ENERGY IN URBAN PLANNING AND IN RESTRUCTURING AREAS

Presentation of Local Project
Tyrrelstown Housing Dublin

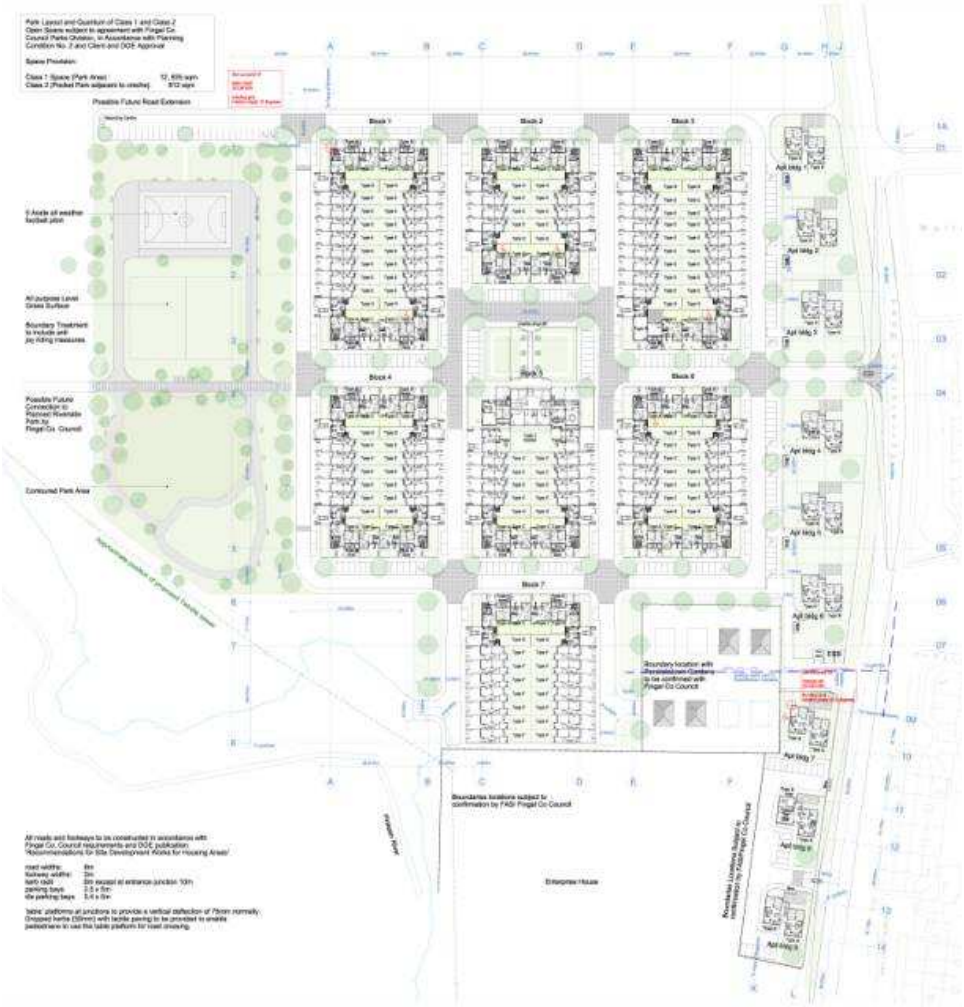
Stephen Cavanagh

G C A

Gerry Cahill Architects

Final ENPIRE Meeting and Workshop, Dublin, 19 November 2009

Introduction



Tyrreslltown Housing

A new development of Social Rented, Shared Equity and Affordable Purchase dwellings providing 234 family homes, a community centre, crèche and public park.

By **National Association of Building Co-operatives (NABCo) Society Ltd** a Government approved Housing Body

Outline design	2001 - 2002
Approvals	2002 - 2005
Detail design	2005 - 2006
Construction	2008 - 2010

Introduction

National Association of Building Cooperatives (NABCo) Society Ltd.

NABCo
The Co-operative Housing Association

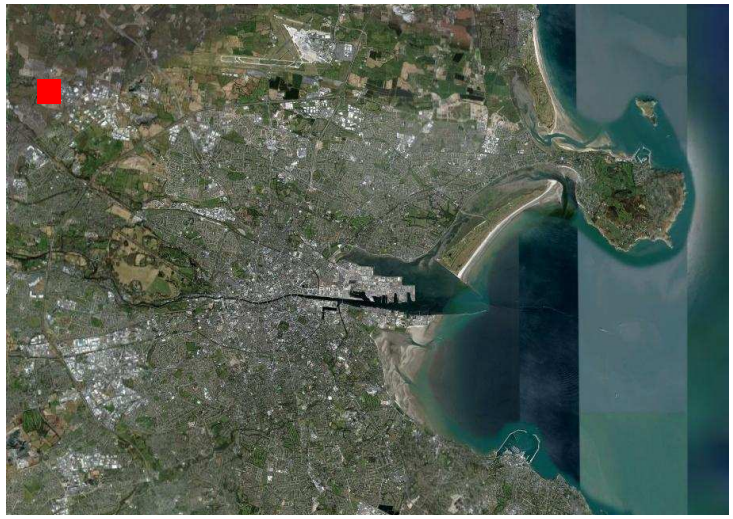
A non profit organisation concerned with the relief of housing needs, poverty and deprivation, through the building and management of houses and apartments.

Fingal Co Council

Local Authority (Municipality)

Fingal County Council
Comhairle Contae Fhine Gall

Project context



The site is located to the North West of Dublin, just outside the perimeter M50 Motorway.

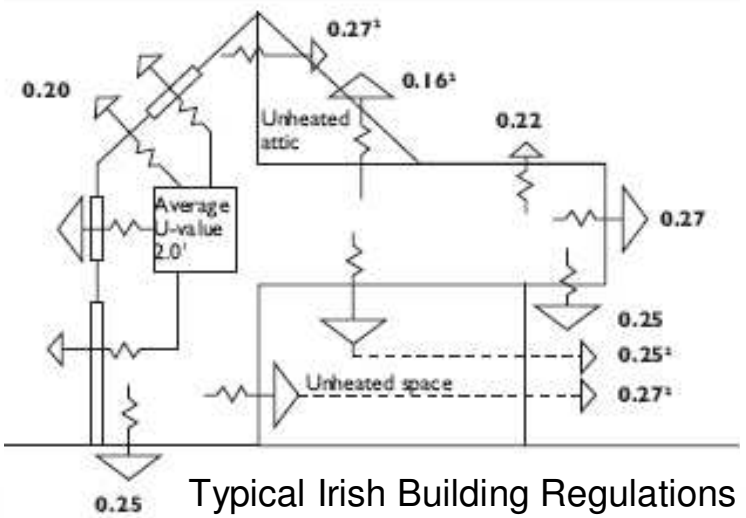
It measures 5.3 Hectares and has an outer suburban context with existing housing to the east and south and Damastown Industrial Estate to the west.

The land is mostly greenfield but includes a small area of decontaminated brownfield land.

Inventory

Existing situation

Insulation	U Values
Walls: 80mm PIR	0.24 average
Windows: DG Low E, Argon Filled, Wood Frame	1.5
Roof : 300mm Mineral Wool	0.14
Floors: 110mm EPS	0.20



Typical Irish Building Regulations

Inventory

Energy Data for a typical dwelling

Energy Rating	**B3**
Primary Energy: Consumption	137.27 KWhr/m^2/Yr
CO_2 emissions	29.11 $KgCO_2$ /m^2/Yr

Energy infrastructure:	Mains gas and electricity
Primary Heating System:	Gas fired boilers with distribution system of steel panel radiators.
Secondary Heating System:	Solid Fuel open fires

Ambition for Energy / CO_2

Formulation of the Energy Ambition

Both stakeholders have a strong concern for the welfare of the lower income tenants who will occupy the dwellings.

Fuel poverty / Delivery of Affordable Warmth are driving issues

Final targets were determined by researching what was practically achievable and affordable within a limited budget and existing design

A non binding, aspirational energy ambition was agreed

Ambition for Energy / CO_2

Energy Ambition 2008

"Within the project we have the ambition to achieve a reduction in CO2 emission of at least 25% compared to the Irish Building Regulations. An energy vision study will be conducted to identify available options to achieve this ambition level. On the basis of the study results a decision will be made which improvements can be implemented, given budget and planning limitations."

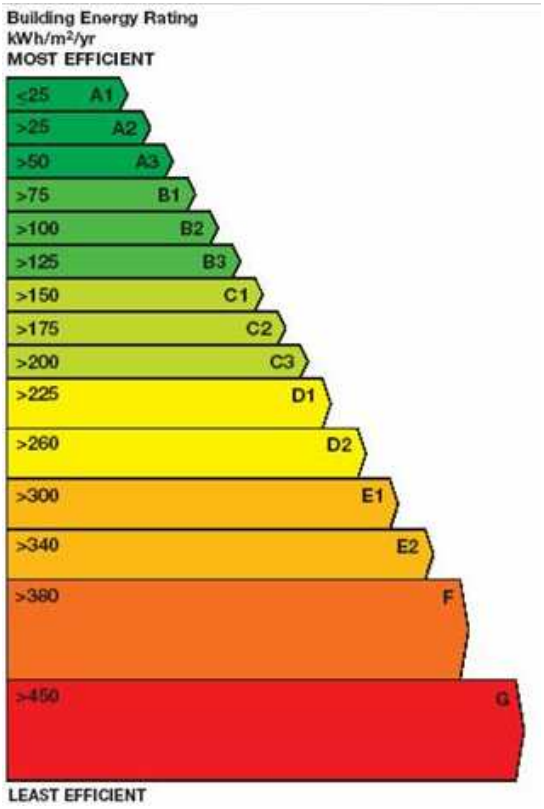
To be achieved in 2 stages:

- *Upgrade existing 2005 Design to comply with 2008 regulations (mandatory)*
- *25% Improvement on 2008 Regulations (Non binding aspirational)*

Ambition for Energy / CO_2

Targets

Standards and Ambitions (Typical Dwelling)	Primary Energy Consumption	Energy Label BER Rating
Existing Design (Primary Energy Consumption) Existing Design 2005 Building Regulations	**150KWh/ m^2/ yr**	**C1**
Existing Design (CO_2 emissions per dwelling): Existing Design 2005 Building Regulations	30 kg CO_2 / m^2/ yr	
Stage 1 Ambition (Primary Energy Consumption) Compliance with current 2008 Building Regulations	**90KWh/ m^2/ yr**	**B1**
Stage 1 Ambition (CO_2 emissions per dwelling): Compliance with 2008 Building Regulations)	19kg CO_2 /m^2a/ yr	
Stage 2 Ambition (Primary Energy Consumption) (25% improvement on 2008 Building Regulations)	**67.5 KWh/ m^2/ yr**	**A3**
Stage 2: Ambition (CO_2 emissions per dwelling) (25% Improvement on 2008 Building Regulations)	14.3 kg CO_2 /m^2/yr	



Ambition for Energy / CO_2

Stage 1 Compliance with New Building Regulations

Revised Building Regulations for dwellings were introduced in 2007, after building costs for the project had been agreed, requiring:

- A 40% reduction in energy demand and CO_2 emissions associated with heating, domestic hot water and lighting. (60% expected by 2010)

and

- A proportion of heat or power to be generated from on site renewable energy sources:

  min 10kWh/m^2/a from solar thermal panels, heat pumps or biomass

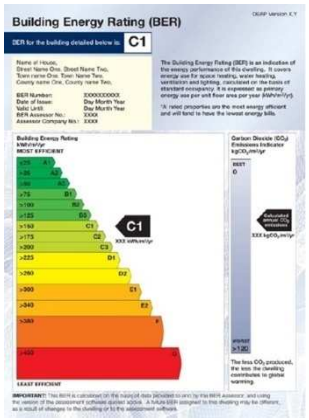
  or,

  min 4kWh/m2/a electricity from solar photovoltaic or wind turbines.

Ambition for Energy / CO_2

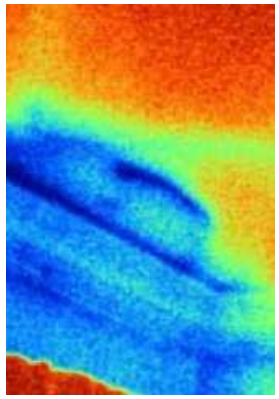
Technical tools used

Architects:



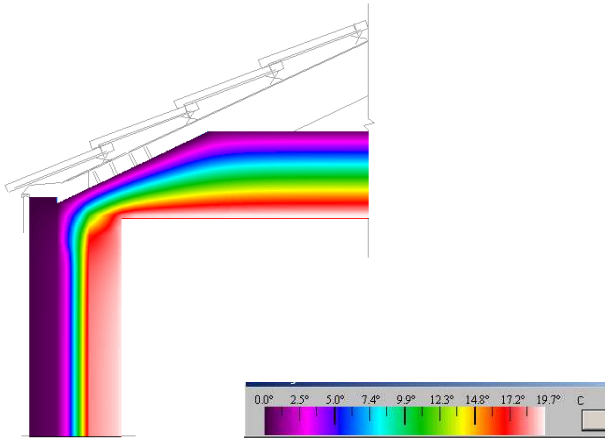
Energy Performance Assessment (DEAP)

Air tightness Testing



Thermal Imagery

UCD:



Thermal Bridging Analysis ('Therm')

Dynamic Energy Modelling ('Energy Plus') - results tbc

Ambition for Energy / CO_2

DEAP

Dwelling Energy Assessment Procedure

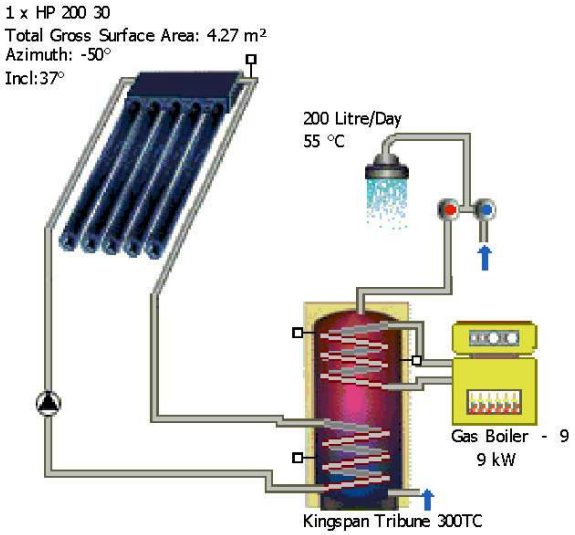
The Irish official procedure for calculating and assessing the energy performance of dwellings which is an adaption of the UK's Standard Assessment Procedure (SAP).

Takes account of the energy required for space heating, ventilation, water heating and lighting, less savings from renewable energy technologies and calculates annual energy consumption and CO_2 emissions.

Energy Vision Study

Most Promising Options:

1. Add Solar Collectors for the provision of domestic hot water



2. Upgrading efficiency of gas boilers

3. Provide room sealed stoves to open fire places

Energy Vision Study

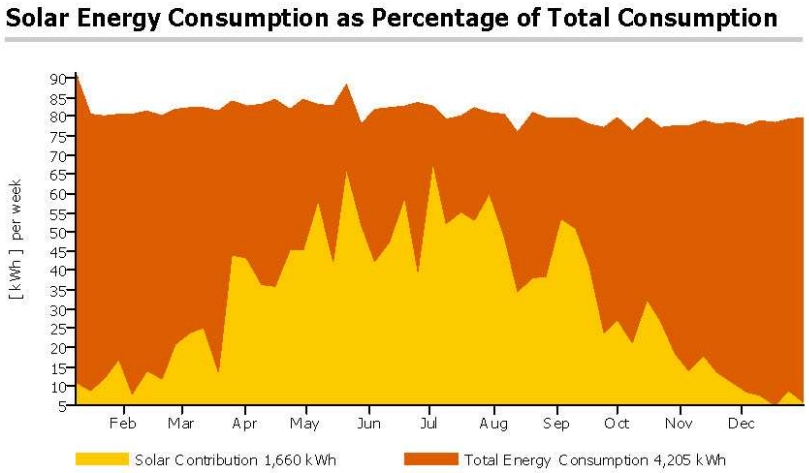
Solar Energy Analysis

Typical 3 Bed House, 5 Occupants

- Panels 10 deg off east towards south with tubes rotated 25deg for better orientation towards south
- Solar Yield: 1660 kWh/ annum
- Primary Energy Reduction

(equivalent energy if produced by a boiler) = 2155 kWh/annum

- Bottlenecks: Funding Body, Technical Approval



Energy Vision Study

Room Sealed Stoves With dedicated external air supply

CE

5 kW
Nominal Output

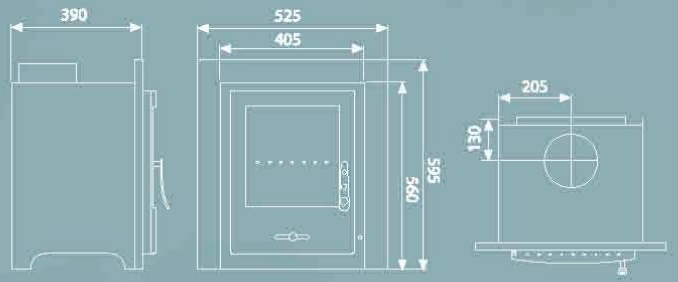
77%
Efficiency

Clean Glass System

Double Combustion

Cast Iron & Metallic

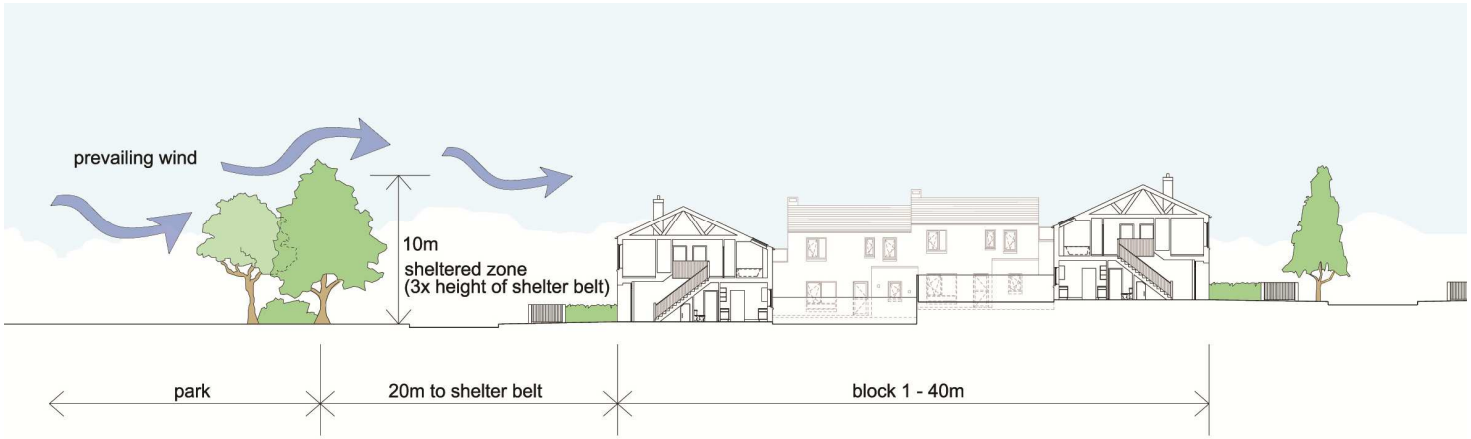
- Cast Iron door with Heat Resistant Glass to 750 deg C
- Top outlet flue 150mm
- Vermiculite lined interior
- Primary air regulation
- Weight 55kg
- Optional Stainless Steel or metallic curved frame for wall-mounting.



Energy Vision Study

Recommended energy saving possibilities at urban scale

- Provide shelter belt planting to North & West boundaries



- Change street lighting from high pressure sodium to higher efficiency LED lights (60% improvement)
- Wind generated electricity using exposed park area (easiest distribution network to retrofit)

Energy Vision Study_ Results

Stage 1 Ambition: Compliance with 2008 Regulations

Energy Saving Measure	Energy Saved (kWhr/m^2/ Yr)	Reduction in CO_2 (Kg/m^2/ Yr)	Cost per dwelling (excl. tax)
Upgrading of gas boiler specification from 78.8% to 90+% efficiency	12.12	2.24	Original budget + € 458
Installation of Solar Domestic hot Water System	15.44	2.79	€ 5285 (system) € 305 (electrics)
Incorporation of DoEHLG standard Details for Improved Air tightness including airtight attic hatches to minimise leakage to 4 m3/ hr/m2	7.65	1.66	€ 225 € 150 Thermal Imaging € 150 Smoke Audit
Incorporation of DoEHLG improved construction details for reduced thermal bridging Including revised cill and eaves details.(Thermal bridging factors improved from 0.11 to 0.08)	4.16	0.91	Cost Neutral
Provision of low energy fixed lighting	8.78	2.19	Cost Neutral
Totals	**45.32**	**9.26**	**€ 6573**

Equivalent to 33% improvement in energy performance, 32% reduction in CO_2 emissions

Energy Vision Study_ Results

Stage 2 Ambition: 25% Improvement on 2008 Regulations

Energy Saving Measure	Energy Saved ($kWhr/m^2/Yr$)	Reduction in CO_2 ($Kg/m^2/Yr$)	Cost per dwelling (excl. tax)
Fit Room Sealed Wood Stove to open fires (6kw, 76.85% efficiency)	9.65	4.29	Stove €572 supply Flexi-flue €100 Installation €500
Separate Time & Zone Control of Heating System	3.17	0.52	Approx. €500
Full Fill of External Cavity Walls	1.75	0.3	Approx. 50m2 total Await ing costs from Airpack Ltd
Additional 300mm of fiberglass insulation to attic space	1.93	0.31	Approx. 43m2
Air to Water Individual Heat Pumps**	14.59	0.11	Tbc

** where air source heat pump is primary heating and HW system, gas boiler as secondary heating system plus wood stove

Energy Vision Study_ Results

Summary

	Standards and Ambitions (Typical Dwelling)	Energy Performance and CO2 Emissions	% Reduction	Energy Label BER Rating
Existing Situation	Existing Design (Primary Energy Consumption) Existing Design 2005 Building Regulations	137.27 kWh/m2/yr	–	B3
	Existing Design (CO_2 emissions per dwelling): Existing Design 2005 Building Regulations	29.11 kg CO_2 /m^2/yr	–	
Stage 1 Ambition	Stage 1 Ambition (Primary Energy Consumption) Compliance with current 2008 Building Regulations	91.95 KWh/m^2/yr	- 33 %	B1
	Stage 1 Ambition (CO_2 emissions per dwelling): Compliance with 2008 Building Regulations)	19.85 kg CO_2 /m^2/ yr	- 32 %	
Stage 2 Ambition	Stage 2 Ambition (Primary Energy Consumption) (25% improvement on 2008 Building Regulations)	77.2 KWh/ m^2/ yr	- 43 %	B1
	Stage 2: Ambition (CO_2 emissions per dwelling) (25% Improvement on 2008 Building Regulations)	14.73 kg CO_2 /m^2/yr	- 49.5 %	

Implementation and evaluation

Realisation

Stage 1 Ambition: an application for additional funding has been submitted, works are expected to commence 2010

Stage 2 Ambition: remains aspirational but we have strongly recommended that room sealed stoves are fitted in, at least the dwellings for the lowest income groups.

Implementation and evaluation

Monitoring energy/CO_2 reductions

Not all units were required to comply with the new regulations so it will be possible to compare the utility bills and occupant's experience for similar dwellings with and without the energy saving improvements.

Feedback

Lessons learned

Upgrading individual existing dwellings can only go so far towards achieving moderate energy ambitions. The integration of district / neighbourhood scale heating and power supply centres are essential to meet higher targets.

Obtaining funding is generally the biggest problem. Clear demonstration of the gains and benefits for low income tenants help justify costs. Good evidence of projected performance and pay back is essential and the real impact on Fuel Poverty must be proved.

For the successful procurement of good quality energy efficient buildings, all Stakeholders need to be well informed and aware of the environmental, economic and social impacts of their buildings as well as their legal obligations. All parties must engage positively in the brief development process rather than rely solely on project managers or consultants.

Dissemination

Dissemination and Potential for Replication

- Architecture Ireland Magazine Article December 2009
- Poster exhibition in town halls around Dublin
- Draft Energy Policy Guidance document for discussion with NABCo for use by the Voluntary Housing Sector based on ENPIRE process and Local Project Experience

Dissemination

Guidance Document on Energy Policy for Voluntary Housing Providers based on ENPIRE experience

- Environmental, economic and social impacts of buildings
- Current Legislation
- Energy Ambitions and ENPIRE process
- Delivering Affordable Warmth Strategies
- Cost effective solutions and funding
- Selection and briefing of Consultants
- Directions to recommended information resources

Thank you

stephen@gca.ie