EXERGY ENERGY

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***Executive's Checklist for:***
***Solar & Battery Storage***

*Battery storage is a proven means to achieve resiliency for your organization; however, achieving 99% resiliency with battery storage alone is expensive. The upfront CAPEX required to power a 24/7 organization with a 1 MW-per-hour load is over $42 million, roughly 35-times more expensive than a natural gas generator (~$1.2 million) capable of providing the same service.*

*Combining a solar array to recharge the battery reduces the cost of attaining 99% resiliency, however not all organizations have the rooftop space or land available to install the required solar to provide operational power and to recharge the batteries during the day. For the example discussed above, almost 160 acres of land would be required for the 7.8 Megawatt-dc solar installation required to power operations and to recharge the batteries for use during the night when solar output is unavailable (excluding the space required to house the batteries).*

*Even with such hurdles, certain applications "pencil" for solar and battery storage as an optimal choice. The following checklist/procedure outlines the steps and thought process, from design to installation, behind the undertaking of a solar and battery storage installation that provides resiliency sufficient for 99% of outages.*

***Solar + Battery Storage Checklist:***

1. **Determine resiliency objectives.** *It is recommended that you hire a professional electrical engineer to ensure proper load analysis.*
    a. Analyze load using billing and interval data.
        i. What is the load shape?
        ii. How does the shape of the load change depend on different time parameters?
            1. Over the course of a day
            2. Over the course of a week
            3. Over the course of a month
            4. Over the course of a year
    b. Understanding the shape of your load and how it changes through the course of a day and throughout the year is critical to determining the viability of solar generated electricity for your application.
2. **Conceptual Design & Engineering:**
    ***a.*** Once you understand the nature of your load profile, the next step is to design and engineer the installation. The first step of the design process for a solar + battery storage installation is to determine how much solar and how many batteries are required to ensure your organization will be able to withstand 99% of outages. You will

need enough solar to power your operation and to fully charge the batteries during the day.

i. For a 24/7 operation with a load of 1MW-per-hour, a 7.8 Megawatt-dc solar array is required to fully charge a 57-hour battery installation.
   1. The cost of the battery installation would be ~$21.1 million with the cost of the solar installation coming in at ~$10.5 million.
   2. Total cost of resiliency plan, without installation and other service fees comes in ~$26.4 million, roughly 26.4-times more expensive than a natural gas generator (~$1.2 million) capable of serving the same load.

ii. Important Questions/concerns:
   1. How much land or rooftop space is available for solar panels?
   2. What are your CAPEX objectives?
   3. To learn more, read our eBook ***"Battery vs. Generator".***
   4. Determine whether your organization will go with ground-mounted or rooftop-mounted solar panels.

*b. It is recommended that you hire a professional solar developer to aid in the design process, especially to aid in determining the quantity of solar required.*

**3. Permitting & Code Compliance:**

a. Determine local regulations and codes that apply to battery storage installations.
   i. Hire legal representation or reach out to the Authority Having Jurisdiction (AHJ) to determine what procedures to follow and what codes to comply with.
   ii. If your organization is a life-saving entity, battery storage might be prohibited for emergency backup power applications, that is unless you have up to 60 hours of storage available.

b. Submit design package to AHJ for approval.

**4. Equipment Procurement:**

a. Determine the optimal battery rating and manufacturer.
   i. Batteries range in rating from 30 minutes to 4 hours of discharge time.
      1. Shorter duration batteries are more expensive than longer lasting batteries because they are designed to discharge large amounts of energy over a short period of time.
      2. Longer duration batteries are cheaper because they are designed to discharge steadier and more even amounts of energy for longer periods of time.

b. Select a solar panel manufacturer to aid in determining the best panels for your specific requirements and to assist in their procurement.

**5. Installation:**

a. Once the design package has been approved by the AHJ and the necessary equipment procured, the next step is the installation process.
   i. Work with your contracted solar developer to install the panels and to complete connectivity.
   ii. Electrical engineers and other contractors will also be critical to a successful and efficient installation process.

***FOR ADDITIONAL INFORMATION, OR TO SPEAK WITH AN ENERGY PROFESSIONAL, PLEASE CONTACT US AT WWW.EXERGYENERGY.COM OR EMAIL INFO@EXERGYENERGY.COM.***