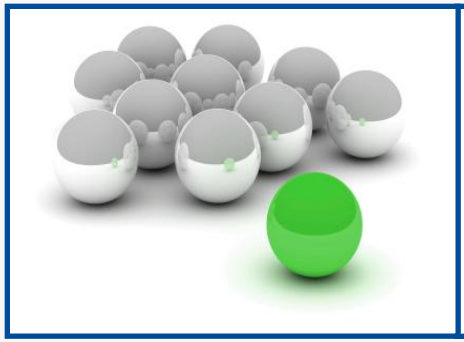
ACAL Energy Company Presentation

Dr. Sukbae Cha, CEO

Stanford Program on European Entrepreneurship & Innovation

April 13, 2009



ACAL Energy

- *Developing a new low cost, reliable 'big' PEM Fuel Cell architecture thru better chemistry*
  - ✓ *Will enable Fuel Cells to replace IC engines in stationary, auto and micro-CHP applications*
- *Experienced Management Team and Board*
  - ✓ *AIM, NASDAQ listing successes, over $.7B generated for investors*
- *Total investment into the company about £7M, combination of pubic and private funds*
  - ✓ *£4M raised December 2008 from UK VCs, European and Japanese Corporations*

Company Founded in 2004 by Former Unilever and ICI Employees

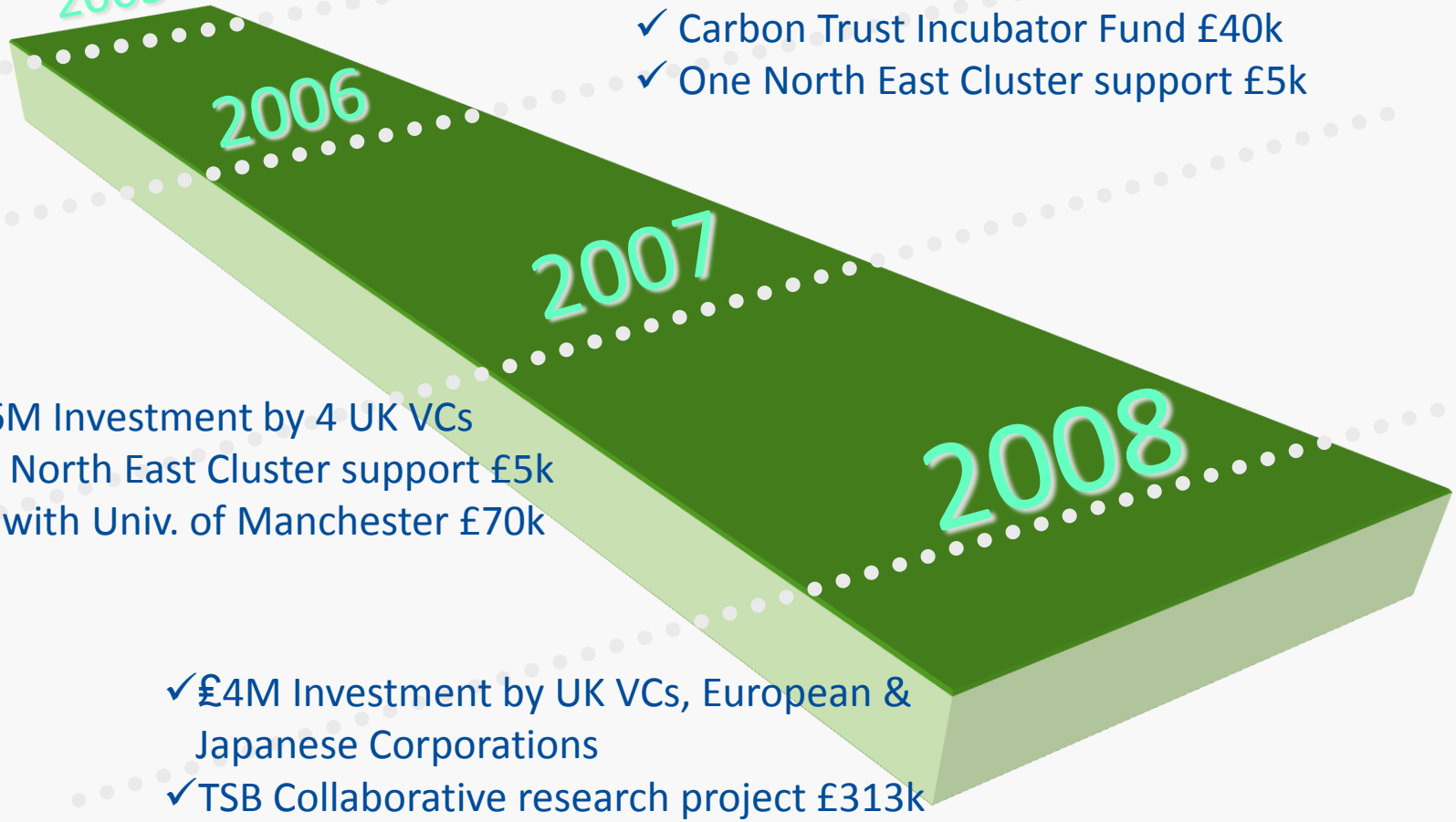
Dr. Andrew Creeth,

Ms Amanda Lyne

ACAL Team – Many Years of Business Creation Experience

- SB Cha – Chief Executive Officer
  - ✓ *CDT, Philips, BCG, Texaco*
- Bob Longman – VP Engineering
  - ✓ *Co-founder Plasmon, Cambridge Consultants*
- Bob Pettigrew – Non Exec Chairman
  - ✓ *Co–founded Generics, 20 business creation experience.*
- David Fyfe – Non Exec Director
  - ✓ *Chair and CEO of CDT Ltd, CEO of Harris Speciality Chemicals*
- James Wilkie–Npn Exec Director
  - ✓ *Birmingham Univ., Technical Director JM Fuel Cell*
- Strong technical, commercial support from corporate investors

Financing History



✓ ERDF Loan £10k

✓ Carbon Trust Incubator Fund £40k
✓ One North East Cluster support £5k

✓£1.6M Investment by 4 UK VCs
✓One North East Cluster support £5k
✓KTP with Univ. of Manchester £70k

✓£4M Investment by UK VCs, European & Japanese Corporations
✓TSB Collaborative research project £313k
✓Carbon Trust Investment Grant for R&D

Fund Raising Timeline

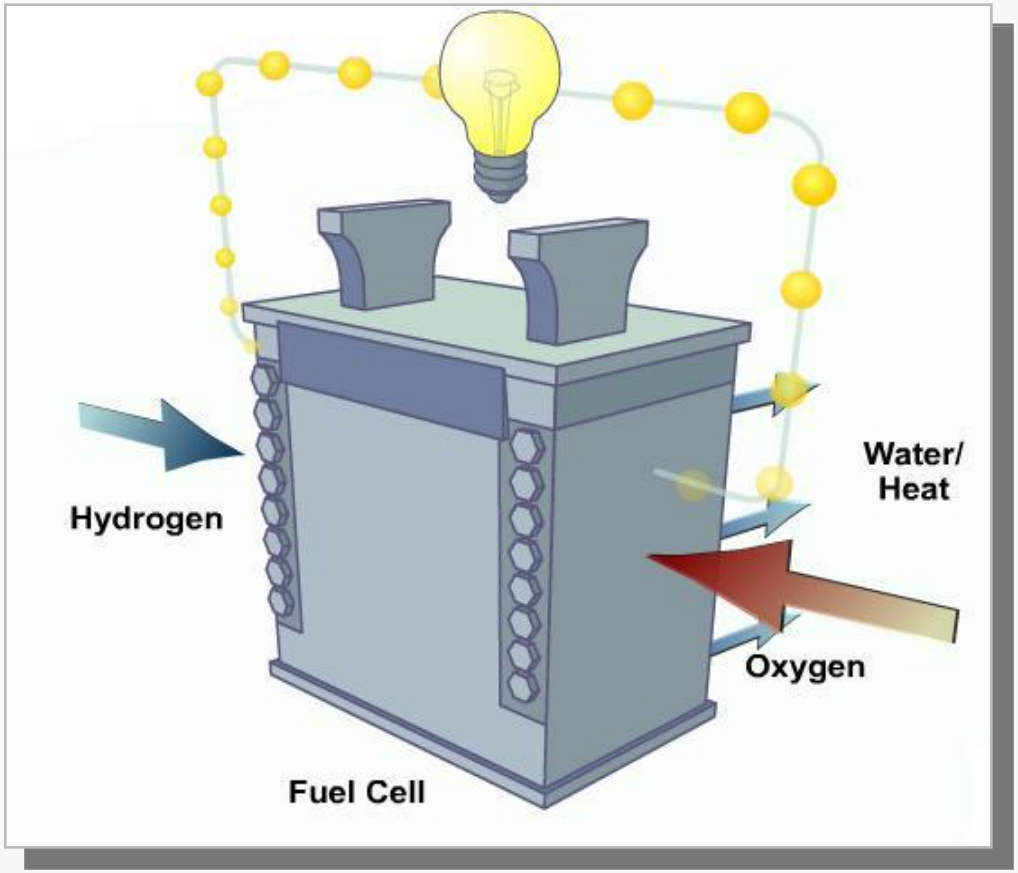
- August - October 2007: Rebuild business strategy, move away from small portable applications to larger applications
- October – December 2007: Build detailed business plan, begin adding more technical resource
- January- February 2008: Select corporate finance advisor, legal advisor, prepare supporting documents
- February 2008: Kick-off process, start meeting potential investors
- March 2008: First potential lead investor emerges, begin preparing for due diligence
- April - July 2008: Corporate investors emerge, existing investors make commitments, it looks like we have a deal
- August 2008: Lead investor pulls out, CTI step in
- September – December 2008: Finish DD, legal documents, final close

ACAL Energy Today

- *Located at the Heath Technical Park, Runcorn, UK*
- *Occupy about 4,000 sq. ft lab and office space*

- *Have grown in 18 months from 5 people to 23 total employees, mostly engineers and chemists*

Fuel Cells Offer Potential for Clean, Renewable Power



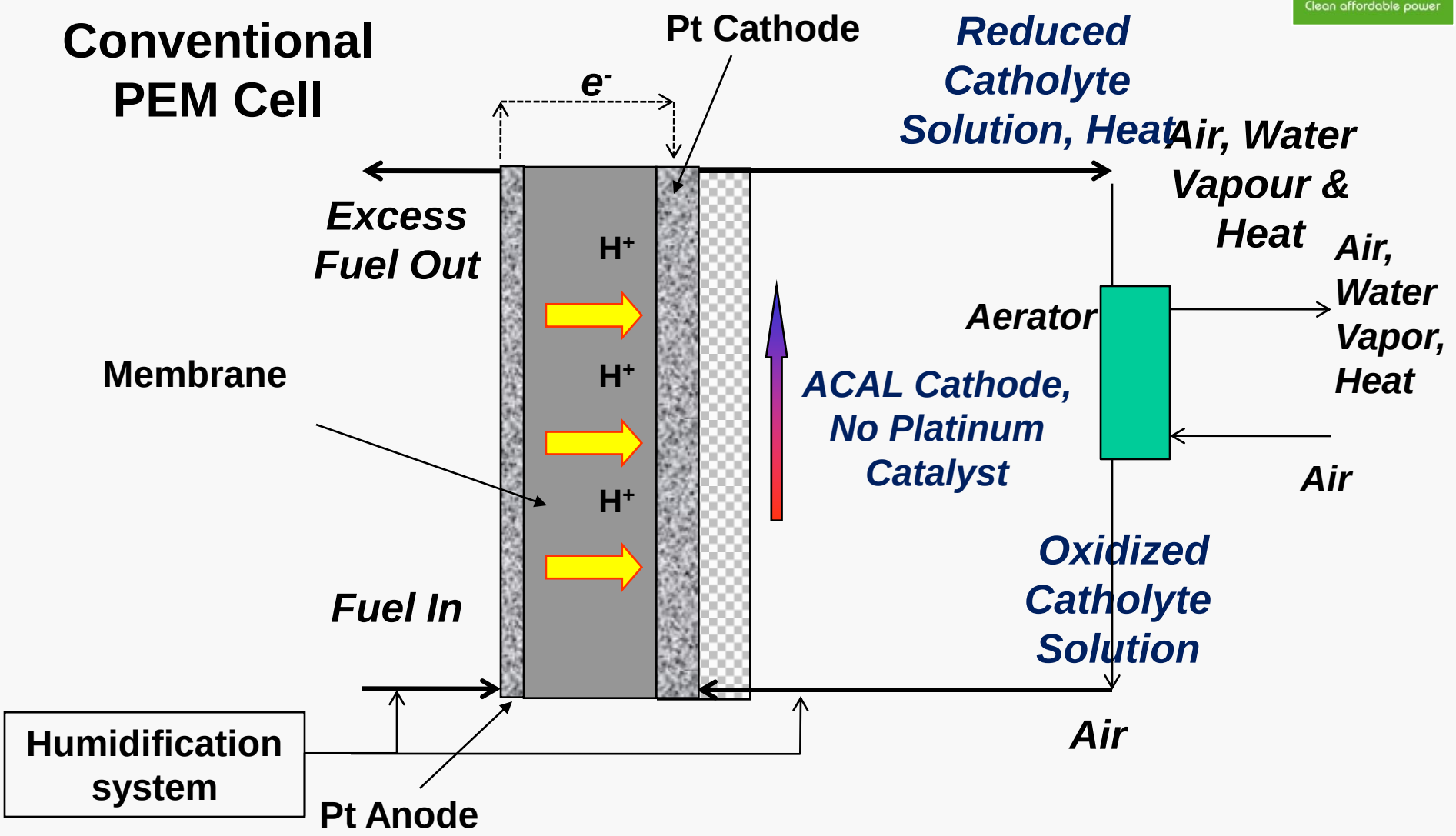
The Opportunity:

- ✓ Clean
- ✓ Quiet
- ✓ Efficient

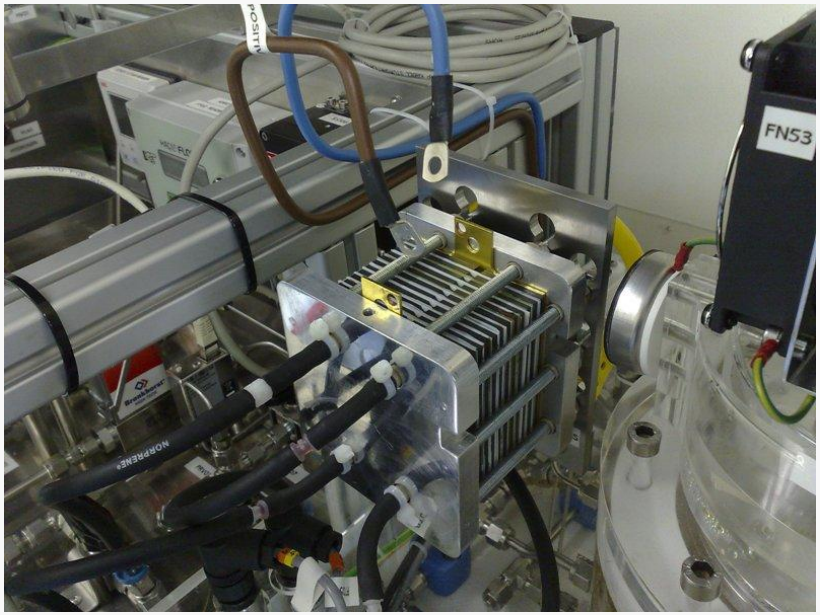
The Challenge:

- X Too expensive
- X Poor performance
- X Not yet commercial

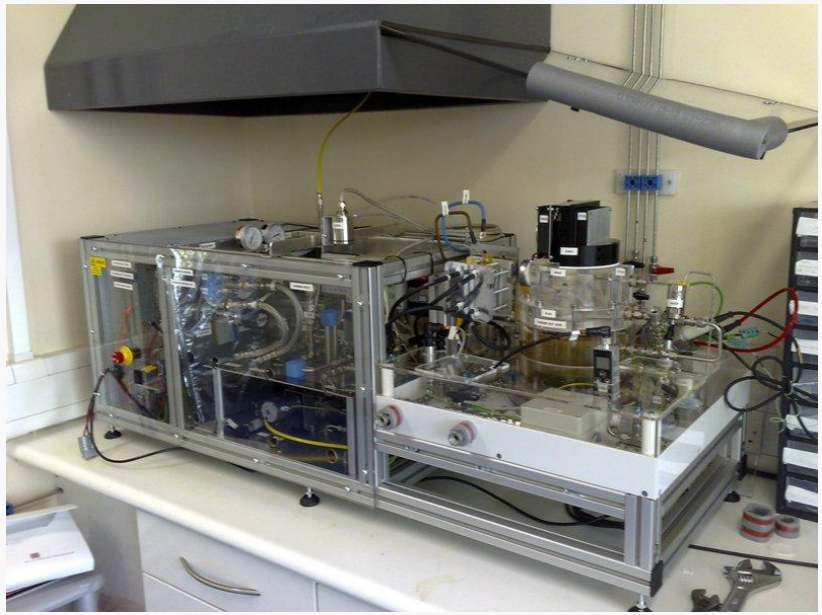
ACAL PEM Cell



10 Cell Stack



50W System

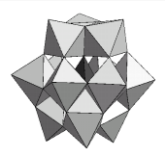


ACAL Core Technology
Catalyst/Mediator Chemistry

Current Generation System

Polyoxometallate
Inorganic association complex

Very stable and robust
Power density approaching Pt

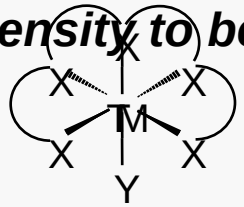


Can deliver 0.6-0.8+W/cm^2, ready today for back-up power and remote power applications.

Next Generation System

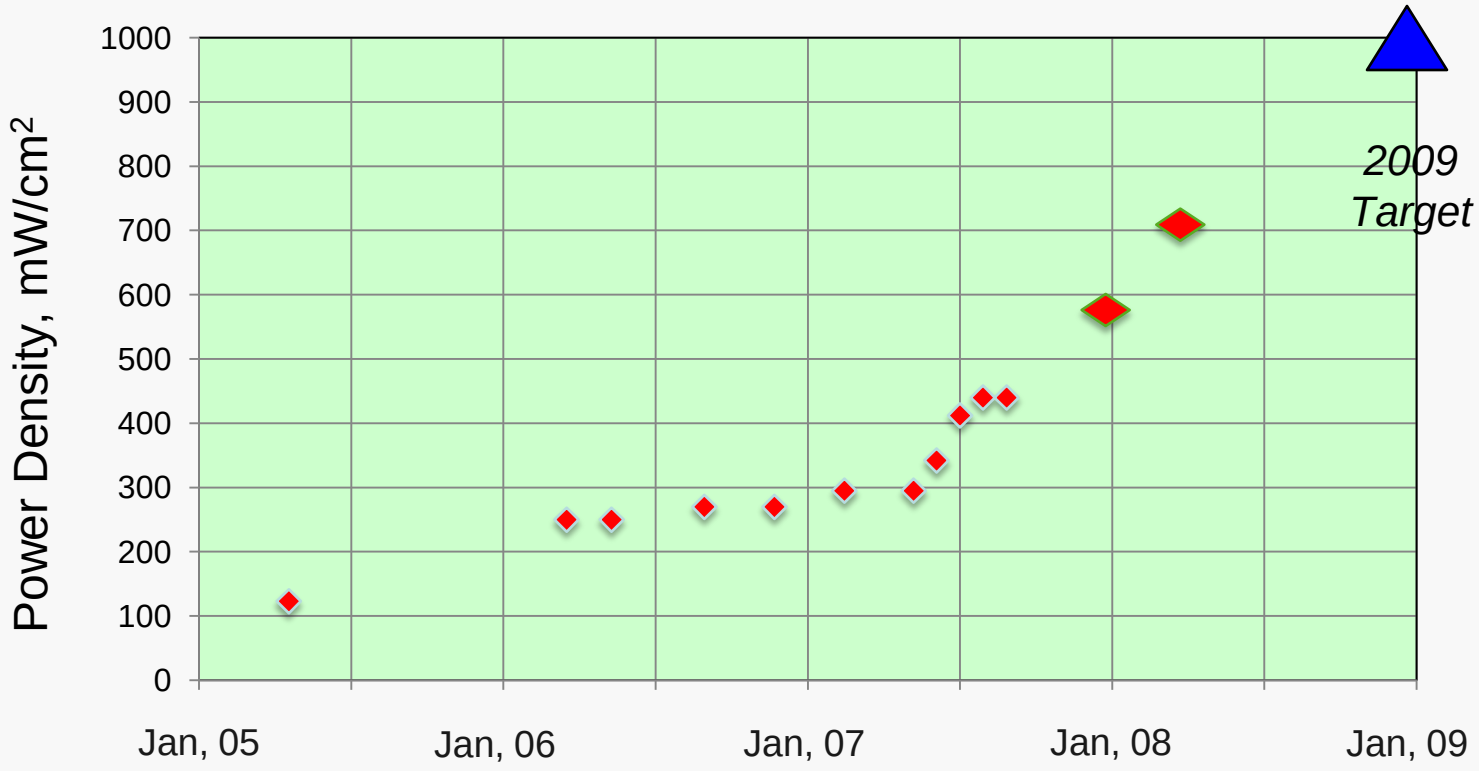
Transition metal-ligand complex

Higher potential catalyst
Power density to beat Pt



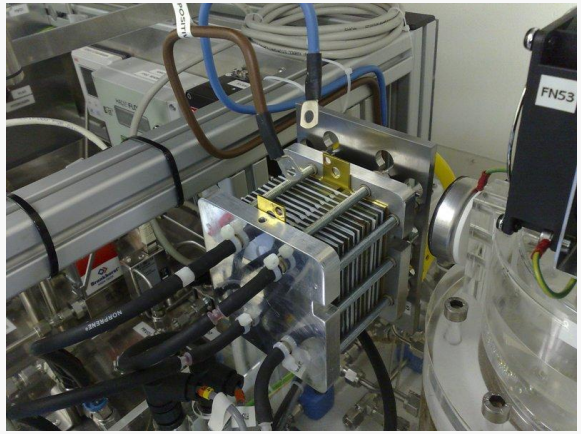
Will deliver up to 1W/cm^2, ready end of 2009 for larger remote power, transport applications

Peak Power Increasing Rapidly

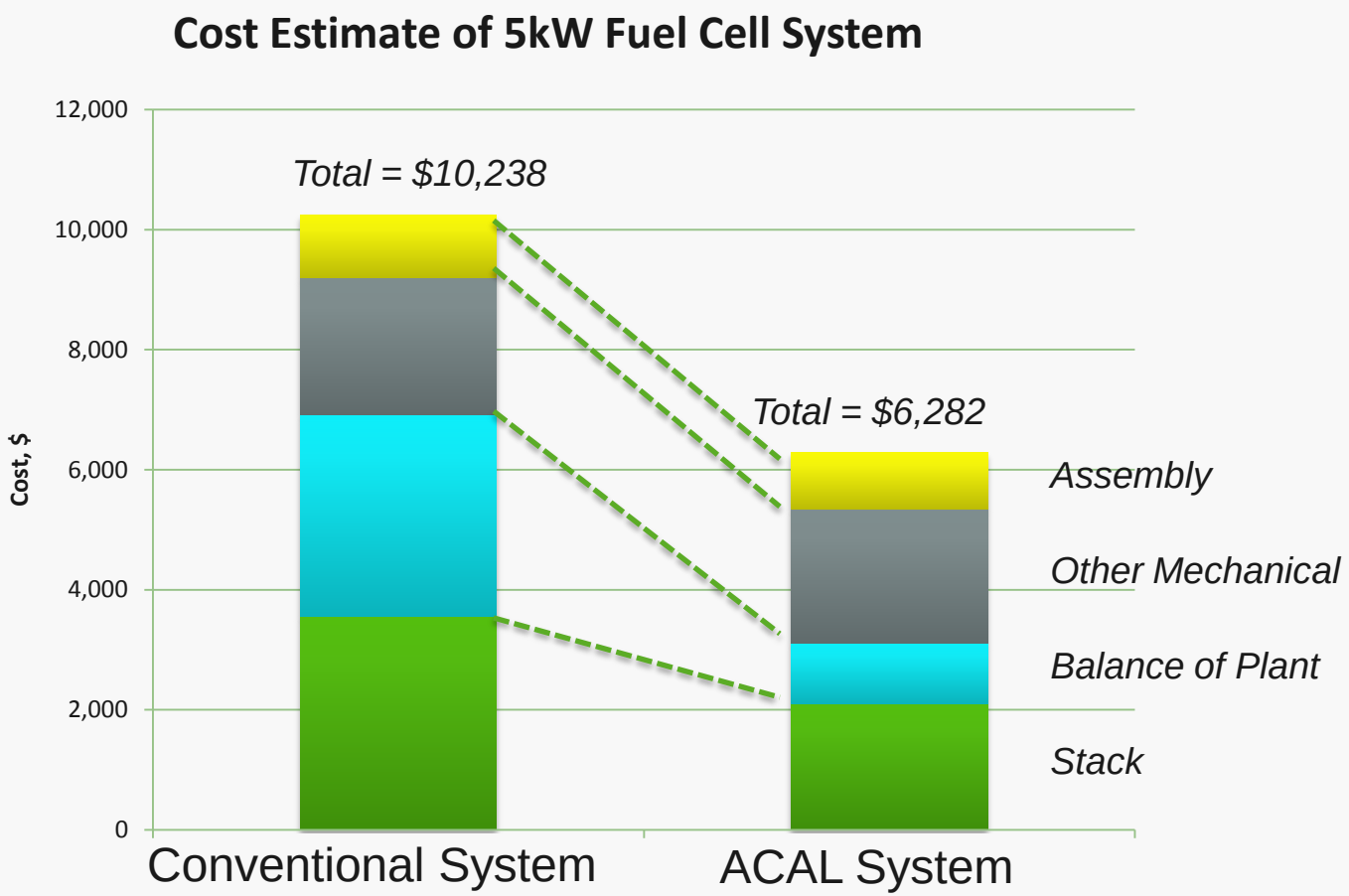


Substantial Cost Reduction Possible

- Very low cost stack
  - ✓ *Eliminates Pt from Cathode, simple graphite cathode*
  - ✓ *Simple bi-polar plate design, will enable low cost, high volume manufacture*
  - ✓ *Hydrocarbon membrane work well, lower cost than nafion*
- Large net balance of plant cost reduction
  - ✓ *Eliminates air and fuel hydration equipment,*
  - ✓ *Eliminates high pressure compression*
  - ✓ *Liquid cathode system replaces liquid cooling system – more efficient heat removal*



ACAL System Could 40% Less Expensive



System Cost ($) for 5kW Back-up Power Application – Conventional System is non-pressurized liquid cooled system

ACAL Technology More Reliable and More Robust

- ✓ *Eliminates membrane dehydration*
- ✓ *Eliminates cathode oxidation*
- ✓ *Eliminates peroxide formation*
- ✓ *Eliminates cathode catalyst agglomeration*
- ✓ *1-100kW+ units possible*
- ✓ *0-100% operating range, rapid response*
- ✓ *Flexible thermal management*
- ✓ *0-100% air humidity air*
- ✓ *More resistant to air contaminants*
- ✓ *Simpler water management*
- ✓ *Catholyte replaceable, system repairable*

ACAL Technology Removes Most Barriers toMass Commercialisation

Market Need	ACAL's Technology Delivers
Reduction of the amount of expensive catalyst	√
Less severe operating conditions	√
Catalysts that last longer	√
No need to pressurise	√
Lower maintenance costs	√
Simple mechanism to control temperature	√
Simple method to manage water	√
Improved security of supply	√

Lower Cost;
Better Reliability;
Longer Lifetimes

ACAL Business Strategy Summary

- Simpler business model: Sell fuel cell modules and chemicals
  - ✓ *IP based competitive advantage – 15+ filings to date*
  - ✓ *Core capabilities: chemistry, module engineering.*
  - ✓ *Aggressive drive to cost down – less than $500/kw module in 5 years*
- Market targets
  - ✓ *Pre 2012: H2 fueled 1-5kW stationary power module, followed by reformate fueled module for stationary power and CHP.*
  - ✓ *Post 2012 products: Larger stationary power (20kW+), expand to automotive with an auto partner*
- Build partnerships with key supply chain companies and OEMs
  - ✓ *Module production JV, chemical supply, lead system OEM, automotive*

Development Pipeline

acal energy
Clean affordable power

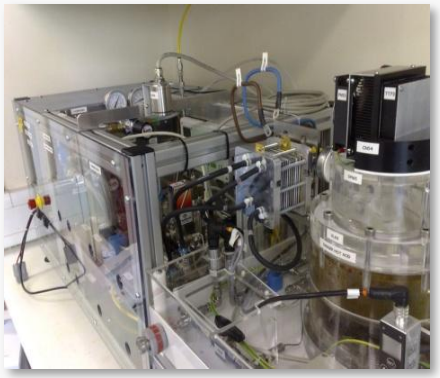
2007

Proof of Concept demonstrated

50 W Stack

2008

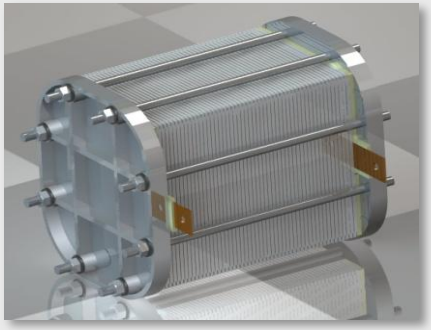
Engineering System Proven



50 W Unit

2009

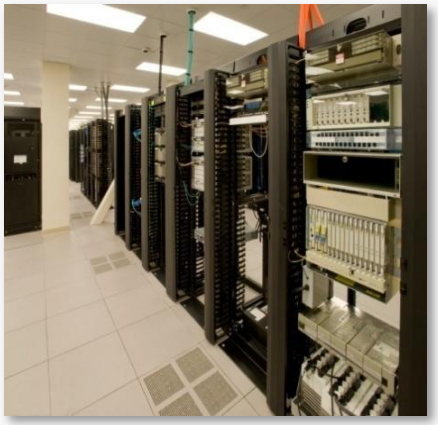
Product Demo Delivered



1 kW Demonstrator

2010

Application Testing Complete



System Modules

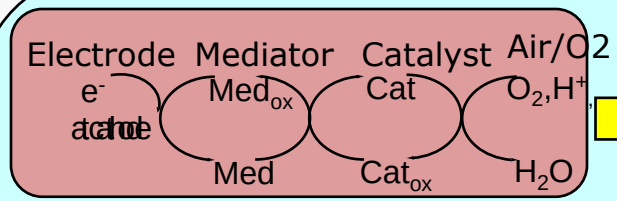
Partnership Strategy

acal energy
Clean affordable power

MANCHESTER 1824

University of HUDDERSFIELD

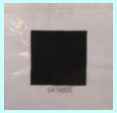
UNIVERSITY OF LIVERPOOL

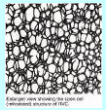


Chemistry and Chemicals

Cell, System Design

Engineering Design and Build





Key Components, inc non-PT anode

Precision Systems

KMWE

Precision Components

SOLVAY

SUMITOMO CHEMICAL

Market Applications Short Term

acal energy
Clean affordable power

Diesel Genset replacement for back up, UPS and auxiliary power (Up to $10billion market)

Fuel Cells are:
- Quieter: 70db at 1m (typical FC) vs. 70 db at 7m (diesel)
- Cleaner: No NOx, SOx, PM10, unburned HCs
- Cooler operation
- Smaller & lighter

Market Applications Longer Term

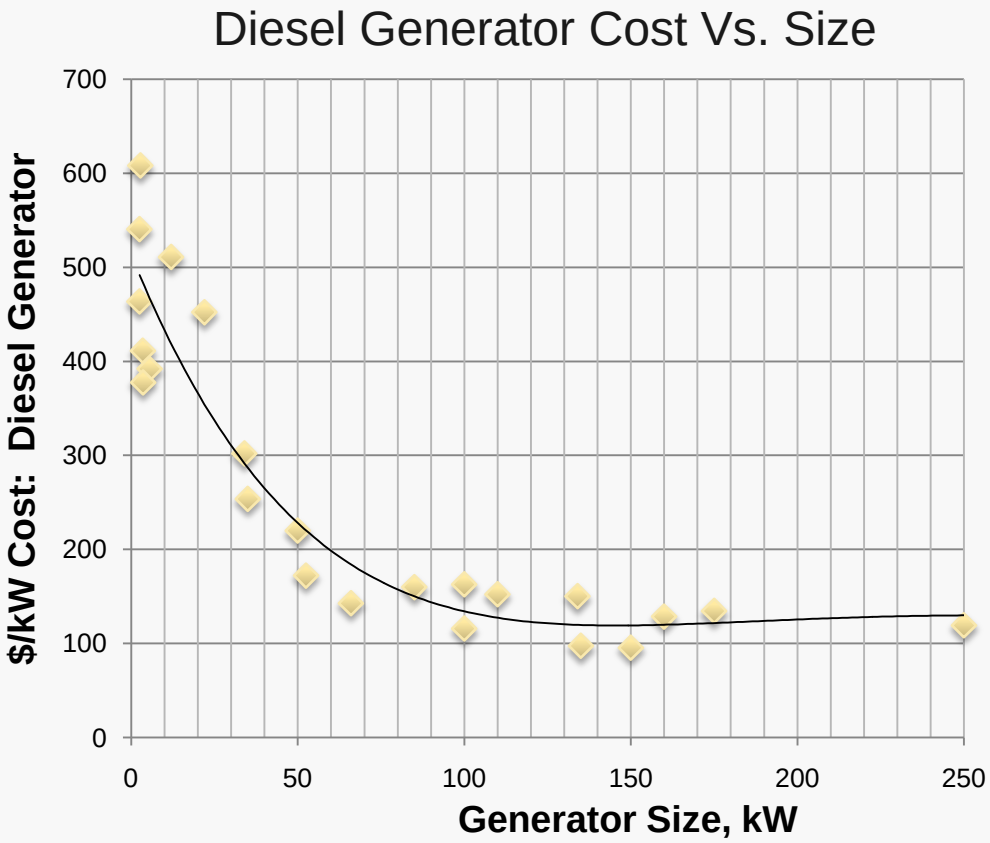
acal energy
Clean affordable power

Reduction of CO2 emissions and moving away from fossil fuels

Micro CHP for small scale industrial and domestic distributed energy

Replacement of ICE in transport applications

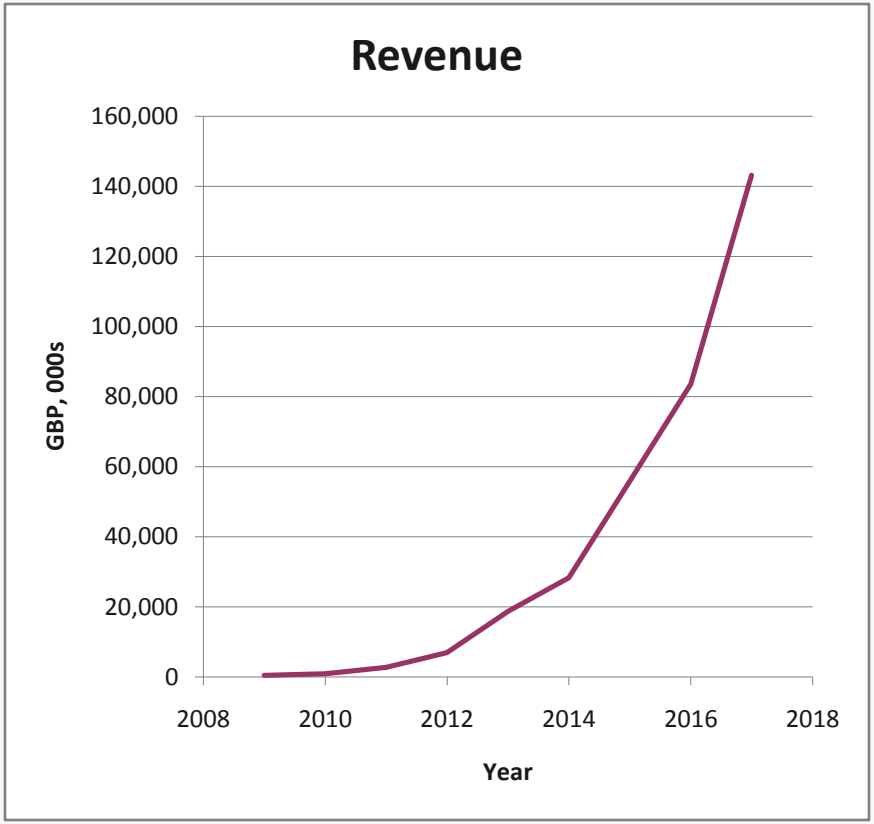
Cost Barrier is Challenging

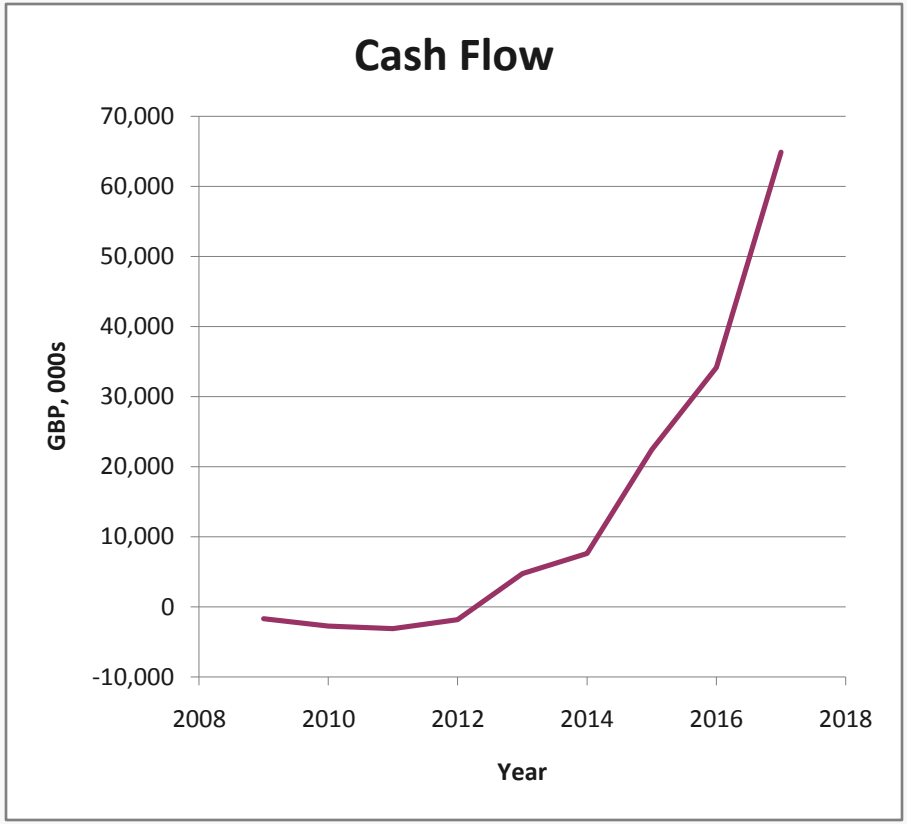


Key Milestones Over Next 18 Months

- Chemistry ready for first products
- First commercial products available
  - ✓ *Alfa, beta 1kW demos*
  - ✓ *Evaluation Kit for sale*
- Production Partnerships
  - ✓ *POM commercial capacity mid 2010*
  - ✓ *First production capacity for evaluation kits by end 2009*
- Commercial engagement
  - ✓ *Evaluation kit sales 2010*
  - ✓ *Lead module customer by end 2010*
- Fund raising to start again in early 2010

ACAL Energy Profitable 2013





Some Takeaways from ACAL Experience

- There some great ideas and very talented people in UK and the rest of Europe
- Seed funding available but development funding more difficult, gap in the 'middle'
  - ✓ *Smaller VCs don't have the resources, larger VCs looking for revenues*
  - ✓ *Grants help but public sector funding also lacking at this stage*
- New environment and energy technologies are expensive and take longer to become self sustaining business
  - ✓ *Government policy often most important driver*
- International opportunity, some regions have invested in certain sectors for many years
  - ✓ *Partnerships, linkages can make a significant difference*

acal energy

Clean affordable power

Thank you for your time!