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Water & Energy In Maryland

2010 Water Resources Symposium

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on Thursday, Oct. 28, 2010

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Powering Treatment Plants with Sun and Wind: Sustainability Practices at WSSC

Water and Energy in Maryland

MWRRC Fall 2010 Symposium

UNIVERSITY OF MARYLAND

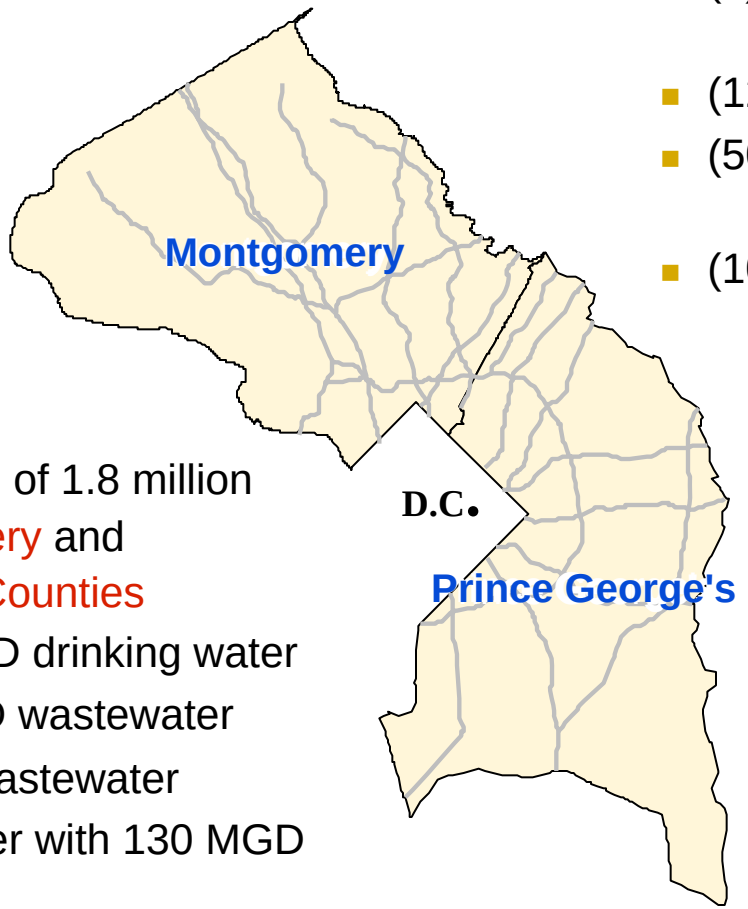
October 28, 2010

Rob Taylor
Energy Manager

Washington Suburban Sanitary Commission

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

WSSC Energy Costs- FY'10

Fuel	Cost	%
Electricity	$27,338,000	97.0%
Natural Gas	$757,000	2.7%
Diesel, F.O. #2, Propane	$92,000	.3%
Total	$28,187,000	100.0%

Energy is approximately 5% of WSSC's annual operating cost

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Sustainability

- "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.

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WSSC Sustainability Goals

- 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.

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Achieving the Triple Bottom Line

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

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

- Community elations
- Odor & Noise Control
- Worker Health & Safety
- Aesthetics

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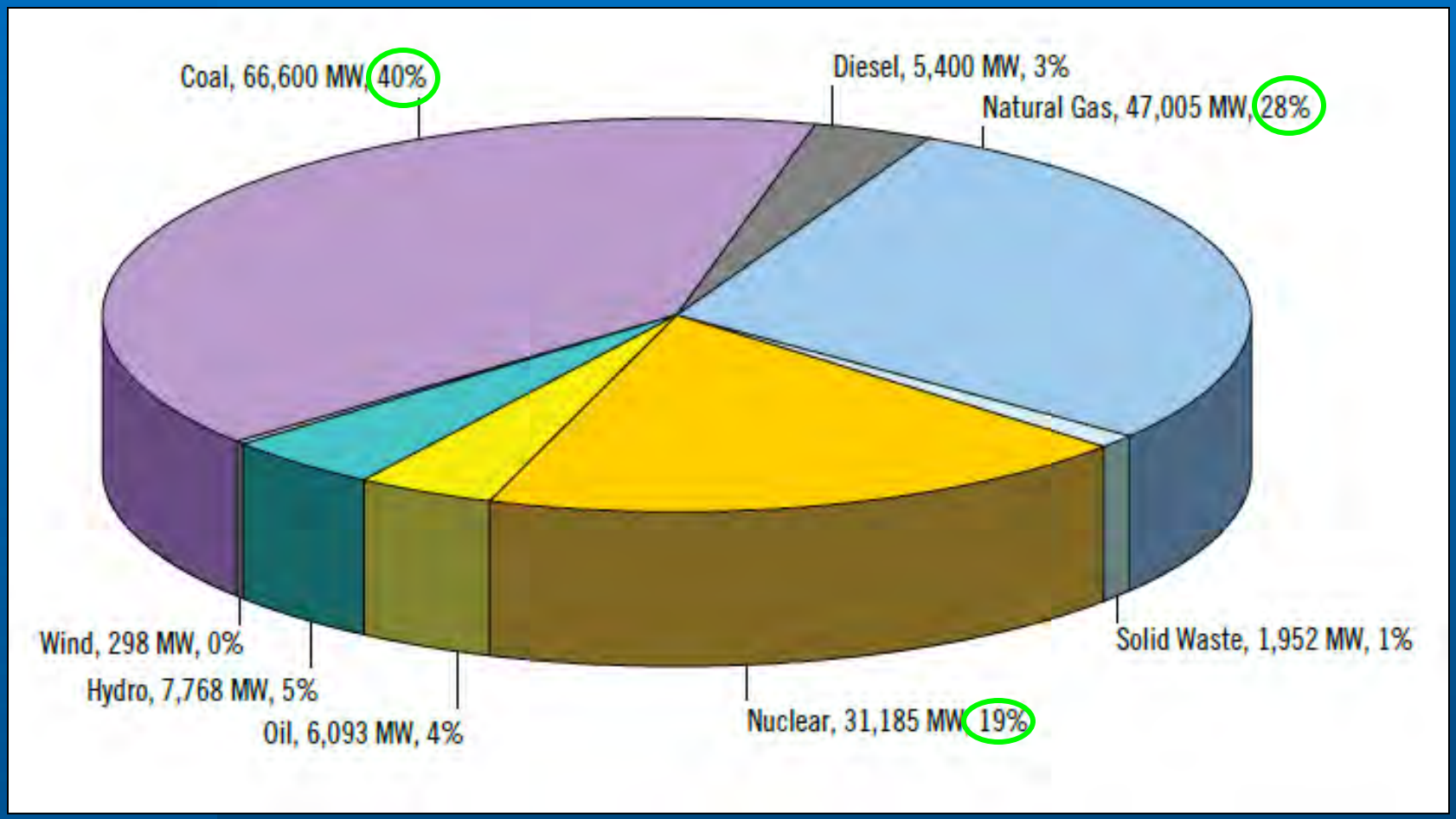
Fuel Mix of PJM Generation - 1/1/10



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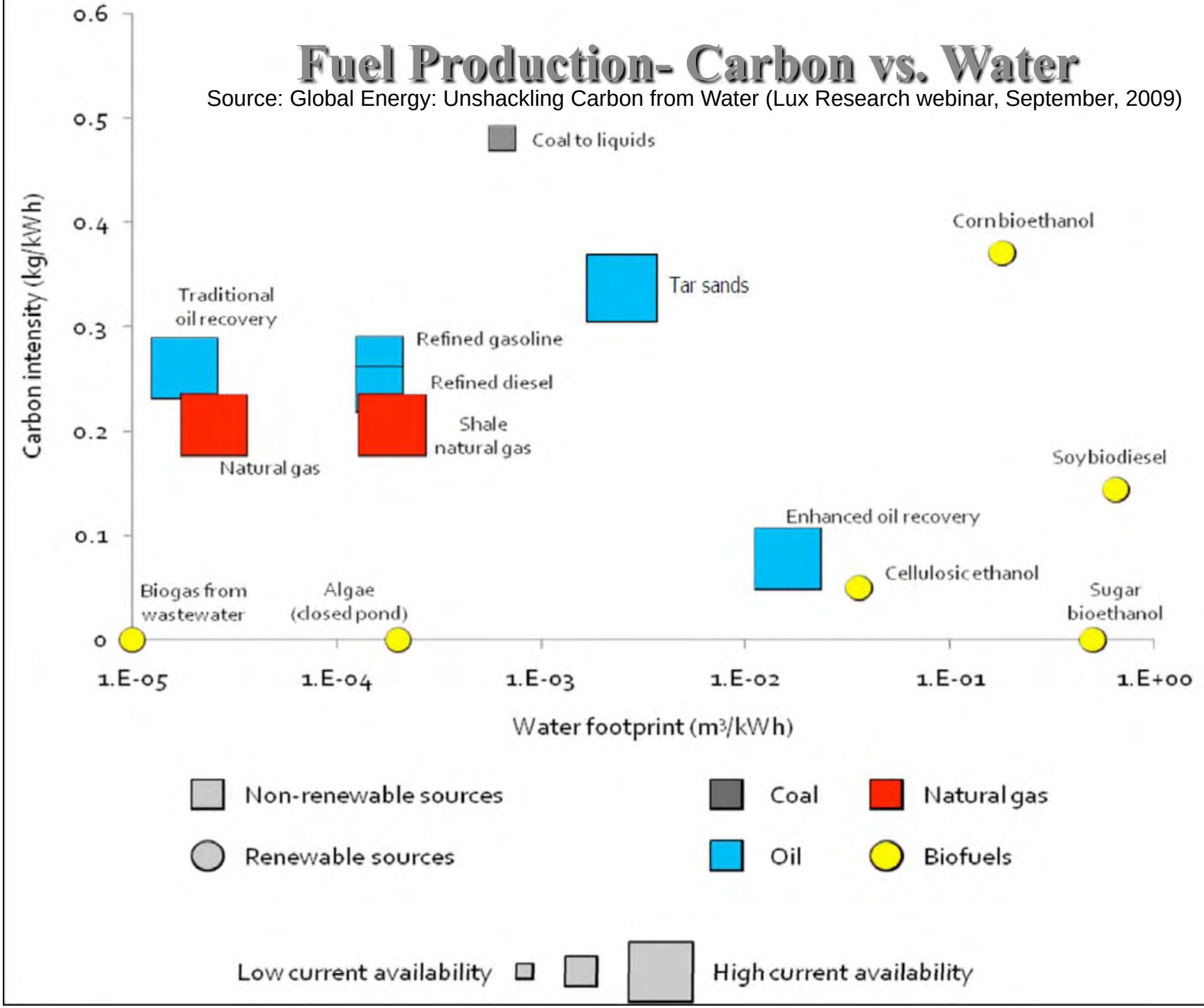
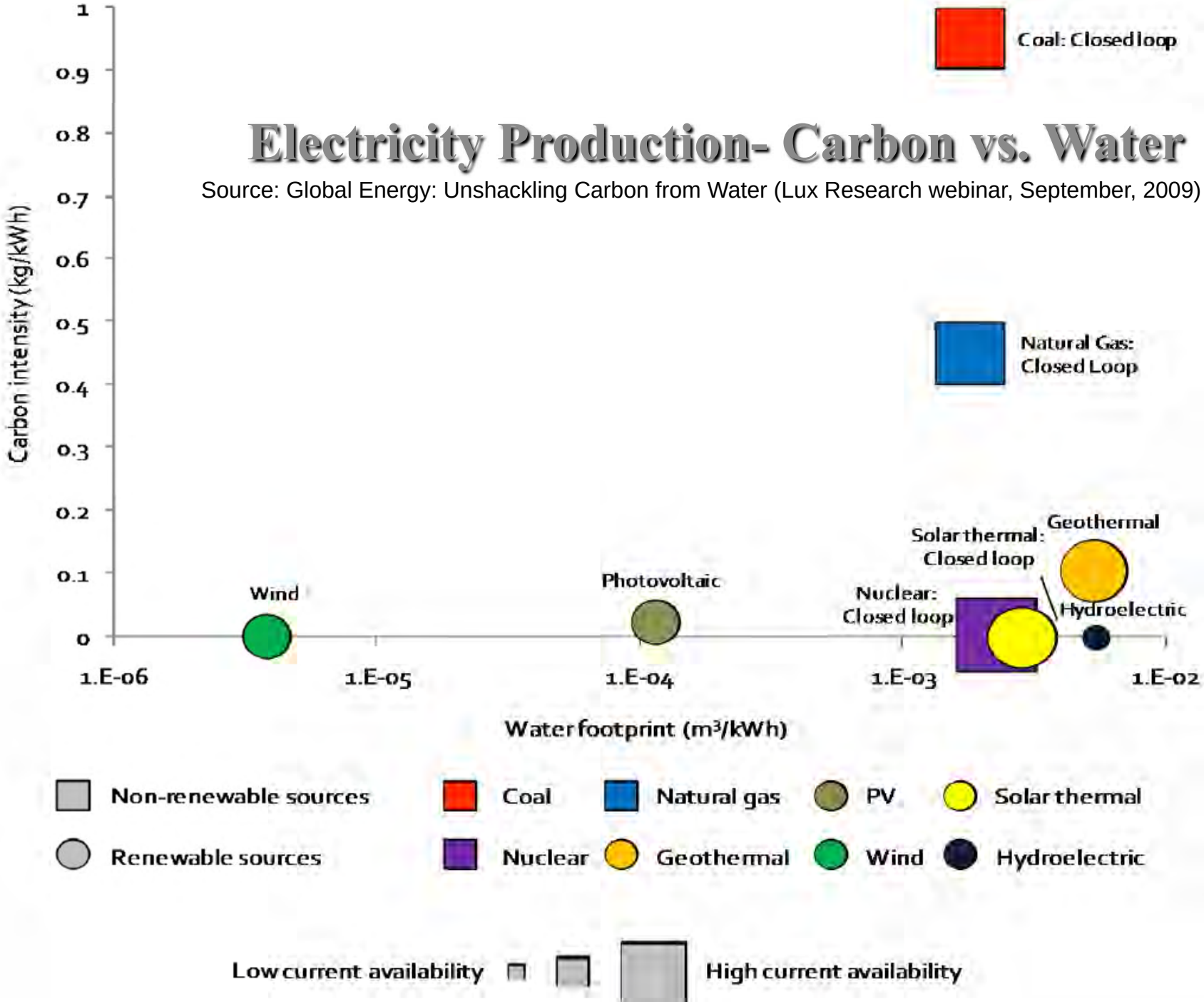
Fuel Production- Carbon vs. Water

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

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Wind Objectives- WSSC

- 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.

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WSSC Renewable Energy (Wind) Purchase Power Agreement

- 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.

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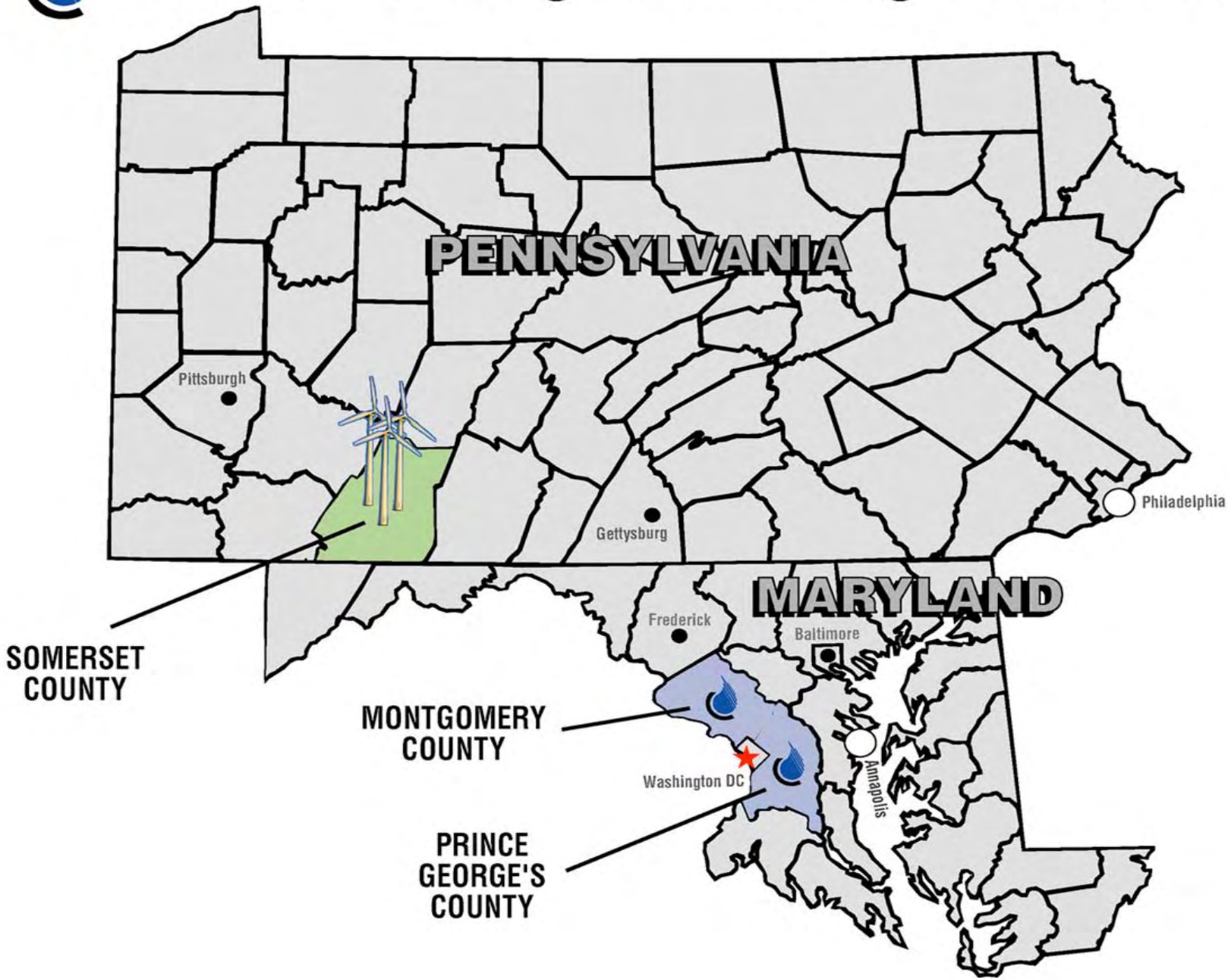
WSSC: *Producing Water Through Wind Power*



Edison Mission: Wholesale/Wind Farm

29.4 MW Capacity

Allegheny Plateau

Somerset County, PA

Pennsylvania

Constellation Energy

Maryland

Retail Licensed Power Supplier

pjm

Baltimore, MD

Mid-Atlantic Interstate Transmission Power Grid

BG&E and PEPCO:

Electric Distribution Companies

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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

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- 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 Under Construction - August 2007

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Forward Wind Farm
Somerset County, PA (March 2008)

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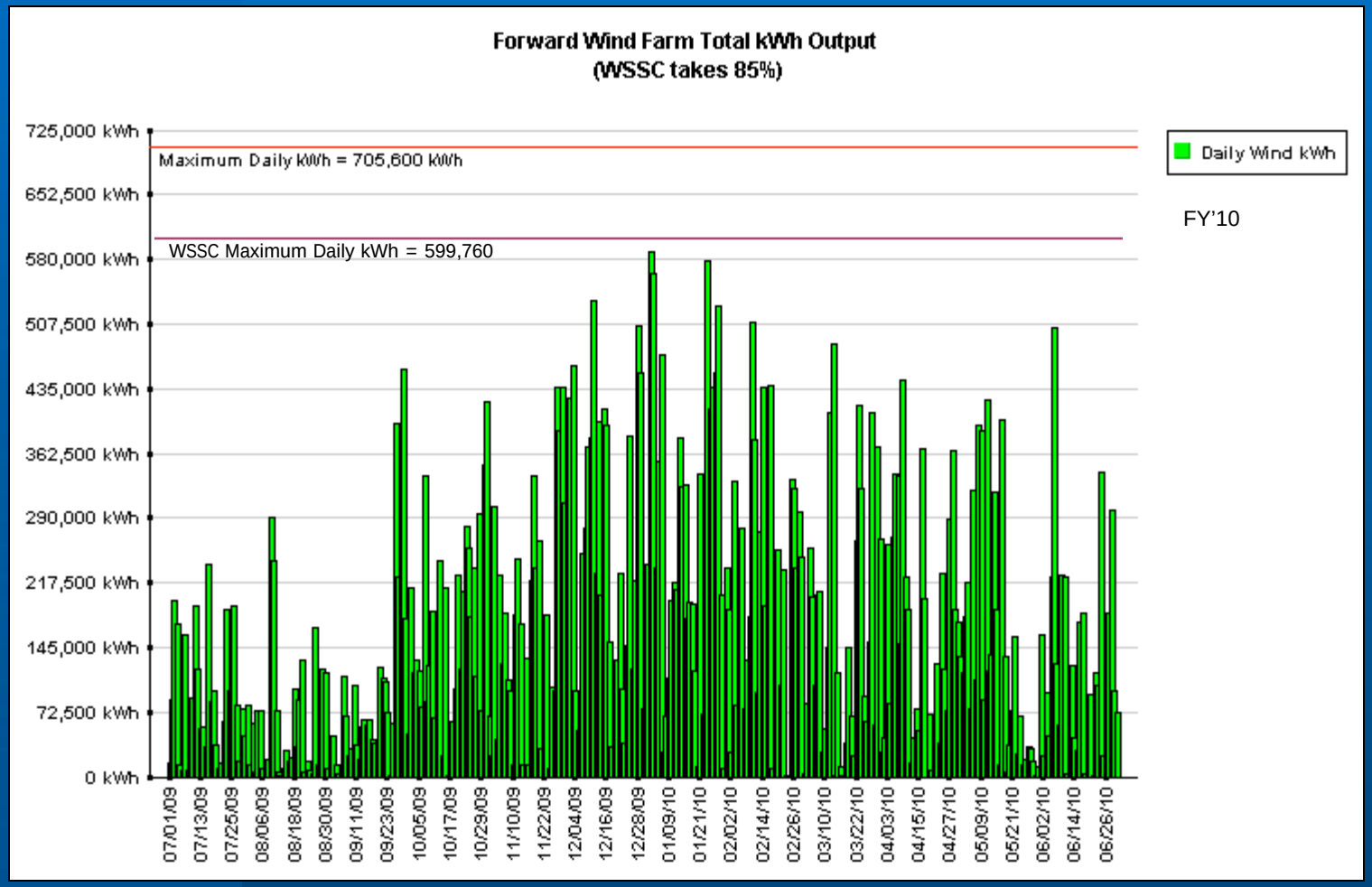
Direct Wind is Variable, Contingent



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Renewable Energy Initiatives- Solar

Planning Stage

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Western Branch WWTP Solar Ground Area Available

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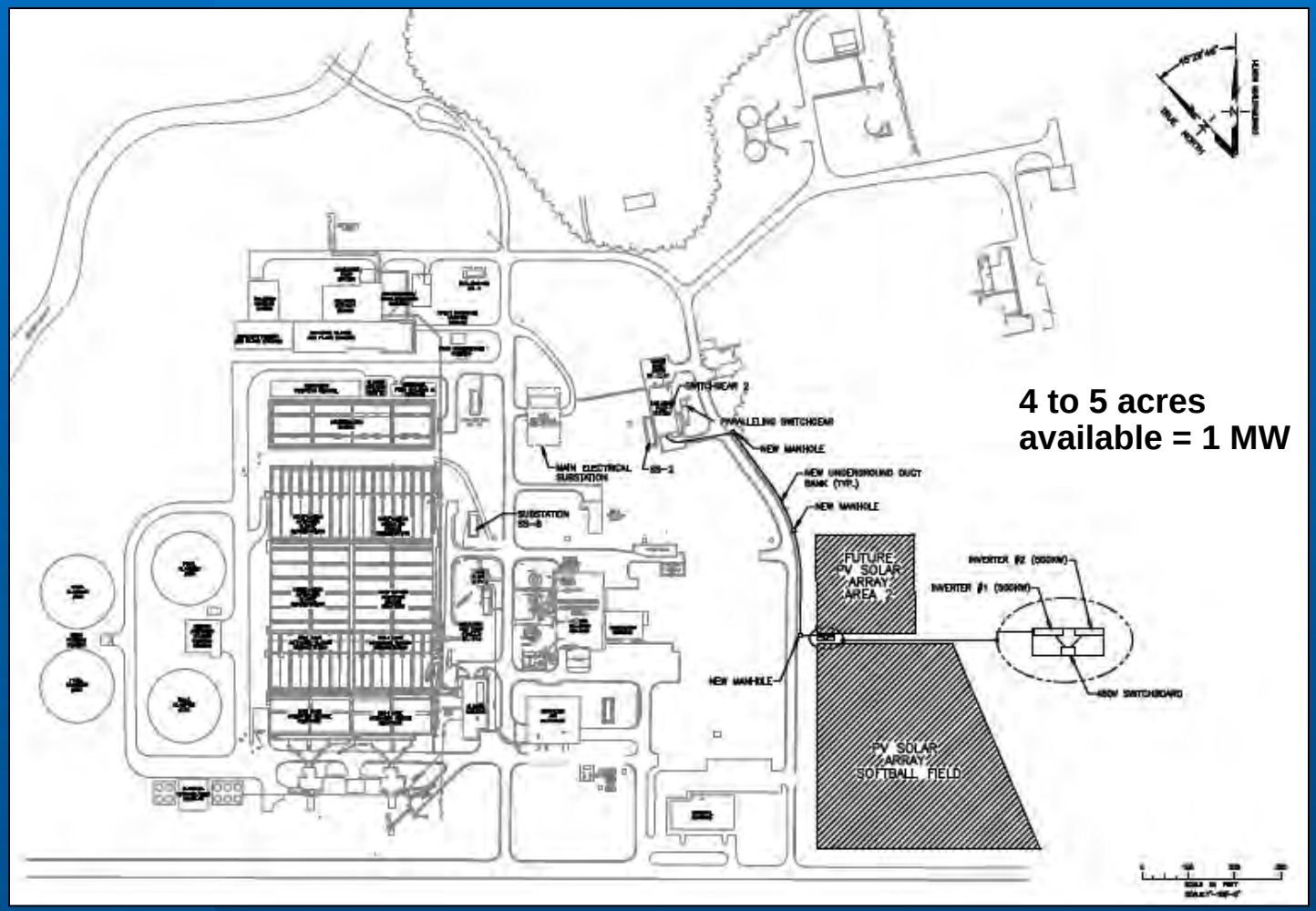
Western Branch WWTP Solar Ground Area



4 to 5 acres available = 1 MW

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Seneca WWTP Solar Ground Area Available

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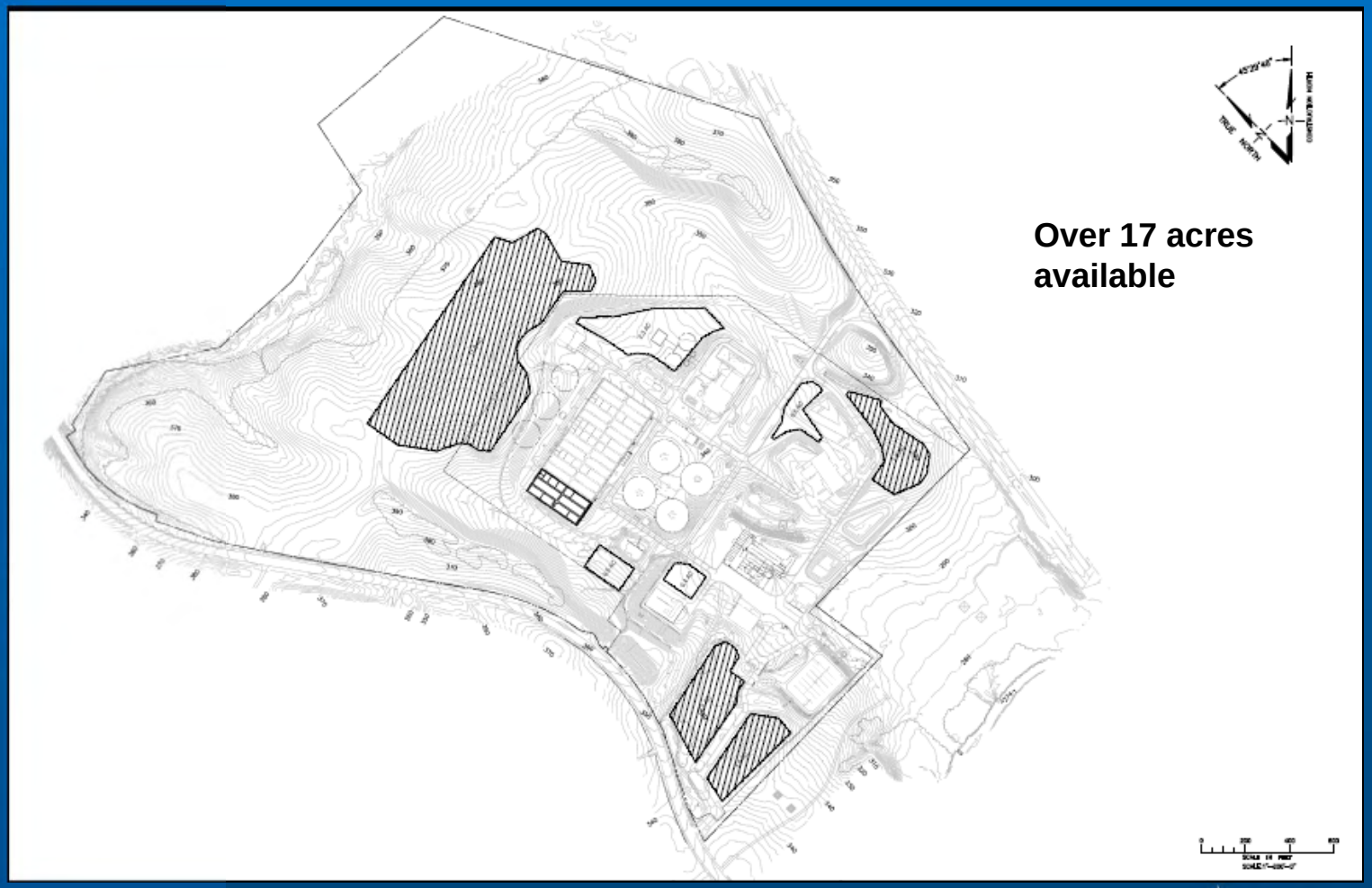
Seneca WWTP Solar Ground Area



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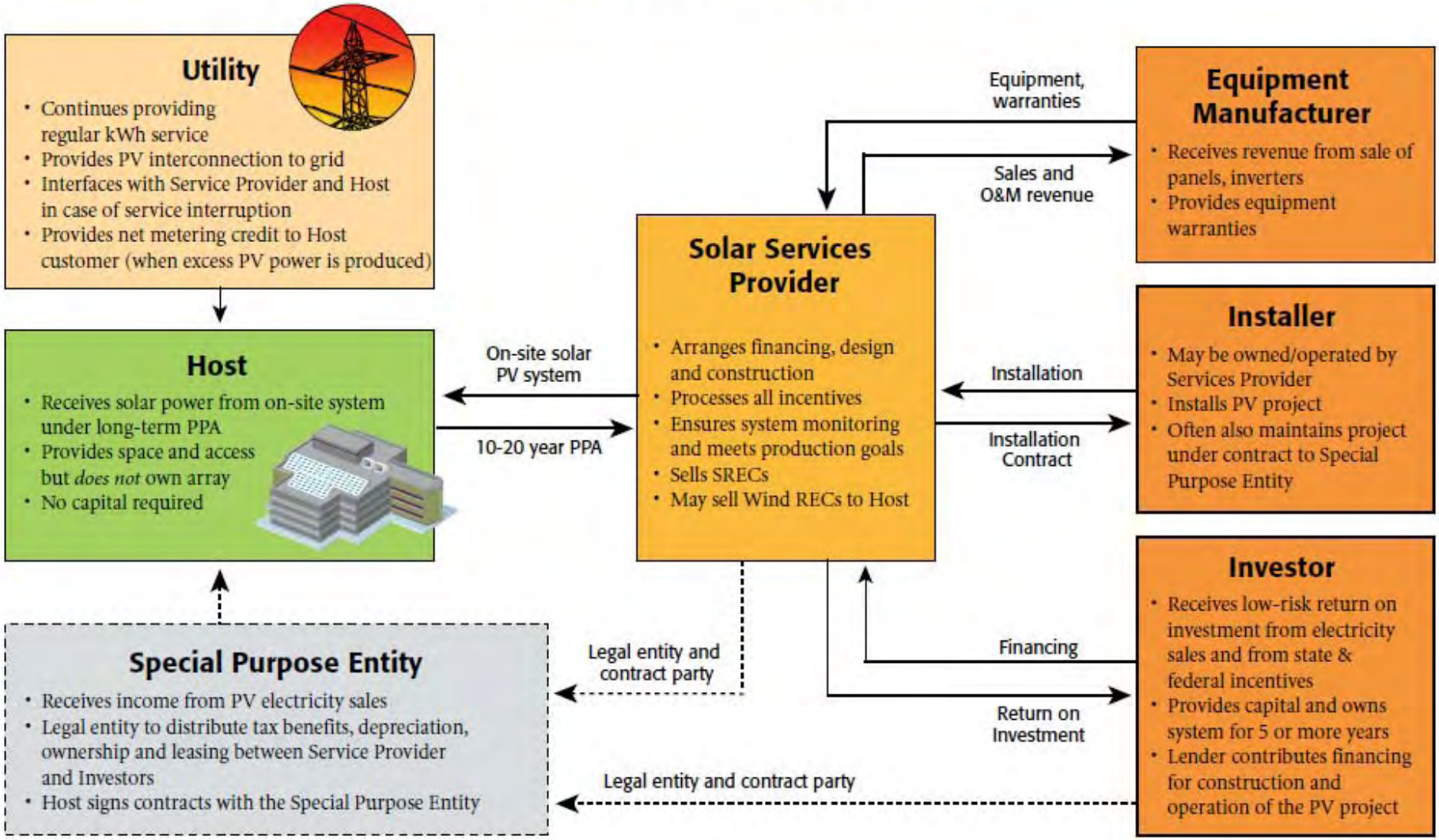
Roles of SPPA Participants



Source: Customer's Guide to Solar Power Purchase Agreements, Rahus Institute, 2008

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Solar PV System Considerations

- 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.

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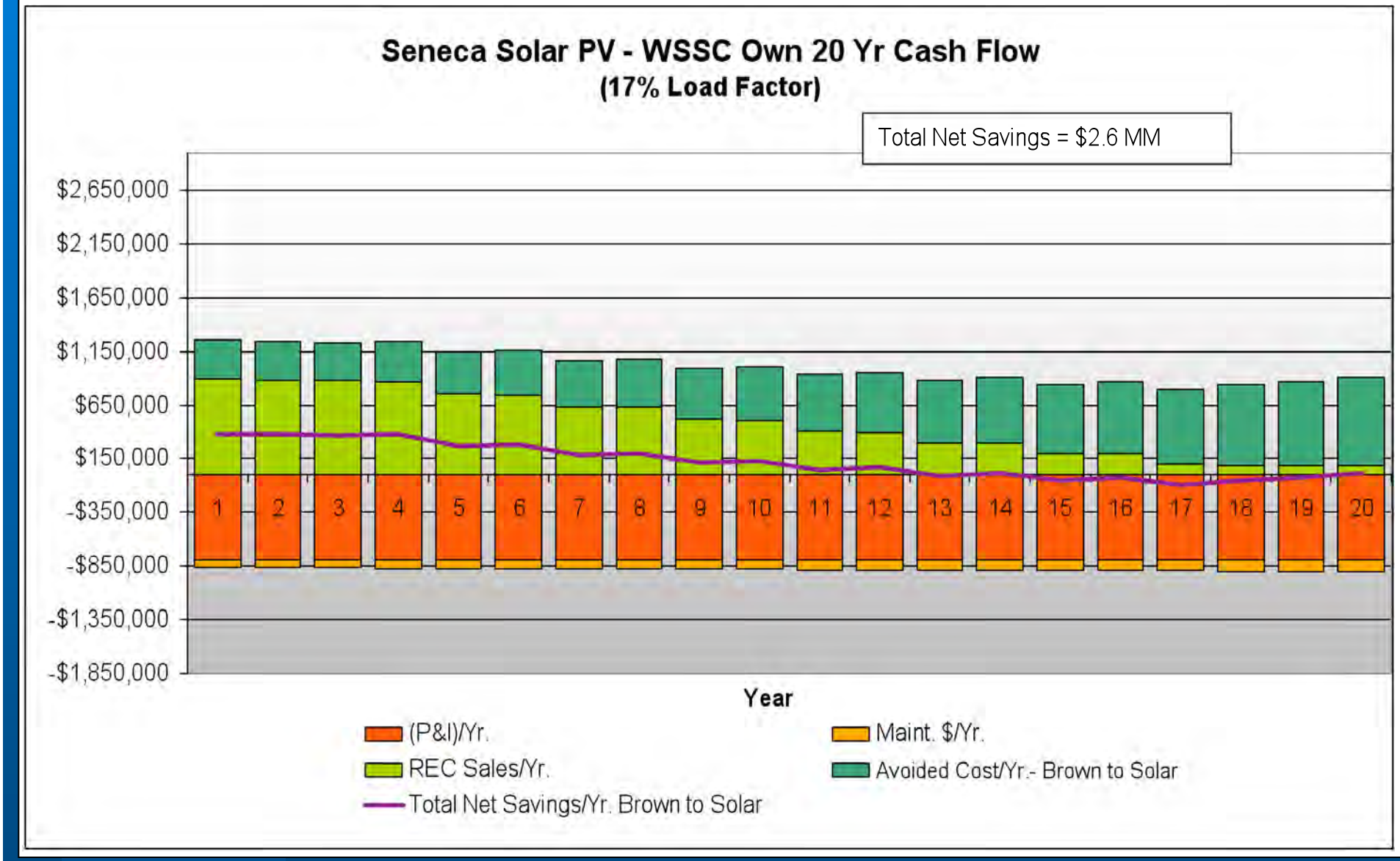
Solar PV Project- Seneca WWTP

WSSC **Owned** (20 yr), 17% LF

Installed Capacity	2,000	kW
Capital Cost:	$ 16,000,000	
Grant (10%):	$ 1,600,000	
WSSC Net Capital Cost:	$ 14,400,000	
% of ACP Value:	75%	ACP= Alternative Compliance Payment
Cost of Capital (Bond):	1%	
Annual Energy Production:	2,978,400	kWh
Electricity Escalation Rate:	5%	per yr. (start yr 4)
Maint. Escalation Rate:	2%	per yr.
Solar Cell Degradation Factor:	1%	per yr.

(P&I)/Yr.	Maint. $/Yr.	Solar System Output kWh/Yr.	REC Sales/Yr.	Avoided Unit Cost $/kWh Brown vs Solar	Avoided Cost/Yr.- Brown to Solar	**Total Net Savings/Yr. Brown to Solar**	NPV	Yr.
$ (793,000)	$ (72,000)	2,978,400	$ 894,000	$ 0.1200	357,000	**$ 386,000**	$371,000	2011
$ (793,000)	$ (73,000)	2,948,616	$ 885,000	$ 0.1200	357,000	**$ 376,000**	$719,000	2012
$ (793,000)	$ (74,000)	2,919,130	$ 876,000	$ 0.1200	357,000	**$ 366,000**	$1,044,000	2013
$ (793,000)	$ (75,000)	2,889,939	$ 867,000	$ 0.1260	375,000	**$ 374,000**	$1,364,000	2014
$ (793,000)	$ (77,000)	2,861,039	$ 751,000	$ 0.1323	394,000	**$ 275,000**	$1,590,000	2015
$ (793,000)	$ (79,000)	2,832,429	$ 744,000	$ 0.1389	414,000	**$ 286,000**	$1,816,000	2016
$ (793,000)	$ (81,000)	2,804,104	$ 631,000	$ 0.1459	434,000	**$ 191,000**	$1,961,000	2017
$ (793,000)	$ (83,000)	2,776,063	$ 625,000	$ 0.1532	456,000	**$ 205,000**	$2,111,000	2018
$ (793,000)	$ (85,000)	2,748,303	$ 515,000	$ 0.1608	479,000	**$ 116,000**	$2,192,000	2019
$ (793,000)	$ (87,000)	2,720,820	$ 510,000	$ 0.1689	503,000	**$ 133,000**	$2,282,000	2020
$ (793,000)	$ (89,000)	2,693,612	$ 404,000	$ 0.1773	528,000	**$ 50,000**	$2,315,000	2021
$ (793,000)	$ (91,000)	2,666,675	$ 400,000	$ 0.1862	554,000	**$ 70,000**	$2,358,000	2022
$ (793,000)	$ (93,000)	2,640,009	$ 297,000	$ 0.1955	582,000	**$ (7,000)**	$2,354,000	2023
$ (793,000)	$ (95,000)	2,613,609	$ 294,000	$ 0.2052	611,000	**$ 17,000**	$2,364,000	2024
$ (793,000)	$ (97,000)	2,587,473	$ 194,000	$ 0.2155	642,000	**$ (54,000)**	$2,334,000	2025
$ (793,000)	$ (99,000)	2,561,598	$ 192,000	$ 0.2263	674,000	**$ (26,000)**	$2,320,000	2026
$ (793,000)	$ (101,000)	2,535,982	$ 95,000	$ 0.2376	708,000	**$ (91,000)**	$2,273,000	2027
$ (793,000)	$ (103,000)	2,510,622	$ 94,000	$ 0.2495	743,000	**$ (59,000)**	$2,244,000	2028
$ (793,000)	$ (105,000)	2,485,516	$ 93,000	$ 0.2619	780,000	**$ (25,000)**	$2,232,000	2029
$ (793,000)	$ (107,000)	2,460,661	$ 92,000	$ 0.2750	819,000	**$ 11,000**	$2,237,000	2030
$ (15,860,000)	$ (1,766,000)		$ 9,453,000		10,767,000	**$ 2,594,000**		



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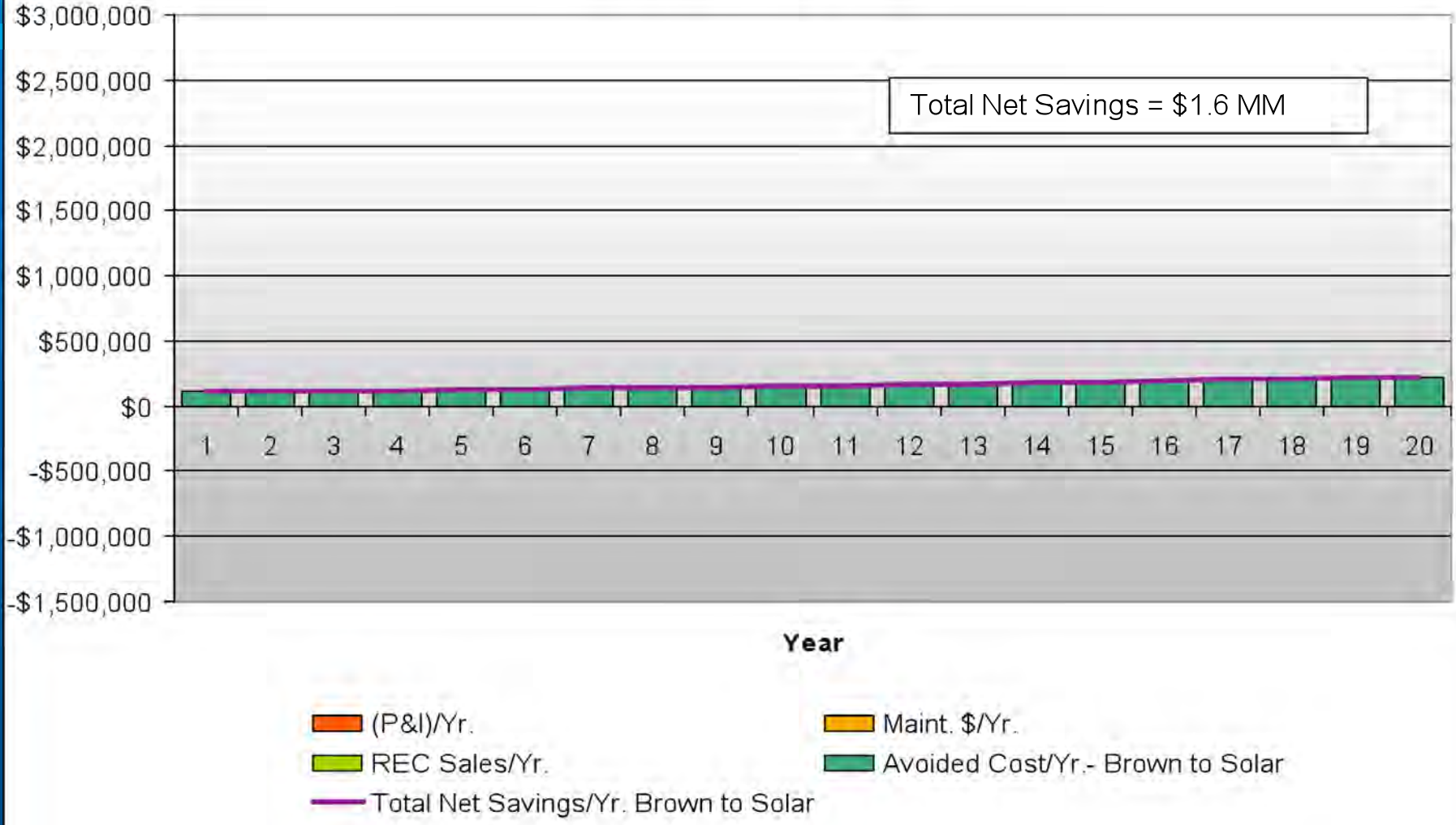
Solar PV Project- Seneca WWTP

Installed Capacity	2,000	kW
Capital Cost:	$ -	WSSC **PPA** (20 yr), 17% LF
% of ACP Value:	80%	ACP= Alternative Compliance Payment
Annual Energy Production:	2,978,400	kWh
Fossil Electricity Escalation Rate:	5%	per yr. (start yr 4)
Maint. Escalation Rate:	N/A	
Solar Cell Degradation Factor:	1%	per yr.

Year	(P&I)/Yr.	Maint. $/Yr.	Solar System Output kWh/Yr.	REC Sales/Yr.	Avoided Unit Cost $/kWh Brown to Solar	Avoided Cost/Yr.- Brown to Solar	**Total Net Savings/Yr. Brown to Solar**
1	$ -	$ -	2,978,000	$ -	$ 0.0200	60,000	**$ 60,000**
2	$ -	$ -	2,948,000	$ -	$ 0.0200	59,000	**$ 59,000**
3	$ -	$ -	2,919,000	$ -	$ 0.0200	58,000	**$ 58,000**
4	$ -	$ -	2,890,000	$ -	$ 0.0210	61,000	**$ 61,000**
5	$ -	$ -	2,861,000	$ -	$ 0.0221	63,000	**$ 63,000**
6	$ -	$ -	2,832,000	$ -	$ 0.0232	66,000	**$ 66,000**
7	$ -	$ -	2,804,000	$ -	$ 0.0243	68,000	**$ 68,000**
8	$ -	$ -	2,776,000	$ -	$ 0.0255	71,000	**$ 71,000**
9	$ -	$ -	2,748,000	$ -	$ 0.0268	74,000	**$ 74,000**
10	$ -	$ -	2,721,000	$ -	$ 0.0281	77,000	**$ 77,000**
11	$ -	$ -	2,694,000	$ -	$ 0.0295	80,000	**$ 80,000**
12	$ -	$ -	2,667,000	$ -	$ 0.0310	83,000	**$ 83,000**
13	$ -	$ -	2,640,000	$ -	$ 0.0326	86,000	**$ 86,000**
14	$ -	$ -	2,614,000	$ -	$ 0.0342	89,000	**$ 89,000**
15	$ -	$ -	2,588,000	$ -	$ 0.0359	93,000	**$ 93,000**
16	$ -	$ -	2,562,000	$ -	$ 0.0377	97,000	**$ 97,000**
17	$ -	$ -	2,536,000	$ -	$ 0.0396	100,000	**$ 100,000**
18	$ -	$ -	2,511,000	$ -	$ 0.0416	104,000	**$ 104,000**
19	$ -	$ -	2,486,000	$ -	$ 0.0437	109,000	**$ 109,000**
20	$ -	$ -	2,461,000	$ -	$ 0.0458	113,000	**$ 113,000**
							$ 1,611,000

Seneca Solar PV - PPA 20 Yr Cash Flow
(17% Load Factor)



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Renewable Energy Impact on Energy Costs

Renewable Technology	Savings/Yr. (1st yr)	Actual or Estimated
Hydro	$ 220,000	Actual
Wind	$ 700,000	Actual
Solar (Seneca/WB)	$ 90,000	Estimated
Total	$1,010,000	

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Measuring Sustainability – Carbon Footprint

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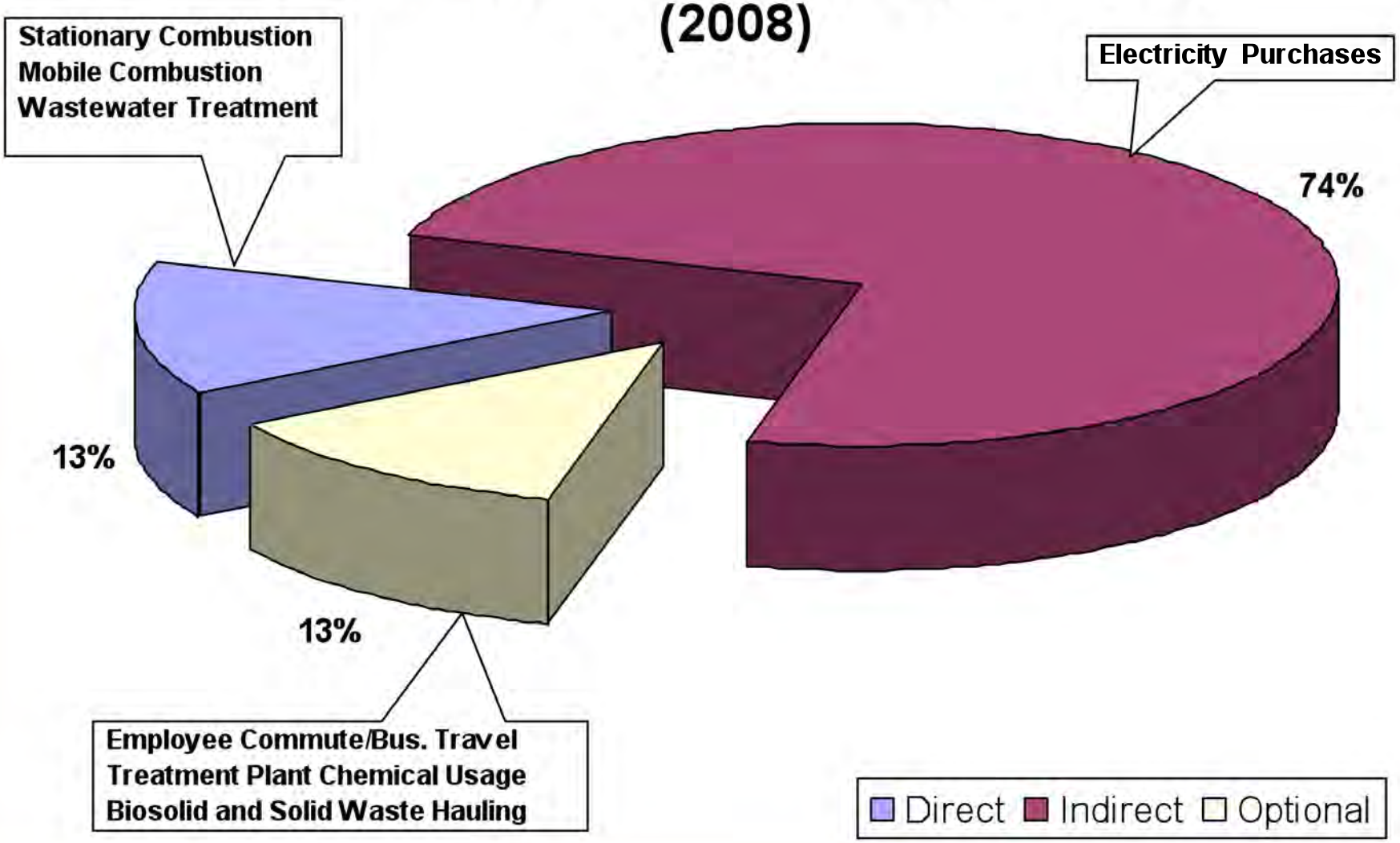
WSSC- GHG Breakdown by Category (2008)



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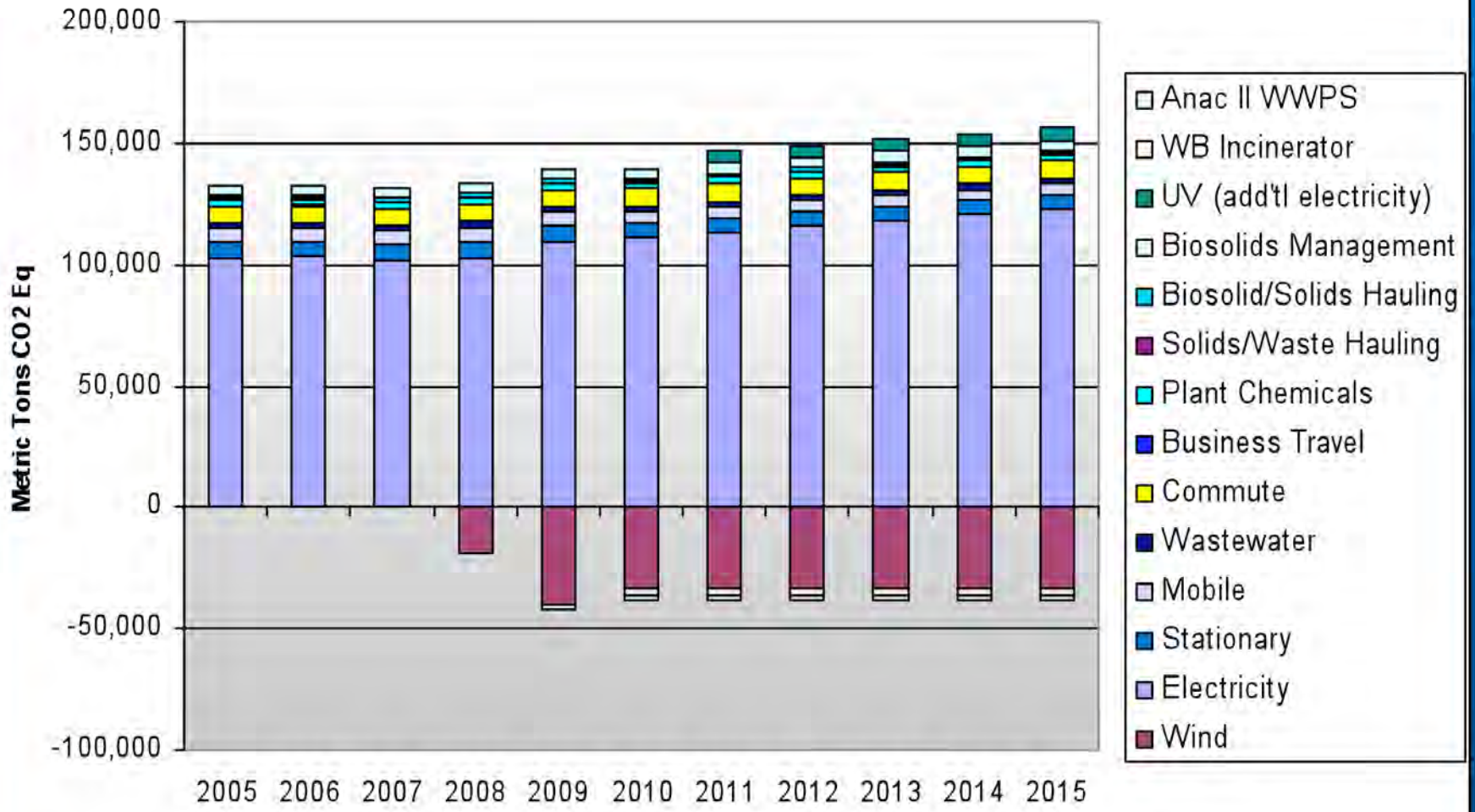
WSSC GHG Emissions and Reduction Projections: 2008 - 2015



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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

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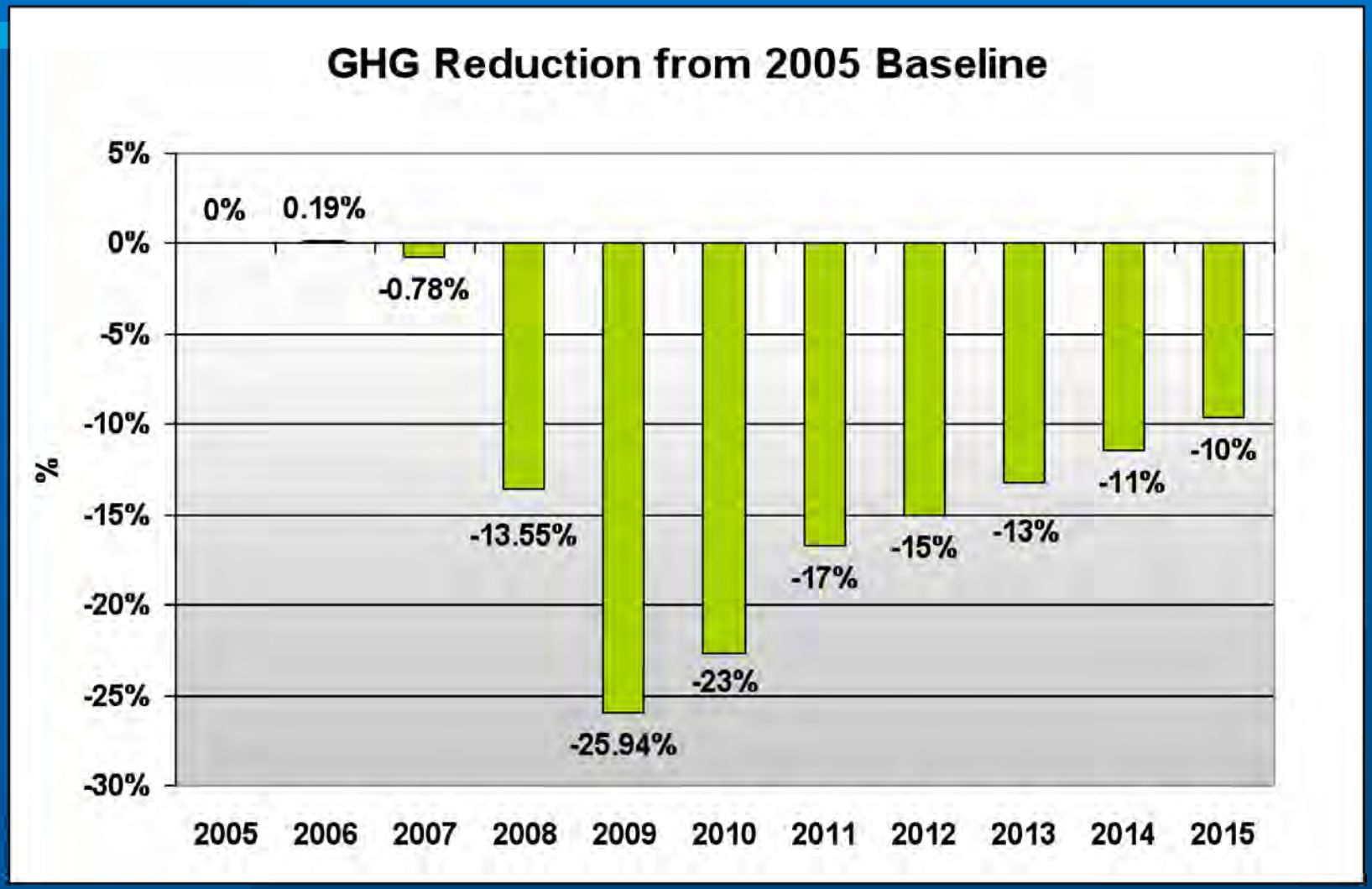
WSSC GHG Projections to 2015



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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?

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Reclamation and Reuse?

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Non-Residential Toilet/Urinal Flushing ?

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Questions/Discussion

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