Strategies for Biomass Gasification

Outline of Presentation

+ DOE Programs
+ Other Agencies
+ Presidential Executive Order
+ Basis for Gasification
+ Methodology
+ Strategic Elements
+ Conclusion
# Strategies for Biomass Gasification

## Background

<table>
<thead>
<tr>
<th>DOE Programs</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office of Industrial Technologies</td>
<td>Forestry and Agriculture</td>
</tr>
<tr>
<td>Office of Transportation Technologies</td>
<td>Biofuels</td>
</tr>
<tr>
<td>Office of Power Technologies</td>
<td>Biopower</td>
</tr>
<tr>
<td>Office of Science</td>
<td>Basic Sciences</td>
</tr>
</tbody>
</table>
Strategies for Biomass Gasification

Federal Investment in Biomass Research
($ Millions)

- **Bioenergy Science**
- **Biofuels**
- **Biomass Resources**
- **Biopower**
- **Integrated Assessments**

Legend:
- **DOE**
- **USDA**
- **NSF**
- **EPA**
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Smart Integration

Technologies

Policies

Markets
Strategies for Biomass Gasification

Presidential Executive Order

“Bioenergy is a means to achieve objectives - to heat our homes, to fuel our vehicles, to power our factories while producing virtually no greenhouse gas pollution.”

“I am setting a goal of tripling America’s use of bioenergy and biobased products by 2010. That would generate as much as $20 billion a year in new income..., while reducing greenhouse gas emissions by as much as 100 million tons a year - the equivalent of taking more than 70 million cars off the road.”
### Summary of Available Biomass Resources in Quadrillion BTUs

<table>
<thead>
<tr>
<th></th>
<th>Current Use</th>
<th>Additional Available</th>
<th>Total Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Wood</td>
<td>0.08</td>
<td>0.51</td>
<td>0.59</td>
</tr>
<tr>
<td>Forest Residues</td>
<td>0.37</td>
<td>0.01</td>
<td>0.38</td>
</tr>
<tr>
<td>Mill Residues</td>
<td>0.65</td>
<td>0.01</td>
<td>0.66</td>
</tr>
<tr>
<td>Ag Residues</td>
<td>0.00</td>
<td>3.95</td>
<td>3.95</td>
</tr>
<tr>
<td>Energy Crops</td>
<td>0.00</td>
<td>1.07</td>
<td>1.07</td>
</tr>
<tr>
<td>Other</td>
<td>1.95</td>
<td>0.00</td>
<td>1.95</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3.05</strong></td>
<td><strong>5.55</strong></td>
<td><strong>8.60</strong></td>
</tr>
</tbody>
</table>
### Strategies for Biomass Gasification

<table>
<thead>
<tr>
<th>Markets</th>
<th>Today</th>
<th>Projected (2020)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation †</td>
<td>1.5</td>
<td>10.6</td>
</tr>
<tr>
<td>Biofuels (10⁹ gallons)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>11</td>
<td>55</td>
</tr>
<tr>
<td>Biobased Chemicals (10⁹ lbs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power**</td>
<td>10.2</td>
<td>56</td>
</tr>
<tr>
<td>Electricity (GWe)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comm./ Residential Heat (10¹⁵ Btu)</td>
<td>0.34</td>
<td>0.7</td>
</tr>
</tbody>
</table>

† includes corn and cellulosic ethanol

* assumes successful implementation of Bioenergy Initiative and favorable policy measures

** includes landfill gas & MSW0
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Biopower Capacity Projection, 2000-2020*

*Market Potential with Supporting Policy Measures
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Gasification is a crucial technology in meeting the 3x goal

- Co-production of power, fuels and chemicals
- $\text{H}_2$, syngas
- CHP
Approach/Methodology

- Define Mission Statement
- Conduct Situation Analysis
- Define Strategic Elements/Goals
- Implement Strategic Planning Process
Mission Statement

Support the development of gasification technologies for the conversion of biomass into clean, sustainable energy and other products.
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Situation Analysis

Lead to conclusions defined in terms of:

+ Science: Not sufficient
+ Technology: Barriers exist
+ Market: Large potential exists
+ Awareness: Limited
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**Strategic Elements**

- Build on successful and existing technology platforms
- Plan and implement a robust RDD&D program
- Establish supportive infrastructure
- Promote public communication programs
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Technology Platforms
U.S. DOE and Industry have built and successfully operated:

- Specialized research and analysis facilities
- Pilot plants and process development units
- Demonstration plants
**Technology Platform Goals**

+ Rapid deployment of gasification using specialized test facilities to:
  
  - Evaluate a variety of biomass feedstocks
  - Conduct critical parametric gasification tests
  - Evaluate biomass-specific enabling technologies and product gas upgrading
  - Determine performance of energy conversion devices

+ To improve system reliability while capitalizing on past investments
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Robust RDD&D Program
+ Conduct Basic Research
+ Develop Modular Systems
+ Develop and Demonstrate High-efficiency Systems
+ Develop Biorefinery
+ Model Process
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Robust RDD&D Goals

+ Improve feedstock properties
+ Develop unit operations to improve reliability
+ Develop better gas conditioning
+ Develop cost competitive gasification systems
+ Promote co-production of power, fuels, hydrogen, chemicals, and other products
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Establish Infrastructure

+ Develop infrastructure
+ Standardize gasification products
+ Remove regulatory and financial market barriers
+ Improve energy policy and market analysis tools
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Infrastructure Goals

+ Establish biomass feedstocks as a marketable commodity
+ Make biomass gasification products easily distributable
+ Encourage Federal and state policy makers to promote gasification technologies
+ Ensure that biomass technologies are adequately addressed by policy analysis tools
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Establish Communication

+ Communicate the Benefits and Performance of Biopower

+ Targeted audiences include:
  
  ™ Policy Makers
  ™ The Public
  ™ Industry
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Communication Goals

- Create communication program with government decision makers
- Support policy development that leads to appropriate legislative incentives
- Inform the public that biomass can produce multiple products, including power
- Support education and training programs that service a biobased industry
Next Steps

+ Gather feedback from Stakeholders
  - 2000 Gasification Technologies Conference, San Francisco, California
  - Bioenergy 2000, Buffalo, New York
  - Stakeholder Review

+ Complete process and publish Plan
  - January 2001

+ Continue to update process