Providing Renewable Energy at a State DOC Facility

… While remaining Budget Neutral.

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Incorporating Renewable Energy into Public Facilities

The Drivers for Renewable Energy Solutions -

- State Renewable Portfolio Standards (**RPS**)
- Concern about **Environmental Impact** – Reducing "Carbon Footprint"
- Economic Development impact – Local **Job Creation**
- Dependence on "Foreign Oil" and its **Volatility**

Challenges for State Agencies to Overcome -

- Life after ARRA – Increasing **Pressure on Capital Budgets**
- **Uncertainty of Federal Incentive** Program Longevity
- **Utilities Inability to Integrate** intermittent Renewable Energy Resources
- **Permitting Variability** State to State

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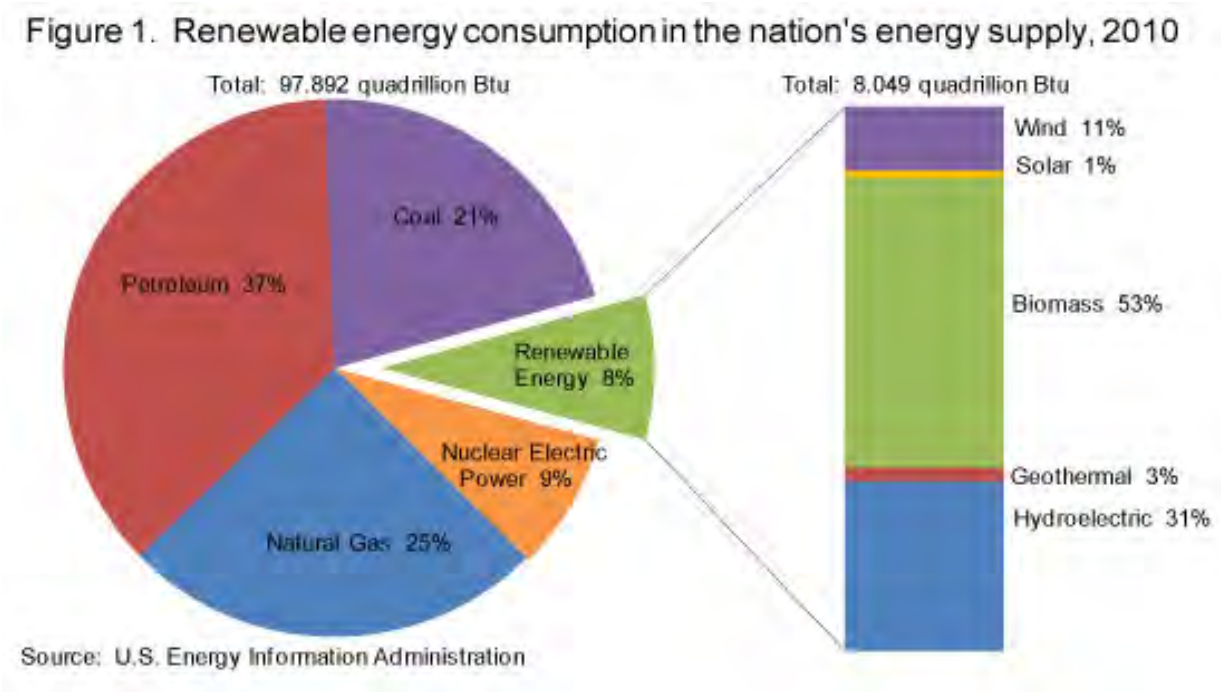
Utilizing Renewable Energy in Missouri - Biomass

- Available from **various sources** – wood, crop, or animal waste, energy crops
- Numerous available Biomass **conversion technologies**
- Electric, thermal or BioFuel **output options**
- The "workhorse" of Renewable Energy – **available 24/7**
- **Largest segment** of Renewable Energy industry – even Hydro



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Benefits of Biomass vs. Fossil Fuels or Other Renewables

Compared to Fossil Fuels -

- Woody Biomass considered **Carbon Neutral**
- Renewable Energy **incentives and credits** available for Biomass
- Broad number of **feedstocks** for **diversity**
- **Local job creation** – keeps fuel spend local

Compared to other Renewables -

- The “workhorse” of Renewable Energy with **24/7 availability**
- **Utility friendly** as “baseload” generation with no back up requirement
- **Thermal or Electric** output applications
- Usually **does not require incentives** to make a business case

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Case in Point: Missouri DOC – Licking, MO (and Charleston, MO)

Situation

- Part of overall State energy project that included :
  - Metering & enterprise info system
  - Major building energy efficiency
  - Priority of carbon reduction
- Less than 10-yr old state prison
- Built on low first cost basis
- Propane gas fired boiler plant
- Lots of wood residuals in the area

Solution

- Switch fuel from **propane** (>$12/MMBtu) to waste wood biomass (<$3/MMBtu)
- Build new 10 MMBtu combustion boiler
- **Baseload** the biomass boiler
- Utilize gas boilers for peak and backup
- Cogeneration not economic – low rates
- Under 10-yr payback – $3.3M cost

Dramatically Improved Carbon Footprint!

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Modular On-Site Erection…
Boiler Section being Hoisted on to the Top of the Combustion Section…

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Emission Controls hoisted in Place – PM control...

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Fuel Feed and Ash Removal Systems being Attached…

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And the Building is Built Around it…

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Output Connected to the Existing Plant, now as a Back-up…

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2 to 3 days wood storage…

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Automated conveyors bring the fuel into the building…

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Wood Chips fed to the Boiler…

Converted to Thermal Energy…

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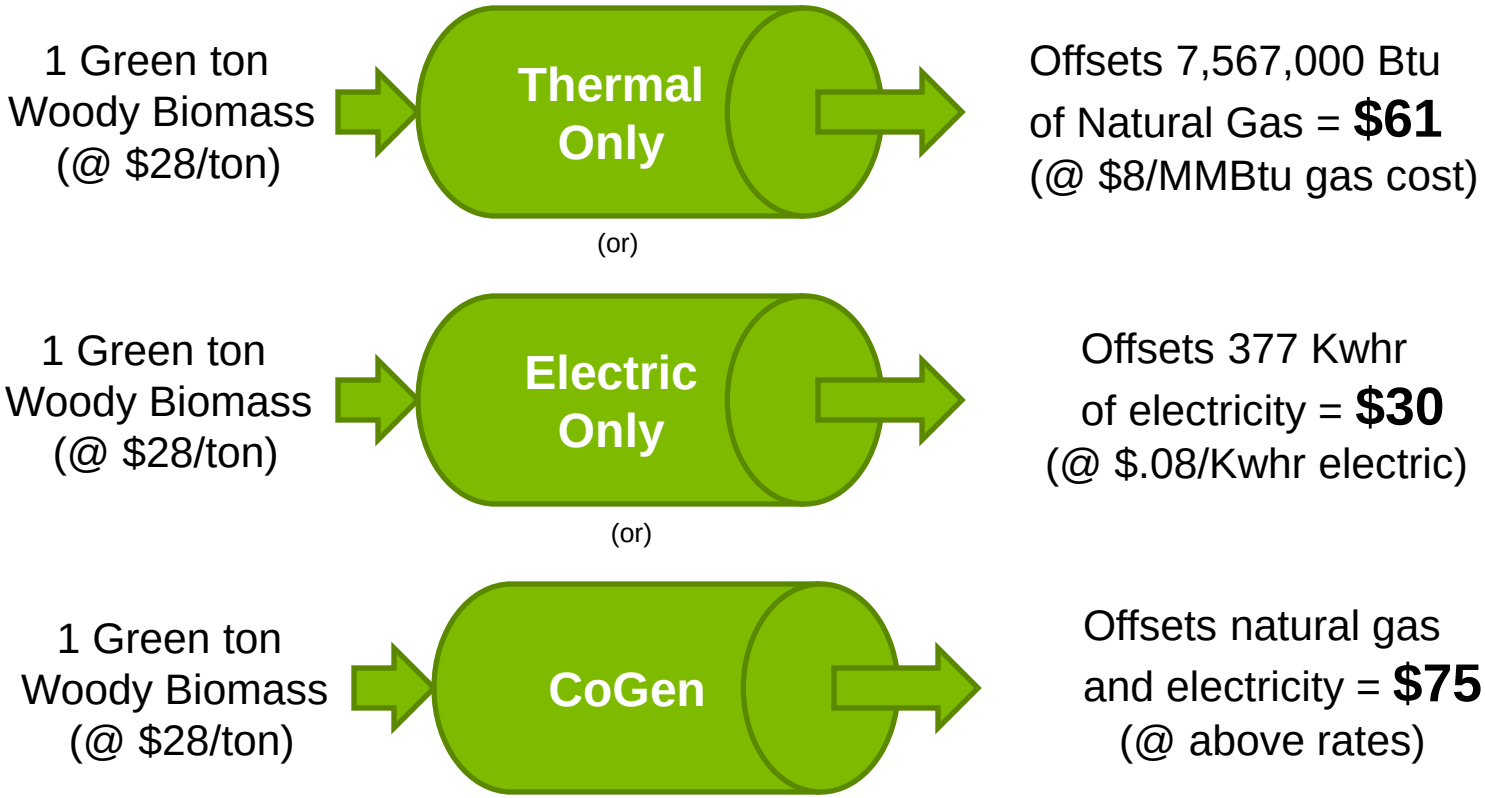
Biomass Energy Value

- Remember – Thermal output value is much higher at today's prices than electric output!



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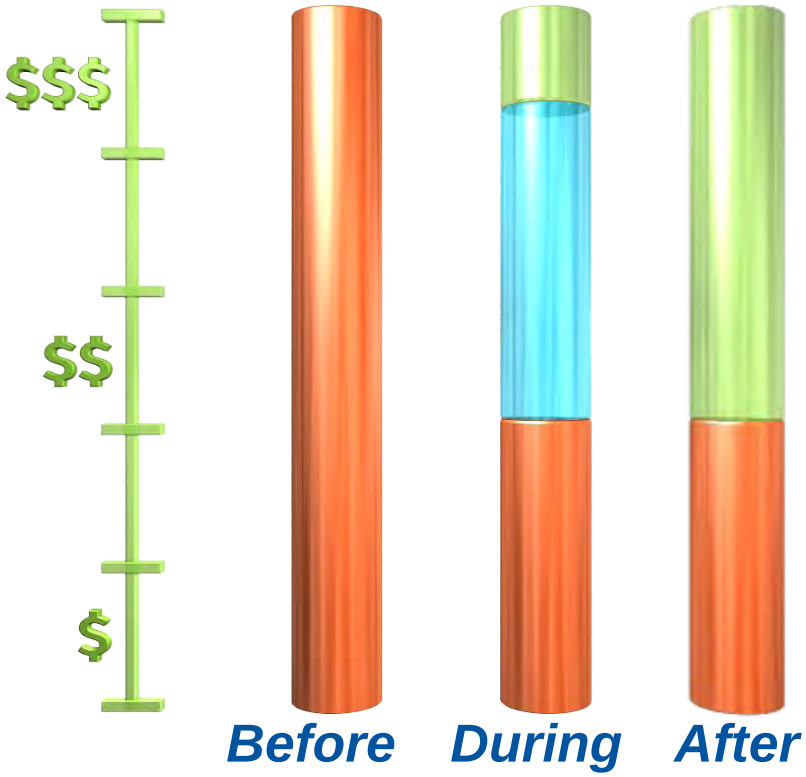
Performance Contracting - Funding



- Your Utility Bill
- Payment for Efficiency Upgrades
- Your Savings

In short, **Performance Contracting** is a procurement tool that allows you to leverage the savings you get from making building improvements in order to pay for the improvements… Guaranteed!

Note: above graphic is for illustrative purposes.

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Why Woody Biomass is typically the “Fuel of Choice”

Relative Biomass Costs (Ballpark)

Biomass Fuel Type	$ / Green Ton	Moisture Content	BTU/LB (As-Delivered)	$ / Dry Ton	$ / MMBTU	Availability
Wood Pellets (bulk)	$140	7%	7,905	$151	$8.86	Limited
Energy Cubes (bulk)	$100	7%	7,905	$108	$6.33	Limited
Corn Stover (densified)	$80	15%	7,225	$94	$5.54	Corn Belt Only
Torrefied Wood	$100	3%	10,000	$103	$5.00	Limited
Switchgrass	$65	15%	7,225	$76	$4.50	Limited
Corn Cobs	$50	30%	5,950	$71	$4.20	Corn Belt Only
Green Wood (chipped or ground)	$30	45%	4,675	$55	$3.21	Broad

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Keys to Biomass Success

(Summary of What We Have Learned Over Last 10 Years and dozens of Projects)

- Scale is your friend – Bigger is Better
- Thermal is more valuable than electric
- Good thermal load factor (50% or higher) – Most sensitive project variable
- Job preservation / creation is a key selling point today
- Small District systems difficult – often won't fund the infrastructure
- Woody Biomass typically the "fuel of choice" in today's market
- Focus on the markets that are conducive to Biomass Solutions
- Don't forget about the Carbon offset value
- **Many options to fund Biomass projects –**
  - **Performance Contracting**
  - Design/Build/Own/Operate/Maintain (DBOOM)
  - Tax Exempt Municipal Lease/Bond
  - Debt/Equity Financing with Tax Benefits

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Where the Biomass Solution Fits Best

Facility Type	Scale Factor	Load Factor	CHP Factor	Space Factor	Overall Rating
K-12 Schools	Poor	Poor	Poor	Fair	Poor
Higher Ed.	Excellent	Good	Excellent	Good	Very Good
Industrial	Good	Good	Excellent	Good	Good
Hospitals	Good	Good	Good	Fair	Fair-Good
District Systems	Excellent	Good	Good	Good	Good
Federal Sites	Excellent	Excellent	Good	Good	Excellent
State/Local Govt	Good	Fair	Fair	Fair	Fair
Retail/Comm.	Poor	Poor	Poor	Poor	Poor

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