Rapid Decarbonization

for the Built Environment

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U.S. Green Building Council
Georgetown University

Four Questions

1. Where do building emissions come from?
2. How we have tried to reduce emissions in the past?
3. How will we reduce emissions in the future?
4. What you can do today?

Where do GHG emissions come from?

Causes of GHG Emissions

Emissions are generated when:

- Fuel is burned
- Pollutants are emitted
- Fossil fuel-based energy is purchased
- Building users and service providers burn, emit, or buy energy

GHG Emissions Sources

Common emissions include:

- Natural gas, diesel, fuel oil
- High global warming potential refrigerants
- Steam and electricity
- Transportation, waste, water, building materials, more

Determinants of Emissions

Long Term Impact

- Land use and location
  - Materials
    - Transportation
      - Property type and space use
        - Energy supply
          - Efficiency of systems
            - Effectiveness of operations
              - *More*

Short Term Control

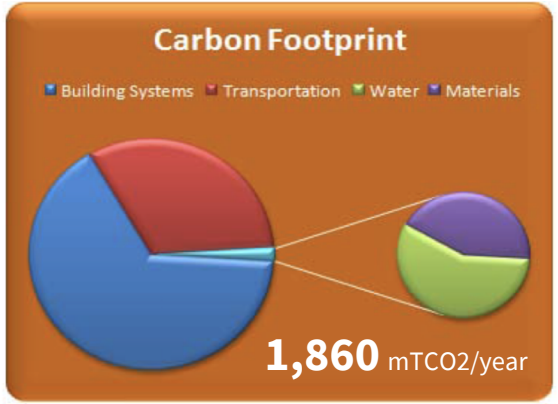
Office Prototype

135,000 sf

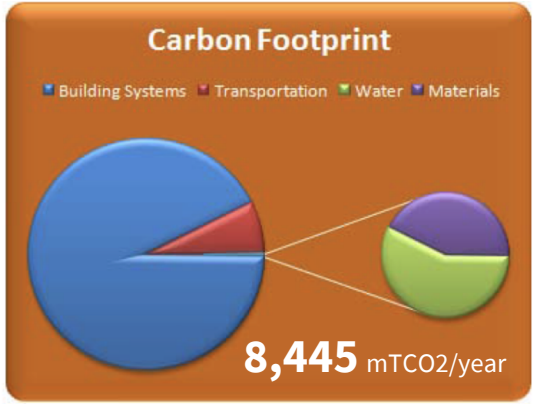
Variation in emissions with:

- Energy efficiency
- Transportation
- Embodied energy in water

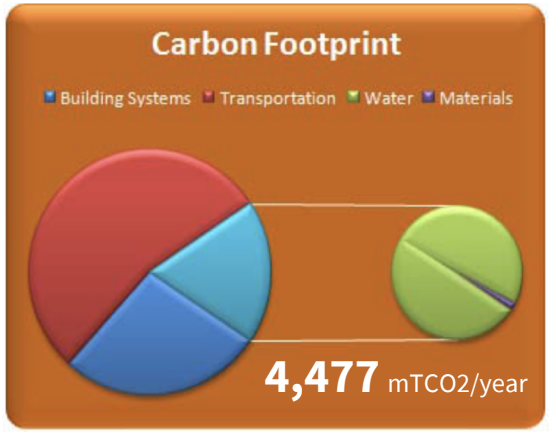
High efficiency + TOD



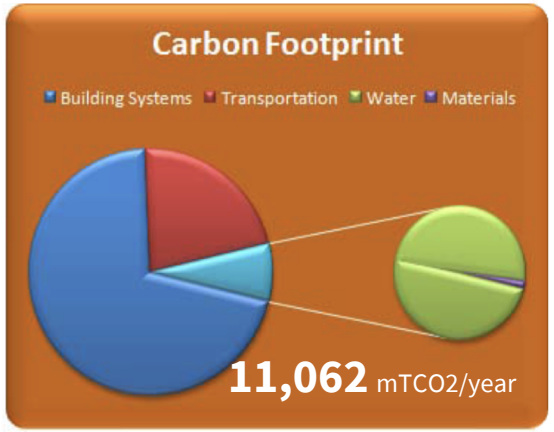
Low efficiency + TOD



High efficiency + Sprawl



Low efficiency + Sprawl



What have we done in the past?

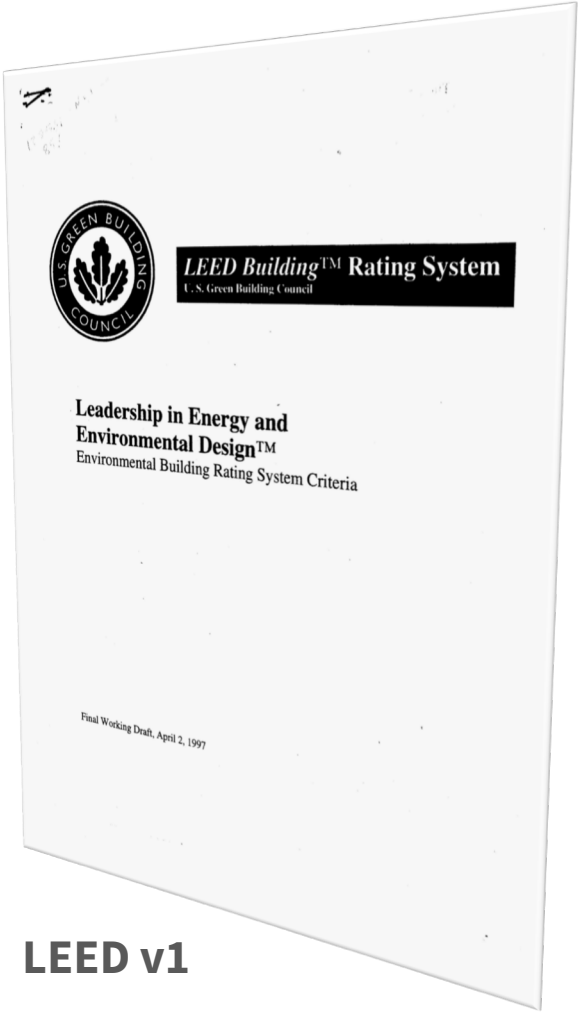
Prevailing Paradigm

For the last 25+ years, emissions reduction =

- Integrated design
- Improved efficiency
- A bit of clean energy
- A preference for denser, transit-accessible locations
- Water conservation, waste diversion, and materials selection

LEED Building™ Tally Sheet

Prerequisites (11)
Building Materials (7 Credits)
Construction Waste Management (2 Credits)
Energy (10 Credits)
Existing Building Rehabilitation (2 Credits)
Indoor Air Quality (3 Credits)
Landscaping (2 Credits)
LEED™-Certified Designer (1 Bonus Credit)
Occupant Recycling Equipment (1 Credit)
Operations and Maintenance Facilities (2 Credits)
Ozone Depletion/CFCs (2 Credits)
Siting (3 Credits, plus 1 Bonus Credit)
Transportation (3 Credits, plus 1 Bonus Credit)
Water Conservation (4 Credits)
Water Quality (2 Credits, plus 1 Bonus Credit)

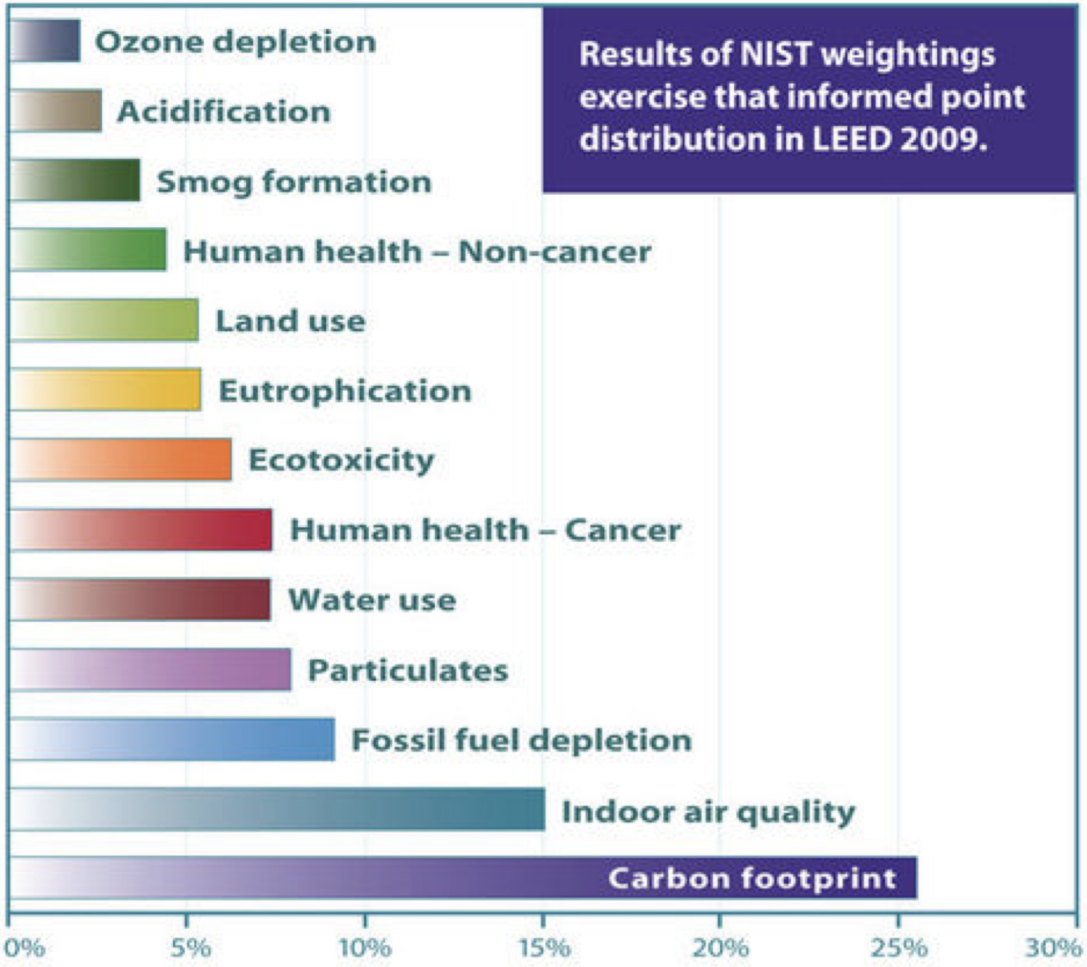

U.S. GREEN BUILDING COUNCIL

LEED Building™ Rating System
U. S. Green Building Council

Leadership in Energy and Environmental Design™
Environmental Building Rating System Criteria

Final Working Draft, April 2, 1997

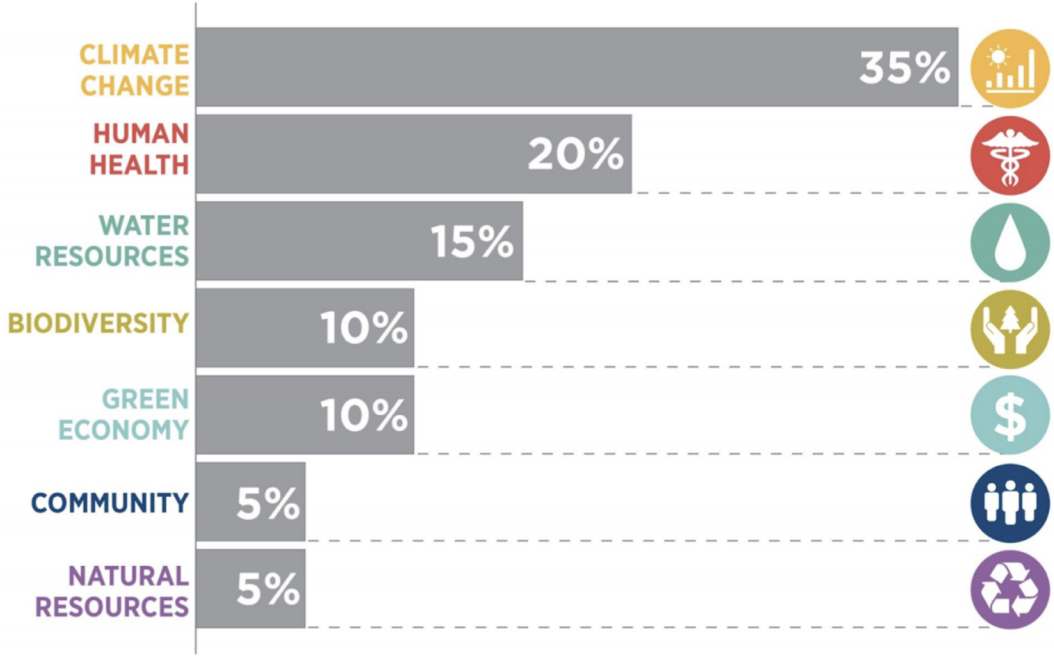
LEED v1

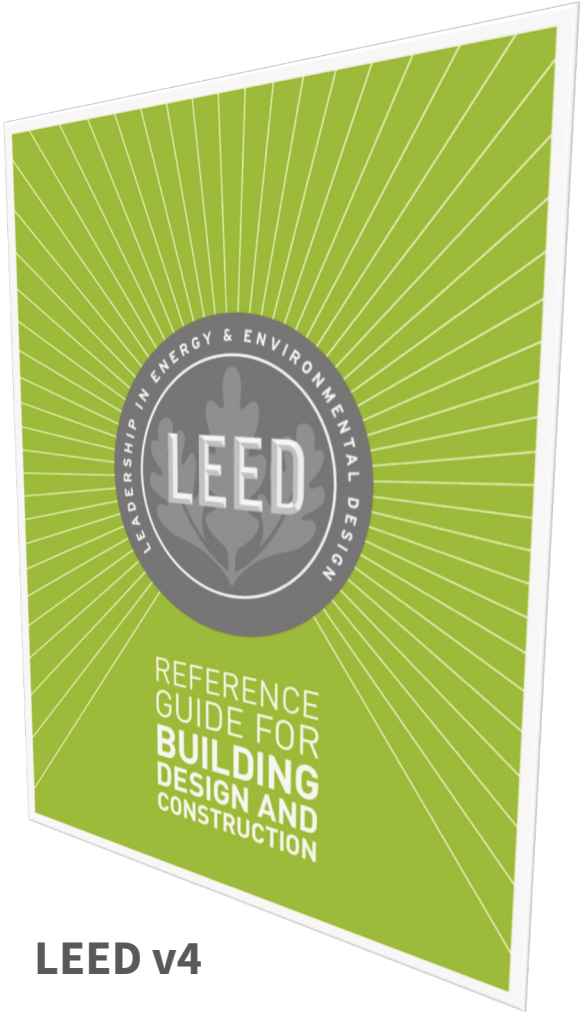

Results of NIST weightings exercise that informed point distribution in LEED 2009.
Ozone depletion
Acidification
Smog formation
Human health – Non-cancer
Land use
Eutrophication
Ecotoxicity
Human health – Cancer
Water use
Particulates
Fossil fuel depletion
Indoor air quality
Carbon footprint
0%
5%
10%
15%
20%
25%
30%

LEED 2009 FOR
NEW
CONSTRUCTION
AND MAJOR RENOVATIONS
For Public Use and Display
LEED 2009 for New Construction and Major Renovations Rating System
USGBC Member Approved November 2008
U.S. GREEN BUILDING COUNCIL
LEED
USGBC

LEED v2009

LEED v4 SYSTEM GOALS

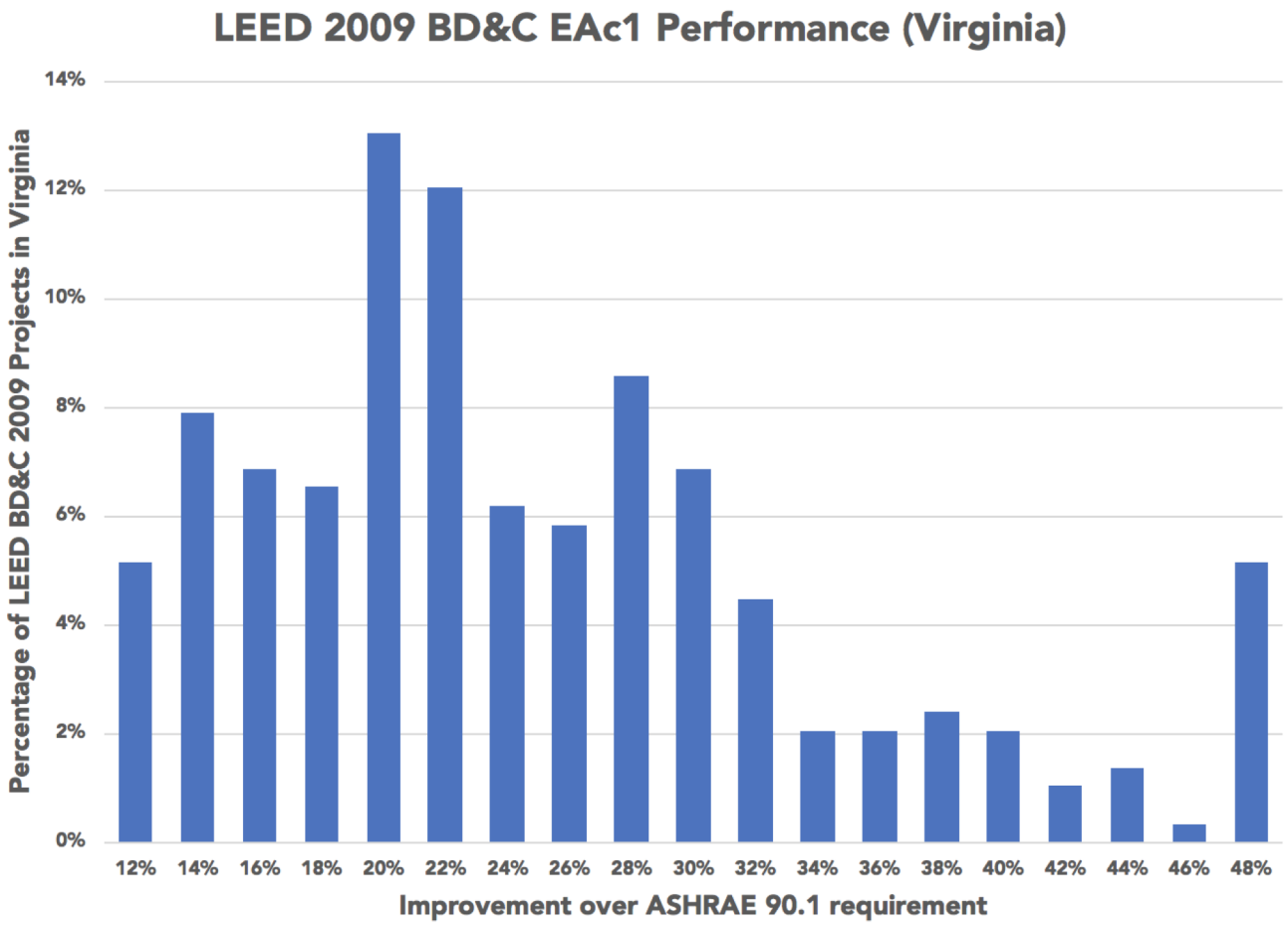




LEED v4

Results

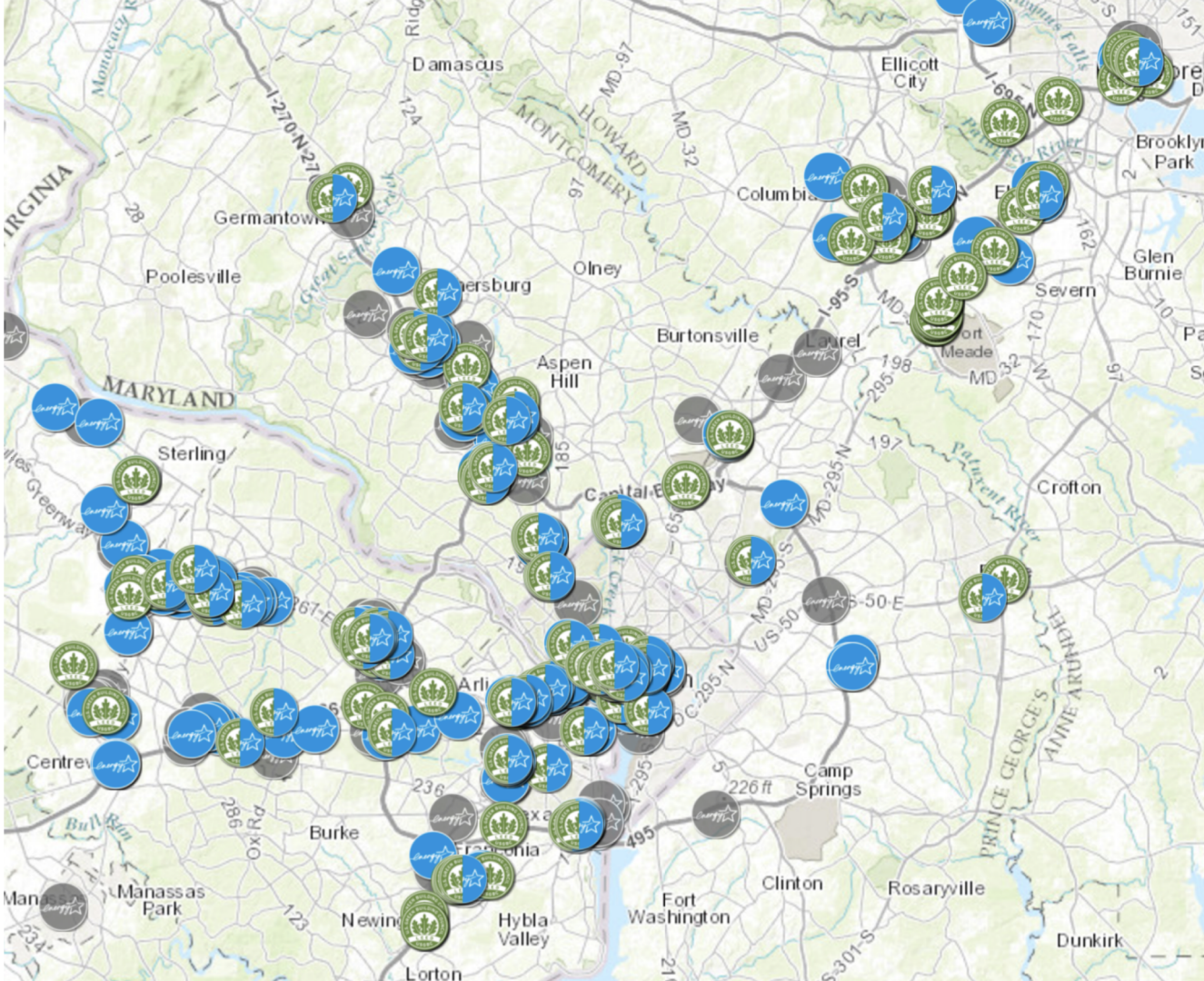
Efficiency



Data: LEED 2009 BD&C
Virginia only from GBIG.org

Results

Location



Results

Materials

Construction
waste diversion
>90% of projects

Reuse of structure
12% of projects

Data: LEED 2009 BD&C
Virginia only from GBIG.org

Results

Water

Water efficient landscaping

Average of -91%

Indoor fixture efficiency

Average of -26%

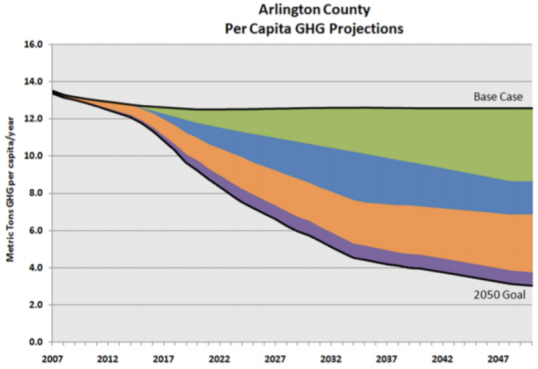
Data: LEED 2009 BD&C
Virginia only from GBIG.org

Challenges & Opportunities

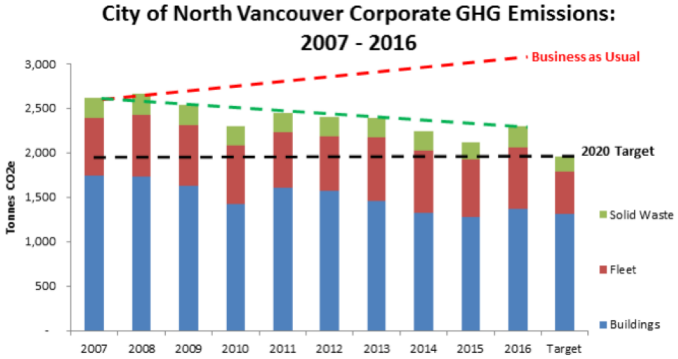
- Expectations are changing
- Clean, distributed energy is cheaper
- Energy use ≠ emissions

Expectations for Communities

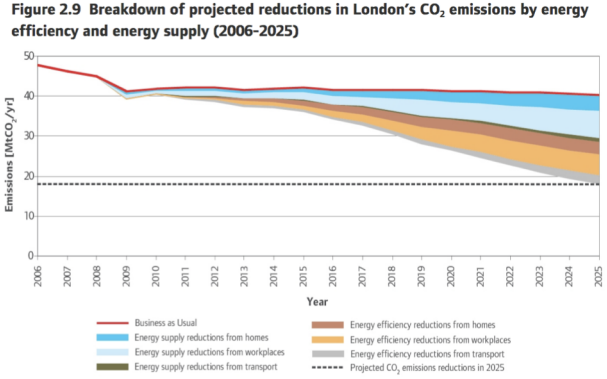
Arlington, VA



Vancouver, BC

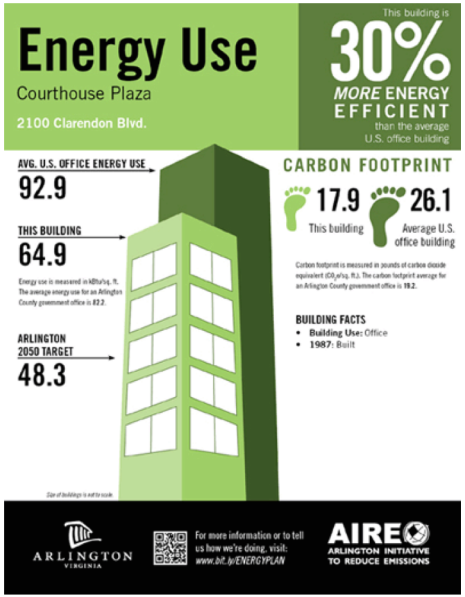


London, UK



Expectations for Buildings

Arlington, VA



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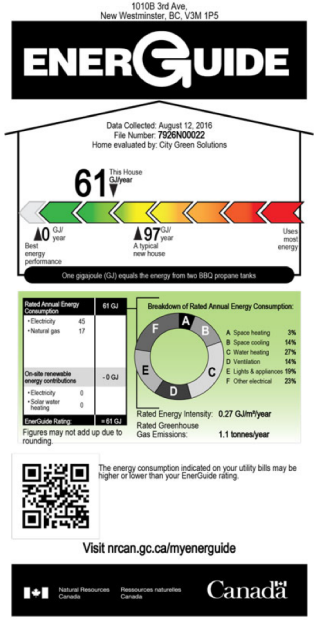

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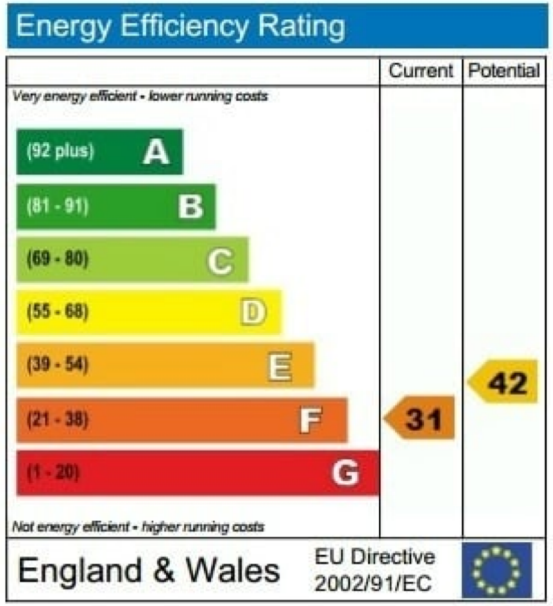
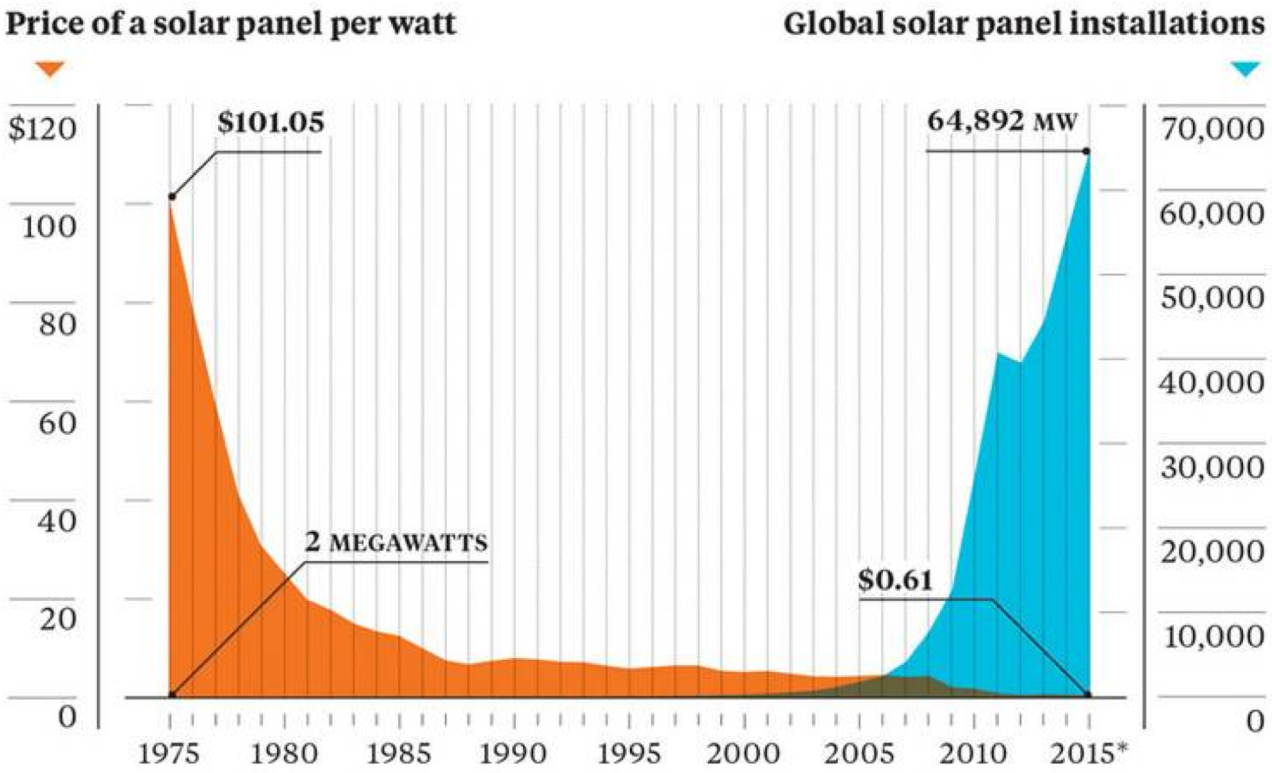
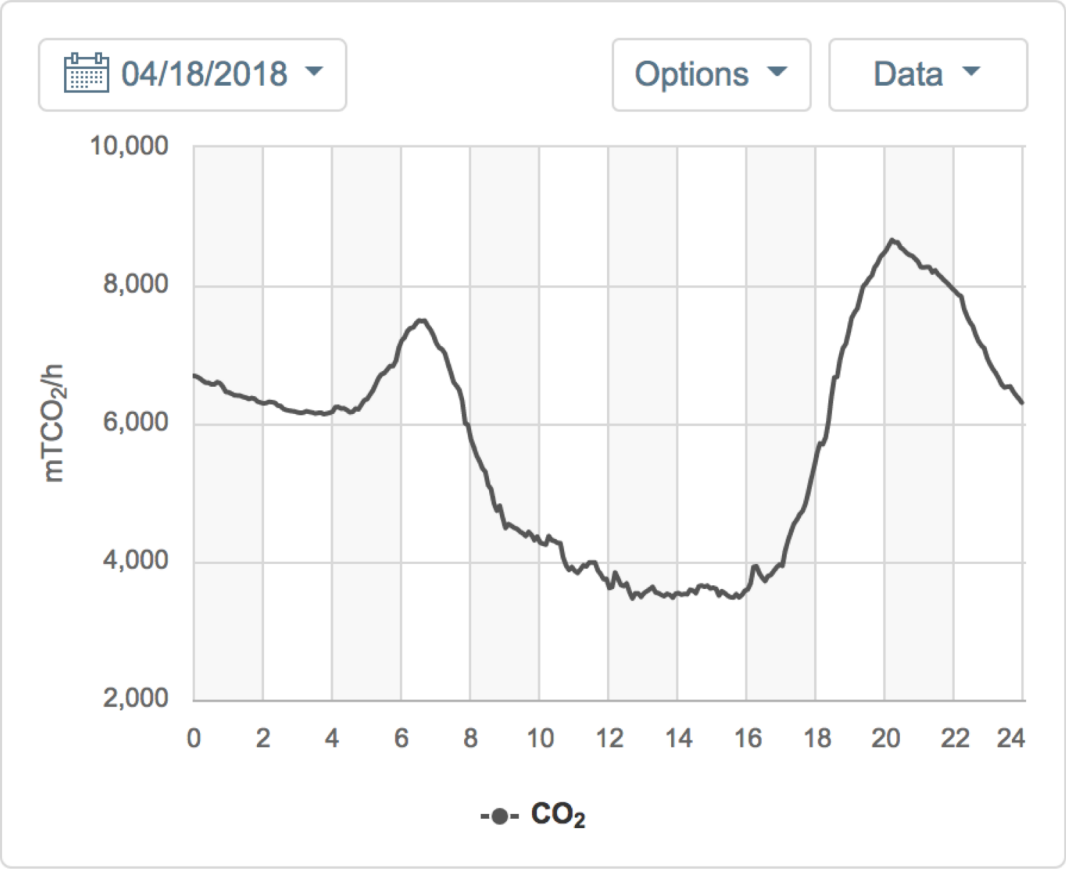


More Clean, Cheaper Clean Energy



Ducks!

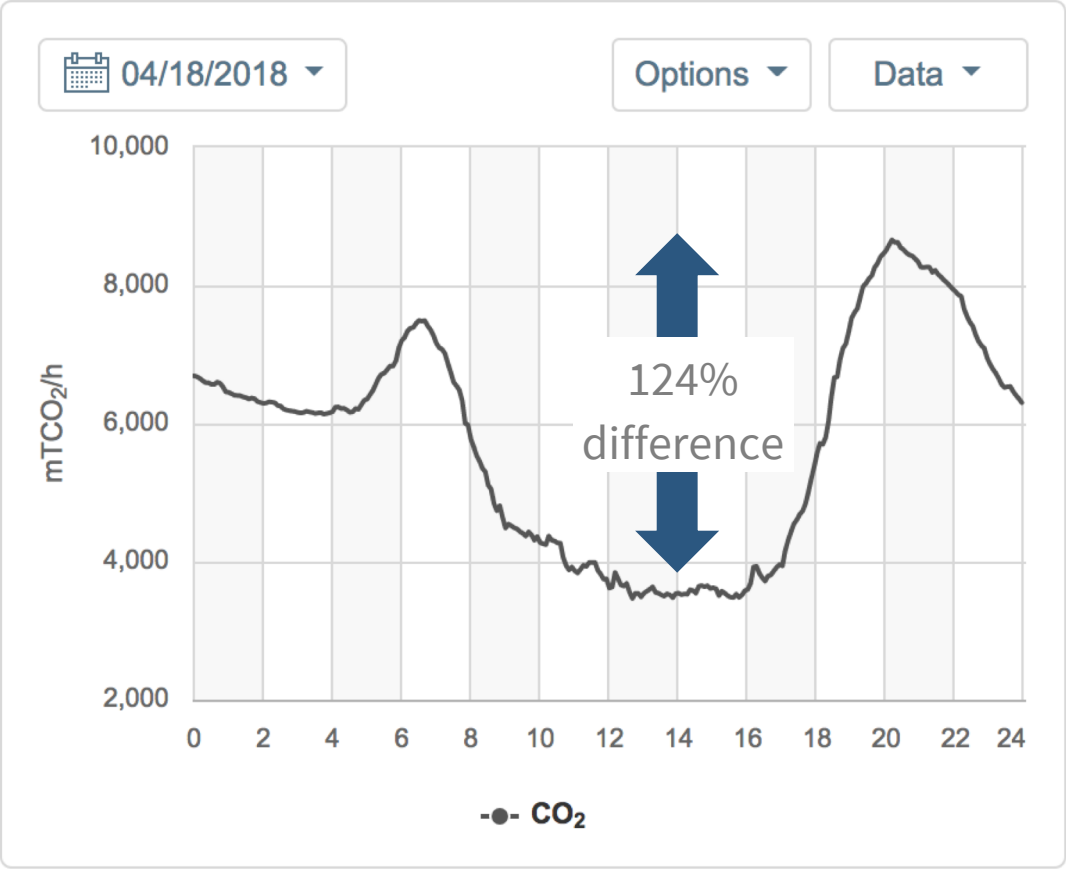
Decoupling energy use from emissions



California ISO

Ducks!

Decoupling energy use from emissions



California ISO

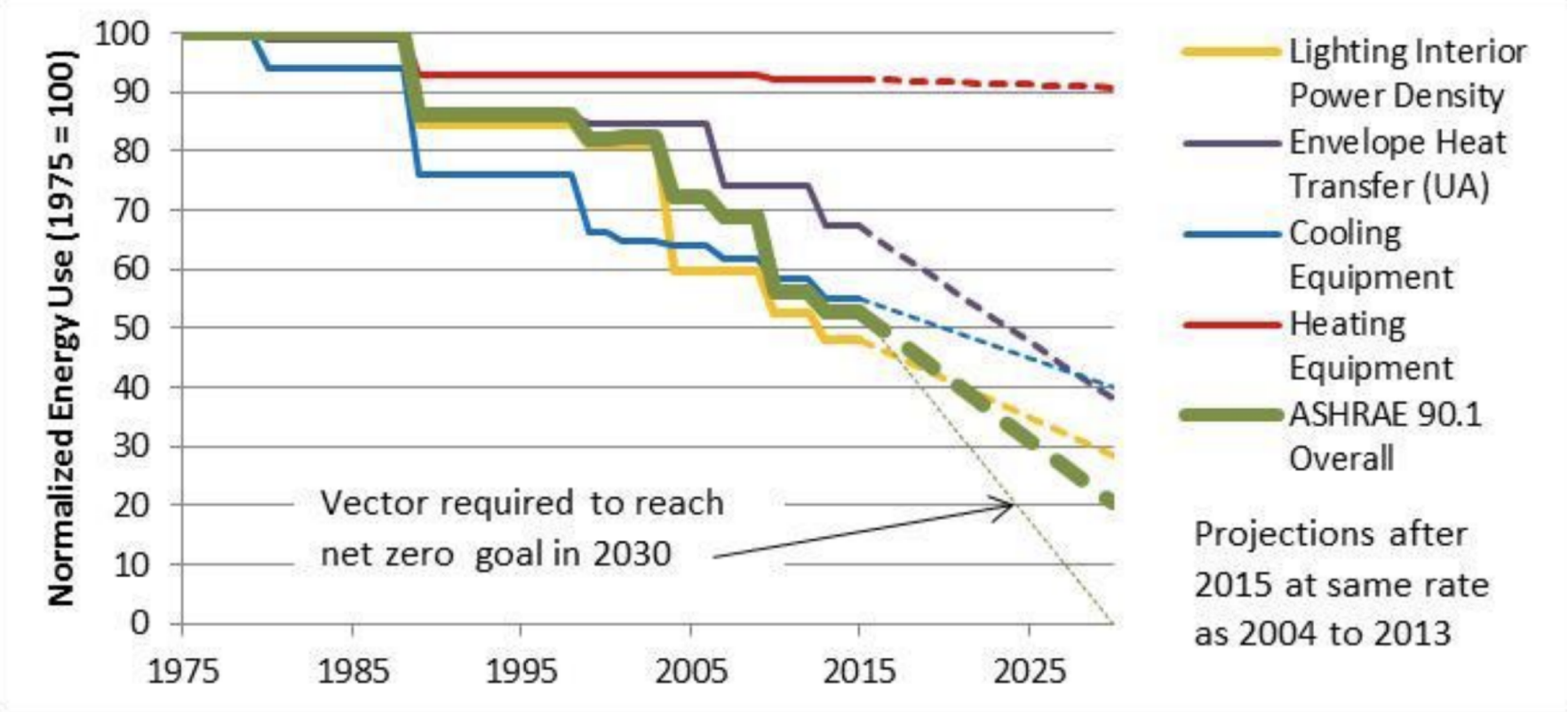
Where are we going in the future?

A New, Emerging Paradigm

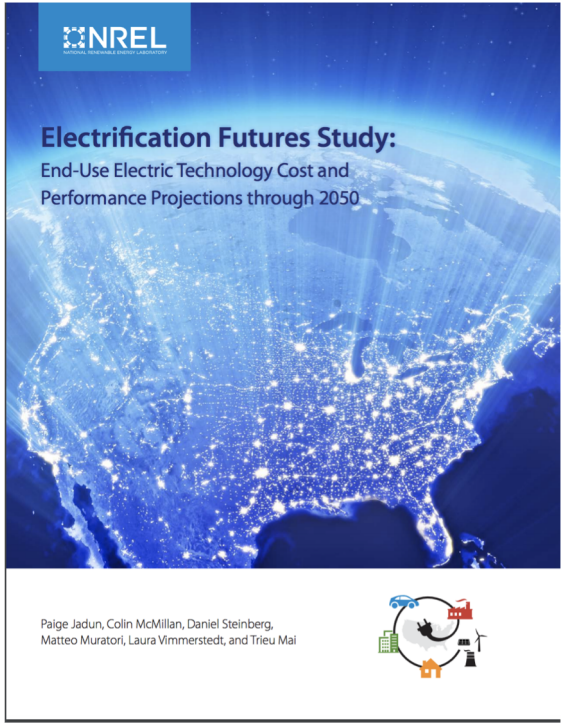
- More efficiency
- More electrification
- More clean energy
- More dynamic energy supply
- More focus on life cycle emissions

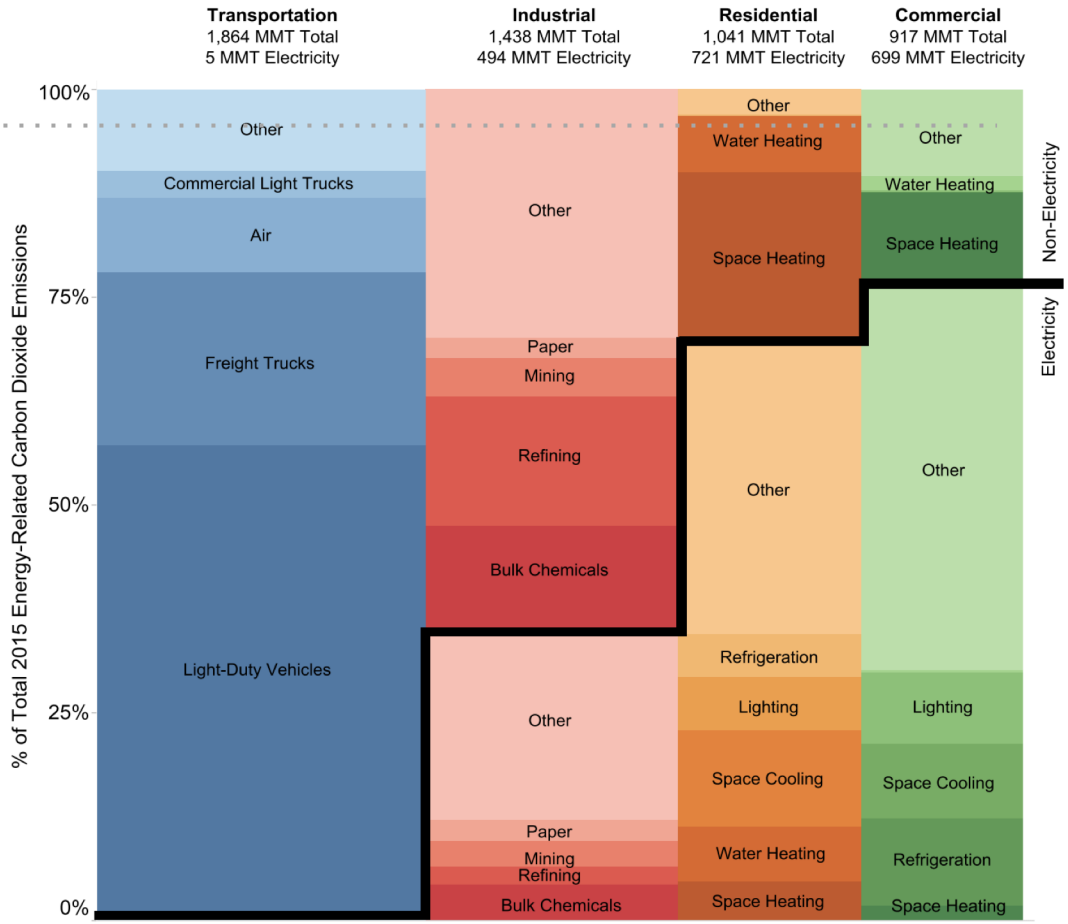
Dramatic acceleration in decarbonization.

More Efficiency



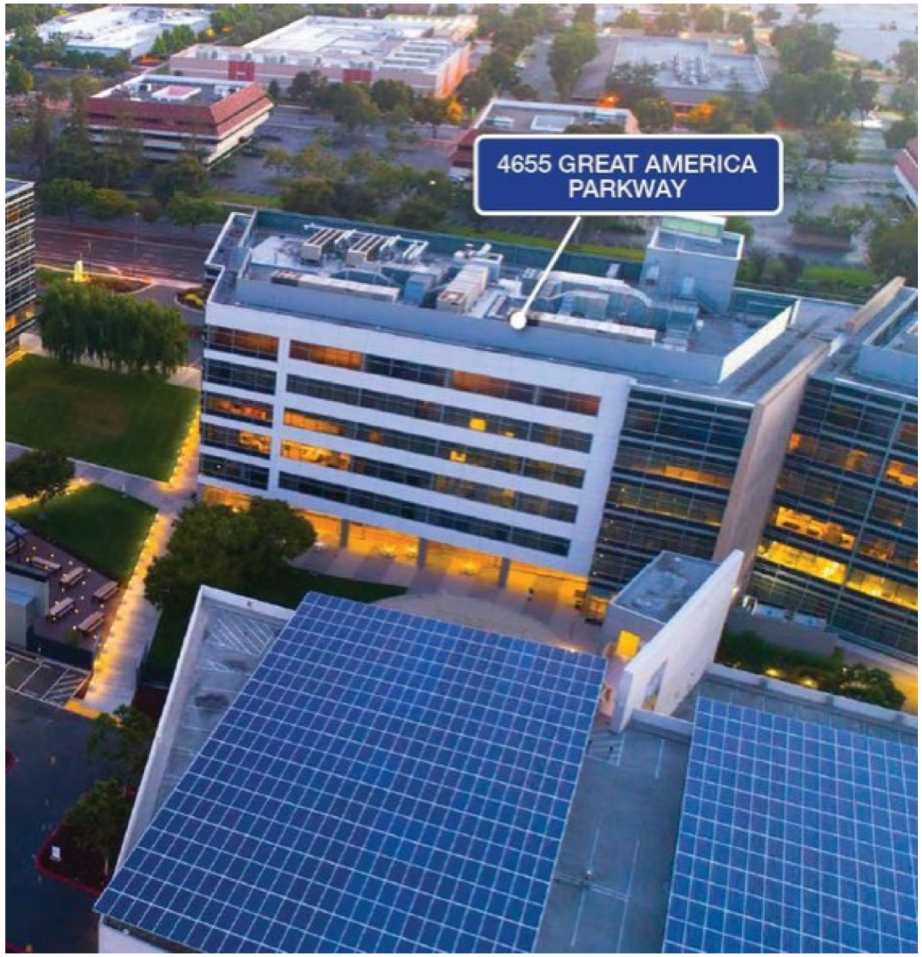
More Electricity





More Projects

Large-scale, distributed energy generation



PGIM

More Corporate Purchasing

Digital Realty Announces Expansion of Industry-Leading Renewable Energy and Sustainability Initiatives

December 05, 2017
Download this Press Release (PDF 126 KB)

Company announces addition of 96 megawatts of renewable energy capacity in Ashburn and Chicago

Kilroy Realty Announces Commitment to Achieve Carbon Neutral Operations by Year End 2020 at the Global Climate Action Summit

Published: Sept 14, 2018 12:16 p.m. ET

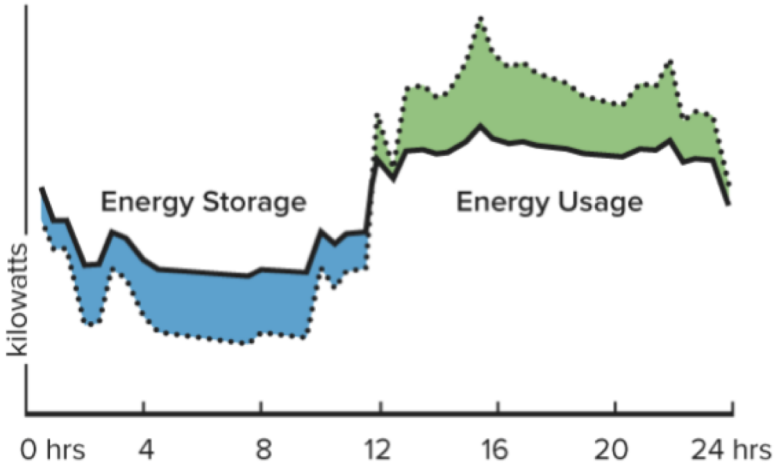
Aa

IRON MOUNTAIN DATA CENTERS OFFER CUSTOMERS 100 PERCENT RENEWABLE ENERGY

Shift to wind power enables company to offer cost stability and "carbon-neutral" data center services

More Interactive Loads

Demand management, storage, and load shifting technology can reduce demand charges and emissions.



More Lifecycle Analysis

Construction and building materials contribute to embodied energy and carbon.

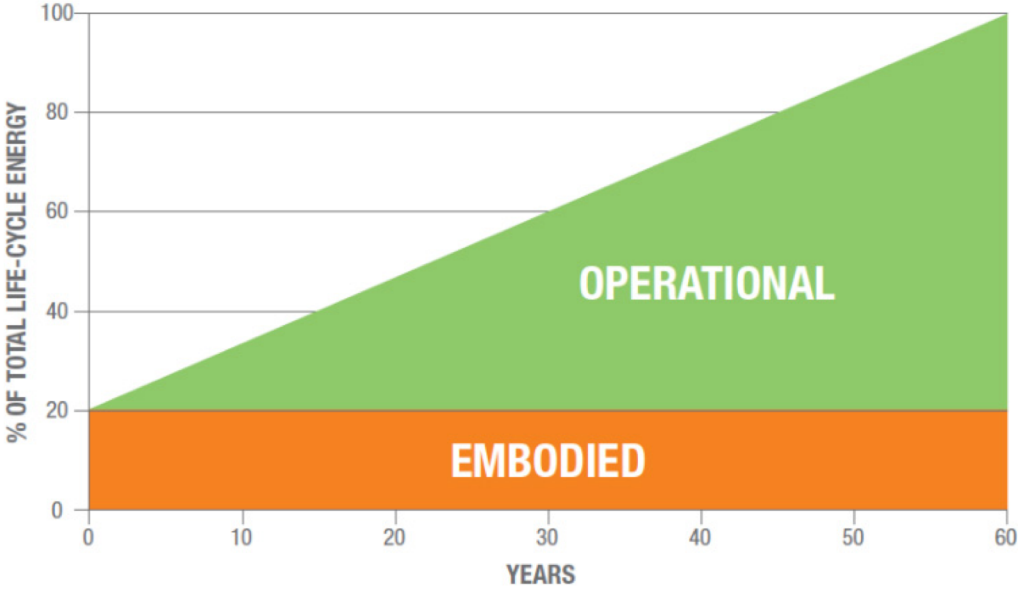
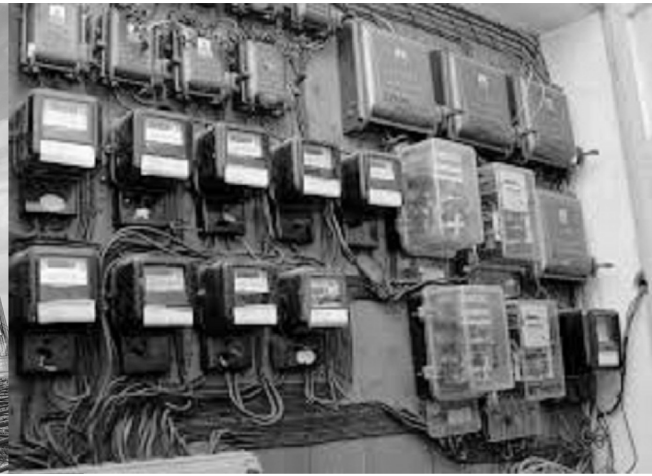


Figure 1: Typical breakdown of embodied and operational impacts during 60-year building life.

What can you do now?

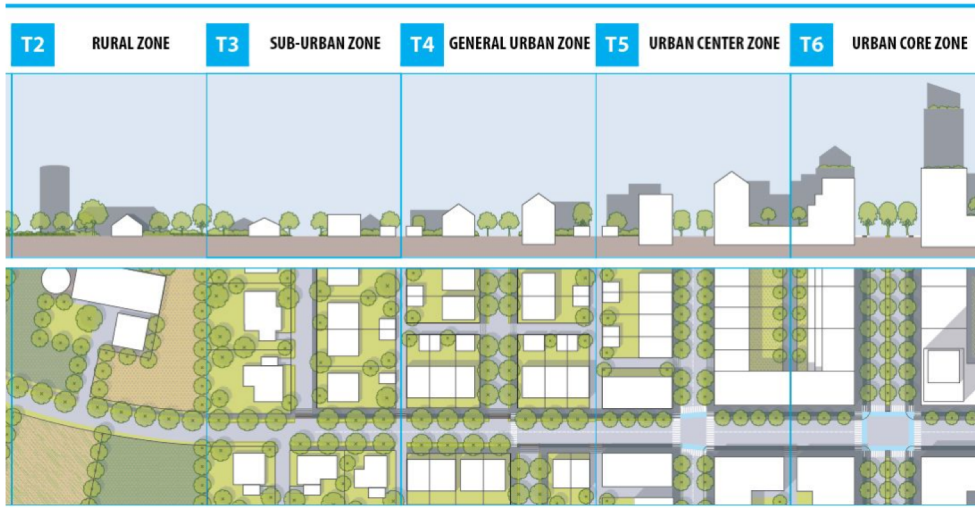


5 Opportunities for Action

1. Focus on the fundamentals
2. Buy clean, renewable energy
3. Use rating systems effectively
4. Measure operational performance
5. Prepare to be a good “grid citizen”

#1 Fundamentals

Size, density, and location are the fundamental determinants of GHG emissions.



#2 Clean Energy

Buy clean, renewable energy, now.

University Announces Massive Wind Power Purchase

15-year buy is a key part of BU's Climate Action Plan

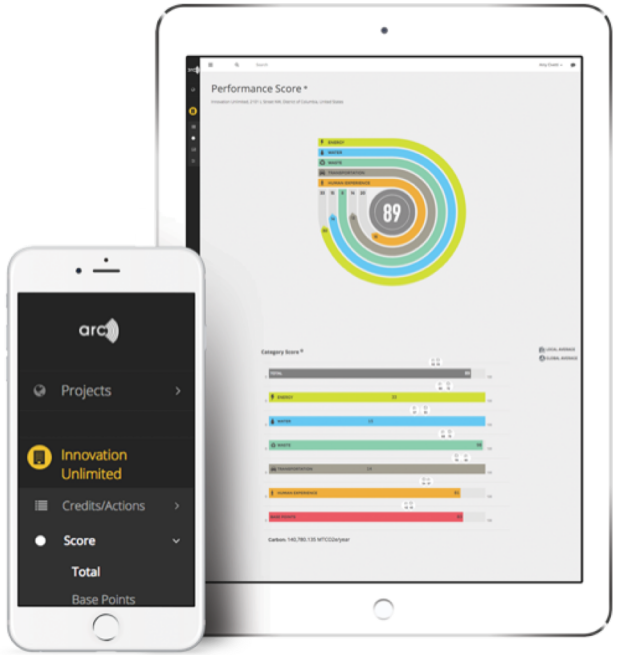
A Midwest wind farm similar to this one will get essential investment from BU as part of the University's Climate Action Plan.

#3 Rating Systems

Use tools to achieve emissions reduction goals.

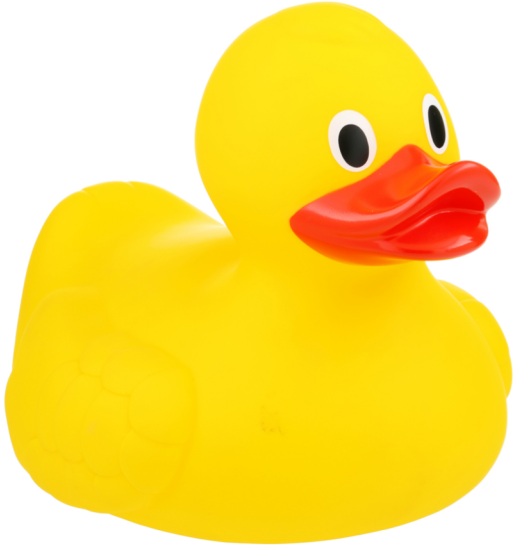
#4 Operational Performance

Track and improve performance over time.



#5 Grid Citizenship

Understand and prepare to work with a dynamic grid.



More

Resources to explore and follow.

USGBC.org

ArcSkoru.com

GRESB.com

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