Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 136 (2017) 85–90

Energy Procedia

www.elsevier.com/locate/procedia

4th International Conference on Energy and Environment Research, ICEER 2017, 17-20 July 2017, Porto, Portugal

An energy information system for retrofitting smart urban areas

Álvaro Sicilia[a]*, Leandro Madrazo[a], Marco Massetti [a], Fabian López Plazas[a], Eric Ortet[a]

[a]*ARC, La Salle Engineering and Architecture, Ramon Llull University, Barcelona, Spain*

Abstract

This paper presents the ENERSI platform, an energy information system that provides advanced energy services by means of integrating energy related data from multiple domains and formats using Semantic Web technologies. The platform services can provide qualified information at different scales – from building to district, city and region – to different kind of users – such as building owners, city planner, energy agencies, architects, contractors and consultants – to take decisions aimed at improving the building energy performance in their respective decision-making realms.

© 2017 The Authors. Published by Elsevier Ltd.
Peer-review under responsibility of the scientific committee of the 4th International Conference on Energy and Environment Research.

Keywords: energy information systems, semantic web, smart cities, energy efficiency, energy services

1. Introduction

One of the main objectives of a smart city is to improve the energy performance of buildings. Buildings are responsible for 40% of energy consumption and 36% of carbon emissions in the EU [1]. In order to adopt the appropriate measures to improve the energy efficiency of the building stock, the different agents involved in building refurbishment – among them, owners, energy providers, facility managers, design teams, local administrators and private developers – need to have reliable data that enables them to assess the actual performance of buildings in order to analyse them and draw meaningful conclusions to help make better informed decisions.

Nowadays, energy related data is dispersed in numerous proprietary and open data sources and it might have different levels of quality. These data are continuously changing, since cities are dynamic systems in continuous

* Corresponding author. Tel: +34 93 290 24 49
E-mail address: asicilia@salleurl.edu

1876-6102 © 2017 The Authors. Published by Elsevier Ltd.
Peer-review under responsibility of the scientific committee of the 4th International Conference on Energy and Environment Research.
10.1016/j.egypro.2017.10.291

transformation. Therefore, continuous access to reliable data sources from multiple domains and applications and their integration are fundamental in the creation of an energy information system. Having information about the actual performance of buildings is not only necessary to upgrade the building stock, but also to implement policies at different urban scales, and to strengthen local business activities through the exploitation of the integrated data. For example, manufacturers of insulation materials might be interested to know in which city districts they could market their products.

In recent years, several energy information systems have been developed which make use of multiple data sources. The REEGLE project has collected energy-related data from different sources (e.g., the World Bank and International Energy Agency among others) [2]. The data integrated by REEGLE are based on statistics of building properties and building performance at the national level. These kinds of data are important for decisions taken at a political level. However, more detailed data is needed to get to know the energy performance of buildings within an urban area.

In the INSMART project, a GIS-based energy information system has been developed which includes data obtained through door-to-door surveys. Furthermore, smart meters have been used to simulate the energy demand for a dozen building typologies in four cities [3]. Gathering survey and monitoring data requires a high amount of resources, so it is difficult to scale up such data acquisition process to a whole urban area. Using building typologies can help to assess the energy performance of buildings that have not been surveyed or monitored. However, the accuracy of the energy simulation for a building type is not same as that which could be achieved by making a simulation for each building.

These limitations can be overcome, and the accuracy of the energy data of buildings can be increased, provided that building data is available. For example, the energy performance certificate (EPC) of buildings provides information about the efficiency of a dwelling or building as well as recommendations to improve it. EPCs are determined from the physical characteristics of the buildings by means of a simulation tool. Even though the simulation is done with simplified methods, the results are much more accurate than those obtained from building typologies or statistical data. Nowadays, EPCs data are increasingly available as a result of the adoption of the Energy Performance of Buildings Directive 2010/31/CE [4] which requires EU member states to facilitate residents with the information about the energy efficiency of their dwellings.

In the RÉPENER project (http://arc.salleurl.edu/repener), a semantic energy information system named SEÍS (http://www.seis-system.org) was created which integrated data from EPCs, building monitoring data, and geographic data using Semantic Web technologies [5]. SEÍS provides specific services to building owners, designers, facility managers, and energy experts for buildings located in Catalonia. At the time of developing RÉPENER, the number of certificates that the Catalan Institute for Energy (ICAEN) could facilitate was not very large (only around 200 certificates). Besides, the information contained in the EPCs was not as comprehensive and detailed as it is nowadays.

Following the results achieved in RÉPENER, the objective of ENERSI, a project co-funded by the Spanish National R&D Plan 2014-2017, has been to design and implement a platform which facilitates access to energy information to organizations and customers by means of ad-hoc services customized to users' needs. The ENERSI platform integrates data sources from multiple domains and formats to provide advanced energy services using Semantic Web technologies. The platform provides quality information to enable different users' types to improve the decision-making process in their respective realms. Currently, the ENERSI energy information system contains data from over 400,000 EPCs issued in Catalonia, enriched with data from the Spanish cadastre, geographical data, census sections, technical building inspections, catalogues of refurbishment measures, and building renovation assessment tools. Even though the current implementation is circumscribed to the Catalan territory, these services can be scaled up to the whole of Spain and even to other European countries.

2. The ENERSI platform: an energy information system

ENERSI is an energy information system (EIS) that provides advanced services to different agents by integrating data from multiple domains and format; services that can be tailored according to particular needs of users. The data that potential customers of the platform's services provide is enriched with the data already contained in the platform. One of the main challenges of the ENERSI platform is to integrate data which are usually stored on proprietary databases that have been designed for specific applications and purposes and whose reuse or sharing is difficult. Furthermore, data structures are usually known only by the developing team who created the database or by the data owner who is usually the domain expert. Thus, the schemas of the data structure are not generally available, and if

Download English Version:

https://daneshyari.com/en/article/7917873

Download Persian Version:

https://daneshyari.com/article/7917873

Daneshyari.com