Policy Perspectives for an Evolving Energy Efficiency Landscape

CARMEN BEST, DIRECTOR OF POLICY & EMERGING MARKETS, RECURVE

OCTOBER 10, 2019

NEEC
NORTHWEST ENERGY EFFICIENCY COUNCIL

About NEEC

- NEEC
  - Non-profit Business Association
  - 100+ Members
  - 20+ years
  - Advocating for EE
- SBC
  - Non-profit charitable Organization
  - Partnered with Industry
  - 1+ years
  - Accelerating smart buildings adoption through education and demonstration

- Train the workforce for the future
  - Building Operator Certification Program
  - Technical Webinars
  - YouTube
- Demonstrate smart technologies and practices
  - Tool Lending Library
  - Case Studies
  - Site Visits
- Convene the industry through hosting and participating in events
  - Gathering Space
  - Why Smart Buildings
  - Smart Buildings Exchange

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Carmen Best
Director of Policy & Emerging Markets, Recurve

- Supports the growth of meter and performance-based energy efficiency across the country
- Prior to Recurve, spent several years at the California Public Utilities Commission where she evaluated demand forecasting, integrated resource planning and improvements in the deployment of energy efficiency for statewide energy policy
- Supported Recurve in the creation of transparent methods and open-source software to revolutionize the way energy efficiency is measured, deployed and procured

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RECURVE
SHAPE THE FUTURE OF ENERGY

Policy Perspectives for an Evolving Energy Efficiency Landscape

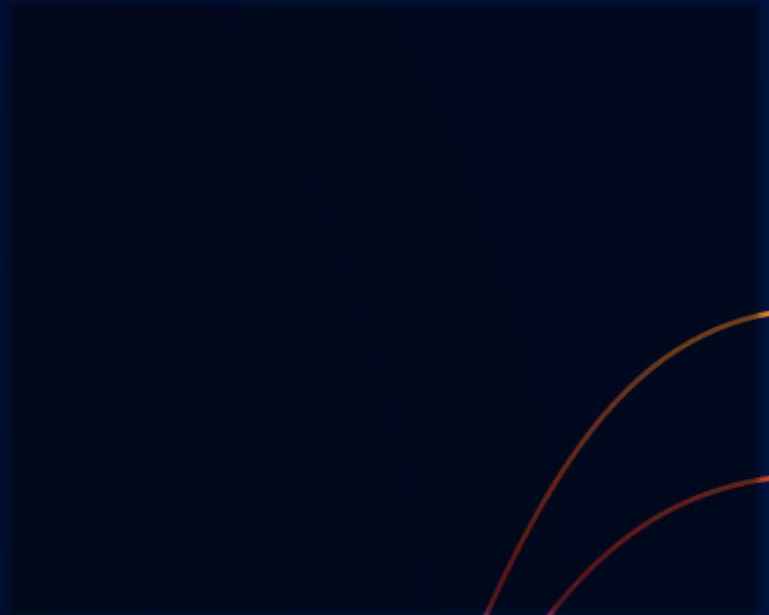
Northwest Energy Efficiency Council

October 10, 2019

Carmen Best, Director of
Policy & Emerging Markets

Who am I?

- ✓ Evaluation consultant in Wisconsin
- ✓ California Public Utilities Commission staff for almost 10 years
- ✓ Managed large scale evaluation portfolios to inform resource planning & financial incentive payments for investor owned utilities
- ✓ Joined RECURVE in 2018 to support market solutions to scale energy efficiency and grid integration



RECURVE

What is RECURVE?

CALTRACK

- Standard M&V Calculation Methods
- Monthly, Daily, and Hourly
- Public Stakeholders Empirical Process
- www.CalTRACK.org

LFENERGY OPENEEMETER

- Python CalTRACK Engine
- Open Source Apache 2.0
- How It Works: https://goo.gl/mhny2s
- Code Repo: https://goo.gl/qFdW4P

LFENERGY

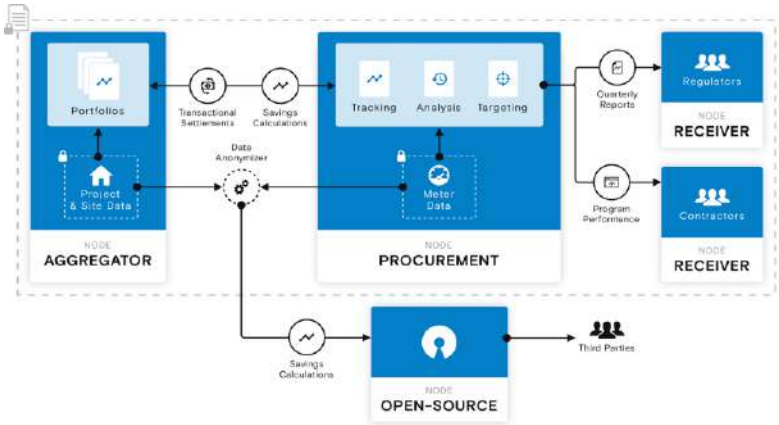
RECURVE

What is RECURVE?

Recurve SaaS Platform

- Program and Procurement Network
- Telemetry, Targeting, and Analytics
- CalTRACK Compliance
- SaaS "OpenEEmeter Inside"
- Data Pipeline (ETL)
- Encryption and Security
- Scalable to Millions of Meters

Distributed Nodes



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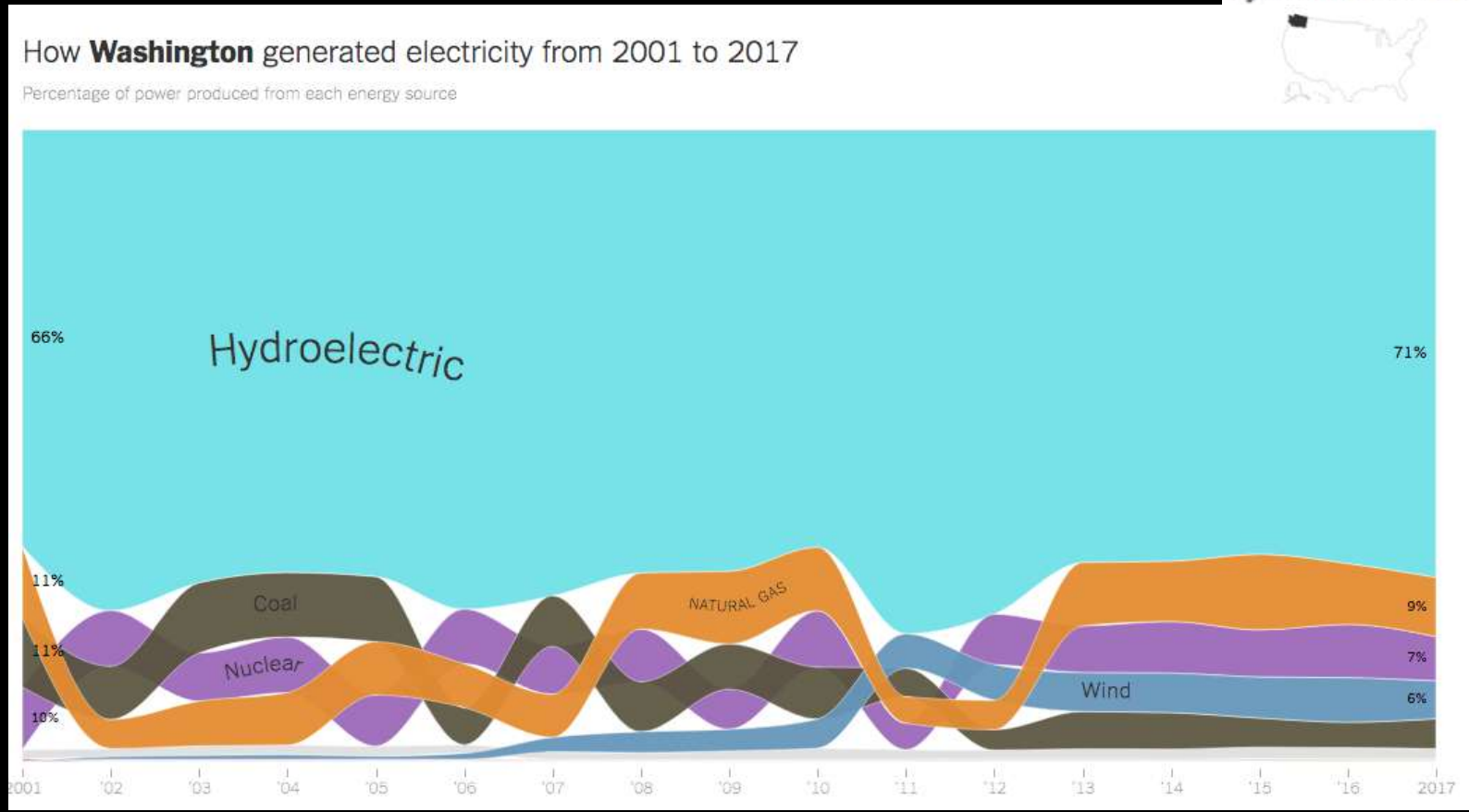
Change is inevitable.

RECURVE

How **The Northwest** Generated Electricity from 2001 to 2017

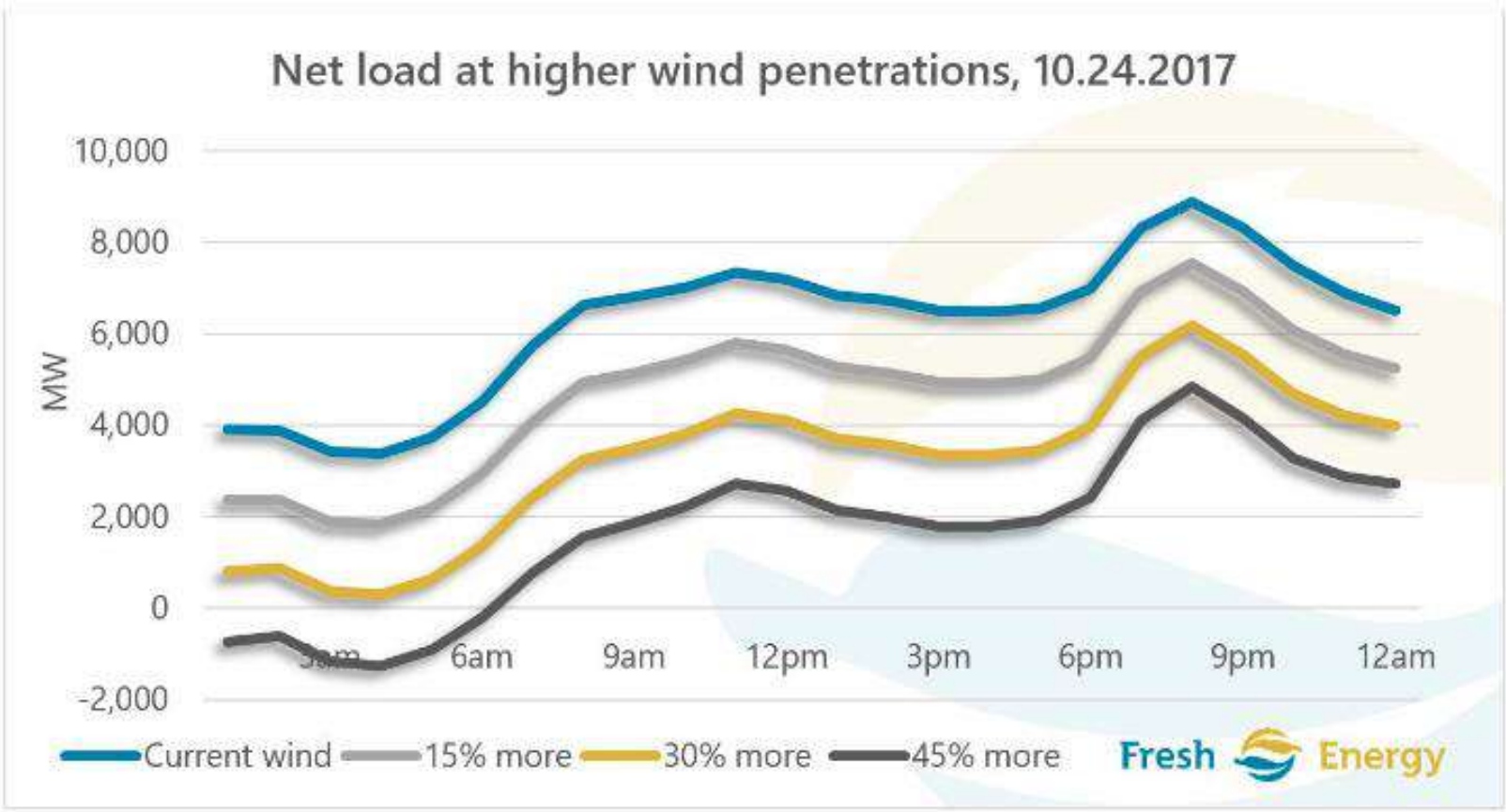
The New York Times

By NADJA POPOVICH DEC. 24, 2018



https://www.nytimes.com/interactive/2018/12/24/climate/how-electricity-generation-changed-in-your-state.html

Renewable Energy is Driving New Grid Dynamics



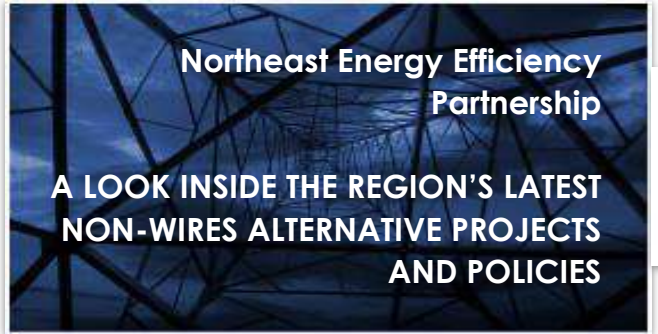
Many ways to manage & value

Non-Wires Alternatives
Local Capacity Markets
Beneficial Electrification

Non-Wires Alternatives

CASE STUDIES FROM LEADING U.S. PROJECTS

E4 THE FUTURE · PLMA Load Management Leadership · Smart Electric Power Alliance

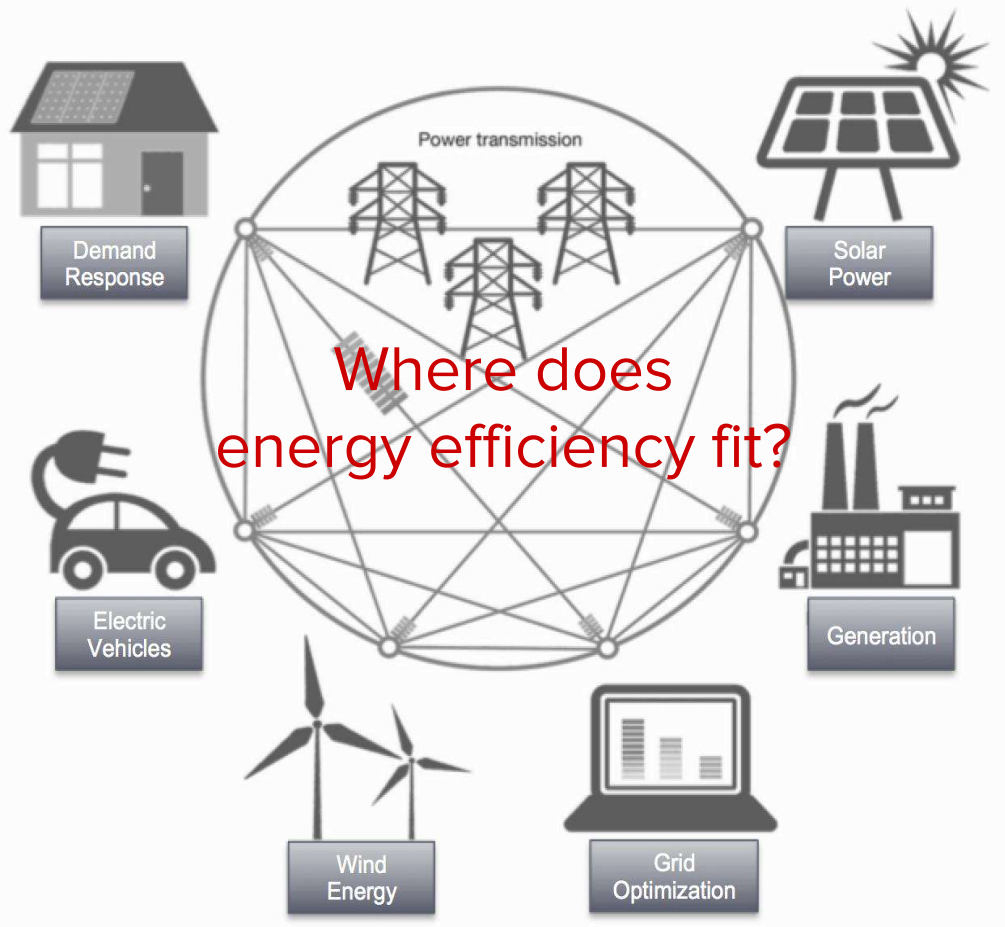


ACEEE
American Council for an Energy-Efficient Economy

Energy Efficiency in Capacity Auctions: A Historical Review of Value

Incredible Changes are Underway…

Distributed energy markets are the future of integrated grid management



Justifications of Energy Efficiency

Past		Future
First in the loading order, or fixed input to grid resources	→	Quantifiable, procurable, reliable grid resource
Meeting energy efficiency savings goals ~ carbon goals	→	Energy efficiency savings align with actual carbon offsets
Customer bill savings	→	Customer energy management and service

RECURVE

Three Key Components for Scale...

Meter-Based Quantification

- ✓ Transparent
- ✓ Consistent
- ✓ Accessible

Performance Payment

- ✓ Accountable
- ✓ Flexible
- ✓ Scalable

Competitive Procurement

- ✓ Comparable
- ✓ Integrated
- ✓ Responsive

RECURVE

Meter-Based Quantification

Policy Action	Market Opportunity
Track changes in consumption for targeting & participants	Improve cost effectiveness and enhance customer experience
AMI deployment and integration for all DER activities	Consistent, accessible data, and hourly impacts
Adopt definition of "savings" that considers change in consumption	Align incentives with carbon goals; and build confidence with forecasters

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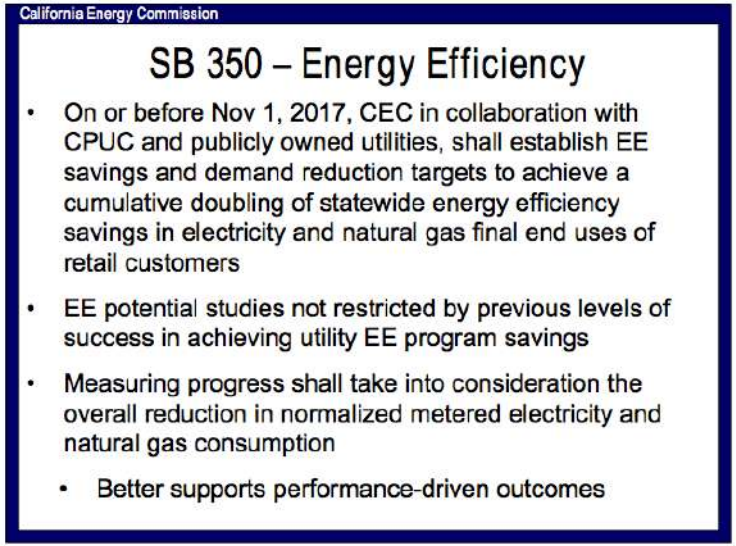
Normalized
Metered
Energy
Consumption

Is a Means To Streamline and Scale EE to Double Energy Efficiency in California

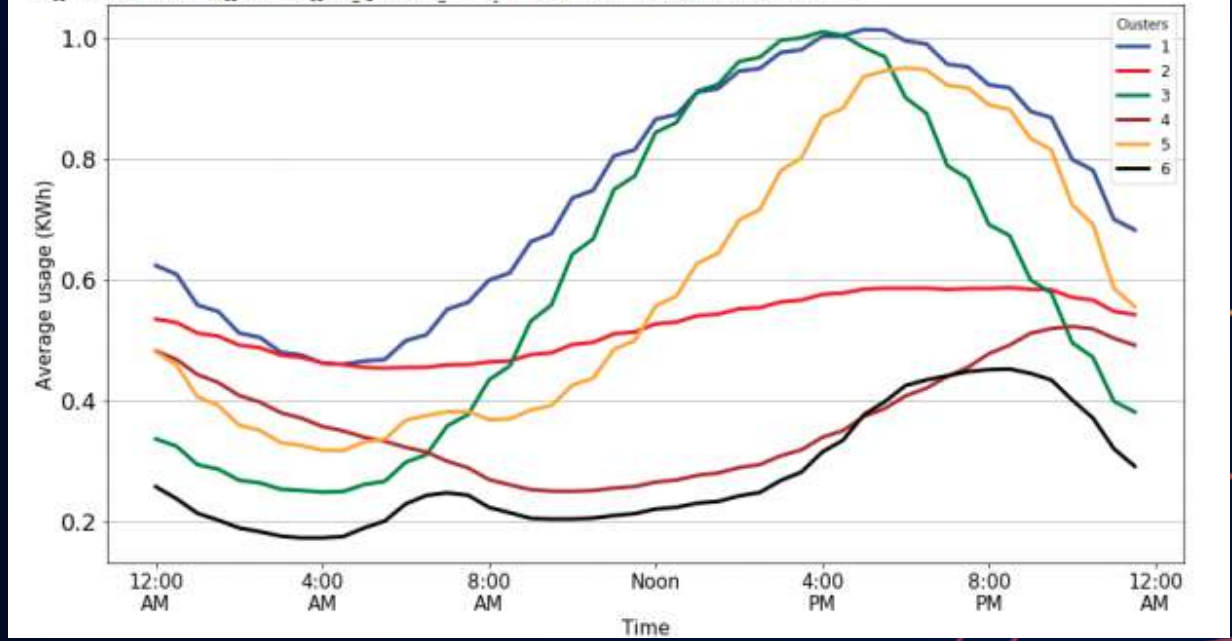


"The energy efficiency savings and demand reduction …. achieving the targets established pursuant to paragraph (doubling of EE by 2030) **shall** be measured taking into consideration the **overall reduction in normalized metered electricity and natural gas consumption** where these measurement techniques are feasible and cost effective." – SB 350

Six unique load shapes: A segmentation analysis of Illinois residential electricity consumers

"This information can be used to improve the effectiveness of energy efficiency programs and dynamic rate designs by helping to target those initiatives at those customers whose participation would have the biggest impact on the system, as well as those customers who would benefit from them the most."

Figure 5: Average usage by customers in different clusters in KWh



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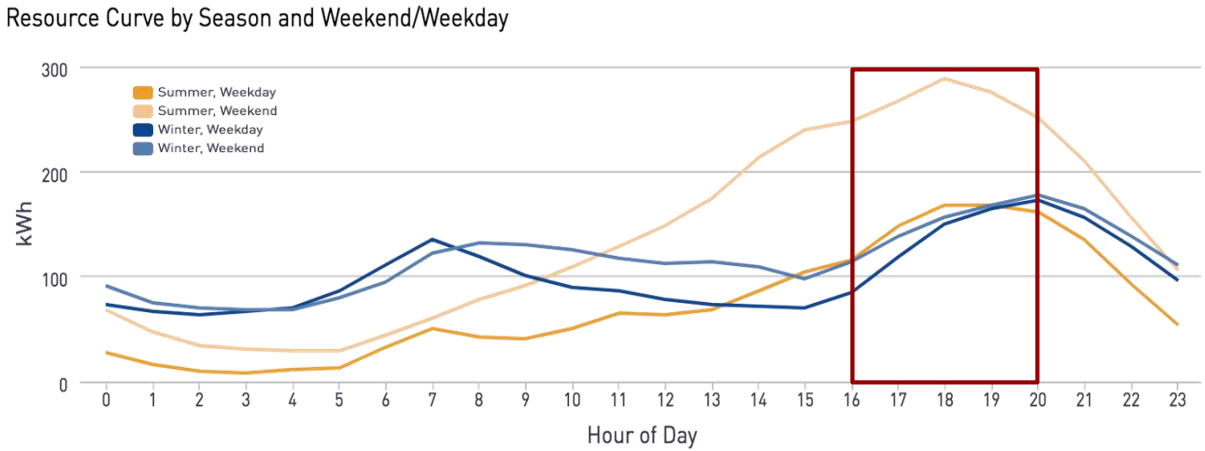
By Jeff Zethmayra, Ramandeep Singh Makhijaa, Citizens Utility Board

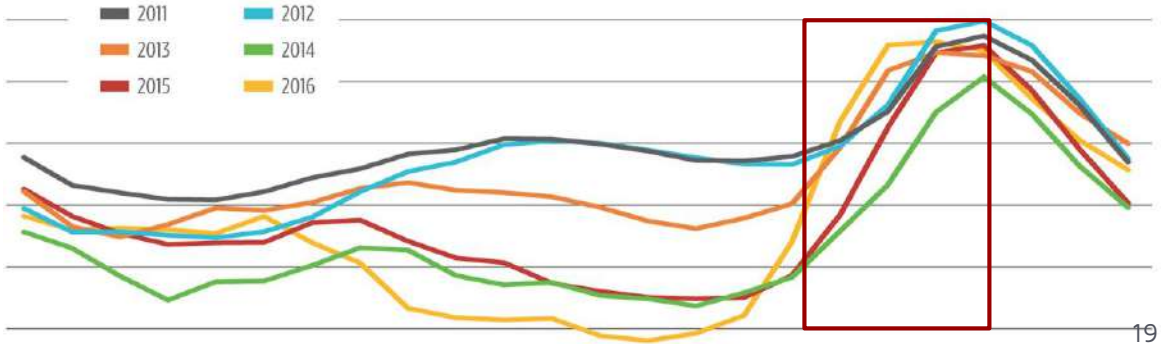
https://www.citizensutilityboard.org/wp-content/uploads/2019/06/ClusterAnalysisFinal.pdf

Sending the Right Price Signal

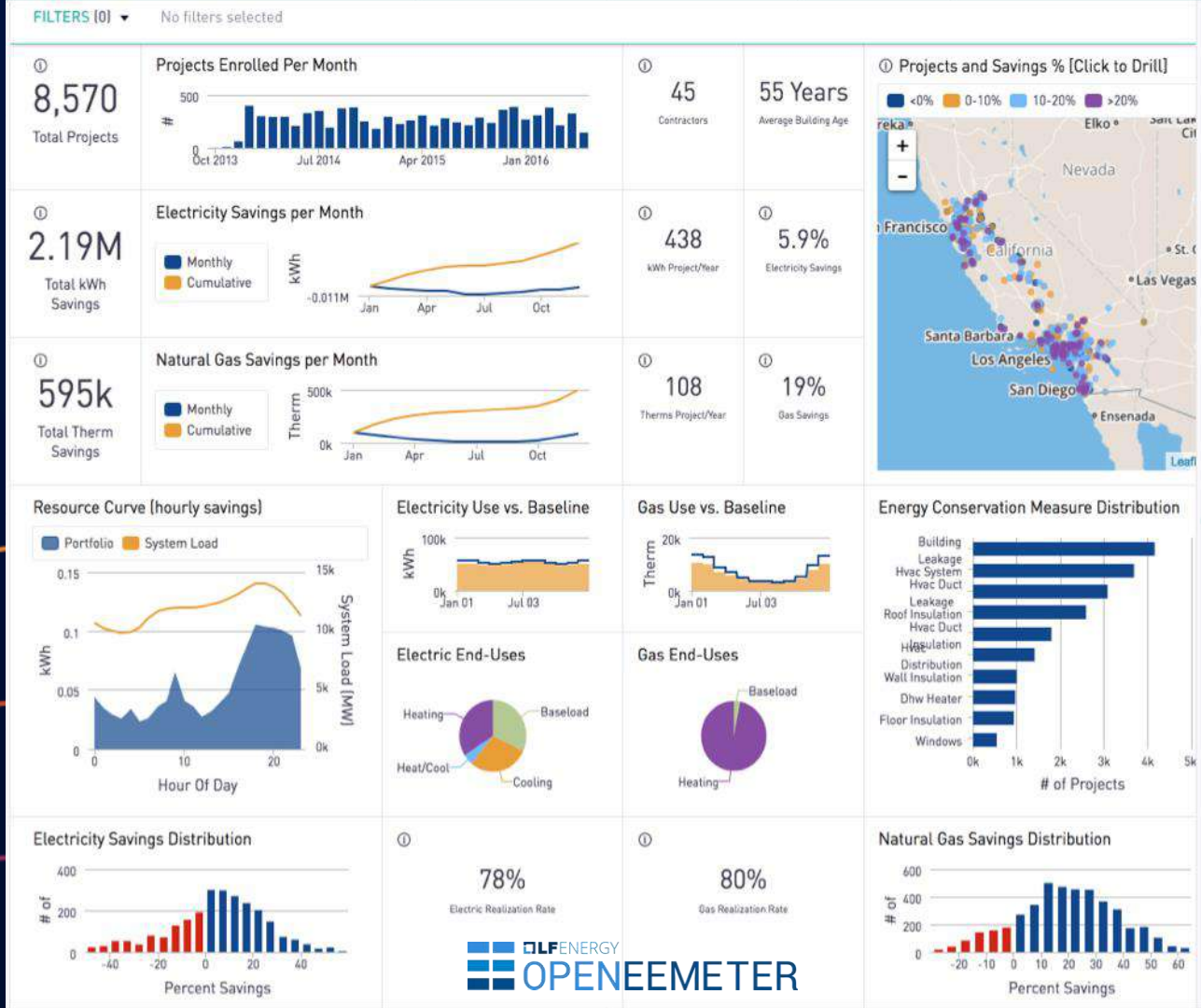
Resource Curve

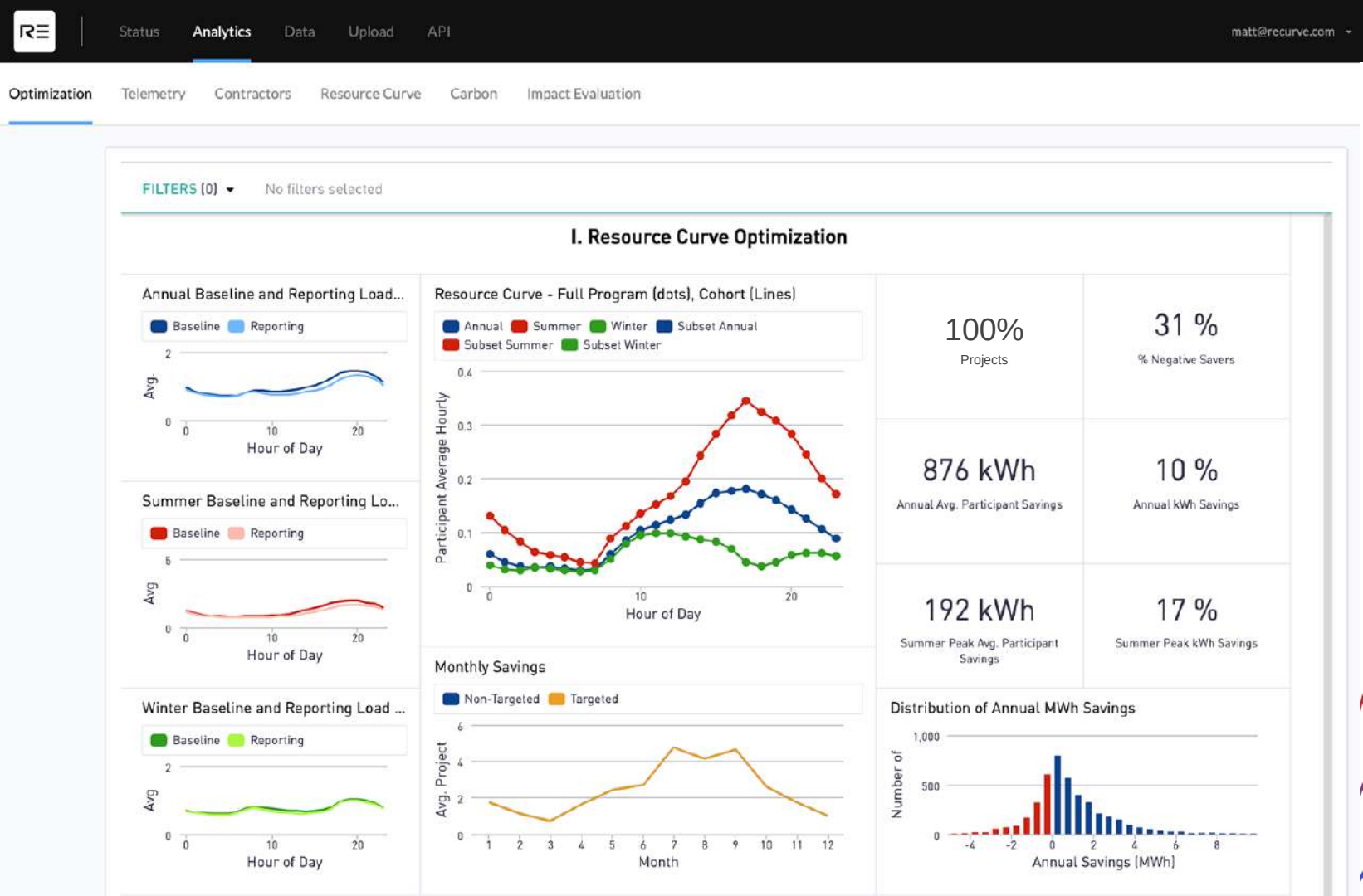


Duck Curve



Track Programs and Business Impacts in Real-Time





Electric Resource Curve

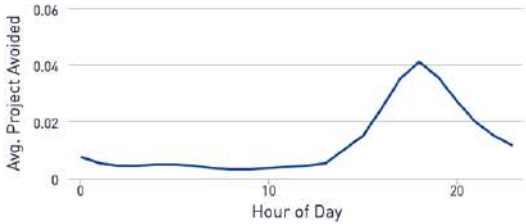
Residential HVAC and Shell

FILTERS (0) No filters selected

II. Portfolio Avoided Cost and GHG

Average Project Electric Utility Avoided Costs

Marginal GHG Analysis



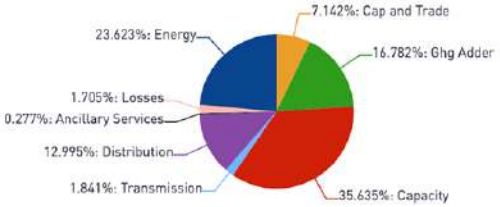
.298 Tons

Avg. Project Annual GHG Savings From Electricity

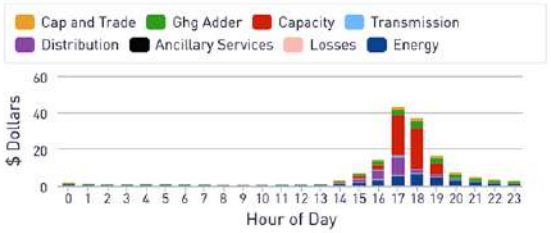
.34 Tons/MWh

$ Avoided GHG per MWh Savings

Avoided Cost Profile (Positive Only)



Average Project Annual Electric Utility Avoided Costs



$152.66

Avg. Project Annual Electric Utility Avoided Costs

$ .17/kWh

$ Avoided Cost per kWh Savings

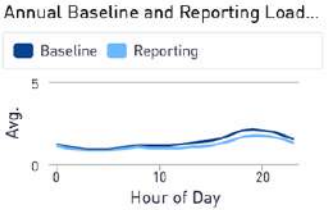
Electric Avoided Cost

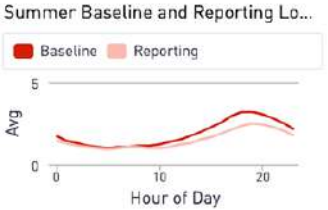
Residential HVAC and Shell

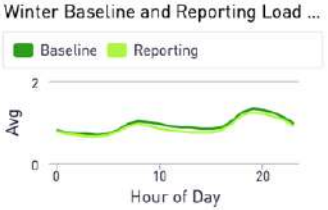
50% of Projects

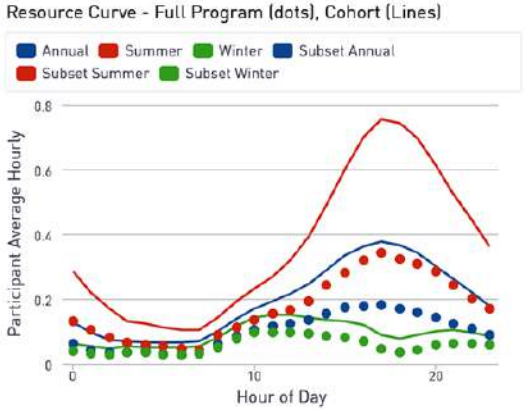
FILTERS (1) ▾ 3_Summer_Peak_kWh Top Half

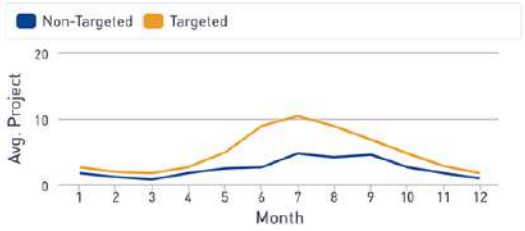
I. Resource Curve Optimization







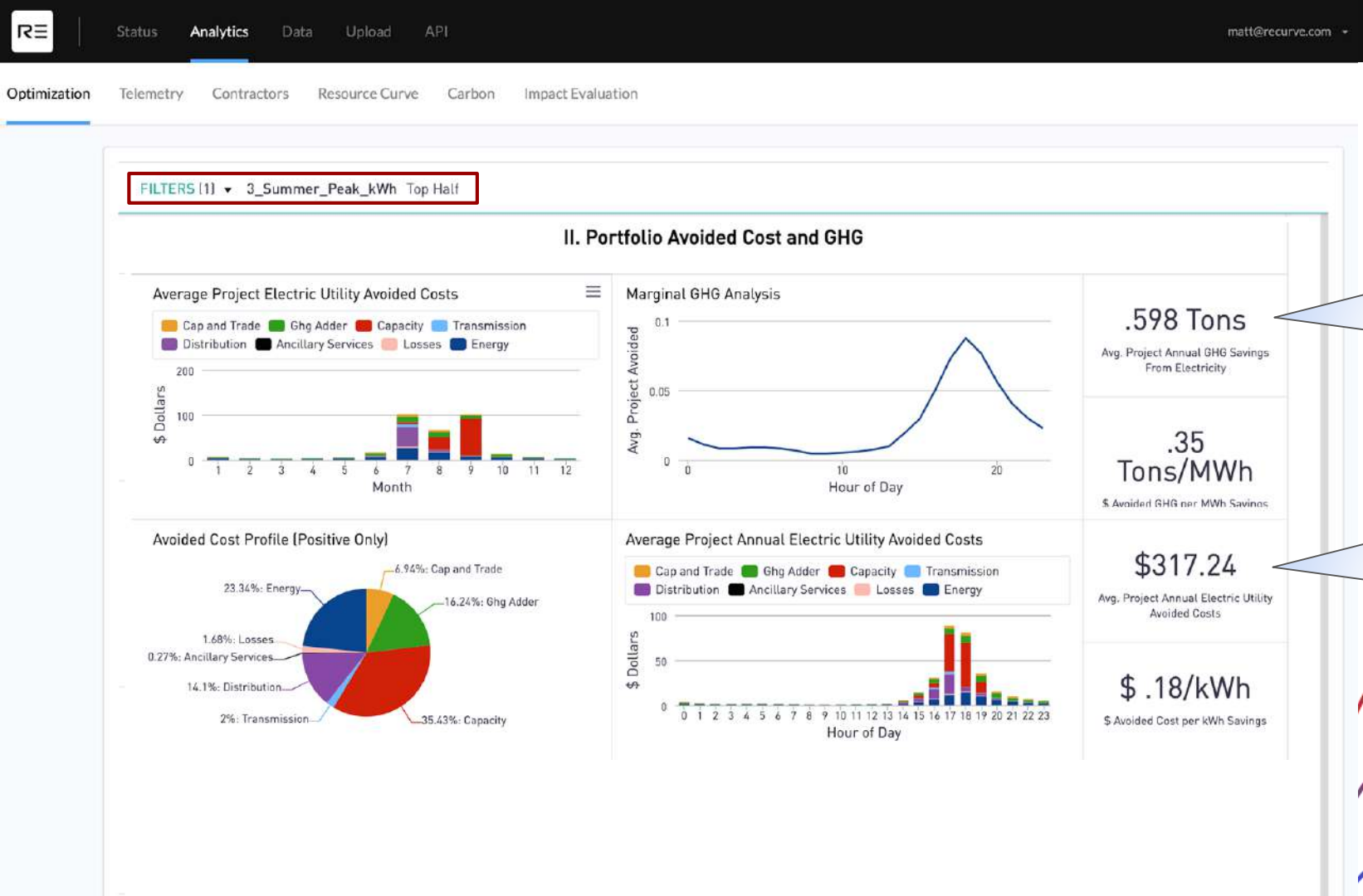




50% Projects	18 % % Negative Savers
1,723 kWh Annual Avg. Participant Savings	14 % Annual kWh Savings
428 kWh Summer Peak Avg. Participant Savings	24 % Summer Peak kWh Savings

40% Fewer Negatives

40% More Peak Summer



50% of Projects

2x Avoided GhGs

2x Avoided Cost

10% of Projects

FILTERS (2) 3_Summer_Peak_kWh Top 10% 5_Summer_Shoulder_Ratio Top 10%

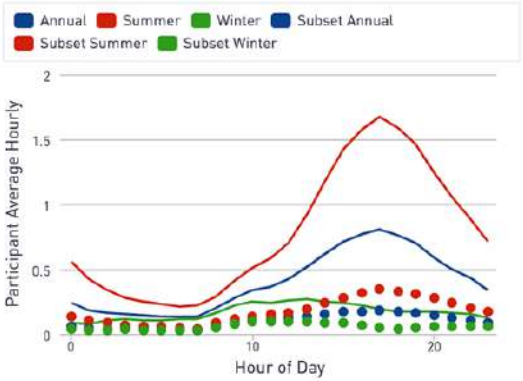
I. Resource Curve Optimization

Annual Baseline and Reporting Load...

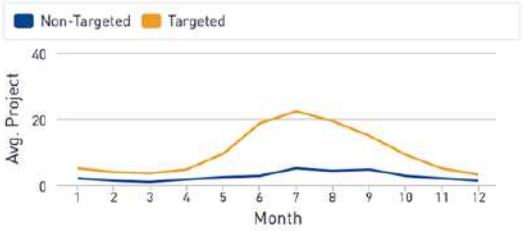
Summer Baseline and Reporting Lo...

Winter Baseline and Reporting Load ...

Resource Curve - Full Program (dots), Cohort (Lines)



Monthly Savings



10% Projects	8 % % Negative Savers
3,516 kWh Annual Avg. Participant Savings	20 % Annual kWh Savings
921 kWh Summer Peak Avg. Participant Savings	32 % Summer Peak kWh Savings

Distribution of Annual MWh Savings

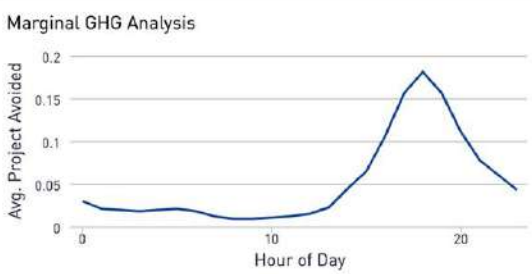
75% Fewer Negatives

2x Peak kWh Summer

10% of Projects

FILTERS (2) 3_Summer_Peak_kWh Top 10% 5_Summer_Shoulder_Ratio Top 10%

II. Portfolio Avoided Cost and GHG

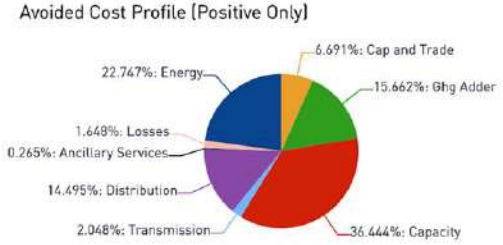


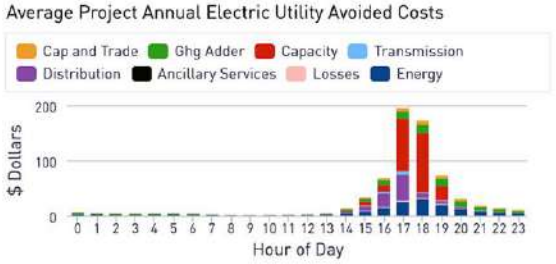
1.234 Tons

Avg. Project Annual GHG Savings From Electricity

.35 Tons/MWh

$ Avoided GHG per MWh Savings





$678.93

Avg. Project Annual Electric Utility Avoided Costs

$ .19/kWh

$ Avoided Cost per kWh Savings

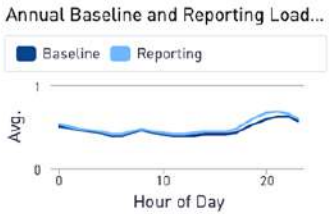
4x Avoided GhGs

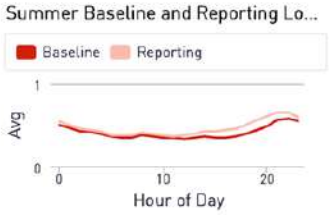
4.5x Avoided Cost

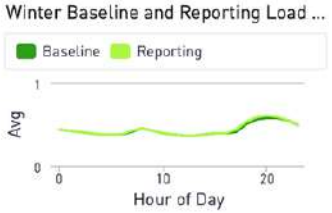
25% of Projects

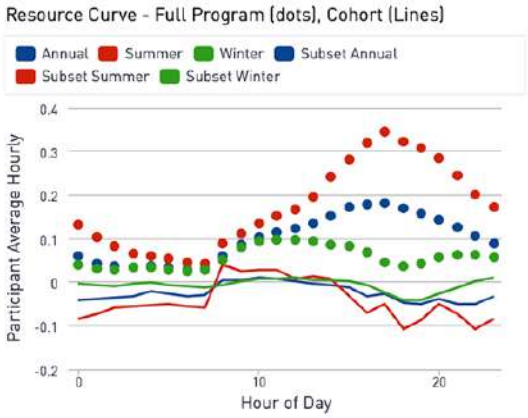
FILTERS (1) 3_Summer_Peak_kWh Bottom Quartile

I. Resource Curve Optimization









25% Projects	51 % % Negative Savers
-205 kWh Annual Avg. Participant Savings	-5 % Annual kWh Savings
-45 kWh Summer Peak Avg. Participant Savings	-18 % Summer Peak kWh Savings

51% Negative

Energy Use Increases

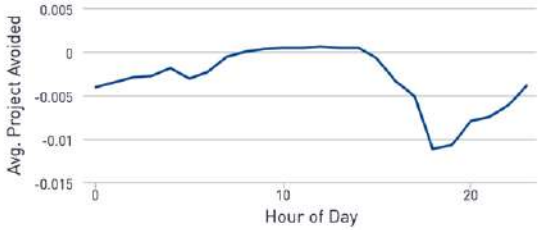
25% of Projects

FILTERS (1) 3_Summer_Peak_kWh Bottom Quartile

II. Portfolio Avoided Cost and GHG

Average Project Electric Utility Avoided Costs

Marginal GHG Analysis



-.076 Tons

Avg. Project Annual GHG Savings From Electricity

-.37 Tons/MWh

$ Avoided GHG per MWh Savings

Avoided Cost Profile (Positive Only)

Query returned no matching rows.

Average Project Annual Electric Utility Avoided Costs

-$26.86

Avg. Project Annual Electric Utility Avoided Costs

$ -.13/kWh

$ Avoided Cost per kWh Savings

Improve Cost Effectiveness and Customer Experience

RECURVE

Performance Payments

Policy Action	Market Opportunity
Default to performance oriented program designs	Outcome drives accountability
Eliminate technology specific requirements	Creative solutions for customers
Market support comes through training, data and risk management	Grow businesses around effective market solutions

RECURVE

Statewide Policies on Performance

- Legislation
- Regulatory Reform
- Executive Order

California Public Utilities Commission

nyserda
Energy. Innovation. Solutions.

...the core of the P4P model is the design and alignment of the performance-based requirements between the program administrator and the service provider as well as the corresponding services/requirements between the service provider and the customer. (New Efficiency: New York)

EnergyTrust of Oregon

...expand meter-based savings pilot programs, including pay for performance pilot programs by January 1, 2019. (Executive Order No 17-20, Accelerating Energy Efficiency in Oregon's Built Environment)

CASE STUDY

PG&E P4P: Residential

- Performance payments made monthly based on OpenEEmeter running CalTRACK 2.0
- Four (4) Aggregators with varied business models
- $25M total payments based on kWh & Resource Curve (time based savings)

Unparalleled flexibility to pursue a range of improvements and activities over time to achieve residents' savings goals

Retrofit

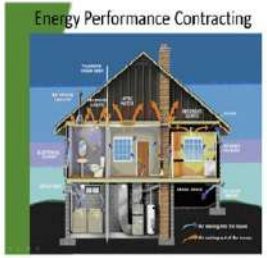
- Whole House
- HVAC
- Lighting
- Outdoor/Pool Deck

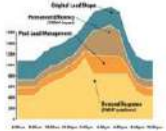
Operational

- Smart Thermostats
- Home Energy Management Systems
- Smart Appliances

Behavioral

- Homeowner Incentives
- Demand Response
- Other specially designed programs





CASE STUDY

PG&E P4P: Residential

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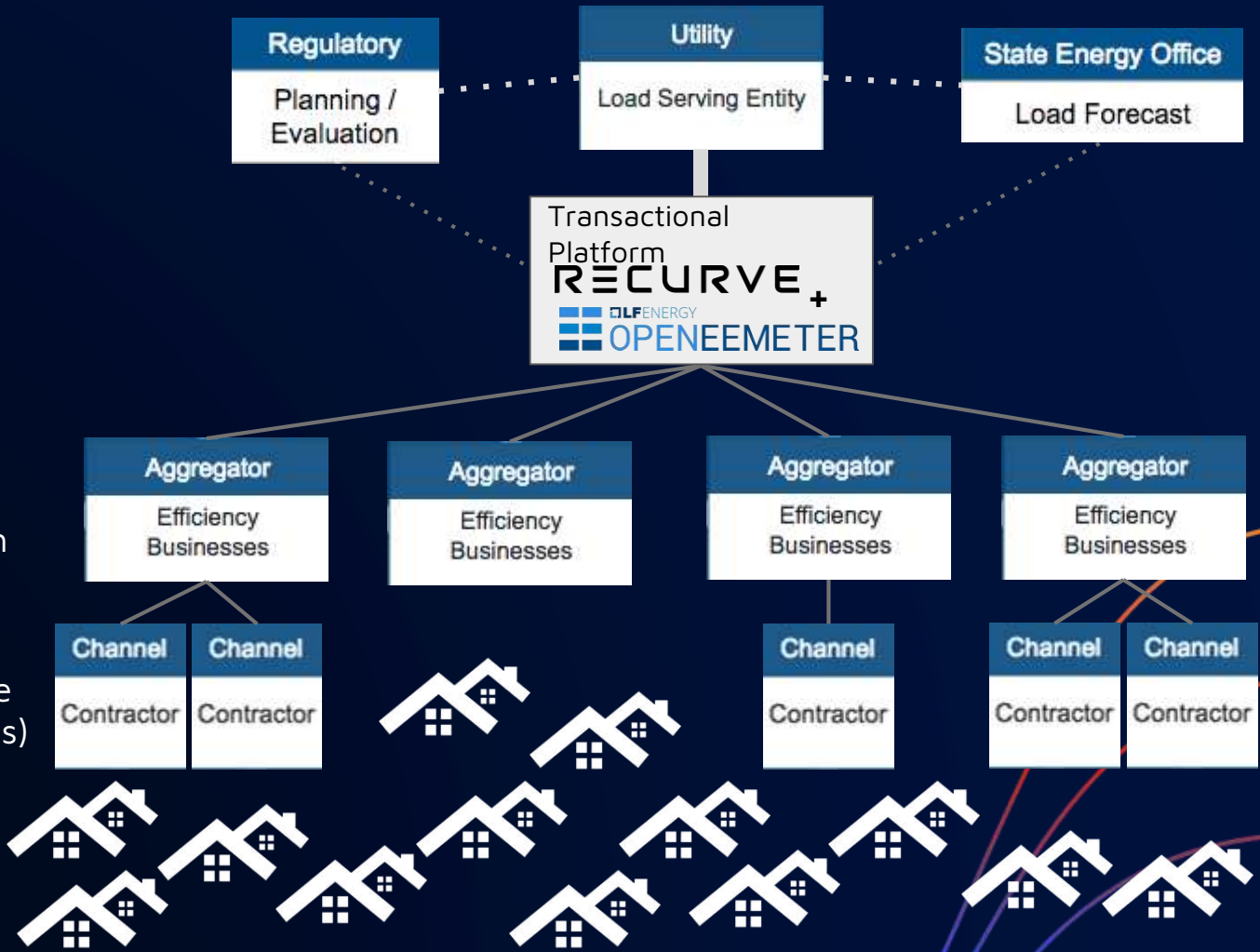
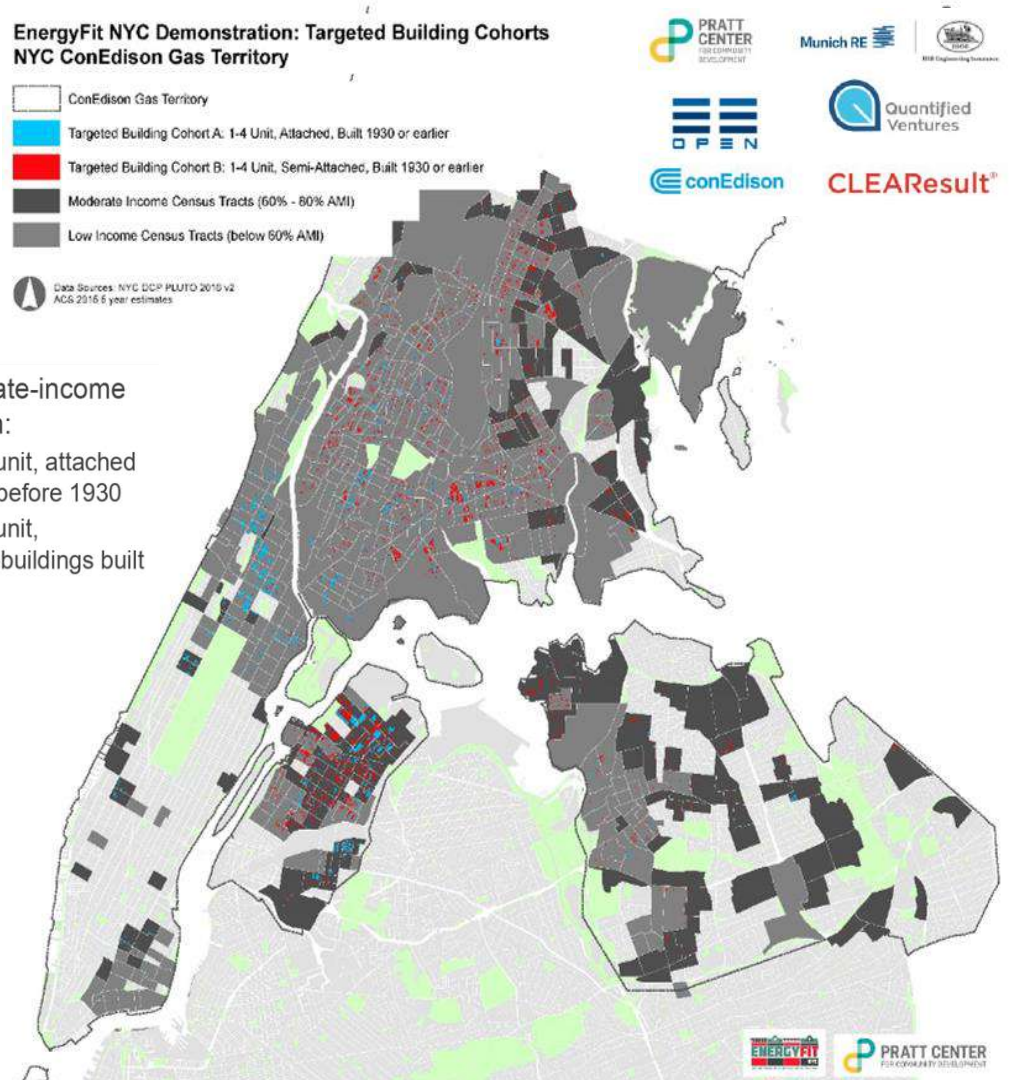


RECURVE

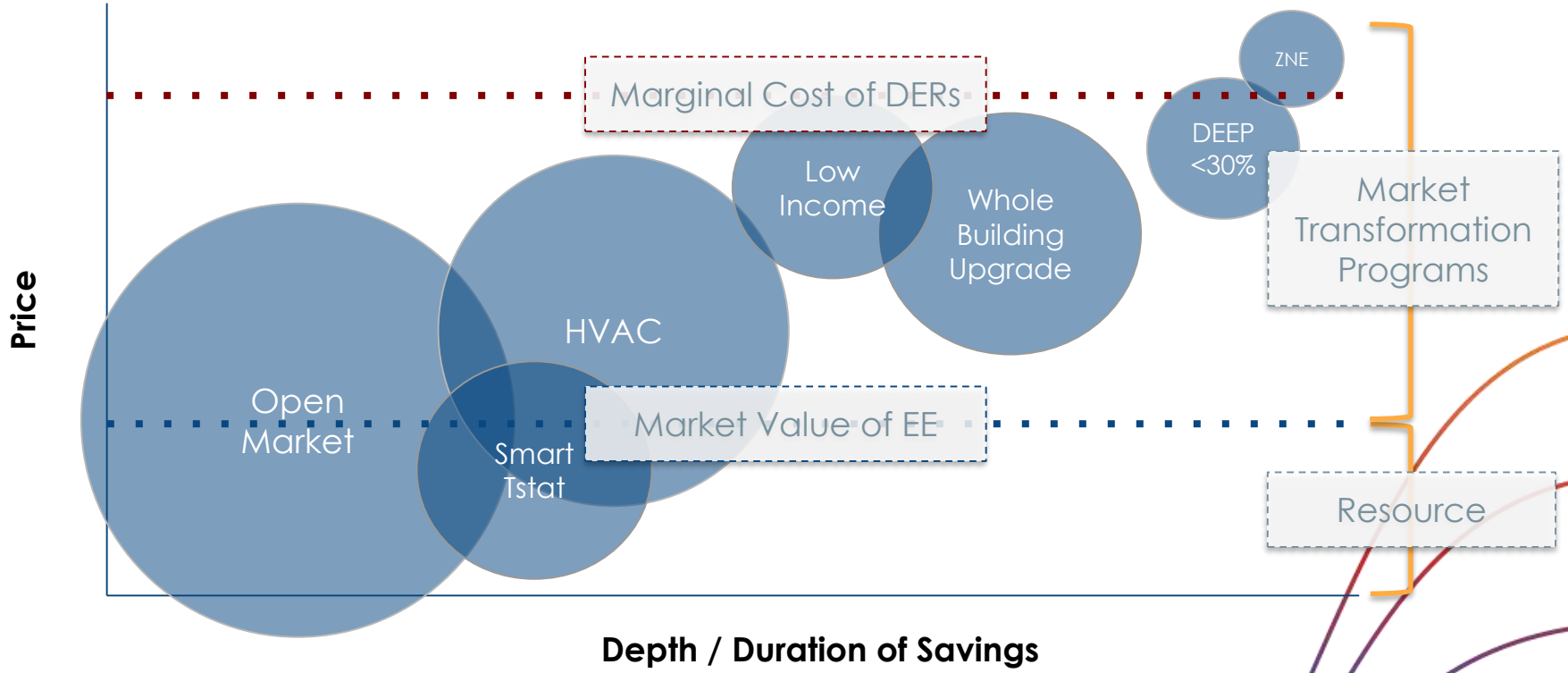
Con Edison EnergyFit LMI P4P Rev Demo



Low- and moderate-income residents living in:

- **Group A**: 1-4 unit, attached buildings built before 1930
- **Group B**: 1-4 unit, semi-attached buildings built before 1930

Program Design => Market Design



RECURVE

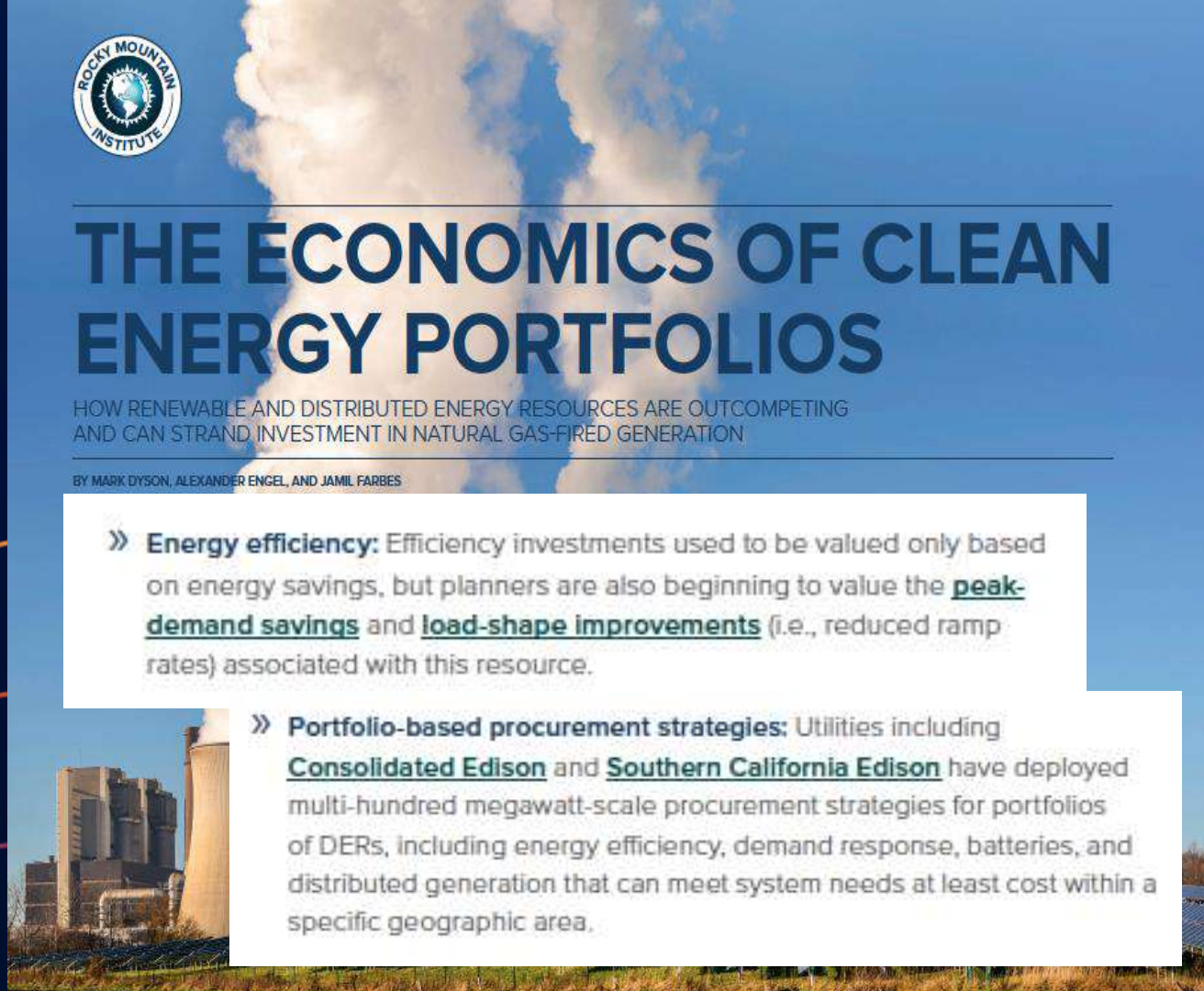
Performance Supports Market Innovation & Growth

Competitive Procurement

Policy Action	Market Opportunity
Adopt technology neutral solicitations	Offer comprehensive solutions that drive reduction in consumption
Use meter-based outcomes for payment / criteria	Compete with consistent metrics to demonstrate value
Fund more DERs via procurement funding & tied to grid planning	Expand funding sources and streamline rules and regulations

RECURVE

Clean Energy Portfolios Win on Price



https://rmi.org/insight/the-economics-of-clean-energy-portfolios/

SMUD's 2018 Net Zero Carbon IRP

- IRP focus: **Maximize local benefit**
- IRP's 2 key strategies:

Electrification
(Buildings & Vehicles)

Carbon Free Energy Sources

$1.7 Billion investment plan for electrification over the next 21 years

SMUD®

SMUD's Carbon Optimization Tool

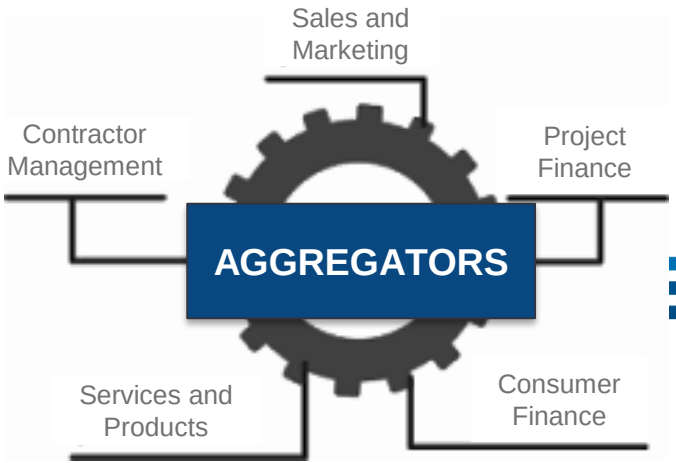
Calculates marginal carbon savings and cost effectiveness in order to optimize programs within budget and market adoption constraints

Enables SMUD to shift away from a first year kWh savings metric to a carbon reduction metric common to both energy and electrification

Uses the hourly marginal carbon emissions from the grid and the hourly load/ savings profiles of individual efficiency and electrification measures as well as the carbon reduction from fossil fuels eliminated by the customer

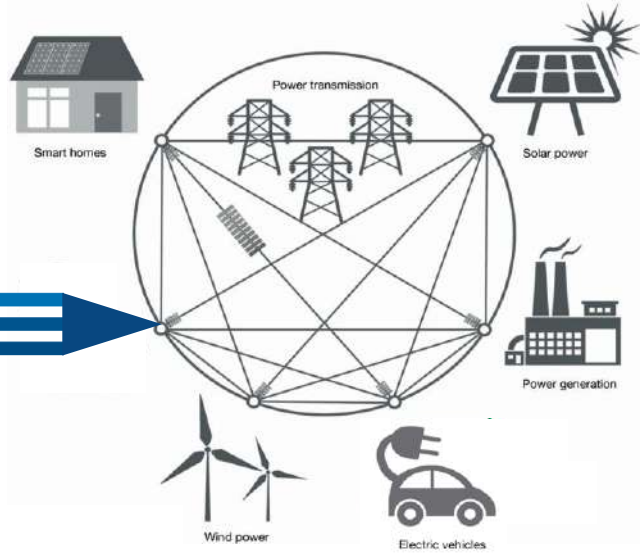
Project Finance: The long-term financing of projects based upon projected cash flows rather than the balance sheets of its sponsors.

Energy Efficiency fits a Future Full of Opportunity



DEMAND CAPACITY

Grid Resource

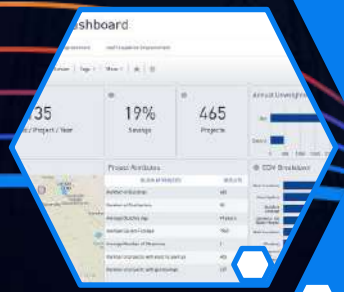


Business Models

Savings Comfort Health

RECURVE

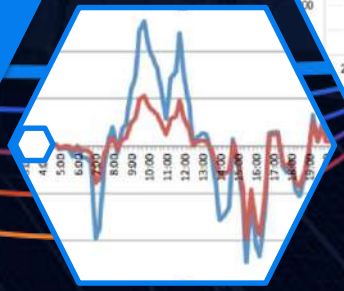
SHAPE THE FUTURE OF ENERGY



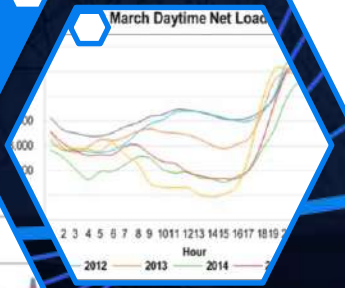
Pay for Performance

Resource Curve

Demand Capacity



Procurement



EEMeter

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Policy & Emerging Markets
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Additional References from Q&A

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International Energy Program Evaluation Conference (IEPEC) 2019

PAY FOR PERFORMANCE

- How to Evaluate Pay for Performance Programs: A Payday for Participants and Utilities – *Alexandra Czastkiewicz, EcoMetric Consulting* [abstract]
- Predictions with Restrictions: C&I Metered Energy Consumption – *Sarah Monohon, Evergreen Economics* [abstract]
- Policy Pathways to Meter-Based Pay for Performance – *Carmen Best, OpenEE* [abstract]
- We Say We Want a Revolution… What is it Going to Take to Get There with Pay for Performance? – *Hilary Polis, Opinion Dynamics* [abstract]

Thank you for attending!

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