Climate Heritage NETWORK

Working Group 3

BUILDING REUSE IS CLIMATE ACTION!

Why recycling buildings makes carbon sense, and

rapid carbon reduction to net zero makes the case for building reuse.

October 8, 2021

DISMANTLING BARRIERS, SCALING UP CULTURE-BASED CLIMATE ACTION

Building Reuse is Climate Action!

FRIDAY, 8 OCTOBER | 3:00 PM BST

In the run-up to COP26, Join our Climate Heritage Mobilisation @ Climate Fridays Webinar Series!

FEATURED SPEAKERS:

Mark Thompson Brandt
MTBA Associates

Lori Ferris
Goody Clancy

Nathan Lott
Preservation Resource Center of New Orleans

Stephanie Phillips
City of San Antonio Office of Historic Preservation

Shanon Miller
City of San Antonio

THIS WEBINAR ORGANISED BY CLIMATE HERITAGE NETWORK WORKING GROUP WORKING GROUP 3.

Historic England

Climate Heritage NETWORK

#ClimateHeritage

Climate Heritage NETWORK

INTRODUCTION - SPEAKERS

- **Mark Thompson Brandt**, OAA, RAIC, FAPT-RP, LEED AP, CAHP,
  Principal, Sr. Conservation Architect & Urbanist, **MTBA Associates Architects, Ottawa**
- **Lori Ferriss**, AIA, PE, LEED AP BD+C,
  Director of Sustainability and Climate Action, **Goody Clancy, Boston**
- **Stephanie Phillips**
  Senior Specialist, City of **San Antonio Office of Historic Preservation**
- **Nathan Lott**
  Head of public policy research and advocacy, **Preservation Resource Center of New Orleans**

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AGENDA: Building Reuse is Climate Action

LEVERAGING TOOLS & DATA

LEARNING FROM CASE STUDIES

DEVELOPING POLICY CONTEXT

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INTRODUCTION: CONTEXT

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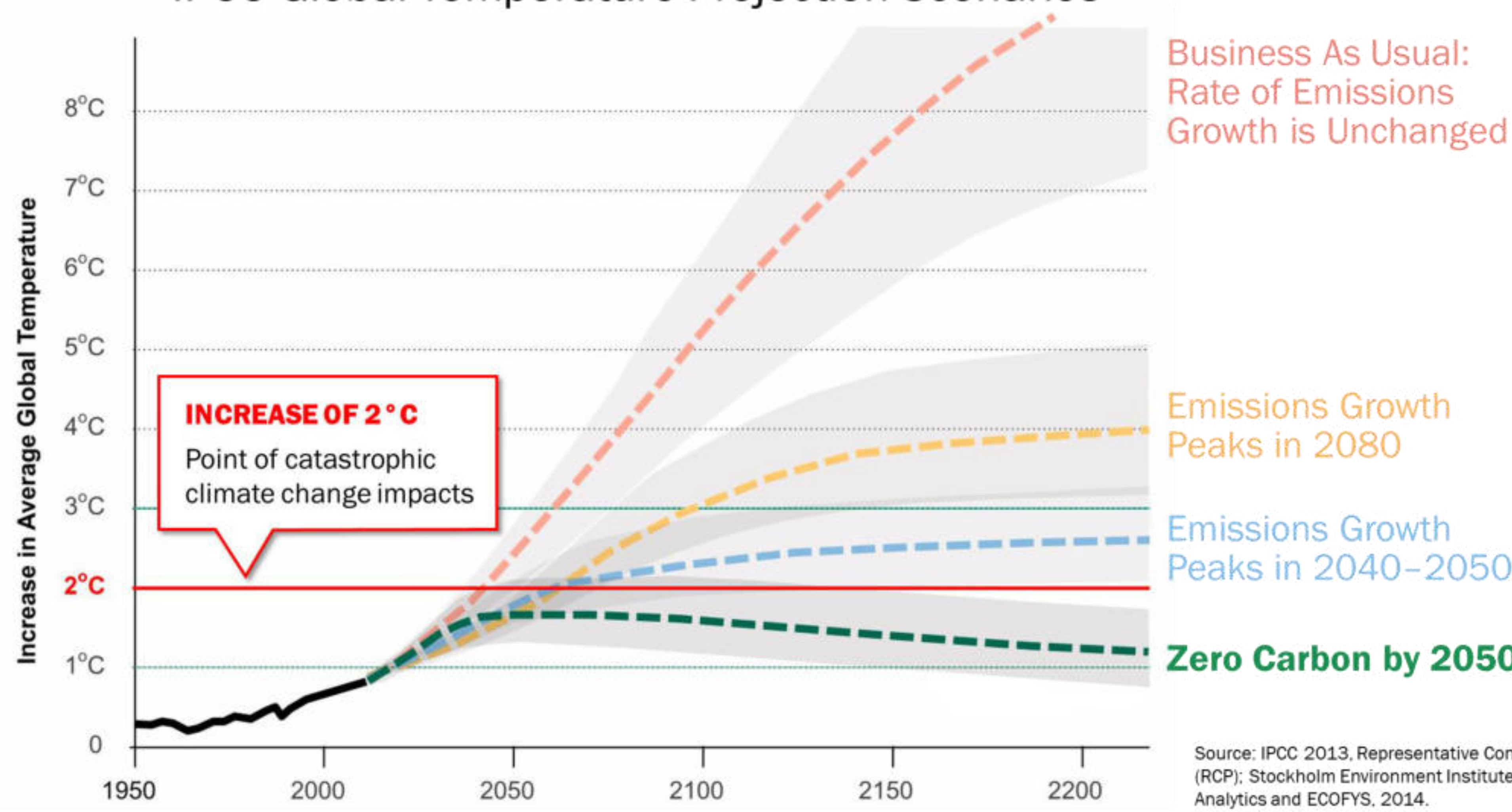
IPCC Global Temperature Projection Scenarios



Source: IPCC 2013, Representative Concentration Pathways (RCP); Stockholm Environment Institute (SEI), 2013; Climate Analytics and ECOFYS, 2014.

Note: Emissions peaks are for fossil fuel CO2-only emissions.

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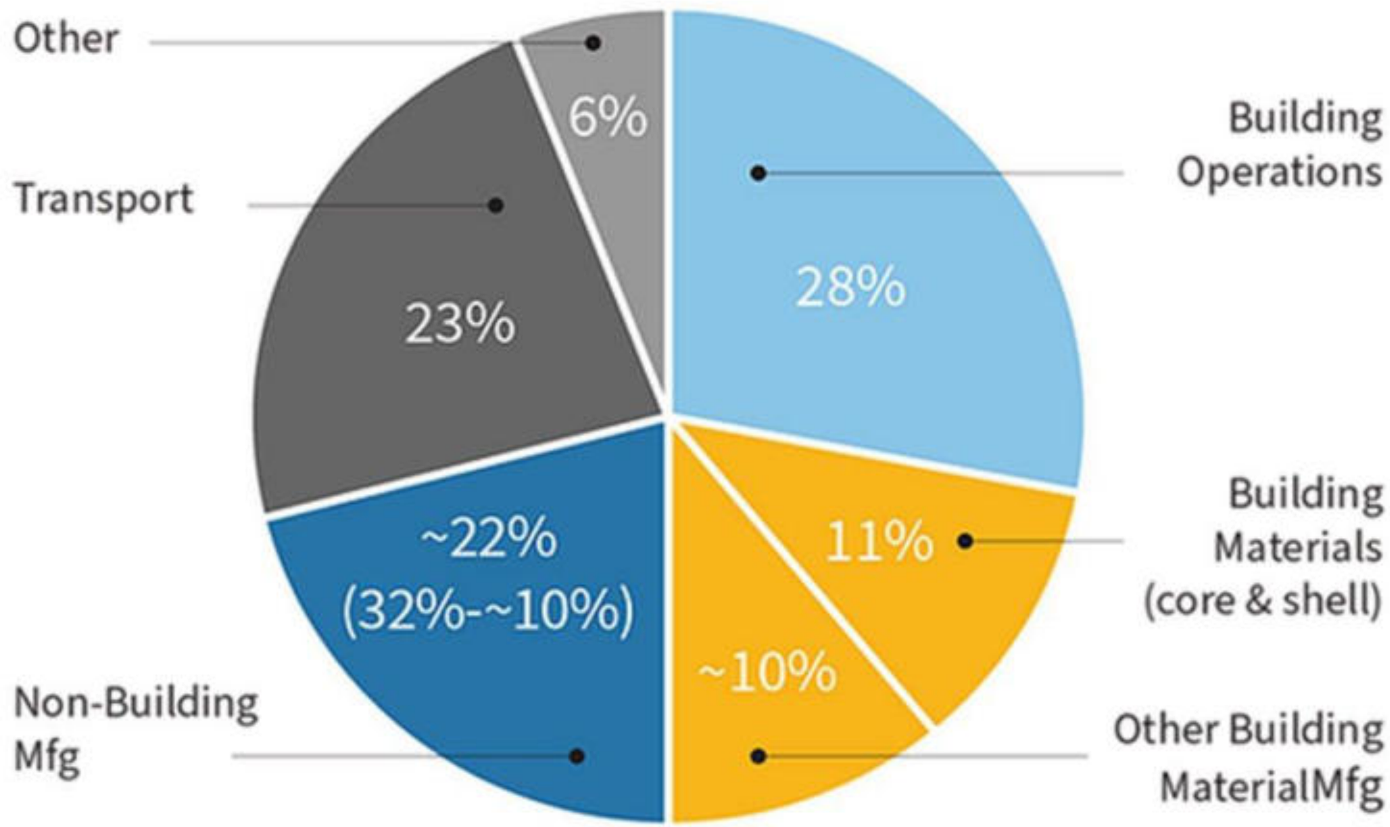

Adapted from 2019 Global Status Report, Global Alliance for Building and Construction (GABC) and Architecture 2030.

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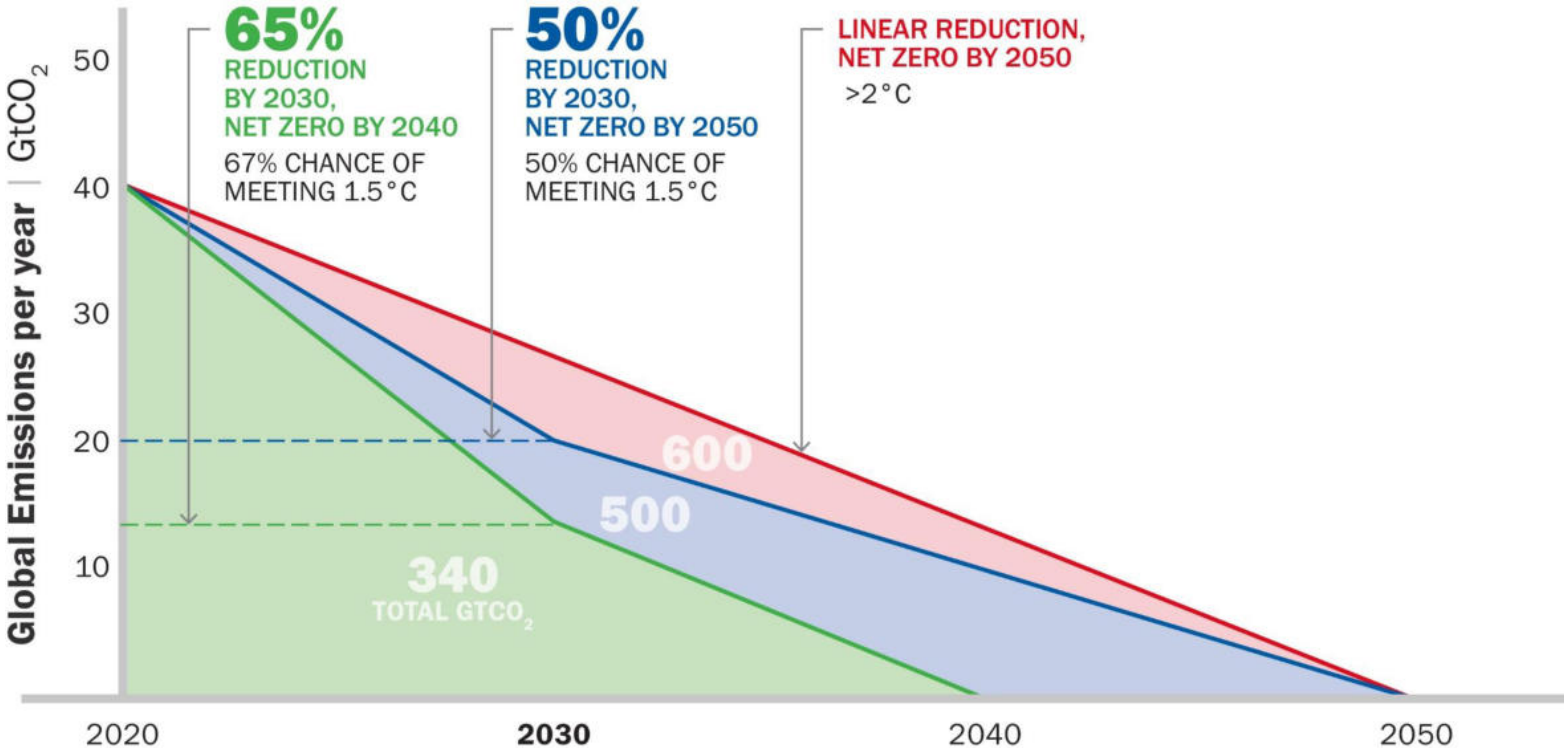
NETWORK

Reusing and retrofitting an existing building can result in a 70%–85% reduction in embodied carbon emissions compared to new construction.

— ZERO NET CARBON COLLABORATION FOR EXISTING & HISTORIC BUILDINGS, 2019

Building Reuse is Climate Action:
Tools and Data

The Time Value of Carbon



© GOODY CLANCY
DATA SOURCE: ARCHITECTURE 2030

Loss of Cultural Heritage

The First Official Climate Refugees in the U.S. Race Against Time

A Native American tribe struggles to hold on to their culture in a Louisiana bayou while their land slips into the Gulf of Mexico.

source: Isle de Jean Charles Resettlement Program

The Reuse Imperative

We have a lot of buildings:
~ 235 billion m^2

- they are not very efficient
- we can't afford to replace them all
- we can't afford to leave them alone

We build a lot of buildings:
~ 6 billion m^2/yr

- more efficient to operate, but not to build
- we can't afford to keep building them all

Definitions: Carbon

Carbon ≈ CO_2e = Greenhouse Gases ≈ CO_2

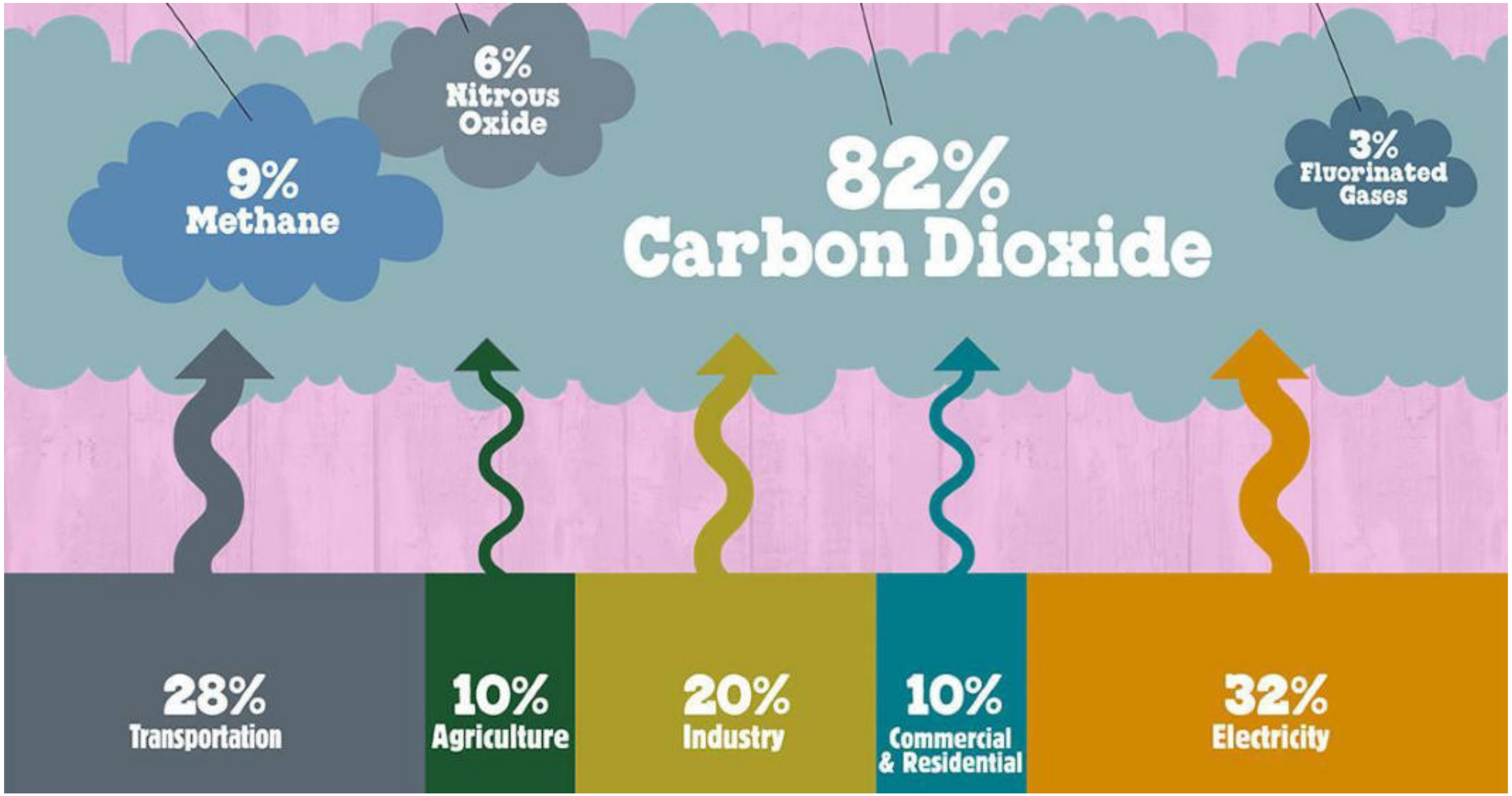


Image credit: Ben & Jerry's

Definitions: Embodied Carbon

The **carbon footprint of a material,** greenhouse gas emissions from extraction, processing, transportation, fabrication, and assembly and end-of life of a material or product.

Image credit: Skanska

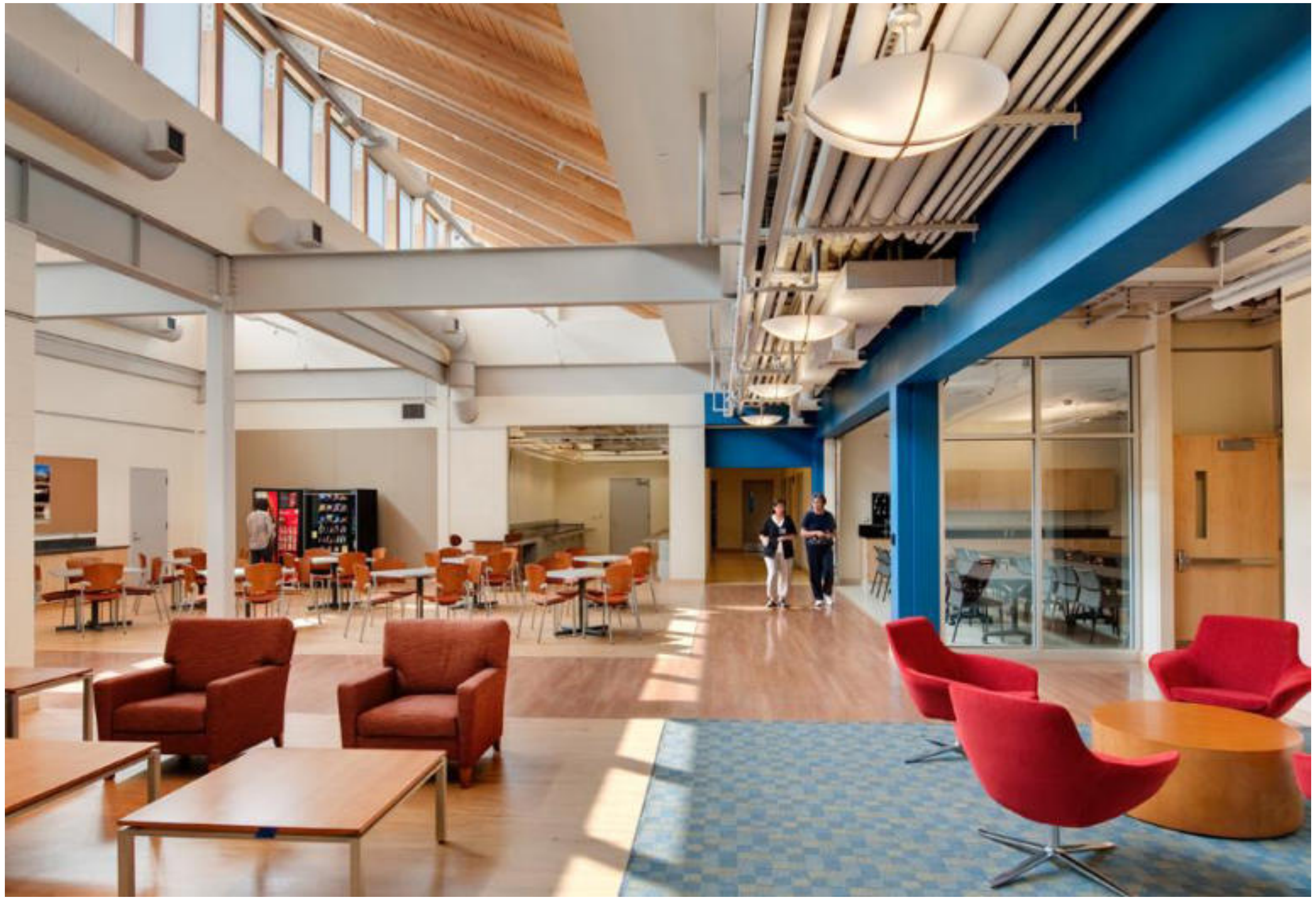
Definitions: Operational Carbon

The greenhouse gas emissions resulting from energy used to heat, cool, light, power, and otherwise use a building.

Image credit: Skanska

Definitions: Avoided Impacts

Environmental impacts avoided by making one choice over another (e.g. carbon emissions savings resulting from rehabilitation and upgrade of an existing building compared to demolition and construction of a new structure).



Definitions: Life Cycle Assessment

An analysis technique to assess environmental impacts associated with all the stages of a product's life, from raw material extraction through materials processing, manufacture, distribution, use, and end of life

Available Tools and Data – Life Cycle Assessment

tally
One Click LCA
Athena Sustainable Materials Institute
EC3
Edge
Excellence In Design For Greater Efficiencies

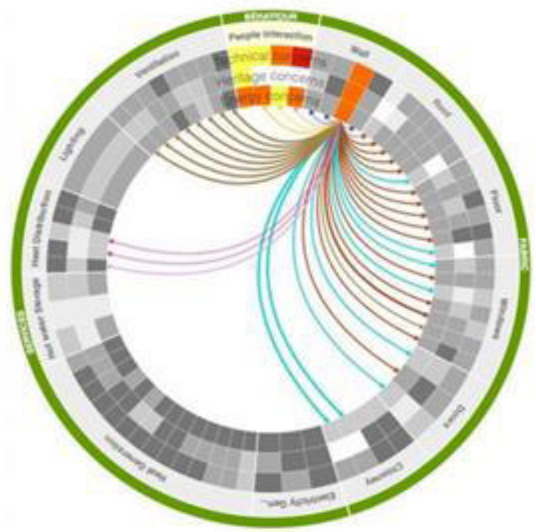
Software Tools

sphera
GaBi Database
FEDERAL LCA COMMONS
EPD
ENVIRONMENTAL PRODUCT DECLARATION
circular ecology
ecoinvent

Data Sources

Available Tools and Data – Tools for Heritage Structures

STBA
SUSTAINABLE TRADITIONAL BUILDINGS ALLIANCE



HEET Worksheet

OXFORD CITY COUNCIL

STICH

C.A.R.E.

Carbon Avoided : Retrofit Estimator

Compares:

- Embodied carbon
- Operational carbon
- Avoided carbon

Existing, Reuse & New Scenarios

- Existing Baseline Building
- Reuse & Retrofit Existing
- Replace Existing w/New

Development team:

Larry Strain, Siegel & Strain Architects, Erin McDade Architecture 2030, Lori Ferriss, Goody Clancy

C.A.R.E.

Carbon Avoided : Retrofit Estimator

What it Does

Evaluates total carbon emissions of existing building reuse compared to new construction

Who it's For

- Public officials
- Planners
- Preservation officers
- Building owners
- Real estate developers
- Building industry professionals

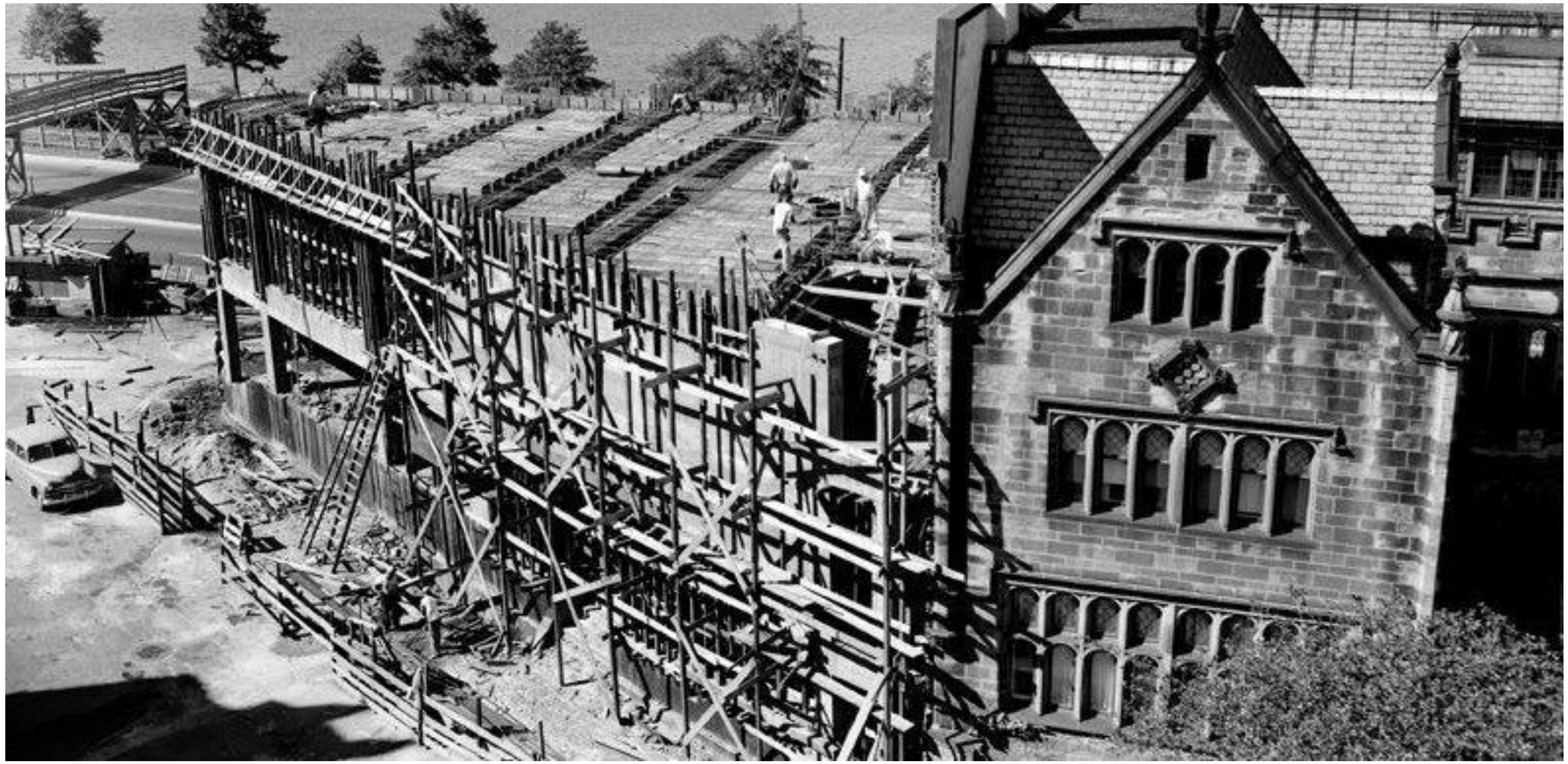
C.A.R.E.

Carbon Avoided : Retrofit Estimator

User Interface:

- Excel dashboard with drop down menus
- A menu of renovation and upgrade options
- Four new building options
- Options for operational efficiency
- Embodied carbon modifiers

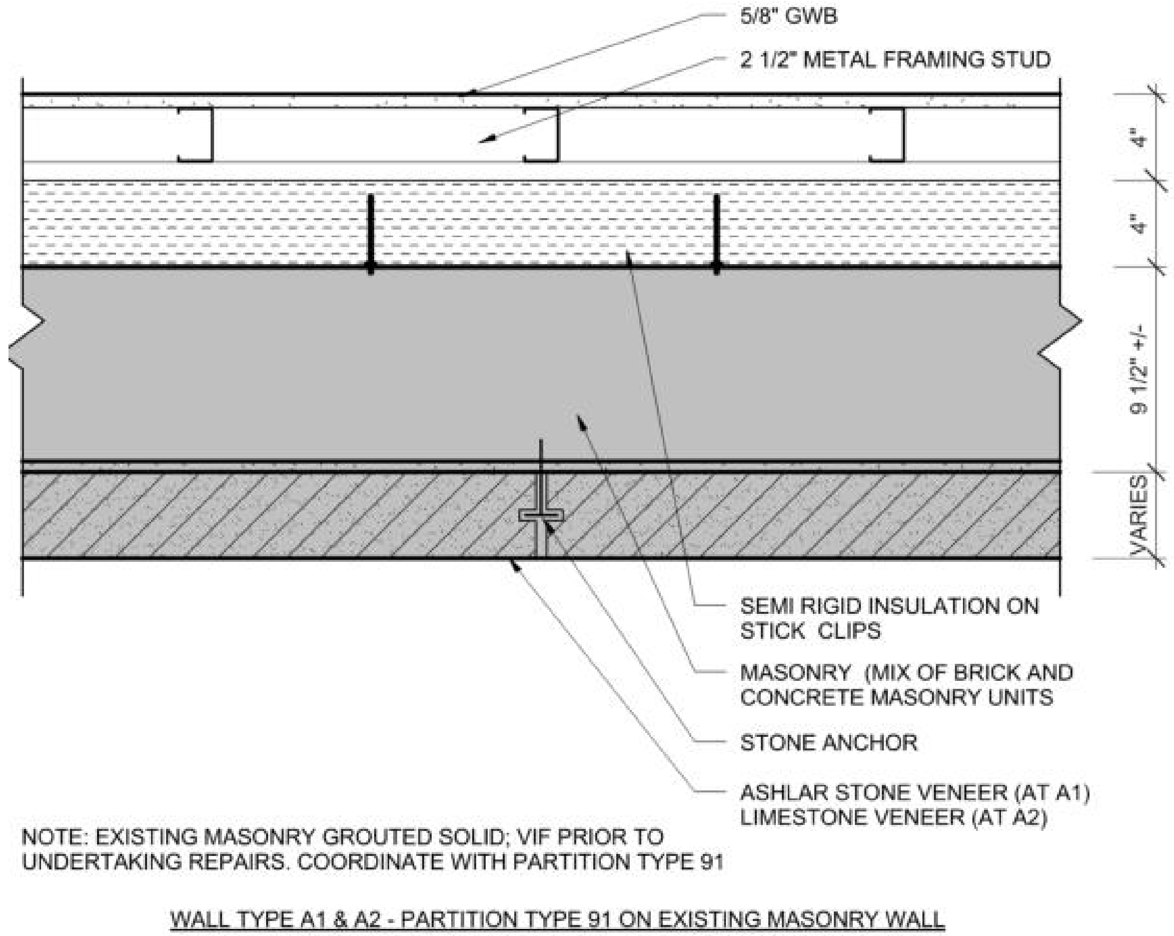

BOSTON UNIVERSITY



C.A.R.E.

Carbon Avoided : Retrofit Estimator

- Scope of renovation included:
  - *New windows with high-performance glazing*
  - *Insulating interior face of exterior walls*
  - *Roof insulation*
  - *New VRF units and high-efficiency condensing boilers*
- Preserved 86% of structure and enclosure
- Reduced operational energy use by 70%



C.A.R.E.

Carbon Avoided : Retrofit Estimator

BUILDING SITE & PROJECT USE TYPE

Click in the white cells to select from a dropdown menu or enter information about your building site and planned project use type.

State	Massachusetts
Zip Code	2115
Primary Use Type	Education
Existing Building Floor Area	18,000 sf
Operational Timeline	15 years

key climate dates: 2030 & 2040

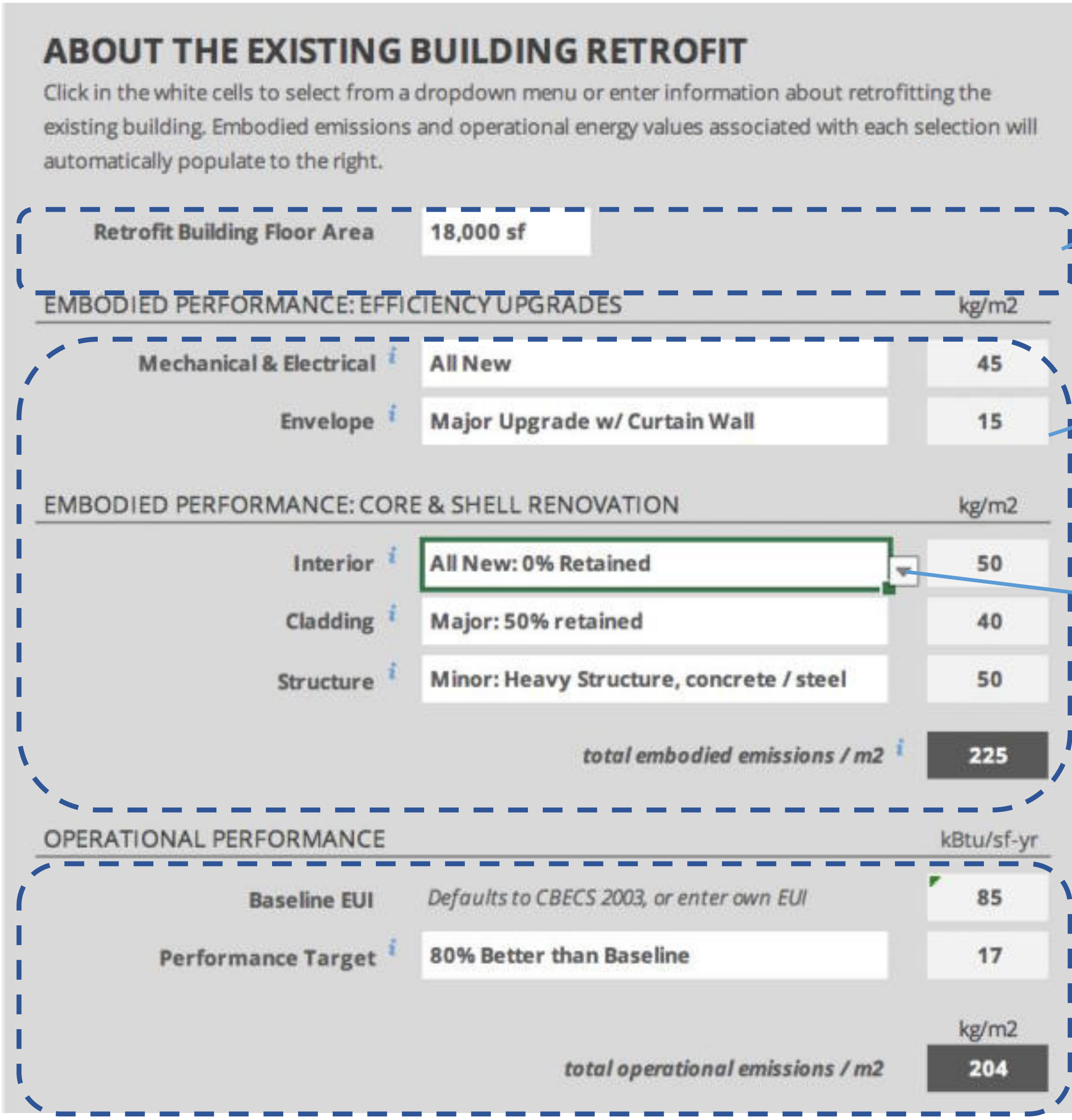
Climate Zone Mapping (State, Zip Code)

Database Use Type (Primary Use Type)

Total Carbon Emissions (Existing Building Floor Area, Operational Timeline)

C.A.R.E.

Carbon Avoided : Retrofit Estimator



ABOUT THE EXISTING BUILDING RETROFIT

Click in the white cells to select from a dropdown menu or enter information about retrofitting the existing building. Embodied emissions and operational energy values associated with each selection will automatically populate to the right.

Retrofit Building Floor Area	18,000 sf	
EMBODIED PERFORMANCE: EFFICIENCY UPGRADES		kg/m2
Mechanical & Electrical	All New	45
Envelope	Major Upgrade w/ Curtain Wall	15
EMBODIED PERFORMANCE: CORE & SHELL RENOVATION		kg/m2
Interior	All New: 0% Retained	50
Cladding	Major: 50% retained	40
Structure	Minor: Heavy Structure, concrete / steel	50
	total embodied emissions / m2	225
OPERATIONAL PERFORMANCE		kBtu/sf-yr
Baseline EUI	*Defaults to CBECS 2003, or enter own EUI*	85
Performance Target	80% Better than Baseline	17
		kg/m2
	total operational emissions / m2	204

Size of Renovated Building for Total Emissions

Embodied Carbon of Renovation

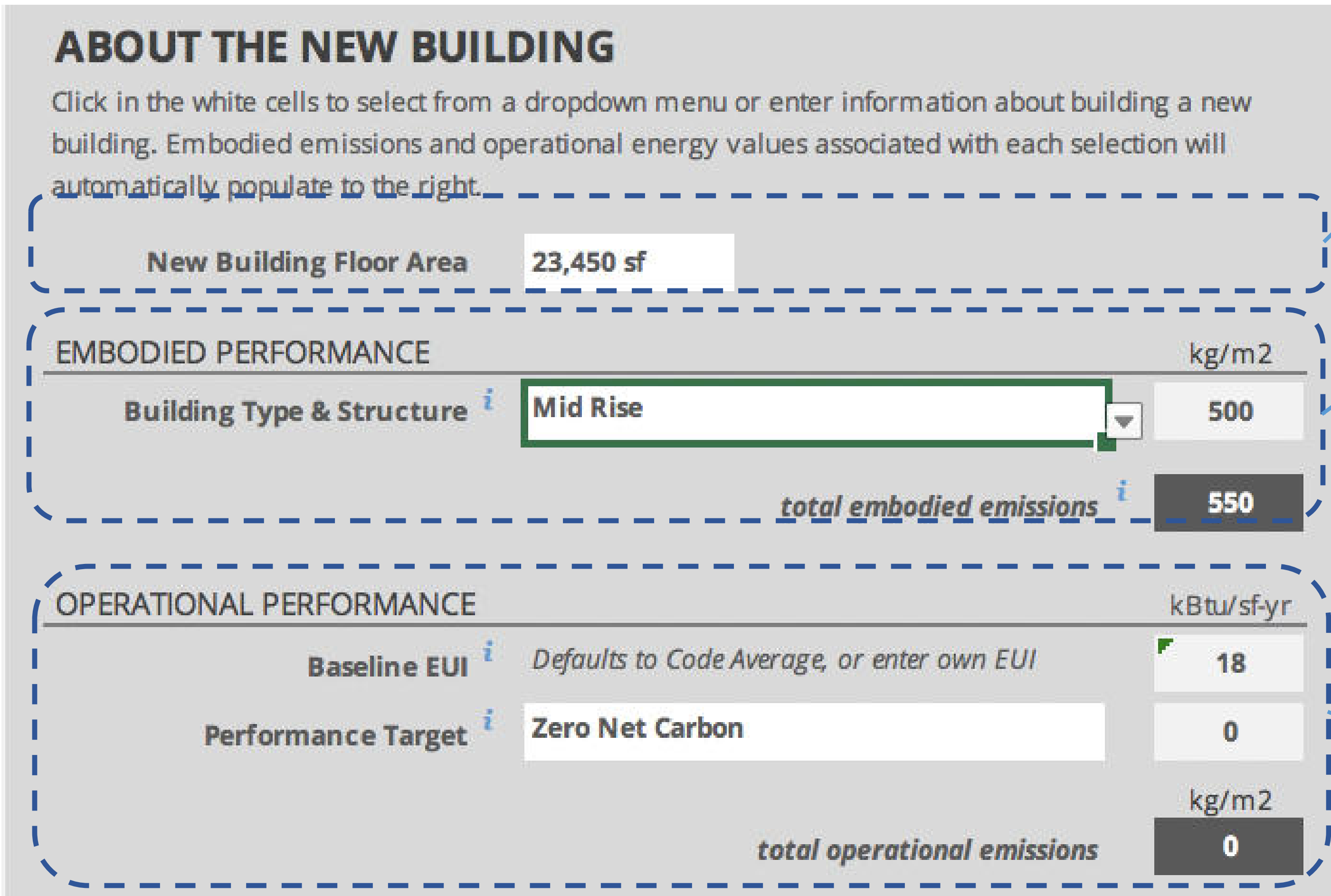
No Upgrade
Minor: Finishes Only
Minor: 75% Retained
Major: 50% Retained
All New: 0% Retained

Drop down menu

Operational Energy of Renovation to Convert to Operational Emissions

C.A.R.E.

Carbon Avoided : Retrofit Estimator



Size of New Building for Total Emissions

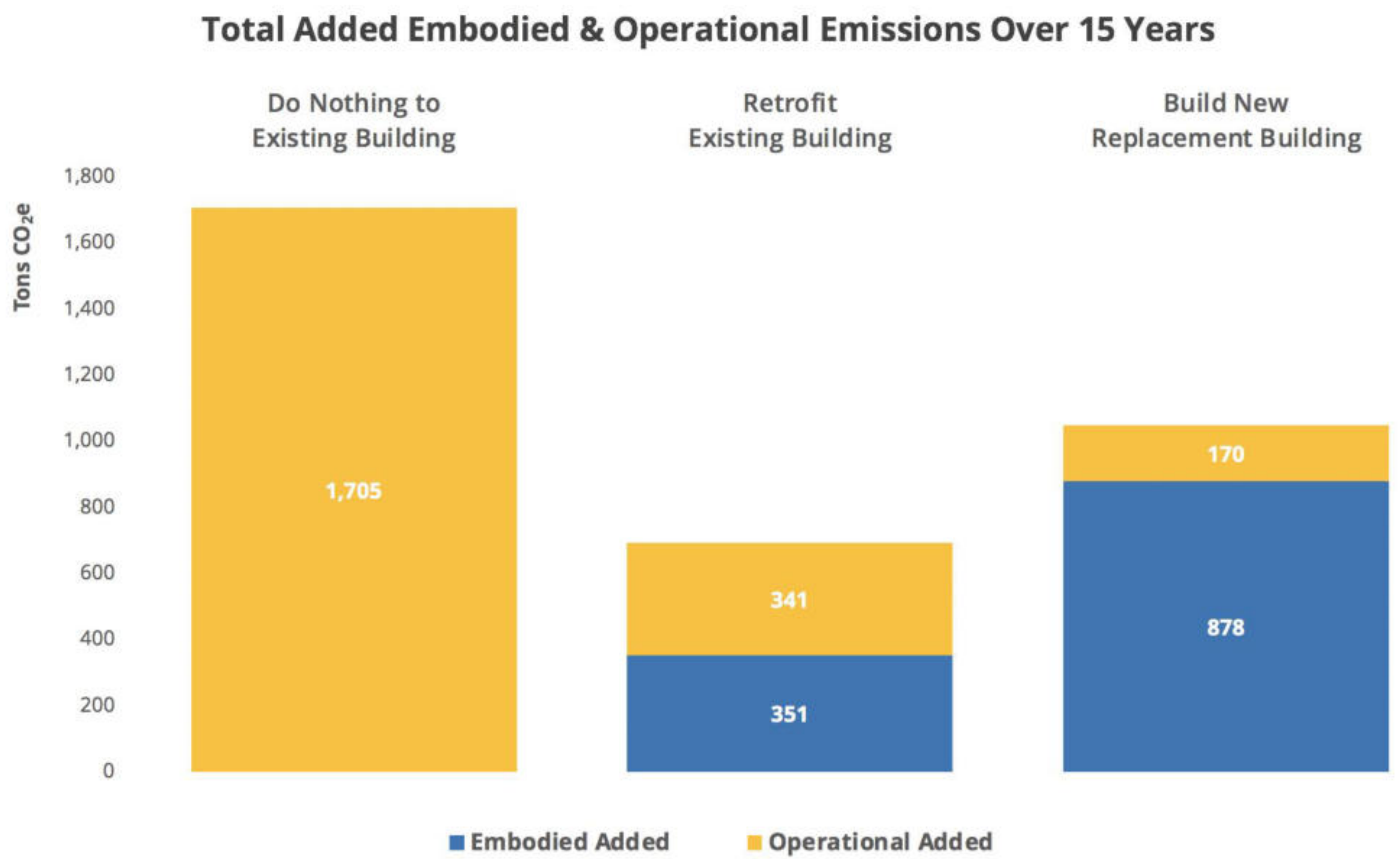
Embodied Carbon of New Building

Drop down menu

Operational Energy of New Building to Convert to Operational Emissions

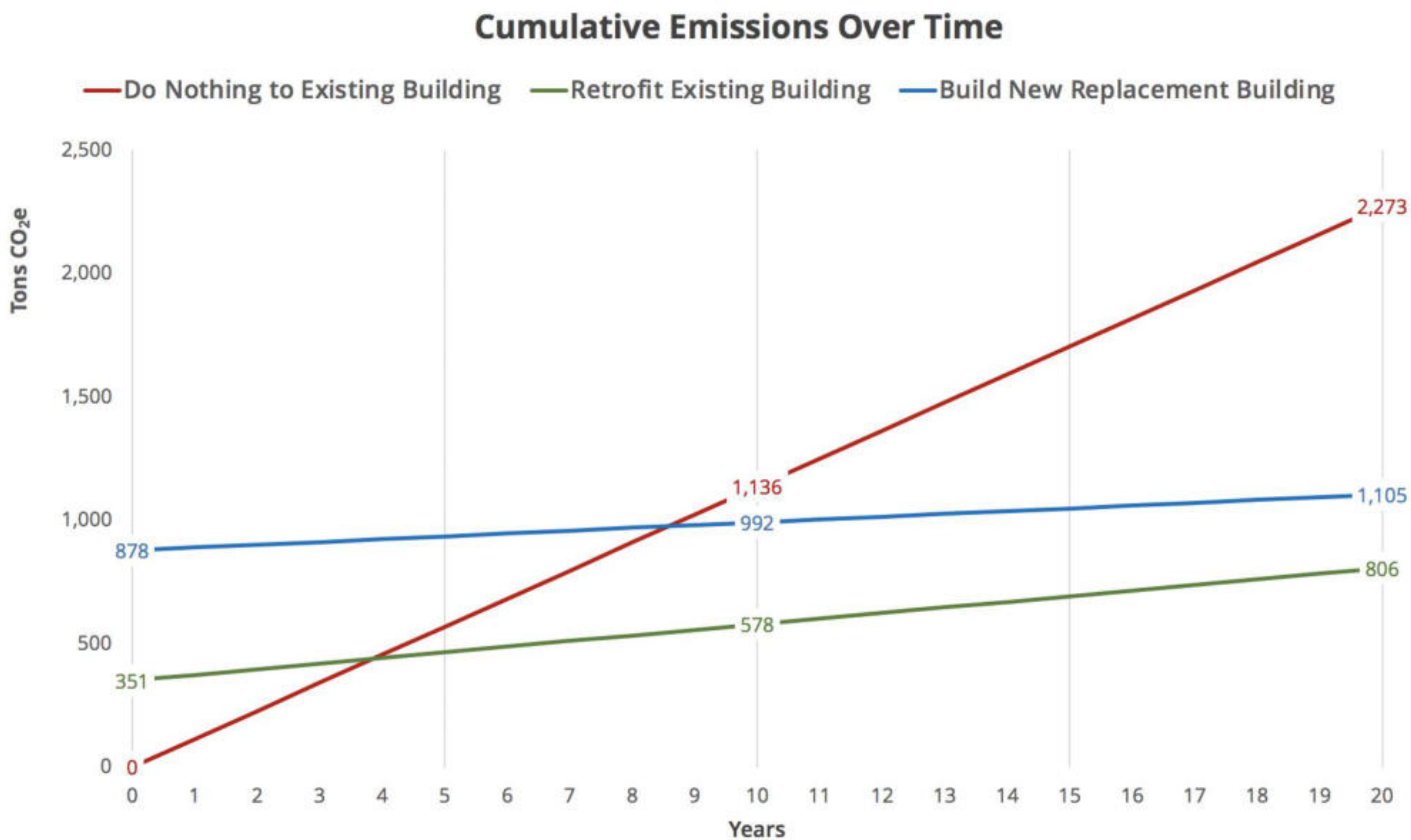
C.A.R.E.

Carbon Avoided : Retrofit Estimator



C.A.R.E.

Carbon Avoided : Retrofit Estimator



Next Steps

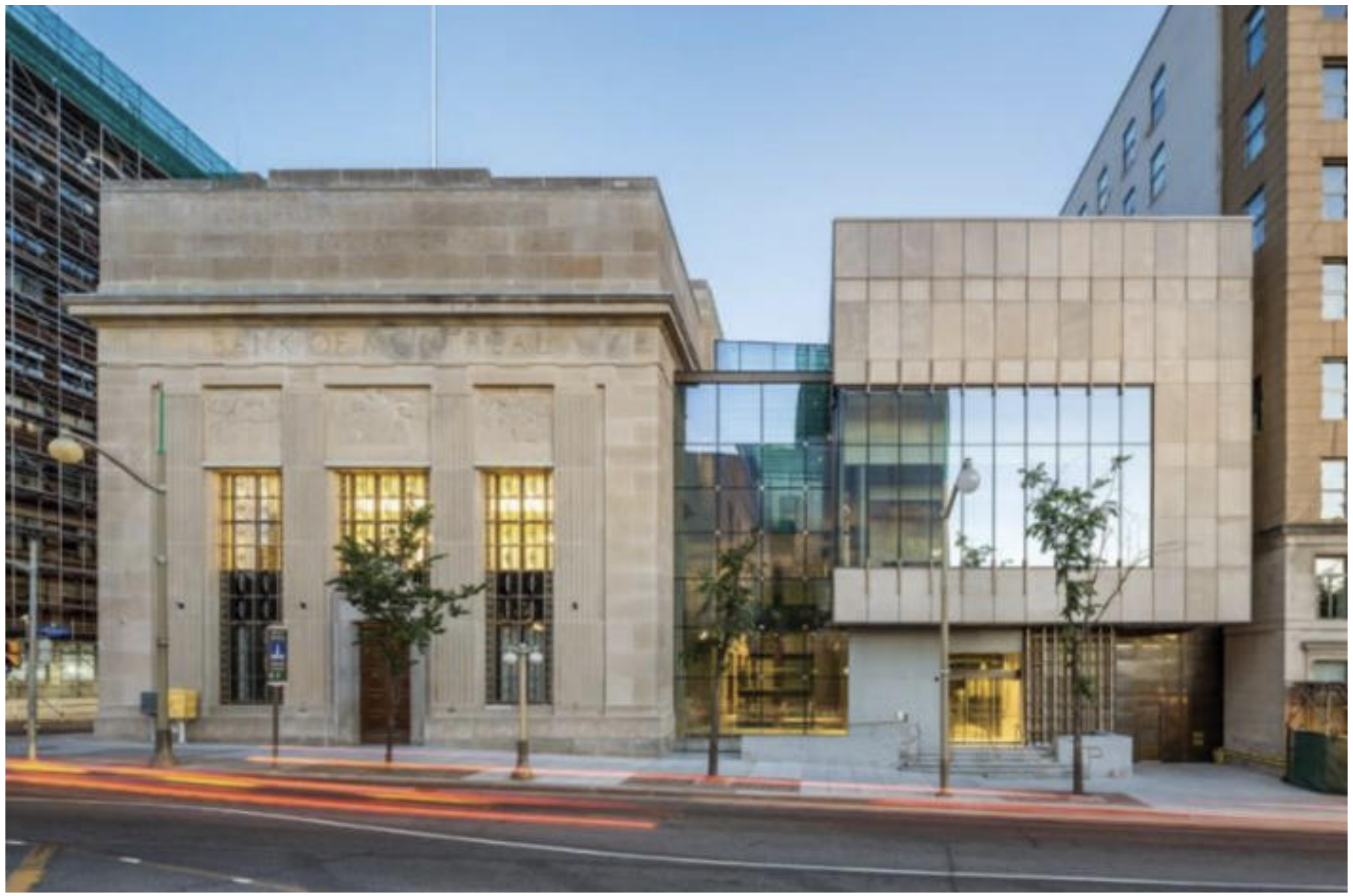
- Web application development
- Expansion to additional geographic regions
  - Energy use data
  - Typical retrofit actions
  - Building typologies
- Ongoing data collection

Visit **znccollaboration.org** to sign up for updates!

Building Reuse is Climate Action:
Case Studies

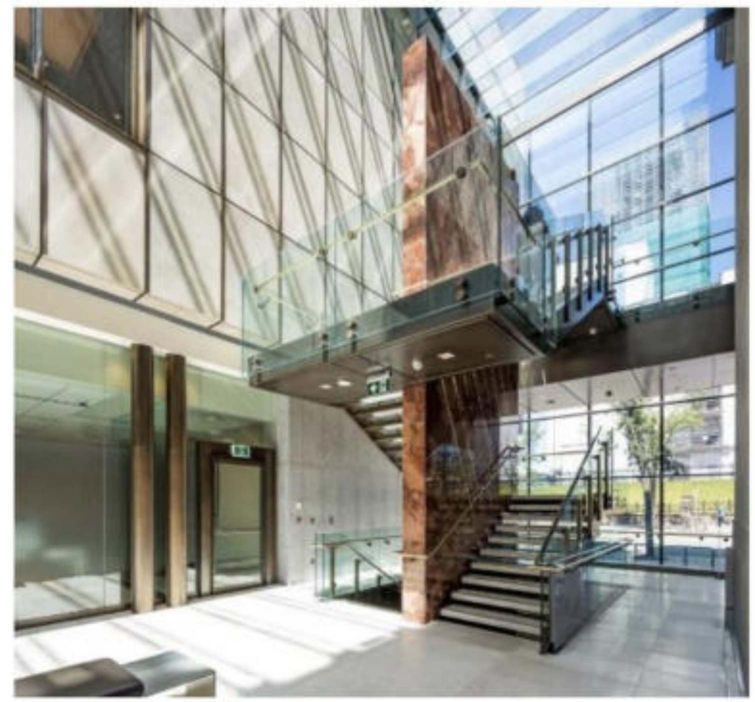
Case Study: Sir John A. MacDonald Building

Ottawa, Ontario, Canada



Inherently Sustainable Features:

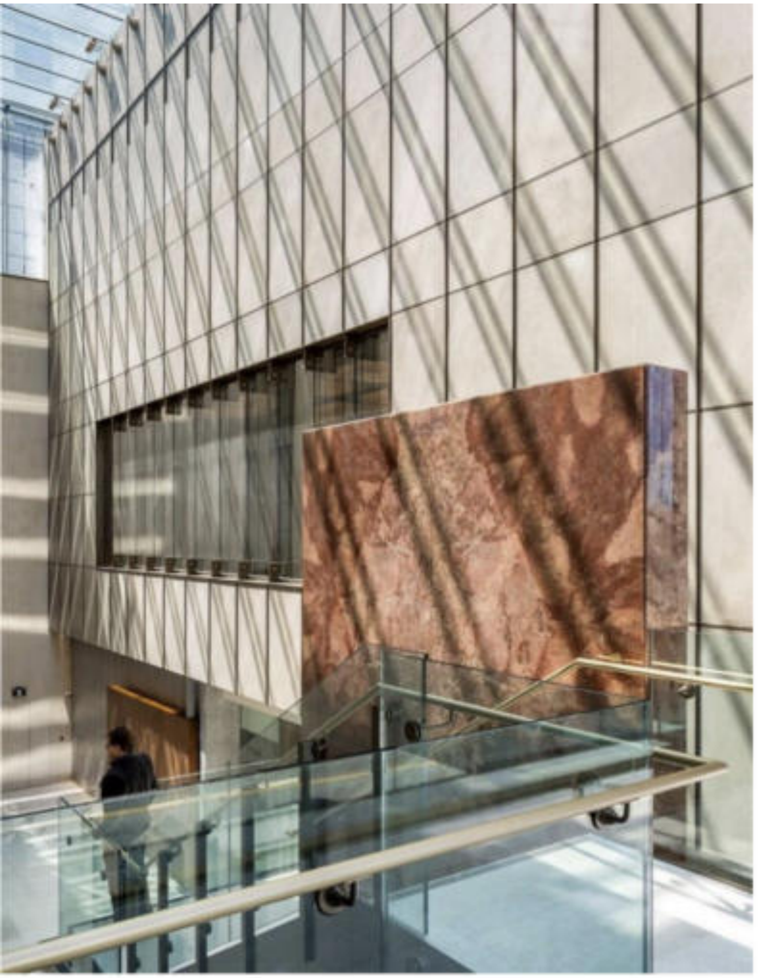
- Thermal mass from triple wythe masonry walls
- Durable, robust, reusable materials
- Daylighting and passive resilience
- Embodied energy of building elements
- Prime downtown location, close to public transit

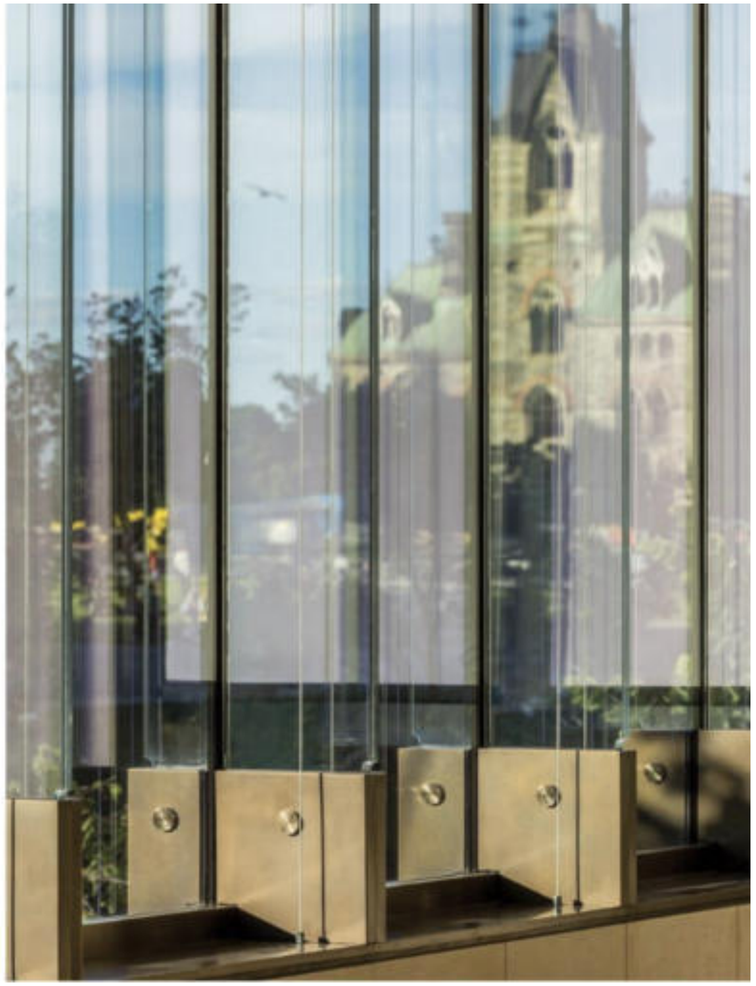


Images: ZNCC Case Studies: Sir John A. MacDonald Building, Ottawa, NORR + MTBA Report

Case Study: Sir John A. MacDonald Building

Ottawa, Ontario, Canada





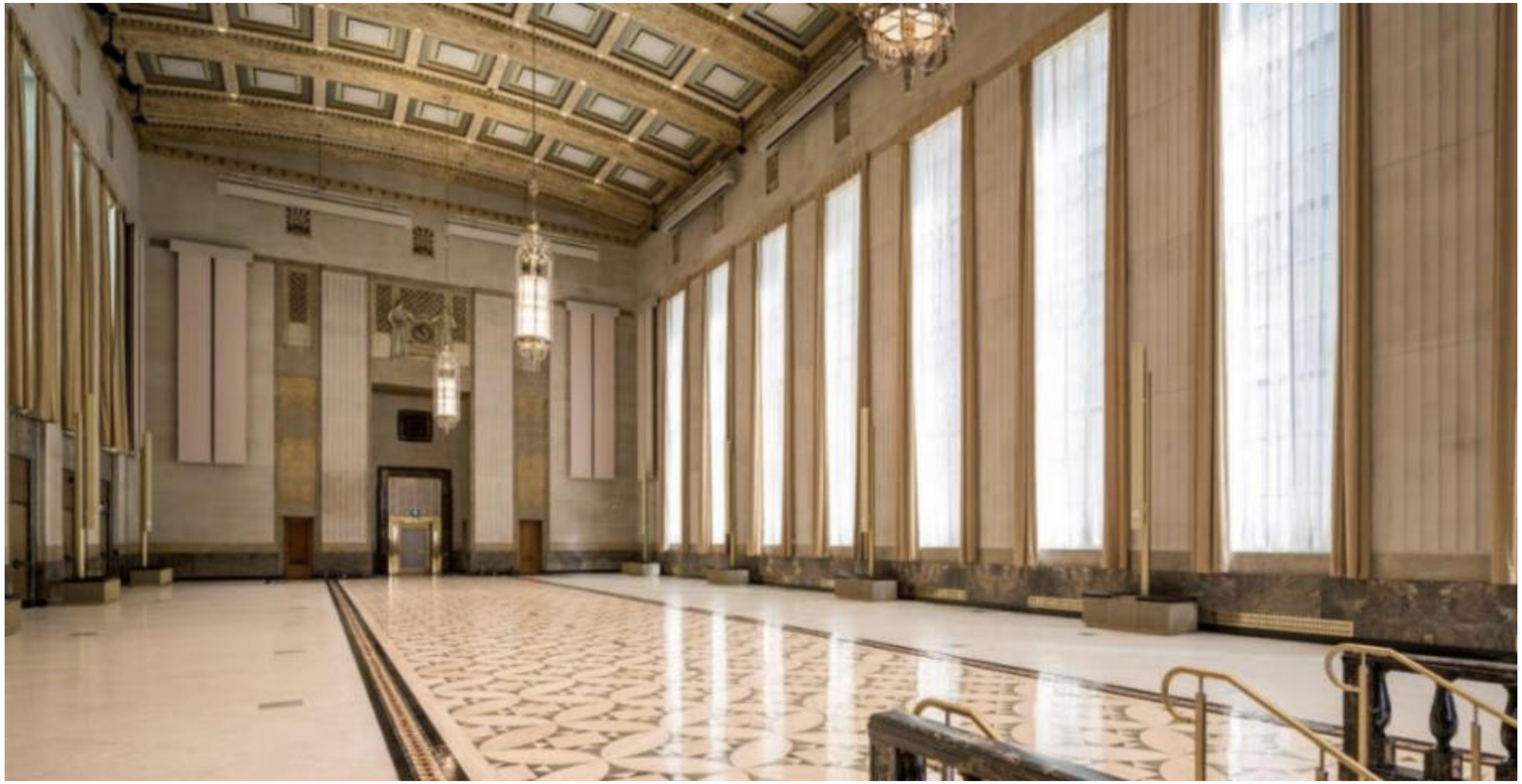
Key Strategies for Sustainable Rehabilitation:

- Reducing landfill via extremely high percentage of retained materials
- Augmenting building envelope effectiveness
- Rehabilitating large bronze and steel windows
- Retaining durable, natural exterior and interior materials
- Customizing a hybrid energy efficient mechanical and electrical systems specifically for this building/use
- Installing automated building control systems
- Installing water conserving fixtures
- Installing radiant floor system
- Using high albedo roofing material
- Leveraging inherently sustainable existing features

Images: ZNCC Case Studies: Sir John A. MacDonald Building, Ottawa, NORR + MTBA Report

Case Study: Sir John A. MacDonald Building

Ottawa, Ontario, Canada



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Images: ZNCC Case Studies: Sir John A. MacDonald Building, Ottawa, NORR + MTBA Report

Case Study: 1934 Office Building

Brussels, Belgium

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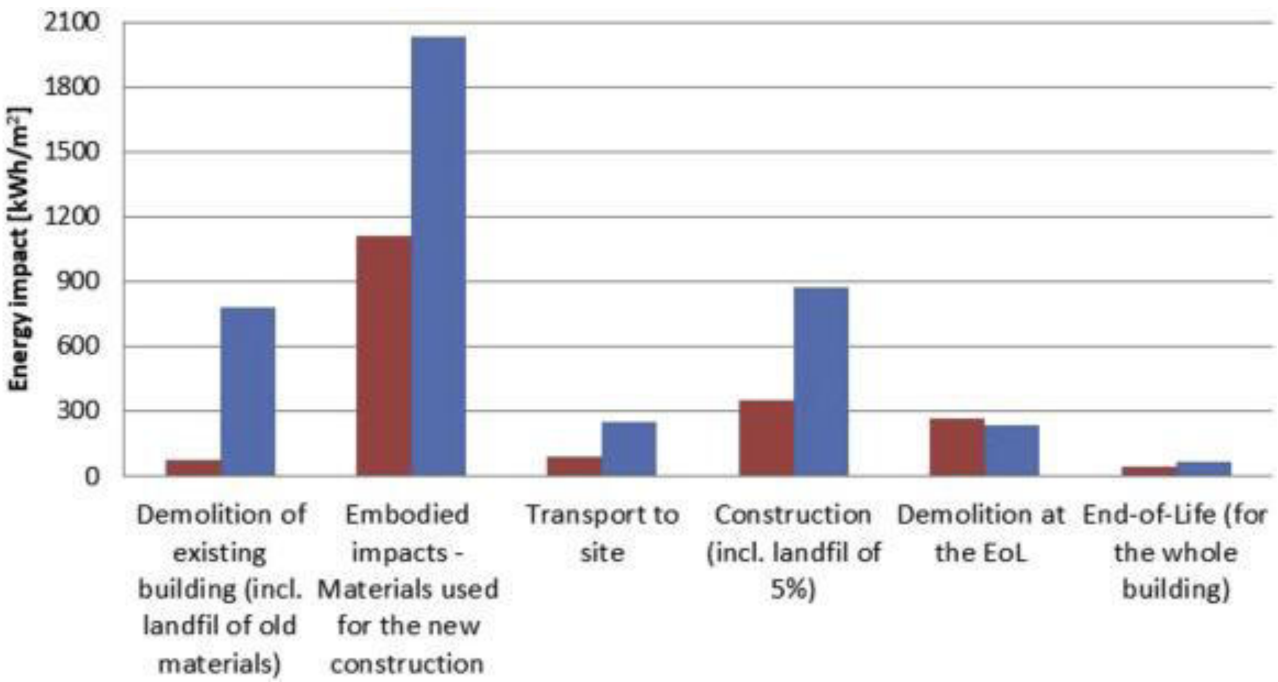
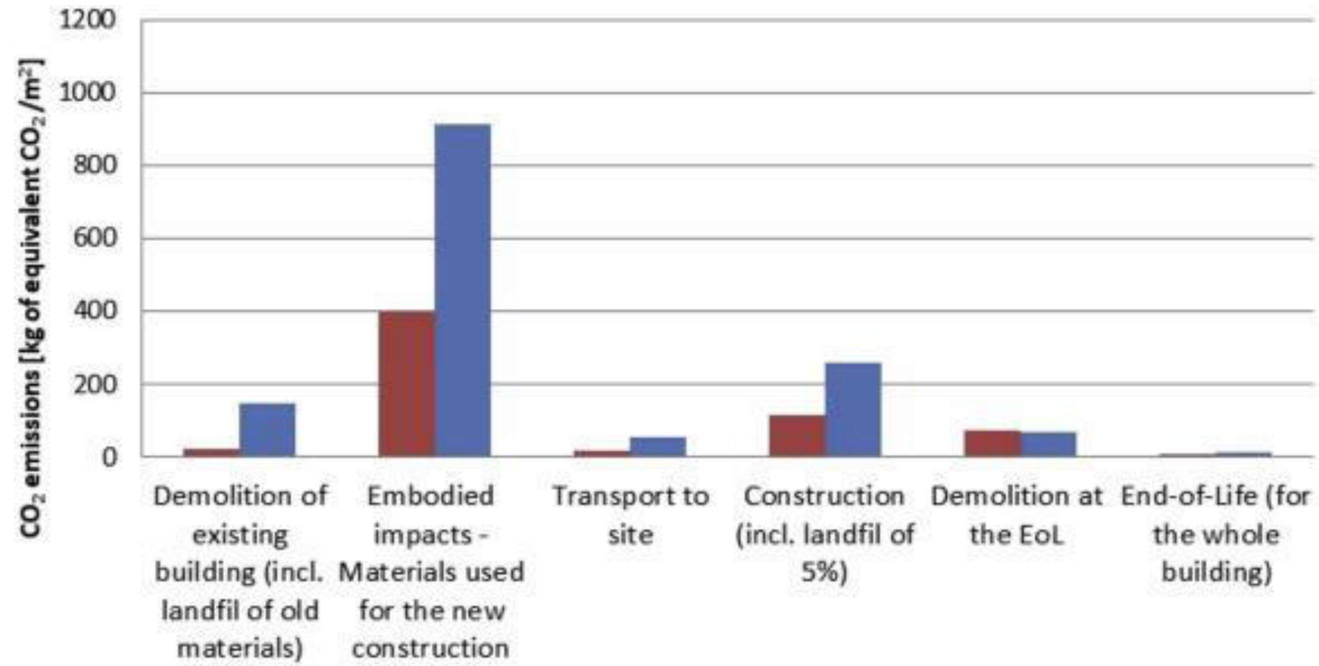
Images: https://doi.org/10.1016/j.jenvman.2018.02.055

Case Study: 1934 Office Building

Brussels, Belgium





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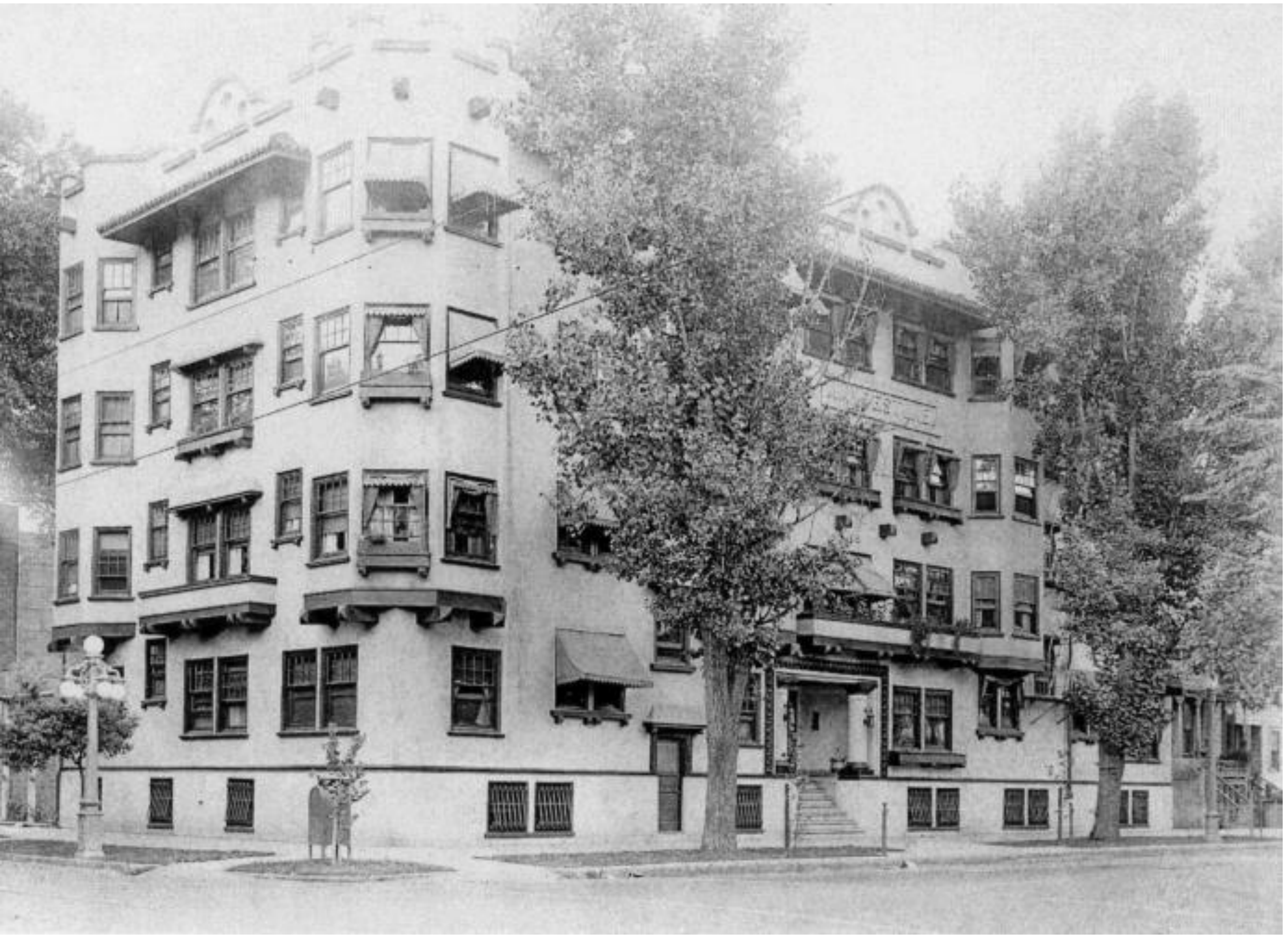
Images: https://doi.org/10.1016/j.jenvman.2018.02.055

Case Study: Maydestone Apartments

Sacramento, California, USA



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Images: https://ohp.parks.ca.gov/?page_id=24834

Case Study: Maydestone Apartments

Sacramento, California, USA

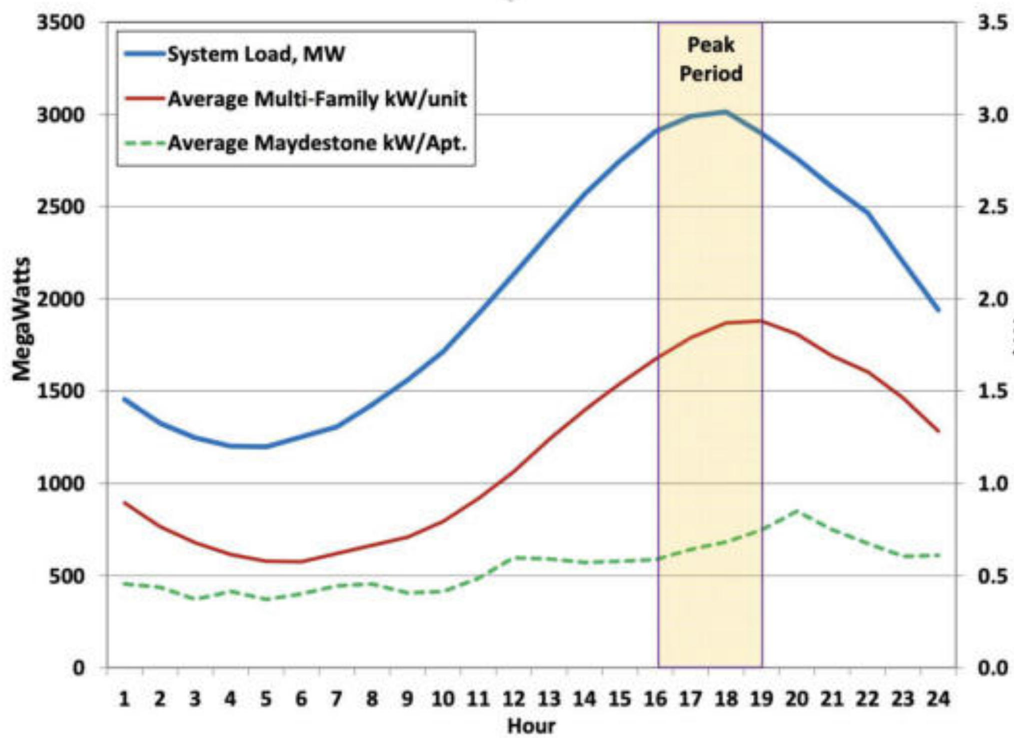


Figure 3-2 Peak Day Demand Profile Comparisons of System, Multi-Family, and Maydestone

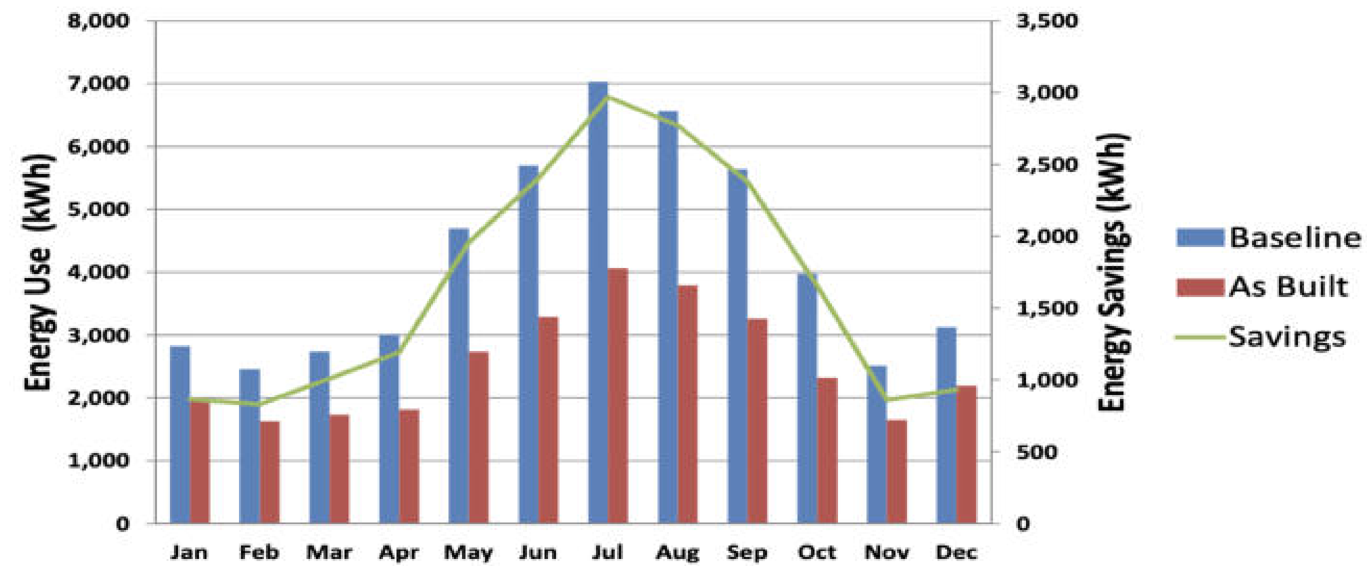
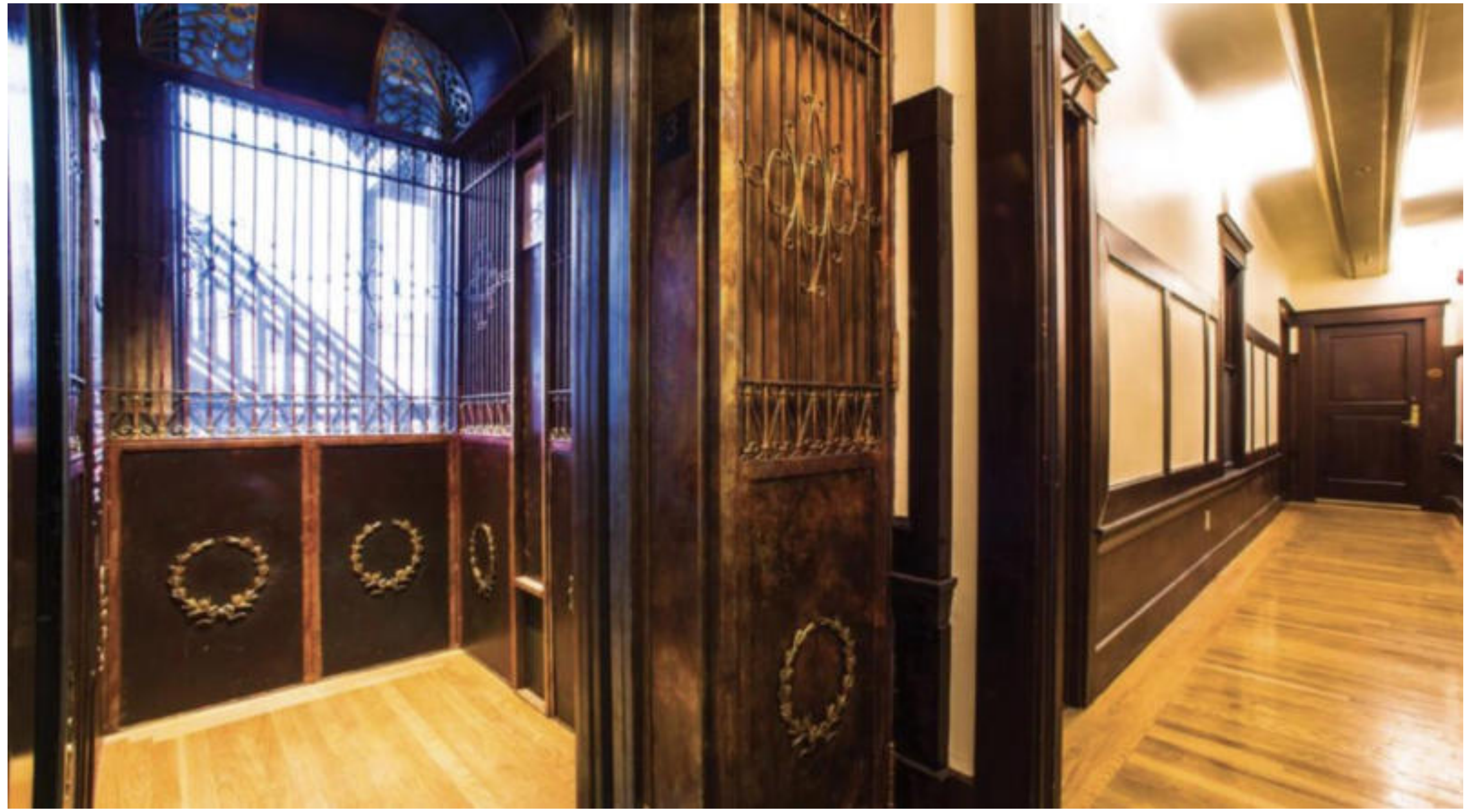


Figure 4-7 Comparison of Pre and Post Estimated Energy Use for High Efficiency Heat Pumps

Images: Maydestone Deep Energy Retrofit Monitoring Report (2014)

Case Study: Maydestone Apartments

Sacramento, California, USA



Images: https://www.comstocksmag.com/article/rising-ashes / https://www.comstocksmag.com/article/hidden-treasures

Case Study: The Segsa House

Valencia, Spain

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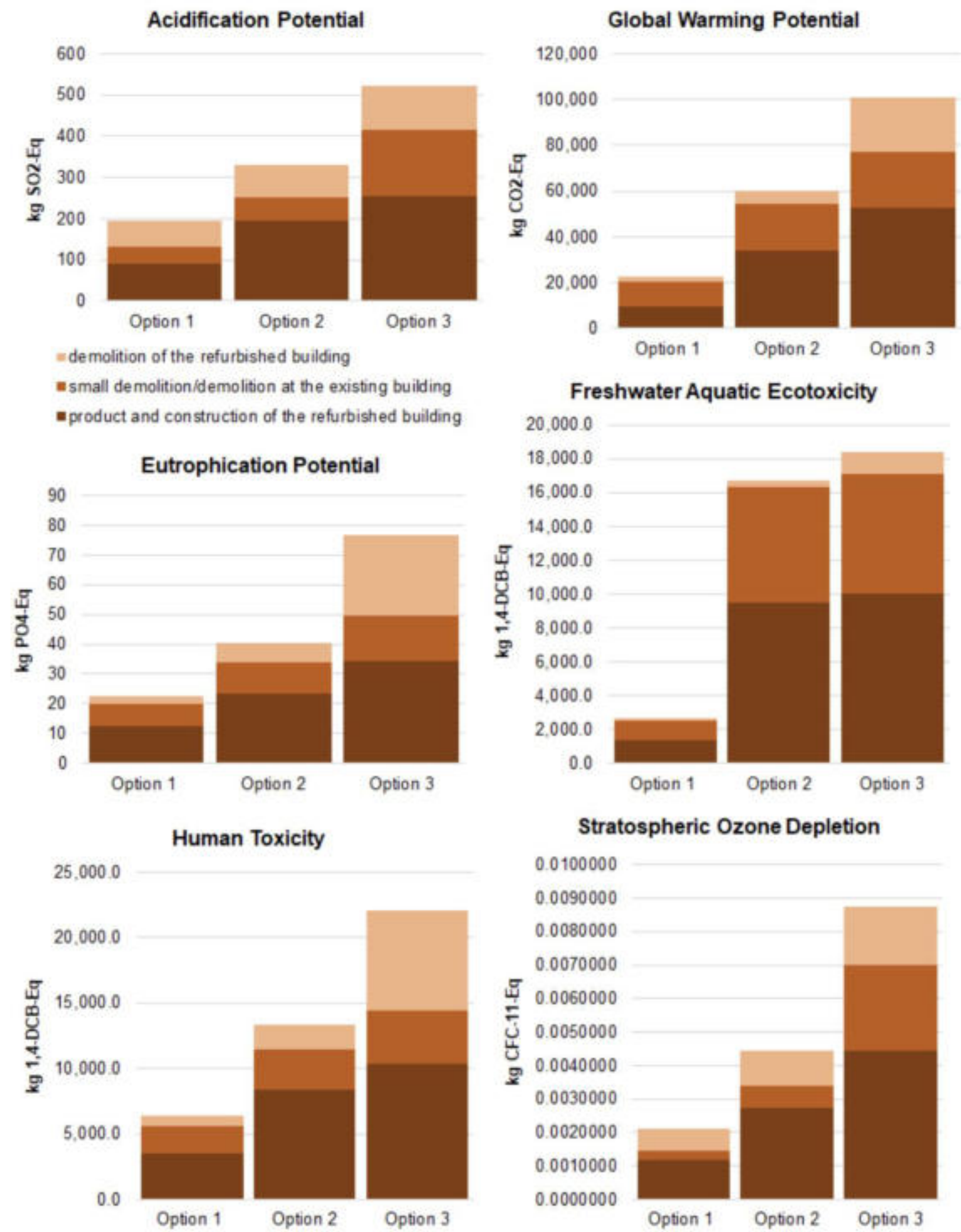
Images: www.esg.pt/versus/pdf/versus_heritage_for_tomorrow.pdf

Case Study: The Segsa House

Valencia, Spain



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Images: www.esg.pt/versus/pdf/versus_heritage_for_tomorrow.pdf

Case Study: The Segsa House

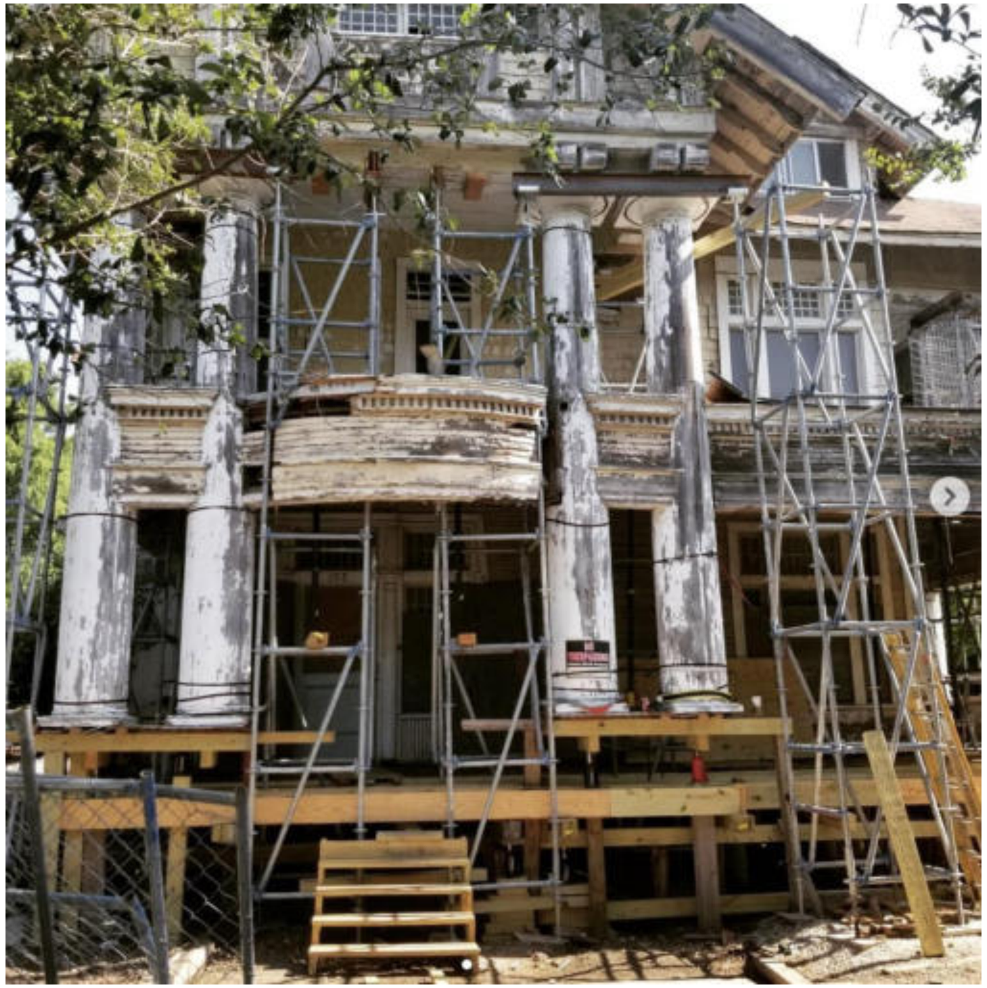
Valencia, Spain

Climate Heritage Network

Images: www.esg.pt/versus/pdf/versus_heritage_for_tomorrow.pdf

Case Study: Kelso House Climate Heritage Learning Lab *(in progress)*

San Antonio, Texas, USA



CITY OF SAN ANTONIO OFFICE OF HISTORIC PRESERVATION

POWER OF PRESERVATION

LAKE | FLATO ARCHITECTS

ZERO CARBON CERTIFICATION

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Images: City of San Antonio Office of Historic Preservation / Power of Preservation Foundation

Case Study: Kelso House Climate Heritage Learning Lab *(in progress)*

San Antonio, Texas, USA

Climate Heritage Network

Images: City of San Antonio Office of Historic Preservation / Power of Preservation Foundation

Case Study: Kelso House Climate Heritage Learning Lab *(in progress)*

San Antonio, Texas, USA

Climate Heritage Network

Images: City of San Antonio Office of Historic Preservation / Power of Preservation Foundation

Building Reuse is Climate Action:
Developing Policy Context

Policy – Actors and Actions

GOVERNMENT

- Multilateral Commitments
- National Governments
- Provinces / U.S. States
- Cities / Counties
- Agencies

INVESTMENT & INCENTIVES

- Grants / Tax Credits / Rebates
- Tools / Technical Assistance
- Education / Training
- Leading by Example

INSTITUTIONS

- Corporations
- Religious Entities
- Universities
- Museums / Sites

REGULATION & COSTS

- Building Codes
- Restrictions on Products
- Taxes on Property
- Pollution Taxes or Limits
- Carbon Offsets
- Divestment

Policy – Examples of Good Practice

WHAT?

- ✓ The Heritage Energy Counter: specialized energy consultants for immovable heritage
- ✓ Government sponsor: Flanders (Belgium)
- ✓ ErfgoedEnergieloket

GOAL?

- ✓ Training and supporting restoration architects in the energy optimizations of heritage buildings

WHY GOOD PRACTICE?

- ✓ Holistic approach: heritage values, energetic efficiency and building physics mutually influence each other
- ✓ Education

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Policy – Examples of Good Practice

WHAT?

- ✓ Heritage Energy Efficiency Tool (HEET)
- ✓ Government Lead: Oxford City Council
- ✓ Heritage Energy Efficiency Tool (HEET) | Oxford City Council

GOAL?

- ✓ Helping to assess energy efficiency improvements for historic buildings
- ✓ Target audience: owners of buildings in the city of Oxford

WHY GOOD PRACTICE?

- ✓ The tool acknowledges that historic buildings need to be incorporated in the goal to reduce carbon emissions by 2050, across all sectors by 80%
- ✓ "Historic buildings play their part in a national built environment with less carbon emissions."

Policy – Examples of Good Practice

WHAT?

- ✓ "Mosquées et bâtiments verts"
- ✓ Political partner: The Moroccan Ministry of Energy, Mines and Sustainable development
- ✓ 1909-Factsheet-Mosquées-Bâtiments-Verts-FR.pdf (giz.de)

GOAL?

- ✓ Reducing the energy bill of mosques
- ✓ Promoting renewable energies, increasing energy efficiency, creating jobs

WHY GOOD PRACTICE?

- ✓ Assoun mosque in Rabat: interventions lowered the energy bill by 60%
- ✓ Exemplary in the way it deals with sacred heritage ad energy efficiency
- ✓ Social and economic factors are incorporated: creating jobs + education +sensibilisation

CONCLUSIONS

* Heritage conservation professionals have the skills to design interventions into existing buildings while retaining value; hence they would make good leaders to help scale up deep green retrofit, rehab and reuse of the massive inventory of existing buildings

**L.C.A. tools, C.A.R.E. and Versus methodology allow holistic building fleet management for higher impact investments with fewer unintended negative consequences

**Heritage buildings can be laboratories for innovation at a time when society needs to scale-up building performance retrofits

**Heritage buildings and actors can also help educate the public and increase understanding and support for building reuse as climate action

THANK YOU!

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Susan Ross
Tessa De Marie

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WG3 “WORKING” SLIDES

Full print size is U.S. legal, landscape orientation

Website/Library/Resources/Outreach

Resource/Article	Description	Link	Category	Media	Proposed by
Building Resilience Guidelines	Six examples of Project Case Studies	**Building Resilience**			Susan Ross
HES Inform Guides		**Inform Guides**			Katherine Carter
HES Sort Guides		**Short Guides**			Katherine Carter
HES Technical Papers		**Technical Papers**			Katherine Carter
HES Refurbishment Case Studies		**Refurbishment Case Studies**			Katherine Carter
HES Planning Guidelines	Planning Guidelines	**Historic Environment Policy Statement**			Katherine Carter
HES Planning Guidelines	Planning Guidelines	**Managing Change in the Historic Environment: Use and Adaptation of Listed Buildings**			Katherine Carter
Elliot Jones: article	*"5 Ways to Reduce Embodied Carbon on Your Next Building Project"*				
Larry Strain, FAIA: article	*"10 Steps to reducing embodied carbon"*				