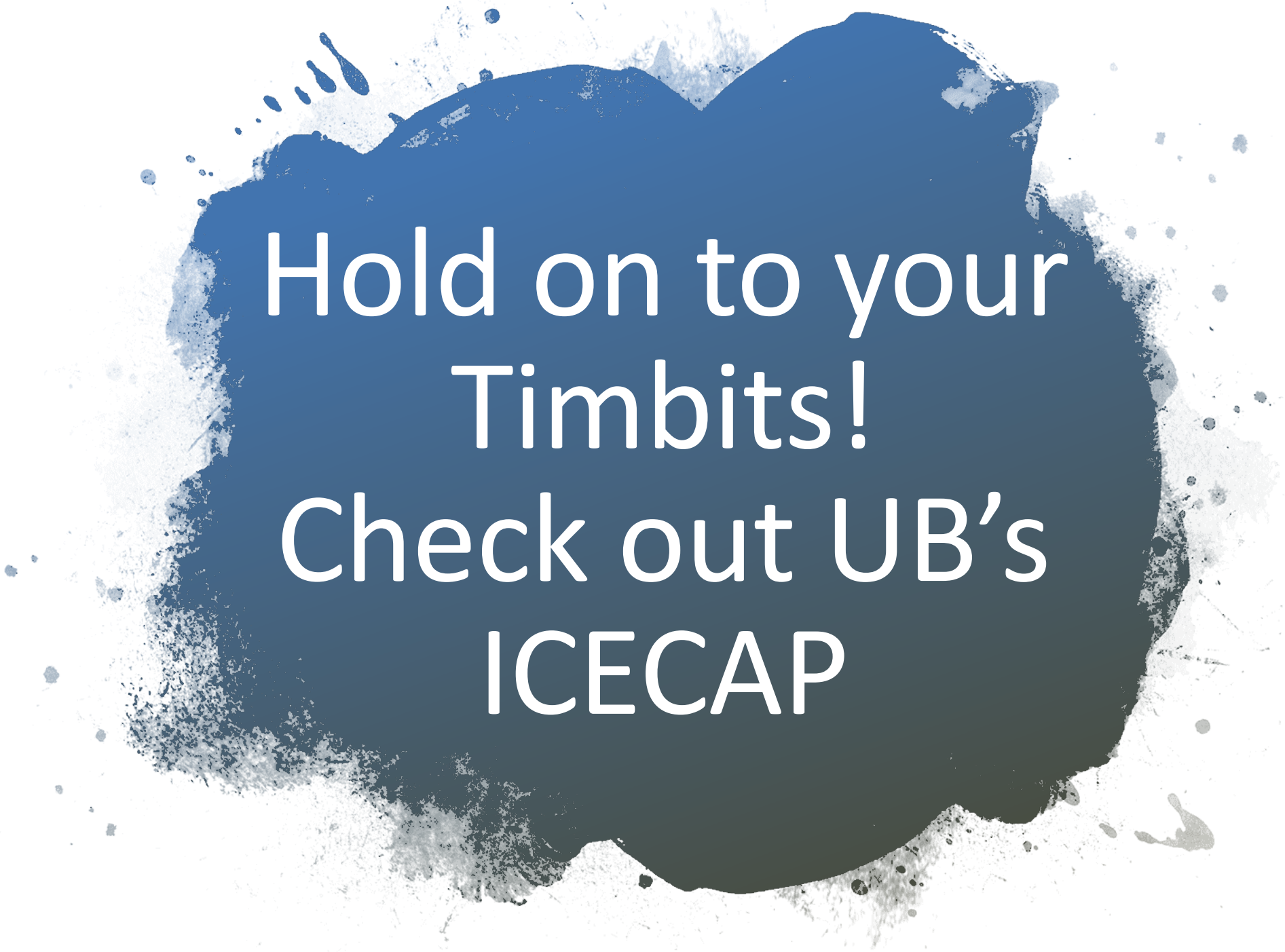

Hold on to your Timbits!
Check out UB’s ICECAP

Responding with Poll Everywhere

How is your day going?

Table of Contents

Introduction (Why)

- Phasing out coal power by 2020
- Mandate 50% renewable power by 2030
- Mandate 100% clean power by 2040
- State Agencies to Decarbonize their Investment Funds and Investment in Clean Energy
- Increase Carbon Sequestration and Meet the US Climate Alliance Natural and Working Lands Challenge
- Prohibit Use of Plastic Bags

NY “State of the State” Sustainability Goals

100% renewable electricity supply by 2025 (50% by 2020)

25% building energy consumption reduction by 2030.

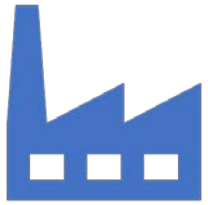
0% waste in all campuses by 2030

Begin phasing out single use plastics by 2020

Eliminate all single use plastics on SUNY campuses by 2025

50% greenhouse gas emissions reduction by 2030 - 90% by 2050 (from 1990 levels, Executive Order 166)

Framework for a More Sustainable SUNY Goals



Source 100 percent of its electricity from zero-net-carbon sources, as soon as possible

All new SUNY buildings will be designed to achieve zero-net carbon emissions

Invest in deep-energy retrofits and energy efficiency while performing critical maintenance

2018 State of University System: Sustainability Goals

Grow where we've already grown

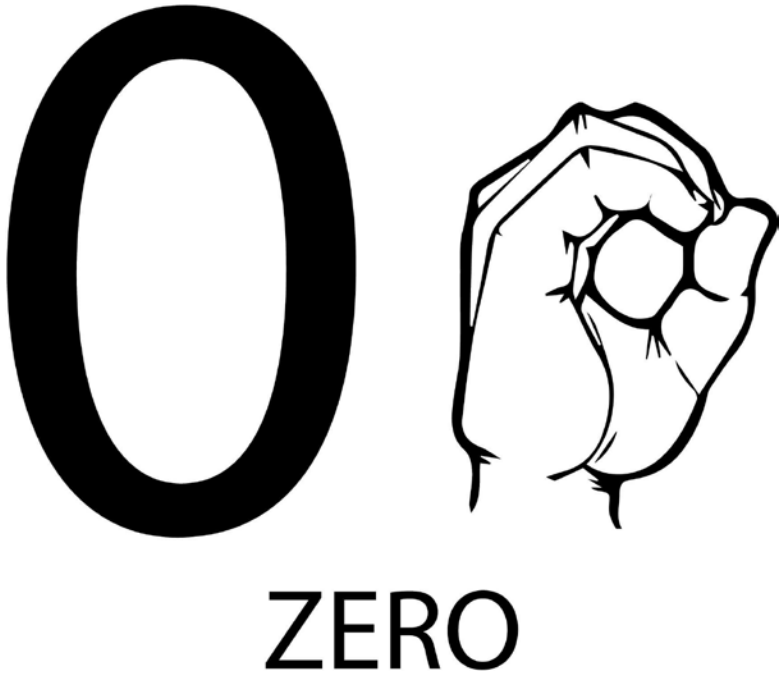
Build and protect walkable communities

Better connect our region by diversifying our transportation options

Protect Farm land, parks and natural areas

Maintain fiscally sound local governments

One Region Forward



University at Buffalo Goal:

Zero Carbon By 2030

UB’s Greenhouse Gas Footprint (What)

Updates to UB's 2009 CAP with ICECAP

01

MORE GRANULAR CARBON DATA

02

ONGOING CARBON DATA CAPTURE IN AN ONLINE PLATFORM

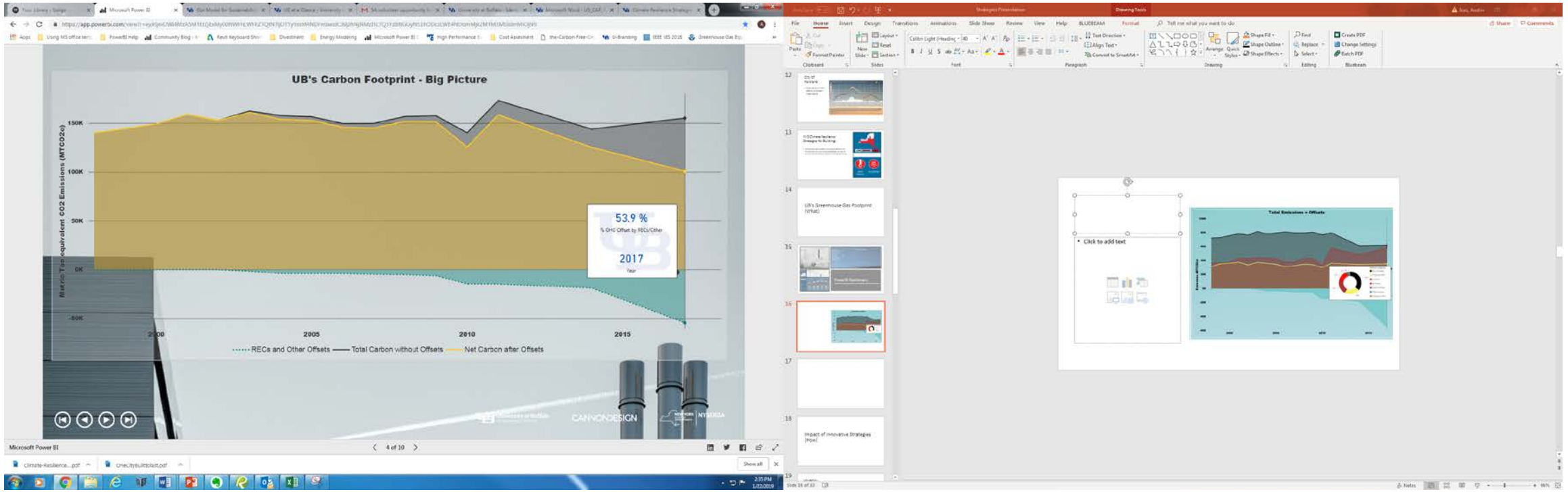
03

INTERACTIVE DASHBOARD SERVES AS A "TRACKER" AND A "PLANNER"

04

ACCOUNTABILITY AND CAMPUS ENGAGEMENT

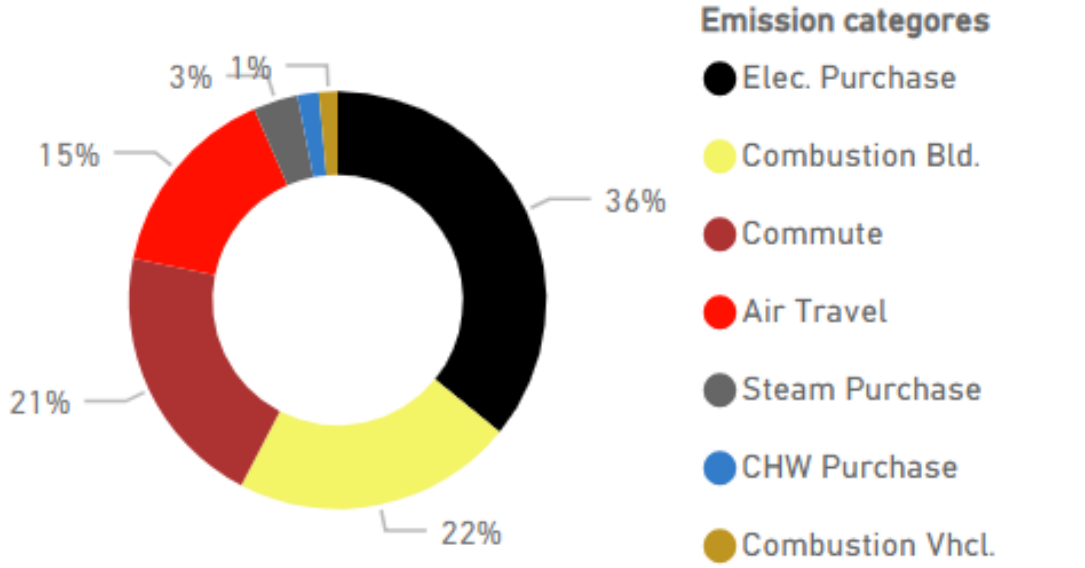
UB ICECAP: Big Picture

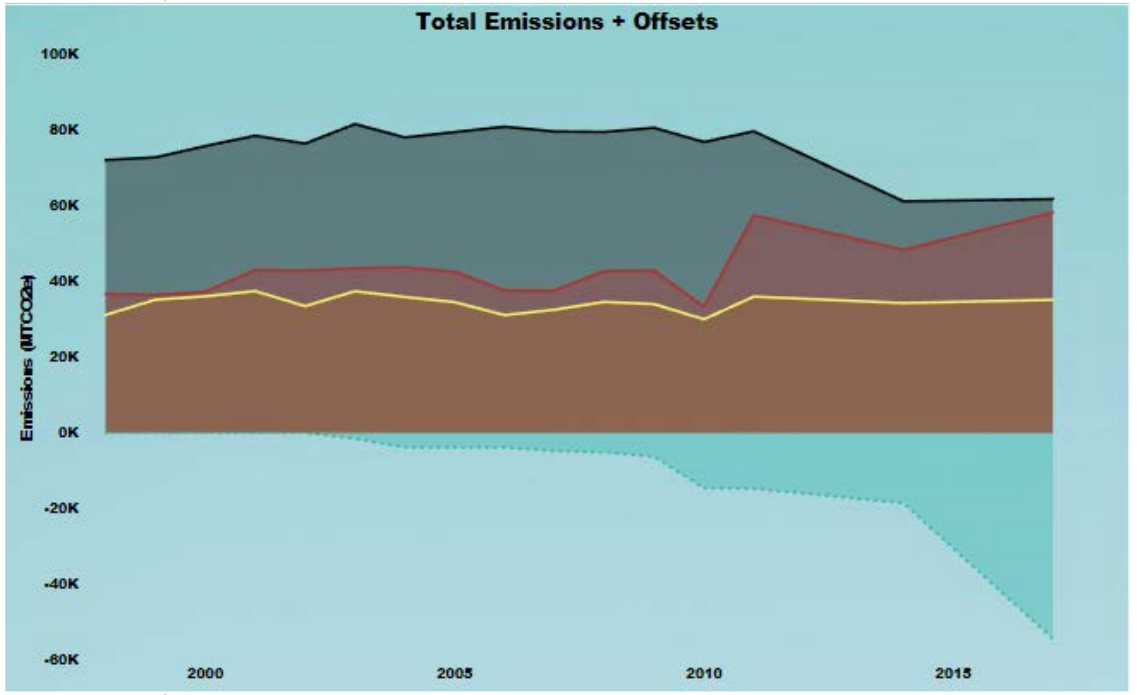


UB ICECAP (2017)

- 36% Emissions due to Elec Purchase
- 22% due to onsite Combustion
- 21% due to commuting
- 15% due to air travel
- Remaining 6%
  - Steam Purchase
  - Chilled Water Purchase
  - Onsite combustion vehicles

36% Commuting and Transportation





Impact of Innovative Strategies (How)

ICECAP Strategy Breakdown

Building Energy Efficiency	• Benchmarking/monitoring, lighting upgrades, space use management, LEED Standards
Renewable Energy	• Onsite renewable, building solar, geothermal, PPAs, offsite generation
Transportation and Commuting	• Increased public commuting, parking policies, offsetting air travel
Materials	• Green procurement, recycling policies, waste audits, composting, waste to energy
Behavior, Education and Community	• Studies/classes on education, research focused on sustainability, community engagement

What are the IMMEDIATE/SHORT term (now-2025) strategies to reduce UB's greenhouse emissions?

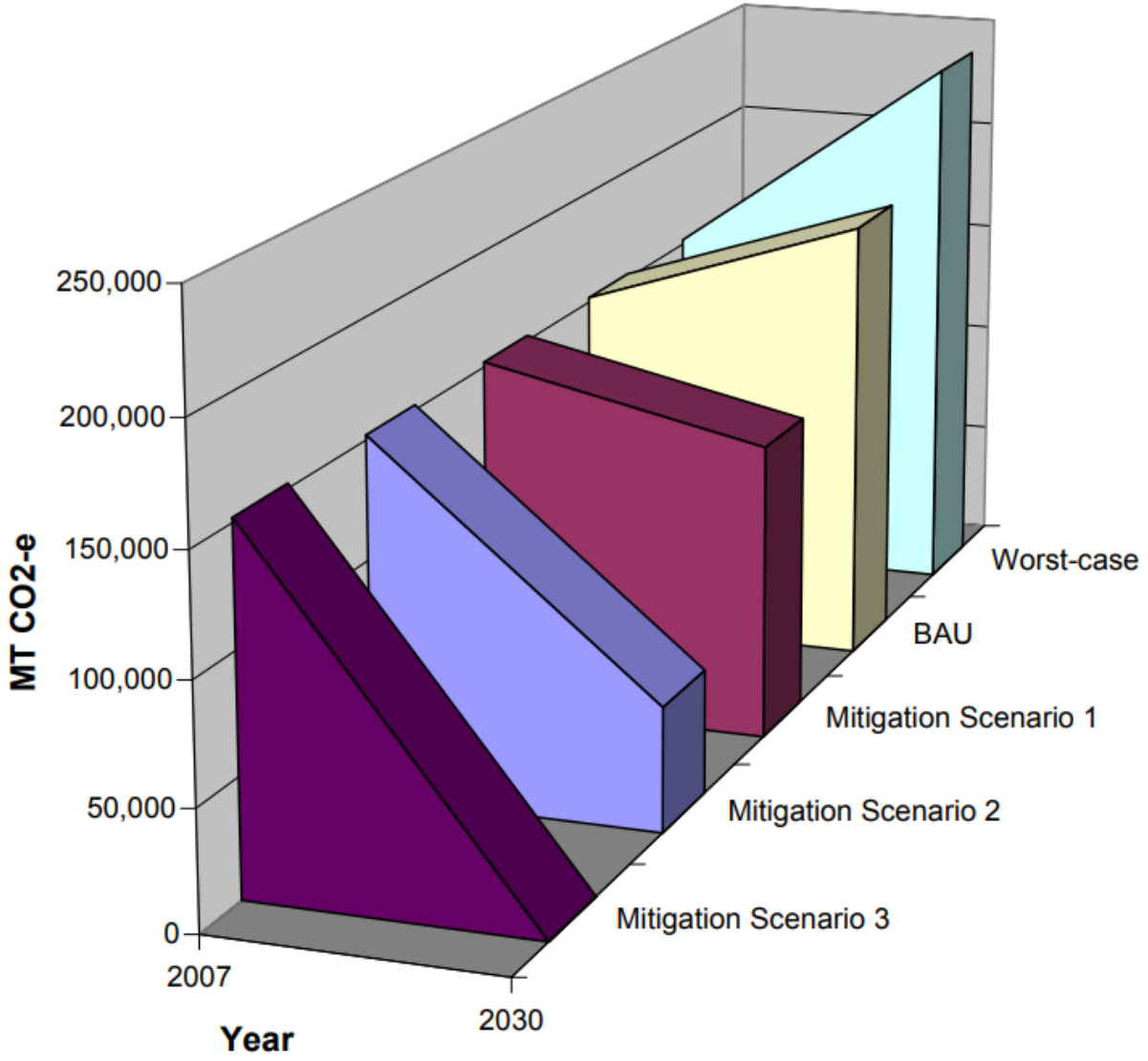
What are the MEDIUM term (2025-2035) strategies to reduce UB's greenhouse emissions?

What are the LONG term (2035-2050) strategies to reduce UB's greenhouse emissions?

Thank You

University at Buffalo – 2009 CAP

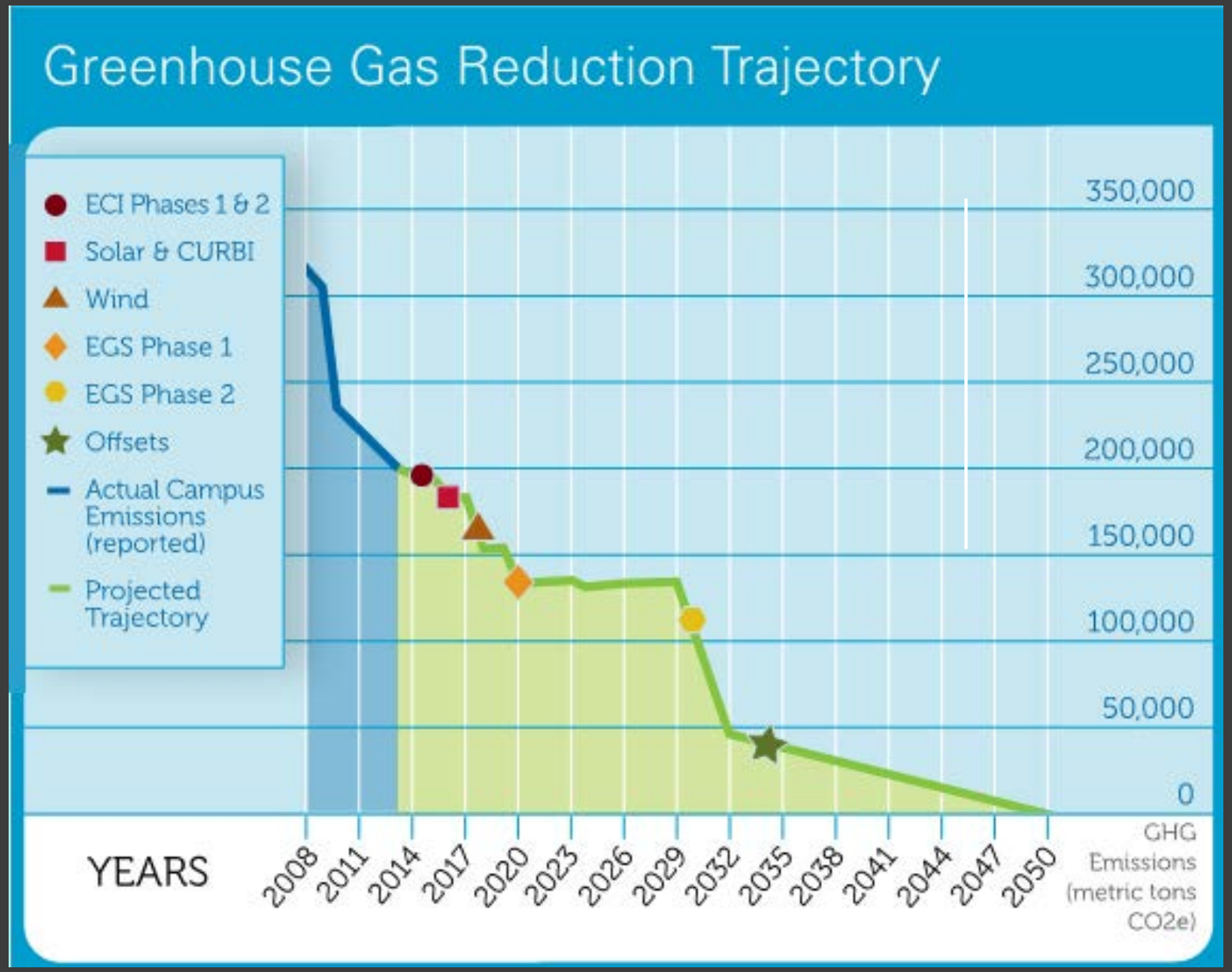
- Incremental Progress not clearly shown
- Areas unclear
- Not clear which specific strategies causing difference
- Responsible parties/strategies not shown

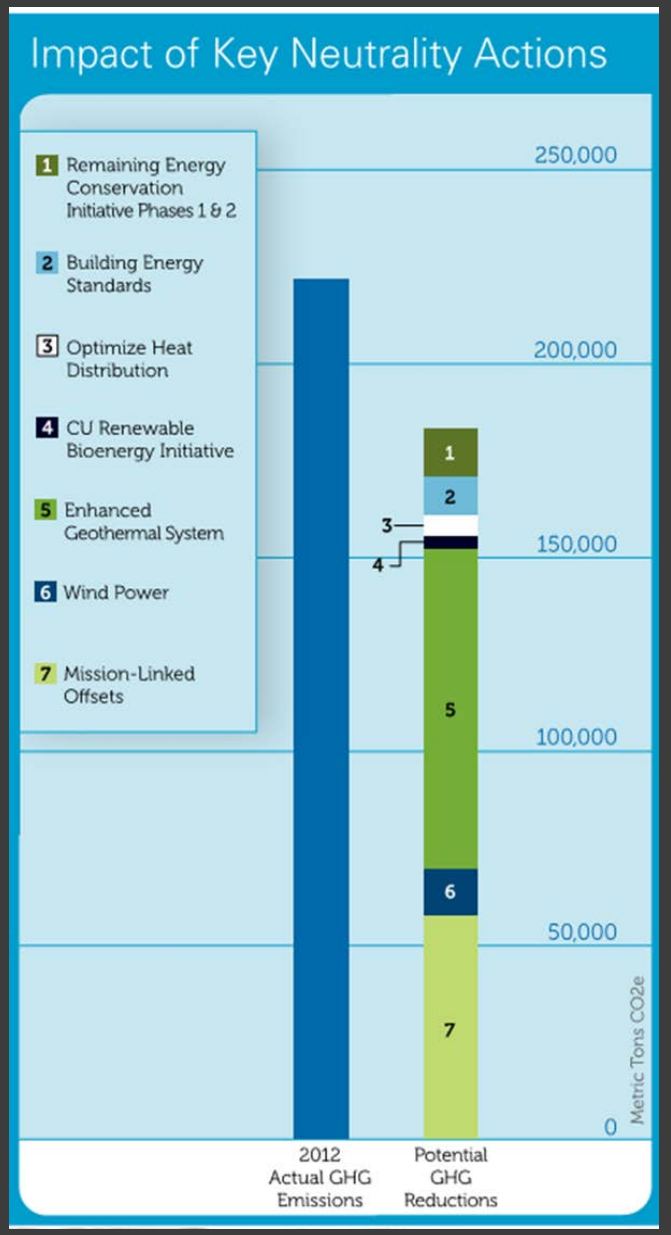


UB-2009 Action Plan

- A look into the 2009 Action Plan emissions projections
- Link to PowerBI timeline

Carbon Mitigation Strategies Other Universities

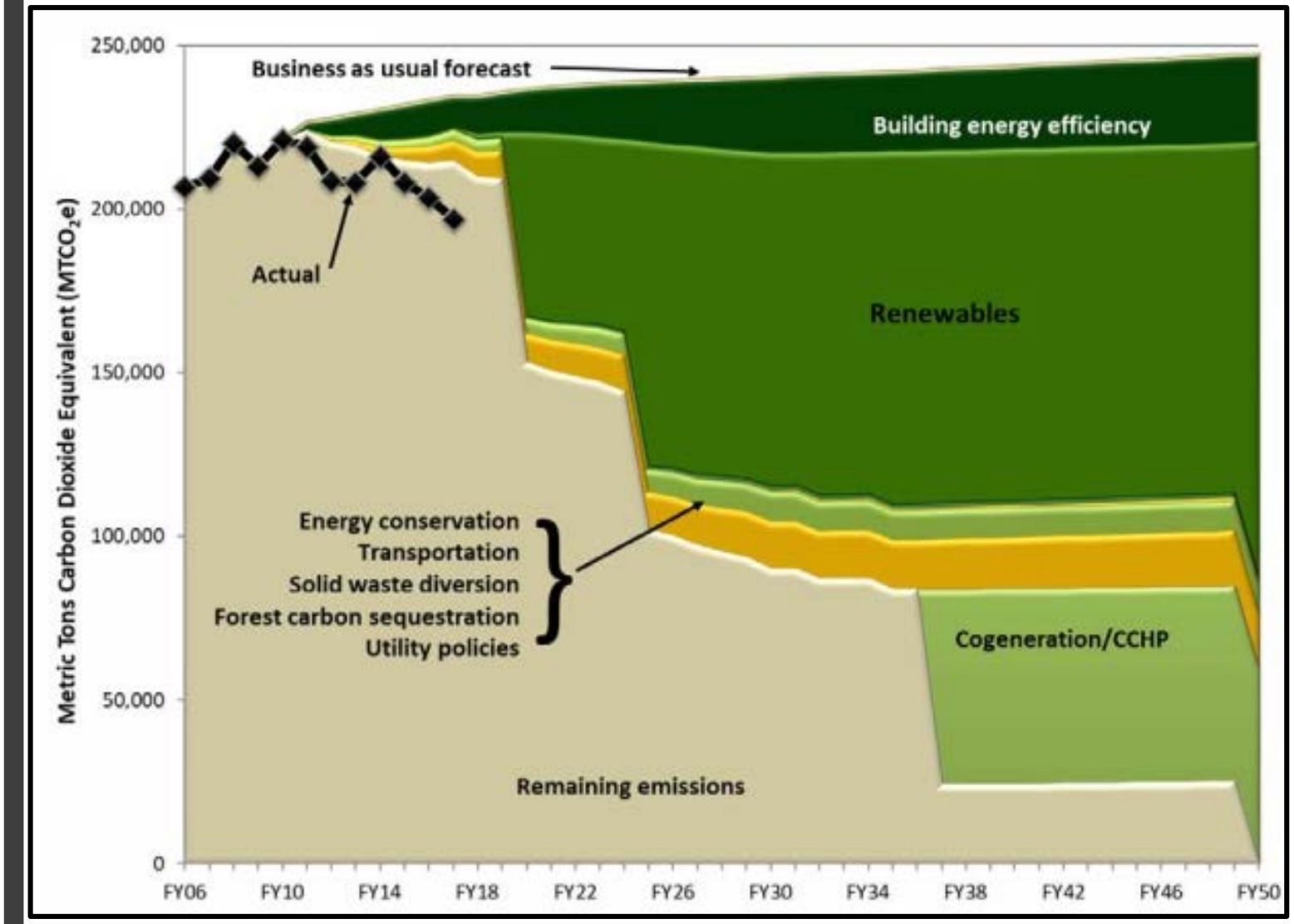




Cornell University

CSU – 2018 CAP

- Bundled in short (0-7 yrs), medium (7-20 yrs) and long term (>20 yrs) packages
- Renewables appear to be large source of carbon reduction
- Co-gen also responsible for significant reduction in long term



CSU – 2018 CAP

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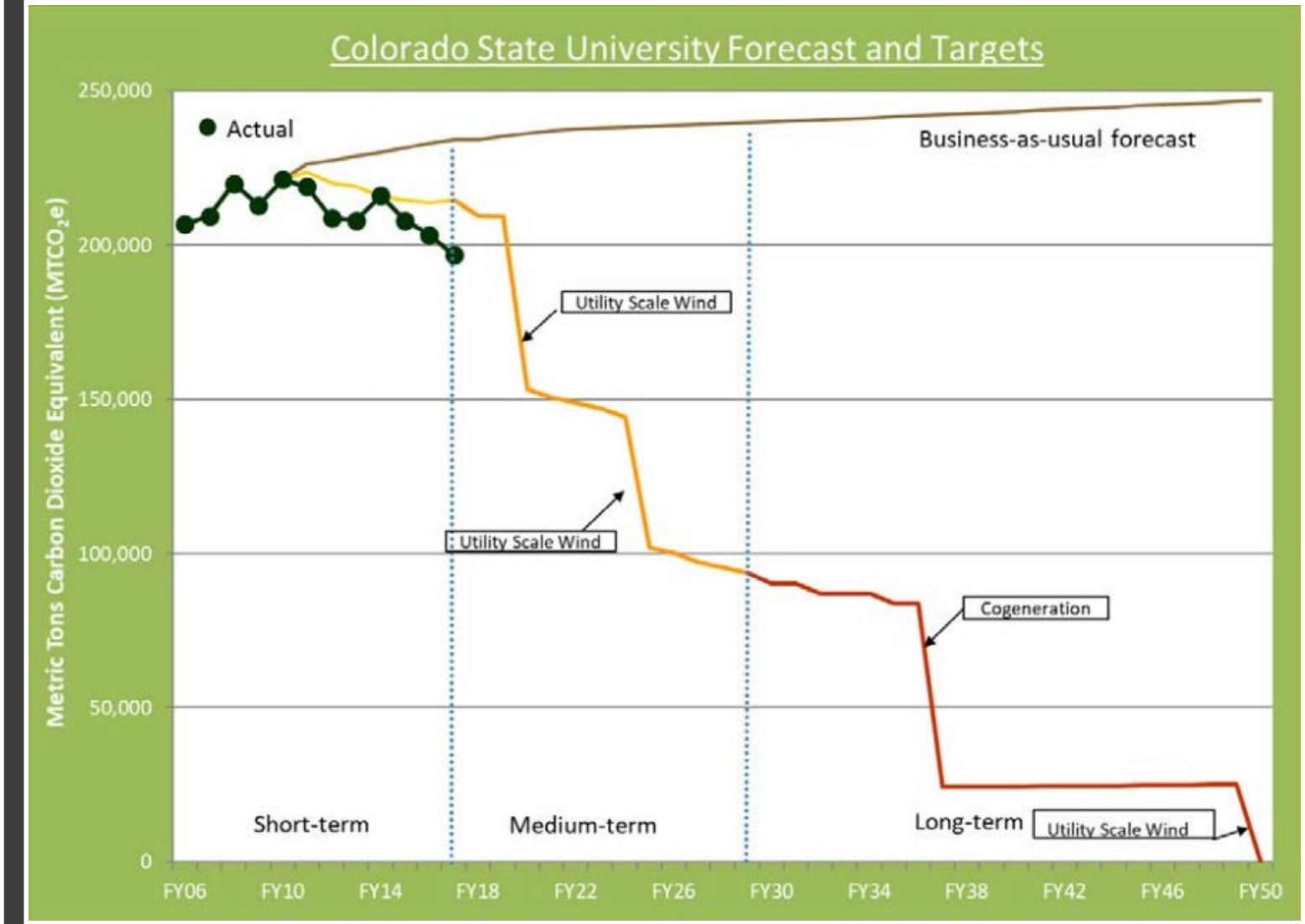
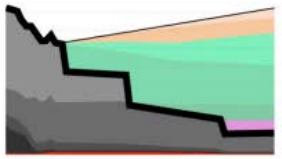
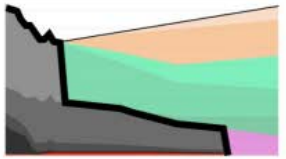
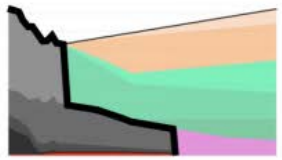


Boston University

- Separate Plans Similar to UB – 2009 CAP
- Carbon neutrality date is 10 yrs later than UB
- Strictly Scope 1 and 2 emissions
- Pilot studies to be held to better understand scope 3 emissions
  - Transportation
  - University's influence on individual decisions

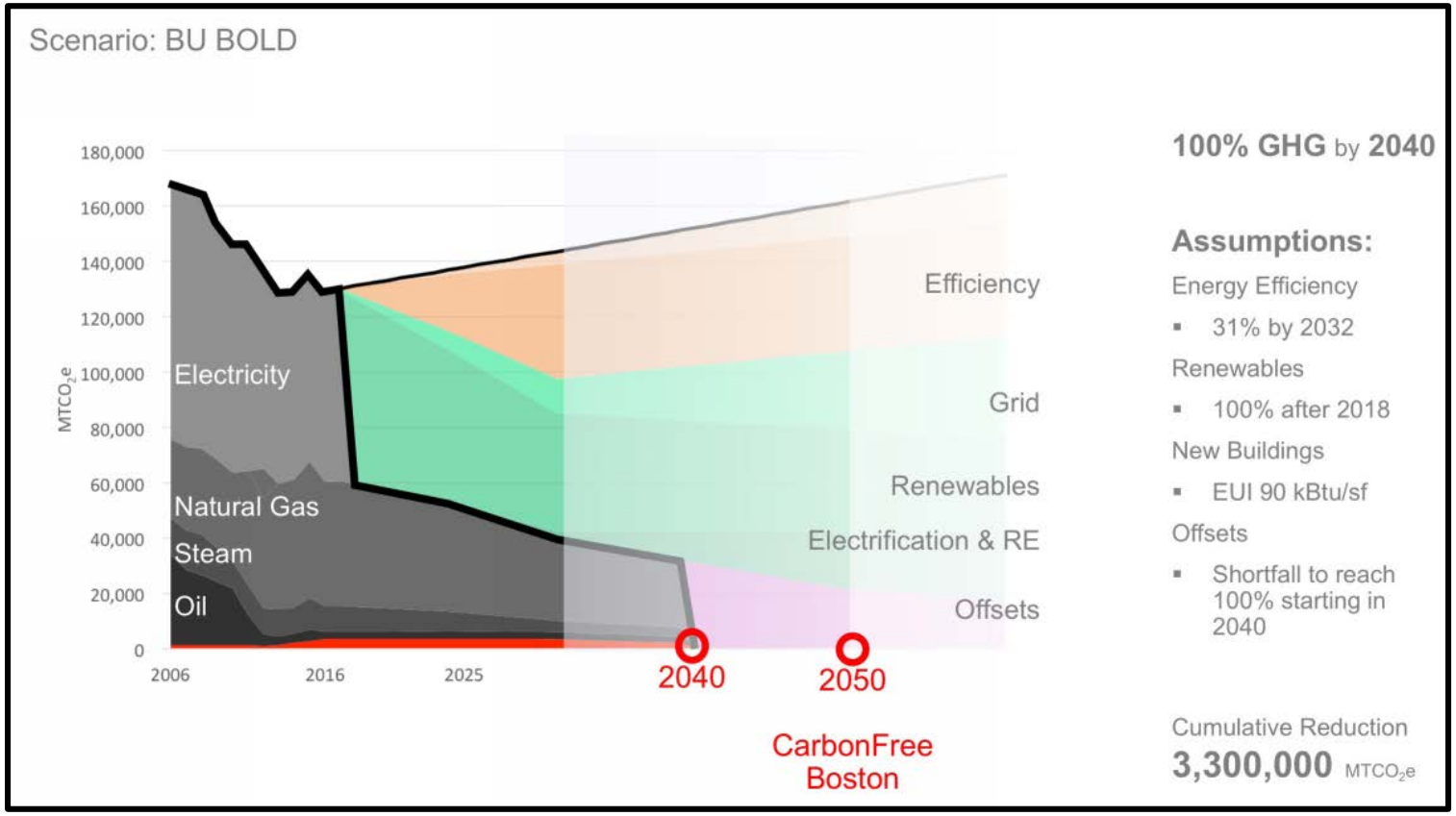
ENERGY: RECOMMENDATIONS

Strategies	BU Good	BU Better	BU BOLD
Goal (GHG reduction)	80% by 2050	100% by 2050	**100% by 2040**
GHG Cumulative Reduction MTCO2e through 2050	2,100,000	2,800,000	**3,300,000**
Relative to City of Boston	Falling short	Aligned with goal	**Ahead of goal**
Energy Efficiency Impact % GHG Reduction	17% by 2050	31% by 2042	**31% by 2032**
Energy Efficiency Strategies	Metering, Monitoring & Verification LED Lighting & Controls Existing BAS Optimization BUMC Labs Program	Add: CRC Conversion to Digital Controls Rooftop HVAC Optimization Dorm Energy Controls Optimization	Accelerated Energy Efficiency Schedule
Renewable Energy	50% until 2030 100% after 2030	100%	**100%**
Electrification & Steam to Hot Water	With natural replacement of aging equipment	With natural replacement of aging equipment	**With natural replacement of aging equipment**

Boston University: BU Bold

- Light Orange: New construction
- Darker Orange: Efficiency improvements in existing buildings
- Light green: Decarbonization of Grid
- Medium Green: Purchase of renewable energy
- Dark green: Electrification of heating of buildings and sourcing with renewables
- Magenta: Certified offsets



Building Resiliency

Boston University Resiliency Study

- Main concern is future flooding of campus and city
- Focuses therefore on flood protection and designing buildings to prevent catastrophic losses due to flooding

FIGURE 10: THE 1% EVENT IN 2070

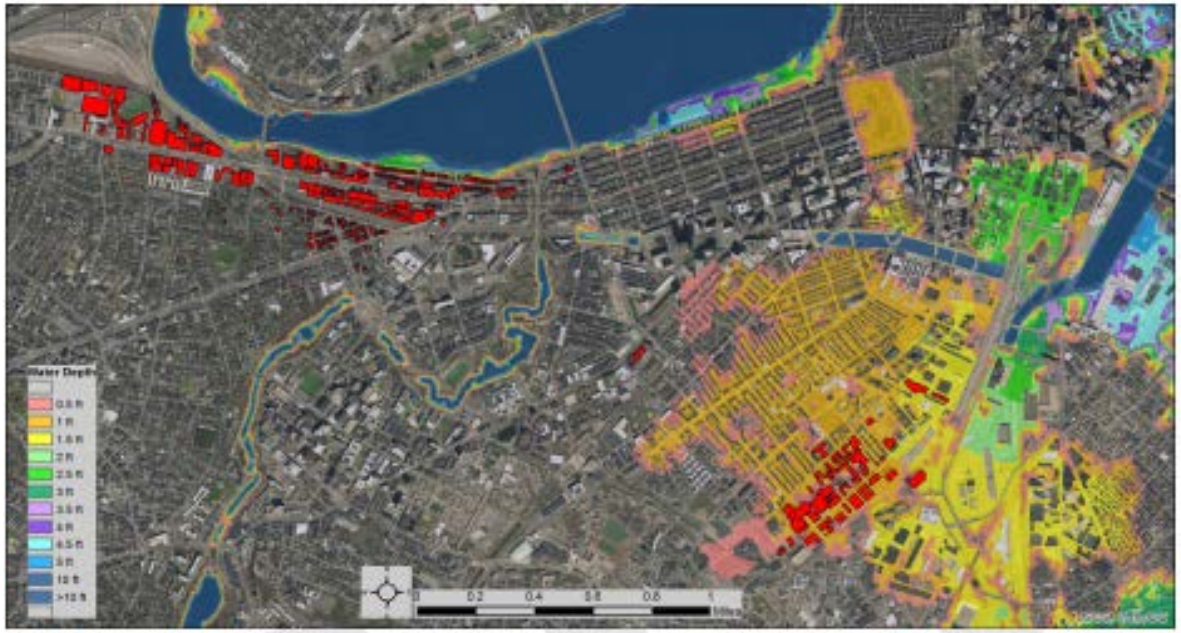
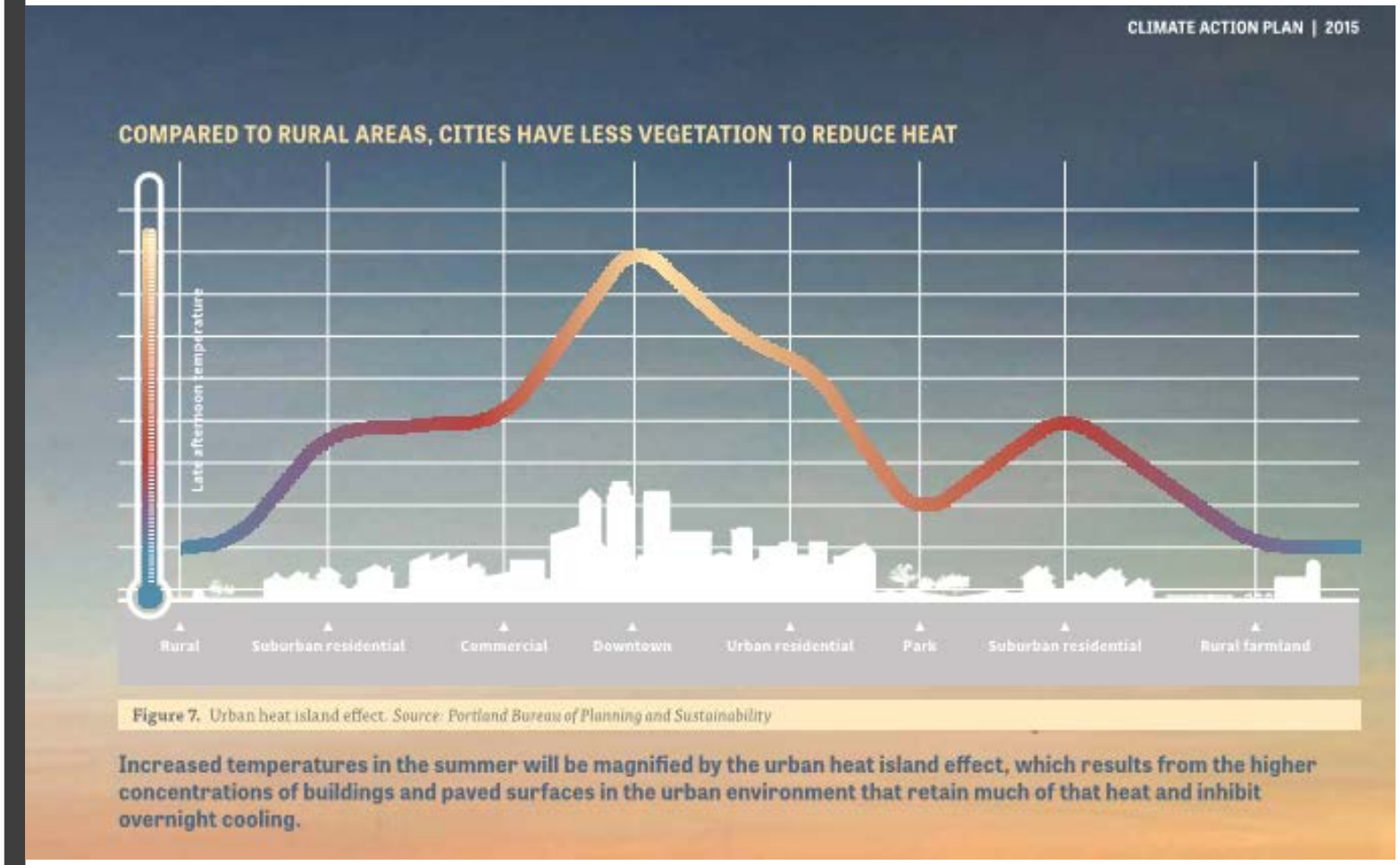
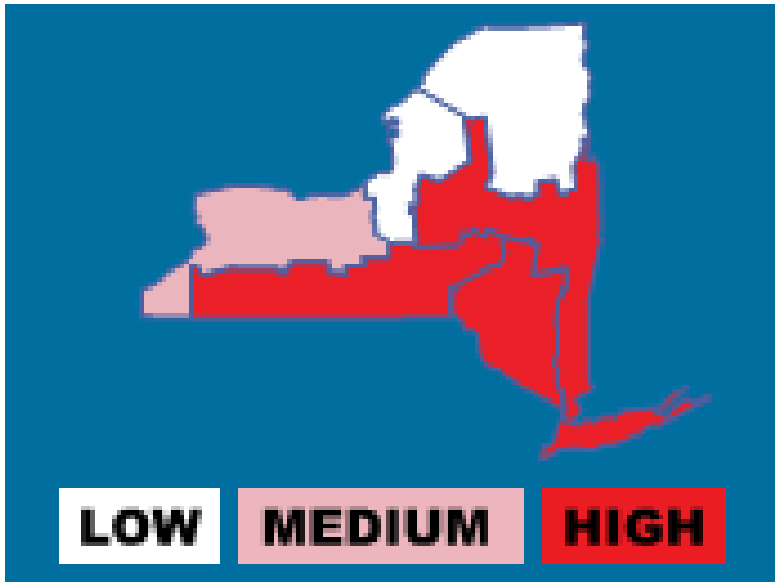


FIGURE 11: THE 0.2% EVENT IN 2070

City of Portland

- Case study on the effects of Urban Heat Island
- Noted in the design of new buildings in the urban environment





Hurricanes/Tropical Storms

Windows
Wind Protection
Emergency Management
Redundant Building Systems

Flooding

Neighborhood Flood Protection
Building Flood Protection
Building Systems Flood Protection
Building Foundations
Green Infrastructure
Gray Infrastructure

Severe Storms

Roof Covering
Roof Drainage

Wildfire

Neighborhood Fire Protection
Building Fire Protection

Heat Waves

Insulation
Neighborhood Development
Urban Heat Island
Building Ventilation
Indoor Air Quality
Passive Building Systems
Active Building Systems
Building Operations
Potable Water Systems
Reclaimed Water Systems

Pest Infestation

Integrated Pest Management

NYS Climate Resilience Strategies for Buildings

- For the Buffalo region strategies with a high priority are:
  - Emergency Management
  - Redundant Building Systems
  - Roof Covering
  - Roof Drainage
  - Insulation
  - Neighborhood Development
  - Urban Heat Island
  - Building Ventilation
  - Passive Building Systems
  - Active Building Systems
  - Building Operations

Building Energy Efficiency

University at Buffalo

- UB Building Dashboard
- Largest Emitters of eCO2
  - North Campus
    - Natural Sciences Complex
    - Cooke & Hotchsetter Complex
    - Spine Complex (Capen, Norton, Talbert)
  - South Campus
    - Biomedical Education Building
    - Biomedical Research Building
  - Downtown
    - COE Bioinformatics & Life Sciences
    - Clinical Translational Research Center

Case Studies by Others:

- CSUEB: Linear reduction in energy use per building to 0 at 2040, replacement of natural gas heating with electric heat pumps (powered by renewables)
- University at Washington: Implementation of site specific energy resources for each building and campus

Renewable Energy

University at Buffalo

- Norton Hall solar array
- Installation of 1MW solar strand
- REC purchases accounting for around 54% of total carbon emissions

Case Studies

- CSU: Building level solar (short), Solar PPAs (Medium), Solar Purchases (Long), Ground source heat pump used on specific portion of campus
- Cornell: Installation of Enhanced Geothermal systems
- CSUEB: Plan to replace all of purchased electricity with renewable sources of energy (mix of on site, low-carbon grid electricity, and an offsite community shared solar model)

Transportation and Commuting

University at Buffalo

- Public transportation
  - NFTA Bus routes
  - Potential of light rail to North Campus
- On campus transportation
  - Stampede and shuttles
- Air travel: 15% of total GHG emissions
- Commuting 21% of total GHG emissions

Case Studies

- BU: Acknowledged uncertainties of calculating scope 3 emissions and recommends further pilot studies to accurately quantify emissions
- CSUEB: incentivize both faculty and staff to use public transportation, offsets for directly financed air travel and student air travel by 100%
- University at Washington: Development of videoconferencing as an attractive alternative to air travel

Materials/Waste

University at Buffalo

- Recycling and Procurement Policies:
  - Recycling
  - Recycled Paper
- Composting throughout all dining facilities
- Percentage of waste used in offsite waste to energy plant

Case Studies

- Cornell University: CURBI waste to energy system
- UNH: Institute campus wide re-use program for faculty, staff and students

Behavior, Education, & Community

University at Buffalo

- Sustainability Office!
- RENEW Institute
- Sustainability classes
- Graduate study programs

Case Studies

- Cornell: Recruitment of key faculty
- Boston University: Using courses to help in energy audits for climate action planning
- University at Washington: Establishment of a faculty and staff “Green Fund” to be used on UW projects