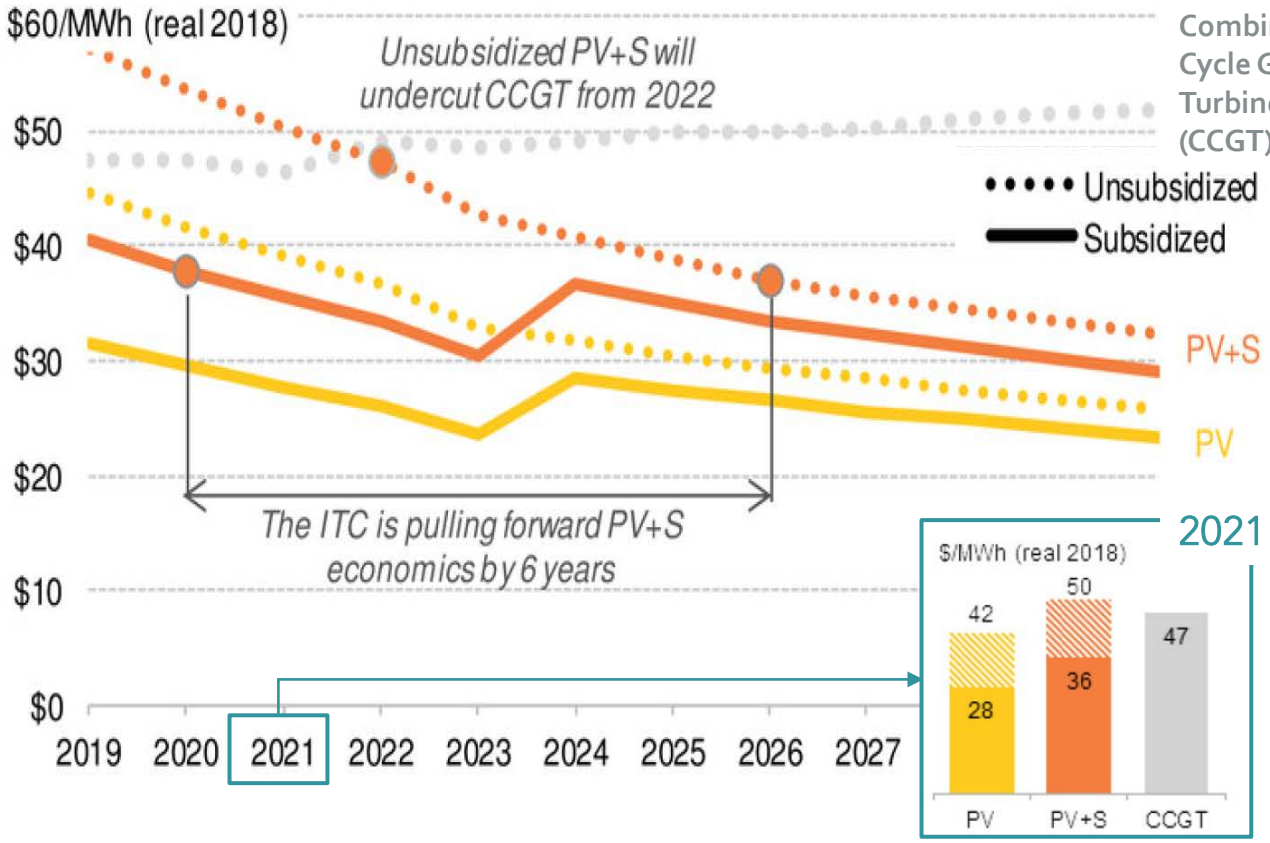
Eos Energy Storage

NAATBatt Workshop

November 16th, 2018

Solar + Storage is Here

Levelized Cost of Energy of PV + S in the South West U.S.



PV + S Requirements

- 4+ hours of discharge
- Wide Thermal Operating Range (i.e., min HVAC)
- 100% Depth of Discharge
- Low Maintenance
- DC-coupled w/ Solar array
- Safe, no need for fire suppression
- High local content

Solar + storage is economic today… and a perfect fit application for the Eos battery

Source: BNEF. 2018.

ZnYTH® Battery Overview

Lowest Cost

- Low cost bill of materials
- No supply-chain constraints/concerns
- Automated manufacturing

Inherently Safe

- No thermal runaway, wide temperature range
- Non-flammable, non-toxic electrolyte
- Environmentally benign, fully recyclable

Long-Lasting

- Chemistry "re-sets" after full discharge
- Key components (i.e., Titanium) last 30+ years
- Minimal capacity degradation w/ 100% DOD

Localized Production

- Inexpensive manufacturing lines can be set-up around the globe
- ~$8mm capex for GWh/yr capacity
- Economies of scale at low volumes

Abundant low-cost materials

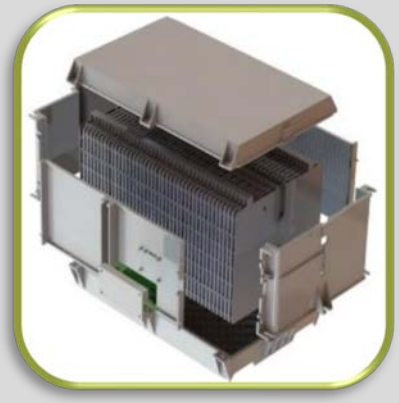
Zinc

Titanium

Carbon

Water & Salts

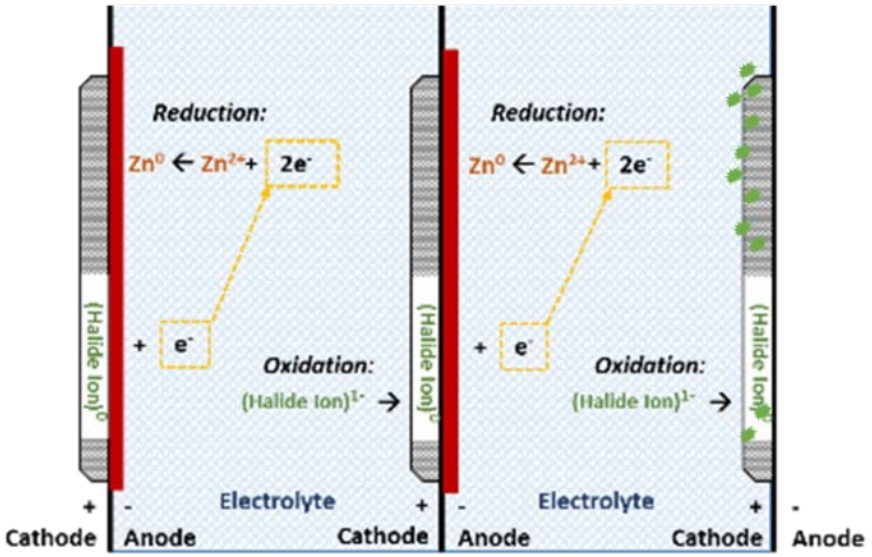
Non-flammable plastic



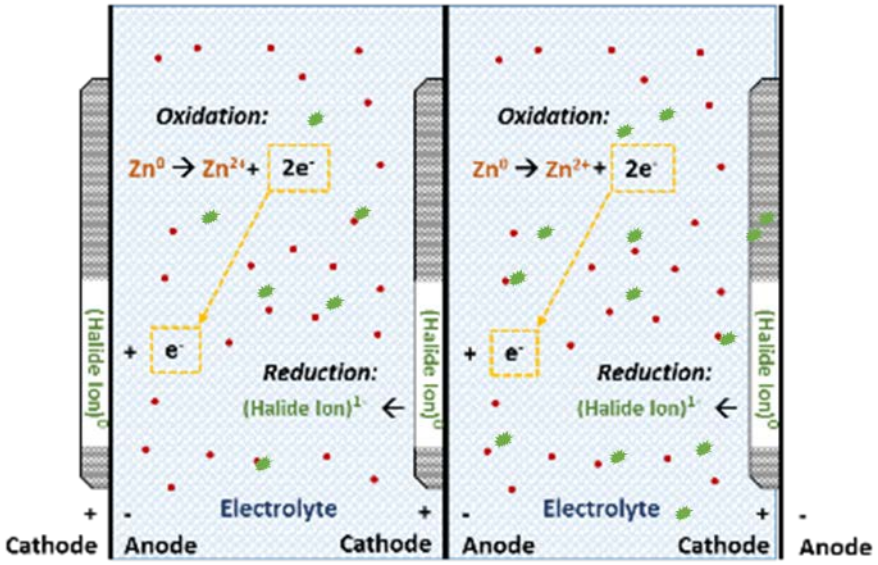
ZnYTH® Chemistry Overview

- Reversible zinc plating (reduction) and reversible halide oxidation with large aqueous electrolyte pool in a sealed bipolar battery
  - Zn and Zn^{2+} accumulate at the anode current collector (treated Ti sheet)
  - Ha and Ha^- accumulate at the cathode current collector (high surface area carbon felt)

Top of Charge



End of Discharge and Rest



Large surface area allows for high utilization
Large electrolyte pool reduces shorting and need for expensive separators

Eos Aurora DC System

Monitoring / Analytics

- Battery Level Granularity
- SOC / SOH Estimation
- Warranty support

Optimization / Regulation

- Maximize kWh output
- Minimize wear / stress
- Interface w/ customer EMS controls

Protection / Maintenance

- Outdoor-rated, ready to install enclosure
- Field serviceable
- Built-in protection

Plug and play, ready-to-install system with BMS providing optimization and protection

Highly Efficient, Local Manufacturing

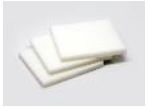
Commodity Materials

Zinc

Titanium

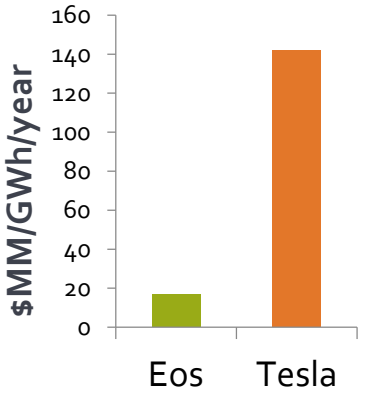
Carbon

Plastic



Comparison of MFG CapEx Required

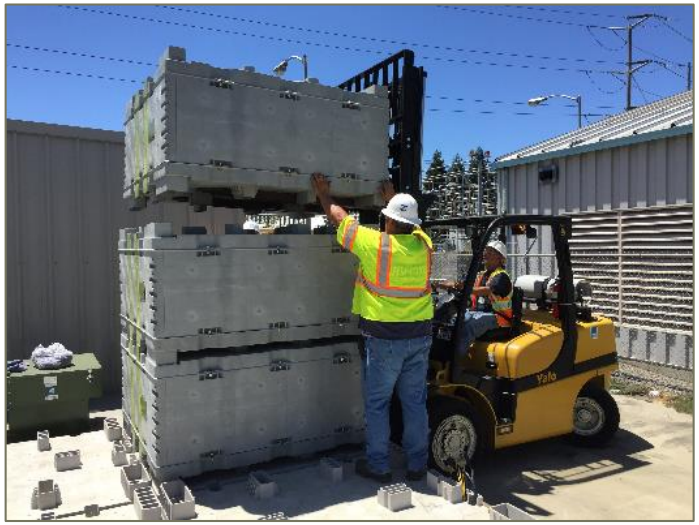
Eos		Tesla
1 GWh/yr	2020 Mfg Capacity	35 GWh/yr[1]
$6-8M	Upfront Capital	$5B[1]
$230/kWh	DC Battery Price	$280/kWh



1. From Tesla's Gigafactory Presentation; Estimate based on stated 30% reduction in current cost of battery pack

Eos' manufacturing is a fraction of the cost of conventional Li-ion

Deployments & Product Launch



Target Storage Applications & Value

	Solar + Storage	Reduce T&D Buildout	Demand Management	Microgrids / Rural Access	EV Charging
					
Reduce Cost	☑	☑	☑		☑
Reduce Pollution	☑		☑	☑	☑
Enable Access			☑	☑	☑

Storage will enable tremendous value and help to achieve policy goals

Eos DC-coupled Solar + Storage

- Eliminates redundant inverter cost
- Reduces conversion efficiency losses

Eos DC-coupled solar + storage pilot underway

10-MW Solar PV: 20-Year Average Energy Delivered

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.9	5.0	5.4	5.2	5.1	5.2	5.4	5.4	3.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Feb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	4.3	5.6	6.0	5.9	5.8	5.6	5.8	5.2	4.3	2.1	0.0	Target Period				.0
Mar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	5.7	6.8	6.7	6.6	6.6	6.5	6.6	6.6	5.7	3.3	0.4	0.0	0.0	0.0	0.0	0.0
Apr	0.0	0.0	0.0	0.0	0.0	0.0	1.0	4.6	6.9	7.5	7.7	7.5	7.5	7.7	7.5	7.2	6.4	4.6	1.2	0.0	0.0	0.0	0.0	0.0
May	0.0	0.0	0.0	0.0	0.0	0.0	2.7	6.1	7.3	7.8	7.8	7.7	7.8	8.0	7.6	7.6	7.0	5.6	2.3	0.1	0.0	0.0	0.0	0.0
Jun	0.0	0.0	0.0	0.0	0.0	0.0	3.2	6.2	7.3	7.7	7.8	7.9	7.8	7.8	7.7	7.5	7.0	5.9	3.0	0.3	0.0	0.0	0.0	0.0
Jul	0.0	0.0	0.0	0.0	0.0	0.0	2.2	5.2	6.4	6.8	7.3	7.5	7.4	7.6	7.5	7.4	6.5	5.1	2.4	0.2	0.0	0.0	0.0	0.0
Aug	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.8	5.8	6.6	7.4	7.2	7.4	7.3	7.5	7.1	6.6	5.0	1.5	0.0	0.0	0.0	0.0	0.0
Sep	0.0	0.0	0.0	0.0	0.0	0.0	0.4	3.9	6.2	6.8	6.9	7.0	6.8	6.9	6.7	6.2	5.5	3.0	0.3	0.0	0.0	0.0	0.0	0.0
Oct	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.8	5.7	6.1	6.3	6.1	6.2	5.8	6.5	6.2	4.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Nov	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	4.8	5.9	5.5	5.2	5.1	5.2	5.2	5.0	2.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Dec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	3.1	4.9	5.0	4.9	4.6	4.8	5.1	4.4	2.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0

10-MW PV+S with Four Hours of Storage: 20-Year Average Energy Delivered

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.9	5.0	5.3	5.2	5.0	5.1	5.4	5.4	3.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Feb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	4.3	5.6	6.0	5.9	5.8	5.6	5.8	5.2	4.3	2.1	0.0	Target Period				.0
Mar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	5.7	6.8	6.7	6.6	6.6	6.5	6.6	6.6	5.7	3.3	0.4	0.0	0.0	0.0	0.0	0.0
Apr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	1.2	5.1	6.4	6.6	7.2	7.5	10.0	10.0	10.0	9.8	0.0	0.0	0.0	0.0	0.0
May	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	7.3	7.6	7.7	8.0	7.6	10.0	10.0	10.0	10.0	0.1	0.0	0.0	0.0	0.0
Jun	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	7.6	7.9	7.8	7.8	7.7	10.0	10.0	10.0	10.0	0.3	0.0	0.0	0.0	0.0
Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	5.1	6.7	7.4	7.5	7.5	10.0	10.0	10.0	9.8	0.2	0.0	0.0	0.0	0.0
Aug	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	3.6	5.4	6.8	7.2	7.5	10.0	10.0	10.0	9.9	0.0	0.0	0.0	0.0	0.0
Sep	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	4.3	5.8	6.4	6.7	9.9	9.7	9.6	9.0	0.0	0.0	0.0	0.0	0.0
Oct	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	3.3	5.0	6.5	9.9	9.5	9.2	8.7	0.0	0.0	0.0	0.0	0.0
Nov	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	4.8	5.9	5.3	5.0	4.9	5.0	5.0	4.9	2.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Dec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	3.1	4.9	5.0	4.9	4.6	4.8	5.1	4.4	2.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0

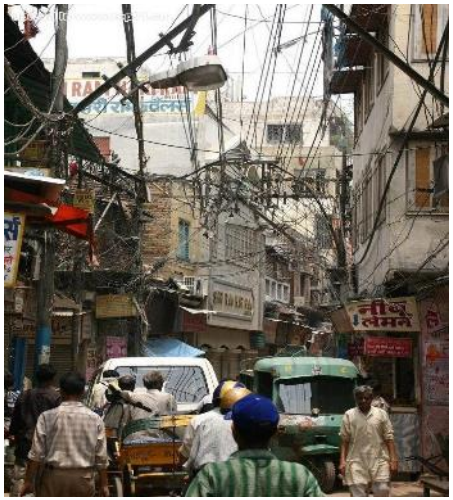
Solar + Storage Economics

Storage Capex + Opex	PV + S LCOE
$300/kWh	$42/MWh
$200/kWh	$33/MWh
$100/kWh	$24/MWh

Assumes charging cost by adding incremental PV is $0.011/KWh; 30 year life of asset

Technology Drives Industry Transformation

Telecom



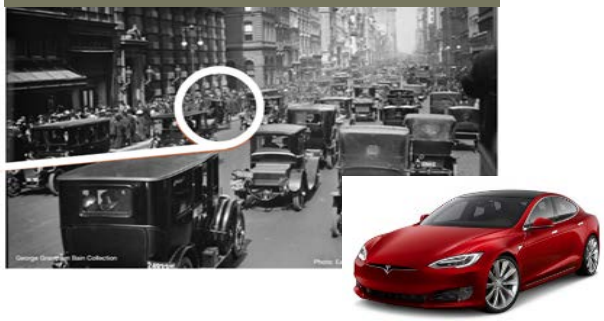
Transportation

5TH Ave NYC, 1900

where is the car?

5TH Ave NYC, 1913

where is the horse?



Energy

The mobility and energy industries are evolving rapidly just like telecom