New York State of Opportunity. | Department of Public Service

Grid of the Future Technical Conference Overview of Grid Flexibility Study

24-E-0165

September 27, 2024

Meeting Information

- Please remain muted
- Use chat or raise hand functions to ask questions during Q&A
- Questions received during the presentations via the chat will be addressed first
- Today's recording and presentation materials will be posted on DMM

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Next Steps

- All filings for this proceeding are under Case 24-E-0165 on the Dept.'s Document and Matter Management System (DMM)

- Upcoming Technical Conferences: Monitor DMM for future announcements

- Contact Staff at andy.owens@dps.ny.gov

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1. Team Introductions

2. Project Overview

3. Modeling Grid Flexibility Value

4. Data Sources

5. Next Steps

6. Q&A

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1. **Team Introductions**

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The Core Brattle/DNV Team

Brattle	DNV

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Brattle Project Manager

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Modeling Lead

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DSIP Assessment Lead

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Market Characterization Lead

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GOTF study overview

Phase I: Grid Flexibility Potential Study	Phase II: Grid of the Future Plan 1 (DSIP Assessment)	Phase III: Grid of the Future Plan 2 (Roadmap)
• Quantitative assessment of cost-effective, achievable potential for grid flexibility • Identify barriers and preliminary options for addressing barriers • Outcome: Grid Flexibility Study Report	• Review DSIPs relative to prioritized list of evaluation elements • Update DSIP guidance for utilities • Outcome: Grid of the Future Plan (1st iteration)	• Develop roadmap for achieving long-term grid flexibility vision for New York • Establish framework for updating the roadmap over time • Outcome: Grid of the Future Plan (updated)

GOTF study overview

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Focus of today's discussion

# Grid Flexibility Potential Study: Scope

Study objectives

- Create awareness and understanding of untapped grid flexibility opportunity
- Develop realistic potential estimates that are based on observed program performance and participation in other jurisdictions
- Identify programs/technologies with the largest and most cost-effective potential
- **Make the potential study actionable by directly relating the grid flexibility potential estimates to key activities that are necessary to achieve the potential**

Analysis scope

- Study horizon: Years 2030 and 2040
- Geographic granularity: Each IOU plus PSEG/LIPA
- Customer segments: Residential, small C&I, large C&I
- Programs/technologies: All practical behind-the-meter options

The path to achieving New York's grid flexibility potential

New York's Achievable Grid Flexibility Potential (Illustrative)
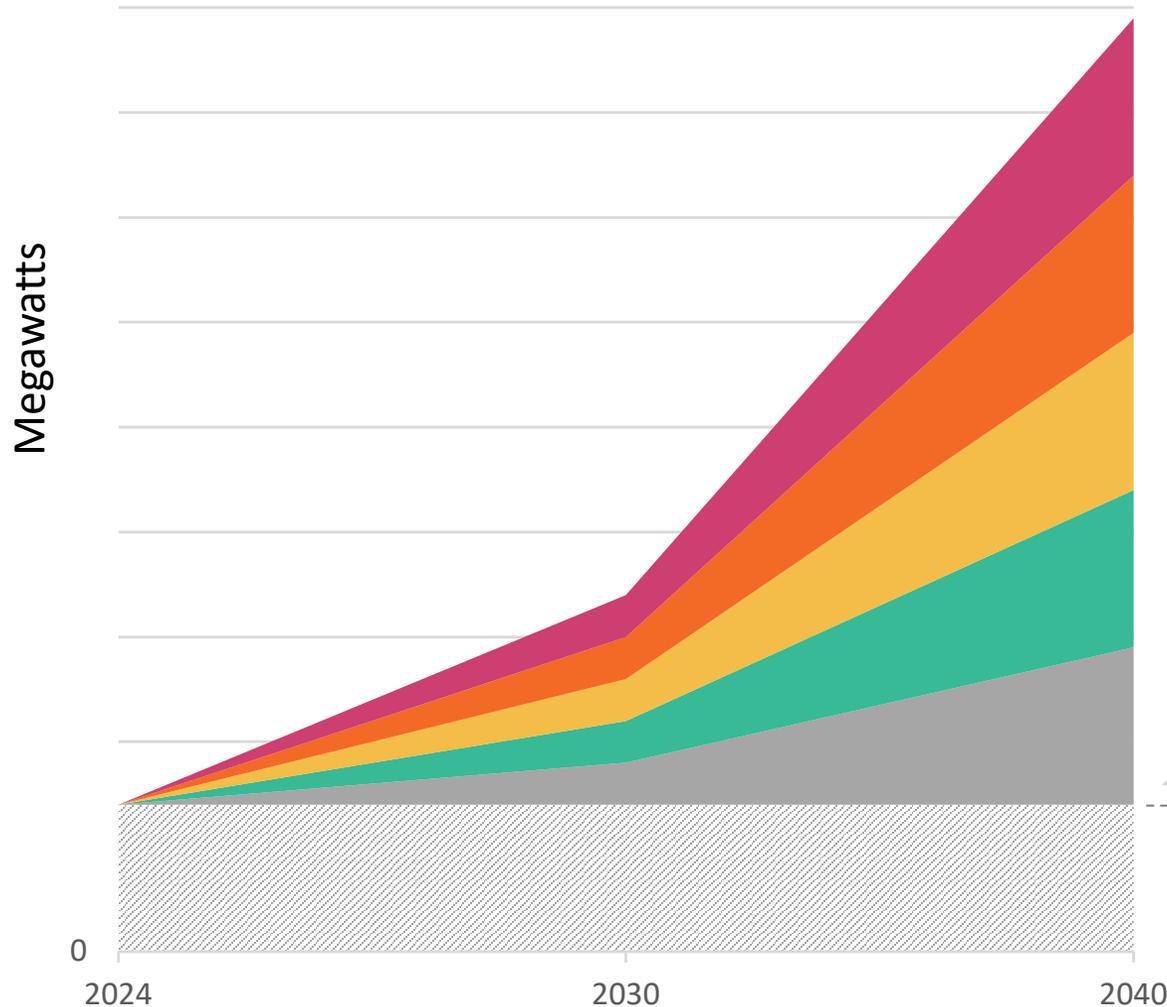
Contributors to the Potential

4 **Improve customer engagement:** Innovation in customer engagement and coordination with third-party providers increases participation in demand flex programs

3 **Reduce program costs:** Cost of implementing demand flex programs (e.g., incremental technology cost, DERMS and OEM fees) declines through efficiency and scale improvements

2 **Monetize full value stack:** Expand monetizable value of programs to include the full value stack, e.g., VDER tariff is available to all grid flexibility resources

1 **Introduce new programs:** Scale offerings such as EV managed charging and BTM battery VPPs beyond the pilot phase; potentially transition to default TOU

0 **Business as usual:** Continue with current full-scale programs; some modest increase in participation due to growth in customer base, tech adoption, and program experience

Existing capability

Actions to unlock the potential

The matrix shows actions that can enable achievement of the grid flexibility potential. The grid flexibility potential study will comprehensively identify these actions and describe options for pursuing them.

	DER marketplace / full value tariff	Seamless device interoperability	R&D funding for demand flex innovation	Align utility incentives with opportunity	Integrate grid flex into operations & planning	Etc...
1 Introduce new programs		✓	✓			
2 Monetize full value stack	✓			✓	✓	
3 Reduce program costs		✓	✓			
4 Improve customer engagement			✓	✓		

Modeled programs and customer classes

Category	Program	Res	Small C&I	Large C&I
Heating/cooling	Smart thermostat HVAC control	X	X	
	Grid interactive water heating (incl. heat pumps)	X		

Modeled programs and customer classes

Category	Program	Res	Small C&I	Large C&I
Heating/cooling	Smart thermostat HVAC control	X	X	
	Grid interactive water heating (incl. heat pumps)	X		
Electric vehicles	EV time-of-use (TOU) rate	X		
	EV managed charging - home	X		
	EV vehicle-to-grid	X		
	EV managed charging - workplace		X	X
	Managed MHDV program			X

Modeled programs and customer classes

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	EV vehicle-to-grid	X		
	EV managed charging - workplace		X	X
	Managed MHDV program			X
Large customers	Interruptible tariff			X
	Auto demand response - major end uses			X

Modeled programs and customer classes

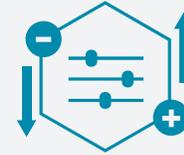| Category	Program	Res	Small C&I	Large C&I
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	EV managed charging - home	X		
	EV vehicle-to-grid	X		
	EV managed charging - workplace		X	X
	Managed MHDV program			X
Large customers	Interruptible tariff			X
	Auto demand response - major end uses			X
Other	Behind the meter battery storage	X	X	
	Time of use (TOU) rates	X	X	

Key analytical features of the study

Temporal Granularity	Value Stacking	Grid Flex Dispatch	Scenario Analysis
Hourly granularity captures opportunities associated with load shifting and renewables integration.	Grid flexibility operations are simulated to maximize total benefits across multiple value streams, while accounting for associated tradeoffs and opportunity costs.	Simulated dispatch accounts for operational and behavioral constraints inherent in grid flexibility programs, such as availability of load, depth of reduction, and acceptable frequency of curtailment.	Multi-scenario analysis accounts for uncertainty. Base case market characterization and system outlook aligns with established NY studies.

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The FLEX model

1 Parameterize Programs
- Build database of new programs
- Estimate per-participant costs and participation
- Identify value proposition and applicable grid services
- Establish load impacts and operational constraints.

2 Establish Marginal Costs and Market Depths
- Generation capacity value
- T&D value
- Energy value
- Ancillary services value

3 Develop 8,760 hourly avoided costs

| Allocate marginal costs based on hourly loss of load probability | Combine hourly costs to create stacked value profile |

4 Optimally dispatch programs and calculate B/C metrics

| Simulate optimized hourly dispatch | Calculate total benefits across value streams |

5 Identify cost-effective incentive and participation

| Establish relationship between adoption and incentive | Identify economic incentive level and associated participation |

6 Estimate incremental cost-effective potential

| Calculate cost-effective potential by program | Estimate portfolio impacts after participation overlap |

Recent Examples of FLEX Modeling

FLEX is the analytical engine behind a wide range of high-profile studies for utilities, government, research organizations, and technology companies. Examples include:

- US DOE's 2023 VPP Commercial Liftoff Report
- Brattle's 2023 study, Real Reliability: The Value of Virtual Power
- Berkeley Lab's 2023 U.S. Building Sector Decarbonization Scenarios to 2050
- State of Maryland's 2023 GHG Abatement Study
- Xcel Energy Colorado's 2022 Demand Response Potential Study
- US DOE's 2021 A National Roadmap for Grid-Interactive Efficient Buildings
- Pepco's 2021 assessment of electrification impacts in Washington, DC

Characterizing flexibility programs

Per-participant impacts

- Modeled DR programs target many customer end-uses and range in occurring almost daily to only targeting a few days a year. Event frequency is developed from an extensive review of existing and pilot programs in other jurisdictions

- Per participant impacts are derived from existing programs in other jurisdictions, pilot studies, or utility provided data where applicable

Program eligibility

- Customers can only participate in DR programs if they have the relevant end-use technology (e.g. EVs, heat pumps)

- Eligibility rates are developed based on primary and secondary research, consistent with CLCPA targets

Participation Inputs

- We developed achievable participation assumptions based on a review of DR potential studies from a variety of jurisdictions, which use primary market research, program participation in other jurisdictions, and other methods to establish participation rates

- These "base" participation rates are then adjusted in our modeling based on the cost-effectiveness of the program

Cost effectiveness analysis

We will analyze cost-effectiveness from the utility cost perspective, to ensure that grid flexibility is considered on a level playing field relative to other utility investments.
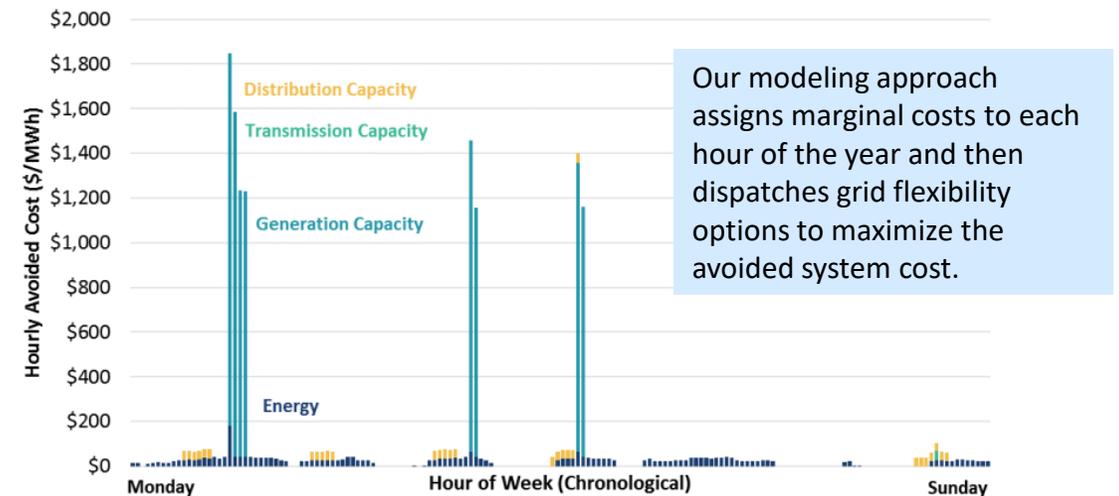
Costs include:

- Marketing and administrative
- Incremental equipment cost
- Labor and installation
- Participation incentive

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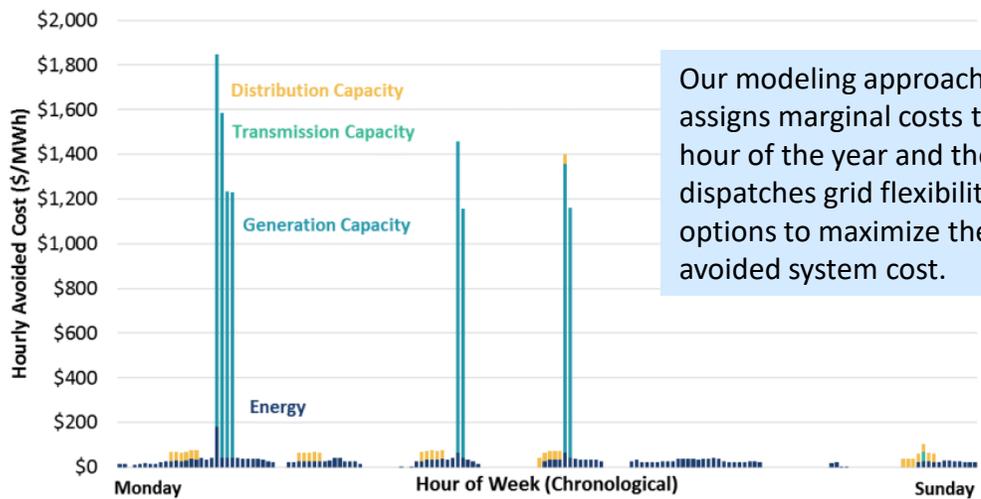- Labor and installation
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Avoided costs include:

- Energy and ancillary services
- Generation capacity
- Transmission capacity
- Distribution capacity

Illustrative Hourly Marginal Cost "Stack"

Our modeling approach assigns marginal costs to each hour of the year and then dispatches grid flexibility options to maximize the avoided system cost.

Source: One week of hourly system avoided cost data from a prior Brattle study assessing demand response potential in Xcel Energy, Colorado.

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Requires a more nuanced approach because:

- It will likely comprise a large fraction of the total value of flexibility for some utilities
- Value varies locationally within utility systems
- Value depends on existing headroom and scale of load growth
- Value may not be temporally aligned with other parts of the value stack

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Distribution value modeling approach

	1. Develop high-level estimate of capacity constrained locations	2. Estimate the % of utility region the is capacity-constrained	3. Model cost-effective flexibility potential
Approach	• Assume all substation loads grow at forecast utility system load growth rate • Grow current summer and winter peak loads and check if/when rated capacity is exceeded	Compare the number of customers served by capacity-constrained substations to total customer count to estimate the % of customers that could potentially provide distribution value using load flexibility.	• Develop separate cost-effectiveness models for constrained locations (with higher avoided costs) and for unconstrained locations (with lower avoided costs) • Adjust flexibility potential results to account for lower avoided costs once capacity constraints are resolved
Outputs	• List of overloaded substations • MWs of overload at each substation	% of customers that could provide distribution value	• Load flexibility potential and BCA ratio in unconstrained areas • Load flexibility potential and BCA ratio in constrained areas

Avoided cost data approach

Grid flexibility resources provide system value by shifting or reducing load out of high marginal cost hours. We characterize the hourly system costs for each modeled utility in 2030 and 2040

Avoided Cost	Data Source	Hourly Allocation Methodology
Energy prices	Integration Analysis forecasted hourly LMPs by zone, consistent with Scenario 2: Strategic Use of Low-Carbon Fuels • 2030: Gaps Analysis from Baseline Scenario 1 case • 2040: Scenario 2 w/ 14GW of storage and fossil turned into high variable cost DEFRs	Hourly modeling conducted by GE for revised Integration Analysis
Generation capacity	Forecasted net CONE values based on Integration Analysis data	Allocate annual value over top net load hours, using a similar methodology to NYISO energy limited resource accreditation
Transmission capacity	Utility 2018 MCOS studies	Allocate annual value over top system load hours
Distribution capacity	Utility data on distribution capacity expansion project capex	Allocate annual value over top system load hours.

Sensitivity analysis design

We will test high/low sensitivity cases for modeling assumptions that are key drivers of grid flexibility potential.

Avoided cost sensitivity cases:

- Avoided transmission and distribution (T&D) capacity cost
- Avoided generation capacity cost
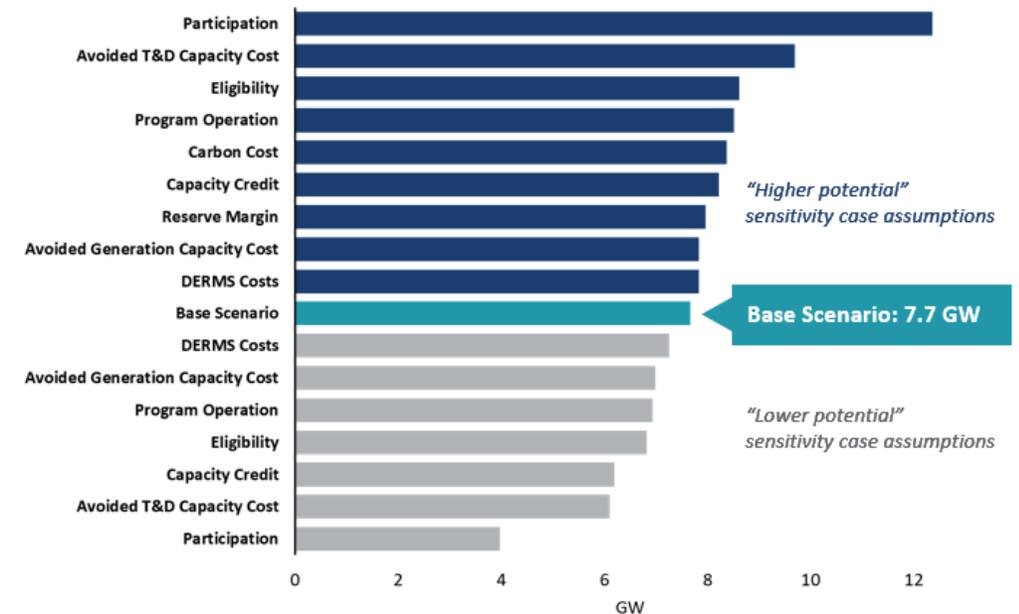- Avoided energy costs
- Renewables deployment

- **Customer sensitivity cases:**
  - Eligibility (i.e., technology adoption)
  - Participation

- **Program sensitivity cases:**
  - Program operation (dispatch frequency and per-participant impact)
  - Program costs

Illustrative Sensitivity Analysis Results
California VPP Market Potential Study

Note: Sourced from prior Brattle report, "California's Virtual Power Potential: How Five Consumer Technologies Could Improve the State's Energy Affordability"

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Utility data request overview

Brattle and DNV have been working closely with the NY utilities to adequately characterize each utility system. We will need to supplement utility provided data in order to:
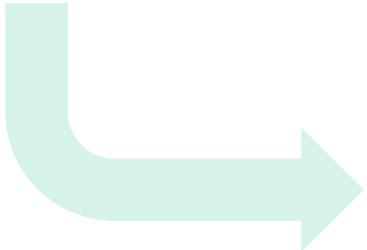
1. **Fill in missing data gaps needed for Flex potential modeling**

2. **Standardize assumptions across utility data to create a consistent state-wide view**

3. **Extend data forecasts through 2040, if not available from utilities**

We summarize available utility data and Brattle/DNV approaches to fill in the remaining gaps for the market characterization components of the potential study.

Market characterization and supporting data

	Demographic Data (Base Year & Forecast)	Saturation Data (Base Year & Forecast)	Load Shapes (Base Year)	Load Shapes (Forecast and End-Use)	Existing Grid Flexibility
Data Requested	• Customer characteristics (counts & consumption) by segment	• Saturation of key end-use equipment	• System and segment load shapes	• Forecasted load shapes • End-use load shapes	• Current program data
Availability	Varied	Varied	Available	Varied	Available
Gaps	• Low Income • Single / multifamily • DAC	• Base year saturations • Forecasted saturations (all utilities)		• Future year system/segment shapes • End-use load shapes (all utilities)	

NY Specific Sources	National Sources	Utility Data
• NYSERDA Stock and Baseline Assessments • NYSERDA Integration Analysis	• EIA RECS & CBECS • Census ACS data • NREL ResStock and ComStock	• Extrapolation or scaling of utility provided data

See appendix for details.

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Key next steps

Additional technical conferences

- DSIP evaluation study methods overview

- Potential study results review

- Grid of the Future Plan review (1st iteration)

Other outreach

- Ongoing expert interviews

- Stakeholder survey to prioritize barriers and solutions

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Appendix

Market Characterization Appendix

	Demographic Data	Saturation Data (Base Year)	Saturation Data (Forecast)	Segment & System Load Shapes	Forecast Load Shapes	End-Use Load Shapes	Grid Flex
Utility Data	• Base year segment-level customer counts • Limited base year residential segmentation (single family, multifamily, etc.) • C&I segmentation (small, medium, large)	• Base year saturation data developed from utility-provided data, where available (i.e., AMI, smart t-stat, etc.)	• N/A	• All system and segment load shapes provided • Segment shapes normalized to align w/segment-level annual MWh and not to exceed system-level MWh (where appropriate)	• Used future year system-level shapes where available • Segment-level shapes normalized to system-level hourly shapes where necessary	• Some end-use data provided (limited), but uniform approach for all utilities used	• All grid flex program data developed from utility-provided program information/data
Gaps	• Low Income segmentation • Single/multifamily segmentation • DAC segmentation	• Base year saturations for most technologies/measures	• Forecasted saturation data for all utilities	• NA	• Future year system shapes • Future year segment shapes	• End-use load shapes for most utilities	• N/A
Additional Data or Analysis	• Residential low-income segmentation (incorporating utility crosswalks for customer proportions) leveraged **Census ACS County Level Data** • Single and multifamily splits also determined by **ACS** if not provided by utility • Residential DAC segmentation from **CJWG final dataset (2023)** by county	• Residential Base year Saturations – scaled to current year based on growth factors from previous report. **NYSERDA Residential Stock Assessment (2018)** • Commercial Base year Saturations – scaled to current year using growth factors from previous report. **NYSERDA Commercial Stock Assessment (2021)** • Additional scaling and normalization factors incorporated from **EIA RECS & CBECS** where gaps existed in baseline and stock assessments	• Forecasted saturation rates all align with CLCPA Scenario 2 Integration analysis • Future saturations and/or new sales goals identified, and interim years scaled accordingly • Stock turnover replacements and interim technology adoption determined by average equipment age from the **NYSERDA stock and baseline studies** and **NYSERDA Integration Analysis Technical Supplements (Final Scoping Plan, Scenario 2)**	• N/A	• Where future year system- and/or segment-level shapes not provided, **scaled current year shape** by total MWh and by day type and climate zone (summer peak, winter peak, avg monthly weekday, avg monthly weekend, etc.)	• **NREL ResStock and ComStock** end-use load profiles used to determine hourly proportion of energy end-use for each customer segment in current and future years • **Saturation forecast data** determines proportion of electric vs. fuel heating by customer segment and year • Assumes end-use shapes (customer behavior) generally do not change over time, but rather the proportion of the end-use that is electric vs. fuel (includes EV shapes aligned w/future adoption)	• N/A

Phase II: Grid of the Future Plan 1 (DSIP Assessment Report)

Study objectives

- Develop and prioritize elements that will be most impactful to the DSIP process
- Review utility DSIPs from three perspectives
  - Backward looking compliance
  - Forward looking alignment
  - Legislative headwinds and tailwinds
- Work with the DPS to develop updated DSIP guidance for utilities

Analysis scope

- National and international secondary research into best practices in DER integration and DSP
- Framework and scorecard development
- Synthesis and recommendations

Phase III: Grid of the Future Plan 2 (Roadmap)

Study objective: Establish a vision for the NYS electric system in 2030 and 2040, a roadmap for achieving that vision, and a framework for updating the roadmap over time

Analysis scope

- Assess current structure of NY electric system, including wholesale market rules and utility tariffs and programs for flexibility

- Develop the 2030 and 2040 vision for the technical, regulatory, and commercial arrangements that will promote flexibility

- Assess 2025 DSIP updates and evaluate how well each plan supports the 2030 and 2040 vision

- Identify and characterize significant gaps and barriers to flexibility

- Develop grid evolution roadmap with actionable recommendations on grid planning, program design, wholesale market coordination, etc. to promote flexibility

- Develop guidance for the 2026 DSIP updates