An overview of Fuel Cell Developments in the UK

UK / Japan Automotive Technology Forum

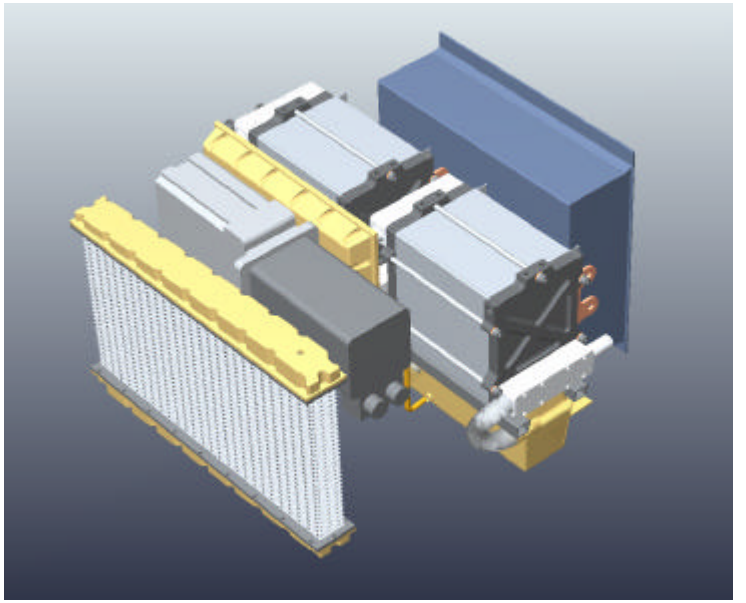
2nd December 2003

INTELLIGENT ENERGY™

UK Fuel Cell Industrial Base

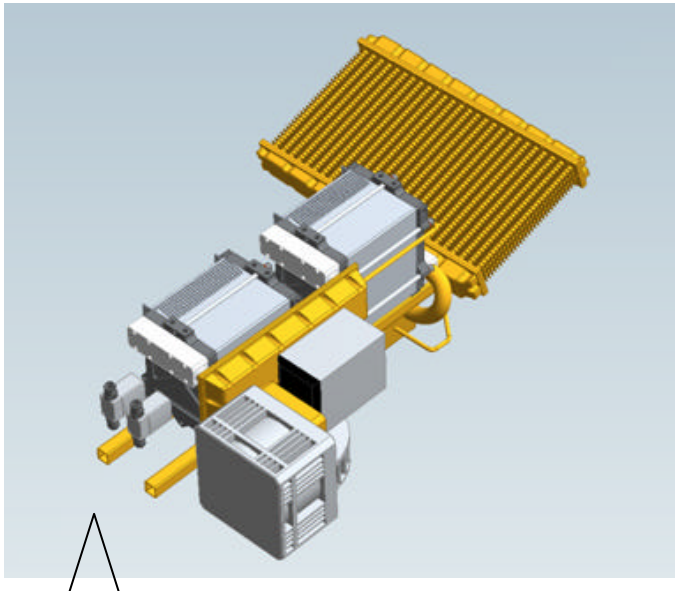
Carbon Trust March 2003

- Stacks 5
- Components 50
- Integration 14
- Materials 14
- Fuel 4
- Consultancy, Information and Finance 20



Layers and Entities

Carbon Trust March 2003



End User

Portable

Stationary

Mobile

System Integration

Stacks

Fuel Systems

Power Conditioning

BoP

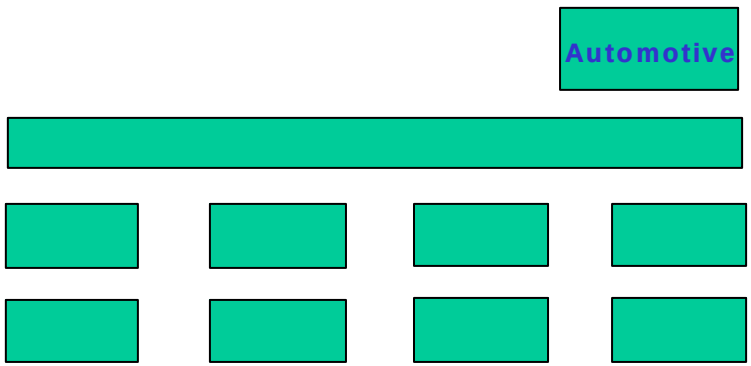
Sub-components and materials suppliers

Automotive Application

Implementation

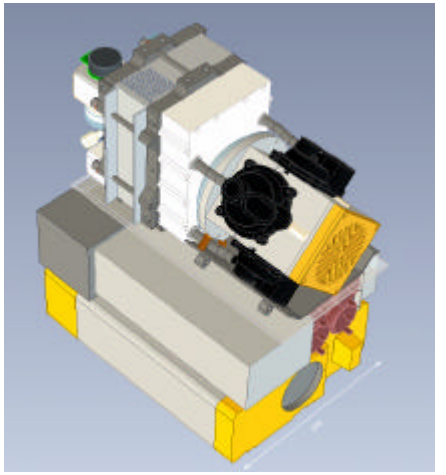
Electric Drive

Other Variants	APU	Charger / Range Extender	FC



Automotive Application

Technologies



Automotive Application

Commercial Developers

Stacks

Adelan
Ceres Power
Rolls Royce

Intelligent Energy
QinetiQ

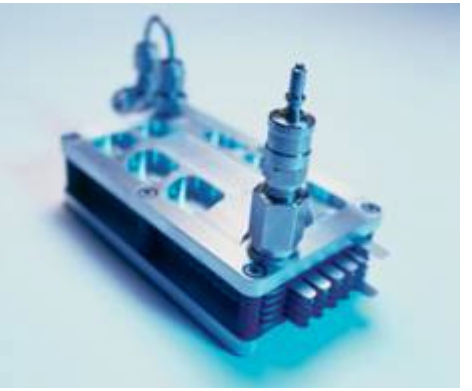
SOFC

PEM

Automotive Application

New Innovation

SOFC - Key Developments



New and Unique Tubular Designs
- Robust Thin Wall Fabrication
- High Resistance to Cracking

Intermediate Temperature Operation (550C)
- Metal Supported Components
- Matched Thermal Expansions

Quick Start-Up

Modular Construction Capabilty

Wide Range of Fuels

Automotive Application

New Innovation

PEM - Key Developments

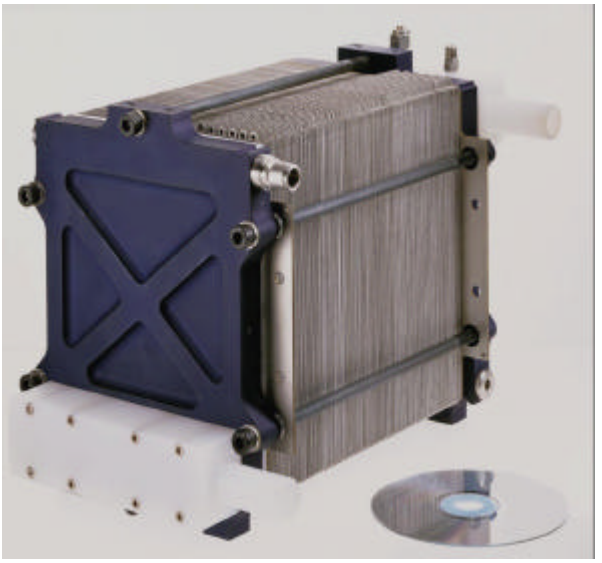
Advanced Water Management

- No external humidifier
- No water cooling circuit (no antifreeze)
- Simplified stack construction (no cooling plates)
- Reduced radiator size
- Rapid start from below zero (-25C)

High power density

Reduced balance of plant
(Better System Integration)

Reduced cost and build time



Automotive Application

Technology Thrust

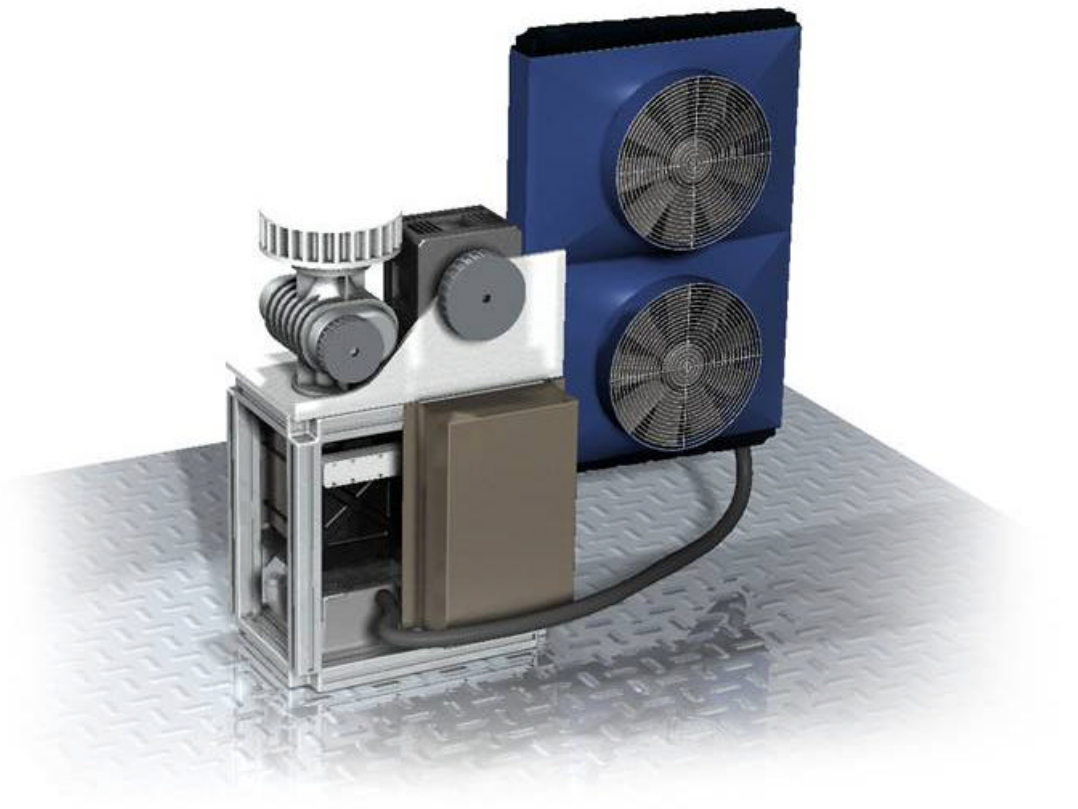
Common Objectives

Cost Reduction

Appropriate Durability

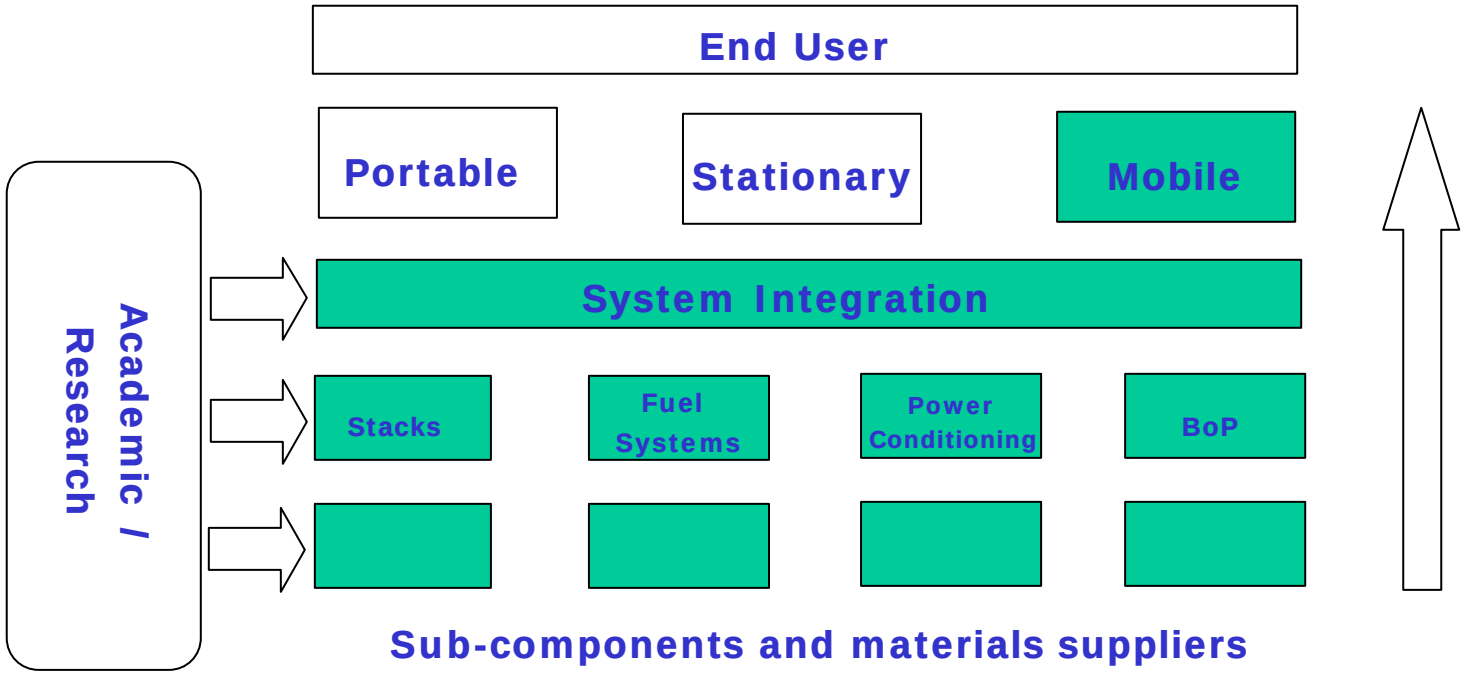
Systems Simplicity

Vehicle Integration / Demonstration



Layers and Entities

Revisited



Working with partners.
Generating new ideas.
Integrating knowledge
and Providing solutions.

End