CPD Introduction
Introducing Glen Dimplex

Glen Dimplex is a leading international industrial group, with over 30 businesses and ten thousand employees around the world.

We offer an unrivalled range of low carbon heating, cooling and ventilation products, as well as an extensive portfolio of brands in the cooking, cleaning, refrigeration and entertainment sectors.
Glen Dimplex in Europe

- Founded 1973 – We are now the world’s largest electric heating manufacturer
- We hold significant positions in the domestic appliance markets, with an annual turnover of €2bn
- We are privately owned, and finance expansion from our own resources
- This has included years of consistent investment in renewable technologies
Glen Dimplex in the U.K

In the UK we deliver innovative solutions for domestic, industrial and commercial heating and air movement.

In the professional world, we have the solution portfolio and market understanding to support major developments and projects, many of which provide the examples that support today’s CPD presentation.
We manufacture many of the best known brands in the heating, cooling, ventilation and air conditioning sectors:
How heat pumps can help your project to pass Planning and Building Regulations
Learning Outcomes

- Understand current planning and building regulations
- Understand the software used to meet these regulations
- Ability to specify heat pumps to help meet these requirements
Contents

Drivers
- Planning requirements & Building Regulations
- BREEAM
- SBEM

Legislation

Incentives
- Non-domestic RHI
- Enhanced capital allowances
- Low running costs

Financial Incentives
What is a Heat Pump?

Heat Pump - *Noun* (Google)
“A device that transfers heat from a colder area to a hotter area by using mechanical energy, as in a refrigerator.”

Five key refrigeration components make up a vapour compression cycle.

- Refrigerant
- Evaporator – energy collector
- Compressor – increases pressure
- Condenser – energy delivery
- Expansion valve – reduces pressure
An air source heat pump system comprises of three elements:

1. A fan which draws air over the heat pump evaporator.
2. An air to water heat pump, which raises the heat from the evaporator to a higher temperature.
3. A heat distribution system which provides this heat to the property.
A ground source heat pump system comprises of three elements:

1. A ground heat exchanger which collects energy from the ground.
2. A “brine” to water heat pump, which raises the heat from the ground collector to a higher temperature.
3. A heat distribution system which provides this heat to the property.
Heat Pump Performance

**COP**

Coefficient of Performance (% or ratio)

\[
COP = \frac{\text{Heat Produced}}{\text{Electric Consumed}}
\]

\[= \frac{\text{Total useful energy transferred}}{\text{Total energy consumed}^*}\]

*Total energy consumed = compressor + fans + pumps + aux heaters + controls

Applicable Standards BS EN 14511

**SPF/SCOP**

Seasonal Performance Factor (or Seasonal Efficiencies)

\[
SPF/SCOP = \frac{\text{Total heat produced}}{\text{Total electric consumed}}
\]

\[= \frac{\text{Total useful energy transferred}}{\text{Total energy consumed}^*}\]

*Total energy consumed = compressor + fans + pumps + aux heaters + controls

Applicable Standards BS EN 15450 (Design), BSEN 15316 (Calculations), BSEN 14825
BSEN14825 – Seasonal Performance

• BSEN calculates SCOP for heat pumps.

• 14825 mandates part load test data points for heat pumps. Therefore specific by product.

• 14825 also specifies a calculation methodology to estimate the performance of the heat pump under three climate zones.

• 14825 calculates an SCOP specific to your building.

• Contact your manufacturer.
Energy Collection

Heat flow density from the earth’s core is approx. 0.1 W/m².

Solar energy is transferred to the ground via radiation and latent / sensible heat within rainfall. This energy can then be extracted using different types of collector to transfer the energy to a heat pump system.

• Temperature range of the ground surface at 1m deep, approximately +3°C to +17°C
• Temperature range in deep layers, approximately +8°C to +12°C
• Operating range of brine to water heat pump -5°C to +25°C

As the heat is extracted, the ground temperature will drop, therefore it must be ensured when designing your system that the brine outlet temperature does not fall below 0°C.

Extraction rates will depend upon the ground type, moisture levels and ground water flow – consult British Geological Survey for more details.

Not All Heat Pumps are Equal

Specifying the most efficient product possible is important, as this will maximise the carbon efficiency of the building.

• Monobloc units have higher COP
• Some manufacturers sacrifice COP for KW output
• Inverter products sacrifice COP for kW for variable kW output
• Inverter products cannot be optimised for noise due to the wide range of compressor operating frequencies
# Impact of SCOP on Running Cost and Carbon

Examples assume 10000kWh of heat produced
Eg 10000/SCOP * Electrical Tariff

<table>
<thead>
<tr>
<th></th>
<th>SCOP 3</th>
<th>SCOP 3.5</th>
<th>SCOP 4</th>
<th>SCOP 4.5</th>
<th>Gas (4p per kWh, 90% efficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running Cost (10p per electric) per kWh heat</td>
<td>£333</td>
<td>£285</td>
<td>£250</td>
<td>£222</td>
<td>£444</td>
</tr>
<tr>
<td>Carbon per kWh heat</td>
<td>1726</td>
<td>1479</td>
<td>1295</td>
<td>1150</td>
<td>2399</td>
</tr>
<tr>
<td>Current Regs 0.518 kg/co2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Carbon per kWh heat</td>
<td>1333</td>
<td>1142</td>
<td>1000</td>
<td>888</td>
<td>2399</td>
</tr>
<tr>
<td>Future Regs 0.4 kg/co2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*% carbon reduction over gas</td>
<td>42%</td>
<td>53%</td>
<td>59%</td>
<td>63%</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Future Carbon proposed by SAP 2016 consultation
Planning Regulations – Local Considerations

• National planning review requires local authorities to have a local plan.

• Typical improvements required by some authorities:
  • BREEAM excellent
  • 20% carbon reduction over Part L
  • 10% renewables contribution

• Met using calculation software such as SBEM, SAP or ENE.

• GLA London Plan requires 35% lower carbon than Part L.
Building Regulations – Part L

- Affects all new buildings.
- Calculates carbon for your building.
- Compliance demonstrated via SBEM for Non-Dom.
- Compliance demonstrated via SAP for Dom.

Consideration of high-efficiency alternative systems for new buildings

25A. (1) Before construction of a new building starts, the person who is to carry out the work must analyse and take into account the technical, environmental and economic feasibility of using high-efficiency alternative systems (such as the following systems) in construction, if available-
(a) Decentralised energy supply systems based on energy from renewable sources;
(b) Cogeneration;
(c) District or block heating or cooling, particularly where it is based entirely or partially on energy from renewable sources;
(d) Heat pumps.
The National Calculation Method (NCM) is required to meet Part L non domestic regulations.

- Calculates the TER and BER.
- SBEM developed by Department for Communities and local government.
- Demonstrates building regulation compliance rather than a design tool.
- Numerous dynamic simulation models to support the design process.
- Typical programmes used include IES, Design Builder.
iSBEM Screenshots

Entering the SCOP

Outputs BER and TER
BREEAM

• Assessment method used to rate for buildings.
• Considered best practice for sustainable design.
• Typically covers schools, healthcare buildings, offices, industrial units and more.
• Points/credits awarded for a range of categories:
  - Energy, waste, materials, water consumption, pollution, health and wellbeing, transport, etc.
• CO₂ savings also an important factor in achieving high BREEAM scores for projects with sustainability targets.
## BREEAM Drivers

<table>
<thead>
<tr>
<th>BREEAM Rating</th>
<th>Requirements</th>
<th>Typical Clients</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Excellent</strong></td>
<td>• Requirements by some clients&lt;br&gt;• Typically universities or prestigious developers&lt;br&gt;• Requirements of some planning applications&lt;br&gt;• Requirements for new public sector buildings and refurbishments</td>
<td></td>
</tr>
<tr>
<td>• Local authority depending upon the local plan&lt;br&gt;• New government buildings&lt;br&gt;• Department of health new build&lt;br&gt;• DEFRA for new build</td>
<td></td>
<td></td>
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<tr>
<td><strong>Very Good</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Local authority depending upon the local plan&lt;br&gt;• Government refurbishment&lt;br&gt;• Homes and communities agency (English partnerships)&lt;br&gt;• Department of education projects over £2m&lt;br&gt;• Department of health refurbishment&lt;br&gt;• DEFRA refurbishments</td>
<td></td>
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</table>
Heat Pumps and BREEAM

- Heat pumps influence the energy category.
- Energy efficiency is demonstrated by SBEM.
- Heat pumps can be monitored via a building management system (BMS).
- Heat pumps passive cooling space achieves low and zero carbon (LZC) credits.
- Credits for just considering the feasibility of heat pumps in the design.
- Innovation credits can be achieved using heat recovery with heat pumps.
- Passive cooling from GSHP collectors.

**BREEAM credits**

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Management</td>
<td>23</td>
</tr>
<tr>
<td>Health and Wellbeing</td>
<td>14</td>
</tr>
<tr>
<td>Energy</td>
<td></td>
</tr>
<tr>
<td>Energy efficiency – 12</td>
<td></td>
</tr>
<tr>
<td>Energy monitoring – 1</td>
<td></td>
</tr>
<tr>
<td>External lighting – 1</td>
<td></td>
</tr>
<tr>
<td>Low and zero carbon tech – 3</td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>6</td>
</tr>
<tr>
<td>Water</td>
<td>9</td>
</tr>
<tr>
<td>Materials</td>
<td>11</td>
</tr>
<tr>
<td>Waste</td>
<td>5</td>
</tr>
<tr>
<td>Land Use and Ecology</td>
<td>10</td>
</tr>
<tr>
<td>Pollution</td>
<td>14</td>
</tr>
<tr>
<td>Innovation</td>
<td>10</td>
</tr>
</tbody>
</table>
Summary Slide and Key Lessons

- SCOP should be calculated to 14825 by manufacturer, always better than default
- Heat pumps can gain you BREEAM credits (Energy and innovation)
- Heat pumps have more impact in buildings, which have a higher proportion of heating and hot water load
- Manufacturer SCOP’s will vary, some are better than others
- Heat pumps offer lower running costs than gas
- Heat pumps offer lower carbon than gas, lowering by an additional 23% in the next regulation edition
- Heat pump SCOP has an impact on running cost
- Heat pumps attract RHI funding
Heat Pump Case Studies

Bishops Wood Community Centre and Substation
SI100TE, 100kW GSHP
System uses only waste heat from a transformer
Heating the substation offices and a local community centre
Replacement for an existing electrical heating system

Durham University – Business School Extension
SI75TE 75kW GSHP
System uses a series of boreholes
3 x UFH circuits providing heating to the space
Funding Support: Renewable Heat Incentive

- Government scheme aimed at incentivising take up of renewable heat technologies.
- Important that Metering must be included in all heat pump specifications in order to claim RHI.

<table>
<thead>
<tr>
<th></th>
<th>Air Source</th>
<th>Ground Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial property</td>
<td>100kW</td>
<td>100kW</td>
</tr>
<tr>
<td>Space heating demand</td>
<td>200,000kWh/yr</td>
<td>200,000kWh/yr</td>
</tr>
<tr>
<td>Heat pump SCOP</td>
<td>3.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Annual running costs for HP system (10p/kWh)</td>
<td>£5,714</td>
<td>£5,000</td>
</tr>
<tr>
<td>RHI tariff</td>
<td>2.54p/kWh for 20 years</td>
<td>*7.8p/kWh for 20 years</td>
</tr>
<tr>
<td>RHI income</td>
<td>£5,080 / year</td>
<td>£15,600</td>
</tr>
</tbody>
</table>

* Average Rate, actual rate tiered based on operational hours
What are building services engineers?

• Building services engineers are responsible for ensuring the cost-effective, environmentally sound, sustainable design and maintenance of energy-using elements in buildings. As such, they are essential to the Government's aim in reducing carbon emissions. Working closely with architects and other engineers, they help develop exciting sustainable buildings, and in doing so make them more energy efficient, more able to make the most effective use of our dwindling natural resources and better able to protect public safety.

• Andrew Marsh-Patrick, WSP Associate Director, said: “The business case is compelling. Costs are coming down fast and, using real-life data, we have shown that over a lifetime, heat pumps are now 25% cheaper than the conventional gas boilers and chillers used to heat/cool commercial buildings.”
Unbelievable 3
Thank you for your attention. Questions?