BLUE PLANET
RESEARCH

NELHA ESS 2018 Conference

BATTERIES AND HYDROGEN

LiFePO4 & H2

(The Perfect Marriage)

BPR ENERGY LAB

85 kW PV Array

BATTERY STORAGE

HYDROGEN STORAGE

MICROGRID EXAMPLE

Assumptions

- Modular Physical Storage - ISO Containers 8'x8'x20'
- Environmentally Safe, Sustainable and Recyclable - Fossil Fuel Free
- Project Power/Energy Requirement- 50 kW ac / 1,200 kWh /day
- Design represents daily use with 4 days Energy Reserves (4 MWh Autonomy)
- AC PCS (Inverter) sized larger than peak load, or redundant array (90-100 kW)
- Electrolyzer ouput 12-60 kg/day depending on hydrogen application
- Electrical Energy for charging or electrolysis provided by solar PV

MICROGRID EXAMPLE

Battery Energy Storage System

- Blue Ion M Class One Megawatt Hour LFP Battery
- Battery Efficiency 95%
- Total Energy Storage- 1,000 kWh (One Megawatt Hour)
- Energy is coupled to Power
- Total Component Cost: $650,000
- Cost per kWh: **$650/kWh**

MICROGRID EXAMPLE

Compressed H2 Storage System

- Kelley GTM Containerized Gas Storage 220 kg of H2 @ 3,250 psi ($130K)
- 80 kW H2 Fuel Cell- 18 kWh net / kg of H2 continuous output ($140K)
- FC Efficiency 60%
- Total Energy Storage- 3,960 kWh (4 Megawatt Hours)
- Energy is decoupled from Power
- Total Component Cost: $270,000
- Cost per kWh: **$68/kWh**

BEST SOLUTION

Hi-Performance LFP and Economical H2

- Blue Ion M Class One Megawatt Hour LFP Battery for daily cycling of energy
- Continuous Output-50 kW AC
- Battery Efficiency >95%
- Total Energy Storage- 1,000 kWh (1 Megawatt Hour)

+

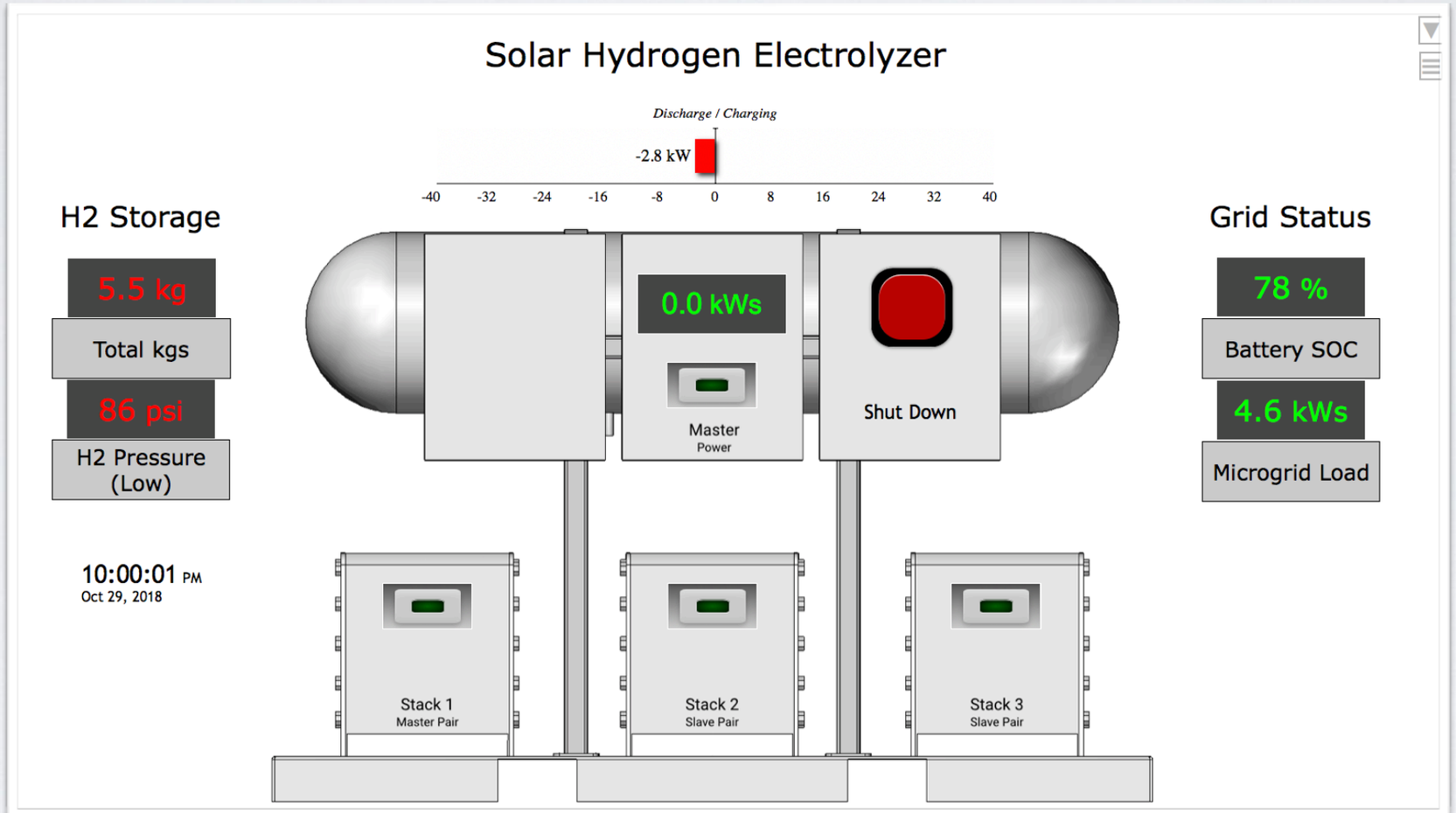
- Kelley GTM Containerized Gas Storage 220 kg of H2 for long term backup energy
- 80 kW H2 Fuel Cell- 18 kWh net / kg of H2 continuous output
- FC Efficiency 60%
- Total Energy Storage- 3,960 kWh (4 Megawatt Hours)

MICROGRID CASE STUDY

Conclusions

- ISO Containers are modular and easily transportable
- Environmentally Safe, Sustainable and Recyclable
- Batteries can provide daily turnover of energy with fast response
- Hydrogen can provide long term affordable backup power
- The combination of BESS and H2/FCs provide a fossil fuel free solution
- Hydrogen can be accumulated from excess energy that would be wasted
- Once backup storage is full, H2 can be used for other applications

EMCc
Software Controls



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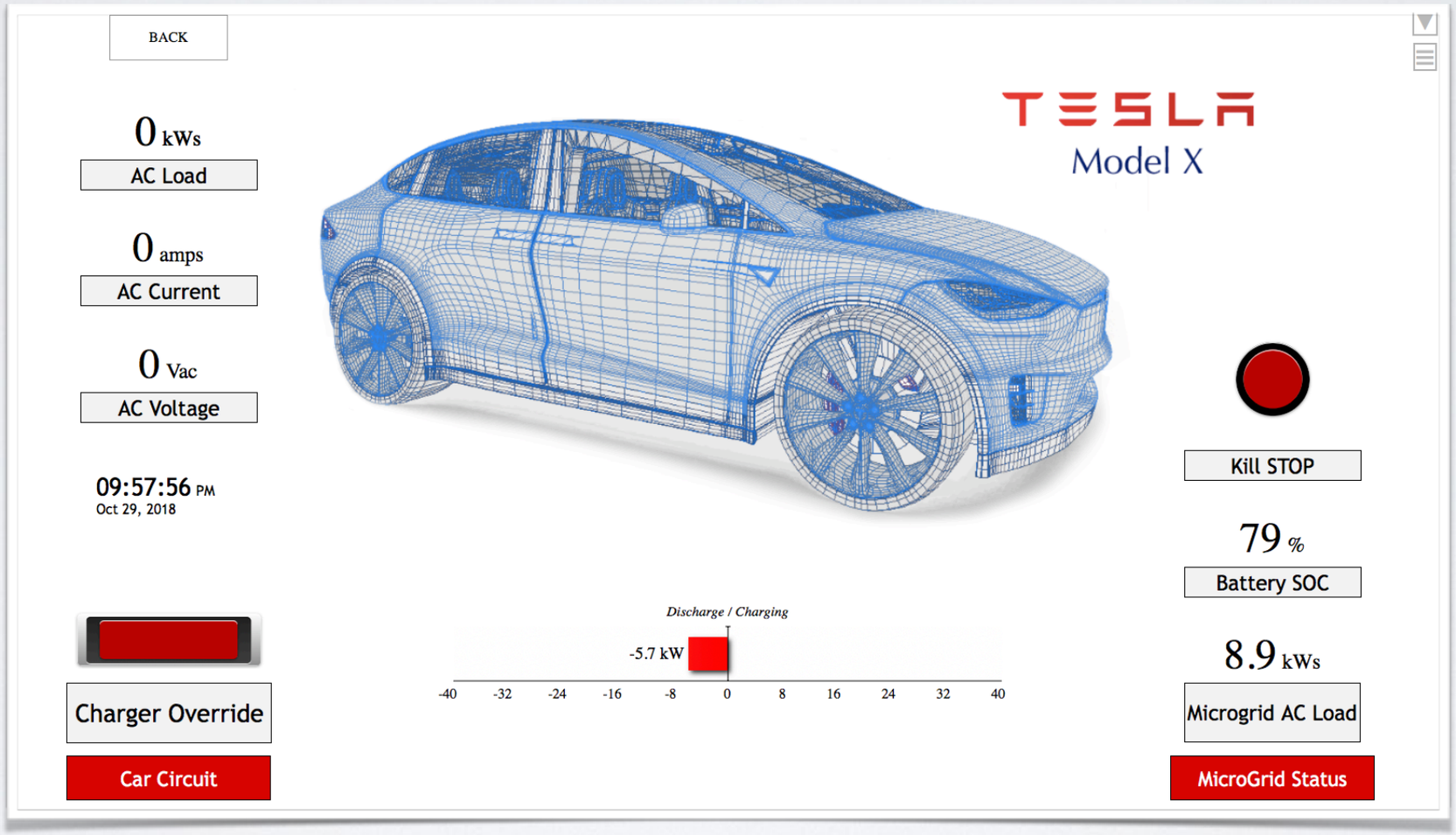
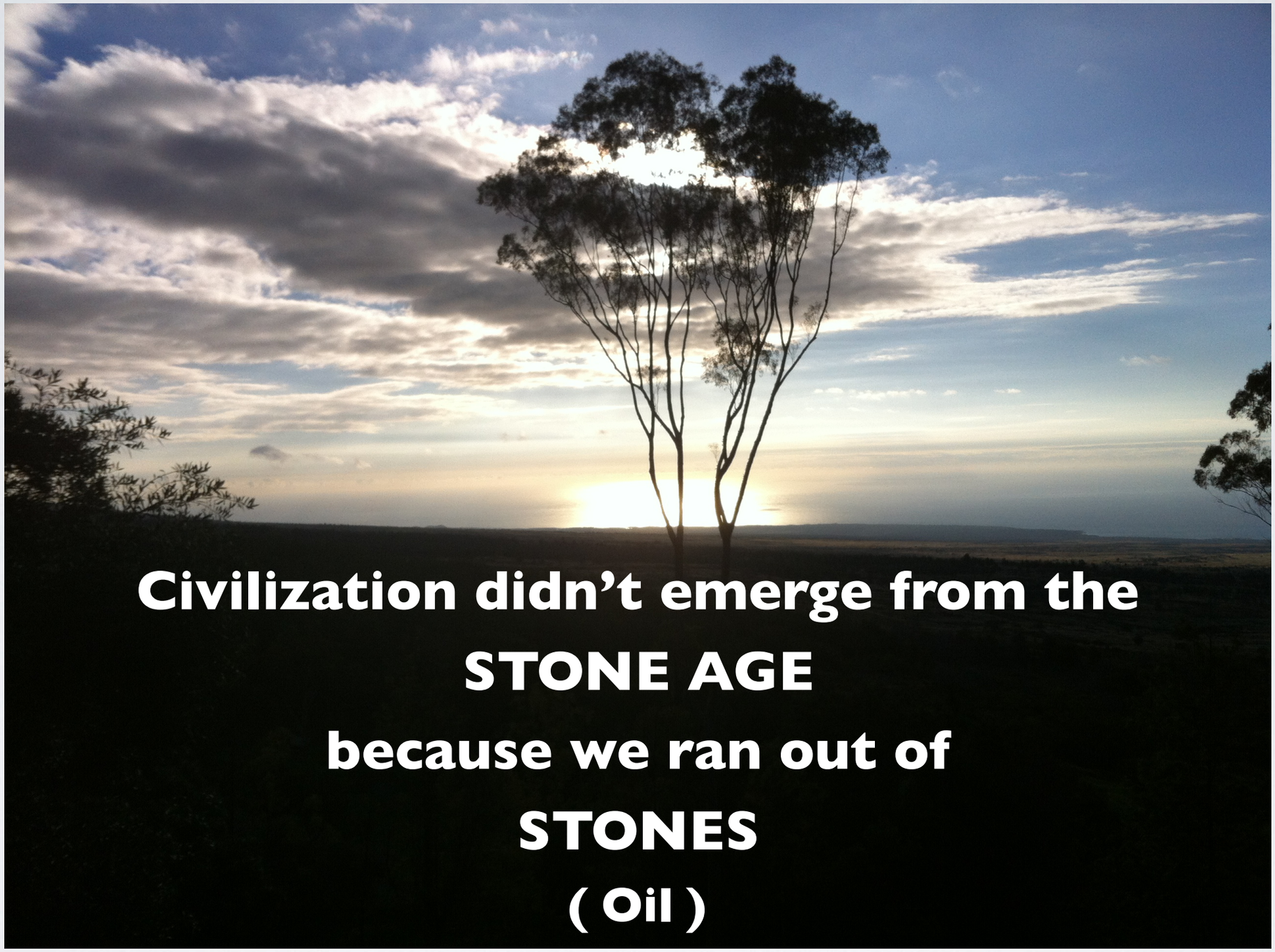


BLUE PLANET RESEARCH

Bi-Partisan Civic Responsibility

Last August when Hurricane Lane threatened the Big Island, BPR came to the aid of HELCO by supplying cylinders of Solar Renewable H2 to allow startup of their generator that had just come out of maintenance.


Civilization didn’t emerge from the
STONE AGE
because we ran out of
STONES
(Oil)