Eos Energy Storage

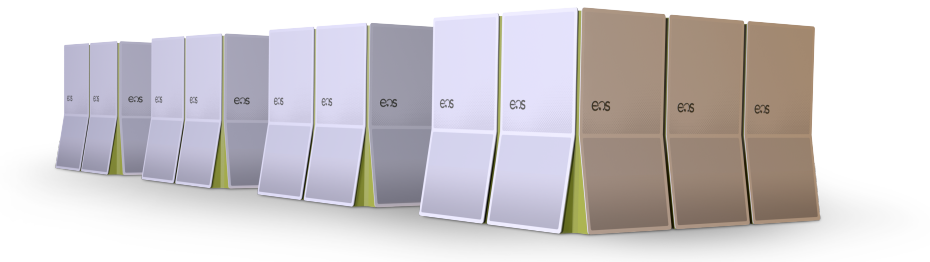
Company and Product Overview

January 2017

Eos Energy Storage Overview

The Mission

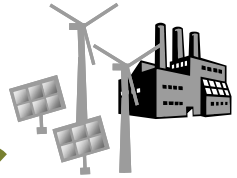
- Cost effective energy storage solutions which are not only less expensive than other battery technologies, but less expensive than the most economical alternative for the same services



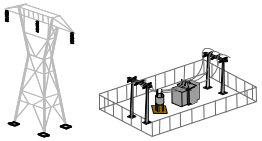
The Solution

- **Technology** – Eos' proprietary zinc hybrid cathode Znyth® sealed battery technology
- **Product** – Eos Aurora® 1000|4000, safe, long-lasting, reliable DC battery system providing 1 MW of energy, 4 hours continuously with millisecond response
- **Price** – At $160/kWh in volume, the Eos Aurora solution is the lowest cost energy storage product on the market with affordable extended warranties and capacity guarantees
- **Availability** – Taking orders with H1 2017 capacity sold out

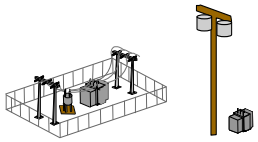
Problem: Peak Demand Drives Massive Infrastructure Investment at Low Utilization



Generation



Transmission



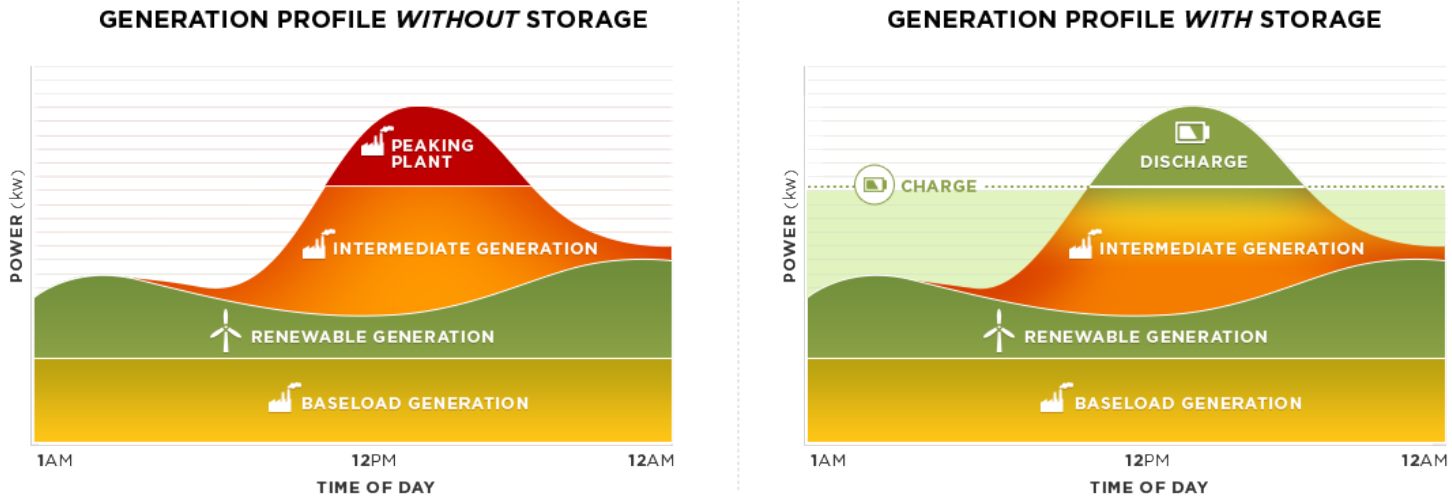
Distribution

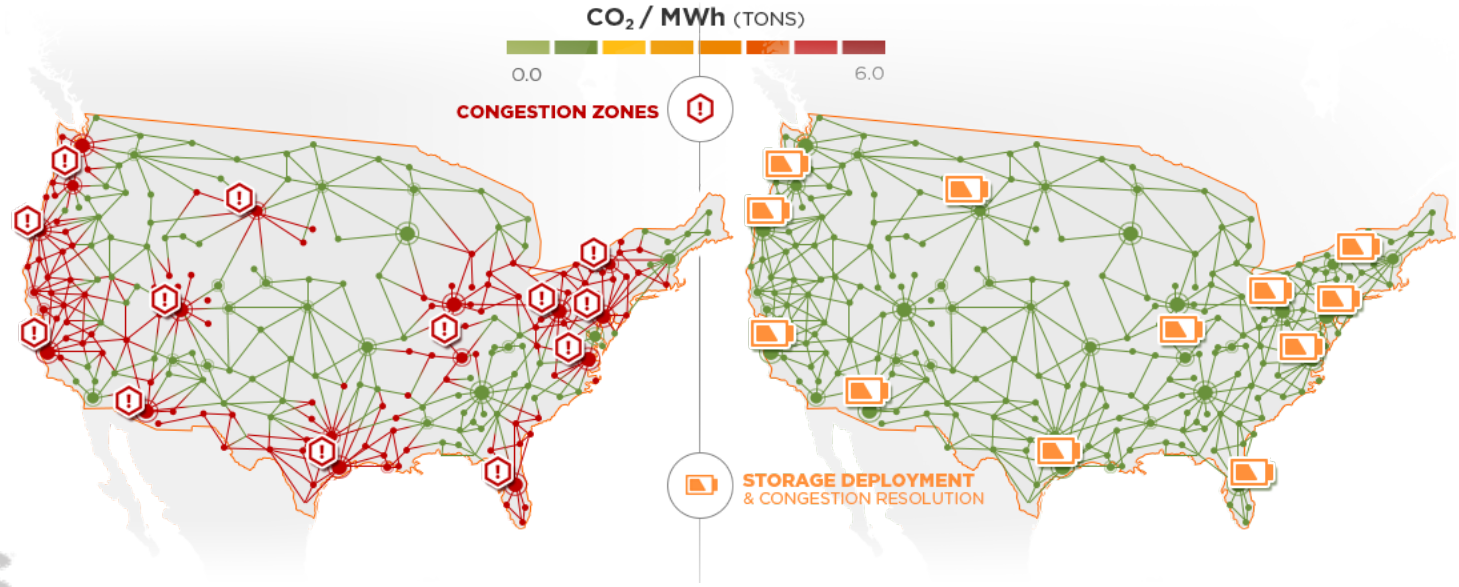
# in U.S.	17,350 plants	164,000 miles	3 million miles
Utilization (Capacity Factor)	47%	43%	34%
Projected spend 2010-2030	$505B	$298B	$582B
Projected underutilization	~$1.4 TRILLION of future US infrastructure will be underutilized without storage		

(1) The net **capacity factor** of a power **plant** is the ratio of its actual output over a period of time, to its potential output if it were possible for it to operate at full nameplate **capacity** continuously over the same period of time.

(2) Chart Sources: "Electric Power System Asset Optimization." NETL, March 2011

Solution: Eos Offers Locational Capacity to Shave Peak and Alleviate Transmission and Distribution Congestion





Eos Partnered with Global Utilities to Understand and Address the Need for Energy Storage

eosGENESIS | Detailed business case analysis, product development, testing, evaluation, pilot demonstrations and commercial roll-out

Partner with Global Utilities

nationalgrid · Enel · Exelon · ENGIE · AEP American Electric Power · conEdison · nrg · PNM

Define the Need for Energy Storage

Underutilization of grid infrastructure

Local peaking capacity needs in urban areas

Grid instability from intermittent renewables

Reliability concerns from aging infrastructure

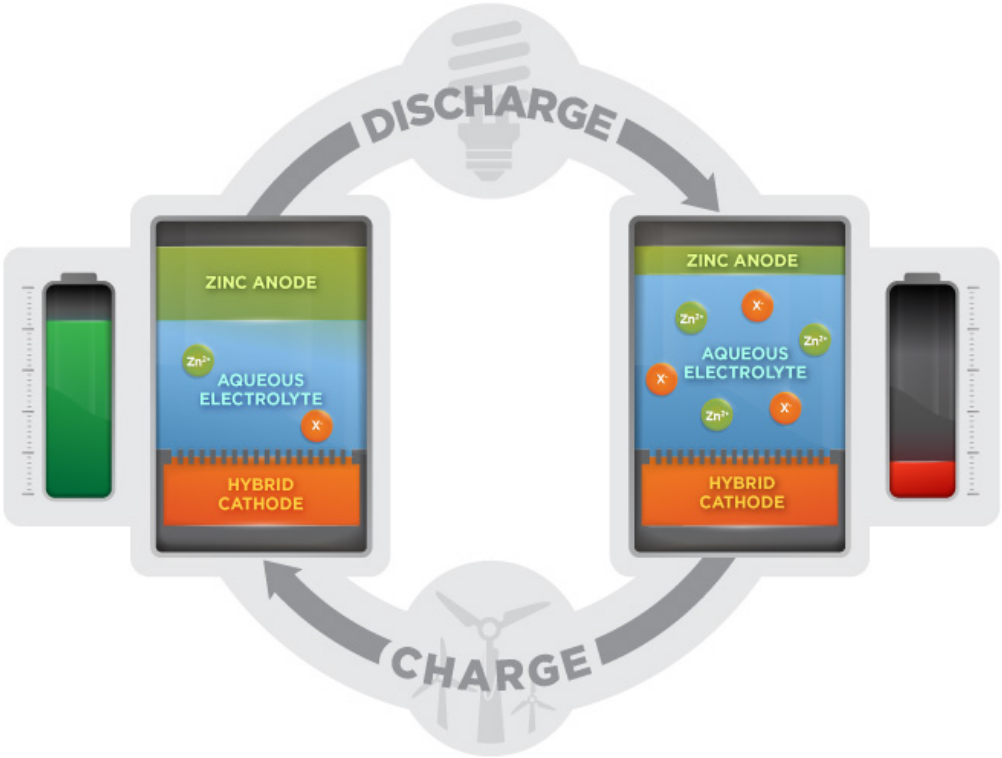
Define the Solution

4 hour energy storage for energy applications

- Low Price/kWh
- High Efficiency
- Long Life
- Safe
- Energy Dense

Znyth® Technology Overview

- Zinc hybrid cathode technology uses aqueous electrolyte and abundant low-cost materials
- Proprietary corrosion-resistant coating on current collectors enables long life
- Simple membrane-less design allows for low-cost manufacturing and rapid scale up



Environmentally friendly materials, aqueous electrolyte and bipolar electrode enable inherently safe, long lasting product

Eos Aurora® 1000|4000 DC Battery is Uniquely Designed to Meet Market Need for Energy Storage

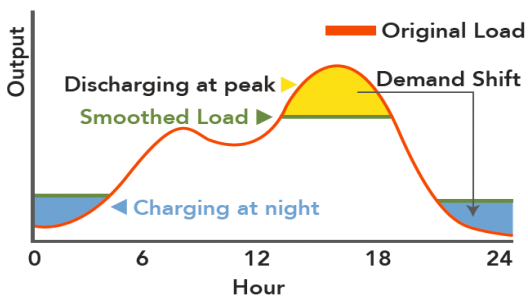
Low Price	**$160/kWh** (>10MW) **$200/kWh** (<10MW)
Long Life	**5,000 cycles (~15 years)** at 100% DOD
Energy Dense	23 kWh/m^3 (DC system)
Efficiency	**75%** at 100% DOD
Safety	Non-flammable, non-hazardous, non-corrosive

Pricing includes:

- **Batteries, enclosure, DC protection, and BMS**
- **Outdoor rated, plug-and-play Energy Stack™**
- **10-45°C operating range; HVAC typically not required**

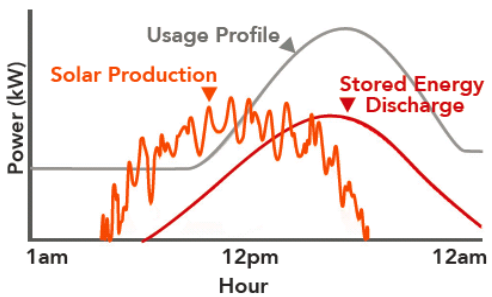
High Valued Energy Storage Applications

Peak-Shaving and Demand Management



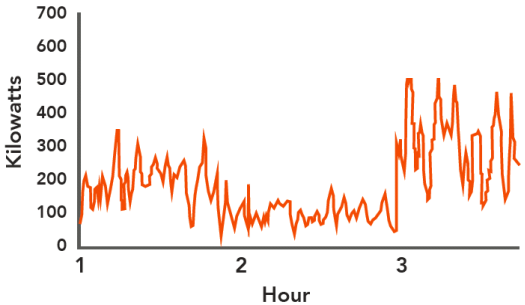
- Store excess base-load generation and renewable energy produced off-peak
- Discharge during peak hours

Renewable Integration Solar/Wind Sifting



- Counteract intermittency of renewable generation
- Smooth production cycles

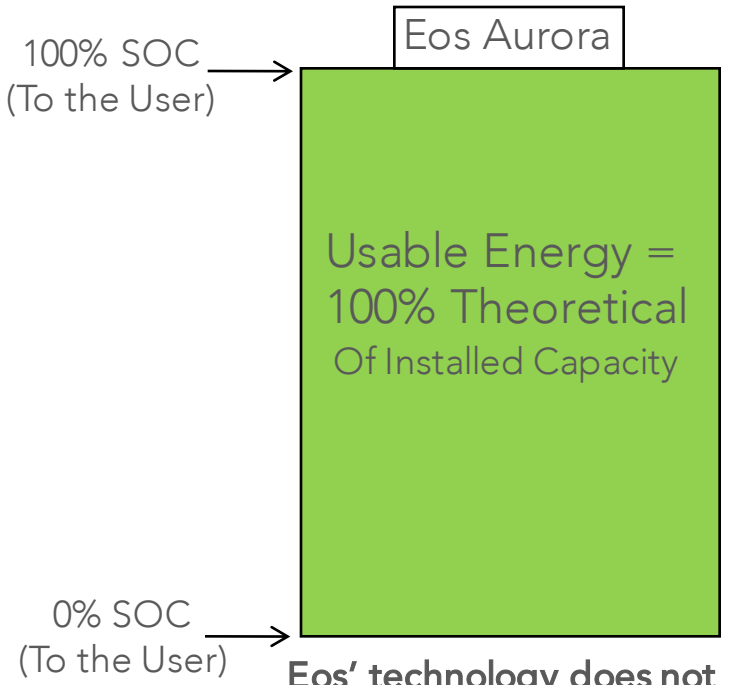
Ancillary Services For Grid Stability



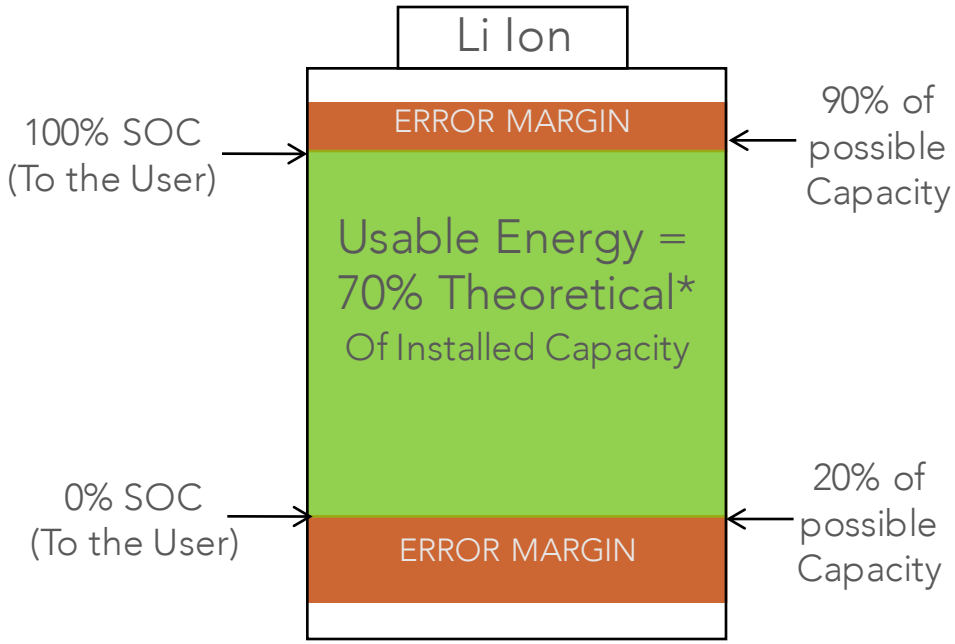
- Eligible for entry to ancillary markets
- Monetize your asset and bring additional revenue

Eos Aurora optimized for millisecond response and long-duration discharge (C/4), with surge capability (C/3, 15 minute)

Usable Energy and Depth of Discharge: Eos vs. Li-Ion



Eos' technology does not require restricted depth of discharge. 100% of installed discharge capacity is usable.



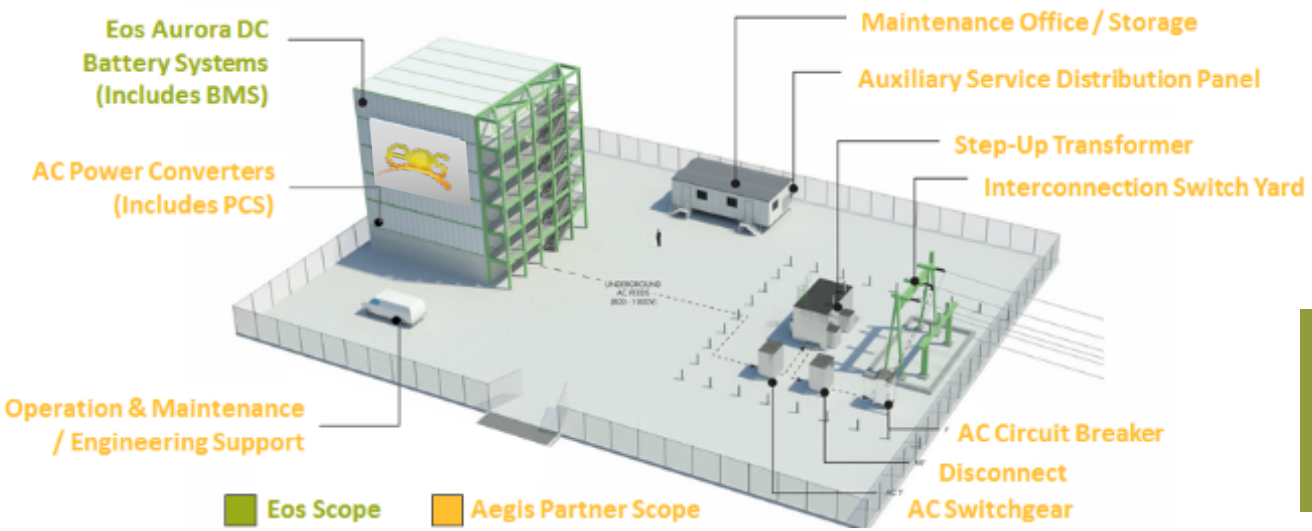
Margin Contributors[1]:
-Flatness of Discharge Curve
-Voltage Sensing Accuracy
-Current/Temp Compensation Accuracy

Depth of discharge constraints decrease battery system utilization and require greater up-front capital investment to achieve equivalent energy output

1: Figure inspired by Linear Technology 2014
*: Some Li-Ion companies claim up to 90% utilization

Eos Aegis Program: Partnering with Major Global System Integrators

- Eos will provide the Aurora DC system, including Battery Management System; Eos will also provide technical training to Aegis Partner at the outset
- Aegis Partner to provide power conversion and controls beyond the DC system required for a turnkey AC-integrated product, including installation, O&M, and full product warranty



eos AEGIS

Eos bid ~1 GWh of turnkey projects with these and other Aegis Partners

Aegis Partners

SIEMENS

Northern POWER SYSTEMS

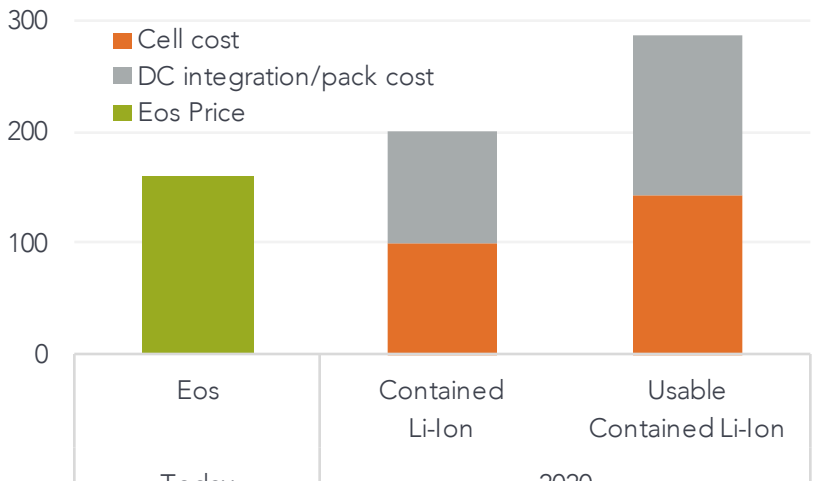
Parker

TOSHIBA

IHI

Eos Battery and System Cost Lower Than Li-Ion with Growing Cost Advantage

Eos Price vs. Li-ion Usable Cost/kWh Comparison[1]



Notes:

- Li-Ion cell cost publicly announced by GM
- Li-Ion cost assumes 70% depth of discharge (DoD); Eos cost assumes 100% DoD – all Eos kWh are usable
- Eos cost validated by major contract manufacturers and suppliers

Eos cost lower at lower volume and capex; DoD range widens gap in cost per usable kWh; Safety and stack design reduce balance of system cost

	Eos Znyth	Lithium-Ion
Cell / Battery Cost	+ Abundant low cost materials; Simple, easy-to-assemble design minimizes manufacturing capex + 100% DoD maximizes capacity utilization for lower $ per usable KWh + Manufacturing does not require clean room; Uses commoditized equipment and processes	– Costly and scarce materials; Complex product design (potentially >100 parts) – Typical max 70% DoD results in greater cost per usable kWh – Expensive and specialized facility, clean room for purity tolerances/safety; Significant capex for specialized equipment

	Eos Aurora	Lithium-Ion
DC System Cost	+ Inherent safety allows for simple packaging, self-balancing and string-level monitoring; can eliminate HVAC & fire suppression costs. Recyclable. + Stack design minimizes wiring, racking & container costs	– Safety concerns require strong protective packaging and cell-level monitoring; Hazardous materials require costly disposal – Risk of thermal runaway requires high cost HVAC, fire suppression and containerization

1. Based on Eos internal research and analysis

Eos Launching Residential and Commercial/Industrial Product

Eos is working with original equipment manufacturers (OEMs) to package, distribute and service storage appliance products, using Eos' safe, low-cost, long-life batteries

Resi Product
3 kW|12 kWh

C&I Product
40 kW|160 kWh

Target Performance

Low Price	$300/kWh (resi) $200/kWh (C&I)
Long Life	15 years daily, 100% DoD
Energy Dense	23 kWh/m^3 (DC system level)
Efficiency	75% at 100% DoD
Safety	Non-flammable electrolyte; non-hazardous and non-corrosive when shipped

Eos Wins $2M Project to Demonstrate Resi and C&I Systems at UCSD

UCSD

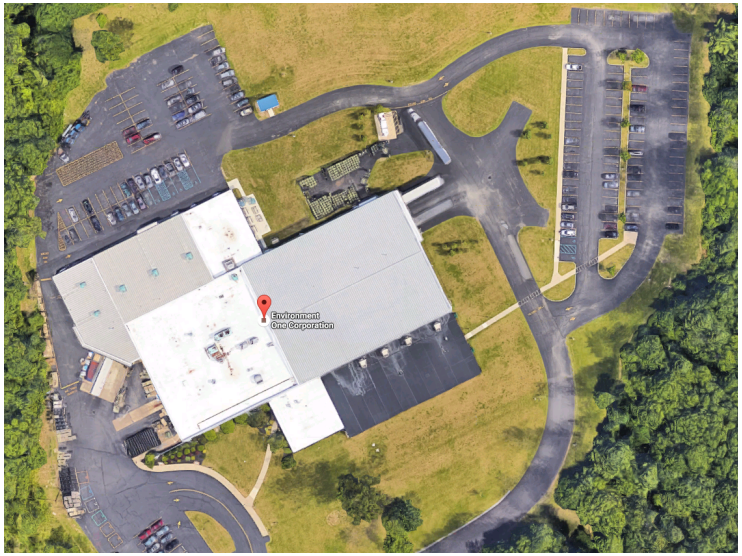
California Energy Commission

IPS International Power Supply

Eos collaborating with major OEMs for the Residential/C&I product

Eos Batteries Now Manufactured Off Of Multi-$B Contract Manufacturer's Production Line

Eos Pilot Assembly Line, Edison, NY



Contract Manufacturers	• **Manufacturing Services Agreements signed with major global Contract Manufacturing Partner; first batteries delivered in July 2016** • All other supply agreements in place to achieve volume scale-up
Minimal Capex	• Minimal CapEx required for rapid scale-up, leverage existing equipment
Designed for Manufacturing	• Product design optimized for assembly using standard manufacturing equipment and processes (6 parts, safe materials, flexible facility)
Production Cost	• Lowest battery production costs[1] with further cost reduction through economies of scale, materials optimization, and automation

Target Markets and Example Business Cases

1. Utility

Distributed energy storage systems for grid optimization and resiliency

- Peak load management
- Deferred infrastructure upgrades
- Renewable integration
- Frequency regulation

2. Microgrid

Batteries plus distributed generation off-set costly diesel fuel

- Microgrid configurations if integrated with solar, wind, and/or diesel generator
- Used to serve and back up critical loads

3. C&I

Larger units for commercial enterprises w/ inelastic demand

- Short-term back-up
- Building energy/demand management
- Microgrid capabilities

4. Residential

Standalone storage appliance or hybrid solar + storage system

- Home energy management
- Self-consumption of on-site renewables
- Backup power

Eos' cost and performance enables profitability in a wide range of distributed energy storage markets

Eos Garners Significant Media Attention

"'We have confidence in Eos's technology… and compelling value proposition."
NRG

Clean Technica

"'They've got a cost factor that makes it economically viable to use their batteries.'"
Con Edison

The New York Times

"'Eos will be in a position to change the way utilities do business.'" Public Service Co of New Mexico

POWER Engineering

"Energy storage giant of the not-too-distant future."

2Green Energy

"This price point and performance makes energy storage look economic on the grid."

Forbes

"We really like Eos' low-cost… and business acumen."
1 of 5 Companies Positioned to Succeed in Grid Energy Storage

greentechmedia:

"Is THIS the Biggest Invention of the Decade?"

The Motley Fool

The Future Requires (Better) Batteries

THE WALL STREET JOURNAL. WSJ

8 disruptive companies that utilities should watch in 2014

Utility DIVE

Startup Promises Revolutionary Grid Battery

MIT Technology Review

Charge of the Lithium Brigade

The Economist

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