

Specialists in Campus Energy Solutions

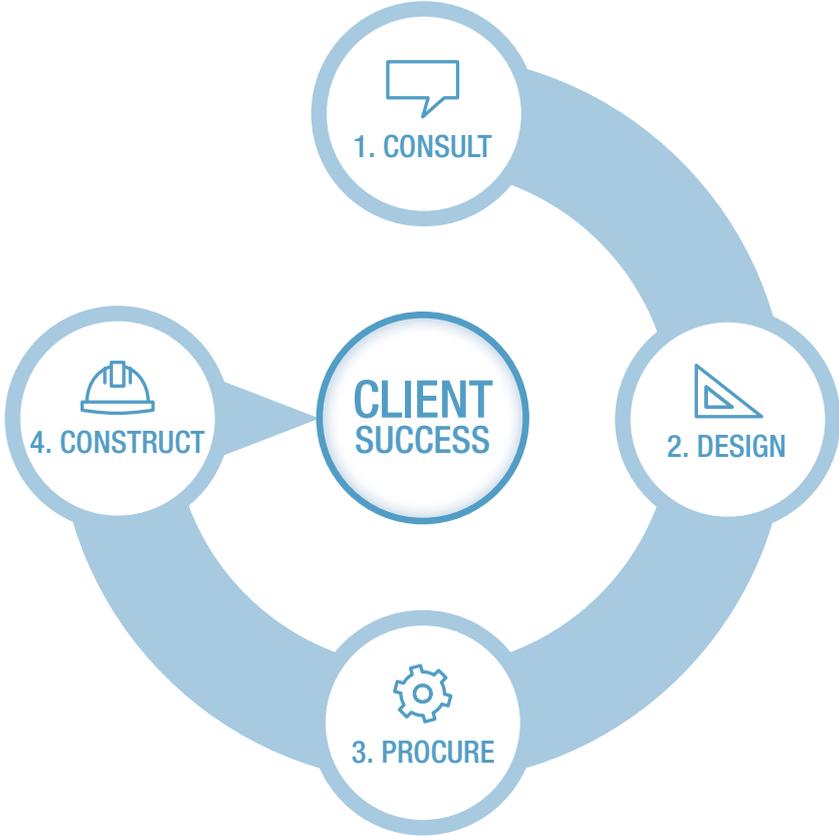
Universities, manufacturing plants, healthcare facilities, airports, military installations, corporate complexes, government offices — no matter the mission of the individual campus, the diversity of the buildings and expanse of property create complex energy and power challenges. But the size and scope of campus-sized operations create opportunities to lower costs, reduce carbon footprints and optimize reliability that would be impractical for smaller operations.

Helping campus-sized operations meet these challenges — and seize these opportunities — is the mission of our *OnSite* Energy & Power team. Whether it's building your own highly efficient generating station or creating a detailed 30- to 40-year master plan to support your campus growth, the team delivers individualized, customized solutions.

Our dedicated group, which focuses on campus-level environments, has earned its place as a trusted adviser to dozens of campuses. We offer complete analysis, design and construction services, enabling us to handle your project seamlessly from concept to completion. We have an unmatched reputation for delivering the largest and most complex projects within the owner's timeline and budget.

// **ONSITE ENERGY & POWER SERVICES**

- // Utility master plans
- // Central utility plants
- // District energy systems
- // Thermal distribution
- // Combined heat and power plants/microgrids
- // Thermal energy storage
- // Electrical transmission and distribution
- // Demand-side energy savings
- // Regulatory compliance and emissions reduction strategies
- // Procurement and construction
- // Startup and commissioning
- // Operations and maintenance



Seamless collaboration — the integration of consulting, designing, procurement and construction — produces success, for you and your project.

Representative Clients

// ABILENE CHRISTIAN UNIVERSITY	⋮	// DULLES INTERNATIONAL AIRPORT
// ARCHITECT OF THE CAPITOL	⋮	// DUPONT
// AUBURN UNIVERSITY	⋮	// ENWAVEUSA
// AUSTIN ENERGY	⋮	// FORT LEONARD WOOD
// CLEMSON UNIVERSITY	⋮	// GAINESVILLE REGIONAL UTILITIES
// COLUMBIA UNIVERSITY	⋮	// HARVARD UNIVERSITY
// CORIX UTILITIES OKLAHOMA INC.	⋮	// HONEYWELL
// CORNELL UNIVERSITY	⋮	// HOUSTON AIRPORT SYSTEM
// CREIGHTON UNIVERSITY	⋮	// IOWA STATE UNIVERSITY
// DELL CHILDREN'S MEDICAL CENTER	⋮	// LEE COUNTY ELECTRIC COOPERATIVE
// DENTON MUNICIPAL ELECTRIC	⋮	// LOCKHEED MARTIN
// DENVER INTERNATIONAL AIRPORT	⋮	// MATEP LLC
// DISTRICT ENERGY ST. PAUL	⋮	// MAYO CLINIC

// THE MEDICAL CENTER CO.	⋮	// THERMAL ENERGY CORP.
// MIAMI UNIVERSITY-OHIO	⋮	// UNIVERSITY OF ALABAMA
// MIDWEST ENERGY	⋮	// UNIVERSITY OF CALIFORNIA-DAVIS
// MILWAUKEE REGIONAL MEDICAL CENTER	⋮	// UNIVERSITY OF COLORADO-BOULDER
// NORTHWESTERN UNIVERSITY	⋮	// UNIVERSITY OF GEORGIA
// NRG THERMAL	⋮	// UNIVERSITY OF KANSAS
// OHIO STATE UNIVERSITY	⋮	// UNIVERSITY OF SOUTH ALABAMA
// PARKLAND HEALTH & HOSPITAL SYSTEM	⋮	// UNIVERSITY OF TEXAS-AUSTIN
// PENNSYLVANIA STATE UNIVERSITY	⋮	// UNIVERSITY OF TEXAS SOUTHWESTERN MEDICAL CENTER
// PURDUE UNIVERSITY	⋮	// UNIVERSITY OF UTAH
// SOUTH TEXAS ELECTRIC COOPERATIVE	⋮	// U.S. ARMY CORPS OF ENGINEERS
// TEXAS A&M UNIVERSITY	⋮	// VEOLIA

// MASTER PLANNING

Creating a road map for your most effective path forward.

Campus growth plans are continuously changing. For your energy and power infrastructure to effectively support your evolving physical infrastructure, it must grow and change as well. That's why creating an energy master plan is a best practice for most campuses. To establish the necessary capacity, optimize efficiency, minimize the carbon footprint and maximize reliability and resiliency, the master plan is often revisited every five to 10 years.

Our OnSite Energy & Power team understands the complexities of energy master planning for campuses. Our comprehensive, holistic approach includes reviewing existing data, interviewing operators and stakeholders, examining base case and anticipated load profiles, analyzing opportunities for emerging technologies and much more. Knowing that utility systems don't operate in isolation, we also consider their relationship with interconnected campus operations like IT and maintenance.

We analyze and develop a comprehensive plan with discrete results for the production, distribution and consumption/ demand-side utility needs. The bottom line: You get the detailed, fact-based, accurate information you need to prioritize action and proceed in the most effective — and cost-effective — manner, everywhere on campus.

Technology innovations to support campus growth.

// Texas A&M University
College Station, Texas

The campus is expanding its facilities by nearly 13 million square feet. Our *OnSite* team analyzed chilled water, hot water and electrical power systems to effectively support this extensive growth. Analyzing cost scenarios, Burns & McDonnell developed a path forward — incorporating innovative new technologies — to help the campus expand most efficiently. Several short-term energy projects are underway, and the *OnSite* team helped secure a \$10 million U.S. Department of Energy grant to help defer costs and deliver a faster return on investment.

// 13 million -square-foot campus facility expansion

// \$33 million life cycle savings (including capital recovery)

// 17,000+ tons of chilled water capacity replacements and upgrades

// 3 million-gallon thermal energy storage tank





// CENTRAL UTILITY PLANTS, DISTRICT ENERGY SYSTEMS
AND THERMAL DISTRIBUTION

Single-source heating and cooling for top efficiency, minimal disruption.

Centralized resources provide opportunities for optimization and taking advantage of system interdependencies, diversity and localized resiliency. Not having to manage a diverse assortment of boilers, chillers, furnaces and other equipment scattered across dozens of buildings can give you greater energy efficiency, provide greater reliability and significantly reduce your maintenance burden.

Every cooling and heating system is only as good as its distribution network, and on far-flung campuses, those networks are complex construction efforts and are perhaps even more complicated to maintain and retrofit. And since those networks carry potential hazards like high-pressure steam, the system must maintain absolute integrity across the grounds, inside walls, in ceilings, under roads and through tunnels.

Our *OnSite* team has delivered the benefits of central utility plants, district energy systems and thermal distribution networks to dozens of campus environments. We analyze your system and develop a plan to help you achieve maximum success. We can design new capacity or effectively upgrade, retrofit or expand existing capacity — on the plant side, the district energy/distribution side, or both. We determine optimal routes and protect existing structures while maintaining flexibility for future growth. Our experience in assessing and incorporating new and emerging technologies can help your campus gain ever greater benefits from centralized utility systems for years — or decades — to come.

CHILLER PLANT & COMBINED UTILITY PLANT, UNIVERSITY OF CHICAGO
Chicago, Illinois
Photo credit: Doug Snower

Powering growth during construction.

// Airbus
Mobile, Alabama

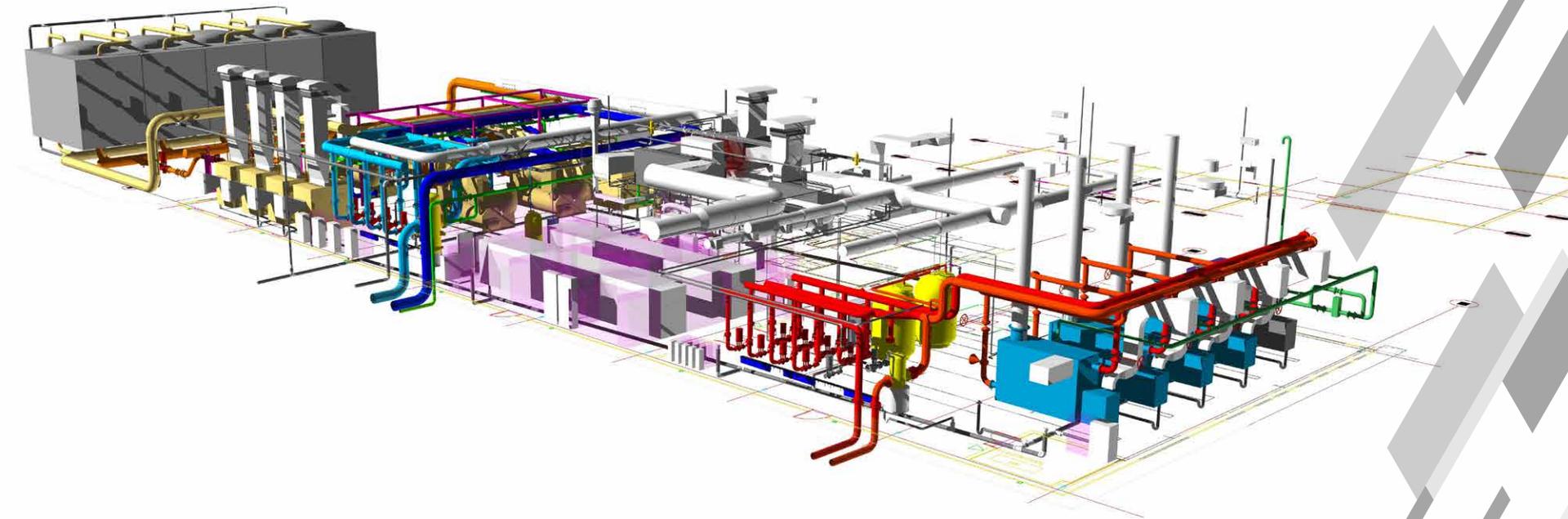
When Airbus launched its initiative to build its new A320 assembly plant, it wanted its central utility plant (CUP) and the related distribution infrastructure to be the first projects built. The CUP would service subsequent structures, requiring it to be operational within 13 months — far fewer than the typical 18 months required for such a system.

Working in conjunction with Honeywell, our *OnSite* team had the plant ready ahead of schedule and under budget, providing 4,200 tons of chilled water and 44 million BTUs per hour of chilled water.

// 13 months to operation

// 4,200 tons of chilled water

// 44 million BTUs per hour of hot water



// COMBINED HEAT AND POWER/MICROGRIDS

Reclaim waste heat and put it to work for you.

Many campuses can benefit from cogeneration — using waste process heat to produce useful work. This dramatic, efficiency-improving step reclaims excess heat to generate electricity or distributed thermal energy. The result is significantly lower utility costs, greater reliability through the implementation of microgrids and a reduced carbon footprint. Many innovative facilities are even running trigeneration plants, using excess heat to power chillers and generating cooling capacity as well.

Our *OnSite* team analyzes the needs of your campus environment and can model demand and compute spark spread — the localized, fluctuating difference between gas and electricity costs — to properly size a combined heat and power (CHP) plant for optimum service and fastest return on investment. Since Burns & McDonnell is one of the few design-build contractors in the CHP space, we combine experience designing for constructability with seamless integration of the construction process. Our experience ranges from 500-kW facilities to 200-MW plants, and our knowledge of available federal and local incentives has helped our clients save tens of millions of dollars.



On-site generation for a growing medical campus.

// Gainesville Regional Utilities South Energy Center
Gainesville, Florida

In conjunction with GRU, the *OnSite* team designed a cost-effective solution to provide services to the expanding University of Florida Shands Cancer Hospital campus. The new combined heat and power trigeneration facility generates 4.3 MW of electricity using natural gas and utilizes waste heat to produce 30,000 pounds per hour of steam and 4,200 tons of cooling capacity, potentially providing 100% of the facility's power, heating and cooling needs. The hospital now requires an expansion to this facility, and our *OnSite* team is partnering with GRU to expand the CHP plant.

// 4.3_{MW} of generation

// 4,200_{tons} of cooling capacity

// 100% of hospital's power, heat and cooling needs

// THERMAL ENERGY STORAGE

Heating and cooling, on your schedule.

The ability to time shift your utility needs — strategically generating heating and cooling energy when rates are lower and storing it to use when utility rates are higher — can be one of the most effective cost-saving strategies that a campus can put to work in its operations. And since brownouts and blackouts are notoriously common around periods of peak demand, essentially disconnecting from the utility during these times can provide an increase in reliability.

Whether thermal energy storage is right for your campus — and if so, defining the tank capacity, optimum operational schedule and whether to store ice or water — can make a huge difference in the success of your project.

Our *OnSite* team has developed a broad range of thermal energy systems, analyzing such factors as hourly demand profile, fluctuating daily and seasonal power costs, and anticipated growth plans to create a customized solution that focuses on the specific needs of your campus. Recent projects include ice systems from 5,000 to 90,000 ton-hours and water systems from 500,000 gallons to 9 million gallons — and everything in between.



Efficient cooling in the Texas summer sun.

// Thermal Energy Corp. (TECO)
Houston, Texas

Charged with centrally serving the utility needs of the 45 buildings within the Houston Medical Center system, TECO projected a large increase in cooling demand. It was evaluating a load-leveling scenario as the most cost-effective way to meet this growth. The *OnSite* team worked with TECO to build the world's tallest chilled water storage tank — 150 feet tall with an 8.8 million-gallon capacity — serving individual facilities through a complex pumping and piping system. The result? In one Texas summer month alone, the tank saved TECO \$500,000 in energy costs.

// 150-foot-tall chilled water storage tank

// 8.8 million-gallon capacity

// \$500,000 in saved costs in one month

// ELECTRIC DISTRIBUTION

Campus-owned power for greater reliability.

More and more campuses are taking complete ownership, operation and control of their power generation, transmission and distribution networks. For many, the advantages can be substantial: superior reliability over grid dependence, elimination of easement challenges in construction, and significant energy cost savings.

As a trusted adviser to campuses benefiting from this move, our *OnSite Energy & Power* team knows the key to fast return on investment and ongoing success. It lies in analyzing your campus' situation, accounting for your future needs and carefully weighing the myriad of options that come into play when considering the move to self-operation — or upgrading current operations. Our team has designed and built or retrofitted a broad range of substations, from 4-kV to 500-kV, and a wide range of distribution systems across numerous classes. In addition, we have worked with the majority of electrical utilities across the nation — experience that can be valuable in helping your project run smoothly and provide a fast payback with increased reliability.

NORTHWEST TRANSMISSION LINE, BC HYDRO
British Columbia



Delivering power across a province.

// AltaLink
Calgary, Alberta

The Burns & McDonnell *OnSite* team is partnering with AltaLink, Alberta's largest transmission company, to provide services including detailed engineering and design, procurement and construction management, mostly related to challenging electrical transmission lines and substation projects throughout the province.

The team recently designed and constructed two new substations and 101 km of 240-kV double-circuit transmission line in northern Alberta. An innovative structure and foundation that saved AltaLink nearly \$100 million (Canadian). The team has completed several diverse projects over three years, all delivered on time and on budget.

// 100+ km of 240-kV T-line built to date in muskeg

// \$100 million (Canadian) in savings

// 9 projects delivered to date, on time and on budget

// 20+ current projects



// DEMAND-SIDE ENERGY SAVINGS

Engineering-based approach to optimizing building assets.

With rapidly emerging technologies and advanced analysis tools, the demand side of the energy equation is far from static. Opportunities exist to reduce the energy consumed within your buildings.

Using sophisticated — in many cases proprietary — modeling tools, our *OnSite* team uncovers these pockets of energy efficiency opportunities — even after the low-hanging fruit has been picked. We provide a customized, engineering-based approach and can conduct assessments based on ASHRAE standards. That means sophisticated analysis, in-depth product knowledge and real-world tracking of your annual energy demand on an hourly basis. The result is a plan that better fits the needs of every individual building — especially for the highest energy users. We can even help you arrange for financing.



Reducing the energy draw of lab facilities.

// Pennsylvania State University
State College, Pennsylvania

Penn State brought in our *OnSite* team to see if high energy use could be reduced in its lab buildings. While the nature of lab operations leads to the need for high, energy-intensive airflow, our specialized knowledge of laboratory systems enabled the team to specify highly efficient zone-level HVAC controls and new lab exhaust systems for four key facilities. The team anticipates a 40 percent reduction in overall building energy use.

// 40% reduction in building energy use

// 11-year program simple payback period

// 275 kBtu/square-foot baseline energy use intensity versus benchmark building

// REGULATORY COMPLIANCE AND EMISSIONS REDUCTION STRATEGIES

Experience to navigate regulatory challenges.

From single boilers to the largest CHP plant, every energy and power project can bring multiple federal and local permitting challenges. Many require complex exhaust modeling, studies or public review. It is vital that necessary permitting steps are incorporated into the project schedule. These speed bumps could add weeks or months of costly wait time or inspection challenges. Our *OnSite* team helps you identify required permits, submit paperwork correctly and interact with the appropriate agencies to obtain permits efficiently and on schedule.

Looming large is the Industrial Boiler Maximum Achievable Control Technology — the Industrial Boiler MACT — rule, the emission standard established by the U.S. Environmental Protection Agency aimed at reducing air emissions from industrial boilers and process heaters. Many campus operations are investigating the need for and the type of retrofits that will put them on the front end of compliance with pending regulations. Our team can analyze your systems, evaluate your technology options and help you choose the right one — a decision that could minimize the impact of MACT-related costs on your operations and possibly reduce your energy costs.



A proactive approach to boiler compliance.

// Purdue University
West Lafayette, Indiana

Our team helped Purdue identify options for air pollution control modifications that would allow a coal-fired boiler to comply with Boiler MACT and other regulations. The study showed that the boiler was within the guidelines for most smokestack exhaust components, including nitrogen oxide, sulfur dioxide and carbon dioxide, but a technology solution was needed to help reduce hydrogen chloride levels. The team evaluated alternatives and designed a dry sorbent injection system to move the plant to full compliance.

// \$18 million in cost savings

// 33,500 ton-hours in chilled water storage

// 12 million square feet of space in more than 140 major buildings

// CONSTRUCTION, COMMISSIONING, STARTUP,
OPERATIONS AND MAINTENANCE

Confidence for taking design through to completion.

Bringing your campus utility vision into reality, on schedule and within your budget is a tall order. Our *OnSite* team is one of few that provides design, construction and startup services under one roof. We make projects flow seamlessly from one stage to the next. Our depth of engineering experience helps us meet a greater range of technical challenges, avoiding pitfalls and keeping all aspects of the project running smoothly and efficiently. In many design-build projects, we participate in the procurement process early, specifying major equipment and integrating it directly into the design. We know the major vendors and negotiate early, giving us cost leverage.

Effective commissioning is integrated into the design-build process, with professionals functionally testing and dynamically challenging all plant systems. We perform commissioning as a stand-alone, third-party provider, reporting directly to the owners while your builder is constructing the facility, or we can work in conjunction with our own design and construction teams. We even retro-commission facilities already in operation.

You also want to be ready to operate your state-of-the-art CHP facility, electrical substation or CUP right out of the gate. Our Facility Operation Services (FOS) team can help you with a customized plan for moving forward reliably and efficiently. FOS provides trained management, technical operations and maintenance personnel. It can staff your facility 24/7/365, run it, monitor it, repair equipment, perform maintenance, handle purchasing and more — freeing your staff to concentrate on what it does best.



FOS O&M SUPPORT, HONEYWELL FM&T
Kansas City, Missouri



Design and construction that fits in an urban setting.

// EnwaveUSA
New Orleans, Louisiana

Utility provider Enwave hired Burns & McDonnell to design and build a new steam plant to meet load growth of the University Medical Center. The challenging urban project was constrained on all four sides by high-voltage power lines, parking lots and residences. Further, the facility needed to withstand Category 5 hurricane winds, which top 150 mph, and 20 feet of flooding, requiring the team to build a reinforced second floor and locate heavy equipment there. The project met both deadline and budget demands.

// 26,000_{-square-foot} plant

// 7_{-day} operation without grid connection

// 210,000_{pounds per hour} peak steam capacity

Experience and knowledge to operate efficiently.

// Kansas City International Airport
Kansas City, Missouri

Burns & McDonnell Facility Operation Services (FOS) is providing operation and maintenance of the central utility plant (CUP) and industrial wastewater treatment plant (IWTP) serving the Kansas City International Airport Overhaul Base. The CUP supplies steam for heating and process loads, chilled water for cooling and compressed air for process on a continuous basis. The agreement also provides for significant corrective maintenance and capital improvement to the CUP and IWTP systems to optimize operations and improve efficiency and reliability. FOS experience has enabled operation of the facility using half the personnel of the previous operator, saving money while providing efficiency and reliability.

// 2,500 tons of chilling capacity

// 300,000 pounds/hour steam

// 1,833,000 square feet of buildings maintained on 128 acres





Campus power systems are complex. No matter the mission of your operation, the Burns & McDonnell OnSite Energy & Power team is your partner in seizing opportunities for growth and efficiency, fulfilling your vision — successfully.



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