CERIS : Civil Engineering Research and Innovation for Sustainability

SusCity – Urban Data Driven Models for Creative and Resourceful Urban Transitions

Summary

Cities are the center of economic and societal development and today over half of the world's population resides in cities, and up to 80% is projected for 2050. Cities generate more than 80 percent of global GDP, consume 75% of natural resources and generate 50% of global waste. Resource efficiency is therefore key for cities to contribute to local and global sustainability and offer at the same time high potential for financial savings.

This project focuses on developing and integrating new tools and services to promote urban resource efficiency with minimum environmental impacts while contributing to promote economic development and preserving actual levels of reliability.

Dispersion of agents producing data at urban level leads to mixed results in applying indicators in different environments and sometimes with little gain in urban performance. This project will advance the science of urban systems modeling and data representation supported by urban "big data" collection and processing.

A major broad impact consists on advancing emerging business models for energy and mobility solutions in a rich data and ICT driven context, with increasingly customized alternatives to the citizen, empowering him to an active role in urban design. The use of renewable energy contributes to "net-zero energy" cities enabling new business models associated with the concept of energy supply and demand "aggregation", which is the process of linking small groups of industrial, commercial, and residential customers into a larger virtual power unit to make them "visible" from the electric system point of view. An effective management of "aggregators" requires advanced models and distributed control systems, with fine time and spatial resolution due to challenges linked to "intermittency" and "variability" of renewables and also the dynamics of energy consumption (consumer behavior) in urban functions such as mobility or housing.

The project intends to catalyze the generation and proliferation of scalable urban interventions through the development and deployment of a multi-dimensional Urban Systems Simulator and Dashboard (USD). While the visualization and communication of data is essential, urban models will provide the ability to envision alternative scenarios and new services and products, founded on rigorous urban science.

The team proposes to couple a multi-dimensional simulation with physical urban modelling and data collection machine to serve these objectives.

This project is structured in six work packages:

WP 1 – Urban Analytics: The main objectives are to develop and apply a new suite of models on energy consumption, material use and mobility needs, and cross implications of the material-energy nexus through the embodied energy of materials.

WP 2 – Information Services and Data Processing Platform: The objective is to develop an ICT platform to support the USD, by collecting and managing data from the city environment, processing it in a standard format enabling its exchange in different layers and providing its visualization, using an open architecture, common standards and protocols and well defined interfaces.

WP 3 – Smart Building Solutions: The objectives are the development of decision-aid tools for different stakeholders in the buildings sector to help them adopt more efficient energy practices. These include predicting, monitoring and controlling buildings performance; innovating buildings design, construction, and maintenance; recommend new policies, regulations and practices focused on the Southern European reality.

WP 4 – Innovative Mobility Solutions: The main goal is to develop innovative mobility solutions to promote energy, environmental and economic efficient transport chains (door-to-door).

WP 5 – Smart Grid Based Services: The goal is to develop integrated modelling, control and assessment tools to support the design and implementation of MG and MMG management strategies integrating micro and mini-generation technologies, distributed storage solutions, EV (including V2G mode) and load management techniques (following the demand-side management strategies developed in WP3).

WP 6 – Urban Competitiveness Lab: The goal is to create an urban competitiveness lab where specific outcomes towards urban sustainability take place with multiple stakeholders (Municipality, public agencies, private partners and academia), organized in an Advisory Committee and where policy recommendations to promote city competitiveness are tailored.

Project Reference

MITP-TB/CS/0026/2013

Leading Institution

INESC-TEC – Instituto de Engenharia de Sistemas e Computadores Tecnologia e Ciência (Portugal)

Partners

MIT – Massachusetts Institute of Technology (United States of America), ADENE – Agency for Energy (Portugal), CML – Câmara Municipal de Lisboa (Portugal), EDP Distribuição (Portugal), FCUL – Faculty of Sciences of the University of Lisbon (Portugal), IBM (United States of America), IDMEC-IST – Instituto de Engenharia Mecânica do Instituto Superior Técnico (Portugal), IST – Instituto Superior Técnico (Portugal), ITDS (Portugal), LNEG – Laboratório Nacional de Energia e Geologia (Portugal), NOVABASE (Portugal), R&D Nester (Portugal), UC – University of Coimbra (Portugal), UMinho – University of Minho (Portugal)

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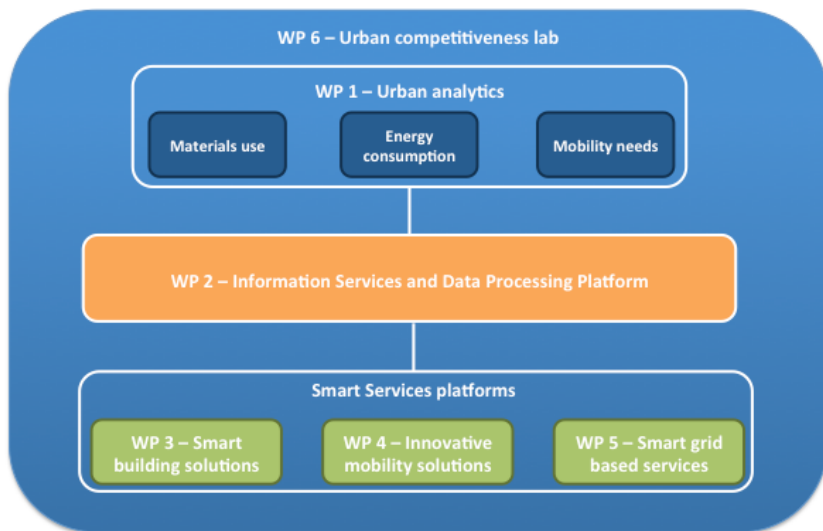
Funding

Figure 1. Project structure.

Period

2015-2018

Total

1 253 031.00€

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50 000.00€

Project Website

is4.tecnico.ulisboa.pt/projects/sus
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