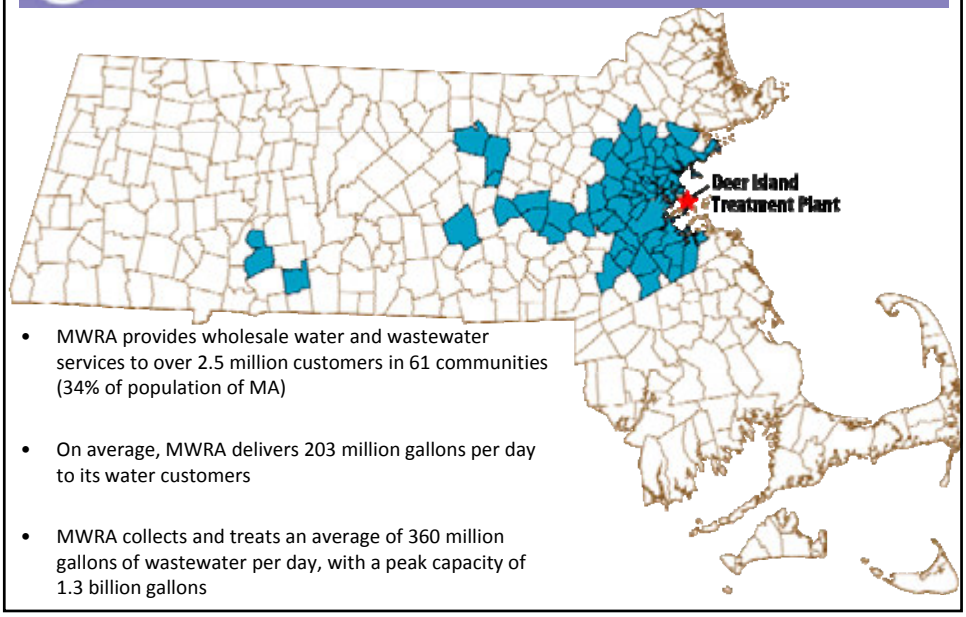
Massachusetts Water Resources Authority

Deer Island Treatment Plant

David F. Duest
Director, Wastewater Treatment

MWRA Service Area



- MWRA provides wholesale water and wastewater services to over 2.5 million customers in 61 communities (34% of population of MA)
- On average, MWRA delivers 203 million gallons per day to its water customers
- MWRA collects and treats an average of 360 million gallons of wastewater per day, with a peak capacity of 1.3 billion gallons

Deer Island Wastewater Treatment Plant

- Result of $3.8 Billion Construction Project
- 2nd Largest Wastewater Treatment Plant in the United States

Detroit	671 MGD/1600 MGD
MWRA/DITP	360 MGD / 1310 MGD
Stickney, Chicago, IL	750 MGD/1200 MGD
Blue Plains, DCWASA	370 MGD/1.076 BGD (advance/ nit/denit)

- Treatment Capacity:
  - Maximum
    - 1.3 Billion Gal/Day combined sewer system
    - Up to 700 MGD by Secondary Treatment
  - Average Daily Flow:
    - 360 Million Gal/Day
- Built on 210 Acres
  - includes 60 acres of public access area

The ultimate Recycling Facility:
Water – Cleaned and returned to Water Cycle
Solids removed -
Anaerobically Digested – Produce Heat & Power
Remaining Solids – converted to Fertilizer Pellet

Power is Critical to DITP Operations

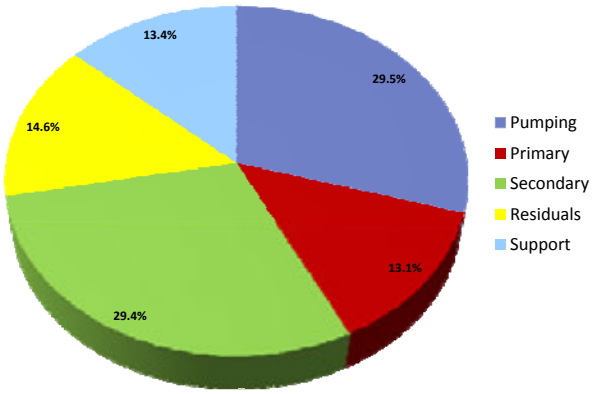
Pumping Operation & Secondary Treatment are the major electricity demands at Deer Island

Total energy demand

- **145M kWh/yr**

Total on-site generation:

- **44.2M kWh/yr** (30%)
- **41.0 M kWh Green** (28%)



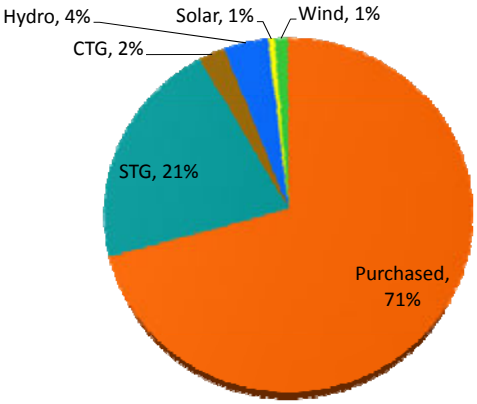
4

Renewable Energy At Deer Island

Digas/Steam – 20-22%, Hydro – 4%, Wind – 1.2%, Solar – 0.6%. Total Renewable – 26-28%

5

DITP – Green Energy Production (FY17)



Green Energy Assets:

- **Digas – STG/BPSTG – 32.4 M kWh**
- **Hydro Power – 5.9 M kWh**
- **Wind Power – 1.9 M kWh**
- **Solar – 0.85 M kWh**

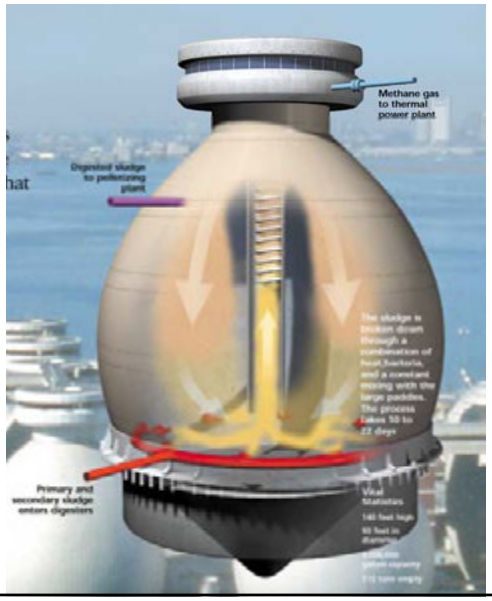
Maximizing On-Site Green Energy Production is a priority for MWRA

- 26-28% of DITP's total energy demand met by green energy
- 64% of DITP's energy needs (heat + power) met by Digester Gas

6

Renewable Energy at MWRA

Green Energy through Wastewater Treatment: Anaerobic Digestion



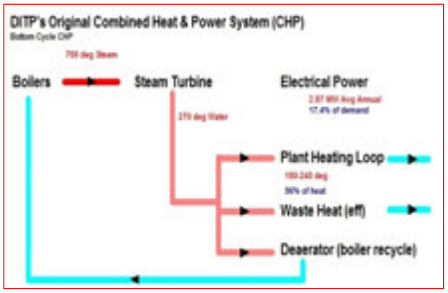
8

DITP – Digester Gas Generation & Use

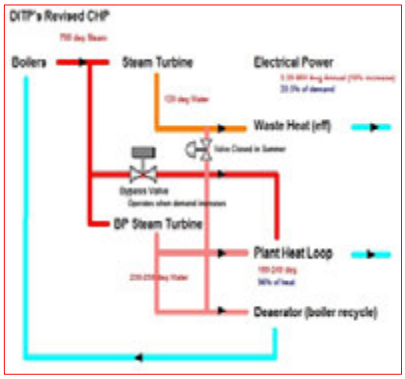
- Anaerobic Digestion:
  - 240 dtpd solid in, 100 dtpd to FRSA for pellet conversion
  - Digas - 188 kscfh generated on average @ 62-65% methane
- OSTPP: Bottom-Cycle Generation
  - Digas – 98+% utilized
  - 95+% of heat demand met by Digas (remainder by Fuel Oil, 250 Kgal)
  - 32.4 M kWh generation from Steam Turbine

9

Combined Heat & Power Process – Currently Used by DITP



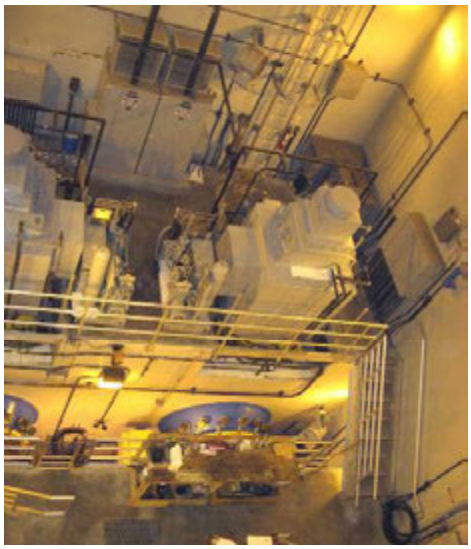
- **Bottom Cycle Generation**
  - Heat First – 60% efficient
    - Generate Steam then Hot Water
  - Power Second – 9% efficient
    - Generate Electricity from Steam
- New BPSTG / Steam Bypass Valve improves steam to electricity conversion process by extracting more heat per unit steam



10

Hydroelectric Power

- Energy Recovery from Plant Effluent
- Two 1 MW Hydroelectric Generators
- Electricity Production – 6M kWh/yr



11

Wind Turbines

- Two, 190-foot turbines installed in August 2009
  - Generate 1.9 million kWh per year
- Ogin Experimental 100 kW unit
  - Claim to be 33% more efficient than traditional turbines
  - Fully funded by Ogin
  - Engineering prototype

12

Solar Power

- 100 kW photovoltaic system completed in May 2008
- 180 kW photovoltaic system completed in February 2010
- Solar through Power Purchase Agreement partially funded through ARRA
  - Total Installation of PPA - 450kW
    - Grit roof – 220kW
    - Parking lot ground – 230kW



13

Operations / Process Control – EE Efforts

COMPLETED

- Main Pump Station Shaft Height Adjustments
  - No cost
  - 4.5M kWh/yr savings
- Lighting
  - Phases 1, 2, 4 (A, B), R/T, 5, 6 Exterior Roadway Phase 1-3
  - $2.2M total cost
  - $700k incentive provided
  - 3.5M kWh/yr savings



Operations / Process Control – EE Efforts

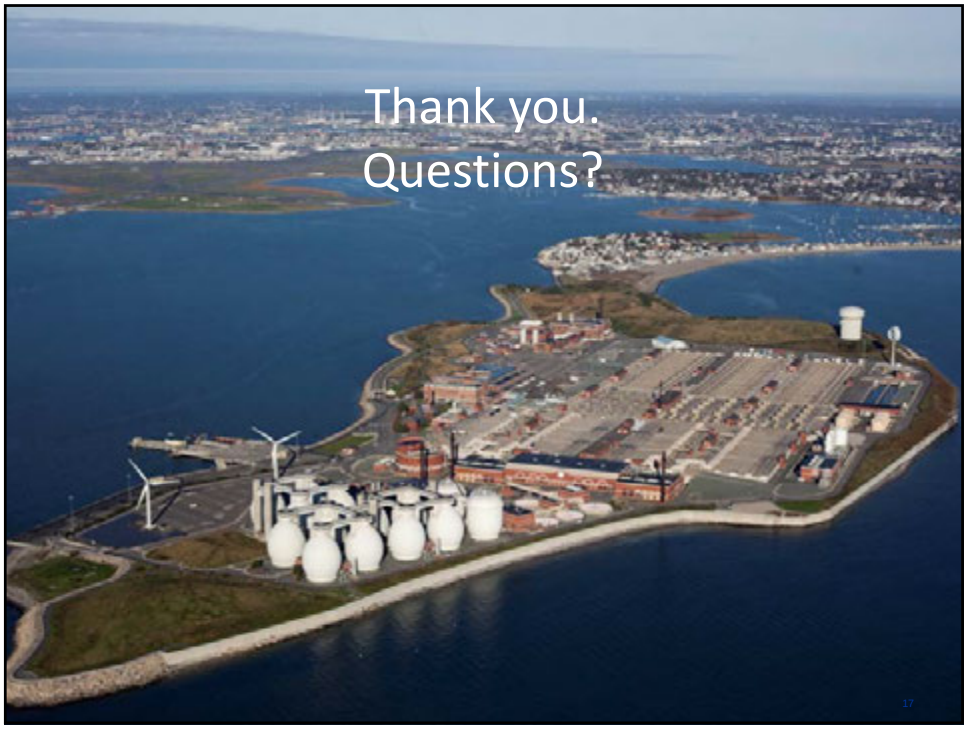
COMPLETED

- Secondary Optimization
  - Shut off last stage aerator
    - 3.4M kWh/yr savings (No cost)
  - DO Probe Installation/Reduction of Cold Box Operation
    - $234k total cost
    - $148k incentive provided
    - 3.5M kWh/yr savings
- Reduce Second Channel Blower Run Time
  - 320,550 kWh, $30k (no cost)
- Low Pressure Plant Water System Set point Adjustment
  - 158,250 kWh, $15k (no cost)
- Operate One Cooling Tower
  - 397,300 kWh, $37k (no cost)
- Second Digester Pump only in winter months
  - 525,600 kWh, $50k (no cost)

Operations / Process Control – EE Efforts

FUTURE

- More Lighting
- Secondary Optimization (completed in early FY17)
  - Installation of VFD's in Stage 5 & 6 reactors
    - 18 VFDs on 100 hp mixer motors – saving 3.4 MkWh annually
- Odor Control – fan controls
- Instrument Air Compressors
- More Water reduction / conservation efforts
- Pump Systems Optimization


Thank you.
Questions?