



Hydrogen and Fuel Cells

Shannon Baxter-Clemmons, PhD, Executive Director
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Collaborating

Coordinating

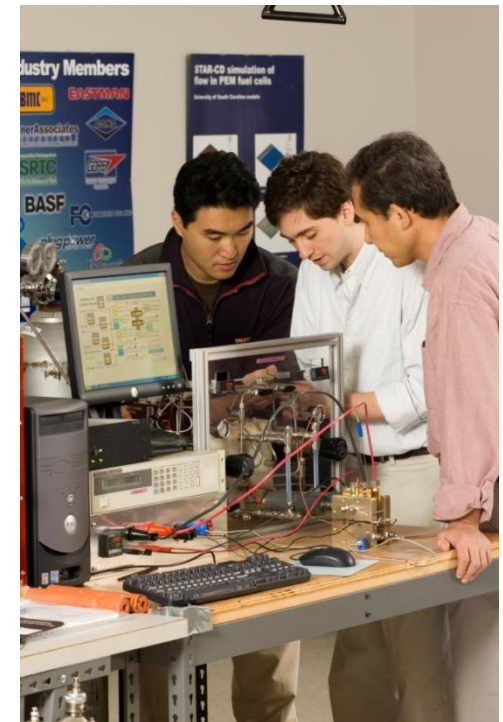
Creating

SCHFCA Mission

The South Carolina Hydrogen and Fuel Cell Alliance is a public-private collaboration for cooperative and coordinated utilization of resources in the state used to advance the commercialization of hydrogen and fuel cell technologies.

SC Research Institutions

- Savannah River National Laboratory
- Applied Research Center: Hydrogen
- University of South Carolina
 - NSF Industry/University Cooperative Research Center
 - Solid Oxide Fuel Cell Center of Excellence
- South Carolina State University
 - James E. Clyburn Transportation Center
- Clemson University
 - International Center for Automotive Research



State of the States: Fuel Cells in America



Top 5 (alphabetical)
California, Connecticut,
New York, Ohio, and
South Carolina.

South Carolina
is one of the
Top 5 Fuel Cell
States
in the U.S.A.



Partners



I/U Cooperative Research
Center for Fuel Cells

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SC Hydrogen and Fuel Cell Permitting Law

- Introduced by Speaker Harrell--Passed into law in 2010
- Policy is a result of cooperative work between:
 - **state officials**
 - **industry representatives**
 - **codes and standards experts**
 - **Municipal Association of South Carolina**



South Carolina is the first state in the US to permit hydrogen and fuel cell deployments at the state level using existing internationally recognized codes and standards.

SC Hydrogen and Fuel Cell Permitting Law

Places the authority and responsibility of permitting hydrogen and fuel cells in SC in the jurisdiction of the Office of the State Fire Marshal.

Benefits:

1. Increases public safety by creating a state expert at the Office of the State Fire Marshal
2. Creates a better business environment for the placement of hydrogen and fuel cell facilities
3. Raises South Carolina's profile as a progressive place for hydrogen and fuel cells.



Columbia Fuel Cell District

Harnessing The Elements For Change.
Building A Fuel Cell Economy In The Columbia Region.



Columbia College

University of South Carolina



Benedict College

Allen University



Lexington County
A municipal partner engaged in adopting fuel cell technology.



Midlands Technical College
Developing integrated curriculum to train fuel cell technicians.



Columbia Metropolitan Airport
Potential user of fuel cell technology in ground transportation vehicles.



Fort Jackson
The largest Initial Entry Training Center for the U.S. Army, interested in fuel cell applications for the military.



Fort Jackson Fuel Cell Applications

Capacity	Back Up Function
15 KW	Emergency services center and 911 call center
30 KW	Critical communications and IT services
5 KW	Base-wide energy management control center



10-5 KW units in 3 locations

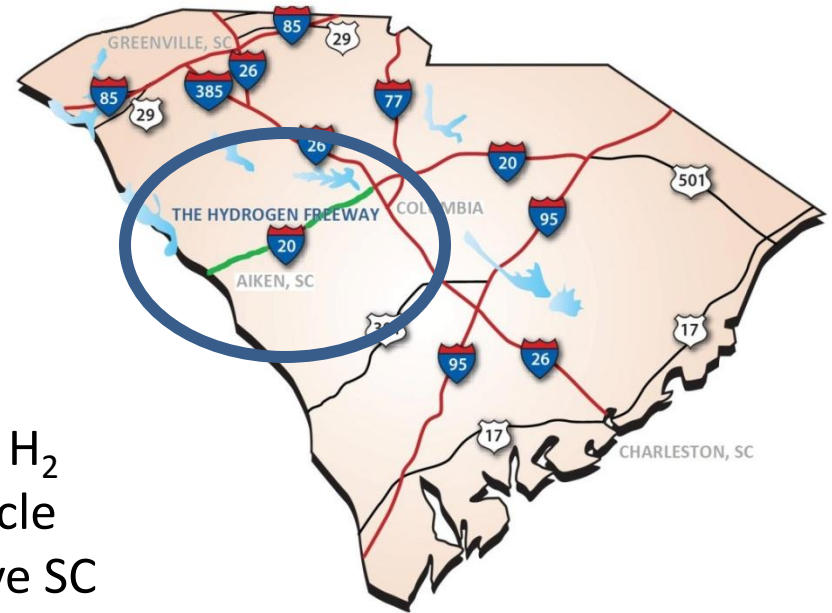


Ft. Jackson Emergency Services Center

Ft. Jackson Telecommunications Center

S.C. Hydrogen Freeway

- Sage Mill Hydrogen Station
 - Capacity: 80 kg/day
- Columbia Hydrogen Station
 - Capacity: 120 kg/day



First H₂ vehicle to drive SC H₂ Freeway

Fuel Cell Vehicles

Several major automakers have recently announced intentions to get fuel-cell models into showrooms by 2015 including GM, Daimler, Toyota, and Honda

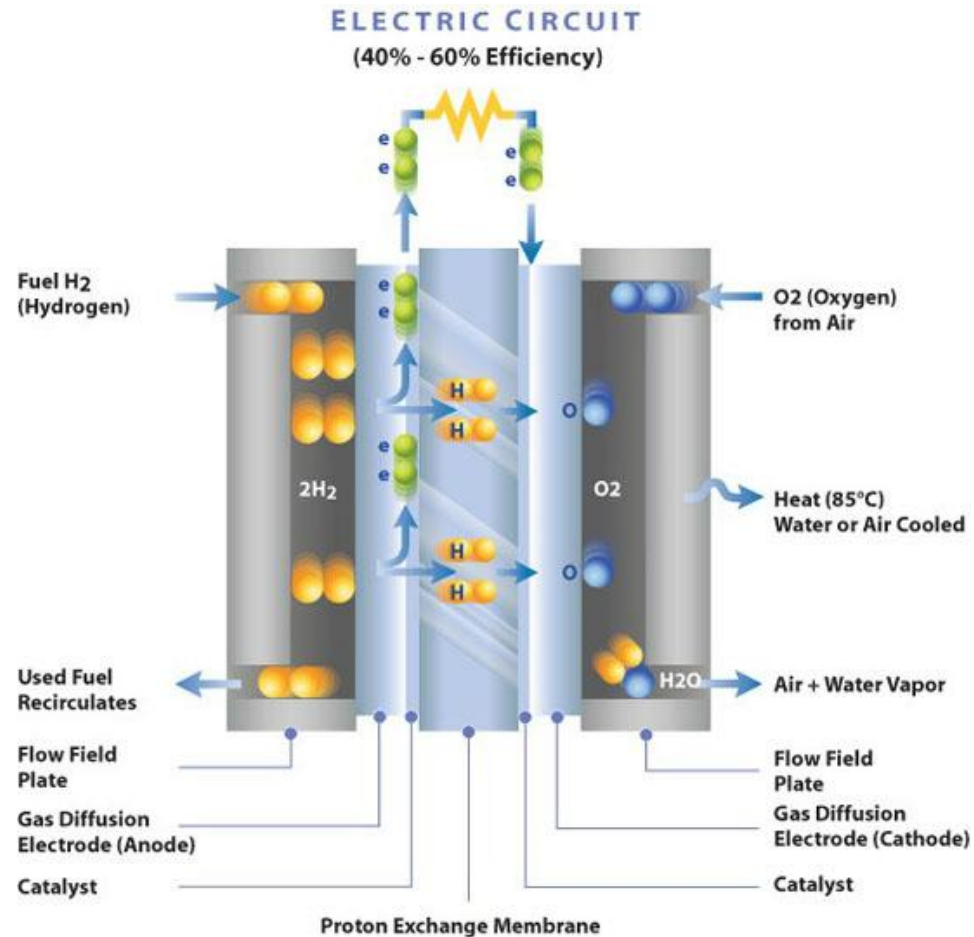
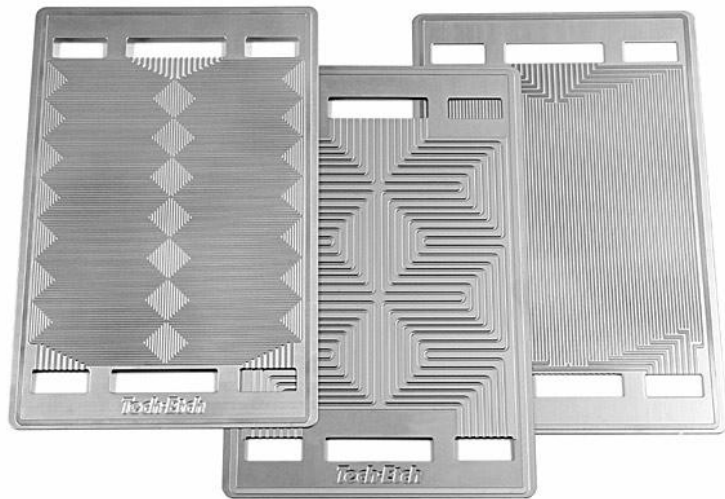


Energy Security Becomes a Local Issue

- Couples transportation and stationary energy
- “Firms up” renewable resources
- Allows for the use of indigenous fuel sources
 - Renewables, nuclear, fossil fuels
- Breaks traditional energy paradigms
 - Monopolies
 - Fueling infrastructure
 - Vehicle capabilities



What is a fuel cell? How does it work?



Currently putting together Case Studies that examine the

Current Market Value Proposition

for hydrogen and fuel cells in:

Cell Phone Towers

Combined Heat and Power (CHP)

Forklifts



Market Value Proposition

Hydrogen Fork-Lifts

Bridgestone-Firestone Plant &
GENCO warehouse in Aiken, SC

Creates jobs for operation,
maintenance, and distribution of
technology



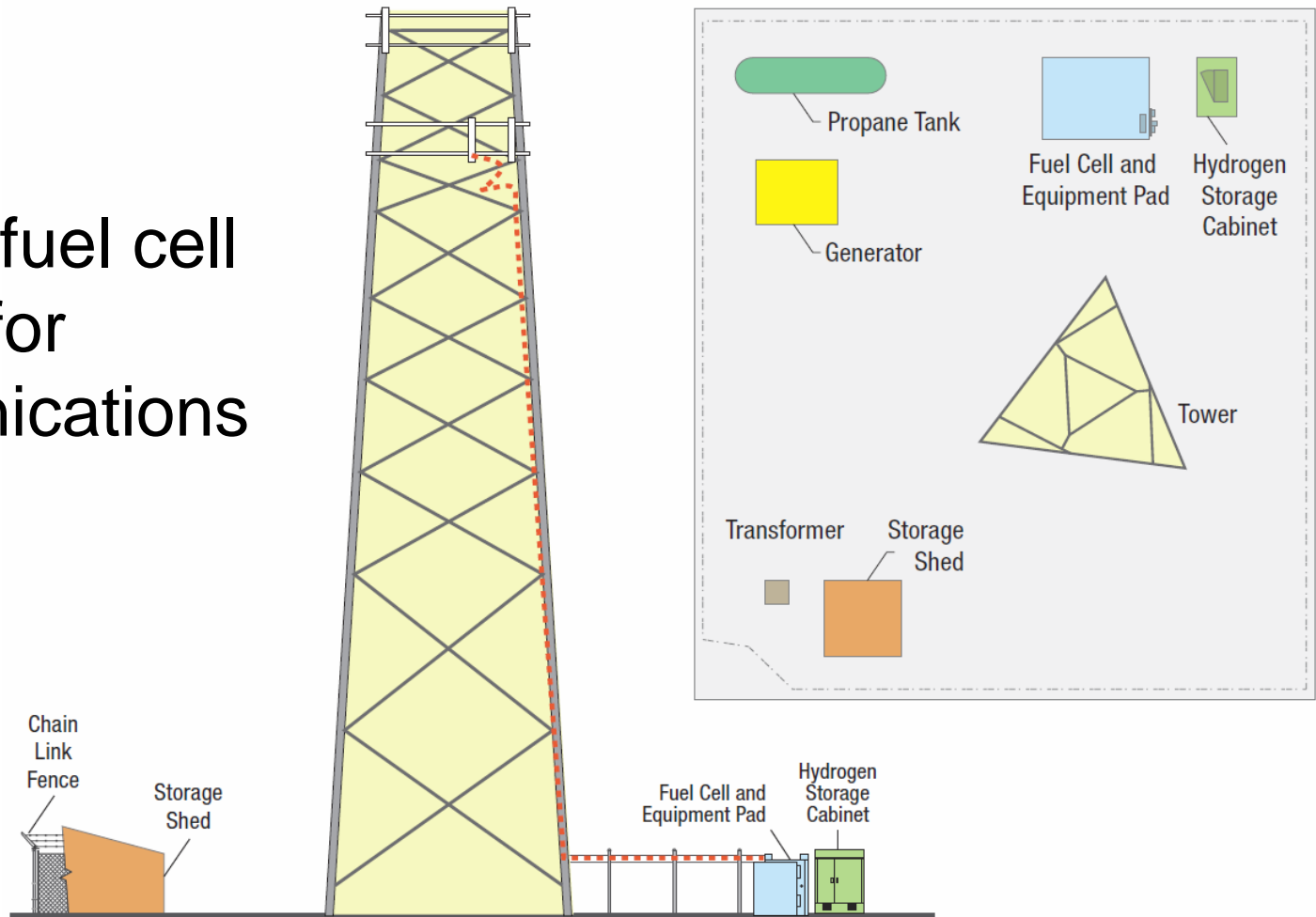
**Key Strategy to increasing
hydrogen through put of
local hydrogen station**

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Example of fuel cell application for telecommunications



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Fuel Cell/Battery Side by Side

INITIAL COSTS

BTS Qty	Power Required		Fuel Cell System			Conventional Battery		
	Amps @ 48 VDC	kW	Cost (\$ US)	Footprint		Cost (\$ US)	Footprint	
				SF	lbs		SF	lbs
1	35	1.68	31,806	13	854	12,000	9	975
2	70	3.36	31,806	13	963	19,000	18	1,950
3	105	5.04	45,564	27	1,515	26,000	27	2,925
4	140	6.72	45,564	27	1,624	33,000	36	3,900
5	175	8.40	45,564	27	1,733	40,000	45	4,875

Fuel Cell/Battery Side by Side

TEN YEAR COSTS

BTS Qty	Power Required		Fuel Cell System			Conventional Battery		
	Amps @ 48 VDC	kW	Cost (\$ US)	Footprint		Cost (\$ US)	Footprint	
				SF	lbs		SF	lbs
1	35	1.68	47,237	13	854	66,100	9	975
2	70	3.36	47,444	13	963	101,700	18	1,950
3	105	5.04	76,183	27	1,515	137,300	27	2,925
4	140	6.72	76,390	27	1,624	172,900	36	3,900
5	175	8.40	76,596	27	1,733	208,500	45	4,875

Notes

1. 4 Hours of support power is required
2. Cost reflects turn-key estimate for typical installation
3. Cabinet configurations with best life cycle cost used for fuel cells (others available)
4. Costs include estimated annual lease, fuel, maintenance, and replacement expenses



- Builds hybrid and all-electric city buses
- Building a \$68 million plant in Greenville
- Breaking ground in July 2010
- Expected to generate over 1,000 jobs





Industry



- Build Hydrogen Fuel Cell generators and hydrogen fuel canisters for commercial uses
- Moved its manufacturing and administration to Columbia, creating over 1,000 jobs
- Partner with Midlands Tech—hired first 5 fuel cell technology graduates in 2010
- An SCLaunch! partner company



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Check-out South Carolina!



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