

Sharing Cities

Common Solutions
for Shared Challenges

D1.5 Final Technical and Financial Report



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Strategic impact

Vision

Sharing Cities' vision is of a more agile and collaborative smart cities ecosystem, delivering more liveable, attractive and resource-efficient cities.

Sharing Cities is a major international smart cities project addressing some of the most pressing urban challenges facing today's cities such as energy use, low carbon transport and buildings, and harnessing data for the good of the city.

The programme brings together 34 partners from across government, industry and academia to create solutions together that have more chance of success and sustainability as a result. Our user-centered, city-needs led approach is helping shape the smart city marketplace.

The project draws on €24 million in EU funding. It aims to trigger €500 million in investment and to engage over 100 municipalities across Europe.



European Innovation Partnership

Sharing Cities is a part of a family of 19 programmes that make up the European Innovation Partnership on Smart Cities and Communities (EIP-SCC01).

EIP-SCC01 is a major undertaking supported by the European Commission bringing together cities, industries, SMEs, investors, researchers and other smart city actors to shift the market from being focused on technical solutions to become more focused on the needs of the city.

Lighthouse & Fellow cities

The Sharing Cities model is built for scale. Combining three capital cities and two financial hubs, the project aims to shape the market for smart cities through collaboration, replication and scale up of urban digital services and platforms.

The Sharing Cities consortium brings together six cities:

Lisbon, London, and Milan: The 'lighthouse' cities have worked together since 2016 to develop and implement urban digital solutions and new models for collaboration. We have run 10 smart city projects in mobility, energy efficiency, data management and citizen engagement each of our lighthouse cities.

Bordeaux, Burgas, and Warsaw: The 'fellow' cities play an active role in driving the adoption of specific solutions by replicating what worked in the lighthouse cities.

The programme encourages learning and scale-up in at least 100 other cities across Europe and around the world.



Lisbon

Partners

Cities and Public Bodies	Networks and NGOs	Academia and Research	Industry and Small and Medium-sized Enterprises	European Innovation Partnership on Smart Cities and Communities

Objectives

Scale

We want to shift smart city technology from the fringes to the mainstream by scaling up what works, now that we have proven that properly designed and common smart city solutions can be integrated in complex urban environments. We want to encourage cities to work together as much as possible to enjoy the benefits of scale (cost, capacity, time) and shared learning.

Digital first

Demonstrate the positive impact of adopting a data-driven approach to city infrastructure. We want to drive the adoption of new digital services which will help citizens make better choices around transport and energy efficiency, and when scaled up will enhance cities' ability to meet key targets.

Open up & accelerate the market

Develop business models and identify investment opportunities in order to aggregate and replicate smart city solutions in cities of different sizes and maturities. We aim to accelerate the pace by which we make transformative improvements and enhance sustainability in urban environments by providing the information needed for others to commission with confidence.

Share & collaborate for society

Respond to the increasing demand for public participation, enhance mechanisms for public engagement, and improve local governments' capacity for policy making and service delivery through collaboration and co-design, resulting in outcomes that are better for citizens, businesses and visitors.

Solutions



Building retrofit

Install energy efficient measures in existing public, social and private building stock. This can link to other solutions like the integrated energy management system to optimise energy performance.



Shared e-mobility

A portfolio of linked initiatives supporting the shift to low carbon shared mobility solutions. Specifically: Electric Vehicle (EV) carsharing; e-bikes; eV charging; smart parking; e-logistics.



Digital Community Engagement

Shift perceptions and change behaviours towards sustainable smart city services through rewards in exchange for continued and improved citizen engagement.



Smart lampposts

Integrated smart lighting with other smart service infrastructures (EV charging; smart parking; traffic sensing; flow data; wifi).



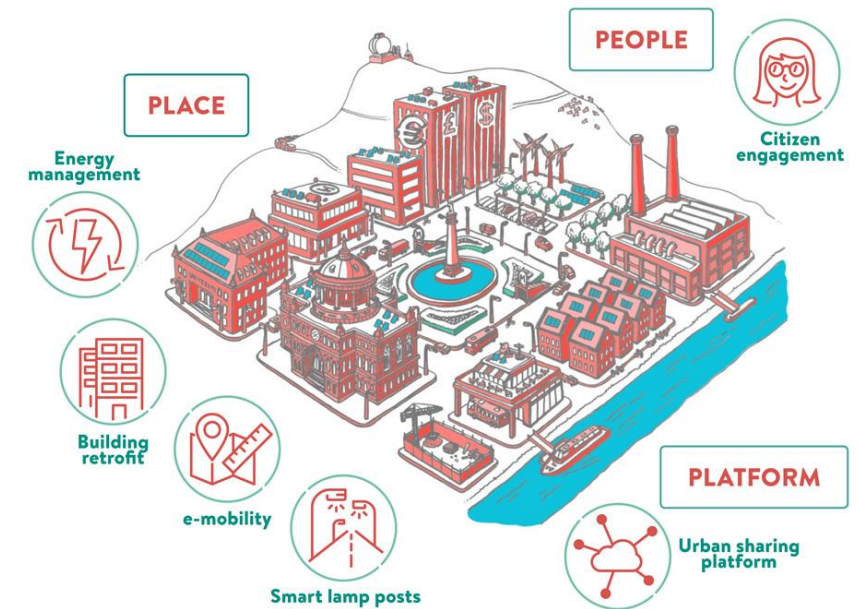
Sustainable energy management systems

An advanced controls system and interface that integrates and optimises performance of energy assets in a district to support sustainable energy management.



Urban data sharing platform

A way to manage data from a wide range of sources including sensors and traditional statistics. The platform uses common principles, open technologies and standards.



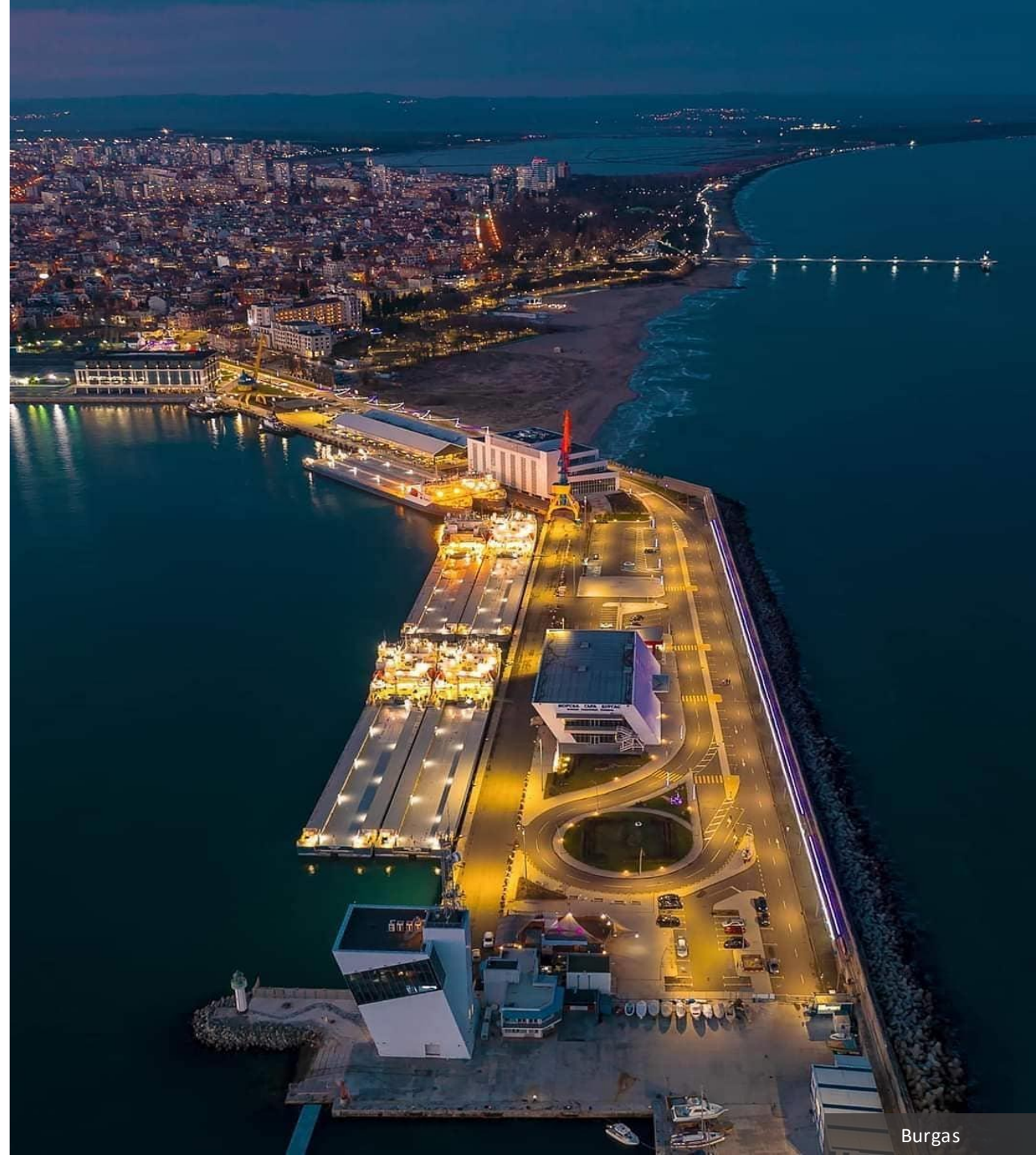
Smart city expertise, delivery and networks

- **Smart City Delivery Experience** – Applying lessons learned and the compounded impact of implementing a combination of smart city measures at a district level has been relevant to the combination of interventions needed as we recover from COVID-19. Our expertise gained from the programme covers large scale programme management, business models and financing, and engagement and networking has served the best interest of our cities and partners.
- **IoT Framework** – In each of our cities we have developed a framework that supports the commissioning of Internet of Things (IoT) technology with more confidence and a focus on outcomes. This can help cities/municipalities to express their needs and to stimulate the market, so that IoT is implemented across cities.
- **Use Case menu** – We are built up a menu of uses for smart infrastructure that encompasses support for vulnerable people, culture and night-time economy, transport, sustainability, connectivity and the economy.
- **Performance monitoring information** – We have collected information before and during the COVID-19 crisis, meaning we can see first-hand the impact that it has had on certain aspects of our cities.
- **Access to city networks** – The programme is well networked within Europe. This includes:
 - UK Smart Cities Group (chair, 15 UK cities)
 - EU Horizon 2020 EIP-SCC01 (co-chair, 100+ European cities)
 - EU Smart Cities Information System
 - Open and Agile Smart Cities (OASC)
 - G20 Smart Cities Alliance



Economic

- **Street sensors** – Engagement in the market to identify which sensors can help contribute to city outcomes. For example, footfall monitoring, LED signage, cultural services, payment systems, social distancing monitoring etc.
- **Digital districts & Opportunity Areas** – We have acquired access to investment-ready technology that can help to create digital districts in opportunities areas. Well-connected and adaptable districts will be much better placed to react to this crisis and any future crises that may arise.
- **Building a smart city marketplace** – Furthermore, we have stimulated demand in smart city solutions to build a more vibrant smart city marketplace, which is a rapidly growing area of the economy and draws in a large number of SMEs.
- **Culture** – Getting people back into our town centres once Covid restrictions have been lifted will involve thinking about how they serve as cultural centres and hubs as well as retail centres. Smart technology can play a key role in this from the look and feel of a street (lighting & sound) to wayfinding and safety.
- **High Street recovery** – By combining information from sensors with key data sets we can make evidence-based decisions on how best to target economic interventions. For example, by combining footfall with data from credit card providers and mobile operators, we can build a much more detailed picture of how people are accessing services.



Social

- **Digital community engagement and behaviour change** – We have successfully tested digital behaviour change and community engagement approaches that are ready to be scaled up. These can be used for a wide range of outcomes, such as encouraging public transport or engaging with a community.
- **Vulnerability** – We have explored ways in which smart technology can support vulnerable people to be more independent; from technology to support older people to remain connected to supporting visually impaired people to navigate the streets. We can increase this and also use this technology to better support those who need to be shielded from COVID-19.
- **Mobility** – As our cities return to normal more people will resume their commutes across our cities. The work we have done around smart and electric mobility can support the rise in active travel and also play an important part in maintaining improved air quality.
- **Street sensors** – The sensors deployed by the programme have provided valuable data for policy makers/city officials to assess the impact of the programme's interventions and identify scale up opportunities according to need.



Housing

- **Retrofitting buildings** – We now have extensive experience of retrofitting buildings to make them more energy efficient and better connected. As our citizens are encouraged to spend more time in their homes, the quality of those homes becomes more important. We have provided support to regeneration schemes across our cities, applying our learning in this area and help to ensure that more people live in low carbon and well-connected homes, as well as encourage growth in the deep-retrofit marketplace.
- **Decentralised energy management** – Through our work on the Sustainable Energy Management System (SEMS) we have trialled and tested, in real world situations, successful algorithms that can control energy inputs and outputs across multiple buildings, resulting in 10% energy reduction which could provide significant benefits for large scale housing providers. This type of data driven technology feeds into the discussion on decentralised energy, an area that may increase in importance following COVID-19.
- **Historic buildings** – We are at the cutting edge of retrofitting historic buildings (like Lisbon City Hall) to make them more energy efficient and connected. As we look at a potential period of economic recession and reduced visitor numbers, our historic buildings may benefit from reducing their costs.
- **Resident engagement** – We have trialled and tested a number of very successful resident engagement programmes as part of our retrofitting work. We have learnt a lot around designing a sensitive process of engagement that brings residents onside and puts in place a citizen-led governance structure.



Playbooks

Sharing Cities has captured the experiences of deploying smart technology solutions and the lessons learned along the way in a series of playbooks. Cities and partners can use this research to reduce barriers, speed up processes and ensure a consistent approach.

You will find detailed guidance on formulating a value proposition for smart solutions, in economic, social, environmental, and financial terms; and a practical roadmap to roll-out solutions, including strategic and technical design, ownership structures, business models, financing options and routes to market, stakeholder engagement and communications, and safeguarding citizen interests.

The playbooks are available on the [Sharing Cities website](#).



COVID-19 Recovery plans.

Even before the crisis there was a discussion about how our cities are becoming 'sensor rich' cities.

The pandemic has accelerated a transformation in the way that we live and work to become much more digital-centric and technology-dependent.

The programme has explored ways in which it can recover effectively and focus on three key areas of economic, social and housing recovery.

The adoption of smart technologies is complicated by a wide variety of technologies, approaches and uses-cases - making it difficult to know 'what good looks like' or understand how to deploy smart technologies in meeting outcomes.

The lessons from Sharing Cities have helped our cities respond to this challenge.

Environmental impact

Implementation Highlights

 Building Retrofit

		Original Bid		Final revision of the GA	
		Area	Total Impact	Area	Total Impact
		(m2)	kWh/yr	(m2)	kWh/yr
London	Public Housing	25 274	2 682 407	19 480	2 404 295
Lisbon	Public Housing	14 925	719 304	8 810	922 120
	Public Tertiary	5 292	289 903	6 766	326 030
	Private Housing	3 000	142 129	3 286	151 115
Milan	Public Housing	4 633	422 437	4 633	458 667
	Private Housing	21 000	1 558 570	24 637	1 862 273
		74 124	5 814 750	67 612	6 124 500

Despite a decrease in the total area retrofitted (when compared to the initial proposal), the energy efficiency measures implemented delivered a significant decrease in the buildings' energy needs. This enabled an increase in the programme's total impact.

Implementation Highlights



Shared e - mobility

City	Mobility mode	Initial number of vehicles/assets	Initial expected emission saving (tons CO2)	Number of vehicles/assets actually deployed	Final expected emission saving (tons CO2)
London	Autonomous eVs	8	228.88	8	230.75
	eV car sharing	20		20	
	eBike sharing	30		30	
	Shared eLogistics	0		6	
	Smart Parking	300		93	
	EVCP	21		180	
Lisbon	Shared eLogistics	80	692	150	3,637.20
	eV car sharing	65		20	
	eV bus sharing	2		0	
	eBike sharing	30		1,230	
	Smart Parking	30		125	
	EVCP	30		22	
Milan	eV car sharing	62	205	62	646.21
	Shared eLogistics	9		11	
	eBike sharing	150		150	
	Smart Parking	125		125	
	EVCP	61		72	
Totals		1,023	1,125.88	2,300	4,514.17

When compared against the original bid, the programme has delivered a 124% increase in the number of assets/vehicles implemented. The total amount of emissions saved (tons Co2) by the programme is 300% more than first envisaged.

Sharing Cities: Smarter Cities Through Collaboration

Embedding smart city solutions at scale, engaging citizens and improving cities

**A NETWORK OF INTEGRATED, LOW CARBON TECHNOLOGIES
SHAPED BY DATA AND CITIZENS**

REAL-TIME URBAN
DIGITAL
INFRASTRUCTURE

CO-DESIGNED
WITH
CITIZENS

DATA-SUPPORTED
DECISION
MAKING

6 million kWh/yr
saved through retrofitting
67,612 sqm in 34 large
buildings of different types.
Pioneering retrofit of Lisbon's
City Hall leads to...

36%
energy
savings

DIGITAL SOCIAL MARKET

In Milan, over 2,000 people
are registered on **SharingMi**,
the peer-to-peer,
eco-friendly network which
encourages greener choices



The Sustainable
Energy Management
System (SEMS)
reduces energy
bills by 10%

If deployed at UK
level, this could reduce
emissions **30% by 2050**

CO₂ reduction
30%
65%

TECHNOLOGY: E-BIKES

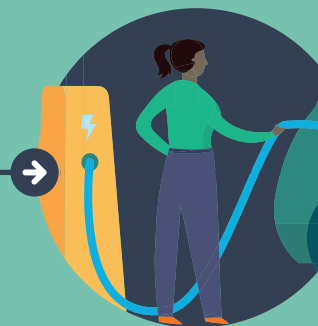
Our city-led, docked e-bike
schemes have transformed
the way people move
around cities.

Lisbon plans to expand its
bike fleet to over 2,000 -
80% will be electric.



TECH: SHARED E-MOBILITY

We have led the way in
testing mobility as a service:
1410 e-bikes operational
167 e-logistics vehicles
274 ev charging points
343 smart parking spaces



**ENVIRONMENTAL
BENEFITS**

Accelerate efforts to
decarbonise cities

**SOCIETAL
BENEFITS**

Create better places
to live, work & play

**ECONOMIC
BENEFITS**

Stimulate the smart
city marketplace

SHARINGCITIES

Sharing Cities: E-mobility solutions

HOW LISBON'S BIKE SHARING SCHEME BECAME THE CATALYST FOR AN ACTIVE CYCLING CULTURE

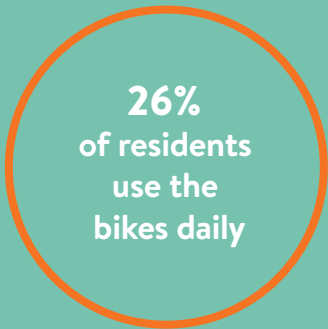
Portugal has one of Europe's lowest rates of cycling. Car ownership is traditionally very high.

Lisbon is an old city with many historic districts and narrow streets. It is also very hilly.

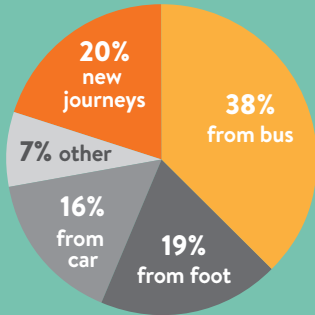
Lisbon introduced its first city-led bike sharing scheme in 2017 through Sharing Cities to help realise its new city strategy for mobility.

Upgrading lisbon's cycling infrastructure has unlocked the city's micro-mobility network. Since 2017, 3 million journeys have been made by 16,000 users.

Daily users



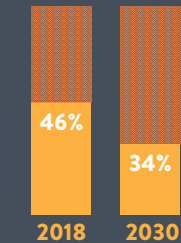
Mode shifts



FUTURE IMPACT: LISBON

Cycling lanes expected to double to over 200km.

3-fold planned increase in bike fleet with 2,000 bikes in circulation, 80% of which will be electric.



Target reduction in private car use to 34% by 2030

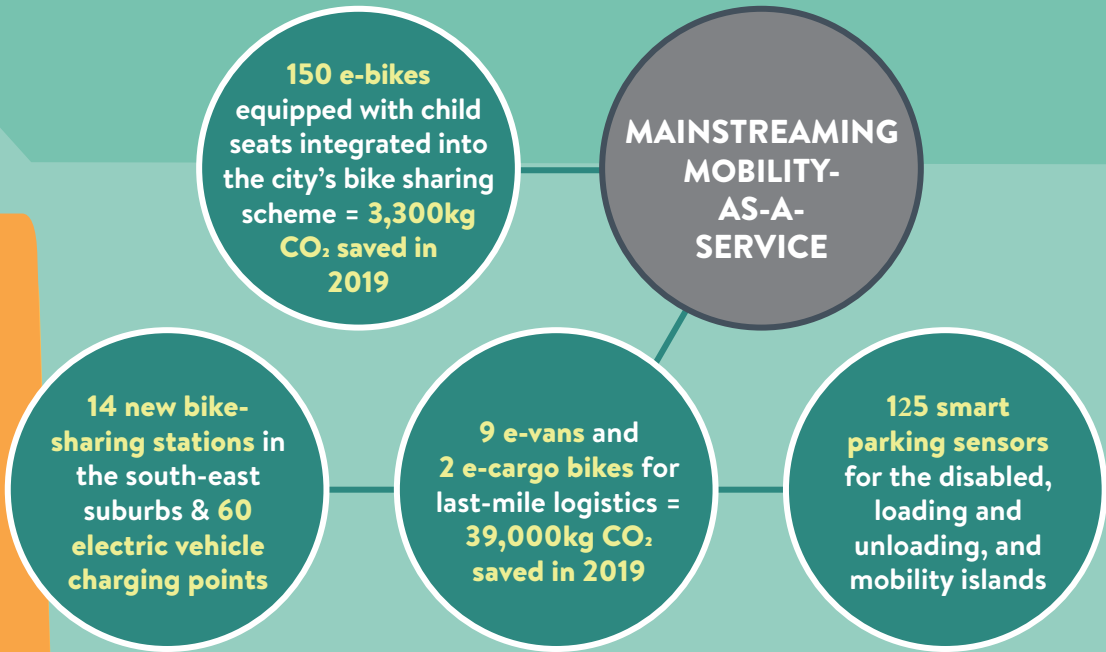


MILAN: A HUMAN-CENTRIC E-MOBILITY STRATEGY DELIVERS FIRST AND LAST-MILE MOBILITY OPTIONS ACROSS THE CITY

Mainstreaming Mobility-as-a-Service
Expanding accessibility to sustainable transport has been a key priority of the Municipality of Milan.

10 mobility islands have been implemented in Milan to respond to strategic goals set by the city

What is a mobility island?
A mobility island brings together multiple mobility services in one location, making it easier for people to access a range of low carbon mobility options.



IMPACT: MILAN

Greater access to low-carbon mobility options for families.

Improved access to e-mobility network for people living outside the city centre.

35km of new cycle paths planned by December 2020 beyond pilot area.

Sharing Cities: Building retrofit solutions

SMART, LOCAL AND FAIR ENERGY SYSTEM IN THE ROYAL BOROUGH OF GREENWICH, LONDON

In London's Greenwich Peninsula ward conservation area two social housing estates underwent a deep energy retrofit.

41% of the borough's emissions come from housing, with 10% of households living in fuel poverty.

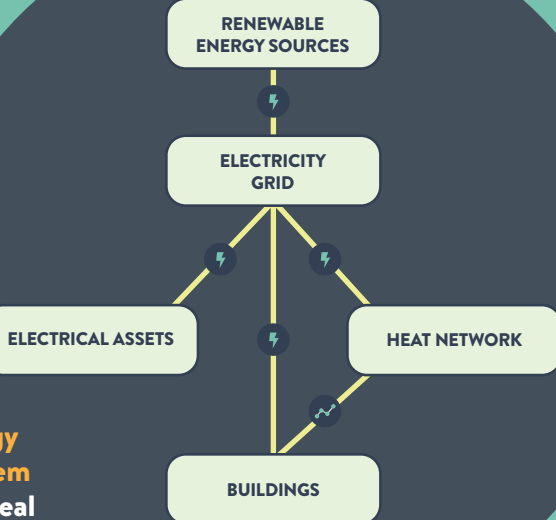
LOCAL INTERVENTIONS

Energy efficiency fabric improvements

Water source heat pump: Drawing water from the Thames basin to deliver locally generated energy with lower emissions

Internet of Things (IoT) technologies: Smart thermostats, temperature, humidity and boiler sensors, and energy monitoring

Sustainable Energy Management System (SEMS): Taking in real time data and using dynamic energy management to achieve additional cost and carbon savings at a district level



HELPING MILAN REALISE ITS VISION FOR NEAR-ZERO EMISSION DISTRICTS

In Milan, building heating systems are responsible for nearly 50% of local emissions.

In Sharing Cities' pilot area, 70% of real estate assets were attributed G-F energy class.

Before & After: Complex Interventions

- Photovoltaic Panels
- Roof & facade thermal insulation
- High-performance stairwell windows
- LED lighting
- Thermal regulation & thermostats
- Heating system remote management

CO-DESIGN PROCESS

Over 900 families & 12 co-design meetings

DESIGN

Scenarios Presentation

KNOWLEDGE

Sharing of energy analysis

TRUST

Introduction & Listening

IMPACT: LONDON

With Greenwich Energy Hero, residents were able to momentarily reduce their energy consumption by 80% and alleviate pressure on the grid during peak demand.

At Ernest Dence estate, the completion of the retrofit works combined with the installation of a heat pump could lead to 68% CO2 savings.

527,000kg CO₂

2.4M kWh
(667 homes annual usage)

Projected annual savings after retrofit works completed

IMPACT: MILAN

60% energy reduction across entire retrofit programme.

Greater citizen awareness of retrofit impact on energy bills, environment and wellbeing.

470,000kg CO₂

annual savings

Key Monitoring Data



Building Retrofit

Escola Básica Engenheiro Duarte Pacheco Retrofit – Lisbon

- A decrease of 9,672 kWh/year was registered due to retrofit
- 35% reduction building energy needs
- Retrofit led to CO2 emissions reduction of 37%
- 27°C presents itself as an ideal temperature solution. Being over 24°C, demands less cooling effort from the HVAC- avoid spending energy
- PV installation can produce 650% more than what the school consumes – annual return of 13.525€.
- Simple payback period of 12.3 years

Paços do Concelho Retrofit/SEMS – Lisbon

- Energy savings varied between -1% and 16%, with an average value of 7 % for the period between May 2017 and May 2018.
- Energy savings increased significantly to 36% on average between June 2019 and February 2020
- On average 90% of solar generation used for self-consumption.

Key Monitoring Data



Building Retrofit

Retrofit – Milan (public/private residential buildings)

- Thermal energy savings for space heating due to the retrofit works vary between 25% and 43% in terms of kWh/year and between 25% and 38% if correlated to the winter weather conditions (kWh/year HDD).

Ernest Dence building retrofit - London

Heat pump installation

- 47% reduction in operational CO2 emissions.
- This amounts to a total reduction of 180t or 25kg/m2 per annum.
- 19% operational cost increase (£1.5,000 or 2£/m2 per annum)

Fabric retrofit (roof + walls + glazing)

- 20% space heating energy savings (53kWh/m2 per annum).
- Leads to 9% total CO2 savings and 13% total operational cost savings.

Flamsteed building retrofit – London

Communal lighting

- 8.6t CO2 savings per annum (0.7kg/m2)
- £2,496 savings per annum (0.2£/m2)

Building fabric retrofit

- Emissions savings in the range 129t-146t (10.6kg/m2-12kg/m2)
- Operational cost savings in the range of 21,000-32,000£ (1.7£/m2-2.6£/m2) per annum

Key Monitoring Data



Shared e-mobility

E-bike sharing scheme – Milan

Emissions saved, E-bike fleet VS Private ICE cars (LCA based on ISO)

- 6.1 tons CO₂eq
- 11.1 kg NO_x
- 14.3 kg NMVOC
- 0.7 kg PM_{2.5}

EV fleet for municipal fleet and carsharing - Lisbon

Municipal EV fleet

- 311,945 trips
- 2,704,791 km travelled
- 97,206 driving hours
- 0.154 kWh/km

Municipal EV car-sharing

- 10,901 trips
- 72,160 km travelled
- 3,143
- 0.166 kWh/km
- EV more cost competitive than ICEV in long term
- High utilization of EV leads to payback period of less than 7 years
- Full fleet adoption of EV by replacing older ICEV – 410 fewer tons of CO₂ annually,

Case studies



Case study: Sustainable Energy Management System (SEMS)

The opportunity

The Sustainable Energy Management System (SEMS) is an advanced modular system that centralises information and control of local energy systems and devices, optimising across the energy network to achieve cost savings, social benefits and environmental improvements.

National and regional carbon reduction targets are instigating a dramatic shift in how energy is produced, distributed and consumed at every scale. Rapid electrification of our transport and heating systems is essential in meeting these targets and our ability to supply electricity through local, renewable power is crucial. Integrating policy objectives across multiple sectors has been an insurmountable challenge to date, creating inefficiencies and underperformance; however, SEMS internalises decision making across all energy vectors to identify and implement the best course of action based on your stated objectives and within the constraints of the system.

The London Context

A zero-carbon London will not be achieved only through top-down policy; it also requires bottom-up action from local stakeholders. The SEMS approach supports local areas to consider the current and future energy system, the interactions within the system and to optimise current and planned assets.

Early development work of SEMS in the Royal Borough of Greenwich, has indicated potential cost savings of 10% for the operation of a local heat network, maximising self-consumption from installed solar PV and reducing peak electricity demand, supporting the distribution network operator and relieving constraint areas to provide new EV charging infrastructure at lower costs.

Smart Districts

The modular nature of SEMS makes the technical solution highly adaptable to different areas. The larger the geographic scale and the greater the diversity of energy assets/systems, the higher the potential returns. However, multiple competing stakeholders can add significant complexity. Therefore, SEMS is an ideal solution at a district level, in developments with an obvious lead organisation; this could be a local authority, management company or city administration.

Developing a SEMS will rarely be a stand-alone solution. The costs of implementation are considerably reduced if it is considered along with other interventions, such as new communications infrastructure, building construction or utilities provision. The data connections and information generated from SEMS also creates opportunity for other solution providers to develop services and solutions that add additional value.

A new approach

SEMS is already demonstrating added value. The city simulation tool, developed to assess the performance of SEMS' optimisation algorithms, is supporting investment decisions by showing how new assets would perform within the local system.

The Sharing Cities Digital Social Market is also complementing SEMS by rewarding residents for making positive behaviour changes; benefiting themselves, stakeholders and the wider area. The emergence of new products and services, such as time-of-use energy tariffs and heat-as-a-service, also complement SEMS as they become inputs into the optimisation problems – delivering higher savings and efficiency.

The future landscape of the energy system is changing. While the detail is uncertain, the direction is established; and the role for integrated systems connecting energy assets and leveraging the increased data availability to optimise across ever-growing networks will become increasingly important as the necessity and scrutiny of reducing our carbon emissions at lowest cost intensifies.



Case study: E-mobility

The opportunity

Emerging mobility trends in cities present challenges both for local authorities and citizens alike. These can have negative impacts including worsening congestion, poor air quality, increased likelihood of collisions and a lack of parking spaces. All these factors can impact the quality of life in cities. Sharing Cities' three lighthouse cities tested a variety of e-mobility schemes. In this section we've highlighted some of the programme's most successful solutions.

London: Supporting the Greenwich Low Emission Neighbourhood programme

In an effort to encourage modal shift away from cars, the borough has implemented a business model and service for e-cargo bikes, and introduced an e-bike sharing scheme allowing residents and car owners to rent an e-bike for a month, and later opt to buy the bike at a discounted price. The success of the scheme has led to an expansion of the fleet to 30 e-bikes and a wider geographical coverage.

The borough has upgraded its lamp posts with LED lighting, electric vehicle charging points (EVCP) and smart parking sensors connected in an integrated system. E-vehicle and coach parking spaces are equipped with sensors integrated into the road surface and which communicate occupancy in real time. EVCP supplier installs points at no cost to the borough; they operate the points and receive all revenues, and points are integrated into the wider Source London network.

The borough's Urban Sharing Platform is a successful example of how data from a broad range of suppliers including smart parking, e-bikes, e-Cargo bikes, EV charging and sustainable energy sources can be combined and appropriately shared to demonstrate CO₂ and financial savings.

Milan: Expanding the e-bike sharing network

As a leader in e-mobility with a large conventional bike sharing scheme already in place, adding e-bikes to the mix presented some challenges. For example, the existing docking stations infrastructure couldn't be used to recharge e-bikes. So instead, the scheme requires vans to circulate between docks to swap the e-bikes' batteries. The vans are also used to reallocate bikes where needed, using an intelligent algorithm.

It guarantees that bikes are available in all stations of the network. E-bikes have been added to Milan's BikeMi regular bike scheme, as part of a citywide e-mobility strategy to reduce car ownership. The scheme's success means that the city now plans to extend it more widely. It is also launching e-bikes with child seats to provide improved access for families.

Lisbon: Creating a cycling culture from scratch

The Portuguese capital rolled out its first bike sharing scheme in 2017 through Sharing Cities to help realise its new city strategy for mobility.

As Lisbon lacked a cycling culture or tradition, it was vital to plan and deploy the scheme carefully. The pilots proved a big success however, so the scheme, called GIRA, was rapidly expanded to across almost the entire city. It is owned and run by EMEL, the municipal mobility company that also manages the city's parking infrastructure.

The scheme now has 810 bikes, around 50 per cent of which are e-bikes, and 81 docking stations. Lisbon plans to expand the scheme further, especially in the residential suburbs. As an indirect result, the city has increased bike lanes too, with provision expected to double to almost 200km by 2022.



Case study: Greenwich Energy Hero

The opportunity

The Royal Borough of Greenwich brought together two Sharing Cities solutions to demonstrate how energy management can be augmented by citizen engagement. The Digital Social Market encourages citizens to engage with and use sustainable services, shifting perceptions and changing behaviours through rewards. The Sustainable Energy Management System centralises information and controls many local energy systems and devices.

Greenwich Energy Hero was offered as a service to households in the Royal Borough of Greenwich. It brings awareness to balancing the demand and supply of electricity and has tested households' ability to change their behaviours and patterns of electricity consumption in return for rewards.

The approach

A new residential demand side response service was co-designed with local residents by the multi-disciplinary project team: Kiwi Power, the Future Cities Catapult and the Royal Borough of Greenwich.

The Greenwich Energy Hero app displays live electricity usage and energy saving tips, as well as users 'hero status' which reflects points they have earned for interacting with the service.

Greenwich Energy Heroes are asked to reduce their electricity for a temporary period through an app notification. Users are allocated points based on their reduction in electricity from their baseline during an alert, and for other engagement in the service. Their points can be converted into vouchers or a donation to a local charity at quarterly intervals.

All households in Greenwich were eligible. By installing CT clamps on electricity meters and linking this to the app, households of all types can engage with the demand side response. They do not need an electric car, household appliances connected to the internet, or solar panels installed to receive rewards for eco-friendly behaviour and changing their electricity consumption patterns.

Key insights and outcomes

Key achievements in this project have been effective communication of the idea of demand side response to users, with a regular cohort of users responding to alerts and demonstrably reducing their energy use.

"This app is easy to use. We are a lot more conscious about when we turn lights and appliances on and off, and we have a much better idea now of how much energy each appliance uses. A great tool to help bring energy bills down and help the environment" — David, Greenwich Energy Hero User

In a survey of users:

79% of users indicated that the live usage tab, where users can keep an eye on their real-time electricity usage, was the most enjoyed app feature.

69% of people said that they took part in Greenwich Energy Hero to help the electricity grid, so more renewable energy can be used in the future.

95% of people have been talking to others about the project.

When taking part in a Peak Energy Alert, users stated that the three easiest ways of reducing or delaying electricity were:

- Washing machines, dishwashers or tumble driers (95%)
- Household chores (vacuum, ironing etc.) (63%)
- Charging small personal devices (mobile phone, laptop, etc) (53%).

In the first point conversion period, 92% of those that took part donated their points to the Bexley Community Hospice, the Mayor's chosen charity.

"This is a fantastic way to reduce electricity usage, make Greenwich greener and donate to a wonderful charity that contributes so much to the Royal Borough of Greenwich." — Cllr Mick Hayes, Mayor of the Royal Borough of Greenwich

Financial summary

Financial Summary – Funding Allocations

City/partner group	Total Grant Award	Percentage of grant allocation
London	€3,805,880.07	15%
Milan	€7,113,667.89	29%
Lisbon	€6,166,193.39	25%
Transversal	€6,636,329.97	27%
Fellow Cities	€1,031,873.66	4%

Financial Summary – January 2016 - June 2019

City/partner group	EC Contribution Requested	Percentage of grant allocation claimed
London	€ 1,447,523.05	38%
Milan	€ 5,437,531.34	76%
Lisbon	€ 3,372,923.20	55%
Transversal	€ 4,284,569.23	65%
Fellow Cities	€ 687,472.34	67%