GrowSmarter

Transforming cities for a smart, sustainable Europe

FACTSHEETS

SUSTAINABLE URBAN MOBILITY

9. Sustainable delivery
10. Smart traffic management
11. Alternative fuel-driven vehicles
12. Smart mobility solutions

• STOCKHOLM • COLOGNE • BARCELONA •

GrowSmarter

Transforming cities for a smart, sustainable Europe

Main authors: Esben Pejstrup (ICLEI Europe) & work package leader Paul Fenton (City of Stockholm)

Contributors: All partners in GrowSmarter, especially site managers in GrowSmarter's three Lighthouse Cities; Julia Egenolf (Cologne), Gonzalo Cabezas (Barcelona) and Mika Hakosalo (Stockholm).

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Design: Martin Freire and Rebekka Dold

About GrowSmarter:
In a rapidly urbanising world cities need to become smarter to respond to citizen needs and to reduce their environmental footprint. GrowSmarter brought together cities and industry to integrate and demonstrate '12 smart city solutions' in energy, infrastructure and transport, to provide other cities with valuable insights on how they work in practice and opportunities for replication. The idea was to create a ready market for these smart solutions to support growth and the transition to a smart, sustainable Europe.

About the publication: This booklet presents the solutions demonstrated in GrowSmarter under the action area Sustainable Urban Mobility.

More information: More information about the solutions described in these factsheets can be found in different reports on www.Grow-Smarter.eu/insights. Recommended readings include:

Concluding report Sustainable urban mobility

Report on technical and social validation

Report on Smart City market introduction

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SMART ACTION AREA 3: SUSTAINABLE URBAN MOBILITY

Sustainable urban mobility is the third of 3 action areas on which the GrowSmarter project has focused.

Improved mobility for citizens and businesses can make cities more attractive and competitive. Meeting Europe's goals of tackling congestion, improving air quality, accessibility and sustainability in most cities will require substantial changes in the transport system and operations, and in the mobility behaviour of people and businesses. Too many vehicles in cities are powered by oil, and alternative fuels are under-used. Innovation, a re-think of public-private sectors cooperation and how to engage citizens more directly in new mobility systems and services is essential. The Lighthouse cities have applied a range of sustainable urban mobility solutions, as described in the following factsheets.

32. Neighbourhood parcel delivery room
33. Distribution of freight using e-cargobikes in inner city
34. Traffic management simulation tool
35. Travel demand management app
36. Traffic signal priority for heavy duty vehicles using alternative fuels
37. Charging infrastructure for e-vehicles
38. V2X - Vehicle-to-Everything (charging)
39. Alternative fuel stations for heavy-duty vehicles
40. Green parking index in combination with car-sharing pool with Electric Vehicles
41. Electrical and cargo bike pool
42. Mobility Station
43. Electrical and conventional car- and bike- sharing
44. Smart taxi stand system

To find out more about the other solutions area please visit:
www.grow-smarter.eu/solutions

Neighbourhood parcel delivery room

Smart solution 9
Sustainable delivery

Measured impacts

88%
of residents think the service is a good idea

35
packages a day needed for viable implementation

24
hour access to parcel delivery room

Stockholm

Technical partners

Carrier
rasmus.linge@cslogistics.se
Stockholmshem
olle.kronby@stockholmshem.se

City contact

Paul Fenton:
Paul.Fenton@stockholm.se

What is it?

A parcel delivery room located on the bottom floor of a multi-storey apartment complex that enables residents to order items for home delivery using a “c/o” address. Parcels will arrive at a central terminal before being transported using e-cargo bikes to the delivery room. Couriers and residents can access the delivery room using a smartphone app 24 hours a day 7 days a week. This service improves residents’ access to postal services whilst reducing delivery traffic.

What did GrowSmarter do?

GrowSmarter originally planned to install parcel lockers in the foyer of an apartment block in the neighbourhood Årsta in Stockholm, but as there was limited space at the site and there were signs parcel delivery was taking off in Stockholm, it was decided to upscale this solution to use previously unused space in the basement of the building.

Access to the room is controlled by a smartphone app, and delivery of wide

range of parcels (e.g. furniture) is possible, as the full space of a room can be used for storage. All packages were delivered by Move-By- Bike, a bike and e-bike transport company.

Lessons learnt

It is important to identify physical space for a service box or delivery room early in a renovation project. Such space should be accessible for residents and couriers, yet not compete with other functions such as cycle garages, laundry rooms etc. A variety of possibilities exist (e.g. installing refrigerators for food deliveries) and the relative advantages or disadvantages should be evaluated on a case-by-case basis to ensure a sound business model. Early dialogue with the companies involved in the demonstration helped in the preparation and implementation of the measure. Geographic locations in relation to key logistic terminals is another important aspect to take into account.

The delivery rooms can be coupled to a variety of services in order to minimize environmental impact from deliveries and assist with circular economy initiatives.

Upscaling & replication potential

The potential for adaptation and further improvements to this measure is high. Additional functions can be added, such as delivery of refrigerated goods or other services demanded by residents, such as sharing of cycles, ladders, machine tools or other items.

A wide range of cities and other stakeholders have shown interest in replicating this measure, including PostNord, the postal service of Denmark and Sweden. The project partners and app provider have also developed related services using a similar approach, including unmanned "delivery containers" for use at construction sites *(see factsheet 9: Construction consolidation centre)*. Alternative solutions for payment include residents' paying for the service in their rent, or payments by users or by postal service companies. For a broader and sustainable upscaled scenario it is vital to integrate postal/ logistic agents and e-commerce related check-out services.

How did the measure work?

Technical feasibility ●●○

Not challenging from a technical perspective, except from minor problems with sensor installation. Security concerns were addressed with installation of cameras in the rooms.

Economic feasibility ●○○

Should be further investigated. Economic feasibility depends on number of parcels that can be delivered at daily basis. Tenants did not pay for implementing the delivery room in this project.

Replication potential ●●○

High potential to replicate. Municipalities have key role in selecting the locations and fostering collaboration.

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Distribution of freight using e-cargobikes in inner city

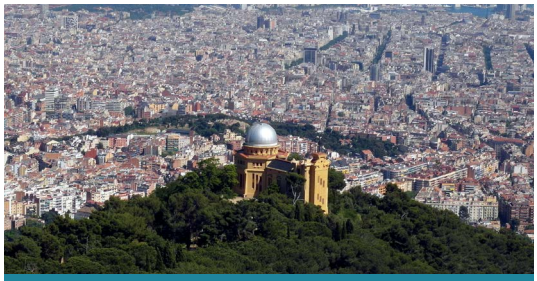
Smart solution 9 & 11
Sustainable delivery & alternative fuel driven vehicles for decarbonizing and better air quality

Measured impacts

95.9%
reduction in CO_2 emissions

97.5%
reduction in energy (kwh) use

21.7%
reduction in noise (dB)



Barcelona

Technical partners

CENIT
Paco Gasparin
francesc.gasparin@upc.edu

i2cat
Marisa Catalán
marisa.catalan@i2cat.net

City contact

Gonzalo Cabezas
gcabezasr@bcn.cat

What is it?

A last-mile delivery service using e-cargo bikes from a micro-consolidation centre in a central location in the city. The solution is suited to neighbourhoods, where traffic restrictions mean cars and trucks can only make deliveries in the morning and night, whereas cycle delivery is possible throughout the day.

What did GrowSmarter do?

GrowSmarter facilitated the launch of a last-mile delivery service in the old town of Barcelona. Temporary premises for the micro-consolidation centre, charging infrastructure for the e-bikes, and permits for operation in the old town was all secured in order to launch.

On- bike sensors were used to assist with routing, and monitoring of the service and environmental conditions along the routes.

Lessons learnt

Last-mile delivery is an emerging market segment which with creative support from the city administration could be rolled out more widely. Support would include designating entire zones within densely populated areas of the city as only accessible for e-bike delivery; monitoring non-compliance; and – in this case – identifying premises for the micro-consolidation centre and agreeing a tenancy arrangement to enable implementation.

The main challenges were related to Identifying a suitable location for the service, agreeing the terms of operation, and ensuring a suitable installation of the sensor units on the bikes were. It was important to reach a trade-off between robustness, safety and functionality.

This solution offers emission-free deliveries in parts of cities where it is most needed, such as historical centers and areas with high traffic volumes.

Upscaling & replication potential

This measure can be adapted and replicated in most European cities. Cities need flexible spaces that emerging businesses can use as premises. Municipal processes may need to speed up to keep pace with markets and clarify issues – such as the formal relationships between service providers, data ownership or the need for additional support mechanisms, e.g. restrictions on delivery times or use of delivery bays – in order to creatively change framework conditions in favour of sustainable parcel delivery.

Delivery volumes play an important role, therefore contracts with logistics companies are necessary to upscale the solution. Regulation from the municipal side can be a strong driver; for example, last-mile deliveries in city centres could be required to be only by bike.

How did the measure work?

Technical feasibility

No major problems occurred, but data collection was challenging from the technical perspective.

Economic feasibility

Emerging market segment, but the high initial investment costs can be a barrier to further expansion. Large volume of deliveries needed to ensure optimal economic implementation which is best achieved through partnerships with large distributors providing a steady income.

Replication potential

Possible to replicate in cities with similar infrastructure requirements. The policy and administrative barriers discussed above should be alleviated though.

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Traffic management simulation tool

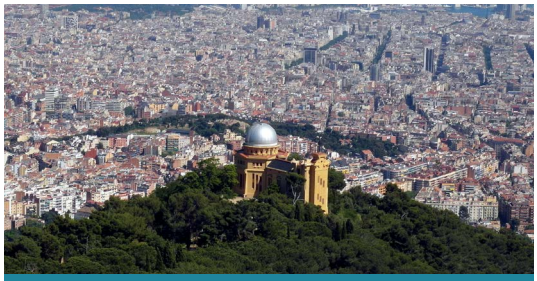
Smart solution 10
Smart traffic management

Estimated impacts

15%
reduction in CO_2 emissions

38,5%
reduction of time delay in traffic

27,5%
Reduction in traffic density (vehicles per km)



Barcelona

Technical partners

CENIT
Paco Gasparín
francesc.gasparin@upc.edu

City contact

Gonzalo Cabezas
gcabezasr@bcn.cat

What is it?

A theoretical model for a traffic management tool to assist traffic managers in urban areas when making decisions on congestion avoidance. Applying a so-called Macroscopic Fundamental Diagram (MFD) can offer significant benefits in diminishing the entry of vehicles to congested areas thereby reducing the traffic density and increasing the traffic flow. The theoretical approach can also be used to assess other policy areas, such as air quality.

What did GrowSmarter do?

In contrast to the other measures in GrowSmarter, traffic management through MFD was primarily a research initiative rather than an empirical demonstration. The implementation phase consisted in building the model to simulate a city district. District @22 was chosen in Barcelona, as it has recently experienced fast growth and therefore needs a change in traffic flows to adapt to new needs.

Barcelona's Department of Mobility provided the research group CENIT – Center for Innovation in Transport – the data required to introduce all traffic lights into the model, along with the direction of the flow of each street and the number of lanes. Data collection at 22 points in the network enabled traffic light optimisation to enable improved traffic flows. Application of this model indicates how to alleviate congestion with resultant positive impacts in terms of e.g. reduced energy consumption and emissions.

As traffic patterns vary a lot due to differences in street design and traffic flows, smaller areas should be studied in order to obtain meaningful results.

Lessons learnt

This kind of system requires a homogenous network to function optimally, whereas many cities have multiple networks operating in parallel (meaning some traffic lights can be operated from a central control, whereas others require manual adjustment by technicians on site). Changes to traffic management systems in one district inevitably result in up- or downstream impacts observed elsewhere.

Upscaling & replication potential

Depending on data availability, the tool could be used in other cities with congestion problems after validation for the city of Barcelona. An emission reduction by 15% can be achieved according to the simulation results and additional benefits include reduction of accidents as well as improved air quality. The County of Barcelona sees these results as promising and is planning to replicate use of the tool.

How did the measure work?

Technical feasibility

Obtaining data needed for the model has been challenging. Data were needed from multiple entities and in some cases, there was a lack of willingness to share the data. The validation procedures can also be a challenge.

Economic feasibility

Difficult to verify the economic feasibility, since it is a theoretical measure.

Replication potential

An important feature is that the area to start the MFD must be no more than 10 km2. From here, if you study the area where you want to apply the solution, replication can be feasible.

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Travel demand management app

Smart solution 10 & 11

Smart Traffic Management & alternative fuel driven vehicles for decarbonizing and better air quality

Measured impacts

1114
trips logged in application

87
users

Stockholm

Technical partners

KTH
Markus Robért
markus.robert@abe.kth.se

City contact

Paul Fenton:
Paul.Fenton@stockholm.se

What is it?

A smartphone app to help users plan journeys with reduced environmental impact, and to help drivers locate alternative fuel stations and electric vehicle charging points. Data gathered via the app can also help authorities to follow up changes in travel behaviour in a way that is more effective and has a greater response rate that traditional travel surveys.

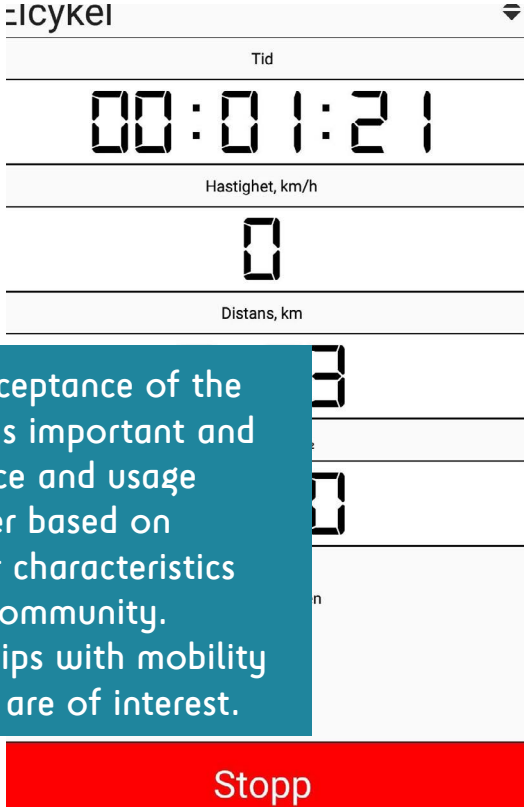
What did GrowSmarter do?

The project funded development, testing and demonstration of the app. This process took significantly longer than expected due to technical problems related to the GPS functionality in the app, which rapidly drained the smartphones' batteries. Once this was resolved and the visual identity of the app was finalised, the app was made public and has subsequently been used by individuals in the Årsta area of Stockholm and organisations such as KTH – Royal Institute of Technology

and different municipalities.

Lessons learnt

When developing such an application, it is important to have a clear idea of which market niche and target group(s) it will serve and what business models and communication actions are appropriate to ensure market adoption. Adjusting the app is time-consuming and rival products emerge on a regular basis, meaning it may be necessary to rethink and redesign applications on a repeated basis. It is easy to underestimate the technical complexity and costs of app development. Issues such as data ownership and management should be considered. A clear and user-centric demonstration plan, involving particular actions to reach "challenging" target groups (e.g. elderly residents who do not use smartphones) forms a critical component of a demonstration project and should be developed early.



Social acceptance of the measure is important and acceptance and usage may differ based on particular characteristics of each community. Partnerships with mobility providers are of interest.

Upscaling & replication potential

Cities and organisations welcome tools that "nudge" citizens towards more informed, conscious decisions about their travel, but need to ensure such services represent value-for-money in respect to other alternatives. Solutions such as this can be replicated in other contexts, although their actual impact on user behaviour is unclear. Linking so-called enabling services to appropriate local or national incentive systems can support nudging towards sustainable travel choices.

How did the measure work?

Technical feasibility ● ● ○

The measure is technically feasible, but the real challenge is in attracting customers when the app is introduced to real users addressing their everyday mobility needs

Economic feasibility ● ○ ○

Highest costs related to software development. Partnerships with different mobility service providers could potentially secure revenue streams.

Replication potential ● ● ○

Possible to replicate in other cities and contexts but adaptations to local needs may be necessary.

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Traffic signal priority for heavy duty vehicles using alternative fuels

Smart solution 10
Smart traffic management

Impacts

PRIORITISES
a cleaner fleet

PROMOTES
the transition away from fossil-fuelled transportation

REDUCES
time spent in traffic for renewable fuelled vehicles

Stockholm

Technical partner

Carrier
Rasmus LInge
rasmus.linge@cslogistics.se

City contact

Paul Fenton:
Paul.Fenton@stockholm.se

What is it?

Synchronisation of traffic signals to prioritise freight distribution using renewable fuelled heavy vehicles. The measure aims at reducing environmental impacts and improving safety by improving traffic flow and reducing the number of starts and stops for heavy vehicles.

What did GrowSmarter do?

Carrier incorporated Hydrotreated Vegetable Oil (HVO) fuelled heavy vehicles into their fleet in Stockholm. A test route was proposed but amended following a pre-study that indicated negative impacts for other road users. Alternative routes with fewer traffic lights were identified, making the potential positive impacts of the demonstration smaller, but also reducing the risk of negative impacts for other road users. One of these routes were selected for the test, guidelines were defined, and technical systems were adapted to enable the demonstration. Specially-adapted mobile phones

were programmed and installed into the test vehicles to enable data collection.

Lessons learnt

The process of route selection illustrates the complexity of integrating such a system into a dynamic traffic system. Prioritising one mode of transport, or one type of fuel or technique, will create incentives for small numbers of users, yet risk generating larger negative impacts for other road users not prioritized by the system. The indirect system impacts of such innovation are thus hard to assess.

Of course, by offering an incentive to adopt non-fossil fuels in vehicle fleets, the measure aims to promote a transition to cleaner vehicles and fuels which, if successful, would eventually remove the need for an incentive. However, at this scale, and operating in isolation from other potentially complementary stimuli (e.g. congestion charge rebates or other benefits), the impacts of this action are limited to the CO2 saving generated by use of HVO in the fuel tank.

It is important to thoroughly investigate routes and impacts on all kinds of road users. Implementation may proceed slowly due to capacity constraints on the actors involved.

Upscaling & replication potential

Upscaling this solution may increase its effectiveness as an incentive but also risk generating short-term negative impacts in terms of congestion or emissions, until the techniques promoted by the incentive become widely-adopted. Integrating signal priority may be desirable on certain intersections or sites, such as ports, or form part of a systemic approach involving zoning, access restrictions or congestion charging. Replication is possible in most cities.

How did the measure work?

Technical feasibility ●○○

The measure is technically feasible, but careful selection of the routes is needed in order to avoid negative impacts on other road users.

Economic feasibility ●○○

Potential benefits depend on the magnitude. Such measures can be particularly attractive for private businesses in the freight sector.

Replication potential ●●○

The measure could be replicated by private actors in the goods distribution sector. The magnitude of implementation influences the potential profitability.

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Charging infrastructure for e-vehicles

Smart solution 11
Alternative fuel-driven vehicles for decarbonising and better air quality

Measured impacts

42
Tons CO_2 reduction annually in Cologne

68
Tons CO_2 reduction annually in Barcelona

Stockholm, Cologne & Barcelona

Technical partners

Stockholm
Fortum

Cologne
RheinEnergie: c.remacly@rheinenergie.com

Barcelona
City of Barcelona: gcabezasr@bcn.cat

City contacts
Paul.Fenton@stockholm.se
Julia.Egenolf@stadt-koeln.de
gcabezasr@bcn.cat (Barcelona)

What is it?

Charging facilities that offer rapid charging points which allows for an almost empty battery to be fully charged in less than 30 minutes, and normal charging stations where the batteries are charged at low current for a longer period of time - usually overnight. These can be used by multiple user-groups including private vehicles, taxis, and car-sharing services.

What did GrowSmarter do?

The project introduced five rapid charging points in Barcelona and one in Stockholm. A further eight normal charging points were installed at Valla Torg in Stockholm. A total of 10 charging stations (each with 2 charging points) using green electricity from renewables were installed in the project area in Cologne *(see factsheet 42: 'Mobility stations')*.

In addition, an innovative form of Vehicle-to-Building charging was demonstrated in Barcelona *(factsheet 38)*.

The charging points installed had different characteristics:

Barcelona
- Only fast charging stations were installed
- Located on public land and operated by municipality
- Free to use chargers - mainly used by taxis

Stockholm:
- Normal charging stations in residential areas
- Fast charger owned by private partner on public land
- Fee on fast charger – mainly taxis and couriers

Cologne:
- Users register for service
- Car-Sharing part of mobility stations
- Free to use chargers

The charger location strategy has to depend on whether public land or private land will be used.

Lessons learnt

Installation of chargers on publicly-owned land is more complicated than on private land. Owning both land and electricity grid connection allows for installing charging infrastructure more rapidly. Clear agreements about complex issues such as data management, maintenance, costs and revenues are important.

It is important to find new ways of accounting for measures which may not have obvious economic benefits, but offer benefits related to reduced CO_2, noise, etc. Evaluation of charging behaviour shows that drivers with access to chargers at home or work tend to use these for long charging periods. On-street charging is characterized by shorter periods.

Upscaling & replication potential

Incentives such as free parking for electric vehicles, or free electricity, may help stimulate markets but must form parts of coherent long-term strategies for sustainable urban mobility. European cities are rapidly upscaling and replicating charging solutions as the electric vehicle fleet grows.

How did the measure work?

Technical feasibility ●●●

All of the types of charging facilities in GrowSmarter are possible to install without major difficulties. The capacity of the local electric grid and finding suitable locations are the main challenges.

Economic feasibility ●○○

The economic feasibility of this solutions is dependent on the local regulation and uptake of e-vehicles.

Replication potential ●●●

Possible to replicate in cities which aim for a better integration of e-mobility services. Local aspects should be taken into account, such as, for example the available electric grid capacity on the selected locations.

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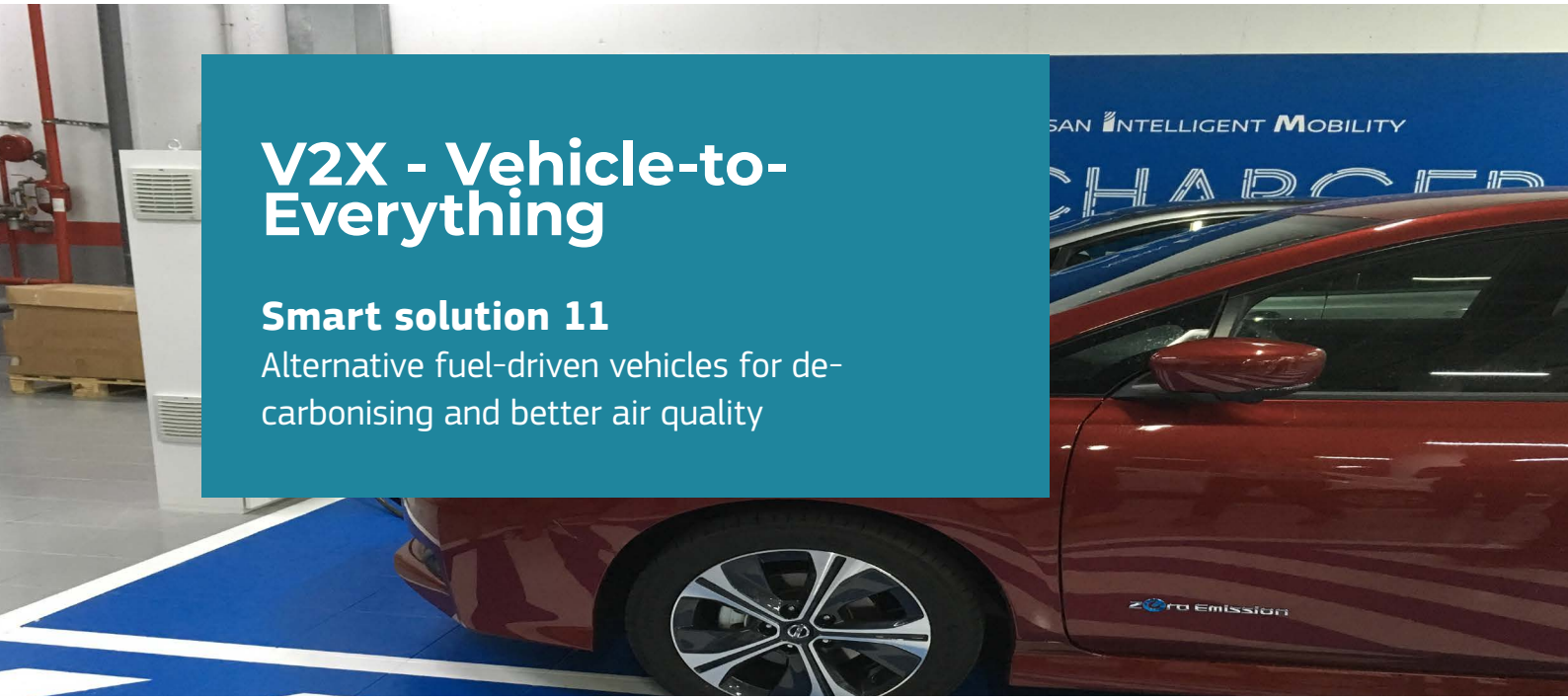


V2X - Vehicle-to-Everything

Smart solution 11

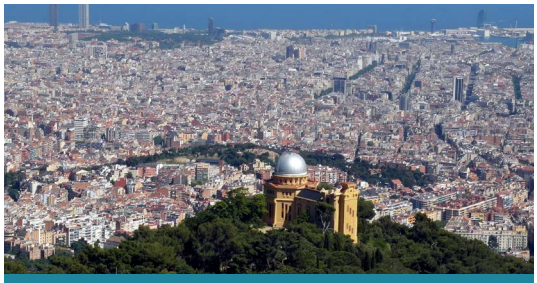
Alternative fuel-driven vehicles for de-carbonising and better air quality

Measured impacts

17,5%
reduction in CO_2 emissions

13%
reduction in energy consumption

16%
reduction in energy costs



Barcelona

Technical partners

NISSAN
Xavier Pons
XPonsRoig@nissan.es

IREC
Cristina Corchero
ccorchero@irec.cat

City contact

Gonzalo Cabezas
gcabezasr@bcn.cat

What is it?

The V2X (Vehicle-to-Everything) system allows for bi-directional energy flow and interaction between the vehicle and the grid. In this way, the electric vehicle can be efficiently charged and discharged. With the V2X chargers, users can store energy in their electric vehicle and discharge it later to benefit them in terms of lower energy costs and CO_2 emissions, better autonomy, or demand profile flattering.

What did GrowSmarter do?

Within GrowSmarter, this measure has been deployed at Nissan's headquarters in Barcelona and focuses on the integration of V2B (Vehicle-to-Building) services with on-site renewable energy generation and energy storage systems in the building. This was done with the installation of two V2X chargers, a photovoltaic (PV) plant and an energy storage system.

In order to control and optimize the operation of the V2X chargers and the storage, an Energy Management System and a Supervisory Control and Data Acquisition system were developed and integrated with the facility by the research center IREC.

Lessons learnt

The challenging technical issues faced during the implementation of the measure indicate that an improvement of the maturity of the technology is needed in order to facilitate the replication of this kind of solution. Concerning regulation, V2X should be included in grid codes. Grid-related policy frameworks in many countries do not recognize electric vehicles or the following supply equipment as a distributed energy storage resource capable of injecting power into the network.

> A key issue is to improve the understanding of V2X'S value to consumers and develop customer-focused business models.

It is not clear yet that business models using V2X technology are economically sustainable. Other factors, such as environmental responsibility and energy autonomy may also influence the V2X value proposition to end users. For a high social adoption of the technology it is recommended to promote its benefits, as well as manage potential concerns, such as data security, battery aging and range anxiety.

Upscaling & replication potential

The concept of electric vehicles in conjunction with the V2G chargers providing services to the building has been successfully demonstrated. Nevertheless, it is not clear that business models using V2X technology are economically sustainable. Concerning the replicability of the measure, further work should be done with the aim of reaching the full potential of V2X chargers.

How did the measure work?

Technical feasibility ●●○

The measure is technically feasible. However, it has been challenging to implement due to the complexity of the solution and the lack of maturity of the V2X technology.

Economic feasibility ●○○

It is not demonstrated that business models using V2X technology are economically sustainable. Novel business models have to be tested.

Replication potential ●●○

The measure could be replicated in other cities in public or private buildings with EV fleets. How this measure is replicated will depend on the context of the city.

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Alternative fuel stations for heavy-duty vehicles

Smart solution 11
Alternative fuel-driven vehicles for decarbonising and better air quality

Measured impacts

7
alternative fuel stations installed at five locations

28%
of vehicles sold in 2018 were alternatively fuelled

10%
increase in alternatively fuelled heavy duty vehicles (excluding 100% HVO-fuelled trucks) from 2016 to 2018

Stockholm

Technical partners

City of Stokcholm
Per-Erik Österlund
per.erik.osterlund@stockholm.se

City contact

Paul Fenton:
Paul.Fenton@stockholm.se

What is it?

An expanded refuelling network for alternative fuels used in heavy-duty vehicles. Like buses, heavy-duty vehicles require different facilities in fuel stations than cars and other light vehicles such as high-capacity pumps and larger bays.

What did GrowSmarter do?

The project funded staff costs, enabling the city of Stockholm to work strategically with stakeholders to identify appropriate sites and assist with the necessary planning applications and secure permits. In total, seven alternative fuel stations were installed at five locations around the city. These fuel stations increase the availability of renewable fuels such as ED95 (bioethanol), CBG (biomethane) and HVO (biodiesel) for use in heavy duty vehicles in Stockholm and the surrounding region.

Lessons learnt

This measure demonstrates that there is demand for use of alternative fuels in heavy goods vehicles on a fully commercial basis. Installation of new pumps on existing facilities located on privately-owned land is relatively uncomplicated, in the sense that installations are made on a commercial basis. However, installation takes much longer if development plans have to be changed, particularly if more than one public sector organisation has ownership of the road infrastructure. Another important lesson concerns the need to reach agreements with partners about data collection, either voluntarily or as part of formal environmental inspection.

Generally speaking, there is an increase of ”clean” heavy duty vehicles in Stockholm in numbers, but not as an overall share of the vehicles operating. This is due to a construction boom increasing the need for transporting goods at a faster pace than renewable fuel production can follow. There is high demand for biofuels and willingness to produce it, yet EU regulations and a lack of raw materials is still holding back production.

Special agreements for data collection are needed. Cities need to establish strategic partnerships for establishing dedicated infrastructure for heavy vehicles.

Upscaling & replication potential

Dedicated infrastructure is required to enable distribution using heavy goods vehicles operating on alternative liquid and gaseous fuels. Cities need to work strategically in partnership with relevant stakeholders to ensure such infrastructure is established and support users in making a transition to alternatively-fuelled heavy goods vehicles. Part of establishing these partnerships is agreements on how data will be collected and handled, so that the city can monitor environmental impacts and identify ways to further accelerate the transition to alternative heavy duty fuels. Another key issue concerns business models, as fuel station operators may have to diversify their business to cover investment costs for alternative fuel infrastructure.

How did the measure work?

Technical feasibility ●●●

The measure is technically feasible and socially accepted among relevant stakeholder groups. The potential to increase biofuel usage in the sector is large.

Economic feasibility ●●○

Fuel station operators may need to diversify their businesses to cover investment costs. The public sector could, where possible, offer accelerate planning processes or offer subsidies on land/ property rights to accelerate roll-out.

Replication potential ●●●

Possible to replicate in various contexts and city environments.

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Green parking index in combination with car-sharing pool with Electric Vehicles

Smart solution 12

Smart mobility solutions

Measured impacts

90%
reduction in CO_2 emissions

43 809
kilometers travelled by users.

16.3%
of tenants have a smaller interest in owning their own car

Stockholm

Technical partner

Stockholmshem
Olle Krönby
olle.kronby@stockholmshem.se

City contact

Paul Fenton:
Paul.Fenton@stockholm.se

What is it?

The Green Parking Index aims to reduce the amount of space that cars occupy in Stockholm. By reducing the demand for private parking places, this helps to encourage the use of alternative forms of transport and the introduction of car sharing schemes.

What did GrowSmarter do?

The City of Stockholm uses the “Green Parking Index” when planning new property developments. GrowSmarter implemented the approach in the context of the large-scale renovation of the residential area Valla Torg *(see factsheet 6: Energy efficient refurbish..’)*. Stockholmshem (the building owner) implemented an electric vehicle (EV) car-sharing service open to the public, where Valla Torg residents did not have to pay membership fees to use the service during the demonstration period. The car-sharing service enable Stockholmshem to reduce the number of parking spaces at their

site and offer residents in the district access to sustainable vehicle transport, discouraging private ownership of cars.

Lessons learnt

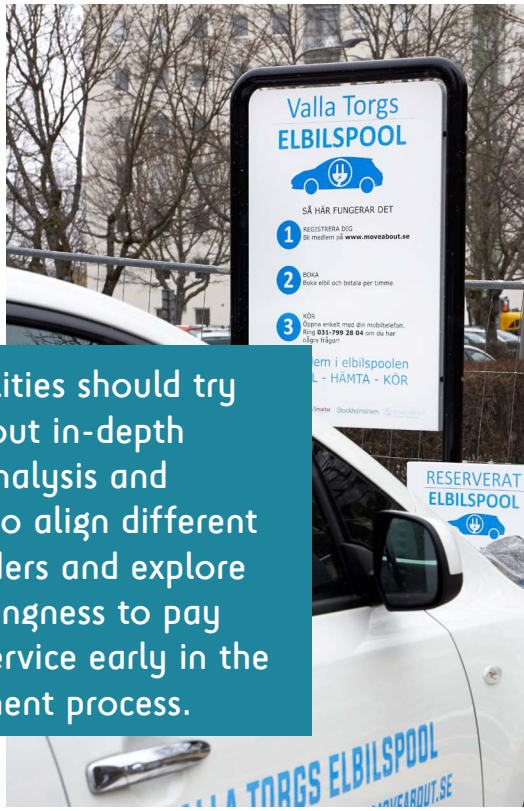
The combination of EU funding and green parking index enabled stakeholders to convene and demonstrate a new service for rental housing tenants. As this approach is new for the rental housing company, not all arrangements were considered ideal (e.g. Stockholmshem paid the electricity costs of using the system both for their own residents and non-residents). The car-sharing pool is successful and frequently used by residents.

Upscaling & replication potential

This measure can be upscaled and replicated in many contexts. Housing companies, both public and private and for both owner-occupied and rental properties, can – along with other organisations – stimulate uptake of car-sharing services by dedicating parking spaces to car-sharing. Depending on the interest of other carpool service providers, a replication may generate higher parking revenues. If the willingness to pay is high for residents, parking spaces can be allocated to suppliers at market prices. A risk with this is that if the pool service is not used, the supplier will not be able to cover its fixed costs and therefore operate the service.

The Green Parking Index is a better business case for new buildings than for renovating existing buildings, where a subsidy might be needed. Additional costs can occur for securing the power supply for charging. It is recommended that cities regulated cost of private parking in order to support expansion of car-sharing services.

Stockholmshem took on the cost/risk during the project and had some difficulty finding a business-model that reduced their costs while still covering the costs of the supplier firm. The measure is highly economically feasible in new construction due to the cost reduction of fewer required parking spaces.



Municipalities should try to carry out in-depth market analysis and attempt to align different stakeholders and explore their willingness to pay for the service early in the development process.

How did the measure work?

Technical feasibility ●●●

The measure is technically feasible, however securing the necessary electric grid capacity can be a local challenge.

Economic feasibility ●●○

Difficult to evaluate the economic benefits at this stage since they are not captured by the partners involved.

Replication potential ●●○

Higher interest for such a measure in city centres. Replication strongly dependent on willingness to pay for the service.

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Electrical and cargo bike pool

Smart solution 12

Smart mobility solutions

Measured impacts

99%
reduction in CO_2 emissions per km

173
kilometers travelled with the cargo bikes

16.3%
of tenants have less interest in owning their own car

Stockholm

Technical partner

Stockholmshem
Olle Krönby
olle.kronby@stockholmshem.se

City contact

Paul Fenton
Paul.Fenton@stockholm.se

What is it?

An electric cargo bike pool located alongside the electric vehicle car-sharing pool *(see factsheet 40)* in a residential housing area. Use of electric bicycles makes it possible to travel further with greater comfort for a wider range of citizens than normal bicycles. Electric cargo bikes offer a practical solution for families without cars or individuals shopping or making other large purchases.

What did GrowSmarter do?

The rental housing company Stockholmshem procured an e-cargo bike pool service from a contractor to be placed at their housing complex at Valla Torg. The measure was also supposed to include an e-bike pool, but the combination of a national subsidy for e-bike purchases and the inclusion of procurement criteria for e-bikes in a bike-sharing scheme led to the decision to focus exclusively on e-cargo bikes.

Implementation of this measure was complicated, as few companies existed that offered e-cargo bike pool services. Similar services operate in other locations in Sweden, but most are operated by members or volunteers, or linked to local businesses/public services. By launching this measure, Stockholmshem demonstrated a service that can add-value for tenants by increasing access to sustainable transport.

Lessons learnt

The business model for private e-cargo bike pools is emerging and until now has mainly been the domain of not-for-profit service providers. Key issues to resolve when implementing e-cargo bike pools include the issues of maintenance and storage, along with the business model for concessions, membership, etc. However, there is potential to develop this service, as e-cargo bikes offer advantages over conventional bicycles and other mobility services, such as free-floating scooters or kickbikes, as e-cargo bikes are suitable for family travels or transportation of large bulky items.

Develop a clear idea of the service and user needs early in a development process.

Upscaling & replication potential

Cities across Europe are increasingly adopting similar approaches towards clean urban mobility. Incentives such as the Swedish Government's 25% subsidy for purchases of e-bikes and e-cargo bikes can help stimulate adoption by individuals, but other tools could be considered to help stimulate e-cargo bike pools. These could include zoning restrictions allowing e-cargo bikes where motorized traffic is not allowed *(see factsheet 34: 'Distribution of freight..')*, green parking indexes that oblige developers or property owners to deliver such services or integration into bike-sharing systems or mobility stations *(see factsheet 45: Mobility station')* offering "Mobility-as-a-Service" subscription packages. It is recommended that cities regulate cost of private parking in order to support expansion of car-sharing services.

How did the measure work?

Technical feasibility ●●○

No major technical issues, but securing the bikes has proven an issue. Placing the bikepool inside a building to prevent theft could be advantageous.

Economic feasibility ●○○

it is difficult to assess the economic feasibility in existing residential areas. The measure is economically feasible in new construction thanks to the green parking index *(factsheet 40)*.

Replication potential ●●○

The measure is more feasible in new construction as the cost-reduction of fewer parking spaces, due to green parking index, makes up for the cost of running the bike-pool.

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Mobility Station

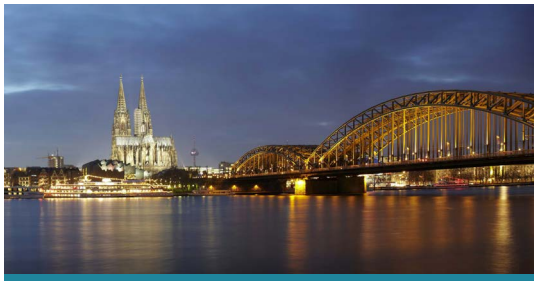
Smart solution 12
Smart mobility solutions

Measured impacts

10
Mobility stations created

54
sustainable vehicles used in GrowSmarter Cologne

60%
in CO_2 reductions



Cologne

Technical partners

Cambio Cologne:
tanya.bullmann@cambio-carsharing.de
KVB:
thomas.bischof@kvb-koeln.de
Ampido:
yasotharan.pakasathanan@ampido.com
Rhein Energie:
c.remacly@rheinenergie.com

City contact

Julia Egenolf:
julia.egenolf@stadt-koeln.de

What is it?

A mobility station offers multiple transport alternatives at one location. The mobility stations can vary in both size and type of location, and the transportation alternatives can include public transport, electric car-sharing, conventional car-sharing, timesharing of private and (during the project) public parking spaces, as well as conventional bike-sharing and e-bike-sharing.

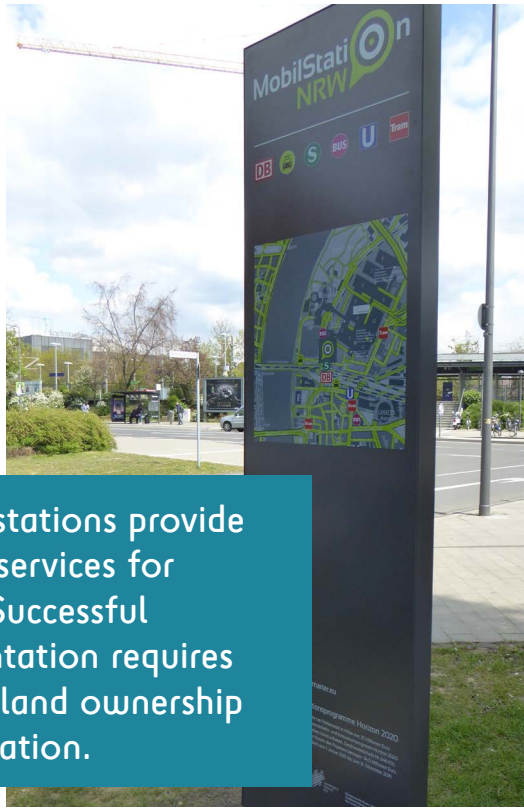
This solution is designed to improve air quality and lower traffic and carbon emissions by making it easier for local residents to transition to more energy/ emission-efficient transport alternatives.

What did GrowSmarter do?

Ten mobility stations, each with various formats, were implemented in or near the neighbourhood of Mülheim in Cologne and at the refurbishment site of the project.

The key steps taken to establish mobility stations include identification of possible locations (including analysis of customer needs), securing permits, preparing parking spaces and installing equipment, and preparing customer interfaces such as ticketing systems and signage. The mobility station signage developed by Cologne has become the standard used in the Federal State of North-Rheine Westphalia.

The city wanted to encourage behavioural change away from cars towards more active modes of transport like walking, cycling and public transport. Customers can pay for public transport as well as car-sharing using public transportation ticket (Multiticket or eTicket) from the public transportation provider KVB.



Mobility stations provide valuable services for citizens. Successful implementation requires focus on land ownership and regulation.

Lessons learnt

It is important to understand who owns the land on which mobility stations are located and to ensure that locations are visible sites that match user needs or preferences (i.e. easily accessible). There may be restrictions on use of public land for private ventures (leading to prohibitions, additional costs or fees, or need for exemptions from laws). The dynamic nature of the market for mobility solutions means new private mobility operators are emerging, adding to the complexity of developing business models for service providers but offering potential to integrate additional services into or close by mobility stations (e.g. cargo bikes, scooters, delivery boxes, more).

Upscaling & replication potential

Many cities are introducing mobility stations as part of their work with Sustainable Urban Mobility Plans. Cologne has developed a master plan for mobility stations within the city limits. The city's experiences highlight a range of tasks and challenges that other cities can learn from to replicate the concept.

How did the measure work?

Technical feasibility

The measure is technically feasible. Main challenges related to identification of suitable locations and land ownership.

Economic feasibility

A mobility station cannot be evaluated separately. The introduction of these stations in conjunction to public transport hubs has large potential in increasing public transport shares and achieving positive externalities with emissions' reduction.

Replication potential

Good replication potential. The mobility stations should be equipped with more bike- and car-sharing.

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Electrical and conventional car- and bike- sharing

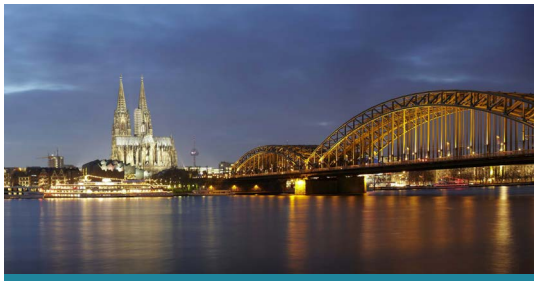
Smart solution 12
Smart mobility solutions

Measured impacts

73%
reduction in CO2 emissions

8
car- and bike-sharing stations operated

Up to 40
car- and bike-sharing stations planned



Cologne

Technical partners

Cambio Cologne:
Tanya Bullmann
tanya.bullmann@cambio-carsharing.de

KVB:
Thomas Bischof
thomas.bischof@kvb-koeln.de

Rhein Energie:
Christian Remacly
c.remacly@rheinenergie.com

City contact
Julia Egenolf:
julia.egenolf@stadt-koeln.de

What is it?

Electric and conventional car- and bike-sharing services were integrated into mobility stations *(Factsheet 42)* using charging infrastructure at public charging locations. This enables the effective usage of electric vehicles in different locations around an urban area.

What did GrowSmarter do?

This measure began in 2016 and was completed in late 2017 in Cologne with eight car-sharing locations, seven of which including e-charging. Three locations also included e-bikes Key steps included the identification of suitable locations for car-sharing as well as bike-sharing locations and the development and formalisation of agreements with the City administration and private stakeholders to ensure installation of the facilities.

The car-sharing company Cambio, the public transportation company KVB and the Cologne city administration signed contracts to enable the use of

parking spaces for e-car-sharing as well as e-bike-sharing services.

Users of public transportation has the opportunity to use the car- and bikesharing services with their public transportation ticket (Multiticket or eTicket), and the solution thus reduces the need for private car ownership.

Lessons learnt

Identifying sites at which services could be located was time consuming. In terms of operation, the optimal sites for mobility stations are not always ideal for car-sharing. Car-sharing services must be located in optimal locations to ensure financial viability of operations and significant shifts in citizen behaviour (with resultant environmental benefits). This is best achieved through long-term planning and cooperation.

> Location is key! Cities must build partnerships for establishing dedicated infrastructure for electric vehicles. Special agreements for data collection are needed.

City administrations could explore ways to streamline processes, which currently depend on engagement of actors across a range of municipal departments to, for example, grant permits for parking spaces. Mobility stations can serve as “shop windows” for a range of services and can therefore be useful in marketing. These should be supported with integrated ticketing platforms to ensure fast transactions and enable public transport tickets to be “topped up” with other services.

Upscaling & replication potential

Deciding which locations should be chosen for the car-sharing locations is key for the implementation of an otherwise technically feasible measure with high potential to replicate. Legislation that promotes such services and facilitates regulation for the rented parking spaces should be in place before implementing the measure.

How did the measure work?

Technical feasibility ●●●

The measure is technically feasible without any major issues faced. Issues related to land allocation and legislator gaps are important to be considered and prevented.

Economic feasibility ●●○

Challenging to achieve, since the location of the stations was not optimal. Moreover, the electric vehicles cost more, and acceptance issues may have led to reduced utilization rates.

Replication potential ●●●

Car- and bike sharing stations can be implemented everywhere. Particularly suitable are residential and mixed areas with a good local infrastructure and a good access to public transport as well as a good network of cycle paths.

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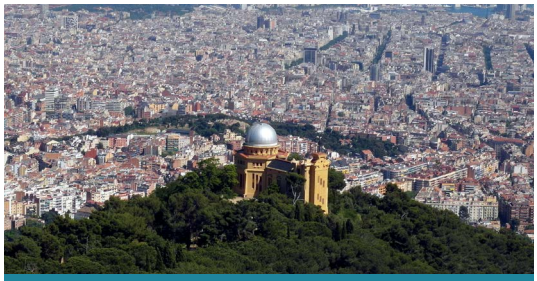
Smart taxi stand system

Smart solution 12
Smart mobility solutions

Estimated impacts

Up to 50%
reduction in CO_2 emissions possible if all taxis use stands

Up to 50%
reduction in kilometres driven possible if all taxis use stands



Barcelona

Technical partners

CENIT
Paco Gasparín
francesc.gasparin@upc.edu

City contact

Gonzalo Cabezas
gcabezasr@bcn.cat

What is it?

The smart taxi stand system is a new form of information system for taxi users and drivers, making use of sensors at taxi stands to monitor the number of waiting taxis in real-time. This is based on the creation of four scenarios and aims to increase the current occupation of the stalls in order to see a reduction of kilometers driven and pollution.

What did GrowSmarter do?

Implementation involved extensive discussions with the Regulatory Institute for Taxis. Taxi operators were informed about the measure and the temporary closure of taxi stands during installation of the sensors (one day per site). A driver survey indicated strong support of the measure, given its potential to reduce search traffic. In contrast to many cities, taxies in Barcelona are not prohibited from cruising around searching for customers and do not have to use determined taxi stands.

Sensors were installed at three taxi stands with a total of 13 parking spaces. 30 taxis also shared all data generated by their rides. It was analyzed how the launch of an application could affect the creation of scenarios that reflect the favorable use of the stops.

Lessons learnt

Valuable experience was gained regarding the optimal placement of sensors for obtaining measurements, which types of taxi stands are appropriate for sensors, and the type of issues related to data communication between the sensors and the data management system. As with other measures, the process of obtaining permits for physical works took time. Similarly, the costs of network access and system use, and issues related with data costs (free for the City administration during the project phase) are long-term challenges for actions of this type. In the absence of regulations guiding taxis to use taxi stands, customers continue to prefer to hail on-street or be collected at, for example, their residence or office.

> Long-term strategies should take into account the implications of technologies (e.g. maintenance, maturity, etc.) and their desirability.

Upscaling & replication potential

Sensor-based systems are likely to interest cities or sites with taxi stands, particularly those that enforce zones or restrictions on where customers may be collected, such as airports. Such systems can be linked to other requirements, e.g. use of non-fossil fuel vehicles, to accelerate the transition to sustainable transportation. Taxi companies increasingly use proprietary applications, which could be linked to sensor-based systems to provide real-time information on taxi location and availability. Similarly, sensor-based systems may contribute to development of mobility station or MaaS (Mobility as a Service) offerings or enable synergies with other kinds of mobility services.

How did the measure work?

Technical feasibility

The installation of the sensors is feasible, but the battery depletes quickly. The development of an application has resulted in some issues.

Economic feasibility

Taxi stops need to be promoted to favour urban mobility. This will favour the pollution and travel time reduction of taxi drivers without a customer.

Replication potential

This measure is replicable if a suitable technology is chosen with enough time given to perform the analysis of the utilization of the taxi rank.

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MEET THE PROJECT TEAM:

GrowSmarter brought together cities, networks, academia and industry sharing a wealth of experience and technical know-how. To find out more, please visit **www.grow-smarter.eu/the-team**

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CONTACT:

info@grow-smarter.eu | *@EUGrowSmarter*

*For more information about the **GrowSmarter** project, please visit:*

www.grow-smarter.eu

STOCKHOLM

COLOGNE

BARCELONA