

**06.17.2022**

**Petaluma  
Fairgrounds  
Advisory  
Balanced  
Decarbonization**



**Carl Elefante** FAIA FAPT  
Principal Emeritus Quinn Evans  
Senior Fellow Architecture 2030  
2018 President American Institute  
of Architects



**The  
Greenest  
Building  
is...**



**One That  
is Already  
Built**

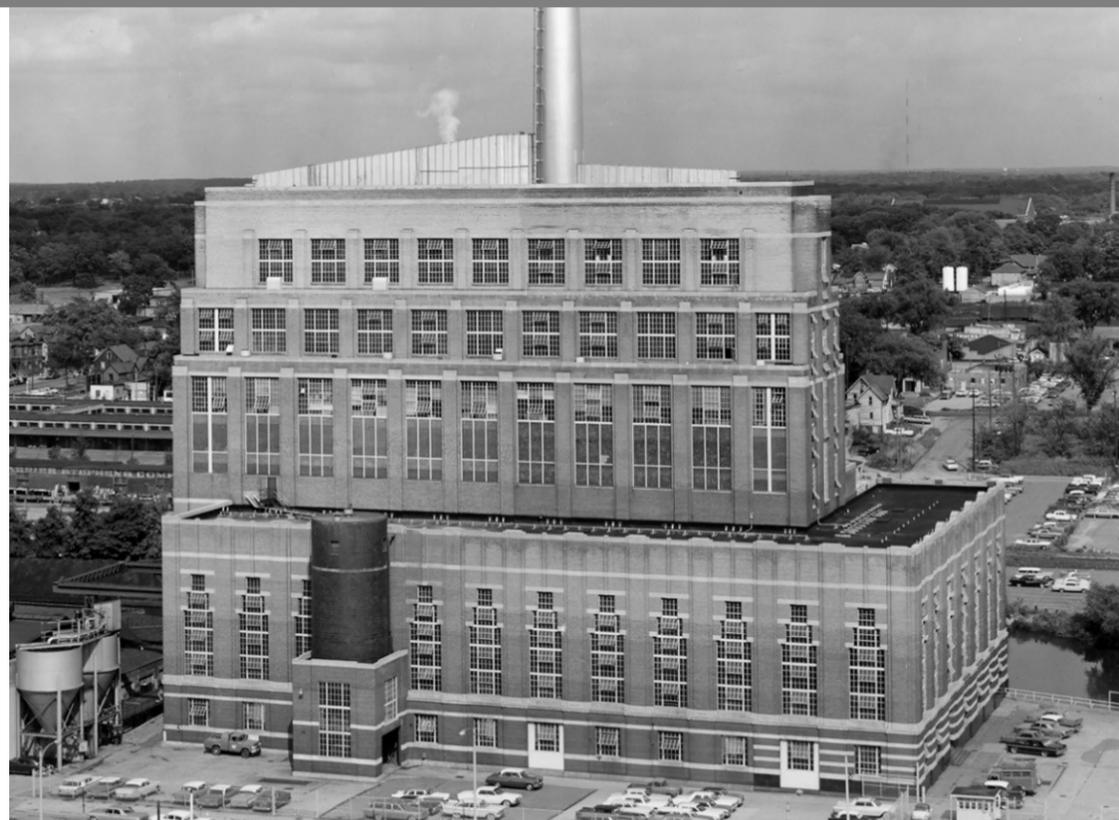




**The  
Greenest  
Building  
is...**



**One That  
is Already  
Built**



# SDAT Study Area 1

## APPENDIX STUDY AREA 1 DETAIL

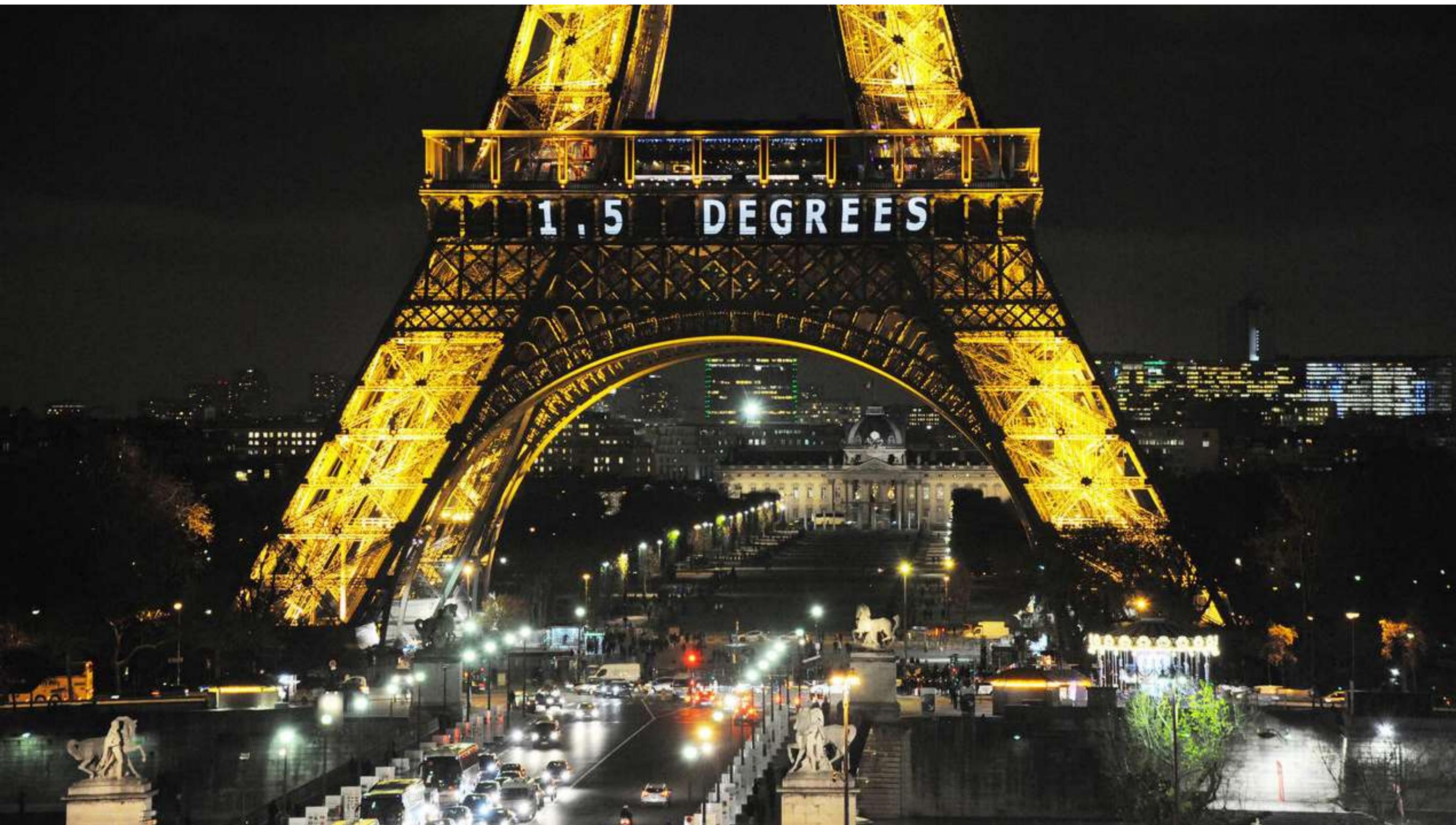
### Study Area 1: Fairgrounds (Figure 1)

The Sonoma Marin Fairgrounds is located in the geographic center of Petaluma. This location has the potential to bridge the east-west divide and address our shifting economy and our agricultural future. It also serves as one of the largest evacuation centers in Sonoma County. The property touches on all aspects of the Scope of Issues.



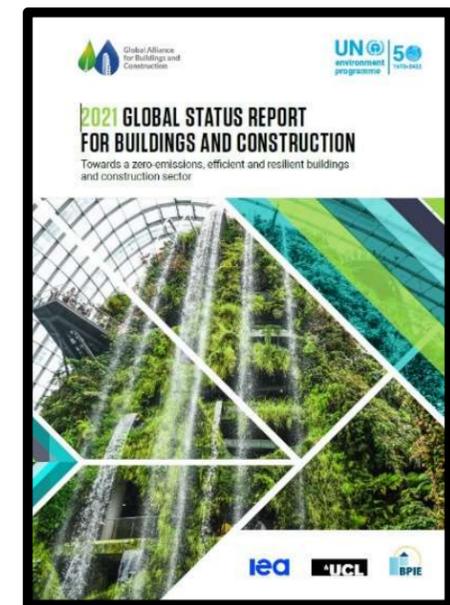
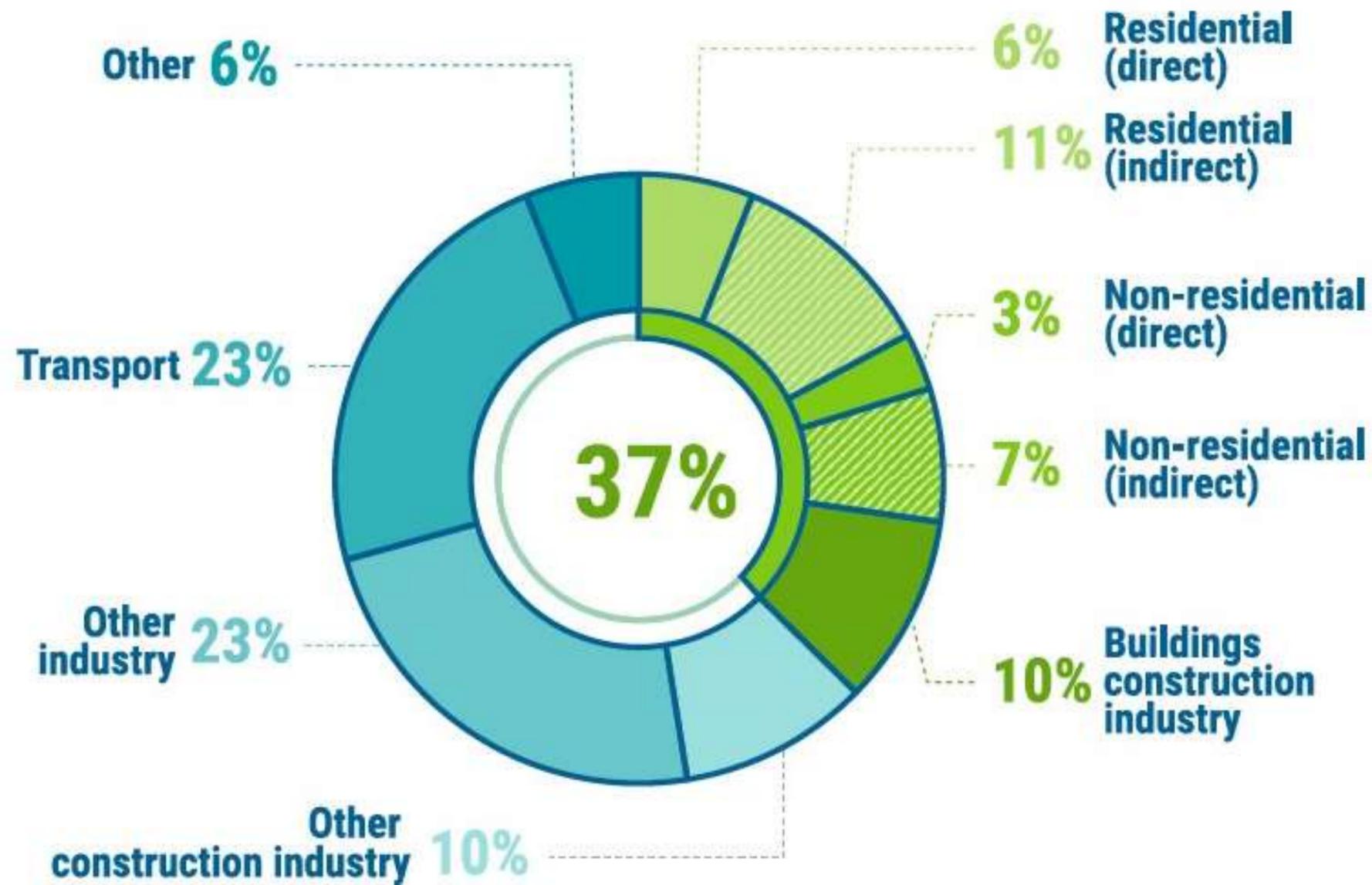


# **Building Sector Decarbonization**



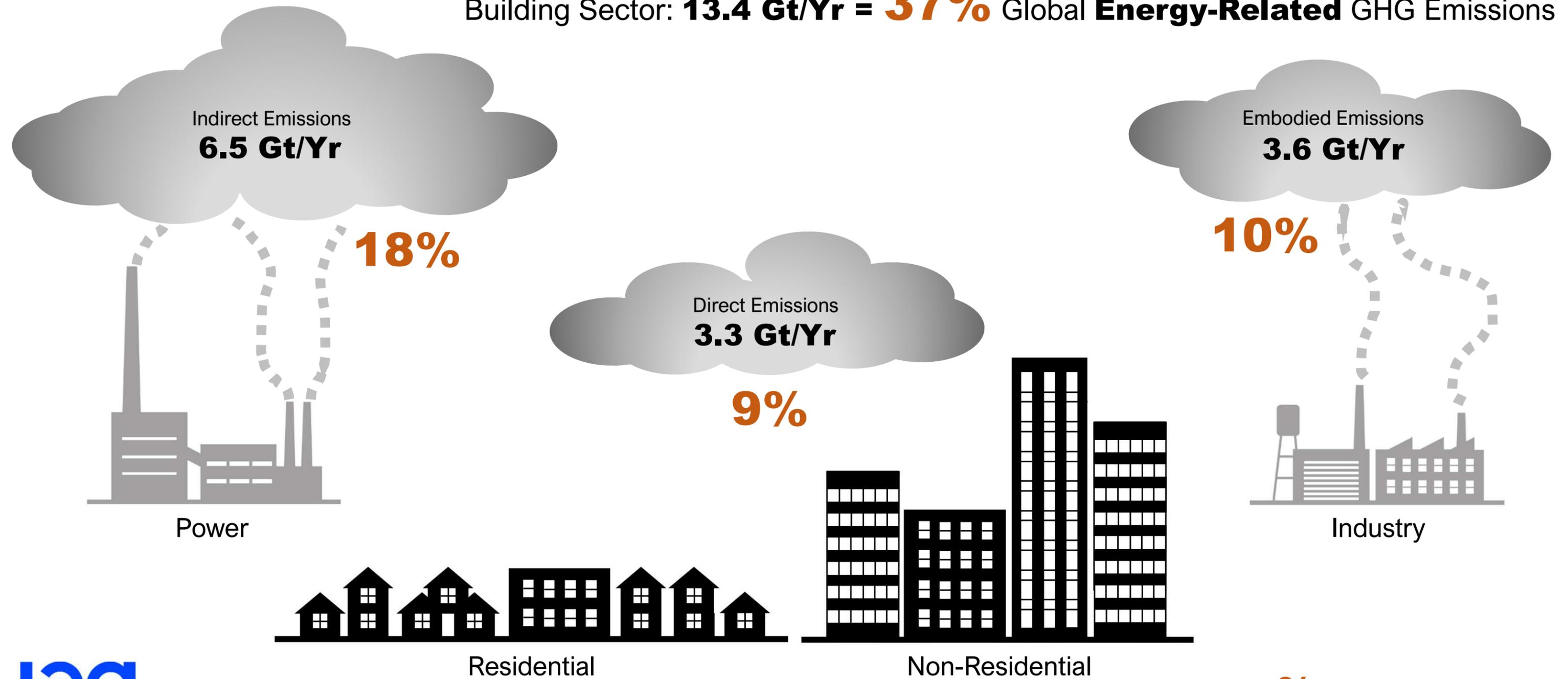


# Global Building Sector GhG Emissions



**Global Alliance  
for Buildings and  
Construction**  
*2021 Global  
Status Report*

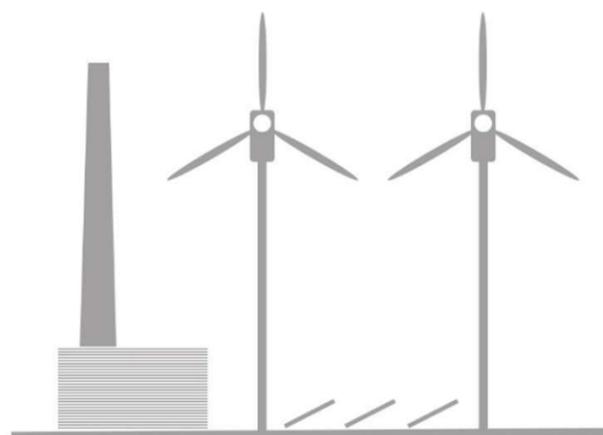
Building Sector: **13.4 Gt/Yr** = **37%** Global **Energy-Related** GHG Emissions



% Annual Emissions

## POWER

- Convert to Renewable Energy



Green Power

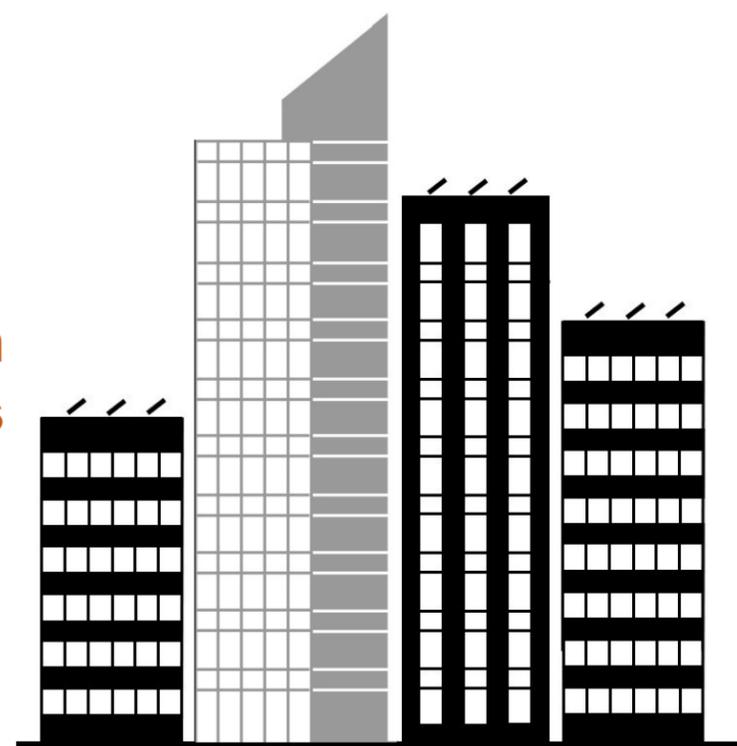
## BUILDINGS

- High-Performance Codes
- All-Electric Buildings
- Building-Integrated Renewables

**25% Growth**  
**50% ZNE Retrofits**



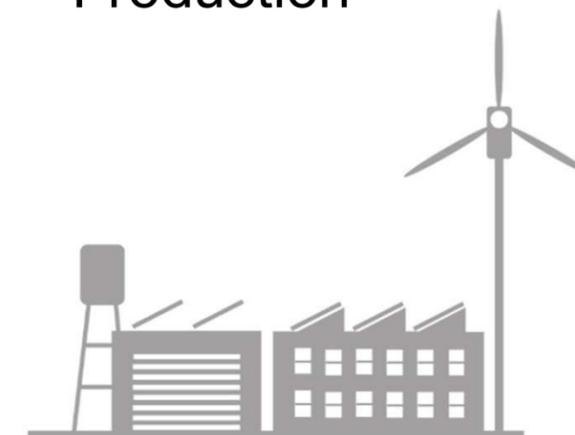
Residential



Non-Residential

## INDUSTRY

- Convert to Renewable Energy
- Decarbonize Materials & Production



Green Industry

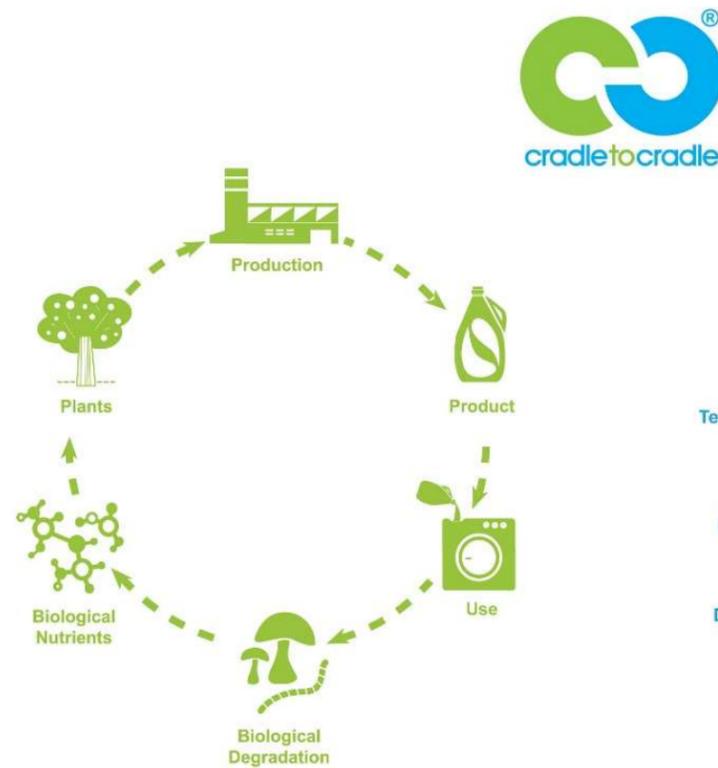
**Building Sector GHG Emissions – ZERO by 2040 Strategy**



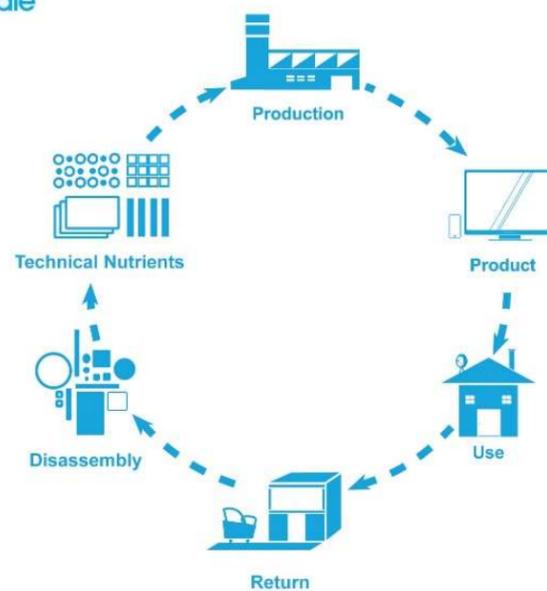
# **Building Life-Cycles**



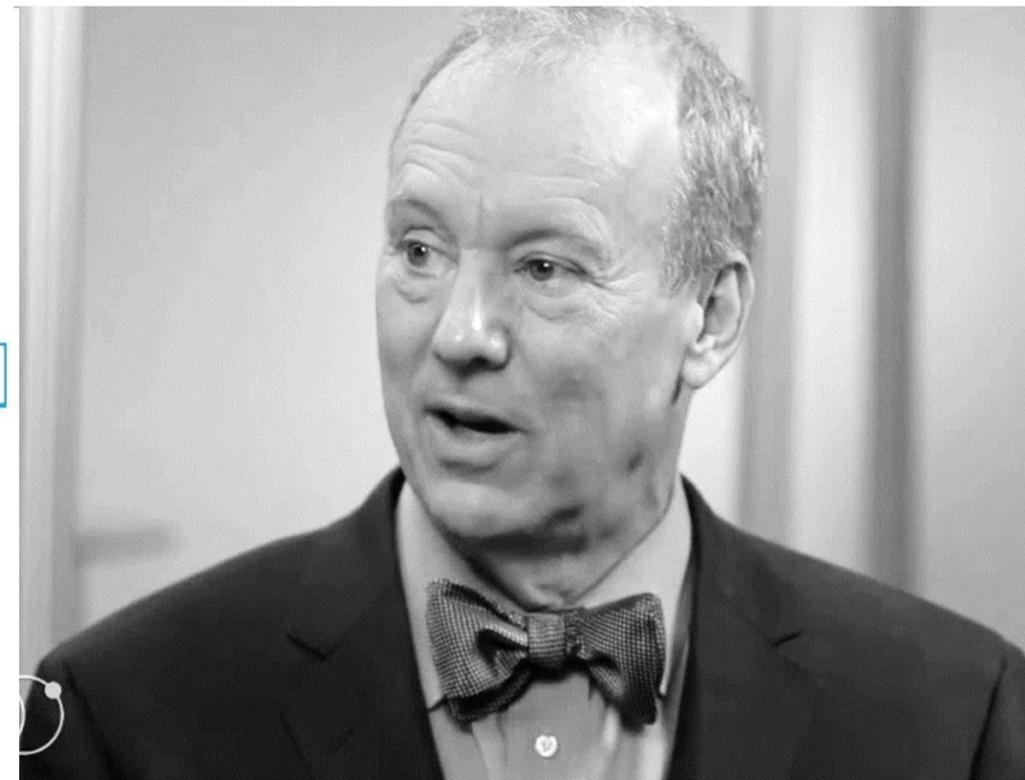
# Material Life-Cycles



Biological Cycle

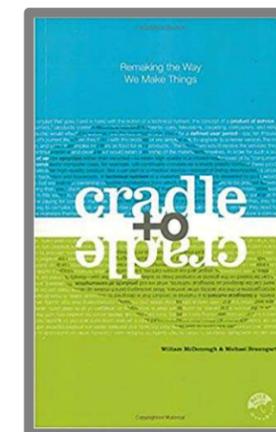


Technical Cycle



**Bill McDonough**

***Cradle to  
Cradle***





# Assembly Life-Cycles



**Triple-Glazed IGU**



**Double-Glazed IGU**

Glass Panes

Glass Coating (typ. Low-E)

Gas-filled Cavity (typ. Argon)

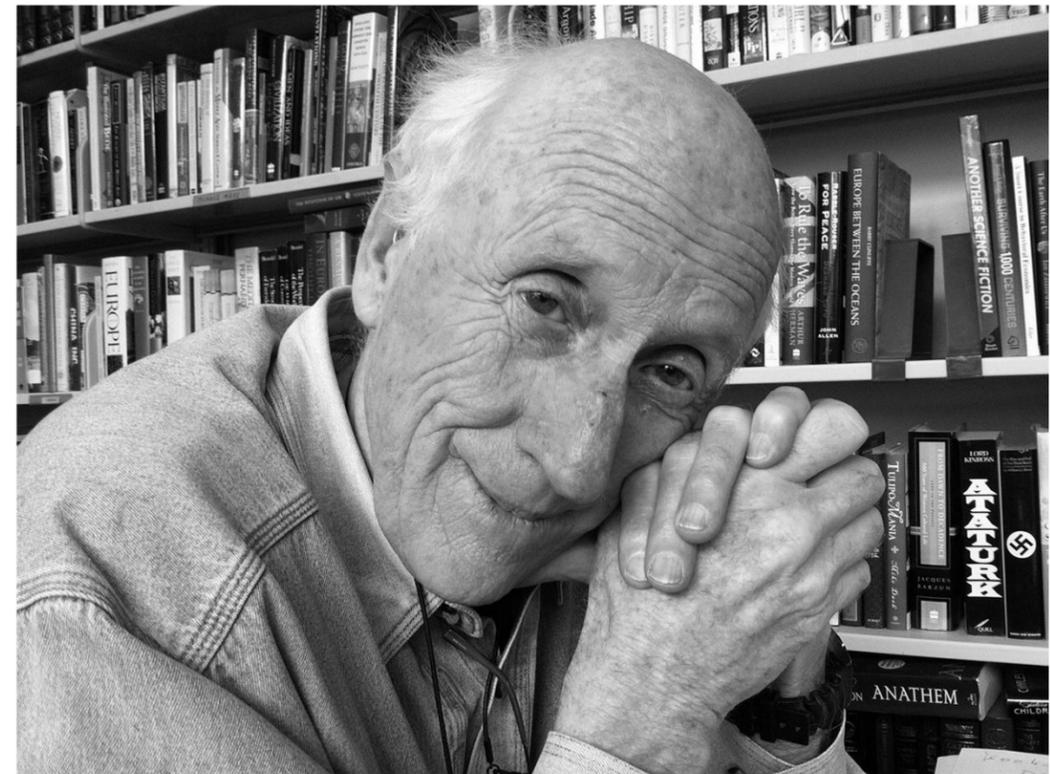
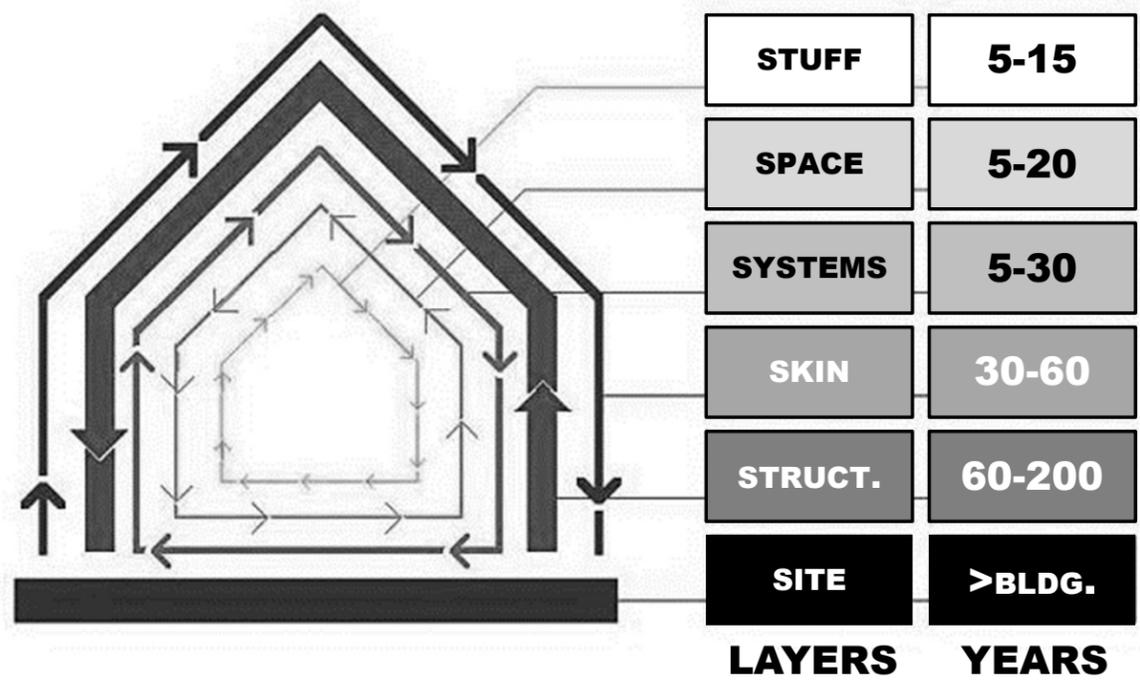
Desiccant

Spacer Bar

**Sealant**

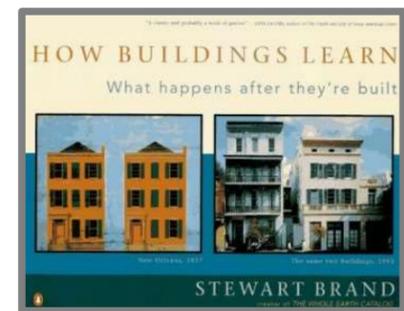


# Whole Building Life-Cycles



**Stewart Brand**

***How Buildings Learn***

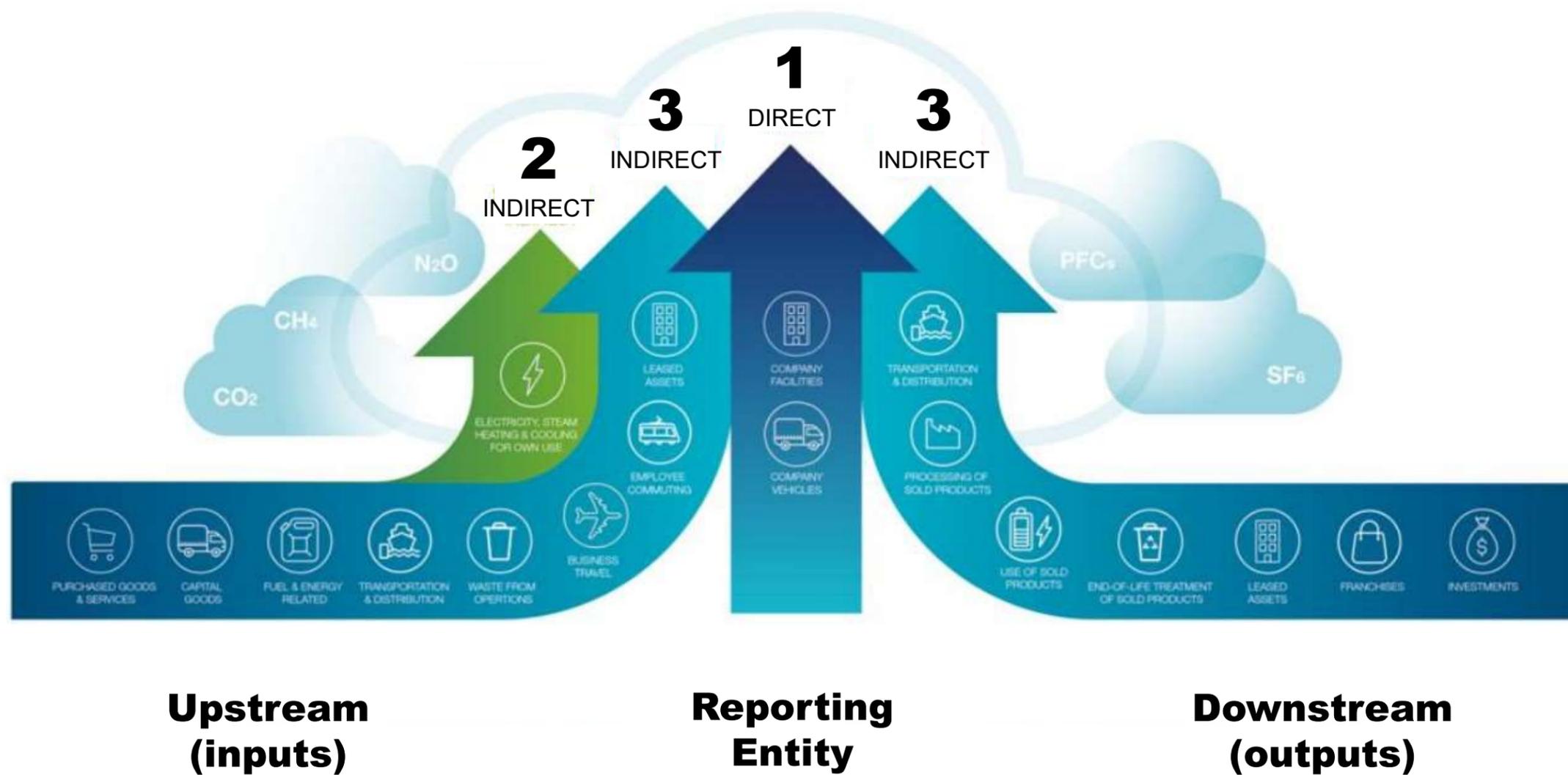




# **Whole-Life Carbon Accounting**



# Scope 1, 2 & 3 Emissions



- 1 DIRECT**
  - Processes
  - Buildings
  - Transport
- 2 INDIRECT**
  - Off-site Power
- 3 INDIRECT**
  - Upstream Activities
  - Downstream Activities



# Operational Emissions – Direct $\approx$ Scope 1

Gas Cooking



Gas-Fired Water Heaters



Gas-Fired Boilers



# Operational Emissions – Indirect $\approx$ Scope 2

Rooftop Chillers



Heat Pumps



Lighting



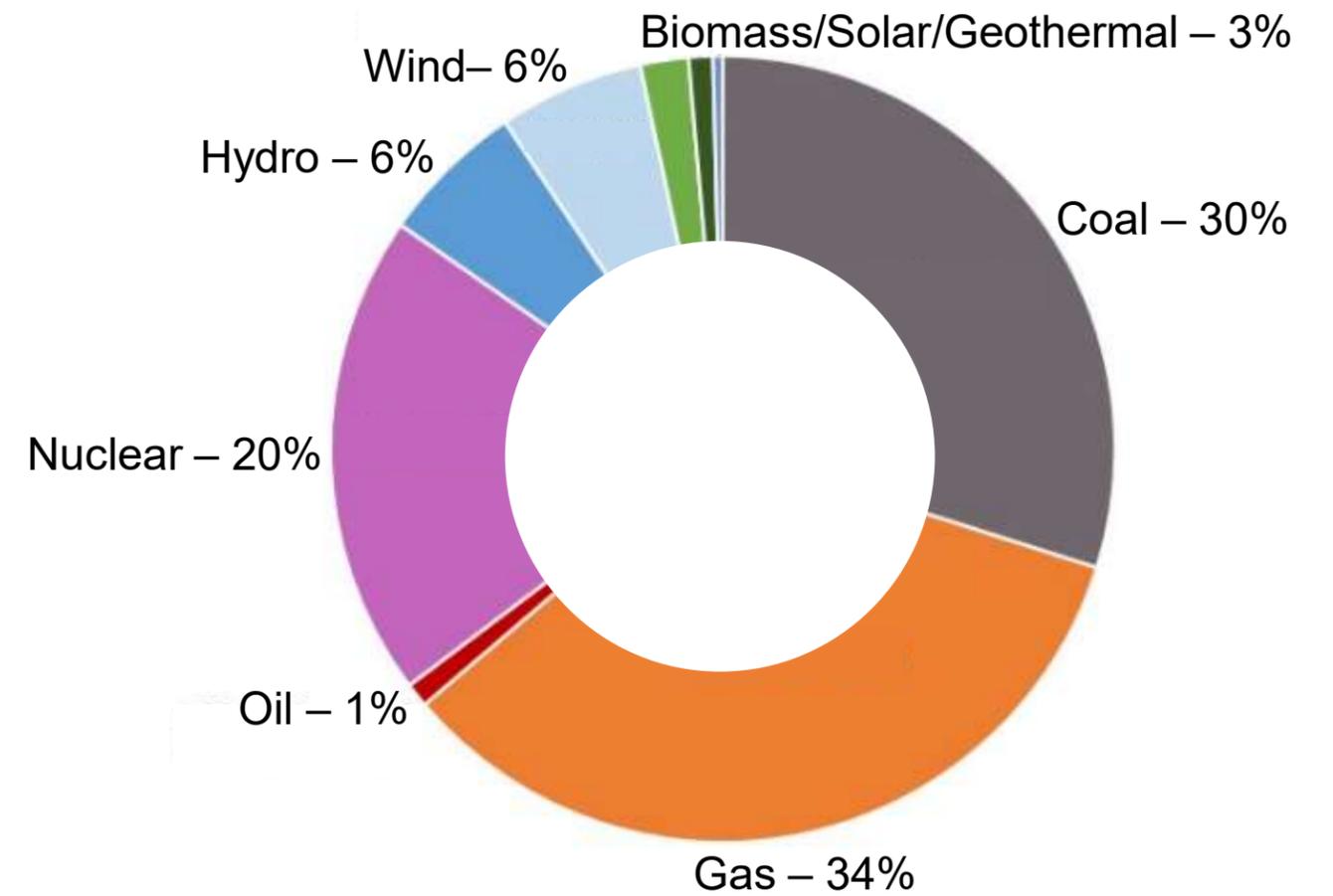
Plug Load



# Operational Emissions – Indirect $\approx$ **Scope 2**



Coal-Fired Power Plant



**Electricity by Source**

US Energy Information Agency



# Embodied Emissions $\approx$ Scope 3

Steel Furnace



Concrete Trucks



Concrete Batching Plant



Concrete Placement



# **Balanced Building Sector Decarbonization**



# Building Sector Roadmap

## **Build to Code**

**ASHRAE 90.1 2019 + IECC 2021**

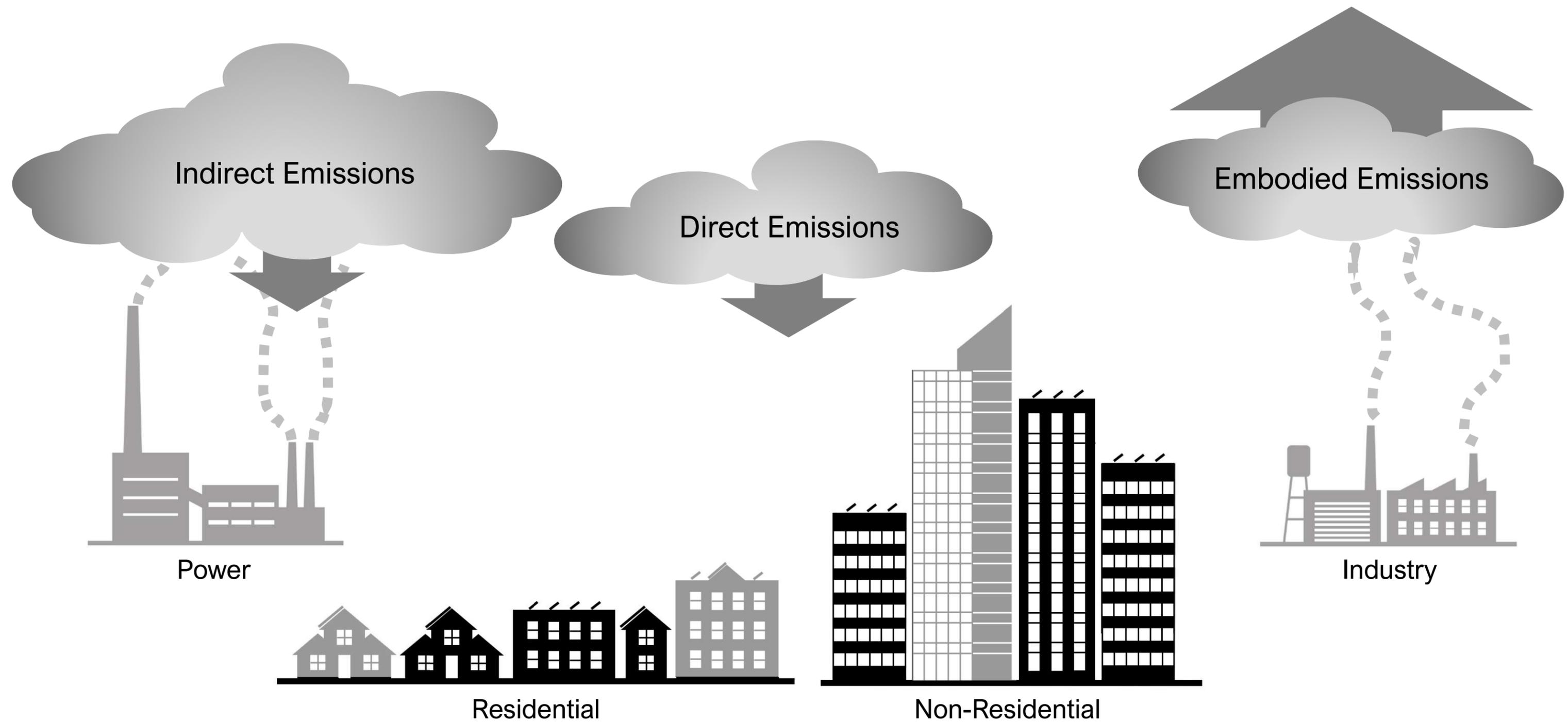
## **Electrification + Renewables**

**No Gas + On-Site + Off-Site**

## **Zero-Out Embodied Carbon**

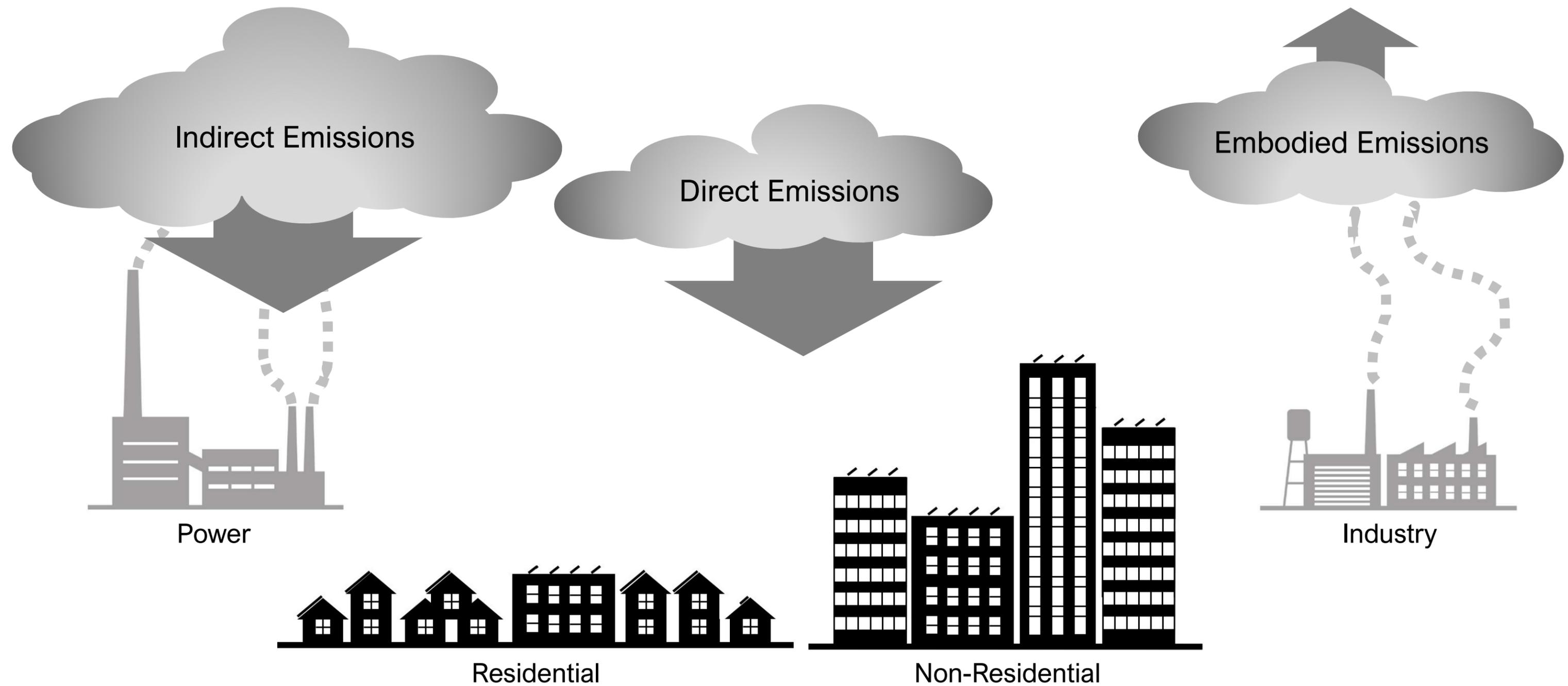
**Re-Use + Reduce + Sequester**





# Building Sector GHG Emissions – Growth Strategy

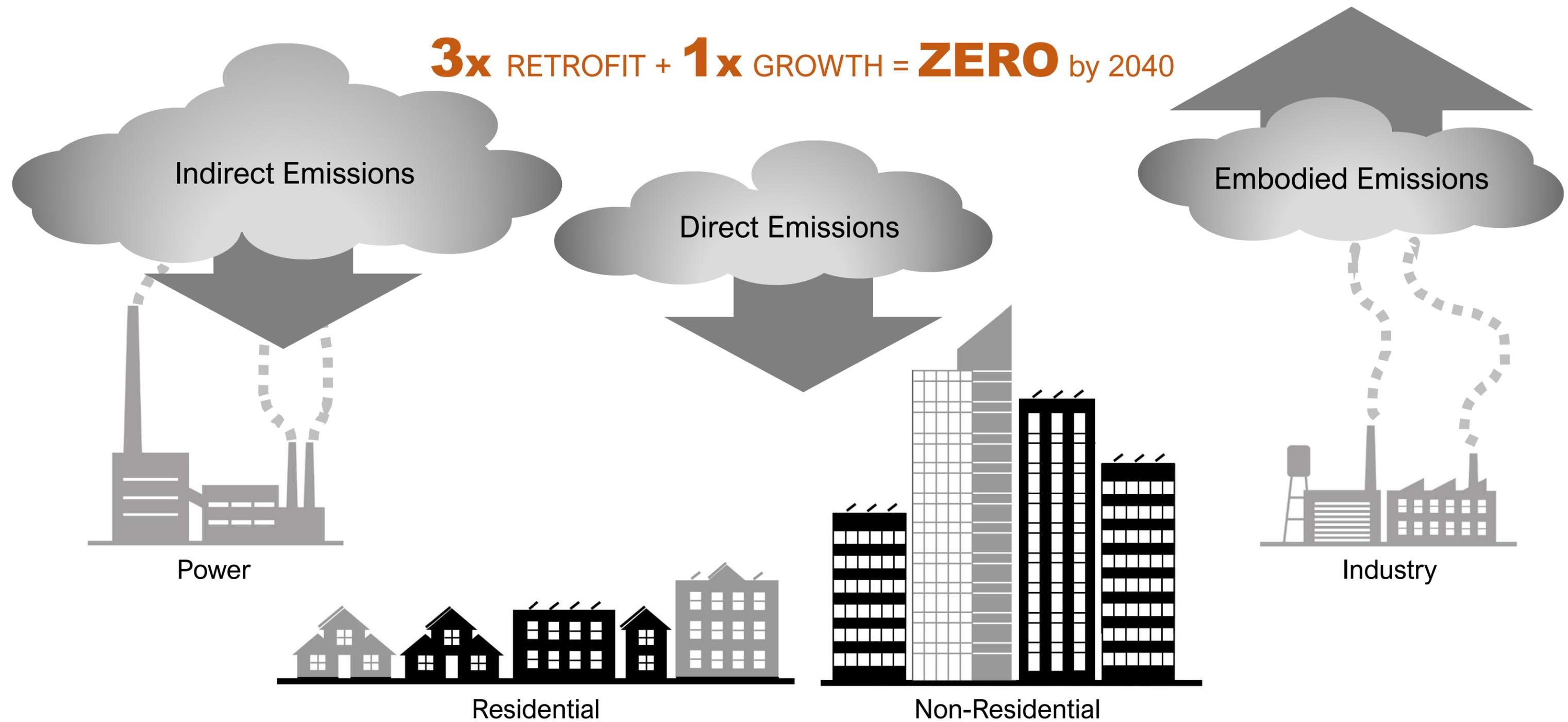




# Building Sector GHG Emissions – Retrofit Strategy



**3x** RETROFIT + **1x** GROWTH = **ZERO** by 2040



**Building Sector GHG Emissions – Balanced Retrofit + Growth**



**The  
Greenest  
Building  
is...**

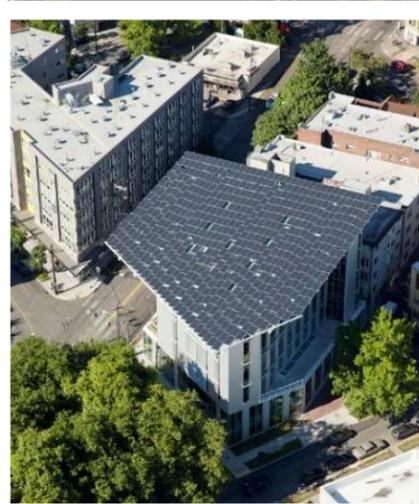


**One That  
is Already  
Built**





# Energy-Positive Buildings



Bullitt Center  
Miller Hull



Wayne Aspinall Federal Building  
Westlake Reed Leskowsky





# Carbon-Positive Materials



Mjøstårnet  
Brumunddal, Norway  
Voll Arkitekter

# SDAT Study Area 1

## APPENDIX STUDY AREA 1 DETAIL

### Study Area 1: Fairgrounds (Figure 1)

The Sonoma Marin Fairgrounds is located in the geographic center of Petaluma. This location has the potential to bridge the east-west divide and address our shifting economy and our agricultural future. It also serves as one of the largest evacuation centers in Sonoma County. The property touches on all aspects of the Scope of Issues.



06.17.2022

**Petaluma  
Fairgrounds  
Advisory  
Balanced  
Decarbonization**



**Carl Elefante** FAIA FAPT  
Principal Emeritus Quinn Evans  
Senior Fellow Architecture 2030  
2018 President American Institute  
of Architects