Local GHG Inventories

Virtual Training on Community Greenhouse Gas Inventories

Led by **MAPC** and **DNV GL Energy Insights**

June 25, 2020

ZERO to 101

NOTIFICATION OF RECORDING

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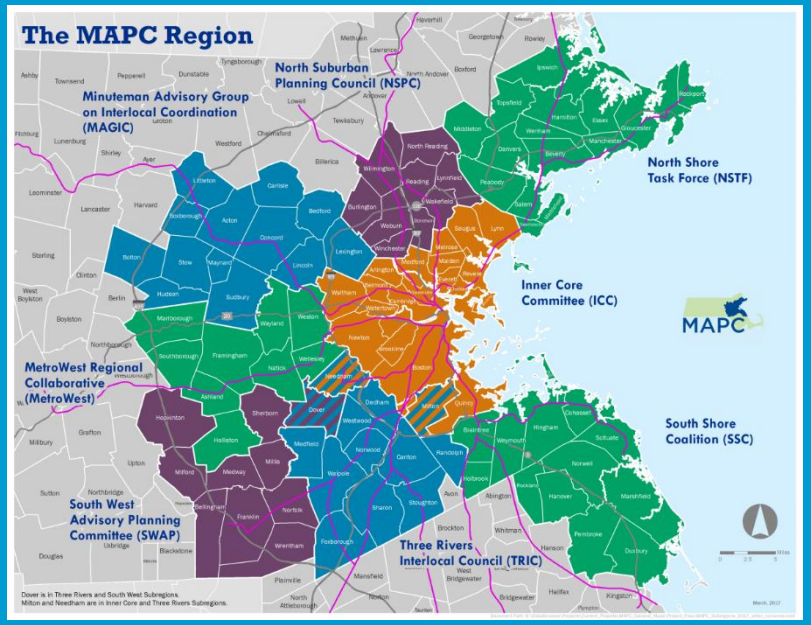
MAPC
METROPOLITAN AREA PLANNING COUNCIL

Today's Agenda

1:00 – 1:10 PM	Welcome & Introductions
1:10 – 1:20 PM	Greenhouse Gas Inventory 101
1:20 – 1:30 PM	Introduction to the Tool
1:30 – 1:40 PM	Community Pilot – Lessons Learned in Arlington, MA
1:40 – 2:10 PM	Data Collection Boot Camp Stationary Energy Transportation Waste
2:10 – 2:25 PM	Q&A
2:25 – 2:30 PM	Wrap Up & Next Steps

DNV GL: Locally based in Medford, delivering climate change planning services around the globe for a safe, reliable, and sustainable energy future.

MAPC: Serving the people who live, work, and play in the 101 cities and towns of Metro Boston.



MAPC's Net Zero Services

DATA

Data collection and development of a GHG inventory

Inventory analysis and summary report development

Training and/or coaching on use of MAPC's new Tool

Communications materials with GHG inventory data

PLANS

Assessment and mapping of vulnerable populations

Development of community engagement strategy

Creation of net zero action roadmaps

Creation of climate action plans

GOALS

Development of ordinances / goal setting language

Support on adoption process

Net Zero Framework for Action

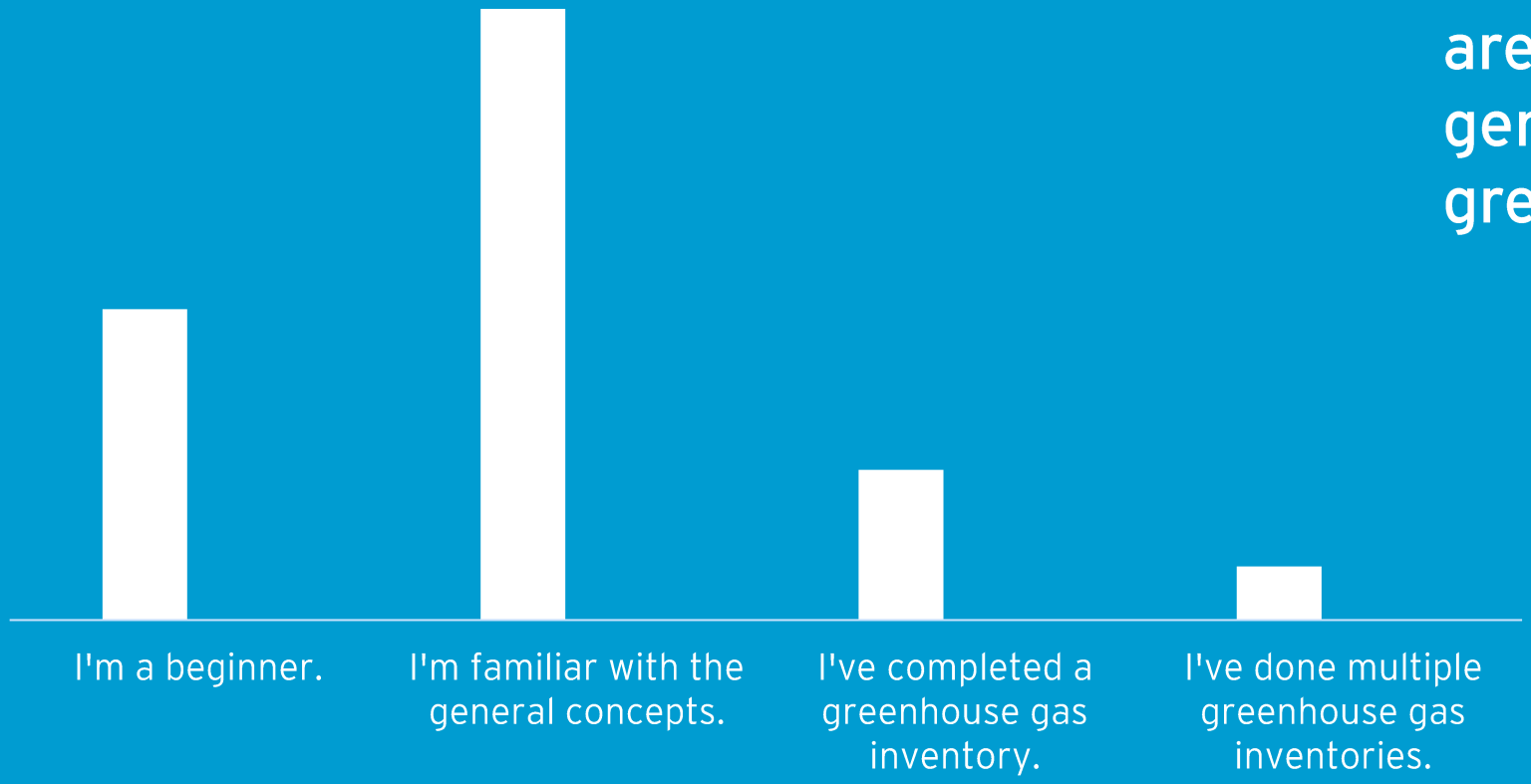
Recruit Support from Community

Pursue Commitment

Prioritize Holistic Planning

Gather Necessary Information

Registration Questionnaire



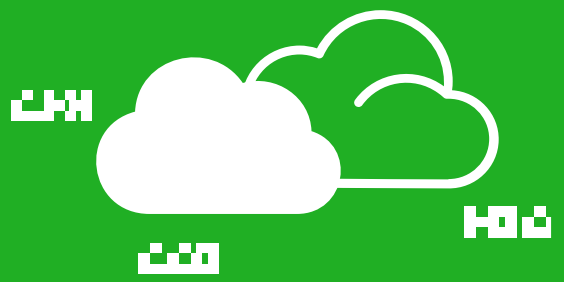
Over half of registrants are familiar with the general concepts of greenhouse inventories.

Getting to know you!

Greenhouse Gas Inventories 101

Covering the Basics and Getting to Know the Global Protocol

What is a Greenhouse Gas Inventory?



A **GHG inventory** accounts for the emissions resulting from a defined geographic area (e.g., city, town, state, etc.) in a given year.

The primary greenhouse gases include: **carbon dioxide** (CO2), **methane** (CH4), and **nitrous oxide** (N2O).

The Global Protocol also includes: perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulfur hexafluoride (SF6) and nitrogen trifluoride (NF3).

Greenhouse Gas Inventory Frameworks

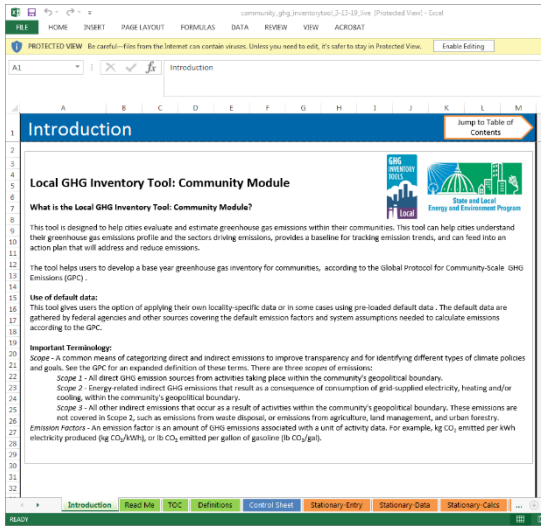
GUIDANCE

GREENHOUSE GAS PROTOCOL

Global Protocol for Community-Scale Greenhouse Gas Emission Inventories

An Accounting and Reporting Standard for Cities

WORLD RESOURCES INSTITUTE · C40 CITIES · ICLEI



TOOLS

ClearPath

AN ICLEI USA TOOL

CDP™

DRIVING SUSTAINABLE ECONOMIES

REPORTING

The Global Protocol for Community-Scale Greenhouse Gas Inventories

- Developed by the World Resources Institute, C40 Cities, and ICLEI Local Governments for Sustainability.
- Establishes reporting requirements for all community GHG inventories and provides detailed guidance for quantifying GHG emissions.
- Uses a scopes framework for GHG emissions.

Reporting Levels with the Global Protocol

The Global Protocol provides communities with two levels for reporting GHG emissions: BASIC and BASIC+.

- BASIC level reporting includes GHG emissions sources that most commonly occur in communities and, for the most part, have readily available data.
- BASIC+ level reporting expands on the sources covered by BASIC and is a more comprehensive inventory of all GHG emissions.

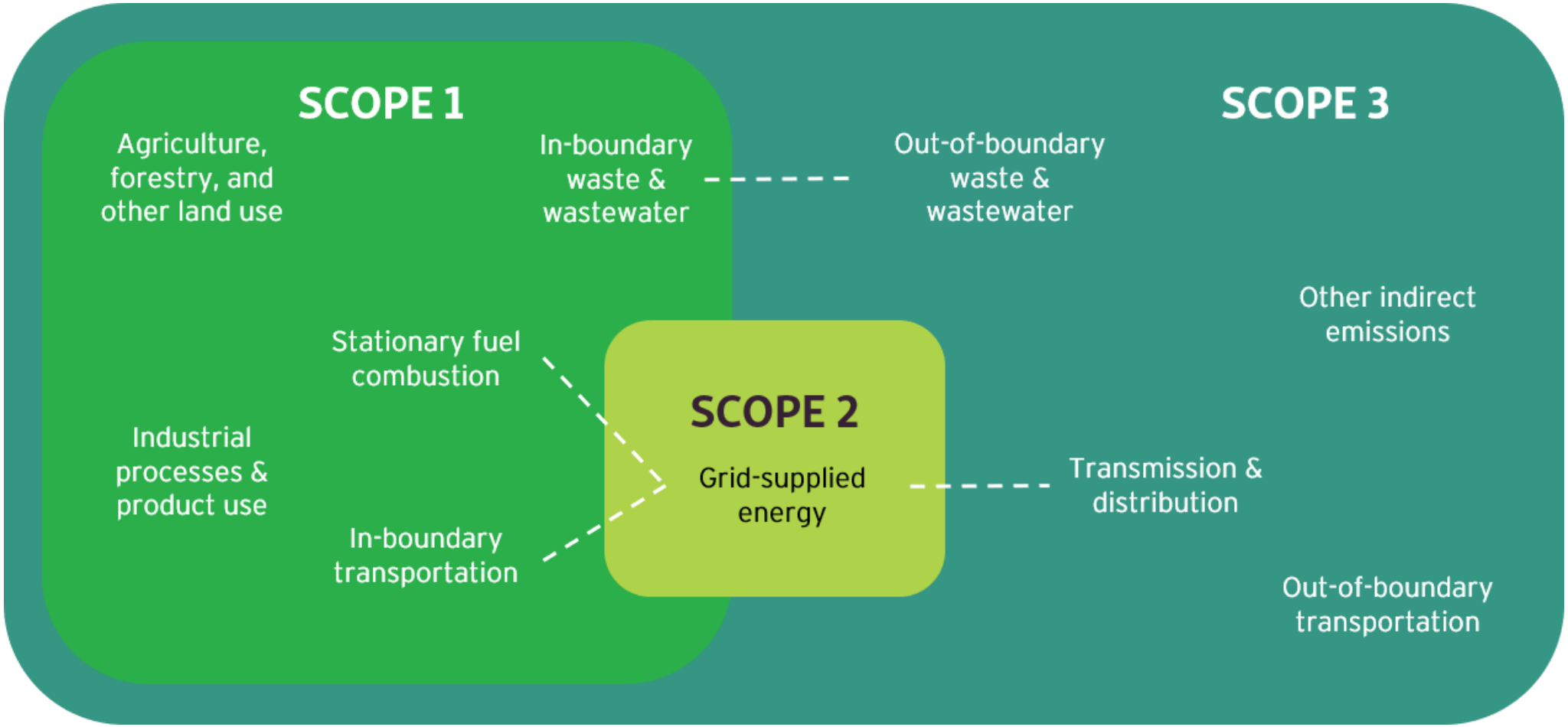
Global Protocol GHG Inventory Sectors

Sectors	Sub-sectors
Stationary Energy	Residential buildings
	Commercial and institutional buildings and facilities
	Manufacturing industries and construction
	Energy industries
	Agriculture, forestry, and fishing activities
	Fugitive emissions from oil and natural gas systems
Transportation	On-road
	Railways
	Off-road
Waste	Disposal of solid waste generated in the city
	Biological treatment of waste generated in the city
	Incineration and open burning of waste generated in the city
	Wastewater generated in the city
Potential Additional BASIC+ Sectors	
Industrial Process and Product Use	
Agriculture, Forestry and Other Land Use	
Other Scope 3	

What is the Scopes Framework?

- **Scope 1** emissions are physically occur within the geographic boundary
- **Scope 2** emissions occur as a result of use of grid-supplied electricity, heat, steam and/or cooling) within the city boundary,
- **Scope 3** emissions occur outside of the geographic boundary but are driven by activities within the geographic boundary.

Scopes & Boundaries of GHG Emissions



Introduction to MAPC's New Tool

MAPC's New Resources and How to Use Them

MAPC Project Goals & Outcomes

1 A localized guide and consistent approach for municipalities, that includes:

- Recommended approaches to calculating emissions in adherence with GPC
- Preferred localized emissions factors (where available)
- Instructions on where to collect data locally
- Guidance on timeframe and staff workload

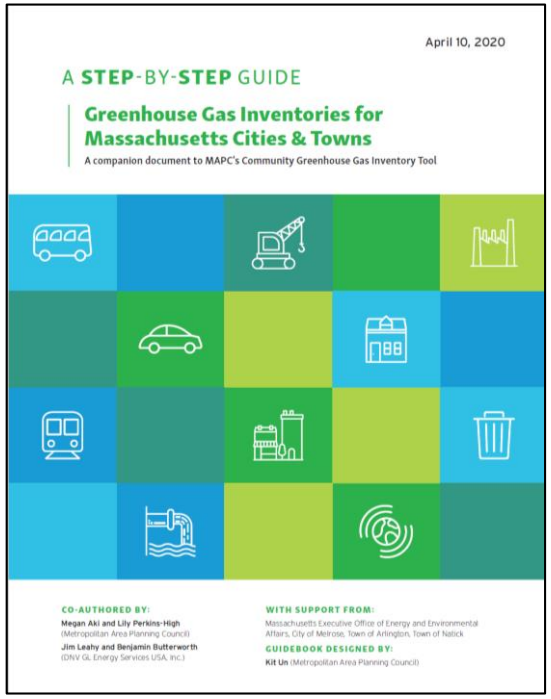
2 An easy-to-use tool for accounting and tracking GHG emissions over time, that provides users with:

- User-friendly data entry points for activity data and emissions factors
- Open access to all formulas and applied factors with details on what calculations are being performed
- Chart and table outputs with a snapshot for that inventory year and historic emissions over time

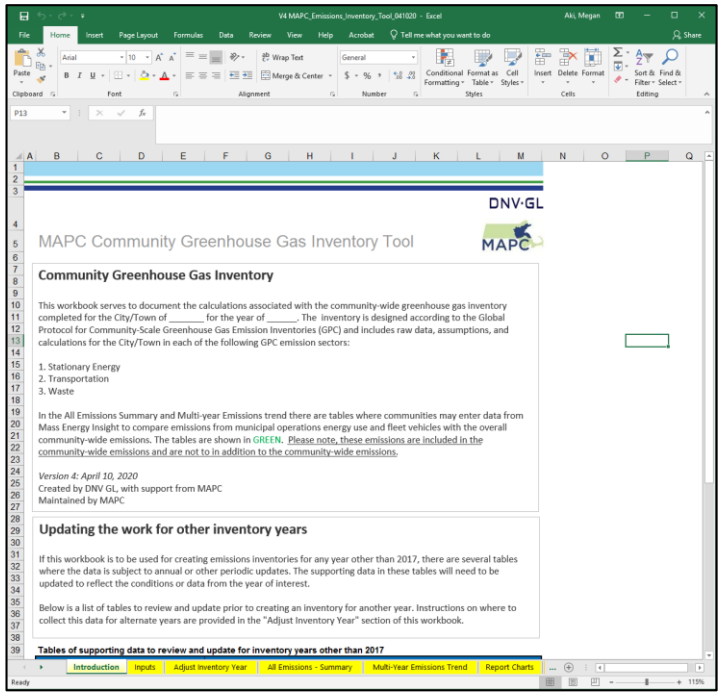
3 A training for municipal staff and volunteers from the participating communities, that leads to:

- Multiple individuals in each community with the understanding and capacity to interact with and update the GHG inventory tool
- An established process for updating and hard copies of training materials

MAPC's New GHG Inventory Resources

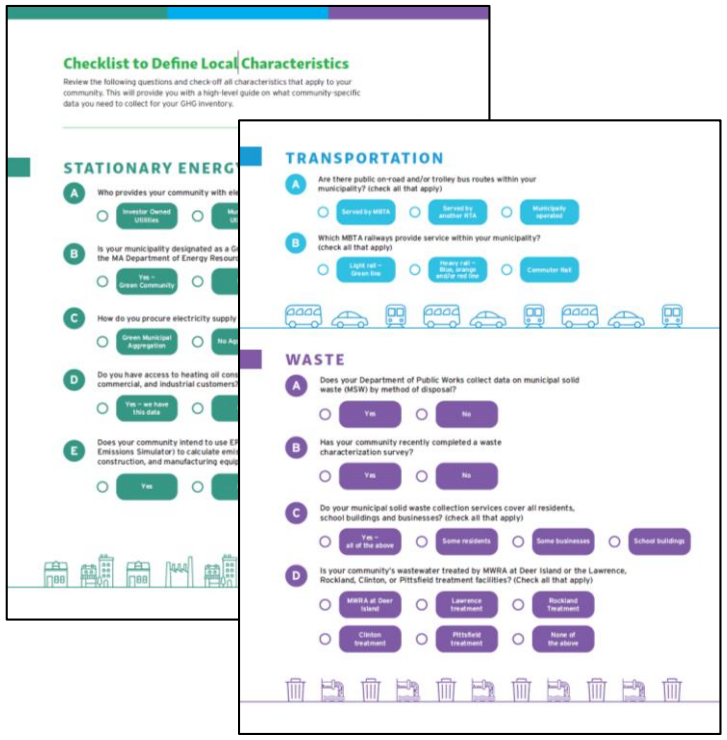


The Guide – "A Step-by-Step Guide on Greenhouse Gas Inventories for Massachusetts Cities & Towns"

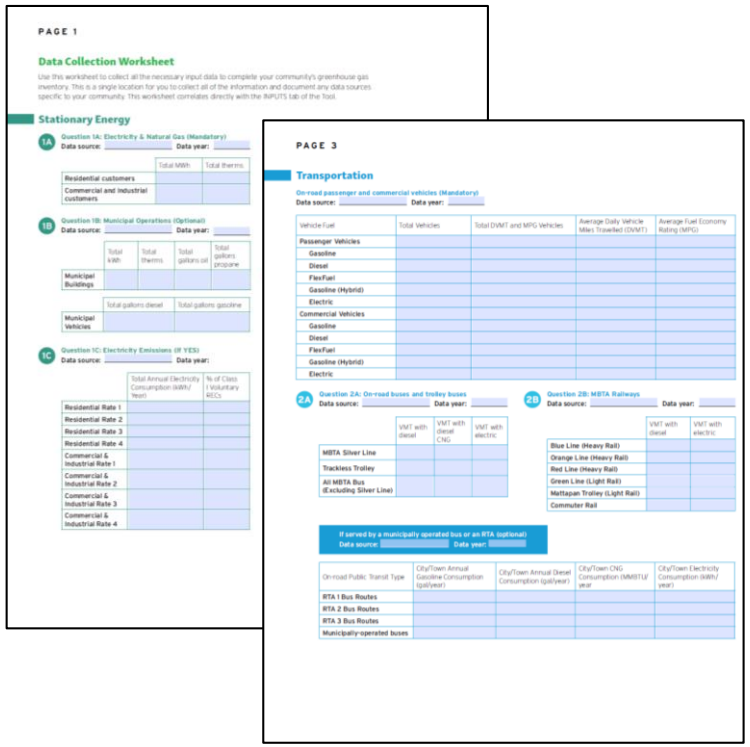


The Tool – "MAPC's Community Greenhouse Gas Inventory Tool"

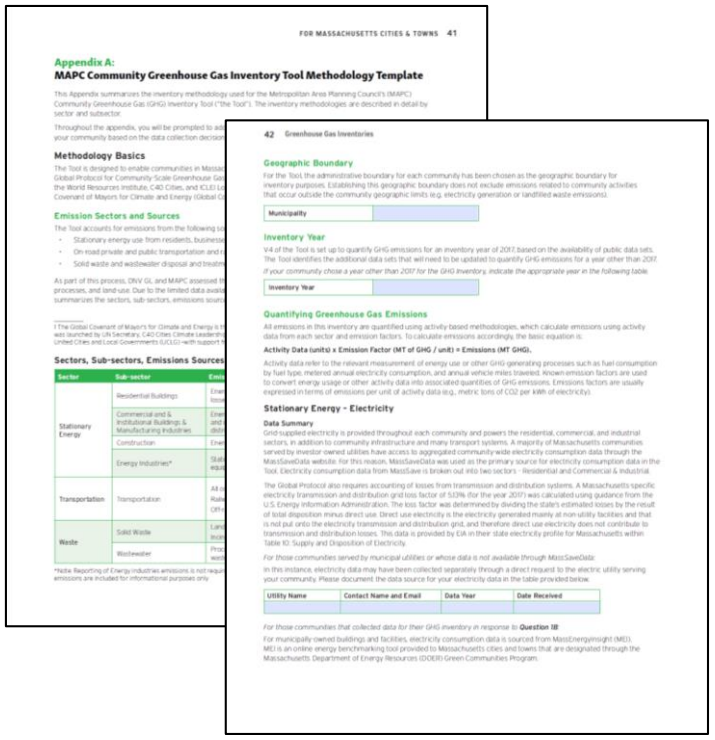
The Guide



Checklist to Define Local Characteristics

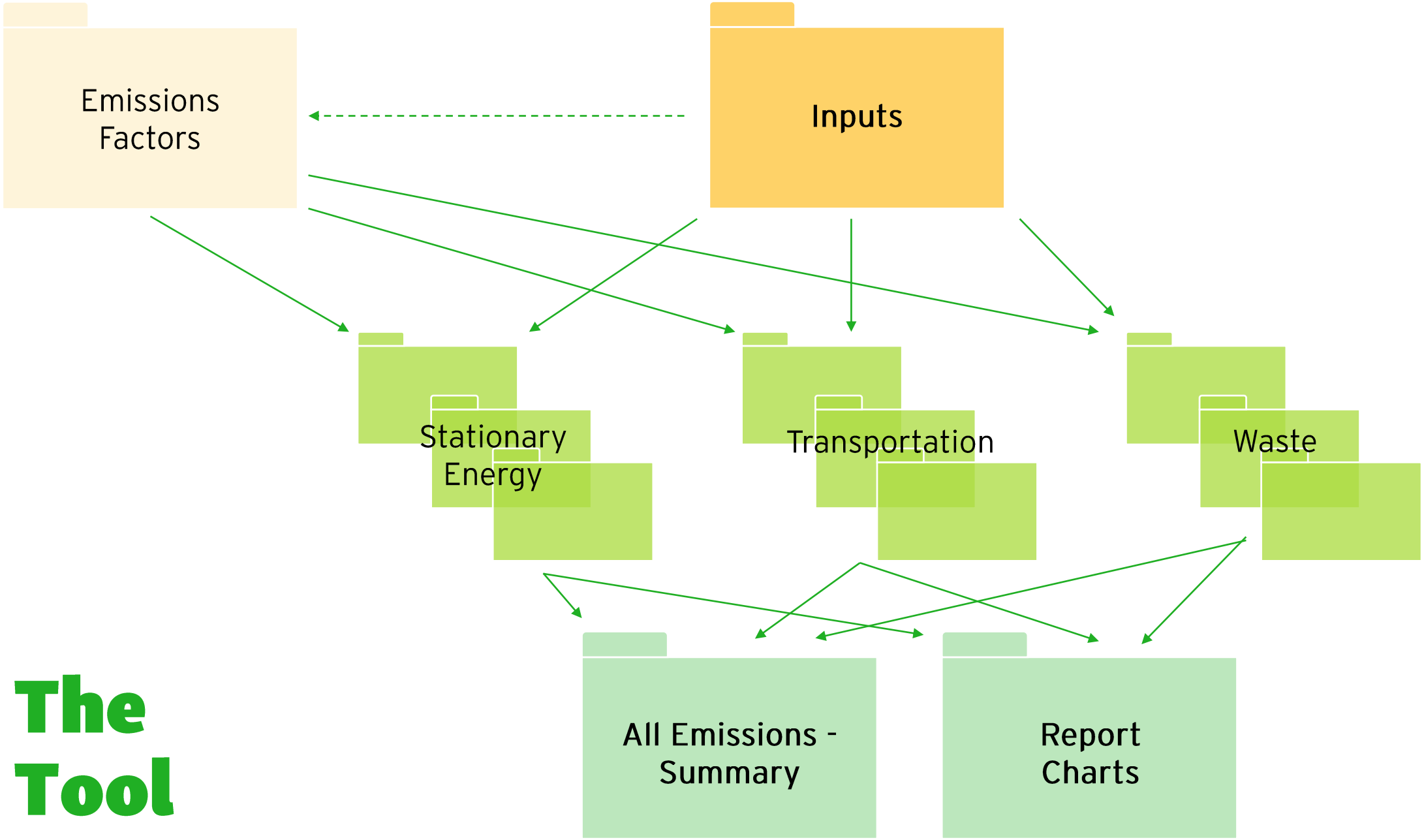


Local Data Collection Worksheet



Methodology Template

The Tool


Emissions Factors
Inputs
Stationary Energy
Transportation
Waste
All Emissions - Summary
Report Charts

Sectors and sources included

Sector	Sub-sector	Emissions sources	Energy types
Stationary Energy	Residential	Energy use in residential buildings as well as losses from distribution systems.	Electricity Natural gas Heating fuel oil Petroleum products
	Commercial, Industrial, and Manufacturing	Energy use in commercial, government and institutional buildings, manufacturing and industrial facilities, as well as losses from distribution systems.	
	Construction and Landscaping	Energy use from construction and landscaping equipment and activities.	
	Energy Industries	Stationary combustion of fuel in various equipment, such as boilers and generators.	Various – may include natural gas, propane, diesel, and waste-to-energy
Transportation	On-road vehicles	All trips taken by passenger and commercial vehicles registered in the community. Portion of trips taken within the community boundary by on-road buses and trackless trolleys.	Gasoline Diesel CNG Electricity
	Railways	Portion of trips taken within the community boundary by public light and heavy rail.	
Waste	Solid Waste	Municipal solid waste disposed in/by landfills, incineration, composting, and anaerobic digestion.	Landfill gas (methane)
	Wastewater	Process and fugitive emissions from treating wastewater.	Not applicable

BASIC sources *not* included

Stationary Energy:

- **Agriculture, forestry, and fishing activities:** emissions that result from direct fuel combustion to support these activities (e.g., machinery, generators, pumps, etc.)

Transportation:

- **Commercial and national railways:** passenger and freight activities associated with commercially owned railways servicing or running through communities
- **Waterborne navigation and aviation:** ships, ferries, and other boats operating within the community boundary, and air travel occurring within the community boundary.
- **Off-road vehicles:** emissions that result from airport equipment, agricultural tractors, chain saws, forklifts, snowmobiles, etc.

Waste:

- **Industrial waste:** waste generated from industrial processes and technologies.

Optional sources included for tracking

Energy industries

- Emissions accounted for in natural gas consumption and grid-supplied electricity emissions factors
- Option to track separately

Privately-hauled waste

- Residents served by private haulers
- School buildings
- Commercial entities

Regional transportation authorities

- Basis for replicating simplified methodology for tracking emissions

Getting Started

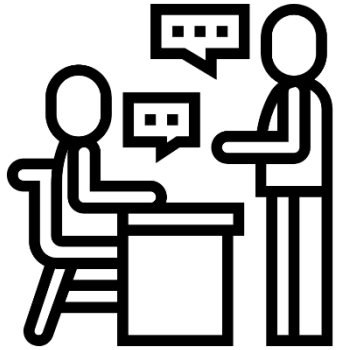
What year am I calculating GHG emissions for?

2017

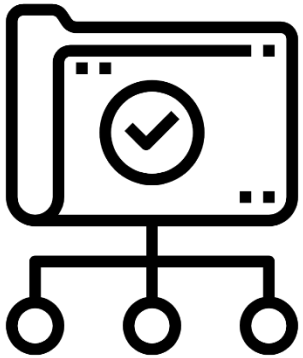
What is the geographic boundary for this GHG inventory?

Municipal border

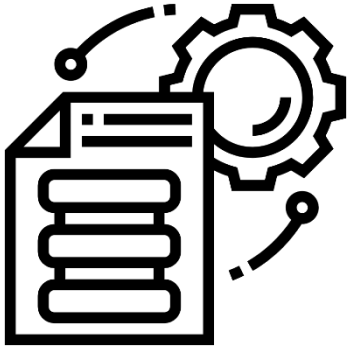
Creating a Local Process



Identify a responsible party for GHG inventory updates.



Store all files and supporting data in a central location.



Log changes made to the data and methods.

Global Protocol Data Principles

Relevance	The reported GHG emissions shall appropriately reflect the emissions occurring as a result of activities and consumption patterns of the city.	*Does the data set directly relate to the geographic boundary of the GHG inventory?*
Completeness	Cities shall account for all required emissions sources within the inventory boundary. Any exclusion of emission sources shall be justified and clearly explained.	*Does the data set include all information for the selected baseline year?*
Consistency	Emissions calculations shall be consistent in approach, boundary, and methodology.	*Does the data adhere to the methods of the GHG inventory? Can the same methods be used year over year?*
Transparency	Activity data, emissions sources, emissions factors, and accounting methodologies require adequate documentation and disclosure to enable verification.	*Can the data be readily documented and shared with the public?*
Accuracy	The calculation of GHG emissions shall not systematically overstate or understate actual GHG emissions.	*How close to reality is any of the estimated data being used?*

How to use these resources

1. Review the **Guide.**
2. Fill out the **Checklist to Define Local Characteristics.**
3. Identify the data you need to collect.
4. Issue any data requests necessary and collect publicly available data.
5. Complete the **Data Collection Worksheet**
6. Add collected data in the "**Inputs**" tab of the Tool.
7. Fill out the **Methodology Template** to reflect the data collection decisions that were made.

Community Pilot

Lessons Learned in Arlington, MA

Ken Pruitt - Energy Manager

- Hired in July 2017
- Original role
  - Municipal energy efficiency
  - Green Communities Act grants and reporting
- Now also
  - Energy procurement
  - CCA
  - EV charging infrastructure
  - Long-range climate planning

Clean Energy Future Committee

- Established by Select Board in 2018
- 15 members, including reps from government, businesses and residents
- Mission: Lead Arlington to Net-Zero GHG Emissions by 2050
- Working on Net Zero by 2050 Plan
  - With MAPC, Natick and Melrose, funded by EEA
  - Project included GHG inventory using the methods you are learning today

The Data Entry Team

- Bad idea if only one person understands GHG inventory
- I recruited four volunteers: one from CEFC (in addition to me), three enviro advocates
- Group kept small enough be manageable, but large enough to ensure continuity even with turnover

Team Training & Documentation

- Team attended training session with DNV GL & MAPC in Medford and virtually
- Gave copies of data entry spreadsheet to everyone, asked them to do their best to fill out and take detailed notes
- I reviewed my answers against theirs to ID areas of confusion
- Based on feedback, I created a Cheat Sheet. Also gave feedback to MAPC to further improve the data entry tool

Time Burden

- Majority of data is publicly available via links provided in the spreadsheet
- Needed to find data on my own:
  - Municipal electricity, gas, oil and fleet fuel usage (MEI)
  - CCA data from our aggregation broker, Good Energy
  - Waste data from DPW
- Took about a week to get CCA data. Only 1-2 hours for MEI and waste data
- Once spreadsheet final, took about 1-2 hours to enter all data in spreadsheet
- Very little time to update in the future - just a few hours

Data Entry Sample – Electricity & Gas

Optional Question Instructions:

1) **If your community's electricity is provided by both Eversource & NGRID**, please indicate below the estimated percentage of electricity that is provided by each investor-owned utility. Total must add up to 100%. This information will be used to estimate the utility-specific weighted electricity emission factor.

2) **If your community's electricity is provided by only one investor-owned utility (either Eversource or NGRID) or is served by a municipal utility**, skip this table.

Investor Owned Utility Electricity Service Coverage	
Electricity Rate	**% of Community Served by Utility**
Eversource (Eastern or Western)	100%
NGRID	0%

Mandatory Question Instructions:

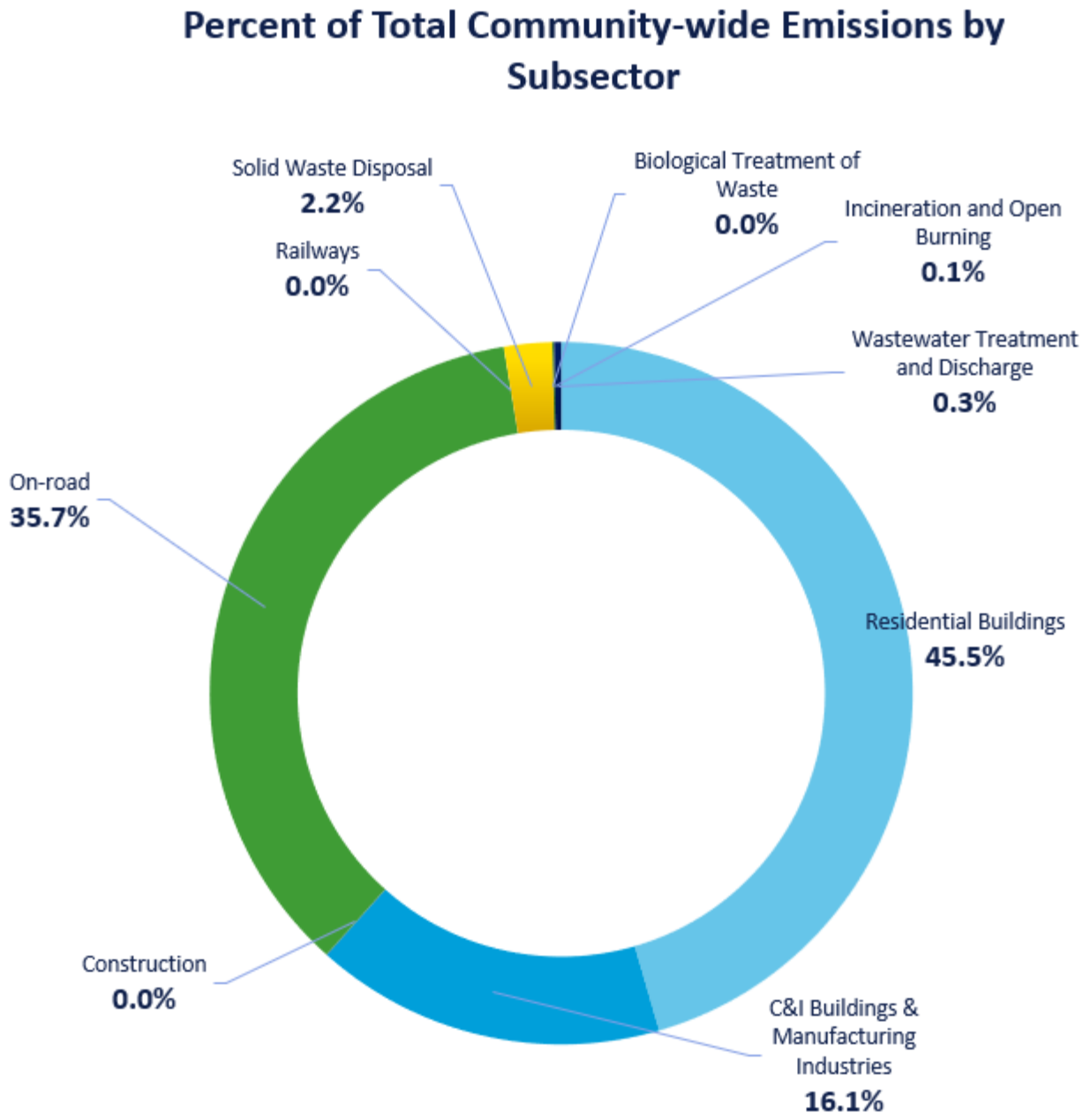
Use the hyperlink to the right to access the "MassSaveData" website. Click on the "Geographic" button in the top right and select "Usage By Month." Use the drop-downs in the top left to select "Electricity" or "Gas" and the appropriate year (2017). Find your community and enter the "Annual" total on the far right for both the "Residential" and "Commercial & Industrial" sectors in the table below. If your community obtains electricity and/or gas through a municipal utility, do not enter that consumption data in this table. See below table for municipal utilities.

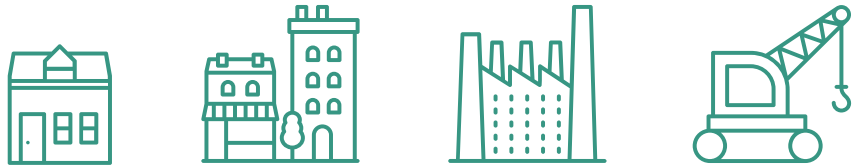
MassSaveData Source

MassSave Electricity and Natural Gas Consumption Data		
Sector	**Total Annual Electricity Consumption (MWh / Year)**	**Annual Natural Gas Consumption (Therms / Year)**
Residential:	104,223	10,854,510
Commercial & Industrial:	55,123	2,946,231
Combined Total:	**159,346**	**13,800,741**

Key Findings

- Total 2017 emissions: 285,119 MT CO2e
- Residential buildings & transportation were 80% of emissions
- C&I buildings significant
- Waste insignificant





Data Collection: Stationary Energy

What data to find and where to find it

Stationary Energy

A. Who provides your community with electricity and natural gas?

B. Is your municipality designated as a Green Community through the MA Department of Energy Resources?

C. Does your community have a green municipal aggregation program in place?

D. Do you have access to heating oil consumption for residential, commercial, and industrial customers?

E. Does your community intend to use EPA MOVES (MOtor Vehicle Emissions Simulator) to calculate emissions from landscaping, construction, and manufacturing equipment?

Electricity and Natural Gas Data

A Who provides your community with electricity and natural gas?

○ Investor Owned Utilities

Download your community's MassSaveData at www.masssavedata.com

○ Municipal Utilities

Make a data request to your municipal utility

○ Both

	Total MWh	Total therms
Residential customers		
Commercial and industrial customers		

Tracking Municipal Operations

B Is your municipality designated as a Green Community through the MA Department of Energy Resources?

○ Yes – Green Community

Access MEI using your log-in credentials at www.massenergyinsight.net/

○ No

Make data request to facilities and accounting departments, or skip this section.

	Total kWh	Total therms	Total gallons oil	Total gallons propane	Total gallons diesel	Total gallons gasoline
Municipal operations						

Green Municipal Aggregation

C Does your community have a green municipal aggregation program in place?

○ Yes

Make data request to your aggregation provider.

○ No

Skip this section.

	Total Annual Electricity Consumption (kWh/Year)	% of Class I Voluntary RECs
Residential Rate 1		
Residential Rate 2		
Residential Rate 3		
Residential Rate 4		
Commercial & Industrial Rate 1		
Commercial & Industrial Rate 2		
Commercial & Industrial Rate 3		
Commercial & Industrial Rate 4		

Deep Dive: Electricity Emissions Factors

Location-based approach: average energy generation emission factors for defined locations (i.e., system emissions factors from ISO New England).

Market-based approach: allocate emissions from energy generators to consumers based on contractual instruments, such as municipal aggregation.

How does the market-based approach work in the Tool?

The Tool takes the base percentage of "non-emitting MWh" reported by MassDEP for your applicable utility provider (either investor-owned or municipal) and adds in the percentage of additional **MA Class I renewables** included in your community's aggregation.

Data Source used in the Tool: MassDEP Emissions Factors for 2017

Estimating Heating Oil Use

D Do you have access to heating oil consumption for residential, commercial, and industrial customers?

○ Yes – we have this data

Input this data into the Tool.

○ No

Collect 3 publicly available data sets for your community to estimate heating oil use.

Housing Tenure by Units in Structure	Housing Tenure by Fuel Type	Employment and Wages Survey Data for all 3 digit NAICS codes

Deep Dive: Heating Oil Estimation

Residential buildings

- Uses survey data on average heating oil use for residential buildings and local housing characteristics to determine an estimate.

Commercial buildings

- Uses survey data on average heating oil use for different commercial industries and local counts of establishments and employees to determine an estimate.

Industrial buildings

- Users survey data on total heating oil use across different industrial uses and local counts of establishments and employees to determine an estimate.

Landscaping, Construction, & Manufacturing

E Does your community intend to use EPA MOVES (MOtor Vehicle Emissions Simulator) to calculate emissions from landscaping, construction, and manufacturing equipment?

○ Yes

Download data sets from MAPC and ACS for your community.

○ No

Skip this section.

	Total square footage (municipality)	Total square footage (county)
Estimated landscaped area		
Commercial construction under development		

	County Employment	City/Town Employment
Total Employment		
Manufacturing Employment		

Data Collection Summary

Publicly Available Data	Local Data Requests
MassSaveData Residential, commercial, and industrial electricity and natural gas consumption. EOLWD State employment and establishment data for heating oil estimate. Census Data Browser Population and manufacturing employment data. Housing by Units Number of households by type for heating oil estimate. Housing by Fuel Type Percentage of homes heated by oil. MOVES Emissions Estimates 2017 data published by MAPC. MassGIS Land Cover Dataset Estimated landscaped area.	Municipal utility electricity and natural gas data MassEnergyInsight Municipal fuel usage. Green municipal aggregation program data Commercial development data (Request from MAPC)

Data Collection: Transportation

What data to find and where to find it

Transportation

A Are there public on-road and/or trolley bus routes within your municipality?

B Which MBTA railways provide service within your municipality?

Massachusetts Vehicle Census

Calculating emissions from on-road passenger and commercial vehicles.

This guide employs the **resident activity method,** where each municipality quantifies the impact of only those vehicles registered within their city.

Updated MAVC data is available at: https://datacommon.mapc.org/

Passenger Vehicles	Commercial Vehicles
Count of all vehicles by fuel type	Count of all vehicles by fuel type
Count of all vehicles with valid DVMT and MPG by fuel type	Count of all vehicles with valid DVMT and MPG by fuel type
Average Daily Vehicle Miles Travelled (DVMT) by fuel type	Average Daily Vehicle Miles Travelled (DVMT) by fuel type
Average Fuel Economy Rating (MPG) by fuel type	Average Fuel Economy Rating (MPG) by fuel type

Public Transportation – On-road

A Are there public on-road and/or trolley bus routes within your municipality?

○ Served by MBTA

Download applicable data sets from MAPC for your community.

○ Served by another RTA

Make data request to your RTA following instructions provided in the Guide.

○ Municipally Operated

Confirm these vehicles are included in your Green Communities' reporting.

	Vehicle Miles Travelled (VMT) with diesel	Vehicle Miles Travelled (VMT) with diesel CNG	Vehicle Miles Travelled (VMT) with electric
MBTA Silver Line			
Trackless Trolley			
All MBTA Bus (Excluding Silver Line)			

Including Regional Transit Authorities

Contact your RTA and request the following information:

- **Total fuel used for transportation** during your inventory base year, by fuel type
- **Total route distance for the system** during your inventory base year, by route or vehicle/fuel type
- **Total route distance for your municipality** during your inventory base year, by route or vehicle/fuel type

On-Road Public Transit Type	City/Town Annual Gasoline Consumption (gal/year)	City/Town Annual Diesel Consumption (gal/year)	City/Town CNG Consumption (MMBTU/year)	City/Town Electricity Consumption (kWh/year)
RTA 1 Bus Routes				
RTA 2 Bus Routes				
RTA 3 Bus Routes				

Public Transportation – MBTA Railways

B Which MBTA railways provide service within your municipality?

○ Light rail – Green line

Download applicable data sets from MAPC for your community.

○ Heavy rail – Blue, Orange, and/or Red line

Download applicable data sets from MAPC for your community.

○ Commuter Rail

Download applicable data sets from MAPC for your community.

	Vehicle Miles Travelled (VMT) with diesel	Vehicle Miles Travelled (VMT) with electric
Blue Line (Heavy Rail)		
Orange Line (Heavy Rail)		
Red Line (Heavy Rail)		
Green Line (Light Rail)		
Commuter Rail		

Data Collection Summary

Publicly Available Data	Local Data Requests
MAPC's Massachusetts Vehicle Census Fuel economy and vehicle miles travelled for passenger and commercial vehicles. MBTA Frequency Weighted Trip Miles (Municipal) Estimated vehicle miles travelled by MBTA transit and bus lines within a city/town. MBTA Frequency Weighted Trip Miles (System-wide) Total vehicles miles travelled and fuel consumption for MBTA transit and bus lines. MOVES Off-Road CO2 and CH4 Emissions Estimates Emissions estimates by county produced by running EPA MOVES for 2017.	MassEnergyInsight Municipal fuel usage. Regional transit authority fuel consumption data. Municipally-operated bus fuel consumption data



Data Collection Bootcamp: Waste

What data to find and where to find it

Waste

A Does your Department of Public Works collect data on municipal solid waste (MSW) by method of disposal?

B Has your community recently completed a waste characterization survey?

C Do your municipal solid waste collection services cover all residents, school buildings, and businesses?

D Is your community's wastewater treated by MWRA at Deer Island or the Lawrence, Rockland, Clinton, or Pittsfield treatment facilities?

Municipal Solid Waste Disposal

A Does your Department of Public Works collect data on municipal solid waste (MSW) by method of disposal?

○ Yes

Make a data request to your Department of Public Works.

○ No

Use the state average breakdown by disposal method.

	Tons Generated in Inventory Year	Percentage of Total MSW
Landfill		%
Incineration		%
Composting		%
Anaerobic digestion		%

Municipal Solid Waste Characterization

B Has your community recently completed a waste characterization survey?

○ Yes

Match this data to the waste categories of the Global Protocol.

○ No

Use the weighted averages from a Massachusetts-specific study.

% of waste content	Inventory Category	Categories Included from Survey
	Food Waste	Ex: organic materials, compost
	Garden and Plant Waste	Ex: yard waste, leaf collection
	Paper	Ex: recyclable items, other trash
	Wood	Ex: construction or demolition debris

Waste Collection Coverage

C Do your municipal solid waste collection services cover all residents, school buildings and businesses?

○ **Yes – all of the above**

No additional data collection.

○ **No – Some residents served separately**

Access total number of households at https://datacommon.mapc.org/browser/datasets/211

○ **No - School buildings served separately**

Make a data request to your school department.

○ **No – Businesses served separately**

No additional data collection.

	# of households
Served by MSW collection	
Total in Municipality	

	# of students enrolled	# of schools
Elementary Schools		
Middle Schools		
High Schools		

Wastewater Treatment

D Is your community's wastewater treated by MWRA at Deer Island or the Lawrence, Rockland, Clinton, or Pittsfield treatment facilities?

- ○ MWRA at Deer Island
- ○ Lawrence treatment
- ○ None of the above
- ○ Clinton treatment
- ○ Pittsfield treatment
- ○ Rockland treatment

Total Population	
% of Population served by Treatment Plant	

Methane or No Methane

- Some but not all WWTP's in MA capture and reuse methane emissions on-site
- The population served by WWTP with methane capture does not contribute CH4 emissions
- All others use MA DEP emissions factor for WW treatment

Data Collection Summary

Publicly Available Data	Local Data Requests
US Census Population Data Wastewater emissions estimates.	Municipal solid waste collection data (total tons collected and percentage of waste by disposal method). Waste characterization survey data. Additional optional data on percentage of residential households served by MSW and school waste estimates. Percentage of community served by wastewater treatment plants.

Questions?

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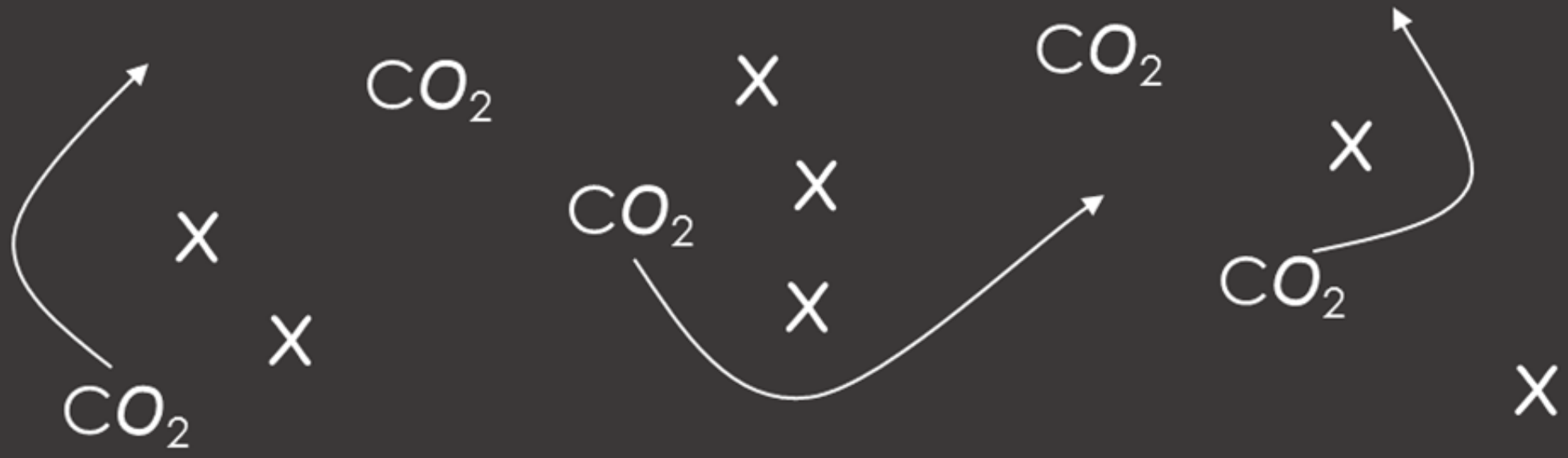
MAPC's Municipal Net Zero Playbook



- Net Zero Buildings
- Zero Emission Mobility
- Clean Energy Supply
- Climate-Smart Permitting and Zoning
- Framework for Action
- Framework for Equity

https://www.mapc.org/net-zero

ZERO TO 101

Net Zero Planning

INTRODUCTION

Net Zero goal-setting, planning, and implementation is a way to advance a community's carbon mitigation efforts. Net Zero planning offers each city or town the framework to form a scope of work and definition of Net Zero that meets its community goals and targets while taking tangible steps toward the need to keep global temperatures from rising above 1.5 degrees Celsius, as institutionalized within the Paris Climate Agreement. A community may determine, for instance, that it will next focus its net zero planning efforts on its largest source of emissions, such as building energy; on leading by example in the municipal sector as a starting point; or on going all-in with a community-wide net zero GHG emissions approach.

ZERO to 101

FROM 101 TO NET ZERO

- What is Net Zero?
- Planning Framework
- Process
- Net Zero Case Studies
- 2017 Clean Energy Forum