



Advancing Solid Oxide Fuel Cells at Acumentrics

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HRD41-1
2009 Fuel Cell Seminar

Outline

- **Acumentrics Background**
- Increasing the operational envelope
- Consortium update
- Conclusions

Acumentrics Corporation

Strategic Partners

GENERAL DYNAMICS
Strength on Your Side™



- *Based in Westwood, Mass.*
- *~40,000 sq. ft facility*
- *Profitable*
- *Critical disciplines in-house*
 - Electrical Engineering
 - Mechanical Engineering
 - Chemical Engineering
 - Thermal Modeling
 - Ceramics Processing
 - Manufacturing
 - Sales & Marketing
 - Automation
 - Finance

Acumentrics Power Conversion Technology

ACG2500 RUPS

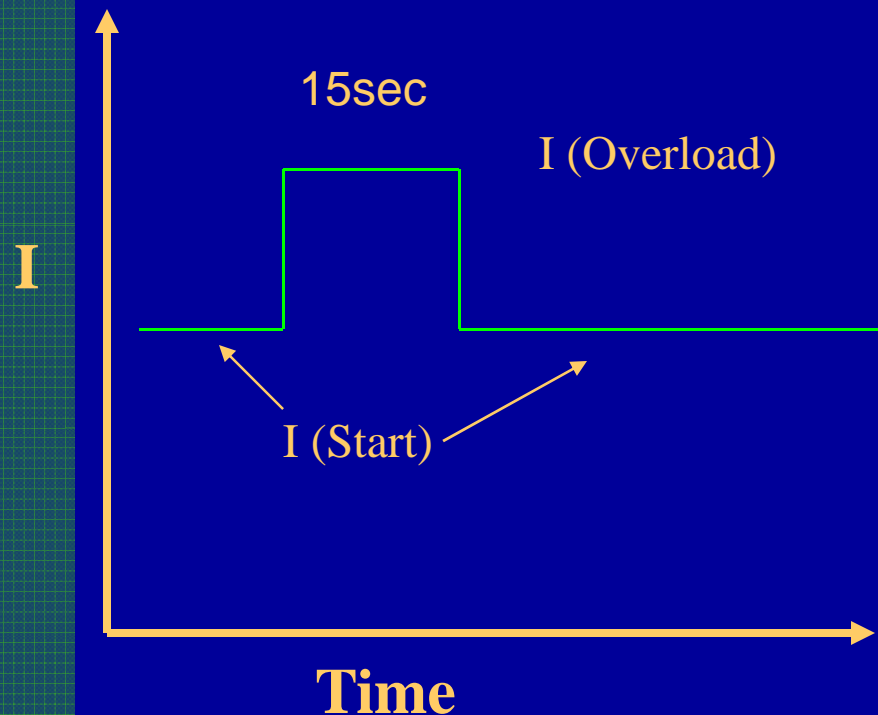
- **Output: 115VAC, 60Hz; 2500VA / 2000 Watt**
- **Universal AC Input: 80VAC-265VAC, 47Hz-400Hz**
- **External 28VDC input**
- **15 minute battery back-up**
- **Parallel operation increases power**
- **MIL-STD 810F Power – Combat Proven**



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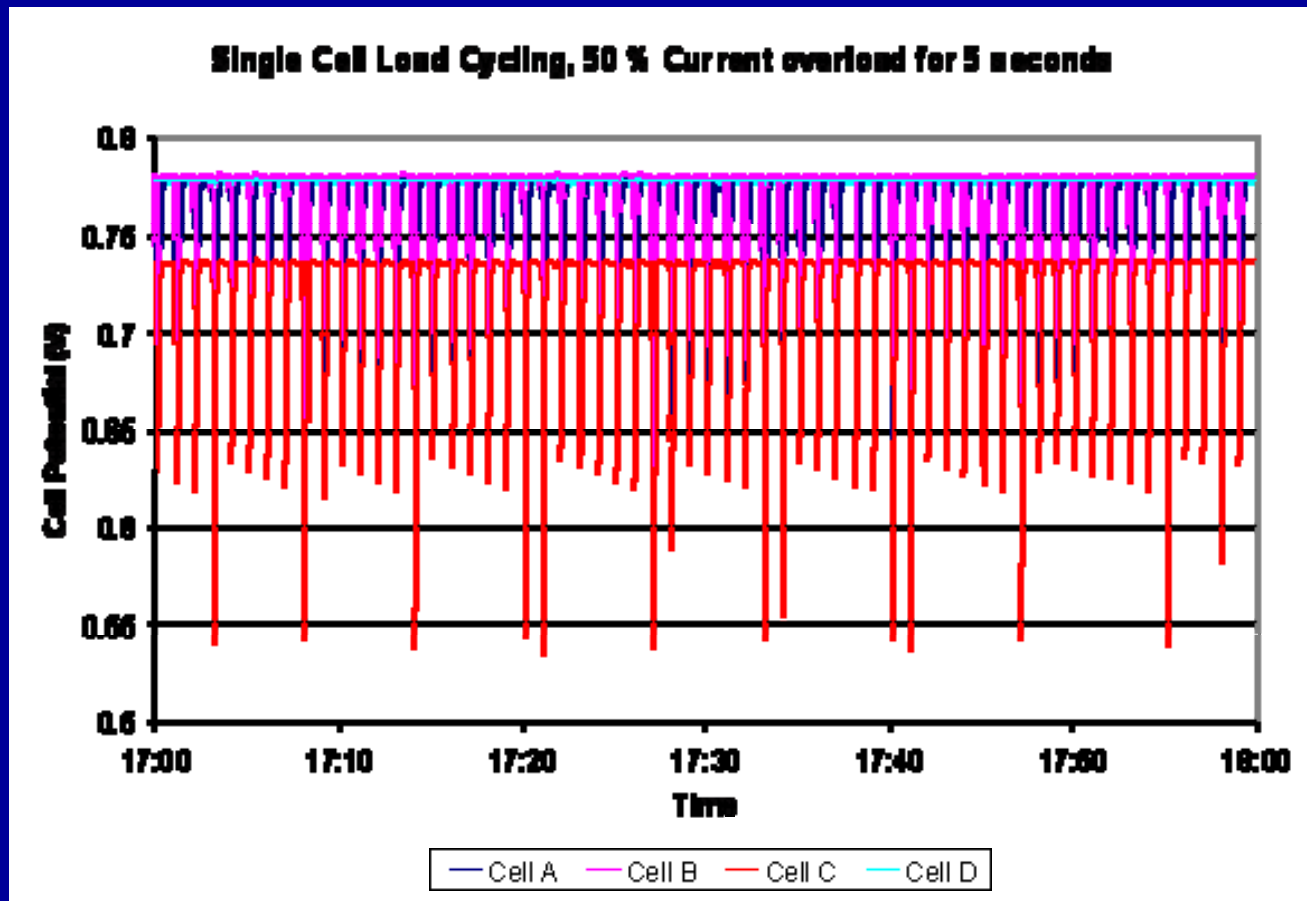
New Testing Techniques



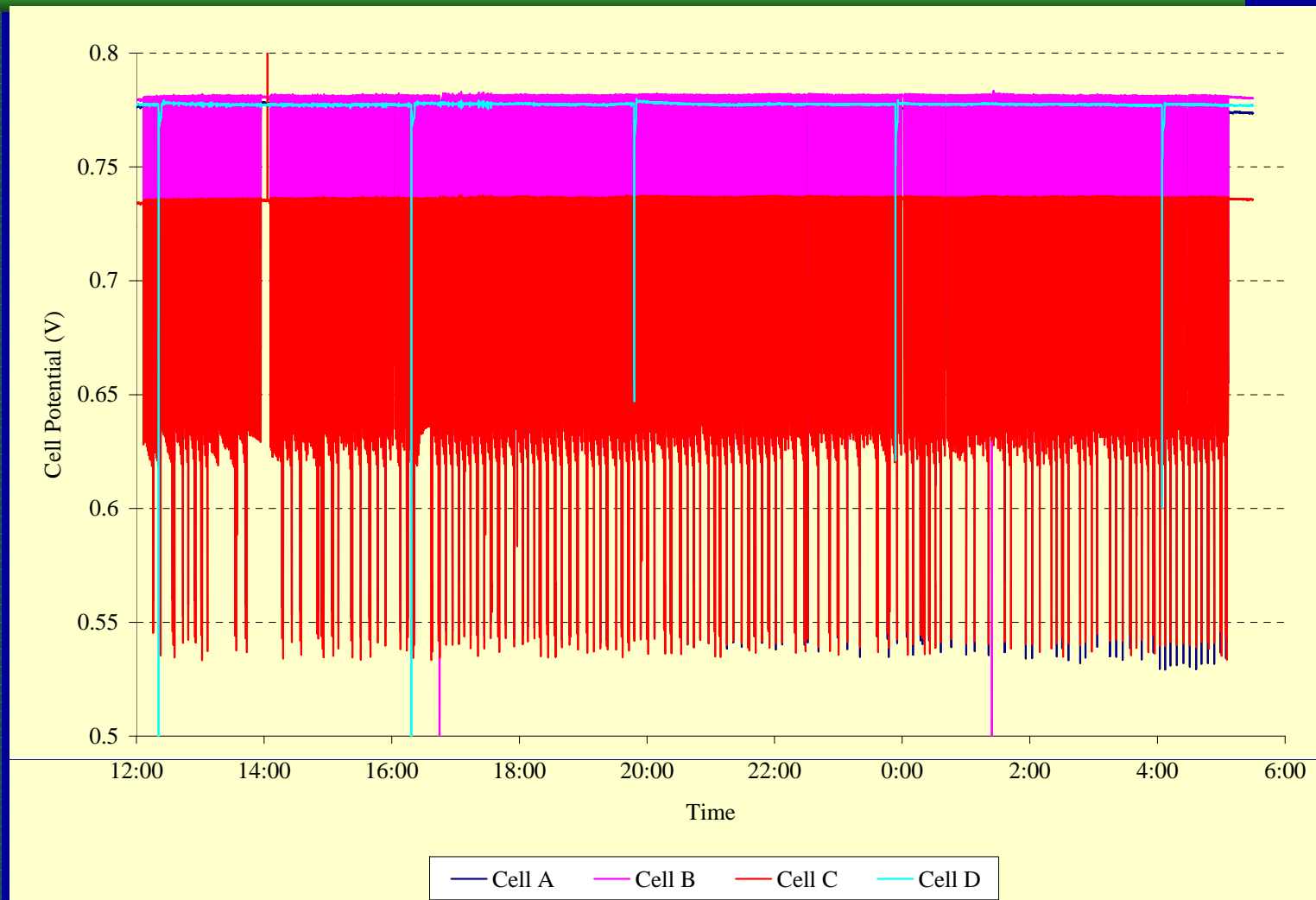
Current Overload	Fuel Utilization
33%	100%
50%	113%
66%	125%
83%	138%
100%	150%

At a set fuel flow, the current is increased and then returned to the initial value
No other parameter is modified

1000x Load Cycling



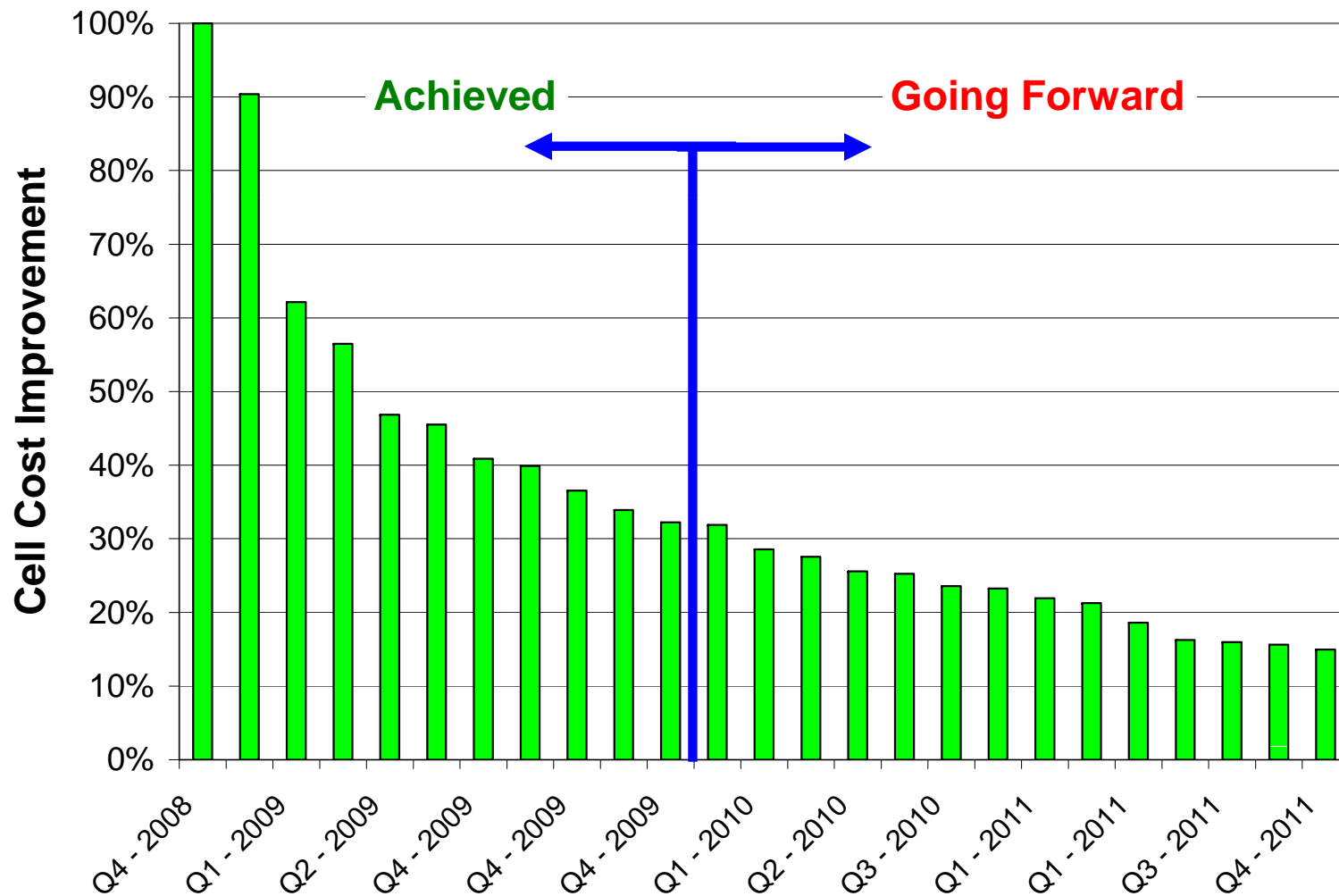
1000 50% Current Overload Cycles on 4 Single Cells



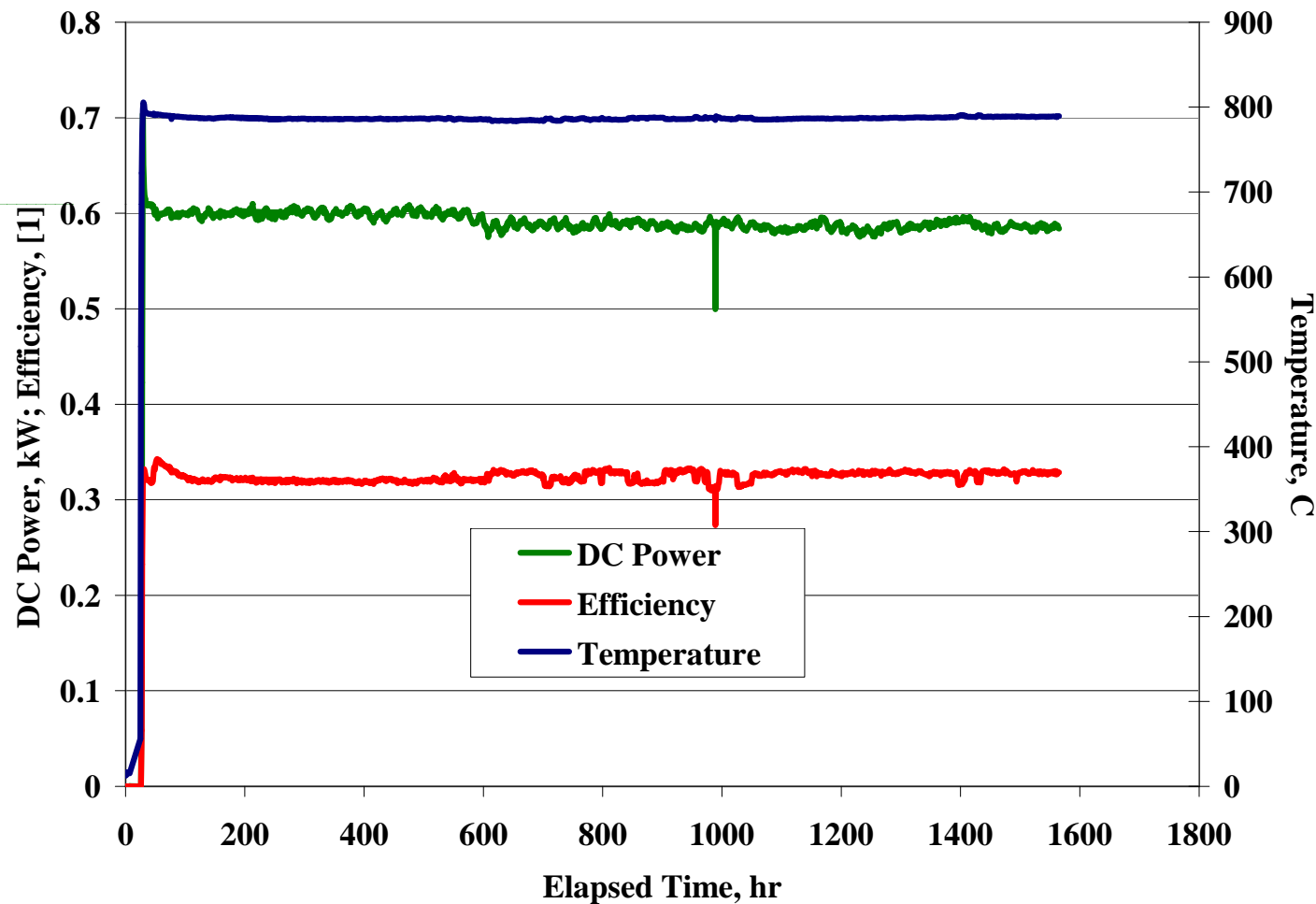
Cycling Summary

- >35 different single cells have been current cycled to 100% FU or greater
 - Of those, >15 different single cells have been current cycled to at least 150% FU
- FU has been pushed as high as 200% (current overload of 266% from baseline of 75% FU)
- Stacks have been cycled 200 times without effect

Cell Cost Improvements



Goal: 1500hr operation with
<1%/500hr degradation rate



Setup:

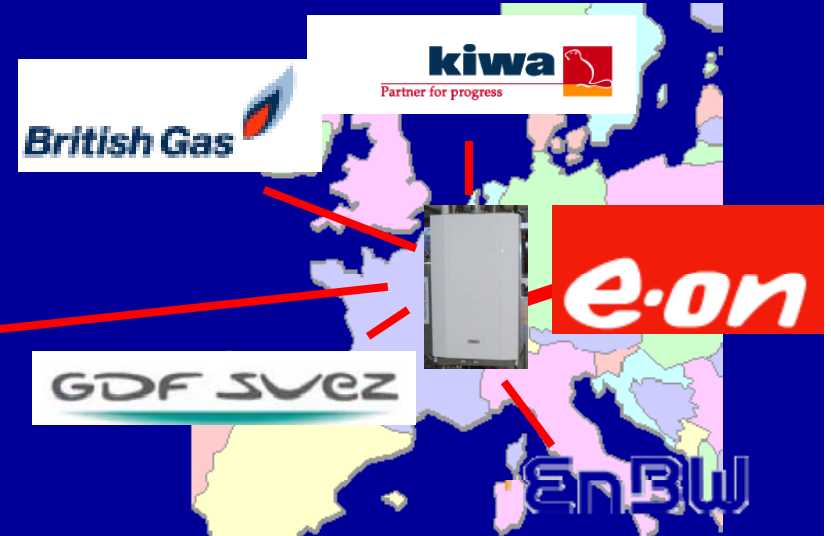
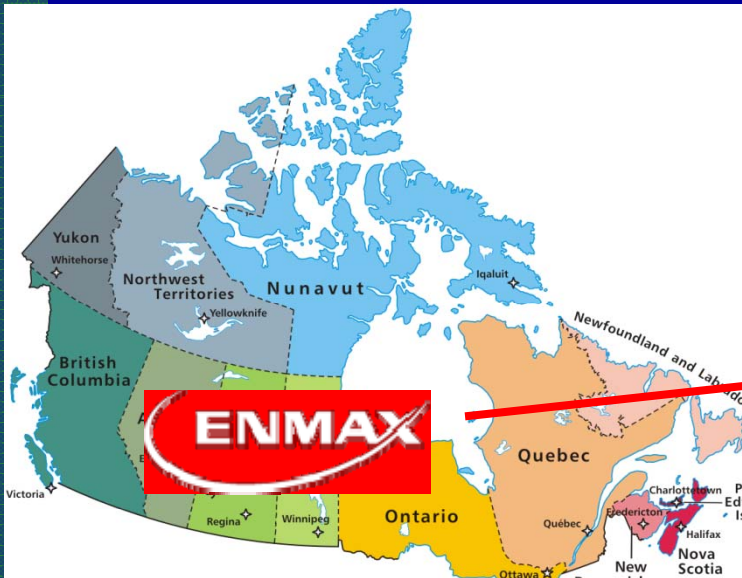
1kW nominal
-Previously had
~473hrs
operation
-Hour-averaged
data shown

0.9%/1000hr
(0.7%/1000hr
counting
starting hours)

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Consortium Members



Near Term Activities

- Continue power cycling of HEA 102
- Continue thermal cycling of HEA 101
- Build HEA 103

- Testing at partner sites

Conclusions

- Acumentrics has continued to extend the operating envelope of its cells, and more importantly, generators
- Consortium testing is now ongoing and will continue through next year, evaluating the combined heat and power system
- Short term system degradation appears to be well within the envelope required for cost-effective operation.
- Moving forward, the challenge is the incorporation of the lessons learned and system capabilities.

Acknowledgements

- EERE
- ONR
- Consortium Members
- Acumentrics Team