Interreg
EUROPEAN UNION
North-West Europe
CleanMobilEnergy
European Regional Development Fund

CleanMobilEnergy

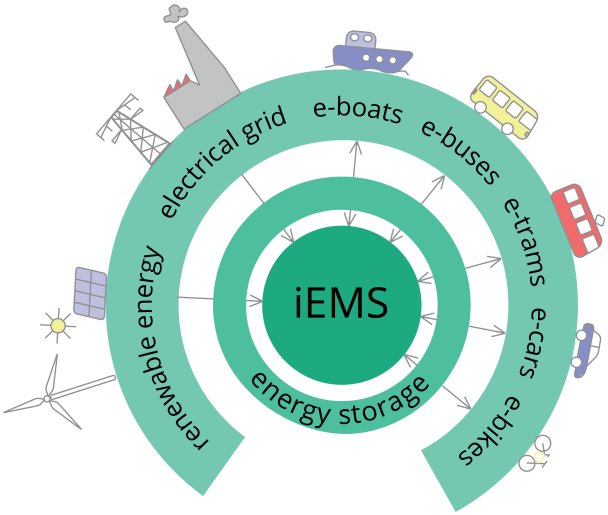
Reducing carbon emissions by combining an interoperable energy management system with renewable energy, storage and charging

In order to combat climate change, European cities are increasingly investing in local renewable energy production, clean e-mobility and charging infrastructure. It is not commonly known that you cannot simply install more and more renewable energy to existing grid infrastructure. However, developments in energy storage systems can unlock great potential. In addition, renewable energy generation and consumption often do not match. This is a problem that can result in too much renewable energy generation when there is no demand, and too little energy production when there is large demand.

To address this mismatch between energy supply and demand, the project CleanMobilEnergy was devised. Currently, energy management systems do not operate multiple operations and devices, CleanMobilEnergy (CME) aims to reduce GHG-emissions by developing and piloting a new intelligent, interoperable energy management system (iEMS). The iEMS will combine renewable energy sources (RES), storage and EV charging to improve the efficiency of RES. Within the CleanMobilEnergy project, an iEMS will be developed, piloted and improved. The socio-economic and environmental profitability of such a system shall also be evaluated over the long term as, theoretically, there are many benefits to be made through the development of the CleanMobilEnergy iEMS.

iEMS

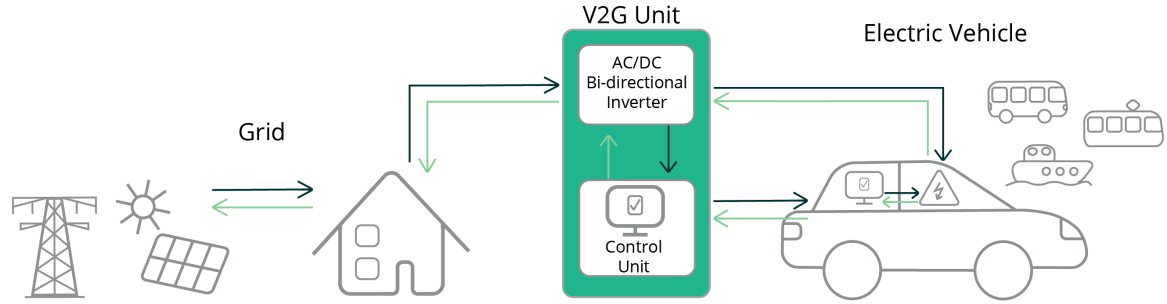
At the heart of the CME Pilots is the iEMS, an energy management system which monitors and controls energy 24/7 in two directions (bi-directional) to effectively balance the grid. The development of this iEMS will close the gap between energy demand and renewable energy production. This will increase energy efficiency and the economic value of renewable energy, and ultimately significantly reduce carbon emissions in North-West Europe and beyond.



E-mobility technologies utilised

CleanMobilEnergy will make it possible for renewable energy sources to be used locally, so e-boats, e-buses, e-trams, e-vehicles and e-bikes can be charged with 100% renewable energy offered at an optimum price. The iEMS involves charging and discharging from e-transport technologies and stationary batteries, thus optimising the operation of RES and allowing e-transportation to be charged with 100% renewable energy. This operation is known as bi-directional charging, or vehicle-to-grid (V2G).

Vehicle-to-grid (V2G) describes a system in which plug-in e-transportation communicates with the electrical grid and balances the difference between energy supply and demand. V2G storage systems allow e-transportation to store and discharge electricity produced from RES using output that fluctuates with demand. The CME project will integrate V2G technology, along with other innovative clean mobility solutions, in four City Pilots: Arnhem, Nottingham, London and Schwäbisch Gmünd. Each of these City Pilots will create a testbed for the iEMS.



Overview of CleanMobilEnergy

Funding
EU - Interreg North-West Europe
Priority 4: Promoting green transport and mobility

Duration
September 2017 - March 2021

Budget
€7.16 Million

Consortium
9 partners

Lead Partner
Gemeente Arnhem

Arnhem, Netherlands

The CleanMobilEnergy City Pilot of Arnhem, NL is a medium sized city with large renewable energy source (RES) uptake and storage. Within this City Pilot, CME partner Gemeente Arnhem (Municipality of Arnhem) will adapt cold ironing, or shore-to-ship power, to directly supply 18-20 ships in the Nieuwe Haven (''New Harbour'') with clean, renewably sourced energy.

The goals of the city pilot in Arnhem are related to the municipality's energy transition programme "New Energy made in Arnhem". This programme targets 14 % sustainable energy by 2020 in order to become energy neutral by 2050, with a 10 % reduction of air pollutants. CleanMobilEnergy contributes to the "New Energy Made in Arnhem" objectives, especially in regards to the optimal integration of renewable energy sources, usage, storage and clean mobility in this City Pilot.

In Arnhem, solar fields, wind turbines and sustainable mobility are currently in place. With the help of the CME project, Arnhem aims to go above and beyond. Specifically, the CME project is realised together with four key components and stakeholders collaborating in the project:

1. The operator of a large solar park;
2. The city-intensive e-mobility charge point operator;
3. An energy intensive river maintenance harbour;
4. A smart storage system for renewably produced energy.

The CME system in Arnhem aims to save energy, with the interoperable Energy Management System (iEMS) monitoring and visualising energy flows. In Arnhem, the iEMS will allow for improved tuning of usage, including the identification and elimination of unnecessary energy use.

With increased usage from renewable energy generation, the Arnhem CME City Pilot provides better local integration of renewable energy sources, allowing growth of renewable energy sources, the reduction of energy export and import and the reduction curtailing, thereby contributing to an increase of renewable generation. Additionally, Arnhem's harbour company recently converted their outdated, polluting diesel fuelled electricity source for a cleaner grid connection. The next step for the harbour management is to use as often as possible the locally produced "new energy made in Arnhem".

Finally, a CME storage device in Arnhem will increase solar energy usage in the period when it is dark. Clean mobility and clean air, together with the charge point operators under CME, increase the share of electric vehicles (EVs), which are fuelled through local, clean sources in Arnhem. Through innovation via applied energy technology, as well as the forward-thinking technical activities of the CleanMobilEnergy project, will contribute to further knowledge-blend, expertise, facilities and opportunities for economic growth and new mobility and energy service in City Pilot Arnhem.

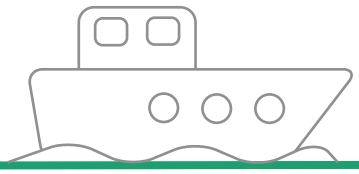


photo credits: Irvin van Hemert

Nottingham, United Kingdom

The second CME City Pilot is Nottingham, UK, a medium sized city with large RES uptake but lacking in RES storage. Currently in Nottingham, electric vehicles and charging are relatively commonplace. However, bi-directional charging is a new technology with only a small number of demonstrations in the UK.

Eastcroft Depot

Eastcroft Depot serves as a centrally located commercial hub for CME partner Nottingham City Council (NCC)'s waste, energy, highways and infrastructure operations. The Eastcroft Depot already boasts Nottingham's Energy from Waste Facility, supplying heat and energy to the UK's largest district heating system. The depot also supplies energy to a private wire electricity network, producing around 27,000 tonnes of CO2 annually.

To further build on their extensive portfolio of existing energy projects, NCC will deliver a City Pilot demonstrator to maximise use of local RES generation and cut carbon emissions and costs associated with charging electric fleet vehicles. NCC will also demonstrate innovative bi-directional vehicle-to-grid (V2G) charging units to allow Eastcroft to use vehicles for short-term energy storage. Together with a large stationary battery, the V2G technology will enable Eastcroft to reduce its peak demand and reliance on grid power supply.

As a historic site, Eastcroft poses the challenge of upgrading the electrical infrastructure in order to support the installation and use of, at a minimum: 88kW solar photovoltaics, a 378kW/676kWh lithium Ion Battery and up to 40 V2G bidirectional charging units. NCC will also be upgrading their fleet through the procurement of 40 battery electric V2G compatible vans and cars. Three of the City Pilot's CME solar PV systems have already been installed in mid-2018. They are expected to generate more than 88,000 kWh of renewable electricity annually, saving approximately £37,600 in annual energy and carbon costs. The energy generated by solar PV will be used either for EV charging or to power buildings in Nottingham.

The components of the pilot will be controlled by the purpose-built iEMS and managed by NCC on site.
Together with the bi-directional chargers and smart charging, this will enable EVs to be used for energy storage and grid balancing services in the City Pilot of Nottingham.

London, United Kingdom

CME City Pilot London, UK currently has large RES uptake at multiple locations, as well as energy storage capacity for RES and EVs. There is also capacity for bi-directional chargers in controlled areas supplied by a private-wire electricity grid.

In London, the CME City Pilot will provide a key strand of evidence in building the systems the city needs to deliver on the Mayor's goal of a zero carbon city by 2050. Particularly, the CME City Pilot will provide a means of managing and optimising a diverse selection of renewable energy generation, storage and consumption loads.

The focus of this City Pilot is connecting energy storage to EV charging stations, solar PV and potentially small-scale wind installations; meanwhile, the iEMS will manage energy flows. This will help facilitate an increase in uptake of sustainably powered electric vehicles throughout London, which represents a significant reduction of CO2 emissions and regulated air quality emissions, in comparison with the current, largely diesel-fuelled fleet. The City Pilot lead, Transport for London (TfL), is a local government body and Transport Authority responsible for managing and developing the transport system in Greater London, England.

One London pilot site will be based at Palestra – one of TfL's main hub offices in central London. Palestra has local renewable generation, with solar PV on the roof. Additionally, Palestra has a fuel cell supplying heat and power in its basement and is connected to both the public electricity grid via London's major Distribution Network Operator, UK Power Networks – as well as the London Underground private wire High Voltage network. The CME pilot will seek to scope and specify an energy storage system located within the footprint of the building. The system is planned to include EV charging, which could include bidirectional V2G chargers.

A specialist energy services company is undertaking a feasibility assessment, site survey and a preliminary technical specification for the energy storage solution at Palestra as part of CME. A key challenge will be for the Energy Management System (iEMS) in CME to be interoperable with both the renewable PV generation, the fuel cell system, the different HV electricity connections and EV chargers, and their various management and control systems and interfaces.

In parallel with the solar panel installations within CME, TfL is investigating the use of second-life electric bus batteries, as well as integrating these units into a manageable storage system, to provide smart energy storage to the City Pilot. The demonstration as a whole will link PV generation and bi-directional EV charging to energy storage and the TfL private AC grid.

The possibility of a second CleanMobilEnergy pilot site is being investigated at one of several London Underground depots. This pilot site would link small-scale solar generation to storage with energy storage and EV charging and open up the opportunity to investigate the transport of renewable energy between TfL sites via the private grid network.

Schwäbisch Gmünd, Germany

The final CME City Pilot is the relatively small city of Schwäbisch Gmünd (pop. 60,000), located in Baden-Württemberg, Germany. Compared to the other City Pilots, Schwäbisch Gmünd has relatively small-scale renewable energy uptake and storage facilities, with the focus of the pilot being connecting residents with electric bikes for transport and "last-mile" solutions in a residential area.

The aim of the City Pilot of Schwäbisch Gmünd is to link the CME project with the sustainable mobility "Hardt" district, as well as to extend the already established infrastructure to other districts in the state of Baden-Württemburg, Germany. Within Schwäbisch Gmünd's Hardt district, transport sharing systems in the form of e-bike ("pedelec") sharing systems are already in place. The CME City Pilot, overseen by CME partner European Institute for Innovation – Technology, will further expand the city's e-mobility sharing opportunities and offer last-mile solutions. In doing so, it will be more feasible to attract and utilise more e-vehicles in the city and region.

Within the CleanMobilEnergy project, e-bikes compatible with the region of Stuttgart's existing transport bike rental and sharing framework will be stationed throughout the city. Additionally, CME plays a strong role in providing the basis for an e-cargo bike mobility solution during the installation and maintenance of the Remstal Garden Show 2019. Working closely with a Schwäbisch Gmünd-based company, these e-cargo bikes utilise advanced "plug-in-play" battery technology – in the form of "Energy Tubes" – to provide efficient and sustainable last-mile solutions. The installation of two Energy Tube battery swapping stations will ensure flexibility and constant supply of energy. The CME City Pilot of Schwäbisch Gmünd will also introduce e-scooters to offer its citizens another form of low carbon mobility. The CME solar photovoltaic (PV) panels and battery storage solutions installed in Schwäbisch Gmünd's "Himmelsgarten" will ensure renewable energy is supplied to the city's e-transportation, further enabling clean mobility in the German City Pilot.

The iEMS implementation in Schwäbisch Gmünd will focus on a high level of energy autonomy on a small city scale, using distributed mobility devices all throughout the municipality, various solar installations, light electric vehicle (LEV)-charging infrastructure & buildings where energy is consumed & stored. Working with other CME City Pilots provides a common technology exchange via delivering a scalable urban solution to be replicated by the partners during post-project rollout. This adds functionalities to the iEMS and creates meaningful data & aggregated information, transnationally developed and shared across the CME partnership and beyond.

Summary

One generic transnational iEMS will be adapted to the four specific City Pilots in Arnhem, London, Schwäbisch Gmünd and Nottingham. These pilots range from small towns to large cities. The four City Pilots cover different types of renewable energy, storage and electric vehicles as well as different contexts and diverse city environments.

CleanMobilEnergy brings together nine different partners from five different countries across North-West Europe. These partners are:

1. Gemeente Arnhem (NL)
2. POLIS Promotion of Operational Links and Integrated Services (BE)
3. Luxembourg Institute of Science and Technology (LU)
4. Centre of Excellence for Low Carbon and Fuel Cell Technologies – Cenex (UK)
5. Transport for London – TfL (UK)
6. Europäisches Institut für Innovation- Technologie – Elfl Tech (DE)
7. Nottingham City Council (UK)
8. Walvoorzieningen Nederland B.V. (NL)
9. Institut d'aménagement et d'urbanisme de l'île-de-France – IAU (FR)

CleanMobilEnergy is a three and a half year Interreg North-West Europe project that aims to reduce GHG-emissions by developing and piloting a new intelligent, interoperable energy management system (iEMS) to combine RES, storage and charging, thus improving the efficiency of RES.

Supported by the Interreg North-West Europe Programme and European Regional Development Fund (ERDF), CleanMobilEnergy has a total budget of €7.2 Million and total ERDF funding of €4.3 Million.

Contact information

Lead Partner
Peter Swart (Gemeente Arnhem)
peter.swart@arnhem.nl

@CME_Project
www.linkedin.com/company/cleanmobilenergy
www.nweurope.eu/cleanmobilenergy

Interreg North-West Europe CleanMobilEnergy
European Regional Development Fund