



Solar Grid Storage

Overview & the MD Konterra Project

MADRI December 2013

Growth Challenges = Opportunity

- ✓ Increased penetration of intermittent solar power and other RE causes utility grid operators to search for additional power balancing technologies
- ✓ Consumers are increasingly demanding emergency backup for power outages
- ✓ Fierce competition in the solar and RE industries drives companies to find ways to lower costs and provide additional benefits

Financed Storage = Cost Reduction, Emergency Power, Grid Stability



Delivering Affordable Storage

Solar Grid Storage is at the forefront of delivering affordable energy storage for commercial solar installations, government entities, and electric utilities

We build, finance, and operate energy storage systems (PowerFactor™)

- A complete PowerFactor™ system including inverter and battery is installed alongside solar energy systems
- Solar Grid Storage finances the PowerFactor™ systems separately from the PV system
- Solar Grid Storage maintains and operates the PowerFactor™ systems for 10 years
- Revenues from grid ancillary services provide the revenues for financing allowing Solar Grid Storage to offer “inverter services” to the PV customer at lower cost than buying an inverter



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Grid and other Benefits

PowerFactor™ Systems Benefit Multiple Parties

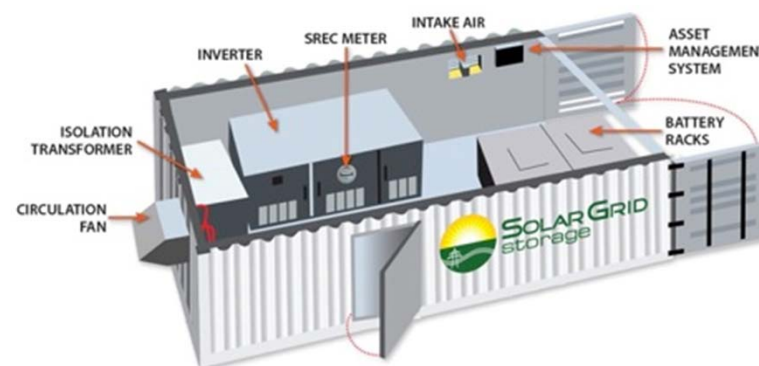
Solar Developer - offers the inverter with multiple uses dramatically *increasing the value* of the system and *differentiating* them from competitors

Host/Customer - reduces PV system cost and includes **backup power** (UPS quality) that enables solar to work *even during power outages*

Utility – provides local distribution system benefits including voltage and VAR control; Solar Grid Storage systems are fully SCADA enabled

Grid - grid operators can use storage for an array of ancillary services – Solar Grid Storage systems are AGC enabled

PV Industry - *accelerates solar deployment*



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Grid Benefits – Currently available

Utility controls DG storage systems as a single or a consolidated resource

- Provides real time Smart Grid data
- Provides ramp rate control for PV and/or distributed generation systems – can turn an intermittent solar resource into a dispatchable system
- Central control provides the utility the option for
 - regional fast responding power balancing,
 - grid wide fast power balancing
- Reduces pressure from widespread grid outages (*customers have uninterrupted power albeit limited capacity*)



Grid Benefits – not yet realized

- Central control for spinning reserve; and black start capability
 - Trade grid mass/momentum for faster responding technologies
- Local Voltage and/or VAR control
 - Faster and less wear and tear than voltage tap changers
 - Market based service?
- Optimizes circuit voltage by raising/lowering unique customer voltage
 - Annual energy reductions of more than 3% of all energy on circuit are possible, depending on the feeder type and deployment strategy
- Buffers EV charging and allows for fast DC-DC charging.
- Allows for micro-grid operation in combination with substation based assets or in isolation.



Key Policy Issues for Storage

- Ensure policies encourage customer sited storage with solar/wind
 - shared use of power conversion equipment
 - Backup power (most outages are in final mile)
- Allow/encourage storage systems to provide grid functions
 - Fast nature of storage is a valuable asset to the utility grid
 - Allow aggregation of small systems and low barrier; PJM good example of 100kW but can aggregate small systems
- Markets encourage best use of technology
- Don't worry about net metering
 - Storage is not a generator – can only store solar/wind for later dispatch or trade off peak power for on peak
 - Easy to include limits in net metering policy -- e.g. no export to the grid beyond capacity of qualified system or total energy. Annual overage paid at wholesale rate is a good policy regarding excess production

Standby and other punitive charges will encourage customers to cut the wires



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Sample Project - MD Game Changer

Solar Grid Storage business model is to work primarily with solar project developers and provide “inverter services” instead of a purchased inverter

- State of MD – MEA was looking for “game changing” technologies to help advance solar – State provided grant funds of \$250k
- MD is a leader in solar installations – program designed like NJ SREC but a few years behind. 9th largest solar state with market growth of 227% between 2011 and 2012 (*IREC Trends Report 2013*)



Konterra – Real Estate Developer HQ

Local commercial/mixed use real estate developer in Laurel MD

- Multi-story office building
- Cash deal for Standard Solar – Entered into Inverter Services Agreement with Solar Grid Storage
- Carport canopy PV from SolAire 400kW
- Two PowerFactor 250's from Solar Grid Storage (500kW ac capacity)
- 300kWh battery from AllCell (L-ion air cooled)



Project Install & Commissioning

- Interconnection completed May 2013 (no hiccups with utility – BGE)
- PV Project construction started June 2013; PowerFactor Systems delivered to site August 2013 – ready for PV DC connections and AC connections to grid and critical loads circuits
- System started producing PV power in late Sept 2013
- PowerFactor system expected to be operating in PJM markets this month
- Ribbon cutting Oct. 2013 : Maryland Governor Martin O’Malley and FERC Chairman Jon Wellinghoff in attendance.
- Press:

“If you want to see the future of renewable energy in the U.S., you should check out the large container sitting next to a nondescript office building off the I-95 corridor in Maryland.”
www.businessinsider.com



Ongoing Issues – customer sited storage

- Integration of on-site existing diesel genset with PV + Storage
 - Genset must disconnect – delayed startup not compatible with battery UPS
 - Customer's generally not familiar with idea of UPS backup power – some costs to move circuits
- Evaluating customer load profile for peak demand reduction potential
- Evaluating battery ops on PV production – need to move to DC PV measurement for PPA and SRECs
 - Prevents gaming
 - Net metering not a concern
- Incentives to add storage to solar to provide backup capabilities during climate events – like solar cost of storage will come down with increased production.



Thank you

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