CiViTAS

Cleaner and better transport in cities

2020 CiViTAS Cleaner and better transport in cities DYN@MO

THE CIVITAS INITIATIVE IS CO-FINANCED BY THE EUROPEAN UNION

CLEANER AND BETTER TRANSPORT IN CITIES – IMPLEMENTING ELECTROMOBILITY IN DYN@MO CITIES FOR LOW CARBON MOBILITY

CiViTAS

Implementing Electromobility in DYN@MO cities

While recognising that electric vehicles are not the solution to solve all urban mobility problems, their introduction certainly contributes to the reduction of local emissions of air pollutants and noise. The DYN@MO cities of Aachen, Gdynia, Koprivnica and Palma are strongly committed – each city in its own way and own scale – to using a combination of instruments to speed up the wider uptake of electric vehicles among the city's fleet and households.

Frontrunner Aachen has set ambitious goals for all transport modes in its long-term e-mobility vision and relevant stakeholders are involved through embedding the topic in its regional Sustainable Urban Mobility Planning SUMP process. In Gdynia, great achievements have been reached by the successful implementation of technical innovations in order to build up a more efficient trolleybus system. The city of Koprivnica has overcome numerous barriers by implementing an e-car charging system, an e-car sharing system and a new e-bus public transport system. The city of Palma has been demonstrating electric vehicles to its citizens by procuring different kinds of e-vehicles within their own fleets and in addition the city has introduced different kinds of incentives in order to create a favourable climate for the early adopters of electric vehicles.

This brochure describes the partner cities' practical experiences of their implementation of electromobility in the 4 partner cities of the CIVITAS DYN@MO project.

The brochure supports the general aims of the CIVITAS Initiative to support cleaner and better transport in cities.


Photo: City of Aachen

DYN@MO project in a nutshell

- DYN@MO (2012–2016) is part of the CIVITAS Initiative, supporting cities to introduce ambitious transport measures and policies towards sustainable urban mobility
- Four DYN@MO cities – Aachen, Gdynia, Koprivnica and Palma – have agreed on a common mission to strengthen sustainable mobility
- The project consists of 28 partners in the four cities supported by Union of the Baltic Cities, Rupprecht Consult and Lund University
- The strategic aims of the DYN@MO project are to:
  - develop "Mobility 2.0" systems and services by applying new web-based technologies
  - implement innovative electric mobility solutions, using new electric and hybrid vehicles, and
  - engage in dynamic citizen dialogue for mobility planning and service improvements

Photo: City of Aachen

From Planning to Implementation: Electromobility in Aachen

Text: Georg Werdermann / City of Aachen

National context of model regions and legal framework conditions

Electromobility ranks high on the political agenda in Germany. For example, Germany has set itself the goal of becoming the lead market and provider of electric mobility by 2020 as part of its long-term zero emission mobility vision. One million electric vehicles on the road by 2020 – that is the bold aim of Germany's "National Electromobility Development Plan." The related energy and climate goals are:

- Electromobility will make a significant contribution to meeting climate protection targets.
- Using renewable sources to meet the energy demands of electric vehicles will also contribute to implementing the development targets for renewable energies and improving grid integration of variable producers, thus helping to raise supply security in the long term.
- The use of modern information technologies and the integration of electric vehicles will raise power grid efficiency in Germany.

Supporting this ambitious vision, various funding programmes have been announced in the past 6 years, part of which is the "Electric Mobility in Pilot Regions" programme. It has allocated a total of EUR 130 million to eight electric mobility model regions across Germany. The Aachen region is part of the model region Rhein-Rur.

On 5 March 2015, the Federal government's draft act on prioritising the use of electrically powered vehicles, the Electromobility Act (Elektromobilitätsgesetz – EmoG) was adopted by the German parliament. The Act aims to apply certain privileges to promote the use of electrically-powered vehicles such as the creation of special parking areas, privileged parking charges, the authorised use of bus lanes and traffic prohibition exemptions. As the city and municipal authorities will be responsible for actually implementing these privileges, it will be them on whom the success of this initiative by the German government ultimately rests. The legislation has come into effect in 2015 and is set to expire in June 2030. According to the new law, vehicles approved in Germany will be identifiable by special number plates.

Electromobility in the Aachen region

In the Aachen region the three essential sectors production, research and implementation are equally advanced. Integrated by the close cooperation of all local stakeholders, these three areas form a strong backbone for a broad range of activities all aimed at the further promotion of electric mobility. Under the brand Elektromobilität Region Aachen (Electromobility in the Aachen Region), all stakeholders have joint forces and work according to their expertise.

A key element has been the Sustainable Urban Mobility Planning (SUMP) process, which has started in 2011. By using the SUMP process, a platform of meaningful best practises was created, founded by eight thematic areas – one of which is electromobility.

Source: Stadt Aachen 2012

As a first result of this strongly citizen-focused process, the Vision Mobility 2050 was developed. Politically approved and endorsed by the city council in 2014, it now serves as a binding thematic framework for all further activities and the next steps in the planning process, such as the Strategy 2030 and related Implementation Notes.

Regarding electro-mobility, the main ambitions described in the Vision Mobility 2050 are:

▶ Aachen is a European competence centre for electro-mobility. All transport means in Aachen should operate without fossil fuels. The electric energy needed for mobility will be produced locally and – as much as possible – based on renewables.

▶ The city will make all efforts to reach the 2050 targets of the European Commission's White Paper earlier.

▶ Aachen is among the leading cities in Germany with the lowest energy consumption per head for mobility.

▶ The early and forward looking shift towards alternative power streams and fuels has led to the situation that mobility is still affordable for everybody – despite rising crude oil prices.

▶ Based on pedelecs and e-bikes as well as the subsequent changes in the public transport system, Aachen has become one of the first cities in Germany to operate a full electric transport network ("electric mobility alliance" integrating cycling/pedelec-sharing, car-sharing and public transport).

▶ Based on electric mobility, Aachen takes a leading role in the development of alternative power streams. It is seeking to achieve the EU targets for 2050 for emission-free car traffic in city areas earlier.

Some first implementation examples

For the promotion of electric mobility in Aachen all transport modes (i.e. car traffic, cycling and public transport) will be considered. Eventually the implementation of an electric mobility alliance will be sought.

By June 2015, approximately 1,000 electric and plug-in hybrid cars were registered in Aachen. With 0.35% of all cars in Aachen being electric, the city scores twice as much as the national average but is still far away from a 2% share, like in Norway.

The following measures have been put in place in Aachen so far:

▶ A pedelec sharing system which aims to offer ultimately 1,000 pedelecs at 100 renting stations.

▶ 52 public charging points (incl. three fast charging points).

▶ A pedelec-based urban freight delivery system.

▶ An articulated full-electric bus running on line-haul.

Photo: City of Aachen

Photo: City of Aachen / Jens Stachowitz

► The new company Streetscooter has developed in a very short time from a RWTH Aachen university spin-off into a leading manufacturer for small electric delivery vans.

► Ladenetz.de; this is a cooperation of municipal utility companies across Germany forming a joint charging infrastructure network supported by a common payment system for the user.

► E-clearing.net; this is a solution to exchange roaming authorisation, charge transaction and charge point information data.

The latter two measures, Ladenetz.de and E-clearing were developed at the Smartlab GmbH, which is a subsidiary of STAWAG, the municipal utility company in Aachen.

Outlook

Until the end of 2015 for all eight thematic areas of the SUMP process (including electro-mobility), a concrete strategy document will be developed based on input of the thematic commissions and a citizen consultation process (among others a public citizen workshop / Bürgerwerkstatt that was held on 13 June 2015).

The Strategy 2030 will define concrete aims, implementation strategies, responsibilities of local stakeholders and budgets. The document will address the following six working areas:

1. Energy production for electromobility
2. Development of concrete use cases
3. Coordination
4. Charging infrastructure
5. Aachen as a competence region for electromobility
6. Electromobility in fleets

Numerical targets for 2030 include:

► 75% of all buses as electric buses

► 25% of all cars as electric cars

► 30% all bicycles as pedelecs by 2030.

For the years to come, emission-free electric mobility will also play a key role in implementing clean-air policies to achieve a better air quality in Aachen.

ELEKTROMOBILITÄT
REGION AACHEN

WWW.EMOBIL-AACHEN.DE

Photo: City of Gdynia

Photo: City of Gdynia

Building up a more efficient trolleybus system in Gdynia

Text: Marta Woronowicz / PKT - Gdynia/PL trolleybus Operator Company

Thanks to the CIVITAS DYN@MO project, the trolleybus transport system in the city of Gdynia has changed direction towards more energy-efficient and, to everybody's surprise, wireless expansion. This is largely due to two recent innovations being tested in the project:

1) The instalment of a braking energy super caps bank installed on one of the substations

2) The launching of regular off-grid operation of two Solaris trolleybuses with an alternative power supply: lithium-ion batteries.

First innovation: Breaking energy super caps

In April 2014, the installation of a super capacitor UCER-01 produced by the Polish manufacturer MEDCOM was completed and its operation started. This braking energy storage device was installed on one of the PKT's 10 power supply substations with the aim to increase the energy efficiency of the whole trolleybus system. The super capacitor works in this way that it captures electricity recuperated by a braking trolleybus. This additional energy accumulated by the supercaps can be consumed later by other trolleybuses, e.g. when there's a temporary energy deficit. Previously, this recovered braking energy was not absorbed instantly by other vehicles on the traction section and was simply wasted and dissipated in the resistor as heat. The new supercap, which works now at 98% efficiency, has overcome this challenge resulting in a daily energy consumption saving of 10–12%. The savings could equal even up to 20%, provided that all the vehicles in the Gdynia trolleybus system were equipped with the recuperation system. Now they account for ca. 55% of the fleet, yet new vehicles are planned to be purchased in the near future and these will replace the ones lacking the braking energy recovery system. Overall, supercaps implementation has significantly reduced energy consumption and additionally enhanced the power management system while ensuring rational usage and levelling the voltage on the network.

Average daily operation results of supercap UCER-01 during various days of the week

Average daily operation results of UCER-01 on various days of the week						
Days of the week	Number of days	Average daily results in the period from 01.08.2014 to 07.12.2015				
		Charged energy (from trolleys to super-cap) [kWh]	Discharged energy (from super-cap to trolleys) [kWh]	Energy efficiency UCER-01 [%]	The energy discharged from super-caps to the bus bars of TS [kWh]	Relative savings due to the work of UCER-01 [%]
Weekdays	92	89	87	97.8	1002	8.0
Saturdays	19	93	90	97.2	730	11.0
Sundays	19	81	79	97.7	557	12.4

Second innovation: Li-Ion Solaris Trollino trolleybuses enabling off-grid operation

As for the second pioneer measure implemented within CIVITAS-DYN@MO, two innovative Li-Ion Solaris Trollino trolleybuses arrived in PKT in April 2015. An official event was organised to celebrate the launch of these state-of-the-art 12 m vehicles into the city's transport system. This type of bus is a hybrid of a trolleybus and an electric bus, containing novel lithium-ion batteries to run autonomously without the traction network for circa 15 km. The batteries are charged directly from the traction network during the regular operation of the trolleybus or the energy may be also charged from a three-phase socket.

So far the inhabitants and visitors to Gdynia and Sopot have been used to the sight of trolleybuses permanently linked to the overhead lines with their pantographs. However, to their huge but positive surprise since 1st May 2015, the newly purchased trolleys have been operating in an extended unwired section of line 21 in the central area of the city. The trolleys get off the traction network, continue on batteries towards a popular Gdynia Aquarium in Skwer Kościuszki Street and finish the offline loop automatically getting back to the traction network again. The total distance of the unwired section covered is 2 kilometres.

The experience gained with the Li-Ion trolleybuses will also be of a great value for another ambitious EU project, ELIPTIC (Electrification of public transport in cities), in which PKT is also a partner. One of the aims of ELIPTIC is to explore the opportunities that the existing electric transport infrastructure offers for further transport electrification without a traction expansion.

The usage of super capacitors and battery technology in the trolleybus system of Gdynia is undoubtedly here to stay. It can be considered as a breakthrough moment and a huge step towards making this transport mode a remarkable energy-efficient trolley-e-bus hybrid.

Comparison of Li-Ion and the traditional Ni-Cd batteries on technical parameters

Type of the traction battery	Ni-Cd	Li-Ion
Battery capacity [kWh]:	16	36
Average charging power (without forming) [kW]:	8–10	36–44
Charging time (without forming) from 0 to 100% [h]:	2	0.9
Nominal energy consumption (without sustaining temp.) [kWh/km]:	1.4	0.88
Average speed on the route [km/h]:	15	15

Key points to remember when implementing similar measures:

1. The breaking energy supercapacitors installed on traction substations can bring significant energy savings if installed in a place where:

- Trolleys with full recovery of braking energy are in use
- Traffic of trolleybuses is relatively small, but big enough so that the investment could be profitable; in the analysed section of the network there should operate at least one but no more than two trolleys at the same time
- The trolleybus stops are quite frequent, yet between them trolleys usually can achieve a significant speed, so they hardly run in an idle mode (and sufficient braking energy is generated)

2. General advantages of battery hybrid trolleybuses in off-grid regular courses:

- No necessity to invest in costly infrastructure (traction, poles, substations etc.)
- Possible to operate in sensitive urban areas where the overhead line is either impossible or obstructive
- Suitable for areas with less intensive courses where the hard infrastructure would not pay off itself in the short run
- Great possibility to electrify public transport in cities by replacing diesel bus courses

*PKT (Przedsiębiorstwo Komunikacji Trolejbusowej), one of the partners in CIVITAS DYN@MO consortium, realises passenger trolleybus transport on 12 lines in Gdynia and Sopot. It covers 5 million vehicle km a year. It maintains 43 km of traction network. At the moment its fleet consists of 91 trolleybuses.

Since 2005 the company has been very active in EU co-funded projects and in 2014 it received a prestigious European Commission RegioStars Award in the category Citystar – Investment Projects in Sustainable Urban Public Transport.

Photo: City of Koprivnica

Electromobility strategy for the City of Koprivnica

Text: Helena Hecimovic / City of Koprivnica

Croatian national context

As part of the National Strategy of Energy Development of the Republic of Croatia of 2009 and the 3rd National Action plan for energy efficiency for the period 2014–2020, a framework for the development of electro-mobility in Croatia was established. The National Strategy of Energy Development describes measures that promote clean vehicles, the planning of more efficient transport systems and a subsidy programme for electric and hybrid vehicles and the infrastructure that belongs to it. Additional benefits, such as free parking and admission to zones with calm traffic are also planned. The Action plan gives priority to eco-driving training schemes, inter-modal cargo transport, stricter regulations for motor vehicles, promotion of clean vehicles, integrated public transport and subsidy programmes for clean vehicles and their supply systems. Until 2020, these subsidies will make it possible to purchase 15,000 electric and 6,000 hybrid vehicles in the country.

Electromobility in Koprivnica

The CIVITAS DYN@MO project has enabled the City of Koprivnica to implement the first national fast-charging system as well as the first local e-car-sharing scheme comprising 6 electric and 2 hybrid vehicles. Local businesses are already adding to the number of clean vehicles in the city and are setting up additional e-car charging stations. Since the beginning of 2014, when the contract for the set-up of the system of e-car sharing stations in Koprivnica was signed, there have been similar developments in other Croatian cities (Cakovec, Pula, Krk) and consistent electromobility promotion efforts by car magazines and Croatia's National Tourist Authority have taken place in the larger region. The first national Nikola Tesla electric vehicles rally was organised in May 2014.

Koprivnica's electromobility strategy aims to reduce the greenhouse gas emissions of the public fleet by 27% as well as to reach operating costs savings of the fleet by 24% by 2020. In partnership with the national electro-

Photo: auto-info.hr


Photo: City of Koprivnica

mobility programme HEP ELEN, five fast-charging stations were set up in Koprivnica during September 2014. Further, a national subsidy provided by the Fund for Environmental Protection and Energy Efficiency enabled the procurement of 5 electric vehicles, 1 hybrid and 1 plug-in hybrid vehicle and 2 small electric buses. The new vehicles have been used by the employees of the municipal authority, municipal businesses and public institutions in an innovative car-sharing scheme. During the first phase of implementation the scheme allowed 200 employees to use the vehicles for their regular working-time activities. At the local level, the promotion of electromobility and the concept of car-sharing can be seen as strong and systematic and it is expected that in the following years it will be also possible for other citizens to join the e-car-sharing scheme. The system is already proving its usefulness and the experience of first practitioners has been shared region-wide (Bosnia and Herzegovina, Croatia, Hungary, Macedonia, Montenegro, Serbia and Slovenia).

Electric buses: national and regional champions

The City of Koprivnica is proud to be the first city in Croatia to start to use electric buses. The regional market for electric vehicles was virtually non-existent before the CIVITAS DYN@MO project. Despite the market constraints (lack of providers, service points and experience), the City of Koprivnica was able to get one provider interested in the idea of converting two regular small buses. After the initial testing has been completed and certificates have been issued by the national centre for vehicles, the vehicles will be used at the first public transport line, connecting the University campus to the town centre, shopping area and a large residential area. The performance of the vehicles will be tested in a four-season period.

Numerous barriers overcome

By establishing the first e-car charging system, an e-car-sharing system and e-bus public transport system, the City of Koprivnica has overcome numerous barriers to the efficient implementation of electric vehicles. For example, national strategic and regulatory documents were implemented for the first time, for which additional explanations and clarifications were required. In addition, during user trainings and workshops organised as part of the CIVITAS DYN@MO project, it appeared that there is an initial lack of trust by the potential users and an underestimation of the vehicles' capacity. The lack of a national e-charger network has also been a significant barrier to a more systematic use of the vehicles for longer journeys. These barriers are consistently being removed, by trainings and workshops, of which one was recently organised in the scope of CIVITAS DYN@MO's consortium meeting in Koprivnica in June 2015.

At the e-charging system launch, Mr Sasa Cvetojevic of Zagreb Entrepreneurship Incubator had the following prophetic words in his speech: "We cannot imagine the importance of today's event in Koprivnica."

Facts on electromobility in Koprivnica

- 6 electric vehicles
- 1 hybrid & 1 plug-in hybrid
- 2 electric buses
- 200 users of the car-sharing system

Photo: City of Palma

Promoting the uptake of electromobility in Palma

Text: Mateu Maimò / City of Palma &
Maarten van Bemmelen / Eurolocal Mallorca

The city of Palma promotes electromobility because it helps to reach local policy objectives regarding the reduction of local emissions of air pollutants and noise. Within the CIVITAS DYN@MO project, Palma is using a combination of instruments to speed up the wider uptake of electric vehicles among local fleet operators and households.

Demonstrate electric vehicles in the municipal fleets

The city can activate the local market for electric vehicles by procuring and demonstrating different types of electric vehicles within its own fleet. Within CIVITAS DYN@MO the city, its municipal companies and subcontractors are demonstrating electric cars (Renault Zoe and Nissan Leaf), small electric cars (Twizys), electric bicycles, mini vans (Nissan e-NV200), a hybrid electric truck (PB Environment) and small fully electric trucks for waste collection (Mega).

Positive incentives for the users of electric vehicles

Through local regulations and taxation instruments, a city can create a favourable climate for the early adopters of electro mobility. The city of Palma has implemented the following incentives:

- Owners of electric vehicles pay a reduced circulation tax.
- Electric vehicles can park for free in the on-street paid parking areas; the so-called blue zones.
- Electric vehicles can access an inner-city traffic connection that is only opened to public transport and residents.
- E-taxis can make use of more attractive shifts.

The city is in discussion with the local freight sector about the possibility to introduce incentives for electric delivery vehicles.

Public charging infrastructure to reduce range anxiety

Public charging points can help to reduce range anxiety among users of electric vehicles in the wider region. In Palma, as of today, the challenge of providing public charging points has not yet been solved satisfactorily. In the past three years, the regional government has been preparing a very ambitious strategy of 2,000 charging points throughout the Balearic Islands. While the implementation of this regional strategy was meeting all kinds of legal and institutional barriers, smaller scale municipal and private initiatives were put on hold.

Since it is still not clear when and whether the ambitious strategy will become reality, smaller scale initiatives started emerging:

► The municipal company SMAP has installed charging points in its underground public parking garages.

► One of the main utility companies started the roll-out of 6 fast charging points throughout the island of Mallorca.

► The city of Palma is realising 5 double charging points for electric scooters during the summer of 2015.

Information and awareness campaigns

A clear communication about electromobility is key to take away existing doubts about technical reliability; range and real costs compared to conventionally fuelled vehicles. In the city of Palma, a series of communication and awareness actions is being implemented:

► The municipal vehicles are exhibited at public events. A large event for municipal fleet operators from the island of Mallorca is foreseen.

► Within CIVITAS DYN@MO, three ambassadors share their experiences of using an electric vehicle through social media: Facebook, Twitter and YouTube.

► The city has cooperated with the local Nissan dealer in the organisation of a two-week exhibition about the Nissan Leaf near Palma Cathedral.

► For the 2015 summer season, Nissan has supplied 60 Nissan Leafs to the car rental companies of Mallorca, boosting the need for public charging points.

► CIVITAS DYN@MO, promotes the calculation tool for electromobility developed by the Unversitat de les Illes Balears. The tool provides information on savings in costs and emissions.

Photo: City of Palma

Photo: City of Palma

Key points to remember when promoting electro mobility

- Before publishing a tender for procuring (special) electric vehicles, make sure that the suppliers can actually deliver the vehicle within your expected timeframe.
- Local companies, especially vehicle dealers and rental companies, should play a central role in the awareness campaigns, since they can offer the possibility of trials to interested future users.
- Ambassadors that share their personal experiences on using electric vehicles can be helpful to take away possible doubts of interested future users.
- Awareness campaigns on electromobility should highlight (future) solutions for range problems and the real cost per trip of electric vehicles compared to conventionally fuelled vehicles.
- Be sure to check the national legal framework for supplying charging points for electric vehicles. In Spain, only recognised bodies are allowed to sell electricity to third parties.

Contacts

Website:

www.civitas.eu

Contacts for the CIVITAS DYN@MO project

Coordination

Georg Werdermann, Project Coordinator

City of Aachen

georg.werdermann@mail.aachen.de

Contact details for the authors:

Georg Werdermann

Project Coordinator

City of Aachen

georg.werdermann@mail.aachen.de

Marta Woronowicz

Project Manager

PKT – trolleybus transport operator from Gdynia

m.woronowicz@pktgdynia.pl

Helena Hecimovic

City Councillor

City of Koprivnica Development Agency North

helena.hecimovic@koprivnica.hr

Mateu Maimò

Engineer at Mobility Department

City of Palma

mmaimo@mob.palma.es

Acknowledgement

This publication is produced under the auspices of CIVITAS WIKI (Advancing Sustainable Urban Transport in an Enlarged Europe through CIVITAS), a support action for coordination and dissemination funded through the EC's Seventh Framework Programme for Research and Technological Development.

Cover photo: City of Palma

2020 CIVITAS Cleaner and better transport in cities DYN@MO

THE CIVITAS INITIATIVE IS CO-FINANCED BY THE EUROPEAN UNION