Cedar Multi’s

Rupert Daly
Why Passivhaus?
Woodside Estate: Background

- 4000 residents (approx)
- Diverse range of nationalities
- 32 languages

- Tenants consist of single people, families, asylum seekers, young people from the care system, those who have been homeless, elderly, disabled.

- Community has issues with high unemployment, poverty, isolation, mental health and people with addictions

- High unemployment
- Benefit dependency
- Income deprived

- Fuel Poverty
- Food Poverty
Woodside Estate: Background

2011

- Estate had suffered from a lack of investment for a number of years impacting significantly on the resident’s quality of life.
- Stock transfer to Queens Cross Housing Association

2012

- Collective Architecture commissioned to carry out Options Appraisal
To be recognised as a leader in providing excellent housing and community services. To create and sustain vibrant communities and to inspire others to do the same.

Woodside Estate: Client Vision
Woodside Estate: Options Appraisal

- Access and Security
- Perception and Identity
- Refuse and Recycling
- Communal areas and Redundant Spaces
- Open spaces
- Play areas
- Ownership & Maintenance
- Utilities
Woodside Estate: Vision
Woodside Estate: Vision

Creating a sustainable community

- Live, Play, Work & Grow
- Reduce, Reuse, Recycle & Recover
- Enhance the existing
- Improved Energy performance

“This options appraisal explores the ambitions of people living in Woodside for their homes and their future. They want to transform their area from a post-industrial corridor between the city centre and the north to a desirable, high quality, vibrant and sustainable local community that draws people in and makes them want to stay.”

Shona Stephen
Chief Executive
Queens Cross Housing Association
So why Passivhaus again?

- Compared to alternative solutions including available grant funding (Feed in Tariff, Renewable Heat Incentive etc.) It is the most financially viable.

- A fabric first approach ensured the main capital investment works are future proofed.

- We are improving the fabric anyway so why not make it count?

- Standards demand quality from holistic detail design consideration to onsite implementation. Funding often considers packages in isolation.

- There is no point in putting lots of renewable energy into a building that leaks energy like a sieve.

- There is no point in putting high quality thermal components into a building if the value is being lost through the junctions/ interfaces.

So how do we do it?
Passivehouse Principles: Perception vs Reality

- **Form Factor** (Wow!)
- **MVHR** (client concern)
- **Airtightness** (surprisingly good already)
- **Loads of Insulation** (only 120/160mm rockwool actually)
- **Minimise Thermal Bridges** (okay but some will be costly)
- **Orientation** (predetermined but consider solar gain)

Excellent Form Factor!
Specification: MVHR - what are the issues.

3. Flat, Occupants and Ventilation

- Concerns over capital cost – unit/ ducting/ infrastructure
- Concerns over gaining access for maintenance
- Concerns over filter costs and replacement interval
- Why can’t we use industry standard?
- What’s to stop Tenant switching it off?
- Why is it needed?
- What’s wrong with flat duct?
- Why, Why, Why?
- Why do we need silencers?
- Why do we need preheaters?

And so begins the insightful journey!
Specification: MVHR options

- Centralised MVHR not practical for distribution
- Operating range for conventional MVHR too high for small apartments
- What are the alternatives?
Specification: MVHR - alternatives

fresh-r®
Specification: MVHR

Heat transfer coefficient is >1000x better than polyethylene

= Much more compact unit
Specification: MVHR

- Wi-fi enabled
  Potential to signal Housing association is there was an issue and to monitor remotely
- Demand controlled – Humidity/ CO2
  Does not require tenant interaction but simple controls available for temporary boost
- Heat exchanger/ Primary filter can be washed instead of replaced
  Saving of £100k over 10 years on this project compared to replacing filters on 6 month basis
- Additional filters optional
- Reduced infrastructure cost
  Less coring for ducts, bulkhead, decoration
- Small enough to be integrated into window frame
Specification: Testing
Specification: Results

one single fresh-r® can ventilate up to 80m²
maximum duct length 10 meter, Ø125 mm

easy to plan
Specification: Result
Passivehouse EnerPHit Standard – PHPP V8

- Mitigate Fuel poverty
- Provide base heating and hot water load FOC
- Significantly reduce landlord running costs
- Improved Indoor Air Quality
- Improved Amenity

- Additional Insulation
- Triple glazing
- Solar thermal
- Mitigate thermal bridges
- Airsource heat pump – required to meet PE target?
- Improve Air Tightness
- Recover heat from ventilation systems – Conventional PH certified
- New lifts
- Change communal lighting to LED
Woodside: Value Engineering

Passivehouse EnerPHit Standard – PHPP V8

- Mitigate Fuel poverty
- Provide base heating and hot water load FOC
- Significantly reduce landlord running costs
- Improved Indoor Air Quality
- Improved Amenity

- Additional Insulation
- Triple glazing – PH certified? Contractors choice
- Solar thermal – Not necessarily a bad thing to omit
- Mitigate thermal bridges – Fire escape balcony affected
- Airsource heat pump – required to meet PE target?
- Improve Air Tightness
- Recover heat from ventilation systems – Conventional PH certified
- New lifts
- Change communal lighting to LED

Requirement to meet EnerPHit certification omitted but Passivehouse standards and assessment to be maintained!
Value Engineering: Thermal Bridges
Woodside: Entrances
Woodside: Entrances
Woodside: Aerial View
Woodside: Existing Photos
Woodside: Site Progress

Airtightness Target

Targeted Equivalent Leakage area per flat
0.6 ACH

Existing Equivalent Leakage Area per Apartment
approx. 5.2 ACH

Air Leakage areas per Apartment
Woodside: Progress

Airtightness interface
Woodside: Progress

Airtightness jointing – Precast panels
Woodside: Progress

- Thermal Break connection plates
So where are we?

Nearer than we thought due to PHPP V9 and PER value!

<table>
<thead>
<tr>
<th>Specific building characteristics with reference to the treated floor area</th>
<th>Criteria</th>
<th>Alternative criteria</th>
<th>Fullfilled?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated floor area m²</td>
<td>8180.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating demand kWh/(m²a)</td>
<td>17</td>
<td>≤ 30</td>
<td>yes</td>
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<tr>
<td>Heating load W/m²</td>
<td>13</td>
<td>≤</td>
<td></td>
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<tr>
<td>Space cooling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling &amp; dehum. demand kWh/(m²a)</td>
<td>-</td>
<td>≤</td>
<td></td>
</tr>
<tr>
<td>Cooling load W/m²</td>
<td>-</td>
<td>≤</td>
<td></td>
</tr>
<tr>
<td>Frequency of overheating (&gt; 25 °C) %</td>
<td>0</td>
<td>≤ 10</td>
<td>yes</td>
</tr>
<tr>
<td>Frequency excessively high humidity (&gt; 12 g/kg) %</td>
<td>0</td>
<td>≤ 20</td>
<td>yes</td>
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<tr>
<td>Airtightness</td>
<td></td>
<td></td>
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<tr>
<td>Pressurization test result n₅₀ 1/h</td>
<td>1.0</td>
<td>≤ 1.0</td>
<td>yes</td>
</tr>
<tr>
<td>Non-renewable Primary Energy (PE)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>PE demand kWh/(m²a)</td>
<td>139</td>
<td>≤</td>
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</tr>
<tr>
<td>Primary Energy Renewable (PER)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generation of renewable energy (in relation to projected building) kWh/(m²a)</td>
<td>69</td>
<td>≥ 75</td>
<td>yes</td>
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<tr>
<td></td>
<td></td>
<td>75</td>
<td></td>
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</tbody>
</table>

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

1-Designer: Rupert Daly
Issued on: City: PHI Low Energy Building? yes

But still not quite EnerPHit yet!
Woodside: Specification compromise

### Storage heat losses

<table>
<thead>
<tr>
<th>Selection of storage tank</th>
<th>Storage 1</th>
<th>Storage 2</th>
<th>Buffer storage tank (only heating)</th>
<th>Compact unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage necessary for HP</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Solar DHW connection</td>
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<td></td>
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<tr>
<td>Heat loss rate W/kW</td>
<td>187.0</td>
<td>3.0</td>
<td>2.0</td>
<td></td>
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<tr>
<td>Storage volume kW/ton</td>
<td>18568</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standby fraction W/kW</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location of storage tank, inside or outside of thermal envelope</td>
<td>1-Inside</td>
<td>1-Inside</td>
<td>2-Outside</td>
<td></td>
</tr>
<tr>
<td>Temperature of mechanical room °C</td>
<td>26.0</td>
<td>26.0</td>
<td>26.0</td>
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</tr>
<tr>
<td>Typical storage tank temperature °C</td>
<td>55.0</td>
<td>55.0</td>
<td>55.0</td>
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<tr>
<td>Manual entry of storage temperature °C</td>
<td>55.0</td>
<td>55.0</td>
<td>55.0</td>
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<tr>
<td>Average standby heat losses storage tank kW</td>
<td>0.945</td>
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<tr>
<td>Additional heat losses storage tank, solar operation kW</td>
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<tr>
<td>Possible utilisation factor of heat losses</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Annual heat losses DHW storage tank kWh</td>
<td>57334</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### Auxiliary calculation - heat losses through storage tank according to EU efficiency classes

<table>
<thead>
<tr>
<th>Storage volume kWh</th>
<th>EER class</th>
<th>Maximum permissible standby heat loss</th>
<th>Heat loss ratio for PhPP calculation</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Too much!
Woodside: **Storage Loss option offset**

- Externally insulate poor performing HW Cylinder – Under consideration
- Reduce size of HW tanks – Under consideration
- Omit tanks altogether – Not in tenants best interest as benefit to off peak tariffs
- Consider waste water heat recovery such as Recoup Pipe+ HE (PH Certified) Maybe next time
- Look at alternative storage options such as SunAMP Phase change material. Maybe next time

Sunamp heat batteries-0.579kWh storage losses per 24hrs
Woodside: Lessons Learned to date

- **Form Factor** – Makes a huge difference to energy performance and cost.
- **Innovation** – Great, but barriers due to perceived risk. Keep it simple.
- **Challenge of refurbishment** - Degree of cost uncertainty and flexibility but overall very suitable for upgrade.
- **Research** – Critical to exploring options. Ask lots of questions.......all the time!
- **Procurement** – Design and Build – Opportunities to work as a team with Contractor and Client to provide effective solutions on a restrictive budget.
- **Large Scale Passive House Refurb** – On this project the challenge is more to do with M&E integration to the existing building than the building envelope.
- **Cost Effective** – Project cost to be confirmed but additional cost to PH standards are likely to be low.
Thank you for your time!

Rupert Daly

r.daly@collectivearchitecture.co.uk