Attachment 10: Academic Research of Indoor Sources of Heat

The academic research on avoidance sources of indoor heat (that could exacerbate indoor temperatures) is limited. However, two recent studies investigated indoor temperatures and thermal comfort in residential settings and found that they are influenced by many variables. Due to the emerging nature of this academic field, the findings from these studies are only useful as preliminary considerations about what influences indoor heat. These specific studies identified the following indoor contributing factors to indoor temperatures:

- Efficacy of insulation
- Efficiency of appliances
- When appliances are used (e.g. time of day, whether there are multiple appliances being used at once)
- Types of lighting
- Building and furniture materials and the material's propensity to retain and radiate heat
- Window orientation
- Use of glazing/reflective blinds
- Use of active cooling (e.g. A/C)[1,2]

These studies suggested that the following strategies could help address elevated indoor temperatures in some cases:

- Optimizing ventilation (reduced indoor temperatures by up to 4°C in one study)
- Adopting electric cooking over gas cooking (resulted in 0.5°C lower temperatures in one study)[3]
- Installing sun-protective window films (reduced indoor temperatures by up to 3°C in one study)
- Upgrading kitchen building materials (e.g. counter tops, cabinets) to heat resistant options with low thermal conductivity (reduced indoor temperatures by 1.5°C in one study)
- Using natural daylight over artificial lighting during peak hours (reduced indoor heat accumulation by approximately 2°C in the study)[4]

Importantly, the above studies demonstrate that the best approach to reduce indoor temperatures (in the absence of active cooling) is highly dependent on the factors listed above (insulation, efficiency of appliances, types of lighting, building and furniture materials, window orientation etc.). Other general factors play a role, including the layout, location and size of the residential property, the occupant's lifestyle and behavioural choices, and how many people live in a residential unit. The optimal

[1] Sayad, Bouthaina & Osra, Oumr & Qattan, Wajdy. (2025). *Optimizing energy and thermal comfort in residential kitchens: an on-site investigation using thermal imaging.* Journal of Asian Architecture and Building Engineering.
[2] Li, Jiajun et al. (2024). *Cooking-related thermal comfort and carbon emissions assessment: Comparison between electric and gas cooking in air-conditioned kitchens.* Building and Environment.
[3] Li et al. (2024).
[4] Sayad, Osra, & Qattan (2025).

strategy to reduce indoor temperature will be unique to each residential unit. The choice of strategy or strategies should also consider principles of circularity and sustainability (e.g., replacing inefficient appliances once they are at the end of their usable life instead of shortly after they are purchased).