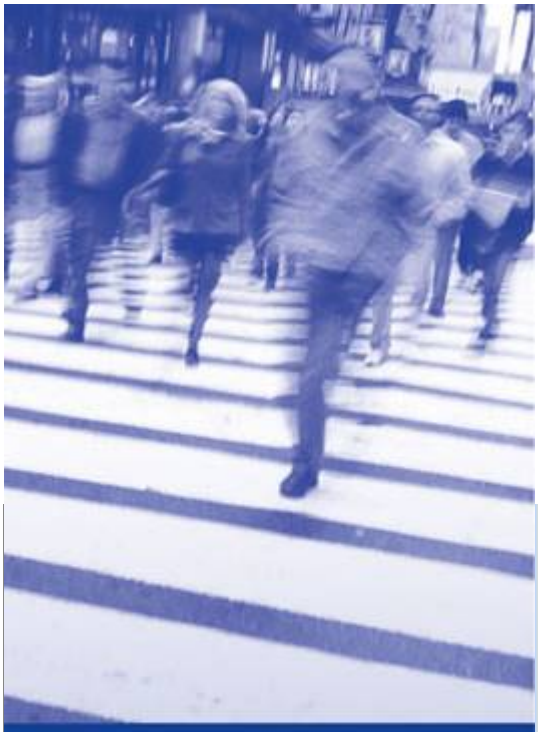

ECCENTRIC

D6.5 Replication package

Testing of EV and EFV vehicles

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CIVITAS
Cleaner and better transport in cities
ECCENTRIC

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Abstract

The cities of Stockholm, Madrid, Munich and Turku have in the CIVITAS ECCENTRIC project worked with test fleets of electric vehicles (EVs), light electric vehicles (LEVs) and electric freight vehicles (EFVs) with selected target groups, new charging infrastructure, as well as incentives and information on clean vehicles and fuels. User groups included private persons, businesses and civil servants in the city administration. The measures implemented provide effective processes and methodologies to cities interested in replication.

Market availability of e-vehicles or services, charging infrastructure, financing mechanisms and incentives as well as political commitment and cross-sectoral collaboration are key drivers for introducing EVs and EFVs in city and business fleets. Barriers involve data collection, grid and infrastructure issues, and a reluctance for EVs and new concepts. Regulatory changes are often necessary to enable the use of new concepts and business models. Conclusions highlight the importance of pilots in getting new user groups familiar with new technologies, involving stakeholders throughout the process and using procurement as a tool in pursuing climate and mobility strategies.

Project Partners

Organisation	Country	Abbreviation
1. Ayuntamiento de Madrid	Spain	AYTOMADRID
2. Grupo de Estudios y Alternativas 21 SL	Spain	GEA21
3.Consorcio Regional de Transportes de Madrid	Spain	CRTM
4. Empresa Municipal de Transportes de Madrid SA	Spain	EMT
5. Universidad Politécnica de Madrid	Spain	UPM
6. Avia Ingenieria y Disegno SL	Spain	AVIA
8. Ingeniería y Consultoría para el Control Automático SL ICCA	Spain	ICCA
9. Stockholms Stad	Sweden	STO
10. Kungliga Tekniska Hoegskolan	Sweden	KTH
11a. Flexidrive Sverige AB.	Sweden	FLEXI
11b. Carshare Ventures BV (Third party)	Sweden	CARSHARE
12. Ubigo Innovation AB	Sweden	UBIGO
13. Mobility Motors Sweden AB	Sweden	MM
14. Cykelconsulterna Sverige AB	Sweden	CYKEL
15. Gomore APS	Sweden	GOMORE
16a. Landeshauptstadt Muenchen	Germany	LHM
16b. Münchner Verkehrsgellschaft mbH (Third party)	Germany	MVG

17. Domagkpark Genossenschaft EF	Germany	DOMAGK
18. Green City EV	Germany	GC
19. Green City Experience GMBH	Germany	GCP / GCX
20. Technische Universitaet Muenchen	Germany	TUM
21a. City of Turku	Finland	TUR
21b. Union of Baltic Cities	Finland	UBC
22. Varsinais-Suomen Liito	Finland	VSL
23. Turun Kaupunkiliikenne OY	Finland	TUKL
24. Western Systems OY	Finland	WS
25. Turun Ammattikorekeakoulu OY	Finland	TUAS
26. Gasum Biovakka OY	Finland	GASUM
27. Obshtina Ruse	Bulgaria	RUSEMUN
28. Club Sustainable Development of Civil Society Association	Bulgaria	CSDCS
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30. FM Logistic Iberica SL	Spain	FMLOG

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List of Acronyms

ACM	Adaptive City Mobility
ca	*circa* (around)
CO_2	Carbon Dioxide
D	Deliverable
EC	European Commission
EU	European Union
EFV	Electric Freight Vehicle
EV	Electric Vehicle
FCEV	Fuell Cell Electric Vehicle
e.g.	*exempli gratia* (for example)
H2020	Horizon 2020
i.e.	*id est* (that is to say)
LEV	Light Electric Vehicle
MIT	Motorised Individual Transport
ML	Measure Leader
NGO	Non-Governmental Organization
NOx	Nitrogen Oxides
TCO	Total Cost of Ownership
SM	Site Manager
WP	Work Package
WPL	Work Package Leader

Executive Summary

CIVITAS ECCENTRIC **Work package 6 (WP6) comprises of seven measures** to accelerate and widen the uptake of clean vehicles in Madrid, Munich, Stockholm and Turku. Measures aim to trigger the wide uptake of clean vehicles (electric, liquid biogas) by companies, municipal fleets and households, offering test fleets, new charging infrastructure, incentives and information; and increase participation of citizens and local stakeholders.

Measures of this WP focus on electric mobility, testing vehicles (Cluster 1) and establishing charging infrastructure (Cluster 2). (European Commission, 2016) This report focuses on presenting lessons and recommendations for upscaling and replication from Cluster 1 of measures testing EV and EFV vehicles. The report contains a summary of the cluster (chapter 2), the short descriptions of each measure (chapter 3) and high level recommendations for replication (chapters 4 & 5). Conclusions (chapter 6) include the importance of pilots in getting new user groups familiar with new technologies, involving stakeholders and using procurement as a tool in pursuing climate and mobility strategies.

1. Introduction

1.1. Purpose of this document

In CIVITAS ECCENTRIC, five cities (Turku, Stockholm, Ruse, Madrid, Munich) have implemented in total 51 innovative sustainable urban mobility measures. The measures were addressing a variety of urban mobility challenges, organised in different thematic clusters. This document is intended to equip practitioners and decision makers with the information needed if they want to replicate measures of the thematic cluster “Testing of EV and FCEV vehicles” or aspects of these measures.

Replicability refers to the possibility of transferring results from a pilot case to other geographical areas. These areas have, of course different local contexts and conditions. When a specific measures proves to be successful in one area of a European city, it should be possible to transfer it to another city (or another area of the initial city), considering, the local conditions.

1.2. Target groups

This document is tailored following the practical needs of project developers, planners and technical staff from cities to develop innovative measures, to consider potential barriers and to be able to select the appropriate solutions to match their contexts. This document provides evidence that particular measures have been successfully implemented in a city and have a good replicability potential.

2. Summary of the cluster testing of EV and EFV vehicles

In the last decade European cities have made significant steps forward in the delivery of sustainable urban mobility policies, proving that major impacts in terms of congestion and reduced emissions can be achieved through ambitious measures. At the same time, suburban districts remain largely unaddressed, with the effects of flagship projects being rarely transferred to these areas. Recent or expected urban growth processes are posing additional pressure to peri-central areas. The main common challenges are to relieve central areas through clean and efficient urban logistics, as well as to increase the attractiveness and sustainable mobility of suburban districts.

The cities of Stockholm, Madrid, Munich and Turku have worked with test fleets of electric vehicles (EVs), light electric vehicles (LEVs) and electric freight vehicles (EFVs) with selected target groups, new charging infrastructure, as well as incentives and information on clean vehicles and fuels. User groups included private persons, businesses and civil servants in the city administration. In Stockholm, companies in craft and delivery services have been testing EFVs and Stockholm's clean vehicle portal has been updated to become more user-friendly. Madrid has procured EVs in the municipal fleet while expanding its fast charging infrastructure network. Turku has procured LEVs to be tested and evaluated by different departments and in Munich, a prototype of a lightweight EV with swapping battery system is used to test a business model for combined uses.

Measure implementation has shown that there is interest and curiosity to test EVs and a demand for more associated facts and incentives. Testing EVs and upgrading the clean vehicle portal has generated valuable lessons learned for practitioners and policy makers. Concrete lessons concern how to organise and manage a test fleet, especially as a city authority, including test users and other involved actors. Implementation has further shed light on the risks from counteracting strategies and incentives for EV deployment, as well as opportunities for cities to create and boost the e-mobility market using procurement. Measure specific implementation results are available in D6.3 Implementation report Testing of EV and FCEV vehicles (Evliati, 2018).

The measures implemented provide effective processes and methodologies to cities interested in replication. The aim of this report is to present these packages in a comprehensive manner. Interviews with Measure Leaders were conducted in January 2020.

Table 1 Measures of this cluster

Measure	Main focus	City	Partner(s)
STO 6.1 Offering EV-test fleets to selected target groups	Companies testing Light Commercial Vehicles	Stockholm	09.STO, 13.MM
MAD 6.2 Test fleets, policy incentives and campaigns for the uptake of electric vehicles	Electrification of municipal fleet, charging infrastructure	Madrid	01.AYTOMAD, 04.EMT
MUC 6.3 Electric lightweight vehicles for car sharing and logistics	EV prototype for combined uses and swappable batteries	Munich	19.GCX
TUR 6.4 Electrification of municipal fleet & promotion of electro-mobility	Municipality testing LEVs and EVs	Turku	21.TUR, 22.VSL, 25.TUAS
STO 6.5 Developing the clean vehicle portal	Information on EVs and charging infrastructure	Stockholm	9.STO

3. From CIVITAS ECCENTRIC cities to replication in other places

Stockholm, Madrid, Munich and Turku introduced and tested fleets of electric vehicles (EVs), light electric vehicles (LEVs) and electric freight vehicles (EFVs) with selected target groups, new charging infrastructure, as well as incentives and information on clean vehicles and fuels. User groups included private persons, businesses and civil servants in the city administration.

In Stockholm (STO 6.1), companies in craft and delivery services have been testing EFVs. The pilot tested and evaluated functionality and acceptance among users, providing the City of Stockholm with data to understand barriers and opportunities for professional users of freight vehicles to shift to electric powered transmission. Prior to the project, knowledge among the target group (craftsmen and delivery sector) on EFVs has been rather low. Vans and light trucks count for 19% of passages in Stockholm inner city (Trafikanalys, 2019).

Madrid (MAD 6.2) has renewed its municipal fleet by replacing over one third of it by EVs and evaluated performance in Inspection services, Municipal Police and Mobility Agents. Public charging infrastructure network was improved by increasing the number of fast charging stations and paying special attention to the quality of the service and setting new models of public-private collaboration. Madrid has also promoted the use of EVs in private fleets through new regulation and strategies on air quality, climate change and sustainable mobility, such as 'Madrid Central' ULEZ or the new Urban Sustainable Ordinance, approved during the course of CIVITAS Eccentric Project.

Munich (MUN 6.3) has tested a prototype of a lightweight EV with swapping battery system to assess and develop a business model for combined uses. Shared usage and the swapping battery system can reduce car ownership and long charging times. Due to licensing issues, the prototype was tested in special events in the CIVITAS ECCENTRIC living lab (the districts of Domagkpark and Parkstadt Schwabing) in Munich.

Turku (TUR 6.4) has procured and tested LEVs and an EV with different departments' employees for commuting, work trips and leisure time. The pilot has provided the city of Turku with valuable input for its e-Mobility Plan, which is being prepared during spring 2020.

Stockholm's clean vehicle portal (STO 6.5) has been updated to become more user-friendly. The portal is Stockholm's and Sweden's leading resource for facts on environmentally classified cars, light and heavy trucks, clean fuels, as well as regulation and incentives for clean vehicles (Figure 1).

Figure 1: Clean vehicle portal is Sweden's leading resource for facts on environmentally classified vehicles, fuels, regulations and incentives (STO 6.5).

4. Evaluating the replication potential

In order to enable replication, an in-depth analysis is required to understand drivers and barriers that facilitate or obstruct effective and successful introduction of electric vehicles in various sectors and services, either as a pilot or as a standard option. Financing and governance aspects are part of this analysis.

4.1. Drivers and enabling factors

Market availability of e-vehicles or services

Implementation of test fleet relies heavily on market availability of e-vehicles or services. Light vehicles, personal cars and light commercial vehicles (light trucks) that are appropriate for the particular area of operation need to be market available. Services that go beyond owning the vehicles, such as leasing or sharing, should also be available, as this is an increasingly preferred option amongst organisations and business users, seeking to maximise capacity utilisation or lacking the capacity to manage an in-house fleet. However, the Turku experience demonstrates that public procurement may create a market for new services. In Turku, tendering of LEVs for the municipality resulted in new business offerings by several different suppliers, leading to new leasing opportunities and business market.

Figure 2: Offering EV-test fleets to selected target groups (STO 6.1) © Mikael Röhr

Charging infrastructure

The second prerequisite for electric fleets is charging infrastructure. For business users, charging infrastructure at the workplace is crucial. This is where the vehicle parks overnight and electricity costs for slow charging (2,3 - 7,4kW) are very low. Charging facilities across the routes the company operates on is a facilitating factor when it comes to delivery or maintenance services. However, many business users do not see public charging, and especially fast charging as the preferred choice, due to high costs that outweigh the otherwise low operating costs of EVs, partly owing to the low electricity rates when slow charging. Other factors contributing to lower operating costs are less frequent need for service and better fuel or vehicle efficiency. Light electric vehicles can charge through a normal electricity plug and do not require dedicated infrastructure, however an appropriate storage space must be available.

For large-scale fleet electrification, the city or organisation needs to investigate the grid supply and sign an agreement with the grid owner prior to installing charging infrastructure. In cases where the city rents the parking facility, an agreement with the property owner is also necessary (Evliati, 2020).

Financing mechanisms and incentives

To date the purchase price of EVs is still a barrier for many business users and private persons in the choice of vehicle. Even if the total cost of ownership (TCO) is in many cases lower than the TCO of conventional vehicles, there is a tendency to overlook in procurement processes. Mechanisms to bridge the price difference between conventional vehicles and electric ones can be found in incentives provided by the regional or national level (e.g. bonus-malus system in Sweden (Transportstyrelsen, 2020), additional cost subsidies as part of pilot projects (e.g. CIVITAS ECCENTRIC) or using TCO calculations in procurement processes instead of purchase costs.

Using the existing structures

The deployment of EV makes use of the same mechanisms and structures in place for regular private vehicles. Street space, financing and insurance, image, and the status quo of motorized individual transport are being used to position the EV in the market and find a place in the politic agenda.

Political commitment and pressure for action

Political commitment is key in supporting pilots or innovative procurement in order to achieve fossil-fuel free cities. Innovative procurement sets environmental requirements and promotes vehicles and services, even though the purchase price alone can be higher. Political support is also important when new types of business models (e.g. shared uses of vehicles) and charging infrastructure need to be explored (e.g. battery swapping systems in mobility hubs). The level can vary from municipal to national, depending on which authority is in charge of urban planning and parking regulations.

Citizens are increasingly requesting action against pollution in cities and climate change. EVs have been marketed as part of the solution, even if CO2 savings are only local. This puts pressure in decision makers to legislate and regulate to facilitate access to new powertrain technologies.

Cross-border collaboration

E-mobility and charging infrastructure is at the intersection of traffic, urban and environmental planning, making it necessary to engage different departments in the city administration. Besides factual expertise, diffusing knowledge on e-mobility usually require technical support in procurement and regulation issues, as well as human resources.

Engaging actors at a national level might be necessary in order to solve regulatory issues that go beyond the municipal mandate. German law, for example, does not allow multipurpose vehicle usage (e.g. using the same vehicle for pizza delivery and taxi). For the implementation of ACM lightweight vehicle, the Bavarian State Ministry of the Interior has helped to find a temporary solution for the vehicle demonstration. However, long-term policies are required in order to enable take-up and commercialisation multiuse purposes.

Wider networking is necessary to identify the relevant test users (e.g. delivery and craftsmen), provide access to test locations or communicate and advertise the pilot to other relevant target groups for replication purposes. Some examples in the Munich measure have been the Chamber of Commerce, Chamber of Labour and other economic networks. Network operators are also crucial for the set up and installation of charging infrastructure. Grid ownership and operation varies between countries.

Pilot design and management

When carrying out pilots, mobility experts need to consider additionally few aspects in advance. First, designing the concept. Ideally, the test should be part of a wider plan; however, this is not always possible in innovation projects.

Second, recruiting the users and managing the pilot setup. It is important to assign sufficient time and human resources to design the concept, identify and recruit the appropriate users and run the pilot. The project manager must communicate with the selected user groups before the pilot starts in order to co-create the process if possible (e.g. the mobility concept in Munich was co- developed with the participating companies) and throughout the pilot to identify and solve bottlenecks. Contracting and insurance, data management and responsibilities of the user and contractor must be clarified right from the start. When it comes to test fleets, having a plan or a concept even after the pilot is just as important (i.e. explore options after the leasing period and who will be responsible if the fleet is purchased).

Car dependency

Car dependent cities, cultures, and institutions are more attractive for EV deployment than markets where the use of Motorized Individual Transport (MIT) is more restricted.

4.2. Barriers

Barriers are inherent to innovation pilots, no matter the thoughtful planning. Overcoming them requires flexibility and pragmatism in order to find the next best solution. Common difficulties that might arise, according to the CIVITAS ECCENTRIC cities experience, are presented below.

One size doesn't fit all

Just as every other product, existing EVs are not a universal solution for all types of businesses, user groups and areas of operation. Their technical specifications (e.g. loading capacity, heating) often imply an impact or compromise with range, making certain user groups uncertain about being able to deliver their work.

In CIVITAS ECCENTRIC, this was exemplified by a fire protection firm testing a light van in Stockholm as well as police officers and mobility agents controlling traffic – sometimes off-road– using e-motorbikes in Madrid. Madrid's municipal police service has also tested a small number of plug-in hybrids and considered them inappropriate due to insufficient range. In Turku, while LEV's would have been perfect for the home care services due to lack of parking, tight schedules and particularly long distances made LEVs less attractive. Combined with the high investment cost, EVs become for some user groups or areas of operation a less attractive choice.

In parallel, market offer varies across Europe. In the light commercial vehicle (LCV) sector, a lack of competitive offer is apparent in Spain. Until last year, only two vehicles (Nissan and Tesla), were available for taxi; however during 2020 the offer is expected to increase. To overcome this barrier, cities and companies may focus on those groups and areas of operation that are compatible and appropriate for electric mobility. An ability to plan one's own trips results in a lower need for opportunity charging and seems to be one enabling factor.

Data collection

Data collection can be challenging and time-consuming, especially when it involves manually registered data or user experiences. Even though formally agreed, commitment by test users in registering and handing data in a consequent manner, can be quite low in reality, resulting in poor quality of data and conclusions with high level of uncertainty. Collecting user feedback is a challenging task and requires clear structures among project partners and participants in order to ensure data quality. While expecting 100% user feedback is not realistic, a sound project management and incentive in connection to the output (e.g. no upfront finance), can facilitate a reasonably good flow of information. Telematic devices may further help gathering information (e.g. use of energy, driving distances) that is important for fleet management and follow-up.

Grid and infrastructure issues

Grid issues and infrastructure issues are likely to occur. Response from grid companies on electricity supply might take long time. In Spain, grid connection works are usually one of the most common causes of delay in charging infrastructure renewal works. To tackle this barrier, Madrid has signed collaboration agreements for the energy transition with the main electric energy distribution companies in the city. Communication between systems (e.g. charging infrastructure and back office) can result in a non-functioning infrastructure, even though it is in place.

“Sometimes you ask for electricity and they have to renew the grid and transform the electricity first.”

Different standards on charging infrastructure and EVs may also cause compatibility issues and have a negative impact on user experience. This was illustrated in Turku, where the EV was not possible to charge in every charging station, requiring the user to check compatibility in advance through a webpage service.

Figure 3: Test fleets, policy incentives and campaigns for the uptake of electric vehicles (MAD 6.2) © EMT Madrid

Reluctance for EVs and new concepts

Reluctance for EVs and new concepts is still prevalent among organisations and individuals. Politicians and city officials may be reluctant in cases of procurement,

where the criterion is often the purchase price. To overcome this issue, it is necessary to highlight other benefits, taking into account operating costs and other values. Besides contributing to better air quality, EVs are pleasant to drive and offer a better working environment for the driver thanks to being silent in the cabin.

Moreover, companies might experience that there are too little incentives for investing in EVs. Madrid has offered municipal charging infrastructure premises to logistics companies in order to facilitate electrification in the sector. The interest has however been quite low since the companies had to pay for charging.

New vehicle concepts allowing for shared uses – both passenger and logistics – may clash with existing regulations. Adaptive City Mobility (ACM) in Munich, where the electric lightweight vehicle with swappable battery system was piloted, highlighted this issue. Furthermore, there can be scepticism among both private and business users on whether the LEV concept can fulfil their core mobility needs. Bilateral discussions and co-creation with potential customers have proven to be an effective strategy to overcome this barrier, helping them understand the benefits of the concept from the very beginning.

Time intensive planning phase

The planning phase of test fleets is time intensive. This is especially true, when involving tendering or procurement and the associated work in drafting contracts, meeting and negotiating with the stakeholders and service provider. The operating phase might also take considerable amount of time to run and solve various issues.

“Some people crashed because they didn’t read the instructions email when we handed out the vehicles”

Instruction to users might prove insufficient; user-friendly technologies might not be as understandable and schedule changes in testing periods might cause confusion. Assigning in-house resources or including these aspects in the contract with the provider can make the process smoother. Seasonality might also affect users’ enthusiasm to test and initiate change. EVs and LEVs have a lower range and are less comfortable to use in colder seasons.

Contractual matters

Finally yet importantly, contractual matters or tensions connected to lack of clarity in expectations might also arise during the operational phase. More often the rule than the exception, there is a risk that contracts between the service providers and the client are not precise enough as this is an innovation pilot and many aspects are unknown in advance. This can regard basic maintenance, such as changing tyres, breakdowns or vandalism, or even sharing of responsibilities throughout the pilot.

Table 2 Drivers and barriers for the uptake of EVs

DRIVERS	BARRIERS
Market availability of e-vehicles or services	One size doesn't fit all
Charging infrastructure	Data collection
Financing mechanisms and incentives	Grid and infrastructure issues
Political commitment	Reluctance for EVs and new concepts
Cross sectoral collaboration	Time intensive planning phase
Pilot design and management	Contractual matters

4.3. Success factors in testing EVs

Users

Figure 4: Electrification of municipal fleet & promotion of electro-mobility (TUR M6.4) ©□ City of Turku

Central in the success of piloting vehicles are the users. A good understanding and knowledge of the target groups, as well as access to the right contacts and network has contributed to identify the relevant contacts, either as users or as process facilitators (e.g. finding charging infrastructure). In all cities, the approached users have

been interested, curious and open in testing new vehicles (EVs, LEVs and EFVs), designs and concepts (e.g. ACM sharing). Private and business users of ACM in Munich found the vehicle fun to use, have given positive feedback on ACM and suggested new ways for how it could be used, helping new ideas to emerge (e.g. ACM as a coffee van or 'own account' transportation). The municipal users in Madrid are satisfied with their EVs and business users of EFVs in Stockholm (craftsmen and delivery companies) would in their majority recommend other companies to invest in electric vehicles. Users in Turku described the LEVs as handy and nice.

Visibility

Driving electric vehicles in urban areas is a very visible way of testing new technological solutions. The test-users become often messengers and foster a dialogue among customers, colleagues and the public.

Favouring landscape factors

Landscape factors, such as public opinion, local and national strategies and economic situation are also important. Many Measure Leaders of the CIVITAS ECCENTRIC measures have spoken about a good timing to test and invest in electric mobility.

In Madrid, measure implementation has coincided with the City Council drafting the Air Quality Plan and Strategy, opening for new measures with strong focus on mobility. Regional government in Madrid also promotes electric mobility through its programs. At the same time, an open debate on which actor in society shall lead electrification, has resulted in a positive attitude to EV investments by the media. The years of the economic crisis are also behind Madrid and other cities in southern Europe, having today a better budget as compared to the last decade.

Stockholm and Turku aim to become fossil fuel free and carbon neutral by the end of this decade. Short-term pilots have a tendency to be more easily accepted and there is more room for experimentation with new solutions when funding comes from external sources than the city's own budget.

Table 3 Landscape factors affecting piloting EVs in different sectors

- Local and national instruments to incentivise clean vehicles and infrastructure among private persons and businesses (e.g. tax relief, free parking, purchase bonus)
- Local and national strategies for carbon neutrality
- Sharing economy boom offering a variety of new shared vehicles
- Market availability of e-versions for nearly all types of vehicles (light vehicles, personal cars, light freight vehicles)
- Debate / raising awareness on climate change and climate action favouring zero

emissions technologies and new ways of travelling in the city

- Mobility experts are keen to influence modal share towards cleaner modes
- General public curious to test new technologies

4.4. Ensuring long-term sustainability – from pilot to full-scale

CIVITAS ECCENTRIC project has financed different parts of measure implementation (Evliati, 2018). Three out of five measures have essentially been pilots while two of them are an extension of an ongoing process or project. Conducting an e-mobility pilot as a city entails a facilitating role amongst many partners and problem-solving issues with the service providers, the fleet, the users as well as handling feedback from citizens and eventual delays in delivery.

Besides the drivers and success factors mentioned in the previous sections, a full-scale introduction of EVs in city and commercial fleets necessitates a few additional aspects. For cities testing new vehicles, it is easier to justify full-scale investment when the results are clear (e.g. lower emissions, lower total costs), are fit for the purpose and contribute to the city's strategy. Investment on LEVs, for example, can easily be motivated if their usage proves to replace car trips.

Figure 5: WP10_ Electric lightweight vehicles for car sharing and logistics (MUC 6.3) ©□ Adaptive City Mobility

New concepts such as ACM can be upscaled if the swapping battery system and multipurpose use can generate income and if the demand among business and private users is high. A long-term mobility concept or a process for management, sharing and operations is also necessary. GCX has developed the business concept for the energy supply and the mobility concept. These could not be tested 'in the field' during long-term tests due to the technological state of the ACM vehicle and its infrastructure.

Regulatory changes are therefore necessary to enable the use of new concepts, which the current legislation does not foresee.

Furthermore, various skills and competences are necessary, which normally are spread across the city administration and beyond. Involving colleagues with relevant expertise (e.g. procurement and law, marketing and networking activities, etc.) will ensure that the process is legally sound and correctly communicated.

Table 4 Recommendations for introducing EVs, LEVs and FEVs in business fleets

- Study carefully experiences from similar projects.
- Have a clear and realistic idea of what is aimed and why but be flexible to adapt to changing circumstances.
- Explore and find which unit in the city is the most appropriate to own the process and define division of responsibilities if other units in the city or the region are involved.
- Analyse your facility capacity prior to procuring a large amount of vehicles, so that all vehicles can charge there.
- Involve subcontractors early and dedicate time to get all involved partners on board, foster a common understanding and align expectations.
- Train and assist users in using and charging the vehicles.
- If commitment relies on a grant or subsidy, provide the grant, if possible, after delivery of results to ensure higher commitment.
- Take advantage of fleet renewal processes, when leasing contracts are ending.
- Do not own the fleet yourself; lease it and prepare detailed contracts, including specific information about responsibilities and sanctions, if the provider cannot deliver according to contract.
- Use public procurement to push the EV market.
- Communicate the call for tender to as many vehicle providers as possible, even to those not offering leasing services.

- Plan for the steps after the pilot, e.g. selling the vehicles to the test-users.

4.5. Foreseeable Impacts

Awareness and visibility of electric mobility

A key aspect in test-fleets is the user experience. Test-driving an EV is the best way for new users in various sectors to be acquainted with how it functions and overcome range anxiety. The demonstrations have led to awareness among a wide group of municipal employees and private companies users, not limited to craftsmen and delivery services.

The majority of users have been satisfied with driving electric and there is a clearer understanding for which type of users an EV is more appropriate. Municipal EVs driving through the city is a very visible way to set a good example and to demonstrate the effort cities are making for better air quality and meeting their environmental targets. It is also a first-hand promotion for the service providers of clean technologies.

This visibility can initiate or widen the dialogue on electric mobility. The ACM test has made the topic of shared uses, lightweight vehicles and swapping batteries more visible in Munich, Germany and beyond.

Impact of LEVs on car use and other modes of transport

Whether LEVs replace car trips or other modes of active or public transport is still open for debate. For the test group in Turku, car was the prevalent option when travelling longer distances, but LEVs were a viable alternative for shorter distances and during leisure time.

“A schoolteacher outside Turku city centre, where there is more space and less traffic, used a cargo bike during sports events to move the equipment needed in class. Otherwise he would have used his car.”

Tests like those carried out in CIVITAS ECCENTRIC may highlight where the potential for a shift can be found, e.g. use in urban or peri-urban areas, type of LEVs, type of target group and type of trips (leisure or work).

At the same time, the link between supporting EV and supporting MIT is clear. EVs can potentially to perpetuating the prevalence of the private vehicle over other modes of transport.

Impact on air quality

Test fleets demonstrate the potential for air quality improvement in specific sectors and user cases for which electrification is appropriate and feasible. Although the impact on air quality throughout the pilot per se might be difficult to assess, test fleets help identify

the relevant sectors and target groups and illustrate the potential of a full-scale introduction of EVs in business fleets.

Impact on urban space

Despite the positive impact on local air quality, EVs are still advocates of motorised individual transport. Longer vehicle life cycles, structural changes in the market and perpetuation of car dependency can therefore compromise the use of public space in the coming decades.

Feedback to the car industry for technical improvements

User views on the vehicles' functionality, including aspects like range, noise, heating and loading capacity may give valuable feedback to the car industry for technical improvement. Testing of ACM and the communication around it has contributed to the discussion and the creation of start-ups with lightweight vehicles (e.g. Citroen).

Table 5 Examples of indicators for measuring success of test fleets

- Acceptance (e.g. how many would recommend others in their sector to invest in EVS/EFVs)
- Impact on walking, cycling, public transport and conventional car trips
- Frequency of technical failures on vehicles, battery and charging
- Changes in mobility patterns
- Business potential

5. Policy Recommendations

This section presents concluding policy recommendations for policy and decision makers interested in implementing EV test fleet measures in their cities.

5.1 Electric mobility must be part of urban (mobility) planning

Use of public space is highly contested and the rise of EVs and charging infrastructure bring it at stake even more for the decades to come. Longer vehicle life cycles, structural changes in the market, and perpetuation of current car dependency, will arguably continue to put pressure on public space unless there is a comprehensive view of mobility and urban planning in general.

Promoting the uptake of EVs for passenger transport is in essence promoting motorized individual transport (MIT). Decisive action to counteract this aspect of EV and charging infrastructure deployment is crucial. Particularly important are the efforts to reduce the space available for MIT, including but not limited to roads, parking, servicing, maintenance and associated infrastructure.

Failing to counteract the attractiveness of MIT and the resulting (established) car dependency, neutralises any benefit EV can bring in favour of sustainable mobility. Perpetuation of old policies and mobility behaviours block the abatement of vehicle kilometre travelled (VKT), keeping congestion at least in the current levels. Local contaminants will not decrease either, because an immediate adoption of EVs and charging technologies is not expected, and none of the Civitas ECCENTRIC measures proves it differently.

From this perspective, the effort and resources for EV deployment can only contribute to sustainable urban mobility if they are accompanied by parallel and even stronger actions to counteract MIT, car dependency and VKT. On the long term, failing to fight back local contaminants and congestion today is likely to hinder economic performance and competitiveness in the future, endangering EV technologies themselves.

5.2 Utilising the full pilot potential

Testing EVs and infrastructure during smaller scale pilots is the best way to diffuse knowledge and collect valuable feedback. New potential users have the opportunity to get familiar with emission free vehicles under real life circumstances. Citizens tend to approve changes easier if they are informed beforehand and their opinion is asked. The threshold is also lower if people know this is a pilot and not necessarily a permanent solution. For cities, pilots offer good way to test and validate new technology and assess functionality before launching large-scale procurements. Likewise, business users can test and validate the technology that fits their needs. Peers recommending EVs is a much more effective tool than wide communication channels to reach out to the wider public.

5.3 Procurement as a tool to create and boost e-mobility market

The measures in Madrid and Turku concern electrification of the municipal fleet where the vehicle and service provider was selected through procurement. In the first case, procurement was done in connection to ending contracts and was used to favour EV providers. Offers surpassed the initial target. In the second case, procurement was used to create a new market for LEVs. Four suppliers in Turku initiated the type of the requested leasing as a response to the municipality demand. These two examples highlight how a city can use procurement as a lever for driving e-mobility.

5.4 New business models call for regulatory updates

New concepts and products such as multi-user and multi-purpose vehicles and swapping battery systems are emerging to solve issues like underused vehicle capacity and charging. Since these concepts are new, they are often not included in existing legislation, like many other EV related issues. Regulations can therefore impede piloting and slow down the potential of these solutions.

Classification of vehicles (e.g. e-scooters, light EVs like ACM) that do not fall into an existing category and multipurpose use for both logistics and passengers are examples of local or national regulations that need to be updated. A battery swapping system would potentially require integration into mobility stations, for which different actors need to come together and plan accordingly.

5.5 User and stakeholder involvement

Co-creation and communication with users regarding the pilot aim and process is fundamental. Key stakeholders within the city, at the regional and national level, together with providers and operators need to be involved during the design phase of the pilot and must remain active throughout implementation. In case of new business models, such as the shared use and swapping battery system, it is important to develop ideas together with city stakeholders and other actors in order to have products and services that function and serve their purpose. A continuous involvement and feedback from the users can help match relevant testers with products in the long run, and communicate to providers.

5.6 A holistic thinking when designing EV fleets

Before the pilot, it is important to think thoroughly its aim and how to achieve the highest impact. Ideally, pilots should contribute to the city's mobility and environmental strategies and be part of a wider plan.

Managing a test fleet involves technology, the human factor and a number of regulatory and administrative issues. For public bodies, purchase of goods and services goes through public procurement. In cases where there is no market for the required service, it is possible that procurement will create one and it is therefore important to include as large group of potential providers as possible.

Regarding the choice of the vehicle, it is advisable to involve models from several manufacturers, especially for pilot purposes. This will enable comparing results and may facilitate market uptake later. *If possible, it is advisable to test those before launching the procurement, in order to minimise surprises.*

Decide what the scope of the experiment is (e.g. work travel or leisure). *For vehicles tested by different users in consecutive periods and different locations, it is useful to have digital planning tools to manage users' schedules and changes that occur. Appropriate length for testing periods is dependent on the type and scope of the pilot, and the need to capture seasonal variation.*

When planning for a large electric fleet, it is important to analyse the grid in the parking facility prior to start. Charging infrastructure must be available and functioning.

Resource capacity in terms of time and personnel is also important to plan for. In public-private collaboration, it is advisable for the city to have access to or even manage data collection. If there are subsidy dependencies, make sure to provide the funding afterwards.

5.7 Take advantage of the structures in place

Existing economic and social structures can enable the prevalence of motorised individual transport facilitates the large-scale adoption of EVs. The predominant position of MIT in the public and political discussion should be utilised to speed up actions for new power technologies (e.g. new business models and regulatory updates).

Moreover, car dependency ensures the success of commercialisation strategies. An active and healthy car market facilitates the transformation of the associated products and services (e.g. power supply, insurance, financing, maintenance, resell, etc.) to serve the new vehicles and its users properly.

6. Conclusions

The experiences of four cities in CIVITAS ECCENTRIC that implemented five measures for the uptake of electric vehicles highlight important factors that may be relevant to other cities. The examples from CIVITAS ECCENTRIC indicate the following:

- Test fleets are key in getting new users acquainted with clean technologies and identify the sectors and user cases where electric vehicles are appropriate. They offer an excellent opportunity to bend boundaries and scepticism on functionality and costs and provide solid ground to justify long-term investment.
- Users are curious and there is a favourable political and economic environment in Europe for this type of investments, opening up a window of opportunity for testing and evaluating potential of EVs in various sectors.
- Despite the plethora of tests, data collection is still challenging.
- Fleet electrification requires cross-disciplinary competencies and stakeholder involvement is crucial in carrying out pilots or introducing EVs in various sectors.
- EV have to be promoted as part of a holistic view of urban and mobility planning. Otherwise its benefits can be outnumbered by its drawbacks and secondary effects.
- Procurement is a powerful tool for driving electrification in cities and there is a need to use it actively in pursuing local air quality and mobility strategies.

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