



Applied Intellectual Capital  
Ventures in Sustainable Technology



# ‘Mind the Gap’

Enabling Technologies for Low Carbon  
Transport

Ian McDonald Chief Engineer – Electrical Engineering





## Introduction

- My name is Ian McDonald Chief Engineer - AIC labs Europe Ltd and M.D of S.E Technologies based at Hethel engineering centre in Norfolk.
- Collaborative member of the HEC-Ventures low carbon vehicle consortium.
- Formerly Chief Engineer – Lotus Engineering 1998-2007.
- Automotive engineering background since 1977 including PSV's, Formula 1, Luxury sports, EV and Hybrids.

## The Pivco Years

- In 1997 Lotus asked me to go to Norway for 2 days



Image source THINK Nordic



## The PIVCO - THINK

- Battery pack was Nickel-Cadmium weighing in at around 500Kg and containing 11.5 kWh of energy. The motor is a liquid cooled 3-phase AC induction motor.
- Top speed was 70mph with a range of around 50 mile
- A car built around a battery



# The Battery Pack

Self contained in a steel box

SAFT Nickel Cadmium shown right

In 2004 it was announced that Zebra would supply new power packs (Sodium Nickel Chloride)

In June 2008 a Li-ion battery was installed in a demonstrator vehicle in the U.S



In 2009, the TH!NK website advertises no less than 3 battery options



## Moving Goal Posts

- 'Battery energy density doubles every 5-7 years'
- 'A Battery takes around 5 years to thoroughly test'
- A new car takes around 5 years to introduce
- Manufacturers have to put a stake in the ground
- The majority of EV companies are SME's

Small volumes

Separate Chassis

Composite structures



# EV Technology Gaps



Battery and vehicle cost

Range perception

Length of re-charge

Image

Safety



## Enablers



- Reduction in battery size and cost

Average commuting per day in the UK is about 18 miles at an average speed of 18mph for 1 hour



Image source - Tesla cars media dept



# Smaller Packs a Punch ✓



2<sup>nd</sup> Generation Li-ion

Smaller battery

Customer defined range

Green renewable energy

# Range Extenders

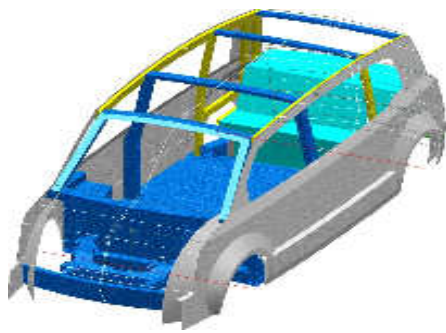


- Various initiatives both sides of the Atlantic
- US Money likely to be spent in U.S
- A recent European concept car had a 30mile range on battery, with a 140PS range extender – why?
- A 30kw range extender can maintain 60mph
- HEC-Ventures are currently engaged in the design of a scalable, ultra-efficient two stroke bio-fuel range extender unit specifically for automotive us.  
(patents app for)

# Adaptable EV Platform



- Mainstream manufacturers reduce costs through shared platforms
- HEC-Ventures and Automotive Design Partnership ADP are part of the E-CAB consortium
- Develop a flexible composite shared platform
- Elementary modules carried over between models
- Designed to accept HEC-V range extender



# EV ~~Gaps~~ Enablers



## Battery and vehicle initial vehicle cost

Reduce battery mass and volume, reduce cost

## Range perception

Range extension using bio fuel derived I/C

## Length of re-charge

Reduce the size of the battery, reduce charge time, efficiency

## Image

Composite vehicles, beautify transport – adaptable lightweight

## Safety

Batteries away from the crash zone, structural integrity, fit for purpose

# Thank you



**Glyn Owen –**

**HEC Ventures Limited,  
Hethel Engineering Centre,  
Chapman Way, Hethel,  
Norwich,**

**NR14 8FB**

**01953 859100**



*S.E Technologies*

**Ian McDonald –**

***Sustainable Electrical  
Technologies Limited***  
Hethel Engineering Centre,  
Chapman Way, Hethel,  
Norwich,

**NR14 8FB**

**01953 859100**

Automotive Design Partnership  
Ltd.

**Chris Saunders –**

**ADP Ltd.  
Unit 7B  
West Station Business Park  
West Station Road  
Maldon**

**Essex, CM9 6FF**

**01621 840105**

[www.automotivedesignpartnership.com](http://www.automotivedesignpartnership.com)

