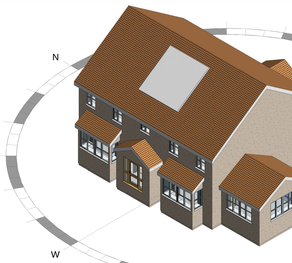
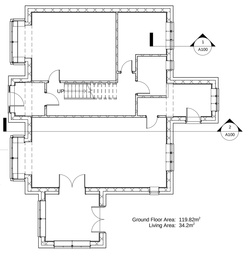
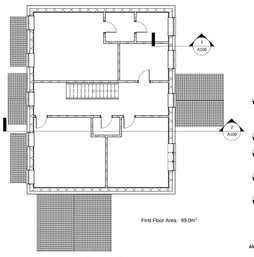


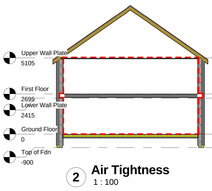
3 IsoMetric Front



5 Ground Floor
1 : 100



6 First Floor
1 : 100



2 Air Tightness
1 : 100

Airtightness Strategy

- 12mm Sand/Cement plaster layer to be applied to interior surface of external wall substrate
- 25mm Service Cavity provided to external walls to maintain integrity of Sand/Cement airtightness layer
- Air Control Vapour Layer provided by proprietary membrane across upstairs ceiling and lapped with plaster airtightness layers on external walls
- Proprietary tapes to be used at all external frame junctions and lapped with Sand/Cement airtightness layer
- Proprietary tape to be used at junction of external walls and floor screed
- No penetrations through ceiling membrane except for loft hatch
- 25mm Service Cavity provided in ceiling to maintain integrity of AVCL layer
- Proprietary pre-insulated airtight loft hatch to be sealed to AVCL using proprietary tapes
- Unavoidable penetrations through walls (e.g. MVHR exhaust and inlet etc.) to be sealed using proprietary grommets
- MVHR flexible ducts located in voids of I-Joists
- Loadbearing internal support walls connected to external walls with proprietary wall connectors to maintain integrity of airtightness layer on external walls
- Loadbearing internal walls built off floor to maintain integrity of floor airtightness layer (structural slab thickened and reinforced locally)
- Proprietary sealing tapes used on external frames for weathering and wind tightness.

Scope:

3 Storey 4-bedroom Residential Dwelling in Rural Location (area 200m² approx.)

Baseline: New House to current Building Regulations

Alternative: New House to nZEB Recommendations

Element	TGDL 2011	TG NZEB Standard Recommendation
SEAI Rating	A3	
U-Value	0.18 W/m²K	
MPEPC	0.40 kWh/m²	
Renewable Energy Technologies Requirement	Min. 10kWh/m²/y (Biomass, Heat Pump, Biofuel CL (electric))	25kWh/m²/y Max
Air Permeability (w/hour)	5	3
Thermal Bridging	0.08 W/m²K	
Primary Energy		250kWh/m²/y Max
Net Primary Energy		2kWh/m²/y Max
Maximum Heat Loss Area	0.70 (m²)	
Windows Internal Surface Temp	17.7 (deg C)	
Condensation Risk	90% (min)	
Heat Recovery Efficiency	90% (min)	

Design Strategy Used in Deap Analysis

- U-values U-values to be the same for both houses (i.e. same fabric in both houses)
- Single Leaf External Wall Insulation system
- Floor U-values to be the same for both houses
- Floor Insulation sandwiched between floor screed and structural slab
- Default Deap values used for external frames in both houses
- Oil-fired conventional heating system for baseline house
- Heat Pump with underfloor heating for alternative house
- Solar PV technology to be deployed by both houses
- Same hot water cylinder in both houses
- Zoned heating in both houses
- Smart Controls in both houses
- Mechanical Ventilation in both houses (Zient Requirement)
- Wood stoves to be deployed in both houses (Zient Requirement)
- Same Air Permeability value for both houses
- Y-Factor calc. for TGDL House used ACD Psi values
- Y-Factor calc. for Euro House used Bespoke Psi values calculated using Psi-Therm Software

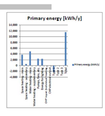
Deap Results for TGDL House

Results

	Delivered energy (kWh/y)	Primary energy (kWh/y)	CO_2 emissions (kg/y)
Space heating - main	10,000	11,000	2,400
Space heating - secondary	0	0	0
Water heating - main	4,000	4,400	1,000
Water heating - supplementary	0	0	0
Pumps, fans, etc.	400	1,400	300
Energy for lighting	1,800	4,700	1,000
CHP electricity delivered (heating systems only)	0	0	0
CHP electrical output (individual heating sys)	0	-1,400	-300
Total	16,200	20,100	4,400
Type 1	0	0	0
Type 2	0	0	0
Total	0	0	0
per m² floor area	162	201	44
	A3	G34	G34

Building Energy Rating

	Primary energy (kWh/m²/y)	CO_2 emissions (kg/m²/y)
Total	201	44
Maximum permitted	0.00	0.00
	Complies	Complies



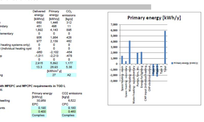
Deap Results for Euro House

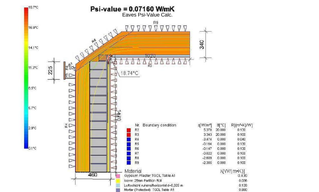
Results

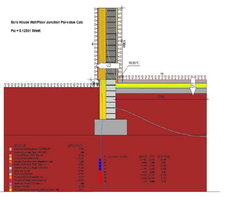
	Delivered energy (kWh/y)	Primary energy (kWh/y)	CO_2 emissions (kg/y)
Space heating - main	2,000	2,200	500
Space heating - secondary	0	0	0
Water heating - main	1,000	1,100	300
Water heating - supplementary	0	0	0
Pumps, fans, etc.	400	1,400	300
Energy for lighting	1,800	4,700	1,000
CHP electricity delivered (heating systems only)	0	0	0
CHP electrical output (individual heating sys)	0	-1,400	-300
Total	5,200	8,000	1,800
Type 1	0	0	0
Type 2	0	0	0
Total	0	0	0
per m² floor area	52	80	18
	A1	A1	A1

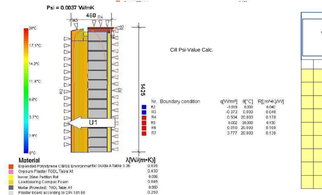
Building Energy Rating

	Primary energy (kWh/m²/y)	CO_2 emissions (kg/m²/y)
Total	80	18
Maximum permitted	0.00	0.00
	Complies	Complies

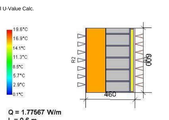








Wall U-Value Calc.



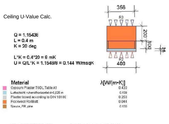
Q = 1.77567 W/m
L = 0.6 m
K = 20 deg

L*K = 20*0.6 = 12 mK
U = Q/L*K = 1.77567/12 = 0.148 W/msqK

Material	λ[W/(m*K)]
Gypsum Plaster TGDL Table A1	0.430
Isover 25mm Partition Roll	0.035
Mortar (Protected) TGDL Table A1	0.900
Mortar screed according to DIN 18160	1.000
Quinn Lite Seven	0.130
Rockwool External Wall DD Slab	0.036
Rockwool REDiAt Silicone Top Coat	0.300
Sand/Cement Render, TGDL Table A1	1.000
Spruce, FIR, pine	0.130

Nr.	Boundary condition	q[W/m²]	θ[°C]	R[(m²K)/W]
R1		-1.776	0.000	0.040
R2		1.776	20.000	0.130
R3				

Ceiling U-Value Calc.

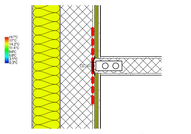


U = 1.1542
L = 0.4 m
K = 20 deg

L*K = 0.4*20 = 8 mK
U = Q/L*K = 1.15408 = 0.144 W/msqK

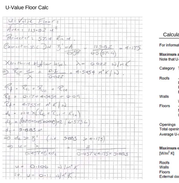
Material	λ[W/(m*K)]
Gypsum Plaster TGDL Table A1	0.430
Lafarge/Lafarge Plasterboard 0.220 m	0.130
Flexible board as cooling to DIN 18160	0.203
Rockwool Flexi 100	0.036
Spruce, FIR, pine	0.130

Nr.	Boundary condition	q[W/m²]	θ[°C]	R[(m²K)/W]
R1		-1.154	19.500	0.100
R2		-1.154	0.000	0.130
R3				



7 External Internal Junction
1 : 10

U-Value Floor Calc.



Calculated U-Value confirmity with TGDL Guidance

Conformity with guidance within TGDL 2011

For information only, not part of DEAP. Relevant for new-build.

Maximum average U-values of element types (TGDL), Section 1.3.2.2 and Table 1, Column 2): *

Note that U-values will generally need to be better than these limits in order for dwelling to comply with MPEPC and MPCPC requirements.

Category	Type	U-value [W/m² K]	Max value [W/m² K]	Complies
Roofs	Pitched roof - Insulation at ceiling	0.16	0.16	-
	Flat roof	0.16	0.16	-
Walls	Walls	0.21	0.21	-
Floors	No underfloor heating	0.21	0.21	-
	Underfloor heating	0.15	0.15	-

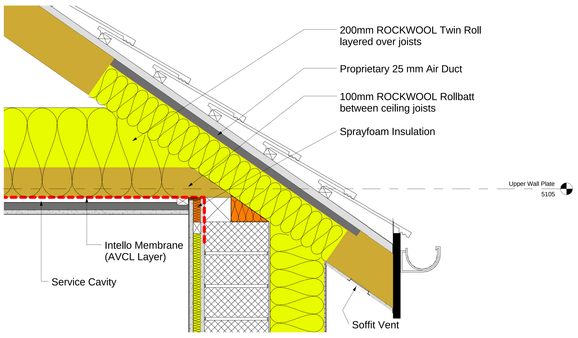
Openings

Total opening area (windows+roof lights/doors) as % of total floor area: 204.44 %

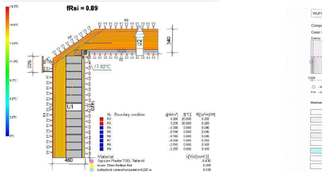
Average U-value of openings [W/m² K]: 0.147 — 1.75 — Complies

Maximum elemental U-values (TGDL), Section 1.3.2.2 and Table 1, Column 3):

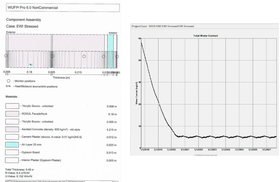
	TGDL Ref	U-value in dwelling [W/m² K]	Max value [W/m² K]	Complies
Roofs	0.16	0.16	0.16	Complies
Walls	0.21	0.21	0.21	Complies
Floors	0.15	0.15	0.15	Complies
External doors, windows and rooflights	-	-	2	Complies



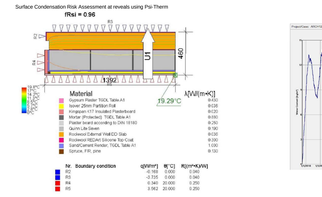
Surface Condensation at Eaves Junction Risk Assessment using Psi-Therm to calculate fRsi and Min. Interior Surface Temp.

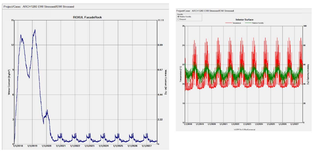


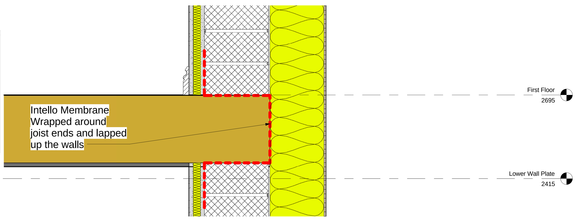
Interstitial Condensation Risk Assessment for externally insulated wall in stressed state using WUFI



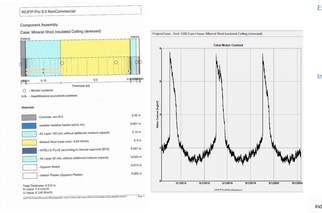
Surface Condensation Risk Assessment at reveals using Psi Therm







Interstitial Risk Assessment for insulated ceiling in stressed state using WUFI



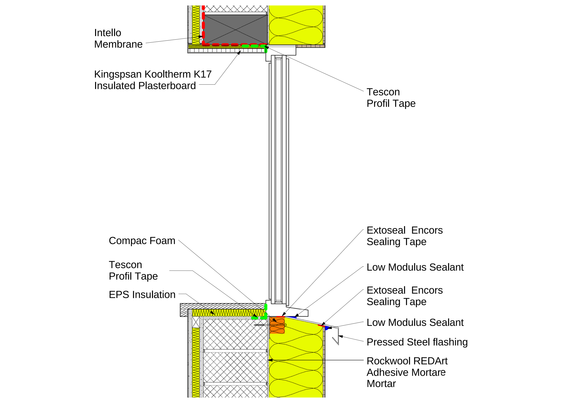
WUFI Conclusions/Observations

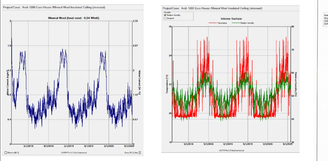
Externally Insulated Wall (Worst Case – Stressed)

- Source of external moisture assumed to be caused by pathway provided by break in mastic sealant to external frames
- Assembly drying out over first 3-4 years until it reaches a state of equilibrium
- Seasonal wetting and drying after Year 4
- Relative Humidity of assembly components in equilibrium and below critical 80%
- Interior Surface Relative Humidity in 40-60% range (ideal conditions)

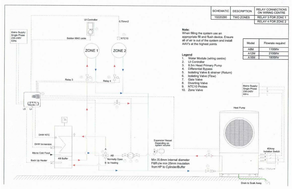
Insulated Cold Ceiling (Worst Case – Stressed)

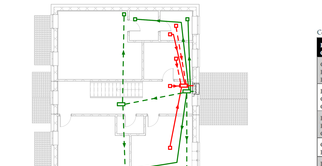
- Internal moisture source assumed to find pathway into ceiling assembly through leak/tear in AVCL
- Assembly water content in equilibrium and wetting and drying according to season and following a definite pattern
- Relative Humidity of components following seasonal wetting and drying pattern
- Relative Humidity of top surface of insulation at 90% for 2-3 months every year (as expected)
- Relative Humidity of Interior Surface in 40-60% range (ideal for Indoor Air Quality)





Indictive Space Heating and Hot Water Schematic





4 MVHR
1 : 100

MVHR Strategy

MVHR wall unit located in utility room

All duct runs contained in first floor web void provided by I-Joists

Fresh air vents located as far away from room doors as possible

Exhaust air ducts kept as short as possible

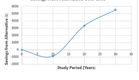
Collector manifolds used

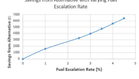
Cost Optimality Study using current Economic Variables

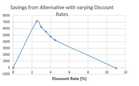
Comparison of Present-Value Costs

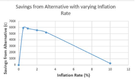
Initial Investment Costs	Base Case (Bldg. Regs. House)	Alternative (Euro House)	Savings from Alternative
Capital Requirement as of Base Date	€14,000	€28,000	-€14,000
Energy Consumption Costs	€25,811	€14,539	€11,272
Recurring & Non-Recurring OM&R Costs	€4,472	€4,834	-€361
Capital Replacements	€2,316	€3,213	-€898
Residual Value at end of 30 years	-€464	€0	-€464
Subtotal	€33,164	€22,586	€9,519
Total PV LCCost	€46,164	€40,586	€5,519

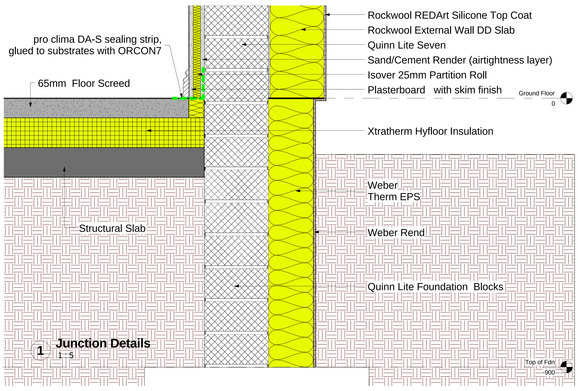
Sensitivity Analysis



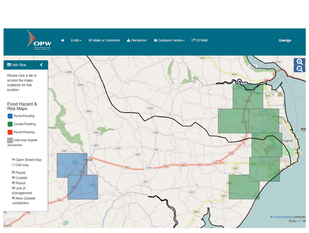


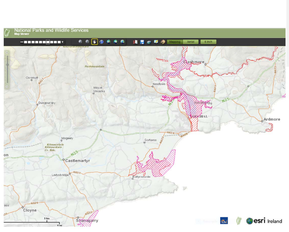






1 Junction Details
1 : 5





HPI - Home Performance Index

PROJECT	ARCH 1280 nZEB Project
DATE	5/1/2017
ADDRESS	Gortaroo, Youghal, County Cork
OVERALL SCORE	46%
	CERTIFIED

HOME PERFORMANCE INDEX HPI

CERTIFIED

DIT Dublin Institute of Technology Institiúid Teicneolaíochta Átha Cliath

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PROJECT

DT775

TITLE

ARCH 1280 nZEB Project

DRAWN BY	DATE
Padraic Cullen	May 2017
SCALE @ A3	
As indicated	

15/05/2017 08:59:20