Florida Renewable Energy Technologies Grant Program Application

RENEWABLE ENERGY PROJECTS

PART I – COVER LETTER

PROPOSAL INFORMATION			
Proposal Title:	Using High Efficiency Biomass Gasification for Industrial Drying		
Proposal Area(s): (check all that apply)	☐ Hydrogen ☒ Biomass ☐ Solar	☐ Geothermal ☐ Wind ☐ Ocean	☐ Waste Heat ☐ Hydroelectric ☐ Other
Project Type:	☐ Demonstration Project ☐ Research Project	☒ Commercialization Project ☐ Development Project	
Project Location:	Jacksonville, FL		
Proposer (Organization):	Florida Biomass Energy Consortium (FBEC)		
Proposer FEID No:	Pending formation of FBEC as an LLC		

TECHNICAL CONTACT INFORMATION					
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BUSINESS CONTACT INFORMATION					
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FUNDING REQUEST AND COST SHARE	
1. Total Amount of Grant Funds Requested:	$2,500,000.
2. Total Cost Share (Provided by applicant and project partners):	$3,788,575.
3. Total Project Cost (Add amounts in 1 and 2):	$6,288,575.
4. Cost Share Percentage (Divide amount in 2 by amount in 3):	60.25%

CERTIFYING OFFICIAL	
Certifying Official's Signature	Stephen A. Segrest
Certifying Official's Name (printed):	Stephen A. Segrest
Title:	Managing Partner
Organization:	Florida Biomass Energy Consortium, LLC

PART II – PROJECT NARRATIVE

Section I: Project Summary/Abstract

Name of Applicant: Florida Biomass Energy Consortium (FBEC)

Project Director: Steve Segrest

Principal Investigators: Rolf Maurer, Dr. Evan Hughes, Richard Schroeder

Project Title: Using high efficiency biomass gasification for Industrial drying.

Project Objectives:

1. Demonstrate commercially viable and innovative biomass gasification technology for industrial use.
2. Reduce and stabilize the energy costs to the BPB-NA wall board plant in Jacksonville, FL by displacing natural gas with lower cost biogas.
3. Demonstrate a wide range of Florida produced biomass feedstocks capable of supplying the clean energy for industrial drying through gasification.
4. Launch biomass energy toward a major industrial role throughout Florida by removing the barriers of technology, economics, and risk perception.
5. Establish technical and economic benchmarks needed to procure private sector financing to allow future project replication within Florida.
6. Create economic development within the State.

Project Description: The proposed project ("Project") is to build and operate an integrated biomass gasification system using an improved Wellman-Galusha[1] ("W/G") single-stage fixed bed gasifier; Coen burners, and heat exchanger at BPB-NA's (world's largest manufacturer of wallboard) plant in Jacksonville, Florida. The Industrial application of the Project is to directly displace natural gas use with biogas for end-use wallboard product drying. Fuel feed stocks will include wood chips from local forestry operations; paper and wallboard wastes currently land filled; and dedicated energy crop pelletized switch grass.

Impact of Project: This biomass gasification project will define and establish both the technical and economic viability of using Florida's biomass resources for industrial drying process which presently use natural gas as the primary energy source. The cost of biogas to dry industrial products is expected to be ~50% lower than the cost of natural gas paid by industrial companies such as BPB-NA in the summer of 2006. Lower and controlled industrial energy costs will allow Florida's industries to better compete globally, thereby stimulating Florida's economy while also enabling industrial growth to occur due to more competitive energy costs derived from Florida grown biomass. Florida's agri-business will also have the potential to grow substantially to generate the biomass required by industrial energy users.

Major Participants: BPB-NA @ Jacksonville, FL wall-board manufacturing plant

[1] COAL GASIFICATION – Existing Processes and New Developments, H. D. Schilling, B. Bonn, & U. Krauss Published in English in 1981 by Graham & Trotman Limited, Bond Street House, 14 Clifford Street, London W1X- 1RD, ISBN 0 86010 263 7 - Copyright 1979 by Verlag Gluckhauf GmbH, Essen

Section II: Project Background

The proposed project ("Project") is to build and operate an integrated biomass gasification system using a modified Wellman-Galusha ("W/G") single-stage fixed bed gasifier; Coen burners, and heat exchanger at BPB-NA's (the world's largest manufacturer of wallboard) plant in Jacksonville, Florida. The Industrial application of the Project is to displace natural gas use with biogas for end-use wallboard product drying. Estimates of the Project's economics have been reviewed by BPB-NA's management. Economics reflect that the cost of biogas can be ~50% lower than the cost of natural gas that was experienced earlier in 2006. All sources of biomass fuel feedstock used in the gasifier will be Florida-derived resources. Fuel feedstock will include wood chips from local forestry operations; paper and wallboard wastes currently land filled; and dedicated energy crop pelletized switch grass. Energy efficiency of the gasifier will be +85% and overall energy efficiency of the integrated gasification system will be +70%. The Project utilizes commercially proven multiple technologies of gasification, gas burners, and heat exchange. Hundreds of W/G design gasifiers (almost entirely for coal gasification) are in commercial operation throughout the world with decades of excellent availability/operating performance. The BPB-NA Project will use a modification of the W/G gasifier developed by HMI of Houston, Texas (the lead engineering project partner of the project). HMI's modifications of the W/G design include the use of a refractory lined reactor vessel and fuel feed and processing systems specifically designed for biomass feedstock. In 2002 HMI partnered with Ansaldo in Genova Italy (one of the largest engineering companies in Europe) to update the W/G gasifier technology for biomass gasification. The biomass ARI/HMI gasifier demonstrated commercial operational status exceeding the 1 MWe gas generation design goal with a 90+% conversion efficiency of the green Faggio wood chips gasified The automated fuel feeding system operated as designed achieving a 90+% availability. Gas burners and heat recovery (heat exchanger) will be purchased from the Coen Company, a world leader in clean combustion technology with over 15,000 installations worldwide.

Historically, two major obstacles of using renewable energy biogas in industrial facilities have been (1) the inability to produce clean biogas compatible with industrial equipment or industrial processes (such as product drying) designed to use clean burning natural gas, or (2) the high economic costs of cleaning the biogas. The BPB-NA Project reflects major technology innovation by coupling, for the first time in the U.S., proven gasification technology with proven burner and heat-exchange technology to enable low-capital-cost, mild gasification of biomass to provide very clean drying heat that can be applied directly to the final industrial product, in this case wallboard.

Commercial demonstration success of the BPB-NA Project will have a dramatic impact within Florida. First, industrial product drying occurs in almost every manufacturing plant and is extremely energy intensive. The proposed integrated systems biogas approach would have tremendous market potential to replicate with industrial companies in Florida such as food processing (especially citrus), chemical manufacturing, and phosphate fertilizer, etc. Second, replication of the gasification technology would result in increased global competitiveness of Florida's industrial companies by reducing energy costs. Third, economic development would be created through the economic multipliers of energy created entirely within Florida (jobs, goods and services purchased). Fourth, with the commercialization of the HMI biomass gasifier private sector financing would become available as technical and economic successes in this project are established enabling investors to perform due diligence confirming that biomass gasification projects have low risks in order to make financing decisions.

Section III: Project Objectives:

1. Demonstrate commercially viable and innovative biomass gasification technology for industrial use.
   - Fully integrate the biomass gasifier, burner, and heat exchanger into wallboard drying operations at the BPB-NA Jacksonville facility.
   - Achieve an availability factor of at least 80% (i.e., hours when the system is available to operate divided by hours operation desired per year).
   - Achieve energy efficiency of the integrated biomass gasification system (gasifier, burner, and heat exchanger) of no less than 67%, when latent heat is counted as a loss.

2. Reduce and stabilize the energy costs to the BPB-NA wallboard plant in Jacksonville by displacing natural gas with lower cost biogas.
   - Achieve operating cost of the integrated biomass system of ~$5.50 per MMBtu, based on the MMBtu of natural gas energy content that need not be purchased because biomass gas has replaced it as the heat source.
   - Achieve an availability factor of at least 80% (i.e., hours when the system is available to operate divided by hours operation desired per year).

3. Demonstrate a wide range of Florida produced biomass feedstock capable of supplying the clean energy for industrial drying through gasification.
   - Demonstrate the technical feasibility of gasifying wood, supplied by FBEC team member BioResource Mgt., achieving gasification energy efficiency of no less than 80%, when latent heat is counted as a loss and moisture content of the wood is less than 45%.
   - Demonstrate the technical feasibility of gasifying paper waste from BPB-NA wallboard manufacturing, achieving gasification energy efficiency of no less than 90%, when latent heat is counted as a loss and moisture content of the paper waste is less than 15%.
   - Demonstrate the technical feasibility of gasifying energy crops of pelletized switchgrass, achieving gasification energy efficiency of no less than 90%, when latent heat is counted as a loss and moisture content of the pelletized switchgrass is less than 15%.

4. Launch biomass energy toward a major industrial role throughout Florida by removing the barriers of technology, economics, and risk perception.

5. Establish technical and economic benchmarks needed to procure private sector financing to allow future project replication within Florida. Get from banker and get them to say this project did it

6. Create economic development within the State. Name the agency and their approval a la banker

Section IV: Project Description

FBEC will design, engineer, install and own/operate an innovative but proven biomass gasification system (Ref: Wellman-Galusha gasifier basis[1] and HMI/ARI biomass gasifier with Ansaldo in Genova, Italy commissioned in 2002). The efficient gasification of wood chips and other bio fuels (e.g. pelletized waste paper and switch grass) will provide clean thermal energy @ 2500º F to the wall board dryer at BPB-NA's Jacksonville, FL wall board manufacturing plant. The HMI automated gasification process de-ashes the biomass feedstock converting the solid biomass fuel into a clean gas with pyrolysis liquid aerosol. The advanced HMI gasifier (derived from the commercial W-G gasifier) is more automated with the following features for efficient biomass gasification:

- Automated fuel feeding and bed level control
- Automated ash removal and ash level control
- Continuous monitoring of gas & pyrolysis liquids quality/production quantity

The biomass gasifier will displace up to 40% of the natural gas burned by BPB-NA @ Jacksonville plant required to continuously reheat the wall board dryer recirculation air. Employing biomass gasification will reduce the energy cost for BPB-NA's wall board dryer operation by about 20% with a cap on the energy cost and generate carbon credits for BPB-NA to utilize worldwide at their operations outside of North America.

This innovative biomass gasification project will convert waste wood delivered to the Jacksonville, FL site of BPB-NA's wall board manufacturing facility and recycled waste wall board paper into a "hot-raw" gas (including pyrolysis liquids) which will be immediately burned to generate products of combustion @ 2400-2500º F which will indirectly and cleanly (without any contamination) reheat recirculation dryer air from 370º F to 700+º F to meet the dryer performance requirements. Up to 40 MMBtu/hr of natural gas will be displaced by gasifying wood waste. This amounts to about 45% of the natural gas used daily at this BPB-NA facility, so the wood gasification system could be doubled in capacity at a later date to displace nearly all of the natural gas used for wall board drying.

FBEC will work closely with the Jacksonville plant manager and BPB-NA to obtain all permits required to construct and operate the biomass gasification facility. The commercial gasifier operational background and experience of HMI will insure that all permits are obtained as accurately and expeditiously as possible. This will include permitting of waste wood delivery to the site via truck or barge plus storage and handling of the waste wood on-site prior to gasification.

Burning the hot-raw biogas using Coen's commercial dual fueled burners with the combustion products monitored and contained in a special refractory lined combustion chamber is an integral part of the permitting process. Heat recovery from the clean and hot products of combustion again using a specifically designed heat exchanger and exhaust system included in the site permit will combine the gasification operational expertise of the FBEC team with the COEN Company and BPB-NA. The entire gasification/combustion/heat recovery system will be controlled and monitored by state of the art thermal and environmental control systems to insure safe and clean operation.

The work to be performed is summarized in the Tabulation of Tasks and the completion of the tasks (months from the start of the project) below:

No.	Task/Activity Description	Start	Complete	Deliverables and Outputs	Deliverable Output Due Dates
1	Permitting & Site Preparation	April 07	Aug 07	Permits finalized and Site prepared	Project Status Report
2	Gasifier Design & Wood Yard Design (incl. structural & foundations)	1	4	Gasifier design/structure & foundation design complete & Wood Yard equipment specified	4
3	Gasifier fabrication complete – Delivered to site with Wood handling equipment	3	6	Deliver gasifier equipment and structure to site with wood handling equipment Complete foundations	6
4	Gasifier instrumentation & controls design purchase & delivery	2	4	Instrumentation & control system design complete & equipment purchased and delivered to site	4
5	Biogas burner; combustion chamber; heat exchanger Design Package, PO's, & Site Delivery	3	8	Specification and design of the complete combustion system and heat recovery-heat exchanger with Coen Company and delivery	8
6	Complete foundations for all equipment and erection of equipment	4	9	Complete all foundations and erection of hardware	9
7	Gasifier - electrical & instrumentation and controls completion	5	11	Completion of gasifier electrical and instrumentation & controls	11
8	Integrate Gasifier controls with burner-combustion system controls, heat exchanger and recirculation dryer air	10	13	Confirm integration of gasifier and burner combustion system control & operation with reheating recirculation air	13
9	BPB-NA dryer retrofit recirculation air re-heat ducting and controls design, fabrication & installation	4	14		14
10	Gasifier system Check-out and Commissioning	13	15	Demonstrate gasifier and burner combustion-heat exchanger system operation and control with continuous 5 day run	15
11	Coupling of dryer reheat air heating with biogas driven heat exchanger operation – Performance Test	15	17	Deliver reheat air to heat exchanger for performance verification and operation – 72 hour performance test	17

BPB-NA corporate and Jacksonville plant engineering will assume responsibility for the dryer modifications to reheat the dryer air using the clean sensible heat from the gasified wood waste. This initial phase of the dryer retrofit will be limited

to the recirculation air from the two dryer zones closest to the FBEC heat exchanger. Phase II of this biomass gasification conversion process will displace an additional 40 MMBtu/hr natural gas with waste wood derived biogas and further protect BPB-NA from additional natural gas price spikes.

A key requirement of this project will be a long term waste wood supply contract which will enable FBEC to enter into an energy supply contract with BPB-NA which will provide both a fixed base energy price and a capped maximum energy price for the wood derived biogas. Above the base price, BPB-NA will always pay less for biogas per MMBtu than natural gas.

Section V: Renewable Energy Review Criteria Discussions.

Cost Share Percentage - ~$3.79 million of project costs would be cost shared almost entirely from BPB-NA and $2.5 million would be provided from the State of Florida, totaling a total project cost of ~$6.29 million. The cost share percentage is 60.25%.

Economic Development – In today's global economy, economic development must also be viewed as preserving the competitiveness of existing U.S. Industry against increasing foreign competition. An illustration of this point is the recent American Chemistry Council's ("ACC") testimony before the U.S. Congress.[1] In their remarks, ACC explains the correlation between the escalating cost of energy (primarily natural gas) and issues such as the outflow of capital investment from the U.S. to other world economies; plant closings and job loss for U.S. Industrial companies. A powerful exhibit in the ACC testimony is a comparison of U.S. versus foreign prices for natural gas, where prices ranged from ~50% to 80% lower in countries like India, Indonesia, Turkey, Argentina, and Russia. BPB-NA is a perfect illustration of this competitiveness concern as the company competes in a global marketplace and where energy costs represent the second highest component of their wallboard product operating costs (second to transportation costs). Project economics developed jointly by FBEC and BPB-NA indicate that the production cost of biogas can be ~50% lower than natural gas prices that BPB-NA paid during 2006. From a traditional "economic development" perspective, the biomass gasification project also ranks high. A crucial component of this argument is that the bio-gas is 100% produced in Florida (versus natural gas imports). The Central Florida Development Council and IFAS/University of Florida estimate that there would be a local and state economic multiplier of conservatively 3 times associated with bio-gas produced in Florida.[2] For example, assuming the BPB-NA biomass gasification project produces 250,000 MMBtu's of biogas per year valued at $6 per MMBtu, the project would have an economic multiplier impact within the local economy of ~$4.5 million per year (increases in jobs, goods and services purchased, tax base, etc.).

Technical Feasibility – The technical strength of the BPB-NA Project (which has been vigorously reviewed by BPB-NA Engineering Staff in their due diligence) is the use of three technologies (gasification, burner, heat exchanger) that have been in commercial operation worldwide for decades. According to industry sources, over 300 Wellman Galusha ("W/G") gasifiers have been used worldwide, primarily converting coal to gases for industrial heat/power use.[3] The BPB-NA Project will use a design modification of the W/G gasifier developed by HMI: (1) the use of a refractory lined reactor vessel, and (2) fuel feed and processing systems specifically designed for dedicated biomass fuel feedstocks. Beginning in 2002, HMI has partnered with Ansaldo Engineering (one of the largest engineering companies in Europe) to commercialize and successfully demonstrate this modified W/G biomass gasifier technology in Genoa, Italy. The gas burner and heat exchanger used for the integrated gasification system will be also be commercially established technology, provided by Coen, a world leader in clean combustion technology with over 15,000 installations worldwide.

Innovative Technology – Two major barriers in using biomass gasification in industrial facilities have been (A.) the inability to produce clean biogas compatible with industrial

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[1] Testimony of the American Chemistry Council before the Energy and Mineral Resources Committee, May, 2005 (http://www.americanchemistry.com/s_acc/bin.asp?SID=1&DID=807&CID=206&VID=109&DOC=File.PDF)/

[2] Economic multipliers of Florida biomass energy developed by Dr. D.R. Carter of the University of Florida IFAS (www.ifas.ufl.edu), J. DeGennaro of the Central Florida Development Council (www.cfdc.org).

[3] Modeling Countercurrent Fixed-bed Gasification, A Dissertation presented to the Department of Chemical Engineering, Brigham Young University, Michael L. Hobbs, 1990.

equipment or processes (e.g., drying of the manufactured product) designed to use clean burning natural gas; or (B) the high economic costs of cleaning the biogas. The proposed project eliminates these major technological and cost barriers to achieve comparable end-use operating results, i.e., biogas does the same job as clean natural gas. This is done through the integration of biomass gasification and heat exchange technologies. The BPB-NA Project reflects major technology innovation and pragmatism by coupling, for the first time in the U.S., proven gasification technology with proven burner and heat exchange technology to enable low-capital-cost, mild gasification of biomass to provide very clean drying heat that can be applied directly to the final industrial product.

Production Potential – Product drying is a process used in most manufacturing in Florida, the U.S., and the world. Because of its clean burning characteristics, natural gas is almost exclusively used in industrial drying, because of the need for manufactured product quality. Industrial product drying is energy intensive. According to industry sources, countries with a well developed process industry can easily spend 10% of their national energy consumption on thermal separation (i.e., drying) processes.[4] Recognizing the high and unstable cost of natural gas for Florida industries, successful commercialization and demonstration of the integrated biomass gasification system at BPB-NA would very likely create demand to replicate the integrated design in most industrial companies within the State: food processing (especially citrus), chemical manufacturing, and phosphate fertilizer, to highlight a few. Success at BPB-NA could also affect energy applications well beyond industrial drying, including applications to industrial and utility steam boilers, cofiring and reburn NOx control in power plants, bottoming cycles in natural gas combined cycle power plants, and other thermal or steam supply in industry. In Florida this potential could total to 5% of all fuel use in utility-owned power generation, 50% of natural gas use in industry, all coal use in industry other than in cement manufacturing, 20% of coal use in cement manufacturing, and 20% of natural gas use in the commercial sector. The total could be as much as 1 to 2 quads of biomass energy use in Florida (1 quad = 10^{15} Btu/year), about 1500 to 3000 times the capacity of the single full-size module to be installed at BPB-NA

Energy Efficiency – Energy efficiency of the biomass gasifier is estimated to achieve ~85%. Overall efficiency of the integrated gasification system is estimated to be ~72%. This overall system efficiency is derived by reflecting the efficiency of both the gasifier and the heat exchanger (i.e., 85% gasifer efficiency times 85% heat exchanger efficiency equals ~72% efficiency for the integrated system). These efficiencies are excellent for high moisture fuel gasification where moisture reduces efficiency because the fuel energy used to evaporate the moisture (latent heat) is lost. As a point of reference, energy efficiency of the BPB-NA Project compare to ~35% with electric power from biomass gasification combined cycle (2nd Law of Thermodynamics). As discussed previously, a major barrier in the industrial use of biogas has been the historical inability to technically and/or cost effectively produce clean gas for industrial equipment or processes (i.e., the equivalency of natural gas). The BPB-NA Project eliminates this barrier through an integrated use of commercially proven technologies, including the use of a heat exchanger. The small loss in overall system efficiency through the incorporation of a heat exchanger is an exceedingly small price to pay for biogas to achieve the equivalency of natural gas for industrial use.

[4] Learning from Experiences with Industrial Drying Technologies, Centre for the Advancement and Dissemination of Demonstrated Energy Technologies, 1994.

Fostering Awareness and Public Integration – As discussed in Project Objectives and Measures of Success, FBEC will take specific actions to foster awareness of the integrated biogas system installed at BPB-NA in Jacksonville. This will include actions such as FBEC working with and giving presentations to Regional Economic Development Councils within Florida (e.g., Central Florida Development Council, etc), working with Investment Banking Firms to establish the specific information needed in order to procure future private sector financing for this technology, publicize results and implications to industrial companies and within the science and engineering communities, newspaper and magazine interviews, etc. Also BPB-NA will be taking high profile actions in their marketing (e.g., "green labeling), public relations, and stewardship (e.g., climate change) efforts at a local, State, National, and International level. Pragmatically speaking however, the greatest transfer of awareness will occur naturally through the highly competitive nature of U.S. Industry which is always looking for competitive advantage. If opportunities exist to achieve low cost, reliable, environmental friendly renewable energy, companies will apply this technology within our State to achieve a competitive advantage.

Project Management – The "Project Management Team" assembled is exceptionally strong and is unprecedented for a project of this type. BPB-NA (the world's largest manufacturer of wallboard) is putting its major manufacturing in Jacksonville at risk to demonstrate this integrated biomass gasification system. Senior management of BPB-NA is accepting this risk versus the potential reward of significantly lowering energy costs, demonstrating confidence in the ability of BPB-NA's engineering staff to work with FBEC. FBEC members have both the expertise and experience directly targeted to achieving success with the Project: Rolf Maurer is a partner in HMI (an engineering firm) and has over 30 years experience managing the operation of industrial gasifiers at numerous sites in the US and worldwide (including China). Dr. Evan Hughes has directed biomass R&D at the California Energy Commission and EPRI for 27 years. Steve Segrest has over 20 years of project development experience with major energy companies and was awarded "Man of the Year" in 2002 by the U.S. Department of Energy's Southeastern Biomass Program. Richard Schroeder has 30 years of experience in procuring biomass resources in Florida.

Duration & Timeline – The construction phase of the BPB-NA Project is expected to take 13 months. The total duration of the project to include all testing (e.g., switchgrass biofuel feedstock testing, etc.) is 24 months.

Location Served – The Jacksonville area: enhanced job preservation, new job creation, and economic multipliers on 100% Florida produced energy.

Multiple Technologies – In addition to the three technologies discussed in this proposal (biomass gasification, burner, and heat exchanger) Waste heat from the dryer stack will be recovered and reused in the gasifier air/steam blast.

Section VI: Measures of Success

Objective, each followed by its Measure:

1. Demonstrate commercial…biomass gasification … for industrial use.
   - Fully integrate the biomass gasifier, burner, and heat exchanger …
     - BPB-NA Jacksonville wallboard plant approves design.
     - FBEC executes an Engineering, Procurement, and Construction (EPC) Contract with HMI (gasifier) and Coen (burner, heat-exchange). A requirement within the EPC Contract will be to achieve commercial in-service of the integrated biomass gasification system where the system operates continuously for a minimum of X days or Y hours achieving stipulated engineering criteria (e.g., availability, efficiency, gas quality, etc.), with X or Y, etc. to be specified in the EPC contract, along with the details of measuring, specific definitions, and the description of terms and conditions.
   - Achieve availability factor of no less than 80%.
     - FBEC achieves 80% availability during or before the completion of the second continuous 12-month period of regular operation.
   - Achieve energy efficiency of the integrated system (gasifier, burner, and heat exchanger) of no less than 67%, when latent heat is counted as a loss.
     - FBEC, Coen and BPB-NA confirm this in 6-hour performance test.

2. Reduce and stabilize the energy costs to BPB-NA … by displacing natural gas.
   - Achieve operating cost of ~$5.50/MMBtu, and availability of at least 80%.
     - BPB-NA verify achievement of the availability and cost objectives during or before the completion of the second continuous 12-month period of regular operation, as defined in the EPC contract (in 1, above), and based on the MMBtu of natural gas purchase avoided.

3. Demonstrate a wide range of Florida-produced biomass feedstock ….
   - Demonstrate wood … 80% eff. … moisture content … less than 45%.
   - Demonstrate paper waste … 90% eff. … moisture content … less than 15%.
   - Demonstrate switchgrass … 90% eff. … moisture content … less than 15%.
     - FBEC, Coen and BPB-NA confirm all in 6-hour performance tests.

4. Launch biomass energy … throughout Florida by removing the barriers of technology, economics, and risk perception.
   - FBEC issue BPB-verified report(s), brochure(s) and presentations of success

5. Establish technical and economic benchmarks needed to procure private sector financing to allow future project replication within Florida.
   - Project-finance banker sets criteria for acceptable project financing, in advance and, later, verifies that FBEC has met them.

6. Create economic development within Florida.
   - One (or more) Florida governmental economic development office sets criteria, verifies that FBEC has met them, and distributes information to attract new development and continue existing industrial operations.

Section VII: Biographical Sketches

Steve Segrest

Education:
B.S., M.S. University of Georgia. Post graduate work in engineering at Iowa State University and the Georgia Institute of Technology.

Professional Experience:
Executive Director, Common Purpose Institute for Renewable Energy (1998 to present)
Vice President of Project Development, Sterling Energy Services (1997 to present).
Engineering, Finance, Marketing, the Southern Company (1988 to 1996).
Engineering, Finance, Entergy Corporation (1981 to 1987).

Publications:
Segrest SA, AES Green, DL Rockwood, DR Carter, WH Smith, and JA Stricker. 2004. Co-utilization of Biomass Fuel with Coal in Tampa Electric's Integrated Gasification Combined Cycle Unit (IGCC). In: Proc. 29th International Technical Conference on Coal Utilization & Fuel Systems, April 18-22, 2004, Clearwater, FL. Coal Technology Association CD, ISBN No. 0-932066-29-54, Paper 12.

Tamang B, M Langholtz, B Becker, S Segrest, D Rockwood, S Richardson, J Stricker. 2004. Fast Growing Tree Bridge Crops for Ecological Restoration of Phosphate Mined Lands. Proc. First National Conference on Ecosystem Restoration, December 6-10, 2004, Lake Buena Vista, Florida.

Wullschleger, SD, SA Segrest, DL Rockwood, and CT Garten. 2004. Enhancing soil carbon sequestration on phosphate mine lands in Florida by planting short-rotation bioenergy crops. Third Annual Conference on Carbon Sequestration, Washington, DC.

Rockwood, D. L., C. V. Naidu, D.R. Carter, M. Rahmani, T. Spriggs, C. Lin, G. R. Alker, J. G. Isebrands, and S. A. Segrest. 2004. Short-rotation woody crops and phytoremediation: Opportunities for agro forestry? In New Vistas in Agroforestry, A Compendium for the 1st World Congress of Agroforestry 2004, eds. P. K. R. Nair, M. R. Rao, and L. E. Buck. Kluwer Academic Publishers, Dordrecht, the Netherlands.

McBurney Corporation, Lakeland Electric, S.A. Segrest. Co-Utilization of Biomass Wood with Coal in a Pulverized Coal Boiler. U.S. Department of Energy Southeastern Regional Biomass Program. December, 1998.

Awards:
Man of the Year in Renewable Energy Development in the Southeastern U.S. (U.S. Department of Energy's Biomass Energy Program, 2003).

Outstanding Achievement in Terrestrial Carbon Sequestration Management (U.S. Department of Energy's Energy Information Agency (EIA), 2003, 2004, 2005).

Rolf Maurer

Education:
B.S., M.S. Aeronautical and Astronautical Engineering, University of Illinois, 1965 and 1966
Completed course work for PhD, Stanford University, Lockheed Missiles & Space Corporation, Graduate Study Program, 1968-1970

Professional Experience:
President, Hamilton Maurer International, Inc. 2003 to present
Manager Business Development, Dynegy Operating Company. Focus on Industrial Gasification systems, 1991 to 2003
Vice President, Projects for Interkiln Corporation of America. Managed Industrial Gasification Projects in Ceramic Plant built in China, 1986 to 1991
Manager, Industrial Coal Gasification Systems, Black Sivalls & Bryson, Inc. 1979 to 1986
Project Manager, Acurex Corporation. Managed US DOE Gasifiers in Industry Project at Glen-Gery Brick plant in York, Pa. 1971 to 1978
Staff Engineer, Reentry Thermodynamics Department, Lockheed Missiles and Space Corporation 1966 to 1971
Graduate Research Assistant University of Illinois, Department of AAE 1964 to 1966

Publications (selected from many):
Maurer, R.E., A.R., Pooler, F. Repetto, and G. Roskos, HSC's Waste Anthracite Gasified for Economical Anthracite Drying and Industrial Process Heat presented in Section: Co-Utilization of coal, biomass and other fuels, Clean Coal Technology 2005 Conference: Advances in Coal Gasification, Castiadas Conference Center, Sardinia Italy, 10-12 May 2005.

Maurer, R.E., A.R., Pooler, F., Repetto, P. Wellhausen, and T., DeHaan, Clean and Economical Utilization of Coal and/or Coal/biomass Fuels for Industrial Energy and Power Requirements in 2002 and Beyond, Clean Coal Technology 2002 Conference: Growing Energy Demand and Environmental Protection, Chia Laguna Conference Center, Sardinia, Italy, 21-23 October 2002.

Maurer, R. E., Destec's Successes and Plans for Coal Gasification Combined Cycle (CGCC) Power Systems, IGTI Vol. 7, ASME COGEN-TURBO Conference, Houston, TX, 1–3 September 1992.

Maurer, R.E. and Thimsen, D.P., Coal Devolatilization in a Moving-Bed Gasifier, EPRI Report, GS-6797, Final Report, October 1990.

Thimsen, D.P., Maurer, R.E., Pooler, A.R., Pui, D.Y.H., Kittleson, D. B., Fixed-bed Gasification Research Using US Coals, Volume 1 – Program and Facility Description. NTIS DE96010833. October 1984 – Also Volumes 2 – 18 Test Reports for Coal Gasification Performance Reports.

Evan Hughes

Education:
B.S., M.S., and Ph.D., all in Physics, California Institute of Technology (Caltech), 1962, ’63, and ’69

Professional Experience:
Consultant, Biomass Energy and Geothermal Energy (doing work for EPRI, Stanford University, and various others), 2003 to present
Manager, Biomass Energy, Electric Power Research Institute (EPRI), 1990-2003
Manager, Waste to Energy, EPRI, 1988-1990
Project Manager, Geothermal Energy, EPRI, 1978-1988
Manager of Office of Geothermal, Biomass Fuels, and Coal, R&D Division, California Energy Commission, 1975-1978
Senior Analyst, SRI International (SRI, Stanford Research Institute), Operations Evaluation Department (Center for Resource and Environmental Studies), 1973-1975
Assistant Professor of Physics, Pomona College, 1967-1973
Graduate Research Assistant and NSF Graduate Student Fellowship (Infrared Astronomy), Caltech, 1964-1967
Research Assistant, Aerospace Corporation (El Segundo, Calif.), 1963
Summer Employee, Superior Oil Company (Los Angeles, Calif.), 1959 and 1960

Publications (selected from many):

1. Biomass Interest Group: Technical Report for 2002 (biomass resources, technologies and environmental impacts), EPRI 1004209, December 2002, and expanded 2004.
2. Greenhouse Gas Reduction with Renewables (biomass, geothermal, wind, solar, and hydroelecric), EPRI Report TR-113785, December 2000.
3. Economics of Hydrogen Production via Biomass Gasification and Implications for R&D and Policy (two sections of GTI/EPRI/U.Hawaii report to the hydrogen program of DOE), EPRI 1007086, December 2002.
4. Market Assessment of Renewable Energy in California, Evan Hughes co-author of overview tables and primary author of biomass and geothermal sections, EPRI report to the California Energy Commission, EPRI 1001193, February 2001.
5. Biomass Cofiring with Natural Gas in California, EPRI Report 1000625 (for the California Energy Commission), December 2000.
6. Biomass and Geothermal (two sections in the EPRI Technical Assessment Guide – Renewable Energy), EPRI reports in 2000, 2001 and 2002 (EPRI 1004196).
7. Renewable Energy Technology Characterizations (co-funded and co-produced by DOE, NREL and EPRI), EPRI TR-109496, December 1997. (Evan Hughes was a coauthor of the biomass and geothermal sections.)
8. Alternative Future Automotive Transportation Systems: Electric Vehicles vs. Synthetic Fuel Power Vehicles. SRI International report to the NSF, 1976.

Richard Schroeder

Education:
Master of Business Administration, 1990, Nova University
Master of Agriculture, 1976, University of Florida. Agricultural and Extension Education
BS, Forestry, 1972, University of Florida

Professional Experience:
President, BioResource Management, Inc. Firm develops processes, uses and products from under-utilized forms of biomass, including waste vegetation, animal wastes, and other organic materials, 2005-Present.
Vice President Field Operations, Biomass Processing Technology, Inc. headquartered in West Palm Beach, Florida. Responsibilities included project development, biomass procurement, biomass process operations and administrative duties in company developing new technology for conversion of biomass to high value products, 2000-2005.
Vice President of Consolidated Resource Recovery, Inc., formerly Kenetech Resource Recovery, Sarasota. Primary responsibilities included market development and integration of company's current operations with biomass fuel and organic recycling opportunities. During this period company became largest urban wood fuel supplier in Florida and largest vegetative recycler in the US, 1992-1999.
President, and co-founder of Wood Resource Recovery, Inc. in Gainesville, Florida. Site was the first yard waste recycling site permitted by the Florida Department of Environmental Protection, and shipped the first urban wood fuel to industrial users, 1989-1992.
Group Manager for Prison Industries and Diversified Enterprises, Inc. (PRIDE), in Raiford, Florida. Activities included supplying approximately 30,000 tons per year of biomass to a prison central heating facility, the development of a sawmill, planer mill, and pole peeling facility; operating a 3,000 head hog finishing unit and feed mill, and managing 16,000 acres of timber and pastureland, 1984-1989.
Florida Division of Forestry, Starke and Tallahassee, Florida. Served in various positions including County Extension Forester, Nursery Supervisor, Forest Products Specialist and statewide Wood Energy Coordinator, 1976-1984.

PAST AND CURRENT ASSOCIATIONS

- Florida Forestry Association – Past Chairman, Wood Energy Committee
- Forest Products Society - formerly Southeastern Section Secretary Treasurer
- National Bioenergy Industries Association - company representative for Kenetech, participated in activities of Board of Directors
- Florida Organic Recyclers Association- founding member, served on Board of Directors

Publications (selected from many):

- Published numerous articles for trade periodicals such as Biocycle and Resource Recycling.
- Authored sections of the Florida Best Management Practices for Yard Trash Recycling Facilities, 1997, published by the Florida Department of Environmental Protection.

- Contributing author in several University of Florida publications researching biomass production and harvesting.

John W. College

Education:

BS Chemistry and Biology, University of Pittsburgh 1975

Professional Experience:

Special Projects Manager, BPB-NA (2001 to Present)
Plant Manager, BPB (1997-2001)
Technical Director, Dravo Lime Company (1987-1997)
Research Manager, Dravo Lime Company (1985-1987)
Laboratory Manager, Dravo Research (1978-1985)
Laboratory Technician, Dravo Research (1977-1978)

Publications:

Multiple publications related to Magnesium Enhanced Lime Scrubbing, Forced Oxidation of Sulfite Materials to Gypsum, and production of alpha hemi-hydrate gypsum from calcium sulfite, beneficial uses of gypsum, and the status of gypsum use in North America.

Awards:

Winner of Research & Development 100 Award for one of the top 100 patents of 1994.

Eighteen patents in USA plus seven patents awarded in foreign countries that are not patented in the USA.

Dave Salt, M.A.Sc. P.Eng.

Education:

- B.Sc. & M.A.Sc. Mechanical Engineering

Experience:

- Project Management Specialist – 1999 - present
- Co-Owner and Operations Manager of full service Consulting Firm – 13 yrs
- Manager of Engineering for DCS system supplier – 2 yrs
- Systems Engineer designing on-board electronics for agricultural vehicles – 4 yrs
- Mechanical Engineer for full service Consulting Firm – 2 yrs
- In depth knowledge of all facets of capital projects in heavy industrial sector
- Technical management of project teams involving all Engineering disciplines
- Project Manager for over $200million in projects ranging from $500k to $55million
- Management and design for projects covering a wide range of industrial applications
    - Solids processing and handling systems c/w crushing, screening, drying, conveying, batching
    - Liquid systems c/w reactors, pumps, mixers, heat exchangers, columns, boilers, filters
    - DCS and PLC based process controls and instrumentation for continuous and batching systems
    - Flammable liquids, explosive dusts and oxidizing metals
    - Environmental mitigation systems c/w dust collectors, scrubbers, filters, interceptors
    - Site development c/w buildings, services, sewers, grading, paving and government approvals
- Ten+ years experience in the technical management of a multi-disciplined engineering team executing capital projects in the heavy industrial sector:
    - Green field automated brick manufacturing facility involving crushing, grinding, extrusion, and coating of clay shale and the setting, drying, firing, and packaging of residential brick products
    - Automotive paint plant expansion involving automated batch control of bulk resin and solvent delivery, drummed liquid delivery, pigment pre-staging and delivery, dispersion, milling, blending, and filling operations under an oxygen controlled environment.
    - Nylon polymerization process expansion involving DCS controlled feedstock batching, continuous polymerization, extrusion, extraction, drying and recovery. The project involved the detailed design and procurement of proprietary process equipment and ancillaries including hot oil and steam heating, cooling towers, heat exchangers, evaporators, columns, scrubbers, fluidized bed coolers, pneumatic conveying, pumps, and agitators
    - Lime production facility expansion including the retrofit of PLC controls to existing kilns and the installation of new lime handling, separation and load-out equipment

- Greenfield automated ready mix manufacturing facility embracing WCM/EEM principles involving powder and liquid dosing systems, mixers, conveyors, robot palletizing, and automated stretch wrapping
- Strontium production facility including high temperature furnaces operating under high vacuum, rotary calcining, bulk material handling and pneumatic conveying equipment, fume collection/scrubbing, filtration systems and crucible melting furnaces

DAVID M. CORBIN

EDUCATION

Massachusetts Institute of Technology - *Master of Mechanical Engineering, 1991*

Georgia Institute of Technology - *Bachelor of Mechanical Engineering, 1987*

Jacksonville University - *Bachelor of Science, 1987*

PROFESSIONAL EXPERIENCE

Sr. Project Engineer
BPB America Inc., Tampa, Florida – September 2005 to Present
Manage capital improvement projects at various BPB Manufacturing Inc. gypsum board plants in the U.S. and Canada.

Process Engineer
BPB Manufacturing Inc., Jacksonville, Florida - May 2002 to September 2005
Support deployment of World Class Manufacturing, develop and manage the Professional Maintenance pillar, and provide engineering support to the Autonomous Maintenance pillar and the WCM Facilitator to achieve substantial cost savings and improvements in plant performance through successful application of the WCM tools and techniques.

Project Engineer
BPB Celotex Corp., Jacksonville, Florida - April 2000 to May 2002
Responsible for management of capital projects for a gypsum board manufacturing plant in areas including: screw conveyors, reclaim processing and paper scalping equipment, rock crushing and calcining, gypsum pin mixing, paper handling, and plant operating systems.

Project Engineer

Korb Engineering of Florida, Inc., Jacksonville, Florida - July 1999 to March 2000
Provided engineering consulting services to industrial clients. Projects included steel building interior renovation, drainage, and ventilation system design.

Project Engineer
*Anheuser-Busch, Inc.***,** *Jacksonville, Florida - February 1996 to June 1999*

Managed capital improvement projects for the eight packaging lines. Projects included conveyor replacements and modifications, new equipment installations, pasteurizer header redesigns, hydraulic upgrades, and platform design. Worked closely with maintenance, operations, and outside contractors during project installations, routine maintenance, troubleshooting, and safety improvements.

PART III – PROJECT BUDGET

SECTION VIII: Budget Summary

Funding Category	Grant Funds Requested	Cost Share: Matching Funds and Other In-Kind Contributions	
		Funding	Source of Funds
Salaries:	253,800.	529,250.	BPB-NA & FEBC
Fringe Benefits:	-	-	-
Equipment:	2,186,200.	2,147,825	BPB-NA
Travel:	60,000.	84,500.	BPB-NA
Contractual:	-	-	-
Supplies/Other Expenses:	-	1,027,000.	BPB-NA
Indirect:	-	-	-
Totals:	2,500,000.	3,788,575.	
Total Project Cost:	6,288,575	= Grants Funds Requested + Cost Share	
Cost Share Percentage:	60.25%	= Cost Share / Total Project Cost	

Project Task*		Grant Funds Requested	Cost Share: Matching Funds and Other In-Kind Contributions	
			Matching Funds	Source
1	Permitting & Site Prep.	40,000.	31,000.	BPB-NA
2	Gasifier design & wood yard design and completion	210,000.	100,000.	BPB-NA
3	Gasifier & fuel handling equipment procurement & delivery to site	470,000.	20,000.	FBEC
4	Gasifier inst. & controls design, procurement, & delivery to site	220,000	10,000.	FBEC
5	Biogas combustion system and heat exchanger procurement and delivery to site	480,000.	200,000.	BPB-NA
6	Complete foundation for gasifier and combustion system with erection of all equipment	760,000.	200,000	BPB-NA
7	Gasifier – Complete electrical & instrumentation and controls installed	100,000.	10,000.	FBEC
8	Gasifier inst. & controls integrated with combustion system & heat exchanger	60,000.	50,000.	BPB-NA
9	BPB-NA dryer retrofit recirc. Dryer air re-heat turn-key project		2,467,575.	BPB-NA
10	Gasifier system check-out and commissioning	80,000.	10,000.	FBEC

11	Coupling of dryer reheat air heating with biogas driven heat exchanger – Perform Performance Test	80,000.	690,000.	BPB-NA
	Totals:	2,500,000.	3,788,575.	
	Total Project Cost:	6,288,575	= Grant Funds Requested + Cost Share	

SECTION IX: Budget Detail

Personnel					
Salaries (Name/Title/Position)	Hourly Cost ($)		Hours		Totals ($)
Steve Segrest/Project Director/FEBC	125.	*	680	=	85,000.
Rolf Maurer/Technical Director/FEBC	150.	*	680	=	102,000.
Evan Hughes/Technical Consultant/FEBC	150.	*	300	=	45,000.
Richard Schroeder/Fuel Procurement/FEBC	100.	*	500	=	50,000.
John College/BPB-NA Project Management	150.	*	325	=	48,750.
David Salt/BPB-NA Project Management	150	*	390	=	58,500.
Safety Manager/BPB-NA Project Support	100	*	104	=	10,400.
Legal/BPB-NA Project Support	150	*	156	=	23,400.
David Corbin/BPB-NA/Engineering Design	100	*	1300	=	130,000.
Others/FBEC & BPB-NA	100	*	2300	=	230,000.
			Total Salaries	=	783,050.
Fringe Benefits (Rate% * Total salaries applicable)	Rate (%)		Salaries		Total ($)
	0.00 – (NA)				00.
			Total Personnel Expenses	=	783,050.
Equipment					
Description	Unit Cost ($)		Quantity		Totals ($)
HMI 10' Dia. Gasifier (installed Turn-Key)	1,750,000.	*	1	=	1,750,000.
Biogas Combustion System/Heat Exchanger - installed	658,000.	*	1	=	658,000.
Biomass Storage/Handling & Delivery system	250,000.	*	1	=	250,000.
BPB-NA Turn-key Dryer modifications (BPB-NA Budget)	1,676,025.	*	1	=	1,676,025.
			Total Equipment	=	4,334,025

Travel									
Purpose/Destination	Trips		Per Diem		Fare/Rate ($)		Mileage		Totals ($)
Steve Segrest Tampa/J'cksonville	36		-		-		-		21,600.
Rolf Maurer Houston/J'cksonville	24		-		-		-		19,200.
Evan Hughes SF/Jacksonville	12		-		-		-		12,000.
Richard Schroeder FL/J'cksonville	12		-		-		-		7,200.
John College Pitt/Jacksonville	10		-		-		-		13,000.
David Salt Tampa/J'cksonville	3		-		-		-		3,900.
Safety Las Vegas/J'cks'nville	2		-		-		-		2,600.
David Corbin Tampa/Jack'ville	20		-		-		-		39,000.
others	20		-		-		-		26,000.
							Total Travel	=	144,500.

Contractual					
Name or Services	Fee/Rate ($)		Hours		Totals ($)
			Total Contractual	=	-

Supplies and Other Expenses					
Description	Unit Cost ($)		Quantity		Totals ($)
BPB-NA plant "tie-in" (3 day lost production)					195,000.
BPB-NA (Est. 1 Mo. Start-up – production lost)					702,000.
Real Estate (2 Ac) – Leasehold Value					130,000.

			Total Supplies and Other Expenses	=	1,027,000.
Overhead/Indirect					
Base of Calculations	Rate (%)		Base ($)		Total ($)
Total Budget					
			Total Budget	=	6,288,575

Section IX: Commitment Letters from Third Parties

BPB-NA commitment letter is attached (PDF file).