Behind-the-meter PV and Storage Adoption

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Spatially | Temporally





Images from NYSEG/RGE PV Hosting Capacity maps: https://www.arcgis.com/apps/webappviewer/index.html?id=84de299296d649808f5a149e16f2d87c

Spatially | Temporally





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Spatially | Temporally

Daily (January)

Hour of the day



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Individual home load effects





Individual home load effects





Individual home load effects





Individual home load effects





Aggregate load effects: peak day system load over time with adoption



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Aggregate load effects: peak day system load over time with adoption





Aggregate load effects: peak day system load over time with adoption







- How many buildings already have solar/storage?
- How many buildings could have solar/storage?
- How fast will buildings adopt solar/storage?
- How will those buildings be distributed?
- How does that solar/storage affect the local grid?





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Why do we need historical adoption data?

- Train the adoption model
- Rule out future adoption for premises that have already adopted
- Model current grid conditions





What data is needed?

Data type	Adoption modeling	Load modeling
System location (coordinates, address)	\checkmark	\checkmark
Installation date	\checkmark	
System size (kW)	\checkmark	\checkmark
Array configuration (tilt, azimuth)		\checkmark
Equipment specifications (inverters, modules)		\checkmark
External effects (shading, soiling)		\checkmark





Where does the data come from?



PowerClerk[®]

Synchronize your PowerClerk interconnection program

Utility interconnection records

Custom Import

Send Clean Power Research a custom file format containing required information





What if the data doesn't contain enough detail?



Building footprints

CPR can match addresses to building footprints to infer some specifications



Spec Inference

Infer battery and PV adoption and PV system specifications using NET load data (AMI data)





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Historical Adoption

What if the data doesn't contain enough detail?



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CPR can match addresses to building footprints to infer some specifications





Spec Inference

Infer battery and PV adoption and PV system specifications using NET load data (AMI data)





Adoption potential

What is the upper bound of adoption?





Adoption potential

Detailed solar resource potential study process overview



Adoption potential

- Solar resource potential can be used to determine an upper bound of power from rooftop systems
- For adoption modeling, we also use the idea of customers with "solar access" to set the upper bound
 - Data from utilities about businesses and households
 - Census data
 - Owner-occupied single-family homes often makes a good proxy







Flex Forecast: Behind-the-Meter PV Adoption Modeling





Combines historical adoption, technological cost, and socioeconomic data to model adoption

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Provides utility planners with the ability to build forecasts based on dozens of scenarios



Developed in partnership with SMUD and deployed for Eversource Massachusetts



Utilizes CPR's trusted SolarAnywhere[®] irradiance modeling and state of the art solar rates database



Connects with Integral Analytics' LoadSEER to forecast adoption load impacts into the future

Solar + SPSS Adoption Saturation Profile





Solar and Solar + Storage adoption model



- The logistic regression model is based on historical adoption and results in a probabilistic forecast of solar adopters based on a number of predictive factors which can include:
 - Market penetration
 - Total system cost
 - Incentives
 - Payback
 - Social and economic data
- Solar + Storage adopters are then determined as a subset of solar adopters based on an attachment rate

Scenarios

Running scenarios

- Scenarios are defined using an Excel template
- Scenarios can be run on demand through PowerClerk

Scenario results

- Typically takes a few minutes per scenario
- Results available in Excel and CSV formats with special formatting options available for integration with Integral Analytics LoadSEER

Common scenarios:

- Solar or storage pricing
- Incentive introduction or retirement
- Rate pricing or structure changes
- Solar tariff changes
- Customer interest in DERs
- Valuation of reliability



Flex Forecast Scenario Comparisons

Solar installed cost





Modeled PV Adoption Rates for Residential Customers in the Boston Area





Optional Forecast Geographic Breakdown

Flex Forecast Results

Demographic Data by Geographic Area

Density, Housing, Land Cover, and Economic Characteristics

> Annual Predicted Adopters by Geographic Area

Commercial Solar Capacity by ZIP Code in Eversource Massachusetts Territory in 2050







Adoption Load Impact

Bulk PV fleet power estimations

- Model individual PV systems or aggregate systems to the circuit, feeder, or substation level
- System specific weather data that can be time correlated to real net loads back to 1998, or used with TGY data
- Can also provide real time and forecasted production









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• Munis/IOUs/Co-ops

100+ Solar Industry Partners

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- Research: Napa, CA
- Satellites: NY & MA

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 Meteorology/Atmospheric
Science/Engineering/Environment/Resources/Business

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Cloud-Based Services

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Secure with High Availability

Utility Industry's Leading Business Process Automation Software for DERs and Beyond



Customer Engagement and Adoption Modeling Software for Utilities



Bankable Solar Data and Intelligence for Financial Planning, Operations & Forecasting

