



COMPREHENSIVE ENERGY PLAN  
PROGRESS REPORT FOR 10/1/2021 –  
12/31/2021 REPORTING PERIOD

January 14, 2022



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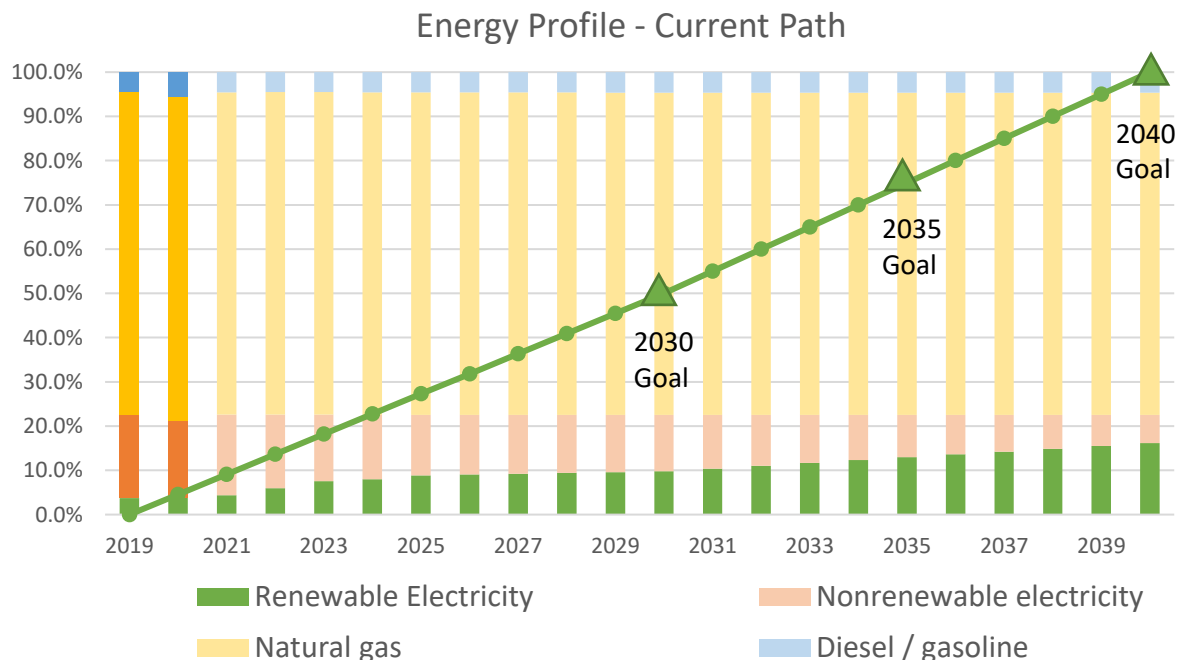
## EXECUTIVE SUMMARY

In April 2019 the Madison Metropolitan School District Board of Education adopted a resolution to meet 50% of the district's operations energy needs with renewable energy by 2030, 75% by 2035 and 100% by 2040. This report represents the first step in developing a Comprehensive Energy Plan for the District to achieve these goals. This report presents an analysis of the both the current state of energy use and sources as well as projections for energy use based on current plans for expansion, energy efficiency and renewable energy sourcing. Understanding the current path will inform and provide the basis for developing strategies needed beyond current plans to achieve the stated goals.

To provide context for understanding of the district's energy use, the report begins with a brief summary of past energy conservation efforts which demonstrate the district's long-term commitment to energy efficiency resulting in a reduction in Energy Use Intensity (EUI) of the district's buildings by over 25% since the early 1980's.

The process began with collection and analysis of all 2019 energy usage data for the building & facilities and transportation sectors. The year 2019 was chosen for the baseline as it was the year in which the resolution was adopted and is the most recent year during which district operations were not impacted by pandemic-related factors. This was followed by analyzing energy sources which determined that in 2019 a total of 3.8% of the district's energy came from renewable sources.

From this starting point, a projection of the current path of renewable energy was developed based on currently planned building modifications and PV installations included in the referendum projects, utility generation mix forecasts, expected enrollment growth and future building plans.



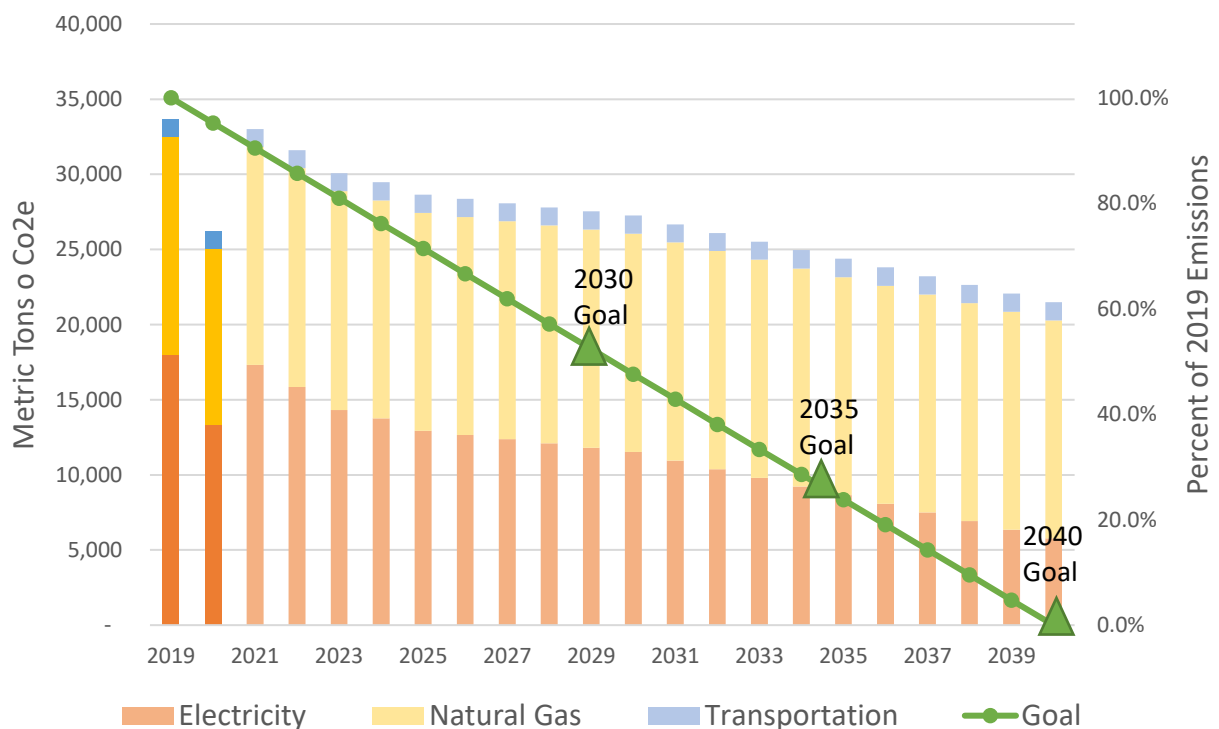
As can be seen in the graph above, the district is on track to procure a significant portion of their electricity from renewable sources (43% by 2030, 58% by 2035 and 72% by 2040) and not too far off from the established goals for electrical use. However, current plans do not include converting the district's fossil fuel use to renewable sources which is where the bulk of the effort will be required to achieve the goal of 100% renewable energy by 2040.

## EXECUTIVE SUMMARY

While the percentage of energy coming from renewable sources is a useful metric, it is expressed only on a relative basis and does not reflect the absolute amount of energy used or related emissions. In addition, it does not illuminate differences in greenhouse gas (GHG) emissions between various non-renewable sources. For this reason, many climate-related goals are stated in terms of reduction in GHG emissions compared to a baseline (such as the IPCC goal to eliminate GHG emissions globally by 2050<sup>1</sup>). Based on this, it is useful to also examine GHG emissions associated with the district's energy use.

Combining projections for utility emissions, reductions in purchased electricity due to the district's self-produced renewable electricity and direct emissions from district fossil fuel use, a projection for the district's total GHG emissions was established.

### GHG Emissions Profile - Current Path



The goals for emissions reduction shown in the graph above have not been formally adopted by the district. However, they do align with the timeline established for the district's renewable energy goals with a 50% reduction by 2030, 75% by 2035 and 100% by 2040. In the next few years emissions will be reduced closely following a straight-line projection of these goals. However, in later years, reductions following the current path level off and diverge from the goal. This also illustrates the need to focus future plans on reducing the district's fossil fuel use.

<sup>1</sup> [Intergovernmental Panel on Climate Change Summary for Policy Makers](#)

## HISTORY OF ENERGY PLANNING

The Madison Metropolitan School District has been committed to energy conservation for over 40 years. Dating back to the early 1980's, the district took advantage of Federal funding through a program called Institutional Conservation Program (ICP) that provided grants to match funds for energy related work with paybacks ranging from 3 to 5 years that were implemented in schools and hospitals.

The district was awarded over \$570,000 in matching grants under this program and implemented over \$1 million dollars of energy conservation related projects. Projects included boiler modifications and controls, addition of pipe insulation, pool covers, ventilation reductions, lighting retrofits, and programmable time clocks.

### 1981 - 1997

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In 1981, the district consumed 21,552,431 kWh of electricity and 3,377,783 therms of natural gas and 188,727 gallons of fuel oil for a combined total energy use of 447,644 MMBTU. In 1981 the district gross area of 3,929,519 sq. ft.

Numerous rebates were awarded through the local utility for steam trap replacement, boiler tune-ups and lighting retrofits. In addition to the energy related projects, maintenance work also took advantage of opportunities to improve facility performance with replacement windows with improved thermal performance, addition of insulation during roof replacement work, pipe insulation, conversion of steam systems to water and installation of automated building controls.

Technology advances in the areas of energy conservation allowed district to replace T-12 lamps with T-8 lamps, replacement of magnetic ballast with electronic, installation of vending machine controls to limit operation during occupied times, installation of computer management software to shut down computers during non-occupied times, changing incandescent lamps to compact fluorescent lamps, LED exit lights, installation of VFD (variable frequency drives) on large equipment motors, installation of occupancy controls on HVAC and lighting system and changing pneumatic control systems to DDC (direct digital control).

### 1998 - 2003

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In 1998 the district entered into a Performance Contract with Honeywell Inc. to provide energy savings in the form of guaranteed savings by implementing automation, mechanical replacements, VAV (variable air volume) conversions, lighting, water conservation work and operational cost avoidance. The first phase primarily dealt with projects in the 4 high schools. Additional schools were covered in subsequent phases. This work contributed to a total cost avoidance in excess of \$16 million dollars over a ten-year period.

In 1999, the district achieved the distinction of Summa Cum Laude honors presented by the US EPA Energy Star Buildings Partnership. This honor is awarded top performing universities and school districts nationwide by meeting the challenge of working toward energy efficiency goals.

## HISTORY OF ENERGY PLANNING

### 2004 - 2010

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In 2004 the district contracted with Solar Mining to install solar pool heating systems at the 4 high schools. The solar systems produce between 600 and 700 btu's of energy per square foot of solar array per day. It has been estimated that these system will reduce greenhouse gases by 195,400 pounds annually.

Focus on Energy has also provided funding through grants and rebates associated with the district's on-going energy efforts. Funding has been provided for wind studies, steam trap replacement work, boiler upgrades and lighting retrofits.

In 2006, the district was awarded the Governor's Award for Excellence in Energy Efficiency. This award was presented by Governor Doyle and Focus on Energy Business Programs in recognition of our dedication to improve energy efficiency in Wisconsin.

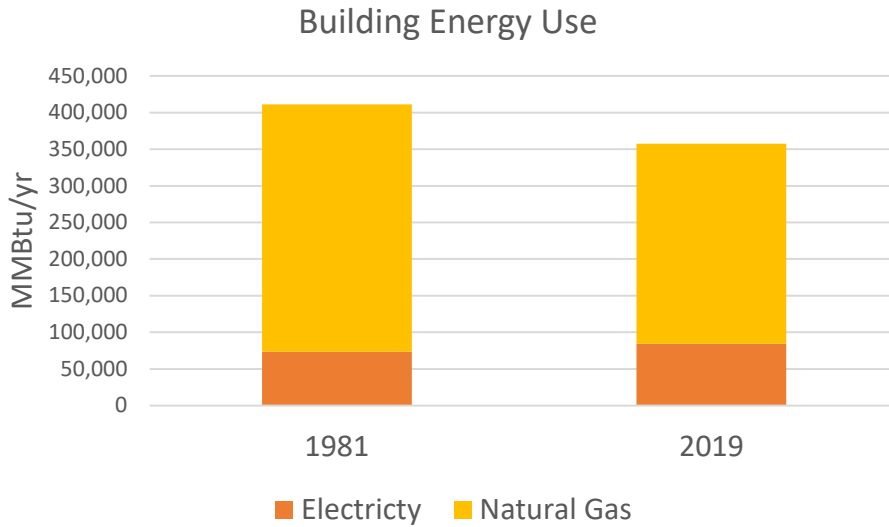
In 2010 the district hired McKinstry to begin a program aimed at behavior-focused energy awareness and operational efficiency designed to reduce costs, increase efficiency and promote environmentally friendly operations.

An example of the district's commitment to overall energy performance is the Olson Elementary School. Constructed in 2008, the facility achieved a LEED award of Silver in New School Construction. LEED stands for Leadership in Energy and Environmental Design. The design incorporated geothermal HVAC systems, energy efficient lighting, day lighting strategies, photovoltaic solar and energy efficient construction.

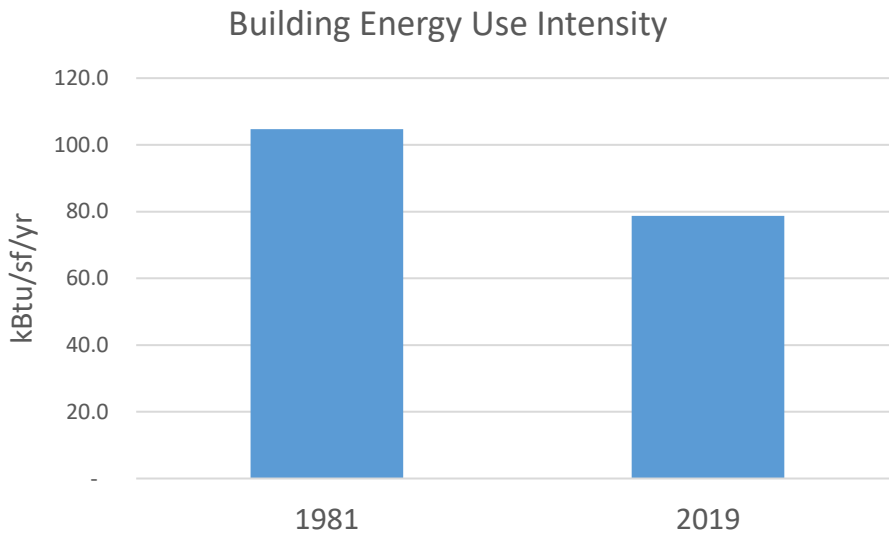
### 2011 - PRESENT

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The district has expanded over the past 40 years in the number of facilities it operates and total area. Net area has increase by 612,000 square feet, technology use in the educational program continues to change, personal computers increased, and the amount of air-conditioned space has increased. Yet the total district building energy consumption in 2019 is less than what was consumed in 1981. Although electrical energy usage has increased due to the factors cited above, as shown in the graph below, the reduction in natural gas usage has more than offset that amount.



While the overall 13% reduction in energy use is notable, the 25% reduction in Energy Use Intensity is more dramatic. Energy Use Intensity (EUI) is the total energy used divided by total area served. This metric allows the comparison of energy use between facilities of different sizes.



The district’s on-going energy conservation work has been recognized by the Environmental Protection Agency, Energy Star program. Energy Star certification signifies that a building performs in the top 25 percent of similar facilities nationwide for energy efficiency and meets strict energy efficiency performance levels set by the EPA.

To date, nineteen Madison Metropolitan Schools have received the “Energy Star” label. They include Allied Learning Center -2002, Allis Elementary -2008, Black Hawk Middle/Gompers M/E -2007, Cherokee Middle - 2006, Crestwood Elementary - 2007, East High - 2008, Emerson Elementary - 2008, Franklin

## HISTORY OF ENERGY PLANNING

Elementary - 2008, Jefferson Middle - 2006, Kennedy Elementary - 2007, Lake View Elementary -2007, Lapham Elementary -2005, Midvale Elementary - 2006, Muir Elementary - 2006, O’Keeffe /Marquette E/M - 2007, Sandburg Elementary – 2007, Shorewood Elementary -2007 and Stephens Elementary - 2007<sup>2</sup>.

The District is committed to improving the educational environment for students while at the same time, reducing non-renewable energy use and associated greenhouse gas emissions. This Comprehensive Energy Plan represents the latest and most ambitious in a long line of efforts to maximize the effectiveness of energy use while minimizing environmental impacts in a cost-effective manner.

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<sup>2</sup> [http://www.energystar.gov/index.cfm?c=k12\\_schools.bus\\_schoolsk12](http://www.energystar.gov/index.cfm?c=k12_schools.bus_schoolsk12)



## 2019 ENERGY USE & EMISSIONS

Although the district’s energy resolution is stated in terms of achieving various benchmarks in terms of percentage of renewable energy, it is useful to understand both the amount of the district’s energy which comes from renewable sources and the greenhouse gas (GHG) emissions associated with the district’s energy use. While these metrics are related, the impact they have on the path forward can be very different. Both the share of renewable energy and GHG emissions will be evaluated in this study and therefore a baseline is needed for both metrics in order to compare future performance and demonstrate progress towards renewable energy and emissions reduction targets. The year 2019 was chosen for the baseline as it was the year in which the resolution was adopted and is the most recent year during which district operations were not impacted by pandemic-related factors.

### ENERGY USE PROFILE

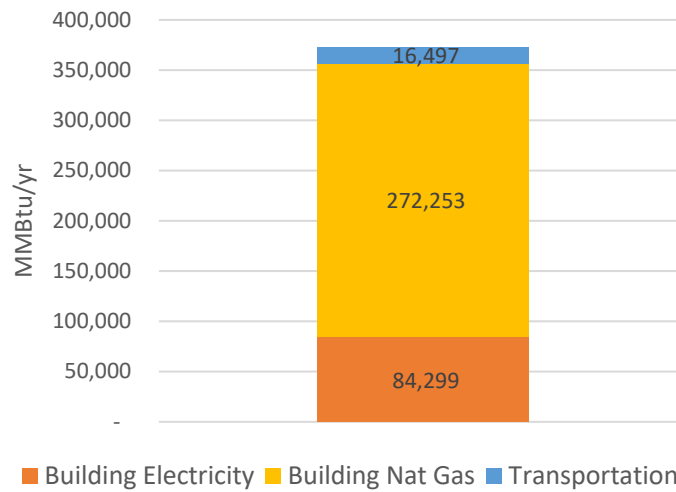
The process began with collection and analysis of all 2019 energy usage data for the Building & Facilities and Transportation sectors. Design Engineers worked with the district’s various Operations Departments that included Facilities and Transportation to understand the best channels for requesting and acquiring this data. Key account representatives from Madison Gas and Electric provided guidance on the appropriate paths for gathering building and facility energy use data. The following table summarizes total district energy use by source.

2019 Energy Use by Source			
	Purchased Units		MMBtu
Electricity	kWh	24,783,175	84,560
Natural Gas	therms	2,730,968	273,097
Diesel	gallons	40,324	5,605
Propane	gallons	47,000	4,301
Gasoline	gallons	53,156	6,591

Electricity and natural gas usage was obtained from the utility provider. Transportation fuel (diesel, propane and gasoline) is a combination of fuel purchased and used directly by the district and fuel purchased and used by the district’s bus contractor but used for district operations. Actual 2019 fuel use related to bussing was not available yet at the time of this report, so the figures presented are based on miles driven on a representative day and nominal fuel efficiency data for school buses.

As shown in the table above and following graph, the vast majority of the district’s energy use is for building operations with the majority of that being natural gas used for building heating.

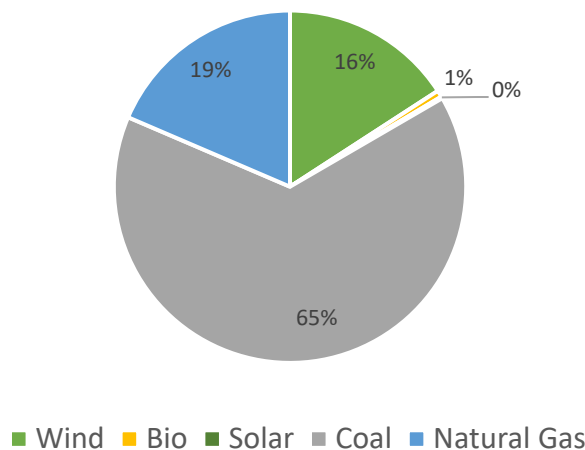
2019 Energy Use by Sector



ENERGY SOURCE PROFILE

The share of energy used by and for the district which comes from renewable sources is a combination of purchased and self-generated renewable electricity. The vast majority of electricity purchased by the district comes from Madison Gas and Electric (MG&E) who in turn produces and procures a portion of the electricity they provide to customers from renewable sources. In 2019, electricity purchased from MG&E came from the sources shown in the following graph. Based on this a total of 17% of the electricity the district purchased came from renewable sources.

2019 MG&E Generation Profile

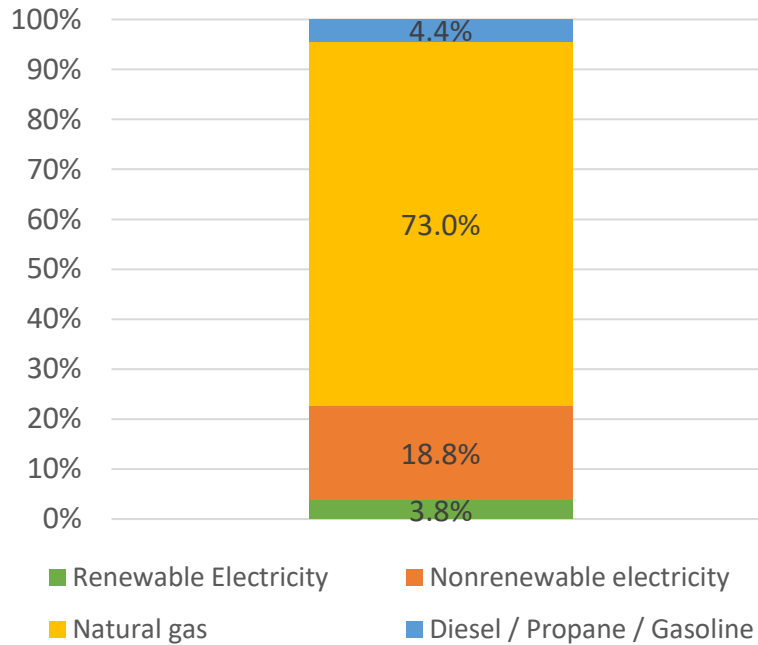


The district installed a small amount of photovoltaic electricity generation at five sites in 2006 with a total installed capacity of 7.5 kW. Although specific production data is not available, based on solar

## 2019 ENERGY USE & EMISSIONS

production in similar locations, the assumed production is 9,000 kWh/yr. Although this did not contribute significantly to meeting the district’s electricity demand, it did serve the purpose of demonstration and raising awareness. Based on the share of purchased electricity coming from renewable sources, a total of 3.8% of the district’s energy use came from renewable sources in 2019.

### 2019 District Energy Source Profile



### GREENHOUSE GAS EMISSIONS PROFILE

While the percentage of energy coming from renewable sources is a useful metric, it is expressed only on a relative basis and does not reflect the amount of energy use or related emissions on an absolute basis. In other words, tracking only the percentage of renewable energy does not show trends of increasing or decreasing energy usage over time. In addition, it does not illuminate differences in damaging greenhouse gas (GHG) emissions between different non-renewable sources. For this reason, many climate-related goals are stated in terms of reduction in GHG emissions compared to a baseline. For example, the Intergovernmental Panel on Climate Change (IPCC) has established a widely recognized pathway to limiting global warming to 1.5° C by reducing CO<sub>2</sub> emissions from 2010 levels by 45% in 2030 and reaching net zero emissions by 2050. Based on this, it is useful to also examine GHG emissions associated with the district’s energy use.

One of the primary steps in conducting a GHG emissions inventory is to identify the activities that result in generation of GHG emissions. For the district, the primary relevant activities include the usage of electricity and natural gas in buildings, as well as bus and vehicle fleet fuel usage. While there are

## 2019 ENERGY USE & EMISSIONS

other district activities that contribute to GHG emissions, (e.g. solid waste generation), they are not significant when compared to emissions associated with energy use and are therefore not included in this analysis.

In order to convert energy use to the total amount of carbon dioxide equivalent (CO<sub>2</sub>e) produced annually a calculation-based methodology was used to determine these emissions in units of CO<sub>2</sub>e with the general formula as the following:

$$\text{Emissions} = \text{Activity Data} \times \text{Emission Factor}$$

In the formula above, *Activity Data* may be, for example, metered annual electricity or natural gas consumption. *Emission Factor* may be, for example, the average annual emission rate for a utility producing and delivering electricity or natural gas to a facility. The *Emission Factor* is typically expressed in CO<sub>2</sub>e emissions per unit of energy delivered, such as pounds per megawatt hour (lbs CO<sub>2</sub>e/MWh), pounds per therm (lbs CO<sub>2</sub>e/therm) or pounds per gallon (lbs CO<sub>2</sub>e/gal). The emissions factor is intended to include both CO<sub>2</sub> emissions associated with direct combustion of the fuel as well as other related greenhouse gas emissions associated with delivering the fuel (e.g. methane leaks associated with sourcing and delivering natural gas).

The emission factors used in calculation of emissions for each operational activity that generates GHG emissions is summarized in the table below:

Activity	Emission Factor	Unit	Emission Factor	Unit
Electricity	1,603	lbs CO <sub>2</sub> e/MWh	470	lbs CO <sub>2</sub> e/MMBtu
Natural Gas	11.7	lbs CO <sub>2</sub> e/therm	117	lbs CO <sub>2</sub> e/MMBtu
Diesel	22.4	lbs CO <sub>2</sub> e/gallon	161	lbs CO <sub>2</sub> e/MMBtu
Propane	12.7	lbs CO <sub>2</sub> e/gallon	139	lbs CO <sub>2</sub> e/MMBtu
Gasoline	19.6	lbs CO <sub>2</sub> e/gallon	158	lbs CO <sub>2</sub> e/MMBtu

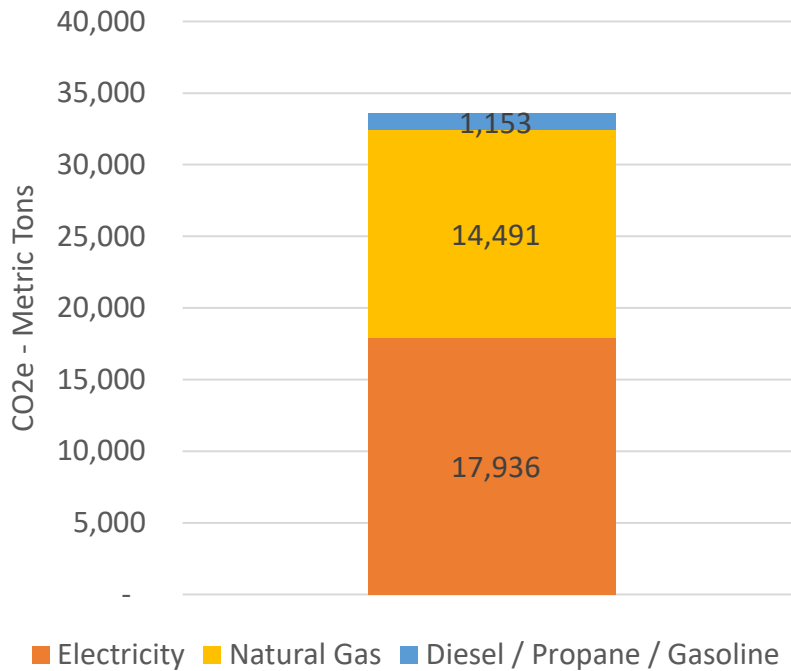
Note that the emissions associated with purchased electricity is significantly higher per unit of energy than that of natural gas. This is due to the fact that a relatively high percentage of MG&E's electricity was generated using coal which has a high emission factor. Natural Gas, Diesel, Propane and Gasoline emission factors were all sourced from the EIA<sup>3</sup>.

The chart below summarizes the baseline emissions for the 2019 calendar year which totaled 16,688 metric tons of CO<sub>2</sub>e.

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<sup>3</sup> EIA Greenhouse Gases Equivalencies Calculator Calculations and References

### Emissions Profile - 2019



As is consistent with the fact that the district’s purchased electricity has a relatively high emission factor, a greater share of emissions is associated with the district’s electrical usage than the share of total energy that comes from electrical usage. This is significant in that in the near term, a reduction in electrical energy usage will result in a greater reduction in emissions than the same reduction in natural gas energy usage. However, as a greater share of MG&E’s electricity is produced using renewable sources over time, this dynamic will shift and ultimately a greater reduction in emissions will come from a reduction in natural gas usage. This will be discussed further in the Current Path Projections section of the report.

## 2020-2040 CURRENT PATH PROJECTIONS

This section of the report provides a projection of both the percentage of energy coming from renewable sources and GHG emissions based on currently planned building modifications and PV installations included in the referendum projects, utility emissions forecasts, expected enrollment growth and future building plans. The combination of these elements provides the full picture of the District's projected current path for renewable energy and GHG emissions between calendar years 2020 and 2040 assuming no further renewable energy or emissions reduction measures are taken. As the Comprehensive Energy Plan is fully developed, additional scenarios considering varying levels and pace of adoption of onsite renewable generation, energy efficiency and electrification will continue to be analyzed.

Within this section the terms emission factor, emissions intensity, and emissions rates are all used interchangeably to describe the pounds of CO<sub>2</sub> equivalent emissions per unit of energy delivered.

### DISTRICT ENERGY USE

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Projections to the District's overall energy use for calendar years 2020 through 2040 have been incorporated based on the most recent annual data, timelines for referendum projects, future construction plans and enrollment projections.

The total floor area of buildings operated by the district is currently approximately 4,500,000 square feet. The current referendum projects include comprehensive renovations of 1,570,000 square feet and additions totaling 254,000 square feet. The renovations incorporate numerous energy efficiency measures which will tend to reduce energy intensity. However, they also include adding square footage, adding air conditioning and increasing ventilation rates which will offset some of the efficiency gains. The net effect of improved energy efficiency and improved indoor environmental control is currently estimated to be a net reduction in energy intensity (kBtu/sf/yr) for the renovated area of 15%. This will be refined as the study progresses and more specific information on projected energy use becomes available from Focus on Energy analysis. The projections assume all referendum projects are placed in use in 2024. For all subsequent years, the current path projection assumes that electricity and natural gas usage remain flat. Note that the projection does not include any new building area added after the current referendum projects and it assumes that any future addition of air conditioning will be accompanied by improvements in energy efficiency to offset the associated additional electrical usage.

The projected transportation fuel usage is scaled from existing usage based on projected enrollment according to the following table<sup>4</sup>. No other change in diesel, propane or gasoline usage has been modeled for calendar years 2019 through 2030, since no plan has yet been developed to transition these vehicle fleets.

Total District Enrollment			
2019-2023	2023-2028	2028-2033	2033-2038
27,855	28,173	28,369	28,634

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<sup>4</sup> July 2019 MMSD Long Range Facilities Plan

## 2020-2040 CURRENT PATH PROJECTIONS

The table below shows the projected total energy use for these years and provides a breakdown by the building and transportation sectors.

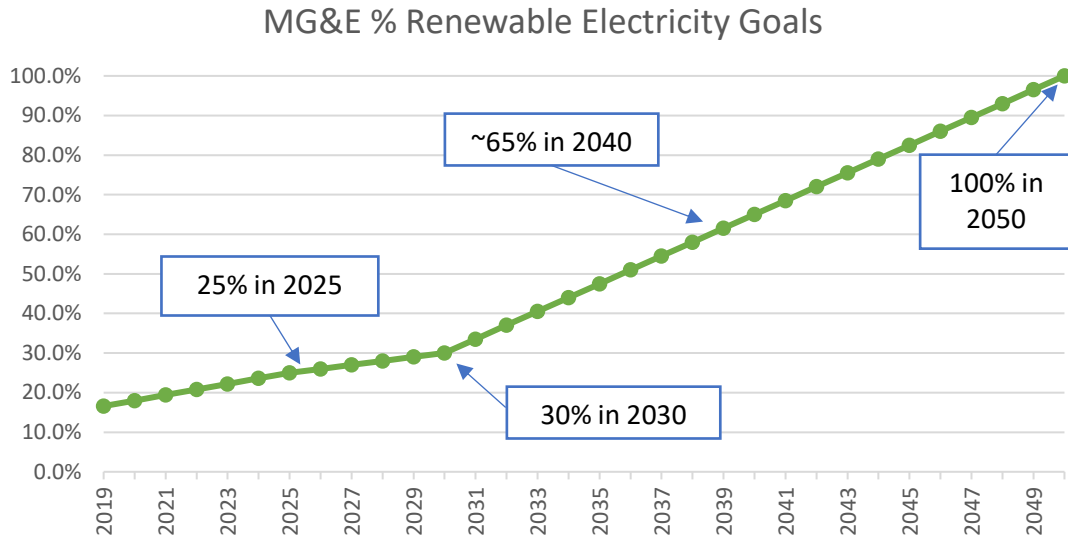
Projected Annual Energy Usage								
	Building				Transportation			Total
Year	Electricity (MWh)	Natural Gas (therms)	Building Energy (MMBtu)	EUI (kBtu/sf)	Diesel (gal)	Propane (gal)	Gasoline (gal)	MMBtu
2020	18,685	2,202,456	283,998	63.1	41,493	48,363	54,697	16,975
2021	24,783	2,730,968	357,657	79.4	41,493	48,363	54,697	16,975
2022	24,920	2,746,018	359,628	79.4	41,493	48,363	54,697	16,975
2023	24,920	2,746,018	359,628	79.4	41,493	48,363	54,697	16,975
2024	24,814	2,734,389	358,105	74.9	41,967	48,915	55,322	17,169
2025	24,814	2,734,389	358,105	74.9	41,967	48,915	55,322	17,169
2026	24,814	2,734,389	358,105	74.9	41,967	48,915	55,322	17,169
2027	24,814	2,734,389	358,105	74.9	41,967	48,915	55,322	17,169
2028	24,814	2,734,389	358,105	74.9	41,967	48,915	55,322	17,169
2029	24,814	2,734,389	358,105	74.9	42,259	49,255	55,707	17,289
2030	24,814	2,734,389	358,105	74.9	42,259	49,255	55,707	17,289
2031	24,814	2,734,389	358,105	74.9	42,259	49,255	55,707	17,289
2032	24,814	2,734,389	358,105	74.9	42,259	49,255	55,707	17,289
2033	24,814	2,734,389	358,105	74.9	42,259	49,255	55,707	17,289
2034	24,814	2,734,389	358,105	74.9	42,654	49,715	56,227	17,450
2035	24,814	2,734,389	358,105	74.9	42,654	49,715	56,227	17,450
2036	24,814	2,734,389	358,105	74.9	42,654	49,715	56,227	17,450
2037	24,814	2,734,389	358,105	74.9	42,654	49,715	56,227	17,450
2038	24,814	2,734,389	358,105	74.9	42,654	49,715	56,227	17,450
2039	24,814	2,734,389	358,105	74.9	42,654	49,715	56,227	17,450
2040	24,814	2,734,389	358,105	74.9	42,654	49,715	56,227	17,450

The data for 2020 is actual while the data for remaining years is projected. The 2020 data is significantly impacted by the curtailment of operations due to the pandemic. Projections are based on the 2019 baseline with modifications as discussed above. It is important to note that the referenced EUIs correspond to site rather than source. In other words, the energy use shown includes energy used on site and does not reflect energy consumed in producing and delivering energy to the site.

### UTILITY RENEWABLE GENERATION

In order to project the share of renewable energy used by the district, it is necessary to account for utility plans for their generation mix. MG&E has established a goal of net-zero carbon electricity by 2050 and in their Energy 2030 Framework set interim goals reaching 25% renewable electricity by 2025 and 30% by 2030. Projections in this report assume a straight-line progress between these milestones as shown in the following graph. Based on this, MG&E is projected to produce 65% of electricity from renewable sources in 2040.

## 2020-2040 CURRENT PATH PROJECTIONS



### DISTRICT RENEWABLE GENERATION

The district has a small amount of existing renewable generation capacity and is in process of installing additional capacity. Specifically, the district has secured 3 MW of solar PV capacity through a partnership with MG&E in the Hermsdorf Solar project in Fitchburg. This provides the district with renewably sourced electricity generated by their share of this project. The project is anticipated to come online some time in 2022 and is projected to generate electricity at the rate of 1,200 MWh per MW of peak installed capacity.

In addition, the district is planning for a total of 935 kW of PV to be installed at individual schools as part of the referendum projects as follows:

- Lafollette: 200 kW
- East: 195 kW
- West: 500 kW
- Memorial: 180 kW
- Southside: 85 kW

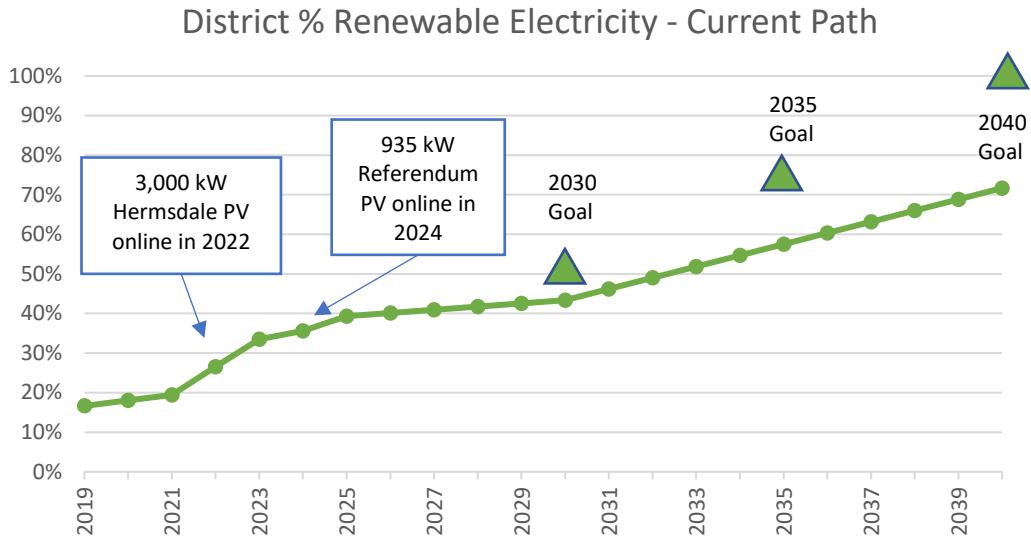
These systems are projected to come online in the fall of 2024.

### DISTRICT ENERGY SOURCE PROFILE

Based on the combination of utility and district plans for installation of renewable electricity generation, the current path projection for share of electrical energy is 43% in 2030 and 72% in 2040.

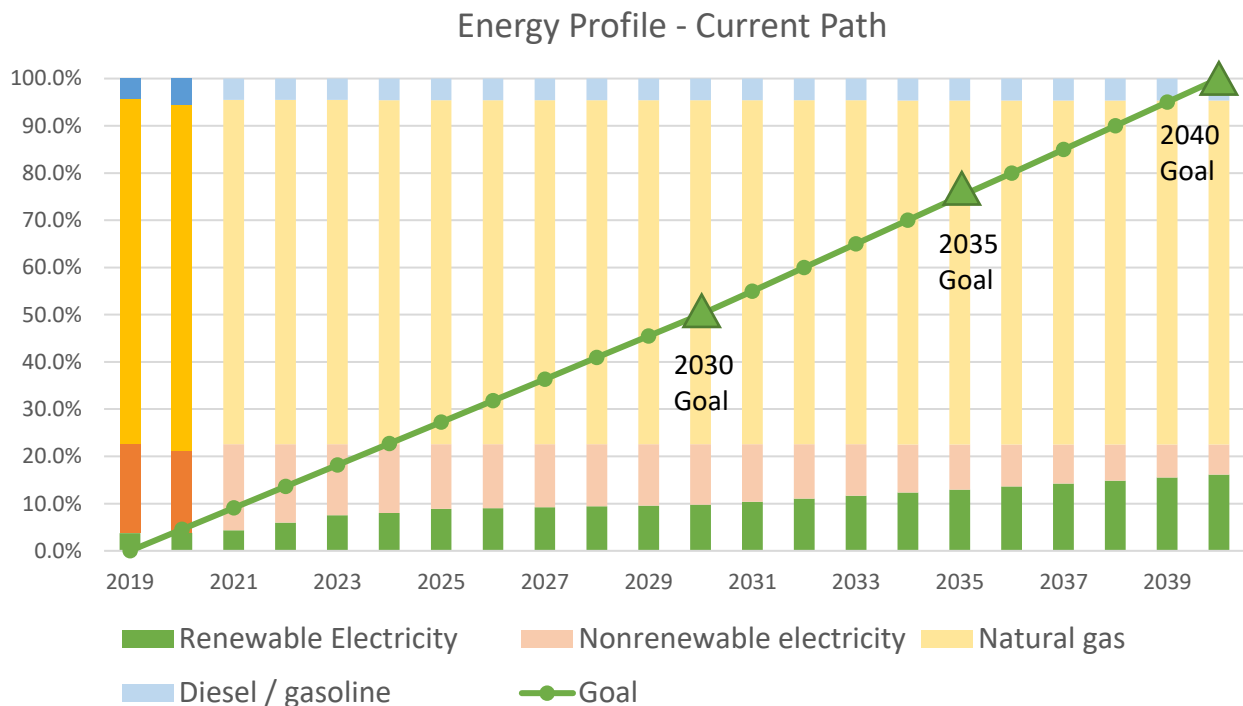


## 2020-2040 CURRENT PATH PROJECTIONS



The current path projections for the district’s use of other energy sources (natural gas, diesel, propane and gasoline) are based on maintaining the existing rates of usage with adjustments for building modifications and enrollment projections as described above.

The following graph illustrates projections for the percentage of total district energy to be provided from renewable sources through 2040 assuming no further measures are put in place to increase renewable energy.



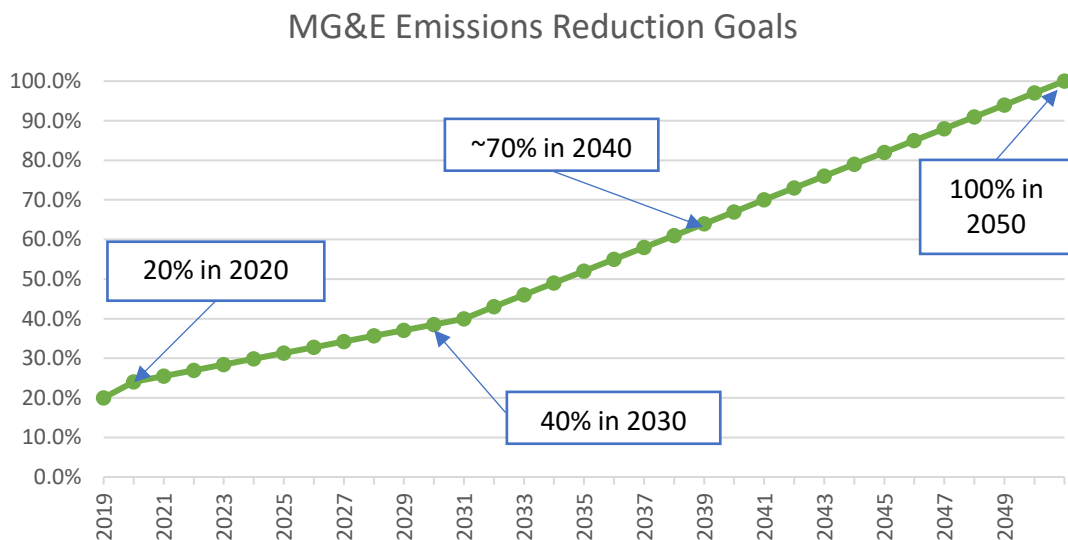
## 2020-2040 CURRENT PATH PROJECTIONS

As can be seen from the previous two graphs, the district is on track to achieve a significant portion of their electricity use from renewable sources (43% by 2030, 58% by 2035 and 72% by 2040) and not too far off from the established goals for electrical use. However, current plans do not include converting the district's fossil fuel use to renewable sources which is where the bulk of the effort will be required to achieve the goal of 100% renewable energy by 2040.

### UTILITY GHG EMISSIONS INTENSITY

Similar to projecting the share of the district's energy coming from renewable sources, it is necessary to account for utility plans for their generation mix to arrive at projected emissions. MG&E has established a goal of net-zero carbon electricity by 2050 and in their Energy 2030 Framework set interim goals for emissions reduction from 2005 levels of 20% by 2020 and 40% by 2030. Projections in this report assume a straight-line progress between these milestones as shown in the following graph. Based on this, MG&E is projected to reduce carbon emissions from 2005 levels by 70% by 2040 which corresponds to the date the district is targeting 100% renewable energy.

When calculating past and projecting future emissions from the Buildings & Facilities sector of the GHG inventory, an understanding of the source emissions from the respective utilities serving these facilities is key. Electricity emissions rates are of particular importance, since the utilities serving the District's buildings have varying emission reduction targets and timetables for achieving them. The District's facilities are served by three different electric utilities: MidAmerican Energy, Alliant Energy, and Linn County REC. The chart below reflects the projected emissions intensity for each of these electric utilities for the calendar years 2018 through 2030:



## 2020-2040 CURRENT PATH PROJECTIONS

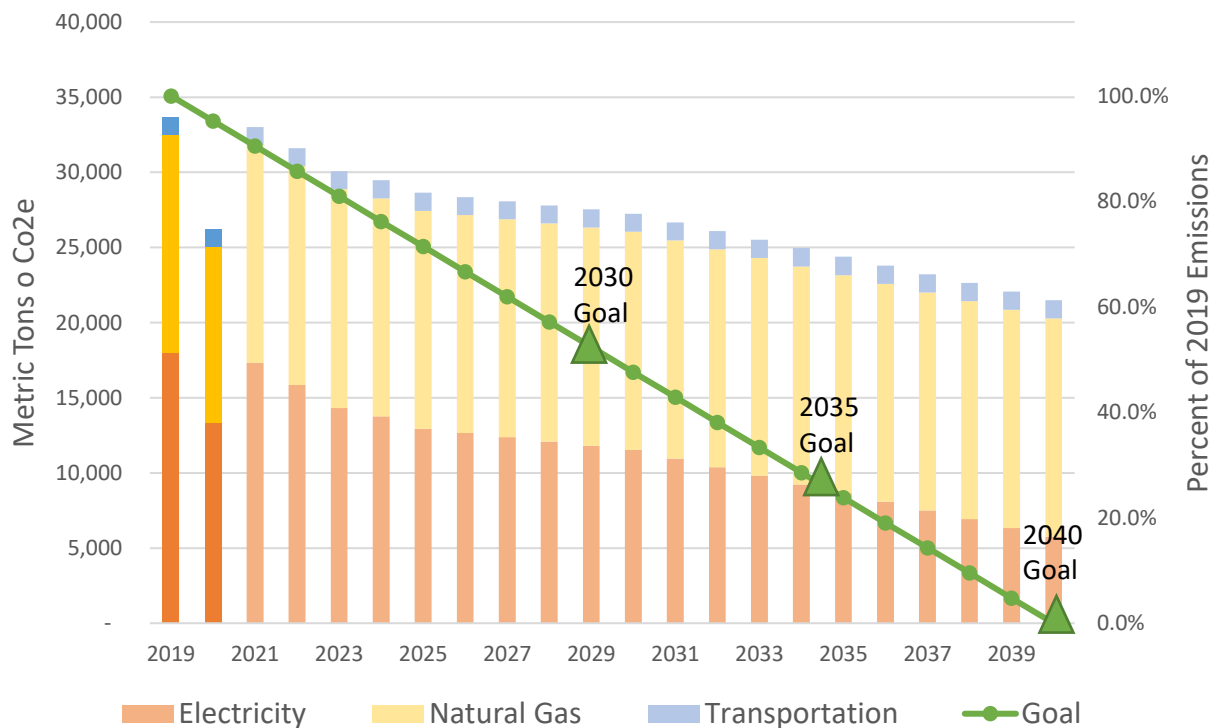
### NATURAL GAS, DIESEL, PROPANE AND GASOLINE GHG EMISSIONS INTENSITY

The emissions intensity associated with the district’s projected natural gas usage for calendar years 2020 through 2040 is expected to remain at 11.7 lbs CO<sub>2</sub>e/therm. The current source of the District’s natural gas supply, MG&E is not known to have any planned projects which would reduce the emissions associated with this fuel source. Similarly, the emissions intensity of diesel, propane and gasoline used for vehicles is expected to remain at 22.4, 12.7 and 19.6 lbs CO<sub>2</sub>e/gal respectively. While there is the possibility of reducing emissions with diesel by utilizing bio diesel, this is not currently planned so is not part of the current path projection.

### PROJECTED DISTRICT GHG EMISSIONS

Combining projections for utility emissions, reductions in purchased electricity due to the district’s renewable energy production and direct emissions from district fossil fuel use, a projection for the district’s total GHG emissions can be established.

GHG Emissions Profile - Current Path



The goals for emissions reduction shown in the graph above have not been formally adopted by the district. However, they do align with the timeline established for the renewable energy goals with a 50% reduction by 2030, 75% by 2035 and 100% by 2040. In the next few years emissions will be reduced closely following a straight-line projection of these goals. However, in later years, reductions following

## 2020-2040 CURRENT PATH PROJECTIONS

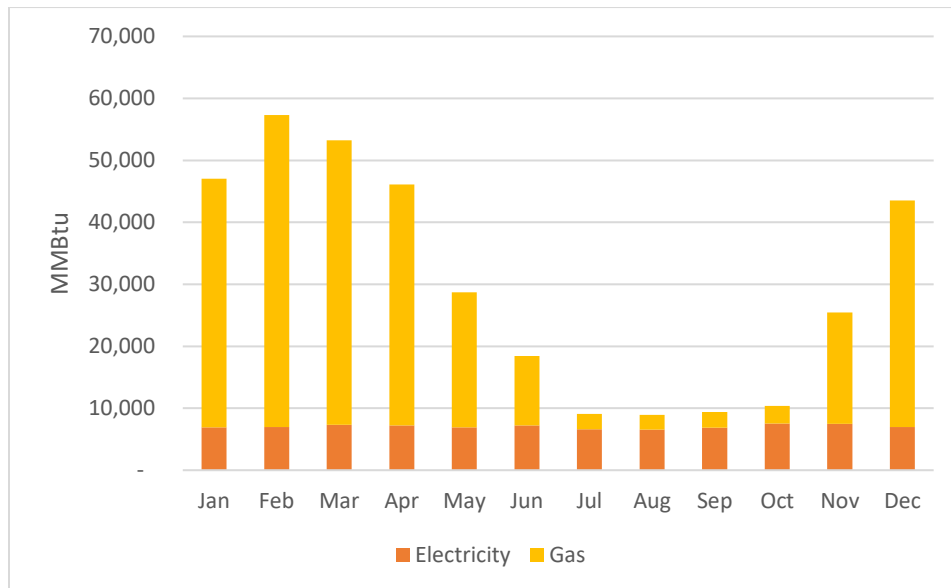
the current path level off and diverge from the goal. This is due to the fact that in the early years, a larger share of emissions is associated with electricity use and are reduced due to new district-owned renewable generation coming online along with the fact that emissions from purchased electricity are reducing due to changes in the utility generation mix. In later years, a larger share of emissions is associated with natural gas and the current path does not include a strategy for reducing fossil fuel use.

## APPENDICES

APPENDIX A – ELECTRICITY CONSUMPTION

APPENDIX B – NATURAL GAS CONSUMPTION

2019 Monthly Energy Use				
	Electricity		Gas	
	kWh	MMBtu	therms	MMBtu
Jan	2,031,622	6,932	401,293	40,129
Feb	2,048,212	6,988	503,276	50,328
Mar	2,146,414	7,324	459,020	45,902
Apr	2,113,627	7,212	388,955	38,896
May	2,034,205	6,941	217,441	21,744
Jun	2,117,803	7,226	112,001	11,200
Jul	1,936,649	6,608	24,895	2,490
Aug	1,922,690	6,560	23,773	2,377
Sep	2,004,054	6,838	25,794	2,579
Oct	2,200,799	7,509	28,711	2,871
Nov	2,188,917	7,469	180,082	18,008
Dec	2,038,183	6,954	365,727	36,573
<b>Total</b>	<b>24,783,175</b>	<b>84,560</b>	<b>2,730,968</b>	<b>273,097</b>



School	2019 Area (sq-ft)	2021 Area (sq-ft)	2024-2040 Area (sq-ft)
Administration	84,200	84,200	84,200
Allied	10,350	10,350	10,350
Allis Elementary	82,000	82,000	82,000
Anana Elementary	70,600	70,600	70,600
Badger Rock Middle School	0	66,525	66,525
Blackhawk/Gompers	24,818	24,818	94,444
Capital HS (previously Hoyt)	104,960	104,960	104,960
Chavez	33,900	33,900	34,600
Cherokee Middle	88,000	88,000	88,000
Crestwood Elementary	89,390	89,390	89,390
East High	67,675	67,675	67,675
Elvehjem Elementary	458,816	458,816	476,113
Emerson Elementary	72,234	72,234	72,234
Franklin Elementary	51,760	51,760	51,760
Hamilton/Van Hise	54,091	54,091	54,091
Hawthorne Elementary	78,875	78,875	78,875
Henderson Elementary	124,997	124,997	124,997
Holzman Building	30,000	30,000	30,000
Huegel Elementary	64,000	64,000	64,000
Jefferson Middle	81,029	81,029	81,029
Kennedy Elementary	67,220	67,220	67,220
La Follette High	326,940	326,940	371,132
Lake View Elementary	73,744	73,744	73,744
Lapham Elementary	87,955	87,955	87,955
Leopold Elementary	58,822	58,822	58,822
Lincoln Elementary	34,475	34,475	34,475
Lindbergh Elementary	68,896	68,896	68,896
Lowell Elementary	2,000	2,000	2,000
Lussier	40,500	40,500	40,500
Maintenance/Food Service	68,160	68,160	68,160
Mansfield Stadium	3,600	3,600	3,600
Memorial High	363,092	363,092	405,045
Mendota Elementary	49,400	49,400	49,400
Midvale Elementary	64,950	64,950	64,950
Muir Elementary	141,660	141,660	141,660
O'Keeffe/Marquette	137,110	137,110	137,110
Randall Elementary	61,540	61,540	61,540
Sandburg Elementary	42,864	42,864	42,864
School Forest Cabins	6,287	6,287	6,287
Sennett Middle	98,300	98,300	98,300
Sherman/Shabazz	130,760	130,760	130,760
Shorewood Elementary	60,950	60,950	60,950
Spring Harbor	32,534	32,534	32,534
Stephens Elementary	72,000	72,000	72,000
Thoreau Elementary	58,500	58,500	58,500
Toki/Orchard Ridge	112,263	112,263	112,263
Warehouse	362,112	362,112	442,785
West High	8,400	8,400	8,400
Whitehorse/Schenk	118,353	118,353	118,353
Wright	55,150	55,150	55,150
<b>Total</b>	<b>4,480,232</b>	<b>4,546,757</b>	<b>4,801,198</b>