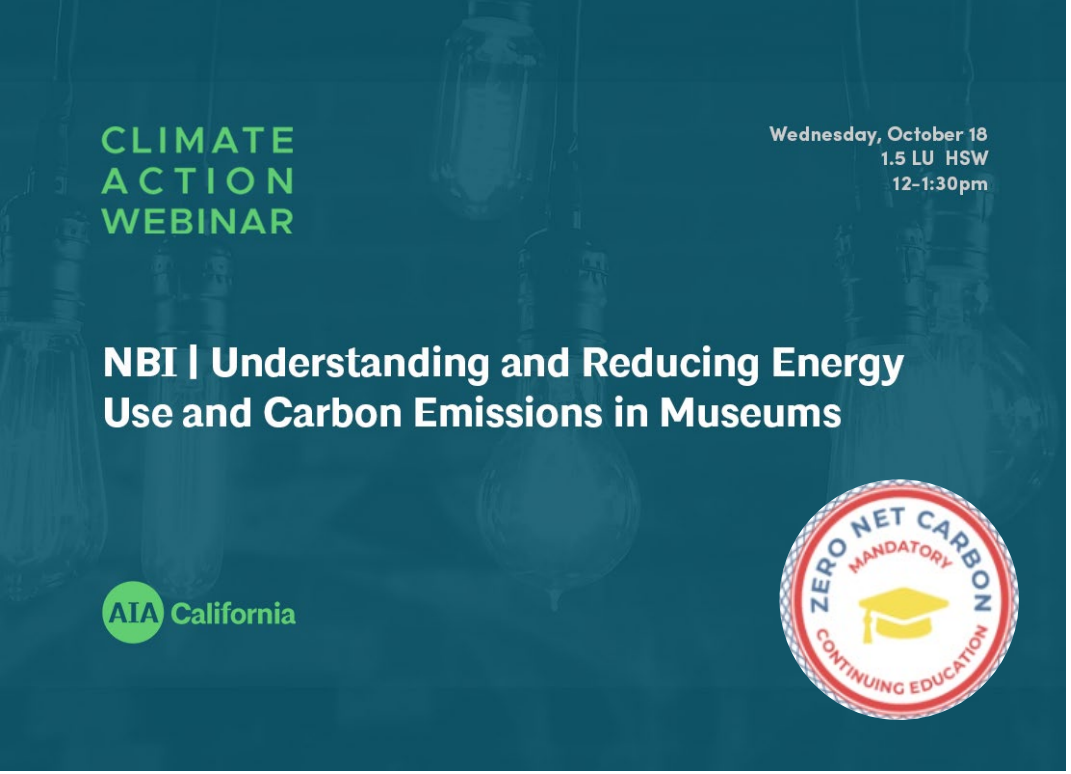

WEBLY BOWLES, AIA
LEED BD+C & O+M
ASSOC. DIRECTOR, CODES & POLICY | NBI

SARAH SUTTON
CEO | ENVIRONMENTAL & CULTURE PARTNERS

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SHANI KREVSKY, AIA
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PROJECT DIRECTOR | EXPLORATORIUM

KATE SCURLOCK, AIA
SR. ASSOCIATE | GWWO ARCHITECTS

ANNE SCOTT-PUTNEY
PRESIDENT & CEO | HERITAGE MUSEUMS & GARDENS

JUDITH HOLT
CONSULTANT | HERITAGE MUSEUMS & GARDENS

HENRY ART
SUSTAINABILITY PROJECTS MANAGER | CLARK ART INSTITUTE

Learning Objectives

NBI | Understanding and Reducing Energy Use and Carbon Emissions in Museums

Name at least two building use patterns common to museums and cultural institution buildings that present challenges for reductions in operational energy use and associated greenhouse gas emissions.

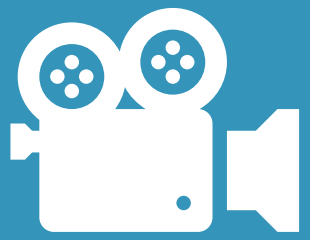
Review examples of how energy targets can be established for museums and cultural institutions given the difficulties in benchmarking this building type.

Have an overview understanding of the New Building Institute's Culture Over Carbon and Carbon Inventory projects that address this building sector.

Explore case studies documenting carbon emission reduction strategies being employed by leading edge museums and cultural institutions.

AIA Continuing Education Provider

Housekeeping Reminders



A recording of today's presentation will be made available on our website

Today's session qualifies for 1.5 AIA HSW/LU & 1.5hrs of ZNCD

Please use the Q&A function to ask questions for today's presenters

Cultivate a positive learning environment

SPEAKERS

WEBLY BOWLES, AIA
LEED BD+C & O+M
ASSOC. DIRECTOR, CODES & POLICY | NBI

SARAH SUTTON
CEO | ENVIRONMENTAL & CULTURE PARTNERS

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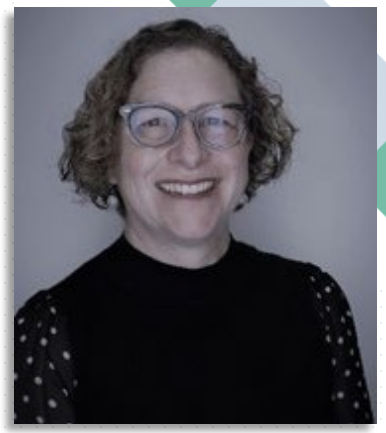

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SUSTAINABILITY PROJECTS MANAGER | CLARK ART INSTITUTE

Climate Action in the Cultural Sector

October 18, 2023

Sarah Sutton
Co-founder and CEO

Environment
& Culture
Partners

Environment & Culture Partners (ECP)

Strengthening and broadening the cultural sector's climate action

A Washington State nonprofit leveraging climate work through partnerships

- Within the cultural sector
- Among sectors
- In community

Trash Lab, Madison Children's Museum *courtesy Sarah Sutton*

The U.S Cultural Sector:

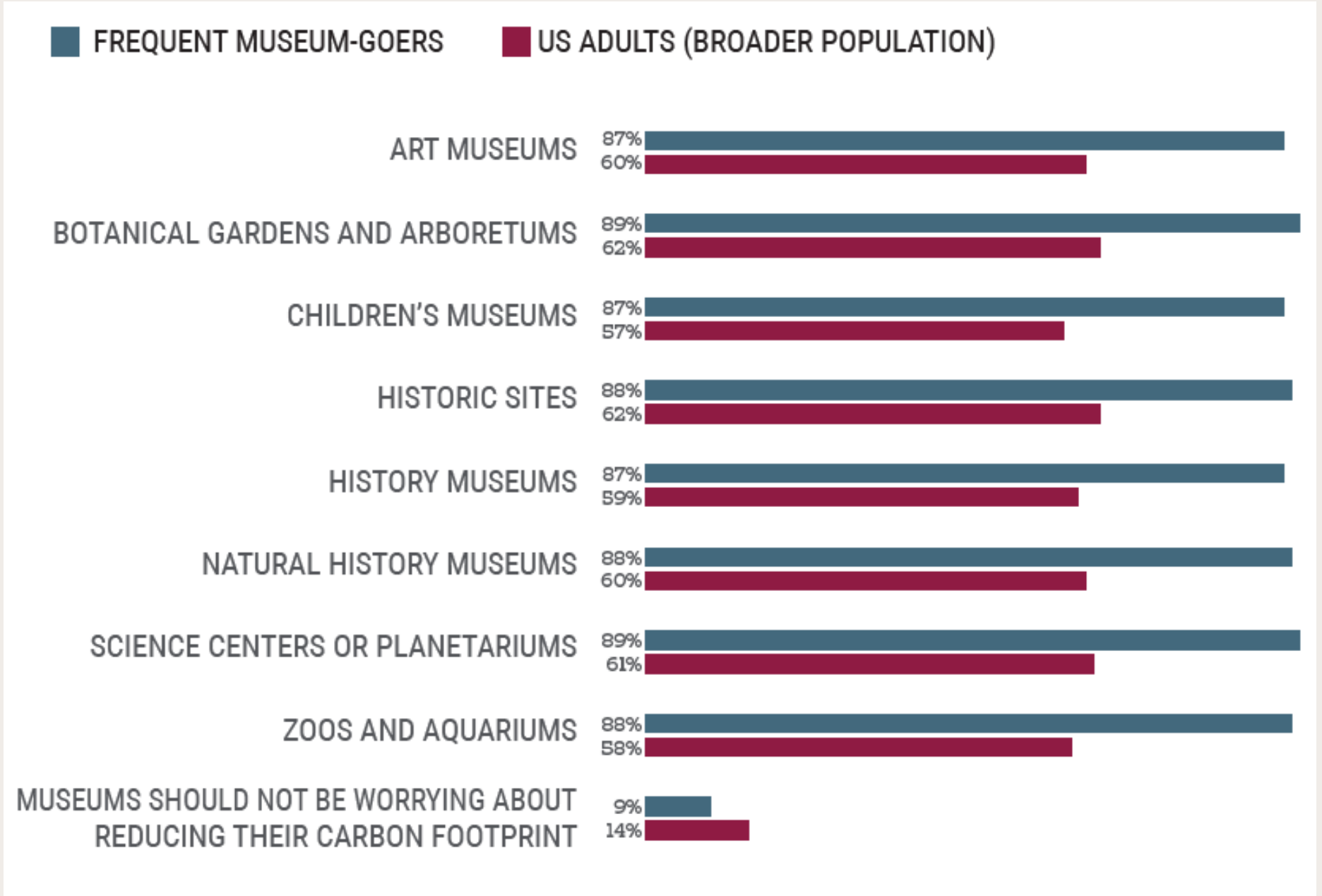
~ 35,000 museums, zoos, gardens, aquariums and historic sites

~ 500,000 people visit annually in the post-COVID recovery

Responsible for ~4M metric tons of CO2e from energy use alone

Snow Man, Alt Group, New Zealand

Question: What types of museums should be working to reduce their carbon footprint and operate in more sustainable ways?



Sources: 2022 Annual Survey of Museum-Goers, n = 90,747; 186 museums participating 2022 Broader Population Sampling, n = 1,017

Common Concerns/Confusion

For a Museum

- Mission creep
  - We're not a science center; we don't "do" climate here.
  - We're a children's museum, we don't talk about climate.
- Climate change is complicated; it's way too hard to talk about with visitors.
- Museums are/should be exempt.
- What if we don't make our goals?

About Climate Change

- The climate has changed before.
- Not all the scientists agree it's happening anyway.

About Taking Action

- It costs too much.
- We don't have time.
- I don't know how to.
- I can't make a difference.

Environment and Culture Partners

2004 – 2008

Construction boom

- LEED, WELL, Living Buildings

2009 – 2016

Reluctant adoption

- Energy efficiency and generation
- Public engagement
- Building efficiency and design

Present -

Acceleration: sector-wide collaborative action

- Research
- Goal-setting
- Partnerships
- Implementation

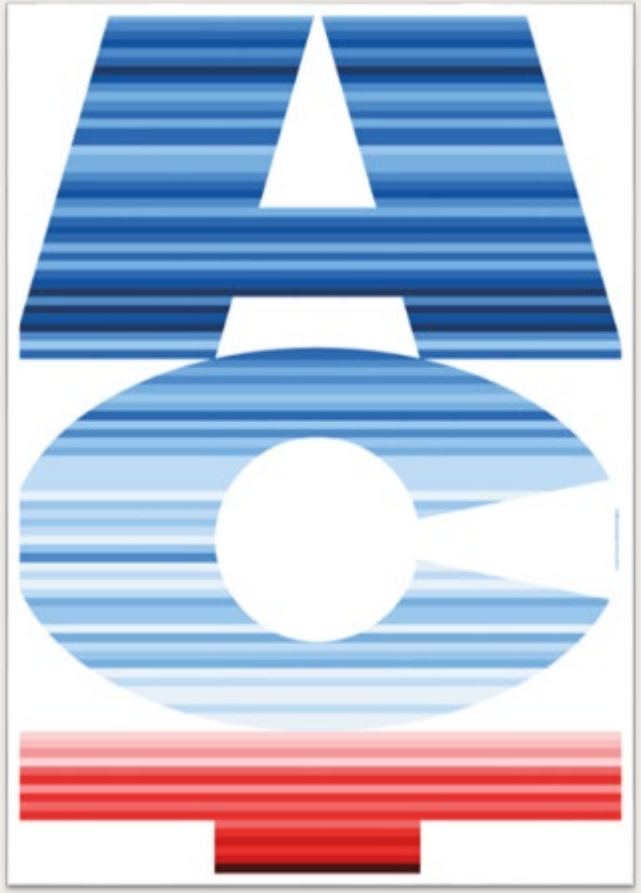
The Crash

2008

Broader Engagement

- We Are Still In → America Is All In
- Mitigation → Adaptation, Engagement, Resilience
- Individual, national, and global climate goals

2017 – 2022



ACT, Erich Brechbühl, Mixer / Lucerne, Switzerland

Press Release, April 22, 2021

The President's GHG emissions target of **50-52% by 2030** "builds on leadership from mayors, county executives, governors, tribal leaders, businesses, faith groups, **cultural institutions**, health care organizations, investors, and communities who have worked together tirelessly to ensure sustained progress in reducing pollution in the United States."

THE WHITE HOUSE

AMERICA IS ALL IN

Frankenthaler Climate Initiative

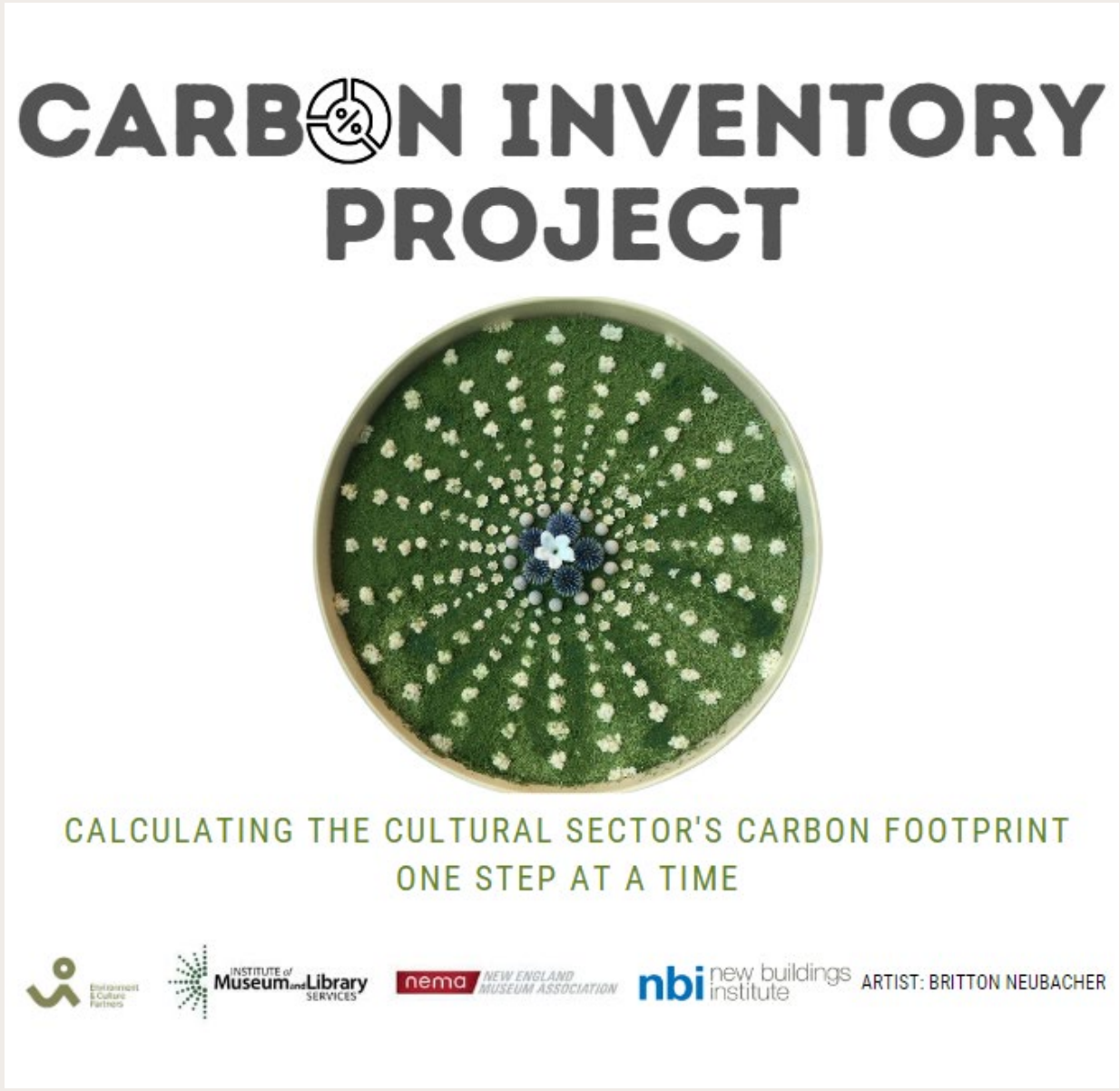
- First nation-wide program to support energy efficiency and clean energy use for the visual arts and the largest private national grant-making program to address climate change through cultural institutions
- Over three years, awarded $10.8M supporting 175 projects at 150 art organizations
- Two more years and $4.2M to grant nationwide

Helen Frankenthaler, *Cool Summer*, 1962, oil on canvas, 69 3/4 x 120 inches (177.2 x 304.8 cm).

Calculating the cultural sector's carbon footprint one step at a time

2023 participants account for 5% of the estimated **4 million Metric Tons of CO2e** emitted by the entire cultural sector in 2022.

Annual Carbon Day 6.16 reporting on sector performance.



1–100 ENERGY STAR® Score

So many other building types can get their scores; museums and other cultural institutions cannot – yet.

LEARN MORE AT energystar.gov

ENERGY STAR® Progress & Goals Report

N/A

ENERGY STAR® Score[1]

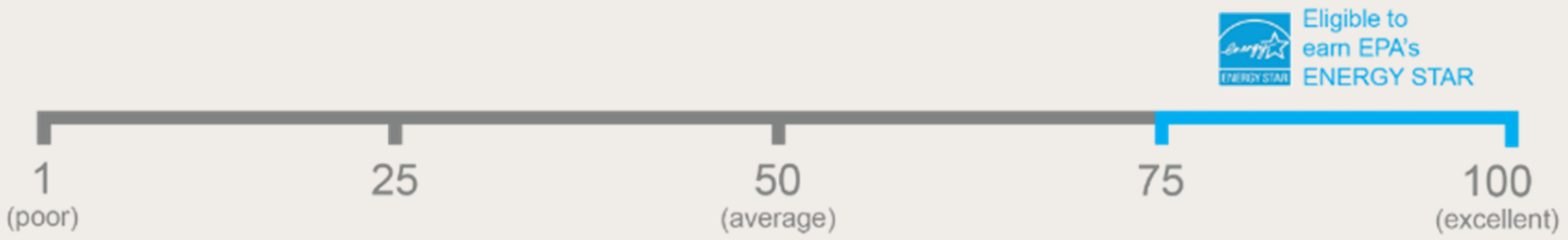
Test Property 1 (Small, single building Museum)

Primary Property Type: Museum
Gross Floor Area (ft²): 10,000
Built: 1970

For Year Ending: November 30, 2022
Date Generated: July 07, 2023

Property Address:
Test Property 1 (Small, single building Museum)
0001 Test Property
Testville, Wyoming 00001

Property ID: 24510566



Min-Max:
70° +/- and 50% RH +/-

These collections environment “standards” are

- Difficult to meet.
- Unevenly applied.
- Not applicable to all collections materials
- May influence energy costs.

Culture Over Carbon data tells us

- Art museums have high thermal baseloads (energy use for heating air or water, or dehumidifying) due to use of fossil fuels.
- They also have high energy use per square foot, likely because of their energy expenditure for collections environments.

That means we need to find out if using wider +/- ranges can influence energy savings.

Thank you

Sarah Sutton
Co-founder and CEO
sarah@ecprs.org

www.ecprs.org

Environment
& Culture
Partners

Culture Over Carbon

Understanding the Impacts of Museums' Energy Consumption

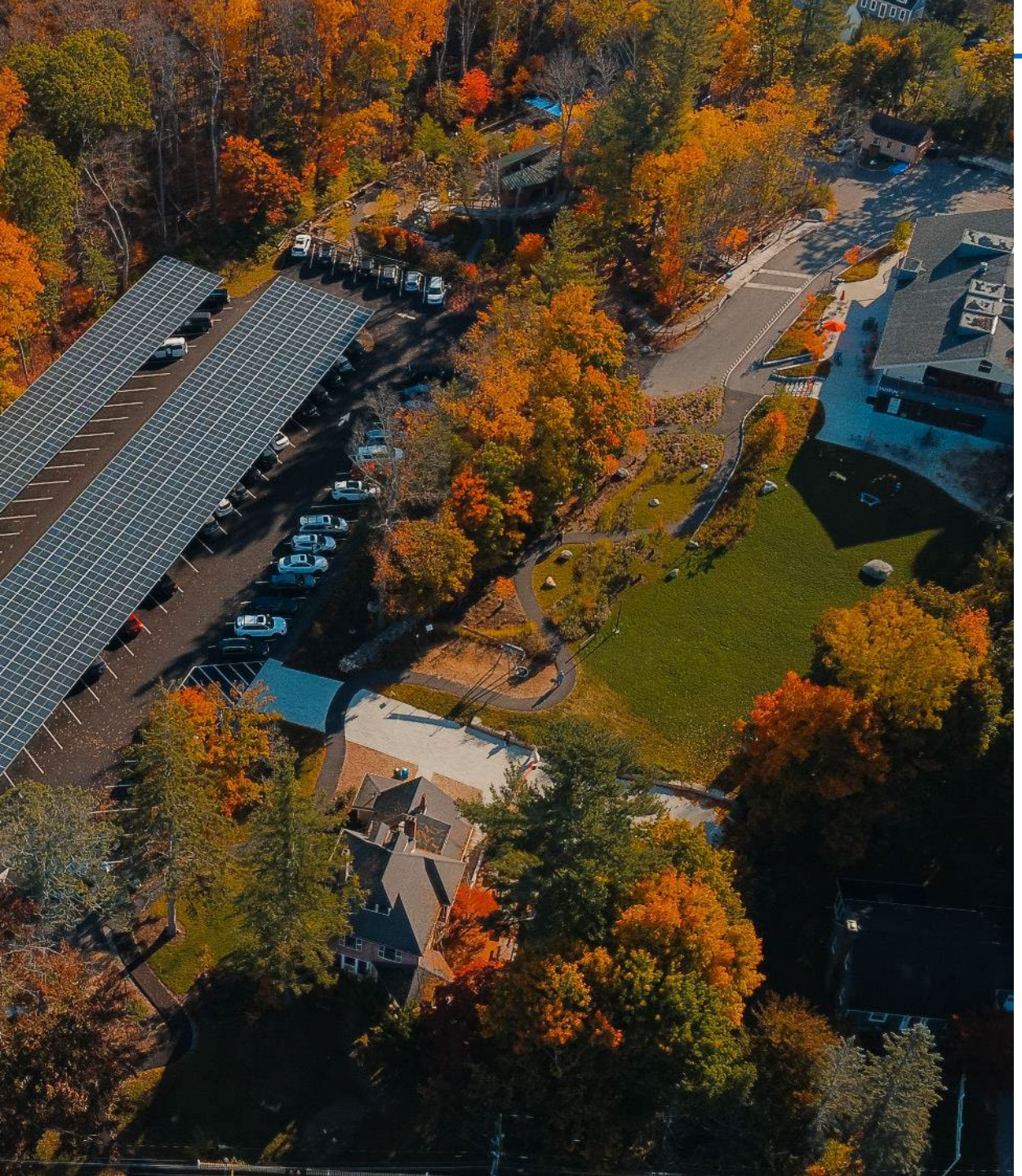
October 2023

Environment & Culture Partners

nbi new buildings institute

nema

INSTITUTE of Museum and Library SERVICES



Culture Over Carbon

Nationwide review of energy use in cultural institutions at individual institutions and for the sector:

- Analyzed energy use in 230 buildings of 133 institutions.
- Looking for field-wide use patterns and key efficiencies.
- Providing data preparing for expected building code and policy changes.
- Working toward a sector-wide benchmark and an Energy Star Portfolio Manager category for Museums.
- Estimating the sector's energy impacts on climate to support strategic planning for making reductions.

A collaborative project of the New England Museum Association, New Buildings Institute, and Environment & Culture Partners

Discovery Museum, Solar Array, Acton, MA

Why Measuring Matters

Understanding energy use enables cultural institutions to…

- Hold themselves accountable for emissions
- Set a footprint reduction goal
- Recognize and celebrate the important carbon footprint reduction work being done
- Seek funding for projects that will improve efficiency and reduce carbon
- Contribute to reports that demonstrate progress such as the U.S. National Determined Contribution (NDCs)

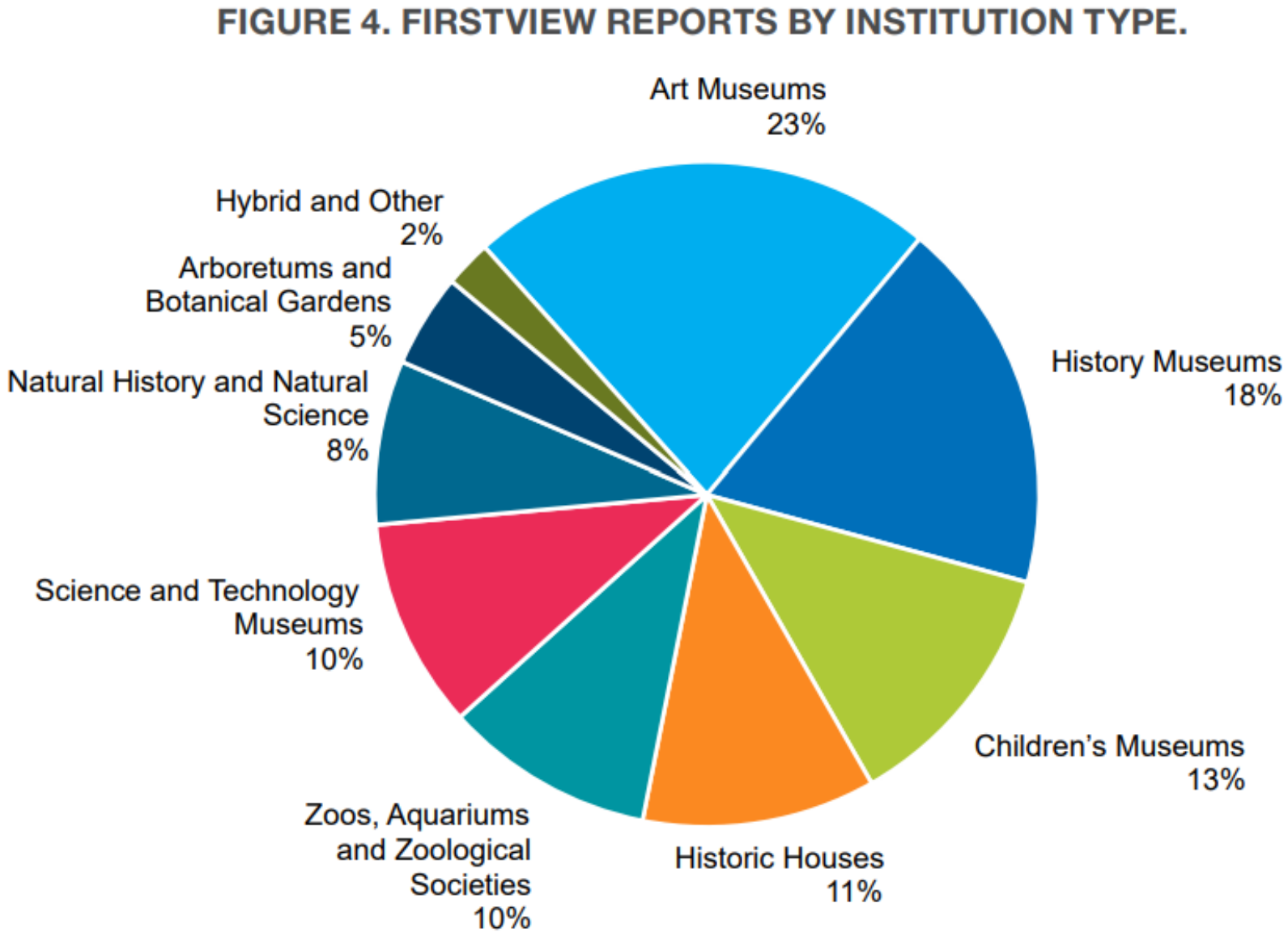
Alaska Burning, 2019

Photo Credit: Parker Brophy

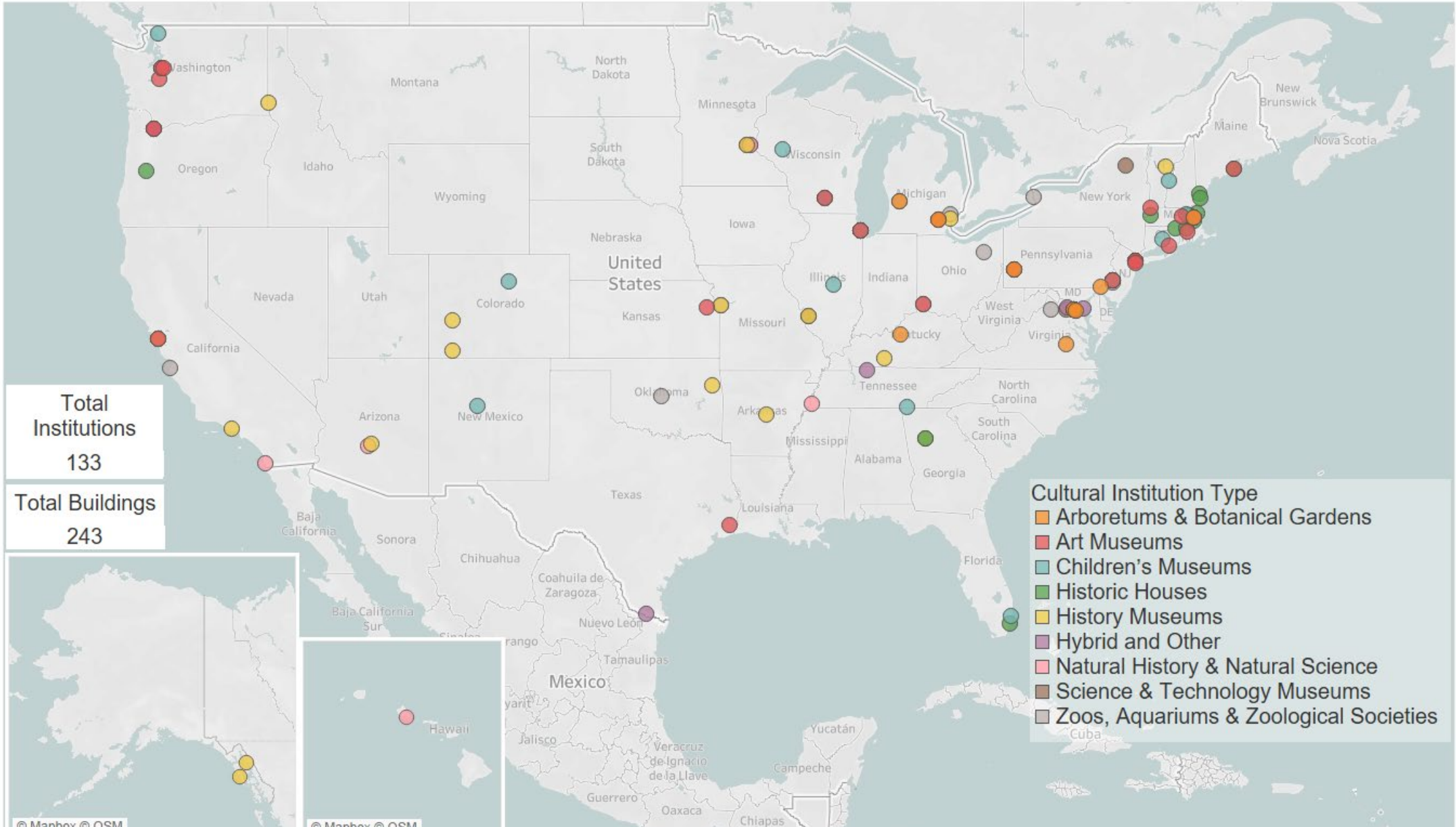
Participation and Analysis

Institution Participation

- **133** total institutions included in the study
- **88** provided enough data to generate a FirstView report
- **189** building reports created



Participation by Institution Type



FirstView® Report

About Your Building

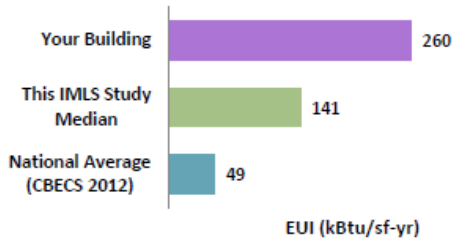
Location	City, NJ
Institution Name	Example Aquarium

Reference Data

Electricity	Jan 2021 - Dec 2021
Thermal	Jan 2021 - Jan 2022
Chilled Water	None in this building
Bldg. Size	200,000 square feet
Bldg. Type	Zoos, Aquariums and Zoological Societies

How Your Building Compares

The chart to the right compares your building's annual energy use intensity (EUI) with national standards. EUI is a common energy metric that measures your building's energy use per square foot. This figure is calculated by dividing total annual energy use by the size of your building (kBtu/sf-yr). Your building's EUI is compared to the CBECS* median for public assembly buildings as well as this IMLS study** median performance for zoos, aquariums and zoological societies.



Energy Efficiency Diagnostics for Your Building

Category	Status
Heating and Ventilation Efficiency	Typical
Cooling Efficiency	Poor
HVAC Reheat	No apparent problems
Thermal Baseload	High
Light and Plug Loads	Typical
External/Process Load	High
Data Consistency	Orderly

FirstView generates automated diagnostics by analyzing your building's energy use patterns and comparing it to data from other IMLS study participants and similar buildings.
Click here to learn more.

Energy Efficiency Findings and Recommendations for Your Building

Based on your building's energy use patterns, you may be able to reduce energy use by focusing on improvements in the following areas:

- This building may be a good candidate for cooling system improvements. Excess outside air rates, high outside air infiltration, poor control settings, and 24-hour fan schedules may be present.

- This building has a high gas baseload, which may be associated with domestic hot water (DHW) use, excessive reheat during warmer months, or process loads. Potential issues may include: high DHW setpoints, poor water heater efficiency, gas process loads, and/or HVAC reheat.

- This building may have elevated external or process loads. Increasing the efficiency or improving the scheduling of these loads, if possible, may provide energy and carbon reductions.

Find more detailed information about your building's energy use on the following page.

This report is funded by a National Leadership grant (2021-2023) from the Institute of Museum and Library Services (IMLS).

* The 2012 Commercial Buildings Energy Consumption Survey (CBECS) is a national building survey commonly used to represent the energy use of typical existing building stock in the United States.

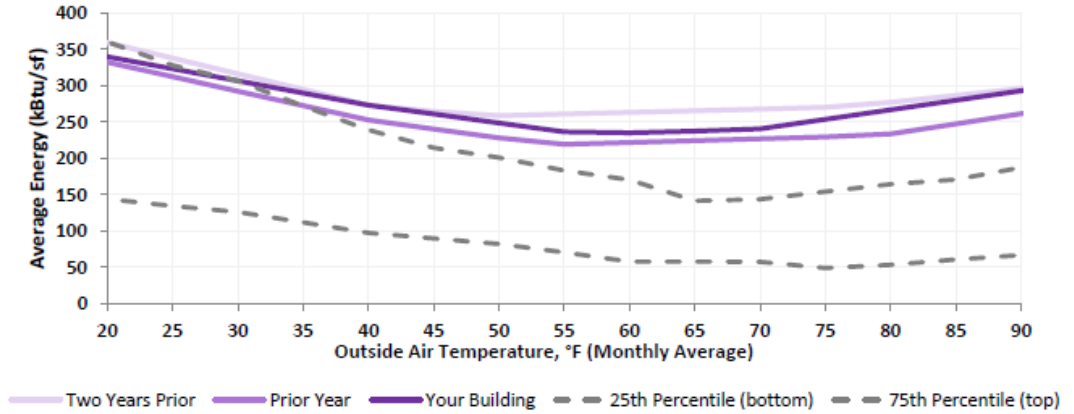
**The IMLS research project includes energy performance data from over 190 United States museums, arboretums and botanical gardens, historic houses, aquariums, zoos, and zoological societies.

FirstView® Report

Your Building's Energy Use and Carbon Emissions Compared to its Peers

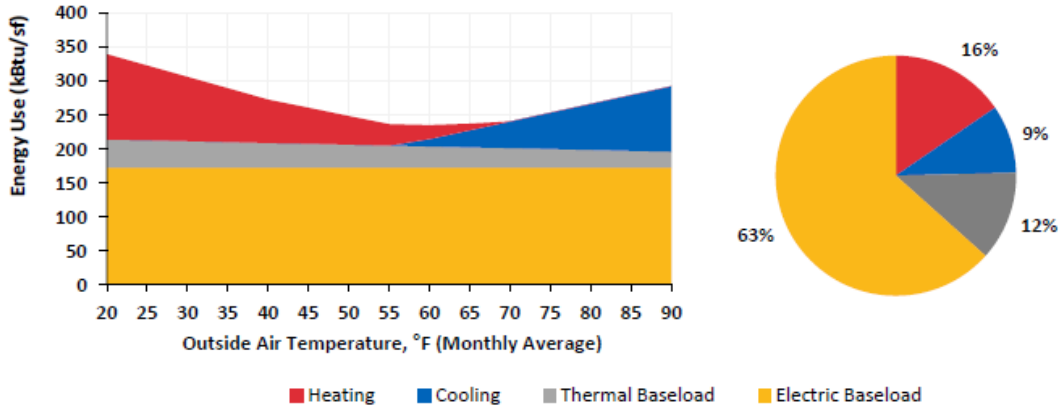
The chart below shows your building's energy use as modeled by FirstView at various temperatures alongside energy signatures of other zoos, aquariums and zoological societies from the IMLS study. The purple energy signature line represents total energy use from electricity, fossil fuel gas, chilled water, and/or other fuels used in your building. The reference band represents the performance range of the middle 50% of buildings (25th to 75th percentile). Areas where your building's signature is higher than the reference band indicate higher energy consumption than typical peer buildings.

Your building's estimated carbon intensity is 20.5 kg CO2e/sf-yr, compared to this IMLS study median of 7.2 kg CO2e/sf-yr.



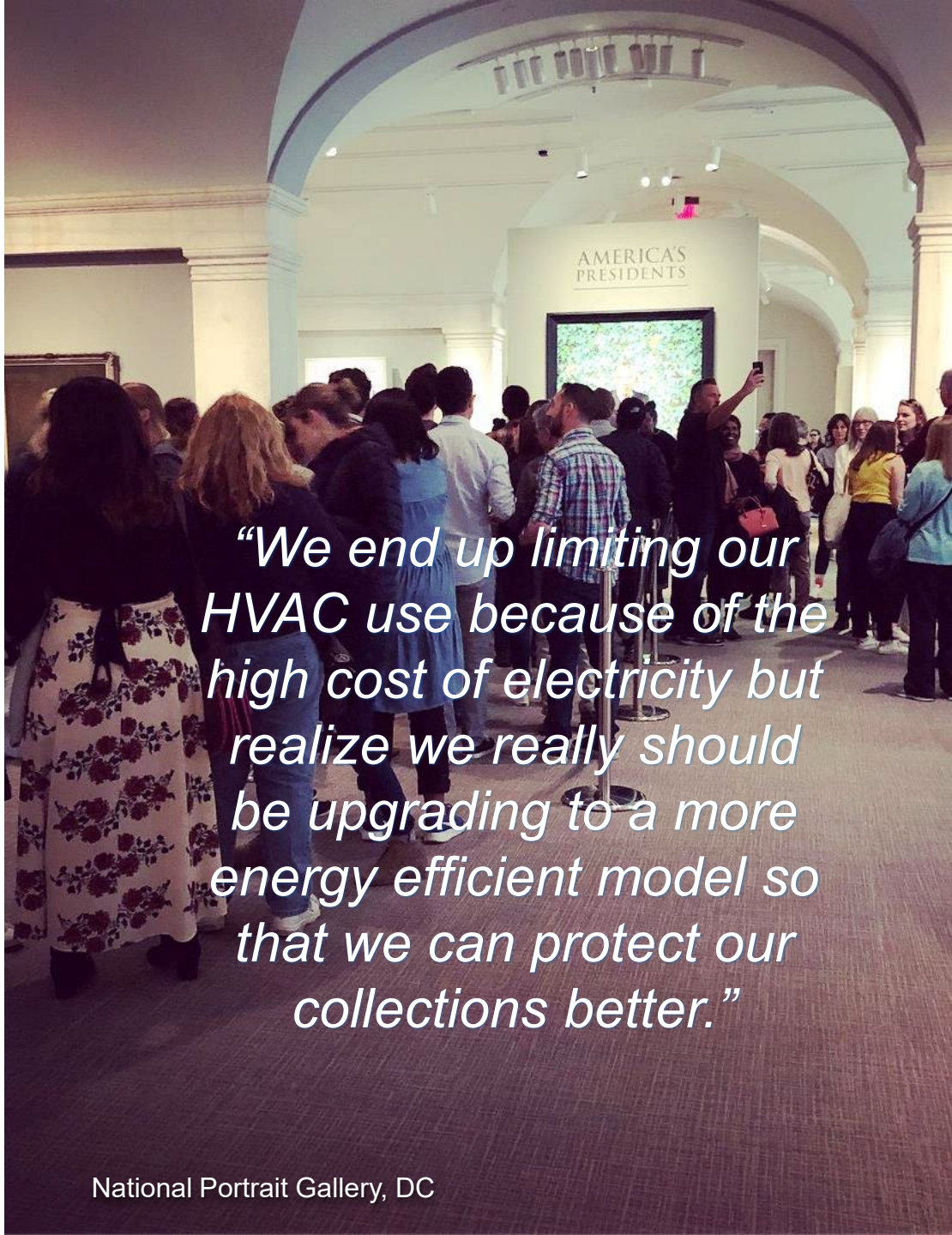
How Energy is Used in Your Building

These charts show your building's total energy use split into four end-use categories: heating (electric, gas, district hot water, and/or steam), cooling (electric and/or chilled water), electric baseload (e.g. plugs, lights, and equipment), and thermal baseload (e.g. gas used for water heating) which has been adjusted for weather. This offers insights into energy consumption patterns, including how your building's energy use is allocated. FirstView identifies end-uses with high usage compared to similar buildings and has those listed in the diagnostics on page 1. Click here to learn more about understanding FirstView results.



Energy Findings

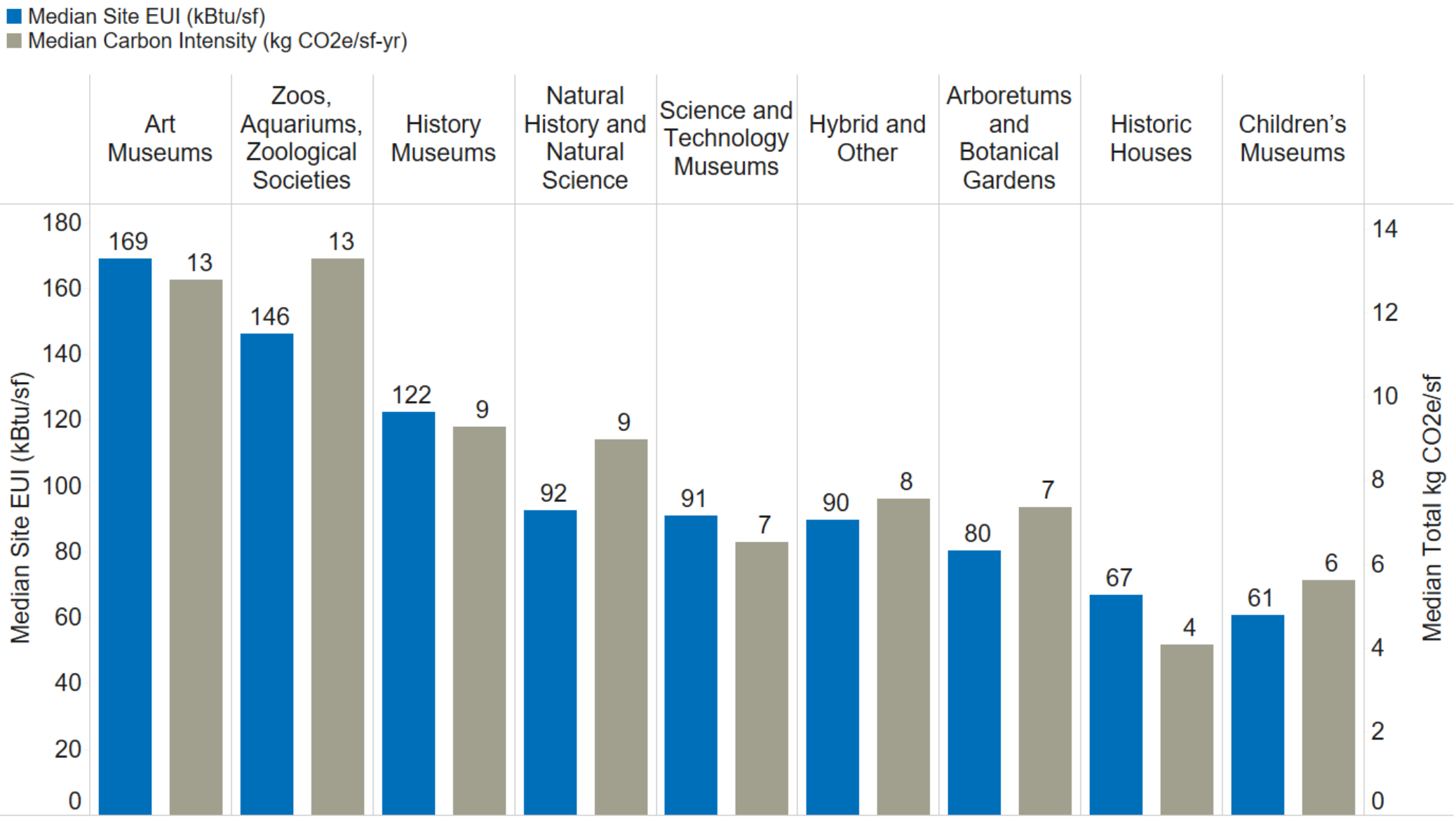
- Art museums are largest energy users, likely due to humidity requirements
- Very high heating for historic houses
- Outliers across most building types (e.g., 300+ EUI)
- Wide spread of energy use across most institution types



"We end up limiting our HVAC use because of the high cost of electricity but realize we really should be upgrading to a more energy efficient model so that we can protect our collections better."

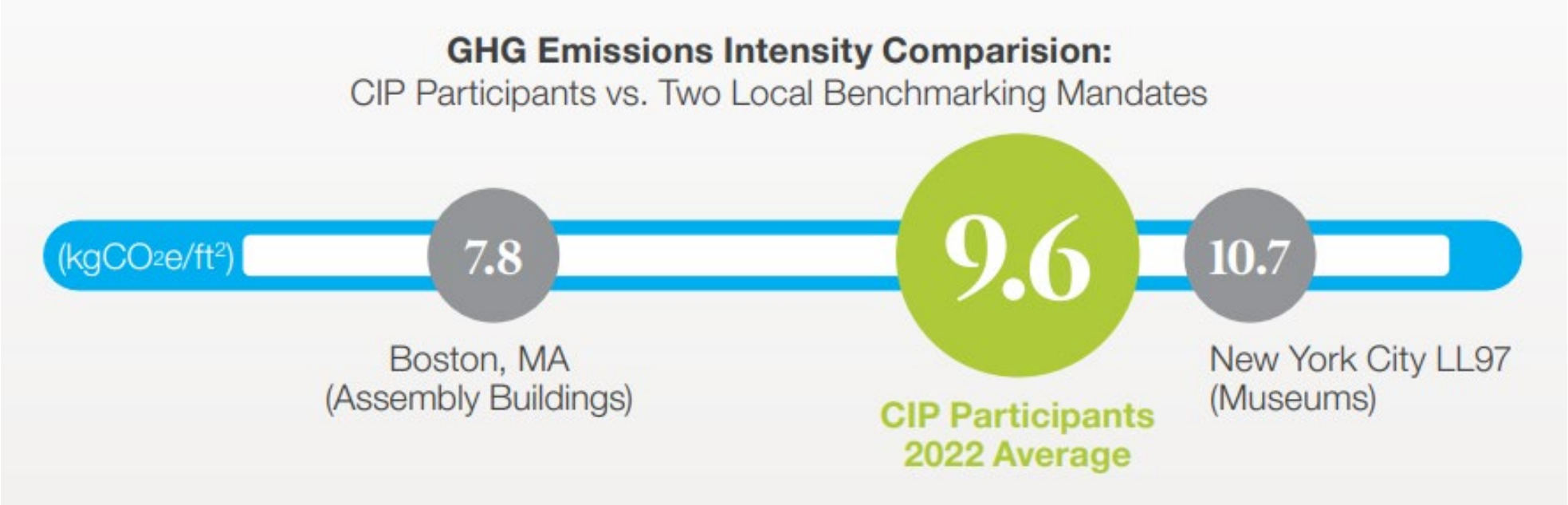
National Portrait Gallery, DC

EUI and Carbon Intensity



Carbon Intensity – CIP Cohort

- Ranged from less than zero (due to onsite renewables) to approximately 49 $kgCO_2e/ft^2$



Recommendations & Resources

Overall Recommendations for Museums

- ❑ Create a system replacement plan
- ❑ Conduct building system commissioning
- ❑ Use efficient lighting and harvest free daylight
- ❑ Install and maintain automatic building system controls
- ❑ Consider improvements to the building envelope (e.g., walls, windows, and doors)
- ❑ Reuse and store energy
- ❑ Select efficient hot water heating
- ❑ Replace inefficient heating & cooling equipment
- ❑ Promote energy efficiency activities

LBJ Museum, Lady Bird Johnson Office, TX

Recommendations for All Buildings – Including Cultural Institutions!

https://newbuildings.org/resource/an-insiders-guide-to-talking-about-carbon-neutral-buildings/

Resources

https://ecprs.org/engagement/culture-over-carbon/

Thank you!

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Technical Associate
Mischa@newbuildings.org

nbi new buildings institute

www.newbuildings.org

Exploratorium Pier 15: Pathway to Zero Energy

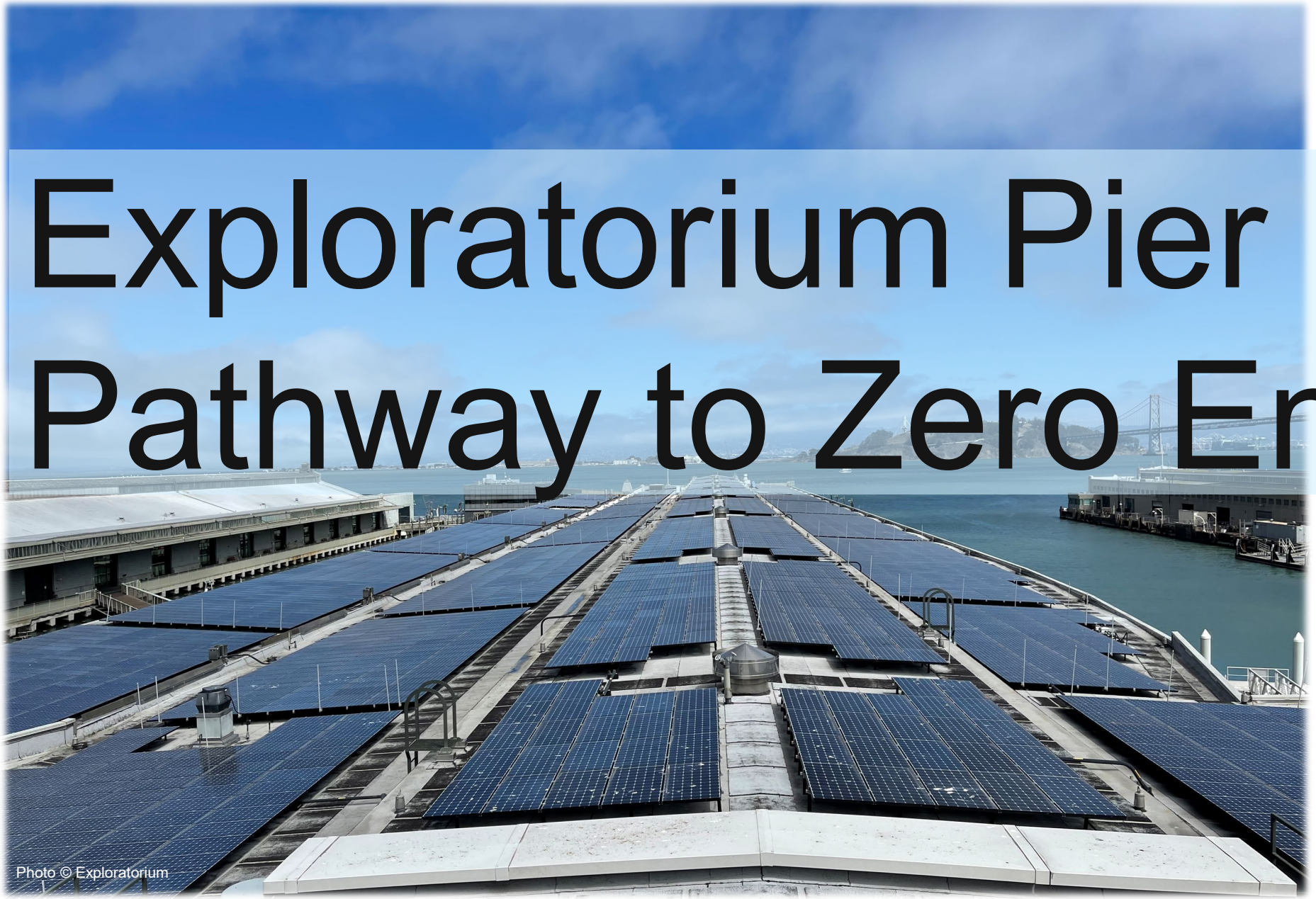


Photo © Exploratorium

<u>A Case Study</u>
Operating a high performance building, 10 years and counting

Background

The Exploratorium opened to the public in 1969 at the Palace of Fine Arts in San Francisco. In 2013 we moved to Pier 15 on the Northeast waterfront.

There is an increasing need to develop public understanding of Science and Technology.

- Frank Oppenheimer 1968


Palace of Fine Arts 1969

Why Zero Net Energy?

Our goal is to continue to generate enough energy from our on-site solar panels to meet our annual energy needs and thus reduce our greenhouse gas emissions and reliance on fossil fuels.

- Our location positions us in a front row seat of resiliency and adaptation.
- As a verified ZNE building we aim to be a leader within the museum community.

Planning for SLR

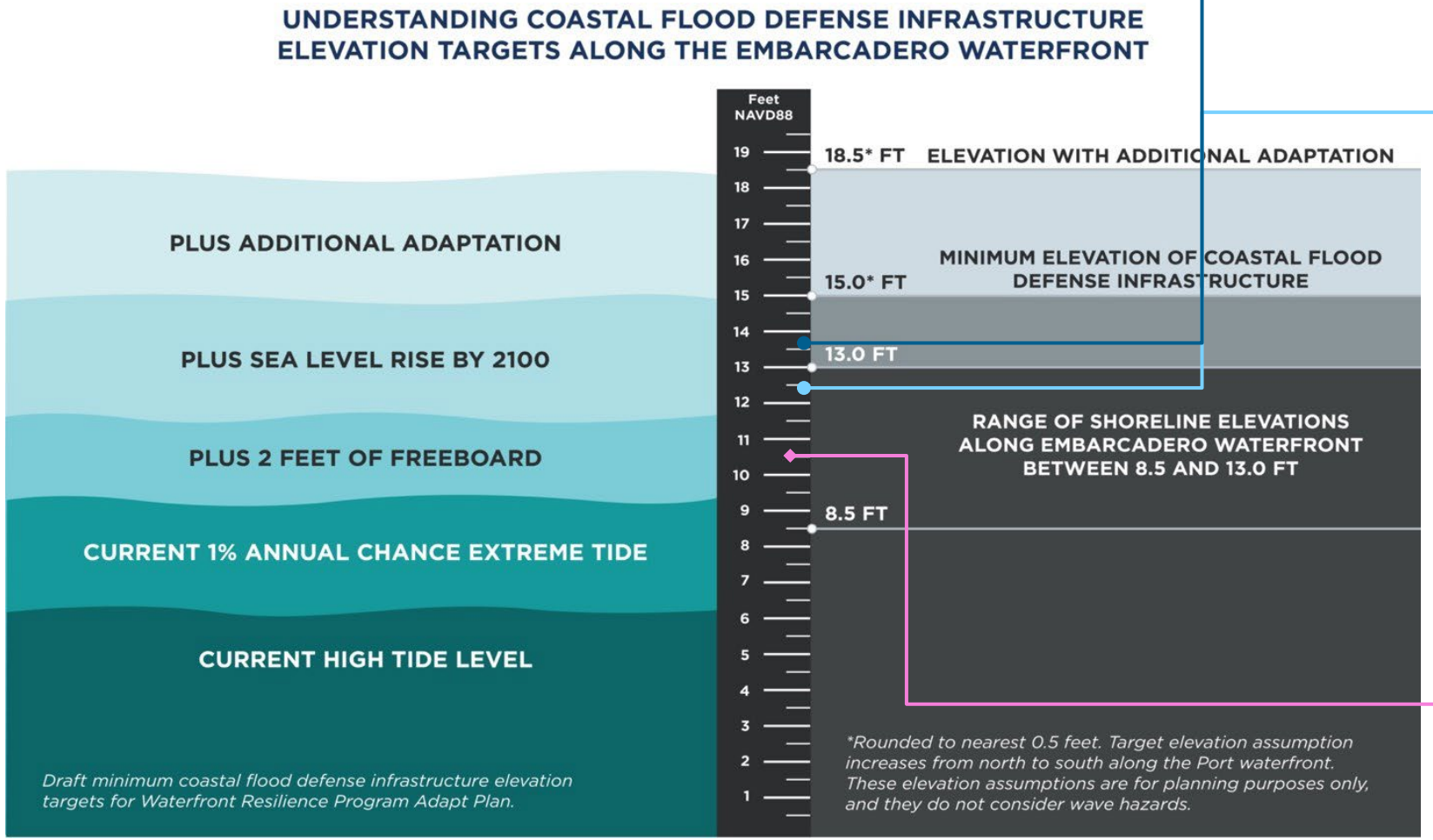


Image courtesy 9/12/22 Port of San Francisco Capital Planning Committee

Average Pier 15 Elevation
+13.33’ NAVD 88

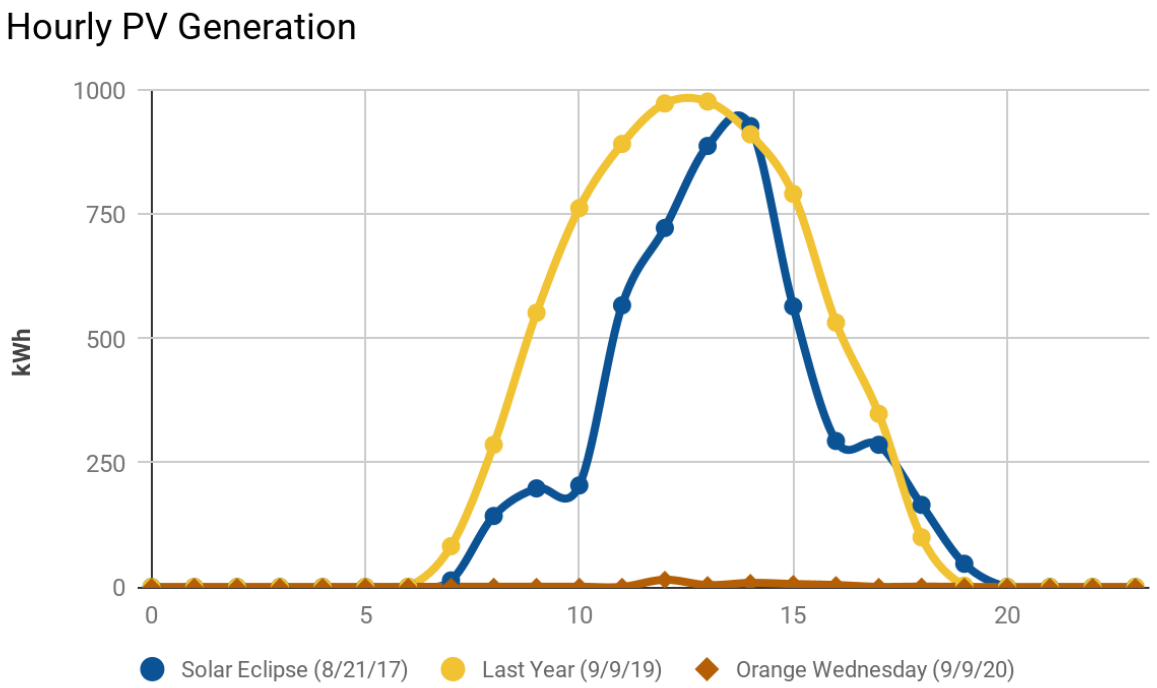
Current Pier 17 Elevation
+12.35’ NAVD 88

In just 10 years the expected impacts of SLR have increased.

Anticipated SLR in 2009:
55”

More frequent wildfires

On September 9th, 2020, the Bay Area experienced a day of perpetual twilight as a result of local wildfires.

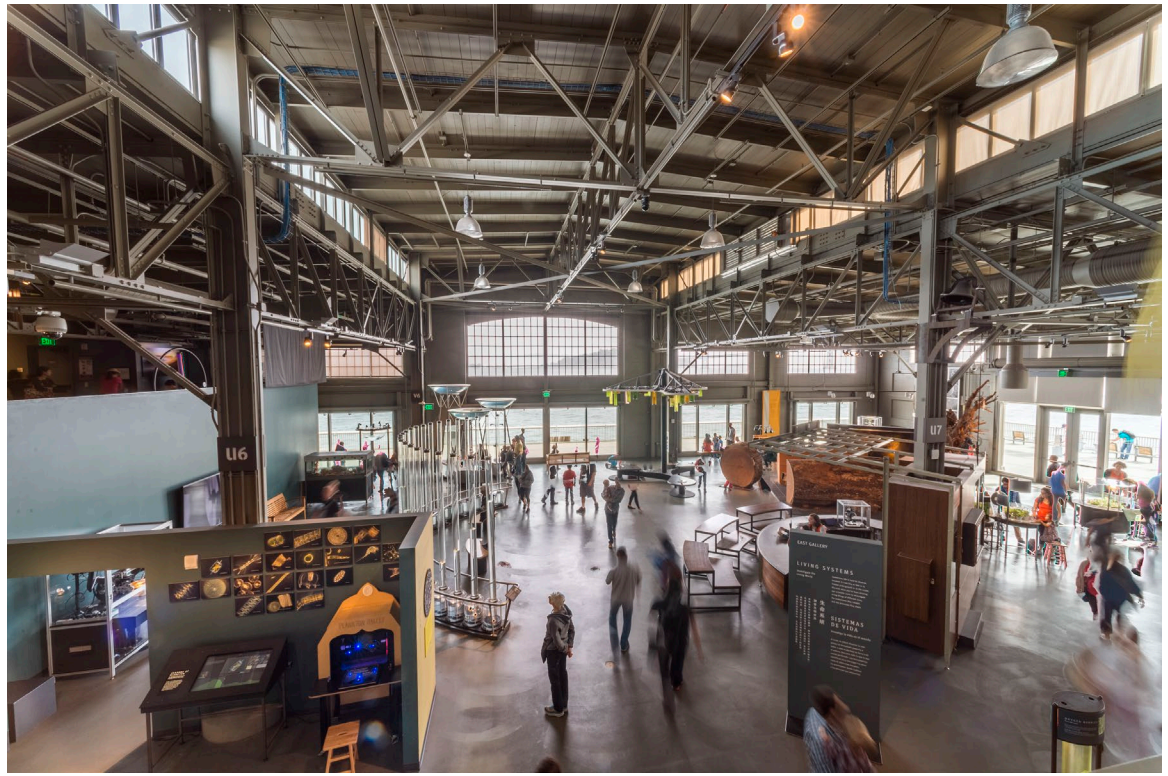


Daily Energy Produced	kWh
Monday 9/7/20	5,792
Tuesday 9/8/20	3,615
Wednesday 9/9/20	**63**
Thursday 9/10/20	1,047
Friday 9/11/20	3,380
Saturday 9/12/20	4,225
Sunday 9/13/20	3,079

The building design does the heavy lifting

Photo © Exploratorium

The transfromation of a historic shed into a sustainable building



Photos © Exploratorium

Photo © Sunpower

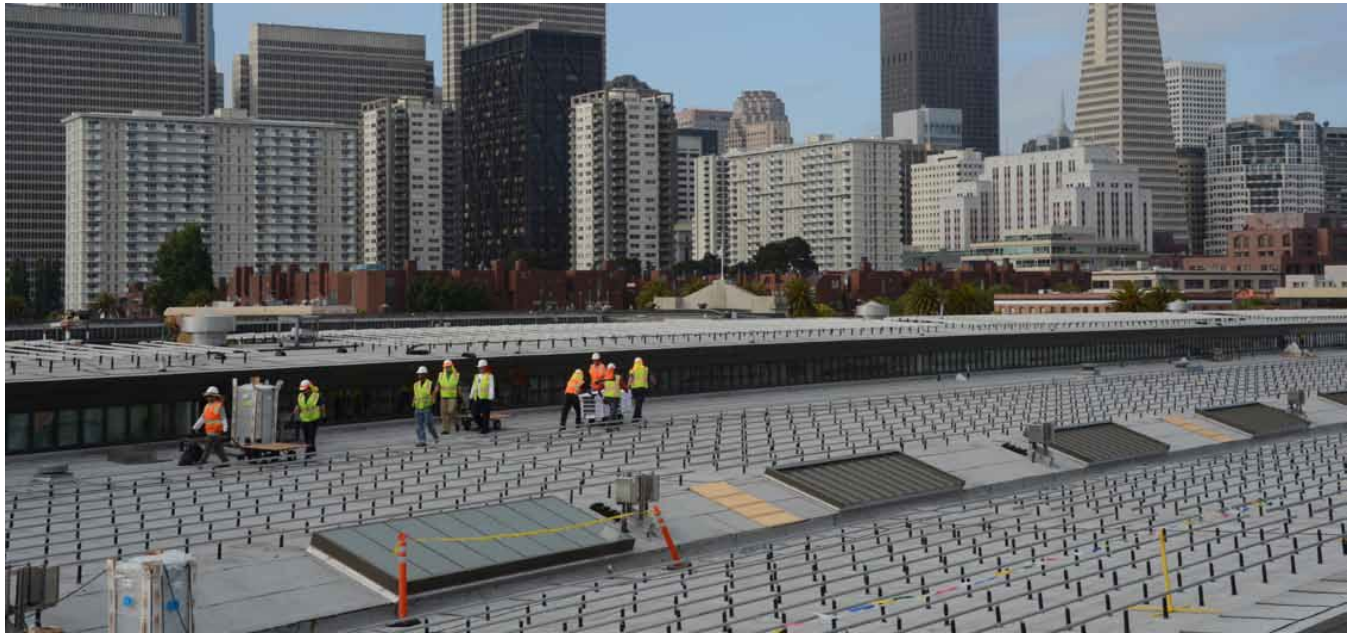


Photo © Exploratorium

1.4 MW DC of Photovoltaics

- 5,874 high efficiency SunPower SPR-245 high efficiency PV modules
- 75,000 sq. ft. roof area covered
- Average annual production is 2,000,000 kWh
- ~ 24,000 roof penetrations
- Fixed-tilt array

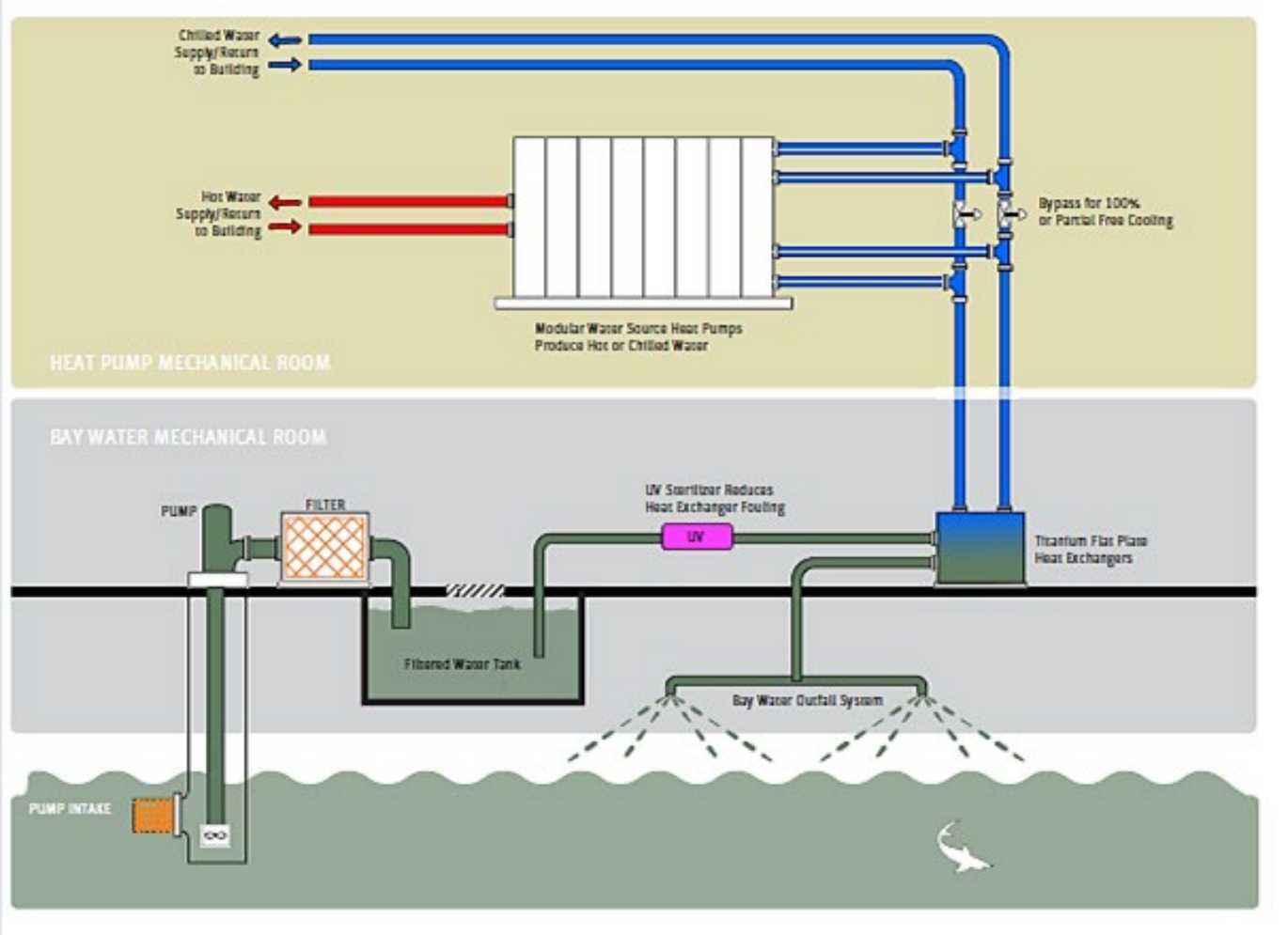


Image Source: Integral Group

Bay Water Heating & Cooling System

- All electric fully hydronic system, including Air Handlers & Water-Source Heat Pumps
- No cooling tower or boiler
- Titanium plate heat exchangers are paired with a 400 ton water-to-water heat pump
- Bay water temperature is relatively stable year round and is used as a heat source or sink
- “Free Cooling” economizer mode is available 4-6 months of the year

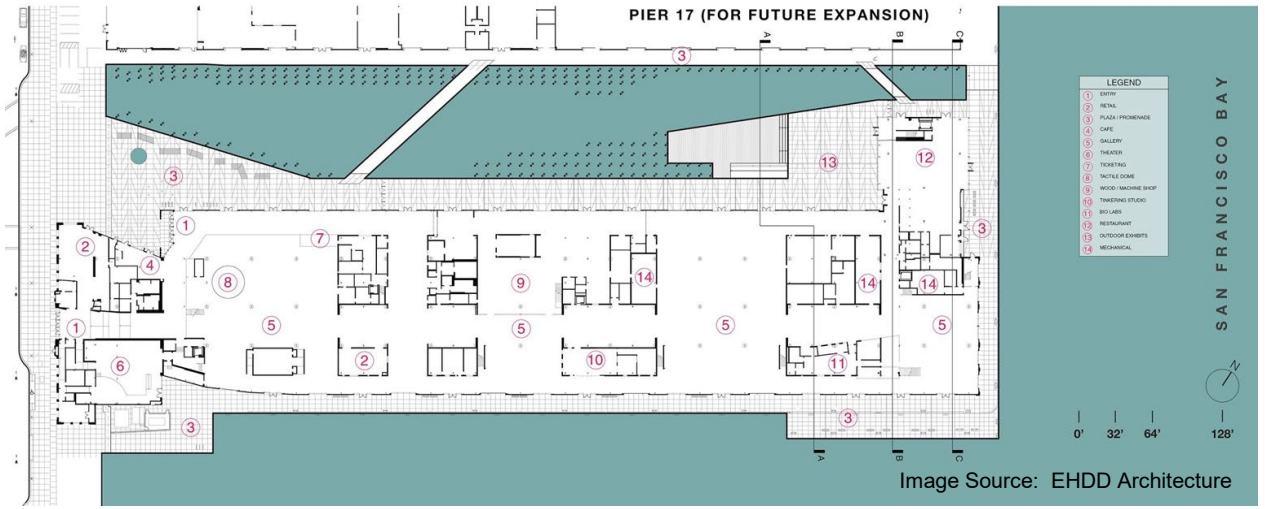


Image Source: EHDD Architecture

Daylighting & Building Envelope Improvements

- Interior “buildings” set back from the perimeter, bringing natural light into galleries
- Insulated glass windows with fritted or low-e glass
- Added insulation in roof & under topping slab
- Energy Star “cool roof”

But how you operate it is key

Photo © Exploratorium

Just setting the goal doesn’t make it so

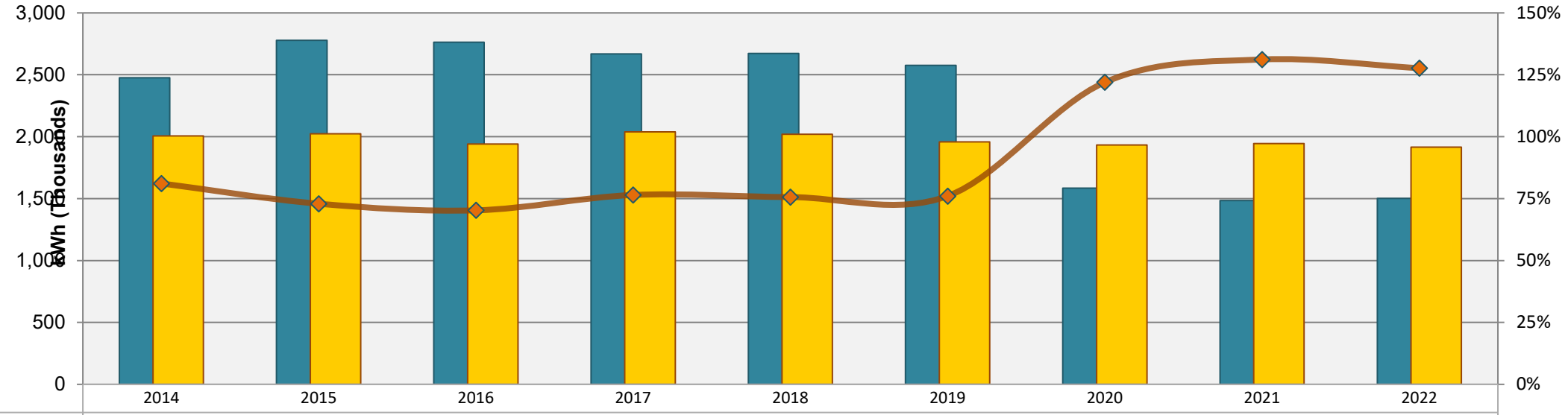
Our path to Zero Energy was not without challenges. Know what your design engineers are modeling - original model excluded the kitchens/food service areas and was not set to achieve ZNE but simply meet ASHRAE 90.1

- Not your average building type
- Inverter Outages
- Warmer bay temps mean less availability of Free Cooling (a direct impact of climate change)
- No room for energy storage (limits ability for implementing emerging technologies)
- Successful attendance/power hungry exhibits and events

Annual Trends

Average Performance (kWh)	
Production	1,975,000
Consumption	2,342,000

Site EUI (kBtu/ft2)	
2015 Modeled	45.6
2022 Actual	23.3

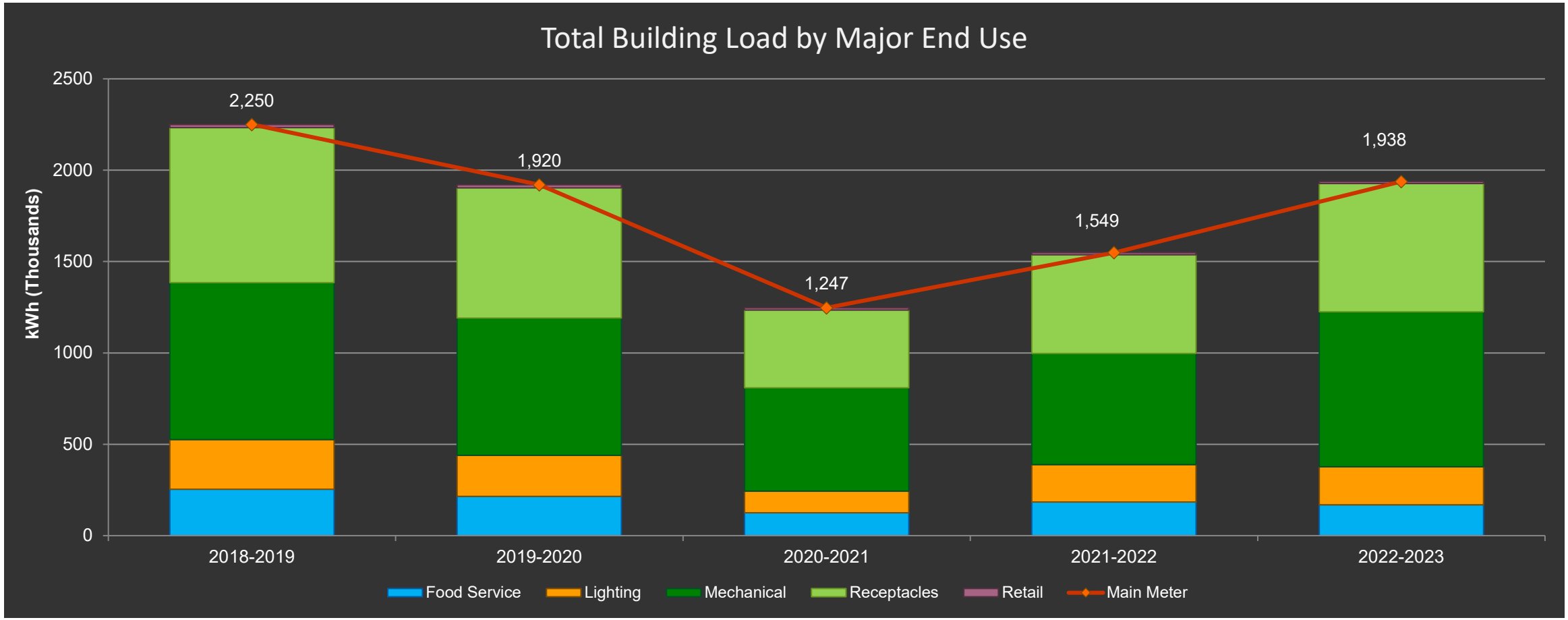


	2014	2015	2016	2017	2018	2019	2020	2021	2022
Consumption (Total Building Load)	2,475,311	2,776,931	2,762,678	2,667,302	2,672,374	2,576,698	1,584,795	1,483,321	1,501,370
Production (Onsite Solar)	2,006,610	2,023,950	1,939,897	2,038,477	2,019,565	1,957,718	1,931,969	1,944,950	1,916,065
ZNE	81%	73%	70%	76%	76%	76%	122%	131%	128%

Formulas for calculating Zero Energy (Total Building Load Includes Food Service): $Onsite\ Solar\ Generation\ (PVA + PVC) + Utility\ Consumption\ (PG\&E\ Kwh\ delivered) - Utility\ Production\ (PG\&E\ kWh\ received) = Total\ Building\ Load$

$Production \div Total\ Building\ Load = Zero\ Energy\ Status$

Pier 15 Energy Consumption: Rolling 12-Month Trend (July-June)



Cumulative Energy Trend

We have consumed a total of **24.3 gWh** and produced **20.7 gWh** of electricity since opening in February 2013. In other words…

85%

of Pier 15's **total** energy needs has been generated by the on-site renewable solar power since move-in to Pier 15!

*This is a reduction of **16,186** tons of CO2…*

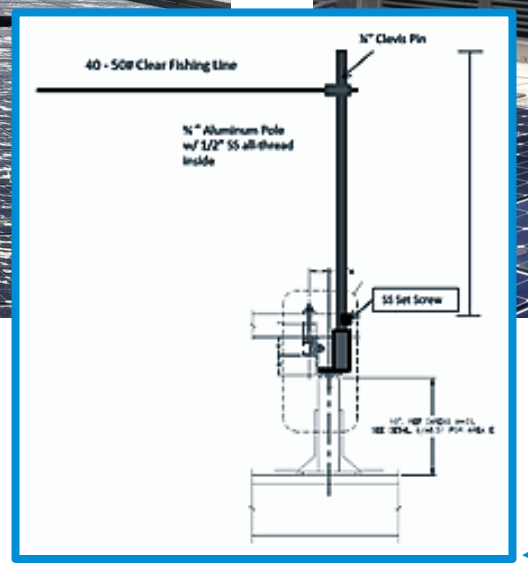
which is equivalent to:

Enough electricity to power **286** homes over the past ten years

Carbon sequestered by **17,510** acres of forest

The annual emissions of **3,268** passenger cars

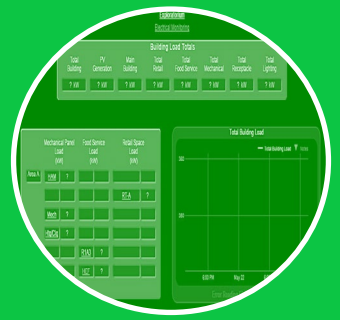
Installing PV panels on a low slope roof



Lessons Learned

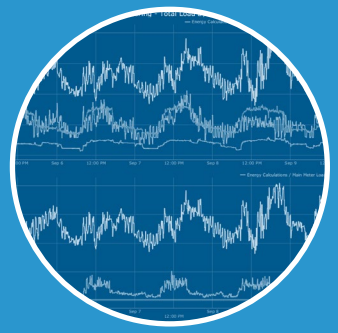
Commitment from Senior Leadership is essential to support the goal. Ongoing champions are key to achieving it.

Be aware of site constraints and conditions



Don’t rush the commissioning process

New environments require a fundamental shift in how we work



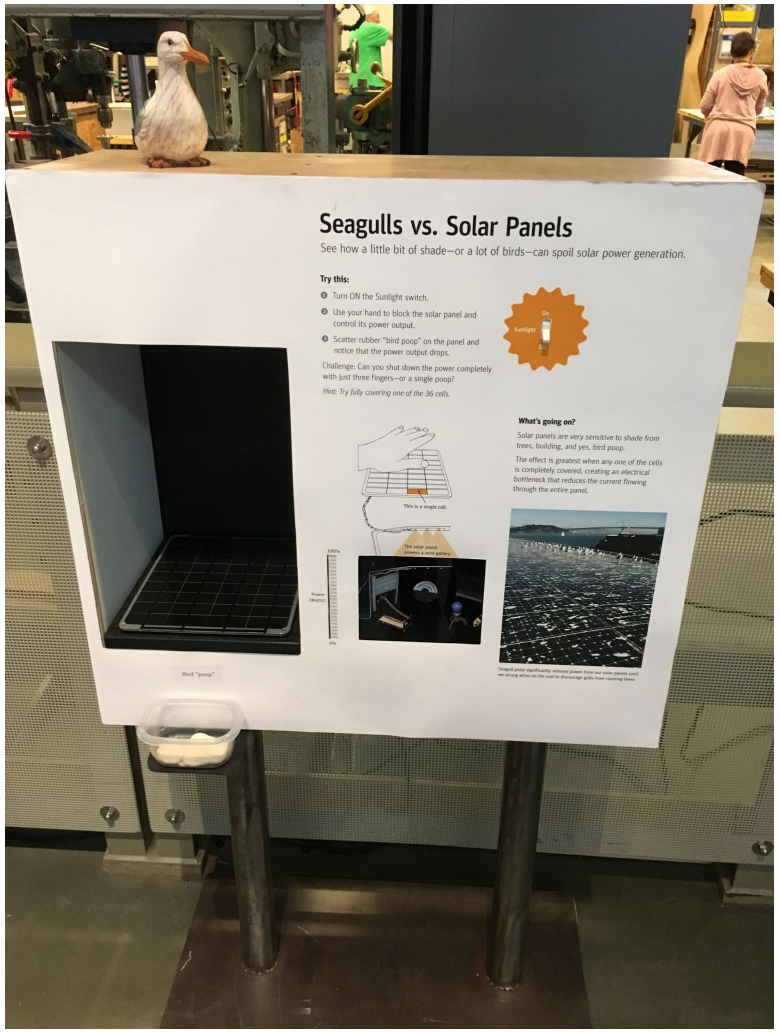
Actively manage & monitor energy use

Review & reassess energy needs to reflect changing conditions

Make energy efficiency part of your ethos

And zero net energy & decarbonization will follow

- Tell the story!
- Localized control for lighting and plug loads
- Always look for energy conservation opportunities
- Plan for energy storage
- Robust O&M program
- Have room for emergent technologies



Thank You.

Interested in learning more?
https://www.exploratorium.edu/about/sustainability-the-exploratorium-as-exhibit

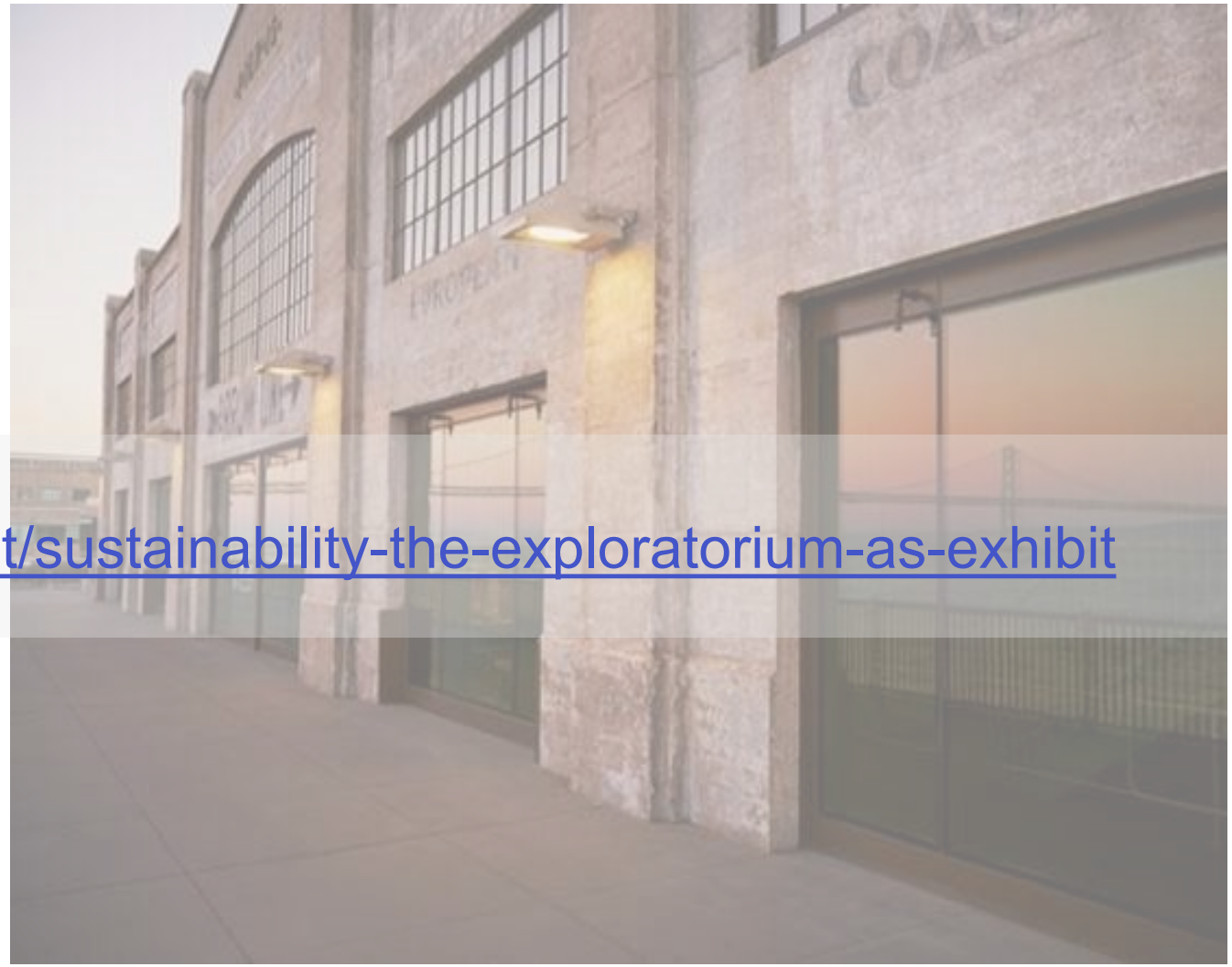


Photo © Bruce Damonte, WE-EF

Shani Krevsky
Project Director, Campus Facilities
skrevsky@exploratorium.edu

"Sustainability is fundamental to the mission of Heritage."

Anne Scott-Putney,
President, CEO, Heritage Museums & Gardens
Sustainability Plan Approved by Board of Trustees, 2019

HERITAGE
MUSEUMS & GARDENS

HERITAGE
MUSEUMS & GARDENS

- Largest cultural attraction on Cape Cod
- 130,000 visitors/year
- 100 acres of woodlands and living collections
- Three museums
- 17 total buildings

Strategic Sustainability Plan

Approved by

Board of Trustees - 2019

HERITAGE
MUSEUMS & GARDENS

- To be a model of sustainability,
- To stop the use of fossil fuels to reduce carbon dioxide emissions, and
- To provide public engagement in these issues through exhibits and education.

Expressed in Events and Exhibits

HERITAGE
MUSEUMS & GARDENS

One third of the Exhibit on Preserving Cape Cod

Wampanoag Wetu and Garden

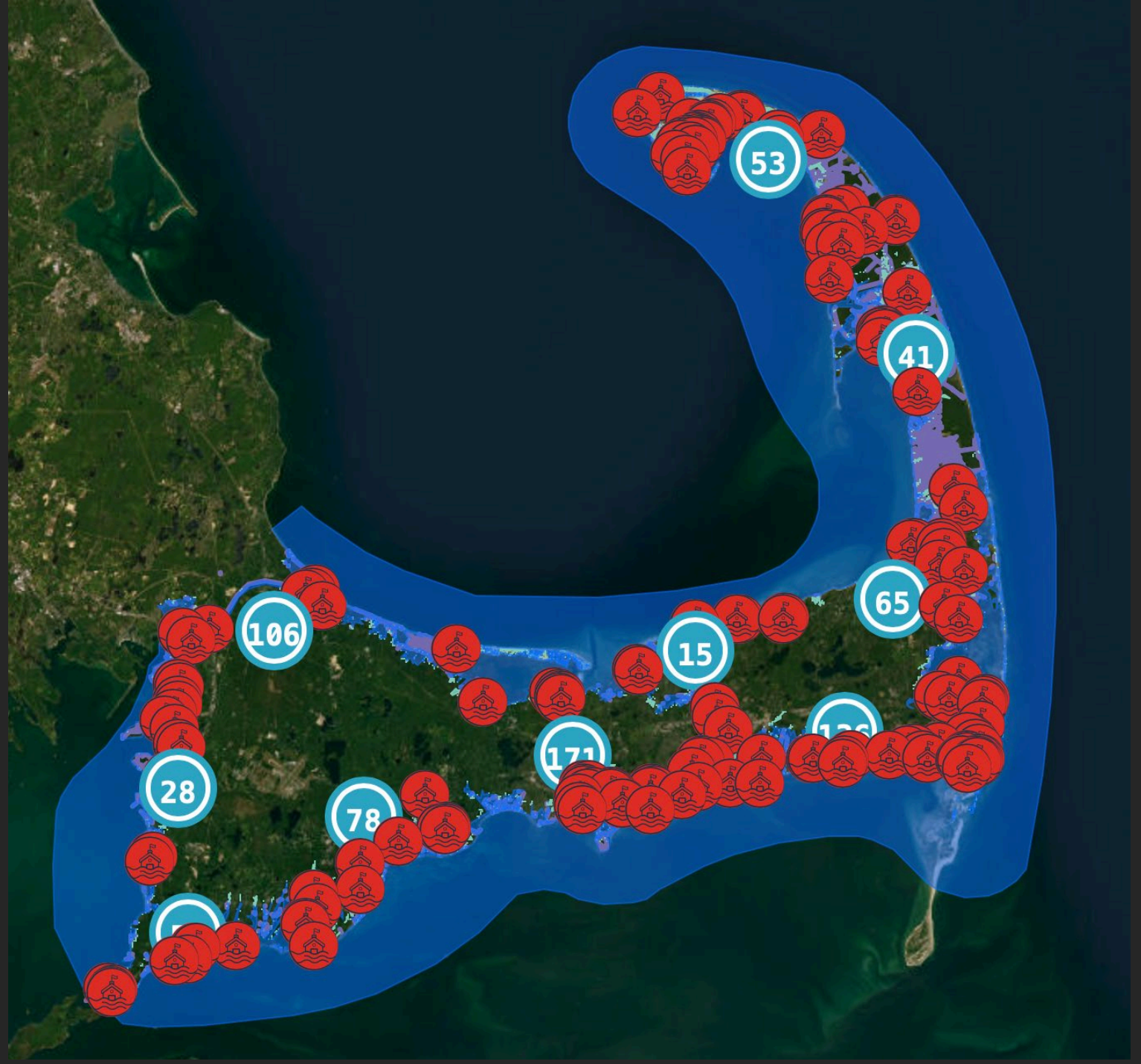
1917 Milburn Electric Car

Treasured Trash Art

Cape Cod Commission

Cape Cod
7+ billion
pounds CO2
Per year

Sea Level Rise Viewer
6 foot rise



HERITAGE
MUSEUMS & GARDENS

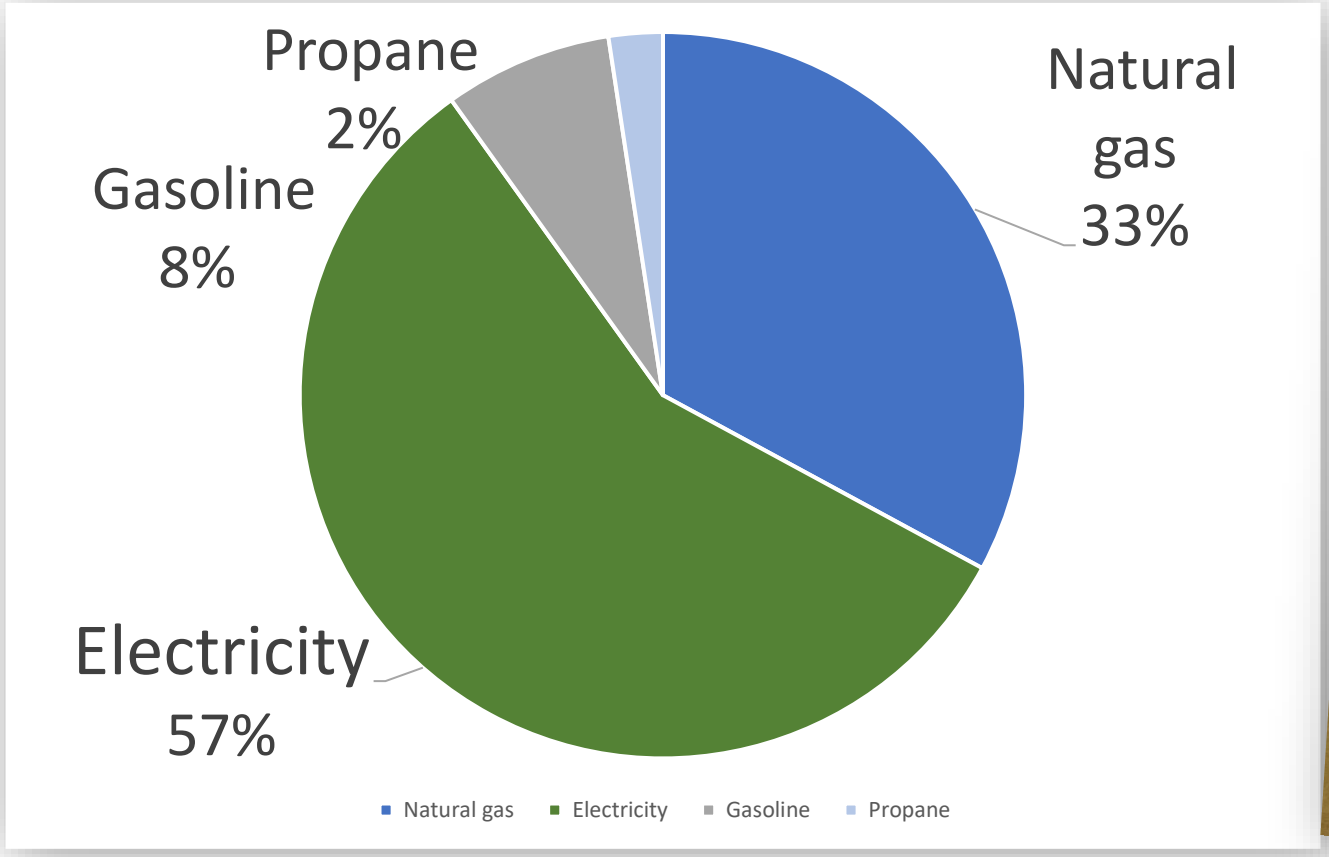
Sustainability Beacon Project

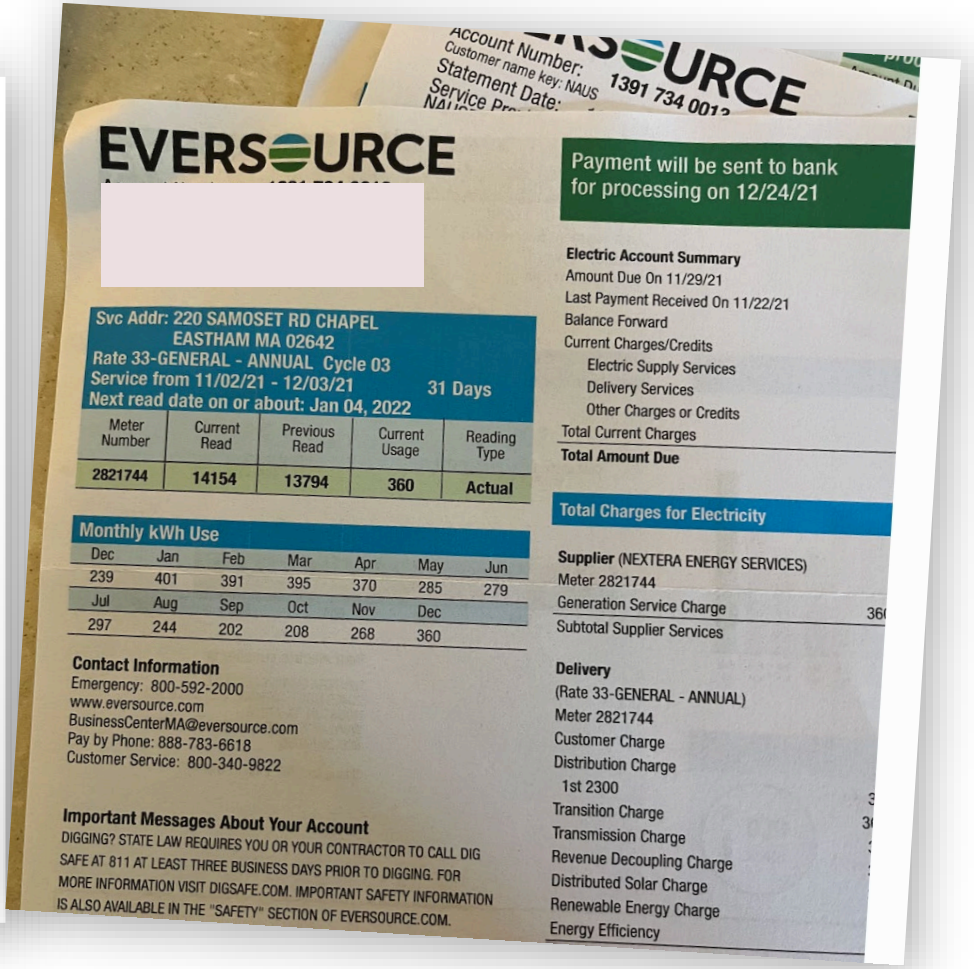
Measured	Set Goals	Action Plan
• **10-year energy use**	• **Reductions**	• Conservation
• **CO2 emissions**	• **50% by 2030**	• Electrify
• **CO2 sequestration**	• 80% by 2050	• Deploy solar

A model for projects on Cape Cod,
in Massachusetts and throughout the US.

HERITAGE
MUSEUMS & GARDENS

Measure Use to Benchmark





EVERSOURCE

Payment will be sent to bank for processing on 12/24/21

Svc Addr: 220 SAMOSET RD CHAPEL
EASTHAM MA 02642
Rate 33-GENERAL - ANNUAL Cycle 03
Service from 11/02/21 - 12/03/21 31 Days
Next read date on or about: Jan 04, 2022

Meter Number	Current Read	Previous Read	Current Usage	Reading Type
2821744	14154	13794	360	Actual

Monthly kWh Use

Dec	Jan	Feb	Mar	Apr	May	Jun
239	401	391	395	370	285	279
Jul	Aug	Sep	Oct	Nov	Dec	
297	244	202	208	268	360	

Contact Information
Emergency: 800-592-2000
www.eversource.com
BusinessCenterMA@eversource.com
Pay by Phone: 888-783-6618
Customer Service: 800-340-9822

Important Messages About Your Account
DIGGING? STATE LAW REQUIRES YOU OR YOUR CONTRACTOR TO CALL DIG SAFE AT 811 AT LEAST THREE BUSINESS DAYS PRIOR TO DIGGING. FOR MORE INFORMATION VISIT DIGSAFE.COM. IMPORTANT SAFETY INFORMATION IS ALSO AVAILABLE IN THE "SAFETY" SECTION OF EVERSOURCE.COM.

Electric Account Summary
Amount Due On 11/29/21
Last Payment Received On 11/22/21
Balance Forward
Current Charges/Credits
Electric Supply Services
Delivery Services
Other Charges or Credits
Total Current Charges
Total Amount Due

Total Charges for Electricity

Supplier (NEXTERA ENERGY SERVICES)
Meter 2821744
Generation Service Charge
Subtotal Supplier Services

Delivery
(Rate 33-GENERAL - ANNUAL)
Meter 2821744
Customer Charge
Distribution Charge
1st 2300
Transition Charge
Transmission Charge
Revenue Decoupling Charge
Distributed Solar Charge
Renewable Energy Charge
Energy Efficiency

HERITAGE
MUSEUMS & GARDENS

Carbon Dioxide Sequestration

Species	Diameter BH inches	Diameter BH cm	Circumference BH inches	LOCATION	Growth fac	CONDITIO	Taxa	Beta 0	Beta 1	DBH LN	LN of Biomass	Biomass	Carbon in K	Carbon in pounds	LB to KG fac	Carbon in US Tons	age of tre	C in lbs added per year per tree
White Pine	121.7	309.0	382	GOS - large	2.5		Pinus Strobus	-2.6177	2.4638	5.73	11.51	99,524.29	49,762.15	109,706.62	2.20462	54.85	123.60	887.58
Norway Maple	84.9	215.6	266.5	GOS - large	2.5		Acer	-1.8011	2.3852	5.37	11.02	60,799.22	30,399.61	67,019.58	2.20462	33.51	86.23	777.21
Black Locust					2.5					5.24	10.82	50,128.52	25,064.26	55,257.17	2.20462	27.63	75.55	731.37
Canadian					2.5					5.40	10.96	57,430.34	28,715.17	63,306.04	2.20462	31.65	88.66	714.05
Norway Spruce					2.5					5.21	10.62	41,034.06	20,517.03	45,232.25	2.20462	22.62	73.13	618.55
Black Locust					2.5					5.03	10.30	29,671.47	14,835.74	32,707.16	2.20462	16.35	61.48	532.02
Fir					2.5					5.13	10.38	32,204.65	16,102.32	35,499.51	2.20462	17.75	67.63	524.94
Hickory					2.5					5.02	10.27	28,883.44	14,441.72	31,838.50	2.20462	15.92	60.83	523.40
Black Locust					2.5					5.00	10.22	27,345.80	13,672.90	30,143.55	2.20462	15.07	59.54	506.31
Black Locust					2.5					5.00	10.20	26,969.35	13,484.67	29,728.58	2.20462	14.86	59.21	502.06

- 5 Plots of sample plantings
- 25 Volunteers
- 316 trees/stems
- 4,750 calculation

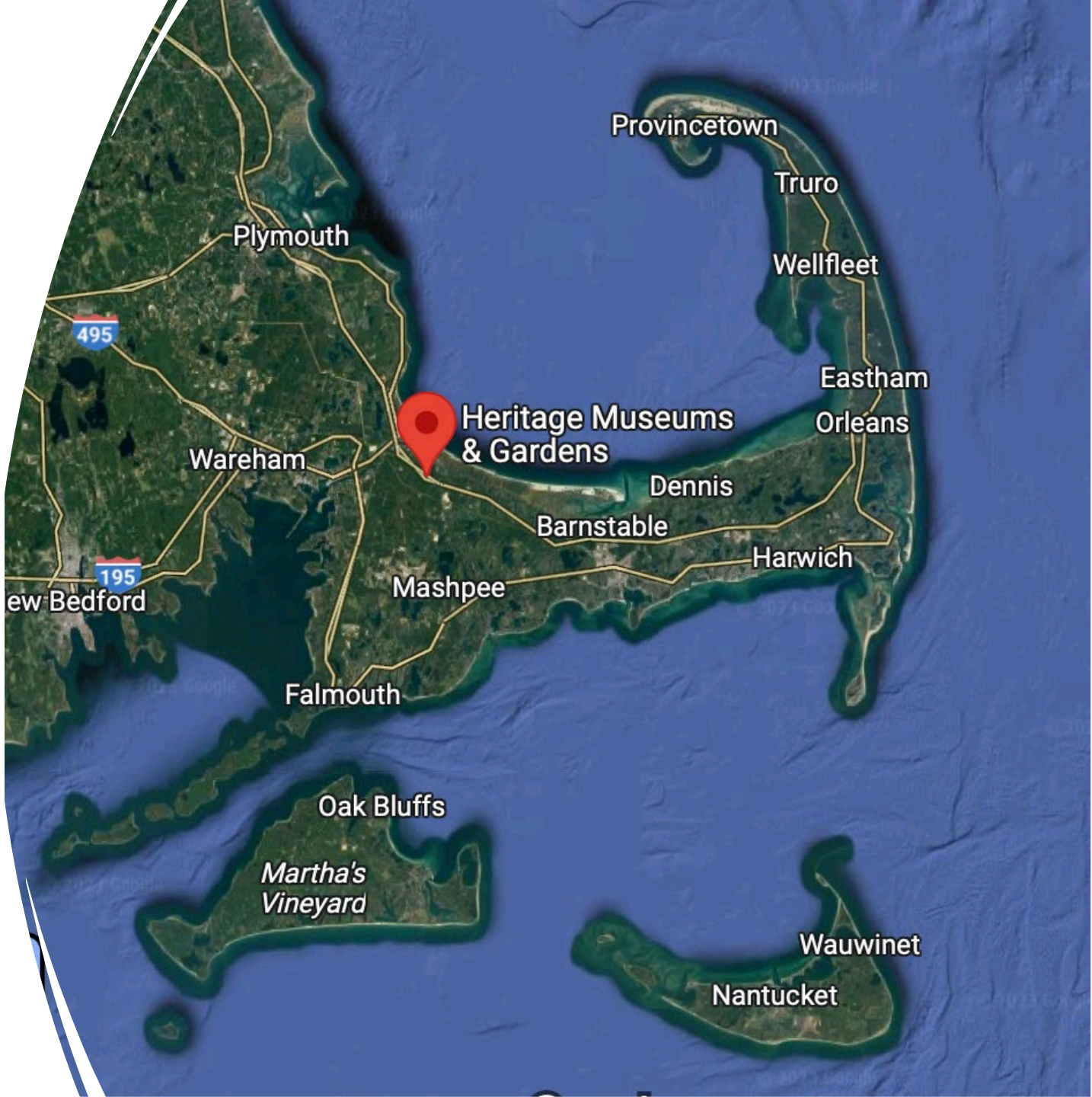
Affiliates

- Cape Cod Commission
- Woodwell Research Center

HERITAGE
MUSEUMS & GARDENS

Cape Cod Commission Study

Land Use	ACRES
Forests (Trees & Shrubs)	75.94
Grasslands	5.68
Built (Impervious)	4.47
Non-forested wetland	0.08
Man-made bare	7.32
Natural barren	1.54



HERITAGE
MUSEUMS & GARDENS

Building Management

Energy Assessments

- Conservation first
- Electrify where possible
- Deploy Solar from the grid

HERITAGE
MUSEUMS & GARDENS

Existing Buildings - Unique Challenges

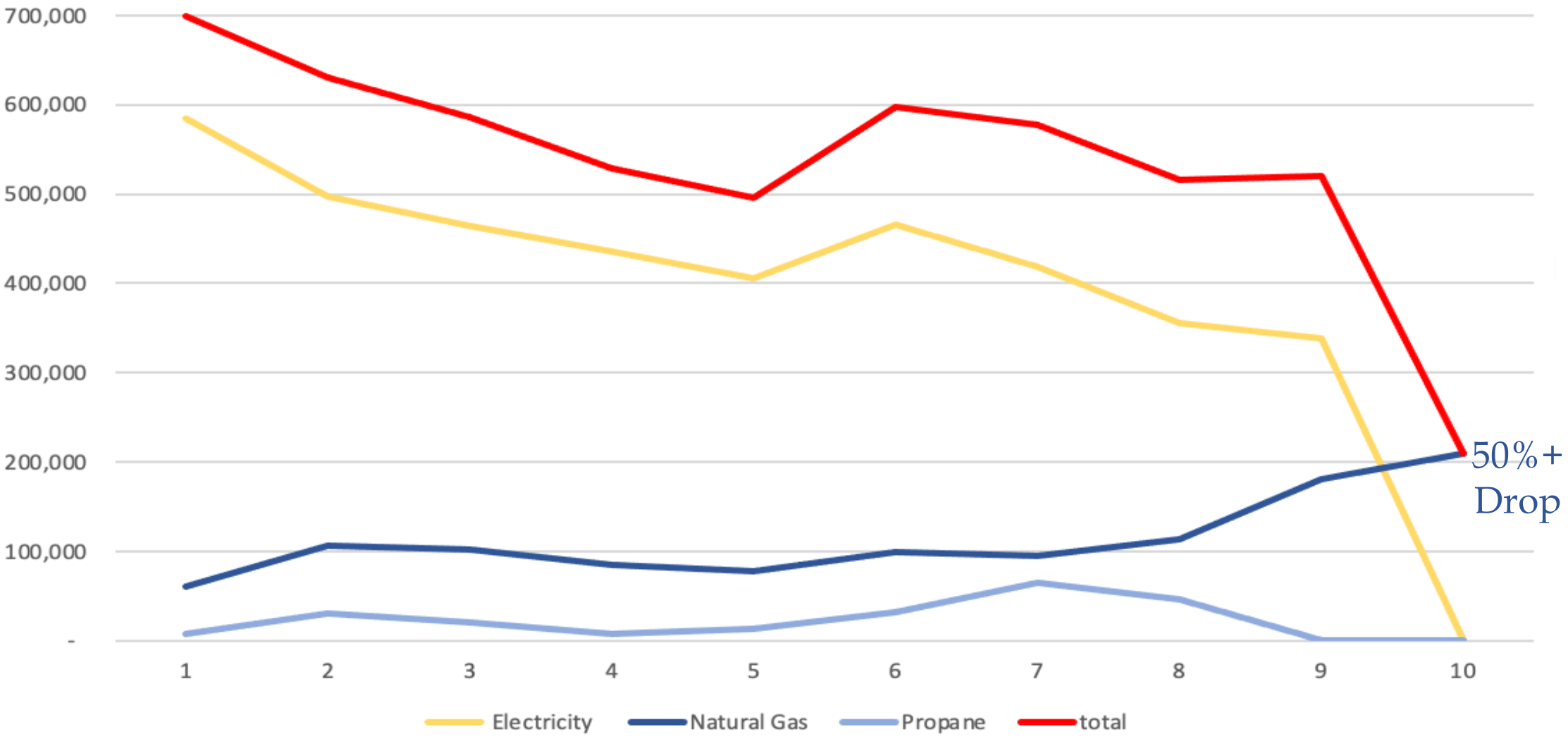
- Inadequate Welcome Center
- From Round Barn to Round Yurts
- Date back to the 1600s
- K-2 School
- Hard to Heat Greenhouse
- One meter for electricity
- Humidification needs

Grounds Management

- Electrify everything
- Waste management
- Water management
- Deploy grid solar

HERITAGE
MUSEUMS & GARDENS

Carbon Dioxide Emission Reduction
2013 to 2022



HERITAGE
MUSEUMS & GARDENS

Sustainability Beacon Project

Measured	Set Goals	Action Plan
• **10-year energy use**	• **Reductions**	• **Conservation**
• **CO2 emissions**	• **50% by 2030**	• **Electrify**
• **CO2 sequestration**	• 80% by 2050	• **Deploy solar**

A model for projects on Cape Cod,
in Massachusetts and throughout the US.

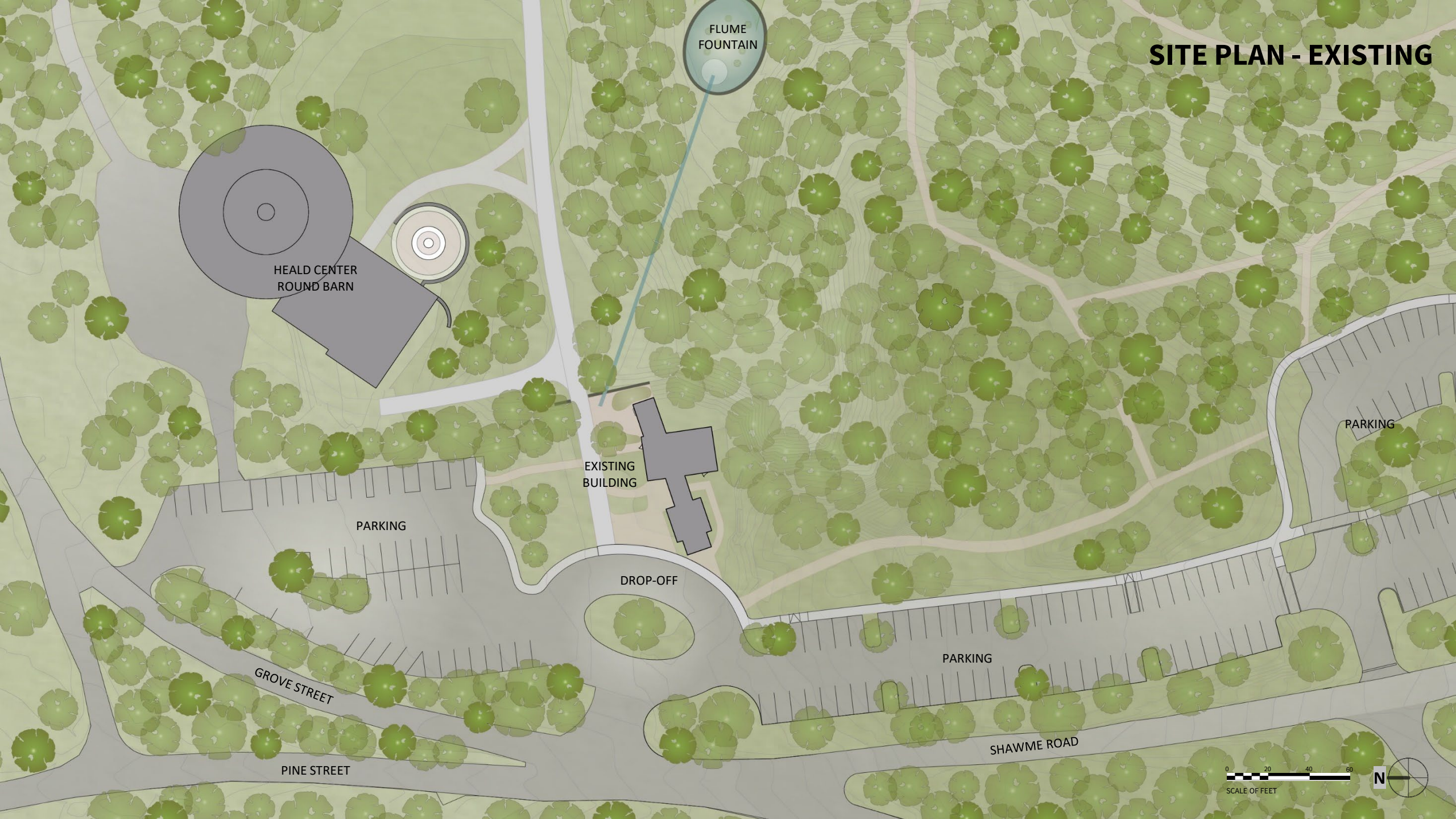
New Welcome Center Complex

- Model and interpret sustainability
- Net Zero Strategies
- Improve welcome sequence
- Create gathering center
- Expand visitor services
- Improve retail facility
- Enhance natural vistas

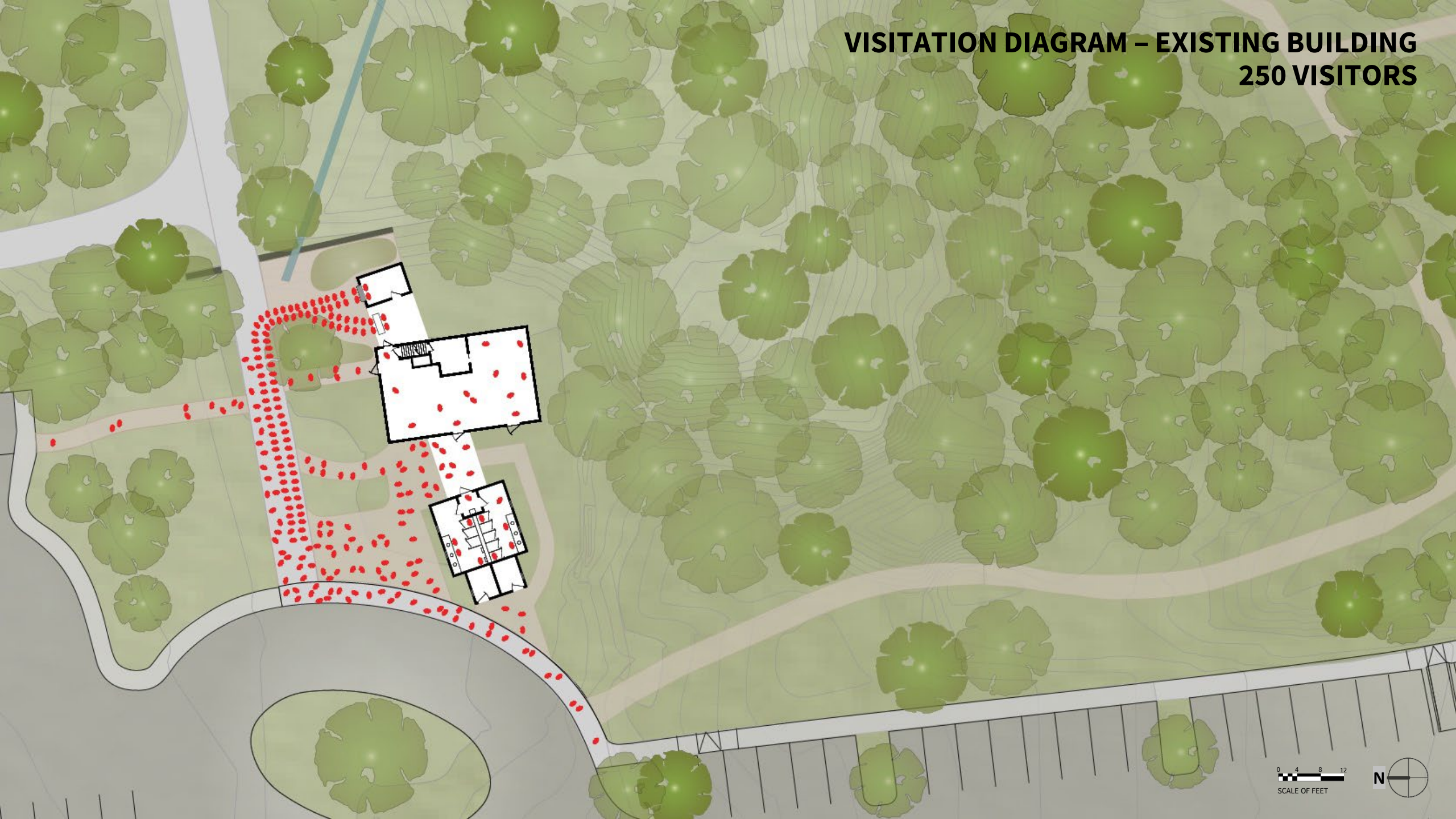
HERITAGE
MUSEUMS & GARDENS

GWWO ARCHITECTS

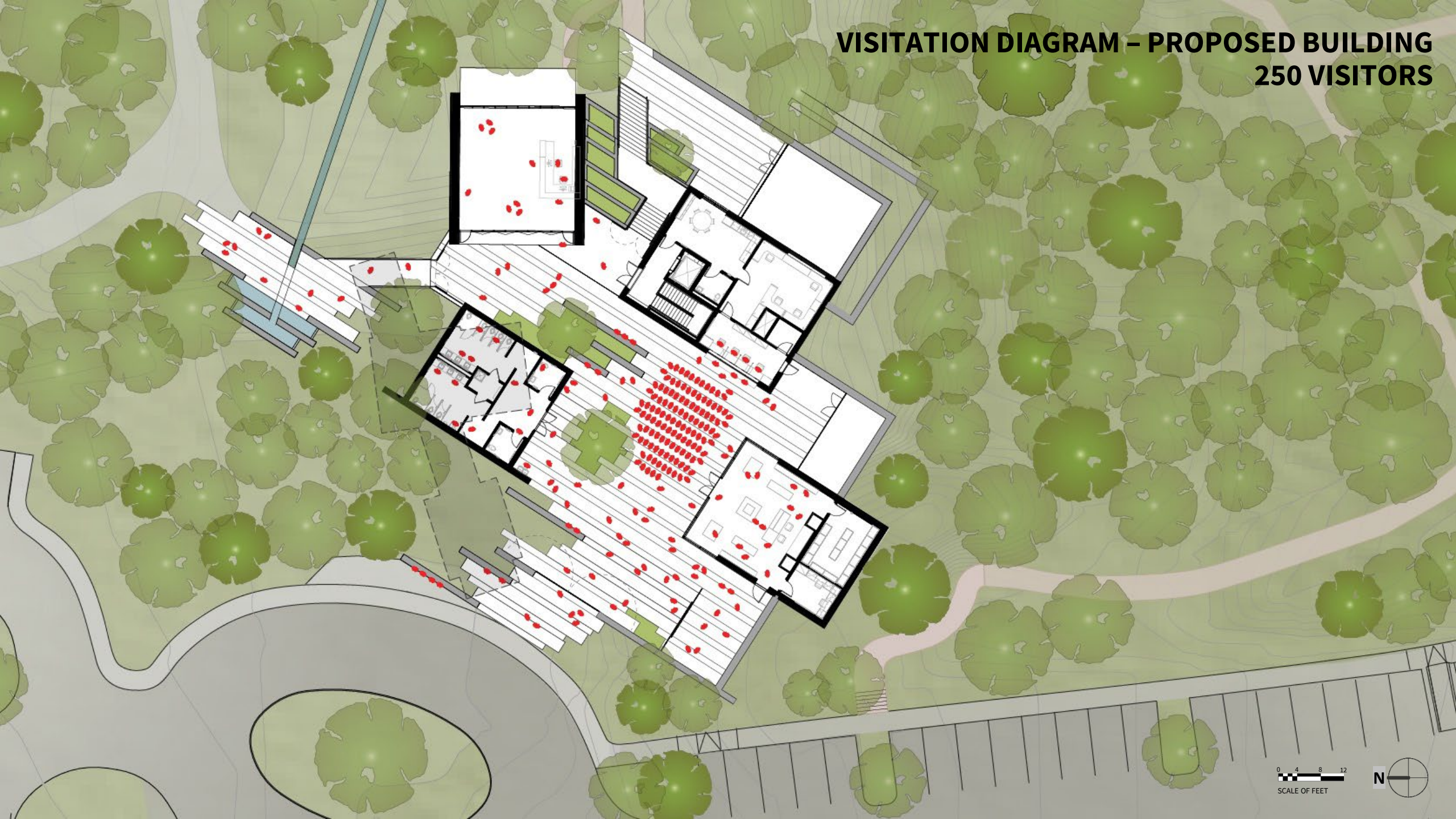
SITE PLAN - EXISTING



VISITATION DIAGRAM – EXISTING BUILDING
250 VISITORS



VISITATION DIAGRAM – PROPOSED BUILDING
250 VISITORS




UPPER FLOOR PLAN
1. DROP-OFF
2. MOBILITY TRANSPORT PICK-UP
3. EXISTING BUILDING (DEMO)
4. ENTRANCE GATE
5. OUTDOOR SALES
6. COURTYARD
7. GIFTSHOP
8. RESTROOMS
9. TICKETING
10. ELEVATOR LOBBY
11. OUTDOOR STAIR
12. STAFF AREA
13. OPEN OFFICES
14. VISITOR SERVICES/ORIENTATION
15. LOWER-LEVEL PLAZA
16. FLUME PLAZA
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
0 4 8 12
SCALE OF FEET
N

LOWER LEVEL FLOOR PLAN

1. LOWER-LEVEL ELEVATOR LOBBY
2. LOWER-LEVEL PLAZA
3. OUTDOOR STAIR
4. ACCESSIBLE PATH CONNECTION
5. MAINTENANCE YARD
6. MECHANICAL
7. STORAGE
8. BOARD ROOM
9. BOARD ROOM DECK

0 4 8 12
SCALE OF FEET

N

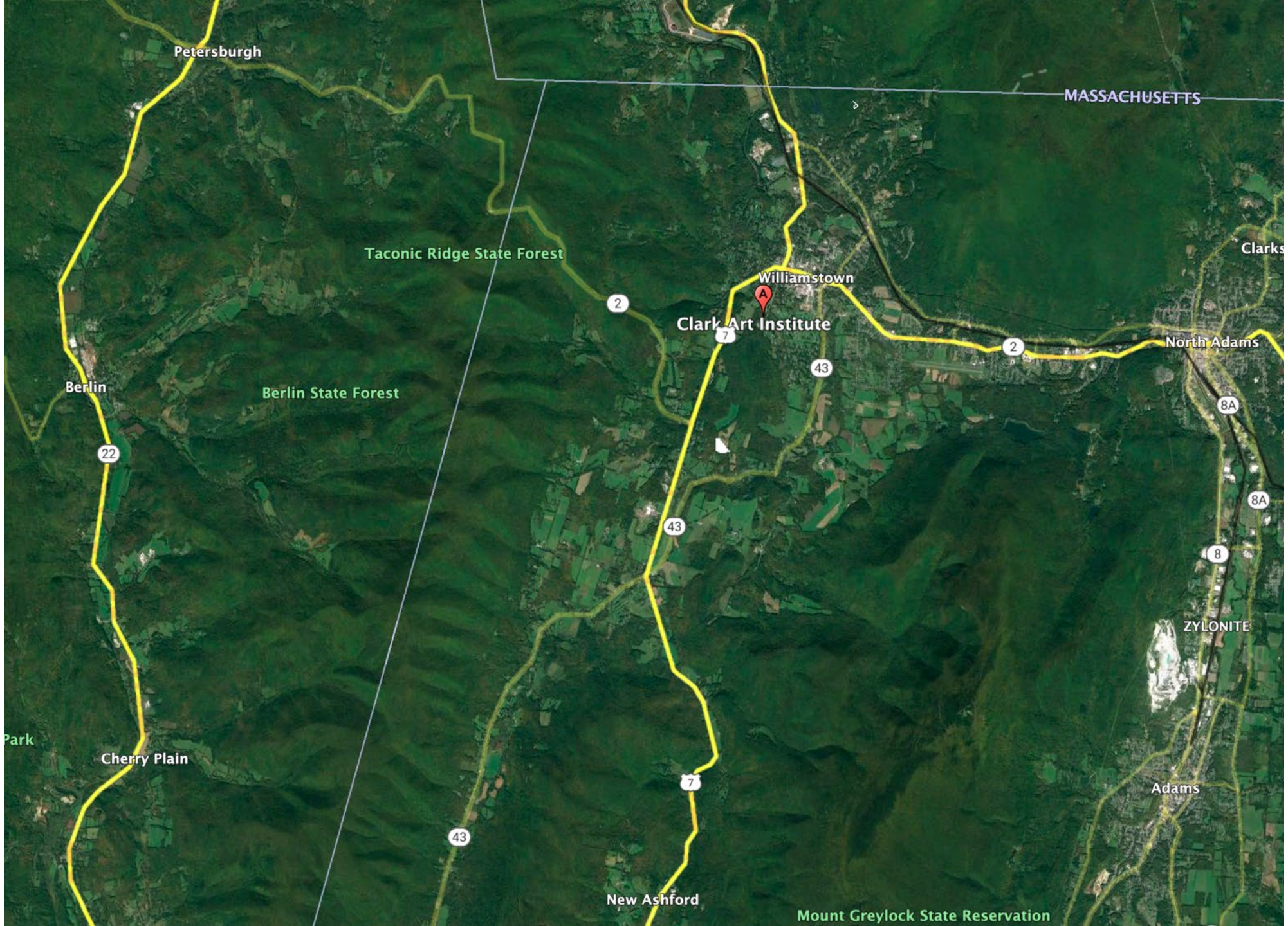

Restrooms
HERITAGE

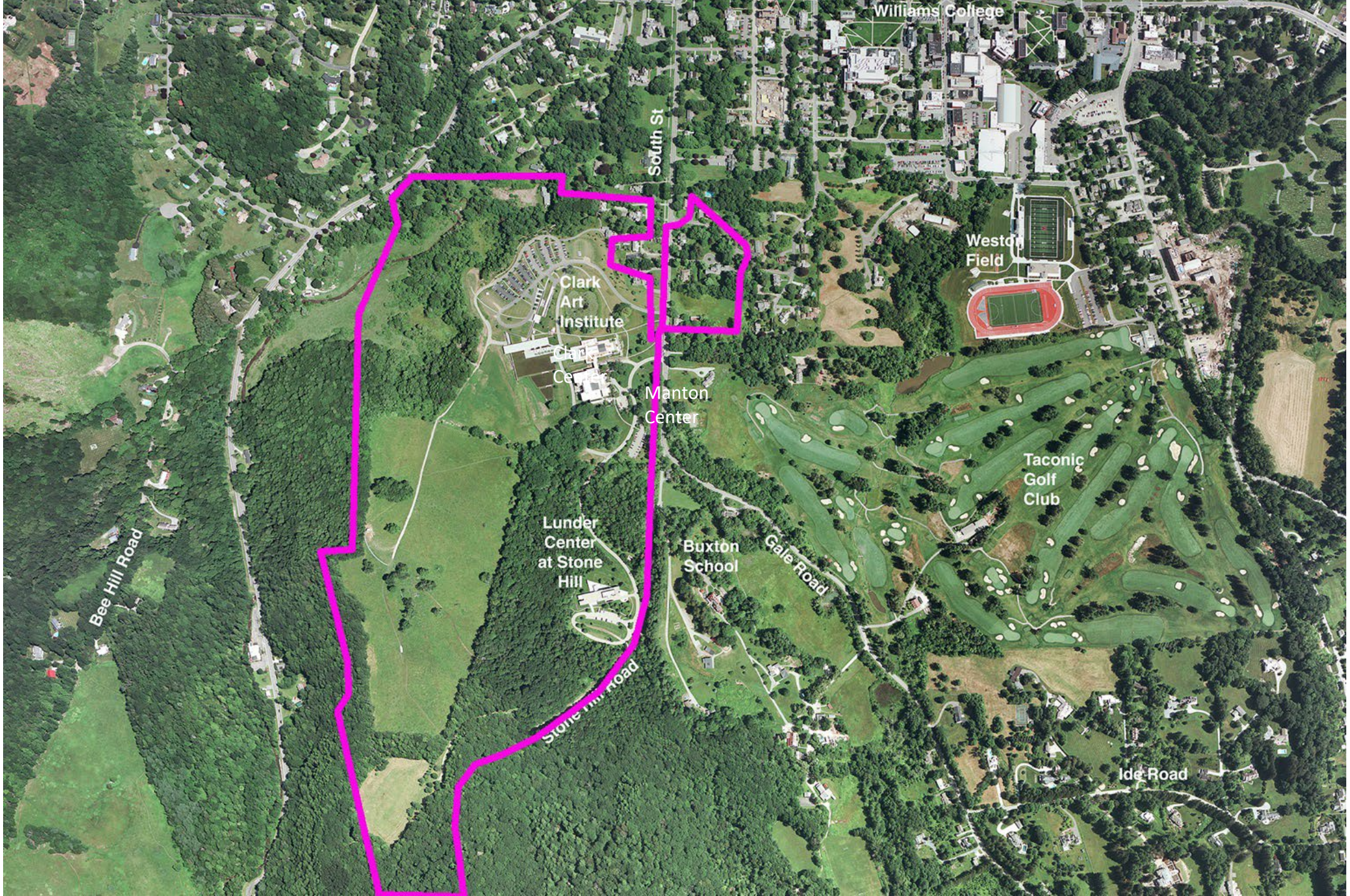

Clarissa S. Nye Visitor Center

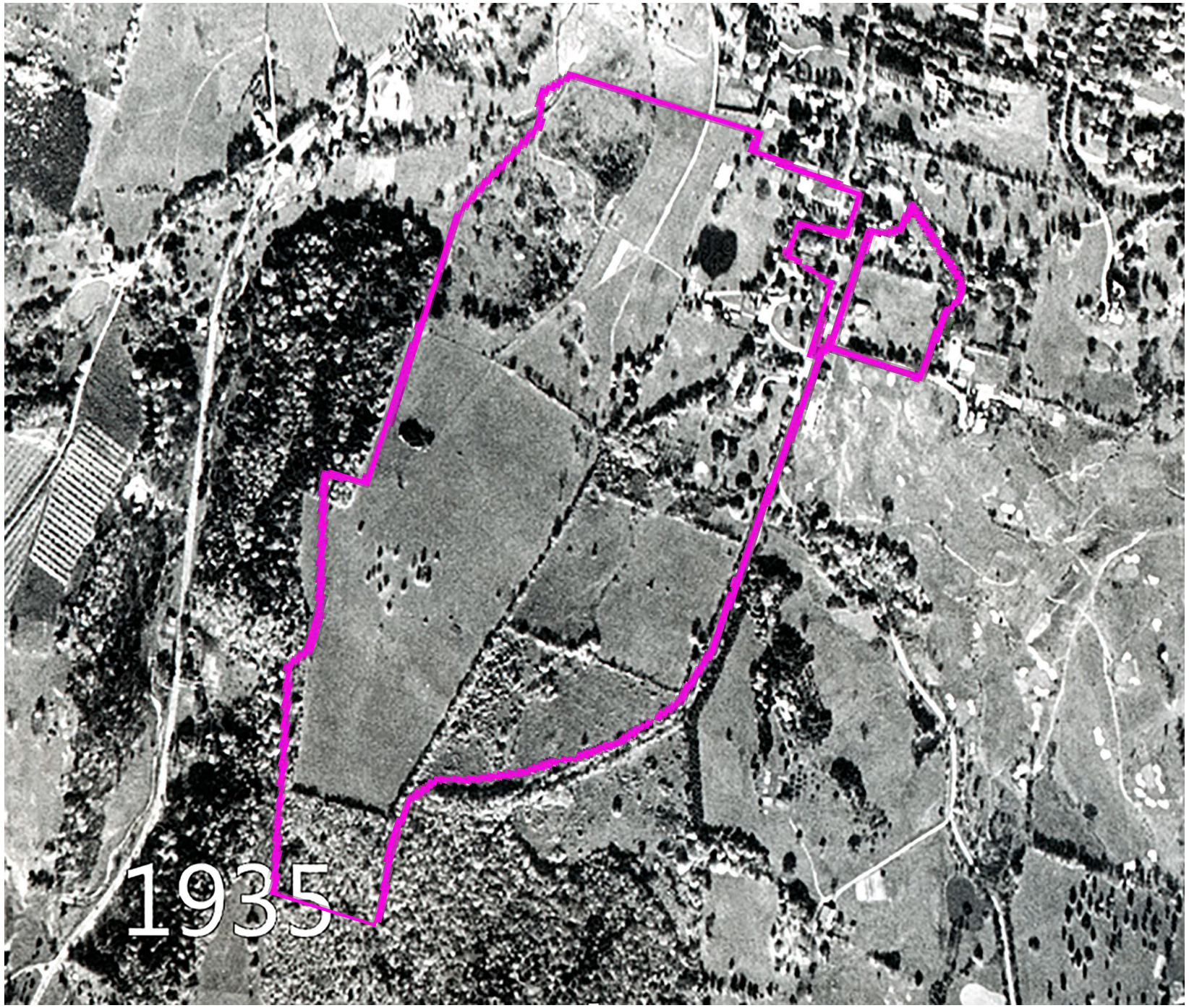

Dexter Rhododendrons
The Old East Mill
1828

CARBON: , BUT CONTINUING, A SHORT HISTORY @

Henry W. Art, Ph.D.
Sustainability Projects Manager
The Clark Art Institute
Williamstown, MA

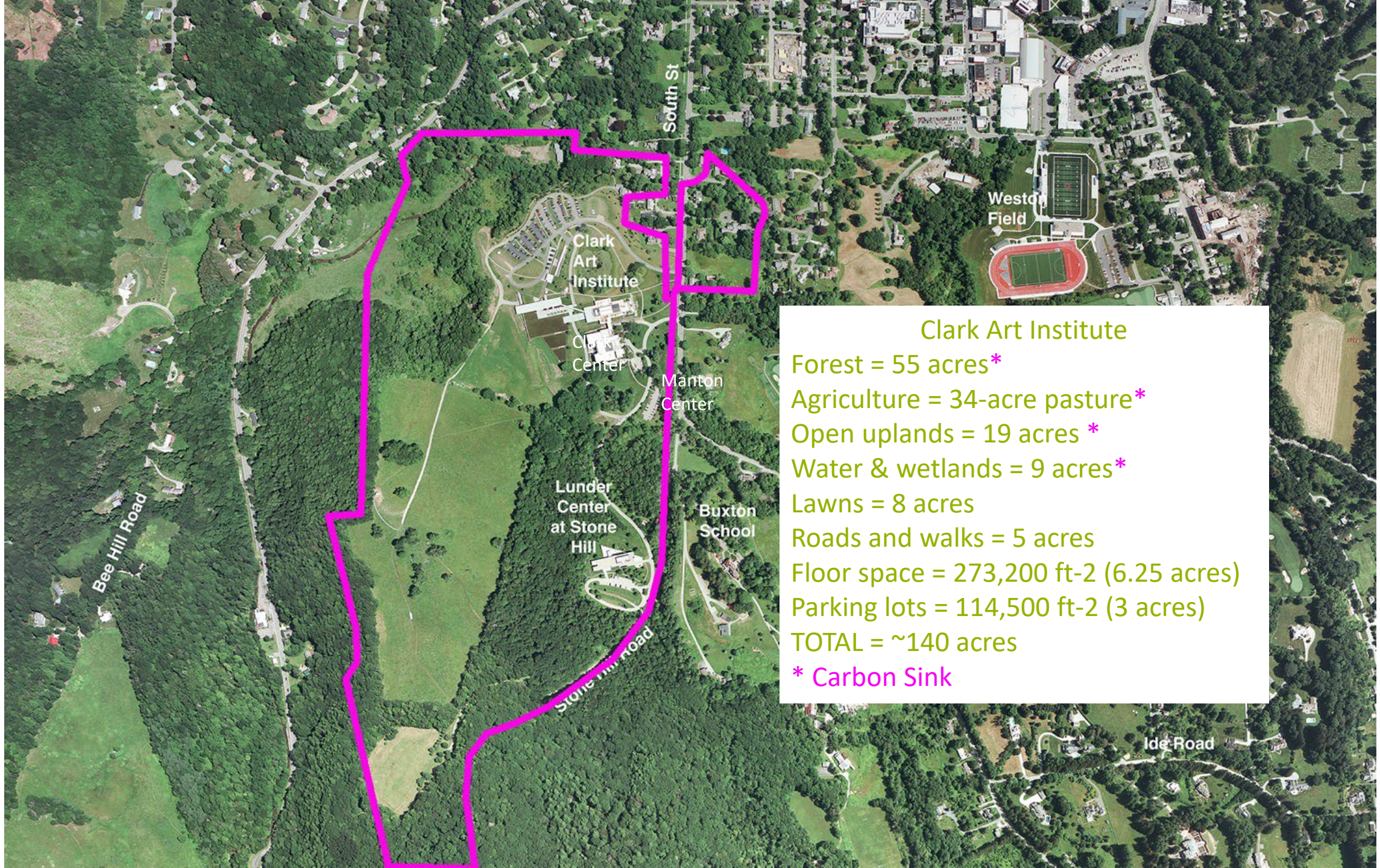

Petersburgh
MASSACHUSETTS
Taconic Ridge State Forest
Williamstown
Clark Art Institute
Clarks
North Adams
Berlin
Berlin State Forest
ZYLONITE
Park
Cherry Plain
Adams
New Ashford
Mount Greylock State Reservation
2
7
43
22
8A
8


Williams College
South St
Weston Field
Clark Art Institute
Manton Center
Taconic Golf Club
Lunder Center at Stone Hill
Buxton School
Gale Road
Bee Hill Road
Stone Hill Road
Ide Road


1935

Northern Stone Hill , 1935-2015

Laurie Glover, 2016



Clark Art Institute

Forest = 55 acres*
Agriculture = 34-acre pasture*
Open uplands = 19 acres *
Water & wetlands = 9 acres*
Lawns = 8 acres
Roads and walks = 5 acres
Floor space = 273,200 ft-2 (6.25 acres)
Parking lots = 114,500 ft-2 (3 acres)
TOTAL = ~140 acres
* Carbon Sink

The Sterling and Francine Clark Art Institute under construction, 1954

1952

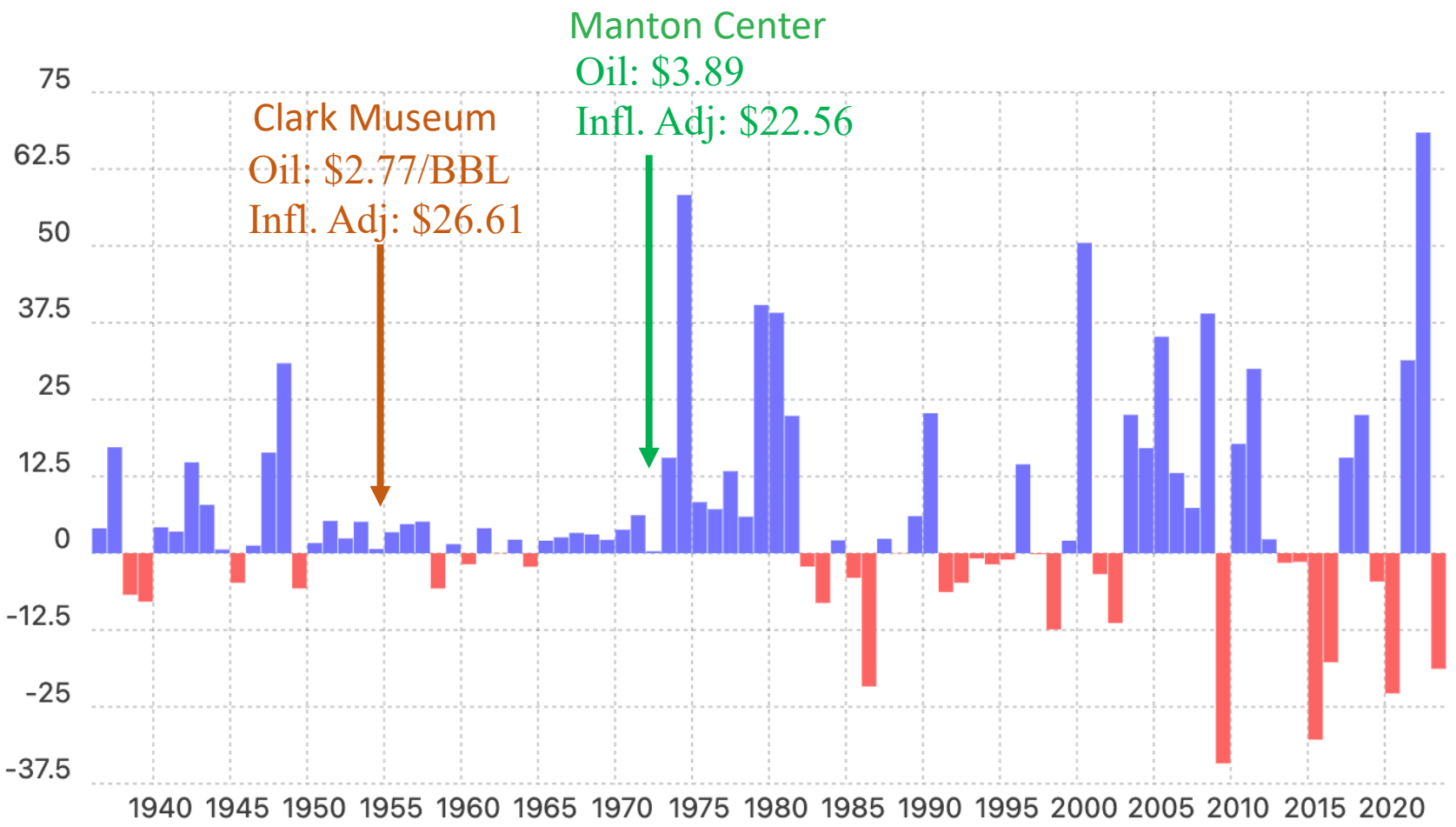
Construction on the museum begins. In the same year, the Robert Sterling Clark Foundation is established in New York City and in its early years the Foundation supports the work of the Institute in Williamstown.


Museum Building
1955


Gallery 2 - “Renoir Room”

Price Inflation for Fuel oil since 1935

Consumer Price Index, U.S. Bureau of Labor Statistics



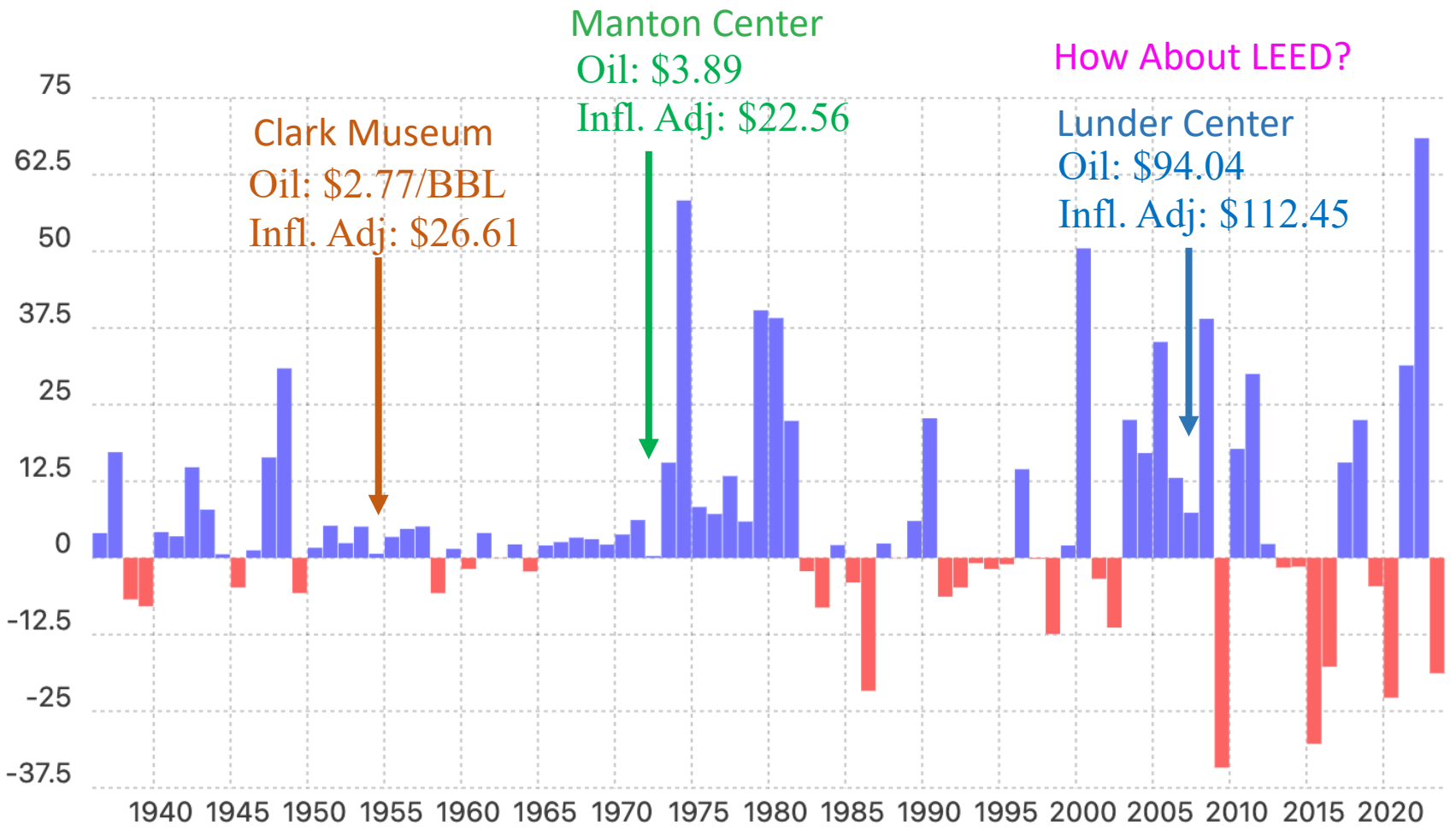
Years with the largest changes in pricing: 2022 *(68.45%)*, 1974 *(58.29%)*, and 2000 *(50.48%)*.

https://www.2013dollars.com/Fuel-oil/price-inflation


Manton Research Center
1973
The Architects Collaborative

Price Inflation for Fuel oil since 1935

Consumer Price Index, U.S. Bureau of Labor Statistics



Years with the largest changes in pricing: 2022 *(68.45%)*, 1974 *(58.29%)*, and 2000 *(50.48%)*.

https://www.2013dollars.com/Fuel-oil/price-inflation


Lunder Stone
Hill Center
2008
Tadao Ando


HUMANE ECOLOGY
EIGHT POSITIONS
JULY 15—OCTOBER 29, 2023

Pallavi Sen, *Experimental Greens: Trellis Composition*, 2023,

EDDIE RODOLFO APARICIO
***Mano dura,* 2023**

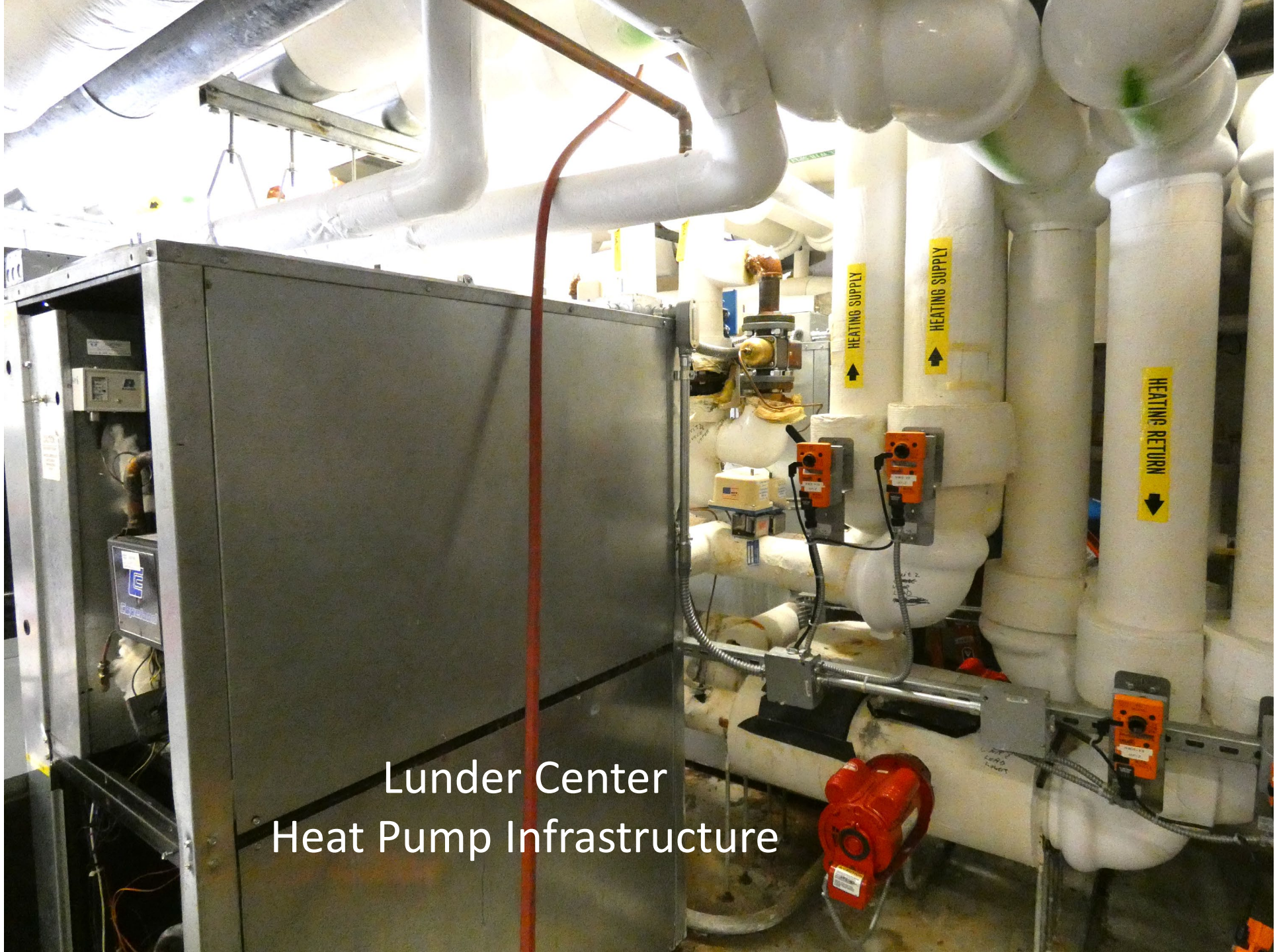
Juan Antonio Olivares
***Fermi Paradox III*, 2019.**


Lunder Center
2008

Williamstown + Atlanta Art Conservation Center at the Lunder Stone Hill Center

https://williamstownart.org/

First Geothermal Heat Pumps In Williamstown

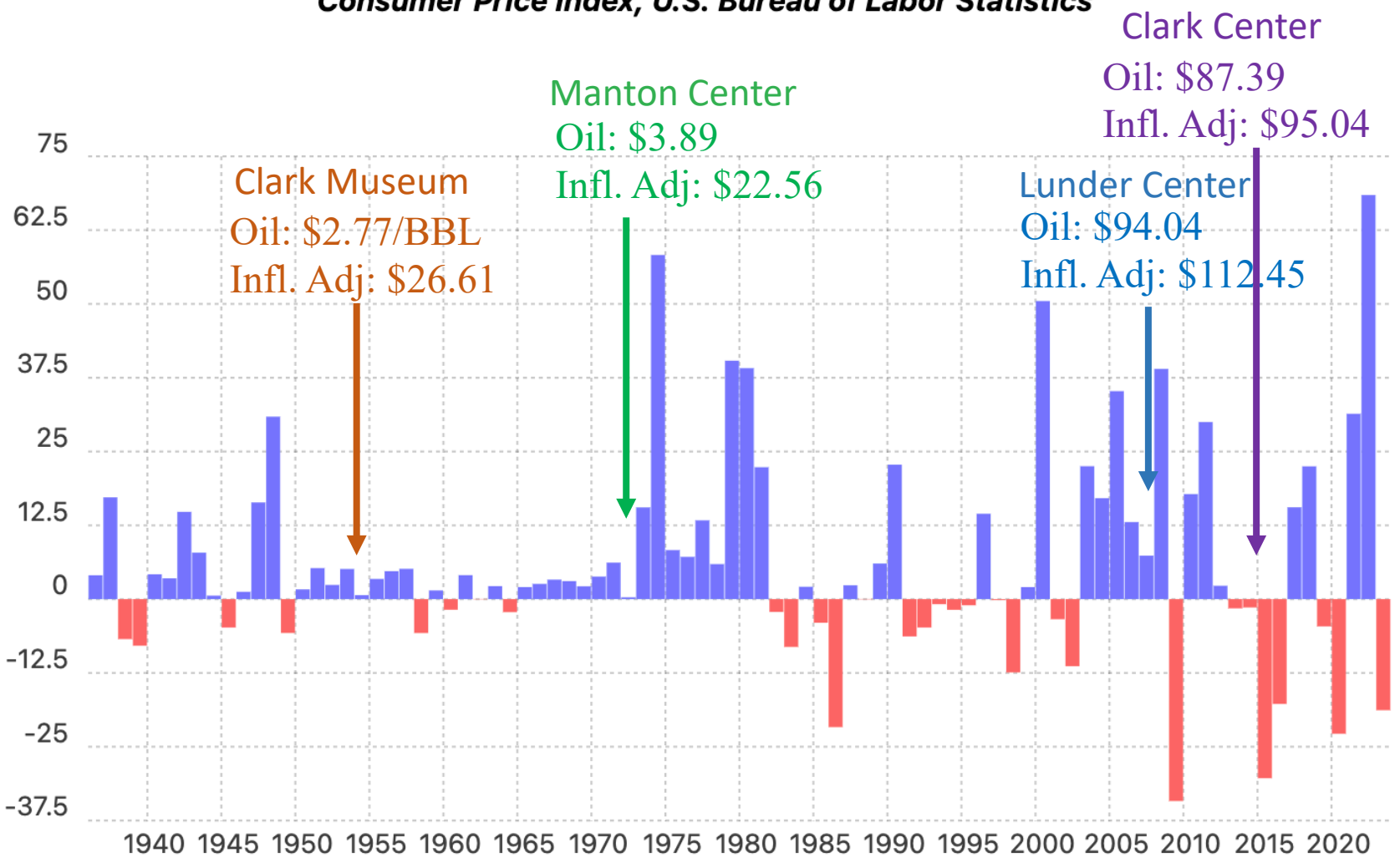


Lunder Center
Heat Pump Infrastructure

Variable Frequency Drives

Price Inflation for Fuel oil since 1935

Consumer Price Index, U.S. Bureau of Labor Statistics



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https://www.2013dollars.com/Fuel-oil/price-inflation

Clark Center
2014
Tadao Ando

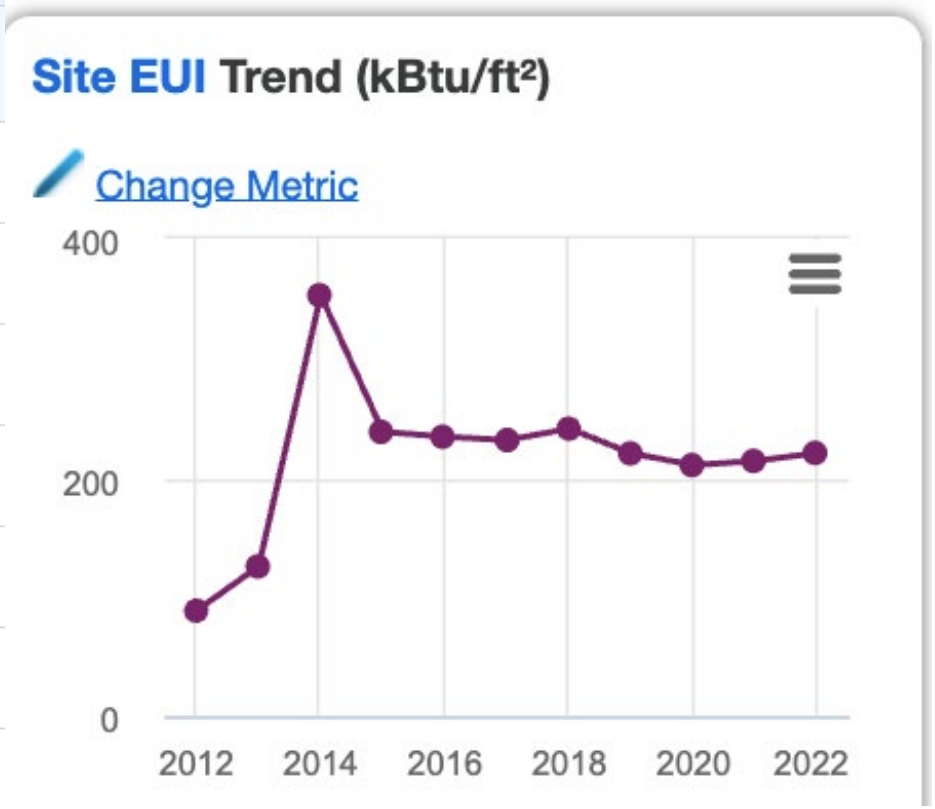
Clark Center
2014


2020

2023, it's Time to Benchmark

EPA – Energy Star Portfolio Manager

Name	Use	Gross Floor Area
Lunder Stone Hill Center	Museum	27100 Sq. Ft.
Wall - Barn & Office	Mixed Use Property	2233 Sq. Ft.
Wall - House	Single-Family Home	3350 Sq. Ft.
Hoffman House	Single-Family Home	2500 Sq. Ft.
Levin House	Mixed Use Property	2000 Sq. Ft.
Visiting Scholars' Residence	Multifamily Housing	10275 Sq. Ft.
Main Clark Museum Complex	Museum	225751 Sq. Ft.



Carbon Day 2023 Results

Green House Gas Emission equivalent in $kgCO_2$ equivalent/ft^2

Lowest = <0 $kgCO_2$ eq./ft^2

(for institutional generating renewable energy)

Average Museum = 9.6 $kgCO_2$ eq./ft^2

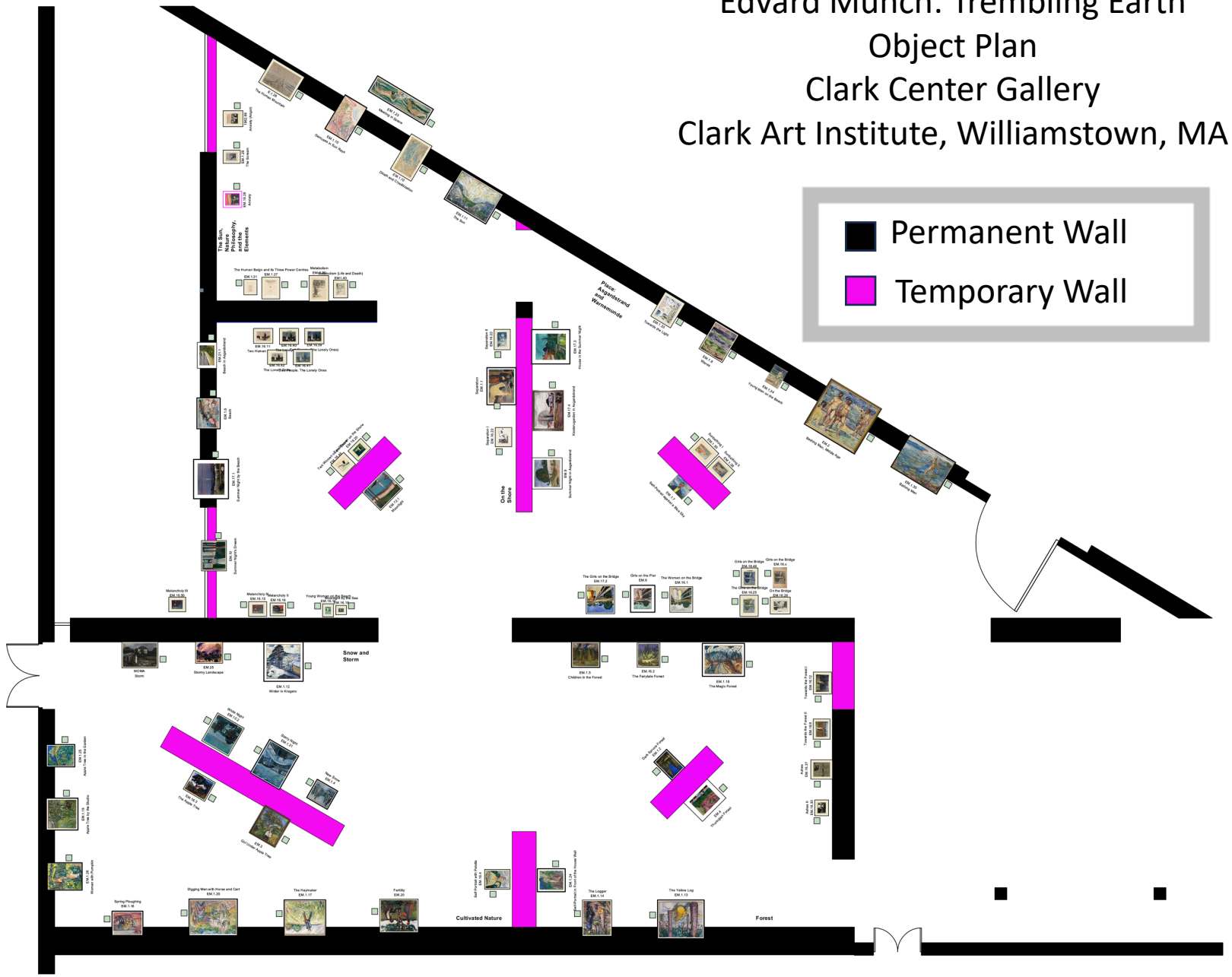
Average NYC Museum = 10.7 $kgCO_2$ eq./ft^2

The Clark = 13.4 $kgCO_2$ eq./ft^2

Highest = 49 $kgCO_2$ eq./ft^2


EDVARD
MUNCH
TREMBLING EARTH

Edvard Munch: Trembling Earth
Object Plan
Clark Center Gallery
Clark Art Institute, Williamstown, MA



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Drawing Number	1
Scale	1:150

IKD LLC.
119 BRAINTREE STREET, SUITE 201 BOSTON, MA 02134
32 HEATHER AVENUE, SAN FRANCISCO, CA 94118

OVERALL OBJECT PLAN

2023
Project No. 05484

THE CLARK
EDVARD MUNCH: TREMBLING EARTH


LED Lights
3 feet
12 feet


THIS SIDE UP
European
spindrift
Elegant
FACIAL TISSUE
ONLY
CANTON SOLAMENTE


Alarm batteries
COMPOST
WE RECYCLE

Need to Accommodate
Adequate Spaces to
Manage Scope 3
Greenhouse Gas Emissions,

Please,

THANK YOU!