Wood Energy: A Tool for Climate Change Mitigation

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WERC Wood Energy Technical Assistance Team

- Help Facility Owners Evaluate and Implement Wood Energy Projects
- Technology and Vendor Neutral

WES Energy · Environment · Enterprise

WERC Wood Education and Resource Center

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Modern Wood Energy Systems

Characteristics

- Efficient
- Clean Burning
- Automated

Types

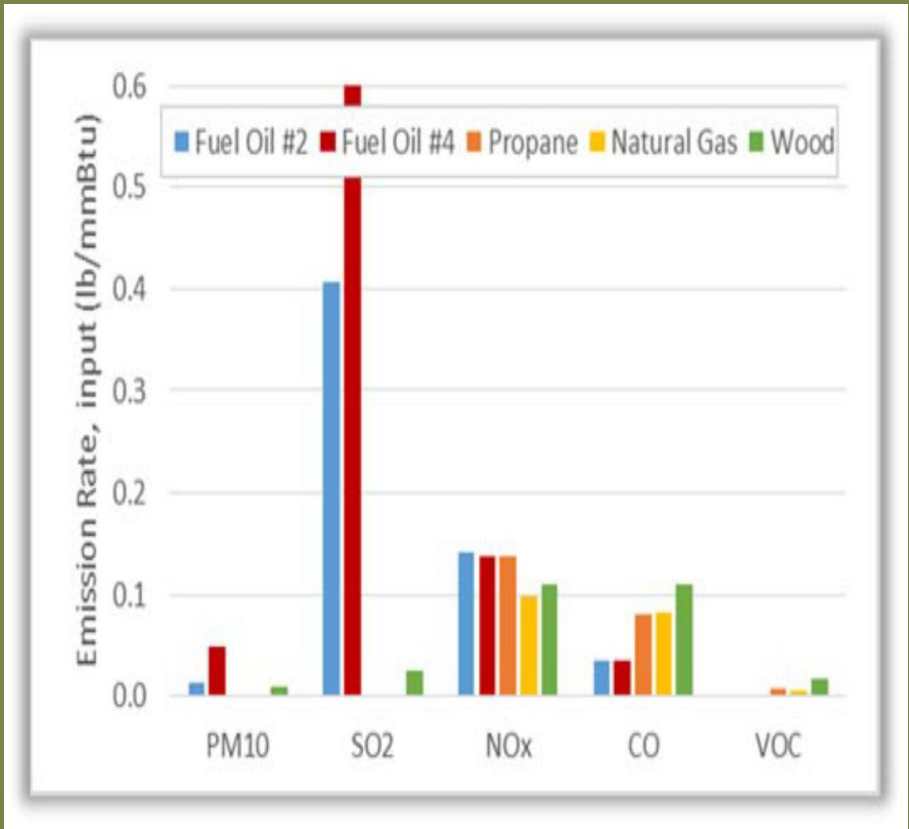
- Firewood
- Pellets
- Wood Chips
  - Semi-dry
  - Green

Key project components

- **Fuel**
  - Firewood
  - Chips (wet/dry)
  - Pellets
- **Combustion system –** *w/wo flue gas condensation*
- **Heat transfer system**
  - Air,
  - Water
  - Steam
- **Ash management system -** *manual or automated*
- **Operation control systems**
- **Emissions control system**
  - Cyclone/multiclone
  - ESP
  - Fabric filters

Maryland Air Quality Regulations

- Rules address system ≥350,000 btu/hr.
- Requires biennial boiler tuning
- Particle control requirements fit risks
- Great model for other states



Source: USDA Forest Service, 2020. Analysis of 55 systems in Northeast and Midwest

Wood Energy Emissions

- **Recent Harvard research used model data to determine wood emissions health impacts. This data treats all $PM_{2.5}$ emissions equally.**
- **Other research indicates that not all $PM_{2.5}$ emissions have equal impacts on human health.**
- **NYU researchers:** The study found that $PM_{2.5}$ from wind-blown soil and the burning of biomass, such as wood, were "non-significant contributors" to mortality risk related to $PM_{2.5}$.
- Study followed 445,860 adults in 100 U.S. metropolitan areas from 1982-2004. **It is available at:** **https://ehp.niehs.nih.gov/doi/10.1289/ehp.1509777**

Wood Energy System Summary

- Remember the goal
- Choose the right system
- Properly size the system
- Thermal storage is a key component
- Emissions controls
- Add flue gas condenser if appropriate

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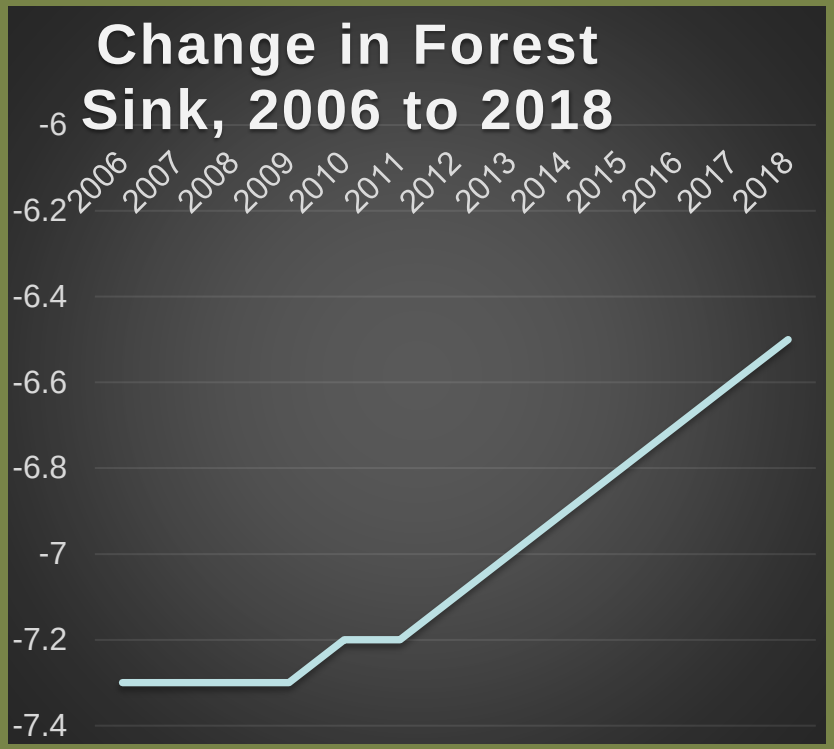
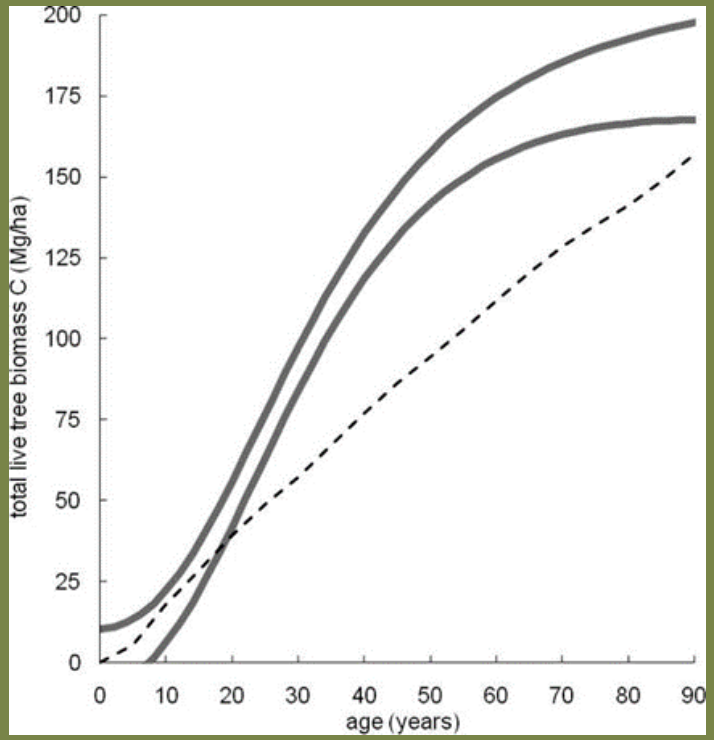
Forests Could Capture More CO^2

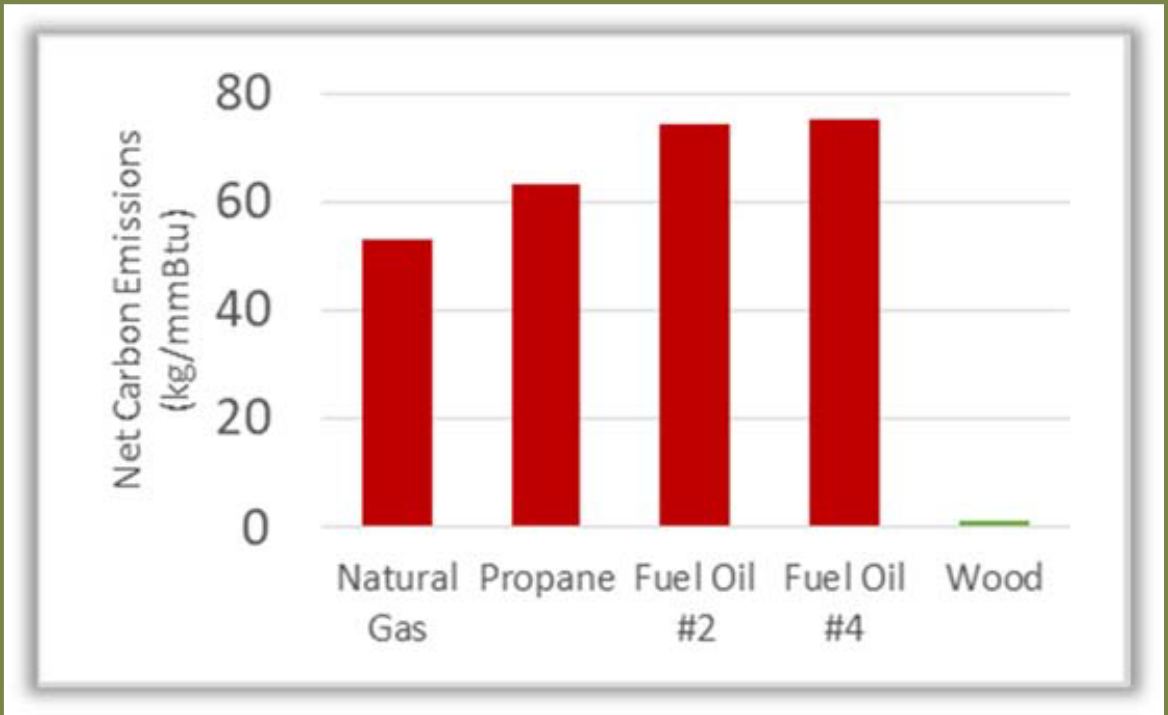
Forest is largest carbon sink in Maryland
~7 million metric tons of CO2e every year

But!! ..it is slowing. An ageing forest in need of management.





Wood Energy Reduces Net Carbon Life Cycle Contributions



Substituting fossil fuels with wood provides a net reduction in direct carbon emissions.

Source:
USDA Forest Service 2020

Note: Emissions factors are calculated in accordance with EPA and IPCC, and are determined according to standard accounting practices for sale of carbon offsets on the voluntary market.

Wood Energy Reduces Costs

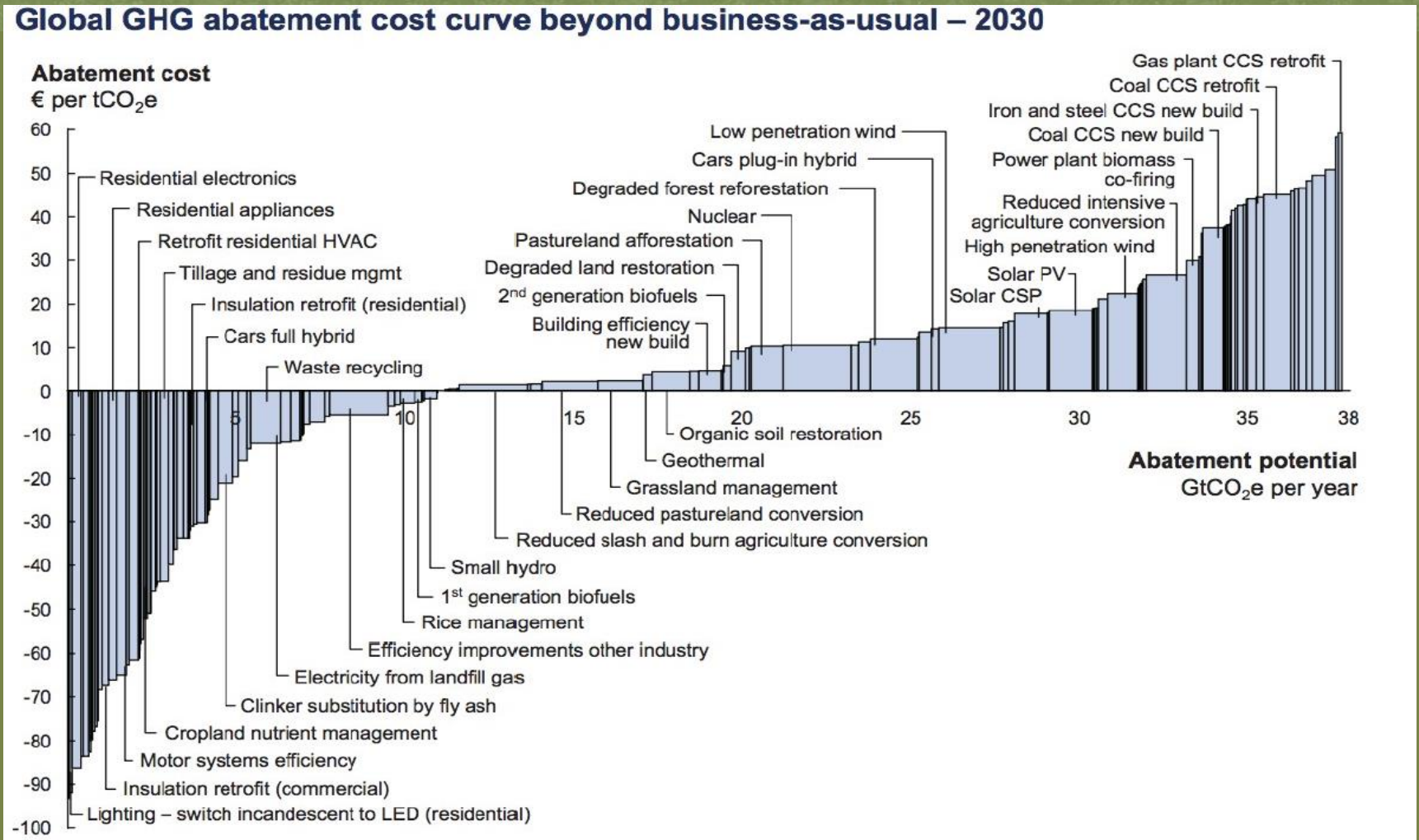
- Wood-fuels are derived from local resources and offset non-local fossil fuel purchases.
- Carbon abatement (e.g., solar and wind) often costs a lot of money to achieve. Wood energy is the opposite: it actually saves $84/tonne of CO2e.
- This savings is based on operating and capital costs over system life. We are not including the local economic benefits in this calculation.

Decarbonization of Thermal Energy

- **States/institutions are beginning to address thermal renewable energy in their long-term energy plans**
  - Many states have beginning to offer direct incentives for thermal renewable energy (tax benefits, grants, loans, RPS, Thermal RECs, etc.)
  - University of Maine, Colgate University, Middlebury College, University of New Hampshire, etc. have used wood to decarbonize their district energy systems

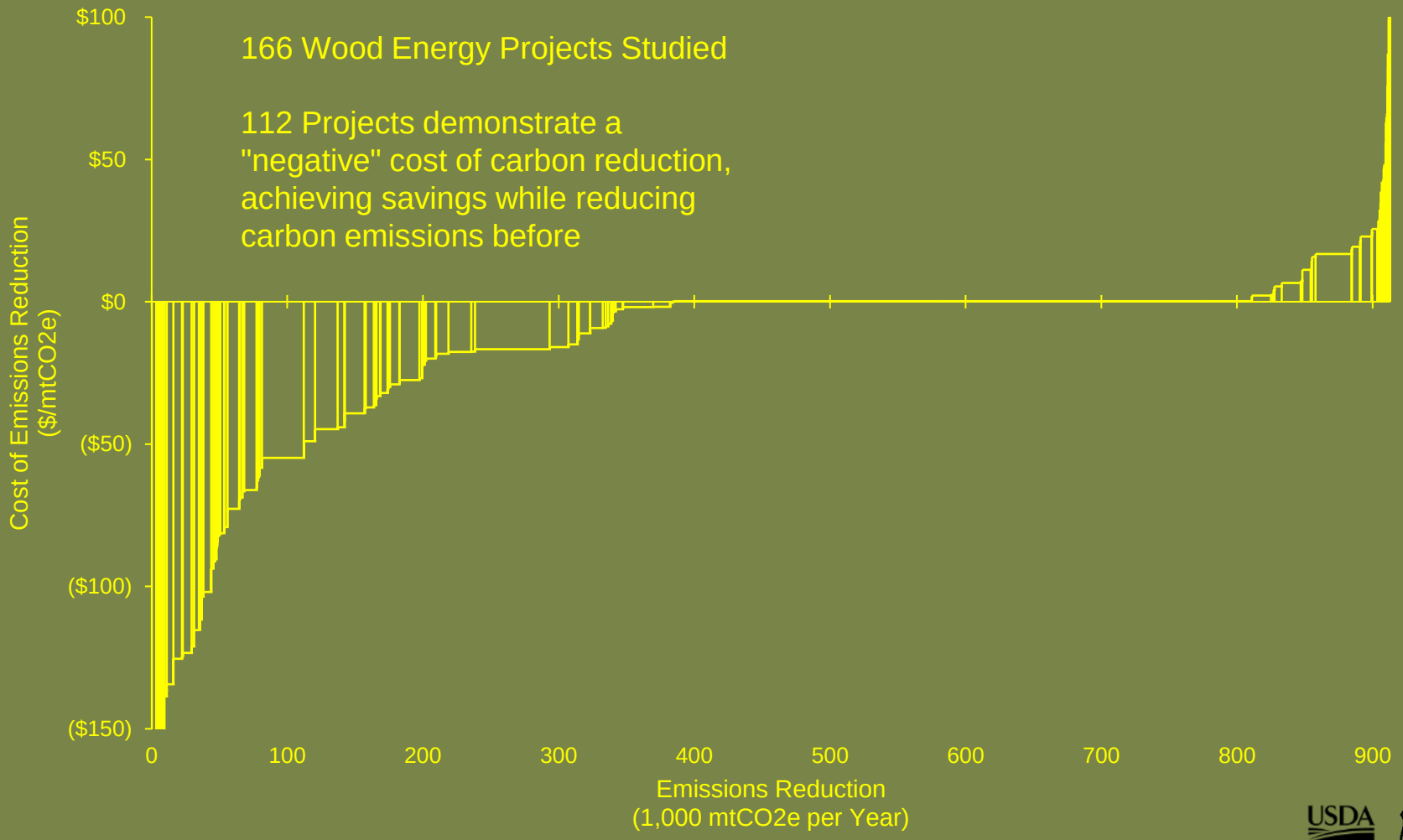
- **Industrial steam users are beginning to to address carbon emissions from thermal energy use**
  - Options are limited, particularly for high temperature systems
  - Biomass can be a very cost effective solution for appropriate applications

International GHG Abatement Costs

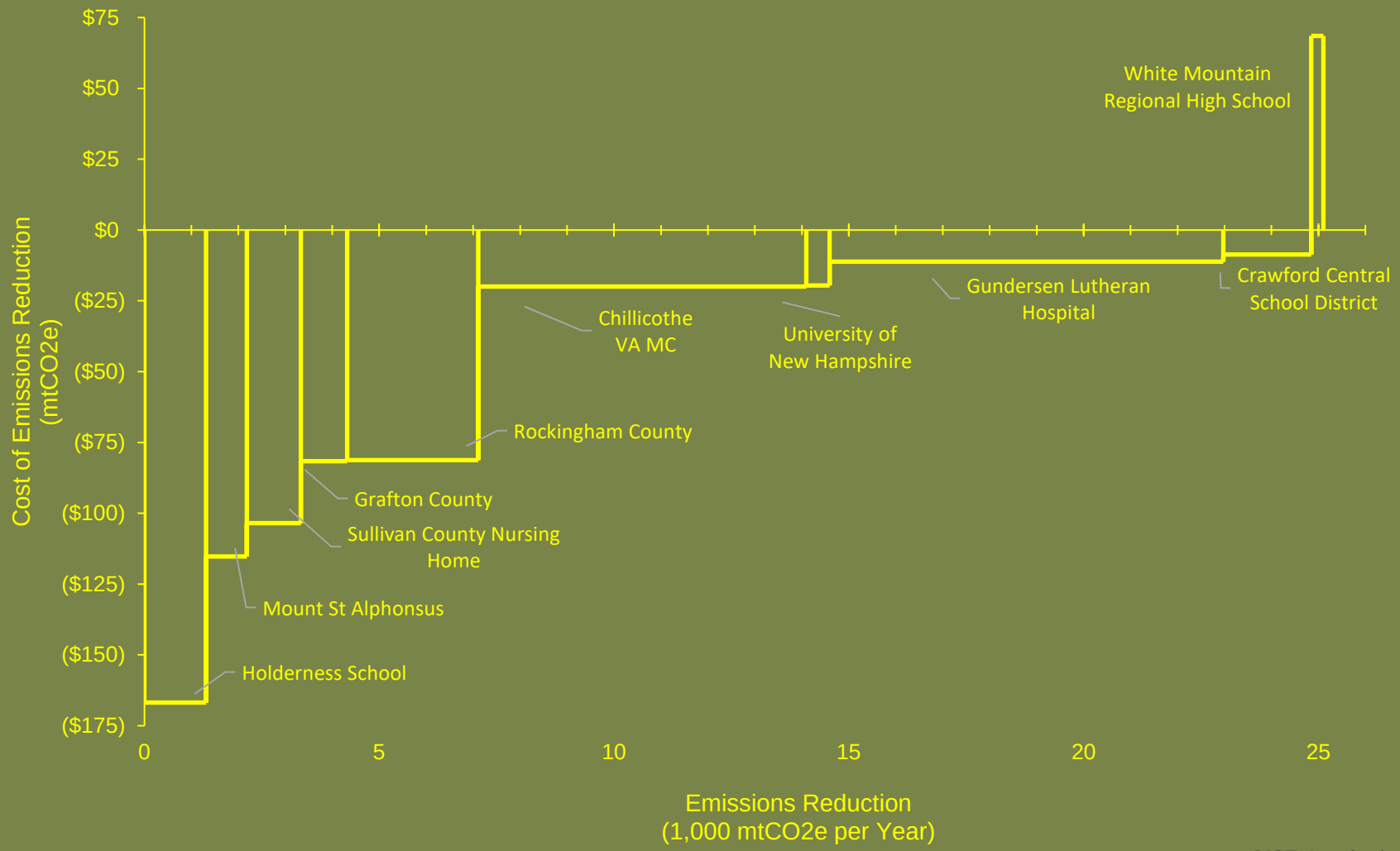


Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO_2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.
Source: Global GHG Abatement Cost Curve v2.0

Wood Energy GHG Abatement Costs



Wood Energy Abatement Costs



Wood Energy Supports Resilient Forests

- Nearly all forests in Maryland have too many trees (overstocked).
- More intensive management improves forest health by reducing stocking.
- Wood energy facilities provide a market for forest management and manufacturing residues.

Where Does the Wood Come From?

• Wood Recyclers	400,000 tons*
• Arborists	200,000 tons
• Removals	785,000 tons
• Aggregators	(market response)
• Total	1,380,000+ tons

Enough for 50 CHPs ranging from 500 KW to 5 MW and 800 schools**

MD Forest Abatement Capacity

- **Annual Growth of MD Forests(trees≥5")**
  - 6,082,600 green tons
- **This Growth Level Captures CO^2**
  - About 9,123,900 short tons of CO^2/year
- **Available Wood Residues for Energy**
  - 1,380,000 green tons/year
- **CO^2 Emissions from Residue Use**
  - 1,269,600 short tons of CO^2/year
- **Avoids alternative residue fates that include methane generation.**

Summary

- Maryland's forests can play a major role in GHG/Climate Change mitigation
- More intensive forest management is beneficial
- Wood energy from forest residues provides both climate and economic benefits
- CO^2 and particulate emissions are manageable

Wood Energy

- Clean
- Efficient
- Automated
- GHG benefits

For more information

https://www.fs.usda.gov/naspf/programs/wood-education-and-resource-center/woody-biomass-technical-assistance

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