

## ABOUT BLACK & VEATCH

Black & Veatch is a leading global consulting, engineering, and construction company specializing in enterprise wide solutions and infrastructure development in energy, water, information, and government markets. With more than \$2.7 billion in revenue, we have more than 100 offices worldwide, and have completed projects in more than 100 countries on six continents. Black & Veatch employs a total staff of approximately 9,000 involved in a wide range of engineering and management consulting services relating to utility development and operations, finance, economics, planning, environmental, civil, electrical, structural, and mechanical engineering, as well as construction, science, and architecture.

We have built our quality reputation by providing our clients with high quality and responsive services. We take pride in building strong relationships with our clients; many have retained our services continually for more than 40 years. Our goal is to provide our clients with services meeting their specific needs using innovative processes and techniques. We have a proven track record; more than 80 percent of our projects are performed for repeat clients. The company's web site address is <http://www.bv.com>.

### ***B&V Management Consulting***

Enterprise Management Solutions is the Management Consulting Division of Black & Veatch with more than 300 consultants. We deliver value through the application of first-hand industry expertise, exceptional program and project execution, thought leadership, proven methodologies and processes, and ethical business practices. Our proven capability to deliver is local, national, and international. We are a dynamic organization that strives to change as our clients' needs evolve. In a format where deep experience is blended with strong project execution and value focus, our engagements can draw on experienced senior executives, economists, senior policy experts and consultants experienced in regulatory matters, engineers and internationally-respected subject matter experts. For more information go to [www.bv.com/consult](http://www.bv.com/consult).

### **Independent Engineering Overview**

Black & Veatch has performed hundreds of Independent Engineer due diligence assessments of projects worldwide. Our clients have sought our services because many of the power and cogeneration projects developed in recent years used project financing. The scope of services rendered varies with each client, and ranges from feasibility assessment for projects using new technologies to complete assessment of all phases of a project. These assessments can encompass a project from conception to ongoing annual audits of operation and maintenance once the facility is in commercial operation.

In addition to providing independent engineering services on new plants, we routinely provide support to clients who are developing bids for the acquisition of existing assets. We have performed these services for acquisition of entire utilities (generation, transmission, and distribution), for generating assets sold separately, and for transmission and distribution assets sold separately. Summary tables are included for new plant due diligence and refinance projects as well as merger and acquisition due diligence for existing assets. The projects identified in the following sections are representative of Black & Veatch Corporation's independent engineering consulting service engagements on new construction projects.

# SUBJECT MATTER SPECIALISTS

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INDEPENDENT ENGINEERING PROPOSAL

## SUBJECT MATTER SPECIALISTS

### ***Independent Engineering Subject Matter Specialists***

We will propose a project team of experienced Black & Veatch professionals. The following individuals are proposed for the Project:

#### **John Achenbach – Project Executive**

Mr. Achenbach has a B.S. in Systems Engineering, and is a licensed Professional Engineer in the States of Florida, Hawaii, Michigan, Nevada, Pennsylvania, New York, and the United Kingdom. He is the executive in charge of the independent engineering solution set. Mr. Achenbach is located in Manhattan, and will provide the executive leadership and management so that the lender's needs are being met in a timely manner. He will also be available to meet with the lenders in their offices periodically as the due diligence process progresses. Mr. Achenbach has over 30 years experience with power generation systems, including due diligence assignments on nearly all types of fossil fuels, hydroelectric, nuclear, biomass, wind and geothermal power plants.

#### **Chris Klausner – Project Manager**

Mr. Klausner has a B.S. in Mechanical Engineering, an M.B.A., and is a licensed professional engineer with 20 years experience. Chris has managed or participated in the due diligence of over 11 GW of new plant construction financings (exclusive of M&A transactions) across a broad range of technologies including fluidized bed boilers, biomass, advanced combustion turbine, combined cycle, integrated gasification combined cycle, pulverized coal, and other renewable energy projects. Mr. Klausner will manage the project and coordinate the technical, contract and financial model reviews among our various specialists. He has worked on several fluidized bed projects including: design of three waste coal and one coal fired CFB facilities; independent engineering three pet coke fired CFB projects, 454 MW coal fired CFB, and independent engineering project manager for three recent biomass projects.

#### **Randy Becker – Technical Quality Control**

Mr. Becker has a B.S. and M.S. in civil engineering. He has served in numerous senior positions in the power industry since 1969, with a concentration in due diligence reviews of power generation facilities using a broad range of generation technologies. Mr. Becker has prepared numerous independent engineering reports across a broad range of technologies including wind, coal-fired, simple cycle, combined cycle, hydro-electric, and other renewable technologies. Mr. Becker will serve as the quality control manager and is also located in Boston.

#### **Thiam Giam – Manager**

Mr. Giam has a B.S. in electrical engineering and an M.B.A. He is an experienced manager in the electric power industry. He has extensive project management, engineering, procurement, and construction experience, as well as solid enterprise management consulting experience. His areas of expertise include business process review, contract review/negotiation, vendor/subcontractor management, independent engineering due diligence, litigation support, interconnection study/procedure review, cost estimating, budgeting, cost control, proposal preparation, procurement, CPM scheduling, optimal power generation expansion modeling, production costing modeling, protective relay setting, substation electrical arrangement, and control and protection design. He will be responsible for the interconnection and electrical design reviews, as well as development of the project financial model.

#### **Tom Trimble – Fluidized Bed Boiler Subject Matter Specialist**

Mr. Trimble has a B.S. in Mechanical Engineering and has over 30 years of experience in the design support of electric power generating stations. This experience includes over 15 years specializing in steam generator

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technologies with over 6 years of experience directly with Babcock & Wilcox. Tom Trimble is a member of Black & Veatch's Steam Generation Group, which specializes in steam generation technologies, including: pulverized coal, cyclone, stoker, atmospheric fluidized bed, gas, oil fired units, and heat recovery steam generators downstream of combustion turbines. A small sample of the systems Mr. Trimble is responsible for includes technology selection studies, system analyses, system design specifications, purchase specifications and bid evaluations for steam generators, auxiliary boilers, burners, and draft fans.

## **Mark Aron - Fuel Handling Specialist**

Mr. Aron is a Mechanical Engineer currently assigned to the Bulk Material Handling section of the Consulting Engineering Services / Renewable Services business line within B&V Energy. The Bulk Material Handling section provides investigations, studies, procurement specifications, design layouts, technical bid evaluations, contract administration, and engineering for bulk material handling systems in power plants, bulk material terminals, and air quality control systems for new and existing facilities. Prior to joining B&V, Mr. Aron was president and part owner of a pneumatic conveying equipment design and manufacturing company. Mr. Aron has served in many capacities within the engineering field, including design engineer, project engineer, startup engineer, engineering manager, and manufacturing manager. Mr. Aron has also worked with a wide variety of bulk materials including fly ash, bottom ash, selective catalytic reduction (SCR) ash, economizer ash, limestone, plastics, and various other dry bulk foods and chemicals.

## **Judy McArdle – Construction Monitoring Specialist**

Ms. McArdle is a principal with a B.S. in Mechanical Engineering and over 20 years of experience both in power plant design and as an Independent Engineer. Ms. McArdle is located in New Hampshire and will serve as a local representative to the project team. She will be available to meet with representatives of Cate Street, as needed, to facilitate communication among the client and the project team. One of her recent independent engineering assignments was for due diligence and construction monitoring of the Neptune Regional Transmission project on behalf of a very large syndicate lender group. Ms McArdle will also provide construction monitoring support.

## **Doug Timpe – Environmental Subject Matter Specialist**

Mr. Timpe has a B.S. in Zoology and a M.S. in Biology and is a project manager in Black & Veatch's Environmental, Health & Safety Services Section. He has over twenty years of direct experience in environmental impact analysis. His primary responsibilities include designing, conducting and supervising field surveys and environmental impact evaluations; preparing license and permit applications for industrial, commercial, and government facilities, supervising multidisciplinary project teams within Black & Veatch, and selecting and managing subcontractors for specialized work. He is also responsible for contact with regulatory agencies to discern and resolve project-related environmental issues. As a consultant, he is also responsible for evaluating the permitting of existing and proposed power facilities of all types.

## **Other Professionals**

In addition to these highly qualified individuals, Black & Veatch's engagement team will be supported by other consultants and specialists from within Black & Veatch. Through our more than 9,000 professionals, we provide complete engineering, construction, financial, technical and management consulting services for industry, utilities, and government agencies. Our project team will be able to utilize specialists throughout the company that include business consultants, O&M experts, engineers from all disciplines, boiler specialists, cost estimating specialists, construction specialists, and others as may be needed.

# QUALIFICATIONS AND EXPERIENCE

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Black & Veatch has provided a very broad range of services related to biomass projects as well as those projects utilizing fluidized bed construction including consulting, engineering, EPC, technical advisor, and construction. We have provided engineering, procurement, and construction related services on over 1750 MW of fluidized bed generating stations.

### Select Relevant Projects

Project	MW	Fuel	Boiler Type	Purpose
Nacogdoches	100	Wood Waste	FB	Financing
Gainesville Renewable Energy Center	100	Wood Waste	FB	Financing, Ongoing
Mt. Poso Conversion	44	Wood Waste	CFB	Equity
Project Carl	24	Wood Waste/Litter	FB	Equity
Shasta	60	Wood/Ag Waste	Stoker	Equity Investment
Multitrade	80	Wood	Stoker	Financing
Down East Peat, LP	27	Peat/Wood	FB	Financing
Gabriel Power	25	Wood/Ag Waste	FB	Owner Feasibility
Confidential Developer	100	Wood	Multiple	Owner Feasibility
Genesee Power Station	35	Wood/Wood waste	Stoker	EPC
Fibrominn	55	Turkey Litter	Stoker	Equity Investment
AES Puerto Rico	454	Coal	CFB	Financing
Bay Shore Power Company	149	Pet Coke	CFB	Financing
Reading Energy Company	19.5	RDF	FB	Financing
Reading Energy Company	40.4	RDF	FB	Financing
Panther Creek	83	Waste Coal	FB	Financing
Cambria Cogeneration	85	Waste Coal	FB	Financing
Oglethorpe Power	100	Wood Biomass	BB	Technology Selection
Oxford Energy	25	Rice Hulls	Stoker	Financing

### Select Project Descriptions

Black & Veatch is recognized as one of the most diverse providers of biomass (solid biomass, biogas, biofuels, and waste-to-energy) systems and services. Black & Veatch was the lenders' engineer for the world's largest stand-alone wood-fired power plant (Multitrade), won the Power Magazine Power Plant Award for design and construction of the 35 MW wood-burning Grayling Station, and was responsible for the turnkey conversion of the Central Wayne incinerator to a modern waste-to-energy plant. The latter project is the only new WTE energy plant to come online in the United States in the last decade.

Black & Veatch has provided services for over 50 different waste and biomass fuel types. Projects have included a wide variety of conversion processes including combustion, cofiring, gasification, pyrolysis, plasma arc, anaerobic digestion, biofuels (ethanol and biodiesel), and torrefaction.

Black & Veatch has experience in biomass projects ranging from early technology investigation to full participation in design and construction activities.



### Nacogdoches Power, LLC

Black & Veatch was retained by American Renewables to prepare an independent engineering report to support the potential financing of the 100 MW bubbling bed wood waste biomass project to be located in Texas. Our scope of review included: plant design, major equipment vendor review, review of construction

# QUALIFICATIONS AND EXPERIENCE

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contracts and schedules, evaluation of financial projections, market price forecast, environmental and permitting review, and evaluation of various project agreements. 100 percent of the equity of the project was purchased prior to completion of the financing.

## **Mt. Poso Repowering**

Black & Veatch was retained by the project lenders and investors to evaluate the conversion of this coal and waste fired CFB project in California to a wood waste fired biomass project. Our review included assessment of the project, environmental and permitting, condition assessment, evaluation of the plant modifications to the boiler, material handling and other systems, review of the financial model, review of the power purchase agreement, and preparation of an independent engineer's report to support the financing.

## **Plant Carl Repowering**

Black & Veatch was retained by a potential equity investor to evaluate a 24 MW biomass project to be constructed in Georgia. The project proposed to use an existing B&W boiler that would be modified to a bubbling bed design. The boiler was originally installed to serve the pulp and paper industry in 1993. Black & Veatch review included a long term PPA, interconnection, fatal flaw permitting assessment, and design review.

## **Gabriel Power Company**

Black & Veatch was retained by the Gabriel Power Company to produce a project design manual for a 25,000 kW biomass burning, electric generating plant. The cogeneration facility, capable of producing 229,500 lbs/hr of steam, is designed for basic steam cycle operations using wood as a base fuel.

Black & Veatch prepared a project design manual describing the proposed plant, its design features, equipment, and physical arrangement. An estimate of construction costs, schedule, net output, operating costs, and other conceptual design information was also provided.

The plant consists of a single 25,000 kW steam turbine generator and a single biomass fueled boiler. The plant cycle was designed for a standard extraction/condensing steam turbine generator, to ensure high availability and reliability. Steam to the turbine, provided from the steam generator at 850 psig and 900° F. will be extracted from four stages of the turbine generator for feedwater heating. Feedwater leaving the high-pressure heater and entering the steam generator will be approximately 365°F. Steam not extracted from the turbine generator for feedwater heating will be processed in a steam condenser designed to produce 2 in. HgA exhaust pressure.

The steam generator, an atmospheric fluidized bed fueled unit, was designed to burn wood and wood waste. Capabilities also include burning other materials such as orchard prunings, peach pits, almond shells, etc., and up to 20 percent coal.

## **Confidential Developer**

Black & Veatch provided a confidential client a report on the state-of-the-art in biomass technologies and commercial equipment suppliers. The report included a background on the biomass energy industry, a review of biomass technologies, profiles for leading biomass vendors, and conclusions and recommendations on expected capital costs, preferred technologies for each fuel, and vendor conclusions. The report provided cost and performance information for the following boiler sizes: 250,000, 500,000, and 1,000,000 pounds per hour of steam. Black & Veatch also provided high-level pro forma data for a nominal 100 MW wood fired power plant. Data provided included net plant heat rate, gross power output, net output, auxiliary power consumption, primary fuel consumption, fuel for stabilization, annual fuel consumption, capital cost, fixed operations and maintenance cost, variable operations and maintenance cost, and annual capex plan for operations. Wood is the proposed biomass fuel, with supplementary fuels including waste tires and petroleum coke.

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## **Genesee Power Station**

Black & Veatch, with joint venture partners Townsend & Bottum and The Christman Company, provided the design, procurement, construction, start-up, permitting, and licensing of the Genesee Power Station on a turnkey basis. The plant, which went into commercial operation in January 1996, consists of a waste wood fired 330,000 lbs/hr steam generator with a nominal 39 MW gross output condensing steam turbine generator. The plant is designed for a guaranteed electrical output of 35 MW. The wood fuel consists of demolition, construction, urban, industrial, lumbering, tree-trimming, and sawmill wood wastes that is delivered to the plant by truck and stacked out with mobile equipment. The waste wood fuel is reclaimed via an under pile chain type reclaimer, and is fed to the hydrograte stoker fired boiler after final sizing by disc screens and hogs.

The plant is in the Dort-Carpenter Industrial Park located in Genesee Charter Township. The township borders the north side of Flint, Michigan.

## **Fibrominn**

Black & Veatch provided a technical assessment of the 55 MW net Fibrominn biomass power plant in Benson, Minnesota. The plant will be fueled primarily by poultry litter, complemented with other agricultural biomass. The plant will be the largest poultry litter fired project in the world.

The evaluation was carried out for a potential purchaser of the plant, which was under construction at the time of the review. The objective of this project was to provide a high level assessment of the status of the project and a review of potential technical risks associated with the project structure, technical design, and construction plan.

## **Confidential Financier**

Black & Veatch assisted a confidential client with preliminary evaluation of biomass projects. The client is interested in supporting development of multiple biomass projects. Two of the leading development candidates are a New York plant powered with wood chips and a Hawaii plant powered with herbaceous energy crops such as arundo donax. The company requested Black & Veatch's assistance with preliminary evaluation of these two projects. Black & Veatch provided typical project characteristics over a range of project sizes from 5 MW to 65 MW. Data included net plant heat rate, fuel consumption, emissions, capital costs, operating and maintenance costs, typical capacity / availability factors, and a review of most appropriate conversion technology for fuel and plant scale.

## **Panda Energy**

Black & Veatch performed a broad survey of biomass combustion and gasification technologies and vendors available worldwide. Over 300 potential processes were identified. The biomass would be used to generate heat and/or power with project output ranging from 30 to 100 MW. Fuels investigated included wood, woody biomass, cow manure, poultry litter, sewage sludge and municipal solid waste. Black & Veatch evaluated potential technologies / vendors on many aspects, including commercial status, performance, emissions, capital and operating costs, and the range of fuel firing capabilities

## **Johnson Controls, Inc.**

Black & Veatch is performed design engineering services for a waste wood fueled gasification cogeneration facility for Johnson Controls, Inc. to be installed on the campus of the University of South Carolina. This cogeneration facility is capable of gasifying up to 242 tons/day of waste wood while generating a maximum of 1.28 MW of electricity and exporting up to 60,000 lb/h of 100 psig saturated steam to the existing campus heating system. The process consists of three separate trains of wood gasifiers, a single oxidizer, and a single waste heat boiler. Black & Veatch completed both the conceptual engineering and detailed engineering activities.

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## **Arizona Public Service**

Black & Veatch was selected by Arizona Public Service (APS) to provide consulting and engineering services to investigate cofiring wood at APS's Cholla plant, unit 1. Unit 1 is a 110 MW pulverized coal fired plant. In Phase 1 of the work, Black & Veatch surveyed wood fuel sources; evaluated and prepared conceptual designs for different co-firing alternatives; projected impacts on boiler efficiency, emissions, and availability; evaluated impacts on other plant equipment; analyzed project economics; and developed a plan for further project implementation.

## **Confidential Client**

Black & Veatch provided engineering services to a confidential client to examine converting their existing Northeast US generation facility to burn 100 percent biomass (wood chips and/or wood pellets). The plant currently burns a mix of coal, pet coke, and tires in a circulating fluidized bed. Net plant output is about 50 MW. Black & Veatch provided an engineering evaluation of the necessary changes to the fuel handling and feeding systems, boiler design issues, and other factors impacting the proposed project. Conceptual designs were prepared for the necessary facility modifications and a project cost estimate was developed.

## **Gainesville Regional Utilities**

Black & Veatch investigated alternatives to provide 30 MW of biomass capacity for Gainesville Regional Utilities (GRU). The study began with a screening assessment of over 30 potential standalone and cofiring alternatives. The technology review included gasification, pyrolysis, torrefaction, and other advanced technologies. Cofiring was investigated in existing pulverized coal and new circulating fluidized bed (CFB) boilers. Detailed assessment was performed for the preferred alternative: cofiring about 600 tons per day of wood residues in a new 220 MW CFB. Black & Veatch estimated differential impacts to the boiler efficiency, net plant heat rate, emissions, capital cost and operations and maintenance cost.

## **Traverse City Light and Power**

Black & Veatch performed a boiler assessment study for a proposed new 20 MW wood waste cogeneration facility in Traverse City, Michigan. The proposed facility would be located on a green or brown field site utilizing waste wood as its primary source of fuel. The review looked at three boiler technologies: stoker grate, bubbling fluidized bed, and gasification. The assessment included fuel burn rate, fuel flexibility, steam production, and expected flue gas pollution emission rates for each technology.