

Part L Review Consultation Event

cSBEMw Demonstration and Discussion

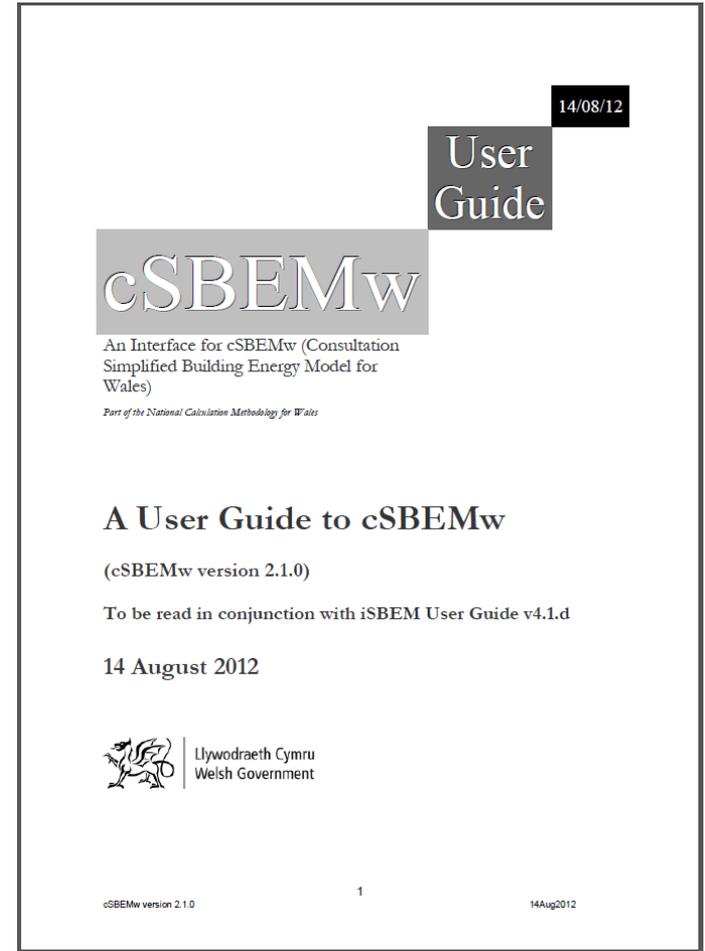
Overview

- *Introduction to cSBEMw*
 - *Software improvements*
 - *Changes resulting from updated NCM*
- *Outputs from cSBEMw*
 - *Delegate feedback and discussion*
- *Closing remarks*

Introduction to cSBEMw

Introduction to cSBEMw

- www.2013walesncm.bre.co.uk/
- Further information on software improvements available in the *User Guide*



Introduction to cSBEMw – NCM Change

- Purpose of analysis, availability of gas supply

cSBEMw 2.1.0 - General - Example building -

General Project Database Geometry Building Services Ratings Building Navigation About iSBEM

File Options General Information

Basic information about Project, Owner and Certifier

Project details Special considerations Building details Certifier details Owner details

Building Regulation, Bye-Laws & EPBD parameters

Purpose of the analysis: Consultation of Welsh Building Regulations Part L 2013

Weather (location): London

Stage of analysis: As built

Rating with improvements: kgCO2/m2 emissions

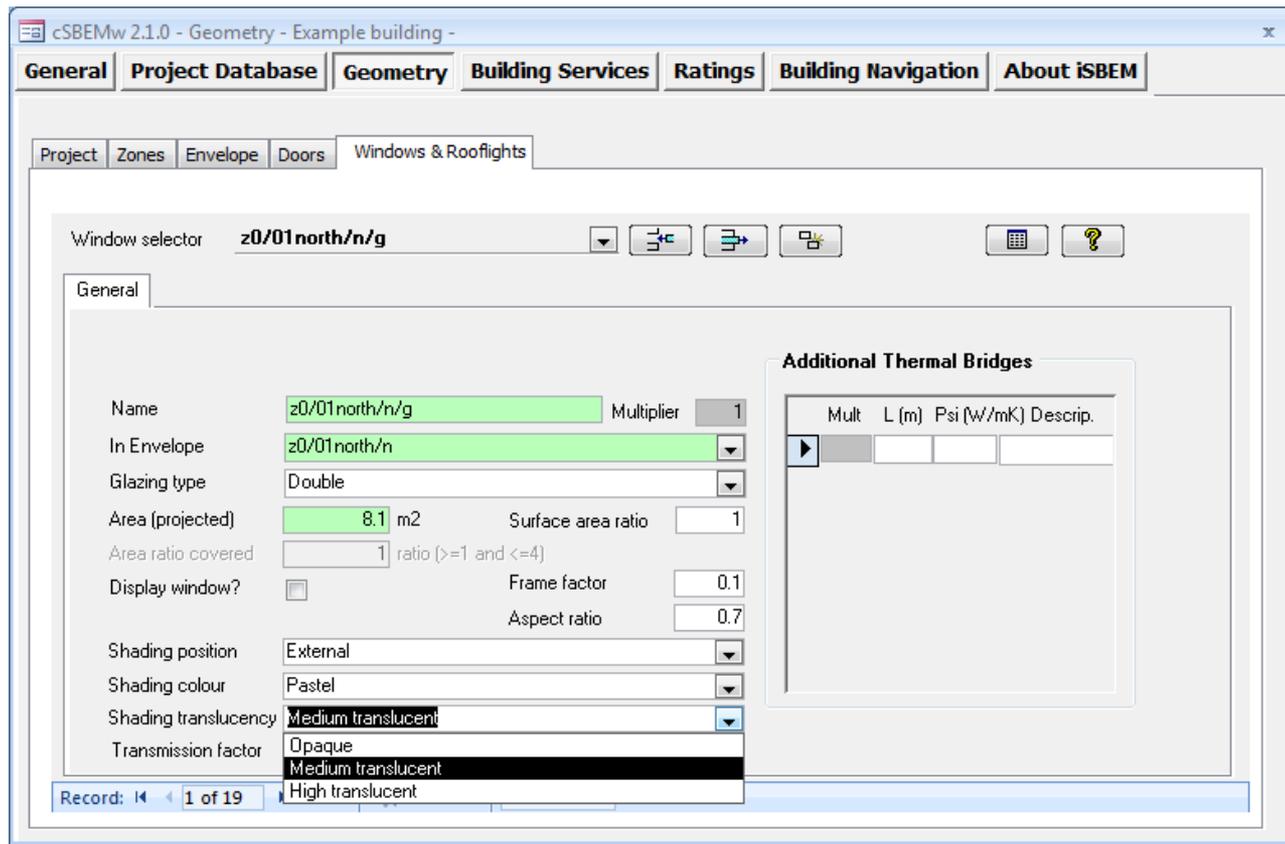
Related party disclosure: Not related to the owner

Tick if mains gas supply is available to development site:

This version implements the compliance criteria for Consultation on Part L of Building Regulations 2013.

Introduction to cSBEMw

- Improved treatment of shading



Introduction to cSBEMw

- Improved treatment of shading

The screenshot shows the cSBEMw 2.1.0 software interface. The 'Geometry' tab is active, and the 'Windows & Rooflights' sub-tab is selected. The 'Window selector' is set to 'z0/01north/n/g'. The 'General' properties for this window are displayed, including Name, In Envelope, Glazing type, Area (projected), Area ratio covered, Display window?, Shading position, Shading colour, Shading translucency, and Transmission factor. A dropdown menu for 'Transmission factor' is open, showing options: Opaque, Medium translucent, and High translucent. Overlaid on the right side of the interface is a table titled 'Table 1: Data for typical solar protection devicesⁱ'. The table has two main columns: 'Transmittance' ($\tau_{e,B}$) and 'Reflectance' ($\rho_{e,B}$). The Reflectance column is further divided into four categories: 'white', 'pastel', 'dark', and 'black'. The rows represent different device types: 'Opaque', 'Medium translucent', and 'High translucent'.

	Transmittance $\tau_{e,B}$	Reflectance $\rho_{e,B}$			
		white	pastel	dark	black
Opaque	0,0	0,7	0,5	0,3	0,1
Medium translucent	0,2	0,6	0,4	0,2	0,1
High translucent	0,4	0,4	0,3	0,2	0,1

Table 1: Data for typical solar protection devicesⁱ

Introduction to cSBEMw – NCM Change

- *District heating parameters*

The screenshot displays the cSBEMw 2.1.0 software interface for 'Example building'. The 'Building Services' tab is active, showing 'District Heating Parameters' for the whole project. The interface includes a navigation menu at the top with tabs for 'General', 'Project Database', 'Geometry', 'Building Services', 'Ratings', 'Building Navigation', and 'About iSBEM'. Below this, a sub-menu shows 'Global and Defaults' selected, with other options like 'HVAC systems', 'HWS', 'SES', 'PVS', 'Wind generators', 'Transpired solar collectors', and 'Zones'. The main content area is titled 'Building services detail for the whole Project' and contains a 'Project building services' section. This section is divided into three main areas: 'Metering provision for lighting systems', 'District Heating Parameters', and 'Other building details'. The 'District Heating Parameters' section contains two questions: 'Do you know the carbon dioxide conversion factor of the DH network?' and 'Do you know the primary energy conversion factor of the DH network?'. Both questions have radio button options for 'No, use default value' and 'Yes, conversion factor is'. The 'Yes' options are selected, and the conversion factors are entered as 0.293 kgCO2/kWh and 1.2 kWh/kWh respectively. The 'Other building details' section shows the 'Electric power factor' set to >0.95.

cSBEMw 2.1.0 - Building Services - Example building -

General | Project Database | Geometry | **Building Services** | Ratings | Building Navigation | About iSBEM

Global and Defaults | HVAC systems | HWS | SES | PVS | Wind generators | Transpired solar collectors | Zones

Building services detail for the whole Project ?

Project building services

Metering provision for lighting systems

Is the lighting separately sub-metered?

No or don't know Yes

M&T with alarm for "out of range" values?

No or don't know Yes, it does

Other building details

Electric power factor >0.95

District Heating Parameters

Do you know the carbon dioxide conversion factor of the DH network?

No, use default value 0.293 kgCO2/kWh

Yes, conversion factor is 0.293 kgCO2/kWh

Do you know the primary energy conversion factor of the DH network?

No, use default value 1.2 kWh/kWh

Yes, conversion factor is 1.2 kWh/kWh

Introduction to cSBEMw – NCM Change

- District heating parameters

The screenshot shows the 'Building Services' tab in the cSBEMw 2.1.0 software. The 'District Heating Parameters' section is active, containing the following settings:

- Metering provision for lighting systems:**
 - Is the lighting separately sub-metered? No or don't know Yes
 - M&T with alarm for "out of range" values? No or don't know Yes, it does
- Other building details:**
 - Electric power factor: >0.95
- District Heating Parameters:**
 - Do you know the carbon dioxide conversion factor of the DH network?
 - No, use default value 0.293 kgCO₂/kWh
 - Yes, conversion factor is 0.293 kgCO₂/kWh
 - Do you know the primary energy conversion factor of the DH network?
 - No, use default value 1.2 kWh/kWh
 - Yes, conversion factor is 1.2 kWh/kWh

District Heating

49. Where district heating systems are used for space heating and/or hot water, the primary energy factor for space heating and/or hot water in the notional building will be 0.85 kWh/kWh regardless of the fuel(s) used in the actual district heating system. For the purposes of calculating the TER the fuel emission factor for space heating and/or hot water will be 0.15 kgCO₂/kWh. This represents a typical, though, not exceptional district heating system supplied by gas-CHP with an electrical efficiency of 30% and heat efficiency of 50% supplying 70% of the heat load. In this way district heating systems offering improved performance are incentivised.

Introduction to cSBEMw – NCM Change

- *Lighting design illuminance*

The screenshot displays the cSBEMw 2.1.0 software interface for 'Building Services - Example building'. The 'Building Services' tab is active, and the 'Lighting' sub-tab is selected. The 'Record selector' is set to 'z0/01east'. The main content area is titled 'What information is available on lighting?' and contains three radio button options:

- Full lighting design carried out
 - Total wattage: 742 W
 - Design illuminance: [] Lux
- Lighting chosen but calculation not carried out
 - Lamp lumens per circuit watt: 40
 - Light output ratio: 0.25
- Lighting parameters not available
 - Lamp type: T8 Fluorescent - halophosphate - low frequency ballast

Additional information includes a note: 'If left blank, default assumption will be 150 lux' and a section 'Are air-extracting luminaires fitted?' with radio buttons for 'Yes' and 'No or don't know' (selected).

At the bottom, a status bar shows 'Record: 1 of 19', 'No Filter', and a 'Search' button.

Introduction to cSBEMw

- *Improved treatment of PV systems*

cSBEMw 2.1.0 - Building Services - Example building -

General Project Database Geometry Building Services Ratings Building Navigation About iSBEM

Global and Defaults HVAC systems HWS SES PVS Wind generators Transpired solar collectors Zones

Record selector **PVS1**

General

Name **PVS1** Multiplier **1**

Do you know the Peak Power of the array?

No, use Type and Area

Type **Mono crystalline silicon**

Area **1** m2

Yes, Peak Power is **3.5** kWp

Orientation **South**

Inclination **30** ° (Degrees)

Overshading **None or very little (<20%)**

Ventilation strategy **Unventilated modules**

Record: 1 of 1 No Filter Search

Introduction to cSBEMw

- *Improved treatment of PV systems*

The screenshot shows the cSBEMw 2.1.0 software interface. The main window is titled "cSBEMw 2.1.0 - Building Services - Example building -". The "Building Services" tab is active, and the "PVS" sub-tab is selected. The "Record selector" is set to "PVS1". The "General" section is expanded, showing the following configuration:

Name	PVS1	Multiplier	1
Do you know the Peak Power of the array?			
<input type="radio"/> No, use Type and Area			
Type	Mono crystalline silicon		
Area	1	m2	
<input checked="" type="radio"/> Yes, Peak Power is			
	3.5	kWp	
Orientation	South		
Inclination	30	° (Degrees)	
Overshading	None or very little (<20%)		
Ventilation strategy	Unventilated modules		

At the bottom of the window, there is a status bar showing "Record: 1 of 1", "No Filter", and a "Search" button.

Previously:

The comparison screenshot shows the previous configuration for a PV system:

Name	Solar PV	Multiplier	1
Type	Monocrystalline silicon		
Area	40	m2	
Orientation	South		
Inclination	30	° (Degrees)	

Outputs from cSBEMw

Outputs from cSBEMw

- *Actual/Notional values*

cSBEMw 2.1.0 - Ratings - Example building -

General | Project Database | Geometry | Building Services | Ratings | Building Navigation | About iSBEM

Building Regulation check

Consultation of Welsh Building Regulations Part L 20: ?

Building Rating | Calculation Logs | Calculation Errors | Supporting Documents

	Heating	Cooling	Auxiliary	Lighting	Hot Water	Total	
Actual	3.4	25	28.57	31.6	23.81	112.37	kWh/m2/yr
Notional 7%	8	12.47	21.32	30.65	23.92	96.35	kWh/m2/yr
Notional 10%	8	12.47	19.18	30.61	23.92	94.17	kWh/m2/yr

1. CO2 emissions mandatory requirement

BER kgCO2/m2/yr BPEC kWh/m2/yr

	10%	11%	20%	
TER	<input type="text" value="38.93"/>	<input type="text" value="38.45"/>	<input type="text" value="35.3"/>	kgCO2/m2/yr
Pass	NO	NO	NO	

	7%	10%	
TPEC	<input type="text" value="197.57"/>	<input type="text" value="192.09"/>	kWh/m2/yr
Pass	NO	NO	

Check Regulation

Click on text below for...

- SBEM Outputs
- Data Reflection - Actual Building
- Data Reflection - Notional Building
- Approved Documents Checks
- Additional Details Report

Calculation progress: HVAC type 1 - Zone 16 of 16

Outputs from cSBEMw

- *Data Reflection Report (Inputs)*

Storage system: NO

1/1 SE System	Parameter Value	Comments / Warnings
Name:	SES-1	
Multiplier:	1	
Area [m2]:	10	
Orientation:	South	
Inclination [deg]:	30	
Collector type:	Evacuated tube	
Solar storage volume [l]:	800	
Solar reheating type:	Separate solar cylinder	
Storage insulation type:	Uninsulated	
Storage insulation thickness [mm]:	0	
Heat exchanger:	YES	
Distribution pipes insulated:	YES	
Circulation system:	forced circulation system with PV	

1/1 PV System	Parameter Value	Comments / Warnings
Name:	PVS1	
Multiplier:	1	
Peak power [kWp]:	3.5	
Orientation:	South	
Inclination [deg]:	30	
Overshading:	None or very little (<20%)	
Ventilation strategy:	Unventilated modules	

1/2 HVAC System	Parameter Value	Comments / Warnings
General		
Name:	Zones without HVAC system	
Type:	No Heating or Cooling	

1/3 Zone	Parameter Value	Comments / Warnings
General		
Name:	z0/02	

Computer | Protected Mode: Off | 100%

Outputs from cSBEMw

- SBEM Main Calculation Output (Outputs)

SBEM Main Calculation Output Document

Wed Sep 05 09:20:09 2012

2.1.0.3

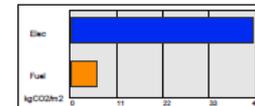
Building name

Example building

Building type: B1 Offices and Workshop businesses

SBEM is an energy calculation tool for the purpose of assessing and demonstrating compliance with Building Regulations (Part L for Wales) and to produce Energy Performance Certificates and Building Energy Ratings. Although the data produced by the tool may be of use in the design process, **SBEM is not intended as a building design tool.**

Building Energy Performance and CO2 emissions

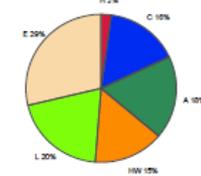


0 kgCO2/m2 displaced by the use of renewable sources.

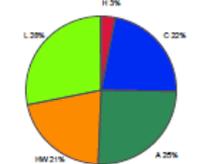
Building area is 2900 m2

Annual Energy Consumption

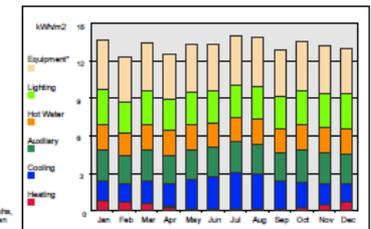
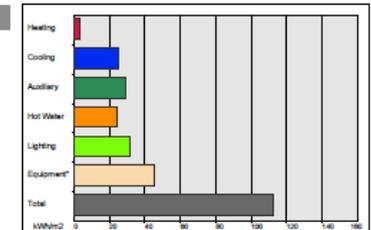
(Pie chart including Equipment end-use)



(Pie chart excluding Equipment end-use)



(*) Although energy consumption by equipment is shown in the graphs, the CO2 emissions associated with this end-use have not been taken into account when producing the rating.



Outputs from cSBEMw

- BRUKL (Outputs)

BRUKL2 Output Document  HM Government
Compliance with Welsh Building Regulations Part L 2013

Project name

Example building As built

Date: Wed Sep 05 09:20:09 2012

Administrative information

Building Details
Address: 56 London Road, LONDON, SW23 1HA

Certification tool
Calculation engine: SBEM
Calculation engine version: 2.1.0.3
Interface to calculation engine: iSBEM
Interface to calculation engine version: 2.1.0
BRUKL2 compliance check version: v2.1.0.2

Owner Details
Name: John Jones
Telephone number: 987654321
Address: 53 London Road, LONDON, SW23 1HA

Certifier details
Name: <ea name>
Telephone number: <ea phone>
Address: <ea address>, <ea city>, XXXX XX

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

Consultation Options for TER Saving	10%	11%	20%
Target Emission Rate (TER), kgCO ₂ /m ² .annum	38.9	38.5	35.3
Building Emission Rate (BER), kgCO ₂ /m ² .annum	48.9		
Consultation Options for TPEC Saving	7%	10%	
Target Primary Energy Consumption (TPEC), kWh/m ² .annum	197.6	192.1	
Building Primary Energy Consumption (BPEC), kWh/m ² .annum	244.8		

Outputs from cSBEMw

- BRUKL (Outputs)

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

2.a Building fabric

Element	U _{lim}	U _{calc}	U _{calc}	Surface where the maximum value occurs*
Wall**	0.35	0.16	0.16	z0/D1east/e
Floor	0.25	0.1	0.25	z1/D1centre/fe
Roof	0.25	0.15	0.15	z1/D1centre/c
Windows***, roof windows, and rooflights	2.2	1.5	1.5	z0/D1north/n/g
Personnel doors	2.2	2	2	z0/D3/w/d
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_{lim} = Limiting area-weighted average U-values [W/m²K]
 U_{calc} = Calculated area-weighted average U-values [W/m²K] U_{calc} = Calculated maximum individual element U-values [W/m²K]

* There might be more than one surface where the maximum U-value occurs.
 ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
 *** Display windows and similar glazing are excluded from the U-value check.
 N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	3

Outputs from cSBEMw

- BRUKL (Outputs)

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- HVAC for the example building

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	4.2	1.2	0.75
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			YES

1- HWS for the example building

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
0.85	-

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
z1/03	-	-	1.5

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
z0/02	230	-
z1/02	240	-
z1/03	120	-
z0/01east	740	15
z0/03	4400	15
z1/01centre	2790	-
z0/01north	250	15

Outputs from cSBEMw

- BRUKL (Outputs)

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
z0/01east	N/A	N/A
z0/03	N/A	N/A
z1/01centre	N/A	N/A
z0/01north	NO (-67.1%)	NO
z0/01west	NO (-18.5%)	NO

Page 2 of 5

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

Outputs from cSBEMw

- BRUKL (Outputs)

Technical Data Sheet (Actual vs. Notional Building)		
Building Global Parameters		Building Use
	Actual	Notional
Area [m ²]	2900	2900
External area [m ²]	4307.5	4307.5
Weather	LON	LON
Infiltration [m ³ /h/m ² @ 50Pa]	3	5
Average conductance [W/K]	993.58	1618.42
Average U-value [W/m ² /K]	0.23	0.38
Alpha value* [%]	13.59	11.58
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging		
% Area	Building Type	
31	A1/A2 Retail/Financial and Professional services	
16	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways	
63	B1 Offices and Workshop businesses	
	B2 to B7 General Industrial and Special Industrial Groups	
	B8 Storage or Distribution	
	C1 Hotels	
	C2 Residential Inst.: Hospitals and Care Homes	
	C2 Residential Inst.: Residential schools	
	C2 Residential Inst.: Universities and colleges	
	C2A Secure Residential Inst.	
	Residential spaces	
	D1 Non-residential Inst.: Community/Day Centre	
	D1 Non-residential Inst.: Libraries, Museums, and Galleries	
	D1 Non-residential Inst.: Education	
	D1 Non-residential Inst.: Primary Health Care Building	
	D1 Non-residential Inst.: Crown and County Courts	
	D2 General Assembly and Leisure, Night Clubs and Theatres	
	Others: Passenger terminals	
	Others: Emergency services	
	Others: Miscellaneous 24hr activities	
	Others: Car Parks 24 hrs	
	Others - Stand alone utility block	

Outputs from cSBEMw

- BRUKL (Outputs)

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.4	8
Cooling	25	12.47
Auxiliary	28.57	19.18
Lighting	31.6	30.61
Hot water	23.81	23.92
Equipment*	45.24	45.24
TOTAL	112.37	94.17

* Energy used by equipment does not count towards the total for calculating emissions.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0.88	6.03
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0.44	0

Energy & CO₂ Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m ²]	276.91	193.42
Total consumption [kWh/m ²]	112.37	94.17
Total emissions [kg/m ²]	48.9	35.3

Outputs from cSBEMw

- BRUKL (Outputs)

HVAC Systems Performance									
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling									
Actual	266.1	5.7	0	0	5.3	0	0	0	0
Notional	154.5	37.2	0	0	1.4	0	0	---	---
[ST] Single-duct VAV, [HS] District heating, [HFT] District Heating, [CFT] Electricity									
Actual	11.3	265.8	3.6	26.1	29.6	0.88	2.83	1	3.7
Notional	24.6	168.9	8.4	13	20	0.82	3.6	---	---

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Outputs from cSBEMw

- *Delegate Feedback*
 - *Are the input/output reports sufficient?*
 - *What do you use the reports for?*
 - *Any other comments?*

Closing Remarks

Closing Remarks

- *Non-Domestic Part L Update this afternoon*
- *Any questions?*

Proposed Notional Building Specifications

- 7% TPEC Specification

Element	Side lit or unlit (where HVAC specification is heating only)	Sidelit or unlit (where HVAC specification includes cooling)	Toplit
Roof U-value (W/m ² .K)	0.18	0.18	0.18
Wall U-value (W/m ² .K)	0.26	0.26	0.26
Floor U-value (W/m ² .K)	0.22	0.22	0.22
Window U-value (W/m ² .K)	1.8 (10% FF)	1.8 (10% FF)	N/A
G-Value (%)	40%	40%	N/A
Light Transmittance (%)	71%	71%	N/A
Roof light U-value (W/m ² .K)	N/A	N/A	1.8 (15% FF)
G-Value (%)	N/A	N/A	55%
Light Transmittance (%)	N/A	N/A	60%
Air-permeability (m ³ /m ² /hour) Gross Internal Area greater than 250m ²	3	5	5
Air-permeability (m ³ /m ² /hour) Gross Internal Area less than or equal to 250m ²	5	5	5
Lighting Luminaire (lm / circuit watt)	55	65	65

Element	Side lit or unlit (where HVAC specification is heating only)	Sidelit or unlit (where HVAC specification includes cooling)	Toplit
Occupancy control (Yes/No)	Yes	Yes	Yes
Daylight control (Yes/No)	Yes	Yes	Yes
Heating efficiency (Heating and hot water)	88%	91%	91%
Central Ventilation SFP (W/l/s)	1.8	1.8	1.8
Terminal Unit SFP (W/l/s)	0.5	0.4	0.4
Cooling (SEER / SSEER)	4.5 / 3.6	4.5 / 3.6	4.5 / 3.6
Cooling (SSEER) ⁶⁷	2.7	2.7	2.7
Heat recovery efficiency (%)	70%	70%	70%
Variable speed control of fans and pumps, controlled via multiple sensors (Yes/No)	Yes	Yes	Yes
Demand control (mechanical ventilation only). Variable speed control of fans via CO ₂ sensors (Yes/No)	No	Yes	Yes
Renewable Energy Contribution Monocrystalline PV with an efficiency of 15%. Active area of south facing panels (120kWh/m ² /year output) equivalent to stated % of gross floor area but limited to 50% of roof area.	For 10% aggregate reduction in TER: 1% of gross internal area		

Proposed Notional Building Specifications

- 10% TPEC Specification

Element	Side lit or unlit (where HVAC specification is heating only)	Sidelit or unlit (where HVAC specification includes cooling)	Toplit
Roof U-value (W/m ² .K)	0.18	0.18	0.18
Wall U-value (W/m ² .K)	0.26	0.26	0.26
Floor U-value (W/m ² .K)	0.22	0.22	0.22
Window U-value (W/m ² .K)	1.8 (10% FF)	1.8 (10% FF)	N/A
G-Value (%)	40%	40%	N/A
Light Transmittance (%)	71%	71%	N/A
Roof light U-value (W/m ² .K)	N/A	N/A	1.8 (15% FF)
G-Value (%)	N/A	N/A	55%
Light Transmittance (%)	N/A	N/A	60%
Air-permeability (m ³ /m ² /hour) Gross Internal Area greater than 250m ²	3	5	5
Air-permeability (m ³ /m ² /hour) Gross Internal Area less than or equal to 250m ²	5	5	5
Lighting Luminaire (lm / circuit watt)	65	65	65

Element	Side lit or unlit (where HVAC specification is heating only)	Sidelit or unlit (where HVAC specification includes cooling)	Toplit
Occupancy control (Yes/No)	Yes	Yes	Yes
Daylight control (Yes/No)	Yes	Yes	Yes
Heating efficiency (Heating and hot water)	91%	91%	91%
Central Ventilation SFP (W/l/s)	1.8	1.8	1.8
Terminal Unit SFP (W/l/s)	0.4	0.3	0.4
Cooling (air-conditioned) (SEER / SSEER)	4.5 / 3.6	4.5 / 3.6	4.5 / 3.6
Cooling (mixed mode) (SSEER) ⁶⁸	2.7	2.7	2.7
Heat recovery efficiency (%)	70%	70%	70%
Variable speed control of fans and pumps, controlled via multiple sensors	Yes	Yes	Yes
Demand control (mechanical ventilation only). Variable speed control of fans via CO ₂ sensors	Yes	Yes	Yes
Renewable Energy Contribution Monocrystalline PV with an efficiency of 15%. Active area of south facing panels (120kWh/m ² /year output) equivalent to stated % of gross floor area but limited to 50% of roof area.	For 11% aggregate reduction in TER: None For 20% aggregate reduction in TER: 5% of gross internal area Welsh Government's preferred option		