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Water & Energy
In Maryland
2010 Water Resources Symposium
hosted by the Maryland Water Resources Research Center
at the University of Maryland, College Park
on Thursday, Oct. 28, 2010

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(all contact information current as of Oct. 2010)
Powering Treatment Plants with Sun and Wind: Sustainability Practices at WSSC

Water and Energy in Maryland
MWRRC Fall 2010 Symposium

Rob Taylor
Energy Manager
WSSC Service Area
(Maryland)

- (2) Water Treatment Plants
- (5) Wastewater Treatment Plants
- (12) Water Pumping Stations
- (50) Wastewater Pumping Stations
- (10) Field Offices/Lab/HQ

- Serves population of 1.8 million
- Serves Montgomery and Prince George's Counties
- Provides 170 MGD drinking water
- Collects 200 MGD wastewater
- Treats 70 MGD wastewater
- Supplies DC Water with 130 MGD wastewater

Serves Montgomery and Prince George's Counties
Provides 170 MGD drinking water
Collects 200 MGD wastewater
Treats 70 MGD wastewater
Supplies DC Water with 130 MGD wastewater
## WSSC Energy Costs - FY’10

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<th>Fuel</th>
<th>Cost</th>
<th>%</th>
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<td>Electricity</td>
<td>$27,338,000</td>
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<td>Natural Gas</td>
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<td>Diesel, F.O. #2, Propane</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$28,187,000</strong></td>
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Energy is approximately 5% of WSSC’s annual operating cost.
“Meeting the present needs without compromising those of future generations.”

- World Commission on Environment and Development - 1987

- Same or improved level of service sustained into the future with minimal environmental impacts and involving conservation of resources.
provide safe and reliable water to a growing customer base.

- Return clean water to the environment.

Minimize energy consumption/GHG emissions.

Maximize utilization of renewable energy.

Maximize energy (and residuals recovery) from Wastewater Treatment Plants.

Be an asset to the community.
Achieving the Triple Bottom Line

- Sustainability
- Cost Savings
- Benefit-Cost Ratio
- Process Efficiency
- Productivity
- Financial Risk
- Rates

- Water Quality
- GHG Emissions
- Local Air Quality
- Green Buildings

- Community relations
- Odor & Noise Control
- Worker Health & Safety
- Aesthetics
Fuel Mix of PJM Generation - 1/1/10

- Coal, 66,600 MW, 40%
- Natural Gas, 47,005 MW, 28%
- Nuclear, 31,185 MW, 19%
- Diesel, 5,400 MW, 3%
- Solid Waste, 1,952 MW, 1%
- Oil, 6,093 MW, 4%
- Hydro, 7,768 MW, 5%
- Wind, 298 MW, 0%
Fuel Production - Carbon vs. Water

Source: Global Energy: Unshackling Carbon from Water (Lux Research webinar, September, 2009)
Electricity Production - Carbon vs. Water

Source: Global Energy: Unshackling Carbon from Water (Lux Research webinar, September, 2009)
Renewable Energy Initiatives - Wind
Hedge future fossil fuel generation cost increases by buying **physical** wind power (at a fixed price).

Buy from wind farm located within **Appalachian air shed** to reduce coal power plant emissions and improve local air quality.

Own environmental attributes (Renewable Energy Credits - RECs) **at no extra cost**.
Wind Farm began production April 2008.

No capital investment; power purchase only.

Annual wind purchase = 33% of total WSSC consumption.

WSSC supplements wind with conventional (brown) power block purchases.

WSSC receives 85% of 29.4 MW wind farm.

Fixed price for 10 yrs. (generation).

RECs included in price.
WSSC: Producing Water Through Wind Power
Edison Mission: Wholesale/Wind Farm
29.4 MW Capacity
Allegheny Plateau

Somerset County, PA
Pennsylvania

Constellation Energy
Retail Licensed Power Supplier

Maryland

Mid-Atlantic Interstate Transmission Power Grid

Baltimore, MD

BG&E and PEPCO:
Electric Distribution Companies

Washington Suburban Sanitary Commission

...drinking water and sewer services to Prince George's County and Montgomery County, Maryland...
Environmental Benefits (GHG)

- Reduction of:
  - CO2: 83,700,000 lbs/yr.
  - SO2: 583,000 lbs/yr.
  - NOx: 188,000 lbs/yr. (precursor to ozone)

= 10,000 cars off the road
- **Blades**: 141 ft. long
- **Tower (Hub)**: 262’ high
- **Max Output**: 15 mph wind speed
- **Shutoff**: 50 mph wind speed
- **Max Blade Tip Speed**: 158 mph
Forward Wind Farm
Somerset County, PA (March 2008)
Direct Wind is Variable, Contingent

Forward Wind Farm Total kWh Output
(WSSC takes 85%)

Maximum Daily kWh = 705,600 kWh

WSSC Maximum Daily kWh = 599,760

FY’10

Washington Suburban Sanitary Commission
Renewable Energy Initiatives- Solar

Planning Stage
Western Branch WWTP Solar Ground Area Available
Western Branch WWTP Solar Ground Area

4 to 5 acres available = 1 MW
Seneca WWTP Solar Ground Area

Over 17 acres available
Roles of SPPA Participants

Utility
- Continues providing regular kWh service
- Provides PV interconnection to grid
- Interfaces with Service Provider and Host in case of service interruption
- Provides net metering credit to Host customer (when excess PV power is produced)

Host
- Receives solar power from on-site system under long-term PPA
- Provides space and access but does not own array
- No capital required

Solar Services Provider
- Arranges financing, design and construction
- Processes all incentives
- Ensures system monitoring and meets production goals
- Sells SRECs
- May sell Wind RECs to Host

Special Purpose Entity
- Receives income from PV electricity sales
- Legal entity to distribute tax benefits, depreciation, ownership and leasing between Service Provider and Investors
- Host signs contracts with the Special Purpose Entity

Manufacturer
- Receives revenue from sale of panels, inverters
- Provides equipment warranties

Installer
- May be owned/operated by Services Provider
- Installs PV project
- Often also maintains project under contract to Special Purpose Entity

Investor
- Receives low-risk return on investment from electricity sales and from state & federal incentives
- Provides capital and owns system for 5 or more years
- Lender contributes financing for construction and operation of the PV project

DC to AC loss (usually 90%).

Solar Degradation (1% per year).

Low Load Factor (17% in MD area).

Unpredictable Output.

Reliability Risk: interface with existing electrical equipment.

Net Metering: installed capacity limited to 2 MW.
### Solar PV Project- Seneca WWTP

<table>
<thead>
<tr>
<th>Installed Capacity</th>
<th>2,000 kW</th>
<th>WSSC Owned (20 yr), 17% LF</th>
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<td>Grant (10%)</td>
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<td>WSSC Net Capital Cost</td>
<td>$14,400,000</td>
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<tr>
<td>% of ACP Value</td>
<td>75% ACP= Alternative Compliance Payment</td>
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<tr>
<td>Cost of Capital (Bond)</td>
<td>1%</td>
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<td>Annual Energy Production</td>
<td>2,978,400 kWh</td>
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<td>Electricity Escalation Rate</td>
<td>5% per yr. (start yr 4)</td>
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<td>Maint. Escalation Rate</td>
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<td>Solar Cell Degradation Factor</td>
<td>1% per yr.</td>
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<td>Solar System Output kWh/Yr.</td>
<td>REC Sales/Yr.</td>
<td>Avoided Unit Cost $/kWh Brown to Solar</td>
<td>Avoided Cost/Yr.-Brown to Solar</td>
<td>Total Net Savings/Yr.-Brown to Solar</td>
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**Total Net Savings:** $1,611,000
Seneca Solar PV - PPA 20 Yr Cash Flow
(17% Load Factor)

Total Net Savings = $1.6 MM

Year

- (P&I)/Yr.
- REC Sales/Yr.
- Maint. $/Yr.
- Avoided Cost/Yr. - Brown to Solar
- Total Net Savings/Yr. Brown to Solar
### Renewable Energy Impact on Energy Costs

<table>
<thead>
<tr>
<th>Renewable Technology</th>
<th>Savings/Yr. (1st yr)</th>
<th>Actual or Estimated</th>
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<tbody>
<tr>
<td>Hydro</td>
<td>$220,000</td>
<td>Actual</td>
</tr>
<tr>
<td>Wind</td>
<td>$700,000</td>
<td>Actual</td>
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<tr>
<td>Solar (Seneca/WB)</td>
<td>$90,000</td>
<td>Estimated</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$1,010,000</strong></td>
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Measuring Sustainability – Carbon Footprint
WSSC- GHG Breakdown by Category (2008)

- Stationary Combustion
  Mobile Combustion
  Wastewater Treatment

- Electricity Purchases

- Employee Commute/Bus. Travel
  Treatment Plant Chemical Usage
  Biosolid and Solid Waste Hauling

- 74%
- 13%
- 13%

Legend:
- Direct
- Indirect
- Optional

Washington Suburban Sanitary Commission
WSSC GHG Emissions and Reduction Projections: 2008 - 2015

- Anac II WWPS
- WB Incinerator
- UV (add'l electricity)
- Biosolids Management
- Biosolid/Solids Hauling
- Solids/Waste Hauling
- Plant Chemicals
- Business Travel
- Commute
- Wastewater
- Mobile
- Stationary
- Electricity
- Wind

Metric Tons CO2 Eq

External Forces Increasing WSSC Energy Use

- Aging Infrastructure - water main breaks, more water leakage.
- Expanding population - additional water meters, increasing wastewater flow.
- New Pumping Stations.
- More stringent EPA regulations:
  - ENR
  - Biosolids disposal
GHG Action Plan - Goals

- Use County and State Targets
- 2005 Baseline
- Cap CO2 by 2010
- Reduce by 10% every 5 years
- Reduce 80% by 2050
- Reduce Operating Costs

 How do we get there?
Reclamation and Reuse?

As part of the city's conservation effort, this site uses recycled water for irrigation. Do not drink.

Como parte del programa de conservación de agua de la ciudad, en este lugar se usa agua reciclada para irrigar. No bebe.

Washington Suburban Sanitary Commission
Non-Residential Toilet/Urinal Flushing?

This fixture uses non-potable reclaimed water—do not drink.
Questions/Discussion