



Eaton keeps healthcare facilities running when you need it most



Diagnostic and critical equipment such as MRIs, CT-Scans and other monitoring equipment are vital tools for doctors to accurately diagnose patients, monitor health, and help determine the right treatment plan. Hospitals and healthcare clinics rely on these tools every day.

So, what happens when the hospital utility power drops out or requires additional power? Eaton's XLM supercapacitors allow doctors help their patients by providing reliable peak and backup power to healthcare facilities, where even a short downtime can have an immense negative impact.

To help ensure that interruption of these critical loads is minimized, there are relevant codes and standards in the United States that must be

met. NFPA 110 defines power restoration and capacity requirements for emergency systems. One of which is a 10 second or less restoration, or a Type 10 designation, which all but requires on-site, long-term secondary power supply, such as a diesel generator. NFPA 70, otherwise known as the National Electrical Code (NEC), requires Type 10 power restoration for systems essential for human life. NFPA 99, governing healthcare facilities, defines which loads are classified as life safety loads and requires Type 10 restoration.

XLM supercapacitor modules are designed to provide backup energy to uninterruptible power supplies (UPS) for critical applications during power loss, from brownouts to full outages. The XLM is ideal to bridge the short-term gap between the power outage and code required, long-term secondary source, giving doctors and healthcare facility managers the confidence that essential

diagnostic tools are always accessible.

In addition to being reliable energy storage, the XLM supercapacitor module offers a low cost of ownership for healthcare facilities that can help defer large capital expenditure when high power requirements cannot be met by the existing power distribution system. It offers a long operating life and eliminates battery or flywheel maintenance, control and replacement costs.

Eaton's XLM supercapacitor modules are high-reliability, high-power density, ultra-high capacitance energy storage devices utilizing electric double layer capacitor (EDLC) construction combined with proprietary materials and processes. They feature low ESR for high power density along with environmentally friendly materials, as well as being Reduction of Hazardous Substance Directive (RoHS) compliant. This results in an inherently safe construction, a

key consideration for healthcare facilities. The XLM modules are maintenance-free with lifetimes up to 20 years, equal to or longer than the UPS, and can operate in temperatures from -40 °C to +65 °C.

Critical care beyond backup power

A healthcare facility selected XLM modules paired with a UPS to provide 20 kW of backup power for two minutes or 164 kW for 13 seconds. Additionally, the same XLMs provide 364 kW for two seconds to support CT scan pulses while the generator is providing power. This multipurpose system helped defer additional investment, generator stress and retrofit in other, more expensive distribution equipment while also providing low maintenance operations for 20 years.

Having access to critical medical equipment and care when needed most provides peace of mind to doctors, and ultimately to patients. Eaton is the hidden power in healthcare facilities.

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Supercapacitors Strengthen Renewable Energy Utilization



Towards the end of 2017, the United States had over 50 gigawatts (GW) of installed Photovoltaic (PV) solar generation capacity¹ and over 80 GW of wind generation². Similarly, but even more prevalent, the European Union had just over 100 GW of installed PV solar generation³ and nearly 170 GW of wind generation⁴. These are peak generation figures. Additionally, China total installed PV solar generation capacity is a staggering 130 GW, with 53 GW added in 2017⁵.

With the continued increase in renewable distributed generation, using this

energy supply can be more of a stumbling block than generating it. Utilities desire a firm, consistent supply of energy, from all of its sources, in order to meet the demand instantaneously. If supply is not consistent, whether from overcast days or shifting cloud cover, then it can be taken offline as it cannot reliably support grid needs. This can drastically reduce the utilization of the renewable source and effect the revenue return on the physical assets. To assist with this firming of renewable generation, energy storage is often integrated to balance supply and demand.

Supercapacitor modules are a compelling choice when energy density, or capacity, must be balanced with power density—or how fast that energy must be absorbed or delivered. This capability is required on a real-time basis to match demand and control the ramp up or down of the energy supplied by renewable technologies.

Shifting cloud cover and changing power loads for distributed grid generation and consumption results in minute-by-minute variation in power surplus or deficit. These surpluses or deficits can be absorbed or supplied as needed by supercapacitors.

The XLM Supercapacitor Module from Eaton can be wired in series and parallel configurations to meet application requirements; this includes voltage levels, power charging and discharging needs (kW) and bulk energy storage requirements (kWh). The XLM Module enables high power density and uses environmentally friendly materials resulting in RoHS compliance. Supercapacitor modules offer millions of charge/discharge cycles regardless of depth of discharge that can result in up to a 20 year lifespan.

Eaton's XLM supercapacitor can help efficiently and rapidly balance supply and demand in distributed or decentralized

energy systems supplemented by alternative energy sources.

This supercapacitor module is a high-power, high reliability, ultra-high capacitance energy storage device. It can be used as the sole energy storage solution or used in combination with batteries to increase the life of an energy storage system and eliminate the need for replacement parts and batteries. Having the right power system helps improve return on investment in alternative energy applications.

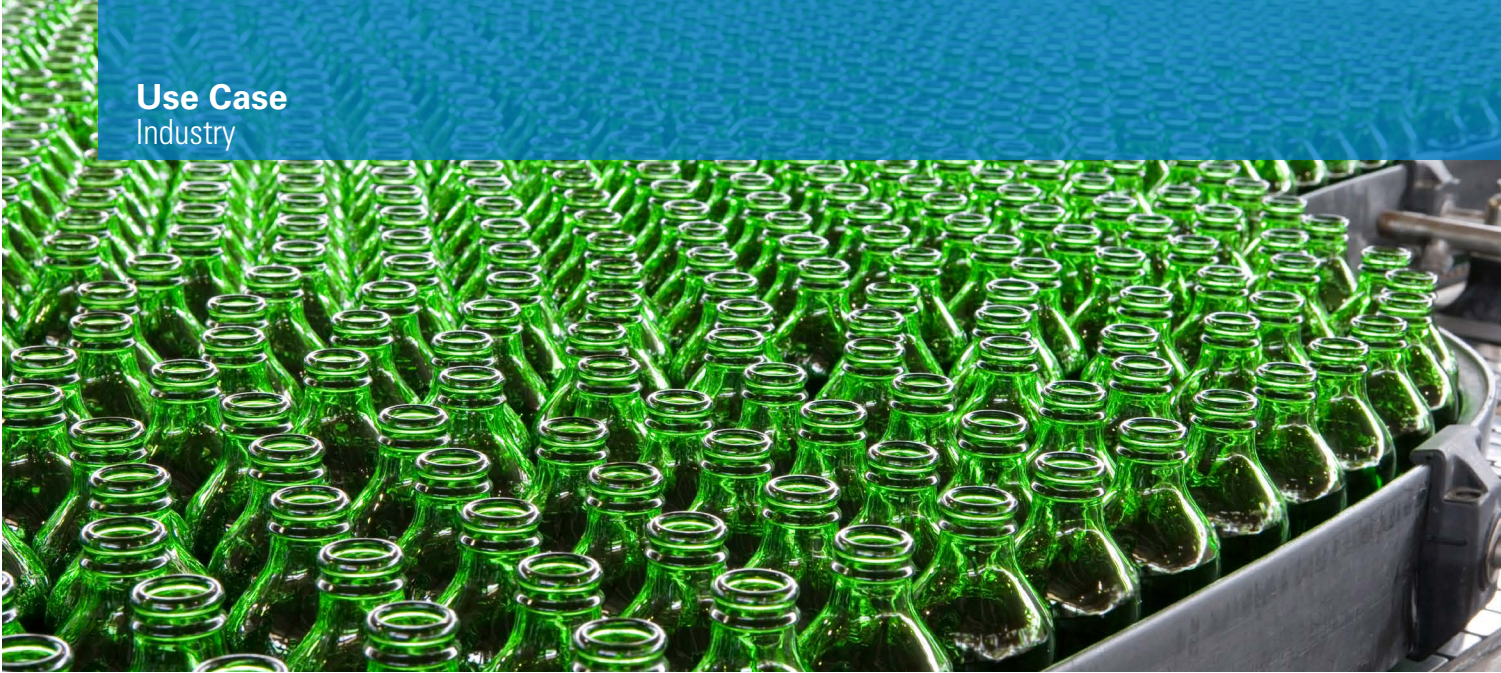
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Use Case Industry



Keeping Industry Moving with Eaton



A power loss, even for milliseconds, can cause hours of downtime with the potential to cost a manufacturing facility millions of dollars in lost productivity and scrapped work-in-process inventory, a reality that many facility owners and operators face. To protect an industrial facility from common power quality problems and blackouts for even the shortest period of time, Eaton has developed the [XLM-62](#) supercapacitor module. This is an ideal, reliable solution for applications in manufacturing and infrastructure projects, as well as for applications where traditional battery backed solutions cannot be used, are expensive or unreliable.

During a brownout, power spike or blackout – when the main electrical power is lost or unstable – the XLM-62 module is able to react instantaneously. This immediate backup is critical to prevent equipment from stopping and to protect irreplaceable data – allowing the system to ride through power quality problems and protect

operations until the utility power returns or a longer-term backup solution, such as a generator or fuel-cell, can be brought on line.

A short runtime backup power solution has traditionally meant high-maintenance batteries, or a less efficient mechanical flywheel with the potential to need additional floorspace to meet the power needs of the application. The XLM-62 supercapacitor module offers an energy storage solution that is highly reliable, economical and maintenance free. With up to a 20 year lifetime and operating ambient temperatures from -40 °C to +85 °C, the XLM-62 can be installed in virtually all indoor or outdoor locations and in just about any climate. The resulting lower infrastructure and operating costs, and greater scalability of the supercapacitor module, manufacturers receive an excellent return on investment. Eaton's supercapacitors use environmentally friendly materials and are Reduction of Hazardous Substance Directive (RoHS) compliant.

Powering the brewery

A large global brewery recognized these benefits and installed two 250 kW voltage sag ride through protectors at one of their new bottling facilities with Eaton's XLM-62 supercapacitor modules as the backup energy source. The inherent unreliable and unpredictable grid power required high availability backup power due to the frequent power quality issues. Due to the location of this facility, a system with very low ongoing maintenance was highly desirable as well. The capability to operate in wide operating temperatures also influenced the decision to integrate the XLM-62.

Having the right power backup can save a manufacturing facility lost time, sellable inventory and millions of dollars; a fact that this brewing company has witnessed firsthand. Eaton's XLM-62 supercapacitor modules are the hidden power behind industry.

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Use case Frequency regulation



Providing grid resiliency with supercapacitors



A long standing challenge faced by electrical utilities is balancing the supply, or generation, and the demand, or load, when transmitting and distributing electrical energy across connected and isolated grid systems. This balance ensures grid reliability and stable voltage frequency. The risk with a gap of supply versus demand is dropping frequency which can cause grid operators to start load shedding to protect generation assets as the stress increases. When this gap is larger, load shedding is not sufficient which overstrains assets forcing plants to be shut down for protection, resulting in cascading power outages. Conversely, where instantaneous supply is higher than demand, this power could be dissipated as heat via condensers or load banks

to keep the voltage surge or increase in frequency from harming generation assets or other connected elements.

Due to the constant variability of grid demand, balancing can be very difficult. However, there are systems and measures that can be implemented. Traditional generation assets, such as fossil fuel, nuclear or hydroelectric plants with spinning turbines, provide inherent inertia to help provide some frequency regulation. There are also other ancillary services that can be dispatched for longer term supply gaps to ensure reliable and quality power.

The increase of grid tied, distributed renewable generation and the retirement of traditional plant assets reduces the inherent grid inertia, introducing increased risk to grid reliability and resiliency on the supply side. Furthermore, the renewable sources can be unreliable, such as scattered cloud cover over photovoltaic arrays or varying weather conditions for wind turbines¹.

Energy storage systems are being deployed to help respond to imbalances in grid supply and demand. The [XLM supercapacitor module](#) and [XLR supercapacitor module](#) can provide ultra-fast response due to the low ESR construction of the XL60 supercapacitor cells. This feature, along with their maintenance free nature, helps ensure the energy storage system is always available for ultimate resiliency.

Eaton's supercapacitor modules are capable of millions of charge/discharge cycles with no replacements or maintenance which can provide up to a 20-year lifetime depending on operating environmental conditions. The physics of supercapacitor construction allow for minimal effects on lifetime and the depth of discharge, from near full discharge to smaller, limited cycles.

The high power density (kW/L) can help reduce the footprint of the energy storage required to meet the needs of the grid

when compared to battery or kinetic energy storage. This power density can help reduce capital expenditures by reducing the amount of energy storage oversizing needed to meet the instantaneous power required for improved grid reliability.

With the deployment of energy dense lithium-ion battery systems for longer term services and operational reserves, supercapacitor modules can be installed in parallel to reduce the number and intensity of very high peak discharge currents that can rapidly degrade the lifetime of the batteries. By extending the life of batteries with supercapacitor modules, operational expenses and maintenance costs are reduced for the transmission and distribution assets.

Eaton's XLR and XLM supercapacitor modules provide an ultra-fast response, long lifetime, maintenance free and cost-effective energy storage as a sole solution or by augmenting battery systems to help ensure a balanced and resilient utility grid.

[1 Eaton renewable firming use case](#)

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Use case
Data center



Eaton keeps your data center online for the long term



As computing power demands increase, the need for “always on,” reliable storage is critical. The challenge for any data center isn’t just to create the server to store the data, it’s also to keep the server running at all times to avoid any data loss or emergencies for customers, even during a power outage. In doing so, data center operators have elected to require local power generation to ensure long term non-grid power supply.

With local generator or fuel cell power generation tied into the power distribution scheme, the backup time required of the UPS energy storage reduces from hours or minutes to seconds. This time measured in seconds is to bridge the gap from when utility power drops to when the long term, local power generation is ready to handle the load requirements.

UPS backup power solutions have traditionally meant low cost, high-maintenance batteries, or a less efficient mechanical flywheel with spontaneous, unplanned maintenance events. Recent

developments in various battery chemistries offer higher energy dense products, but still have periodic maintenance and face restrictions on the environments in which they can be installed. The higher energy density may not be advantageous for the short backup times that are more frequently being requested.

Flywheels market similar features as supercapacitors including low annual maintenance and high-power density. But, reports have been made about the immense costs of unplanned events requiring lengthy repairs.

Eaton’s XLM supercapacitors offer a backup power solution that is highly reliable, lightweight, and virtually maintenance-free. With a low total cost of ownership and greater scalability, data center operators get a greater return on their assets.

The XLM module features high power electrochemical double layer capacitor (EDLC) cells paired in series along with

proprietary materials to match front terminal batteries that OEM and service technicians are familiar with.

Eaton’s supercapacitors run on lifetimes up to 20 years. With wide operating temperatures from -40 °C to +85 °C, data center owners and operators reduce their cooling costs by raising their average ambient temperature. Not only does this reduce cooling energy costs but also the potential to reduce overall upfront HVAC equipment costs.

The XLM supercapacitor module helps keep data centers in operation without the loss of data or damage to equipment caused by power quality problems. Integrated with a UPS, the XLM reduces the total cost of ownership, from floor space and weight factors to reduction in operations and maintenance costs. The XLM is an optimal energy storage product for individuals desiring compact, low-maintenance bridge power.

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