Presentation for the ITFMA Seminar
Low or Zero Carbon Housing
Timber Frame's Role
21st May 2008

Timber Frame Housing
Technology Options
2008 and onwards

Bill Quigley
NuTech Renewables Ltd

NuTech Renewables

NuTech Renewables Ltd

Expert assistance in making the move to renewable energy

NuTech Renewables Ltd is the leading supplier of fully integrated renewable energy technologies in Ireland.
If you are in the process of designing an 'A' rated house, then NuTech have the proven track record to achieve your goal.

- We Design
- We Supply
- We Install
- You Build

NuTech Renewables Specialise in Solar Ventilation and Solar Hot Water

NuTech Renewables Ltd
Warrenpoint & Dublin
info@nutechrenewables.com
ROI: 048 4175 3031 NI: 028 4175 3031
www.nutechrenewables.com

Carbon emissions and Energy Supply in the World

- **Is there a problem?**
- **In the UK, the Stern Report had been commissioned by the then Deputy Prime Minister Gordon Browne and was launched by him with Tony Blair with huge media attention in April 2007 – he called for immediate action**
- **One of the main conclusions was:**

…..'failure to act on CO2 emissions could mean a radical change in life on this planet as we know it'

- **That's a problem!**

NuTech Renewables

Possible effects on Ireland?

- **Montreal is the same Latitude as:**

……..LYONS!!!!

- **Ireland is the same Latitude as Hudson Bay in Canada**

- **If the North Atlantic Drift switches off OR weakens then**

….. That will be a really serious problem!

- **This happened before - there was a mini ice age in Shakespeare's time**

NuTech Renewables

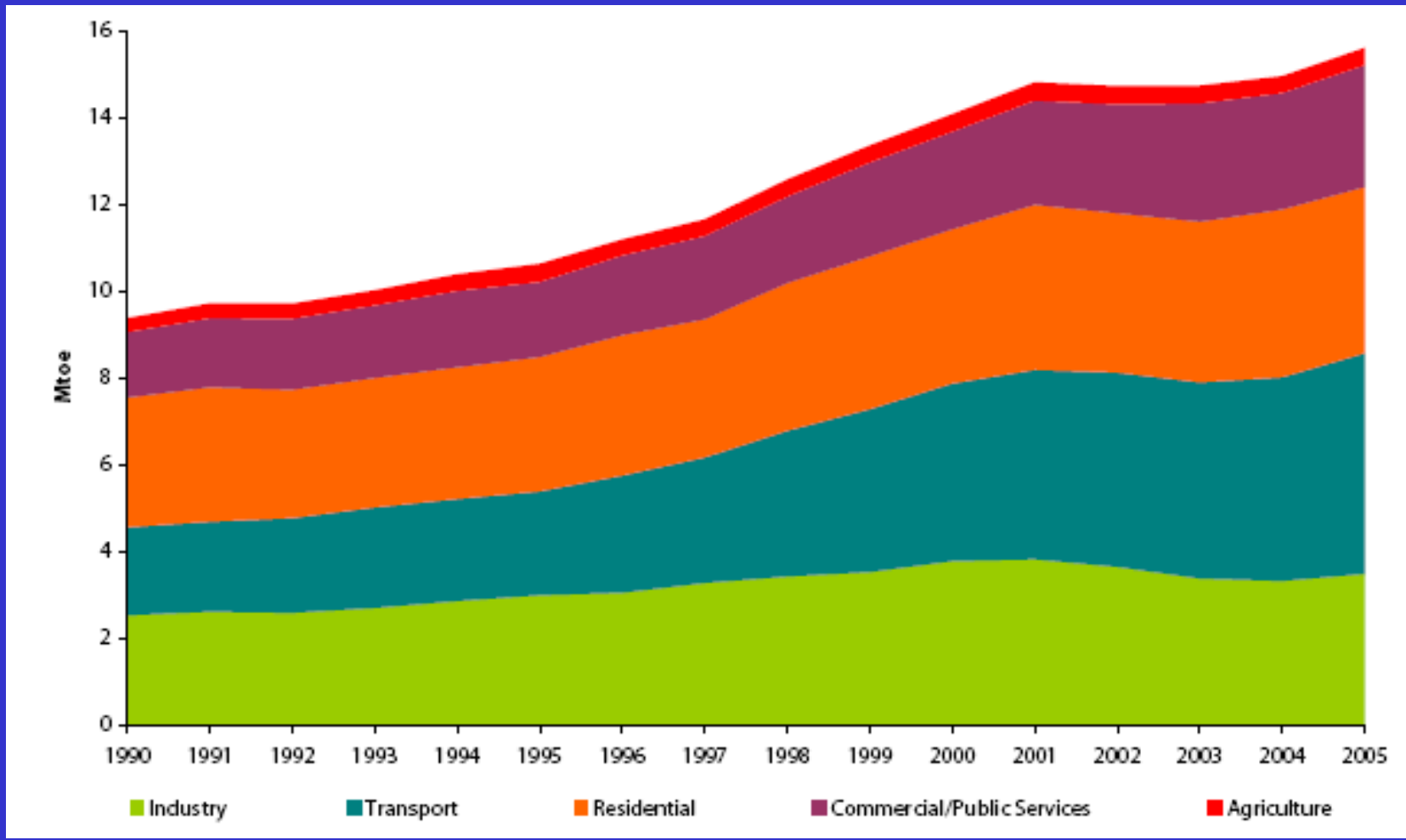
Carbon emissions and Energy Supply in Ireland

- **The Irish Government also has a serious problem in terms of the Security of Supply issue – 87% of our energy will be imported for the next 20 years (Source: SEI)**

- **Oil Prices are now regularly in excess of 100 $ per barrel (125 $ per barrel last week) – that's a problem also!)**

NuTech Renewables

Total Primary Energy Requirement by Sector - Ireland (Source – SEI)



Residential is 25% of total

NuTech Renewables

A time of change is a time of opportunity

Can the Timber Frame Industry provide a genuine Low Energy solution?

We believe it can and should

NuTech Renewables

Energy Use for space heating, ventilation and hot water in Housing in Ireland

In a typical Irish house built to satisfy the requirements of TGD L of the 2005 Building Regulations, it is worthwhile looking at how energy is used and heat is lost in housing. Simply put:

- 1/3 is heat lost through the fabric of the building
- 1/3 is heat lost caused by air infiltration and necessary air for ventilation
- 1/3 goes to energy to provide domestic hot water

Extra insulation can only save a certain amount of energy

Focus on air infiltration and the domestic hot water load

NuTech Renewables

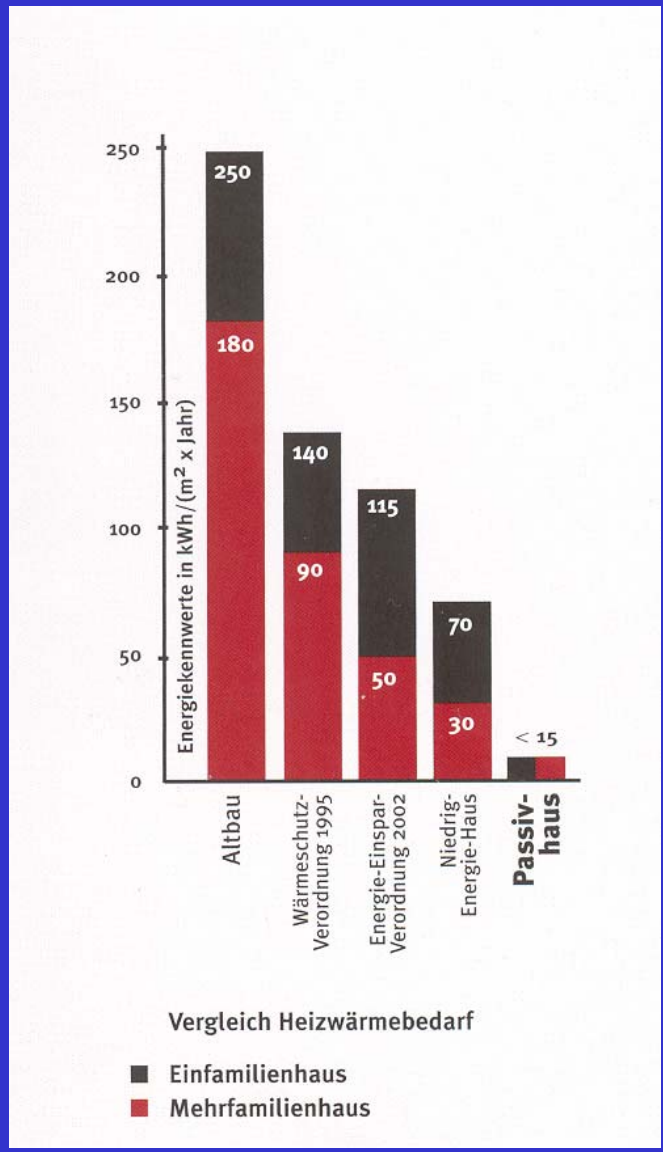
Passive Houses

Very Low Energy Demand

Requirements

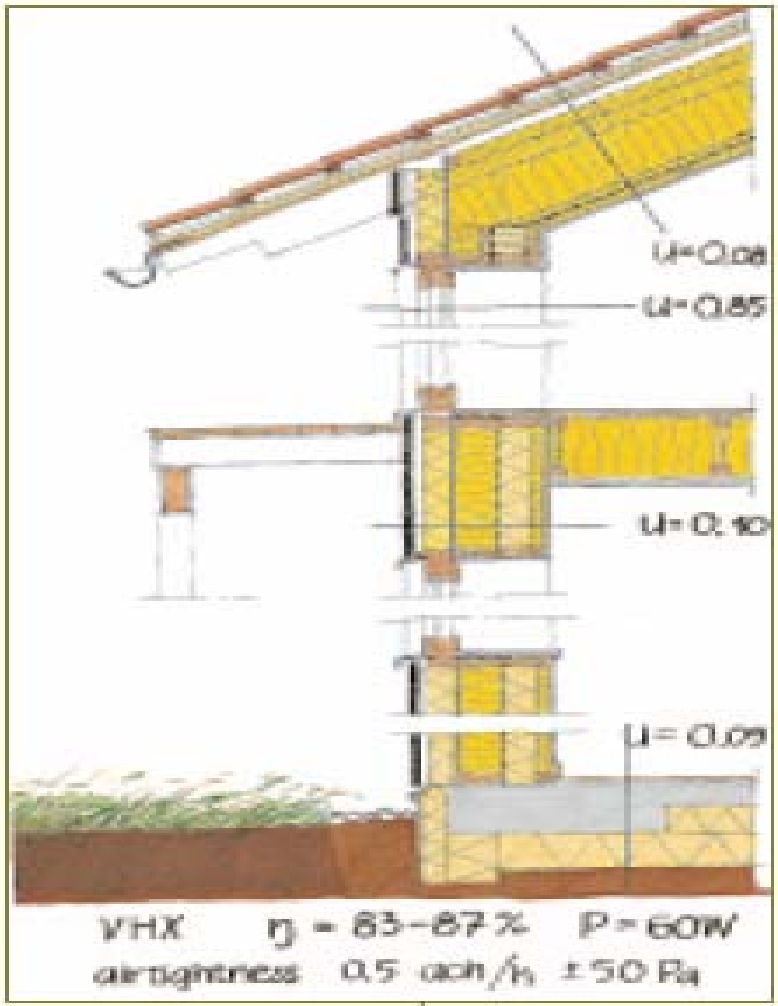
(a) less than 15 kWh/m2.Year

(b) Less than 10W/m2 heating load



NuTech Renewables

Passive Houses in Germany & Austria



täthet = airtightness - oms/h = ach

External wall:
U value: 0.10 W/m^2K
Framed construction with 43 cm insulation.

Roof:
U value: 0.08 W/m^2K
Masonite beams with 48 cm insulation.

Floor:
U value: 0.09 W/m^2K
Concrete slab laid on 25 cm insulation.

Windows:
U value: 0.85 W/m^2K
Three pane windows with two metallic coats and krypton fill.
Energy transmittance 43%.
Light transmittance 63%.

External door:
U value: 0.80 W/m^2k

Passive Houses in Ireland

Nutech

Option	U-Values of ext. wall	U-Values of roof	U-Values of floor	Average U-Value of windows and doors	Space heating requirement
1	0.10 W(m²K)	0.10 W(m²K)	0.10 W(m²K)	0.80 W(m²K)	8 kWh/(m²a)
2	0.15 W(m²K)	0.15 W(m²K)	0.15 W(m²K)	0.80 W(m²K)	13 kWh/(m²a)
3	0.10 W(m²K)	0.10 W(m²K)	0.10 W(m²K)	1.10 W(m²K)	13 kWh/(m²a)
4	0.175 W(m²K)	0.15 W(m²K)	0.15 W(m²K)	0.80 W(m²K)	15 kWh/(m²a)
5	0.27 W(m²K)	0.16 W(m²K)	0.25 W(m²K)	0.80 W(m²K)	22 kWh/(m²a)
6	0.10 W(m²K)	0.10 W(m²K)	0.10 W(m²K)	2.20 W(m²K)	28 kWh/(m²a)
7	0.15 W(m²K)	0.15 W(m²K)	0.15 W(m²K)	2.20 W(m²K)	34 kWh/(m²a)
8	0.27 W(m²K)	0.16 W(m²K)	0.25 W(m²K)	2.20 W(m²K)	45 kWh/(m²a)

Source: MosArt Architecture

NuTech Renewables

Air Leakage Testing using NuTech's Minneapolis Blower Door

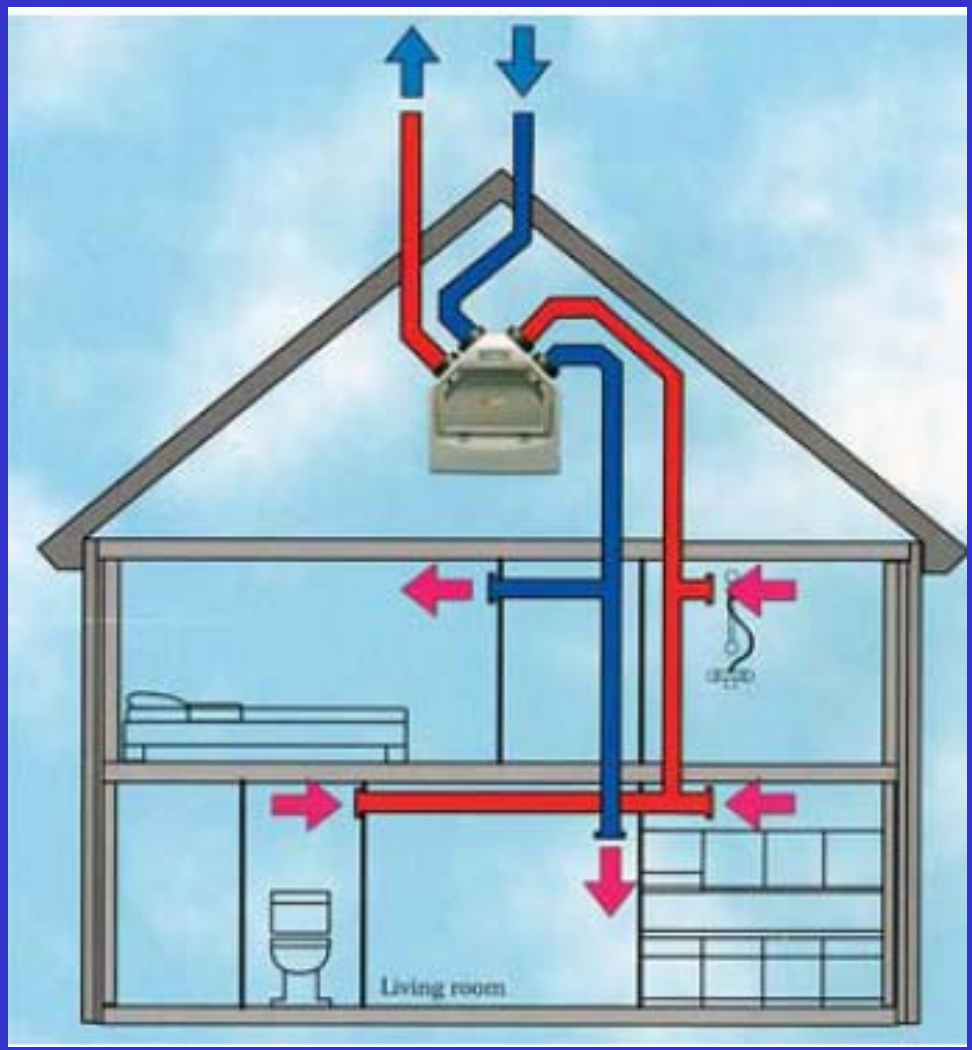
Passive Houses require that the level of Air Infiltration should be less than 0.6 ACH at 50 Pa – this equates to 0.03 ACH at Normal Pressure – all use Heat Recovery Ventilation

Compare this to TGD L 2008 – the requirement is 10 ACH at 50 Pa i.e. an air infiltration rate of 0.5 ACH at Normal Pressure!

NuTech Renewables

Air Infiltration and the necessary air for Ventilation

Use a Heat Recovery Ventilation System



If air being removed from ‘wet’ rooms is at 20C and incoming fresh air is at 5C then the fresh air going to the house will be at 18C after the heat exchange process

NuTech Renewables

Air Infiltration and the necessary air for Ventilation

Passive Houses

- Air Infiltration = 0.03 ACH at Normal Pressure
- HRV system provides 0.3 ACH of fresh air

NuTech Design

- Air Infiltration = less than 0.1 ACH
- HRV system complies with UK Part F 2006
- HRV will give 12 litres of fresh air per person per second. This equates to approx 0.7 – 0.9 ACH on average

NuTech Renewables

Air Leakage Testing using NuTech's Minneapolis Blower Door

These are actual test results for low energy houses that are reasonably airtight.

This house has an air leakage rate of 1.84 Air Changes per Hour at 50 Pa. This equates to an air leakage rate of 0.092 ACH at normal atmospheric pressure (divide the 50 Pa rate by 20 is the accepted rule)

BUILDING LEAKAGE TEST

Date of Test: 22-11-06
Test File: 4 Killeagh Gardens Test 4.cfa
Technician: Darren O'Hare

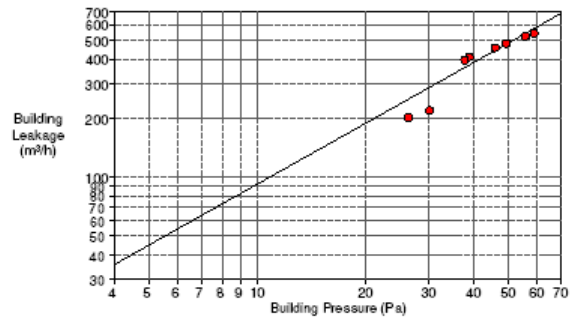
Customer: Leahy bros
Building Address: 4 Killeagh Gardens

Phone:
Fax:

Airflow at 50 Pascals: (50 Pa = 0.2 w.c.)	482 m³/h (+/- 3.5 %) 1.86 ACH (1/h) 4.64 m³/(h*m²) Floor Area
Leakage Areas:	102.4 cm² (+/- 25.4 %) Canadian EqLA @ 10 Pa 38.4 cm² (+/- 40.2 %) LBL ELA @ 4 Pa
Minneapolis Leakage Ratio:	
Building Leakage Curve:	Flow Coefficient (C) = 8.5 (+/- 62.7 %) Exponent (n) = 1.031 (+/- 0.162) Correlation Coefficient = 0.93290

Test Standard:	EN 13829	Test Mode:	Depressurization
Type of Test Method:	B	Regulation complied with:	
Equipment:	Model 4 (230V) Minneapolis Blower Door		

Inside Temperature:	12 °C	Volume:	260 m³
Outside Temperature:	8 °C	Surface Area:	
Barometric Pressure:	101325 Pa	Floor Area:	104 m²
Wind Class:	3 Gentle Breeze	Uncertainty of Building Dimensions:	%
Building Wind Exposure:	Partly Exposed Building	Year of Construction:	2006
Type of Heating:	Wodtke/Rads/140 AHU		
Type of Air Conditioning:	Sunwrm 140/ Lossnay		
Type of Ventilation:	None		



NuTech Renewables

Is there another way to achieve a very Low Energy House?

We believe there is

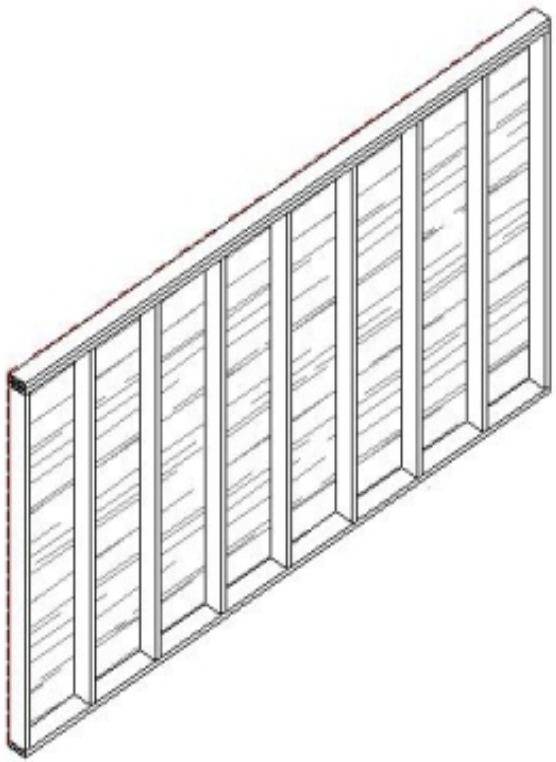
Use much more standard levels of insulation in timber frame construction
- U-Value of 0.16 to 0.20 W/m2.K in the walls
- U-Value of 0.16 in the floor
- U-Value of 0.14 in the roof
- DG windows with a U-Value of 1.3 to 1.4 (care regards the % of window to floor area

Achieve reasonably attainable levels of airtightness (Less than 0.1 ACH at Normal Pressure)

Use technology to achieve the energy savings!

NuTech Renewables

Timber Frame – Achieving the U-Value



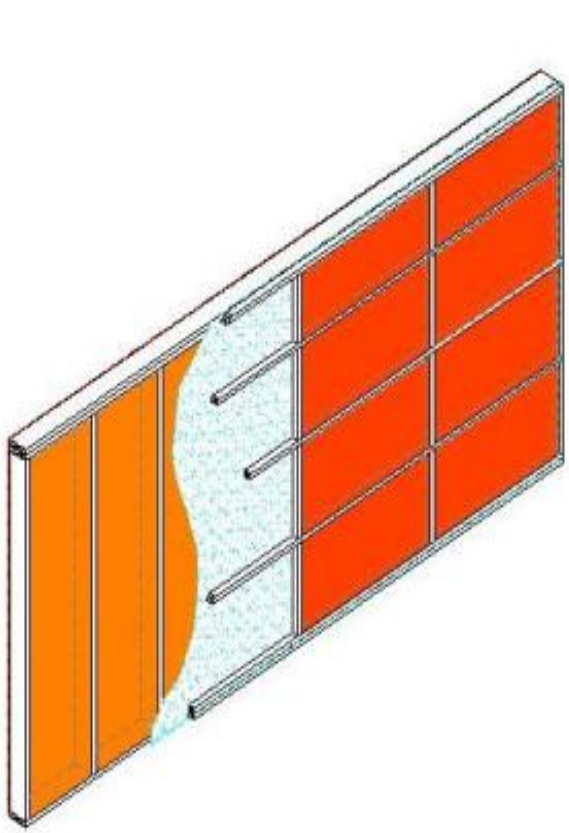
Standard Timber frame

140mm + 140mm HD FG

U-Value = 0.27 W/m2.K

NuTech Renewables

Timber Frame – Achieving the U-Value



Timber Frame Wall for Low Energy Housing

140 – 200 mm stud + Factory fitted with HD insulation AND Vapour Barrier which acts as an Airtightening layer also

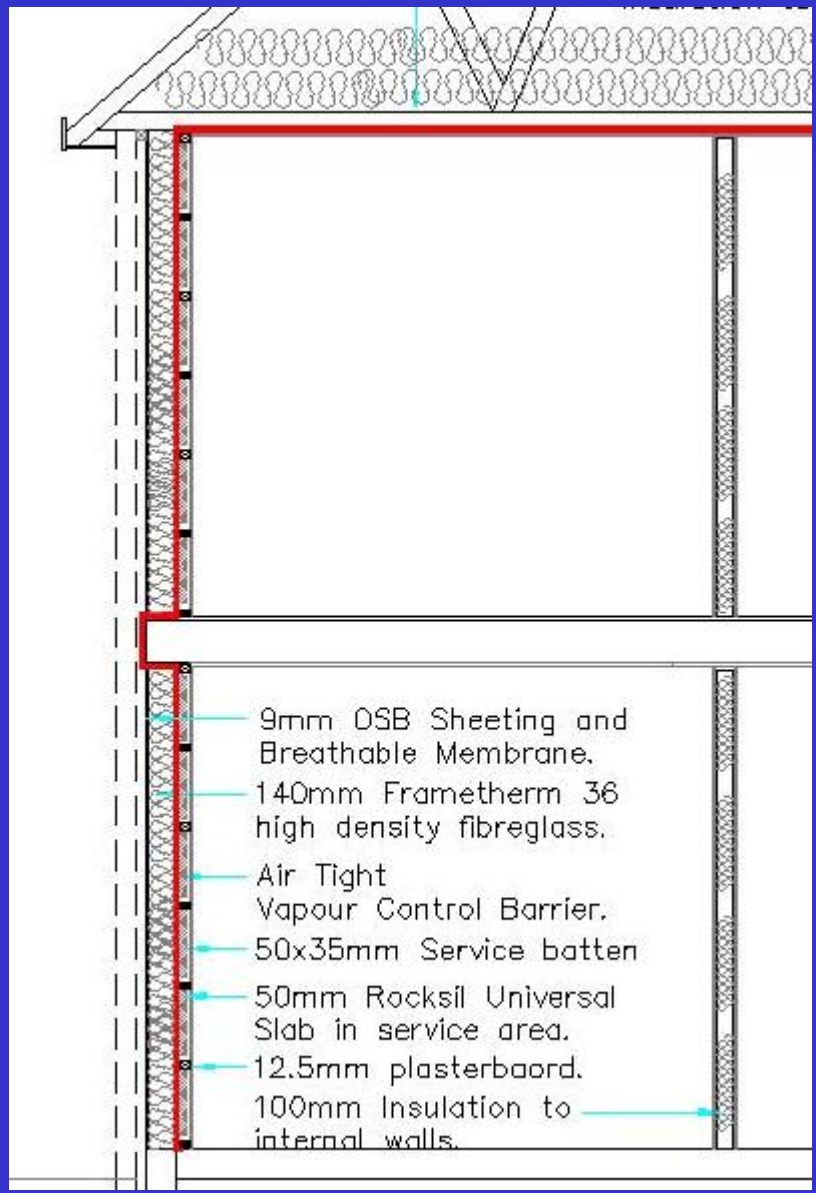
Service cavity filled with insulation

U-Value = 0.16 to 0.20 W/m2.K

NuTech Renewables

Filled Timber Frame Panel on site

NuTech Renewables



Fully sealed airtight membrane

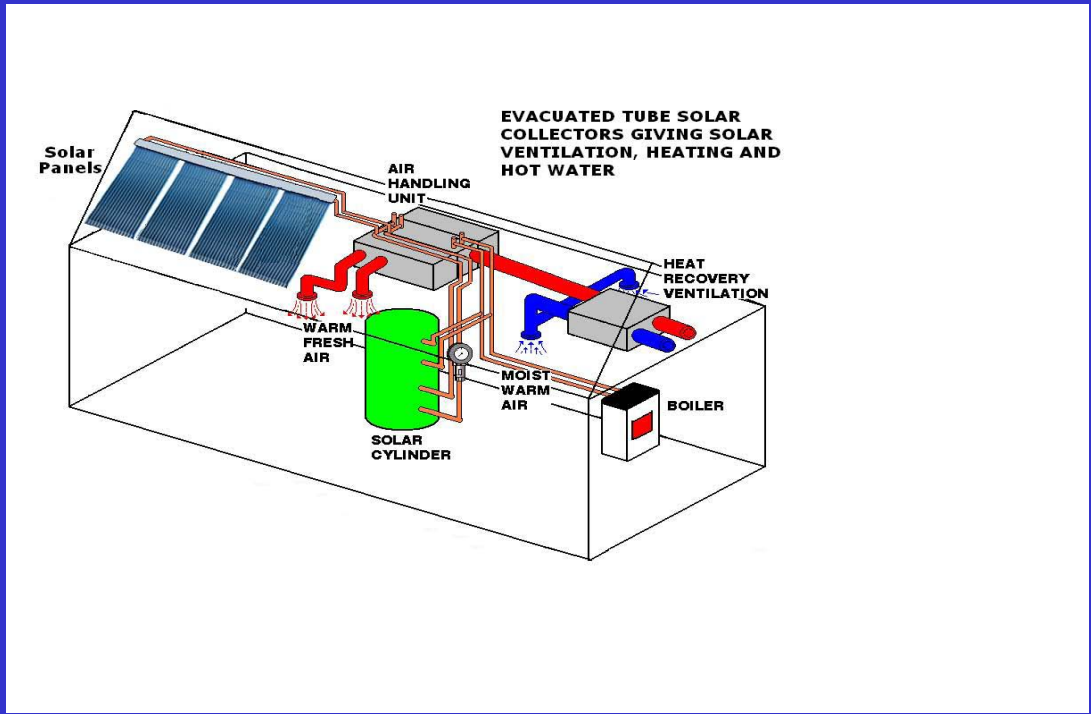
Limit Repeated Cold Bridges

Limit Linear Thermal Bridges at junctions

As much off-site as possible

NuTech Renewables

Intelligent Renewable Energy Systems (IRES)

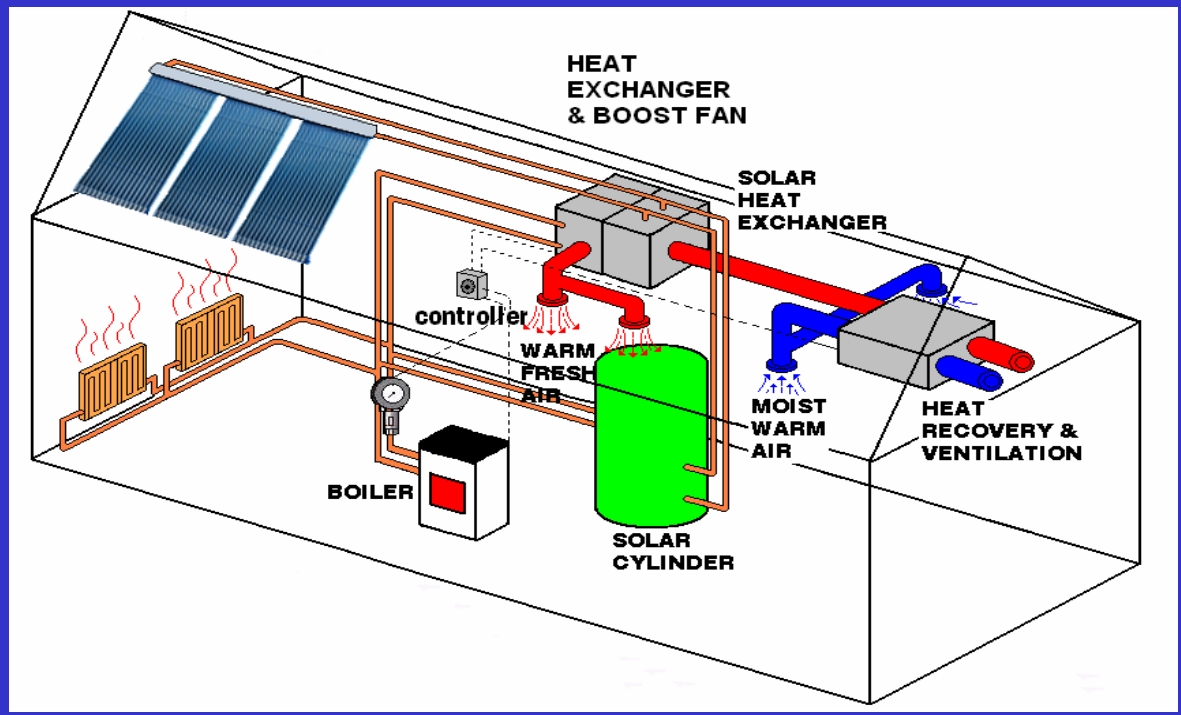


The more solar collectors we use on the roof – more energy we save WITHOUT any implications for Summer overheating

- We Design – You Select!
- We do a Preliminary BER assessment
- We Supply
- You Build (We train your plumber and roofer)
- Blower Door Test on actual house
- Final BER Certification can be arranged

NuTech Renewables

Intelligent Renewable Energy Systems (IRES)



<u>For very large houses a slight difference in approach</u>

- We integrate solar technology with HRV BUT we also have a normal heating system
- We do a Preliminary BER assessment
- You can then select
- Blower Door Test on actual house
- Final BER Certification can be arranged

NuTech Renewables

Housing at Killeagh, Co Cork

Space Heating + Ventilation + Hot Water = 750 kg of wood pellets per year

Equivalent to approx 300 litres of oil per year

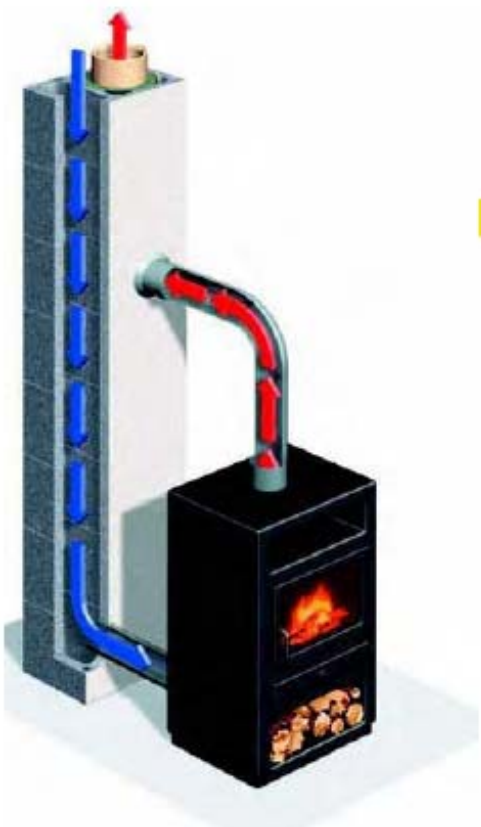
Walls	– 0.27
Gd Floor	– 0.20
Roof	– 0.16
Windows	– 1.90

NuTech Renewables

Housing with chimneys

Advanced Chimney Technology

SCHIEDEL
Chimney Systems



- Room sealed combustion system
  - Combustion air is drawn in from the top of the chimney down a separate compartment
  - Exhaust gases are safely delivered to the atmosphere
  - Glass fronted appliance designed to take air from outside of the house

NuTech Renewables

Housing for Wicklow County Council in the village of Knockananna – A3 Housing

Walls	– 0.18 W/m2.K
Gd Floor	– 0.18 W/m2.K
Roof	– 0.16 W/m2.K
Windows	– 1.60 W/m2.K

ACH < 0.1 at Normal pressure

NuTech Renewables

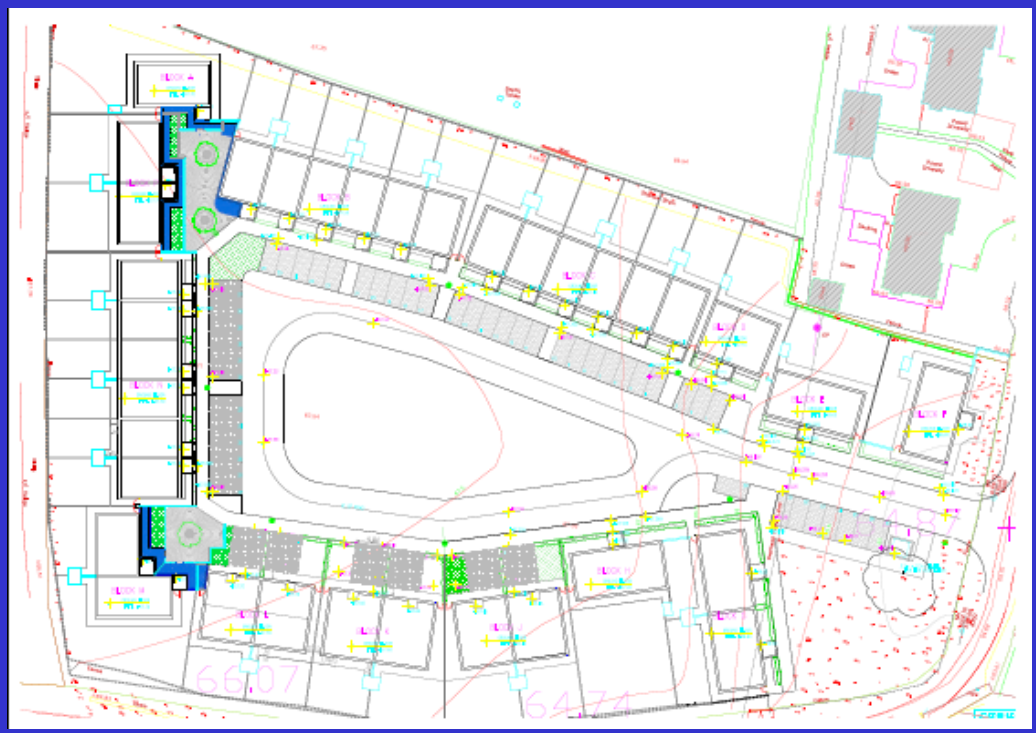
Housing for Fingal County Council in Swords in Co Dublin – 35 Houses

A3 Houses

Floor = 0.2 W/m2.K

Walls = 0.2 W/m2.K

Windows = 1.9 W/m2.K



6m2 gross Air Solar collector

Air to Water Heat Pump

NuTech Renewables

Mitsubishi Ecodan Heat Pump

Set-up in office as a part of the integrated system

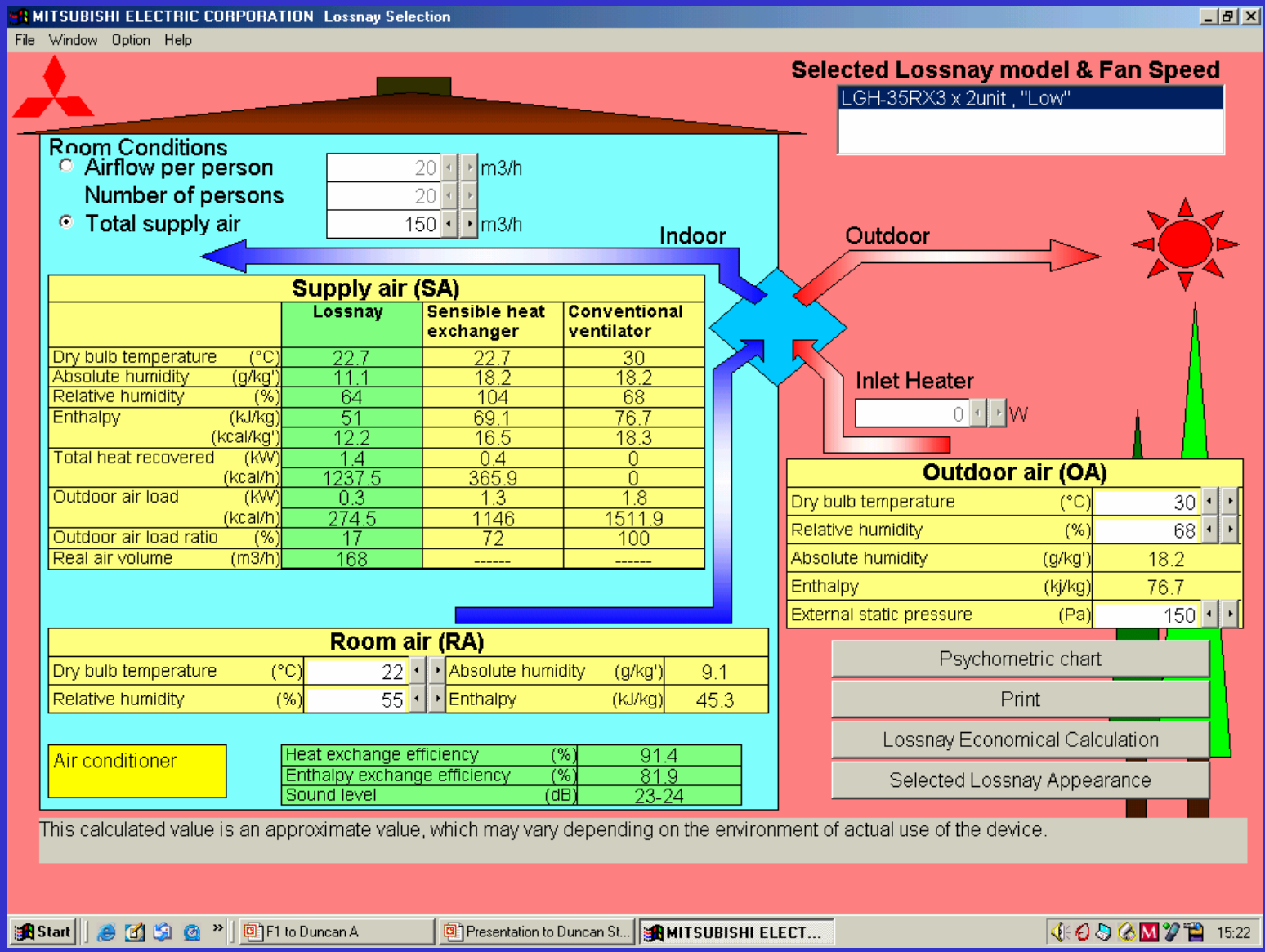
NuTech Renewables

Mitsubishi Ecodan Heat Pump

Set-up in office as a part of the integrated system

NuTech Renewables

Heat Recovery Ventilation



NuTech Renewables

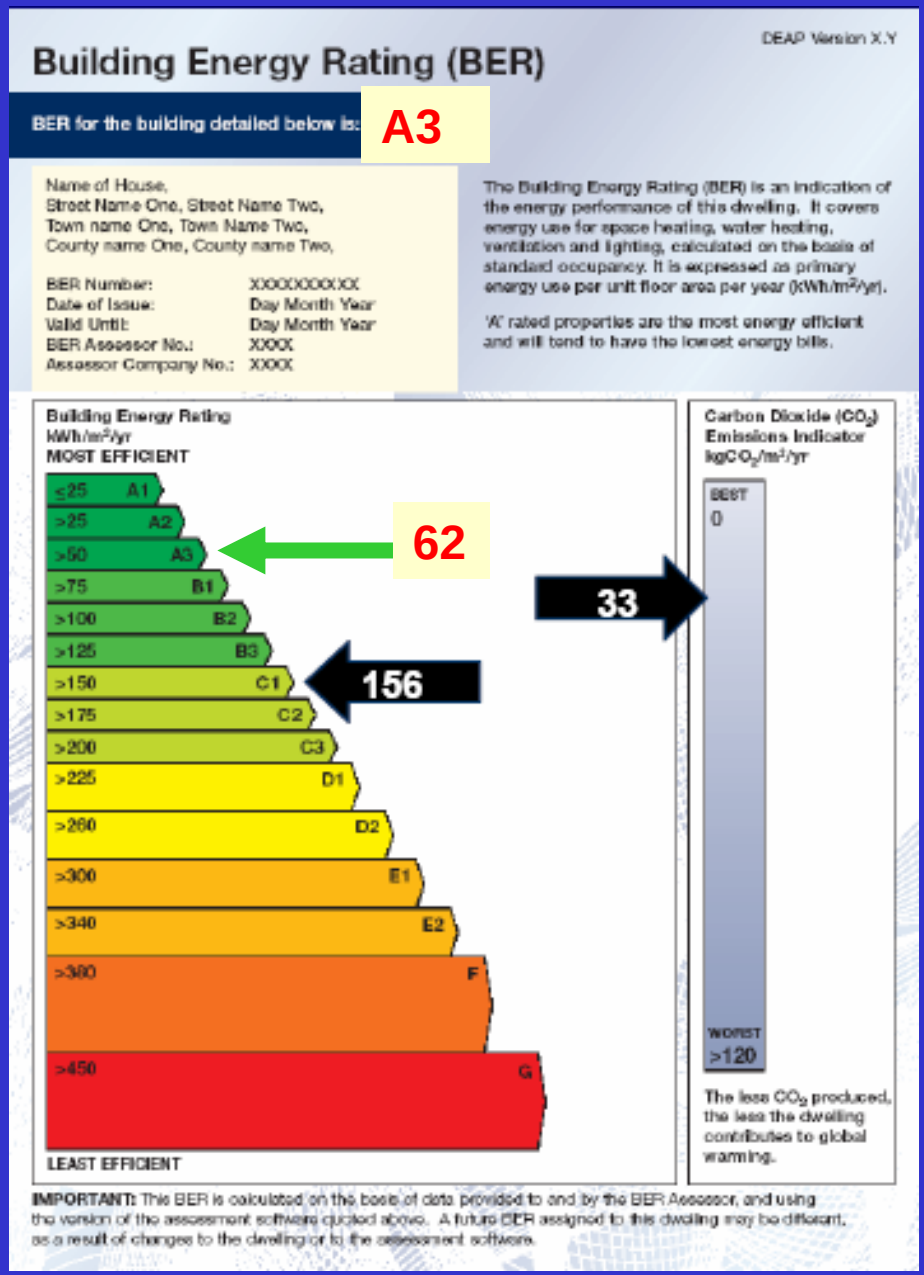
On a final note:

Balanced Thermal Mass in our climate is a good idea!!!!

We need fast response to reasonably small inputs

For Cooling:

- Highly insulated houses
- Special Lossnay type HRV systems
- Keep the sun out (design of glazing + Brise Soleil)
- Work closely with Architect on design
- Provide contractors with the solution



Housing to meet the proposed 2010 Regulations will be 60% better than the 2006 Regs and will have a BER of 62 kWh/m2.year

There may be changes in the Renewable Energy Requirement also

The Airtightness requirements will almost certainly be increased!

NuTech Renewables

To Achieve a house to satisfy the 2010 Regs an A3 House

- Use a wall U-Value = to or < 0.20 W/m2.K]
- Ground Floor U-Value = to or < 0.16 W/m2.K
- Roof U-Value = 0.12 W/m2.K
- Windows – use DG, Soft Low-E [U-Value = or < 1.4]
- Air Infiltration rate = 0.1 Air Changes per Hour [Blower Door Tested]
- Heat Recovery Ventilation [Efficiency = 86% and Spec Fan Power = 1.12]
- 92% efficient Boiler + room sealed log fireplace with combustion air from outside
- Electric Lighting by CFL's
- NuTech Solar H&V with HRV and Solar Hot Water

RESULT = 62 kWh/m2.Year [An A3 House]

RESULT = With Heat Pump and 'Tweaking' can be
49 kWh/m2.year [An A2 House –close to Passive]

NuTech Renewables

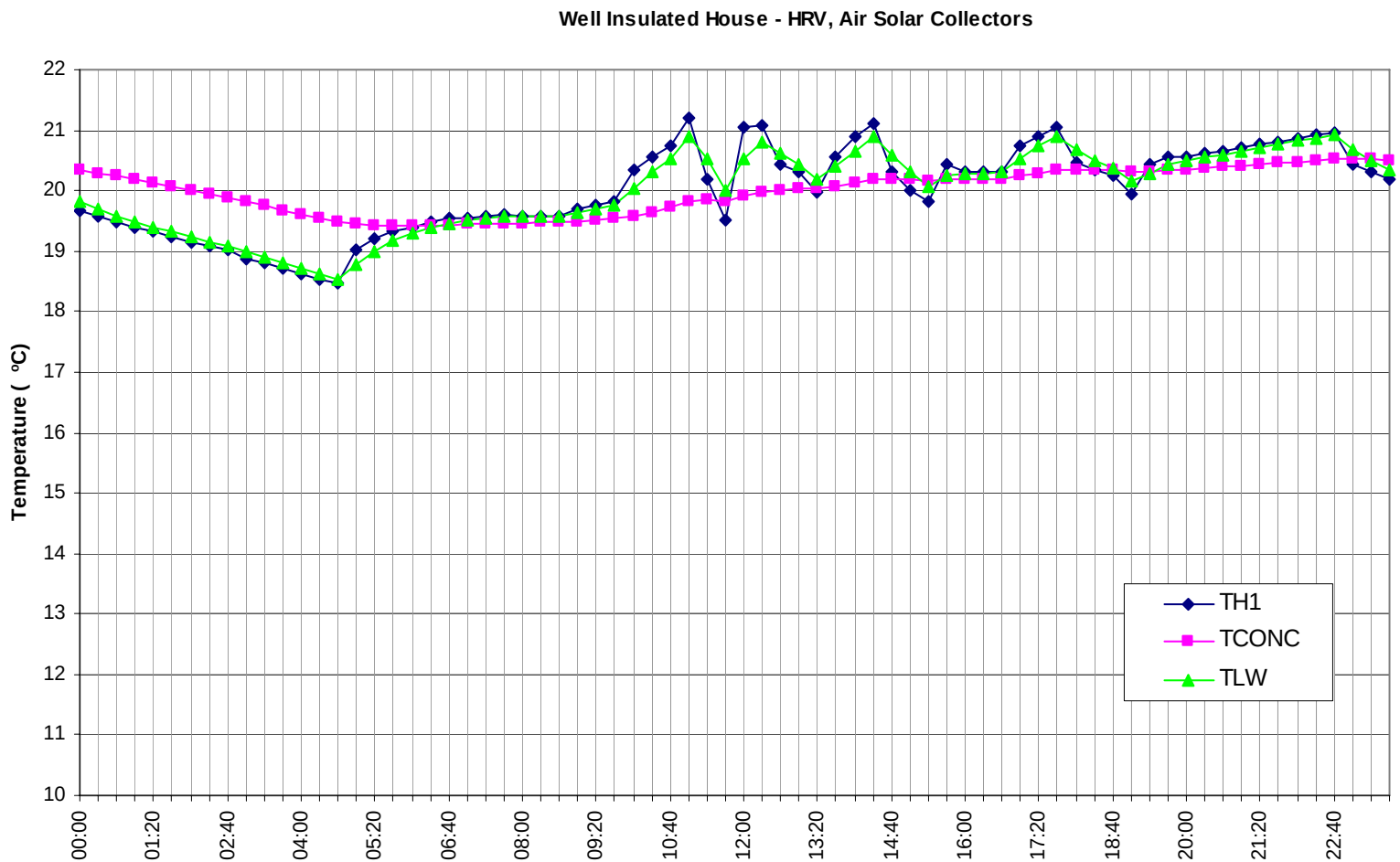
A word of caution!

NuTech

- An A3 house sounds great ……but
- It will use less than 75kWh/m2.year…say we have an A3 house that has a BER of 70 kWh/m2.year
- This means in a 100 m2 house it will use 7,000 kWh of Primary Energy for Space Heating, Ventilation, Hot Water and Electric Lighting
- Now, if we deduct the electricity for lighting, pumps, fans, etc – the balance is about 4,500 kWh per year for Heating, Ventilation and Hot water
- Now change that from primary Energy to delivered Energy and the total becomes approx 4,000 kWh per year
- 1 litre of oil contains approx 10.5 kWh of energy
- Therefore the oil usage for Space Heating, Ventilation and Hot Water will be about 380 litres of oil per year
- That's a small amount of oil – approx 1/3 of a typical fill of oil!!!
- Hence, emphasis on workmanship!

NuTech Renewables

Computer Simulation – Temperature



NuTech Renewables

In Conclusion

We can achieve Low Energy and Near Zero CO2 houses using factory filled and fitted Timber Frame panels

We must use Integrated Solar and HRV technology to achieve this Low Energy Solution (Reduce Energy Demand and then Efficient Energy Supply)

A2 and A1 houses will require site generated electricity by way of photovoltaic panels or similar renewable energy electricity

Thank you for listening……

Bill Quigley
NuTech Renewables

Tel: 01. 663 63 72
Fax: 01. 663 63 73
Mobile: 086 88 363 99
e-mail: bill.nutech@gmail.com

WEB: www.nutechrenewables.com

Factory / Showroom: Tel: 048 4175 30 31
Fax: 048 4175 41 51

NuTech Renewables