



U.S. Department of Energy

OAK RIDGE NATIONAL LABORATORY

CHP Subcontractors Coordination Review Meeting



April 14, 2005
Energetics Inc.
901 D St, SW
Washington, DC

Name of Contract and Subcontractors

Market Potential for Opportunity Fuels in DER/CHP Applications



Paul L. Lemar, Jr.

President

703-356-1300 x 204

pll@rdcnet.com

Description of Task(s)

- Objective: assess the use of alternative or opportunity fuels in DER/CHP applications

Opportunity Fuel: Any fuel that has the potential to be used for economically-viable power generation, but is not traditionally used for this purpose

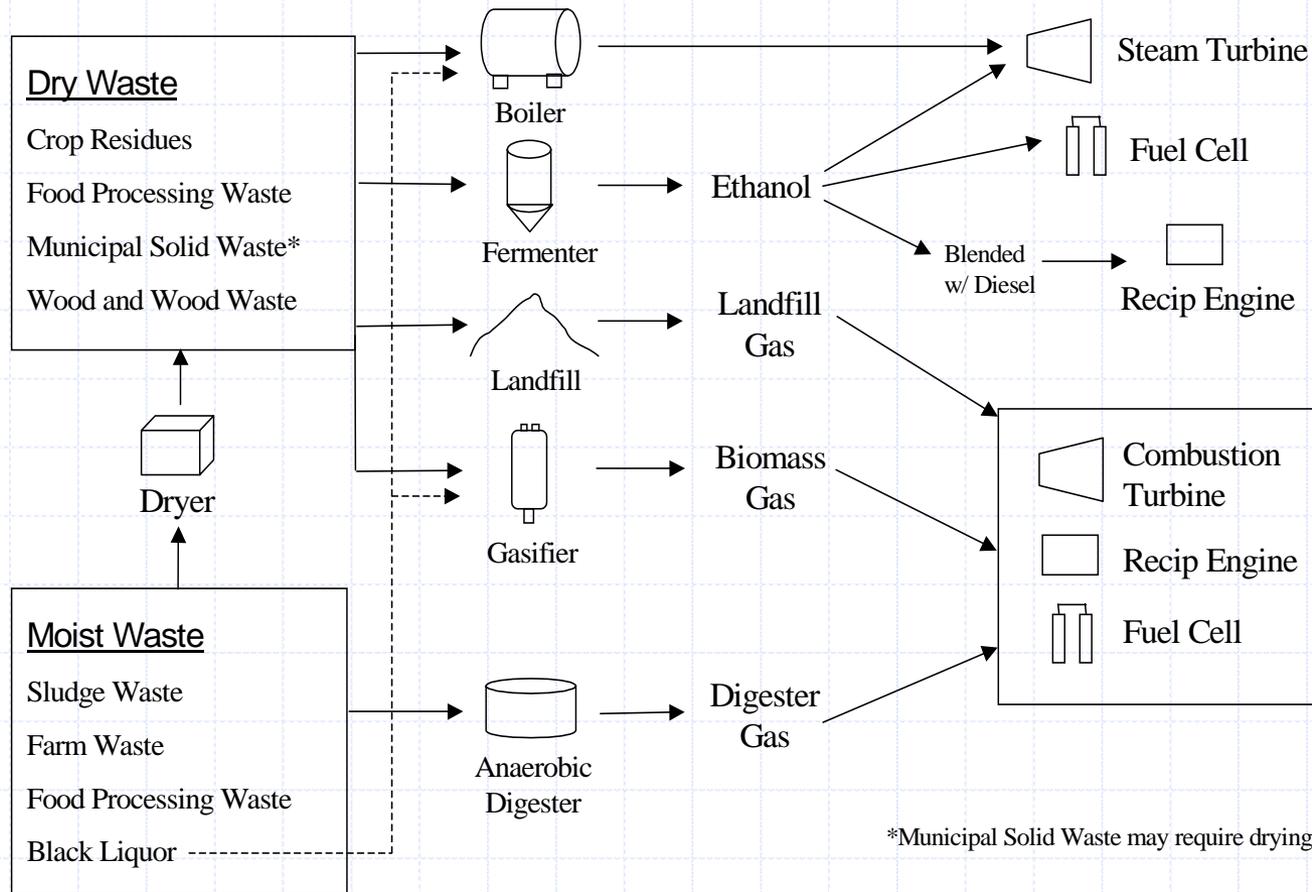
- Approach:

1. Collect and evaluate opportunity fuel information
2. Explore DER/CHP technology options
3. Develop potential market estimates and make recommendations

Description of Progress Against Task(s)

- Task 1. Collect Opportunity Fuel Information (Completed)
 - Reviewed previous studies
 - Collected information on opportunity fuels
 - Current status
 - Market considerations
 - Availability
 - Cost (acquisition, transportation, storage, processing)
 - Quality (Btus per cfm/pound, sulfur content, etc.)
 - Environmental issues
 - Screened fuels and selected the top fuels with the most potential for DER/CHP projects for further analysis

Processing Technology Key to Use of Opportunity Fuels

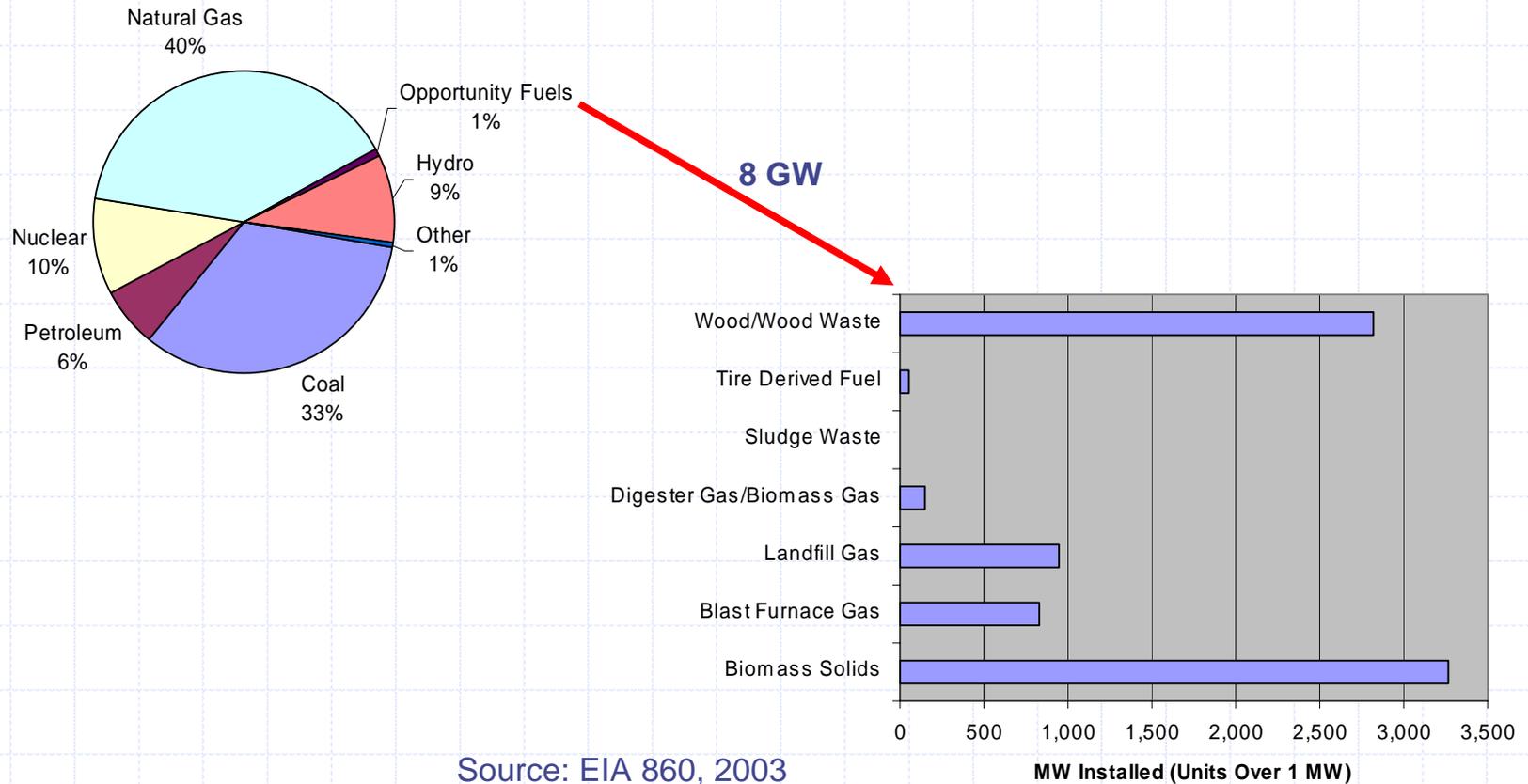


Why are Opportunity Fuels Not Used More Often?

- Availability of fuel source often inconsistent in volume and in quality, resulting in variations in fuel volume, BTU content, and contaminants
- Often requires changes (adding \$) to generating equipment or purchasing processing equipment (digester, filtration, gasifier)
- Site where fuel is located has little thermal and/or electric demand
- Costs to transport fuel to ideal site can kill projects
- Producing/processing fuel can be labor intensive
- Technology not yet commercialized for small-scale use in U.S.

Opportunity Fuels Contribute Little to U.S. Generating Capacity

2003 Nameplate Capacity (1024 GW)



Source: EIA 860, 2003

Opportunity Fuel Performance Chart: Selecting the Top Candidates

Opportunity Fuel	Availability	Heating Value	Fuel Cost	Equipment Cost	Emissions / Environment	DER/CHP Potential	Rating	Limitations
Anaerobic Digester Gas	●	●	●	●	●	●	5.0	Need anaerobic digester
Biomass Gas	●	●	●	○	●	●	4.0	Gasifiers extremely expensive
Black Liquor	○	●	●	●	●	●	3.0	Most BL already used up by mills
Blast Furnace Gas	○	○	●	●	●	○	2.0	Limited availability, low Btu
Coalbed Methane	●	●	●	●	●	●	5.0	Coal mines - lack CHP demand
Coke Oven Gas	○	●	●	●	●	●	3.0	Availability - most already used
Crop Residues	●	●	○	●	●	●	3.0	Difficulty in gathering/transport
Food Processing Waste	●	●	●	●	●	●	4.0	Limited market, broad category
Ethanol	●	●	●	●	●	●	4.0	Currently only used for vehicles
Industrial VOC's	○	○	●	●	●	●	2.0	Must be used w/ NG turbine
Landfill Gas	●	●	●	●	●	●	4.5	Landfills – little demand for CHP
MSW / RDF	●	○	●	○	●	●	3.0	Low heating value, contaminants
Orimulsion	○	●	●	●	●	●	2.5	Orimulsion not available in U.S.
Petroleum Coke	●	●	●	●	○	○	3.5	Many contaminants; large apps
Sludge Waste	●	○	●	○	●	○	2.5	Low heating value, contaminants
Textile Waste	●	●	●	●	●	○	3.0	Must be cofired; larger apps
Tire-Derived Fuel	●	●	●	●	●	●	4.0	Best suited for large apps
Wellhead Gas	●	●	●	●	●	●	4.5	Oil / gas wells – no CHP demand
Wood (Forest Residues)	●	●	●	●	●	●	4.0	Fuel can be expensive
Wood Waste	●	●	●	●	●	●	4.5	Waste may have contaminants

Key: ● = excellent / not an issue, ● = average / could become an issue, ○ = poor / major issue

Description of Progress Against Task(s)

- Task 2. Evaluate CHP Technology Options (Completed)
 - CHP Technology price, performance, and emissions parameters were evaluated (new and retrofit technologies that can use the opportunity fuels)
 - Microturbines
 - Reciprocating engines
 - Combustion turbines
 - Steam turbine systems
 - Fuel cells
 - In some cases, existing technology can be used with little modification and no additional maintenance
 - In other cases, equipment and maintenance costs can double what they were “off-the-shelf” (with natural gas or coal)
 - Auxiliary equipment (gasifiers, filtration equipment, etc.) was also considered

Evaluating CHP Technology Options

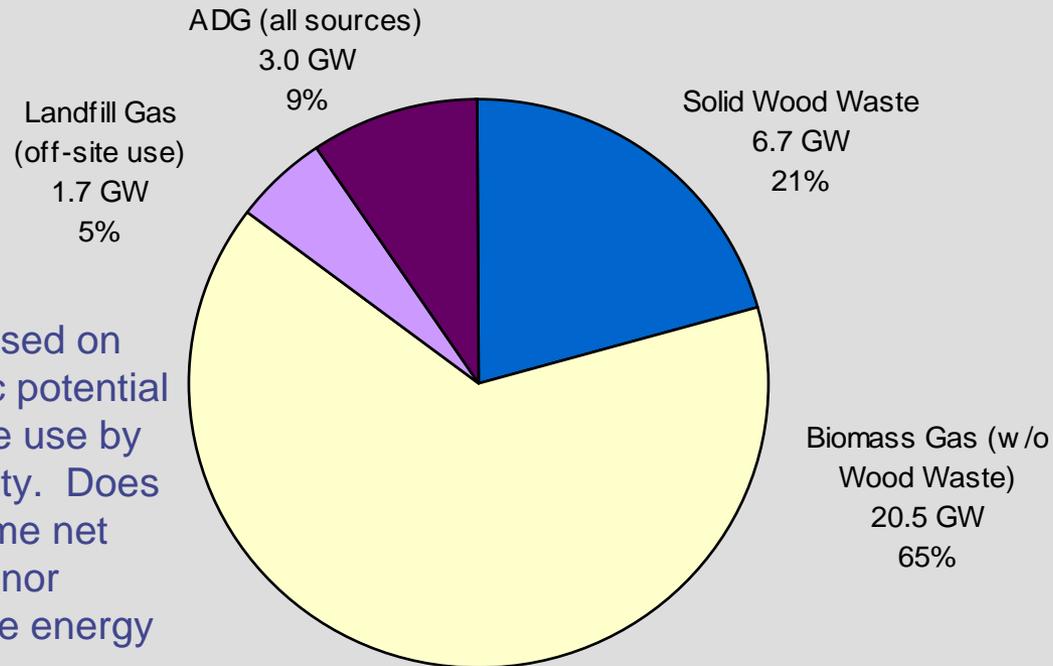
- CHP technology price, performance, and emissions parameters have been evaluated
 - Microturbines
 - Reciprocating engines
 - Combustion turbines
 - Steam turbine systems
 - Fuel cells
- In some cases (such as coalbed methane and processed TDF), existing technology requires little modification or additional maintenance
- In other cases (such as ADG or LFG combustion turbines), equipment and maintenance costs can cost 150-200% of the “off-the-shelf” price (with natural gas)
- Auxiliary equipment (gasifiers for biomass gas, digesters for ADG, filtration equipment for low-Btu gases, etc.) will also add capital cost

Description of Progress Against Task(s)

- Task 3. Develop Potential Market Impacts and Make Recommendations (In Progress)
 - A more in-depth analysis of availability and installed capacity for the 4 chosen opportunity fuels
 - The availability of each fuel's resources is examined on a state-by-state or even site-by-site in some cases

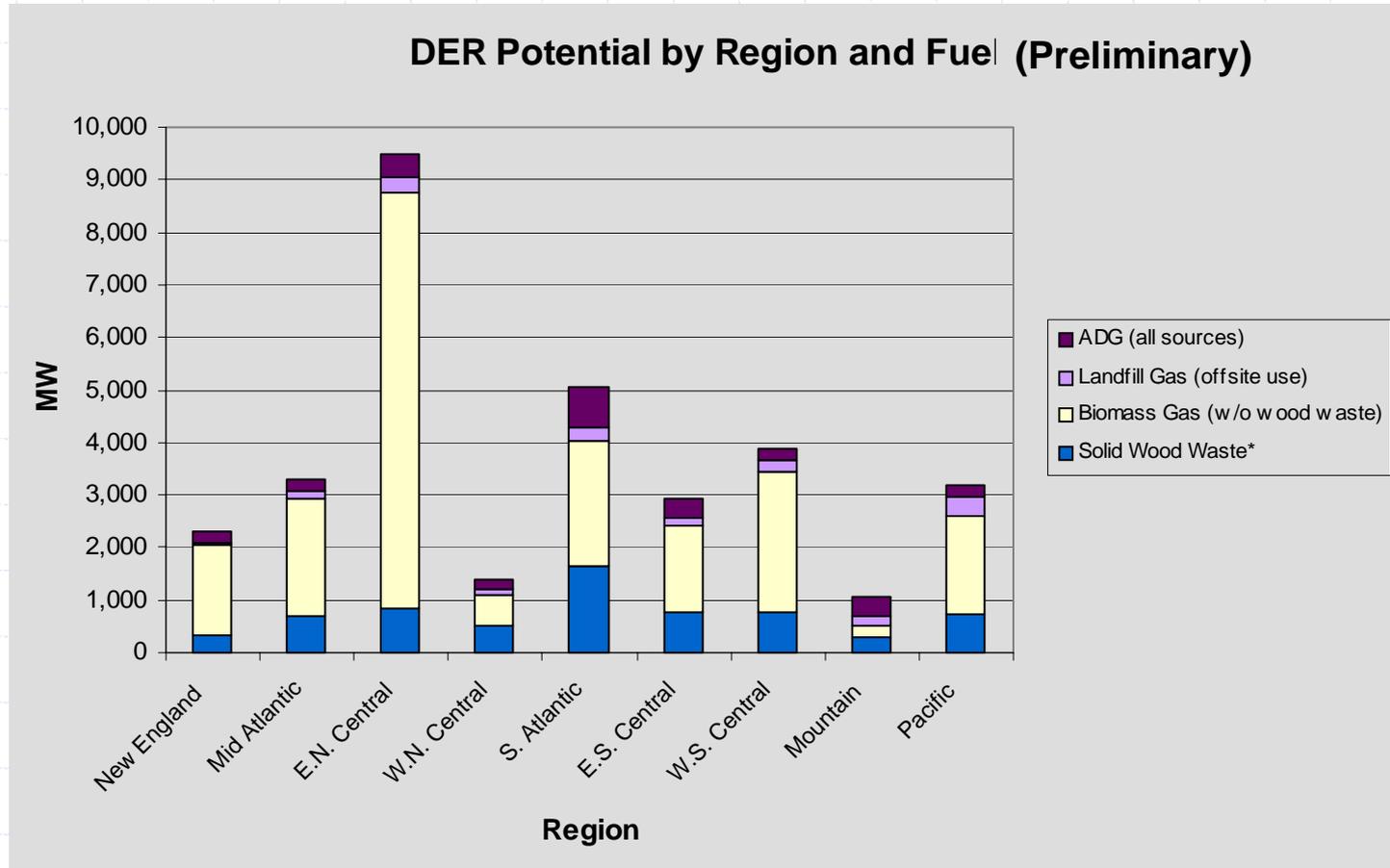
Preliminary Market Potential Favors Biomass and Wood Waste

DER Potential for Opportunity Fuels (Preliminary) (31.9 GW Total)



Note: Based on economic potential for on-site use by host facility. Does not assume net metering nor renewable energy credits.

Most U. S. Regions Offer Significant Potential



And the Top Opportunity Fuels Appear to Be

- The opportunity fuels that currently have the most potential for US DER/CHP projects are:
 - **Anaerobic Digester Gas** - over 6,800 municipal/industrial WWTPs could potentially benefit, as well as over 7,000 dairy farms and 11,000 hog farms - over 3 GW of electric capacity could be achieved.
 - **Biomass Gas** -any solid biomass fuel can be gasified - over 500 million tons (7,500 Trillion Btu) is available each year, potentially producing 21 GW.
 - **Landfill Gas** - currently about 380 landfills host LFG-to-energy projects, of which about 280 produce electricity (2.3 GW) - over 1,000 more could have DER potential, and could add 1.7 GW.
 - **Wood Waste** - can usually be obtained inexpensively or free, and can be used in boiler-steam turbine systems - potential for 7 GW exists.
- Together, these fuels offer 32 GW in economic potential
- Near term, landfill gas, anaerobic digester gas, and wood waste will lead the way

Deliverables and Availability

<u>Deliverable</u>	<u>Status</u>
Task 1 Status Report	Completed
Task 1 Draft Report	Completed
Task 2 Status Report	Completed
Task 2 Draft Report	Completed
Task 3 Status Report	Completed
Task 3 Draft Report	Completed
Draft/Final Report/PPT	Planned

- All deliverables will be available in PDF format for both hard copy and electronic delivery

Coordination with Stakeholder Groups and Other Project Teams

- Presented Interim Results at GTA Policy Forum (Oct 2004)
- Conducted Webcast for DOE Central Region Stakeholders (Dec 2004)
- Summary of Interim Results Presented at NYSERDA CHP Conference in Syracuse (Jan 2005)
- Presented Preliminary Results at AWMA Conference and at Northeast CHP Initiative Spring Meeting (April 2005)
- Other Stakeholder Interactions being Considered

FY04-05 Timeline

- Preliminary Results of Task 3 Undergoing Internal Review
- Draft Report Scheduled for April/May 2005
- Review and Final Report Scheduled for May/June 2005

Questions?

