Real Reliability
The Value of Virtual Power

PRESENTED BY
Ryan Hledik

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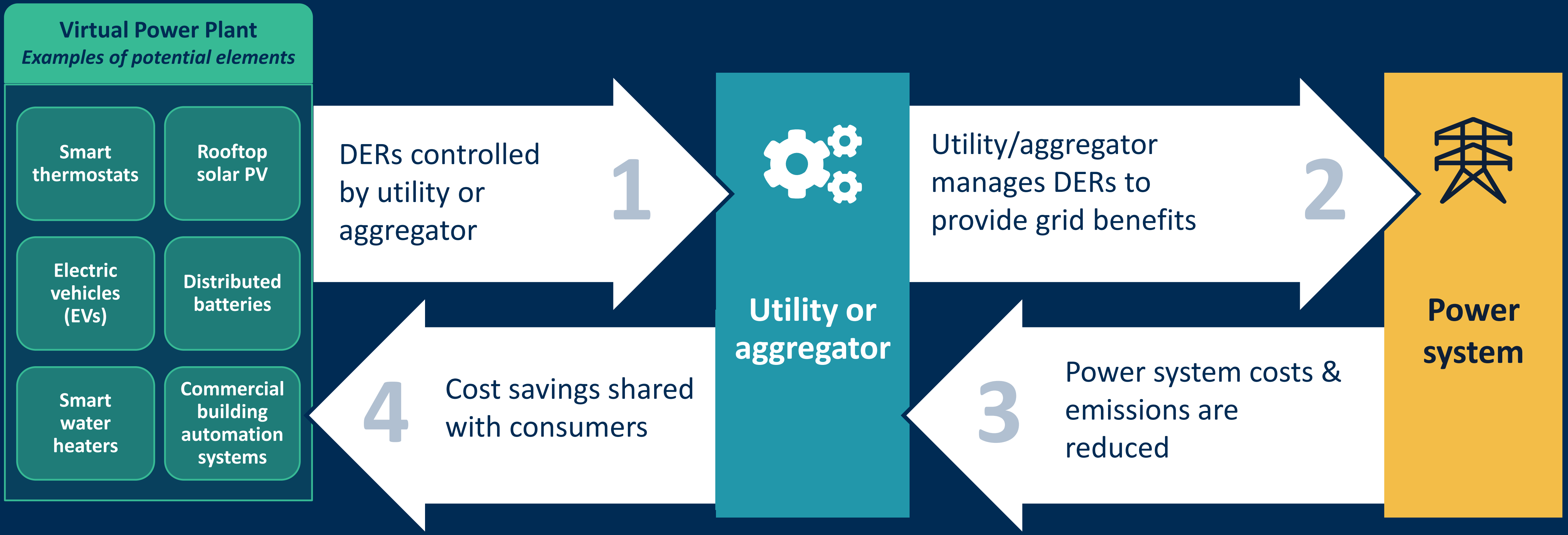
What Is a VPP?

A VPP is portfolio of distributed energy resources (DERs) that are actively controlled to provide benefits to the power system, consumers, and the environment.



VPPs are at a deployment inflection point

Drivers

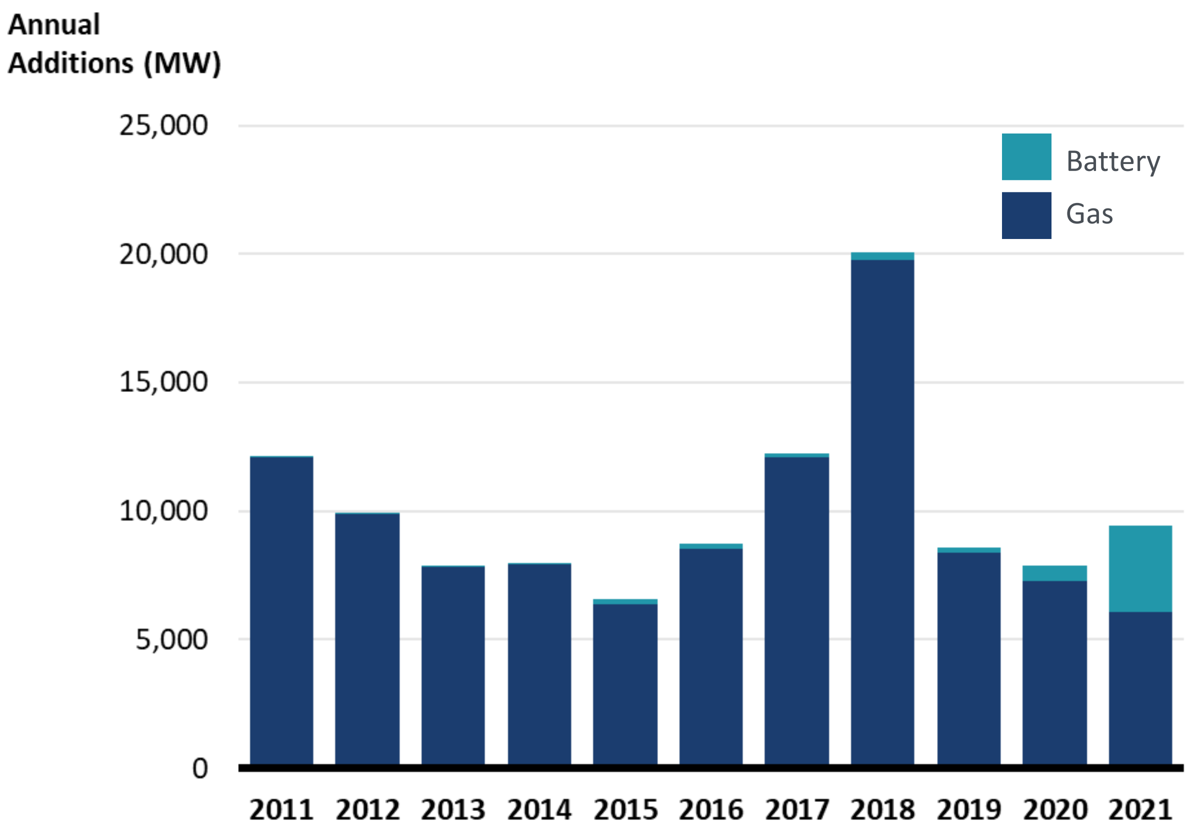
- Declining DER costs
- Technological advancement
- Inflation Reduction Act
- FERC Order 2222
- Growing model availability
- The decarbonization imperative

	PRESENT	2030
Homes with Smart Thermostats	10%	34%
Homes with Electric Water Heating	49%	50%
Residential Rooftop Solar	27 GW	83 GW
Behind-the-Meter (BTM) Batteries	2 GW	27 GW
Light-Duty Electric Vehicles	3 mil.	26 mil.

Resource adequacy needs persist in the US

- $120 billion of investment in past decade
- Driven by electrification, coal retirements, and growing renewables dependence
- Our study:
  - Can VPPs reliably serve this resource adequacy need?
  - And can they compete economically with gas peakers and batteries?

Historical U.S. Capacity Additions for Resource Adequacy
~110 GW, 2012-2021



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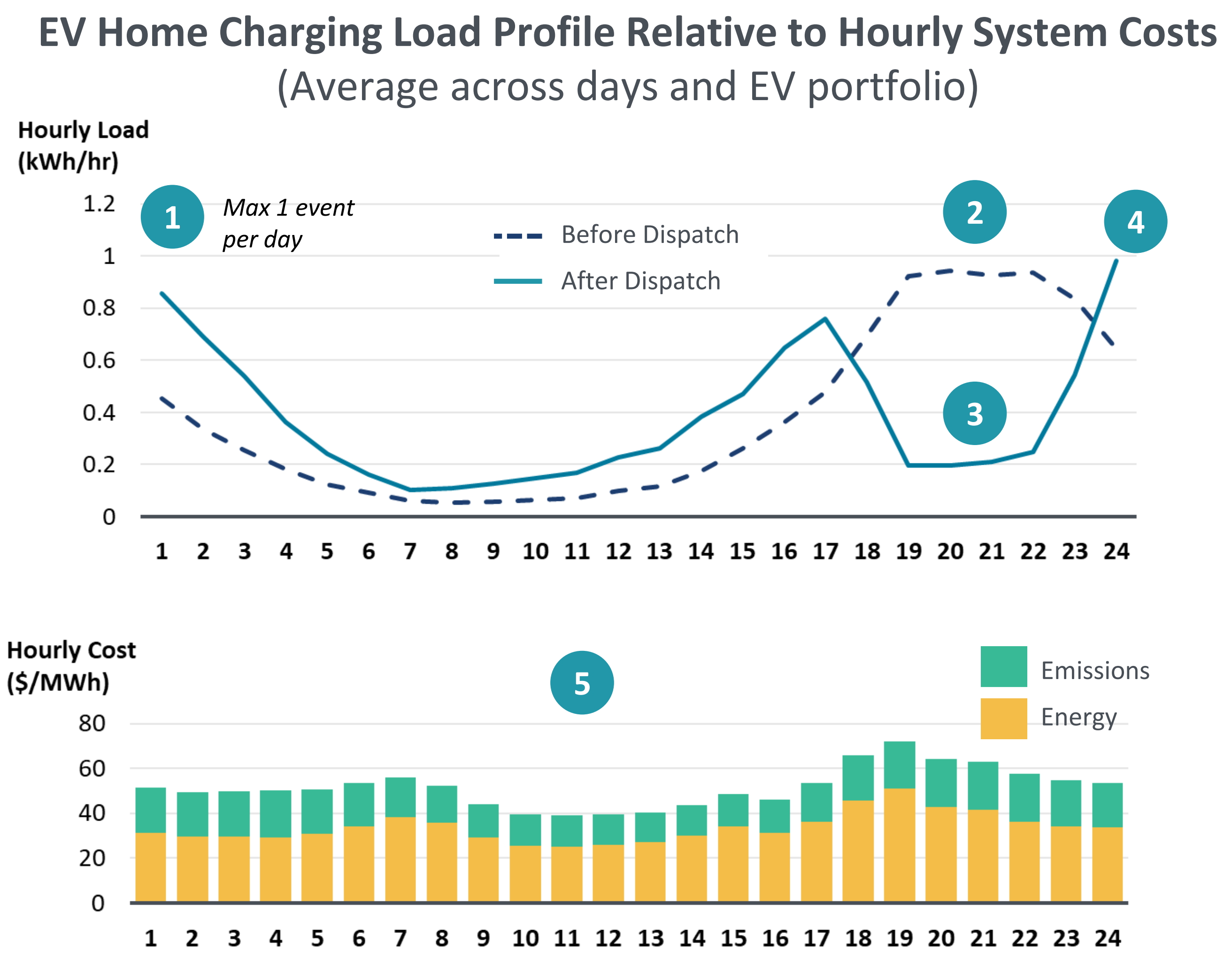
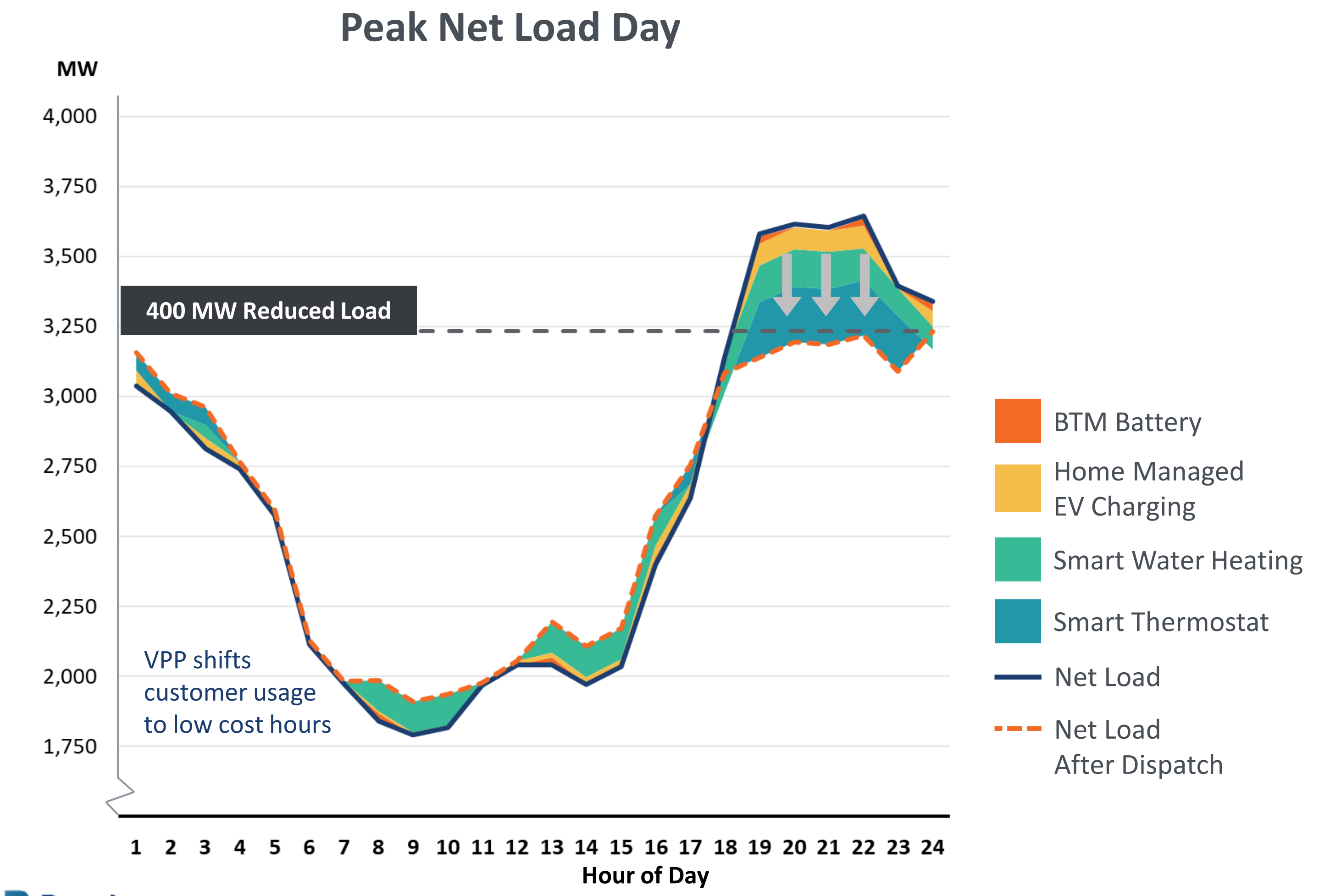
Simulated VPP dispatch is based on observed performance in actual deployments

1. Limits on customer tolerance for number of interruptions
2. Load impacts limited to actual available load during system peak hours
3. Load impacts account for event opt-outs, remain within customer tolerance range
4. Pre- and post-event load building to ensure customer usage ability
5. Dispatch is simulated to maximize avoided power system costs, in addition to providing resource adequacy



The modeled VPP can fully provide 400 MW of resource adequacy for a moderately-sized utility

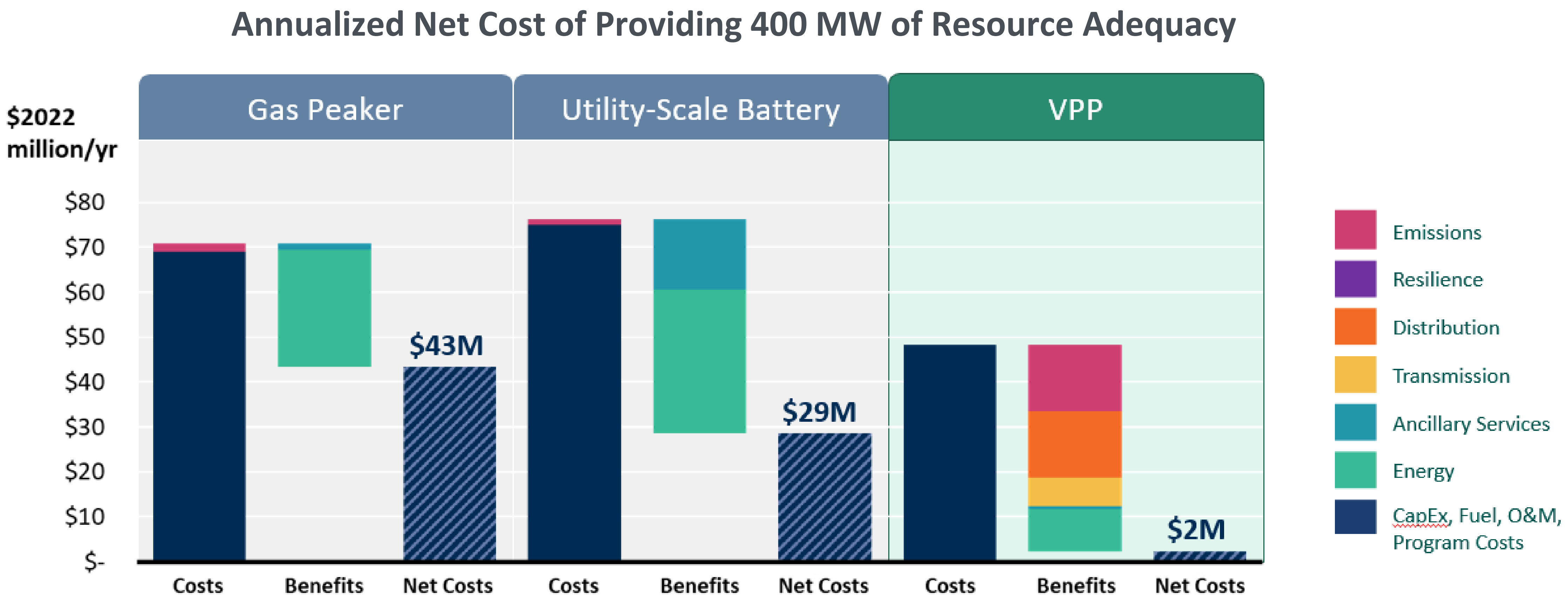
We modeled four commercially available residential demand flexibility technologies for an illustrative utility composed of 1.7 million customers and 50% renewables



The VPP reduces load in:

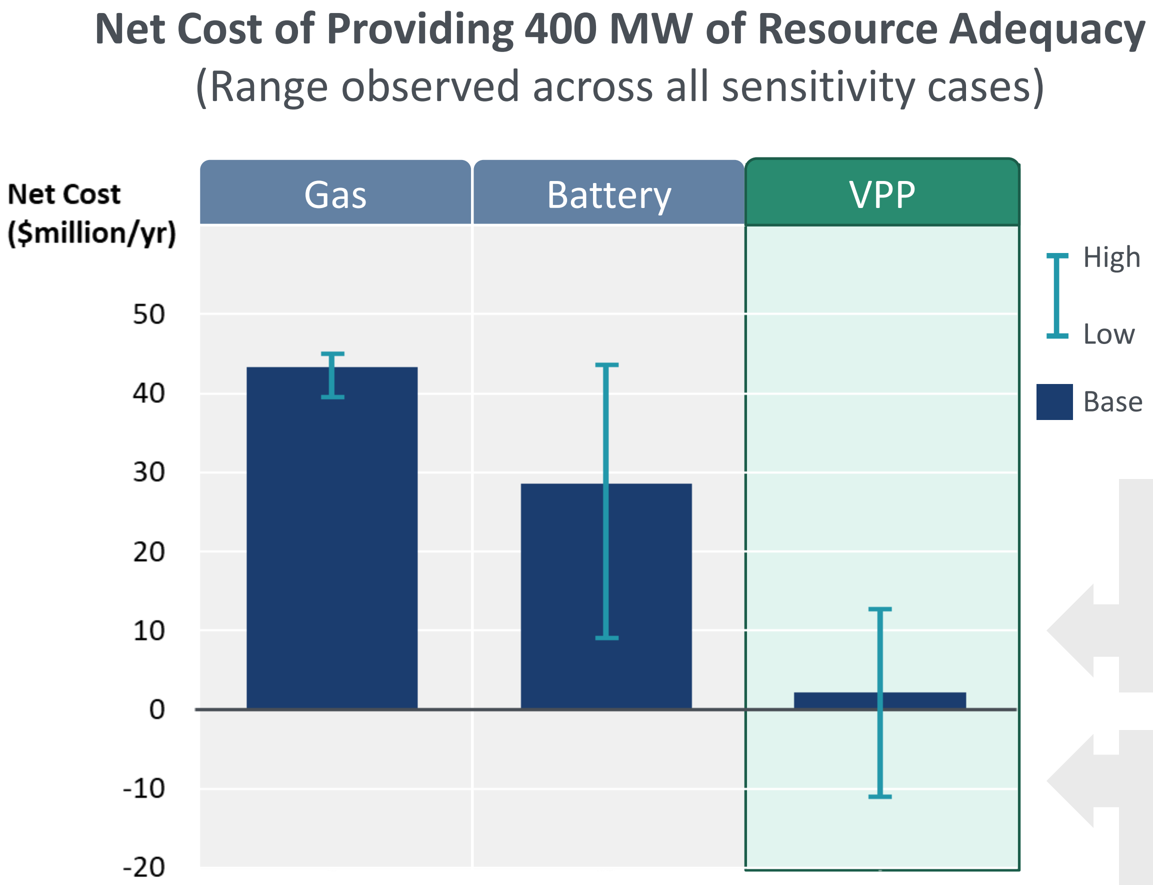
- Summer and winter
- 7 months
- 63 hours of the year
- 7 consecutive hours

Resource Adequacy… For Cheap



RMI estimated that 60 GW of VPPs could be deployed nationally by 2030. At that scale, VPPs would save $15 to $35 billion in resource costs relative to the alternatives over 10 years … plus $20 billion in societal benefits

The VPP could provide resource adequacy at a *negative* net cost to society



Economic competitiveness of battery storage and VPPs varies across markets, depends trajectory of future cost declines.

In markets with higher T&D costs or higher GHG emissions costs, the additional (i.e., non-resource adequacy) value of a VPP can outweigh its costs

VPPs can provide several additional major benefits not modeled in this study

Increased renewables deployment

Flexible scaling

Better power system integration of electrification

Enhanced customer satisfaction

Faster grid connection

Improved behind-the-meter grid intelligence

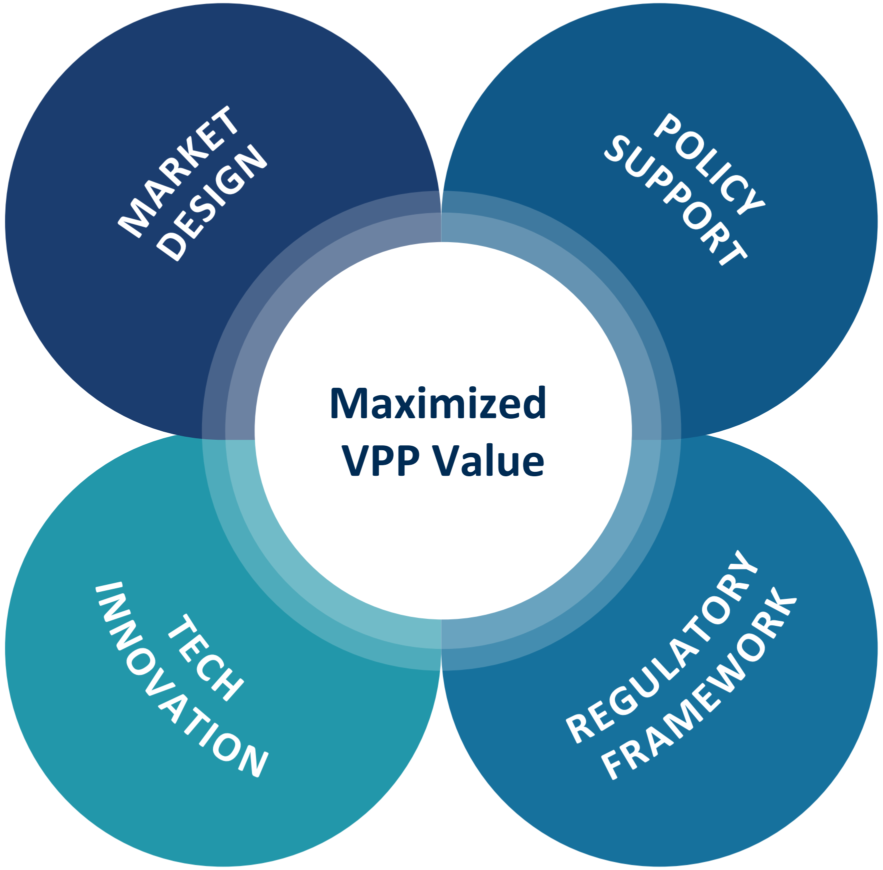
The ideal conditions for VPP deployment

MARKET DESIGN

- Wholesale markets provide a level playing field for demand-side resources.
- Retail rates and programs incentivize participation in innovative, customer-centric ways.

TECHNOLOGY INNOVATION

- DERs are widely available and affordable. DERs can communicate with each other and the system operator.
- Algorithms effectively optimize DER use while maintaining customer comfort and convenience.



POLICY SUPPORT

- Codes and standards promote deployment of flexible end-uses.
- R&D funding supports removal of key technical barriers.

REGULATORY FRAMEWORK

- Utility business model incentivizes deployment of VPPs wherever cost-effective.
- Utility resource planning and evaluation accounts for the full value of VPPs.

Three low-risk actions utilities and regulators can take now

1. Conduct a jurisdiction-specific VPP market potential study. Then establish VPP procurement targets.

2. Establish a VPP pilot. Test innovative utility financial incentive mechanisms.

3. Review and update existing policies to comprehensively account for VPP value.

For more information:

https://www.brattle.com/real-reliability/

Clarity in the face of complexity

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