EXERGY ENERGY

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Executive's Checklist for:
Genset Implementation

An emergency power genset is unmatched in its capacity to provide economic and reliable resiliency. Compared to other standby technologies, such as battery storage or fuel cells, generators are more cost-effective and practical. The process of designing, procuring, and installing a genset, although worth it, is not straightforward – there is a plethora of considerations to ensure your organization can continue running in the face of an outage.

Given the economic and human costs of an outage, the design process is critical for Always-On operations. The complete design-to-implementation process is complex and is best broken down into four specific phases: goal designation, genset design, permitting, and installation. The following checklist outlines the steps required to facilitate the installation and application of an emergency standby genset.

1. ***Identify & Designate Power Objectives***:
    a. *The first step is to determine how much energy the generator will need to supply your organization in the case of an outage. To be truly resilient, it is important that the genset be capable of supplying 100% of your power needs.*
        i. **Determine your organization's operational energy needs**:
            1. Analyze billing history to determine peak load
            2. Analyze electricity interval data to determine the shape of your organization's load and how it changes over time
            3. It is recommended that you hire an electrical engineer to analyze your load to ensure accuracy and to ensure robust genset design
2. ***Conceptual Design and Engineering:***
    a. *Once your objectives are defined, the next step is project design.*
        i. Determine municipal, state, and federal codes & regulations that apply to standby generator in your locality. These regulations can influence everything from fuel selection to generator placement
            1. Hire legal representation or reach out to the Authority Having Jurisdiction (AHJ) to determine relevant regulations
                a. Codes and regulations apply to:
                    i. Generator noise
                    ii. Generator location
                    iii. Fuel selection & storage
                    iv. Emissions
        ii. **Select the fuel to power your generator***. The two most common fuel selections are either diesel or natural gas.* Fuel selection can have important implications for reliability. To learn more about the importance of fuel selection**,** **read this**

eBook. Below are a few questions to help determine the correct fuel for your operation

1. Does your organization have access to natural gas lines?
    a. If so, going the natural gas route is almost always more cost-effective and reliable
2. Is your organization a life-saving operation such as a hospital or fire station?
    a. Depending on the applicable regulations, or your organization's classification, there are regulations pertaining to onsite fuel storage. When onsite fuel is required, diesel is (by default) the standard as it is very difficult to store large quantities of natural gas

iii. Determine the design and location of the genset*:*

1. Select between an indoor or outdoor installation:
    a. Local climate:
        i. If flooding is common, basements should be avoided
        ii. If there is significant wind, debris can become lodged in the generator, clogging vents leading to overheating. In such circumstances, indoor use is optimal
        iii. If the genset is outside, will you be able to access the generator for maintenance during a storm?
2. Determine the optimal size and rating for the generator:
    a. See step 1 → The sizing process is critical to achieving resiliency. An undersized genset can experience excess strain, leading to failures and outages. Oversized gensets can cause issues of their own and can even damage equipment.
    b. To ensure proper sizing, it is recommended to obtain an expert opinion. Although this is an added expense, proper sizing can save you money in the long term from avoiding damage and economic loss due to an outage.
3. Equipment selection:
    a. Once the generator size has been accurately determined, the next step is equipment selection. Some important considerations are:
        i. Emission requirements:
            1. Genset designs are classified on a tier system by the quantity of emission they release. Many jurisdictions require "Tier 4" gensets, which generate the fewest emissions. Tier 4 specifications are cheaper for natural gas than diesel gensets, and also allow for cost-effective participation in ancillary programs.

3. ***Permitting Process:***
    a. Before an installation can proceed, a project must be approved by the local Authority Having Jurisdiction (AHJ). To ensure this process is seamless, it is very important that the relevant designs meet applicable codes and regulations.
        i. ***Prepare the submittal package for permitting:***
            1. Design architectural & structural plans
            2. Design electrical & mechanical plans
            3. Design civil and zoning plans
        ii. It is recommended that you **hire a qualified representative** to aid in the formulation and submitting of the design for permitting to ensure accuracy and avoid prolonging approval. This of course comes at a cost.
        iii. The submitted design will **need to be "chaperoned"** through the various stages of approval:
            1. Planning
            2. Zoning
            3. Electrical
            4. Structural
            5. Civil
            6. Mechanical
            7. Fire
            8. Building
4. ***Installation Process:***
    a. The installation Process can be broken down into various phases:
        i. **Installation**:
            1. Hire or contract a certified installation team as well as other necessary trade workers such as electrical engineers and labor
            2. Provide the construction schedule to the AHJ
            3. Conduct and coordinate AHJ and other 3rd party inspections
        ii. **Start-Up**:
            1. After final AHJ approval, the generator can finally be started. It is important that a qualified individual conduct the initial start-up to ensure safety
        iii. **Commissioning Following Preliminary Functionality**:
            1. Program the Automatic Transfer Switch (ATS)
                a. The ATS is responsible for taking your organization's load off the grid in case of an outage and switching it to generator power.
            2. Program exercise and maintenance schedules
            3. Ensure communication between the genset and the programming interface
            4. Final Testing
                a. Once the installation and genset programming is complete, it is important to test the genset to ensure all electrical components

and operational characteristics comply with local AHJ requirements.

5. ***Maintenance, Training, Close-Out Package*:**
    a. Following a successful commissioning, the next steps involve acquiring and training individuals to maintain and operate the generator
        i. Hire pre-trained staff or train existing staff to maintain and operate genset
        ii. **Compose close-out package**:
            1. The close-out package includes all final documentation of the original approved plan, permits, signed-off inspections, construction photos, warranty paperwork and all other relevant documents

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