Co-Digestion at Deer Island Treatment Plant

David Duest
Dan O'Brien
MWRA
John F. Donovan
Eric Spargimino
CDM Smith

Presented at the Annual North East Residuals and Biosolids Conference

Concord, New Hampshire

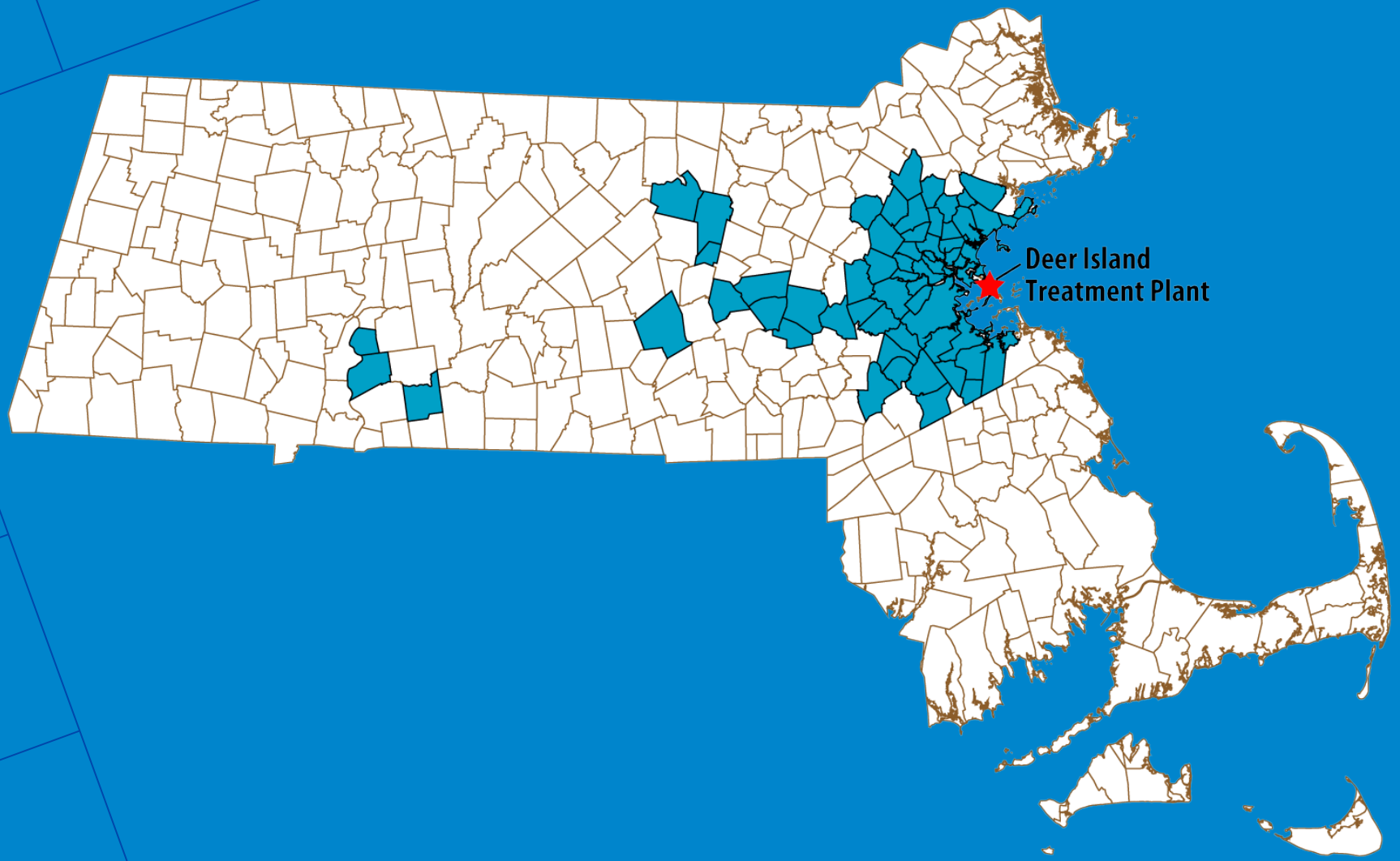
October 29-30, 2013

CDM Smith

Presentation Outline

- Introduction to the Massachusetts Water Resources Authority
- Description of Current Residuals Processing Facilities
- Co-Digestion Feasibility Study Results
- Co-Digestion Impact to Combined Heat and Power
- Deer Island Co-Digestion Pilot Program Status
- Summary

MWRA Service Area



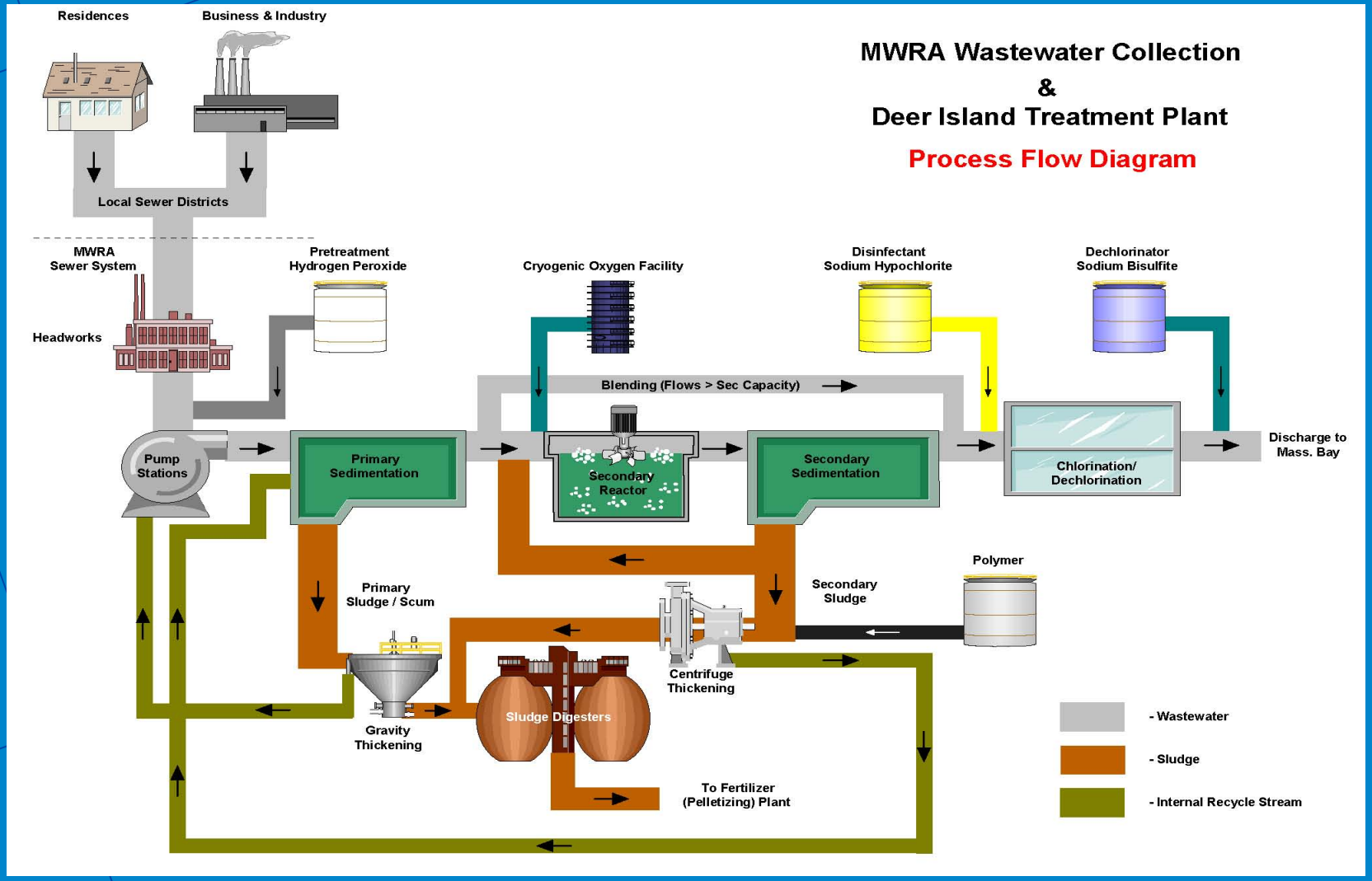
An Environmental Success Story

- In 2001, $3.8 billion Boston Harbor Project was completed
- Second largest wastewater treatment plant in the country
- Average daily flow of 365 million gallons –
  peak capacity 1.3 billion gallons
- Treated wastewater is discharged 9.5 miles out into the deeper waters of Mass. Bay

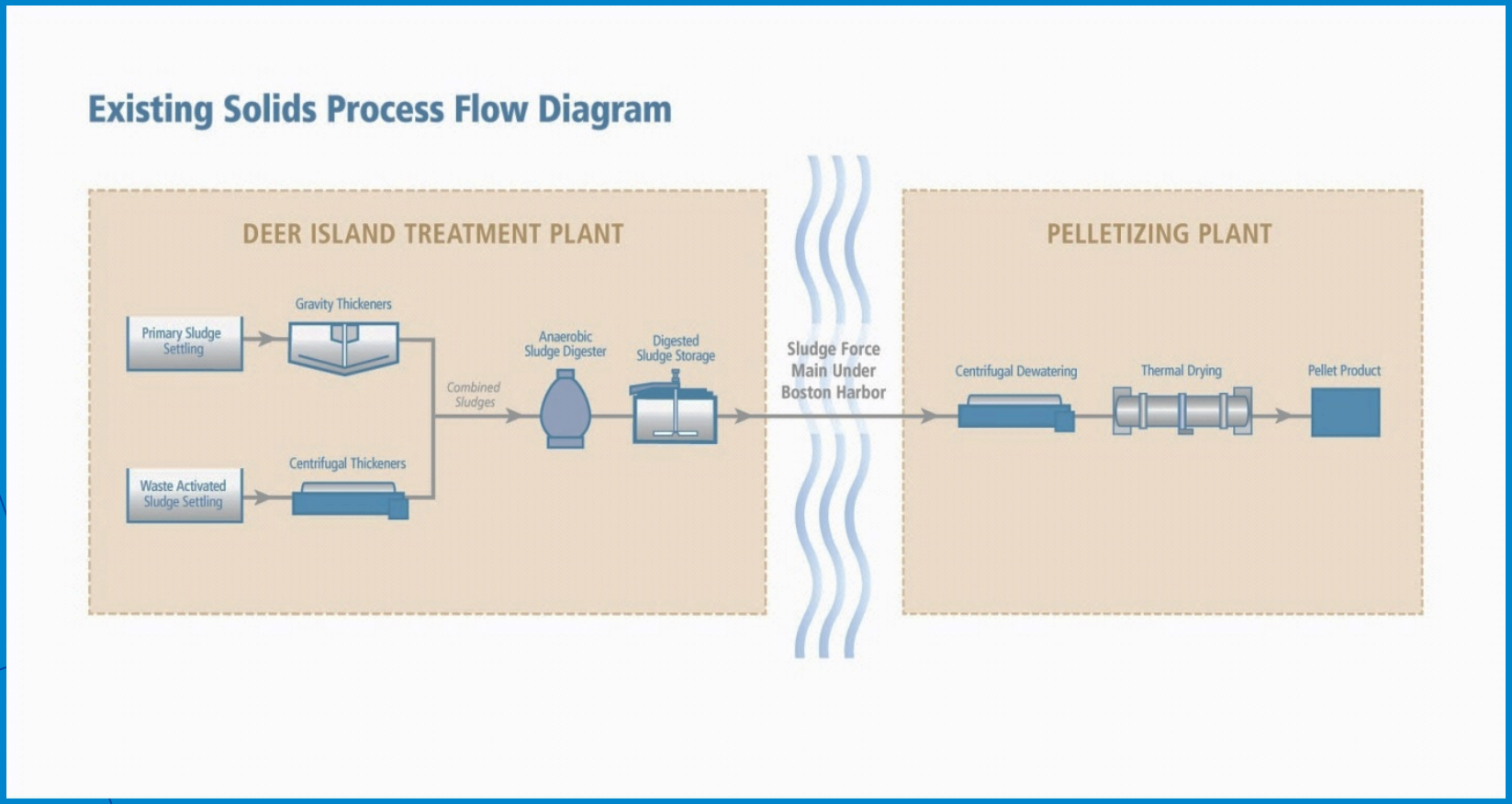
Recycling Residuals

- Deer Island Treatment Plant: Removes 90+% solids & organics
- End Result: Class A Fertilizer & Renewable Fuel for Energy Recovery

Treatment Processes



Residuals Processing – Schematic Overview



Deer Island Treatment Plant – Residuals Processing

Residuals Processing Performance – Deer Island

- Sludge to Digestion – 246 dry TPD
  - 70% by weight scum and primary sludge after gravity thickening
  - 30% by weight waste activated sludge after centrifuge thickening
- Twelve egg-shaped digesters (3 MG each)
- Eight currently in use with 21 day detention time
- Approximately 60 percent VSR

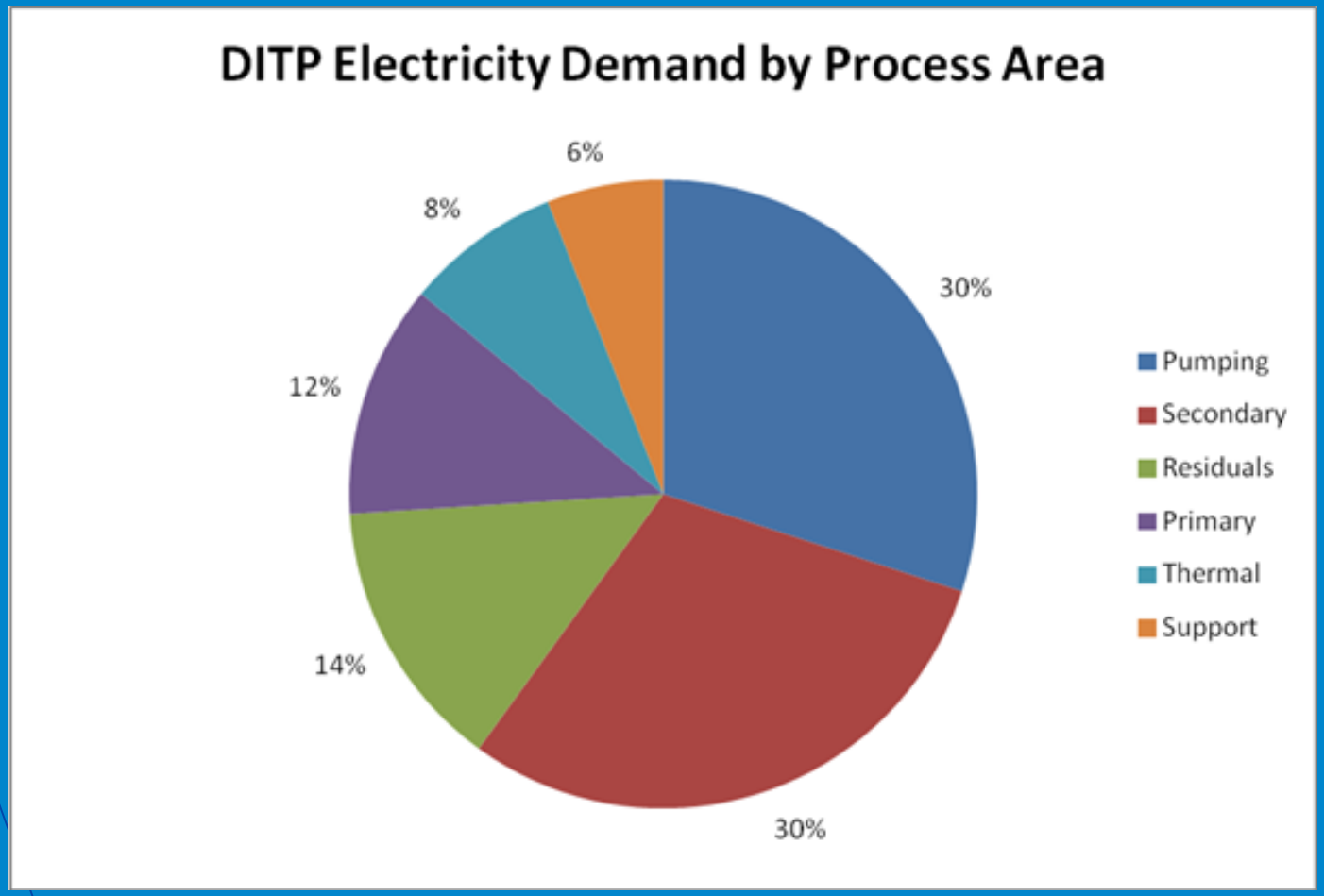
Residuals Processing Performance – Deer Island

- Biogas Production Approximately 190,000 scf per hour
- Greater than 97% Biogas Use in Boilers with Steam Turbine Generators for Power Production
- Meets 98% of Plant Heating Requirements
- Value of Biogas to MWRA:
  - $15-20 million per year as heat
  - $3 million per year as power

Residuals Processing Performance – Pellet Plant

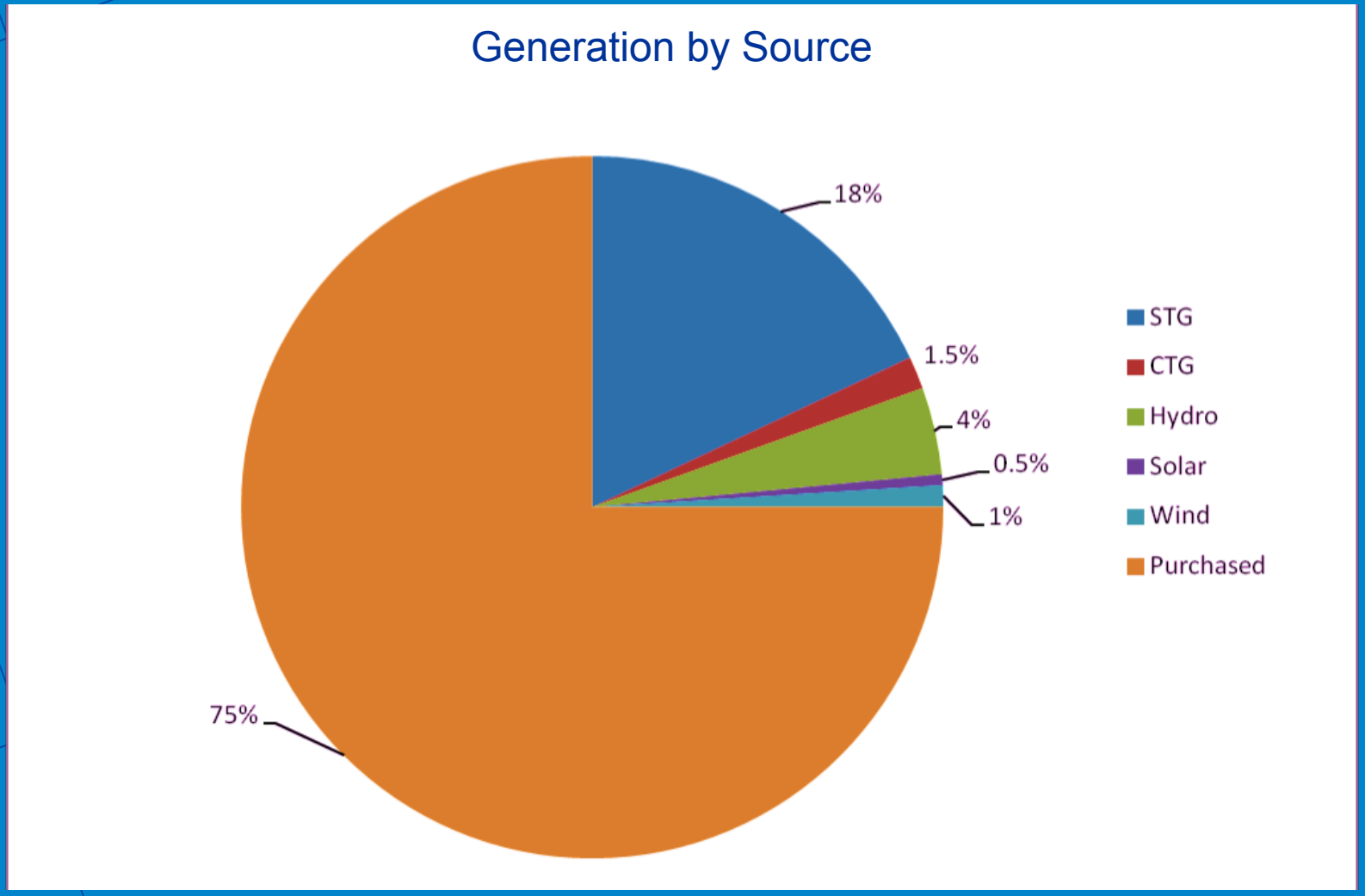
- Digested Sludge Pumped 7 Miles to Dewatering and Thermal Drying Facilities (106 dry TPD)
- Centrifuge Dewatering to 27% Solids
- Thermal Drying in Rotary Drum Dryers to Produce 95% Solids Class A Pellet Product
- Pellet Nutrient Content: 4-3-0 (N-P-K), Slow Release Fertilizer
- 100% Beneficial Use Including
  - Turf Farms
  - Golf Courses
  - Fertilizer Blenders
  - Cement Kiln
- All Offsite Processing and Marketing by Contract Operator: NEFCO

DITP Electrical Demand (~17MW)



Deer Island Wind and Solar Projects

DITP Electrical Generation



Co-Digestion Feasibility Study

- Types of Organic Wastes
  - Fats, Oils, Greases (FOG)
  - Source Separated Organic Food Wastes (SSO)
  - Industrial Organics (Baking, Brewing, Dairy, Bottling)
- MADEP Initiative
  - Will ban SSOs from Landfills and Waste to Energy Facilities
  - Encouraging Diversion to Anaerobic Digesters
- Laboratory Study UMass/Amherst
- Pilot Study at Deer Island

Food Wastes Have Many Times the Biogas Potential as Wastewater Biosolids

	Biosolids	Food Wastes
Gallons/d	10,000	10,000
Percent Solids	5	13
Volatile Solids	75	85
VS Converted	55 - 65	82 - 88
Biogas Yield (CF/lb)	15	13.5
Biogas Volume (CF/d)	26,000	102,000
mmbtu/d	14	56
kWh/y	600,000	2,300,000

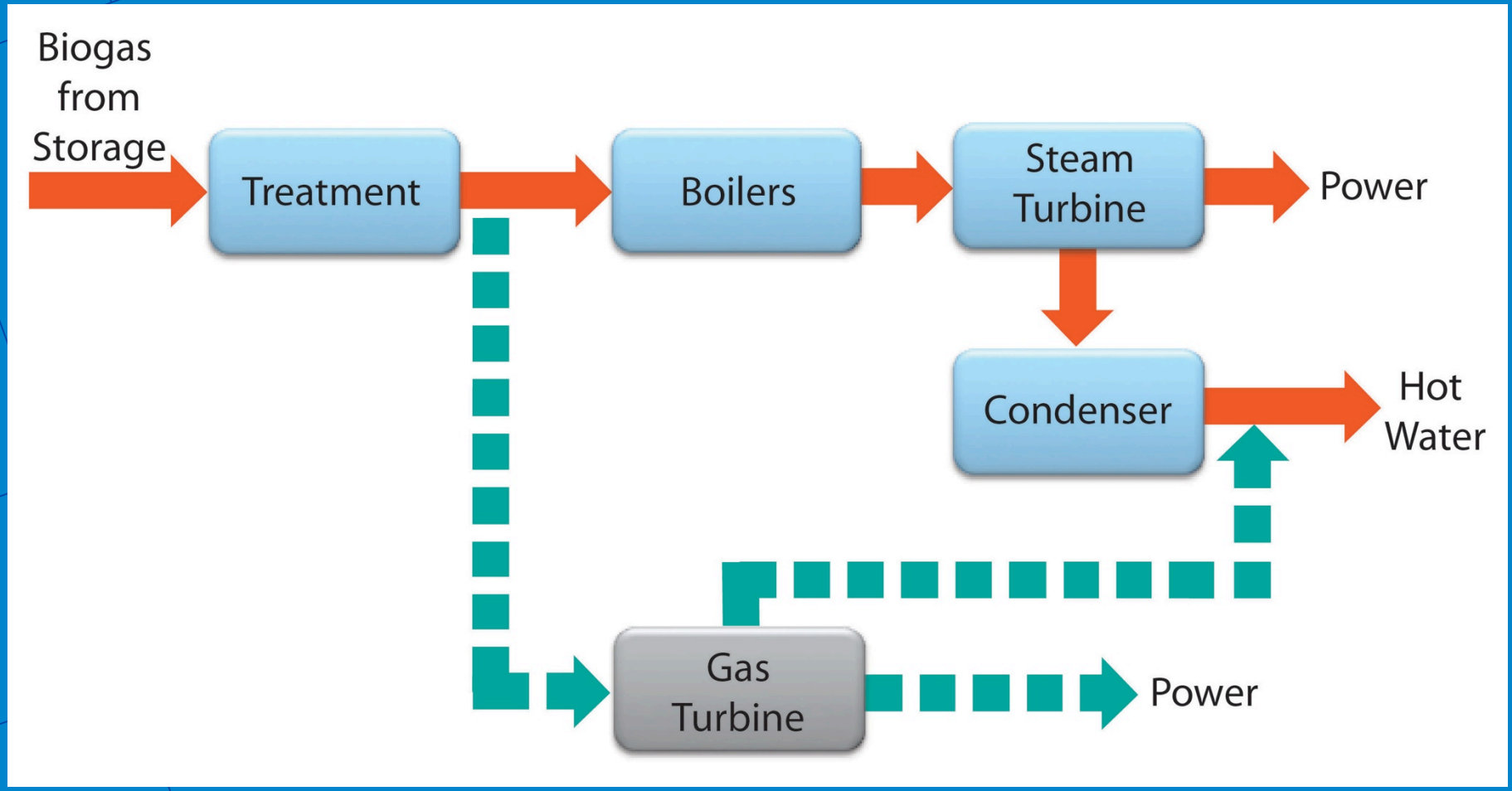
Co-Digestion Process Performance

Category	Pilot Scale	Full Scale
Digester Feed		
Sludge gal/day	1,140,000	1,140,000
Food Waste gal/day	36,000	120,000
wet tons/day	150	500
Total	1,176,000	1,260,000
Percent Increase	3	11
Biogas Production		
Sludge (SCFH)	187,000	187,000
Sludge Plus Food Wastes (SCFH)	202,000 – 220,000	238,000 – 255,000
Percent Increase	8 - 18	27 - 36

Estimate of Food Waste Tipping Fee

Category	Cost
Capital Costs	$21,000,000
Operation and Maintenance Costs	$2,830,000
Total Annual Costs	$4,200,000
Value of Additional Biogas	$2,630,000
Net	$<1,570,000>
Break Even Fee	
$/wet ton	$9
$/gallon	$0.04

Deer Island Combined Heat and Power Plant



Pilot Program Status

- Schedule

  RFQ/P – 7/31/2013

  Proposals – 9/13/2013

  Board Authorization – 10/16/2013

  Startup – 6/2/2014

- Capital Improvements

  On-Island – MWRA

  Off-Island – Waste Management/Save That Stuff

- Year 1 Operational Plan

  First SSO to one digester, then to two digesters.

  SSO quantities ramp up from 12,000 to 36,000 gpd.

Presentation Summary

- MWRA operates one of the most successful biosolids management programs in the U.S.
- Biosolids Pellet Product 100% Beneficial Use and Nearly 100% Utilization of Biogas.
- Co-Digestion of Biogas and Food Wastes is Technically and Economically Feasible.
- The Authority may undertake large-scale co-digestion with food wastes and other organics pending pilot testing.