Going with the Flow: Water Utilities Enhancing Energy Efficiency, Management, and Recovery

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Los Angeles Department of Water & Power

BETTER BUILDING CHALLENGE

Better Plants Challenge

U.S. Department of Energy
May 2016

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Assistant Director – Water Operations
Los Angeles Department of Water and Power

Los Angeles Department of Water & Power

Water System Overview

Our Water System infrastructure:

- Service Area (473 sq. miles)
- Residents served 4 million
- About 697,100 water service accounts
- About 7,260 miles of distribution mains
- 114 local tanks / reservoirs
- 9 LAA reservoirs
- 88 pump stations
- 421 pressure regulator stations
- 23 chlorination stations
- 7 fluoridation stations
- 60,400 fire hydrants
- 1 Filtration Plant
- 1 Ultraviolet Plant

Sources of Water for Los Angeles

Sierra Mountains

Bay Delta

LA Aqueduct

State Water Project

Colorado River Aqueduct

Local Groundwater, Stormwater, Conservation & Recycling

BETTER PLANTS CHALLENGE

Overview:

- Organization goals or desired outcome
- Barriers/Challenges
- Approach
- Execution
- Measuring success
- Outcome

Los Angeles Aqueduct Filtration Plant

- Oxygen Plant
- Lighting
- Flash Mixers
- VFD's
- Shade Balls

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OXYGEN PLANT

Cryogenic

- Twin 900hp compressors (4160V)
- 4 hour typical startup time
- Maintenance intensive
- Operated manually
- 30 years old (Life expectancy 26 years)

VSA (Vacuum Swing Adsorption)

- Twin 250hp blowers (480V)
- 10-minute startup time
- Minimal Maintenance
- Fully Automated

Savings:

- Annual Cost Savings: $322k
- **Decrease in energy consumption: 44%**

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LIGHTING, FLASH MIXERS, VFD

Lighting:

- 3000+ LED bulbs
- Annual Cost Savings: Min $57K
- **44% decrease in energy consumption**

Flash Mixers:

- Original
  - 4 100hp motors
  - Paddle wheel mixing
- New
  - 4 50hp pumps
  - 4 50hp backup units
  - Jet mixing
- Annual Cost Savings: $186K
- **49% decrease in energy consumption**

Variable Frequency Drives:

- Upgrading 16 obsolete VFD's
  - 12 qty (30hp)
  - 4 qty (200hp)

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SHADE BALLS

To Date:

- 96 Million Balls
- $34.5 Million($.36each)
- Protects water quality
- Saves 300 MG/Year
- Reduces Chlorine usage by 95%
- Annual Cost Savings: $17k
- **67% decrease in energy consumption**

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BIGGER PICTURE

Locations:

- Admin Buildings \ Work Yards
- Treatment Facilities
- Pump Stations

Analytical Tools:

- Sustainability Software
- Water/Energy nexus

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FACILITIES

Work Facilities:

- Cooling system
- Solar
- LED Lighting
- Drought tolerant landscaping

Stations:

- Energy efficient pumps and motors
- Optimizing equipment selection
- Time of day pumping

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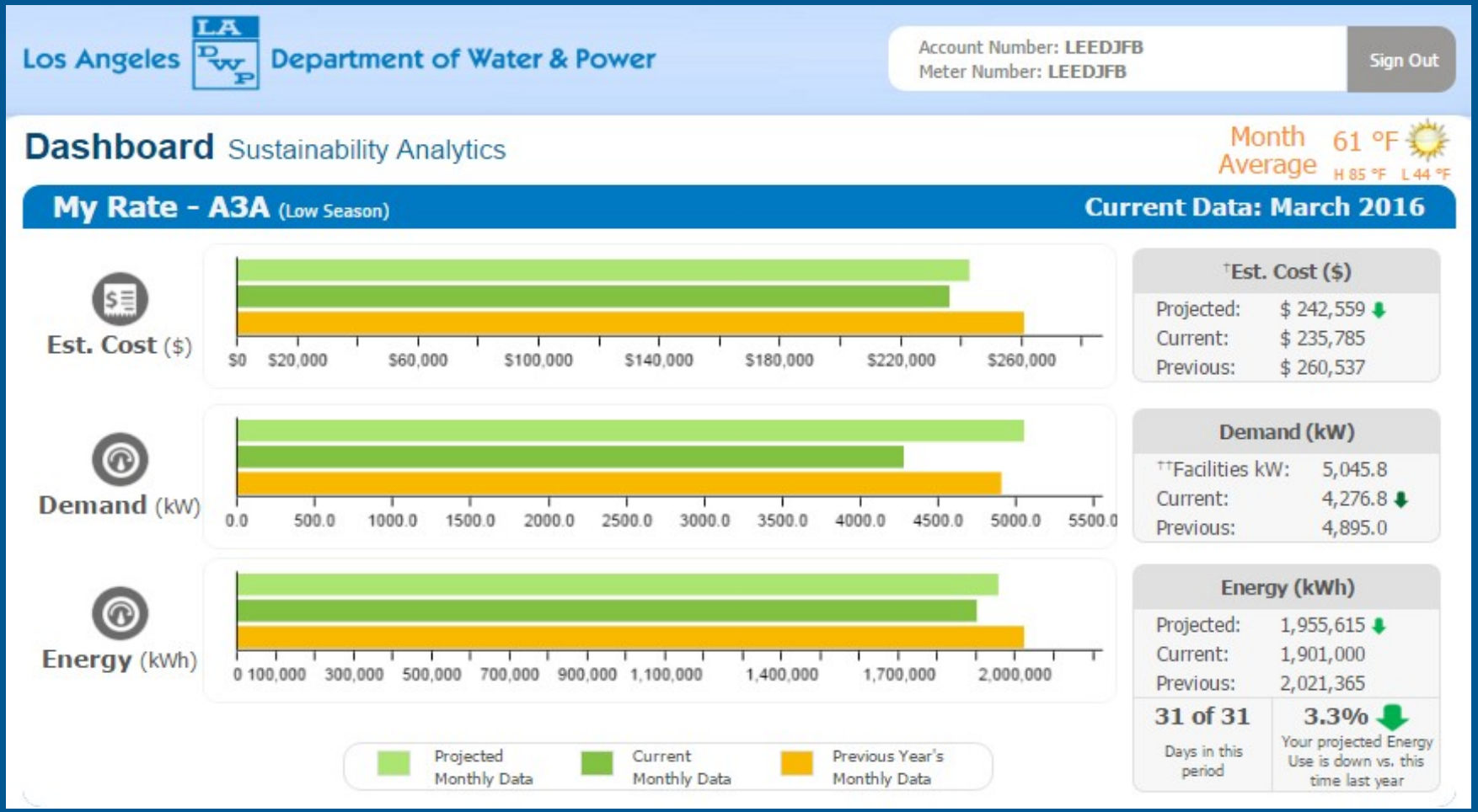
SUSTAINABILITY TOOLS OVERVIEW

- Web Access to track facility load usage
- Easy to use sustainability dashboard
- Key performance indicators
- Historical usage tracking
- Drill down to monthly and daily usage
- Temperature integration
- Energy Star data requirements
- Export capabilities

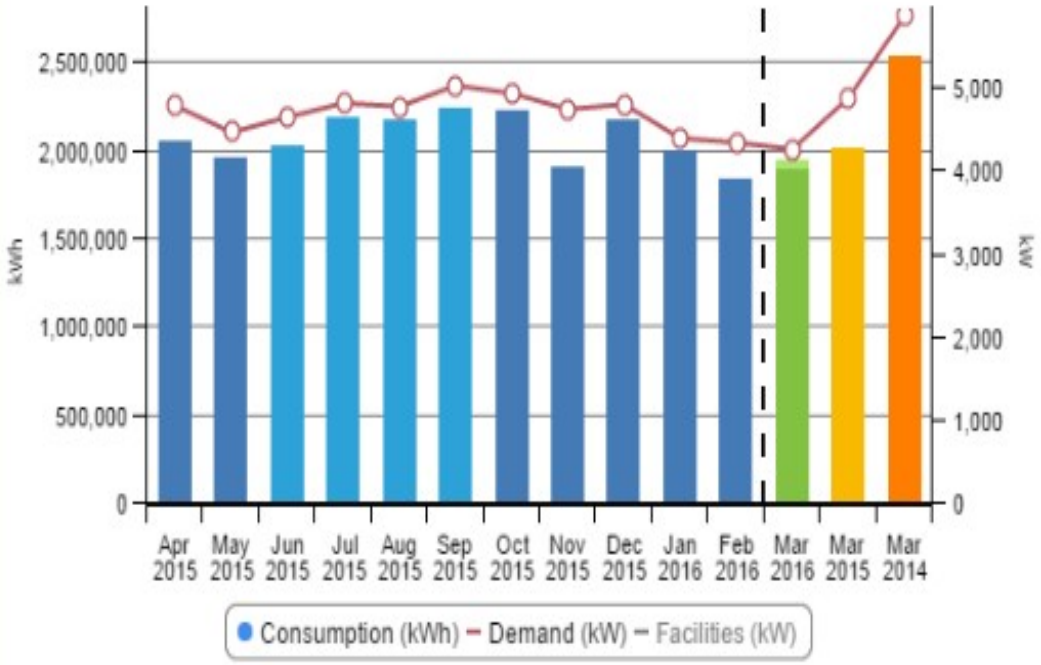
Performance Indicators



Historical Usage Energy Tracker

Load Tracker (* indicates that month has the missing interval data)

View Another Month | Monthly Analytics



Month	Demand	Energy	¢/kWh
Mar 2016 *	4,276.8kW	1,901,000kWh	¢ 12.4
Feb 2016	4,356.5kW	1,853,278kWh	¢ 12.6
Jan 2016	4,409.3kW	2,009,487kWh	¢ 12.4
Dec 2015	4,819.2kW	2,185,466kWh	¢ 12.8
Nov 2015	4,758.7kW	1,922,510kWh	¢ 13.1
Oct 2015	4,949.8kW	2,243,717kWh	¢ 12.8
Facilities kW	5,045.8kW		Next

What is Water Nexus?

- Energy Intensity (EI) of LADWP water supplies
- Water Supply Mix
- Water Supply Management plan
- Historical energy and carbon footprint
- Projected energy and carbon footprint

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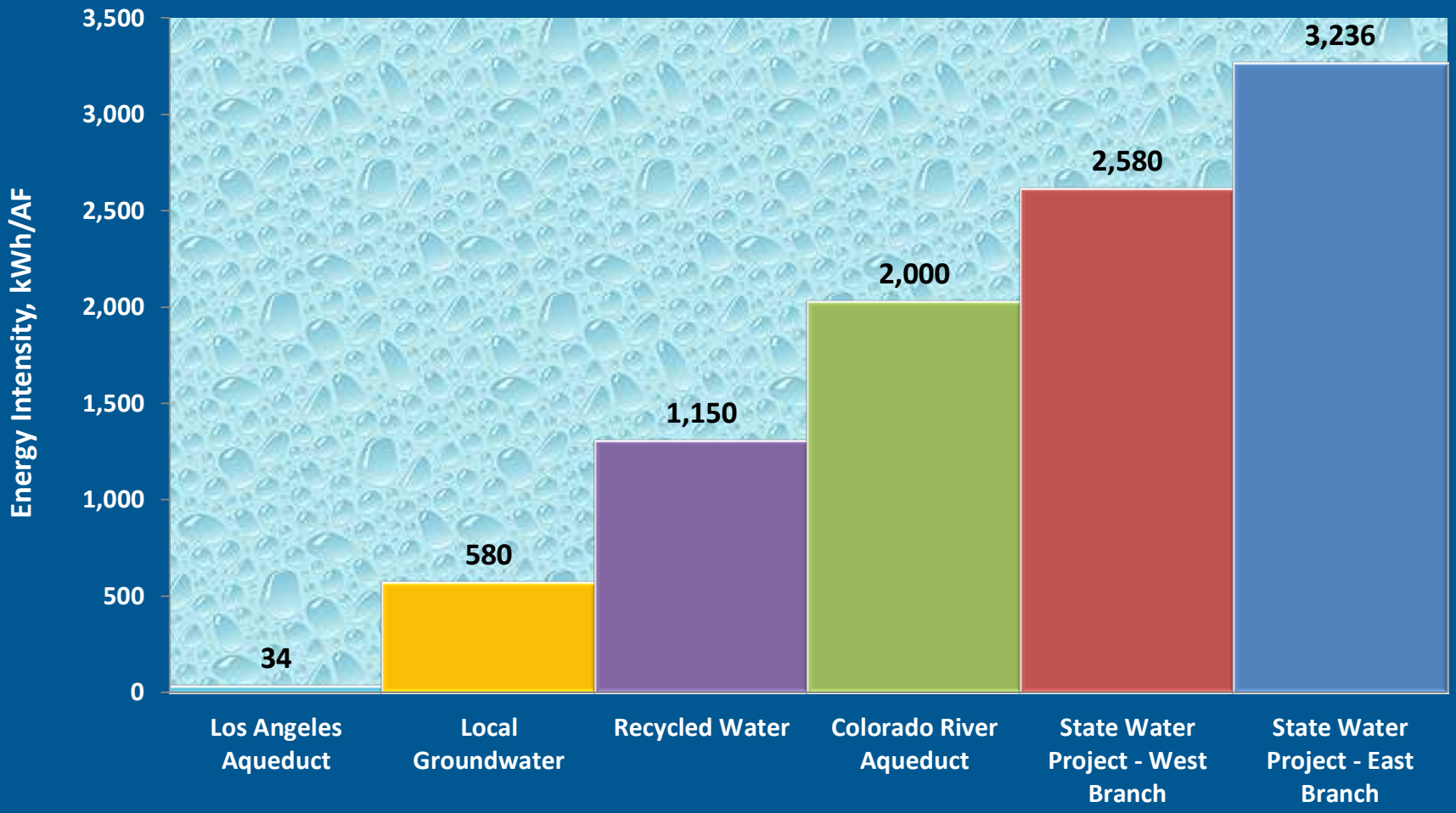
Water Supply Energy Intensity (FYE 2010 – FYE 2015)



Includes treatment, and excludes 2,429 kwh/AF LAA hydropower

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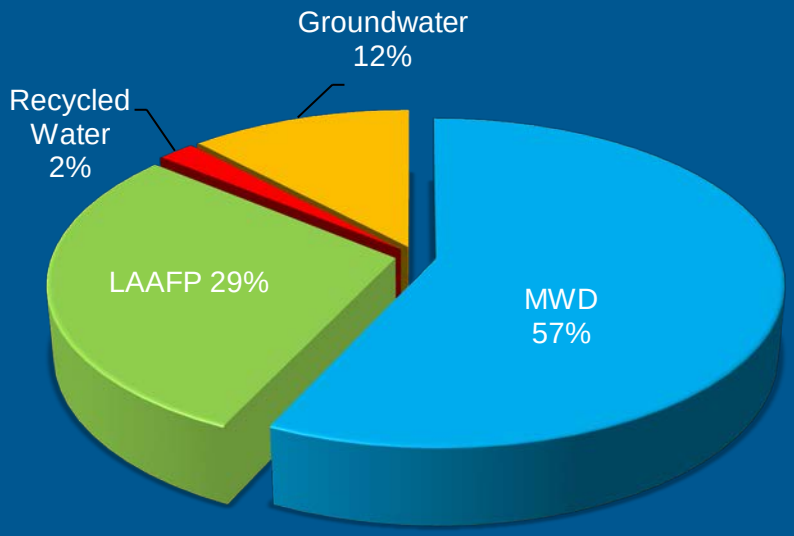
URBAN WATER MANAGEMENT PLAN SUPPLY GROWTH

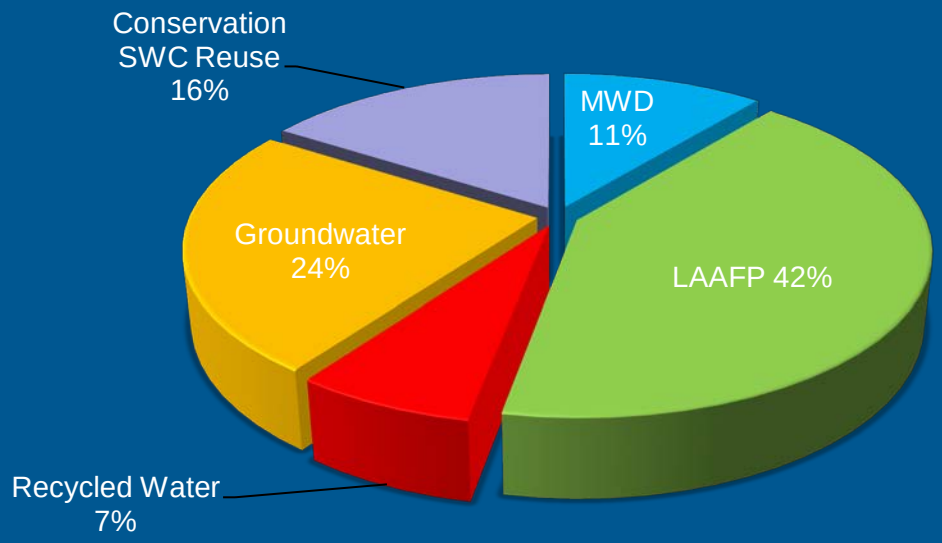
TODAY

FYE 2011-2015 Average
Total: 550,130 AFY



FUTURE*

FYE 2040
Total: 675,700 AFY



*Estimated from the 2015 Urban Water Management Plan
Future supply condition does not reflect 118,034 AF of existing conservation.

Questions?

Treatment Plant Pathway to Energy Neutrality

Logan Olds

VVWRA General Manager

VVWRA covers 446 acres

Victorville, CA

2008

- Planning to address nutrient and capacity issues
- Initial idea to use existing assets to move to energy neutrality

May, 2012

- Partnership with local electric utility

SOUTHERN CALIFORNIA EDISON®

SBCSA • Apple Valley • Hesperia • Victorville
VVWRA
Taking the Waste Out of Wastewater

Would you throw away your used car?

SBCSA • Apple Valley • Hesperia • Victorville
VVWRA
Taking the Waste Out of Wastewater

2012

- **Develop RFP for** :
  a. Biogas Optimization
  b. Energy Production
  c. Power Purchase Agreement (PPA)

No such thing as luck!

Success is where opportunity and preparation meet!

June, 2013

- Construction of Omnivore digester improvements begins
- Public Private Partnership (PPP) $2.6 million

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VVWRA
Taking the Waste Out of Wastewater

Omnivore

Innovative technology

Recuperative Thickener

August, 2013

- **COMPLETED: Phase IIIA Regulatory Upgrade Project**
  - UV
  - Gas conditioning system
  - Helical grease skimmer
  - Ferric chloride station
  - Convert CL2 contact tank to recycled water storage

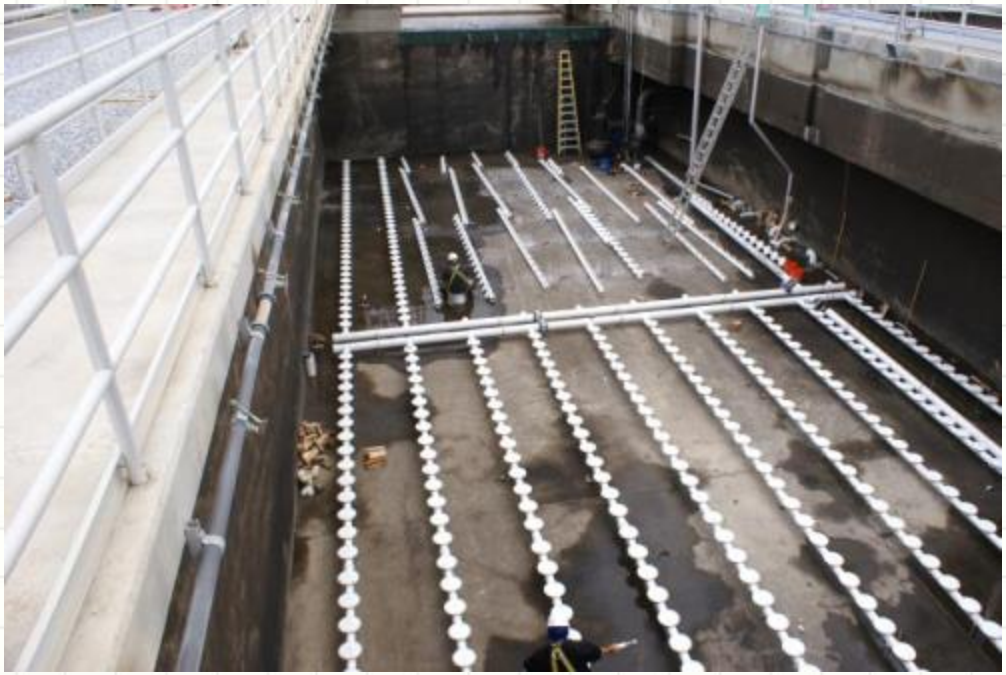
- **Initiated UV system RetroCommission Project with Edison**

April 2014

- Construction of Biogas to Energy project begins

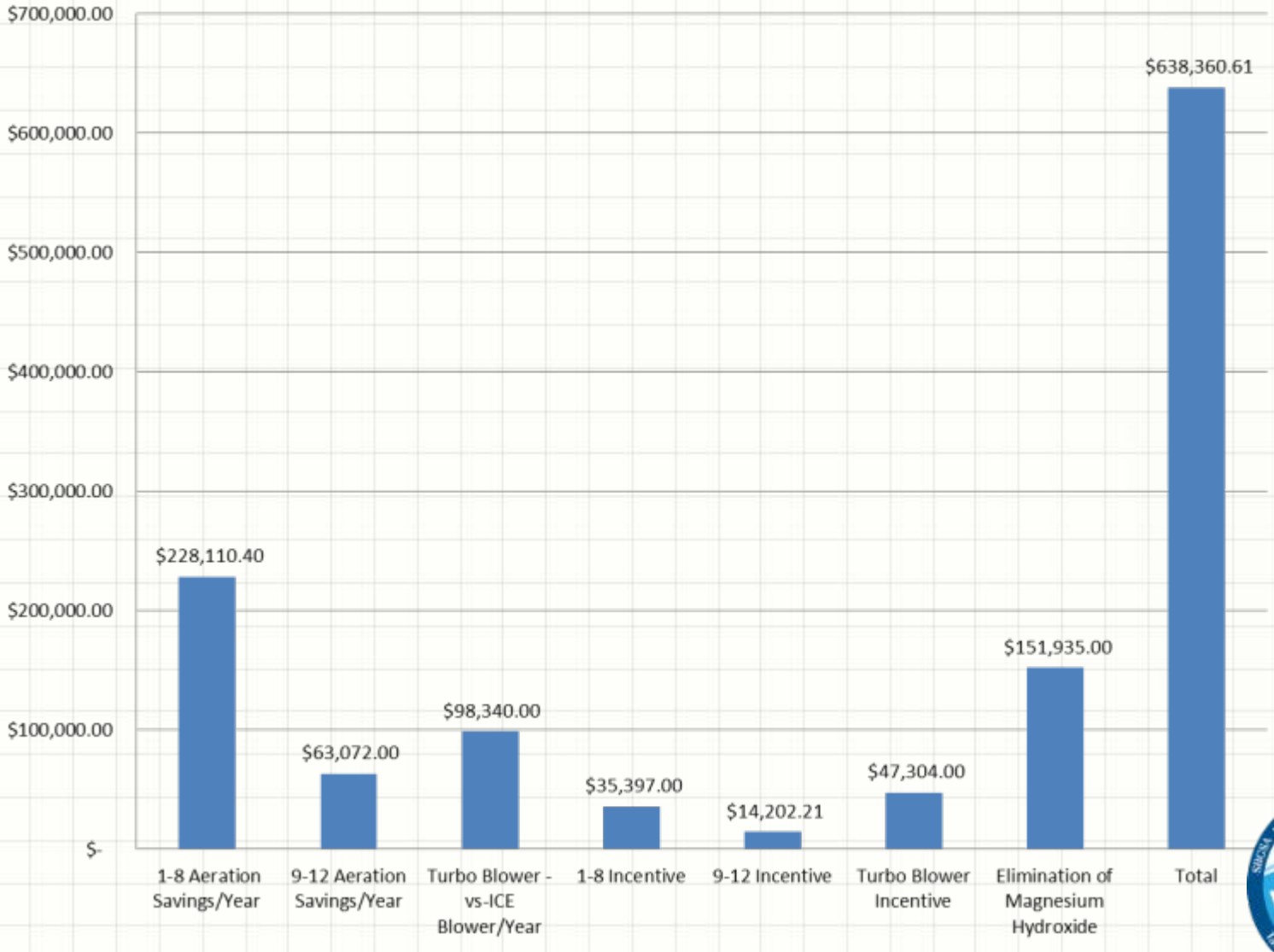
December 2013

- Coordination with Edison electrical utility regarding On Bill Financing for Aquarius Diffusers



SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

Savings and Incentives

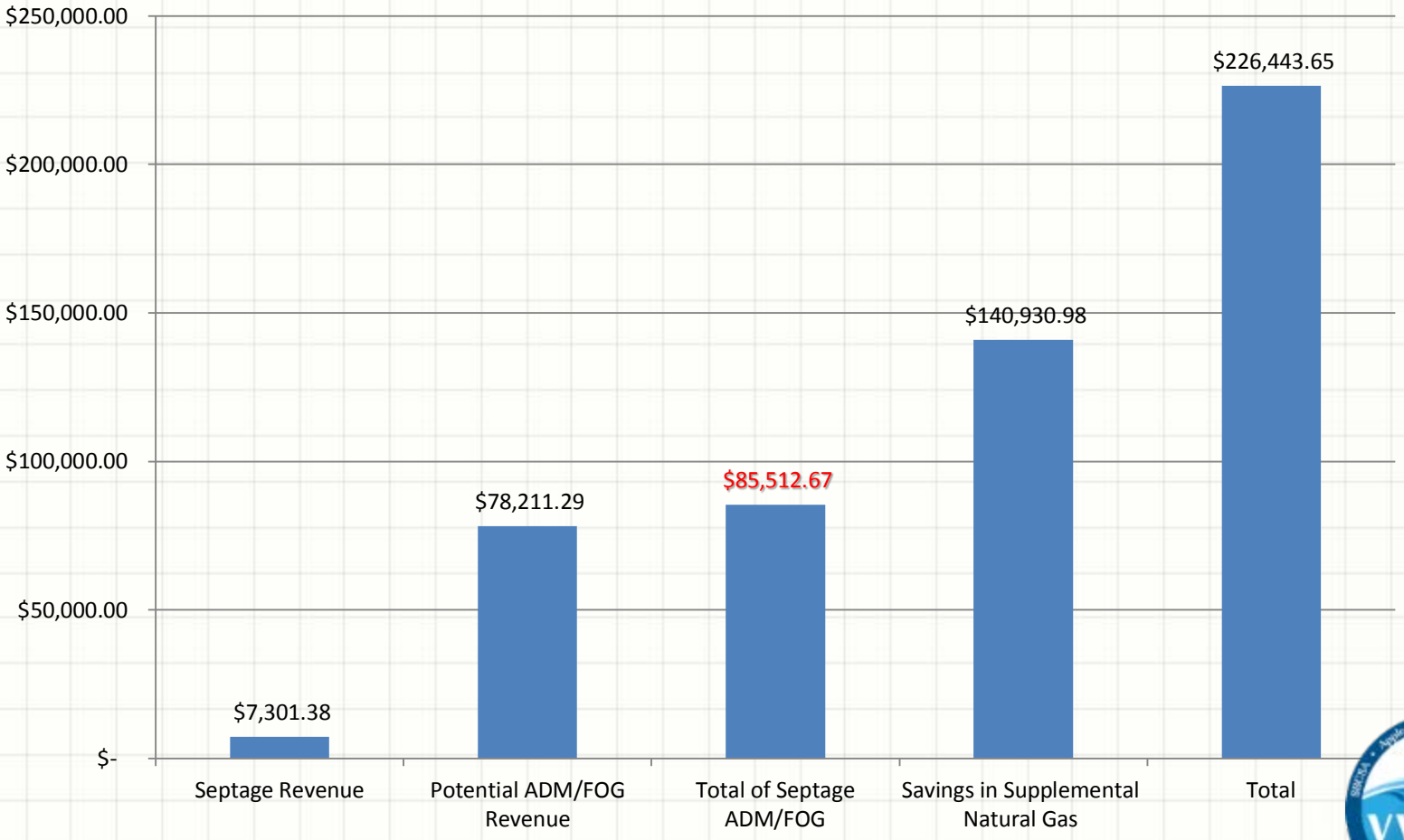


VVWRA

June 2014

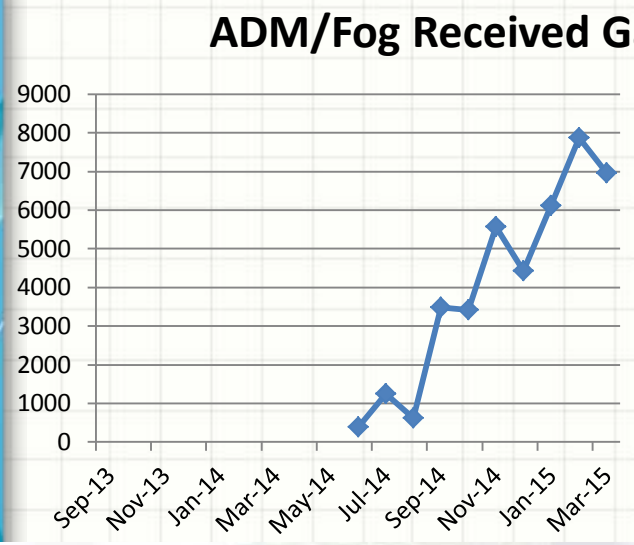
- Began experimenting with receiving imported waste

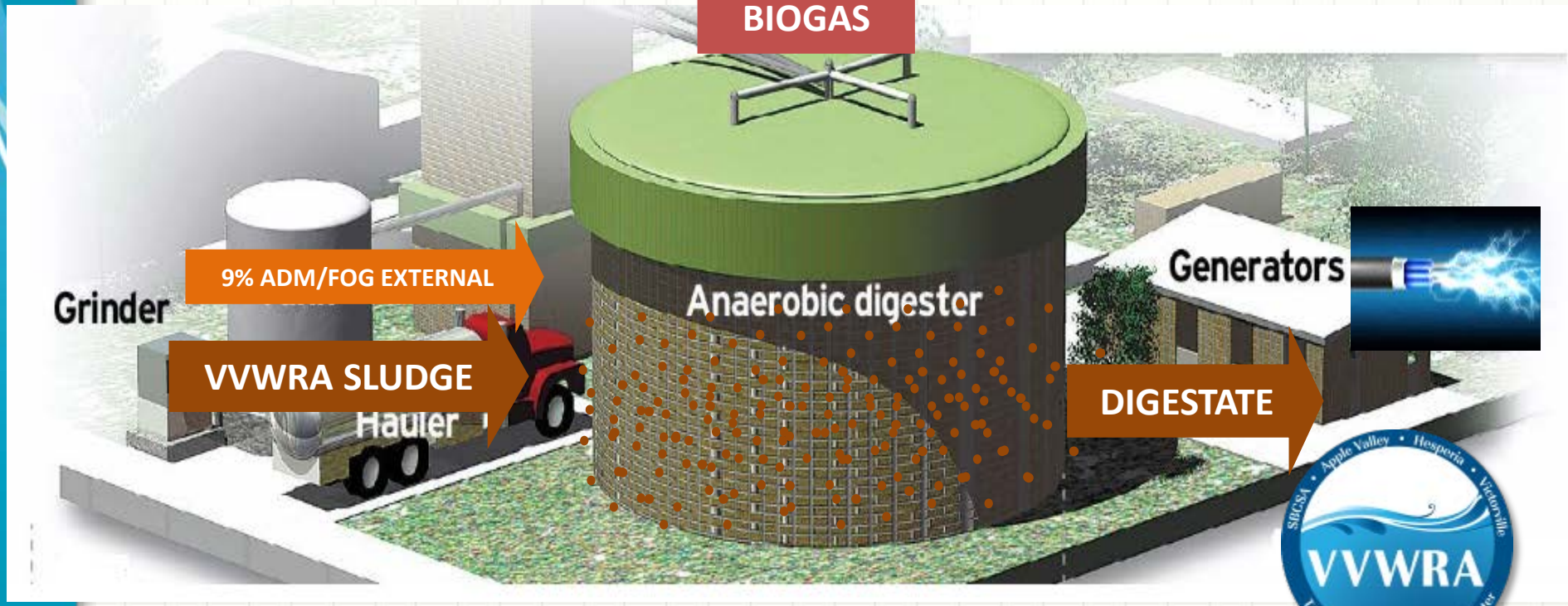
ADM/FOG/Septage Potential Revenue

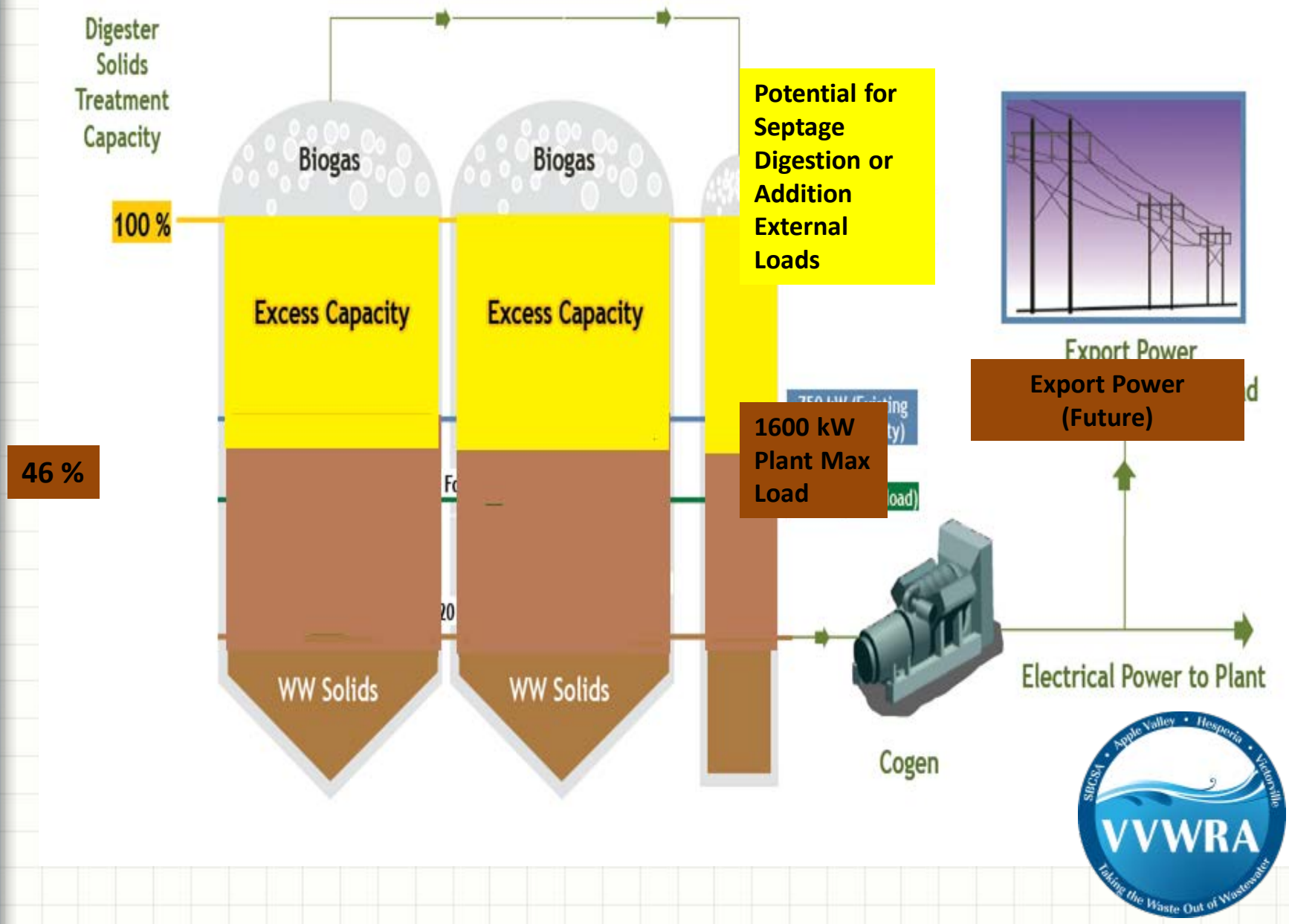


*** Net Revenue after full time septage attendant is factored in.**

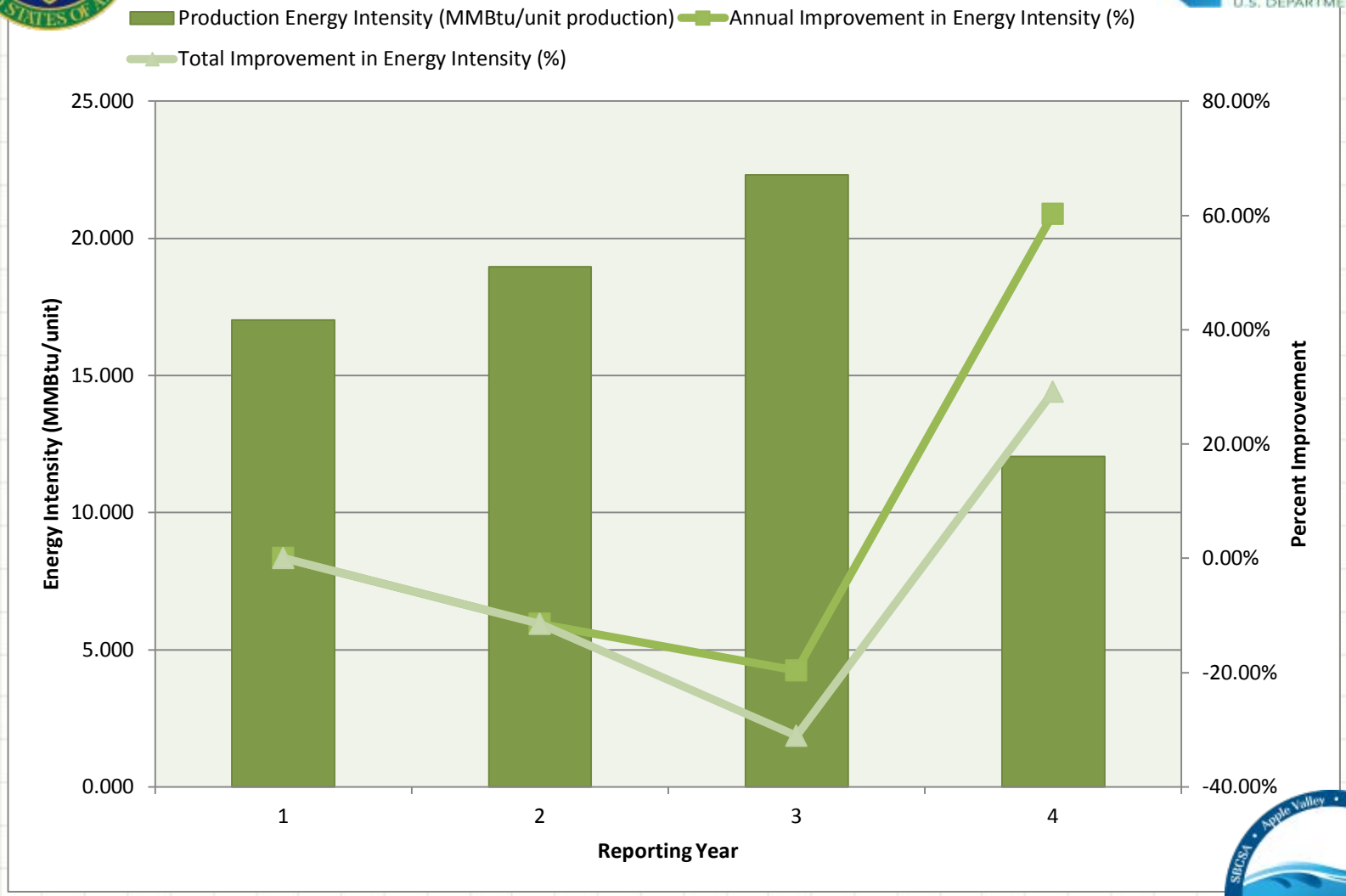
ADM/FOG


ADM/Fog Received Gallons
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
ADM/Fog Received Gallons

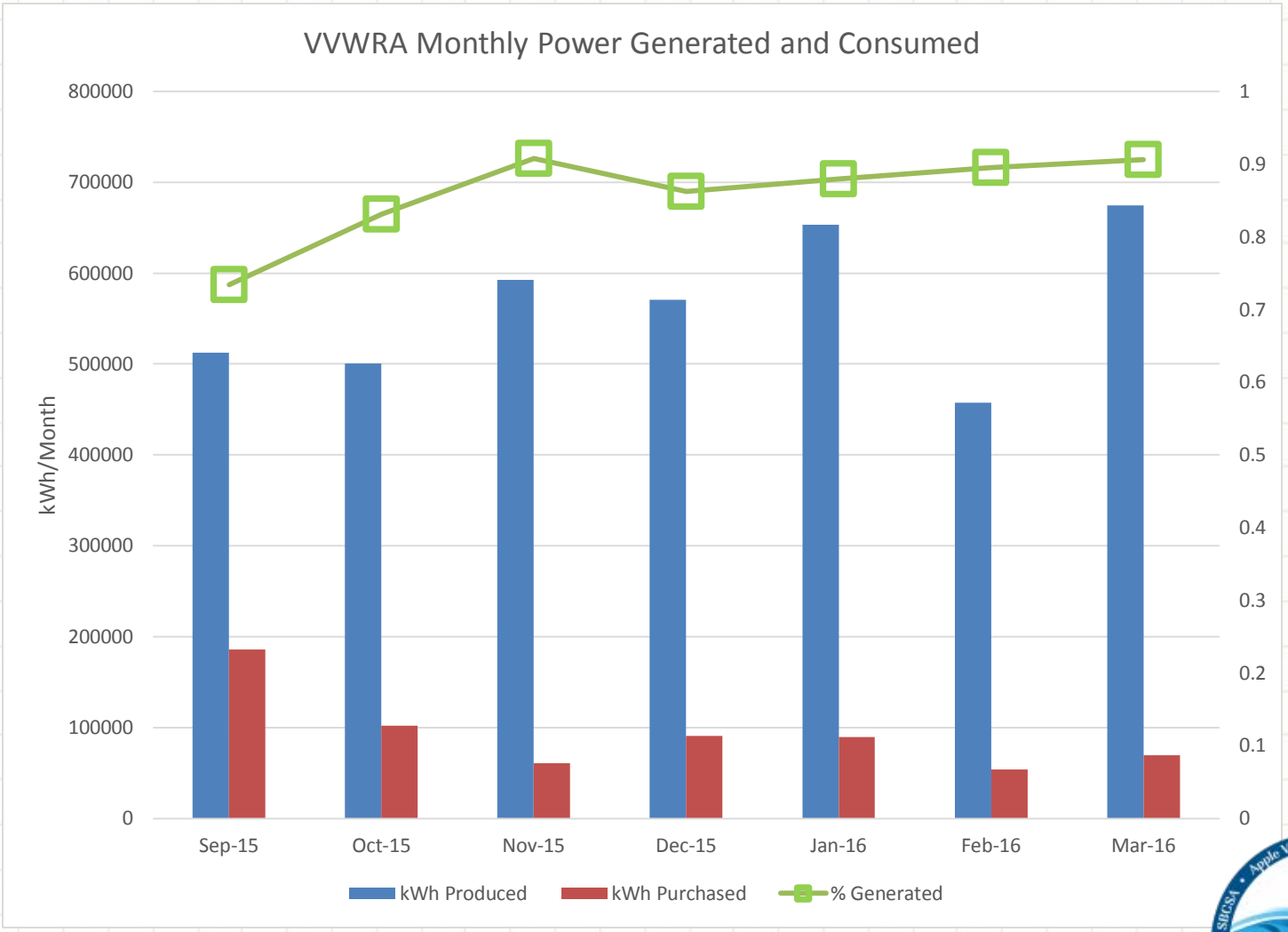

262% Increase BIOGAS
9% ADM/FOG EXTERNAL
Grinder
VVWRA SLUDGE
Hauler
Anaerobic digester
Generators
DIGESTATE
SBCSA • Apple Valley • Hesperia • Victorville
VVWRA
Taking the Waste Out of Wastewater


Digester Solids Treatment Capacity
Biogas
Biogas
100 %
Excess Capacity
Excess Capacity
WW Solids
WW Solids
46 %
Potential for Septage Digestion or Addition External Loads
1600 kW Plant Max Load
Export Power
Export Power (Future)
Cogen
Electrical Power to Plant

DOE Better Plants Program

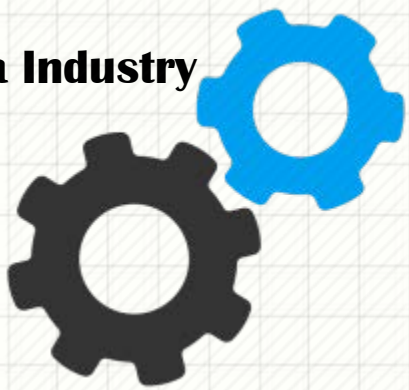


Energy Consumption & Production



New Colleagues

Area Industry



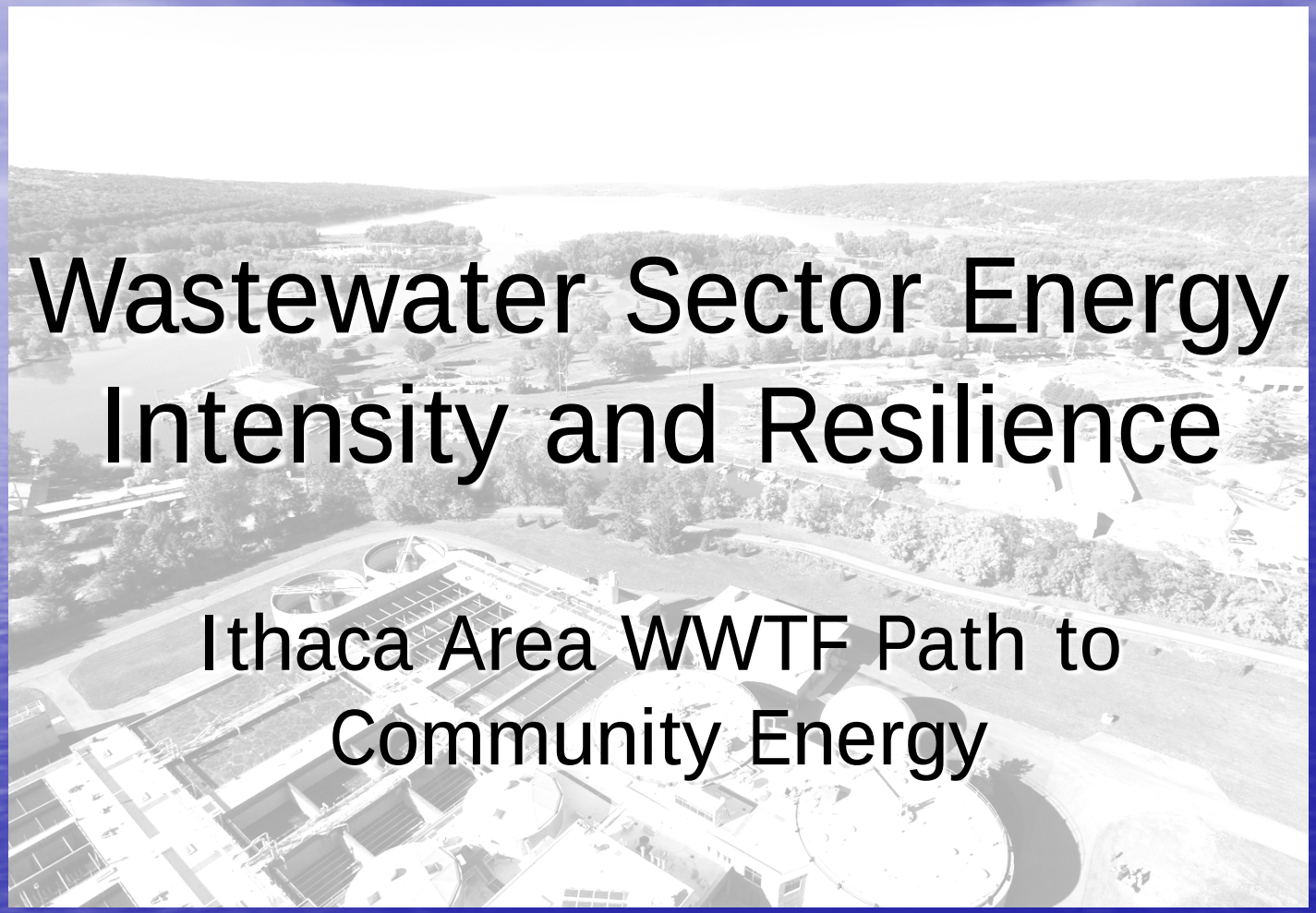
What's next?

- RFP
- CEC grant for Battery Storage System and Microgrid

Logan Olds

Victor Valley Wastewater Reclamation Authority

lolds@vvwra.com



Wastewater Sector Energy Intensity and Resilience

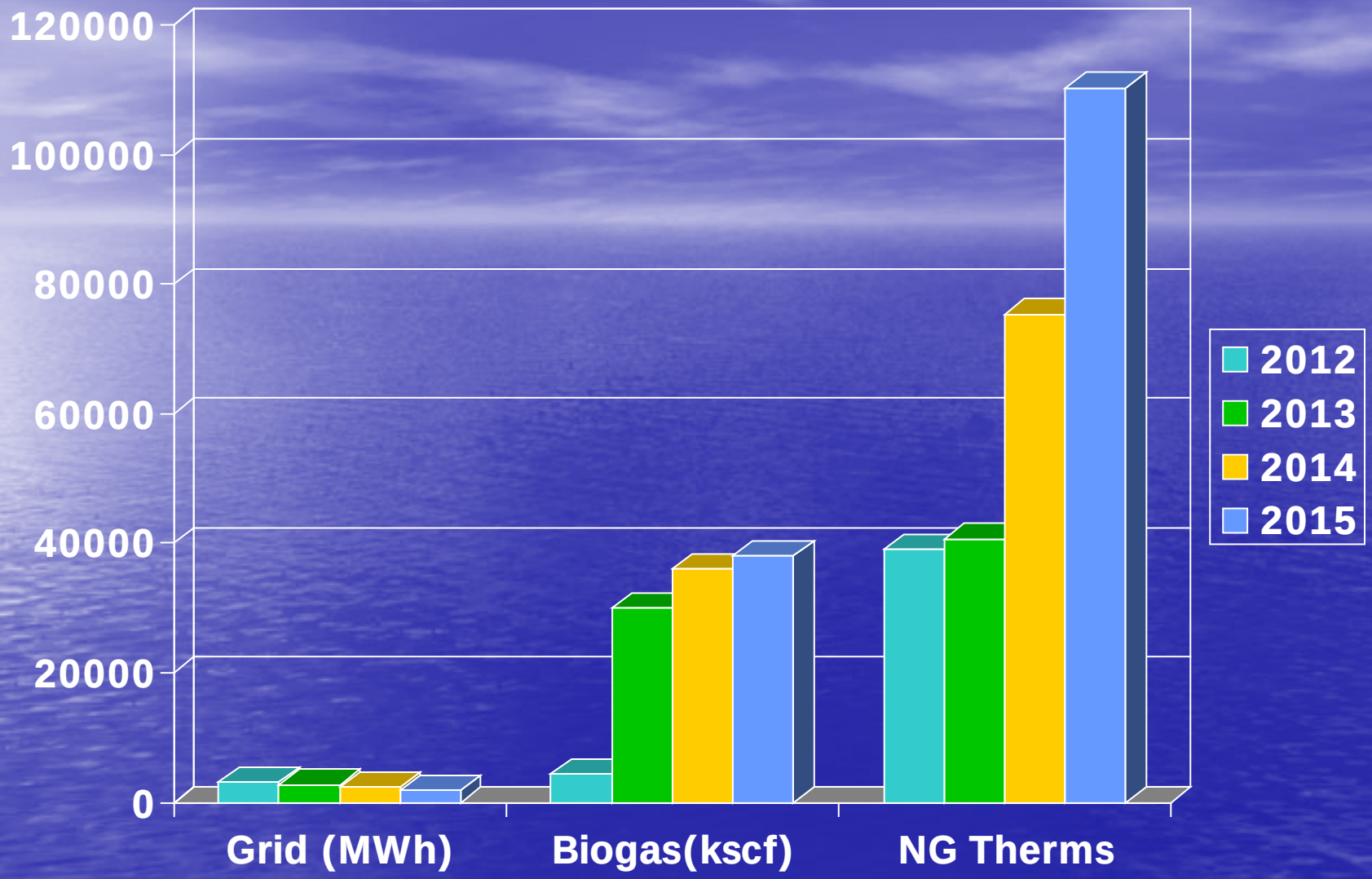
Ithaca Area WWTF Path to Community Energy

Discussion Topics

- What is energy intensity at a WWTF?
- Showcase Program – Aeration System Improvements
- Community Carbon to Energy
- Town\Gown Relationship
- Resiliency and the NY Prize

Energy Intensity

- Intensity Reduction versus Fuel Dependence
- Shifting load to biogas derived electric and heat
- Poor performance in reducing energy intensity – Natural Gas use increased
- Lots of external variables-Flows and Cold


120000
100000
80000
60000
40000
20000
0
Grid (MWh)
Biogas(kscf)
NG Therms
2012
2013
2014
2015

Why Increase?

- Increased heating space with new trucked residual disposal facility.
- Need to look at greater HVAC controls in new building.
- Turn off air circulation system during off hours
- Change location of thermostats
- Automatic turn off when doors open and close to admit customers

Why Increase II?

- New Digester mixing means more active volume to heat
- New trucked residual receiving center means increase in volume into digester to be heated
- 2015 winter coldest in several decades- February coldest ever

Showcase Project-Aeration

- Second only to pumping energy requirements for most suspended growth plants
- Old system used centrifugal blowers with no dissolved oxygen level controls
- Loaded vs Unloaded dissolved oxygen requirements very different
- Potential to reduce electrical requirements for aeration by 50%=125 Hp

Community Carbon to Energy

- Anaerobic Digesters coupled with a flexible trucked residuals receiving center provide foundation
- Work with local food processing companies to find carbon intensive residuals to feed digesters
- Examples include septage, grease, other plant biosolids,hydrolysate, glycol, still bottoms and other dairy residuals

Community Carbon to Energy

- Currently derive nearly 40% of biogas from trucked residuals
- Receive approximately 4 million gallons per year of trucked residuals
- Digesters still not fully loaded
- Other carbon sources still available for harvesting

Town/Gown and Community Energy

- Two Campuses are served by Ithaca Area WWTF- Ithaca College and Cornell University
- Both have food waste and other carbon intensive waste
- Energy to Lead Grant for $1million to process food waste and manure from Cornell in the works

Food Waste

- Cornell has over 900 tons of food waste
- Cornell has been collecting and composting for several years
- Contamination with non-digestible a problem
- Grant application would provide source separation and pulping to clean and process for the digester
- Biogas production would supply another 500,000 kWhrs per year

Manure

- On campus teaching dairy barn produces approximately 2million gallons per year
- Land spreading has become a problem
- Use of sand as bedding a problem for digesters
- Grant app would allow for the purchase of sand separation equipment
- Biogas produced could yield another 500,000 kWhrs

Energy Resiliency and the NY Prize

- Superstorm Sandy and Tropical Storms Irene and Lee devastated large parts of NYS
- Governor created NYSERDA program to utilize microgrid concepts to create more resiliency for critical facilities
- WWTF could serve as node for a local microgrid in Ithaca

NY Prize Feasibility Study

- Ithaca successful in obtaining $100k first phase one funding for feasibility study
- Results of study are promising
- Increase in biogas will drive new CHP
- Use of open space around plant can support around 430 kW of solar PV
- Grid connect is feasible and local utility, NYSEG, is supportive

NY Prize Phase 2

- Phase 2 will provide funding for detailed design with a 15% local match
- Details for the application are still pending
- Our project would provide electricity to schools, public works facilities, bus garage and other proximal customers
- Could lead to heating district or biosolids drying as well

Conclusions

- There is a nexus between our path to net zero and community energy
- DOE Better Plants drives us to be more holistic in our processing of data with regards to energy intensity
- Community carbon can improve Town/Gown relationships
- NY Prize creates greater grid resilience