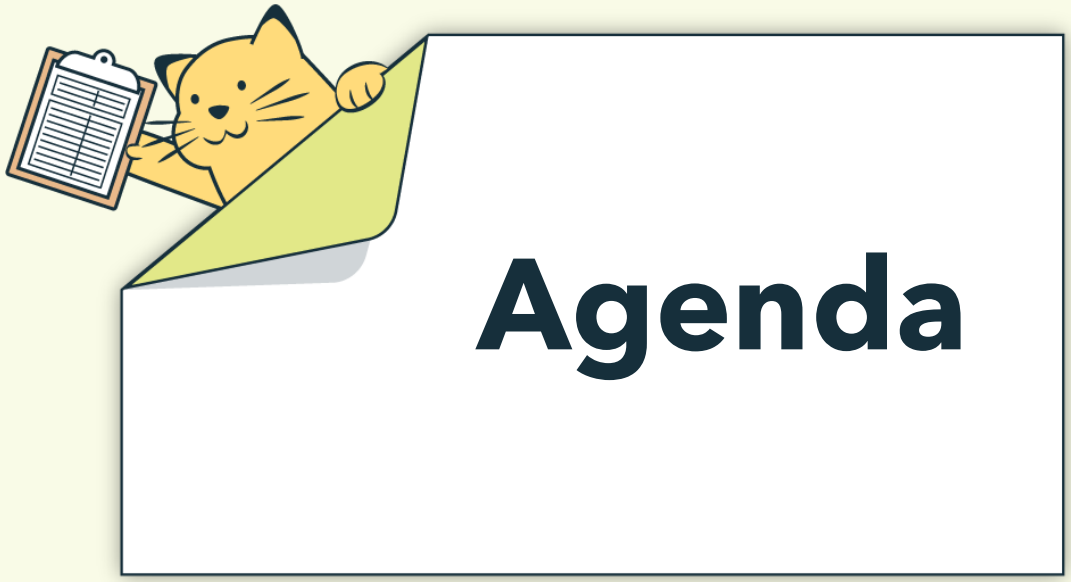
ENERGYCAP

Get the Most Out of Your Data

John Heinz // VP, Strategic Accounts



Agenda

- ✓ Bringing utility bills and real-time interval data together
- ✓ Add carbon to bill and interval data
- ✓ 5 steps to energy and carbon reduction

Value areas of both applications

EnergyCAP UtilityManagement

- Monthly and yearly
- Detailed bill analysis and bill workflow
- Portfolio-level and aggregate rollups, common and global UOM
- Looking at the rear view, take action to correct for the future
- Focus on reporting, quick summaries, getting answers quickly

EnergyCAP SmartAnalytics

- Minutely, hourly, daily, monthly, yearly
- Advanced views of interval and time series data
- Point and meter tracking, equipment or zone areas
- Actionable now so don’t have surprises in the future
- Focus on analytics, simulations, what ifs, verifying performance

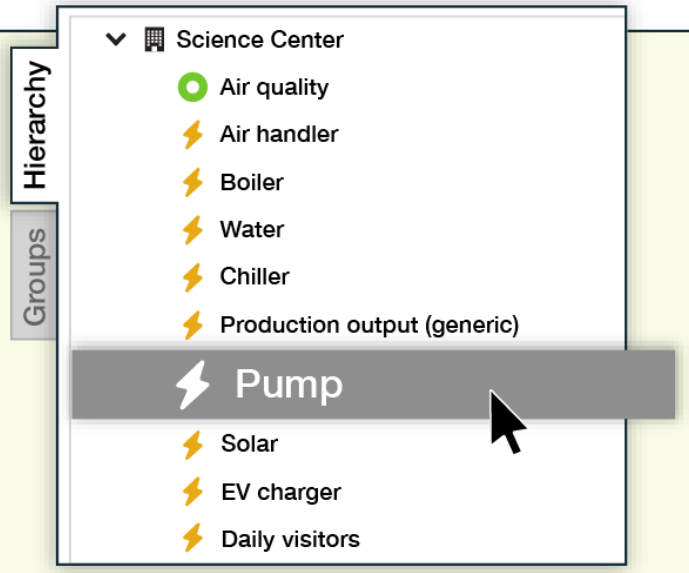
Might not be the same team members using each!

SmartAnalytics // Real-time energy and sustainability analytics

ENERGYCAP SmartAnalytics™

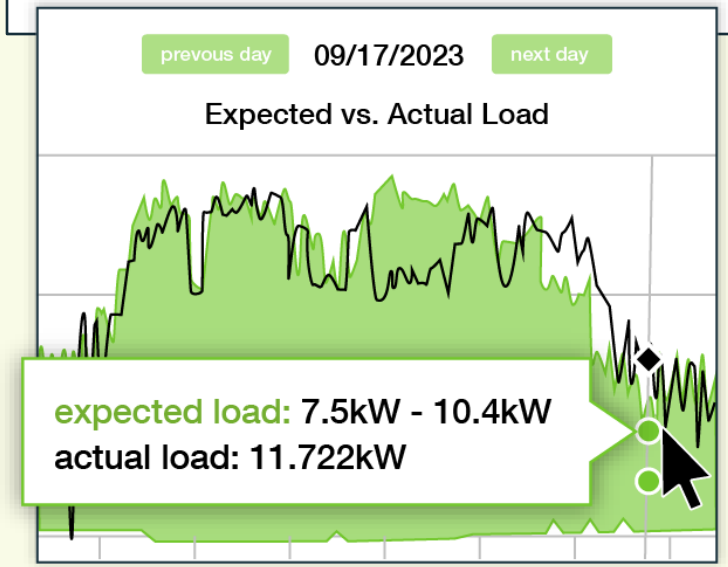
Capture

Capture real-time data from virtually any source and type of device.



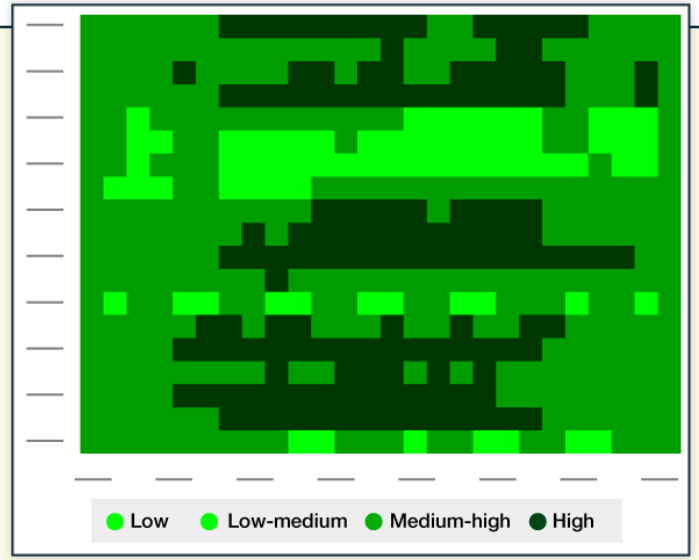
Monitor

Monitor data quality, detect outliers, and receive alerts and alarms.



Analyze

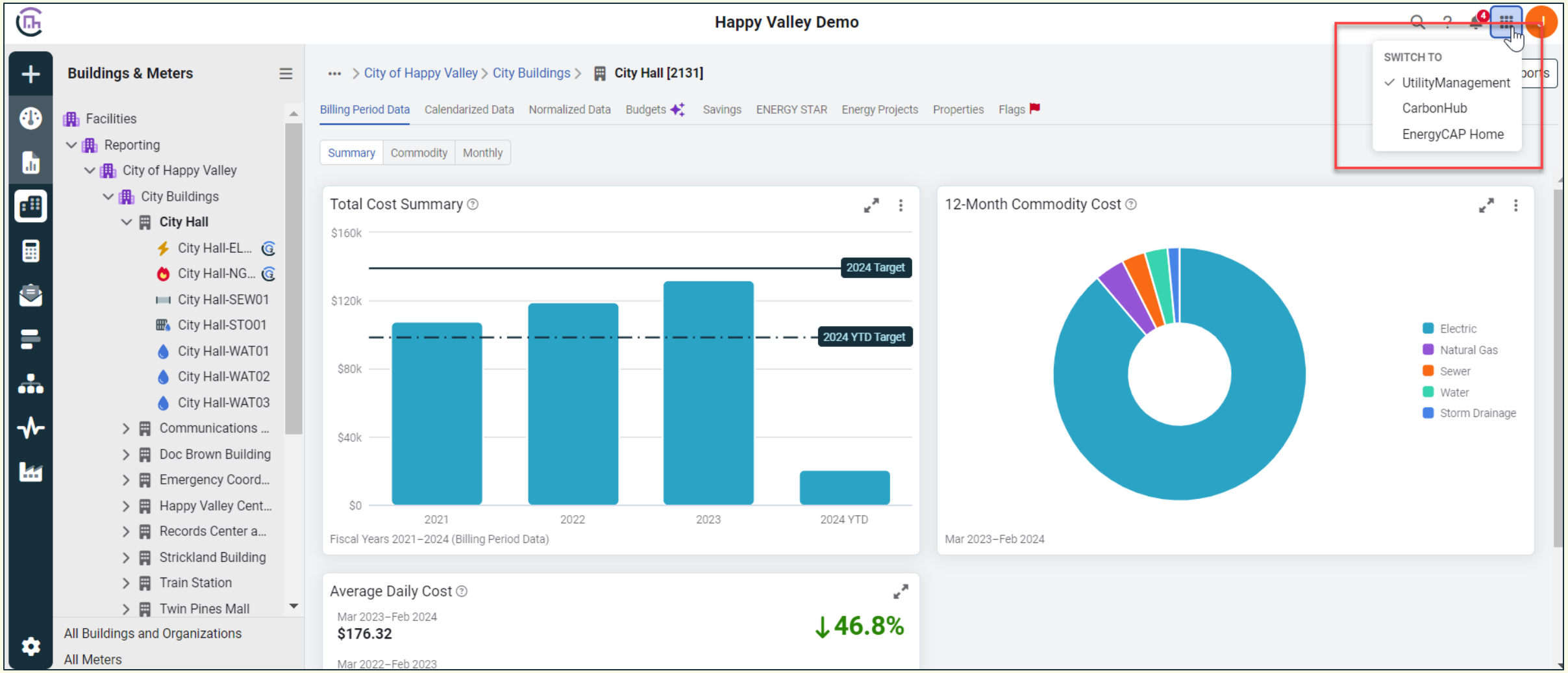
Access robust analysis and reporting functionality.



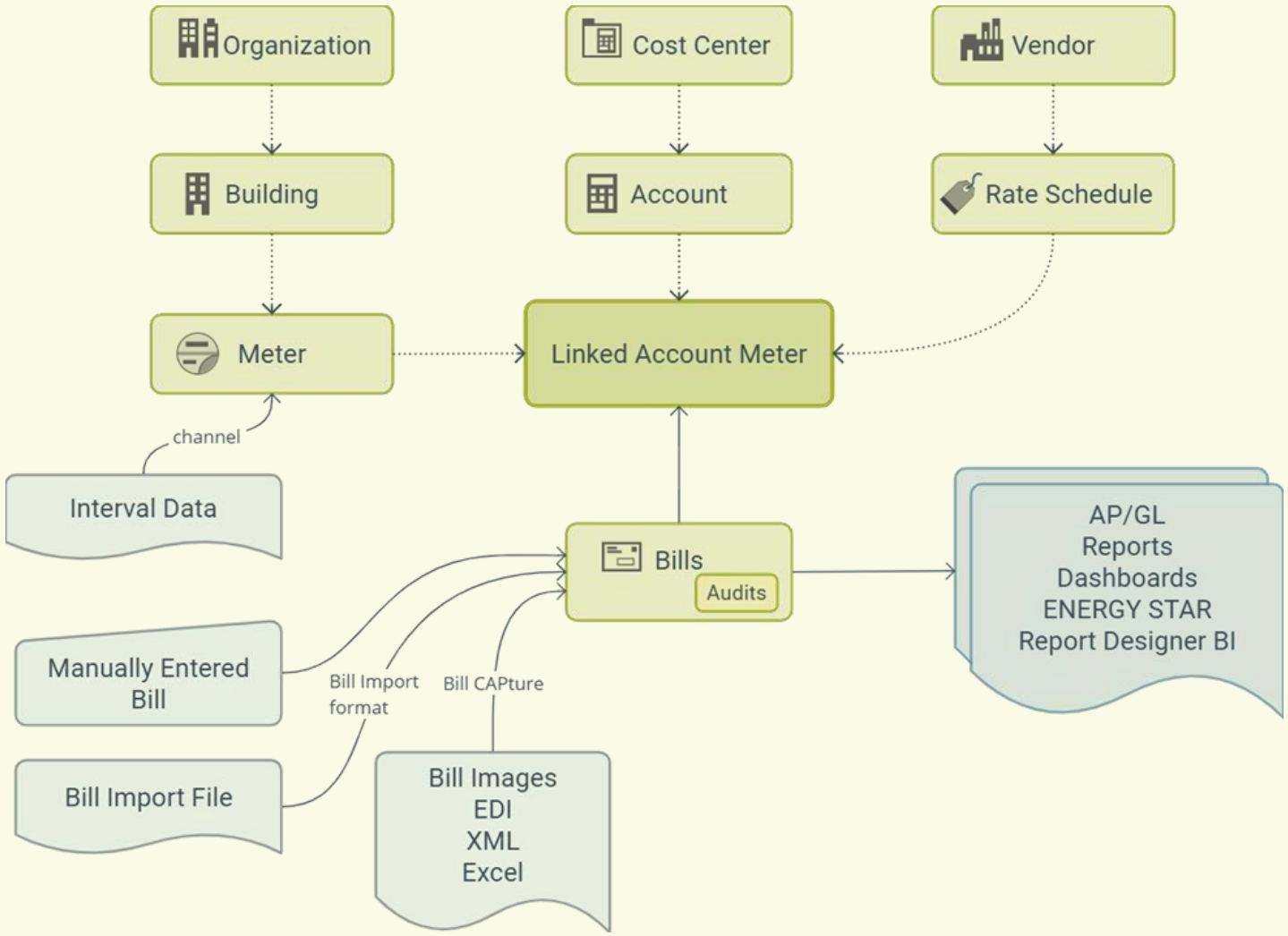
SmartAnalytics // Real-time energy and sustainability analytics

- API
- Data systems
- Files
- Gateways
- Meters
- Sensors
- Solar and PV
- Third-Party Integrations
- Utility Companies - UIDI

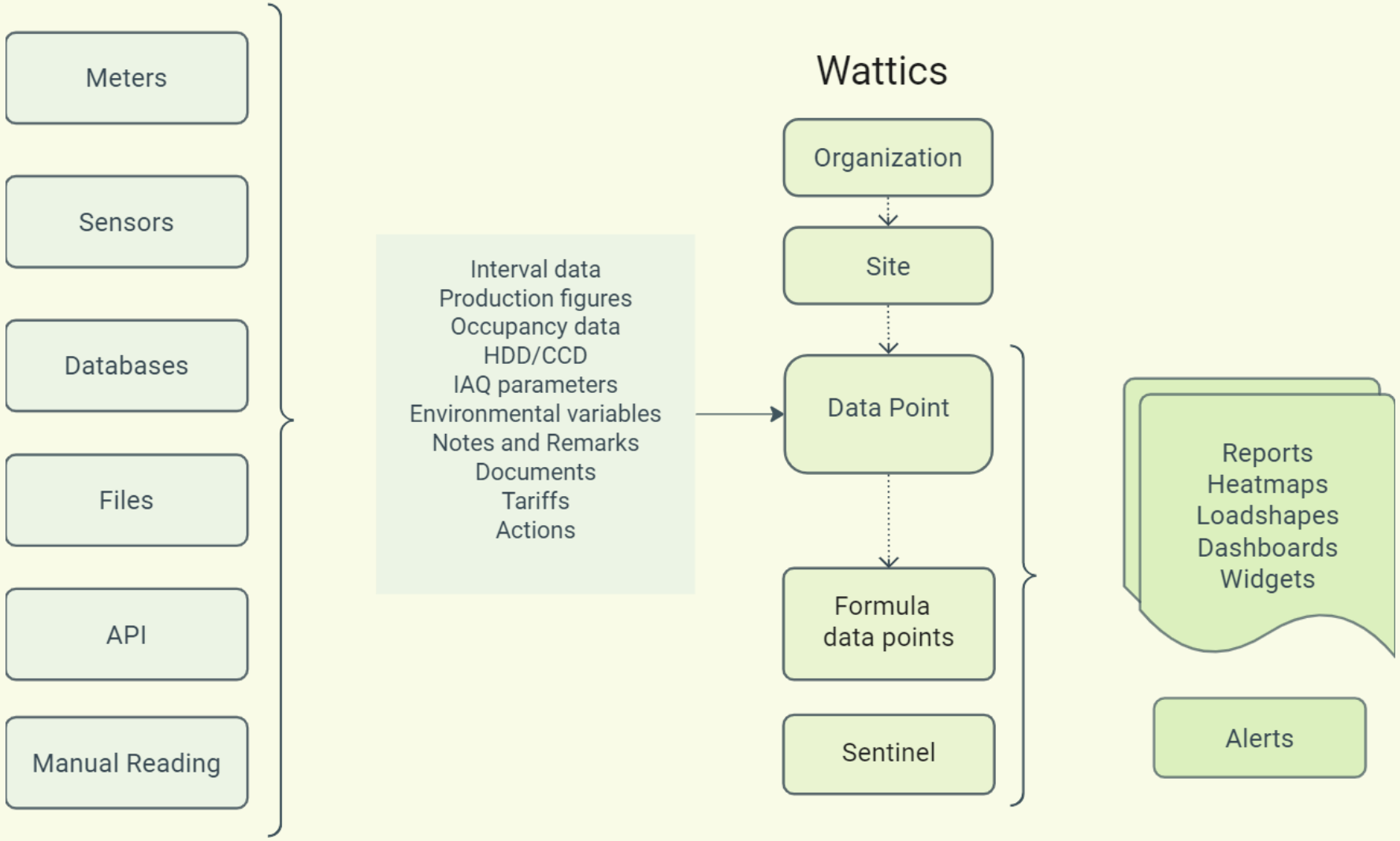
Single Login – Access All Applications



Data Elements // UtilityManagement

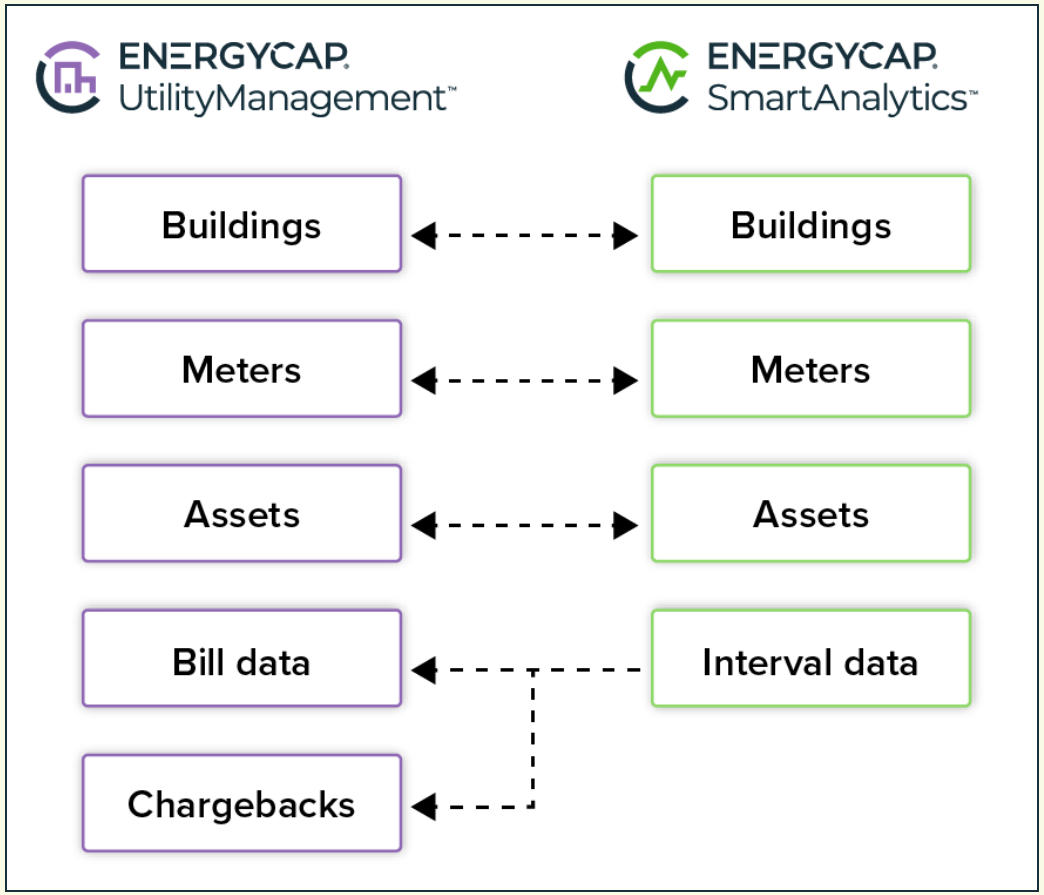


Data Elements // SmartAnalytics

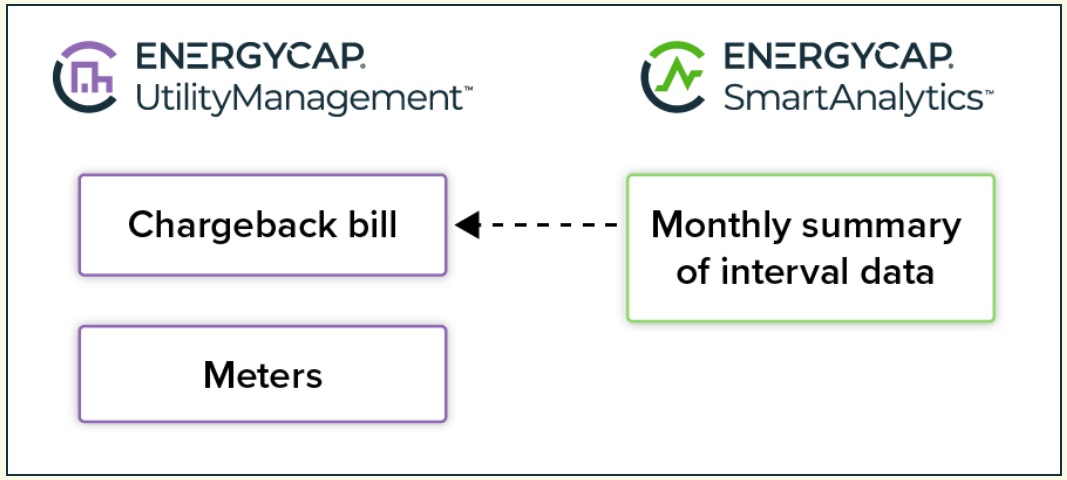


Share and Combine Objects

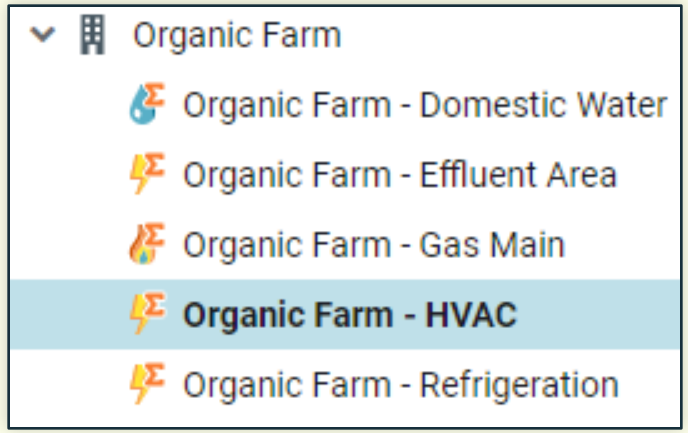
Share Buildings, Meters, Assets, and Interval Data

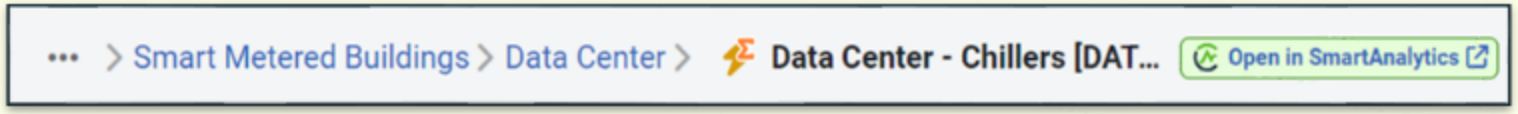


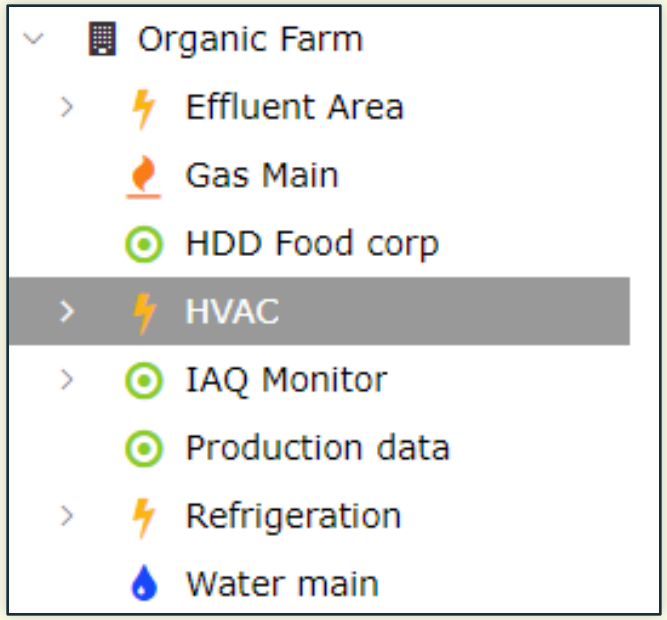
Create Monthly Bills from Interval Data

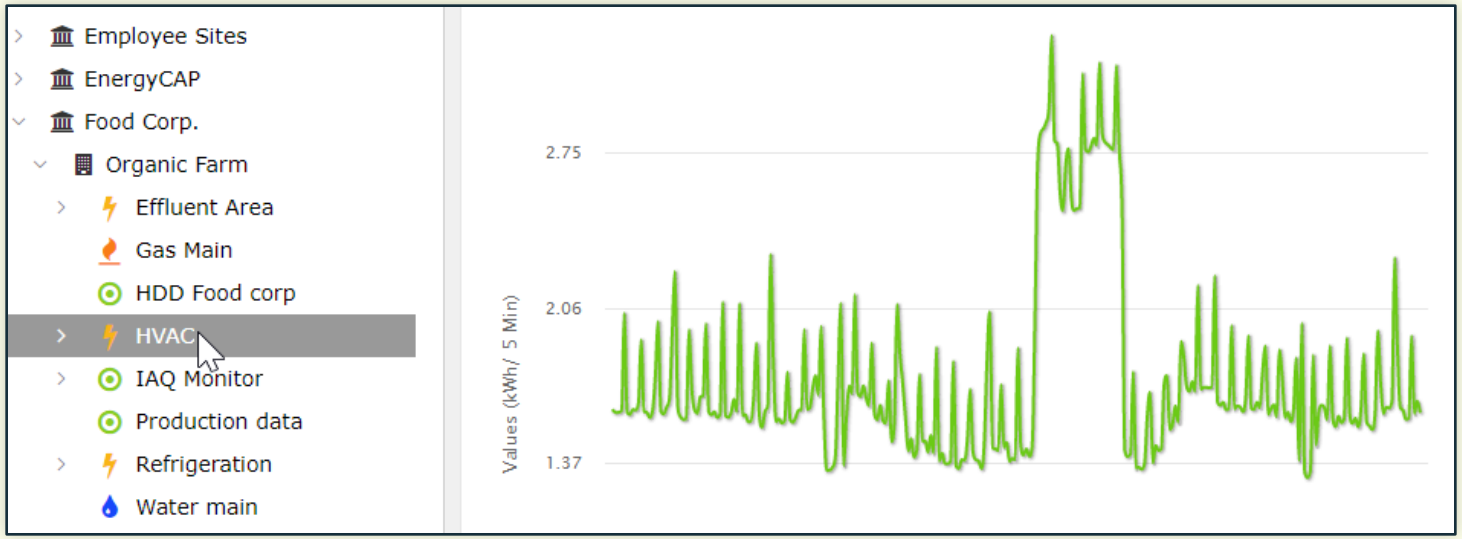


Link Meters to Share Data

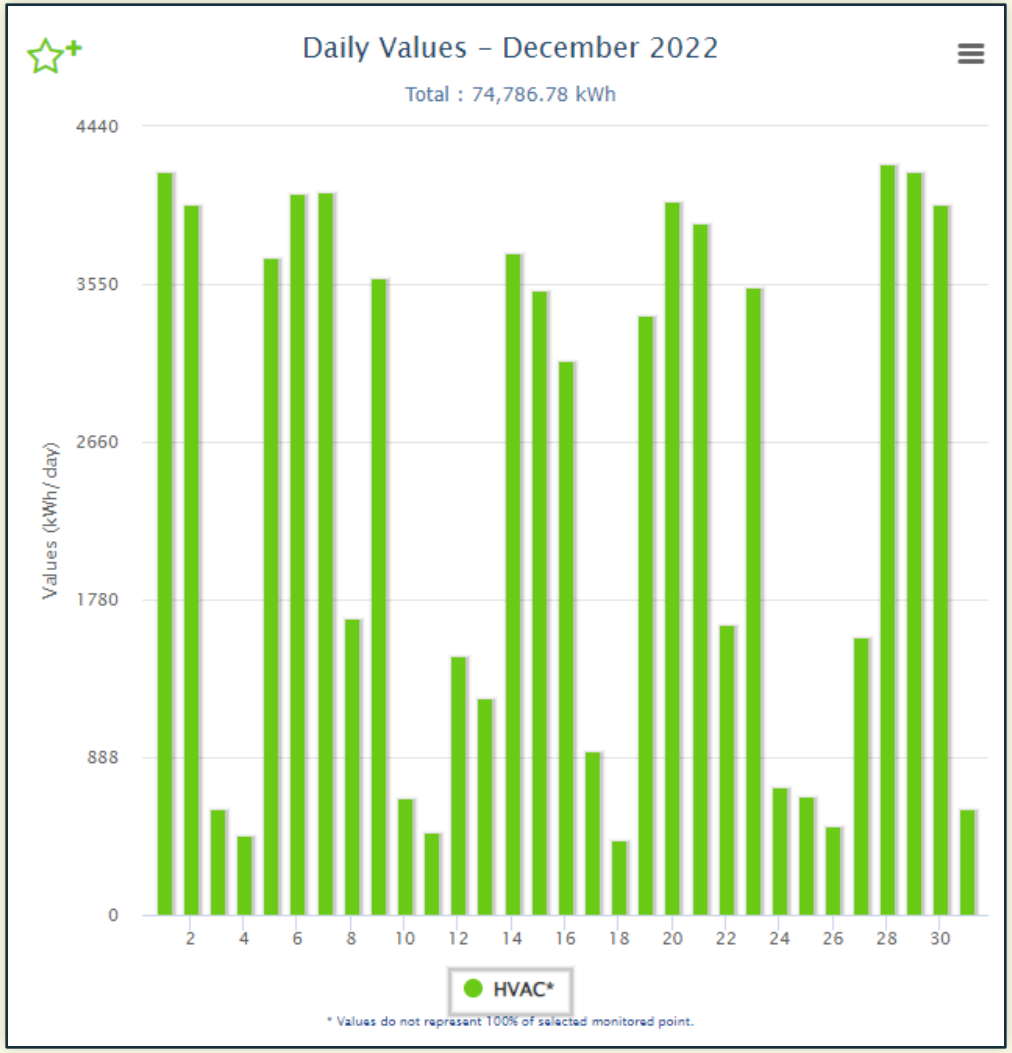


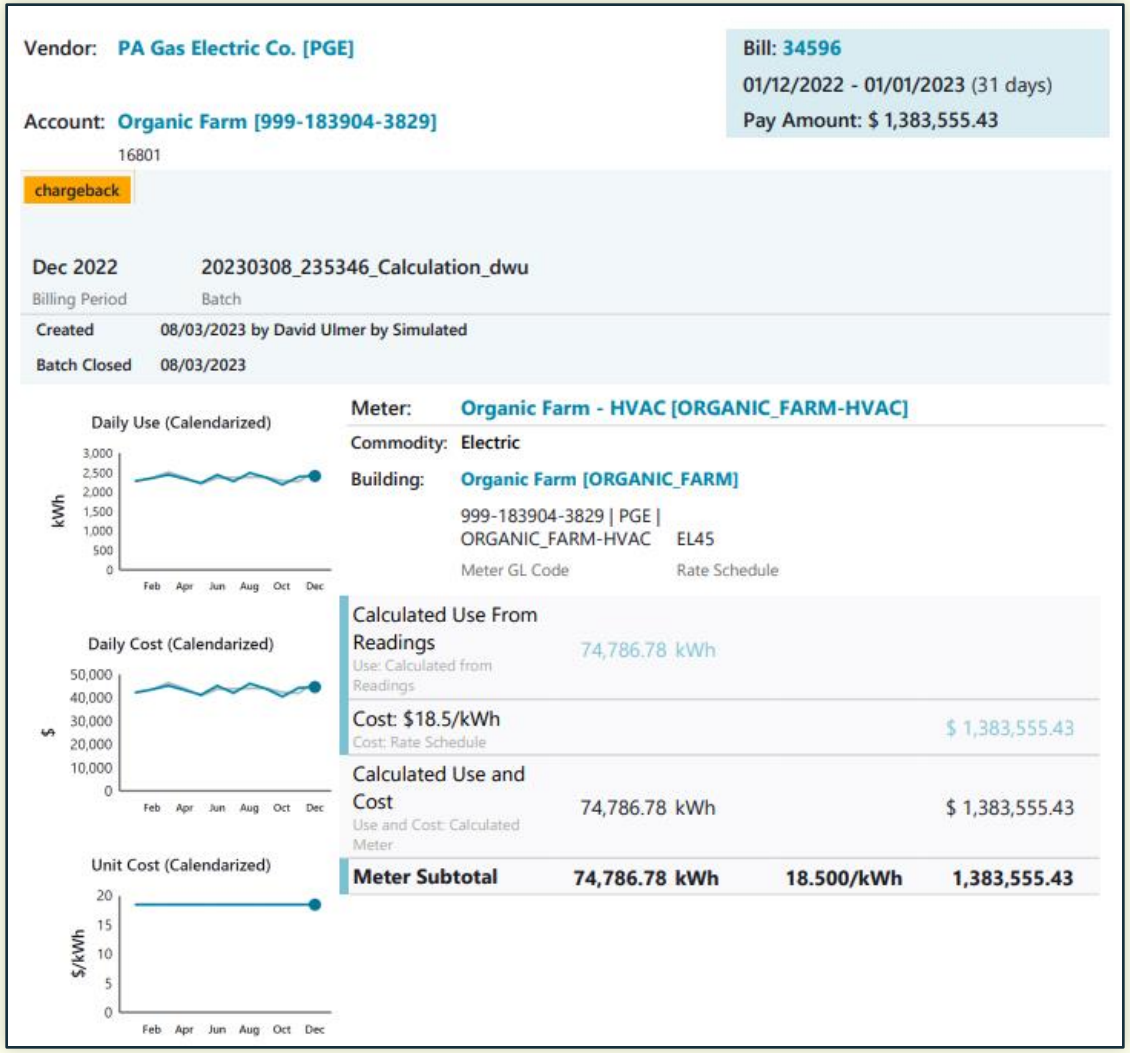






Convert Interval Data to Monthly Values





Bill Reconciliation // Billed vs Metered

Find variances of billed vs metered use and demand

Aurora Public Schools — Report-35 - Bill Use Reconciliation Report

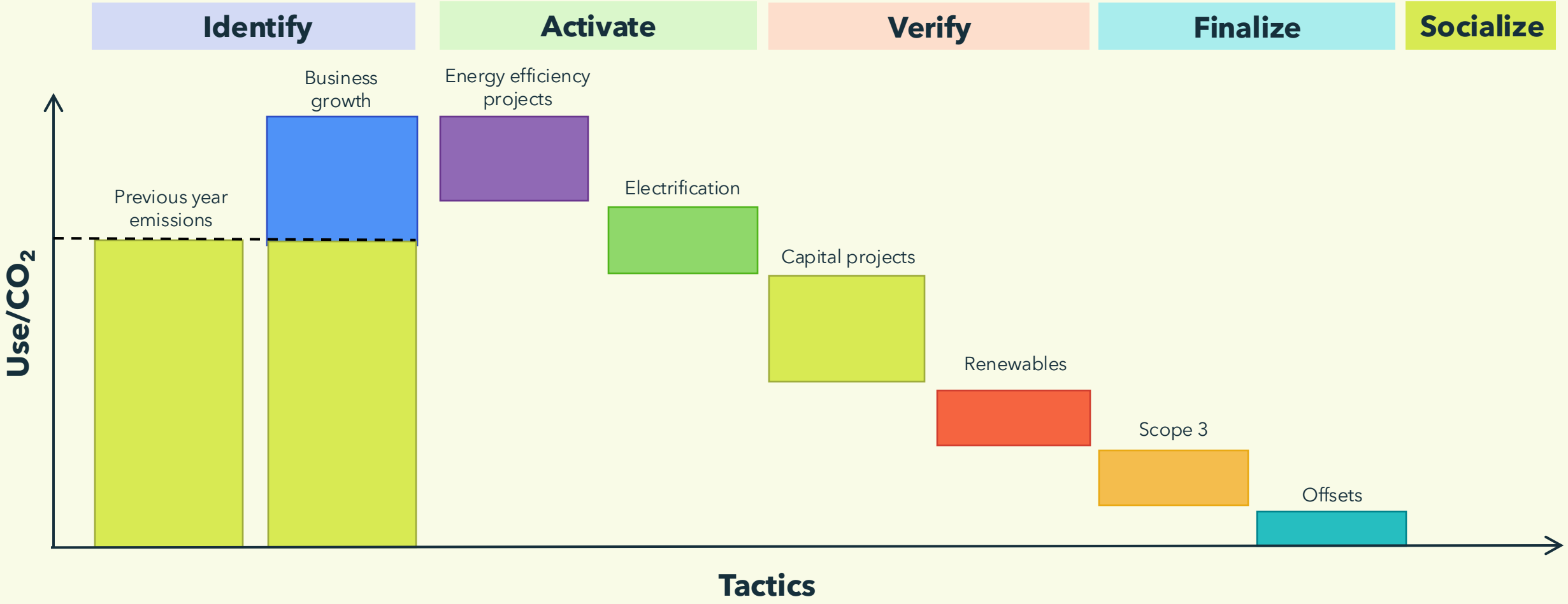
Electric

Meter Code	Place	Billing Period	Start Date	End Date	Billed Use	Metered Use	Unit	Variance	Variance %	Actual Demand on Bill	Billed Demand on Bill	Max Demand on Bill	Max Metered Demand	Unit	Variance	Variance %
300980468EL	Altura ES	201707	7/19/2017	8/17/2017	32,000.00	31,083.58	kWh	(916.42)	-2.86%	229.28	229.00	229.28	224.72	kW	(4.56)	-1.99%
300980468EL	Altura ES	201708	8/17/2017	9/18/2017	44,480.00	43,348.20	kWh	(1,131.80)	-2.54%	251.36	251.00	251.36	245.61	kW	(5.75)	-2.29%
300980468EL	Altura ES	201709	9/18/2017	10/17/2017	33,280.00	30,660.00	kWh	(2,620.00)	-7.87%	234.08	234.00	234.08	230.77	kW	(3.31)	-1.41%
300980468EL	Altura ES	201710	10/17/2017	11/15/2017	30,560.00	29,177.85	kWh	(1,382.15)	-4.52%	209.00	209.00	209.00	202.32	kW	(6.68)	-3.19%
300980468EL	Altura ES	201711	11/15/2017	12/18/2017	36,480.00	13,638.24	kWh	(22,841.76)	-62.61%	162.40	162.00	162.40	157.86	kW	(4.54)	-2.79%
300980468EL	Altura ES	201801	1/19/2018	2/20/2018	40,320.00	14,849.67	kWh	(25,470.33)	-63.17%	183.00	183.00	183.00	173.61	kW	(9.39)	-5.13%
300980468EL	Altura ES	201803	2/20/2018	3/21/2018	37,600.00	35,844.33	kWh	(1,755.67)	-4.67%	176.00	176.00	176.00	169.43	kW	(6.57)	-3.73%
300980468EL	Altura ES	201804	3/21/2018	4/19/2018	30,240.00	29,560.76	kWh	(679.24)	-2.25%	172.16	172.00	172.16	168.32	kW	(3.84)	-2.23%
300980468EL	Altura ES	201805	4/19/2018	5/18/2018	34,560.00	33,670.15	kWh	(889.85)	-2.57%	208.00	208.00	208.00	199.49	kW	(8.51)	-4.09%
300980468EL	Altura ES	201806	5/18/2018	6/19/2018	21,120.00	20,702.95	kWh	(417.05)	-1.97%	205.00	205.00	205.00	198.23	kW	(6.77)	-3.30%
300980468EL	Altura ES	201807	6/19/2018	7/19/2018	18,080.00	17,684.46	kWh	(395.54)	-2.19%	159.00	159.00	159.00	152.89	kW	(6.11)	-3.84%
300980468EL	Altura ES	201808	7/19/2018	8/17/2018	36,320.00	35,531.49	kWh	(788.51)	-2.17%	234.00	234.00	234.00	224.94	kW	(9.06)	-3.87%
300980468EL	Altura ES	201809	8/17/2018	9/18/2018	43,840.00	42,682.23	kWh	(1,157.77)	-2.64%	260.00	260.00	260.00	252.47	kW	(7.53)	-2.90%
300980468EL	Altura ES	201810	9/18/2018	10/17/2018	36,640.00	35,258.89	kWh	(1,381.11)	-3.77%	254.08	254.00	254.08	246.02	kW	(8.06)	-3.17%
300980468EL	Altura ES	201811	10/17/2018	11/15/2018	33,120.00	28,899.03	kWh	(4,220.97)	-12.74%	184.16	184.00	184.16	175.34	kW	(8.82)	-4.79%
300980468EL	Altura ES	201812	11/15/2018	12/18/2018	42,240.00	40,322.30	kWh	(1,917.70)	-4.54%	172.32	172.00	172.32	168.08	kW	(4.24)	-2.46%
300980468EL	Altura ES	201901	12/18/2018	1/21/2019	39,840.00	39,315.45	kWh	(524.55)	-1.32%	164.48	164.00	164.48	163.47	kW	(1.01)	-0.62%
300980468EL	Altura ES	201902	1/21/2019	2/20/2019	39,360.00	39,075.85	kWh	(284.15)	-0.72%	174.00	174.00	174.00	172.18	kW	(1.82)	-1.05%
300980468EL	Altura ES	201903	2/20/2019	3/21/2019	38,080.00	37,519.37	kWh	(560.63)	-1.47%	180.00	180.00	180.00	176.04	kW	(3.96)	-2.20%
300980468EL	Altura ES	201904	3/21/2019	4/19/2019	28,640.00	28,399.36	kWh	(240.64)	-0.84%	182.24	182.00	182.24	177.76	kW	(4.48)	-2.46%
300980468EL	Altura ES	201905	4/19/2019	5/20/2019	33,760.00	33,441.48	kWh	(318.52)	-0.94%	195.20	195.00	195.20	193.09	kW	(2.11)	-1.08%
300980468EL	Altura ES	201906	5/20/2019	6/19/2019	16,160.00	15,929.72	kWh	(230.28)	-1.43%	136.16	136.00	136.16	138.42	kW	2.26	1.66%
300980468EL	Altura ES	201907	6/19/2019	7/19/2019	14,720.00	14,483.25	kWh	(236.75)	-1.61%	197.12	197.00	197.12	186.85	kW	(10.27)	-5.21%

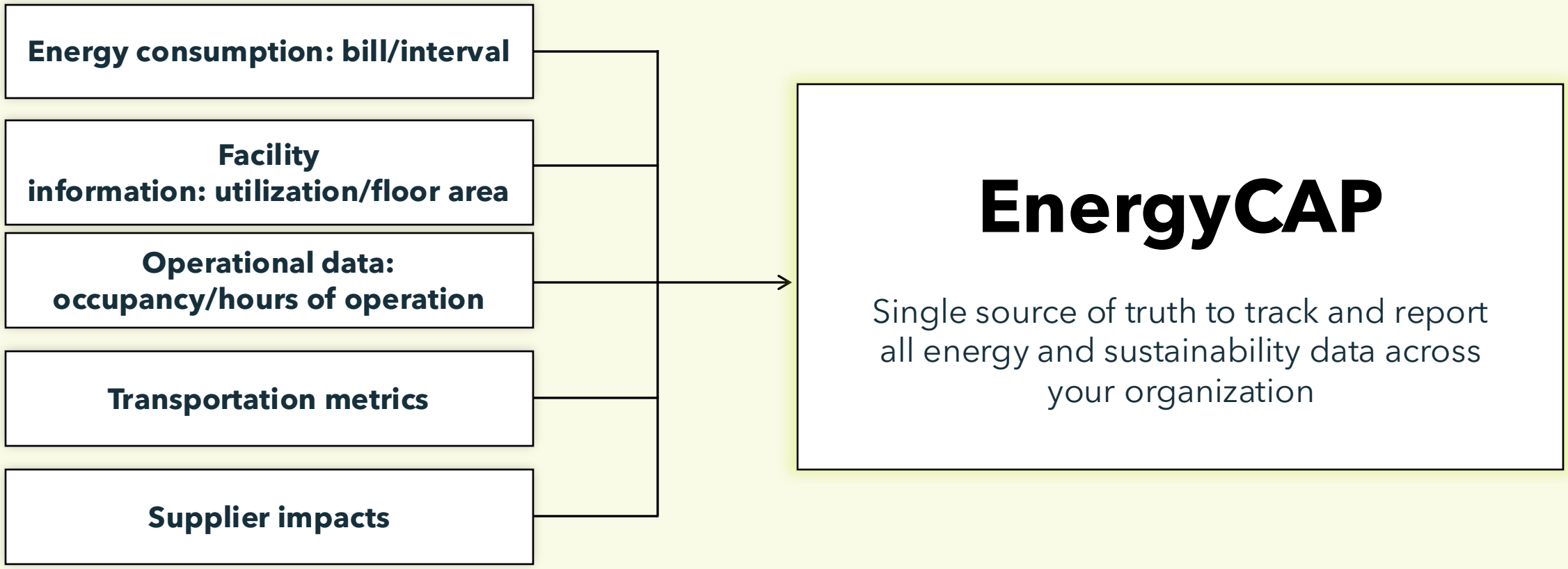
Using data to your advantage

5 Steps to Energy and Carbon Reduction Using Data

There are a multitude of tactics to decarbonize and reduce use & cost in your operations. Order matters...

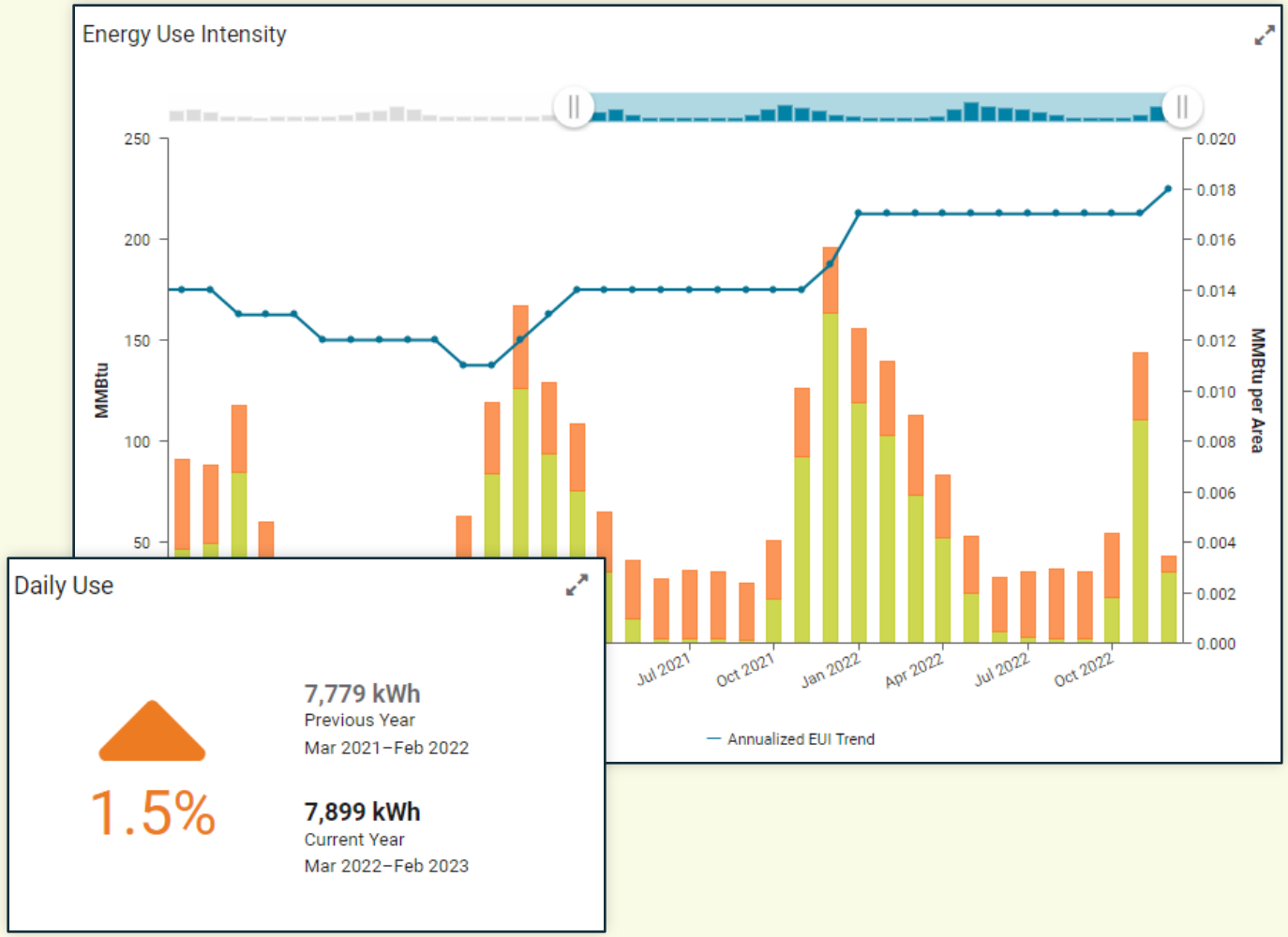


Data is foundational



Identify buildings needing special attention

- Establish KPIs and Metrics
- Analyze to find outliers and targets for savings
- Increases in EUI which considers weather
- Consumption spikes
- Increases in costs
- Higher demand



Identify using benchmarking

Building Name	Building Code	Calendarized Total Emissions ($t CO_2e$)	Aug 2022 - Jul 2023	Aug 2023 - Jul 2024	% Difference
Highland Creek Treatment Plant	005649-P01		17,114	14,409	-15.8 %
Main Treatment Plant	001052-P01		16,006	15,926	-0.5 %
Humber Treatment Plant	000579-P01		6,524	4,075	-37.5 %
Toronto-York Spadina Subway	005388-P01		6,455	5,207	-19.3 %
Malvern Garage & Shop	005354-B01		5,230	4,627	-11.5 %
Mt. Dennis Bus Garage	006204-B05		4,074	3,906	-4.1 %
Hillcrest, Gunn, Bathurst Garage	005088-P01		4,058	4,985	22.8 %
Union Station	001007-B01		3,717	3,976	6.9 %
Zoo Main Meter	000576-P02		3,568	3,097	-13.2 %
Bermondsey Yard CNG	OEYCNG		3,176	3,448	8.6 %
Ellesmere Yard CNG	EYCNG		3,040	3,036	-0.1 %
Old City Hall	004094-B01		2,907	1,396	-52.0 %
Oakvale Substation	001815-P01		2,872	3,001	4.5 %
Birchmount Bus Garage	005828-B01		2,504	7,199	187.6 %
700 Arrow Rd	005400-P01		2,464	2,292	-7.0 %
McNicoll Bus Garage	MBG		2,319	1,818	-21.6 %
Metro Hall	005181-B02		2,309	2,345	1.6 %
City Hall	000541-B04		2,230	2,107	-5.6 %
R.L. Clark Water Treatment Plant	005630-P01		2,189	2,341	6.9 %
F.J. Horgan Water Treatment Plant	005315-P01		2,055	1,971	-4.1 %
John Street Pumping Station	004084-B01		1,965	1,508	-23.3 %
Queensway Garage & Shop	005853-B01		1,964	2,593	32.0 %

Three ways to benchmark:

1. Against itself monthly or yearly. Important to calendarize and normalize.
2. Against peers within portfolio.
3. Against industry standards like ENERGY STAR, CBECS, and other benchmarking standards.

Identify

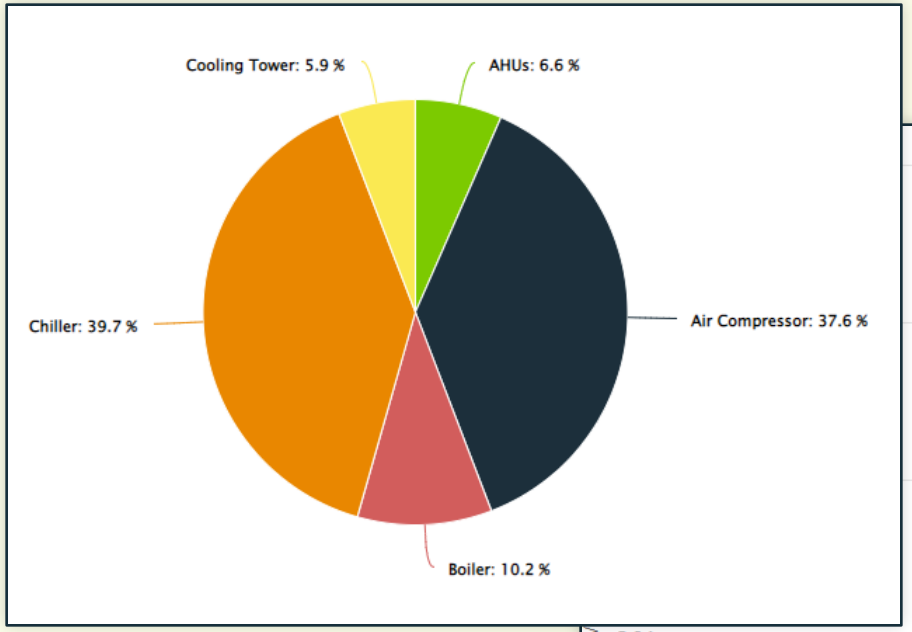
Interval data provides deeper insights

- Go deeper than monthly snapshots
- Heatmaps to see usage patterns and trends
- Identify times when usage seems to be problematic, or schedules aren't being followed
- Understand intensive periods and how that impacts your utility bill based on time of use rates

Identify

Isolate to understand use and carbon drivers

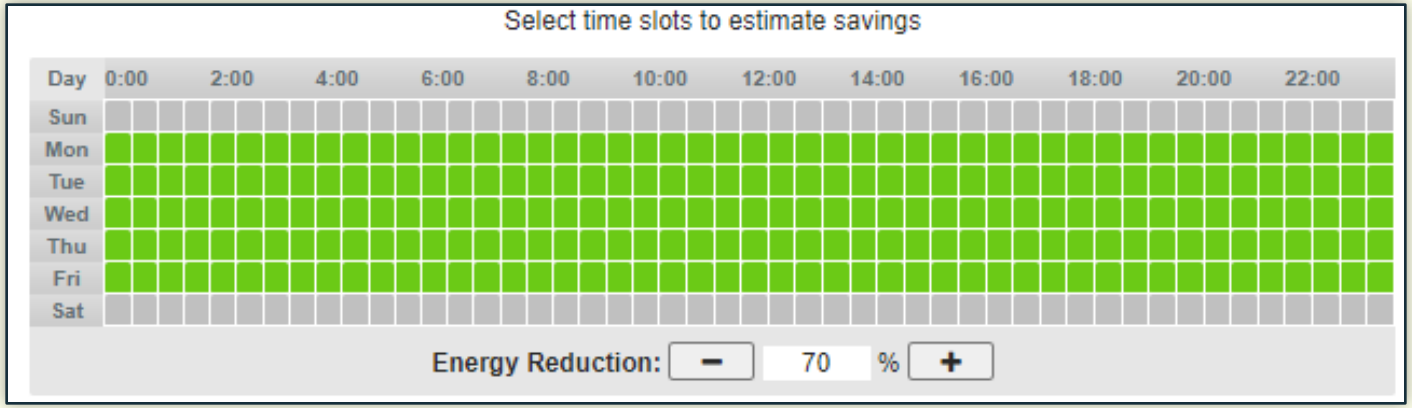
- Determine what zone, equipment, time of day, day of week is causing the spikes
- Depends on level of metering
- Overlay multiple points to compare, helpful when monitoring equipment (HVAC, Chillers, Refrigeration, etc.)

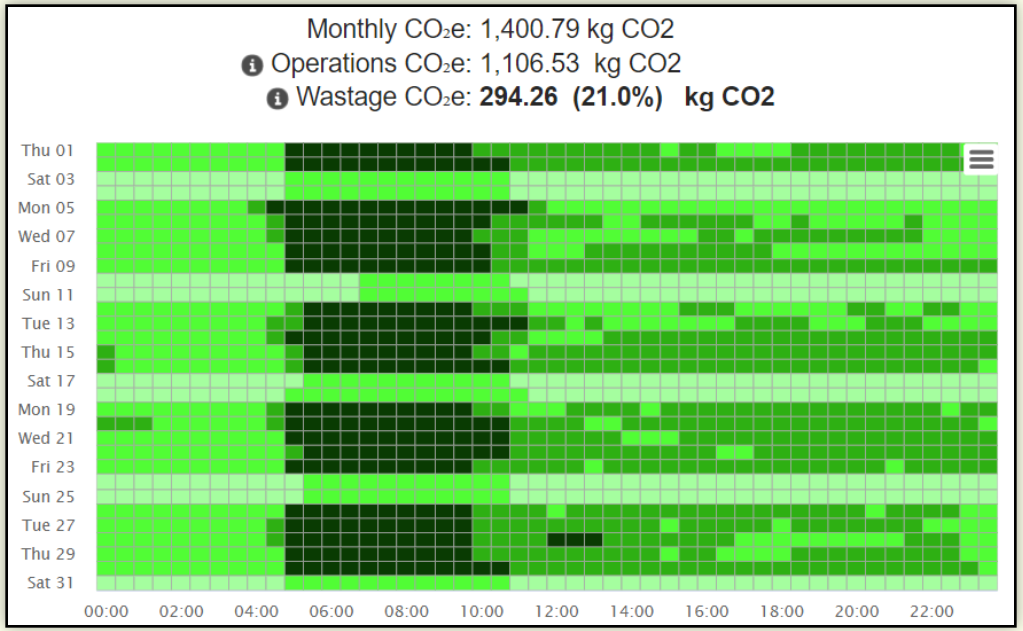


Activate

Activate by planning initiatives to drive savings

- Perform schedule optimization to target reduction strategies and most effective time periods

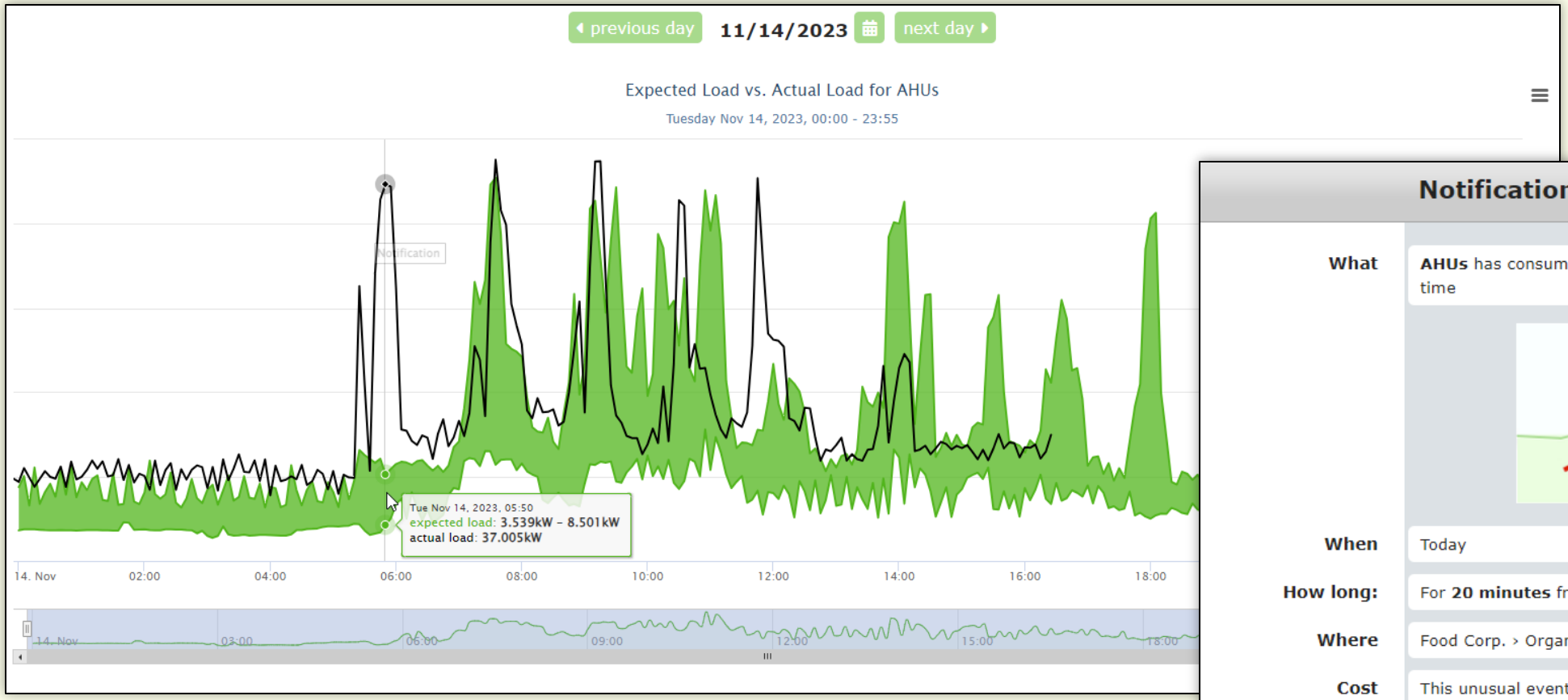




- Heatmaps to simulate and visualize time periods of intensive usage/emissions and what the new schedule would look like
- Calculate projected use, cost, and carbon savings by making reduction changes

Activate

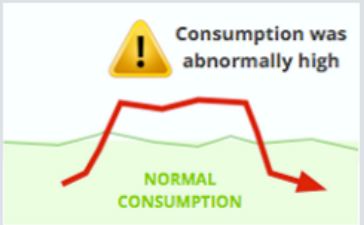
Machine learning and AI to predict behavior



Notification details

What

AHUs has consumed **270%** more than usual at this time



When Today

How long: For **20 minutes** from **05:40** to **06:00**

Where Food Corp. › Organic Farm › HVAC

Cost This unusual event has cost you about €3.34

Overall trend Consumption is greater than usual **until 06:00**

Activate

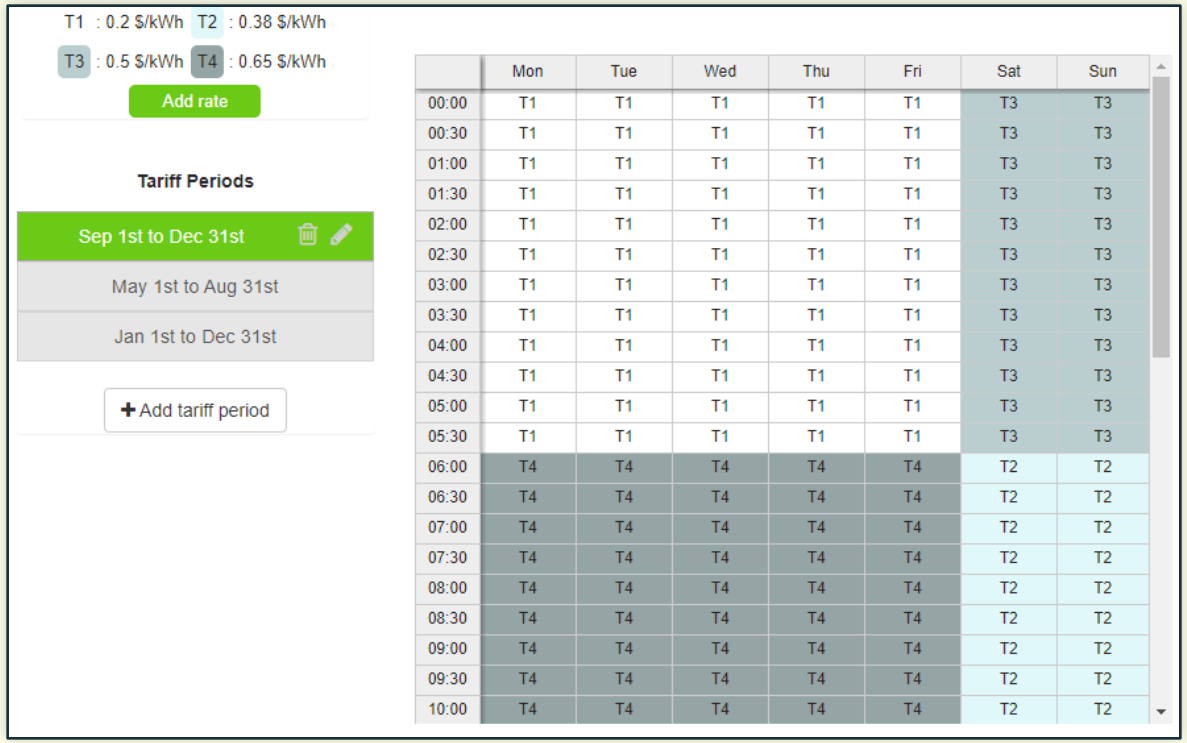
Demand management

- Limiting demand can be greatest potential for savings opportunities on bills
- Some rates use highest demand for any point during a timeframe
- Limiting demand spikes make for more predictable and lower cost bills
- Setup alarms to monitor peak periods

Activate

Build tariffs and run “what if” scenarios

- Time of use charges
- Seasonal rate structures
- Better visibility into times of day causing cost spikes



	Mon	Tue	Wed	Thu	Fri	Sat	Sun
00:00	T1	T1	T1	T1	T1	T3	T3
00:30	T1	T1	T1	T1	T1	T3	T3
01:00	T1	T1	T1	T1	T1	T3	T3
01:30	T1	T1	T1	T1	T1	T3	T3
02:00	T1	T1	T1	T1	T1	T3	T3
02:30	T1	T1	T1	T1	T1	T3	T3
03:00	T1	T1	T1	T1	T1	T3	T3
03:30	T1	T1	T1	T1	T1	T3	T3
04:00	T1	T1	T1	T1	T1	T3	T3
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05:00	T1	T1	T1	T1	T1	T3	T3
05:30	T1	T1	T1	T1	T1	T3	T3
06:00	T4	T4	T4	T4	T4	T2	T2
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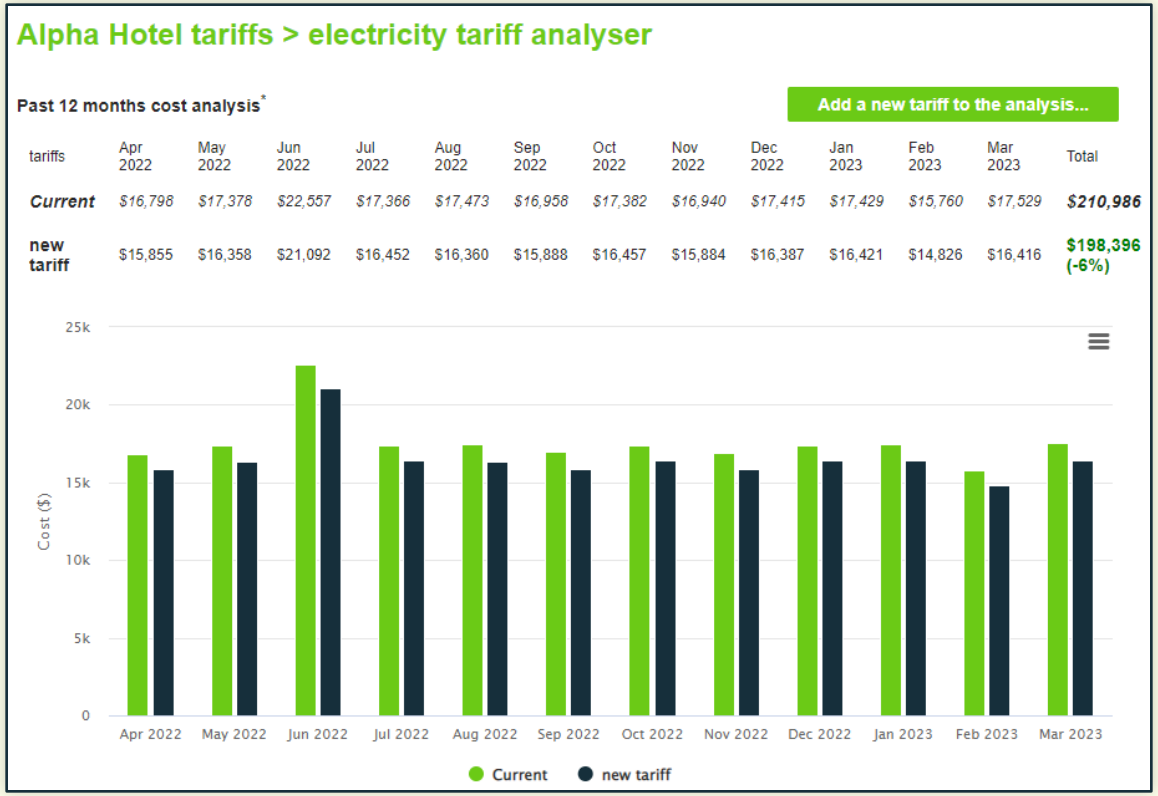
07:00	T4	T4	T4	T4	T4	T2	T2
07:30	T4	T4	T4	T4	T4	T2	T2
08:00	T4	T4	T4	T4	T4	T2	T2
08:30	T4	T4	T4	T4	T4	T2	T2
09:00	T4	T4	T4	T4	T4	T2	T2
09:30	T4	T4	T4	T4	T4	T2	T2
10:00	T4	T4	T4	T4	T4	T2	T2



Activate

Create project plans

Zero-Cost Energy/Carbon Conservation Opportunities

- System schedules
- Turn off lights
- Turn off computers and monitors
- Seasonal water temperature adjustments
- Economizers
- Take advantage of natural light

Low-Cost Energy/Carbon Conservation Opportunities

- Programmable thermostats
- Repair broken valves
- Occupancy sensors for lighting, HVAC
- Reduce lamps in over-lighted areas
- Use rebated programs for lighting upgrades
- Calibrate sensors

High-Cost Energy/Carbon Conservation Opportunities

- Construction
- Asset upgrades
- Energy transition
- District energy
- Electrification of fleet vehicles

Verify

ISO 50001

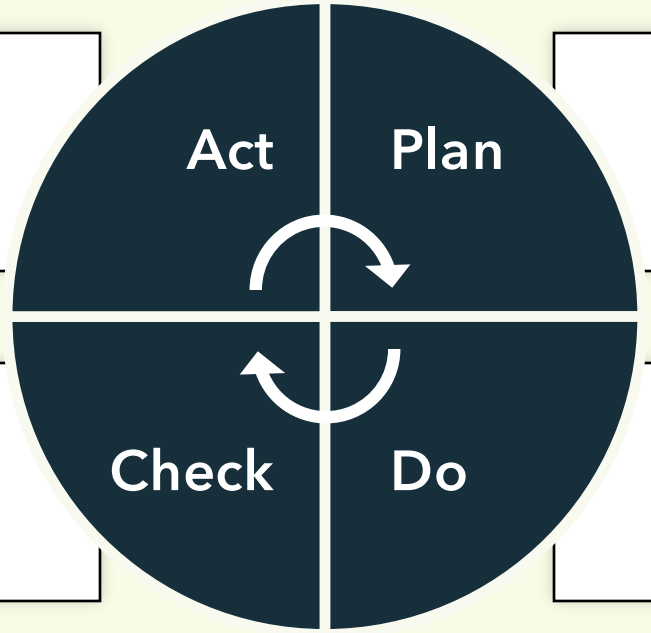
ISO 50001 creates a broad framework for an organization to implement an energy reduction program using the ISO PDCA continuous improvement process.

Plan: Identify aspects and impacts by implementing goals and objectives

Do: Implement; including training and operational control measures.

Check: Assess the measurements and report results to decision makers.

Act: Decide on changes needed to improve process.



Verify

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

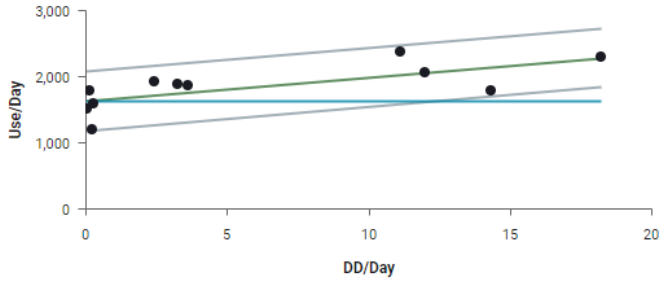
OPTION D
Calibrated Simulation

Verify

Option C // Use monthly data, account for weather

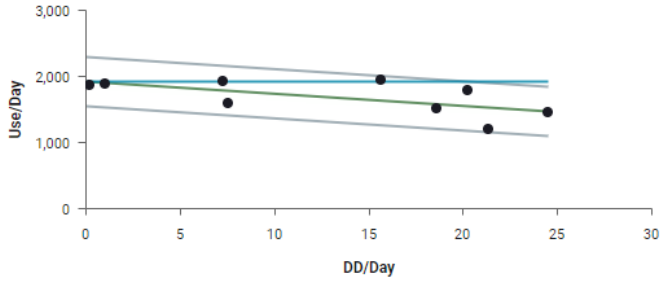
Electricity

Cooling Adjustment — Off / On



Base load	1,623.21 kWh/day
Weather factor	36.26 kWh/CDD 3.07 (t-stat)
R2	0.51
Minimum R2	0.27
Adjusted R2	0.51
CVRMSE	0.13
NDB	0.00
Standard Error	248.63

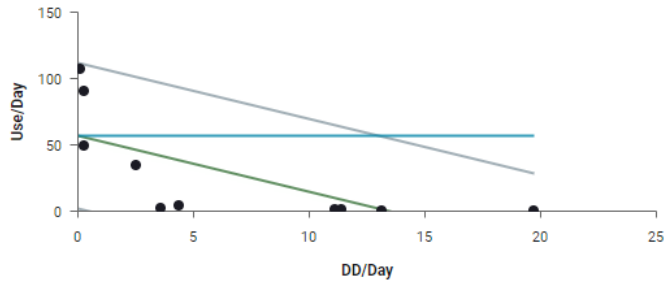
Heating Adjustment — Off / On



Base load	1,913.90 kWh/day
Weather factor	-18.07 kWh/HDD 0.00 (t-stat)
R2	0.00
Minimum R2	0.34
Adjusted R2	0.00
CVRMSE	0.00
NDB	0.00
Standard Error	0.00

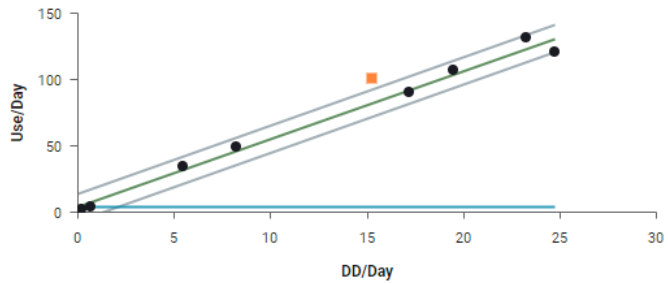
Natural Gas

Cooling Adjustment — Off / On



Base load	57.05 THERM/day
Weather factor	-4.22 THERM/CDD 0.00 (t-stat)
R2	0.00
Minimum R2	0.30
Adjusted R2	0.00
CVRMSE	0.00
NDB	0.00
Standard Error	0.00

Heating Adjustment — Off / On



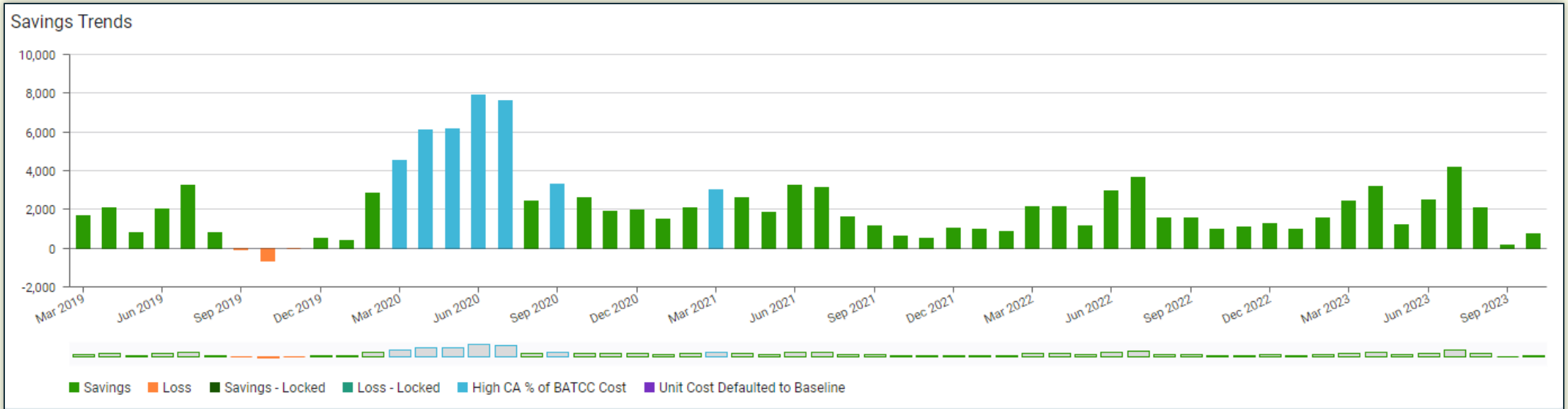
Base load	3.64 THERM/day
Weather factor	5.14 THERM/HDD 23.21 (t-stat)
R2	0.99
Minimum R2	0.39
Adjusted R2	0.99
CVRMSE	0.08
NDB	0.00
Standard Error	5.84

data point · outlier · user-removed · best fit · 2 standard deviations · base load

Statistics are compliant with **IPMVP Option C**

Verify

Option C // Report savings



Billing Period	Cost			Cost Avoidance		Cooling		Heating		Use			Use Avoidance	
	Baseline	BATCC	Actual	Amount	%	DD	Adj.	DD	Adj.	Baseline	BATCC	Actual	Amount	%
Nov 2023	$ 4,500	$ 6,720	$ 5,942	$ 778	11.6%	38	✓	134		50,312	51,110	45,193	5,917	11.6%
Sep 2023	$ 6,076	$ 8,972	$ 8,783	$ 189	2.1%	470	✓	0		65,626	68,056	66,624	1,432	2.1%
Aug 2023	$ 4,815	$ 7,297	$ 5,216	$ 2,082	28.5%	485	✓	0		51,611	54,040	38,625	15,415	28.5%
Jul 2023	$ 6,393	$ 8,793	$ 4,607	$ 4,185	47.6%	489	✓	0		68,942	66,295	34,738	31,557	47.6%
Jun 2023	$ 6,928	$ 8,675	$ 6,161	$ 2,513	29.0%	231	✓	0		73,040	68,616	48,735	19,881	29.0%
May 2023	$ 4,388	$ 5,876	$ 4,679	$ 1,197	20.4%	55	✓	29		48,308	47,836	38,091	9,745	20.4%
Apr 2023	$ 5,868	$ 8,078	$ 4,893	$ 3,185	39.4%	121	✓	73		64,979	66,248	40,124	26,124	39.4%

Verify

Option B // Use interval data, account for more variables

Define the model by which consumption during the reporting period will be estimated. This estimation is the basis for determining how the consumption would have continued had the ECMs not been implemented.

Type: Linear Regression — days grouping: All days (1 model)

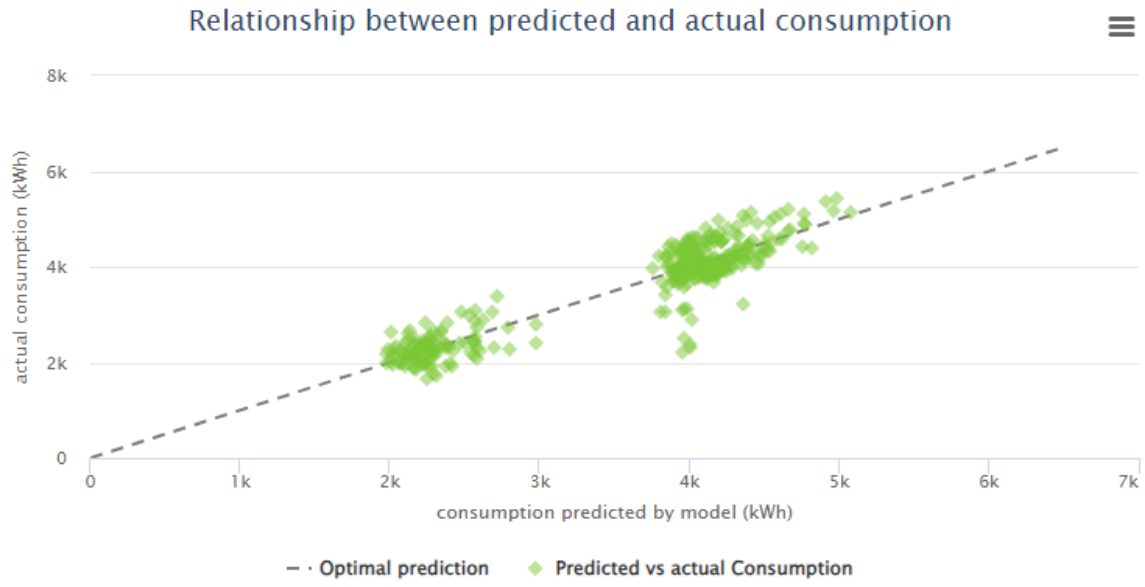
Variable(s) to use:
- HDD
- CDD
- Occupancy
- DB Offices

Generate Model

Output

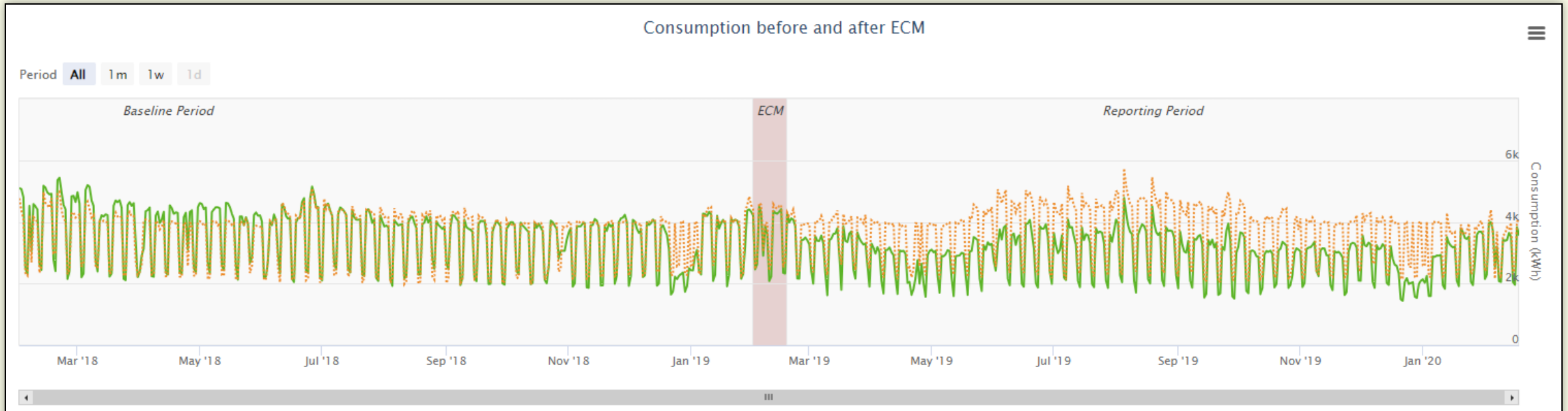
Formula: **-42.28 * HDD + 320.33 * CDD + 30.91 * Occupancy + 1.26 * DB Offices + 2176.13**

R^2: **0.86**



Verify

Option B // Report Savings



Baseline Period

January 31, 2018 - January 31, 2019

Payback Period: **7.46 Year**

Reporting Period

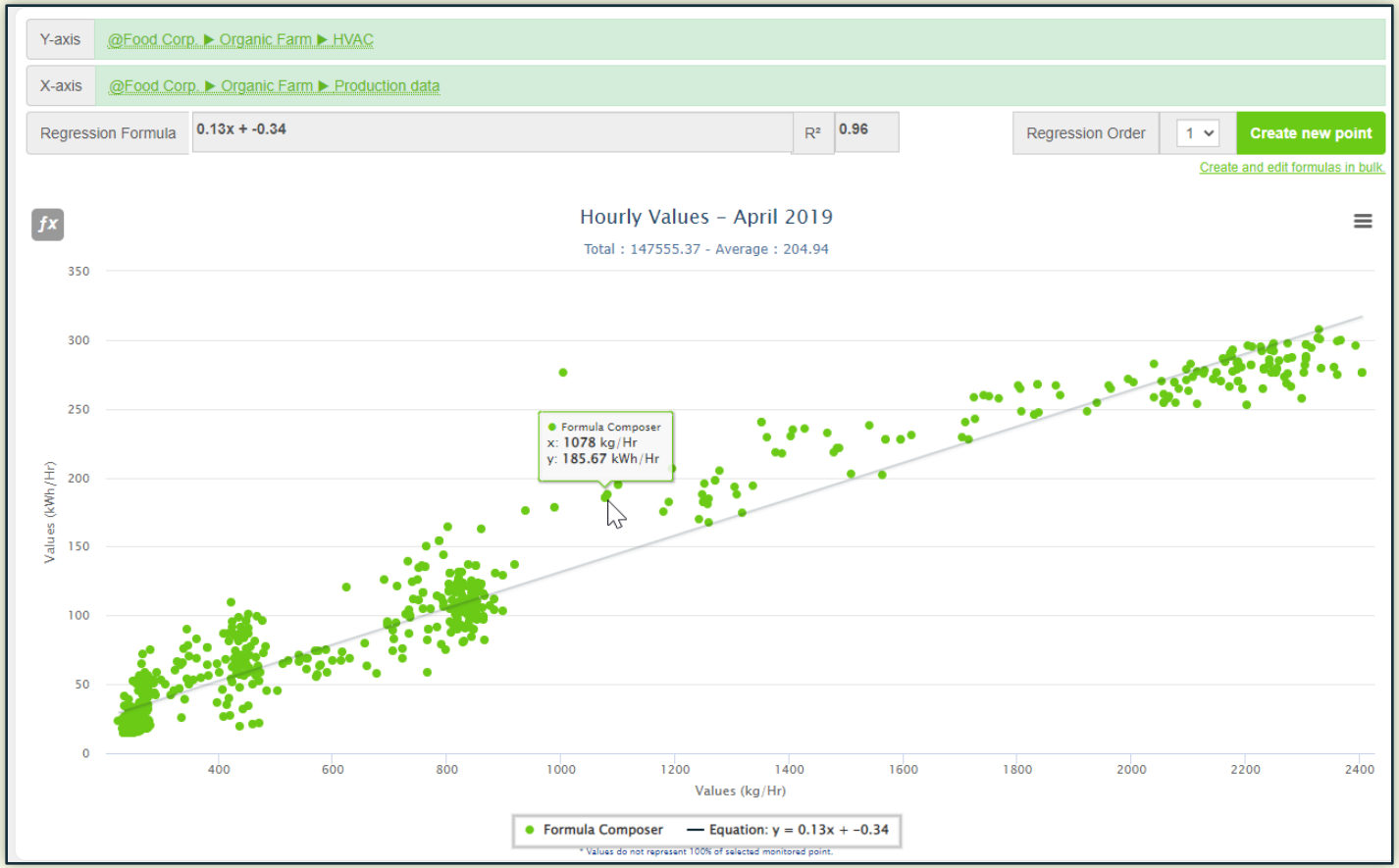
February 18, 2019 - February 18, 2020

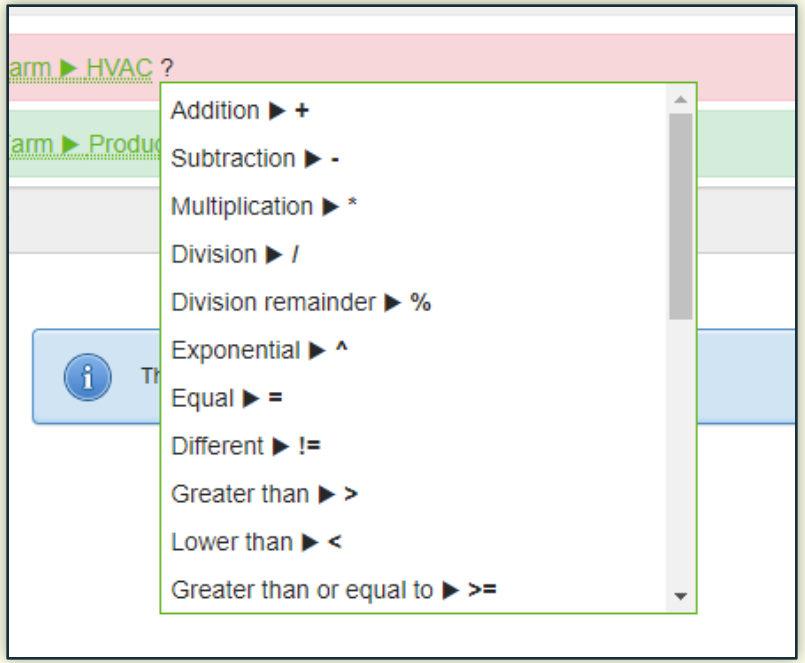
Estimated consumption	Actual consumption	Savings per year
1,338,656.97 kWh	1,065,000.82 kWh	273,656.15 kWh
$160,454.87	$126,014.84	$34,440.03
200,798.55 kg of CO_2	159,750.12 kg of CO_2	41,048.42 kg of CO_2

Verify

Formulas and comparisons

- Formulas to compare, aggregate, reduce, create targets, and more
- Formula points function like metered points, have sentinel, alarms, alerts, heatmaps, etc…

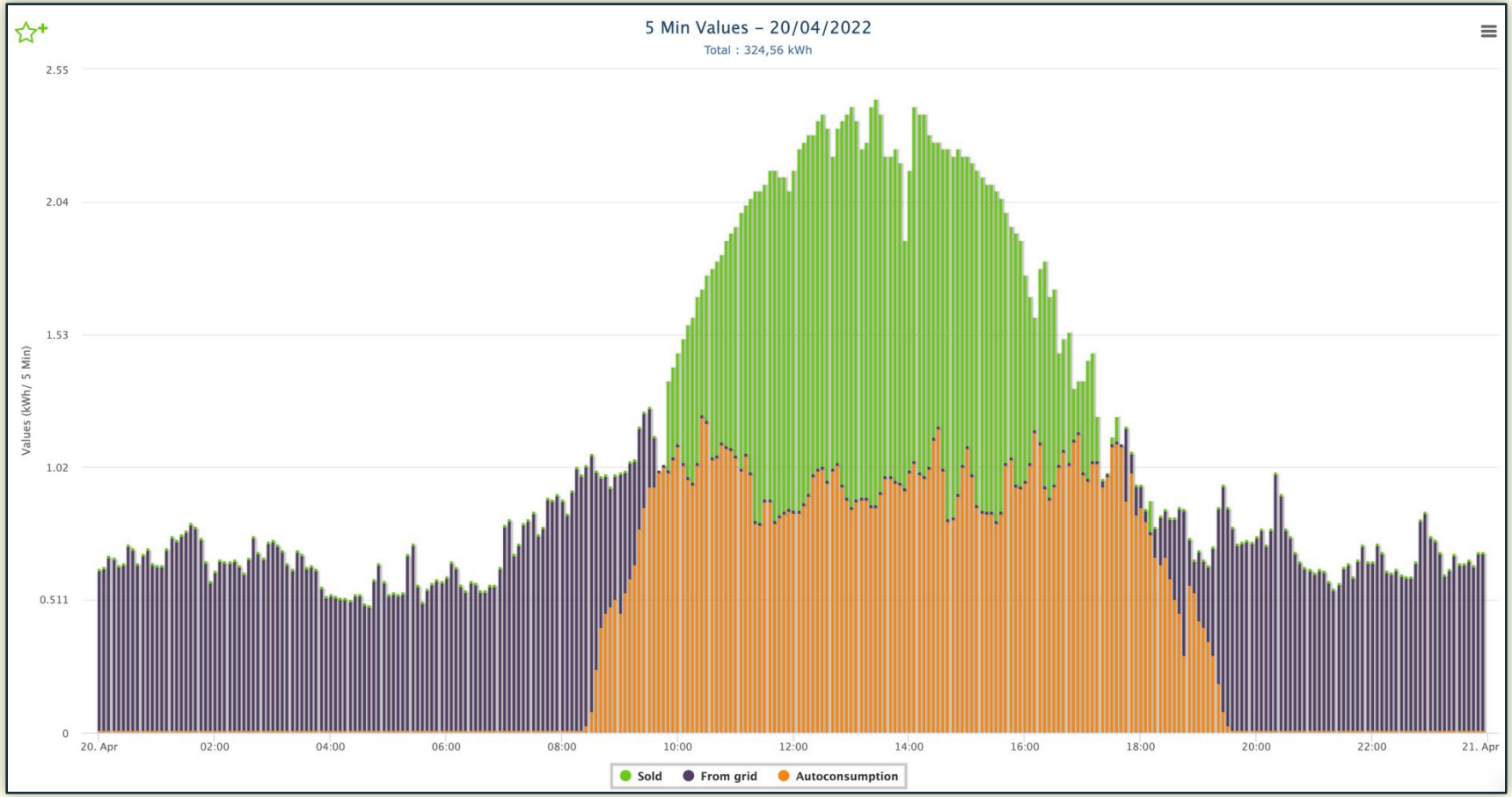




Finalize

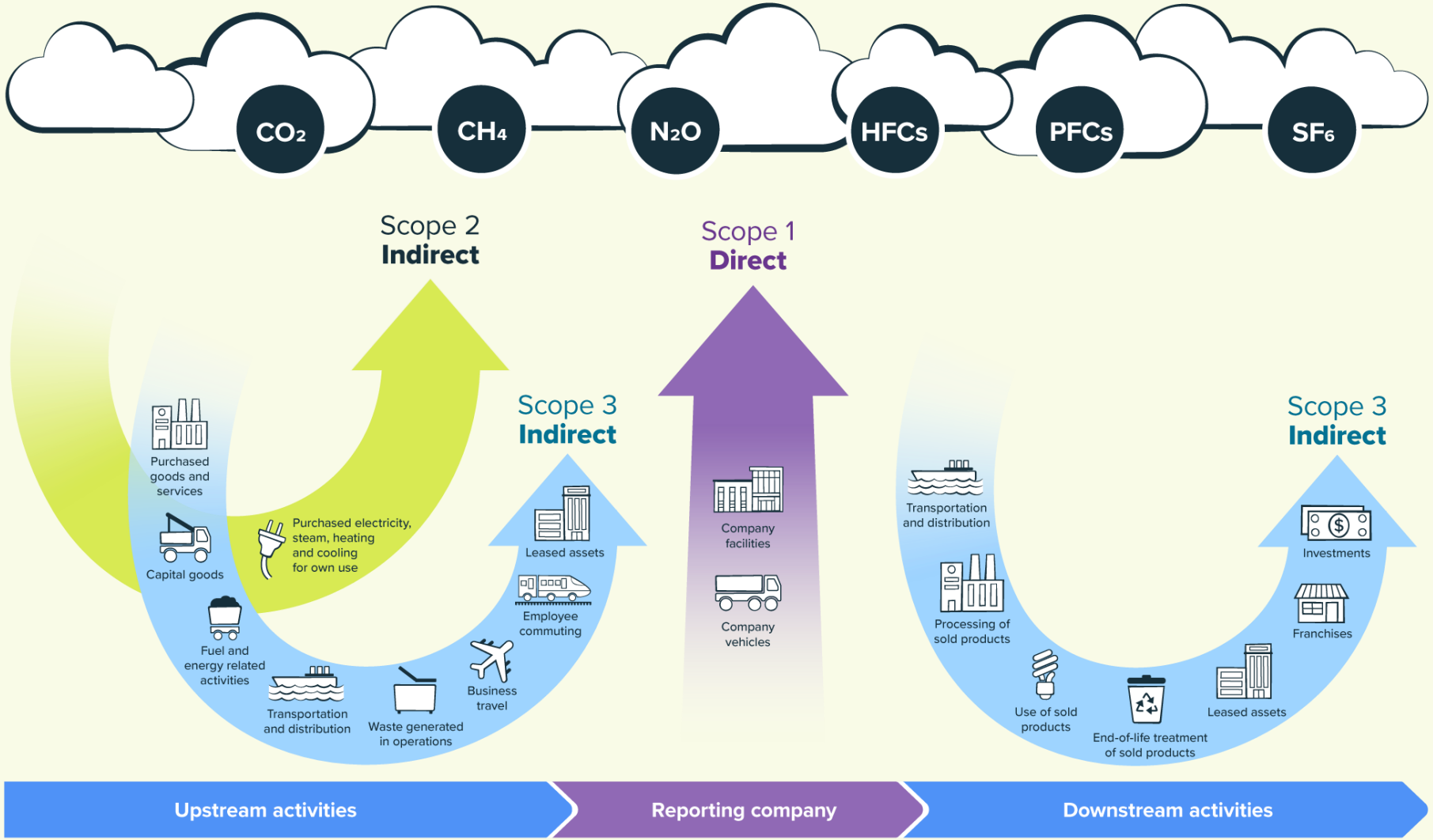
Understand consumption sources

- Report on sources in real-time
- Track generation and selling activities
- Apply CO2 in real-time to generation and consumption
- Track renewables



Finalize

Add carbon factors for sustainability reporting



Finalize

Scope 3 by use, volume, distance, weight-based, and cost-based

SCOPE 3

- 01. Purchased Goods and Services
- 02. Capital Goods
- 03. Fuel and Energy Related Activities
- 04. Upstream Transportation & Distribution
- 05. Waste Generated in Operations
- 06. Business Travel
- 07. Employee Commuting
- 08. Upstream Leased Assets
- 09. Downstream Transportation & Distribution
- 10. Processing of Sold Products

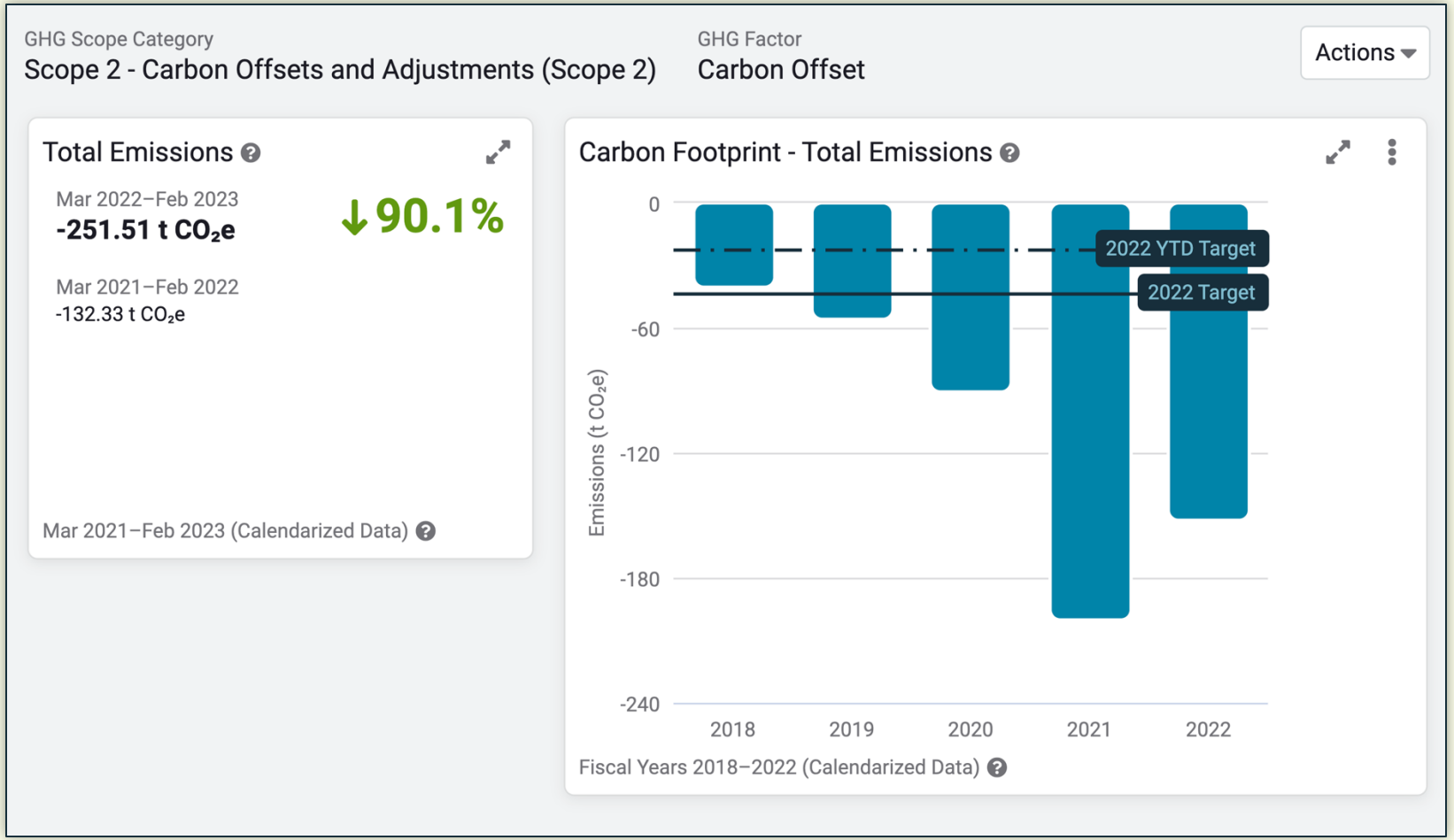
- 06. Business Travel
  - Long Haul Flights
  - Medium Haul Flights
  - Rental Cars
  - Short Haul Flights
- 07. Employee Commuting
  - Bus
  - Commuter Rail
  - Passenger Vehicles

- ENC Purchased Goods and Services
  - Accounting Fees
  - Advertising and Marketing Expense
  - Financial Service Fees
  - Hardware
  - Hosting
  - Legal Fees
  - Printing Expense
  - Software
  - Stationary

Finalize

Track offsets and renewable energy credits (RECs)

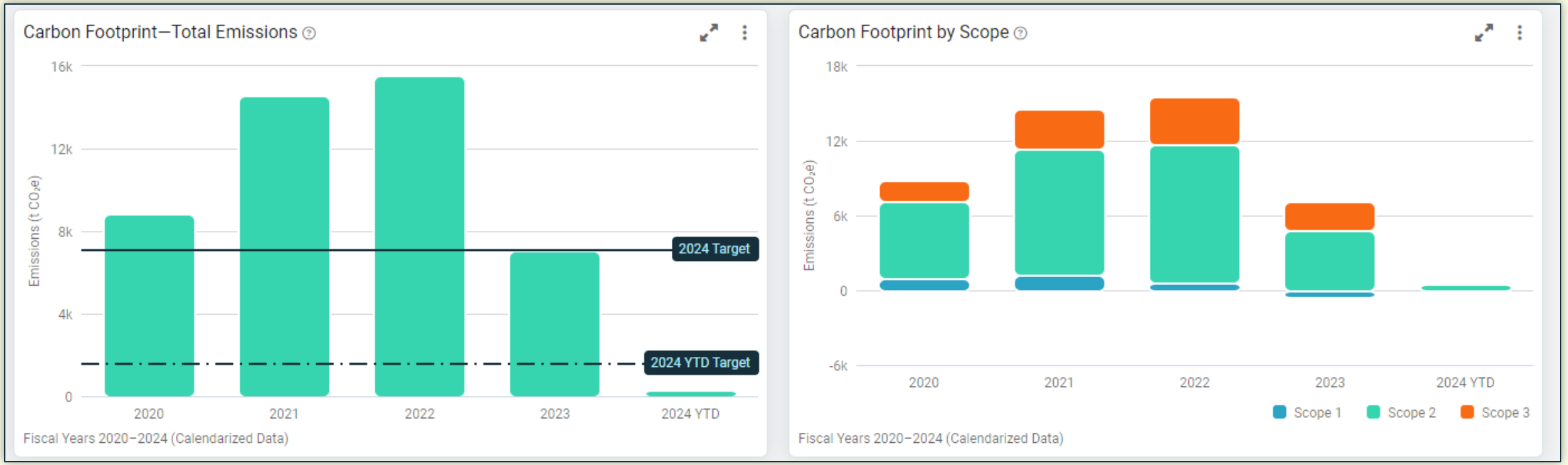
- Carbon Offsets and RECs
  - Carbon Offsets: Scope 1
  - Carbon Offsets: Scope 2
  - Carbon Offsets: Scope 3
  - Electric RECs (non-solar)
  - Solar RECs (SRECs)



Socialize

Necessary to measure progress

Track baselines, set targets, measure and report progress towards organizational goals



Socialize

Customizable, shareable reports

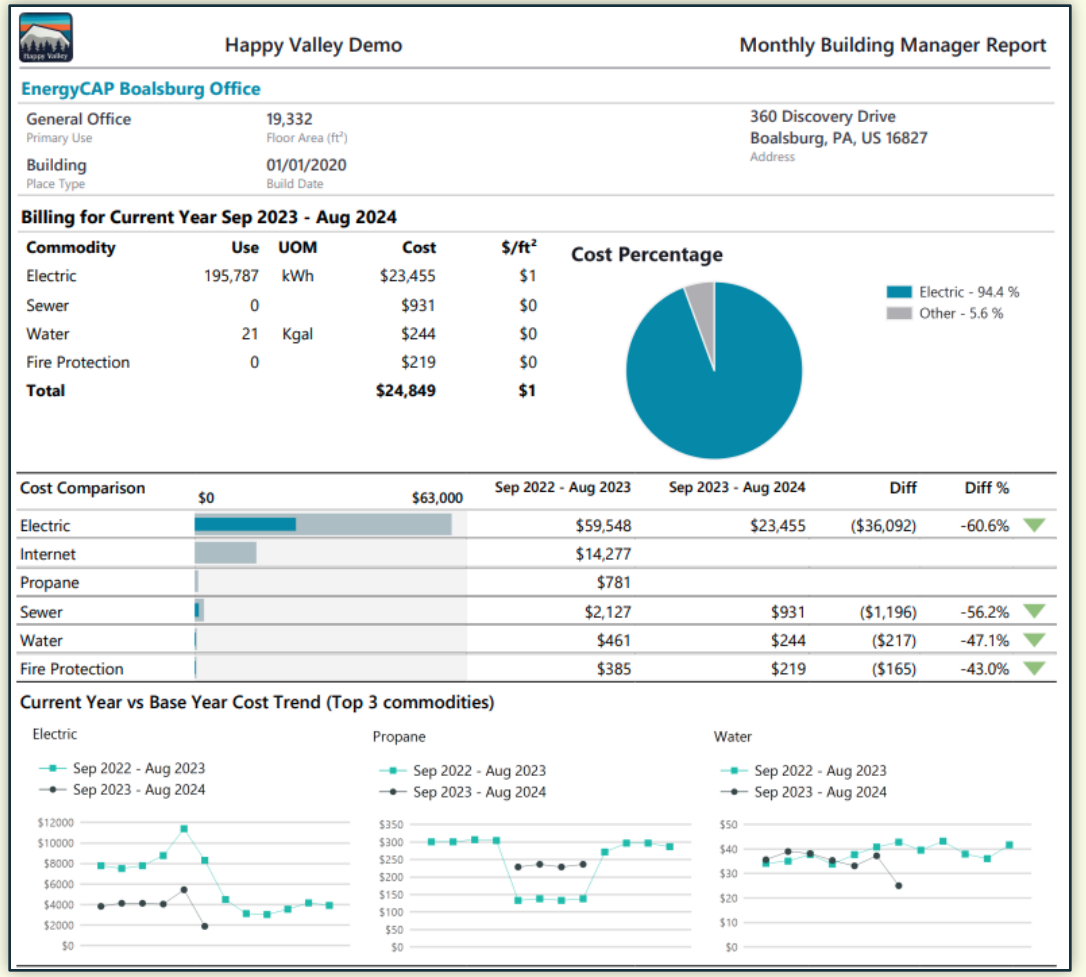
Happy Valley Demo

Report-44 | **Emissions Summary Report**
Jan 2023 - Dec 2023

Sustainability Reporting

Emissions Performance History

Date Range	Total Emissions	Target Performance
2018	100,148.67 t CO_2e	
2019	93,888.02 t CO_2e	
2020	6,621,044.95 t CO_2e	
2021	7,016,775.51 t CO_2e	* Base Year
2022	7,626,300.41 t CO_2e	20.76%
2023	7,527,189.97 t CO_2e	19.19%



Happy Valley Demo — Monthly Building Manager Report

EnergyCAP Boalsburg Office

General Office Primary Use	19,332 Floor Area (ft^2)	360 Discovery Drive Boalsburg, PA, US 16827 Address
Building Place Type	01/01/2020 Build Date	

Billing for Current Year Sep 2023 - Aug 2024

Commodity	Use	UOM	Cost	$/$ft^2$
Electric	195,787	kWh	$23,455	$1
Sewer	0		$931	$0
Water	21	Kgal	$244	$0
Fire Protection	0		$219	$0
Total			**$24,849**	**$1**

Cost Percentage

Cost Comparison ($0 – $63,000)	Sep 2022 - Aug 2023	Sep 2023 - Aug 2024	Diff	Diff %
Electric	$59,548	$23,455	($36,092)	-60.6%
Internet	$14,277			
Propane	$781			
Sewer	$2,127	$931	($1,196)	-56.2%
Water	$461	$244	($217)	-47.1%
Fire Protection	$385	$219	($165)	-43.0%

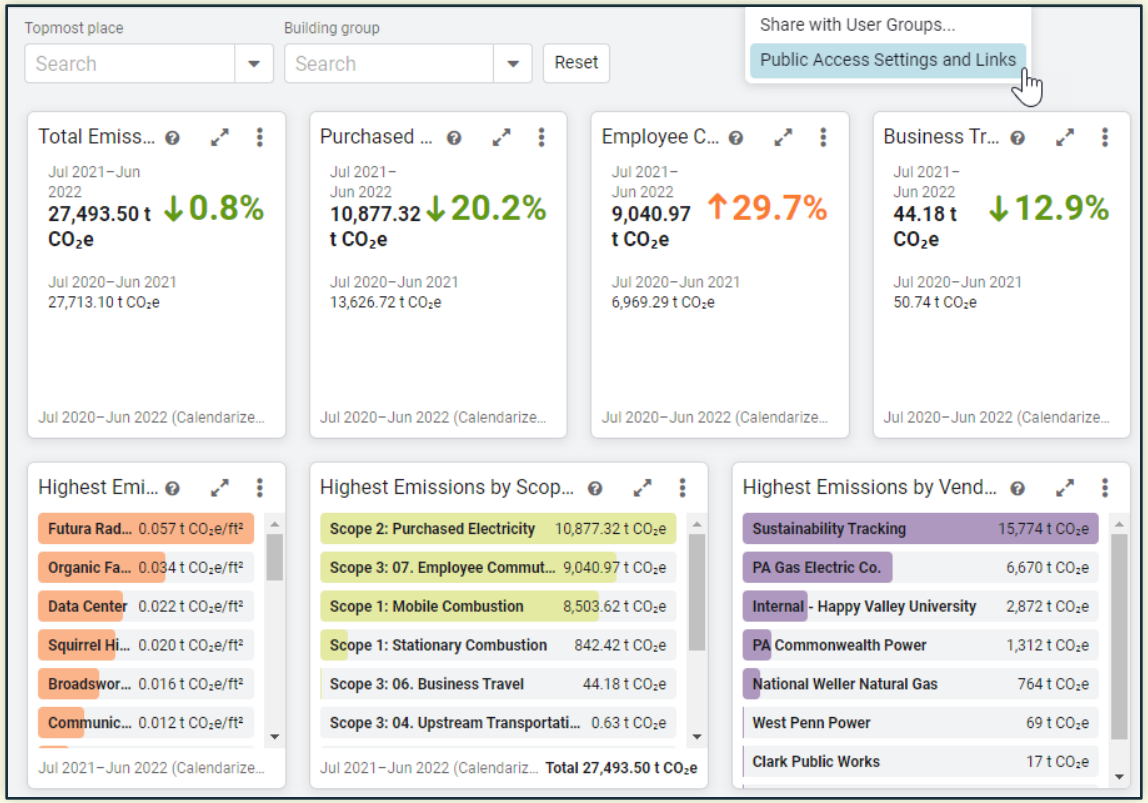
Current Year vs Base Year Cost Trend (Top 3 commodities)

Socialize

Communicate results via dashboards

Live data feeds

Public links and embeddable



Questions?

Take the session survey:

Get the Most Out of Your Data