Takoma Park Greenhouse Gas Inventory – 2015 Update

This memo examines the changes in Takoma Park's emissions from 2012 to 2015, compares results to those of the Metropolitan Washington Council of Governments' (MWCOG) inventory for Takoma Park and provides guidance on how to use MWCOG's inventory in future years to compare to Takoma Park's 2012 baseline.

Greenhouse Gas Trends

From 2012 to 2015, the City of Takoma Park saw an increase in annual greenhouse gas (GHG) emissions from 84,800 MT CO_2e to 87,700 MT CO_2e. As shown in Table 1, this increase was due primarily to an increase in electricity use in the combined multi-family residential and commercial sectors as well as an increase in residential natural gas use. As Figure 1 shows these two sources were already the largest contributors of emissions in the City, so their substantial increases more than negated the decreases that were seen for many of the smaller sources.

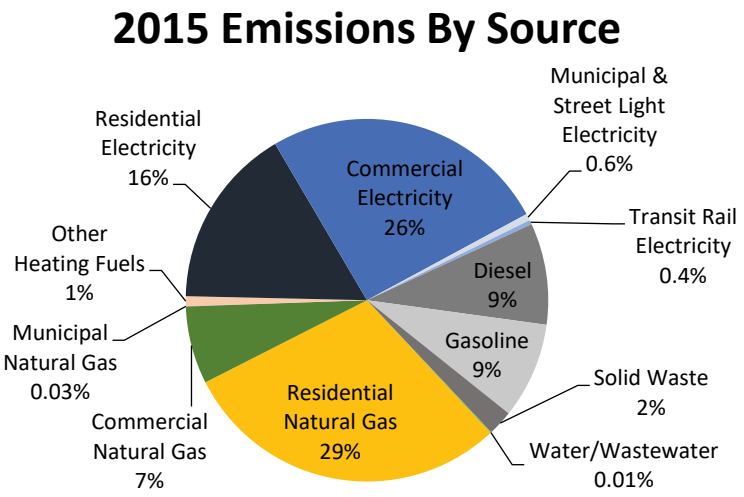

Figure 1 - 2015 Emissions by Source

Table 1 - Emissions Comparison 2012-2015

Source	2012 Emissions (MT CO_2e)	2015 Emissions (MT CO_2e)	Change (%)
Electricity			
Residential	14,200	14,200	0.1%
Multi-family	4,830		-
Commercial	15,100	22,400[1]	12%
Municipal	271	195	-28%
Street and Traffic Lights	364	336	-7%
Natural gas			
Residential	20,960	25,800	23%
Commercial	6,240	6,070	-3%
Municipal	85	30	-65%
Fuel Oil	2,580	771	-70%
Corn Fuel	1	1	-
On-road vehicle transportation			
Personal Vehicles	8,130	7,030	-13%
Gasoline - Municipal	466	473	1%
Diesel - Municipal	221	210	-5%
Diesel - Commercial	7,320	7,320	-
Transit[2]			
Diesel	403	403	-
Rail	338	338	-
Solid waste disposal	3,280	1,980	-40%
Water/Wastewater	70	64	-9%
Total Emissions[3]	84,800	87,700	3%

[1] In 2015 multi-family residential electricity emissions were reported with commercial electricity.
[2] New data was not available for the transit sector.
[3] Total emissions may not match the sum of the emission sources due to rounding.

While the city's overall emissions increased, municipal emissions decreased from 2012 to 2015. Municipal emissions include municipal buildings' natural gas and electricity use, traffic and streetlights, and fuel for municipal vehicles. In total, these sources saw a reduction of 163 MT CO_2e or 12% from their 2012 levels. More than half of this reduction was due to decreases in electricity use while the remainder came almost entirely from reductions in natural gas use. These emission reductions can be attributed to the city's concerted efforts to lead by example. For example, 1,500 streetlights are being converted to LED and upgrades will be complete in 2018, lighting in municipal buildings was upgraded to LED lighting, one municipal building had its HVAC system replaced with a high-efficiency system, and city staff implemented behavior changes to reduce energy use. The results of these activities can be directly seen in the city's inventory and offer support for future activities.

Emissions by Sector

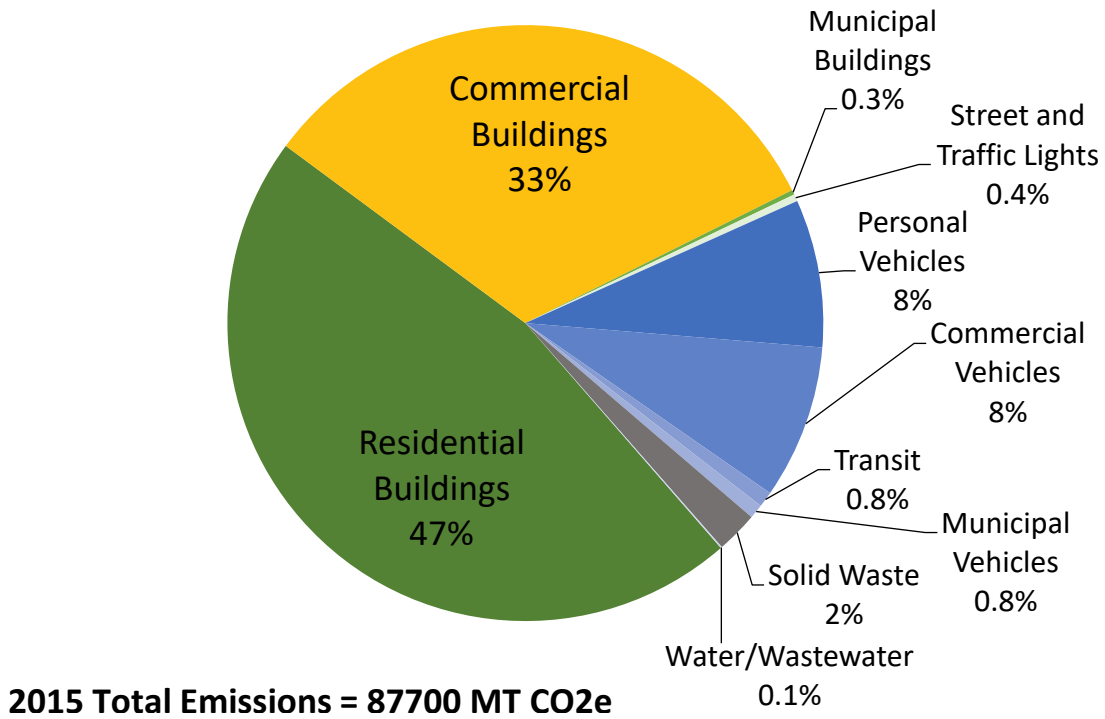

Figure 2 - 2015 Emissions Proportions by Sector

Residential Energy

Residential energy use is the largest source of emissions in Takoma Park, making up nearly half of all emissions, as shown in Figure 2. As such, the City's GHG mitigation activities have focused on residential activities. The positive impact of these activities can be seen in the residential sector's electricity use trends. Four different residential energy sources are tracked, electricity and natural gas are dominant and fuel oil and corn fuel make up very small portions of the energy mix. When compared to 2012, emissions from residential energy saw an increase of about 8%. Much of this increase is likely explained by the increase in energy required for heating and cooling due to changes in the weather. These changes in heating and cooling needs are represented by changes in heating degree days (HDD) and cooling degree days (CDD). 2015 saw a 15% increase in CDD and an 8% increase in HDD over 2012 levels (EnergyCAP, 2018), meaning energy use for both cooling and heating would be expected to increase if nothing else changed. The significant increase in CDD, while maintaining relatively constant emissions, is a strong indicator that the City's residential energy programs made a positive impact on the City's residential energy demands, as the City saw an overall 10% decrease in residential kWh per CDD from

2012 to 2015. One other trend of note is the reduction of fuel oil emissions even while heating requirements increased. This reduction occurred because, according to the American Community Survey, there was an almost 50% decrease in the number of homes using fuel oil as their heating source between 2012 and 2015 (US Census Bureau, 2018). This decrease in heating oil use could explain some of the substantial increase in residential natural gas as users switch fuel types.

Commercial & Multi-Family Energy

Commercial and multi-family energy is the second largest emissions sector in the City at 36% of total emissions. For this sector two sources of emissions are tracked in the City's inventory: electricity and natural gas. In 2015, the sector saw a 12% increase in emissions over 2012 levels. This increase came, despite a small decrease in natural gas emissions, because of the 15% increase in electricity emissions. The increase in electricity emissions occurred despite a reduction in the emission intensity per kWh, due to a substantial increase in electricity use. The increase in electricity use is partially explained by the changes in weather as the commercial kWh per CDD stayed nearly constant, increasing by less than 1%.

Transportation

Transportation accounts for approximately 15% of Takoma Park's emissions and is broken into four categories for analysis: personal vehicles, commercial vehicles, transit, and municipal vehicles. Emissions from these sources were estimated through a household survey, which was not repeated for 2015. Due to the lack of new data for vehicle miles traveled (VMT), 2010 VMT data was used with updated fuel economy data to calculate emissions. This assumption is likely inaccurate, as VMT increased statewide from 2012 to 2015; but, due to the difficulty in acquiring new data, no updates were made. The change in vehicle efficiency resulted in a 6% decrease in emissions from 2012 to 2015.

Without updated VMT data, commercial vehicle and transit use were also assumed to be constant. This assumption was supported by a lack of change in transportation patterns in the American Community Survey (US Census Bureau, 2018). Municipal vehicle emissions, the only source for which new data were available, saw an overall decrease of 1% - with gasoline use increasing slightly and diesel use decreasing. The difficulty associated with the data sources used for transportation suggest that for future inventories a new data source should be used to better reflect the community's transportation emissions.

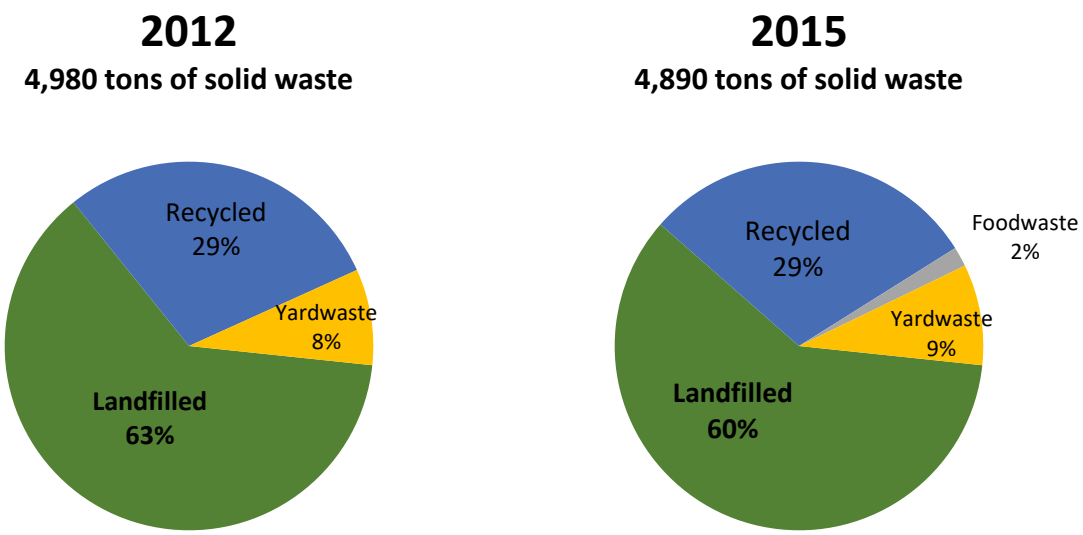

Figure 3 - Solid Waste End Treatments 2012-2015

Emissions from municipal solid waste account for 2% of the City's 2015 emissions. As shown in Table 1, these emissions saw a significant decrease of 40% from 2012 to 2015. This decrease is almost entirely due to process changes at the landfill as the amount of waste landfilled saw a smaller, 9% decrease. In 2012 Takoma Park's solid waste was being sent to an incineration facility while in 2015 it was sent to a landfill where emissions were captured and used for electricity generation. Figure 3 shows how the makeup of the City's waste stream changed between 2012 and 2015. Other than the creation of the City's new food-waste collection program in 2013, there were very limited changes to the City's waste stream.

Water/Wastewater

Water and wastewater is the smallest tracked emission source in the City, accounting for only 0.1% of total emissions. In the previous inventory water and wastewater emissions had been found by scaling the total emissions from the Washington Suburban Sanitation Commission (WSSC) by Takoma Park's portion of the population served. Updated data from WSSC was not available so the value provided by MWCOG was used for 2015 and in order to not show an artificially large drop in emissions, the baseline value was updated using the same data source.

Comparing the 2012 and 2015 Inventories

Due to changes in data available, there are some differences in methodology between the 2012 and 2015 inventories. When possible, the methodologies laid out in Appendix C of the 2013 Sustainable Energy Action Plan were used with the alternative data sources to minimize the impact on the inventory's outputs. The most common difference between the two inventories is the use of inputs from MWCOG's inventory rather than data collected specifically for Takoma Park. This was done for commercial and multi-family electricity, commercial natural gas, and water and wastewater emissions. Beyond the change in input data for these sources, there was no change in methodology. MWCOG electric and natural gas data was collected for ZIP code 20912, which closely matches but does not exactly match Takoma Park City boundaries. Data for 2012 was collected at ZIP+4 code level to more closely match City boundaries; however, the difference is small and arguably does not justify the effort to obtain this more detailed data.

All electricity calculations, including residential electricity saw a change in their emissions factor. Takoma Park's inventory was previously based on the published emissions factors for Pepco's Standard Offer Service. The inventory now uses the regional eGRID value to more accurately represent the community's blend of electricity sources as well as bring the inventory into better alignment with MWCOG. To prevent the appearance of any artificial trends eGRID emission factors from 2012 were applied to the baseline data.

Fuel oil was the only emission source with a significant change in methodology. This change was due to the availability of higher quality use data from MWCOG. Fuel oil use is now calculated in gallons rather than therms, based on gallons per household derived from MWCOG's fuel oil data. A Takoma Park specific value for the number of households using fuel oil is still used as it differs greatly from MWCOG's value. The methodology is as follows:

1. MWCOG's total residential fuel oil was divided by the number of households that used fuel oil
2. The percentage of households that use fuel oil for heating was found using the American Community Survey and multiplied by the total number of households in Takoma Park
3. The Takoma Park number of households was multiplied by MWCOG's normalized fuel use number to obtain the total gallons of fuel oil used in Takoma Park
4. A per-gallon emission factor was applied to this total to obtain the residential fuel oil emissions

For all other sources the 2012 process and data sources were used. These emissions sources include residential natural gas, corn fuel, solid waste, and all municipal emissions.

Comparing the 2015 Inventory to the MWCOG Inventory

As the City moves forward with its GHG tracking it is important to note how its inventory differs from the inventory provided by MWCOG. For this analysis there are two categories for differences in the inventories, one-time differences that are due to some unique circumstance of the 2012 and 2015 inventories and differences that will carry through all future analyses. The one-time differences are primarily differences in data sources, for example data were available for residential electricity and natural gas usage because the city submitted the information to compete for the Georgetown University Energy Prize. As this will not be the case in subsequent years, the reporting will transition to using the data available from MWCOG for future inventories.

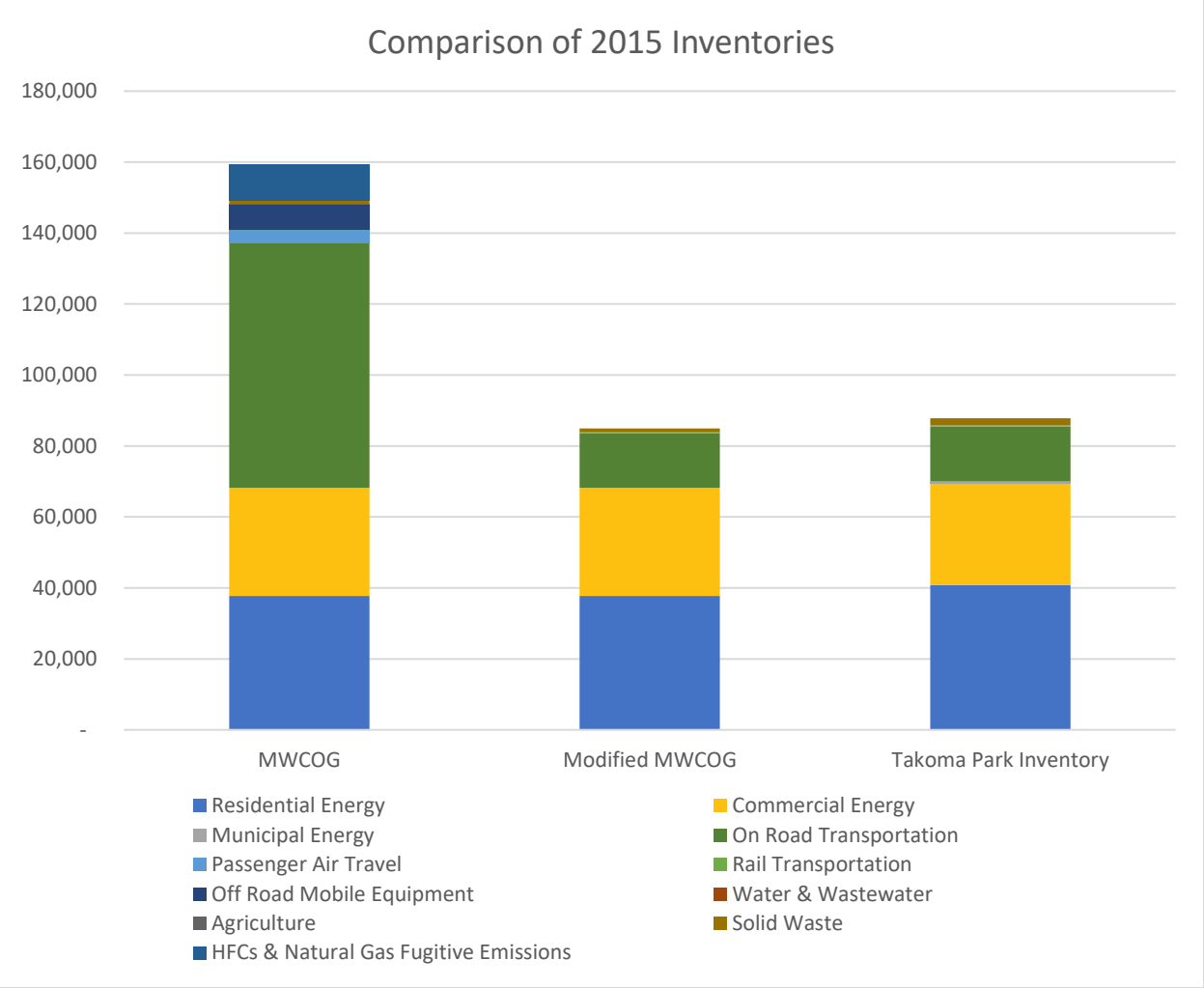

Figure 4 - Comparison of Inventory Structures

As shown in Figure 4, there are significant differences between the inventory that has been completed for Takoma Park and MWCOG's inventory while the Modified MWCOG inventory is very similar to Takoma Park's. The "Modified MWCOG" column represents an inventory that uses MWCOG's emission data for every source except transportation and has removed all emission sources that are not included in Takoma Park's inventory. The differences between the three inventories shown in Figure 4 are due either to the inclusion of different sources in the two inventories or the use of different data sources and methodologies. Some differences are permanent and some will fall out of future inventories.

The permanent differences between the two inventories are related to differences in which sources are being tracked. Propane, Agricultural, and Industrial emission sources have all been left out of the Takoma Park inventory even though MWCOG does allocate some emissions from these sources to Takoma Park, because based on information provided by the City, these sources do not occur in City boundaries. These sources have been allocated to Takoma Park based on their presence in Montgomery County and the City's portion of the total population. HFCs (hydrofluorocarbons) and fugitive emissions from natural gas were also excluded from the Takoma Park inventory as they were not in the originally tracked scope and, due to the primarily residential nature of the City, do not occur to the extent estimated by MWCOG. One source not included in the MWCOG inventory has been tracked for the 2012 and 2015 Takoma Park inventories: corn fuel. However, this emission

source makes up only 0.001% of overall emissions in Takoma Park and does not need to be included in further inventories.

Some sources that have available data from the MWCOG inventory used Takoma Park specific data rather than the prorated MWCOG data. These sources will not always be available, for example residential energy data were only available due to the City's submission to the Georgetown University energy prize. The impact of these different sources varied greatly - for on-road transportation and electricity they were quite notable, while landfilled waste had a much smaller impact on the overall inventory.

The inventory comparison makes it obvious that on-road transportation emissions are, by far, the biggest difference between the two inventories. Due to geography and community makeup, the methodology used by MWCOG to estimate on-road vehicle emissions is a poor estimate for Takoma Park because the estimate is based on modeling performed for Montgomery County using the EPA's MOVES model. This region includes much larger highways than exist in Takoma Park which means that, when broken out by population, Takoma Park's emissions are significantly overestimated. To model transportation emissions in a manner more focused on Takoma Park, emissions were calculated in the same manner as the 2012 inventory using updated fuel efficiency values for the appropriate modes of transportation. For a more detailed description of the methodology used see Appendix C of the 2013 Sustainable Energy Action Plan.

To calculate emissions associated with solid waste Takoma Park specific inputs and methodology were used due to the data's availability and to maintain consistency where possible with the previous inventory. This methodology led to emissions that were 85% higher than those found by MWCOG. However, due to the small proportion of emissions that solid waste accounts for, this difference is not significant to the inventory as a whole.

Completing Future Inventories Using MWCOG Data

The data provided by MWCOG are of high quality and will generally require little alteration to be appropriate for a Takoma Park specific GHG inventory. While there may be slight losses in accuracy due to the change in data sources, they are expected to be very small and will allow more effort to be focused on mitigation activities rather than tracking.

The only emissions source that needs to use an alternative data source is on-road transportation. As discussed earlier, the data provided by MWCOG are not representative of the emissions that occur within City boundaries. However, the methodology used by MWCOG to model emissions for Montgomery County, the EPA MOVES model, is an excellent data source that, with the appropriate inputs, could be run specifically for Takoma Park. It is recommended that the City attempts to have the MOVES model run specifically for Takoma Park the next time the community inventory is being updated by MWCOG. Doing this would keep the inventory procedurally aligned with MWCOG and would provide high quality, up-to-date emissions data for the on-road transportation sector. The outputs from the MOVES model would account for all on-road transportation including municipal vehicles and on-road transit options such as buses.

For all other sources that are included in Takoma Park's inventory, using the equivalent data from MWCOG will be appropriate given the similar level of accuracy, quantity of emissions, and reduced effort required. When using MWCOG's data the only sources that may be tracked separately are municipal electricity, natural gas, and transportation. If tracked, these municipal sources should then be subtracted out from the corresponding sources (commercial electricity and natural gas and on-road transportation) so that they are not double counted. As noted earlier, some emissions sources that are included in MWCOG's inventory have not been included in Takoma Park's inventory, so to facilitate comparisons from year to year the following sources should continue to be left out of Takoma Park's inventory:

- Residential LPG (Liquified Petroleum Gas)
- Commercial Fuel Oil
- Commercial LPG
- Passenger Air Travel
- Off Road Mobile Emissions
- Enteric Fermentation
- Manure Management
- Ag Soils
- HFCs
- Natural Gas Fugitive Emissions

Due to the level of alignment that has been shown to exist between the two inventories it is strongly recommended that Takoma Park complete all future inventories using MWCOG data. When the inventory is being brought into alignment with this modified MWCOG structure, it is important that any changes in methodology of MWCOG inventory's data also be used to update the 2012 baseline to prevent any artificial trends in emission levels.