Demand Flexibility as a Resource

Efficiency, Demand Response, Storage, and Electrification

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Load Shaping IS Not Just a California Problem

New England (ISO-NE)
UK (Nat. Grid)
France (RTE)
California (CAISO)
Australia (NEM)
Our Goal is Decarbonization
Renewables Require Load Balancing

March 23, 1:15 pm: Negative Pricing

April 15, 12:15 pm: Huge Variability

> 800 GWh renewables curtailed in 2019
Demand Flexibility is a Non-Wires Alternative

Oakland Clean Energy Initiative

OCEI Peak Day Hourly Resource Need

MW
Electrification To Decarbonize Buildings

Winter Load Shapes:

Heat Pump Buildings vs. Gas Heated Buildings
Demand Flexibility To Enable Grid Integration of Behind the Meter DR, EE, E+, RE, and Storage
One of These Things is Not Like the Other...
Markets Need Standard Weights and Measures

**CALTRACK**

- Hourly Standard M&V Methods
- Monthly, Daily, and Hourly
- Public Stakeholders Empirical Process
- [www.CalTRACK.org](http://www.CalTRACK.org)

**OpenEEMETER**

- Python CalTRACK Engine
- Open Source [Apache 2.0](https://www.apache.org/licenses/LICENSE-2.0)
- How It Works: [https://goo.gl/mhny2s](https://goo.gl/mhny2s)
- Code Repo: [https://goo.gl/qFdW4P](https://goo.gl/qFdW4P)
CalTRACK
Hourly
Time of Week
Temperature (TOWT)
Model
Forecasting the Counterfactual:
Commercial Building Baselines
Automated Metered Telemetry

Portfolio Tracking

Combined electricity and gas resource curve by month shown against baseline (MMBTU/Day)

- Baseline Usage
- Lower Reporting Usage
- Higher Reporting Usage

- 0.096 (46.204%)
- 0.03 (47.200%)
- 0.12 (44.200%)
- 0.11 (15.200%)
- 0.021 (56.200%)
- 0.019 (54.200%)
- 0.027 (55.100%)
- 0.02 (14.200%)

- 18.04 MMBTU ±67.03%
  Combined Elimated Savings

- 0.1545 MMBTU
  Combined Predicted Savings

- 11.680%
  Combined Realization Rate

- 16.36%
  Combined Savings

- 110.3 MMBTU
  Combined Counterfactual

8 months
Combined Project Maturity

Site Level M&V

Time series of energy consumption and model values during the baseline and reporting periods (Therms)

- Meter readings
- Model exceeds meter
- Meter exceeds model
- Residual

- 168.5 Therms ±44.3%
  Effected Savings

23.52%
Percent Savings

716.3 Therms
Counterfactual

0.3203
COV of E

2,045 HDD
Baseline Heating Demand

0 CDD
Baseline Cooling Demand

12 months
Baseline Length

887.9 Therms
Baseline Usage
BUSINESS MODELS

3RD Party Providers (aggregators)

DEMAND FLEXIBILITY

Contractor Management
Sales and Marketing
Project Finance
Services and Products
Consumer Finance

Savings Comfort Health
Building a Virtual Power Plant from Behind the Meter with Demand Flexibility
Electric Flexiwatts
Residential HVAC and Shell
Electric Avoided Cost

Program Average

.397 Tons
Project Annual GHG Savings From Electricity

.41 Tons/MWh
Avoided GHG per MWh Savings

$146.97
Project Annual Electric Utility Avoided Costs

$.152/kWh
$ Avoided Cost per kWh Savings
23% of Projects

3_Summer_Peak_kWh Top Quartile  5_Summer_Shoulder_Ratio Top Half

Climate_Zone 4  Year 2020

2.5X Greater Savings

70% Fewer Negatives
22% of Projects

No Customer Savings

Increased Peak Demand

Climate_Zone 4  Year 2020