

Nantes

Hamburg

Helsinki



**A guide for the transition of
EU cities towards a new
concept of Smart Life and
Smart Economy**

**SMART PEOPLE
SMART ECONOMY
SMART CITIES**

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↑ Nantes | Hamburg | Helsinki

EDITORIAL

After almost 6 years of fruitful collaboration, mySMARTLife project comes to an end.

The mySMARTLife consortium has worked hard to accomplish ambitious targets in terms of energy and emissions savings through the implementation of innovative measures. As a large demonstration project, mySMARTLife has fostered the creation of smart districts, considering energy efficiency measures to reduce energy demand, greenhouse gases and pollutants emissions, together with the integration of renewable energy sources and energy storage in energy grids. Clean mobility solutions were also deployed across the cities. This was possible thanks to the strong collaboration among the Lighthouse and Follower Cities, supported by

all the technical and non-technical partners during the execution of the work.

The gained knowledge and experience have been shared and exchanged among mySMARTLife cities and extended also to our mySMARTLife Cities Network. Dedicated workshops have been held to discuss and learn about mobility, citizen engagement, efficient buildings, smart lighting and ICT topics.

Advanced technological solutions connected with renewable energy integration, refurbishment of buildings, sustainable mobility solutions, etc. have been implemented. Just to cite some of the most innovative ones: organic photovoltaic solar

panels and new 24-meter e-buses from Nantes, district heating based on high shares of renewable hydrogen and logistics micro hub in Hamburg, autonomous e-buses and "Carbon Ego" app from Helsinki.

Additionally, non-technical actions have been put in place, and overall, an active citizen engagement, together with a structured business approach have been the backbone of this ambitious project.

All the knowledge acquired in mySMARTLife has been shared with the members of our collaboration framework; our 17 fellow projects, Scalable Cities and the Smart Cities Marketplace that have accompanied us during all this process. All these

valuable insights have also been offered to the brand-new Mission on Climate Neutral and Smart Cities, with which we have started to collaborate as well.



Rubén García Pajares,
CARTIF Technology Centre,
mySMARTLife Project Coordinator

ABOUT mySMARTLife

mySMARTLife aims at making the three Lighthouse Cities of Nantes, Hamburg and Helsinki more environmentally friendly by reducing their CO₂ emissions and increasing the use of renewable energy sources.

The activities of mySMARTLife focus on **“Inclusive Cities”**, offering a high quality of life to residents. **“Smart People”** are playing a vital role in their city’s development. **“Smart Economy”** is an innovative and dynamic economic concept aiming at guaranteed employment and an adequate income, attracting talents and providing goods and services according to the actual requirements.

140 actions – Within the three Lighthouse Cities, 140 demonstration actions were carried out, ranging from technical actions (refurbishments of buildings, usage of renewable energies, clean transport and supporting ICT solutions) to social / non-technical actions (citizen engagement, development of innovative business models).

mySMARTLife IN A NUTSHELL	
3 Lighthouse Cities:	Nantes (France), Hamburg (Germany), Helsinki (Finland)
3 Follower Cities:	Bydgoszcz (Poland), Rijeka (Croatia), Palencia (Spain)
Coordination:	CARTIF Technology Centre
27 partners from 6 countries	
Duration:	70 months Dec 2016 - Sept 2022
EU Funding:	€ 18 656 102,41

mySMARTLife Cities Network – Cities from Europe and beyond were invited to exchange experiences and learn directly from mySMARTLife.



On their way to becoming Smart Zero Carbon Cities, the three Lighthouse Cities of Nantes, Hamburg and Helsinki have generated various innovative solutions in the fields of energy efficiency, sustainable mobility and intelligent use of Information and Communication Technologies (ICT).

In this booklet, you can find best practices on how to minimise your city’s energy demand and maximise renewable energy supply. Each solution therefore comes with a short description, benefits of the solution, facts & figures, lessons learned

and challenges. Each intervention described in this booklet was rated by the respective mySMARTLife team in a 5-star rating scheme called “Potential for Replication”. The aim of the 1 to 5-star rating scheme, with 5 stars given to the intervention with the highest ease of replication, is to provide the reader with additional guidance when considering each intervention for replication.

With this booklet, the mySMARTLife consortium wants to assist cities in their decision-making process and share its experiences and knowledge. The road might be bumpy, but it is well worth it!

mySMARTLife FACTS & FIGURES

Retrofitting:
49,102 m² have been retrofitted in the three Lighthouse Cities

Energy savings, both in retrofitted buildings and new ones (thanks both to passive measures and to the integration of RES*): **8.6k** kWh/yr. with associated monetary savings that are equal to **€1,2** M

* RES stands for “Renewable Energy Sources”.

4,810 tCO₂/yr CO₂ emissions saved thanks to the implementation of sustainable mobility measures. In monetary terms, **€1,8** M would be saved.

SUSTAINABLE ENERGY FOR ALL

Secure, affordable and sustainable energy actions are at the core of mySMARTLife. This could be engaging retrofit actions such as the example from Nantes Metropole demonstrates, but also innovative hydro combined heat and power plants (Hamburg) and heat response as the example from Helsinki shows.



NANTES – FIT FOR RETROFITS

Managing energy demand is today one of the major challenges of the energy transition. In its roadmap for energy transition, Nantes Metropole has committed itself to addressing fuel poverty, reducing the energy consumption and thus the greenhouse gas emissions in its territory, and improving the comfort of occupants in their homes. Achieving these objectives requires the facilitation of energy renovations.

"Mon Projet Renov" is a single desk retrofitting service developed and proposed by Nantes Metropole. It is part of the smart actions developed in Nantes within the mySMARTLife project and is a free-of-charge public service.

Through this online service platform, Nantes Metropole enables the residents to access relevant information to help them in the development of their retrofitting project. Once their project is mature enough, the platform offers them contacts to listed local companies and can even play a role as an intermediary in the proposal of costs estimates



by the company but also showcases financial aid available to the residents.

LESSONS LEARNT & CHALLENGES

"Mon Projet Renov" is a remarkable initiative to face directly one of the main barriers to retrofitting buildings, and, more generally, the energy transition of cities: the lack of trust and information available to residential homeowners. "Mon Projet Renov" has also improved this aspect of retrofitting by simplifying access to existing financial support.

BENEFITS

- Easily accessible overview of the retrofitting market, thus increased uptake of individual retrofitting measures
- Support at every stage of the retrofit process through easily accessible information
- Strengthening the local economy through increased uptake of renovation measures
- Increased health, indoor comfort conditions and quality of life
- Increased energy efficiency, and thus reduced energy bills
- Reduction of carbon emissions
- An online platform such as "Mon Projet Renov" offers a very concrete and complete response at a reasonable cost
- Free and reliable information with high dissemination potential, no conflict of interest on the part of the developer (the city is interested in both the residents' well-being and the local companies' satisfaction), technical and financial solutions offered, involvement of local companies, and diversity of the offer

POTENTIAL FOR REPLICATION



FACTS & FIGURES

€56 million in financial aid: between 2018 and 2025, Nantes

Metropole will allocate **€7** million per year to grants for the energy renovation of private homes. This fund will complement state aid.

500 subsidised housing units per year: this is the objective for low-income households thanks to the "Mon Projet Renov" grants.

700 BBC* renovations per year for condominium housing: this is the objective of the "Mon Projet Renov" subsidy programme.

* BBC stands for "Bâtiment Basse Consommations" (Low consumption building); BBC is a French retrofitting standard with specific targets.

READ MORE

metropole.nantes.fr/renover-logement



Mon Projet Renov System



HAMBURG – HYDRO IS THE WAY TO GO

The new construction area “Schleusengraben” is a focus development area of the City of Hamburg along the shores of an old industrial channel. The general development of the “Schleusengraben” is divided into six different areas - each area with its own investor and its own architectural and energy supply concept.

The University of Applied Sciences Hamburg, the energy utility company enercity AG and the gas grid operator Gasnetz Hamburg GmbH have tested a district heating system with a hydrogen content of up to 30% in the fuel gas in one of these development areas, the “Am Schilfpark” area. In the scope of the energy transition, it is expected that hydrogen will play an important role in the energy and mobility sector.

In the area “Am Schilfpark”, the heat supply system, consisting of two combined heat and power units (CHP) and two gas boilers, was made hydrogen-

capable. Additionally, a monitoring system and the hydrogen injection and gas mixing system were installed.

LESSONS LEARNT & CHALLENGES

The importance of the use of hydrogen as a storage medium for regenerative power and for reconversion into electricity by CHP units will increase in the future. The technical requirements of the individual components must be adapted to be hydrogen-compatible and thus to meet the individual requirements of a secure heat supply.

The results of the technical infrastructure testing allowed the partners to identify required fine-tuning processes to cope with divergent reaction cycles as well as pressure and timing requirements for the hydrogen injection based on different heat demand.

When heat demand is low, CHP units tend to serve the system in terms of their electricity feed-in

behaviour. In winter, however, they tend to behave contrary to the system.

During the tests, it was shown that highly fluctuating loads of the heating devices lead to problems in regulating the amount of hydrogen fast enough. As a result, the allowed limit is sometimes exceeded, so that the hydrogen content cannot always be kept constant at 30%.

BENEFITS

- Hydrogen can be fed into the gas grid in this section and no separation of the gases is necessary before combustion
- The heating system is flexible for up to 30% hydrogen in the fuel gas
- Hydrogen can serve as a storage medium for renewable electricity and can be converted back into electricity with the help of CHP units
- Findings regarding plant behaviour and operation can be used as a basis for further research projects
- The gas network operator can use the experience for the development of the gas network and possible additional infrastructure
- The tests enable the plant operator and manufacturer to adjust the plants so that operation with hydrogen functions properly
- The materials and components of the feed-in system as well as the pipelines do not show any leaks or altered functions due to the use of hydrogen

POTENTIAL FOR REPLICATION



FACTS & FIGURES

The local district heating network, which is mainly located in the basement and underground car park, is over 460 m long and distributes the heat to residential buildings in the development area. The two CHPs have a capacity of **50 kW_{el} / 100 kW_{th}** each and the two gas boilers a capacity of **500 kW_{th}** each.

In July 2021, the share of hydrogen in the fuel gas was **10%** and in August **15%**.

In April 2022, the second hydrogen feed-in started with **15%**. In June 2022, **20** and **25%** hydrogen injection were tested. A hydrogen share of **30%** was achieved on the 29th June 2022.

A paper was published in May 2021 that examines the system efficiency of hydrogen reconversion with CHP plants (Decher et al., 2021: *System Support Analysis of Hydrogen Regeneration with CHP*).

READ MORE:



mySMARTLife
information booklet





HELSINKI - HEAT DEMAND RESPONSE

Smart heating management systems play an important role in reducing the energy consumption in Helsinki's building stock. Different systems were piloted in a residential apartment building in Merihaka (the smart heating solution of the energy management provider Salusfin) and an office building in Viikki Environment House (the smart heating solution of the Finnish start-up Fourdeg).

The purpose of heat demand response is to reduce the need for heat during peak consumption hours and enable greater system-level flexibility. Generally, the peak production that follows peak consumption is more expensive than the basic production due to more expensive energy sources, fuels and energy procurement.

MERIHAKA - RETROFITTING PROJECT & SMART HEATING

In Merihaka, a coastal residential area in central Helsinki, the installation of smart controls for the management of apartment level heat demand was the key to the retrofitting measure. The primary target area consists of 12 residential condominium buildings: 1,323 flats, 115,955 total sqm with 71,450 living sqm.

In the area, a total number of 167 apartments were equipped with the Salusfin Oy system that includes smart thermostats connected to the district heating through Internet of Things (IoT) and cloud-based intelligence to load the balance of the network. Energy savings can range from 10% to 25% depending on the user's activity and motivation.

VIIKKI ENVIRONMENT HOUSE - SMART DEMAND RESPONSE SYSTEM & RENEWABLE ENERGY STORAGE

The Viikki Environment House is a high-performance office building in Helsinki. Part of the energy consumed in the building is produced on-site: the solar panels placed on the façade and roof cover 572 m² and produce 20% of the energy consumption along with four wind turbines. The energy needed for heating water and interior spaces is provided by Helsinki's district heating network. The cooling is supplied through a cost-free borehole water system that consists of 25 boreholes, each 250 m deep and making 95% of the cooling energy renewable.

There is a building automation system that manages the building's indoor conditions (heating, ventilation and air-conditioning). Another control system, including electricity storage, manages electricity production and use. The storage is connected to other building energy loads to enable better optimisation and provide the nearby public e-car charger with solar energy.

During the mySMARTLife project, these systems have been adapted with an extra layer of intelligent control. The offices have been equipped with smart heating control that enables heating the rooms according to their use and piloting of a heat demand response service. In addition, modifications to the existing building automation systems have been made to render the energy saving systems easier to manage and monitor.

READ MORE:

Retrofitting of
the Residential
Construction



mySMARTLife
promotes Helsinki's
energy actions



LESSONS LEARNT & CHALLENGES

The implementation of smart thermostats and piloting the heat demand response functionality was easier in a non-residential building such as the Viikki office building. In residential buildings, an internet connection by the housing company (instead of personal internet connections of the residents) would be needed if the communication of the device is done via the internet.

Smart thermostats could be suitable for heat demand response if the residential building already has them. However, currently, smart thermostats are still rare, and therefore, the solution is not easily scalable.

The Viikki pilot demonstrated that an office building can be harnessed for heat demand response so that the rooms of the building will contribute with their capability. Buildings and premises, especially with known usage schedules, are efficient for heat demand response use.

During the heat demand response testing phases, the thermal comfort of the residents in the Merihaka building and the occupants in the Viikki office building were analysed by frequently asking the occupants to provide feedback on their thermal comfort. In Merihaka, the thermal comfort was not observed to be affected by the heat demand

response testing runs. In the office environment, a slight correlation between decreased thermal comfort and the heat demand response was detected while analysing the feedback.

The business scenario analysis gave the information on the capabilities of heat demand response in Helsinki. The business-as-usual scenario, including the connection of 550 residential buildings and 50 business premises, schools and similar types of buildings, showed that investment in heat demand response can be profitable with a reasonable pay-back time (10 years).



BENEFITS

MERIHAKA
• The solution expects to achieve 10-25% energy savings through smart heating management and user control
• Saving converted to CO ₂ emissions can be up to 80 t of CO ₂ per building per year
• Precise and smart heating control on apartment level
• Remote heating controls
• Machine learning and ventilation/window open features
• Scheduling and optimisation, absence temperature
• Improved indoor comfort and awareness

VIIKKI
• Smart heating control decreased energy consumption by 8%
• Up to 44% improvement in satisfaction with the room temperature thanks to the human thermal model-based control
• The action demonstrated that buildings with known usage schedules can be efficiently used for heat demand response

POTENTIAL FOR REPLICATION (MERIHAKA)



POTENTIAL FOR REPLICATION (VIIKKI)



FACTS & FIGURES

MERIHAKA

Demand response solution was installed in **167** apartments

Easy installation for the **167** apartments was prepared in advance

400 thermostats got replaced

400 valves for each radiator were renovated and tested

Installation was done in phases, total time required: **3** months

VIIKKI

Solar panels placed on the façade and roof cover **572** m² and produce **20%** of the energy consumption along with four wind turbines

Cooling is supplied through a cost-free borehole water system that consists of **25** boreholes, each **250** m deep and making **95%** of the cooling energy renewable



URBAN DATA PLATFORMS – DATA IS THE KEY

Urban Platforms are expected to form a core building block with which cities can better manage the current explosion in volumes of urban data. Using data platforms, cities can also share data between city departments to improve residents' services and overall outcomes for society.



NANTES – EXTEND THE PLATFORM

The extension of the Nantes Urban Data Platform was developed based on a common architectural framework, co-constructed and defined by each of the three Lighthouse Cities (Nantes, Hamburg and Helsinki). This framework of open specifications enables the three cities to share their information and developments through interoperability at three levels: integration of all types of input data into the SensorThings Application Programming Interface (API) data model, exposing output data through this same SensorThings API, and reusing, replicating a service at specifications level from one Urban Data Platform to another.

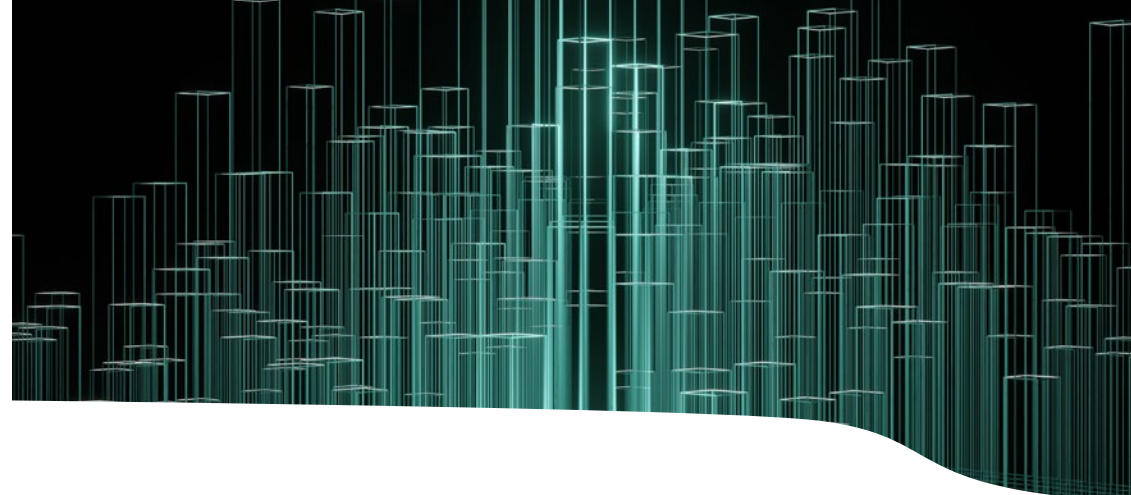
Within the framework of mySMARTLife, developments have integrated data from different project sources such as:

- public equipment load curves, from the energy data lab developed by the Electricity Distribution System Operator Enedis
- data from electric vehicle recharging sessions from public car parks in Nantes Metropole
- distribution data (temperatures, flows) from the substations of the district heating network
- evaluation of the mySMARTLife interventions



READ MORE:

Urban Data
Platform



LESSONS LEARNT & CHALLENGES

- Data integration can only start once the data publisher has chosen which IT system it will deploy, and the transversal activities implemented within the Urban Platform depend on these choices. We used a macroscopic level of action dependencies at planning level, but we could not always work them out with enough genericity and sometimes a change of data publisher implied new developments.
- Latency is an important question when it comes to implementing use cases within the Urban Platform as it is a platform of platforms. On Nantes demosite, all data is generated by dedicated monitoring systems and integrating them into the platform can lead to a greater delay.

BENEFITS

- Support for the implementation of public policies, thanks to the city's data interconnection and availability capacities
- Resource in the Information System, in line with today's data challenges and the metropolitan data strategy
- Contribution to improving and/or developing new services with data
- To promote a standardised, open and interoperable data model and API
- Better handling of the city's urban data

POTENTIAL FOR REPLICATION



FACTS & FIGURES

5 M+ data integrated

15 use cases created from the project data



HAMBURG – SYSTEM OF SYSTEMS

The Urban Data Platform Hamburg follows a system of systems approach and aims at making the city's urban data findable, accessible, interoperable, and re-usable between systems. The Urban Data Platform builds on the existing Spatial Data Infrastructure and extends it with additional components, e.g., for handling sensor data or conducting data analysis. IT systems and/or services in various urban areas can thus be connected in a way that enables them to recognise one another and automatically exchange data. The data can be configured and evaluated individually via the Urban Data Platform and can be accessed in real time, depending on the user's needs. Easy access to the data, combined with their great topicality, allows quick analyses at any time, which in turn contributes to quick decision-making. The Urban Data Platform Hamburg acts as the operating system for the digital twins of the City of Hamburg.

The City of Hamburg Urban Platform is supplemented on a test basis with the Smart City Ecosystem of T-LABS (Deutsche Telekom AG) to form a "System of Systems" following the DIN Spec 91357 on "Open Urban Platforms". The aim is to improve the standardised connectivity to allocate (open data) apps and services to authorities, citizens and stakeholders. Digitisation leads to new service opportunities and data generation, which will be aligned, harmonised and managed by the Hamburg Urban Data Platform.

LESSONS LEARNT & CHALLENGES

- Implementation of a Digital Strategy in Hamburg as an indispensable prerequisite for the Urban Data Platform Hamburg
- Development and implementation of an Urban Data Platform by European cities themselves is crucial for full success (see also the Lighthouse City Lyon)

- Implementation of the Urban Data Platform by a Hamburg authority itself ensures independence from a vendor and enables knowledge building within the authorities
- Subsequently, it ensures agile, cost-effective and rapid further development following the needs of the city and its citizens
- Convincing industry partners to use open international standardised interfaces can be challenging
- Industrial contractors often prioritise economic aspects over other goals

BENEFITS

- Provision of real-time data infrastructure as open-source code in a git repository for easy reuse by municipalities in Europe (<https://bitbucket.org/geowerkstatt-hamburg/hh-udp-iot/>)
- Enabling reuse by other municipalities in Germany and Europe
- Subsequent use of the real-time data infrastructure developed in mySMARTLife for other projects, e.g., within the framework of the ITS World Congress 2021 and the ITS strategy of the City of Hamburg
- Replicating of infrastructure, real-time data concepts and front-end developments by other cities, e.g. Berlin
- The approach: public money - public code, was fully implemented

POTENTIAL FOR REPLICATION



FACTS & FIGURES

Under full control of a Hamburg authority

Use of open international, standardised APIs, i.e. WFS, OAF, WMS, SensorThingsAPI etc.

74,000 sensors integrated

Real-time traffic light data from approx. **700** intersections

Real-time electric vehicle charging data from more than **1,300** charging points integrated

Real-time data from ~ **300** bicycle renting stations

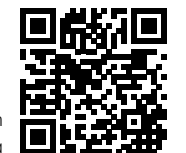
Event-based distribution using MQTT

More than **3,000** datasets integrated

READ MORE:



Digital strategy for Hamburg



Urban Data Platform Hamburg



HELSINKI – SUPPORTING THE DIGITAL TWIN

The mySMARTLife project set a new ambitious goal of defining the urban platform as a supportive element of the Helsinki's digital twin, Climate Atlas. The Climate Atlas was the first service to build on the 3D city model and expand it into a digital twin of the city with the simulations and scenarios.

For the IoT data acquisition, this approach meant more focus on the geospatial nature of the context. In practice, improved expression of the geospatial context of the data was accomplished by using the information model of the SensorThings API. This API is produced by the Open Geospatial Consortium, an organisation for the standardisation of geospatial information. By ensuring the compatibility of IoT data with the SensorThings API, cities can also achieve better interoperability with the CityGML city information models that form the basis for digital twins.

The Helsinki data platform is capable of processing and managing real-time data streams. The variety of actions in mySMARTLife has helped define the data models of the platform generically enough so that they can be applied to several domains.



READ MORE:

Helsinki
Urban Platform



Heating demand
prediction based on
3D city models

They are suitable for data from buildings, mobility and environmental monitoring, among others. The need for enterprise-grade performance and usability of an urban data platform became evident. For this reason, the implementation of the Helsinki Urban Platform is currently based on well-known and mature products such as Apache Camel, Apache Kafka, Postgre database and Snowflake data lake. The key components are mainly open source and ready to be scaled up to support the needs of the city. The components defined in mySMARTLife were used when the city created the first open data pipelines that were used to monitor the usage of outdoor exercise equipment and the water temperatures of swimming places with IoT sensors.

LESSONS LEARNT & CHALLENGES

While the needs of mySMARTLife could have been met with many existing data acquisition platforms, special innovative solutions were developed to improve data interoperability and quality for the urban context, especially the geospatial dimension of the smart city data.

Modern data systems were developed iteratively: an agile, iterative process creates more innovative and up to date solutions than the traditional waterfall approach. mySMARTLife allowed for new ideas and revisiting and updating concepts that turned out to bring limitations.

The role of a digital twin in the smart city context has become clearer. It is essential to understand the spatial nature of data to be able to link the geospatial features with the attributes created by sensors or other live data sources. The geo-spatial

and socio-technical context are the main differences between a digital twin for a smart city and generic digital twins for industry.

The City of Helsinki currently operates on over 900 ICT systems and applications. The urban platform concept needs to meet the volumes and the variety of information in the smart city context and not just limit itself to manage a few IoT sensors.

BENEFITS

- The Urban Platform is based on widely used and mature components that are available both as on-premise and hosted (SaaS) services
- The SensorThings data model provides a good, generic schema for a variety of data, not limited to IoT applications
- The Urban Platform is developed through experimentation and pilots with real-life use case

POTENTIAL FOR REPLICATION

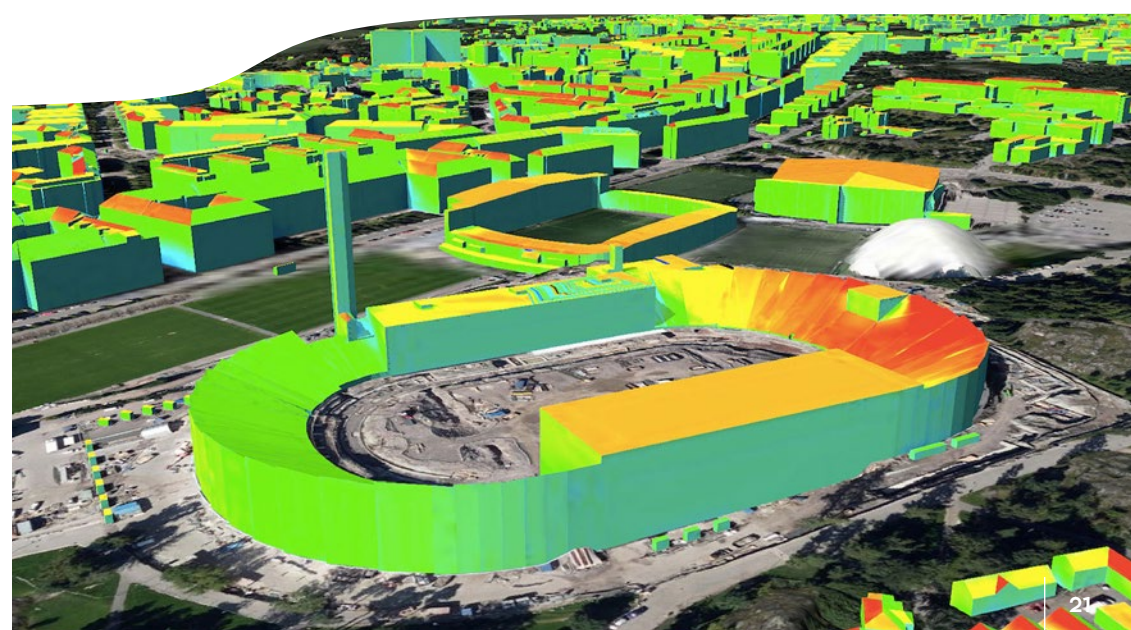


FACTS & FIGURES

The mySMARTLife Urban Platform in Helsinki currently processes over **10,000** events per minute.

The Helsinki digital twin contains information of over **70,000** buildings.

It currently takes less than a day to connect a new data source into the Urban Platform.



MOBILITY – MOVE IT, MOVE IT

mySMARTLife's ambition to invest in public and multimodal transport as well as in sustainable and electric mobility is strong and citizen activities and involvement in these topics are very high. In the following chapter, we have selected three interesting examples from our Lighthouse Cities.

THE E-BUSWAY – THE NANTES WAY

In Nantes Metropole, transport represents the main source of greenhouse gas emissions (49% of total emissions). Nearly 88% of these emissions are generated by cars and 11% by public transport. Therefore, transport represents an essential lever for significantly reducing the city's emissions.

An innovative action in mySMARTLife is the use of 22 fully electric e-Busways delivered by the local company Semitan, responsible for the public transport network of Nantes, and Nantes Metropole. They are 100% electric bi-articulated buses (24 m long, 150 seats) allowing 55,000 passengers a day to be carried without having to execute heavy infrastructure work. Therefore, the number of passengers to be transported in peak hours is increased by 35%.

Unique in the world, this bus line benefits from rapid charging technology by bottle-feeding. This technology allows the bus to recharge over short periods when passengers get on and off the bus without impacting the operation of the line.

LESSONS LEARNT & CHALLENGES

- To adapt an existing bus line: arrange the stations, electrical infrastructures etc.
- A new technical centre had to be set up, new knowledge had to be acquired, driving the new bus had to be learned and the line had to be adapted (e.g. through special roundabouts) because the length of the bus brings new constraints.



READ MORE:

Nantes
eBusway



BENEFITS

- Reduction of energy consumption by 30%
- 2 million kilometres travelled with these e-Busways have saved 3,000 tonnes of CO₂
- 35% increase in the number of passengers that can travel on the same bus, from 110 to 150 persons
- New services for users such as USB ports under each seat or a panoramic view at the back of the bus
- Comfortable, stable and safe journey thanks to the two engines located in the middle of the bus
- Reduction in noise pollution due to a silent engine
- Fast charging that does not impact travel times

POTENTIAL FOR REPLICATION



FACTS & FIGURES

100% electric bi-articulated buses (24 m long, 150 seats)

Transportation of
55,000 passengers per day

12 fast charging stations deployed (10 on the Busway line, 2 in depots)



ELEXITY – HAMBURG DRIVES ELECTRICALLY

There are a total of 527 buses on 154 lines in Hamburg and its surrounding area. The majority of the Verkehrsbetriebe Hamburg-Holstein GmbH (VHH) fleet still drives with diesel or hybrid drive. But that was to change to procure exclusively electric buses from 2020 onwards. Until 2030, the conversion to electromobility will be completed in Hamburg.

The use of electrically driven buses helps to avoid environmentally harmful CO₂ emissions. The public transport operator VHH procured 60 electric buses for the Borough of Bergedorf to be charged with locally generated renewable energy. That is why one of the first electric bus workshops in Northern Germany was built here (2018). VHH has invested around €10 million in the modern workshop in

Bergedorf, which is specially designed for the maintenance and repair of electric buses. At the same time, the existing processes at the warehouse were adapted and the employees of VHH were trained to be fit for e-mobility.

The electric buses in Bergedorf require a modern charging infrastructure as well as smart charging management. VHH enters new territory at this point and has set itself the goal of creating clear technical foundations and standards as quickly as possible. To power the e-buses, the company decided to use the overnight charge system. This system could also help solve renewable energy storage problems. The electricity that could not previously be fed into the grid, finds an optimal application and can be used by VHH to operate the e-buses.

LESSONS LEARNT & CHALLENGES

- VHH tried charging with local renewable energy but could not reach the goal. This proved to be economically and energetically unsustainable, the costs for converting the existing wind turbines were too high, but they use renewable energy from the grid.
- VHH had planned to equip roof areas with photovoltaic systems to use local renewable energy, but were unsuccessful due to regulatory hurdles.
- VHH driving and duty scheduling system needs an update due to the new e-mobility; VHH is going through a tender process for a new duty scheduling system.
- VHH is working on a smart charging schedule as they are more familiar with the preconditions that vehicles must meet.

BENEFITS

- VHH is using renewable energy to charge its e-bus fleet
- They have experience in building infrastructure for charging and workshops
- They had the opportunity to play a key role in shaping the preconditioning of their buses in accordance with VDV 261, resulting in more range
- VHH has gained a lot of experience with the operation of e-buses, workshops and battery management

POTENTIAL FOR REPLICATION



FACTS & FIGURES

VHH owns and operates **670** vehicles for the 2022/23 timetable change, including **105** e-buses

124 charging points spread over **3** locations with a maximum charging power of **150** kw

Max. reach of **260** km per e-bus



READ MORE:



mySMARTLife
information booklet



THE ROBObus – HELSINKI HOPS ON

The automated electric minibus, with a passenger capacity of up to eight seats, produces no emissions and no noise. The robobus was operated at low speed (approximately 20km/h) in road traffic among other vehicles. It had been given an official public transport line number (94R and 26R) on its pilot route in Helsinki as part of mySMARTLife providing an urban mobility use case that contributed to life quality and modal shift away from private cars. It complemented the network of Helsinki's metropolitan public transit authority Helsinki Region Transport (HSL) and for the first time, an autonomous driving minibus had been incorporated into the Finnish mobility journey planner (Reittiopas).



READ MORE:

Autonomous
Electric Bus Pilot

LESSONS LEARNT & CHALLENGES

Automated vehicles have been heavily featured lately and their potential benefits in public transport have been noted. Robot buses as a complementary service in first/last mile mobility, replacing walking and cycling as well as serving people who are already using public transit, will only produce more CO₂ emissions.

The technology itself of automated vehicles and related systems as well as regulations considering automated operations are not yet mature enough to be fully uptaken by public transport authorities and operators.

The focus of near future pilots of automated vehicles in the EU should be in the development of the technology rather than trying to provide an incomplete mobility solution to serve an area.

The presence of passengers is generally slowing down the development as they have to be taken into account during the operation, and, among other things, new features cannot be tested and developed due to safety reasons.

As there is a lack of dedicated test areas for automated vehicles, cities play an important role in serving as a testbed for developing automated vehicle solutions both in densely and sparsely populated areas. Traffic safety authorities, legislators and other authoritative bodies also represent an important group that enables testing and development in a real traffic environment.

BENEFITS

- A fully automated bus service can provide more cost-effective public transport solutions compared to traditional human-operated solutions
- The overall service level and coverage of public transport can be potentially increased through automation
- With automated technology, safety can be increased while human-made errors can be decreased
- CO₂ emissions can be decreased while offering a public transport solution in areas where public transport could not be established due to low demand and high costs
- CO₂ emission can be decreased while offering a more demand-based solution and a better personal travel experience and reducing the need for personal cars
- Through the automation of public transport and other vehicles, services can be realised that we cannot even imagine today

POTENTIAL FOR REPLICATION



FACTS & FIGURES

5,185 passengers travelled with the robobus during the two pilots in Helsinki Kivikko and Kalasatama.

The robobus operated on weekdays from **9 AM** to **3 PM**.

At least one responsible person (operator/safety driver) was always on board.

The pilot aimed to test and operate the robobus in active road traffic, in two long-term pilots for the first time in Finland's history as part of the public transport system with official bus line numbers (94R and 26R).

The bus operated on public streets among other road users and followed predetermined approximately **1 km** long routes at the maximum speed of **18 km/h** like a tram on virtual tracks.

The bus ride was free, offering everyone the experience of driverless driving.

Passengers were mainly satisfied with the ride but complained about the relatively slow speed and harsh braking.



POWER TO THE PEOPLE

As the concept of "Smart People" is at the core of the mySMARTLife activities, involving the citizens in the urban transformation process is key.



"In Nantes, citizen dialogue is part of the city's DNA from policy design to public action. Various methods can be used to involve citizens in the city's transformation. Notably, to shape the future of energy transition and what it implies for the city and its inhabitants, a major public debate was conducted in 2016-2017. It drew attention to specific points such as IT that should be local and responsible."

Guillaume Chanson,
Nantes Metropole Project Coordinator



"Citizen engagement has played a vital role in carbon neutral actions in Helsinki for years. 'Living Labs' are gatherings of people who use and develop the end products, and these have been widely utilised as part of this project. For Helsinki, we aim to do it with the people for the people."

Maria Uusitalo,
mySMARTLife Lighthouse Lead,
City of Helsinki



"Communication with the population and the involved stakeholders forms a main pillar of Smart City development. Citizen exchanges and meetings have been organised in the heart of the neighbourhoods Schleusengraben and Bergedorf-Süd located in the district of Bergedorf, keeping the population informed and fostering exchange about the development of Smart City solutions."

Marie Finke,
Senate of the Free & Hanseatic
City of Hamburg - Senate Chancellor



"As part of the activities of the Energy Management Office, we carry out consultations when creating plans and strategies. The implementation of mySMARTLife and other EU international projects have taught us to create stakeholder groups for tasks not only when it is required by law, but also when it is not. We consult solutions with people interested in a given topic. The consultations enable the development of optimal solutions to specific issues thanks to the exchange of views and getting to know the citizens' point of view. At such meetings, completely new, innovative solutions arise."

Tomasz Bońdos,
Energy Management Office Coordinator,
Follower City Bydgoszcz



"A smart city is one that adapts to its citizens and prioritises their interaction and participation in decision-making. In Palencia, we have set up a Citizens Participation Website as part of mySMARTLife. It is a great way to engage with the residents, give them the opportunity to make their voice heard and to interact with us directly. Here, all the residents of Palencia can see legislative proposals such as the Sustainable Mobility Plan or the Climate and Sustainable Energy Action Plan from the Municipality and give us their opinion."

Mario Simón,
Mayor of Follower City Palencia



EXPLOIT IT ALL

In mySMARTLife, exploitation activities were focused on the industrial partners and their main solutions. In this section, the methodology applied and presented in the exploitation roadmaps is introduced.

METHODOLOGY AND RESULTS

Benefitting from its long experience in the exploitation for Smart Cities and Communities projects such as CITYFIED and REMOURBAN, Steinbeis Europa Zentrum (Steinbeis) offered an expert approach tailored to the structure of the mySMARTLife project, its resources and stakeholders.

The exploitation methodology applied was subdivided into seven main parts focusing on IP management, market uptake and knowledge transfer.



mySMARTLife EXPLOITATION PLAN

1st part - Setting the Exploitation and Market Deployment strategy: mySMARTLife used the first six months of the project to describe the different steps and activities related to exploitation (regarding IP management, exploitation workshops, knowledge-transfer events, the content of technology and market watch). With this first plan, the partners responsible for these activities (TECNALIA, ESADE and Steinbeis) could further exchange and arrange their activities to ensure synergies and coherence.

2nd part - Clarification of exploitable results (ERs) and guidance towards market deployment: In mySMARTLife, this part served as a backbone for the exploitation methodology. It consisted of three workshops organised between February 2018 and September 2019, which set the pace by indicating the next steps, checking and validating the progress and providing some feedback.

3rd Part - Analysis of the market: After using a survey (developed by ESADE) answered by the partners of the consortium and considering the available resources for the partners and the opinion of the project coordinator, the most interesting and promising ERs were selected:

- Smart Lighting
- Electric Power Tenant Supply
- Heat Demand Response Services
- Open Urban Platform

4th Part - Technology and Market Watch: Based on the selection of the key ERs, Steinbeis regularly prepared a catalog of existing cooperation profiles related to the technologies developed within mySMARTLife and distributed it to all project partners. During the last year of the project, Steinbeis developed a patent analysis of 12 ERs.

5th Part - Roadmap of ERs through feasible business cases: After providing a methodology, Steinbeis organised a workshop where the partners interested in the selected ERs worked together to develop a roadmap for increasing the impact to be reached by these ERs. Following this workshop, the partners further developed the roadmaps to use as guidelines for the exploitation of the selected ERs.

6th Part - Business plan: Identification and evaluation of business opportunities and initial business model(s): Following the clarification of ERs, the preparation of the market analysis and the preparation of exploitation roadmaps, ESADE with the support of Steinbeis provided the partners a methodology to draw preliminary business plans for the selected ERs. Based on the feedback from ESADE and Steinbeis, the partners developed sustainable business plans considering the business opportunities.

7th Part - Knowledge-Transfer Events: During the duration of mySMARTLife, several knowledge-transfer workshops and webinars with the Lighthouse Cities, the Follower Cities and the mySMARTLife Cities Network members have been organised.



SMART LIGHTING IN NANTES

Recent technologies offer the possibility to manage remotely lights, namely lampposts and individually adapt the amount of light to surrounding conditions enabling optimised use of the energy or monitoring maintenance needs. These Smart Lighting solutions create a substantial impact in reducing energy consumption and the emission of greenhouse gases.



READ MORE:

Smart Lighting
Concept

SMART TECHNOLOGIES PER PACK BELONGING

Benefitting from the implementation in Nantes, several lessons concerning public acceptance and behaviours could be raised to make smart lighting better suit public acceptance. Also, exchanges with the member cities of the mySMARTLife Cities Network enabled mySMARTLife project partner ENGIE to review its positioning and perspectives to better and faster meet the expectations of public entities.

ELECTRIC POWER TENANT SUPPLY IN HAMBURG

Local photovoltaic systems (or other sources) that are directly connected and located near customers are a very effective way to use and generate electricity. The short distances between production and consumption reduce transmission losses and reduce the load on the public power grid. Since the plants are built on existing buildings or other infrastructure, further landscape consumption is avoided. Tenant electricity supply could make an important contribution to climate protection and the reduction of CO₂ emissions. Currently, legal and regulatory frameworks as well as bureaucratic hurdles delay and complicate the widespread implementation of the concept.

CONCEPT OF ELECTRIC POWER TENANT SUPPLY

In mySMARTLife, EnergieNetz Hamburg (ENH) stressed the importance of a "European transformation". Some states in the EU have similar framework conditions with financial burdens on self-produced and self-consumed energy while others have chosen a different path. It would be helpful to compare the conditions and find out, which way is the most beneficial for a wide-scale spread of solar energy-based systems, which also help to reduce CO₂ emissions. The regional conditions must also be considered.





HEAT DEMAND RESPONSE SERVICES IN HELSINKI

Heat Demand Response Services are among the solutions that are improving the efficiency and flexibility of the district heating systems. The purpose of the heat demand response solution is to reduce the need for heat during peak consumption hours and to enable greater flexibility. The peak consumption times increase the costs and emissions of energy production - immediate energy production capacity (number of energy production plants) needing to be much higher than the average need - and if the peaks are cut, economical savings and emissions reductions are reached. With the consumption being shifted to a different time of day, the demand response solution flattens out peaks that would otherwise occur. This shift necessitates namely the use of the architectural foundations of a building, such as stonewalls, as heat reservoirs.

DEMAND RESPONSE IS THE OPTIMISATION BETWEEN PRODUCTION AND CONSUMPTION

In mySMARTLife, the partners Helen (HEN), Salusfin (SAL), Fourdeg (FOU) and VTT Technical Research Centre of Finland (VTT) worked together on the development of a large-scale concept of heat demand response services answering the technical requirements and addressing the energy provision matters. This concept, if more widely implemented, could shave peak heat loads and thus reduce heat generation costs. The potential benefits of heat demand response at the system level, and the options for implementation were evaluated in Helsinki. The ways of deployment were assessed from different perspectives using business scenario analysis. HEN, SAL, FOU and VTT worked together and implemented new smart thermostats to remotely regulate the temperature in residents' flats and office rooms considering energy consumption optimisation while keeping a high comfort. For further information, see also the previous chapter "Helsinki - Heat demand response".



READ MORE:

Heat Demand
Response

REPLICATE, REPLICATE

Replication is about the possibility for upscaling in the local contexts, and beyond the circle of mySMARTLife's cities. This way, any municipality interested in developing smart actions will find inspiring examples in mySMARTLife's initiatives and how the various challenges can be overcome, as they are in Bydgoszcz, Palencia, and Rijeka.



CITY OF BYDGOSZCZ

Bydgoszcz is in Northern Poland, facing the rivers Brda and Vistula. With its 353,215 inhabitants (2017), it is the largest city of the Kujawy and Pomerania region and the eighth largest in Poland. As a local authority government institution, Bydgoszcz has competences, deriving from the Communal Self-Government Act, to manage the technical and social infrastructure as well as safety and public order independently and to organise spatial and environmental issues within the city borders.

CONTINUOUS ENGAGEMENT TOWARDS A SMART FUTURE

The final smart actions that have been chosen for replication by the City of Bydgoszcz are categorised under mobility and city infrastructure and comprise **e-mobility, photovoltaics (PVs) on public buildings** and **smart lighting** systems.

As regards **mobility**, through its **Electromobility Development Strategy**, Bydgoszcz has been developing ambitious targets to be a sustainable and efficient city with a well-developed public transport network. Some actions included in the replication plan are:

- Increase of electric vehicle charging points (up to 210). The city plans it and the implementer is the designated Distribution System Operator.
- Increase of the share of electric vehicles: 30% of the vehicles used by the municipality by 2030.
- Equipping municipal companies with electric or gas cars
- Analysis of the use of zero-emission buses
- Creating a clean transport zone in the centre of Bydgoszcz
- Expansion of the ITS system
- Construction of bicycle roads and bus lanes

The **PV development strategy** focused on the installation of PV panels on education buildings (11 schools) and the distribution to public buildings (schools, institutions, transport stations).

Further to this action, Bydgoszcz has already introduced RES technology to over 40 public buildings and has plans for a more structured and strategic approach to the development of photovoltaics, as part of a bigger city plan, through the Regional Operational Programme: introducing photovoltaics in more public schools to minimise the energy cost, swimming pools, and selective waste collection points.

The City of Bydgoszcz also implemented an **intelligent lighting control system** which contained more than 185 lighting cabinets by the end of 2020, and approximately 9,500 LED light points. Reports on CO₂ reduction monitoring showed a 65% reduction in electricity consumption and CO₂ emissions. In addition, the use of new LED light sources with significantly longer service life has translated into lower lighting maintenance costs.

These replication actions are supported by **social acceptance campaigns**, which facilitate their implementation at every stage and increase their impact.

CITY OF RIJEKA

The City of Rijeka is the third largest city in Croatia with a population of 128,624 inhabitants. It is located on Kvarner Bay, an inlet of the Adriatic Sea, and is situated on an area of 44 km². Rijeka is an industrial, administrative, cultural and university centre of the region which serves about 400,000 inhabitants.

RIJEKA – A STEP BY STEP APPROACH TO REPLICATION

Rijeka has selected the most promising smart actions – based on the baseline assessment, the analysis and activities conducted during the implementation of the mySMARTLife project (PESTEL, Lighthouse Cities smart actions). During this process, consultations with the local stakeholders have been held.





← District Heating Biomass Power Plant Palencia

As a next step, the city developed smart actions further based on 3D modelling, energy system scenarios, a social acceptance campaign and study tours/mentoring activities in Nantes, Rijeka and Bydgoszcz. The replication plan is now completed, and the acquired knowledge has been applied, such as PESTEL, capacity building, interventions value chain, city model canvas, public procurement and innovative funding, as well as social acceptance.

The six smart actions Rijeka is focusing on are:

- Smart bus stations and smart traffic platform (Smart mobility)
- Smart public lighting
- Smart metering and smart meter data management (Smart grids)
- PV panels: energy storage and sharing (integration of renewable energy sources)
- Citizen involvement/participation in energy savings
- Open data geographic information system (GIS) & platform

CITY OF PALENCIA

The City of Palencia is in the Autonomous Community of Castilla and León (Spain). Palencia has a population of 80,000 inhabitants. Local industry is mainly in the automotive sector and agricultural production, but the main activities are related to the service sector. Palencia is also proud of its historical and cultural background as being the settlement of the first University in Spain.

TRANSFERRING SUCCESSFUL BIG SCALE SOLUTIONS TO A SMALLER SCALE

The strategic plan of the city and the SEAP (Sustainable Energy Action Plan) of Palencia included in the Covenant of Mayor's initiative constitute the initial framework of the replication plan of Palencia. The innovative methodological approach of mySMARTLife and the description of the decision, consultation, dissemination and execution processes that Lighthouse Cities have

reported on their experience in similar actions, have helped Palencia to rectify the processes to be followed and, in this way, to be more efficient in the planning and execution of their actions.

Thanks to mySMARTLife, Palencia's replication actions have become a template to replicate for other Spanish municipalities, such as Vitoria and Burgos, who are exploring topics like energy efficiency.

Palencia is currently focusing on four main topics:

- **District Heating:** In collaboration with Palencia eco-energies, the Palencia city council will replace the gas and fuel heating and sanitary water systems of 15 municipal buildings by connecting them to a heat network generated in a biomass and solar energy plant that Palencia eco-energies is building.

- **EV for the municipal fleet:** eleven vans and four electric motorcycles have replaced conventional vehicles used by municipal services since September 2019
- **Smart Citizen Platform:** 9 of the 11 modules developed for the platform are in service and help municipal employees work more efficiently and provide citizens with the data and information they are interested in: Municipal GIS, Spatial Data Infrastructure, LIDAR Mobile Mapping, Smart Urban Planning, Smart Tourism, Energy Efficiency of Smart Buildings, Citizen Participation Platform, Application of Urban Services, Smart Water Metering, and Smart Garden Irrigation. The modules for Smart Urban Mobility are being tested.
- **Energy monitoring of buildings:** monitoring since March 2020 and smart lighting

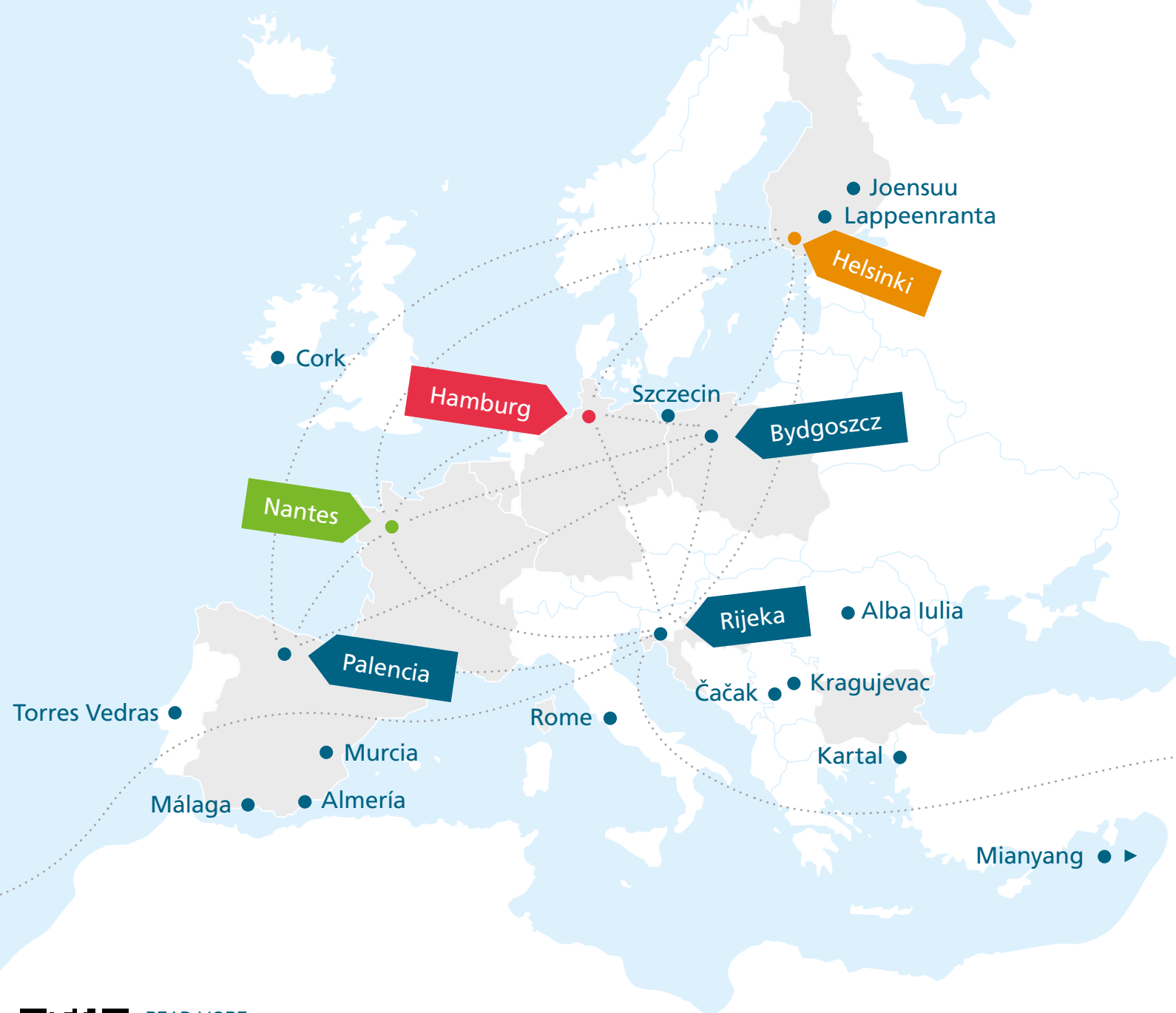
mySMARTLife CITIES NETWORK

To spread the knowledge, we share the experiences made in the mySMARTLife demonstration cities within the mySMARTLife Cities Network.

Cities from Europe and beyond had the chance to benefit directly from the mySMARTLife findings and to learn from the experience of the Lighthouse Cities by joining the mySMARTLife Cities Network. Together, they build up a strong network of cities to make their cities smarter and more sustainable.

The following 16 cities from Europe and beyond build up the mySMARTLife Cities Network:

- Joensuu (Finland)
- Cork (Ireland)
- Szczecin (Poland)
- Funchal (Portugal)
- Torres Vedras (Portugal)
- Alba Iulia (Romania)
- Murcia (Spain)
- Málaga (Spain)
- Almería (Spain)
- Rome (Italy)
- Kartal (Turkey)
- Lappeenranta (Finland)
- Čačak (Serbia)
- Mianyang (China)
- Medellín (Colombia)
- Kragujevac (Serbia)



The mySMARTLife Cities Network representatives were invited to take part in workshops as part of the regular partner meetings and study tours to the demonstration sites in Nantes, Hamburg and Helsinki.



READ MORE:

mySMARTLife
Cities Network

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