

LEADING THE WAY

CampusEnergy2022

Feb. 15-18 | Westin Boston Seaport District Hotel | Boston, Mass.





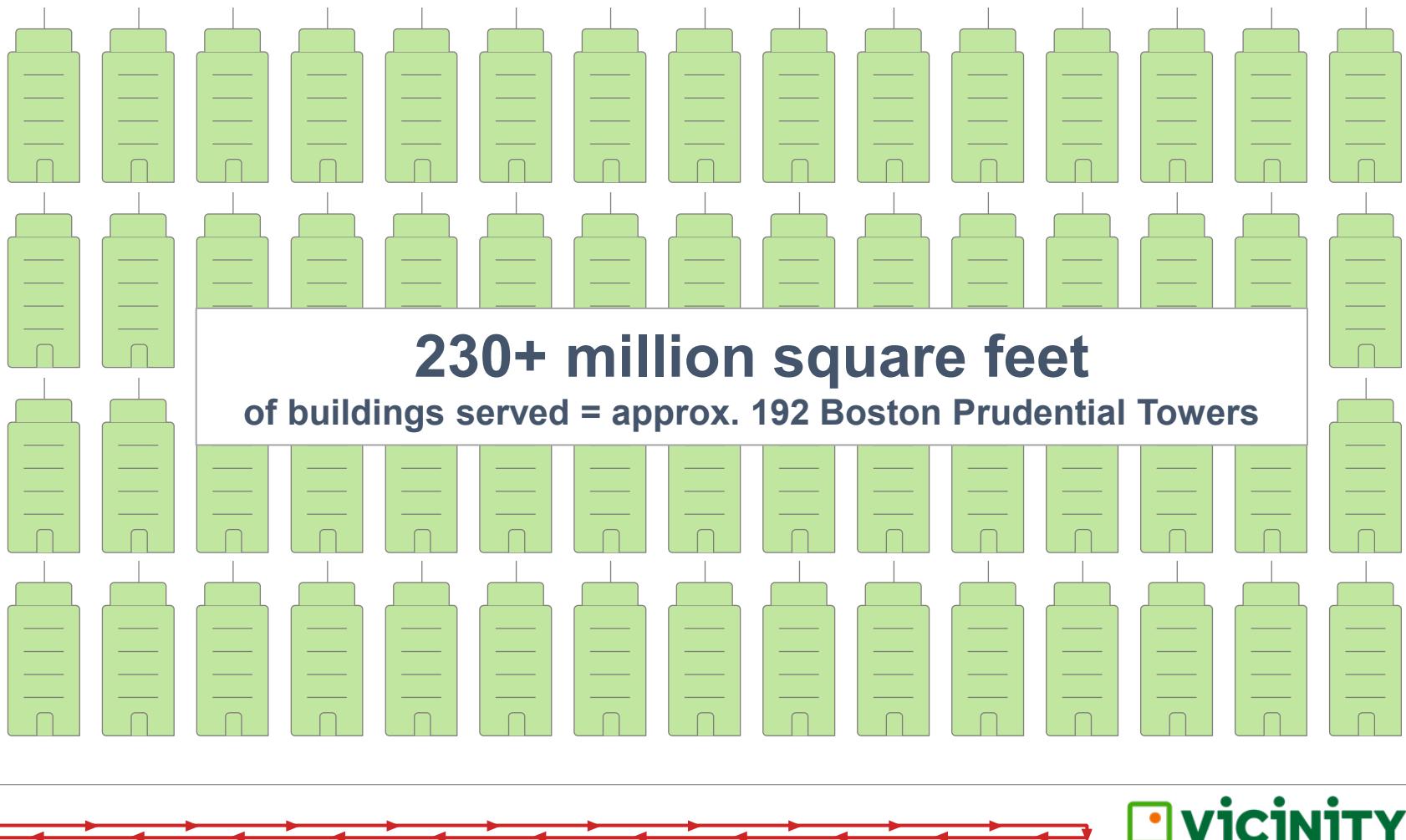
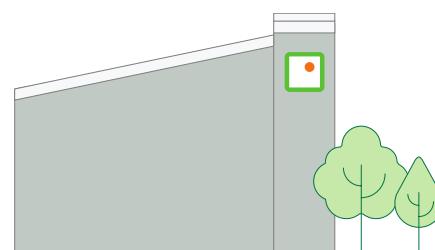
New Ways of Approaching Optimization at Vicinity Energy's Baltimore District Cooling Campus

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Ben Erpelding, P.E., *Chief Technology Officer*, Optimum Energy

About Vicinity

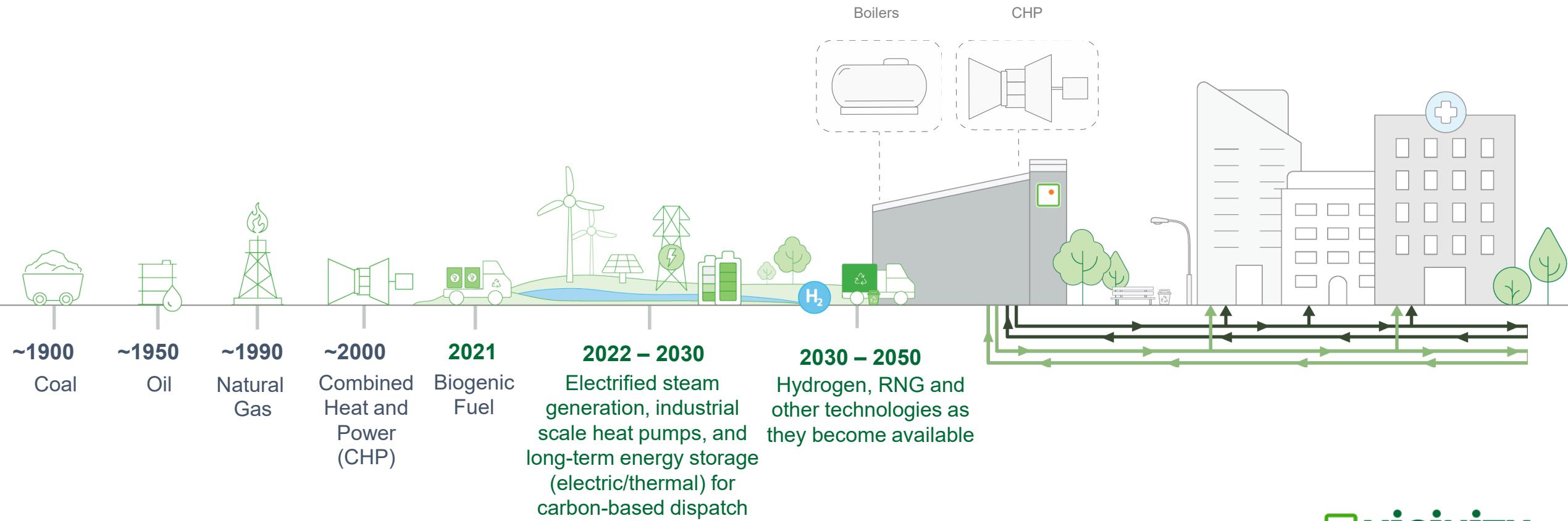
Vicinity's assets are poised to support building decarbonize and lower carbon emissions in our communities.

- **19 district energy systems** poised for decarbonization nationwide
- **230+ million square feet** of buildings served
- **400+ MW of CHP** owned and operated
- Potential to **avoid 2 million metric tons of carbon annually**



Leading the Way to New Innovative Energy Sources

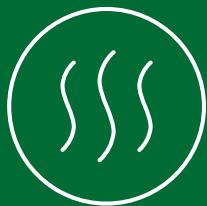
Vicinity Energy has a 100-year history of greening and is aggressively pursuing innovative technologies to achieve ***net zero carbon emissions by 2050... or sooner.***



The 4 Pillars of our Net Zero Carbon Roadmap

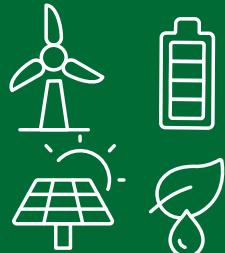
As clean energy technology continues to evolve, our team is dedicated to adapting quickly to emerging trends and developing innovative solutions and opportunities to green our system.

Green Steam



Systems fed with low carbon, CHP green steam

Agile Operations & Fuel Flexibility



Able to apply the latest fuel and technology innovations to our portfolio

Investments in Efficiency



Constantly improving efficiency of our systems and investing alongside our customers

Reliability and Resiliency



Delivers 99.99% reliable clean energy to our customers 24/7

Agile Operations & Fuel Flexibility – Biogenic Liquid Fuel

Vicinity is partnering with Lifecycle Renewables in Pennsylvania and Massachusetts to purchase waste cooking oil to replace the use of #6 oil.

- LR100 has the lowest carbon footprint of any commercially available biofuel.
 - Simple water removal and filtration process
- Introduces a circular economy of repurposing waste cooking oil from restaurants, food manufacturers, hospitals, and cafeterias
- Reduces greenhouse gas emissions by over 80% and reduces particulate matter emissions by 10 times
- Keeps waste out of the municipal wastewater systems and landfills
- Reduction in SO₂, NO_x, CO, and PM over #6 and ULSD fuels
- Minimal modifications necessary on fuel oil burners or equipment.



Investments in Decarbonization – Vicinity is Electrifying Now

Our aggressive decarbonization plan includes electric boilers, industrial-scale heat pumps, thermal batteries, among other cutting-edge technologies on the horizon.



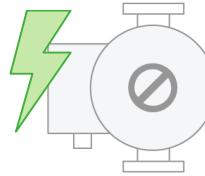
Electric Boilers

2021/22 –

- 50MW electric boiler (120,000 lb/hr)
 - In final design
 - Equipment being sourced
- Filing process with ISO-NE has begun

2023/24 –

- Installation of electric boiler at Kendall Station
- Connected to existing high-voltage transmission lines
- Heating produced will be from net zero/renewable power



Heat Pumps

2021/22 –

- 3rd party design nearly complete
- Issuing a request for proposal (RFP)

2023/25 –

- Plan to install largest heat pump complex in MA
- Use heat “lifted” from the Charles River to make steam and preheat the feedwater
- Dramatically reduces our carbon footprint in the near term



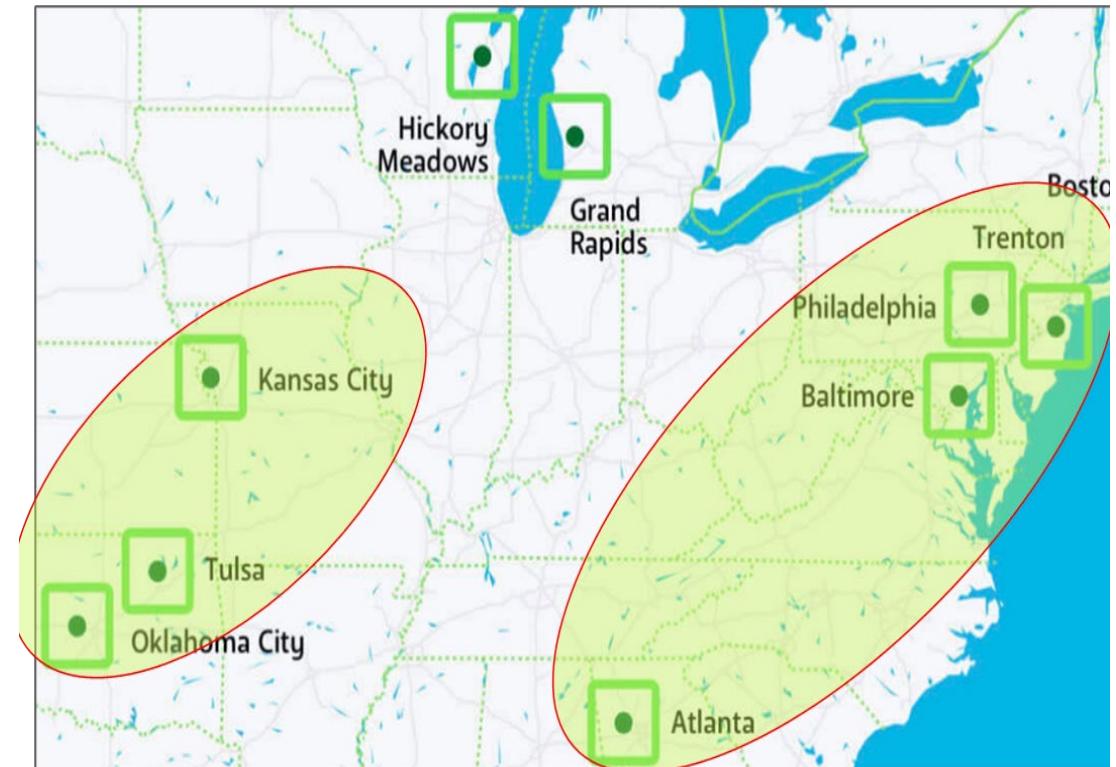
Thermal Salt Batteries

2026/27 –

- Mitigate cost and carbon content of electrical peaks by “peak shaving”
 - Alignment with winter offshore wind peak
- Dramatically lower cost of electrified steam, driving adoption

Investments in Efficiency – Vicinity Chilled Efficiency Optimization

- Vicinity has partnered with Optimum Energy access the potential for Optimizing the chilled water operations at their plants.
- The sites were assessed based on the opportunity for Vicinity to gain savings at the site.
- Not all sites were equal in the opportunity for savings.
- Optimum looked at each site holistically and performed optimization modeling to maximize the efficiency of the entire chilled water system.



Vicinity Chilled Efficiency Optimization – Sites

- Vicinity Site selection:
 - Total cost of the project
 - Utility incentive
 - Internal financial and operational review of Optimum's savings model
 - Expected annual savings
- Vicinity and Optimum reviewed Vicinity's seven chilled water operations
- Vicinity's Baltimore site was selected for a pilot project in late 2020 and the project was completed in the Fall of 2021
- Next Systems for Optimization are our Trenton and Oklahoma City sites

Vicinity Baltimore – Overview

Sustainable Green Steam for a Cleaner Future

Over 50% of the steam delivered to Baltimore customers is “green steam”—steam generated through zero carbon, non-fossil fuel-based renewables. By using sustainable, alternative fuel sources, Vicinity is reducing Baltimore’s carbon footprint by nearly 30,000 tons per year and helping Maryland meet its goal of generating 50% of its energy from renewable resources by 2030. These efforts align with Vicinity’s Clean Energy Future—our formalized commitment, vision and roadmap to achieve net zero carbon by 2050.

Central Chilled Water and Ice Storage is Keeping the City ‘Cool’

Vicinity also supplies many buildings in the downtown Baltimore business corridor with reliable central chilled water services—offering a cost-effective alternative to replacing, operating and maintaining in-house cooling equipment. As one of the largest ice thermal storage systems in the U.S., Vicinity’s innovative system uses ice to augment electrical chilling capacity during the day. By reducing electricity use during peak demand, Vicinity takes pressure off the electrical grid when power usage is at its highest, while also helping to reduce costs for customers.

Vicinity Baltimore – District Cooling System

- Plant 1
 - 3 x 1800-ton Trane Duplex chillers
 - 48,500 ton-hrs of ice TES
- Plant 2
 - 3 x 2000-ton York YK chillers
 - 3 x 1280-ton FES screw chillers
 - 40,500 ton-hrs of ice TES
- Plant 3
 - 2 x 1700-ton and 3 x 1350-ton Trane chillers
- Plant 4
 - 1 x 2400-ton Trane Duplex chiller

Vicinity Baltimore Baseline

Base load
approximately 1700
to 2000 tons

Peak load
approximately
16,500 tons

Month	Total				
	Ton-hrs	Total kWh	kW/ton	Plant kWh	Plant kW/ton
Jan	1,575,900	1,389,788	0.882	1,173,645	0.745
Feb	1,355,600	1,265,841	0.934	1,060,172	0.782
Mar	1,698,600	1,838,723	1.082	1,627,817	0.958
Apr	2,785,300	2,776,023	0.997	2,565,318	0.921
May	4,364,200	4,205,115	0.964	3,994,210	0.915
Jun	5,643,900	5,157,244	0.914	4,946,339	0.876
Jul	7,541,000	7,490,931	0.993	7,280,025	0.965
Aug	6,988,800	7,206,162	1.031	6,995,256	1.001
Sep	5,503,500	4,968,650	0.903	4,757,744	0.864
Oct	3,435,114	3,054,158	0.889	2,843,252	0.828
Nov	1,706,814	1,600,786	0.938	1,465,329	0.859
Dec	1,622,800	1,485,894	0.916	1,275,835	0.786
Totals	44,221,528	42,439,315	0.960	39,984,942	0.904

Summary of Scope of Work

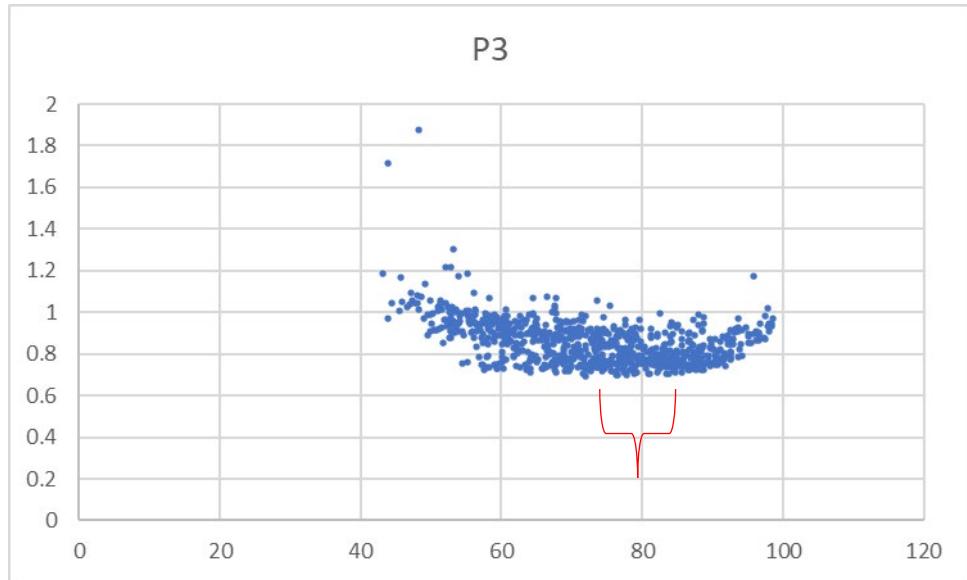
Plant 1, 2, 3 and 4

- Convert plant to variable primary-only
- Add VFDs to condenser water pumps
- Add VFDs to cooling tower fans
- Add new chiller flow meters
- Move integral Trane chiller supply temperature sensors
- Clean hot deck of cooling towers
- Fix cooling tower fan sheaves and fan pitch
- Clean dirty strainers
- Add power meters to each of the three (3) York chillers
- Open manual throttle valves at all pumps
- Chilled water plant and district optimization



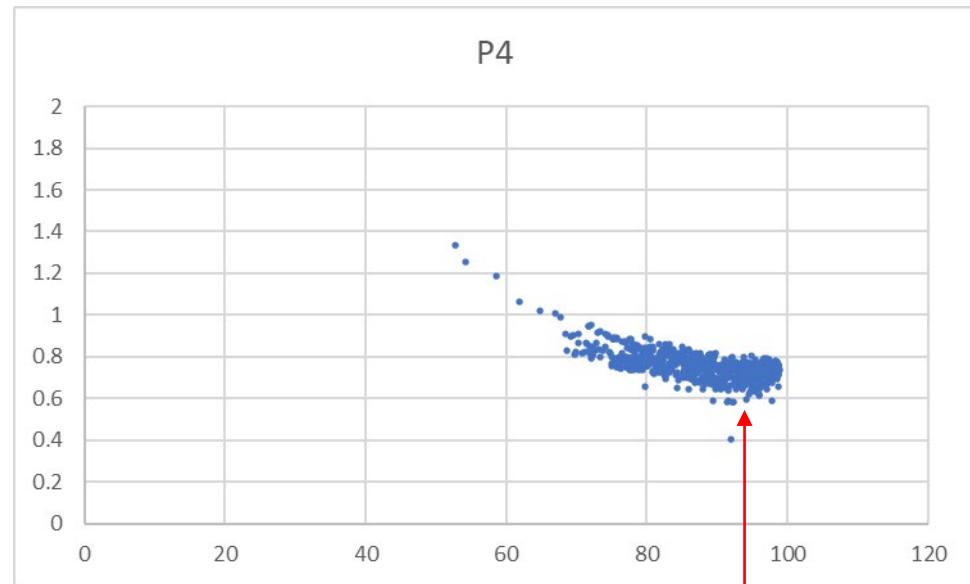
Optimized District Plant Staging

DP controlled plant (master plant)

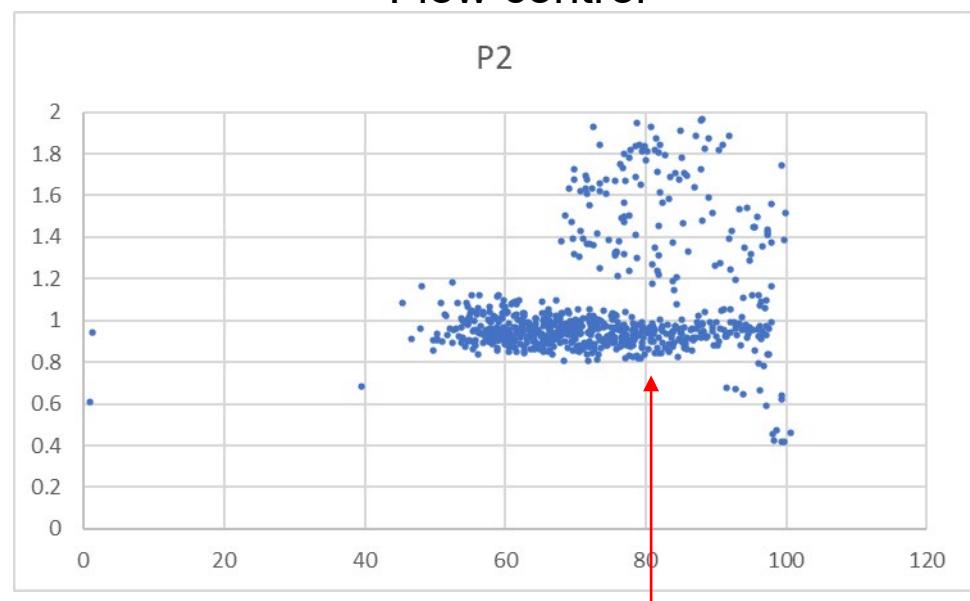


Total Plant kW/ton vs average full load amps on running chillers

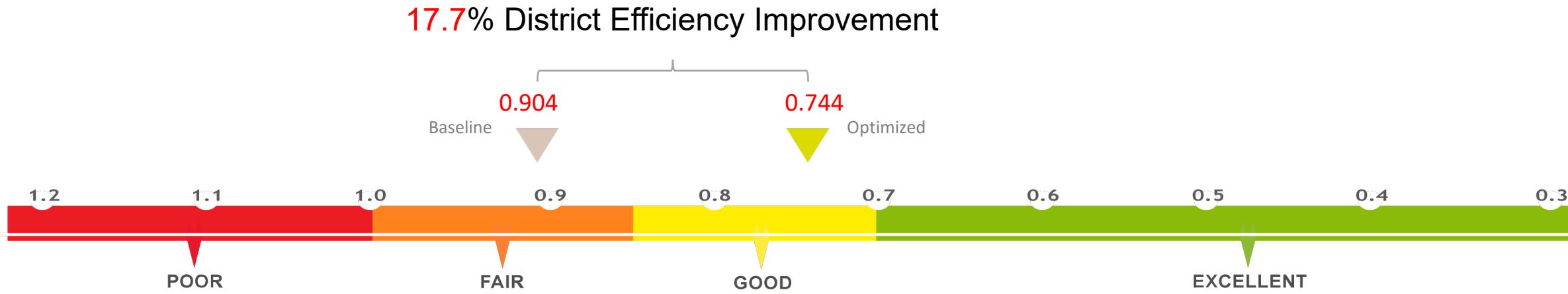
Flow control



Flow control



Vicinity Baltimore



Average annual chilled water plant efficiency in kW/ton.
Input includes: chillers, tower fans, condenser pumps, and chilled water pumping.

7,067,000 kWh/yr in savings
\$1,025,000 BG&E Utility Incentive

Lessons Learned

- Healthy cooling towers
- Good instrumentation
- Optimization is a journey not a one-time event

Totals For Vicinity				
OAT	OE Chiller Ton	Vicinity Tons	CT kW/Ton	Chiller kW/Ton
74.5 °F	8342.4 Tons	8370.2 Tons	0.030 kW/Ton	0.545 kW/Ton
OAH	OE Total Plant kW	Vicinity Total kW	CDWP kW/Ton	Dist CHWP kW/Ton
29 %	5,504.6 kW	5,788.6 kW	0.044 kW/Ton	0.047 kW/Ton
OATWB	OE Plant Eff.	Vicinity Plant Eff.		
56.0 °F	0.659 kW/Ton	0.691 kW/Ton		

Questions

Thank You!

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Vicinity Energy

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