nZEBs in the near future

Review on definitions and guidelines of national strategic plans

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SUMMARY

- Introduction
- nZEB definitions, terms and parameters
- National plans for nearly zero energy buildings
- National situation point
- Final Remarks

Introduction

INTRODUCTION

Buildings in the past

Buildings in the present

Buildings in the future

EVOLUTION PROCESS

CONCEPTS

Autonomous building 1930-1950	Solar building 1930-1940	Passive building 1990	Net Zero Energy Buildings 2000…

REGULATION

EPBD [2002/91/EC]	EPBD *recast* [2010/31/EU]

http://batchgeo.com/map/net-zero-energy-buildings

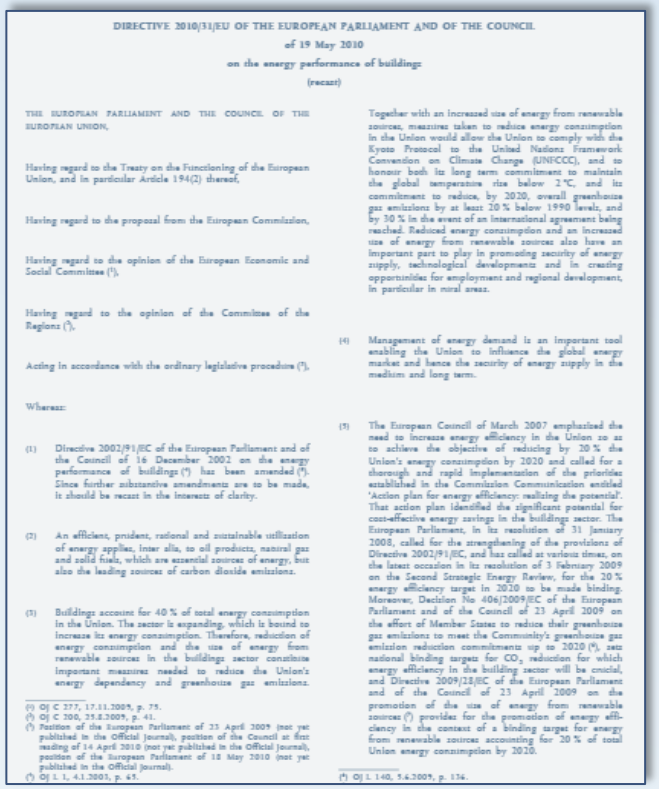
Net ZEB - EU Initiatives

- Buildings Performance Institute Europe (BPIE)
- Concerted Action (CA) EPBD
- BUILD UP - The web portal was established by the European Commission in 2009
- Intelligent Energy Europe (IEE) - a number of ongoing research projects

Net ZEB - International Initiatives

- IEA Joint Project Solar Heating & Cooling Programme: Towards Net Zero Energy Solar Buildings (Task 40)
- World Business Council for Sustainable Development's Energy Efficiency in Buildings (EEB) project - leading industry-only group
- World Green Building Council (WorldGBC) - union on national Green Building Councils
- Net-Zero Energy Home (NZEH) Coalition
- The Zero Energy Commercial Buildings Database
- Massachusetts Zero Net Energy Buildings Task Force
- Zero Energy Building Research Alliance (ZEBRAlliance)
- ASHRAE: Guidance for Net-Zero Energy Design
- California's Long Term Energy Efficiency Strategic Plan includes two "Big Bold Strategies" on zero energy buildings

INTRODUCTION



DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 19 May 2010
on the energy performance of buildings
(recast)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 194(2) thereof,

Having regard to the proposal from the European Commission,

Having regard to the opinion of the European Economic and Social Committee (1),

Having regard to the opinion of the Committee of the Regions (2),

Acting in accordance with the ordinary legislative procedure (3),

Whereas:

(1) Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings (4) has been amended (5). Since further substantive amendments are to be made, it should be recast in the interests of clarity.

(2) An efficient, prudent, rational and sustainable utilisation of energy applies, inter alia, to oil products, natural gas and solid fuels, which are essential sources of energy, but also the leading sources of carbon dioxide emissions.

(3) Buildings account for 40 % of total energy consumption in the Union. The sector is expanding, which is bound to increase its energy consumption. Therefore, reduction of energy consumption and the use of energy from renewable sources in the buildings sector constitute important measures needed to reduce the Union's energy dependency and greenhouse gas emissions. Together with an increased use of energy from renewable sources, measures taken to reduce energy consumption in the Union would allow the Union to comply with the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), and to honour both its long term commitment to maintain the global temperature rise below 2 °C, and its commitment to reduce, by 2020, overall greenhouse gas emissions by at least 20 % below 1990 levels, and by 30 % in the event of an international agreement being reached. Reduced energy consumption and an increased use of energy from renewable sources also have an important part to play in promoting security of energy supply, technological development and in creating opportunities for employment and regional development, in particular in rural areas.

(4) Management of energy demand is an important tool enabling the Union to influence the global energy market and hence the security of energy supply in the medium and long term.

(5) The European Council of March 2007 emphasised the need to increase energy efficiency in the Union so as to achieve the objective of reducing by 20 % the Union's energy consumption by 2020 and called for a thorough and rapid implementation of the priorities established in the Commission Communication entitled 'Action plan for energy efficiency: realising the potential'. That action plan identified the significant potential for cost-effective energy savings in the buildings sector. The European Parliament, in its resolution of 31 January 2008, called for the strengthening of the provisions of Directive 2002/91/EC, and has called at various times, on the latest occasion in its resolution of 3 February 2009 on the Second Strategic Energy Review, for the 20 % energy efficiency target in 2020 to be made binding. Moreover, Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 (6), sets national binding targets for CO_2 reduction for which energy efficiency in the building sector will be crucial, and Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources (7) provides for the promotion of energy efficiency in the context of a binding target for energy from renewable sources accounting for 20 % of total Union energy consumption by 2020.

(1) OJ C 277, 17.11.2009, p. 75.
(2) OJ C 200, 25.8.2009, p. 41.
(3) Position of the European Parliament of 23 April 2009 (not yet published in the Official Journal), position of the Council at first reading of 14 April 2010 (not yet published in the Official Journal), position of the European Parliament of 18 May 2010 (not yet published in the Official Journal).
(4) OJ L 1, 4.1.2003, p. 65.
(5) OJ L 140, 5.6.2009, p. 136.

DIRECTIVE 2010/31/EU

Recast of Directive on Energy Performance of Buildings 2010

"nearly zero energy building"[…] has a very high 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 on-site or nearby [EPBD]

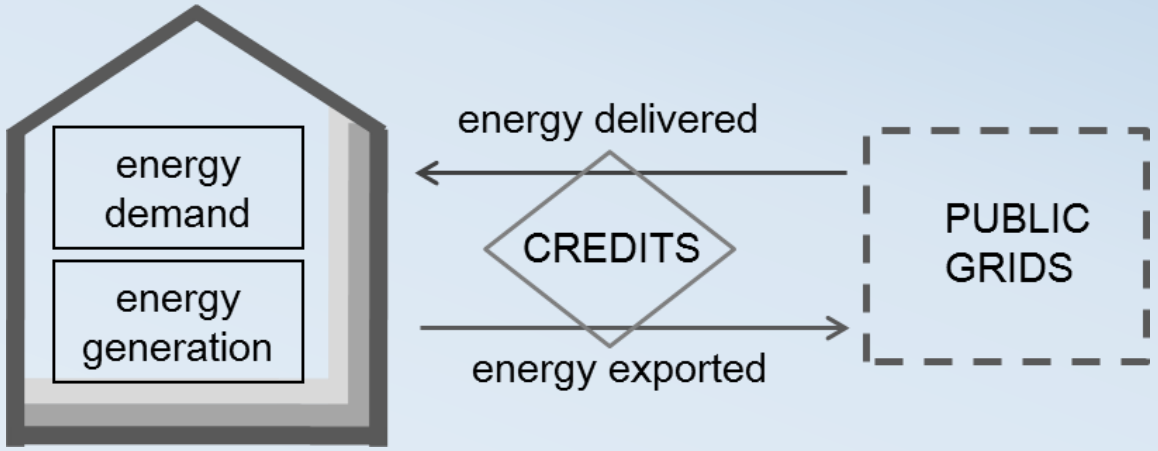
Article 9 Nearly zero-energy buildings

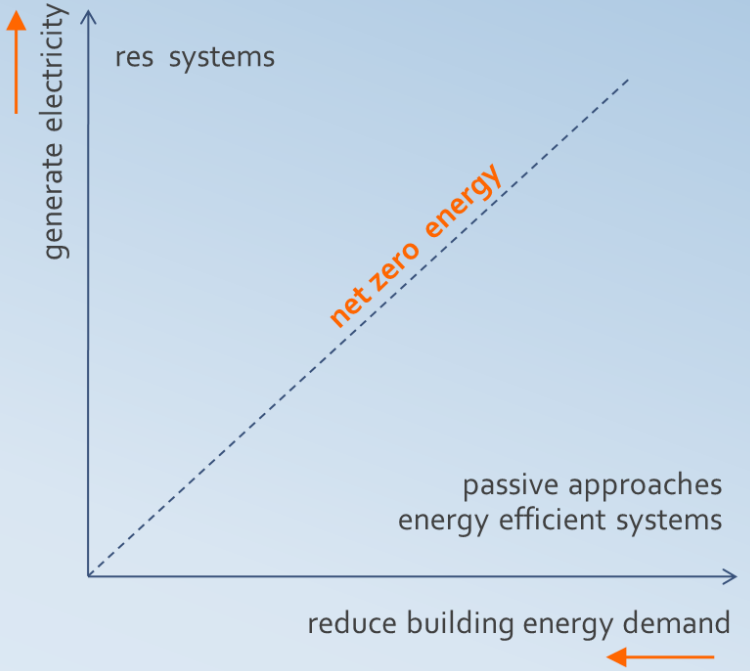
- by 31 December 2020, all new buildings are nearly zero-energy buildings
- after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings
- draw up national plans for nZEB public sector leading example

Interim target by 2015

National definition for nZEB/NetZEB (including building retrofit towards NetZEB levels

nZEB definitions, terms and parameters





$$EB = \sum_{i} EEi \times fe,i - EDi \times fd,i$$

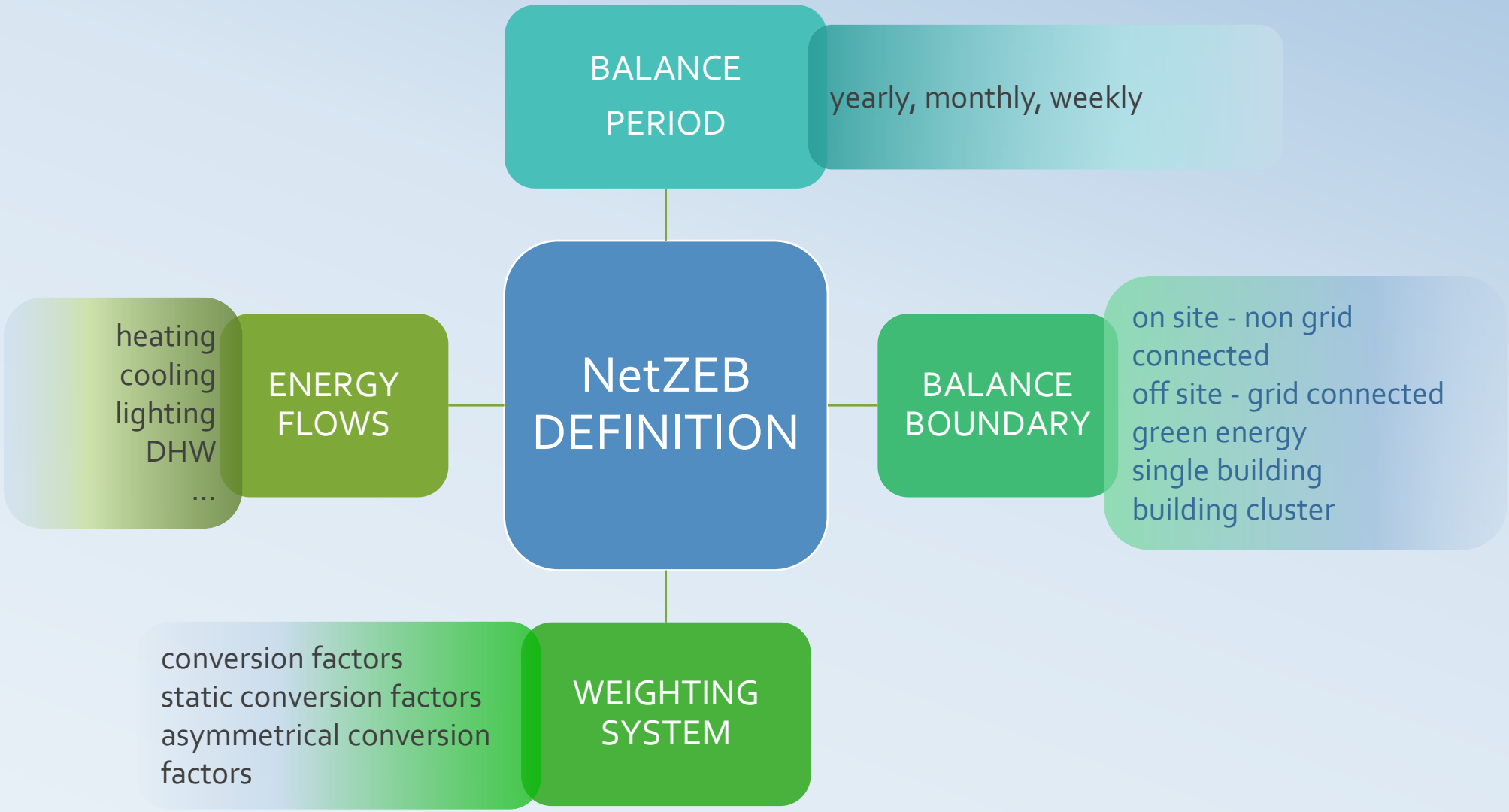
HOLISTIC NZEB METHODOLOGY APPROACH

- Two fundamental steps:

  (a) reduce building energy demand

  (b) generate electricity or other energy carriers to get enough credits to achieve the desired energy balance

Net ZEB DEFINITION



Net ZEB parameters

Renewable Energy Supply option [Marszal et al. 2011]

RES-footprint	• Use renewable energy sources available within the building's footprint.
RES-on site	• Use renewable energy sources available at the building site.
RES-off site	• Use renewable energy sources available off site to generate energy on site.
RES-purchase green	• Purchase off-site renewable energy sources.

Net ZEB limited	• weighted energy use for heating, DHW, cooling, ventilation, and lighting (for non-residential buildings only) • weighted energy supplied by on-site generation driven by on or off-site sources • static and symmetric primary energy factors are possible.
Net ZEB primary	• weighted energy use for heating, DHW, cooling, ventilation, lighting and every kind of plug loads • weighted energy supplied by on-site generation driven by on or off-site sources • static and symmetric primary energy factors are possible.
Net ZEB strategic	• weighted energy use for heating, DHW, cooling, ventilation, lighting and every kind of plug loads • weighted energy supplied by on- and off-site generation systems driven by on- or off-site sources • static and asymmetric primary energy factors
Net ZEB emission	• CO_2 equivalent emissions, heating, DHW, cooling, ventilation, auxiliaries, built-in lighting, every kind of plug loads • weighted energy supplied by on-site generation systems driven by on- or off-site sources • static primary energy factors, symmetric or asymmetric, depending on the energy carrier, technologies used as energy supply systems and their location.

Definitions [IEA, 2012].

Related terms for definitions [Kurnitski et al. 2011].

building energy performance
(EN15316-1:2007)

- Calculated or measured amount of energy delivered and exported actually used or estimated to meet the needs associated with a standardized use of the building, energy used for heating, cooling, ventilation, domestic hot water, lighting and appliances.

delivered energy
(EN15603:2008)

- Energy, expressed per energy carrier, supplied to the technical building systems through the system boundary, to satisfy the uses taken into account (e.g. heating, cooling, ventilation, domestic hot water, lighting, appliances etc.) or to produce electricity.

exported energy
(EN15603:2008)

- Energy, expressed per energy carrier, delivered by the technical building systems through the system boundary and used outside the system boundary.

net delivered energy
(EN 15603:2008)

- Delivered minus exported energy, both expressed per energy carrier. Net delivered energy values are expressed separately for each energy carrier, i.e. for electricity, fuels, district heat, etc.

system boundary
(EN 15603:2008)

- Boundary that includes within it all areas associated with the building (both inside and outside of the building) where energy is used or produced. All areas associated with the building typically refers to footprint of the building site.

national plans for nearly zero energy buildings

UK

IRELAND

SLOVAK REPUBLIC

BULGARIA

DENMARK

FINLAND

GERMANY

LITHUANIA

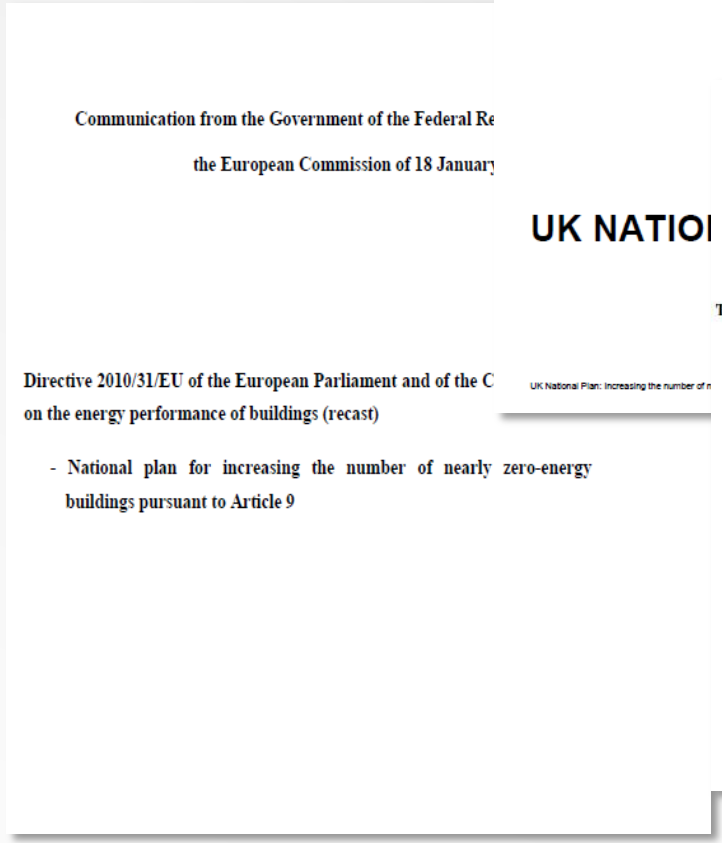
NEDHERLANDS

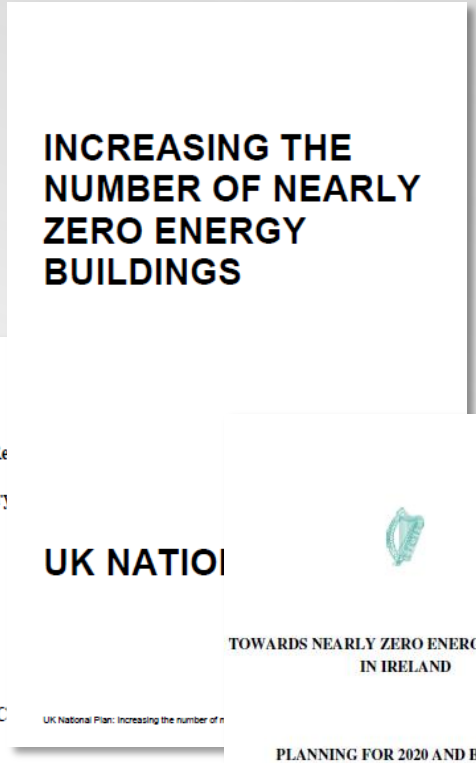
SWEDEN

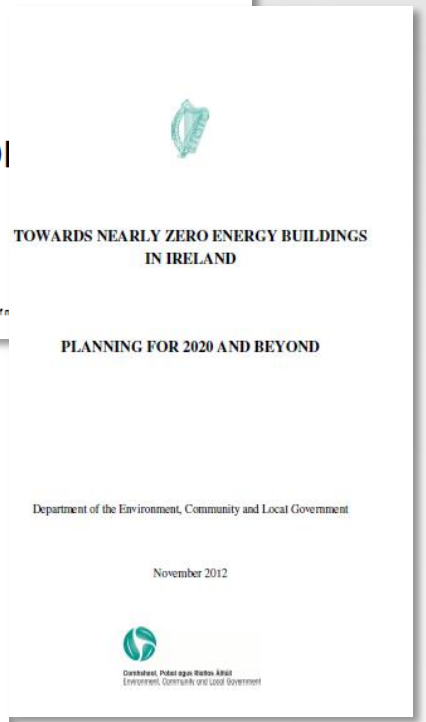
FRANCE

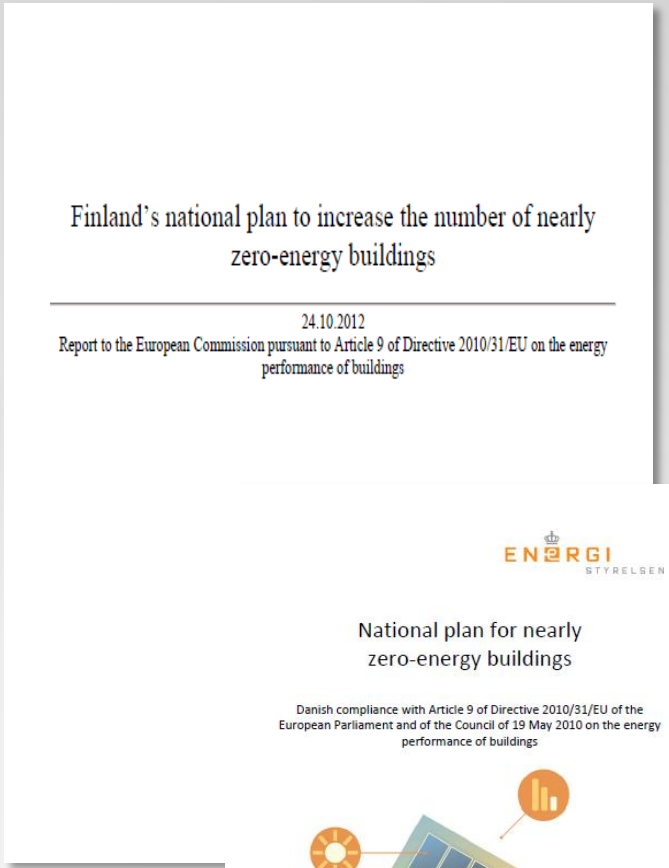
BELGIUM

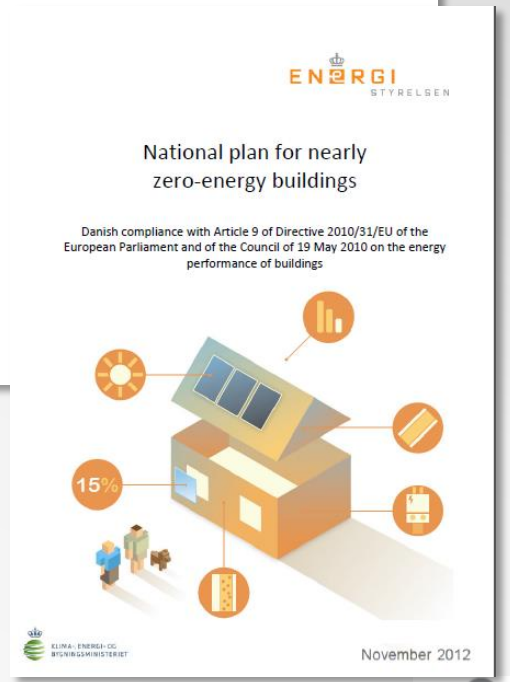
CYPRUS











NATIONAL PLANS FOR NEARLY ZERO ENERGY BUILDINGS

ECOFYS
sustainable energy for everyone

AUSTRIA
CZECH REPUBLIC
FRANCE
GERMANY
GREECE
HUNGARY
ITALY
NEDHERLANDS
NORWAY
POLAND
SPAIN
SWEDEN
SWITZERLAND
UK
USA

Towards nearly zero-energy buildings

Definition of common principles under the EPBD

Final report

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Date: 14 February 2013

Project number: BESDE10788

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Towards nearly zero-energy buildings

Definition of common principles under the EPBD

Final report

LNEG

Key parameters of NEEAP/NEAPR together with EPBD requirements on plans for increasing the number of nearly zero-energy buildings

NEEAP, NREAP elements for promotion of nZEB

Regulation	Supervision (energy advice and audits)	Economic incentives and Financing instruments
Energy performance Certificates	Information and Demonstration	Education and Training

EPBD requirements for nZEBs

National definition	Intermediate targets new buildings	Intermediate targets public buildings
EPBD Art. 9 P. 3(a)	EPBD Art. 9 P. 3(b), P. 1(a)	EPBD Art. 9 P. 3(b), P. 1(b)
Policies, financial measures public buildings	**Policies , financial measures new buildings**	**Policies, financial measures for refurbishment**
EPBD Art. 9 P. 3(c), 9 P. 1(b), Art. 6, Art. 4, Directive 2009/28/EC Art. 13(4)	EPBD Art. 9 P. 3(c), P. 1(a), Art. 6, Art. 4, Directive 2009/28/EC Art. 13(4)	EPBD Art. 9 P. 3(c), P. 2, Art. 7, Art. 4, Directive 2009/28/EC Art. 13(4)

NATIONAL PLANS FOR NEARLY ZERO ENERGY BUILDINGS

1) Definition	2) New buildings		3) Public buildings		4)Refurbishment
	2015 targets	2021 measures	2015 targets	2019 measures	nZEB measures
National definition of nearly zero-energy building, including a numerical indicator of primary energy use	Targets for new buildings on how to ensure that by December 2020, all new buildings are nZEB	Policies and financial or other measures to promote that by December 2020, all new buildings are nZEB	Targets for new buildings occupied and owned by public authorities to be nZEB by December 2018	Policies and financial or other measures to promote that by 2018, all buildings occupied and owned by public authorities to be nZEB	Policies and financial measures for the transformation of buildings that are refurbished into nZEB

NATIONAL PLANS FOR NEARLY ZERO ENERGY BUILDINGS

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template

a) Regulation
b) Economic incentives and financing instruments
c) Energy performance certificates
d) Supervision (energy advice and audits)
e) Information and Demonstration
f) Education and training

national situation point

National situation point

National targets (Intermediate and 2020) for improved energy performance of new and existing buildings undergoing major renovation existing in PNAEE2016 and PNAER2020

PNAEE2016 targets

PROGRAM	Accumulated Energy savings (tep)		CO_2 emissions reduction (tCO_2)	
	2016	2020	2016	2020
Residential and service Buildings	320.932	582.727		
Government Energy Efficiency in Public Buildings	112.170	253.988	489.647	1.108.715
Behaviour - Information and communication of energy efficiency	-	-	-	-

PNAEER2020 targets

- The program for the use of renewables for heating and cooling sets for 2020 an **increasing of 9%** compared with 2010 taken as reference;
- Major contribute of solar thermal and biomass;
- The total renewable energy use for heating, cooling and transport predicted for **2016 and 2020** is **5.259ktep and 5.737ktep,** respectively.

Elements of policy packages for the promotion of nearly zero-energy building (new and existing buildings undergoing major renovation)

National situation point

Regulation

No definition of nearly zero-energy building performance standard available.

Economic incentives and financing instruments

Energy Efficiency Fund (FEE), Innovation Support Fund (FAI), Strategic Energy Efficiency Plan for promoting energy efficiency in the industrial, retail, residential and services sectors (PPEC), Portuguese Carbon Fund (FPC), National Strategic Framework (QREN), Joint European Support for Sustainable Investment in City Areas (JESSICA)

Energy performance certificates

The certificates for nearly zero energy buildings are not yet available

Elements of policy packages for the promotion of nearly zero-energy building (new and existing buildings undergoing major renovation)

National situation point

Supervision (energy advice and audits)

PNAEE2016: certificate a total of 2225 public buildings. 550 of these buildings will be covered by Eco-innovation Action Plan – EcoAP, that has as principal objective to improve of energy efficiency in public buildings by means of monitoring and audits and is expected an energy savings of these buildings in about 30%.

Information and Demonstration

EcoAP is assisted by the initiative Barometer of Energy Efficiency in Public Buildings (Barómetro da Eficiência Energética na Administração Pública) which has as objective a continuous divulgation of the energy efficiency and audits results. Later on will be promoted a Guide of Energy Efficiency of Public Buildings (Guia da Eficiência Energética na Administração Pública)

Education and training

Trainings on building energy performance regulation have been developed by various institutions (universities and research institutes) in order to prepare experts leading and performing energy certification of buildings residential and non-residential

final remarks

Final remarks

- National roadmaps towards nZEBs are needed for all member states including: detailed application in practice of the definition of nZEB, intermediate targets for improving the energy performance of new buildings by 2015, information on the policies and financial or other measures adopted in the context of for the promotion of nZEBs

- National situation point: looking at PNAEE2016, PNAER2020 consistent with the strategic guidelines set out by EPBD for increasing the number of nZEBs. However energy performance calculation and demonstration methods for nZEB are not yet available.

Thank you

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