The Kitchen Fridge: A Microcosm of Building Energy, Environment, and Efficiency

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Focusing on the Refrigerator Study

- System coverage achieved through model in combination with an AC meter and suite of climate sensors
- Refrigerator model allows exploration of ‘slack’ (e.g., increase set points, defer compressor/defrost cycles, etc.)
- Energy-saving tips: (1) keep fridge stocked instead of empty ($C_{air} < C_{food}$); (2) a stocked fridge can withstand higher set points; (3) let food cool before inserting in fridge (smaller $\Delta T$)
- Solid state is much less efficient than compressor refrigerator

Applications to the Building Ecosystem

- Building HVAC uses similar components to refrigerators – think “Building = Large Refrigerator”
- Coverage of HVAC system is a superposition of subsystems, monitored by well-placed electricity, gas, and climate sensors
- Building subsystems are easier to decompose than fridge (larger scale, more sense points, less perturbation by human activity)
- Refrigerator efficiency, driven by policy, still has room to improve. Building HVAC, with less strict policy, is less refined.