



1 MW Super Capacitor Hybrid Power Generator

Stand Alone Capable Operation but
welcomes input from Solar and Wind





10 kWh HSCG Module

CEG Super Capacitor (CEGSC) Power Generation and Storage Systems not only dramatically lower operating costs when configured to provide primary power using the grid as backup, but are extraordinarily effective back up systems when deployed in that role. They provide an enormous upgrade to both fossil fuel and conventional battery-based generators as they are quieter, lighter, smaller, more durable, require virtually no maintenance, their batteries last much longer and reduce fuel cost by as much as 90%. In addition, HSCG Batteries make these systems the lightest available so they can more easily be placed on rooftops.

These benefits are achieved by integrating proprietary HSCG Batteries into CEG's broad range of energy generation and storage products creating an entirely new performance standard. The new CEGSC Power Systems combine the durability and functionality of previous systems with substantively enhanced performance achieved by the addition of these innovative batteries. The following table highlights differences among the various options.

| PERFORMANCE COMPARISON | HYBRID SUPER CAPACITOR GRAPHENE+ BATTERIES VS CONVENTIONAL ENERGY STORAGE | | | |
|-----------------------------|---------------------------------------------------------------------------|--------------------------------|-------------------------------|-------------------------------|
| Function | HYBRID SUPER CAPACITOR GRAPHENE+ BATTERIES | Standard Super Capacitors | Lithium-ion (general) | Lead Acid Batteries |
| Charge Time | 3 to 6 Mins | 20 - 30 Mins | 1 to 2 Hrs | 4 to 8 Hrs |
| Charge/Recharge Life Cycles | 1,000,000 | 1,000,000 | 3,000 to 5,000 | 200 to 300 |
| Energy Discharge | Programmable! | FAST | SLOW | SLOW |
| Voltage | 2.7 V or 4.2 V | 2.7 or 3.0V | 3.6 - 3.7V | Many |
| Energy Density (Wh/kg) | Phase 1: 200 to 240, Phase 2: 230 to 330 | NA (Fast Discharge) | 150 - 250 | 40 to 50 |
| Power Density (W/kg) | > 20,000 | 18,000 | 150 to 250 | < 100 |
| Farrads / Capacitor | 100,000 | 3,000 | NA | NA |
| Efficiency | 99% | 99% | 85% - 95% | 60% - 75% |
| Charge Temperature | -40° to 60° C (-40° to 140° F) | -40° to 65° C (-40° to 149° F) | 0° to 45° C (32° to 113° F) | -20° to 50° C (-4° to 122° F) |
| Discharge Temperature | -40° to 60° C (-40° to 140° F) | -40° to 65° C (-40° to 149° F) | -20° to 60° C (-4° to 140° F) | -20° to 50° C (-4° to 122° F) |
| Risk of Fire | NO | NO | YES | NO |
| Shipping Restrictions | NO | NO | YES | NO |
| Hazardous Components | NO | NO | YES | YES |
| Performance Fade | NO | NO | YES | YES |
| Depth of Discharge | 100% | 100% | 80% | 50% - 75% |
| Cost/kWh | To Specifications | \$1,400 | \$200 | \$100 |

= 0 # 8 " batteries

- Recharge in as little as three minutes versus hours for lithium-ion and lead acid batteries
- Up to 1 million charge / discharge cycles (typical of capacitors) versus 3,000 to 5,000
- Virtually no fade in performance for 1 million cycles (typical of capacitors)
- Programmable rate of discharge - as slow as conventional batteries, as fast as capacitors or anywhere in between
- 33 times more farads per capacitor than standard super capacitors
- Operate in extremely cold and extremely hot conditions
- Free of hazardous materials, no end of life toxic waste
- No transportation restrictions versus batteries with risk of fire
- 100% depth of discharge (lithium-ion can require twice as many batteries)
- Sold with integrated proprietary Battery Management Systems

Dramatically Reduces Fuel Consumption While Producing Pure Sine Wave Power!

Power is often generated by inefficient fossil fuel generators which run constantly, regardless of the power consumed. This creates noise, pollution and dirty power which damages equipment and electronics. With a generator running continuously, maintenance and fossil fuel costs are significant and often exorbitant.

In contrast, power generated by CEG renewable energy systems is drawn from proprietary Hybrid Super Capacitor Graphene+ Batteries which summon generators (typically only 1/3 of the time, and often not at all) only when batteries need charging, dramatically reducing fuel and maintenance costs. Even greater savings are realized in areas where fuel deliveries are challenging.

Energy stored in batteries is fed through inverters to produce clean power, free from voltage spikes, drops, ripples and noise.

Stand Alone Capable operation but can accommodate input from solar or wind!

System Components

- Two MSZI 3880 modules for parallel redundancy to charge batteries when generative is active and to create a virtual grid when the generator is inactive
- MSXI Grid Tied Modular Inverter between batteries and grid for bidirectional flow capability
- MSXI 1367 Power Shifting Module (15 modules/MW)
- Proprietary 1,000 kWh Hybrid Super Capacitor Graphene+ Batteries
- ATS switches between generator and MSZI 3380 for virtual grid
- Four 280 kW Diesel Generator Groups
- 1,200 kVA Step up Transformer Pocket Station

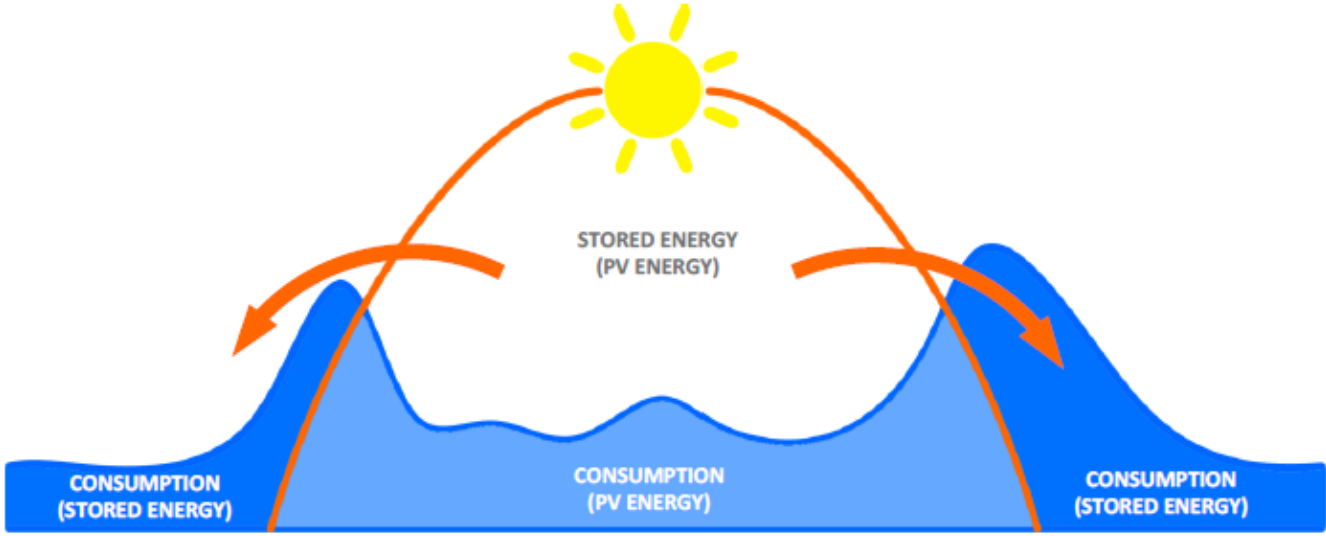
PROPRIETARY CHARGE CONTROLLER - CEG's charge controller optimizes battery efficiency via a unique algorithm that monitors and controls the entire system and receives automatic software upgrades via Wi-Fi or via Onclave's Secure IoT® solution.

INTEGRATED PROPRIETARY POWER FACTOR UNITS - CEG Hybrid Power Generators incorporate proprietary Power Factor Capacitors which supply power to meet demand surges, thereby enhancing efficiency and prolonging battery amp hours.



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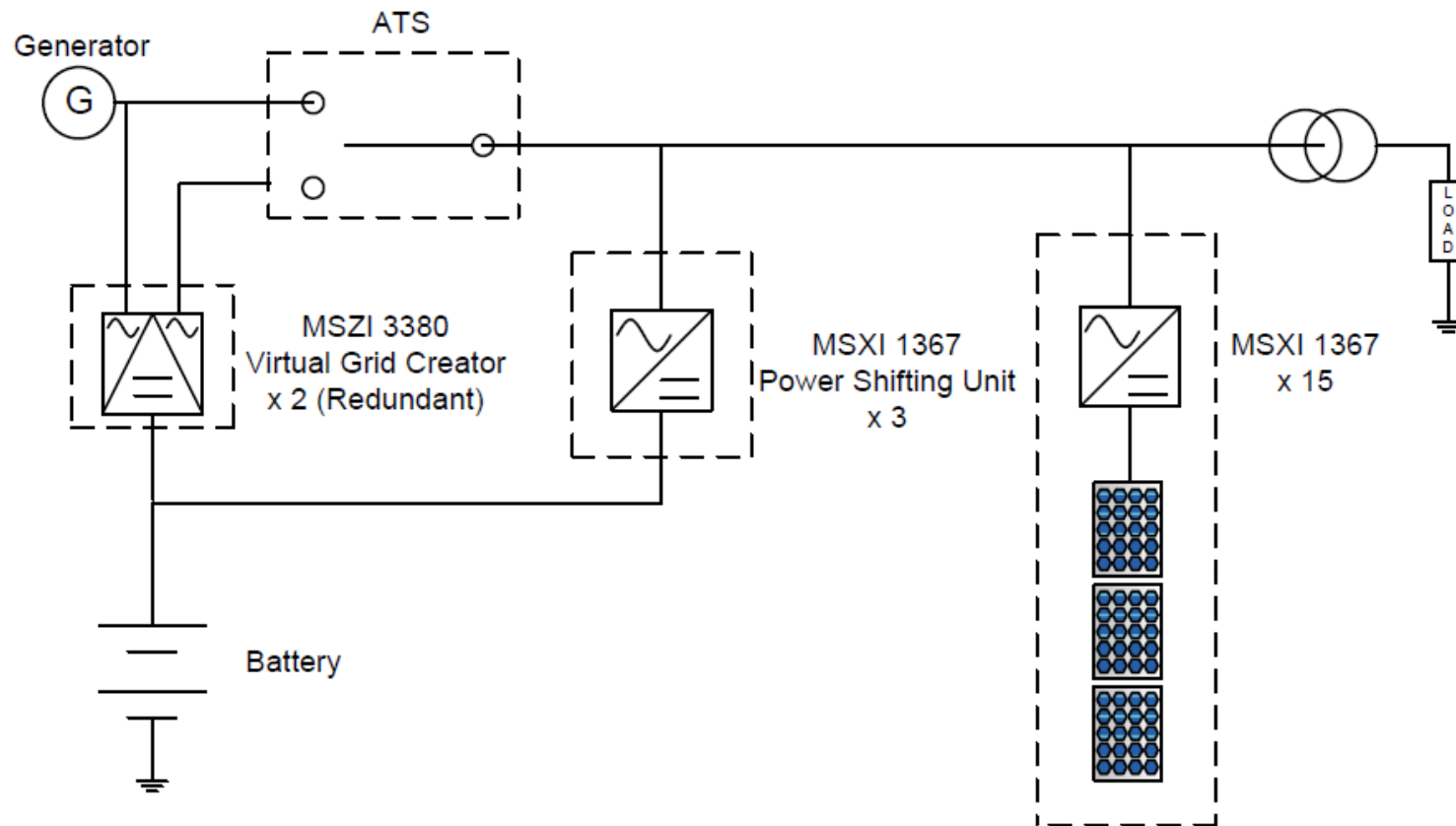
Catalyst Fuel Reduction System



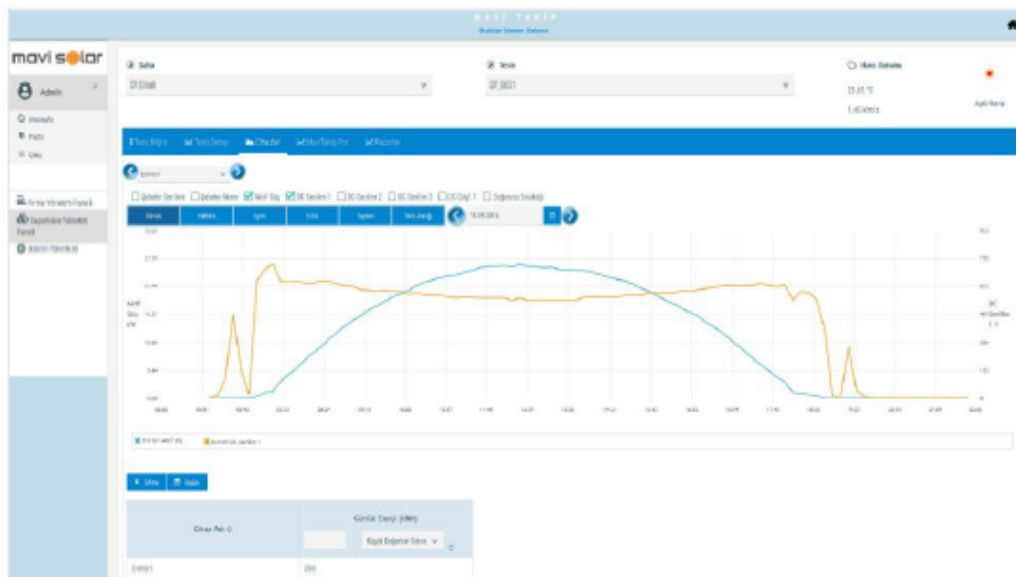
Typical PV Production & Consumption Profiles and Power Shifting Property

Excess PV Energy is stored in HSCG Batteries for later use

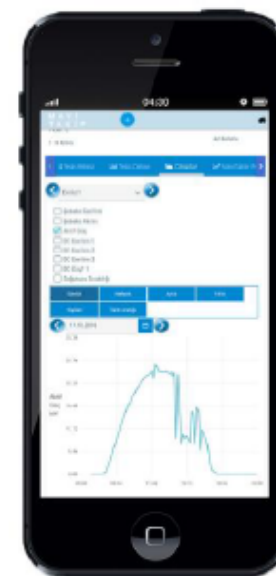
2. Single Line Diagram



Data Logger and Remote Monitoring System

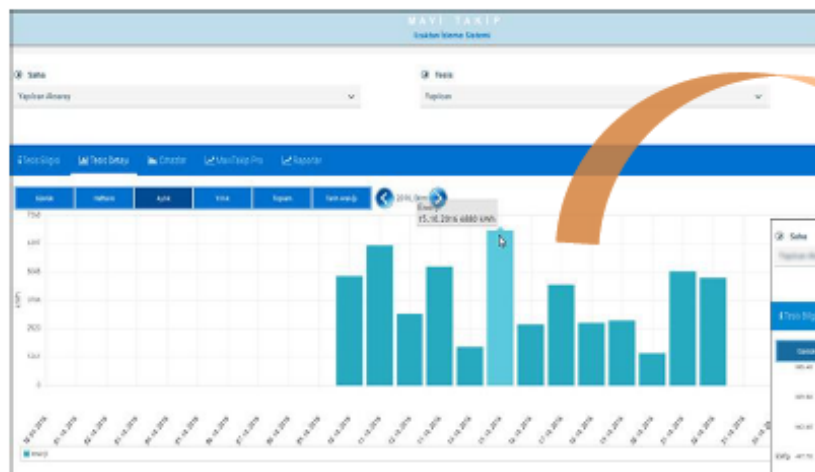


Our customers can follow their plants from all over the world 7/24 via their personalized password and user name.



Compatible with every mobile platform thanks to its Responsive architecture

Data Logger and Remote Monitoring System

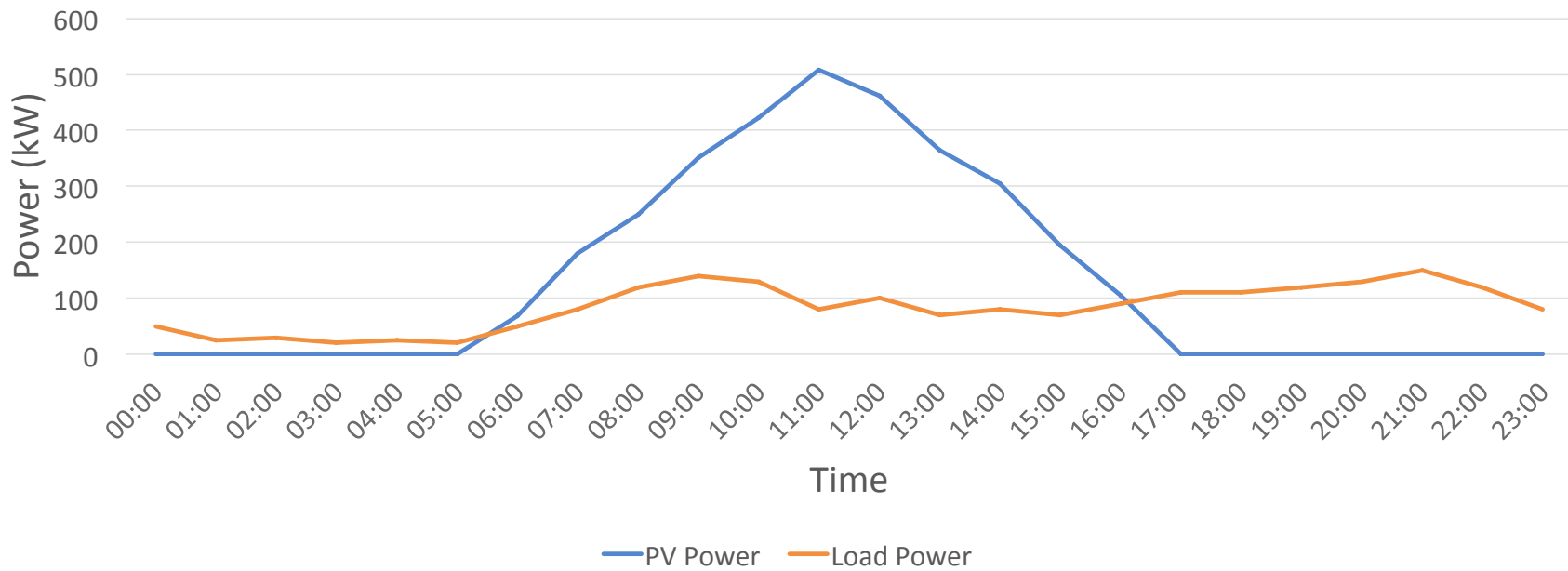


Thanks to interactive graphical feature, if the user clicks on a column given in a bar chart, production data is shown automatically

Daily, Weekly, Monthly and Annual data of PV ESS can be monitored between specified dates from monitoring interface.



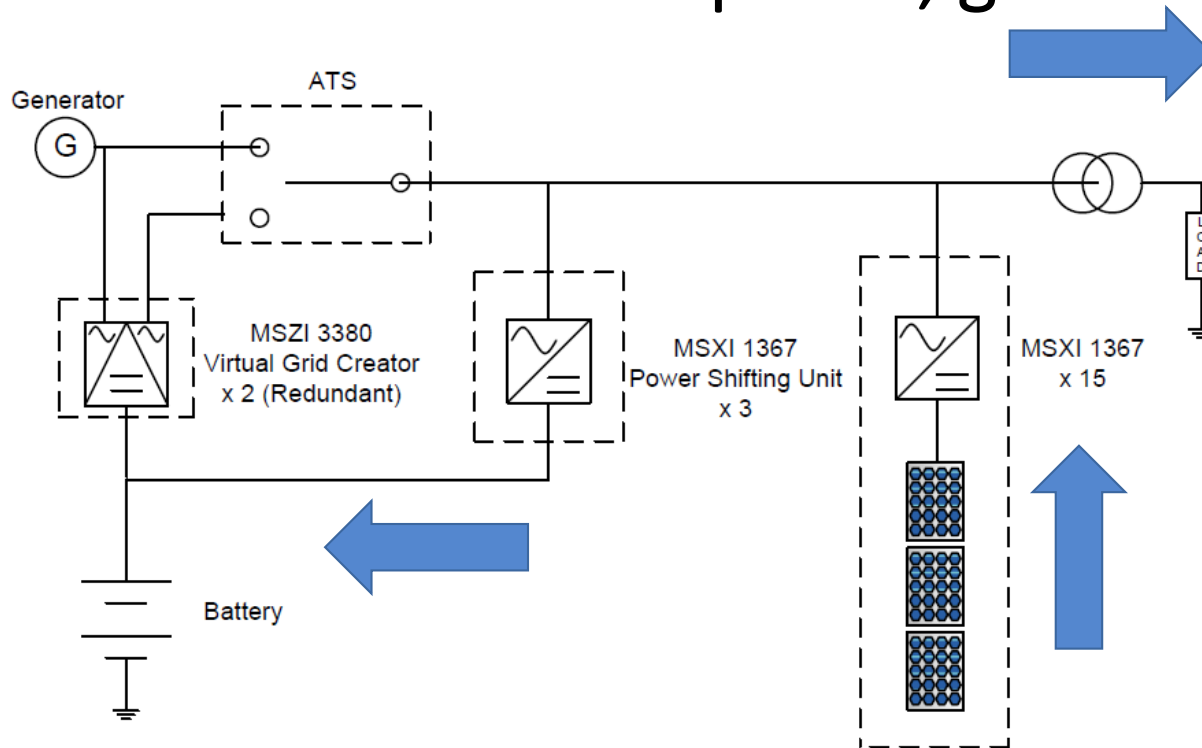
PV Power and Load Power in a Typical July Day



05:30 – 16:30: Battery Charging (PV Power > Load Power)

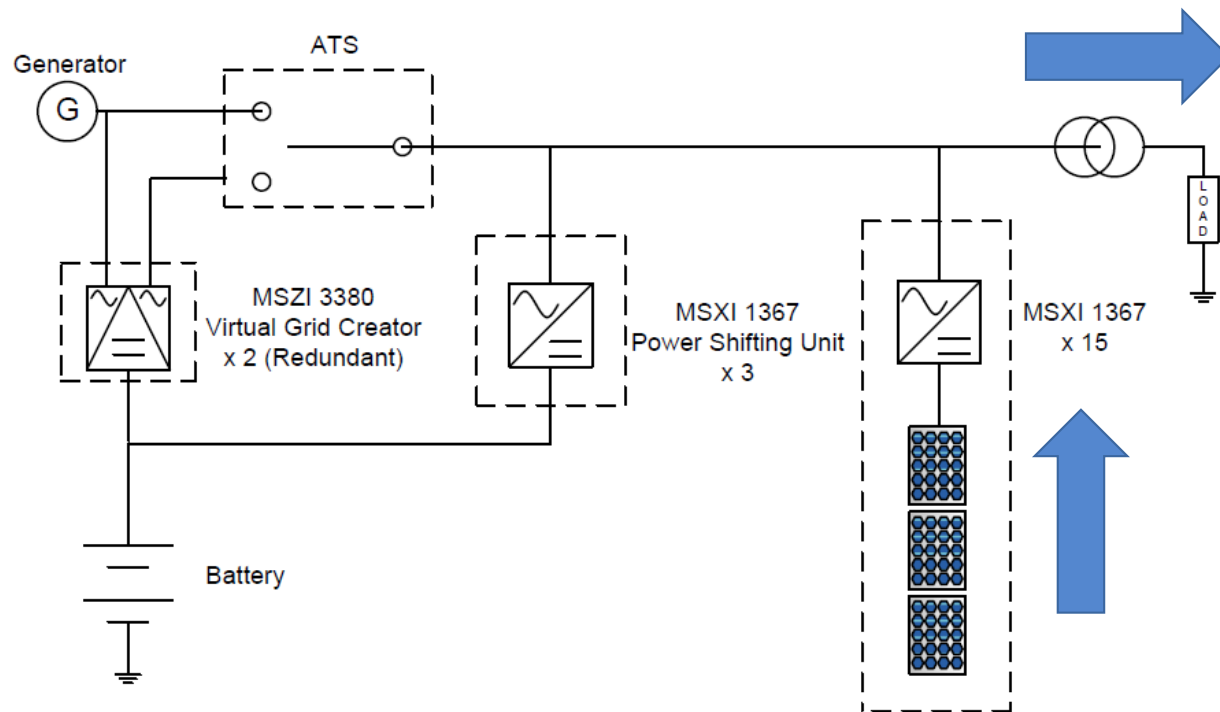
SCENARIO 1-CHARGING

PV power is more than load power, genset OFF



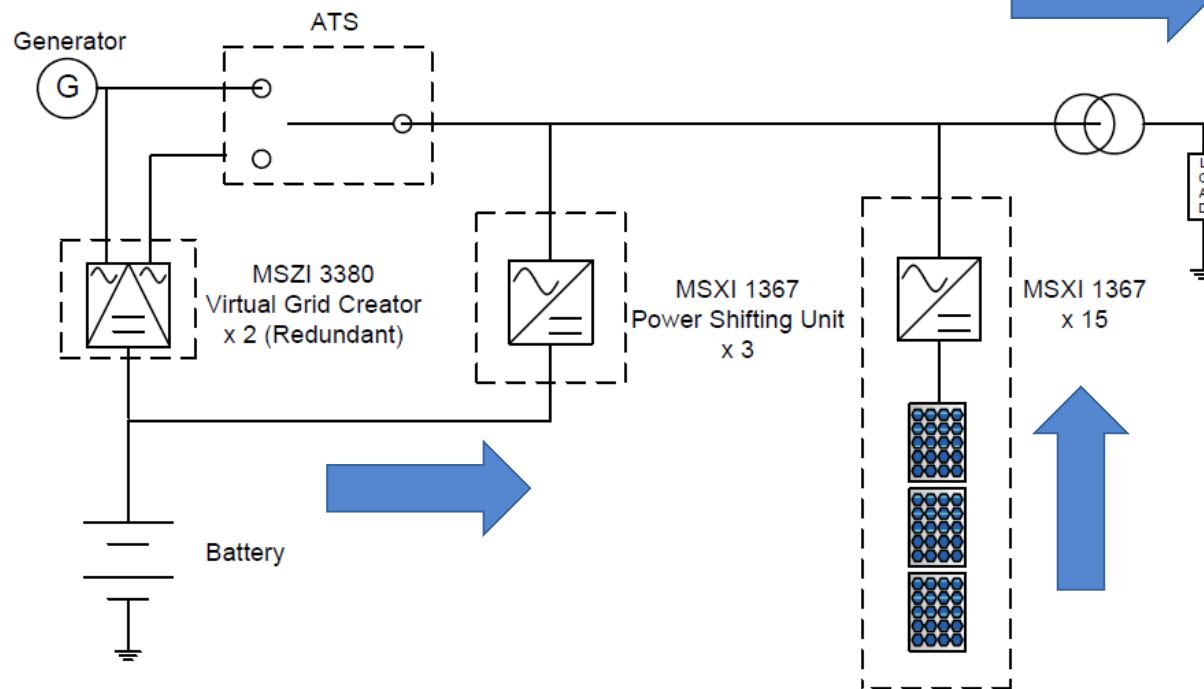
SCENARIO 2-END OF CHARGE

PV power is more than load power, genset OFF



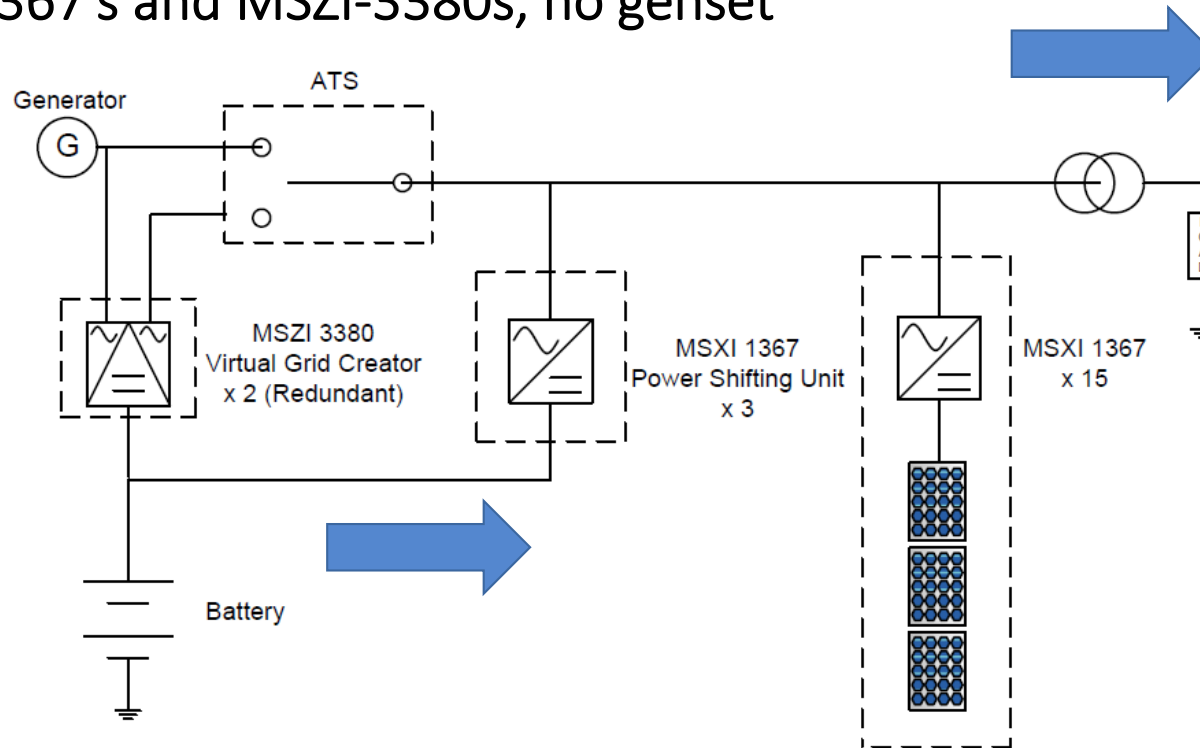
SCENARIO 3 - PHOTOVOLTAIC + BATTERY

PV power is less than load power, genset OFF



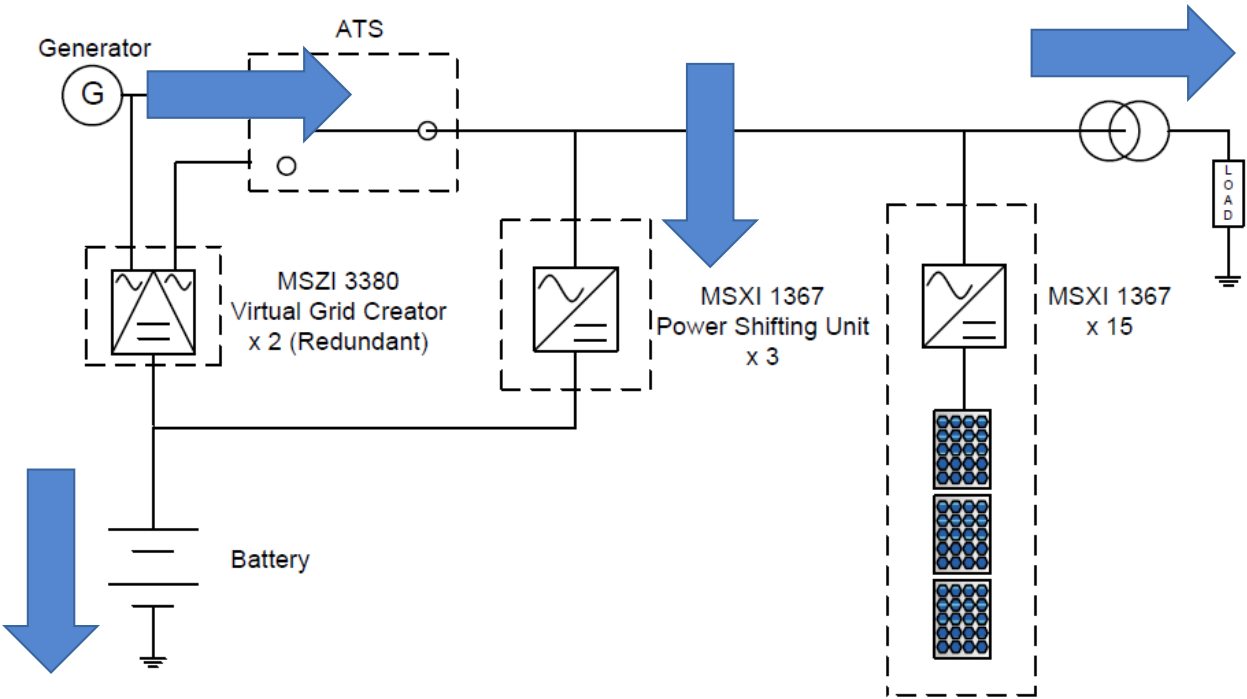
SCENARIO 4-BATTERY OPERATION

no PV power , up to 250kW load power supplied by MSXI-1367's and MSZI-3380s, no genset

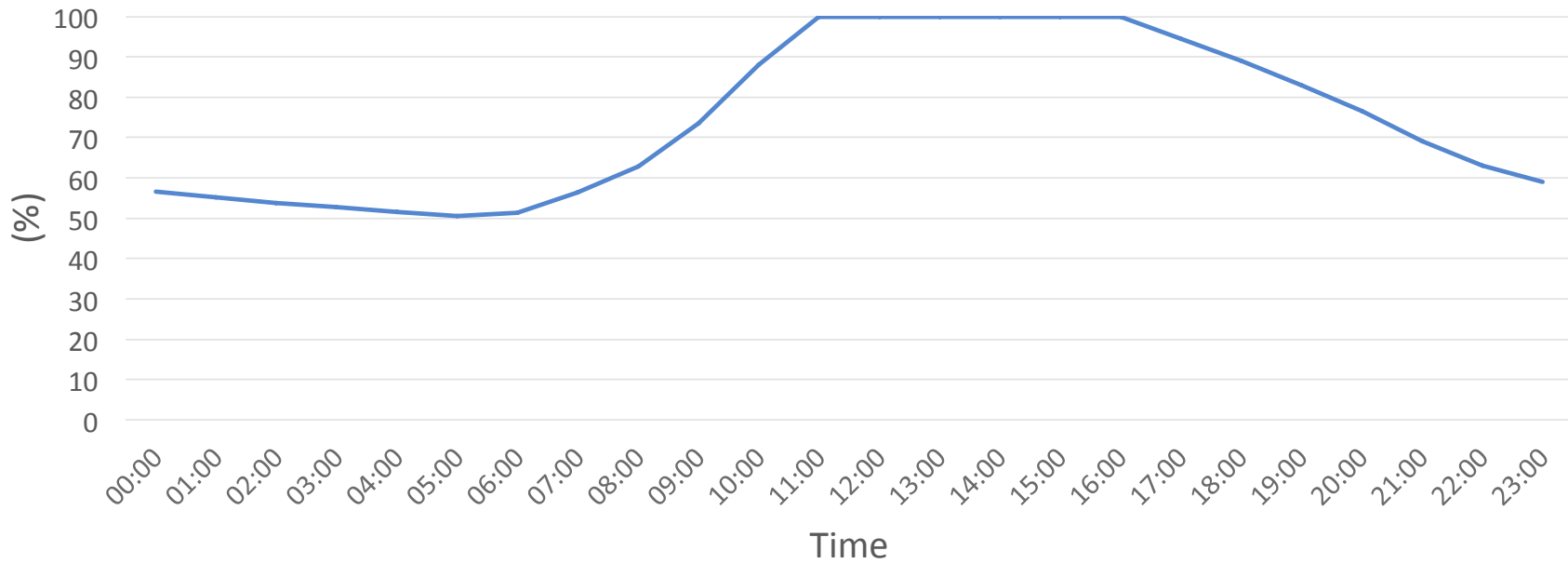


SCENARIO 5-GENSET OPERATION

no PV power, batteries discharged or load power more than 250kW
genset operates at nominal power, batteries charged by the genset



Battery Average State of Charge



Average State of Charge of a 1,000 kWh Battery



Project Modeling

The unique capabilities of HSCG Batteries greatly expand options for integrating CEG power systems with complimentary energy sources. Generators can be significantly downsized, solar and wind can be utilized more effectively and dependence on the grid's expensive power can be reduced. Specific examples include the ability of HSCG Batteries to charge so quickly that they require only modest generator run time to provide power over extended periods, and their expanded storage capability permits solar arrays to provide more kilowatt hours from a smaller array. More efficient use of solar and minimal use of the generator is especially compelling, as it both reduces the cost of generator fuel and eliminates the consequential tainting of the renewable energy label on those projects.

Integration with more extensive solar arrays can be taken a step further where the space and commitment to renewable energy exist. Enhancing solar arrays with CEG's proprietary HSCG Batteries can actually provide inexpensive primary power 24/7 while using the grid as backup. The dramatically greater life of HSCG Batteries reduces maintenance costs and provides significantly more robust returns on investment. This permits an affordable, consistent supply of energy and an attractive economic model.

Specifically, CEGSC Systems assure that all energy generated by the solar array is stored in CEG's innovative HSCG Batteries, to be distributed under user defined

conditions. Optional last resort generators contained in some CEG systems keep fuel consumption to a bare minimum as they operate a fraction of the time, storing energy in mere MINUTES in fast charging HSCG Batteries. This completely, or virtually, eliminates power generation from any source other than renewables.

This flexibility in design enhances operation. CEG's proprietary control algorithms interact seamlessly with solar, wind and the grid and can be monitored remotely via the web or CEG app with a custom username and password. This permits the operator to monitor individual batteries, each solar panel, each inverter, the charge controller, fuel tank level and generator performance. They can also track incoming power and outgoing power as well as diagnose issues in real time with available alerts for loose connections, grounding faults, short circuits and over circuit faults.

CEG provides incredibly sophisticated yet durable systems, turnkey solutions, robust technical support, project modeling, site evaluations, systems engineering, product commissioning, parts, warranties and service agreements.

Because CEG customizes each system, sustainable applications are assured that their needs are not compromised in favor of one size fits all models. Tailored solutions incorporate operating needs, backup requirements, grid dependability, climate, space constraints and budgets. Project modeling starts with CEG's *Power Consumption Questionnaire*.



Company Overview

The inevitable ascension of renewable energy has now occurred, fostered not only by the emergence of innovative, economically attractive technologies but by the ability to connect those technologies to the appropriate customers. Incentive driven enterprises will be replaced by companies featuring both technologies and products that are financially and environmentally attractive and are supported by marketing and sales platforms that will let them access their appropriate markets. Those are the companies that will complete the transformation of renewable energy from a subsidized peripheral source of power into a mainstream supplier of overall energy needs.

Catalyst Energy Group (CEG) is precisely that combination. Possessing a large multi-national manufacturing capability, a cutting edge design and engineering laboratory and a sales and marketing team with international reach, CEG offers an innovative, uniquely effective and adaptable array of energy generation and storage products that feature unmatched performance in extraordinarily durable configurations. CEG's decades of manufacturing and engineering capabilities provide the capacity to accommodate the needs of large multi-national customers while its creative design laboratory relentlessly integrates refinements and innovation into each of its products.

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The effectiveness of energy generation and storage systems is determined by some simple math. How efficiently does the product accumulate and store power and for how many kW or MW hours can it provide that power? In terms of kW hours, many of the smaller, and sometimes mobile "solar" units available, are actually conventional fossil fuel generators disguised as renewable products and too often the larger Megawatt units are one size fits all ponderous devices that output very few hours of stored energy. CEG products are different. In every configuration, they provide the vast majority of their power from renewable sources and in larger sizes can be customized to specifically address the needs of the customer.

CEG systems range in size from 3 kW to 1 MW and are available in both mobile and stationary configurations with proprietary firmware capable of optimizing functionality to meet each customer's operating conditions. These systems don't function simply as a conduit, accumulating power and then transferring that power, but as a legitimate storage facility as gathered energy is always sent to batteries initially and then distributed at times required by the customer. All products are engineered as plug and play, are designed to accommodate new technologies as they become viable and can be daisy chained to meet demand of any size.

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