ENERGY MANAGEMENT ASSOCIATION

WEBINAR

AIA Provider Number: 50111116

Course Number: EMA2007L

Building Analytics for COVID-19 and Post-COVID-19 Building Operations

With your speakers

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AIA Continuing Education Provider

WHO WE ARE

- CopperTree Analytics is the developer of the software KAIZEN
- KAIZEN is a powerful patented analytics tool that utilizes Artificial Intelligence (AI) to translate your building's data into useful information
- KAIZEN continuously monitors your building's performance and energy consumption. It measures that data against optimal performance guidelines and the building's own baseline; alerting you if a fault is detected or if the building performance is sub-optimal

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AGENDA

- Analytics for Fault Detection and Compliance Reporting
- Investing in Sensors
- Energy Reporting During the Pandemic
- Communicating Results to Occupants

HVAC Analytics and COVID-19 Pandemic

- ✓ Adjusting Existing FDD Rules
- ✓ Rules for Compliance Reporting

HVAC Analytics

- ✓ Leverages existing BAS data
- ✓ Quickly process millions of data samples
- ✓ Provides actionable insights
- ✓ Increase energy efficiency, building performance
- ✓ Reduce maintenance time and cost
- ✓ Improve occupant safety and comfort

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HVAC Analytics During COVID-19

Is my existing analytics platform still providing meaningful results?

- ✓ Check that building schedules are not hard coded into rules
- ✓ Review thresholds and dead bands used in rules
- ✓ Ensure any modifications in sequence of operation are reflected in the analytics logic
- ✓ Review Insight histories

How can I improve my analytics platform to help during COVID-19?

- ✓ Add new equipment (UV lights, filtration systems, etc.) data to analytics
- ✓ Ensure current analytics implementation is fine-tuned for occupant safety and comfort while being energy efficient
- ✓ Use Analytics for Compliance Reporting

Building Health Compliance: Measurement and Reporting (Air System Example)

Track

- ✓ Total Supply CFM
- ✓ Total Exhaust CFM
- ✓ Filter DP
- ✓ Fan Speed
- ✓ Temperature

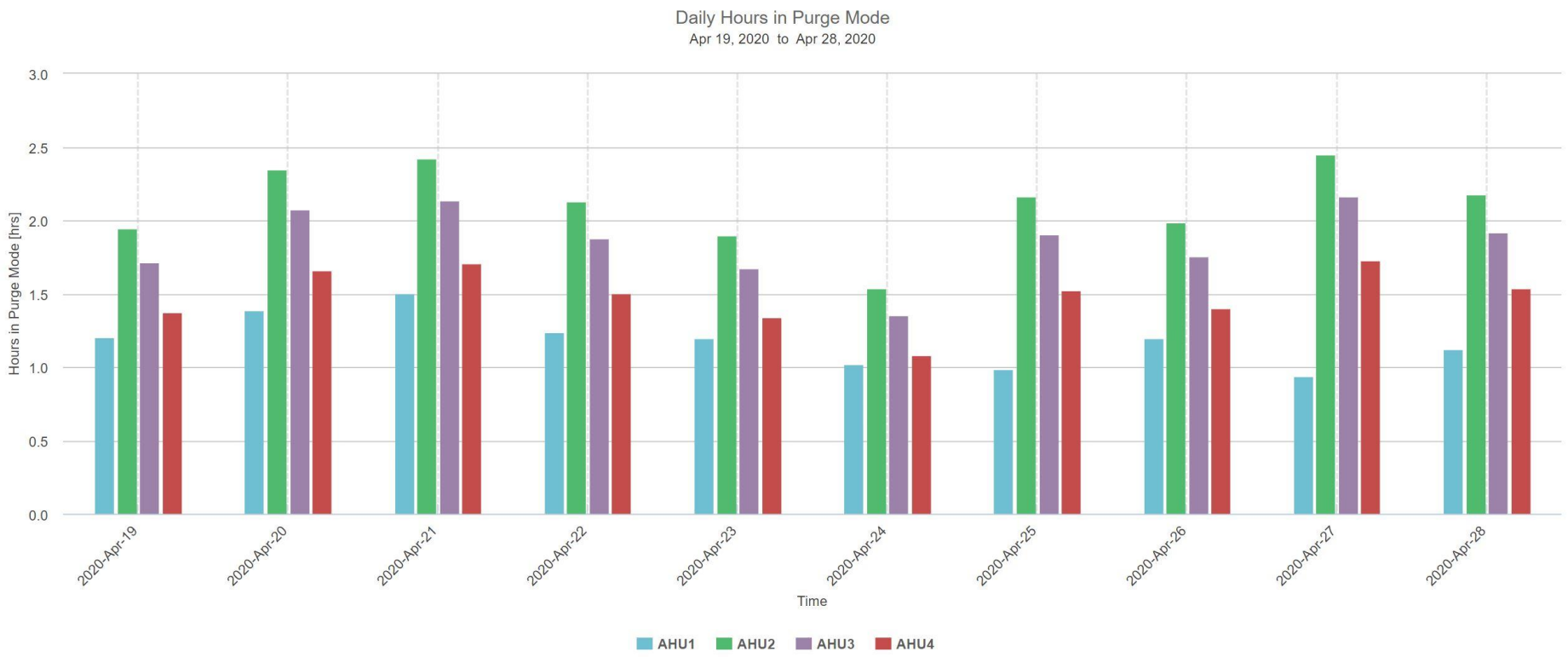
Calculate

- ✓ Air Change Rates
- ✓ Active Purge Time
- ✓ Clean Air Metrics
- ✓ Optimal Filter Change Times

Analytics Provide Daily, Weekly, Monthly Reports as Well as Email Alerts and Dashboards

- ✓ Filter Replacement Notifications
- ✓ Trended Air Change Rates
- ✓ Trended Air Purge Time
- ✓ Clean Air Metrics
- ✓ Schedules of Operations
- ✓ Comfort Metrics, Temperature vs Setpoint, Airflow analysis and Co2 levels

Compliance Reporting Example: Air Purge Analysis



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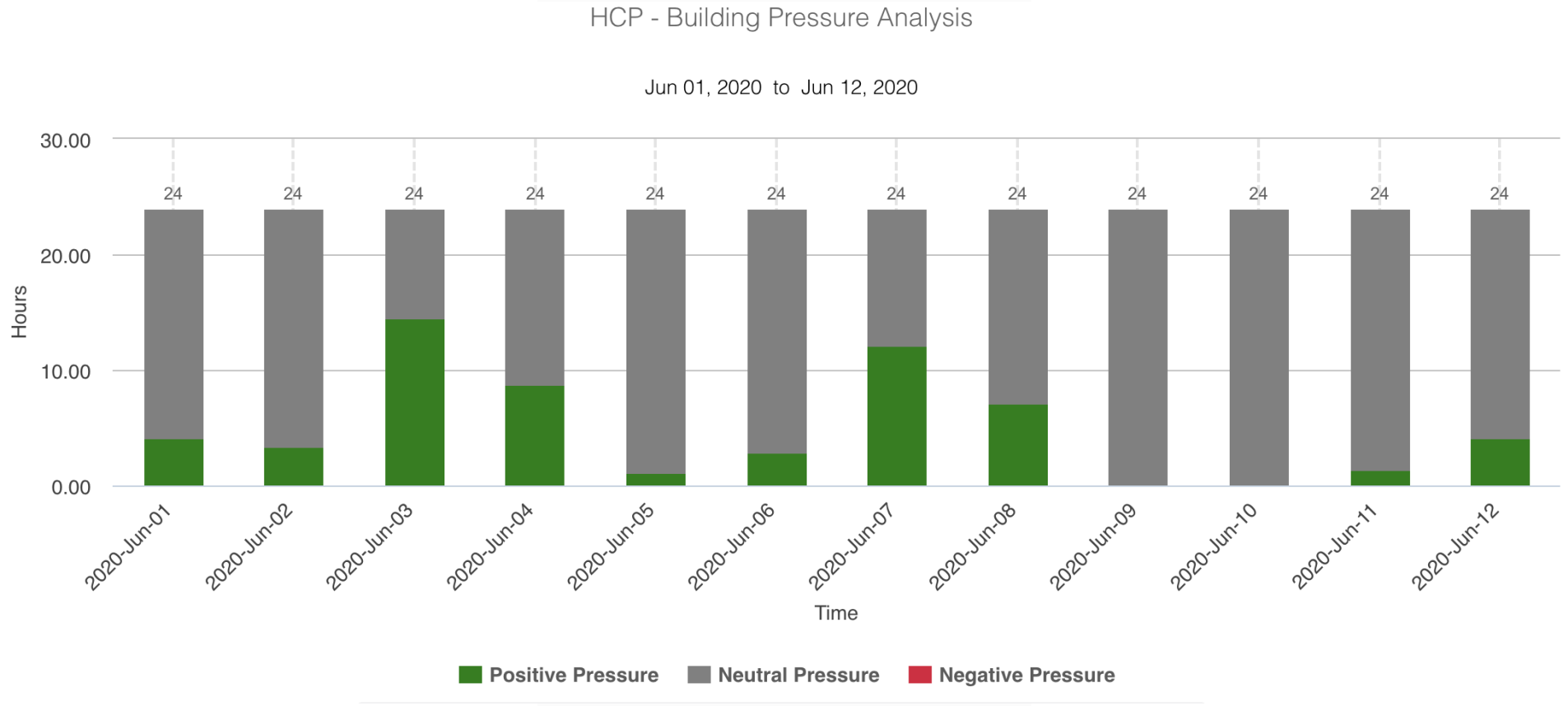
Compliance Reporting Example: Building Pressure Analysis



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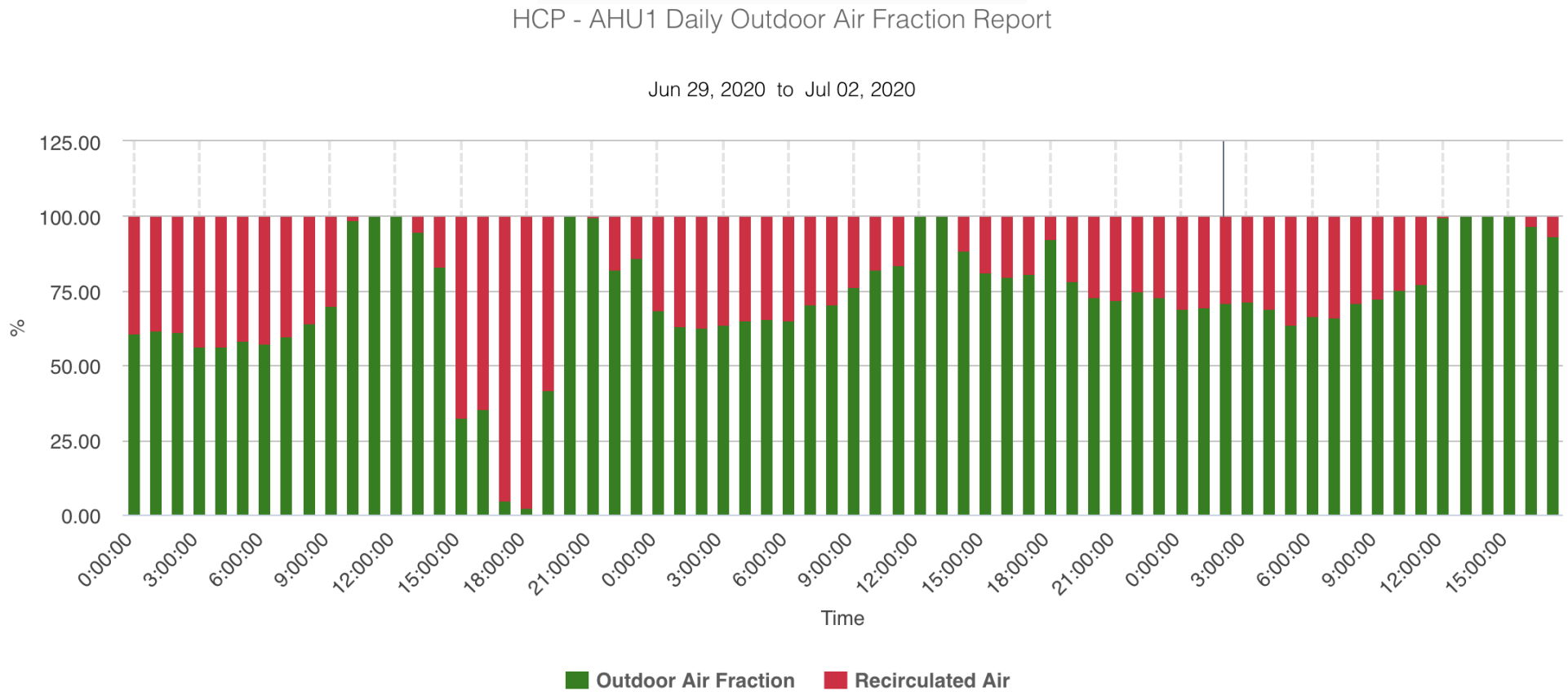
Compliance Reporting Example: Outdoor Air Fraction - Daily



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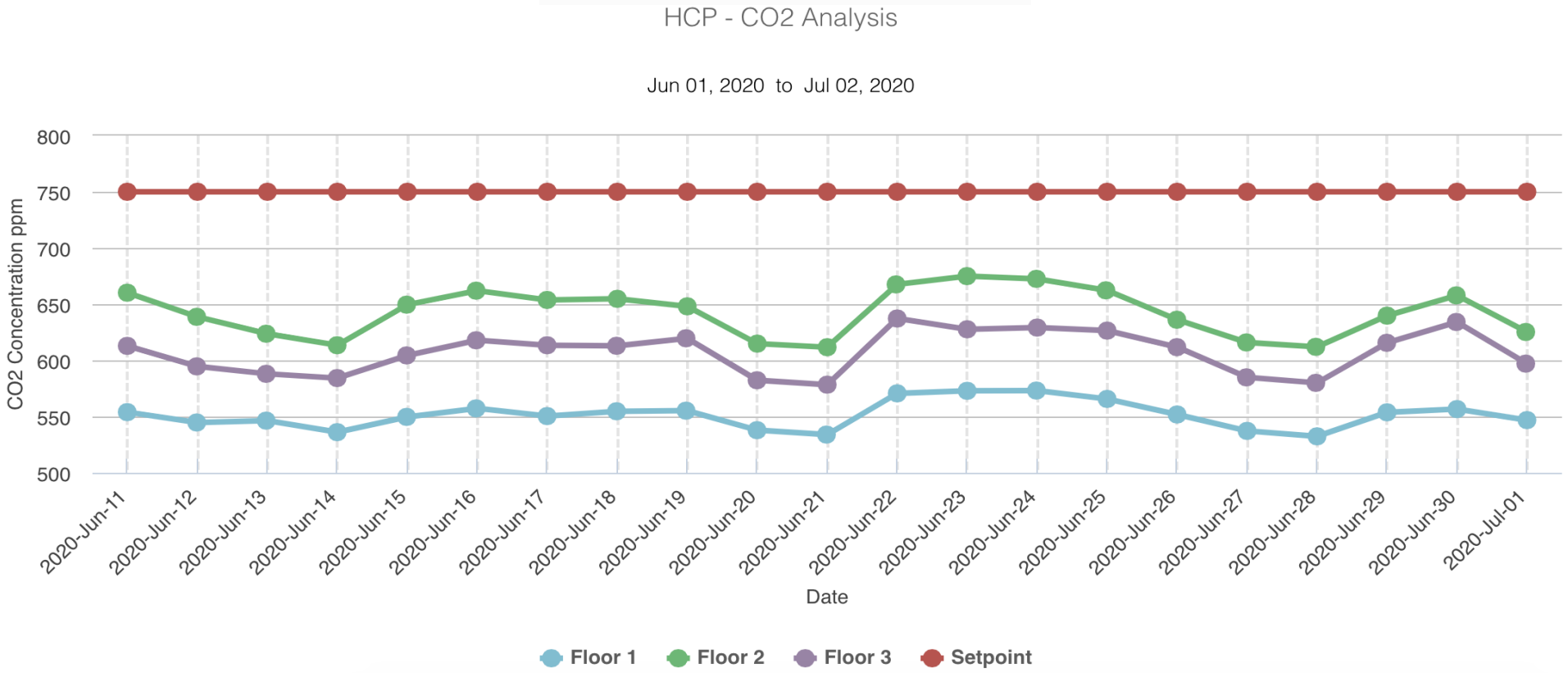
Compliance Reporting Example: Zone CO_2



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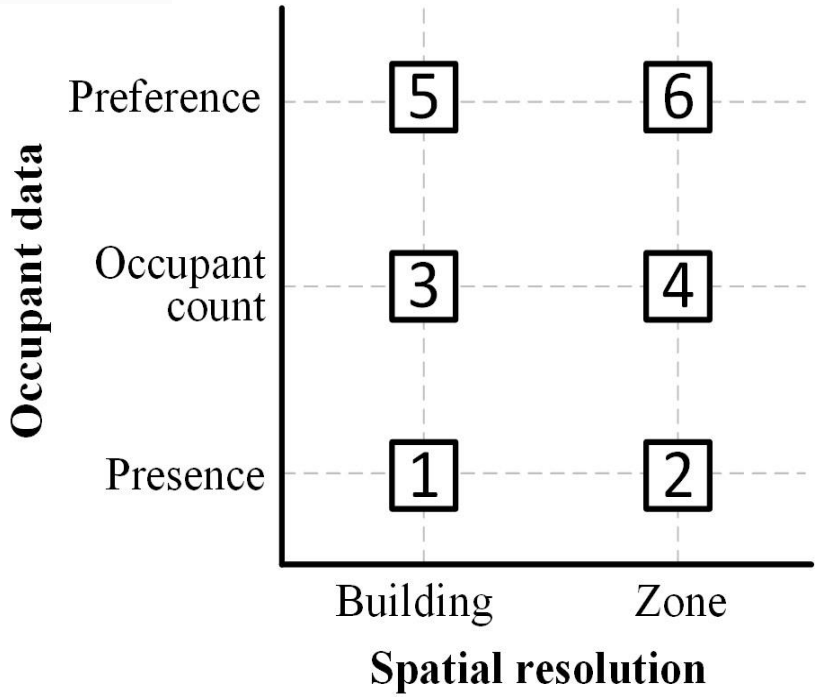
Investing in Sensors

- ✓ Occupant Sensing Technologies
- ✓ Other Sensors Recommended for Compliance Reporting

Occupancy Sensing Information Grades

- ✓ Implicit vs Explicit sensing
- ✓ Security considerations
- ✓ Looking ahead: occupant-centric control



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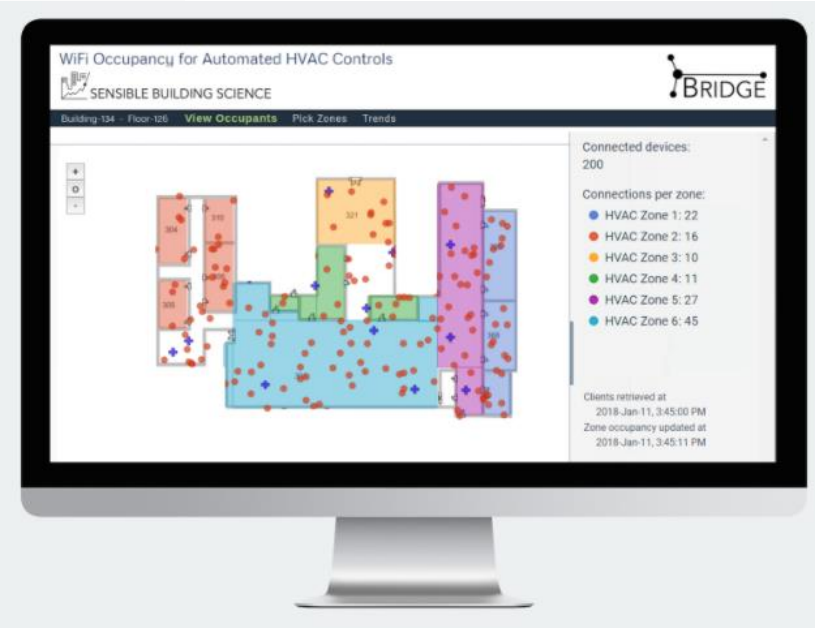
Occupancy Sensors and Counters

- ✓ Motion detectors
- ✓ People counting cameras
- ✓ Wi-Fi
- ✓ CO2 or other IAQ
- ✓ Integration to existing systems:
  - ✓ Lighting Controls
  - ✓ Booking Software



Sensible Building Science: The Bridge

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Zone Sensors for Compliance

- ✓ Zone Temperature plus:
  - ✓ Occupancy, Humidity and CO2
- ✓ Fully programmable Smart Sensors
- ✓ Real-time alerts to occupants

Delta Controls: enteliZONE BACnet Thermostats (eZNT)

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Zone CO_2 Sensors

- ✓ Better indication of zone occupancy
- ✓ More granular than Return Air CO_2
- ✓ Monitor air changes
- ✓ IAQ sensors

BAPI: BAPI-Stat "Quantum" CO2 Sensor

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Mixed Air Temperature Sensors

- ✓ Used to calculate % OA Fraction
- ✓ Used to calculate Cooling and Heating BTUs
- ✓ Used to detect leaking heating and cooling valves
- ✓ Used to detect leaking dampers

$$\%OA = \frac{(X_R - X_S)}{(X_R - X_O)} x100\%$$

Where:
X_R = Return Air Temperature
X_S = Mixed Air Temperature
X_O = Outside Air Temperature

Air Flow Stations – Are they worth it?

- ☹ Costly
- ☹ Inaccuracies with lower flows
- ☹ Requires regular calibration

- ✓ Approximate air flow using fan speed and max flow rating

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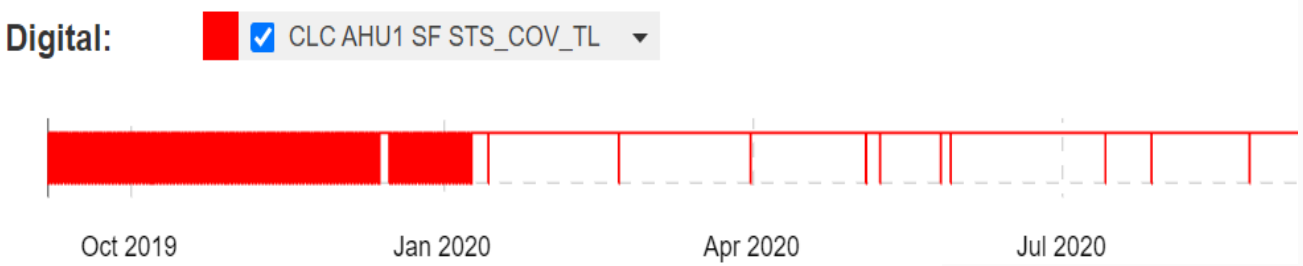
Other Documentation

- ✓ Collect design documents for ventilation systems
  - ✓ Mechanical schedules, specifications on design use
- ✓ Compare design occupancy to actual occupancy
- ✓ Record CFM min and max for airflow delivery systems

Energy Reporting

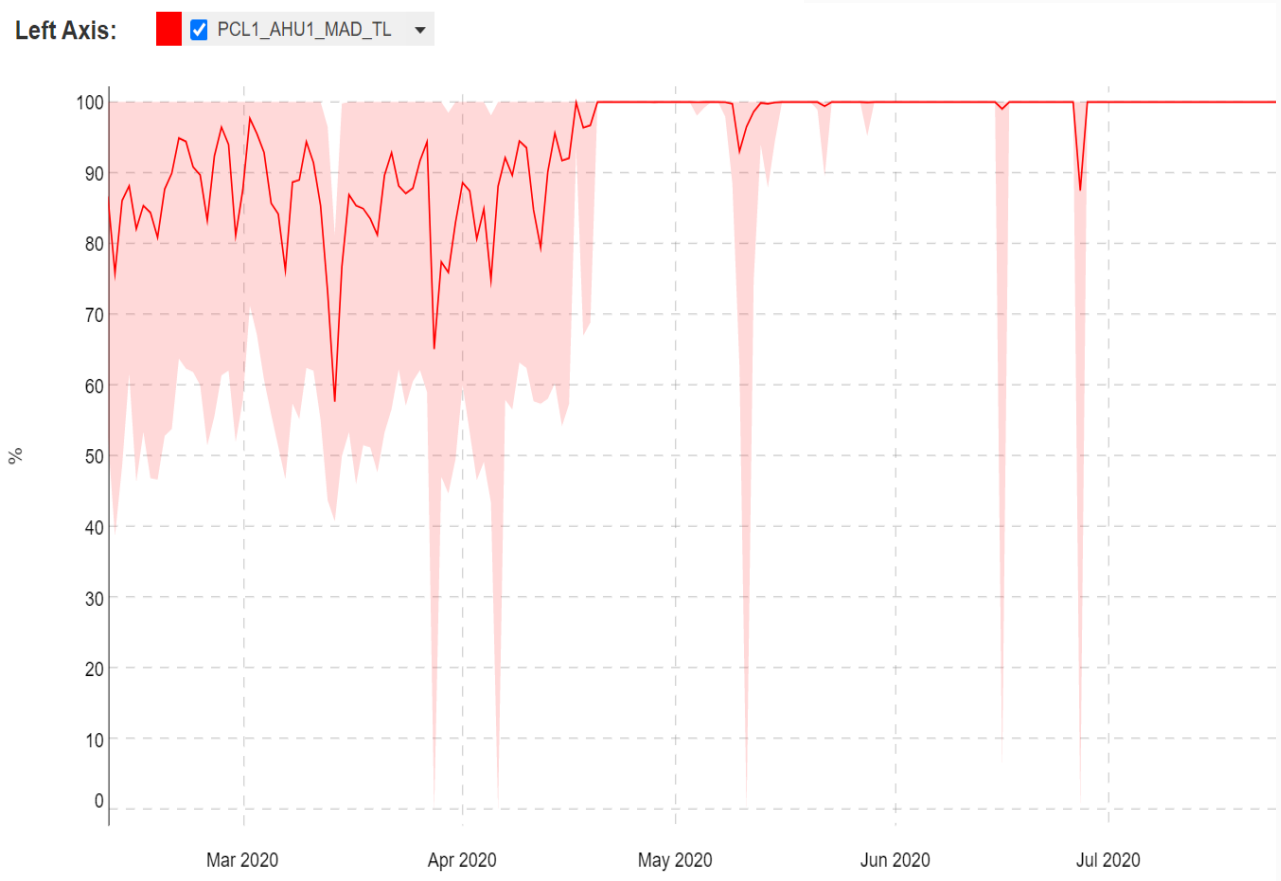
- ✓ Energy Faults
- ✓ Energy Reporting and Changing Occupancy

Energy Faults During COVID-19: Examples



- ✓ Equipment Running 24/7 - safety over energy, but how much is too much?
  - ✓ Understand actual building occupancy
  - ✓ Increase equipment run time if need be
  - ✓ Take advantage of Compliance Reports and analytics results to optimize performance

Energy Faults During COVID-19: Examples

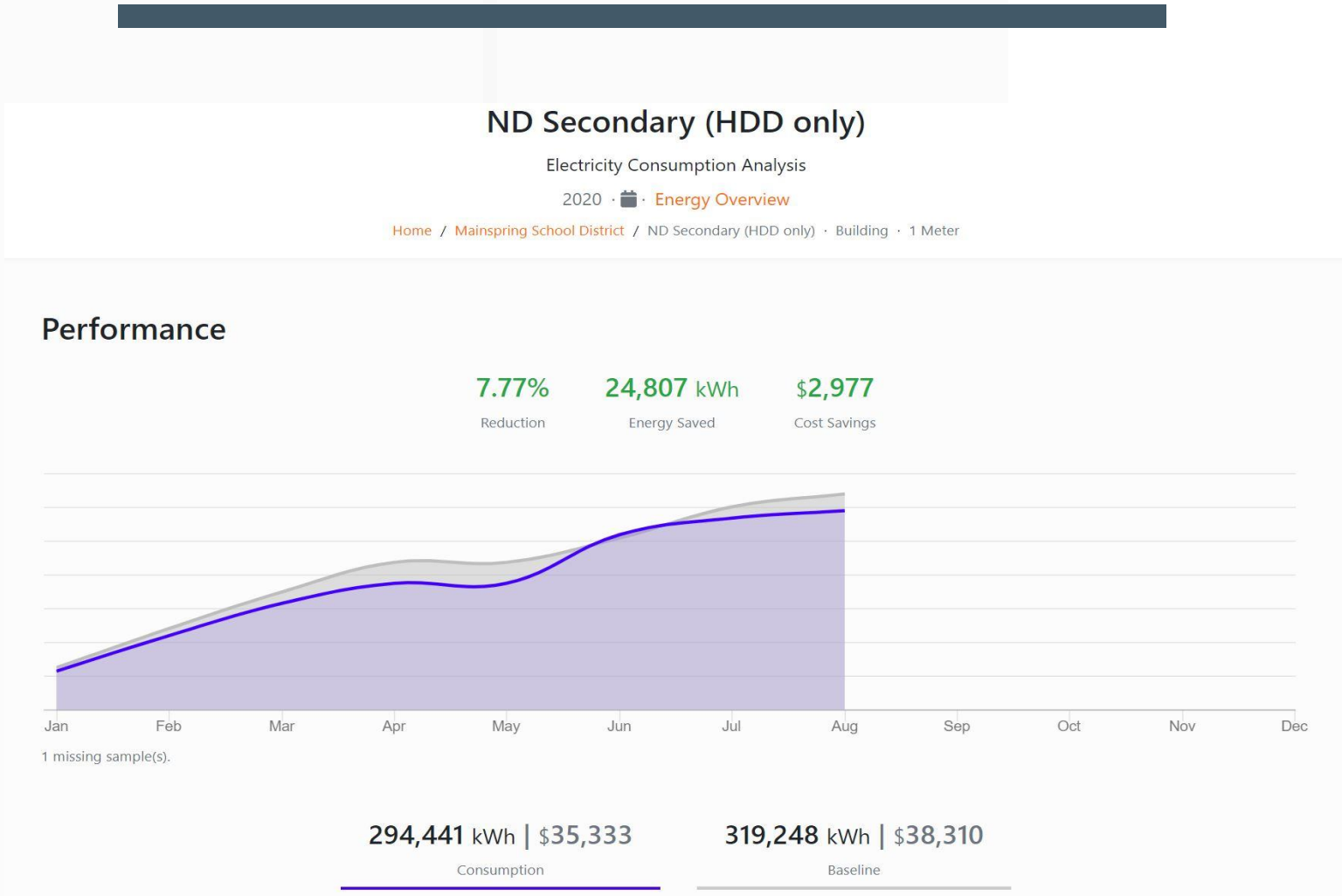


- ✓ Overridden Outdoor Air Damper Control
  - ✓ Do you need 100% outdoor air? Review VAV performance.
  - ✓ Optimize control sequence if needed
  - ✓ Improve feedback from terminal units
- ✓ Check for valve saturation
- ✓ Check for central plant related issues (hierarchical rules)

Energy Reporting During COVID-19

One Independent Variable:

Degree Days

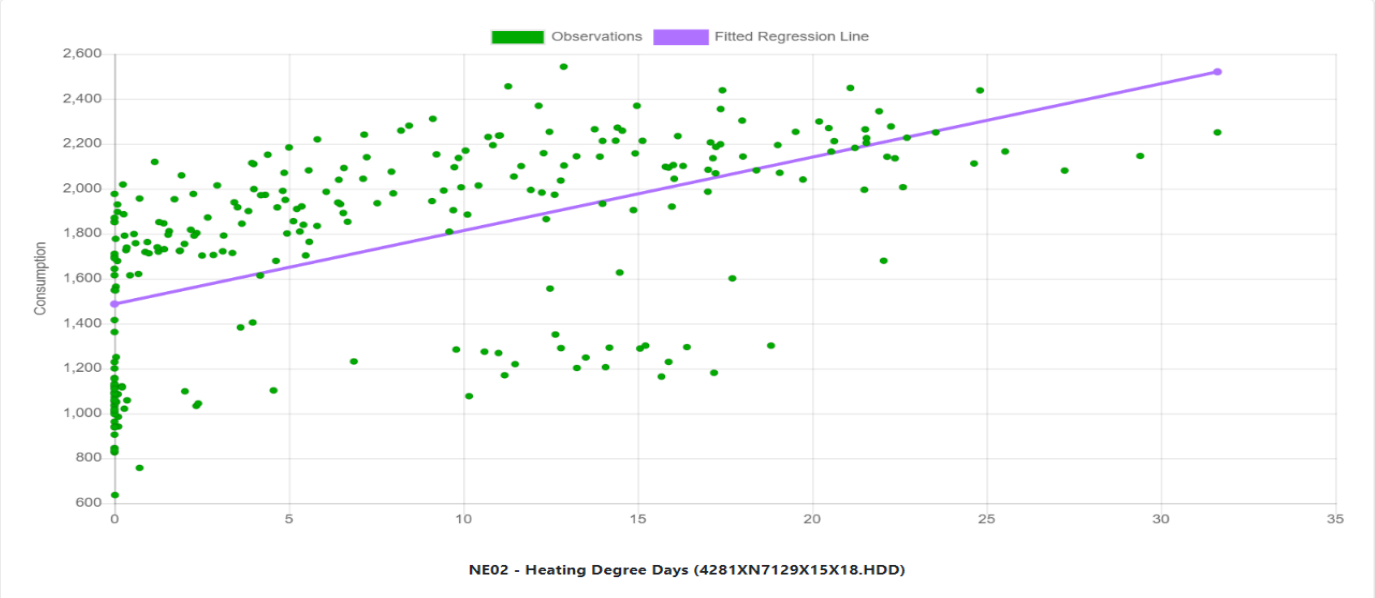


Linear Regression Analysis

Built In Baseline - Daily Interval

Model:	Ordinary Least Squares	**R-squared:**	0.316
Method:	Least Squares	**Adj. R-squared:**	0.313
No. Observations:	260		
Df Residuals:	258		
Df Model:	1		

	Coefficients	Std Error	t Stat	P-values	[0.05	0.95]
constant	1486.5790	33.207	44.767	0.000	1421.188	1551.970
NE02 - Heating Degree Days (4281XN7129X15X18.HDD)	32.7036	2.999	10.905	0.000	26.798	38.609



R-Squared value: 0.316

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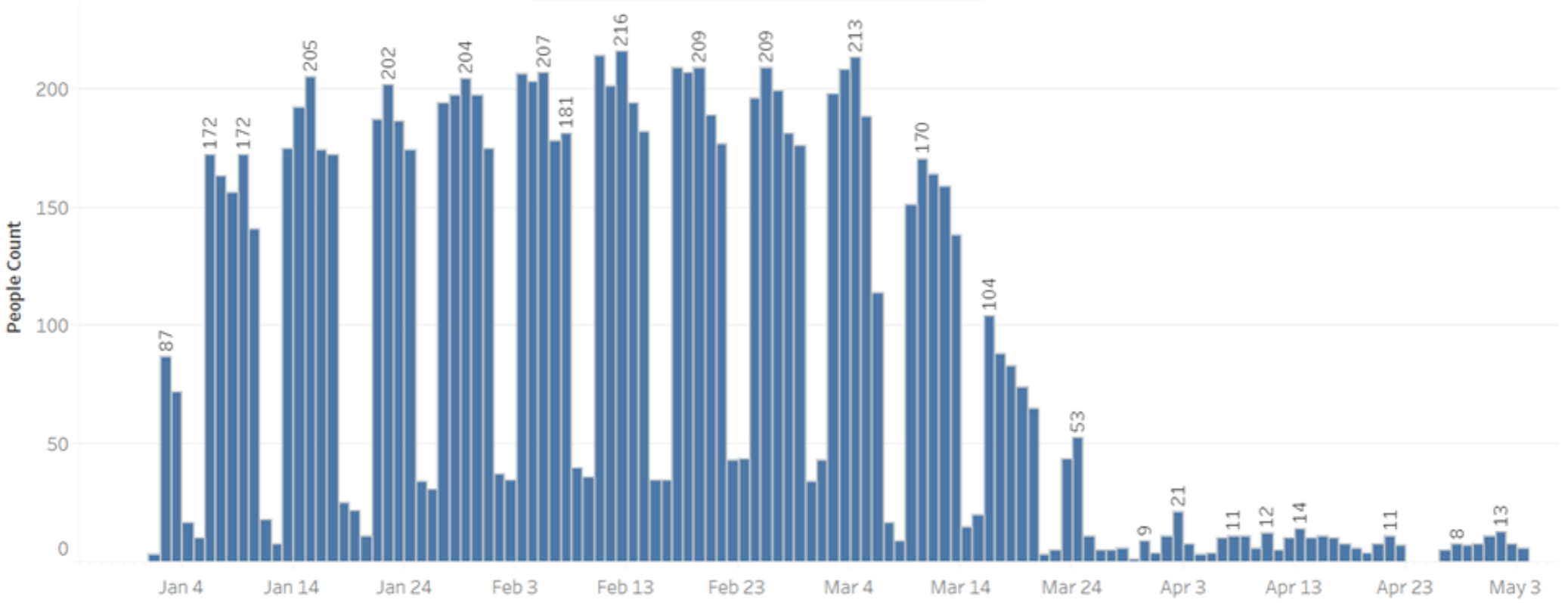
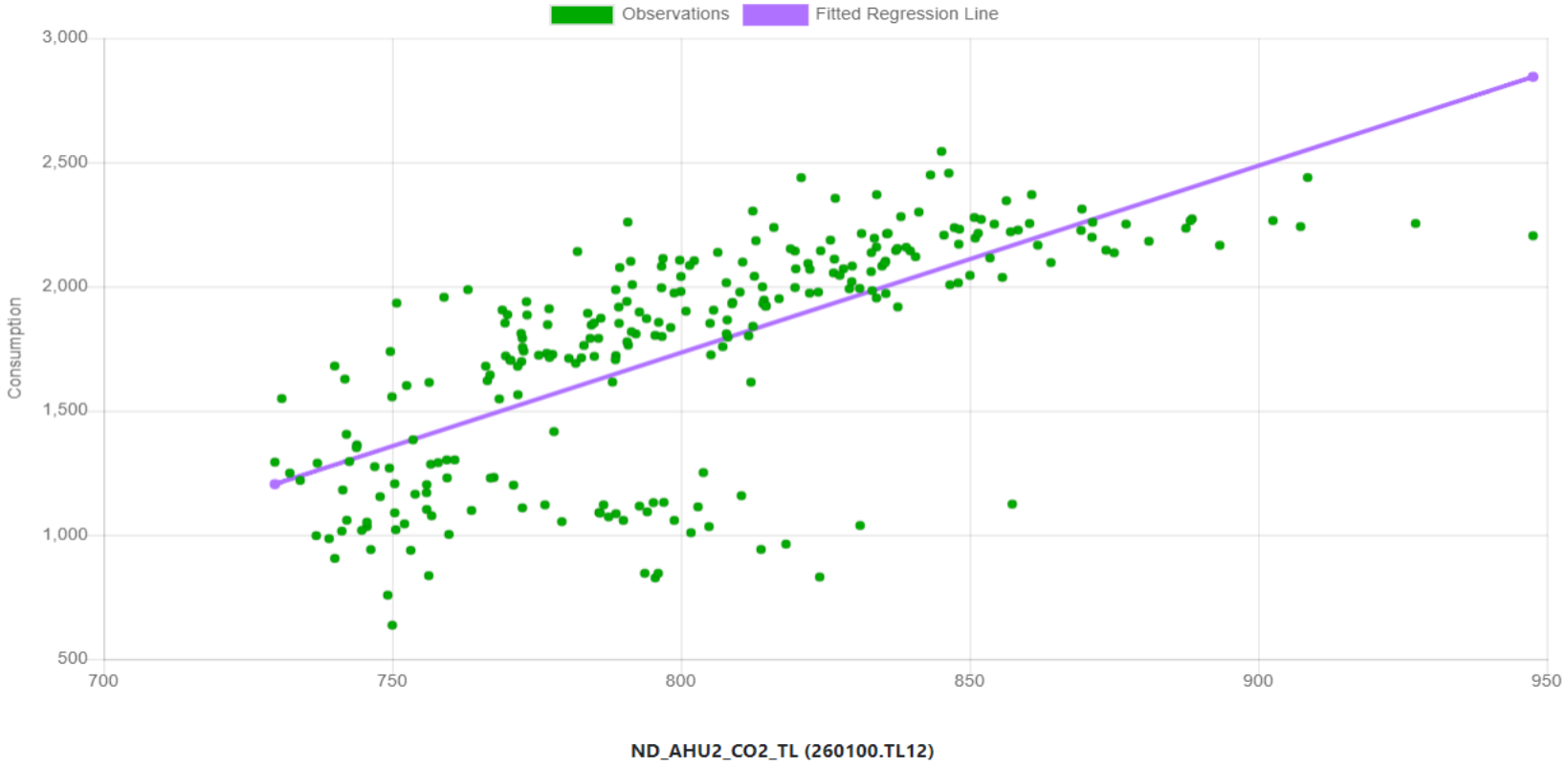


Changing Occupancy During COVID-19

Linear Regression Analysis Using Occupancy/CO_2



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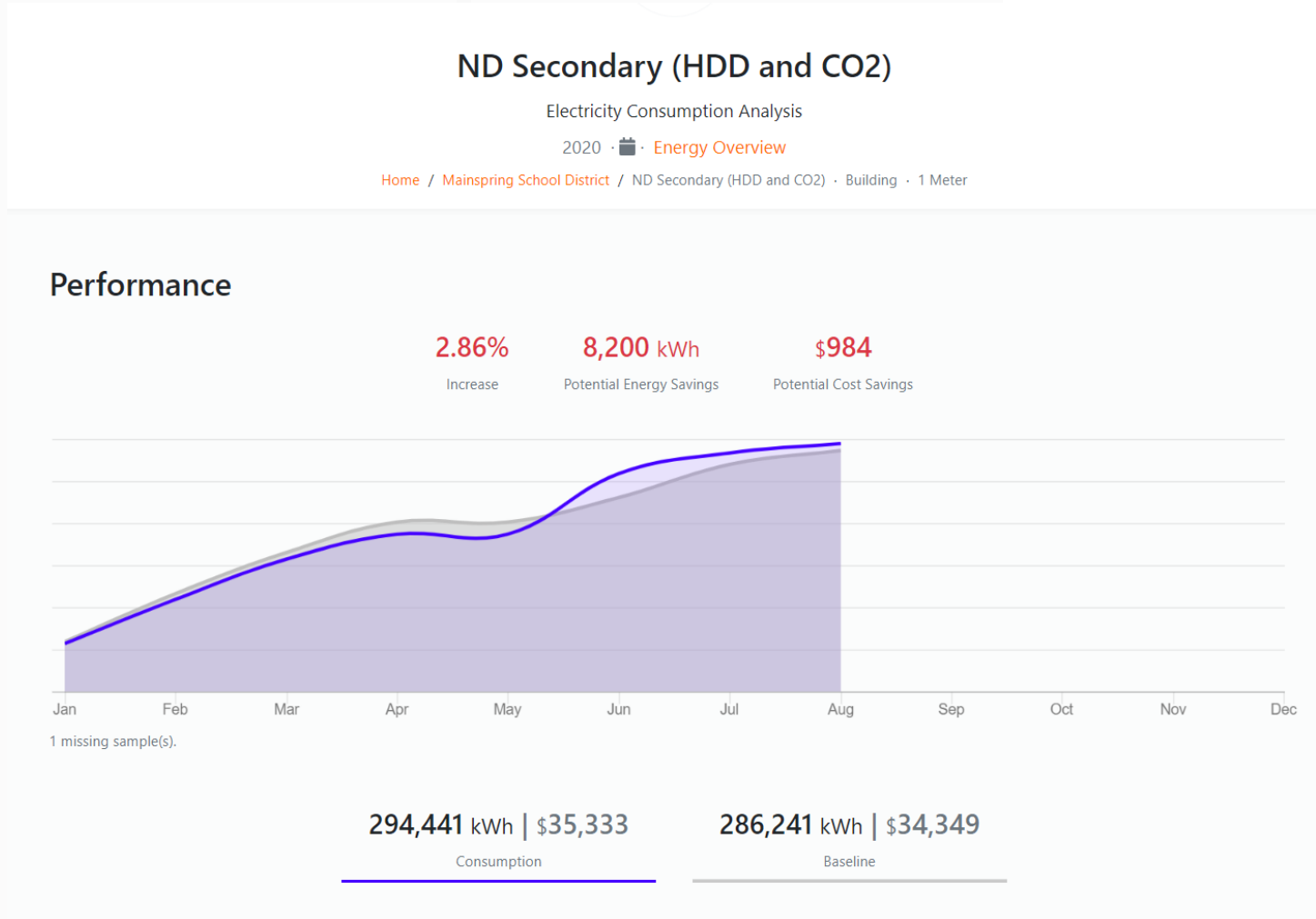
Energy Reporting During COVID-19

Two Independent Variables:

- Degree Days
- Occupancy/CO_2



Communicating Results to Occupants

- ✓ Gaining Trust and Building Confidence
- ✓ Delivering Reports

Don’t Wait to Communicate

- ✓ There is a greater need to communicate to your occupants now than before
- ✓ It is important to build occupant confidence
- ✓ Buildings that communicate vs buildings that do not – is this the new difference?

Delivering Compliance Reports

Tenants

- ✓ Posted sign
- ✓ Daily email
- ✓ Weekly communication meetings

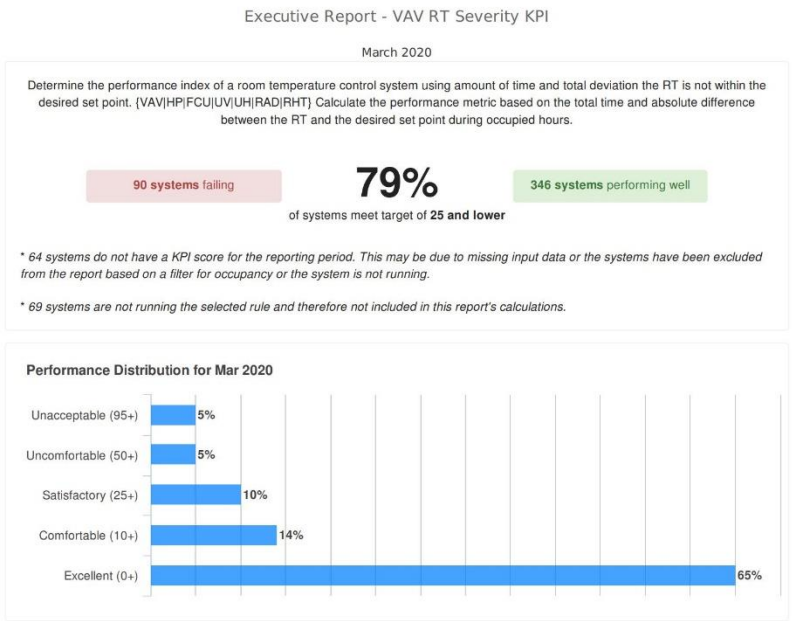
Public

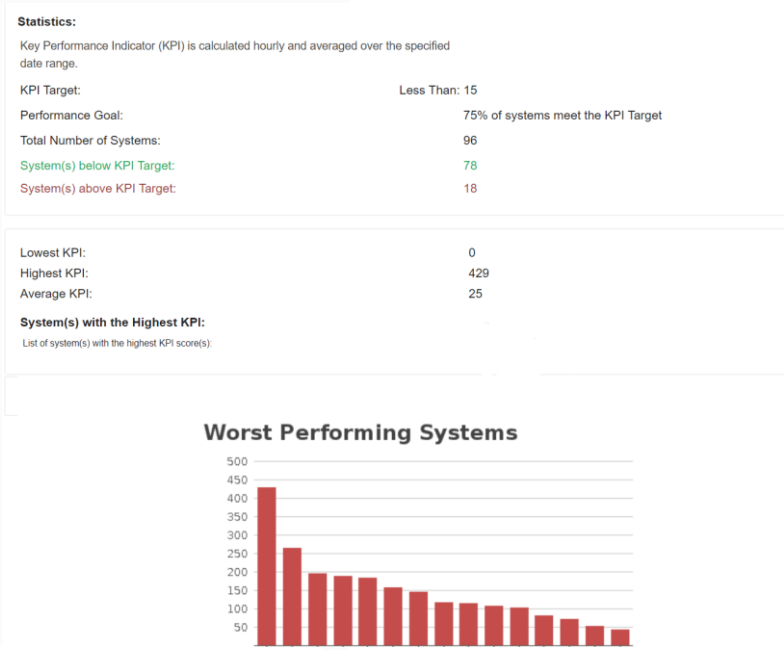
- ✓ Dashboards
- ✓ Website

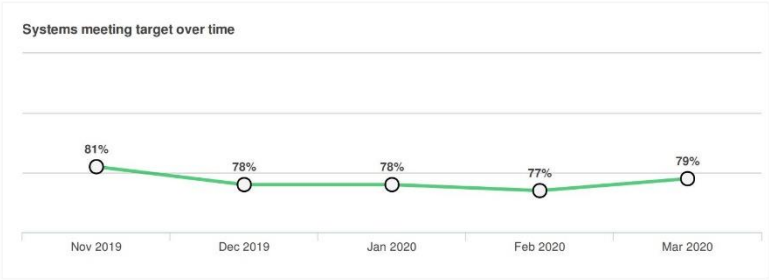
Owners

- ✓ Monthly emailed report
- ✓ Summary level info

Examples of High-Level Summaries







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Conclusion

- Building Analytics is a powerful tool that can be leveraged to operate your buildings safely and efficiently
- Consider investing in sensors that will improve occupant safety and equipment performance
- Energy Reporting initiatives should factor in changing occupancy
- Communicate safety metrics and building performance to occupants

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QUESTIONS?

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Course Number: EMA2006L

Thanks to our Associate Member: CopperTree Analytics

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