Advancing renewable energy & energy efficiency in the Commonwealth
CLEANENERGYRESULTS
www.mass.gov/dep/cerp

HARVARD Kennedy School
JOHN F. KENNEDY SCHOOL OF GOVERNMENT

MassDEP 40th Anniversary
40 Years Cleaner
40 Years Greener
Celebrating Four Decades of Environmental Progress

Massachusetts Clean Energy Partnership For Drinking Water And Wastewater Facilities

Assessment Of Economic And Environmental Results

August 19, 2016

Ann Lowery, Jamie Doucett, Michael DiBara – MassDEP

Karry Jiao – MassDEP intern (Kennedy School of Government 2016 Fellow)

Agenda


Analysis
Results
Project Scope
GOAL
Group 2 & 3
Project Background
Conclusion

Background Initiatives And Results

Pilot (2007-2010) and ARRA Funding & Green Infrastructure (2008)

Efficiency Savings ($ and KWh), On-site Energy Generation, GHG Reductions

Energy Leaders Supports (2010-2014)

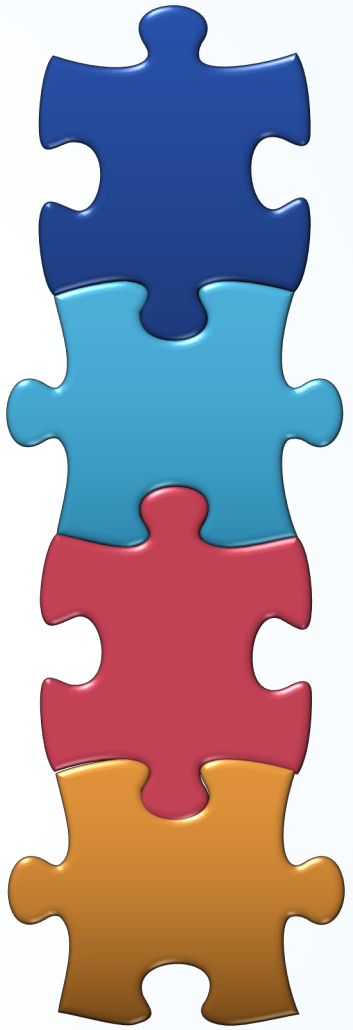
Engagement and Using Plan-Do-Check-Act Model

Clean Energy Results Program (CERP) (2011)

New Goals: Supporting Zero Net Energy Facilities

'Gap' Grant Funding (2014)

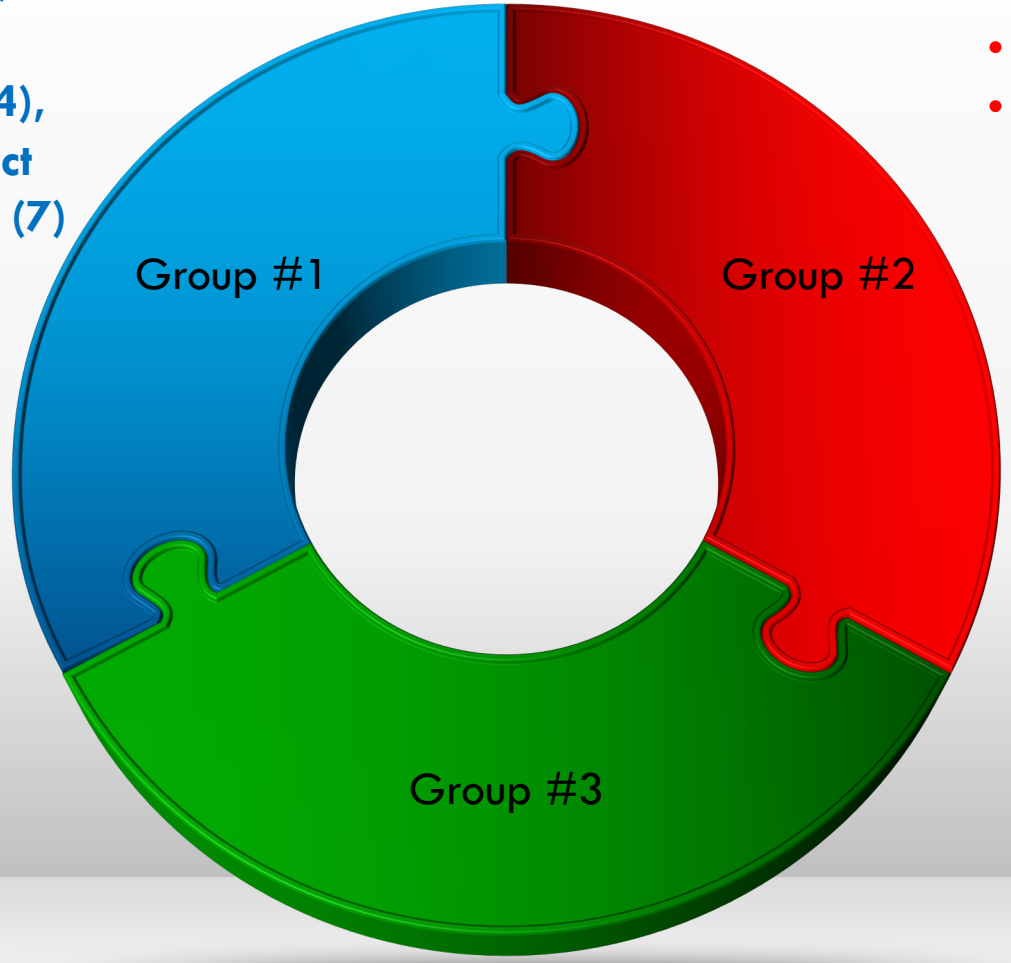
Small Grants to Move Energy Projects to Construction



Your Logo

Project Scope

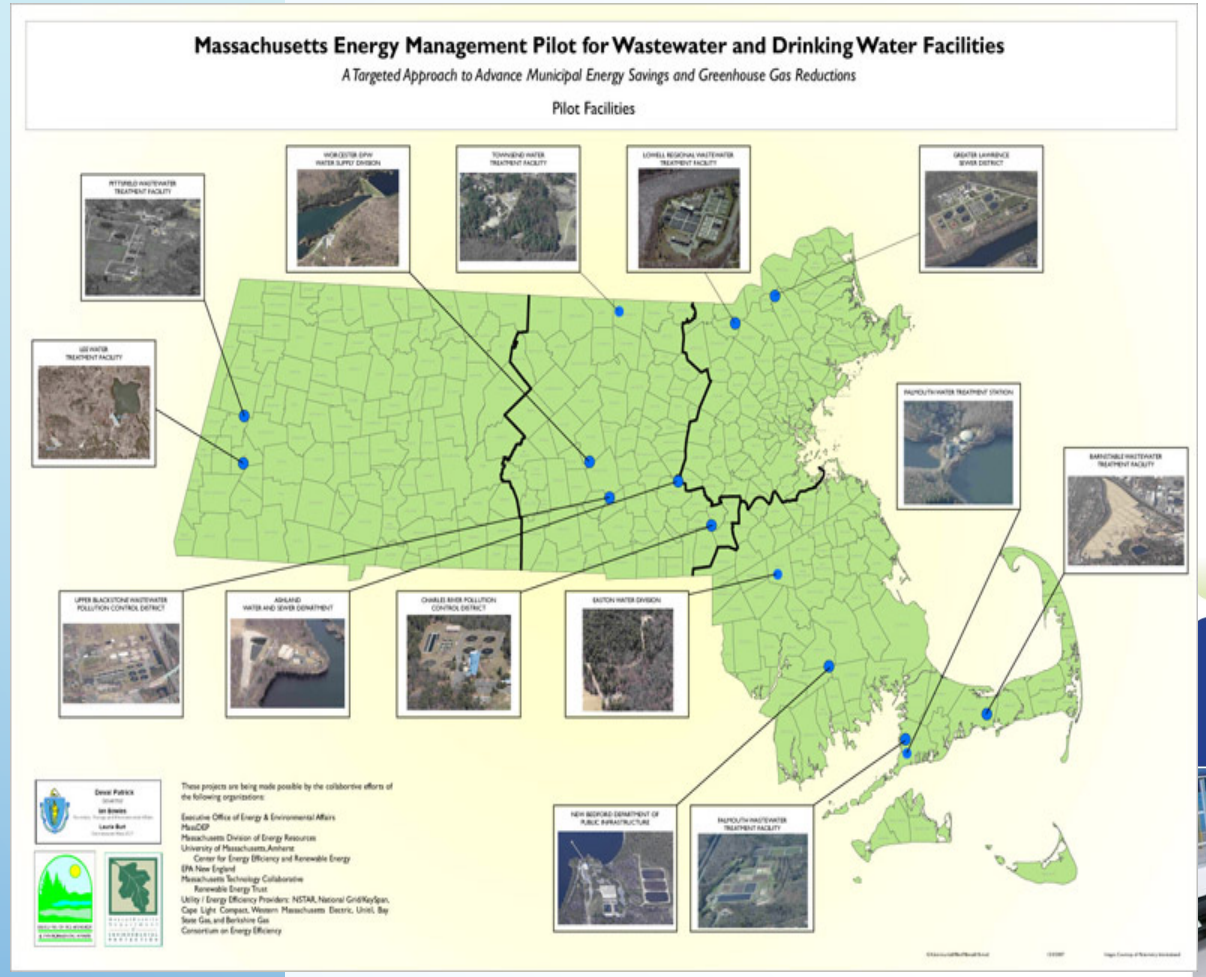
- 21 Facilities (2007-2010)
- MassDEP Pilot (14), Area Green Project Reserve Facilities (7)



- 21 Facilities (2012)
- MA DOER Energy Evaluations

- 18 Facilities (2014)
- CERP 'Gap Funding' Implementation (MassDEP, MADOER, MACEC

Group 1: 21 Facilities
MA Energy Pilot (2007 – 2010)



Results: National Model

($1.2B ARRA SRF for 'Green Infrastructure')

- Saving **$5 million** annually
- **10 Megawatts** of Clean Energy installed
- **23,000 tons** of GHG emission reductions / year

EPA GREEN RESERVE

The **American Recovery and Reinvestment Act (ARRA), Green Project Reserve** of 2009, through the State Revolving Fund, provided funding for a wide variety of qualifying projects in the categories of: ***green infrastructure, energy efficiency, water efficiency, and other innovative projects***. For more information on ARRA, to find out if your current or future planned project meets the necessary criteria, and how to apply, visit **www.Recovery.gov**.

Massachusetts Energy Management Pilot Program for Drinking Water and Wastewater Case Study

Reducing energy costs, lowering greenhouse gas emissions, and saving communities money through the identification of energy-efficient opportunities at water treatment facilities.

Some Key Energy Variables at Play

Flow, Water Temperature

Projects Implemented in Different Years (schedule)

Treatment Type

Energy Price

Wastewater – Nutrient Removal (Phosphorus, Nitrogen)

Size of Facilities

Data Sources

1

- MassEnergyInsight Database (MA DOER)
  - Participated Facilities' Electricity, Gas and Fuel Usage from FY12-FY16
  - Participated Facilities' Energy Cost from FY12-FY16

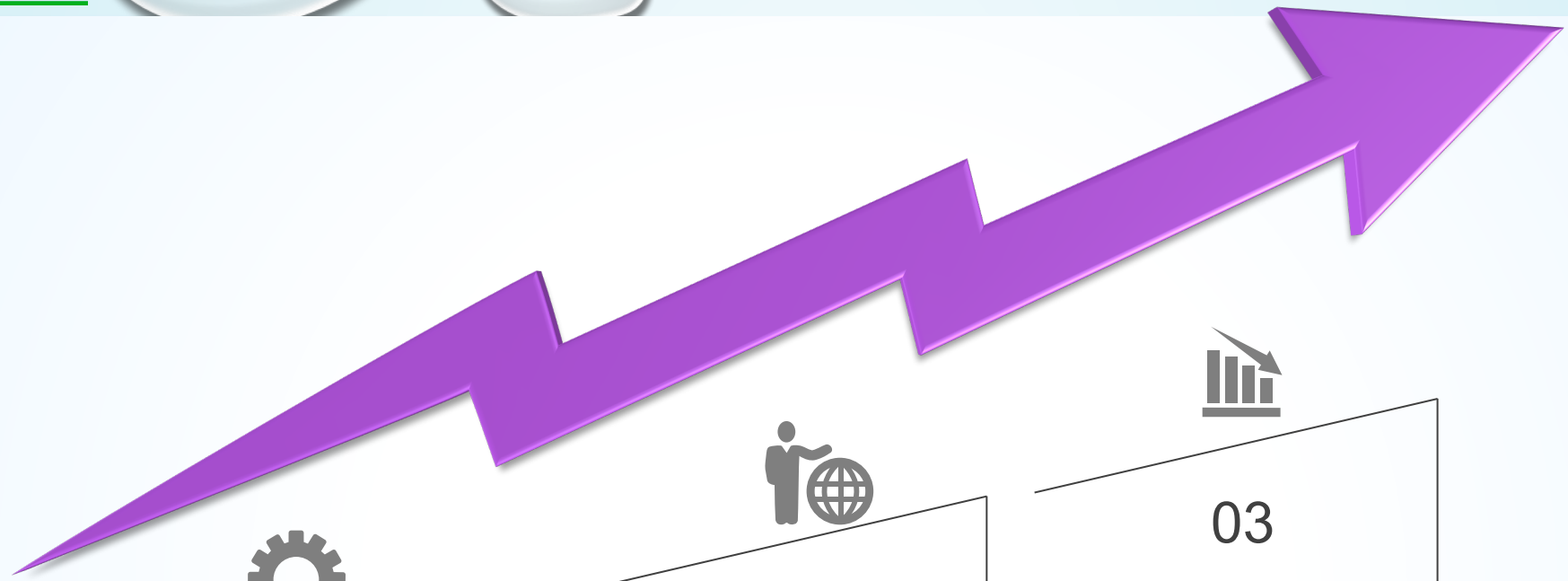
2

- Facility Response To Request
  - 6 wastewater facilities and 3 drinking water facilities responded to our request
  - Energy Usage from FY08-FY11
  - Energy Cost from FY08-FY11

3

- Powerdash, Solrenview, Facilities and State Vendor
  - Participated Facilities' Energy Generation since upgrade completed
  - Renewable Energy Credit Revenue

Methods Used For Calculations



01

- Compiling the data from different resources

02

- Digging up the important index used for measuring the results

03

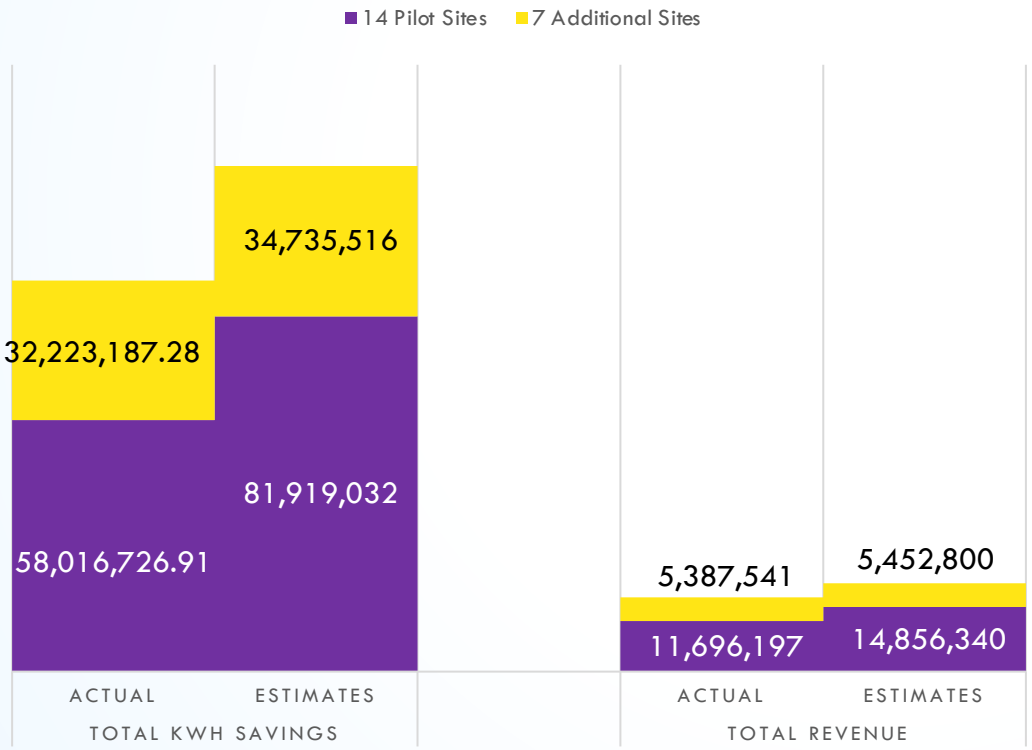
- Conducting sensitivity Analysis to approve the accuracy

Key Index

- Renewable Energy Generation
- Energy Usage Savings
- Renewable Energy Credit Revenue
- Greenhouse Gas Emission

Group 1 Results (FY13-FY16)

Actual	Total KWh Savings (KWh)	Total Revenue ($)	Estimates	Total KWh Savings (KWh)	Total Revenue ($)
14 Pilot sites	58.02M	11.70M	14 Pilot sites	81.92M	14.86M
7 sites	32.22M	5.39M	7 sites	34.74M	5.45M
Grand Totals	90.24M	17.08M	Grand Totals	116.65M	20.31M



Actual Energy Savings (KWh) is

-22.64%

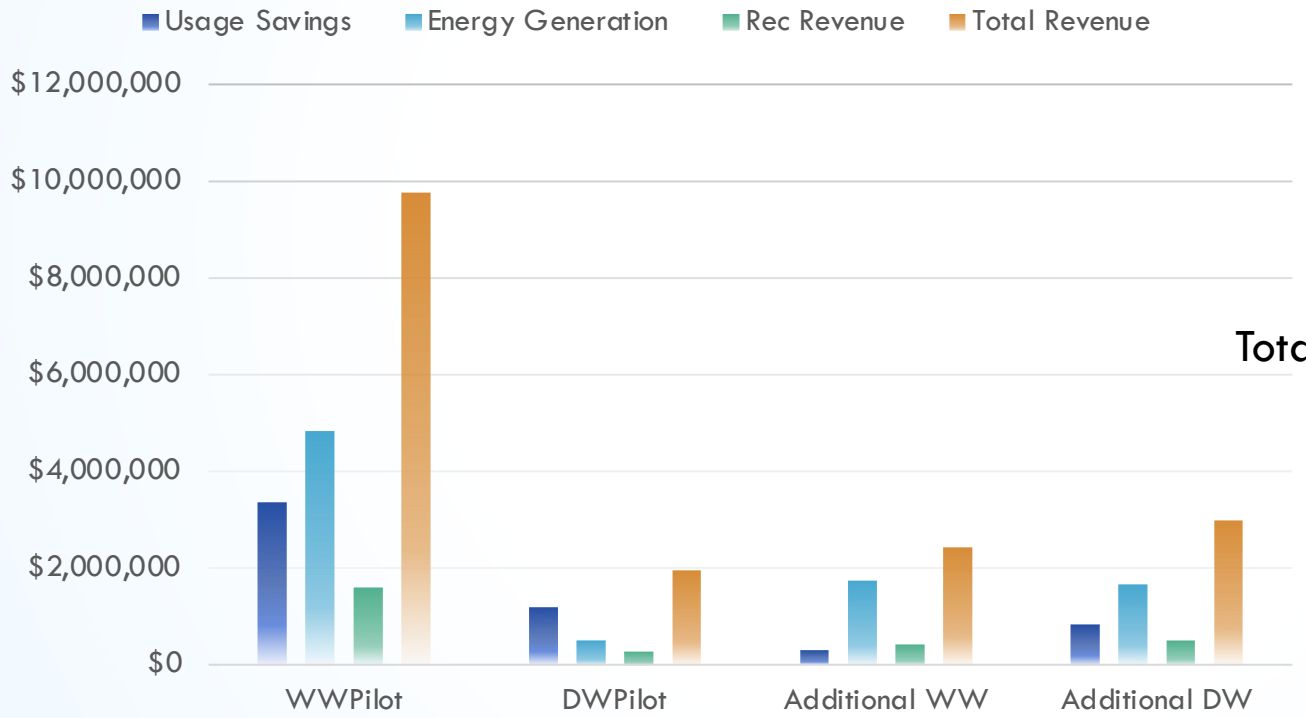
compare with the estimates in 2007

Actual Total Revenue ($) is

-15.88%

compare with 2007 estimation

	Usage Savings	Energy Generation	Rec Revenue	Total Revenue	GHG (tons)
WWPilot	$3.34M	$4.81M	$1.59M	$9.76M	9,790.55
DWPilot	$1.19M	$0.48M	$0.27M	$1.94M	1,283.33
Additional WW	$0.29M	$1.72M	$0.40M	$2.42M	4,061.06
Additional DW	$0.83M	$1.65M	$0.50M	$2.97M	4,789.29

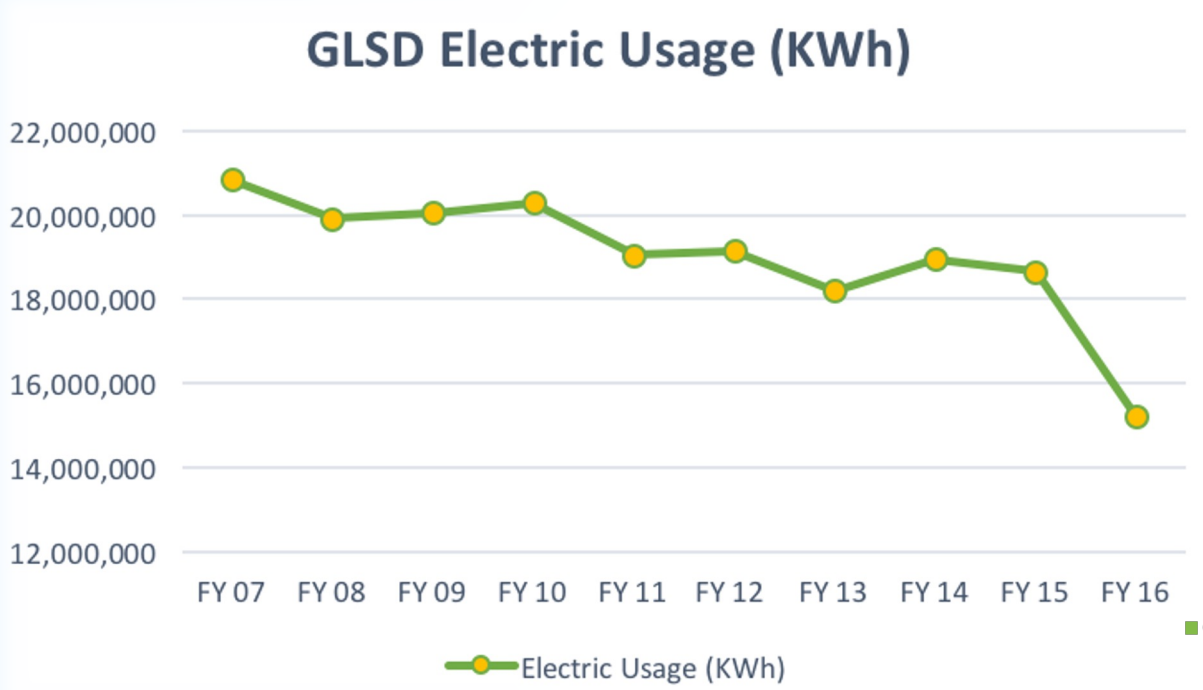


Total Green House Gas Reduction

19.92 tons

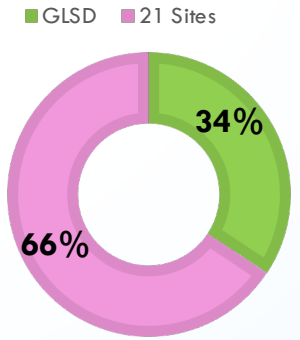
Greater Lawrence Sanitary District

	Total Usage Savings (KWh)	Usage Savings ($)	Energy Generation	REC Revenue	Total Revenue
GLSD	19.62M	$3.58M	$0.36M	$0.11M	$4.05M

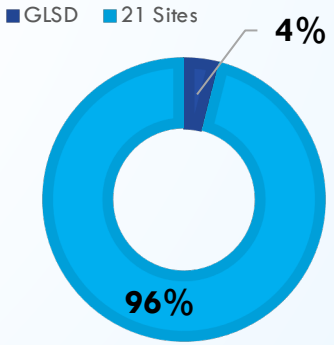


Average $/Kwh from FY07-FY16

13.6 cents



Usage Savings ($)



Energy Generations ($)

Greater Lawrence Sanitary District Wastewater Treatment Plant

Anaerobic Digestion - Organics to Energy (2013-2018)

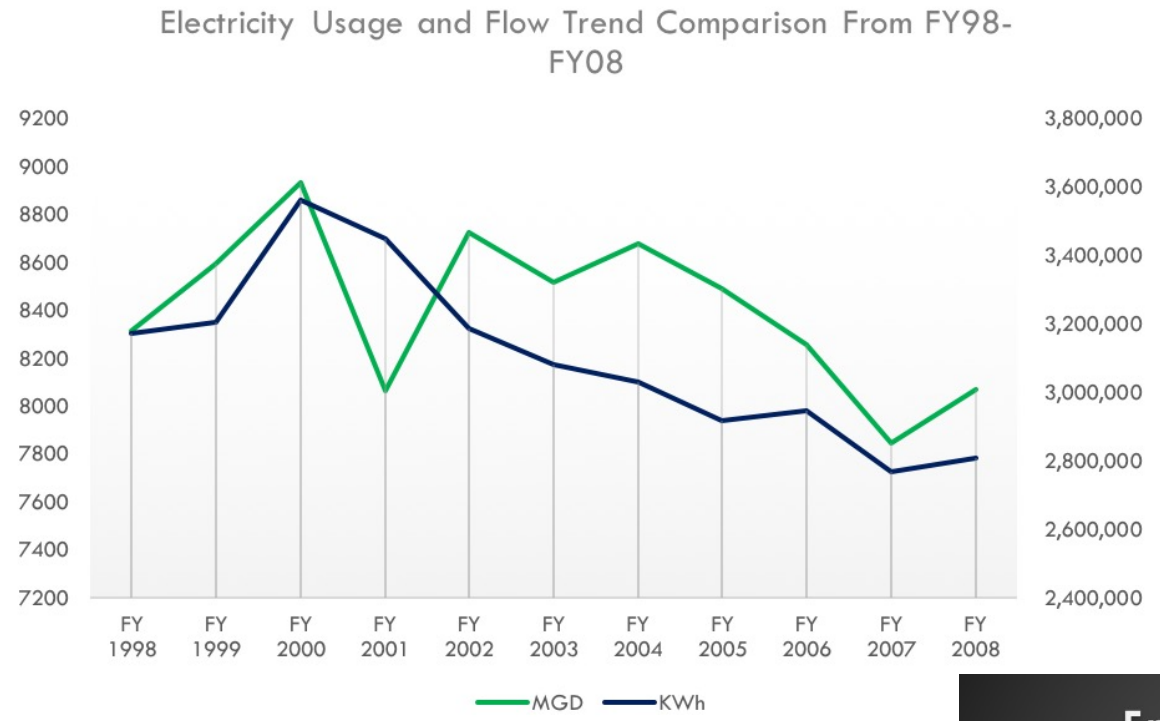
- Co-digestion is feasible - 2013 Study
- 4th digester under construction: Estimated to process up to 92,000 gpd of Source Separated Organic (SSO) materials, 3 MW of on-site power generation
- Estimated to meet 40% of the Commonwealth's goal for SSO

Grants Awarded

MA Clean Energy Center	$ 400,000
MassDEP	$ 500,000
MA DOER	$ 5,000,000
Total State Grants	$ 5,900,000
Anticipated SRF Loan Assistance (construction)	$22,900,000

.....Zero-Net Energy by 2018

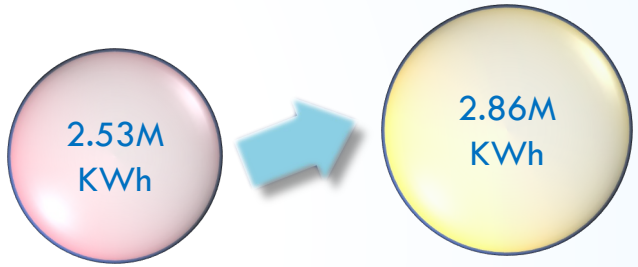
Worcester Water Treatment Plant

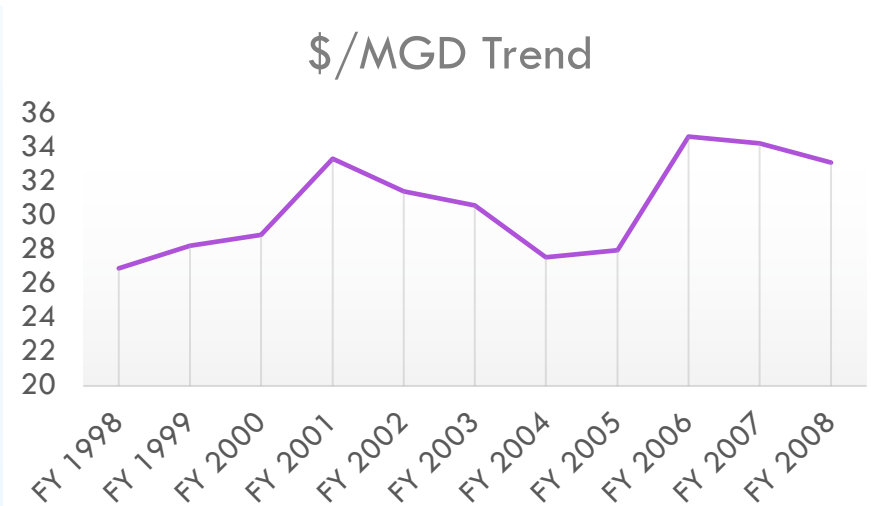


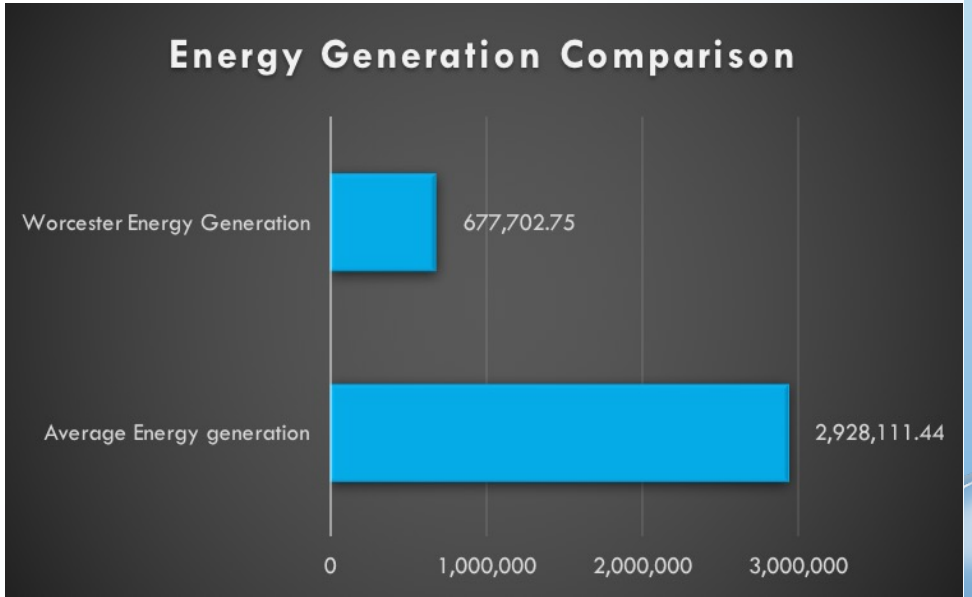
Average $/Kwh from FY07-FY16

11 cents

Electricity Usage in 2007 & 2016



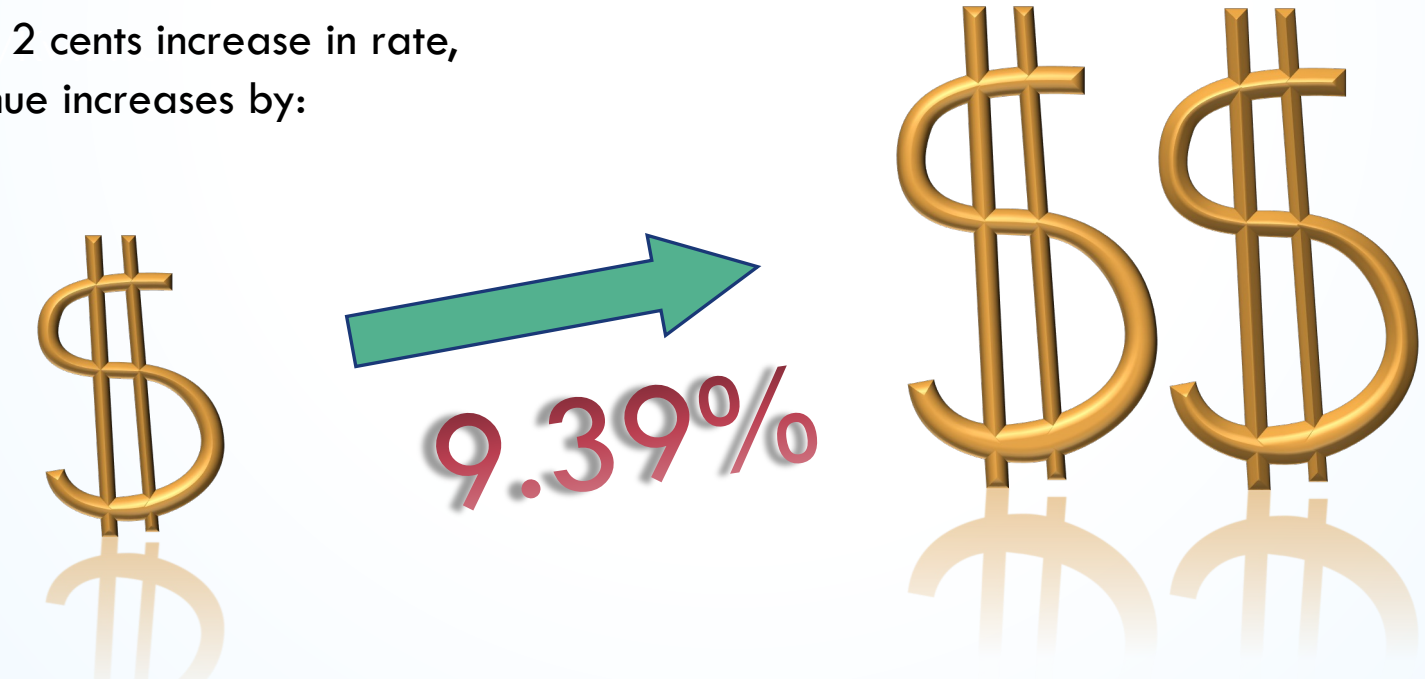




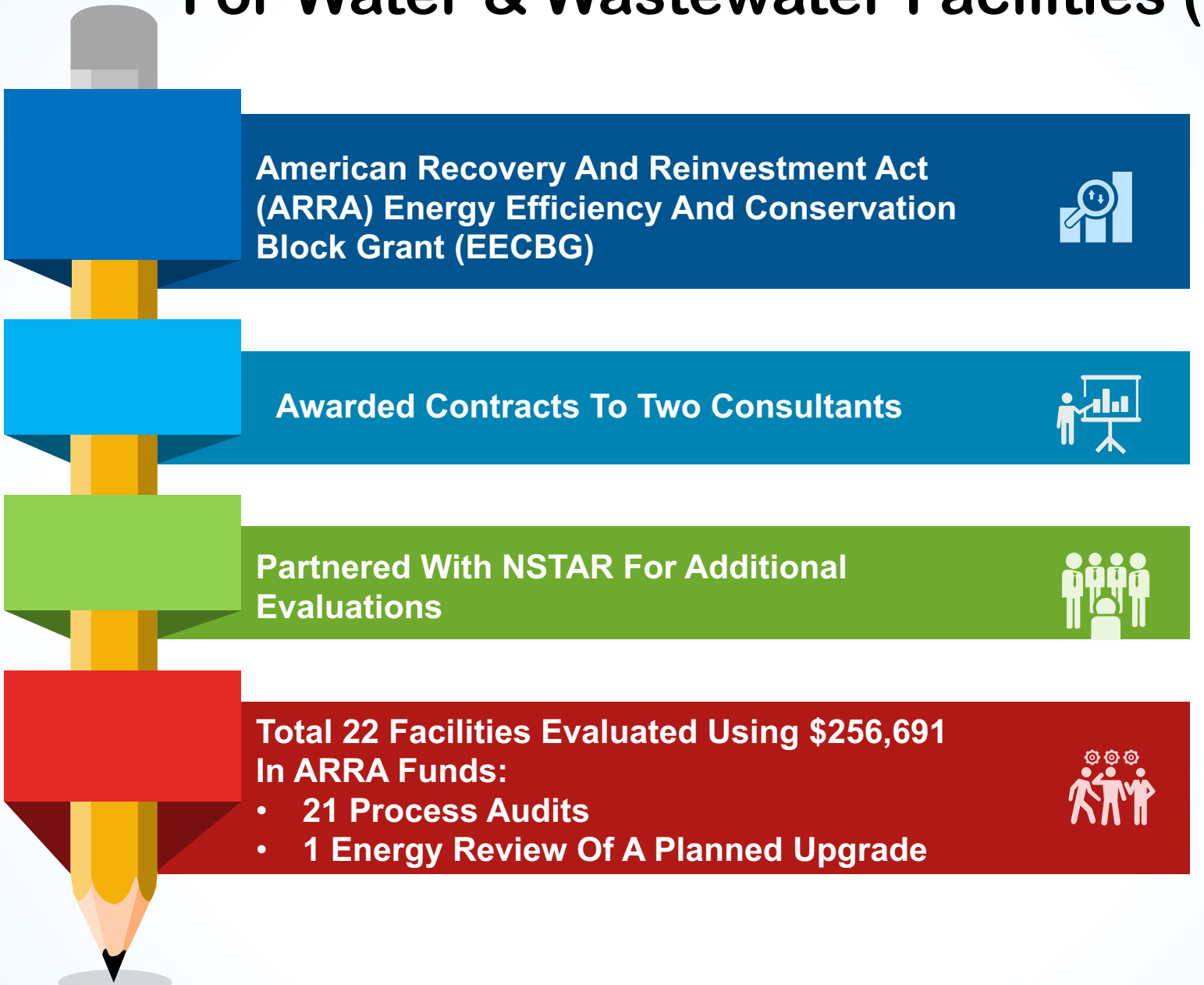
Sensitivity Analysis

Sensitivity Analysis	0.147 $/KWh	0.16 $/KWh	0.18 $/KWh	0.20 $/KWh	0.22 $/KWh
Usage Savings	5.65M	4.76M	5.36M	5.96M	6.46M
Energy Generation	9.27M	9.37M	10.54M	11.71M	12.88M
Total Revenue	16.97M	16.89M	18.66M	20.43M	22.11M

Every 2 cents increase in rate,
Revenue increases by:



Group 2: MA DOER Energy Evaluations For Water & Wastewater Facilities (2012)



American Recovery And Reinvestment Act (ARRA) Energy Efficiency And Conservation Block Grant (EECBG)

Awarded Contracts To Two Consultants

Partnered With NSTAR For Additional Evaluations

Total 22 Facilities Evaluated Using $256,691 In ARRA Funds:

- 21 Process Audits
- 1 Energy Review Of A Planned Upgrade

Group 2: MA DOER Energy Evaluations (2012)

21 facilities evaluated using $256,691 (ARRA funds)

Comprehensive energy efficiency audits

13

Drinking Water Facilities

8

Waste Water Facilities

Summary Of Evaluation Recommendations

150 ECMs recommended:

- Predominantly pumps, motors & drives, also aeration, process, HVAC, lighting

Cost Savings	Total Cost	Utility Incentives	Simple Payback
$916,754	$3,604,128	$325,464	3.6 years

- Energy savings

Electricity (kWh)	Natural Gas (Therms)	Propane (Gallons)	GHG Reductions (pounds)
6,233,309	5,827	1,643	5,250,161

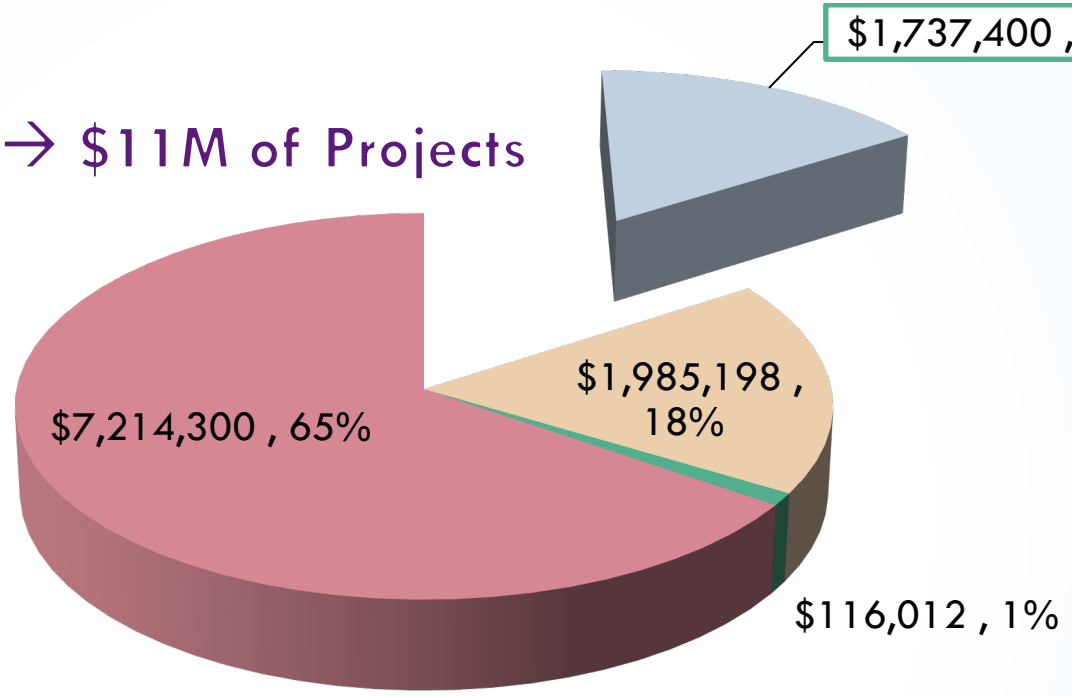
165 Homes

467 Cars

Group 3: CERP Gap Funding Implementation Grants (2014)

ROI:

$1.7 M Gap Grant → $11M of Projects



Projected Results: 2014 'Gap' Funding

Gap Funding

01

31 Energy-Saving projects moving forward

- Energy efficiency & on-site clean energy generation
- 1,500 kw (CHP), 4 solar PV (497 kW), water-source heat pump

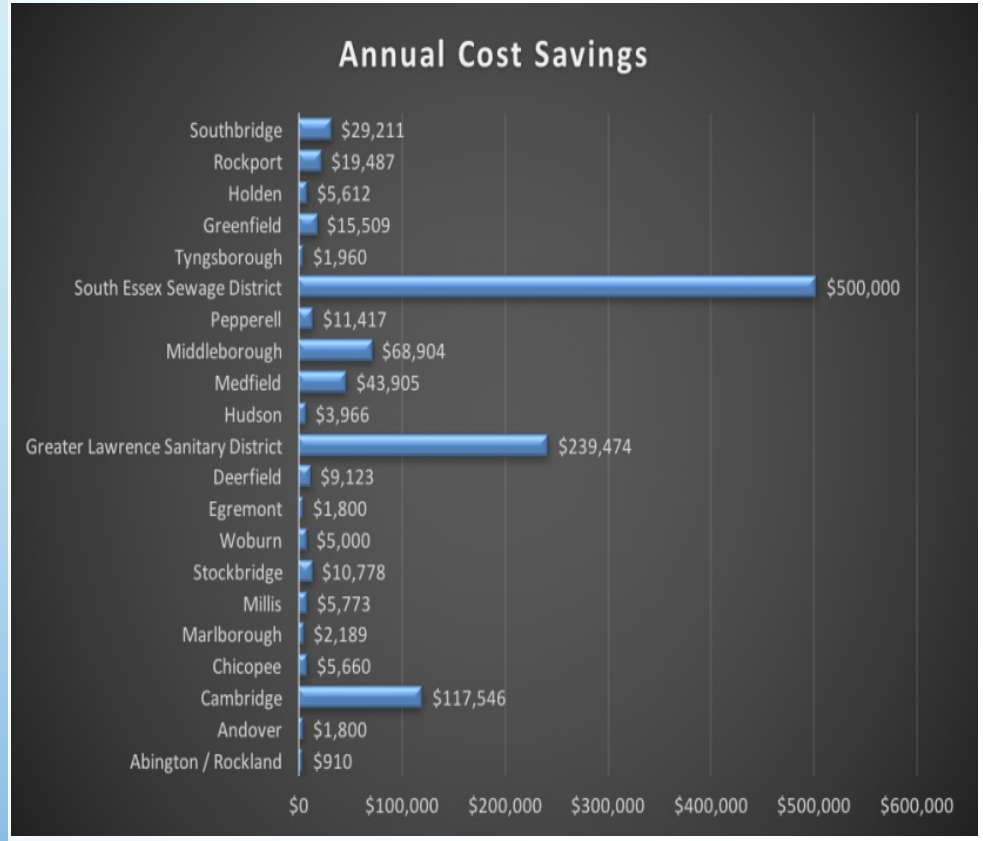
02

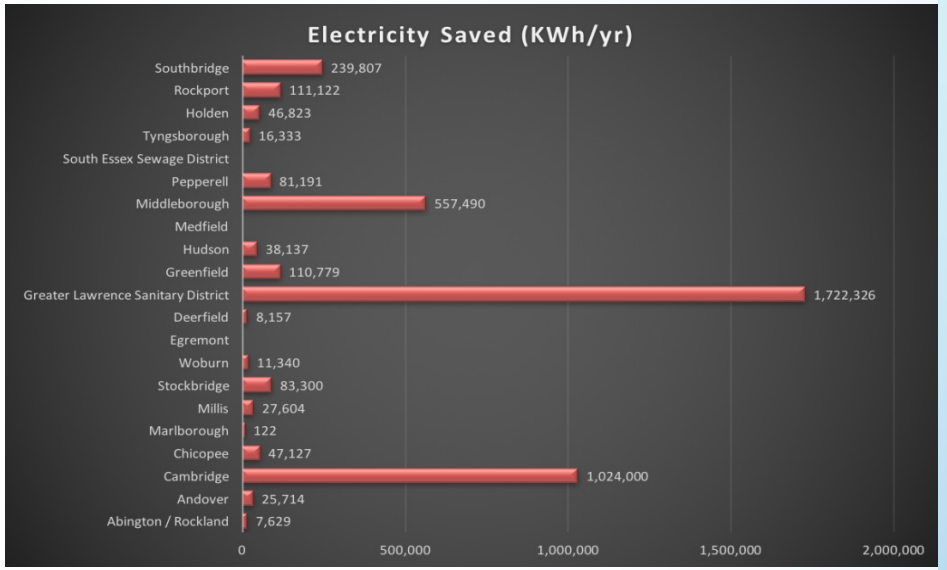
Approx. $1.2M in annual cost savings for facilities

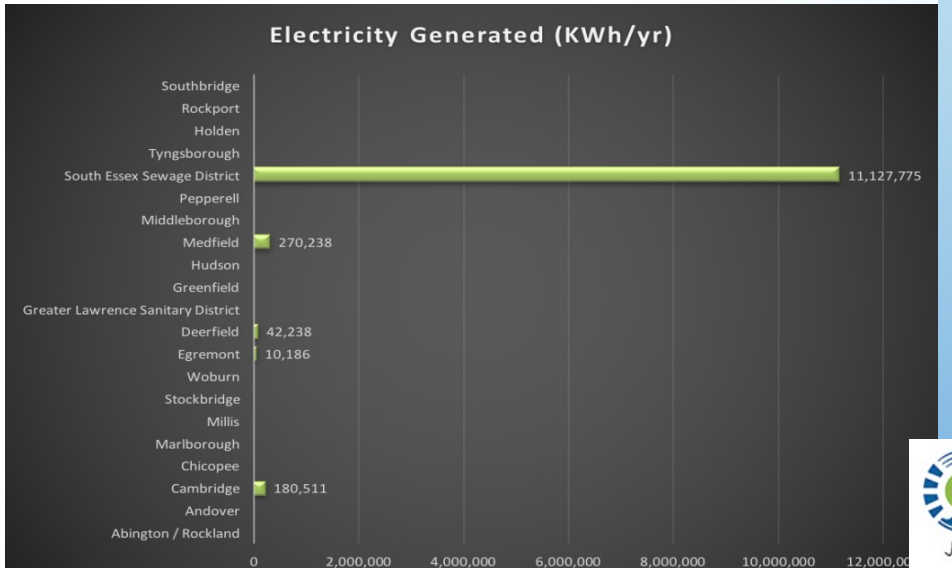
03

Approx. 15.3M kWh in annual electricity savings or on-site power generation

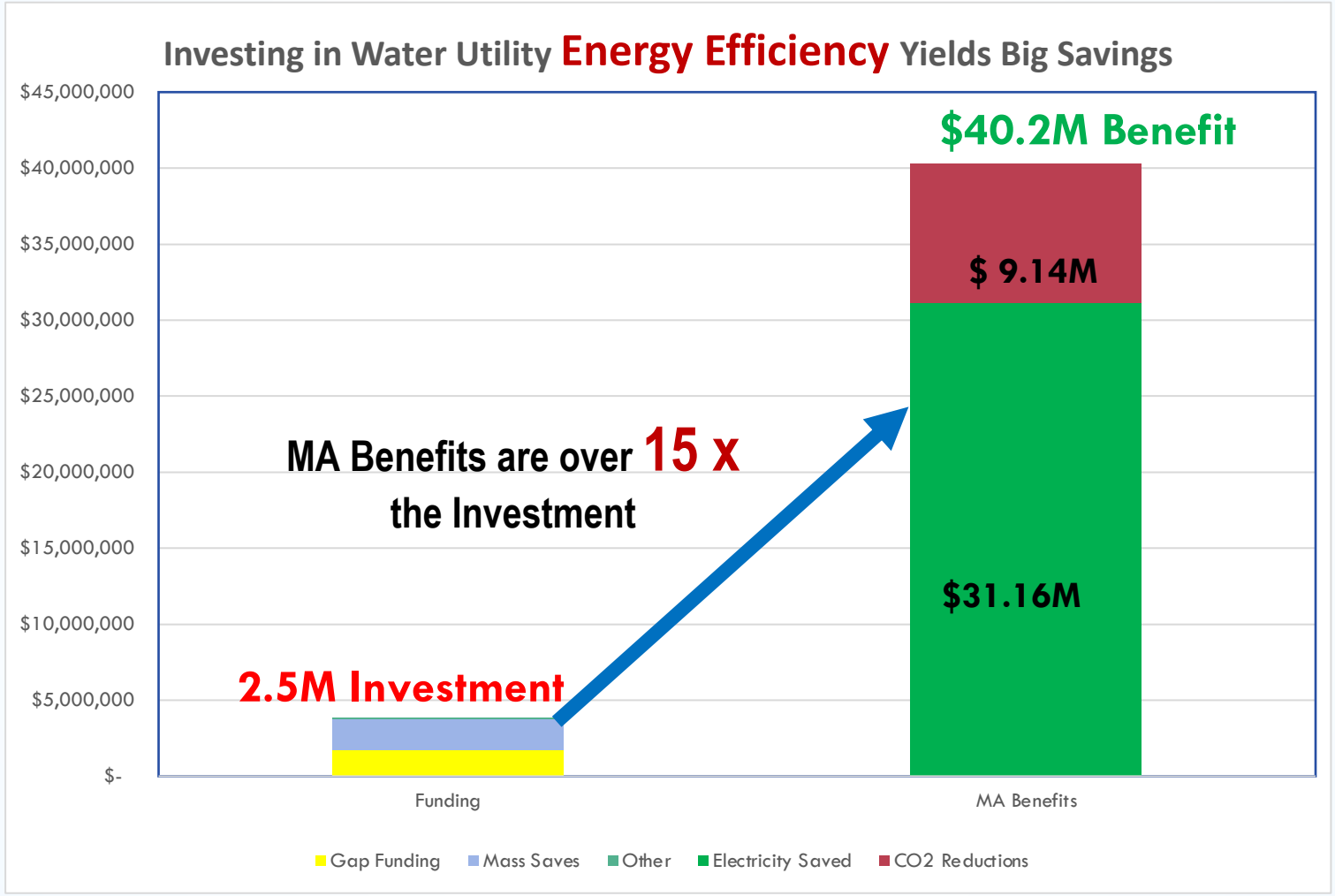
2014 Gap Funding Projects: Estimated Cost And Electricity Savings, Generation







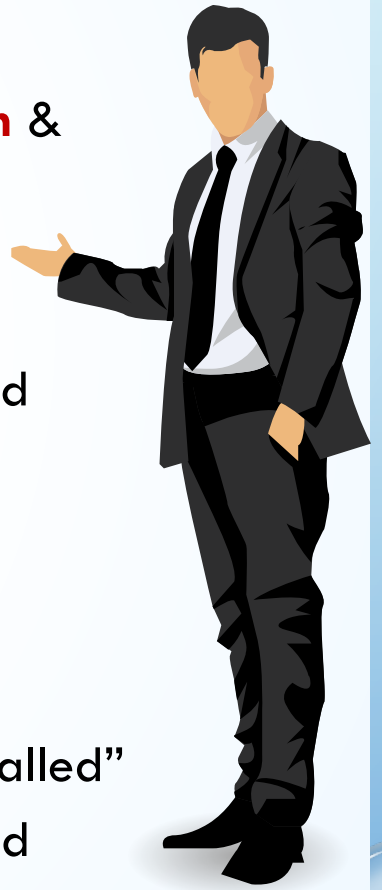
2014 Gap Funding Cost / Benefit Analysis, American Water Works Association, D.C. (2016)



Conclusion

1 Group 1

- Actual results were **16%** & **23 %** lower than the estimates (FY2013 – FY2016)
- The 21 group 1 facilities have achieved '**actual**' energy savings of **90.24M KWh** & **17.08M** total revenue
- Overall, these cumulative energy reductions and savings have helped facilities reduce their operating costs and greenhouse gas emissions



2 Group 2

- Comprehensive energy audits can identify significant energy efficiency opportunities at water and wastewater facilities

3 Group 3

- Gap implementation grants can move "stalled" energy saving projects to construction, and result in a good public return-on-investment

Questions