PROGRESSIVE

Successes in Energy Management @ Progressive

February 27, 2024

Topics

Intro & Ice Breaker

About Progressive and our Efforts

An Engineering Approach

HVAC & Building Automaton Programming

Lighting Projects

Campus 2 Solar Array

Energy Savings in a WFH & Hybrid World

Intro

- Erik Rasmussen, CEM
  - Sustainability Engineering Consultant
  - BS in Mechanical Engineering
  - 16 years of experience in energy engineering, auditing, HVAC, automation, and sustainability
  - Joined Progressive's Real Estate Engineering Team in 2013

- Mark Mansell, CEM
  - Senior Engineering Consultant
  - 44 Years of experience in commercial and industrial HVAC, automation, and electrical systems
  - Joined Progressive's Real Estate Engineering Team in 2007

REAL ESTATE & CORPORATE SERVICES

Ice Breaker

How much does Progressive spend on electricity annually?

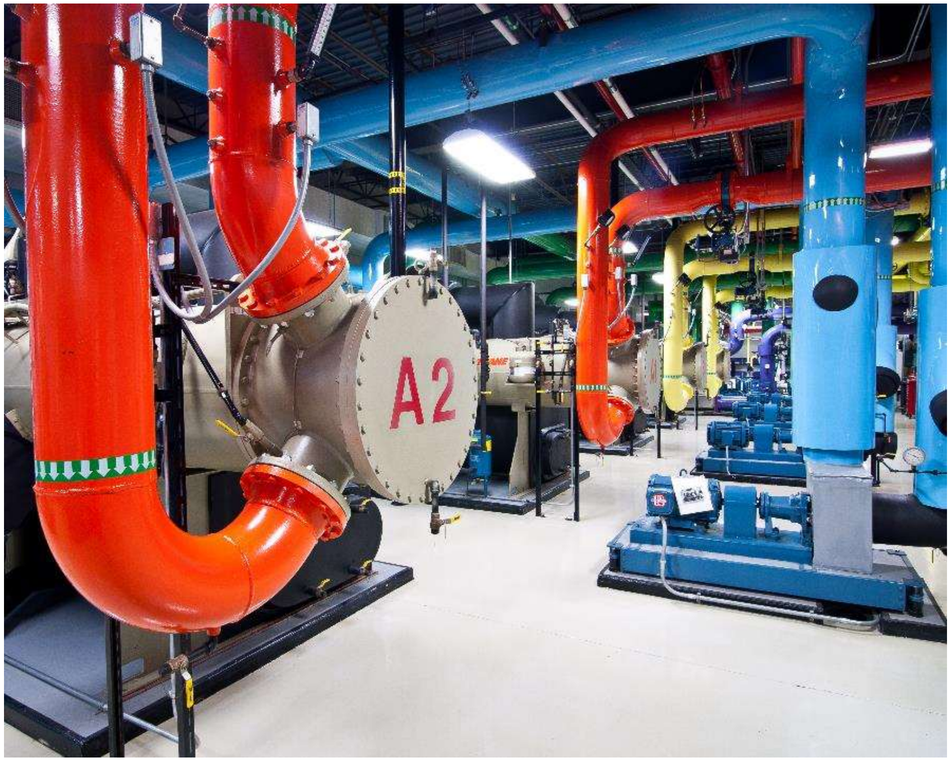
How many buildings does Progressive have nationwide?

About Progressive

- Progressive was started in Cleveland, OH in 1937. We are now the 2nd largest insurer of personal automobiles in the US with over ~$60B in premium written in 2022.
- Over 300 offices nationwide and over 50,000 employees
- ~6.5 Million square feet of office space
- Corporate campuses in Ohio, Florida, and Colorado Springs
- Consolidating multiple data centers to 3 primary locations

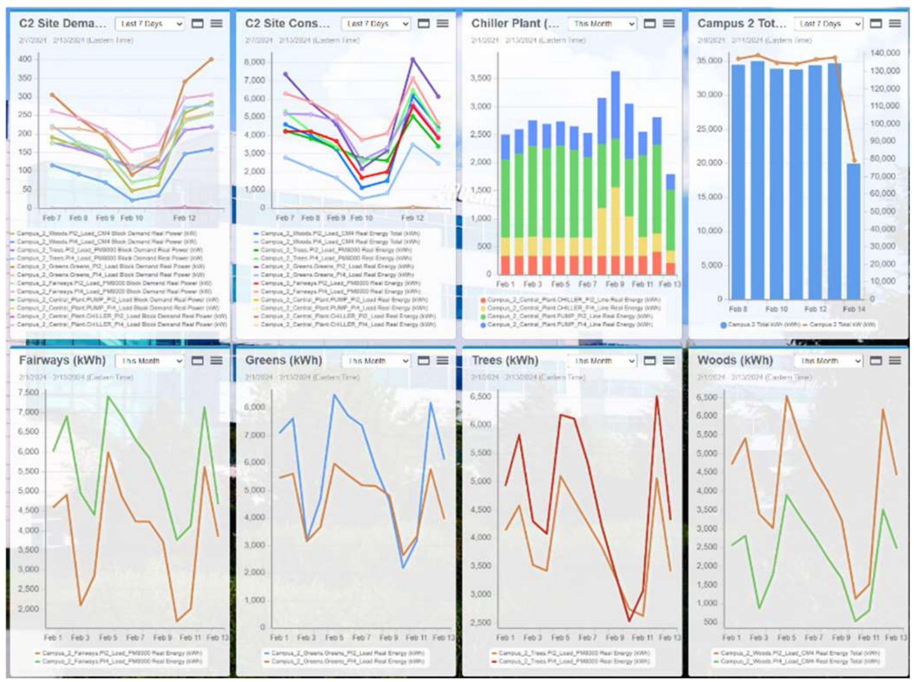
An Engineering Approach

- The Real Estate Engineering Team was formed in 2007 and is responsible for:
  - Building automation systems programming and administration
  - Review of project drawings
  - Run-the-business (RTB) efforts to ensure uptime
  - Energy management
  - Energy procurement
  - Environmental sustainability and carbon neutrality
- In-house teams for HVAC Techs, Electricians, and Plant Engineers



Energy Management Overview

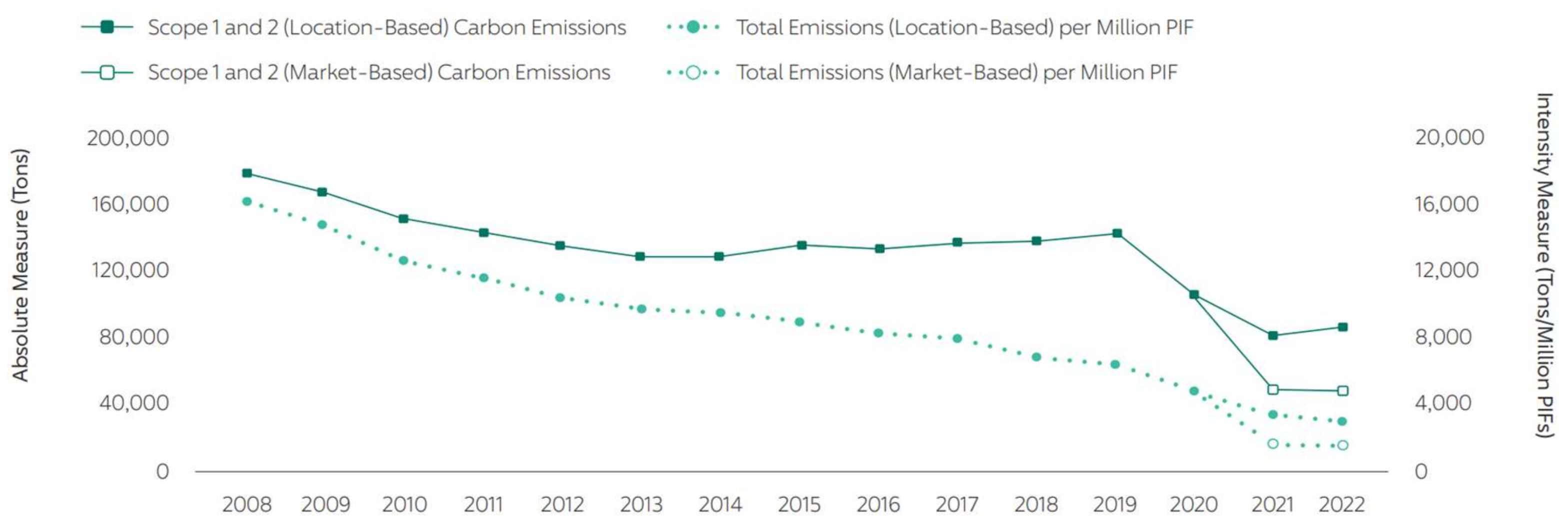
- Successfully reduced electric spend from ~$18M to ~$9M between 2007 and 2022 while doubling in size as a company
- Energy savings contest between regional sites



Sustainability Goals

- Progressive has been a good steward of the environment and reducing energy consumption before sustainability became a buzzword.
- Committed to Carbon Neutrality on Scope 1 & 2 carbon emissions by 2025
- Committed to Net-Zero in the following decade

Scope 1 and 2 Carbon Emissions 2008–2022[1]



HVAC & Building Automation Upgrades

2007

- Engineering team created
- Begin advanced automation programming and implementing schedules nationwide

2010

New 400-ton chiller and “free cooling” upgrades at Campus 1

2014

“Free cooling” upgrades at main data center

2018

Replace over 500 pieces of HVAC equipment and all related automation controls in 2 buildings at Campus 1

2020

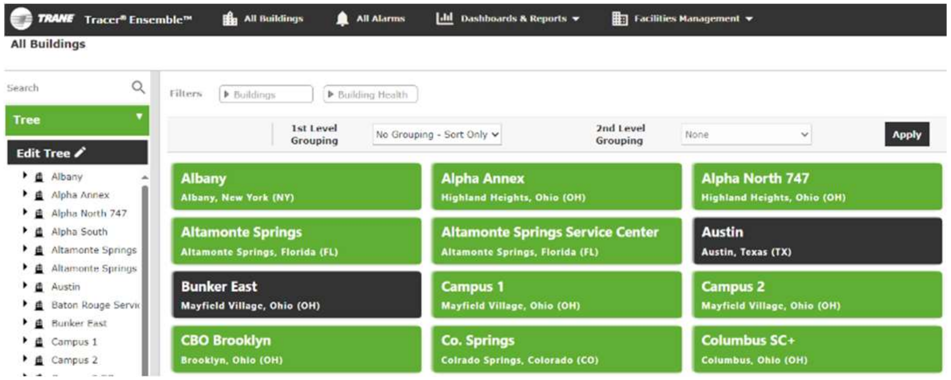
Replace the chillers at Riverview, FL campus with three new variable speed 300-ton chillers

Today

- Currently working on building automation upgrades at Campus 2
- Re-evaluation of previously differed energy projects through a sustainability lens

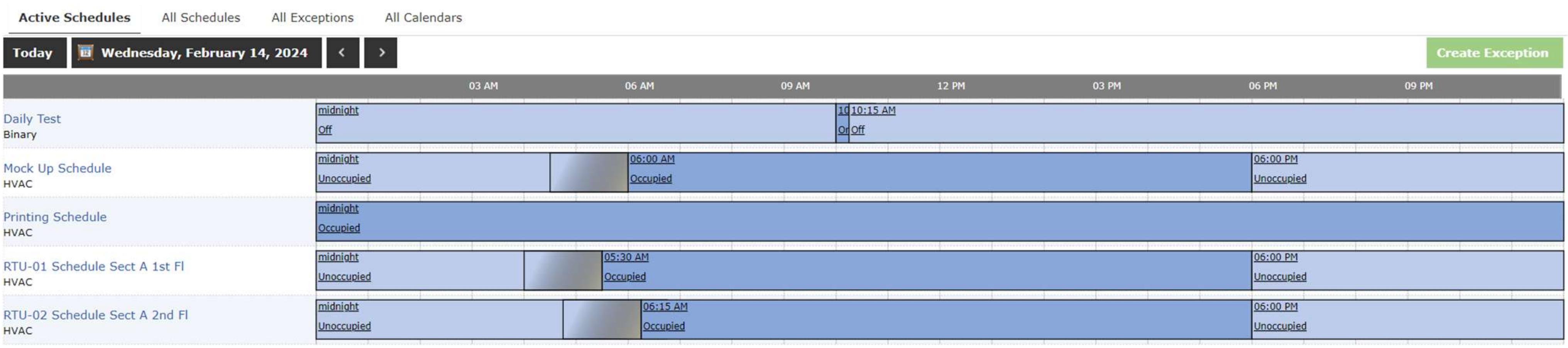
BAS Overview

- Multiple vintages of Trane controls including Tracker, Tracer Summit, and SC / SC+
- Nationwide enterprise network allows us to bring 63 sites into a common Tracer Ensemble web-based front end
- Engineering and HVAC team members have attended advanced factory training classes
- Bringing programming and troubleshooting in-house allows us to focus on solutions that are the best long-term solution rather than an “easy fix” for a contractor
- Data logging and alarming to alert us to malfunctions and energy inefficiencies
- You can’t optimize what you can’t measure!



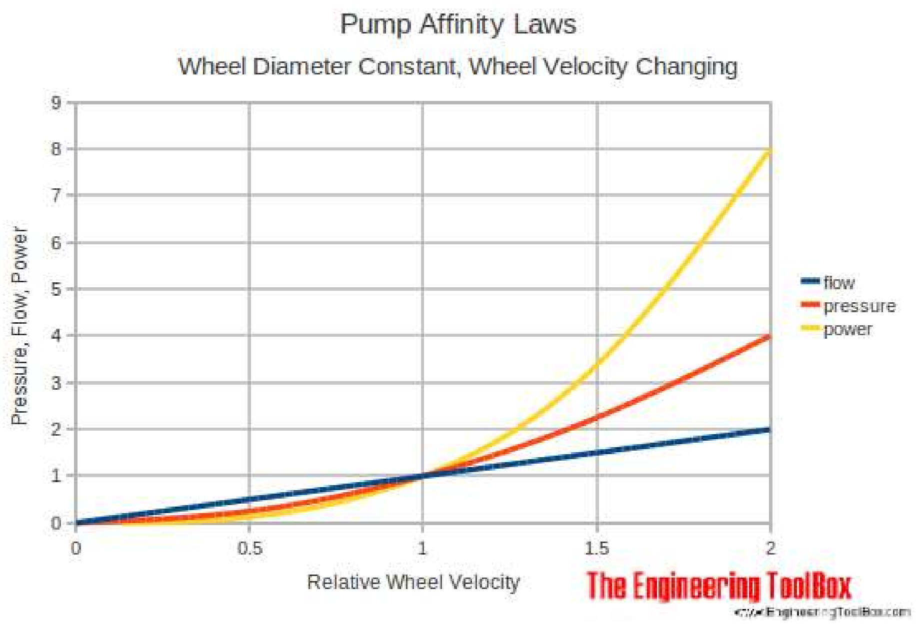
BAS Scheduling

- Getting accurate info from occupants and facility managers is key
- Make sending schedule updates part of the business groups' process
- Utilize advanced scheduling features such as Optimal Start / Stop
- Comfort and employee productivity must remain your top priority



Equipment Staging

- The Fan and Pump Affinity Law is your friend!
- Power consumption is cubed (x^3) relative to speed increase
- Focus on staging equipment based on efficiency curves.
- Avoid waiting until a piece of equipment reaches 100% speed or cannot make setpoint before adding.



Critical Zone Reset (VAS)

- Optimize duct static based on VAV damper positions
- Program increases duct static pressure of AHU or RTU when any one VAV reaches 95% air valve position
- Decrease the duct static pressure setpoint when all VAV's are less than 85% open
- It may be necessary to exclude some VAV's from the program. Examples include IT closets, unoccupied areas, stairwells, and thermostats impacted by sun exposure

Variable Air Systems

Delete | Create Variable Air System

	Name	Occupancy	AHU Heat/Cool Mode	Supply Fan	Discharge Air Temperature	Duct Static Pressure	Average Space Temperature
☐	RTU-1 VAS	Occupied	Cool	33.0 %	60.4 °F	1.230 in(H_2O)	72.4 °F
☐	RTU-2 VAS	Occupied	Cool	5.0 %	59.7 °F	0.870 in(H_2O)	72.6 °F
☐	RTU-3 VAS	Occupied	Cool	46.0 %	58.4 °F	1.160 in(H_2O)	70.9 °F

Critical Zone Reset (VAS) – Continued

RTU-1 VAS

Variable Air Systems

Outdoor Conditions
30 °F / 53 % RH

< Applications

Status | Alarms | Data Logs | Functions and Calculations | Configuration | Members | Support | Details

Log Data

Active Diagnostics

Conditions	Value
System Type	VAV
Duct Static Pressure Active	1.130 in(H_2O)
Duct Static Optimization Duct Static Setpoint	1.200 in(H_2O)
Outdoor Air Flow Active	---
Ventilation Optimization Outdoor Air Flow Setpoint	0.0 cfm

Status	Value
Occupancy Status	Occupied
Operating Mode	Occupied
System Mode	On
System Mode Time Remaining	---
Air Handler Mode Request	Occupied
Common Space VAV Mode Request	Occupied

Members

Air Handler

Name	Discharge Air Temperature	Discharge Air Temperature Setpoint Active	Duct Static Pressure Active	Duct Static Pressure Setpoint Active	Operating Mode	Occupancy Request	Controlled By
RTU-01	61.2 °F	62.3 °F	1.130 in(H_2O)	1.200 in(H_2O)	Occupied	Occupied	RTU-1 VAS

VAV Box

Name	Space Temperature Active	Space Temperature Setpoint Active	Air Valve Position Command	Operating Mode	Occupancy Request	Controlled By
VAV-01-1-001	74.3 °F	75.0 °F	34.0 %	Occupied	Occupied	RTU-01 AREA
VAV-01-1-002	75.3 °F	75.0 °F	45.0 %	Occupied	Occupied	RTU-01 AREA

Supply Air Reset

- Program calculates the average space temperature from multiple zones and compares to the heating or cooling setpoint
- This works best with uniform and standardized setpoints throughout the building or area to prevent zones from “fighting” each other

Linear Reset

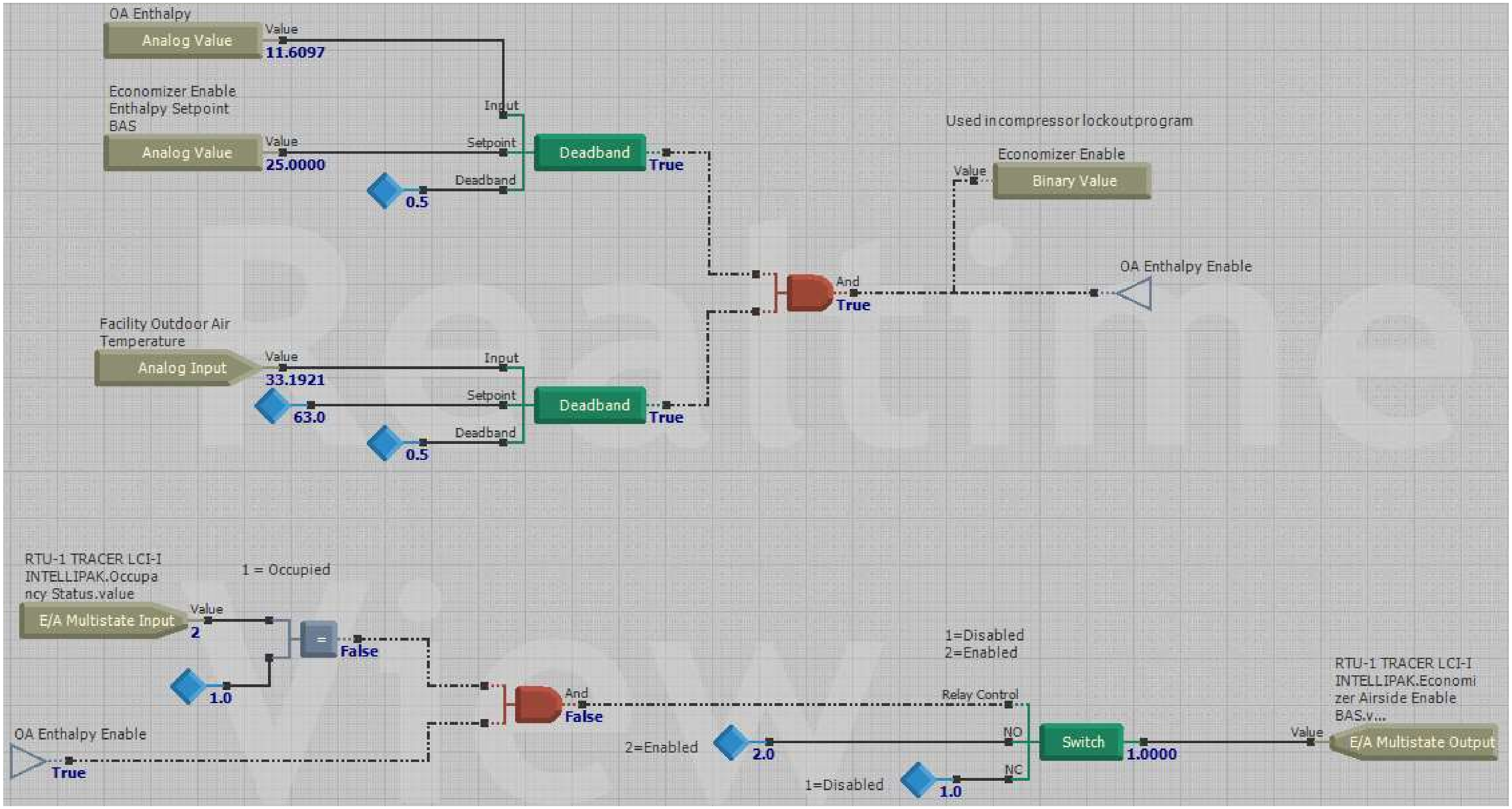
Actions... | Delete | Create Linear Reset

☐	Name	Input Reference	Input Reference Value	Output Reference	Output Reference Value	Update Frequency	Status
☐	RTU-01 DA Reset	Omega-N SC+ (30000) / RTU-01 AREA / Space Temperature Average / Value	72.5 °F	Omega-N SC+ (30000) / RTU-01 / Discharge Air Cooling Setpoint BAS / Value	63.0 °F	Update Every 1 Minute	Unconditional
☐	RTU-02 DA Reset	Omega-N SC+ (30000) / RTU-02 AREA / Space Temperature Average / Value	72.6 °F	Omega-N SC+ (30000) / RTU-02 / Discharge Air Cooling Setpoint BAS / Value	61.3 °F	Update Every 1 Minute	Unconditional
☐	RTU-03 DA Reset	Omega-N SC+ (30000) / RTU-03 Area / Space Temperature Average / Value	70.9 °F	Omega-N SC+ (30000) / RTU-03 / Discharge Air Cooling Setpoint BAS / Value	63.0 °F	Update Every 1 Minute	Unconditional
☐	RTU-04 DA Reset	Omega-N SC+ (30000) / RTU-04 AREA / Space Temperature Average / Value	70.2 °F	Omega-N SC+ (30000) / RTU-04 / Discharge Air Cooling Setpoint BAS / Value	60.0 °F	Update Every 1 Minute	Unconditional

Economizer Enthalpy Control

- Utilize a single high quality outdoor air temp and dewpoint or wetbulb sensor for all units in the building
- Possible to share the OADB and OAWB/DP between multiple geographically close buildings by sharing points through the network

Economizer Enthalpy Control Example



Chilled Water Reset Strategies

- Reset chilled water temperature setpoint based on outdoor air temperature
- Make sure chilled water temperature is low enough to allow dehumidification
- Reset secondary chilled water pump speed based on AHU CHW valve positions
  - This assumes a Primary/Secondary chiller plant design
  - Valves must be properly sized control valves and butterfly valves

Retro-Commissioning

- You can’t optimize broken equipment
- Damper and valve actuators either seized up or not calibrated are common culprits
- Consider implementing a sensor calibration program to check accuracy of sensors
- Perform daily rounds and “virtual” rounds by checking your BAS at the start of each shift

Successful Energy Projects

- Water-side free cooling and refrigerant migration chillers
- Riverview new chillers
- UPS replacements
- Campus VAV and BAS retrofit project
- All of these projects had a favorable ROI!

Lighting Retrofits

2012

Early LED retrofit projects began with exterior parking lot fixtures

2013-2014

LED lamp replacements began

- Elevator Cabs
- Campus 1 Main Street Downlights

2015

Industry starts to see steep decline in LED lamp and fixture costs

2016-2017

Larger scale roll out of projects including:

- Artwork Track Lighting
- Downlights

2018

- LED T8 “tubes” become economically viable
- Progressive purchases 25,000 LED T8 lamps to retrofit Campus 1, Discovery, Eastmark

2022 - 2023

- Retrofit ~20,000 lamps with LED at Campus 2
- Corporate-wide parking lot LED retrofits are in planning

Raccoon Approved!

Campus 2 Solar Array Construction

- Construction began in 2021
- Hurdles tying into the FirstEnergy substation delayed the project many months
- Began delivering power to Campus 2 in January 2023

Campus 2 Solar Array Facts

13 DC to AC inverters convert power from 4,134 solar panel modules generate 1.8 megawatts of power and are estimated to generate 2.3 million kilowatt-hours annually.

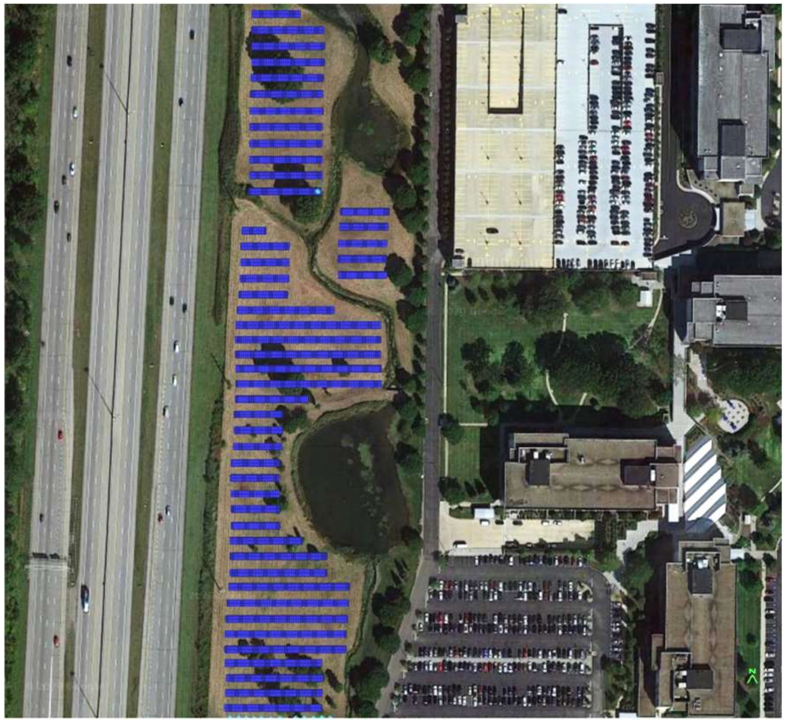
That's enough energy to:

Power 205 homes for a year

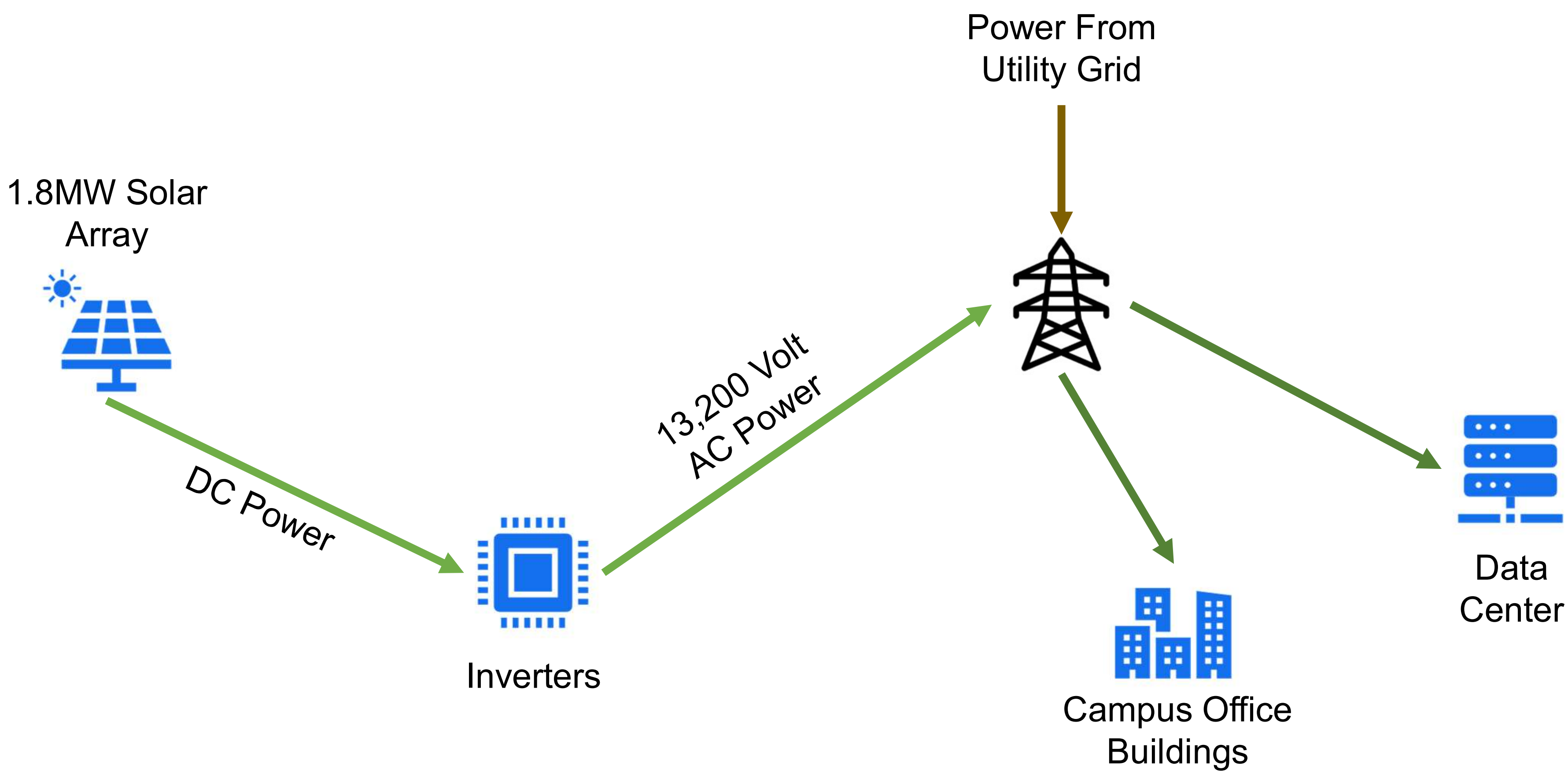
Drive 19 round trips to the moon in a Tesla Model Y

Charge 198 million smart phones

Compared to using coal to generate electricity, the solar array is the equivalent of planting 27,000 trees!



Campus 2 Solar Array Power Flow



Campus 2 Solar Array Performance

- Installation cost was ~$2.1M with a ROI of 6 to 8 years
- Annual energy savings ~$300k
- Estimated lifetime savings of up to $5M
- Feeds into utility substation which serves all of Campus 2 and data center

Shuttered Building Savings

- Minimize energy use in buildings in a WFH or hybrid world
- Set BAS systems to unoccupied
  - 60degF Heating Setpoints
  - 80degF Cooling Setpoints
  - Humidistats will occupy zones above 65% RH to dehumidify and prevent mold
- Alarming for zones that are outside of set parameters
- Work with business units to consolidate people to a minimal number of areas

Questions

Questions?

Thank You

Energy Successes @ Progressive

February 2024

Biographical Information

Erik Rasmussen, CEM

Erik is the Environmental Sustainability Program Manager at Progressive. He joined Progressive's Real Estate Engineering team in 2013 as a Facility Engineer. Erik holds a BS in Mechanical Engineering and has 16 years of experience in energy engineering, auditing, HVAC, automation, and sustainability.

Mark Mansell, CEM

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