Increasing the Value Proposition: Small-Scale Fuel Cell Applications

April 19, 2018
1:00 PM – 2:00 PM ET

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House Keeping

All participants are in “Listen-Only” mode. Select “Use Mic & Speakers” to avoid toll charges and use your computer’s VOIP capabilities. Or select “Use Telephone” and enter your PIN onto your phone key pad.

Submit your questions at any time by typing in the Question Box and hitting Send.

This webinar is being recorded

You will find a recording of this webinar at:

www.fchea.org/events/
http://neesc.org/events/past-events/

The Connecticut Hydrogen Fuel Cell Coalition is a proud member of FCHEA
Today’s Moderator

Joel M. Rinebold
Director of Energy, CCAT
Chair, NEESC

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About NEESC

The Northeast Electrochemical Energy Storage Cluster (NEESC) is a network of industry, academic, government and non-governmental leaders working together to help businesses provide energy storage solutions. The cluster is focused on businesses that provide the innovative development, production, promotion and deployment of hydrogen fuels and fuel cells to meet the pressing demand for energy storage solutions.

The cluster spans an area in the northeastern United States from New Jersey to Maine. Its formal organization is funded by the US Small Business Administration’s Regional Cluster Initiative. NEESC is administered by the Connecticut Center for Advanced Technology, Inc. (CCAT).

WWW.NEESC.ORG

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About the Fuel Cell and Hydrogen Energy Association (FCHEA)

• FCHEA represents the leading companies and organizations that are advancing innovative, clean, safe, and reliable energy technologies.

• FCHEA drives support and provides a consistent industry voice to regulators and policymakers. Our educational efforts promote the environmental and economic benefits of fuel cell and hydrogen energy technologies.
Our members
Today’s Presenters

Dr. Alberto Ravagni, SOLIDpower

Sean James, Microsoft

Dan Connors/Steve Almeida, Aris Energy Solutions

The Connecticut Hydrogen Fuel Cell Coalition is a proud member of FCHEA
Dr. Alberto Ravagni, SOLIDpower

Co-founder and CEO of SOLIDpower

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Aris Energy Solutions, LLC & SOLIDpower

Fuel Cells deployment in the U.S.

Steve Almeida Jr
Aris Renewable Energy
Director – Fuel Cells & CHP
SOLIDpower – Company Overview 2

- Commercialized Fuel Cells products
  - 14 Million operating hours
    - 1,000 installations,
    - 10y service contract
    - CE certification in Europe, UL in process

- kW-to-MW platform
  - WW efficiency record
    - Worldwide Record efficiency: 61%
      - 61% NET AC, delivered onsite, 85% in CHP mode.
      - Single system availability >98%
      - Historic durability record broken by SP material system (70'000 hours)

- Market Leader in Europe
  - >50 utility customers
    - Microgrid and Virtual power plant demonstrated.

- Lowest Manufacturing costs
  - Stack mat cost <100$/kW,
    - Unsubsidized grid parity at low manufacturing output (few MW)
    - Manufacturing Cost-based LCOE, fuel excluded.
      - < $0.08/kWh @ 10MW/y prod.
      - < $0.06/kWh @ 50 MW/y prod.

- 1.5 and 2.5 kW commercialized
  - 3-6-12 kW modules in preparation

- 14 Million operating hours
  - 1,000 installations,
  - 10y service contract
  - CE certification in Europe, UL in process

- >50 utility customers
  - Microgrid and Virtual power plant demonstrated.

- Lowest Manufacturing costs
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SOLIDpower today

- 1000 mCHP systems deployed
- 16 million operative hours
- 10 years stack durability record
- Market entry data center with Microsoft
- 10kW system operating in Korea
- €40m investment to ramp-up to mass production
Small Business / Residential Applications
DOE National Labs

Distributed power in cloud data centers

Distributed clean power in metropolitan areas

Microsoft

Brookhaven National Laboratory

National Fuel Cell Research Center

University of California - Irvine

Southern California Gas Company

Be Power Tech

Oak Ridge National Laboratory

Power and cooling:
«The AC system which produces power»
1,5 kW, 6 kW and 12 kW units - comparison
Applications and Products

Multi-site building & grid integration MW demonstration

- **Residential**
  - 70 sites
  - 100 kW

- **Multi-apartment**
  - 70 sites
  - 100 kW

- **Commercial-SME**
  - 3-4 sites
  - 400 kW

- **Grid-scale & Data Center**
  - 1-2 sites
  - 400 kW

Applications and Products

- **1 kW**
- **10 kW**
- **100 kW**
- **MW**
- **Multi-MW**

- **Stark-TRE**

- **STEP 1**
- **STEP 2**
- **STEP 3**
Planned Product Roadmap in US: Modular Approach

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>BlueGEN 1.5kW (1.5 kW, Rack-size)</td>
<td>BlueGEN 1.5kW</td>
<td>BlueGEN 6kW</td>
<td>BlueGEN 12kW (large stack)</td>
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<tr>
<td></td>
<td>Stark-TRE</td>
<td>2x130 kW</td>
<td>480 kW</td>
<td>960 kW</td>
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**Steps:**
- **STEP 1:** 1 kW
- **STEP 2:** 10 kW, 100 kW
- **STEP 3:** MW, Multi-MW
Market demand for small fuel cells

Certified proven product

Cost solved by users confirmation

Integration

- Standardize building integration
- Simplified connection(s)
- Simplify paperwork
Aris Energy Solutions

Dan Connors
Director – Fuel Cells & CHP

Steve Almeida
Director – Fuel Cells & CHP

The Connecticut Hydrogen Fuel Cell Coalition is a proud member of FCHEA
• Corporate Background
  • 5 year old renewable energy company, co-owned and co-located with 35 year old construction company in Mt. Vernon NY
  • Mission is to provide sustainable and resilient solutions to a wide range of Commercial, Institutional and Residential clients leveraging relationships from both the construction and the NYC/NY State electric utility business

• Product Lines
  • mCHP Fuel Cell (SOLIDpower)
  • CHP reciprocating engines (35kW class Yanmar CHP)
  • Innovative wind/solar powered off-grid light (Aris Wind’s Remote Power Unit)

• Capabilities
  • Equipment/system supply, installation and maintenance
  • Project development and execution of energy/construction projects including our own products and/or integrated with others (ex: Community Solar project on our own roof top)
Aris Energy Solutions’ Perspective on mCHP Fuel Cell Applications/Markets

- Targeted Markets with 1.5kW BlueGen
  - Residential (via utilities and financing partners)
  - Multi-family residential
  - Small commercial - examples:
    - Bank branches for critical power portion of loads
    - Gas stations for storm resiliency
    - “Data Closets” and “Data Rooms”
- Targeted Markets with 6kW BlueGen
  - Multi-family residential
  - Small commercial – larger loads
  - Institutional – distributed resilient power at targeted locations

- Aris/SOLIDpower US Progress Thus Far
  - 1+ Year operating experiences at Brookhaven National Lab with excellent results, four events at Brookhaven to showcase with major banks, ConEd, NYPA, NYC DCAS, Port Authority, other key large commercial customers
  - Contract with National Grid for residential demonstrations in their Brooklyn, Queens, Long Island gas service territory
  - Substantial interest from other utilities in Northeast and California regions
  - Establishing distribution/asset ownership partnerships with ESCO’s/others
Thank you

Steve Almeida Jr.
Aris Energy Solutions, LLC
Director Fuel Cells & CHP
506 South 9th Ave. Mount Vernon, NY 10550
Email: salmeida@aris-re.com
Office: (914) 663-2747 x263
Cell: (914) 839-3257

www.aris-re.com
Sean James, Microsoft

Director of Energy Research at Microsoft

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The Stark and Simple Data center

Changing data centers to change the world. How smart innovation and early adopters will usher in the next energy revolution.
The steam factory Line Drive
Energy efficiency in datacenters

Source: Reinventing Fire (Lovins)
Server Integrated Fuel Cells

Higher power availability
• Reduces potential points of failure

Lower infrastructure costs
• Elimination of electrical distribution, power conditioning, and back-up infrastructure

Dramatic improvement in efficiency
• Reduced Power Utilization Efficiency (PUE)
• Reduced loss from power generation to the mother board

The first universal datacenter design
• Utilizes methane, a fungible energy source
• Avoids customization to accommodate differing voltages, frequencies
Fuel Cell Build stages
The Stark and Simple Data center

Changing data centers to change the world. How smart innovation and early adopters will usher in the next energy revolution.

Thank you!
Questions
Upcoming Events

Hannover Messe – Join us in Hall 27, booth E80

Increasing the Value Proposition: Hydrogen Recycling and CO2 Upcycling (Webinar) TBD: 1:00 PM – 2:00 PM ET

Export Control & Cybersecurity (Webinar) TBD: 1:00 PM – 2:00 PM ET

June 12, 2018: 8:00 AM – 8:00 PM, Washington, D.C.

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