



MACALESTER

Climate Action Roadmap

FALL 2025



BRAILSFORD & DUNLAVEY





BRAILSFORD & DUNLAVEY

YOUR TEAM



Second Nature



Food Service



Student Housing



Unions



Recreation



Campus Edge



Academics



Health & Wellness



Athletics



Venues



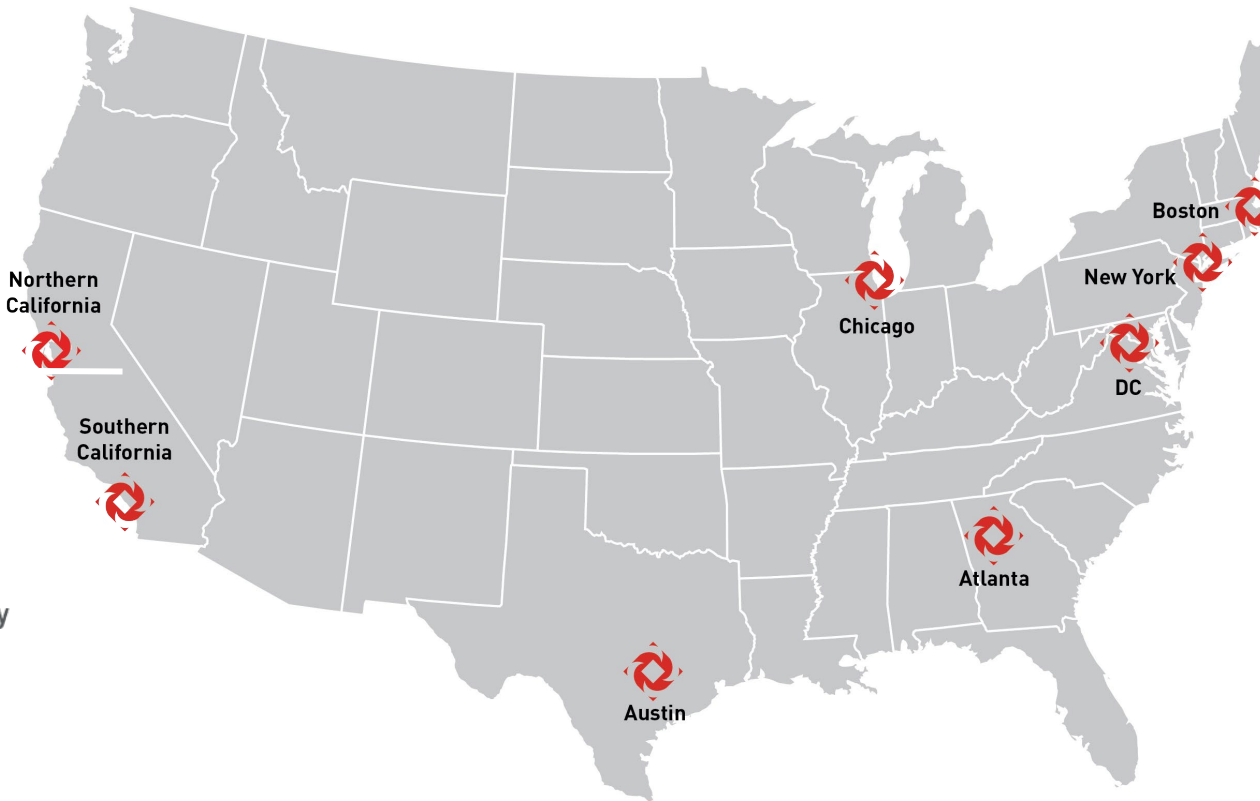
Workforce Housing



Retail



Energy & Sustainability



30+

Years In The Industry

850+

Higher Education Clients

100+

Climate Action / Utility Master Plans

1,600+

University and College Projects



BRAILSFORD & DUNLAVEY



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- 02** Strategic Alignment
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- 04** Climate Action Roadmap
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01

Climate Action Goals



Macalester Goal Setting

GETTING TO ZERO



Fully Decarbonize Scopes 1 & 2
Emissions by 2050

Eliminating fossil fuels at the source



Independent Carbon Neutrality or
Decarbonization Targets for
Scope 3 Sources*

Utilizing offsets and other strategies to balance emissions

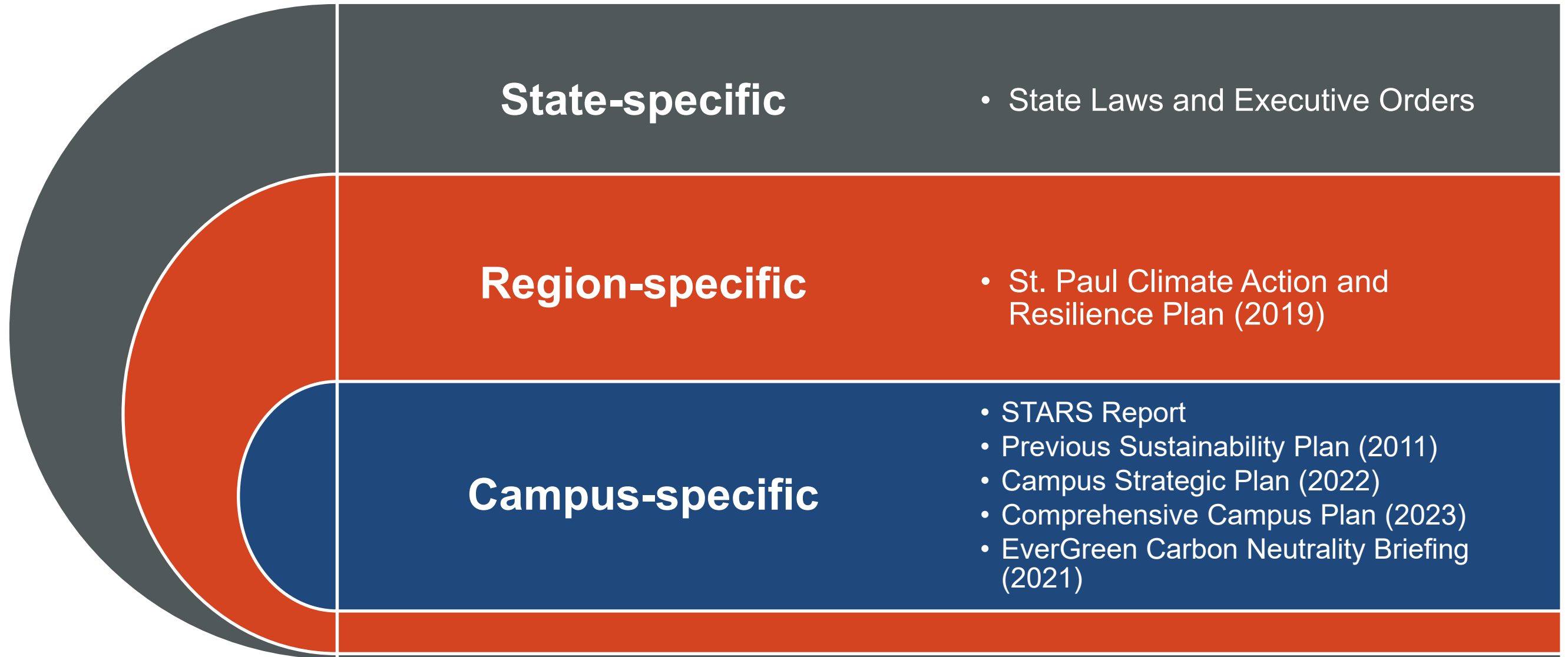
02

Strategic Alignment



Strategic Alignment

ALIGNING THE CLIMATE ACTION ROADMAP WITH CAMPUS, LOCAL, AND STATE EFFORTS



Strategic Alignment Analysis



Comprehensive Campus Plan (2023)

- Energy efficiency of buildings and improvement of lowest-performing buildings
- Renovation of plant infrastructure
- Exploring renewable energy resources
- Achieving zero waste
- Ensuring equity as part of every sustainability decision



Campus Strategic Plan (2022)

- Promoting sustainability through the modernization and expansion of existing facilities
- Includes the emphasis of sustainability in student curriculum



EverGreen Carbon Neutrality Briefing (2021)

- Different decarbonization options for current central steam and natural gas boilers
- Recommends transitioning steam systems to low-temperature hot water and expanding cooling distribution to enable future adoption of carbon-free solutions



Previous Sustainability Plan (2011)

- Reference point with successes and learning moments
- Climate neutrality goal of 2025
- Emphasis on leadership, operations, and education



STARS Report

- Gold Rating
- Points of distinction including climate justice programs, express bike partnerships, and engagement via pop-ups at athletic events



St. Paul Climate Action and Resilience Plan (2019)

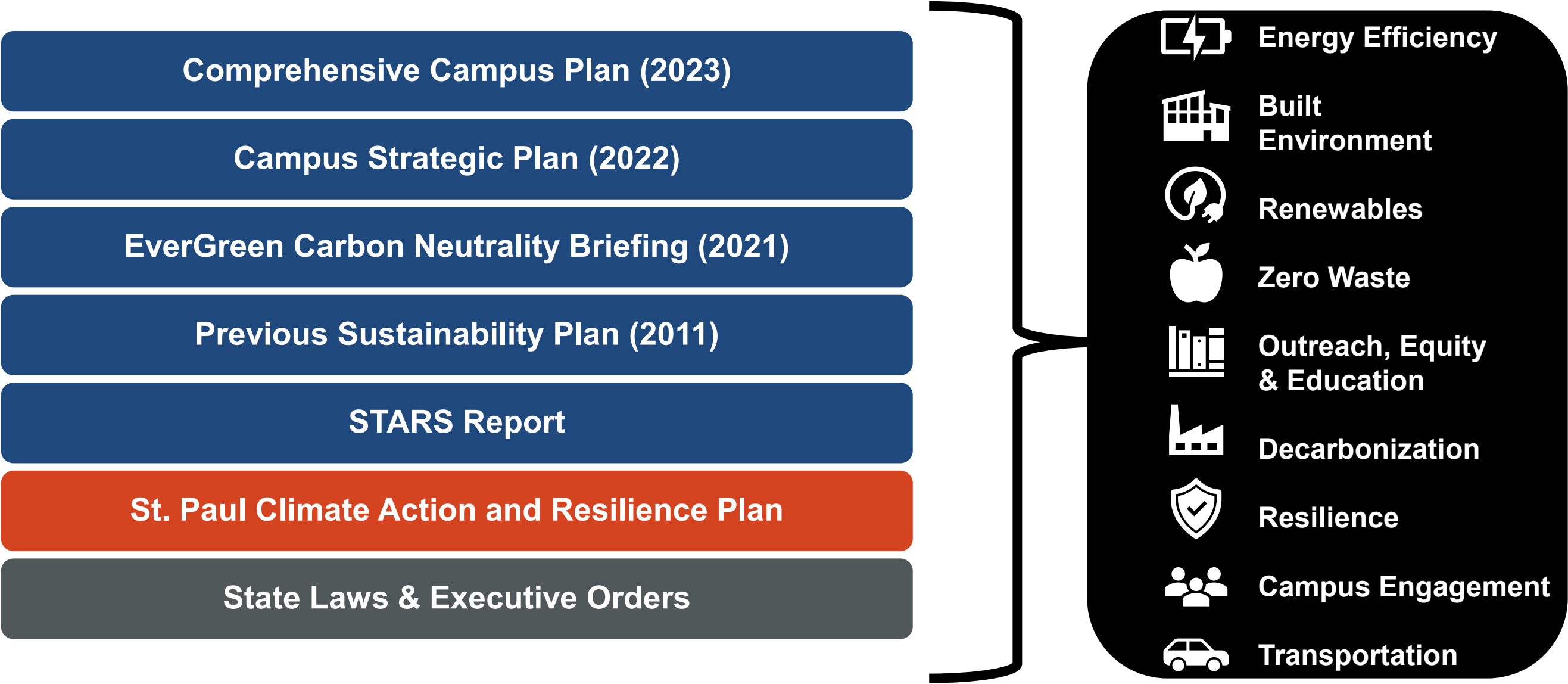
- Roadmap to city-wide carbon neutrality by 2050
- Preparing for climate impacts and prioritizing equitable solutions
- Emphasis on enhancing urban resilience



State Laws & Executive Orders

- Minnesota's Clean Electricity Standard (2023)
- Commits all utilities to provide customers with 100% carbon-free electricity by 2040

Strategic Alignment Analysis



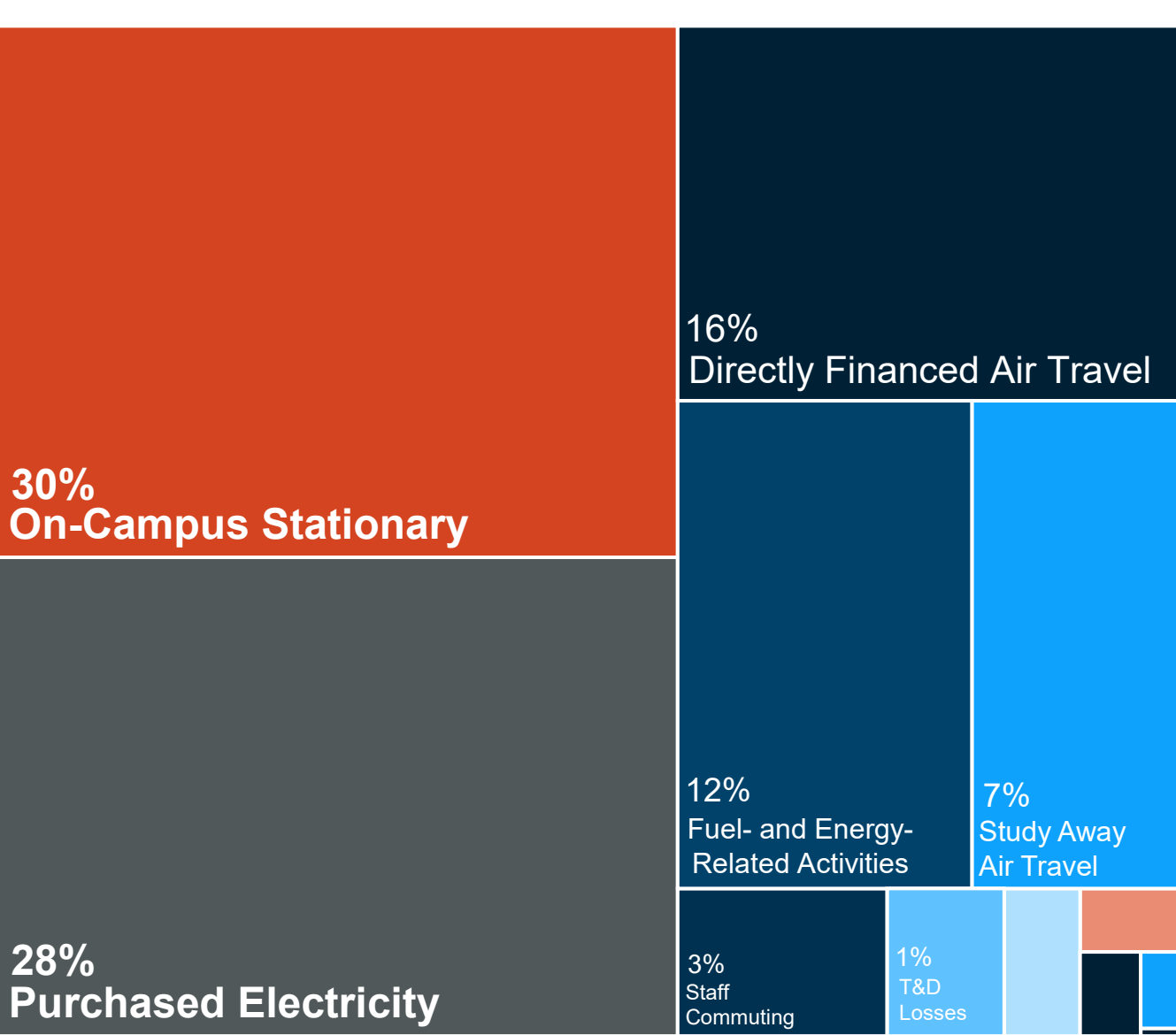
03

Greenhouse Gas Emissions Baseline & Business-As-Usual Forecast

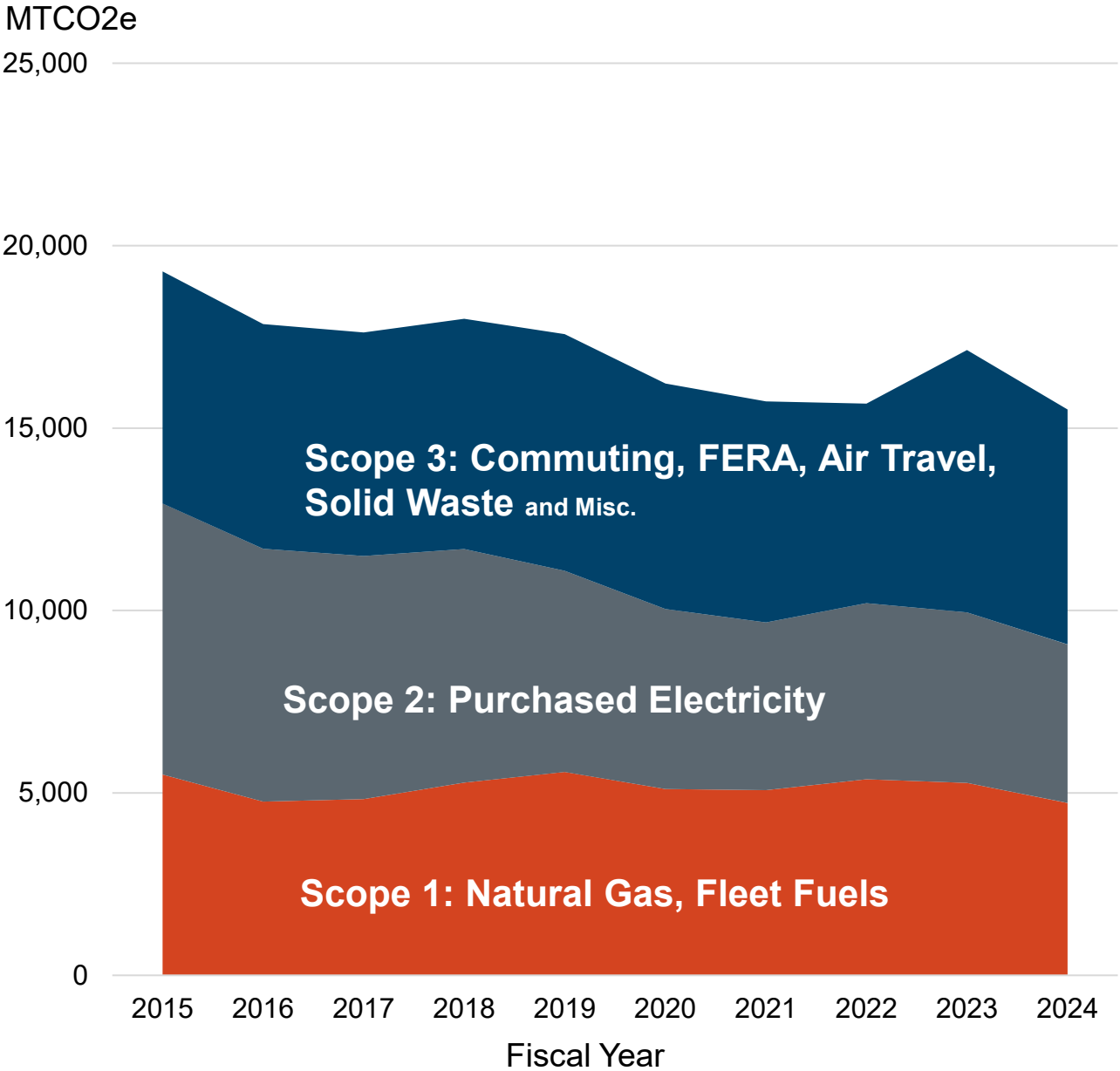


Greenhouse Gas Emissions Baseline

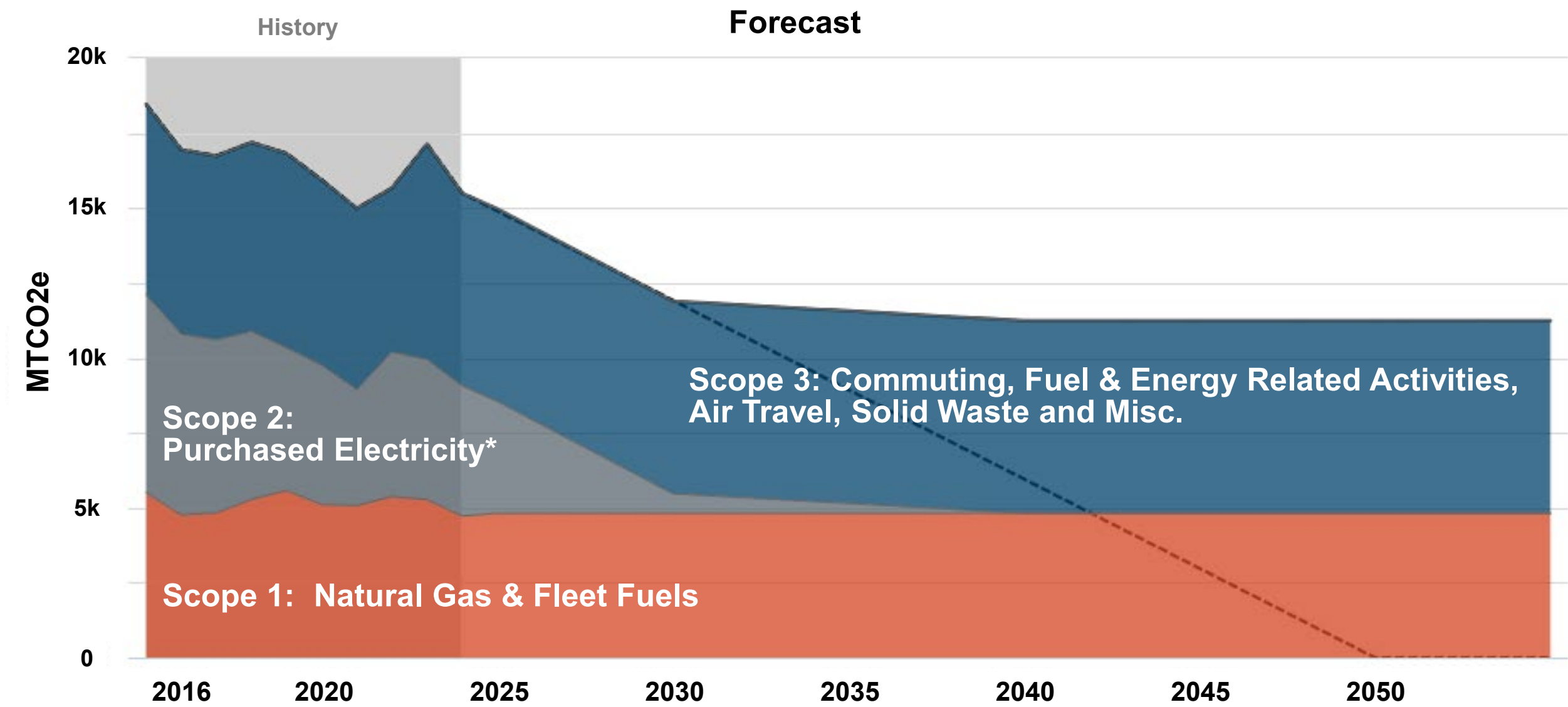
IDENTIFYING EMISSIONS DRIVERS



Emissions Breakdown: FY 2024

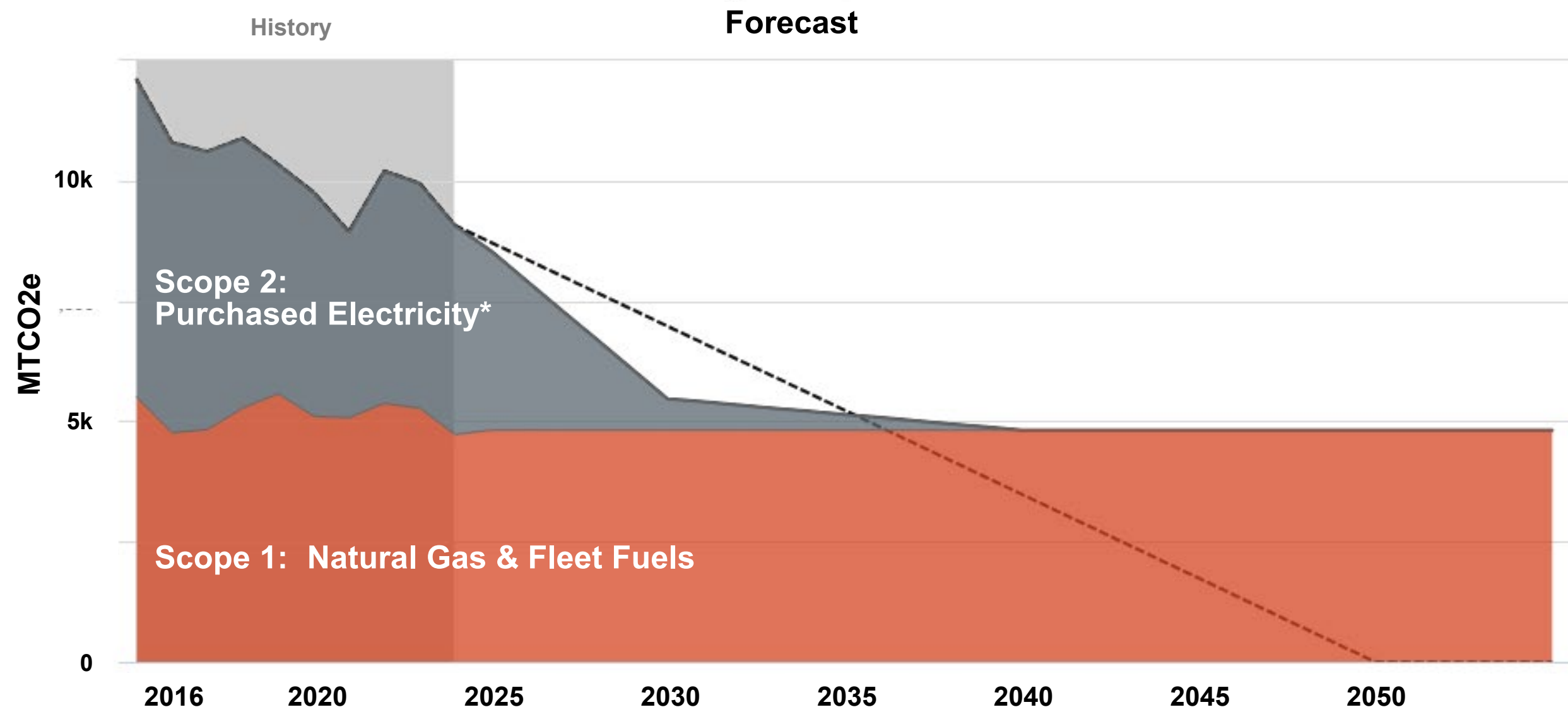


Forecasting Business As Usual



Forecasting Business As Usual

HIGHLIGHTING SCOPES 1 AND 2



04

Climate Action Roadmap



Macalester Climate Action Roadmap

1 FUEL TRANSITION

1.1

Central Plant Conversion w/
Geothermal & Low-Temp Hot Water

1.2

Renewable Energy Development

2 ENERGY EFFICIENCY

2.1

Building
Improvements

2.2

Lighting & Plug
Load Reductions

2.3

Establish Green
Revolving Fund

2.4

Behavior Change
Initiatives

3 CURRICULUM & RESEARCH

3.1

Expand &
catalogue climate
action curriculum

3.2

Campus as a
Living Lab

3.3

Climate Justice

3.4

Climate
Resilience

4 RESIDUAL EMISSIONS

4.1

Scope Three Deep Dive

4.2

Zero Waste
Programming

4.3

Macalester Funded
Travel

Macalester Climate Action Roadmap

OVERLAY OF CLIMATE RESILIENCE C-BENEFITS AND IDEAS ASSESSMENT RESULTS

1 FUEL TRANSITION

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4 RESIDUAL EMISSIONS

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Scope Three Deep Dive

4.2

Zero Waste Programming

4.3

Macalester Funded Travel

1. Fuel Transition

INITIATIVES DEFINED

1.1 Central Plant Conversion w/ Geothermal & Low-Temp Hot Water

Outcome: Energy efficient and low-carbon central plant operations through the transition to a modern district hot water system

- Convert central heating and cooling systems to ground-source heat pump-based central heating and cooling plant (*Comprehensive Campus Plan*, pg. 26)
- Couple with low-temperature hot water renovations (*see Initiative 1.2*)
- Replace current distribution piping with piping suitable for LTHW conversion
- Develop learning opportunities for students to engage in the process – engineering, finance, etc. (*see Initiative 3.2*)

1.2 Renewable Energy Development

Outcome: Visible commitment to climate resilience and avoided energy costs

- Identify opportunities or spaces for onsite solar development (e.g. over West 2 parking lot - *Comprehensive Campus Plan*, pg. 20)
- Explore options for renewable energy development on-campus (e.g. On-site aquifer-based geothermal - *Comprehensive Campus Plan*, pg. 36) (*see Initiative 1.1*)
- Explore feasibility of offsite renewable energy resource (e.g. utility scale solar, wind, VPPAs, etc.)
- Develop learning opportunities for students to engage in the process – engineering, finance, land use planning, etc. (*see Initiative 3.2*)

1. Fuel Transition

MODELING ASSUMPTIONS & IMPACTS

1.1 Central Plant Conversion w/ Geothermal & Low-Temp Hot Water

GHG Impact: (14.9%)

Cash Flow (Million, NPV): \$12.3M

- Assumes:
 - Includes conversion to ground-source heat-pump based central plant and distribution infrastructure upgrades
 - Approximately 35% of campus transitioned to new plant by 2030, and the rest of buildings connected to central plant transitioned by 2040 (see *Comprehensive Campus Plan*, pg. 34)
 - Efficiency of old steam plant: 80%
 - 4.0 Efficiency factor of new heat pump system
 - 20% O&M savings because of the transition

1.2 Renewable Energy Development

GHG Impact: (0.3%)

Cash Flow (Million, NPV): (\$0.6M)

- Assumes:
 - 1.0 MW installed capacity (see *Comprehensive Campus Plan*, pg. 34)
 - 13.6% capacity factor
 - Capex @ \$2 / watt

2. Energy Efficiency

INITIATIVES DEFINED

2.1 Building Improvements

Outcome: Optimized, high-performance functionality and improved energy performance in buildings

- Continue leveraging building automation system to maximize HVAC Efficiency and installing building-level metering
- As HVAC package units reach end of life or are low performing, conduct total cost of ownership analyses for technologies beyond like-for-like replacements (e.g. heat pump technology, etc.)
- Prioritize building envelope improvements in building renovations (e.g., energy efficient windows, etc.)
- Continued commissioning of building systems and controls

2.2 Lighting & Plug Load Reductions

Outcome: Reduced energy usage

- LED lighting conversions (interior lighting, exit signs, exterior w/ bi-level controls)
- Replace devices and equipment with energy-efficient upgrades
- Install automatic shut offs, occupancy sensors, smart outlet automation
- Utilize students for measurement and idea formation (*see Initiative 3.2*)

2.3 Establish Green Revolving Fund

Outcome: Capacity to reinvest in GHG reduction projects

- Research history of Macalester Clean Energy Revolving Fund (CERF) and understand successes and opportunities
- Set funding goals, identify funding sources, and identify key decision-makers
- Could be established as a repository for voluntary GHG reduction contributions (*see Initiative 4.3*)
- Engage finance students in the policy formation and fund establishment (*see Initiative 3.2*)

2.4 Behavior Change Initiatives

Outcome: Heightened awareness of energy use for sustained energy use reductions

- Dedicate staff time to create and promote efficiency programs and establish behavior change visuals (i.e., signage, dashboards, public key performance indicators, etc.) to increase awareness
- Educate building operators and key staff (e.g. custodial) on how to recognize efficiency opportunities
- With the deployment of building level metering (*see Initiative 2.1*) and in partnership with Campus as a Living Lab (*see Initiative 3.2*), create energy efficiency competitions in student Housing

2. Energy Efficiency

INITIATIVES DEFINED

2.1 Building Improvements

GHG Impact: (8.4%)

Cash Flow (Million, NPV): (\$2.3M)

- Average 5-year paybacks
- 20% energy reduction in NG
- 10% energy reduction in electricity
- 10-year implementation

2.2 Lighting & Plug Load Reductions

GHG Impact: (0.3%)

Cash Flow (Million, NPV): (\$1.5M)

- Average 5-year paybacks
- 10% energy reduction (electricity)
- 5-year implementation

2.3 Establish Green Revolving Fund

GHG Impact: NA

Cash Flow (Million, NPV): \$0M

- *Not modeled – fund mechanics and funding allocations would need to be established*

2.4 Behavior Change Initiatives

GHG Impact: NA

Cash Flow (Million, NPV): \$0M

- *Modeled with Initiative 2.2*

3. Curriculum & Research

INITIATIVES DEFINED

3.1 Expand & Catalogue Climate Action Curriculum

Outcome: More expansive and thorough climate action educational opportunities

- Infuse climate education in courses required for graduation
- Emphasize and promote the importance of climate action within existing course offerings
- Develop and adopt climate action learning outcomes that apply to the entire Macalester student body
- Utilize the Green Revolving Fund (*see Initiative 2.3*) to grow sustainability and climate action-focused research, utilizing the campus as a living lab (*see Initiative 3.2*)

3.2 Campus as a Living Lab

Outcome: Utilization of the campus environment for place-based learning

- Develop partnerships with on- and off-campus groups and organizations for place-based learning and emergent technology deployment
- Expand programming and applied research opportunities on-campus and at the Ordway Field Station (*Campus Comprehensive Plan, pg. 25*)

3.3 Climate Justice

Outcome: Ensured institutional literacy and action on climate justice issues and solutions

- Bolster community engagement, education, and research concerning climate justice
- Allocate faculty resources for a fellowships or learning communities to integrate climate justice into existing course curriculum
- Intentionally align the Sustainability and Diversity and Inclusion offices to drive climate justice education and adoption

3.4 Climate Resilience

Outcome: Shared understanding of climate vulnerabilities and collaborative research and solution creation

- As part of a Campus as a Living Lab project (*see Initiative 3.2*), conduct a climate vulnerability and strengths assessment for the Mac community, infrastructure, and energy systems
- Building on assessment, develop curriculum to educate the Mac community and utilize the Campus as a Living Lab (*see Initiative 3.2*) to test solutions

3. Curriculum & Research

MODELING ASSUMPTIONS & IMPACTS

3.1 Expand & Catalogue Climate Action Curriculum

GHG Impact: *NA*

Cash Flow (Million, NPV): \$0M

- *Not modeled – no direct GHG impact*

3.2 Campus as a Living Lab

GHG Impact: *NA*

Cash Flow (Million, NPV): \$0M

- *Included in other modeled initiatives with direct GHG impact*
- *Impacts dependent on extent of programming*

3.3 Climate Justice

GHG Impact: *NA*

Cash Flow (Million, NPV): \$0M

- *Not modeled – no direct GHG impact*

3.4 Climate Resilience

GHG Impact: *NA*

Cash Flow (Million, NPV): \$0M

- *Not modeled – no direct GHG impact*

4. Residual Emissions

INITIATIVES DEFINED

4.1 Scope Three Deep Dive

Outcome: Improved understanding of and plan for the reduction of scope 3 emissions

- Improve data collection and tracking processes for scope three emissions as protocols are adopted
 - Data collection should include a better understanding of the current campus sponsored travel
 - Include students in the process of data collection and solutions generation (*see Initiative 3.2*)
- Benchmark regional or operational peers to identify success stories and opportunities for innovative reduction tactics Mac could implement
- Develop education and adopt incentives to encourage adoption of alternative transportation by faculty and staff

4.2 Zero Waste Programming

Outcome: 90% waste diversion from landfill and incineration

- Macalester is currently diverting 73% of solid waste from landfill
- Implement the waste reduction projects laid out in the [Macalester College Zero Waste Action Plan](#) to achieve a 90% diversion rate

4.3 Macalester Funded Travel

Outcome: Increased awareness and adoption of sustainable business travel

- Develop a clear policy for travel approvals including decision-making entities, budgets, and rationale
- Develop education campaign for the Mac community outlining the GHG impacts of travel by mode and alternative solutions
- Create guidelines for formation of a voluntary travel mitigation fund including suggested offset contributions
 - Funds should be deposited to Green Revolving Fund (*see Initiative 2.3*)

4. Residual Emissions

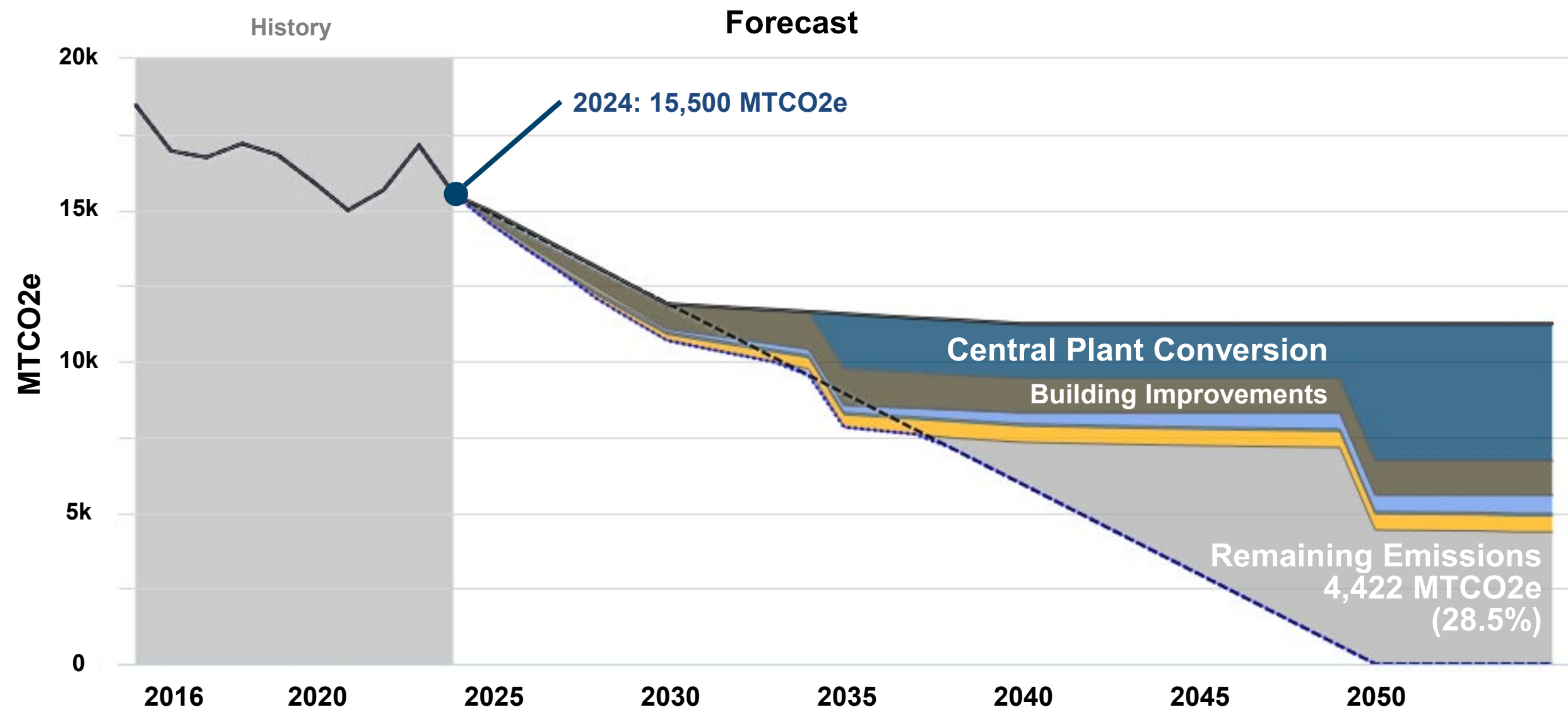
INITIATIVES DEFINED

4.1 Scope Three Deep Dive	GHG Impact: (3.5%) Cash Flow (Million, NPV): \$0M
<ul style="list-style-type: none">Assumes:<ul style="list-style-type: none">Starting in 2028, by 2040, 10% reduced Scope 3 emissions<ul style="list-style-type: none"><i>After 4.2 and 4.3 already in effect</i>Natural greening of the commuter fleet assumptions based on national and regional trends	
4.2 Zero Waste Programming	GHG Impact: (0.6%) Cash Flow (Million, NPV): \$0M
<ul style="list-style-type: none">50% reduction in landfill emissions by 2030<ul style="list-style-type: none">Emissions with waste recovery (e.g. recycling, composting, etc.) are not modeled	
4.3 Macalester Funded Travel	GHG Impact: NA Cash Flow (Million, NPV): \$0M
<ul style="list-style-type: none">No direct GHG impact – not modeled	



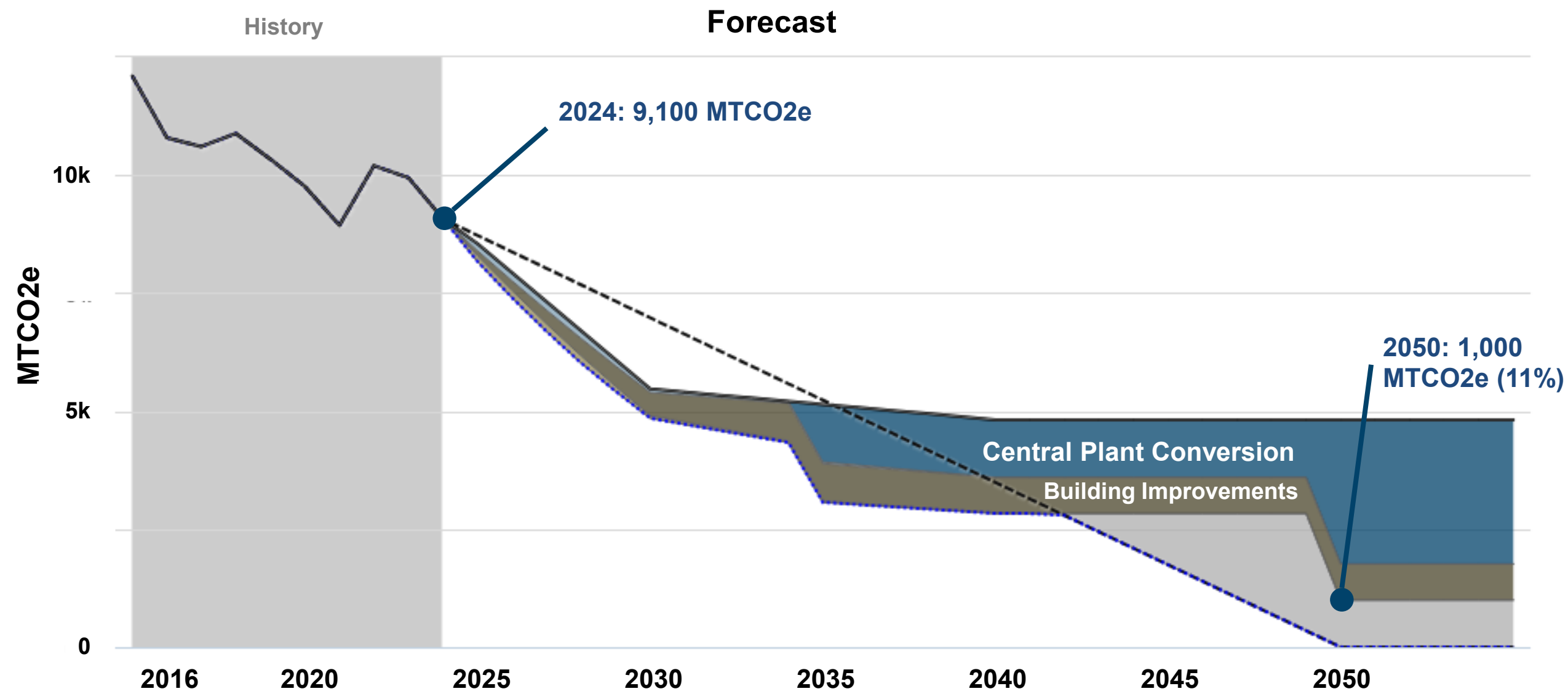
Solutions Portfolio – Reduction in Scope 1, 2 & 3

REDUCTION IN TOTAL EMISSIONS BUT WITH 28.5% OF 2024 EMISSIONS REMAINING



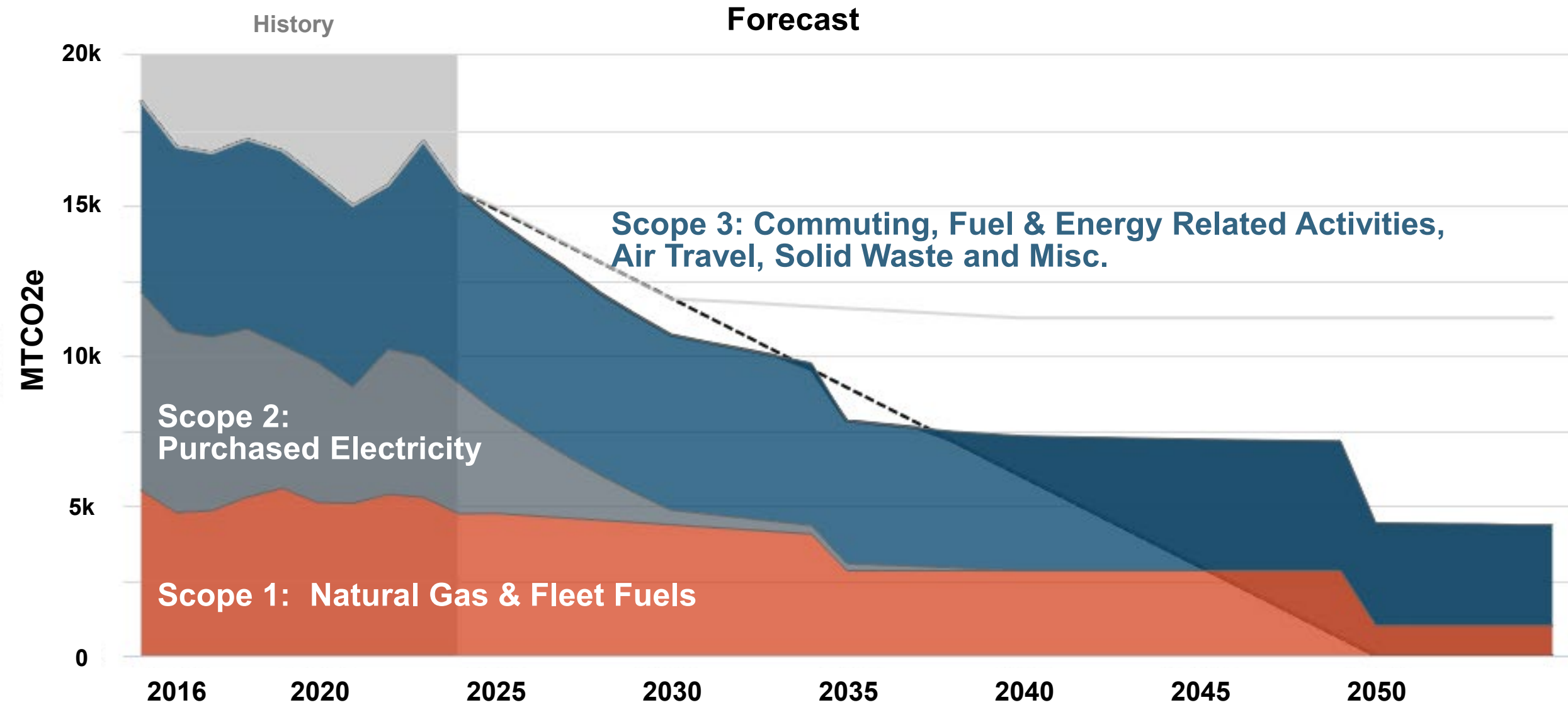
Solutions Portfolio – Reduction in Scopes 1 & 2

11% OF 2024 EMISSIONS REMAINING



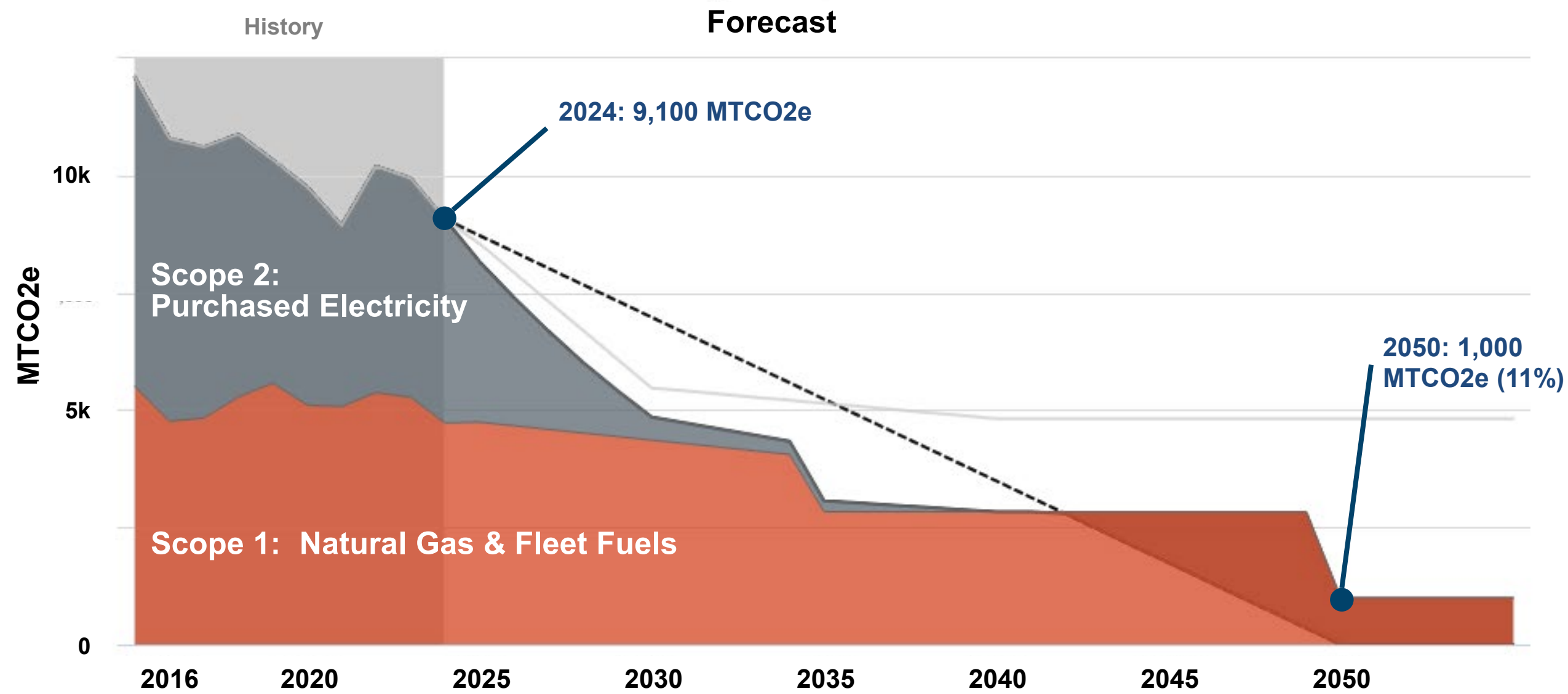
GHG with Adopted Roadmap Solutions Portfolio

SCOPES 1, 2 & 3



GHG with Adopted Roadmap Solutions Portfolio

SCOPES 1 & 2



05

Business Case



Energy & Utility Financial Context

BUSINESS AS USUAL IS NOT FREE

Item	30 Year Outlook		
	FY 24	Cumulative ¹	Net Present Value ²
Utility Bills (Electricity, Natural Gas, Water)	\$1.9M	\$68M	\$35M
O&M	\$1.7M	\$82M	\$39M
Capital Expenditures	\$1.6M	\$99M	\$45M
Total	\$5.3M	\$249M	\$119M
Carbon Risk ³	\$0.9M	\$50M	\$23M
Total with Carbon Risk	\$6.2M	\$299M	\$142M

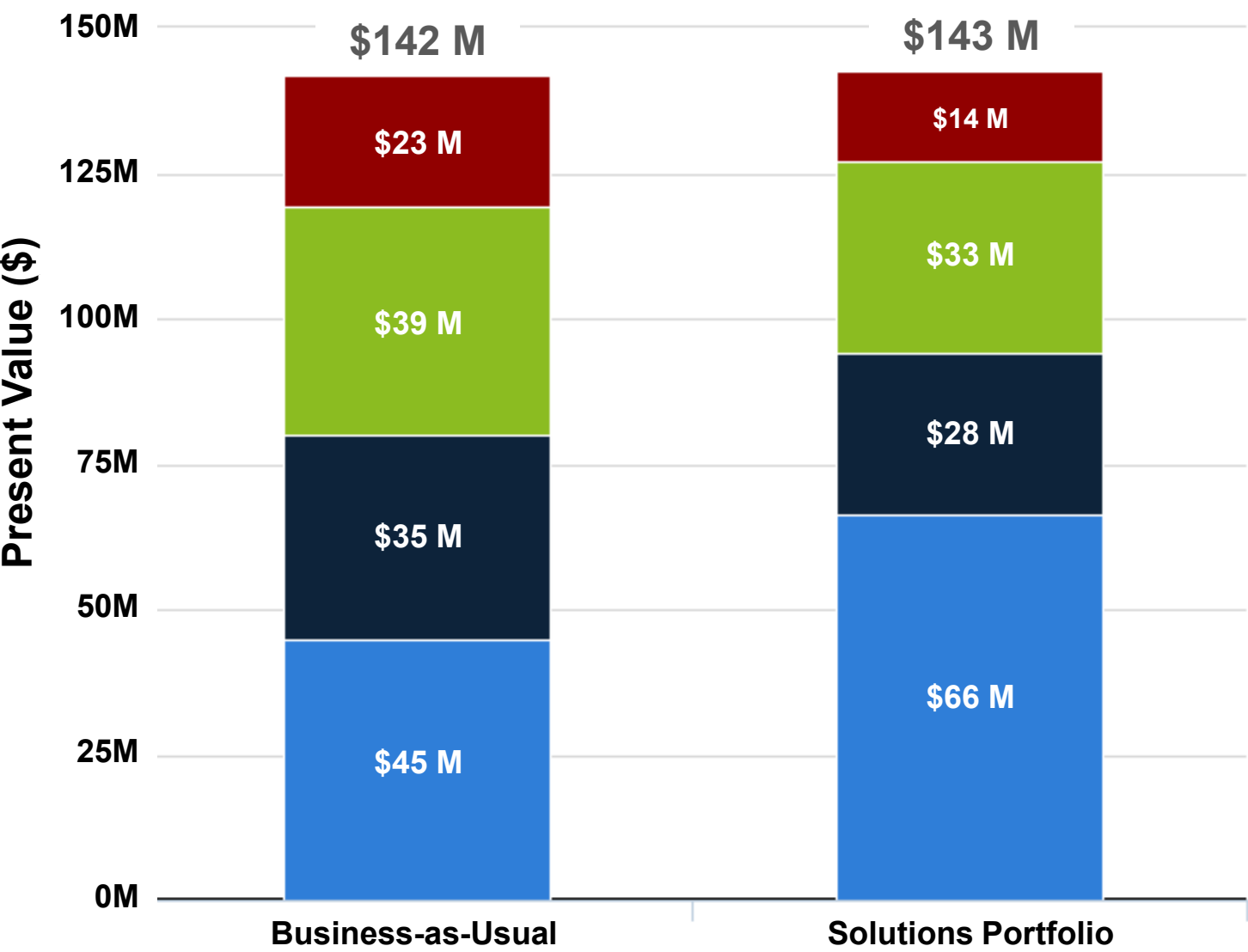
1 Inflation Rate = 2.5%, Capital Escalation Rate = 4%

2 Discount Rate = 5%

3 \$51/MTCO₂e in 2024, escalated at 5% yearly

Financial Implications

LIFE-CYCLE COST COMPARISON THROUGH 2055



Social Cost of Carbon

Also called “Carbon Risk”. The estimation of the economic damages resulting from GHG emissions. Modeled at \$51/MTCO_{2e}

Operations & Maintenance

Utilizing Operations and Maintenance data provided by Macalester

Commodities

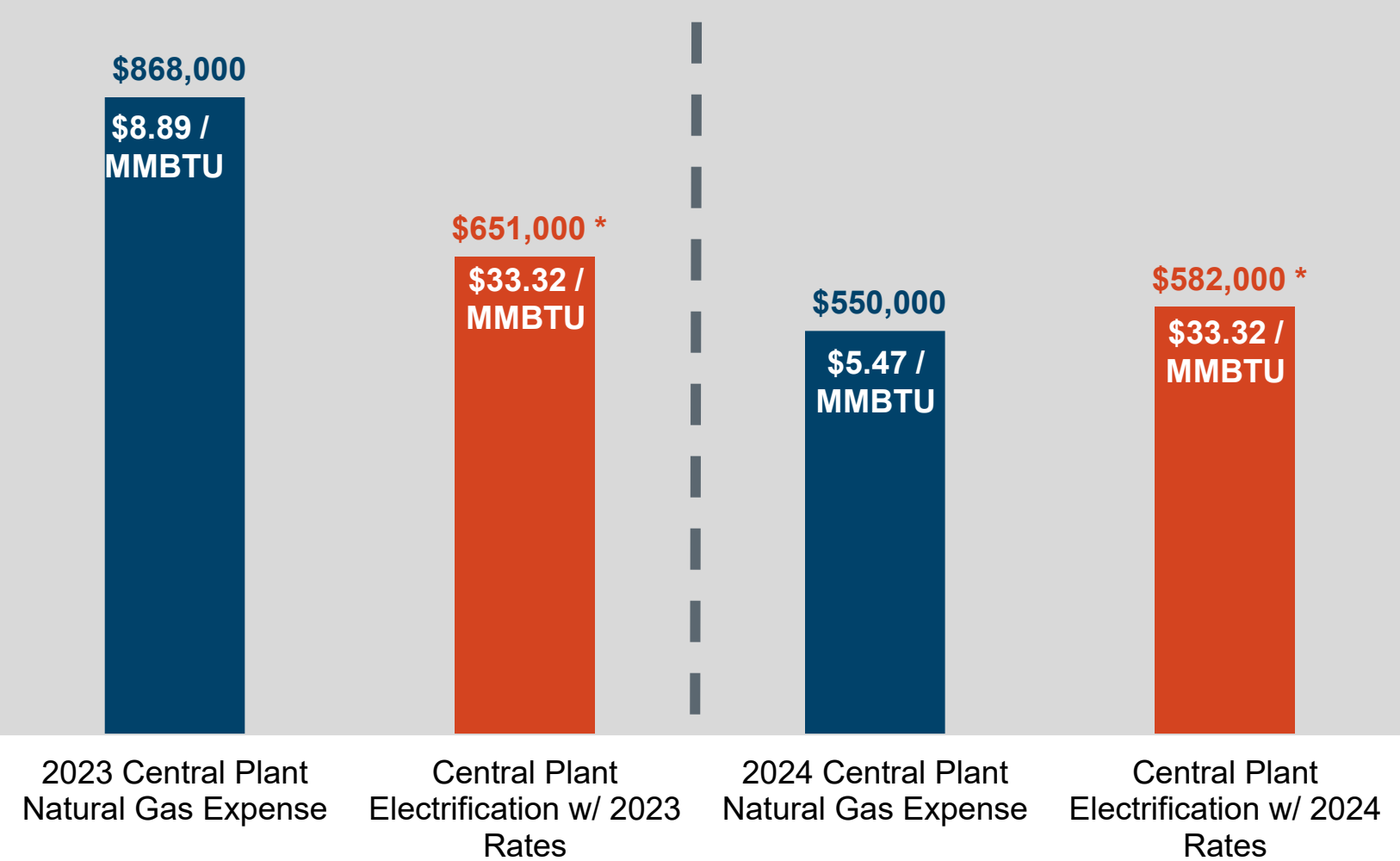
Procurement of natural gas and electricity modeled with current Macalester utility usage and Xcel Energy electricity rates.

Capital Expenses

Utilizing Capital Expenditure data provided by Macalester

Financial Impacts of Central Plant Electrification

ESTIMATED FUEL TRANSITION EXPENDITURES



Electricity is more expensive, but less is needed to meet the same energy demands.

Natural gas rates vary year over year, resulting in varying degrees of savings.

**Electricity costs are modeled for commodity only*
**Assuming 80% efficiency.*
**Assuming coefficient of performance of 4.0 (400% efficiency) for electric systems.*
**Assumes all systems were electrified in 2024.*

Business Case Talking Points

ADVOCATING FOR CHANGE

- › In order to deliver the proposed Climate Action Roadmap, Macalester will need to increase funding allocation to capital projects – primarily to fund a central plant conversion with low-temp hot water distribution
- › Utilizing a total cost of ownership mentality, this investment will reduce operating, maintenance, and utility expenses in the long-term with newer, more efficient equipment
- › Despite a shift to electrification, utility expenses will still go down due to needing less inputs and electric equipment utilizing the fuel inputs more efficiently
- › There is a cost to doing nothing that should not be ignored – not addressing climate change has potential to impact Macalester in ways that have not yet been quantified

Thank you.



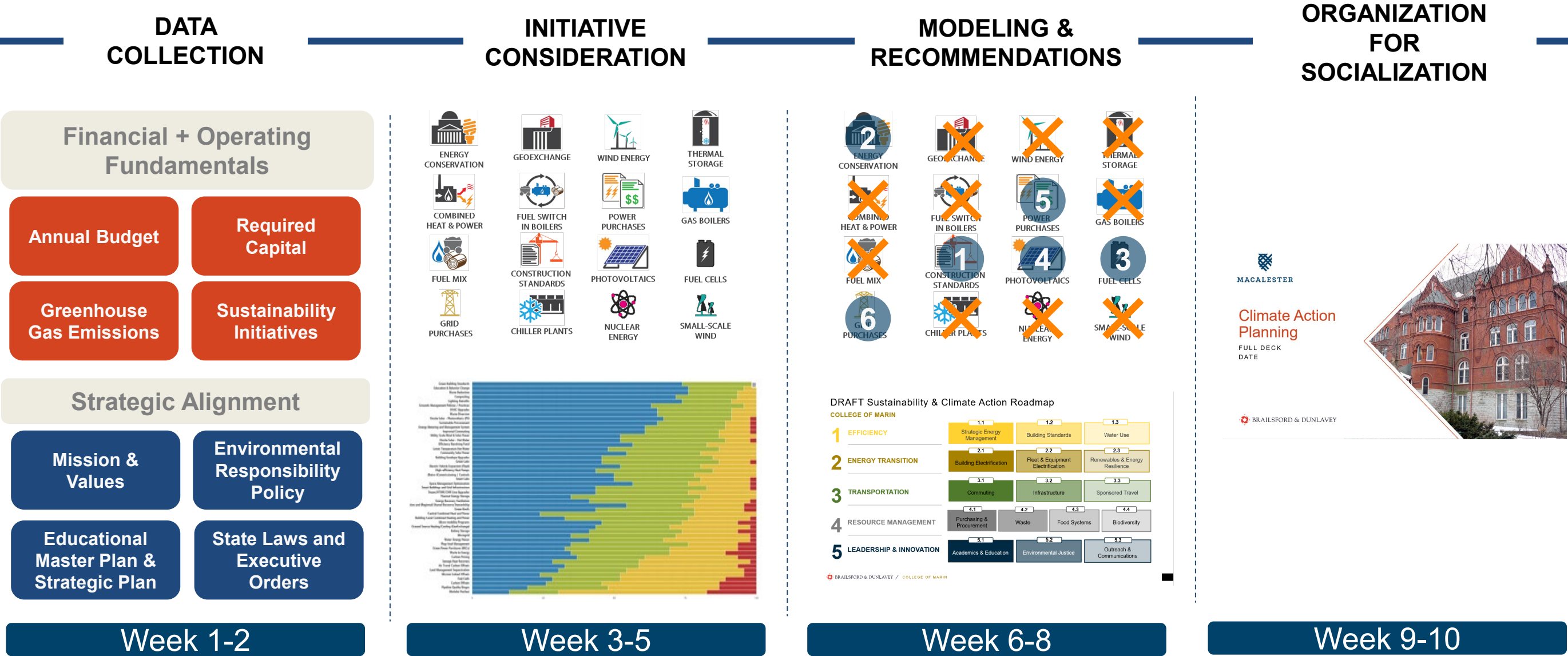
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Appendix



Process Overview

SEPTEMBER – NOVEMBER



Project Schedule

Meeting	Focus	Date* <i>*subject to change</i>
Kick-off Meeting	Introduction, Approach, and Meeting Cadence	September 5
Regular Meeting #1	Goal Setting Strategic Alignment & Review BAU Model Ideas Assessment Overview	September 18
Regular Meeting #2	Finalize BAU Draft Solutions Portfolio Roadmap	October 3
Regular Meeting #3	Refine Solutions Portfolio Roadmap Initiative Definitions	October 10 (Full Sustainability Advisory Committee)
Regular Meeting #4	Initiative Definitions Building the Business Case	October 31
Regular Meeting #5	Final Solutions Portfolio Roadmap Business Case Finalized	November 14
Final Presentation	Full Sustainability Advisory Committee	December 5

Understanding the Baseline

ENSURING QUALITY DATA REPRESENTATION

Assumptions Summary

- Used FTE trends to backfill **missing data**
- Direct Transportation – using fleet inventory with assumptions on MTCO2e/vehicle
- Wastewater – assumed 80% of purchased potable water leaves as wastewater
- Electricity T&D Losses – used EPA's eGrid factors
 - Midwest Reliability Organization West (MROW)

	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
Scope 1 - Direct Emissions	5,502	4,762	4,831	5,279	5,575	5,108	5,075	5,375	5,274	4,725
On-Campus Stationary	5,417	4,674	4,744	5,192	5,485	5,021	4,990	5,283	5,184	4,637
Direct Transportation	85	88	87	87	89	87	85	92	89	88
Scope 2 - Indirect Energy Emissions	7,431	6,929	6,651	6,398	5,505	4,861	4,488	4,721	4,549	4,221
Scope 3 - Other Indirect Emissions	6,360	6,154	6,133	6,309	6,485	6,182	6,058	5,471	7,197	6,434
Faculty Commuting	153	159	158	157	161	157	154	165	161	161
Staff Commuting	422	439	435	433	443	433	423	456	444	444
Student Commuting	4	4	4	4	4	4	4	4	4	4
Directly Financed Air Travel	2,092	2,174	2,154	2,147	2,197	2,146	2,099	1,537	2,694	2,542
Study Abroad Air Travel	1,022	1,062	1,053	1,049	1,074	1,049	1,025	804	1,445	1,061
Solid Waste	97	101	100	99	102	99	97	105	102	101
Wastewater	48	48	48	46	45	39	30	46	41	49
FERA	2,151	1,856	1,884	2,062	2,178	1,994	1,982	2,098	2,059	1,841
T&D Losses	369	311	298	312	281	258	238	250	241	224
Gross Emissions	19,293	17,845	17,615	17,987	17,564	16,147	15,616	15,561	17,013	15,373

Ideas Assessment

OVERVIEW

- › Informs the campus community of climate action planning efforts
- › Gains an understanding of what the Mac community sees as potential climate reduction solutions
- › Measures campus collective interest and general familiarity with solutions
- › Does **NOT** make inferences about specific student populations
- › **IS NOT** a human subject survey



Logistics

IDEAS ASSESSMENT - DISCUSSION



Review & Approval

- What campus approvals are necessary?
- We will share a link with this group for review and suggested edits



Distribution

- Method of distribution?
- B&D will provide a link for the Ideas assessment and template email language



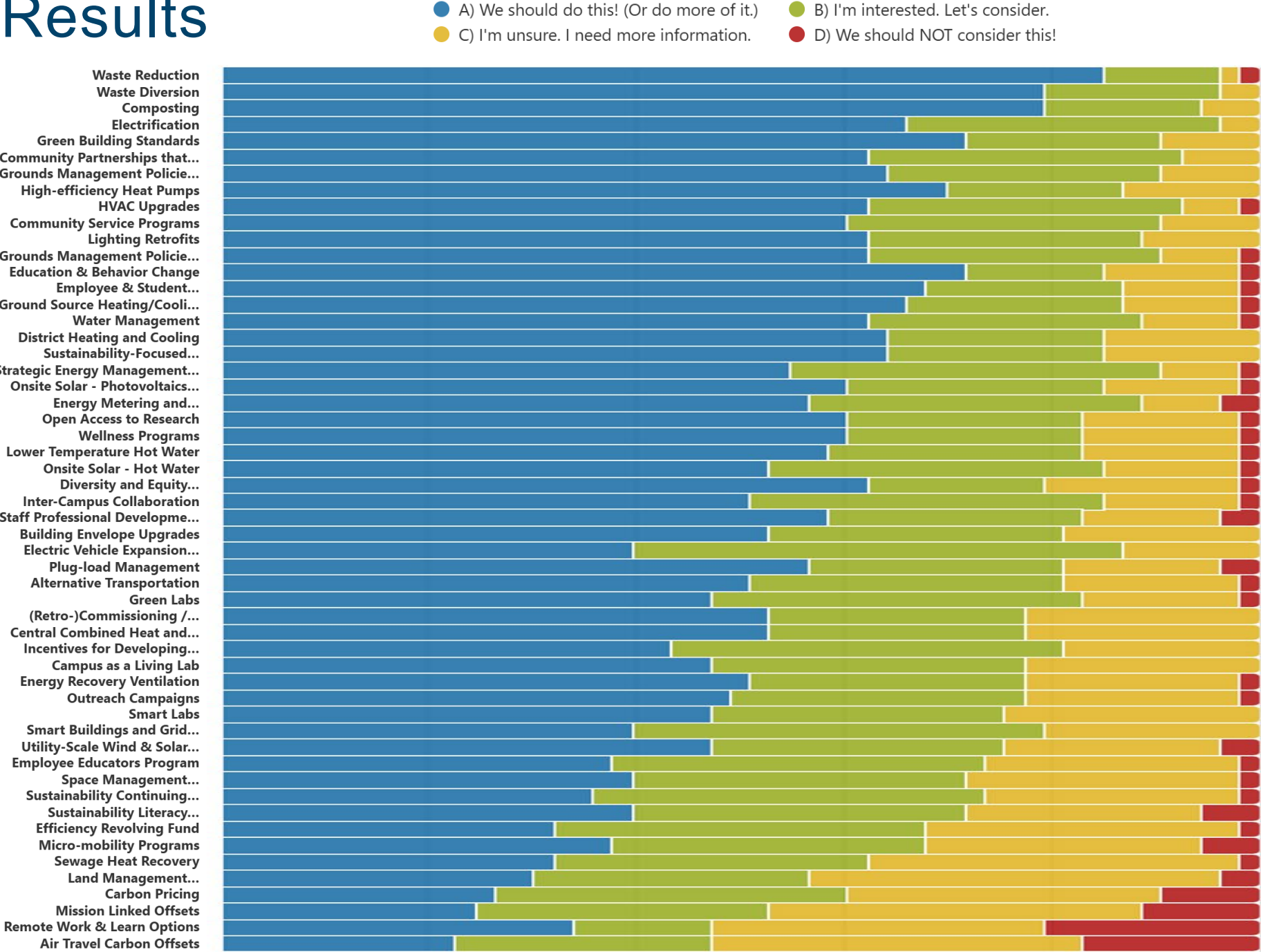
Timing

- Goal is to have results available for presentation at first Sustainability Advisory Committee Meeting (Oct 10)
- Proposing opening the assessment Sept 24 – Oct 3

Ideas Assessment Results

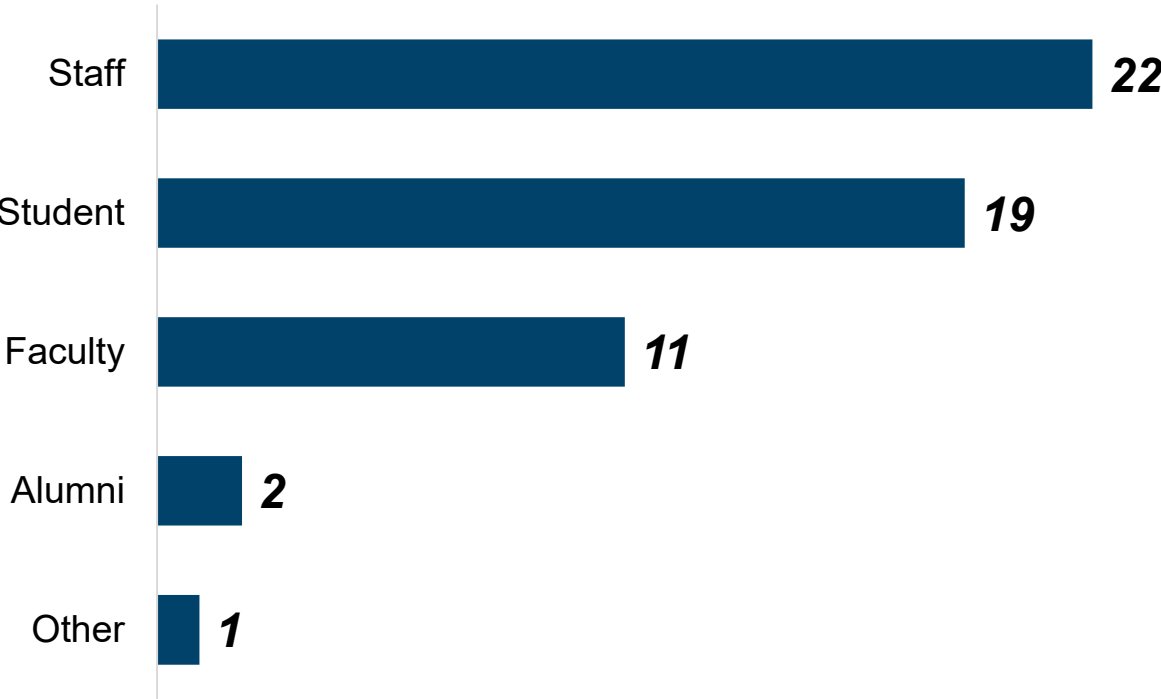
- Most Popular:
1. Waste Reduction
 2. Waste Diversion
 3. Composting
 4. Electrification
 5. Green Building Standards

- Least Popular:
1. Air Travel Carbon Offsets
 2. Remote Work & Learn Options
 3. Mission linked offsets
 4. Carbon Pricing
 5. Land Management Sequestration



Ideas Assessment Results

WHO RESPONDED?



RANKED RESPONSES

	Score	First Choice	Second Choice	Third Choice
		10 Points	8 Points	5 Points
Ground Source Heating/Cooling (GeoExchange)	91	7	2	1
Education & Behavior Change	90	5	5	
HVAC Upgrades	77	3	4	3
Campus as a Living Lab	49	1	3	3
Onsite Solar - Photovoltaics (PV)	46	2	2	2
Waste Reduction	46	3	2	
Green Building Standards	41	2	2	1
Utility-Scale Wind & Solar Power	39	1	3	1
District Heating and Cooling	36	2	2	
Building Envelope Upgrades	35	3		1
Grounds Management Policies / Practices	30	2		2
other	28	1	1	2
High-efficiency Heat Pumps	26		2	2
Waste Diversion	26	1	2	
Electrification	25	2		1
Inter-Campus Collaboration	23	1	1	1
Diversity and Equity Coordination	23	1	1	1
Lighting Retrofits	23	1	1	1