

INTERREG MED Programme

2014-2020

ESMARTCITY

Enabling Smarter City in the MED Area through Networking

(3MED17_1.1_M2_022)

Priority Axis 1. Promoting Mediterranean innovation capacities to develop smart and sustainable growth

Specific Objective 1.1 To increase transnational activity of innovative clusters and networks of key sectors of the MED area

WP2 – Project Communication

Activity 2.9 – Coordination with the Interreg MED Programme Communication Strategy

Deliverable 2.9.10 – Study Visit in Copenhagen

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Dissemination Level		
PU	Public	X
PP	Restricted to Programme Partners and MED Programme	
RE	Restricted to a Group defined by the Partnership and MED Programme	
CO	Confidential, only for members of the partnership and MED Programme	



1 Contents

1	Contents	2
2	Introduction	3
3	Study Visit II Overview	3
4	Visit to DTU Risø Campus	4
5	Visit to Svalin Community	7
6	Visit to EnergyLab Nordhavn	9
7	Visit to Doll Living Lab	12
8	Lessons Learnt	14



2 Introduction

The ESMARTCITY project enrolls into pilot testing activities associated with the Smart City paradigm and more specifically application domains of Smart and Energy Efficient Buildings, and Smart Public Lighting. In furthermore addresses the need for policy change in MED cities related to innovation and the Smart City paradigm.

In this context, it is envisaged that the ESMARTCITY project will perform two Study Visits in cities that can be characterized as advanced in the Smart City theme in an effort to learn from their good experiences. These cities will play somehow the role of mentor for the project activities as the ESMARTCITY consortium is expected to study their experience, integrating it into its own pilot testing activities, and being more fruitful towards transfer and capitalization in the wider MED area.

The two cities envisaged in the Application Form are Cologne, Germany and Copenhagen, Denmark. Project Steering Committee has taken a decision to substitute Cologne, Germany with Nice, France. In this context the two study visits were performed in Nice, France and Copenhagen, Denmark.

The present deliverable provides information about the second Study Visit in Copenhagen, Denmark.

3 Study Visit II Overview

The 2nd Study Visit was performed on June 6-7, 2019.

On June 6, 2019 the ESMARTCITY consortium visited:

- DTU Risø Campus in Roskilde
- Svalin Community

On June 7, 2019 the ESMARTCITY consortium visited:

- EnergyLab Nordhavn
- Doll Living Lab in Glostrup



4 Visit to DTU Risø Campus

The Center for Electric Power and Energy (CEE)¹ of the Department of Electrical Engineering² of DTU (Danmarks Tekniske Universitet)³ was established in 2012. It addresses energy issues supporting the transformation of the energy system via a range of new technologies and solutions, new knowledge, theory and methods. Its mission is to provide cutting-edge research, education, and innovation to meet the future needs of society regarding a reliable, cost-efficient, and sustainable energy system based on renewable energy.

DTU CEE strategic objectives include

- Maintaining its leading academic standing in Europe in the areas of electric power and energy
- Safeguarding sustainable growth meeting the needs for research, education and innovation within electric power and energy
- Achieving excellence in collaboration
- Educating 100 top-quality, research-based engineers per year meeting the increasing need for professionals in the energy field
- Presenting a balance profile between methodological approach and applied research with high impact
- Being a dynamo for innovation in the energy technologies field including smart grid and smart energy
- Being a strong organization within DTU

Its research themes include

- Digital Energy Solutions
 - Consumers, services and business models
 - Data-driven energy solutions
 - Digital solutions in T&D grids
 - Control center tools
- Interconnected Energy System
 - Integrated Energy Infrastructure
 - Smart energy in smart cities and communities
 - Energy market design and flexibility

¹ <https://www.cee.elektro.dtu.dk/>

² <https://www.elektro.dtu.dk/>

³ <https://www.dtu.dk/>



- Optimized HVDC and transmission grid
- Optimized Electric Energy Technologies
 - Novel equipment concepts in power systems
 - Cost-effective wind power
 - Storage and electric vehicle integration
 - Prosumer response technologies

With a total number of about 100 employees, DTU CEE is located at two campuses at Lyngby and Risø, with different testing facilities. ESMARTCITY consortium visited the Risø campus.

CEE strengths lie in smart grids with market based flexibility and demand response, next generation energy markets, novel methods for stability and operation of power system, electric vehicle integration technology.

PowerLabDK⁴ represents a world class experimental platform offering testing, technology development, educational training, and demonstration of energy technologies. It is deployed in four sites including Bornholm island, a renewable energy island, model of a future energy system, renewable energy island isolated and easy to monitor. At Risø campus, PowerLabDK large-scale test is located.

The PowerLabDK Energy Systems Integration Lab (SYSLAB) comprises

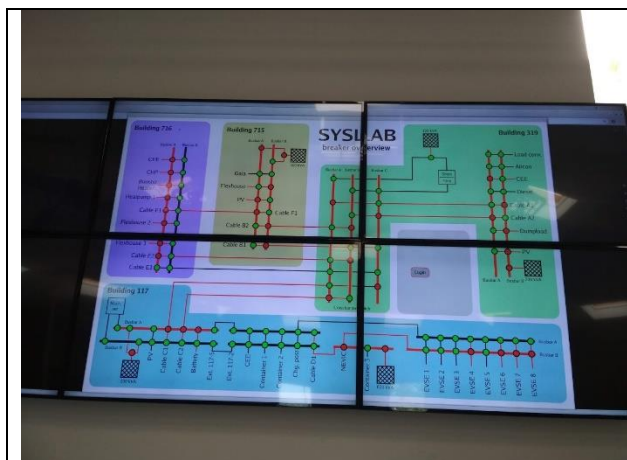
- 400V grid
- Renewable energy units (wind turbines, PV panels)
- Converter
- Controllable loads
- Power storage battery
- Embedded computing & flexible communication platform
- Connection to PowerFlexHouse facility
- Connection to Electric Vehicle Interoperability Center

It may be used for interactions between components in a heterogeneous system, system control concepts and communication. SYSLAB is in the process of being extended to integrate heat pump, rock storage, solar thermal, smart office, storage tank, lab heating, P2G / G2P, hybrid gas heat pump.

The Electric Vehicle Lab is associated with Europe's first commercial use of electric vehicles offering services to the energy market (V2G).

⁴ <http://www.powerlab.dk/>







5 Visit to Svalin Community

Svalin is a community of 20 households in Trekroner, Roskilde, Denmark. The community, both houses and shared infrastructure, accommodate energy relevant infrastructure, such as PV panels, geothermal heat pump, and electric vehicles. The community as a whole is energy positive, producing more energy that it consumes.

The community enrolls into the Energy Collective⁵ project. The project discusses direct sharing and trading of electric energy among peers without the intervention of the national grid. This approach drives towards more customer-centric energy market. Svalin community provides a real-world experiment for the project. The project approach involves consumer centric electricity market relying on energy collectives and peer-to-peer setups, and proposes blockchain technology as the backbone support technology.

⁵ <https://the-energy-collective-project.com/>





6 Visit to EnergyLab Nordhavn

The EnergyLab Nordhavn⁶ is a project developed between 2015-2019 at Copenhagen's Nordhavn offering a full scale smart city energy lab. The purpose is to demonstrate how electricity and heating, smart energy-efficient buildings, electric transport can be integrated towards an intelligent, flexible and optimized energy system.

The project is supported by Energy Technology Development and Demonstration Programme⁷ and it relies on an ecosystem of collaborating partners: DTU, City of Copenhagen⁸, CPH City and Port Development⁹, HOFOR¹⁰, Radius¹¹, ABB¹², Danfoss¹³, Balslev¹⁴, Nerve Smart Systems¹⁵, Glen Dimplex¹⁶, MetroTherm¹⁷, and PowerLabDK.

Different pilots are demonstrated at the site of the Nordhavn towards achieving an integrated energy system:

- A large battery is integrated into the power grid supporting supply of electricity during peak loads and utilizing power from renewables such as wind turbines and PV panels
- At Copenhagen International School the largest set of solar panels in Nordhavn makes it a large prosumer. Energy flexibility of the building is achieved via building management system
- District heating in combination to a heat pump offers also hot water use. A storage tank is used to provide flexibility
- Twelve apartments are equipped with advanced home automation systems and provide their data to demonstrate contribution of flexible households to energy system optimized operation

⁶ <http://www.energylabnordhavn.com/>

⁷ <https://ens.dk/ansvarsomraader/forskning-udvikling/eudp>

⁸ <https://www.kk.dk/>

⁹ <https://byoghavn.dk/>

¹⁰ <https://www.hofor.dk/privat/>

¹¹ <https://radiuselnet.dk/>

¹² <https://new.abb.com/dk>

¹³ <https://www.danfoss.com/da-dk/>

¹⁴ <http://www.balslev.dk/forside/>

¹⁵ <https://nervesmartsystems.com/>

¹⁶ <https://www.glendimplex.dk/>

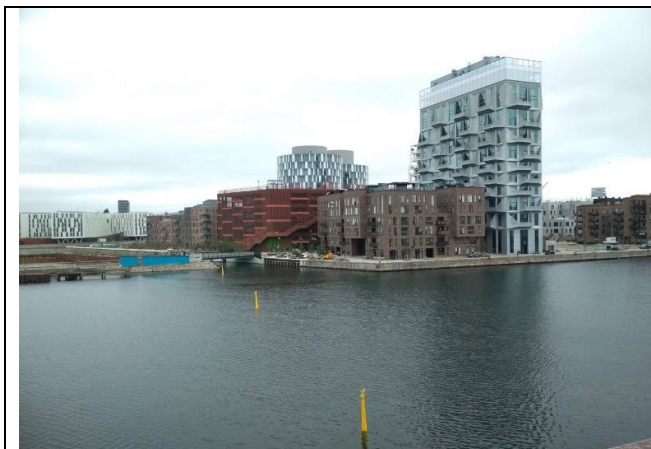
¹⁷ <https://www.metrotherm.dk>



- At harbor park thermal heat capacity is added as a flexible element of the energy system by short-term reductions of interruptions of district heating supply without influence to the customer comfort levels
- Smart control of heating systems in 85 apartments provides extra flexibility
- Water heaters in a set of town houses provide flexibility shifting between district and electric heating
- A large heat pump at the cruise terminal is used as a flexible element on the electricity market and for charging cruise ships
- Energy.Hub is a co-working platform for companies in the field of urban development and energy solutions

All these interventions drive towards Denmark's national goal of becoming totally independent from fossil fuels by 2050.





7 Visit to Doll Living Lab

Doll Living Lab¹⁸ is a leading institution of its kind in Europe for intelligent lighting and Smart City services. Its purpose is to act as a bridge between the industry, academia/research and the public sector towards development of sustainable cities through technological innovation.

Its main focus is on offering demonstration and testing of the latest solutions related to Smart Cities in a number of sectors such as Digital Infrastructure (City WiFi, Mobile/GSM Networks, Low Power Wide Area Networks), Outdoor Lighting (Intelligent solutions, Light management systems, built-in Smart Technologies), Environmental Monitoring (Air Quality, Noise Pollution, Temperature), Waste Management (Sensor-based systems, End-to-End cases), Parking and Mobility (Sensor based parking systems, Electric Vehicle Charging Systems, Traffic counting systems, Autonomous Vehicles). The objective is to offer an integrated approach towards facing these challenges instead of traditional silo approach.

Doll is formed by a consortium of DTU, City of Albertslund¹⁹, and GATE21²⁰, receiving funding from local, regional, national and European sources. A number of providers of Smart City IoT devices, providers of digital networks and IoT platform environments, and knowledge partners have joined forces to enable testing and demonstration cases.

Doll work is taking into account the following elements

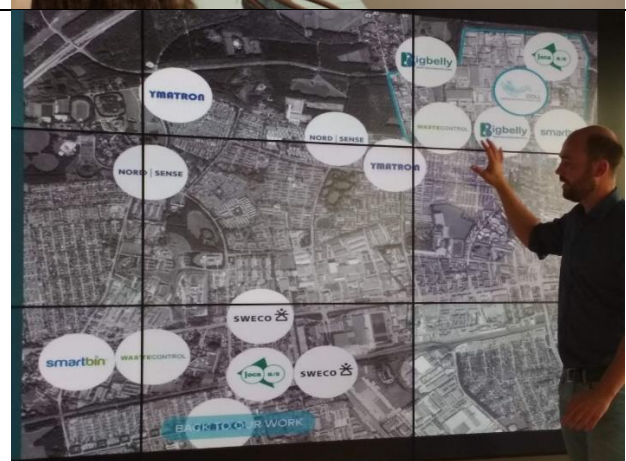
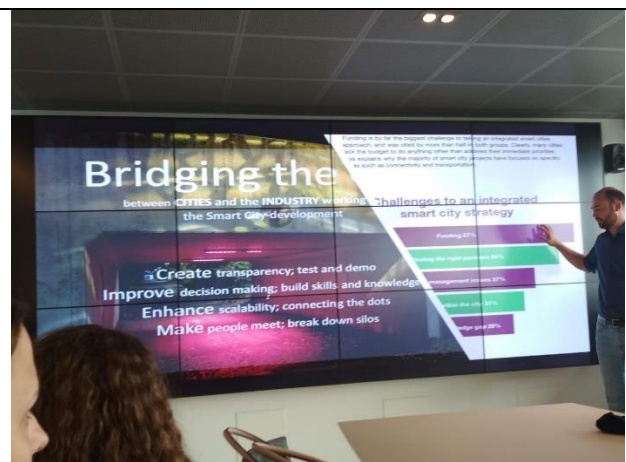
- Urban development comprising Sustainable Urban Planning, Local climate strategies, Action plans, and Liveability
- Sustainability comprising UN Development goals, Energy effectiveness, and Resource optimization
- Ecosystem between industry and knowledge stakeholders consisting of Smart City Cluster Denmark, Open & Agile Smart Cities, The Academy for Smarter Communities
- Digitization and IoT including Smart City concept, IoT, Big Data, Digital Infrastructures, Digital Solutions
- Usecases on real scale being real life, plug and play, practice oriented, of system perspective, tested and demonstrated

¹⁸ <https://doll-livinglab.com/>

¹⁹ <https://albertslund.dk/servicemenu/english/>

²⁰ <https://www.gate21.dk/>







8 Lessons Learnt

Study Visit in Copenhagen provides useful insight to the ESMARTCITY consortium as it brought the partners against innovative solutions that can change the life of the citizens and enhance their well being, while addressing the issue of sustainable development and growth. Some of the lessons learnt include the following:

- There are different open research questions with reference to specific application domains in Smart Cities, such as Smart Energy. These questions cover a range of aspects on energy efficient building flexibility, grid services, design of energy infrastructure, fuel-shift technologies, storage, future heating solutions, electric vehicle flexibility. The way that technology will proceed in answering there questions will largely determine the way that



the Smart City concept will evolve in the near future at least with reference to Smart Energy domain.

- The cities should follow a unifying approach with reference to the Smart Energy domain trying to combine different solutions ranging from Renewables, Storage, Smart and Efficient Buildings, Smart Lighting, Electromobility, Converters, District Heating, and trying to apply new energy system paradigms.
- Energy collectives could provide a new paradigm for energy systems towards a more customer-centric energy market. With citizens become energy prosumers rather than simply consumers direct sharing and trading of electric energy among peers without intervention of the national grid, supported by such technologies as blockchain, could alter the way that energy is produced and consumed in cities.
- The idea of Smartness for a city is relative. What determines what is smart for a city is a combination of the existing infrastructure and the existing ecosystem that can cooperate in order to provide new and innovative solutions and applications at city level.
- Technological innovation can significantly increase the flexibility with reference to different parameters of city energy systems. Both power sector and heat sector can be quite flexible without loss of comfort for people, leading to an intelligent and optimized energy system at city level.
- Traditional idea of facing the different Smart City application domains independently from one another, i.e. in silos, is not necessarily producing the best solutions for the city and its citizens. There is a need to address the needs of the cities in their entirety and following a holistic approach, breaking the silos, and facilitating systems and solutions that taking into account existing infrastructure can offer new innovative services for more than one application domains.
- The idea of a City System Platform that can accumulate information and data from the underlying systems, implementations, applications employed for different city application domains can facilitate the role of the city in decision making, system operation and maintenance, following results and reporting, building action plans and enhancing city policies and strategies.

