CATALYST converge

Advanced (M&V) using special adjustments

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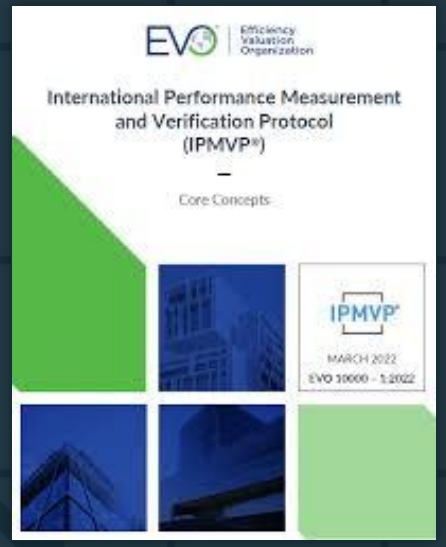
Agenda

1. Purpose of Measurement and Verification
2. What are you trying to measure?
3. Summarize M&V options & cost avoidance
4. Special adjustments
5. Lighting retrofit example
6. Demo
7. Common CA reports
8. Free industry tools to help with adjustments

Purpose of Measurement and Verification (M&V)



IPMVP – International Performance Measurement and Verification Protocol

M&V is a standardized method for measuring and verifying the energy savings from energy efficiency projects. It provides a framework for quantifying energy savings and verifying the effectiveness of energy conservation measures.

Does not specify calculation methods, it only establishes a common set of principles and guidelines.

What are you trying to measure?

Operational Changes

- Align HVAC schedules with occupancy
- Modify set points
- Establish energy conservation culture
- Improve preventative maintenance

Efficiency Changes

- Lighting retrofits
- Install VFDs on pumps
- Update BAS
- Implement retrocommissioning projects
- Improve weatherization
- Demand controlled ventilation

IPMVP options

Retrofit Isolation

OPTION A
Retrofit Isolation:
Key Parameter(s) Measurement

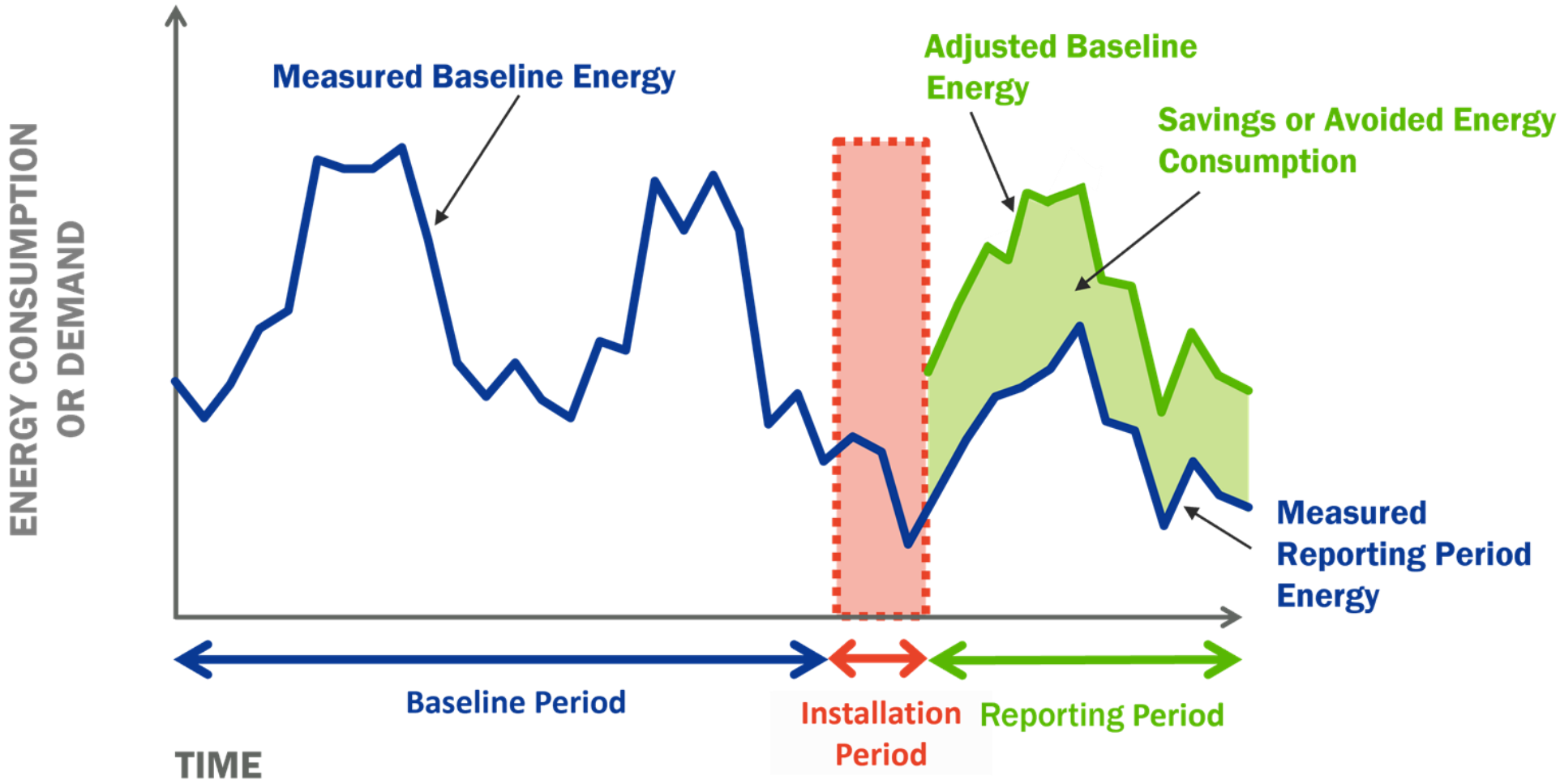
OPTION B
Retrofit Isolation:
All Parameter Measurement

Whole Facility

OPTION C
Whole Facility

OPTION D
Calibrated Simulation

Baseline Adjusted to Current Conditions (BATCC)

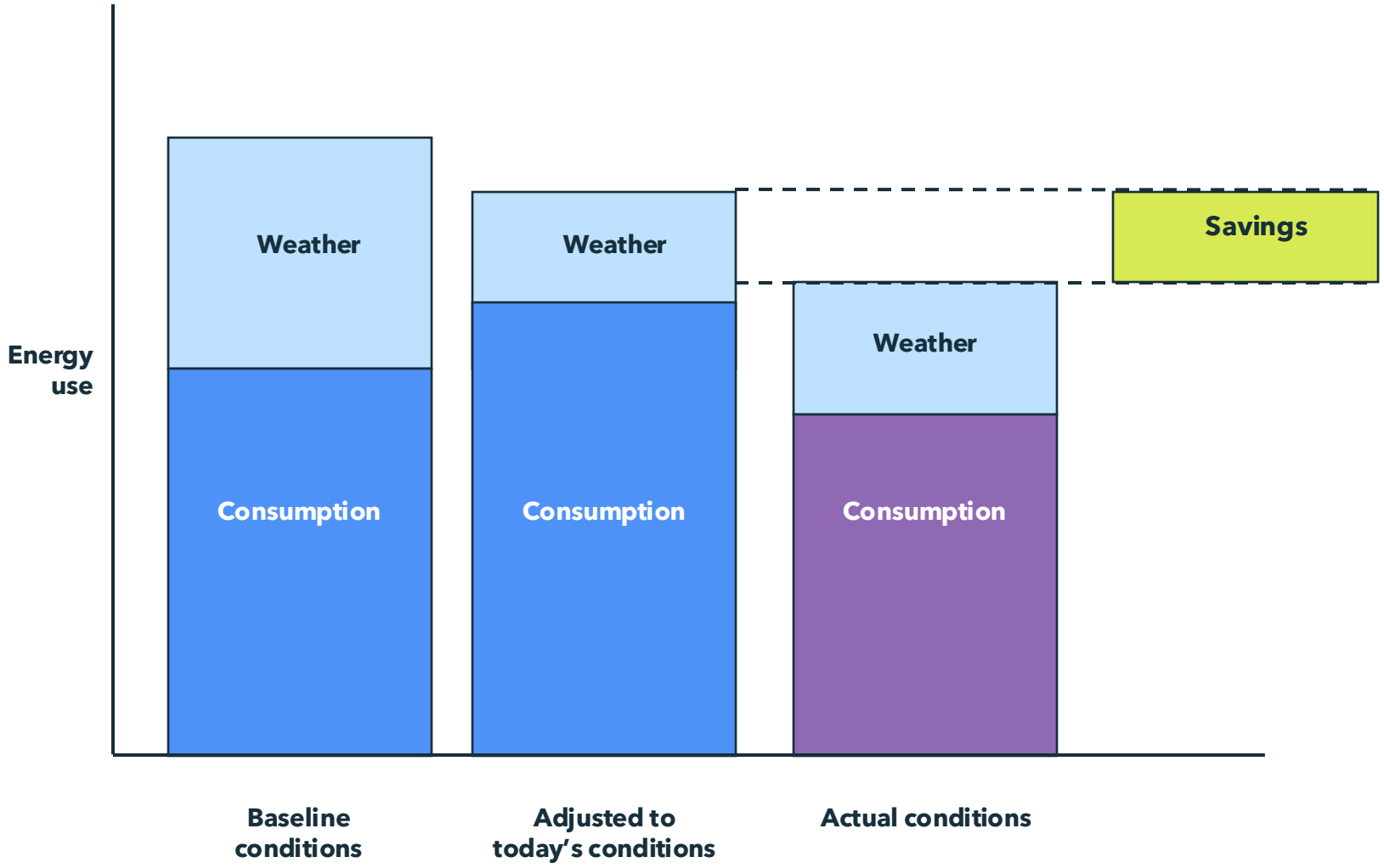


Cost avoidance calculation

Conceptual Steps

1. Baseline is established
2. If meter is weather sensitive, the baseline use is broken down into two piece – weather use and non-weather use using linear regression model
3. The baseline use is adjusted to current conditions (BATCC) to match weather and other conditions.
4. BATCC use – current use = cost avoidance use
5. BATCC cost is determined by valuing the BATCC use at the current “average unit cost” (AUC) rate
6. Cost avoidance = BATCC cost – current cost

Baseline Adjusted to Current Conditions (BATCC)



The basics of setting up cost avoidance in EnergyCAP

1. Identify a “fair” baseline period
   - Consider unique meter events
   - Consider the benefit of being consistent
2. Complete a “data integrity check”
3. Set baseline start date and savings start date
4. Check weather models
5. Process savings
6. Interpret the results
7. Determine if any “special adjustments” are necessary
8. Don’t share results until completing a “sanity check”

Special adjustment

(“non-routine baseline adjustment” in IPMVP lingo)
a customized calculation used to modify energy baseline or reporting period data. It accounts for significant, unexpected changes in a facility's static factors (such as floor area, permanent equipment additions, or major shifts in operational use) that are unrelated to the installed energy conservation measures.

Special adjustments

Continuous

An adjustment in effect year-round starting on a specific date

- Retrofitted mechanical systems
- Lighting retrofit
- Added 100 new computers

Recurring

An adjustment in effect certain days of the year starting on a specific date

- Added air conditioning to a location – seasonal event
- Added irrigation zones on a water meter – seasonal event
- Portable classrooms removed part of the way through the base year.

Special adjustments - methods

Frequently Used

Add x.xxxx per day to the BATCC non-weather use

Add x.xxxx% to the total BATCC use

No loss No Gain (Savings equals zero)

BATCC cost = BATCC use times x.xxxx user-defined unit cost

Cost avoidance = avoided use time x.xxxx user-defined unit cost

Important Notes

- ✓ Be sure to track building square footage
- ✓ Order of adjusts matters if you're using %

Special adjustments - methods

Seldom Used

1. Add x.xxxx per day to the BATCC demand
2. Add x.xxxx% to the total BATCC demand

Not yet fully implemented

3. Add x.xxxx% to the weather (cooling) BATCC use
4. Add x.xxxx% to the weather (heating) BATCC use
5. BATCC cost = BATCC demand times x.xxxx user-defined unit cost
6. Cost avoidance = avoided use times calculated average unit cost
7. Multiply Average Unit Cost by x.xxxx% to approximate marginal unit cost
8. Replace the BATCC demand with x.xxxx per day
9. Replace the total BATCC cost with x.xxxx per day
10. Replace the total BATCC use with x.xxxx per day

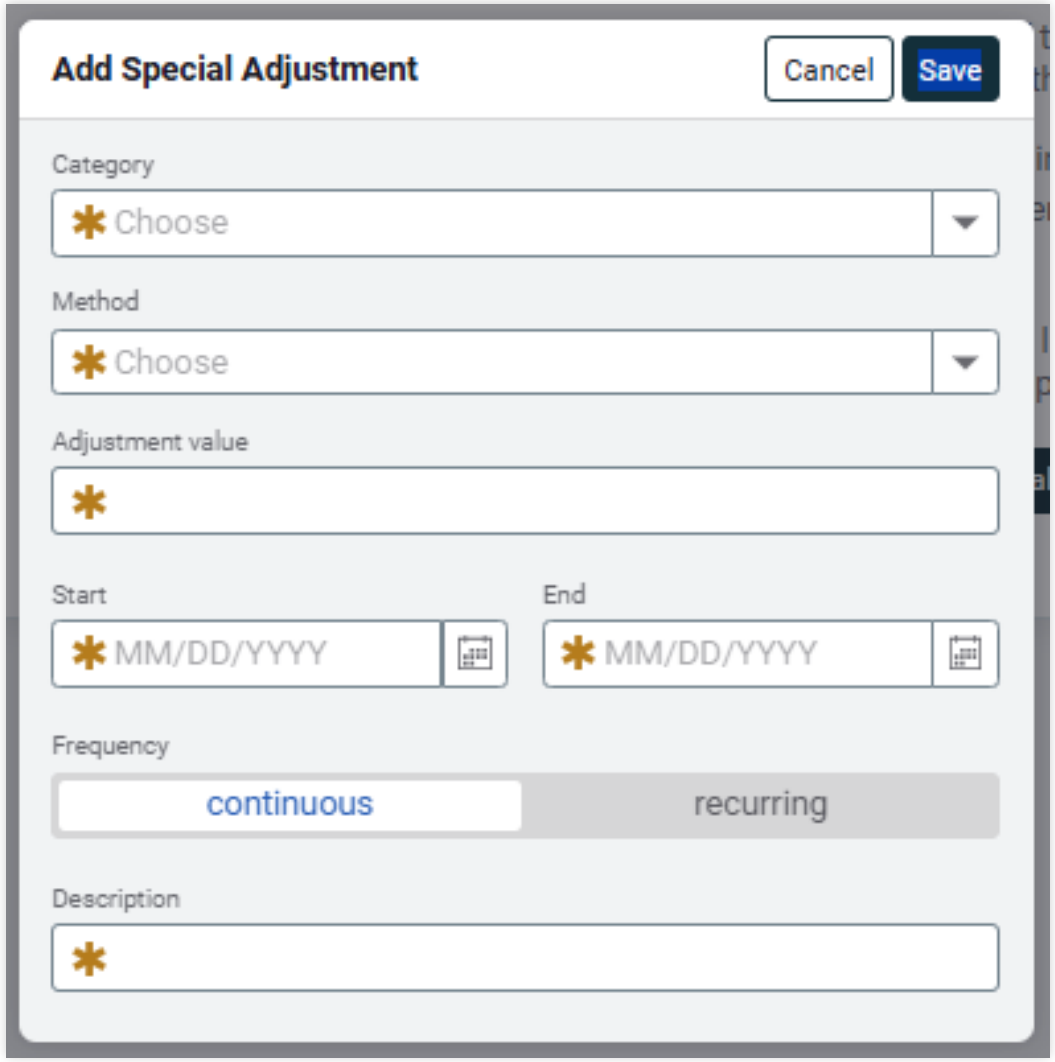
Lighting retrofit example

Scenario: An Energy Manager is actively making operational and efficiency changes to her organization. Her leadership team wants to understand the energy and financial impact for both objectives.

Retrofit details:

- Building = Discovery Drive
- Replacing HO T5 fluorescent lights (40 Watts) with LED tubes (15 Watts)
- 500 total fixtures with 4 bulbs per fixture = 2,000 total bulbs
- Measured/assumed operation = 10 hours/day
- Anticipated load change = (40 – 15) x 2,000 x 10 = 500,000 Watts * hr/day = **500 kWh/day**
- Financial impact = 500 kWh/day x 30 days x ($.15 AUC) = $2,250/month

EnergyCAP—expert-driven energy management



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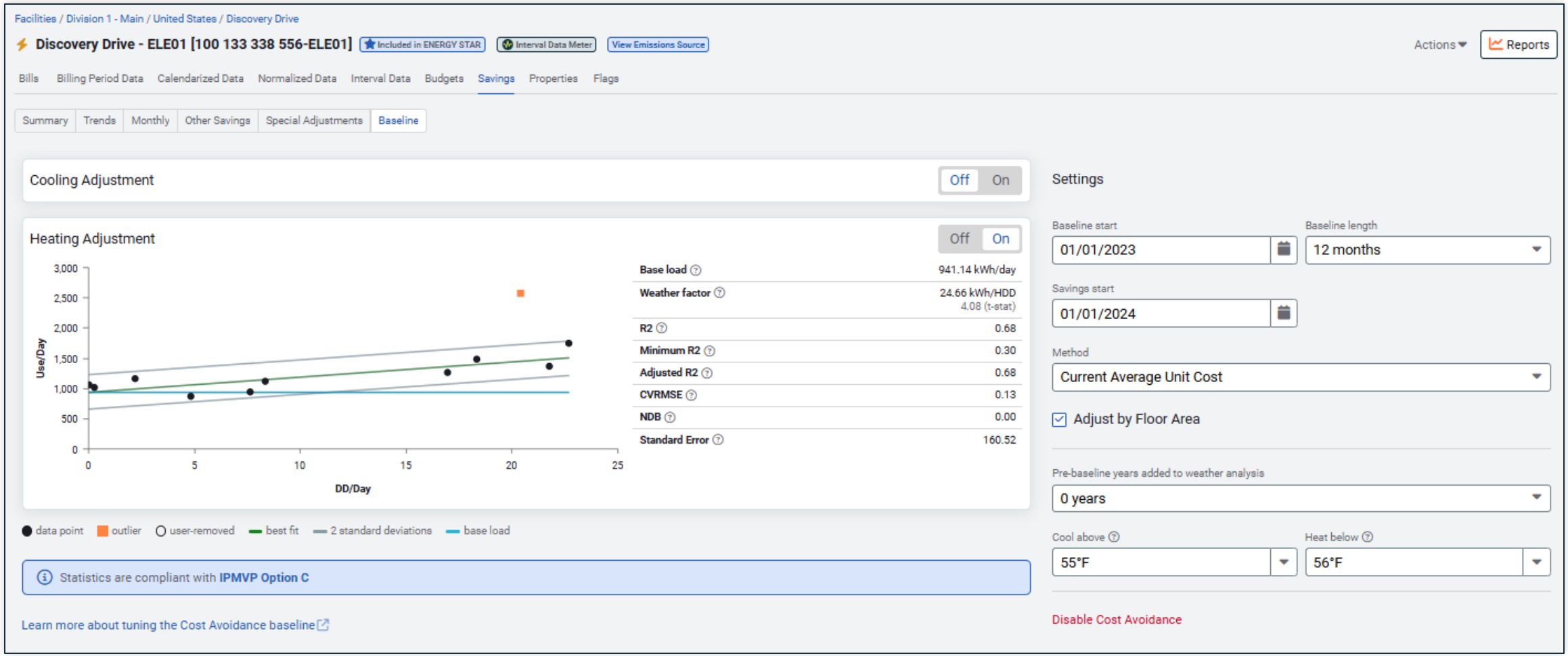


Cost avoidance

Reports

14 – Cost Avoidance

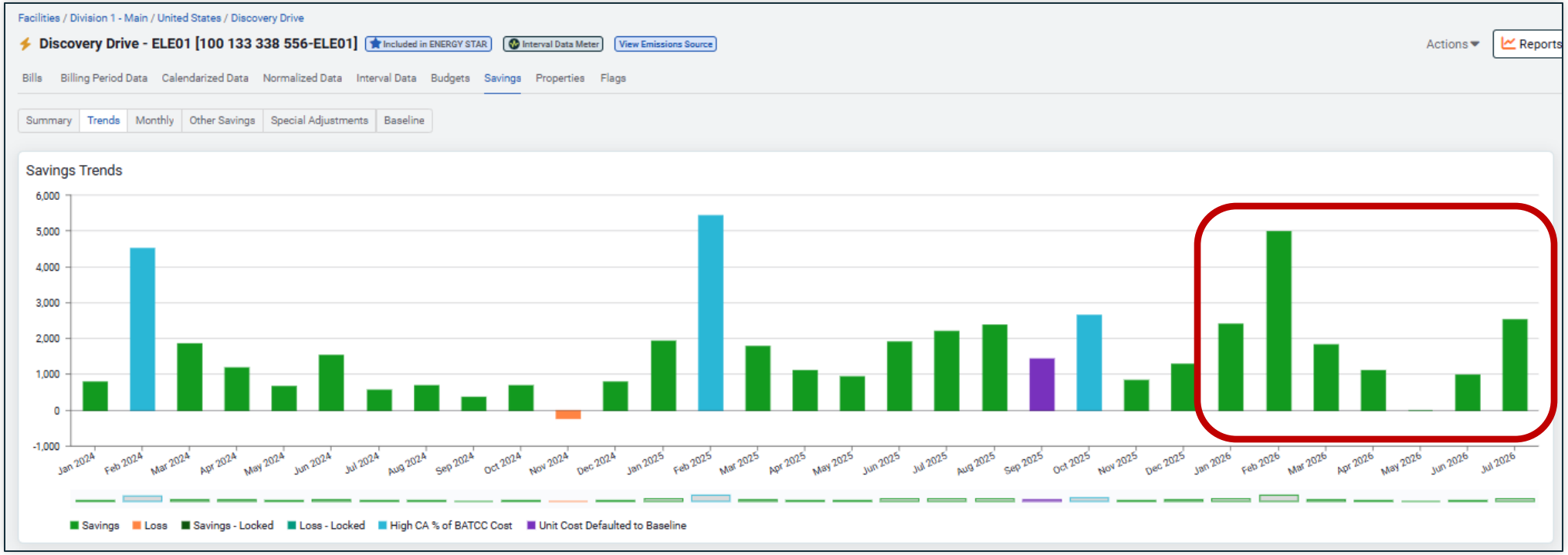
23 – Energy Conservation Program

24 – Cost Avoidance Summary

25 – Meter Special Adjustment List

28 – Baseline Report

EnergyCAP—expert-driven energy management



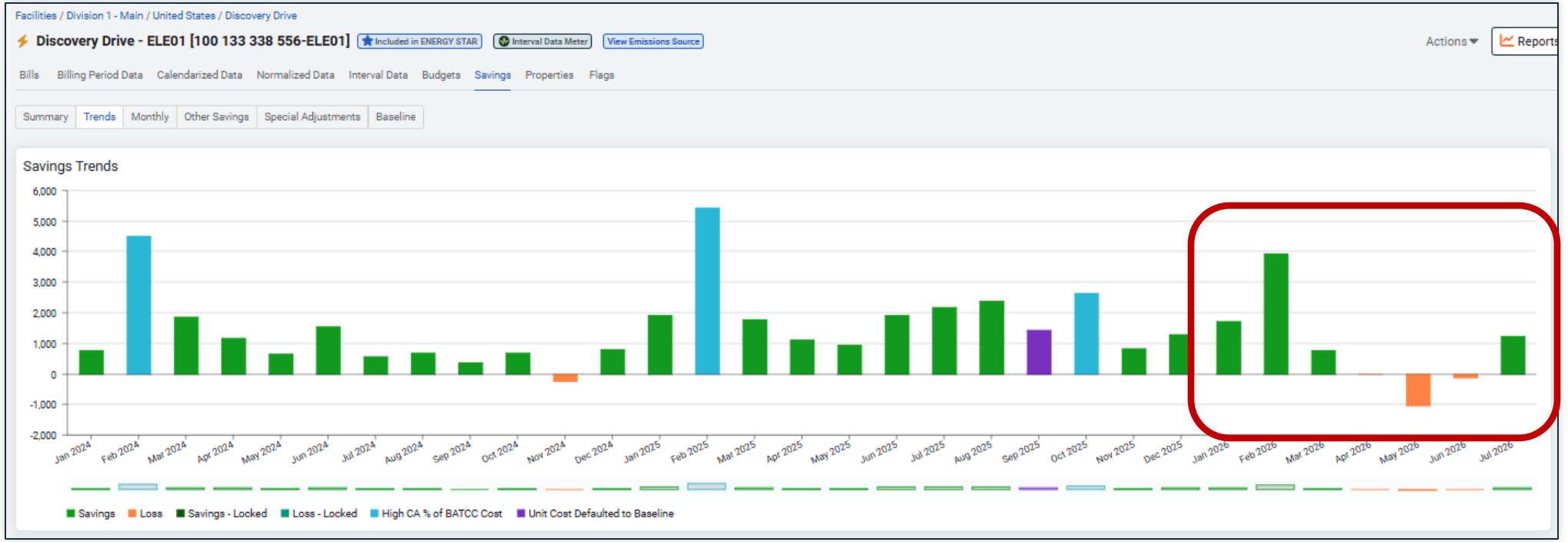
Happy Valley Demo

Report-24 - Cost Avoidance by Month

Energy Summary

	Use				Cost					
	BATCC	Actual	Avoid	Avoid %	BATCC	Actual	Avoid	Avoid %	Other Savings	Total Savings $
Electric (KWH)	1,229,884	861,042	368,842	30.0%	$157,292	$105,877	$51,414	32.7%	$0	$51,414
Total (MMBTU)	**4,196**	**2,938**	**1,258**	**30.0%**	**$157,292**	**$105,877**	**$51,414**	**32.7%**	**$0**	**$51,414**

EnergyCAP—expert-driven energy management



Happy Valley Demo

Report-24 - Cost Avoidance by Month

Energy Summary

	Use				Cost					
	BATCC	Actual	Avoid	Avoid %	BATCC	Actual	Avoid	Avoid %	Other Savings	Total Savings $
Electric (KWH)	1,179,884	861,042	318,842	27.0%	$149,887	$105,877	$44,009	29.4%	$0	$44,009
Total (MMBTU)	**4,026**	**2,938**	**1,088**	**27.0%**	**$149,887**	**$105,877**	**$44,009**	**29.4%**	**$0**	**$44,009**

EnergyCAP—expert-driven energy management

Category

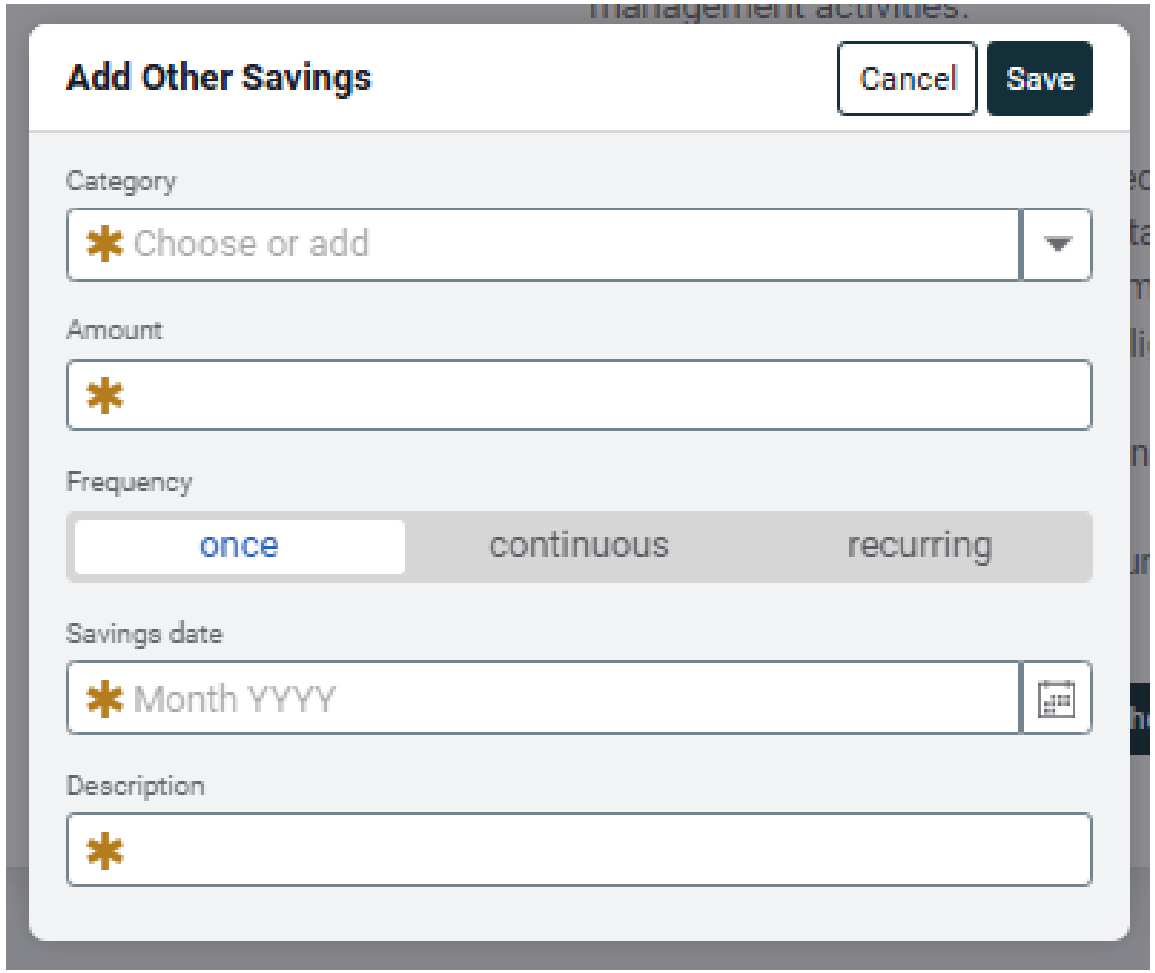
- Demand Response
- Meter Consolidation
- Other
- Rebate
- Refund
- Utility Rate Reduction

Amount

Frequency

Savings Date

Description



Before you get started

Bring all the stakeholders together to discuss

- Project objectives and costs
- Benefits – including non-energy benefits (NEBs)
- Principles of M&V
- M&V options
- Balance cost, accuracy, and risk
- Match rigor to the project complexity
- Align expectations early

Energy modeling tools

Free

- EnergyPlus
- OpenStudio
- Ladybug and Honeybee
- SAM (System Advisor Model)
- eQUEST

Questions