BD-12466 County of Cuyahoga
S&C Electric Company
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Cuyahoga County Utility & Microgrids– BD-12466

For any questions about this letter of intent, contact:

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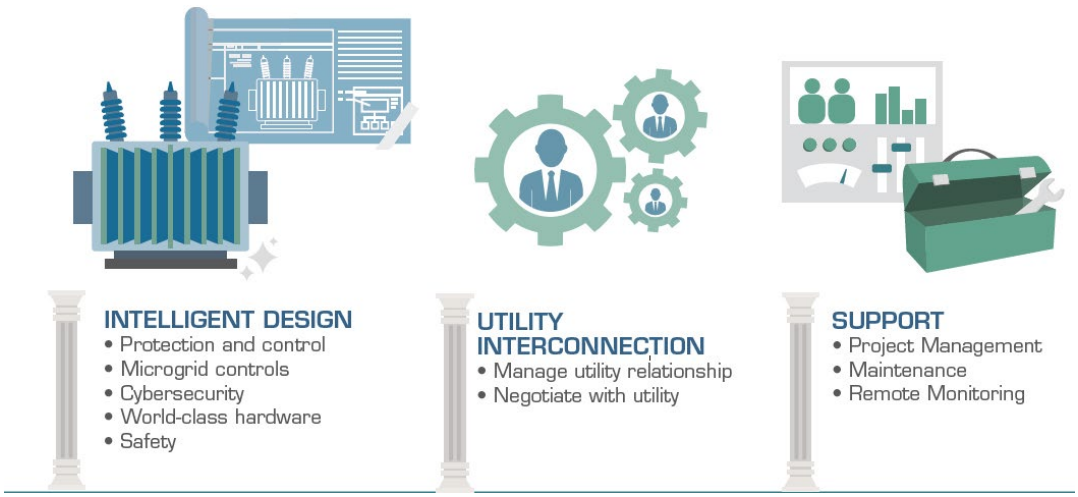
WHY S&C?

Overcoming the Risks of Advanced Microgrids

Microgrids are inherently unique and different from traditional power systems. Integrating a variety of distributed generation sources into one electrical system is a challenging task, which is further complicated by achieving microgrid functionality such as islanding, peak shaving, and renewable smoothing. Many customers are surprised by the risk involved with designing and building an advanced microgrid. A poorly designed microgrid can be unsafe, have interconnection problems, and may lack the necessary support to maintain the microgrid for the long-term.

S&C's team of experts fully understands these risks and addresses them by incorporating the following three pillars of advanced microgrids:

- **Intelligent Design –** Covering all aspects of safety, protection and controls, hardware, and cybersecurity, S&C offers comprehensive engineering services and advanced microgrid controls – S&C's GridMaster® microgrid controller – to design and build sophisticated microgrids.
- **Utility Interconnection –** S&C has over a century of close working relationships with utilities nationwide. From the first liquid power fuse to today's smart grid technologies, S&C was born and raised designing and manufacturing switching and protection products for the distribution grid. We are familiar with each utility and their requirements and will manage the project interconnection process directly with the utility.
- **Support –** S&C's experienced project managers guide the successful implementation of your microgrid throughout the project lifecycle through final commissioning. S&C also provides proactive post-installation support through our 24/7 Global Support & Monitoring Center and ongoing maintenance from regional field service centers.



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S&C is a Full System Integrator

We are not simply an engineering firm leaning on past designs, nor are we a packager with expertise in one or two components without real knowledge of how to put the whole system together. As a full system integrator, S&C provides custom, product-agnostic microgrid system designs, applying patent-pending techniques to achieve our customers' desired system functionality. We focus on providing a full solution, covering project finance, design engineering, and project management, as well as ongoing support and maintenance.

S&C has extensive experience integrating both traditional and renewable generation assets into microgrid systems. S&C has integrated new and legacy generators at our Catalina Island, Oncor, Ameren, and North Bay microgrid projects. S&C's scope across these projects included block-loading gas generators and integrating existing and new diesel generators. S&C's 30+ microgrid installations also include the following assets:

- Battery energy storage systems with islanding and black start capabilities – S&C projects include over 880MW of inverter-based products worldwide
- Renewables (solar & wind) – S&C has interconnected over 7GW of renewables
- Thermal generation integration – fossil fuel generators, CHP (combined heat and power), Fuel cell technology.

Continuing our tradition of innovation and microgrid design expertise, S&C provides the most important elements essential for the appropriate functioning of an advanced microgrid – namely the GridMaster® Microgrid Control System -- to allow automatic islanding during a blackout, as well as reconnection to the grid once the utility restores power.

True Success is Measured in Years

S&C understands that our customers often operate their microgrids for decades and we are committed to maintaining long-term partnerships with each microgrid project. These partnerships are centered around long-term support, which includes services such as 24/7 remote monitoring through our Global Support & Monitoring Center (GSMC), as well as support for maintenance and emergency response.

S&C has provided engineering and procurement services for a microgrid at the largest egg factory farm in Hawaii. The microgrid serves the farm's various loads and integrate multiple distributed generation sources, including rooftop solar arrays, diesel generators, and a battery energy storage system. S&C configured and installed the GridMaster® Microgrid Control System to manage the 100% islanded microgrid.

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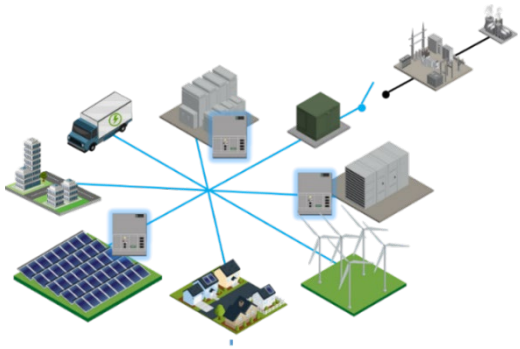
MICROGRID EQUIPMENT

Advanced, cybersecure microgrid controls



The S&C GridMaster® Microgrid Control System operates as a distributed control architecture in which multiple Intelligent Power Controllers (IPCs) act in concert to provide safe and reliable control of the microgrid while providing additional functional capabilities. This approach involves having control "nodes" connected to specific devices or equipment within the microgrid, in stark contrast to the typical centralized "master" control, which exhibits a fatal single point of failure and tends to lack flexibility and scalability. Each node is in constant communication with all other nodes in the network and the GridMaster software manages control decisions for system optimization. The GridMaster Microgrid Control System supports a wide variety of communication protocols and mediums. Interfacing with existing legacy infrastructure equipment is simplified with the GridMaster Microgrid Control System's agnostic, open architecture-type approach to communications and control.

S&C employs a defense-in-depth cybersecurity strategy inherent in the GridMaster system. This multi-layer approach to cybersecurity encrypts all communication, secures all input and output signals, and utilizes a secure algorithmic approach to controls optimization which the programmable logic controller (PLC) cannot address. As a result, we are the first microgrid system to receive an Authority to Operate (ATO) and cyber type accreditation from the US Department of Defense.

Request for Information – Required Questions

1. ***What role(s) from Section 3 would the respondent fulfill?***

   Design of Distribution Infrastructure, Distributed Generation, and Microgrids

   S&C has experience designing, implementing, testing, and maintaining dozens of microgrids in utility, military, and commercial & industrial environments. Our engineering expertise allows S&C to fit into the design process at whatever level is required by the project needs. We have completed projects that start with feasibility studies, as well as those that continue to grow into more detailed design specifications and full construction drawing packages. Having spent the time to complete full integration of DERs on various projects, S&C understands the common pitfalls and can work with Cuyahoga County to avoid those issues early in the design process to save time and money

2. ***Are there other roles not identified in Section 3 that the County should be aware of?***

   Communication and Cybersecurity

   A thorough electrical design is critical to the safe operation of a microgrid, but without a well-designed and cybersecure communication network, equipment could be subject to attack or damage from various threats. Employing the GridMaster Microgrid Control System, a platform designed with cybersecurity from the start, helps reduce the threat from bad actors. S&C's world class communication and cybersecurity team complements our strong electrical engineering skillset by designing robust, cybersecure communication networks microgrids and other DER-based projects that meet the Department of Defense's highest standards.

   Microgrid Operator Training

   One of the most critical but often overlooked roles in microgrid design and development is working closely with the operators of the system to ensure that they have a solid understanding of the principle behind automatic or manually executed processes. S&C ensures that microgrid operators are trained and work alongside the engineers while testing and commissioning to build out their hands on experience. In addition, it

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is often the system operators who have the deepest knowledge for how various processes might be altered to make the system work more effectively.

3. What challenges or barriers could you see for your role(s) as envisioned by the County and what might be ways for the County to address those challenges?

There are many challenges that must be contemplated in the design of a microgrid. Failure to properly design or partner with the right companies for the project will result in negative events in the implementation and operational phases of the project.

S&C has directly dealt with many challenges in the design and execution of many microgrids. We have overcome challenges such as working in remote regions, addressing scope changes during development, and solving unforeseen technical issues that arose during project execution.

Some of the challenges that S&C has encountered and overcame in past projects include:

- **Ambiguous use cases.** Often the prospective microgrid owner may not have a clear understanding of their desired use cases. This ambiguity in customer requirements can lead to over- or under-design of controller functionality and results in a system that does not meet expectations.
- **Equipment specification alignment**. The design of the system requires a holistic approach where all parties and components are aligned. For example, all microgrid equipment specifications must reflect design, construction, communication, control, and operational requirements. In some projects, these efforts are not adequately coordinated, resulting in unnecessary challenges during commissioning or other phases.
- **Engaging system operators.** It is vital to identify the microgrid system operator up front and to have them engaged in all aspects of the design and operation of the system. Microgrids and their control systems are fundamentally complex. Working with the system operator can ensure the designed features of the control system meet their needs will result in better operation and timely maintenance. Furthermore, this can ensure the operator fully understands the intricacies of the design when operating the system after commissioning.
- **Cybersecurity**. It is critical that microgrid controls are designed to be and the associated network systems are designed to be cyber-secure. This effort can be substantial, and requires experienced, specialized engineers.
- **Device protection.** Microgrid protection presents unique challenges. For example, the fault current levels can vary significantly across grid-tied and islanded operation. Furthermore, fault currents in a microgrid can be bi-directional. These challenges can require protective equipment to be replaced to achieve selectivity across modes of operation. S&C has seen others overlook these challenges, resulting in microgrids with equipment that that trips offline unnecessarily or where faults can be challenging to locate because of a lack of selectivity. S&C engineers have led the development of industry guidance on microgrid protection, including IEEE PES-TR71 and IEEE P2030.12.
- **Selecting appropriate DERs.** Selecting rotating machine generators (e.g. diesel or natural gas generators) that balance cost, fuel efficiency, and dynamic needs can be challenging. Often generators that are more fuel efficient have worse dynamic performance, and vice versa. S&C has extensive experience weighing the microgrid system needs and selecting a combination of resources that meet the needs of the specific application. In some cases, this can be best addressed by adding battery energy storage systems, if cost justified.
- **Integrating DERs.** In some cases, S&C has observed others overlooking critical considerations when integrating DERs, especially if they are of different variety, vintage, or manufacture. Getting microgrid DERs to work together well requires careful consideration and thorough study. Through S&C's years of experience successfully integrating microgrid systems with a wide variety of DERs, we avoid complications during commissioning and operation by ensuring interoperability considerations are adequately considered and studied during the design phase.

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- **Developing business cases.** In many cases, customers that are interested in microgrid systems are not able to justify the cost of the investment. It is critical that clear use cases and the value of these use cases are developed and calculated to ensure the project makes both technical and financial sense.
- **Coordinating and integrating stakeholders.** Where there is insufficient coordination between the design team and the control system integrators, S&C has observed generators being purchased that aren't designed to run in stand-alone mode, or where renewable power is grossly oversized compared to the installed energy storage, or where legacy equipment remains in place even though it can't be controlled and can't report its status. Overcoming these limitations can incur additional unanticipated project costs.

4. What's the typical timeline/cycle for the respondents proposed role(s)? (e.g. it takes X year(s) to find customers for a microgrid and build it)

S&C has proven project management aptitude in microgrid projects. These skills come from years of planning and executing successful utility, military, and commercial & industrial microgrid projects. S&C's experienced project managers focus on the granular details needed to ensure proper planning and execution. Based on this experience, the following should be considered when planning and executing the Cuyahoga County microgrid project:

- Scope – Engineers need to perform a detailed assessment of the existing electrical system. All available documentation must be captured and reviewed. Information that is missing needs to be obtained via an RFI process or collected from the field. In parallel, the engineers must meet with the client to define the needs of the microgrid, use cases, etc. This scope evaluation process should be performed early in the project to ensure all details of the existing system are gathered and considered when preparing the project specifications and design package. Failure to perform this work can lead to details being overlooked, resulting in schedule delays and cost overruns.
- Schedule – Stakeholder management will be key to ensure an accurate project schedule. During project initiation, all project stakeholders must be evaluated, and their needs must be addressed to ensure the schedule stays on track. Special emphasis must be placed on microgrid testing. Specific details on how and when the microgrid can be tested needs to be defined early in the project to ensure the project schedule is accurate. This is especially important since the microgrid will be integrated with an existing electrical system.
- Cost – To mitigate the risk of cost overruns Cuyahoga County must select an experienced microgrid integrator with a long track record of successfully designing, integrating, testing, and commissioning microgrids. This microgrid integrator needs to have successful working microgrids in the field, not just conceptual designs yet to be constructed and commissioned.
- Procurement Process – Standard electrical equipment is often used in a non-traditional manor on microgrid projects. Existing specifications for equipment may not be adequate to fulfil the equipment needs of the project. Therefore, project engineers need to develop detailed project specific equipment specifications unique to the Cuyahoga County project. These need to be reviewed in detail with manufacturers early in the procurement

5. Would the respondent meet with the County and / or its representatives to present ideas and to answer follow up questions?

Yes, we welcome the opportunity to meet in-person, following all CDC guidelines and Cuyahoga County's health protocols, or to host an online call. For additional questions, please contact Chris Nakis.

6. All respondents will be placed on a list for other respondents to consider for teaming and/or subcontracting. If your entity requires exclusion from this list, please state so.

S&C would welcome the opportunity to team with, or subcontract to, other respondents.

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Request for Information - Optional Questions:

1. ***Vision***

   S&C has provided additional information for the overall vision within the responses of the required questions.

2. ***Business Economic Models***

   - **How do you envision revenue flowing through the various entities?**
     Budget tracking and management is a key responsibility of the S&C Project Management team. For each project, time-phases resource and budget curves are created and reviewed for feasibility and reasonableness. Once all the work is budgeted and planned, the budgets are time-phased in accordance with the schedule for performing the work. This forms the time-phased budget baseline referred to as the performance measurement baseline and will measure both the Work Breakdown Structure (WBS) and organization performance.
   - **The County envisions a scenario where the developer/concessionaire is compensated through a pass-through model from power purchase agreements with individual customer/off-takers. Do you see any problems with this model or have suggestions on possible alternative compensation models?**
     S&C can work with different types of compensation models and can work to find an alternative that works for both the customer and the S&C billing department.
   - **What process would you take with the County to design customer billing (i.e., tariffs) in a fair and transparent way?**
     Billing can be discussed as S&C begins to invoice Cuyahoga County to design a fair and transparent way to provide invoices.
   - **What types of tariffs are needed to support the County initiative?**
     Specific tariffs can be decided after receipt of a purchase order.
   - **Would you be willing to provide the capital for the scope/role the County envisions?**
     Yes, S&C can provide a scope based on the specifications Cuyahoga County provides.
   - **How would you ensure prices for specific projects (e.g. new distribution line or a microgrid) are competitive?**
     S&C offers competitive pricing based on market knowledge and experience to be within an expected range.

3. ***Organization Models***

   - **Would you be willing to contract directly with the County to be responsible for the full scope of this initiative?**
     S&C is flexible to the service(s) we provide. S&C can serve as a developer, consultant, owner's engineer, provider of microgrid controls (hardware and software), and utility connection coordinator between Cuyahoga County and the utility.
   - **What are the tradeoffs for one firm serving all roles versus separate firms serving separate roles?**
     S&C prefers to be involved from the initial stages and would be interested in discussing an ongoing role in the future phases that would still be compliant with the procurement procedures of Cuyahoga County. Writing and evaluating RFPs to implement the plan are valuable services that can be provided as well as Project Management and Commissioning. We find that EPC firms will want full access to the design team and provider of equipment and services, S&C and our Development Team foresee an active role in future phases which will account for a small percentage of the overall project but that are extremely beneficial in completing the development. With multiple firms working on the project, all areas within the scope can be addressed.

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- **How would you structure the relationship between yourself, the County, and other entities (if applicable)?**
  A division of responsibility is created at the request for proposal stage so that tasks are assigned between the customer, S&C, and any additional subcontractors.
- **What level of pre-design and other information or assurances would you need to respond to an RFP/Q and engage in negotiations with the County?**
  S&C can provide a budgetary proposal to Cuyahoga County as well as an RFI to request additional information once the initial review of the RFP is completed.
- **What level of commitment would you need to have from potential County utility customers to respond to an RFP/Q and engage in negotiations with the County?**
  S&C is happy to provide a firm or budgeted proposal for Cuyahoga County based on the RFP/Q received without prior commitment.

4. Concession Agreement & Other Contracts

All agreements and terms and conditions can be discussed and negotiated after receipt of a purchase order.

5. Initiative Timelines

- **What is a typical turn-around time for you to sign a contract for your role(s)?**
  Timing varies for each contract; however, S&C keeps the customer up to date on every role assigned.

- **What is a typical development time for a microgrid, from customer recruitment through operation? What are the major milestones?**
  Development timelines vary from project to project. Once specifications are issued by Cuyahoga County our project management office will issue a preliminary project schedule to define milestones and project timelines.

6. Technology

- **What technologies should the County consider to address power issues for commercial and industrial customers? (power quality issues vs. short power outages vs. long power outages)**
  Commercial and industrial customer needs can vary dramatically depending on their individual energy, resiliency, and redundancy requirements. For customers with power quality concerns, inverter-based storage technologies are often the most effective solution, although more advanced spinning generation can also provide some power quality assistance.
  CHP generation should also be considered for customers with high heating loads in addition to electrical loads.
  Short-duration outages can often be handled by the same inverter-based storage technologies, although the sizing of the storage compared to peak loads can start to quickly increase costs.
  For long-duration power outages, spinning generation (diesel, natural gas, propane, etc) is often the most economical solution as it can be sized appropriately. Long-duration outages can quickly become costly when dealing with battery or similar storage technologies alone.
- **Can you provide high-level cost estimates for distribution infrastructure, distributed generation, and/or microgrid technologies across different sizes? (e.g. 14.4 kV feeder, 1 MW/1 MWh battery, 5 MW solar PV)**
  Distributed generation and distribution infrastructure costs tend to scale with the size of the units, the costs for microgrid control are more typically dependent on the complexity of the required use cases. A 5MW PV and BESS system that only performs simple operations could be cheaper to

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implement than a much smaller but more complicated microgrid capable of islanding, energy arbitrage, seamless transitions, and other advanced features.

- **Are there ranges of economic feasibility that the County should be aware of when considering on-site generation, storage, etc. For example, do projects only over X MW prove to be economically feasible in your experience?**
  While typically projects with a larger overall power footprint can be more economically feasible, it is not a firm rule. When considering storage, the more decisive factor is often the C-rating (ratio of power to energy, kW-to-kWh) which will determine how long loads can remain energized during an outage as well as allow for more than one use case to be considered simultaneously. For example, a battery storage rated at 1 MW/4 MWh could potentially use some of the additional energy for power quality or energy arbitrage while maintaining sufficient capacity to still support critical loads during a power outage. If the BESS were 1MW/1MWh, more of the energy capacity would be required to stay "in reserve" for an outage, reducing the amount of secondary or tertiary use cases that the device could cover.
- **How should cybersecurity of the utility, individual microgrids, customers, or other pertinent entities be ensured?**
  S&C's cybersecurity team works closely with our customers and other internal teams to ensure that the communication backbone for a microgrid is highly secure. Cybersecurity is built around a concept of Defense-in-Depth, ensuring that critical loads remain energized even in the event that bad actors make it past the first initial layers of security. This layered approach includes advanced network design, encrypted communication, hardening of every device on the network, and constant monitoring.

7. *Diversity, Equity, and Inclusion*

- **How will you ensure Diverse, Equitable and Inclusive (DEI) partnership(s) throughout this Initiative?**
  S&C is not certified under these classifications, but we would actively seek out firms with those certifications for EPC work beyond the scope performed by S&C.

8. *Other*

- **What potential risks, setbacks, or hurdles do you see for this Initiative?**

Based on S&C's experience with microgrid projects, some of the lessons learned below is what we believe should be implemented for a successful project to avoid risks, setbacks, or hurdles:

- **Ensure you have expert partners committed to your long-term success**
  Every component of a microgrid contributes to the system's overall success—on Day One and Day Ten Thousand. Selecting services and products for microgrids based on proven track records of quality, consistent performance, and outstanding long-term support is a critical component of success. Services and products providers structured for lowest initial cost are rarely the best sources for microgrid applications. Cost assessments for microgrids are best made with a life-cycle horizon.
- **Confirm your sequence of operations early in the design process**
  The sequence of operations determines when to start and stop elements of the microgrid. There are many operational and economic benefits to managing peak loads and optimizing the system. Also, it is wise to include an extra connection breaker or two in the system design to accommodate the connection of additional future equipment for system expansion.
- **Implement a monitoring and performance verification plan**

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If you can measure it, you can manage it. A modest investment in submetering as part of the system design will yield valuable information that will facilitate proactive maintenance and retro-commissioning.

- **Hire Commissioning Experts**
  Ensure that the system will be commissioned properly upon completion and that any on-site staff who interact with the microgrid are present to gain knowledge of the system.
- **Invest in Operations and Maintenance (O&M)**
  The EPC firm will likely require an O&M plan as part of the warranty agreement. Using monitoring systems will facilitate preventative maintenance. Following the recommended maintenance intervals suggested by the equipment manufacturer will keep the warranty valid and ensure optimal system performance. Shortcuts in O&M can jeopardize resiliency and performance.

- **Please provide any other information that you feel would be pertinent to the County at this stage of the process.**
  S&C welcomes the opportunity to continue discussions for the Cuyahoga County microgrid project as specifications are developed for an RFP.