The Pathway to Net-Zero Carbon Buildings (NZCB)

Nick Jenkins
Kingspan Facades
The planet and humanity is at a critical point…

- Globally, by 2020 total annual greenhouse gas (GHG) emissions have reached a record 53.5 GtCO$_2$e$^1$.
- Under BAU, estimated total GHG emissions will reach 65 GtCO$_2$e in 2030$^1$.
- Requires pan-global political leadership to immediately implement mandatory regulatory measures.
- Kingspan’s EnvelopeFirst™, optimally insulated envelopes, facades and whole building measures can help to avoid 3.8 GtCO$_2$e emissions annually.

Annual global Green House Gas (GHG) emissions.
Sustainability in buildings is shifting to ‘Whole life’…

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>DESIGN &amp; CONSTRUCTION</th>
<th>IN USE</th>
<th>END OF LIFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>49%</td>
<td>42%</td>
<td>2-5x</td>
<td>70-80%</td>
</tr>
<tr>
<td>of all new construction emissions in the next 20 years will be embodied carbon.</td>
<td>operational energy of buildings is heating and cooling</td>
<td>reported performance gap between actual and predicted energy use.</td>
<td>of global construction industry waste is discarded to landfill, i.e. 30% of all global waste to landfill.</td>
</tr>
<tr>
<td>12% of materials used in EU construction in come from recycled (often downcycled) sources.</td>
<td>17% of all CO2 emitted by manufacture is from building materials.</td>
<td>1% increase in productivity in the last 20 years for construction, which is also very low on the digitalisation curve.</td>
<td>90% of our lives are spent indoors, indoor air quality and natural daylighting most important for health.</td>
</tr>
</tbody>
</table>

© Zak World of Façades London Conference
...and this creates a set of drivers for the built environment.

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>DESIGN &amp; CONSTRUCTION</th>
<th>IN USE</th>
<th>END OF LIFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Embodied Carbon</td>
<td>BIM Solutions</td>
<td>EnvelopeFirst – reducing Heating &amp; Cooling demand</td>
<td>Re-use</td>
</tr>
<tr>
<td>Long Life Materials</td>
<td>Transport</td>
<td>Digital Twin – monitoring and maintenance</td>
<td>Remanufacture</td>
</tr>
<tr>
<td>Reusable Building Products</td>
<td>Site Waste</td>
<td>Health &amp; Wellbeing – indoor air and daylighting</td>
<td>Refurbishment</td>
</tr>
<tr>
<td>Zero Waste Manufacturing</td>
<td>Off-site</td>
<td></td>
<td>Recycling</td>
</tr>
<tr>
<td>Zero Carbon Manufacturing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Conservation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recycled/Renewable Content</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recyclable Packaging</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take-back Schemes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The pathway to NZCBs.

The annual energy and emissions savings shown are based on integration and application of world class building envelope and facade insulation technologies.

3.8 Gt of CO₂e annual savings

- $570bn global annual cost savings
- 18,537 TWh of energy savings globally
- 8.8bn barrels of oil
- 1.6bn cars taken off the road
- 2.5m passenger jet flights around the world
- 1.6bn cars taken off the road
- 2.300 gas fired power stations annual output
- 680m UK homes
- 55x the UK’s heating and cooling energy consumption
- 280x London’s electricity consumption
- 20m Hectares of Amazon Rainforest (approx. size of UK)
- 3.8 Gt CO₂e expressed as cubes laid side by side is equivalent to...
  - 280,000,000 km
  - 6,400 times around the world
  - 330 return trips to the moon

2 Under standard ambient temperature and pressure T= 298.15 K = 25°C and 1.013 bar.
# Existing building stock – the major opportunity.

<table>
<thead>
<tr>
<th></th>
<th>BAU:</th>
<th>CURRENT POLICY:</th>
<th>2°C SCENARIO:</th>
<th>15°C SCENARIO:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2030</td>
<td>2030</td>
<td>2030</td>
<td>2030</td>
</tr>
<tr>
<td></td>
<td>53.5 GtCO₂e</td>
<td>59 GtCO₂e by 2030</td>
<td>40 GtCO₂e by 2030</td>
<td>24 GtCO₂e by 2030</td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.4 Gt</td>
<td>Agriculture and land use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.4 Gt</td>
<td>Transport and industrial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.7 Gt</td>
<td>Energy in Buildings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.7 Gt</td>
<td>Embodied Carbon</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Opportunity
- Energy efficiency heavily features in most cost effective emissions reduction pathways.
- Renovation is key.

### Risk
- Specific actions on buildings not included in the majority of country NDCs.
- With no mandatory building energy codes.

### Energy Efficiency
- The largest source of new energy over the next 30 years will be saved energy.

---

**Energy Efficiency is the first green fuel**

---

© Zak World of Façades London Conference
Renovate or replace?

Research suggests that the average embodied, operational-related and demolition-related CO₂ is responsible for 24%, 75% and 1%, respectively, of Life Cycle Carbon Footprint (LCCF).
Renovate or replace?

The UK building stock includes an estimated 28 million properties. These include approximately 22 million residential and 6 million non-residential buildings, which are responsible for around 26% and 18% of the UK’s total CO$_2$ emissions, respectively$^{[8,9]}$.

While around 75% of the UK housing stock that will exist in 2050 has already been built$^{[10]}$, much of the effort for improving energy efficiency is focused on new buildings, which only add around 1% to the UK building stock every year$^{[11]}$. 
Build to Design Performance.

- Robust compliance with regulations and codes; annexed documents; industry standards; related guidance; and, sector / project specific requirements are key to successful project outcomes.

- This should include transparent ‘Chain of Custody’ (Golden Rule) throughout design and specification; procurement; manufacture; construction; completion and handover; and in-use phases.

- An integrated project team approach adopting RIBA Plan of Work 2013 stages facilitates robust & compliant project delivery.
How it’s done: IKON, Kingscourt, Ireland
IKON, Kingscourt, Ireland

IKON is attempting 25 points in the Energy and Atmosphere category, 23 of which are tied to the building’s energy use and renewable generation.

- Optimize Energy Performance – 50% improvement in energy performance
- Renewable Energy Production – 10% renewable energy
- Green Power and Carbon Offsets – 100% of total energy use offset
How it’s done: Ten Square Hotel
How it’s done: Astellas Pharmaceuticals, Inc.
How it’s done: Goya, Belgium
How it’s done: Centennial College, Canada
It’s in our hands.

© Zak World of Façades London Conference

NickJ enkins
Kingspan Facades
e. nickJ enkins@kingspan.com