A Method for Evaluating Façade Performance for Thermal Comfort
Preliminary Findings

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Facade design – Thermal comfort

- Use of comfort model to influence facade design:
  - Sophisticated model → reduce complexity for industry
  - Distill yearly dynamics → performance indicator
  - Make efficient and effective use of comfort model
Thermal asymmetry

- Influence of thermal asymmetry on comfort
- Fully glazed facade
- Assumptions
  - No direct solar radiation
  - Uniform glass surface temperature
  - Interior surface temperature = interior air temperature
- Overall thermal comfort = \( f(\Delta T \text{ asymmetry}) \)
  \[ \Delta T = T_{\text{glass surface}} - T_{\text{interior air}} \]

Thermal asymmetry: \( T_{\text{in}} = 24^\circ \text{C} \) [0.6 clo, 1.2 met]
**Thermal asymmetry: $T_{in} = 22^\circ C$ [0.6 clo, 1.2 met]**

![Graph showing overall comfort and overall sensation vs. temperature on glass surface for $T_{in} = 22^\circ C$.]

**Thermal asymmetry: $T_{in} = 20^\circ C$ [0.6 clo, 1.2 met]**

![Graph showing overall comfort and overall sensation vs. temperature on glass surface for $T_{in} = 20^\circ C$.]
Smart control concept

- Harness potential for smart control
  - Sense facade surface temperature
  - Actuate interior air temperature
- Optimize thermal comfort and energy use

Smart control: $T_{\text{glass}} = 40^\circ\text{C}$ [0.6 clo, 1.2 met]

Graph showing overall comfort and overall sensation versus interior air temperature $\theta_{\text{air}}$ [°C].
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Smart control: \( T_{\text{glass}} = 30^\circ \text{C} \) [0.6 clo, 1.2 met]

Smart control: \( T_{\text{glass}} = 20^\circ \text{C} \) [0.6 clo, 1.2 met]
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Smart control: $T_{\text{glass}} = 10^\circ C$ [0.6 clo, 1.2 met]

![Graph showing overall comfort and overall sensation vs. interior air temperature $\theta_{\text{air}}$]