Part L–NZEB & Major Renovations

NZEB, Wexford

Seán Armstrong,
Senior Adviser,
Building Standards Section,
DHPLG

An Roinn Tithíochta, Pleanála agus Rialtais Áitiúil
Department of Housing, Planning and Local Government

Outline

- EPBD Requirements-NZEB
- Part L Dwellings-current requirements
- Part L-Dwellings-NZEB
- Part L-Buildings other than Dwellings-NZEB
- EPBD -BERs
- Next Steps

Energy Performance of Buildings Directive (EPBD) and NZEB

- Member states to ensure that all new buildings are “Nearly Zero Energy Buildings” by 31st Dec 2020
- Member states to ensure that all new buildings owned and occupied by Public Authorities are `Nearly Zero Energy Buildings’ after 31st Dec 2018
- Major Renovations to be at Cost Optimal Level in Building Codes

EPBD Definition- Nearly Zero Energy Building

'nearly zero-energy building' means a building that has a very high energy performance, as determined in accordance with Annex I. ***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;*

RTE PV Array

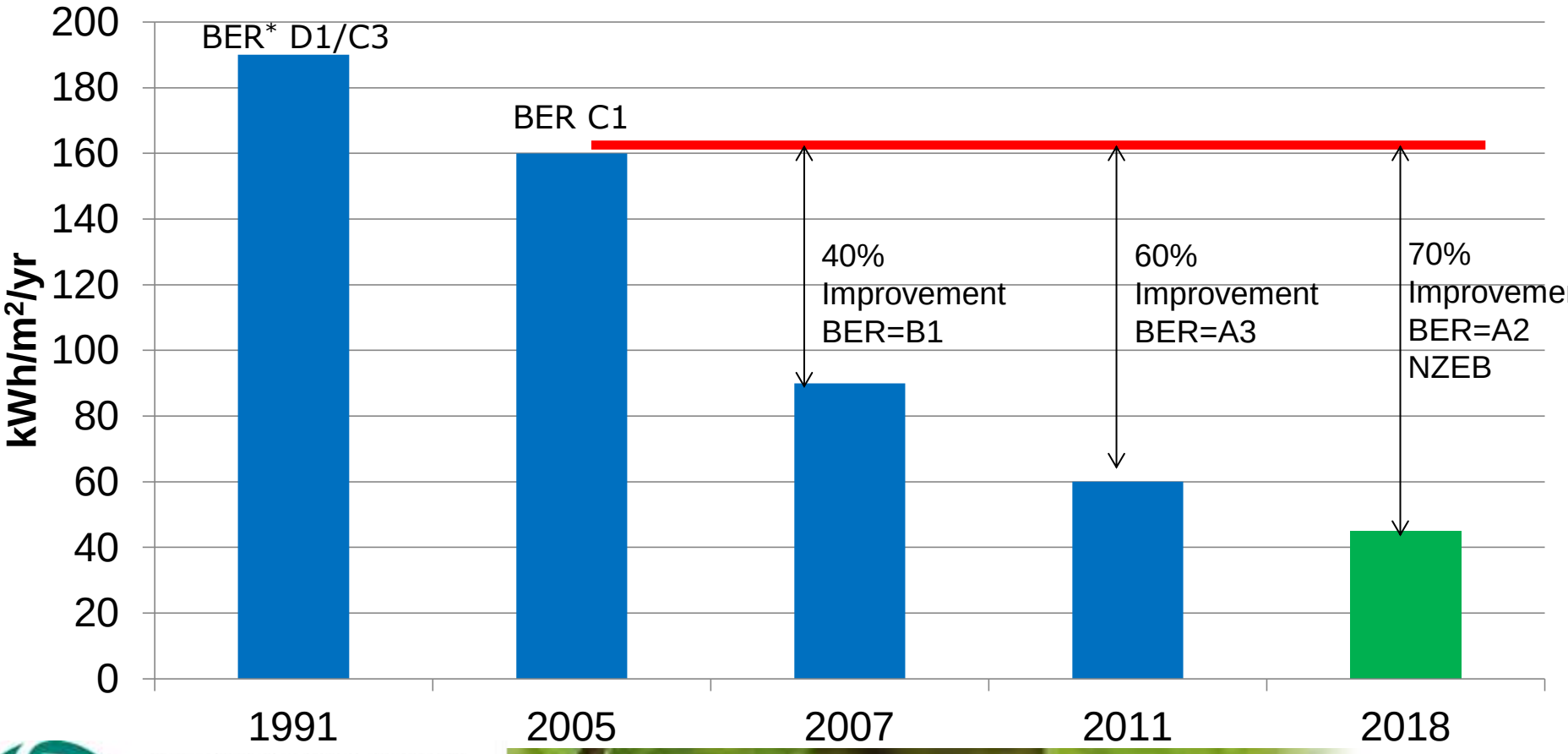
An Roinn Tithíochta, Pleanála agus Rialtais Áitiúil
Department of Housing, Planning and Local Government

EPBD - Major Renovation

‘major renovation’ means the renovation of a building where more than 25 % of the surface of the building envelope undergoes renovation;

Article 7 Member States shall take the necessary measures to ensure that when buildings undergo major renovation, the energy performance of the building or the renovated part thereof is upgraded in order to meet minimum energy performance requirements set in accordance with Article 4 in so far as this is technically, functionally and economically feasible.

Building Regulations Part L Development - Dwellings



An Roinn Tithíochta, Pleanála agus Rialtais Áitiúil
Department of Housing, Planning and Local Government

*Building Energy Rating (BER)

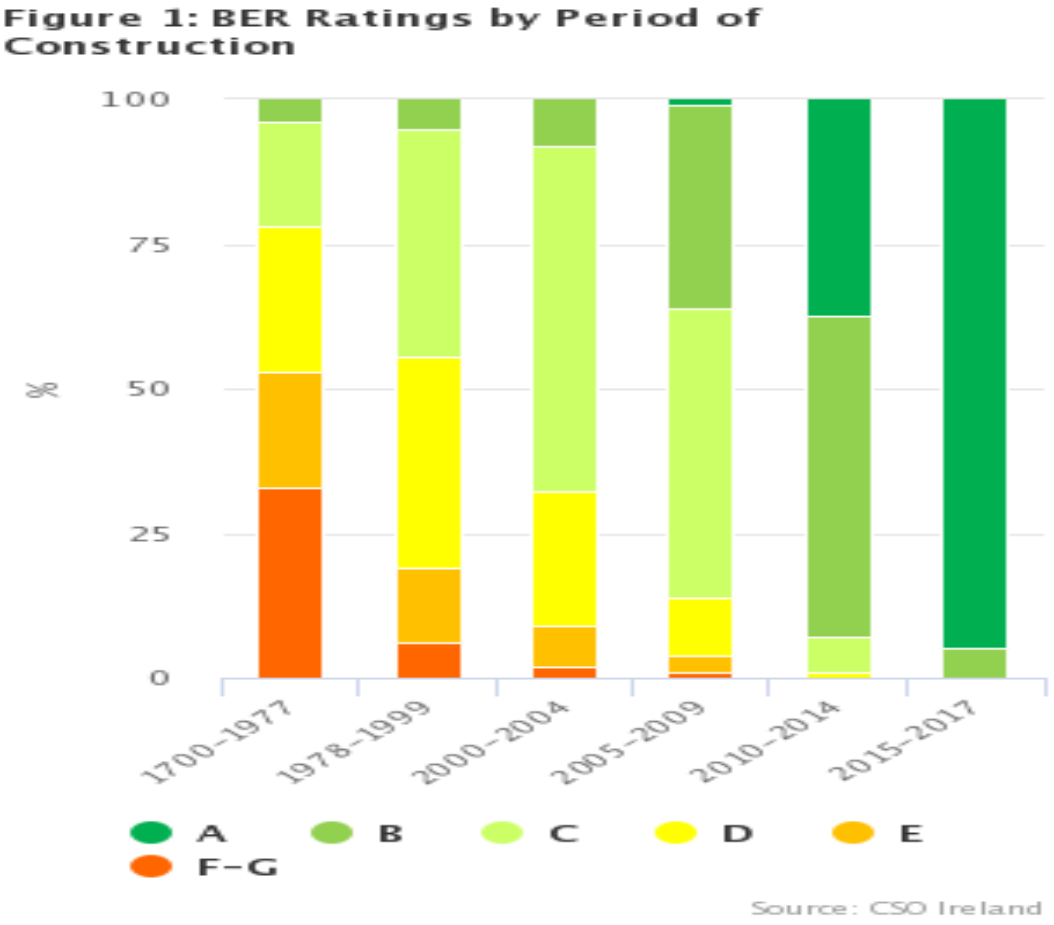
Part L Current Requirements

- 60% reduction in Energy use and Carbon Dioxide emissions requirements on 2005 requirements
- Advanced Fabric Performance
- Advanced Services Efficiency
- Mandatory Renewables

Part L Current Requirements

	Dwelling heated by mains gas	**Dwelling heated by oil**
Primary energy [kWh/m^2/yr]	59	59
CO2 emissions [kg/m^2/yr]	12	14
EPC	0.40	0.40
CPC	0.37	0.45

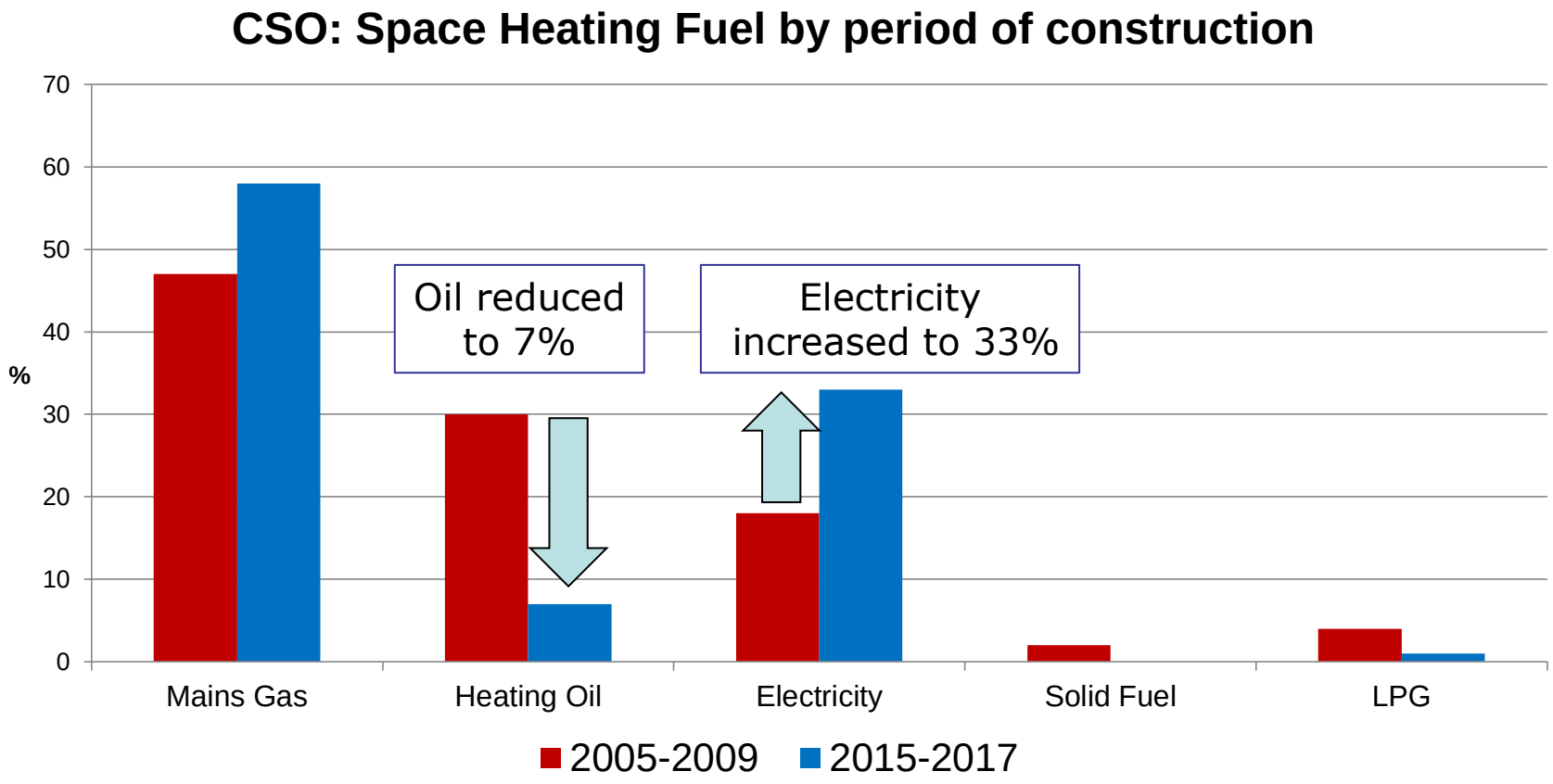
CSO: “94% of dwellings built during 2015-2017 were "A" rated”



An Roinn Tithíochta, Pleanála agus Rialtais Áitiúil
Department of Housing, Planning and Local Government

http://www.cso.ie/en/releasesandpublications/er/dber/domesticbuildingenergyratingsquarter32017/

Space Heating in New Dwellings

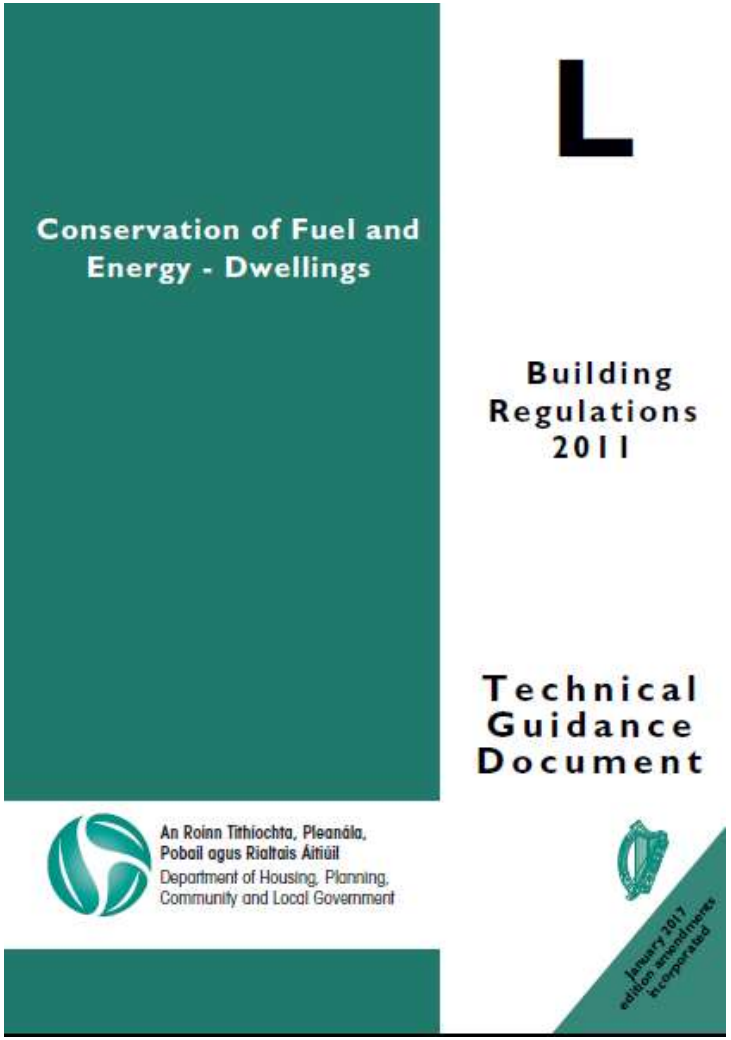


An Roinn Tithíochta, Pleanála agus Rialtais Áitiúil
Department of Housing, Planning and Local Government

http://www.cso.ie/en/releasesandpublications/er/dber/domesticbuildingenergyratingsquarter32017/

Implementation of NZEB-Dwellings

- SI 4 of 2017 amended Building Regulations to include the definition of NZEB on 17th Jan 2017
- TGD L 2011-Dwellings has been amended to include numerical indicators for NZEB Dwellings on the 22nd Feb 2017. The numerical indicators provide MPEPC of 0.30 and MPCPC of 0.35 for dwellings.
- A full review of Part L for NZEB Dwellings to take place in Q1 2018 to apply from early 2019



TGD L 2018-Dwellings NZEB

- Advanced Fabric performance
- Improved airtightness performance
- Calculated thermal bridging
- Renewables
- Review Ventilation provisions

Example performance

	TGD L 2011 Dwelling heated by mains gas	**TGD L 2018 Dwelling heated by mains gas**	**TGD L 2018 Dwelling heated by heat pump**
Primary energy [kWh/m^2/yr]	56	43	40
CO2 emissions [kg/m^2/yr]	10	8	7
EPC	0.40	0.30	0.28
CPC	0.37	0.28	0.23
Renewable Energy Ratio (RER)	0.18	0.22	0.36

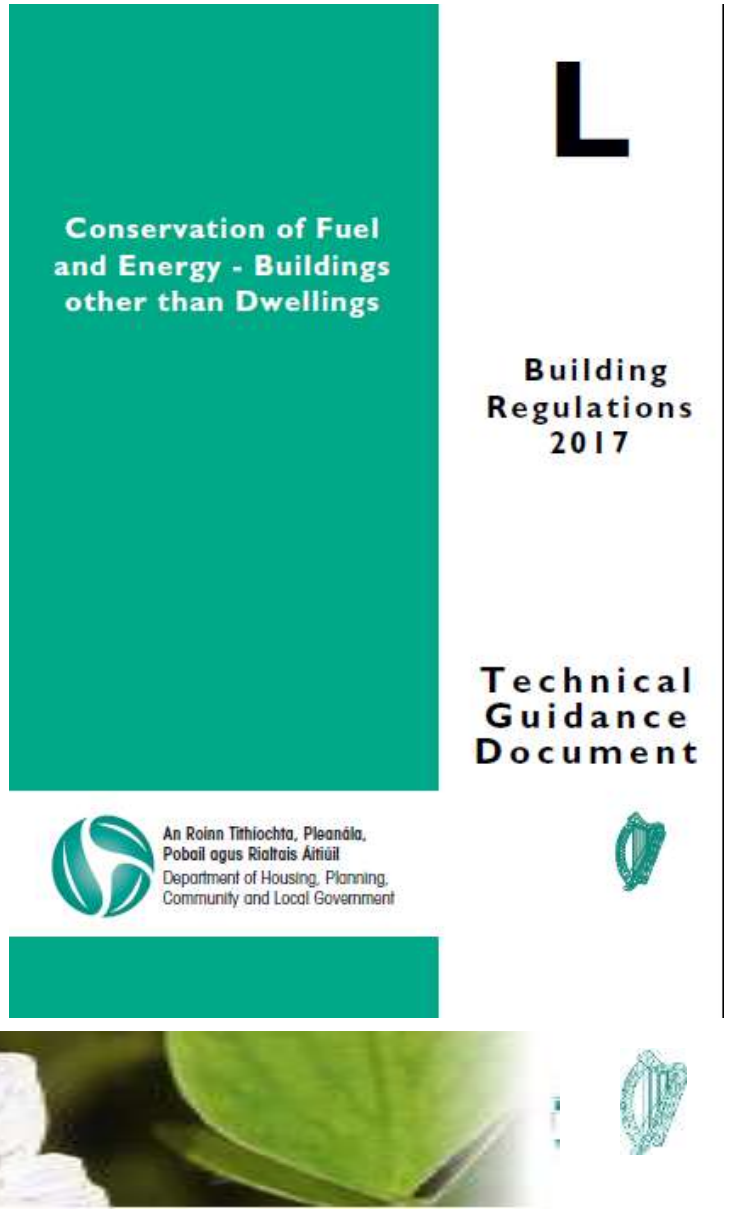
TGD L 2018-Dwellings
Major Renovations

- Where more than 25 % of the surface of the building envelope undergoes renovation the energy performance of the building or the renovated part thereof is upgraded in order to meet minimum energy performance requirements with a view to achieving a cost optimal level (Art. 4) in so far as this is technically, functionally and economically feasible.

- Cost Optimal study shows this as typical being equivalent to a BER of B3 on an average dwelling subject to technical, functional and economic feasibility.

Implementation of EPBD-Part L Buildings other than Dwellings

- TGD L Buildings other than Dwellings is currently under review to provide detailed NZEB guidance and include Major Renovations performance requirement:
  - Public Consultation – Complete
  - Final Publication- Nov 2017
  - Application- 1st Jan 2019
- NZEB Interim Specification for Public Buildings issued 23rd Dec 2016 for buildings commencing design in early 2017
- Extensive Consultation with Stakeholders:
  - OPW,DES,HSE,SEAI, Construction Industry Council (RIAI,SCS,EI,ACEI,CIF),CIBSE,IGBC,IBEC
  - Multiple industry workshops to approximately 1500 professionals



Key Components of performance requirement TGD L Buildings other than Dwellings

- Provides an improvement in performance in the order of 60% over 2008 TGD L
- Improved Fabric Specification
- Advanced Services and Lighting specification
- Renewable Energy Ratio of 20% with flexibility of 10%
- Major Renovations

Proposed Performance requirements for Buildings other than Dwellings Specification- Reference Building-Fabric

Parameter	Current reference values-TGD L 2008	Reference values-TGD L Public Consultation
Total Floor Area and Building Volume	Same as actual building	Same as actual building
Opening Areas	Offices and Shops –windows and pedestrian doors are 40% of the total area of exposed walls	Offices and Shops –windows and pedestrian doors are 40% of the total area of exposed walls
Walls	U=0.27 W/m^{2}K	U=0.18 W/m2K
Roofs	U=0.16 W/m2K	U=0.15 W/m2K
Floor	U=0.25 W/m2K	U=0.15 W/m2K
Thermal bridging	Add 16% to fabric heat loss	Actual Length of Key Junctions x Advanced psi value
Air Permeability	10m^3/(hr.m^2)	5m^3/(hr.m^2) Floor area $\leq$250m^2 3m^3/(hr.m^2) Floor area >250m^2
Window U Value Solar energy transmittance	2.2 W/(m^{2}K) 0.72	1.4 W/(m^{2}K) 0.40

Services

Parameter	Current reference values-TGD L 2008	Proposed reference values-TGD L 2017/Public Sector Specification
Heating efficiency (heating and hot water)%	0.73 CoP	91% Gas Boiler
Cooling Seasonal Energy Efficiency Air conditioned building Ratio (SEER)	SEER=1.67	SEER=4.5
Lighting	divide the illuminance by 100, then multiply by 3.75 W/m2 per 100 lux	65 lm/circuit watt
Occupancy Control	Local Manual Switching	Automated
Daylight Control	Local Manual Switching	Automated
Central Ventilation SFP	2 (W/(l/s))	1.8 (W/(l/s))
Variable speed control of fans	No	Yes
Renewable Energy Ratio	None	20% using photovoltaics

TGD L Buildings other than Dwellings- Renewable Energy Ratio (RER) from ISO 52000

- Renewables requirement will be included in TGD L Buildings other than Dwellings as the ISO 52000 Standard Renewable Energy Ratio (RER)- 20% with a flexibility of 10%.

$$RER = \frac{E_{\text{Pren;RER}}}{E_{\text{Ptot}}}$$

- Renewable energy sources include Photovoltaics, Heat Pumps (Air source and ground source), Biomass, Solar Thermal ,Primary Energy Savings from Combined Heat and Power (CHP), Renewable district heating

Proposed Energy and Carbon Dioxide emissions performance for NZEB Office Buildings

Table 13: Summary of energy modelling output for the different buildings

Building type	Primary energy	CO2 emissions	Building Energy Rating		Energy Performance Coefficient (Performance relative to current Part L reference building)	Carbon Performance Coefficient (Performance relative to current Part L reference building)
	kWh/yr/m²	kg/yr/m²	Indicator	BER	EPC	CPC
Office NV 2F: LMF - Ref	178.6	36.2	0.8	B2	1.00	1.00
Office NV 2F: LMF - Opt1	62.8	12.6	0.3	A2	0.35	0.35
Office NV 2F: LMF - Opt2	65.2	13.0	0.3	A2	0.37	0.36
Office AC 2F: LMF - Ref	296.7	61.9	1.4	C3	1.00	1.00
Office AC 2F: LMF - Opt1	100.1	20.7	0.5	A3	0.34	0.33
Office AC 2F: LMF - Opt2	102.3	21.0	0.5	A3	0.34	0.34
Office NV 4F: MC - Ref	162.8	33.3	0.8	B2	1.00	1.00
Office NV 4F: MC - Opt1	60.1	12.1	0.3	A2	0.37	0.36
Office NV 4F: MC - Opt2	61.4	12.3	0.3	A2	0.38	0.37
Office AC 4F: MC - Ref	285.4	60.0	1.4	C3	1.00	1.00
Office AC 4F: MC - Opt1	98.6	20.5	0.5	A3	0.35	0.34
Office AC 4F: MC - Opt2	99.7	20.6	0.5	A3	0.35	0.34

http://www.housing.gov.ie/sites/default/files/public-consultation/files/report_to_calculations_for_part_l_2017.pdf

20% Renewable Energy Ratio (RER)

Table 15a Summary of PV system required to meet a 20% renewable energy ratio

Building type	Renewable Energy Ratio	PV panel capacity	PV panel area	Roof space required for PV	
	RER	kWp	m²	%	m²
Office NV 2F: LMF - Ref					
Office NV 2F: LMF - Opt1	20%	12.9	90	25%	181
Office NV 2F: LMF - Opt2	20%	13.4	94	26%	188
Office AC 2F: LMF - Ref					
Office AC 2F: LMF - Opt1	20%	20.6	144	40%	288
Office AC 2F: LMF - Opt2	20%	21.0	147	41%	295
Office NV 4F: MC - Ref					
Office NV 4F: MC - Opt1	20%	24.6	172	48%	344
Office NV 4F: MC - Opt2	20%	25.1	176	49%	351
Office AC 4F: MC - Ref					
Office AC 4F: MC - Opt1	20%	40.4	283	78%	565
Office AC 4F: MC - Opt2	20%	40.8	286	79%	571
Office NV 4F: LMF - Ref					
Office NV 4F: LMF - Opt1	20%	24.6	172	48%	344
Office NV 4F: LMF - Opt2	20%	25.1	176	49%	351
Office AC 4F: LMF - Ref					
Office AC 4F: LMF - Opt1	20%	40.4	283	78%	565
Office AC 4F: LMF - Opt2	20%	40.8	286	79%	571

An Roinn Tithíochta, Pleanála agus Rialtais Áitiúil
Department of Housing, Planning and Local Government

http://www.housing.gov.ie/sites/default/files/public-consultation/files/report_to_calculations_for_part_l_2017.pdf

10% Renewable Energy Ratio (RER)

Table 15b Summary of PV system required to meet a 10% renewable energy ratio

Building type	Renewable Energy Ratio	PV panel capacity	PV panel area	Roof space required for PV		EPC and CPC improvement to qualify for RER 10%	
	RER	kWp	m²	%	m²	EPC	CPC
Office NV 2F: LMF - Ref						0.900	0.900
Office NV 2F: LMF - Opt1	10%	5.8	41	11%	81	0.317	0.313
Office NV 2F: LMF - Opt2	10%	6.0	42	12%	84	0.329	0.323
Office AC 2F: LMF - Ref						0.900	0.900
Office AC 2F: LMF - Opt1	10%	9.3	65	18%	130	0.304	0.300
Office AC 2F: LMF - Opt2	10%	9.5	66	18%	133	0.310	0.306
Office NV 4F: MC - Ref						0.900	0.900
Office NV 4F: MC - Opt1	10%	11.1	77	22%	155	0.447	0.441
Office NV 4F: MC - Opt2	10%	11.3	79	22%	158	0.454	0.447
Office AC 4F: MC - Ref						0.900	0.900
Office AC 4F: MC - Opt1	10%	18.2	127	35%	254	0.399	0.387
Office AC 4F: MC - Opt2	10%	18.4	129	36%	257	0.402	0.390
Office NV 4F: LMF - Ref						0.900	0.900

http://www.housing.gov.ie/sites/default/files/public-consultation/files/report_to_calculations_for_part_l_2017.pdf

Increase in Capital costs-Offices

- Offices 2.0% to 2.4%

Table 18a Summary of cost modelling output excluding Prelims, Overheads and VAT

Building type	Total Construction CAPEX	Floor area pro-rated CAPEX	delta CAPEX		
	€	€/m²	€	€/m²	%
Office NV 2F LMF - Ref	3,420,000	2,375			
Office NV 2F LMF - Opt1	3,498,318	2,429	78,318	54	2.3%
Office NV 2F LMF - Opt2	3,486,918	2,421	66,918	46	2.0%
Office AC 2F LMF - Ref	3,967,200	2,755			
Office AC 2F LMF - Opt1	4,064,078	2,822	96,878	67	2.4%
Office AC 2F LMF - Opt2	4,052,612	2,814	85,412	59	2.2%
Office NV 4F LMF - Ref	6,840,000	2,375			
Office NV 4F LMF - Opt1	6,996,636	2,429	156,636	54	2.3%
Office NV 4F LMF - Opt2	6,971,156	2,421	131,156	46	1.9%
Office AC 4F LMF - Ref	7,934,400	2,755			
Office AC 4F LMF - Opt1	8,127,528	2,822	193,128	67	2.4%
Office AC 4F LMF - Opt2	8,102,231	2,813	167,831	58	2.1%

Increase in Capital costs-Other Buildings

- AC Hotels 4.6% to 5.4%
- AC Retail 2.4% to 3%
- NV Mixed Use 1.3% to 1.5%

Hotel AC: MC - Ref	5,198,800	2,050			
Hotel AC: MC - Opt1	5,481,061	2,161	282,261	111	5.4%
Hotel AC: MC - Opt2	5,439,041	2,145	240,241	95	4.6%
Hotel AC: LMF - Ref	5,198,800	2,050			
Hotel AC: LMF - Opt1	5,475,468	2,159	276,668	109	5.3%
Hotel AC: LMF - Opt2	5,439,041	2,145	240,241	95	4.6%
Retail AC: LMF - Ref	3,031,250	2,425			
Retail AC: LMF - Opt1	3,121,065	2,497	89,815	72	3.0%
Retail AC: LMF - Opt2	3,103,561	2,483	72,311	58	2.4%
Mixed-use NV: LMF - Ref	4,869,000	3,000			
Mixed-use NV: LMF - Opt1	4,944,351	3,046	75,351	46	1.5%
Mixed-use NV: LMF - Opt2	4,931,507	3,039	62,507	39	1.3%

Transitional Arrangements

- In general, this document applies to works, or buildings in which a material alteration or change of use or major renovation takes place, where the work, material alteration or the change of use commences or takes place, as the case may be, on or after 1st Jan 2019.

- Technical Guidance Document L - Conservation of Fuel and Energy (2008 edition) ceases to have effect from 31st Dec. 2018.

- However, these documents may continue to be used in the case of buildings:
  - where the work, material alteration or the change of use commences or takes place, as the case may be, on or before 31st December 2018, or
  - where planning approval or permission for buildings has been applied for on or before 31st Dec 2018, and substantial work has been completed by 1st Jan 2020

- "Substantial work has been completed" means that the structure of the external walls has been erected.

EU Study CT5 Report Selected Examples of NZEB

http://www.epbd-ca.eu/wp-content/uploads/2011/05/CT5_Report_Selected_examples_of_NZEBs-final.pdf

4.13.2 Horizont-Building Strassen

Author(s):	Markus Lichtmeß, Gobket Lavandier & Associés S.A. Project developer: Groupe Schuler
Illustration:	
Project aim:	NZEB and HQE ("Haute Qualité Environnementale - Certivéa") certification.
Building address:	163 rue de Kiem - L-8030 Strassen Luxembourg
Building type:	Residential: — Non-residential: X — Public: — | New: X — Renovated: — Office building
Building size:	3,200 m² net floor area
Building envelope construction:	Concrete structure. External insulation of the building with a minimum 24 cm mineral wool for external walls. The windows have triple glazing.
Building envelope U-values:	Wall: 0.13 W/m².K Window: 0.82 W/m².K Roof/ceiling to the attic: 0.11 W/m².K to the outside; 0.18 W/m².K to unheated zone Cellar ceiling/ground slab: 0.19 W/m².K to unheated zone
Building service systems:	Heating is based on a biomass (pellet) boiler. Heating and cooling distribution through concrete core activation. Cooling is generated by a scroll compressor with a hybrid water chiller combined with free chilling during the night. All zones are equipped with CO_2-sensors to regulate the hygienic air stream.
Included renewable energy technologies:	Pellet boiler included. The roof is fully covered with PV (938 m² and 138 kW_p).

New Build:
- Walls 0.13 W/m^{2}K
- Windows 0.82W/m^{2}K
- Roof 0.11W/m^{2}K
- Renewables-Pellet boiler and 938m2 PV

4.16 Norway

4.16.1 Powerhouse Kjørbo

Author(s):	Martin Strand, Norwegian Building Authority
Illustration:	
Project aim:	Demonstrate the possibility of transforming a typical 1980s office building into a plus-energy office building, generating more energy during its lifetime than what was used during the production of materials, construction, operation and demolition. The project is aiming for a BREEAM-NOR 'Outstanding' classification, the highest classification in BREEAM-NOR. It will also fulfil all requirements in the Norwegian passive house standard for non-residential buildings, NS 3701.
Building address:	Kjørbovelen 18 - 20, 1337 Sandvika, Norway

Building type:	Residential	Non-residential	Public	New	Renovated
		X			X
	Office building				

Building size:	5,200 m² net floor area
Building envelope construction:	Old structural elements in concrete were kept, highly insulated timber frame walls and charred wood cladding added to maintain the aesthetics of the old black glass façade. Use of tailor-made aluminium-framed openable windows with triple glazing. The design airtightness of the building envelope is 0.50 air changes per hour at 50 Pa (tests have shown actual results of 0.3 air changes per hour). Exposed concrete for high internal inertia is used. Low emitting materials reduce ventilation demand for indoor air quality control.

Building envelope U-values:		
	Wall	0.13 W/m².K
	Window	0.80 W/m².K
	Roof/ceiling to the attic	0.08 W/m².K
	Cellar ceiling/ground slab	0.14 W/m².K
	Thermal bridge value ('normalised')	0.02 W/m².K

Building service systems:	Electricity is covered by solar panels on roof. Geothermal heat pumps, for heating, cooling and hot water. Own heat pump to re-use heat from the cooling of server parks as heating. Exterior sunscreen automated system. Innovative ventilation system with extremely low pressure drop over the components and in the ventilation ducts. Components with high pressure drop, such as the heat recovery unit, are bypassed when not in use. The system utilises displacement ventilation, demand-controlled lighting and better use of daylight.

Retrofit:
-Walls 0.13 W/m^{2}K
-Windows 0.80W/m^{2}K
-Roof 0.08W/m^{2}K
-Renewables: Photovoltaic and geothermal heat pump

Primary School
SN Mhuire Moynalty

Air tightness building envelope:	0.54 air changes per hour at 50 Pascals
Windows:	U-value = 0.85 W/m²K
Roof Windows:	U-value = 0.94 W/m²K
Exterior Wall:	U-value = 0.10W/m²K
Roof:	U-value = 0.08W/m²K
Floor:	U-value = 0.10W/m²K
Ventilation:	Mechanical Ventilation with Heat Recovery efficiency 78%
Energy Production:	48m² solar photovoltaic array
Space Heating:	Biomass Boiler (wood pellet)
Space Heating Demand:	(PHPP) 13kWh/(m²a)
Primary Energy Demand:	(PHPP) 45kWh/(m²a)
BER rating:	A2

AN ROINN OIDEACHAIS AGUS SCILEANNA | DEPARTMENT OF EDUCATION AND SKILLS

eanála

, Planning

NZEB Projects under development

OPW Leeson Lane

ESB HQ

Forensic Labs

TGD L-Buildings other than Dwellings Major Renovations

- Define as *"more than 25% of the surface area of the building envelope undergoes renovation"*
- Provide menu of measures to bring to cost optimal when more than 25% of surface area undergoing major renovation:
  - Upgrade inefficient heating systems
  - Upgrade inefficient cooling systems and
  - Upgrade inefficient lighting systems

Next steps-Part L

Buildings other than Dwellings

- Published Part L -Buildings other than Dwellings to achieve NZEB and Major Renovations–Nov 2017
- Application from 1st Jan 2019

Dwellings

- NZEB and Major Renovation Public Consultation-Q1 2018
- Application-early 2019

Recast Implementation

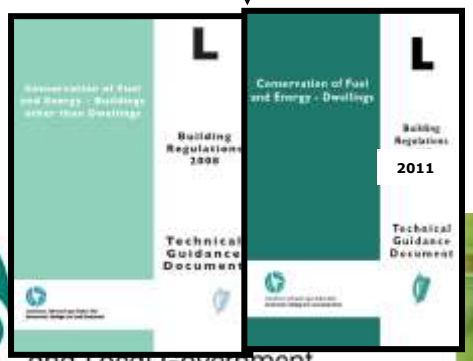
Recast EPBD

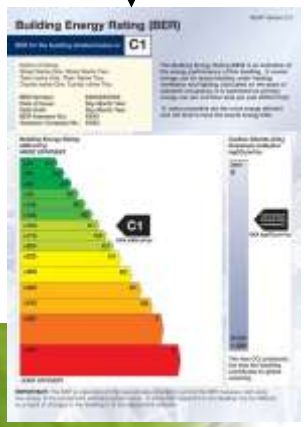
Cost Optimal

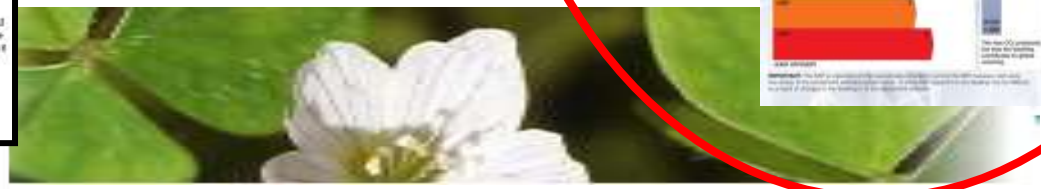
NZEB 2020

Major Renovation

Building Energy Ratings/Advertising
Display Energy Certificates



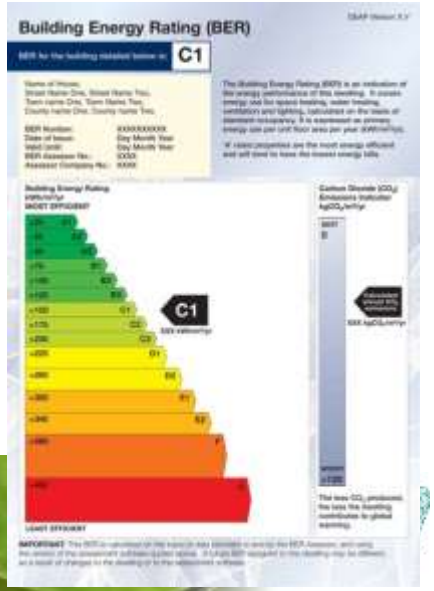




and Local Government

BER Certificate

- SI 243 of 2012 EU Energy Performance of Buildings Regulations (revokes SI 666 of 2006)
- Since 1st Jan 2009 a BER certificate is required when buildings are sold, rented or before being occupied for the first time.
- SEAI are authorised authority responsible for quality of BER, data used, BER assessor etc.



An Roinn Tithíochta, Pleanála agus Rialtais Áitiúil
Department of Housing, Planning and Local Government

Enforcement

Production of a BER certificate to a Building Control Authority

13. (1) A Building Control Authority, or an authorised officer thereof, may

demand from—

(*a*) an owner, or

(*b*) an agent acting on behalf of such owner,

of a building which is situated within the functional area of that Building Control Authority, the production of a printed copy of the BER certificate and the accompanying advisory report required in respect of the building

Enforcement

Where a Building Control Authority, or an authorised officer thereof, makes a demand under either paragraph (1) or paragraph (2), the owner, or the agent acting on behalf of the owner, shall produce to the Building Control

Authority—

(*a*) the printed copy of the BER certificate there and then, or

(*b*) within 28 days after the day on which production of the BER certificate was demanded, a reasonable explanation to the satisfaction of the Building Control Authority for the failure by the owner, or the agent acting on behalf of the owner, to produce the printed copy of the BER certificate.

Advertising BER Certificate

- Since 9th Jan 2013 a person who offers for sale or letting (whether in writing or otherwise) and any agent acting on behalf of such person in connection with such offering,shall ensure that the energy performance indicator of the current BER certificate for the dwelling is stated in any advertisements, where such advertisements are taken relating to the sale or letting of that building.

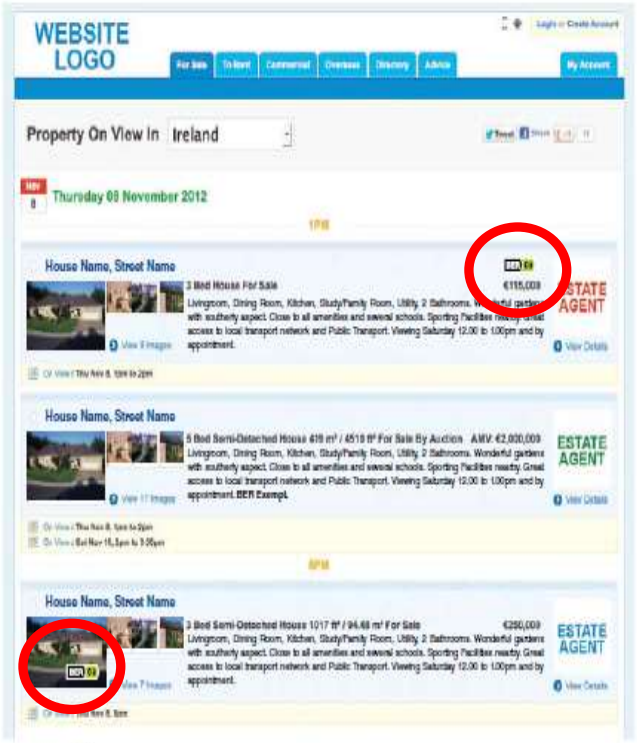
An Roinn Tithíochta, Pleanáil agus Rialtais Áitiúil
Department of Housing, Planning and Local Government

Enforcement-Advertising

5) A Building Control Authority, or an authorised officer thereof, may demand from—

(*a*) an owner, or

(*b*) an agent acting on behalf of such owner, of a dwelling, or as appropriate a building other than a dwelling, which is situated within the functional area of that Building Control Authority, such evidence as it deems necessary or expedient for the purposes of demonstrating compliance with the advertising provisions of this Regulation.



www.housing.gov.ie

email:buildingstandards@housing.gov.ie