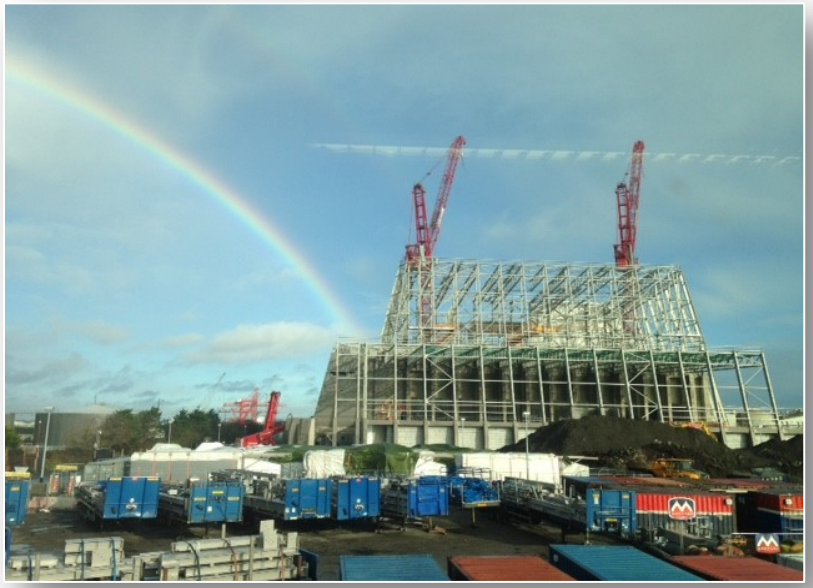

Presentation to Governor McAuliffe's Executive Order 57 Working Group

December 1, 2016
Frazier Blaylock

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Covanta in the Commonwealth

•Existing Renewable Infrastructure

- Covanta operates 2 facilities in Virginia –
  - **Alexandria/Arlington and Fairfax County**
  - Employs 130 people with payroll of $15 million
  - $1.9 million in local taxes, host fees and surcharges
  - Spend $79 million in the state economy
- Covanta's Renewable Power
  - Produce 113 megawatts of base load electricity
  - Enough energy to power 100,000 homes each year
- Convert 1.40 million tons of waste per year into renewable energy
  - Avoiding the equivalent of ~ 1.40 million barrels of oil each year

Benefits of Waste-to-Energy to Virginia

- Currently comprises 19% of Virginia's non-nuclear zero carbon electricity generation
- Achieves significant GHG reductions in waste management & manufacturing sectors through landfill diversion and metal recovery
- Reduces emissions of the potent GHG methane
- Generates baseload renewable electricity near load centers
- Recognized as zero carbon power in the Clean Power Plan
- Eligible to generate Emission Rate Credits
- Cost competitive with other unsubsidized renewables

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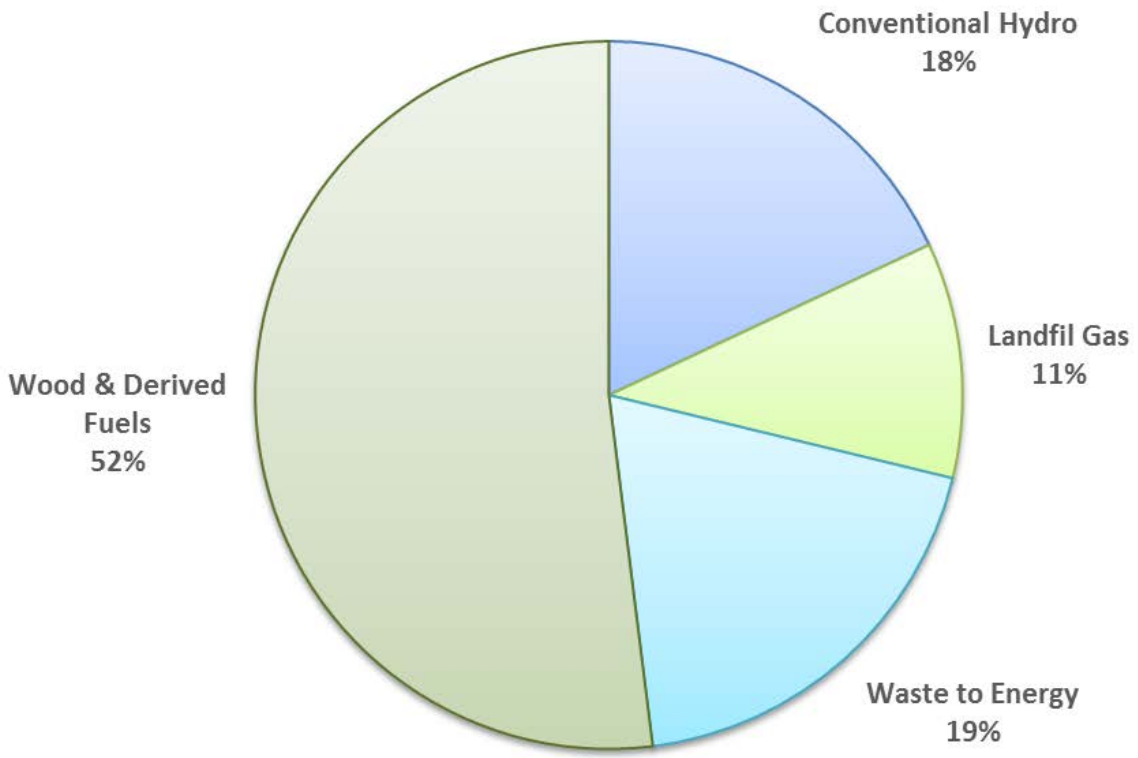
Key EO57 Reduction Plan Considerations

- The plan should encourage diversity of generation to promote grid stability & minimize price volatility
  - Baseload v. intermittent
  - Geography, distance to load centers & transmission
- Preservation of existing renewables increases the impact of additional renewable generation
  - Plentiful and cheap natural gas disadvantages renewables with on-going operations & maintenance costs, like waste-to-energy
- The state can realize greater GHG reductions by considering GHG benefits affected by the electric sector, but achieved outside of electric sector

Virginia's non-nuclear zero carbon energy



Source: *U.S. EIA Form EIA-923 Data for Virginia, 2014*

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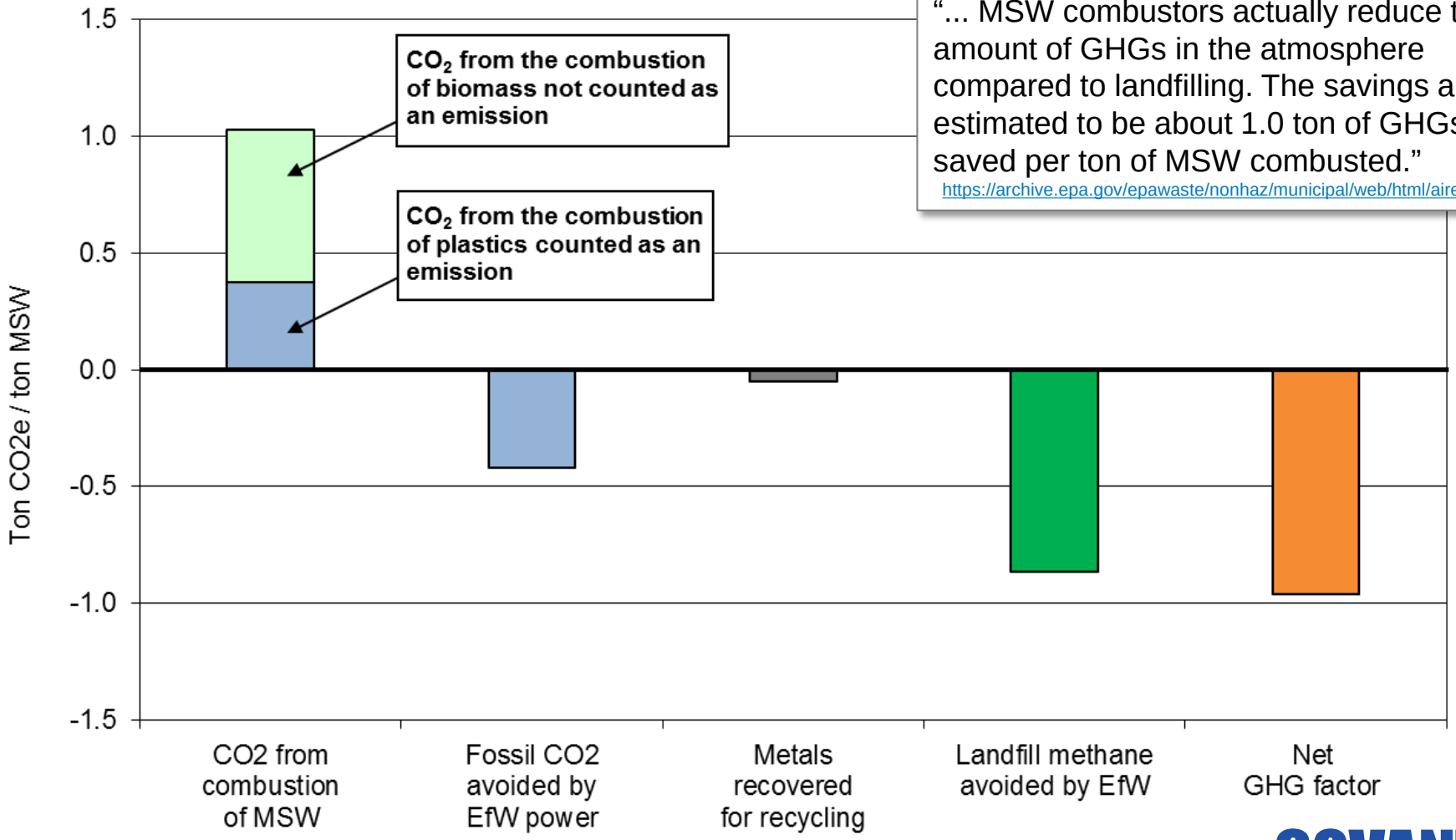
GHG Benefits of EfW



U.S. EPA

"... MSW combustors actually reduce the amount of GHGs in the atmosphere compared to landfilling. The savings are estimated to be about 1.0 ton of GHGs saved per ton of MSW combusted."

https://archive.epa.gov/epawaste/nonhaz/municipal/web/html/airem.html

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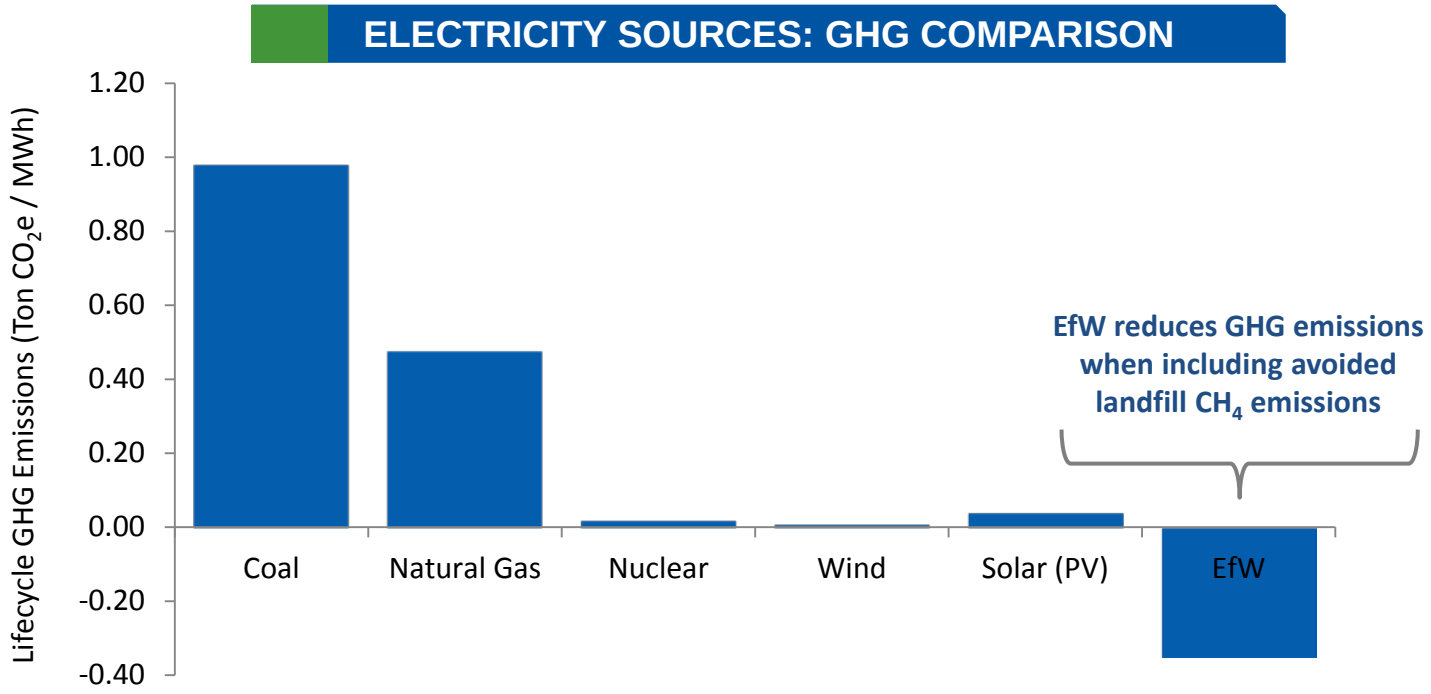
Electricity Sources: GHG Comparison



Sources: Sathaye et al. (2011) "Renewable Energy in the Context of Sustainable Development"; NREL Life Cycle Assessment Harmonization Results and Findings webpage, accessed 8/2015; U.S. EPA, NC State University, RTI International (2014) MSW Decision Support Tool.

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GHG Benefits of EfW: International Recognition

- **U.S. EPA Clean Power Plan**
- **U.S. EPA Scientists:** "If the goal is greenhouse gas reduction, then WtE should be considered an option…"
- **European Environment Agency:** "As recycling and incineration with energy recovery are increasingly used, net greenhouse gas emissions from municipal waste management are expected to drop considerably by 2020"
- **IPCC:** WTE recognized as a "key GHG mitigation technology"
- **Rio UN Conference:** "We therefore commit to further reduce, reuse and recycle waste (3Rs), and to increase energy recovery from waste"
- **Davos World Economic Forum:** WTE included in the list of 10 low-carbon energy technologies

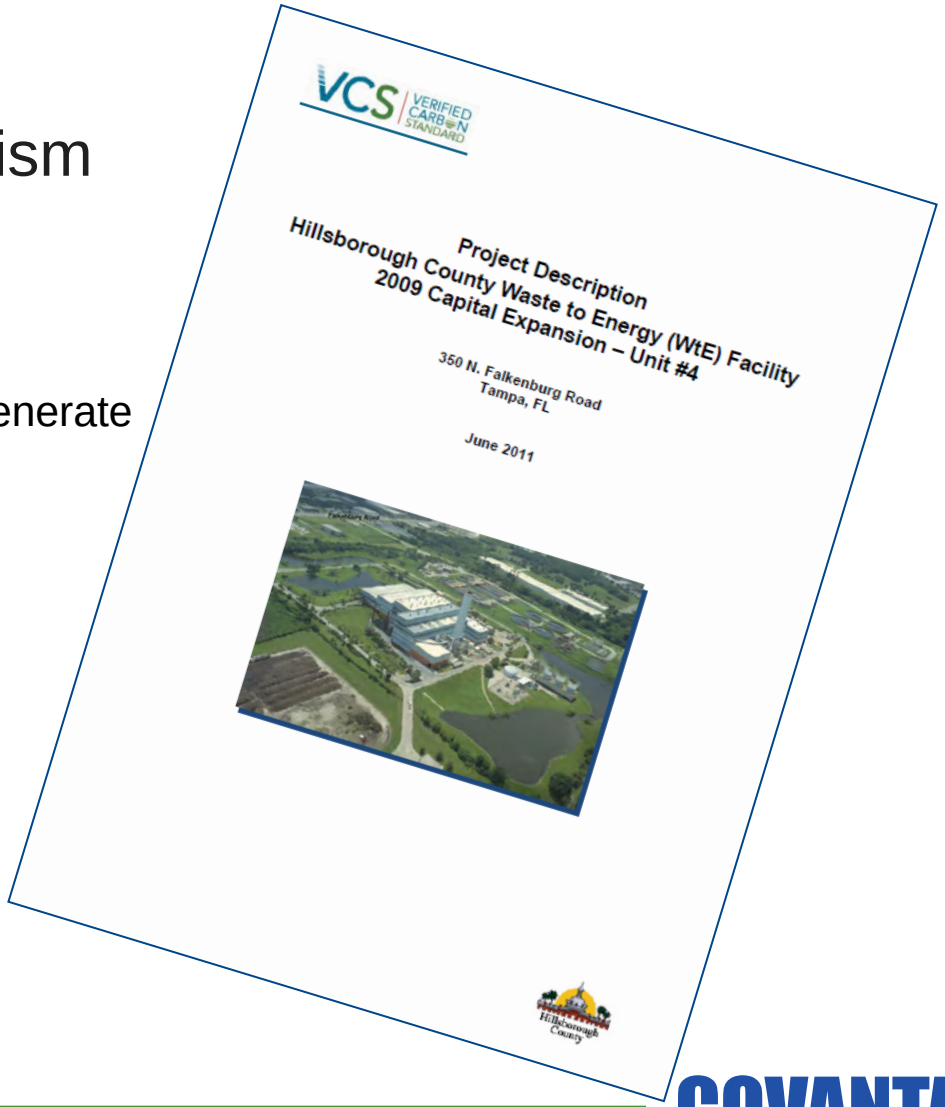
Carbon Offsets

- Clean Development Mechanism
- Voluntary Market (VCS)

  Lee County, FL
  - First EfW facility in North America to generate carbon offset credits
  - Validated & 1st verification - 2009

  Hillsborough County, FL
  - Validated & 1st verification – 2011

  H-Power (Honolulu)
  - Validated – 2014



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EfW under the EPA Clean Power Plan

- Excluded from Regulation
  - Stack CO_2 emissions do not count against state mass goals
  - EfW facilities do not have an emission rate requirement
- Eligible to generate Emission Rate Credits (ERCs)
  - New capacity added after 2012 can generate ERCs for states with rate-based plans

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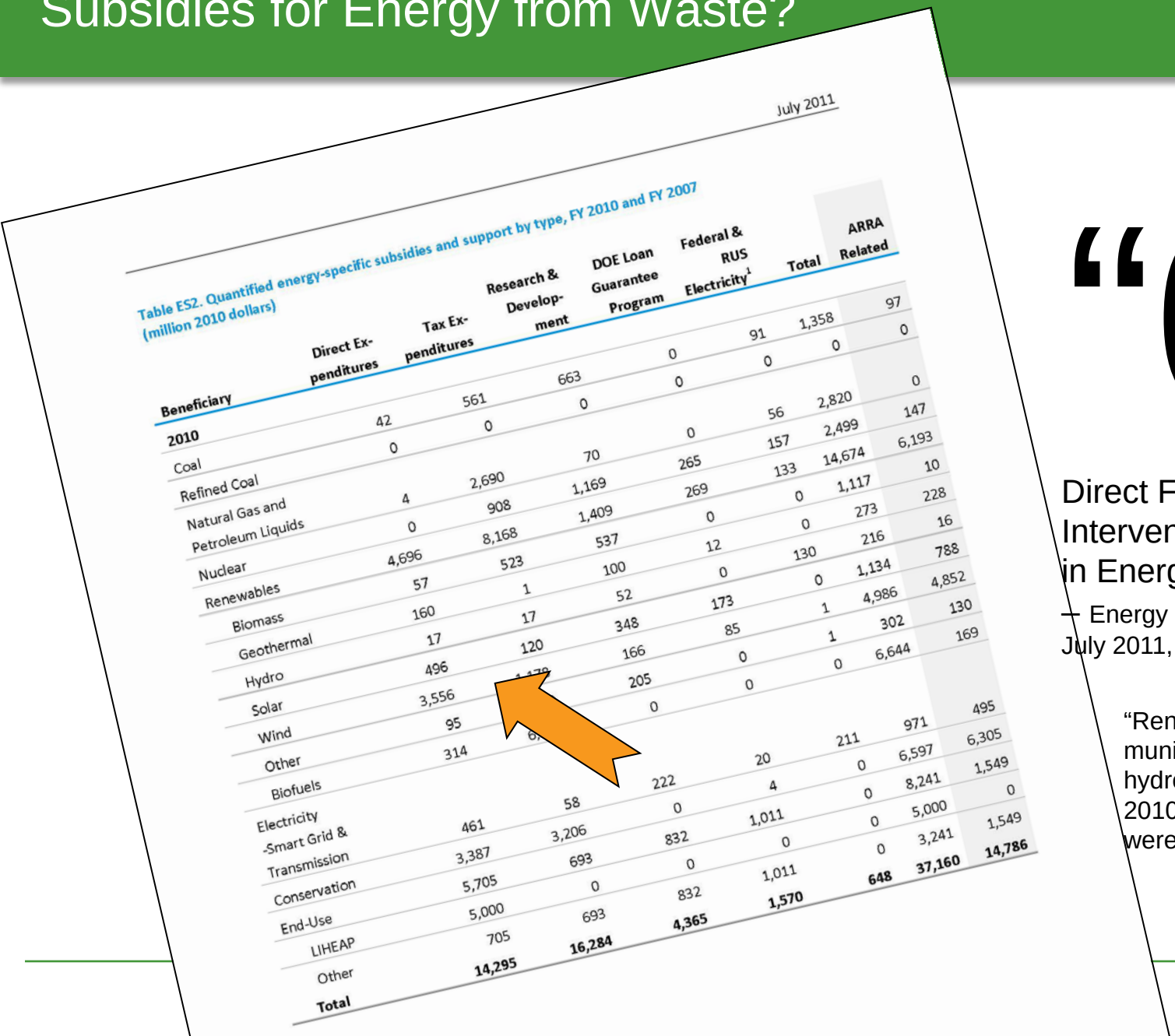
Subsidies for Energy from Waste?



July 2011

Table ES2. Quantified energy-specific subsidies and support by type, FY 2010 and FY 2007 (million 2010 dollars)

Beneficiary	Direct Expenditures	Tax Expenditures	Research & Development	DOE Loan Guarantee Program	Federal & RUS Electricity[1]	Total	ARRA Related
2010							
Coal	42	561	663	0	91	1,358	97
Refined Coal	0	0	0	0	0	0	0
Natural Gas and Petroleum Liquids	4	2,690	70	0	56	2,820	0
Nuclear	0	908	1,169	265	157	2,499	147
Renewables	4,696	8,168	1,409	269	133	14,674	6,193
Biomass	57	523	537	0	0	1,117	10
Geothermal	160	1	100	12	0	273	228
Hydro	17	17	52	0	130	216	16
Solar	496	120	348	173	0	1,134	788
Wind	3,556	[illegible]	166	85	1	4,986	4,852
Other	95	[illegible]	205	0	1	302	130
Biofuels	314	[illegible]	0	0	0	6,644	169
Electricity							
-Smart Grid & Transmission	461	58	222	20	211	971	495
Conservation	3,387	3,206	0	4	0	6,597	6,305
End-Use	5,705	693	832	1,011	0	8,241	1,549
LIHEAP	5,000	0	0	0	0	5,000	0
Other	705	693	832	1,011	0	3,241	1,549
Total	**14,295**	**16,284**	**4,365**	**1,570**	**648**	**37,160**	**14,786**

"0"

Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2010

– Energy Information Administration
July 2011, page xiii

"Renewable other" (landfill gas, municipal solid waste and hydrogen) received $302M in 2010; however, no subsidies were allocated to MSW (EfW).

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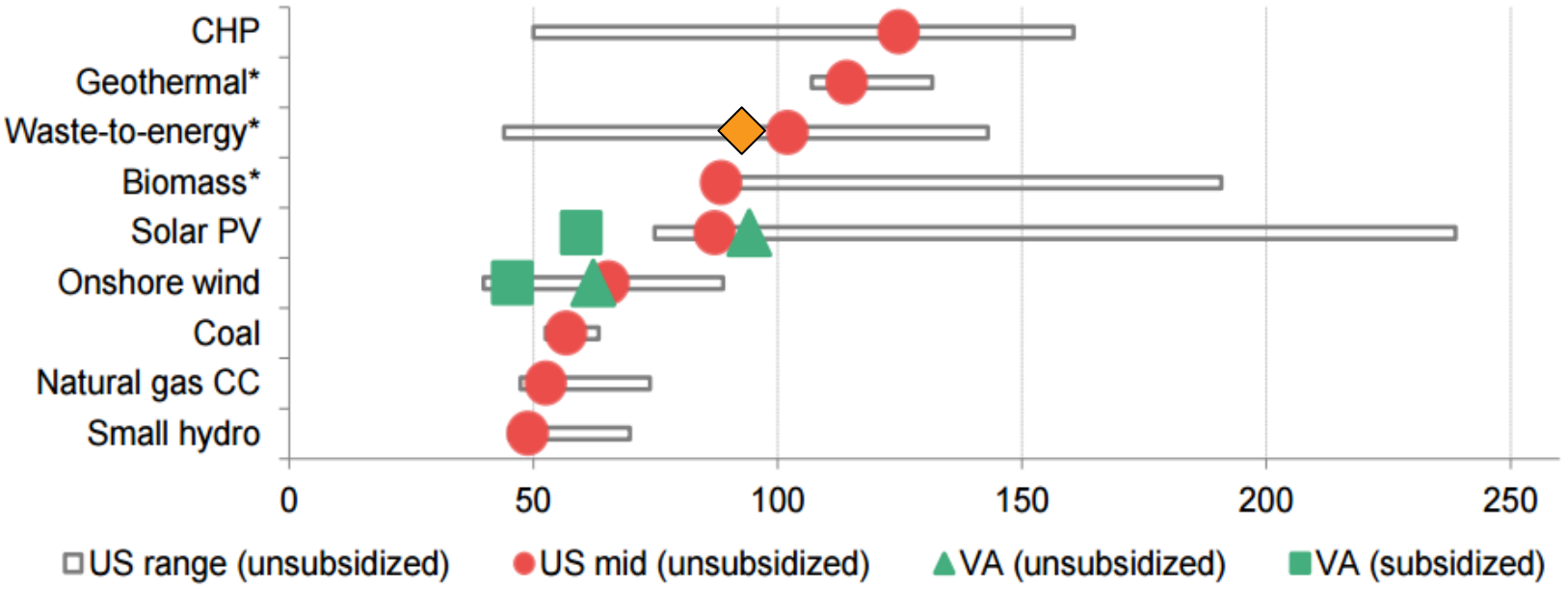
UNSUBSIDIZED LCOE OF SELECT TECHNOLOGIES IN THE US COMPARED TO SUBSIDIZED AND UNSUBSIDIZED LCOE OF ONSHORE WIND AND SOLAR PV IN VA, H1 2016 ($/MWH)

Bloomberg NEW ENERGY FINANCE



◆ Reflects U.S. average, estimated by Covanta

Source: Bloomberg New Energy Finance Notes: *LCOE for waste-to-energy in this report is a global estimate; biomass and geothermal LCOEs are Americas region estimates; all other LCOEs in Figure 13 are either US or PA-specific. Variations in PA versus US average result from variations in capacity factor, capex and financing rates. Bars indicate the range of unsubsidized LCOE for each technology in the US. Key policies such as the $23/MWh Production Tax Credit (PTC) and accelerated depreciated (MACRS) bring down unsubsidized LCOEs to subsidized levels. LCOE for combined heat and power (CHP) is for reciprocating engines with CHP. LCOE for small hydro assumes 56% capacity factor, but this can vary significantly depending on annual rainfall conditions.

WTE is Reliable Baseload Power

- **WTE is baseload renewable energy, with higher capacity factors than other renewables or traditional fossil generation**
- **WTE is located close to load centers, reducing transmission losses**

U.S. EIA / EPA Capacity Factors	
WTE*	64.6%
Coal	63.8%
Natural Gas combined cycle	42.2%
Hydroelectric	39.8%
Other Renewables	33.9%

* Combined Heat & Power (CHP) Plants excluded

Sources:

U.S. EIA 2009 Electric Power Annual

U.S. EPA eGRID 2012 v1.0

Thank You