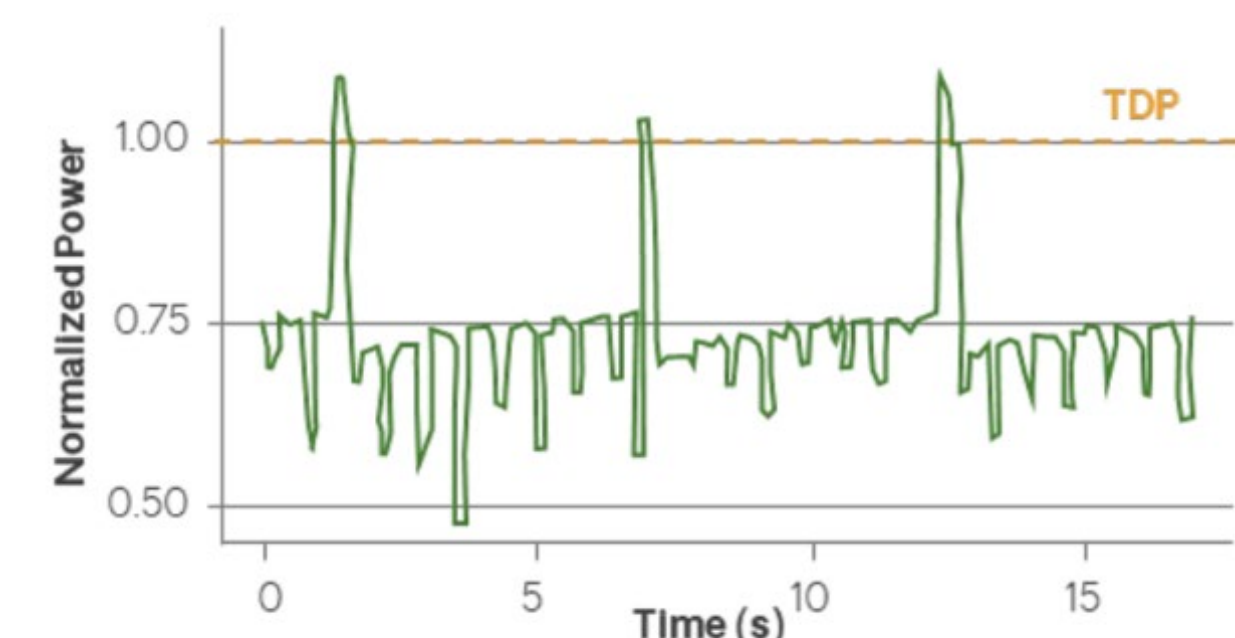




PRACTICAL SOLUTIONS FOR POWER RESILIENCE IN MODERN FACILITIES, GRIDS, AND MICROGRIDS

Overview

Surging power demands from artificial intelligence data centers, advanced manufacturing, and electric vehicle charging are straining grid and microgrid reliability and power quality.



Supercapacitors are known solutions but lack the **scalability and turnkey design** needed for mainstream adoption in high power, high voltage applications like the DOE-funded microgrids in Cordova, Alaska and Puerto Rico. **This material is based upon work supported by the U.S. Department of Energy, Office of Electricity (OE), Energy Storage Division and supported by Sandia PO 2609666.**

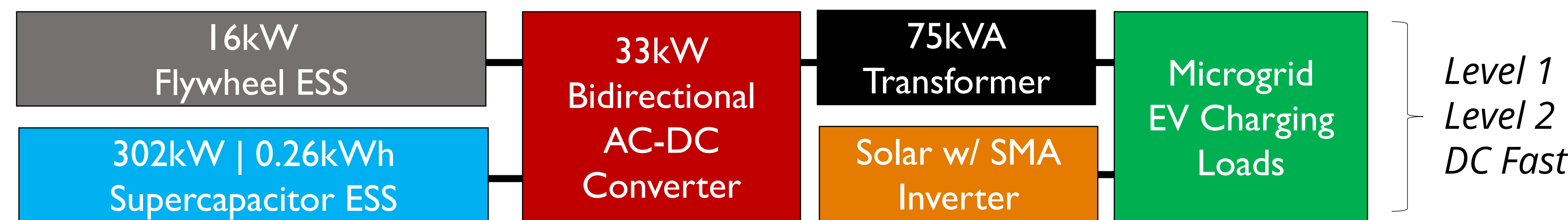
Approach & Objectives

This work demonstrates a supercapacitor solution that is scalable, modular, and easily installed in relevant environments to improve power resilience.

1. Address supercapacitor scalability challenges
2. Operate supercapacitors in microgrid environment
3. Demonstrate power resilience use cases including black start, voltage regulation, and load leveling
4. Determine how supercapacitors complement batteries to optimize microgrid design and operations

System Design

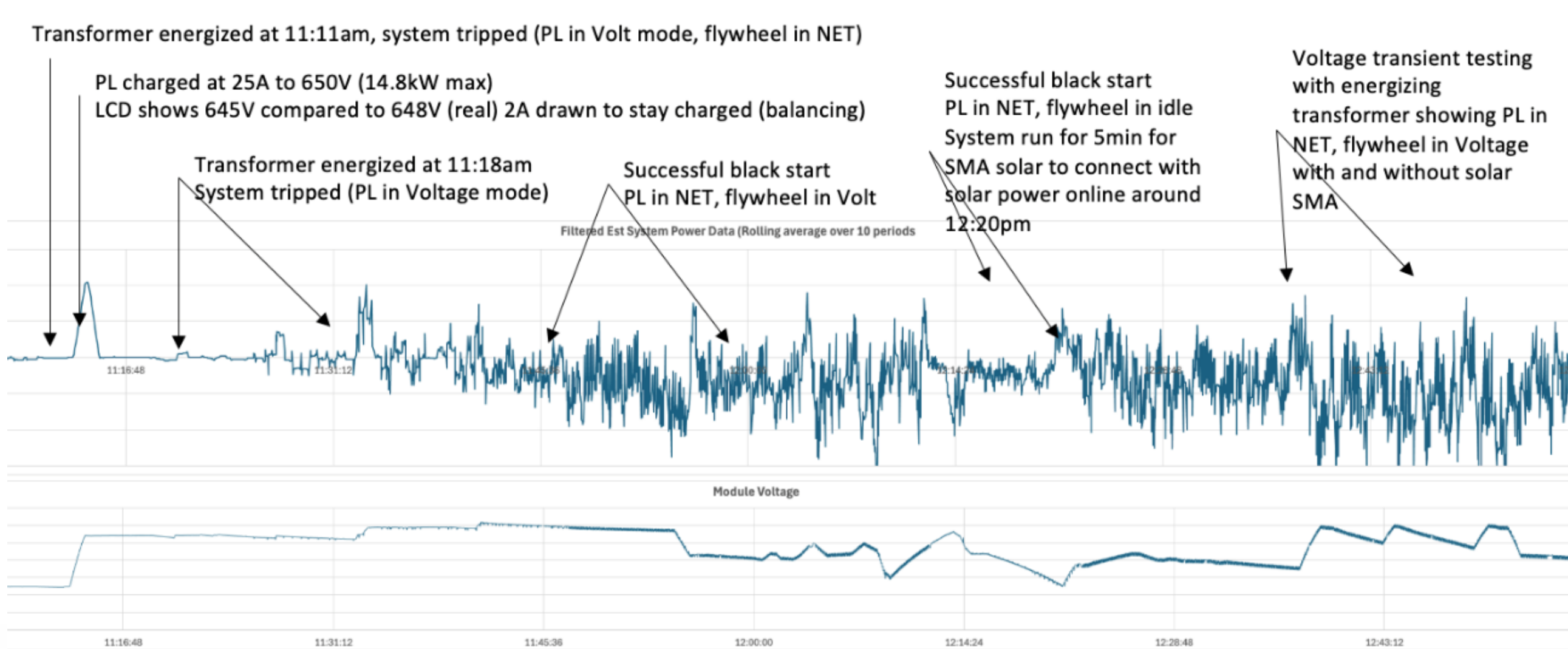
Orlando Utilities Commission provided access to their utility 480V three phase microgrid. Capacitech built a 3.6F, 720Vdc supercapacitor solution using 36 PowerLink modules.



12 PowerLink modules installed on 6ft tall, 4ft wide half slotted framing strut

Results

Successful tests: *black start, voltage regulation, and load leveling*



Highlights

- PowerLink installed by two technicians within a few hours
- High power balancing **20x faster** than legacy designs with overvoltage protection systems effective
- PowerLink responded to distortions in voltage due to inrush currents, **reducing downtime by 50%**

Insights Gained

- We recommend connecting the supercapacitor to its own dedicated AC-DC converter in grid following/firming mode
- Load leveling (*balancing sources and loads*) functionality significantly simplifies microgrid controls

Enabling Technologies

Capacitech's power resilience solution, the PowerLink, features:

- **High-power density** and rapid response supercapacitors
- Intelligent and high-power cell balancing to **optimize size**
- Conduit form factor to **enable new placement options for fast, easy installation** (*no forklifts, concrete pads required*)
- High-power density, rapid response

Impact

- Reduce power demand on grids and microgrids from modern loads, like artificial intelligence data centers
- Black start energy resources after natural disaster
- Reduce \$/kW-year by 72% for power resilience initiatives
- Fortify US grid infrastructure against brownout and blackout conditions by regulating voltage and frequency
- Improve resource utilization (fuel cell, generators, etc...)