Appendix D – GHG Targets, Calculators, and Inputs

This chapter provides additional information that was considered when defining Miami's interim GHG reduction target, a description of modifications made to the original solid waste emissions estimates, as well as documentation for the GHG calculator inputs used in the Pathways tool when defining the city's GHG reduction scenario.

Interim Target-Setting Considerations

Selecting an appropriate interim GHG target that supports the City's longer-term carbon neutrality goal was informed, in part, by the 2018 United Nation's International Panel on Climate Change (IPCC) *Special Report on Global Warming of 1.5°C (SR15*), which outlines the need for global emissions to drop at least 45% by 2030 to keep warming to *1.5*°C.[1] It also included C40's 2016 report *Deadline 2020,*[2] which focuses on the need for cities to accelerate action with ambitious interim targets, and assigns categories based on GHG emissions and economic thresholds to help cities plan a "fair-share" of global reductions toward an average per capita emissions of 2.9 MT CO_2e by 2030.

To determine the interim 2035 target, the City first analyzed its assigned Deadline 2020 trajectory and reviewed the feasibility of the strategies needed to achieve the target. The recommended "steep decline" in emissions would require a rapid and dramatic increase in use of public transit and bicycles, conversion of nearly all vehicles to electric, massive reduction in energy use in buildings, and a completely carbon-free energy sector including total phase out of natural gas. The City's lack of foundational policies and programs, limited legislative jurisdiction, and inability to financially support adoption of new technologies determined that the goal was not realistic. The current interim target established in the plan (i.e., 60% reduction below 2018 levels by 2035) reflects goals and strategies that the City feels are ambitious, yet achievable based on existing federal and state law, the city's authority, and market forces. The City will work to implement this plan and add to the City's goals as momentum is established and learning can inform future planning.

Based on Miami's population projections, the City's 2035 target would result in per capita emissions of about 2.0 MT CO_2e per person in 2035. This Plan, and its 2035 target, qualifies City of Miami to join the 471 cities, 23 regions, 1,675 businesses, 85 large investors, and 569 universities (as of 2021) worldwide participating in the UN Race to Zero campaign.[3] The interim target was defined to balance science-based, fair-share reduction goals with the City's jurisdiction, to create a target that is a legitimate steppingstone toward long-term carbon neutrality. Achieving this interim target will ensure Miami is on track to meet the Paris Climate Agreement goals and achieve carbon neutrality by 2050. As this is the City's first GHG Plan, we will also continue to evaluate and pursue more aggressive climate action during plan implementation and strive to exceed our established target years.

[1] https://www.globalcovenantofmayors.org/wp-content/uploads/2019/09/2327_For_cities_by_cities_v18_1.original.pdf
[2] https://www.c40.org/researches/deadline-2020
[3] https://unfccc.int/climate-action/race-to-zero-campaign

Solid Waste

The 150,000 tCO_2e created by incinerating Miami's solid waste to create electricity (documented in the 2018 inventory) should be categorized as energy sent to the grid in the stationary emissions sector (per the GPC GHG inventory protocol) because this waste is combusted to produce energy that jurisdictions then consume as electricity. The other 40,000 tCO_2e estimated in the original inventory was miscalculated, attributing characteristics of municipal solid waste to the residue that is created by the waste-to-energy incineration process. Unlike municipal solid waste, that residue does not have carbon content that could decompose in a landfill environment to generate additional greenhouse gas emissions; it is an inert material in relation to greenhouse gas emissions when sent to landfill. Therefore, those original emissions estimates were removed from the GHG planning process in this plan.

Pathways Inputs and Assumptions

The following table documents the GHG calculator inputs used in the Pathways tool to develop Miami's final GHG reduction scenario. The relevant GHG strategies are listed in the first column, GHG calculator implementation assumptions for 2035 and 2050 are shown in the second and third columns, and general implementation assumptions, where relevant, are shown in the fourth column. Note that information is provided as it appears in the Pathways tool, and in most instances is describing the changes to occur from the 2018 base year conditions included in the model.

Strategy	Implementation in 2035	Implementation in 2050	Assumptions
Grid Decarbonization	100% Renewable Energy	100% Renewable Energy	Biden Administration Executive Order: Build a carbon pollution-free electricity sector by 2035[4]
New construction – efficiency (Commercial)	• 100% LED Lighting • 29% of new space heaters are electric; 71% of new space heaters are high-efficiency natural gas boilers • 100% of new cooling systems are electric heat pumps • 5% of new water heaters are electric heat pumps; 95% of new water heaters	• 100% LED Lighting • 40% of new space heaters are electric; 60% of new space heaters are high-efficiency natural gas boilers • 100% of new cooling systems are electric heat pumps • 20% of new water heaters are electric heat pumps; 80% of new water	N/A

[4] https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/

Strategy	Implementation in 2035	Implementation in 2050	Assumptions
	are high-efficiency natural gas boilers 15% of new stoves are electric; 85% of new stoves are natural gas	heaters are high-efficiency natural gas boilers 28% of new stoves are electric; 72% of new stoves are natural gas	
New construction – efficiency (Residential)	• 100% LED Lighting • 100% of new space heater are electric • 100% of new cooling systems are electric • 83% of new water heaters are electric; 17% of new water heaters are high-efficiency natural gas boilers • 86% of new stoves are electric; 14% of new stoves are natural gas	• 100% LED Lighting • 100% of new space heater are electric • 100% of new cooling systems are electric • 86% of new water heaters are electric; 14% of new water heaters are high-efficiency natural gas boilers • 88% of new stoves are electric; 12% of new stoves are natural gas	• N/A
Space cooling – efficiency (Commercial)	• Retrofit 40% of systems to electric heat pumps	• Retrofit 100% of systems to electric heat pumps	• Lifespan of typical cooling systems is roughly 20 years • 100% of equipment owners with electric systems will voluntarily increase equipment efficiency at end of life
Space cooling – efficiency (Residential)	• Retrofit 40% of systems to electric heat pumps	• Retrofit 100% of systems to electric heat pumps	• Lifespan of typical cooling systems is roughly 20 years • 100% of equipment owners with electric systems will voluntarily increase equipment efficiency at end of life

Strategy	Implementation in 2035	Implementation in 2050	Assumptions
Space heating – efficiency/fuel switch (Commercial)	• Retrofit 7% of low-efficiency natural gas boilers to electric heat pumps • Retrofit 40% of low-efficiency natural gas boilers to high-efficiency natural gas boilers	• Retrofit 14% of low-efficiency natural gas boilers to electric heat pumps • Retrofit 65% of low-efficiency natural gas boilers to high-efficiency natural gas boilers • Retrofit 100% of existing electric heaters with electric heat pumps	• Lifespan of typical heating systems is roughly 20 years • 10% of equipment owners will voluntarily electrify gas equipment at end of life • 60% of equipment owners will voluntarily increase equipment efficiency at end of life
Space heating – efficiency/fuel switch (Residential)	• Retrofit 100% of existing electric heaters with electric heat pumps	• Retrofit 100% of existing electric heaters with electric heat pumps	• Lifespan of typical heating systems is roughly 20 years • 100% of equipment owners with electric systems will voluntarily increase equipment efficiency at end of life
Water Heating – efficiency/fuel switch (Commercial)	• Retrofit 7% low-efficiency natural gas boilers to electric heat pumps • Retrofit 40% low-efficiency natural gas boilers to high-efficiency natural gas boilers	• Retrofit 14% low-efficiency natural gas boilers to electric heat pumps • Retrofit 65% low-efficiency natural gas boilers to high-efficiency natural gas boilers	• Lifespan of typical water heating systems is roughly 20 years • 10% of equipment owners will voluntarily electrify gas equipment at end of life • 60% of equipment

Strategy	Implementation in 2035	Implementation in 2050	Assumptions
			owners will voluntarily increase equipment efficiency at end of life
Water Heating – efficiency/fuel switch (Residential)	• Retrofit 7% low-efficiency natural gas boilers to electric heat pumps • Retrofit 11% low-efficiency natural gas boilers to solar hot water heaters • Retrofit 100% of existing electric heaters with electric heat pumps	• Retrofit 14% low-efficiency natural gas boilers to electric heat pumps • Retrofit 28% low-efficiency natural gas boilers to solar hot water heaters • Retrofit 100% of existing electric heaters with electric heat pumps	• Lifespan of typical water heating systems is roughly 20 years • 10% of equipment owners will voluntarily electrify gas equipment at end of life • 100% of equipment owners with electric systems will voluntarily increase equipment efficiency at end of life
Cooking – efficiency/fuel switch (Residential) ***Note: No actions for commercial***	• Retrofit 7% of natural gas stoves with electric stoves	• Retrofit 14% of natural gas stoves with electric stoves	• Lifespan of typical cooking equipment is roughly 20 years • 10% of equipment owners will voluntarily electrify gas equipment at end of life
Mode shift – walk/bike/transit	• 10% shift away from passenger vehicle trips to walking and biking	• 16% shift away from passenger vehicle trips to walking and biking	• Bloomberg Electric Vehicle Outlook 2020[5]: 16% of all VMT from shared

[5] https://about.bnef.com/electric-vehicle-outlook-2020/

Strategy	Implementation in 2035	Implementation in 2050	Assumptions
	• 5% shift away from passenger vehicle trips to transit	• 8% shift away from passenger vehicle trips to transit	mobility usage by 2040
Passenger vehicle – fuel switch/efficiency	• 40% of passenger vehicles, light-duty trucks, and medium-duty trucks are electric	• 50% of passenger vehicles, light-duty trucks, and medium-duty trucks are electric	• Bloomberg Electric Vehicle Outlook 2020[6]: 31% of world's passenger cars are electric by 2040

[6] https://about.bnef.com/electric-vehicle-outlook-2020/