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Project Angel
TSB - Design for Future Climate: Adapting Buildings

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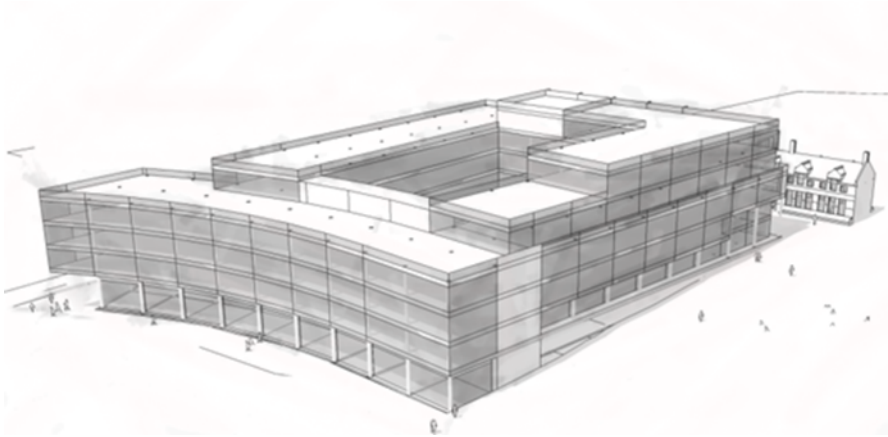
November 2012



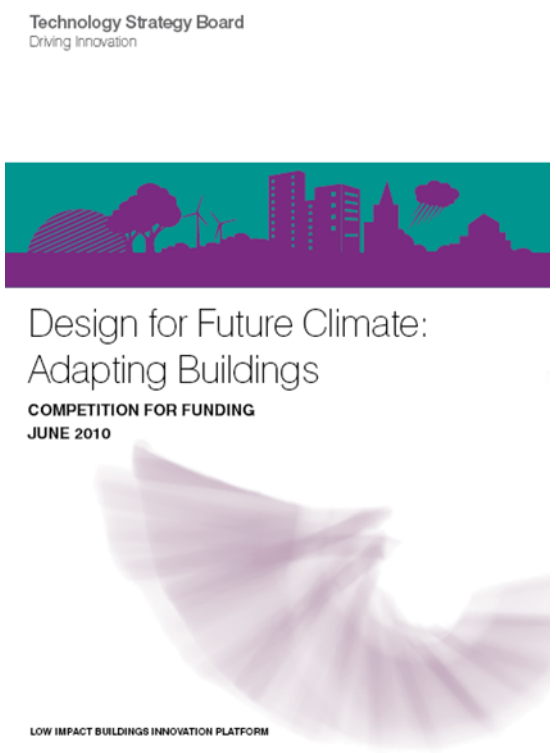
Mitigation Vs. Adaptation

Climate change mitigation: Designing buildings that reduce greenhouse gas emissions and the extent of future climate change.

Climate change adaptation: Designing buildings that can function as normal under future climate scenarios.

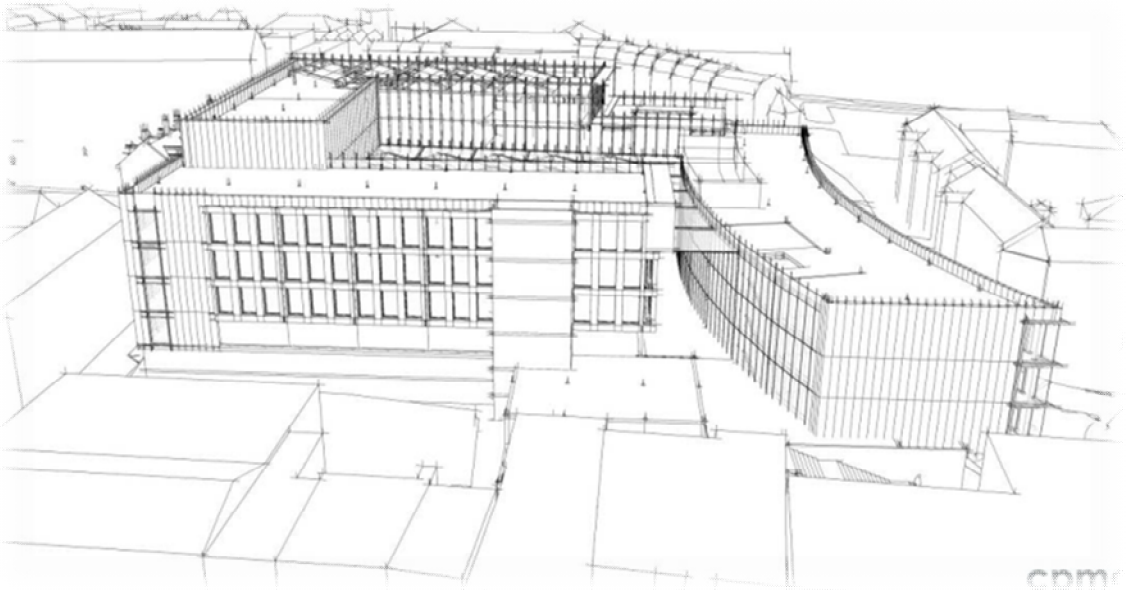
Technology Strategy Board Design for Future Climate: Adapting Buildings

- TSB has invested £5m for developing strategies for climate change adaptation.
  - Design strategies for robustness and adaptation to climate change.
  - Consider the lifetime of the building.
  - Overcome market failures in adapting building designs to the future climate.
  - Produce a wealth of knowledge to support industry.
  - Consider new and existing building stock.



Project Angel - Background

- Project Angel comprises:
  - Providing 10,000sq.m office space for private and public sector.
  - Low carbon and energy efficient.
  - Bringing to life an underused and unattractive area, located within the Northampton City Centre.
  - Creating a new public space as a gateway to the town centre.



Project Angel – Risk Assessment

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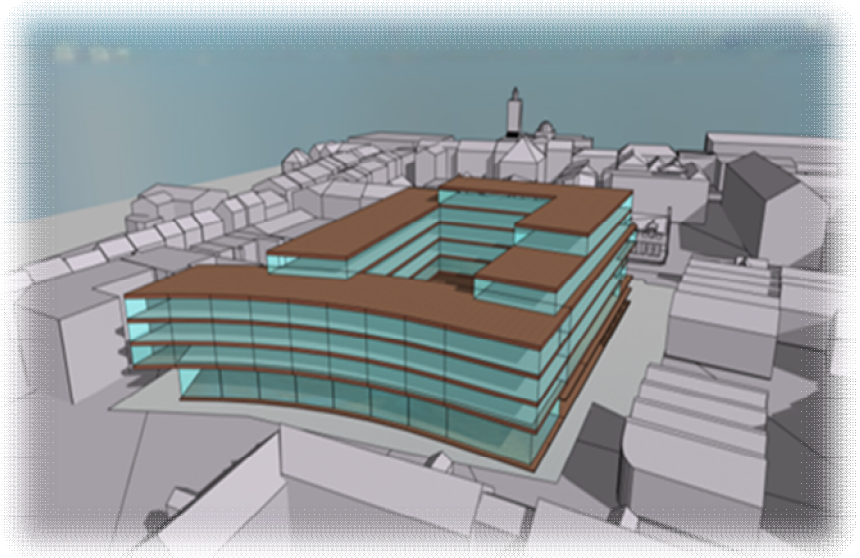
- Site specific risk assessment was carried out using UKCP09 climate predictions:
  - Future weather predictions produced by the Met Office.
  - High, Medium and Low emissions scenario.
  - 10%, 33%, 50%, 66%, and 90% probabilities.
  - Defined for 2030, 2050, 2080.

- Site is likely to be subject to:
  - Overheating: Increase between 1.5 & 6 ºC.
  - Water stress:
    - Summer rainfall to change by between 5% & -55%.
    - Winter rainfall to increase by between 5% & 60%.

Project Angel – Baseline Building

- Cooling: Chilled Beams.
- Heating: Gas fired Boilers.
- Ventilation: Mechanical/ minimum fresh air.
- 82.4% glazed external façade.
- No shading.
- G-value of glazing: 0.6
- No green roof.
- U-values:
  - External Walls: 0.2
  - Glazing: 0.65
  - Roof: 0.2
  - Ground floor: 0.2



Project Angel – Adaptation Options

- Design strategies investigated:
  - Reduce glazing.
  - Reduce G-value.
  - External Shading.
  - Green Roofs.
  - Phase Changing Materials.
- Each design strategy modelled for 1990's average, 2030, 2050 and 2080.
- Considered overheating (against BCO guidelines), energy consumption and carbon emissions.
- Costs, life cycle carbon and SWOT analysis of options.

Findings

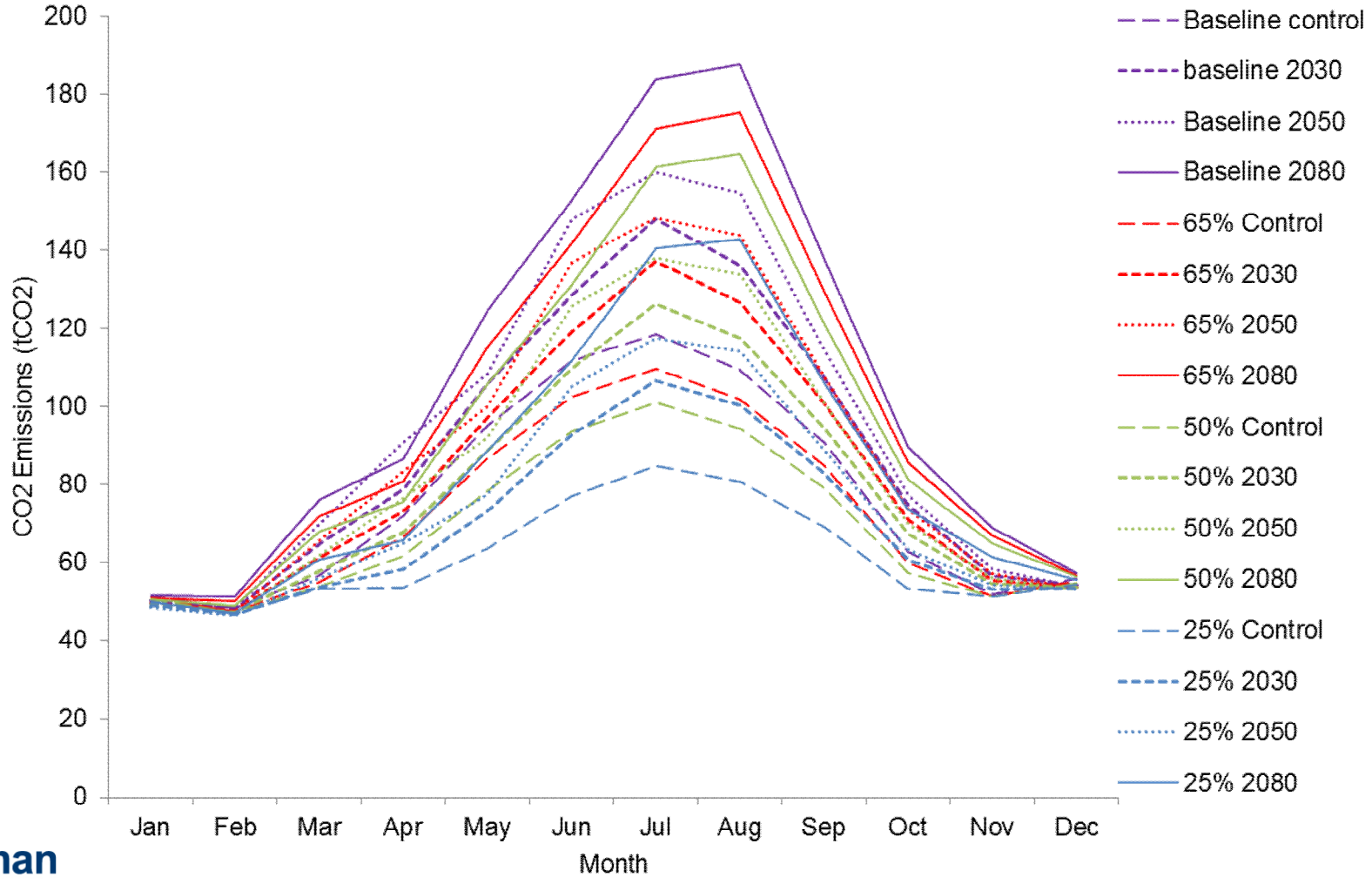
- Most effective climate change adaptations:
  - **Glazing %**
  - **G-value**

  Most significant reductions of incoming solar gains

- Horizontal shading significantly more effective than vertical shading:
  - Greater reduction in summer cooling demand and overheating.
  - Reduced increase in winter heating demand.
- Better methods required for modelling green roofs and Phase Changing Materials.

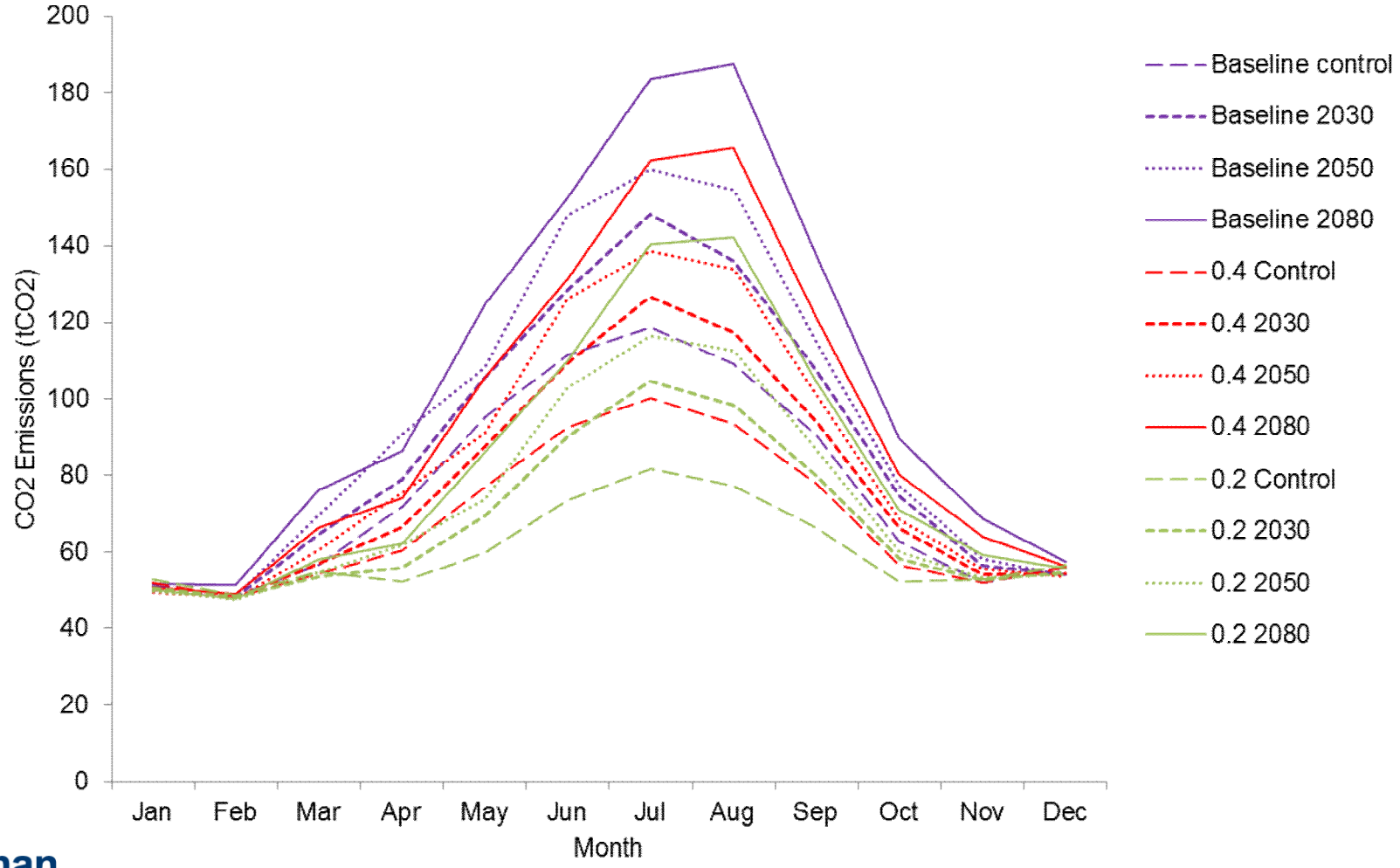
Findings – Glazing Percentage

- Reduced overheating - 50 & 25% glazed façade did not overheat in 2050 & 2080.
- Reduced cooling and heating loads as well as embodied carbon.



Findings – G-Value

- Reduced overheating in 2050 & 2080 – 0.2 G-value did not overheat in 2050 or 2080.
- Reduced cooling loads but increased heating loads.



Next Steps

- Refine adaptation strategy.
- Investigate the effects of the adaptation strategies on:
  - Internal daylight levels.
  - Artificial lighting demand.
  - Build and refurbishment costs.
- Investigate impact of findings on other commercial buildings.
- Develop climate change adaptation requirements with Northampton for use in future developments.