

Integrated Water & Energy Master Planning



**Bioengineering
GROUP**
Building Sustainable Communities
on an Ecological Foundation

Bioengineering Group employs sustainable design principles and renewable energy technologies to provide site development outcomes that are energy efficient, cost-effective, compliant with applicable regulations, and consider the surrounding environment and water quality. Highly skilled at balancing the “triple bottom line” of social, economic, and environmental objectives into our projects, we work with municipal, federal, and private clients to provide innovative and sustainable master planning services and site engineering and design. Our many years of watershed planning and ecosystem restoration work has provided us with a deep network of stakeholder relationships and internal teamwork habits now being tapped by our clients to support their energy program needs. We comfortably perform large-scale master planning processes as well as integrated site design and related permitting on some of the largest public works projects of our time—as well as smaller scale projects—as our clients embark on their first exercises in adopting new approaches and techniques.

Bioengineering Group’s interdisciplinary approach is based on assessing the building and site as a whole system working symbiotically rather than pieces that operate independent of each other. Our specialized team of experts evaluates water and renewable energy resources including existing and planned future requirements, and incorporates the various components of energy generation, management, and distribution into the master planning process. Going beyond strategy, we guide and execute complex energy projects by utilizing available energy generation, tapping renewable sources, and ranking and prioritizing strategies based on sustainable design principles. This process ensures initial investments translate to future savings.

Bioengineering Group’s core expertise was built on capturing rain water or process water at source, minimizing pollutant load, harvesting for potential reuse on site, and using the physical and chemical properties of water in its various forms (stormwater, process water, waste and/or gray water). Our design philosophy is geared towards protecting and restoring the environment, water and air quality, and habitat values. By evaluating water

and energy demands, considering available resources (including renewable ones), and allocating resources strategically, we keep both life cycle costs and environmental impacts low. Our methods develop sites that use less water and energy and also pollute less. The benefits accrue at the watershed and energshed™ scales to achieve resource efficiency and reduced dependence on fossil fuels.



Inside Building



Outside Building



Infrastructure and Region

Integrated Water & Energy

Master Planning



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Bioengineering Group's expertise includes building envelop energy assessments, design of green roofs, wastewater treatment systems, energy quality flow analysis, and complex multi-criteria decision making tools. Our services include energy audits, research and feasibility studies, modeling and decision support tools for energy and water systems, innovative, integrated water and energy solutions, and education. Specifically, we provide:

- **Sustainability Master Planning Services** to fully integrate existing and future water and energy quality requirements and opportunities on installations.
 - **Building energy optimization assessments** in compliance with **Energy and Process Assessment Protocol (EPAP)**, a 3-level audit procedure on how to find and assess energy inefficiencies in existing facilities, developed by US Army Engineer Research and Development Center (ERDC) Construction Engineering Research Laboratory (CERL). These assessments include the equipment used in the building for climate control and processes, number of people, lighting, construction materials, office equipment, and overall building use; as well as evaluating water use and providing recommendations for water conservation.
 - **Net-zero facility design** including energy/water/waste analysis used to recommend renewable energy, water conservation measures, and sustainable waste handling plans for design of net-zero carbon footprint facilities.
 - **Life cycle cost assessments** to evaluate the lifetime cost of a product from production of the product, use of the product, and final disposal of the product. This includes equipment used in production and implementation as well as transportation costs and maintenance. Using a life cycle analysis, a product can be chosen which is least costly environmentally and monetarily throughout the products useful life.
- **Energyshed™ Management** to sustain and enhance energy functions that affect greenhouse gas emissions, water consumption, efficiency, and inhabitants through distributed generation and usage.
 - Solid relationships with **specialized teaming partners** for the execution/implementation of projects.
 - Numerous **LEED® Accredited Professionals**.
 - **EPACT05 and EO 13423/13514 Compliance**.

We adhere to the High Performance and Sustainable Buildings (HPSB) Guiding Principles:

- 1. Employ Integrated Design Principles**
 - Integrated design
 - Commissioning
- 2. Optimize Energy Performance**
 - Energy efficiency
 - Measurement and verification
- 3. Protect and Conserve Water**
 - Indoor water
 - Outdoor water
- 4. Enhance Indoor Environmental Quality**
 - Ventilation and thermal comfort
 - Moisture control
 - Daylighting
 - Low-emitting materials
 - Protect indoor air quality during construction
- 5. Reduce Environmental Impact of Materials**
 - Recycled content
 - Biobased content
 - Construction waste
 - Ozone depleting compounds



Poorly operating HVAC system to be reconfigured for increased energy efficiency and performance

Energy Assessment and Building HVAC Review Global Products, Inc., St. Peters, MO

After a fire that at a manufacturing facility, Bioengineering Group provided an assessment of the facility's energy use and climate control issues with a goal of improving energy efficiency. Using thermal imaging, blower door test, physical observations, and a comprehensive energy model, we evaluated the facility and recommended ways to improve the working climate for employees and reduce the facility's overall energy consumption. Our recommendations included repairing leaking and damaged HVAC equipment and redesigning intake/exhaust plenum arrangements; redesigning process area exhaust systems and fresh air intake; sealing the building envelope by repairing weathered caulking and areas where gaps were evident; implementing shade trellises along the south portion of the facility to reduce heating due to solar glare; redesigning the layout of process equipment to produce smoother operations; low power lighting; and renewable energy solutions including solar and geothermal.



Existing ducts, insulation, and light fixtures affect building energy demand

Net-Zero Energy Building Design, River Wharf Realty Trust, Salem, MA

Bioengineering Group analyzed the property for the feasibility of geothermal heating and cooling to replace existing HVAC equipment. We conducted a blower door infiltration test to evaluate the building envelope and constructed an energy use model. Using the energy use and infiltration test, we calculated subsequent maximum loads based on average seasonal temperature fluctuations during the building's normal operating hours in the summer and winter months. The design consisted of three 400-foot closed loop geothermal wells based on thermal load test following the drilling of the first well to confirm the estimated design and optimize the well depth for overall efficiency.



Energy efficient solar development

Energy Quality Flow Analysis for Ultra-Low Energy Communities, US Army Construction Engineering Research Laboratory, Champaign, IL

Bioengineering Group was selected to assist the US Army at the installation level to provide installation energy leadership insight on the direct benefits of understanding their current energy flow, including recoverable energy losses. Bioengineering Group worked to develop an Energy Quality Flow Analysis (EQFA) model to understand and reduce energy consumption at the installation level. The EQFA determined the use of energy resources or energy savings methods and alternatives based on the base's preferences and priorities; optimized energy use in capital projects allowing installation managers to achieve mandated ultra-low energy objectives; prioritization of energy needs given preferences and requirements such as mission criticality, cost, energy savings, aesthetics, energy security, or others; alternatives by varying the decision makers' preferences or energy resource availability or cost. From the resulting menus of energy-saving options, installation energy managers were able to select implementable energy-saving methods as well as to design or revise energy-saving capital projects or other direct investments.