Subfreezing Start/Stop Protocol for an Advanced Metallic Open-Flowfield Fuel Cell Stack

Presented at: US DOE New Projects Kickoff Meeting
Washington, DC

13-14 February 2007

Objective

This project will demonstrate a PEM fuel cell stack that is able to perform and start up in subfreezing conditions, respecting allowed energy budget, and showing limited impact at extreme temperatures over multiple exposures, without irreversibly degrading its performance more than 5%.

Table 3.4.2. Technical Targets for Automotive-Scale: 80-kW_e (net) Integrated Transportation Fuel Cell Power Systems Operating on Direct Hydrogen[a]

Characteristic	Units	2003 Status	2005 Status	2010	2015
Cold start-up time to 50% of rated power					
@-20°C ambient temp	sec	120	20	30	30
@+20°C ambient temp	sec	60	<10	5	5
Start up and shut down energy[f]					
from -20°C ambient temp	MJ	na	7.5	5	5
from +20°C ambient temp	MJ	na	na	1	1
Durability with cycling	hours	na	~1,000[g]	5,000[h]	5,000[h]
Unassisted start from[i]	°C	na	-20	-40	-40

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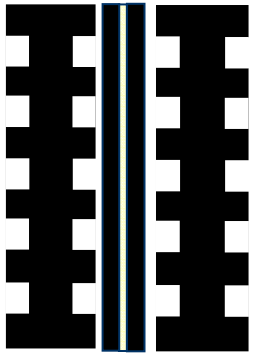
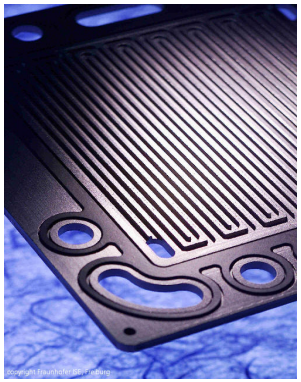
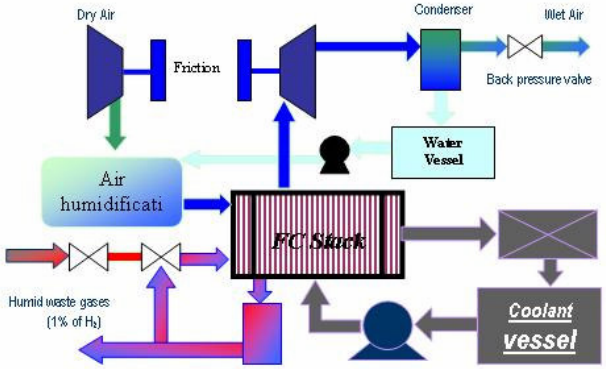
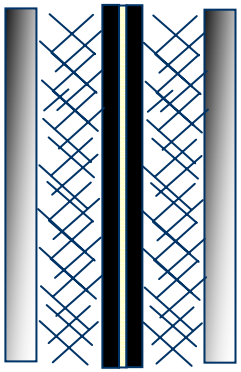
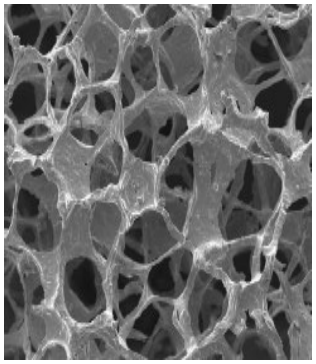
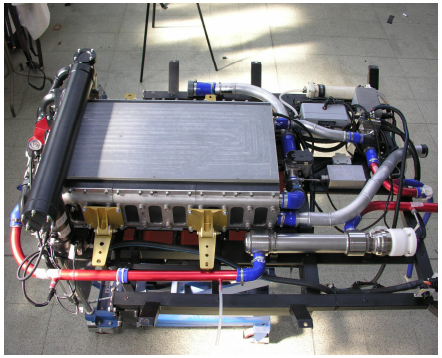
Nuvera Technology Differentiators

	Flowfield	BPA Material	Humidification
Standard	 Directed Flow	 Graphite	 External Humidifier
Nuvera	 Open Flow	 Base Metal Alloy	 100% Internal

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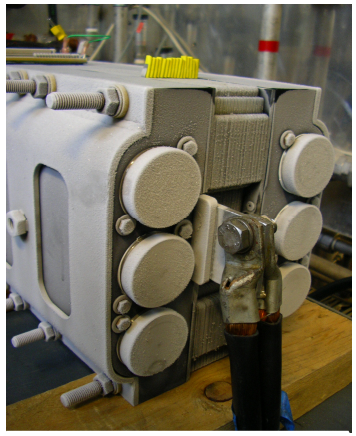
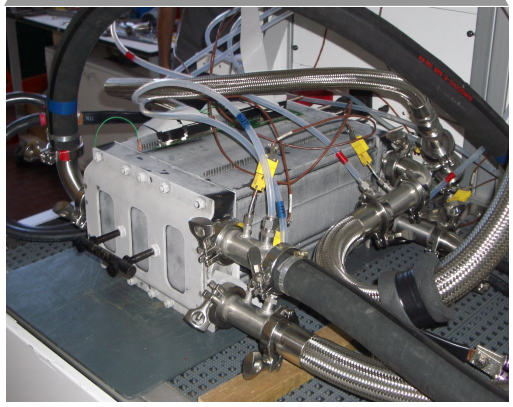
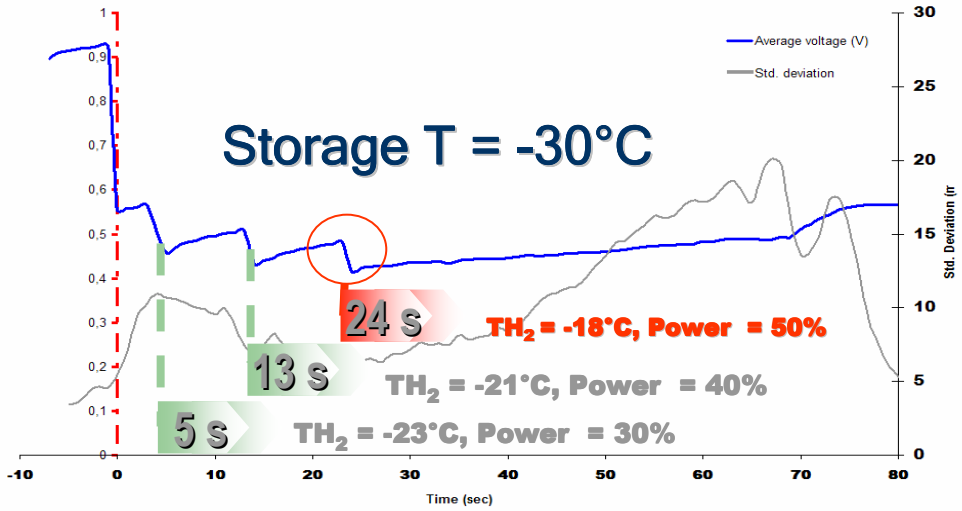
Cold Operation Experience



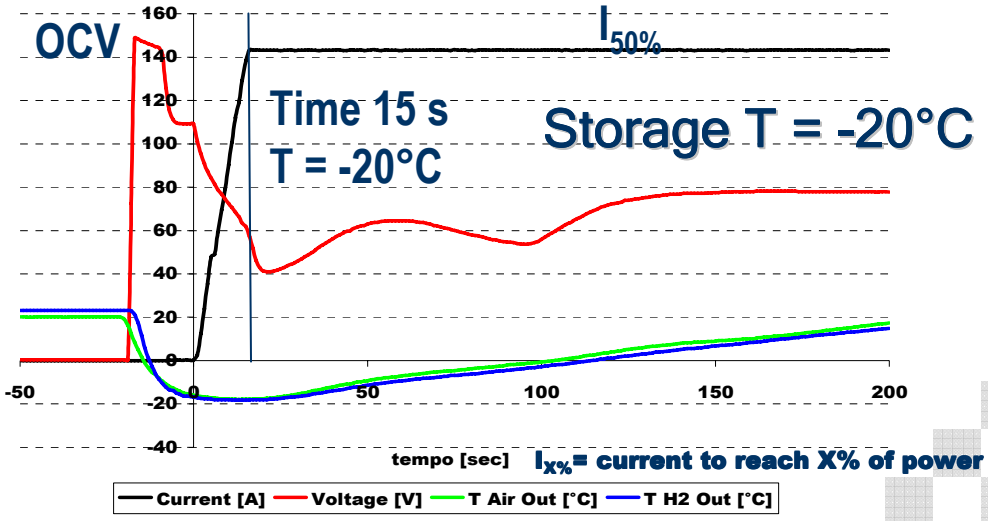
Scale up



16 cells (3,4 kW power)



128 cells (27 kW power)



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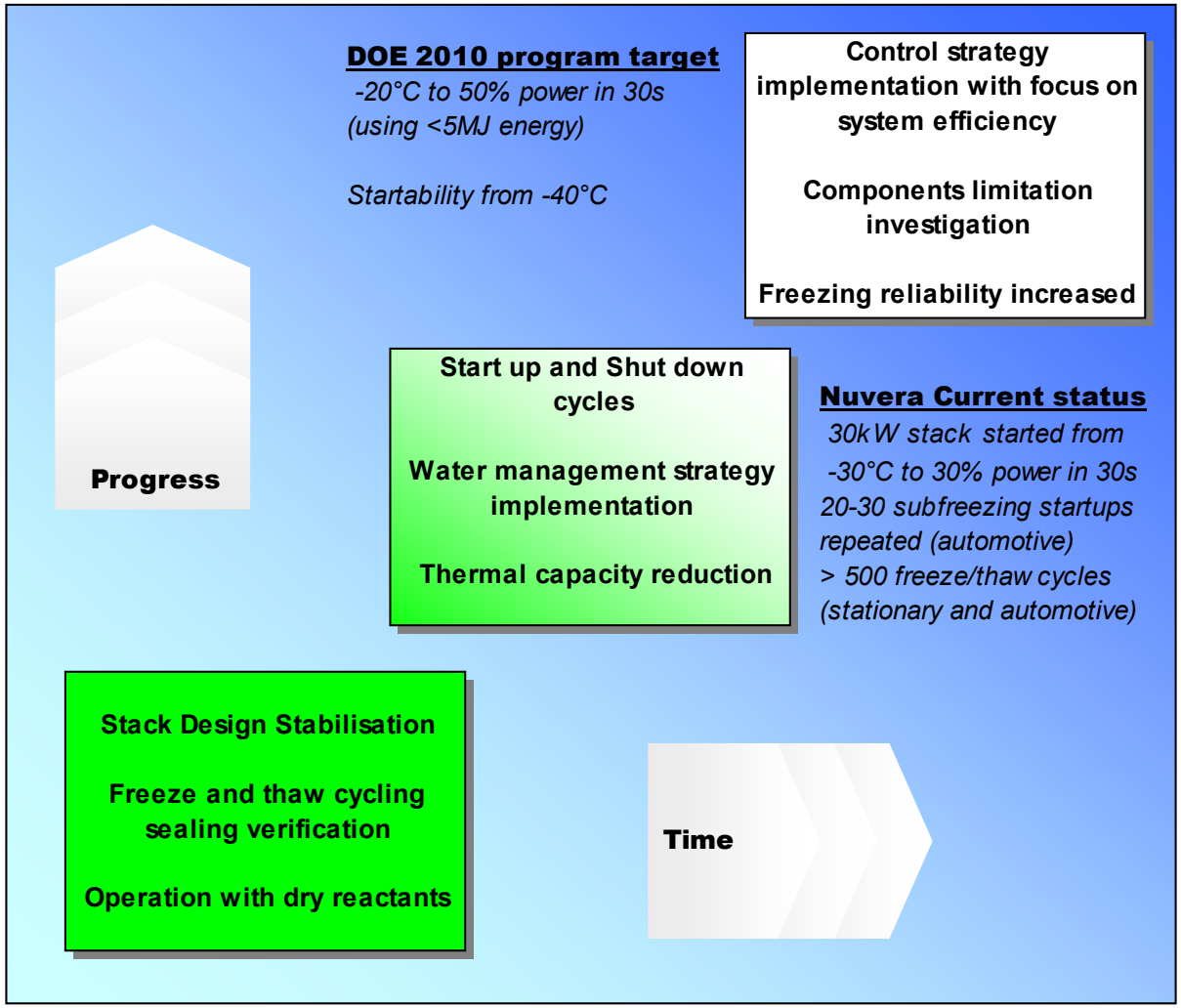
Approach



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Project Overview

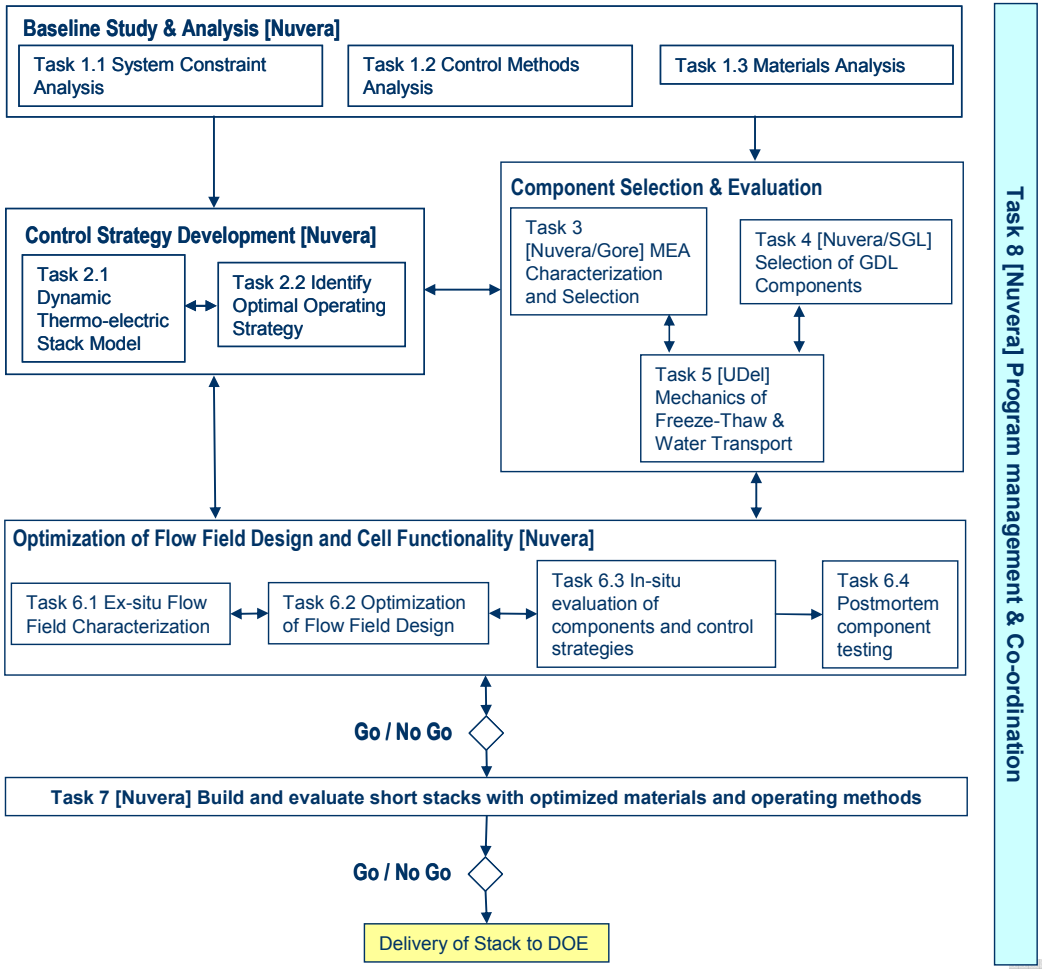
Project Team:

NUVERA FUEL CELLS

GORE Creative Technologies Worldwide

SGL CARBON GROUP

UNIVERSITY OF DELAWARE



Budget & Funding Needs

Active project duration is 36 months.

DOE FISCAL YEAR	2007	2008	2009	2010	TOTAL
Beginning	10/1/06	10/1/07	10/1/08	10/1/09	V
Ending	9/30/07	9/30/08	9/30/09	9/30/10	V
# Active Project Months	6	12	12	6	V
Est'd Project Funding Need	**$631,583**	**$2,011,390**	**$1,853,661**	**$473,854**	$4,970,488

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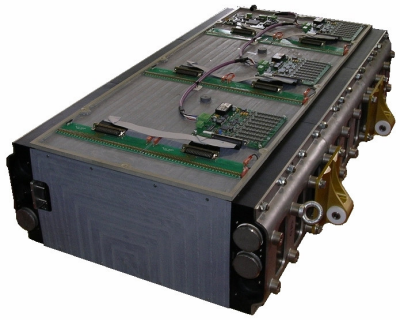
Summary

Specific goals of the project

- Start-up to 50% rated power from -20C in 30 seconds using <5 MJ of energy
- Decay <5% with 1000X exposure to -40C

Success enablers

- Open & low thermal mass flowfield
- Internal humidification
- State of the art material (MEA, GDL) combinations
- Proven methods and targeted controls optimization
- Project Team (Nuvera, Gore, SGL, & Univ of Delaware)



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