Hybrid approach for large-scale Energy Performance estimation based on 3D city model data and typological classification

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Extended Abstract

"Smart-cities" is certainly one of the current hottest topics in the information technology research area. Many definitions exist in current literature (Fenger, 1999), (Giffinger, 2007), (Giffinger, et al., 2010), (Washburn, et al., 2009) and all of them have a factor in common: the existence of an underlying ICT infrastructure that connects the physical infrastructure of the city with web 2.0 capabilities and enables innovative solutions for city management, in order to improve sustainability and the quality of life for citizens. Urban metropolises, despite covering only 2%, of the Earth's surface are the lead contributors of greenhouse gas production accountable for around 80% of the oil, gas and coal world consumption. Therefore, energy consumption efficiency of residential houses is an important factor having an impact on the overall city ecosystem and quality of living and it would greatly benefit from an ICT-enabled smart approach. In fact, increasing building energy efficiency would not only mean a cut-down in energy expense for citizens, but would also have an impact on the overall production of CO2 at energy plants and also, even if less intuitively, on the city air pollution.

In this context, 3D city modelling can be an essential tool (Prandi et al.2014) for energy planners and municipal managers, enabling them to perform accurate diagnostics of the existing building stock, and to plan low-carbon urban energy strategies. Indeed on top of that several smart services can be designed in order to support the increase of building energy efficiency and improve the city quality of life.

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The paper will illustrate the concept and the development of smart services, which allow the assessment of the energy performance of all the residential buildings in a city, its validation and visualization in a format accessible to citizens and urban planning experts alike.

The development of these services is part of the scope of the SUNSHINE[1] (2013) project (Smart UrbaN ServIces for Higher eNergy Efficiency), that aims at delivering innovative digital services, interoperable with existing geographic web-service infrastructures, supporting improved energy efficiency at the urban and building level.

The work focuses on the preliminary results for the Building Energy Performance Assessment. The aim is to evaluate the accuracy and strength of a new approach that automatically calculates the heating demand of whole district areas, modelled in 3D. The service provides an automatic large-scale assessment of building energy behaviour and the visualization of the assessed information using the so called Energy maps which will be made publicly available via a 3D virtual globe interface based on WebGL.

The presentation of the energy maps in a 3D spatial-geographic framework, leveraging on interoperable OGC standards, allows citizens, public administrations and government agencies to evaluate and perform analysis on the building energy performance data, and provides a global perspective on the overall performance conditions of the residential building stock as well as on its fluctuations on the neighbourhood and block scale.

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[1] http://www.sunshineproject.eu