MARYLAND
CLEAN ENERGY CENTER

Thermal Wood Energy

June 1st, 2022

Overview

- Maryland Clean Energy Center and Wood Innovations background
- What is advanced wood energy?
- Where does the wood come from?
- Where is it practical & case studies
- Where can you learn more?

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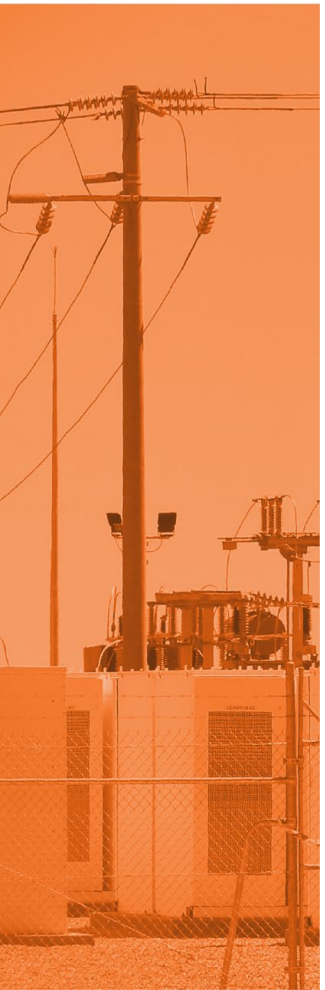

- **What is MCEC?**
  Corporate instrumentality of the state created by the General Assembly with a statute-directed mission to advance clean energy and energy efficiency products, services, and technologies as part of a specific economic development strategy.

- **What does MCEC do?**
  Advances the adoption of clean energy, energy efficiency products, services, and technologies.

- **How does MCEC carry out its mission?**
  Leveraging private capital to help homeowners, businesses, and government entities recue energy costs.

- **Learn more at www.mdcleanenergy.org**

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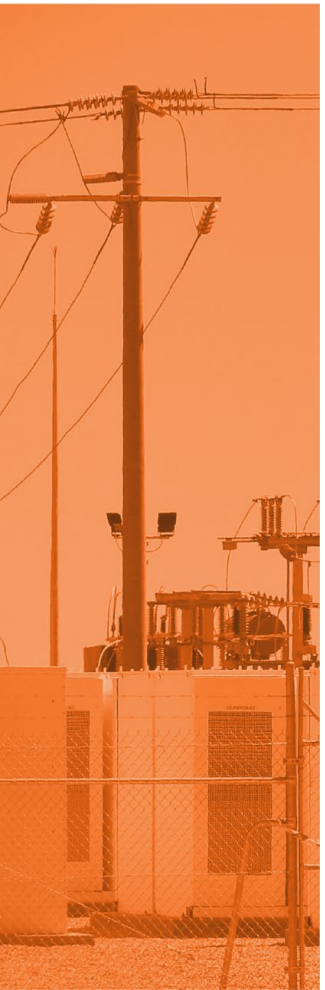
USDA Wood Innovations Grant

- **Purpose**

  Stimulates and expands wood energy products and wood energy markets.

- **Wood Energy Coordinator role**

  Education, facilitate a switch from fossil fuels, stimulate the wood energy team, provide additional wood energy opportunities across MD



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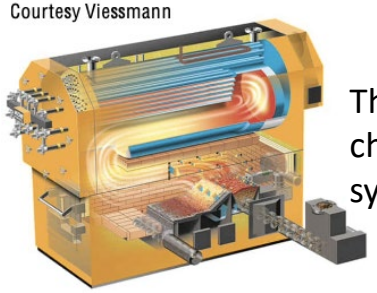
What is Advanced Wood Heat?

- **Solar battery**
  Converts solar-derived stored energy to thermal
- **Thermochemical**
  Converts wood to only thermal energy
- **Steam turbines/engines, ORC systems, Stirling engines**
  Uses the excess energy to generate electricity called Combined Heat and Power (CHP)
- **Adsorption or Absorption Chillers**
  Thermally-driven cooling, "Tri-generation" of thermal, CHP, and cooling

Courtesy Viessmann



Thermo-chemical system

Courtesy of Turboden

Organic Rankin Cycle (ORC)

Courtesy Thermax

Absorption Chiller

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Types of Residues

Chips

Cordwood

Pellets

Source	Units	Fuel HHV, mmBtu/unit	Seasonal Conversion Efficiency	Fuel Delivered Cost/Unit	Heat Cost, $/mmBtu
Green Wood Chips (~40% MCwb)	Tons	10.30	0.70	$60	$8.35
Dry Wood Chips (~25% MCwb)	Tons	12.90	0.75	$80	$8.27
Wood Pellets (~7% MCwb)	Tons	16.00	0.80	$250	$19.53
Natural Gas (in MD)	Thousand Cubic Feet	1.04	0.80	$15.67	$18.89
#2 Fuel Oil	Gallons	0.14	0.80	$3.91	$34.91
Propane	Gallons	0.0913	0.80	$3.79	$51.84
Electric Resistance	kWh	0.0034	0.99	$0.14	$41.74

Data from the The U.S. Energy Information Agency, U.S. Forest Service Wood Energy Technical Assistance Program, University of Wisconsin-Madison's Energy Efficiency and Renewable Energy Division of Extension, and Wilson Engineering Services

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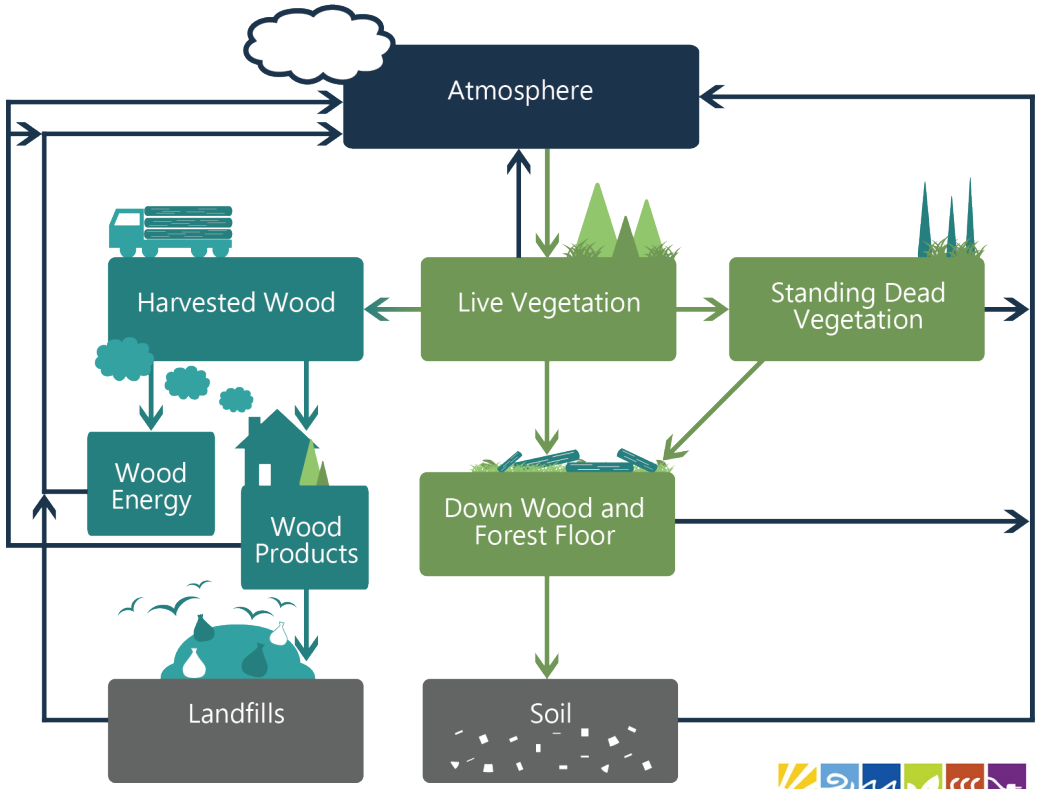
Where Do Residues Come From?

- **Fuel-grade wood**

  Does not create demand but fills supply need. Closes the forest/timber industry loop through creating solution for the by-product

- Collected from timber slash (woody material typically left behind after a timber harvest), thinning from healthy and climate-adapted forest stand densities, urban tree management, the products industry, and untreated wood that otherwise would be recycled, landfilled, or burned.
- Maryland produces approximately 2,000,000 tons of fuel-grade wood annually. Without a sustainable destination, most end up in landfills, open burning, or decomposing.



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Where These Systems Make Sense

- **Small- to large- sized facilities with old fossil fuel systems or currently being constructed**

  Shortest payback time

- **Constant thermal demand, possible high electricity demand**

- **No access to natural gas/dependent on liquid fossil fuels or electric from grid**

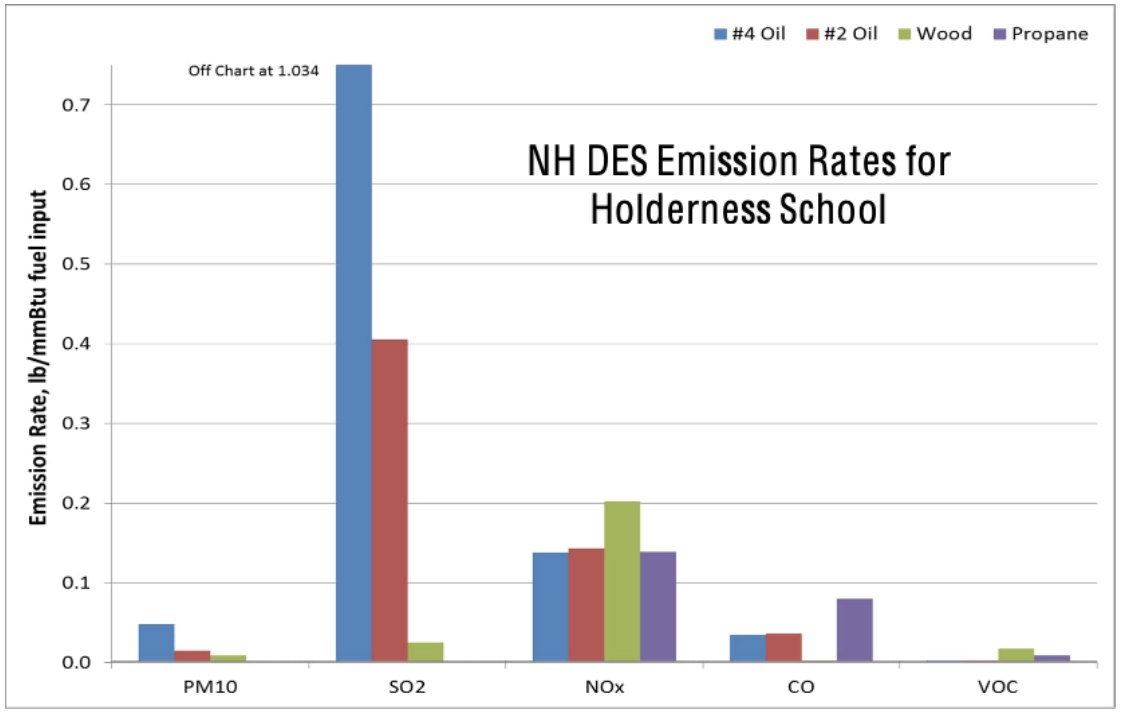
  Converts solar-derived stored energy to thermal

- **Examples;**

  Hospitals, schools/universities, nursing homes, factories/warehouses

What are the Concerns?

- **Emissions**
- **Example: Holderness School in New Hampshire. Installed in 2014.**
  Uses an electrostatic precipitator for emissions control. Other options include bag houses/fabric filters, and flue gas purifiers.



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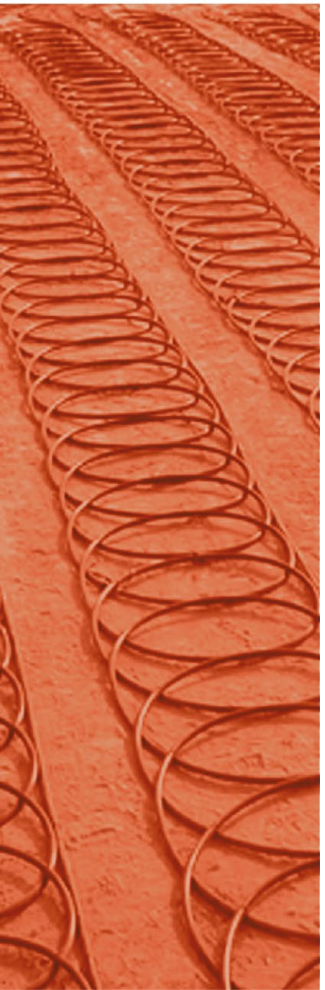
What are the Concerns?

- **Forest health and using the Southeast as a model**
  Different type of land distribution – Maryland is like New England in property size, regulations

- **Competition with other renewable sources**
  Complementary based off different strengths & weaknesses



Case Study: Middlebury College

- **Switched to wood from #6 oil to meet their carbon reduction goal**
  In 2007, set goal to be carbon-neutral by end of 2016.
- **Began operating the chip-fueled CHP gasification system Jan. 2009**
  Reduces carbon emissions by ~12,000 tons, about 40% of the college's 2006 emissions. Zero net carbon emissions from net growth of forests in region. 99.5% efficiency of exhaust system removing particles.
- **25,000 tons of wood chips used, sourced within a 75-mile radius**
- **Huge savings**
  Reduction of 1,000,000 gallons of #6 fuel oil used annually. Produced 15-20% of the campus's electricity.
- **Local economic impact of $1,000,000 for wood-related purchases**

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Case Study: Sullivan County, PA School District

- **Reason why they switched: Meet local, state, and federal goals**
  Economic development, creation of green jobs centered on renewable energy, and reducing dependence on foreign oil.

- **2.8 mmBtu/hr gasification system, a hot water boiler, and a 3,000-gallon hot water thermal storage tank serve 3 buildings**
  800 tons of wood chips/year that replace 52,000 gallons of fuel oil/year.

- **Huge savings**
  $140,000 annual energy savings. 69% of the project covered by grants, the rest was covered by a 1% 10-year loan. 525 mtCO2/year net carbon offset and eliminates 960 lbs/year of sulfur dioxide emissions.

Where to Learn More?

- **Maura Ross – mross@mdcleanenergy.org**
  www.mdcleanenergy.org/biomass-maryland/
- **Biomass Thermal Energy Council**
  www.biomassthermal.org/
- **Northern Forest Center**
  https://northernforest.org/
- **Wisconsin Energy Efficiency and Renewable Energy – Division of Extension**
  https://fyi.extension.wisc.edu/energy/wisconsin-state-wood-energy-team

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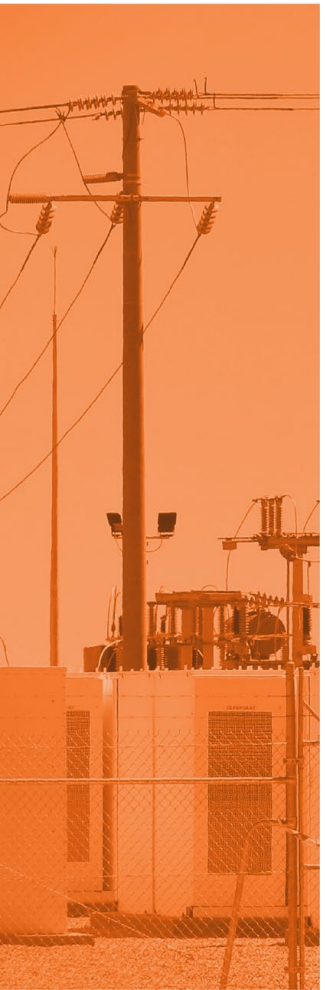
Any Questions?



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