

# Black Liquor Gasification

## An External Benefits Study of Black Liquor Gasification

### Summary

This project assesses level of understanding and positions of key constituencies involved in the deployment of black liquor gasification (BLG), a technique with potentially far-reaching effects on economic viability and environmental quality in communities with pulp mills. Motivation for this analysis derives from results of an outside financial cost-benefit analysis of BLG indicating substantially higher IRR when environmental and renewable energy benefits are taken into account. Results from preliminary community indicate that prioritized issues like water quality coincide with BLG external benefit. This project is 30% complete.

### Key Questions

- ▶ How can we assess stake-holder priorities among the social impacts (on environment, local communities, firm viability, labor force) if the conventional chemical recovery cycle were replaced with black liquor gasification and combined cycle power generation?
  - What factors most influence the choice of BLG or alternative technologies?
  - What attitudes do key personnel at plants and in local communities have toward the various impacts of BLG?
- ▶ Are there strategic research alliances to leverage existing and future learnings leading to BLG commercialization (e.g., coal gasification)?

### Key Results to Date

A recent financial assessment of black liquor gasification lists significant national benefits from commercializing black liquor gasification combined cycle cogeneration systems (BLGCC) (Table A). Prospective internal rates of return (IRR) on incremental investments in BLGCC in

### Value Proposition

*Based on results from a comprehensive outside study, the benefits of black liquor gasification are compelling if economic values for environmental and renewable energy benefits are taken into account. This awareness will be necessary at mill, community, and governmental levels to facilitate commercialization. This project aims to foster such understanding.*

**TABLE A (Larson (2003))**  
**Benefits of BLGCC Commercialization**

Category	Prospective National Benefits
Economic	<ul style="list-style-type: none"> <li>○ Pulpwood reduction of 7% (higher pulp yield)</li> <li>○ Energy savings, cumulative, up to \$6.5 billion (25 years)</li> <li>○ Emission credit values: \$450 million SO<sub>2</sub>, \$3.2 billion NO<sub>x</sub>, \$3.1 billion CO<sub>2</sub></li> <li>○ Job preservation, growth</li> </ul>
Environmental	<ul style="list-style-type: none"> <li>○ Potential for reduced cooling, makeup water for mill and for grid power displaced</li> <li>○ Reduced solid waste, grid power plant</li> <li>○ Pulpwood (see above)</li> <li>○ Emission credits (see above)</li> <li>○ Particulate, VOC's, TRS reduction</li> <li>○ Additional benefits if BLGCC helps catalyze biomass-based energy industry</li> </ul>
Security	<ul style="list-style-type: none"> <li>○ More electricity produced (up to 156 billion kWh - 40% of which is renewable - within 25 years of introduction)</li> <li>○ Fossil energy savings up to 360 trillion BTU/yr within 25 years of introduction</li> <li>○ Potential for fuels and chemicals production from black liquor</li> </ul>
Knowledge	<ul style="list-style-type: none"> <li>○ Advances in materials science, syngas cleanup, alternative pulping, etc.</li> </ul>

place of Tomlinson systems were calculated to be up to 20% without considering the value of any environmental or renewable energy benefits of BLGCC (Larson et al). If economic values for environmental and renewable energy benefits were included, IRR's of 35% or higher became possible (e.g., considering values for renewable energy attributes similar to those that benefit wind power and closed loop biomass systems) (Larson et al).

Accordingly, it is essential that the wider economic benefits attached to environmental, economic development and security of BLGCC be understood and elucidated to key stakeholders so that key constituencies (regulators, community officers, researchers and mill personnel) can act in consort to facilitate future policy review and decision making.

To work toward accomplishing this objective, three central objectives have been completed to date:

- ▶ A sample frame (detailed examination) that identifies currently operating pulp mills that employ a Tomlinson boiler, with an identification of those mills that will face a 'rebuild or replace' for their existing Tomlinson Boiler(s) in the next decade
- ▶ A list of community economic development officials and local environmental protection division officials in each community with a pulp mill. Special attention was given to locate several officials in communities with firms facing a 'rebuild or replace' decision
- ▶ A web site to identify on state maps the location of each pulp mill with links to census information regarding each community, basic mill information (pulping capacity and status), and links to our project description.

Work has been initiated on a phone interview process designed to gain an objective assessment of the positions of key individuals in areas including the relevant mill's economic, labor and environmental contributions and community involvement. To this end, a comprehensive effort was undertaken to locate relevant community contacts in each area proximate to at least one of the 136 then-operating pulp mills.

Subsequently, as a sample pre-interviews were conducted with twenty-five communities with integrated pulp mills which are not expected to rebuild or replace their recovery boilers in the next ten years. The goal was to identify concerns *before* the interview process to allow greater focus on relevant topics. We identified community leaders and officials in each community and most of the eligible firms for the study. Careful pre-survey and interview instrument design helps to assure that a high quality and publishable process focus on a relatively small sample (but buttressed by another twenty-five firm and community interviews). Finally we have begun to interview community officials, covering twenty-five communities with pulp mills not facing imminent rebuild or replace decisions.

Several clear messages have already emerged. We found in initial interviews and pre-surveys that the environmental priorities of USEPA and local environmental and county policy officials are not the same. While strategic goals are similar, EPA's review concerns appear dated, following up on older concerns (water-borne and airborne emissions) that locals by and large feel are addressed. Local officials are much more concerned about reductions in water use overall, including the quantity of warm water returns (even if very clean).

We noted some very important mental models that some community officials employ in interpreting BLG. Terms such as 'hog fuel boiler,' 'chemical recovery,' or 'evaporation process,' signal a much more dangerous environmental process that is uncontained to many interviewees, even though the process is contained with appropriate environmental controls. This distracted the interviewee away from our central environmental and economic development concerns, even from leaders quite favorably disposed to their local paper mill.

## Implications for Industry

Policy focus for BLG centers considerably on timing and on understanding the true economic, energy, environmental, security, and knowledge benefits. A significant fraction of industrial

pulping capacity faces an immediate decision to either rebuild their boilers (delaying full replacement for ten years) or replace them now with a new boiler. If firms replace today, they will wait another thirty years to adopt BLG; so the particular needs of these twenty-five to thirty-five mills and their communities are paramount.

Absent highly targeted research and plant investment coordination, the full economic and social benefits of black liquor gasification will not be realized. While the construction of a strategic inventory of technology and financial investment possibilities is within reach in the wake of review and comment on the recent cost-benefit assessment, implementation requires tactical coordination among dozens of local, state and federal agencies, legislative bodies, universities, individual firms, plant managers and shared industry-wide institutions. Surveying stake-holders is essential to match particular tasks to realistic mission priorities. Additional coordination is needed with regard to the questions of (1) who will conduct and who will sponsor separate components of critical research and (2) who must participate in particular ways to establish a package of regulatory and financial incentives to facilitate cost and time efficient BLG commercialization.

## **Anticipated Results and Implications**

At this point researchers have conducted pre-interviews. As they proceed with full interviews and incorporate the results into their maps and website, they will provide everyone involved in decisions on whether to utilize BLG or alternative techniques with valuable perspective grounded in real-world experience.

## **Industry Involvement and Impact**

This project is grounded in extensive interviews with participants in the field. To build trust

among interviewees – firms and community officials alike – we constructed a website link for subjects to review prior to interview. A hyperlink was attached to an introductory letter to set up an interview time.

A surprising side-benefit is that our site maps pulp mill location, age of the boiler, and plant owner and has links to census data with descriptions of basic economic conditions in the county. This information has attracted several outsiders, including several people at DOE.

Dr. Farmer served as a DOE reviewer on the major economic evaluation by DOE of BLG (Larson et al). The complementarities of the two studies allowed us to revise our study to avoid redundancy and to focus in policy-relevant areas.

Some interviewees asked that we list their names as local contacts on the site. We plan to present this option to interviewees.

## **Publications**

- ▶ Farmer, M. C., Sinquefield, S., Report, “Update and Adjustments to: ‘An External Benefits Study of Black Liquor Gasification’”, June 15, 2003.

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## **References**

- ▶ Larson, E. D., Consonni, S., and R. E. Katofsky, Report, “A Cost-Benefit Assessment of Biomass Gasification Power Generation in the Pulp and Paper Industry”, October 8, 2003.

