

What's the Plan?

Webinar Series

zeb
Vancity

Planning for Building Decarbonization: Commercial Buildings

Tue May 16, 2023
9.30 - 11am PDT
zeb.org

DECARBONIZED



**The Zero Emissions
Building Exchange**

zeb_x

Podcast

RESOURCES

 Enter your search

20 posts found

Categories

- ☐ Articles
- ☐ Reports
- ☐ Case Studies
- ☐ Videos & Slides
- ☒ Podcasts

Series

- ☐ Deep Emissions Retrofit Dialogues
- ☐ CleanBC Net Zero Energy-Ready Challenge Playbook
- ☐ CleanBC Net Zero Energy-Ready Challenge Winners
- ☐ Decarb Lunches
- ☐ Tech Demo Workshops
- ☐ Decarbonization Planning

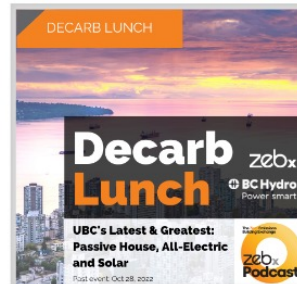
Systems

- ☐ Mechanical
- ☐ Building Enclosure
- ☐ Solar Energy
- ☐ Geothermal
- ☐ Domestic Hot Water Heat Pump

Subjects

[Reset all](#)
[Podcasts x](#)


Decarb Lunch: Nov 2022, The OSO Residential Development



Decarb Lunch: Oct 2022, UBC's Latest & Greatest: Passive House, All-Electric and Solar



Decarb Lunch: Sep 2022, Getting Unstuck: Homeowner and Contractor perspectives on home electrification



COLLABORATE
Accelerate Solutions



Community
of Practice

Designers
Builders
Academia
Developers
Manufacturers

zebx
"connecting industry to solutions"

Government
Global Experts
Mission-Aligned Organizations
Industry Associations

~~ADVANCE~~ **ACCELERATE**

Remove Barriers &
Identify Opportunities



Decision
Makers

We're in a
climate
emergency!

SCALE

Build Capacity



zeb.org

We are a broad **coalition working together** to electrify buildings in British Columbia in order to reduce their climate impacts and reliance on fossil fuels.



bzelectrification.org



clfbritishcolumbia.com

Carbon pollution limits and reporting for existing large commercial and multi-family buildings

Initial Regulation Timeline

Initial Year	Regulation
2023	Annual energy and carbon reporting: Commercial $\geq 9,290 \text{ m}^2$ (100,000 ft^2)
2024	Annual energy and carbon reporting: Commercial $\geq 4,645 \text{ m}^2$ (50,000 ft^2) Multifamily $\geq 9,290 \text{ m}^2$ (100,000 ft^2)
2025	Annual energy and carbon reporting: Multifamily $\geq 4,645 \text{ m}^2$ (50,000 ft^2)
2026	GHGi limits come into effect for commercial office and retail buildings $\geq 9,290 \text{ m}^2$ (100,000 ft^2): Office = 25 kg $\text{CO}_2\text{e}/\text{m}^2/\text{year}$ Retail = 14 kg $\text{CO}_2\text{e}/\text{m}^2/\text{year}$
2040	GHGi limits for Office and Retail $\geq 9,290 \text{ m}^2$ (100,000 ft^2): 0 kg $\text{CO}_2\text{e}/\text{m}^2/\text{year}$ Heat Energy Limit for Office and Retail $\geq 9,290 \text{ m}^2$ (100,000 ft^2): 0.09 GJ/ m^2/year

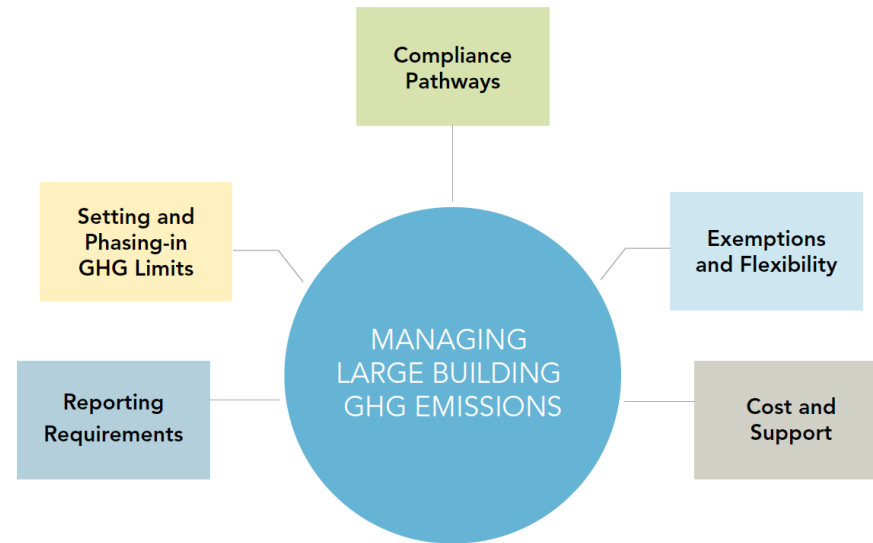
Metro Vancouver Discussion Paper

Potential approaches for managing GHG emissions from large buildings
June 2022

Design Elements

The following are key considerations for developing an approach to reducing emissions from large buildings:

- **Reporting Requirements:** Type of data reported and frequency of reporting.
- **Setting and Phasing-in GHG Emission Limits:** Initial GHG emission limits based on research and analysis, future interim limits based on analysis of reported data from various types of buildings. Limits would be phased in over time for various building types, depending on their capacity to implement changes.
- **Compliance Pathways:** The ways in which a building owner may be able to achieve compliance with the emission limits.



- **Exemptions and Flexibility:** Exemptions or more flexible requirements for certain building types or circumstances.
- **Cost and Support:** Technical support would be available to assist building owners with planning for cost-effective transitions to zero-emission technology. Program fees would be designed to support the achievement of health and environmental benefits from emission reductions, promote continuous improvement, and recover costs of program development and compliance promotion based on the established principles of discharger-pay, equity, and fairness.



The Greater Victoria 2030 District

Leading the effort to create a new model for urban sustainability and shared economic growth.

Three million square feet of Greater Victoria is committed to reducing the environmental impact of building construction and operations.

If you're interested in decarbonization planning, you may be interested in



zebx.org/resources



POLL 1

Tell us about yourself!

Three-part anonymous poll



Who is BOMA BC?

FOUNDED

1911

BC's largest commercial
real estate association

CONTRIBUTION

Industry Value **\$200B+** 

- Employing **37K+** in BC

OUR MEMBERS

Represent

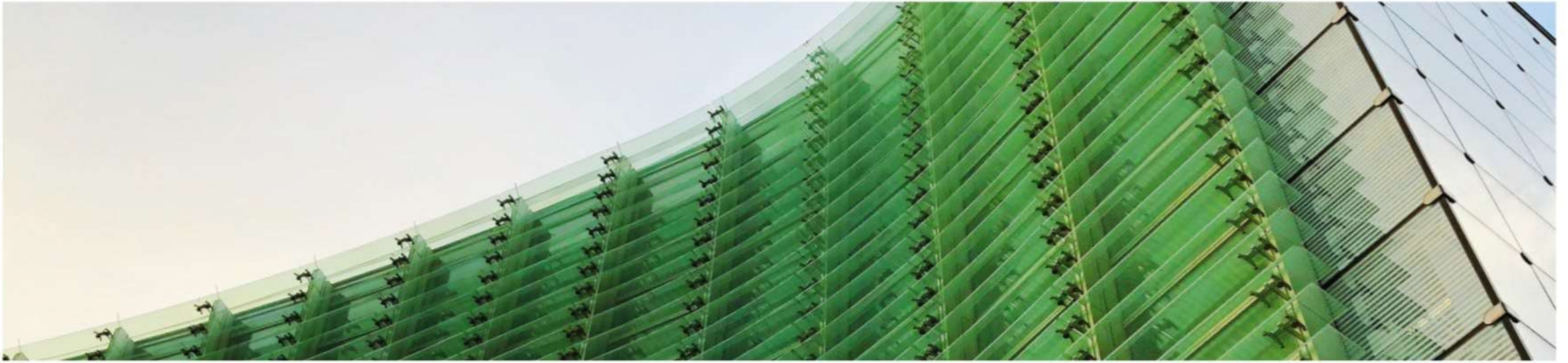
80%

of BC's commercial
real estate professionals

Own or manage

80M+ sqft

of BC's commercial
real estate



Audette'

 **BOMA Energy Training**
for BUILDING OPERATORS

 **BOMA uTrack**
utility tracking system
powered by PUMA



BOMA BEST
BUILDING CERTIFICATION
PROGRAM

GREATER VICTORIA
2030
DISTRICT®

 **sofiac**
energy performance

CLIMATE ACTION PROGRAM

BOMA
BRITISH COLUMBIA





Case Studies on Electrification

RETROFIT FINDINGS FROM:
HSBC CANADA BUILDING
AND HARBOUR CENTRE

03/28/23 | 11:30 AM - 1:00 PM PDT
200 GRANVILLE ST, VANCOUVER BC + ZOOM

FEB. 22ND, 8:45 AM - 4:30 PM PST
1035 W. PENDER STREET, VANCOUVER BC

- FULL-DAY WORKSHOP -

Existing Building Commissioning Essentials






FEB. 1ST, 11:30 AM - 1:00 PM PST
1035 W. PENDER ST, VANCOUVER BC + ZOOM

The Importance of Building Recommissioning and Optimization

BOMA QBT






Free Webinar!
(Members + Non-Members)


BOMA BEST®

How to organize your resources
& achieve a high score!

Tuesday, Dec. 13th, 2022 | 10 AM - 11 AM PST | ZOOM

NOV 16TH/22 | 10:00 AM - ZOOM
FREE FOR ALL BOMA BC MEMBERS

Funding Decarbonization Projects With Minimum Hassle and Risk




EDUCATION SESSIONS AND SEMINARS

BOMA
BRITISH COLUMBIA

RESOURCES FOR BOMA MEMBERS

Harbour Centre – Data Centre Heat Recovery Chiller Case Study

PREPARED BY: Anthony Jones & Associates Inc.



609 Granville Street - Chiller Upgrade Case Study

PREPARED BY: THE AME CONSULTING GROUP



Evergreen Community Health Centre – Make-up Air Unit Electrification Retrofit Case study

PREPARED BY: FRESCo



BOMA BC Building Tune-Up Program Case Study Airport Executive Park, Richmond



Financially Backed by:
Metropolitan Vancouver
Government

Financially Backed by:
Metropolitan Vancouver
Government

Canada 150

Existing Building Commissioning (EBCx) Case Study

Recommissioning of a B-class, low-rise office building in Richmond, BC

PROJECT SUMMARY

Building Name/Type: Airport Executive Park #14, 2-storey office building, 9,170 sq. m., year built in 1981. This facility is one building of a low-rise office park.

Location: Richmond, BC.

Project: BOMA BC (Building Owners and Managers Association) Building Tune-Up Program: an existing building commissioning program primarily targeting the building automation systems (BAS) of B & C class properties.



[Download/View Guide >](#)

GREATERVICTORIA

2030

DISTRICT[®]

GREATER VICTORIA

2030 DISTRICT[®]

Cora Hallsworth
Director

Greater Victoria 2030 District
cora@chrmc.ca



Welcome

The 2030 District is located on the land of the ləkʷəŋən and W̱SÁNEĆ People, including Esquimalt and Songhees Nations, and ləkʷəŋən, W̱SÁNEĆ and Coast Salish territories.



GREATERVICTORIA 2030 DISTRICT[®]



The Greater Victoria 2030 District became an Established District in January 2021



Hosted by BOMA BC, funding from municipal partners, energy utilities, and now Vancity



Partnerships with academia, government and private sector



We are part of a growing network

24 Established Districts
with over 580 million
square feet of
property, and over
1,400 member
organizations



CBRE



Jawl Properties

SHAPE
Uptown



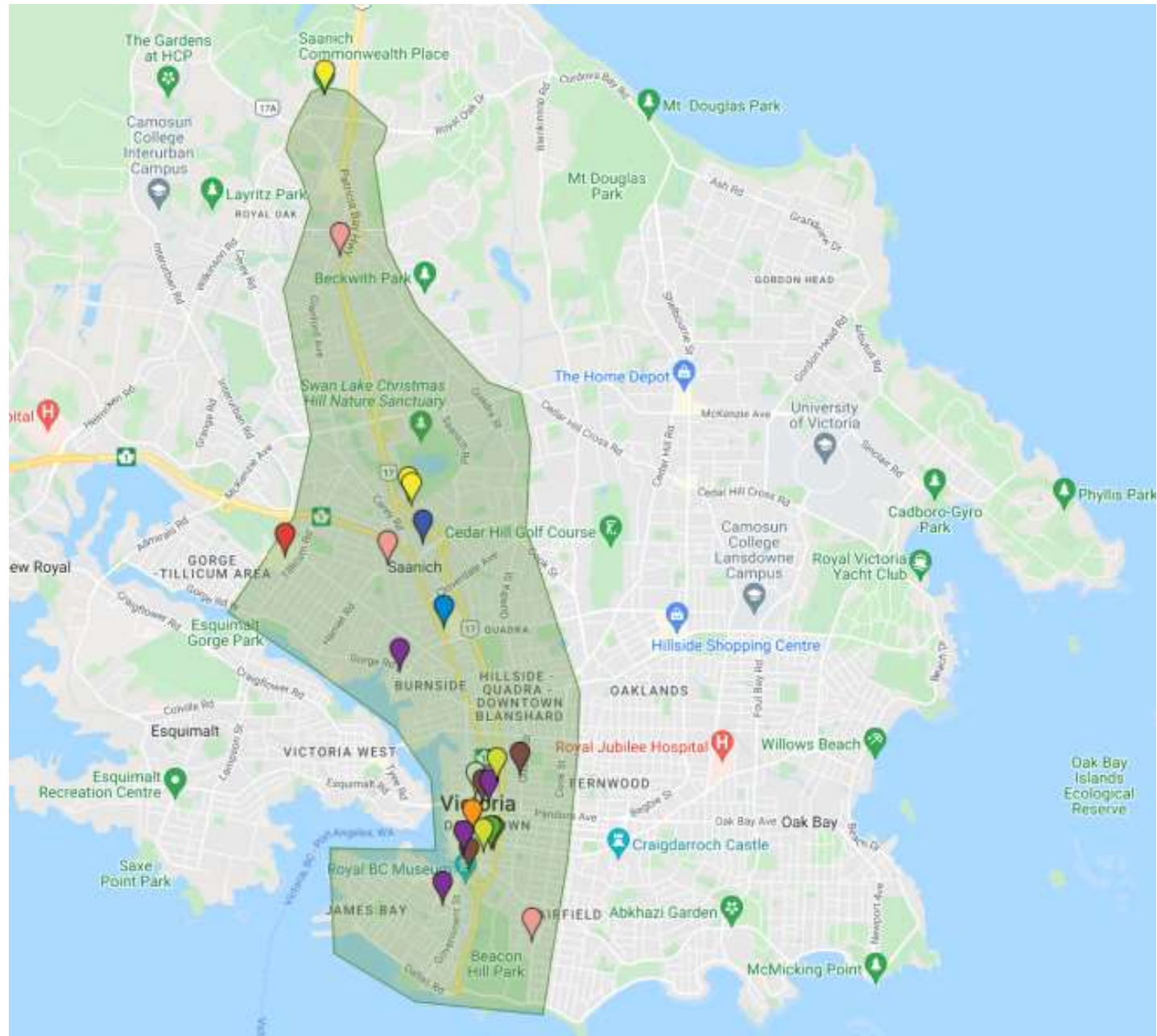
Greater Victoria 2030

District:

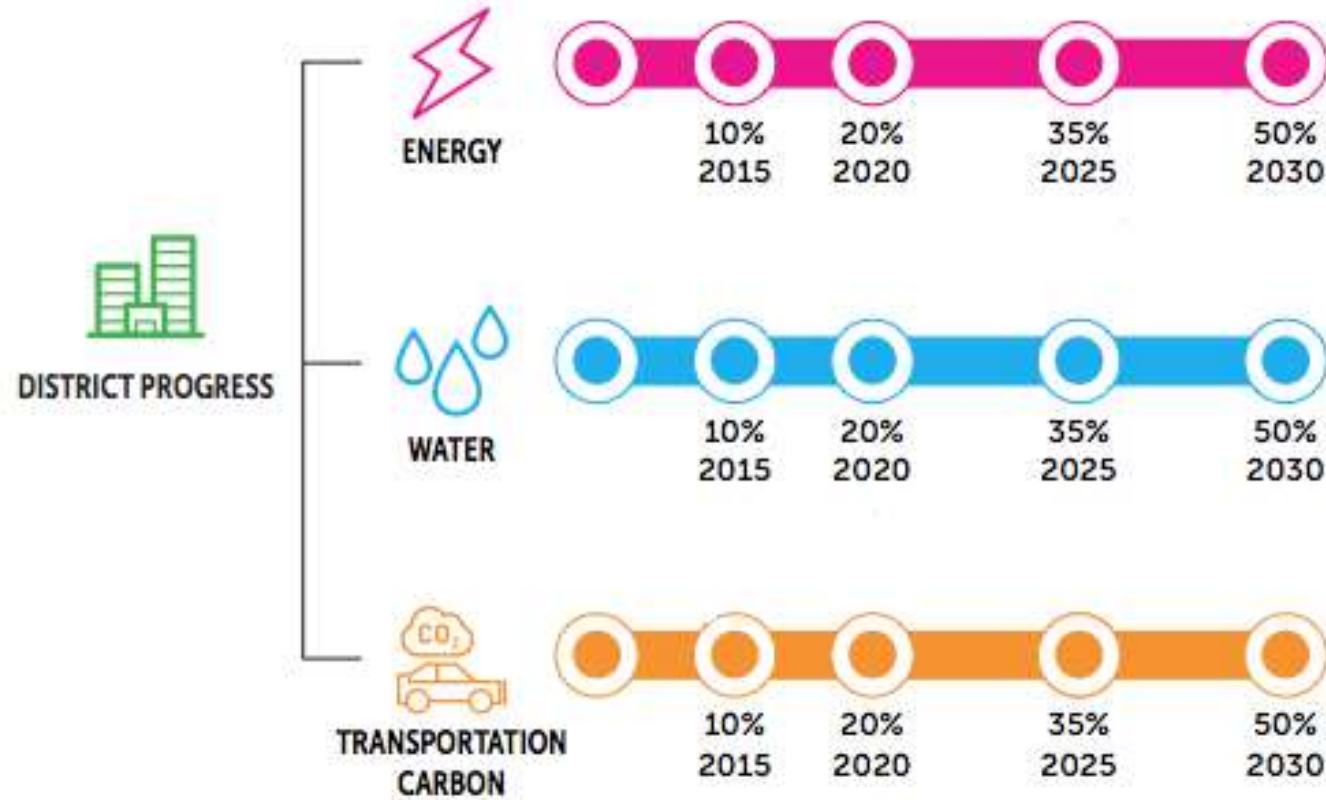
- 4 million sq.ft.
- 44 buildings
- 13 property managers



Greater Victoria 2030 District



2030 Network Targets – driven by Architecture 2030 (Original Targets)



“Designated urban areas committed to meeting the energy, water, and transportation emissions reduction targets of the 2030 Challenge for Planning.”

Beyond 2030

2030 Districts are committed to eliminating emissions:



Building
Energy
Consumption
to zero



Building
Water
Consumption
by 50%



Transportation
GHG
Emissions
to zero

by the year **2040**

2030 District Member Benefits & Services



BENCHMARKING
AND TRACKING
PERFORMANCE



GUIDANCE,
TRAINING +
SUPPORT



FORUM FOR
COLLABORATION +
LEARNING



POOLED
PURCHASING



COMPLIANCE WITH
FUTURE
REGULATIONS



“FUTURE
PROOFING”
BUILDINGS



COMPETITIVE
ADVANTAGE

Energy & GHG emissions benchmarking and energy studies



Topics:

- Resiliency
- BOMA BC Climate Action Program
- Electrification opportunities
- Smart Buildings
- Tenant Engagement
- Municipal Zero Carbon Building Policies
- EV Charging
- Utility Program offerings
- EV market updates/opportunities
- Building Benchmark BC
- Jawl Properties tour
- PACE

Member Meetings



GREATERVICTORIA
2030
DISTRICT®



[ROAR] RESILIENCY TOOL

Improve commercial buildings' resilience to climate change by developing a decision support tool (resiliency tool).

In partnership with:



With funding from:



Annual Progress Report 2022



The Bay Centre made significant cuts to its greenhouse gas emissions and overall energy use between 2011 and 2019. (Jake Romphf/News Staff)

Network of major Greater Victoria buildings charting the path to zero emissions

Local buildings have made substantial cuts in a short timeframe, are taking up innovative systems

JAKE ROMPHF / Apr. 17, 2023 9:05 a.m. / LOCAL NEWS / NEWS



Community Energy Association CEO Dale Littlejohn presented the award to District of Saanich Councillor Ned Taylor (left) and City of Victoria Mayor Lisa Helps (right).

An aerial photograph of Greater Victoria, British Columbia, showing the city built on a peninsula and surrounding islands, with the Strait of Juan de Fuca and snow-capped mountains in the background.

GREATER VICTORIA 2030 DISTRICT[®]

**For more information:
Cora Hallsworth
Director, Greater Victoria 2030
District
cora@chrmc.ca**



**University
of Victoria**

Research towards Decarbonization Planning

Energy in Cities group
ReBuild initiative

ReBuild Initiative

- Lead by Dr. Ralph Evins
- Hosted at the University of Victoria
- Team of 18
 - Post-doctoral researchers
 - Graduate students
 - Technical support



<https://www.uvic.ca/news/academics/2022+rebuild-energy-efficiency-buildings+news>

ReBuild Initiative

Research activities

	Task / support activity	Lead partner	Objective	Working groups				Collab.
A-1	Targeting retrofit measures in commercial buildings	Audette	Develop methods to automatically identify candidates for common retrofit actions by data-mining prior energy audits	Bas	Comm	Data	Model	Miller
A-2	Retrofit Concierge service for home-owners	Open	Develop a data-driven tool to guide homeowners in selecting retrofit options through prediction of home attributes, energy modelling + optimization	Bas	Comm	Data	Model	Miller
A-3	Automated energy model calibration	Morrison Hershfield	Develop automated methods to calibrate detailed building energy models to match high-resolution measured data	Bas	Comm	Data	Model	O'Donnell
A-4	Performance gap analysis for residential deep energy retrofits	Read Jones Christoffersen	Compare as-modelled to as-constructed performance for a suite of deep energy retrofit residential projects (MURB and SPH)	Bas	Comm	Data	Model	O'Donnell
A-5	Evaluation of performance for deep energy retrofits in MURBs	Pembina Institute	Leverage learnings from deep retrofit demonstration projects to accelerate market development for renovation of MURBs	Bas	Comm	Data	Model	Touchie
A-6	Strategies for tenant engagement in the retrofit process	Pembina Institute	Assess tensions and synergies between resident perspectives and technical aspects of retrofits to enhance well-being and satisfaction	Bas	Comm	Data	Model	Hoicka
A-7	An ecosystem for energy retrofit technologies	NRC	Extend NRC tools to support pre- and post-retrofit evaluations of energy, building characteristics and building occupants in	Bas	Comm	Data	Model	Touchie
A-8	Community scale integration of smart retrofits	NRC	Integrate smart buildings at community scale to quantify smart grid and community benefits	Bas	Comm	Data	Model	Athienitis
A-9	Grid flexibility scorecard for buildings	edo / McKinstry	Develop a tool to quickly understand building flexibility in providing load-shifting to the grid	Bas	Comm	Data	Model	Rowe
A-10	Model-based energy audits	Resilient District 2030	Use of calibrated physics-based and surrogate energy models to perform energy audits	Bas	Comm	Data	Model	Pape-Salmon
A-11	Lifecycle and resiliency assessment framework	PNWER	Assess the trade-offs between operational and life-cycle emissions and the resiliency of existing buildings to climate change	Bas	Comm	Data	Model	Pape-Salmon
A-12	Renewal and regeneration in the built environment	Christine Lintott Architects	Preserve and rehabilitate built structures using the processes of renewal and regeneration found in nature	Bas	Comm	Data	Model	McArthur
A-13	Retrofit decision analysis framework and toolset	Stantec	Develop a generative decision support tool to guide stakeholders in selecting retrofit options	Bas	Comm	Data	Model	Froese
A-14	Tools for municipalities to meet carbon targets	City of Victoria / PICS	Develop a framework and dashboards to help cities develop evidence-based policies to meet short and long-term emissions reduction targets	Bas	Comm	Data	Model	Froese
A-15	Identifying optimal retrofit bundles	City of Victoria	Identify optimal packages of retrofit measures that can be costed, incentivised and delivered efficiently	Bas	Comm	Data	Model	McArthur
A-16	National Building Code engagement	BC Hydro	Assess the impact of retrofit policies and incentives across the building stock	Bas	Comm	Data	Model	Pape-Salmon

ReBuild Initiative

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Quantifying Information Gain for Decarbonization Planning

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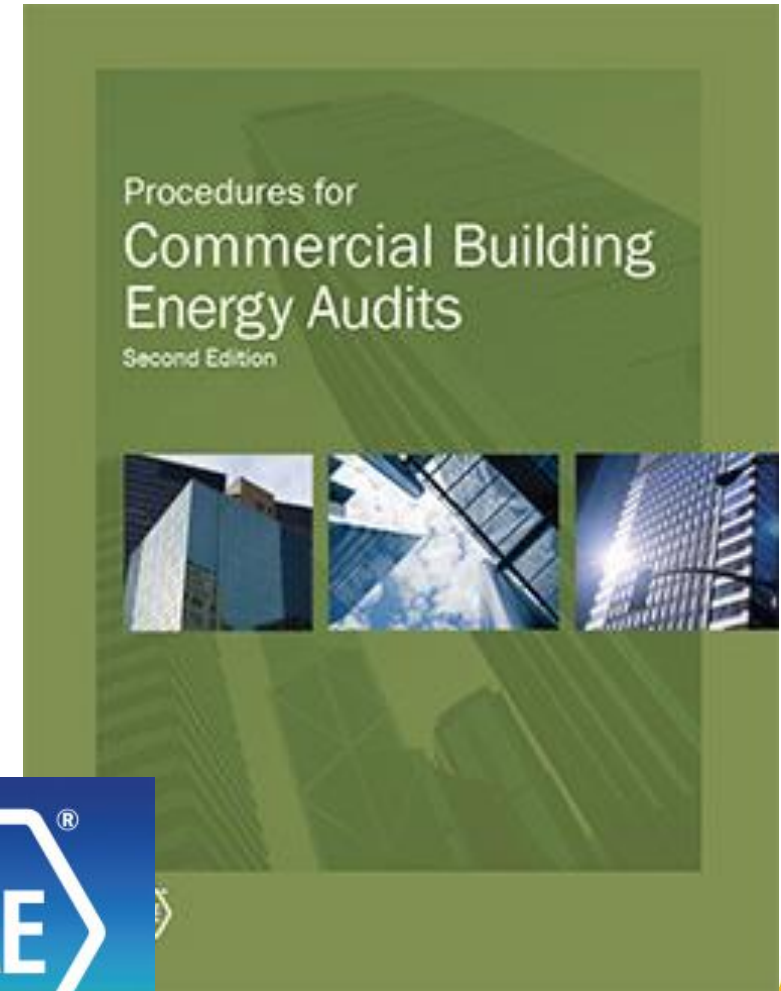
Agenda Today

- A. Research Highlights
 - 1. Model Calibration
 - 2. Sensor Data at Scale
- B. 2030 District Support
 - 1. Target-setting methodology
 - 2. Deep energy studies



Example 1: Energy Model Calibration

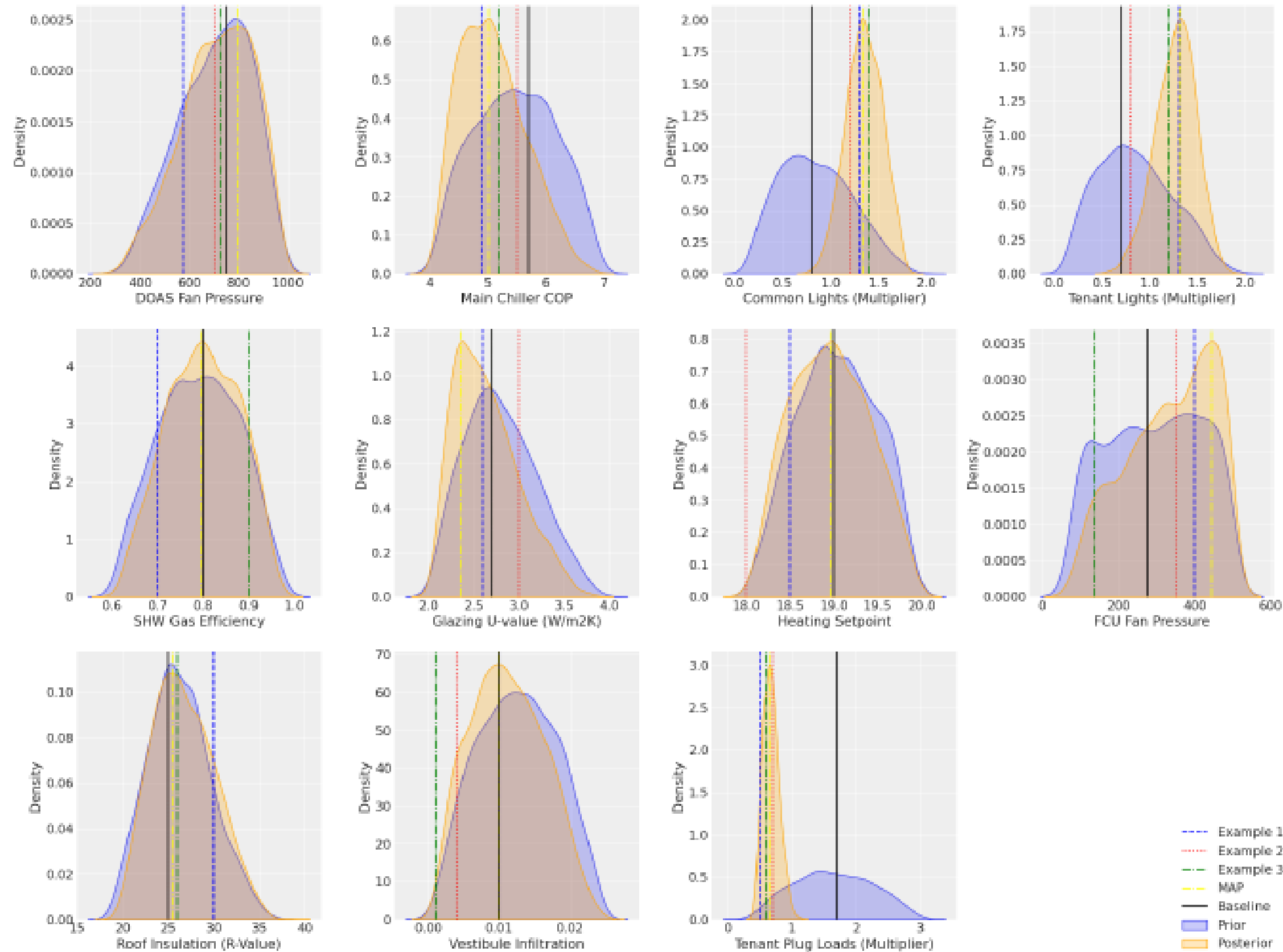
- How can we quantify the confidence in our calibration results?
- How much information gain does our available data give us?



ASHRAE Guideline 14-2014
(Supersedes ASHRAE Guideline 14-2002)

**Measurement of Energy,
Demand, and Water
Savings**

Example 1: Energy Model Calibration



Example 2: Sensor Data at Scale

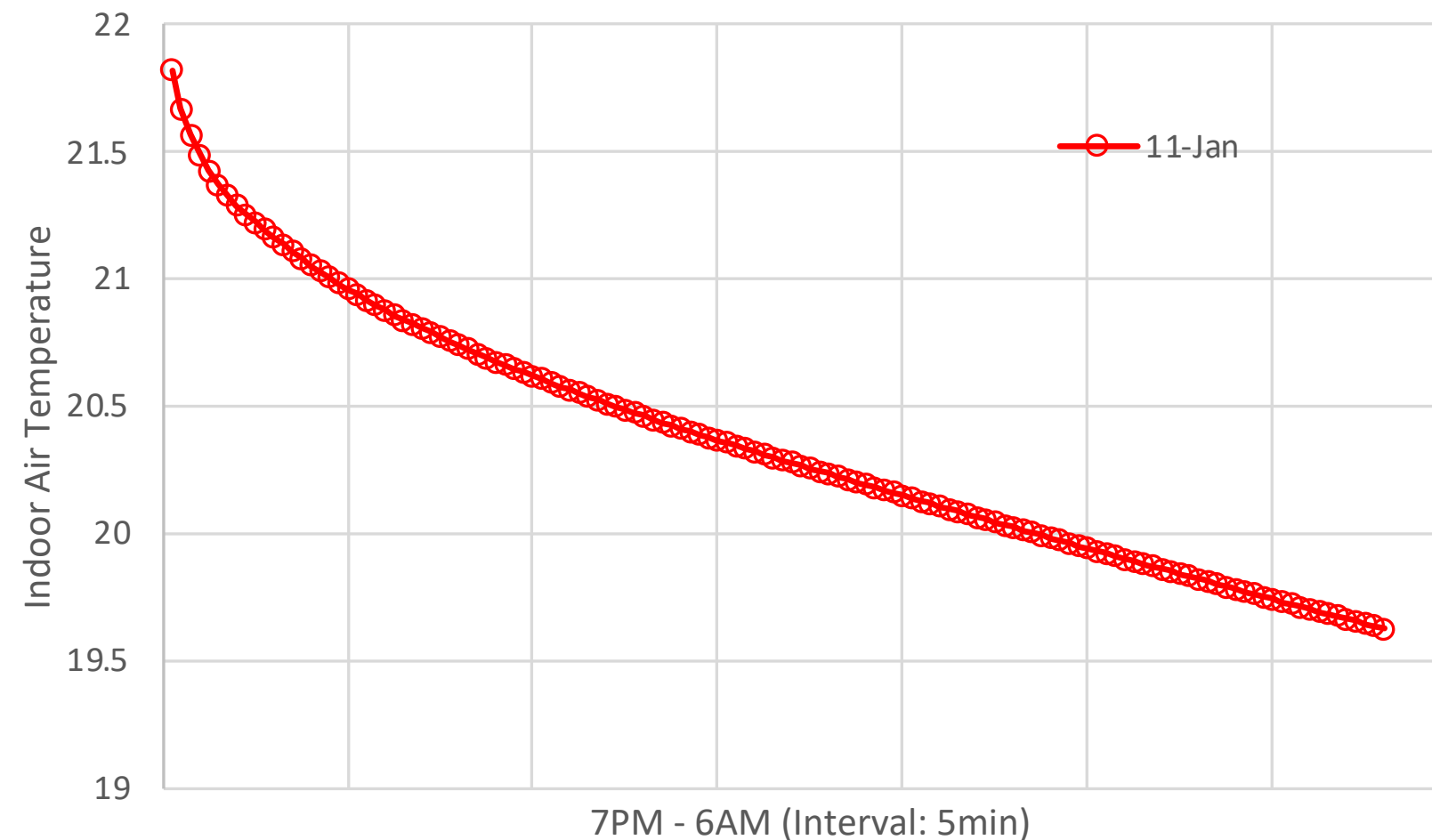
- How can we utilize smart building data at scale?
- Can room temperature data give us hints about the building characteristics?
- How much information does room temperature contain?



Example 2: Sensor Data at Scale

$$C \frac{dT_{in}}{dt}(t) = \dot{Q}_{in}(t) + \dot{Q}_h(t) + \dot{Q}_{sol}(t) - \frac{1}{R}(T_{in}(t) - T_{ext}(t)) - \dot{Q}_{ven}(t)$$

$$\theta(t) = \theta_0 e^{\frac{-t}{RC}}$$



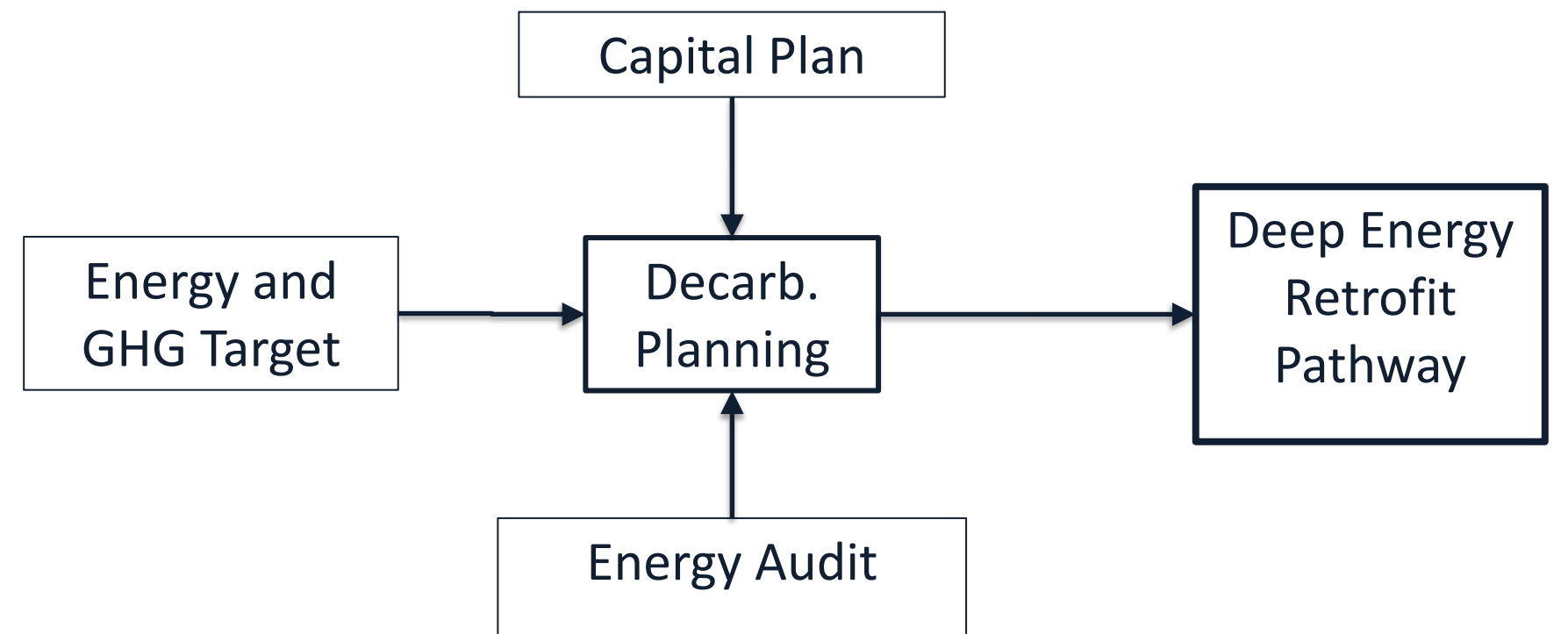
ReBuild x 2030 District

1. Energy and GHG benchmarking and target setting.
2. Energy study procurement and management.
3. Ground-truthing research developments.



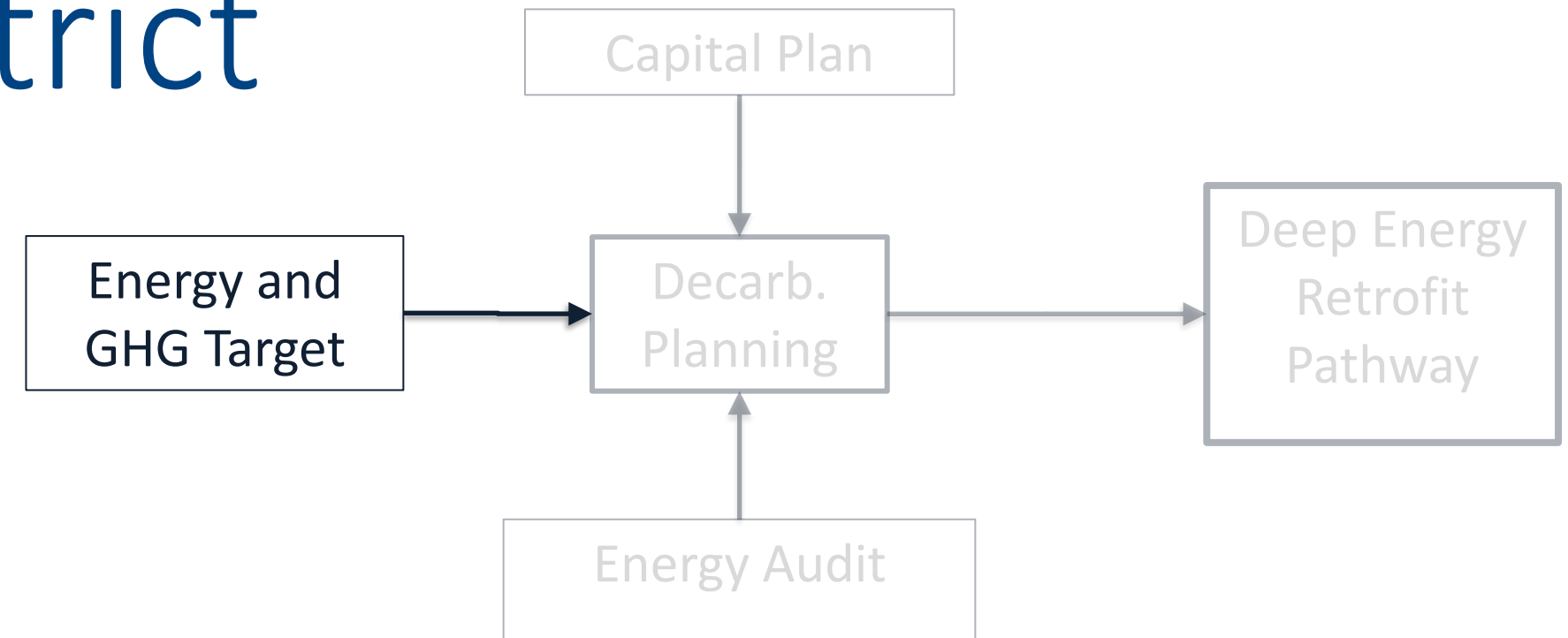
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ReBuild x 2030 District

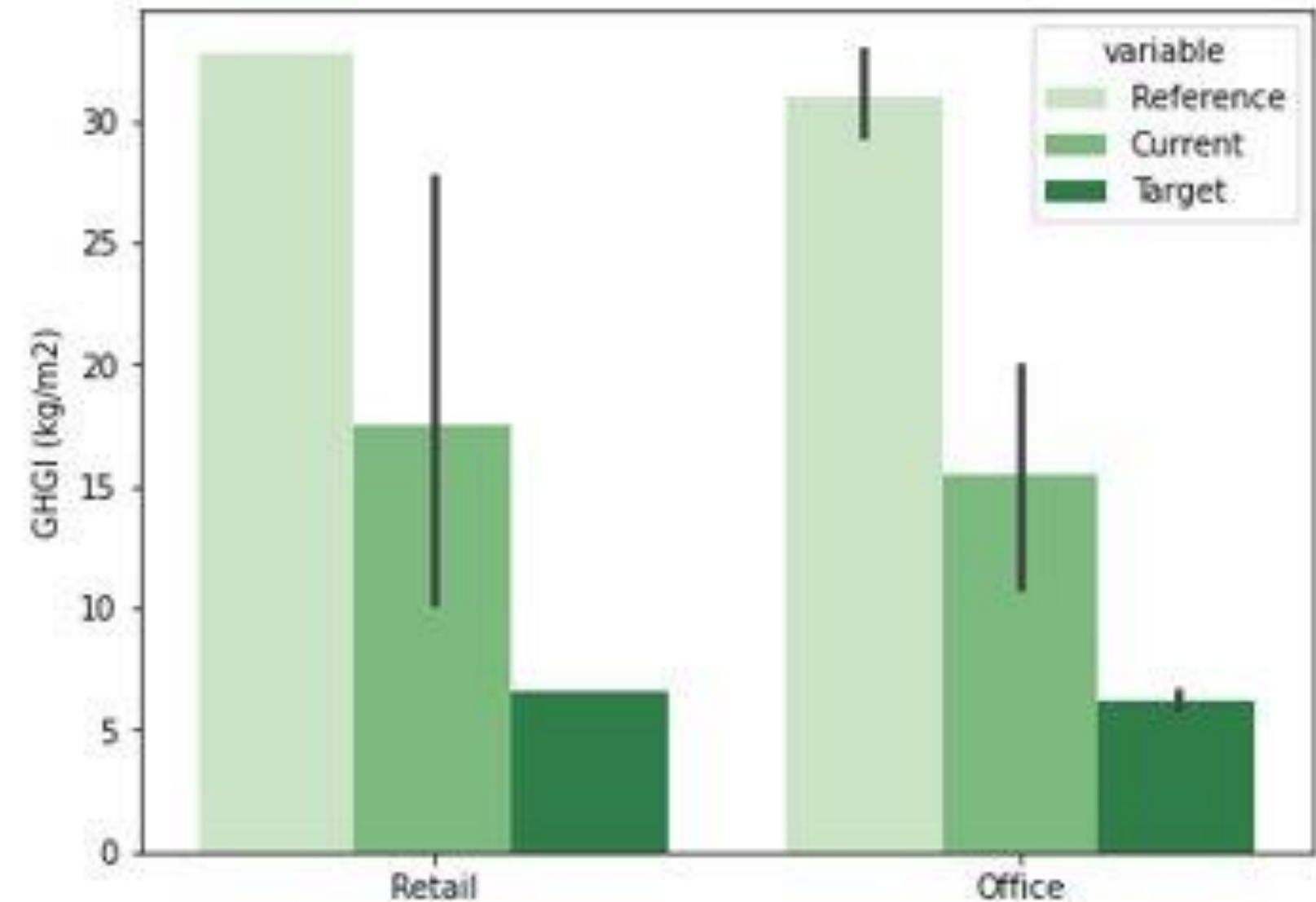
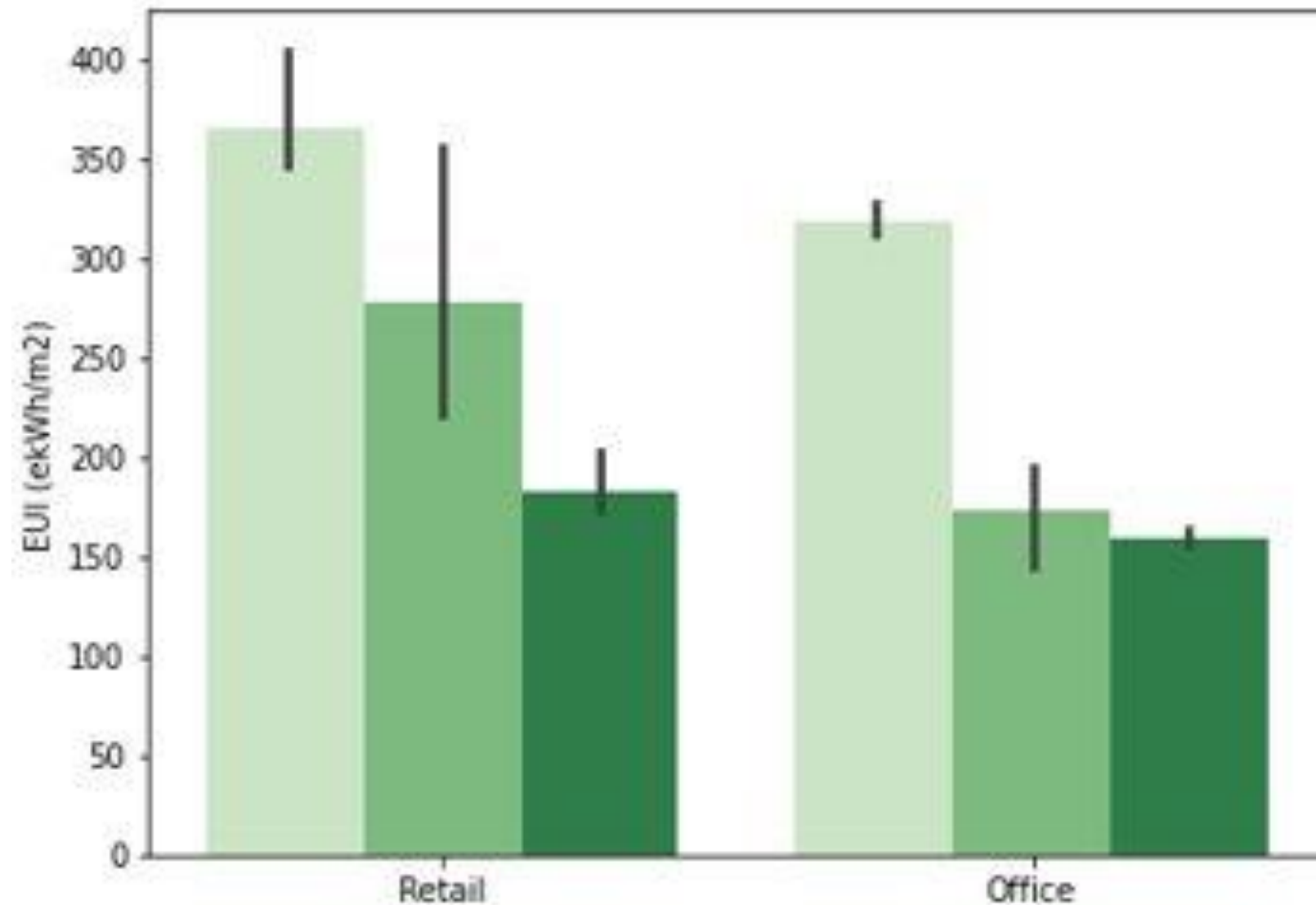
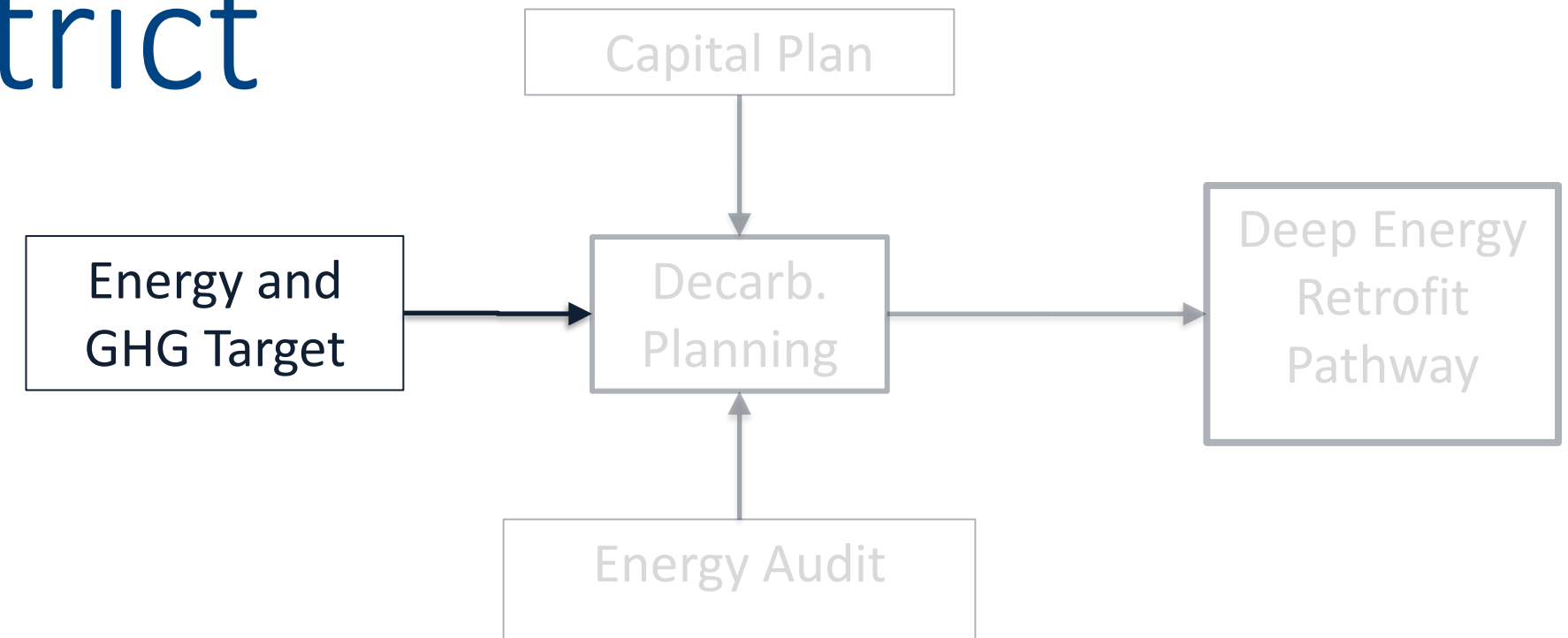
Translating “50% Savings” to
“X kgCO₂e/m²”



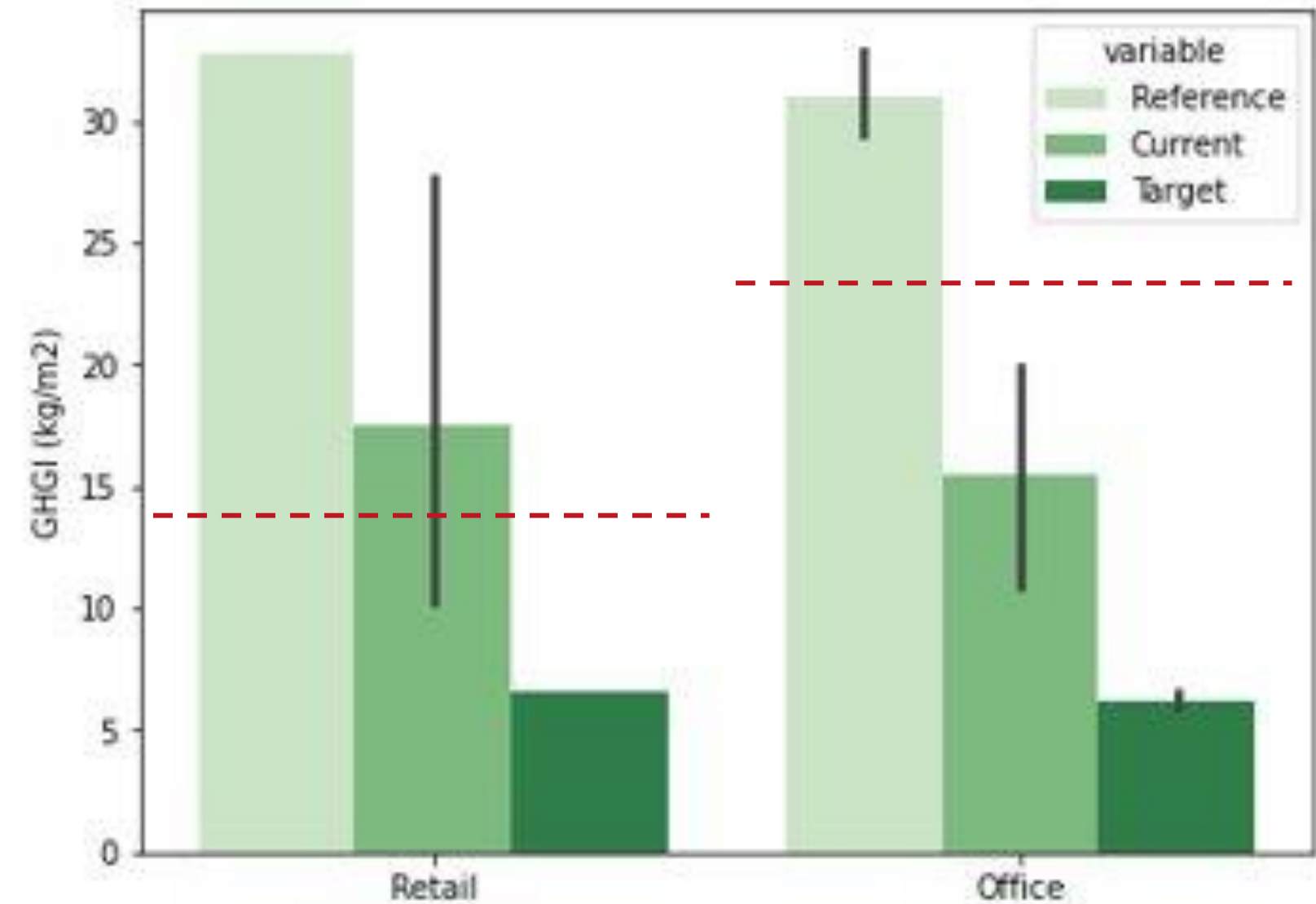
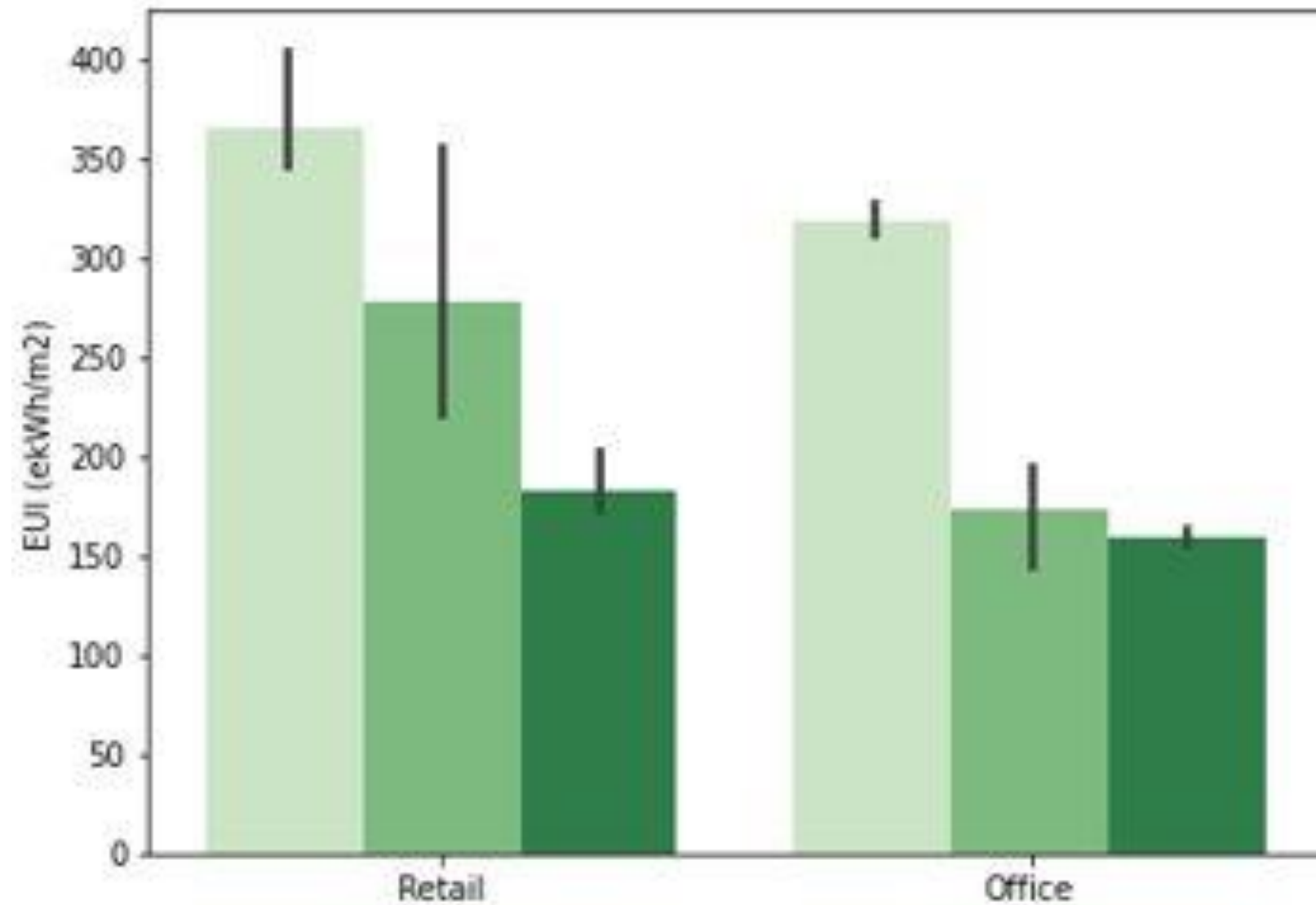
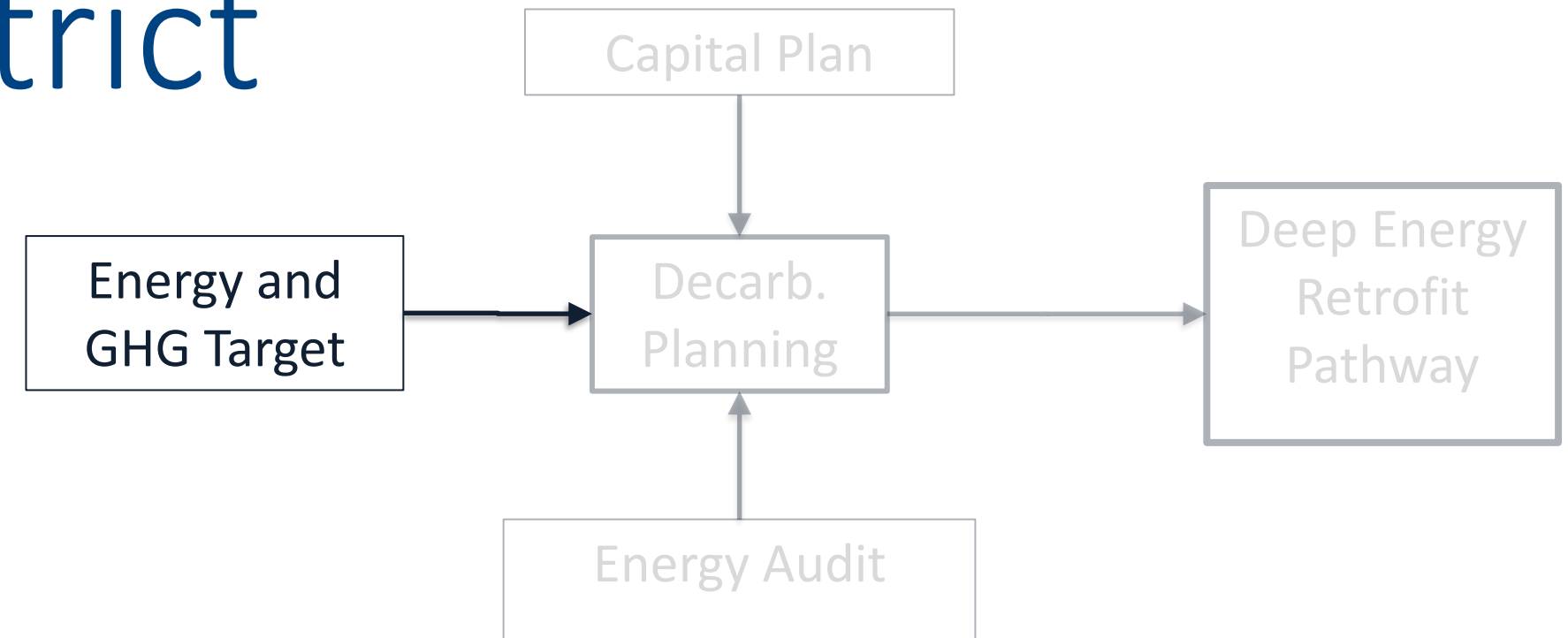
Guiding Principles:

- Consistent
- Rigorous
- Flexible
- Inclusive

ReBuild x 2030 District



ReBuild x 2030 District



**A carbon reduction
plan for every
building**

Audette'

Scalable carbon planning: a case study

- 200 buildings
- Mixed use types
- Want to layer **carbon** into **CAPEX plans**
- Looking for scalable **project levers**



Challenges

- **Lack of capacity & expertise**
- **Budget constraints**
- **Incomplete operational data**
- **Not sure which projects scale across portfolio**



Optimizing
incremental spend
is the bottleneck.

Graduated Intelligence



Market

Portfolio

Building

Project

Delivering the **right**
insights at the **right time.**

Graduated Intelligence

Market

Portfolio

Building

Project



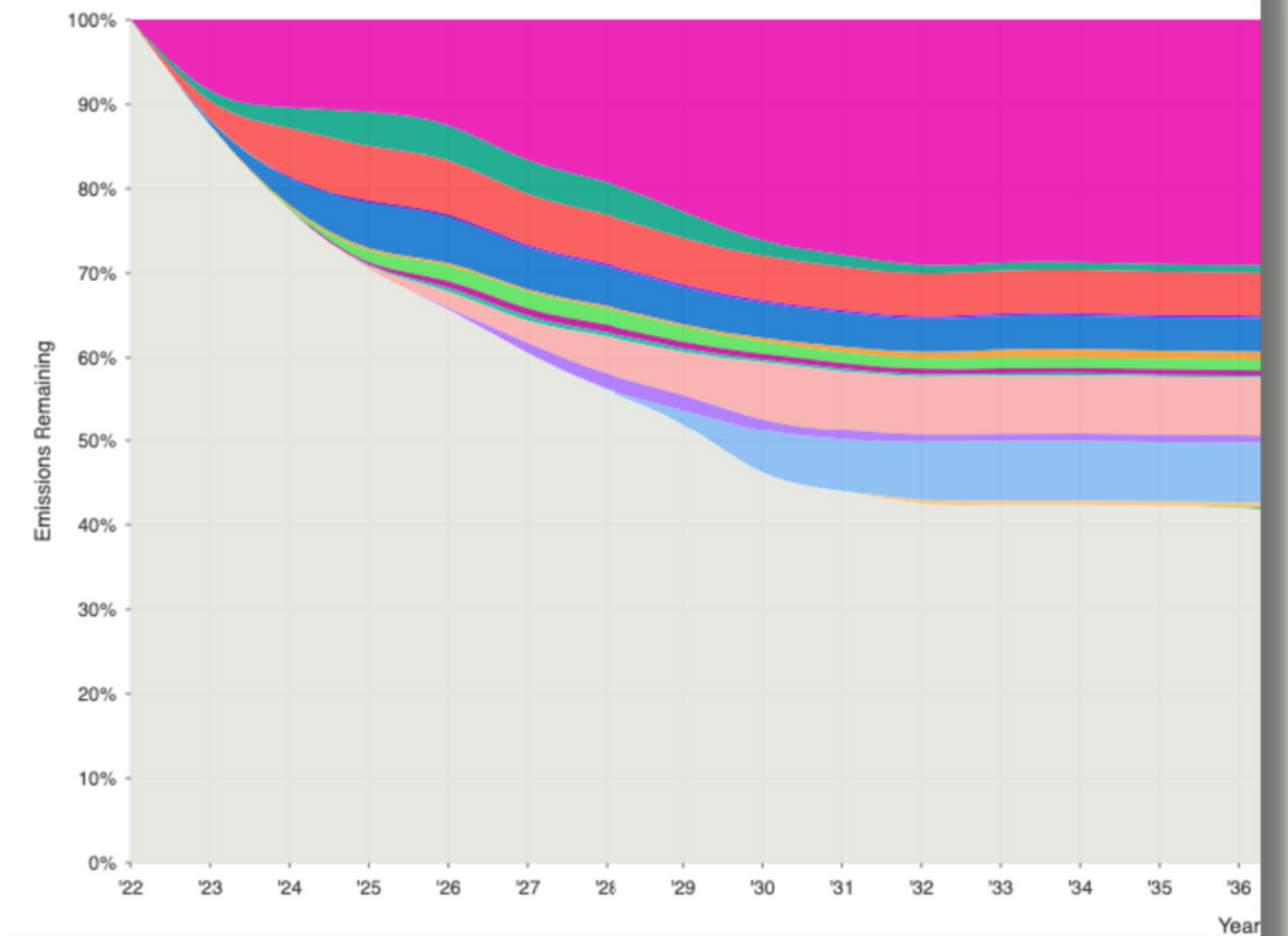
Portfolio tier journey.

Graduated Intelligence

Portfolio

**Reveal projects &
transition costs for every
building.**

Decarbonization Roadmap



Graduated Intelligence

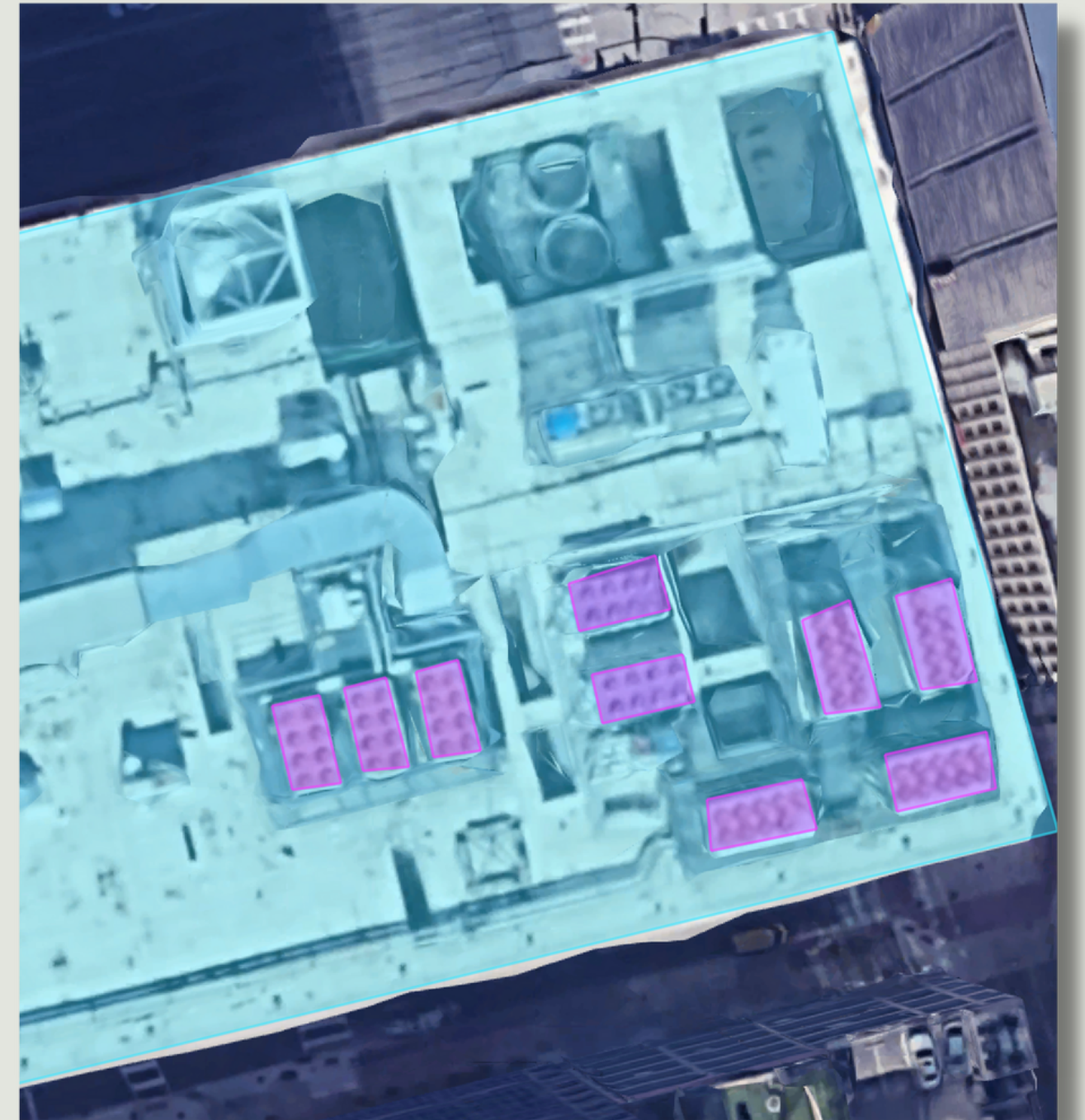
Portfolio

Inputs:

Address, use type, GFA.

+

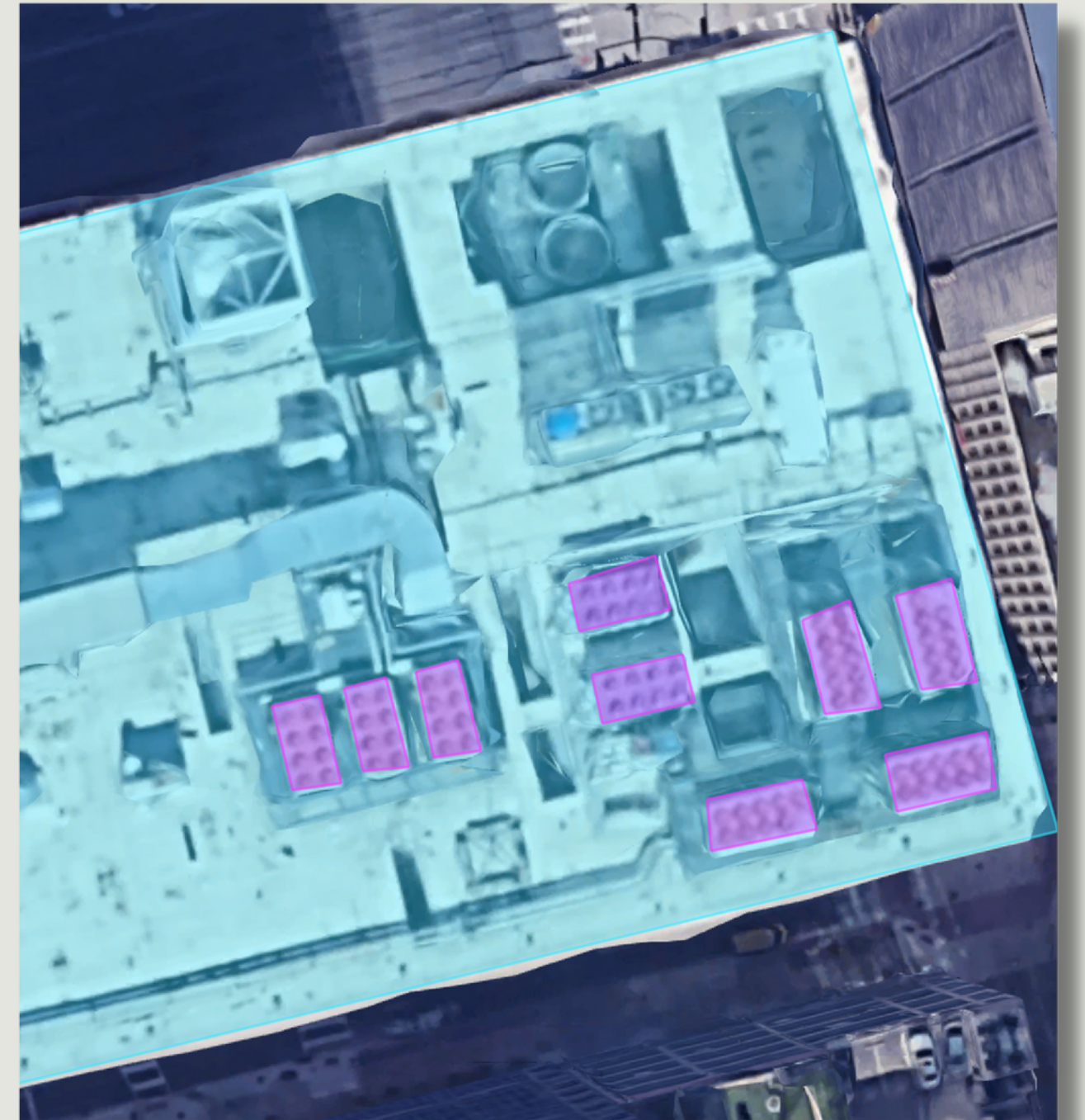
Building feature recognition.



Graduated Intelligence

Portfolio

Output:
Partially validated
decarbonization plans for
each asset.



Graduated Intelligence

Market

Portfolio

Building

Project

Building tier journey.



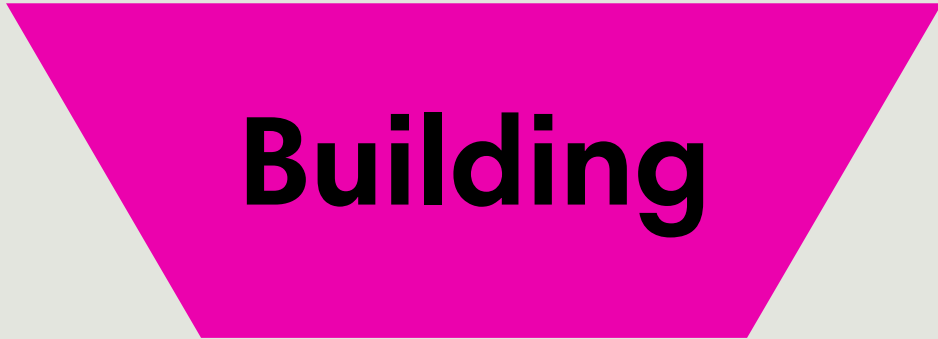
Graduated Intelligence

Building

Turn every retrofit into a carbon reduction project.

Project Name	Low Carbon Upgrade Costs (\$ CAD)	Like for Like Cost (\$ CAD)
Include Energy Recovery During AHU(s) Replacement	\$26 Million	\$23 Million
Increase Roof Insulation to R60	\$176 Million	\$128 Million
Install Advanced Glazing (~R8)	\$2 Million	\$2 Million
Install Air-Source Heat Pump Sized to Replace the Chiller and Supplement/Replace Boiler	\$725 Thousand	\$507 Thousand
Install a Micro Combined Heat and Power System for Domestic Hot Water	\$11 Million	\$569 Thousand
Install a No-Export Rooftop PV System	\$14 Thousand	\$0
Install DCV Controls	\$8 Million	\$0
Install Domestic Hot Water Ambient Air-Source Heat Pump	\$15 Million	\$4 Million

Graduated Intelligence



Input:
'20 Qs' about type, size,
and age of equipment
+
Building attributes.

Project Name	Low Carbon Upgrade Costs (\$ CAD)	Like for Like Cost (\$ CAD)
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Graduated Intelligence

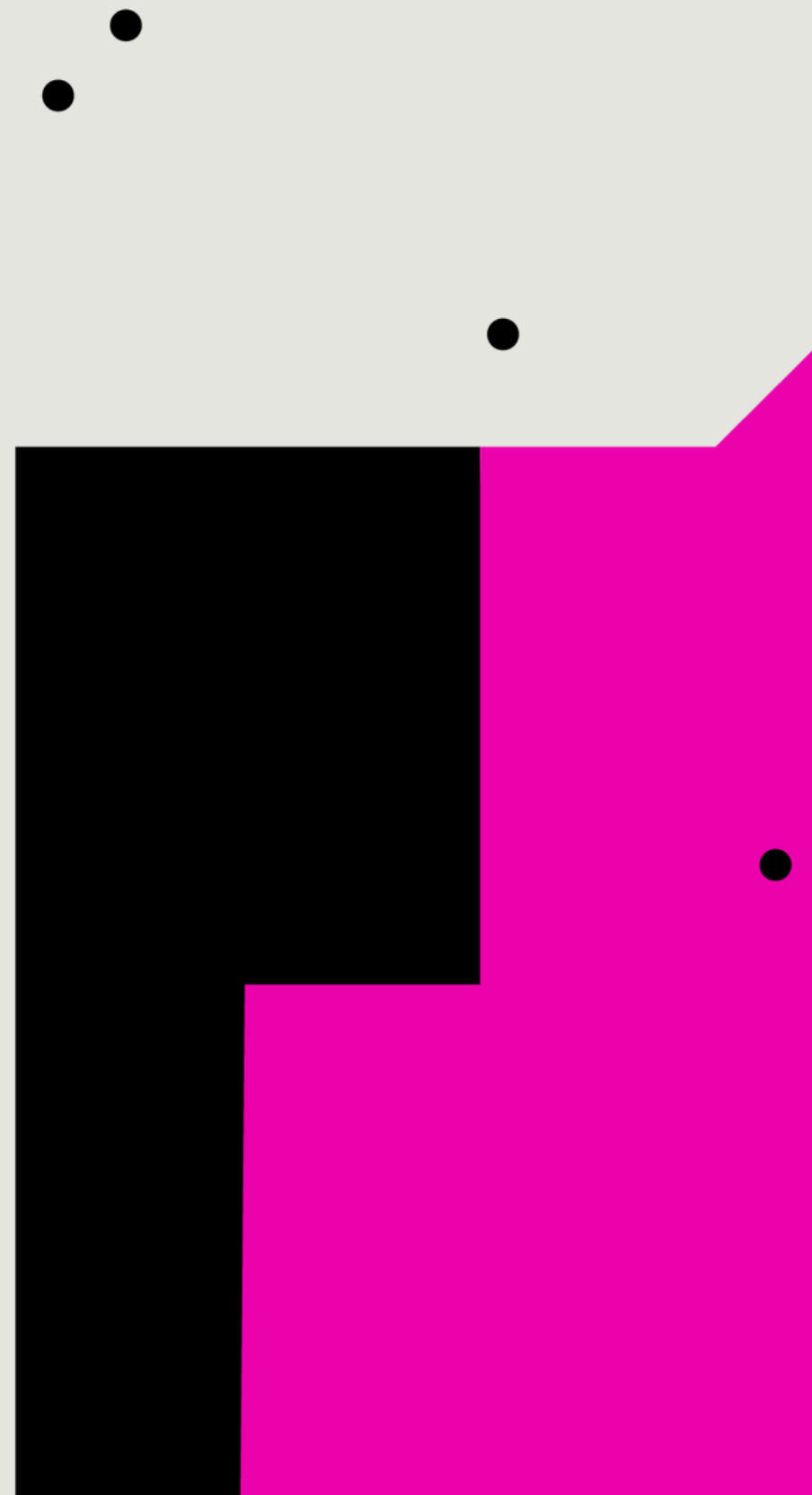
Building

Output:
Validated CAPEX plans
focused on carbon
reduction.

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Outcomes

- **Strategic portfolio plan**
 - **Site-specific roadmaps,
portfolio-wide visibility**
- **Retrofit options analysis beyond
like-for-like**



Lessons learned – BC project levers

\$/tonne

Variable speed drives

Heat pumps
(space & water heating)

Exhaust air heat recovery

Enabling consultants

- Audette streamlines data capture
- Move further up value chain
- Unlocked to highest value
 - Deep investigation
 - Design & implementation



**A carbon reduction
plan for every
building**

Audette'

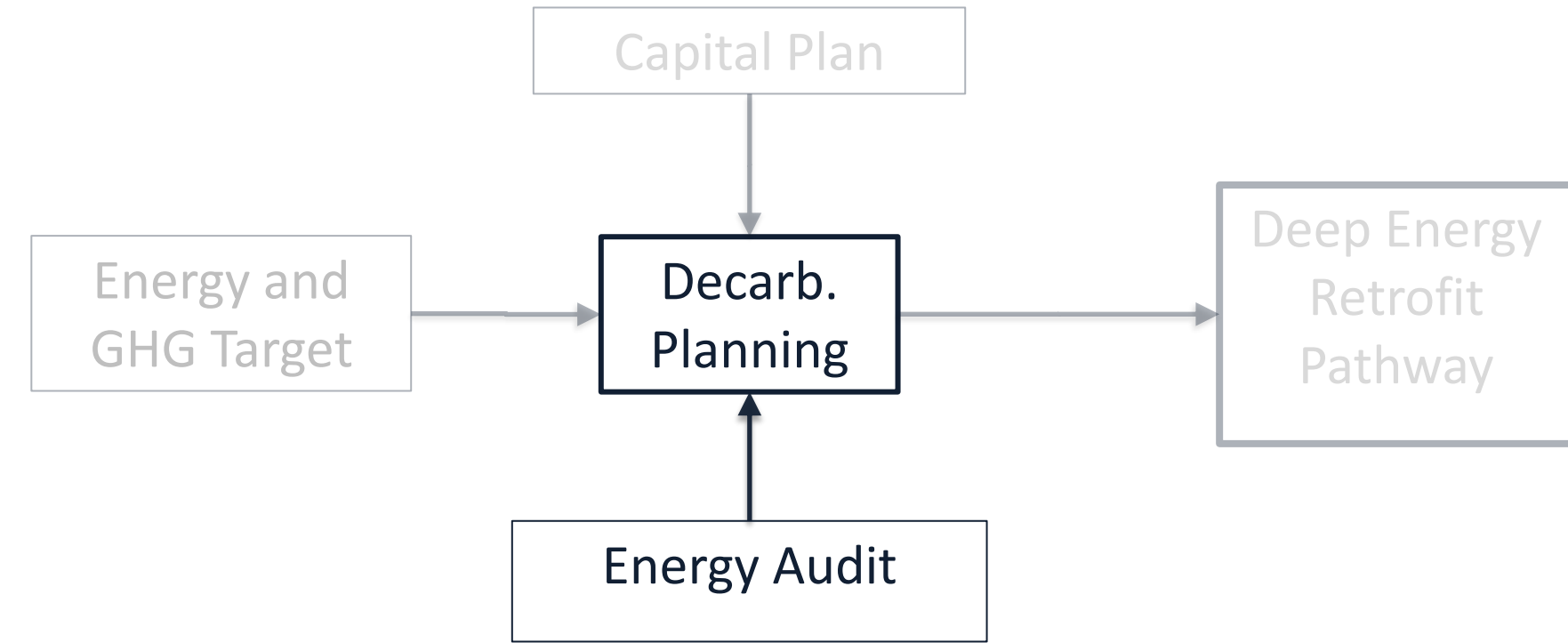
Levelling Up

Typical ASHRAE L2 Audit:

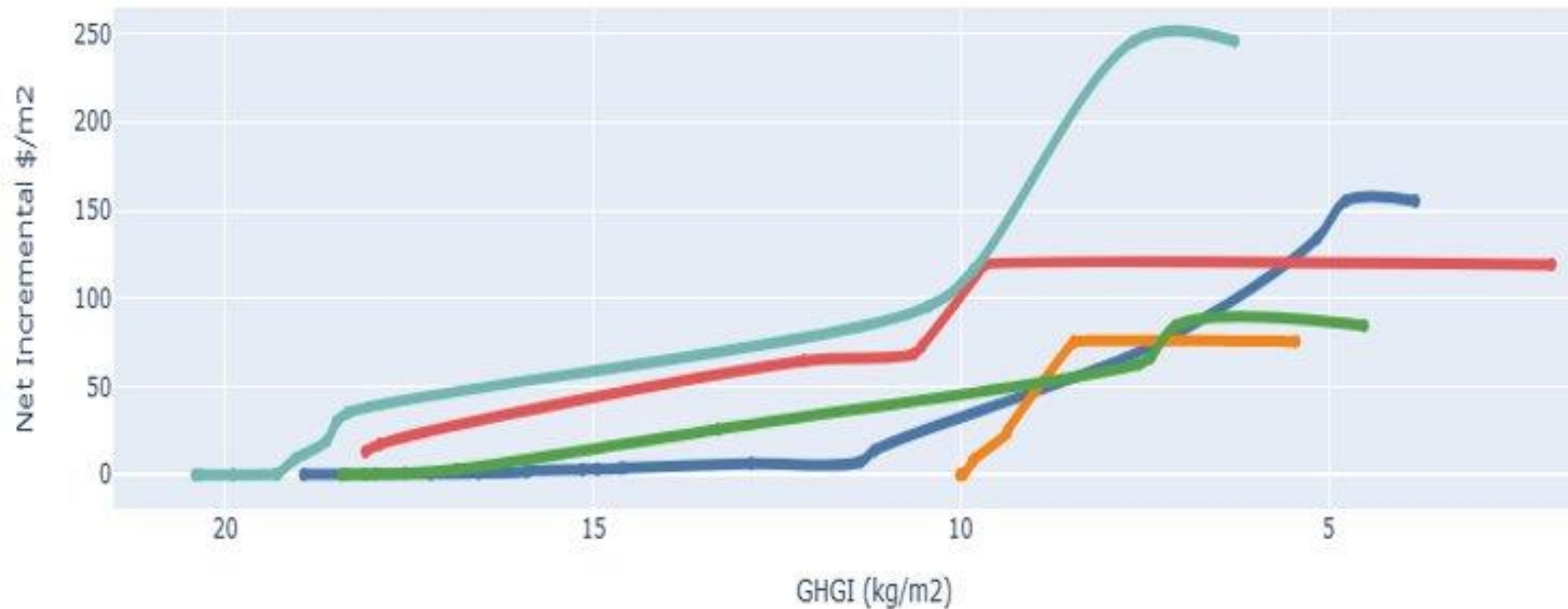
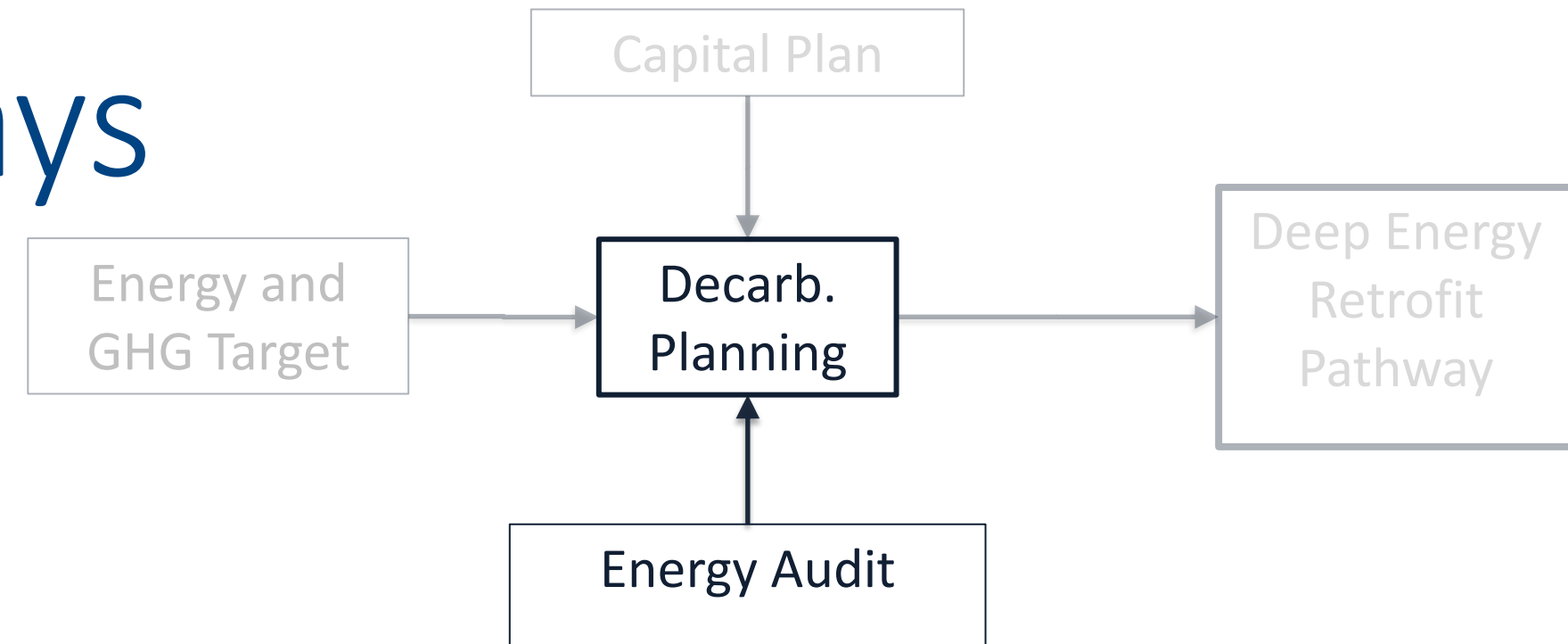
- Like-for-like replacement
- High-efficiency
- System upgrades
- Low payback period

Deep Energy Audit:

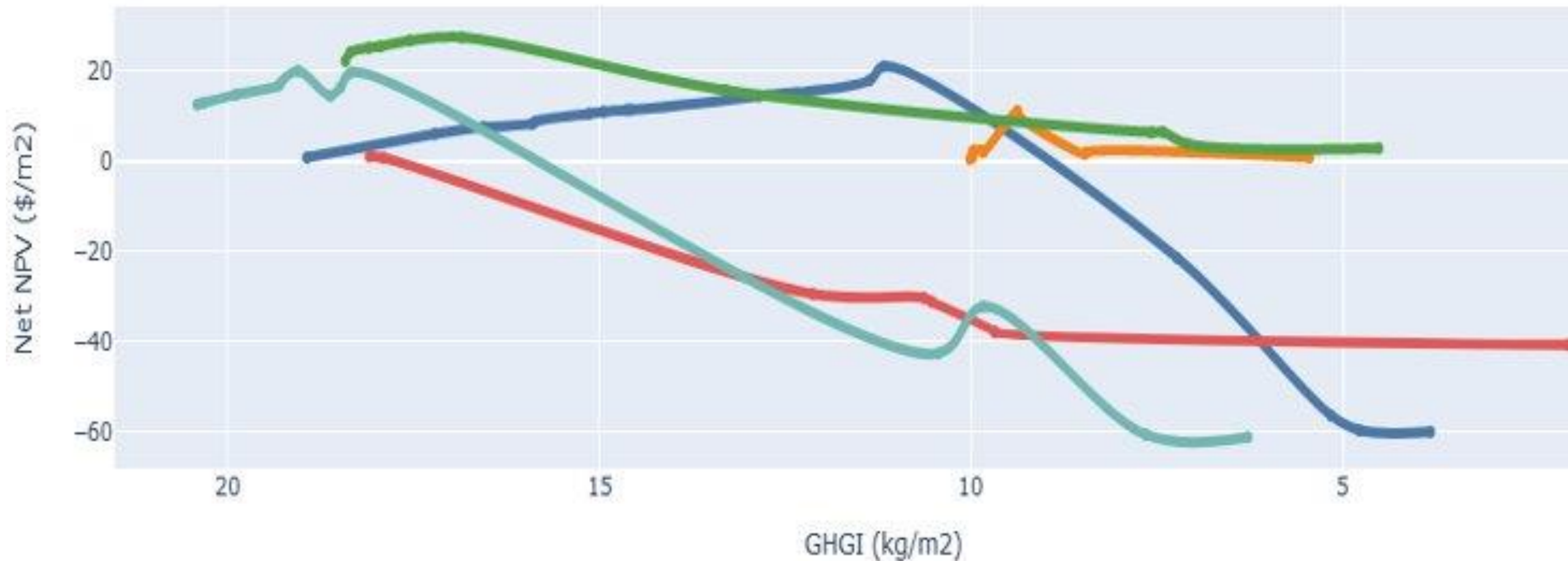
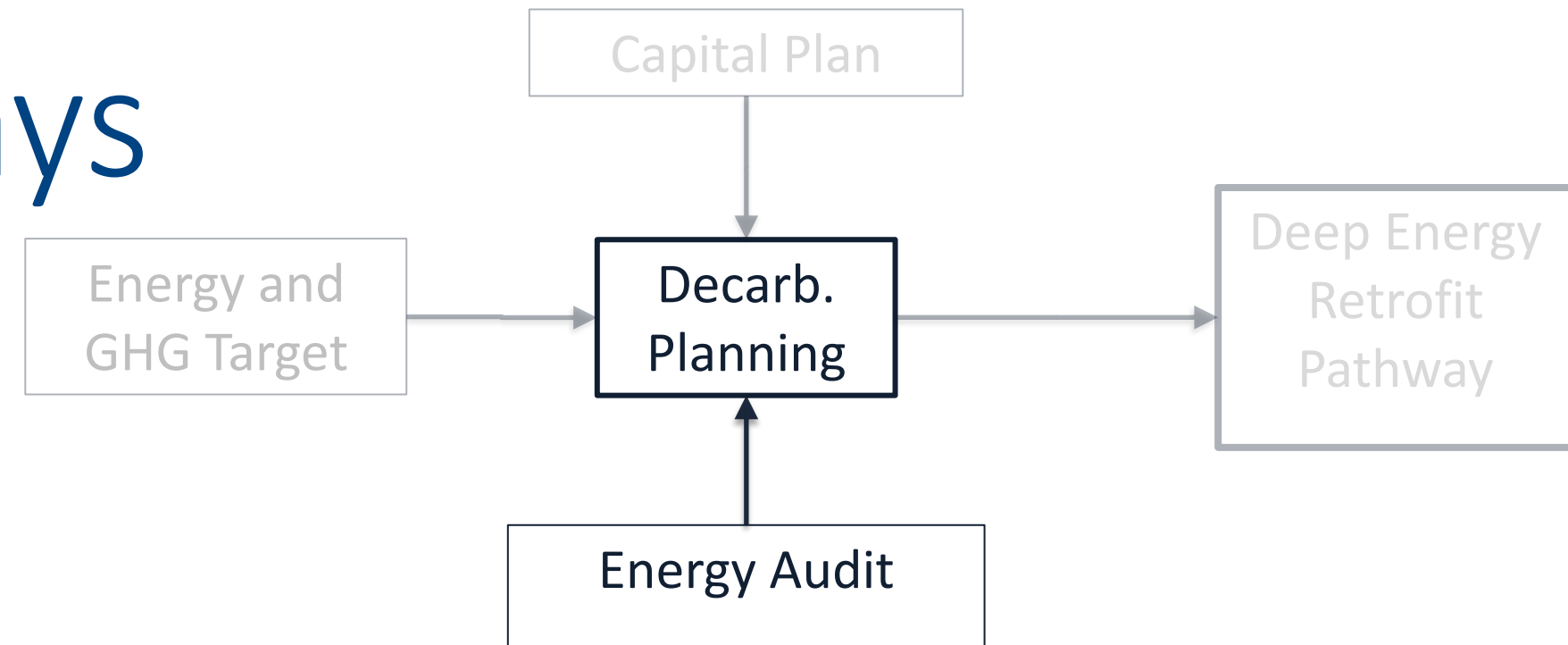
- Set target
- Integrate capital plan



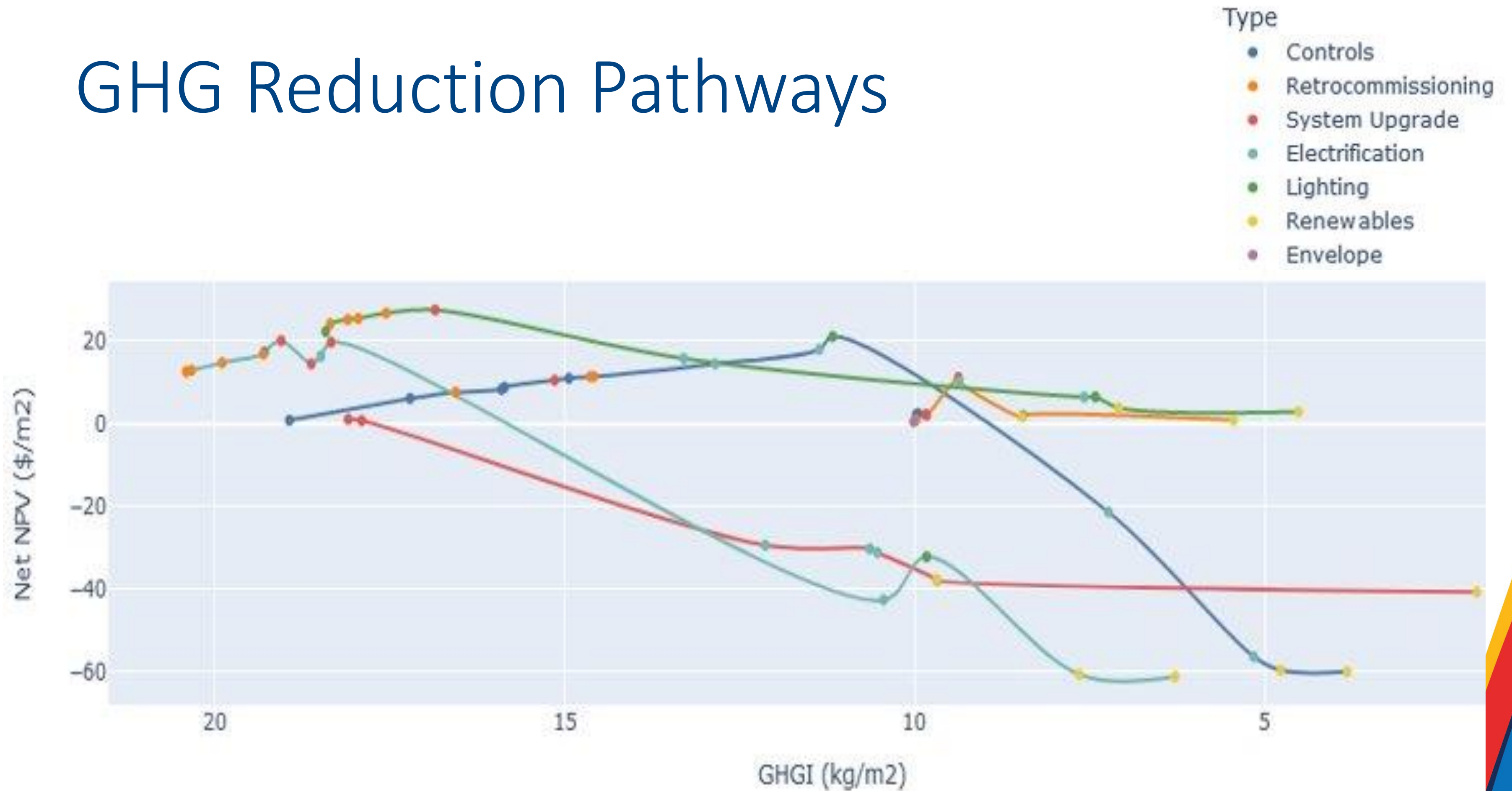
GHG Reduction Pathways



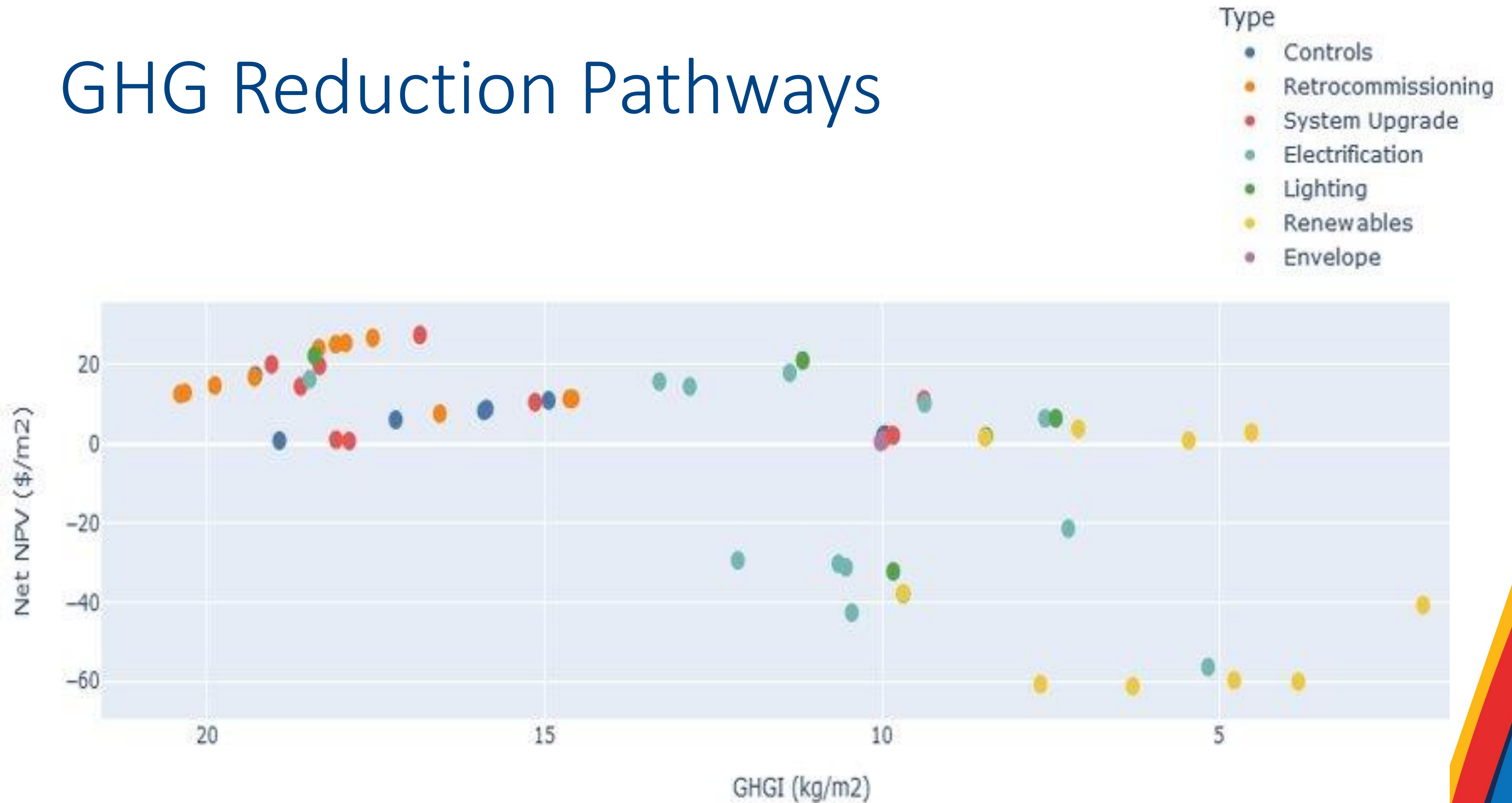
GHG Reduction Pathways



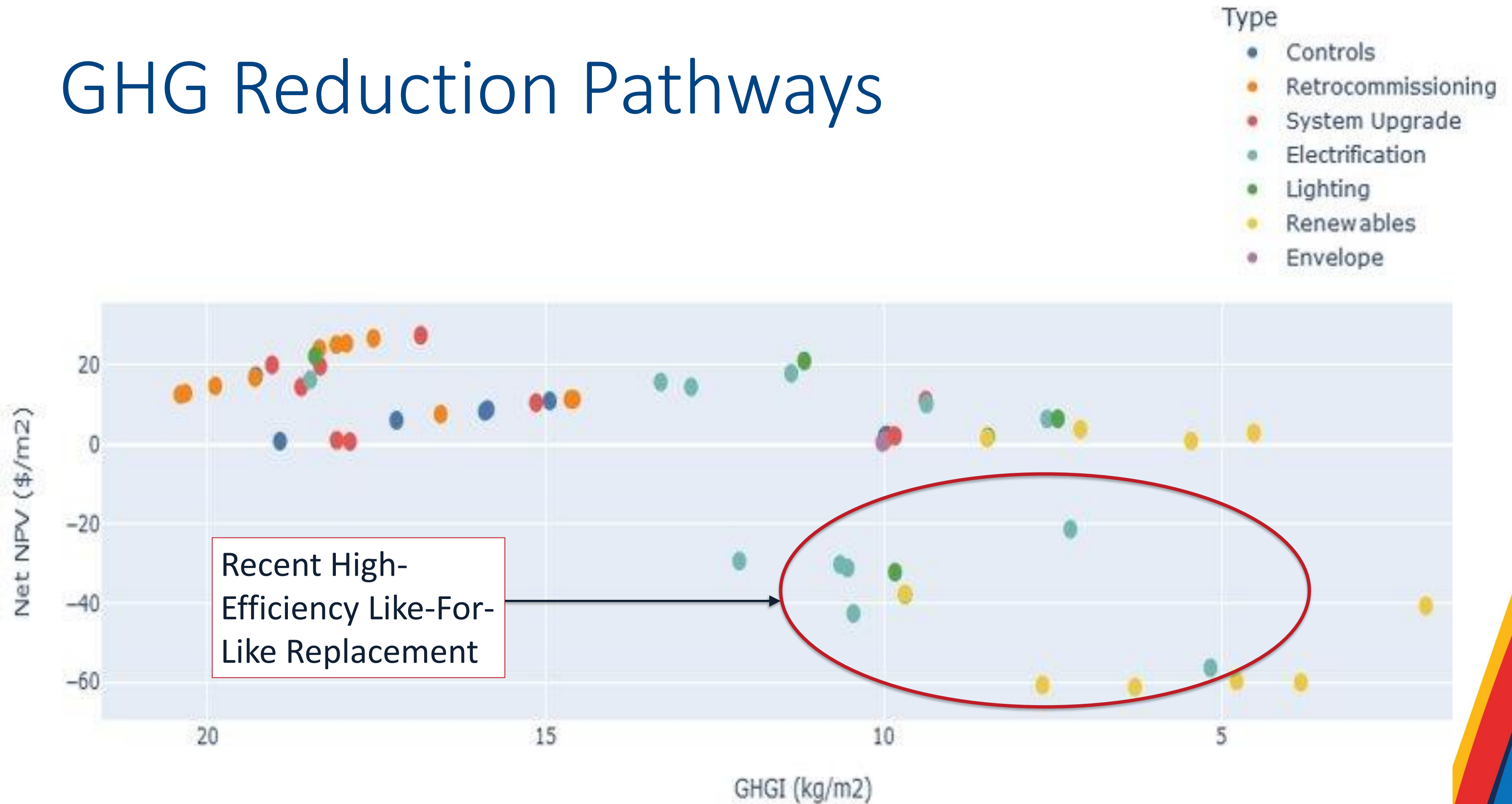
GHG Reduction Pathways



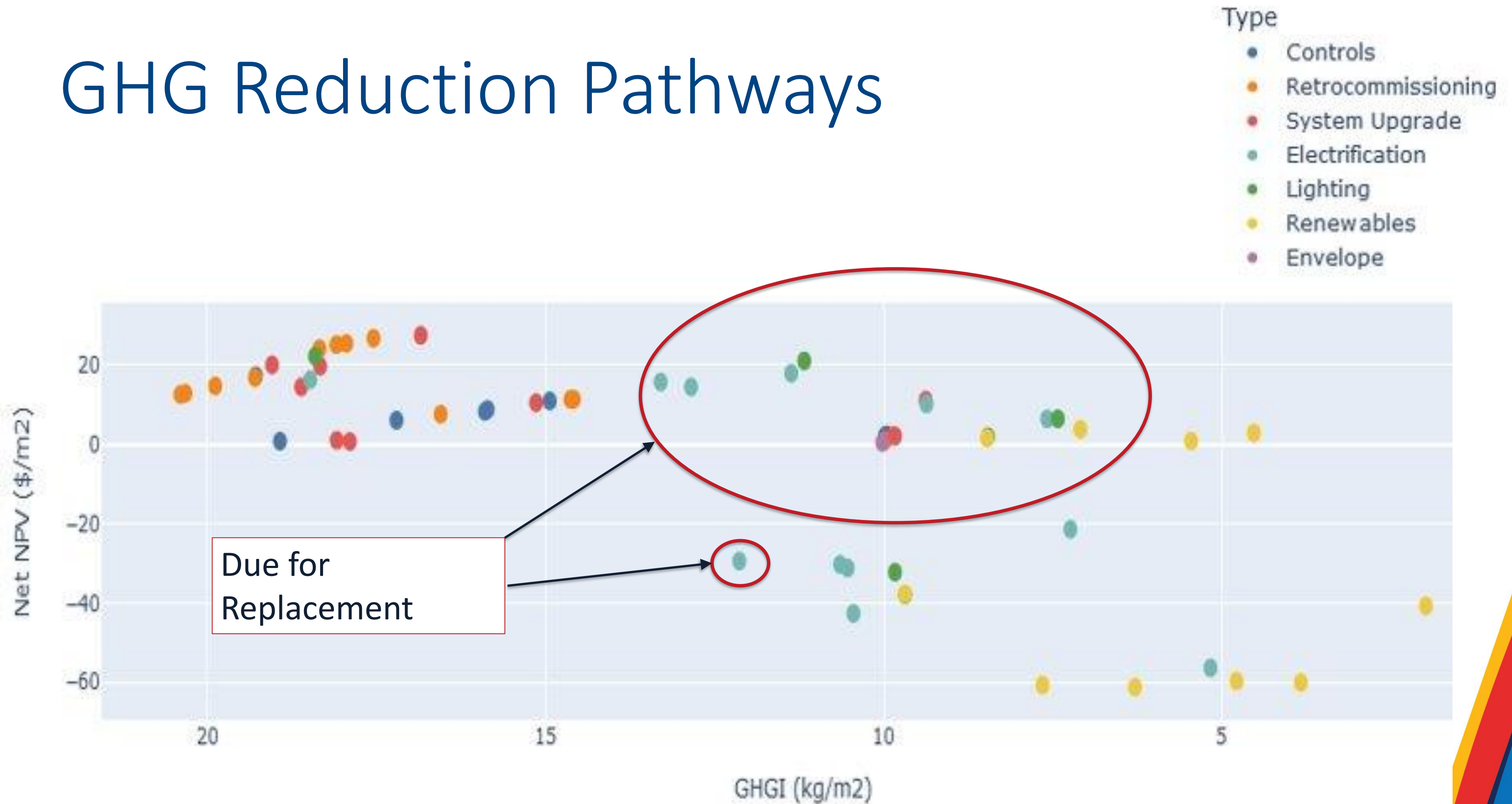
GHG Reduction Pathways



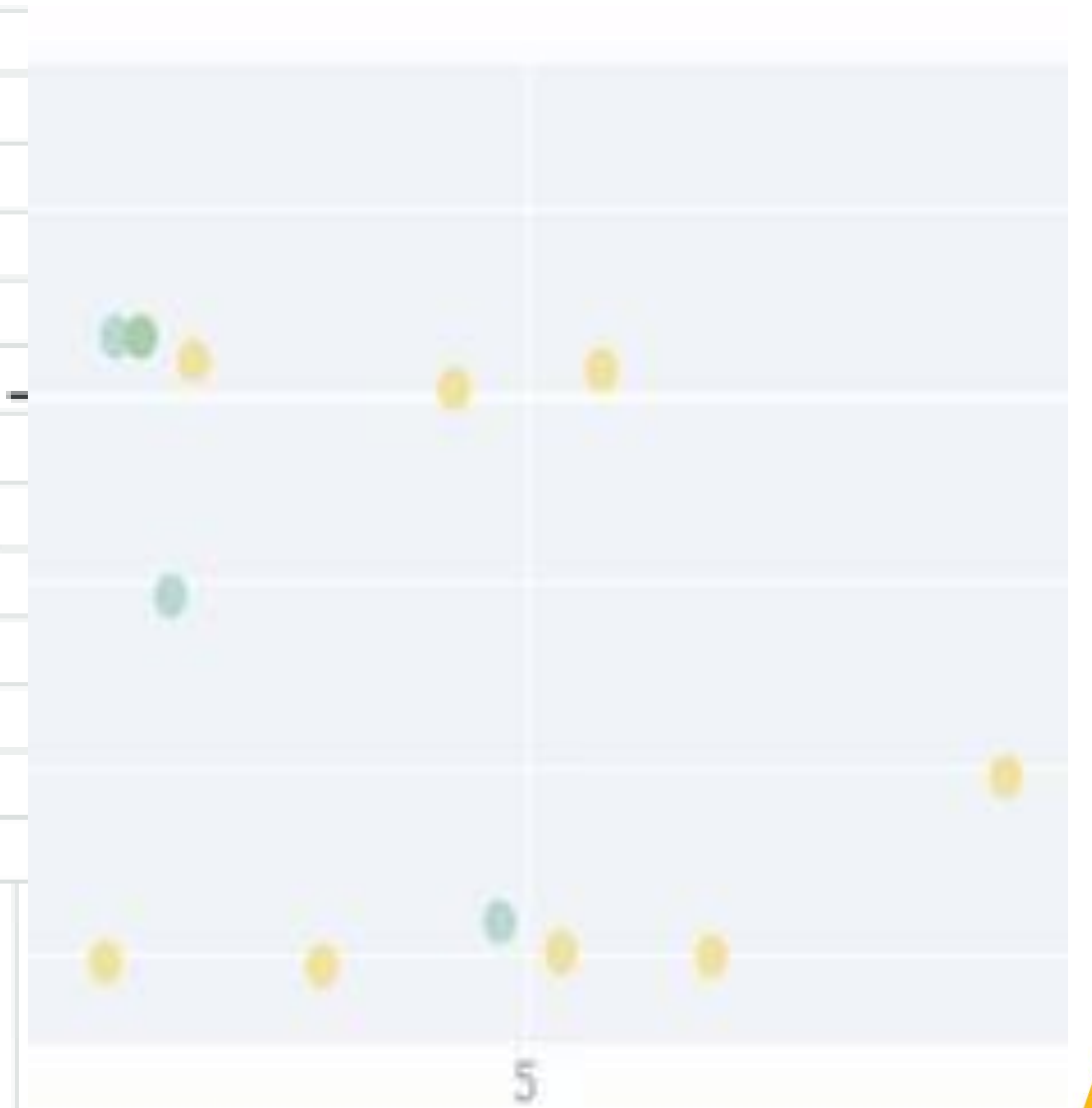
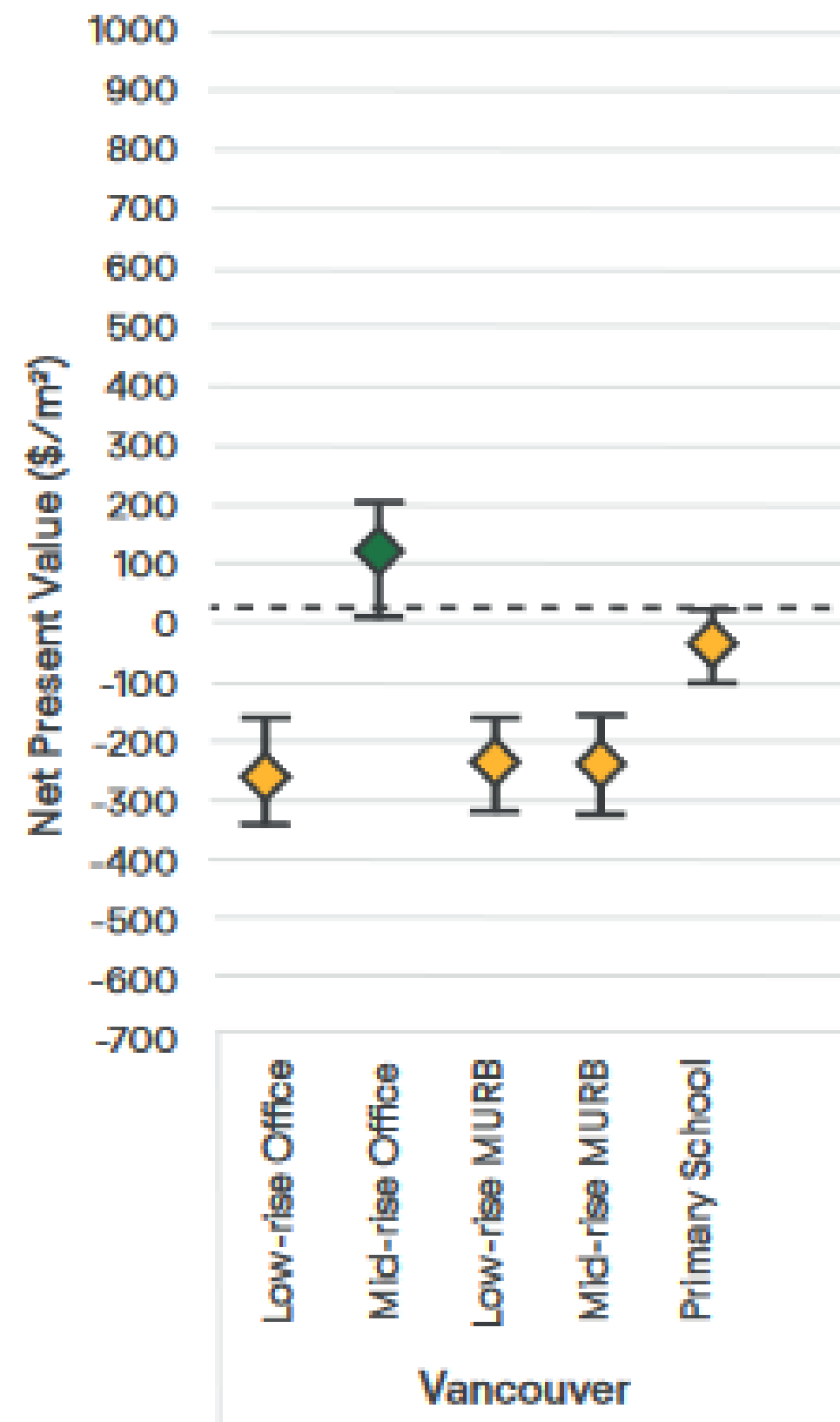
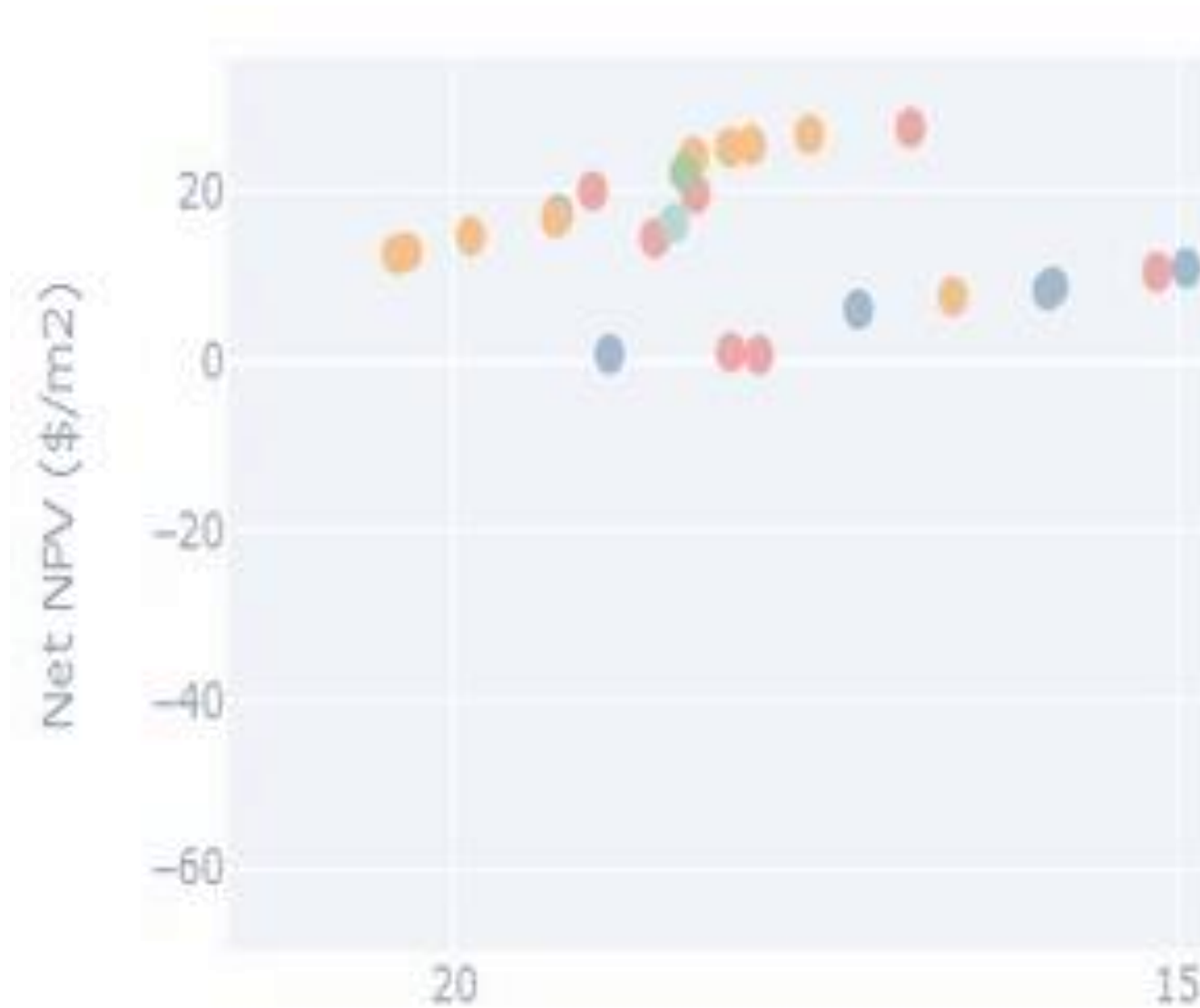
GHG Reduction Pathways



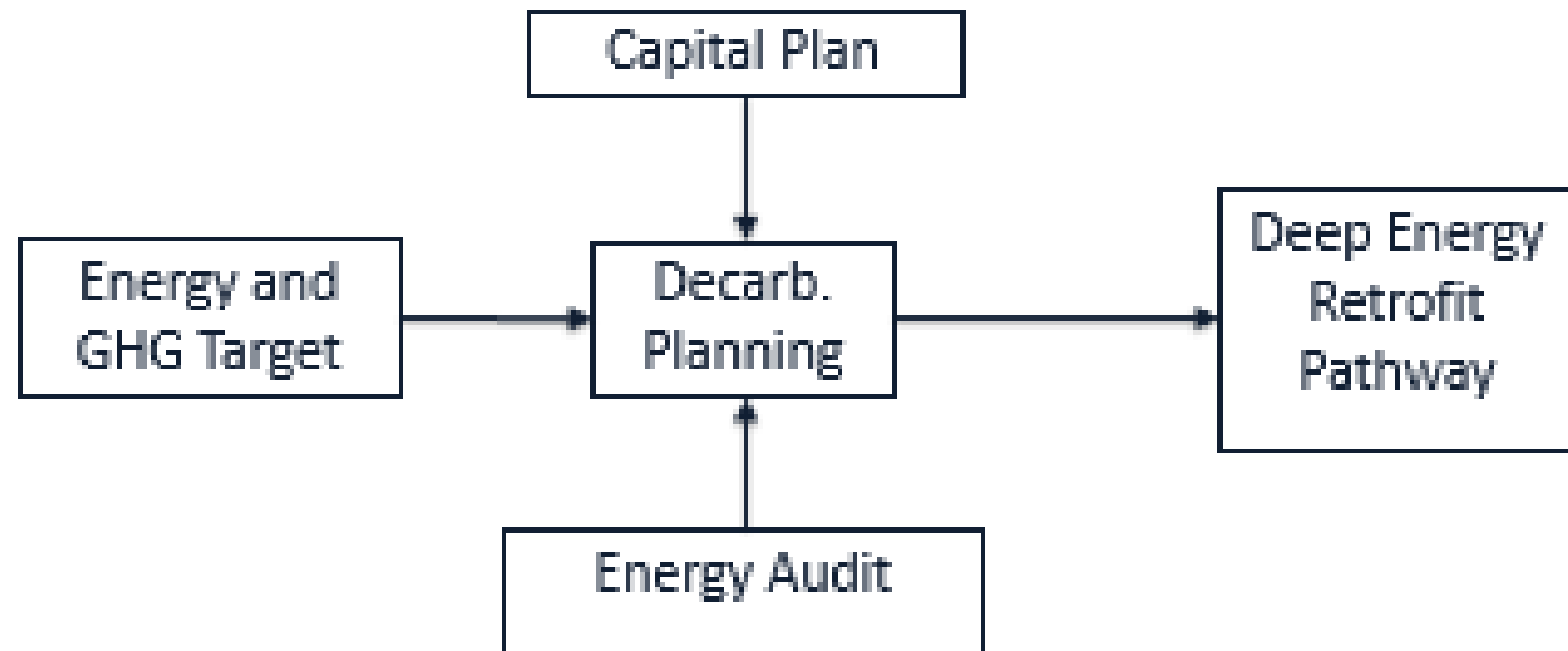
GHG Reduction Pathways




GHG Reduction Pathways



Questions?





A photograph of modern commercial buildings at night. The buildings have large glass windows and are illuminated from within, showing office spaces. The sky is a deep blue. In the foreground, there is a paved plaza with some landscaping, including small trees and bushes. A building under construction is visible in the background.

ZEBx Decarbonization Commercial Buildings

Karen Jawl
Jawl Properties Ltd

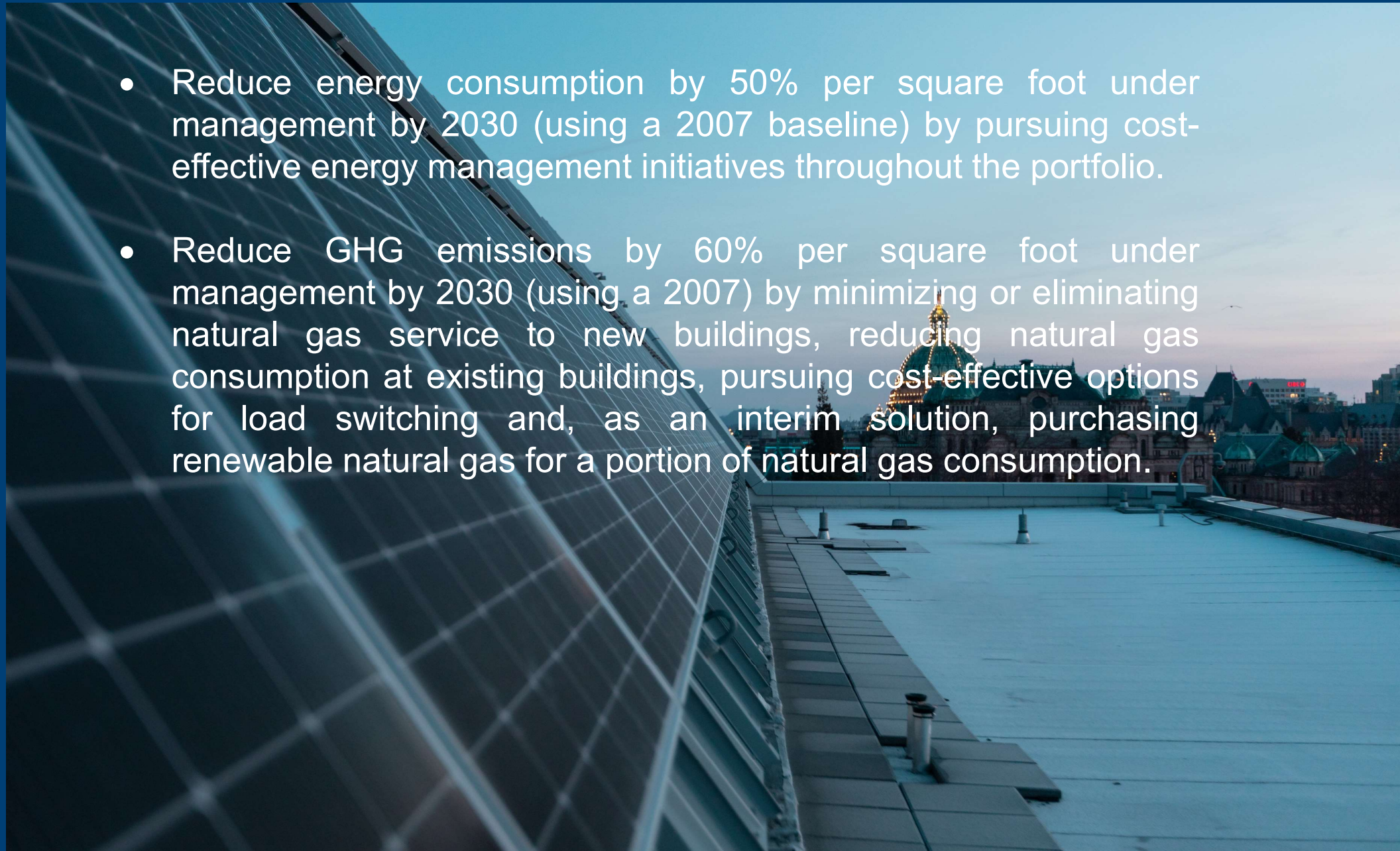
Sustainability

Since 2007, Jawl Properties has been committed to reducing the environmental footprint of its portfolio with a focus on mitigating climate change, conserving natural resources and reducing utility consumption and the associated costs for our tenants.

We believe this is a fundamental part of being a leading landlord but more importantly we believe it is the right thing to do for current generations and the ones that follow.

Sustainability Goals

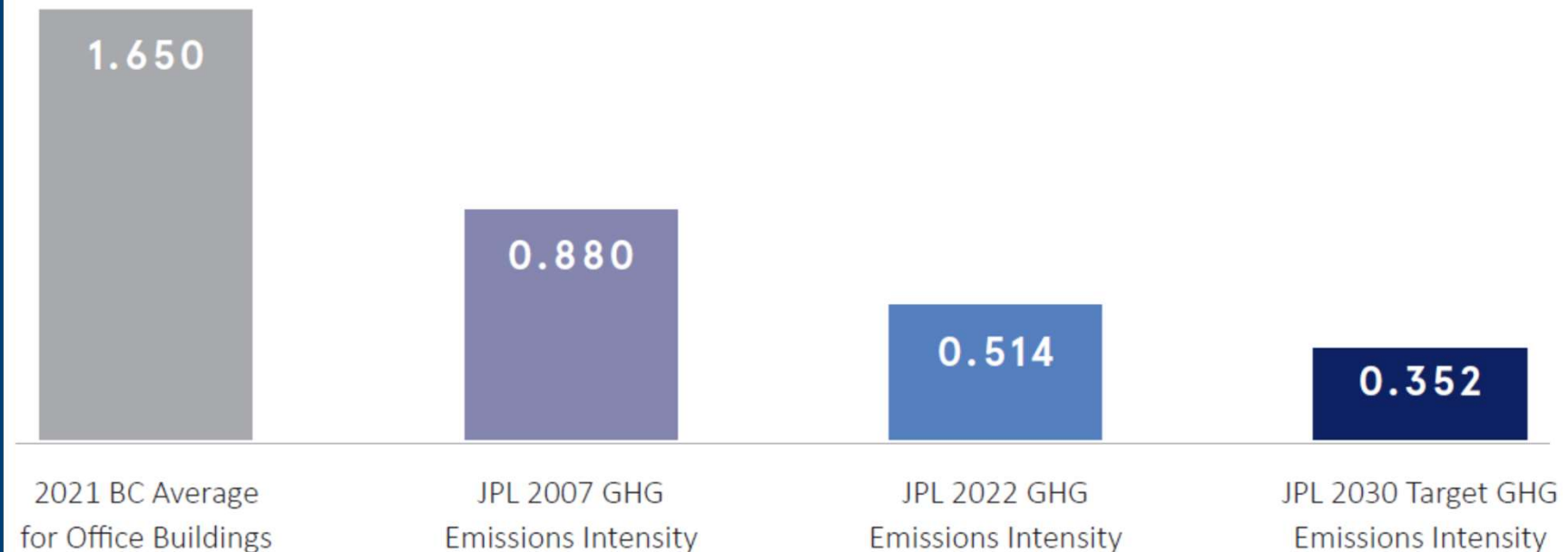
- Reduce energy consumption by 50% per square foot under management by 2030 (using a 2007 baseline) by pursuing cost-effective energy management initiatives throughout the portfolio.
- Reduce GHG emissions by 60% per square foot under management by 2030 (using a 2007) by minimizing or eliminating natural gas service to new buildings, reducing natural gas consumption at existing buildings, pursuing cost-effective options for load switching and, as an interim solution, purchasing renewable natural gas for a portion of natural gas consumption.



Carbon Footprint

Our biggest priority is reducing our carbon footprint. We initially set a target to reduce GHG emissions per square foot by 40% (compared to 2007 baseline) by 2030. We achieved this target in 2021 and accordingly updated our target to reduce GHG emissions per square foot by 60% (compared to 2007 baseline). We are on track to achieve this objective.

GHG Emissions Intensity per Sq.Ft.



Carbon Reduction Road Map

1. Energy Audits & Equipment Inventories
2. Building Controls
 - 20-25% reduction in energy consumption
 - Payback Period < 5 years
 - ROI 18-20%
3. Proactive Planning for Capital Replacement
 - Where can we reduce, where can we electrify?

Carbon Reduction Road Map

Continued...

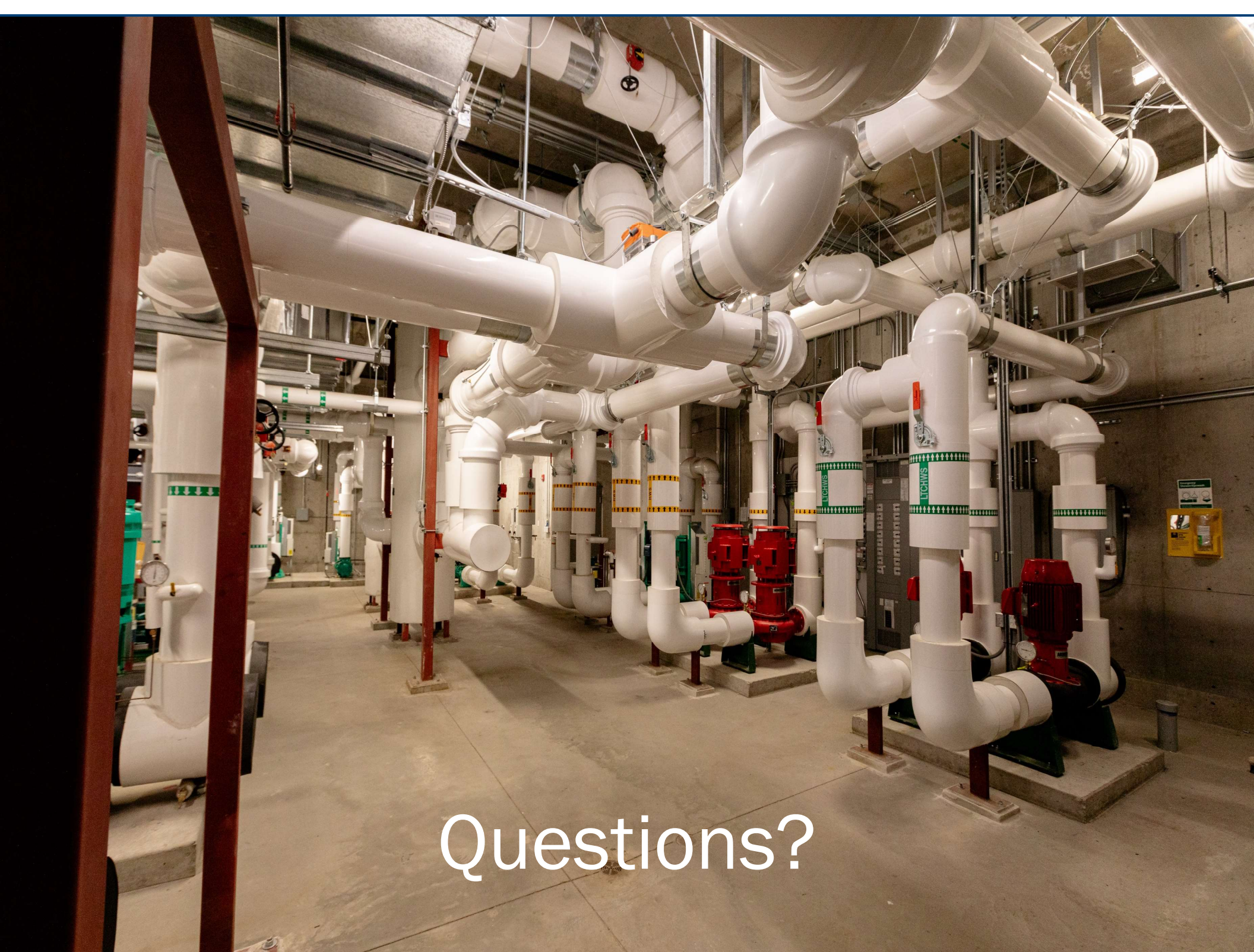
1. Renewable natural gas for a portion of consumption.
2. All new office buildings constructed since 2008 have achieved a minimum of LEED Gold Certification and primarily use clean hydroelectric power supplemented with heat re-capture, geothermal and solar PV.
3. In 2020 Capital Park was ranked 2nd and The Rotunda was ranked 3rd in the Province for GHG Emissions Intensity by Benchmark BC.

Sample Initiatives

- ⦿ Controls programming (reduce waste)
 - Use controls to optimize use of heating
 - Minimize use of back up boilers
- ⦿ Replace gas boilers with electric heat pumps
- ⦿ Envelope upgrades (part of regular capital replacement cycles)
- ⦿ Electrify water heating
 - Converting gas domestic hot water heaters to CO₂ heat pump water heaters.

Decarbonization Challenges

- ⦿ Strict financial argument is trickier
 - But consider the long term
- ⦿ Heat pump technology is evolving
 - Financial incentives are improving
 - Technology is improving
 - Need to be able to deal with more temperature extremes
- ⦿ Needs more advanced planning



Questions?