

100% CLEAN & RENEWABLE MUNICIPAL OPERATIONS

PREPARED BY: OFFICE OF SUSTAINABILITY AND INNOVATIONS



CONTENT

- ENERGY EFFICIENCY UPGRADE POTENTIAL
- CURRENT MUNICIPAL OPERATIONS
- ON SITE GENERATION POTENTIAL
- OFF SITE GENERATION POTENTIAL
- FLEET REVIEW
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- NEXT STEPS



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.

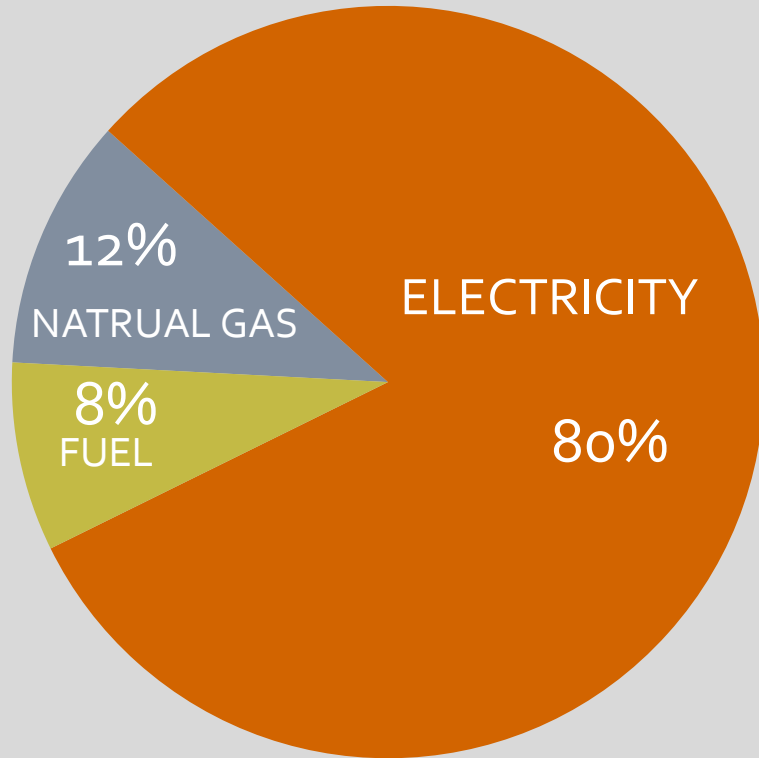
Clean & Renewable = Energy that has little to no pollution and is generated from an unlimited source

GREENHOUSE GAS EMISSIONS IN ANN ARBOR

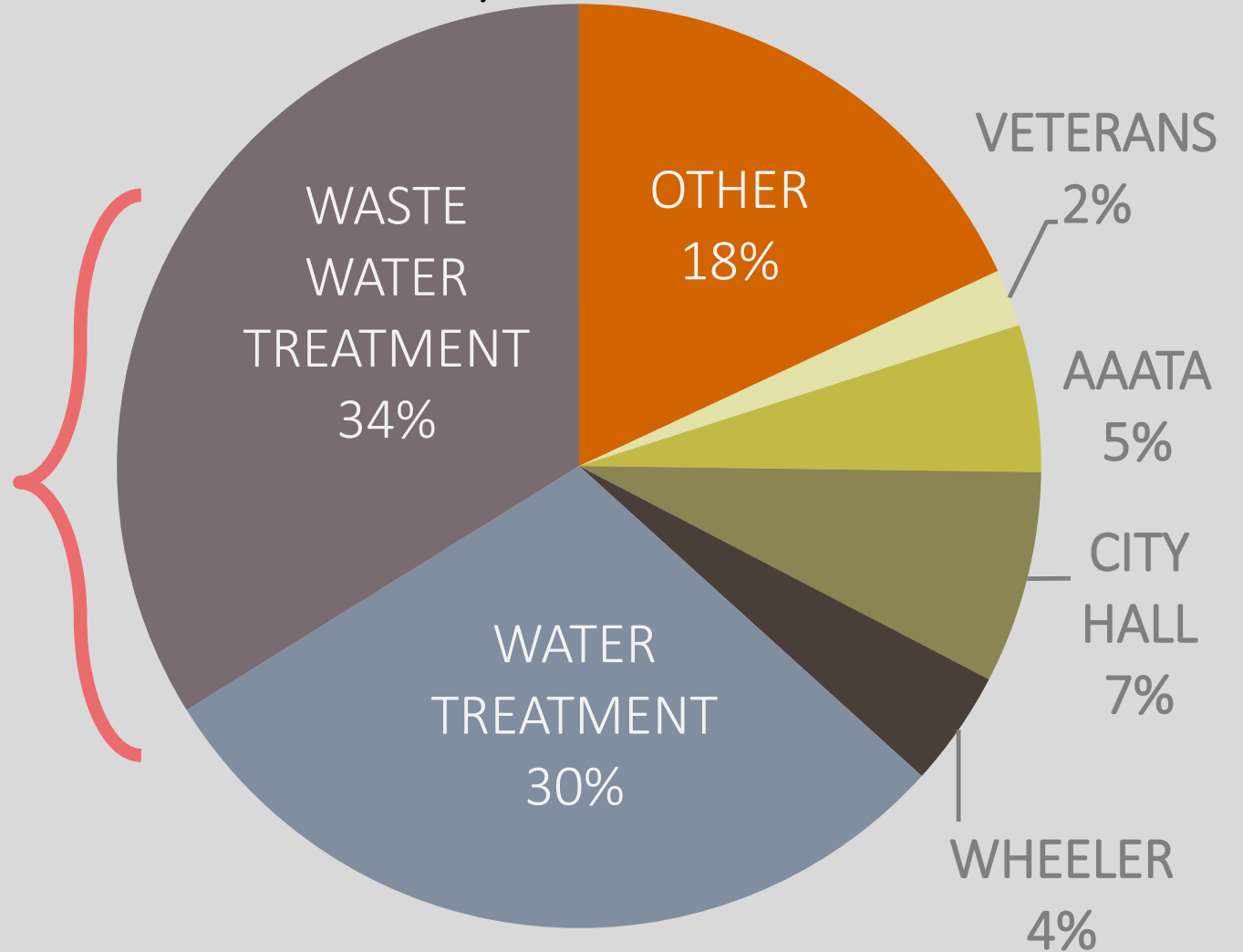


CURRENT MUNICIPAL OPERATIONS

MUNICIPAL EMISSIONS BY TYPE
TOTAL 38,000 MTCO₂e



ELECTRIC USE BY FACILITY
TOTAL 37,000 MWh
30,000 MTCO₂e

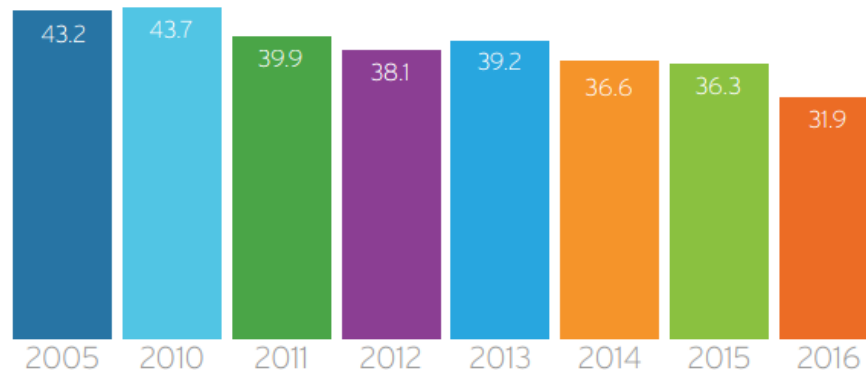


DTE FUEL MIX

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%

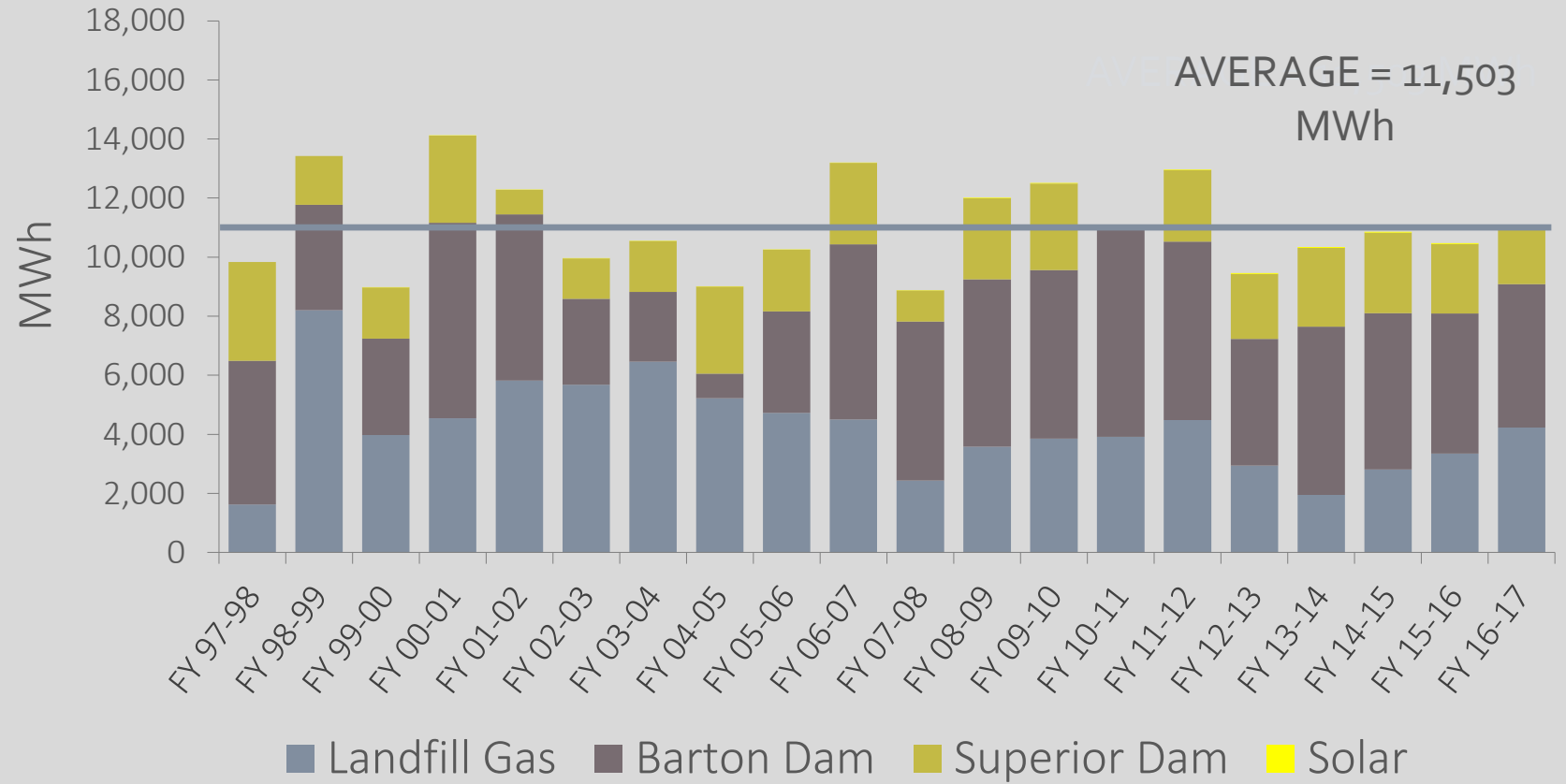
Biofuel	0.09%
Biomass	1.05%
Solid Waste Incineration	0.59%
Solar	0.04%
Wind	5.94%
Wood	0.07%

Greenhouse Gas Emissions in millions of tons of carbon dioxide equivalent (CO₂e)



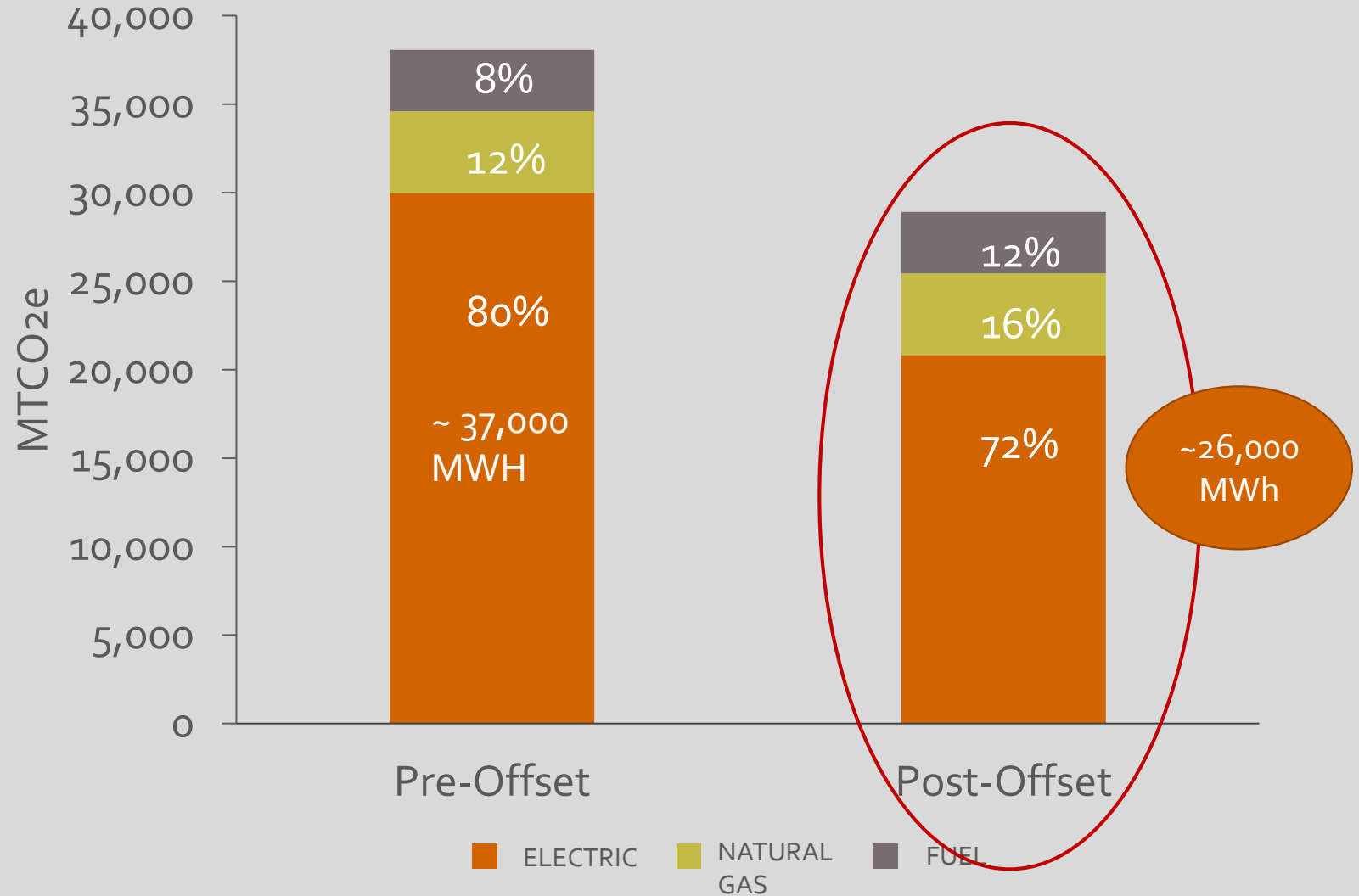
ANN ARBOR'S LOCAL GENERATION

ANN ARBOR RENEWABLE ELECTRICITY GENERATION OFFSET



CURRENT MUNICIPAL OPERATIONS

RENEWABLES OFF-SET



**The greenest watt
is the one that
doesn't have to
be produced**



ENERGY EFFICIENCY



ENERGY EFFICIENCY UPGRADES

LOCATIONS

UPGRADES

Wheeler	LED conversions/install light sensors
Veterans	
Buhr Park	Seal Building Envelope
Fire Station 1	Add insulation where possible
Mack Pool	Reprogram/Install smart thermostats
Fuller Pool	
Airport	Replace/optimize
Fire Station 6	<ul style="list-style-type: none">• HVAC system
Fire Station 4	<ul style="list-style-type: none">• Pumps
Fire Station 3	<ul style="list-style-type: none">• Water Heaters
Northside	<ul style="list-style-type: none">• Boilers/Furnaces
Farmers Market	<ul style="list-style-type: none">• Exhaust Fans
Fire Station 2	<ul style="list-style-type: none">• Air Conditioner/Chiller
Burns Park	Air handling unit
Cobblestone	

WHEELER SERVICE CENTER



GENERATION

TOTAL YEARLY USE
1,629,000 kWh
PROPOSED OFFSET
239,323 kWh
PERCENT OFFSET
15%
EMISSION OFFSET
191 MTCO_{2e}

CHANGES

LIGHTING RETROFITS
MOTION SENSORS

FINANCE

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

VETERANS MEMORIAL PARK



GENERATION

TOTAL YEARLY USE
806,000 kWh
PROPOSED OFFSET
269,942 kWh
PERCENT OFFSET
33%
EMISSION OFFSET
215 MTCO_{2e}

FINANCE

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

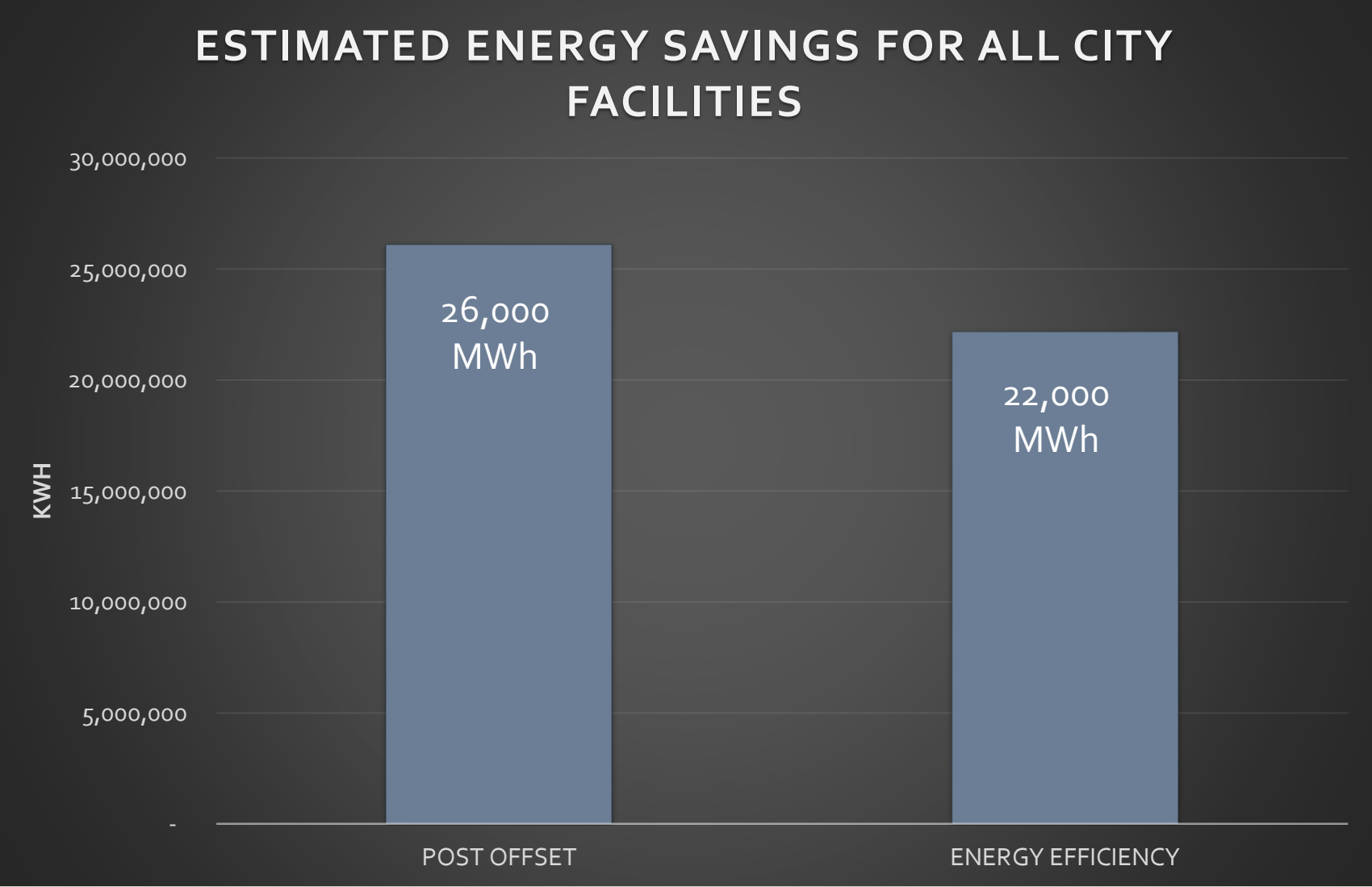
CHANGES

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

ENERGY EFFICIENCY UPGRADES

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%

ENERGY EFFICIENCY UPGRADES



ELECTRIFICATION



Move from natural gas to electric equipment as equipment is being replaced / upgraded



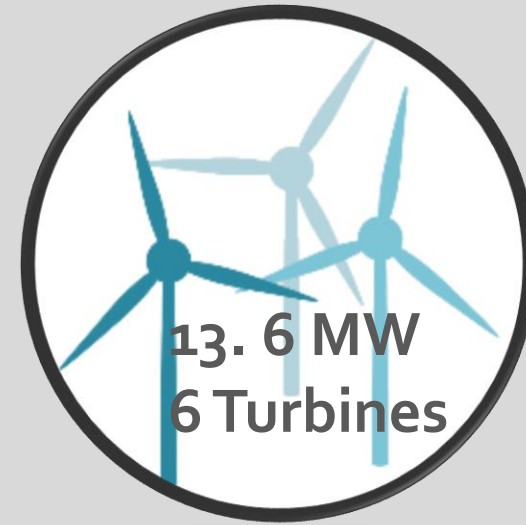
RENEWABLE ON SITE GENERATION POTENTIAL

ANN ARBOR ELECTRIC USE (POST-OFFSET)
TOTAL 26,000 MWh

RENEWABLE
ENERGY
OPTIONS



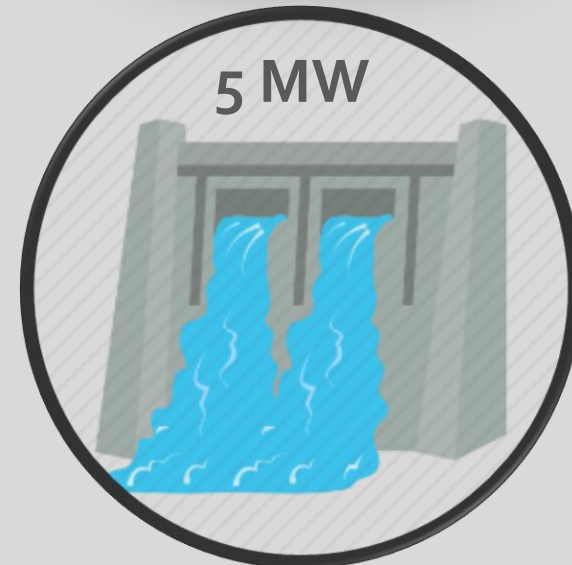
OR



OR



OR



WWTP - BIODIGESTER

GENERATION

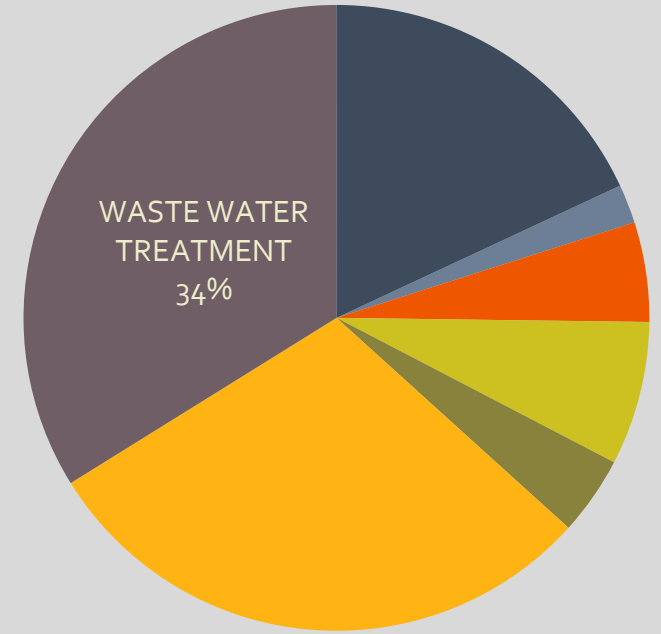
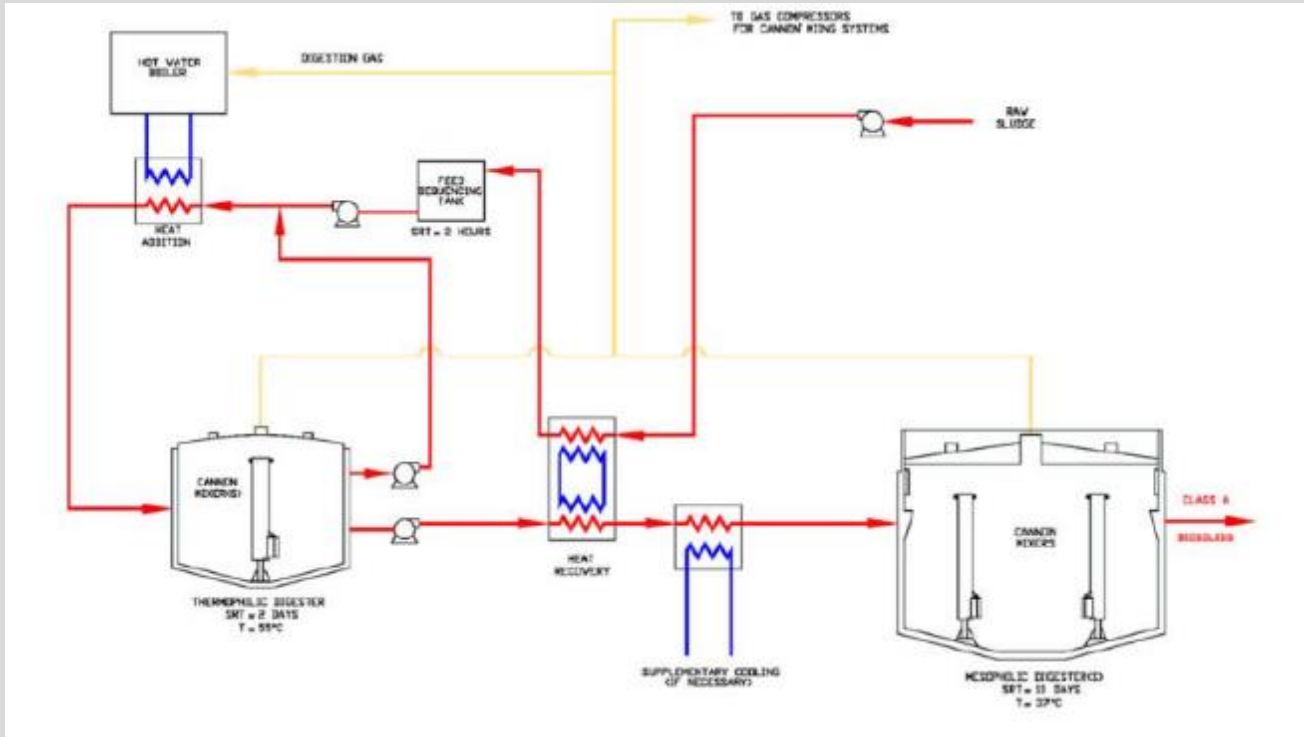
TOTAL YEARLY USE
13,447 MWh
PROPOSED GENERATION
848kW & 335kW Turbines:
3,130 – 5,818 MWh (YEAR)
PERCENT COVERED
23% - 43%
EMISSION OFFSET
2,496 – 4,639 MTCO₂e

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

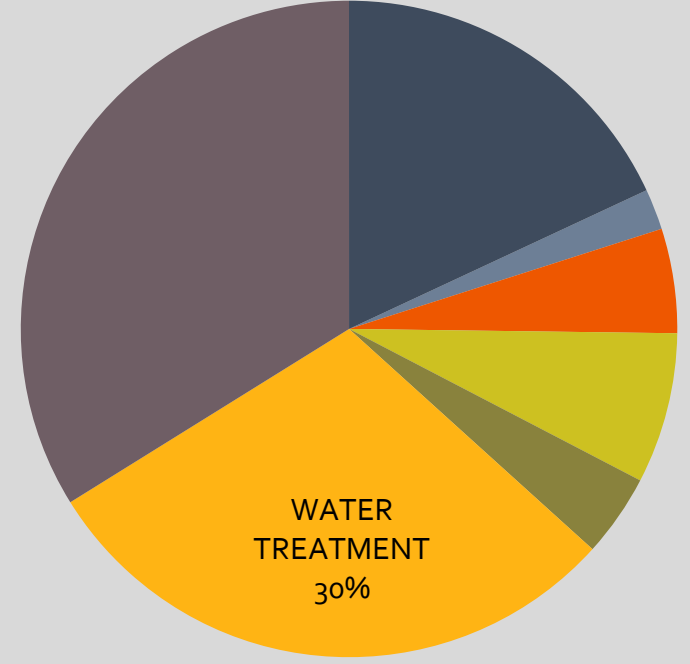
TOTAL YEARLY USE
6,641 MWh (5MW)
PROPOSED GENERATION
1 MW System
1,243 MWh (YEAR)
PERCENT COVERED
19%
EMISSION OFFSET
797 MTCO₂e

FINANCE

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

FACTORS

- UPDATE TO PLANT
- NEW POTENTIAL
- UPFRONT COSTS

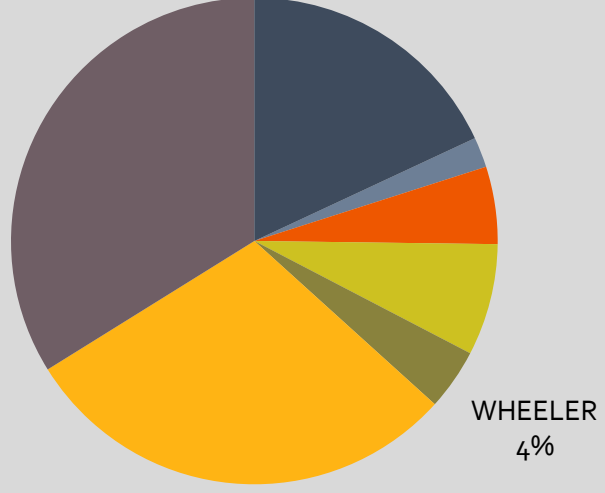


WHEELER - SOLAR



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 MTCO_{2e}



FINANCE

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

FACTORS

- EV FLEET POTENTIAL
- DISTANCE
- UPFRONT COST

VETERANS PARK - SOLAR

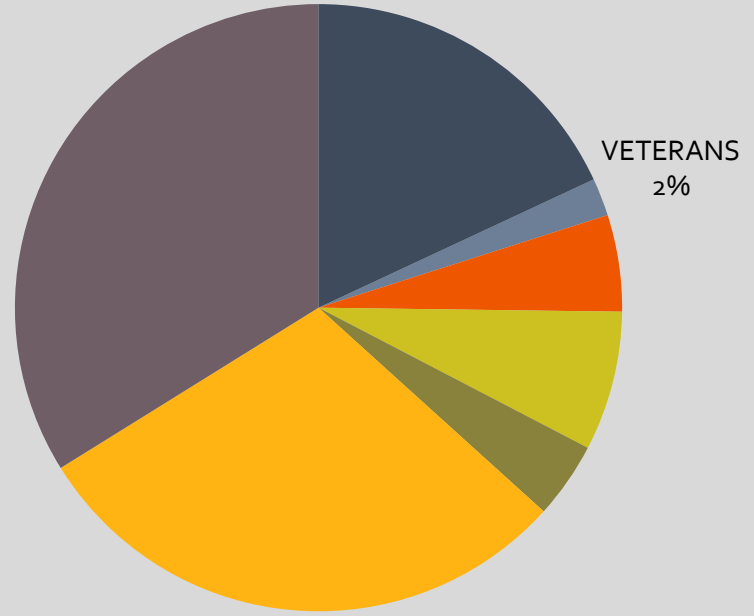


GENERATION

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





RENEWABLE OFF SITE
GENERATION
POTENTIAL

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
1,594 MTCO_{2e}

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

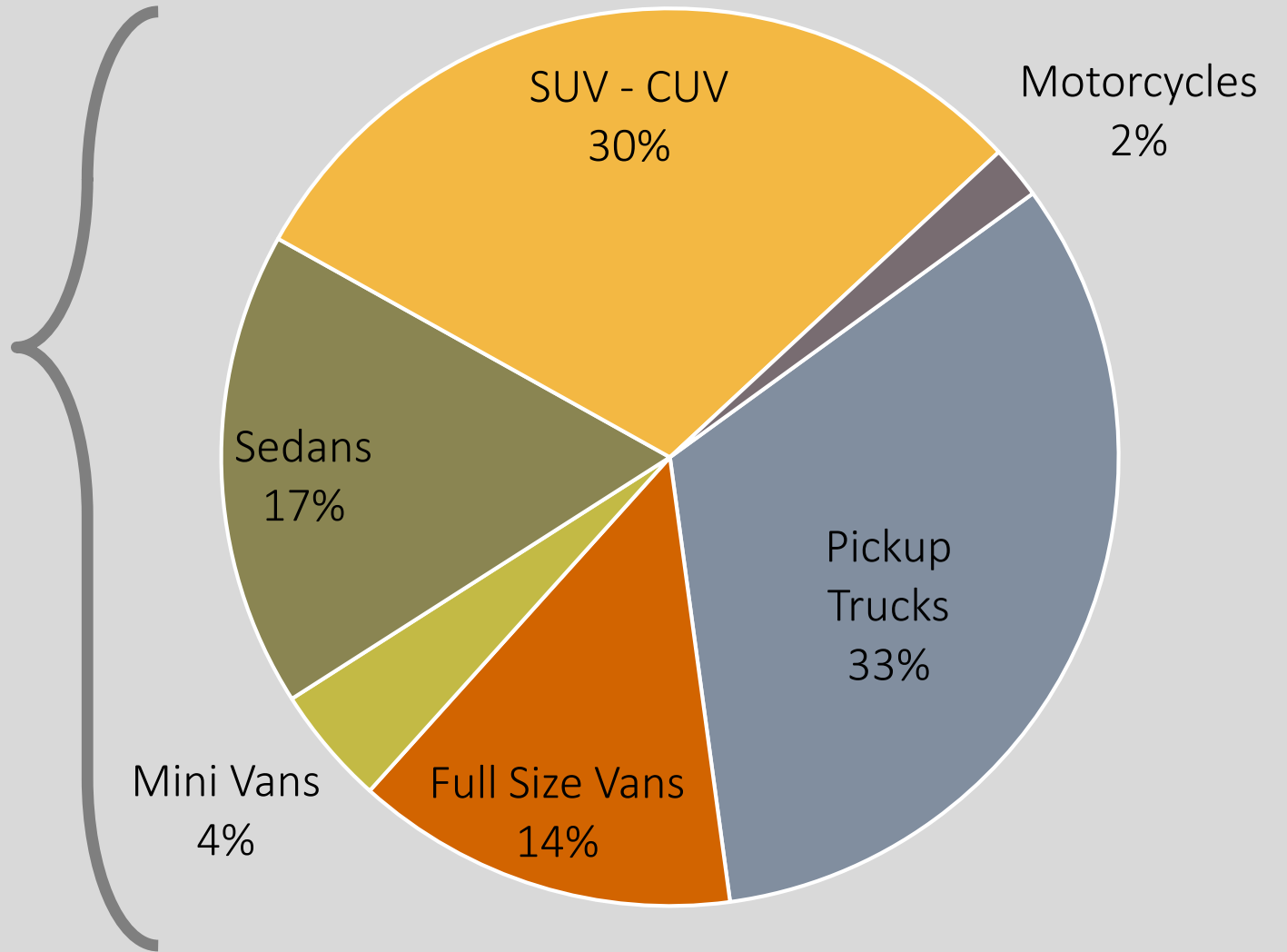
CONSIDERATIONS
PURPA rates
Permitting fees

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 MTCO ₂ e
WTP - SOLAR	1,243 MWh	19%	\$2 Million	\$95,239	797 MTCO ₂ e
WHEELER - SOLAR	6,215 MWh	381%	\$10 Million	\$540,705	3,987 MTCO ₂ e
VETERANS – SOLAR	800 kW	123%	\$1.6 Million	\$97,412	637 MTCO ₂ e
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 MTCO ₂ e
ARGO - HYDRO	2,000 MWh	8%	\$4.3 Million	\$95,239	1,594 MTCO ₂ e
GEDDES - HYDRO	3,350 MWh	13%	\$5.5 Million	\$540,705	2,671 MTCO ₂ e

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



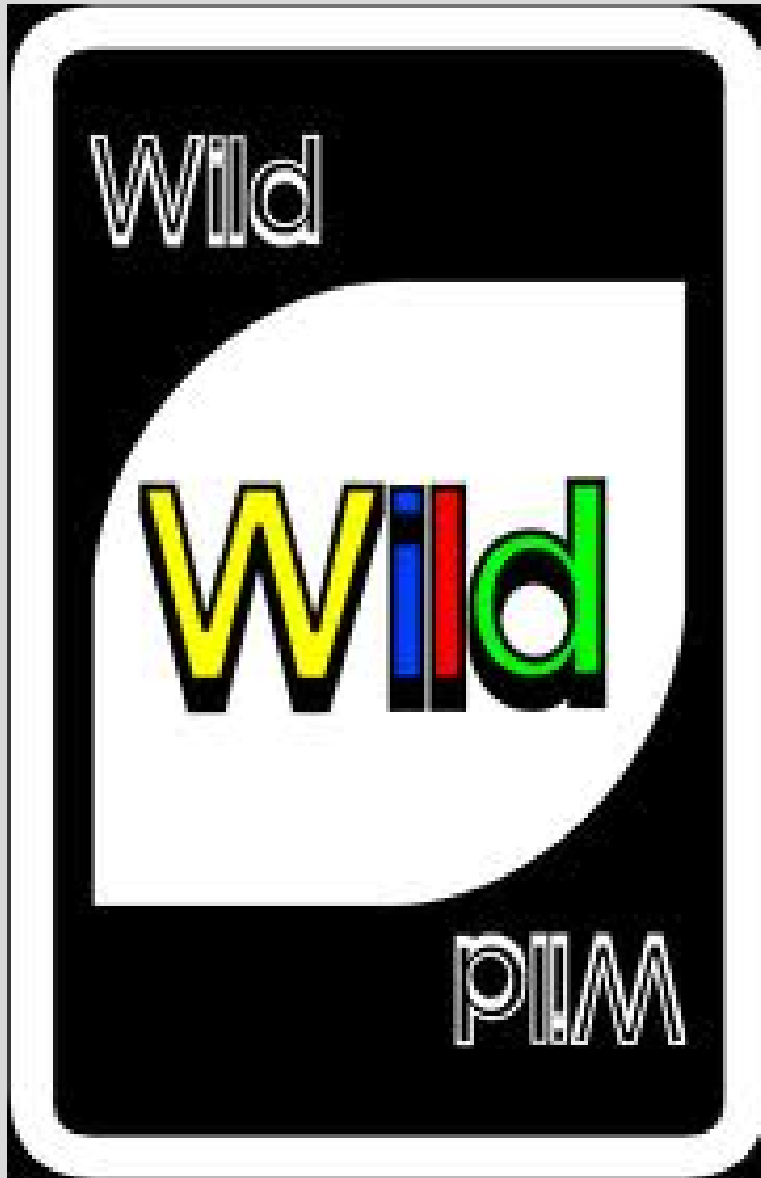


FORD FOCUS	CHEVY BOLT
PURCHASE COST	
\$18,422	\$30,000
FUEL COST PER YEAR	
\$348	\$132
REPAIR & MAINTENANCE PER YEAR	
\$2,526	\$1,116
CO ₂ e EMISSIONS PER YEAR	
1.95Tons	-

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

NET-ZERO FIRE STATION

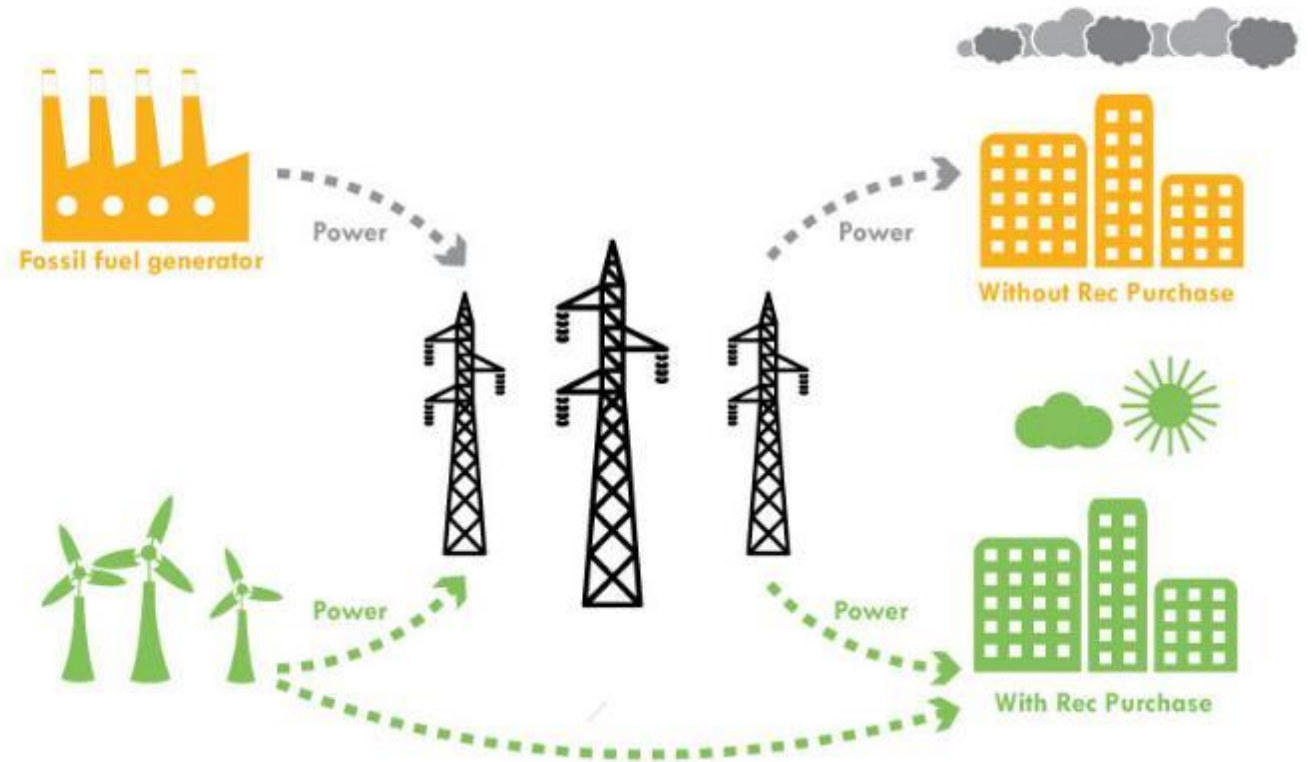


ITS THE THIRD FIRE STATION IN THE COUNTRY
TO BOAST A **NET ZERO** STATUS

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).

What is a renewable energy credit?



- 1 Most renewable projects send their power to the same electric grid as coal and gas-fired generators.
- 2 When you buy power from the grid, you are getting that mingled power.
- 3 Buying RECs allows you to notionally “re-segregate” that power, so that the renewable power is dedicated only to you.
- 4 Each REC is independently tracked and verified.

BATTERY STORAGE



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

SUMMARY OF PLAN

Short Term (0-3 years)

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

- Opportunity tracking
- Energy Monitoring

Medium Term (3-5 years)

- Continued efficiency upgrades
- Continued electrification
- Onsite Installation of renewables (e.g., Wheeler and Veterans)
- All new facilities = net zero
- Built 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

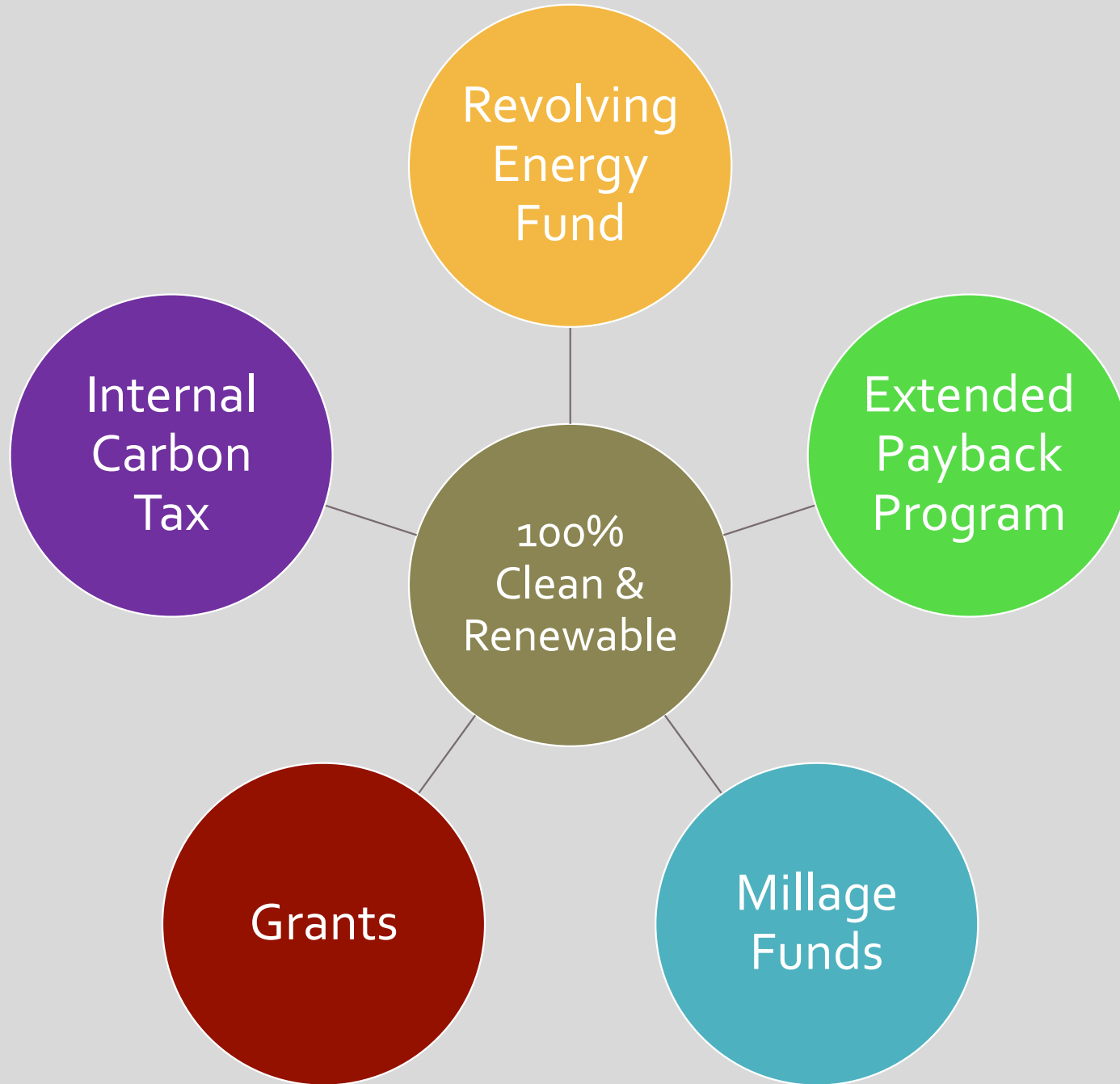
- Efficiency Upgrades
- Funding Identification

Long Term (5+ years)

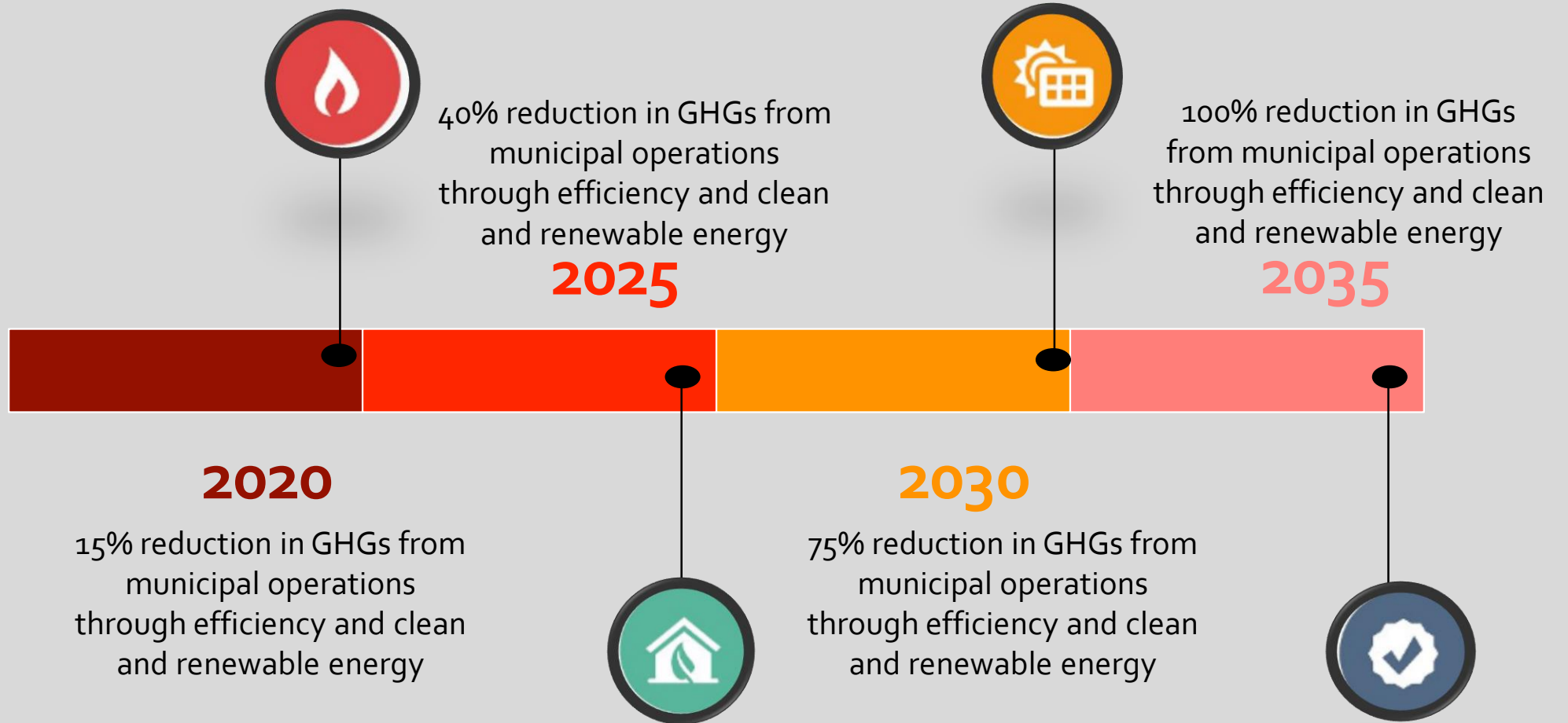
- Continued onsite renewable installations
- Continued offsite renewable installations

- Greenhouse Gas Inventories
- Staff Training and Engagement

FUNDING



TIMELINE & GOALS



THANKYOU

Thank You