MEMORANDUM

TO: Mayor and City Council
FROM: Howard S. Lazarus, City Administrator
SUBJECT: Proposed Plan for Achieving 100% Clean and Renewable Energy for City Operations
DATE: September 11, 2018

This memorandum provides the staff response to Council Resolution R-17-442, Resolution Committing the City of Ann Arbor to 100% Clean and Renewable Energy for City Operations, dated December 4, 2017. The strategy presented in the paragraphs below involves four core elements: 1) energy efficiency; 2) electrification of equipment and appliances; 3) renewable energy installation; and 4) green fleets. The accompanying PowerPoint presentation provides additional details about how staff arrived at these recommendations[1]. Importantly, all recommendations are "living," with the intention and anticipation that adjustments, changes, and new activities emerging over the course of our work will influence our achievement of the goal of 100% clean and renewable.

Current Emissions and Energy Profile

According to the 2015 greenhouse gas emissions inventory, City of Ann Arbor municipal operations account for less than 2% of community wide emissions (38,000 metric tons of carbon dioxide equivalent (MTCO2e)). The majority of these emissions are from electricity usage (80%), followed by natural gas usage (12%), and fuel for fleet vehicles (8%).

Energy Efficiency

Given that the greenest energy is the energy that is never produced, the first prong in our strategy is energy efficiency. A recent energy audit of fourteen city buildings identified a series of efficiency upgrades that the City plans to pursue. We've highlighted Wheeler Service Center and Veterans Memorial Park as two locations we'd like to immediately start making appropriate upgrades. Our next step is to work with

[1] Please see the "notes" of the slides for additional details about each of the slides in the accompanying PowerPoint presentation.

Public Works and Parks to determine a timeline, funding, and support needed to implement these upgrades. Additionally, we will work with the remaining twelve facilities to identify pertinent energy efficiency upgrades, secure resources for upgrades, and move forward with implementing relevant projects. Simultaneously, we plan to undertake energy audits of a sub-set of remaining city buildings in order to identify further energy saving opportunities. Combined, we believe that energy efficiency improvements throughout the City can lead to an energy reduction of at least 15%.

Electrification

The second prong in our strategy is electrification. This means working to ensure that, to the fullest extent possible, all city appliances and equipment are running on electricity (as opposed to natural gas). By doing this, we create the ability for these appliances and equipment to be powered by 100% clean and renewable energy just as soon as the grid is powered by renewables. We will work with the City's purchasing department to integrate this change into the City's Environmental Preferable Purchasing policy and conduct training with staff to ensure they realize the importance of pursuing electric equipment and appliances when replacing or upgrading infrastructure.

Renewable Energy Generation

The third prong in our strategy is renewable energy generation. Currently the City generates, on average, 11,500 MWh of electricity through four renewable projects: a) landfill gas capture; b) hydroelectric at Barton Dam; c) hydroelectric at Superior Dam; and d) solar energy installations. To rapidly scale-up the amount of renewable energy generation within the City, an assessment of solar potential was undertaken at 4 sites, hydroelectric potential at 2 sites, and a biodigester assessment at the wastewater treatment plant. Based on these results, we are planning to move forward with the requisite financial and legal analyses necessary to install: 1) solar at Wheeler Service Center; 2) solar at Veterans Memorial Park; 3) Solar at the Landfill; and 4) hydroelectric at Geddes Dam. In addition, we will work with all other interested and viable sites to 'right' size appropriate onsite renewable systems, including the Water Treatment Plant.

Green Fleets

The final prong in our strategy is greening our municipal fleet by purchasing or leasing more hybrid and electric vehicles. We currently have identified 3 vehicles that will be replaced with electric vehicles in the next fleet cycle. We are also exploring options for leasing a number of EV vehicles in order to further green our fleet. While this is only a modest transition, our plan is to continually transition vehicles to EV or hybrid, to the fullest extent possible, once their useful life is met. As part of this strategy, we will also invest in fast EV chargers and look to move a significant portion of the EV fleet to Wheeler – thereby powering the EVs with the solar installation we hope to have in place in the near future.

Wild Cards

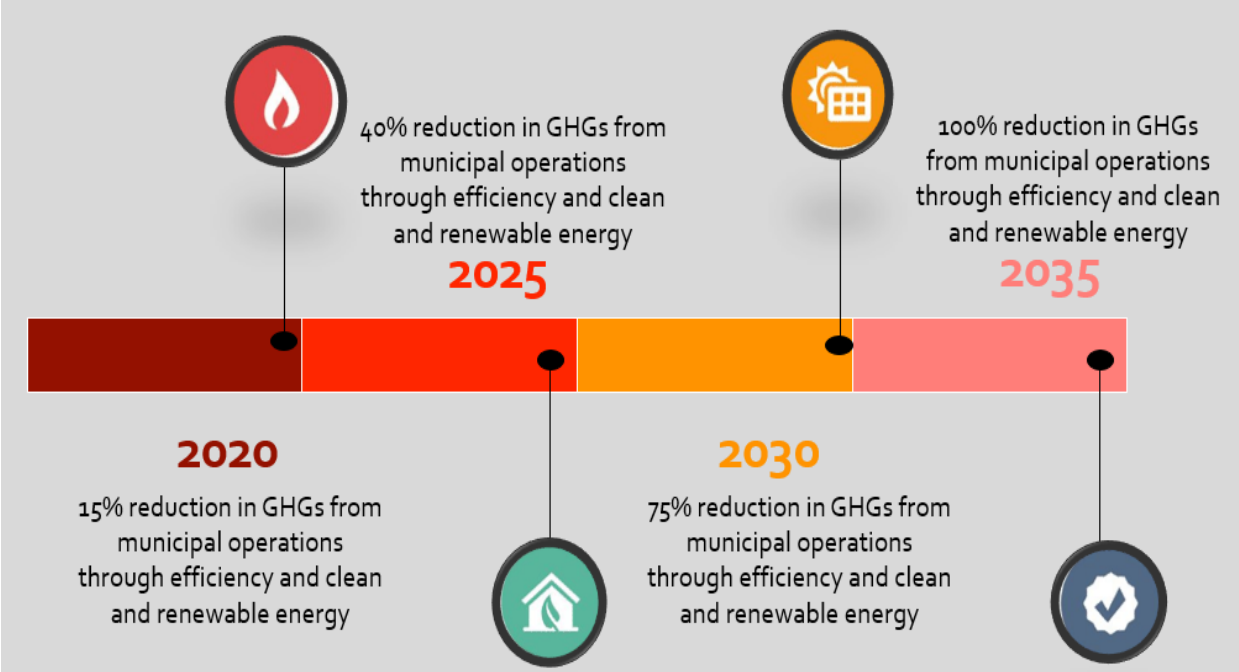
In addition to the aforementioned strategies, we also plan to pursue a number of actions that we call wildcards. These are programs that can serve as pilots and/or as transitional assistance as we work

towards meeting our 100% clean and renewables goals. So far we have identified four wildcard activities: a) creating a net-zero fire station (with support from Chief Kennedy); b) purchasing renewable energy credits/offsets; c) the installation of battery storage capacity to help make renewables more viable; and d) integrating climate and sustainability more fully into city-level planning, decision-making and budgeting. We plan to pursue all four of these options as part of our broader strategy.

Timeline & Goals

The graphic below highlights our interim goals and associated timeline. Our intent is to focus immediately on energy efficiency opportunities, greening our fleet, electrification, and all the feasibility requirements that proceed onsite renewable energy generation. In the mid to long-term we will focus on onsite renewable energy generation, harder to achieve energy efficiency gains, and moving all appliances and equipment to electricity.

The primary staff point of contact for this action is Missy Stults, Sustainability and Innovations Manager. Please do not hesitate to contact either Ms. Stults or me directly if you have any questions or if you would like additional information.



ATTACHMENT

Presentation: 100% Clean and Renewable Municipal Operations

100% CLEAN & RENEWABLE MUNICIPAL OPERATIONS

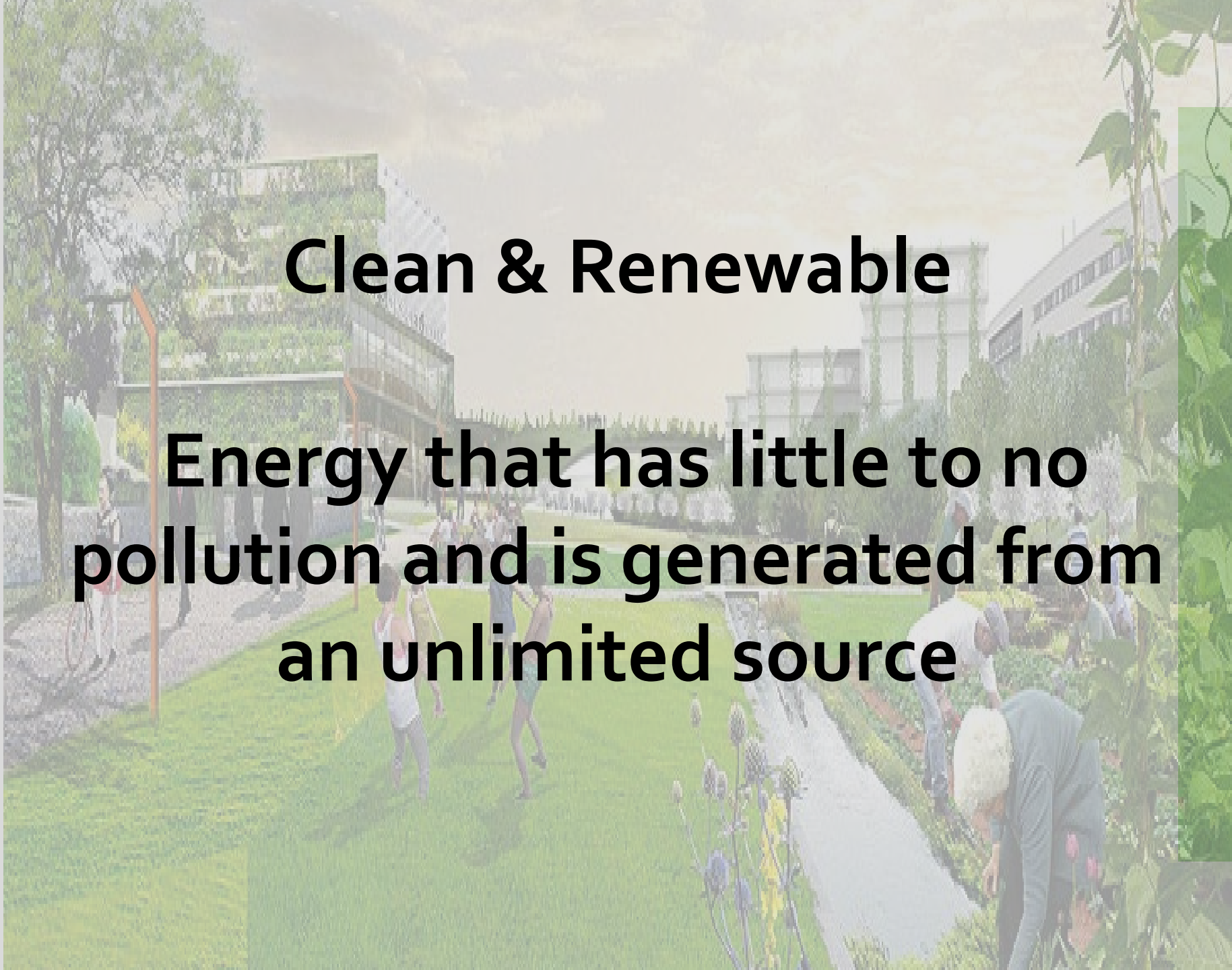
PREPARED BY: OFFICE OF SUSTAINABILITY AND INNOVATIONS

CLEAN & RENEWABLE

Clean = Energy that does not pollute and/or greatly reduces pollution into the environment, including reductions in air contaminants, greenhouse gas emissions, and the production of waste.

Renewable = Energy generated from an unlimited source with zero or nearly zero pollution. Includes generation from sustainable sources such as wind, solar, geothermal, hydro, and biomass.

OUR DEFINITION



Clean & Renewable

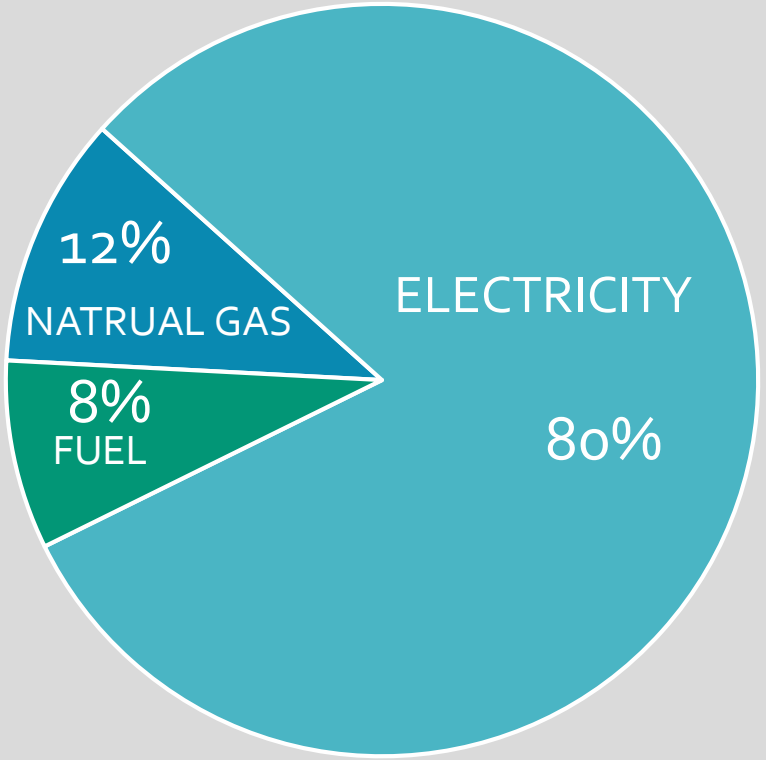
Energy that has little to no pollution and is generated from an unlimited source

GREENHOUSE GAS EMISSIONS IN ANN ARBOR

CURRENT MUNICIPAL OPERATIONS

MUNICIPAL EMISSIONS BY TYPE

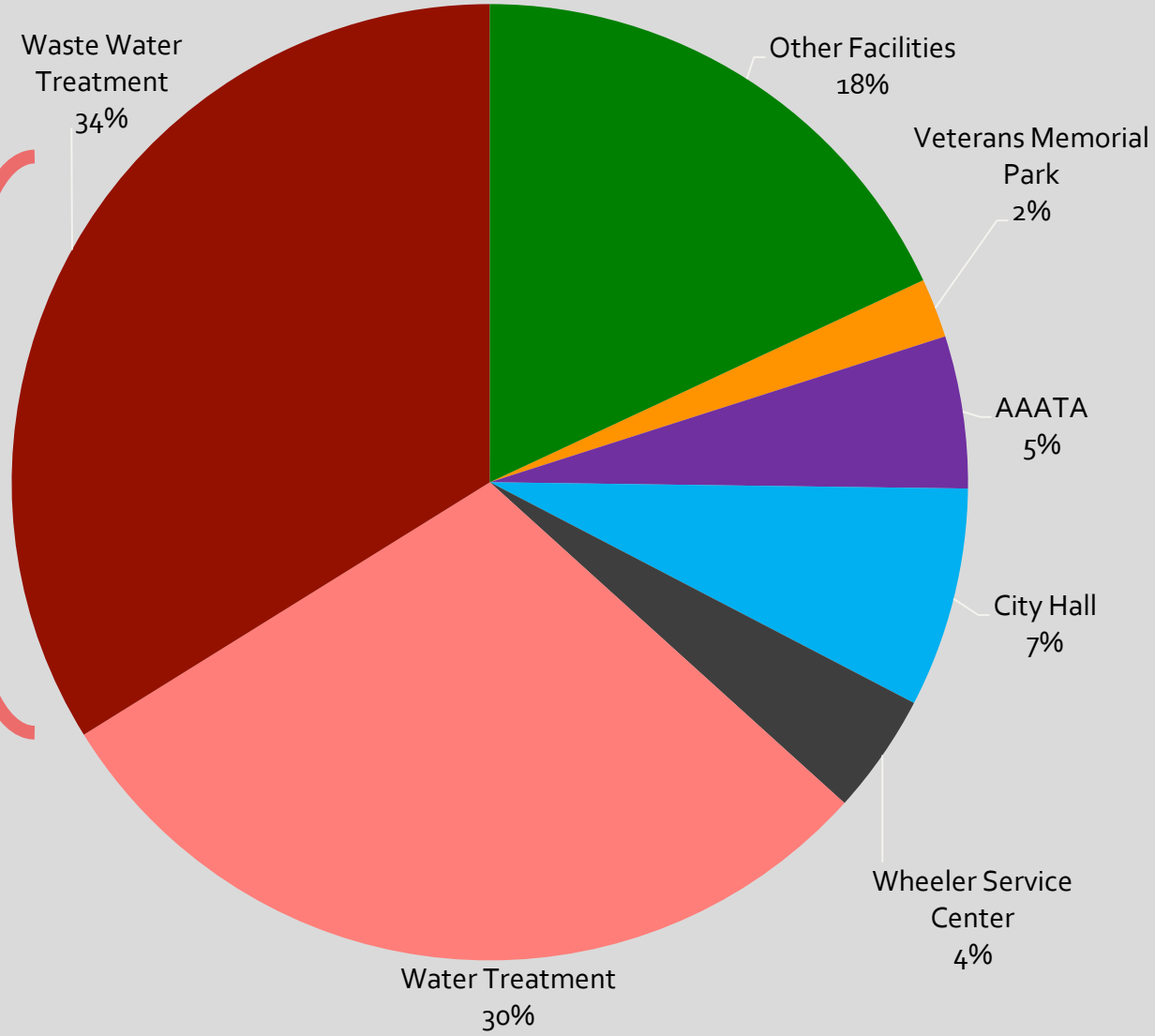
Total: 38,000 MTCO2e



ELECTRIC USE BY FACILITY

Total: 30,000 MTCO2e

Total: 37,000 MWh



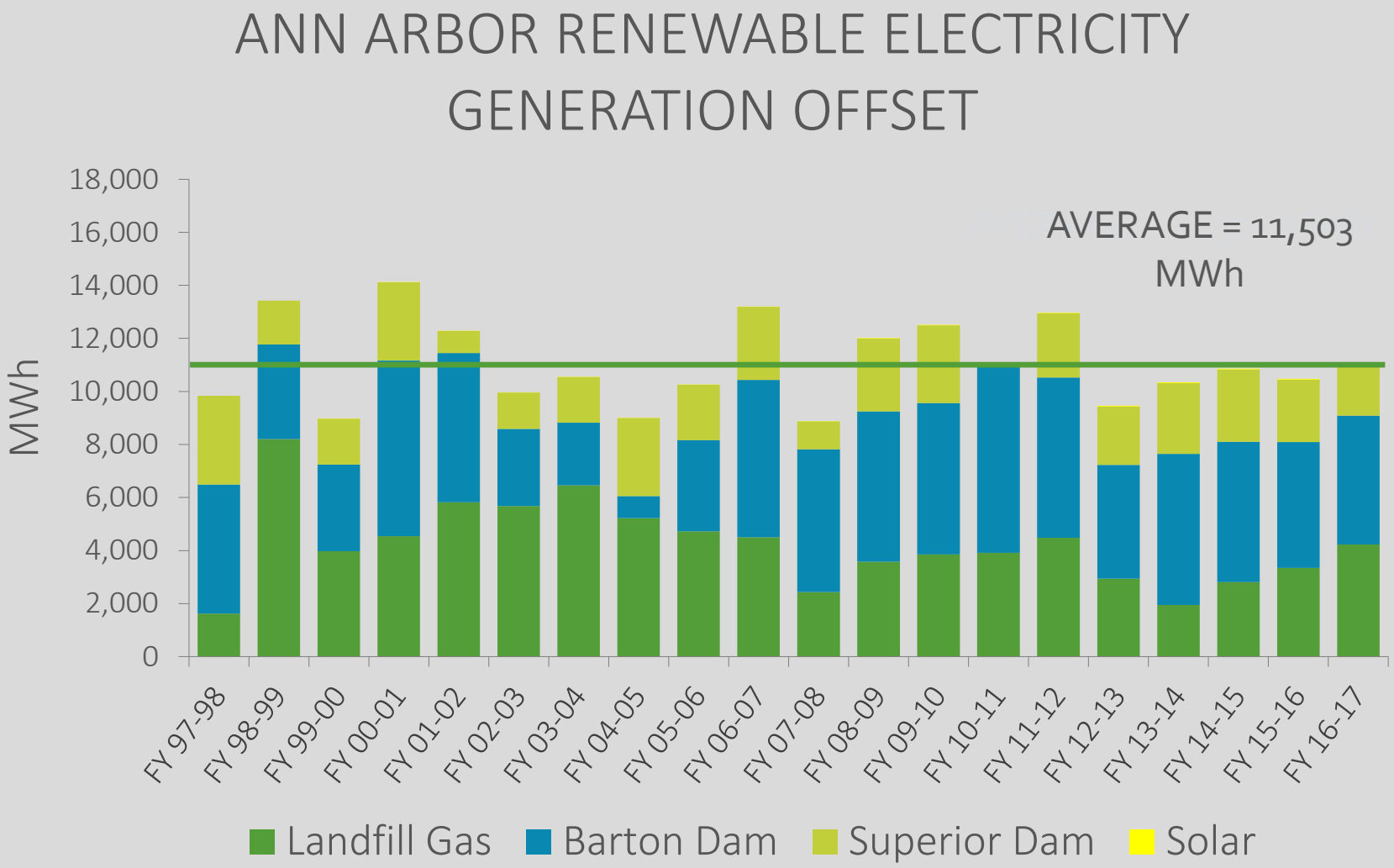
OUR FUEL MIX FROM DTE

Fuel Source for the 12-Month Period Jan. 2015 - Dec. 2015	DTE Energy's Fuel Mix Used to Supply Electricity
Coal	70.14%
Nuclear	18.00%
Gas	3.79%
Oil	0.21%
Hydroelectric	0.11%
Renewable Fuels Total	7.74%

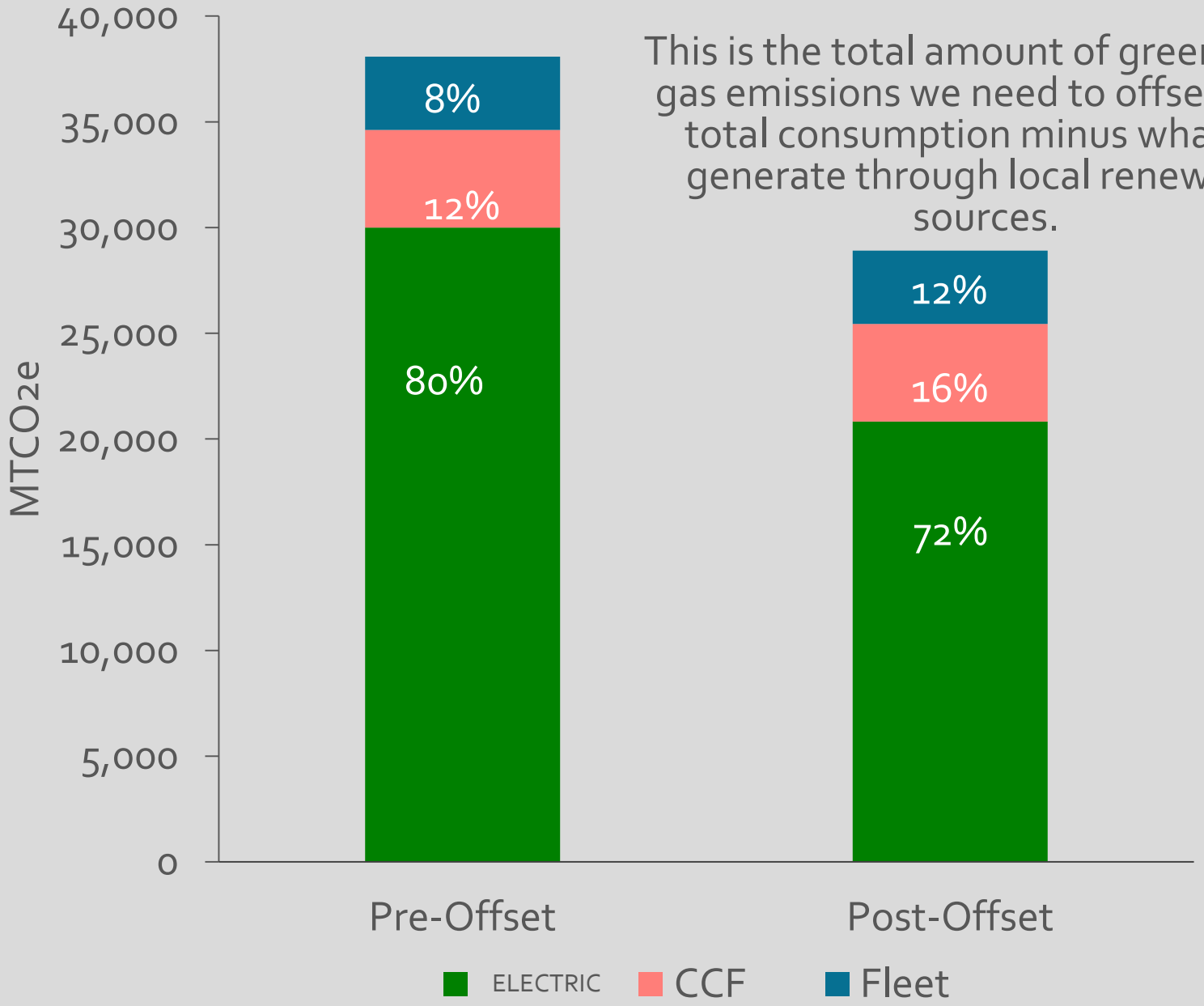
Biofuel	0.09%
Biomass	1.05%
Solid Waste Incineration	0.59%
Solar	0.04%
Wind	5.94%
Wood	0.07%

Our current fuel mix from DTE. As the table shows, most of the energy that powers our electrical grid comes from fossil fuels.

ANN ARBOR'S LOCAL GENERATION



CURRENT MUNICIPAL OPERATIONS



This is the total amount of greenhouse gas emissions we need to offset – our total consumption minus what we generate through local renewable sources.

OUR PLAN: STEP 1: EFFICIENCY

ENERGY EFFICIENCY UPGRADES

Results from a recent energy efficiency audit of 14 City buildings

LOCATION	USE		SAVINGS		%	
	kWh	ccf	kwh	ccf	kwh	ccf
Wheeler	**1,629,000**	**39,512**	**239,323**	**-**	**15%**	**0%**
Veterans	**806,000**	**31,053**	**269,942**	**438**	**33%**	**1%**
Buhr Park	484,480	15,774	101,453	88	21%	1%
Fire Station 1	385,546	9,932	90,503	280	23%	3%
Mack	185,800	26,335	40,961	122	22%	0%
Fuller	142,880	14,805	77,921	137	55%	1%
Airport	112,160	2,717	21,625	(10)	19%	0%
Fire Station 6	61,320	5,882	13,885	333	23%	6%
Fire Station 4	42,190	5,818	7,997	104	19%	2%
Fire Station 3	41,219	3,774	10,462	155	25%	4%
Northside	34,342	1,582	12,394	105	36%	7%
Farmers	24,587	-	11,438	-	47%	0%
Fire Station 2	23,848	5,313	12,832	320	54%	6%
Burns	21,342	1,511	4,898	60	23%	4%
Cobblestone	10,054	2,405	3,928	23	39%	1%
TOTAL	**4,004,768**	**166,413**	**919,562**	**2,155**	**23%**	**1%**

WHEELER SERVICE CENTER

GENERATION

TOTAL YEARLY USE
1,629,000 kWh
PROPOSED OFFSET
239,323 kWh
PERCENT OFFSET
15%
EMISSION OFFSET
191 MTCO2e

CHANGES

LIGHTING RETROFITS
MOTION SENSORS

FINANCE

COST OF UPGRADES
$481,622
YEARLY ELECTRIC COST
$142,653
YEARLY AVOIDED COST
$29,244

VETERANS MEMORIAL PARK

CHANGES

LIGHTING RETROFITS
SEAL ENVELOPE LEAKS
CONTROL RETROFITS
SENSORS
ICE RINK/POOL

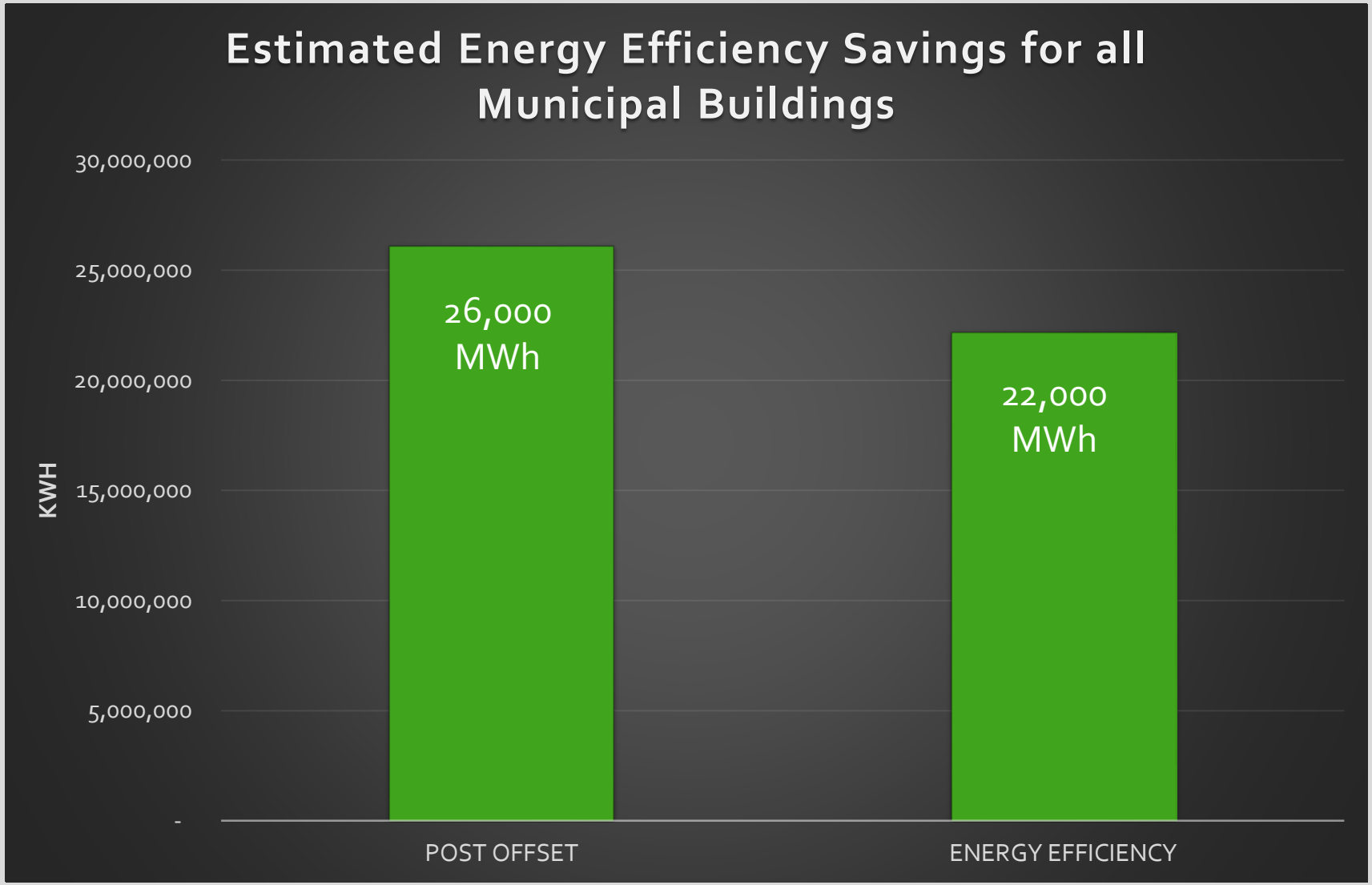
GENERATION

TOTAL YEARLY USE
806,000 kWh
PROPOSED OFFSET
269,942 kWh
PERCENT OFFSET
33%
EMISSION OFFSET
215 MTCO2e

FINANCE

COST OF UPGRADES
$551,336
YEARLY ELECTRIC COST
$79,439
YEARLY AVOIDED COST
$26,715

ENERGY EFFICIENCY UPGRADES



OUR PLAN: STEP 2: ELECTRIFICATION

As we update and replace aging appliances and equipment, move from natural gas to electric – thereby allowing us to eventually power them with renewable energy.

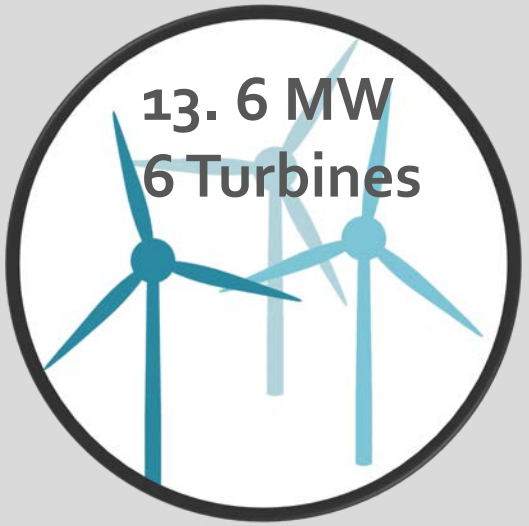
OUR PLAN: STEP 3: RENEWABLE ENERGY

RENEWABLE ENERGY OPTIONS

ANN ARBOR ELECTRIC USE (POST-OFFSET)

TOTAL 26,000 MWh

OR



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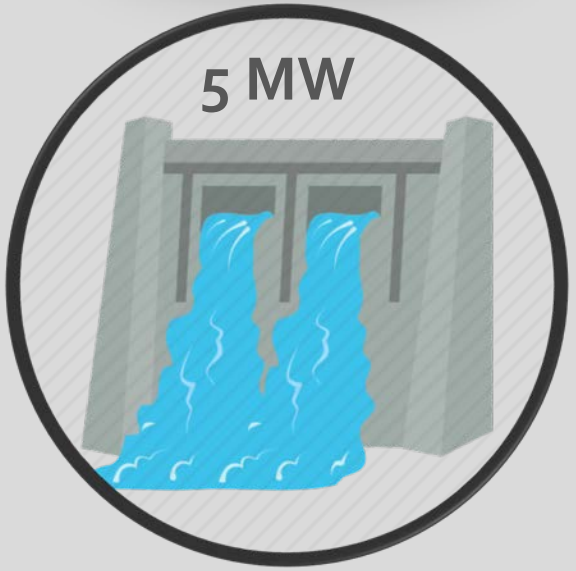
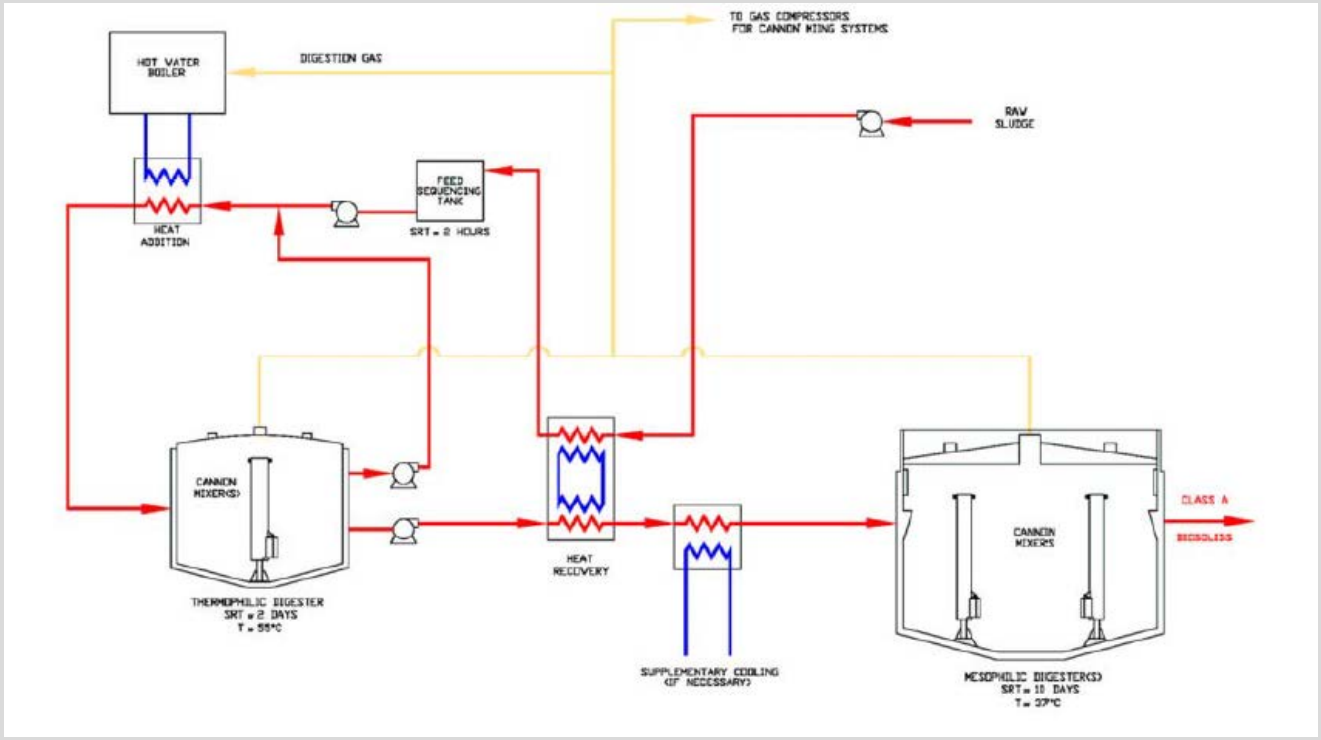
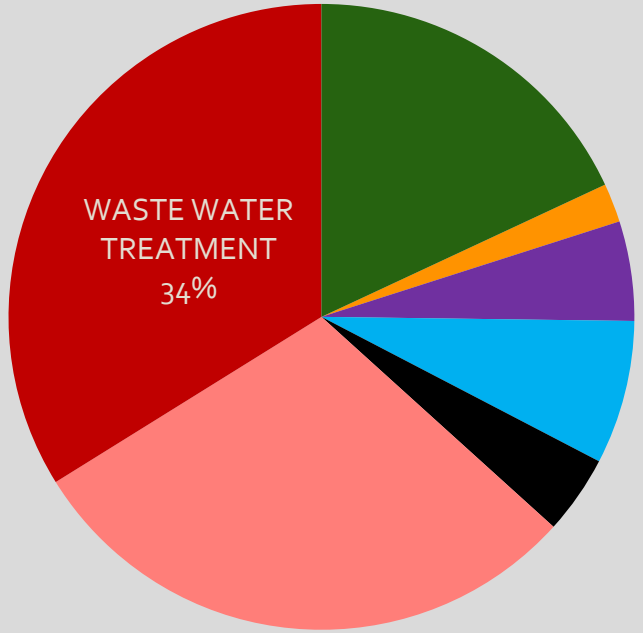


WWTP - BIODIGESTER





GENERATION

TOTAL YEARLY USE

13,447 MWh

PROPOSED GENERATION

848kW & 335kW Turbines:

3,130 – 5,818 MWh (YEAR)

PERCENT COVERED

23% - 43%

EMISSION OFFSET

2,496 – 4,639 $MTCO_2e$

FINANCE

INSTALLED COST

$22,000,000

YEARLY ELECTRIC COST

$1,027,141

YEARLY AVOIDED COST

$239,073 - $444,386

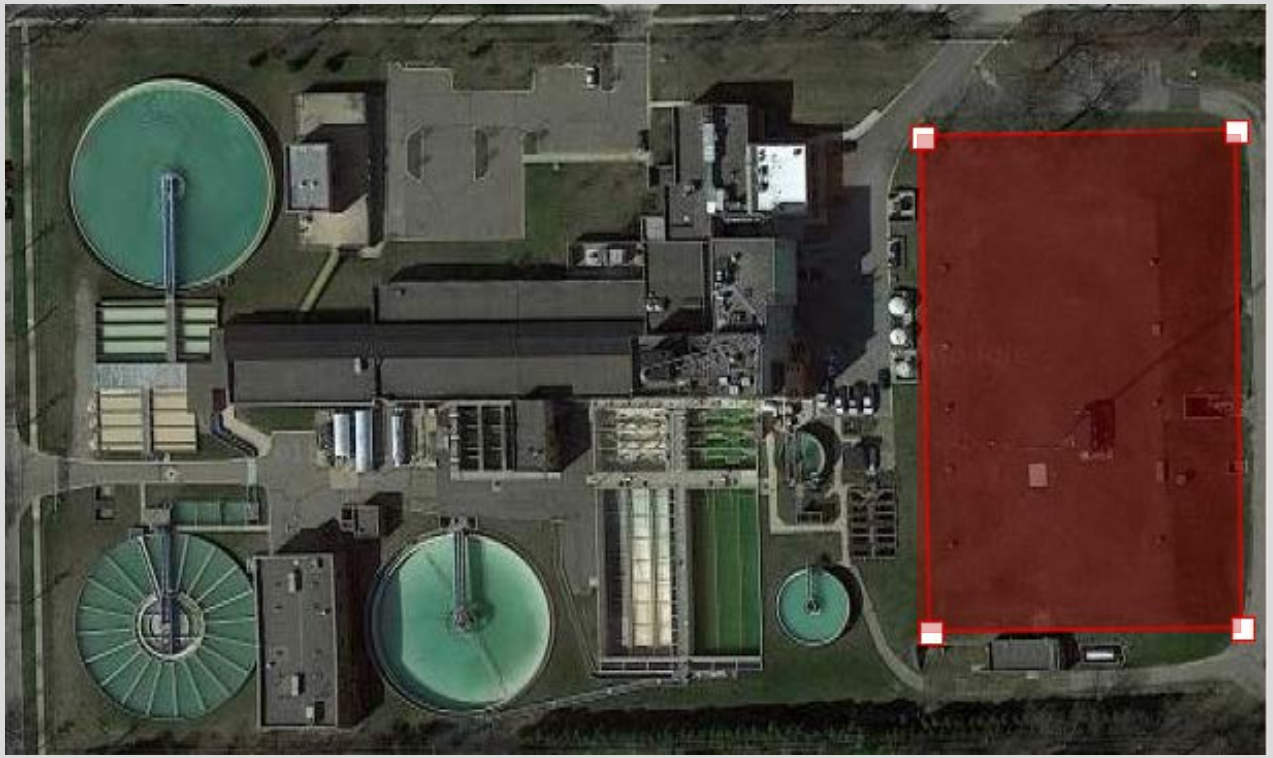
FACTORS

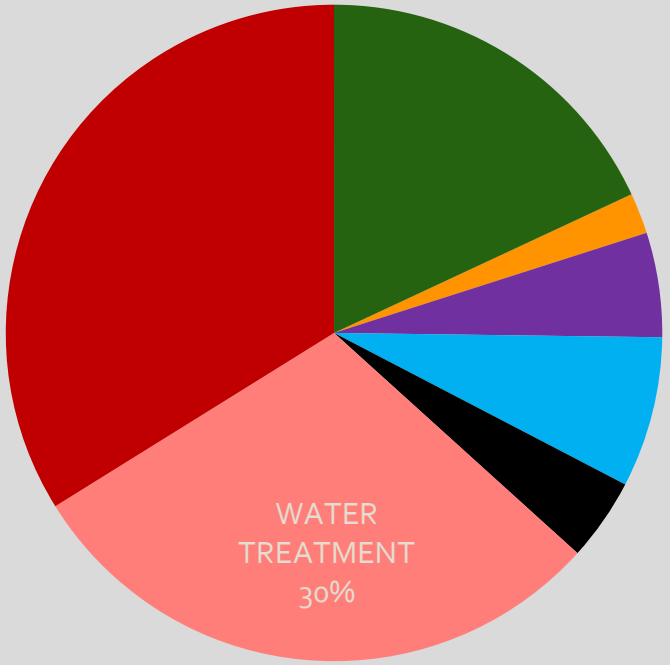
-FUEL QUALITY

-SPACE CONSTRAINTS

-UPFRONT COSTS

WTP - SOLAR





GENERATION

TOTAL YEARLY USE
6,641 MWh (5MW)
PROPOSED GENERATION
1 MW System
1,243 MWh (YEAR)
PERCENT COVERED
19%
EMISSION OFFSET
797 MTCO2e

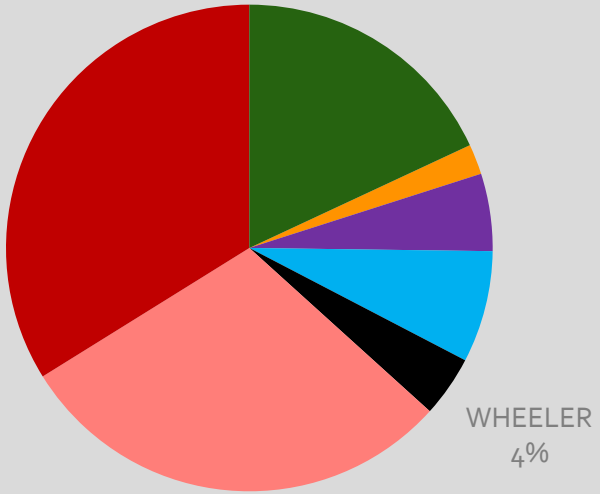
FINANCE

INSTALLED COST
$2,000,000
YEARLY ELECTRIC COST
$508,882
YEARLY AVOIDED COST
$95,239

FACTORS

-UPDATE TO PLANT
-NEW POTENTIAL
-UPFRONT COSTS

WHEELER - SOLAR



FACTORS

-EV FLEET POTENTIAL
-DISTANCE
-UPFRONT COST

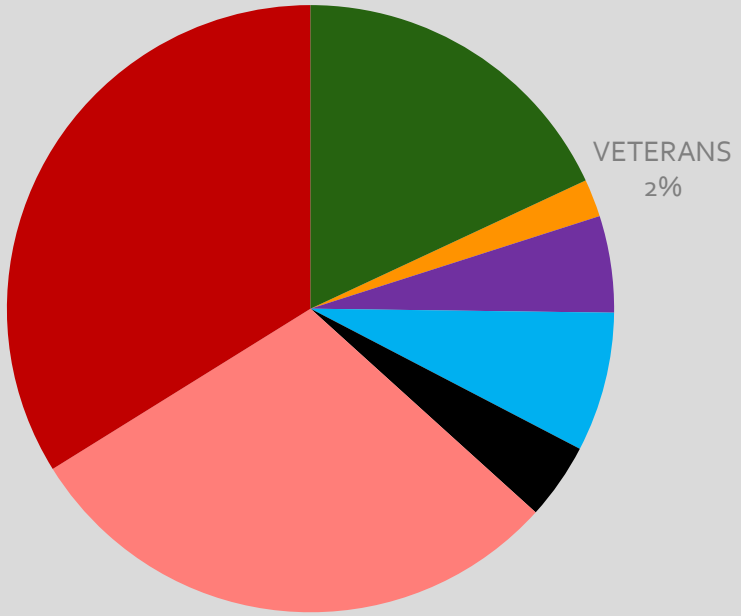
GENERATION

TOTAL YEARLY USE
1,629 MWh (1.3 MW)
PROPOSED GENERATION
5 MW System
6,215 MWh (YEAR)
PERCENT COVERED
381%
EMISSION OFFSET
3,987 MTCO2e

FINANCE

INSTALLED COST
$10,000,000
YEARLY ELECTRIC COST
$142,653
YEARLY AVOIDED COST
$540,705

VETERANS PARK - SOLAR



GENERATION

TOTAL YEARLY USE
806 MWh (650 kW)
PROPOSED GENERATION
800 kW System
994 kWh (YEAR)
PERCENT COVERED
123%
EMISSION OFFSET
637 MTCO2e

FINANCE

INSTALLED COST
$1,600,000
YEARLY ELECTRIC COST
$79,439
YEARLY AVOIDED COST
$97,412

LANDFILL - SOLAR

SOLAR POTENTIAL
20 MW

YEARLY GENERATION
24,860 MWh

EMISSION OFFSET
20,000 MTCO2e

COST
$40,000,000

CONSIDERATIONS
Using Excess Generation
Bobolink
Upfront costs

ARGO - HYDRO

POWER POTENTIAL
370 kW Capacity

YEARLY POTENTIAL
2,000 MWh per year

EMISSION OFFSET
1,594MTCO2e

COST
$4,350,000

CONSIDERATIONS
PURPA rates
Permitting fees

GEDDES - HYDRO

POWER POTENTIAL
670 kW Capacity

YEARLY POTENTIAL
3,350 MWh per year

EMISSION OFFSET
2,671 MTCO2e

COST
$5,482,000

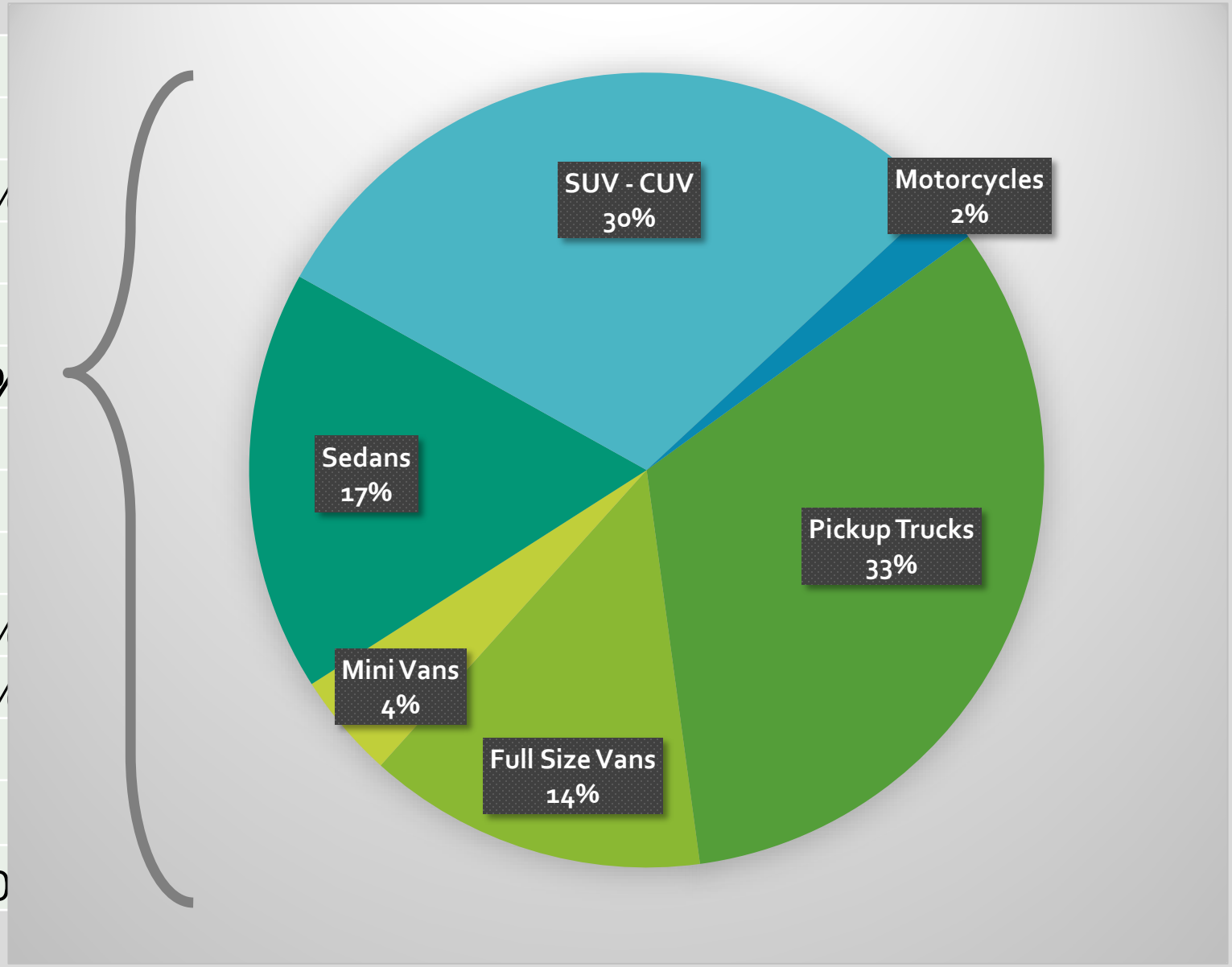
CONSIDERATIONS
PURPA rates
Permitting fees

RENEWABLE POTENTIAL

ON-SITE LOCATION	YEARLY GENERATION	PERCENT COVERED	COST	YEARLY SAVINGS	AVOIDED EMISSIONS
WWTP – BIO	3,130 – 5,818 MWh	23% - 43%	$22 Million	$239,073 - $444,386	2,496 – 4,639 MTCO2e
WTP - SOLAR	**1,243 MWh**	**19%**	**$2 Million**	**$95,239**	**797 MTCO2e**
WHEELER - SOLAR	**6,215 MWh**	**381%**	**$10 Million**	**$540,705**	**3,987 MTCO2e**
VETERANS – SOLAR	**800 kW**	**123%**	**$1.6 Million**	**$97,412**	**637 MTCO2e**
OFF-SITE LOCATION	**YEARLY GENERATION**	**PERCENT COVERED**	**COST**	**YEARLY SAVINGS**	**AVOIDED EMISSIONS**
LANDFILL - SOLAR	**24,860 MWh**	**104%**	**$40 Million**	**$239,073 - $444,386**	**20,000 MTCO2e**
ARGO - HYDRO	2,000 MWh	8%	$4.3 Million	$95,239	1,594 MTCO2e
GEDDES - HYDRO	**3,350 MWh**	**13%**	**$5.5 Million**	**$540,705**	**2,671 MTCO2e**

FLEET

Fire	2%
Golf Carts	1%
Heavy Equipment	10%
Ice Rink Equipment	1%
Large Equipment	6%
Light Vehicles	**24%**
Miscellaneous	1%
Mowing	6%
Police	5%
Small Equipment	17%
Snow Equipment	15%
Solid Waste	4%
Trailer	9%
TOTAL	720



FLEET

FORD FOCUS	CHEVY BOLT
PURCHASE COST	
$18,422	$30,000
FUEL COST PER YEAR	
$348	$132
REPAIR & MAINTENANCE PER YEAR	
$2,526	$1,116
CO_2e EMISSIONS PER YEAR	
1.95Tons	-

OUR PLAN - FLEET

- At least 3 EVs will be added to the fleet
- As vehicle "age out", look to replace with EVs or hybrids
- Track data to demonstrate value of switch (e.g., economic, environmental)

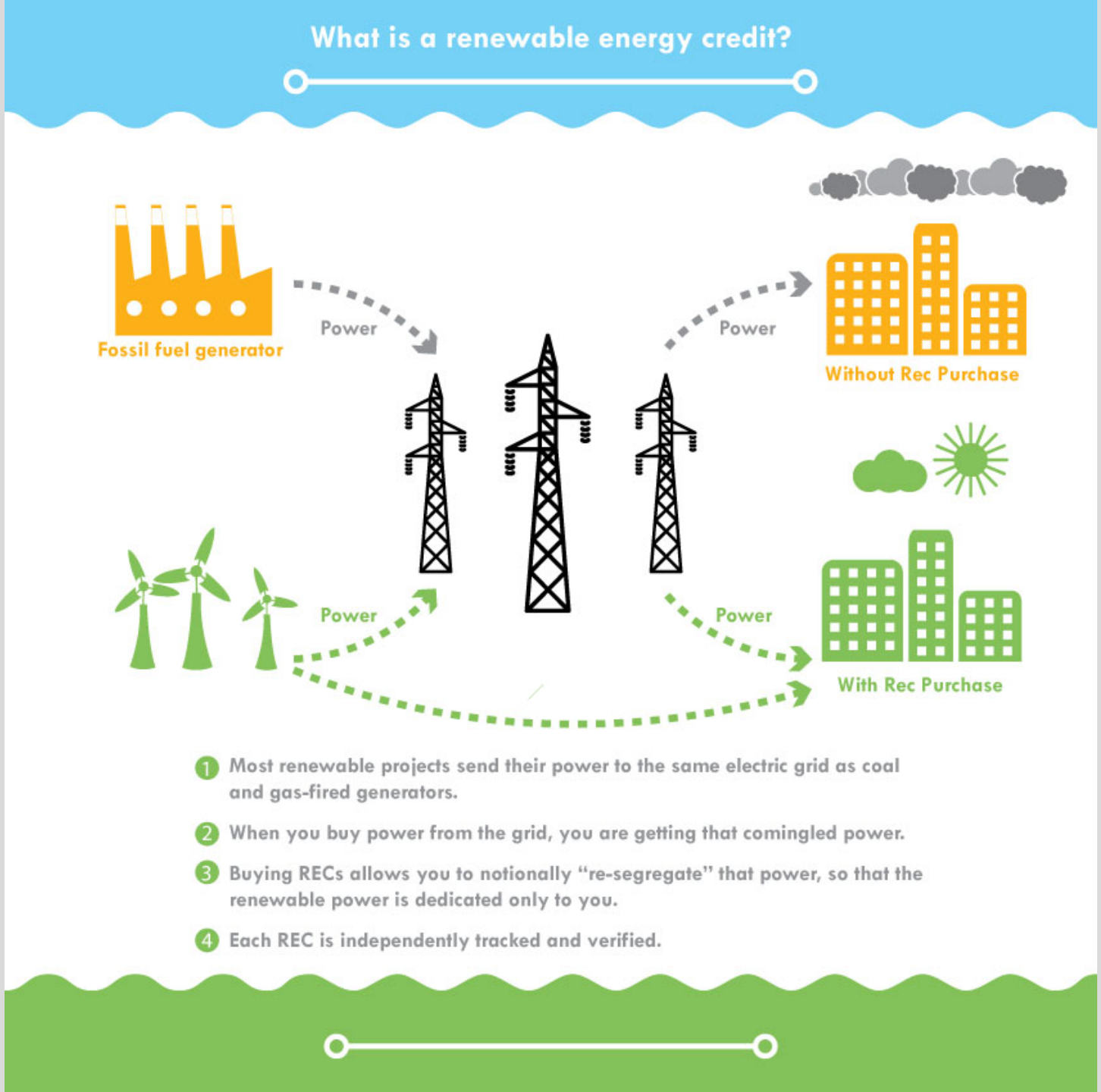
WILD CARDS

"Wild cards" are additional ideas that will help us move forward with achieving our goal of 100% clean and renewable municipal operations

NET-ZERO FIRE STATION

RENEWABLE ENERGY OFFSETS

We will also explore the purchasing of renewable energy credits to help offset emissions. This may be a short-term strategy and/or a technique to offset Scope 3 emissions (e.g., commuting).



BATTERY STORAGE

Continue working with UM colleagues and others to advance battery storage potential

INTERNAL BUDGETING AND PLANNING

Continue working with city staff to ensure that climate and sustainability are holistically and fully integrated into planning, budgeting, and decision making (e.g., CIP, budget process)

SUMMARY OF PLAN

Short (0-3 years)

- Efficiency upgrades at all sites identified in energy audit (staring with Wheeler and Veterans)
- Energy audit of other city facilities
- Implement efficiency upgrades identified during new energy audits
- Purchase electric & hybrid vehicles
- Electrification of appliances
- Legal reviews and specification gathering for onsite and offsite renewable generation
- Design net-zero fire station
- Creation of financing models

Medium (3-5 years)

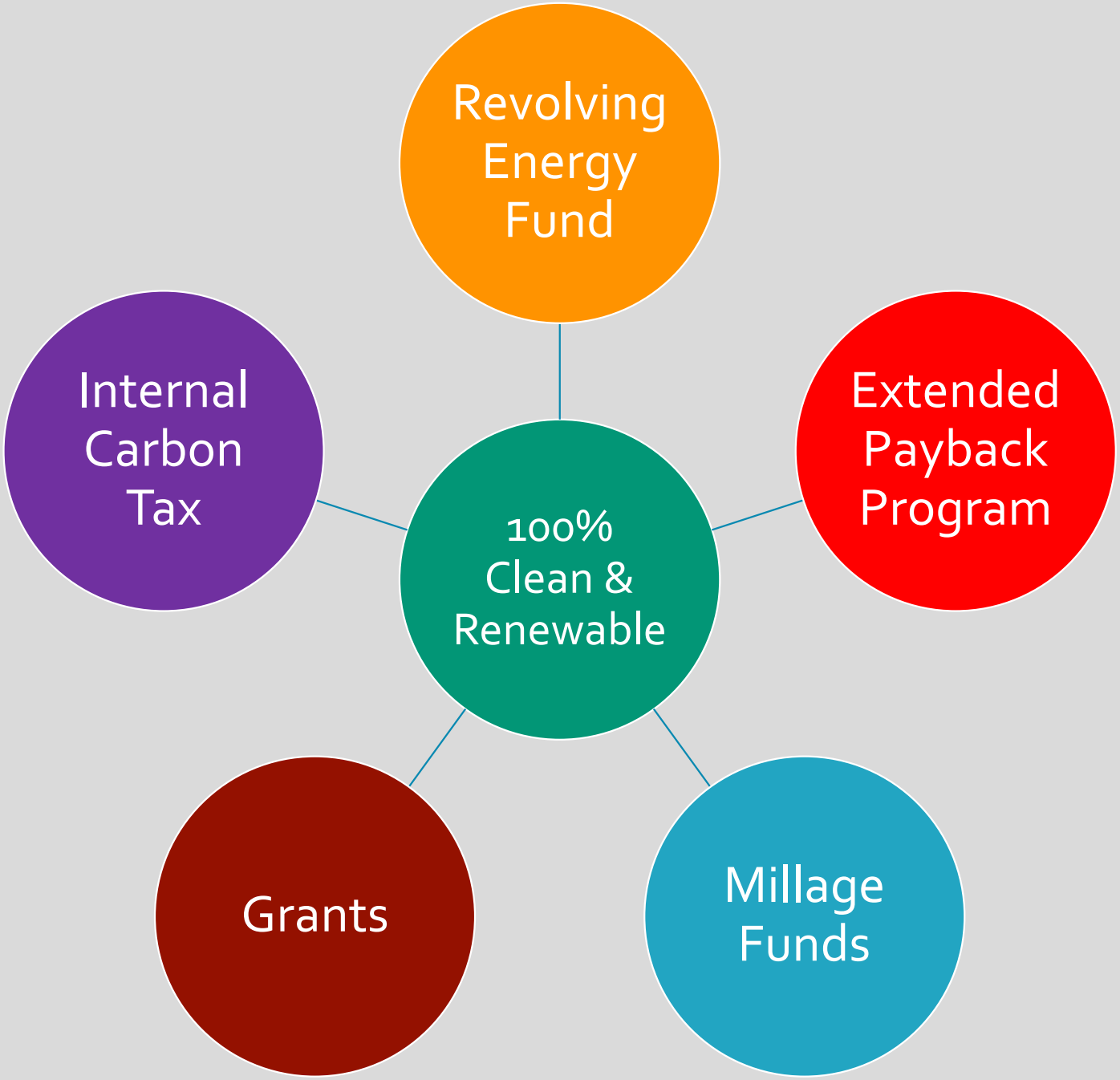
- Continued efficiency upgrades
- Continued electrification
- Onsite Installation of renewables (e.g., Wheeler and Veterans)
- All new facilities = net zero
- Build net-zero fire station
- Continued legal review and specification gathering for onsite and offsite renewable generation
- Offsite installations (e.g., Landfill and Geddes)
- More EVs, including more than light duty vehicles

Long (5+ years)

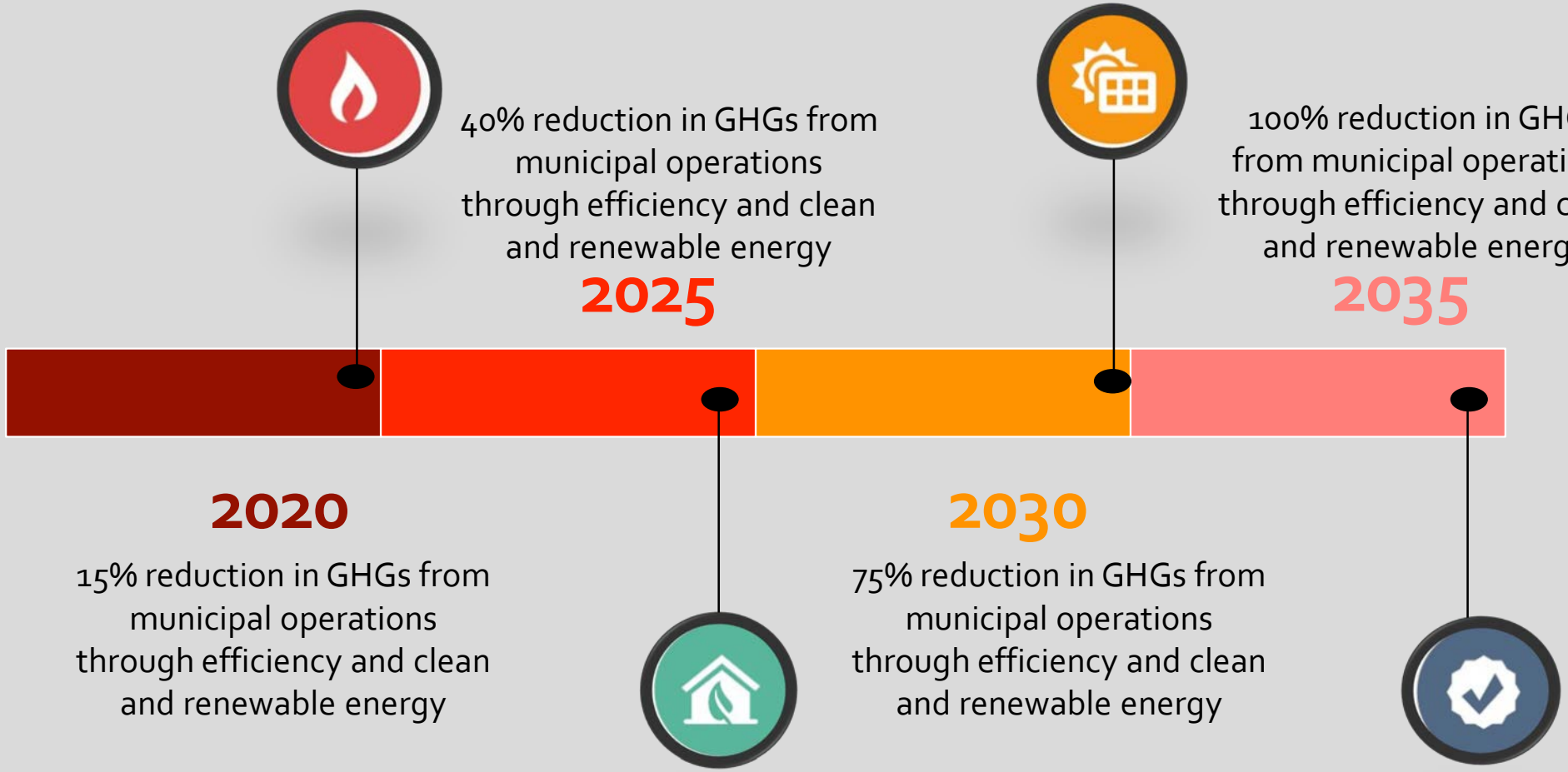
- Continued onsite renewable installations
- Continued offsite renewable installations
- Expansion of lessons learned into the community

- Opportunity tracking
- Energy Monitoring
- Efficiency Upgrades
- Funding Identification
- Greenhouse Gas Inventories
- Staff Training and Engagement

FUNDING


Revolving Energy Fund
Internal Carbon Tax
Extended Payback Program
100% Clean & Renewable
Grants
Millage Funds

TIMELINE & GOALS



THANK YOU