Better Buildings Webinar Series

We'll be starting in just a few minutes….

Tell us…

What topics are you interested in for future webinars?

Please go to **slido.com** and use event code **#DOE** to submit your responses.

Scaling Impact: Multi-Building Approaches to Carbon Reduction

December 1, 2020

3:00 – 4:30 pm EDT

Sarah Zaleski

Senior Advisor – Building Technology Office

U.S. Department of Energy

U.S. DEPARTMENT OF ENERGY

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Polls 1 & 2

We'd like to hear more about you!

Please go to www.slido.com and enter code **#DOE** to respond

Agenda

1. Catalyst Project
2. National Western Center Project
3. National Renewable Energy Laboratory
4. Q&A

Today's Presenters

Catalyst Project

Brad Liljequist
McKinstry

Nick Edney
McKinstry

National Western Center Project

Barb Frommell
City & County of Denver, CO

Laura Rip
Jacobs Engineering Group

National Renewable Energy Laboratory

Shanti Pless
NREL

Ben Polly
NREL

Catalyst Project

Brad Liljequist

McKinstry

Nick Edney

McKinstry

US Department of Energy Better Buildings Webinar

Scaling Impact: Multi-Building Approaches to Carbon Reduction

McKinstry
For The Life Of Your Building

Zero Energy + Carbon: Catalyst + South Landing

Spokane University District

GONZAGA UNIVERSITY

WASHINGTON STATE UNIVERSITY

UNIVERSITY of WASHINGTON

EASTERN WASHINGTON UNIVERSITY EWU 1882

Community Colleges of Spokane

Spokane Community College

Spokane Falls Community College

WHITWORTH UNIVERSITY

Spokane University District

GONZAGA UNIVERSITY

WASHINGTON STATE UNIVERSITY

UNIVERSITY of WASHINGTON

EASTERN WASHINGTON UNIVERSITY
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Spokane Falls Community College

WHITWORTH UNIVERSITY


McKinstry
For The Life Of Your Building
South Landing


McKinstry
For The Life Of Your Building
Catalyst
South Landing


McKinstry
For The Life Of Your Building
District Plant
Catalyst
South Landing

McKinstry
For The Life Of Your Building

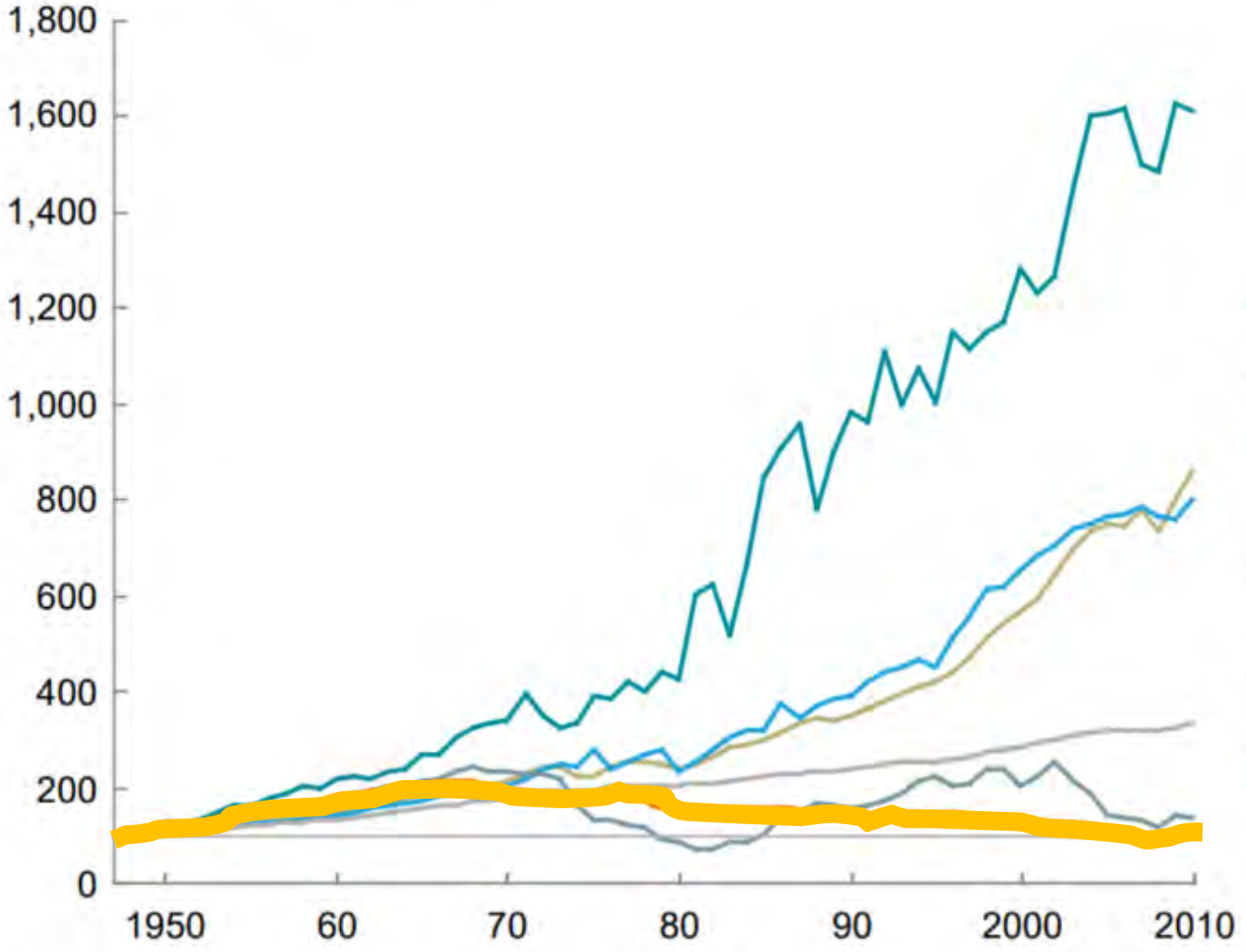
EMERALD INITIATIVE

AVISTA

KATERRA

EASTERN WASHINGTON UNIVERSITY
EWU
1882

Gross value added per hour worked

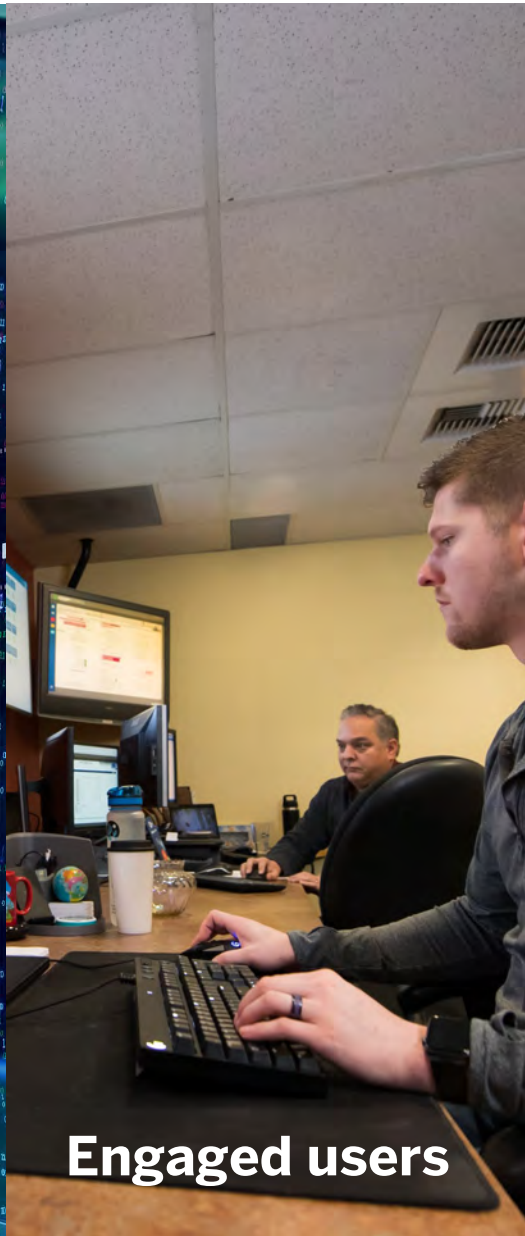


	Compound annual growth rate, 1947–2010 %	Total change
Agriculture	4.5	16.1x
Manufacturing	3.5	8.6x
Wholesale and retail	3.4	8.0x
Overall economy	1.9	3.3x
Mining	0.5	1.4x
Construction	0.1	1.1x

Productivity gains by industry

McKinsey Global Institute (2017). Reinventing Construction: A Route to Higher Productivity.

Expanding the view - Energy District elements



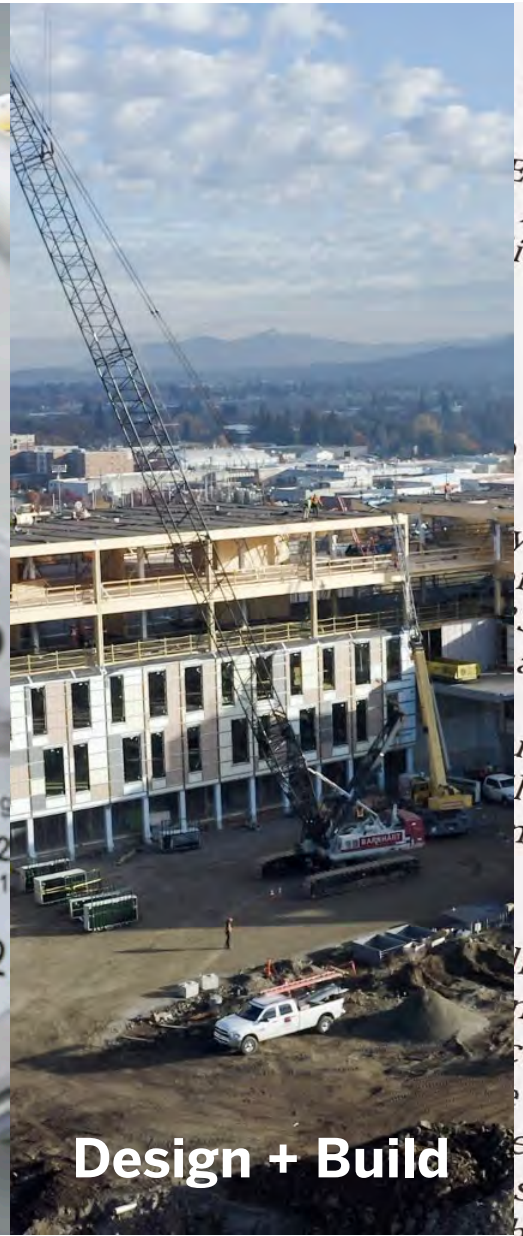
Catalyst – ZE + ZC cornerstone

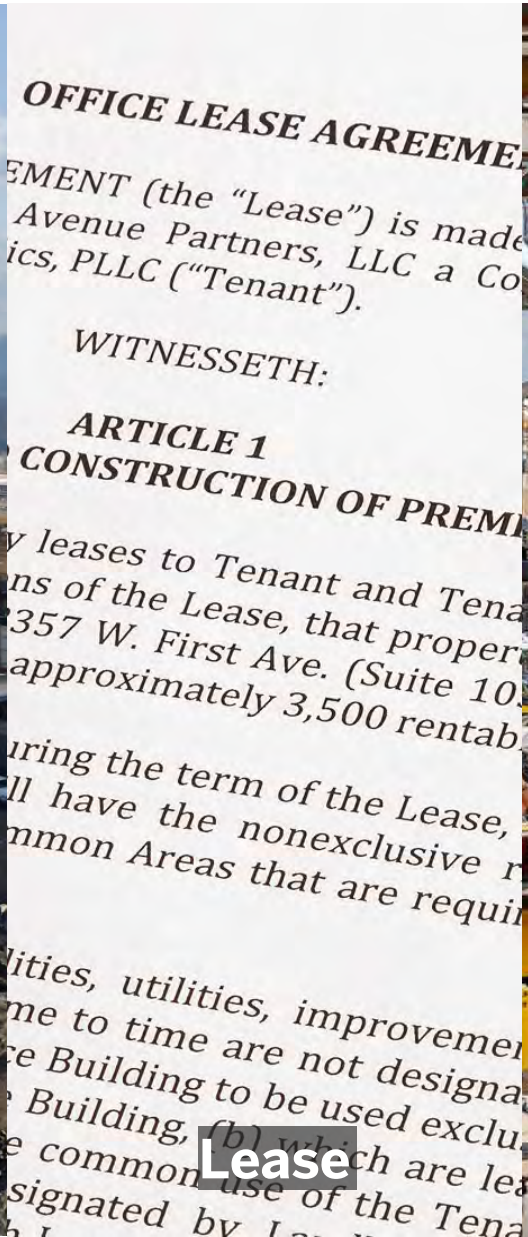
Catalyst – ZE + ZC cornerstone

- Narrow E/W floorplates
- Envelope: insulation
- Envelope: air sealing
- Envelope: windows
- Dedicated outdoor air system
- Diurnal cooling
- Deep daylighting
- Deep plug load engagement
- Cross laminated timber
- bit.ly/mckcatalyst

On- and off-site renewables

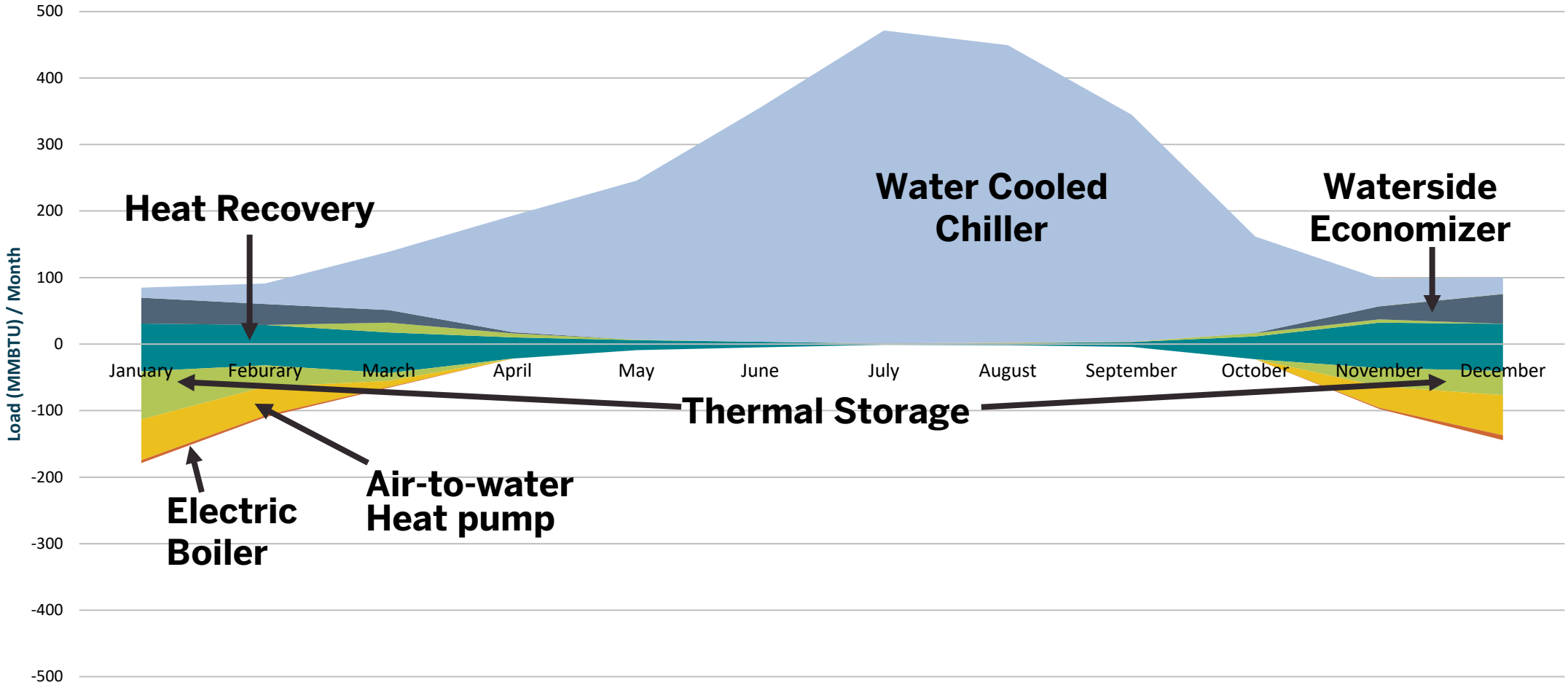
A siloed value chain = opportunity



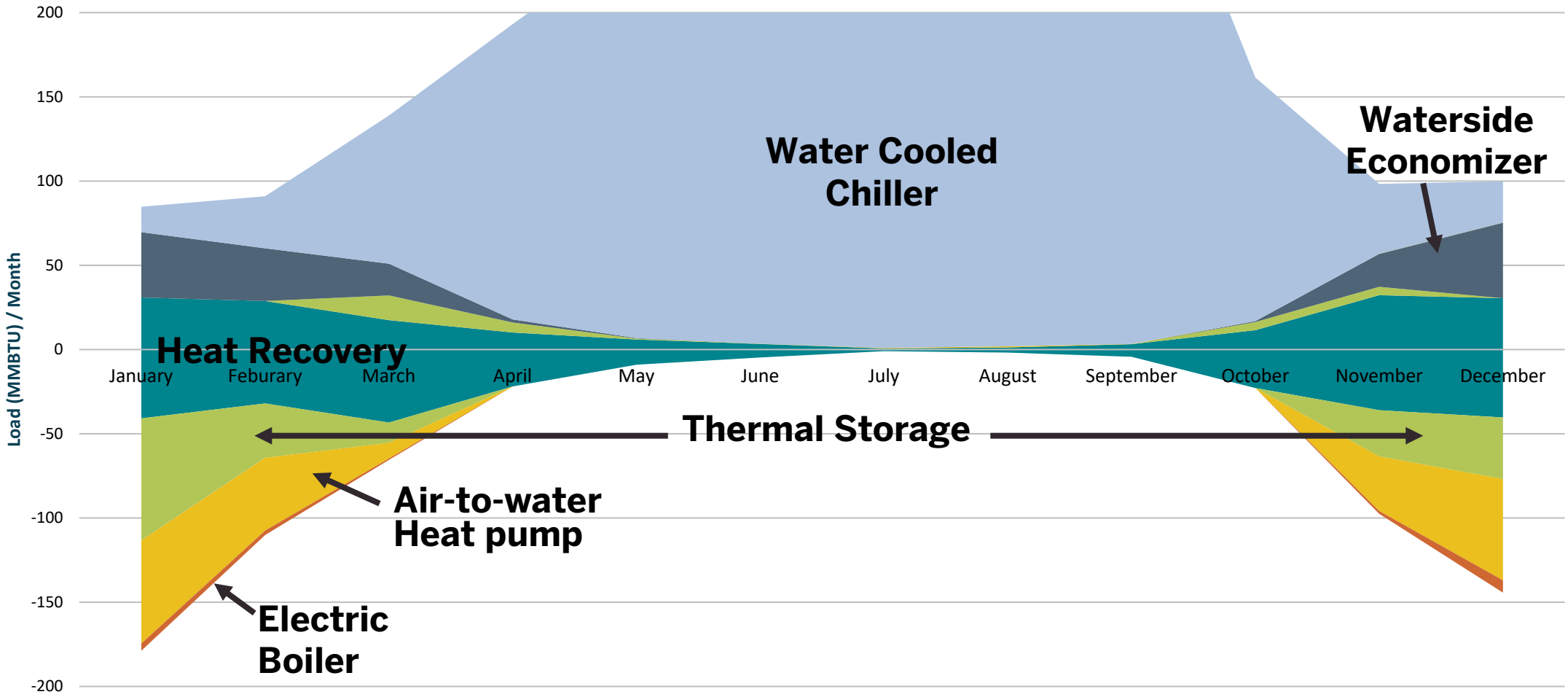


South Landing heating + cooling plant

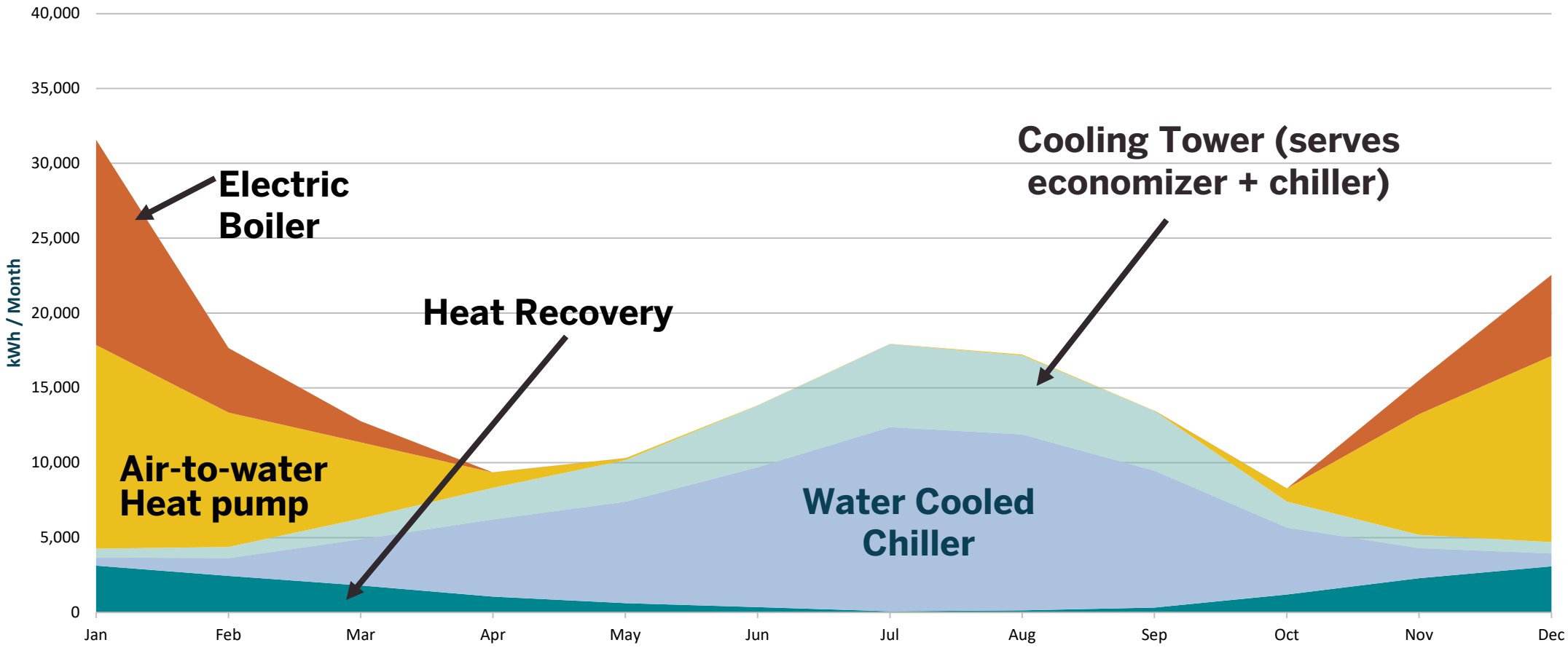
South Landing heating and cooling (provided btu's) by equipment type



South Landing heating and cooling (provided btu's) by equipment type (enlarged)

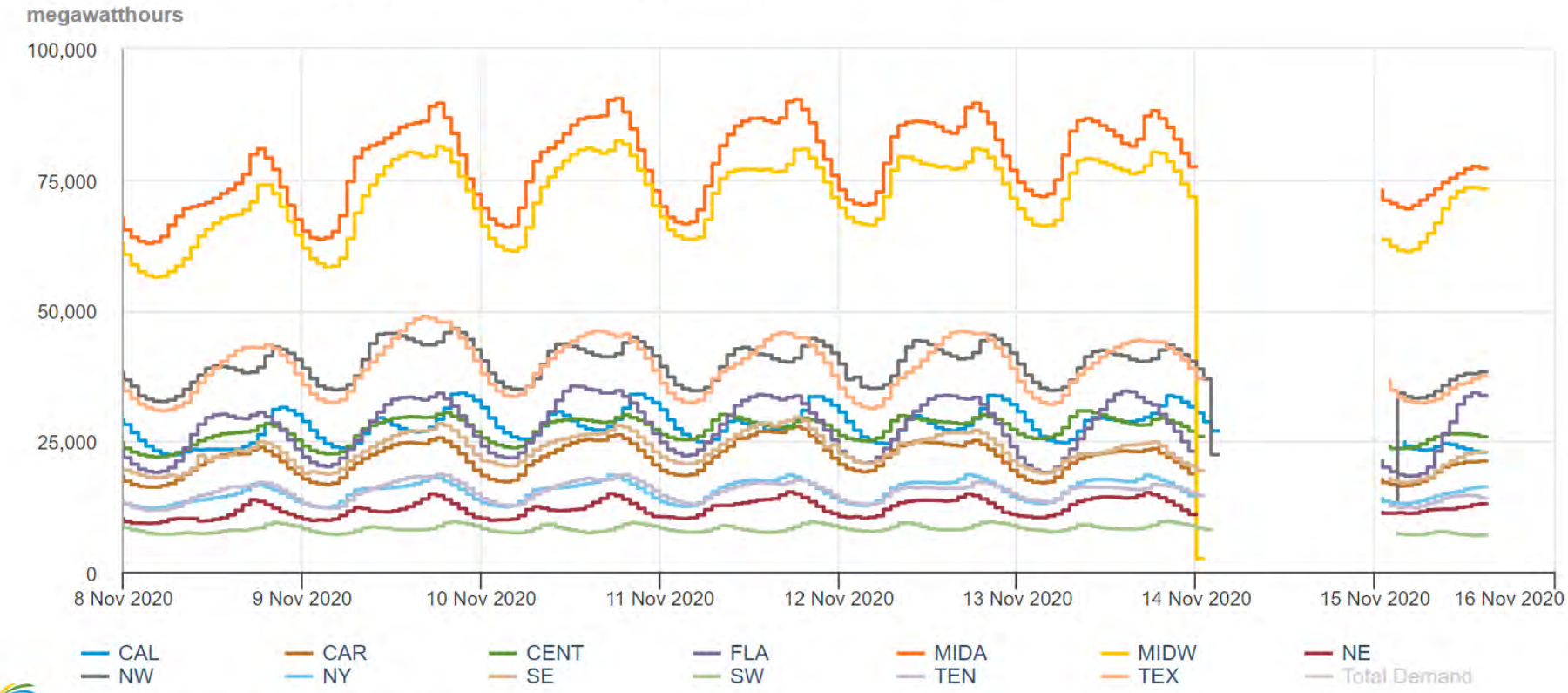


South Landing heating and cooling electricity use



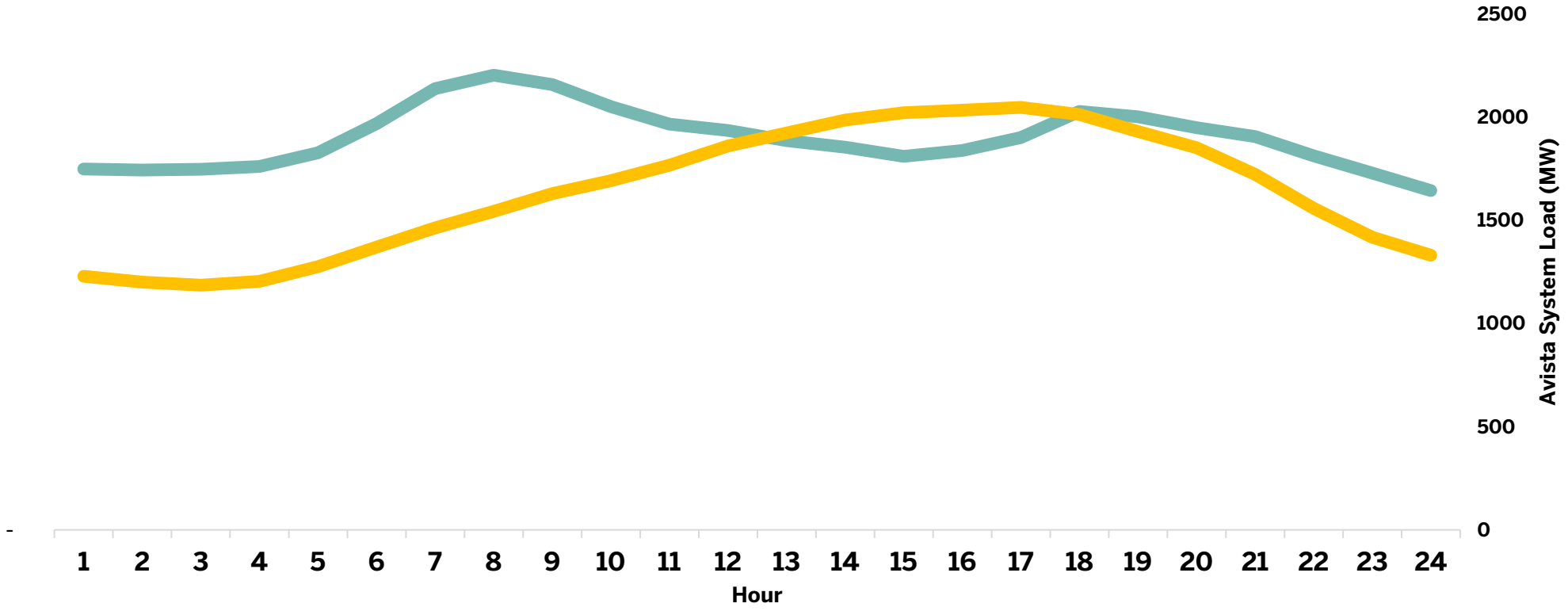
HOURLY ELECTRIC GRID MONITOR

U.S. electricity demand by region 11/8/2020 – 11/15/2020, Eastern Time

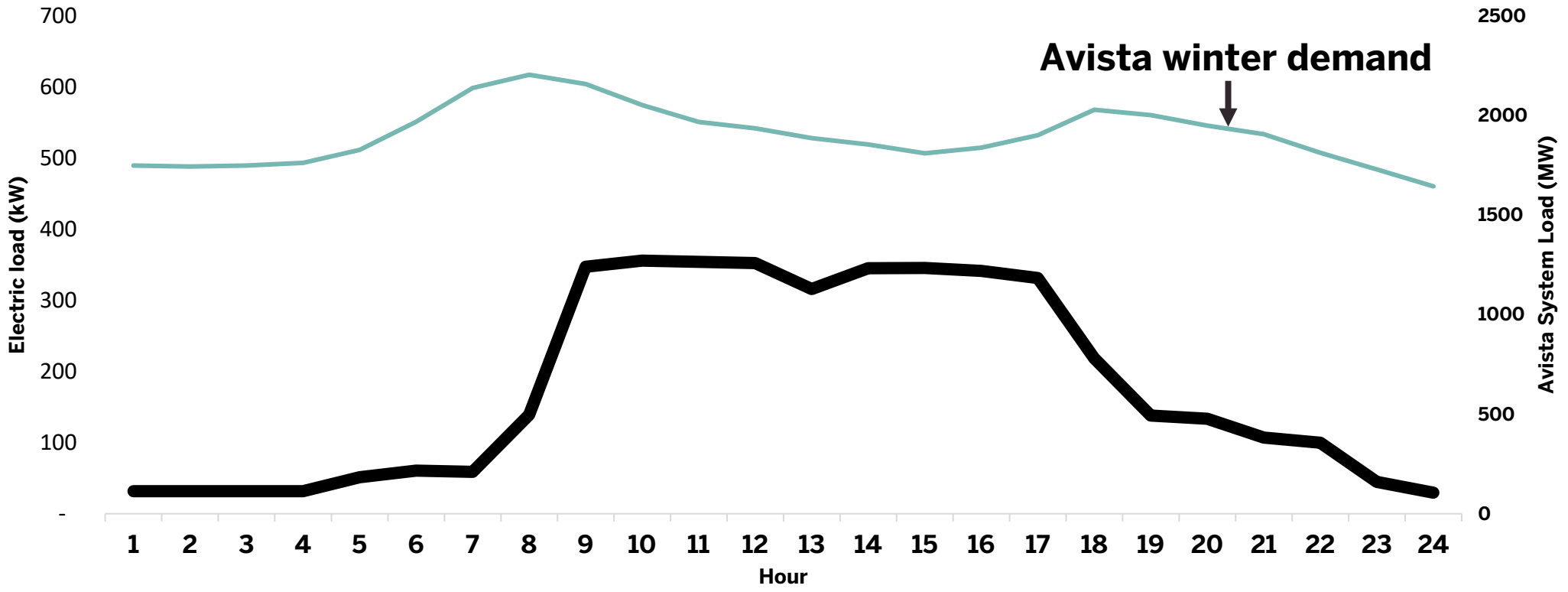


Source: U.S. Energy Information Administration

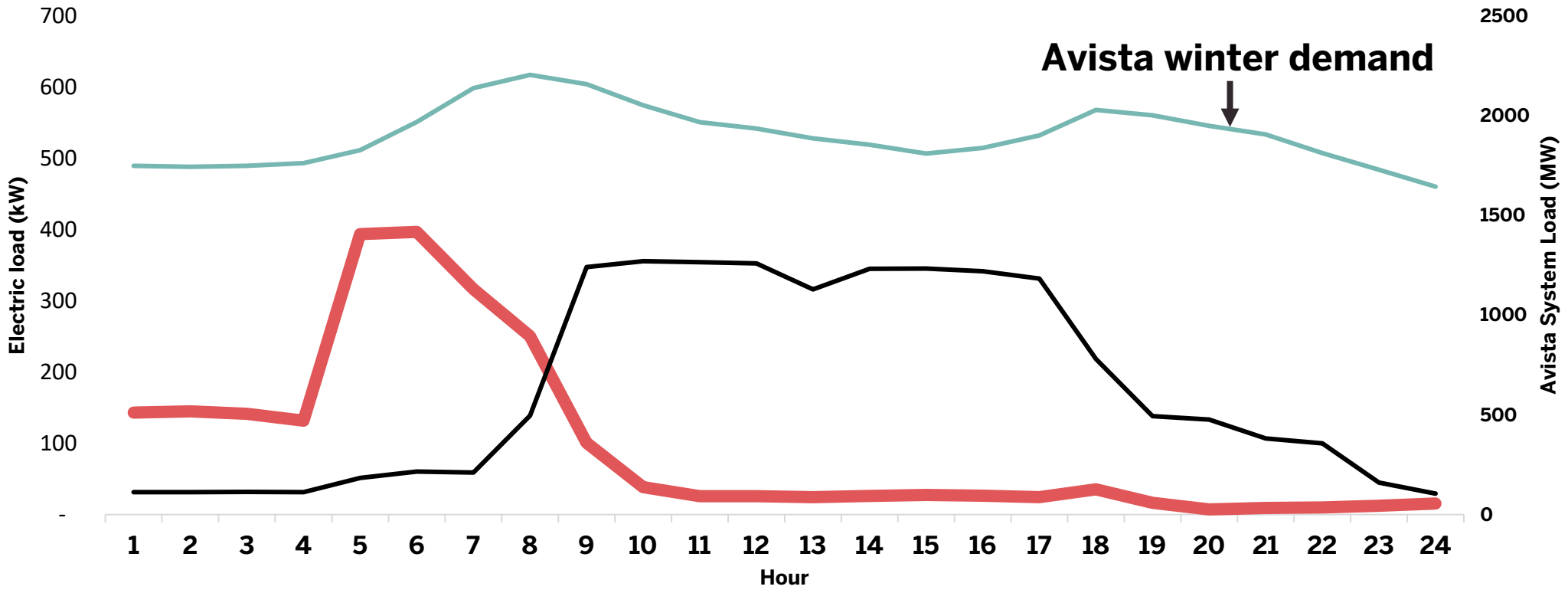
Avista system demand day Summer/Winter



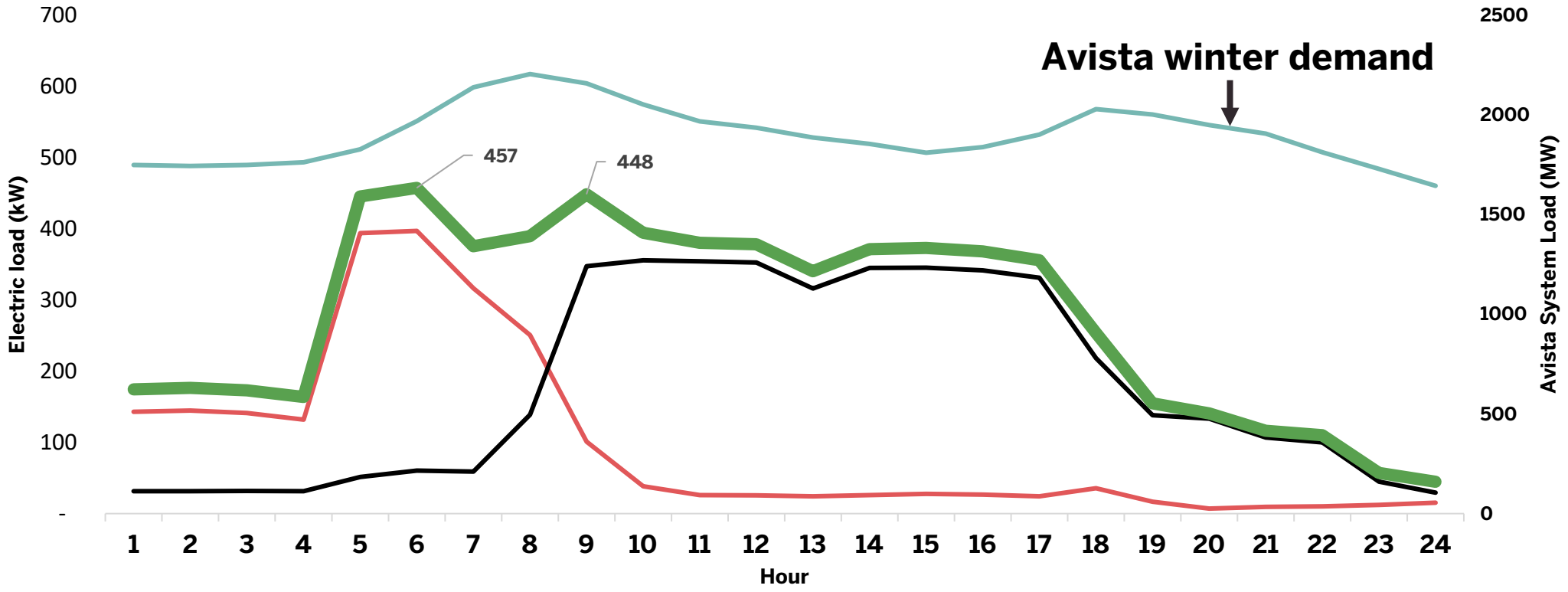
Winter building baseload plug & lighting load



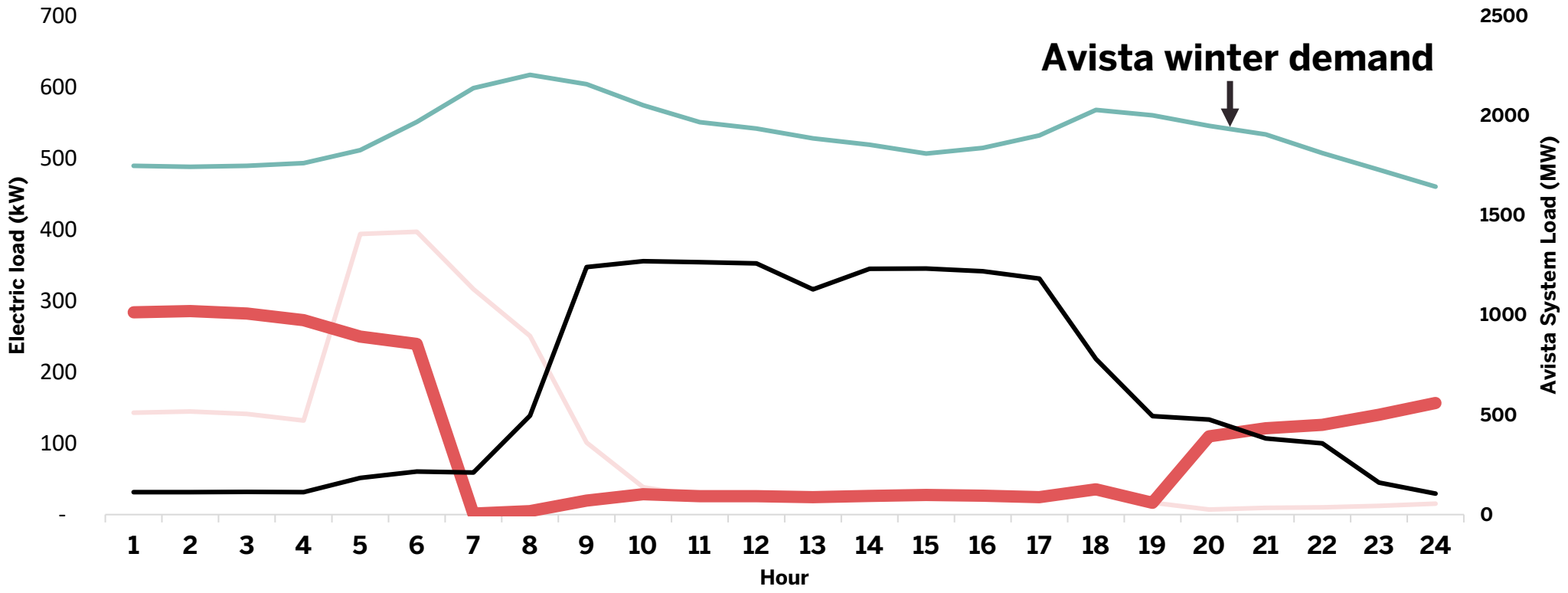
Winter building baseload and heating plant electrification



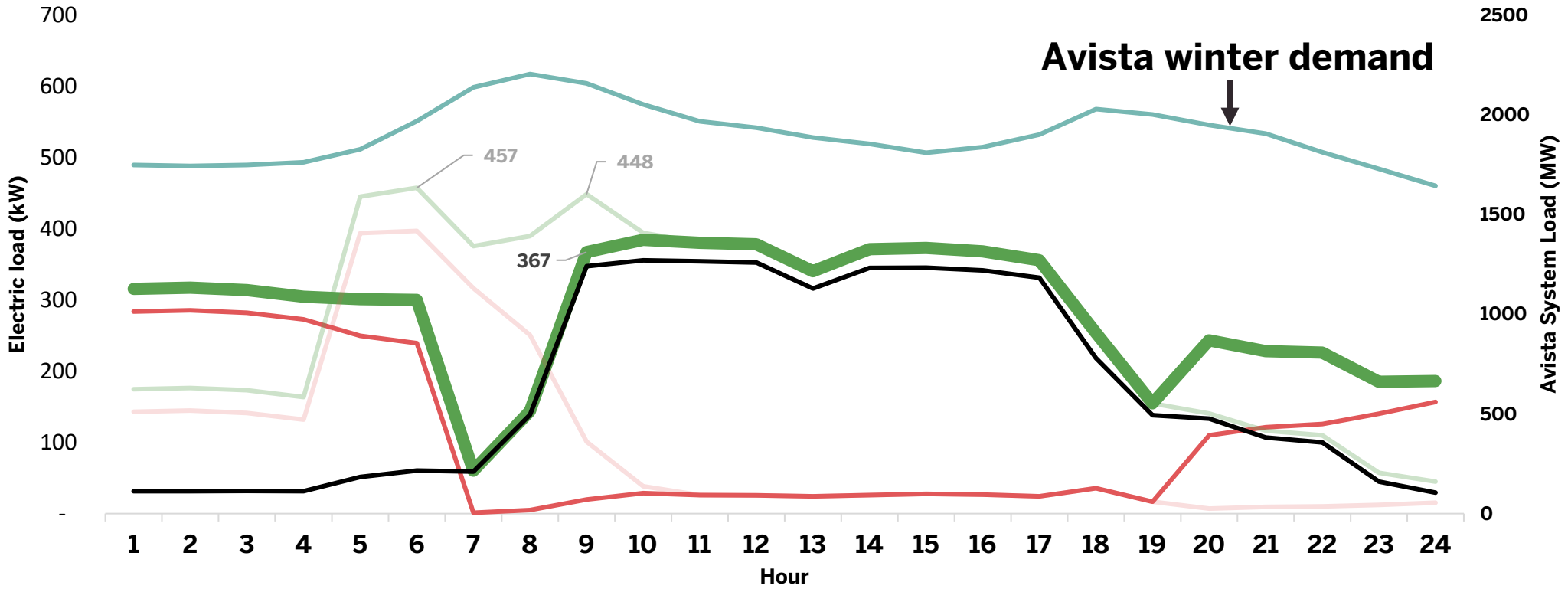
Winter building baseload and heating plant electrification total



Winter building baseload with smart heating plant electrification



Winter building baseload with smart heating plant electrification total



South Landing thermal storage

McKinstry
For The Life Of Your Building

Zero Energy + Carbon: Catalyst + South Landing

bit.ly/mckcatalyst

Catalyst Project

Q & A

Submit Questions
www.slido.com event code **#DOE**

U.S. DEPARTMENT OF ENERGY

National Western Center Project

Barb Frommell

City and County of Denver, CO

Laura Rip

Jacobs Engineering Group

BETTER BUILDINGS CONFERENCE

Scaling Impact: Multi-Building Approaches to Carbon Reduction December 1, 2020

AN URBAN HUB FOR FOOD AND AG DISCOVERY

in the heart of the American West.


DEN
NATIONAL
WESTERN
CENTER
70
DOWNTOWN
DENVER
25
225


“THE TRIANGLE”
60 Acres
PHASES 1&2
190 Acres

DENVER'S LONG TERM CLIMATE GOAL

2018 commitment from the Mayor

Reduce GHG emissions **80%** by 2050 from 2005 baseline

Even bolder recommendations from the public

Reduce GHG emissions **100%** by 2040 from 2005 baseline

We can reduce greenhouse gas emissions AND advance equity and racial justice.

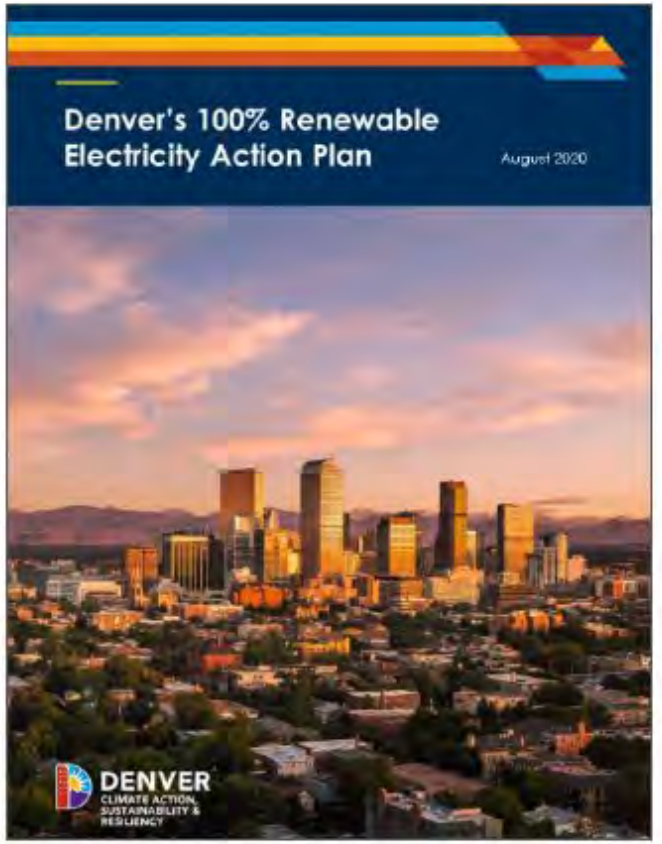
DENVER'S RENEWABLE ELECTRICITY GOAL

2030 - Meet 100% of Denver's community-wide electricity needs through renewable sources

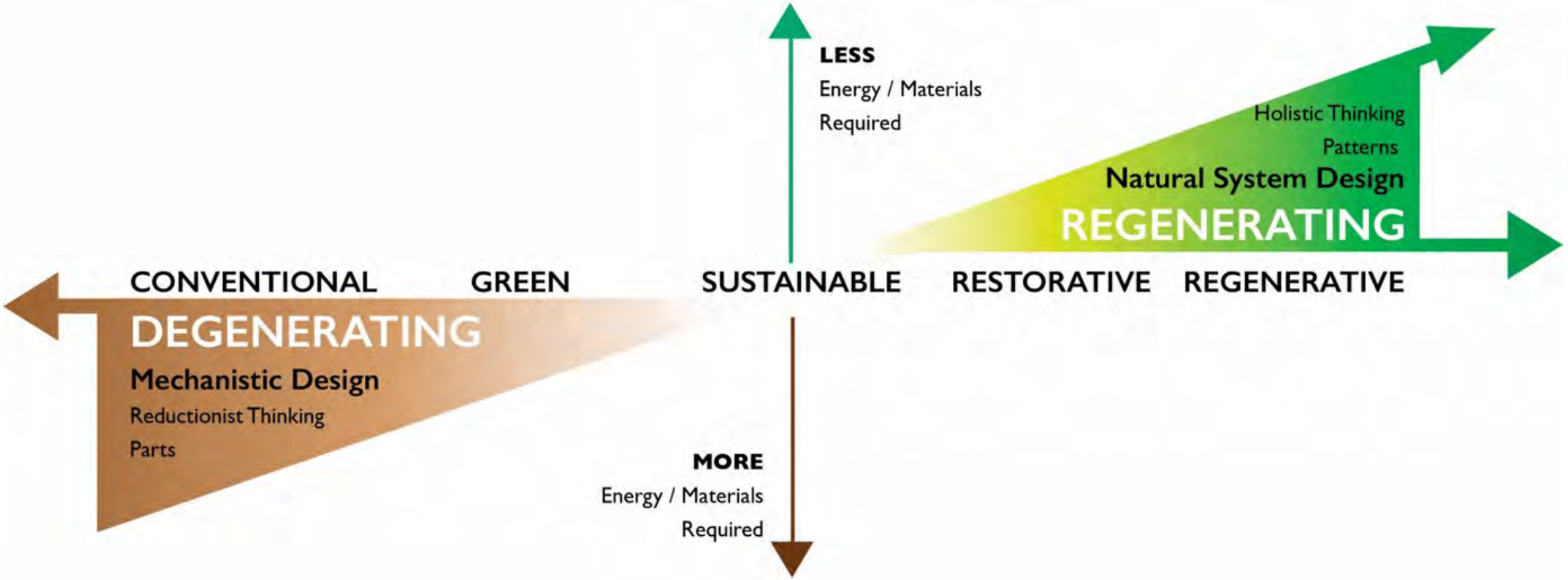
2025 - Achieve 100% RE for municipal buildings

Priorities:

1. Maximize investments in local renewable energy sources.
2. Produce co-benefits such as workforce development, utility bill savings, and more resilient public facilities.



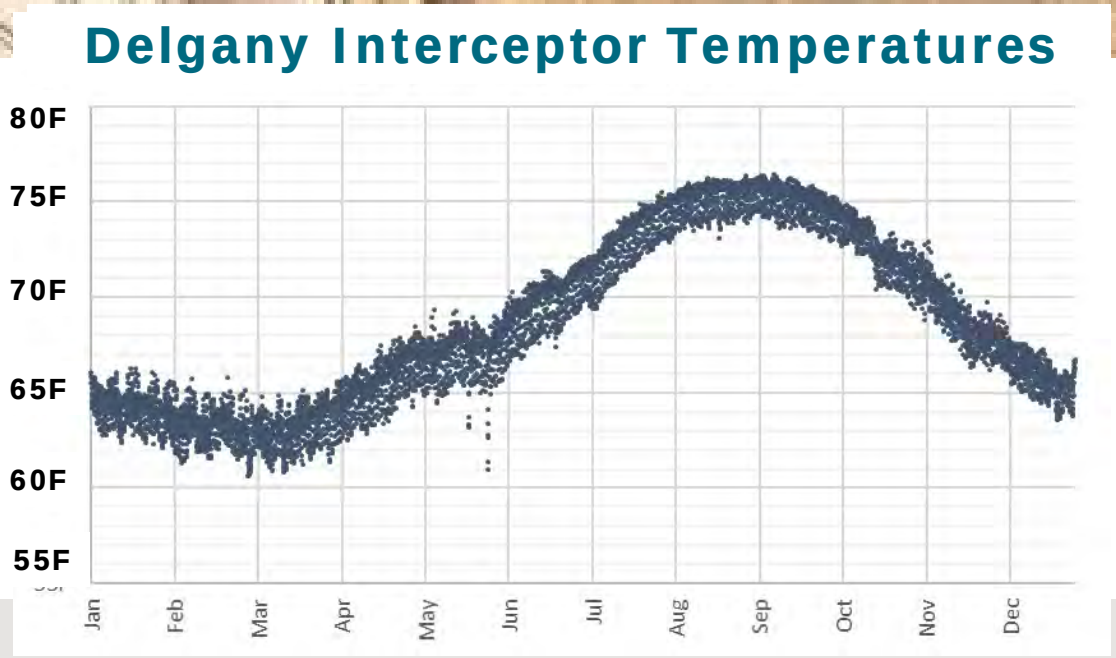
EMBRACE AN ETHIC OF REGENERATION

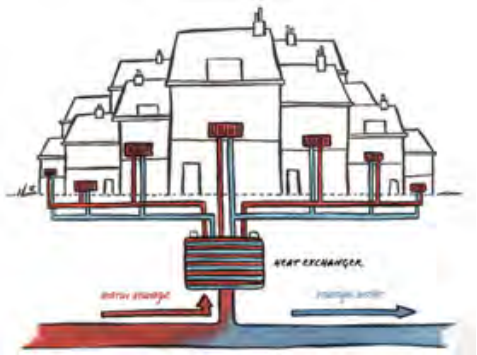


TURN LIABILITIES...

INTO ASSETS!

Wastewater in the Delgany Interceptor contains more than twice the thermal energy needed for the campus.





DENVER
THE MILE HIGH CITY

NATIONAL WESTERN CENTER

A LOW CARBON, RESILIENT CAMPUS

1. Energy Efficient, LEED Gold+ Buildings

Prioritizing energy efficiency to achieve LEED Gold or above.

2. District Thermal using Wastewater Heat Recovery

Utilizing wastewater thermal energy to heat and cool campus buildings efficiently.

3. Renewable Energy

100% renewable electric using a combination of on- and off-site sources

4. Community Resiliency

Ensuring critical facilities have power, heating and cooling, even during extreme events.

DISTRICT HEATING AND COOLING: OUR JOURNEY

NWC Master Plan

2015-2017	2018	2019	2020	2021	2022
Due Diligence	Procurement	Predevelopment	Final design & permitting	Construction	O&M Phase

NWC DISTRICT ENERGY PARTNERS

Metro Wastewater	EAS Energy Partners	NWC Authority	CSU	WSSA	City of Denver
Contributed $8.6M to relocate and bury the Delgany interceptor Providing thermal energy from Delgany Interceptor wastewater at no cost **Board Approved IGA Jan 2019**	Delivers low-carbon, highly efficient heating & cooling to NWC buildings for 40 years Designs, builds, finances, operates and maintains the district energy system Meets stringent performance standards **Competitive Procurement Dec 2018**	Owner of the district energy system Counterparty to EAS in the Campus Energy Agreement Pays monthly energy payments to EAS Enters into operating agreements with CSU and WSSA **Board Approved Feb 2020**	Enters into an operating agreement with Authority Pays energy payments to the Authority for CSU's share of the system capacity **Board Approved Jan 2020**	Enters into an operating agreement with Authority Pays energy payments to the Authority for WSSA's share of the system capacity **Board Approved Feb 2020**	Provides partial credit support to the Authority NWCO delivers a portion of the design/build work DDPHE is providing a $1M grant from enterprise funds toward campus sustainability

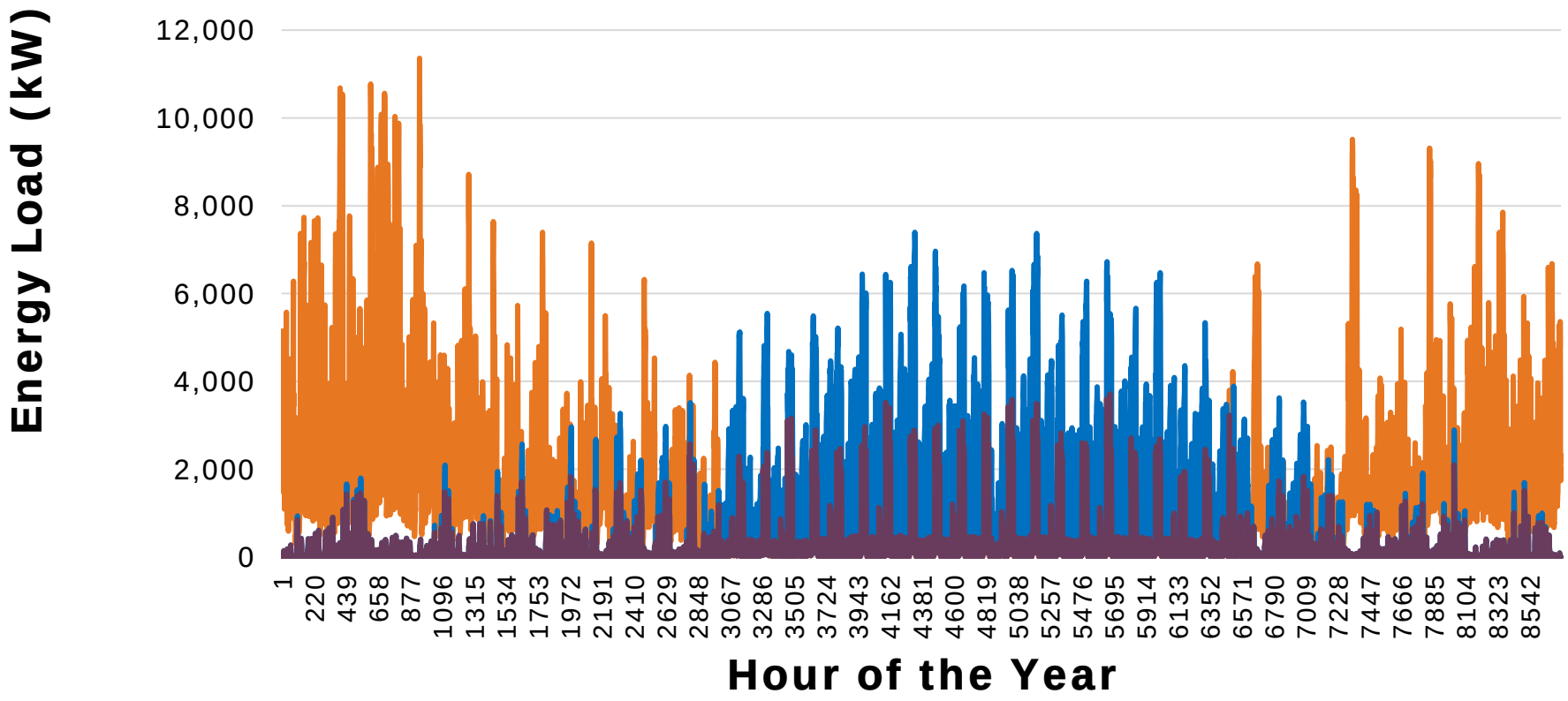
DISTRICT HEATING AND COOLING

The National Western Center will source nearly 90 percent of its heating and cooling from an underground sewer pipeline — a recycled source of thermal energy.

Traditional heating and cooling (source: natural gas)

District heating and cooling (source: wastewater)

DESIGN DEMAND PROFILE



>15% load is simultaneous heating and cooling

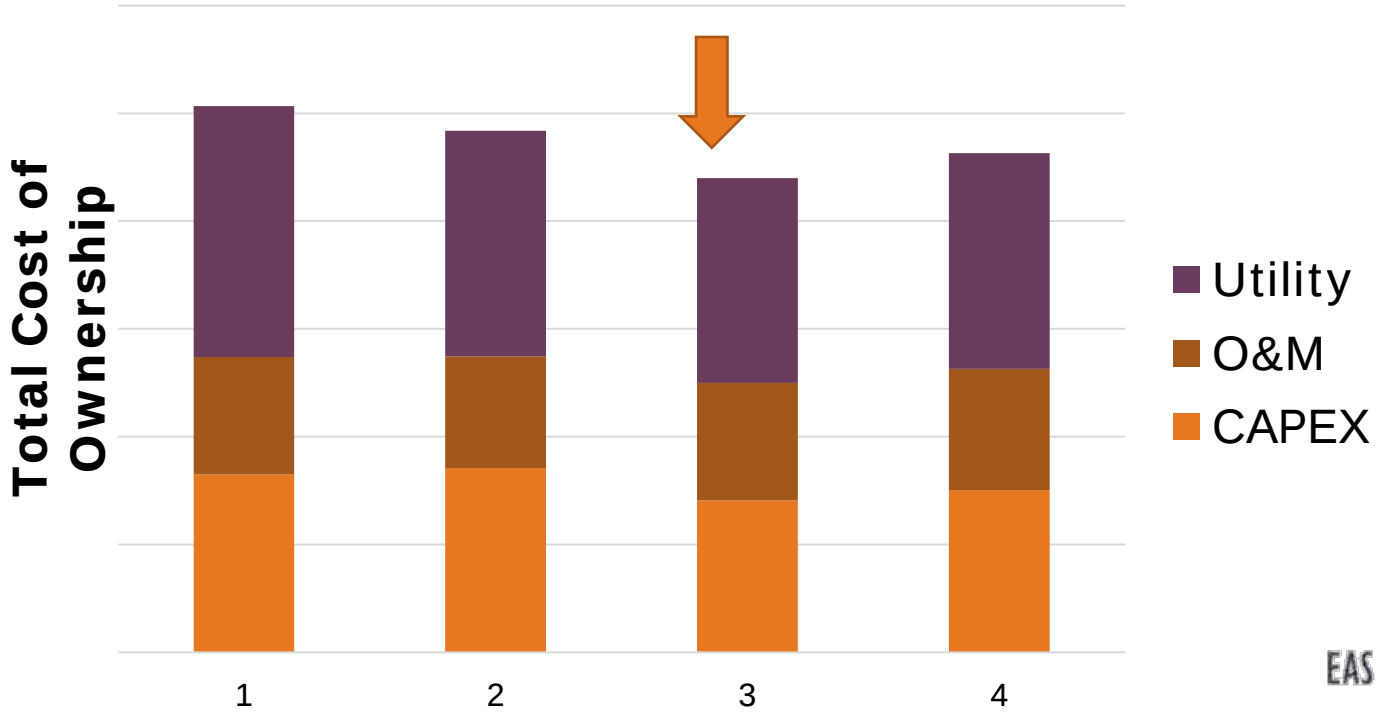
Heating Load

Cooling Load

Simultaneous

ALTERNATIVES ANALYSIS

1) 2-pipe: Boilers + Cooling Towers
2) 4-pipe: Boilers + Chillers
3) 2-pipe: SHR (HEx) + Boilers + Cooling Towers
4) 4-pipe: SHR (Heat Pumps) + Boilers + Chillers



EAS ENERGY PARTNERS

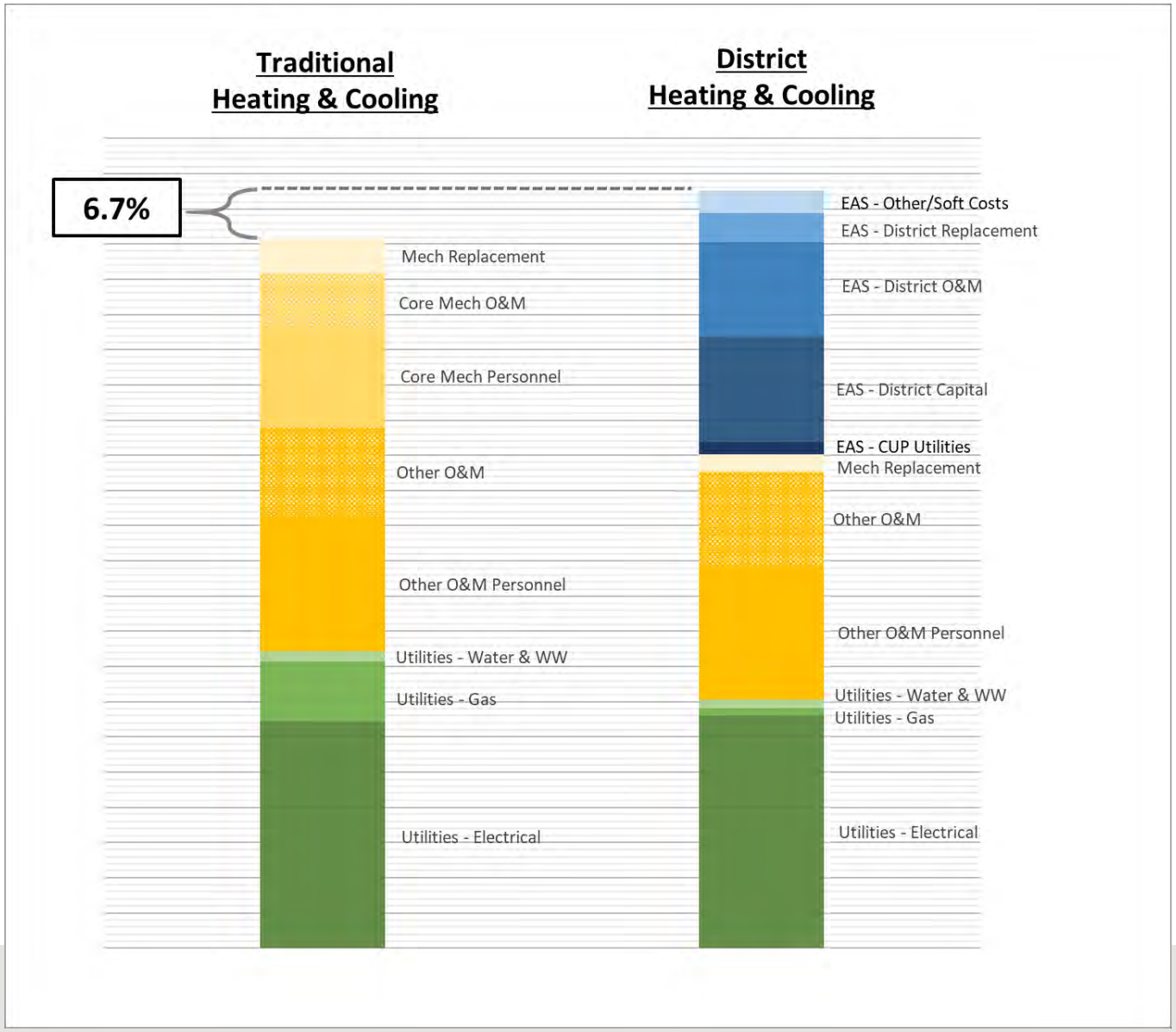
PRICE CERTAIN AND COST COMPARABLE

Every building has heating and cooling costs, no matter what system is used.

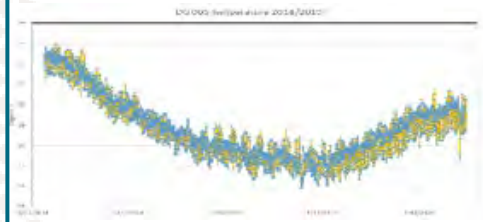
The cost is comparable to traditional systems over the long run (40 years).

Increased capital and financing costs are offset by decreased utility costs & operating costs.

Future carbon tax, carbon credit, etc. will likely reduce the premium.

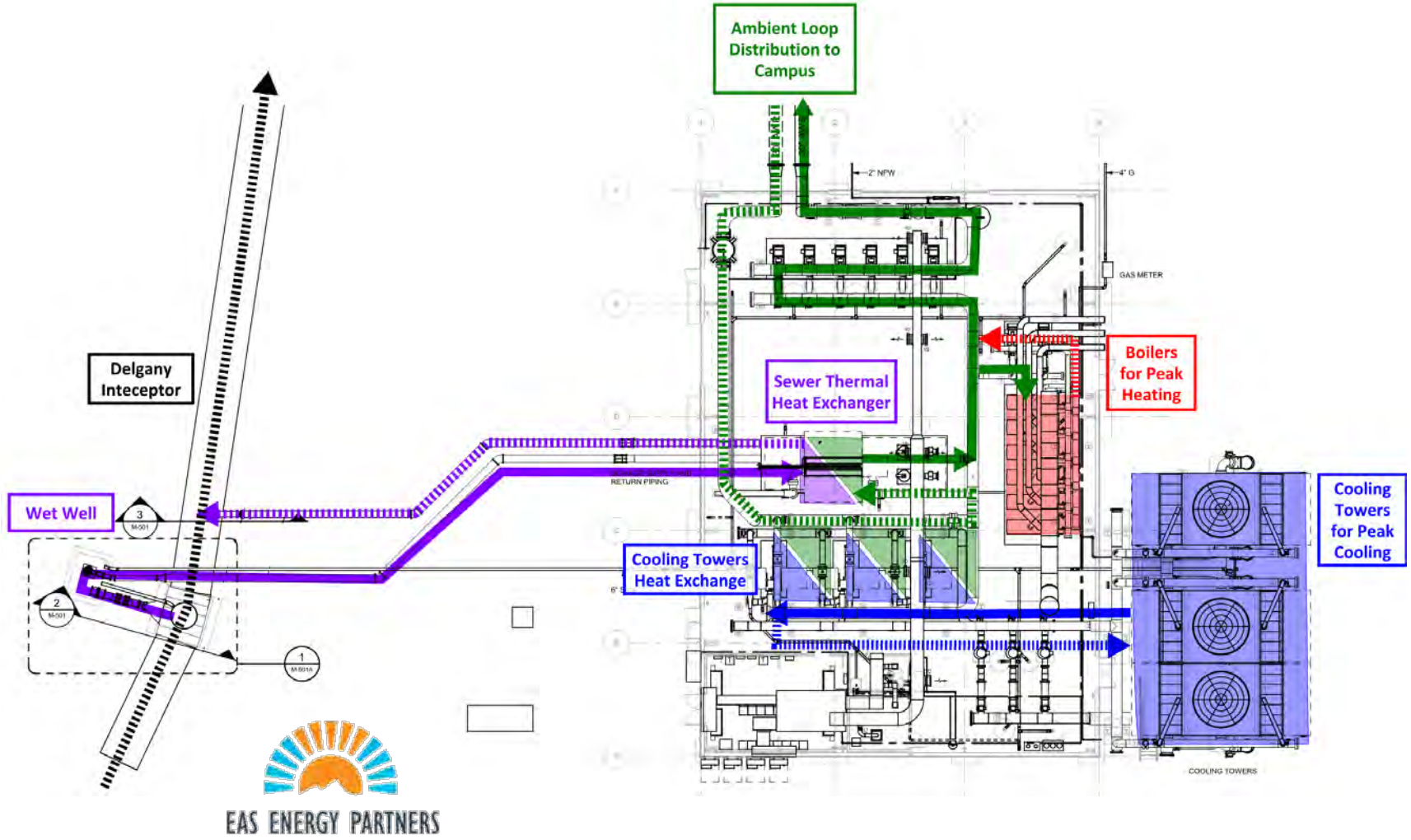


DISTRICT THERMAL WITH HEAT RECOVERY

SOURCE	SCREEN	EXCHANGE	DISTRIBUTE	CONDITION
  Delgany Sewer Line 60-75°F	 Waste screening keeps out solids	 Specialized heat exchanger transfers thermal energy to “ambient loop”	 Ambient Loop Supply Temp ~ 51-77°F 2-pipes From 30” → 6”	 Building heat recovery chillers use ambient loop to more efficiently produce hot and chilled water

SYSTEM DESIGN SUMMARY

- 3.8 MW sewer thermal system
- Sewer thermal meets nearly 90% of campus heating and cooling demand
- Serves 7 buildings
- 1.1M sqft of large event venue, educational, R&D, & office space
- Expandable for future phases
- Utilizes cooling towers for peak cooling only; boilers for peak heating only



DISTRICT IMPACTS

Avoids **2,600 metric tons** of CO_2 emissions each year.

Equivalent to **6.6 million** vehicle passenger miles driven in Denver annually.

Saves **3,168 kgal** of water each year.

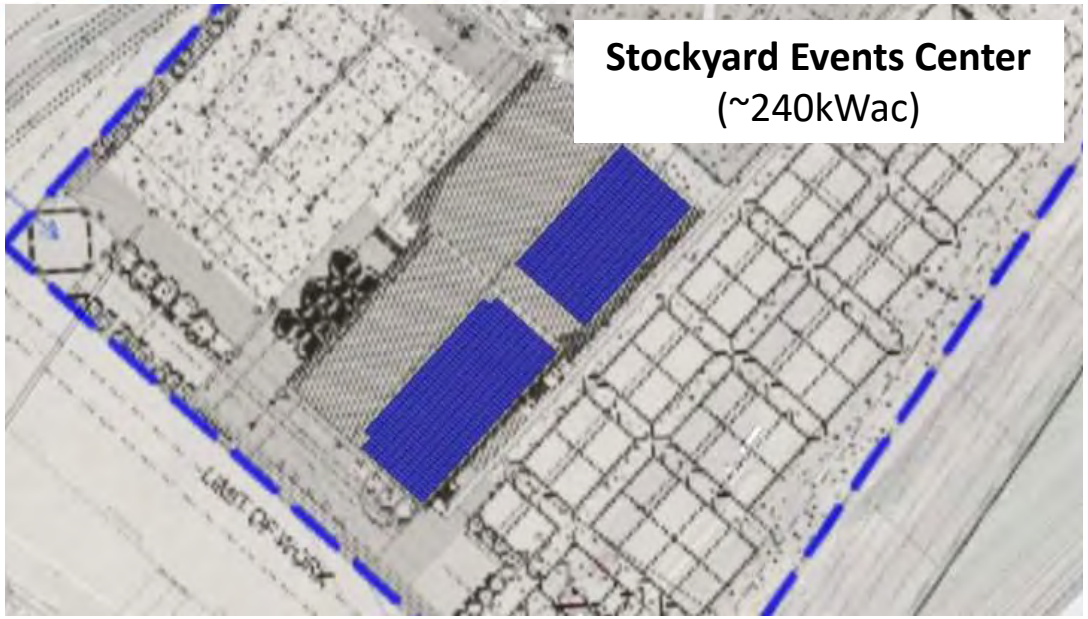
Equivalent to **5 Olympic-sized** swimming pools each year

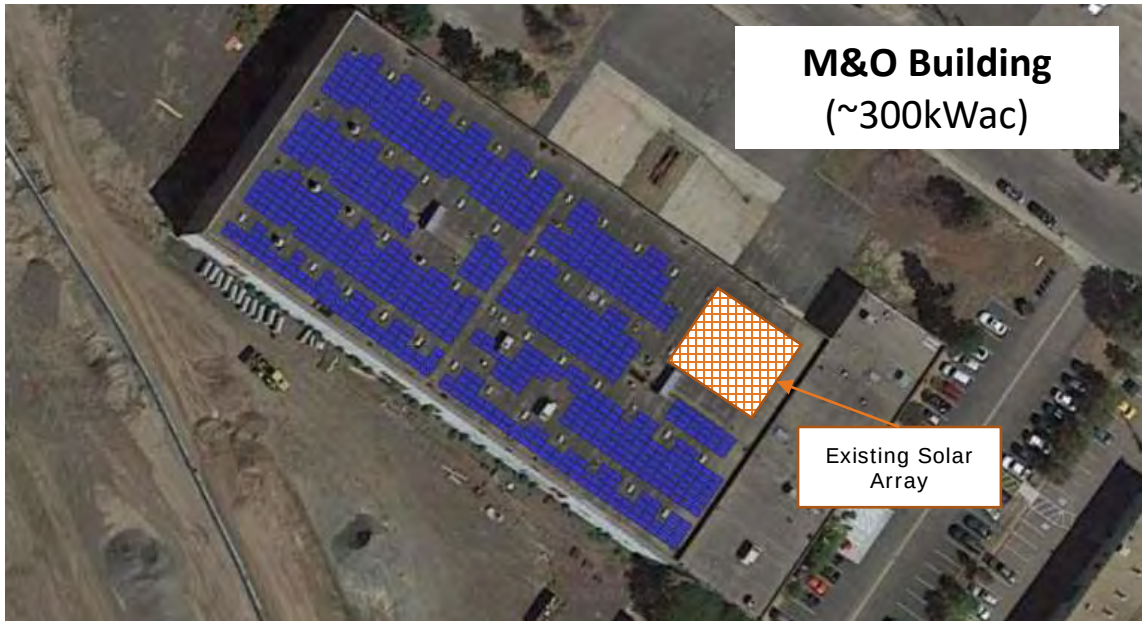
Reduces Metro's effluent temperature to protect the Platte River.

NWC RENEWABLE ENERGY STRATEGY

Goal: 100% Renewable using a combination of on and off-site sources.

RENEWABLE DENVER
Community Solar





RENEWABLE ENERGY STRATEGY

Low carbon electricity achieved by leveraging a portfolio of least cost renewable assets:

Certified Renewable Percentage

Xcel Energy's native generation mix moves NWC ½ way to their goal

Renewable*Connect

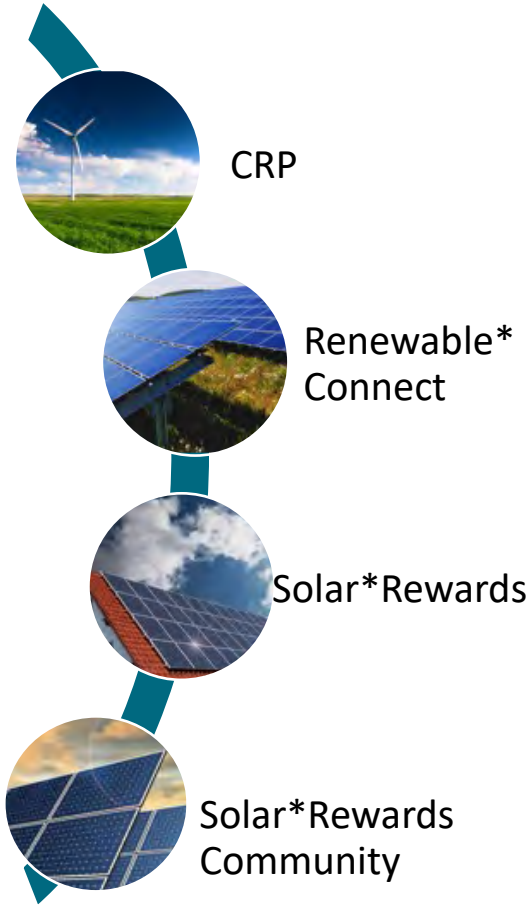
Subscription to offsite renewable to offset majority of remaining load

S*R Medium Program

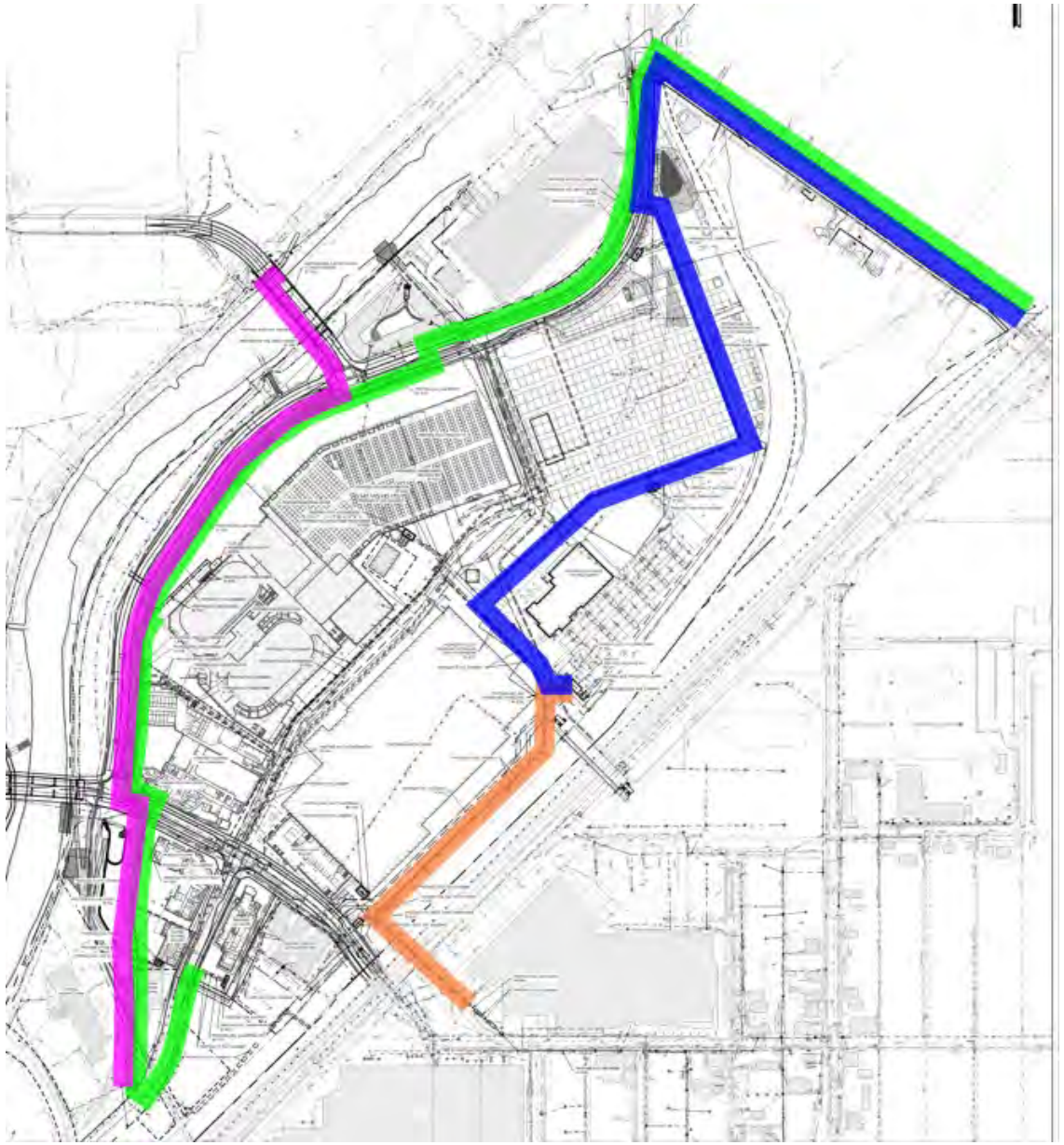
Deploy the most affordable onsite option in the most visible place

Li-S*RC – Xcel Energy owned solar garden

Provides affordable solar option to neighboring communities.



RELIABILITY INHERENT IN DESIGN



4 separate feeders provide redundancy options to service the NWC Campus

Xcel Energy®

COMMUNITY RESILIENCY INITIATIVE

Solar plus Storage based microgrids to support community resiliency

- Community partner defines “critical” infrastructure
- Xcel Energy brings battery storage and islanding capability
- Solar and other generation provided by the site

Benefits:

- Improves resiliency
- Supports Xcel Energy’s clean energy transition
- Provides grid benefits
- Provides clean energy jobs





Xcel Energy®

Enabling Legislation:

- HB18-1270 (http://leg.colorado.gov/bills/hb18-1270)

BETTER FOR OUR COMMUNITIES

Environment

- Reduced emissions
- Cleaner air
- Conserves water
- Healthier neighborhoods
- Reduces WW effluent temperature

Equity

- Economic opportunities
- MWBE participation goals
- Prevailing wage
- Workforce Development
- Community Resiliency

Education

- Educational tours
- Programming support
- Experiential education

THANK YOU

Barb Frommell

Laura Rip

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- twitter.com/DiscoverTheWest
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- linkedin.com/company/national-western-center/

National Western Center Project

Q & A

Submit Questions
www.slido.com event code **#DOE**

U.S. DEPARTMENT OF ENERGY

Shanti Pless
National Renewable
Energy Laboratory

Ben Polly
National Renewable
Energy Laboratory

Scaling Impact: Multi-Building Approaches to Carbon Reduction

Shanti Pless, NREL

Ben Polly, NREL

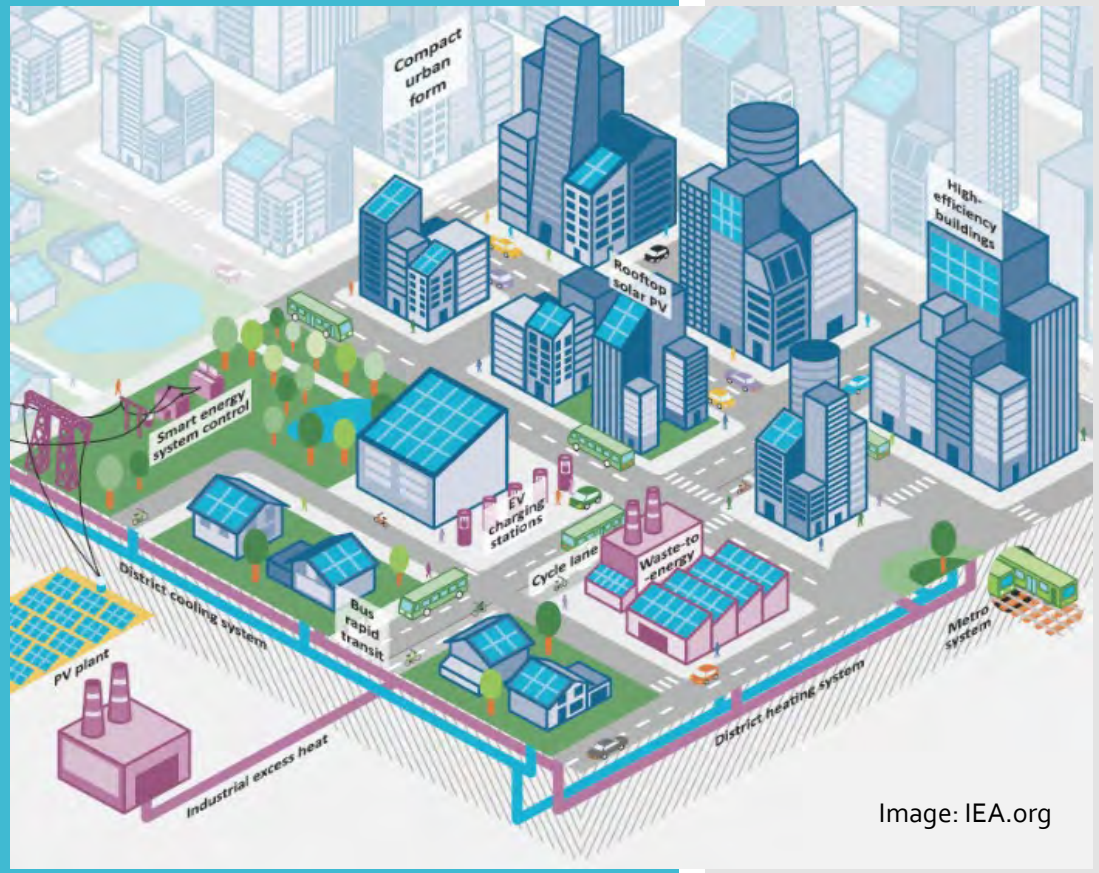


Image: IEA.org

Zero Energy Districts

Zero Energy Buildings

Zero Energy Districts

Quote: http://ecodistricts.org/wp-content/uploads/2013/03/EcoDistricts_Protocol_Executive_Summary_ISSUE_6.242.pdf
Photo by Dennis Schroeder

Unlock new cost-effective energy savings through:

- Upfront planning
- Economies of scale
- Load diversity
- Waste heat capture

Testbeds for new:

- Technologies
- Utility programs
- Business and ownership models

DOE's Zero Energy Districts Accelerator 2017-2020

District Partners

- Sun Valley EcoDistrict (CO)
- Erie County Industrial Redevelopment (NY)
- St. Paul Ford Site Redevelopment (MN)
- National Western Center (CO)
- Huntington Beach Advanced Energy Community (CA)
- Catalyst Spokane (WA)

National Partners

Commit to provide resources and support to districts

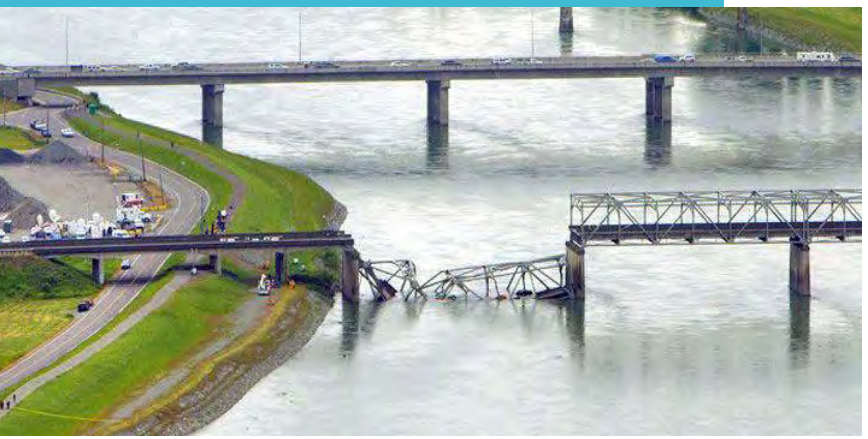
EcoDistricts

U.S. GREEN BUILDING COUNCIL

Xcel

ROCKY MOUNTAIN INSTITUTE

Challenges



Accountability for Ongoing Performance

Financing, Ownership and Governance Models

Calibrating Energy Goals

Difficulty Quantifying Benefits

Utility Engagement

Advanced Analysis Needs

Promising Practices

Communities of the Future: Accelerating Zero Energy District Master Planning

Preprint

Shanti Pless and Ben Polly
National Renewable Energy Laboratory

Sarah Zaleski
U.S. Department of Energy

Presented at the 2018 ACEEE Summer Study on Energy Efficiency in Buildings
Pacific Grove, California
August 12–17, 2018

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https://www.nrel.gov/docs/fy18osti/71841.pdf.

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Office of Energy Efficiency & Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

This report is available at no cost from the National Renewable Energy Laboratory (NREL) at www.nrel.gov/publications.

Conference Paper
NREL/CP-5500-71841
September 2018

Contract No. DE-AC36-08GO28308

https://www.nrel.gov/docs/fy18osti/71841.pdf

A GUIDE TO ENERGY MASTER PLANNING OF HIGH-PERFORMANCE DISTRICTS AND COMMUNITIES

Shanti Pless,[1] Ben Polly,[1] Sammy Houssainy,[1] Paul Torcellini,[1] William Livingood,[1] Sarah Zaleski,[2] Matt Jungclaus,[3] Tom Hootman,[4] and Mindy Craig[5]

1. National Renewable Energy Laboratory
2. U.S. Department of Energy
3. Rocky Mountain Institute
4. Integral Group
5. BluePoint Planning

SUGGESTED CITATION:
Shanti Pless, Ben Polly, Tom Hootman, Mindy Craig, Matt Jungclaus, Sarah Zaleski, Sammy Houssainy, Paul Torcellini, William Livingood. *A Guide to Energy Master Planning of High-Performance Districts and Communities*. NREL Technical Report October 2020 [Link TBD].

AUTHOR CONTRIBUTIONS:
Sarah Zaleski led this publication's overall organization and direction with contributions to and reviews of all sections. Ben Polly and Shanti Pless led content creation and concept development throughout the document with significant contributions from Mindy Craig, Tom Hootman, and Matt Jungclaus. Sammy Houssainy performed example analyses and Paul Torcellini and William Livingood contributed to district scale grid integration content and concepts.

NOTICE

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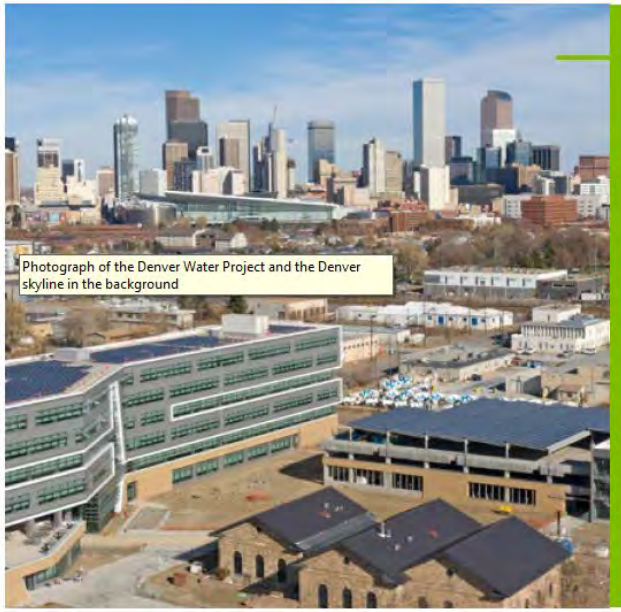
Contract No. DE-AC36-08GO28308

Technical Report
NREL/TP-5500-78157
October 2020

- Focus on Zero Energy principles that support high performance district projects
- Document promising practices from Zero Energy District Accelerator and other advanced energy community projects
- Suggest what analysis is most valuable at what stage
- Leverage, reference, and build on existing resources (IDEA resources, RMI, etc.)

https://www.nrel.gov/docs/fy21osti/78495.pdf



CHAPTER 1

INTRODUCTION defines the high-performance district concept and provides insight into the business case for—as well as the benefits and challenges of developing—a high-performance district.

The new Denver Water Operations Complex uses a large potable water distribution main as a heat source and heat sink, depending on the season.

Photo from Frank Ooms for Denver Water

CHAPTER 2

FOSTERING SUPPORT AND ASSEMBLING A TEAM provides detailed guidance into making the high-performance district business case, including identifying and engaging stakeholders and determining project goals.

The Cornell Tech campus is designed to be resilient and sustainable, and one analysis projects it will generate more than $7.5 billion in economic activity and spur $23 billion in overall economic activity in the next 30 years.

Photo from Lucas Blair Simpson for SOM

CHAPTER 3

DEVELOPING FINANCIAL AND BUSINESS MODELS describes the analyses, models, and planning considerations that help the project team develop and execute the business case for a high-performance district.

Boulder Commons developer Morgan Creek Ventures worked with the Rocky Mountain Institute and its counsel to develop the first zero energy lease in the country for a project of this size.

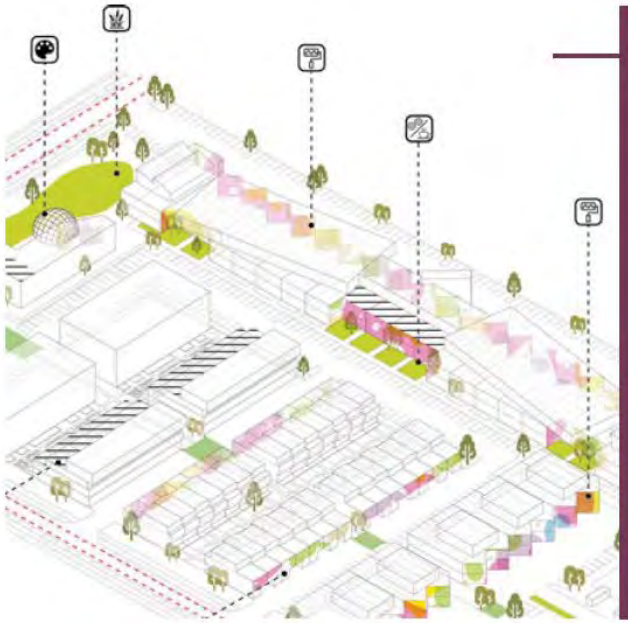
Photo from Bruce Damonte for Morgan Creek Ventures

CHAPTER 4

ENGAGING UTILITIES details what project teams need to know to develop and maintain the critical, collaborative relationships with utilities that are key to the success of a high-performance district.

The National Western Center project team engaged with local utility Xcel Energy and stakeholders to develop an Energy Action Plan for creating a zero energy district.

Rendering from the Mayor's Office of the National Western Center



CHAPTER 5

DEVELOPING AN ENERGY MASTER PLAN establishes the importance of an energy master plan and offers guidance on developing such a plan.

Modern West will be a 16-acre mixed use development In Longmont, Colorado.

Graphic from Modern West Properties LLC

CHAPTER 6

PLANNING FOR ENERGY DEMAND AND EFFICIENCY discusses the analysis and planning required to reduce energy loads cost-effectively and set appropriate energy targets.

All the structures in the Whisper Valley development in Austin, Texas, will be equipped with solar photovoltaics and a ground source heat pump system.

Photo from Rob Aldridge for Whisper Valley

CHAPTER 7

DISTRICT THERMAL ENERGY PLANNING describes the sophisticated district heating and cooling systems that improve the economics of large thermal systems through technology, analysis, and planning.

Montana State University's reduce, reclaim, renewable strategy optimizes building energy efficiency through ground source heat pumps, solar photovoltaics, and infrastructure and energy sharing.

Photo from Adrian Sanchez-Gonzalez for Montana State University

CHAPTERS 6–9

provide a deep dive into the analysis and planning of a high performance district.

Chapters 6–9 are organized as follows:

A brief overview of why the section is important, how it impacts the high-performance district project, and how it relates to other project elements

Analysis and Approaches. What analyses to run, when and how to run them, example analyses, and available tools; each of chapters 6–9 includes at least one example analysis

Considerations. Factors that impact analysis inputs and outputs and tips to expedite the process

Integration. How to integrate the analysis results to optimize cost-effectiveness.

CHAPTER 8

RENEWABLE ENERGY ANALYSIS AND PLANNING details the analysis and other considerations necessary to integrate renewable energy—usually solar photovoltaics—into a district energy system.

Stanford University expects to meet its 100% renewable electricity goal in 2021.

Photo from Robert Canfield

CHAPTER 9

PLANNING FOR GRID INTEGRATION, ENERGY STORAGE, AND ELECTRIC VEHICLES explores the opportunities and technical considerations of integrating district energy systems and electric vehicles with the larger electrical grid.

A Honda FIT electric vehicle charges with electric vehicle supply equipment installed in front of an array of solar photovoltaic panels.

Photo from Capital District Clean Communities Coalition, Albany, New York, NREL 51363

CHAPTER 10

HIGH-PERFORMANCE DISTRICT CASE STUDIES includes a diverse collection of brief emerging high-performance district case studies from around the United States.

The Peña Station NEXT district in Denver, Colorado, is a mixed use community located near Denver International Airport that is expected to be the least cost and most scalable zero energy infrastructure development in the United States.

Rendering from Fulenwider

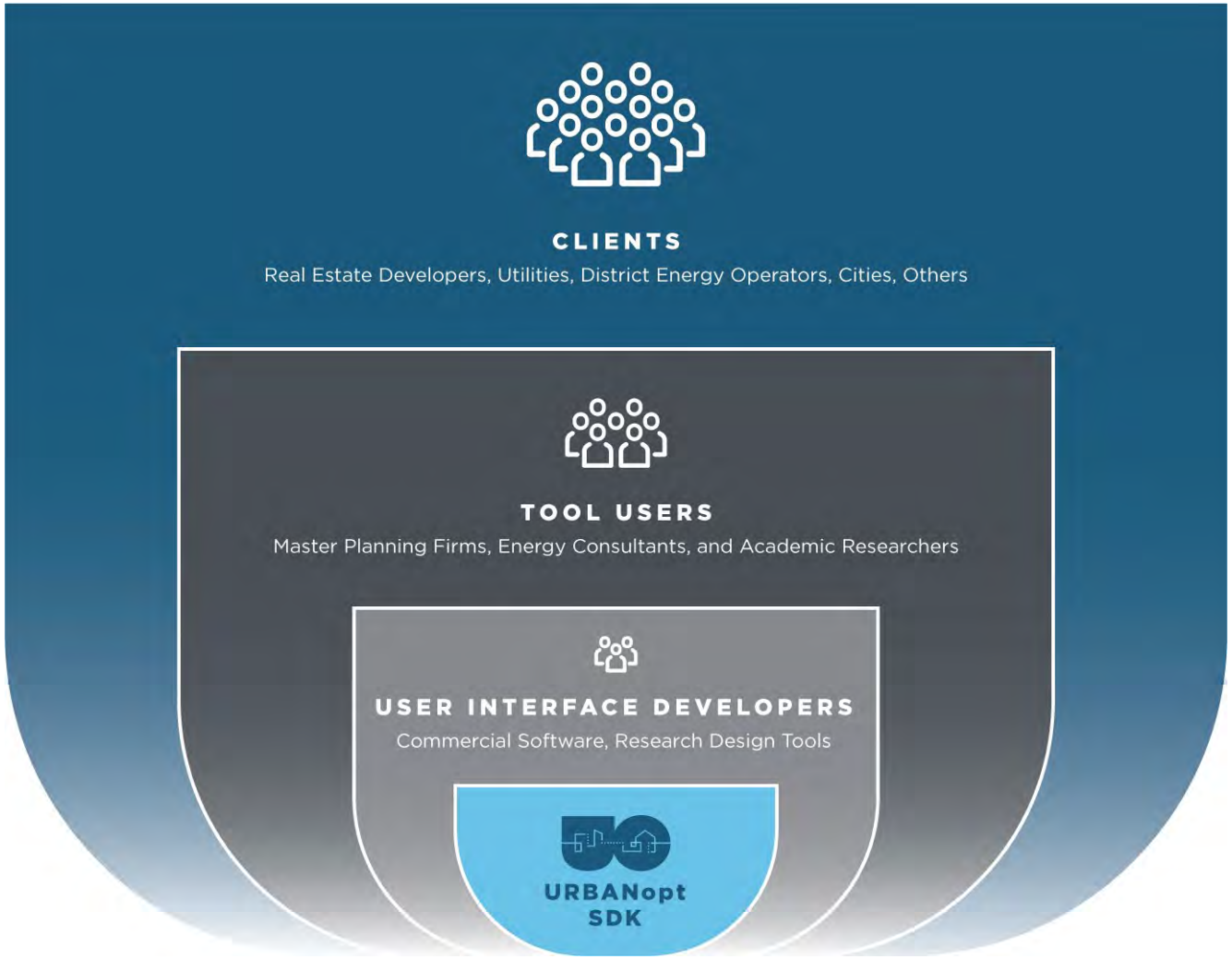
Note that these two-page case studies can be used as stand-alone documents for academic or other informational purposes.

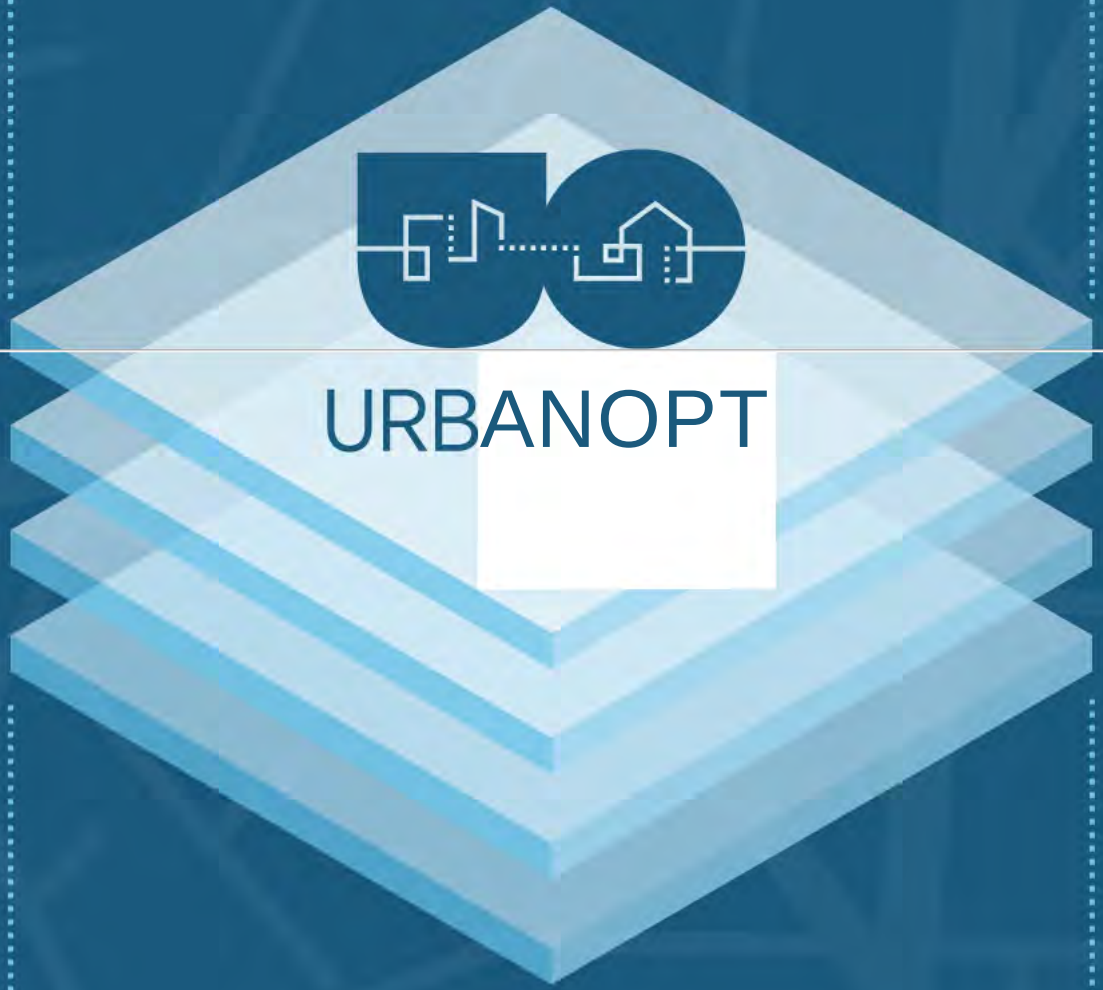
What is URBANopt?

Analytics platform for communities and urban districts

Built on top of OpenStudio®, EnergyPlus™, and the Modelica Buildings Library

Modular, open source platform; “underlying analytics” that can be integrated into private sector tools



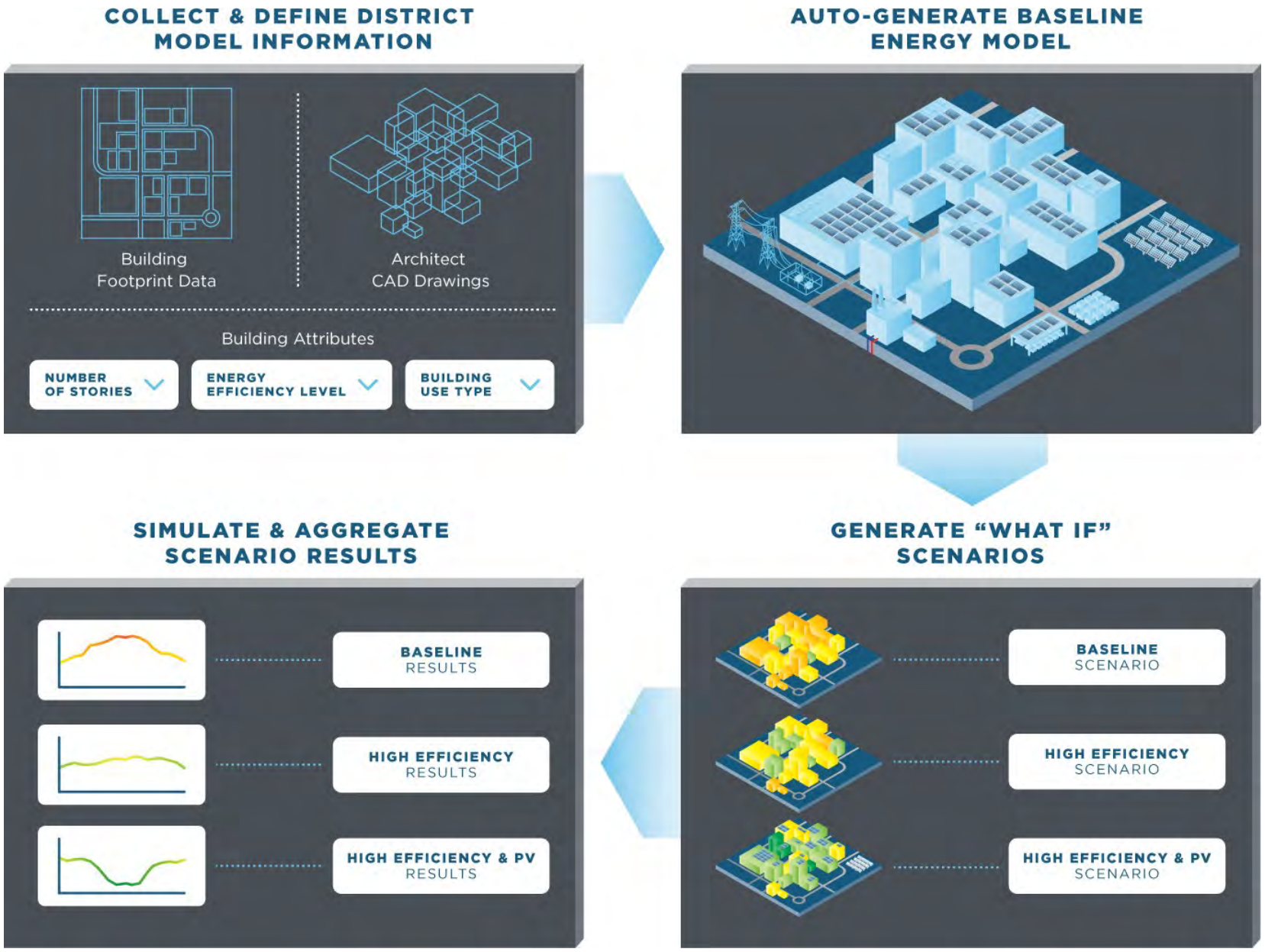


ORGANIZES geospatial information about buildings and energy systems

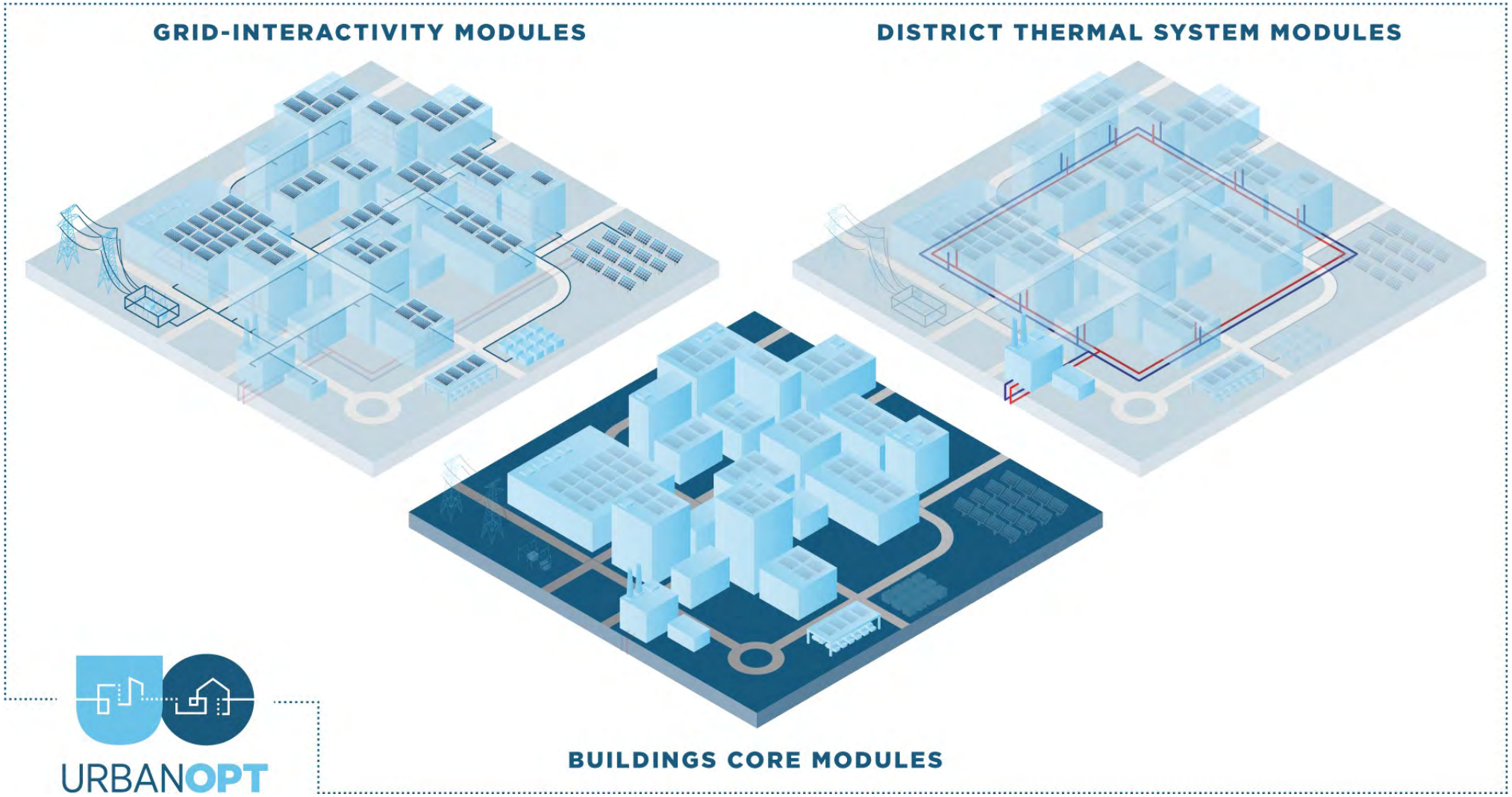
ENABLES creation of highly customized analysis scenarios

AUTOMATES generation of detailed physics-based models from simple inputs

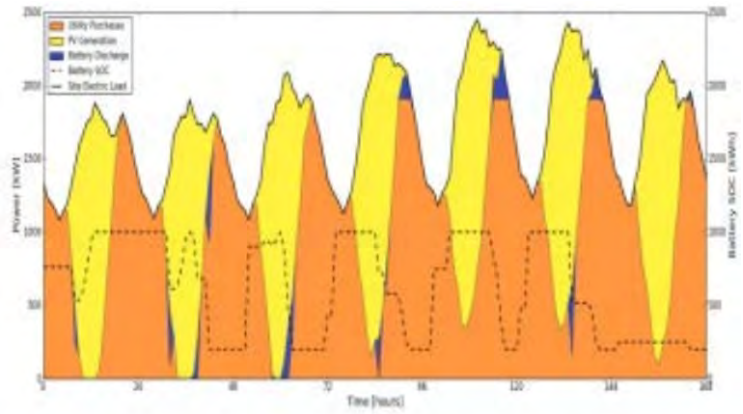
MANAGES simulations, integrations, and aggregation of results by scenario


COLLECT & DEFINE DISTRICT MODEL INFORMATION
Building Footprint Data
Architect CAD Drawings
Building Attributes
NUMBER OF STORIES
ENERGY EFFICIENCY LEVEL
BUILDING USE TYPE
AUTO-GENERATE BASELINE ENERGY MODEL
GENERATE "WHAT IF" SCENARIOS
BASELINE SCENARIO
HIGH EFFICIENCY SCENARIO
HIGH EFFICIENCY & PV SCENARIO
SIMULATE & AGGREGATE SCENARIO RESULTS
BASELINE RESULTS
HIGH EFFICIENCY RESULTS
HIGH EFFICIENCY & PV RESULTS

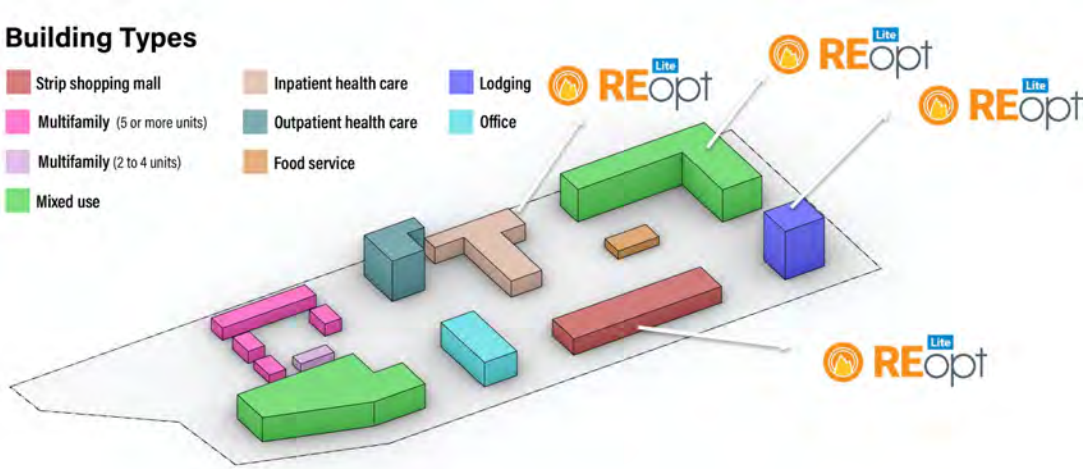
URBANopt Modules



URBANopt/REopt/OpenDSS



Cost-optimal Operating Strategy



Transformer
Electrical Substation
Building
Line/Junction

Thanks and Questions?

- Shanti.pless@nrel.gov
- Ben.polly@nrel.gov

National Renewable Energy Laboratory

Q & A

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www.slido.com event code **#DOE**

U.S. DEPARTMENT OF ENERGY

Q & A

Submit Questions
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U.S. DEPARTMENT OF ENERGY

DOE Invests up to $65 Million in "Connected Communities" Funding Opportunity

What's a Connected Community?

A Connected Community is a group of grid-interactive efficient buildings (GEBs) with diverse, flexible end use equipment and other distributed energy resources (DERs) that collectively work to maximize building, community, and grid efficiency and reduce environmental impacts.

DOE expects to select a number of diverse community-scale projects so that insights from the combined portfolio of selected projects will provide scalable solutions that can be applied throughout the country to increase energy efficiency, change the timing and amount of energy use, and reduce environmental impacts.

This Funding Opportunity Will:

Demonstrate the ability of GEBs and DERs to modify load in both **new developments and existing communities** across diverse climates, geographies, building types, building vintages, DERs utility/grid/regulatory structures and resource bases.

Share technical and market solutions that will increase demand flexibility and energy efficiency

We're Looking For Projects That...

- ✓ Address various grid issues and services
- ✓ Provide benefits for occupants and owners
- ✓ Improve energy efficiency
- ✓ Quantifiable building load flexibility
- ✓ Feature 2 or more types of DERs (aside from DR and EE)
- ✓ Use coordinated controls for energy-efficient and flexible load operations
- ✓ Describe pathways for implementation
- ✓ Include strategies for recruitment and retention of CC participants
- ✓ Feature business model innovations
- ✓ Include diverse project partners and stakeholders
- ✓ Provide benefits for various stakeholders
- ✓ Follow a thoughtful data collection and analysis plan
- ✓ Seek to elucidate the occupant experience
- ✓ Account for cybersecurity and privacy
- ✓ Have a communications outreach plan
- ✓ We encourage projects that are scalable and replicable

Connected Communities Funding Opportunity

We're Looking Forward to Your Applications!

Visit eere-exchange.energy.gov or Scan the QR Code for the Funding Opportunity:

"DE-FOA-0002206: Connected Communities Funding Opportunity Announcement "

Building Technologies Office | Office of Electricity | Solar Energy Technologies Office | Vehicle Technologies Office

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YOU HAVE A DATA CENTER – NOW WHAT?
STORIES FROM THE FIELD

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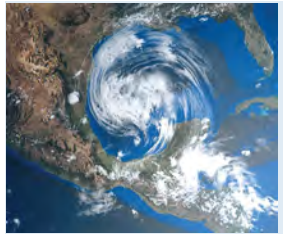

PLANNING FOR RESILIENCE IN MULTIFAMILY HOUSING:
A PORTFOLIO-WIDE APPROACH

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Tue, Dec 8, 2020 | 3:00 – 4:00 PM ET

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Through the Building Envelope Campaign, DOE is working with building owners to save energy and money. In this webinar you'll get an update on the Campaign and be part of an interactive discussion, including hearing from an active participant who will share best practices on incorporating the campaign into your process. This campaign is ongoing and open to new participants. Join the webinar to learn more.


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ON-DEMAND BETTER BUILDINGS WEBINARS

Through Better Buildings webinars, experts discuss a variety of topics from Air Management to Zero Energy. These webinars are helpful resources on key subject areas in energy efficiency, water efficiency, resilience, and more. Below are webinars we have held over previous years. For each webinar, you can watch the video recording and follow along with the slide deck. To sign up for an upcoming live webinar, click here.

EXPLORE BY TOPIC

Building Envelope | Communications & Engagement | Data Centers | Energy Data Management | Financing | Green Leasing | Health & Wellness | Industrial | K-12 Schools | Lighting | Multifamily | Plug & Process Loads | Refrigeration | Renewables Integration | Resilience | Smart Labs | Space Conditioning | Treasure Hunts | Waste Reduction | Water & Wastewater | Workforce Development | Working with National Labs | Zero Energy Buildings

Indicates the session was a part of the 2020 Virtual Summit. To view a full list of the Summit Sessions, click here.

BUILDING ENVELOPE

A building's envelope (walls, windows, roof, and foundation) accounts for approximately 30% of the primary energy consumed in residential and commercial buildings. Explore all previously recorded webinars on this topic by pressing MORE.

- Unsealed: The Building Envelope Campaign (2020)
- Sneak Peek of the Building Envelope Campaign (2020)
- Addressing the Envelope: Recognizing Building Enclosure Improvements (2020)
- Innovative Wall Technologies for Commercial Buildings (2019)
- Energy Savings Impact of Airtightness in U.S. Commercial Buildings (2019)
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