Passive Buildings are Key to the Future Renewable Grid

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Two Scales of Skepticism

At the individual building scale:

Solar panels are cheap. Why would I build to Phius levels when I can build to code and add solar and still zero out my utility bill?

Things PV can provide

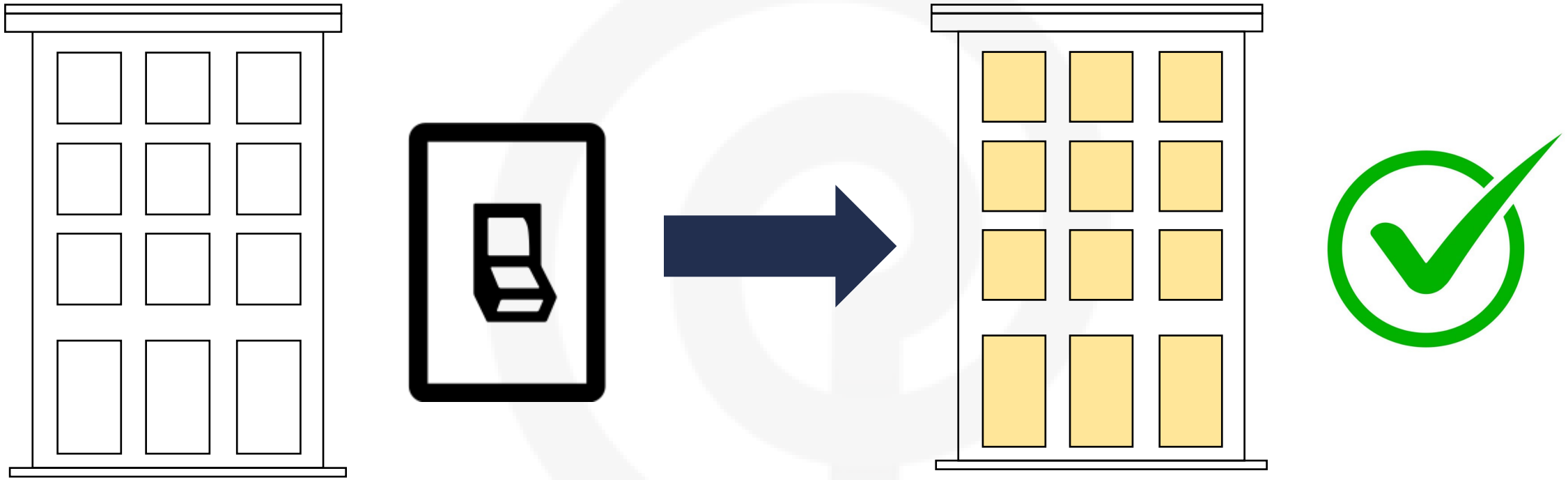
- Reduced Utility Bill

Things PV cannot provide, but passive building can

- Comfort
- Resilience During Outages
- Superior Indoor Air Quality
- Durable and Long-Lasting Building Enclosure

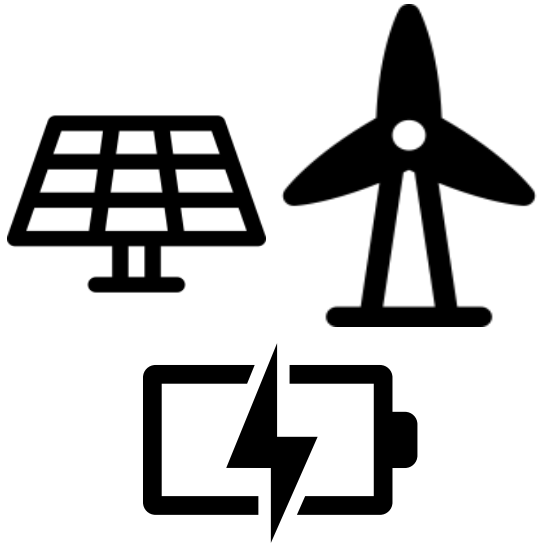
At the grid-level scale:

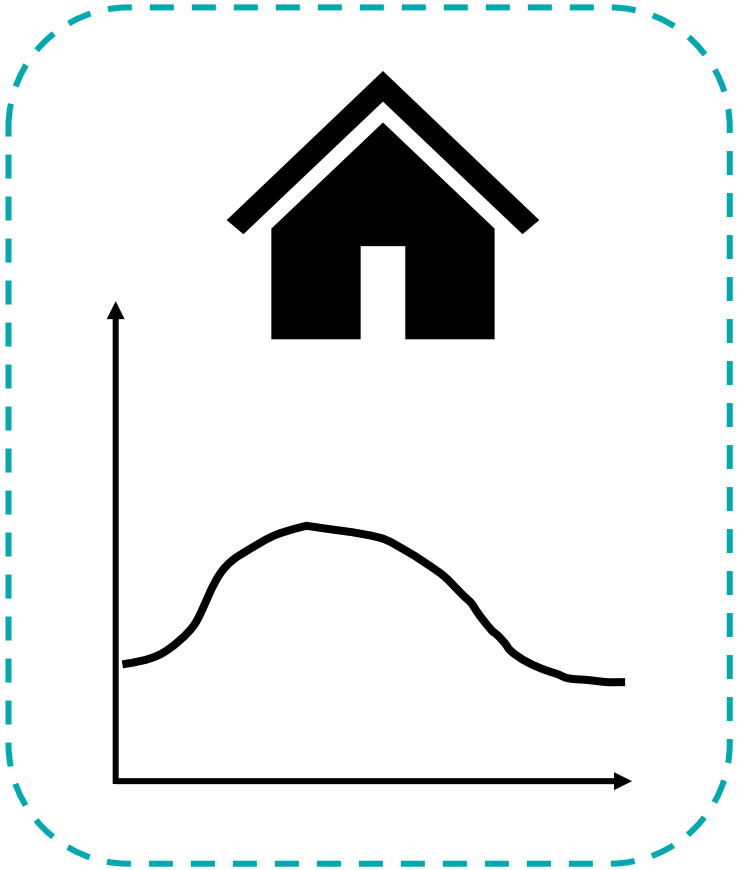
The grid can clean up. Why does my building need to be more efficient if it's just going to run on renewable energy?



Systems Level Thinking

We must consider how the different parts of a system interrelate and how systems work within the context of other, larger systems.





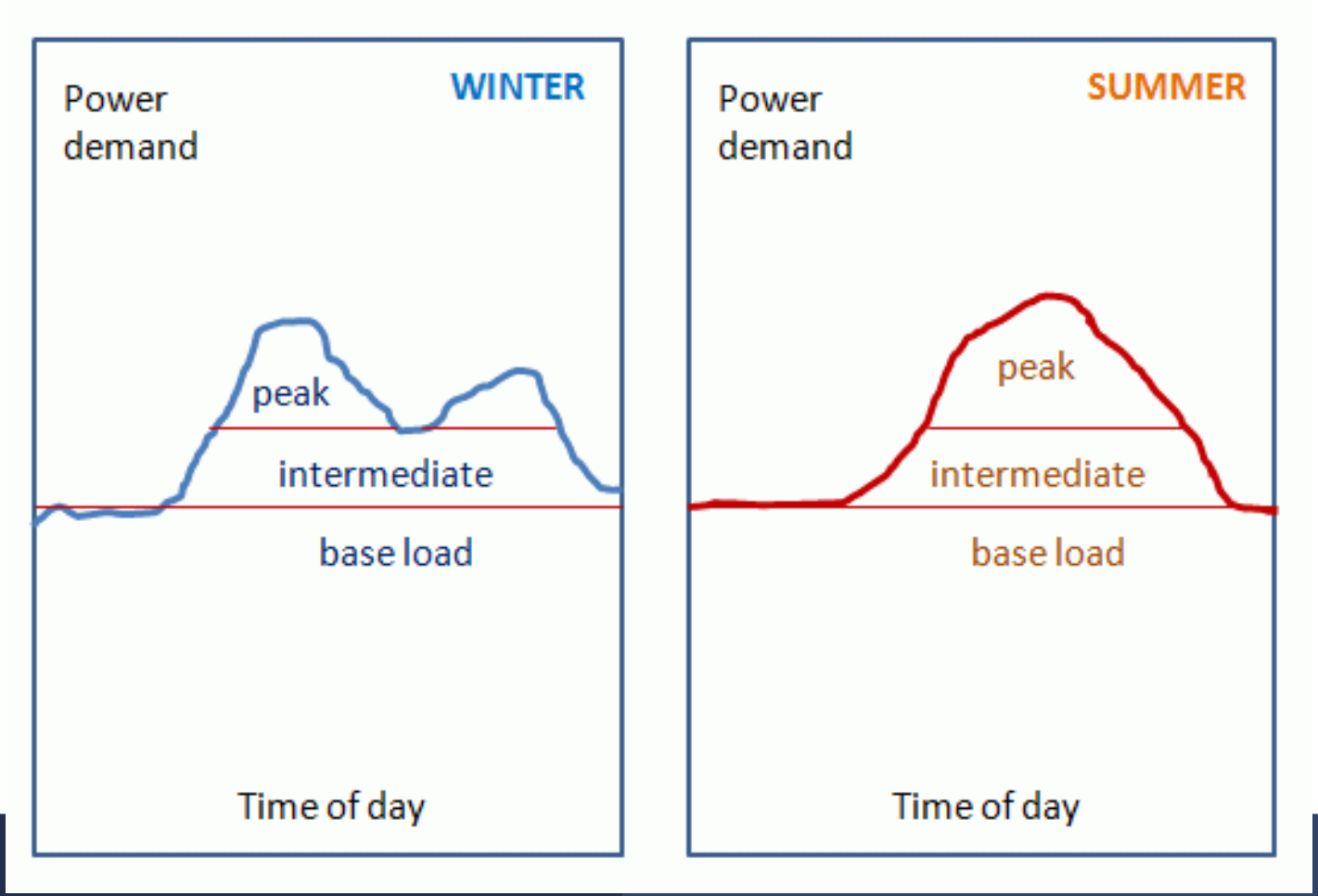
The future renewable energy grid is a system, and each piece must do their part.

CURRENT ELECTRIC GRID INFRASTRUCTURE

Source: Adapted from National Energy Education Development Project (public domain)

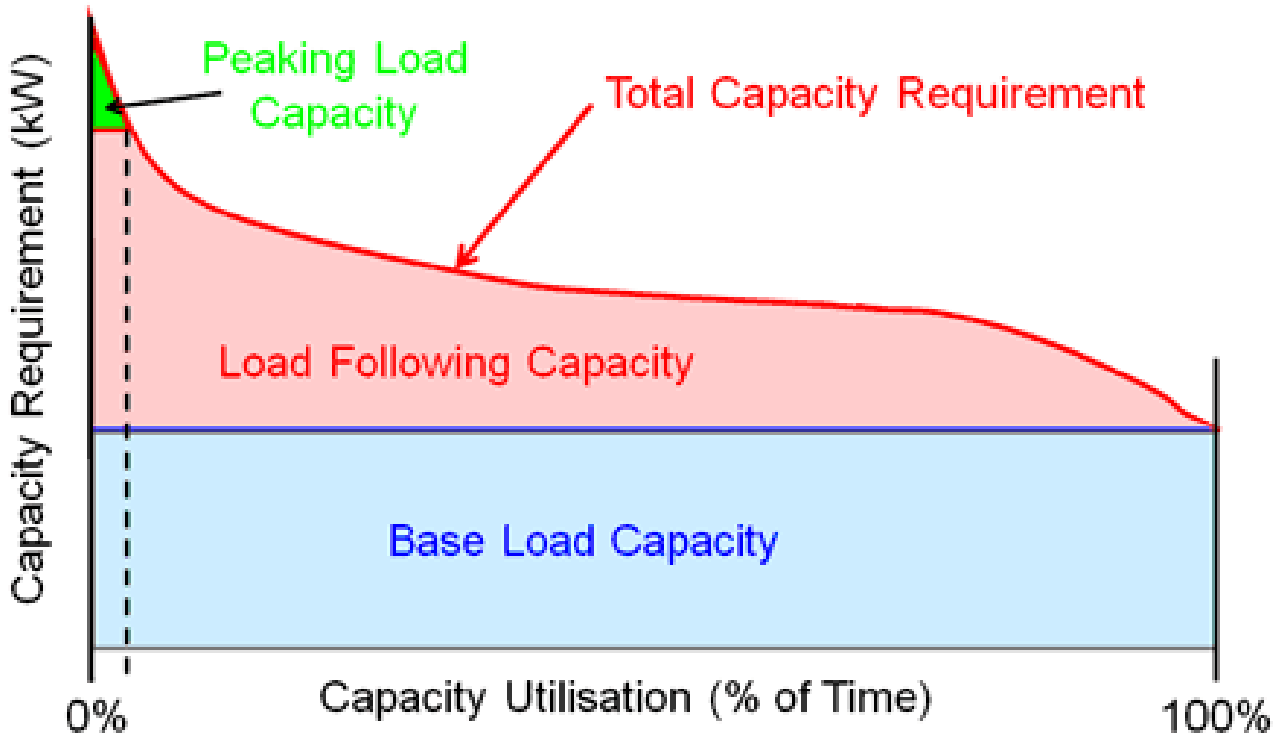
Current Load Profiles on the Grid

General daily patterns / grid loads are predictable, variability is mostly based on space conditioning loads.



Electricity Generation

Capacity | Load Duration Curve



Market Clearing Resources

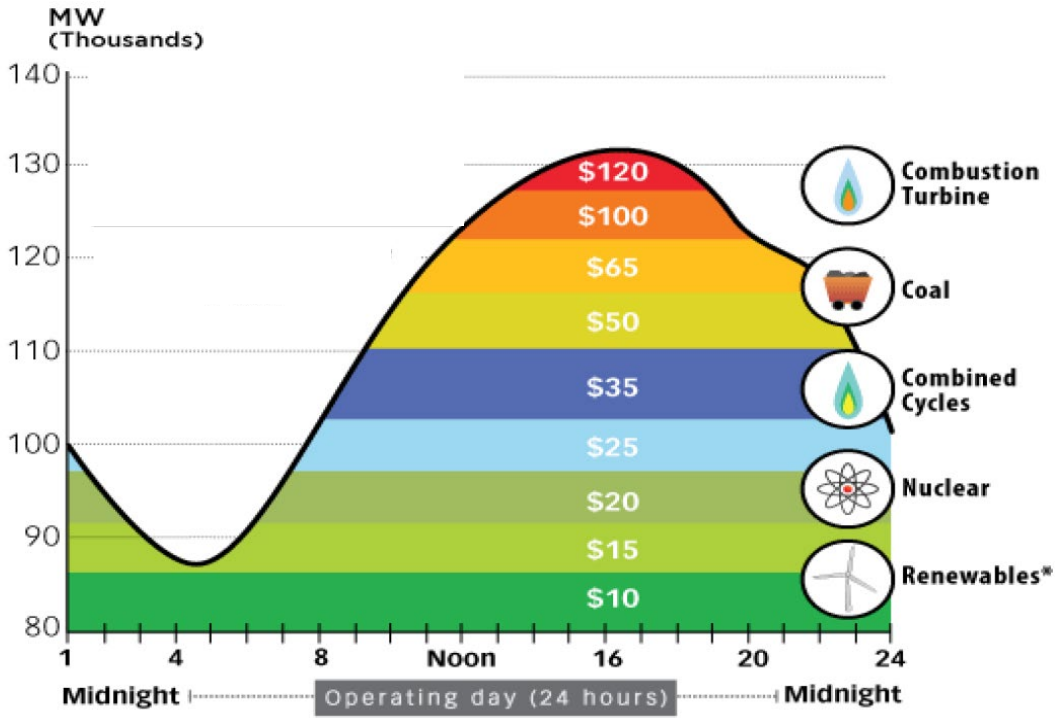
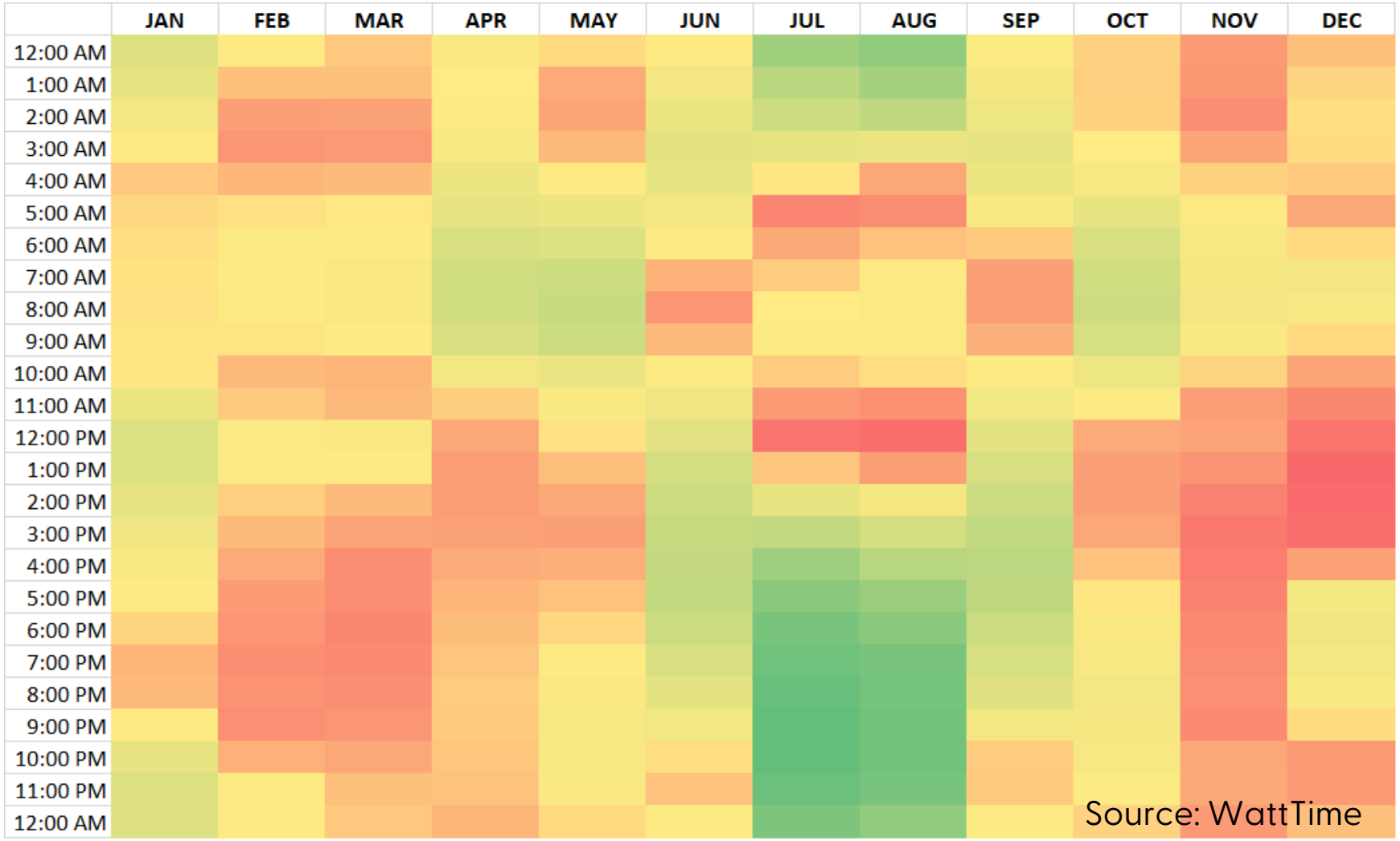


Image Source: Mark Pruitt

HOURLY MARGINAL CARBON EMISSIONS

CHICAGO, IL - 2019



Source: WattTime

Each hour varies based on the generation mix at that time.

THE GRID IS CHANGING

Electrifying heating systems in buildings will shift the grid peak to the winter.

The grid load is increasing from electrification of buildings and cars.

Fossil-fueled generation resources are being replaced with renewable energy resources.

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THE PEAK IS CHANGING: WINTER IS COMING

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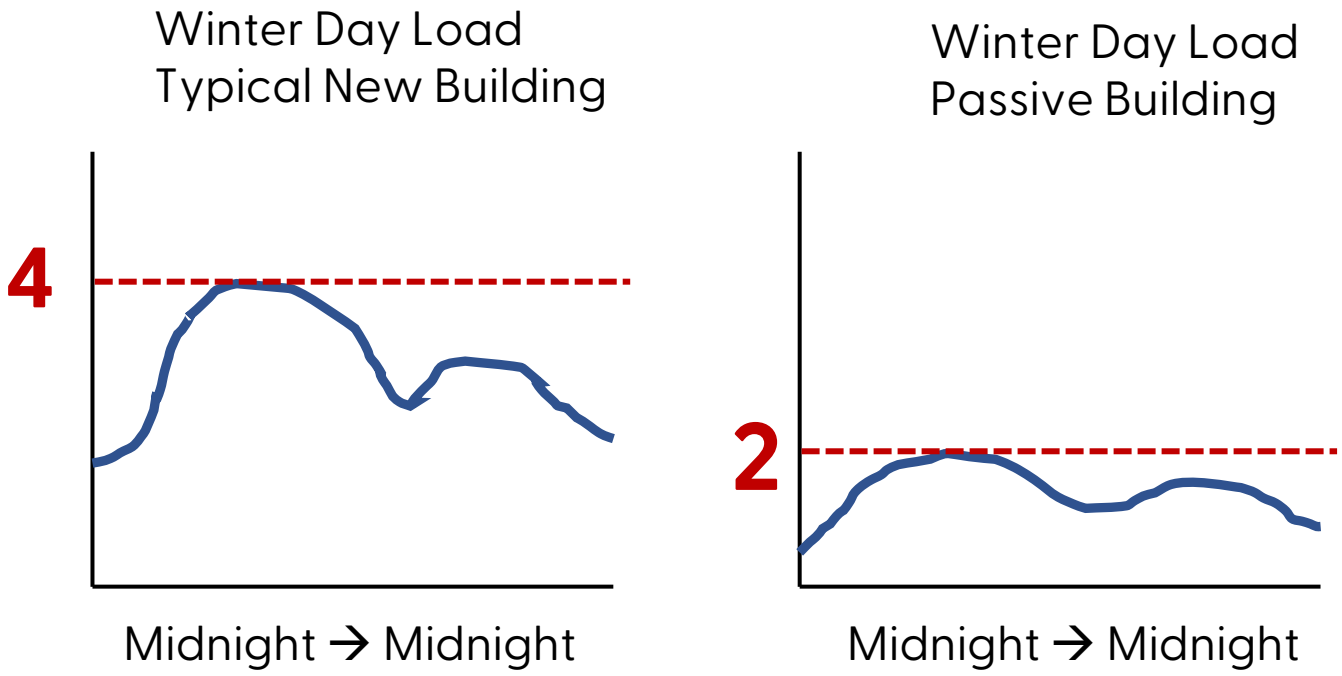
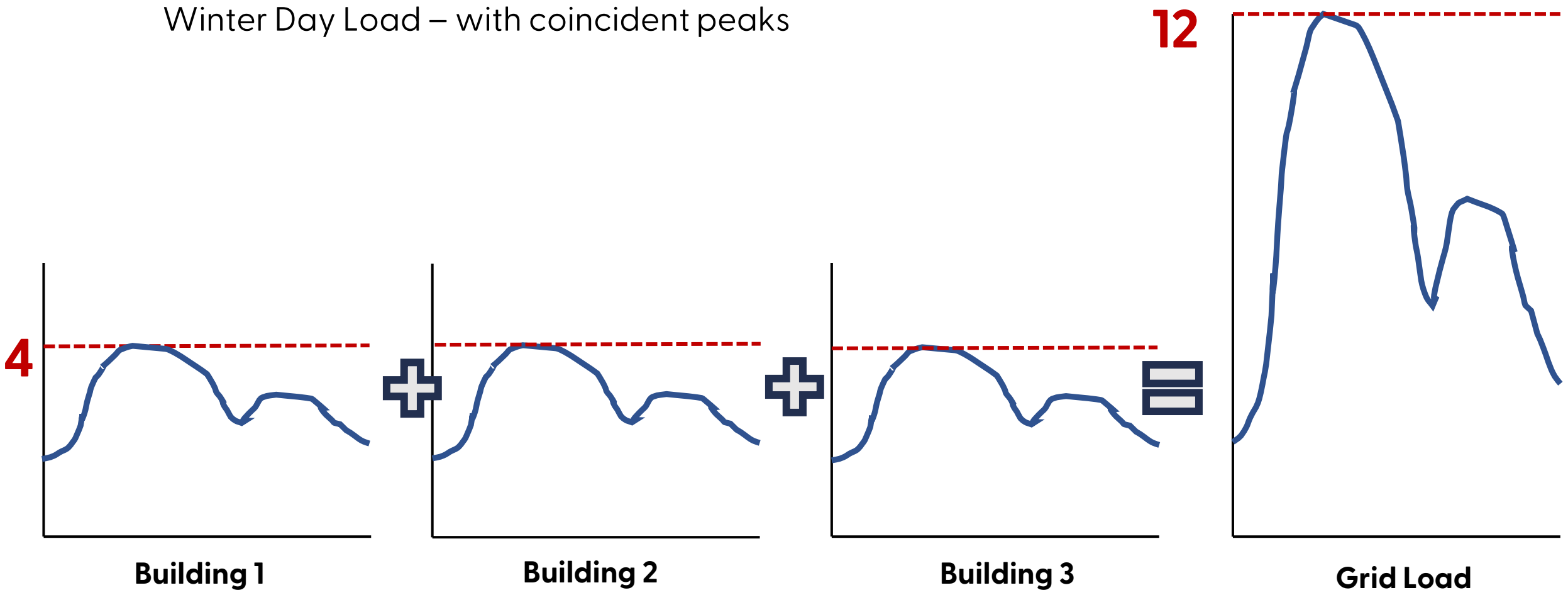


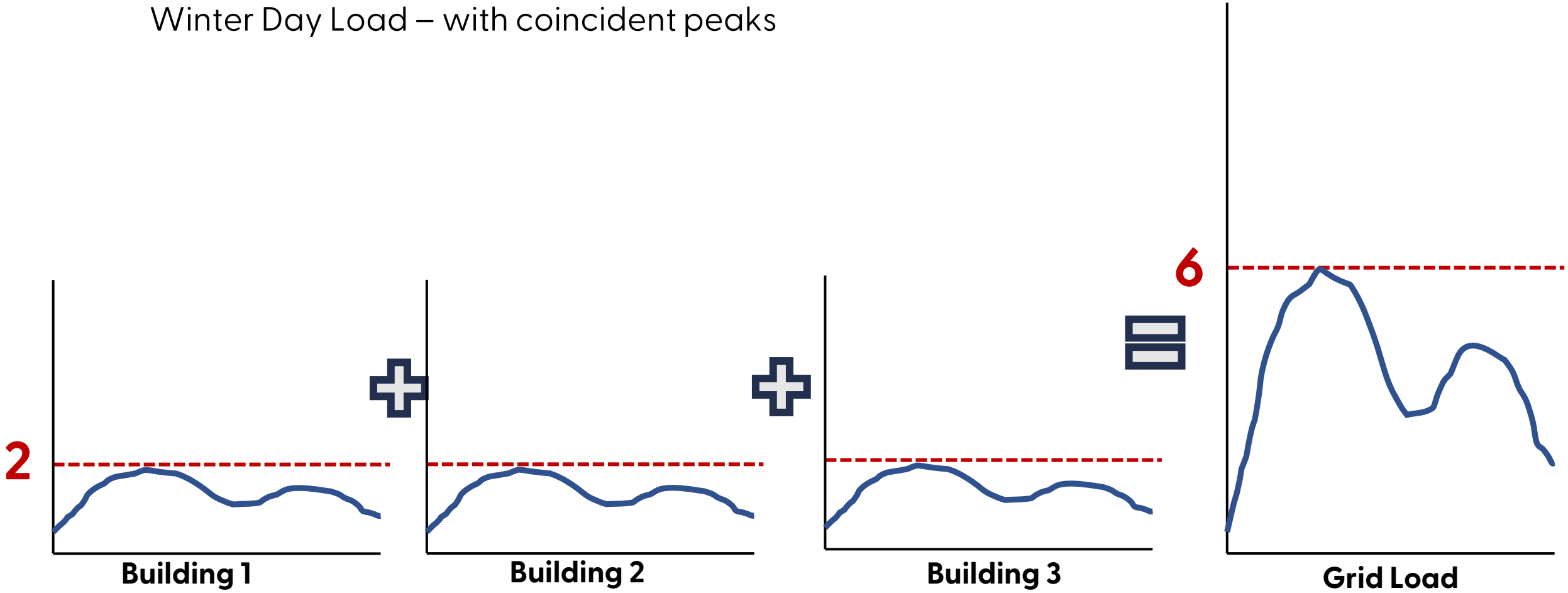
3 *Typical* Building Winter Peaks

Winter Day Load – with coincident peaks



3 *Passive* Building Winter Peaks

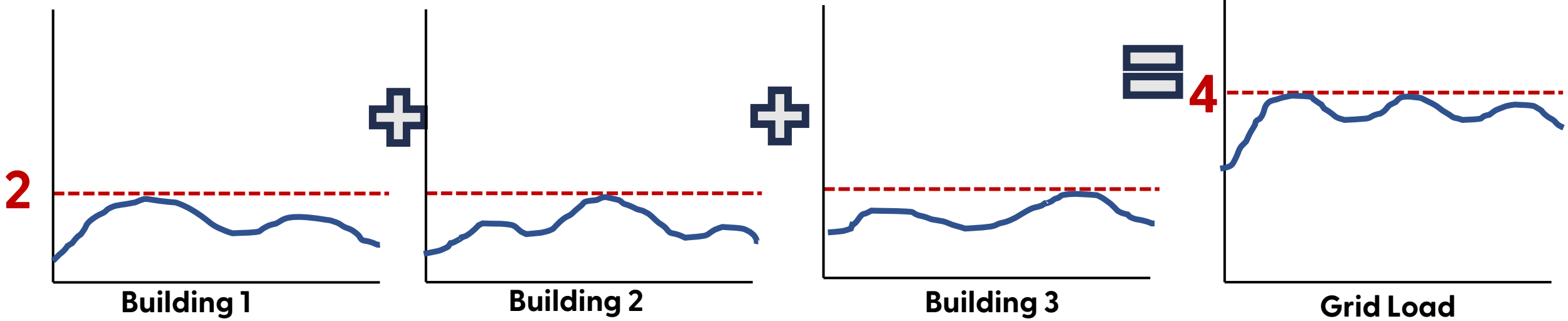
Winter Day Load – with coincident peaks



3 *Passive* Building Winter Peaks

Winter Day Load – with load shifting

Passive building enclosure acting as thermal storage.



Why this matters

Passive building reduced peak winter load by a factor of 3.

If you consider planned redundancy, that's more like a factor of 6 to 7.

This *peak* determines the grid capacity needed.

Grid capacity needed is directly correlated with the cost of transition to renewable energy grid.

Peaks are often met with the most expensive and high carbon-emission generation resources.

And likely will continue to during the transition to a renewable energy grid, due to their responsiveness and compatibility with intermittent generation sources.

THE GRID IS CHANGING

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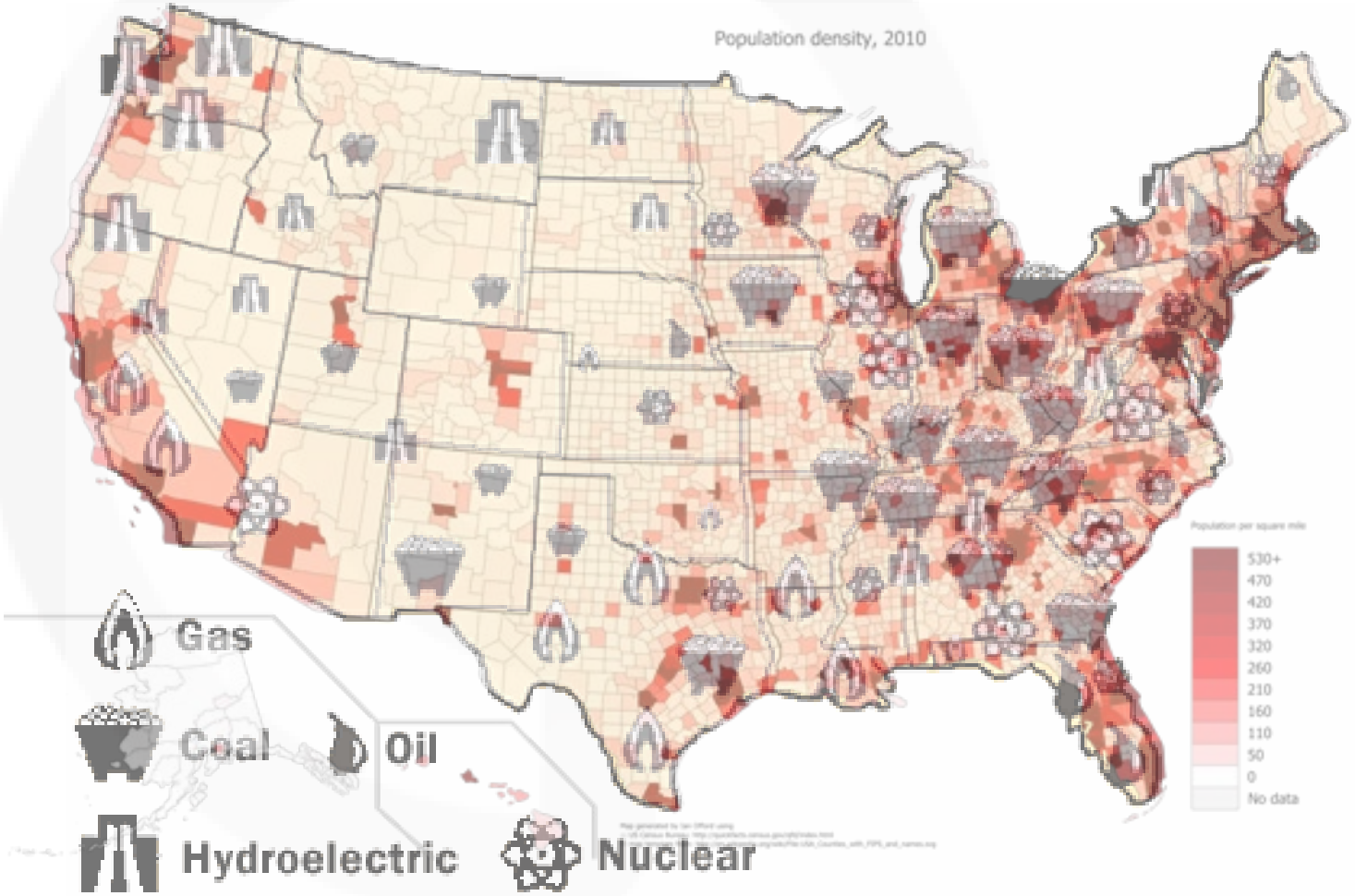
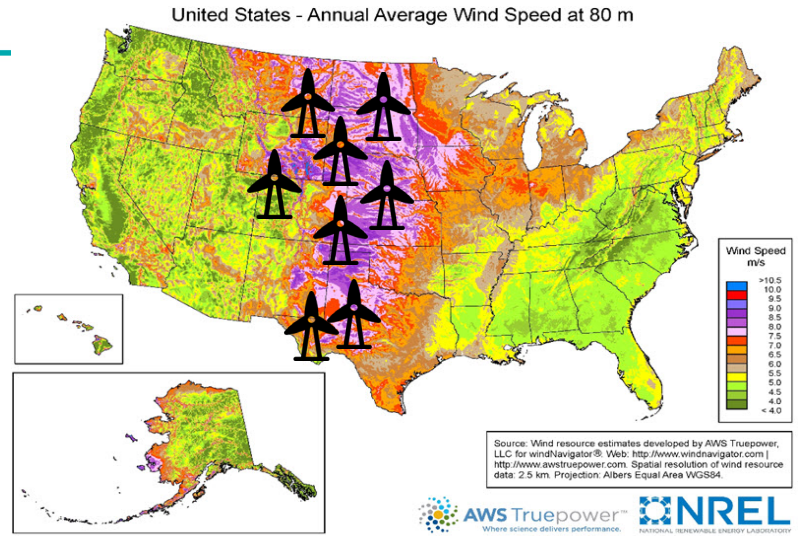
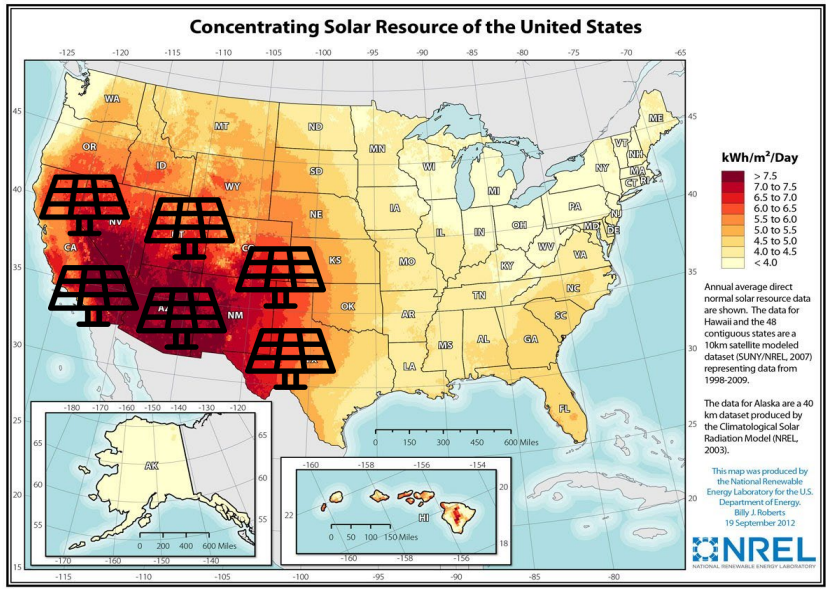
Fossil-fueled generation resources are being replaced with renewable energy resources.

The grid load is increasing from electrification of buildings and cars.

A breakdown of the major power plants in the United States, by type

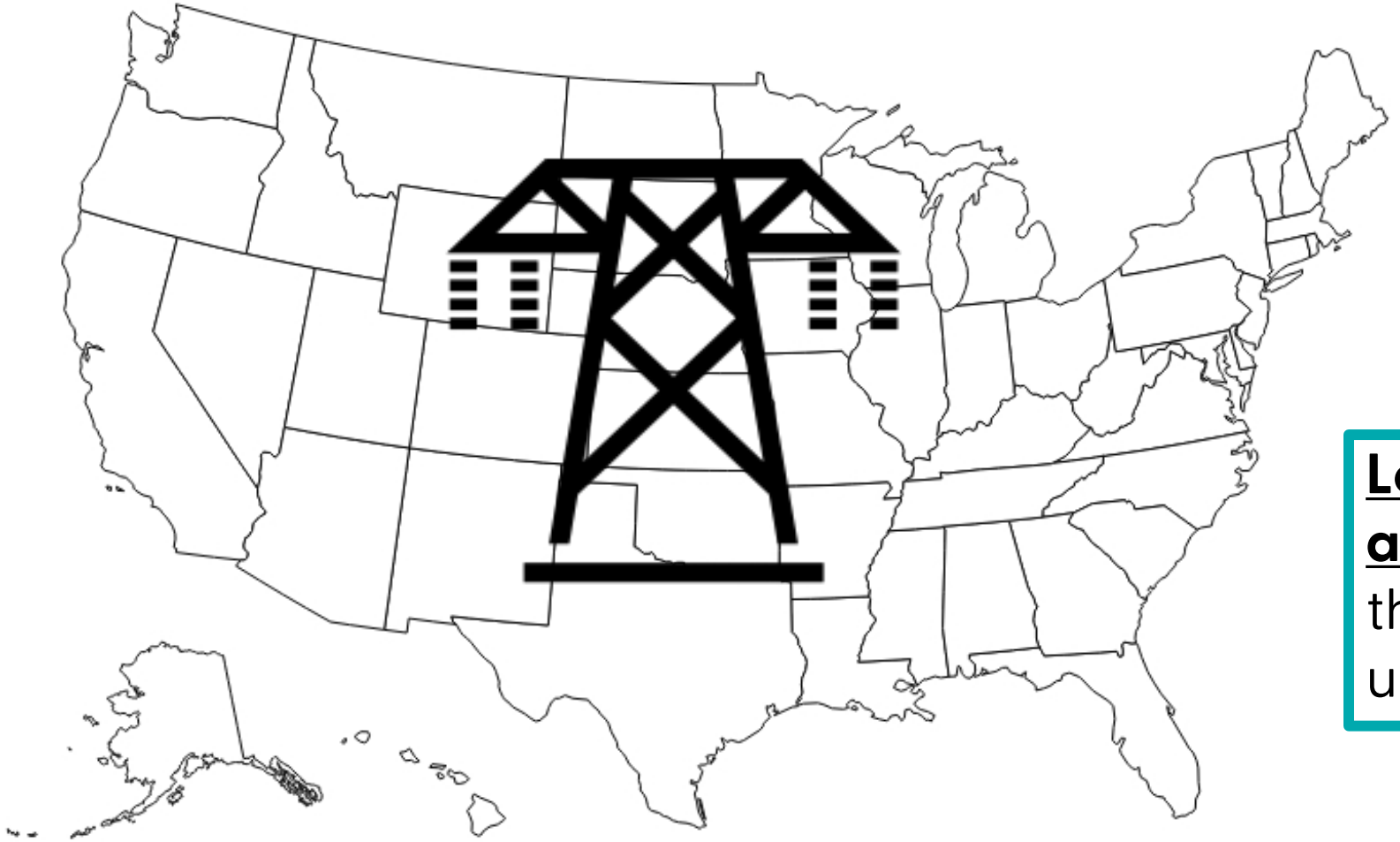






Lots of Future Investment in Transmission

To get the resource to the load



And the "more" the lines need to carry, the more investment is needed.

<u>Lower peaks</u>, and **<u>lower annual energy</u>** use reduce the required investment in updating transmission.

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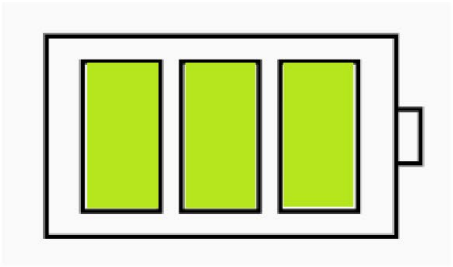
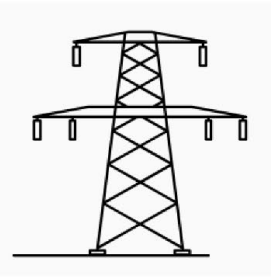
The Ripple Effect of Conservation

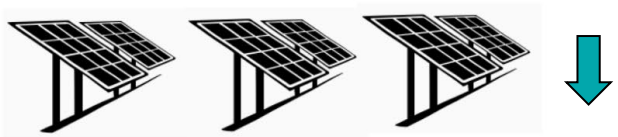
Conservation means less generation, less storage, and less transmission capacity needed

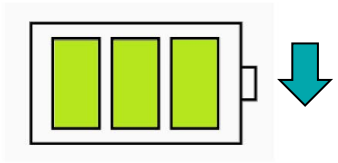
60,000
kWh/yr

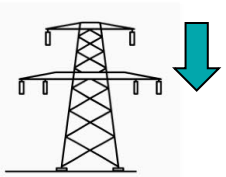




36,000
kWh/yr








The All-Electric F-150 Lightning: Turning Electric Into Lightning | Ford
1:03 / 4:32


The All-Electric F-150 Lightning: Turning Electric Into Lightning | Ford
1:06 / 4:32


The All-Electric F-150 Lightning: Turning Electric Into Lightning | Ford
INTELLIGENT BACKUP POWER
Pro Power Onboard
Off Road
Parking
Transferring Power
Stop
Power Transfer: 1.1 of 9.6 kW
When home is properly equipped and home transfer switch disconnects the home from the grid. Based on 30 kWh use per day using the F-150 with the long range battery.
Your results may vary depending on energy usage.
1:08 / 4:32


The All-Electric F-150 Lightning: Turning Electric Into Lightning | Ford
9.6 kW
AVAILABLE
INTELLIGENT
BACKUP POWER
When home is properly equipped and home transfer switch disconnects the home from the grid. Based on 30 kWh use per day using the F-150 with the long range battery.
Your results may vary depending on energy usage.
1:12 / 4:32

Questions?
Thanks!

Lisa White

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