



# LGFCs Solid Oxide Fuel Cell Prototype System Test

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## ABSTRACT

In this project, LG Fuel Cell Systems Inc. (LGFCs) will deploy a 250kW rated product demonstrator on a site provided by Stark State College in North Canton, Ohio where the system will operate on natural gas and connect directly to the electric grid. The product-like prototype solid oxide fuel cell (SOFC) power system will incorporate current technologies and operate under a range of environmental conditions for at least 5,000 hours to assess progress of system durability, performance and operating cost toward commercial readiness.

The expected outcome of the project is demonstration of improved system reliability and degradation over an extended operating duration that will advance the modular SOFC power system to Technical Readiness Level (TRL) 7. This demonstration is a key step in building confidence in scaling the technology to multiple generator module configurations and gaining support for additional field-testing on the path to a MW scale demonstration.

## BACKGROUND

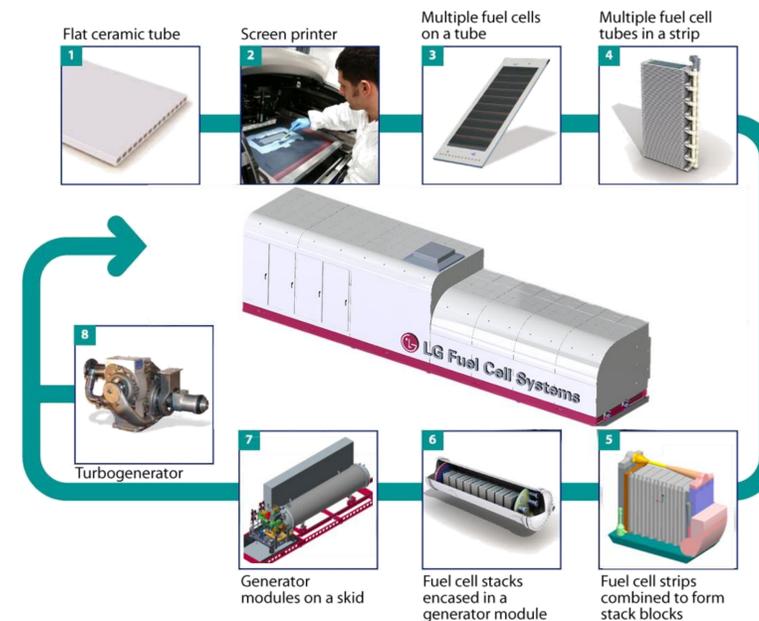
LGFCs has been actively engaged in the development of SOFC technology for over 20 years. LGFCs has its roots in LG Corporation and Rolls-Royce plc. LG Electronics brings state-of-the-art manufacturing expertise through its Production Research Institute and expertise in ceramic materials and paste development through its Chemical & Electronic Material (LG CEM) Company. The technical support from Rolls-Royce is evident in the design of its innovative 1MW natural gas-fueled SOFC system, including pressurized operation using a turbo-generator; fuel side and air-side recycle loops enabled through the use of ejectors, and the tight integration of the sub-systems that enables high-efficiency.

LGFCs has worked with the DOE on a number of projects directly related to SOFC development. An early design study was conducted to examine SOFC electrode performance at elevated pressure. LGFCs was involved in the DOE Solid State Energy Conversion Alliance (SECA) Coal-Based Systems program. Work under the SECA Program has focused on fuel cell material sets to meet cost and performance targets, as well as achieving the reliability and durability for large scale stationary power systems. This work also included block-scale (TRL5) performance and durability testing of advanced set of cell and stack materials. The current SECA work has focused on stack technology advancements including In-stack reforming. The work done under SECA remains very relevant today and is foundational for this project.

## OBJECTIVES

The goal of this program is to test the LGFCs GEN0 modular SOFC power system for a minimum of 5,000 hours while advancing this commercial prototype product demonstrator to a TRL 7. The specific objectives for the proposed work include the assembly of the Fuel Cell Vessel (FCV) rated for 250kW; assembly and packaging of the Generator Module (GM) and Balance of Plant (BOP) packages; installation and interconnection of the power system packages and connection to the fuel supply and power grid; commissioning and shakedown testing to validate assembly and safe operation; and  $\geq 5,000$  hours operation at a base load power rating  $\geq 250$  kW net AC power to the grid. Additionally, the stack cost model developed under earlier DOE-SECA programs will be updated based on the technology and processes to be used for this commercial readiness demonstration test.

## LGFCs SOFC POWER SYSTEM



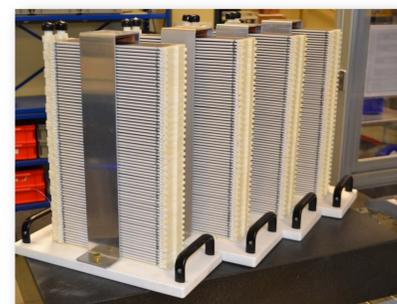
## PRODUCE FEATURES

- Nominal 1MW scale SOFC Power System
- Scalable from 250kW to >20MW
- Electrical efficiency >60% and conducive to combined heat and power
- Fuel flexibility with natural gas and biofuel
- Low Emissions
- High availability for base load operation
- 5 year life for basic cell & stack components
- >20 year life for BOP components

## MEGA-WATT SCALE FUEL CELL FACTORY

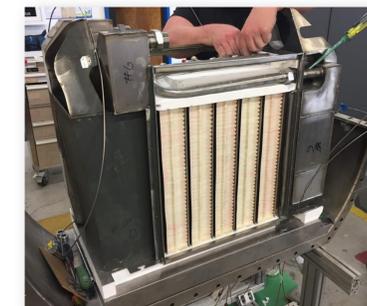


Printed Fuel Cell Tube

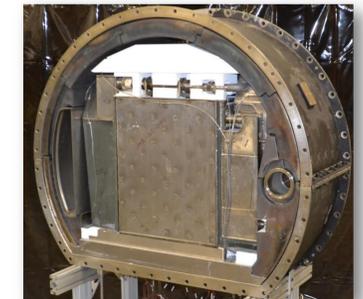


Fuel Cell Strips Ready for Installation

## PROTOTYPE SYSTEM MANUFACTURING



Integrated Block Assembly



Inner Vessel Segment Assembly



Fuel Cell Vessel Assembly

## 250 KW PRODUCT DEMONSTRATOR

The LGFCs 250 KW product demonstrator is schedule for operations in the 4<sup>th</sup> quarter of 2018.



Site Layout



Site Preparation



Generator Module

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