



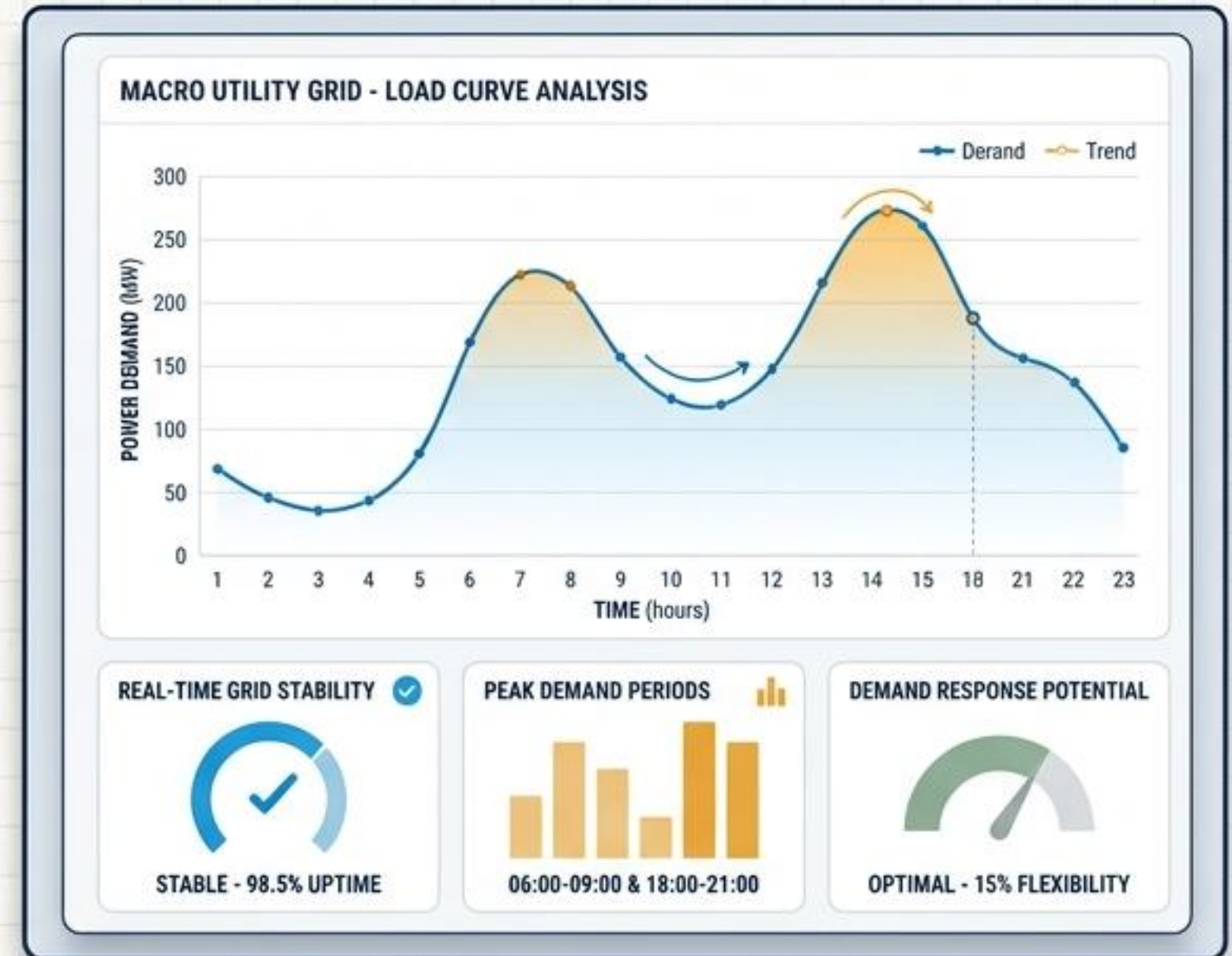
Energy Audit Applied to Buildings and Demand Side Management

Building Energy Efficiency, Water Audits, and Demand Side Management Strategies

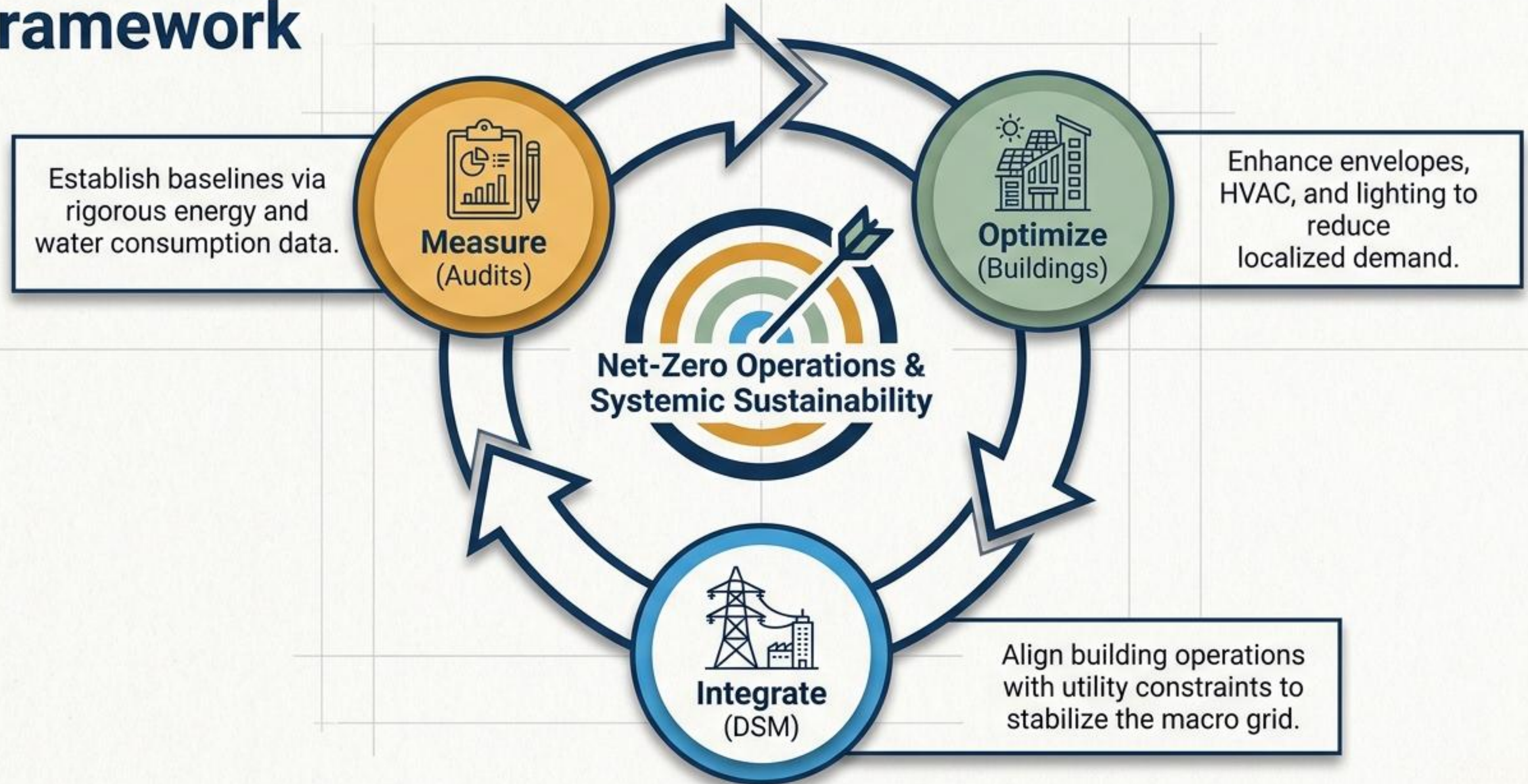
Module-5 | Energy Conservation and Audit

Presenter: Dr. Sathish K. R., Assistant Professor, Dept. of EEE

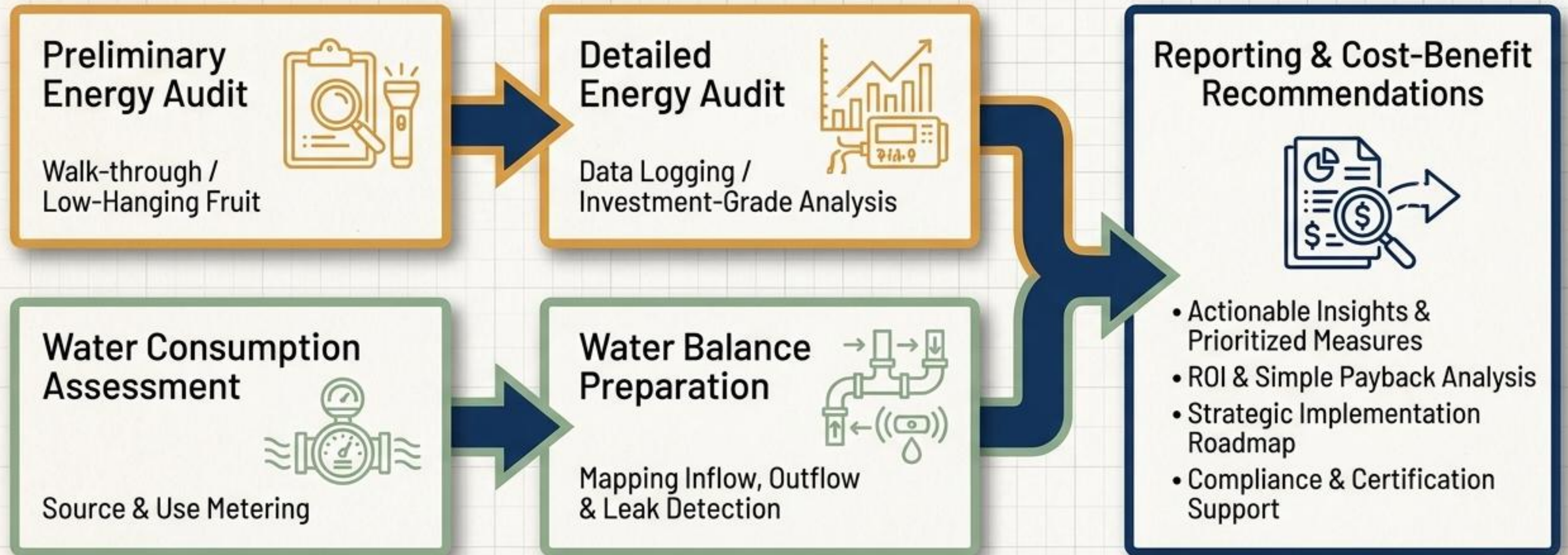
Institution: ATME College of Engineering



The Energy Architect's Framework



Diagnostic Baselines: Energy & Water Audits



Instrumentation & Performance Benchmarking

Thermal & Flow Diagnostics



Detect envelope leaks and track HVAC/water efficiency.

Electrical Profiling



Measure power factor, harmonics, and lighting adequacy.

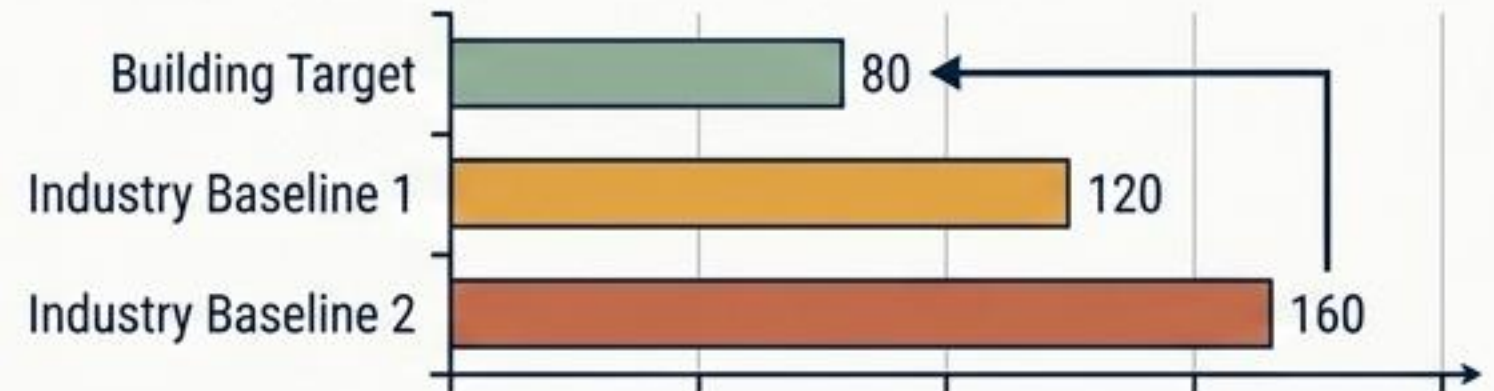
Energy Use Intensity (EUI)



Total Energy Consumed
Per Square Foot / Per Year

The critical metric representing baseline operational load.

Specific Energy Consumption (SEC)



Contextual benchmark comparing performance against established industry baselines.

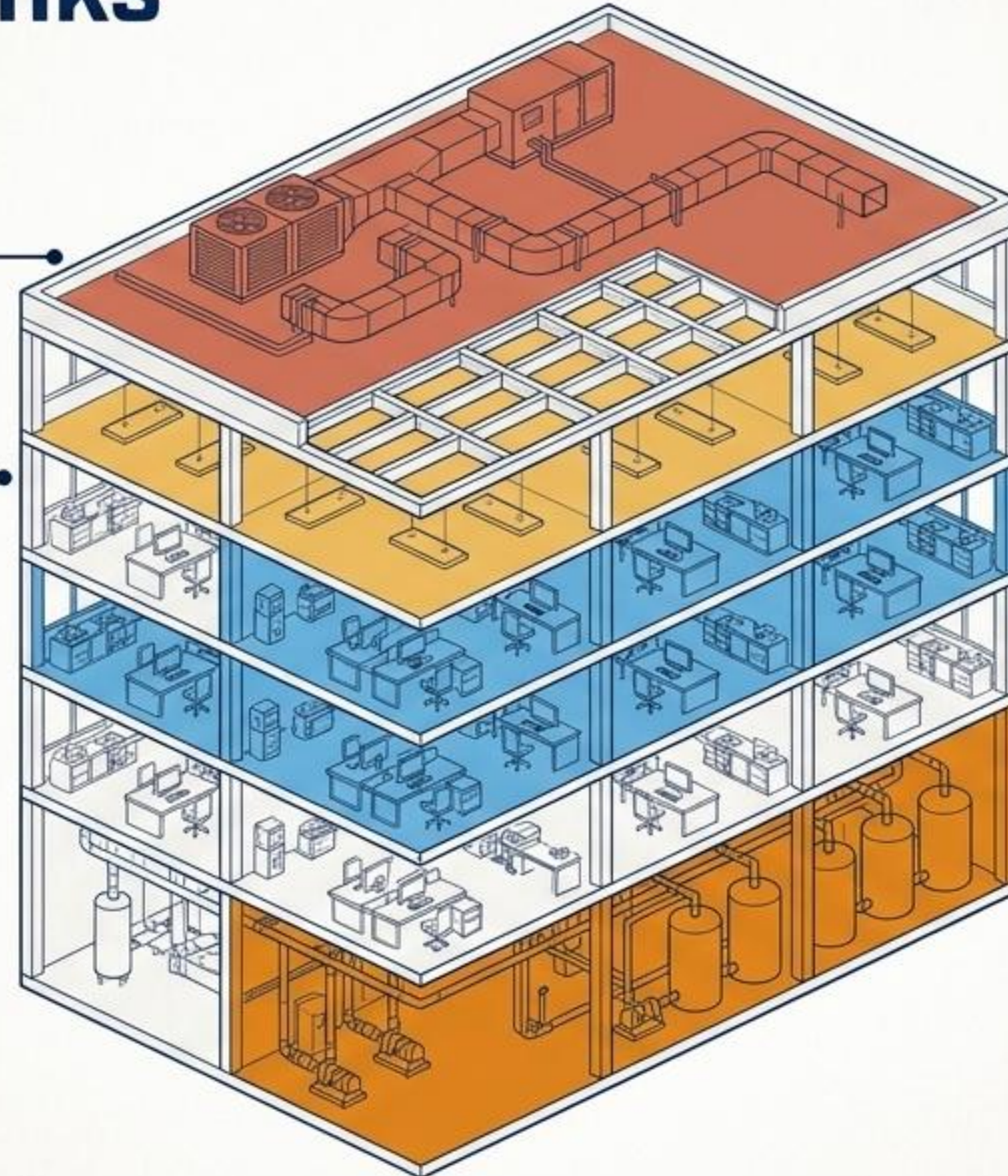
Mapping Consumption: Major Energy Sinks

HVAC Systems

Largest thermal load; highly sensitive to external thermal dynamics.

Lighting Systems

Constant base load, heavily dependent on occupancy and natural light.



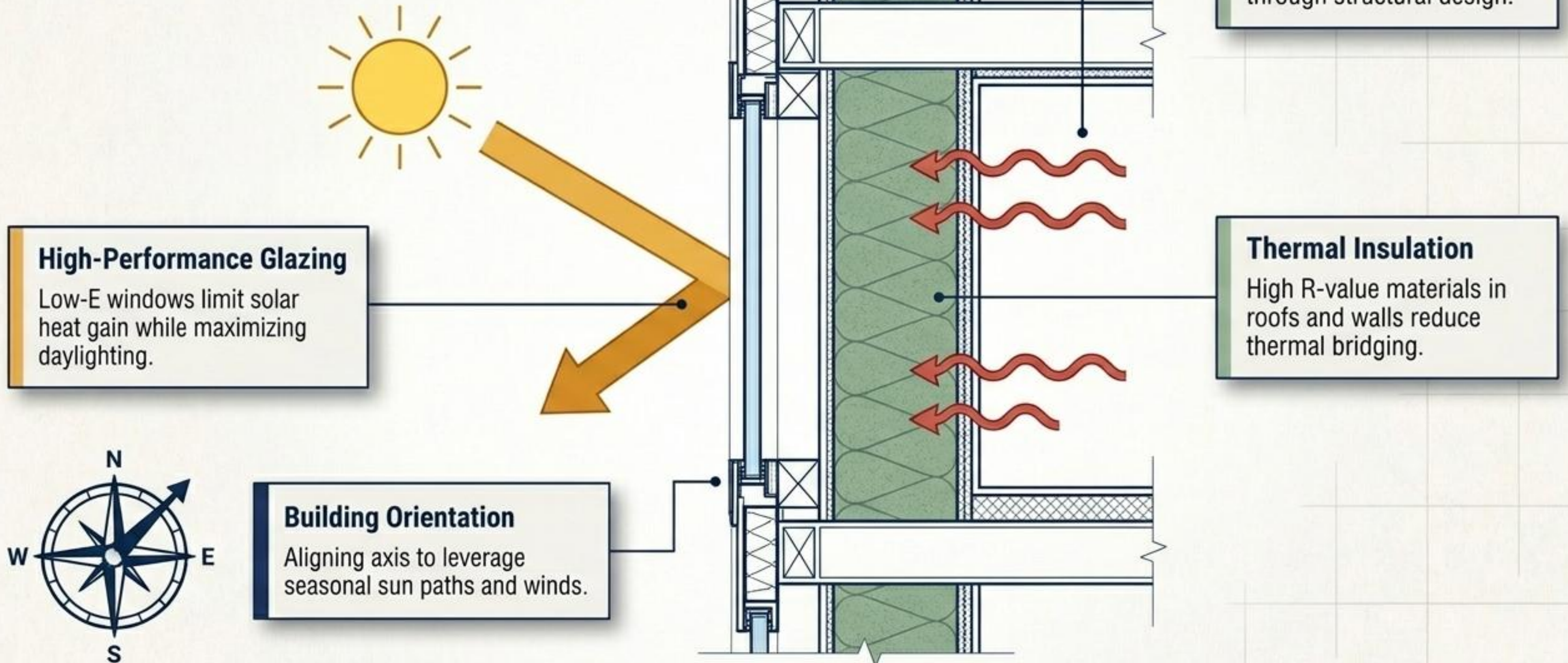
Water Heating & Pumping

Energy-intensive processes linking water and energy conservation.

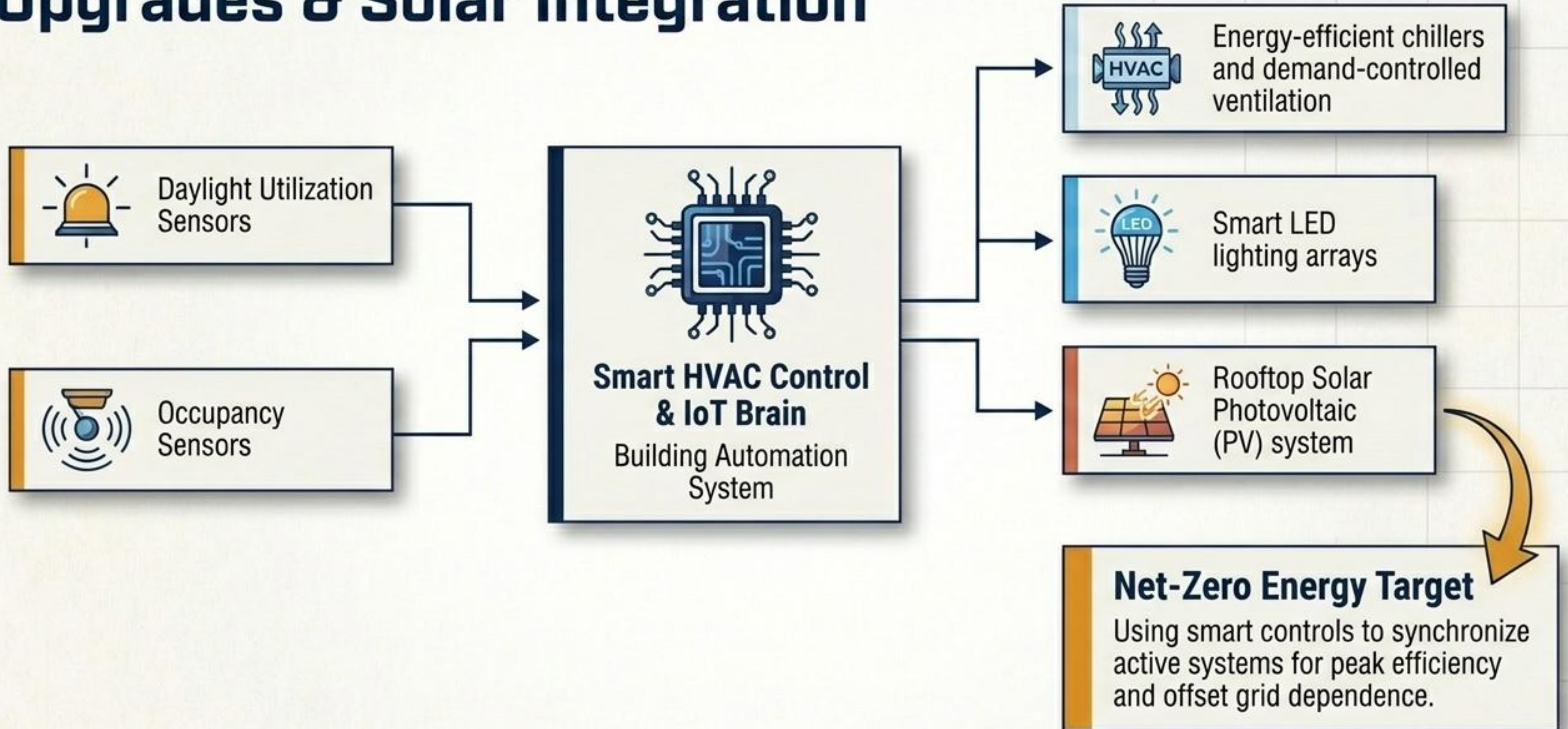
Plug Loads & Equipment

Variable consumption driven by occupant behavior and appliance efficiency.

Defending the Envelope: Passive Design



Active Efficiency: Upgrades & Solar Integration



The Water-Energy Nexus & Conservation



Strategic Application: New Builds vs. Existing Retrofits



New Construction (Proactive)

- High upfront integration of green architecture.
- Optimization of passive building orientation.
- Utilization of integrated sustainable materials.



Existing Buildings (Reactive)

- Focused on high-ROI retrofits.
- Replacing end-of-life HVAC and lighting upgrades.
- Driving rapid consumer behavioral changes.

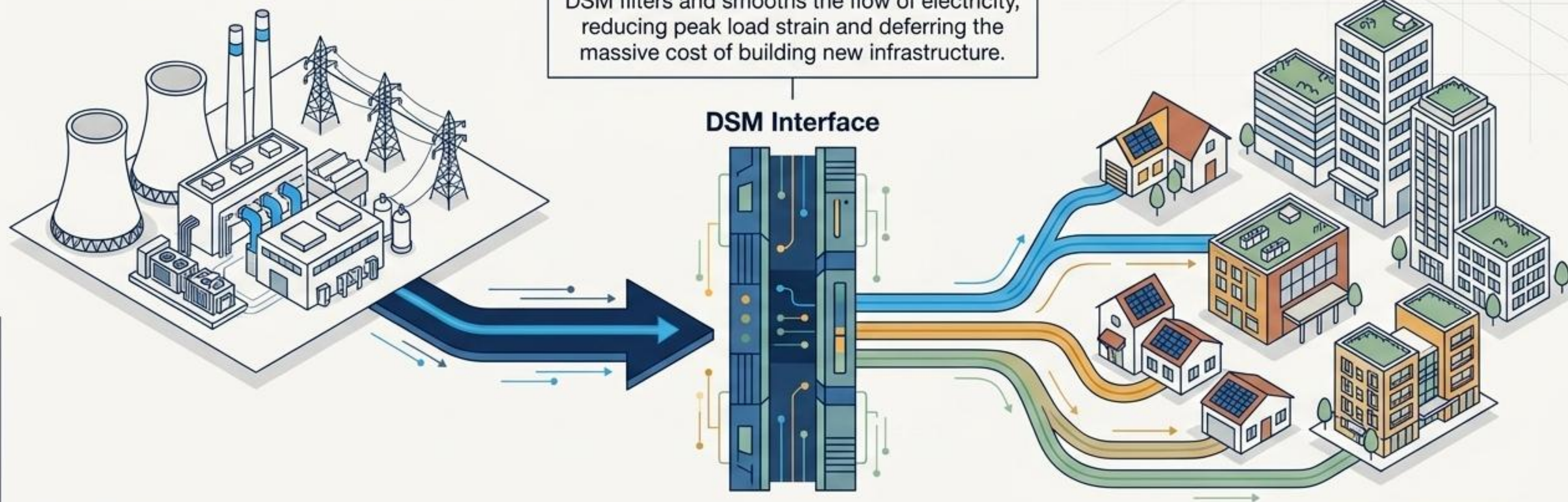
Maintenance Strategies

Both approaches require rigorous predictive maintenance to prevent efficiency degradation over time.

Beyond the Building: Demand Side Management (DSM)

Definition: Actions taken on the customer's side of the meter to change the timing or amount of energy consumption.

DSM filters and smooths the flow of electricity, reducing peak load strain and deferring the massive cost of building new infrastructure.

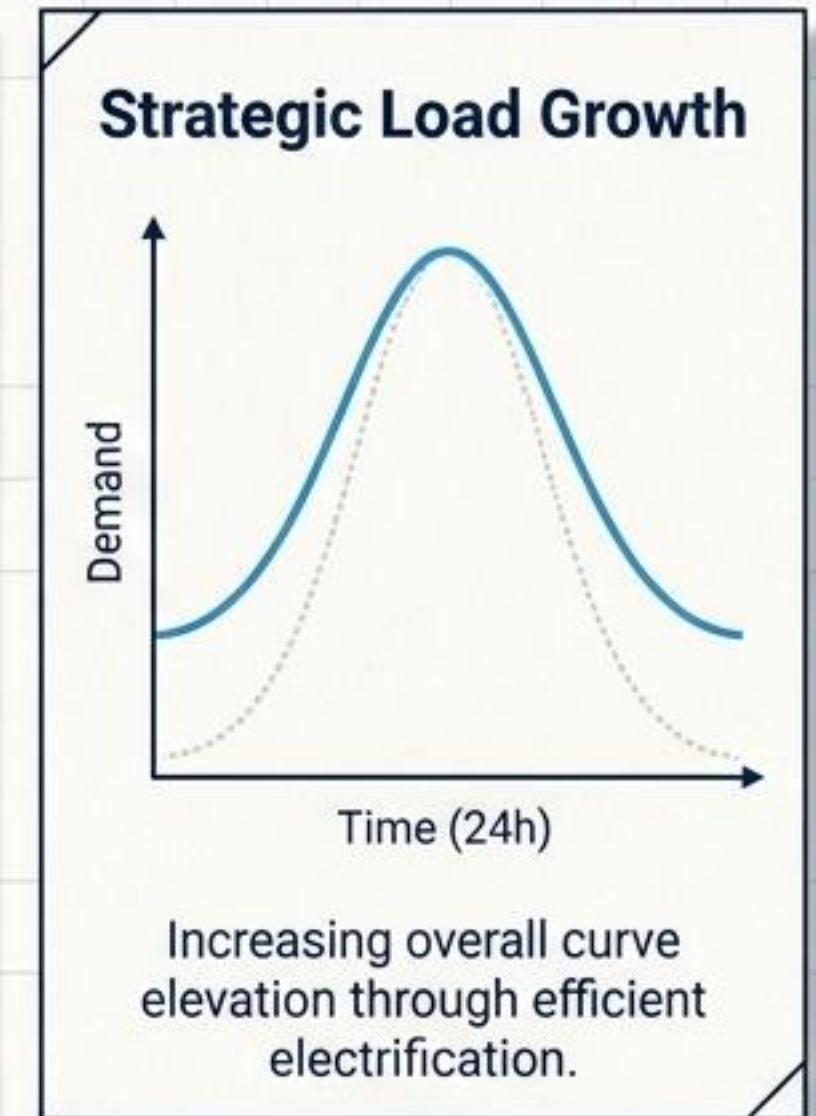
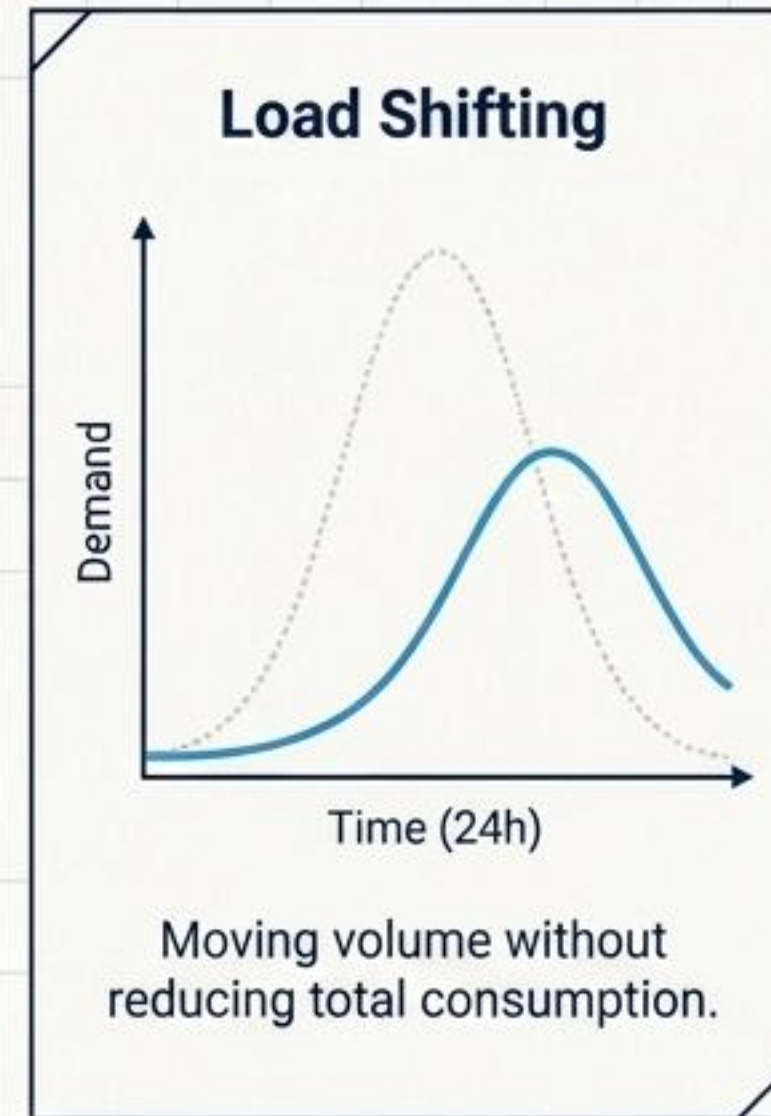
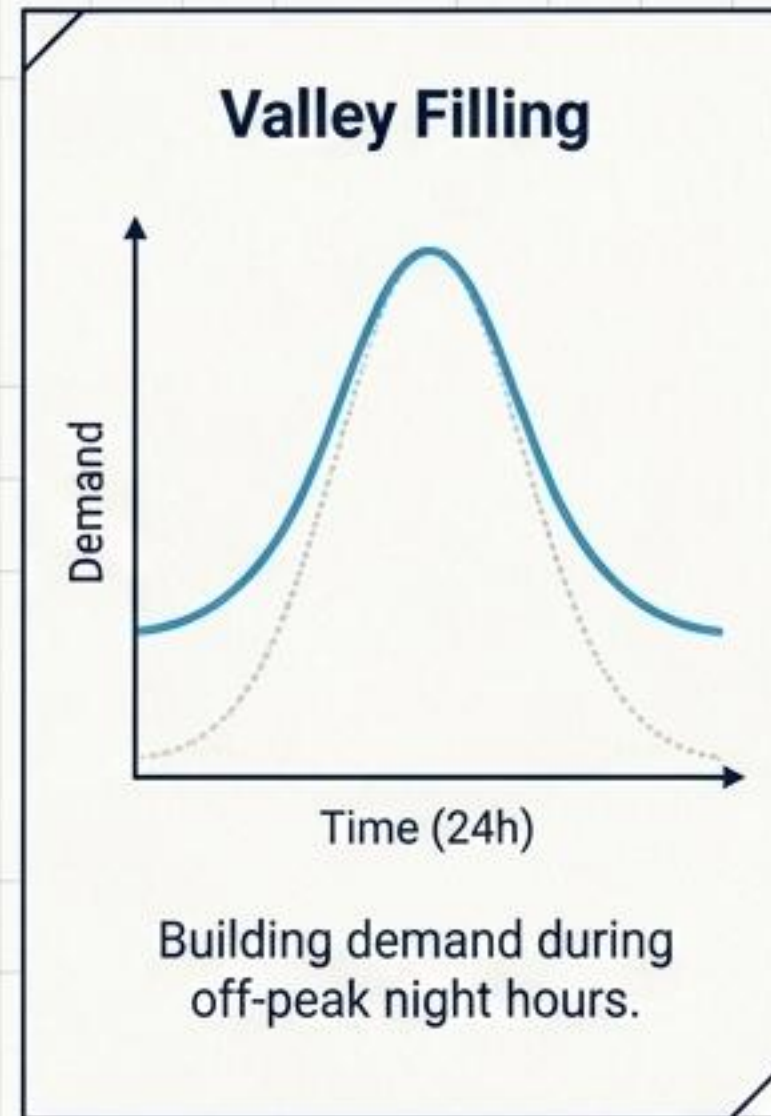
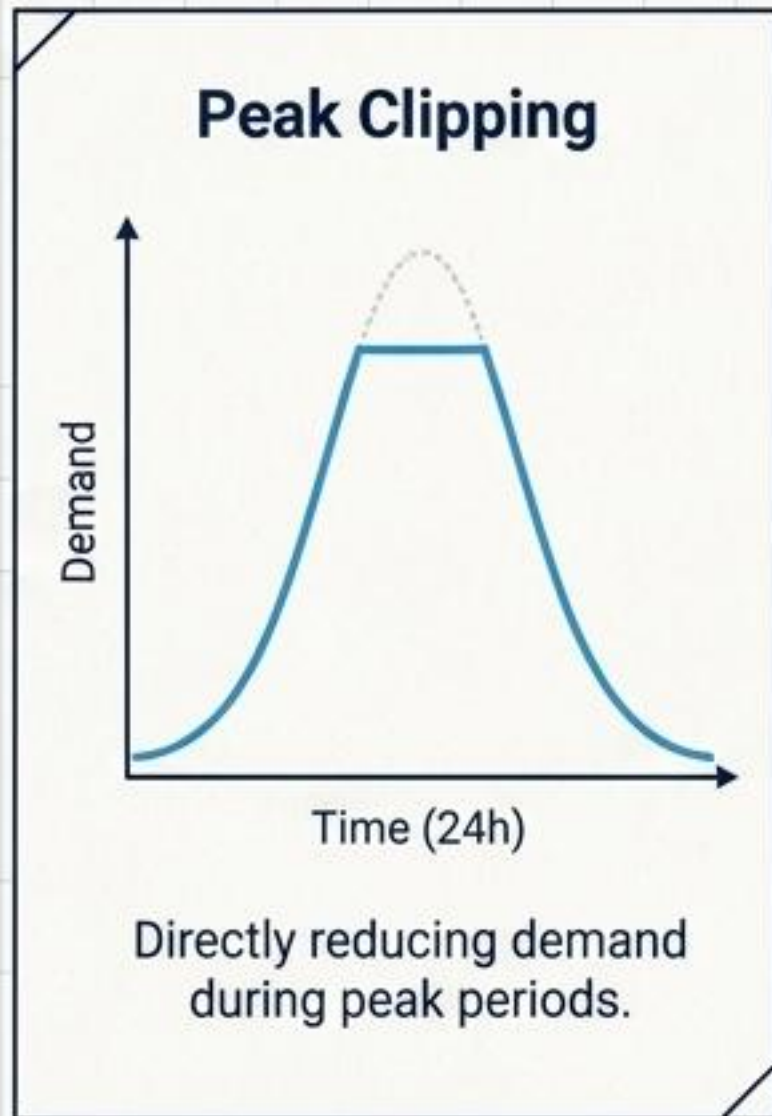


Architecting DSM Programs: The Utility Lifecycle



Ensuring the cost of the DSM program is lower than building new generation capacity.

Shaping the Curve: Load Management Techniques



Economic Levers: DSM Tariff Structures

Tariff Type	Price Volatility	Consumer Predictability	Primary Application
Time-of-Use (TOU) / Time-of-Day (TOD)	Low	High (Pre-set time blocks)	Residential & Commercial
Real-Time Pricing (RTP)	High	Low (Hourly wholesale fluctuations)	Large Commercial
Critical Peak Pricing (CPP)	Extreme (Rare Events)	Moderate (Warning given)	Targeted Interventions
Demand Charges	Moderate	High (Based on highest single kW spike)	Heavy Industrial

Synthesis: Applied Case Studies



Commercial Building Audit

Replacing legacy chillers and retrofitting LED systems resulted in a drastic **30% drop** in Energy Use Intensity (**EUI**).



Educational Institution

Integrated rooftop solar PV and implemented rigorous smart water metering, successfully achieving **net-zero water** status.



Industrial DSM Implementation

Shifted heavy machinery operations to night shifts (**Valley Filling**), utilizing TOU tariffs to slash Demand Charges **by 40%**.

Key Takeaways & Examination Insights



1. Audits (Measure)

Distinguish between Preliminary and Detailed audits. Master the calculation and application of **EUI** and **SEC** benchmarks.



2. Optimization (Build)

Envelopes, HVAC, lighting, and the **Water-Energy nexus** must be managed as a unified, interconnected passive and active system.



3. DSM Strategies (Protect)

Understand utility perspective and accurately diagram the mechanics of **Peak Clipping**, **Valley Filling**, and **Load Shifting**.



4. Economic Levers (Incentivize)

Understand how **TOU**, **RTP**, and **Demand Charges** enforce load management, alter load curves, and yield ROI.