Resource Efficient Electrification (REE) is a heuristic emerging from Empire Building Challenge collaboration

EBC Partners

beam LIVING

Durst

Rudín

HUDSON SQUARE PROPERTIES

LM Development Partners

VORNADO REALTY TRUST

Jonathan Rose Companies

SILVERSTEIN PROPERTIES

Omni New York LLC

EMPIRE STATE REALTY TRUST

Consulting Engineers

JB&B

BURO HAPPOLD

urbs. URBAN SYSTEMS

ecosystem

RMI ENERGY. TRANSFORMED.

the GreyEdge group

Steven Winter Associates, Inc.

BRIGHT POWER

VIDARIS

EMBER STRATEGIES

Pathways to carbon neutrality are riddled with blind spots.

| BLIND SPOT	SOLUTION
Simple Payback Measures	→ Strategic Decarb Assessment (SDA)
1:1 equipment swap	→ Resource Efficient Electrification (REE)
My Engineer says "No!"	→ REE (!)
Electrify everything…at once	→ Electrify everything… efficiently
Wait for better tech to come along	→ Enabling steps
Not a tenant priority	→ ESG, indoor comfort and IAQ benefits
Electricity Produces Emissions	→ CLCPA
Too disruptive	→ Decision tree

A Strategic Decarbonization Assessment is a critical step in the process.

A Strategic Decarbonization Assessment (SDA) is a long-term financial planning tool for building owners to manage carbon emissions and energy use.

- Develop your decarbonization term (years)
- Feed in your baseline starting point
- Define a business-as-usual path and analyze divergence from this
- Develop Discounted Cash Flow model of different investment scenarios with as much detail as possible
- Value non-energy benefits
- Near-term years require more accuracy and detail
- Long-term years are more directional
- Phase-in is critical

Tall building decarbonization requires a whole-systems approach to overcome barriers.
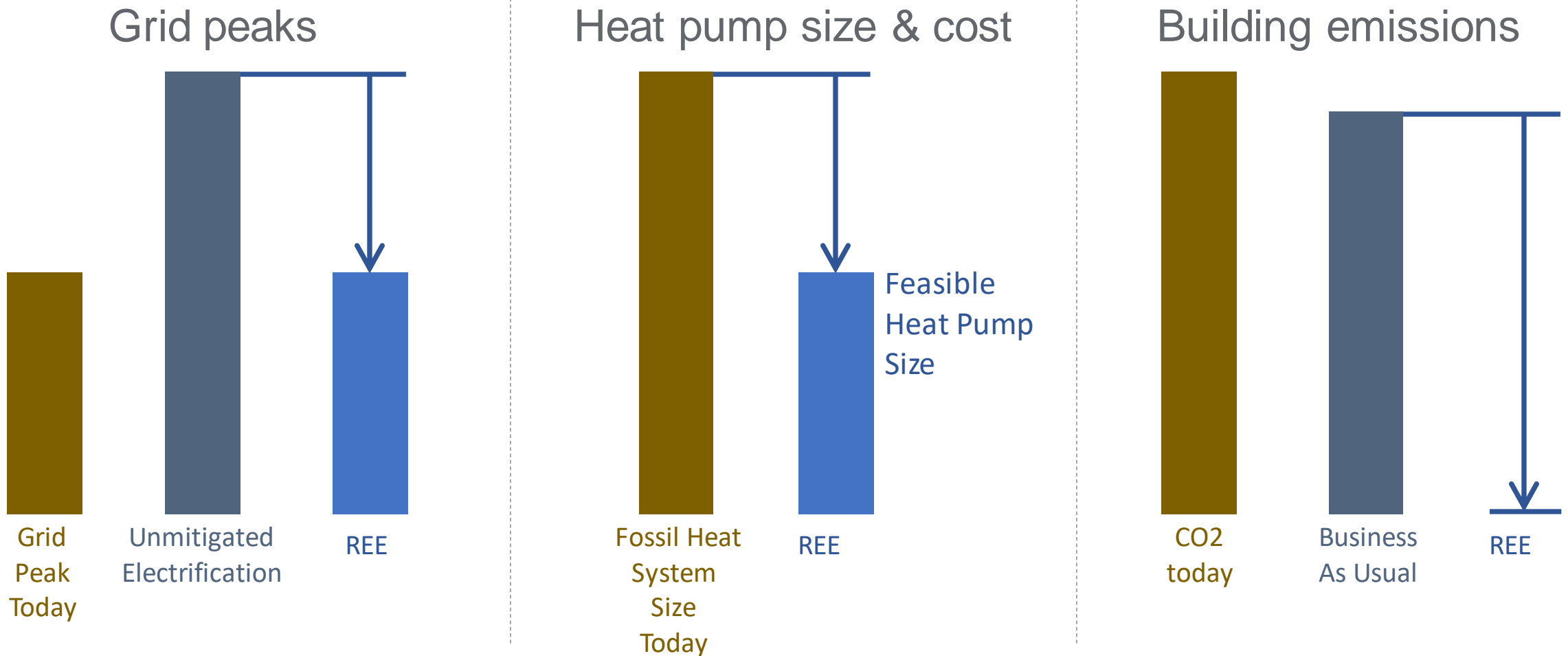
Efficient heat pumps reduce CO2 in tall buildings.
Electric resistance and inefficient heat pump operation may not today.

CO2 / unit of delivered heat

Electricity
COP 1

Gas 93% Efficiency

COP 1.5

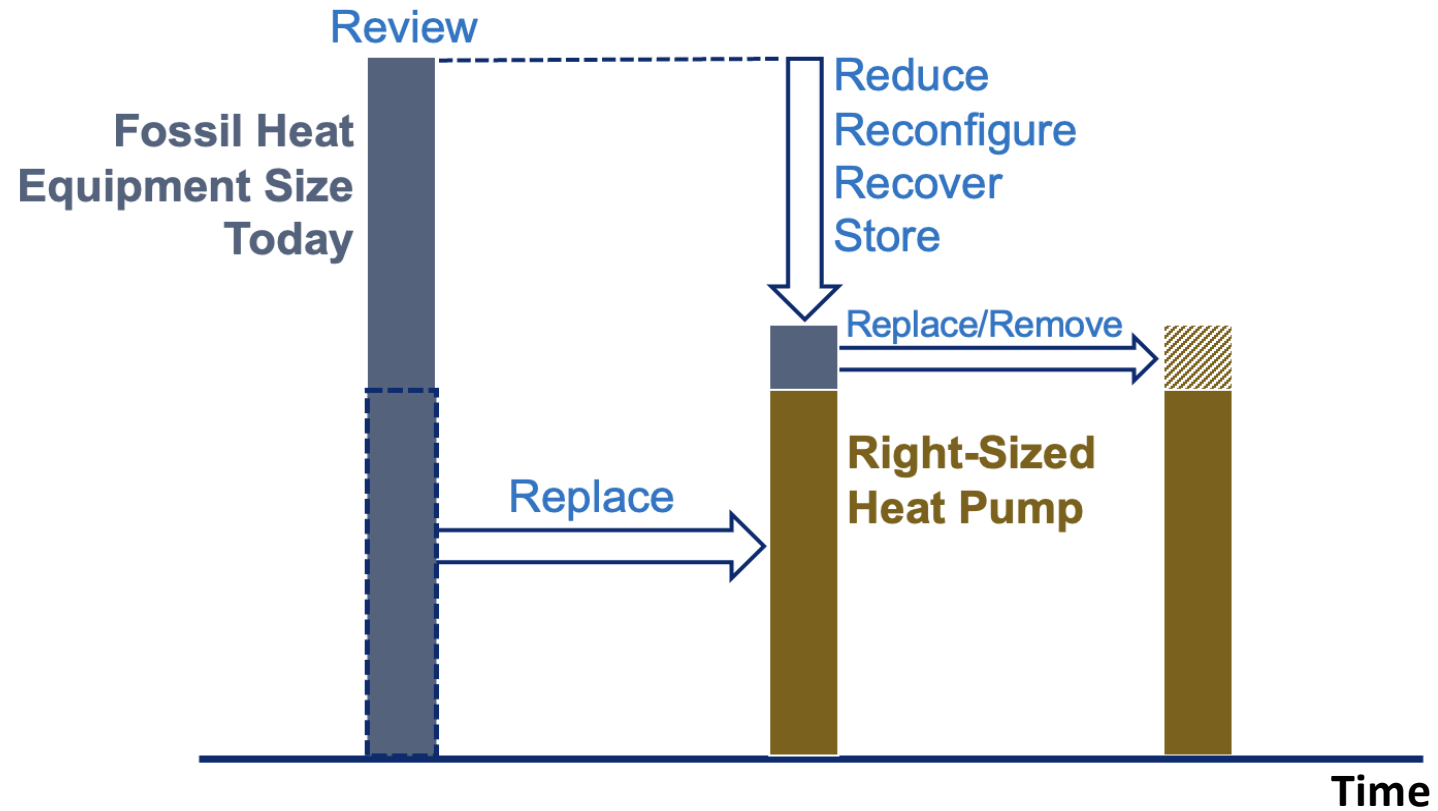Steam (current)

COP 2

COP 3

2022

2040
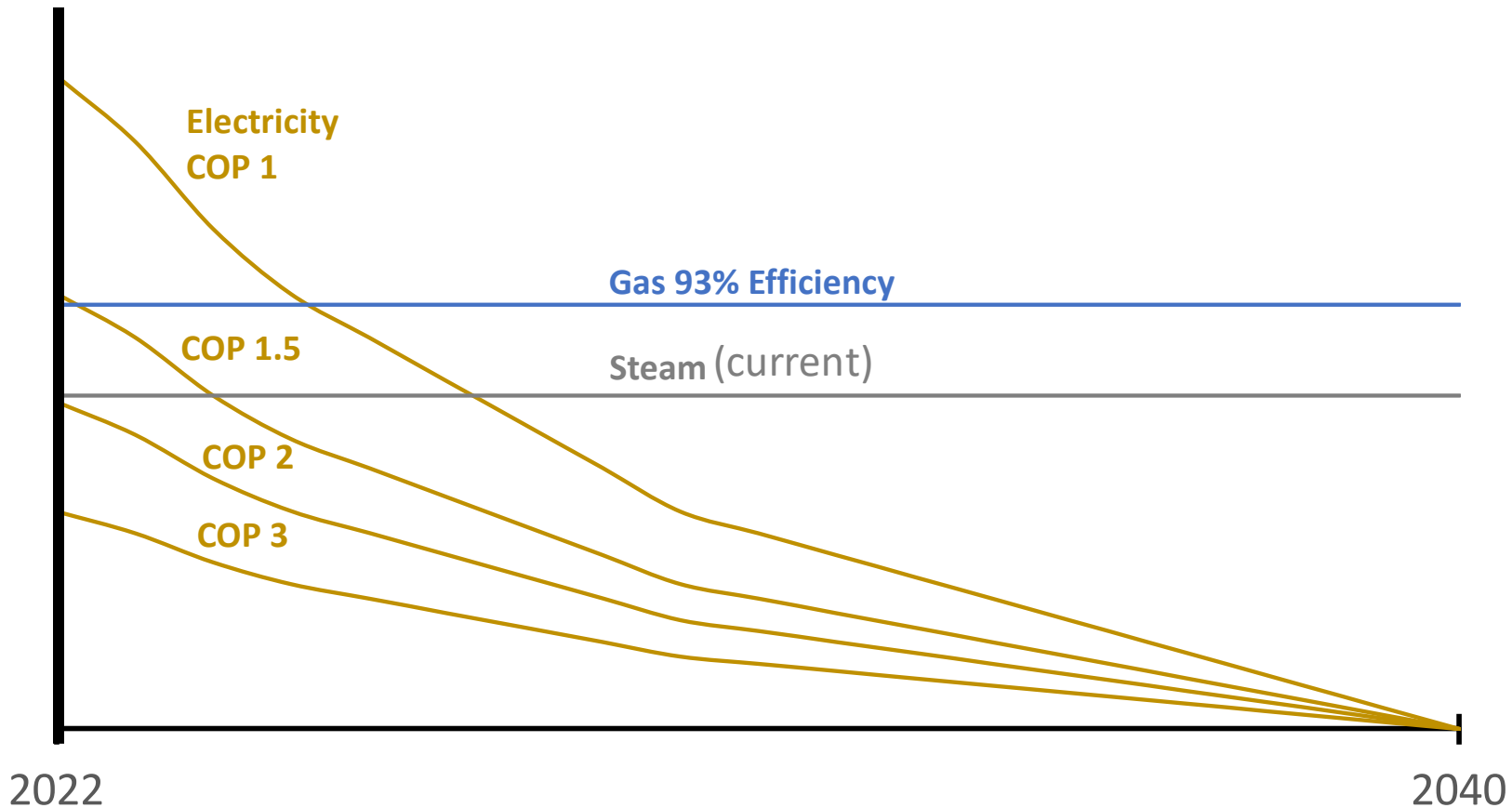
A Heuristic for Decarbonizing Buildings

Resource Efficient Electrification (REE): an incremental methodology and integrated design process combined with strategic capital planning creates a path towards carbon neutral buildings.
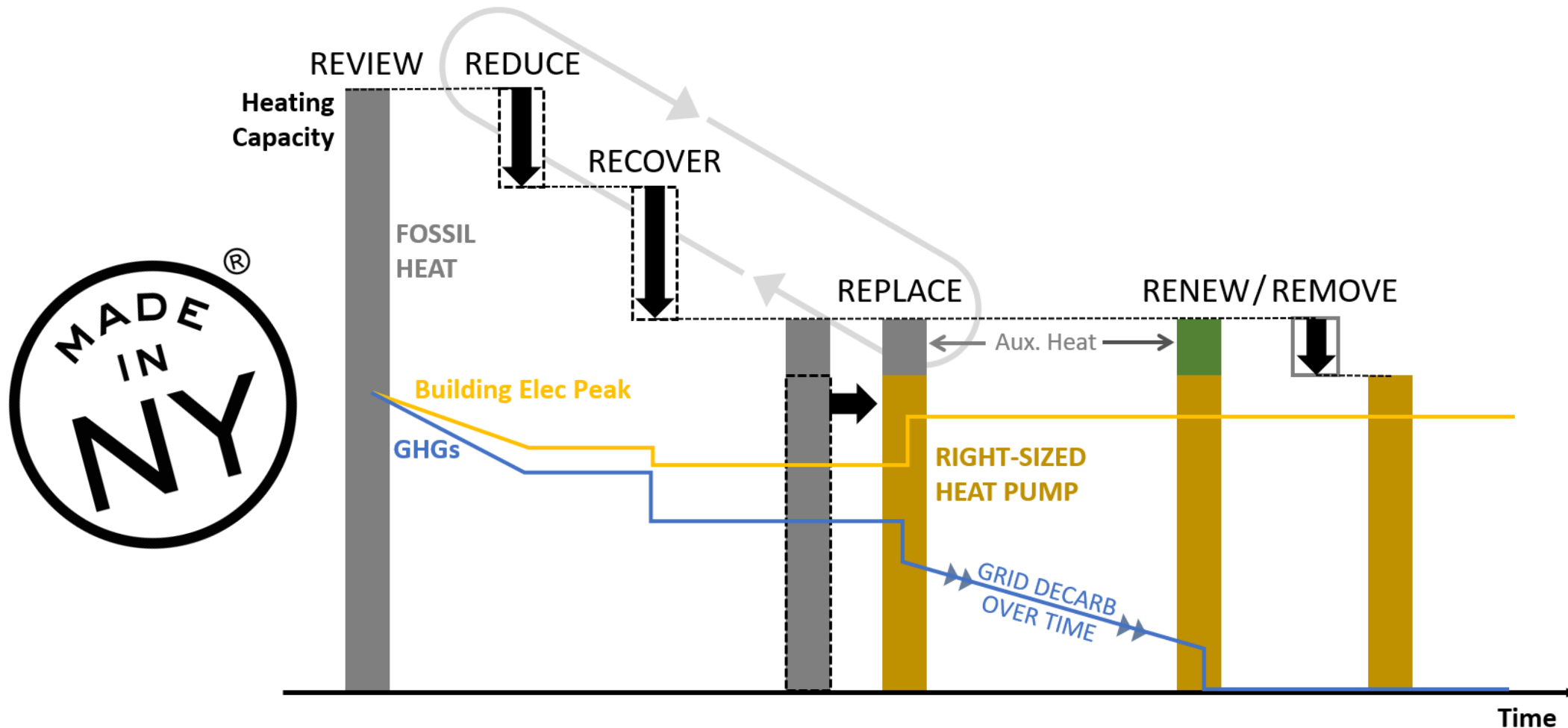
A Heuristic for Decarbonizing Buildings

REE in simpler terms. . . Embrace phasing.

Enabling steps in tall buildings can overcome heat pump size and cost barriers.

|	
Review	• Disaggregate time-of-use profiles to identify heat waste and recovery opportunities and to right-size equipment.
Reduce	• Repair, upgrade and refresh envelopes. • Optimize controls.
Reconfigure	• Eliminate or reduce inefficient steam and forced air distribution. • Create thermal networks and enable heat recovery. • Lower supply temperatures to ranges of optimal heat pump performance. • Segregate and cascade supply temperatures based on end-use.
Recover	• Simultaneous heating & cooling in different zones of building • Eliminate "free cooling" economizer modes • Exhaust heat recovery; absorbent air cleaning • Building wastewater heat recovery • Municipal wastewater heat recovery • Steam condensate • Refrigeration heat rejection. • Other opportunistic heat recovery and heat networking.
Store	• Store rejected heat from daytime cooling, for overnight heating. • Store generated heat— centrally, distributed, or in the building's thermal inertia. • Deploy advanced urban geothermal and other district thermal networking solutions.

Offices can heat themselves much of the year with heat recovery and storage.
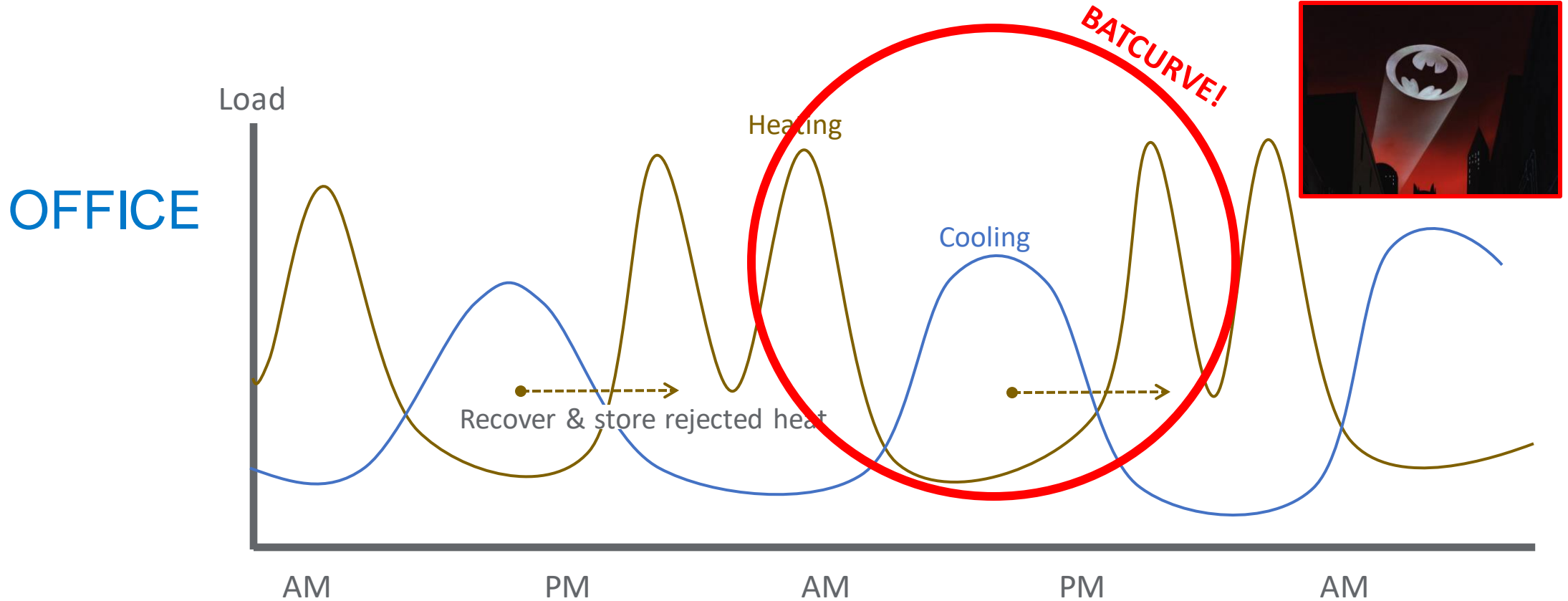
OFFICE

Load

Heating

Cooling

BATCURVE!

Recover & store rejected heat

AM · PM · AM · PM · AM

Illustrative example. Actual time-of-use, disaggregated load profiles should be reviewed for waste, recovery and system sizing.

Multi-family can lower and flatten system peaks by a variety of reduce, recover and store strategies

MULTI-FAMILY
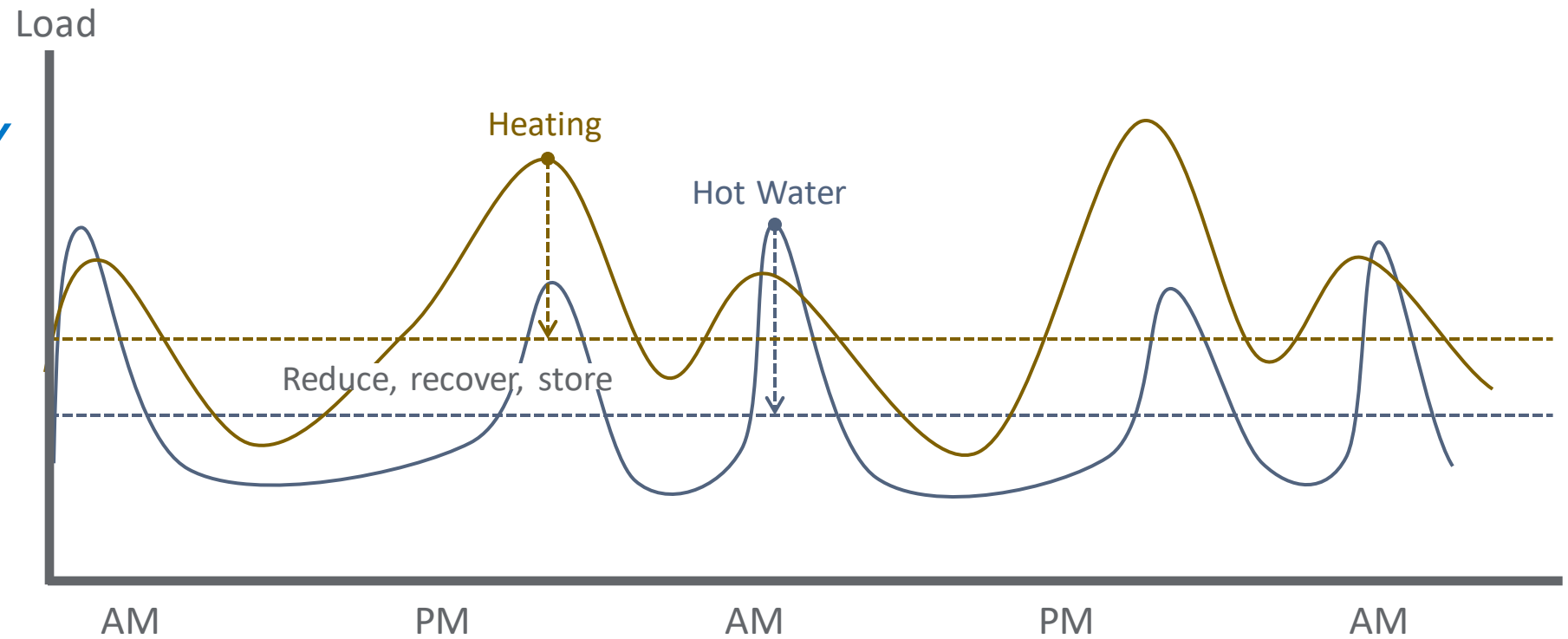
Illustrative example. Actual time-of-use, disaggregated load profiles should be reviewed for waste, recovery and system sizing.
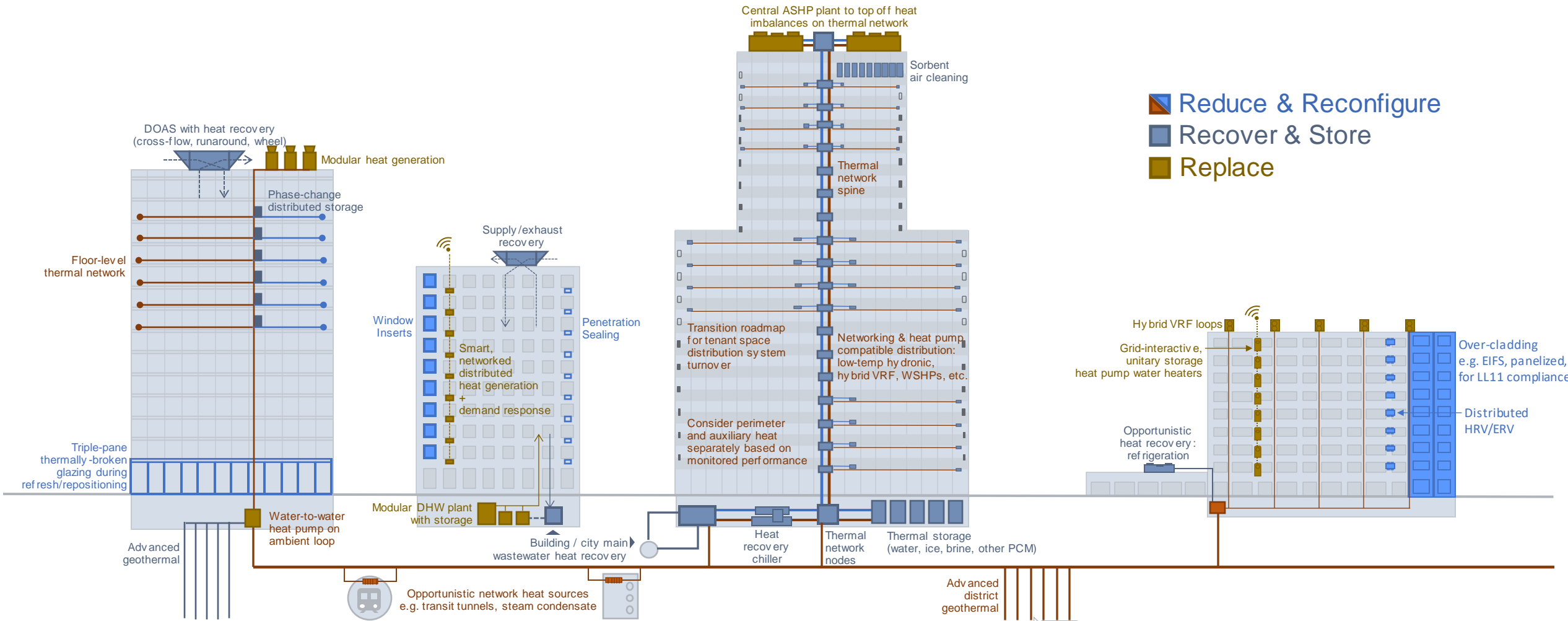
Meet a majority of heating with heat pumps today.
Solve difficult conditions separately, with future-ready optionality.

Annual Energy Usage by Temperature Bin

Heat pumps today

Other heat source today,
with future-ready optionality

Outdoor Temperature (F)
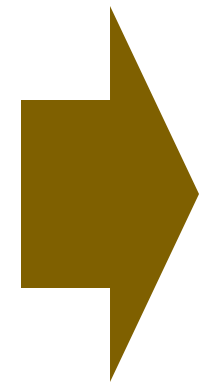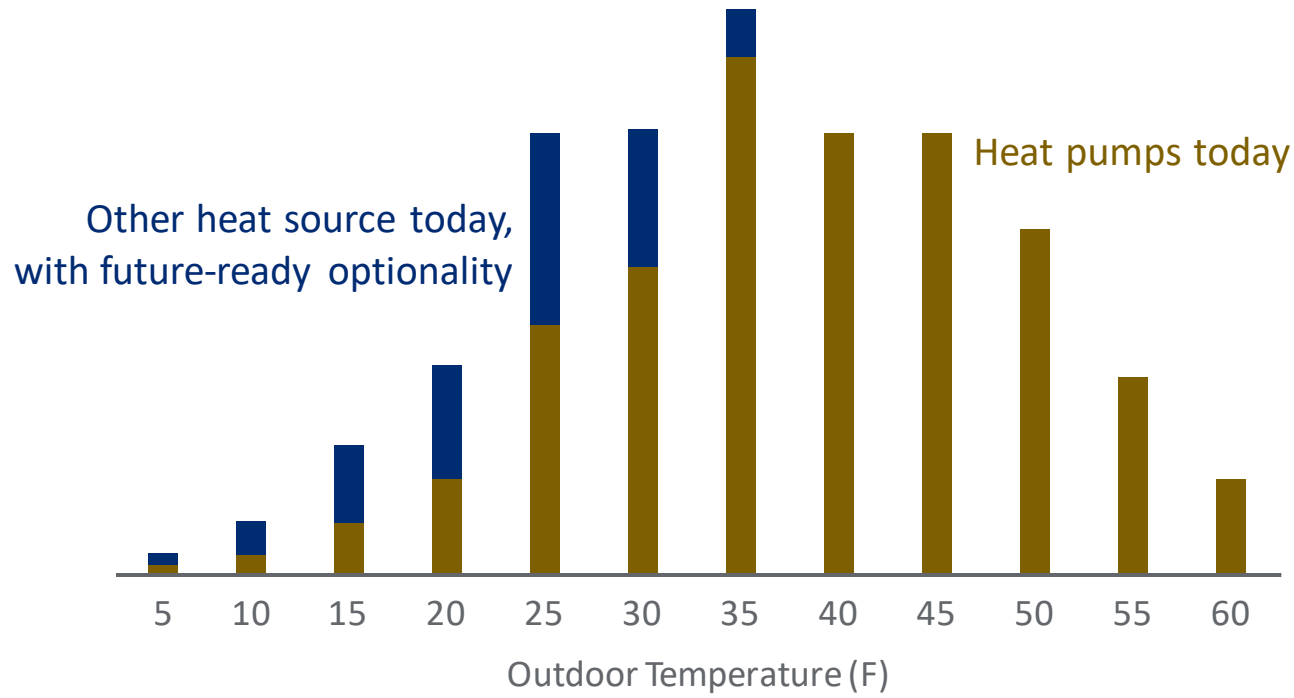
80+%
HEAT PUMP

A whole-system, thermal network approach to clean heat in cold-climate tall buildings:

Central ASHP plant to top off heat imbalances on thermal network

Sorbent air cleaning

Thermal network spine

DOAS with heat recovery (cross-flow, runaround, wheel)

Modular heat generation

Phase-change distributed storage

Floor-level thermal network

Supply/exhaust recovery

Window Inserts

Penetration Sealing

Smart, networked distributed heat generation + demand response

Transition roadmap for tenant space distribution system turnover

Networking & heat pump compatible distribution: low-temp hydronic, hybrid VRF, WSHPs, etc.

Consider perimeter and auxiliary heat separately based on monitored performance

Triple-pane thermally-broken glazing during refresh/repositioning

Water-to-water heat pump on ambient loop

Modular DHW plant with storage

Building / city main wastewater heat recovery

Advanced geothermal

Heat recovery chiller

Thermal network nodes

Thermal storage (water, ice, brine, other PCM)

Opportunistic network heat sources e.g. transit tunnels, steam condensate

Advanced district geothermal

Hybrid VRF loops

Grid-interactive, unitary storage heat pump water heaters

Opportunistic heat recovery: refrigeration

Over-cladding e.g. EIFS, panelized, for LL11 compliance

Distributed HRV/ERV

Reduce & Reconfigure
Recover & Store
Replace

The Empire Building Challenge Process:
Developing a Holistic Decarbonization Strategy

- Assessing Existing Conditions
- Establishing a Decarbonization Goal and Timeline
- Build the Team
- Aligning on Decarbonization and Asset Management Objectives
- Adopting the Resource Efficient Electrification approach
- Design Charrette. . . Iterate.
- Strategic Decarbonization Assessment
- Project Prioritization
- Further Analysis plus Refinement . . . Iterate.

How you can help spread the word. . .

Share Examples → Release and share Empire Building Challenge cohorts case studies and examples of work from our Strategic Partners

Shift the Paradigm → Hold EBC events and webinars propagate the REE message

Develop the Market → Empire Technology Prize, cohort procurement support

Replicate and Scale → Strategic Influence Campaign, Policy, Training, Programs & Finance

Thank You

Connect With Us
[Empire Building Challenge](www.nyserda.ny.gov/EBC) www.nyserda.ny.gov/EBC
EBC@nyserda.ny.gov

NEW YORK STATE OF OPPORTUNITY. | NYSERDA