Energy & Environmental Research Center (EERC)

SOFC Development & Demonstration Test Center (SOFCtc)
EERC, Grand Forks, North Dakota
Built with funding and support from U.S. Department of Energy (DOE)
National Energy Technology Laboratory (NETL)

22nd Annual Solid Oxide Fuel Cell Project Review Meeting
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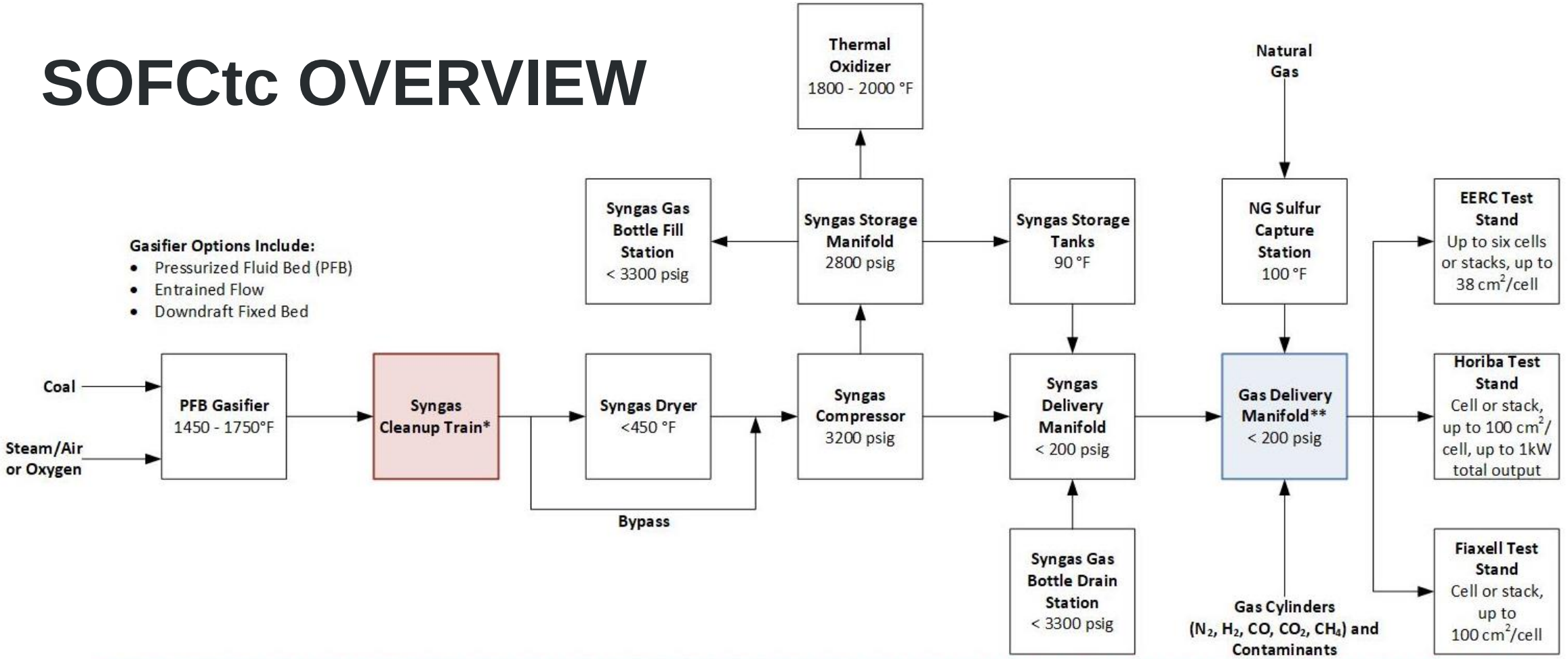
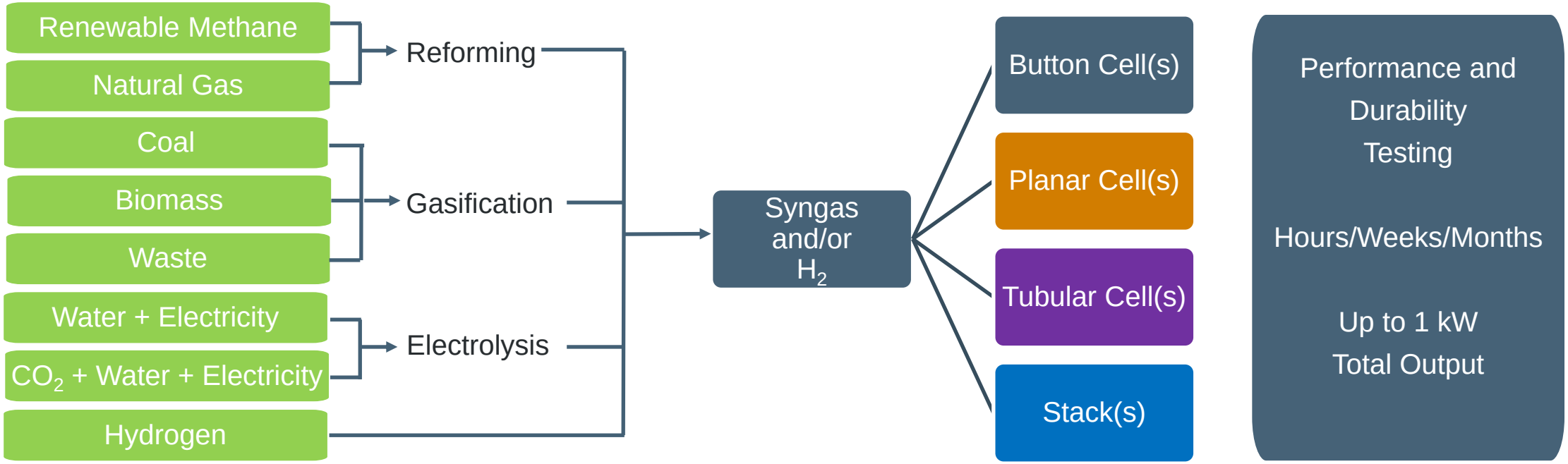
SOFCtc OBJECTIVE

Support U.S. DOE NETL goal of
Advancing SOFC component/system technologies as needed to demonstrate sustainable performance of a ≥10-MWe SOFC system integrated with carbon capture, utilization, and storage (CCUS).

SOFCtc OVERVIEW

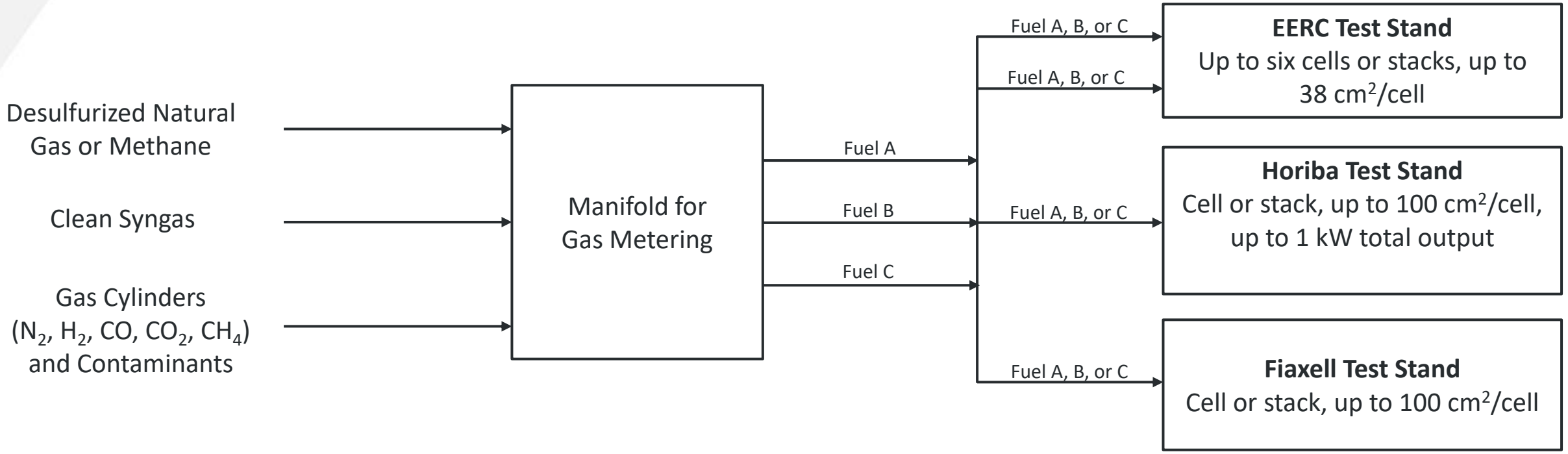


Syngas ($CO + H_2$) Production
H_2 Production and Purification
Gas Blending and/or Contaminant Addition
SOFC System and/or Component Testing



SIMULTANEOUS OPERATION

MULTIPLE TEST STANDS WITH MULTIPLE FUELS



WHAT DO YOU WANT TO LEARN?

- Cell performance and degradation with complex or contaminant-bearing fuels
- Impact of exhaust recycle on SOFC performance
- System integration strategies
  - Thermal integration
  - Carbon capture
- Impact of CO oxidation/H_2 oxidation ratio on SOFC voltage

SYNGAS STORAGE AND DELIVERY

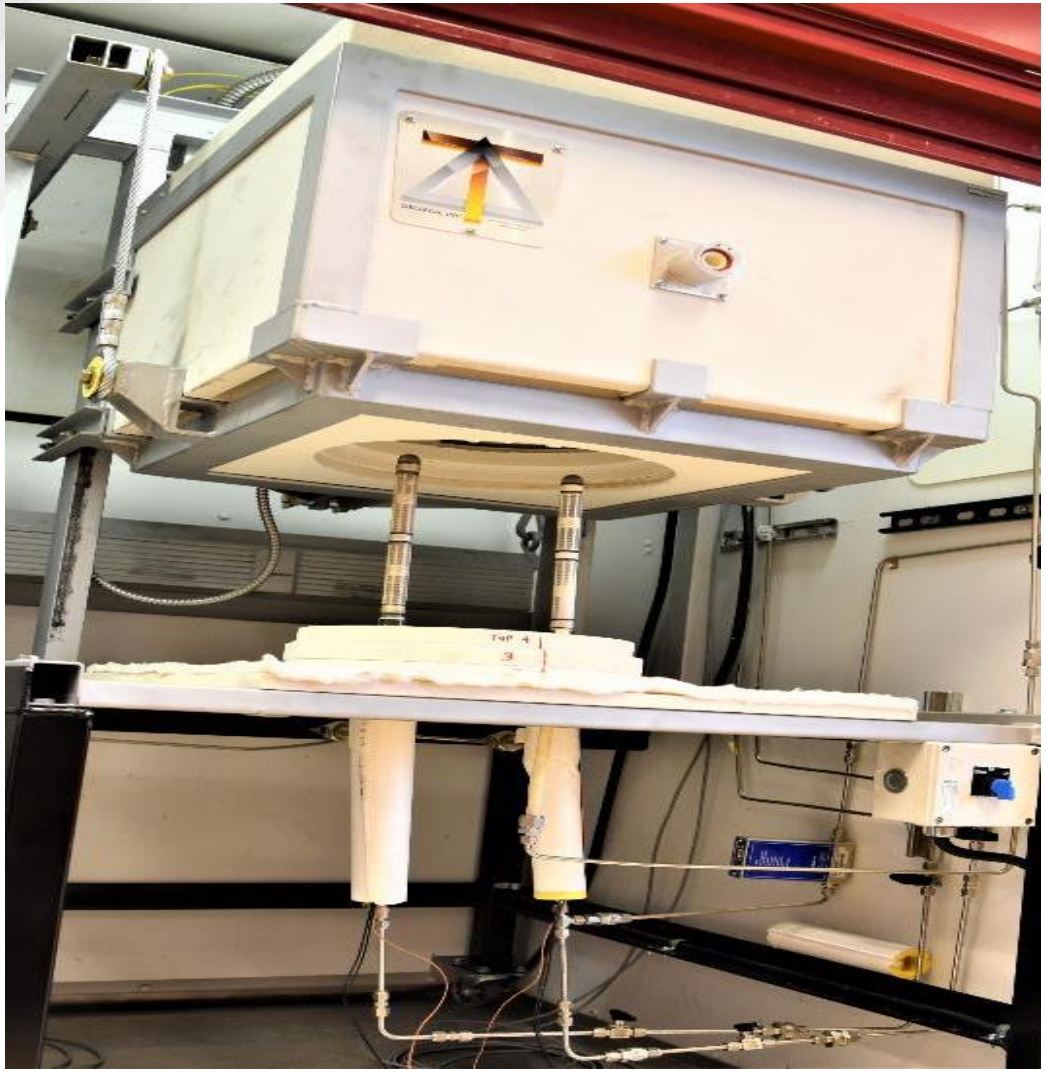
- Storage tank capacity:
  - 20,900 scf at 2600 psi
- Fuel options:
  - Syngas from EERC gasifier (coal, biomass, waste, blend of these)
  - Natural gas (desulfurized)
  - Bottled gas (single or blends of H_2, CO, CH_4, CO_2, N_2, other)
  - Added contaminants
- All three SOFC test stands can be operated simultaneously with up to four different fuels (EERC test stand can accommodate two separate fuels).

HORIBA TEST STAND

Features

- Up to 1-kW cell or stack capacity
- Furnace dimensions:
  - Length: 10 inches
  - Width: 10 inches
  - Height: 10 inches
- Class 1, Division 2, Group 2 enclosure
- Fully automated system
- On-site and remote monitoring
- Fuel supply and exit sampling ports
- Maximum temperature: 1100°C

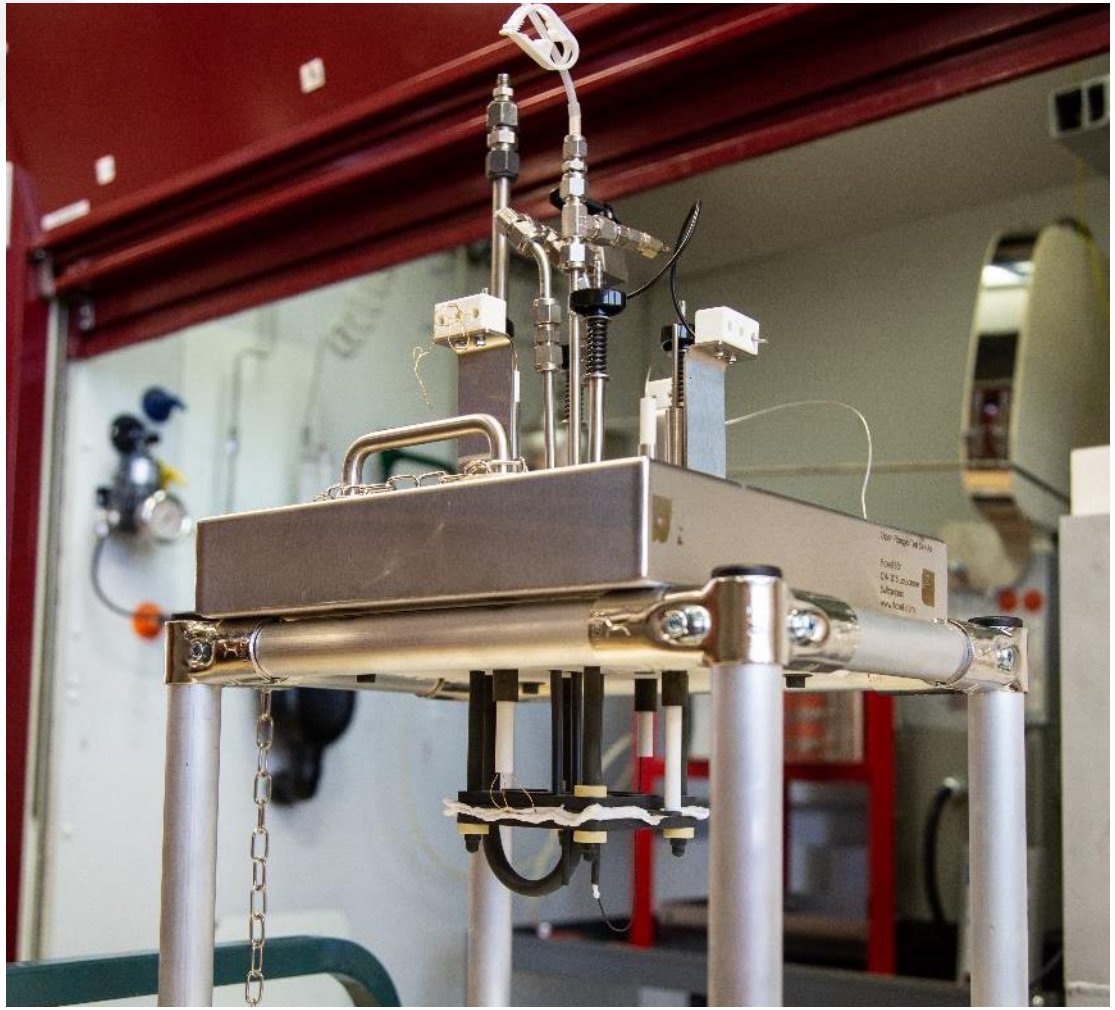
EERC TEST STAND



Features

- Accommodates up to six cells/stacks and two unique fuel specifications simultaneously
- Furnace dimensions:
  - Diameter: 15 inches
  - Height: 13 inches
- Fully automated system
- On-site and remote monitoring
- Fuel supply and exit sampling ports
- Maximum temperature: 1100°C

FIAXELL TEST STAND



Features

- Accommodates a single cell or stack up to 100 cm^2
- Furnace dimensions:
  - Length: 8 inches
  - Width: 8 inches
  - Height: 8 inches
- On-site and remote monitoring
- Maximum temperature: 1000°C

PERFORMANCE ANALYSIS CAPABILITIES

- Potentiostats
  - Six-channel, Autolab
  - Eight-channel, Solartron Analytical
- Direct current loads
  - Five-channel load, zero-volt, 15-amp/channel (quantity two)
  - Single-channel load, 1.5–150 V, 0–200 A, 1 kW
- Current–voltage (IV) tests
- Electrochemical impedance testing (EIS)
- Voltage/current hold tests
- Partial pressure testing for any gas element, anode and cathode side
- Fuel supply and exit gas analysis
  - GC–MS, LGA, FTIR, Dräger tubes
- Imaging, pre- and postmortem imaging of cell components

COLLABORATE WITH THE EERC SOFCtc

- Call us!
- Defining test objectives, desired outcomes
- Assist in designing a test plan
- Consider adaptation of existing or addition of new hardware
- Establish cost and explore possible collaborative funding options

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THANK YOU

Critical Challenges. Practical Solutions.