

Measuring Municipal Carbon and Nitrogen Footprints



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Introduction

As a result of this project, Dover will become the first city to establish a combined GHG and nitrogen inventory for its local government operations (LGO)

- **Carbon Footprint:** Total amount of greenhouse gases (GHGs) produced to directly and indirectly support human activities.¹
- **Nitrogen Footprint:** The amount of reactive nitrogen released to the environment as a result of an organization's resource consumption.²
- **Footprint Baseline:** A selected time period to which future footprints are compared.³



LGO Baseline Benefits

- Leads to the identification of opportunities to improve energy efficiency.
- Demonstrates climate change leadership.
- Allows reduction targets to be set and executed in a cost effective manner.
- Increases the general transparency and consistency of GHG accounting and reporting among institutions.



Emissions Scopes

Scope	Description
1	Emissions from sources that are directly owned or controlled by the organization. Example: combustion of fossil fuels for heating or operation of municipal vehicle
2	Emissions from the consumption of purchased electricity.
3	Emissions that are a consequence of the organization's operations. Example: Employee commuting or business travel.

Project Goals

- **A completed EPA Portfolio Manager profile** for the City and School operated facilities.
- **Baseline carbon and nitrogen footprint calculations** for the City of Dover's municipal operations via Portfolio Manager and the SIMAP tool.
- **Reports**, including recommended goals, to be presented to City leaders, staff and the general public.
- **Recommendations for adaptations to SIMAP** methodologies and the user interface to allow a version that can support municipal calculations while being aligned with the Greenhouse Gas Protocols best practices for LGOs.

Methodology

Overarching Structure

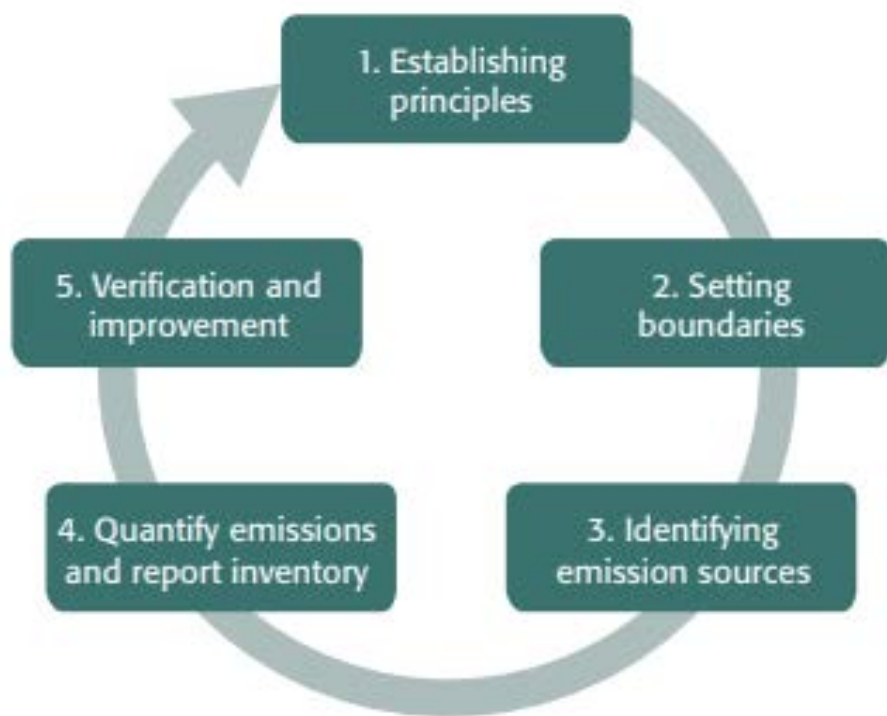


Figure 1. GHG Protocols five major steps for conducting a LGO inventory.³

Data Processing

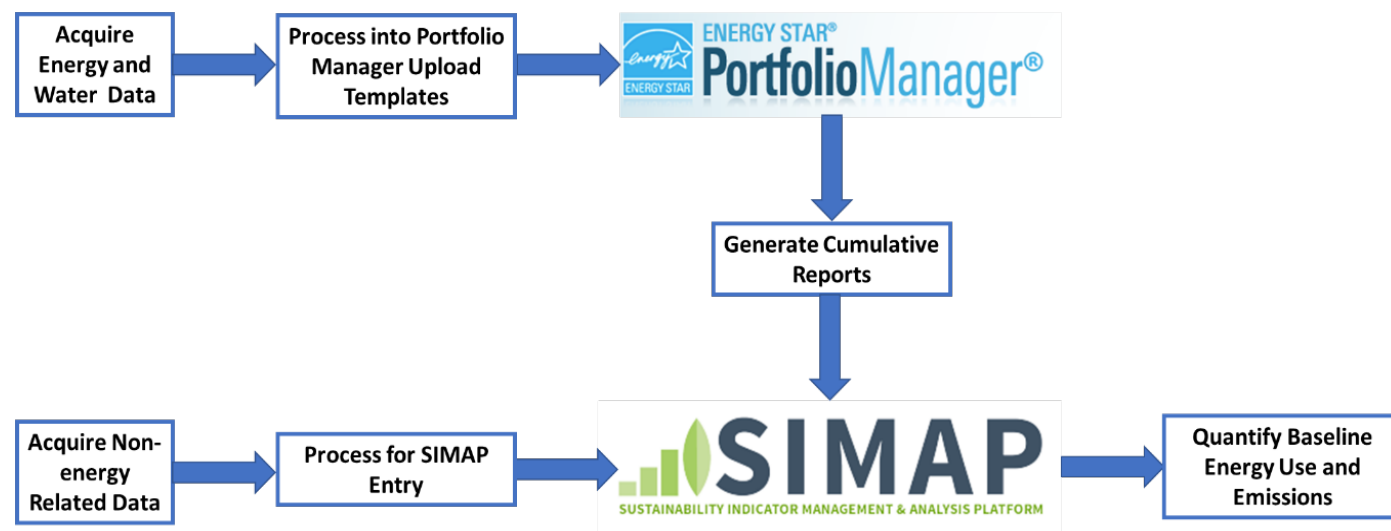


Figure 2. General methodology displaying the steps between data acquisition and baseline quantifications.^{4,5}

Energy Usage

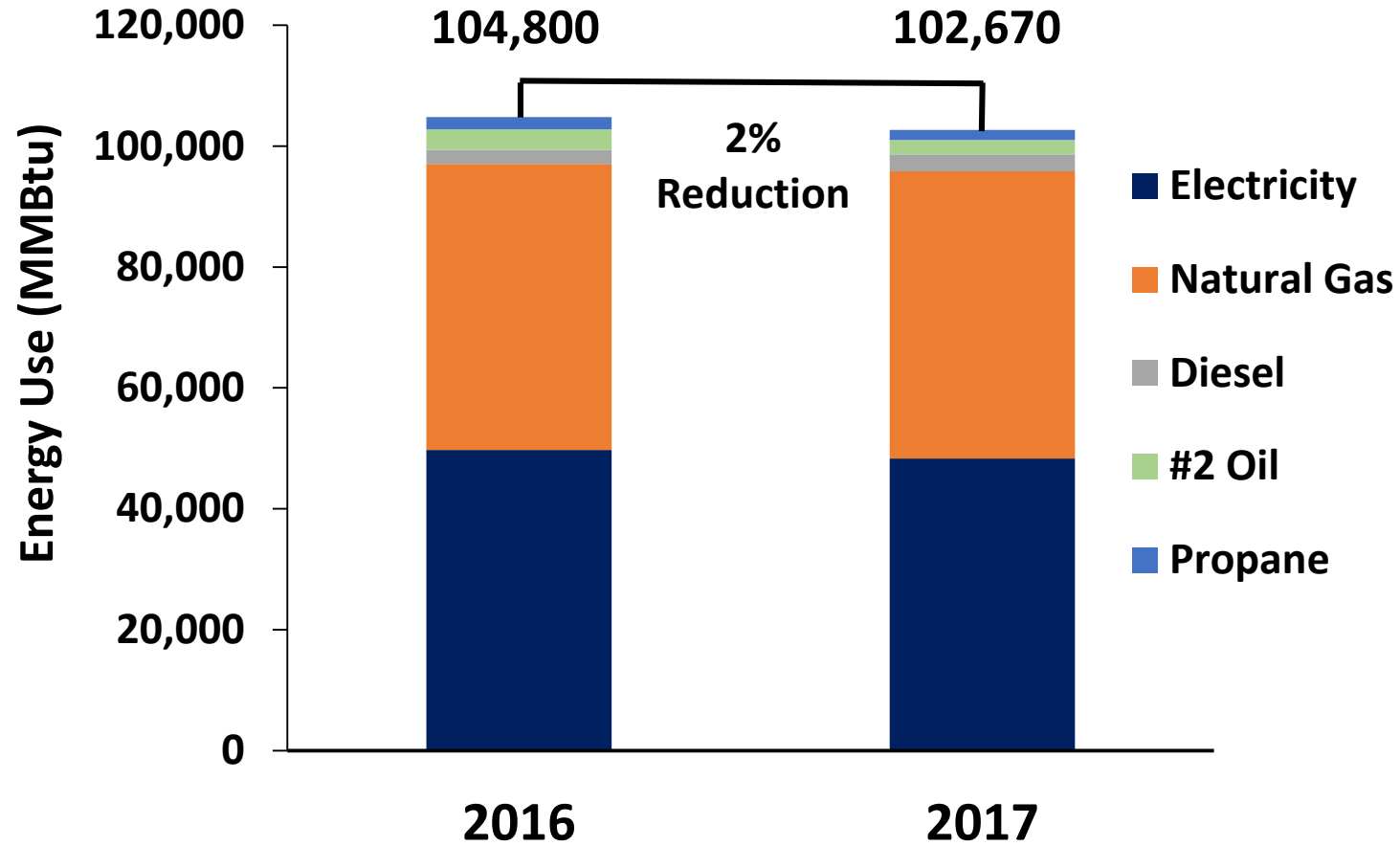


Figure 3. A comparison of Dover's energy use by source between 2016 and 2017.

Energy Cost

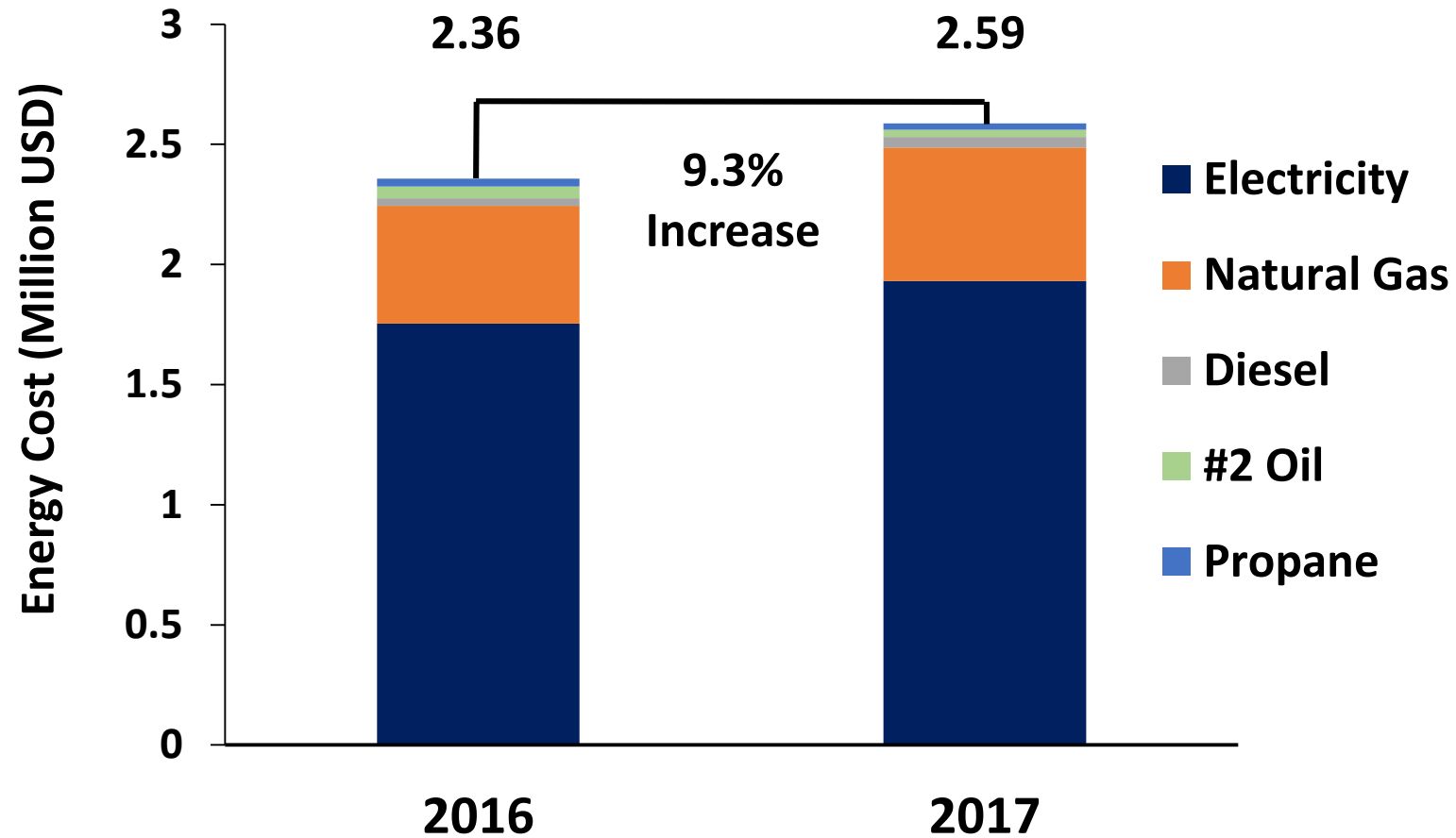


Figure 4. A comparison of Dover's energy cost by source between 2016 and 2017.

Streetlights LED

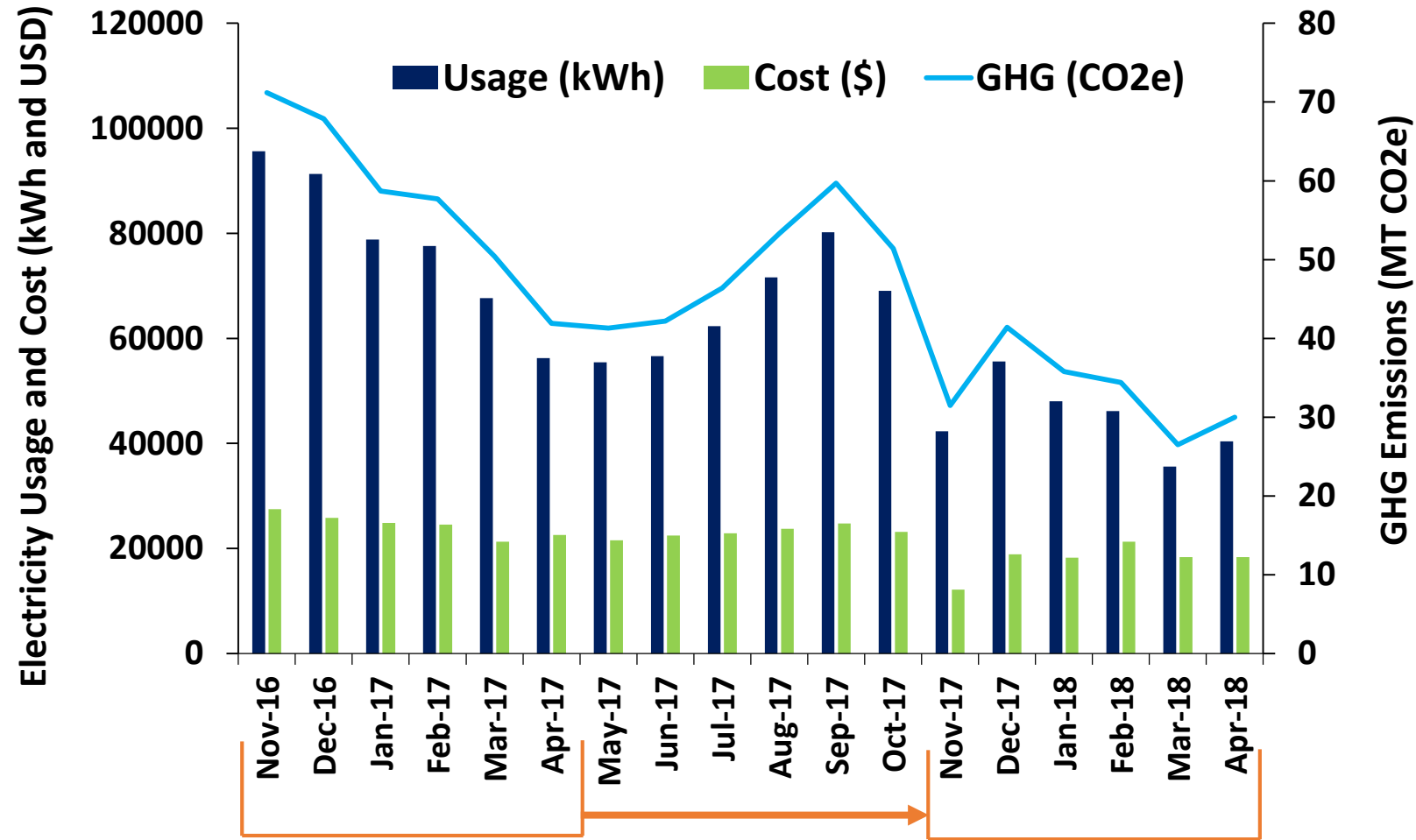


Figure 5. Impact of streetlight LED retrofit

GHG Emissions

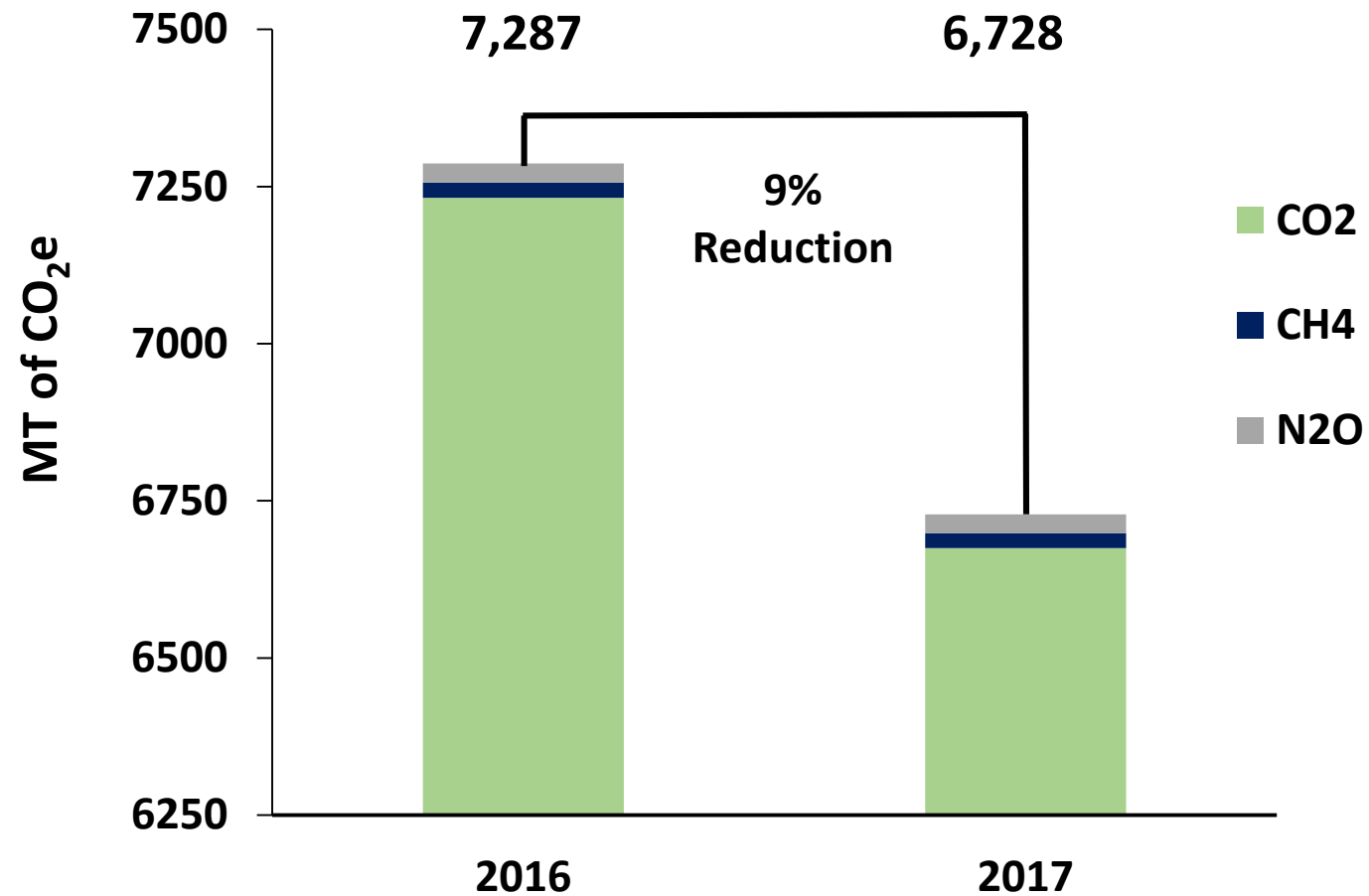


Figure 6. Total GHG emissions normalized by carbon dioxide equivalence for 2016 and 2017 as a result of Dover's LGO.

Making MT of CO₂ Relatable

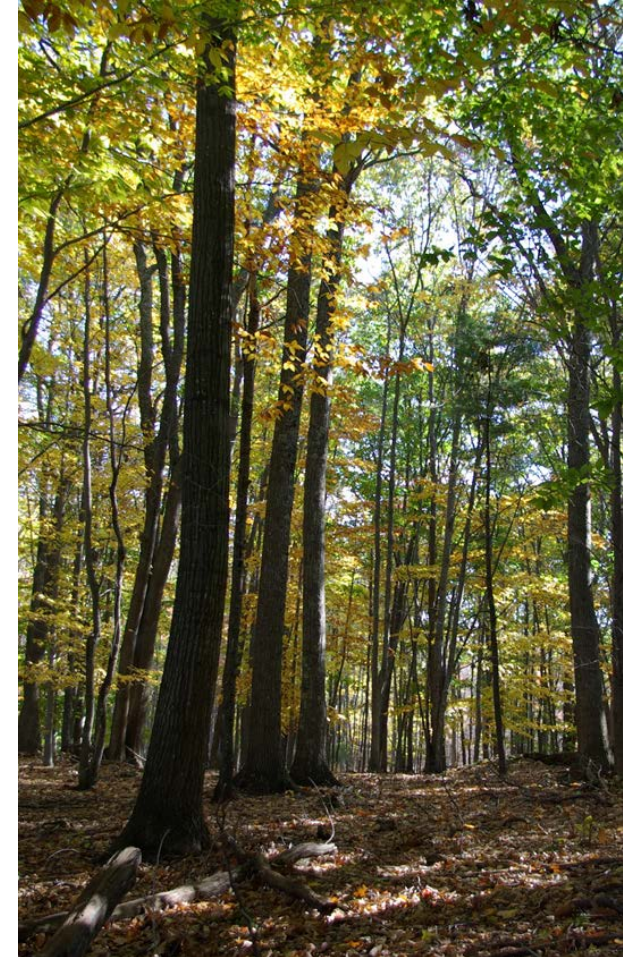


1 MT of CO₂ is enough to fill an average 2 story home (or ~ 1400 ft²) ⁶

7,925 acres of fully developed forest were required to sequester Dover's 2017 LGO GHG emissions ⁷



7,925 acres, or 12.4 mi² of forest is equivalent to ~ 43% of Dover's total land area



Future Work

- Input food use and fertilizer data into SIMAP
- Input employee commuting and travel information
- Generate a complete carbon and nitrogen footprint baseline using SIMAP
- Draft GHG and nitrogen inventory report
- Identify and suggest improvements to SIMAP so it better suits municipalities
- Analyze and review reduction scenarios
- Work with City leaders to establish reduction targets

References

1. Time for Change. What is a carbon footprint – definition. <https://timeforchange.org/what-is-a-carbon-footprint-definition> (accessed June 15, 2018)
2. Galloway, J. N.; Winiwarter, W.; Leip, A.; Leach, A. M.; Bleeker, A.; Erisman, J. W.; Nitrogen footprints: past, present and future. *Environ. Res. Lett.* **2014**, 9.
3. Fong, W. K.; Sotos, M.; Doust, M.; Schultz, S.; Marques, A.; Deng-Beck, C.; *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories*.
4. Energy Star Portfolio Manager. <https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager> (accessed June 8, 2018).
5. Sustainability Indicator Management & Analysis Platform. <https://unhsimap.org/> (accessed June 27, 2018)
6. AECOM. *City of Somerville Greenhouse Gas Inventory Report*. Somerville, MA, 2017.
7. Greenhouse Gas Equivalencies Calculator. <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>. (accessed July 6, 2018)

