



# Sample Market Transformation Plan: Laying the Foundation for Virtual Power Plants

January 2025

## VERSION 1.1

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Modification Note: This version makes clarifying edits. Changes are highlighted in the text in yellow.

## Introduction

To demonstrate the breadth of possibilities, this sample plan lists numerous activities intended to facilitate the development of virtual power plants now or in the future. States that want to pursue this area of opportunity are encouraged to review this sample plan but are not expected to carry out all listed activities; rather, states should tailor their plans to meet their goals, needs, partner capabilities, and available resources.

States are encouraged to review all of the market transformation sample plans, regardless of their intended area(s) of focus for market transformation. Content to be covered in each section of the plan is described briefly in italics prior to the sample text; however, states should consult Section 2 of the [Market Transformation Plan Guidance](#) for a detailed description of information to be included in their plans.

## Summary

*Provide a succinct overview of the state's market transformation plan. An acceptable summary will delineate the state's goal(s), market barriers to be addressed, primary activities, and how progress or results will be measured.*

[ENTER: STATE] aspires to take foundational actions to enable a future where Virtual Power Plants (VPPs) can balance electricity demand and supply and provide utility-scale grid services as a supplement to traditional utility-scale generation resources, such as a power plant. A VPP is a network of distributed energy resources (DERs) (e.g., smart heat pump water heaters, smart thermostats, smart appliances, etc.) that are aggregated and managed through a unified entity to provide energy services and grid support. By using DERs (e.g., smart heat pump water heaters, smart heat pumps, smart thermostats, smart appliances, EV chargers, behind-the-meter batteries, and rooftop solar), VPPs can expand the grid's capacity to manage peak demand like traditional



power plants. In addition to supporting load management, VPPs can increase resilience, reduce greenhouse gas emissions and air pollution, reduce transmission and distribution system congestion, give consumers greater freedom over their electricity supply and cost, create and retain good jobs, and be adapted over time to meet evolving grid needs.<sup>1</sup>

[ENTER: STATE]'s initial objective of its market transformation efforts is to enroll DERs into a demand-side, load flexibility program. [ENTER: STATE] will most likely start with enrollment of smart thermostats installed in conjunction with the Inflation Reduction Act Home Energy Rebates programs: Home Efficiency Rebates Program (Sec. 50121) and Home Electrification and Appliance Rebates Program (Sec. 50122). [ENTER: STATE] plans to track the implementation of DERs installed as part of the Home Energy Rebates programs and expand the load flexibility program to include additional DERs with a long-term goal of leveraging DERs for both supply and demand resources. By facilitating enrollment in load management programs in conjunction with these projects, the rebate programs will simultaneously deliver the benefits of efficiency and electrification upgrades to participating homeowners and establish a statewide system of grid-connected DERs that can help to stabilize the grid for years to come.

[ENTER: STATE]'s primary reason for implementing load flexibility and ultimately VPP programs is to achieve greater grid stability during summer and winter peak energy demand by managing residential electricity load. Specifically, [ENTER: STATE]'s disadvantaged communities have been most vulnerable to grid instabilities. Working with [ENTER: UTILITIES], this plan aims to assess where the grid is most constrained and prioritize disadvantaged communities. Additional objectives include improving energy resilience, reducing costs for consumers, reducing costs for grid operators, minimizing infrastructure investments, enabling participation in energy markets, implementing demand response strategies, supporting the transition to a cleaner energy system, improving overall energy efficiency, and enabling consumer energy independence.

[ENTER: STATE]'s first steps in developing a foundation for future VPPs are to work with [ENTER: UTILITIES] and gain experience implementing device control programs such as a smart thermostat load flexibility program. This will be followed by a plan to enroll addition DERs, such as heat pump water heaters. [ENTER: STATE] will work with utilities, grid operators, regulators, program administrators, program implementers, and aggregators to align on the strategy, regulatory requirements, deployment, design, implementation, and measurement and evaluation.

## Market Landscape

*If including this optional section, use existing information and analyses to briefly set a context for the state's market transformation plan.*

[ENTER: STATE] has made significant achievements in energy efficiency over the last [ENTER: NUMBER] years, including: [ENTER: ENERGY EFFICIENCY (EE) ACHIEVEMENT], [ENTER: EE ACHIEVEMENT], and [ENTER: EE ACHIEVEMENT]. Through the [ENTER: RESIDENTIAL EE PROGRAMS] and the IRA Home

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<sup>1</sup> Pathways to Commercial Liftoff: Virtual Power Plants, U.S. Department of Energy, September 2023 p. 6.

Energy Rebates programs, energy efficiency achievements will continue to grow. As part of these programs, [ENTER: STATE] continues to make homes more energy efficient with a specific focus on disadvantaged and low-income communities. Upgrades to single-family and multifamily homes include DERs such as [LIST UPGRADES: E.G., SMART WATER HEATERS, TIME-OF-USE HEAT PUMPS, SMART THERMOSTATS, SMART APPLIANCES, ETC.].

The following problem statement(s) describe(s) the state's existing and expected grid-related challenges and provide(s) rationale for implementing load management programs that control DERs in the home:

[ENTER: STATE] is experiencing grid instability during summer and winter peak demand. The instability has occurred during the last two seasons and has had an adverse impact on disadvantaged communities. While the grid instability has not caused wide-scale outages, [ENTER: STATE] wants to mitigate against any possible interruptions in energy supply to consumers.

(Other possible problem statements could include but are not limited to:

- [ENTER: UTILITY] is experiencing distribution constraints which has led to congested areas and in the future could lead to outages.
- Energy prices are fluctuating, and peak demand costs are resulting in higher electricity costs for customers.
- The power grid is facing challenges with stability and reliability, especially as more renewable energy resources are added to the grid.
- Traditional energy generation methods rely on fossil fuels, responsible for [ENTER: NUMBER] percent of the state's greenhouse gases.)

According to the *U.S. Department of Energy, Pathways to Commercial Liftoff: Virtual Power Plants*,<sup>2</sup> VPPs can provide many benefits that can address the problem statement(s) listed above. In the long term, [ENTER: STATE] is primarily focused on the following benefit(s) of VPPs:

- **Resource Adequacy** - VPPs can increase the grid's capacity to serve growing electricity consumption by shifting or shedding peak demand to shrink peaks and reduce the need for peaking generation assets.
- **Affordability** - VPPs can lower the cost of electricity to consumers, when compared to than other utility-scale generation by reducing peak demand thereby avoiding the need for new generation.
- **Reliability & Resilience** - VPPs can increase resilience and reliability by providing a geographically diverse footprint of generation sites.
- **Decarbonization and Air Pollution Reduction** - VPPs have the potential to avoid greenhouse gas emissions and reduce air pollution by shifting demand from peak hours served by peaker power plants to off-peak hours served by solar, wind, or nuclear.

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<sup>2</sup> See: [Pathways to Commercial Liftoff: Virtual Power Plants \(energy.gov\)](https://www.energy.gov/pathways-to-commercial-liftoff-virtual-power-plants).

- **Transmission and Distribution (T&D) Infrastructure Relief** – VPPs can help overcome T&D congestion challenges, especially in high load conditions, and increase overall grid efficiency by reducing and shifting peak loads.
- **Community Empowerment** – VPPs offer opportunities for consumers to contribute local resources to the reliability and resilience of their local electricity grid, and to broader clean energy transformation.
- **Flexibility and Versatility** – VPPs have the potential to address and overcome the shifting challenges of a rapidly evolving grid by acting as an adaptable resource.

## Vision and Outcomes

*Describe the state’s vision for its housing stock, particularly as it relates to residential energy use. Define specific outcomes that the state intends to target in support of that vision. Describe its market transformation strategy(ies), including how it seeks to address at least one market condition or barrier and how it aligns with targeted outcomes.*

[ENTER: STATE]’s vision is a stable grid that provides certainty, safety, comfort, and affordable sources of power to communities throughout the state.

[ENTER: STATE] seeks to achieve the following outcomes:

1. Implementation of a load flexibility program that leverages DERs such as smart thermostats.
2. A long-term, scalable strategy to deploy DERs with consumer-friendly and value-driven programs that allow households to easily enroll the DERs in load management programs.
3. Policies and regulations support scalability of grid-integrated DERs and recognize their contribution to energy management and the grid.

[ENTER: STATE]’s strategies for driving the above outcomes include, but are not limited to:

- Make DERs accessible and cost effective for consumers. Use programs such as Home Energy Rebates and [LIST PROGRAM(S)] to implement energy efficiency and electrification measures such as heat pumps and heat pump water heaters and simultaneously allow grid interactivity. Additionally, through the [LIST PROGRAM: E.G., INCENTIVE PROGRAM], rebates will be provided to consumers for smart thermostats to control home heating and cooling.
- Partner with Home Energy Rebate implementers and load management aggregators to signup consumers at the time of DER installations. Train contractors and implementers (including solar, home battery, heat pump water heaters, EV charging implementers, etc.) on VPP programs, their benefits, and how to talk to consumers about VPPs.
- Support utilities, grid operators, municipalities and/or co-ops with the development and administration of load management programs so that DERs can be dispatched, managed, and optimized to help meet the needs of the grid.

[ENTER: STATE]'s proposed plan aligns with the IRA Home Energy Rebates implementation by ensuring that DERs implemented through the Home Efficiency Rebates Program (Sec. 50121) and Home Electrification and Appliance Rebates Program (Sec. 50122) are connected and consumers are provided the means to easily enroll in a load flexibility program to maximize benefits to themselves and the grid.

[ENTER: STATE] envisions that these outcomes will ultimately lead to reduced costs, greater resiliency, and increased comfort to consumers. And, with the implementation of the load flexibility programs, utilities' costs are expected to decrease, thereby allowing utility programs to incentivize greater consumer investment in DERs. Given that the timing of implementation of Home Energy Rebate programs and the development of VPP systems and policies may not fully align, [ENTER: STATE] intends to use the first activity of strategy and planning to develop approaches to mitigate timing and coordination challenges.

## Key Activities, Milestones, and Timeline

*Describe the activities the state will undertake to advance progress toward its stated goals (outcomes). Include a timeline and associated milestones or deliverables for each set of activities.*

The following table provides a summary of the state's primary market transformation milestones.

Table A. Market Transformation Milestones Summary<sup>3</sup>

| Key Activity                                            | Due Date or Frequency                                           | Planned Completion Date |
|---------------------------------------------------------|-----------------------------------------------------------------|-------------------------|
| MT Strategy and Plan                                    | Within 3 months of DOE MT Plan approval and annually thereafter | Jun 1, 2025             |
| Partners Identification and Convening of Advisory Group | Quarterly                                                       | Sep 1, 2025             |
| Assessment of DER Policy and Regulatory Requirements    | Annually                                                        | Oct 1, 2025             |
| Policy Development (as needed)                          | Annually                                                        | Oct 1, 2027             |
| Plan for DER Deployment                                 | Annually                                                        | Jan 1, 2026             |
| Plan for DER Enrollment and Activation                  | Annually                                                        | Jan 1, 2027             |
| Measurement and Evaluation                              | Annually                                                        | Jan 1, 2029             |

<sup>3</sup> The timing of deliverables will vary depending on when plans are approved and awards are made, program launch dates, and other factors. For the purposes of this sample plan, the proposed timeline assumes that the state anticipates receiving approval for its Market Transformation Plan by June 30, 2025.

| Key Activity                                                 | Due Date or Frequency                                                                          | Planned Completion Date |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------|
| Plan for Increased DER enrollment and Future VPP Development | Annually                                                                                       | Ongoing                 |
| Documentation of Findings                                    | Within 12 months of depletion of rebate funds or September 30, 2031, whichever is the earlier. | Jan 1, 2030             |

Table B. Activity Areas and Deliverables

In support of the summary provided in Table A, this table describes the state's planned market transformation activities and deliverables in more detail.

| Activity Area                                                | Deliverables                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Initial Strategy and Plan                                    | <ul style="list-style-type: none"> <li>• Define objectives.</li> <li>• Define timing for initial implementation.</li> <li>• Determine scope for initial implementation.</li> <li>• Determine if additional partners are needed.</li> <li>• Determine if program changes are required.</li> <li>• Define plan for scalability and how to leverage cost savings to further market transformation.</li> <li>• Agree on strategy, outcomes, milestones and timeline.</li> </ul>                                                                     |
| Partner Identification and Convening of Advisory Group       | <ul style="list-style-type: none"> <li>• Identify possible key partners: <ul style="list-style-type: none"> <li>○ Program administrators</li> <li>○ Program implementors</li> <li>○ Utility partners</li> <li>○ DER Aggregators</li> <li>○ Independent system operator</li> <li>○ Public Utility Commission / State Electricity Regulator</li> </ul> </li> <li>• Develop advisory group with partners.</li> <li>• Develop charter, meeting cadence, roles/resp. for partners and advisory group.</li> <li>• Host meetings quarterly.</li> </ul> |
| Assessment of DER and VPP Policy and Regulatory Requirements | <ul style="list-style-type: none"> <li>• Work with utilities to ensure proper regulatory policies are in place for DER deployment, recognition and growth.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                           |

| Activity Area                  | Deliverables                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                | <ul style="list-style-type: none"> <li>• Determine if utilities and/or system operators are able to recognize and account for benefits from VPPs in their resource planning.</li> <li>• Work with utilities to determine if measurement and evaluation policies need to be updated to account for VPP avoided costs, etc.</li> <li>• Identify if new policies need to be established to implement and recognize VPPs. If so, work with regulators, system operators, aggregators, etc.</li> <li>• Adjust strategy and timeline as necessary to reflect any identified policy gaps that need to be addressed.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Policy Development (as needed) | <ul style="list-style-type: none"> <li>• Based on policy assessment, work with utilities to define policies to be developed.</li> <li>• Identify owners of policy development.</li> <li>• Develop timeline and approach for implementing necessary policies.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Plan for DER Deployment        | <ul style="list-style-type: none"> <li>• Develop plan to braid and/or stack Home Energy Rebates with other utility, state and federal programs to maximize DER deployment.</li> <li>• Assess how to maximize DER deployment and acceptance including use of - <ul style="list-style-type: none"> <li>○ Tax credits and rebates</li> <li>○ Utility up-front financing</li> <li>○ Utility on-bill financing</li> <li>○ DER carve-outs in energy portfolio standards</li> <li>○ Compensation for the services DERs provide such as net energy metering and thoughtfully designed successors</li> <li>○ Ongoing performance payments for provision of grid services, and time-varying or dynamic tariffs</li> </ul> </li> <li>• Determine if additional technologies, resources or support are necessary for DER interconnectivity.</li> <li>• Determine who will be contracting with DER aggregator.</li> <li>• Develop contracts between DER aggregator and grid operator.</li> <li>• Work with utility or grid operator to integrate DERs into grid operations (if possible).</li> </ul> |

| Activity Area                          | Deliverables                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Plan for DER Enrollment and Activation | <ul style="list-style-type: none"> <li>• Develop implementation plan including points below: <ul style="list-style-type: none"> <li>○ Work with utilities and system operators to identify high priority locations for DER enrollment - if possible, use as priority implementation areas.</li> <li>○ Work with aggregator to determine approach for enrolling and attracting consumers, including benefits, incentives, rebates, etc.</li> <li>○ Develop marketing materials and consumer training etc.</li> <li>○ Develop process to enroll customers at time of DER installation or other opportune times (e.g., new occupancy).</li> <li>○ Develop tracking for DER implementation and follow-up process for marketing to/communicating with customers who have elected not to initially enroll.</li> <li>○ Develop training for implementers.</li> <li>○ Develop process to collect customer feedback.</li> </ul> </li> </ul>                                                                                                                                       |
| Measurement and Evaluation             | <p><u>Consumer Acceptance and Satisfaction Assessment</u></p> <ul style="list-style-type: none"> <li>• Evaluate processes and procedures for DER deployment.</li> <li>• Evaluate processes for enrollment.</li> <li>• Evaluate acceptance rates for DER.</li> <li>• Develop continuous consumer feedback process and evaluate.</li> </ul> <p><u>Measure and Evaluate Effectiveness of Load Flexibility Programs</u></p> <ul style="list-style-type: none"> <li>• Develop measurement and evaluation plan.</li> <li>• Determine cost effectiveness measures to be used.</li> <li>• Measure total energy generated or provided by VPP.</li> <li>• Measure capacity utilization provided based on how often and to what extent DERs are dispatched.</li> <li>• Calculate consumer cost savings.</li> <li>• Calculate avoided costs for utility-scale energy vs. VPPs.</li> <li>• Calculate cost-effectiveness based on initial investments, rebates, etc.</li> <li>• Evaluate grid reliability and stability impacts.</li> <li>• Evaluate environmental impacts.</li> </ul> |



| Activity Area                                                | Deliverables                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                              | <ul style="list-style-type: none"> <li>• Evaluate system integration and interoperability.</li> <li>• Evaluate regulatory compliance.</li> <li>• Develop measurement and evaluation reports.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Plan for Increased DER Enrollment and Future VPP Development | <ul style="list-style-type: none"> <li>• Develop plan for scaling roll-out of DERs. <ul style="list-style-type: none"> <li>◦ Using cost savings from measurement and evaluation efforts, develop plan to estimate savings that can be used to scale DER and VPP implementation.</li> <li>◦ Develop implementation plan, leveraging lessons learned from targeted implementation and measurement and evaluation.</li> <li>◦ Identify additional partners as needed - utilities, aggregators, implementers.</li> <li>◦ Identify priority locations and timing.</li> <li>◦ Develop training plans.</li> </ul> </li> <li>• Develop plan to expand from load flexibility program to VPP.</li> </ul> |
| Document Findings                                            | <ul style="list-style-type: none"> <li>• Summarize results and lessons learned.</li> <li>• Provide recommendations on how to sustain progress on VPPs after completion on the Home Energy Rebates programs.</li> <li>• Publish and distribute a report with the results and recommendations.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                        |

## Measurement & Findings

*Describe how the state will assess the effectiveness of its market transformation activities and document findings.*

[ENTER: STATE] will track progress in meeting its milestones and measure progress in successfully implementing a load flexibility program. The plan will be updated regularly to account for policy requirements and timing changes in the implementation of the Home Energy Rebate programs and VPPs. Additional measurement and evaluation activities are described in the Actions & Milestones section of this plan.

The measurement and findings will focus on three primary areas:

1. Consumer acceptance and satisfaction assessment
2. Effectiveness of load flexibility programs
3. Measurement and evaluation reporting

Consumer acceptance and satisfaction will evaluate the processes, procedures, and enrollment of the load flexibility programs. Using both quantitative and survey tools, the assessments will provide information on the DER deployment rates, customer enrollment rates in load flexibility programs, customer feedback on the enrollment processes, and customer feedback on the impact of events.

In partnership with [ENTER: UTILITY], the effectiveness of the load flexibility programs will be assessed using traditional measurement and evaluation methods. A measurement and evaluation plan will be developed to determine the cost effectiveness of the programs, total energy provided during events, capacity utilization provided, consumer cost savings and avoided costs.

In partnership with [ENTER: UTILITY], standardized measurement and evaluation reports will be developed to track enrollment and effectiveness of the load flexibility programs.

## Applying and Documenting Findings

As noted above, measurement activities will be planned and carried out over the course of the rebate programs to assess integration of VPPs. In the absence of fully functioning VPPs, progress will be based on extent of customer enrollment in standard load management programs and integration of grid-connected devices as part of rebate projects. Where noteworthy, particularly at the end of the VPP pilot phase and end of the rebate programs, the state will document and disseminate findings not only within the state but to other states, utilities, and relevant groups to ensure that wider audiences can apply lessons learned.

## Additional Background on VPPs

The following information may be helpful to states interested in developing a VPP Market Transformation Plan.

### Reference Documents

- [Pathways to Commercial Liftoff: Virtual Power Plants \(energy.gov\)](https://energy.gov)
- [VPP Policy Principles - RMI](#)
- [Virtual Power Plant Flipbook - RMI](#)

### Examples of VPPs

- [CPower and EnergyHub Partner on Residential Virtual Power Plant for Ameren Customers - EnergyHub](#)
- [Smart Usage Rewards for Aggregators or Direct Enrollees | Con Edison](#)