Project no. 691735

REPLICATE PROJECT

Renaissance of Places with Innovative Citizenship And Technology

This Project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement N° 691735

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REnaissance of PLaces with Innovative Citizenship And Technology

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H2020-SCC-2015 Smart Cities and Communities

Innovation Action (IA)

D5.5 Car Club expanded with ten Electric Vehicles

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1. EXECUTIVE SUMMARY

As part of the Bristol Pilot of REPLICATE the objective has been to roll out Co-wheels car club Electric Vehicles.

Following the first Electric Vehicle (EV) deployment in August 2016, the next step was to identify 10 other suitable EV car club bay locations in the project area. Three locations are now fully installed, commissioned and operational. The final seven EV bays benefitted from the lessons learned from the first phase and so we have carefully chosen locations, produced designs, obtained permissions and the construction is now well advanced.

We opted for a combination of 22kW charge points with the Renault Zoe as we felt this would provide maximum flexibility for the car club business model. The 10 EVs will be operational and start the monitoring phase at the beginning of February 2019. The cars are currently being fitted with on-board telematics and a Trakm8 tracking system and deployed whereupon we will move to the monitoring stage of the project. Initial indications are that we will gather large amounts of very useful data which can inform many aspects of the project.

The EVs will be added to Co-wheels's bespoke booking system, designed to their specification based on ten years of knowledge and experience in providing car club and fleet management services.

The telematics will provide a wide range of performance statistics to understand vehicle usage and help refine services. Going forward we hope to bring in functionality to have access to vehicle state of charge in real time which will allow much more efficient booking to ensure that cars have sufficient charge.

As part of the REPLICATE project we have deployed a range of modern social media techniques, as well as more traditional advertising methods, to ensure maximum take up of the initiatives.

We expect that the expansion of the car club with 11 EVs will improve access and social inclusion, reduce parking demand and lock in sustainable travel behaviours.

Based on initial vehicle use we consider that we should be able to meet our (updated) bid CO2 target.

We believe that the offer we are providing for EVs is highly scalable and replicable. We would stress the importance of strong customer service with good fleet maintenance, good reliable, robust and secure ICT infrastructure, as well as an open pricing model.

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2. REPLICATE

The main objective of REPLICATE project is the development and validation in three lighthouse cities (**San Sebastián** – Spain, **Florence** – Italy and **Bristol** – UK) of a comprehensive and sustainable City Business Model to enhance the transition process to a smart city in the areas of the energy efficiency, sustainable mobility and ICT/Infrastructure. This will accelerate the deployment of innovative technologies, organizational and economic solutions to significantly increase resource and energy efficiency improve the sustainability of urban transport and drastically reduce greenhouse gas emissions in urban areas.

REPLICATE project aims to increase the quality of life for citizens across Europe by demonstrating the impact of innovative technologies used to co-create smart city services with citizens, and prove the optimal process for replicating successes within cities and across cities.

The Business Models that are being tested through large scale demonstrators at the three cities are approached with an integrated planning through a co-productive vision, involving citizens and cities' stakeholders, providing integrated viable solutions to existing challenges in urban areas and to procure sustainable services. Sustainability of the solutions is fostered in three areas: economic and environmental and finally, fostering transparency in the public management.

In addition, the Model features the replicability of the solutions and their scale up in the entire city and in follower cities, particularly in three follower cities (**Essen** – Germany, **Lausanne** – Switzerland and **Nilüfer**–Turkey) that are involved in the project and therefore, have access to know-how and results achieved on the project so they can apply the developed model. At the moment, there are 2 observer cities, Guangzhou (China) and Bogota (Colombia).

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3. INTRODUCTION

3.1 Relation to Other Project Documents

The nature of REPLICATE is that many of the interventions are closely linked with each other. This deliverable is closely linked to other Bristol Pilot deliverables, in particular "*D5.3 Energy Demand Management System"* which dealt with how the energy data from assets such as car clubs could be optimised and "*D5.7. Transport Infrastructure Adaptation Including EV Charge" Point Installation"* which dealt with the provision of the charging infrastructure which will allow car club vehicles amongst others to recharge. There are also links with Cross Cutting Analysis and Scale Up (WP7), Replication (WP8), Exploitation (WP9), Monitoring (WP10) and Communication and Dissemination (WP11).

3.2 Reference documents

This document is based in the following projects level documents:

Ref.	Title	Description
REPLICATE Grant Agreement signed 240713.pdf	Grant Agreement	Grant Agreement no. 691735
DoA REPLICATE (691735)	REPLICATE Annex 1 – DoA to the GA	Description of the Action
REPLICATE Consortium agreement signed December 2015 (7th December version)	Consortium Agreement	REPLICATE project – Consortium Agreement
REPLICATE Project Management Plan	D1.1 Project Management Plan (v.1) (29/04/2016)	REPLICATE Project Management Plan
REPLICATE District Management Plans	D1.4 District Management Plan San Sebastian D1.5 District Management Plan Florence	REPLICATE District Management Plans

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	D1.6 District Management Plan Bristol	
REPLICATE Communication Plan	D11.1 Communication Plan	REPLICATE Communication Plan

Where there are contradictions, the documents listed above supersede this deliverable. The Grant Agreement is the contract with the European Commission so takes precedence over all other documents.

3.3 Abbreviations list

BEV	Battery Electric Vehicle
CA	Consortium Agreement
DoA	Annex I-Description of the Action
DVLA	Driver and Vehicle Licensing Agency
EC	European Commission
EB	E-bike
EV	Electric Vehicle
GA	Grant Agreement
GPS	Global Positioning System
H2020	Horizon 2020
iOS	iPhone Operating System
OWASP	Open Web Application Security Project
PAYG	Pay-As-You-Go
PC	Project Coordinator
PCI DSS	Payment Card Industry Data Security Standard
PL	Pilot Leader
PMP	Project Management Plan

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SOC	State of Charge
TC	Technical Coordinator
WP	Work Package
WPL	Work Package Leader

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4. DELIVERABLE DESCRIPTION

This deliverable covers all aspects of the expansion of the Co-wheels car club with Electric Vehicles.

Section 5 sets out the processes that were followed to expand the EV car club

Section 6 goes in to more detail about the specification of the new EVs.

Section 7 covers the telematics systems used for both operational purposes as well as for monitoring of the REPLICATE objectives.

Section 8 provides a case study of a Co-wheels EV user.

Section 9 explains the approach taken to promote the new vehicles.

Section 10 sets out our findings relating to innovation, impacts and scalability.

Conclusions are detailed in **Section 11**.

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5. ROLL OUT OF EV CAR CLUB

The objective was to expand the existing car club in Bristol with Electric Vehicles (EVs) alongside the placement of e-bikes in a shared corporate scheme. Initially this was to be a total of six EVs deployed on a Pay-As-You-Go (PAYG) basis in on-street car club bays in the project area. However, due to an amendment to the number of e-bikes being delivered and a desire to increase the environmental impact of the combined mobility solutions, this became 11 PAYG EVs deployed in the manner described below.

The first EV was deployed in August 2016 (M7) and occupies a bay outside the Engine Shed in Bristol, a collaboration between Bristol City Council, the University of Bristol and the West of England Local Enterprise Partnership at the heart of Temple Quarter Enterprise Zone. This location sits directly next to Bristol's main railway station, Bristol Temple Meads, and opposite one of Bristol City Council's main office hubs at 100 Temple Street. The placement of this EV was to introduce the concept of the EV to car club users in Bristol, but also to influence use by key users in the city, such as Bristol City Council, from as early on in the project as possible.

With the first EV in place, the next step was to identify 10 other suitable EV car club bay locations in the project area. This task was split into two phases. The first phase focused on working through the process of identifying the first three bay locations, procuring and installing the charge points, making the charge points operational and deploying the EVs. The second phase focused on the remaining seven bays but with the benefit of the lessons learned from the first phase.

The criteria for identifying EV bay locations centred mainly around the availability of on-street parking spaces and the likelihood of them being used by car club members. Due to the significant amount of time and legal process required to create new car club bays, the focus was quickly directed towards existing car club bays in the project area. Co-wheels have invested in advanced data sets and mapping tools. The comprehensive data sets analyse a large number of metrics, including demographic and socio-economic information, but also current travel patterns and car usage levels. Mapping software displays a "propensity to join Co-wheels" as a heat map, clearly showing the areas where car club bays are most likely to become sustainable. However, for the first phase Co-wheels agreed to use three of their existing car club bays, on the understanding that the seven bays in phase two would be new to Co-wheels in line with the intention to 'expand' the car club with electric vehicles. By using existing Co-wheels bays, the question of whether car club members would use the EVs was already answered. Whether those bays were suitable to have an EV charge point installed was subject to a series of quality assurance checks undertaken by Bristol City Council.

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The detailed Quality Assurance process gone through by Bristol City Council is explained in detail in "*D5.7. Transport Infrastructure Adaptation Including EV Charge" Point Installation"*. In summary, a long list of sites was narrowed down to a short list which were then installed. The process started out with general areas where EV car clubs were considered viable. Rough locations for bays were then selected. A desktop study of the locations of underground services was carried out, supplemented by ground penetrating radar where needed. With this information it was possible to develop a draft design for each site. These draft designs were then taken through an internal Bristol City Council process to approve the locations which took in to account things such as impact on the public realm and other road users. A parallel process was carried out with the Distribution Network Operator, Western Power Distribution, to ensure that they would give permission for a new three phase 22kW connection at that location. Where the bay did not have existing legal protection through a car club Traffic Regulation Order, a new Traffic Regulation Order was needed to ensure only the car club could park in the bay.

Once all the technical permissions had been successfully gained, Bristol City Council could issue contracts for the provision of new charge points to be built and connected to the back office system. As would be expected, particularly for new technology such as this, there was a period of snagging to ensure the charge points were fully operational and working as planned.

As of the beginning of December 2018, the first three charge points are installed, tested and operational. The remaining seven charge points locations have been identified, quality assured and agreed, and installation of the charge points in ongoing. The 10 EVs will be delivered and operational by the beginning of February 2019. The vehicles are being fitted with on-board telematics and a Trakm8 tracking system and before the delivery and will be deployed in time for formal monitoring to commence at the start of February 2019.

The cars will be leased from Renault UK Ltd and deployed by Co-wheels using a PAYG, back-to-base model.

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Here below one picture of the Renault Zoe car that will be deployed:

Figure 1: Renault Zoe electric vehicle

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6. TECHNICAL SPECIFICATION OF EV CAR CLUB

6.1 Initial Specification

6.1.1 Vehicle technical specification

The vehicle being used for REPLICATE is Renault Zoe i Dynamique Nav Q90 ZE40.

The Renault Zoe Q90 ZE40 is a full Battery Electric Vehicle (BEV). The maximum power of the BEV is 65 kW (87 hp). The maximum torque is 162 lb-ft. It is front wheel drive and can accelerate from 0 to 62 miles per hour in 13.5 seconds. The top speed is 84 mph.

The battery (ZE40) has a total capacity of 41 kWh. The usable capacity is 37 kWh (estimate). A range of about 140 miles is achievable on a fully charged battery. The actual range will however depend on several factors including climate, terrain, use of climate control systems and driving style. For example, sustaining high speeds in cold weather could result in a range of around 100 miles. However, driving at low speeds in mild weather will increase the range to around 215 miles.

Charging is done using a Type 2 connector and the on-board charger has a maximum power of 22 kW. This charges a fully depleted battery back to full in around 2 hours. A 3-phase grid connection is needed to achieve this. The car club charge points being installed for REPLICATE meet this requirement.

Rapid charging is possible through a Type 2 connection. The maximum rapid charge power is 43 kW. The battery can't be charged continuously at this power. In an average rapid charge session, the average charge power will be around 33 kW. This charges the battery from 10% to 80% in around 50 minutes. A rapid charge like this will add about 95 miles of range.

The combined (motorway and city) energy consumption of the Renault Zoe Q90 ZE40 is about 260 Wh per mile. By comparison, this energy consumption is the equivalent of a fuel consumption of 153 mpg in a traditional petrol car.

The actual energy consumption will depend on several factors including climate, terrain, use of climate control systems and driving style. For example, sustaining high speeds in cold weather could result in an energy use of around 370 Wh per mile. However, driving at low speeds in mild weather will increase the efficiency to about 170 Wh per mile.

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6.1.2 Booking system

All of the EVs will be added to Co-wheels existing booking system and can be booked online or by using the Co-wheels app. From the users' point of view, a car club member books a specific EV at a specific time via their account on line or using their mobile phone. Customer bookings are relayed by text message from the booking software system to the specific car. When a customer presents the correct RFID card at the correct car at the correct time, the on board telematics unit takes the immobiliser off and the customer can enter the car. At the end of a booking, the customer returns the vehicle to its bay and once again presents the RFID card to complete the process.

All EVs have the relevant charging card to access the regional re-charging network, which is securely stored within the on-board computer. This allows members to disconnect from the charge point at the beginning of a session and then to plug back in at the end of the session.

Joining Co-wheels is easy (and fully supported if needed) via the website (http://www.co-wheels.org.uk/). The sign up process ensures a full Driver and Vehicle Licensing Agency (DVLA – the UK Government Agency which holds vehicles and driver records) check is completed and the terms and conditions of usage are accepted by the joining member. Members are asked to choose a secure password, and have bespoke log in details.

Once registered, a member can log in to their secure account and see and edit all personal information as well as making and amending bookings. The booking page is clear and easy to use, showing the cars available close to their preferred location, what type of vehicle it is, and the cost of the hire time for the vehicle. All new members are sent a Co-wheels handbook along with their RFID card, which clearly demonstrates how to make and amend bookings, how to access the cars and what to do in case of emergency. It also contains contact details for the Co-wheels team.

The Co-wheels App (http://www.co-wheels.org.uk/book_and_join_via_our_new_app) is always developing, and can be used by all members to make and view bookings. As more features are added to the app we expect it to play an increasingly important role. Through the App and the website, access to the booking system is 24 hours a day, and, with the secure customer account set up, the vast majority of account administration is available to members 24 hours a day. Co-wheels also makes use of a variety of social media tools including Twitter (https://twitter.com/co_wheels) and Facebook (http://www.facebook.com/co.wheels).

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6.2 Possible upgrades within REPLICATE

6.2.1 Vehicle

To facilitate the formal monitoring of the REPLICATE car club EVs, the vehicles will be fitted with Trakm8 GPS trackers. More information about these trackers and their application to the monitoring programme can be found in Section 7 of this deliverable.

6.2.2 Booking system

Internal software developments within Co-Wheels incorporate algorithm based electric vehicle scheduling software that can handle the complexity of multi vehicle scheduling and dynamic response. The in-car telematics units will also provide real time state of charge information from EVs to the Co-Wheels software, to ensure all customer trip requirements are delivered efficiently.

The combination of real time state of charge information and scheduling of planned trips means that specific vehicles can be allocated to a customer at the start of a booking, rather than in advance, to ensure the EV has the appropriate level of charge, and also streamlining the number of cars required to provide the service, without reducing the number of bookings that members can complete.

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7. DESCRIPTION OF TELEMATICS SYSTEM

Co-wheels have developed their own, bespoke booking system, designed to their specification based on ten years of knowledge and experience in providing car club and fleet management services. Ensuring the system is easy to access and use for their clients and drivers is key to the Co-wheels platform.

Customer accessibility is delivered on multiple platforms. The Co-wheels booking system is fully compliant with Payment Card Industry Data Security Standard (PCI DSS) and Open Web Application Security Project (OWASP) requirements and built on multiplatform accessibility, allowing the system to be accessed easily from desktop, mobile device and tablet. An App has been developed to make and view bookings, currently available for iOS and Android mobile devices.

7.1 Initial Specification

Co-wheels will be able to regularly analyse on a vehicle by vehicle basis:

- the number of bookings per month
- the number of hours booked per month
- the miles driven per month
- the number of members active within a month
- the number of hours that the vehicle is unavailable due to maintenance per month
- Revenue generated per month
- Profit/Loss per month
- Percentage utilisation per month

7.2 Further Developments of Telematics

A further telematics system will be installed for the purpose of monitoring the REPLICATE project. The Trakm8 T10 Lite has the following specification:

- **Insurance approved** – The T10 Lite is insurance approved and accepted by many insurance companies to help reduce premiums.

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- **Small but powerful with Bluetooth connectivity** Despite its small size, the T10 Lite has a powerful processor to provide precise GPS locations, and communicates over the GPRS network utilising complex data sets. The unit has optional Bluetooth connectivity which can minimise data costs.
- **Certified with flexible installation options** The T10 Lite is certified and E-Marked with all the IP, design, development and manufacturing owned by Trakm8 and managed in-house. The T10 Lite offers various flexible installation options dependent upon the Fleet Operators requirements.
- **Monitor fleet activity** The T10 Lite houses a tri-axis accelerometer and gyro to monitor the movement and rate of direction change of the vehicle which provides the Fleet Operator with detailed information about the vehicle activity, driver behaviour and crash analysis. Optional CANBus connectivity for the T10 Lite enables the monitoring of vehicle diagnostics and accurate fuel usage.
- **Commercially flexible** Multiple variants of the T10 Lite are available allowing a solution package to be commercially flexible around the required data set.

Figure 2 is a photo of the telematics unit that will be installed in the REPLICATE EVs.

Figure 2: Trakm8 T10 Lite Telematics Unit

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Trakm8 will install T10 lite units into the Renault Zoes. Once installed, the T10 lite will provide journey data, GPS and State of Charge (SOC). SOC is not yet available as a fully commercial product from Trakm8, but Trakm8 will engineer a solution for the Renault Zoe as an interim solution.

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8. CASE STUDY

8.1 Co-wheels User Case Study

Ambulance worker Severin is a keen electric car user who is looking forward to new EVs being available in the REPLICATE Area.

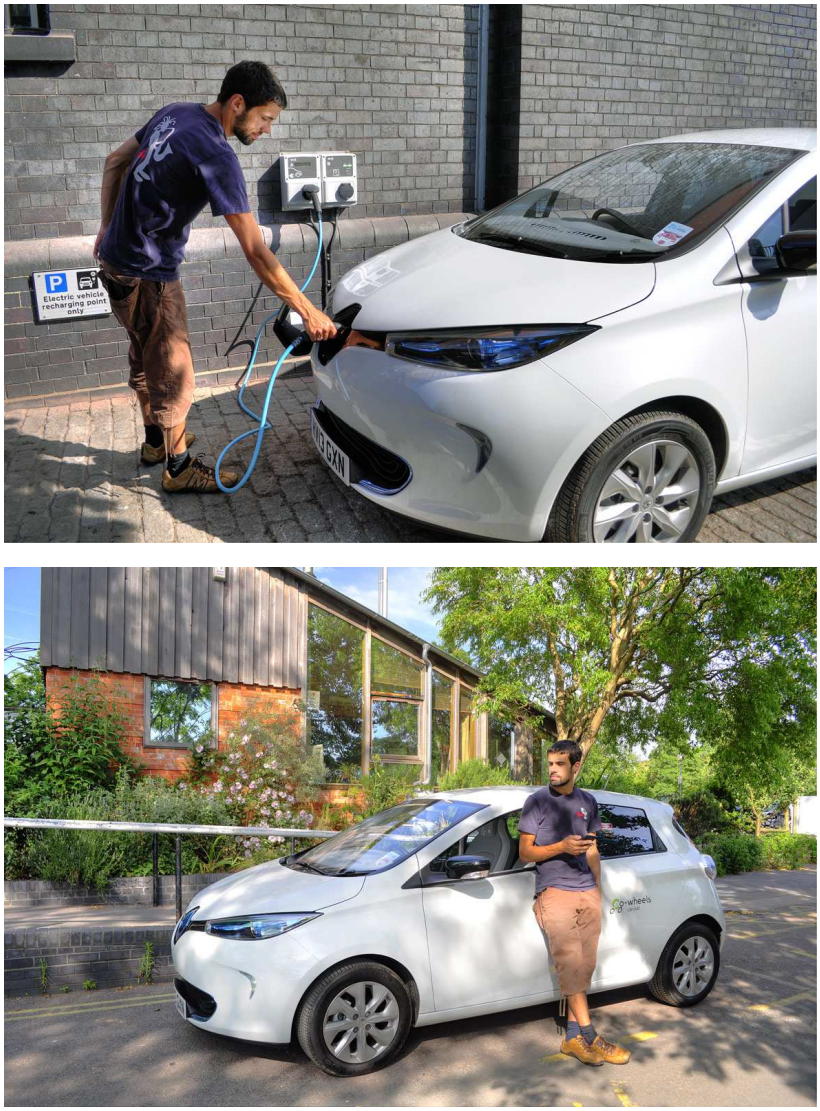

Figure 3: Severin with a new Co-wheels Renault Zoe

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He and his family have been car free now for seven years – he works in the city centre and is a keen cyclist so can manage without a car, but about once a month when he does need one he uses Co-wheels.

Severin always uses our EVs even though there are none currently near his home in Eastville at the northern edge of the REPLICATE project area – so he will really benefit from the new EVs being installed nearby.

"We used to own a car but it was getting increasingly expensive, both my wife and I work in the city centre and as a family we wanted to reduce our carbon footprint so we decided to get rid of it," said Severin

"We can usually cycle for most journeys but sometimes when we need to carry something we just need a car, so we use Co-wheels for bigger shopping trips or for day trips and weekends when we want to get out of the city."

"My mother lives in Spain so when she visits it is invaluable for collecting her from the airport and I also run a book stall at weekends and I need it to transport my stock."

"Since we moved out of the city centre and into Eastville about two years ago it has not been so easy, the only drawback to Co-wheels is that there are not many vehicles nearby and the electric cars are even further away in the centre."

"So, I cycle to College Green, pick up the car, bring it home to fill it with my books then drive it back to the city centre to set up my stall. It would be so much easier if there were more electric cars in our community and I think it will encourage more people to try EVs and be like us and give up car ownership."

"As a family we are committed to car sharing as we don't want to go back to owning a car, and I certainly wouldn't want to commute with one every day because of the congestion in the city centre. So, I am looking forward to having more choice as it helps us keep car free."

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9. PROMOTION

9.1 EV availability

All of the REPLICATE EVs will be fully integrated into the existing car club operation in Bristol. Their locations, availability and state of charge information will be made available through the Co-wheels website, booking system and smartphone app.

9.2 Instructions on how to use EVs

There are a range of ways in which car club members will be provided with information to help induct them into EV usage:

- Co-wheels provide detailed instruction sheets, acting as user guides, for specific EV models on the Electric Cars page of the website. Members are signposted to this page via a link provided on their booking confirmation. Laminated hard copies of these sheets are also provided in the vehicles themselves, alongside the standard vehicle owner's manual.
- Co-wheels also attach tags to the charge cables reminding users to place the cable in the vehicle once it has been unplugged from the charge point, and to plug it in again once the vehicle has been returned to its bay at the end of a booking.

9.3 Future Marketing

Co-wheels have a central sales and marketing department ensuring that the cars will be promoted via all of our tested and proven communication channels.

As a well-established, national service provider, we have excellent experience in the most cost effective methods of promoting the car club service. As Co-wheels is popular with our members, word of mouth and referral schemes are very efficient member recruitment methods.

To reach residents and businesses we would re-launch the scheme with PR via local media and look to maximise follow up activities, such as reaching key membership targets.

The key method of ensuring sign up would be precisely targeted digital adverts with a series of time-limited sign up offers for discounted and incentivised membership, principally:

- Google Adwords – using a Customer Match audience based on existing drivers to send traffic to the Bristol landing page offering a discounted promotion code which they can instantly redeem.
- Facebook – we use a combination of website conversion, lead, 'store visit' and remarketing adverts. This range of ads gives us maximum engagement with potential

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members. They are very precisely targeted using highly customized audience sets matched to our Mosaic data profiles of those most likely to car share and to our existing membership in an area. These are then location targeted to those who live in – or pass by – a ten-minute walk time of each car so we reach everyone who lives, works or travels in all of our locations.

- A series of automated emails linked to the ads and using the data collected from them to encourage people to sign up online and remind them as the offer expires.

We direct all prospective members to a Bristol landing page of our website to ensure the joining offer is localised and relevant, giving them the map location of cars in the city.

Other key activities to ensure growth would be to ensure each fixed bay is clearly marked and signed with our branding system developed to ensure maximum visibility for the club as research shows up to 25% of members can be attracted from on-street presence. We also ensure the graphics are in place on each car.

We are constantly innovating so these techniques will be supplemented by an automated refer a friend system to make it much easier for people to refer friends and share their individual invite via social media, as well as enabling us to offer further incentives to our members who gain the most referrals.

We will also be expanding our digital location based marketing by installing Bluetooth beacons at each car share location tied in to Google's open standard so they get more relevant alerts and search results when they are near our cars. It will also enable us to send notifications via our Co-wheels smartphone app as well as to all mobile phones and tablets notifying them when they are near our cars and directing them to the Bristol web landing page for further information.

Maximising usage would be ensured by a series of welcome emails and videos to 'on-board' new members and familiarise themselves with the booking system. This is supplemented by a content calendar of reminders, activities and member offers – such as Bank Holidays, events and festivals – which are distributed via regular emails, social media promoted posts, in app messaging, and remarketing ads. These would be targeted on regular users to thank and reward them, and to inactive users to incentivise them to use the scheme.

Any leavers would be asked to complete an exit survey to understand their reasons and drive improvement, combined with an incentive offer if they re-join.

Co-wheels will work with our partners to support events, targeting both corporate and residential members. Example events would include sustainable transport initiatives, promoting active travel, low carbon events and health promotion events with the NHS.

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As a Social Enterprise and Community Interest Company, we have excellent communication and promotional channels available to us to promote the service. The network of community groups, and the umbrella organisation of Social Enterprise UK gives us access to a receptive audience of other businesses and residents keen to support environmental and social enterprises.

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10. INNOVATIONS, IMPACTS AND SCALABILITY

10.1 Innovation solution

Bringing together EV charge points with a Smart City Platform to enable car club energy usage to be monitored has been very innovative. Choosing the right vehicle-charge point combination, integrating with the Charge Point Monitoring System and inclusion of EV car clubs within the Co-Wheel booking system has taken extensive work. We have had to solve a number of issues along the way in order to get the system up and running.

We consider the active marketing of the car club products using a range of social media tools to be quite advanced.

We think that our choice of 22kW charge points with a car club vehicle capable of 22kW charging – which is quite unusual – is quite innovative but we think this choice will pay off in the long term as the ability to charge the vehicle much more quickly between uses will be appreciated by users and should make the system more efficient.

Once we have fully installed the new telematics we will have access to a wealth of data which will allow better understanding of charging behaviours and how these could be optimised.

10.2 Social impacts

Formal monitoring has not yet begun, but it is anticipated that the expansion of the car club with 11 EVs will:

- **Improve access and social inclusion** – providing access to cars without the expense of ownership
- **Reduce parking demand** – multiple users share one car and one parking space
- **Lock in behaviour change** – Car clubs act as a catalyst to increased use of sustainable transport
- **Support modal integration** – Car club members make more trips by public transport, walking and/or cycling after joining.

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As a Social Enterprise Co-wheels can provide high quality and socially beneficial services which will directly impact a local council's policy aims. For example, Co-wheels has expanded from central core areas of Bristol to add cars in areas of social inclusion, where transport poverty was previously causing access to employment issues.

10.3 Environmental impacts

Although formal monitoring has not begun yet, one of the 11 EVs has been included in the project as match funding. This vehicle has been operational since August 2016. In that time, it has travelled 9,348 miles (15,044 km), resulting in an estimated 2.1 tonnes of savings in CO2 so far.

Since the bid we have agreed via an amendment to change the proportion of E-bikes (EB) and Electric Vehicles (EV) from 32 EBs/ 6 EVs to 12 EBs/11 EVs. Using the same methodology as in the bid this change is expected to be broadly neutral in carbon terms as shown in Figure 4.

Initiative	**Carbon saving per vehicle per year (tonnes pa)**	**No. of vehicles**	**Total carbon savings per year (tonnes pa)**
Original proposal: 32 E-bikes and 6 Electric Vehicles			
E-bikes	0.36	32	11.52
Electric Vehicles	1.57	6	9.42
TOTAL			**20.94**
Revised proposal: 12 E-bikes and 11 Electric Vehicles			
E-bikes	0.36	12	4.32
Electric Vehicles	1.57	11	17.27
TOTAL			**21.59**

Figure 4: comparison of predicted environmental benefits for different e-bike and Electric Vehicle ratios

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The assumptions for CO2 savings are based on:

- replacing journeys undertaken in vehicles with an average emission level of 140g CO2/km covering 7,000 miles/ 11263 km per year.
- Each electric bike is estimated to undertake 2,574 km per year. The CO2 saved is 0.36 tonnes per bike per year

As part of the monitoring we expect to measure primary energy consumption, predict non-renewable proportion of energy consumed and hence produce more detailed estimates of CO2 savings.

10.4 Replication and scalability potential

There is significant potential for this EV car club expansion to be replicated. This centres around the status of Co-wheels as a successful existing car club that is continuing to grow. There are a number of factors for consideration with regard to replication including track record, fleet maintenance, public facing website, customer services, online booking system and on-road support.

10.4.1 Track record

Co-wheels are the UK's geographically largest independent car club operator, and the only national organisation set up as a Social Enterprise. We operate a fleet of more than 550 cars at over 60 locations across the UK. Some of these are illustrated in

Figure 5. These vary from public access pay-as-you-go schemes to "closed fleet" schemes where we use our purchasing power, management systems, in-car technology and booking platform to manage pool car fleets. We also provide the "cross-over" model, where vehicles are reserved for employee use during agreed office hours, and made available as a community resource outside of hours.

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Figure 5: Map of Co-wheels vehicle locations

The majority of locations have been awarded to Co-wheels following competitive tendering processes. This includes areas that have re-tendered for the service as well as areas where Co-wheels have replaced the incumbent car club operator.

Furthermore, as Toyota preferred car club partner within the UK, Co-wheels deliver advice and consultancy to them on establishing their Toyota Yuko car share operation across Europe.

The success and organic growth of Co-wheels has provided significant experience in optimal set-up for running a viable and self-financing scheme.

Co-wheels were the first car club in the UK to introduce electric cars to the fleet, and they continue to expand the number available.

The fleet team are always trialling new electric cars to ensure the best vehicle to deliver ease of use for members, range and cost of the car. By ensuring provision of the best possible EV, the costs of hiring it are kept low while delivering an excellent customer experience of driving electric.

Co-wheels ensure the smart promotion of electric cars as the first-choice vehicle for members. This includes algorithms to establish that a searched for trip is within the range of an EV, and

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then making sure that the EV is top of the list for booking. Other features are being developed, such as displaying real time state of charge, so members can make last minute bookings with full confidence.

Co-wheels are also working with project teams across the UK on a number of trials involving EVs, including vehicle to grid capabilities, smart charging trials and increasing the number of EVs on the fleet.

10.4.2 Fleet maintenance

Co-wheels have a team of fully trained fleet engineers who are responsible for cleaning and maintaining the Co-wheels cars.

The standard cleaning schedule includes all aspects of cleaning the car, outside and in, as well as completing a multitude of safety checks.

A fleet management software package is used to complete a comprehensive checklist each time the car is visited. This includes all consumables, windscreen wipers, oil and all other fluid levels, tyre pressures and tread depth, and the functioning of all seatbelts. EVs can require fewer service interventions than fossil fuel vehicles as the mechanical parts are simpler which may also lead to fewer unexpected call outs.

10.4.3 Public facing website

Co-wheels have a simple pricing structure, with no complicated membership tariffs or peak/off peak rates. The system automatically calculates the best rate for a specific booking, and clearly shows the trip cost to the member before they confirm the booking.

The pricing page on the website clearly shows ALL costs, including the insurance excess as well as the joining costs and any other possible costs, such as replacement smart cards or unpaid fines.

The Co-wheels website provides comprehensive information for all prospective and existing members, including hosting a car ownership cost calculator, information about the environmental benefits of car clubs, "how to" guides for various electric and hybrid cars, information about the organisation, a clear pricing table, and easy to find contact details.

There is a live chat function on the website, allowing instant questions to be answered by the customer services team. There are also several opportunities for prospective members to leave their details via an on-line form to request more information.

Co-wheels use localised landing pages which is a very useful tool for local marketing. This allows us to localise the service, as well as offering specific incentives for local businesses and residents. It also serves as a data capture portal, for future communication opportunities.

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10.4.4 Customer services

Co-wheels have a dedicated customer services team. The office is open from 8am-8pm Monday - Friday, and 8am-6pm at the weekend.

There is a 24-hour emergency phone number, which is always connected to a member of the team. This number is provided to all members as they join, and is in the car. The on-board telematics systems within the car also have a hands-free phone line directly to the customer services team, which is a 24-hour service.

There is also a live chat facility on our website, with the customer services team ready to help with any quick questions during office hours.

10.4.5 Online Booking system

Co-wheels have developed a bespoke booking system based on ten years of knowledge and experience in providing car club and fleet management services. Ensuring the system is easy to access and use for clients and drivers is key to the Co-wheels platform.

Co-wheels deliver customer accessibility on multiple platforms. The Co-wheels booking system is fully compliant with PCI and OWASP requirements and built on multiplatform accessibility, allowing the system to be accessed easily from desktop, mobile device and tablet. An app has been developed to make and view bookings, currently available for iOS and Android mobile devices.

Throughout the customer journey, the booking system is designed intuitively and allows users to create, amend and cancel bookings as well as and submitting changes to their driver profile and details.

It is also very easy to set up corporate accounts, and invite multiple drivers to that account. One (or more) corporate account owner can easily see who is registered to drive, the bookings in place as well as previous bookings and invoices.

As Co-wheels have developed the platform, specific areas of the system have been developed to benefit from emerging technologies and digital functionality.

Co-wheels's systems can integrate easily into existing transport services, for example bike sharing schemes, public transport smart cards or app access schemes, or residential reward schemes.

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10.4.6 On-road support

All Co-wheels cars are covered by 24-hour breakdown services. In the case of any accident or breakdown, the member is instructed to contact Co-wheels in the first instance, and the team co-ordinate the response required. They work with the breakdown team, and make sure that the member is kept informed of progress and time scales. The breakdown provider has service level agreements that confirm they will reach all breakdowns within four hours, but experience shows that this is within an hour the vast majority of the time, and frequently within 30 minutes. Priority is given to lone / vulnerable drivers.

If a vehicle cannot complete the journey, onward travel is arranged for the Co-wheels member, and Co-wheels is responsible for the on-going recovery of the car.

Co-wheels are responsible for any repairs required to the cars, and endeavour to get all cars back on the road as fast as possible.

Any issues with vehicles are logged on the fleet management software. This automatically informs all members of the fleet team. It details the nature of the issue, and confirms who has responsibility for its resolution. A due date is also set, and, should this date be missed, all fleet team members are emailed again to flag this as urgent.

10.5 Economic feasibility

Co-wheels also have significant experience of scaling up the car club operation, as is shown by their continuing growth in the UK. The key to this is working in partnership. The stronger the relationship with a local authority partner, the more successful and sustainable the scheme will become.

As mentioned previously, the success and organic growth of Co-wheels has provided significant experience in optimal set-up for running a viable and self-financing scheme. This not only refers to the operational systems that ensure the best possible experience for car club members, but also to the positive contributions that a car club can make to key public sector policy areas such as health and wellbeing, the environment, air quality, congestion reduction and cost savings.

Another key consideration for scale up is to ensure appropriate placing of vehicles. Co-wheels has invested in advanced data sets and mapping tools which help to analyse a large number of metrics, including demographic and socio-economic information, but also current travel patterns and car usage levels. The mapping software displays a propensity to join a car club as a heat map, clearly showing the areas where car clubs are most likely to become sustainable. An example of an output from this software is shown in Figure 6.

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Co-wheels use this mapping tool, along with comprehensive real life membership and utilisation statistics, and work in partnership with local authorities to organically expand car club provision.

Despite the obvious benefits of car club expansion, it is important to be careful to balance this with ensuring the long-term financial viability of the service.

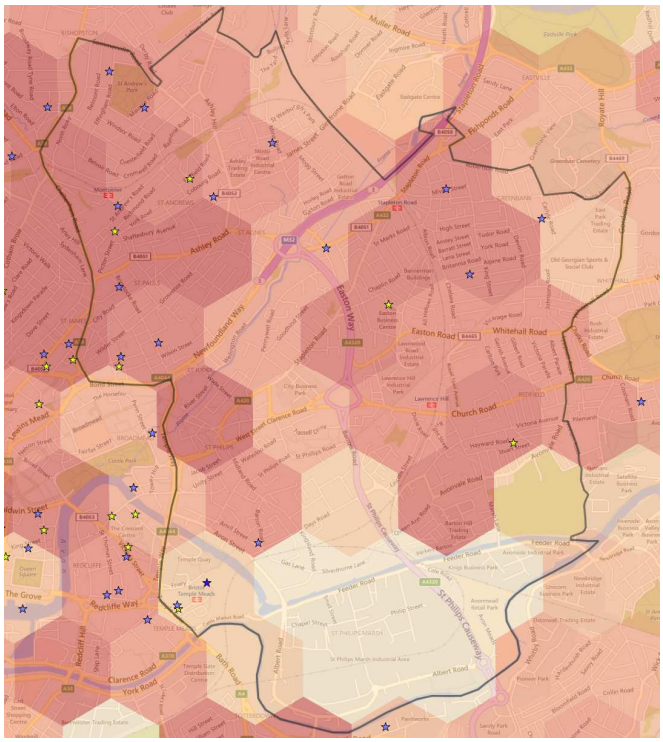

Figure 6: Example of mapping software illustrating propensity to join a car club in the REPLICATE area

Considerable resource is committed in launching new locations, from local authorities in terms of the TRO process, for local residents and businesses in accepting the change of use for the parking bay, and from Co-wheels in the provision of a new, kitted-out vehicle and all associated costs. Therefore, all expansion must be carefully managed, based on the data

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mapping tool, current usage statistics, planned marketing campaigns and in partnership with the Local Authority.

Furthermore, all existing cars should be monitored to ensure a sustainable level of utilisation is maintained, and marketing support can be provided on a bay-by-bay basis if additional resource is required.

10.6 Impact on SMEs

As an SME, Co-wheels is continuing to grow and this project provides a significant opportunity to increase the number of electric vehicles in the fleet. This growth will help to further establish Co-wheels as the leading car club for electric vehicle provision across the board, from public access pay-as-you-go schemes to "closed fleet" schemes. Furthermore, it is an opportunity for Co-wheels to demonstrate the significant added value that a car club can offer for helping councils to meet their environmental and transport policy goals, as well as supporting the process of placing charging infrastructure in locations that are best suited for electric vehicles and the communities which they serve.

Trakm8 is an SME providing telematics, cameras and asset optimisation software. Trakm8's products are designed and manufactured in the UK. REPLICATE is providing new opportunities to test these new products in innovative situations in order to further refine products and services and to explore new markets across the EU.

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11. CONCLUSIONS

In line with the REPLICATE Bristol Pilot objective to roll out Co-wheels car club Electric Vehicles, the first EV was deployed in August 2016 (M7) and occupies a bay outside the Engine Shed in Bristol.

With the first EV in place, the next step was to identify 10 other suitable EV car club bay locations in the project area.

Matching cars and charge points

This task was split into two phases. The first phase focused on working through the process of identifying the first three bay locations, procuring and installing the charge points, making the charge points operational and deploying the EVs. These are now fully installed, commissioned and operational. In December 2018 we received our first full month of data for these three charge points and so we have started to be able to analyse energy usage patterns and trends.

The second phase of EV bays focused on the remaining seven locations but with the benefit of the lessons learned from the first phase. These locations have been carefully chosen, designs produced, permissions obtained and the construction is well advanced.

Vehicle specification

We have selected a combination of three phase Type 2 22kW charge points with Renault Zoe i Dynamique Nav Q90 ZE40 which is one of the few EVS capable of charging at 22kW AC. We felt this combination would provide maximum flexibility for the car club business model.

Co-wheels are expecting delivery of the 10 EVsto Bristol and will be operational by the beginning of February., The vehicles are currently being fitted with on-board telematics and a Trakm8 tracking system and will be deployed in time for formal monitoring to commence at the start of February 2019.

Booking system

All of the EVs will be added to Co-wheels existing booking system and can be booked online or by using the Co-wheels app. Whilst they will be booked in the same way as other Co-Wheels vehicles they will also have a card to allow access to the regional electric charging network.

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Co-wheels have developed their own bespoke booking system, designed to their specification based on ten years of knowledge and experience in providing car club and fleet management services. Ensuring the system is easy to access and use for their clients and drivers is key to the Co-wheels platform.

Telematics

Using its telematics Co-wheels will be able to monitor a wide range of performance statistics to understand vehicle usage and help refine services.

To facilitate the formal monitoring of the REPLICATE car club EVs, the vehicles will be fitted with Trakm8 GPS trackers.

Going forward we hope to bring in functionality to have access to vehicle state of charge in real time which will allow much more efficient booking to ensure that cars have sufficient charge.

Promotion

Co-wheels is providing car club members with a range of information to help them get used to using EVs including detailed instruction sheets and attaching tags to the charge cables reminding users to place the cable in the vehicle once it has been unplugged from the charge point.

Co-wheels have extensive sales and marketing experience that will be used to promote the new REPLICATE EVs. We will use our excellent experience in the most cost effective methods of promoting the car club service including word of mouth , PR via local media and precisely targeted digital adverts including use of Google Adwords and Facebook. Other possible innovative advertising methods may include an automated refer a friend system and digital location based marketing using Bluetooth beacons

Co-wheels will also work with partners to support events, targeting both corporate and residential members. Example events would include sustainable transport initiatives, promoting active travel, low carbon events and health promotion events with the NHS.

Innovation

What is new about the Co-wheels EV car club is the combination of a range of technologies in such a way as to provide a seamless, attractive service for users. Bringing together EV charge points with a Smart City Platform to enable car club energy usage to be monitored has been very innovative. Choosing the right vehicle-charge point combination, integrating with the

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Charge Point Management System and inclusion of EV car clubs within the Co-Wheel booking system have taken extensive work but has resulted in a good solution.

Social

We expect that the expansion of the car club with 11 EVs will improve access and social inclusion, reduce parking demand and lock in sustainable travel behaviours.

Environmental

The first vehicle has been operational since August 2016. In that time, it is estimated to have resulted in a saving of 2.1 tonnes CO2 so far. We consider that we should be able to meet our (updated) bid target of saving 17.27 tonnes of CO2 per annum.

Replication and scalability

We believe that the offer we are providing for EVs is highly scalable and replicable. We would highlight that our proposed business model is based on organic growth of the car club with EVs being added as a natural part of the car club offer. We would stress the importance of selecting areas that market research shows are likely to be keen car club adopters.

We would highlight that we have made substantial efforts to ensure that the EVs are promoted both to new members and to existing members (where it is the right solution for their trip). We are continuing to innovate, developing new features such as displaying real time state of charge, so members can make last minute bookings with full confidence.

We would stress the importance of strong customer service with good fleet maintenance, good reliable, robust and secure ICT infrastructure, as well as an open pricing model.

Economic

We consider that the success and organic growth of Co-wheels has provided significant experience in optimal set-up for running a viable and self-financing scheme. This not only refers to the operational systems that ensure the best possible experience for car club members, but also to the positive contributions that a car club can make to key public sector policy areas such as health and wellbeing, the environment, air quality, congestion reduction and cost savings. Despite the obvious benefits of car club expansion, it is important to be careful to balance this with ensuring the long-term financial viability of the service.

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As an SME, Co-wheels is continuing to grow and REPLICATE provides a significant opportunity to innovate, grow and learn about how best to roll out new, green, smart technologies.