Update on the Town of Middlebury's Progress in Reducing CO_2 Emissions from Town Operations

Richard Hopkins, Mike Roy and Howard Widelitz for the Energy Committee – for Middlebury Selectboard, at their January 10, 2023 meeting.

January 2023

In January of 2021, the selectboard of the Town of Middlebury passed the following resolution:

> Be it resolved that,
>
> (1) The Selectboard establishes the goal that emission of carbon dioxide-equivalents as a result of Town operations be reduced by 80% compared to 2018-2019 fiscal year levels, in or before fiscal year 2029-2030.
>
> (2) The Town's Energy Committee is directed to make an annual report by the end of each calendar year to the Selectboard and the Town Meeting on the previous fiscal year's greenhouse gas emissions.

Per this resolution, the Town Energy Committee is submitting this report on the progress made in the past fiscal year to reduce greenhouse gas emissions.

The Energy Committee is eager to help. We are ready and willing to help with research, analysis, outreach, number crunching, grant writing, or whatever else is required. We understand that exploring new approaches is complicated, and requires time and expertise, and that often the most environmentally responsible choice can be out of reach either due to lack of some required functionality or because of too high a price tag. We also are deeply committed to helping the town achieve this important goal of drastically reducing its GHG emissions in the next 8 years, and are here to help find a way to do this that works for everyone.

Achieving this goal is quite feasible, but requires consistent and early action to replace fossil-fuel-burning equipment – building heat systems and vehicles – with electric equivalents.

Outline

1. Data Sources and Methods
2. Progress through 2022
3. Projections to reach 2029-30 Goal
4. Discussion and Recommendations
5. Appendix: Methodological Notes and Data

Data Sources and Methods

In order to calculate greenhouse gas emissions associated with town operations, we examined the bills the town paid for:

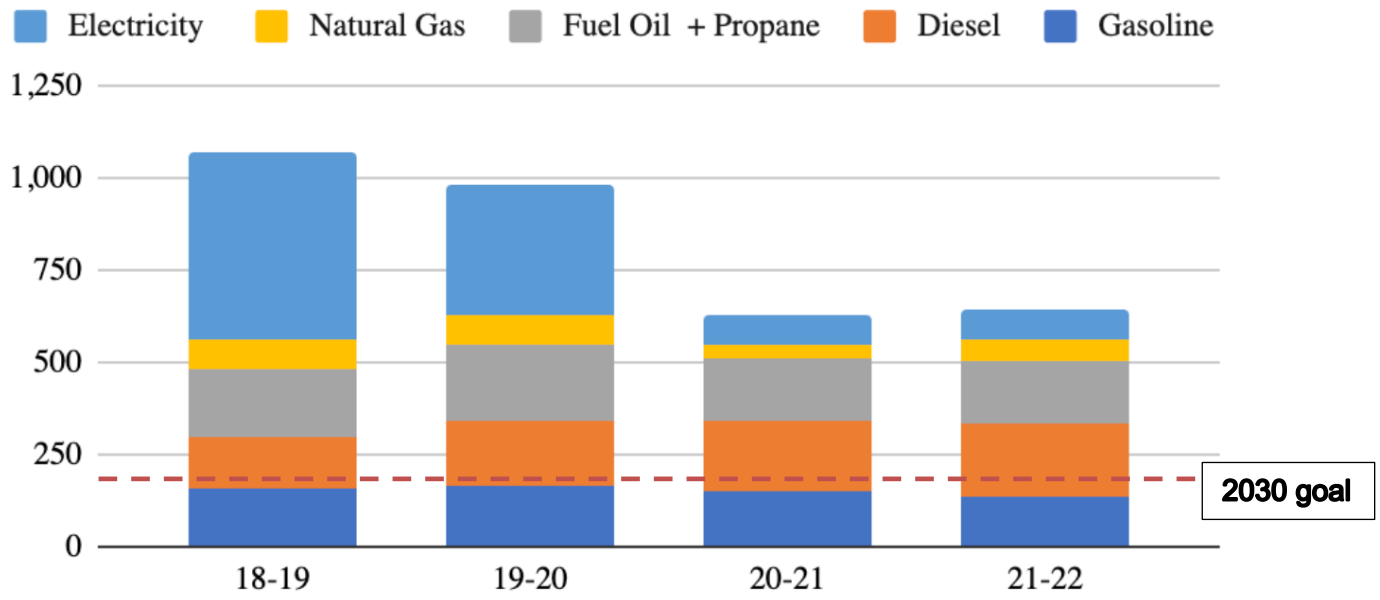
- Gasoline
- Diesel fuel
- Natural gas
- Fuel oil
- Propane
- Electricity

Knowing the quantity of each of these, we used known coefficients that relate gallons or watts of fuel use to CO_2 emissions. We have data from 2018-2022. In the appendix to this report we provide more detail about our methodologies. We counted the electricity received from two solar arrays that the Town has rights to parts of, as having zero CO_2 emissions.

Progress Through 2022

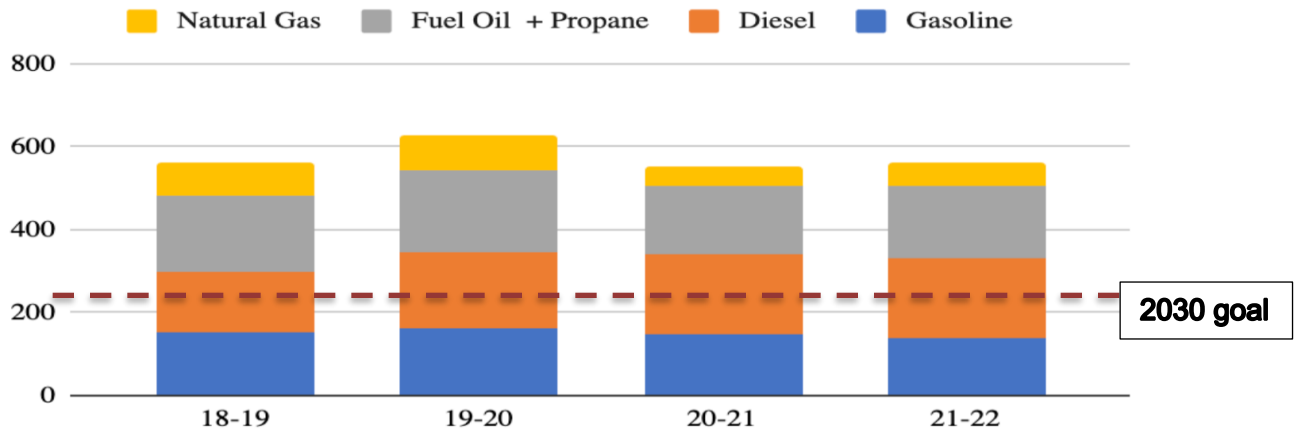
As you can see in the chart below, GHG emissions have dropped from 1072 tons per year to 572 tons over the past four years. This represents a 40% reduction, and is great progress towards our goal of reducing emission to 214 tons by 2029-30.

GHG Emissions, Town of Middlebury operations, 2018-2022 (in tons)



Nearly all of this progress came from changes in the GHG emissions associated with the electricity supplied by Green Mountain Power. Because the electricity is now almost entirely free of GHG emissions, making further progress will have to depend on reducing our own use of fossil fuels (gasoline, fuel oil, natural gas etc), not electricity..

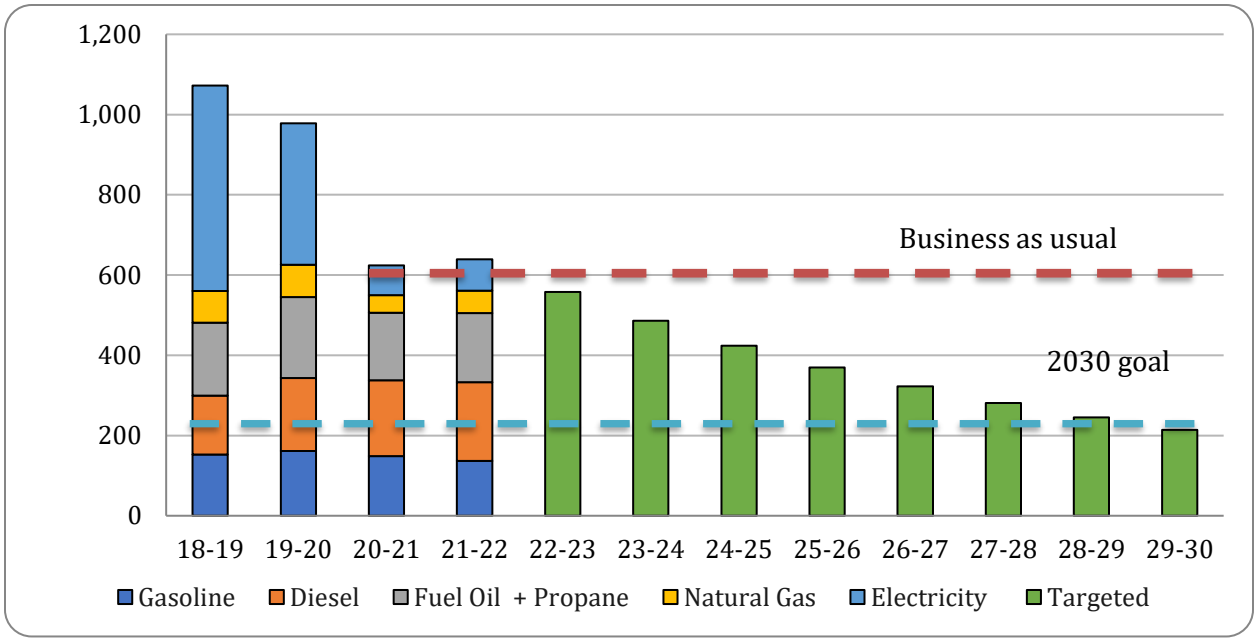
Progress in GHG reduction (excluding electricity)



If we look at GHG emissions excluding electricity over the same four years, the story is very different. We are not making any significant progress in reducing our use of any of the four other energy sources.

One path to reach 2029-30 Goal

Annual Decreases of 13% Required to Reach Goal of 80% Reduction in Tons of CO_2-equivalent by 2029-30



In order to go from about 600 tons to the goal of 214 tons of GHG emissions per year over the next 8 years, we would need to reduce our greenhouse gas emissions by an average of 13% year on year each year for the next 8 years. Almost none of this will come from electricity, and so we will need to focus our attention on the fossil-fuel energy sources. The graphic shows one projected path to do this. If we delay starting our reductions, we will have to make larger reductions each year compared to the previous year.

If we project the annual use of each of the major fuel sources forward over 8 years, based on the past four years, we can see that we will remain at a total of ~500 tons per year until we start making progress in replacing fossil-fuel based equipment with its electrical equivalent.

Discussion and Recommendations

- Technology is available right now to allow us to switch building heat and many vehicles from fossil fuels to electricity.
- We need to electrify everything, as we rely on Green Mountain Power to decarbonize the electricity as required by law. We also need to continue to invest in locally sourced solar to increase the overall amount of renewable energy within our community, for resiliency and to support the growing demand.
- Conservation and efficiency can be implemented quickly and often inexpensively, but can't by themselves get us to 80% reduction in greenhouse gas emissions.
- If electricity is nearly carbon-free, investing in conserving it does not save much in the way of greenhouse gas emissions. It does save money, which can be reinvested in other GHG-reducing measures.
    - For example, the upcoming changes to the wastewater treatment plant, depending on what direction we go, will likely result in big cost savings from a major reduction in our use of electricity and lime, but likely with no net decrease or perhaps an increase in our GHG emissions. Savings from the reduced electrical bill might be used to invest in replacing fossil-fuel powered vehicles and equipment with their electrical equivalents.
- Because the market for electrical replacements for fossil-fuel burning vehicles and equipment is expanding, the number of options available is growing, and their costs are dropping.
- While it is true that the longer we wait the steeper the reductions will need to be, we do need to keep in mind that sometimes a year or two of delay will allow us to purchase electric equipment that is not currently available.

Buildings

- For all new buildings, renovations of existing buildings, and replacement of HVAC systems, we must continue to do our due diligence – to seriously consider use of heat pumps and other alternatives that do not require burning fossil fuel. We need to take into account the total cost of ownership, over the lifetime of the equipment, as well as health and climate costs of continuing to burn fossil fuels.

- Robust cold-climate electric heat-pump technology is already available for existing and new buildings. This includes air-to-air and air-to-water heat pumps, as well as ground-source heat pumps, and both ducted and ductless choices.

- We should reduce fossil fuel energy use in the short run through weatherization, biofuels, upgraded lighting systems, smart controls, etc. and reinvest savings in low-carbon electrical replacements for fossil fuel systems.

Vehicles and Equipment

- For vehicles and other equipment, replace fossil fuel equipment with electric equivalent every time something needs replacing and suitable electric equivalents are available.

- Replace use of fossil diesel with use of biodiesel as much as feasible while transitioning, while assuring that the biodiesel we buy is truly renewable.

- Hybrid gas-electric vehicles do not save nearly as much fossil fuel as fully electric vehicles do.

- Transitioning from fossil-fuel-powered cars and light trucks to their electric equivalents will require some adjustments in vehicle and also staff management, that we can anticipate and plan for.

- Replace fossil fuel equipment with electric equivalent every time something needs replacing. Carefully calculate total cost of ownership as well as how much this will contribute to progress towards our goal.

Appendix: Methodological Considerations

- We include estimated releases of methane in the extraction, processing and transportation of natural gas, in addition to CO_2 released by burning the gas.
    - This increases the amount of CO_2e per unit of gas from 11.7 to 13.5 pounds per ccf (hundred cubic feet)

- We don't use GMP's value of zero for CO_2 releases per megawatt-hour of electricity use, which depends on GMP counting renewable energy credits from elsewhere
- Instead we used the mix of sources that GMP itself reports, before applying the renewable energy credits.
- We count electricity produced by our shares of two solar arrays as producing zero CO_2

- In any case the methods used are the same for all years, so we can rely on trends over time.

The Data

Tons of $C0_2e$ by energy type for Town of Middlebury

Tons of CO2	Gasoline	Diesel	Fuel Oil + Propane	Natural Gas	Electricity	Total
18-19	153	146	182	79	512	1,072
19-20	161	182	201	80	353	978
20-21	149	190	168	44	74	561
21-22	136	197	172	56	78	578