Irish Building Control Institute
2011 Conference

Westport
7.4.2011

Jay Stuart  RIBA
Managing Director
Delap & Waller EcoCo Ltd.

- Integrated Sustainable Design Consultants
- 2008 Green Organisation of the Year Award
- UK Carbon Trust accredited Strategic Design Advice consultants
- CIBSE Low Carbon Consultants
- BREEAM International accredited assessors
- Consultants to Ireland’s Enterprise Ireland Leadership 4 Growth: Sustainable Built Environment Programme
2015 : A Sustainable Construction Industry

Legislative Drivers for Sustainable Development

- EU Kyoto Commitments, EPBD, Building Regulations, LAP’s, DCC Development Plan
- 13.11.08 Recast version of EPBD targets “20/20/20 “ requirements
- 21.3.09 new EPBD amendment passed for 100% RE on site by 2018
- EU require Local Authourity Biodiversity Plans
- Air Quality Directive 2008/50/EC dated 21.5.08
- Landfill charges to continue increasing
- Carbon taxes implemented for Ireland in 2010
- Code for Sustainable Homes in UK
- Ireland, UK propose zero carbon standards for new buildings between 2013 and 2016

Market drivers for Sustainable Development

• Corporate Social Responsibility and corporate environmental policies
• BER Rating for local market
• Environmental rating (BREEAM and LEED) for multinationals
• Energy cost impact on service charges and rent
• Long term value
• Future proofing projects with local energy systems (energy security)
• Future proofing projects with renewable energy systems (low carbon)
• Partnerships with energy services companies (ESCOs)
• Government funding initiatives

• Financial institutions may ultimately only lend / invest in projects that meet their sustainable requirements to protect the value of their long term investment.
All buildings will have to be ‘Zero Carbon Buildings’ operating on renewable energy with minimal impact on the environment.

- office buildings without air conditioning
- dwellings without heating systems
- renewable energy in every building
- local energy networks
- low environmental impact construction materials
- ‘design for disassembly’
- rainwater harvesting and storage
- low water use services and water meters
- low energy water treatment systems
- green roofs and walls
- landscaping integrated with water resources strategy
- no waste to landfill

*Significant design work for early stage project approvals.*
Green is just Good Business

- Reduce energy and water costs
- Future proof investment against increasing resource costs
- Avoid carbon and environmental taxes
- Obtain a higher *Building Energy Rating* to increase its value
- Obtain a higher BREEAM / LEED rating to increase its value
- Create more comfortable, healthier living and working environments
- Generate own renewable energy and sell it to others for a profit
- Achieve energy security
- Innovative financing possible
- Meet your and others’ CSR objectives
- Costs 3% to 8% more to build with ROI of min. 10%

( …….call it green if it suits you. )
Clonburris Masterplan 2007

Sustainability Toolkit & Design Standards
80% DH, RE, 60% energy reduction, 5% Passivhaus
Mixed Use development with up to 16,000 dwellings
# Sustainable Strategies and Required Actions

<table>
<thead>
<tr>
<th>Issue</th>
<th>Indicator</th>
<th>Target</th>
<th>Reference</th>
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<tbody>
<tr>
<td>Resource inputs</td>
<td>Land resource</td>
<td>Protection of ecological features</td>
<td>RI:LEG:01</td>
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<td>Energy resource</td>
<td>Solar design/orientation</td>
<td>RI:ENE:01</td>
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<td>Renewable/low energy sources</td>
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<td>Water resource</td>
<td>Sustainable urban drainage; surface water</td>
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<td>Grey water</td>
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<td>Material resources</td>
<td>Environmental impact of materials</td>
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<td>Responsible sourcing of materials</td>
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<td>Design for recycling</td>
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<td>Insulating global warming potential</td>
<td>RI:MAT:06</td>
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<td>Use of resource</td>
<td>Ecology, urban form, and design</td>
<td>Building Footprint</td>
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<td>Transport and movement</td>
<td>Walkable and cycleable neighbourhoods</td>
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<td>Public transport and modal shift</td>
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<td>Drying space</td>
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<td>Eco labelled goods</td>
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<td>Internal lighting</td>
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<td>External lighting</td>
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<td>Non domestic water use</td>
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<td>External potable water</td>
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<td>Community resources</td>
<td>Community Sustainability Audit</td>
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<td>Social and affordable housing</td>
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<td>Adaptability</td>
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<td>Private space</td>
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<td>Daylighting</td>
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<td>Home office</td>
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<td>Waste Outputs</td>
<td>Emissions</td>
<td>NOx emissions</td>
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<td>Management of construction site impacts</td>
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<td>Home user guide</td>
<td>WO:MN:04</td>
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<td>Post occupancy assessment</td>
<td>WO:MN:05</td>
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</tbody>
</table>

www.clonburris.ie
District Heating

Potential 26,000 customers
Requirements:

- 30% renewable heating energy on site
- 30% renewable electricity
- A district wide ESCo (energy services company)
- 1m wide reservation in streets for district heating pipes
Clomakilty Study

The graph shows the energy production and demand in MWh/year for various sources. The sources include:

- Miscanthus and SRC Willow
- Grass silage for biogas
- Slurry & manure
- Forestry by-products
- Wood-processing by-products
- Solar thermal energy
- Wind energy - on-shore
- Wind energy - off-shore
- Ocean energy
- Electricity demand
- Transport fuel demand
- Total energy demand

The categories with the highest energy demand include Wind energy - on-shore and Wind energy - off-shore, while Miscanthus and SRC Willow have the highest energy production.
**Table 33: RE mix for individual DH schemes of the study area in Scenario 1 (RES-HEAT).**

<table>
<thead>
<tr>
<th>RES-Heat Production Mix</th>
<th>Clonality Town</th>
<th>Timoleague</th>
<th>Courtmacsherry</th>
<th>Rosscarbery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electrical Capacity (MWe)</td>
<td>Thermal Capacity (MWh/yr)</td>
<td>Annual Output (MWh/yr)</td>
<td>% of DH demand</td>
</tr>
<tr>
<td>AD CHP - Animal By-products</td>
<td>0.10</td>
<td>0.11</td>
<td>541</td>
<td>22%</td>
</tr>
<tr>
<td>AD CHP - Grass silage</td>
<td>-</td>
<td>0.00</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>AD CHP - Industry &amp; Municipal Organic</td>
<td>0.22</td>
<td>0.25</td>
<td>1,187</td>
<td>48%</td>
</tr>
<tr>
<td>Biomass Boilers - Wood Chips/Miscanthus</td>
<td>5.50</td>
<td>4244</td>
<td>683</td>
<td>28%</td>
</tr>
<tr>
<td>Biomass CHP - Wood Chips/Miscanthus</td>
<td>0.90</td>
<td>2.10</td>
<td>13,950</td>
<td>86%</td>
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<tr>
<td>Solar Thermal</td>
<td>2.60</td>
<td>1,800</td>
<td>50</td>
<td>4%</td>
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<tr>
<td>Total (MW)</td>
<td>1.12</td>
<td>10.08</td>
<td>20.81</td>
<td>101%</td>
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</tbody>
</table>

**Table 34: RE Mix for DH in Scenario 2 (RES-GAS).**

<table>
<thead>
<tr>
<th>RES-Heat Production Mix</th>
<th>Clonality Town</th>
<th>Timoleague</th>
<th>Courtmacsherry</th>
<th>Rosscarbery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electrical Capacity (MWe)</td>
<td>Thermal Capacity (MWh/yr)</td>
<td>Annual Output (MWh/yr)</td>
<td>% of DH demand</td>
</tr>
<tr>
<td>AD CHP - Animal By-products</td>
<td>0.32</td>
<td>0.36</td>
<td>1,731</td>
<td>70%</td>
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<tr>
<td>AD CHP - Grass silage</td>
<td>-</td>
<td>0.00</td>
<td>-</td>
<td>0%</td>
</tr>
<tr>
<td>AD CHP - Industry &amp; Municipal Organic Wi</td>
<td>-</td>
<td>0.00</td>
<td>-</td>
<td>0%</td>
</tr>
<tr>
<td>Biomass Boilers - Wood Chips/Miscanthus</td>
<td>0.90</td>
<td>683</td>
<td>683</td>
<td>28%</td>
</tr>
<tr>
<td>Biomass CHP - Wood Chips/Miscanthus</td>
<td>-</td>
<td>0.00</td>
<td>-</td>
<td>0%</td>
</tr>
<tr>
<td>Solar Thermal</td>
<td>0.14</td>
<td>90</td>
<td>90</td>
<td>4%</td>
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<tr>
<td>Total (MW)</td>
<td>0.32</td>
<td>1.40</td>
<td>2,504</td>
<td>101%</td>
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</table>
Comparison of Internal Rate of Return of individual RE projects with energy output used on site
# RE Technology Feasibility

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Net Present Value</td>
<td>7.5%</td>
<td>7.5%</td>
<td>£6,140,082</td>
<td>£10,139,138</td>
<td>£12,738,944</td>
<td>£6,019,944</td>
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<tr>
<td>Net Present Value</td>
<td>7.5%</td>
<td>5.0%</td>
<td>£11,756,237</td>
<td>£17,707,493</td>
<td>£21,464,811</td>
<td>£11,732,303</td>
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<tr>
<td>Net Present Value</td>
<td>7.5%</td>
<td>2.5%</td>
<td>£20,555,246</td>
<td>£29,565,076</td>
<td>£35,135,905</td>
<td>£20,682,036</td>
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<tr>
<td>Internal Rate of Return</td>
<td>7.5%</td>
<td>5.0%</td>
<td>11%</td>
<td>13%</td>
<td>14%</td>
<td>11%</td>
</tr>
<tr>
<td>Net Present Value</td>
<td>5.0%</td>
<td>7.5%</td>
<td>£2,642,183</td>
<td>£5,425,352</td>
<td>£7,304,228</td>
<td>£2,462,126</td>
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<tr>
<td>Net Present Value</td>
<td>5.0%</td>
<td>5.0%</td>
<td>£6,494,327</td>
<td>£10,616,519</td>
<td>£13,289,337</td>
<td>£6,380,257</td>
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<tr>
<td>Net Present Value</td>
<td>5.0%</td>
<td>2.5%</td>
<td>£12,414,209</td>
<td>£18,594,178</td>
<td>£22,487,106</td>
<td>£12,401,545</td>
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<tr>
<td>Internal Rate of Return</td>
<td>5.0%</td>
<td>-</td>
<td>9%</td>
<td>11%</td>
<td>12%</td>
<td>8%</td>
</tr>
<tr>
<td>Net Present Value</td>
<td>2.5%</td>
<td>7.5%</td>
<td>£167,242</td>
<td>£2,090,111</td>
<td>£3,458,891</td>
<td>-</td>
</tr>
<tr>
<td>Net Present Value</td>
<td>2.5%</td>
<td>5.0%</td>
<td>£2,842,211</td>
<td>£5,694,912</td>
<td>£7,615,014</td>
<td>£2,665,581</td>
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<tr>
<td>Net Present Value</td>
<td>2.5%</td>
<td>2.5%</td>
<td>£6,865,852</td>
<td>£11,117,188</td>
<td>£13,866,578</td>
<td>£6,758,146</td>
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<tr>
<td>Internal Rate of Return</td>
<td>2.5%</td>
<td>-</td>
<td>6%</td>
<td>8%</td>
<td>10%</td>
<td>6%</td>
</tr>
</tbody>
</table>
Sustainable Concepts

Nearly Zero buildings/development  Integrated Design Process (IDP)
Net Zero bldg/dev  Cradle to Cradle Design
Energy Positive bldg/dev  Resilient Design

Edible Landscape
Industrial Ecology
Local Energy Networks
Zero Waste Development
Zero Soil Removal
Low Impact Material
Asphalt solar collector
Interseasonal energy storage
Vibro compaction stone pile foundations
Thurrock and Clonakilty

- DH in key areas
- Key indicators for DH
- Efficiency Ireland Trust
- Carbon Offset Fund
Low Energy Design

1. Glazing ratio (40% glazing / 60% insulated wall)
2. Natural ventilation strategy
3. Solar shading
4. Glazing specification
5. Window design
6. Airtightness
7. Insulation > wall construction
8. Thermal bridging
9. Efficient systems
10. Renewable energy
Passive House Standard

- Max. 10 W/m² heating energy
- Very airtight
- 200 mm insulation throughout
- Windows with 0.8 W/m²k U-value (triple glazed or innovative)
- HRV
Long Term Financial Benefits

- Conventional Model
- A1 Model Controls
- Manifold + Induction Exhaust
- Manifold + Induction Exhaust + Heat Recovery
- Manifold + Induction Exhaust + Econet
Commercial Target

Typical naturally ventilated office – 250 Kwh/m²/yr
Estimated target for ‘A’ rating – 100 Kwh/m²/yr
150 kWh/m²/yr reduction = €20/m² saving

= €200/m² added value @ 10 year commercial finance

50,000 m² x €200/m² = €10 M added value
Innovative Renewable Energy

- Intermittent renewable sources
- Storage
- Heating /cooling cycles
- Heat pumps
- Stirling engines
- Micro CHP

- Integration of systems
- Controls
Interseasonal Energy Storage in the Ground

**Summer**
Temp > 15°C

- Road collector
- Solar collector
- Surface water

**Winter**
Temp < 7°C

Air- and Floorheating

Heat pump

30°C 40°C

7°C 15°C

Cold Heat Cold Heat
Asphalt Solar Collector

- Most cost effective solar system
- Interseasonal heat storage in ground
- No boiler in this school
- In use in 5 buildings in the UK
SolarWall

Sainsbury’s Logistics Centre, UK
Biomass Energy

Anaerobic digestion

Pyrolysis
Biochar

2,000 yr old ‘terra pretta’ soil

Biochar fertiliser

Ordinary soil

Biochar
A carbon negative zero emissions renewable energy supply system.
Biorefinery

Irish Competence Centre for Biorefining and Bioenergy
www.ccbb.ie
Nanosolar

- Silicon Valley company
- automated factories in US and Germany
- faster, cheaper, increased supply
- 40% reduction in cost in 3 yrs
- efficiency improved 11% to 20%
1.8 KW electricity at 15% efficiency in trials
Chemical Heat Pump

3 stage chemical heat pump and storage system powered by solar thermal

Energy Savings = € 1,400 pa
CO2 savings = 6,400 kg pa

Annual Energy Production:

100% Cooling = 6 000 kWh
50% Heating = 6 000 kWh
100% DHW = 3 000 kWh

Madrid Test House
Wind Energy
Heat pumps to replace oil as cheaper and a single set of standing charges

Air heat pumps are cheap to instal
Can be integrated into ventilation system

Group systems

Variety of systems developing to suit market segments
Summary

Net Zero Buildings and developments

Local energy networks

Community action

Retrofit

Cheap energy storage

Heat pump technology

Wireless controls and energy management systems