Biomass for Electric Power Generation at EDF plants

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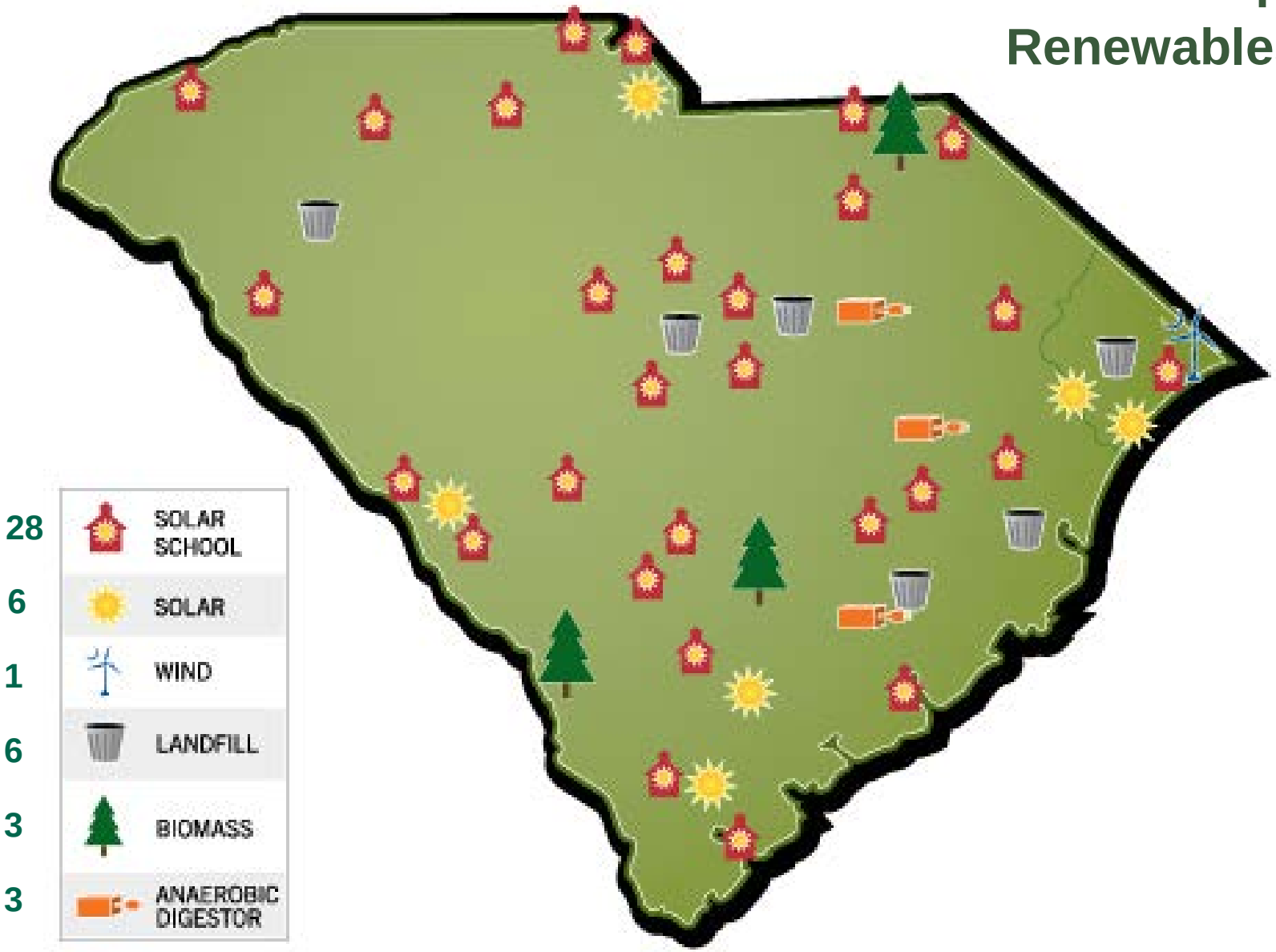
Who is Santee Cooper?

- South Carolina Public Service Authority – a public power provider for the state
- Serves all 46 counties
- Supplies (generates) the power to 20 rural electric co-operatives, as well as 2 cities, 29 large industrial customers and the CAFB.
- Approx. 2 million people are sourced
- Also water supplier – two systems

Santee Cooper Renewables



EDF biomass plants

- 2 identical plants
  - Allendale (Fairfax)
  - Dorchester (Holly Hill/Harleyville)
- Each uses 18,000 tpm (216,000 tpy) of fuel wood
- Have Power Purchase Agreement with Santee Cooper –
  - Monetize tax credits
  - No wood purchasing experience
  - Wanted to test out options for renewables
- Woody biomass is able to ramp up and down ("turndown"), and is dispatchable
- Biomass-to-energy is not determined yet to be acceptable for EPA Clean Power Plan options

Kress Theory on Fuel Wood

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Paper mills developed a fuel wood market that is in balance with their need

- Bark, residues, etc are harvested only as much as needed to supply CHP needs of the nearby mills
- This is not the focus of a paper mill
- Paper mill has developed relationships with their pulp wood suppliers to also supply (premium?) fuel wood
- Their real concern is pulp wood

Kress Theory on Fuel Wood

(cont'd)

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There is an additional supply of fuel wood that can be developed when a market appears

- Land clearing (contractor is paid to remove trees)
- Leftovers from logging (have to be removed to replant)
- Fire hazard wood
- Thinnings (normal forest operations)
- Tree trimming crews
- Ice storm wood –was picked up and ground up
- Urban wood – yard waste, tree trimmings and pallets

In short -

- Any wood that has some work (cost) already "contributed" which makes it cost-effective to collect and deliver.

Findings

Ice storm in spring 2014

- 131,000 tons unable to use at EDF
  - Small pieces of plastic from bags
  - Other fuel wood users could use –
    - Hauled further away
  - Some wood chips burned
  - A lot was landfilled
  - Permitting issue
  - Not good coordination between air and solid waste since burning on ground was allowed.

Findings

- Charleston Co LF – Produces 5,500 – 6,000 tpm of mulch, of which they sell only a small amount.
  - Either picked up curb-side or dumped with tipping fee.
  - Estimate that 80% could be screened and supplied as fuel wood = 4,500 tpm.

- Charleston Co area – A supplier offered to obtain 5,000 tpm of pallet wood from manufacturers and grind,
  - incl Boeing and others as an extension of program to handle waste streams. (Has previously done this for BMW, JCB (Savannah) and others, as Downstream Recycling).

- This equals 9,500 tpm or over half of what EDF plant uses. Would keep 114,000 tpy out of landfills.

Proposal

- Run pilot project with Bees Ferry/Chs Co Landfill with a team (DHEC, RMDAC, Chas Co)
  - Grind urban wood waste and yard waste with different set of screens
  - Screen out fines to use for mulch
  - “Qualify” the fuel wood as acceptable for use at all nearby fuel wood users
  - Make recommendations to modify how wood waste is received if needed
  - Meet legitimacy criteria under EPA NHSM Rule
  - Develop best practices as model for other projects

- Could simultaneously run pilot project with C&D wood waste and/or pallet wood waste to establish procedures for producing an acceptable fuel wood product.

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EPA's NHSM Rule

- Non-Hazardous Secondary Materials Rule for re-classifying your "waste" opportunity fuel to a <u>non-waste</u> fuel material
- The NHSM rule under the Resource Conservation and Recovery Act (RCRA) identifies which nonhazardous secondary materials are, or are not, solid wastes when burned in combustion units for the purpose of determining whether Clean Air Act (CAA) section 112 or 129 requirements apply to the combustion of those materials
- Permit wording varies by plant – EDF's is very restrictive – but if these materials are processed such that the fuelwood is same as what EDF is getting, they can use it.

NHSM Rule[1] – Criteria for Re-Classifying Opportunity Fuel from a Waste Secondary Material to a Non-Waste Fuel Material

1. **Has the secondary material been discarded?**
   - If no, does it meet the fuel legitimacy criteria, below?
   - If yes, can it be *processed* to meet the fuel legitimacy criteria?

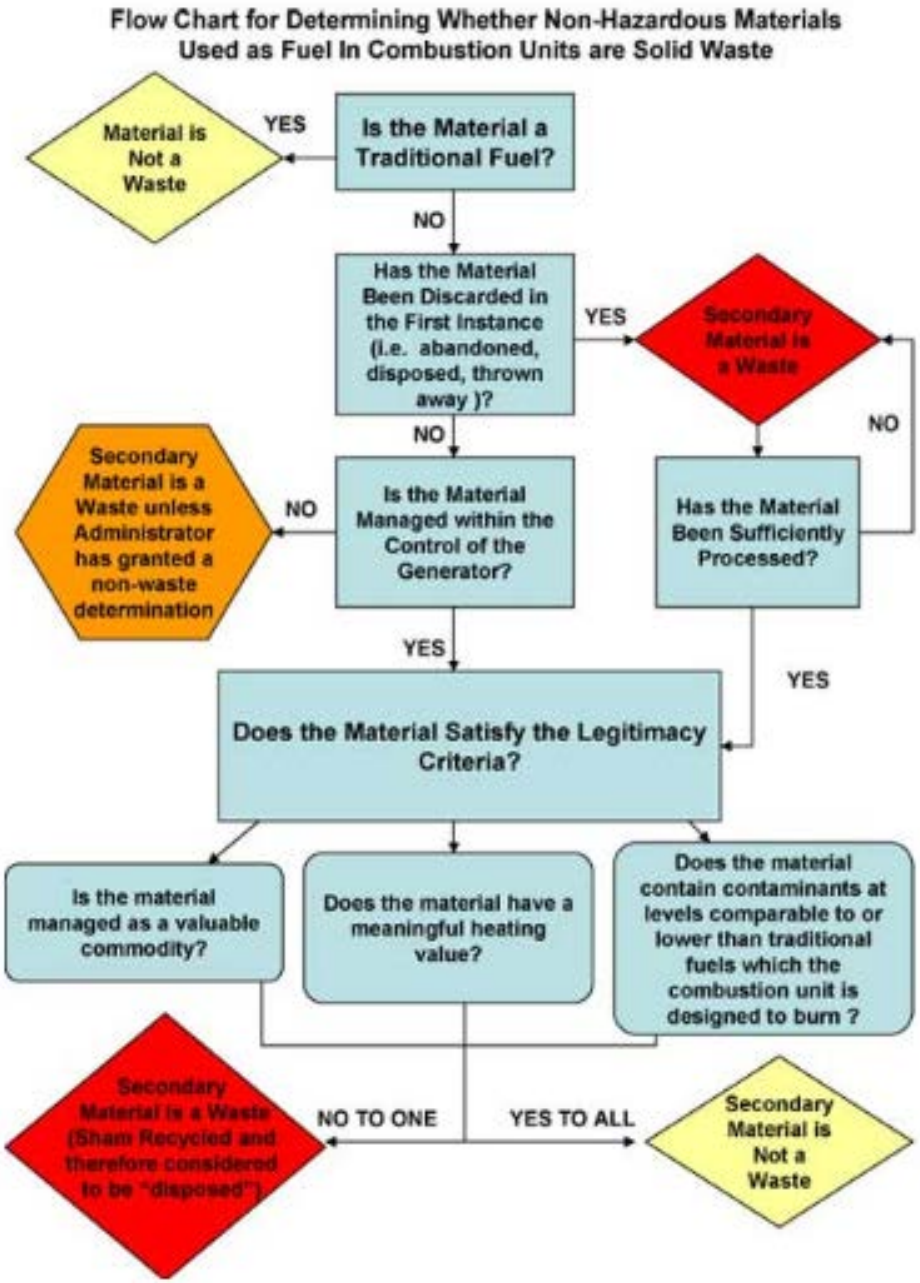
2. **Does the material meet the fuel legitimacy criteria of the NHSM Rule?**
   - Is the material treated as a valuable commodity in the market place?
   - Is the material used in a timely manner?
   - Does it have a meaningful heat content for energy recovery?
   - Are the material's contaminant levels comparable to traditional fuels; e.g., fossil fuels, wood chips?

3. **Who makes the non-waste determination under the NHSM Rule?**
   - ***Self-certify*** non-waste if you generate the opportunity fuel yourself <u>or</u> if you process waste material obtained from third parties into a legitimate fuel material
   - ***Petition EPA*** for non-waste determination if waste material is obtained from third parties for use as a fuel without processing.

[1] 40 C.F.R. § 241.3(c

From EPA website

Flow Chart for Determining Whether Non-Hazardous Materials Used as Fuel In Combustion Units are Solid Waste



Legitimacy Criteria Unpacked

1. Managed as a valuable commodity based on the following factors:

- **storage** of the non-hazardous secondary material prior to use must not exceed reasonable time frames
- either **managed** in a manner consistent with an analogous fuel or otherwise be **adequately contained** to prevent releases to the environment;

Legitimacy Criteria Unpacked

2. Have a meaningful heating value and be used as a fuel in a combustion unit that recovers energy

- General guideline of 5,000 BTU/lb from final rule (can be higher)
- Power plant recovers energy from this material as a fuel

Legitimacy Criteria Unpacked

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2. Contain contaminants or groups of contaminants at levels comparable in concentration to or lower than those in traditional fuel(s) which the combustion unit is designed to burn.

(EPA has data)

Table 2: Contaminant Concentrations in Wood & Biomass Materials[1]

Contaminant	Units	Literature Sources	OAQPS Databases[2]		
		Range	Range	Average[3]	Non-Detect Rate
Metal elements – dry basis					
Antimony (Sb)	ppm	ND - 26[4]	ND - 6.0	0.9	45 %
Arsenic (As)	ppm	ND - 6.8[4]	ND - 298	6.3	57 %
Beryllium (Be)	ppm	--	ND - 10	0.3	69 %
Cadmium (Cd)	ppm	ND - 3[4]	ND - 17	0.6	32 %
Chromium (Cr)	ppm	ND - 130[4]	ND - 340	5.9	14 %
Cobalt (Co)	ppm	ND - 24[4]	ND - 213	6.5	23 %
Lead (Pb)	ppm	ND - 340[4]	ND - 229	4.5	28 %
Manganese (Mn)	ppm	7.9 - 840[4]	ND - 15800	302	<1 %
Mercury (Hg)	ppm	ND - 0.2[4]	ND - 1.1	0.03	22 %
Nickel (Ni)	ppm	ND - 540[4]	ND - 175	2.8	17 %
Selenium (Se)	ppm	ND - 2[4]	ND - 9.0	1.1	69 %
Non-metal elements – dry basis					
Chlorine (Cl)	ppm	ND - 2600[4]	ND - 5400	259	5 %
Fluorine (F)	ppm	ND - 300[4]	ND - 128	32.4	43 %
Nitrogen (N)	ppm	200 - 39500[4,5]	2200 - 4600[5]	3460	0 %
Sulfur (S)	ppm	ND - 8700[4]	ND - 6100	704	5 %
Hazardous air pollutant (HAP) compounds[6]					
Formaldehyde	ppm	1.6 - 27[7]	--	--	--

Sources and Notes:

1. This table includes data for untreated wood and biomass, including bark, bagasse, hog fuel, and agricultural plant residues.
2. USEPA, Office of Air Quality Planning and Standards (2011a & 2011b).
3. Averages are weighted averages of individual facilities responding to the OAQPS survey. Averages only include samples above detection limits.
4. Energy Research Centre for the Netherlands, Phyllis Biomass database. http://www.ecn.nl/phyllis.
5. OAQPS nitrogen range based on 20 samples from two facilities, whereas Phyllis biomass database nitrogen range reflects the results of 394 studies.
6. HAPs listed here include only those HAPs with available data. These are not the only HAP compounds considered contaminants.
7. T. Hunt (2011).

But HOW do you do it?

- Disclaimer: we didn't get there, but Horry Co SWA did.
  - Processed material looked good
  - BTU's were low – wanted to add ground pallets to boost BTUs
- Establish a consistent process with controls – 1)receiving rules and 2)screening arrangement of grinders
- Self certify – with a letter to DHEC? Describe the process, with its controls, and how you have met the legitimacy criteria.

Test run at Bee's Ferry/Chas Co

Find a fuelwood user near you

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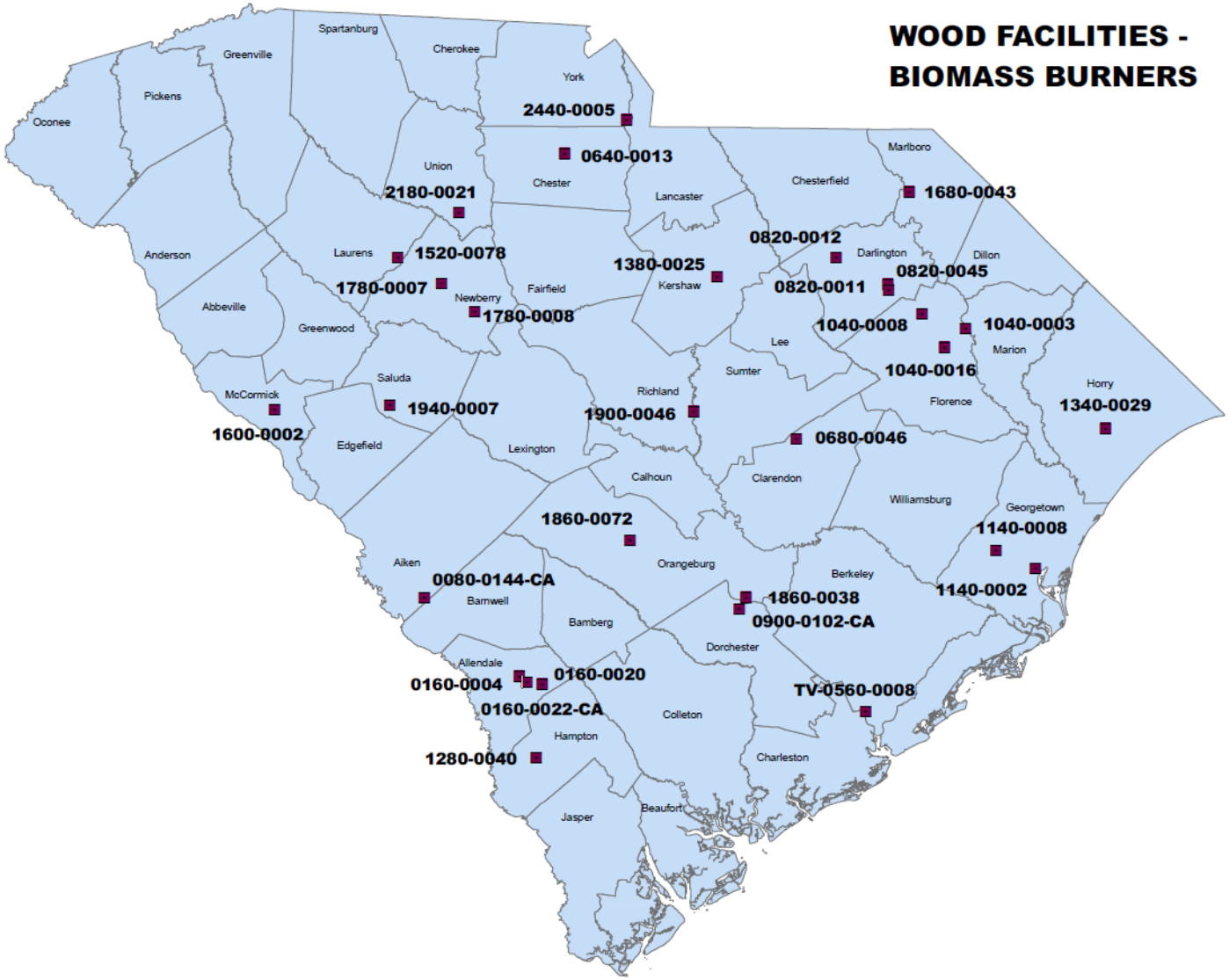

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PALMETTO RESEARCH PROJECT

WIND