



Massachusetts Water Resources Authority

*Presentation to the*  
**Wastewater Advisory Committee**

***MWRA's Renewable and  
Sustainable Energy Initiatives***

*Kristen Patneaude*  
***Program Manager, Energy Management***  
February 5, 2010



## Leading By Example

- As a leading environmental agency, MWRA has been striving to meet the goals established in Governor Patrick's Executive Order 484 (April 2007).
- Goals include:
  - Overall Reduction of Energy Consumption
  - Increase Renewable On-site Energy Production
  - Purchase of Renewable Energy
- Governor Patrick visit to Deer Island in August 2009:  
***"No state agency is leading by example better than the MWRA"***





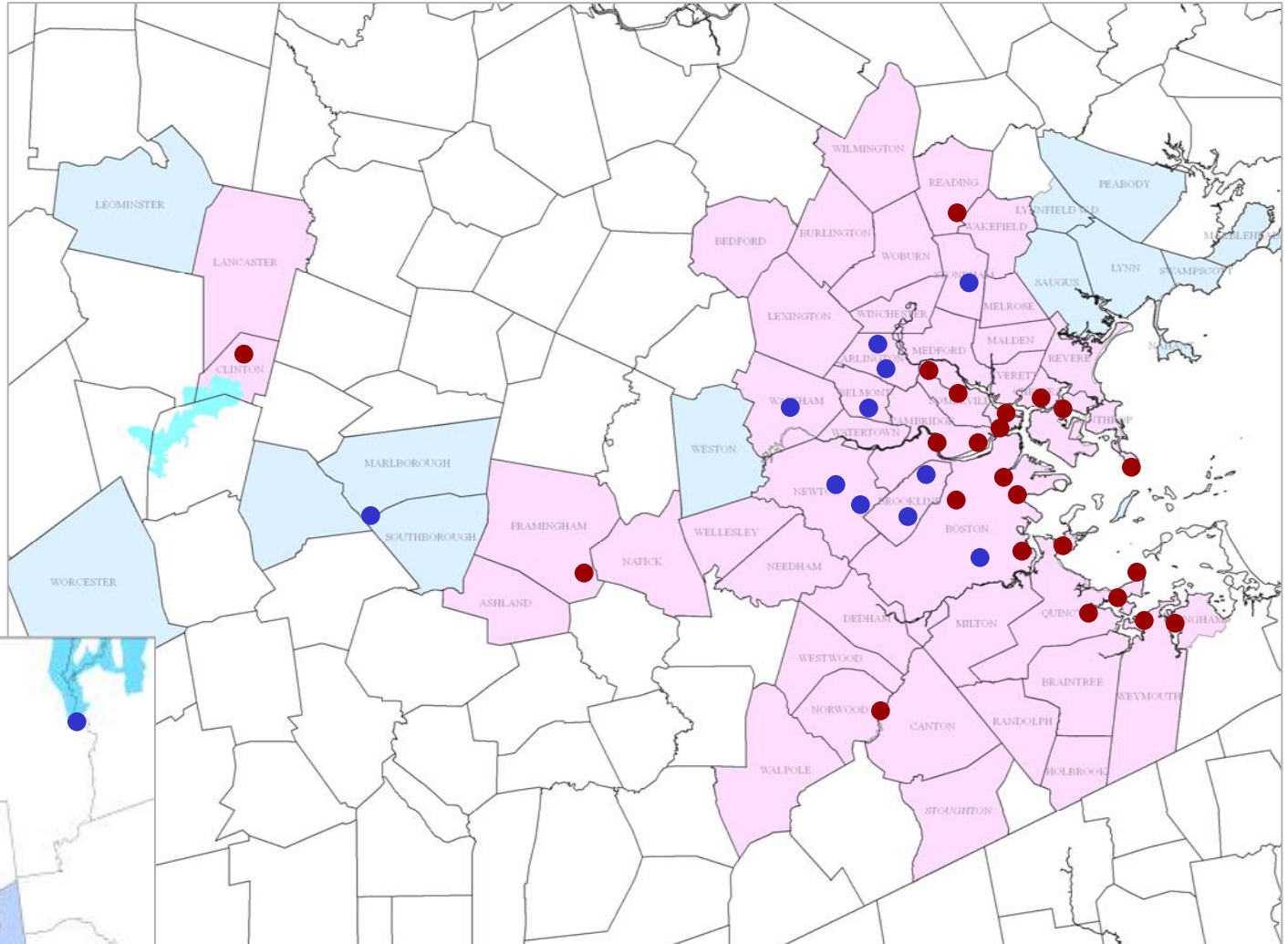
# MWRA Facilities

## Wastewater

- 2 Treatment Plants
- 12 Pump Stations
- 4 Headworks
- 5 CSO Facilities

## Water

- 2 Treatment Plants
- 10 Pump Stations





## MWRA Energy Usage

- MWRA's total energy cost for FY2009 was \$22.5 million
  - MWRA's total electricity cost for FY09 was \$19.7 million and accounts for nearly 87% of all utilities (not including water)
- MWRA's total energy budget is 11% of total CEB budget
- Energy includes electricity, diesel, and natural gas
- Deer Island accounts for 62% of MWRA's energy budget
  - Deer Island electricity demand accounts for over 70% of MWRA's electricity budget



## Self-Generated Renewable Energy

- MWRA self-generated over 40% of it's energy needs in FY09
  - Digester gas heat supply
  - Digester gas STG electricity
  - Hydro electricity
  - Wind
  - Solar
- MWRA self-generated over 18% of it's electricity needs in FY09
  - Or 23% of Deer Island electricity needs



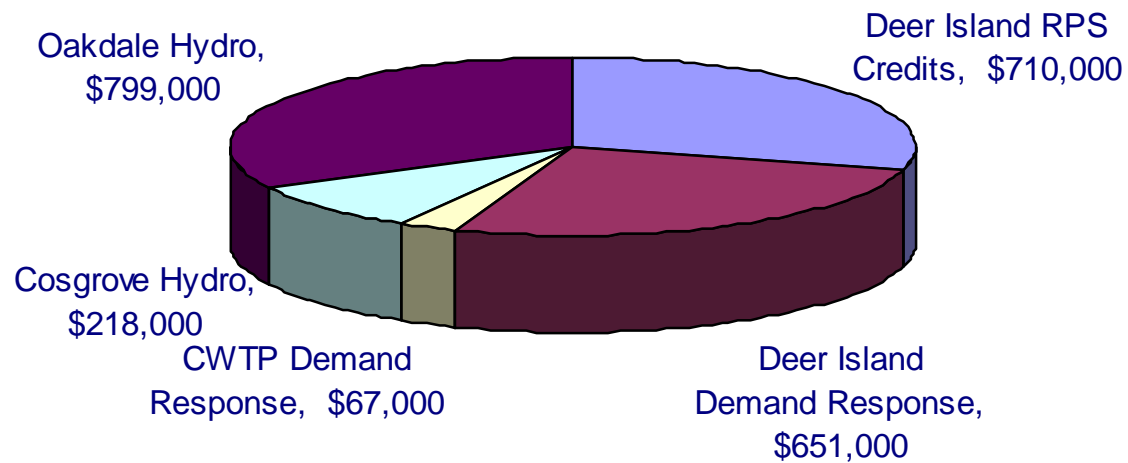
## Deer Island Electricity

- 24% of Deer Island CEB
- 88% of Utilities (electricity, fuel oil, water)
- \$12M/yr
- Total Plant Demand – 18 MW
- Total on Site Generation – 4 MW
  - STG, CTG, Hydro, Solar, Wind
- Competitive Electricity Supply Contract (since 2001)
  - (TransCanada, Constellation NewEnergy, Hess Corporation)



## Non-rate Revenues

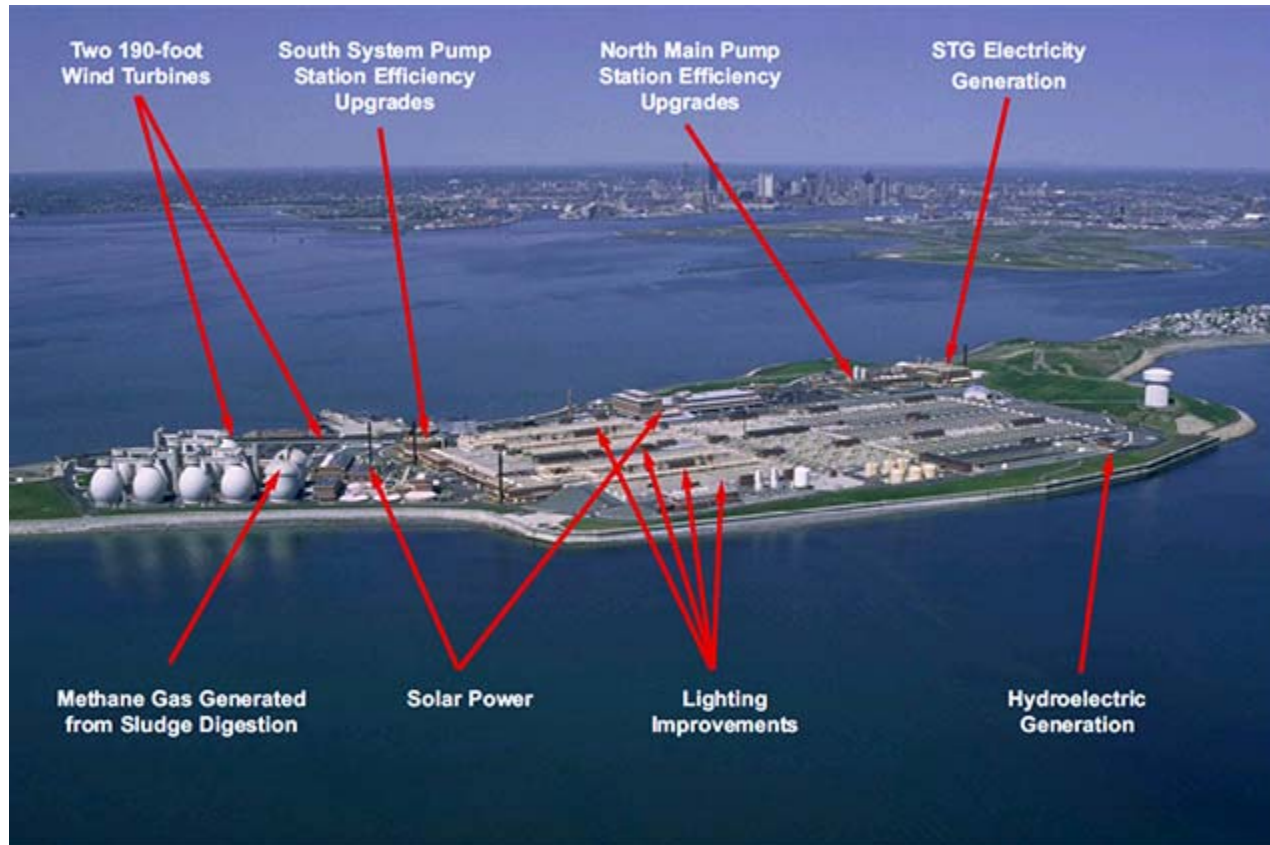
- MWRA generated \$2.4 million from energy sources in FY09





## Renewable Energy at Deer Island

- Deer Island currently self-generates over 23% of its electricity needs and more than half of the Island's energy demand is provided by on-site, renewable generation – with more to come







## Digester Gas

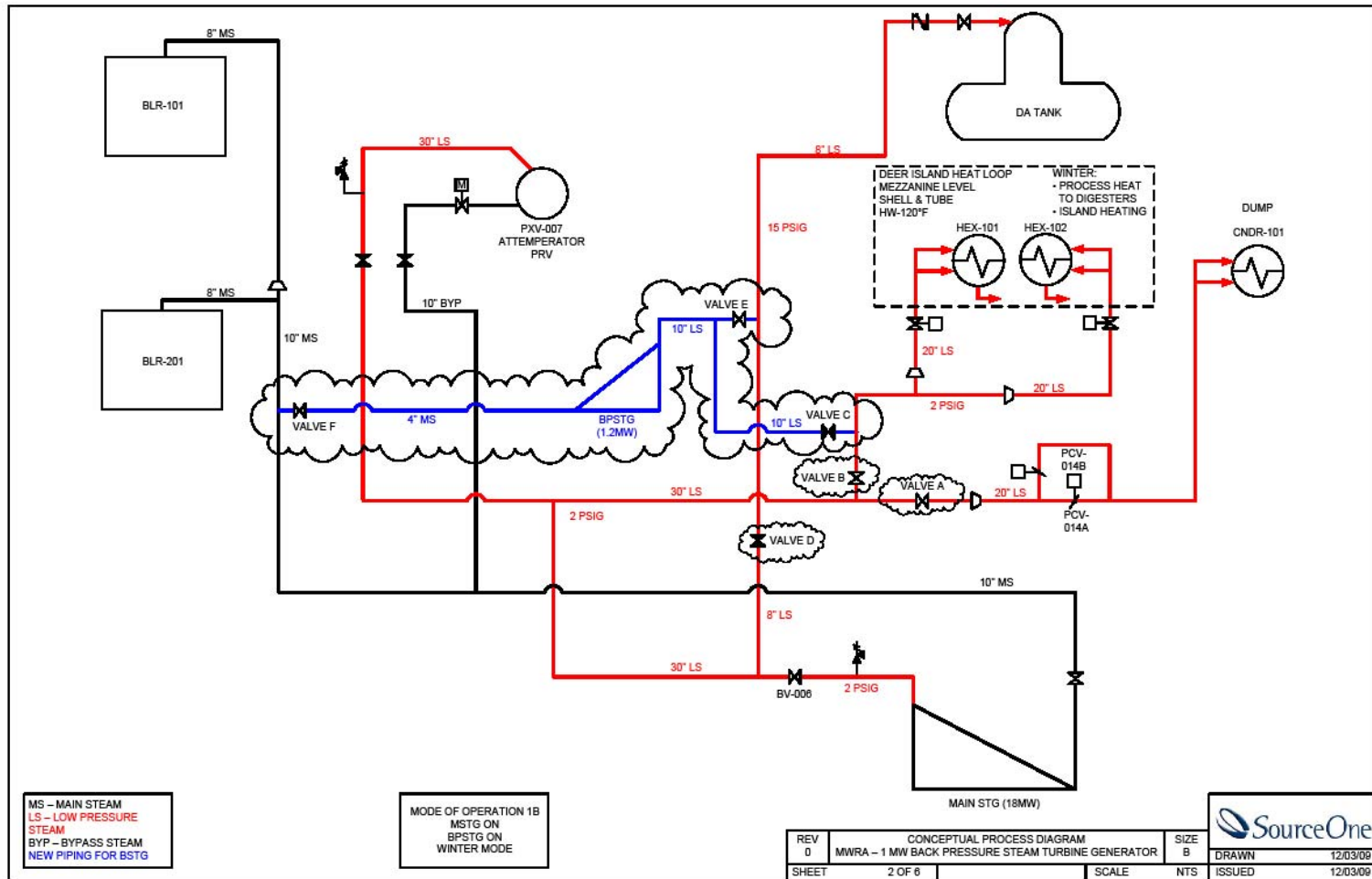
- Current Utilization 98%
- Thermal Value
  - 5 MG (\$10-15M/yr)
- Electricity Production
  - 28M kWh/yr (\$2.8M/yr)
- MA RPS - Renewable Energy Certificates
  - > \$500k/yr





# Methane Utilization: Steam Turbine Generator Upgrade

- Will produce an additional 5 million kWh per year





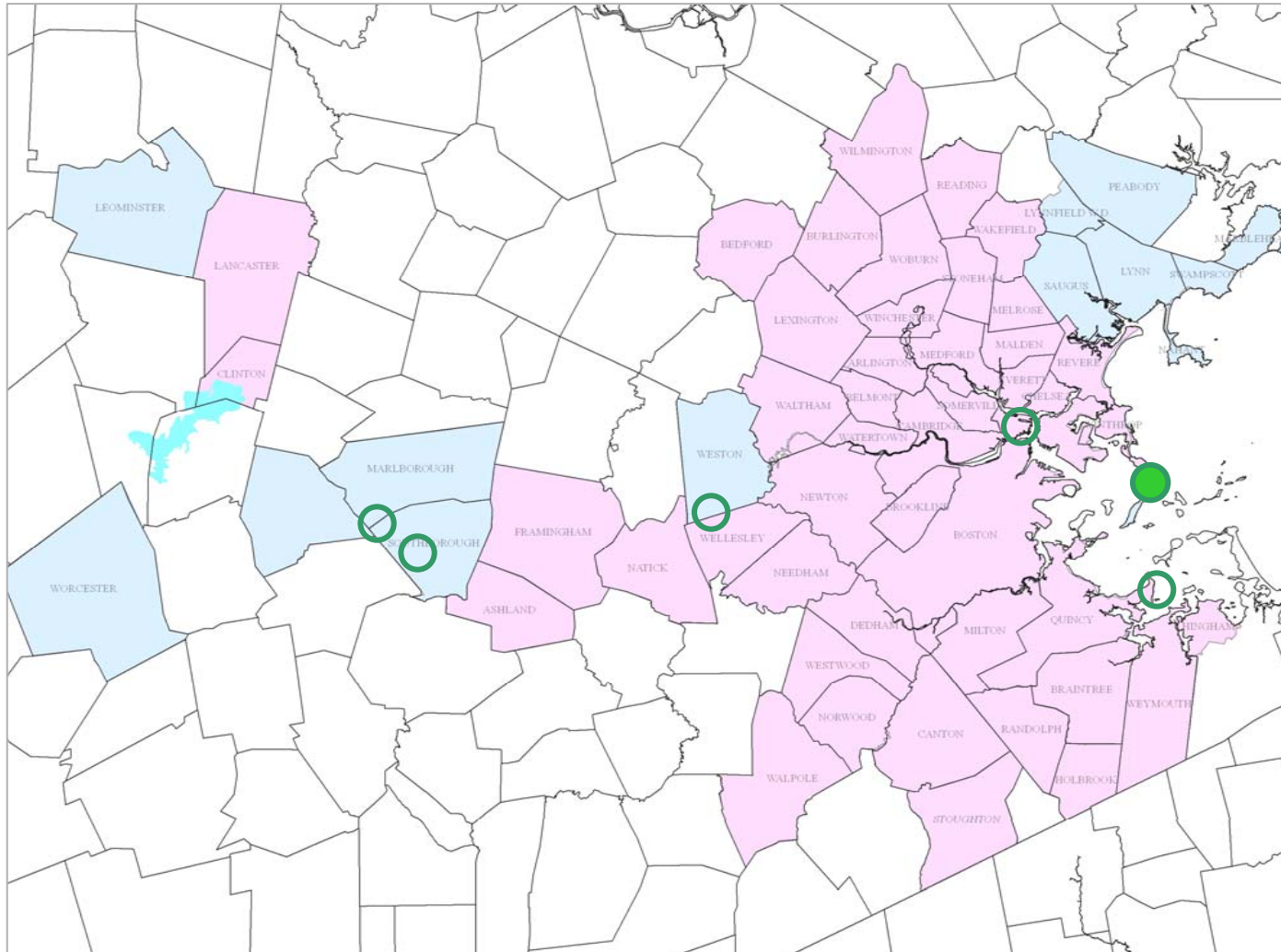
## Methane Utilization: Clinton Wastewater Treatment Plant

- 70% of the plant's heat needs are currently met by burning methane





# Wind Power





## Wind Power: Deer Island

- FAA Approval 190 ft
- Design-Build Contract Award
  - October 2008
- \$4M Total Cost
  - \$400k MTC grant
- Projected 2.3M kWh/yr (\$230k/yr)
- Plans for Additional Turbines





## Wind Power: DeLauri Pump Station, Charlestown

- 1.5 MW turbine
- Will generate 3 million kWh/yr
- 20% consumed by pump station, remainder net-metered to other MWRA electricity accounts
- Electricity savings of \$350,000/yr
- Fully funded through ARRA for total of \$4.7M
- Design/build contract awarded in December 2009
- Turbine height:
  - 230 ft top of tower
  - 364 ft tip of blade
- Power produced equivalent to 300 homes





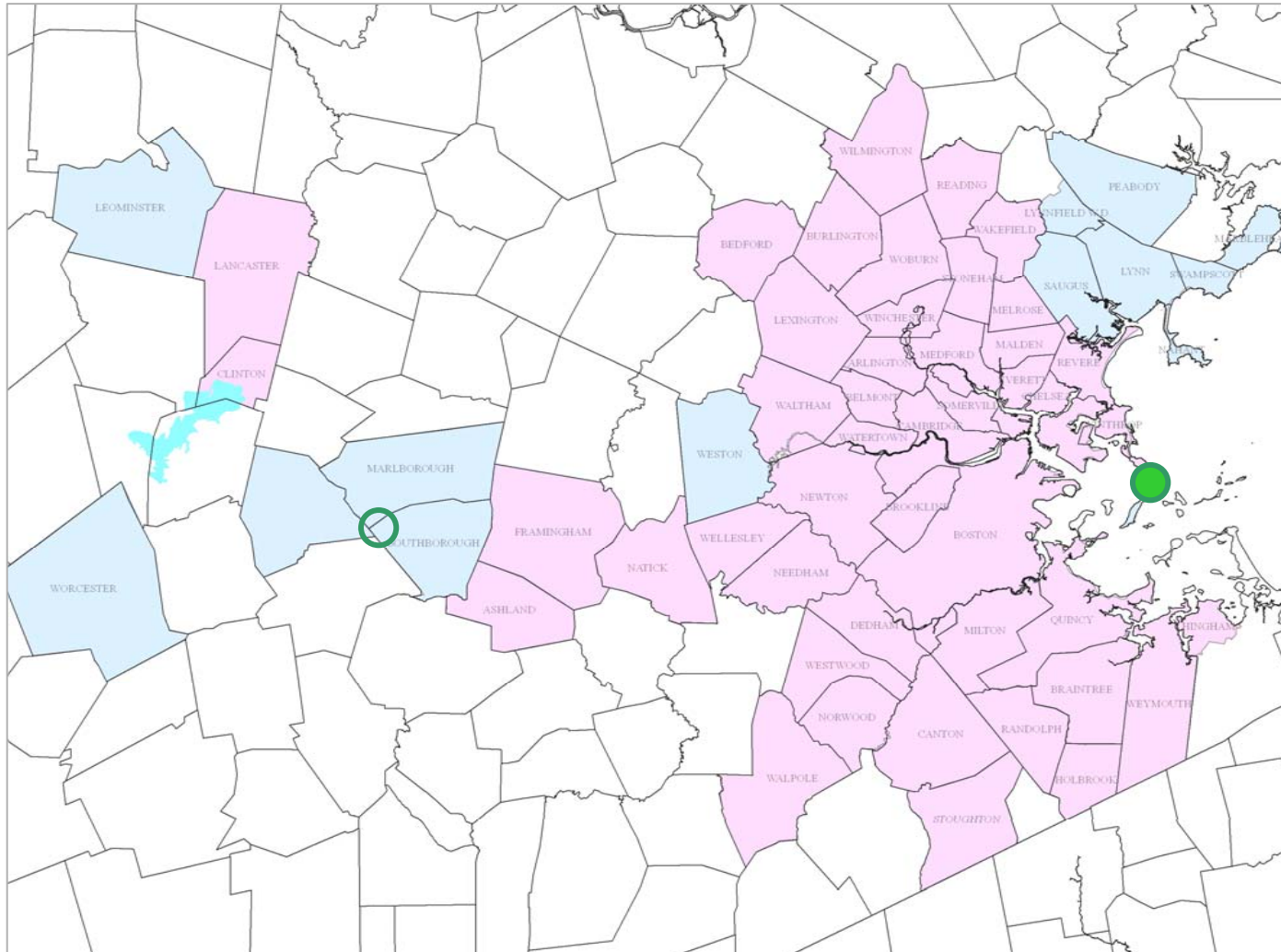
## Wind Power: Nut Island Headworks, Quincy

- 1.0 to 1.5 MW turbine
- Will generate 3 million kWh/yr
- 70% consumed by facility, remainder net-metered to other MWRA electricity accounts
- \$500,000 grant from MTC
- Electricity savings of \$400,000/yr
- FAA Height approval of 328 ft
- Discussions with community ongoing





# Solar Power







## Solar Power: DI Residuals/Odor Control Roof

- Design-Build Contract Award  
- September 2007 – 100kW
- Commissioned May 2008
- \$560k DOER grant; \$310k CREB loan
- Electricity production 110,000 kWh/yr (\$10k/yr)





## Solar Power: DI Maintenance/Warehouse Roof

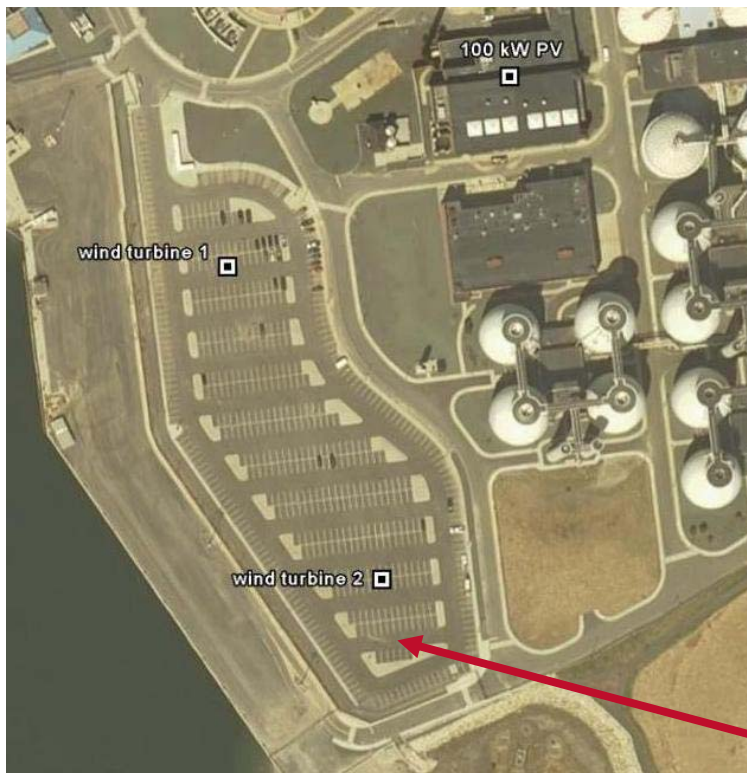
- Recent Award Design-Build Contract – 180kW
- Projected Production 174,000 kWh/yr (\$17k/yr)
- Total Project Cost - \$1.1M
- Partial Funding – American Recovery & Reinvestment Act  
- State Revolving Fund (\$735k)





## Solar Power: DI Power Purchase Agreement

- Proposed Solar Power Purchase Agreement
- Total Installation of 455kW
  - Grit roof – 250kW
  - Disinfection roof – 25kW
  - Parking lot ground – 180kW



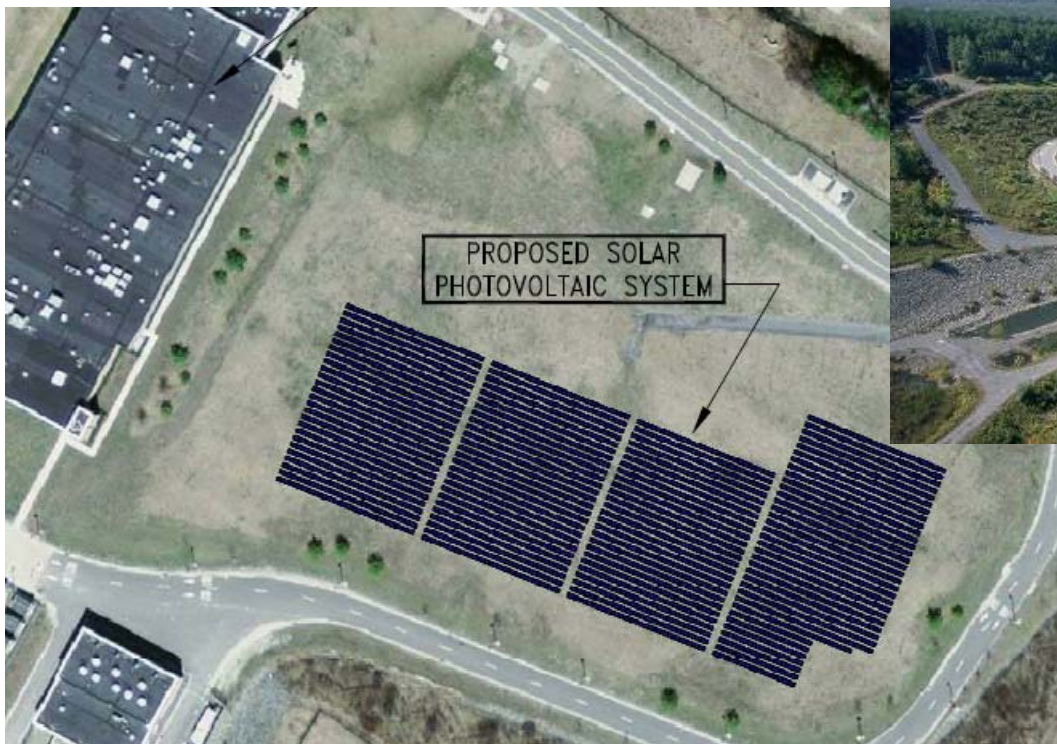
Grit Roof

Parking Lot



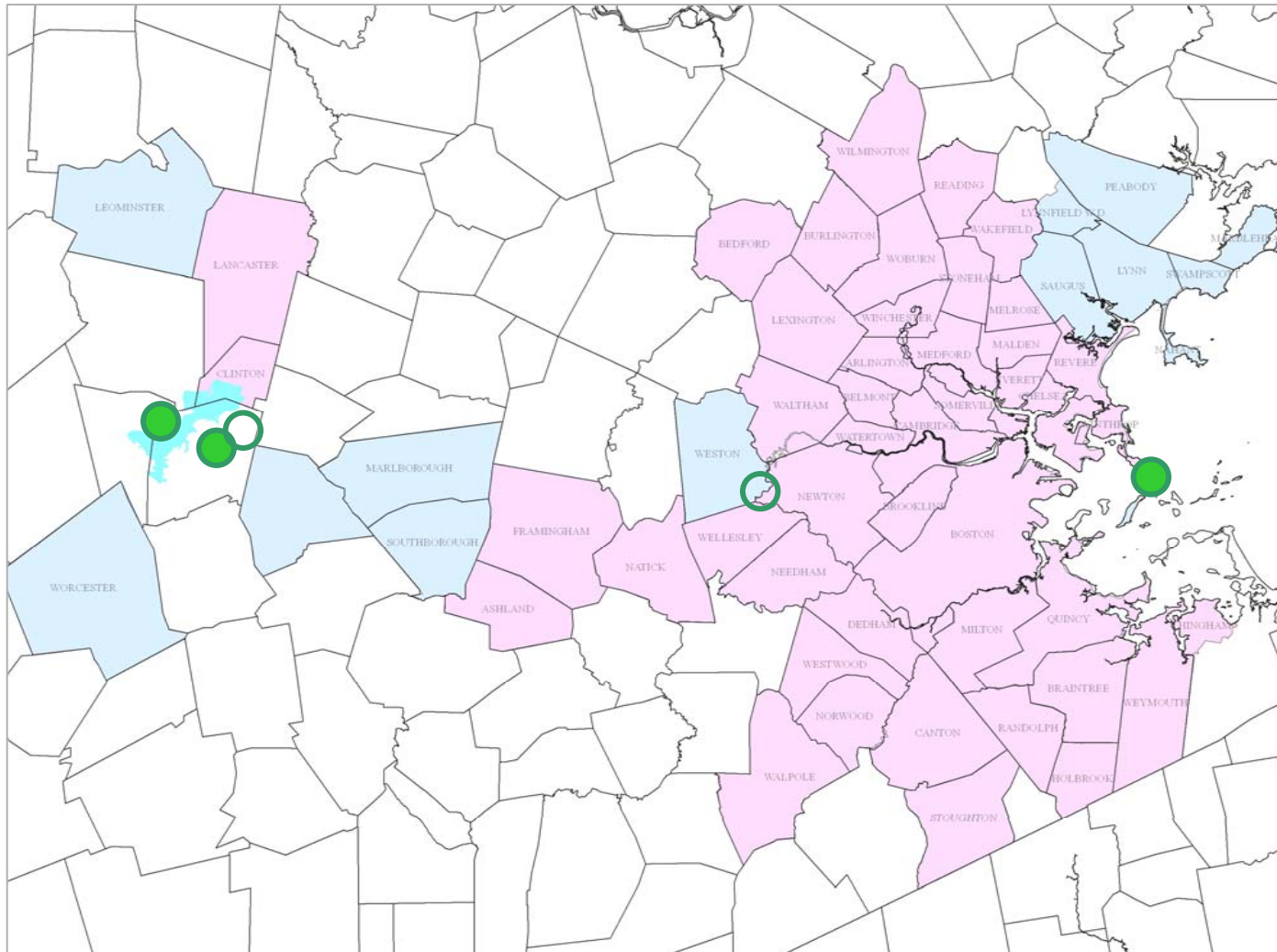
## Solar Power: Carroll Water Treatment Plant, Marlborough

- 496kW ground mount system will generate 616,000 kWh/yr
- Fully funded through ARRA for total project cost of \$2.19M
- Contract awarded in December 2009





# Hydroelectric Power





## Hydroelectric Power: Deer Island

- Energy Recovery from Plant Effluent
- Two 1 MW Hydroelectric Generators
- Electricity Production – 5.9M kWh/yr (\$590k/yr)
- MA RPS - Renewable Energy Certificates
  - Projected ~ \$150k/yr





## Hydroelectric Power: Oakdale Power Station

- Hydroelectric generator produced 9.2 million kWh in FY09
- Revenue for FY09 was \$799,000





## Hydroelectric Power: Cosgrove Intake

- Hydroelectric generator produced 4.4 million kWh in FY09
- Revenue for FY09 was \$218,225







## Hydroelectric Power: Loring Road Covered Storage, Weston

- Will generate 1.2 million kWh/yr
- Almost completely funded through American Recovery and Reinvestment Act (ARRA) and Massachusetts Technology Collaborative
- Construction contract awarded in December 2009





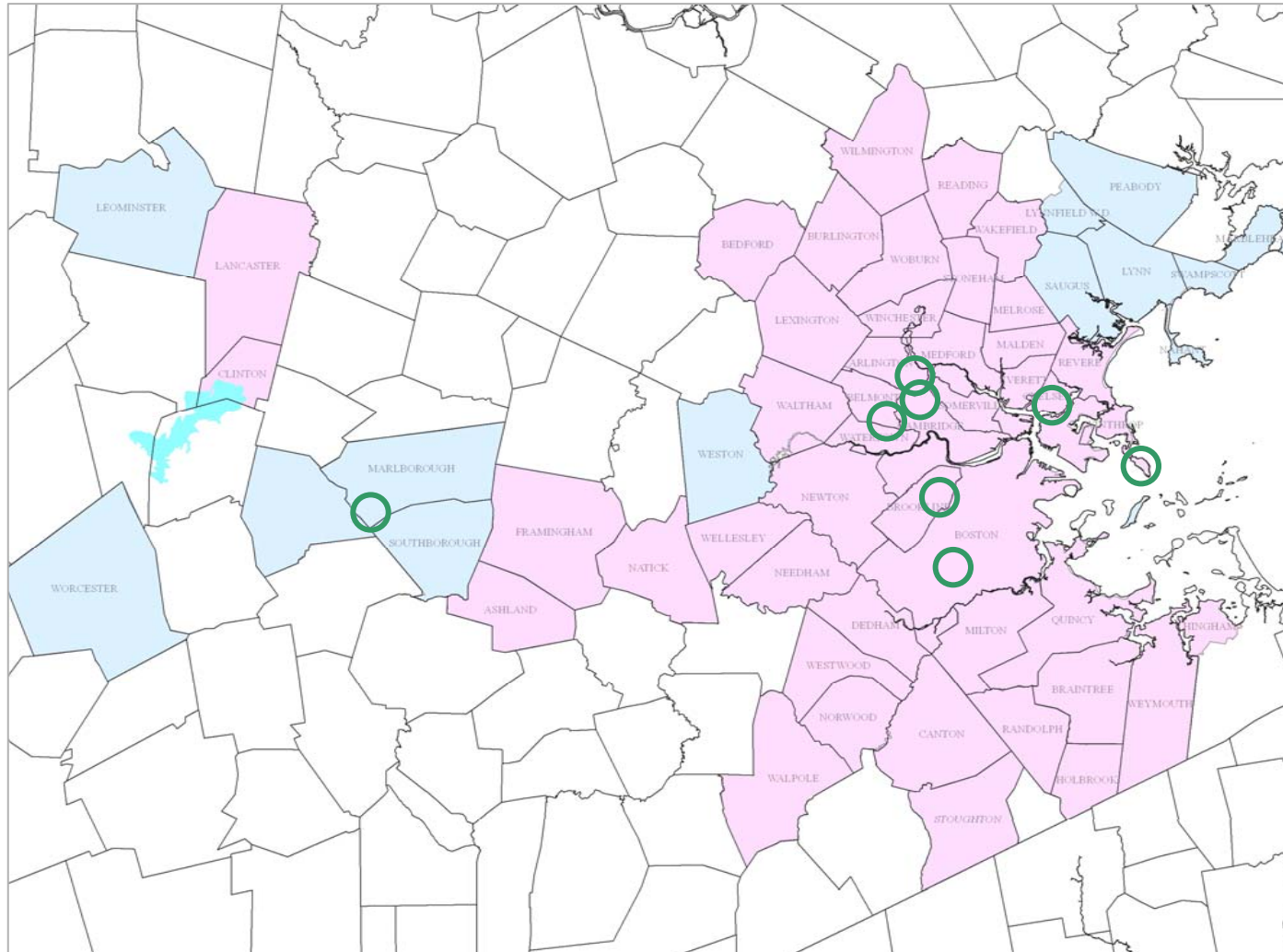
## Hydroelectric Power: Wachusett Dam

- Feasibility study completed for 150kW hydropower turbine (projected 750,000 kWh/yr generation)
- Received design & construction grant of \$375k from MTC in 2009





# Energy Efficiency Projects





## Pump Station Efficiency Upgrades: Deer Island

- South Main Pump Station (8 – 1250 Hp motors)
- North Main Pump Station (10 – 3500 Hp motors)
- Replacement of VFDs (\$150k/yr savings)
- Shaft Level Adjustments (\$300k/yr savings)





## Lighting Improvements: Deer Island

- Multi-phase Program
- Replacement of Lamps, Ballasts, Exit signs
- Integrated Day Lighting and Motion Sensors
- Lighting Controls
- Total savings approximately \$350,000 per year
- Payback 2-3 yrs





## Equipment Upgrades: Rehab of Water Pump Stations

- New VFDs, motors and pumps at 6 water pump stations
- Three stations have been completed (Belmont, Brattle Ct. & Newton St.)
- Will decrease energy use. At Brattle Ct., kWh usage per million gallons pumped has been reduced by 55% when VFD in use
- Eligible for \$190,000 in rebates





## Energy Audits

- Energy audits (lighting and HVAC) have been completed at 13 facilities and recommendations are being implemented at the following locations:
  - Carroll Water Treatment Plant
  - Chelsea Facility
  - Southborough Facility
  - and a number of headworks, pump stations
- Future energy audits of motors and drives planned



## Energy Audits: Carroll Water Treatment Plant

- Recommendation to turn off soda ash mixers resulted in \$200,000/yr savings
- Lighting improvement complete (\$56,000/yr savings)
- Staff evaluating other recommendations from audit including VFDs on pumps and demand controlled ventilation for office space.







## Energy Audits: Chelsea Facility

- NSTAR energy audit completed; recommendations to be implemented in 2 phases:
  - Lighting improvements completed (\$29,000/yr savings)
  - HVAC audit completed. Recommendations to install an energy management system. NSTAR to provide \$169,000 rebate and project expected to save 600,000 kWh annually (\$100,000/yr)





## Energy Audits: Southborough Facility

- Energy audit completed in 2009.
- Recommendations include upgrade to energy efficient lighting, HVAC improvements, and VFD installation. Staff reviewing recommendations.





## Fleet Optimization

- Of the 378 vehicles, 249 are powered by alternative fuel:
  - 195 Biodiesel
  - 33 Hybrid
  - 12 Flex Fuel
  - 2 Propane
- 15 larger vehicles have been retrofitted to remove 50% of emissions
- Electric Vehicles are used on Deer Island and at Carroll Water Treatment Plant





## Green Computing

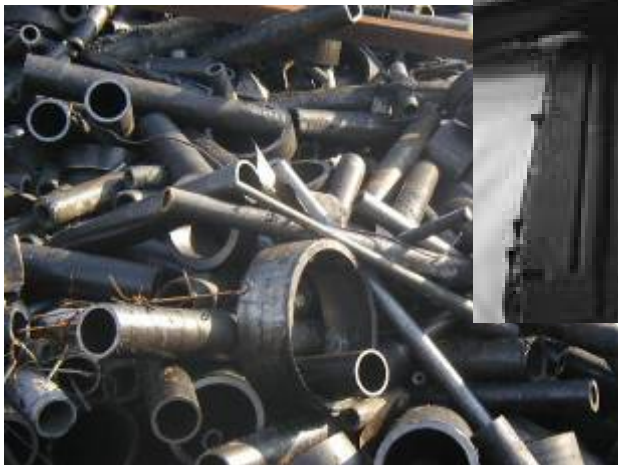
- All new PCs and laptops are Energy Star compliant
- 500 monitors replaced with energy-efficient flat panels
- Energy monitoring software installed to automatically put PCs to sleep when inactive





# Recycling

- MWRA recycles:
  - Paper and cardboard
  - Waste oil
  - Scrap metal
  - Toner cartridges



**MWRA Recycles**  
CNY Facility  
Recycling Locations & Tips

**Mixed Paper**

- White and colored paper
- Fax, photocopy or printer paper
- Laser printer paper

**Cardboard**

- Corrugated boxes
- Cardboard or paper packing materials
- Chipboard boxes (cereal boxes)

**Chelsea Facility**  
Recycling Locations & Tips  
What and How to Recycle

**Mixed Paper\***

- White and colored paper
- Fax, photocopy or printer paper
- Office and plotter paper
- Composition paper
- Computer paper
- Brown craft paper
- Manila & colored folders
- Brown paper bags (not food use)
- Newspapers (including inserts)
- Catalogs and brochures
- Pamphlets and manuals
- Soft cover books, workbooks
- Hardcover books (cover removed)
- Telephone books
- Real estate books
- Junk mail and envelopes
- Magazines

**Batteries**

Recycle your old **Alkaline** and **Lead Acid** batteries with Fast Services and other batteries with the Warehouse

**Cardboard\***

Corrugated boxes  
Cardboard or paper packing materials  
Chipboard boxes (cereal boxes, etc.)

**"How?"**

Break down and flatten boxes, bring to the mixed paper recycle container or drop off at the warehouse.

**Other Warehouse Items**

- Light Bulbs
- Thermometer Lamps
- Urinals
- Gas Cylinders (if empty only)
- Toner Cartridges
- Printers, fax and copier cartridges

**Waste Oil\***

**"How?"**

- Use Fast Services
- Bring to the Warehouse
- Label containers
- Complete Tracking Form
- Call (914) 425-1100 or (914) 425-1101
- 1 Drum/Kit at a Time

**Notes:** Do not recycle in the Recycling Container - Fax, Soft cover books, Hard cover books, Real estate books, Junk mail and envelopes.

For more information, contact: Chelsea (914) 425-1100 or Chelsea (914) 425-1101

**Logos in % used and from**

**Information contact:**  
914 425-1100  
914 425-1101



# Deer Island Wind Turbine Installation

