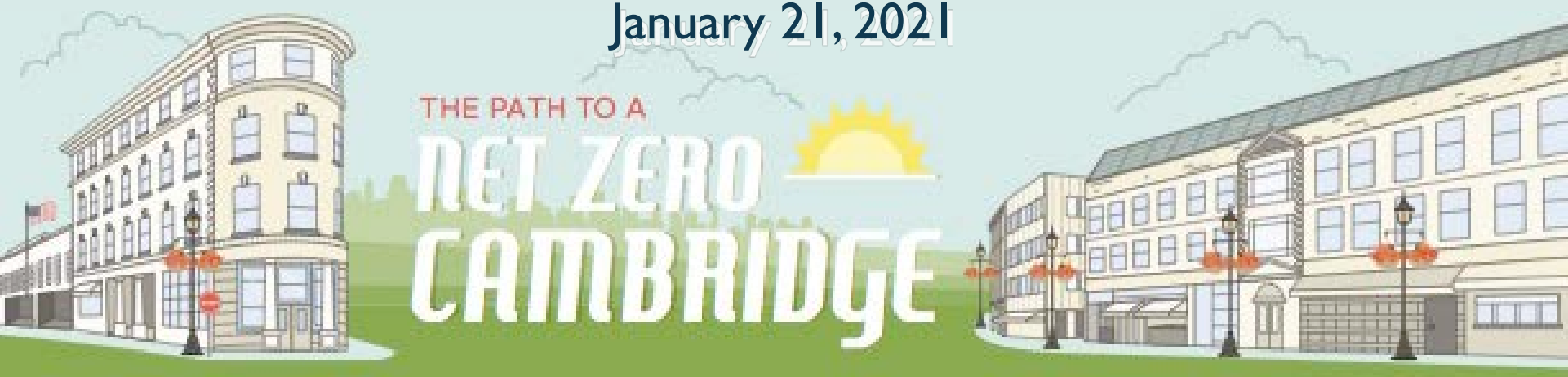
City of Cambridge
Getting to Net Zero Action Plan 5-Year Review

Meeting 3:
Establishing the Framework for NZAP Adjustments

January 21, 2021



Meeting Objectives

- Ensure Task Force members are of the same understanding for determining adjustments
- Begin to capture as broad of a range as possible for NZAP strategy adjustments
- Give task force members a starting point and structure to work from

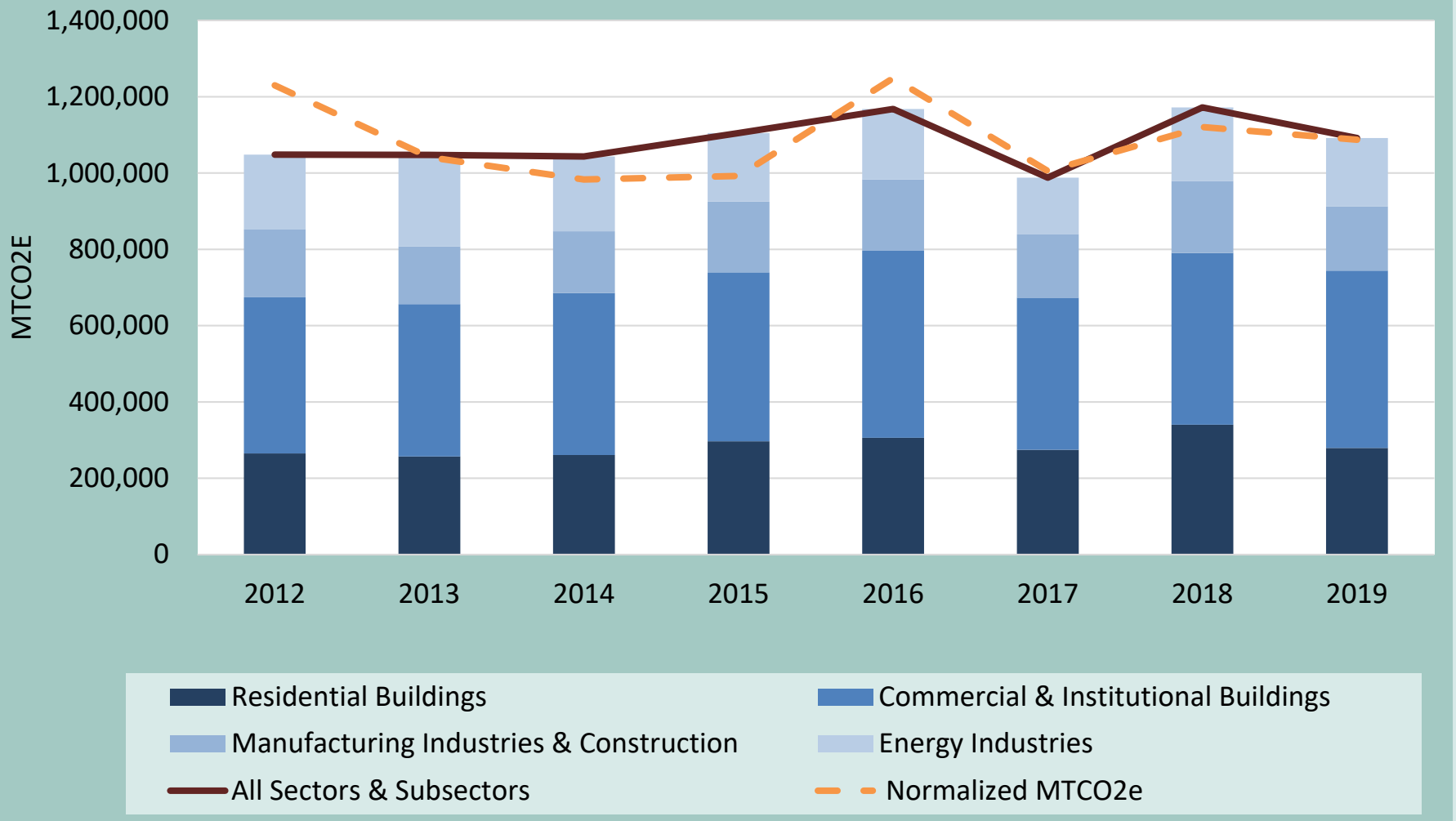
Meeting Agenda

4:00 – 4:20	Part 1: Welcome and Recap of Meeting 2
4:20 – 4:30	Part 2: Context for NZAP Adjustments
4:30 – 4:50	Part 3: Considerations for NZAP Adjustments from Consulting Team
4:50 – 5:20	Part 4: Breakout – Brainstorm Possible Adjustments
5:20 – 5:50	Part 5: Breakout Report Back and Homework Group Organization
5:50 – 6:00	Part 6: Public Comment

Part 1

MEETING 2 RECAP

GHG Emissions Trends from Building Stock



Building Sector CO2e emissions 2012-2019

Measurable Results To-date

From the 5-year impact assessment, 4 NZAP Actions were found to have measurable results to-date

- Custom Retrofit Program (Action 1.1.1)
- Green Building Requirements (Action 2.3)
- Renewal of Municipal Building (Action 2.4.2)
- Rooftop Solar Ready Requirements (Action 3.2)

Assessing Impacts and Co-benefits of NZAP Adjustments

- What is the potential for emissions reductions from an Action?
- What is the technical and economic feasibility of implementing the Action when reflecting upon current Policy and available Technology?
- What other benefits to the community might be realized by pursing an Action?

All adjustments need to be evaluated for equity implications

Co-benefits of NZAP Actions

Consider Each through an Equity Lens		
Government and Policy Development	Economic	Environmental
Leadership by example	Employment Growth	Reduction in Water Use
Promotes Collaboration	Enhanced Economic Competitiveness	Less Materials Use Impacts
Facilitates Public Participation	Reduction in Operation Costs	Reduction in Waste
Enhances Policy Evaluation	Reduction in Cost of Public Infrastructure	Lowers air pollution from generation assets
Enhanced data availability and access	Decreased Energy Costs	Life-cycle Carbon Emissions Reductions
Health and Wellbeing	Climate Resilience	Access and Engagement
Promotes Healthy Lifestyle for Residents	Increased Energy Security	Improved Access to Public Space
Lowers Combustible Gases in Buildings	Provides opp. for hardening infrastructure	Improved Access to Public Transit
Improves Community Aesthetics	Provides opp. for improved building resilience	Improved Access to Employment /Training
Improved Building Comfort/IAQ	Reduces Risk for Vulnerable Populations	Engagement of Local Women/Minority Owned Businesses

Feedback from Task Force on Co-benefits

Following Meeting 2, we asked:

- What are your top priorities for co-benefits that we need to consider when assessing actions?
- Are there other co-benefits that should be considered?
- What other ways might we evaluate adjustments to NZAP actions?

Co-benefits of NZAP Actions

Consider Each through an Equity Lens		
Government and Policy Development	Economic	Environmental
Leadership by example	Employment Growth with emphasis on marginalized populations	Reduction in Water Use
Promotes Collaboration	Enhanced Economic Competitiveness	Impacts of Materials Use
Facilitates Public Participation	Reduction in Operation Costs	Reduction in Waste
Enhances Policy Evaluation	Reduction in Cost of Public Infrastructure	Lowers air pollution and associated health impacts
Enhanced data availability and access	Decreased Energy Costs overall and relative to % of income	Life-cycle Carbon Emissions Reductions / Embodied Carbon
	Provided opportunities for employment training	Reduces urban heat islands
Health and Wellbeing	Climate Resilience	Access and Engagement
Promotes Healthy Lifestyle for Residents	Increased Energy Security	Improved Access to Public Space
Lowers Combustible Gases in Buildings and exposure to CO gases	Provides opp. for hardening infrastructure	Improved Access to Public Transit
Improves Community Aesthetics	Provides opp. for improved building resilience	Improved Access to Employment /Training
Improved Building Comfort/IAQ	Reduces Risk for Vulnerable Populations	Engagement of Local Women/Minority Owned Businesses
Improves building operations/operational performance		Public education (energy/emissions)
		Promotes mobilization of resources provides opportunities for engagement

Feedback from Task Force on Co-benefits

Other feedback received:

Re: Priorities for Actions

"Most important priority is to electrify buildings in Cambridge as quickly as possible, and to take steps to ensure that as much of that electricity as possible comes from fossil-fuel-free sources"

Re: Policy and Tech

"Restructure state level incentive programs to account for and reward carbon reductions"

"Ensure that embodied carbon is considered/evaluated"

Re: Greatest potential for meeting science-based targets:

"BEUDO Requirements - Existing buildings play a huge role in meeting the carbon goals, and we need to challenge the market to proactively come up with and implement solutions to improving their performance

"Combine Net Zero New Construction/Article 22 - While the piece of the pie related to these buildings is not huge, this can happen right now and make sure we are not digging the hole any deeper with our new buildings."

Part 2

CONTEXT FOR NZAP ADJUSTMENTS

NZAP Structure – Actions vs. Action Categories

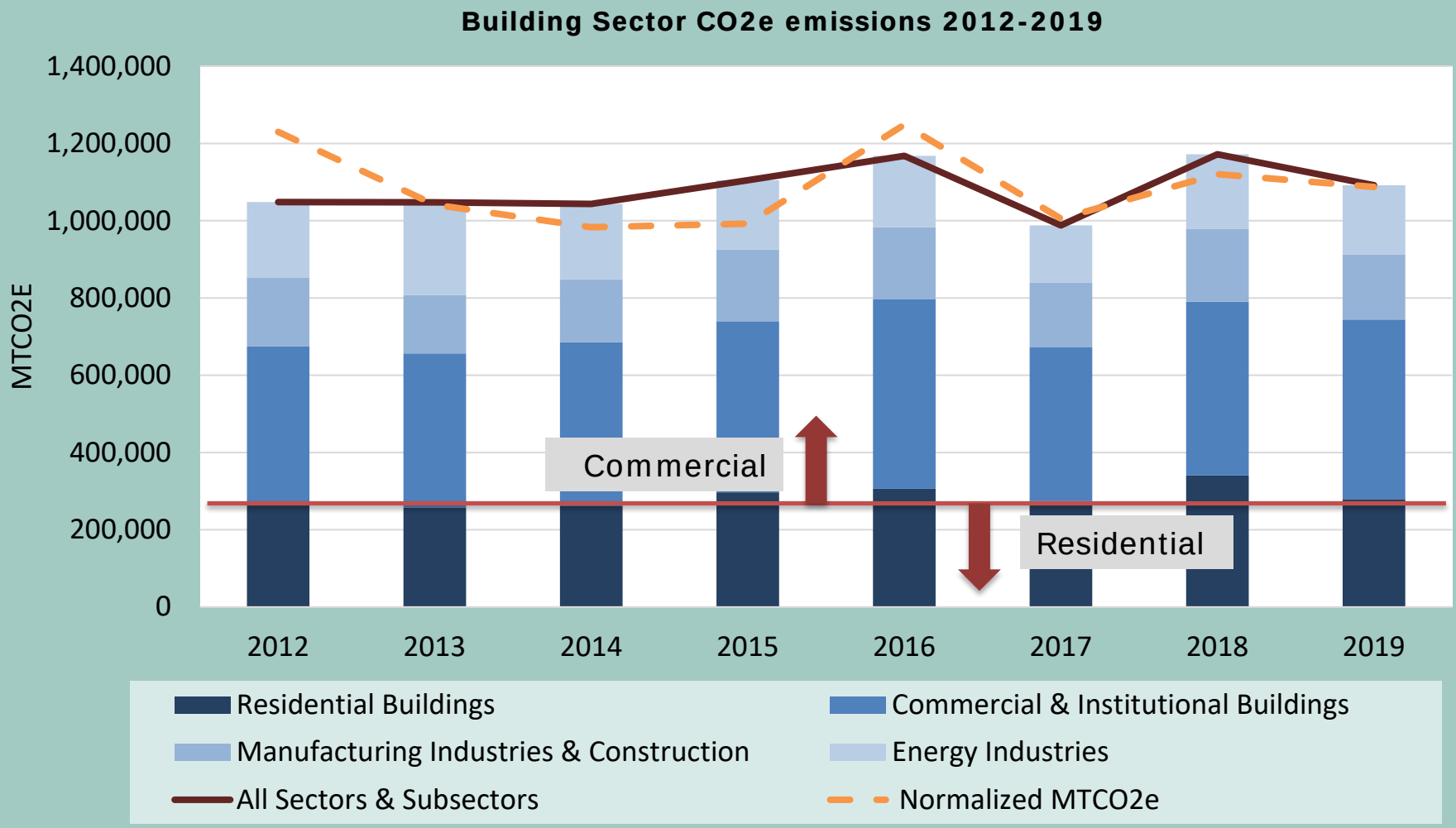
Action Categories	Actions
1. Energy Efficiency	1.1.1 Custom Retrofit Program
	1.1.2 Additional BEUDO Requirements
	1.1.3 Upgrades at Time of Renovation or Sale
	1.1.4 Operations and Maintenance Plan Requirement
2. Net Zero New Construction	2.1 Net Zero New Construction
	2.2.1 Market Based Incentive Program
	2.2.2 Height and FAR Bonus
	2.3 Increase Green Building Requirements
	2.4.1 Net Zero Requirement for New Construction Municipal Buildings
	2.4.2 Renewal of Municipal Buildings
	2.5 Removal of Barriers to Increased Insulation
3. Energy Supply	3.1 Low Carbon Energy Supply Strategy
	3.2 Rooftop Solar Ready Requirement
	3.3 Development of MOU with Local Utilities
4. Local Carbon Fund	4 Investigate Local Carbon Fund
5. Engagement and Capacity Building	5.1 Communication Strategy
	5.2 Develop Ongoing Capacity to Manage NZAP
	5.3 Net Zero Labs Standards

Frames of Reference

Three Frames of reference for considering NZAP Adjustments

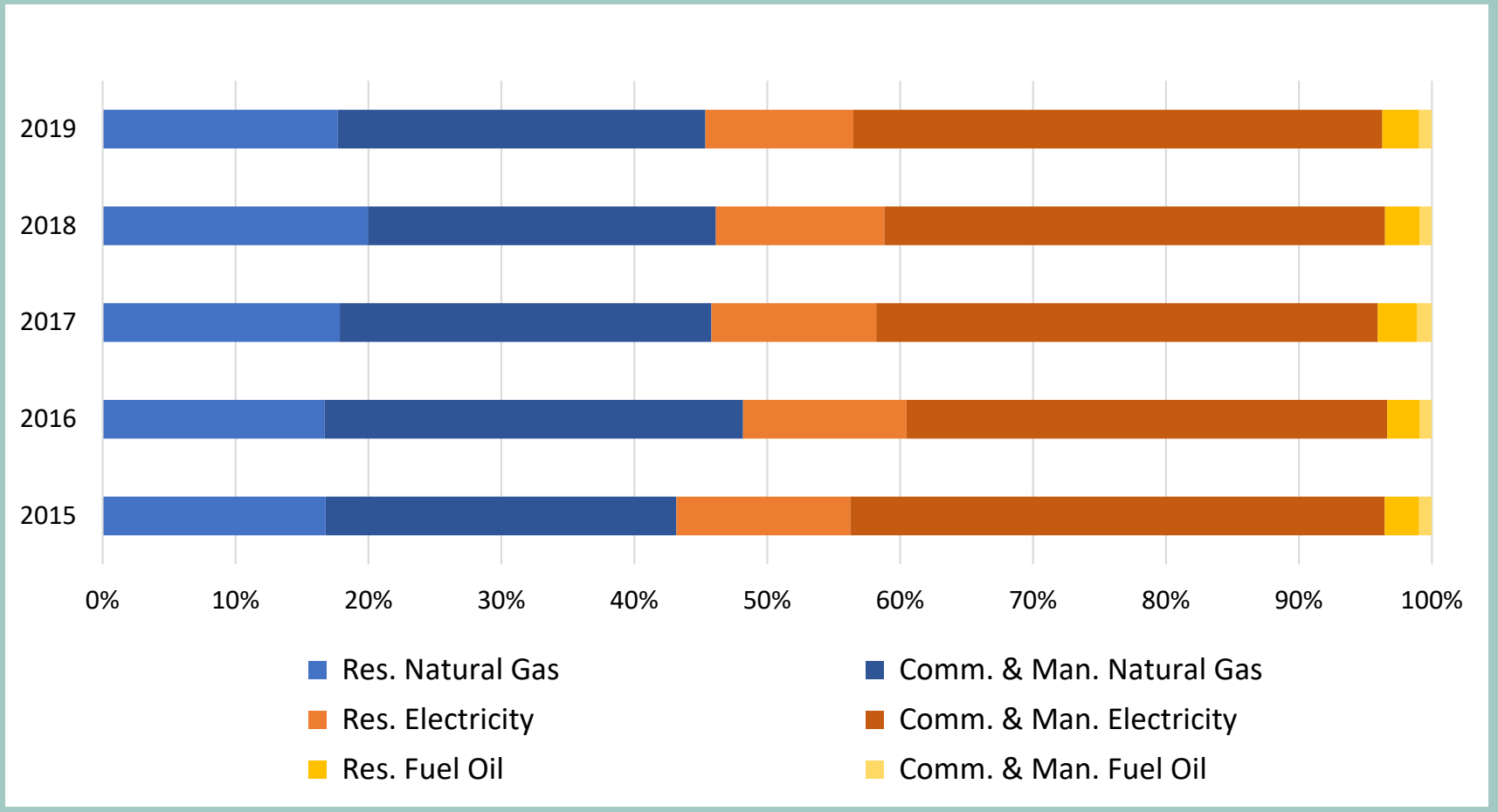
1. Original **NZAP Principles**
2. Current **Science, Policy, Technology and Equity** conditions
3. Overall **potential impacts and co-benefits** to the community
    - *What is the potential for emissions reductions from an Action?*
    - *What is the technical and economic feasibility?*
    - *What co-benefits might be realized by the community if pursing an Action?*

Recent GHG Emissions Trends from Building Stock



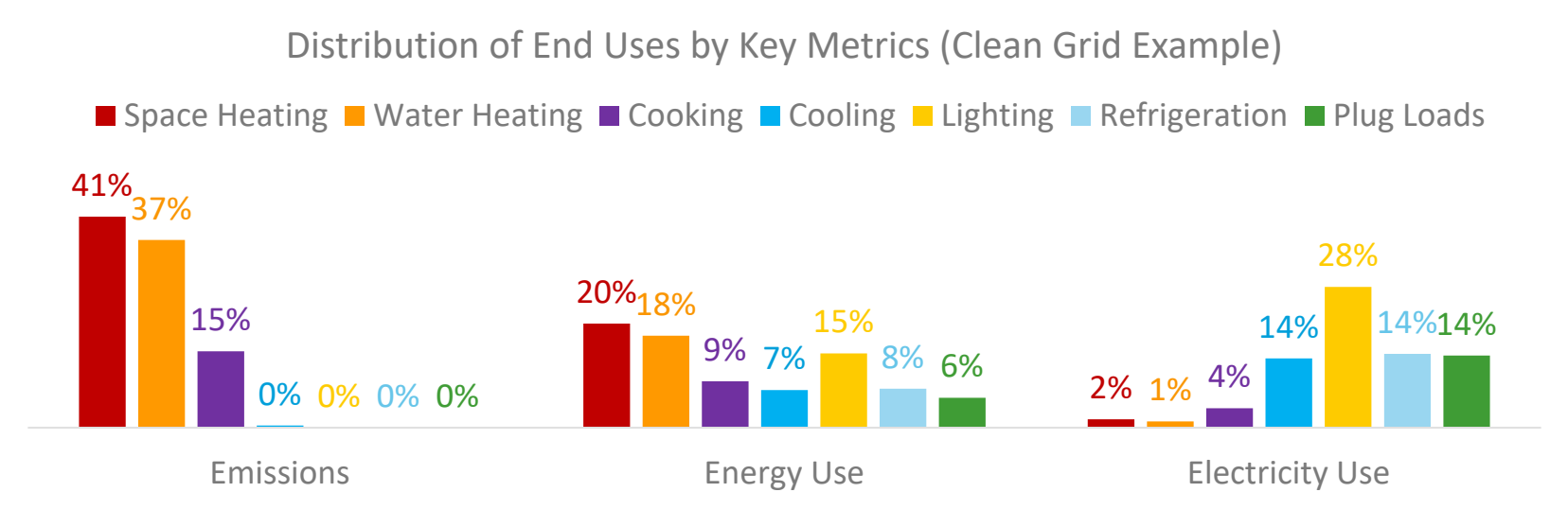
Between 2015 and 2020 Cambridge Added 8.1 million square feet of floor area, yet emissions remained flat

% of GHG Emissions by Fuel



Nearly half of emissions relate to use of natural gas and half relate to electricity consumption

Considerations for Program Development



- By end use, space and water heating, cooking, cooling, lighting, refrigeration, and plug loads are the top energy users in buildings.
- Since each end use leverages a different primary fuel, impacts of actions can be drastically different.
- Where we focus our efforts will be driven by how much progress has been made towards decarbonization

Expectations for NZAP Adjustments

- Original NZAP was a comprehensive assessment and development of a set of actions that would help the city reach it's NZE goals
- Goal of the NZAP 5-year review is not to re-write the plan but consider how to make the existing plan work better

Adjustments may be:

1. Modifications to actions based on priorities or new information
2. Operational – what is needed to make implementation more effective
3. New strategies that will support deep levels of emissions reductions

NZAP Adjustment Guidance

- When considering adjustments, NZTF members may refer to the NZAP Adjustment Tool developed to help guide the process

NZAP Action Adjustment Guideline

This tool was developed to help NZTF think through potential adjustments to the NZAP. The NZAP was originally developed with a robust set of actions that, at the time, represented a comprehensive approach to achieving the city's net zero goals. The current NZAP contains 5 Action Categories and 17 Actions. Adjustments to the NZAP actions may be of operational nature (with respect to implementation), changes in priorities, or the addition of new action actions all together based on conditions that exist today. When considering adjustments, there are three frames of reference that have been discussed:

- Adherence to the original NZAP Principles
- Current Science, Policy, Technology, and Equity conditions
- Potential for emissions reductions and other co-benefits to the community

This guideline is organized according to these frames of reference. Net Zero Task Force members may use this tool to document ideas as well as rate possible adjustments on a scale of 1-5 relative to the anticipated co-benefits of pursuing such an action. NZTF members will be divided into topical working groups to generate ideas for adjustments to energy efficiency, new construction, and energy supply related actions. the working groups shall fill out this template for each idea. The consulting team will then compile this information, prioritize suggestions with NZTF input, and incorporate the feedback into an Updated NZAP.

Action Item for Consideration:	[Enter Action Name]	**Emissions Sector:**	Commercial & Institutional
Description:	[Enter Description]	**Applies to Existing Buildings or New:**	Existing Buildings

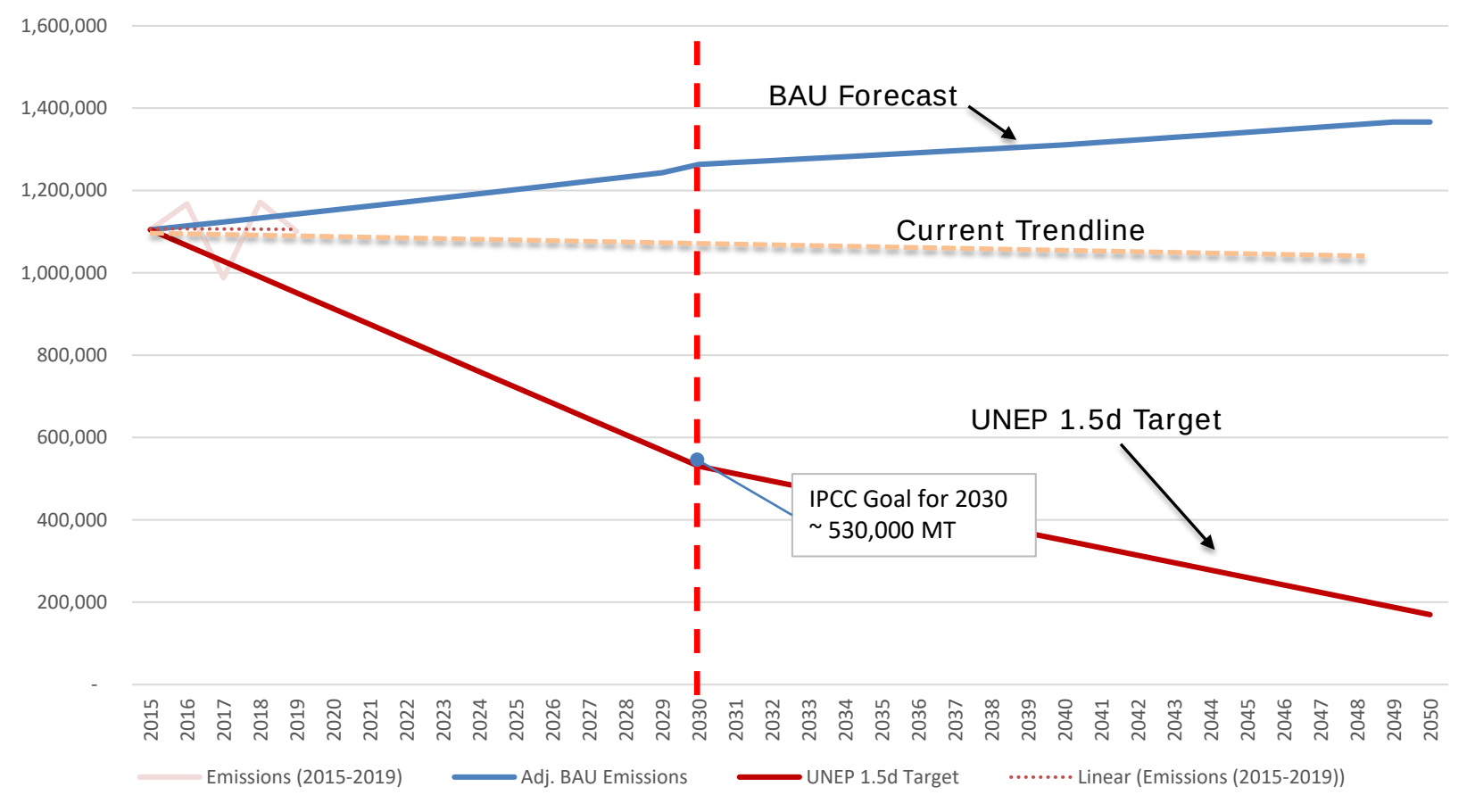
	Adherence to Original NZAP Principles:	**Check off those that apply**	**Notes**
1	Supports climate goals and healthy economic strategies	x	
2	Uses science, market, and data-driven analysis to inform decision making		
3	Support an openness to new ideas when circumstances change		
4	Commitment to allowing the principle of offsets		
5	Commitment to measuring and monitoring impact over time		
6	Ensures consultation is comprehensive and engages affected stakeholders		
7	Commitment to developing informative and replicable models		
8	NEW: Commitment to implementing the NZAP through a racial equity and social justice lens		

Current Science, Policy, Technology, and Equity conditions		**Notes on Potential Adjustment Relative to SPTE**
Science:	The latest scientific assessments that tell us emissions need to be reduced 45% below 2010 levels by 2030 and 100% by 2050 to stay below a 1.5-degree increase. How will this action help support that goal?	
Policy:	Consider how favorable current Federal, State and Local Policies for supporting our effort to reach the science-based goals.	
Technology:	Consider how well established technologies are that are needed to pursue this action	
Equity:	Consider the strength of this action relative to supporting NZAP social equity goals	

Part 3:

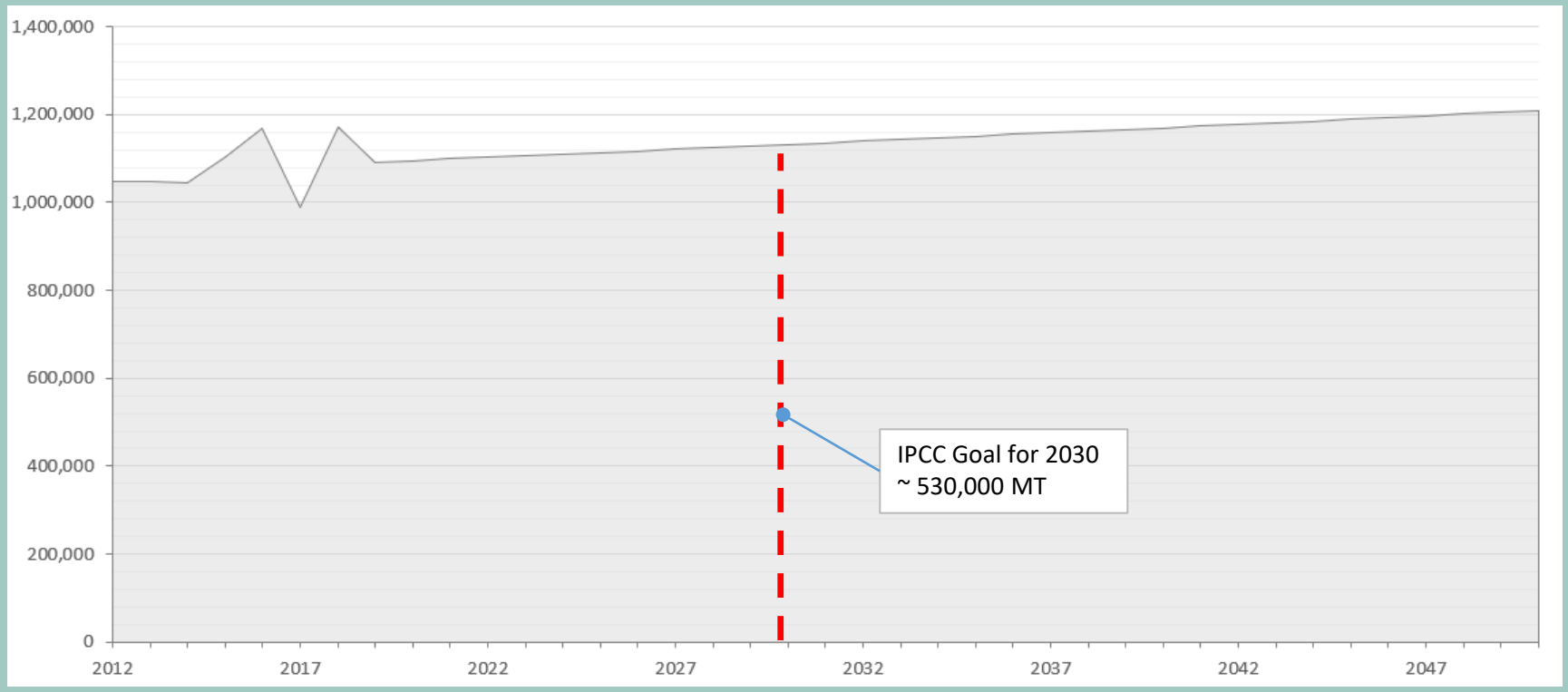
CONSIDERATIONS FOR NZAP ADJUSTMENTS FROM CONSULTING TEAM

GHG Emissions Goals



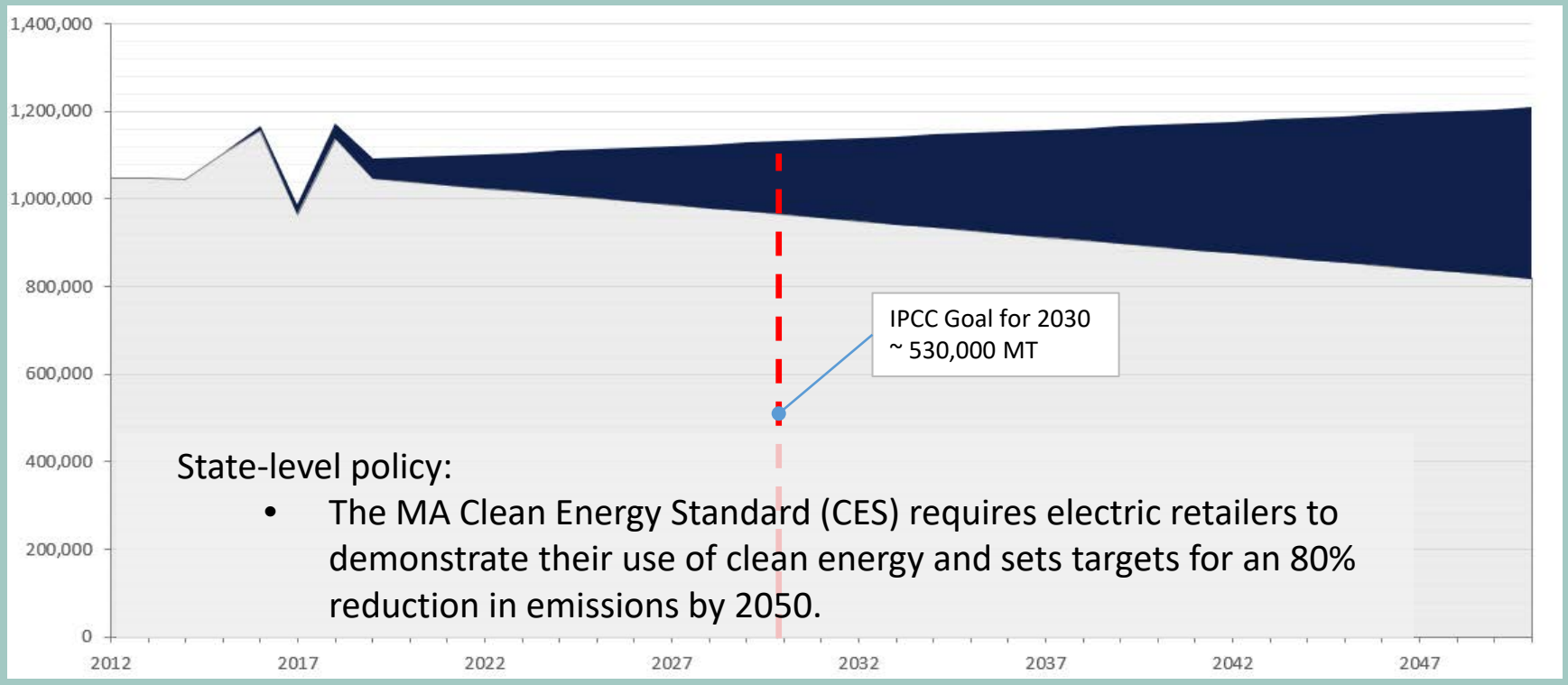
Note: The Current Trendline above does not consider the impacts of NZAP actions that are underway including the BEUDO Performance Requirements which are expected to have a significant impact going forward.

Policy Implications for GHG Emissions Forecast



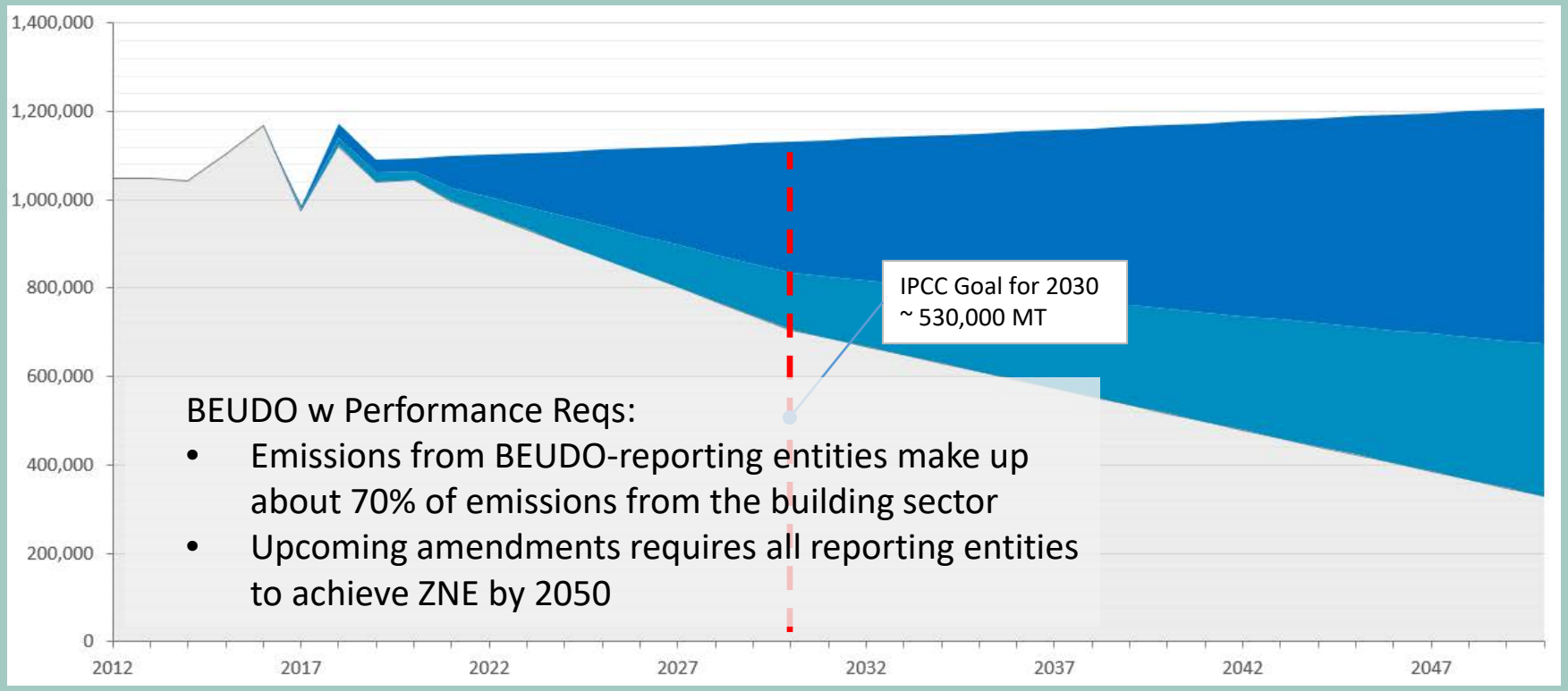
BAU GHG Emissions Forecast

State Policy Implications on GHG Emissions Forecast



GHG Emissions Forecast with State-wide CES Standards Met

City Policy Implications on GHG Emissions Forecast

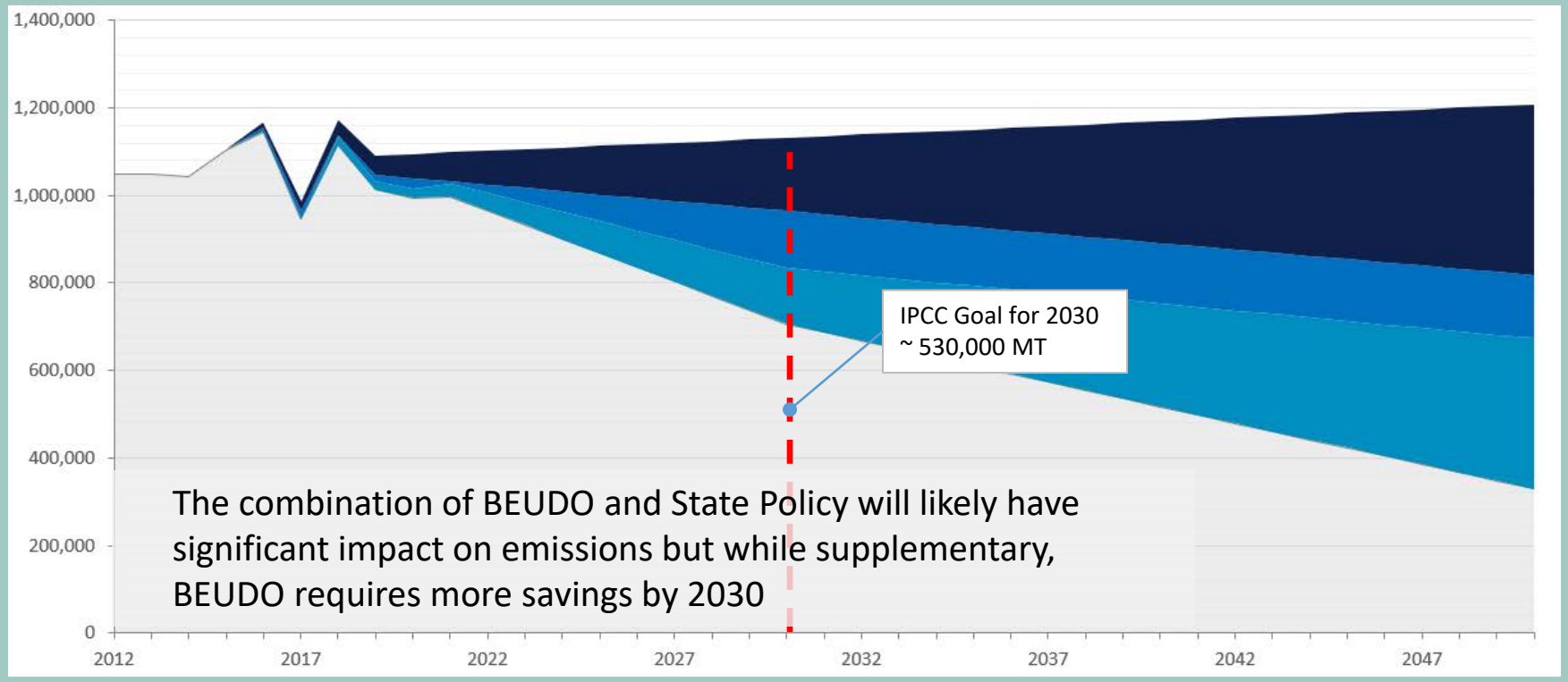


GHG Emissions Forecast with BEUDO goals achieved

Legend:

- Energy Performance Large Buildings (Electricity)
- Energy Performance Large Buildings (Gas)

Policy Implications on GHG Emissions Forecast

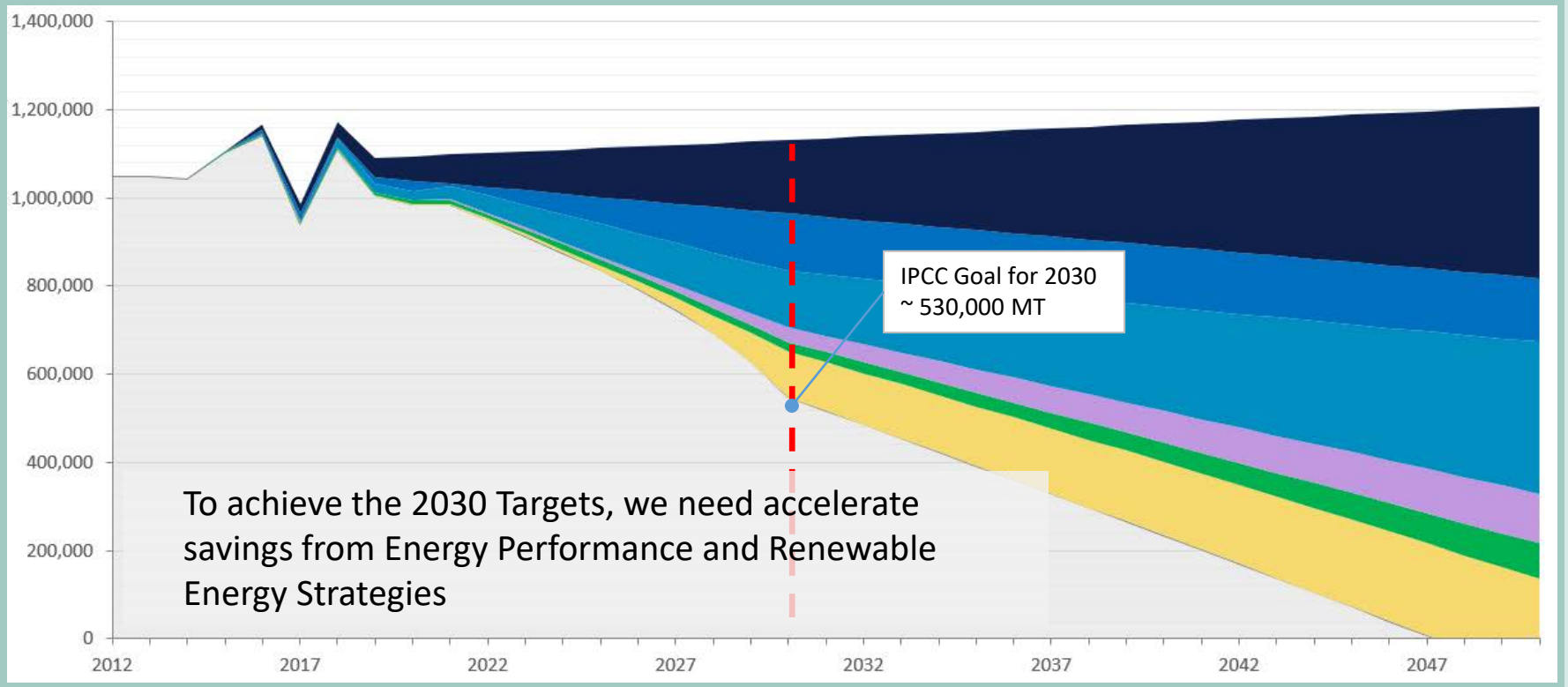


GHG Emissions Forecast with State-wide and BEUDO

Legend:

- State CES
- Energy Performance Large Buildings (Electricity)
- Energy Performance Large Buildings (Gas)

GHG Emissions Reduction Targets



GHG Emissions Targets for Multiple Actions (For Illustrative Purposes Only)

Legend:

- State CES
- Energy Performance Large Buildings (Electricity)
- Energy Performance Large Buildings (Gas)
- EE Retrofits for Homes and Sm. Business
- NZE New Construction
- On-site DER / Renewable Energy

Technology Assessment

Tech Category	NZAP Enabling Technologies	Energy Efficiency in Existing Buildings		Net Zero New Construction		Energy Supply		Relative Impact on Overall Future Cambridge Emissions
		Economic	Technical	Economic	Technical	Economic	Technical	
Thermal Tech	Air / Water Source Heat Pumps	Moderate	Strong	Strong	Strong	n/a	n/a	+++
	Ground Source Heat Pumps	Moderate	Strong	Moderate	Strong	n/a	n/a	++
DER	Rooftop PV	Strong	Strong	Strong	Strong	n/a	n/a	+++
	Solar Thermal	Moderate	Moderate	Moderate	Moderate	n/a	n/a	+
	Fuel Cells	Moderate	Strong	Moderate	Strong	n/a	n/a	+
Energy Efficiency	Lighting Systems	Strong	Strong	Strong	Strong	n/a	n/a	++
	Demand Flexibility	Moderate	Strong	Strong	Strong	n/a	n/a	+++
Materials	PCM / Thermal Storage	Low	Moderate	Moderate	Strong	n/a	n/a	+
	Cement Alternatives	Low	Low	Moderate	Strong	n/a	n/a	++
	Glass	Low	Low	Moderate	Strong	n/a	n/a	++
Thermal Energy Supply	Electrolysis / Hydrogen Blending	n/a	n/a	n/a	n/a	Moderate	Moderate	++
	Geothermal Districts	n/a	n/a	n/a	n/a	Moderate	Moderate	++
Grid-scale Renewables	Wind	n/a	n/a	n/a	n/a	Strong	Strong	+++
	Microgrids	n/a	n/a	n/a	n/a	Moderate	Moderate	++
	Off-site RE Procurement	n/a	n/a	n/a	n/a	Strong	Strong	+++

Estimated Level of Feasibility:

Low Moderate Strong

Scale of Estimated Potential Impact on Overall Future Emissions:

\+ Minor ++ Moderate +++ Significant

Technology Assessment

Tech Category	NZAP Enabling Technologies	Energy Efficiency in Existing Buildings		Net Zero New Construction		Energy Supply		Relative Impact on Overall Future Cambridge Emissions
		Economic	Technical	Economic	Technical	Economic	Technical	
Thermal Tech	**Air / Water Source Heat Pumps**	Moderate	Strong	Strong	Strong	n/a	n/a	+++
	Ground Source Heat Pumps	Moderate	Strong	Moderate	Strong	n/a	n/a	++
DER	**Rooftop PV**	Strong	Strong	Strong	Strong	n/a	n/a	+++
	Solar Thermal	Moderate	Moderate	Moderate	Moderate	n/a	n/a	+
	Fuel Cells	Moderate	Strong	Moderate	Strong	n/a	n/a	+
Energy Efficiency	Lighting Systems	Strong	Strong	Strong	Strong	n/a	n/a	++
	Demand Flexibility	Moderate	Strong	Strong	Strong	n/a	n/a	+++
Materials	PCM / Thermal Storage	Low	Moderate	Moderate	Strong	n/a	n/a	+
	Cement Alternatives	Low	Low	Moderate	Strong	n/a	n/a	++
	Glass	Low	Low	Moderate	Strong	n/a	n/a	++
Thermal Energy Supply	Electrolysis / Hydrogen Blending	n/a	n/a	n/a	n/a	Moderate	Moderate	++
	Geothermal Districts	n/a	n/a	n/a	n/a	Moderate	Moderate	++
Grid-scale Renewables	**Wind**	n/a	n/a	n/a	n/a	Strong	Strong	+++
	Microgrids	n/a	n/a	n/a	n/a	Moderate	Moderate	++
	Off-site RE Procurement	n/a	n/a	n/a	n/a	Strong	Strong	+++

Estimated Level of Feasibility:

Low Moderate Strong

Scale of Estimated Potential Impact on Overall Future Emissions:

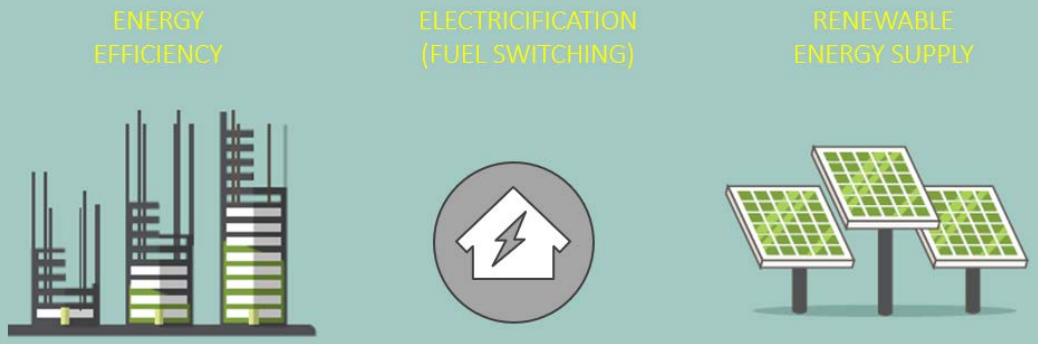
\+ Minor ++ Moderate +++ Significant

Consulting Teams Suggestions for NZAP Adjustments

Reflecting on the challenges previously mentioned and the current Science, Policy, and Technology conditions, the two greatest areas of need are:

- Electricity supply – while current policies suggest the emissions from grid-supplied electricity will decrease, building owners need access to off-site renewable energy to meet emissions reductions goals

- Heating – Emissions from natural gas combustion make-up almost half of city-wide emissions and while it is expected that heat consumption could decrease by up to 59% over the next 20-years (See LCESS Report), reducing natural gas use will be a key and difficult challenge in the years ahead



Pillars of Decarbonization

Consulting Team Suggestions for NZAP Adjustments

Structural Suggestion: Organize NZAP by Decarbonization Strategies and Enabling Actions

To further define the purpose of Actions and enable better tracking of impacts, consider:

- Action Categories as Decarbonization Strategies
- Actions as the activities undertaken to achieve the goals of the strategy
- Tracking emissions impacts at the strategy level (i.e. are these combinations of actions achieving the desired outcome)

Example of Structural Modifications to NZAP

Decarbonization Strategies	Enabling Actions (organized by where impacts occur)
1. Energy Performance Requirements for Large Buildings	1.1.2 Enact Additional BEUDO Requirements
	5.3 Net Zero Labs Standards
	1.1.4 Operations and Maintenance Plan Requirement (*parked*)
2. Energy Efficient Retrofits for Homes and Small Businesses	1.1.1 Custom Retrofit Program
	1.1.3 Upgrades at Time of Renovation or Sale
	5.1 Communications Strategy and Mobilization
	4 Investigate Local Carbon Fund
3. Net Zero New Construction	2.1 Net Zero New Construction
	2.2.1 Market Based Incentive Program (*parked*)
	2.2.2 Height and FAR Bonus (*parked*)
	2.3 Increase Green Building Requirements
	2.4.1 Net Zero Requirement for New Construction Municipal Buildings
	2.4.2 Renewal of Municipal Buildings
	2.5 Removal of Barriers to Increased Insulation
4. Low Carbon Energy Supply	3.1 Low Carbon Energy Supply Strategy
	3.2 Rooftop Solar Ready Requirement
	3.3 Development of MOU with Local Utilities (*parked*)

Consulting Team Suggestions for NZAP Adjustments

For **Energy Efficiency and Electrification**:

- Implement a Point-of-Sale requirement that focuses on replacing fossil-fuel heating systems with heat pumps in homes and small businesses
- Continue to pursue a Carbon Fund to subsidize emissions reducing projects in disadvantaged communities

For **New Construction** Actions

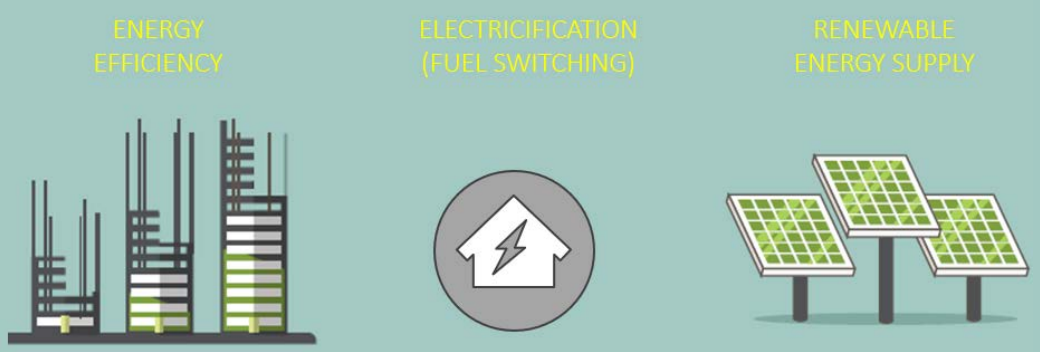
- Net Zero / Passive House Requirements for All New Construction

Consulting Teams Suggestions for NZAP Adjustments

For **Energy Supply** Actions:

- Enable greater access to NZAP compliant off-site renewable energy

- Expand district heating systems incorporating alternate fuel sources for energy production. This may include:
  - District geothermal networks
  - Electrolysis / Hydrogen production
  - Biomass
  - Thermal energy storage



Pillars of Decarbonization

EXAMPLE Modifications based on Consulting Team Suggestions*

Emissions Reduction Strategies	Enabling Actions (organized by where impacts occur)
1. Energy Performance Requirements for Large Buildings	1.1.2 Enact Additional BEUDO Requirements
	Engagement and capacity building through Cambridge Compact (CCSF)
	~~5.3~~ Net Zero Labs Standards
	~~1.1.4 Operations and Maintenance Plan Requirement~~ (no longer being pursued)
2. Energy Efficient Retrofits for Homes and Small Businesses	1.1.1 Custom Retrofit Program
	1.1.3 Electrification Upgrades at Time of Renovation or Sale
	~~5.1~~ Communications Strategy and Mobilization
	~~4 Investigate~~ Local Carbon Fund for Disadvantaged Communities
3. Net Zero New Construction	~~2.2.1 Market Based Incentive Program~~ (no longer being pursued)
	~~2.2.2 Height and FAR Bonus~~ (Determined to not be desirable)
	2.3 Increase Green Building Requirements to All NC ZNE
	2.4.1 Net Zero Requirement for New Construction Municipal Buildings
	2.4.2 Renewal of Municipal Buildings
	~~2.5 Removal of Barriers to Increased Insulation~~ (Incorporated into Art. 22)
	Selection of Materials that Minimize Embodied Carbon
4. Low Carbon Energy Supply	3.1 ~~Low Carbon Energy Supply Strategy~~ Expand District Heating Systems
	3.2 ~~Rooftop Solar Ready Requirement~~ Multi-initiative Solar/DER
	~~3.3 Development of MOU with Local Utilities~~ (no longer being pursued)
	Enable access to NZAP Compliant Off-site Renewable Energy

*This table is provided in the interest of providing NZTF guidance on possible modifications

Part 4:

BREAKOUT SESSION

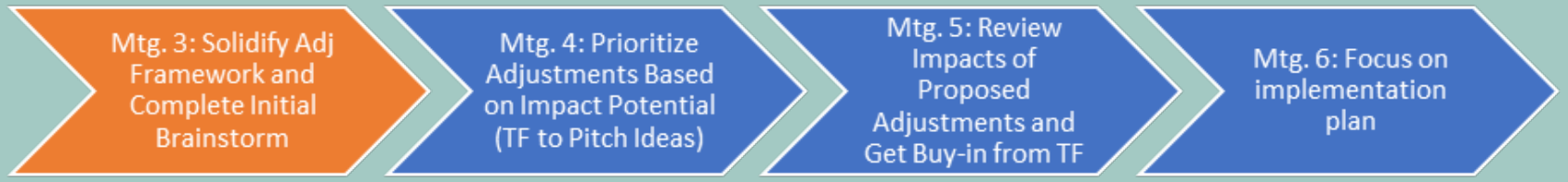
Guidance for Breakout

Objective of this Breakout:

- Socialize content and what it means for process
- High-level brainstorming of action adjustments

Following the meeting:

- Task Force members are asked to come up with a list of recommended changes for their respective areas
- Conduct some additional research
- Complete the NZAP adjustment guidance tool for each proposed adjustment



Guidance for Breakout

Consider Structural Modifications to NZAP

- Suggestions on overall action framework
- Potential new actions within the action categories
- Potential adjustments for capacity building
- Possible elimination of actions

Considerations for new actions or adjustments to existing actions

- Alignment with NZAP Principles
- Reflection of Science, Technology, Policy & Equity
- GHG reduction potential & Co-benefits associated with action

Guidance for Breakout

Reporting out

- Following the breakout groups will take 2 minutes to share what was discussed and their top idea

GROUP ORGANIZATION FOR HOMEWORK

Guidance for Breakout

Homework

- TF will receive an email from appointed facilitator based on breakout groups; *let us know if you prefer a different group*.
- Members should schedule an additional meeting of their group to continue the discussion started today.
- Participants might consider each working on researching one proposed adjustment and evaluating with scorecard.
- Each group is to prepare a "pitch" of the proposed adjustment(s) for the next meeting.

Governance

- Set up organization of note taking, identification of responsibility for pitching at next meeting.
- Google docs may be used to refine proposed adjustments
- Participants can comment on other groups' ideas in the Google docs for the other groups.

NZAP Adjustment Guidance

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Policy:	Consider how favorable current Federal, State and Local Policies for supporting our effort to reach the science-based goals.	
Technology:	Consider how well established technologies are that are needed to pursue this action	
Equity:	Consider the strength of this action relative to supporting NZAP social equity goals	

Part 6:

PUBLIC COMMENT

Closing

- Next Meeting is planned for late February
- Topic: NZAP Adjustments

Thank You!

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