a competitive advantage and as a result such voices in the industry were not opposed to proposed new regulations in this area. Major industry stakeholders such as the largest building insurance company actively supported the adoption of the regulations and engaged with the State energy agency by supporting an energy efficiency road show aimed at introducing several thousand builders and developers to the new standards.

Good practice: Also in Ireland, in advance of the new EP code under the EPBD, to encourage housing developers to go beyond mandatory standards, a demonstration programme of grants required contractors to achieve more than a 40% reduction in energy use and CO_2 emissions above the building regulations at the time. This scheme provided a strong visible evidence base for the benefits of energy efficiency and the feasibility of such projects, introduced new technologies (e.g. mechanical ventilation with heat recovery) and supported learning by doing. Subsequent energy efficiency grant schemes, tax credits and financing schemes have also supported the introduction of improved energy designs and technologies in both the residential and non-residential sectors, including public sector buildings.

6.4 Skills development and technical support

The important capacity building role of skills development was highlighted in the section on achieving Compliance with the EPBD. However the role of skilled members of the supply chain can extend to being amplifiers for the Directive, in their scope to influence their clients of the positive benefits (including non-energy co-benefits) of more energy efficient buildings. In general, non-compliance on the part of the building industry or building owner is considered to be caused mainly by deficits in understanding and skills among the responsible parties (rather than intentional violations). Awareness, skills and coordination between trades and stakeholders therefore plays a key role, and continued support is required to build skills and capacity in the workforce, as well as general education and awareness within the building sector. This need extends to building commissioners, operatives and managers, and indeed the staff of enforcement authorities. This is particularly important in Member States where the inclusion of minimum energy performance regulations is relatively immature, help to strengthen compliance levels and indeed drive ambition beyond basic compliance. As part of this process, practical technical support for the network of parties implementing the EP requirements can play an equally important role in catalysing compliance with related regulations in Member States.

Good practice: Across EU Member States, a number of initiatives are helping to raise standards and improve compliance. The BUILD UP Skills initiative supports the provision of training to building craftsmen and other on-site construction workers and systems installers to ensure high energy performance quality construction works. In the UK, the Zero Carbon Hub has produced the "Builders Book" which illustrates detailed technical and practical solutions to help overcome the construction challenges that impact significantly on building energy performance. In Finland, cooperation within the building sub- sectors and the active involvement of professionals in the field has ensured good acceptance and compliance with the legislation and building codes.

6.5 Energy efficiency renovation of buildings

(to be detailed in Position Paper 10)

Allied to the EPBD, the Energy Efficiency Directive requires Member State authorities to develop and publish their long term strategies for mobilising investment in the energy efficiency renovation of their existing building stocks. All Member States have prepared two cycles of such strategies, typically with a timescale that extends to years 2040 or 2050. This process and its implementation over the years ahead is built on a number of the foundations laid by the EPBD. A key focus in such strategies is the mobilisation of the banking and investment community to make finance available in a form suitable to the needs of building owners on an individual or collective scale. Substantial central EU wholesale finance ('Cohesion Funding') is available for this purpose. Associated with both the EPBD and EED, a structured dialogue has been ongoing between EU financial institutions with the support of the EU authorities aimed at unlocking this field of opportunity.

6.6 Finance – market instruments

(to be detailed in Position Paper 11)

In some EU countries, it has been indicated that the financial costs associated with energy performance measures hinder compliance, even with mandatory requirements. Financial incentives can be a good initial driving force for improving the quality of works, gaining confidence and accelerating earlier compliance with EP requirements (provided they do not contravene EU 'State Aid' rules on fair competition). In Member States, this type of support may take the form of direct grants, favourable loans, tax credits and relief, ESCO financing, white certificates or metering tariffs.

Good practice: Financial incentives may also be key to incentivising buildings going beyond the EP requirements. For example, Belgium (Wallonia), Cyprus, Germany, Slovenia and others established grants for buildings that exceeded the EP requirements. Subsidy schemes in Austria and Germany operate in a way that rewards higher energy performance of new build or refurbishment with higher funding levels or more favourable loan terms. In several EU countries, financial incentive programmes, mainly for energy renovation, also include EPCs as a precondition.

Particularly in the context of the scale of the energy renovation challenge, there is an emerging policy impetus at EU and Member State level to migrate from traditional forms of subsidy to more market based instruments for lubricating energy efficiency investment activity. This will be discussed further in Position Paper 11.

While global energy prices are relatively low since 2014, another market force encouraging acceptance of more energy efficient buildings is energy prices, whether arising from taxation or market conditions.

7 CONCLUSION

7.1 Overall impacts

The principal impacts arising from implementation of the EPBD in general are:

- The beginning of a significant deep contribution by the building sector to reducing operational energy consumption, costs and associated greenhouse gas emissions, as well as energy security, in EU Member States;
- Creation of widespread market visibility and awareness of the energy performance of buildings;
- Expected stimulation of demand, by consumers, progressive developers (private, public or social) and specifiers, for more energy efficient and renewable energy products and services in buildings – both new and existing;
- The introduction of energy performance as an integral requirement (and a new level of complexity) within the building design, specification, procurement and marketing processes;
- Potential impact on property pricing, depending on other market conditions;
- Consequent growing interest in the construction and property sector in many countries in going beyond the minimum standards or seeking to undertake energy-saving refurbishment of the existing building stock.
- Providing a platform for national strategies aimed at mobilising major investment in the deep energy renovation of the existing building stock;
- Increased impetus to innovation (to improve both quality and cost efficiency) by building designers, developers, and other product and service providers, and advancing the learning curve in the construction sector, which has sometimes struggled to adapt in the past;
- Associated upskilling of other service providers within the building industry;
- Consequential demand for enhanced foundational and supplementary education and training providers;
- Provision of a formal obligation for periodic review of certain regulatory requirements, as part of a clear policy path to ‘nearly zero’ (or better) energy buildings.

7.2 Key success factors in implementation: a summary

The best practice ingredients in the formulation and implementation of an EPBD Action Plan or NZEB roadmap can be summarised as follows:

- Leadership and commitment, and publication of a clear action plan/ roadmap for implementation
- Consultation and consensus on both legislative and operational details
- Coordinated structures, clear responsibilities (compliance chain)
- Clear and realistic targets, timetables, tasks and responsibilities
- Allied strategic policy activities (e.g. demonstration projects for NZEBs) within Member States to help build confidence and capacity, and help deliver on targets
- Technical criteria based on robust evidence – from research, market trials, international experience
- Coordinated training programme to ensure sufficient numbers of qualified practising professionals upskilled
- Tools – good quality support documentation and software tools which are validated and compatible with the official administrative systems software
- Investment in on-line databases and smart administrative systems (with a self-sustaining business model enabling frequent upgrading) to enable monitoring, verification, enforcement and providing a platform for guiding future initiatives and strategies
- Well designed and coordinated monitoring, validation, quality assurance and enforcement systems
- Sustained communication campaigns through multiple channels – with the industry and the general public (including political representatives)
- Active collaboration and sharing of best practice implementation experiences among Member States, through the EPBD Concerted Action.

7.3 Next steps

The EPBD has been particularly helpful in giving clarity about the level of future energy requirements in regulatory building codes, notably in establishing a clear policy pathway for adopting NZEBs and driving more renewable energy deployment. It has also promoted new tools and concepts (e.g. a common methodology to calculate the energy performance of buildings, common CEN standards, EPCs, NZEBs, cost-optimality) to drive forward improvements in the energy performance of the building stock. This is accompanied by the stimulation of new or improved professional, trade and industry skills in these fields.

While the overall picture is positive, implementation has not been uniformly effective across Europe. Notably, the level of ambition of the EP requirement is set by Member States, and so there has been a significant variation (Such a variation would not be expected with the ECBC in India). Implementation also coincided with a difficult economic climate in almost all EU Member States, which led to some initial delays in implementation. There is still much room for improvement in enforcement and quality control systems and procedures. But overall, the EPBD has been an instrument for positive change in the performance, skills, innovation and visibility of energy efficiency as an integral factor in the construction and property sector. Entering its third phase of evolution, there is a steady improvement in implementation and that momentum is set to continue.

The aim of this position paper was to highlight the foundational role of the EPBD Action Plan and NZEB roadmap, and their consequences in implementation. It has outlined implementation experiences, including good practices, with all the main steps/ elements of the action plan, having regard to aspects considered most relevant to ECBC implementation in India. These relate to governance, action planning, consultations, legal adoption, technical methodologies and systems development, standards, role of product and service providers, capacity building, administrative systems development, certification, enforcement, promotion and incentivisation. Fuller details on most of these steps and good practice elements of Action Plan implementation will be elaborated in the position papers to follow in this series.

7.4 Web resources

The following is a small selection of websites from which useful information can be obtained on EPBD implementation.

Website title and address	Description
Build Up www.buildup.eu	EU portal for energy efficiency in buildings. Extensive library of documents, webinars etc. relating to EPBD and related implementation
Building Performance Institute Europe (BPIE) www.bpie.eu	A European 'think tank' providing policy research and advice on energy in buildings, with publications and monitoring of progress with EPBD implementation
EU Commission – energy efficiency in buildings https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings	Covering EPBD and allied Directives, independent reports, national reports, events
EPBD Concerted Action www.epbd-ca.eu	Public website for collaborative forum of Member States to assist EPBD implementation