

100% Renewable Energy Action Plan



100% Renewable Energy Strategies for City Operations

April 2018

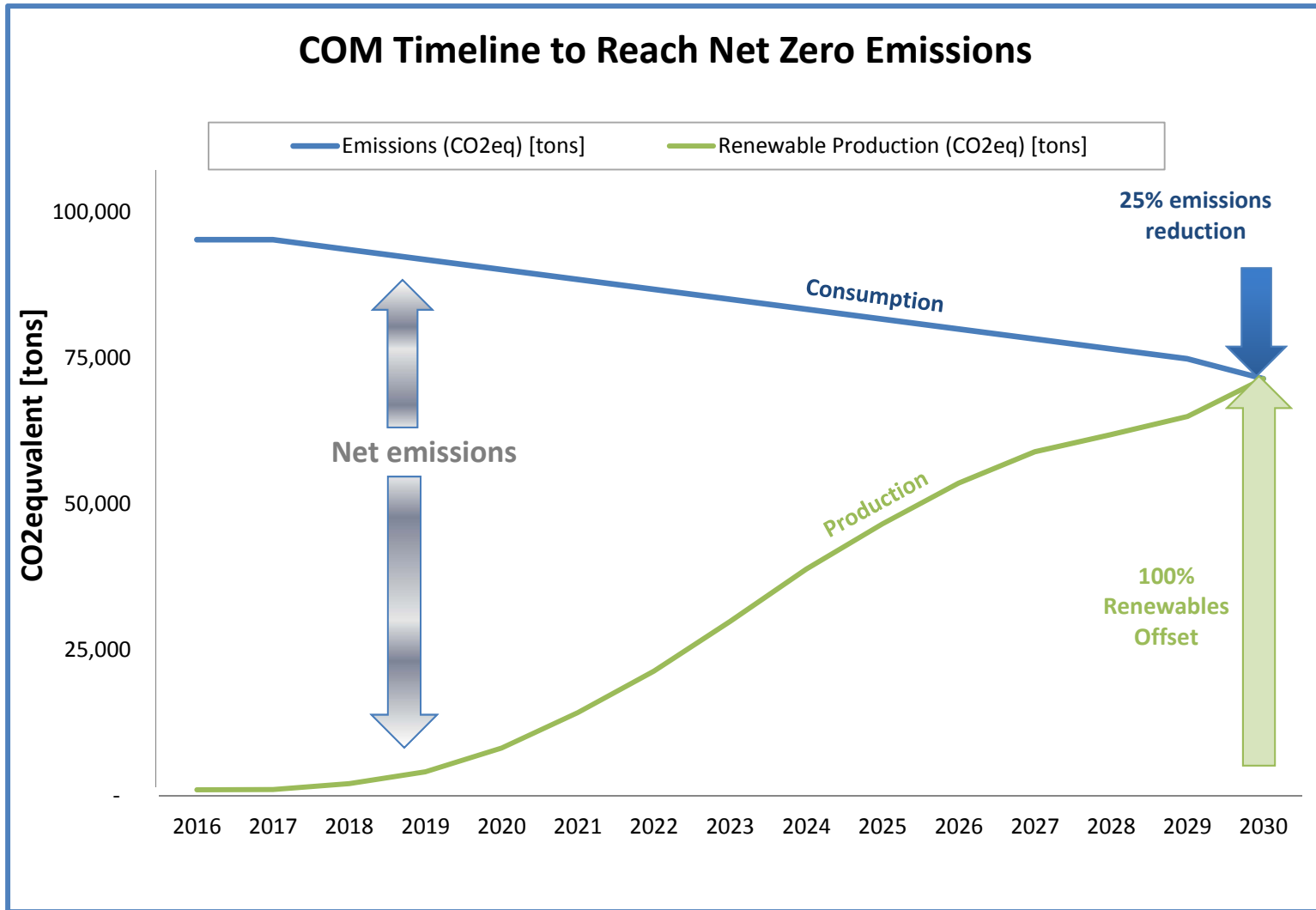


Consultant Project Timeline

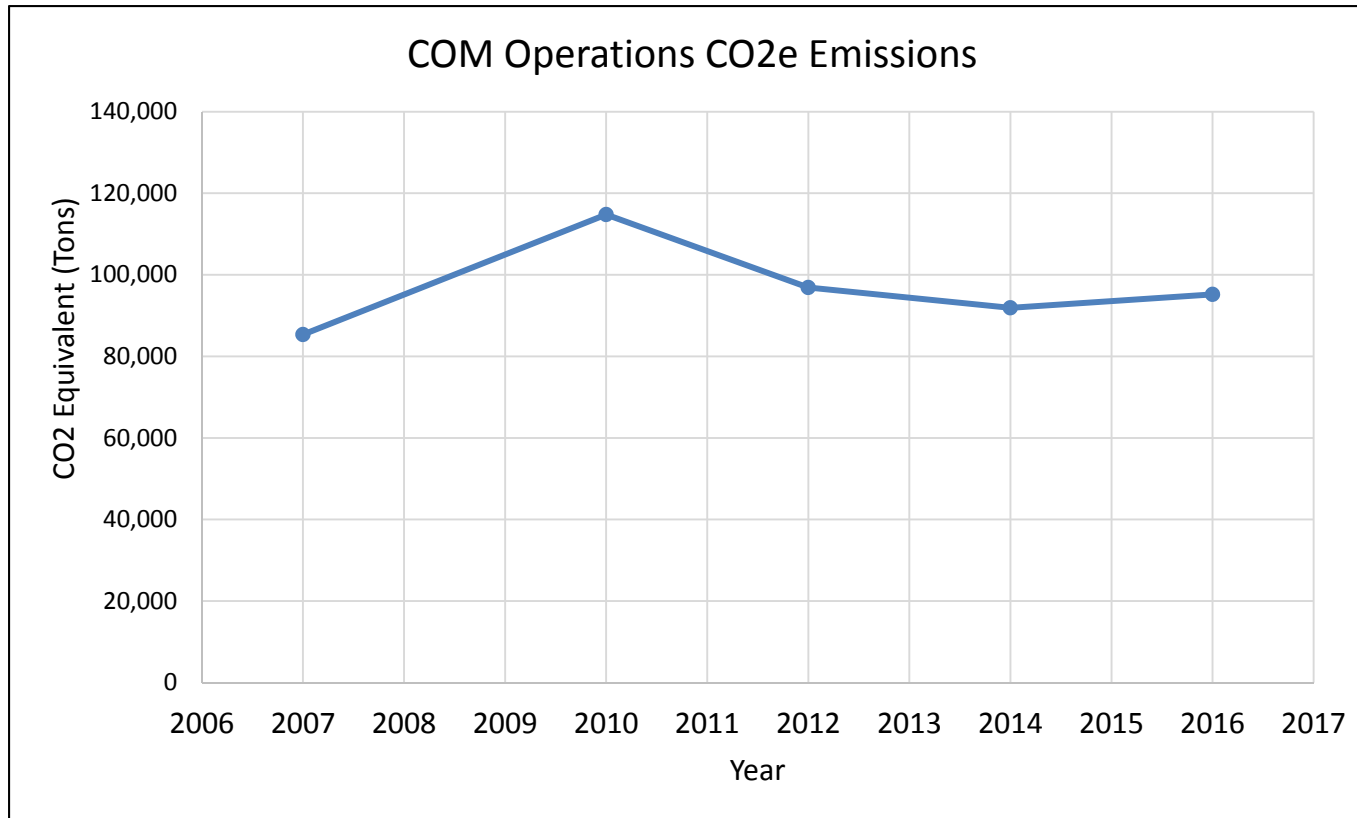
- **April 2nd SMC Meeting: City Operations Strategies Presentation**
- **April 23rd SMC Meeting: Community Strategies Presentation**
- **Racial Equity and Social Justice Focus Group**
- **Draft Report w/ SMC Comment Period**
- **Final Public Meeting**
- **Final Report**



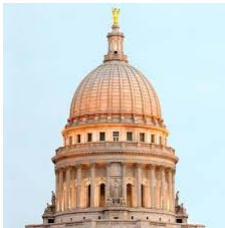
Definitions and Goals: Net Zero Carbon and 100% Renewable



City Operations Carbon Emissions



95,210 CO₂e (tons) = 529 rail cars* of coal stretching from the Capital to East Towne Mall



*Source: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

ICLEI Emissions Tracking Protocol

Sources of City Operation Emissions

City Buildings

- Fire stations
- Police stations
- Libraries
- Monona Terrace
- Housing
- Parking structures
- Metro bus barn
- Recreation
- Offices
- 40% of City-County Building (CCB)

Does not include:

Schools, MMSD (sewer district), County buildings, Truax Airport



Vehicle Fleets

- Garbage trucks
- Fire trucks
- Police cars
- Metro buses
- Water utility fleet
- General fleet vehicles



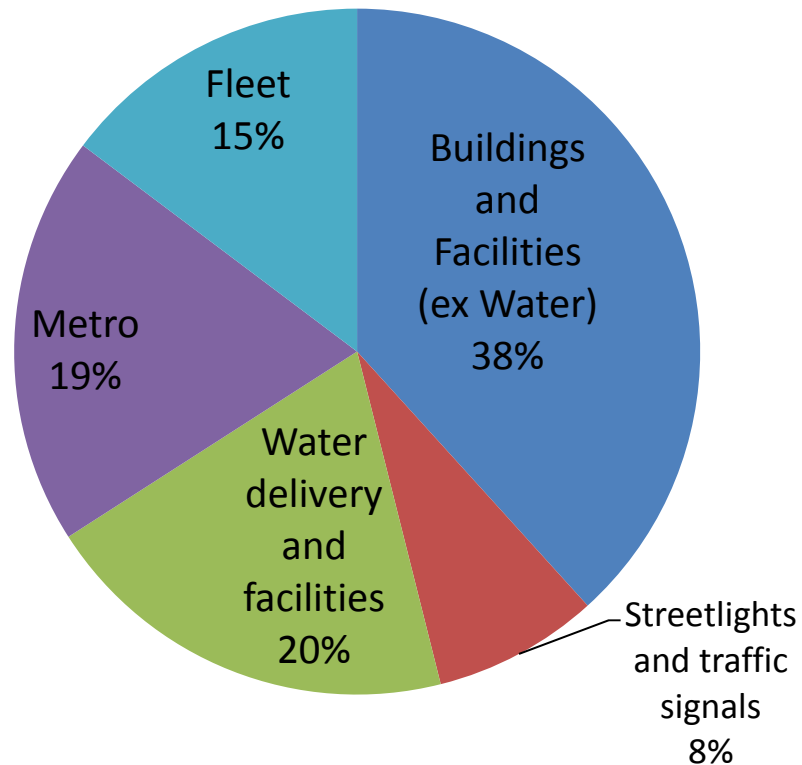
Other

- Water utility pumping
- Street lights and traffic signals
- Retired City Landfills
- Employee vehicle commute miles

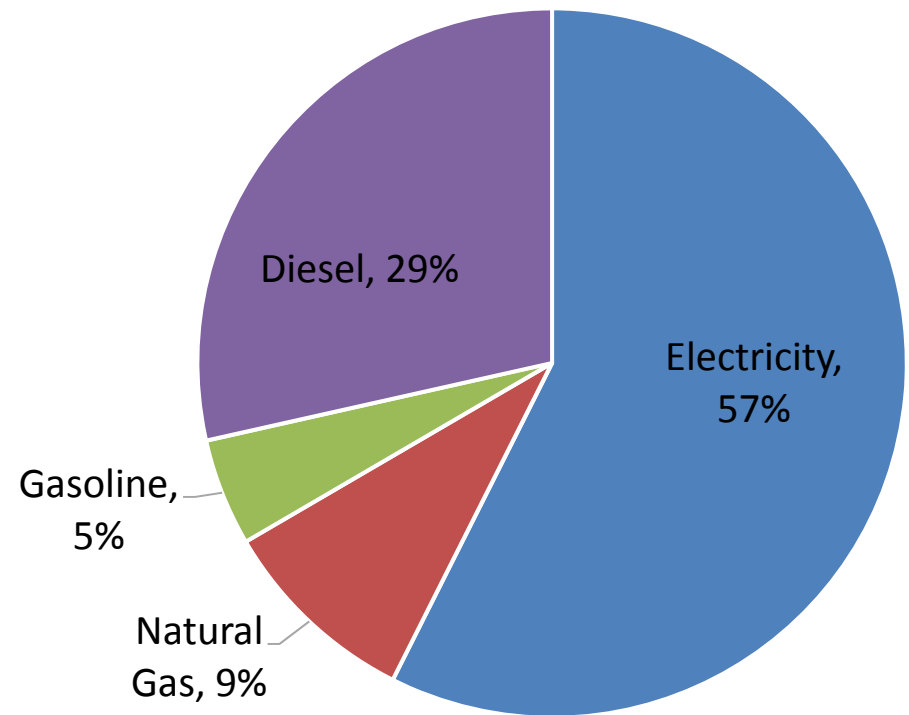


2016 Carbon Emissions Breakdown

***Emissions Data by Category**



***Emissions Data by Fuel**

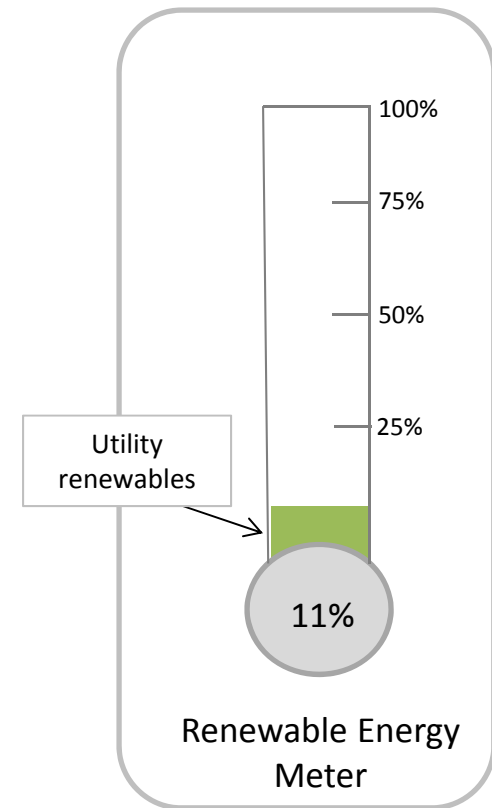
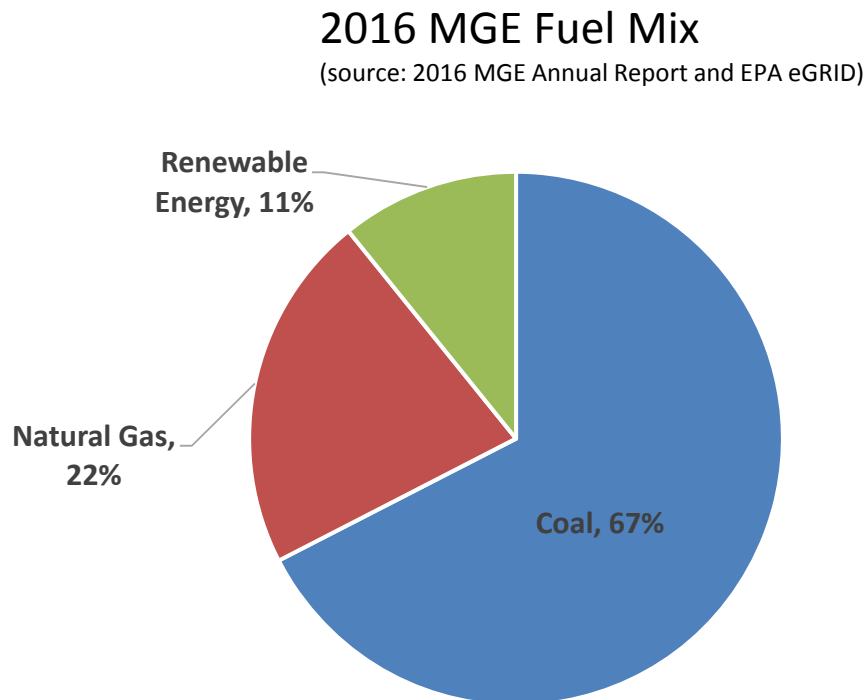


*Excludes landfill emissions and employee commute emissions

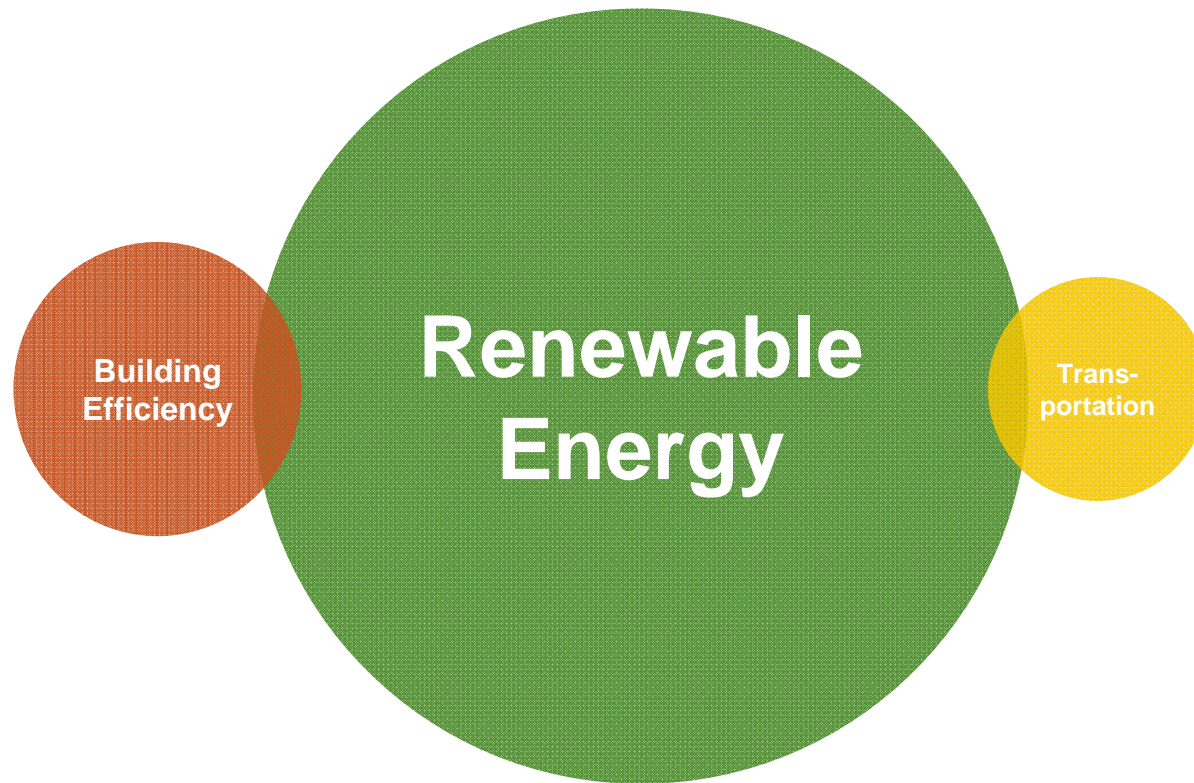


MGE Electricity Generation

- MGE is targeting to reduce CO₂(eq) emissions 40% by 2030 from 2005 levels
- 11% of electric is generated from renewable resources, increasing to 30% by 2030
- MGE purchased 22% of its electricity in 2016



Strategies to 100% Renewable Energy



Rapid Adoption of Renewable Energy Generation

Behind the Meter Solar



Off-Site Solar or Wind



Renewable Energy Credits



Behind the Meter Solar: Phase 1



Costs and Impacts:

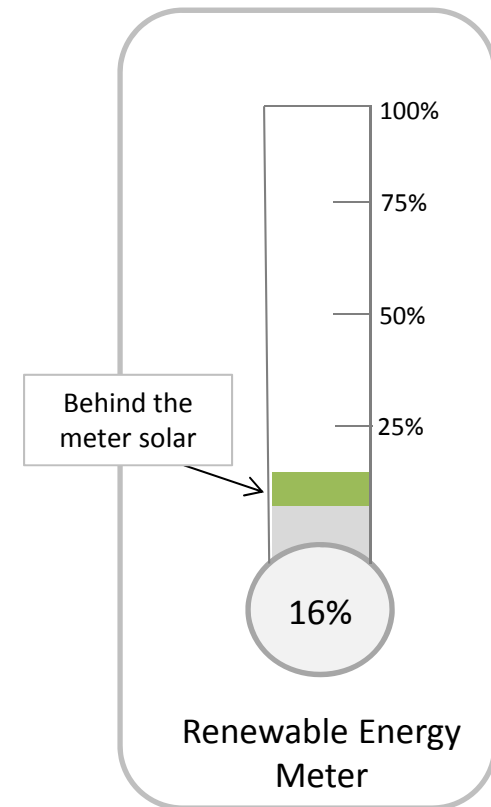
Ownership model	First Cost	Annual Savings	% CO ₂ Reduction	Payback
Option A: City Owned	\$3,700,000	\$250,000	3%	10 years
OR				
Option B: Energy Services Agreement	\$0	\$10,000	3%	immediate

Next Steps:

- 1) Identify projects with largest potential – DONE
- 2) Determine preferred ownership model
City owned or Energy Services Agreement
- 3) Bid and install project
- 4) Repeat

Potential projects:

- Bus Barn
- Streets East
- Paterson Water Utility



5 MegaWatt (MW) Off-Site Solar Farm



Costs and Impacts:

Ownership model	First Cost	Annual Savings	% CO ₂ Reduction	Payback
Third party	\$0	\$24,000	8%	immediate

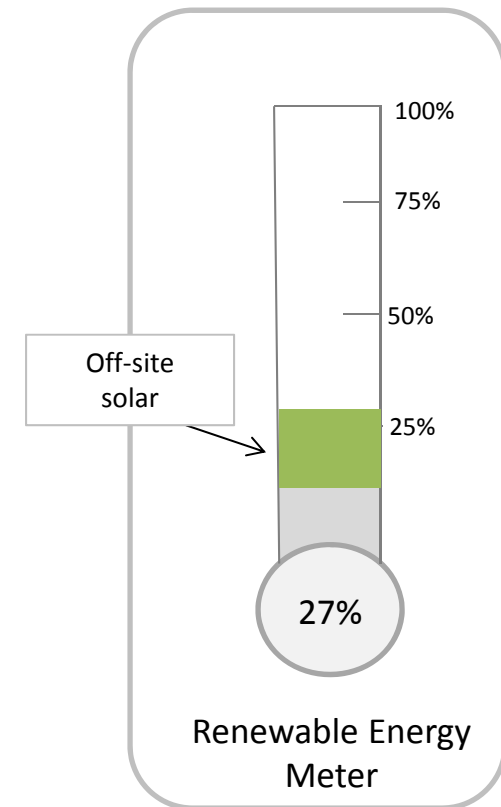
MGE Renewable Rider

Next Steps:

- 1) Continue discussions with MGE
- 2) Select potential site
- 3) Develop contract
- 4) PSC approval
- 5) Third party builds project
- 6) City buys renewable energy from MGE

Potential projects:

- Bus Barn
- Retired landfills
- Third party site
- Dane Cty Airport
- MMSD land



Behind the Meter Solar: Phase 2



Costs and Impacts:

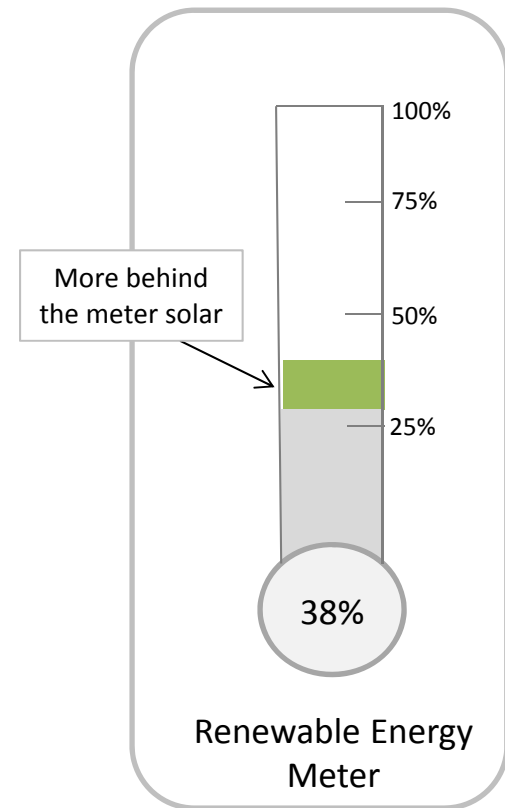
Ownership model	First Cost	Annual Savings	% CO ₂ Reduction	Payback
City Owned	\$11,250,000	\$600,000	8%	19 years

Next Steps:

- 1) Complete Phase 1 and RER off site projects
- 2) Reevaluate project economics

Potential projects:

- Parking garages
- Surface parking lots



Changing Utility Fuel Mix

Costs and Impacts:

Potential for reduced utility costs.

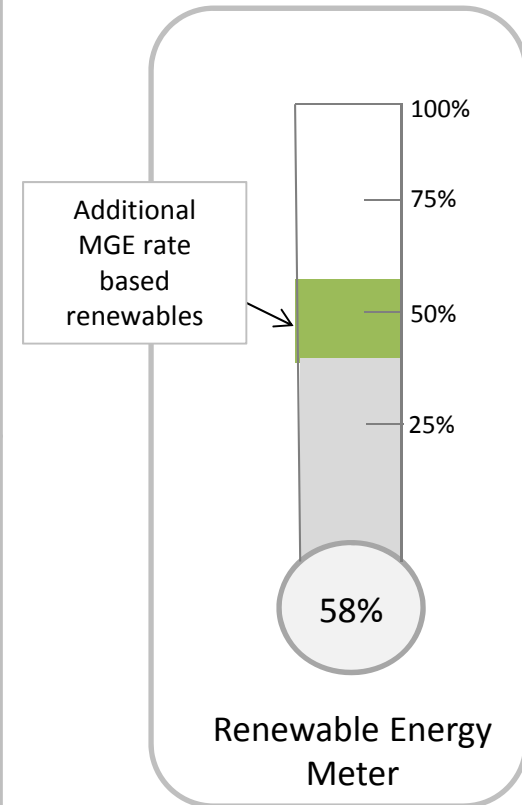


Next Steps:

- 1) Continue MOU discussions

Potential projects:

- Saratoga wind farm
- MGE/WEC 50 MW Solar Project



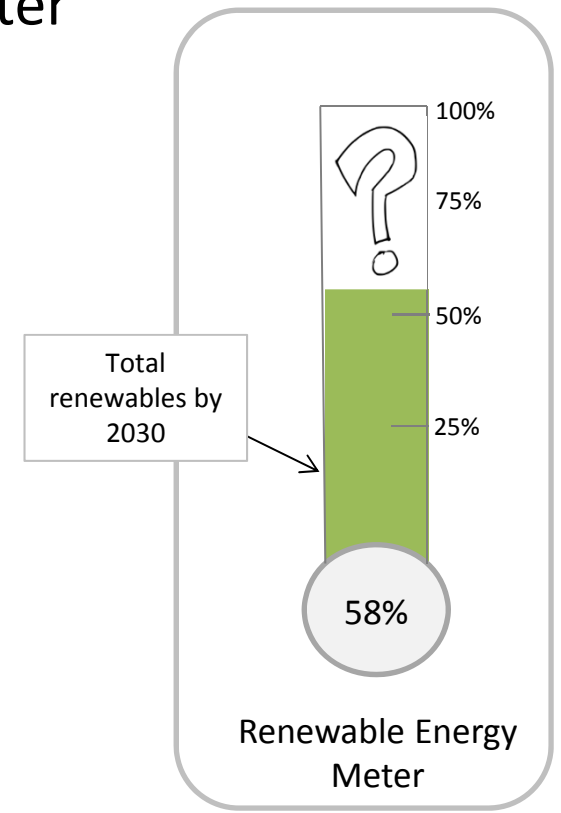
Constraints to COM Hosted 100% Renewable Generation

1) Building and load types

- Large COM buildings don't support large PV systems (example: Monona Terrace)
- Large COM loads don't support large PV systems (example: Pumping station)

2) 100kW Net metering limit for behind the meter systems

3) Renewable Energy Rider Limitations – no net metering



Procure Renewable Energy Credits

Costs and Impacts:

Ownership model	Annual Cost	Annual Savings	% CO ₂ Reduction	Payback
City Purchased	\$157,500/yr	NA	39%	NA

REC contracts are typically for the life of a project, typically 25 years. The term of the contract can be reduced but will result in increased cost of the REC's.

As COM generated renewables increases REC's can offset transportation and natural gas emissions with these REC's.

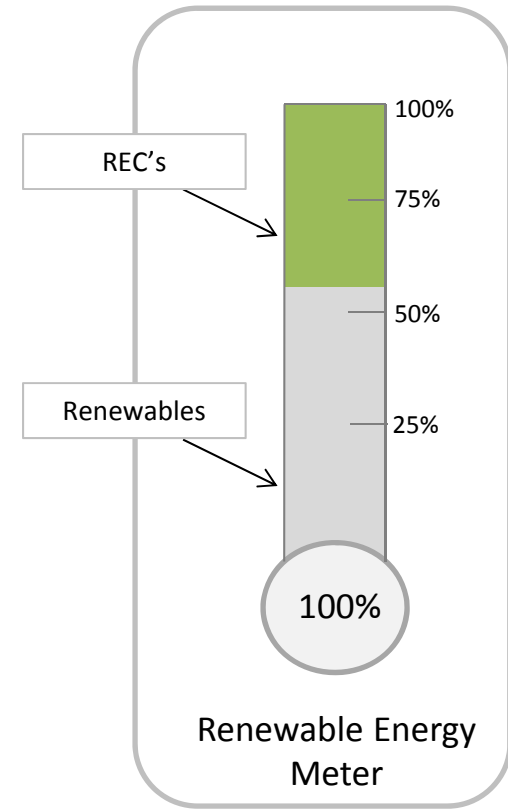
REC's must enable new resources to be built regionally.

Next Steps:

- 1) Procure renewable energy credits contract
- 2) Purchase REC's once project is brought online by third party
- 3) Make annual payments for contracted REC's

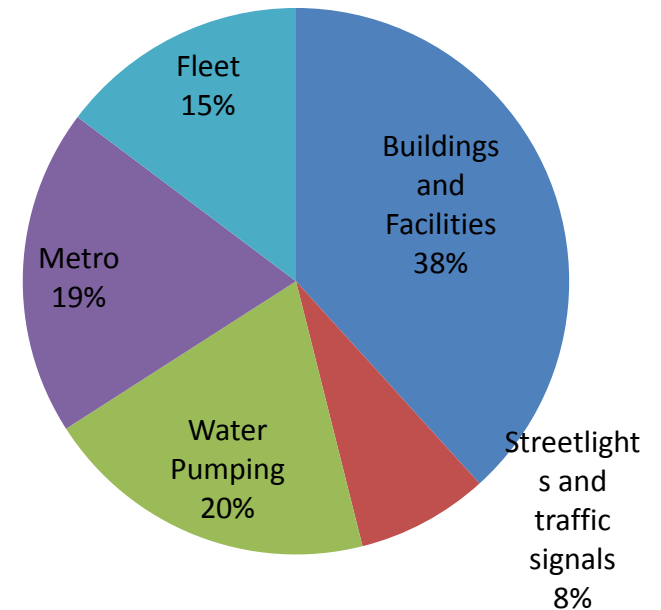
Potential projects:

- UMMEG / One Energy
- Others



Unlocking the Potential Of Energy Efficiency

Goal: Reduce building energy consumption by 25% by 2030



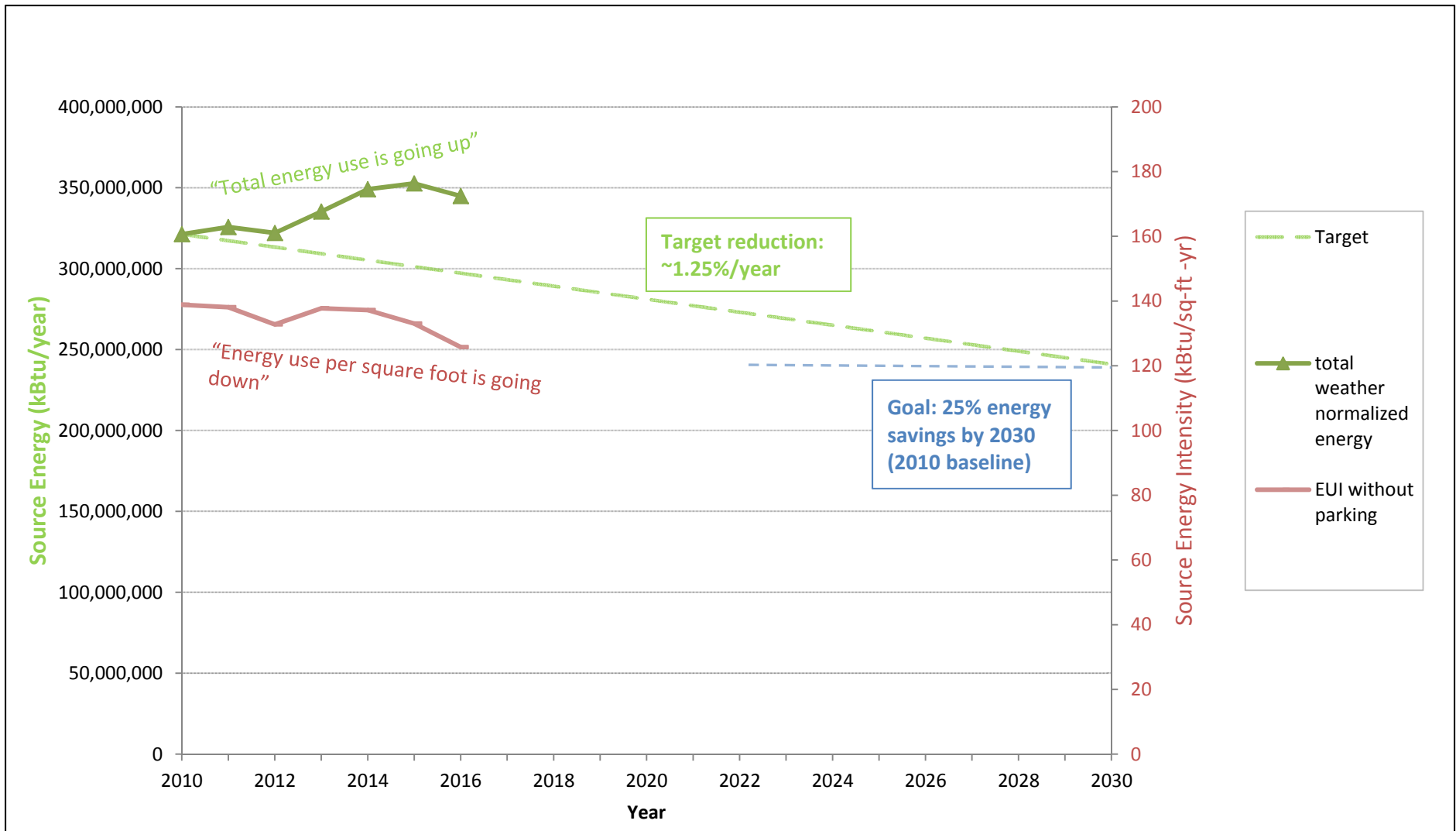
“ The greenest energy is the energy you never consume”



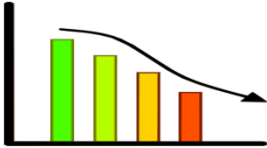



Building Annual Energy Consumption

Goal: Reduce building energy consumption by 25% by 2030

Metric: Weather normalized source energy



Building Efficiency Strategies

<p>Public reporting of COM building performance</p>	
<p>Detailed retro-commissioning of all city facilities</p>	
<p>Implement high payback retrofit opportunities</p>	
<p>Maintain high performance green building standards for new construction. Energy Star certification for all existing buildings.</p>	



Public Reporting of COM Building Performance

Costs and Impacts:

Annual Cost	Annual Savings	% CO ₂ Reduction	Payback
\$0/yr	NA	NA	NA

- Lead by example
- Improve measurement and verification process of energy projects
- Sustainability coordinator to also serve as “energy manager” for city



Next Steps:

- 1) Work with energy tracking tool provider to create publicly available data
- 2) Create user friendly reporting to allow community to interact with tool
- 3) Annually report out on performance

Implement Retrocommissioning



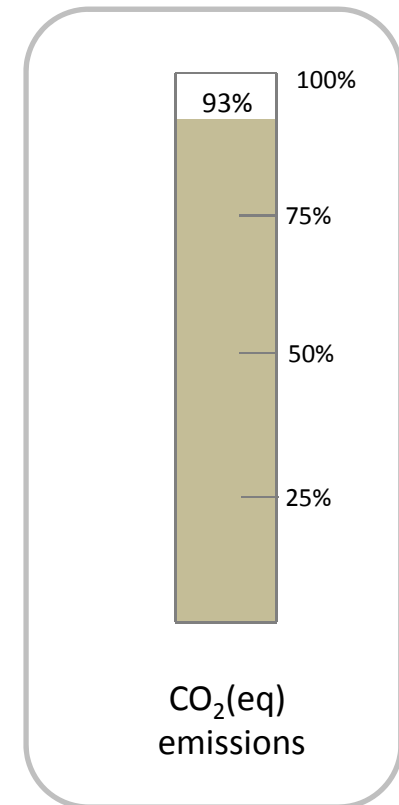
Costs and Impacts:

First Cost	Annual Savings	% CO ₂ Reduction	Payback
\$640,000	\$650,000	7%	1 year

- Low cost energy efficiency implementation
- Managed by sustainability coordinator

Next Steps:

- 1) Identify good building candidates
- 2) Contract with provider
- 3) Identify and implement measures
- 4) Track savings
- 5) Repeat



Implement Energy Retrofits

Costs and Impacts:

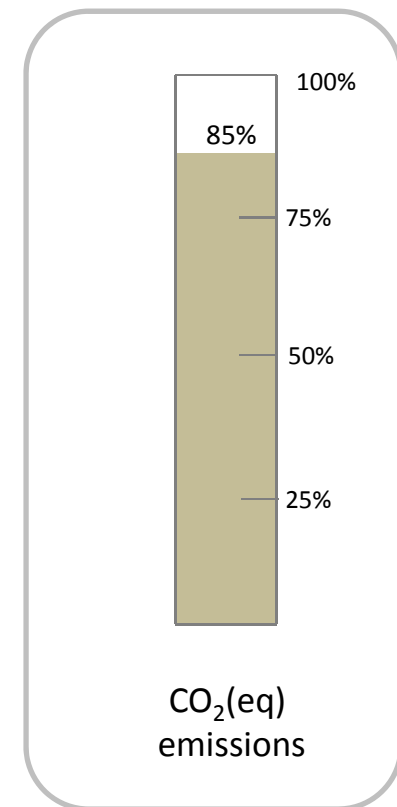
First Cost	Annual Savings	% CO ₂ Reduction	Payback
\$4,500,000	\$660,000	8%	7 years

- Retrofits have payback of 7 years or less
- Lighting
- HVAC
- Water distribution
- Plug loads



Next Steps:

- 1) Identify specific measures through the RCx investigation
- 2) Develop scope of work for projects
- 3) Contract work
- 4) Implement measures
- 5) Track savings
- 6) Repeat



Maintain High Performance Green Building Standards for New Construction

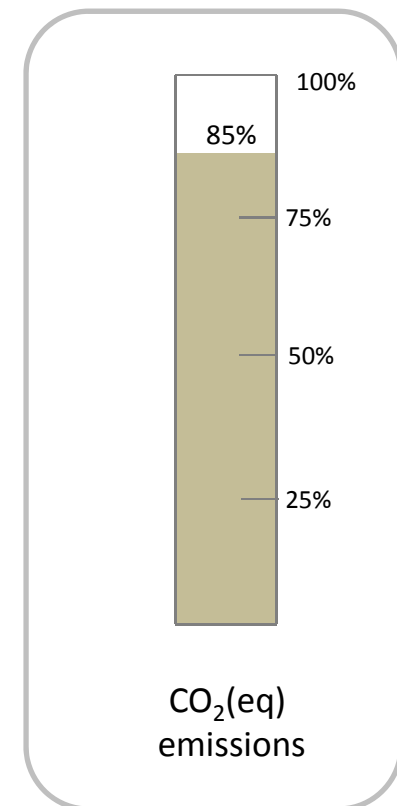
Costs and Impacts:

Annual Cost	Annual Savings	% CO ₂ Reduction	Payback
-	-	-	-





- Utilize stretch codes
- Implement geothermal heating and cooling where feasible
- Incorporate solar PV installation into construction
- Utilize LEED Building standard

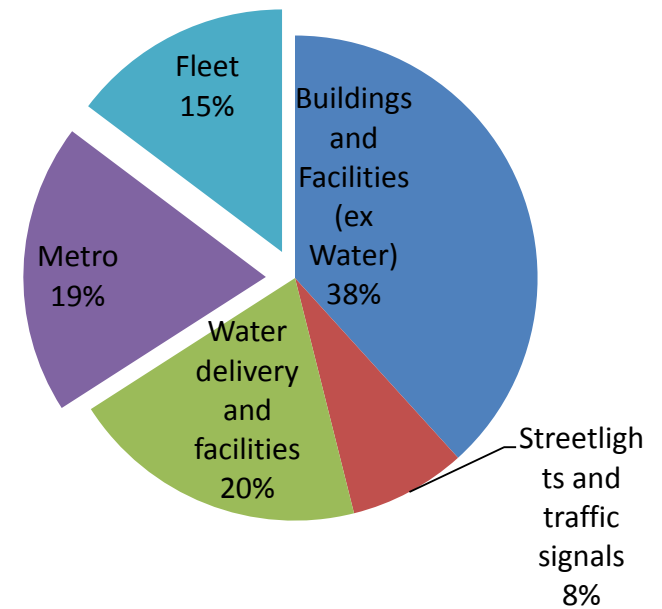
Next Steps:

- 1) Continue on current path
- 2) Market successes of current projects



Transportation Strategies for City Operations

<p>Electrification of bus fleet</p>	
<p>Fleet electric vehicle replacement plan</p>	
<p>Landfill CNG Pilot Program</p>	
<p>Additional transportation strategies</p>	



More to come at the next SMC meeting on Transportation



Summary

- Perfect storm of market forces = going green while reducing cost
 - Solar at grid parity
 - Cheap wind
 - Natural gas more competitive than coal
 - EV / batteries steep cost declines
- Energy efficiency can finance renewables and REC's

