



**2010 South African Biomass Gasification
Technology Innovation Leadership Award**





Frost & Sullivan's Global Research Platform

Frost & Sullivan is entering its 49th year in business with a global research organization of 1,800 analysts and consultants who monitor more than 300 industries and 250,000 companies. The Company's research philosophy originates with the CEO's 360 Degree Perspective,* which in turn serves as the foundation of its TEAM Research** methodology. This unique approach enables us to determine how best-in-class companies worldwide manage growth, innovation and leadership. Based on the findings of this Best Practices research, Frost & Sullivan is proud to present the 2010 South Africa Technology Innovation Award in South Africa to Carbo Consult & Engineering.

Significance of the Technology Innovation Award

Key Industry Challenges Addressed by Technology Innovation Leadership

The three key challenges facing the biomass gasification market within South Africa are:

- High Capital Costs of Equipment
- Availability of Feedstock
- Competing Technologies

High Capital Costs of Equipment

Efficiencies attained by BMG systems are higher than those of small scale steam turbine generation units utilized for application in the agricultural industry for cogeneration of electricity. However, the capital costs of BMG systems are far greater particularly when including the costs of ancillary systems such as feedstock pre-treatment systems. Initial valuation of power generation systems shown by potential end-user is price sensitive, and hence, favours simple steam turbine units. The ability to mitigate maintenance and repair costs and ensure a longer product lifespan, thereby increasing the return on investment of the system, will create a more attractive solution for electricity generation to potential industry end-users.

Availability of Feedstock

Due to the large capital costs of biomass gasification system development, it is important that there is a significantly high availability of feedstock for system operation in order to increase the efficiency of power production and decrease the equipment payback period. Technology innovation, such as the System Johansen Gasifier, targeted to specific, small, niche markets represents a significant opportunity for market development and expansion within South African. Potential attractive markets include community development or private electricity consumption by independent industry players. Niche market targeting could therefore be achieved through limiting the installed capacities of these gasifier systems, such as the System Johansen Gasifier that only range from 40kW to 160kW (255kW if turbocharged). By limiting the total size of these systems while maintaining high efficiencies, these systems decrease the potential for interruptions in feedstock supply while ideally targeting the above small niche markets.

Competing Technologies

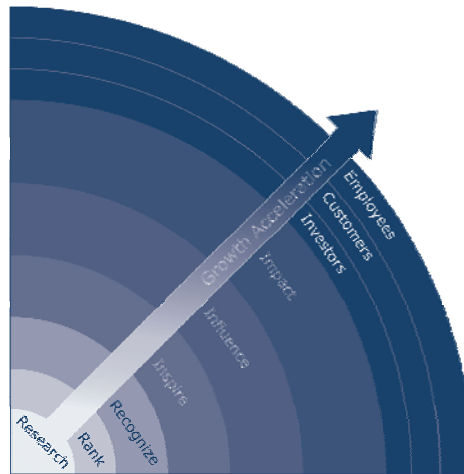
There are other technologies made available to small niche markets for power generation other than biomass gasification technologies. These technologies, mainly simple steam turbines and generator sets, have significantly lower capital costs than those of BMG facilities. Steam turbine systems represent a particular threat due to the large cost differences between these technologies and the lack of extensive pre-treatment of feedstock. Generator sets represent less of a challenge, however, due to their large feedstock costs which are otherwise very small or non-existent for BMG and steam turbine systems when operating out of agricultural processes facilities such as sawmills. Technology innovation within the BMG market represents the opportunity to undercut these technologies by not only costs and efficiencies, but also environment impact. Substantially decreased emissions and waste through biomass gasification, when compared to steam turbines or gensets, represent a key driver toward BMG implementation and concurrent market growth.

Impact of Technology Innovation Award on Key Stakeholders

The Technology Innovation Award is a prestigious recognition of Carbo Consult & Engineering's accomplishments in the biomass gasification industry. An unbiased, 3rd party recognition can provide a profound impact in enhancing the brand value and thereby accelerating the Carbo Consult & Engineering's growth. As captured in Chart I below, by researching, ranking, and recognizing those who deliver excellence and best practices in their respective endeavors, Frost & Sullivan hopes to inspire, influence, and impact three specific constituencies:

- **Investors**
Investors and shareholders always welcome unbiased and impartial third party recognition. Similarly, prospective investors and shareholders are drawn to companies with a well-established reputation for excellence. Unbiased validation is the best and most credible way to showcase an organization worthy of investment.
- **Customers**
3rd party industry recognition has been proven to be the most effective way to assure customers that they are partnering with an organization that is leading in its field.
- **Employees**
This Award represents the creativity and dedication of Carbo Consult & Engineering's executive team and employees. Such public recognition can boost morale and inspire your team to continue its best-in-class pursuit of market leadership in the South African biomass gasification market

Chart 1: Best Practices Leverage for Growth Acceleration



Key Benchmarking Criteria for Technology Innovation Award

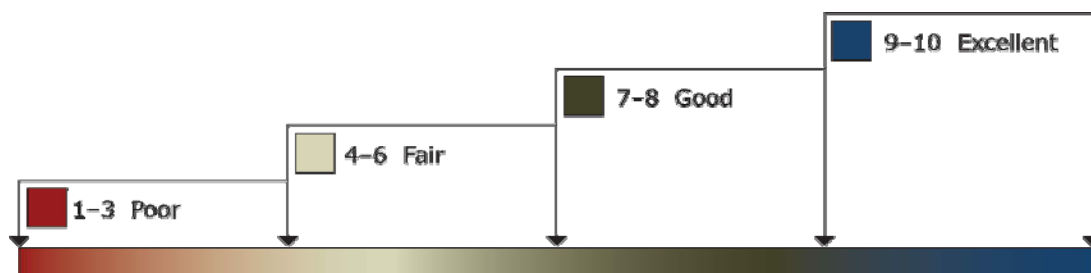
For the Technology Innovation Award, the following criteria were used to benchmark Carbo Consult & Engineering’s performance against key competitors:

- Uniqueness of Technology
- Impact on New Products/Applications
- Impact on Functionality
- Impact on Customer Value
- Relevance of Innovation to Industry

Decision Support Matrix and Measurement Criteria

To support its evaluation of best practices across multiple business performance categories, Frost & Sullivan employs a customized Decision Support Matrix (DSM). The DSM is an analytical tool that compares companies’ performance relative to each other with an integration of quantitative and qualitative metrics. The DSM features criteria unique to each award category and ranks importance by assigning weights to each criterion. The relative weighting reflects current market conditions and illustrates the associated importance of each criterion according to Frost & Sullivan. Fundamentally, each DSM is distinct for each market and award category. The DSM allows our research and consulting teams to objectively analyze each company’s performance on each criterion relative to its top competitors and assign performance ratings on that basis. The DSM follows a 10-point scale that allows for nuances in performance evaluation; ratings guidelines are shown in Chart 2.

Chart 2: Performance-based Ratings for Decision Support Matrix



This exercise encompasses all criteria, leading to a weighted average ranking of each company. Researchers can then easily identify the company with the highest ranking. As a final step, the research team confirms the veracity of the model by ensuring that small changes to the ratings for a specific criterion do not lead to a significant change in the overall relative rankings of the companies.

Chart 3: Frost & Sullivan’s 10 Step Process for Identifying Award-Recipients



Best Practice Award Analysis for Carbo Consult & Engineering

The Decision Support Matrix, shown in Chart 4, illustrates the relative importance of each criterion for the Technology Innovation Award and the ratings for each company under evaluation. To remain unbiased while also protecting the interests of the other organizations reviewed, we have chosen to refer to the other key players as Competitor 1 and Competitor 2.

Chart 4: Decision Support Matrix for Technology Innovation Award

Measurement of 1–10 (1 = lowest; 10 = highest)	Award Criteria					Weighted Rating
	Uniqueness of Technology	Impact on New Products/Applications	Impact on Functionality	Impact on Customer Value	Relevance of Innovation to Industry	
Relative Weight (%)	20%	20%	20%	20%	20%	100%
Carbo Consult & Engineering	10	6	8	9	8	8.2
Competitor 1	6	7	7	6	7	6.6

Criterion 1: Uniqueness of Technology

Carbo Consult is the only company in the world that offers a biomass gasification technology that produces zero tar as a byproduct of gasification, making the technology the cleanest mechanism for producer gas production. The system also limits ash production through gasification of biomass.

Criterion 2: Impact on New Products/Applications

Another advantage of the System Johansen Gasifier in power generation is the capabilities the gasifier system has to not only power gas engines and turbines but also its ability to act as a feedstock source for pre-installed diesel generators. The combination of producer gas produced by the gasifier and a small percentage of diesel is able to power a diesel generator at optimum efficiencies. This significantly decreases the fuel costs of diesel generator operations through the replacement of diesel fuels with biomass, particularly in areas where biomass is cheap and availability is high.

Criterion 3: Impact on Functionality

Tar production in gasification systems can lead to decreases in system efficiencies and an overall decrease in the product life-span resulting from tar accumulation and strain placed on the system mechanics. Removal of tar formation in the producer gas helps to extend the product life-span and maintains higher system efficiencies.

Criterion 4: Impact on Customer Value

The ability of the System Johansen Gasifier to not only limit tar production but remove it completely allows for the extended life-span of products increasing the total payback period for the product through electricity cost savings. This also decreases maintenance and repair costs throughout the product lifespan.

Criterion 5: Relevance of Innovation to Industry

A significant restraint to growth in the market for biomass gasification for power production is the significant capital costs required for equipment and system development and installation. The ability to extend the lifespan of the gasifier makes the option for biomass gasification a more attractive one when end-users are considering various technologies for energy production.

The CEO 360 Degree Perspective™ - Visionary Platform for Growth Strategies

The CEO 360 Degree Perspective model provides a clear illustration of the complex business universe in which CEOs and their management teams live today. It represents the foundation of Frost & Sullivan's global research organization and provides the basis on which companies can gain a visionary and strategic understanding of the market. The 360 degree perspective is also a “must-have” requirement for the identification and analysis of best-practice performance by industry leaders.

The 360 degree model enables our clients to gain a comprehensive, action-oriented understanding of market evolution and its implications for their companies' growth strategies. As illustrated in Figure 5 below, the following six-step process outlines how our researchers and consultants embed the 360 degree perspective into their analyses and recommendations:

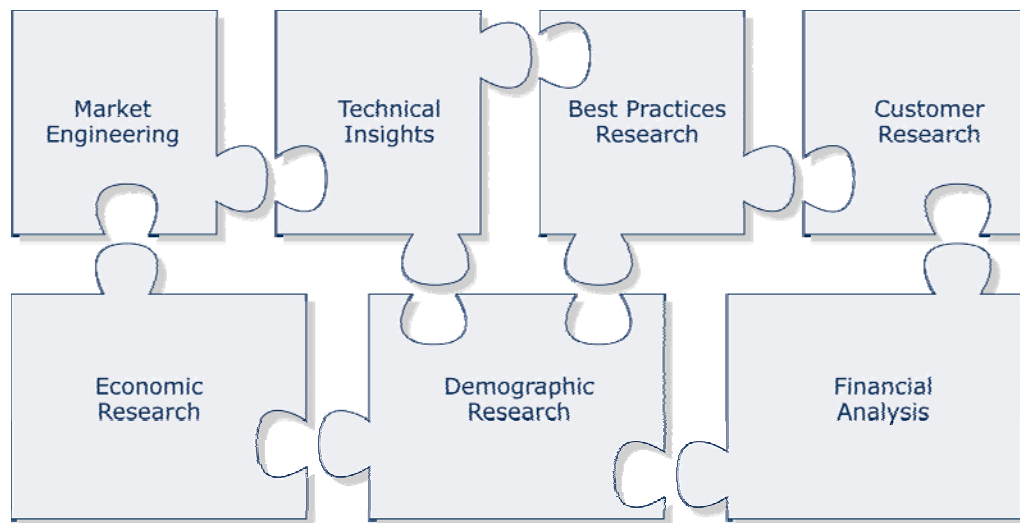
Chart 5: How the CEO's 360 Degree Perspective Model Direct Our Research?



Critical Importance of TEAM Research

Frost & Sullivan's TEAM Research methodology represents the analytical rigor of our research process: it offers a 360 degree view of industry challenges, trends, and issues by integrating all 7 of Frost & Sullivan's research methodologies. Our experience has shown over the years that companies too often make important growth decisions based on a narrow understanding of their environment, leading to errors of both omission and commission. Frost & Sullivan contends that the successful growth strategies are founded on a thorough understanding of market, technical, economic, financial, customer, best practices and demographic analyses. In that vein, the letters T, E, A and M reflect our core technical, economic, applied (financial and best practices) and market analyses. The integration of these research disciplines into the TEAM Research methodology provides an evaluation platform for benchmarking industry players and for creating high-potential growth strategies for our clients.

Chart 6: Benchmarking Performance with TEAM Research



About Carbo Consult & Engineering

Carbo Consult & Engineering is the patent holder for the System Johansen Gasifier (SJG). The SJG is the only gasifier that is able to produce tar free producer gas for electricity production. The company is targeting the implantation of its gasifier system towards community upliftment of rural areas as well as the development of electricity for industry players within the agricultural sector. A recent initiative undertaken by the company was the development of community upliftment project near Alice where a 150kVA system was installed to power a bakery, grain mill and other "home industry" equipment.

<http://www.carboconsult.com/>



About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best in class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation and implementation of powerful growth strategies. Frost & Sullivan leverages almost 50 years of experience in partnering with Global 1000 companies, emerging businesses and the investment community from 31 offices on six continents. To join our Growth Partnership, please visit <http://www.frost.com>.

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