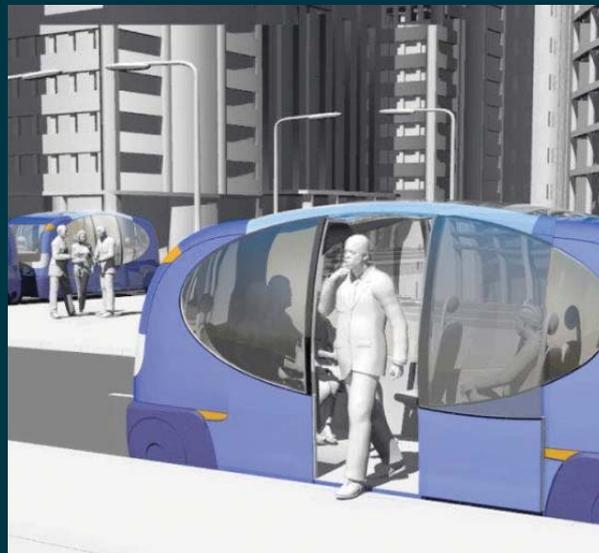


# INNOVATION IN LOW CARBON URBAN MOBILITY

**LowC<sup>VP</sup>**  
low carbon vehicle partnership



Presenting the winners of  
the LowCVP Technology  
Challenge 2012

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"When you are developing leading-edge technology and you trust in your own instinct that you are heading in the right direction, doubts can still creep in. Winning the Technology Challenge not only confirmed that our instincts were correct, it also added valuable credibility to both our product and our company."

Gordon Anderson,  
Operations Director,  
Zeta Automotive



"As a winner of the Challenge, the opportunity to present to a room packed with potential customers was pretty unique and gave a real boost to awareness of CPT's stop-start, engine-boosting and power regeneration technology; normally it would take months of effort to meet this number of decision makers."

Guy Morris, Engineering  
Director & CTO,  
Controlled Power  
Technologies



"Winning the 2009 LowCVP Technology Challenge has provided a huge boost in industry awareness of our leading edge axial flux technology and provided a valuable platform to build customer engagements."

James Rosson,  
Commercial Manager,  
EVO-Electric

# Foreword



**Professor Neville Jackson**  
Chief Technology and Innovation Officer,  
Ricardo UK Ltd  
Chair of the Low Carbon Vehicle Partnership  
Board of Directors.

Citizens, employers and businesses depend on efficient, affordable and clean urban transport systems to provide the mobility they need in today's urban environments. Existing road, rail and tube systems are, however, frequently congested, expensive to maintain let alone expand, and were designed in times when energy efficiency, de-carbonisation and reducing oil dependency were not the priorities they are today.

In London alone, for example, ground-based transport accounts for 22% of the capital's overall CO<sub>2</sub> emissions, and just over 2% of the UK's total. City regions, transport authorities, airport operators and even major event organisers and others are thus increasingly looking to alternative personal and public mobility solutions. They do so not just to cut carbon emissions, but to reduce congestion and overcrowding, improve air quality and promote social cohesion through greater personal mobility.

New technologies and products arise constantly thanks to UK ingenuity and engineering capabilities. However gaining traction with potential customers and investors can be the single most challenging barrier to progress. In the low carbon transport sector, potential customers and cleantech investors seek viable products to save or make them money while lowering carbon emissions. But the sheer breadth of ideas, possible avenues and opportunities are not always matched by the resources

available for proper research and investigation, limiting their horizon-scanning activities.

With the aim of accelerating the market introduction of new and innovative products and technologies, and identifying the most promising ideas, the LowCVP introduced the Urban Mobility Technology Challenge. The Challenge provides an opportunity for emergent supply chain companies and technology developers to promote themselves and add credibility to their low carbon urban mobility solutions.

This initiative gives new entrants to the supply chain the opportunity to present their innovations to a panel of potential major customers, investors and other crucial decision-makers and stakeholders. Past LowCVP Challenges have focused on technologies for passenger cars and HGVs. The winners of past Challenges have gone on to even greater things, and include Flybrid Systems, Hardstaff Group, Flybus, Axon Automotive, EVO Electric and many others.

I expect the winners of this year's Urban Mobility Challenge to go on to achieve similar success and I offer all of them my congratulations.

November 2012



By Jonathan Murray,  
Deputy Director,  
LowCVP

# The Low Carbon Vehicle Partnership (LowCVP)



The LowCVP works to accelerate the shift to low carbon vehicles and fuels and create opportunities for UK business.

## Stimulating Markets for Lower Carbon Technologies

New and improved vehicle and fuel technologies can radically reduce the environmental impacts of road transport given appropriate market conditions. The Low Carbon Vehicle Partnership works to tackle market barriers to the introduction and growth of lower carbon vehicles and fuels to reduce transport's carbon footprint both in and beyond the urban environment. Since its creation in 2003 the Partnership has delivered over one million tonnes of carbon savings through its activities.

A not-for-profit multi-stakeholder partnership of approaching 200 organisations, LowCVP members collaborate to develop consensual, evidence-based solutions to increase the deployment of and market for lower carbon vehicles and fuels. LowCVP's broad membership encompasses the automotive and energy industries, transport users and operators, environmental organisations, academics and central/local

Government policy makers. Together these stakeholders take practical initiatives, share knowledge and information and provide support to Government for policy development.

Funded by a Government grant complemented by member contributions, the LowCVP is an expert, independent advocate for low carbon road transport solutions, helping UK companies to capitalise on the emerging business opportunities.

## Sustainable Urban Mobility

Today more than half the world's population is living in towns and cities, and by 2040 this is expected to have grown to two in three people living in an urban setting. The movement of the world's population to cities presents us with many new opportunities but also provides huge challenges. It offers the potential for further economic development and innovation in how we work and live, but at the same time threatens to exacerbate major

global issues. This is particularly true of transport in the urban environment.

Transport systems have significant impacts on the environment, accounting for between 20% and 25% of world energy consumption and carbon dioxide emissions. Greenhouse gas emissions from transport are increasing at a faster rate than any other energy-using sector, while road transport is also a major contributor to local air pollution and smog. Additionally, in terms of congestion, the Department for Transport is projecting that by 2015 road traffic will have grown by over 30% compared to 2000. Traffic growth on this scale is already causing – and will cause further – gridlock in many urban areas in the UK, as well as problems on the UK's strategic road network.

Urban mobility solutions for the twenty-first century need to be sustainable and efficient to overcome these challenges, which will require clean, low carbon technologies deployed in innovative transport systems.

The LowCVP's Technology Challenge is designed to open and accelerate the pathways through which UK businesses can bring low carbon technologies to the urban market. The work complements that of the UK's Automotive Council which is developing a roadmap in this area and which is working to strengthen the UK automotive supply chain.

The LowCVP's Technology Challenge helps to connect emerging technology-based companies with the established supply chain, major fleet operators, investors and city authorities; reducing the time it takes for new technologies to reach the market, increasing returns for early adopters and delivering CO<sub>2</sub> savings. Early engagement provides competitive advantages for adopters of new solutions and experience helping to improve the product within an urban transport setting. This also benefits UK plc by strengthening the value of intellectual property and establishing skills and engineering excellence that can then be used to create new export markets.



# CAPOCO DESIGN LTD



Capoco Design has developed Mobilicity, an urban transport system based around lightweight electrically powered automated pods which carry up to 24 passengers each. The system's energy demands and CO<sub>2</sub> emissions compare favourably with personal rapid transit (PRT) systems.

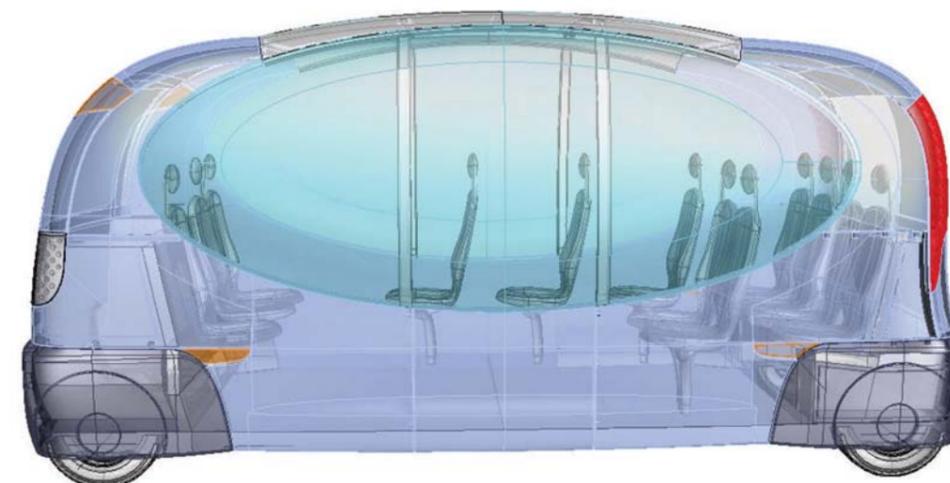
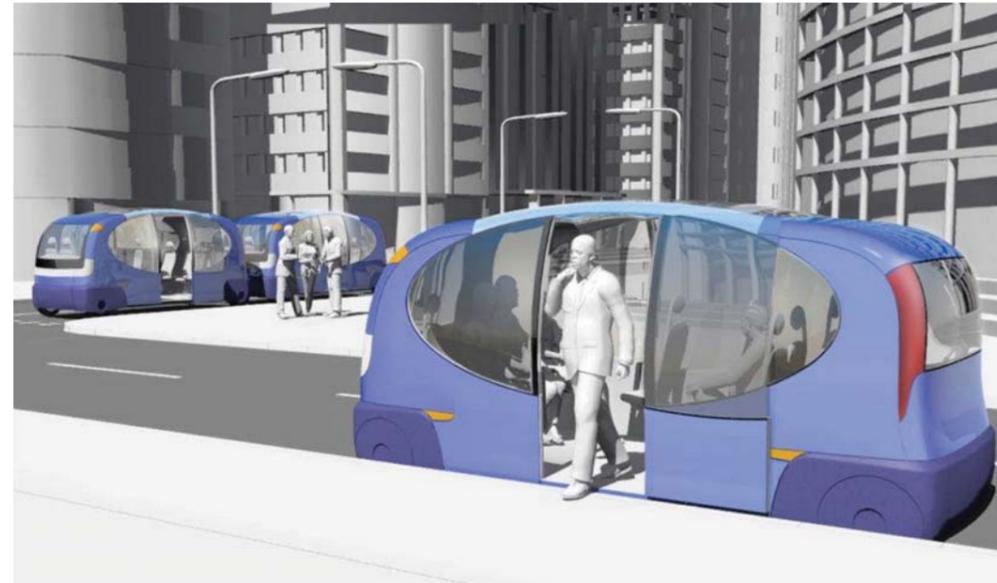
## Based on proven bus technology

Mobilicity is the result of a research programme between the RCA and Capoco Design director Alan Ponsford. Capoco, a bus and coach design company, has worked with many vehicle manufacturers and has expertise in vehicle exterior design, interior layout and structure. Much of the Mobilicity innovation is proven bus/coach technology. Based upon a lightweight, aluminium framed vehicle configured for urban transport, with eleven seats and one wheelchair space, Mobilicity's maximum load compares with a typical UK bus journey: between nine and sixteen passengers.

The Mobilicity vehicle is designed around an electric drivetrain and will launch as a battery electric vehicle, but design packages also incorporate a hydrogen fuel cell version. The critical automation system, which covers the navigation, guidance and collision avoidance, is supplied by Robosoft, a French company.

In contrast to systems such as the Ultra PRT, in operation at Heathrow's Terminal 5, Mobilicity does not retain the characteristics of a private car. It is therefore less likely to deliver traffic jams, according to the designers. They claim Mobilicity exceeds the Ultra system capacity levels by a factor of around 20 during critical rush hour periods, arguing that it is not vehicle lengths which set lane passenger capacity, but the inter-vehicle headway - which remains constant, irrespective of the size of the vehicle. Based on the transport metric of 'pphpd' (passengers per hour per direction), a PRT system will deliver automated traffic jams when applied in a dense urban environment, according to Mobilicity's designers.

Mobilicity requires just half of the energy to transport the same numbers of people as a diesel bus fleet. According to its developers, Mobilicity's performance is seven times better (in terms of CO<sub>2</sub> emissions) than a typical electric car. They cite Mercedes-Benz in-house comparisons that the specific energy consumption of buses is between 29% and 35% of passenger cars. Mobilicity targets half of the typical Mercedes-Benz bus energy value, which would imply energy consumption of around 15% of a typical car. The automated Mobilicity is also expected to excel in the sphere



of urban pedestrian accidents (based on statistics demonstrating that 98% of all UK accidents are driver-based). The intellectual property is covered by three patent applications for: a cellular route system for autonomous vehicles; an autonomous vehicle with control means for optimising the operation of the vehicle; and an autonomous vehicle.

Capoco will not manufacture or operate Mobilicity systems. It plans revenue streams based on system scoping studies, system specification, project introduction, management and royalty payments. The only hardware the company plans to build are two initial prototypes for testing and pilot operations.

## Seeking funding of £2.5-£3.5m

Mobilicity expects to co-operate with external investors to deliver both a highly advanced transport system and a route into a new sector of innovative manufacturing. The original development has been internally funded by Capoco Design. External investors are being sought to fund the pilot system phase, for which Capoco aims to raise between £2.5 million and £3.5 million.

## Key Points

**Automated pods** - Mobilicity lightweight, aluminium framed pods can carry up to 24 passengers and compare favourably with PRT systems - the system is less likely to deliver traffic jams.

**Based on proven technology** - Much of the innovation is proven bus/coach technology.

**Proprietary IP** - three patent applications for: cellular route system for autonomous vehicles; autonomous vehicle with control means for optimising the operation of the vehicle; autonomous vehicle.

**No manufacturing** - Capoco's revenues will be from system scoping studies, system specification, project introduction, management and royalty payments.

**Seeking Funding of £2.5-£3.5m** - External investors are being sought to fund the pilot system phase, for which Capoco aims to raise between £2.5 million and £3.5 million.

**Mobilicity is an urban transport system based around lightweight electrically powered pods which carry up to 24 passengers. The system requires just half the energy to transport the same number of people as a diesel bus fleet.**

# Ecospin Ltd

## Raptor 'stand-on' EV

Ecospin Ltd has developed a road-legal (in the UK), three wheel, 'stand-on', rear wheel-powered electric vehicle, the Raptor. Classed as a Moped Trike, the first vehicle was certified in November 2011 and registered and issued with Road Tax and number plates later that month.

Raptor is aimed at professional users such as police forces, airport security staff, post office delivery personnel, paramedics and private organisations such as theme parks or hotel and leisure complexes. Key markets are businesses where employees are required to walk considerable distances, with the additional need of a quick response to emergency situations. The largest single sector is expected to be warehousing, followed by security, site and event management.

## Set to compete with Segway

The Segway and the (front wheel drive) T3 Motion (launched in 2000 and 2006 respectively) are market leaders in the space - but neither is yet road legal. At its launch, the Segway demonstrated the need of security patrol staff for this type of vehicle. However, to make the Segway compliant for road use would require a complete redesign.

(Segway has lost legal battles in the UK and many Canadian and USA states and is barred from being used on paths or cycle paths.)

The T3 addressed some of the range speed and payload issues of the Segway simply by adding a front wheel and increasing the size to carry larger batteries. However, its deployment is restricted in many areas to off-road use.

## Fully road legal

To achieve full homologation in the UK for road use, the Raptor underwent testing at the MIRA research facility at Nuneaton. The project was overseen by Nick Bower of NBH Enterprises based in Sussex, a vehicle homologation specialist.

The Raptor powertrain (patent pending) incorporates the latest technologies. It utilises a rear wheel drive, rather than the T3's front wheel drive solution, to address traction issues discovered by MIRA whilst testing Ecospin's first front wheel driven concept vehicle. The entire BOM is made in England, with 80% being sourced from the UK.

## Potential UK market: 10,000 units

The management of Ecospin anticipates a UK market for Raptor



of approximately 10,000 units, but is targeting the global market and projects that, within five years, Raptor will be in production at volumes of some 2,000 per annum, equivalent to a turnover for Ecospin of £14 million.

Ecospin, which has received assistance from MAS West Midlands,

has obtained matched funding grants for parcels of works or 'Gateways' worth around £50,000. The company has also secured private funding of £150,000 in cash.

The Ecospin team includes Paul Loomes and Tim Cant, both of whom have extensive expertise in the design and development of products. David Loomes and Carlos Mendez both operate their own fire and security business and bring electrical engineering skills to the team.

## Funding requirements

Ecospin is currently seeking investment of £0.5 million to develop the vehicle. The funding would be used in part to add individuals with financial and marketing skills to the team.

## Key Points

**Road legal competitor to Segway** The Raptor 'stand-on' three wheel vehicle is fully road-legal in the UK - which gives it a strong advantage over the Segway or the T3 Motion.

**Rear wheel drive** - The Raptor powertrain utilises a rear wheel drive to address traction issues discovered by MIRA at the test stage.

**Targeting professional users** Ecospin is targeting professional markets such as police forces, airport security, delivery and leisure applications.

**UK market of 10,000 units** The estimated market for Raptor in the UK is 10,000 units - although Ecospin is targeting the global market.

**Patents pending** - Ecospin has applied for combination patents for drivetrain and configuration in both Europe and the US.

**Seeking investment of £0.5m** - Ecospin is seeking investment of £0.5m to develop the Raptor vehicle and to add to the management team.



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Ecospin has developed a road-legal 'stand-on' electric vehicle which is targeted at professional users such as police forces, airport security, delivery and warehousing operators, paramedics and leisure complexes.

# Esoterix Ltd

Esoterix, a Bristol-based start-up, has developed Buxi, an 'intelligent mobility' technology based around a vehicle which combines the efficiency of a bus with the flexibility of a taxi. Buxi is a multi-point to single-point (and vice versa) commuting system, with passengers sharing vehicle space and cost. Esoterix has received Technology Strategy Board and Bristol Green Capital funding and is trialling Buxi for commuters in November 2012.

## Intelligent Mobility

Intelligent Mobility is the management of vehicles and roads with the aim of using existing capacity more efficiently whilst improving safety and reducing congestion. Buxi aims to be such a solution, offering convenience, by picking up and dropping off anywhere, whilst maximising average vehicle occupancy and minimising total vehicle mileage.

## Technology

Esoterix, assisted by £94,000 of Technology Strategy Board funding, is building upon academic research in the space. The Esoterix Transport Technology, or ETT, system calculates vehicle routes in faster than real time, thereby allowing passengers to book journeys at any

time, including when the service is operating. Esoterix's in-vehicle computer system is known as an Intelligent Transport Device, or ITD.

The ITD combines existing technologies such as vehicle tracking, navigation, authentication and monitoring into an integrated low-cost unit which monitors and reports on the vehicle's location, informs the driver of new pick-ups and traffic problems and authenticates passengers as they board.

## Market

Esoterix claims that many existing flexible transport services, particularly in rural environments, are unsustainable without significant subsidy. However, commercially viable services do exist in destination specific applications (e.g. airport shuttle services) and Buxi is aimed at expanding the provision of such services within major urban areas. It is predicted that the intelligent mobility market will be worth £5 billion within a decade.

Esoterix will offer Buxi, in partnership with minibus companies, as a turnkey solution to employers. It is working with North Bristol Sus Com, an employer group promoting sustainable commuting, to initiate Buxi services in November 2012.

**Buxi is an intelligent mobility technology based around a vehicle which combines the efficiency of a bus with the flexibility of a taxi. Esoterix has received Technology Strategy Board funding for a commuter trial.**



Esoterix plans to take the service nationwide, first by concentrating on out-of-town business parks and secondly by franchising its operations. The company ultimately wants to develop its technology, principally ETT, so that it can introduce more generic, pervasive and inclusive multi-point to multi-point transport services.

Management claims that typical Buxi commuter services would result in a reduction of CO<sub>2</sub> emissions equating to more than 2.6kg of CO<sub>2</sub> per passenger per day. Their introduction would also imply a corresponding decrease in noise pollution from traffic and an improvement in air quality. Buxi can also potentially provide economic benefits in the form of urban regeneration by improved accessibility, access to employment and reduced congestion – in addition to social benefits.

## Key Points

**Intelligent Mobility** - Buxi combines the efficiency of a bus with the flexibility of a taxi: a commuting system in which passengers share vehicle space and cost.

**ETT** - The Esoterix Transport Technology (ETT) calculates vehicle routes and can also be applied to the logistics market.

**ITD** - The in-vehicle computer system, an Intelligent Transport Device (ITD) combines existing technologies such as vehicle tracking, navigation, authentication and monitoring.

**CO<sub>2</sub> reductions** - typical Buxi commuter services would result in reductions of more than 2.6 kg of CO<sub>2</sub> per passenger per day.

**Economic benefits** - side benefits include urban regeneration.

**Seeking funding of £0.5m** - Esoterix seeks to match fund a Technology Strategy Board project.

## Investment

Esoterix is seeking £500,000 of funding to roll out the Buxi commuter service across the UK and to match fund (55%) a Technology Strategy Board-sponsored project to develop ETT for generic multi-point to multi-point flexible transport services. Investment in Esoterix qualifies for SEIS and the company believes its proposition will be attractive to co-investment organisations such as the Angel Co-Investment Fund and the Cleantech Co-Investment Fund.

## Esoterix

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# Hugh Frost Designs Ltd



Hugh Frost Designs (HFD) has developed supply chain and logistics concepts based on the premise that there is sufficient overlap between passenger and freight systems to build on and integrate the respective infrastructures of both.

## To-You - incorporating Freight\*Bus

The company argues that its To-You system can eliminate the need for HGVs on the final leg of a delivery and can consolidate both inbound and outbound freight. To-You will – in due course – incorporate concepts including Freight\*Lift, which replaces the function of the pallet, and Cool\*Run, which is incorporated into Freight\*Lift to transport multi-temperature products in a vehicle without the need for traditional chillers or an insulated body. Freight\*Lift and Cool\*Run are early stage, patent-pending technologies, for which funding is being sought to build a full working demonstrator. HFD has received £30,000 in match funding from the RDA and university sources to develop them.

Core to the '2U' system is the Freight\*Bus concept, which makes use of surplus capacity in a bus during off peak times (10am–2pm and 7pm onwards) for the transport

of freight. HFD believes this could make it possible, in conjunction with other technologies, to decrease city road freight vehicles by 20% – and cars by 40% – thereby reducing traffic congestion. The system is also applicable to suburban and rural areas, which suffer from high environmental costs for parcel deliveries – growing at 23% annually.

Freight\*Bus will require the development of consolidation centres and cross-docks for freight movement and hubs for passenger and freight delivery/collections – typically linked into existing infrastructure – and better integration of the national rail system with buses. The proposed service offers scope for central and local government to redirect bus subsidy funds to other carbon reduction programmes.

The first Freight\*Bus will be a demonstrator, built by converting an existing bus. However, HFD see a commercial opportunity for a major bus manufacturer to develop a unique product.

Initially there will be outlying Urban Consolidation Centres (UCCs) on the outskirts of cities located on trunk and orbital roads, rail routes, rivers and at airports, with temporary and

To-You and the Freight\*Bus concept are based on the premise that there is sufficient overlap between passenger and freight systems to build on and integrate the infrastructures of both – significantly reducing the numbers of both HGVs and parcel vans required on the final leg of a delivery.



permanent cross-docks and large hubs located at key intersections of these and other routes. Medium hubs will be based in town centres, bus and rail stations, industrial estates, university campuses, hospitals, etc. Finally, small hubs will be based at retail centres, major bus stops, petrol stations and drive-through locations.

HFD plans to roll out the system utilising co-operative franchising principles and coalitions of indirect bodies and stakeholders to provide rolling stock and traffic. These will include infrastructure organisations in the road, rail, air, tram and river transport sectors, national and local government, and major bus and rail franchisees.

Investment opportunities are envisaged in the form of independent consortia, franchisees, local government/authorities who might invest in infrastructure, operator franchisees, or individual community hubs – as well as landowners who can provide land for consolidation centres, cross-docks and hubs.

## Searching for angel investor

A first step will be to undertake a full demonstrator for a twelve month period in a small city with a population of around 200,000. HFD is searching for an early stage angel investor to fund the demonstration stage and – in due course – venture capital equity investors to roll out a fully operational version of the system.



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## Key Points

### The To-You Freight\*Bus

- carries freight on existing passenger systems offering scope to significantly reduce both HGVs and parcel vans on the final leg of a delivery.

### Freight\*Lift and Cool\*Run

- technologies to replace the pallet and transport multi-temperature products. Being developed with RDA and university funding.

### Urban Consolidation Centres

- combine with medium and small hubs.

### Co-operative franchising

- HFD plans to utilise co-operative franchising principles to roll out the system.

### Investment opportunities

are envisaged for independent consortia, franchisees and local government.

### Demonstrator development

- HFD is searching for an angel investor and collaborative partners to work on a demonstrator project that will be supported by substantial grant aide.

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# SusMobil Ltd

SusMobil is designing a low carbon, community-owned car club specifically for short inner-city journeys, anticipating a new generation of drivers for whom the concept of 'sharing' will be normal practice. It is working with a sustainability charity and a UK city on a pilot scheme, scheduled for launch in early 2013.

When scaled to a city-wide project, SusMobil estimates that the entire fleet will travel over a million miles per year. Assuming that only 20% of these journeys replace a private vehicle or taxi, there is potential for 200,000 low emission miles per year, in just one city. The company was founded by Phil Edwards, who has 30 years of manufacturing and engineering experience and was the designer of the UK's fastest electric drag-racing motorcycle.

SusMobil is similar to the Paris Autolib scheme, although Autolib vehicles are not specifically designed for intra-city use. Other car clubs are generally aimed at longer hire periods/journeys and tend not to have the flexibility of multiple pick-up and drop-off points: nor do the majority offer electric cars. SusMobil will provide vehicles for short-hop intra-city journeys

The company has identified a

vehicle and data-logging system representing short term solutions for the pilot. Longer term, SusMobil plans to establish a micro-factory in each 'City Hub' to assemble low-range, low-speed, low-cost vehicles, install and manage the infrastructure, and train local employees in engineering and technology skills. The City Hub may also make cars for direct sale and will be the recycling point for disposal of vehicles at end-of-life.

SusMobil is in discussions with several vehicle manufacturers with appropriate vehicle platforms and will develop the route to manufacture in 2012/13. This project requires investment of £250,000 to develop and test a lightweight prototype specifically designed for the short-hop duty, local assembly and easy end-of-life recycling. In time, SusMobil expects a number of manufacturers to produce vehicles that meet the guidelines, offering each city a range of passenger and light commercial vehicles.

A smart data system will manage user-bookings, monitor car activity, locate vehicles, record vehicle performance (charge cycles, miles covered, maintenance records, etc.) and collate user data. Most of the technology already exists, albeit not necessarily in one package, and SusMobil is sourcing it from various

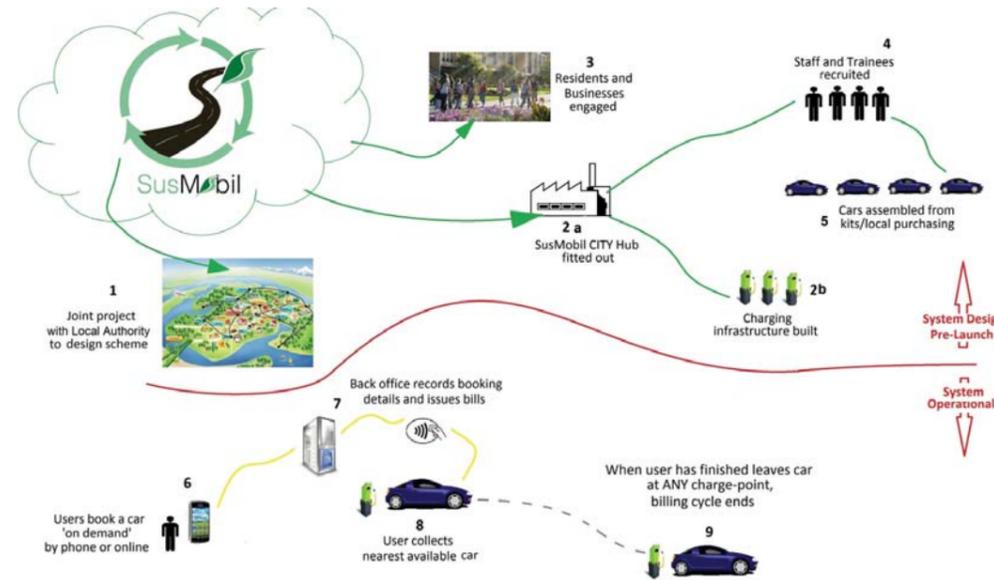


Image courtesy of CarPlus

providers. The scheme requires a network of community charge points which SusMobil envisages being located at businesses interested in promoting the scheme (convenience stores, large employers, cinemas, rail stations, leisure or sports centres, schools and universities).

Funding for a pilot scheme requires £1.5 million, which is expected to come jointly from the host city and a combination of investors/sponsors: the scheme is expected to return a small profit in the third year. SusMobil has two prospective offers from high profile UK locations to implement the pilot and is seeking investment to turn these into live projects.

A City Hub is expected to be managing a network of 300-400 charge points and a fleet of 200-250 cars after a few years, and creating employment and local purchasing in the region. With SusMobil helping local authorities to achieve their carbon reduction goals and create employment, whilst also operating the project on their behalf, it's easy to see why a number of Councils are starting to take notice. The concept can be replicated across the globe.

## Key Points

**Community-owned car club** - aimed at short-hop city journeys and anticipating a new generation of drivers for whom sharing is normal.

**Similar to Paris Autolib** - but the cars will be specifically designed for intra-city use.

**'City-Hub' manufacturing** - longer term, SusMobil aims to assemble low-speed, low-range, low-cost vehicles at micro factories in each 'City-Hub'.

**Pilot scheme** SusMobil has interest from two local authorities looking to implement the scheme, with a view to starting late 2012 and running in Spring 2013.

**Funding of £1.5m** is required to set up and launch the first pilot, whilst a separate investment of £250,000 will secure the vehicle development programme which has a direct route to sales of 250 cars at each of the City Hubs.

SusMobil

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# WeatherVelo Ltd

WeatherVelo, led by Simon Bailey, develops lightweight (under 150kg) single-seat energy-efficient vehicles, to straddle the gap between two-wheelers and cars. A working prototype of WeatherVelo's 'Prime' cabin-scooter, a three-wheeled pure-electric vehicle, is nearing completion.

The company has adapted the CabrioVelo vehicle, developed by Germany's 4 Seasons Velos and completed in 2007, into a more commercially viable product, initially for the British (London) market. WeatherVelo has partnerships with both 4 Seasons Velos and Schöne Linie, which styled the bodywork. It also works with Axon Automotive on assembly of the prototype and chassis development.

While the CabrioVelo has a hybrid pedal-electric drivetrain and a folding roof, the WeatherVelo Prime incorporates a stronger roof and a pure electric drivetrain (since the parallel pedal-drive provided insufficient power in return for the additional complexity). Vehicles are being specified to meet legal requirements and will benefit in London from congestion charge exemption and eligibility to use bus lanes. The Prime, classed as a category 'p' (moped) in the UK, is similar in width to a motorcycle, but with the advantages of inherent stability and weather protection. In

widespread use, like two-wheelers it offers scope to reduce urban congestion and pollution caused by single-occupancy car commuting. Capable of 28mph, the Prime can keep pace amid urban traffic, unlike bicycles or 'pedelecs' (15mph top speed). While not a solution for the school run or long trips, the range should be ample for most urban journeys and offer a faster commute (average traffic speeds in the centre of London are 16.9mph, or 10mph at peak times).

Primary markets include: urban commuting; personal transport; deliveries; runarounds – for local government, airport (airside) and private estates/hotels; and – with custom livery – promotions. Broader market opportunities based on a modification of the platform include: delivery vehicles with increased carrying capacity; alternative specification vehicles for elderly people; or an 'active' version with auxiliary series pedal-drive to charge the battery and provide healthy exercise for the rider/driver.

At its maximum speed of 28mph (45km/h) the WeatherVelo Prime will consume 524.6g of CO<sub>2</sub> per kWh (grid electricity generation) x 0.42kW = 225.6g per hour at 45km/h = 5g/km CO<sub>2</sub> well-to-wheel, making it 40 times more efficient than the average car on the road today. Figures for stop-start



conditions will be determined using new drive-cycle facilities at Bradford University. Being an extremely lightweight vehicle (even compared to the Renault Twizy, Zagato Volpe or Gordon Murray Design T.27) the WeatherVelo Prime offers lower inertia and thus greater efficiency.

Competitors include the wider and heavier Renault Twizy, the Zagato Volpe micro-car (due 2013), the Myers NmG (only available in USA), the CityEl (a low vehicle with limited rider size - production recently suspended) and the Lumeneo Smera (sophisticated but expensive, currently only available in France).

## Key Points

**Bridging the gap between two-wheelers and cars:** the WeatherVelo Prime is an electric cabin-scooter, stemming from many years of Anglo-German research, development and real-world experience.

**Lightweight and affordable:** one-third the weight of Renault's Twizy, WeatherVelo aims to enter the market with a retail price of £3,995 using affordable battery technology (Twizy starts at £6,690 plus £45 monthly battery lease).

**Targeting the London market:** designed with London's urban commuting market in mind.

**Beating urban congestion:** slim like a two-wheeler, it offers scope to reduce urban congestion and pollution caused by single-occupancy car use.

**Axon Automotive links:** WeatherVelo has close links with Axon Automotive, with manufacturing capacity for series/batch production and a turnkey micro-factory system enabling localised production near the end-user.

WeatherVelo is seeking investment of around £180,000 for prototype refinement (improvements to the chassis, drivetrain, wheels, seat and crash-testing) – and will require significantly more investment, in due course, for volume production. This would allow introduction of a more sustainable bodywork material such as ABS or PET, and above all reduce unit costs in line with the target retail price of £3,995 (compare with the Renault Twizy, which is priced at £6,690 plus battery lease). Axon Automotive has manufacturing capacity for series/batch production in Northamptonshire and WeatherVelo may also deploy Axon's turnkey micro-factory system enabling localised production near the end-user.



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**A working prototype of the WeatherVelo Prime three-wheeled EV - a British adaptation of a German design - tailored for the London market, is nearing completion. Funding is sought for prototype refinement.**

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Bonus video content  
in eMagazine



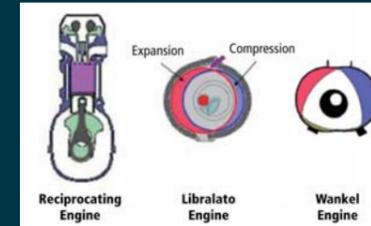
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## Previous winners' comments



"As a direct result of the Challenge, we have been able to engage OEMs, interested in our ultra light, ultra efficient, low cost, low emission, revolutionary rotary engine; which is ideally suited for the 'electromobility' paradigm shift to hybrid and plug in hybrid electric vehicles."

Dan Aris,  
Managing Director,  
Libralato

"Winning the LowCVP Technology Challenge raised awareness of our HCCI control technology not just at a national level but internationally, with interest being received from prospective customers and co-developers around the world."

David Toney,  
Managing Director,  
Oxy-Gen Combustion

"The CO<sub>2</sub> reduction potential of Axon's light weight structural components in carbon-fibre has been given industry-wide recognition as a result of winning the Technology Challenge."

Steve Cousins,  
Managing Director,  
Axon Automotive



Creating the future of transport

## Low Carbon Vehicles

TRL is helping to accelerate the deployment of innovative mobility solutions by:

- Linking new transport technologies
- Understanding user attitudes and behaviours
- Guiding policy development
- Providing robust evaluation and real world solutions

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# Presenting the winners of the LowCVP Technology Challenge 2012

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