

Energy & Power Engineering Services QUALIFICATIONS







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Woodard & Curran is an integrated engineering, science, and operations company. Privately held and steadily growing, we serve public and private clients locally and nationwide.

From our environmental roots to the range of consulting, engineering, and operations expertise we provide today, we work for a diverse clientele - including municipalities, the energy industry, food & beverage manufacturers, colleges and universities, and the real estate community.

Talented people are at the heart of our firm. Our company was founded in 1979 on a simple business concept: provide an enjoyable place to work with opportunity, integrity, and commitment, and we will attract talented people. It happened. At the heart of our company are people who are experts in their fields and passionate about what they do, showing a level of commitment and integrity that drive results for our clients. You experience this power every day in our actions, our solutions, and our promises kept.

Commitment evident in personal approach

Our commitment is reflected in the personal attention, collaborative resources, and dedication to results that we devote to each project. We assign the right people with the right expertise to the job, and provide clients with easy accessibility to senior experts.

Our work is characterized by responsiveness, resourcefulness, and willingness to do what it takes to get the job done properly. Examples range from helping communities garner state and federal funding for wastewater treatment system improvement to managing a multi-vendor manufacturing project through a major snowstorm and getting production lines up and running. We are expert at navigating the complexities of environmental regulations and have been involved in transforming many brownfields sites into marketable properties. In defining moments like these, it is commitment that brings our clients results.

Operating with integrity

Our integrity impacts our decision-making at all junctures of our work — from the openness of our communication to the fairness of our prices to placing your interests above our pocketbook. We hire people who share our values of honesty, respect, and fairness and who want to do the right thing. They, in turn, treat everyone — our people, our clients, regulators, and stakeholders — respectfully and honestly.

Woodard & Curran serves clients locally and nationwide from offices throughout the U.S. The firm operates offices in the locations noted above, as well as treatment facilities in the states that appear in orange.

Enfield, CT

Full-service firm with multidisciplined staff

Our integrity and commitment are matched only by the depth of our expertise. Our staff are specialists in their fields, offering in-depth understanding of cutting-edge technology, astute problem-solving, multidisciplinary engineering, and expert regulatory guidance. The firm has received numerous honors and awards, and we have ranked among *Engineering-News Record's* top 100 environmental firms every year since 2000.

Services to the public sector

We have been serving cities, towns, and state governments for over 35 years. Today, we offer services beginning with studies, concept, and design on through construction and operations to address our clients' energy, solid waste, wastewater, water, stormwater, and civil engineering needs.

These projects often incorporate hydrogeology, Geographic Information Services (GIS), and instrumentation and controls. We also offer strong capabilities in health, safety, and security, including vulnerability assessments of public water supplies, emergency planning, and environmental sustainability.

Services to the private sector

Woodard & Curran provides a range of environmental engineering, science, and operations support to companies in the real estate, bottled water, pulp & paper, automotive, food processing, pharmaceuticals, electronics, oil and gas, mining, processing, and metals forging industries, as well as to hospitals, colleges and universities, and law firms.

While the range of clients we serve has grown, our work has always been characterized by long-term relationships. Typical projects include compliance and permitting; process and infrastructure improvements; corrective and remedial action; expert witness/litigation support; air quality; environmental information management, mining and process plant design; and engineering, procurement, and construction management. Our private-sector clients also benefit from our services in health, safety, and security, and environmental sustainability.

Operations and Management (O&M)

Woodard & Curran operates nearly 50 water, wastewater, and groundwater treatment facilities across the U.S. Our O&M specialists focus on contract operations and other O&M assignments for water, wastewater, groundwater, and solid waste facilities.

We design flexible, expandable solutions that keep operations efficient, maximize existing assets, and conserve costs. Our projects have ranged from quick, hard-hitting operational and training assignments to comprehensive plant evaluations and process control improvements to full contract operations.

WOODARD & CURRAN'S SERVICES OFFERED

Civil and environmental engineering

- wastewater engineering
- civil engineering
- water supply and treatment
- · solid waste management
- · design-build contracting

Operations and management

- contract operations
- utility and asset management
- organizational development
- water & wastewater treatment
- water reclamation
- groundwater remediation
- training services
- · health and safety

Corrective action and real estate services

- due diligence
- site investigation and remediation
- risk assessment
- · real estate development
- environmental ecology
- civil/site engineering and permitting
- natural gas services

Industrial engineering

- food and beverage manufacturing and source infrastructure
- electrical instrumentation, and controls
- · industrial wastewater
- process engineering
- · power engineering

Environmental management consulting

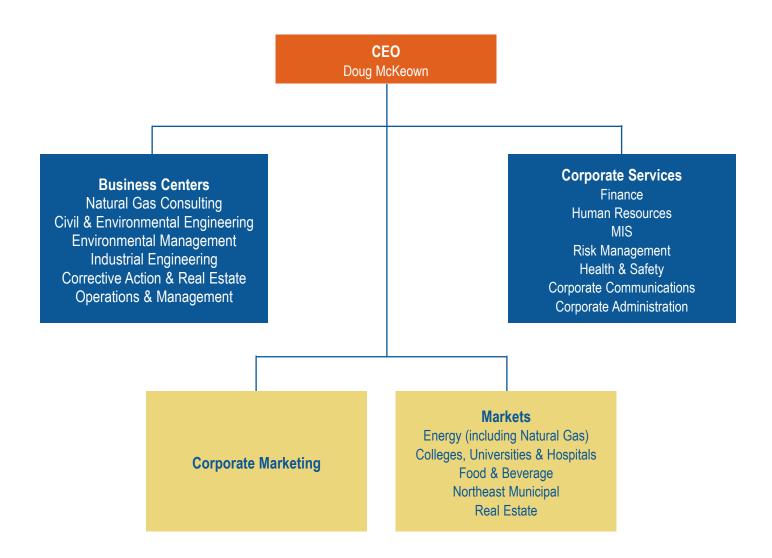
- expert witness
- environmental information systems
- compliance
- · health, safety, and security
- sustainability

Commitment to Safety

At Woodard & Curran, our commitment to safety is based on our vision: To create a working environment that places the highest value on the welfare of the individual. Our goal is to eliminate foreseeable hazards in order to maintain a safe and healthy work environment. We pledge to place the safety and well-being of our employees first and to embody honesty and integrity in the pursuit of our vision: to instill a sense of personal commitment to safety.

Our commitment to safety requires working in partnership with one another and our clients. While leadership's role is critical, everyone must be connected to and have personal value for creating a safe and healthy work environment. We seek employee participation while integrating our client's requirements and expectations.

Woodard & Curran Corporate Organization



Industry Affiliations



































Industry Recognitions

- #84 in Engineering News Record's Top 200 Environmental Firms
- #108 in Engineering News Record's Top 500 Design Firms
- #9 in Boston Business Journal's Area's Largest Engineering Firms
- #4 in Boston Business Journal's Area's Largest Environmental Engineering Firms
- #60 on the Zweig White Hot Firm List





Woodard & Curran has been serving the energy industry for more than 20 years with a broad scope of environmental and litigation support services. Our clients range from small municipal utilities to governmental and regulatory agencies to regional producers, distributors, or transporters of:

- · electricity,
- · natural gas,
- · petroleum products,

- · nuclear energy,
- · combined heat & power,
- · and renewable energy.

Multidisciplinary staff serve as resources to your project team

Many of our staff members have extensive experience working with energy industry clients and in partnership with a number of leading attorneys. We focus on helping clients optimize facility operations, minimize or recycle waste, and prevent pollution.

With 10 offices along the East Coast, we provide our clients with a diverse and mobile team of scientists, professional engineers, and regulatory specialists.

Planning & permitting

Woodard & Curran's team of compliance specialists have in-depth knowledge and experience with specific local, state, and federal regulatory requirements applicable to energy industry clients. Key services include:

- Emergency Management System (EMS) design;
- air emissions and New Source Review (NSR) permitting and performance standards;
- land use and resources/wetlands permitting;
- emergency response planning, including oil and chemical spill prevention, containment, and countermeasure plans;
- Control technology requirements (MACT, BACT, RACT, LAER, BPT, etc.);

- · Title V permit modifications;
- · air quality dispersion modeling;
- · noise monitoring and modeling;
- periodic monitoring and compliance assurance monitoring;
- · periodic reporting requirements;
- · air emissions inventories;
- · health and safety audits; and
- solid waste handling and residual use support.



SERVICES TO THE ENERGY INDUSTRY

- utility infrastructure engineering and design
- water and wastewater engineering
- environmental management and regulatory compliance;
- site investigation, remediation, and due diligence
- litigation and alternative dispute resolution support
- process controls and Supervisory Control and Data Acquisition Systems
- · information management
- sustainable business practices

Utility infrastructure engineering and design

Our engineers, scientists, and operations specialists have worldwide experience in:

- fuel oil, natural gas, inert gas, bulk chemical storage tanks, and distribution systems;
- integrated cooling systems that use
- the latest PLC and DCS technology;
- · loading and unloading systems; and
- low- and high-pressure steam systems.

Water and wastewater engineering

We understand the importance of balancing both compliance and operating efficiency. We engineer high-purity water treatment systems that maximize the use of resources, minimize waste, and optimize facility processes for higher yields.

Our wastewater treatment experts have decades of wastewater treatment and process design experience combined with in-depth knowledge of advanced treatment processes and environmental regulations. We have successfully designed a variety of wastewater treatment systems including:

- · biological treatment systems;
- steam and air stripping;
- · chemical precipitation;
- · ion exchange and membranes;
- UV/peroxide oxidation; and
- · zero wastewater discharge systems.

Site investigation, remediation, and due diligence

Woodard & Curran staff have more than 20 years of experience with site investigation and corrective and remedial activities at environmentally impacted sites in the Northeast and Midwest, including numerous former manufactured gas plants. Key services provided to energy industry clients include:

- property acquisition and risk assessment support;
- decommissioning of fuel pipelines and site remediation services;
- Phase I and II site investigations;
- · remedial design and oversight; and
- voluntary remedial action plans and other regulatory negotiations.

Litigation and alternative dispute resolution support

We provide litigation support on issues including rate disputes, forensic engineering, regulatory hearings, contribution claims, and property transfers.

As technical experts working behind the scenes or testifying on a variety of legal cases, we bring a practice-based understanding of the technical issues that must be resolved to bring cases to successful resolution. This understanding is the result of many years of experience as practicing professionals.

- expert testimony for rate disputes before the Federal Energy Regulatory commission (FERC);
- · forensic engineering; and
- · dispute resolution

SCADA services

Our instrumentation and controls experts have extensive experience designing and implementing SCADA systems for energy industry clients ranging from nuclear power plants to gas transmission facilities. Some examples of SCADA systems we've designed and implemented include:

- spent fuel pool alarm monitoring systems for nuclear power plants;
- remote controls of pressure vaults for gas delivery;
- screens and alarm handling for quick panel operator interface terminals; and
- monitoring and remote control of high-voltage switch gears for electric utilities.

Information Management Systems

Woodard & Curran uses geographic information systems and data management software to develop user-friendly, customized software applications to evaluate environmental conditions for the energy industry.

Our tools also incorporate handheld applications for field data collection and allows users to easily interpret environmental data collected from multiple sources.



We help the energy industry do more with less, conserve resources, and minimize waste and emissions through sustainable business practices. In one case, we're helping a bio-energy company attract investors with a corporate social responsibility report.

POWER ENGINEERING SERVICES



We offer a wide range of all-encompassing power engineering services, from development and permitting, through project execution, to post-project aftermarket plant engineering and field service support.

Woodard & Curran helps generators efficiently deliver power to energy users and gain a competitive advantage. We have delivered successful projects for small municipal electric utilities, independent or merchant power plants, developers and investment firms, industrial combined heat and power applications, and large utility-owned generating stations.

The power engineering staff provides the personal service of a small company backed by the depth of capabilities of a national, full-service engineering firm. We focus on efficient project management, innovative approaches to engineering challenges, and balancing current needs with long-term environmental sustainability.

Our power engineering services for combined heat and power or thermal process or heating distribution systems reach diverse segments of the power generation energy market, including colleges, universities, hospitals, and industrial manufacturing facilities. With services including site selection and feasibility studies, planning and permitting, engineering and design, federal agency relations, and post-project field service support, for more than 20 years, Woodard & Curran has helped clients successfully achieve their objectives.



Consulting Services

- Project development support
- · Capital cost estimating
- · Equipment selection and sizing
- Permitting and agency support
- Financial planning and grant writing support
- Due diligence assessments
- Energy and efficiency audits
- 3D laser scanning services
- · Site Selection

Project Management

- Capital project management, administration and controls
- Program management
- Procurement services and purchasing support
- Budgeting, scheduling, and document control
- Documentation services
- Design/build projects
- Engineering, procurement, and construction management (EPCM) projects

Review and compliance with all codes and standards.

Design Engineering

- Civil
 - Site planning and selection
 - Site design and layout
 - Permitting and planning
 - Ground- and stormwater planning and design
 - Drainage and erosion control
 - Subsurface utility design
 - Structural building design
- Mechanical
 - Equipment selection and size
 - Flow and water balance
 - Mechanical and piping system specifications
 - P&ID, piping, and arrangement drawings
 - Equipment lists
 - Pipe stress analysis
 - Efficiency and performance studies
- Electrical
 - Equipment selection and size
 - Electrical one-line, interconnection, point-to-point, termination diagrams
 - Equipment list and loading schedules
 - Cable and conduit schedule
 - Grounding systems
 - ArcFlash audits and remediation
 - Distribution and sub-station design
 - Switchgear, MCC, and metering systems
- · Instrumentation and Controls
 - Instrumentation size and selection
 - Instrument hookup and connection drawings
 - Instrumentation specifications
 - Instrument lists
 - Control system planning and selection
 - Control system specifications
 - Control system equipment and I/O lists
 - Control strategies, SAMA logic, and control write ups
 - Supplier and integrator supervision
 - Point-to-point and connection diagrams
 - Programmable logic controller and control system programming
 - Alarm management

Field Engineering

- Construction Management and Inspection
- · Safety supervision and administration
- QA/QC supervision and administration
- Commissioning management
- · Commissioning plans and procedures
- Decommissioning

Aftermarket and Plant Engineering Services

- · Plant upgrades and retrofits
- Plant engineering and staff augmentation
- · Procedure writing
- O&M manuals
- Training manuals and programs
- DCS and control system programming and field services

Areas of expertise for the group are industrial and aeroderivative gas turbine generators (simple and combined cycle), biomass fuel handling and combustion systems, control systems (Bailey, ABB, Emerson, and Allen Bradley), air pollution control, process wastewater treatment and handling, and 316B Clean Water Act plans and remediation.

Woodard & Curran's power engineering team is uniquely qualified and has the experience to perform the full life-cycle of a project from conception and execution, to turnover to the client. We have the added capabilities of post-project field engineering expertise and plant engineering support services to meet your needs.

ENERGY & POWER PLANT COMMISSIONING



As a full-service engineering firm with decades of experience providing design and commissioning services, we understand how to carry a design in to the field and ensure your system is operating as planned—ultimately saving you time and money.

The **start-up manager** assigned to your project will be responsible for executing the start-up and commissioning phase and will maintain a systematic schedule while ensuring that each system and item is commissioned safely. A core team of mechanical, electrical, instrumentation and controls engineers will support the startup manager through various phases, as necessary. The start-up team will establish all procedures and controls required for the coordinating and routing system turnover documentation and will follow commissioning procedures, technical interfaces, and correspondence as required to provide:

- · planning and scheduling for all project commissioning activities;
- · coordination of project commissioning activities and interfaces;
- · overall commissioning plan and matrix of responsibilities;
- · startup turnover packages for system turnovers, from construction to start-up and from startup to plant operations staffing;
- · monitoring and reporting of all project commissioning activities;
- · loop testing;
- · training for operations staff;
- · functional and operational testing;
- · startup and commissioning personnel and disciplines to commission all systems;
- performance testing specification development and oversight; and
- initial operations staffing support, as needed.

Woodard & Curran can also provide commissioning services for your heating, ventilating, and air conditioning or other building-related systems in accordance with the equipment manufacturers' recommendations, engineering standards, codes, and the U.S. Green Building Council (USGBC) LEED standards.

Our team has experience in testing and balancing:

- air handlers:
- duct heating or cooling systems;
- chillers and chilled water systems (electric, gas fired, steam or hot water);
- electric thermal storage systems;
- geothermal or air source heat pumps; and
- · ventilation systems and space requirements.

Woodard & Curran's team of licensed engineers and certified energy managers can assist you in the proper commissioning and initial setup of your system. Our dedicated team will help you achieve the expected performance and cost savings you need.



Woodard & Curran provides overall startup and commissioning. including the development of operating procedures for your facility, as well as:

- · hot water or steam boilers of all pressures:
- · natural gas-fired combined heat and power (CHP) packaged systems 70 kW to 15 MW;
- · combustion turbines and microturbines 30 kW to 500 MW;
- steam turbine generators;
- electric generator protection and controls:
- · electric distribution systems within a facility; and
- · burner management systems and boiler fuel conversions.



STRUCTURAL ENGINEERING



Woodard & Curran's specialized structural engineering capabilities allow us to find cost-effective solutions to all types of challenging infrastructure problems. Whether in support of new construction, process improvement, or addressing aging assets, our structural engineers can design buildings, structures, and support systems for mechanical equipment to address a broad array of utility needs. Our structural engineering experts work closely with our site civil, mechanical, and process engineers to develop the optimum design strategy for each individual project.

Capabilities for Power Engineering and Energy Projects

Our engineering staff has worked for numerous energy, industrial, and municipal clients on their power and industrial projects. Our capabilities include:

- · Complete structural and architectural design, plans, and specifications;
- · Process tank design;
- · Building design for power houses;
- · Engine and boiler foundations;
- · Pre-engineered metal buildings for industrial clients;
- Stairs, platforms, mezzanines, equipment supports, monorails, etc.;
- · Solar projects—photovoltaic panels supported on grade, landfills, building roofs;
- Repairs to existing buildings and tanks;
- New construction and upgrades to existing structures/facilities;
- · Construction administration, submittals and site inspection; and
- · Boiler, steam turbine, or CHP unit foundations

Additional Services

The Structural Engineering team conducts condition assessments and building and safety code reviews for industrial and municipal facilities. We have the capability to evaluate a building's structural and architectural components, tanks, sidewalks, and coatings. Woodard & Curran also works on extensive concrete repairs and coatings on concrete and steel tanks, building basements, and lower levels and precast structures. The work includes:

- · Urethane crack injection for leak repair,
- · Multiple waterstop solutions,
- · Sealant replacement,
- · Concrete spall repairs,
- · Waterproof coatings,
- · Major structural rebuilds;
- · Coatings for steel and concrete tanks,
- · Concrete containment areas, and
- Hydrogen sulphide-resistant lining systems for wastewater tanks.



Other Project Work:

- Retaining walls, drainage structures and sea walls;
- Public works garages and pre-engineered buildings for industrial facilities;
- School renovations and reroofing, roof framing evaluations/structural upgrades;
- Design-build;
- ADA compliant restrooms, locker rooms, laboratories, and entrances;
- Biomass boiler buildings and facilities;
- Cogeneration buildings and facilities:
- Boiler stack/chimney designs; and
- Pipe bridges and engineered supports



SMART GRID & UTILITY SERVICES



INVESTMENTS IN NEXT-GENERATION TECHNOLOGY PROVIDE IMMEDIATE RETURNS

The U.S. electric grid is in need of substantial upgrades to its transmission and distribution system to make it more efficient, reliable, and resilient. Many utility companies and organizations are investing in infrastructure improvements; however, more needs to be done to protect against vulnerabilities.

Severe weather, the leading cause of power outages, is estimated to produce economic losses of tens of billions of dollars annually. The growing consensus in the scientific community points to an escalation in the frequency and intensity of severe weather events and flooding from sea level rise due to climate change. These hazards will create even more power outages. In addition, equipment that is outdated or in disrepair increases the occurrence of disruptions. The catastrophic Northeast blackout in 2003 left 55 million people without power in Canada and the United States. This kind of widespread event, and the resulting cascading failure, could have been managed locally or avoided altogether with current smart grid technology.

Woodard & Curran helps public- and private-sector clients design and deploy innovative and cost-effective smart grid and utility solutions to:

- harden infrastructure to withstand severe weather and mitigate risk;
- implement advanced control capabilities to improve transmission and distribution flexibility and robustness;
- · improve network communications, automation, data integration, system monitoring, and security; and
- · plan, design, and manage predictive or preventive maintenance, structural enhancements, or recovery and reconstitution efforts.

With more capacity coming from renewable energy and backup power from traditional power resources becoming more expensive, the production and distribution of electricity needs to become more agile and responsive to demand. Furthermore, an estimated 90% of all outages occur along distribution lines. As our lives become more dependent on technology like electric cars and smart appliances, customer demand for increased capacity and the reliable delivery of energy requires utilities and operators to invest in the next generation of smart grid technology.

Smart Grid Savings and Benefits

According to the Smart Grid Consumer Collaborative, improvements to the smart electrical grid have the potential to increase the efficiency of today's system by around 9% in less than 20 years and save more than 400 billion kilowatt-hours each year. On a local level, the Collaborative estimates that smart grid modernization could yield savings of nearly \$600 for the average household each year.



What is the Smart Grid?

The electrical grid is undergoing a critical period of modernization that will create a more efficient and sustainable delivery of power to households and industry. Nearly 7 percent of electricity generated by power plants is lost during transmission, which not only costs consumers but also contributes to the unnecessary consumption of resources to produce that power. The smart grid consists of state-ofthe-art upgrades to transmission infrastructure, like high-capacity wires that reduce loss during delivery, and integrated network systems that supply real-time data to manage the intelligent production, distribution, and consumption of electricity.

Intelligent Solutions that Drive Results

Woodard & Curran has provided cost-effective and forward-thinking engineering, operations, and technology solutions to utilities and large organizations for many years. We continue to work with accomplished partners throughout the country to support our clients and successfully complete projects of any size.

Our capabilities and expertise encompass the following areas:

Substation

- · substation automation
- turn-key substation design
- construction management
- remote monitoring
- · security
- fiber, microwave, MPLS network design
- · RTU upgrade/replacement

Distribution Automation

- · recloser controller
- · capacity bank controller
- · switch controller
- volt VAR integration
- SCADA
- · distribution optimization systems
- outage management systems
- underground transmission design and automation

AMR/AMI Network Design

- WAN/LAN/NAN design/build
- · mesh network design/build
- · point-to-point design/build
- spectrum analysis
- geospatial support for electric, water, and gas utilities
- integration of GIS system with current asset management system
- · meter and asset location and mapping
- systems integration

Program Management

- engineering
- construction
- procurement
- site acquisition
- OPM



Explore new options before launching conventional solutions.

Chuck Gerry is Woodard & Curran's Director of Smart Grid



erry

Technology. He offers many years of extensive experience in smart grid, wireless and wired communication, networking, and utility solutions.

In addition to supporting the deployment and operational management of a smart grid network in Maine consisting of more than 600,000 smart meters, he has been instrumental in automating electricity distribution systems for multiple utility companies across the United States.

Advanced Metering Infrastructure (AMI)

One essential element of Smart Grid infrastructure is the smart meter. AMI offers utility providers the capability to not only automatically receive usage information but also the ability to manage outages, monitor power quality, and utilize time-based pricing. Utilities have long used this technology at industrial sites. At residential homes equipped with these smart meters, customers will be able to see, in real-time, their consumption statistics and will soon have the ability to lower their power bills by shifting the use of high-power devices, like washing machines, water heaters, or even electric car charging stations to operate when power delivery is less expensive.



NATURAL GAS SERVICES

ENERGY



Woodard & Curran staff have been serving the energy industry for more than 40 years with a broad scope of regulatory, environmental, engineering, and construction support services. Our clients range from small municipal utilities, regional producers, local distribution companies, and transporters of electricity, natural gas, petroleum products, nuclear energy, combined heat and power, and renewable energy. With services including gas engineering, site selection and feasibility studies, planning and permitting, instrumentation, and industrial design, Woodard & Curran employees have extensive and varied experience helping clients achieve their objectives.

Gas Engineering

Woodard & Curran staff have provided services to local gas distribution companies, pipeline companies, LNG facilities and industrial customers for the engineering and design of their distribution systems, gate and regulator stations, transmission lines, routing studies and other related facilities for various natural gas projects. Our personnel have assisted our utility clients with all aspects of these projects from the initial planning, through design and construction. Woodard & Curran can offer our energy clients a one stop source for all their gas engineering and environmental requirements, such as:

- · routing and facility siting,
- · engineering studies,
- pipeline design / upgrade,
- regulator / gate station design,
- · metering and master meter systems.
- bridge & railroad crossings,
- · horizontal directional drill design,

- system analysis (stoner modeling),
- · code compliance & integrity management,
- · O&M procedures,
- · state relocation coordination,
- geotechnical services.
- · health and safety plans,
- base mapping and GIS

Site Selection & Environmental Services

Woodard & Curran staff have varied and extensive experience with site selection and feasibility studies. Key services include:

- · site evaluations,
- environmental and economic assessments.
- · linear project routing,
- · visual simulation modeling,
- · wind studies.

- air emission modeling,
- · property acquisition and risk assessment support,
- · decommissioning of fuel pipelines,
- · Phase I and II site investigations, and
- · site remediation services

Other Natural Gas Services:

- LNG facilities design, modifications,
- compressor stations,
- · energy/supply studies,
- SCADA controls & system automation,
- · project management & scheduling

Services Provided To:

- Local Distribution Companies
- Pipeline Companies
- LNG Facilities
- End Users
- Natural Gas Producers



Key Services:

- site selection & feasibility studies
- pipeline routing & mapping
- planning & permitting
- gas systems design
- pipeline engineering
- SCADA & instrumentation
- HDD layout & design
- gate station design
- pressure regulators design
- industrial & process design
- code compliance & integrity management
- ecological/wetlandsgeotechnical
- civil engineering
- environmental impact assessment

COMBINED HEAT & POWER DISTRIBUTED GENERATION



Combined Heat and Power (CHP) solutions represent a proven and effective nearterm energy option to help organizations enhance their energy efficiency, as well as promote energy independence and environmental quality.

CHP is the concurrent production of electrical and thermal (heating and cooling) energy from a single fuel source—two outputs for one input. CHP is also known as cogeneration, tri-generation, or distributed generation and can be part of a microgrid.

The energy efficiency from a CHP solution comes from recovering the heat that would normally be wasted while generating power to supply heating or cooling needs. CHP is not a single technology but a group of technologies that can use a variety of fuels to provide reliable electricity, mechanical power, or thermal energy at a factory, university campus, hospital, or commercial building—wherever power is needed. CHP has been used in one form or another for more than 100 years.

The benefits of CHP or Distributed Generation:

- Enhanced energy security by helping businesses weather energy price volatility and supply disruptions;
- A reduction of CO2 emissions and other pollutants;
- Improved business competitiveness by managing costs;
- Increased energy infrastructure resiliency by limiting congestion, load reduction, offsetting transmission losses, and disaster recovery;
- · Improved energy efficiency by capturing heat that is normally wasted; and
- Located at or near the point of consumption, which helps avoid electrical transmission losses.

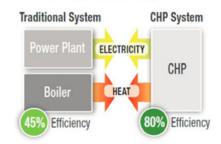
CHP technologies include internal combustion engines, combustion turbines, microturbines, fuel cells, and traditional steam boilers with backpressure steam turbines. These technologies use a variety of fuel types from natural gas, propane, liquid fuels, biofuels, landfill gas, biomass, and hydrogen.

Is your organization a good candidate for CHP?

Our firm has the expertise to provide feasibility studies, modeling, permitting, design engineering, design build or EPC contracting services, and operations and maintenance. We can assist your organization in the technical, financial, and funding modeling to provide the level of detail needed to obtain funding, complete grant applications, and identify preliminary plans.

Woodard & Curran has executed studies, designed, and installed CHP systems ranging from 40 kW to 38 MW. Our staff has experience on larger cogeneration systems ranging from 40 MW to 200 MW, and we have experience with a wide range of applications from food and beverage manufacturing, colleges, universities, hospitals, heavy industrial manufacturing such as pulp and paper and molded fiber, to independent power plants selling electricity and steam to end users.

CHP Process Flow Diagram



We have developed a simple CHP checklist that identifies advantages and establishes if your site is a good fit for a CHP system.

Contact Woodard & Curran's Energy and Power Engineering team for your checklist at: 800-426-4262





STRATEGIC ENERGY PLANNING



Proactive energy management is the most complete way for a facility to maximize control over long-term energy costs, and by extension, the company's carbon footprint. An effective energy management strategy can immediately reduce energy costs and exposure to energy price volatility, broaden the company's energy portfolio, control direct and indirect emissions, develop strategic energy goals and continually build on the gains made. Woodard & Curran is working with our clients to develop comprehensive Energy Strategy Plans that provide the necessary tools and practices to manage expenditures, control carbon output and provide a framework to prioritize energy conservation initiatives, all while meeting operational needs and maintaining comfort.

Creating a Comprehensive Strategy

Woodard & Curran works with clients to develop a customized, comprehensive energy management program that integrate advanced information technology and automation systems; provide a framework for assessing and ranking renewable energy technologies; and develop and implement procurement strategies that fit with a campus' infrastructure and risk appetite.

Energy procurement – Develop an energy procurement strategy for future planning and budgeting purposes.

Choices regarding energy procurement should be informed by a comprehensive strategy that considers market dynamics and fundamentals as well as load control capabilities to create a custom portfolio design intended to stabilize and reduce expenditures. In developing a procurement strategy, we work to understand peak load demand, and establish strategic energy purchasing processes that are within a school's tolerance for risk.

Renewable Energy Alternatives -

Assess and deploy economically viable renewable energy resources to curtail carbon output and hedge against volatile conventional energy prices.

The feasibility of renewable energy technologies such as wind, solar, biomass, photovoltaic, or other emerging resources should be evaluated given the constraints of each facility's unique energy environment.

STRATEGIC ENERGY PLANNING MAXIMIZING CONTROL OF ENERGY COSTS

Goals & Benchmarking



Energy & Cost Reduction **Strategies**



Renewable/ **Alternative** Energy



Project Identification; Evaluation, & **Prioritization**

- Reduce Energy Use
- Reduce GHG **Emissions**
- Reduce Costs
- Understand Strengths and Weaknesses
- Procurement
- Info. Management/ **Operational Controls**
- Community Collaboration
- Conservation/ Efficiency
- Behavioral Change
- Identify appropriate options given site's limitations
 - Wind
 - Solar thermal/PV
 - Biomass
 - Co-gen
 - Geothermal

- Prioritize Projects Based on:
 - Goals;
 - ROI;
 - Funding,
 - Ease of Implementation

An Energy Waste Minimization Plan!

Information Management – Continuous commissioning to ensure the efficiency of energy-related mechanical systems.

Collection of real-time energy cost, consumption and carbon output information that is tailored for various facilities constituencies using electronic data management tools. This data will be used to drive real-time analysis of building energy usage, energy price points, and greenhouse gas emissions and support project prioritization.

Efficiency and Conservation -

Collaborate with and help guide, support, and prioritize energy management opportunities that are consistent with a facilities overall commitment to energy conservation, cost savings and sustainability goals.

We work with our clients to complete energy audits and other related studies to identify energy conservation and efficiency opportunities. We develop energy project prioritization tools to evaluate projects with respect to key drivers (i.e. energy reduction, greenhouse gas

reduction (GHG), ease of implementation, financial payback; curricular potential; operational advancement; and leadership potential). Many states have funding programs that pay for or offset the cost of the studies

Community

Collaboration – Identify and recommend opportunities for participation in partnerships and consortia for both energy procurement and energy generation.

Energy supply aggregation and asset development partnerships can offer substantial economic benefits. On the supply side, aggregation of loads effectively improves the overall load shape and permits access to a wider range of market products. A set development partnership can achieve economies of scale, and create conditions for projects that have a significant impact.

Design a Program That Fits Your Needs

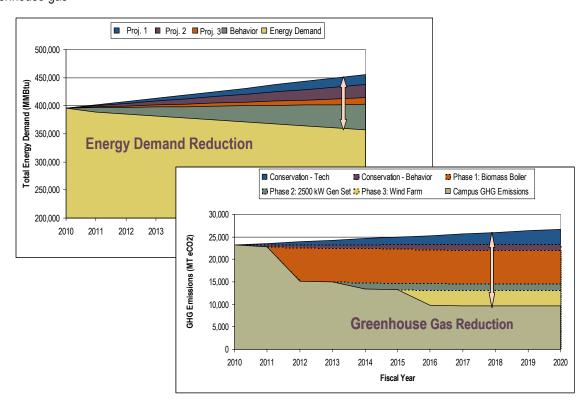
Woodard & Curran's approach to developing an energy management strategy tailored to your facility is highly collaborative. Guided by an understanding of company culture and organizational structure developed through stakeholder analysis and interviews, we work to balance the demands of cost and environmental benefit. Finding a compromise that allows you to meet your environmental commitments while maintaining fiscal responsibility is crucial to a successful energy management strategy. The goal of this process is for a company to be able to systematically identify, select and schedule the conservation

investments that will best help it achieve its goals related to both energy reduction and greenhouse gas reduction.

This process is colored by an in-depth understanding of each facility's risk tolerance and focuses on fostering the behavioral change that is often needed to successfully implement a complete energy management strategy.

Developing an Energy Strategy Plan also provides significant educational opportunities.

Woodard & Curran approaches these projects as a chance to engage the staff in the process. Integral to the successful implementation is the identification and management of both technical (physical equipment) and behavioral (staff behavior choices) conservation opportunities. It also provides an opportunity for companies to reach out to other communities nearby and develop collaborative relationships that can benefit all involved.



UTILITY SYSTEMS AND INFRASTRUCTURE



The more efficient and productive a company is, the more competitive it can be in an increasingly global economy. Woodard & Curran's services in utility systems and infrastructure help companies gain that competitive edge by trimming operating costs and planning for the future.

We help companies in the general manufacturing, pharmaceutical, biotechnology, chemical processing, food and beverage, high-tech manufacturing, pulp and paper, power generation, and textile industries reassess and renovate utility systems and infrastructure, expand manufacturing processes to accommodate new products, and design infrastructure that maximizes the use of resources.

Our engineers, scientists, and operations specialists have worldwide experience in:

- Integrated cooling systems that use the latest PLC and DCS technology;
- Potable, process, and fire protection water systems;
- · Fuel oil, natural gas, inert gas, bulk chemical storage tanks, and distribution svstems
- · Loading and unloading systems;
- Vacuum pump applications;
- · Fume ventilation and extraction ventilation systems; and
- · Low- and high-pressure steam systems.

In-house experts assess client's needs

Our integrated team of environmental scientists and engineers provide the highest level of expertise that only a multidisciplinary consultant can provide.

We conduct energy audits that assess how best a company can improve energy use during manufacturing processes, then we develop a plan that will help trim operating costs through upgrades or new equipment.

Communication key to success

Our experience has shown that effective and frequent communication with stakeholders during the design process can prevent surprises that may delay project schedules and affect budgets. Clear communication also helps projects run more smoothly by soliciting up-front project buy-in from stakeholders.

We realize that while experience and technical expertise are very important to a project's success, these factors can become secondary if project communication is not well managed. In all our projects, especially high profile ones, we work closely with our clients to develop effective and efficient communication pathways in order to keep steady and consistent progress on our projects.

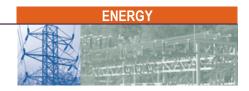
Advantages of working with Woodard & Curran

- · We help clients gain a competitive edge by helping trim operating costs and plan for the future.
- Our energy audits are designed to assess how a company can improve energy use.
- When possible, we focus on reusing existing facilities and equipment to minimize capital costs.



Evaporative condensers at confidential food processor facility.

ELECTRIC TRANSMISSION & DISTRIBUTION



Woodard & Curran has served large utilities, municipal utilities, and privately owned campus-style medium voltage distribution systems throughout the Northeast for many years. Our clients have benefited from our capabilities and experience in:

- · site route planning;
- · permitting;
- · electric system studies;
- · design drawing and specification development;
- · site-civil design services;
- · utility coordination and interconnection applications;
- · planning and scheduling;
- construction support services; and
- · testing and commissioning services.

Woodard & Curran is highly experienced in the execution and management of all environmental, ecological studies, and permitting services for large-scale linear projects. Additional capabilities include using Geographic Information Systems (GIS) to:

- · complete client route-planning objectives;
- · minimize the number of landowners impacted;
- · avoid federal- and state-owned lands; or
- minimize the impact on cultural resources, wildlife habitat, and natural resources.

Utilities benefit by performing electrical engineering studies. Major components within the transmission and distribution system will be understood, and essential decisions can be made for the project—particularly at municipal light plants and cooperatives without significant in-house engineering staffs. These studies can often bring about cost-effective concepts or head off issues that may later be discovered in the project process.

Avoiding complications early in a project is a key to success, which can reduce the overall cost with little investment up front. Woodard & Curran's project approach is to listen to clients, solve problems during each phase, and establish a working partner-ship that will achieve the best system in the long run. We look to use your current assets to the fullest extent. Our goal is to find cost savings for clients, which often leads to more solutions realized during a project.

We bring to each transmission and distribution project the electrical, I&C, and site-civil engineering design skills to perform many of the functions needed for a complete system modification—whether that be a new substation, distribution lines, SCADA system upgrade, transformer replacement, or smart grid upgrade. Smart system upgrades provide utility personnel with instant access to information at any location and allow remote control to resolve operational problems with less equipment damage and fewer wasted road miles. Utilities can then focus on preventive maintenance rather than reactive maintenance.



Woodard & Curran performs many services in house, such as planning, studies, site-civil, and electrical design, which all leads to a more succinct project with fewer hand-off problems. When we do partner with a company to expand our own resources, we select very carefully and integrate our partners seamlessly.



70 MVA Substation Renovation and Design Services at Concord Municipal Light Plant



Water Treatment Plant Solar PV Project City of Lowell, MA

HVAC/PLUMBING/FIRE PROTECTION ENGINEERING



Woodard & Curran has a solid understanding of the unique factors that influence a wide range of facilities: from municipal and educational facilities, which, because of their public nature, must be functional for everyone; to industrial and commercial facilities, which must meet the clients' specific needs. Woodard & Curran's experts supply a broad range of facility assessment and system upgrade design services to ensure building comfort, efficiency and environmentally sustainable.

Municipal and State Facilities

Municipal and state buildings are required to serve a growing number of functions. Today's multi-use municipal building must meet a wide range of requirements while maximizing efficiency and reducing energy costs. Woodard & Curran provides building envelope and mechanical system evaluation and design services for the upgrade of a wide range of municipal and state facilities.

Educational Facilities

Reconfiguring a school to meet fluctuating enrollment, requirements such as Americans with Disabilities Act guidelines, current technology needs, and maintaining overall facility integrity are significant challenges that all school systems face. With a wide range of experience, Woodard & Curran's mechanical engineers can meet a school system's unique needs.

Commercial Facilities

Woodard & Curran strives to create sustainable HVAC, plumbing, and fire protection solutions, and in doing so have employed the most state-of-the-art, innovative applications for our clients. Mechanical engineering focuses both on creating healthy and comfortable indoor environments, while utilizing the most efficient generation and distribution of energy.

Industrial Facilities

Woodard & Curran is committed to serving industrial and manufacturing facilities on a wide range of building services projects—from feasibility studies, to design engineering, compliance and permitting, construction management, procurement and expediting; to complete turnkey projects.

Our engineers have worked on a wide range of projects throughout the world, from small manufacturing facilities to multi-site Fortune 500 firms. Our focus is on providing valuable and cost-effective solutions, utilizing reliable, state-of-the-art technologies, and tactical solutions to give facilities' a competitive edge.



Services

- Facility assessments
- Feasibility studies
- Heating, ventilation, and air conditioning design
- Plumbing design
- Fire protection design
- Sustainable design
- Commissioning
- Design-build
- Energy Assessments
- Code Reviews

ENERGY AUDITS & STANDARDS



Operating and maintaining a commercial or municipal building is an expensive endeavor. Facility operators often look to increase the efficiency of the buildings they manage, but they don't know where to find savings and benefits. Woodard & Curran's Certified Energy Managers have the credentials, expertise, proficiency, and ethical fitness to complete the right level of analysis to meet your energy needs. By acquiring the experience of a professional CEM, you will ensure a high level of competency and design for all energy-related projects.

Defining Levels of Effort for Commercial Building Energy Audits per ASHRAE and Industry Standards:

A commercial building energy analysis can generally be classified into the following three levels of effort:

- Level 1—Walk-Through Analysis
- · Level 2—Energy Survey Analysis
- Level 3—Detailed Analysis of Capital Intensive Modifications

In addition, there is a Preliminary Energy-Use Analysis (PEA), which is a prerequisite for any audit, and there are targeted audits, which do not have a strictly defined level of effort but may be useful or necessary for some situations.

The PEA precedes an audit of the building, and it provides the necessary background data for Levels 1, 2, or 3 analyses. During the PEA, the analyst investigates the building's historic utility use, peak demand, and cost; completes the Energy Cost Index (ECI) of the building (expressed in dollars-per-floor-area-per-year); and develops the Energy Utilization Index (EUI) of the building (expressed in kBtu/ft2 [MJ/m2] per-year). The analyst then compares the building's EUI to the EUIs of similar buildings and then assesses the potential for improved energy performance. The PEA will help determine whether further engineering study and analyses are likely to produce significant energy savings. Monthly energy use and peak demand or, if available, interval billing data (such as 15-minute data), are reviewed to identify efficiency or behavioral modification opportunities.

Level 1—Walk-Through Survey

First, the building's energy cost and efficiency are assessed by analyzing energy bills, compiled in the PEA, and conducting a brief on-site survey of the building. A Level 1 energy survey will identify low-cost/no-cost measures for improving energy efficiency and provide a list of potential capital improvements that merit further consideration. Because calculations at this level are minimal, savings and costs are approximate. A Level 1 analysis is applicable when the desire is to establish the general energy savings potential of a building or to establish the buildings in a portfolio that have the greatest potential savings. Level 1 results can be used to develop a priority list for conducting Level 2 and 3 audits.

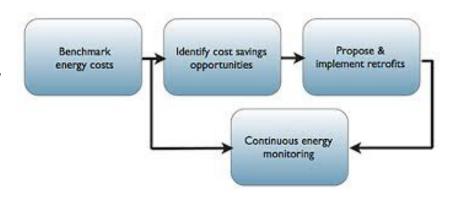


CERTIFIED ENERGY MANAGER IS THE MARK OF A QUALIFIED PROFESSIONAL

Since its inception in 1981, the Certified Energy Manager® (CEM) credential has become widely accepted and used as a measure of professional accomplishment within the energy management field. It has gained industry-wide use as the standard for qualifying energy professionals both in the United States and abroad. It is recognized by the U.S. Department of Energy, the Office of Federal Energy **Management Programs** (FEMP), and the U.S. Agency for International Development, as well as by numerous state energy offices, major utilities, corporations, and energy service companies.

Level 2—Energy Survey and Analysis

A Level 2 audit involves a more detailed building survey, including energy consumption and peak demand analysis. A breakdown of energy end uses within the building is developed. A Level 2 energy analysis will identify and provide the savings and cost analyses of all practical energy efficiency measures (EEMs) that meet the owner's/ operator's constraints and economic criteria, along with proposed changes to operations and maintenance



(O&M) procedures. It may also provide a list of potential capital-intensive improvements that require more thorough data collection and engineering analysis as well as an assessment of potential costs and savings. This level of analysis will provide adequate information for the owner/operator to act upon recommendations for most buildings and measures.

Level 3—Detailed Analysis of Capital-Intensive Modifications

The third level of engineering analysis focuses on potential capital-intensive projects identified during a Level 2 analysis. It requires more detailed field data gathering as well as more rigorous engineering and economic analyses, often including modeling (simulation) of the annual energy performance of the building and vendor pricing. It provides detailed project cost and savings calculations with a high level of confidence sufficient for major capital investment decisions. It often goes beyond the economic analysis of a Level 2 audit and uses a comprehensive life-cycle cost analysis (LCCA) as a decision-making tool.

Targeted Audits

A targeted audit is an investigation with a limited scope, typically a single energyusing system, central plant, or area of the building. Some examples include lightingonly audits, cooling-tower replacements, boiler-control assessments, and tenantimprovement projects. A targeted audit will identify and provide savings and cost analyses for retrofits and control strategy improvements for the systems of interest. The level of effort may be tailored to the needs of the facility. Because the audit is limited to a portion of the building, a whole-building approach (such as end-use allocation and comparisons with historical utility bills) cannot be used to provide a check on analytical methods. Similarly, whole-building simulation is typically not a costeffective approach except for large systems. For this reason, targeted audits rely on measurements, data logging, and trend data to provide a check on the energy use estimates in the base case.

A targeted audit is an investigation with a limited scope. typically a single energy-using system, central plant, or area of the building. Some examples include lighting-only audits, cooling-tower replacements, boiler-control assessments, and tenant-improvement projects.



SOLAR ENERGY SERVICES

ENERGY

SOLAR PV SYSTEMS

Woodard & Curran provides total project solutions for solar PV systems from site feasibility to full design to complete Engineering, Procurement, Construction (EPC) contracts. Additionally our services include Operations & Maintenance long term contracts utilizing our own open structured Solar Performance Monitoring System. We have successfully completed contracts for over 32MWs of solar systems, with over 100 MWs in our pipeline.

Based on our experience, we understand the critical technical and regulatory issues which must be considered when placing large arrays including those located over a capped landfill site. Our engineers have provided the geotechnical, civil, structural, electrical, PV design, PV array renderings, and permitting services for solar energy projects. Our team is well-positioned to provide the technical services to ensure our clients' interests are well represented for each project. Key services include:

- Design Engineer: We have served as the design engineer for solar developers
 which have contracted with communities to deliver solar PV systems and for
 municipalities who are developing their own solar PV projects. Site selection
 and suitability assessments for solar arrays are a component of our engineering
 services.
- Technical Consultant: We have served as the consultant to communities to help them evaluate renewable opportunities (including solar) and assist in the review of proposals and technical design prepared by solar developers.

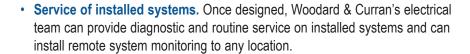


SERVICES

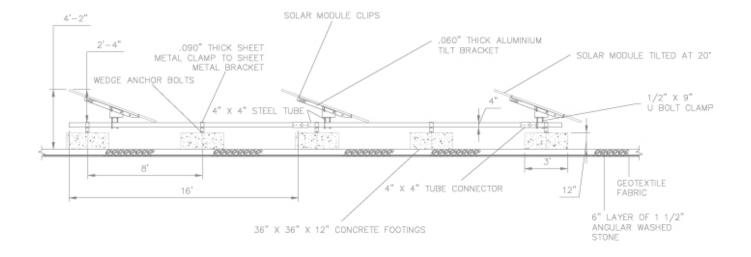
- Site selection & feasibility studies
- Permitting & compliance
- Electrical engineering & instrumentation
- Electrical interconnect application
- · Civil engineering
- Landfill engineering
- Solar PV design
- PV system service
- Aesthetics/renderings
- Funding



- Power Purchaser: Woodard & Curran's Operations Group has long-term operation and maintenance agreements to operate municipal water and wastewater treatment facilities. In this role we pay in the aggregate over \$1M in electrical costs per year. We are currently negotiating Lease and Power Purchase Agreements (PPAs) for long-term solar projects at two of our treatment facilities.
- Proven Experience with Project Funding. Woodard & Curran's has a successful track record with regard to interfacing with its clients on project funding and financing opportunities. Our funding team provides the project team with a wide range of leveraging opportunities with regard to defraying the local share cost of solar projects. Woodard & Curran's funding team helps our Clients decipher and negotiate federal and state funding program eligibility criteria and identify the hot-button issues which define the success or failure of public entities in securing federal and state project funding.







DESIGN/BUILDCONSTRUCTION MANAGEMENT



One of the most efficient strategies for an owner to get a project completed is to hire one company to do it all using a **Design/Build** (DB) execution methodology. Our method is to have a team of professional designers, engineers, estimators, and construction managers working together from the beginning of a project right through commissioning. This methodology is a form of performance contracting with minimal initial input from the owner.

Once a preliminary design is complete, the firm contract scope, schedule, and budget can be defined. The owner benefits from quality control, schedule control, and cost-saving strategies from each professional discipline throughout the project.

Using **Construction Management** (CM) as a contracting strategy with Woodard & Curran as the builder, the actual construction can still be bid to comply with public bidding and funding laws in most cases. This contracting method is commonly known as **EPCM** (engineer, procure, construction management).

Woodard & Curran also adds operations expertise to its EPCM services. The owner can then contract for long-term operations and maintenance (O&M) or choose to **Design/Build/Operate** (DBO) with one firm. With this combination of contracting methods (EPCM and O&M), the owner has only one company responsible for everything, while staying involved and in control of price and quality throughout.

Safety Is a Priority

With any contracting method (DB, EPCM, DBO) safety is a top priority on our construction sites, and before ground is broken, a safety plan is in place. We train our contractors and technicians in all the site hazards and inspect work areas daily.

Our construction managers also have weekly site reviews and monthly audits. Our corporate health and safety managers also periodically inspect the site and report their findings to senior management.

Subcontractor Selection

We work with clients to pre-qualify each contractor before they bid on a project to minimize low-bid issues. We then draft contract documents that are tailored to each project and focus on protecting the client from risks associated with misunderstandings and contractor claims. Services here include:

- · contractor pregualification;
- drafting of contract documents;
- · development of "Issue for Bid" drawings and specifications;
- · bidding and negotiating; and
- final subcontractor selection.



"We had an unbelievable, virtually seamless startup of our process system. The guys that made this happen are the 'A' team... These guys never let up one second to ensure this project was a success."

— Ron Johnson,

Project Manager

Project Manager Confidential Processing Client



Project Execution

Our project team works with plant personnel to efficiently unload and stage all required installation equipment and materials, while minimizing the impact to the existing plant operation. The construction manager will coordinate all contractor activities, from plant access and work schedule to site supervision and punch lists.

We review contract documents and specifications to promote consistency and clarity. This phase of the project is a combined field/office function in which we handle scope changes, technical clarifications, back charges, and schedule maintenance.

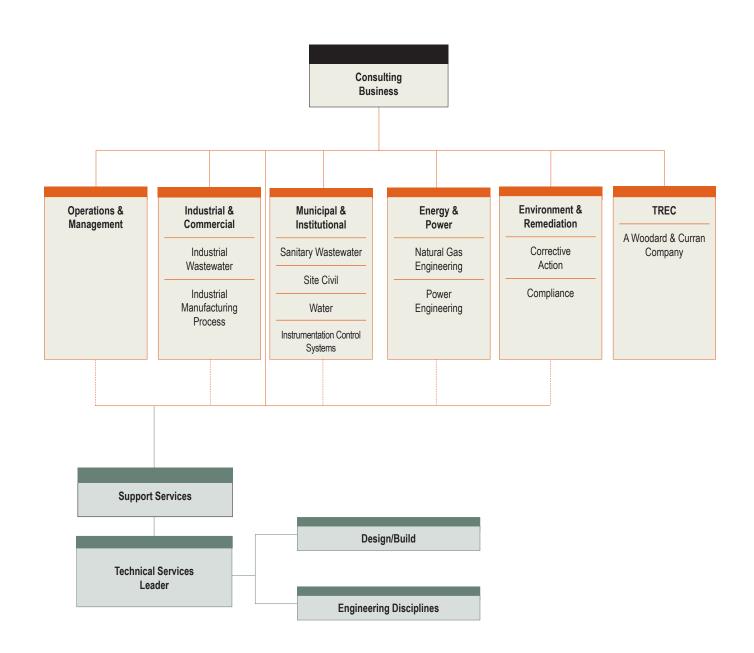
Equipment and Process Commissioning

When it comes time to integrate or start up new equipment, we work closely with vendors to confirm that each equipment center is ready, both mechanically and electrically, for final check-out. The commissioning manager works closely with plant personnel to coordinate operator and maintenance equipment training. Skilled operators are essential to maintaining efficient industrial operations. Our engineers and technicians are expert problem solvers who work closely with vendors to coordinate all aspects of equipment troubleshooting and start-up.





THE FOLLOWING REPRESENTS SELECTED ADDITIONAL SERVICES THE FIRM OFFERS.



COST ESTIMATING & BUILDING PROJECTS



ESTIMATING WITH INTEGRITY

The first principle question for a project is often: how much will it cost? There are a number of ways to approach that question, but for a project of any size, the answer should always be clear and honest.

Woodard & Curran is committed to operating with integrity. It's at the foundation of everything we do. Because of our capabilities as a full-service firm and our experience on numerous industrial and municipal projects of every scale throughout the country, our clients have full confidence in the results we deliver.

In today's economic environment, we understand the funding challenges organizations face. We're always mindful of costsavings strategies and look for innovative ways to provide the appropriate value for our clients.



Cost estimating services:

development budgets

Change order analysis

· Risk review analysis

Bid package development

Pre-bid and post-bid reviews

· Labor, material, and equipment pricing

Conceptual, schematic, and design

· Quantity take-off

As an integrated engineering, science, and operations company, Woodard & Curran has the expertise to develop and complete complex or straight-forward cost estimates. Whether new construction, process improvement, or addressing aging assets, our staff understands how to work closely with owners, architects, subcontractors, suppliers, and project superintendents to estimate and design structures and systems that address a broad array of needs.



- Constructability review
- Value engineering
- · Life-cycle cost analysis
- Project budget control
- · Proposal analysis services
- · Add/deduct alternatives

Our capabilities include providing conceptual or schematic cost estimates for various design options that allow our clients to make informed decisions on the best approach before engaging significant design costs. We use state-of-the-art quantity take-off and historical database pricing software to create comprehensive detailed cost estimates, which can be adjusted based on the scope of the client's needs or changing market conditions.

For example, Woodard & Curran was hired to design, permit, and bid a subsurface stormwater storage facility, stormwater pumping station, force main, and gravity





Our capabilities include providing conceptual or schematic cost estimates for various design options that allow our clients to make informed decisions on the best approach before engaging significant design costs.

storm drain system to convey stormwater from pump station to ocean outfall for the City of Salem, MA. During the estimation phase, we schematically quantified and estimated six different 3.0 MG water storage options as part of the larger flood mitigation project to allow a review and decision based on the pros, cons, and costs of each option. Salem was able to make smart decisions that fit their funding requirements and addressed their infrastructure needs.

Add/deduct alternatives

When reviewing funding and bid opportunities, flexibility is important. Woodard & Curran's expertise allows us to provide budget cost estimates for either add or deduct alternates based on specifically defined design options. This allows our clients to add or remove costs depending on the overall project budget requirements.

In one such instance, when Woodard & Curran upgraded a wastewater treatment plant for the RockTenn Company, the construction estimate included three significant add options for a redundant pump, mixing equipment, and a laboratory. This offered the client several alternatives to add to the project if construction bids came in low enough to include these assets within the allowable funds to complete the work.

When offering add/deduct alternatives, the objective is to provide the client with the benefit of a design that allows for items to be added now or in the future—whenever the funding opportunity makes sense.

Design/build and construction management services

Municipal and industrial clients are turning to Woodard & Curran for our Design/ Build/Operate (DBO) capabilities. With professional designers, builders, and operators working together from the beginning of a project right through operations, an owner benefits from the quality control, schedule oversight, and cost-saving strategies our firm can successfully deliver in this role.

As the Design/Builder, Woodard & Curran knows how to navigate a project from the design and planning phase to startup and operations. We provide guidance and act in the owner's best interests at every stage of the project.

Additional example projects

- Woodard & Curran helped Maine School Administrative District #29 evaluate the financial benefits of a woodchip biomass boiler. Based on a positive long-term cost analysis and successfully securing \$910,000 in grant funds, we assembled a Design/Build team to install the new boiler and provide woodchip storage.
- · A confidential bottling client chose Woodard & Curran to provide complete utilities and process design as well as construction management for a new natural spring water bottling plant in Tennessee.
- · Woodard & Curran provided a wide range of construction services as part of a long-term program of modernization at the 30 MGD wastewater treatment plant in the City of Lowell, MA.
- Woodard and Curran completed a turn-key project, including overall design/ engineering services, project management, equipment procurement, contractor coordination, implementation, and start-up of a new industrial wastewater treatment facility that uses a Moving Bed Biological Reactor and Dissolved Air Flotation treatment system for a confidential client in Massachusetts.

To view more projects we have completed for industrial and muncipal clients throughout the country, visit us online or contact us for more information.



Woodard & Curran knows how to navigate a project from the design and planning phase to startup and operations. We provide guidance and act in the owner's best interests at every stage of the project.

CORRECTIVE ACTION SERVICES



Over the past decade, more and more remediation projects and associated regulatory programs have evolved from a regulatory-standard-based, cleanup approach to risk-based, redevelopment-focused efforts. Woodard & Curran and our clients have found it much more satisfying to work toward a productive end-use as we remediate sites. Our relationships with state and federal regulators help us to effectively navigate the regulations on behalf of our clients. We are committed to being a strategic partner for our clients from the remedial investigation phase of a project through to project completion.

Our senior staff has over 20 years of direct experience with federal programs and providing creative solutions to complicated environmental problems. We have a wide range of capabilities on the cutting edge of technology and risk evaluation, anchored in solid traditional design engineering services. We have a proven track record of successfully turning under-utilized, contaminated properties into retail sites, light industrial facilities, office parks, market rate housing, and waterfront promenades. By using innovative sampling techniques and developing field programs that father only enough data to gain a solid understanding of site conditions, we maintain control of both schedule and expense.

Customized solutions

The remediation of contaminated properties is a complex challenge that requires a full understanding of the interplay between environmental and health risks, the desired current and future uses of the property, and regulatory requirements. Woodard & Curran approaches each remediation project differently, customizing solutions to the demands of the site and integrating current and future site use into all considerations. We address contamination in a risk-based framework and develop approaches that take advantage of all available techniques, from conventional soil excavation and capping to innovative in-situ soil and groundwater treatment programs. We strive to implement cost-effective remedial solutions that minimize risks and maximize future use, while meeting our clients' schedule, budget, and vision.

We fit the solution to the problem, focusing on the development outcome to provide you with the right level of risk assessment, as well as pre-characterization and management of impacted soil, during construction and development of earthwork. Our use of innovative approaches, low-impact design, stakeholder outreach, and development-phased implementation has won awards for brownfields reuse.



Services offered:

- due diligence
- risk assessment & risk management
- brownfields redevelopment
- Massachusetts Contingency Plan
- ecological services
- wetlands services
- operations & management

ECOLOGICAL SERVICES



In the ever-evolving world of environmental regulation and increasingly intense resource use, many projects that formerly entailed simply engineering now have a larger and more important ecological component. From energy development and land redevelopment to remediation to new construction, these projects often depend upon a careful approach to ecological issues in order to succeed.

Our services encompass a broad array of distinct but related ecological fields. Our fully staffed ecological risk assessment team supports a range of energy market clients, site development as well as hazardous waste site remediation, with ecological and toxicological expertise in freshwater, estuarine, and marine aquatic systems, along with a variety of terrestrial ecosystems.

We pair this with our strong wetland-related capabilities, including wetland restoration and mitigation, which allows us to identify, evaluate, and restore these important ecosystems in a variety of settings.

We also offer a diverse array of ecological services, such as vernal pool identification, biomonitoring, habitat characterization and evaluation, river studies, endangered species reviews, and other important functions.

Our Ecological Services group works closely with our Permitting group, supporting state wetland regulations and National Environmental Policy Act (NEPA) permits and providing supporting studies (e.g., Environmental Impact Assessments) for a variety of projects.

Our specific services include the following:

Site Development and Permitting

- · ecological impacts on linear project siting and routing;
- · wetland delineation review;
- wetland enhancement, mitigation and restoration:
- · Conservation Commission technical support:
- · natural resource identification
- vernal pool identification and certification:
- · environmental impact statements;
- biomonitoring and stream habitat surveys; and
- alternative water quality criteria development.

Site Remediation

- EPA Screening and Baseline risk assessments (RCRA and CERCLA);
- Massachusetts MCP Stage I and II ecological risk characterizations;
- wetland and stream restoration
- · dredging support;
- · bioaccumulation studies (tissue collection and analysis);
- · benthic and wetland macroinvertebrate community assessments:
- Natural Resource Damage Assessment (NRDA) evaluations;
- · sediment testing and evaluation;
- contaminant fate and transport studies; and
- · toxicity evaluation.



All energy projects and remediation project have an ecological component that is crucial to their overall success. Woodard & Curran has a dedicated Ecological Services Group with trained ecologists, scientists, and risk assessors experienced in solving complex problems associated with resource protection and

ENVIRONMENTAL STUDIES AND PERMITTING



Today's changing regulatory landscape places nearly every client in a position of uncertainty relative to the regulations that could impact their project or operations.

Woodard & Curran's clients receive guidance from specialists whose experience and knowledge of the technical issues at hand, understanding of opportunities to streamline the permit process, and timely communications with key regulators keep projects on track and on schedule, saving time and money.

Address your regulatory requirements with the guidance of proven experts

Our regulatory specialists play an essential guiding role in the majority of our engineering and design projects; these services are also a major component of more complex projects that require regulatory management expertise to guide a client through the regulatory maze.

In some complex projects involving multiple agency reviews and permit approvals, a regulatory strategy that includes ways to consolidate agency reviews or obtain agreements to meet predetermined review timelines is essential. This can mean the difference between reacting to agency delays rather than managing the permit process to achieve timely approval.

Understand the local, state, and federal implications

Our environmental permitting experience includes an array of local, state, and federal reviews and permits — from straight-forward local board approvals to

complex state and federal environmental and natural resource permits involving air emissions, traffic and land use, water supply, wetlands, riverfront and shoreline, habitat or endangered species protection that require extensive negotiation and mitigation measures to gain full compliance.

Benefit from our comprehensive package of services

- Air Emissions Major and Minor Source License and Source Registration
- Title V Air Permit
- Sewer Extension/Connection Permits
- Wastewater Discharge/NPDES Permits
- Stormwater NPDES Permits
- Water Quality Certification
- Environmental Site Assessments and Compliance Audits
- · Federal & State EIS/EIR Reports
- U.S. Army Corps of Engineers Wetlands and River Permits
- · Site Feasibility Analyses
- Coastal and Freshwater Wetlands Permits and Mapping
- Natural Resource Inventories and Mapping
- Local Conservation Commission Approvals
- Natural Resources Protection Permits (Wetlands, Habitat, Shoreline)
- Environmental Mitigation Plans/ Compliance Monitoring
- Public Participation and Public Hearings

Learn how you'll benefit from our design expertise

Our expertise in environmental engineering and design for wastewater, industrial process, and water supply projects affords us the basis for maintaining our strong role as regulatory specialists able to manage the permitting process. We provide our clients with services that lead to solutions that are technically sound, environmentally safe, and acceptable to regulators and the public at large.



Woodard & Curran assisted the U.S. Veterans Administration at several of its hospital locations with local, State and Federal air and environmental permits associated with cogeneration energy systems modernization.

WASTEWATER TREATMENT



Few environmental consulting firms have the industrial process background and operations expertise that Woodard & Curran offers clients. We understand the demands of manufacturing within regulatory constraints, and we have the wastewater process design and operations expertise that it takes to develop cost-effective, practical solutions.

For more than 30 years, we have assisted industry with their wastewater treatment needs by developing solutions that achieve compliance requirements and give a company a competitive edge.

In addition to our technical expertise, we build alliances by communicating and developing long-term client relationships

Driven by regulation, succeeding with profitability

Time is crucial when meeting regulatory deadlines. We help our clients hit the ground running with our team of skilled engineers and access to cutting-edge technology.

Our wastewater treatment experts have decades of industrial manufacturing process experience combined with in-depth knowledge of advanced treatment processes and environmental regulations. We work with our clients closely to assess compliance issues, perform basic treatability studies, and develop a range of conceptual designs that keep manufacturing considerations in proper focus.

While we work hard to meet immediate needs, we also plan for a client's future so they can respond quickly to market changes and new environmental regulations. We help industries avoid capital upgrades by improving operations and focusing on pollution prevention.

Rapid response meets clients' immediate needs

Our biological treatment expertise and immediate response helped a paper mill avoid permit violations. The mill was on the verge of violation when its sludge volume index (SVI) rose above allowable limits.

Woodard & Curran worked closely with mill personnel to solve the crisis by immediately implementing a dredging program as well as a nutrient addition system and monitoring program.

Then, the aeration system was repaired and upgraded and a dissolved oxygen monitoring program was developed. A temporary polymer addition system was installed and a revised operating strategy was developed.

The teamwork paid off and the filamentous bulking situation improved rapidly without a permit violation.

Full-service design, from upgrades to new facilities



Our specialists have extensive experience addressing wastewater compliance issues for such diverse industries as:

- chemical processing;
- · food and beverage;
- · high-tech manufacturing;
- pharmaceutical and biotechnology;
- · pulp and paper;
- · power generation; and
- textiles.

We have successfully designed a variety of wastewater treatment systems including:

- · biological treatment systems;
- steam and air stripping;
- · chemical precipitation;
- ion exchange and membranes;
- UV/peroxide oxidation; and
- · zero wastewater discharge systems.

We tackle even the toughest environmental challenges by scrutinizing existing infrastructure and evaluating operations to develop a design and compliance plan that matches the appropriate technology to a given industry.

We assess whether to build new facilities or upgrade existing ones, phase or stage implementation to meet strict deadlines, and we design and maintain service during construction. We also optimize systems through the use of SCADA, automation, and information technology.

Taking projects to the next level

We work with our clients to assist them in all stages of project execution, from permitting and conceptual design to engineering services during the construction phase.

Our comprehensive services include:

- bench-and pilot-scale testing programs;
- · conceptual design;
- preliminary and detailed design;
- · preparation of construction drawings and specifications;
- · development of competitive bid packages; and
- · equipment procurement.

Then we help put our clients in the driver's seat by providing startup and operator training services, from preparation of maintenance manuals to staff training.

We also offer contract operations services with one or more of our staff of 200 plus experienced and licensed treatment plant operators.

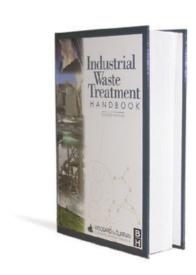
We wrote the book on industrial waste treatment

Our proficiency in the field is reflected in the expertise of our staff and the company's founders. In fact, Woodard & Curran's co-founder, Frank Woodard, authored the first comprehensive engineering text and reference book on industrial waste treatment.

The Industrial Waste Treatment Handbook, now in its second edition, covers the engineering, chemistry, and physics fundamentals of industrial waste treatment; information on laws and regulations; and a detailed discussion of industrial waste management, stormwater management, and pollution prevention and treatment, including groundwater contamination.

Whatever the need, we tailor our services to fit our client's budget and time schedule.

Our experts have worldwide experience in both wastewater process design and operations.



REGULATORY COMPLIANCE SERVICES



To help our clients comply with constantly changing regulatory requirements, Woodard & Curran's compliance team of scientists, engineers, and environmental lawyers provide all necessary services to ensure our clients' facilities and operations comply with applicable requirements. Our Environmental Health & Safety (EHS) Compliance Services Team is staffed by highly trained and knowledgeable professionals that include Professional Engineers, Certified Industrial Hygienists, Certified Hazardous Materials Managers, Certified Professional Environmental Auditors, and Certified Safety Professionals.

We focus on ensuring that our clients are in compliance with applicable federal, state, and local regulations and have long-term strategies in place to ensure ongoing compliance. We tailor our approach to meet our clients' specific needs with a focus on quality customer service, communications, and deliverables.

EHS Compliance Auditing

Virtually every activity conducted at a manufacturing plant, college, hospital, utility, municipality, or public institution is subject to EHS laws. Our staff have been performing multimedia and focused EHS compliance audits since the late 1980s. We have helped over 500 facilities in several different industries throughout the U.S. address their compliance issues through audits. Our audit clients range from small municipal or industrial facilities to 58-campus state university systems. We apply our technical expertise and the knowledge gained through our experience to provide our clients with the most complete understanding of their regulatory responsibilities and the steps necessary for achieving and maintaining compliance.

Emergency Preparedness and Response Planning

Facilities that utilize and store oil and/or hazardous chemicals are potentially subject to many emergency preparedness and response planning regulations. Woodard & Curran develops stand-alone plans that address a single regulatory requirement and Integrated Contingency Plans (ICPs) that address multiple planning requirements in one document. Examples of regulatory programs for which we prepare written plans include: OSHA Emergency Response and Emergency Action, Hazardous Waste Contingency, Facility Response, Oil SPCC, Risk Management, OSHA Hazard Communication, and DOT Security Planning. Our Compliance Services Team can also help design table-top or actual drills to test the effectiveness of the plans. We also provide risk-based emergency preparedness and business continuity contingency planning.

Air Services

Woodard & Curran assists clients in determining the applicability of state and federal air permitting rules to their operations and meeting the requirements of these rules. Services include: developing air permitting strategies tailored to support clients' construction and operating plans; conducting applicability reviews and emissions inven-



SERVICES

- compliance assistance

- Compliance training programs
- EHS compliance audits
- EHS management systems

- Energy audits
- EPCRA filings
- Integrated Contingency Plans
- Job hazard analyses
- Oil SPCC and FRP plans
- OSHA program development and
- Process Safety Management program development

- SPDES/NPDES permitting
- Solid waste permitting
- Stormwater Pollution Prevention
- Underground storage tanks
- Homeland Security support

tories; New Source permitting (NSR/PSD); Title V and Minor Source operating permit applications and program support; performing air dispersion modeling (criteria pollutants and air toxics); and developing emission tracking systems. With our long history of experience in these areas, we can customize our approach, resulting in greater efficiency and cost savings for our clients.

Water, Wastewater, and Stormwater Compliance

We offer permitting services for wastewater and stormwater discharges, including permit application preparation and reporting assistance. Our permitting services include individual SPDES permits, multi-sector general or industrial permits, construction permits, and other site development permits. Some clients hire us to manage all permitted activities and file required reports. We develop Stormwater Pollution Prevention Plans and conduct water system Vulnerability Assessments and drainage surveys. Careful management of permit requirements and skillfully-written applications can reduce your regulatory burden as well as the cost of compliance.

EHS Program Development & Management

Maintaining compliance with applicable regulations is a challenging endeavor. Establishing systems and procedures to keep facilities in compliance can save time and money in the long run by clarifying and streamlining operation, and helping avoid fines and potentially expensive corrective actions. Woodard & Curran has a long history of assisting clients in developing comprehensive and effective compliance programs that facilitate long-term compliance and stakeholder support. We work in partnership with our clients to understand their specific needs and develop written procedures and SOPs designed to achieve and maintain compliance efficiently and cost effectively. We also provide management consulting, including benchmarking of EHS Department operations, budgeting, and staffing.

EHS Training

In order to maintain staff certifications, comply with regulations, or keep staff current with developments in EHS topics, Woodard & Curran's expert trainers provide educational programs on a wide range of topics. We also develop and manage on-line training programs that can be deployed to a wide audience at their convenience. Our training programs are customized to address state-specific requirements, meet each facility's specific needs and apply to its particular operations and circumstances. Examples of some training programs we routinely provide include RCRA hazardous and universal waste management, OSHA Process Safety Management, Hazard Communication Standard, Chemical Hygiene Program, EPA Risk Management Planning, Regulated Medical Waste Management, Bloodborne Pathogens, Oil Spill Prevention Control and Countermeasure (Oil SPCC), and DOT Hazardous Materials training.

EHS Management Systems and Electronic Data Management Tools

Managing an EHS program can be extremely complex, often involving hundreds of discreet tasks, multiple regulatory agencies and programs, numerous deadlines, and a variety of responsible individuals and departments. A well-constructed management system offers numerous benefits, including enhancing regulatory compliance, clarifying responsibilities, making efficient use of resources, proactively managing risks, and providing a framework to measure performance. Additionally, electronic environmental compliance information management systems can be developed to

store, maintain, automate, and report compliance data related to EHS programs, as well as fire safety, radiation safety, etc. When we design an electronic data management system for a client, it is built entirely to their specifications. We can include any regulatory program, schedule, workflow, or reporting requirement that the client wishes to monitor and control.

Health & Safety Program Services

Facilities are subject to a number of other health & safety rules as implemented and enforced by OSHA or corresponding state agencies. Woodard & Curran offers a suite of services to address needs in this area including OSHA compliance audits; comprehensive Process Safety Management audits and program development; job hazard analyses; PPE assessments; workplace accident investigations; written plans and programs such as lockout/tagout, respiratory protection, confined space, and hot work; and initial and periodic employee/supervisor training. Services are aimed at improving safety performance. Protecting staff from personal safety hazards helps avoid slow-downs and interruptions, and can save costs on insurance premiums.

Sustainability and Energy Efficiency Consulting

Rising energy costs are putting stress on already tight budgets and concern over climate change and dwindling natural resources grows. We can help clients evaluate their practices and facilities and institute comprehensive sustainability programs that reduce the environmental impacts of operations and save significant amounts of money. Woodard & Curran conducts baseline environmental impact studies, conducts greenhouse gas emissions inventories, drafts sustainability and corporate responsibility plans, and provides management consulting to guide responsible investment and operations. Our comprehensive energy services include assessment, planning, procurement, design and implementation.





Miles Walker, LEED AP **Vice President**

Miles is a Project Manager and Chemical Engineer with 14 years of experience working in the energy and college and university industries. Miles is the leader of Woodard & Curran's college and university practice that has supported over 300 campuses nationwide. He is a leader in developing Woodard & Curran's energy services as well as renewable energy projects for clients throughout New England. He applies his unique combination of knowledge and experience to help clients develop their assets and potential projects in a cost efficient and sustainable manner. Prior to joining Woodard & Curran, Miles worked at Harvard University where he held positions in Utilities Operations and Environmental Health and Safety, managing environmental programs and developing economic models to determine internal utility costs.



Glenn Almquist **Senior Vice President**

Glenn has 30 years of experience working on projects ranging from research and development investigations to managing assignments for energy, industrial, municipal, and development clients. His most recent experience has focused on serving as principal-in-charge of permitting for energy and commercial/ industrial development and expansion projects, often involving preparation of air permit applications for a variety of minor and major sources of air pollutants, including air toxics sources. He has managed projects requiring air quality, water quality, wetlands, visual, and soil impact assessments, often addressing pollutant impacts to aquatic and terrestrial flora, fauna, and human health. He has provided and managed numerous projects for sewage sludge/residuals processing facilities that have included permitting and environmental compliance, development and management of performance evaluation and compliance testing programs on many types of waste processing and incineration systems. His experience includes work at sewage sludge incinerators, sewage sludge drying systems, municipal waste incinerators, medical waste incinerators and paper mill sludge incinerators.



Daniel Kelley Vice President

As Woodard & Curran's Power Engineering Service Line Leader, Dan Kelley is responsible for the development and implementation of business strategies, as well as the execution of consulting and engineering services, to meet the power generation needs of clients across all markets, including new greenfield or existing brownfield retrofit projects. He has two decades of project management, multi-discipline engineering, and process control systems experience in simple-cycle, cogeneration/ combined heat and power, biomass, gas-fired, and oil-fired plants, from preliminary and detailed design to construction and commissioning to operations and maintenance.



Lloyd Snyder, PE Senior Vice President

Lloyd has more than 25 years of experience in process design, construction management, and equipment troubleshooting and startup for a wide range of industrial clients, including manufacturers and food and beverage processors. He works closely with clients to identify operational needs and manage the implementation of any operational improvements from conceptual design through final commissioning. His expertise includes the design, construction and commissioning of packaging, bottle manufacturing, and water treatment systems. He also has been involved in the development of new packaging systems, recycle and reprocessing systems, and utility system upgrades. Key project experience includes the design, construction oversight, and commissioning of new manufacturing lines for beverage industry clients; process optimization for tobacco manufacturing facilities; and to installation and commissioning of production machinery for the plastics industry.



Dennis Walsh, PE Vice President

Dennis has over 35 years of experience in gas engineering, design and construction management for major utilities. He has a proven record of accomplishment of operational improvements and a strong background in project management on small and large projects, often involving a large number of personnel. His engineering experience includes design and construction of gas transmission and distribution systems, including trenchless technology, main and governor installations, joint seals, paving, plastic inserts, and service installations.



Thomas Cyr Senior Project Engineer

Tom has over 25 years of experience in the areas of power, manufacturing, pulp & paper and process engineering. Project and team-related roles have included plant engineer, construction safety engineer, assistant superintendent, staff engineer, lead mechanical engineer, project manager and senior project engineer. Specific areas of expertise include consulting, process troubleshooting and bottleneck analysis, PID development, pumped system design and optimization, steam and condensate systems, power plant NOx and CO emissions, combined cycle plant modeling, heat balances and piping materials.



Jose Donnell, PE **Project Engineer**

José is a Professional Engineer with 25 years of mechanical and electrical engineering experience in electrical/instrumentation, piping, power transmission, equipment design, estimating, project and field assignments, and construction management for numerous industrial and commercial clients.

José is a highly skilled and lifelong scholar with both a mechanical and electric engineering degree and professional engineering licenses.



Brian Cataldo, PE **Project Engineer**

Brian has over 8 years of experience with the daily operation, facility design and permit consulting to assist clients with solid and liquid waste stream fate. This also includes the management wastewater treatment facilities, asset management and depreciation analyses, and designs to upgrade wastewater process and conveyance infrastructure. Most recently, Brian has been providing compressive energy audits for the coastal Maine wastewater treatment facilities geared to optimizing process control and treatment. His experience includes exposure to the national wastewater industry through involvement with regional Associations.



Gillian Wood, PE, HACCP Associate/Technical Manager

Gillian is a chemical engineer with experience in process design and project management for food processing, manufacturing, pulp and paper, and power industries. As a Senior Project Engineer within the Industrial Engineering Group, she focuses on the design, oversight, and installation of process and utility systems. As a HACCP Certified Engineer, she can provide assistance with Food Safety programs. Additionally, she can provide assistance with the development of permitting documents and/or training documents alike.



Mark Liimakka, AIA Engineer

Mark has four years of experience in the mechanical engineering field. At Woodard & Curran, his primary focus has been with our Power Engineering Service Line on projects including CHP and Biomass plants, solar power facilities, data centers, and manufacturing facilities for a nationally recognized brand. Mark's responsibilities have included design and on-site implementation and oversight.



Linda Schmidt Project Manager

Linda has over 19 years of experience in the natural gas industry. From her past experience as a Gas Design Engineer for PSE&G and as a Gas Field Engineer for National Grid - USA, Linda's expertise and knowledge includes all areas of gas piping utility projects. She also worked as a project manager for National Grid - USA, in their facilities department, where she coordinated large building renovations and construction projects.

In addition to her engineering capabilities, Linda has developed expertise with the environmental and regulatory aspects of gas pipeline installations. As a Client Manager for various siting projects, she has coordinated site assessments for future utility substructures and site development work that included various phases of the site assessment and due diligence process such as Threatened & Endangered Species review, Cultural Resources, Wetlands Review, and Regulatory & Compliance permitting and storm water management, and NYS Article VII.



Andrea Hunt, PE Project Engineer

Andrea has 8 years of experience in the power industry, including piping and equipment design, procurement, and field construction support for combined cycle power plant construction projects. Main design work responsibilities have included P&ID and system design description development for various systems, including but not limited to natural gas, cooling/circulating water, main steam, instrument air, and chemical feed, as well as calculation and specification preparation. Field experience includes provision of construction administrative services, such as responses to RFIs and preparation of engineering change instructions (ECIs), performance of system walk-downs for turn-over package preparation, and procurement of various materials including piping, valves, fittings, low capacity pumps, and instrumentation.



Andrew Fitzpatrick, PE **Associate/Technical Manager**

Andy has over nine years of engineering experience in both manufacturing and consulting environments. He has been involved in a wide diversity of projects from control system engineering, SCADA system programming, power engineering, photovoltaic systems, project/construction management, system startups, and systems testing. He has also been involved with the analysis of existing and new electrical systems including power quality, short circuit, load flow, and arc flash studies. His work has been in the Power, Energy, Water, Wastewater, Industrial, and Food and Beverage Industries.



Kristofor McAlpine Project Technical Specialist 1

Kris has nine years of diverse experience in many phases of electrical engineering for commercial, manufacturing and industrial facilities, including; power, lighting, fire alarm, security, tele/data, and control systems design. Since starting with Woodard & Curran his work has primarily been focused on design for the Municipal and Industrial Water and Wastewater and Food and Beverage Industries.



Bert Wesley Senior Vice President

Bert has more than 23 years of experience in process and sanitary design, utility systems, packaging, construction management, equipment troubleshooting, and startup for a wide range of industrial clients. His expertise includes the specification, design, construction, and commissioning of beverage and water treatment systems. Key project experience includes process design, engineering bid packages, specifications, and commissioning of new sanitary processing systems and utility components for beverage industry clients.



John Trinwand, Jr.
Project Technical Specialist

JT has over 10 years of experience in the design, implementation, and management of SCADA systems in the tunneling, industrial refrigeration, food and beverage, and water/wastewater fields. JT has been contributing to Electrical and I&C design and SCADA implementation in the drinking water and wastewater industries (Municipal and Industrial) at Woodard & Curran.



Kevin Mesick Engineer 2

Kevin has over 3 years of experience involving SCADA system programming, implementation and support dealing primarily with the water and wastewater industries. His experience includes PLC programming using RSLogix500 and RSLogix5000 and OIT/HMI programming using Factory Talk SE/ME, RSView32, Proficy iFix and Wonderware In-Touch.



David Senus, PE Associate/Project Manager

Dave is a Project Manager with over 12 years of experience in civil and environmental engineering. He is responsible for providing design and permitting services to both municipal and private clients on a variety of projects, including site development, utility infrastructure, roadway construction, stormwater management design, and municipal stormwater planning. Dave has a strong interest in water quality improvement projects, specifically design and construction of stormwater management retrofits.



Steven Whipple, PE **Senior Vice President**

Mr. Whipple has worked as an environmental engineer in the field of air quality since 1993. Since 1995 he has been working in a consulting capacity for a variety of private industries and public utilities on environmental infrastructure design and permitting, program management, and energy conversion and optimization projects. Projects typically include permitting, control technology analyses, dispersion modeling analyses, regulatory compliance, green energy applicability and program implementation, and environmental operations and management. Prior to this he worked for the Maine Bureau of Air Quality as a Licensing Engineer and as an Air Quality Scientist.



Kelly Begin, PE **Vice President**

Ms. Begin is an environmental engineer with over 15 years of experience in the air quality field. Ms. Begin has worked with numerous manufacturers, commercial/industrial facilities, hospitals, and colleges and universities on all aspects of air quality work including: air permitting, permit negotiation, dispersion modeling analyses, environmental audits, sustainability audits, greenhouse gas emission inventories and carbon foot-printing, and compliance with Massachusetts Department of Environmental Protection (MassDEP) and US EPA air quality regulations such as New Source Review (NSR), National Emission Standards for Hazardous Air Pollutants (NESHAPs), and New Source Performance Standards (NSPS).

Before joining Woodard & Curran in 2001 Ms. Begin reviewed air permit applications and prepared air permits for the Vermont Department of Environmental Conservation; developed local air toxic regulations for the San Diego Air Pollution Control District; and conducted multi-media compliance and toxic use reduction audits for the Massachusetts Executive Office of Environmental Affairs.



Robert Barton Project Technical Specialist 2

Mr. Barton has over 26 years of experience in industrial settings. He has performed various duties as a maintenance engineer with Calpine Corporation at a 265 MW combined cycle power plant in Rumford, Maine. He was responsible for operation and maintenance of daily and major shutdowns.

His experience also includes: Mechanical Maintenance Engineer Utilities Department, Mead Corporation, Rumford, Maine. Budget and contract administration for major and capital projects. Annual shutdowns and daily maintenance scheduling, annual budgets estimating. Department expert on gas and steam turbines, rotating equipment and boilers and control valves. Capital project management and cost estimating. Proficient operational systems troubleshooter. He also has extensive startup, commissioning, and decommissioning experience on biomass, combustion turbines, fuel oil-fired boilers, and landfill gas to energy facilities.

MECHANICAL ENGINEERS

Tom Cyr, PE Jose Donnell, PE Brian Cataldo, PE Mark Limakka, AIA Andrea Hunt, PE

Brent Sutter, PE Adam Thibodeau, PE Steve Robbins, PE Joshua Ayers, PE

PROCESS ENGINEERS

Gil Ryan, PE Gillian Wood, PE Tom Schwartz, PE Peter Martin, PE

David Krochko, PE Kristy Bishop, PE Carl Wilcox, PE Zareh Maserejian, PE

FACILITY/HVAC ENGINEERS

Jim Sturgis, PE David Senus, PE James Everett

Mark Jacobs, PE, CPD

Jeff Fleschman

PERMITTING & COMPLIANCE

Tom Stoughton, PhD Karen Townsend, PE Steve Whipple, PE Sarah Nicholson, PE Daniel Garson, AICP

Bruce Nicholson, Esq. Brian McGrath, CHMM Celia Raymond Dave Krochko, PE Glenn Almauist

Adam Steinman, Esq.

CADD DESIGNERS

Kris Carlsen James Everett Paul Smith Brendhan McDevitt Richard Martineau **Ernald Ruka** Wesley Webber Dean Boudreau Patti Fillmore **Ned Dubois** Giovanni Amato Stacy Adams

OCCUPATIONAL HEALTH & SAFETY. & SECURITY

Lisa Campe, MPH, LSP Shannon Eyler, CSP, CIH

MANAGEMENT SYSTEMS CONSULTING

Mary House MaryKristin Invanovich Steve Whipple, PE Miles Walker, LEED AP Glenn Almquist

BRINGING TALENT TO PROJECT MANAGEMENT

Woodard & Curran offers flexible, fast-track project management solutions that help clients through the entire process, from design through construction and start up. Below is a selection of Woodard & Curran's project management talent.

ELECTRICAL, INSTRUMENTATION & CONTROLS ENGINEERS

ENGINEERING

Dan Cronin Andy Fitzpatrick, PE Jonathan Grant, PE Kris McAlpine Patrick Halpin Jose Donnell, PE

Shawn Huber, AIA

IMPLEMENTATION Robert Amaral Samuel Lacasse Steve Rose JT Trinward Mark Loyd Kevin Mesick Ross Perry

SERVICE Paul Couture, PMP Joseph Hurley Adam DeFranco Ray Giguere Don Schaefer Jeff Souza

PROJECT MANAGERS

Dan Kellev Tom Eschner, PG Bert J. Wesley, PE Hugh Tozer, PE Lloyd Snyder, PE

GIS/DATA MANAGEMENT

Dave Jacques, PLS

CONSTRUCTION MANAGEMENT ADM

Bob Severance Dave Burton Keller Barton Laurie Regemann

CIVIL/ENVIRONMENTAL **ENGINEERS**

3 PhDs 30 MSs 50 BSs 40 PEs

OPERATIONS

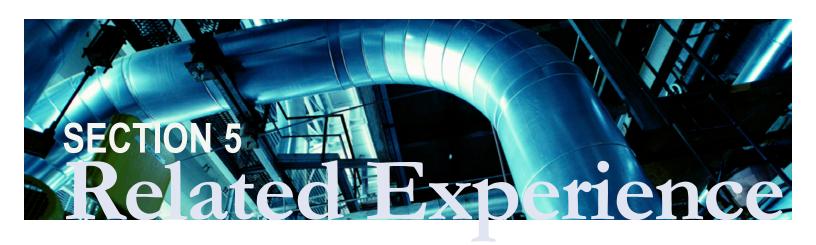
10 Operations Specialists

40 Electricians, Mechanics, Technicians

31 Plant Managers

82 Operators (WWTP)

2 Boiler Operators



PART I - FEASIBILITY STUDIES AND ENERGY AUDITS

The following project profiles represent examples of project studies that include energy audits, cogen feasibility studies, and analysis existing facilities energy load profiles.

PART II - PROJECT EXECUTION AND DESIGN

We have also included example projects where Woodard & Curran completed the design and/or delivered the project as the design builder or EPC contractor.

PART III - ADDITIONAL PROJECT EXPERIENCE

These projects describe related project experience in various industries.

FEASIBILITY STUDIES AND ENERGY AUDITS

ACADIA HOSPITAL BANGOR, ME

TRI-GENERATION PLANT FEASIBILITY STUDY COMPETITIVE ENERGY SYSTEMS

Acadia Hospital is an inpatient and outpatient facility with significant electrical and thermal loads. Woodard & Curran provided an energy audit and evaluation of the electrical, thermal, and process loads to determine if a new natural gas-fired tri-generation facility would provide electrical offset power behind the meter while producing thermal heating, domestic hot water, and cooling for air conditioning. A review of potential combined heat and power units and prime movers was conducted with a focus on providing a system that meets the nominal electrical load and the flexibility and functionality to turndown to meet lower electrical loads while still contributing the highest amount of thermal output throughout the load range. The study and economic analysis determined that the payback period was beyond the client's capabilities and the project did not move forward.



FM GLOBAL RESEARCH CAMPUS, W. GLOUCESTER, RI

ENERGY

ASHRAE LEVEL I ENERGY AUDIT

The Woodard & Curran team provided a Level I walkthrough Energy Audit at FM Global's Research Campus that included a preliminary review of energy data for consumption and usage, a technical field study to understand the facility layout and operations focused on HVAC, domestic hot water, electrical systems & lighting, Energy monitoring options & suggestions, a final report with presentation to the FM Global stakeholders. As part of the report Woodard & Curran provided preliminary plans and cost estimates for upgrades and improvements which included the addition of renewable solar energy and a conversion from fuel oil to liquefied natural gas for all heating systems with an option for combined heat & power to provide electrical offset savings.

HP HOOD AGAWAM, MA

ENERGY AUDIT AND COGEN STUDY

Woodard & Curran provided an energy audit and evaluation of electrical, thermal, and process loads at HP Hood's Agawam dairy facility to determine if a combined heat and power plant was feasible and economically beneficial. The firm's team of engineers analyzed utility data, data taken during site process system inspection, and observation and client testimonials to evaluate the process and regulatory requirements for the facility while using ASHREA methods to determine project costing, simple payback, and long-term returns on the project. The resulting study found that the facility was an ideal fit for a 500 kW natural gas-fired combined heat and power plant with a 4 year or less payback period.



CONCORD MUNICIPAL LIGHT PLANT, CONCORD, MA

FOREST RIDGE SUBSTATION CAPACITY OPTIONS **STUDY**

Woodard & Curran was selected to perform a study to evaluate load data and prior load study predictions to address the 50 MVA Forest Ridge substation. CMLP is a municipal electric company serving the Town of Concord with electricity. Without any power generation capabilities, the entire Town was fed through the Forest Ridge substation using N+1 redundant 50 MVA transformers. Summer load predictions forecasted that the substation would exceed its rated capacity by 2016. Woodard & Curran's engineers evaluated three options for the Forest Ridge substation: 1) Upgrading the two 50 MVA transformers to 70 MVA to match the incoming feeder circuits from NStar; 2) Add a third transformer to allow more capacity or; 3) Install 10-15 MW of Peaking power generation within the Town's distribution network. Option 1 was selected as it required the least amount of additional modifications to switchgear and substation equipment, along with that there was no need for a townwide outage. Woodard & Curran provided preliminary engineering design, cost estimating, and equipment selection during this study for all three options.

NORTHERN MAINE COMMUNITY COLLEGE

ENERGY AUDIT/BIOMASS, PRESQUE ISLE CAMPUS PRESQUE, ME

In 2007, Northern Maine Community
College (NMCC) commissioned an
energy audit for the facilities at the
Presque Isle campus. As a result of that
project, the campus has undertaken
many projects designed to reduce
energy consumption and improve the
efficiency of the facilities and systems.
In 2011, NMCC hired Woodard & Curran
to assist them with their continued effort
to manage campus operating costs and
to utilize a grant from the Department of
Forestry.

The NMCC campus is a dense cluster of buildings that have largely been updated or renovated since their initial construction. Through the issuance of ARRA grant funds through the Forestry Department, NMCC took the opportunity to upgrade the heating source in one of the campus buildings. The project involved removing the old coal boiler and replacing it with a clean burning biomass pellet boiler. Woodard & Curran helped evaluate several biomass systems available to help NMCC choose the most appropriate one for their needs. The boiler that they selected will allow them the flexibility to burn traditional wood pellets as well as participate in the development of other agricultural pellet products that could benefit the local farming economy in Northern Maine.

Feasibility

Woodard & Curran helped NMCC determine the feasibility of the biomass boiler system by taking into consideration the client's unique goals and objectives. The overarching benefits of the project that will be realized by NMCC include:

Continued leadership of the campus on matters related to energy conservation and efficiency.

Educational opportunities for the students of the college to see the latest technologies at work,

Local and Regional solutions to their fuel needs, and

Reduced campus energy costs.

The Design

The biomass boiler at NMCC is designed to serve the Mailman Building and Christie Complex. Woodard & Curran's sizing of the new biomass boiler was determined based on the demand of the two primary heat loads on campus (140,000 sf of buildings), the maximum boiler size that would fit with in the available space, and the largest boiler available within the campus's anticipated budget.

The system has been designed for the biomass boiler to be the primary heat source for the two facilities and to utilize the existing oil boilers in the Christie Complex for shoulder month and peak season loads. This approach diversifies the campus energy portfolio, allows them flexibility to minimize their annual heating cost, creates redundancy in critical systems and prolongs the life of the existing boilers by reducing run time.

When renovating facilities, a creative eye toward new and better uses of systems and spaces is critical. Woodard & Curran located the new fuel storage hopper within the old coal storage bin and this minimized the aesthetic impact of the project and made good use of



space that had been under utilized. It also made the fuel storage facility accessible for deliveries of pellets in an area that would not interfere with campus activities and not occupy limited parking spaces near the building.

Permitting

Woodard & Curran prepared the application to the Maine Department of Environmental Protection to update the campus air license. The air license application included a review of applicable state and federal Clean Air Act requirements, a control technology analysis to determine required air pollution equipment and emission rate limits, as well as a review of monitoring and record keeping requirements. Design documents were coordinated with local code enforcement for compliance with local building code as well as the Fire Marshall's office for compliance with NFPA Life Safety Code.

EXETER AGRI-ENERGY

1MW DAIRY FARM ANAEROBIC BIOGAS **GENERATION FACILITY**

Exeter Agri-Energy at Stonyvale Farms in Exeter, Maine recently installed a complete mix anaerobic digestion system with 1 MW power generation capacity. Exeter Agri-Energy selected a CH-Four complete mix anaerobic digestion system due to its ability to handle co-digestion of dairy manure with offsite substrates. The site location for the project required a nearly \$1,000,000 in 3-phase power distribution upgrade to the farm. In addition, the availability of substrate made the economics of a complete mix system with co-digestion of manure from the 900 milking head herd Exeter Agri-Energy's selected option.

Project Evaluation

Woodard & Curran was hired by a private financing corporation to evaluate the proposed complete mix anaerobic digestion system of off-site substrates. The project team specifically reviewed the CH-Four & Exeter Agri-Energy development proposal for engineering and business risks. The results were presented and the finance corporation made the necessary underwriting adjustments which led them to agree to fund a portion of the nearly \$5M project.

Project Financing

The project was financed with a blend of USDA Rural Development and Energy Efficiency Maine grants, self-financing and the funds from the financing corporation. The State of Maine has legislation to promote small private or municipally

owned renewable energy projects by requiring the electric utility to procure such power at a minimum of ten cents per kWhr. The Exeter Agri-Energy project is the second such small renewable energy project approved and operating in the state.

The project was approved for financing in early August 2011 and to obtain accelerated tax depreciation, the system had to be on-line by December 31, 2011. The project came on-line December 30th which was only four and half months after the start of construction and equipment ordering began.

Other Services

Woodard & Curran also provided civil, mechanical, and electrical construction review services throughout the construction process with weekly reports to the owner and financing corporation. The project consisted of a manure pumping system, two concrete 500,000 gallon complete mix digesters with membrane covers, internal H₂S oxidation on a wood structure within the gas storage volume, moisture reduction system, and a 1MW Guascor generator with heat recovery for system heating. In addition, two 26,000-gallon heated, mixed, concrete off-site substrate receiving tanks were constructed. The digested material was designed to be dewatered in a FAN press for fiber recovery for bedding material. The FAN pressate is pumped to the farm's manure lagoon for land application.

In addition, Woodard & Curran also provided startup assistance to Exeter Agri-Energy and was subsequently hired to help them obtain renewable energy credit (REC) qualification in Maine and Massachusetts. The facility is currently qualified for Maine RECs and Woodard & Curran brokered the REC sale for the first year's power production. Massachusetts's REC requirements changed in the summer of 2011 and the project team is evaluating the cost benefit to Exeter Agri-Energy of installing a SCR to sell RECs to the Massachusetts market.







HANCOCK COUNTY MAINE

ENERGY AUDIT

Woodard & Curran was hired by Hancock County to complete energy audits of seven municipal buildings and spaces to identify energy conservation measures and prepare a master plan. The buildings and spaces were:

- · Hancock County Courthouse;
- · Hancock County Sheriff's Office;
- Hancock County District Attorney's Office (Courthouse Annex);
- · Hancock County Jail;
- · Hancock County Airport;
- · Hancock County Airport Fire Station; and,
- · Hancock County Airport Maintenance Garage.

Our project team worked together to first review energy usage and cost data, previous energy studies and reports and energy procurement contracts, drawings outlining building infrastructure and previously completed energy efficiency improvements for each of the listed buildings or spaces.

Once the initial data gathering was completed, we prepared a baseline energy assessment of each facility and fuel type, including energy consumption breakdowns and Energy Star Portfolio Manager ratings. Compiling a solid baseline of information allowed us to work with the County to prepare an existing equipment and systems profile and database.

Energy Conservation Measures

To help Hancock County prioritize future projects, the team evaluated and scored a list of Energy Conservation Measures (ECMs) that were identified during the energy audit. The list was prioritized in an effort to allow the County to focus on projects that have the highest importance and probability of success.

The final phase of the project involved completing an energy savings analysis, cost savings analysis, greenhouse gas (GHG) reduction analysis, and simple payback analysis for the most promising ECMs and associated findings and recommendations for energy savings. Funding opportunities were identified that could be used to fund projects in the future.

Implementation & Next Steps

Hancock County was anxious to move forward with the highest priority projects. Woodard & Curran assisted the client by creating a performance based Request for Proposals, interviewing potential contractors, conducting prebid walk through meetings, and evaluating bid submissions. The project is currently in Phase I of construction where Woodard & Curran is overseeing heating system improvements and lighting upgrades.

Full Service Firm

Hancock County made a commitment to increase its energy efficiency, update existing infrastructure, and reduce its impact on the environment. This commitment is one directly aligned with Woodard & Curran's strengths as a full service environmental and engineering firm, and takes advantage of our ability to both study and identify real energy savings opportunities, our ability to produce HVAC and electrical design, and our ability to perform creative construction services and oversight.

ENERGY

GARDNER COMPANIES HOULTON, ME

HOULTON ENERGY PARK

Woodard & Curran was hired by Gardner Companies, a privately-held lumber and pulpwood company, to provide preliminary and conceptual design and engineering support services on the development of the Houlton Energy Park project. This unique project's goal was to provide energy independence for the Town of Houlton by utilizing the readily available wood chip by-product produced by a number of lumber companies in the area.

The proposed facility was to include a biomass plant with a 10MW backpressure steam turbine. Engineering services included equipment sizing and selection, capital budget development, and permitting support.



FEDERAL MANAGEMENT COMPANY, INC.

FRESH POND APARTMENTS ENERGY AUDIT AND CHP **STUDY**

Woodard & Curran provided a Level II audit to analyze the electrical, thermal, and domestic hot water energy usage for two high-rise apartment buildings in Cambridge, MA. Woodard & Curran modeled the energy loads to determine the building requirements. This information was used to develop a preliminary approach to install an 85 kW combined heat and power (CHP) unit at each facility to provide electrical offset savings and utilize the waste heat recovery from the CHP to contribute to domestic hot water and building heat loads. Woodard & Curran developed a financial model identifying capital and O&M costs, rebate incentives, simple payback, and rate of return. Electrical utility interconnection applications and utility rebate applications were submitted, negotiated, and approved through Woodard & Curran.

ENERGY





CONFIDENTIAL BEVERAGE COMPANY

TRI-GENERATION FEASIBILITY STUDY

Woodard & Curran's client, a confidential beverage company, is considering developing a tri-generation facility at a plant in the United States. The proposed facility would use landfill gas from a nearby landfill to power a natural gas-fired combustion turbine and a heat recovery steam generator (HRSG). Woodard & Curran was hired to conduct a preliminary feasibility study to evaluate the requirements and challenges of designing, permitting, and installing the system.

Woodard & Curran provided an analysis of the actual and potential air emissions of the facility as currently constructed, and calculated the potential emissions from 10-15 megawatt (MW) and 20-25MW tri-generation systems under consideration.

These calculations were then compared to local, state, and federal air emissions standards to understand the potential permitting and monitoring requirements the new system would be subject to. Calculations showed that the system would not likely be subject to strict limits for some emissions factors, so Woodard & Curran provided recent permit limits issued for similar systems to understand the regulatory burden likely to be placed on the proposed system.

The report then laid out the anticipated permitting process, including potential emissions reduction credits, public hearings, permit fees, and timeline for completion. The final section of the study report summarized the opportunities for renewable energy credits and offsets that the client could take advantage of.

Further, the design team completed the analysis of the power and steam users available to accept the newly generated utility streams. Fully utilizing all available power and steam was key to producing the most attractive ROI for the client.



Woodard & Curran's study for the proposed tri-generation system included potential emissions estimates, permitting analysis, and ROI calculation.

ADDITIONAL PROJECT EXPERIENCE

Thermal Energy / Biomass Feasibility Study Rockingham County Complex, Rockingham, NH

The Woodard & Curran team analyzed the County's request for a 100-ton absorption chiller to provide steam load during the summer months for the biomass boiler. Based on the existing electric chiller size of 80 tons and expected cooling requirements The project team recommended that it is not cost effective and not to pursue a new chiller. The study also included the feasibility and sizing for a new Central Heating Plant consisting of a biomass boiler system and district heating to provide heating and domestic hot water for the County's Nursing Home, Correctional Facility, and Agricultural Center. The existing boiler systems would be used for emergency backup and load trimming during extreme cold days. The Woodard & Curran team provided boiler sizing, preliminary plant design, capital cost estimating, and a preliminary project schedule.

EPA Boiler MACT Compliance – Energy Assessment

Covanta West Enfield & Jonesboro, West Enfield and Jonesboro, ME

The Woodard & Curran team provided an Energy Assessment as per the U.S. EPA "Boiler MACT" regulation, see 40 C.F.R. 63 Subpart JJJJJJ (National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers at Area Sources). Woodard & Curran is a qualified energy assessor conducted the energy audit according to the rule which includes; A visual inspection of the boiler systems, an evaluation of operating characteristics of the affected boiler systems (e.g. stack temperature, feedwater, blowdowns), specifications of energy use systems, operating and maintenance procedures (e.g. steam traps, condensate returns, tune-ups), and unusual operating constraints, an inventory of major energy use systems consuming energy from affected boilers, a review of available architectural and engineering plans, facility operation and maintenance (O&M) procedures and logs, combustion data (e.g. CEMS, performance tests, excess air), and fuel usage logs (at least 2 years), a list of major energy conservation measures within the facility's control, a list of the energy savings potential of the energy conservation measures identified, and a comprehensive report detailing the ways to improve efficiency, the cost of specific improvements, benefits, and the time frame for recouping those investments.

East & West Building Steam and Condensate System Integration **IDEXX Laboratories. Westbrook. ME**

Woodard & Curran was responsible for completing a detailed study of a campus boiler system. The campus was composed of two buildings covering 200,000 sq.ft. and 350,000 sq. ft. respectively. The study included steps necessary to combine and sequence five natural gas burning boilers. Friction loss, pipe routing, pipe sizing, boiler age and efficiency were considered and design of a new system was proposed complete with engineering, procurement and installation. A detailed feasibility study was turned over to the client explaining what options were available and how those options would affect the Capital budget in 2013. Woodard & Curran was hired to execute the detail design of the steam and condensate system integration, boiler modifications, develop contractor bid packages, equipment bid packages, and oversee construction. System went online in December 2013.

PROJECT EXECUTION – DESIGN OR DESIGN/BUILD

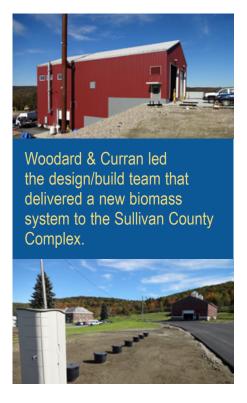
SULLIVAN COUNTY UNITY, NH

DESIGN/BUILD BIOMASS SYSTEM

The Sullivan County Complex is composed of general administrative offices, a nursing home, and a correctional facility. Using USDA Rural Development funding, the County wanted to offset the majority of the heating thermal load for the facilities, which were fired on #2 fuel oil, and replace older obsolete boilers at the nursing home. Woodard & Curran led the design/build team in designing and installing a new biomass boiler, fuel handling and processing system, ash handling system, new biomass boiler building, district steam heating system and tie-in to existing heating systems for each building, and a 40-kW backpressure steam turbine generator for the nursing home.

Specific responsibilities included:

- · Project management, scheduling, planning, major equipment procurement
- · Civil site permitting and plans
- Design engineering
- · Construction Supervision and Oversight
- · Site safety and QA/QC
- Startup & commissioning
- · Training and documentation packages
- · Control system programming and integration



CONCORD MUNICIPAL LIGHT PLANT, CONCORD, MA

WOODARD & CURRAN

70 MVA SUBSTATION RENOVATION AND DESIGN SERVICES

Provided project management, engineering management, and electrical engineering services to upgrade (2) two 50 MVA fully redundant primary transformers and substation equipment to (2) two 70 MVA transformers to allow for predicted future peak loads. Project included a detailed model of the system for loads and faults. Project plans and requirements were developed to obtain equipment and contractor pricing to execute the project in a traditional design bid build contract method. The project included relay protection calculations and coordination and switchgear upgrades.



CO-GENERATION ENERGY SOLUTIONS

A confidential Fortune 100 beverage client chose to partner with Woodard & Curran to provide engineering design and feasibility study services for a co-generation system to produce both electricity and heat energy.

Woodard & Curran was part of the team to help the client identify an opportunity to collect gas from a nearby decommissioned landfill and convert the methane into energy. Woodard & Curran worked with the client to design, engineer, and oversee the construction of a 6.6-MW combined heat and power (CHP) system to convert the gas into energy. The system was designed to produce enough energy to offset the process load energy for an on-site process facility.

Initially Woodard & Curran reviewed the facility's current consumption patterns and outlined future potential patterns to determine facility energy demands. The analysis included a supply-demand capacity analysis showing chilled water demands. The Woodard & Curran team also analyzed potential equipment solutions and determined a reciprocating engine would be the most effective method of providing energy to the facility.

Alternative energy for facility processes

The CHP system provides energy for chilled water for HVAC systems for compressor cooling. Woodard & Curran reviewed the CHP's input and output to the system to establish that it was providing the appropriate amount of energy support for the chillers. The evaluation included:

- · incoming gas supply line for the CHP
- power interconnection with the local and private power systems; and
- steam distribution system and tie-in to the existing and new plant demands.

The CHP facility's process includes three industrial size engines, each capable of producing 2.2 MWs of electricity. Those engines then push the newly generated electricity to the facility for process use and also to three large heat recovery steam generators (HRSGs). These HRSGs function as heat exchangers, taking the engine exhaust gas and generating steam. This steam is then piped into the facility for use in facility process HVAC use. Additionally the steam is piped to a steam-driven turbine chiller. The chiller cools the water to the facility for use in process and the HVAC system.

When a co-generation system is present, special care needs to be given to chiller technology in order to optimize cooling processes and cut down on energy consumption. After designing where the new chiller would be located in the facility. Woodard & Curran worked with the client to determine the most appropriate and efficient chiller



Woodard & Curran helped the client achieve its two-pronged goal of creating a process that is financially intelligent and environmentally conscious.



to integrate with the CHP system. Woodard & Curran and the client chose a steam turbine chiller with existing HVAC controls to meet the goals of the facility. The chiller also utilizes the environmentally conscious R-134a refrigerant to ensure the chilling process is as efficient as possible.

SUMMIT NATURAL GAS OF MAINE



PERMITTING AND ENGINEERING FOR THE CONSTRUCTION OF A NATURAL GAS PIPELINE

In October 2012 Summit Natural Gas of Maine (Summit) sought Woodard & Curran's assistance in realizing their vision to bring clean-burning, low-cost natural gas to more than 50,000 potential commercial and residential customers in 15 communities in the Kennebec Valley. Summit's goal was ambitious: to permit, design, and install more than 65 miles of high-pressure steel transmission pipeline and 85 miles of distribution piping by November 2013 as the first phase of its project. Achievement of the goal would require not only permitting and design capabilities, but also careful management of the many tasks of this large, complex undertaking and the understanding of how and when to engage stakeholders, including state and federal regulators and local municipal representatives.

Woodard & Curran teamed with Cornerstone Energy Services, Inc. to provide the range of services and capacity required for the project. Woodard & Curran provided overall project management, permitting, agency coordination, and engineering services. Additionally, Woodard & Curran provided GIS services, gas engineering support, structural and civil design for bridge crossings, supervisory control and data acquisition (SCADA) services, and support for operations and integrity management plans.

As an initial step, Woodard & Curran reviewed Summit's proposed route, evaluated alternatives, and proposed modifications to the route. The team then completed the layout for 65-miles of 10-, 8-, and 6-inch 1440 psig steel transmission main and associated facilities, including an interconnect station, 8 main line valves, 6 regulators, and 2 pigging stations. Woodard & Curran worked carefully to avoid permitting and future construction conflicts with a competing project being designed and installed during the route evaluation and layout phase.

Woodard & Curran's GIS services were used extensively throughout the project in route evaluation, natural resource evaluation, class location determination, and preparation of permitting documents. In addition, as-built locations of the transmission and distribution piping were updated in the project's GIS weekly during construction.

Woodard & Curran met with the individual towns to understand concerns associated with construction, and also met with the various regulators who oversee the applicable local, state and federal permitting programs to verify what permits applied and understand the regulators' concerns. In order to meet Summit's aggressive schedule, Woodard & Curran developed a permitting approach to keep the project out of the Maine Department of Environmental Protection's (DEP) Site Location of Development process. In addition, Woodard & Curran was able to minimize Natural Resource Protection Act (NRPA) permitting requirements and U.S. Army Corps of



Upon completion, Summit will have completed more infrastructure in Maine during a 12-month period than other projects have in 12 years.

Engineers (ACOE) permitting requirements, thereby reducing the potential for schedule delays associated with agency reviews.

The environmental permitting process for a project of this scale included a variety of field studies, including wetland delineation, vernal pool identification, and cultural resource surveys. Woodard & Curran and its contractors reacted quickly to minimize environmental permitting requirements in response to changing facility locations associated with changing customer and landowner requirements.

Woodard & Curran designed and permitted four bridge crossings for distribution piping, including a 1,200-foot crossing of the Kennebec River between Gardiner and Randolph, Maine. The project also includes 3 Horizontal Directions Drills (HDD) greater than 1,000 feet, multiple in-road HDDs, and multiple Jack and Bores. The use of HDD significantly reduced permitting and mitigation needs for river crossings.

Monitoring gas volumes and quality and managing the associated data were important requirements for Summit for both commercial and regulatory reporting purposes. Woodard & Curran designed the system architecture for the take station, regulator stations, and transport customers; prepared a detailed design of SCADA components and programming; developed site-specific designs the various sites; and implemented the system.

As of September 2013, permitting, design, and installation of Summit's 65-mile Kennebec Valley transmission system and 2013 distribution system is nearly complete. Upon completion, Summit will have completed more infrastructure in Maine during a 12-month period than other projects have in 12 years.



UMASS LOWELL MASSACHUSETTS

INTEGRATING UTILITY ENGINEERING AND ENVIRONMENTAL SERVICES

North Campus Power Plant Renovation

Woodard & Curran supported the University during the design and construction of the renovations of the North Campus Power Plant. Woodard & Curran was brought on board by the lead design firm to design and oversee construction of the site water, sewer, and drainage utility improvements.

Design plans and specifications were developed to integrate the renovated building utilities with the existing utility system on campus. The work was designed to satisfy the building's needs while minimizing the scope of site construction, permitting requirements and costs. The design was incorporated into the complete building renovation construction document package, and publicly bid for construction.

Woodard & Curran also provided air quality services to support the Power Plant upgrades, which involved the replacement of two 1950s vintage boilers with new high efficiency boilers, a new burner for a third boiler, and replacement of the deteriorating masonry stack with three new stacks. Using air dispersion modeling, Woodard & Curran identified a minimum stack height that satisfied the University's aesthetic requirements and met state and federal air quality standards. Woodard & Curran also prepared MassDEP boiler certification materials and an application to modify the facility's air permit and establish an emission cap that optimizes the University's future operational flexibility.

During the construction phase, Woodard & Curran was asked to provide environmental engineering support for soil remediation required due to a historic oil release. When interior construction required an existing oil extraction well to be relocated, Woodard & Curran staff quickly responded to address the issues and minimize the potential impact on the construction schedule. Woodard & Curran provided immediate support to the lead designer and construction contractor for the well's relocation, and the new well was brought online, allowing the University to maintain compliance with Massachusetts Contingency Plan (MCP) requirements.

This project is an excellent example of how our in-house expertise in design and construction as well as environmental services can provide one stop shopping for our clients, and keep projects on schedule and on budget.

Cumnock Hall Water Service Upgrade

Woodard & Curran also worked closely with the University to replace the water service for Cumnock Hall. The work, which was designed and constructed under strict budget and time constraints, was sequenced to minimize the impact on the building served by the water service. Woodard & Curran staff was on site throughout the construction to ensure quality of construction, and to optimize the communication between the University's staff, contractor and the Lowell Regional Water Utility.







WOODARD & CURRAN

VETERANS ADMINISTRATION HOSPITAL, BEDFORD, MA

3.5 MW / 13.8 KV EMERGENCY GENERATOR SYSTEM **DESIGN**

The Woodard & Curran team provided preliminary design for review, detail design for construction, and construction oversight for the VA Bedford campus to decommission and demolish (8) distributed emergency generator sets that fed only selected buildings and a portion of the campus. The team designed a new 3.5 MW system consisting of (3) 1.5 MW emergency generator sets connected to the 13.8 kV bus feeding the campus. The new design would provide N+1 redundancy while feeding the entire campus through the existing electrical distribution system. This reduced the amount of modifications to the existing buildings by keeping the emergency power on the high voltage side of the system.

FEDERAL MANAGEMENT COMPANY, INC.

ENERGY

362 & 364 RINDGE - FRESH POND CHP **CAMBRIDGE, MA**

In 2011, Woodard & Curran was hired by Federal Management Company, Inc. to provide design/build turnkey services for their new combined heat and power plant (CHP) at 362 & 364 Rindge Avenue in Cambridge, MA. The new 170kW, natural gas fired, reciprocating CHP plant was designed to provide behind the meter electrical offset and hot water for heating/domestic supply to the two (2) 23 story, 252 unit high-rise apartment buildings.

Prior to commencing with design work, Woodard & Curran performed a comprehensive energy audit and evaluation of existing equipment to ensure a fully integrated design. Based on the design we developed, Woodard & Curran assisted Federal Management in obtaining a \$750/kW utility rebate compensation which was used to reduce capital investment required by client.

In addition to design services, Woodard & Curran provided overall project management and procurement services.





MAINE SCHOOL ADMIN. DISTRICT 54

WOOD PELLET BIOMASS

Woodard & Curran has assisted MSAD 54 with the evaluation, design and construction of many improvements in the District's facilities for over 20 years. In recent years, MSAD 54 has aggressively pursued opportunities to make their facilities more efficient to operate and to enhance the learning environment for students and staff by upgrading the building envelope as well as mechanical and ventilation systems.

Feasibility Study

MSAD 54 asked Woodard & Curran to evaluate wood biomass technologies, biomass equipment, fuel options and system configurations to determine if the high heating costs at the high school could be reduced. We determined the heat load for the high school and quickly realized that the biomass system could be sized to exceed the high school demand which lead us to consider a centralized heating plant also serving the elementary and middle school nearby. We considered the pros & cons of pellets versus chip fuels and evaluated 6 different boilers to determine the best possible combination for MSAD 54. The outcome of the feasibility study defined a project that would link three school buildings to one wood pellet biomass boiler located in the existing high school boiler. The annual savings would be well over \$100,000 per year and provide the school to take advantage of the lowest cost fuel available.

Site Engineering/Permitting

The opportunity to serve multiple buildings came with significant financial benefits but added a level of complexity to the project. The Skowhegan campus of the high school, middle school and elementary school is quite spread out with buildings, athletic fields and parking lots occupying much of the upland site. Woodard & Curran's civil and environmental engineering experience allowed us to choose a route for the piping that connects the buildings but avoids unnecessary impact to the existing site features as well as mapped wetlands. Woodard & Curran provided civil engineering and environmental permitting for the project including wetland impact permitting and air licensing.

Design

Every clients' goals and objectives are unique to them and for that reason, we believe that biomass boilers are not all equal. As we've done with all our biomass clients, Woodard & Curran evaluated boilers to determine the best possible selection to meet MSAD 54's goals. We considered physical properties, warrantee conditions, serviceability, track record, technical support and efficiency. In the end, MSAD 54 visited several installations and our recommendation of a Hurst boiler for this project was enthusiastically supported by the Building Committee and Administration.



Woodard & Curran has assisted MSAD 54 with the evaluation, design and construction of many improvements in the District's facilities for over 20 years.



The installation of the new biomass boiler and fuel feed system was integrated into the existing boiler room where two existing fuel oil boilers were located. One of the boilers is slated for removal but one will remain to serve as back up to the biomass system during peak and shoulder seasons. The controls and piping arrangement allow the boilers in the high school to fully meet the need of the combined three buildings but to also allow the boilers in the other buildings to serve the same function in case of maintenance or issue. The biomass system was selected specifically to allow the installation of the largest possible boiler that could be made to fit in the existing boiler room.

The pellet storage and feed systems were integrated into the space adjacent to the existing boiler room to allow a simple installation and for easy access for fuel deliveries. Woodard & Curran's design will allow fuel deliveries to occur without interfering with local traffic or bus movements.

Construction

The building modifications and boiler installation is the responsibility of our subcontractor, Buildings Etcetera. Peter Chase, President has more than 30 years experience in the installation and operation of various building and mechanical systems including biomass boilers at JM Huber and Houlton High School. The work was carefully coordinated by Woodard & Curran and Buildings Etcetera to avoid unnecessary impact to the normal operation of the schools which were in use for most of the project schedule. With more than 20 years of experience working together, our work is choreographed to insure that our client's goals and needs are our first priority and satisfaction is at the forefront.

The new 5 Million BTU Hurst boiler is anticipated to be paid for in less than 10 years. To allow the campus to take advantage of future opportunities, the project also included the installation of a new fuel line between the buildings where it can be used to convey gas should natural gas pipelines ever be installed to serve local business including the paper mills. This project allows the MSAD 54 to manage their energy use and select from the most cost effective pricing available.



MAINE SCHOOL ADMIN. DISTRICT 29

BIOMASS BOILER DESIGN/BUILD

Maine School Administrative District 29 (MSAD 29) asked Woodard & Curran to evaluate the opportunity and the economics of adding a new wood chip biomass boiler to the Houlton High School and the Region II Vocational Facilities. MSAD 29 was successful in securing a grant from the Department of Forestry which enhanced an already attractive return on investment and with Woodard & Curran's assistance, successfully increased the grant level to cover emissions equipment that was necessary to insure the school would be able to meet EPA emissions rules scheduled to go into affect.

Wood Chip Boiler Concept Design

Woodard & Curran was selected to continue in the lead role as the Design/Build Contractor for the procurement, design, permitting and installation of the new system and fuel storage facilities. Woodard & Curran's team of engineers and contractors were able to complete a concept design to integrate the new wood chip boiler into the existing No. 2 fuel hot water baseboard systems in the two buildings and complete the system interconnect in less than a month to allow school to open on time. The work of the project included major structural upgrades in an unutilized vocational shop area in the High School to allow chip storage within the facility without building new facilities that would have caused additional delays.

Permitting

In addition to assisting MSAD 29 with securing their grant funds, the work also included the local and state permitting and coordination with enforcement personnel. This included the local building permits, the Maine Department of Environmental Protection (ME DEP) air licensing, and coordination with the Maine State Fire Marshal to ensure NFPA and Life Safety standards are achieved.

Performance Guarantees

The European boiler and feed system was scheduled for delivery by mid-December 2010 with complete installation being anticipated for late winter 2011. Woodard & Curran's contract provides MSAD 29 performance guarantees that the system will provide a cost effective alternative to petroleum based fuel systems while maintaining the existing boilers as a reliable back up to the biomass system. The wood chip fuel will be locally available from pulp wood chip manufacturers whose primary focus is the paper

industry. This secondary use of the wood chips will provide a secondary market for the chip manufacturers while reducing the cost of heating the MSAD 29 and Region II vocational facilities.

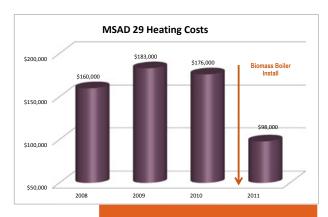
Savings

In its first year of operation, the boiler cut the cost to heat the two facili-

ties by more than 40%. As we anticipated, the savings from fuel consumption more than offset the debt retirement of the project so MSAD #29 has significantly reduced operating costs in their facility and improved their cash flow.



Owner: MSAD 29
Contact: Mike Hammer, Superintendent
Paul Prosser, Facilities Mgr.
Phone: 207.532.6555
Contractor/Engineer: Woodard & Curran
Sub Contractor: Buildings Etcetera



Courtesy of Paul Prosser, Facilities Manager, MSAD 29

U.S. DEPARTMENT OF VETERANS AFFAIRS

PERMITTING AND CIVIL ENGINEERING DESIGN OF **DESIGN/BUILD TRI-GENERATION ENERGY SYSTEM** CHELSEA, ME

Woodard & Curran played a key role on the design/build team for construction of a \$14.4M, biomass-fueled, tri-generation energy system Togus Veterans Affairs Medical Center (VAMC) in Chelsea, ME. Woodard & Curran's role on the project included land use permitting, air modeling and permitting, and civil engineering design services for a team led by DeMaria Building Company of Detroit, MI.

Woodard & Curran's long-standing relationship with the Togus VAMC provided strong credibility to the design team's proposal, and our understanding of Togus' facility and permitting history allowed us to retain permits for the construction of the project on a fast-track timeline. We worked proactively with the regulatory agencies, design team, and VA staff to ensure that all necessary information was collected and submitted upfront, providing complete applications and fast response to regulatory comments.

Permits and regulatory review for the project included:

- an amendment to the facility's Site Location of Development Permit with the MaineDEP:
- a review of adjacent wetland resources for compliance with the Natural Resources Protection Act (MaineDEP) and the Maine General Permit (U.S. Army Corps of Engineers);
- preparation of audit-ready documentation language for compliance with Federal Facilities Stormwater Management requirements (Section 438 of the Energy Independence and Security Act);
- a MaineDOT Driveway Entrance Modification Permit;
- an air regulatory review to determine applicable regulatory programs and corresponding emission control and monitoring system specification;
- a State air emission permit application which included air dispersion modeling; and
- identification and preparation of required air reporting and monitoring plans.

All permits and regulatory approvals for the project were received ahead of schedule, and Woodard & Curran continued to support the project during the construction period to ensure compliance with regulatory conditions.



Woodard & Curran's relationships with the client. regulators, and design team partners, along with sitespecific experience, allowed for permits and regulatory approvals to be received ahead of schedule.

ATLANTA GAS LIGHT ATLANTA, GA

CENTRAL REGION GAS PIPELINE PROJECT - ENVIRONMENTAL SUPPORT

Atlanta Gas Light (AGL)'s Central Region project is a 26-mile natural gas pipeline project; Woodard & Curran worked seamlessly with AGL's engineering design team to assess routing options for environmental issues and provide input into the routes that had the least impacts. The project is located in across three counties, Spalding, Butts and Henry Counties and placed in a newly acquired easement. Woodard & Curran provided comprehensive environmental services for the project, including initial route investigations, detailed ecological surveys, stream and wetland delineation with GPS survey equipment as well as field flagging, historic and cultural resources survey (Phase I), environmental permitting, erosion, sedimentation, & pollution prevention designs, and construction oversight.

During the Phase I Cultural/Historic Resources Survey, two sites were found to be potentially eligible for listing on the National Registry of Historic Places. One site was a rural, country store, circa 1920's and another was an African-American family cemetery. A limited Phase II cultural/historic resources survey was conducted for both locations; the route was realigned to avoid impacts to either of the resources.

Due to this lengthy, linear project being located in one HUC-8 basin with a significant number of resources, the original route had nearly 100 stream resources with 2,250 ft of linear impacts, which exceeds the USACE threshold for permitting under the nationwide permit. To avoid the lengthy Individual Permit process, we worked with AGL staff and the design team to rigorously review stream impacts. The preliminary route was walked with the entire team and field changes were made during the walks to adjust the preliminary alignment so that impacts would be minimized or in some cases eliminated. As a result of this diligence, the stream impacts were reduced to 38 streams with 1,374 ft of linear impacts, well under the threshold of 1,500 ft to use the Nationwide Permit. This approach saved AGL time and allowed gas service to be in place prior to the cold season.

Stream and wetland resources identified were mapped using GIS database software to support the permit applications for United States Army Corps of Engineers (USACE), a stream buffer variance by the Georgia Environmental Protection Division (Georgia EPD), and a National Pollutant Discharge Elimination Service Permit (NPDES) Notice of Intent (NOI) to discharge stormwater.

Construction oversight services included full-time environmental inspection to ensure compliance with all environmental permits. Compliance reporting, including rainfall monitoring and rainfall event sampling as required by the NPDES permit, was provided by Woodard & Curran.



Woodard & Curran provided comprehensive environmental services for the project, including detailed ecological surveys, stream and wetland delineation, historic and cultural resources survey (Phase I), environmental permitting, erosion, sedimentation, and pollution prevention designs.

ADDITIONAL PROJECT STAFF EXPERIENCE

Broadrock Power Partners, Johnston, RI

Landfill Gas to Energy Plant Decommissioning

The Woodard & Curran team provided decommissioning services to oversee the proper deenergization, decontamination, and cleaning of a 10 MW landfill gas to energy facility at the end of the equipment's useful life. Services included environmental sampling and categorizing all potential contaminants or pollutants, developing a matrix of contaminants, process lines, electrical equipment, and creating decommissioning plans with sign off documentation or reports. All procedures, forms, inspections, log books, test sample results, disposal manifests, and daily activities were properly documented and contained in a final project report.

Exelon Power – Fore River and Mystic 8 & 9 Power Stations, Weymouth and Everett. MA

Power Plant Shutdown Planning and Scheduling

The Woodard & Curran team provided plant shutdown maintenance planning and administration services to develop the shutdown schedule that included all internal Exelon and external contractor tasks. Woodard & Curran also provided work package development services. Prior to the shutdown W&C staff worked with Exelon maintenance crews to identify and extract all shutdown related work orders and tasks from the Maximo maintenance system. These tasks were used to develop the overall shutdown schedule and identify the responsible parties to complete the task. This list of work orders were also used to develop work packages for each task consisting of required procedures, safety forms, drawings, or equipment details needed for the responsible party to complete the task. W&C engineers supported Exelon during the shutdown with administration of both the schedule and the work packages for daily updates and completion status.

Consolidated Edison Of New York (Coned Or Cecony), New York, NY W. 59th Street & E. 74th Street Thermal Generating Stations Gas **Addition Project**

Provided project services to facilitate ConEd Engineering design of natural gas addition to W. 59th Street and E. 74th Street Thermal Generating stations to provide dual fuel operation of 11 Boilers and 1 Combustion Turbine. ConEd provided engineering design and contracted Woodard & Curran to facilitate implementing the design at the stations working with ConEd Operations by developing project information packages for a seamless transition. Packages included new system design basis and details (SDOIs), Operating instructions, and Functional Test Procedures for the new natural gas supply and distribution system to the boilers. Other packages included updates of existing Operating Instructions for boiler combustion control, burner management, balance of plant, and steam distribution systems for existing equipment affected or updated during the project. Woodard & Curran expertise was also called upon to develop the commissioning schedule to ensure proper commissioning and testing of the systems while bridging the gap between construction and operations.

Limington Lumber, East Baldwin, ME Steam & Condensate Piping Design and Routing

The Woodard & Curran team provided detail design for construction of new steam and condensate piping system for a new kiln being installed at the mill. The scope of services included integrating the new kiln in to the existing boiler system, balancing load between the (2) biomass boilers on site, and re-designing the existing condensate system to provide adequate storage and treatment capabilities.

Veterans Health Administration – Togus, Augusta, ME Biomass Combined Heat and Power Plant

Provided operations & maintenance support services to recommend staffing levels, operating procedures, and training requirements for new 600 psig / 25,000 lbs /hr of superheated steam generated by a biomass boiler based combined heat and power plant for VA Togus. Project includes a 175 kW backpressure steam turbine generator, district heating loop for the campus, and chilled water systems. Woodard & Curran also provided commissioning oversight and owners representation for the VA in overseeing the contractor and vendors startup and commissioning services to ensure contractual obligations and industry standards were met.

System consisted of Chiptec biomass boiler, Thermal power steam turbine package, 500 Ton York absorption chiller, and balance of plant systems while maintaining existing equipment for emergency backup and load trimming

Gas Turbine Peaking Station Commissioning & Startup Services Vermont Public Power Supply Authority – Swanton Peaking Station, Swanton, VT

Provide Project Management and detail design support services during design build stage of project, and construction management & supervision. Design included electrical interconnect with Vermont Electric Company (VELCO) and line routing. Also provided balance of plant commissioning services for (2) GE Frame 5N gas turbine generators with water injection. Supervised final construcation and pre-commissioning activities for pipe flushes, vessel inspections, and final erection of equipment. Supervised The Wood Group with gas turbine retrofits, assembly, and GT startup. Provided sytem turnover packages and check out documentation. Performed initial O&M staffing during initial 6 months of operation.

160 MW Combined Cycle Power Plant BG Dighton Power, LLC, Dighton, Massachusetts

Provided turnkey project to upgrade infrastructure and tie (2) independent ABB Advant turbine control systems together. Merged Advant HMI stations configuration to provide redundancy. STG and GTG Turbine control systems were standalone Advant OS prior. Upgraded from thicknet MasterBus cabling to CAT5 and network switches.

60MW Combined Cycle Power Plant Construction and Commissioning Atlantic Energy / Progresso Soups, Vineland, NJ

Provide construction quality control and punchlist support during final stages of construction and beginning of startup & commissioning turnover process for all plant systems. Provided commissioning engineering services for all plant systems, interface with construction and client, conducted plant performance test, and final turnover to end client. Provided operations & maintenance support services and supervision during initial 2 months of plant operation. Plant consisted of (1) GE LM6000 gas turbine generator,(1) Deltek heat recovery steam generators, Alstom steam turbine generator, Bailey Infi90 DCS, Ingersol Rand Gas compressors.

Commissioning Oversight for the 14.4 MW Cogen Foxwoods Casino, Pequot, CT

Woodard & Curran staff has experience with and completed commissioning agent services for the 14 MW cogen plant located at the Foxwoods Casino. The system was comprised of natural gas fired (2) 7 MW Solar Taurus 70 combustion turbine generators with Rentech heat recovery boilers to generate 135 psig saturated steam for building heating and cooling. The balance of the plant systems included centrifigual natural gas compressors, feedwater, and condensate return systems integrated into an existing boiler plant. Our staff provided commissioning oversight and coordination for the Casino to supervise equipment suppliers and contractors for proper commissioning and performance testing of the cogen plant systems. Services included developing an overall commissioning plan, individual functional test procedures, and final performance testing.

MSAD #11 Gardiner Area Schools: Energy Conservation and Air Quality **Improvement Project**

Woodard & Curran assisted the Maine School Administrative District (MSAD) #11 school board during the design and installation of natural gas burner upgrades on boilers at three school buildings. The Laura E. Richards elementary school, Middle School, and High School each utilized redundant No. 2 fuel oil boiler burners to supply hot water heating. The District defined the project as burner replacements for one boiler at each location to realize the current energy savings of natural gas and allow for future fuel cost market fluctuations.

Woodard & Curran's role included assessing the existing system to complete a design and to construct the upgrades meeting NFPA 54 - National Fire Gas Code, NFPA 211 – Standards for Chimneys, Fireplaces, Vents & Solid Fuel Burning Equipment and ASME CSD-1-2009 Controls and Safety Devices for Automatically Fired Boilers. Mechanical fabrication and boiler expertise was required to complete the retrofit of the Cleaver-Brooks boiler and equipment communication at burner startup.

The performance-based contracted services were completed within the owner's budget, and once operational the project expects an annual savings of \$120,000. The gas line provided by Summit Utilities in the Gardiner area became available the week of January 27th, 2014. At that time, the elementary school and high school boilers began running via natural gas while the middle school is currently under construction.

32.8 MW Landfill Gas to Energy Cogeneration Design Services **DCO Energy / Broadrock Power Partners** Johnston, RI and Olinda, CA

Woodard & Curran staff performed and led the detail design of two (2) 32.8 MW landfill gas to energy cogeneration facilities at the State landfill in Johnston, RI and the Brea Landfill in Olinda, CA. Each plant consisted of four (4) Solar Taurus 60 gas turbine generator packages with Rentech heat recovery steam generators and a 9.6 MW Dresser Rand steam turbine generator. Projects were executed in an EPC contract mode with full design, bid, and build process.

ADDITIONAL PROJECT EXPERIENCE

Linear Project - Natural Gas Pipeline Permitting Atlanta Gas Light Resources Inc. (AGL)

AGL is an Atlanta-based energy services company, serving approximately 2.3 million customers in six states. Metropolitan Atlanta has been one of the fastest growing metro areas in the country over the past 20 years, which has increased demand on the system and has also spread customers farther away from supply points. This evolving load profile has put a strain on the deliverability of gas within AGL's system.

To address the need for capacity improvements, AGL presented, and the Georgia Public Service Commission (PSC) approved, AGL's Integrated System Reinforcement Plan. The plan was designed as a 10-year, \$400 MM investment to meet the current and expected natural gas demands placed on AGL's gas distribution system.

Phase 1 of AGL's planned improvements consists of nine projects valued at \$175 MM. Woodard & Curran was approved to provide environmental services to AGL for up to 9 projects and was authorized to begin work on Project 1, Johnson Header to Cherokee. This project involves 6.5 miles of new 24-inch pipe and an upgrade to 35 miles of 24-inch pipe. Woodard & Curran began work on this project in March 2010.

Woodard & Curran's scope of work includes: identifying permitting requirements for each pipeline segment and identification of issues that could become problematic; conducting field surveys to identify various characteristics of the right-of-way including wetlands and waterbodies, endangered and threatened species and species of special concern; and historic, architectural, archeological and cultural resource studies as required. Information from the field surveys will be documented and presented graphically on right-of-way maps. Woodard & Curran will be conducting regulatory consultation and preparing permit applications and supporting documents as required by regulatory agencies. Woodard & Curran will also prepare environmental mitigation plans and will detail conditions that must be followed during construction.

During construction Woodard & Curran will be providing environmental inspection services to document and ensure permit conditions are adhered to.

Horizontal Directional Drill Atlanta Gas Light (AGL)

Woodard & Curran was retained by AGL Resources to design a 24" gas main to go across the Chattanooga River and Norfolk Southern Railyard utilizing HDD construction method. W&C's expert gas team designed the 2 crossings which included reviewing land requirements, pipeline stress calcualtions, coordination with Railroad and regulatory agencies, as well as the detail design of HDD pipeline.



Regulator Station Design National Grid - South Herkimer Regulator Station

Woodard & Curran designed two regulator runs for National Grid, that included equipment specification, regulator design and layout and electric & Scada design. W&C's gas team worked with Nat Grid's engineers to incorporate their standards and specifications to fully meet their design requirements. Progress drawings and client meetings were key to maintaining on-time design deliverables to National Grid.

Corbin Intermodal Project Port Authority of NY & NJ - Elizabeth, Union County, New Jersey

The project included relocation of overhead electric sub-transmission systems to an underground conduit and manhole system to accommodate the expansion of Port Newark's rail facilities. Woodard & Curran staff provided the environmental The scope of work included wetland delineation and permitting with the State of New Jersey and the U.S. Army Corps of Engineers for both tidal wetlands and non-tidal wetland systems. State permitting was required to address New Jersey Tidelands claims and Waterfront Development requirements. Our permitting and high level of coordination with the client and design team met the client's aggressive deadlines to implement the project and to overcome the security issues due to the projects proximity to significant air and port facilities.

Wildwood Gas Line Extension Middle Township & City of Wildwood, Cape May County, NJ South Jersey Gas Company

This project included a new 12-inch high pressure gas main extending approximately 2 miles from Route 9 on the mainland to the barrier island to provide gas system reinforcement to the Wildwood area. The construction included a horizontal directional drill under the inter-coastal waterway. Woodard & Curran staff provided the required State of New Jersey Department of Environmental Protection wetland delineation, CAFRA, Waterfront Development, and Tidelands permitting, as well as US Army Corps of Engineers Section 10 and Section 404 permitting.

Gas Main Design and Layout National Grid - USA, Jamaica Bay, Brooklyn, NY

Woodard & Curran staff provided base mapping and gas main design/layout for 13,750 linear feet of 30-inch gas main in Flatbush Avenue. This project included the design of the Belt Parkway crossing using horizontal direction drilling. In addition, the team performed field survey activities, investigated and arranged for required permits, and prepared a Maintenance and Protection of Traffic Plan.

Gas Transmission Pipeline Design Atlanta Gas Light, Atlanta, GA

Woodard & Curran is providing engineering services to Atlanta Gas Light (AGL) for the design of approximately 8 miles of 24-inch steel gas transmission pipeline in Atlanta, Georgia. Services included performing a route selection study as part of a feasibility review of various pipeline route options throughout the project area. Woodard & Curran performed a class location study for two selected routes and prepared a detailed report on the Class Location Study. Once the route was selected, Woodard & Curran performed easement and right-of-way (ROW) surveying, ROW analysis, detailed alignment sheets, and the design of the proposed 24-inch gas



pipeline. The design included two horizontal directional drills (HDD), one under a large Norfolk Southern railyard, and the other under two railroads and under the Chattahoochee River. Woodard & Curran also provided construction management services by reviewing contractor bids, prepared pricing sheets, and contractor specifications.

Gate Station & Heater Design National Grid - Acqueduct Raceway

Woodard & Curran was hired by National Grid for design and engineering of a new gate station to provide gas to the new Aqueduct Raceway Casino project in NYC. Project included piping design, construction drawings, structural design of concrete pits, and piping payout for the station heater, primary and secondary regulator vaults, and developing engineering material specifications.

High Pressure Gas Main Relocation, Orange & Rockland Utilities, Village of Florida, NY

Woodard & Curran staff oversaw engineering and environmental services for the relocation of two miles of a 16-inch steel high-pressured gas main through the Village of Florida in Orange County, New York for a local utility. Engineering services included preparing detailed base mapping, utility verification, gas main layout, profile and tie-in details. Services included soil erosion and sediment control plans and preparing traffic control plans along the proposed gas main route. A full environmental assessment report was completed, which included wetlands review and delineation, threatened and endangered species review, cultural resources review, and various agency coordination activities for permitting. Additional services included preparing highway permit applications, and meeting with the NYSDOT and the Village of Florida's DPW for the coordination of sewer and tree replacement.

Electric Sub-transmission Relocation PSE&G, Corbin Intermodal, Elizabeth, NJ

Woodard & Curran staff provided design and project management services for the relocation of overhead electric sub-transmission systems to an underground conduit and manhole system to accommodate the expansion of Port Newark's rail facilities. The project included the installation of a section of the electrical system under several railroad tracks using jack and bore and horizontal directional drilling trenchless technologies. The project was complicated by its proximity to significant air and port facilities and the associated security issues required to permit and construct adjacent to them.

600-MW HVDC Undersea Cable Project Northeast Utilities, Connecticut to Long Island, New York

Woodard & Curran staff served as Principal-in-Charge for work on a Northeast Utilities (NU), Connecticut to Long Island, New York, 600-MW DC Cable Project. The project involved a 25-mile route, 5 miles of which were terrestrial originating from NU's Norwalk Substation extending to Hempstead Harbor, Long Island. The project involved assessing routing options and extensive geophysical and geotechnical surveys of seabed conditions within Long Island Sound to evaluate several potential submarine cable routes. The project included extensive environmental impact evaluations associated with selected cable routes and landfall locations. These evaluations included impact assessments of shellfish and finfish resources, water quality protection, prevailing tides and currents, and navigational and marine hazards. Final



Woodard & Curran performs full service engineering support for the design of natural gas systems.



draft applications were prepared and submitted to NU for municipal filings and submittal to the Connecticut Siting Council.

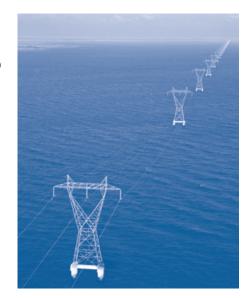
Underground Electric Cable Design and Construction Prysmian, Cross Hudson NYC Electric Line, Edgewater, NJ

Woodard & Curran staff were retained by Prysmian Cable to assist in the design and construction of a 345KV underground electrical cable from northern NJ to Manhattan. Prysmian is the cable supplier and was selected to complete the project "turn-key." Woodard & Curran staff completed the engineering for all land portions of the project. This included the design of several horizontal direction drilling installations near railroads, thorofares, and other environmentally sensitive areas. They also designed several railroad crossings and parallel occupancies in NJ. The Manhattan side of the project required the investigation and preparation of detailed drawings to select a suitable "lane" for the new electric facility, which will terminate at a Con Edison substation.

B. L. England Upgrade Series PEPCO Holdings, Inc (Conectiv), New Jersey

A Woodard & Curran staff member oversaw the following phases of work, which were necessary to reinforce an existing transmission system (both 115kv and 230kv) to allow for the retirement or sale and upgrade of the B.L. England generating station:

- Cardiff Substation (English Creek) to the Lewis Substation (Pleasantville) 138kv electric transmission line, Corson Substation, and Dennis Substation. Feasibility and route assessment of approximately three miles of high-voltage transmission line to supply four upgraded substations. Environmental activities included wetlands delineation; threatened and endangered species habitat assessment including the pine barrons tree frog, coopers hawk, and barred owl; and Phase 1A and 1B cultural resource surveys. Prepared permit applications for FAA, Coastal Area Facility Review Act (CAFRA), and Soil Erosion and Sediment Control. Also provided overall regulatory agency coordination. Environmental, permitting, and construction details were developed and included in the base maps which were prepared via GIS software. Extensive coordination with regulatory agencies was employed to assure that the project's strict construction schedule, which was developed in consideration of the various endangered species along the route, was achieved.
- Cumberland Substation (Millville) to Dennis Substation (Cape May Courthouse) System upgrade 138kv to 230kv electric transmission line. Environmental activities for this 20.5-mile system upgrade included wetlands delineation; threatened and endangered species habitat assessment including pine barrons treefrog, numerous plant species, coopers hawk, northern pine snake, timber rattle snake, red shouldered hawk, and barred owl; and Phase 1A and 1B cultural resource surveys. Prepared permit applications for FAA, CAFRA, New Jersey Tidelands, State Pinelands, U.S. Army Corps of Engineers, and Soil Erosion and Sediment Control. Also provided overall regulatory agency coordination. Environmental, permitting, and construction details were developed and included in the base maps which were prepared via GIS software. Extensive coordination with regulatory agencies was employed to assure that the project's strict construction schedule, which was developed in consideration of the various endangered species along the route, was achieved.



Feasibility Study, Licensing, Air Modeling, Reformulated Fuel FPL, Wyman Station

Due to the success of an initial refined modeling analysis of five residual fuel-burning units at FPL Energy's Wyman Station, Woodard & Curran was asked to determine the feasibility of using a reformulated fuel in existing boilers. As such, a request for a license amendment was prepared and a second modeling demonstration was completed to show that Maine Ambient Air Quality Standards and Increment standards are met when burning the modified fuel. As a result, the facility realized significant cost savings with minimal regulatory burden.

Emissions Study. Gas Turbine Project Social Security Administration

At the request of our client, Willard/Limbach LLC, Woodard & Curran assessed emissions from a newly installed gas turbine at the main U.S. Social Security Administration campus.

After conducting a site visit and inspection, Woodard & Curran addressed the operational parameters of the turbine, with particular focus on optimization measures that can be applied by the manufacturer's representative and/or facility operating personnel. The exhaust stack configuration, past stack test data, and possible re-testing of the stack gas emissions were also investigated.

Environmental Management Services - Cogeneration Facility Verso Paper, Jay, ME

Since 2006 Woodard & Curran has provided environmental management services associated with Verso Paper's on-site 150 MW cogeneration facility. Woodard & Curran completes all air related environmental reporting associated with the facility and ensures the facility operates in compliance with applicable federal and state regulations. In addition, Woodard & Curran also provides data management services and has developed a custom electronic dashboard to support the facility operators.

Permitting Assistance, Strategy Greenville Steam Company, Portland, ME

Woodard & Curran prepared an amendment application for Greenville Steam Company, a Title V facility. The application proposed to burn industrial solid waste materials in an existing biomass boiler, and included an evaluation of air toxic and criteria air pollutants.

To facilitate an expeditious permitting timeline, Woodard & Curran devised an innovative permitting plan and worked with the facility and the state regulators to establish an alternative baseline by which to compare current actual emissions to future potential emissions. Based on the comparison, permit limits were established which streamlined the permitting process while providing the facility with ample operational flexibility.

Woodard & Curran also obtained a solid waste application to beneficially reuse industrial solid waste in the biomass boiler and successfully addressed noise, traffic, solid waste storage, local site location requirements, scenic character, air quality, erosion and sedimentation control, and fuel quality issues. Woodard & Curran worked with the facility to develop an operation and maintenance program and standard operating procedures. The solid waste permit was accepted and processed in record time.



FPL Energy, Wyman Station

Consulting Engineering Services, Electric Power Generating Facility Expansion

Confidential Client

Woodard & Curran was contracted to provide consulting engineering services for evaluating the feasibility of expanding an existing electric power generating facility. Our client was considering expanding the generating capacity of its existing facility by adding a 260-MW combined cycle, natural-gas-fired electric generating unit, parallel to the existing unit. Woodard & Curran conducted research to identify potential environmental and interconnect issues related to the proposed expansion. Our research included:

- review of local zoning and planning ordinances;
- evaluation of the water distribution system and the ability of the system to meet the projected increased demand;
- evaluation of additional wastewater discharge and options to accommodate the increase;
- · screening level noise impact assessment;
- assessment of applicable federal and state air pollution control regulations and potential impacts from the proposed expansion;
- preparation of an image portraying the site as it may appear with the addition of the new unit:
- review of applicable environmental permits and approvals required by state, local, and federal authorities;
- evaluation of the feasibility of the power interconnection and gas supply for the new unit and additional studies required; and
- preparation of a site constraints plan and analysis.

The results of our research were presented to the client in a report that included recommendations for further actions.

Landfill Gas-to-Energy Ridgewood Power, Johnston, RI

Ridgewood Power operates a landfill-gas-fueled, electric-generating facility located at the Central Landfill, Johnston, RI. Woodard & Curran staff served as Project Manager for the initial air dispersion modeling to support air permitting efforts for the original facility, and as Project Manager for subsequent expansion of the facility, including applying for environmental permits when additional capacity was needed. The project involved air permitting of a single Waukesha internal combustion engine and smaller liquid-fuel-fired back-up generator.

Woodard & Curran continues to provide environmental regulatory compliance services to the facility, including health and safety training of plant staff.

Waste-to-Energy/Resource Recovery Facilities – Permitting and Air Measurement Services Multiple Clients

At various locations and for a number of clients, Woodard & Curran staff served as project manager for numerous projects with major companies who operate resource recovery/waste-to-energy facilities. Clients have included Ogden Energy, Wheelabrator, Foster Wheeler, and Montenay. Our staff managed permitting activities for new facilities that required solid waste permit applications, NANSR and



Greenville Steam Company

PSD applications, health risk assessments, and the performance of air dispersion modeling analysis of facility emissions in support of air permit applications. Our staff has also managed air measurement and continuous emissions monitoring systems (CEMS) certification projects for this industry sector.

Energy Consulting Massachusetts Water Resource Authority

Woodard & Curran has served as a technical energy consultant to the Massachusetts Water Resource Authority (MWRA) for several years. As part of efforts to reduce energy use at all MWRA facilities, the firm's engineers reviewed water and wastewater pump stations, headworks facilities and administrative buildings, offering a unique perspective to the MWRA.

Energy Evaluation Town of Plainville, CT

When the Town of Plainville, Connecticut needed to improve efficiency, reduce sludge, and energy and operational costs at its 5.0 MGD Water Pollution Control Facility (WPCF), it did not have the available funds to institute the recommended improvements. Select Energy, an unregulated subsidiary of Northeast Utilities, recommended Woodard & Curran to Plainville town leaders because of its experience with similar upgrade projects. The firm structured an improvement project that will not only improve energy efficiency, but also reduce sludge disposal fees and maintenance costs. Many safety improvements will also be instituted, including an Integrated Contingency Plan for the wastewater facilities.

Woodard & Curran performed a comprehensive evaluation of the town's WPCF and recommended the following improvements:

- · installation of a new rotary drum thickener, sludge pumps, chemical feed system, and controls to reduce sludge disposal costs;
- installation of two new blowers with variable speed drives and dissolved oxygen controls for the post-aeration system;
- · replacement of the existing trickling filter recirculation valve;
- replacement of existing lighting with high efficiency lighting; and
- safety improvements throughout the facility to comply with OSHA regulations.

Additionally, Woodard & Curran implemented an MP-2 maintenance management system to effectively track maintenance costs at the WPCF. The firm also obtained Connecticut Light & Power utility incentives for the variable speed drives and lighting upgrade work and credited these dollar amounts to the project.

Woodard & Curran completed the project using a performance contracting designbuild approach. The firm took sole responsibility for design and construction and guaranteed the projected savings. Woodard & Curran also structured a 10-year taxexempt municipal lease to fund the entire project.

Woodard & Curran used an "open-book" process, sharing all equipment and subcontractor bids with the town. Any savings realized during the construction bidding process were passed along to the town. The \$1.1 million of capital investment will provide Plainville with annual operational savings of over \$120,000.





Plainville, CT

Nuclear Power Station Environmental Health & Safety Compliance Audit Maine Yankee

Woodard & Curran was included in a team audit investigation of the Maine Yankee nuclear power plant, a fully licensed nuclear power station. The firm provided state and federal regulatory expertise regarding hazardous waste, solid waste, Superfund Amendments and Reauthorization Act (SARA) Title III reporting, storm water and wastewater management, and Occupational Safety and Health Administration (OSHA) hazard communications requirements.

The audit team identified several known or potential compliance issues and compared the observed conditions to applicable state and local regulations.

Expansion Feasibility Assessment (permitting, interconnects, site constraints)

Confidential Client

Woodard & Curran is providing permitting services to the owner of one of the premier downtown Boston retail shopping centers for state air permitting of back-up power generation equipment. The particular challenge of this project was its close proximity to both residential and hotel buildings and street-level cafes, which required additional sound design and increased sound screening to meet city noise limits.

Title V Air Permit Application Audit and Air Services Hess Oil Refinery, Saint Croix, US Virgin Islands

Hess Oil Virgin Islands operates the second largest refinery and fuel storage facility in North America on the Island of Saint Croix in the U.S. Virgin Islands. A Woodard & Curran staff member was project manager leading a team of engineers and scientists with an extensive review of Hess Oil Refinery's USEPA Title V air permit application. Hess had used internal resources to complete a Title V air permit application for the entire refinery. Prior to submitting the application to the U.S. EPA Region 2, Hess desired to have an external review of its work to ensure that the document was complete and technically accurate. Due to the extensive nature of the application, Hess requested a detailed review of a single process unit as a means of evaluating the overall quality of the application. The team conducted a preliminary state-side review of the application, which was followed by a week-long onsite process unit and application review that included verification of regulatory requirements, completeness, and calculations presented to support emissions data. Following the site visit, Woodard & Curran prepared and submitted a report of findings and recommendations to Hess for use finalizing the application.

Siting and Licensing Caithness Corporation, New York

Woodard & Curran staff served as Principal in Charge and Project Manager for full-service siting and licensing of power development projects in the eastern U.S. The first assignment consisted of the siting of a 750-MW, combined-cycle facility on Long Island, New York, and a peaking facility in South Carolina. Woodard & Curran staff directed full licensing of the power plant under the New York State Article X process. The project included the preparation of Major Non-attainment New Source Review (NANSR) and Prevention of Significant Deterioration (PSD) applications to the New York State Department of Environmental Conservation (NYSDEC). Assistance was also provided to Caithness with public meetings and workshops in the host town and surrounding communities.



Hess Oil Refinery



Woodard & Curran performs air emissions and New Source Review (NSR) permitting and performance standards, as well as industrial design of air quality control systems.

Environmental Permitting, **AES Enterprise, Southington, CT**

Woodard & Curran staff were Principal in Charge and Project Manager for AES Enterprise for the preparation of all environmental permit and Siting Council applications to license a 750-MW, gas-fired, wet-cooled, combined-cycle power plant for a site in Southington, Connecticut. This work involved up-front municipal consultation, preparation of a Connecticut Siting Council Application, and numerous Connecticut Department of Environmental Protection (CTDEP) environmental applications (NANSR, PSD, water diversion, wetlands) as well as an application to the Army Corps of Engineers. Our staff provided expert witness testimony during agency review hearings and at municipal hearings

Environmental Permitting Services, Cogeneration Facility Slatersville Properties, Slatersville, RI

Woodard & Curran staff provided full environmental permitting services for a 1.8-MW, internal-combustion-engine-powered, inside-the-fence cogeneration facility located in the Slatersville section of North Smithfield, Rhode Island. Engines purchased from a facility in Maine were to be installed in the original powerhouse of a historic mill building on the client's property. Work included diagnostic testing of each of the three engines to establish baseline emissions and to provide data for air quality control equipment vendors. The major filings with RIDEM included air quality and wetlands permit applications. A detailed Best Available Control Technology (BACT) analysis and an air dispersion modeling assessment were incorporated with the air permit.

Environmental Studies and Permit Applications Newbay Cogeneration Center, East Providence, RI

Woodard & Curran staff served as Project Manager for this project that included preparation of PSD and related permit applications for a 79-MW, fluidized bed, coalfired cogeneration facility located adjacent to the Seekonk River, Omega Pond, and a residential area. Factors complicating the permitting process included extensive public resistance to the project, areas surrounding the facility identified as nonattainment for sulfur dioxide, requirements for an assessment of water quality associated with facility water withdrawal and discharge, concern for dry and wet deposition of metals, and cooling tower emission impacts related to air toxic compounds. Our staff was the primary witness testifying at the agency-held public hearings on the air permit. Our staff was also responsible for the preparation of environmental sections of the coastal permits required for the project and provided expert witness testimony at state Coastal Resource Management Council hearings on the project.

Real Estate Study Philadelphia Gas Works, Philadelphia, PA

Woodard & Curran staff provided engineering support on a study of the various facilities owned and operated by Philadelphia Gas Works (PGW) in PA. The study involved determining the condition of the overall facility's condition including overall building assessments, HVAC, structural, and environmental. Staff also prepared a cost analysis including O&M and capital requirements relative to PGW's present and future business needs. The technical assessment was then incorporated into the overall plan. The team's recommendations were submitted to the Pennsylvania Gas Commission for review and approval.



Ecological Permitting, Harbor Dredging, Risk Assessment The Former Chadwick Lead Mills, Salem & Marblehead, MA

This site, on the path to becoming a multi-unit residential development, straddles the waterfront of two municipalities in Massachusetts and is an historical source of lead contamination present in harbor sediments and beaches. To address the ecological issues delaying any remediation or redevelopment of the site, Woodard & Curran was required to dredge and test harbor sediment contamination levels and establish the opinions on impact to coastal ecology.

This project required wetlands permitting; an ACOE permit premised upon mandated harbor dredging, water quality analysis, and archaeological analysis; risk assessment for animal and plant populations; completion of the MA Environmental Policy Act Process; an MADEP 401 Water Quality Certification; two local conditions permits from Salem and Marblehead – the Marblehead permit, having been appealed, was superseded by an MADEP conditions permit; compliance with the National Heritage and Endangered Species Act; a permit under the 1894 Rivers Harbors Act Permit; and a permit under Chapter 91. Stakeholders included the U.S. Army Corps of Engineers, MassDEP, and the Cities of Salem and Marblehead, MA.

Solar Design The Shops LLC, Whitinsville, MA

The Shops LLC selected Tecta Solar to design and build a new 900-kilowatt (kW) solar power generation system on the rooftops of five buildings at the existing 1 Main Street. Woodard & Curran was selected to design the dc electrical distribution system, design existing system upgrades as necessary, and coordinate utility system interconnection for the exporting of generated power.

Solar Design Adesa Boston, Framingham, MA

Con-Edison Solutions selected Tecta Solar and Woodard & Curran to develop a conceptual design for a 4-megawatt (MW) solar power generation system on the rooftops at the Adesa Facility. The facility currently consumes 7 million kW/hr a year. The new generation system is capable of producing 4.4 million kW/hr per year, which will drastically reduce the facilities dependence on the local electric utility. Woodard and Curran designed the dc electrical distribution system, review the existing distribution infrastructure, and determine the most effective means of interconnecting the generation facility into the existing electrical distribution system.

Landfill/Solar Power Facility Confidential Client

Woodard & Curran is currently working with a client that has signed a three-year solar power purchase agreement with the town to build a one-megawatt solar power electrical generation facility on the landfill site. Woodard & Curran has been selected to develop a cost-effective, technically-feasible and regulatory-acceptable approach for installing the solar racks on the landfill. In addition, Woodard & Curran will identify site-specific requirements that will be needed to support the post closure use permit application. Woodard & Curran will achieve state DEP regulatory approval for the project and secure other federal, state or local permits that will be required based on the proposed configuration.



The client is making arrangements with the town to utilize the green power in town at the Sewer Pump Station, Highway facility and/or other public facilities. One megawatt of solar power is enough to power approximately 400 homes.

Landfill/Solar Power Facility The Town of Northbridge, MA

The Northbridge Redevelopment Corporation (NRC), which owns the Northbridge Landfill on Church Street extension, signed a 3-year solar power purchase agreement with the Town of Northbridge to build a 1-megawatt (MW) solar power electrical generation facility on the landfill site. Woodard & Curran was selected to develop a cost-effective, technically feasible, and regulatory acceptable approach for installing the solar racks on the landfill. In addition, Woodard & Curran will identify site-specific requirements that will be needed to support the post-closure use permit application. Woodard & Curran will achieve MassDEP regulatory approval for the project and secure other federal, state, or local permits that will be required based on the proposed configuration.

The NRC is making arrangements with the Town to utilize the green power in town at the sewer pump station, highway facility, and/or other public facilities. One MW of solar power is enough to power approximately 400 homes.

CHP Biomass Expansion Colby College, Waterville, ME.

\$10 Million USGBCLEED Certified, 16,000 SF biomass central heating plant utilizing two (2)-400 BHP fire-tube steam boilers fed by close-coupled wood chip gasifier combustion units. An estimated 22,000 tons of locally sourced wood chips are used to replace 990,000 gallons of No. 6 heating oil each year and anticipate reducing heating costs by approximately \$1.5 million annually. Colby College's new central heating plant is expected to reduce emissions by 9,500 tons of carbon annually utilizing cyclonic dust collectors in the flue gas ducting system and an electrostatic precipitator. Projected costs of oil and wood biomass suggest the facility will pay for itself in six to ten years.

Biomass Power Plant Alexandria Power Associates, Alexandria, NH

\$18 Million 16MW biomass power plant consisting of Zurn Energy traveling grate stoker boiler, General Electric steam-driven turbine generator, Hamon Research-Cottrell electrostatic precipitator, and Bailey Controls System. Project was contracted under a design-build delivery method in order to complete construction and power generation in eleven months. Provided estimating services during the development phase of the project, as well as, field engineering, supervision, start-up and commissioning services during the construction and turnover phase of the project.

Process Improvement and Capital Project Execution Crystal River, Anclote, and Bartow Power Plants, Duke Energy, Florida

Project Engineer responsible for lab sample table and chiller replacement for Anclote unit 5, feedwater heater drain pump design, sizing and installation for Anclote units 1 and 2, oil/water separator design and installation for Anclote units 1 and 2, turbine lube oil purification system installation for Anclote units 1 and 2, and circulating water system improvements at the Bartow plant including, circ water pump analysis, heat exchanger ball cleaning, vacuum priming system replacement and sea water cooling pump design.

Woodard & Curran's team of compliance specialists have in-depth knowledge and experience with specific local, state, and federal regulatory requirements applicable to energy industry clients.

No. 2 Fuel Oil Pipeline Replacement

Arc Light Capital Services, Bayonne Energy Center, Bayonne, NJ

A member of Woodard & Curran's staff served as project manager/lead mechanical engineer responsible for replacing buried fuel oil piping providing distillate fuel oil to eight Rolls Royce Trent 60 gas turbines.

Fuel Oil Upgrade NRG Kendall Station, Cambridge, MA

A member of Woodard & Curran's staff served as lead mechanical engineer responsible for replacing a No. 6 backup oil supply system with a No.2 oil system and retrofitted existing burners to fire on No. 2 fuel for boilers 2 and 3.

Dry Scrubber Project

Babcock Power, FirstLight, Mt. Tom Power Station, Mt. Tom, MA

A member of Woodard & Curran's staff served as lead mechanical engineer for equipment installation included carbon activated mercury capture, powdered lime injection, ash handling and water make-up for 150 MW coal-fired boiler.

Alstom Flue Gas Desulfurization (FGD) Project Spurlock Station, East Kentucky Power, Maysville, KY

A member of Woodard & Curran's staff served as lead mechanical engineer responsible for all aspects of mechanical BOP design for FGD installation on two 500 MW Boilers. Extensive work with fiberglass piping systems at temperatures approaching maximum design conditions.

Sweeny Co-Generation, LP

A member of Woodard & Curran's staff served as lead mechanical engineer responsible for the installation of an anhydrous ammonia SCR system on four Siemens gas turbine/HRSG units for a 480 MW cogeneration power plant exporting steam to Conoco Phillips

Mt. Storm SCR Project Dominion Power, Mt. Storm, WV

A member of Woodard & Curran's staff served as project manager/lead mechanical engineer responsible for the balancing of plant design and management of BOP engineering for the installation of anhydrous ammonia SCR's on coal fired units 1 and 2.

Jet Fuel Storage Tank and Piping Inspections U.S. Government, Multiple Military Installations in Alaska

A member of Woodard & Curran's staff served as lead mechanical engineer responsible for designing repair packages for observed defects, prepared API code documentation for repairs and suitability for service assessment, assisted in secondary containment evaluations and managed site construction of a new 1.5 million gallon API 650 jet fuel storage tank.