

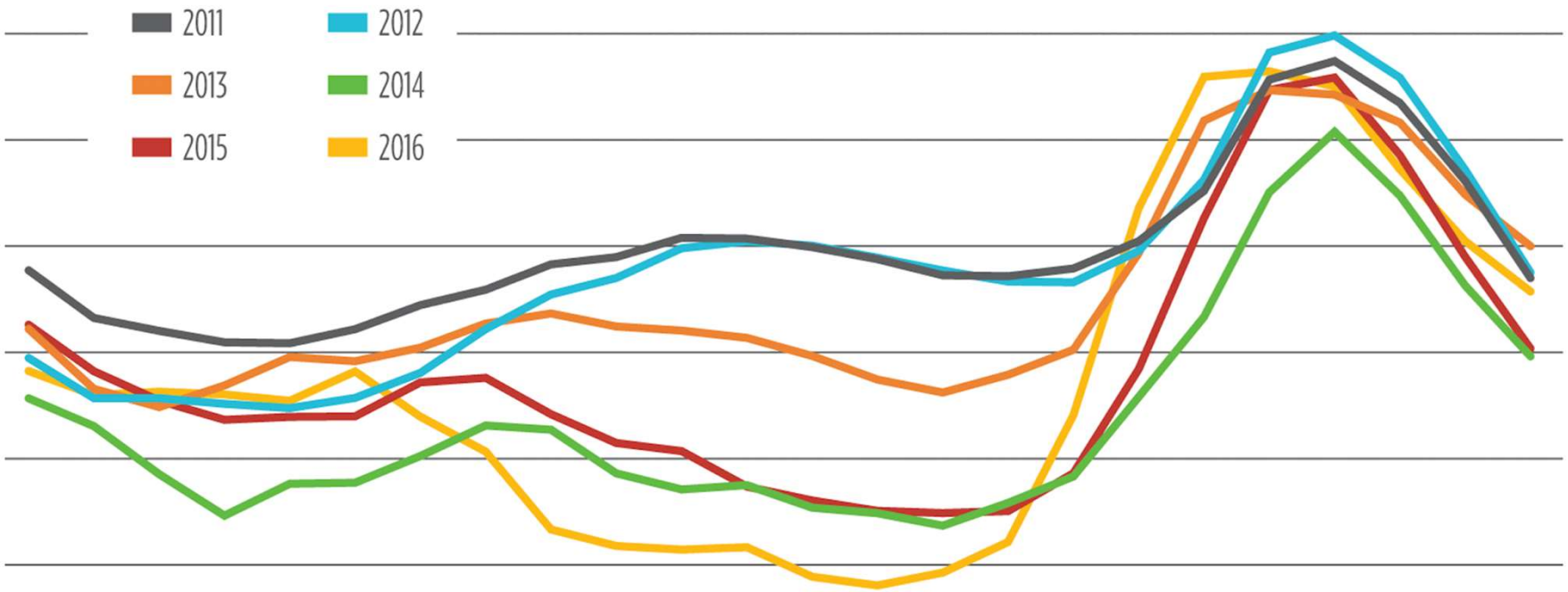

# Flexible Demand as a Resource

## Efficiency, Demand Response, and Electrification



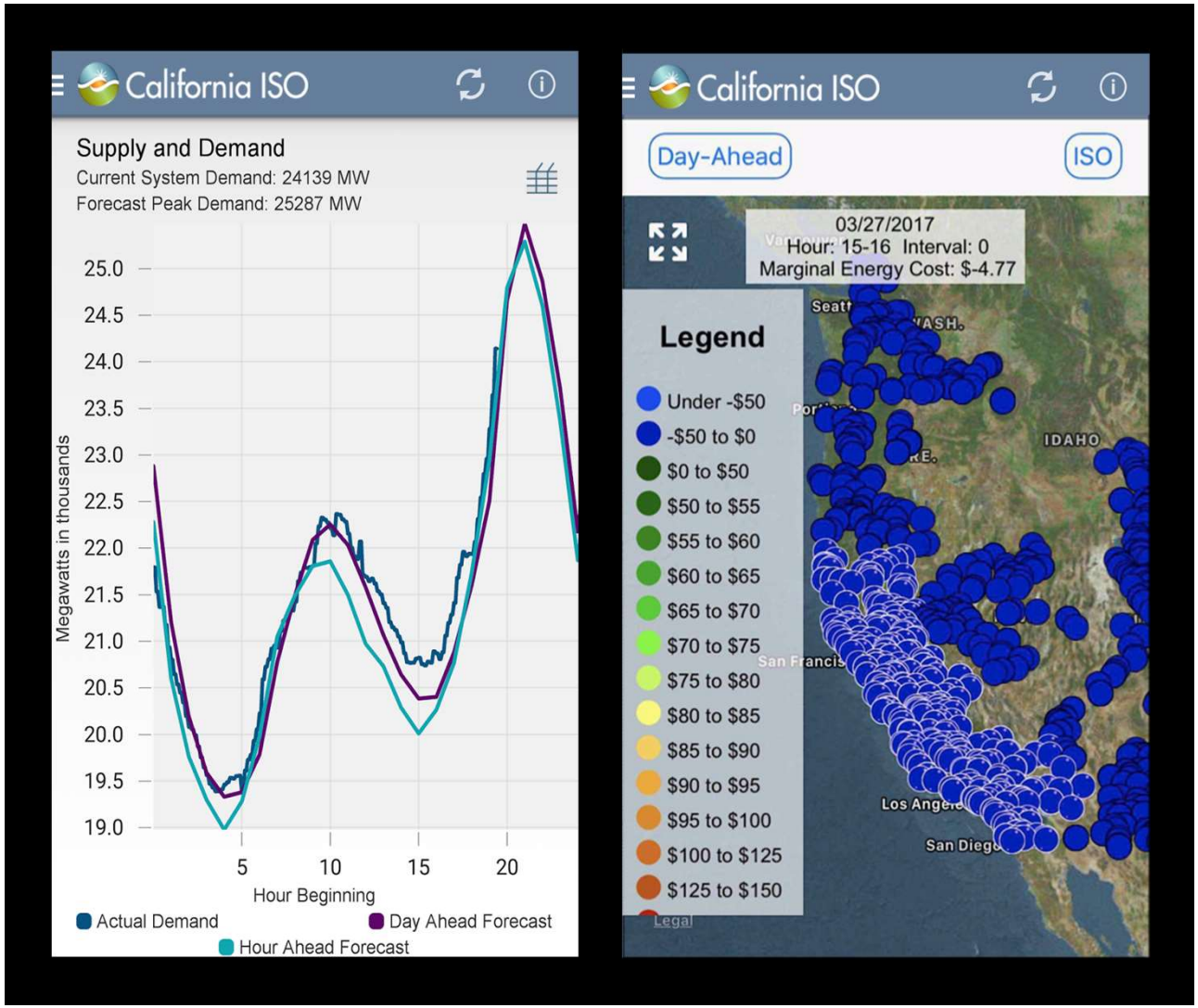

IEA Global Conference on Energy Efficiency
October, 2018

# The Big Bad Duck

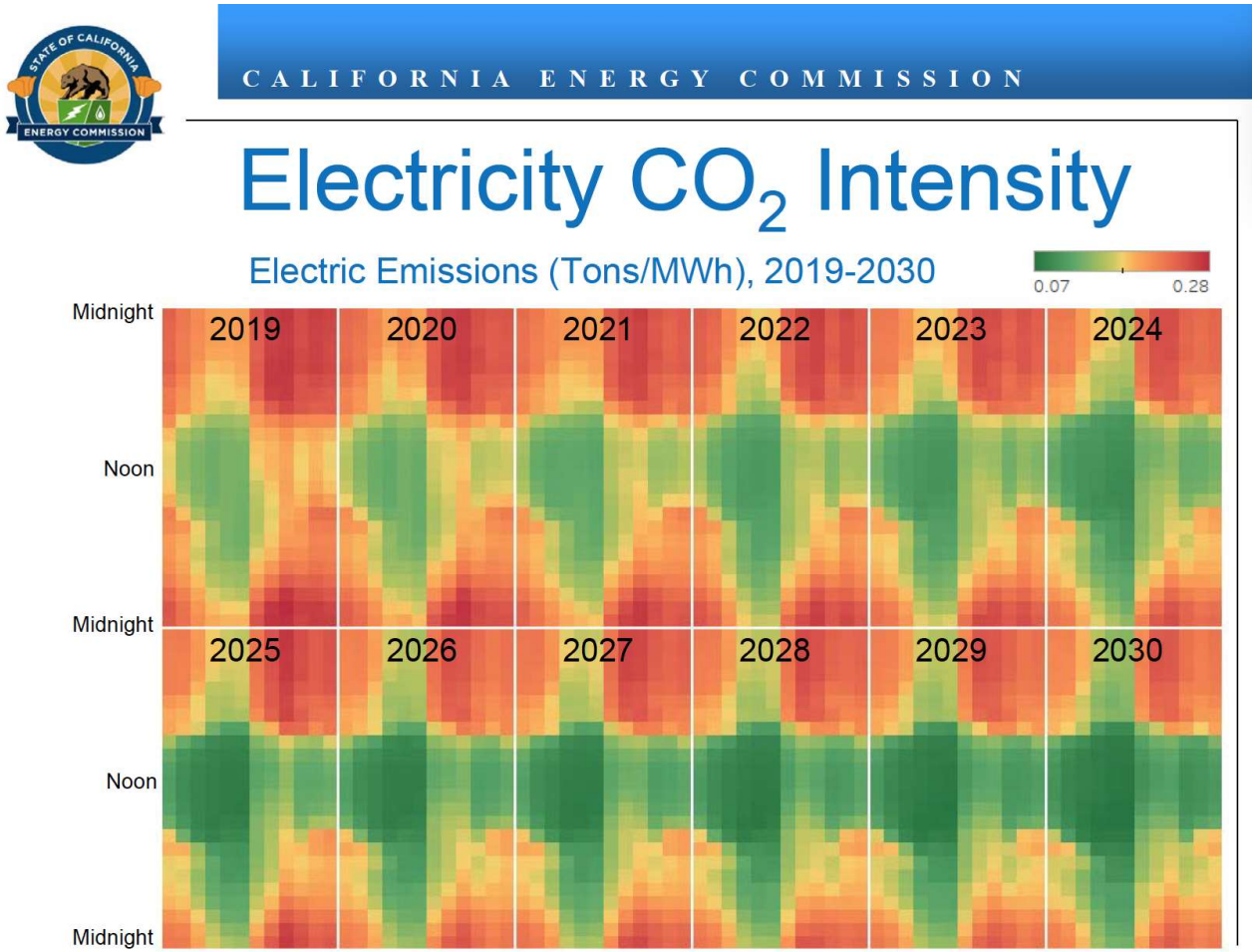



Four Years Ahead of CAISO Projections

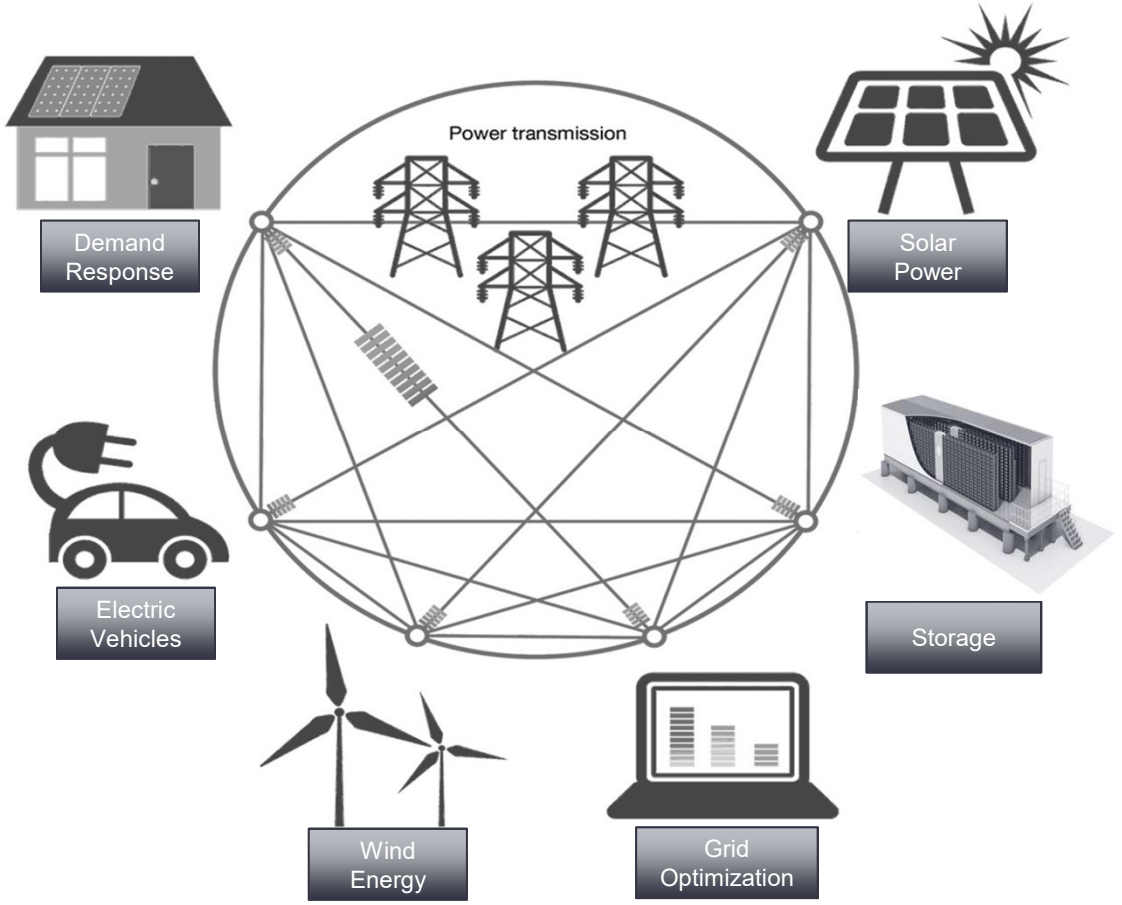
# Lots of Renewables but Nobody Buying

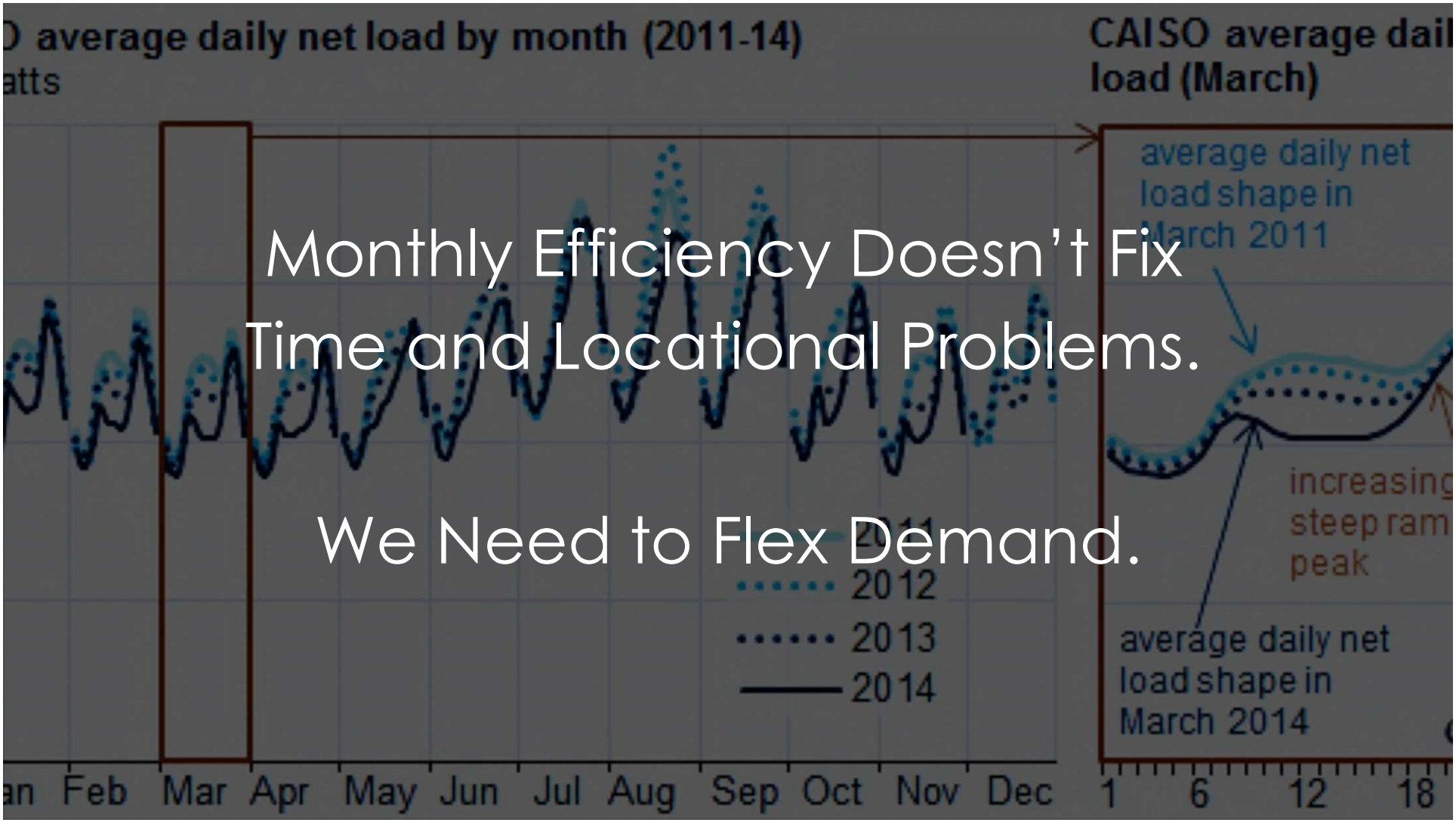


# What Is the Problem We Need to Solve?



# Fitting Energy Efficiency into Distributed Energy Resource Markets

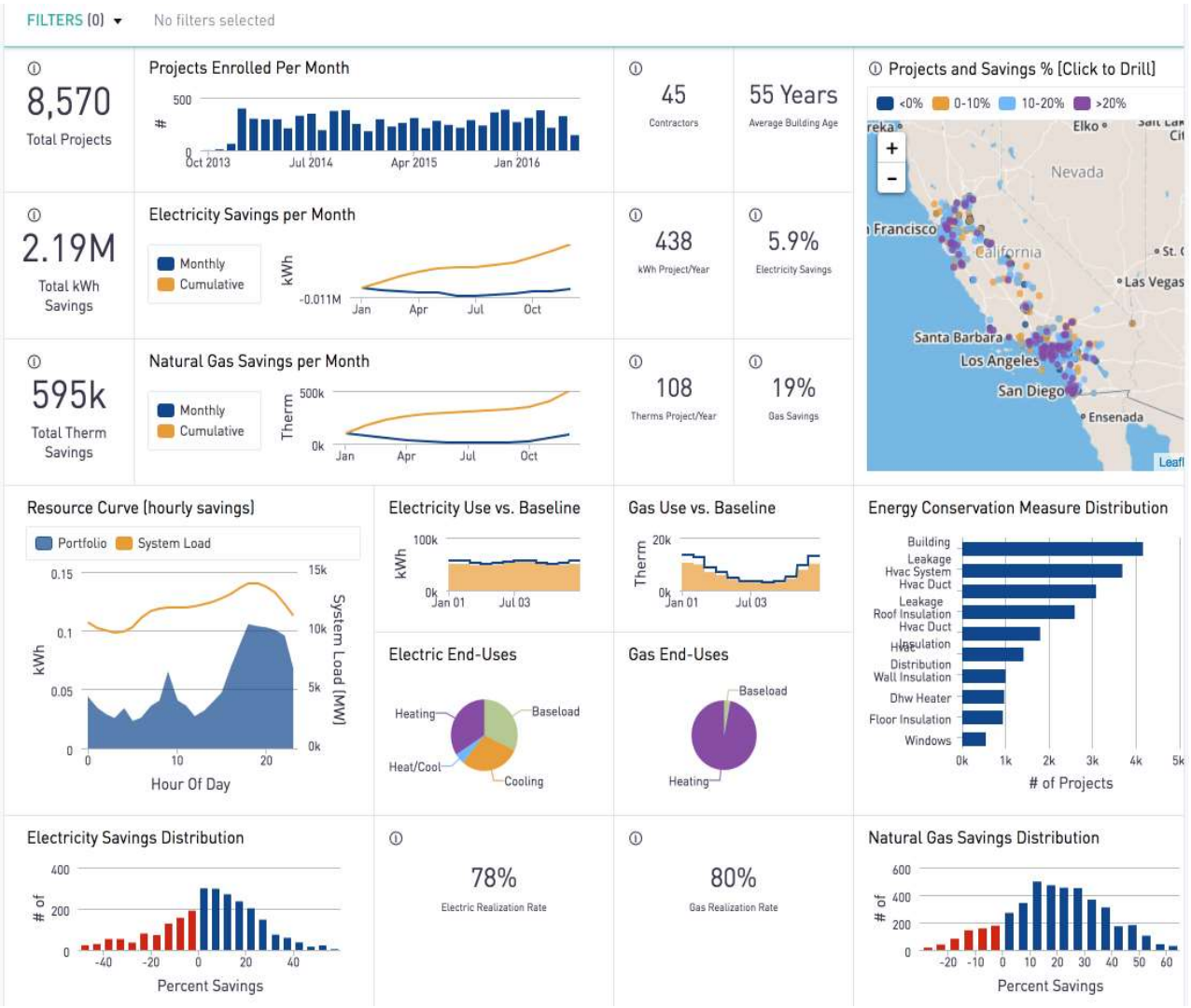





Monthly Efficiency Doesn't Fix Time and Locational Problems.

We Need to Flex Demand.

# Track Efficiency Impacts in Real-Time




open source initiative

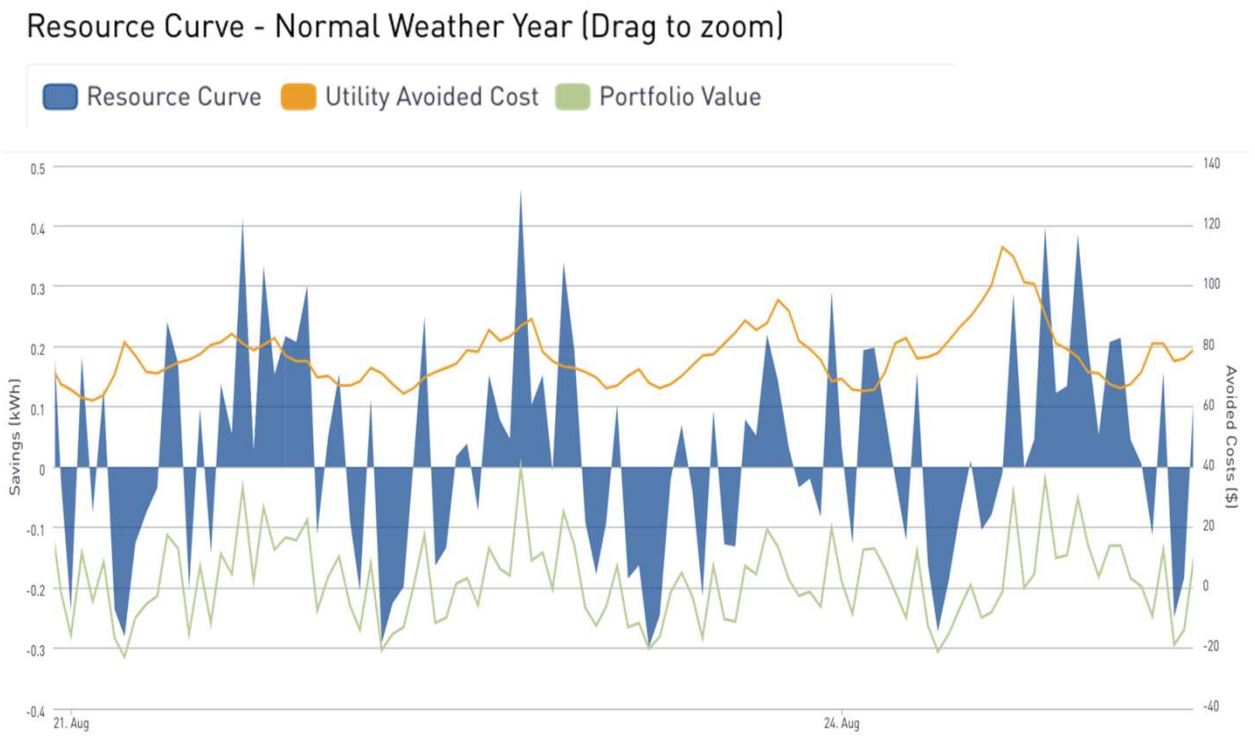
OPEN METER

# Calculating Real Avoided Costs

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OPEN EE METER

| $50.8k | 218k | $101.55 |
| --- | --- | --- |
| Portfolio Normal Year Avoided Costs | Portfolio Normal Year kWh Savings | Normal Year Avoided Costs Per Participant |



# Calculating Real Carbon Reductions




| HOUR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 14.1 | 8.3 | -1.4 | -6.4 | 1.0 | 8.8 | 14.6 | 10.1 | 0.4 | 2.8 | 1.2 | 5.3 |
| 2 | 4.2 | 7.5 | -1.5 | -5.1 | 1.8 | 5.8 | 11.1 | 6.9 | -9.1 | -3.3 | 4.2 | 9.9 |
| 3 | 5.5 | 4.8 | 2.3 | -3.6 | -0.4 | 0.6 | 4.1 | 2.9 | -3.0 | -2.8 | 5.5 | 2.5 |
| 4 | 8.0 | 6.8 | 0.9 | -0.8 | -3.6 | 2.5 | 1.9 | 3.3 | -3.1 | -3.9 | 0.2 | 6.6 |
| 5 | 8.0 | 8.7 | 1.2 | -0.8 | -0.6 | 1.8 | 0.2 | 3.3 | 2.8 | -0.9 | 1.8 | 8.4 |
| 6 | 3.8 | 1.0 | 2.9 | -4.1 | 0.7 | 0.9 | -1.6 | -6.9 | -0.1 | 0.5 | 3.5 | 3.5 |
| 7 | 3.3 | 1.8 | -0.2 | 2.1 | 0.6 | 0.0 | 2.7 | -2.8 | -4.9 | -0.4 | 5.2 | 3.7 |
| 8 | 5.5 | 4.1 | 3.0 | 2.5 | 1.8 | 2.5 | 1.1 | -3.3 | 3.8 | -0.6 | 2.0 | 6.9 |
| 9 | 10.7 | 5.2 | 3.1 | 1.6 | 3.9 | 1.8 | -0.7 | -1.3 | 0.8 | 7.4 | 4.5 | 7.4 |
| 10 | 10.9 | 3.6 | 5.3 | 3.6 | -0.2 | 0.9 | 3.5 | 10.2 | 9.7 | 8.6 | 13.3 | 9.7 |
| 11 | 8.5 | 0.0 | 2.2 | -1.7 | 1.0 | -0.4 | -1.9 | -3.6 | 0.6 | 1.4 | 1.5 | 9.1 |
| 12 | 3.6 | 0.2 | 1.3 | 0.2 | -3.2 | -1.5 | 0.2 | -3.3 | -2.6 | 2.7 | 2.7 | 5.0 |
| 13 | 2.7 | -1.9 | -2.8 | -4.2 | -1.1 | -1.4 | 1.6 | 0.8 | -2.9 | -3.5 | -1.0 | -2.8 |
| 14 | -0.3 | -2.3 | -3.1 | -3.2 | 0.4 | 2.4 | 4.9 | 0.3 | -0.7 | -2.9 | -2.8 | 1.1 |
| 15 | 0.0 | -0.6 | -3.1 | -1.6 | 3.1 | 3.5 | 2.9 | 3.6 | -1.9 | -0.6 | 0.4 | 2.7 |
| 16 | 1.4 | -6.0 | -4.6 | -3.9 | 2.7 | 4.6 | 12.6 | 9.0 | 3.3 | -0.6 | 0.2 | 3.6 |
| 17 | 3.6 | -4.1 | -4.4 | -4.5 | 1.3 | 7.3 | 16.4 | 19.9 | 9.8 | 8.7 | 8.1 | 10.9 |
| 18 | 4.4 | 3.2 | 1.7 | 0.0 | 2.7 | 12.5 | 17.5 | 20.6 | 18.4 | 13.6 | 6.6 | 9.5 |
| 19 | 2.2 | 4.2 | 3.0 | 1.9 | 7.3 | 13.6 | 25.8 | 29.2 | 26.1 | 19.8 | 11.3 | 11.1 |
| 20 | 11.0 | 3.7 | 2.3 | 4.6 | 9.2 | 22.5 | 26.3 | 27.1 | 22.3 | 12.6 | 8.9 | 7.3 |
| 21 | 9.2 | 9.0 | 4.0 | 1.2 | 7.5 | 15.2 | 30.4 | 26.1 | 26.8 | 11.7 | 18.3 | 6.3 |
| 22 | 15.0 | 6.0 | 7.5 | 1.4 | 10.2 | 17.3 | 31.8 | 31.6 | 21.4 | 14.1 | 7.8 | 10.1 |
| 23 | 8.6 | 2.2 | 6.9 | 0.4 | 8.1 | 14.3 | 30.1 | 36.4 | 26.2 | 9.2 | 14.2 | 15.2 |
| 24 | 13.2 | 5.1 | 3.6 | -1.7 | 4.9 | 7.8 | 27.7 | 18.0 | 15.2 | 3.6 | 4.9 | 7.4 |

open source initiative

OPEN EE METER

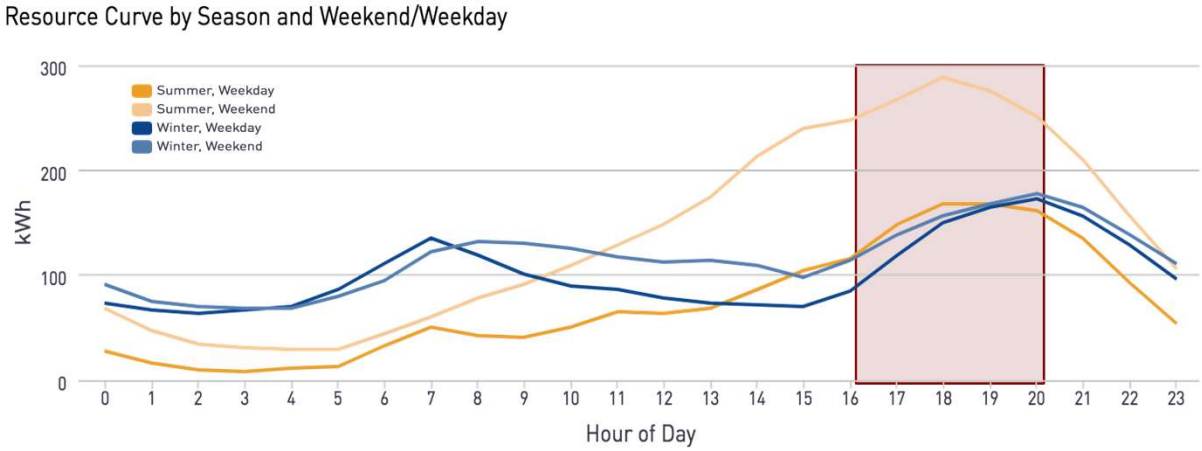
# RESOURCE CURVE

## Time And Locational Savings

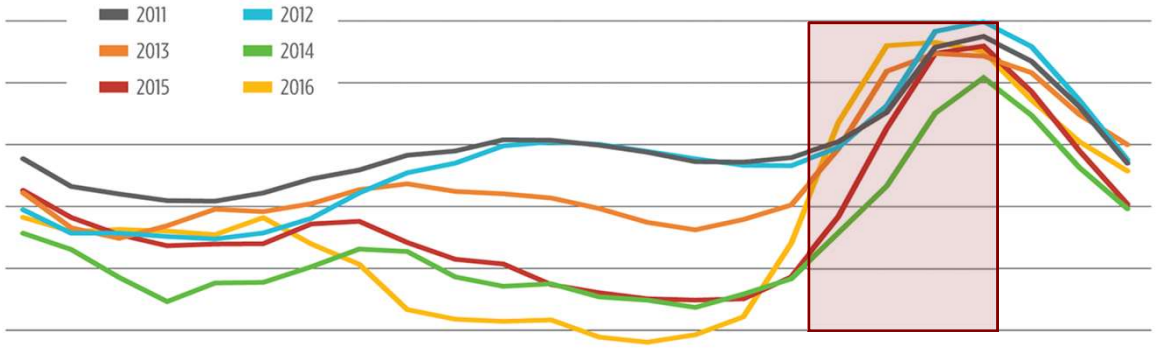
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OPEN EE METER

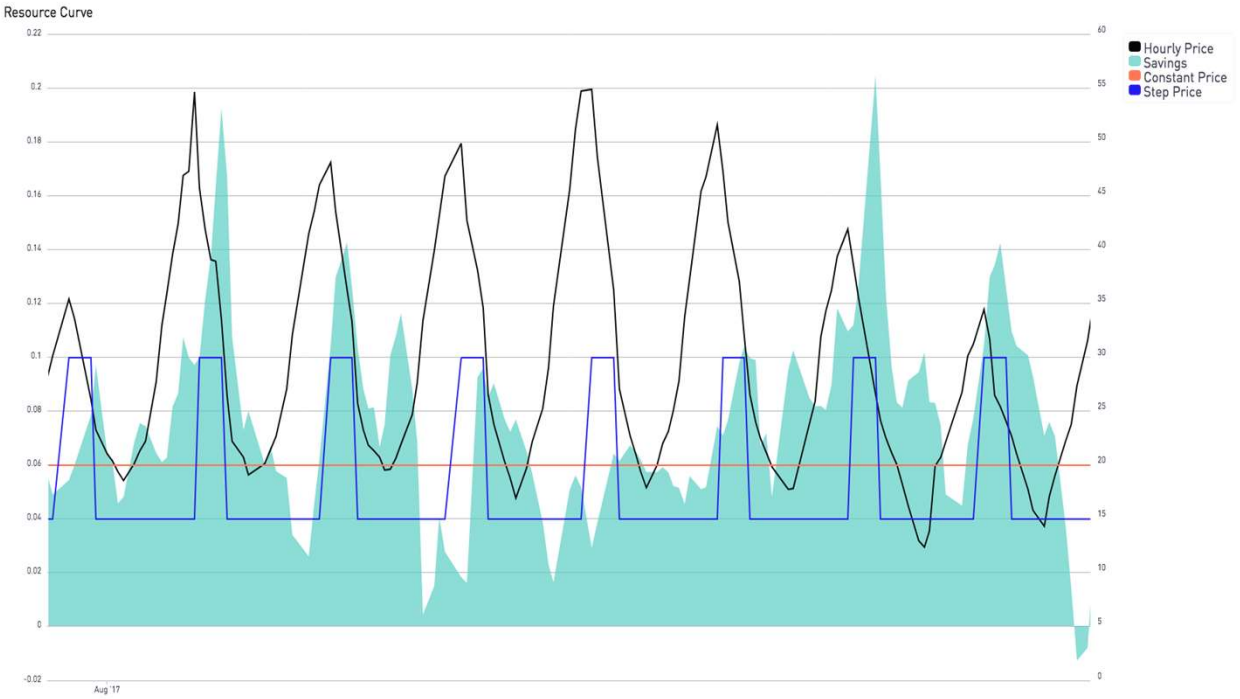
### Resource Curve




### Duck Curve

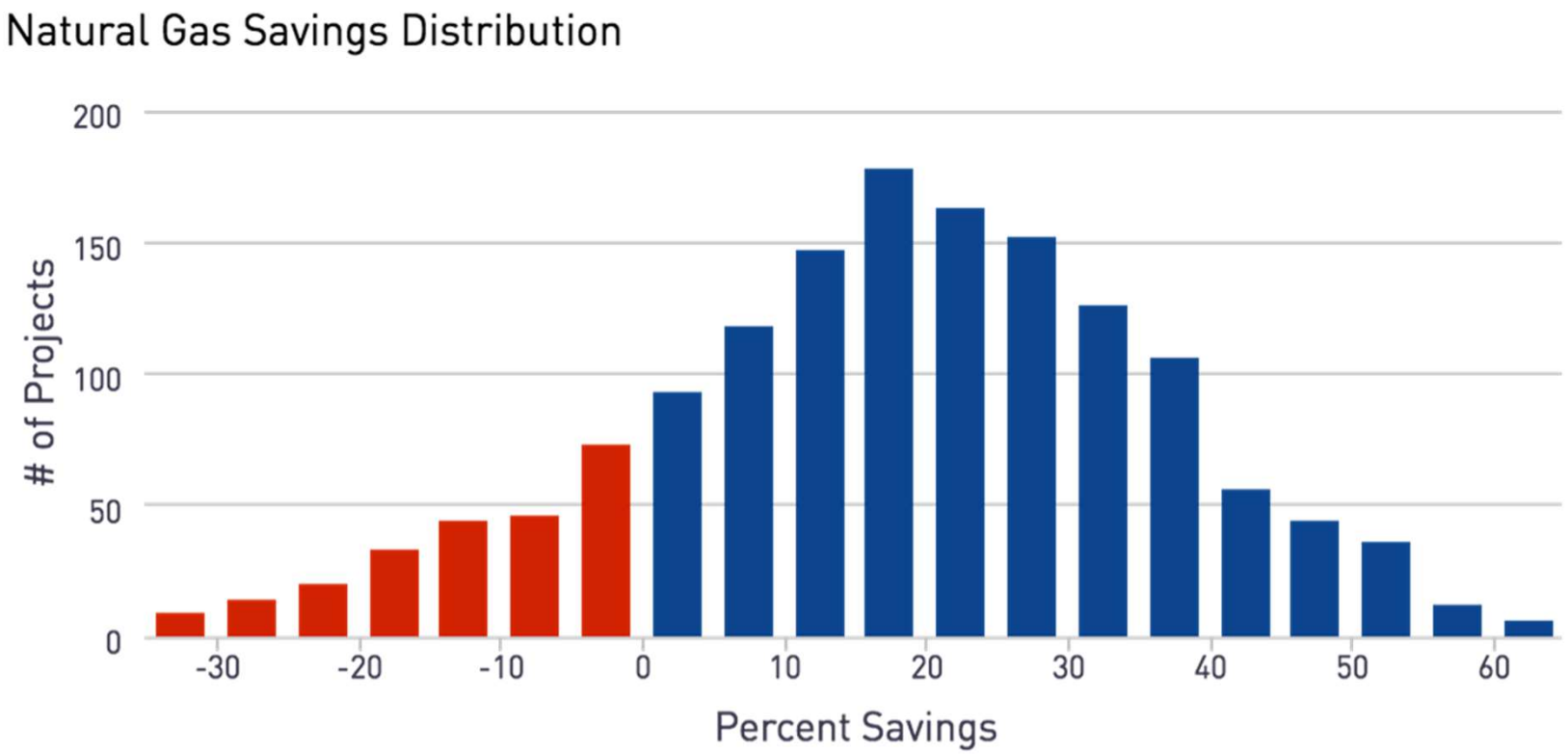


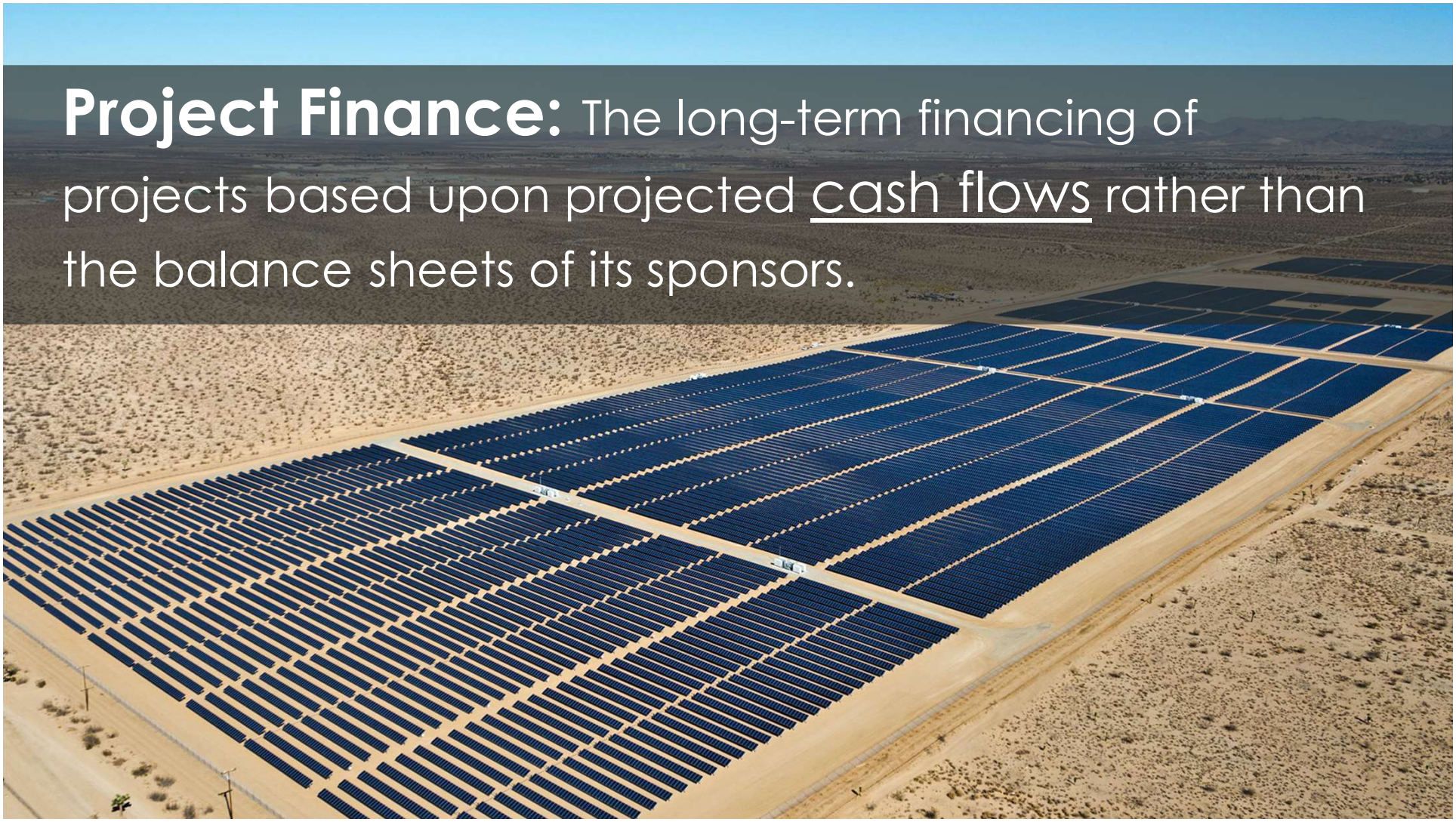
# Sending the Right Price Signal

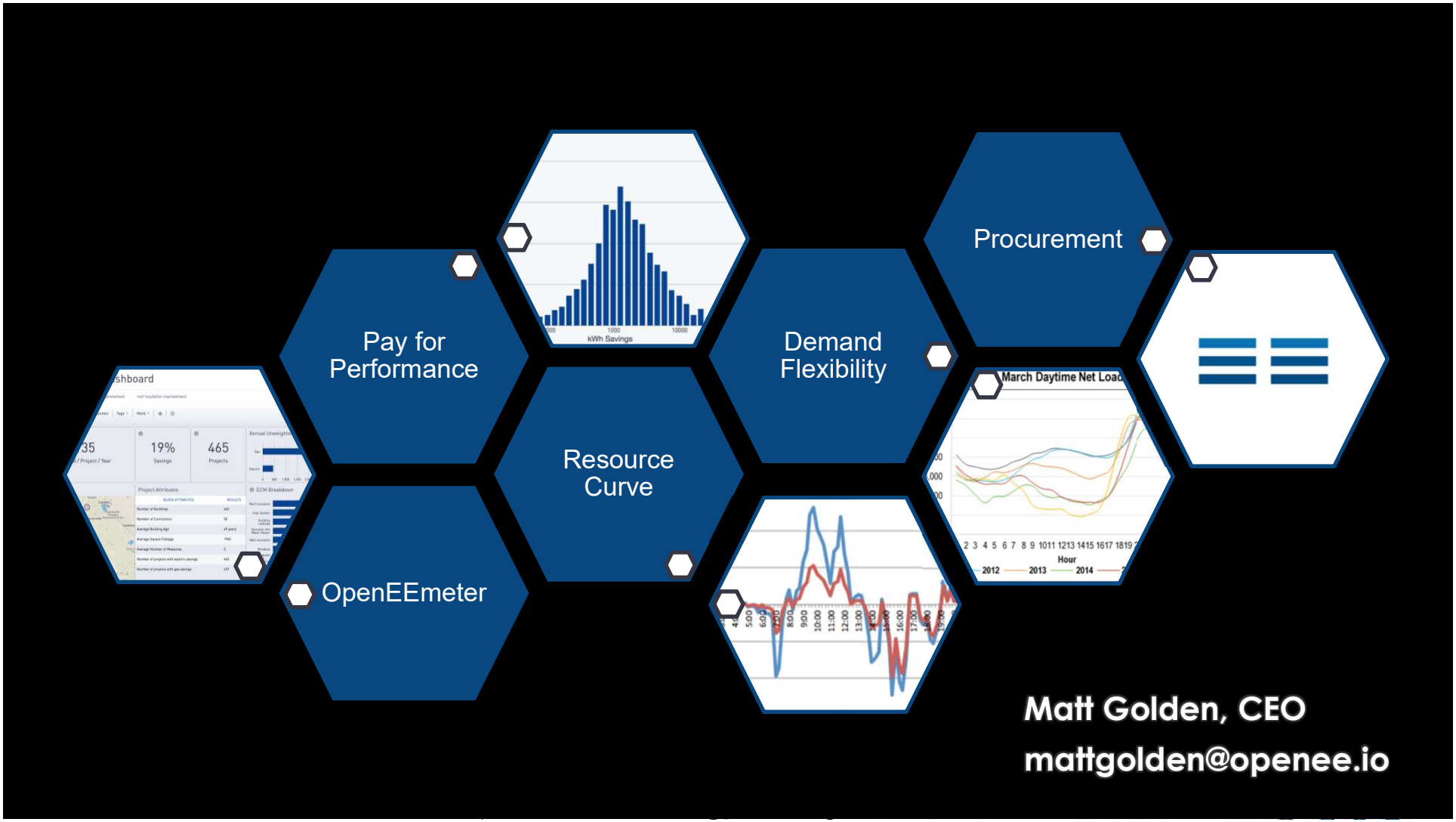



- PG&E Residential Pay-for-Performance Program
- kWh rate + 3x Kicker for savings from 4pm to 8pm
- Payments based on CalTRACK / OpenEEmeter

# Efficiency Risk is Manageable as a Portfolio




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


Pay for Performance
kWh Savings
Procurement
Demand Flexibility
Resource Curve
March Daytime Net Load
Hour
2012
2013
2014
OpenEEmeter
Matt Golden, CEO
mattgolden@openee.io