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Sean Armstrong, DHPLG: Update to Part L

Pratima Washan, AECOM: Cost Optimal Study

Orla Coyle, SEAI: Update to DEAP

Natalie Walsh, NMA & Daniel Matthews HOB: Sean Foster Place

Pratima Washan, AECOM: Overheating Study

Part L of the Building Regulations

Sean Armstrong

DHPLG

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Government of Ireland

EPBD and Part L 2019
NZEB and Major Renovation

Seán Armstrong,
Senior Adviser
Building Standards Section,
Department of Housing, Planning and Local Government

Outline

- Energy Performance of Buildings Directive
- NZEB & Part L Dwellings
- Major Renovations to cost Optimal
- Part F-Ventilation
- Training & Standards
- Cost Optimal
- International Collaboration
- Next Steps

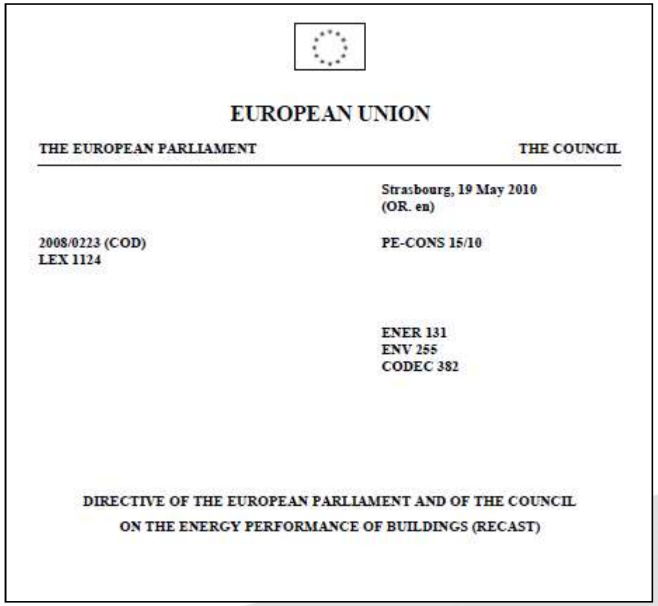
Energy Performance of Buildings Directive (EPBD) NZEB and Major Renovations

Article 9

Member states to ensure that all new buildings are “Nearly Zero Energy Buildings” by 31st Dec 2020

Article 7

Major Renovations to be at Cost Optimal Level in Building Codes



EUROPEAN UNION

THE EUROPEAN PARLIAMENT THE COUNCIL

Strasbourg, 19 May 2010
(OR. en)

2008/0223 (COD)
LEX 1124

PE-CONS 15/10

ENER 131
ENV 255
CODEC 382

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
ON THE ENERGY PERFORMANCE OF BUILDINGS (RECAST)

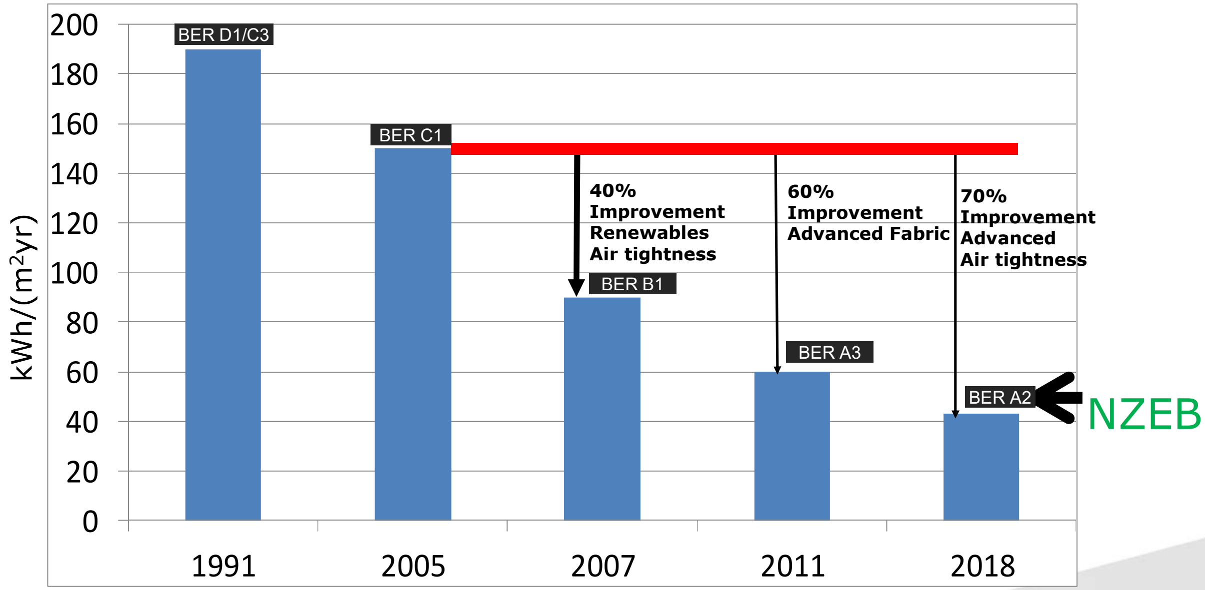
EPBD and RED Definitions - Nearly Zero Energy Buildings & Major Renovation

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

'major renovation' *means the renovation of a building where more than 25 % of the surface of the building envelope undergoes renovation.*

RTE PV Array

Development of NZEB Dwellings in Building Regulations



Part L Building Regulations requirements for new Dwellings (primary energy)

BER-Building Energy Rating

Draft Transitional Arrangements

- NZEB and Major Renovation planned to be signed into legislation by 19th April 2019 with a 6 month lead in.

- NZEB and TGD L 2019 Dwellings to apply to new Dwellings commencing construction from 1st November 2019 subject to transition.

- Transitional arrangements to allow TGD L 2011 - Dwellings to be used where planning approval or permission has been applied for on or before 31st October 2019 and substantial completion is completed within 1 year i.e. by 31st October 2020

- DEAP planned to be published by SEAI by 19th April 2019.

Achieving compliance with TGD L Dwellings 2019

Overall Compliance
Sect. 1.1 calculation in DEAP by achieving MPEPC (0.3) and MPCPC(0.35) (equivalent to 70% Reduction on 2005)

N.B. Check
Overall compliance prior to Commencement at design stage

+

Minimum Threshold Level Compliance
TGD L Sections:

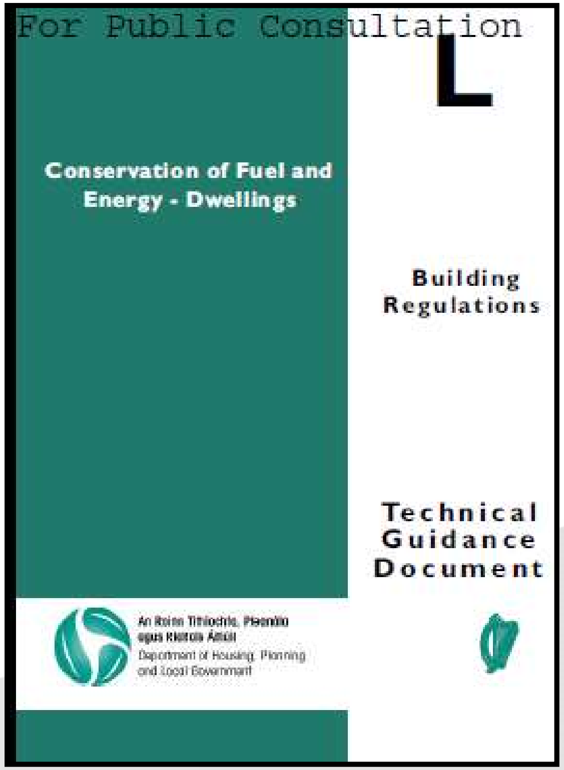
- 1.2 Renewable Energy Ratio =0.20
- 1.3 Building Fabric
  - U-Values (Backstops)
  - Thermal Bridging ACDs
  - Air tightness: Air permeability < 5m3/hr/m2
- 1.4 Building Services
  - Boiler Efficiency 90%
  - Heat Pumps SPF
  - Space Heating Controls (zoning and time control)
  - Insulation
  - Mechanical Ventilation
  - System Efficiency
- 1.5 Construction Quality and Commissioning
- 1.6 User Information

=

Compliance with Part L Dwellings

Overview of key changes to TGD L Dwellings 2019

- Introduction of NZEB, MPEPC=0.30, MPCPC=0.35
- Introduction of Major Renovations to a cost optimal level where technically, economically and functionally feasible
- Introduction of a Renewable Energy Ratio (RER) of 20% as per ISO EN 52000 (to replace $10kWh/m^2/yr$).
- Reduction of air permeability backstop from $7m^3/hr/m^2$ to $5m^3/hr/m^2$
- Table 1- Reduction of wall and floor backstop U-Value from $0.21W/m^2K$ to $0.18 W/m^2K$
- Table 1- Reduction of window backstop U-Value from 1.6 W/m2K to 1.4 W/m2K
- Inclusion of guidance to avoid overheating in dwellings
- Par 1.3.2.5 – removal of variation of U-Value with percentage glazing
- Introduction of calculation of R_u value for corridors in apartments.



Main changes TGD L Appendix E – 2011 vs 2019

- 6 example dwellings including apartments: HP, Gas + PV, NV, CMEV, MVHR
- In semi-detached example, PV increases from 7.9m^2 to 8.63m^2 with gas boiler
- In semi-detached example, double glazing of 1.4 W/m^2K changes to triple glazing 0.9 W/m^2K
- LED lighting accounted for in DEAP (A+ bulbs, 94 lumen/cW, 4 W/m^2)
- Efficient hot water use in showers/taps accounted for in DEAP (125 l/p/d and 6l/min flow restrictor)
- Additional examples added for heat pumps and apartments
- User defined R_u value for unheated corridors included in mid and top floor apartment example

https://www.housing.gov.ie/housing/building-standards/tgd-part-f-ventilation/public-consultation-review-part-l-f-building

Part L Technical Guidance Document Appendix E Semi-Detached Example performance

	TGD L 2011 Dwelling heated by mains gas + PV	TGD L 2019 Dwelling heated by mains gas + PV	TGD L 2019 Dwelling heated by heat pump
Primary energy [kWh/m^2/yr]	56	43	41
CO2 emissions [kg/m^2/yr]	10	8	8
EPC	0.40	0.29	0.28
CPC	0.37	0.26	0.26
Renewable Energy Ratio (RER)	0.18	0.24	0.38

TGD L 2019 - 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 in so far as this is technically, functionally and economically feasible.

- The cost optimal performance level to be achieved is 125 kWh/m^2.yr when calculated in DEAP (B2).

- Qualifying elemental works for surface area calculation defined in Table 6.

- Alternative compliance routes in Table 7.

Major Renovation-Table 6

Table 6 **Elemental works that are included in the surface area calculation for major renovation[1,2,3]**
External walls renovation • External insulation of the heat-loss walls • Replacement or upgrade of the external walls' structure • Internal lining of the surface of heat-loss walls
Windows renovation • Replacement of windows
Roofs renovation • Replacement of roof structure
Floors renovation • Replacement of floors
Extension • Extension works which affect more than 25 % of the surface area of the existing dwelling

[1] Major renovation requirement can be activated by works to a single element or to a combination of elements as per column 1 of table 7.

[2] Where major renovations to walls, roofs and ground floors constitute essential repairs e.g. repair or renewal of works due to fire, storm or flood damage or damage as a result of a material defect such as reactive pyrite in sub-floor hardcore or defective concrete blockwork, it is not considered economically feasible to bring these renovations to a cost optimal level.

[3] Painting, re-plastering, rendering, re-slating, re-tiling, cavity wall insulation and insulation of ceiling are not considered major renovation works.

Major Renovation-Table 7

<table>
<tr><th colspan="3">Table 7 - Cost Optimal Works activated by Major Renovation</th></tr>
<tr><th>Major Renovation > 25% surface area[1,2,3,5]</th><th>Cost Optimal level as calculated in DEAP (Paragraph 2.3.3 a.)</th><th>Additional Works to bring dwelling to cost optimal level in so far as they are technically, economically and functionally feasible
(Paragraph 2.3.3 b.)</th></tr>
<tr><td>External walls renovation</td><td rowspan="4">The cost optimal performance level to be achieved is 125 kWh/m^2/yr.</td><td rowspan="4">Upgrade insulation at ceiling level where U-values are greater than in Table 5
&
Oil or gas boiler replacement[6] & controls upgrade where the oil or gas boiler is more than 15 years old and efficiency less than 86%
&/or
Replacement of electric storage heating[7] systems where more than 15 years old and with heat retention not less than 45% measured according to IS EN 60531.</td></tr>
<tr><td>External walls and windows renovation</td></tr>
<tr><td>External walls and roof renovation</td></tr>
<tr><td>External walls and floor renovation</td></tr>
<tr><td>New Extension affecting more than 25% of the surface area of the existing dwelling’s envelope (see 2.3.6)</td><td>The cost optimal performance level to be achieved is 125 kWh/m^2/yr</td><td>Upgrade insulation at ceiling level where U-values are greater than in Table 5
&
Oil or gas boiler replacement[6] & controls upgrade where the oil or gas boiler is more than 15 years old and efficiency less than 86%
&/or
Replacement of electric storage heating[7] systems where more than 15 years old and with heat retention not less than 45% measured according to IS EN 60531
&
Upgrade insulation at wall level where U-values are greater than in table 5.</td></tr>
</table>

Major Renovation - Examples

Semi-detached house (126 m²): hollow blocks walls with 25 mm mineral wool internal insulation, pitched roof with 50 mm mineral wool insulation on the ceiling, double glazing with 6 mm air gap, 80 % gas boiler installed with no heating controls, solid fuel stove secondary heating.

Proposed works to elements[1]	Major renovation (Yes/No)	Required additional works
A) Window replacement (13 % of envelope)	No	NA
B) EWI or IWI of walls (35 % of envelope)	Yes	Upgrade insulation at ceiling level to 0.16 W/m²K or better as per table 5, and 90 % efficiency condensing gas boiler replacement and controls upgrade: time and temperature controls for space heating + time and temperature controls on domestic hot water
C) EWI or IWI of Walls and windows replacement (48 % of envelope)		
D) EWI or IWI of Walls and replacement of roof structure (61 % of envelope)		
E) EWI or IWI of Walls and replacement of floor (61 % of envelope)		

[1] Major Renovation of all elements should meet the requirements of Table 5 where material alteration applies.

Primary energy consumption before major renovation: 233 kWhr/m²/yr

Proposed works package B) is based on the following specification: 100 mm EWI, 300 mm attic insulation, 91 % efficiency gas boiler, full zone time and temperature controls on space heating with weather compensation, time and temperature control on domestic hot water with insulated primary pipework.

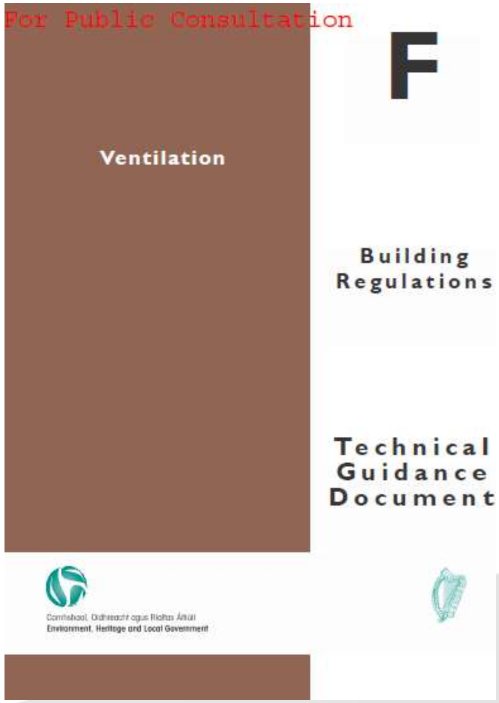
Primary energy consumption post major renovation: 121 kWhr/m²/yr

Regulatory Impact Assessment

- Uplift costed across 5 dwelling types (semi-detached, detached, bungalow, apartment-mid and top floor) using different combinations of fabric, services, ventilation and renewables.
- The average uplift in cost across all dwelling types modelled was 1.9% over current construction costs depending on the dwelling archetype and design specification applied.
- Overheating assessment on all types with some mitigation measures (reduced solar transmittance, appropriate use of blinds).
- High rise apartments assessed for renewables.

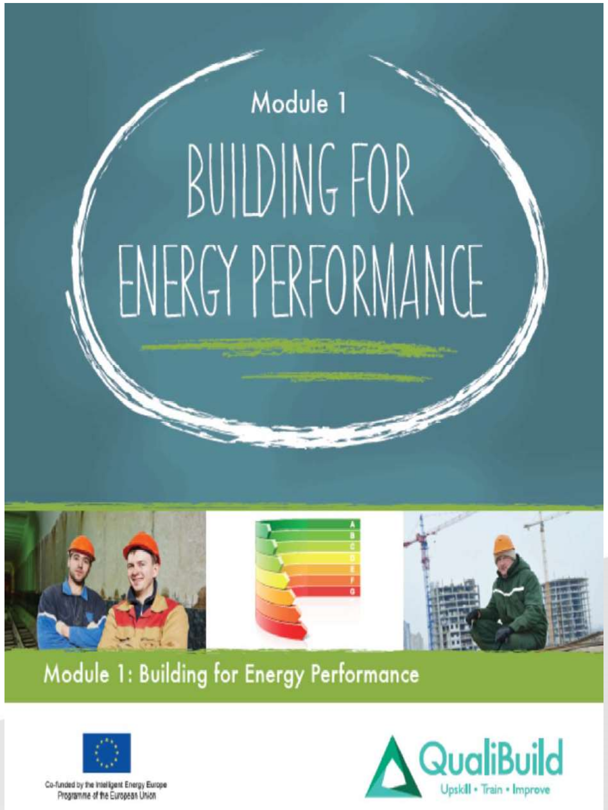
Overview of key changes to TGD F 2019

- Mechanical Ventilation guidance for AP ≤ 3 $m^3/hr/m^2$
- Guidance provided for Continuous Mechanical Extract Ventilation
- Introduction of certification of ventilation systems installation
- New examples for apartments
- Installation and Commissioning guide for Ventilation systems
- Same application date and transition as TGD L 2019



Training/Skills/Standards

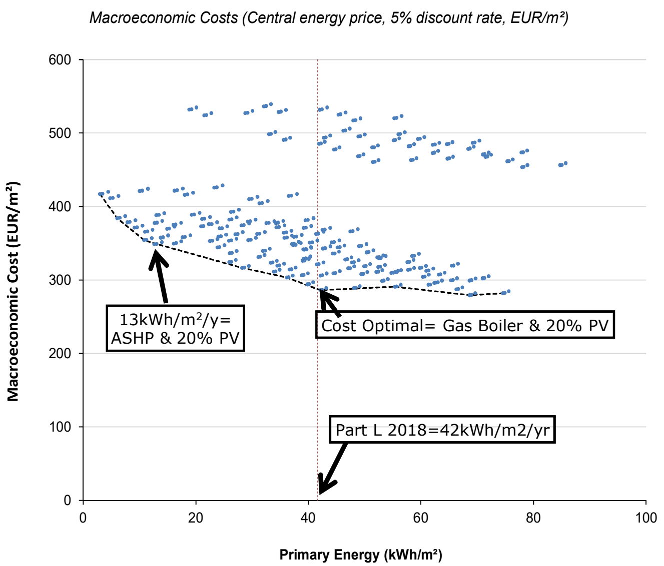
- SEAI - DEAP/NEAP, BER Assesors, Registered Contractors, Grant Schemes Technical Specification
- Solas/ Waterford/Wexford ETB- NZEB Specification - vocational add on qualifications for existing crafts persons (awareness, blocklayers, carpenters, foremen, plasterers, plumbers, electrician)
- Advanced Engineering and Architectural training 3rd Level Institutes eg. Technological University Dublin, NUIG,CIT,LIT
- NSAI Standards- SR 50-2 (Solar Thermal), SR 54 Retrofit, SR for Heat Pumps and Solar PV
- NSAI Certification schemes
  •Agrément Certification
  •Air tightness testers
  •Thermal Modellers
  •Windows Energy Performance
  •External Insulation
  •Cavity Insulation
  •Ventilation Validation
- Industry Led CPD – RIAI, EI, SCSI, ACEI, CIBSE, IGBC, CIAT, CIF



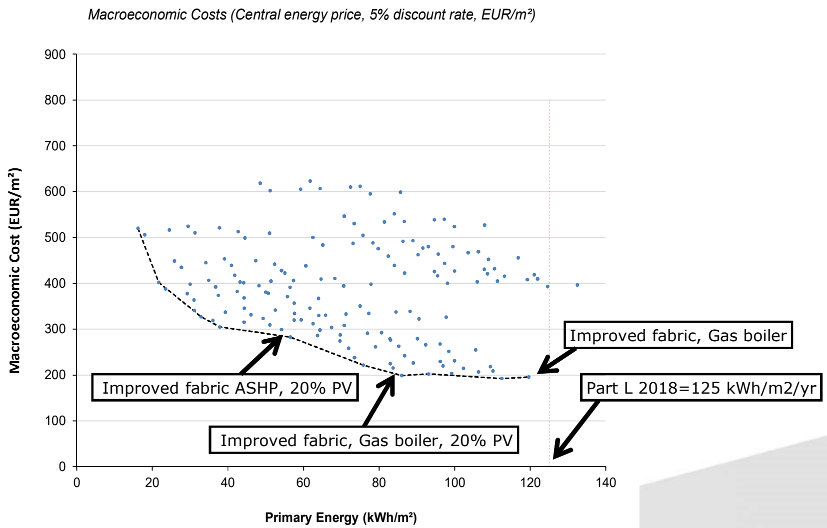
http://www.qualibuild.ie/wp-content/uploads/2015/01/D2.3-QualiBuild-FES-Training-Manual-Final_PU.pdf

Cost Optimal 2018

New Semi-Detached



Major Renovation Semi-Detached



Energy Performance of Buildings Directive 2018

- EV Charging by 10th March 2020
- Review Cost Optimal Report by March 2023

TGD L 2017: Amendment
EV Charging for New Buildings –10th March 2020

Scope		MS Obligation
New Buildings and	**Non-residential** buildings with more than 10 no. parking spaces	• Ensure the installation of **at least 1 no. recharging point** • Ensure the installation of **ducting infrastructure for at least 1 in 5 no. parking spaces**
Buildings undergoing **Major Renovation**	**Residential** buildings with more than 10 no. parking spaces	Ensure the installation of **ducting infrastructure for every parking space**
Existing Buildings *	**Non-residential** – all buildings with more than 20 no. parking spaces	Lay down requirement for the **installation of a minimum number of recharging points** – applicable from 2025

Buildings - International Comparison

GBPN 2013

World Bank 2018

Comparison of Energy Efficiency Policies for New Buildings

International Collaboration

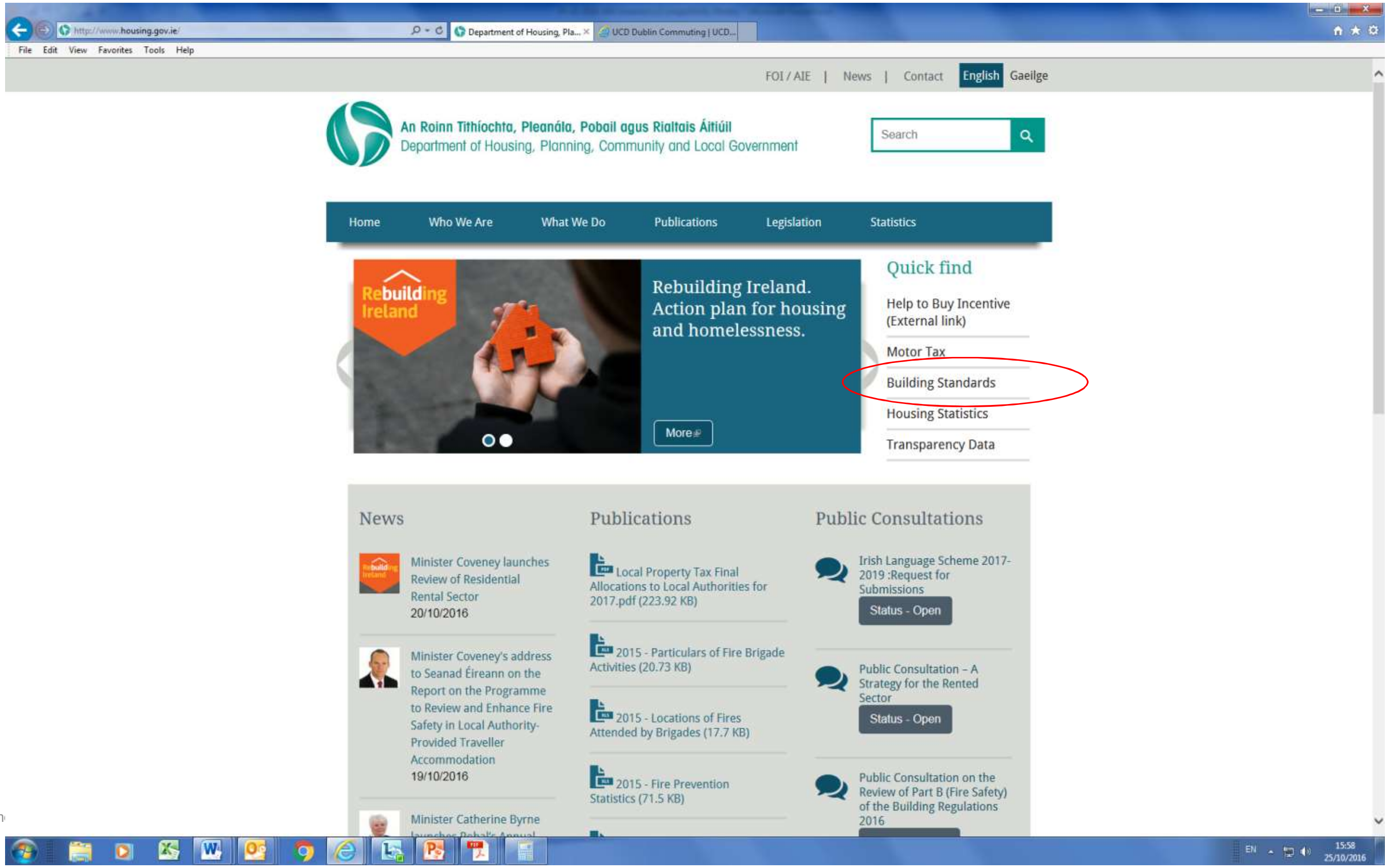
- Ireland member of IEA Air Infiltration and Ventilation Centre
- United Nations Economic Commission for Europe Centre of Excellence for High Performing Buildings in Wexford
- Ireland is a lead participant in the EU Commission Concerted Action meetings for 27 member states

Next steps

- Introduce NZEB & Part L & Part F legislation by 19th April
- Publish DEAP by 19th April
- Implement validation scheme for ventilation 2H 2019
- Develop guidance for mitigation of overheating 2H 2019
- Develop National Standards for Heat Pumps and Photovoltaics
- Support the Development of NZEB skills delivery in collaboration with WWETB, Professional Bodies and Third Level Institutes

www.housing.gov.ie

email:buildingstandards@housing.gov.ie



Cost Optimal Study

Pratima Washan

AECOM

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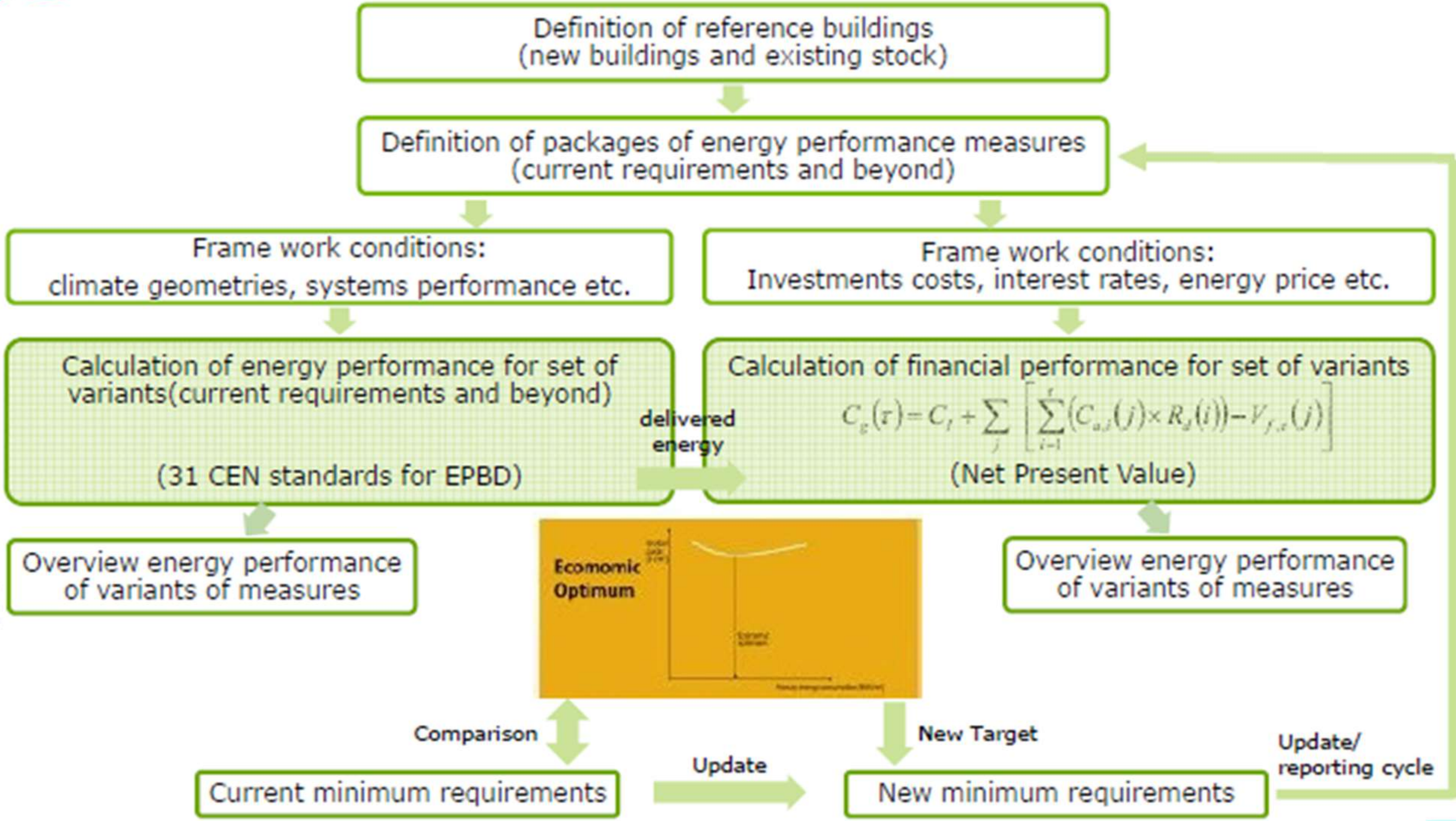
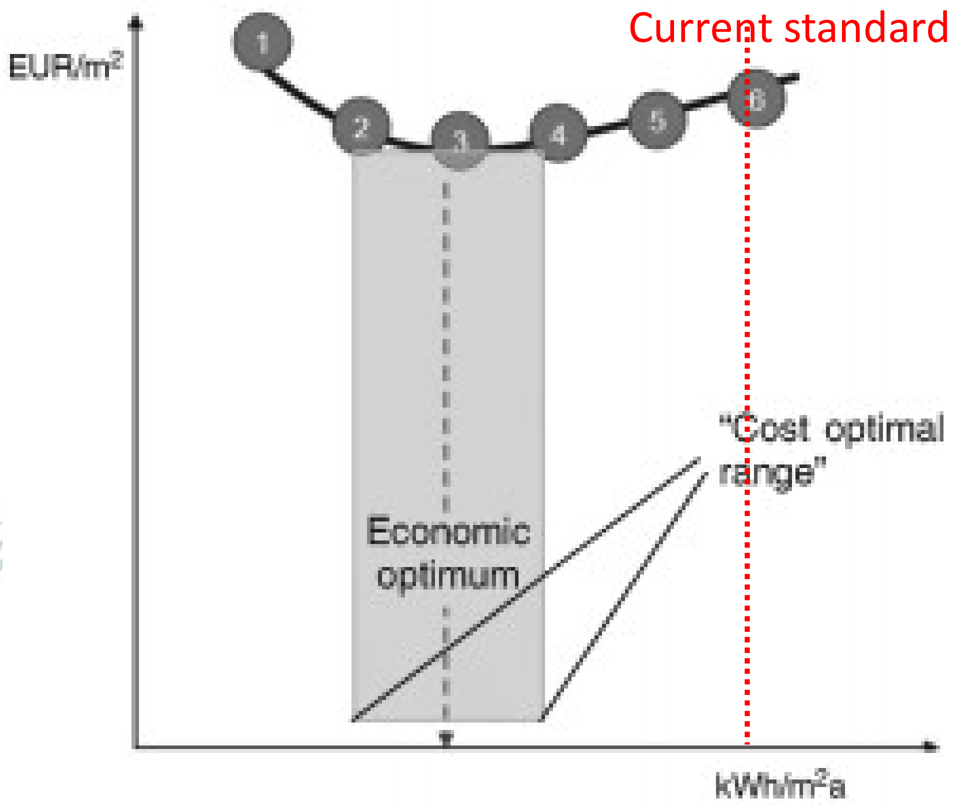
Calculating cost-optimal levels for building energy performance

- Requirement under European Energy Performance of Buildings Directive (EPBD)
- Defined as "*the energy performance level which leads to the lowest cost during the estimated economic lifecycle* "
- Covers new buildings and renovation of existing buildings and/or elements

Methodology overview



Cost-optimal curves



Cost calculations:

- Macro-economic: Discount rate 5%
- Financial: Discount rate 7%

Sensitivity:

- Discount rates (3% macroeconomic, 7% financial)
- Low, central, high energy prices
- Alternative PEF for grid electricity
- Alternative cost of carbon (macro-economic only)

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Scope of analysis – New build

Dwelling types:
Detached
Semi-detached
Bungalow
Mid-floor flat
Top-floor flat
Apartment block

4 x Heating systems:
Gas boiler
Biomass boiler
ASHP
District heating

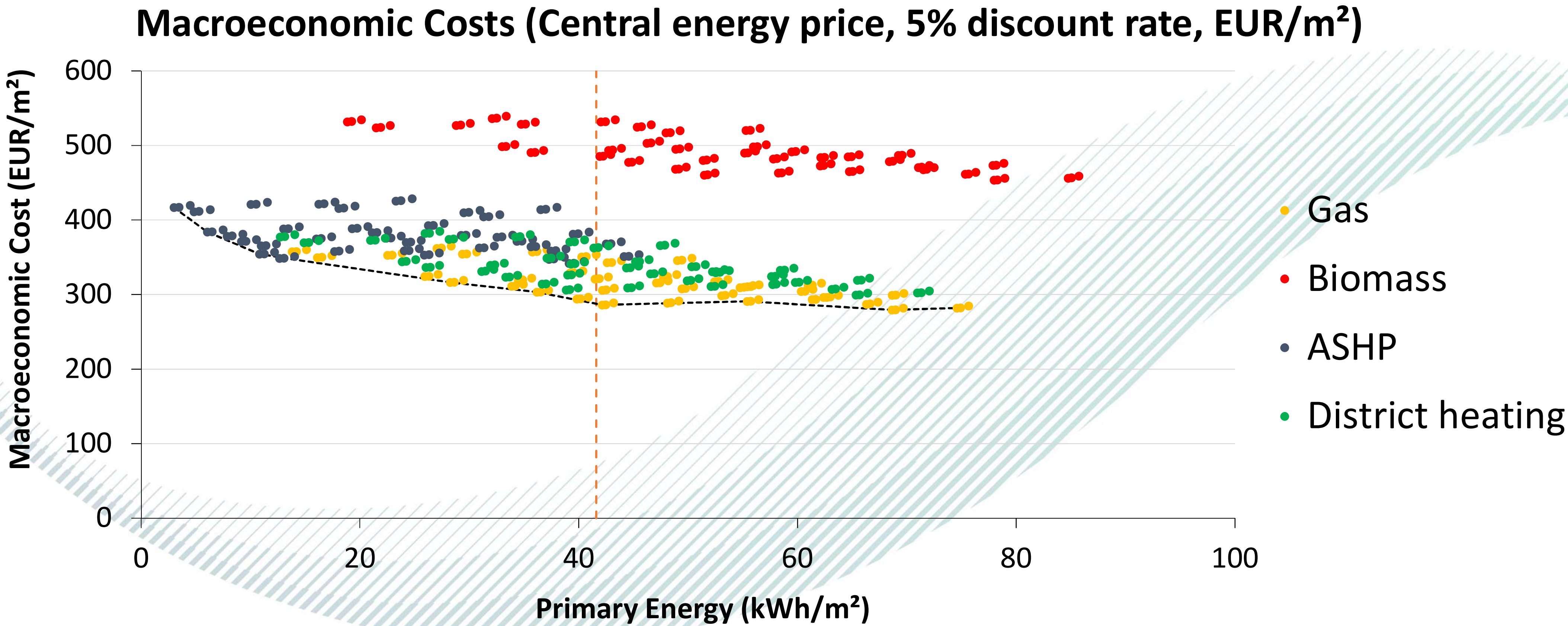
3 x Lighting pks:
Luminaire efficacy
Power density

3 x Hot water pks:
Shower flow rate
WWHR

4 x Fabric packages:
Walls
Floors
Roof
Windows
Thermal bridging
Air Tightness
Ventilation (NV, MEV, MVHR)
Thermal mass

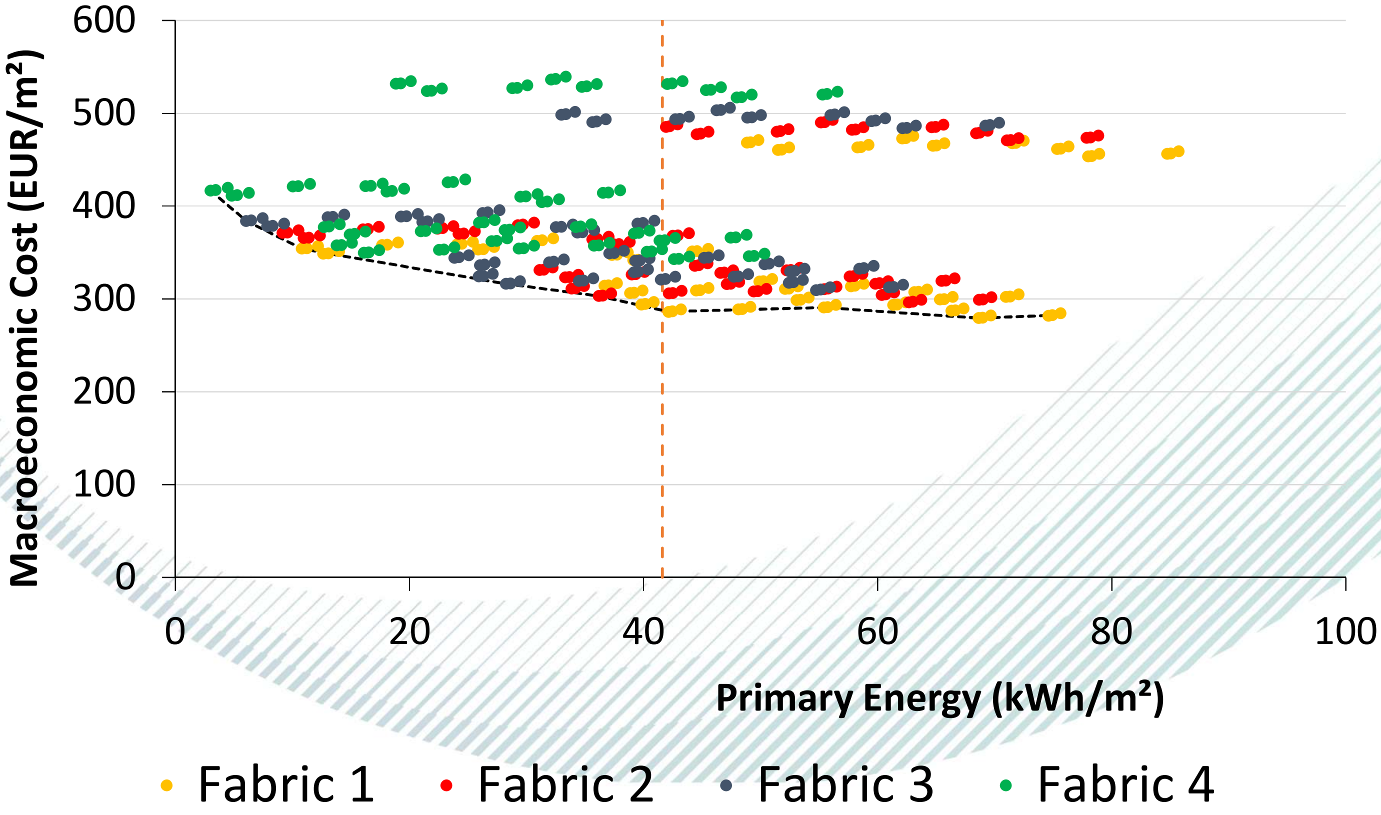
3 x PV packages

Semi-detached house – New build



Semi-detached house – New build

Macroeconomic Costs (Central energy price, 5% discount rate, EUR/m²)



Fabric options		1	2	3	4
Wall		0.2	0.17	0.15	0.13
Roof	House	0.16	0.13	0.10	0.10
	Flat	0.19	0.13	0.11	0.11
Floor	House	0.18	0.16	0.13	0.13
	Flat	0.2	0.18	0.13	0.13
Window		1.6	1.3	0.9	0.8
Thermal bridging	House	0.08	0.08	0.04	0.04
	Flat	0.15	0.08	0.05	0.05
Air Tightness		5	5	3	1
Ventilation		NV	cMEV	cMEV	MVHR + HR
Thermal Mass		Med	Med	Low	Low

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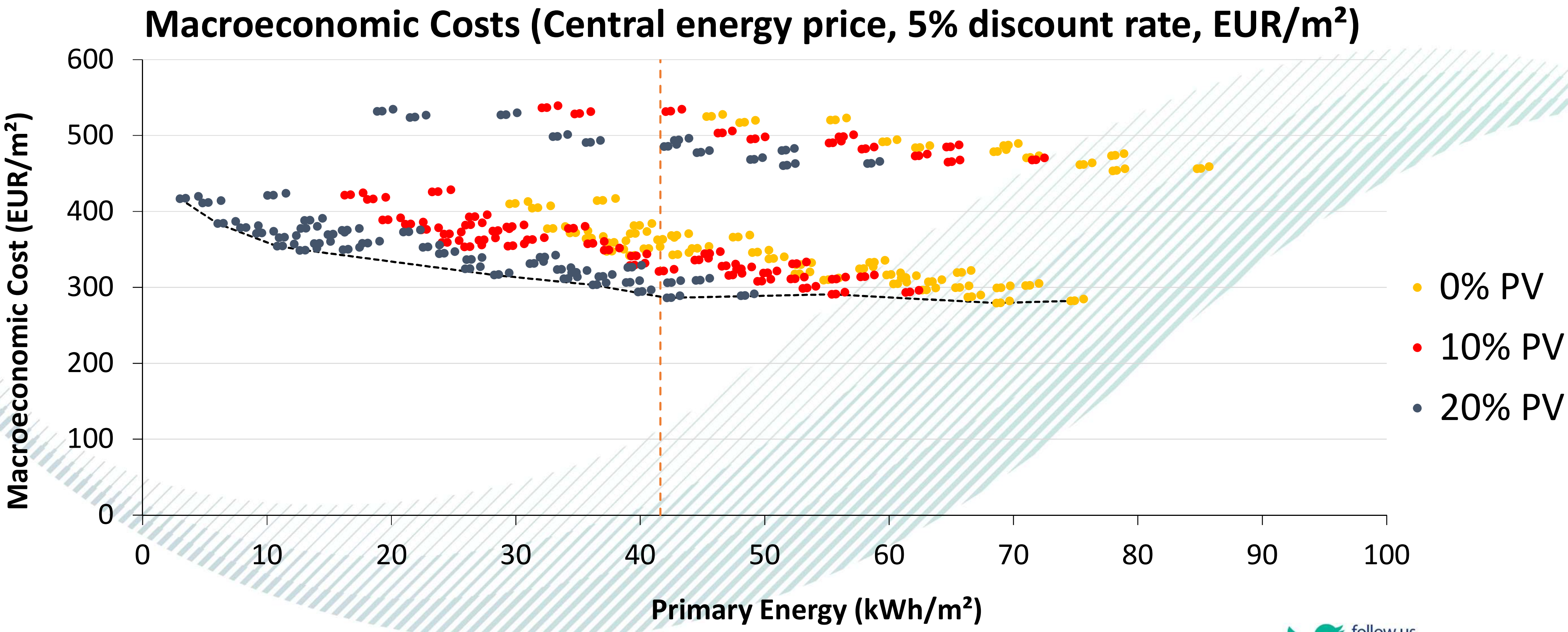
Semi-detached house – New build



Comparative gap analysis – New dwellings

Reference building	Cost Optimal Range ($kWh/m^2/yr$)	Cost Optimal Level ($kWh/m^2/yr$)	2018 Requirements($kWh/m^2/yr$)	Gap between cost optimal and Part L 2018
Bungalow	34 – 94	34	52	gap >15%
Detached house	36 – 74	43	42	no gap
Semi-detached house	42 – 75	42	42	
Mid-floor flat	59 – 77	59	40	
Top-floor flat	64 – 97	80	47	
Apartment	56 – 84	66	43	
Average	47 – 83	52	45	

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Scope of analysis – Existing build

Dwelling types:

Detached
Semi-detached
Bungalow
Mid-floor flat
Top-floor flat
Apartment block
Mid-terrace

Construction:

Cavity wall
Hollow block

Elements

Heating –

Gas, Gas + SHW, ASHP

Fabric elements –

Walls, Roof, Floor, Windows

Packages

4 x Heating systems:

Gas boiler
Biomass boiler
ASHP
Storage heaters

3 x Lighting & Hot water:

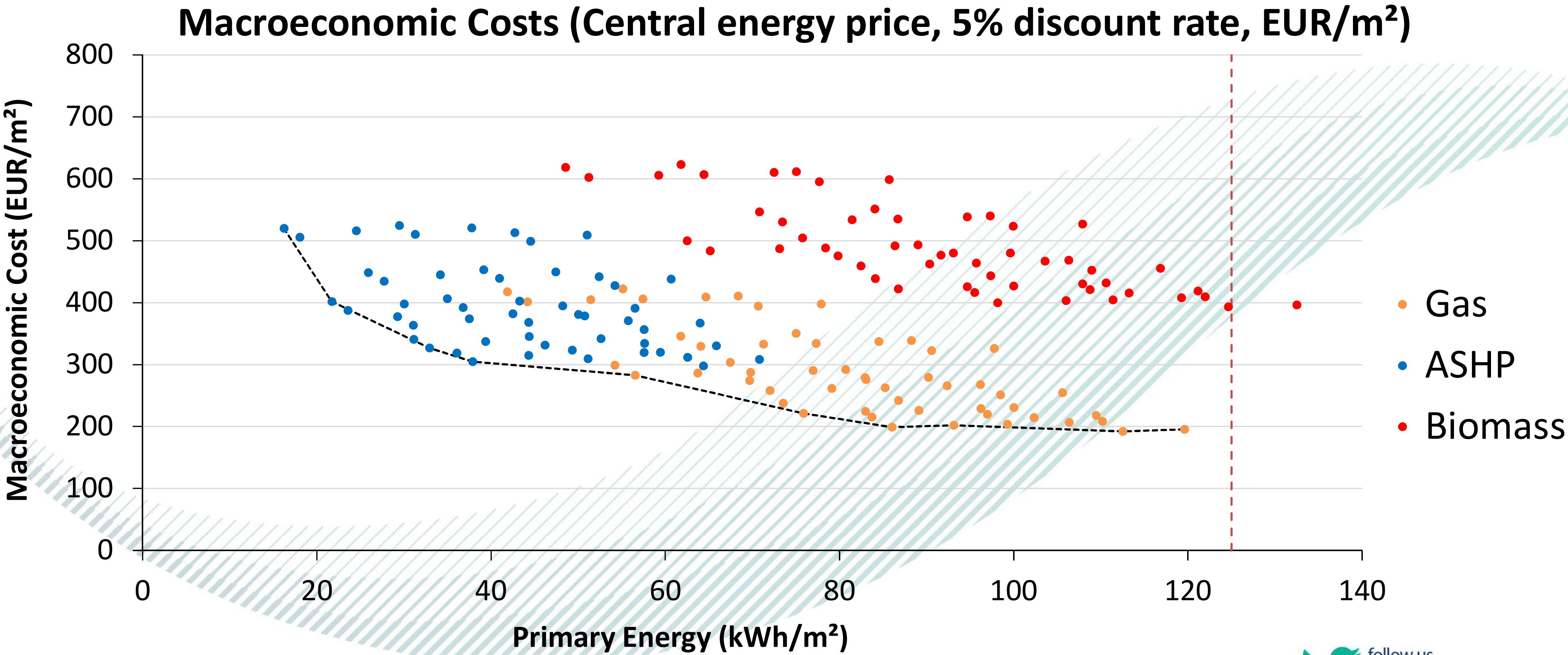
Luminaire efficacy
Shower flow rate
WWHR

6 x Fabric packages:

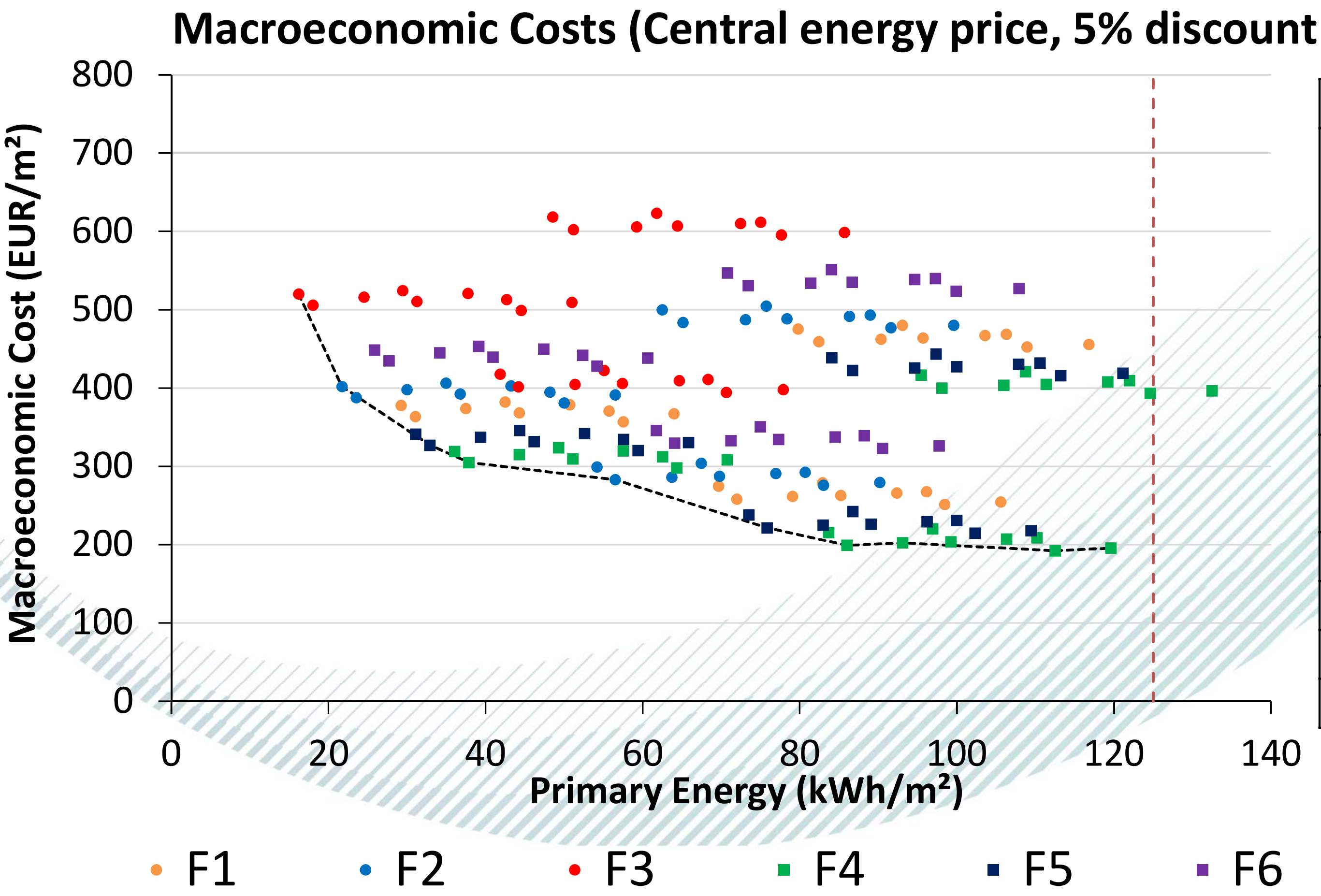
Walls
Roof
Windows
Air Tightness
Ventilation (NV, MEV)

3 x PV packages

Semi-detached house – Existing, cavity



Semi-detached house – Existing, cavity



Fabric options		1 -3	4 -6
		Roof, wall, windows	Roof, walls for houses Wall, windows for flats
Cavity wall		0.31/ 0.16	0.31/ 0.16
Solid wall		0.37 – 0.13	0.37 – 0.13
Roof	House	0.13 – 0.10	0.13 – 0.10
	Flat	0.13 – 0.11	0.35
Window	House	1.4 – 0.8	2.8
	Flat	1.6- 0.8	1.6- 0.8
Air Tightness		10 -3	10 -3
Ventilation		NV/ cMEV	NV/ cMEV

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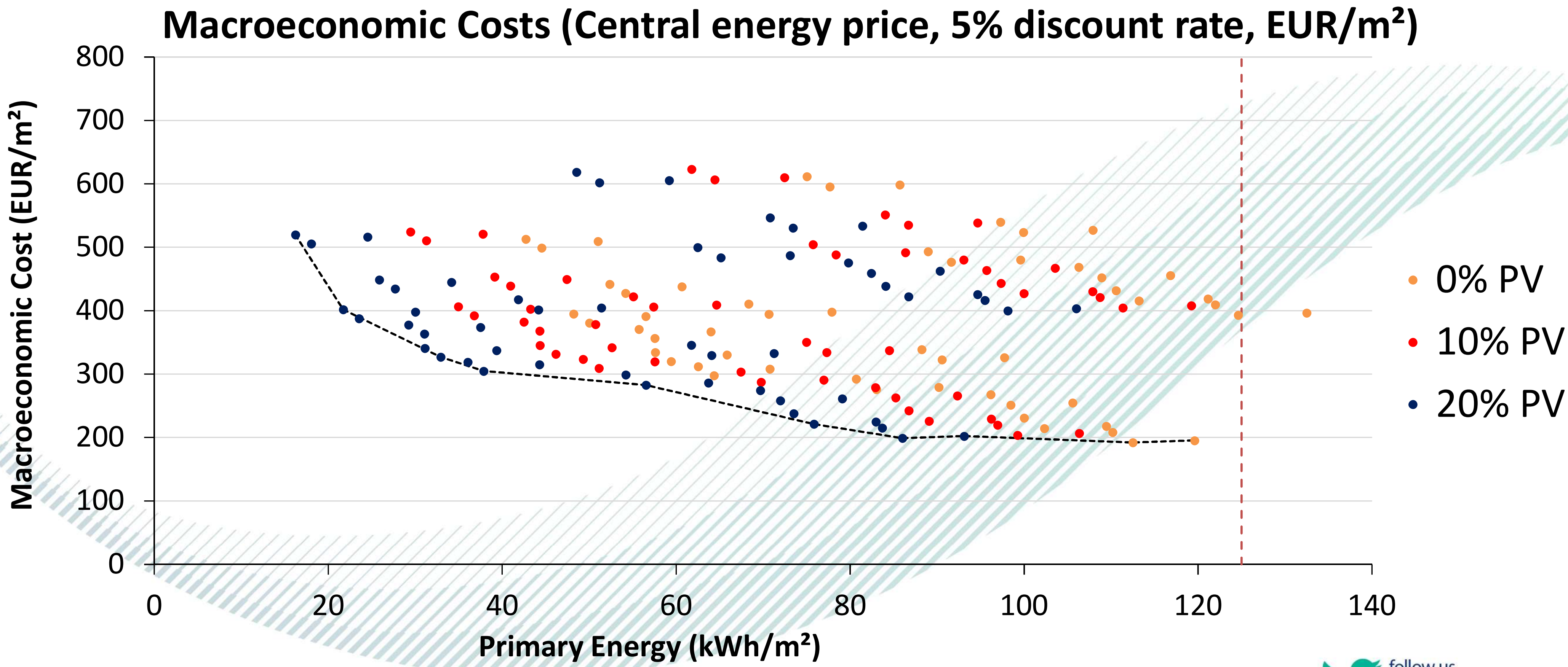
Semi-detached house – Existing, cavity



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Comparative gap analysis – Existing Elemental

Reference building	Cost Optimal Level	Current Requirements	Cost optimal solution
Cavity walls	0.31 W/m^{2}K	0.55 W/m^{2}K	fully filled cavity
Solid walls	0.37 W/m^{2}K	0.35 W/m^{2}K	no gap
Roof, pitched	0.13 W/m^{2}K	0.16 W/m^{2}K	150mm mineral wool between joists + 200mm
Roof, flat	0.11 W/m^{2}K	0.16 W/m^{2}K	200mm PIR insulation
Floor (houses only)	0.22 W/m^{2}K	0.45 W/m^{2}K	20mm of Vacuum insulated Panel
Windows, houses	1.4 W/m^{2}K	1.4 W/m^{2}K	No gap
Windows, flats	0.9 W/m^{2}K	1.4 W/m^{2}K	Triple glazing
Heating	Gas boiler (91%)	Gas boiler (90%)	No gap

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Comparative gap analysis – Existing packages

Reference building Cavity wall	Cost Optimal Range (kWh/m²/yr)	Cost Optimal Level (kWh/m²/yr)	2018 Requirements(kWh/m²/yr)	Gap between cost optimal and Part L 2018
Bungalow	90 – 151	90	125	gap >15%
Detached House	90 – 122	116	125	no gap
Semi-detached House	86 – 120	112	125	~ within 15%
Terraced House	116 – 125	116	125	no gap
Mid-Floor Flat	65 – 95	76	125	gap > 15%
Top-Floor Flat	93 – 125	107	125	gap > 15%
Apartment	75 – 106	87	125	gap > 15%
Average, cavity wall	90 – 123	103	125	
Average, solid wall	89 – 124	105	125	

Update to DEAP Methodology

Orla Coyle

SEAI

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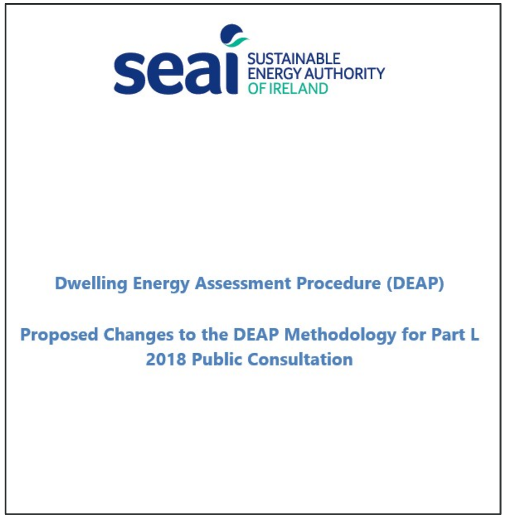
DEAP Methodology

DEAP/ BER Methodology in place for 10 years

Part L Public Consultation

- https://www.housing.gov.ie/node/8753
    - Dwelling Energy Assessment Procedure (DEAP) - 4.1 Draft Public Consultation Example A E1.1 (264.31 KB)
    - Dwelling Energy Assessment Procedure (DEAP) - 4.1 Draft Public Consultation Example B E1.2 (264.14 KB)
    - Dwelling Energy Assessment Procedure (DEAP) - 4.1 Draft Public Consultation Example C E1.3 (264.32 KB)
    - Dwelling Energy Assessment Procedure (DEAP) - 4.1 Draft Public Consultation Example D E1.4 (264.16 KB)
    - Dwelling Energy Assessment Procedure (DEAP) - 4.1 Draft Public Consultation Example E E1.5 (264.91 KB)
    - Dwelling Energy Assessment Procedure (DEAP) - 4.1 Draft Public Consultation Example F E1.6 (264.15 KB)

DEAP 4 – Launched in Summer 2018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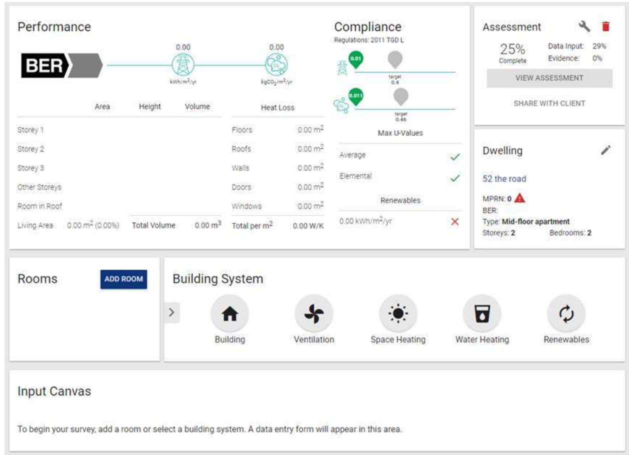
Dwelling Energy Assessment Procedure (DEAP)

Proposed Changes to the DEAP Methodology for Part L 2018 Public Consultation



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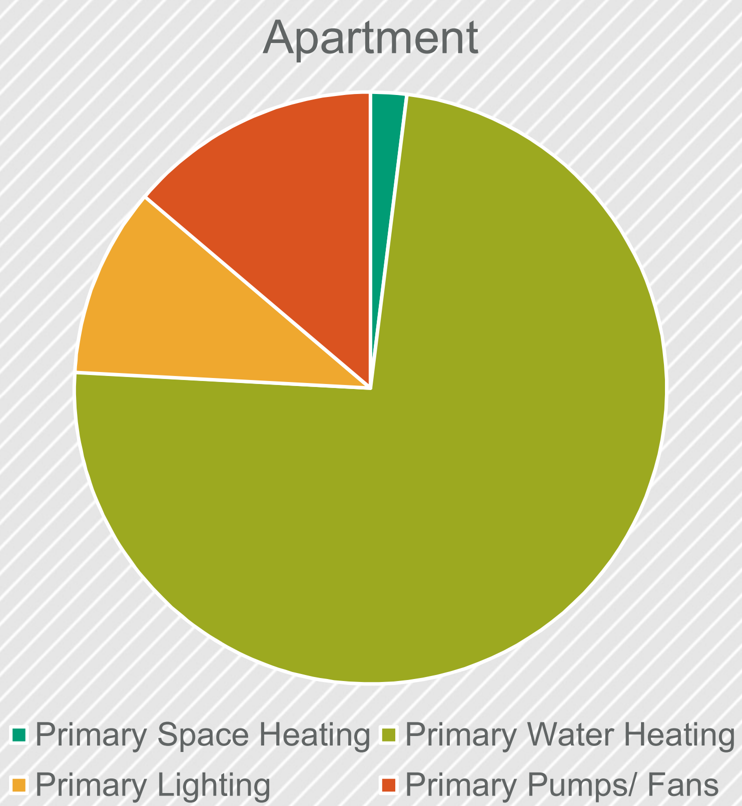
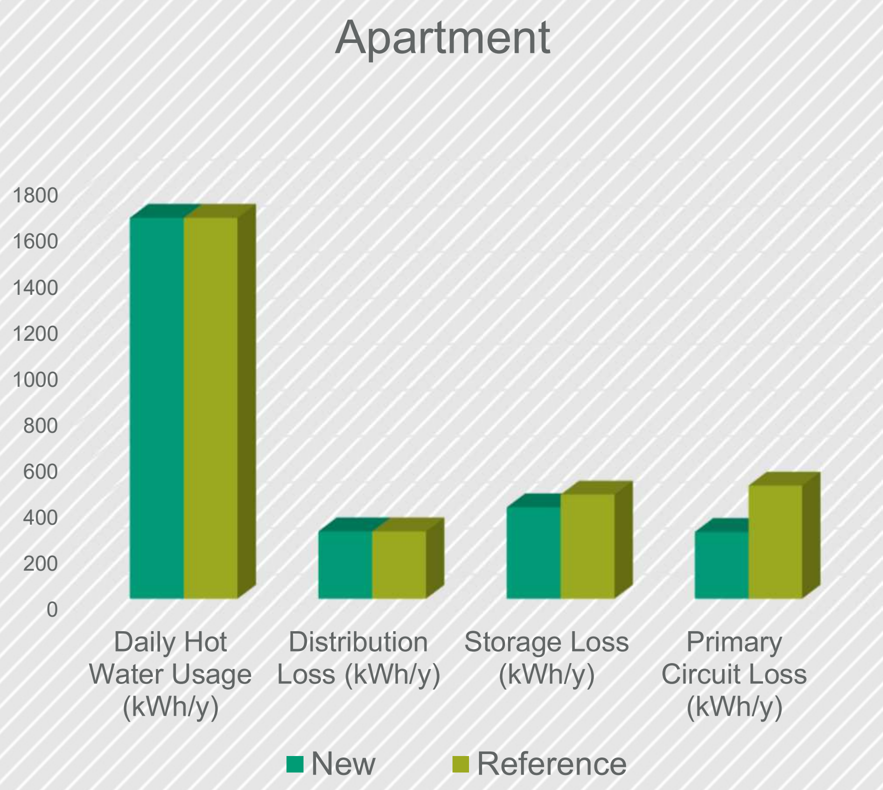
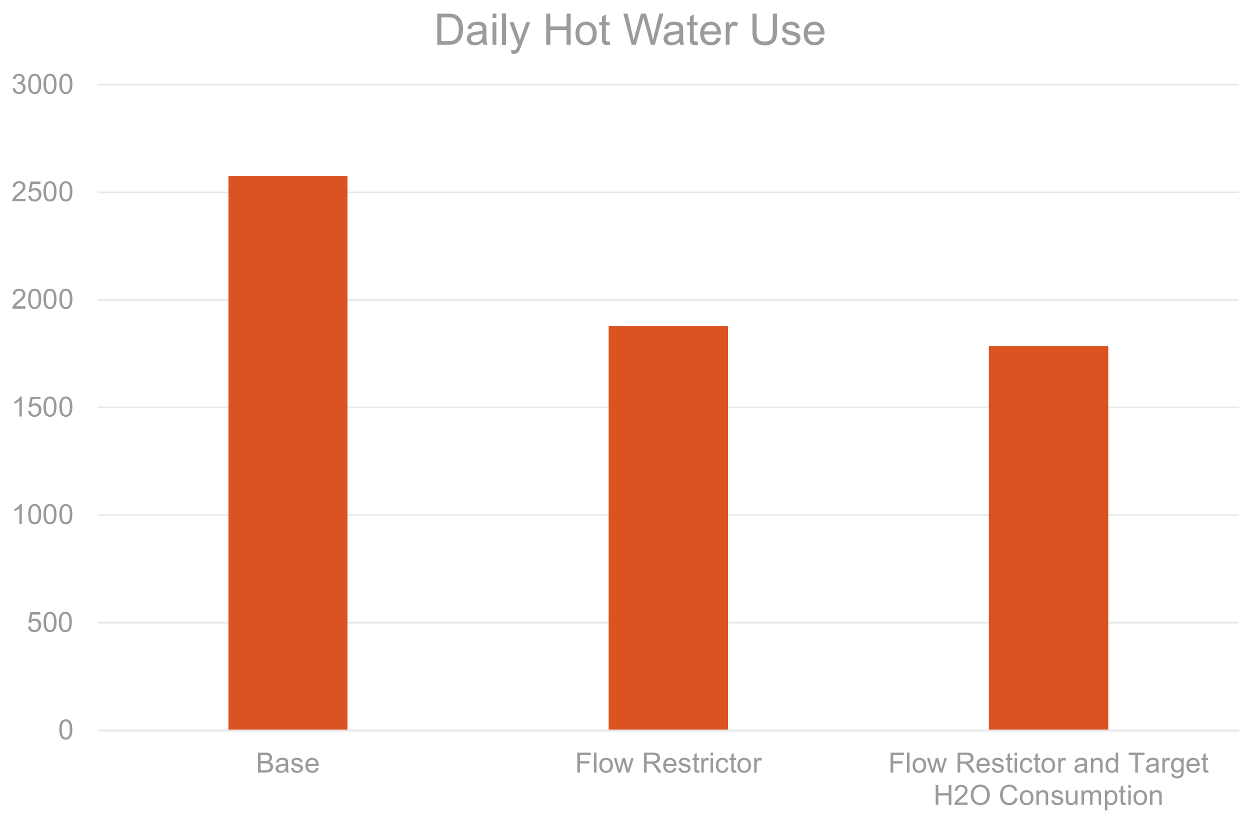
Regulatory Impact Assessment





DHW Energy – Proposed Changes



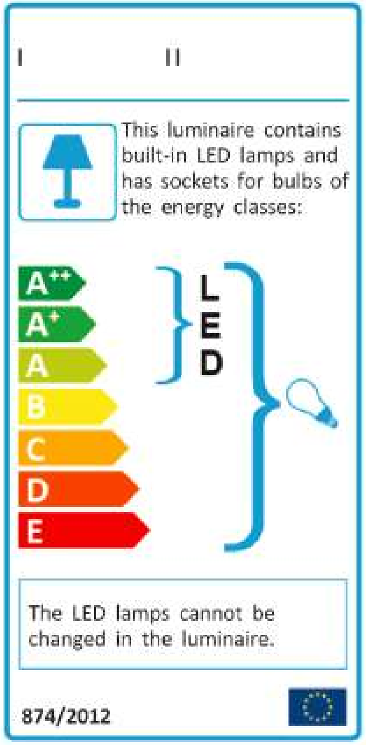
Lighting Energy – Proposed Changes

Portable Lighting:

- Efficiency improved based DECC (UK) of the Household Electricity Survey (HES) in June 2013
- 21 lumen/W

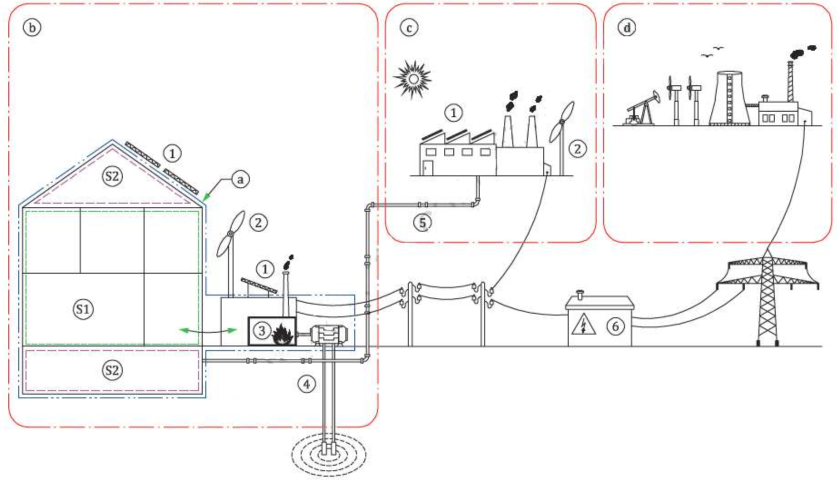
Fixed lighting:

- New buildings: the assessor enters details based on design of the installed lighting, including Wattage, Efficiency and/or Lux levels.
- Existing buildings, the assessor enters default efficiency based on the lamp type/ rating with the lighting level fixed.



Renewable Energy Ratio

- Calculated in line with ISO 52000
- Included:
  – PV
  – Solar
  – Wind
  – Heat Pump
  – Biomass/ Biogas
  – District heating
  – CHP



Key

a	assessment boundary (use energy balance)	1	PV, solar
b	perimeter: on-site	2	wind
c	perimeter: nearby	3	boiler room
d	perimeter: distant	4	heat pump
S1	thermally conditioned space	5	district heating/cooling
S2	space outside thermal envelope	6	substation (low/medium voltage and possible storage)

The Renewable Energy Ratio *RER* = $\dfrac{E_{Pren}\text{ Primary Energy of the Renewables}}{E_{Ptot}\text{ Total Primary Energy}}$

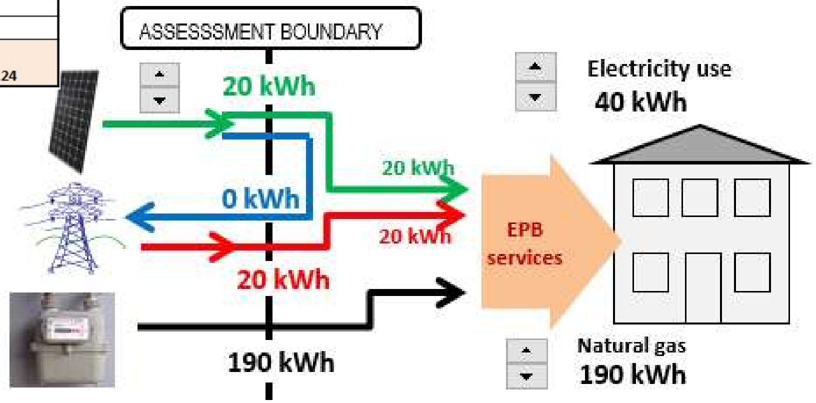
- c

Renewable Energy Ratio - General

PV/ Wind/Solar/Biomass/ Biogas/ District Heating

- *Equation 1* $Ep,_{ren} = \text{Generated Energy} \times Fp,_{ren}$
- Equation 2 $Ep,_{tot} = \text{Generated Energy} \times Fp,_{ren} + \text{Generated Energy} \times Fp,_{nren}$

		E	fPnren	fPren on-site	EPnren	Epren on-site	EPtot	RER
		kWh			kWh	kWh	kWh	nrb-os
+ Delivered energy	PV/Wind	815.1	0	2.08	0.0	1695.4	1695.4	
+ Delivered energy	Other	0.0	0	1	0.0	0.0	0.0	
+ Delivered energy	Solar	0.0	0	1	0.0	0.0	0.0	
+ Delivered energy	Biomass	0.0	0.1	1	0.0	0.0	0.0	
+ Delivered energy	Biodiesel	0.0	0.3	1	0.0	0.0	0.0	
+ Delivered energy	Bioethanol	0.0	0.34	1	0.0	0.0	0.0	
+ Environmental energy	HP	0.0	0	1	0.0	0.0	0.0	
+ Saved energy	CHP	0.0	0	1	0.0	0.0		
+ Delivered energy	District Heating	0.0	0.6	0.4	0.0	0.0	0.0	
+ Delivered energy	Grid	-366.5	2.08	0	-762.4	0.0	-762.4	
+ Delivered energy	Thermal	5580.6	1.1	0	6138.6	0.0	6138.6	
TOTAL STEP A					5376.2	1695.4	7071.7	0.24

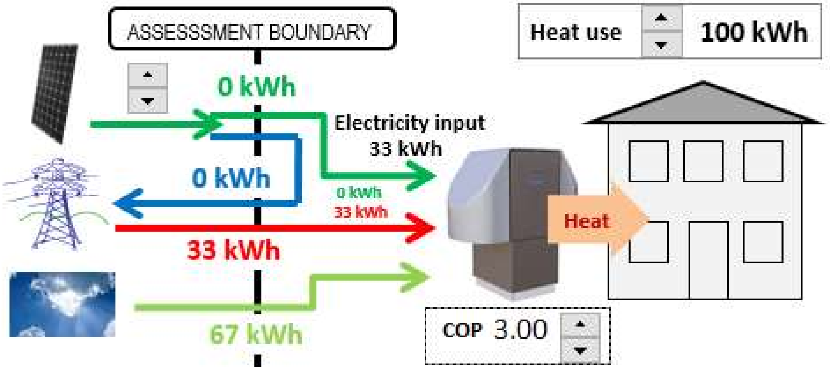


Renewable Energy Ratio – Heat Pump

Heat Pump

- *Environmental Energy = (Htg Demand$_{HP}$ - Consumed Energy$_{HP}$)*

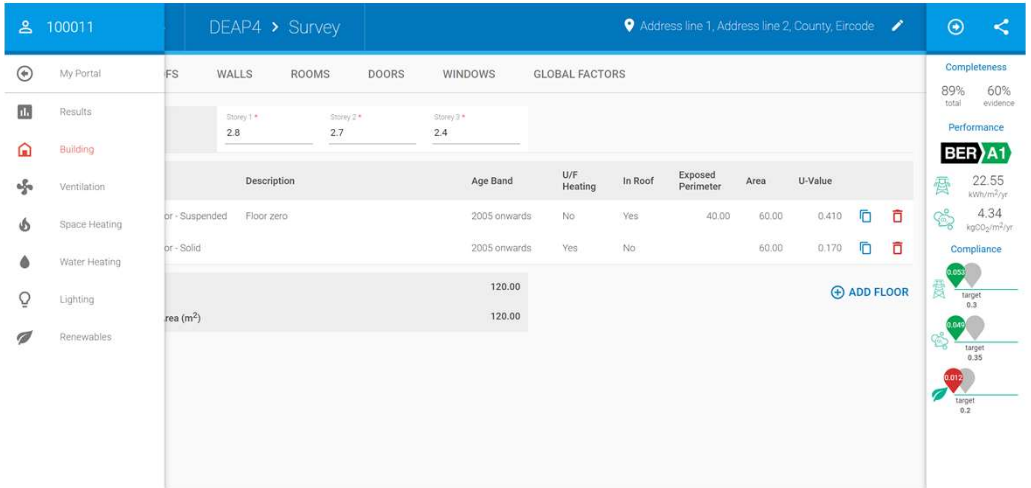
		E	fPnren	fPren on-site	EPnren	Epren on-site	EPtot	RER
		kWh			kWh	kWh	kWh	nrb-os
+ Delivered energy	PV/Wind	0.0	0	2.08	0.0	0.0	0.0	
+ Delivered energy	Other	0.0	0	1	0.0	0.0	0.0	
+ Delivered energy	Solar	0.0	0	1	0.0	0.0	0.0	
+ Delivered energy	Biomass	0.0	0.1	1	0.0	0.0	0.0	
+ Delivered energy	Biodiesel	0.0	0.3	1	0.0	0.0	0.0	
+ Delivered energy	Bioethanol	0.0	0.34	1	0.0	0.0	0.0	
+ Environmental energy	HP	1842.4	0	1	0.0	1842.4	1842.4	
+ Saved energy	CHP	0.0	0	1	0.0	0.0		
+ Delivered energy	District Heating	0.0	0.6	0.4	0.0	0.0	0.0	
+ Delivered energy	Grid	1571.3	2.08	0	3268.4	0.0	3268.4	
+ Delivered energy	Thermal	0.0	1.1	0	0.0	0.0	0.0	
TOTAL STEP A					3268.4	1842.4	5110.8	0.36

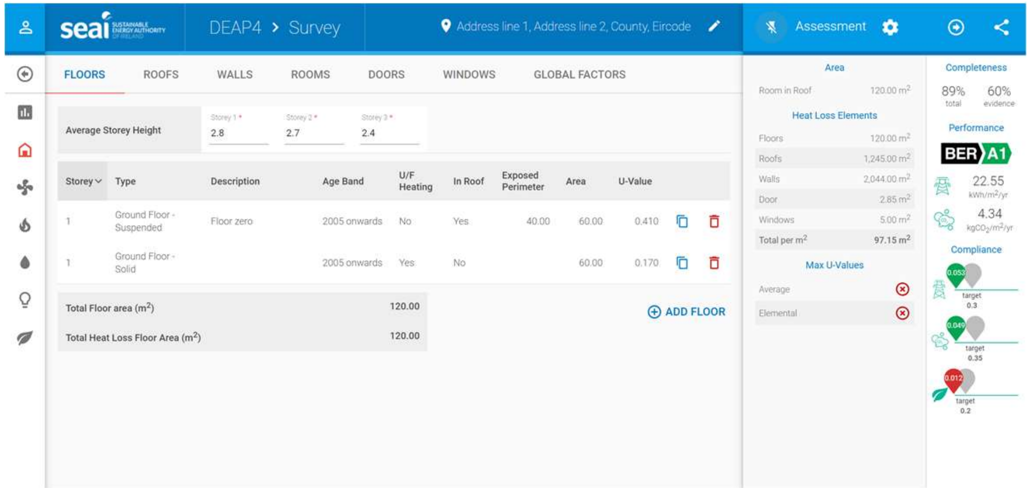


Update to Software

- April 2019 – in conjunction with Part L
  - Workbook 4.2.0 incorporating changes to Part L and incorporation of Heat Pump Tool
  - DEAP Manual 4.2.0
  - DEAP Survey Guide

- Summer 2019
  - Software 4.2.0 incorporating spreadsheet and interface changes
  - DEAP Manual 4.2.1





Heat Pump Consultation

The technical changes include:

- Revised standard EN15316-4-2 updated from 2008 to 2017 version
- Direct-exchange (DX) heat pumps
- Gas fired heat pumps (GAHP)
- Low temperature heat pumps for space heating only
- Exhaust air heat pumps (EAHP)
- Double-duct heat pumps and heat recovery systems incorporating heat pump functionality
- New approach to bivalent systems and clarification for buildings heated by more than one heat pump
- Accounting for the “degradation coefficient” in oversized heat pumps
- Other calculation refinements

DEAP Heat Pump Methodology: Proposed Changes for Consultation *Q1 2019*

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DEAP Heat Pump Methodology Proposed changes

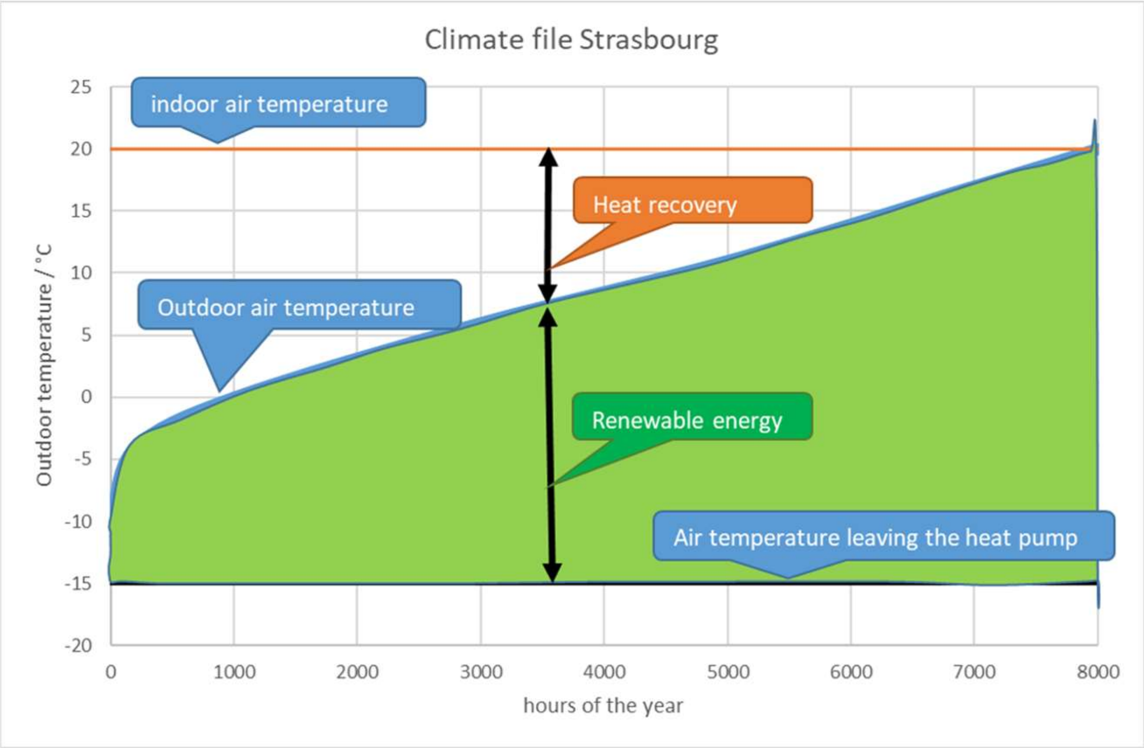
For Public Consultation: *Q1 2019*

V1.0

Exhaust Air Heat Pumps – Renewable Contribution

Renewable Contribution in line with Renewable Energy Directive

% Renewable based on load provided by Heat Pump versus load provided by Heat Pump and Ventilation system specific to Irish weather data



Case Study – Sean Foster Place

Natalie Walsh, NMA

Daniel Matthews, Homan O'Brien

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GARLAND
Concepts Realised

HOMAN O'BRIEN

AUSTIN REDDY & COMPANY

Sustainable Engineering Solutions Ltd

Maurice Johnson & Partners
FIRE SAFETY ENGINEERING & ACCESS CONSULTANTS

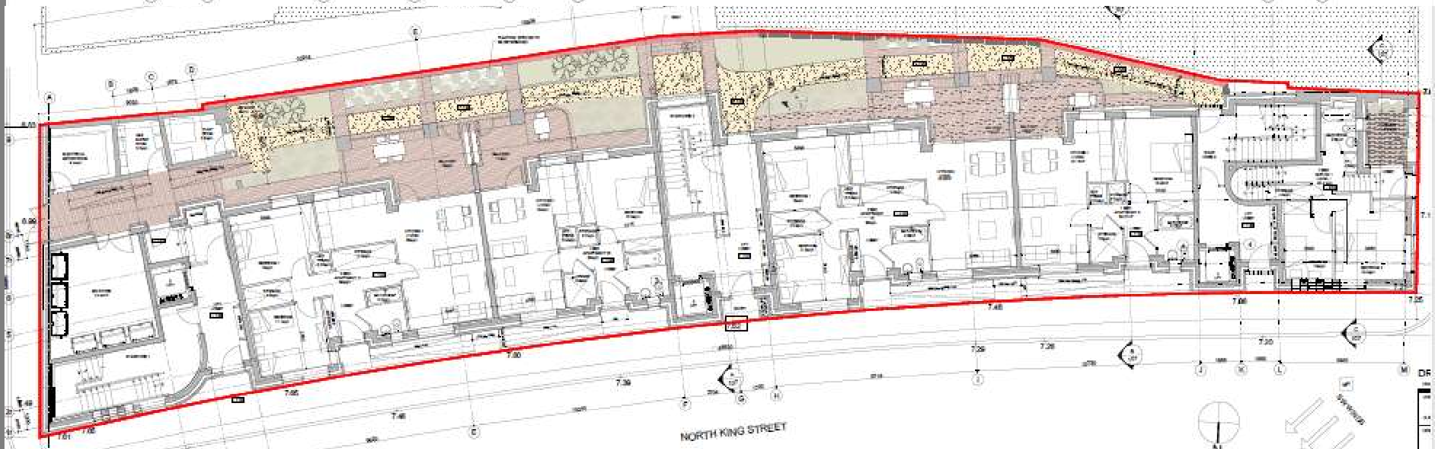
murray & associates
landscape architecture

PSDP Turner & Townsend

NMA ARCHITECTS NZEB PILOT SEAN FOSTER PLACE HOUSING

NORTH KING STREET DUBLIN CITY COUNCIL MARCH 2019

NORTH ELEVATION



GROUND FLOOR PLAN

NMA ARCHITECTS NZEB PILOT SEAN FOSTER PLACE HOUSING

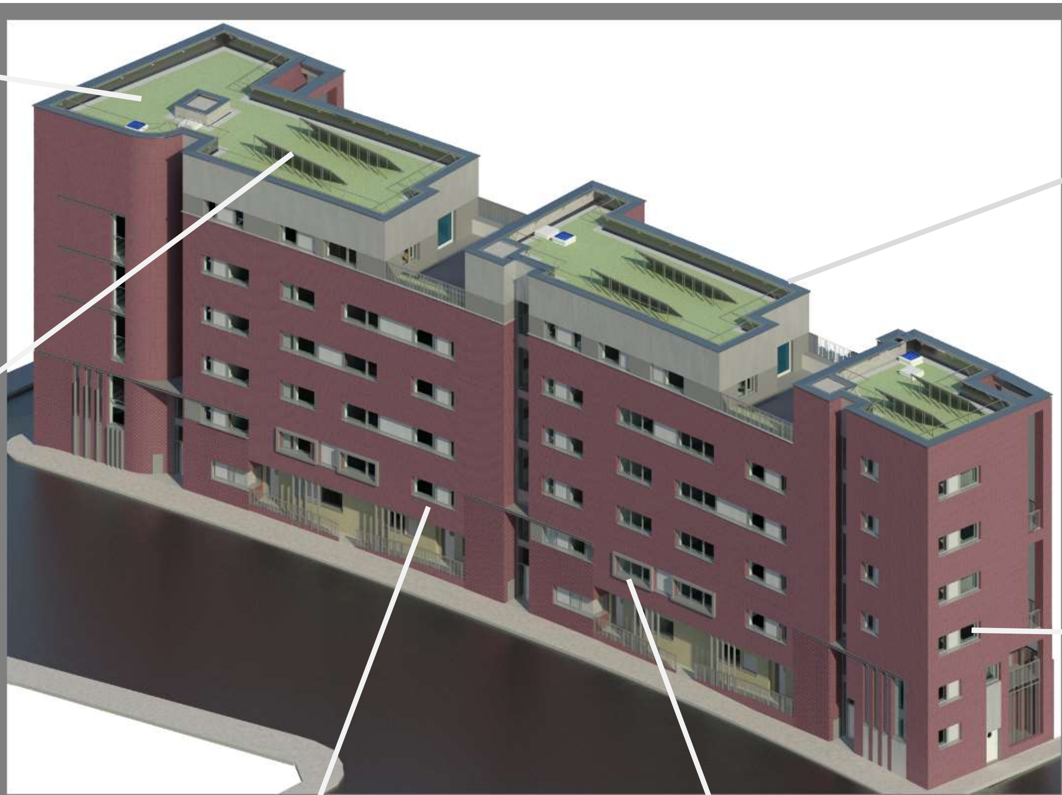
NORTH KING STREET DUBLIN CITY COUNCIL MARCH 2019

GREEN ROOFS help mitigate against URBAN HEAT ISLAND EFFECT by increasing the building's solar reflectance index and delaying surface water run-off

sustainable solutions

1.5 PV PANELS per apartment provide energy efficient fuel for apartments and achieve renewable energy compliance with Part L requirements for DEAP analysis

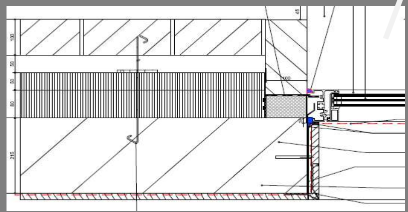
renewable fuels



SOLAR shading to south facing balconies and solar gain to apartments with g value of 0.42

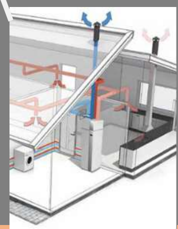
solar heat gain

TRIPLE GLAZED WINDOWS provide reduced heat loss of 0.8 W/m²K with sound reduction **building fabric**



air tightness rate

INSULATED cavity wall construction of 0.15 W/m²K with high AIR TIGHTNESS OF 2m³/hr/m²



heating / ventilation method

HIGH EFFICIENCY exhaust air heat pump to each unit

Low energy strategies

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NZEB DESIGN DEVELOPMENT

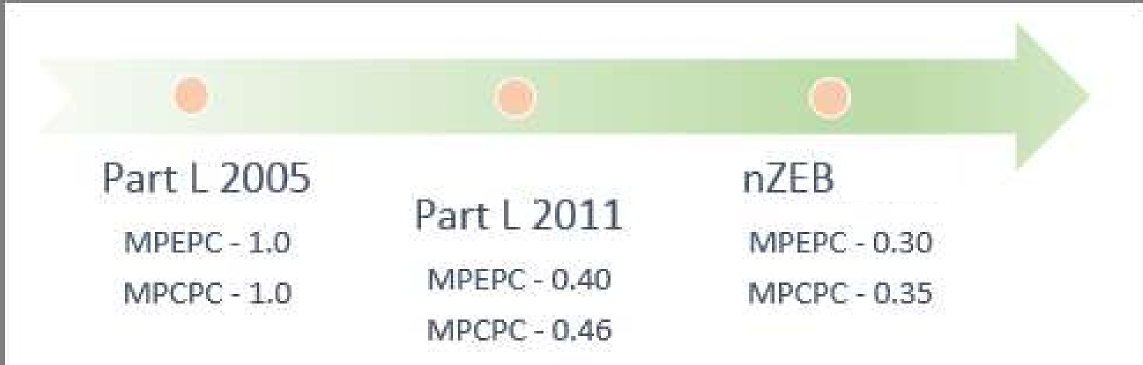


Fig 01. Part L for Dwellings and NZEB timeline (source: NMA Architects)

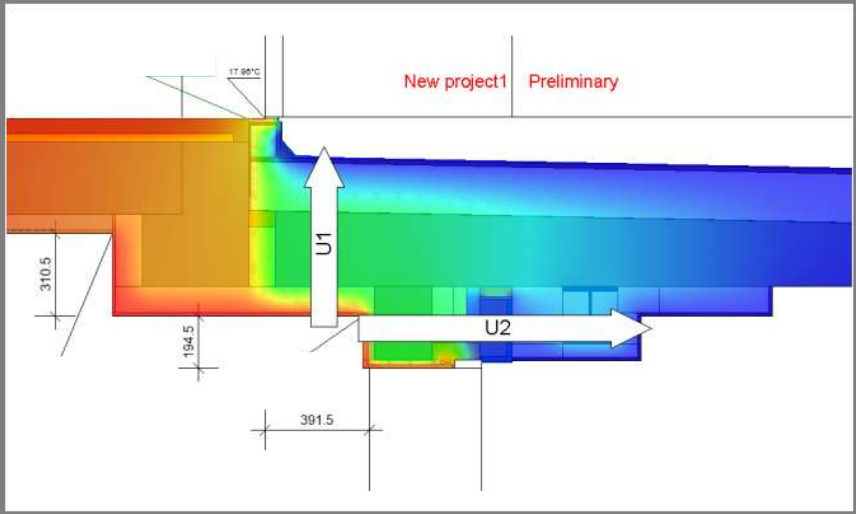
NZEB energy targets

Unit	Primary Energy (kWh/m2/yr)	Cost (€*)
NZEB Apartment 10	38.64	270.02
Part L Apartment 10	51.78	342.00
Annual calculated saving	13.14	71.98

cost comparisons

BUILDING FABRIC Thermal Bridge Modelling

- Modelling the junctions has the potential to improve the BER rating considerably if well detailed
- Detailed analysis of building junctions was made to optimise thermal performance
- Junctions were modelled by thermal bridge analysis
- Calculation of surface temperatures and psi values

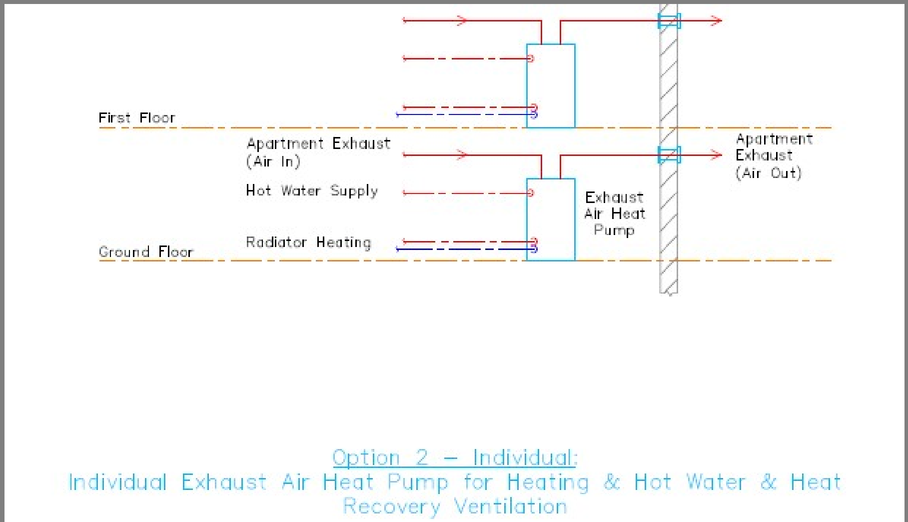


thermal modelling of architectural detailing

HEATING SYSTEM - Space heating + Domestic hot water

site restrictions and building requirements impacted on the selection of heating system

- district heating was discounted because of scale & restrictions
- All types of heat pumps and were considered and evaluated
- Ventilation and heating strategies for the apartments considered
- Focus on comfort to occupants and user friendliness
- The ventilation system comprises of acoustically attenuated passive wall vents in the bedrooms and living rooms to outside air and extract from kitchen, wet rooms and stores



Sample of schematic used to explore heat pump options with Design Team

HEATING SYSTEM Exhaust Air Heat Pump

- Heat Pump type selected was Exhaust Air Heat Pump with integrated hot water storage and whole house extract ventilation unit

- Many benefits for a space constricted development in particular the integration of space heating, domestic hot water and ventilation system in one item

- Considerations to be taken in siting the unit include: noise to adjacent rooms, route for exhaust ductwork to external, service access and door undercuts

- System components to be considered include insulated exhaust ductwork, passive wall vents and external grilles

- Growing market sector with new products being introduced continually

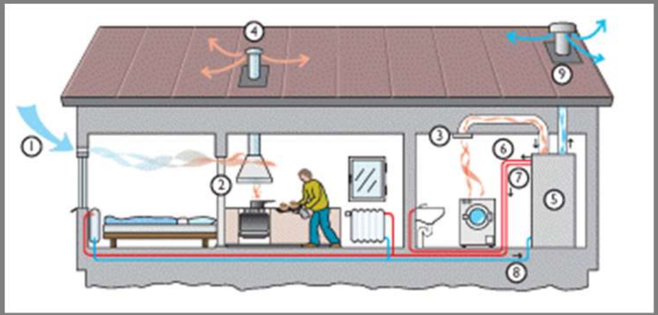


Diagram of exhaust air heat pump operation

Typical exhaust air heat pump installation

ON-SITE COMPLIANCE - Challenges to achieving NZEB

- market difficulties with sourcing high performance products
- industry culture
- training of sub-contractors
- skilled contractors
- training of installers
- site management experience
- quality assurance on site and airtightness testing
- heat pump selection

ON-SITE COMPLIANCE - Pre-site Stage Compliance Methodology

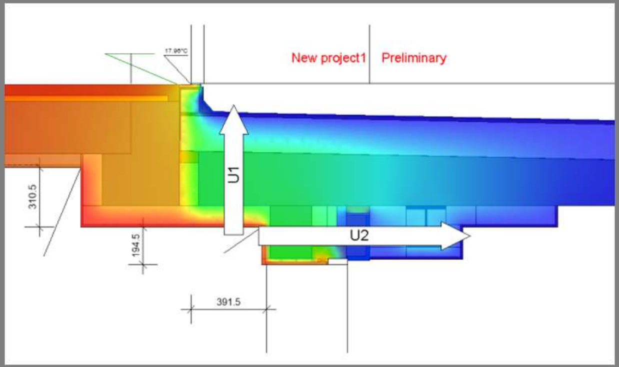
- NZEB Compliance Strategy Review Process
- 12 week compliance period
- NZEB solution critical components for Dwellings:

  - opaque fabric u values
  - glazing performance
  - thermal bridging
  - infiltration rate
  - whole house extract system ventilation
  - hot water system: heat pump serving hws cylinder
  - lighting energy efficient LED luminaires
  - exhaust air heat pump with integrated hot water storage
  - renewable energy technology: pv panel installation

ON-SITE COMPLIANCE - Site stage Compliance

- NZEB Co-ordinator + Site Supervisor (pilot project)
- Mechanical + Electrical coordinator
- NZEB Co-ordinator role separate from the role of contracts manager / site manager / site engineer / site foreman
- Contractor's Supervision and co-ordination is required to ensure the NZEB is achieved
- Provision of - checking prior to submittal - of detailed NEAP (common areas) methodology compliance data for DEAP and NEAP
- Selection of sub-contractors with experience + technical skills required to meet NZEB performance requirements
- Selection of materials, products, systems, equipment and components necessary to meet NZEB, performance requirements
- Timely appointment of sub-contractors + suppliers to ensure key components requirements confirmed at the start of the project

ON-SITE COMPLIANCE - Site stage Compliance



thermal modelling of
architectural detailing

- Thermal modelling – Contractors co-ordination and supervision to achieve compliance with thermal modelling requirements as set out in the NZEB Compliance Specification

- Organising tool box talks for all relevant sub-contractors and personnel whose work will or may impact on achieving NZEB performance requirements - Holding further tool box talks as necessary where evidence of non- compliance is highlighted by the ER

ON-SITE COMPLIANCE - Site stage Compliance

- Providing detailed method statements as part of the NZEB Compliance Strategy Review Process for ensuring compliance with NZEB performance requirements addressing potential site problem areas including:
  - services and renewable energy technology installation
  - services penetrations
  - quality of workmanship
  - thermal bridging
  - air tightness including all gaps between building elements
  - quality of workmanship to cavity walls
  - quality of workmanship to roofs
  - quality of workmanship to balconies
  - services
- Managing remedial / replacement works where non compliances are highlighted by Employers Representative including providing evidence of resolution to satisfaction of ER

ON-SITE COMPLIANCE - Site stage Compliance

- **Training** toolbox talk on site, on appropriate fixing requirements, and avoidance of gaps in insulation

- **Air tightness** Contractor shall appoint and notify to ER, of an air tightness specialist at the start of project

  All services penetrations through walls, floors, soffits and roofs need to be supervised to ensure that they do not compromise overall thermal performance of building

- **Services & Renewable Energy Technology** Co-ordinate services + renewable energy technology requirements to ensure compliance with performance requirements - to include all elements required to meet NZEB performance requirements including those set out in Employer Designed NZEB solution critical components section

Overheating Study

Pratima Washan

AECOM

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Do new homes with advanced thermal performance tend to overheat?

- Are certain dwelling types more prone to risk of overheating?
- Which design features most influence the risk?
- What is the sensitivity to weather data?
- What type of interventions can help mitigate the risk?
- Is there scope/ need to refine existing tools to adequately capture the risk?

When is a dwelling considered to have a high risk of overheating?

CIBSE TM59 compliance criteria

- **Criterion A** - For living rooms, kitchens and bedrooms: Internal temperature should not exceed a defined comfort temperature by 1 °C or more for >3% of occupied hours over the summer period (May – Sept)
- **Criterion B** - For bedrooms: Internal temperature should not exceed 26°C for more than 1% of annual hours between 10pm and 7am

Analysis based on standard occupancy.

Criterion A threshold comfort temperature reduced by 1°C for buildings with vulnerable occupants.

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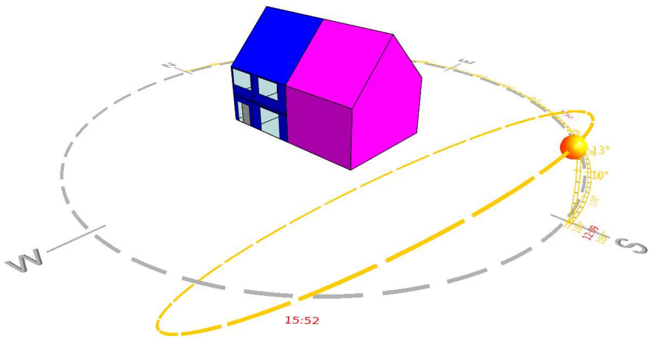
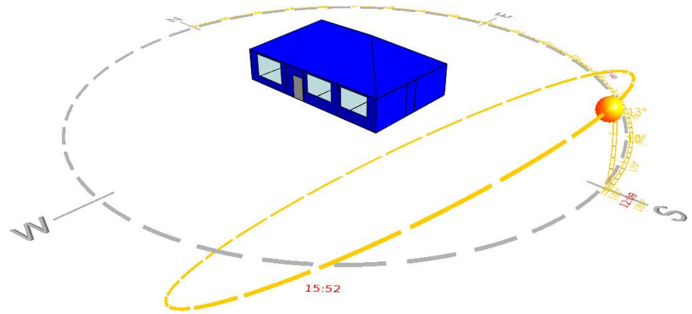
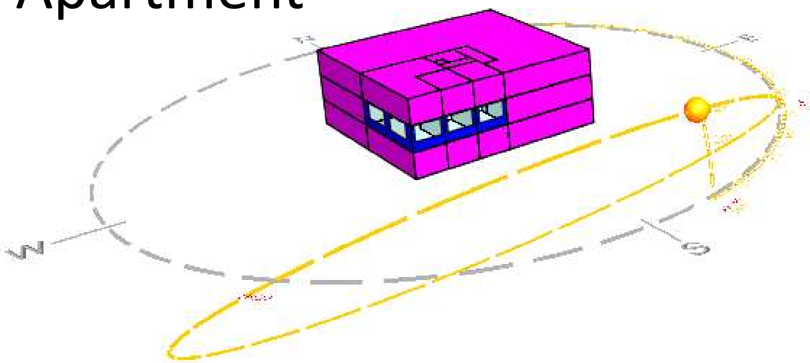
Modelling parameters and assumptions

- Future weather data – DSY1 2020s High emissions scenario
- Daytime occupancy in all rooms
- Internal gains (lighting, equipment) as per TM59
- 18°C set point for heating excl. June, July and August
- Fabric thermal performance as per TGD L 2018
- Medium thermal mass, masonry construction
- Windows in occupied rooms start to open when internal temp >22°C, fully open when >26°C
- Openable area $1/20^{th}$ of floor area for habitable rooms

Modelling parameters and assumptions

Semi detached house	Bungalow
	
Apartment	
	

Modelling scenarios

Individual

- Weather data
- Glazing areas and g-value
- Ventilation & window opening areas
- Dwelling design and construction
  - Orientation
  - Thermal mass
  - Ceiling heights
- Window shading
- Internal gains

Combined

Weather data

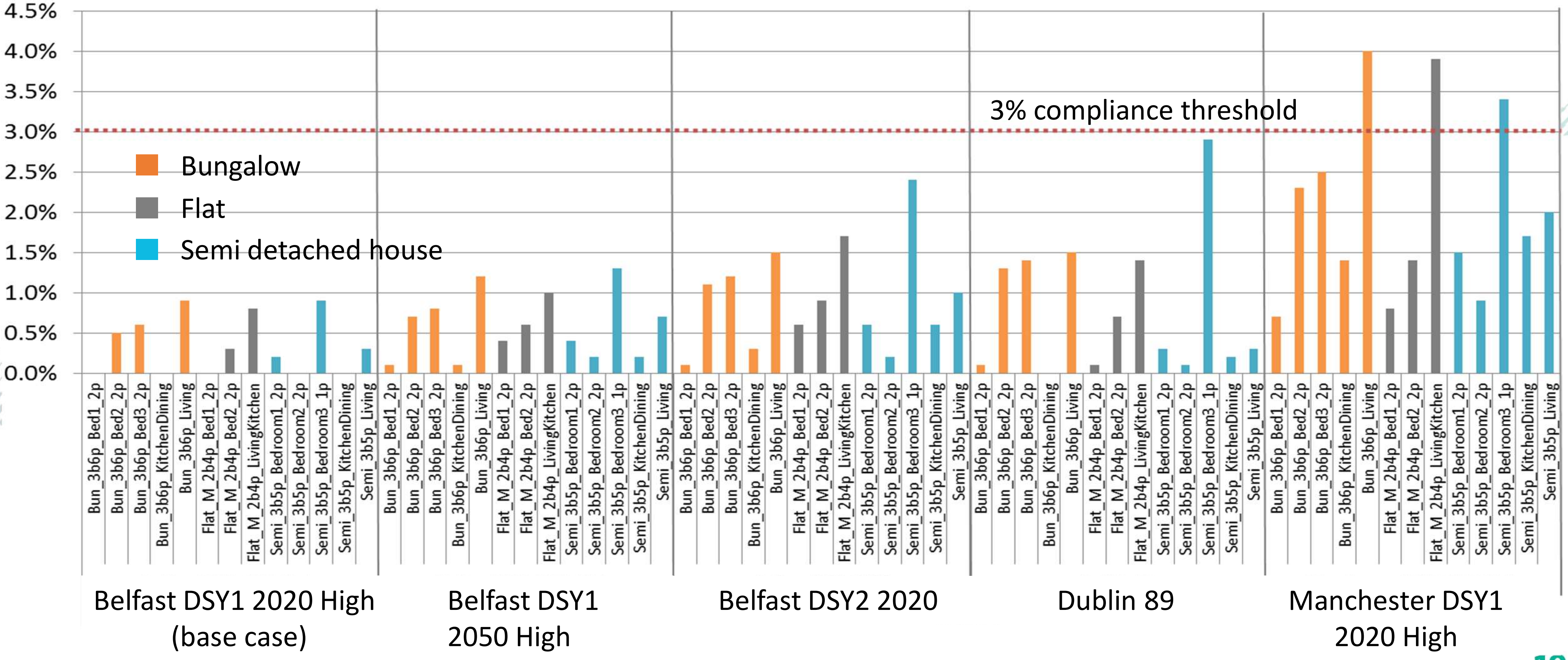
+

Single sided ventilation

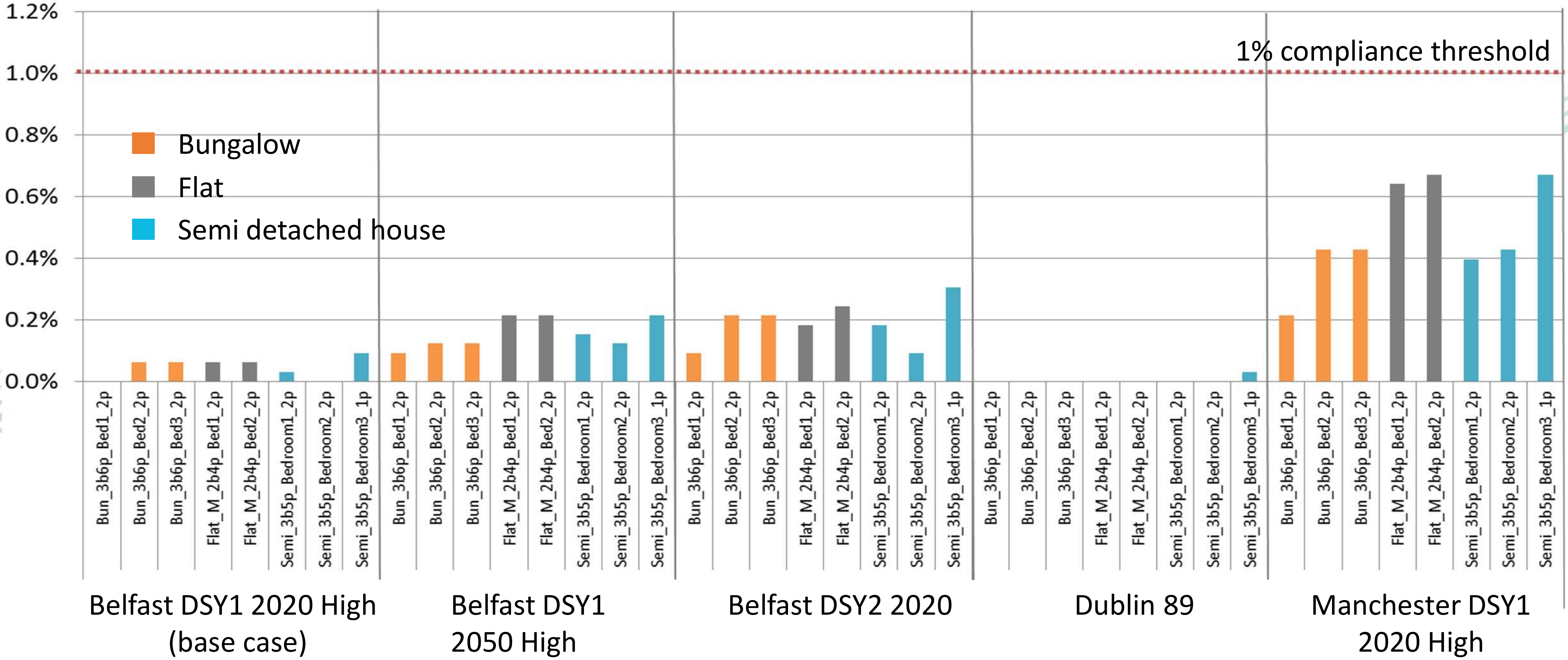
+

Glazing area /window opening area/ shading / fabric U-values

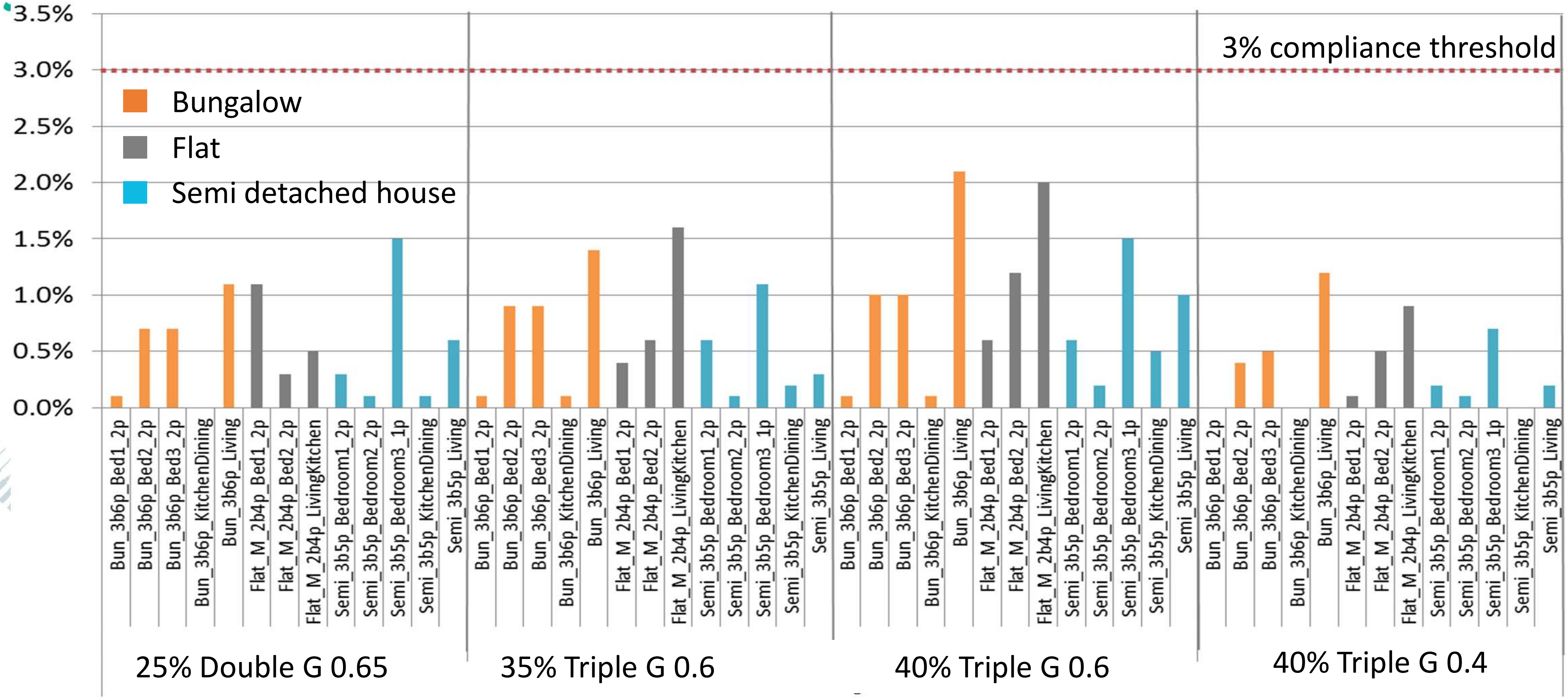
Overheating risk - Weather data – Criterion A



Overheating risk - Weather data – Criterion B



Overheating risk – Glazing – Criterion A



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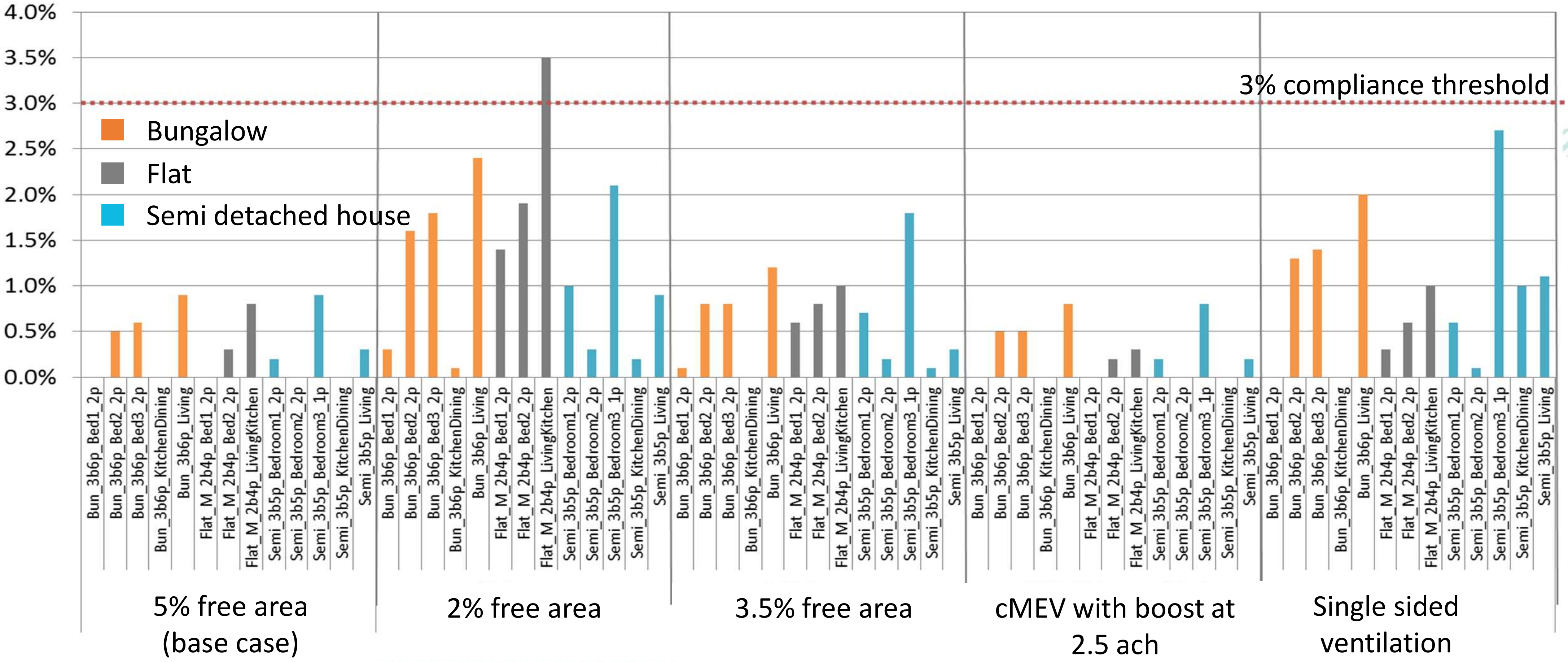
Overheating risk –Ventilation – Criterion A



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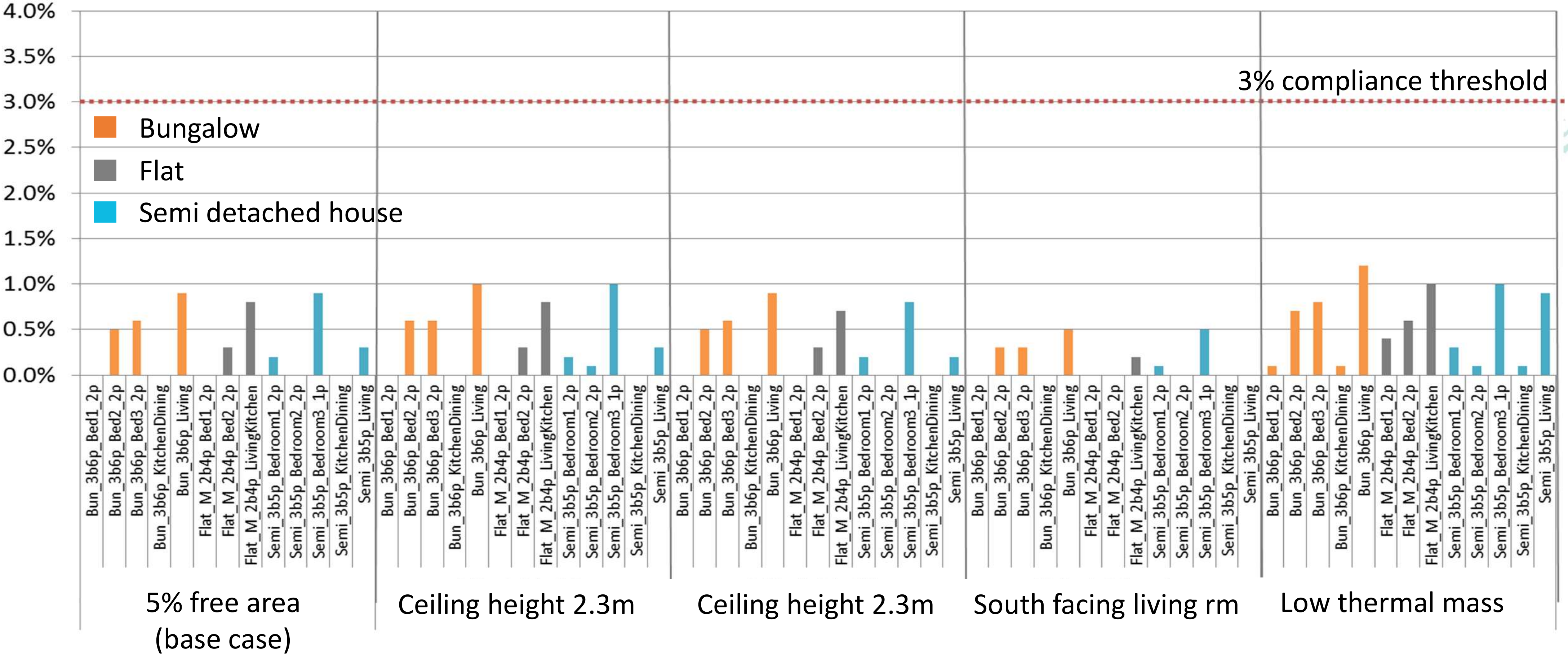
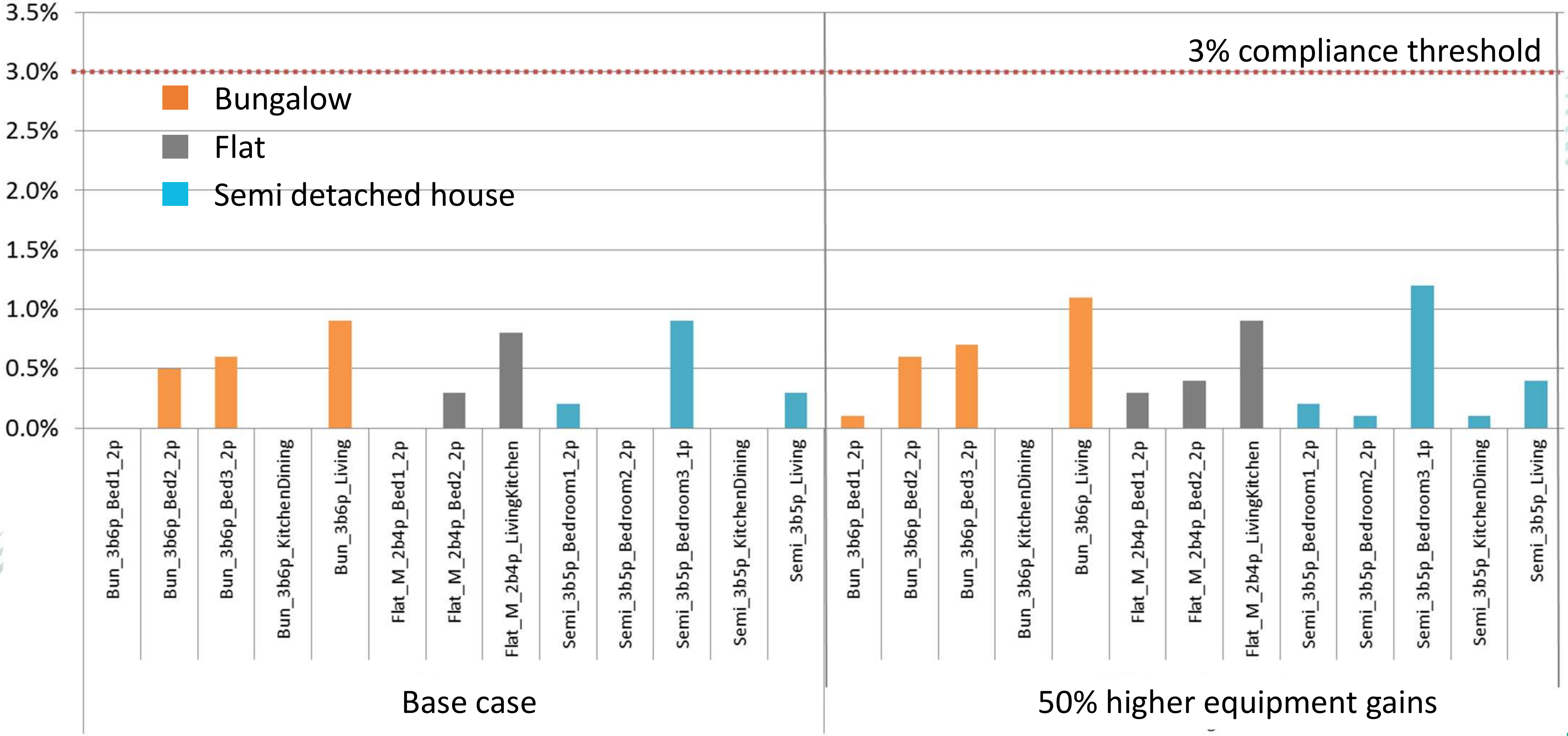
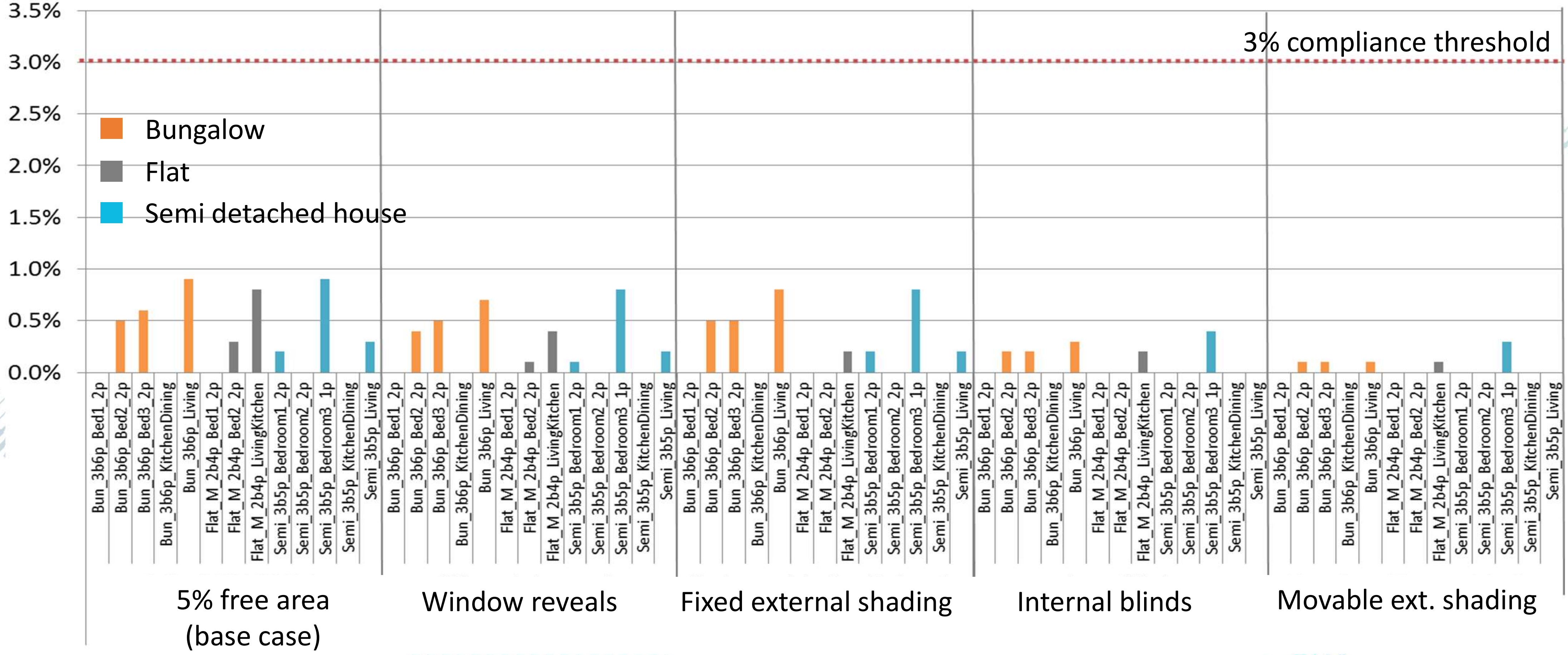
Overheating risk –Design – Criterion A



Overheating risk –Internal gains – Criterion A



Overheating risk – Shading – Criterion A



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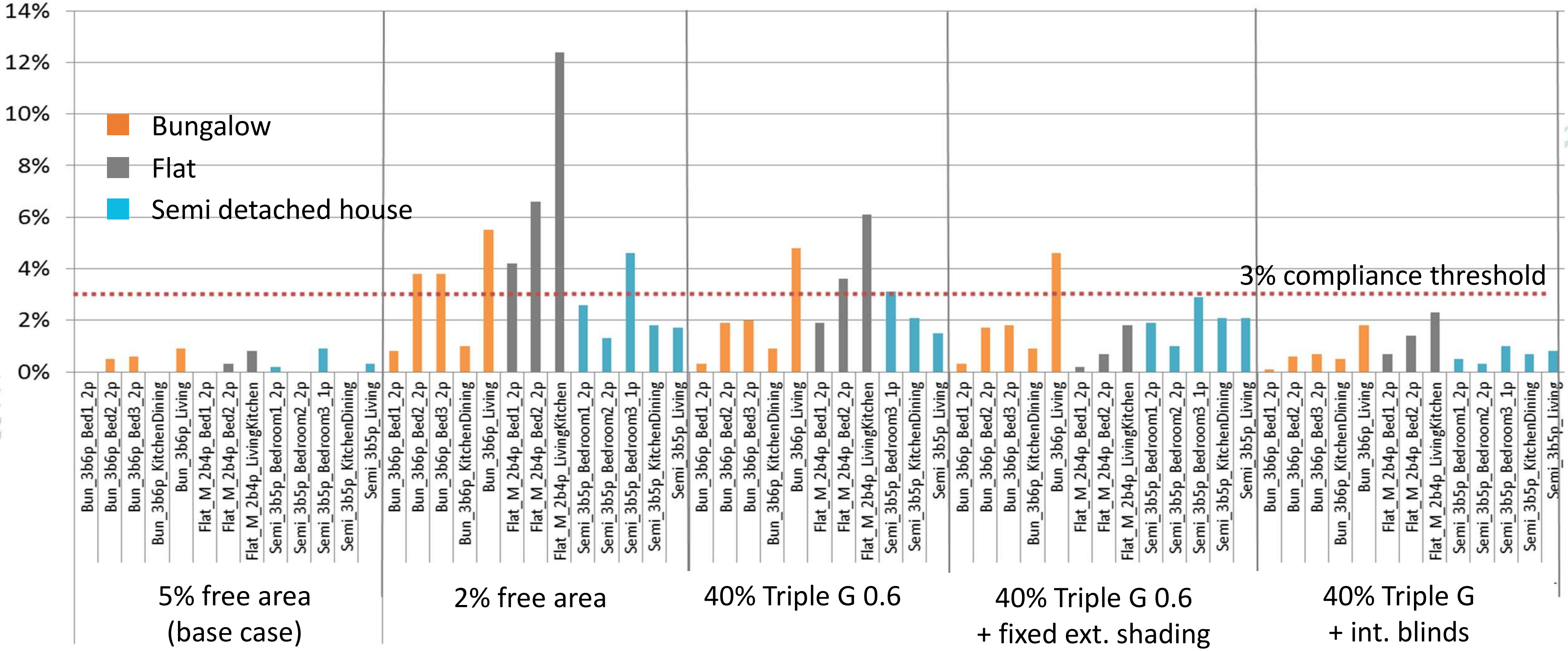
Overheating risk – Combined – Criterion A



Belfast DSY2 2020 + single sided ventilation

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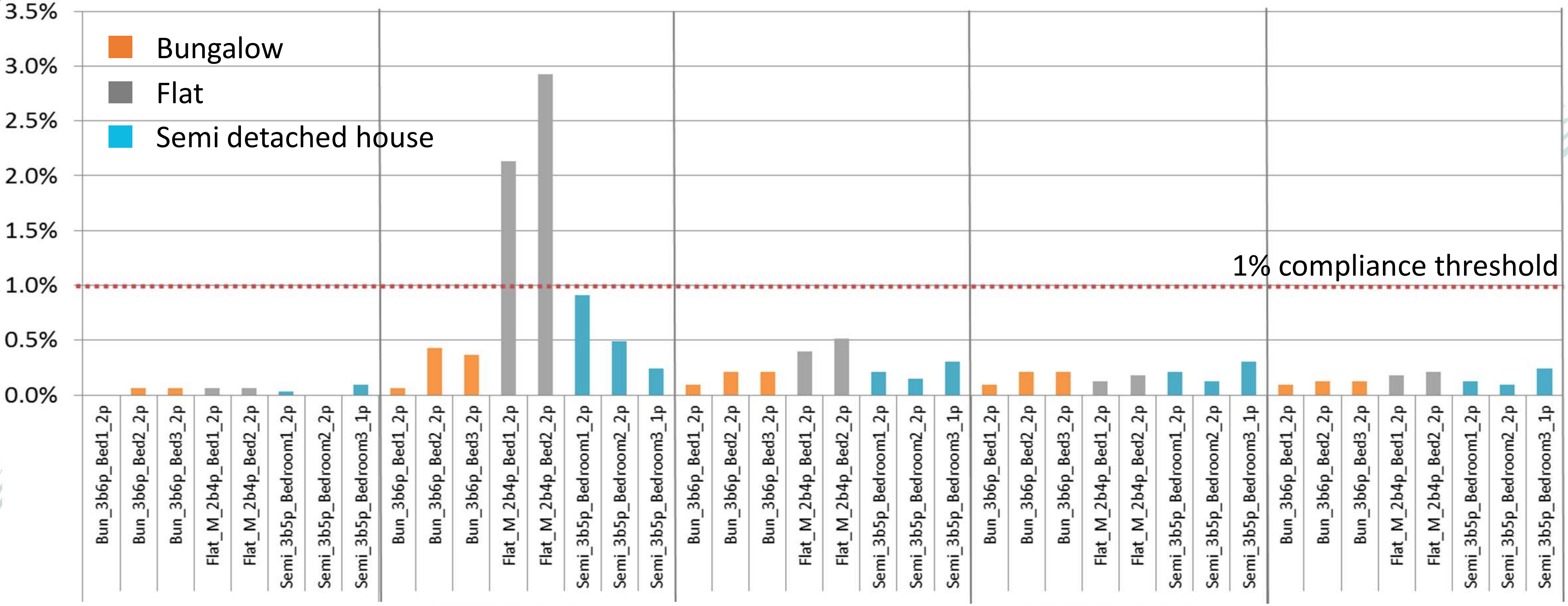
Overheating risk – Combined – Criterion B



Belfast DSY2 2020 + single sided ventilation

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Summary

- Modelling of 2018 fabric standards using future/current weather data highlights the need to consider overheating risk in new build design
- Key parameters to consider
  - Net solar gains (glazed areas, window g-value, shading)
  - Ventilation rates (window opening areas; ability to cross-ventilate)
- Choice of weather data – fit for purpose over a significant proportion of the building life; build resilience
- Aggregated impacts are critical!

Panel Discussion

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