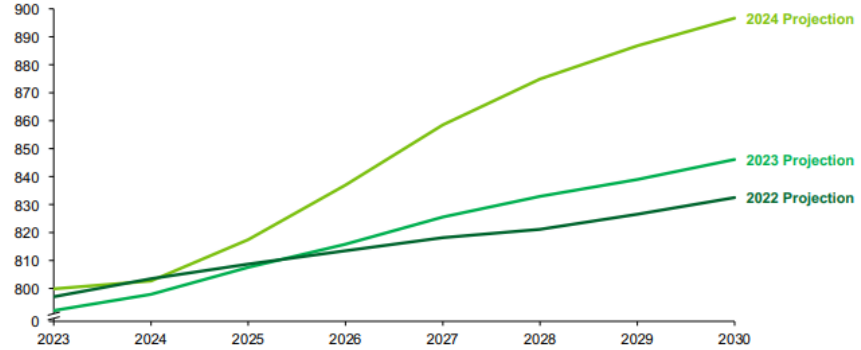
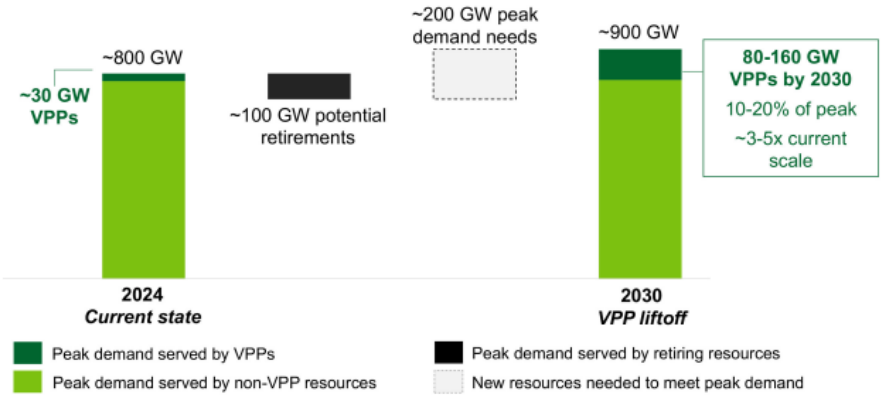
Context: Peak Demand Growth and VPP Potential

U.S. summer peak hour demand by year (2023-2030), GW



Source: NERC 2024 Electricity Supply and Demand data

US peak electricity demand



Imperative 1

Expanding DER Adoption With Equitable Benefits

Case Study: Roanoke Cooperative, NC

***Roanoke Cooperative** uses an inclusive utility investment to reduce upfront cost and financing barriers to adopting water heater control switches and smart thermostats.*

- **Roanoke Cooperative (RC)** launched the Upgrade to $ave program in 2016 to reduce energy bills for the fourth lowest income Congressional district in the U.S.
- The Board of Directors targeted upgrading 1000 homes with energy efficiency and demand response measures. They approved use of the Pay As You Save® (PAYS®) system, an inclusive utility investment model, for the design of the utility program and tariff.[18,lviii,lix]
- RC paid upfront for all cost-effective energy upgrades at a member's residence and recovered its costs through a fixed, monthly cost recovery charge that was lower than the estimated savings from the upgrades on an annual basis.[lx,19]
- To enroll customers, RC assessed the energy savings potential of the building rather than the owner's income or creditworthiness, allowing all members to access low-cost financing options.
- Participating members reduced electricity usage by ~20% because of upgrades and the utility realized peak demand savings of ~20% during summer and winter peaks.
- Including the cost of capital and program operation costs, the utility sees $2M+ NPV over the lifetime of the upgrades.

Detailed case study provided in Appendix A.iii.

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Imperative 1

Expanding DER Adoption With Equitable Benefits

Case Study: San Diego Community Power, CA

San Diego Community Power *leverages upfront, stackable incentives to provide the opportunity for no-cost solar and batteries to qualified priority populations.*

- **San Diego Community Power (Community Power)** launched the Solar Battery Savings program in 2024.
- The program was designed to benefit all customers through upfront incentives to lower the initial cost of home solar and battery storage resources.
- Community Power worked with state and local programs to ensure their incentives could stack with other programs such as California's DAC-SASH and SGIP[20,lxi,lxii] programs and the City of San Diego's Solar Equity program to allow priority populations in particular to cover the entire cost of solar and storage resources through available incentives.

Detailed case study provided in Appendix A.iii.

Imperative 2

Simplifying VPP Enrollment

Case Study: Minnkota Power Cooperative, ND *(No-regrets action)*

Minnkota Power Cooperative *enrolled 40% of customer base by communicating financial benefits of enrollment in simple and concise terms.*

- **Minnkota Power Cooperative's** demand response program has enrolled 55,000 customers (40% of customers) and can serve 350 MW, 35% of winter peak load,[lxxi] through the program.[lxxii]
- Minnkota provides clear financial benefits for enrollment and participation – upfront incentives to purchase the DERs and customer eligibility for the off-peak program rate, which is roughly half the standard rate, to enroll in the program.[lxxiii]
- During peak events, Minnkota is able to temporarily control DERs including heat pumps, water heaters, EV chargers, and commercial & industrial loads.
- Minnkota also worked to cultivate widespread buy-in from member distribution co-operatives to message the enrollment benefits, providing customers a uniform messaging approach.[lxxiv,lxxv]

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Imperative 2

Simplifying VPP Enrollment

Case Study: Arizona Public Service, AZ *(High-impact action)*

***Arizona Public Service** Cool Rewards enrolled 97,500+ thermostats by establishing an online marketplace that offers pre-enrollment at point of purchase.*

- **Arizona Public Service (APS)** launched **Cool Rewards**, a smart thermostat program, in 2018 after the Arizona Corporation Commission authorized demand response and load management programs for the utility.
- As of November 2024, the Cool Rewards program has enrolled over 97,500 connected thermostats with the ability to shed over 160 MW of load during peak demand events from both residential and small to medium-sized business customers.
- APS established a smart thermostat marketplace on their website where all customers could get an instant $30 rebate at checkout.[lxxvi]
- APS allowed customers to receive an additional $85 off upfront by pre-enrolling into the Cool Rewards program after providing basic information (e.g., name and address).
- Embedding pre-enrollment into the point-of-sale process reduces marketing and recruiting costs for the program. As of the end of October 2024, 9,290 Cool Rewards pre-enrollments were processed through APS marketplace, which was built in partnership with **Enervee**.[lxxvii]

Detailed case study provided in Appendix B.ii.

Imperative 3

Increasing Standardization in VPP Operations

Case Study: National Grid, ConnectedSolutions, MA and NY

***National Grid established a multi-device VPP** within 4 months with <$500k upfront investment that now provides up to 250 MW of peak shaving benefits.*

- **National Grid** developed and launched its ConnectedSolutions 'bring-your-own-device' (BYOD) VPP in less than four months to provide low-cost, low-emissions peaking capacity in Massachusetts and New York.[42]
- In this configuration, National Grid contracts with **EnergyHub**, an edge DERMS vendor that integrates multiple DER software systems into one platform. The heterogenous aggregation is controlled as one cohesive, utility-scale resource.
- National Grid sends notices to EnergyHub in advance of peak hours to dispatch demand reductions from the customer-owned DER aggregation that EnergyHub manages on National Grid's behalf.
- National Grid required little change to its internal organizational operations to implement the VPP. System integration is low; a National Grid employee logs into EnergyHub's online portal to send instructions and collect data.

Imperative 3

Increasing Standardization in VPP Operations

Case Study: Green Mountain Power, Energy Storage System Leasing Program, VT

Green Mountain Power launched a utility-owned and operated battery VPP *that offers backup power for participants, peaking capacity, emissions reduction, and transmission benefits for the grid, and lower costs for all customers.*

- **Green Mountain Power** fully launched the Energy Storage System (ESS) Leasing program in 2020 to improve system reliability in the face of extreme weather while reducing costs for all customers.[43]
- GMP operates the program with **Tesla** technology. Tesla supplies the battery hardware (Powerwalls) and acts as the software platform that aggregates and orchestrates battery dispatch.
- Tesla uses real-time load data provided by Green Mountain Power via an API to strategically dispatch batteries to shave peaks on the distribution system.

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Imperative 3

Increasing Standardization in VPP Operations

Case Study: Rocky Mountain Power, WattSmart, UT

Rocky Mountain Power developed a battery VPP *that integrates directly into its grid operations system and enables many grid services.*

- **Rocky Mountain Power** developed its Wattsmart battery VPP in partnership with **sonnen** to deliver high-value grid services cost-effectively and increase battery adoption among customers.
- RMP creates significant value for the grid by obtaining a "full stack" of valuable grid services from the batteries, paying participants upfront and ongoing performance incentives.
- Unlike VPPs used only during peak hours or peak seasons (summer, winter), RMP may use its batteries 365 days of the year, 24 hours per day.
- RMP's grid operations team directly dispatches the batteries using a distributed battery grid management system (DGBMS) that integrates battery controls directly into the utility's energy management system without any intermediate software layers.
- The network of batteries can respond automatically to grid signals in as little as three seconds (sonnen and Core+ batteries) and no slower than 50 seconds (other brands). RMP personnel can override automated dispatch at any time.
- The Wattsmart VPP is growing rapidly, with a near-term goal of reaching 100 MW by recruiting customers with solar arrays (>80,000 in Utah) and offering battery incentives to motivate customers to 'firm' their renewable power.

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Imperative 4

Integrating Into Utility Planning & Incentives

Case Study: Colorado PUC, CO

***Colorado PUC** established a performance incentive mechanism to accelerate DER interconnection, helping improve DER deployment to support VPP potential.*

- **Colorado PUC** approved a performance incentive mechanism for **Xcel Energy** to speed up interconnection of DERs (Order 23AL-0188E) in October 2023.[civ]
- The PIM requires Xcel to refund customers 4% of the interconnection fee per day delayed beyond Xcel's internal timeline targets (e.g., 50 days).
- If Xcel interconnects the DER faster than the target timeline, the value would be credited against any penalties accrued for exceeding the target.
- The PIM aims to align Xcel incentives with ratepayer interests to support DER interconnection, enabling faster DER deployment and supporting greater VPP potential at scale.

Imperative 4

Integrating Into Utility Planning & Incentives

Case Study: New York State PSC, NY

***New York State PSC** implemented a value compensation methodology to reward DERs for a range of delivered grid benefits.*

- In 2017, **New York State PSC** implemented a Value of Distributed Energy Resources Value Stack (VDER, or the Value Stack) to better compensate and incentivize DERs for provided grid value.
- The Value Stack includes six values to determine DER compensation:
  - Energy Value (Locational Based Marginal Price, LBMP)
  - Capacity Value (Installed Capacity, ICAP)
  - Environmental Value (E)
  - Demand Reduction Value (DRV)
  - Locational System Relief Value (LSRV)
  - Community Credit (CC)
- This model allows for value stacking across multiple revenue streams (including wholesale market revenues) to fully reward DERs for delivered grid benefits.
- The Value Stack provides location-specific compensation to reward VPPs that have the greatest impact on alleviating distribution system constraints.

Detailed case study provided in Appendix D.ii.

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Imperative 5

Integrating Into Wholesale Markets

Case Study: Australian Energy Market Operator (AEMO)

Australian Energy Market Operator *established a centralized, standardized DER registry to provide visibility to DER specifications and location to eligible entities.*

- In 2020, the **Australian Energy Market Operator (AEMO)** established a centralized DER registry to better manage the grid, improve system reliability as the grid becomes more decentralized, and deliver energy at a more affordable price.
- The register provides a common, standardized information fact base with visibility to DER specifications (e.g., type, capabilities, resource ownership) and location.
- Customers, AEMO, distribution utilities, DER industry, and other third parties (such as emergency services) can access the register.
- Entities are required to provide data in certain formats and timelines; for example, utilities are required to provide DER information in accordance with the DER Register Information Guidelines under the National Electricity Rules to ensure standardization, and DER installers are required to submit data within 20 days of installation.[68.cxxvii,cxxviii,cxxix]

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Imperative 5

Integrating Into Wholesale Markets

Case Study: Ontario Independent Electricity System Operator (IESO)

Ontario Independent Electricity System Operator (IESO) *created market-wide standards for meter registration to standardize data collection and reduce IT costs*

- **Ontario IESO** has established market-wide standards for meter registration across numerous distribution utilities and 5 million smart meters.[cxxx]
- Market rules require that each metering installation used for settlement purposes is on a list of pre-approved meters established by IESO that meet specific performance standards (e.g., accuracy, security).
- Establishing a market-wide approach to metering simplifies and standardizes data collection while reducing IT costs to develop, manage, and protect the database.
- This spurred additional engagement with various grid stakeholders to expand third-party access to this database, including for demand response aggregators.[cxxxi,69]