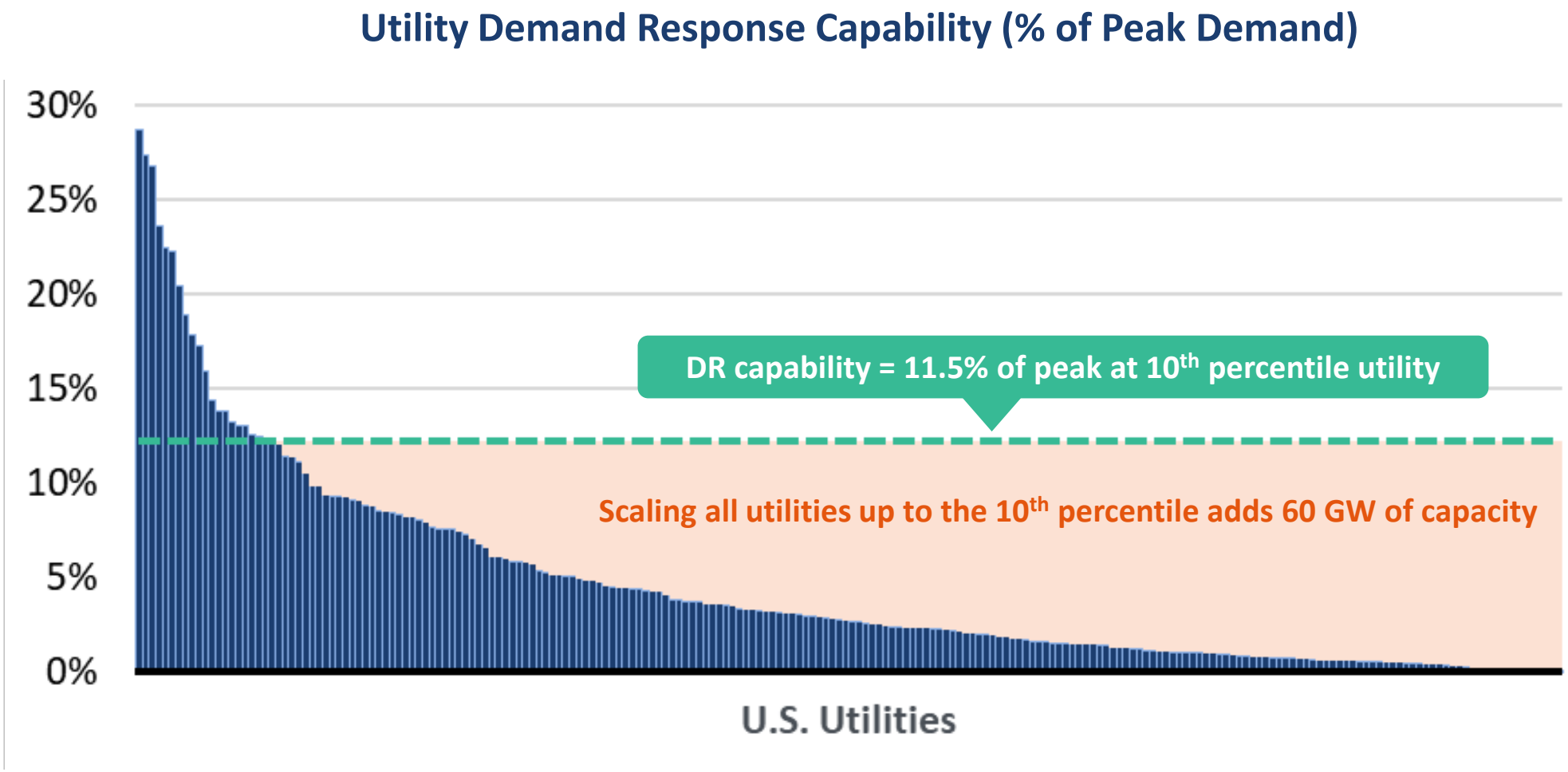
U.S. Generation Capacity: Mind the Gap

	2016 to 2023 (Historical)	2023 to 2030 (Forecast)
Demand: Peak Load Growth	**24 GW (+3%)**  **Limited growth** - Overhang from Great Recession - Efficiency improvements - Decoupling of GDP and electricity demand	**>100 GW (+14%)**  **Massive growth** - Data centers - Building electrification - Electric vehicles - Advanced manufacturing
Supply: Needed Investment in Capacity for Resource Adequacy	**$90 billion (83 GW)**  **Persistent investment despite limited demand growth** - Coal replacement - Renewables integration - Increasingly volatile weather	**$250-$350 billion (~240 GW)**  **Likely infeasible with traditional generation resources** - Equipment shortages - Interconnection delays - Affordability concerns - Decarbonization constraints ***Innovative solutions are needed to address supply/demand gap***

The opportunity to scale



Source: Brattle analysis of data from Form EIA-861 2022. The 60 GW opportunity to scale is estimated as the additional capacity that would result from all analyzed utilities scaling capability to 11.5% of their peak load. The analysis includes the 238 utilities that: (i) reported DR capability to EIA in 2022, (ii) reported peak demand of at least 100 MW, and (iii) are investor-owned, municipal, cooperative, state, or federal utilities. 12 utilities are excluded due to data anomalies.

Our work with LBNL

Purpose:

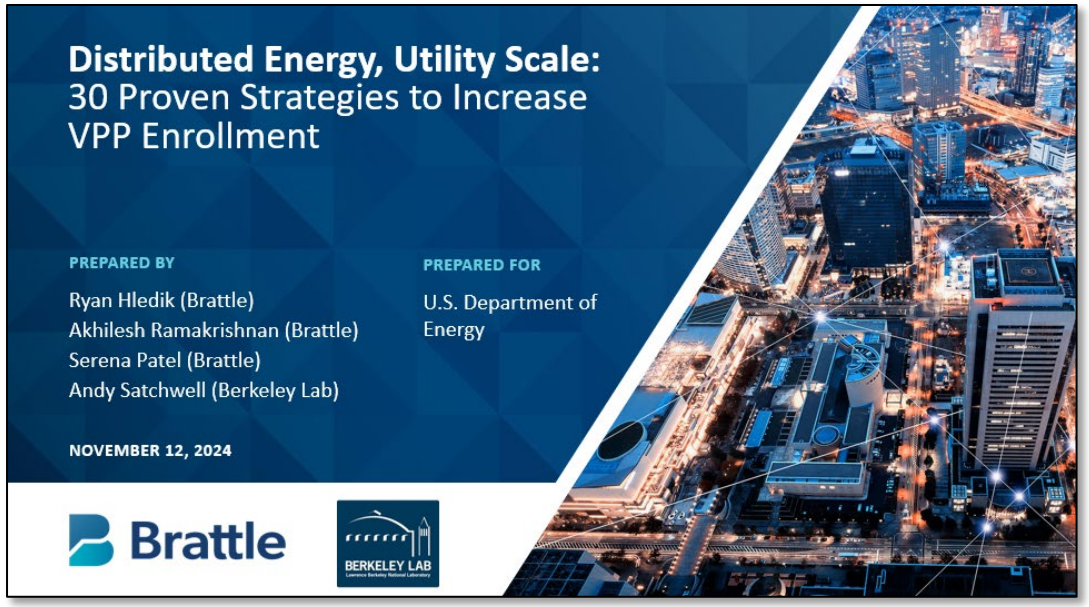
- Identify strategies that successful VPPs have used to expand customer enrollment and achieve scale.
- Provide a guide for utilities, aggregators, and regulators looking to scale/set up VPP programs.

Interviews with 15 VPP solutions providers that have successfully scaled their programs

Focused on strategies that were used to enroll and retain customers in programs

Impact and feasibility survey to help new VPPs programs prioritize implementation of the strategies

For more information (forthcoming, December 2024):



Examples of scale

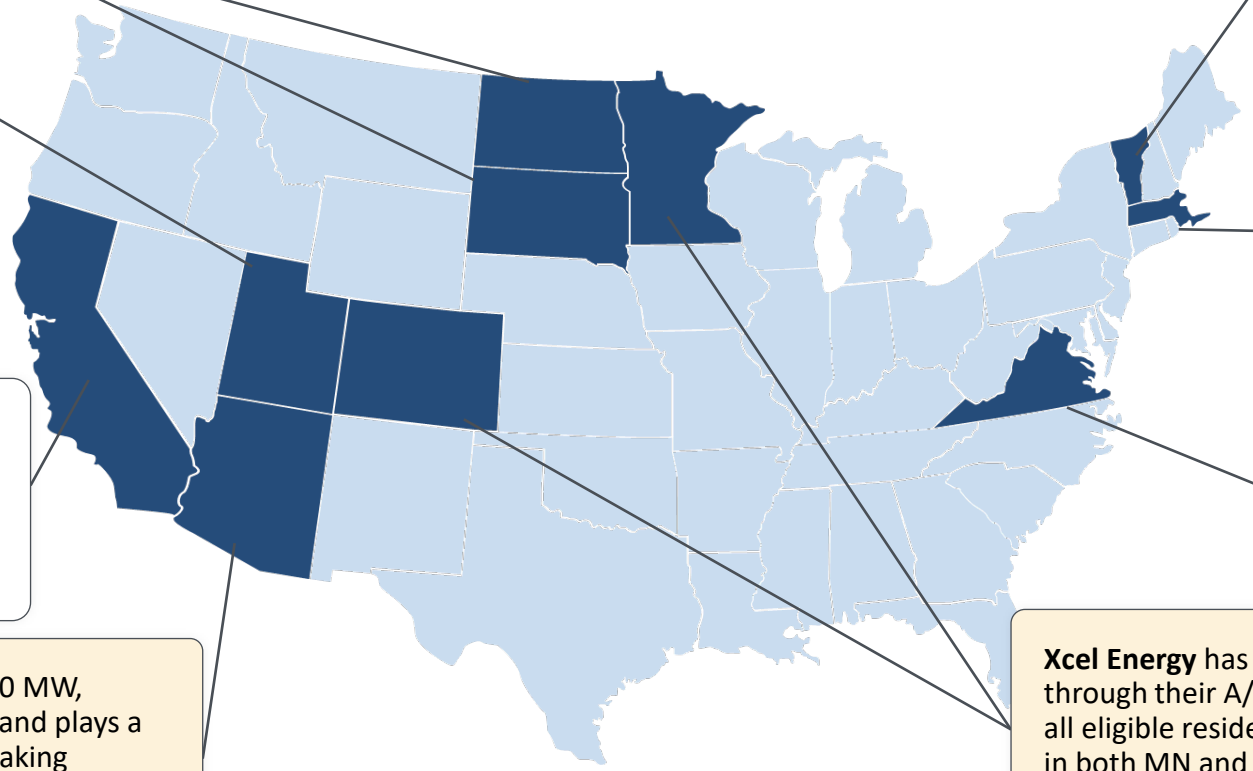
Note: Map will be updated

OtterTail Power's total DR capability is over 15% of its system peak demand

Rocky Mountain Power has almost 300 MW of peak demand reduction capability, and 20% enrollment among all residential customers. Its battery VPP program had 14.3 MW enrolled as of 2023.

PG&E currently operates 20 MWs of Smart AC load control switches, 10 MWs in a Bring Your Own device VPP Program, and 19 MW in Emergency Load Reduction Program.

Arizona Public Service VPP, close to 200 MW, consists primarily of smart thermostat and plays a crucial role during Arizona's record-breaking summer temperatures. In 2024, APS called its first location-based demand response event.



Green Mountain Power has about 70 MW enrolled in its VPP program, making it Vermont's largest single peaking power source.

National Grid had 2,900 battery VPP participants at the start of 2023 (31 MW) and nearly 300 MW of capacity enrolled in its thermostat program by the end of 2020

Duke Energy has 16% of residential customers enrolled in air-conditioning load control, with over 1,500 MW of capacity

Xcel Energy has 390 MW of DR capability in MN through their A/C control programs, with over half of all eligible residential customers enrolled. Their utilities in both MN and CO are in the top 10% of IOUs by DR capability.

30 strategies to increase enrollment

Marketing

1. Concise messaging about program benefits
2. Multiple motivators for participation
3. Top-of-funnel marketing
4. In-person promotional events

Enrollment Process

5. Seamless enrollment process
6. Pre-enroll devices sold on utility marketplaces
7. Point-of-sale enrollment at retailers
8. Offer easy enrollment in multiple programs
9. Integrate value-add services into programs
10. Provide referral incentives

Ecosystem Partners

11. Harmonized messaging from utilities and OEMs
12. Engage customers through trusted entity
13. Partner with local installers
14. Exchange learnings with other utilities

Incentive Design

15. Maximize the financial incentive
16. Ensure customer pays a portion of device cost
17. Offer ongoing participation payments
18. Bundle device financing options with programs
19. Align price signals
20. Offer active and passive control models

Engagement and Retention

21. Improve program design over time
22. Regularly remind customers of their rewards
23. Payments through channels customer will notice
24. Communicate societal impact of participation
25. Call regular testing events
26. Offer easy unenrollment
27. Offer flexibility to opt out of events
28. Limit event notifications in automated programs
29. Allow customers to set control range
30. Target end-uses with multiple technologies

30 Strategies: Impact and Ease of Implementation

Based on perspectives of VPP solutions providers

Ryan's highlights

1 **Concise messaging about benefits.** The headline should be the financial incentive. Also, key program features such as the ability to opt out

5 **Seamless enrollment process.** E.g., offering multiple options for user authentication, pre-populating forms with customer data, and minimizing the number of clicks/forms

7 **Point-of-sale enrollment at retailers.** For example, a checkbox to indicate enrollment when adding a device to the cart on a marketplace or retailer website

9 **Package with other value-add services.** For example, subscription pricing or real-time energy monitoring.

15 **Maximize the financial incentive.** Requires navigating the tension between financial attractiveness and cost-effectiveness.

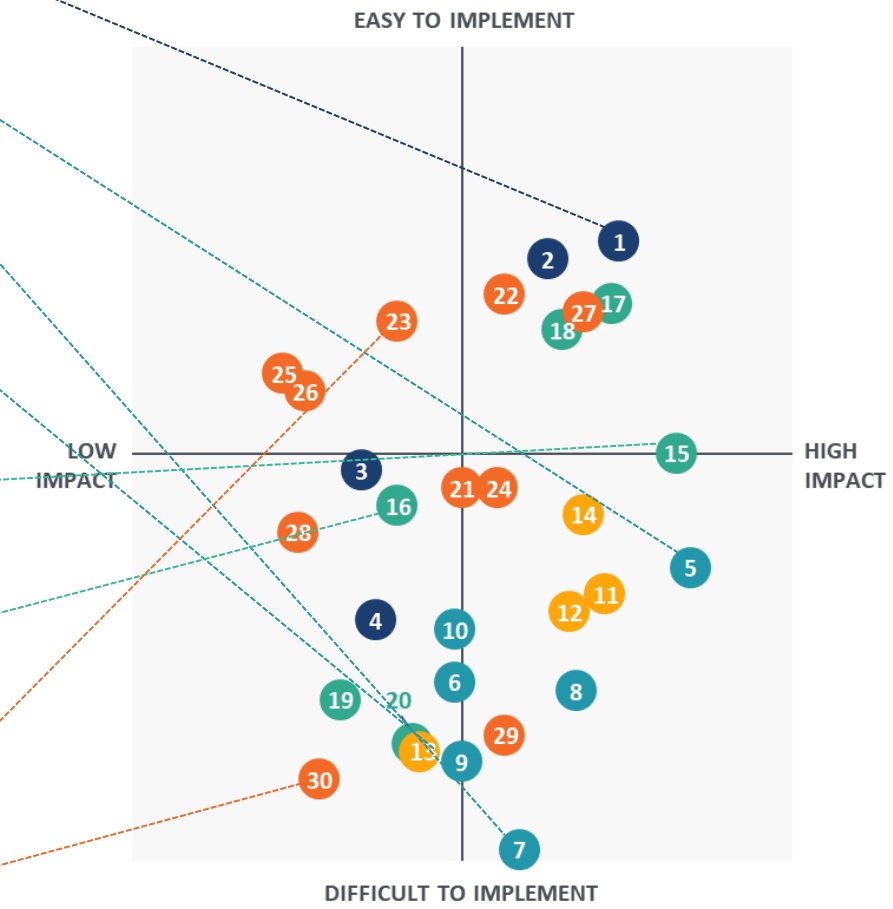
16 **Ensure customer pays a portion of the device cost.** This ensures customers are emotionally invested in their purchase.

23 **Pay through channels customers will notice.** It is important for customers to realize that they are benefitting from participation

30 **Target end-uses with multiple technologies.** E.g., smart thermostats and A/C switches have different advantages and disadvantages.

30 Strategies: Impact and Ease of Implementation

Based on perspectives of VPP solutions providers



From strategy to action

Regulators

1. Use the strategies as a checklist.
2. Require that the proposals include a plan to scale.
3. Review and address areas where existing regulations may limit successful implementation of the strategies.

Utilities

1. Evaluate existing programs against the 30 strategies.
2. Where additional funding is required to implement the strategies, clearly define potential impacts and ratepayer benefits.
3. Streamline the enrollment process.

Aggregators

1. Advocate for solutions a coordinated fashion.
2. Provide empirical support demonstrating the efficacy of the strategies to convince regulators and utilities to enable them.
3. Deliver on commitments to scale.