

Quantifying Demand Flexibility in Commercial Buildings: A Desktop Modeling Method

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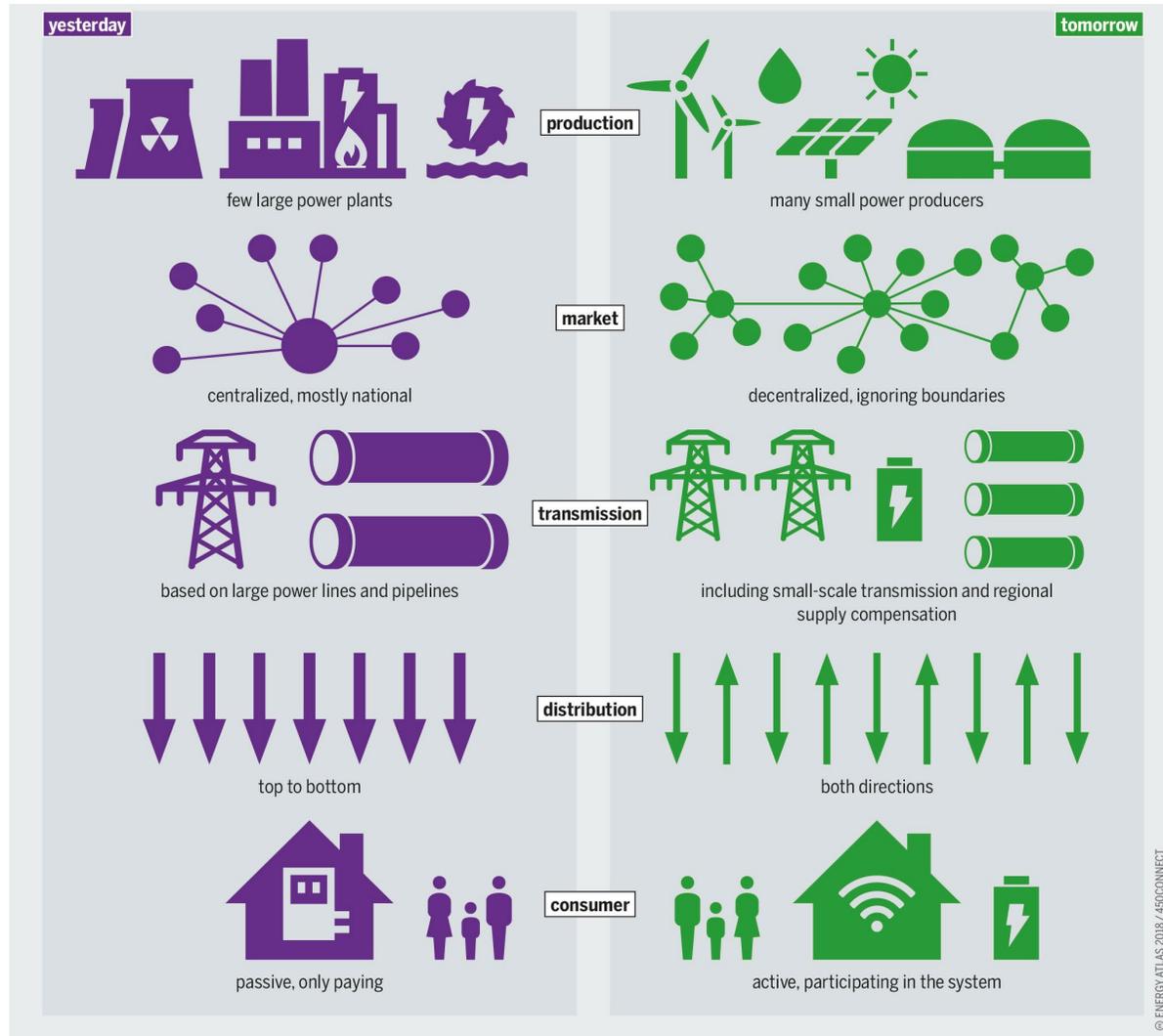


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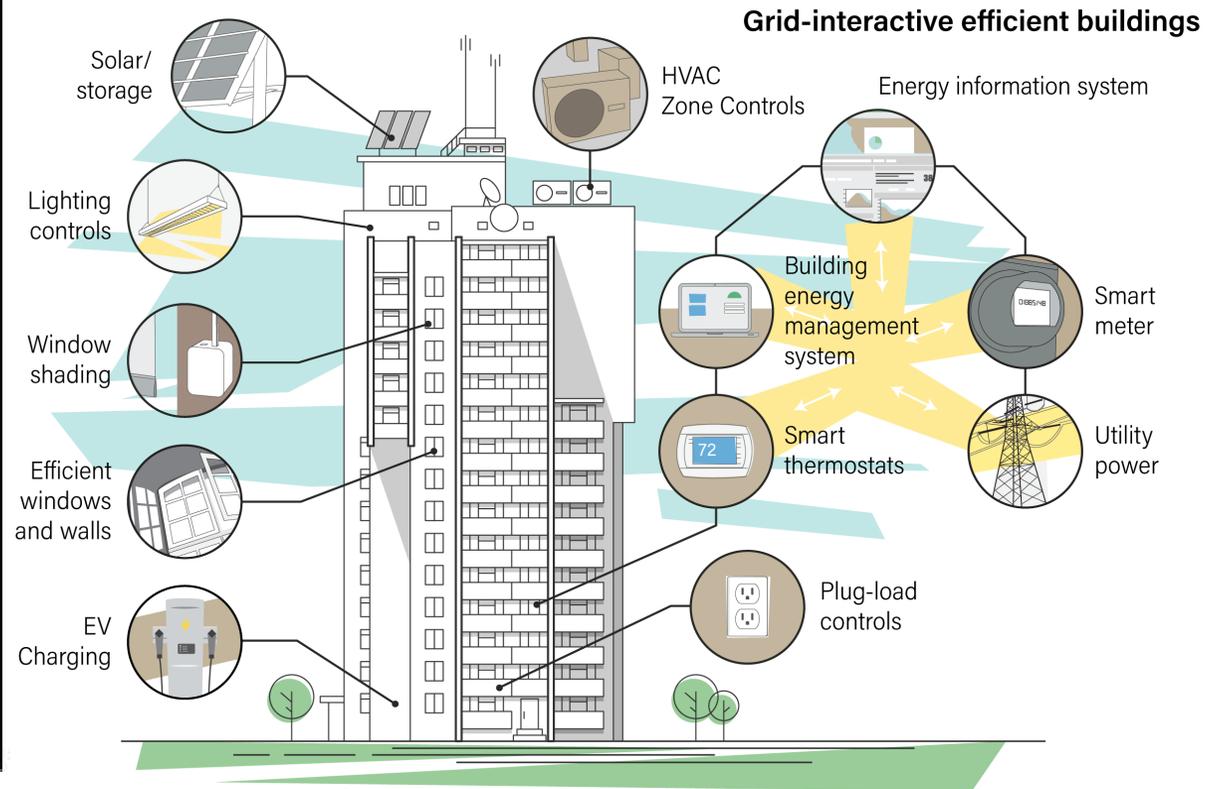
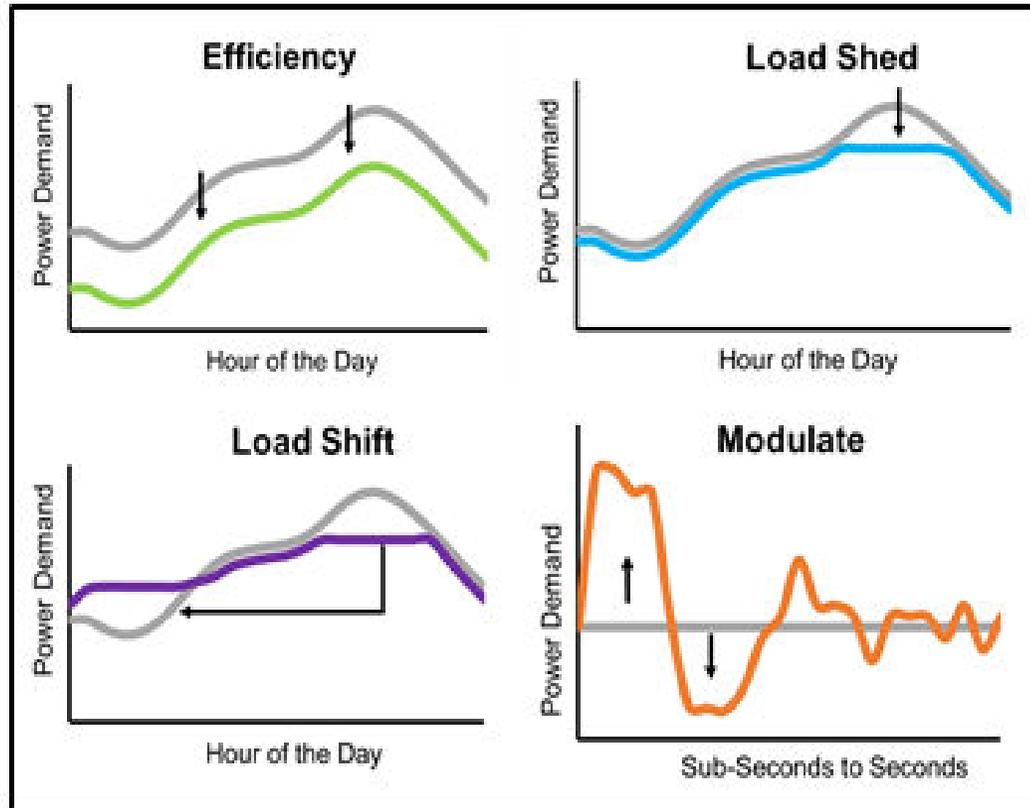


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An evolving grid needs consumers as active participants



The changing roles of buildings: from energy consumers to a grid resource

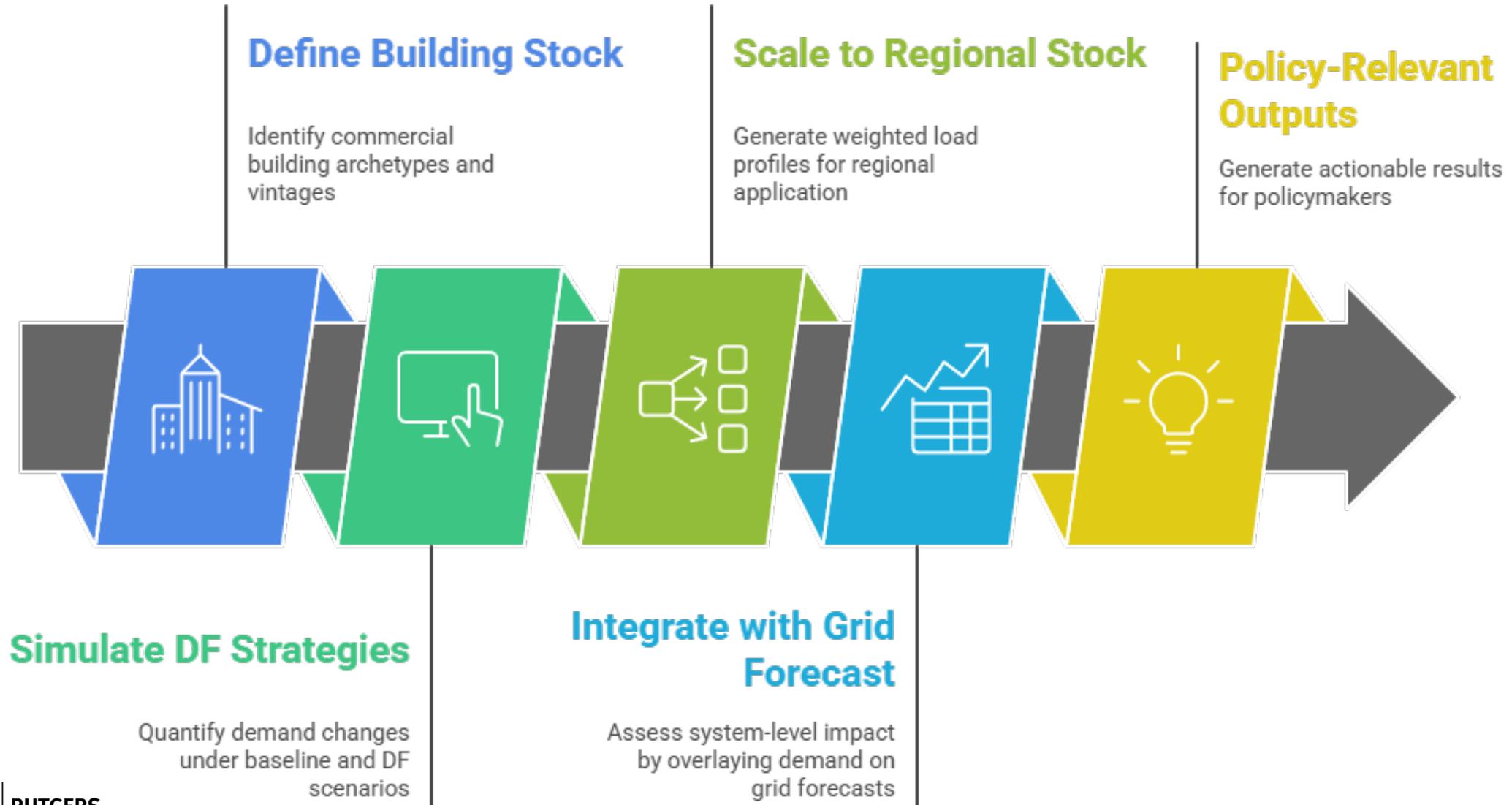


To design a tool that allows jurisdictions to quantify technical demand-flexibility (DF) potential at low-cost as a first filter before committing to more intensive field studies.

To provide a physics-based understanding of which building sectors and DF strategies show the highest savings.

Project aims

Methods and analytical framework

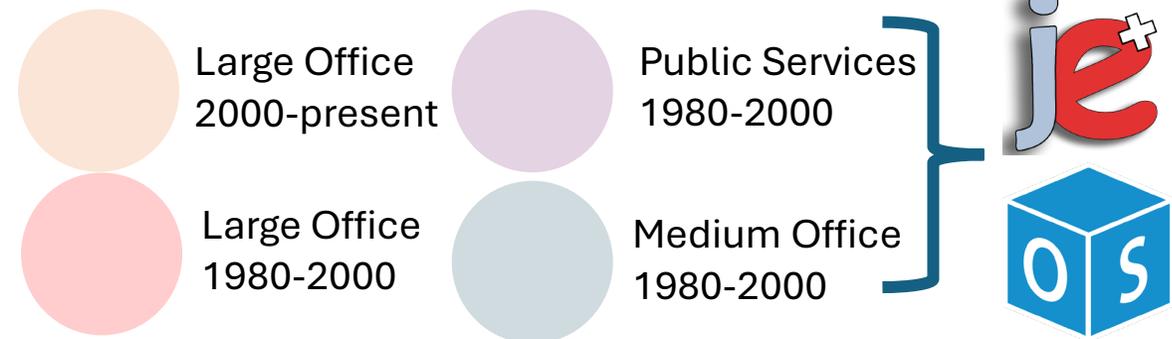


Step 1: Define commercial building stock

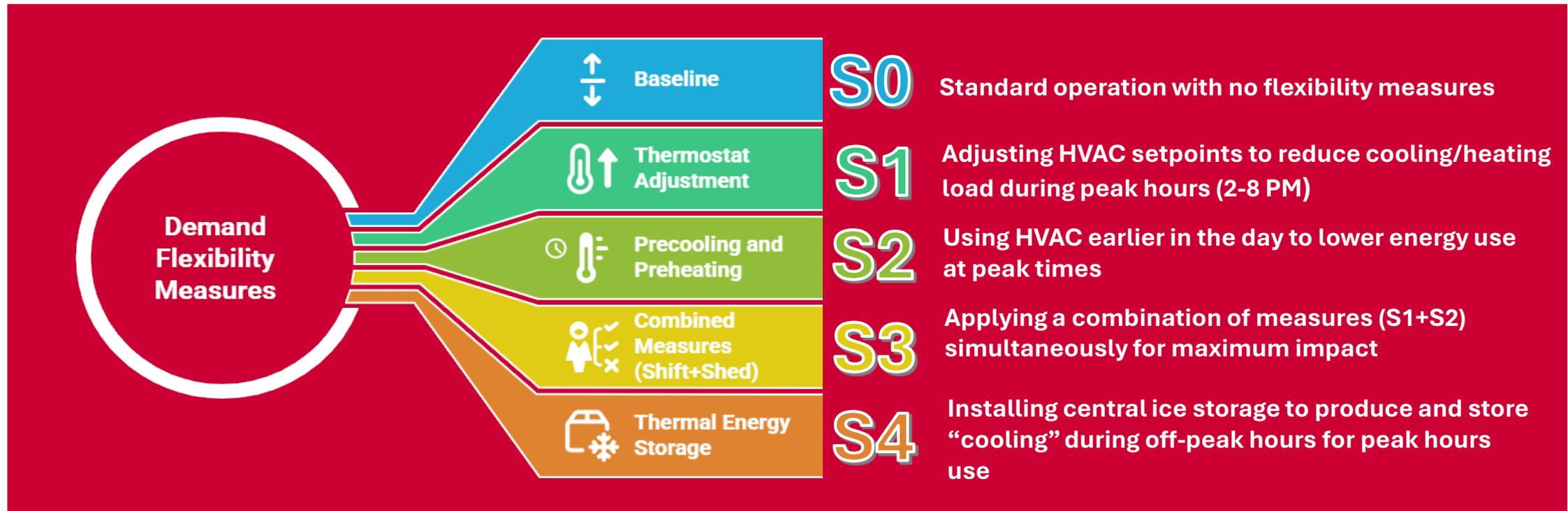
Identify the most prevalent and suitable building use types and building vintage combinations to understand the DF enabling technology of the building stock

Inputs:

- CBECS 2018 microdata
- ComStock building energy models (BEMs)



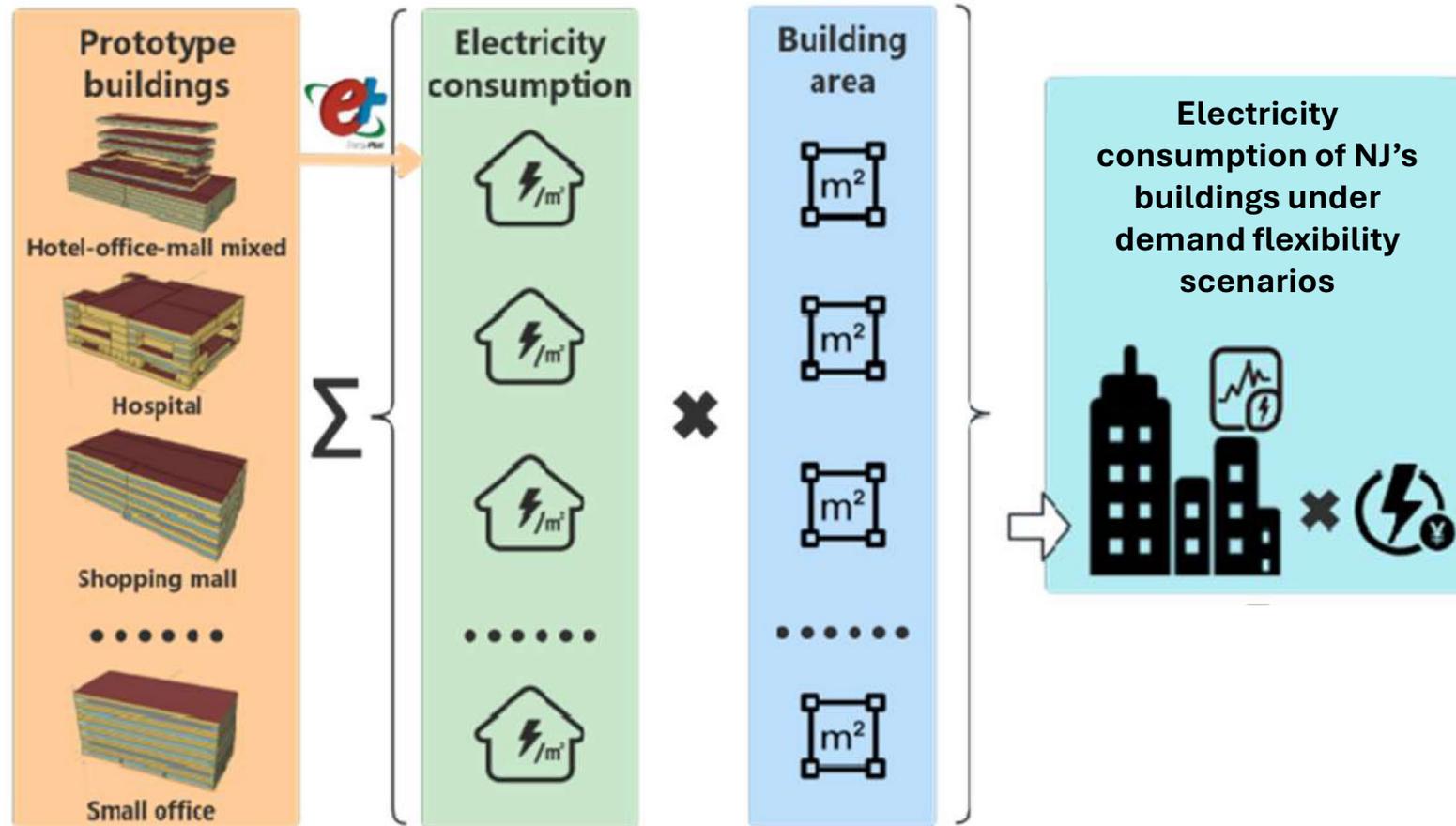
Step 2: Simulate demand flexibility strategies



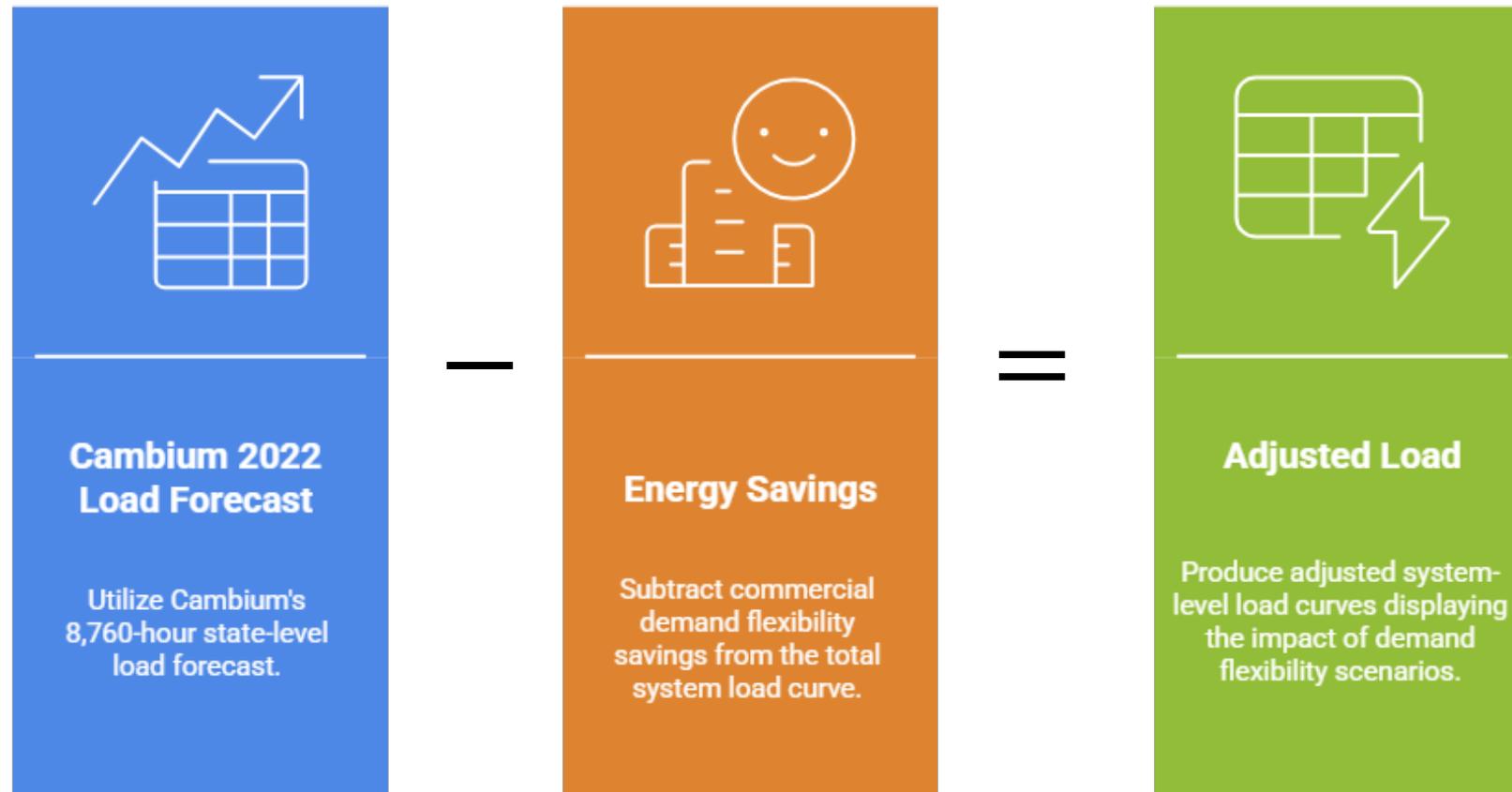
Input: Building energy model + TMY3 2018 weather file

Output: Hourly relative electricity savings by scenario, type, and code vintage.

Step 3: Scale simulated results to stock



Step 4: Integrate with grid forecast



Step 5: Policy-relevant outputs

Prioritization: Rank building type and DF strategy by peak load impact, automation capability.

Technology penetration: Report BAS and smart-thermostat adoption by segment to understand DF readiness.

IF: large offices show a high TES potential

THEN: run a baseline study on large office buildings & design an incentive for TES with target of 3% peak reduction

IF: Retail and Restaurants have low BAS but high smart-thermostat penetration

THEN: run a thermostat pilot and incentivize per-event DF load shed

Case Study:

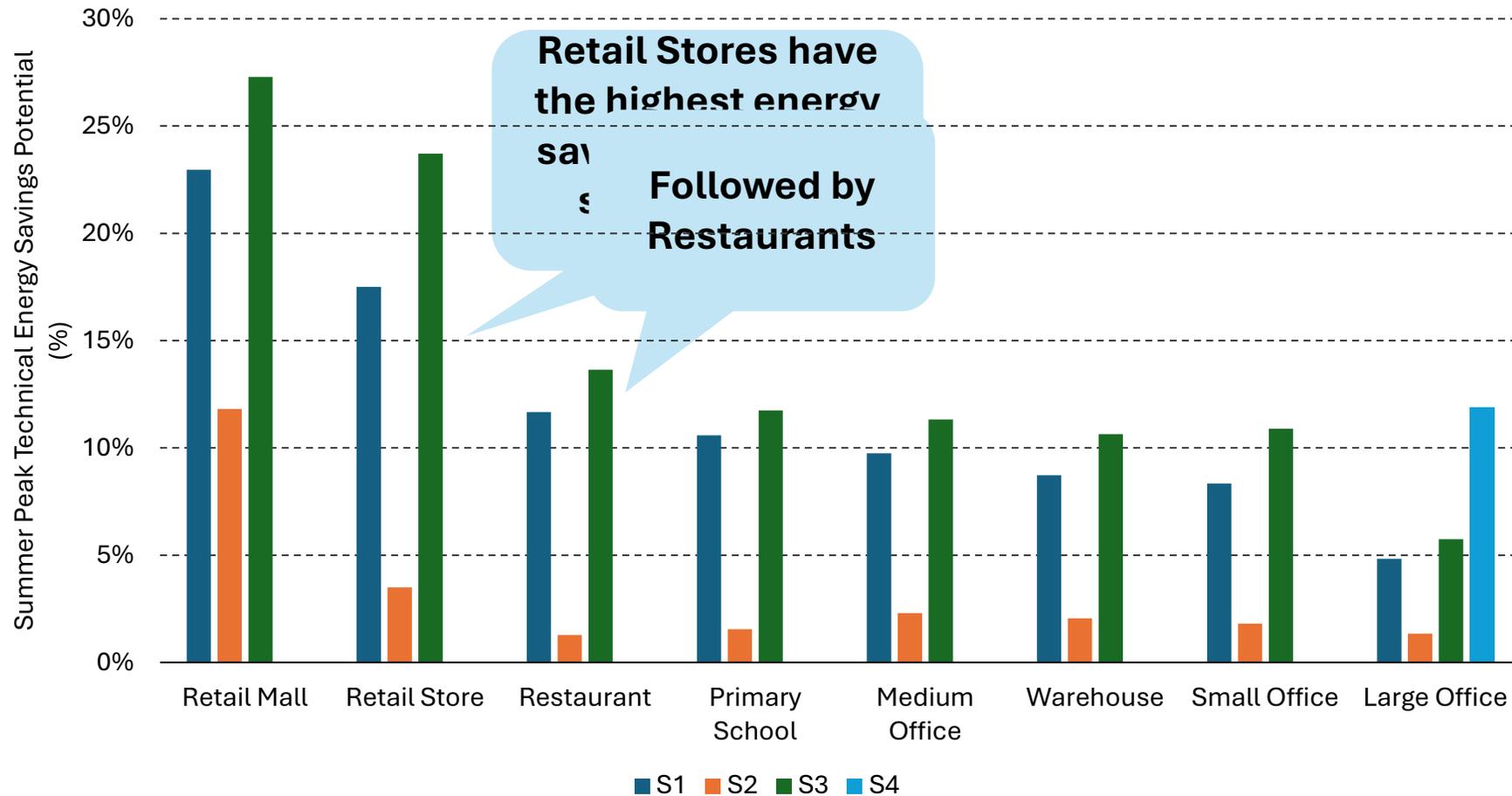
A Jurisdiction in the PJM Mid-Atlantic region

Concerns about rising electricity costs and grid reliability as clean energy transition progresses

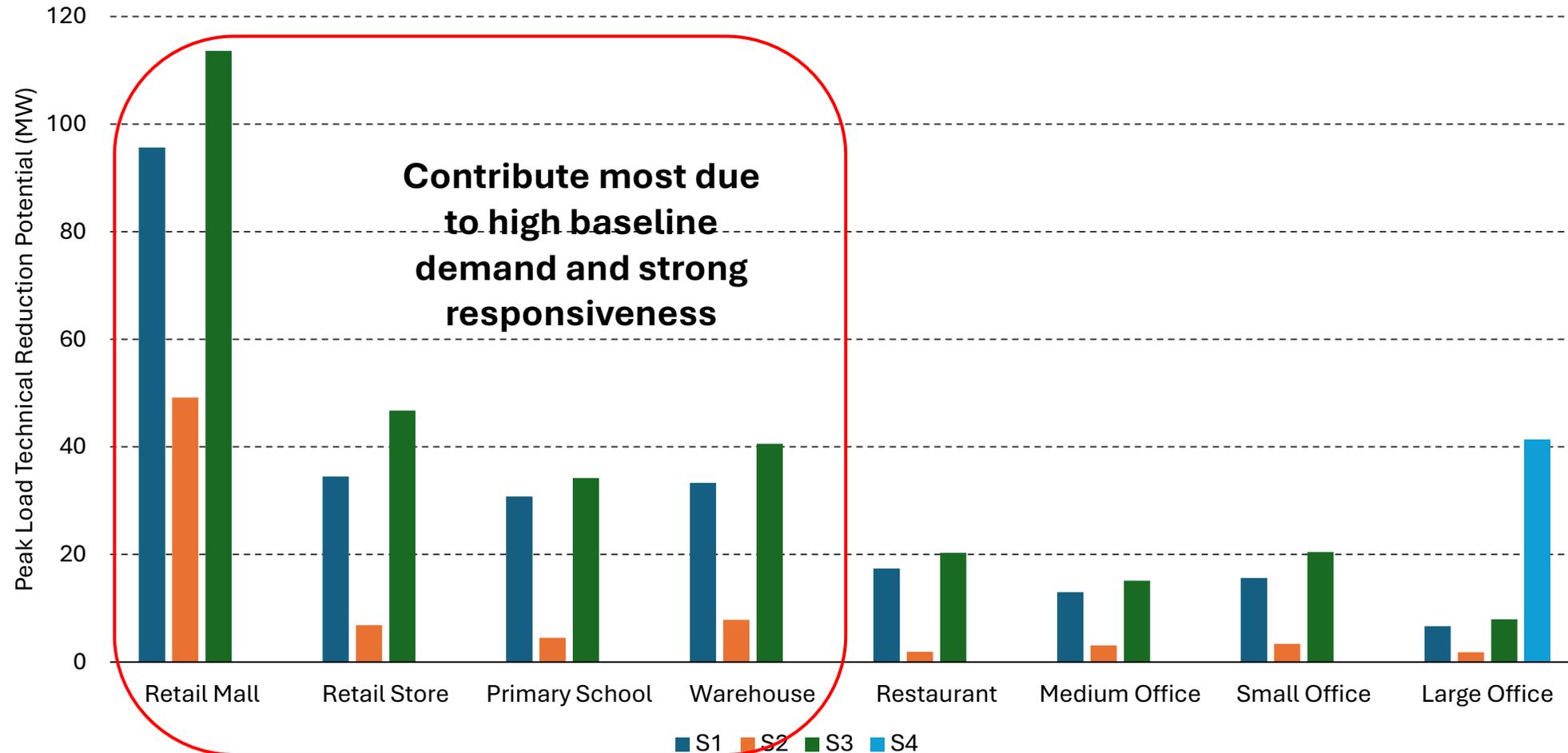
Roll out of AMI and other DF technologies complete/on-going



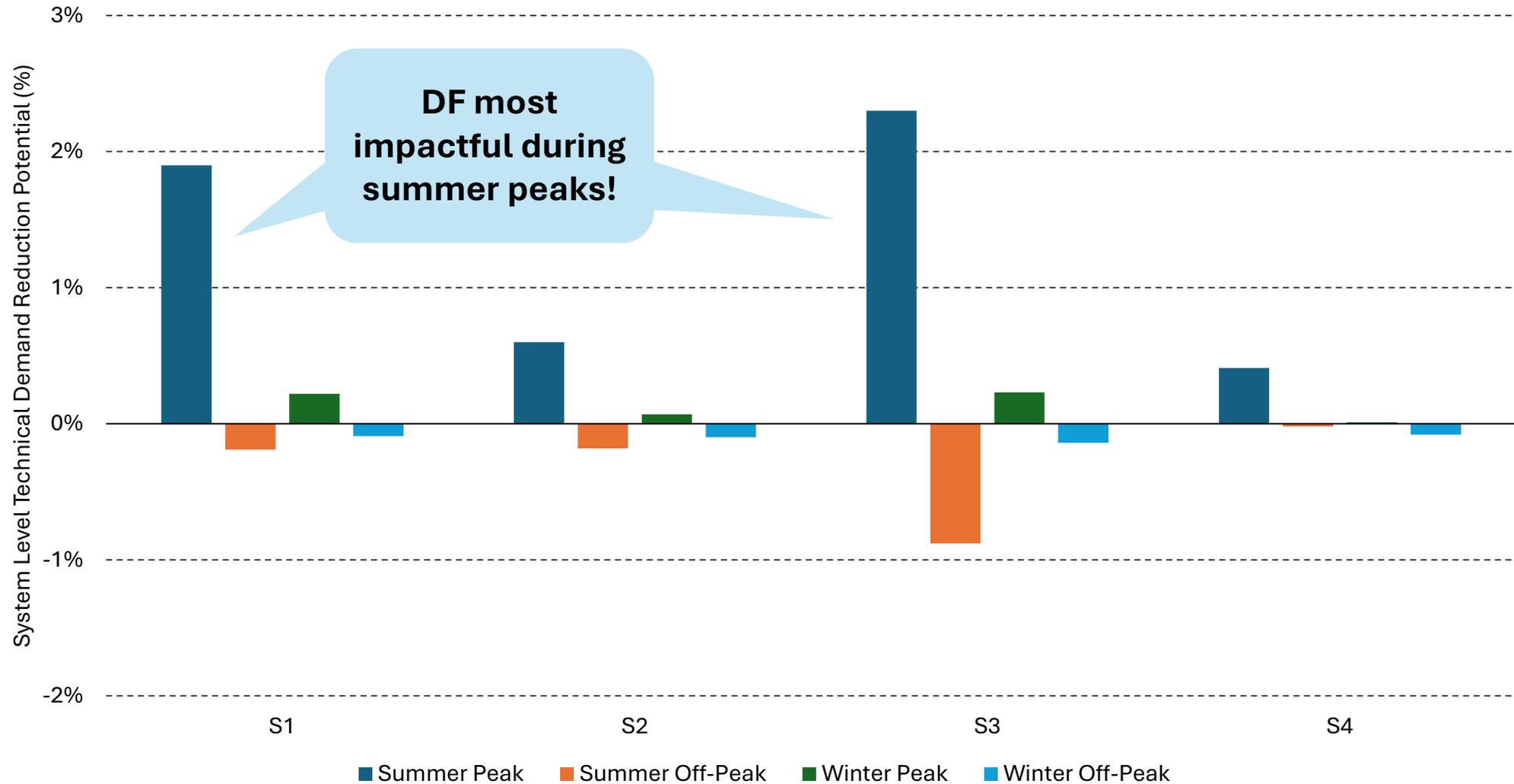
Technical building level potential



Technical sector level impacts



System grid level impact



Conclusions and next steps

Case Study	<p>Pre-cooling and thermostat adjustments may shave summer peak load over 2%. Large retail, warehouses, school, and large offices show highest savings potential. There is a need to add BAS technology in Retail sector, Restaurants, Small Offices and Warehouses sectors.</p>
Broader Impacts	<p>Replicable, low-cost desktop method: Built on public datasets and OpenStudio with documented assumptions and parameters. Easy to run simulations.</p> <p>Program direction: Use results to prioritize segment × strategy, set initial peak reduction goals, and choose event windows.</p>
Next Steps	<p>Refine peak windows by building type</p> <p>Economics & comfort: Add cost and comfort trade-offs to move from technical to achievable potential; test under candidate TOU/CPP rates.</p>

Thank you!
Questions?

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