SUNSHINE – Smart UrbaN ServIces for Higher eNergy Efficiency

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1 ABSTRACT

SUNSHINE – "Smart UrbaN ServIces for Higher eNergy Efficiency" delivers innovative digital services, interoperable with existing geographic web-service infrastructures, supporting improved energy efficiency at the urban and building level. Specifically, SUNSHINE delivers a smart service platform accessible from both a web-based client and from an App for smartphones and tablets. In parallel to technical integration a key standardisation activity will also result in the definition of the extension of existing data model (CityGML) through the definition of a specific Application Domain Extension (ADE) on building energy behaviour, something very important for the pilots within SUNSHINE and its large-scale uptake beyond current locations.

SUNSHINE is a European funded project in the competiveness and innovation framework program for the duration of three years with 16 partners from ten countries and it started in February 2013.

2 INTRODUCTION

Energy consumption in urban areas is increasingly recognized as an important source of global greenhouse gas emissions. Cities account for approximately two-thirds of global primary energy consumption and 71 % of energy-related greenhouse gas emissions (IEA 2010). Energy demand patterns vary widely from city to city and across countries. Today, energy use in residential, commercial and public buildings accounts for 40 % of total global final energy consumption (UNEP 2007). There is a huge energy saving potential in this sector and significant scope for adopting more efficient technologies and services in buildings (IEA 2010).

Energy certification of buildings is a key policy instrument for reducing the energy consumption and improving the energy performance of new and existing buildings. It should provide information that may increase demand for more efficient buildings, thereby helping to improve the energy efficiency of the building stock in the country (ARKESTEIJN, K., VAN DIJK, D. 2010).

SUNSHINE – "Smart UrbaN ServIces for Higher eNergy Efficiency" is a step towards this policy and is a tool to improve the energy efficiency of buildings and urban areas. This paper presents the young European funded project SUNSHINE, which will develop a smart service platform for planners and public administration to extract analytical indicators necessary for the definition of energy saving policies for the existing public buildings asset and to define energy pre-certification mechanisms. Further, building managers can use SUNSHINE to optimize energy use of large-scale optimization of public illumination network. SUNSHINE uses three scenarios which lead into a smart service platform that will be accessible from web-based client and from an App for smartphones and tablets. An important aspect of the SUNSHINE project is the use of a scalable approach, based on CityGML standard format, which makes a simultaneous representation of the energy balance at architectural and urban scale possible. CityGML is an open data model and XML-based format for the storage and exchange of virtual 3D city models particularly suited to applications.

The SUNSHINE technology will be the result of the customization and integration of existing software components developed by other EC-funded projects focusing on smart-city technologies, including BRISEIDE, i-SCOPE and i-Tour (DE AMICIS, R., CONTI, G., PRANDI, F 2010).

In the SUNSHINE project eight work packages are planned (figure 1) which are basically structured in preparatory work, technical development and the deployment of the pilots. Awareness, networking and dissemination will accompany the project over the entire duration. These activities include the involvement of stakeholders, information linkage with Smart City Portfolio working group and other related EU funded projects. A further aim of this work package is the organisation and coordination of user meetings, seminars, workshops at international, national and local level to be hosted by the various partners of the consortium.

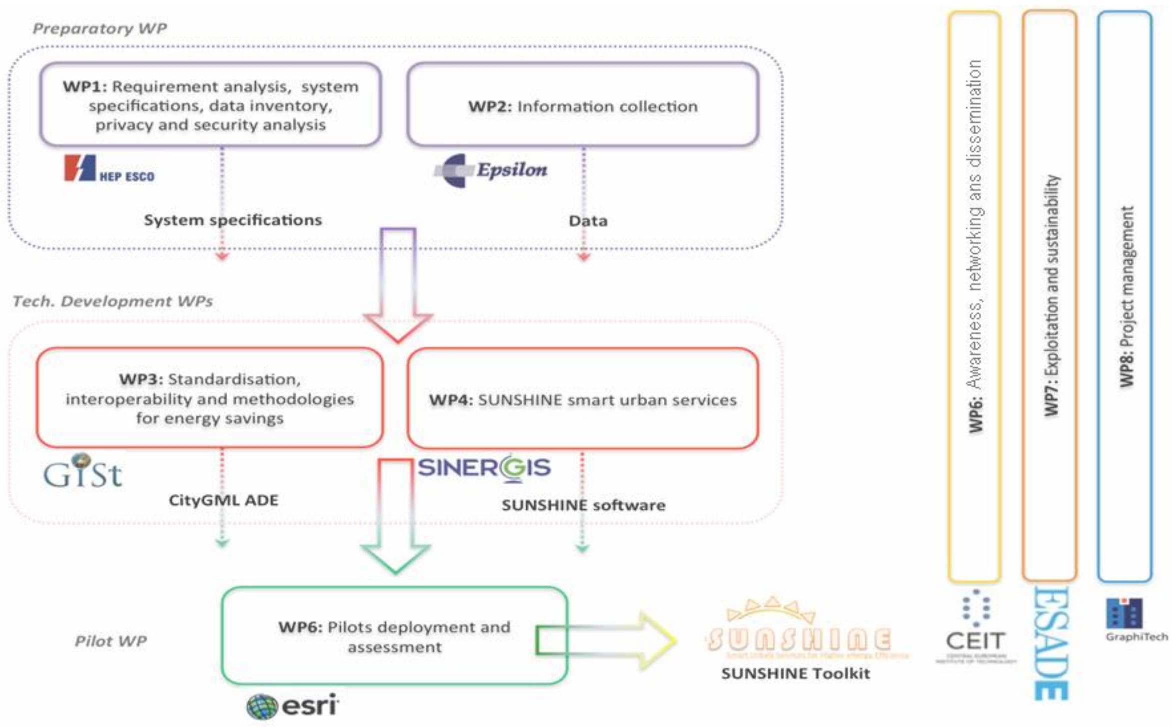

Fig.1: Overview of the work packages (source: GraphiTech)

3 SUNSHINE SCENARIOS – PILOTE USER CASES

Within the SUNSHINE project three different scenarios are planned which will be a desktop-based user-friendly 3D geobrowser supporting OGC standards. In particular, the SUNSHINE platform will allow the three following scenarios.

3.1 Scenario 1: Assessment of energy performances and electronic energy pre-certification

The automatic large-scale assessment of building energy behavior based on data available from public services (e.g. cadastre, planning data etc.) which are involved in the project via letter of commitment. The information on energy performances will be used to automatically create urban-scale “ecomaps” to be used for planning activities and large-scale energy pre-certification purposes.

User case: A building manager from the local public housing agency of Ferrara, Italy, starts a web-client to assess energy behavior of a set of 150 public buildings located city-wide (note that a single public building asset may be a multi-unit dwelling such as an apartment block).

The web-client connects to a SUNSHINE smart service that in turn connects to existing web services run by several departments of the municipality (e.g. cadastre, urban planning department etc.). The latter expose relevant data (including type of building, use category, geometry, size and shape, age and climatic zone, etc.) that has been compiled to ensure compliancy to a single interoperable profile of standards from OGC.

The SUNSHINE smart service uses this information to generate the 3D model of the relevant portion the city encoded as CityGML standard format, including estimation on performances for each building according to the SUNSHINE CityGML ADE (Application Domain Extension) on building energy efficiency. The information calculated by the system can also be double checked against actual consumption values available from the local energy provider.

As result the system returns both a 2D and 3D “ecomaps” (the latter being the full CityGML model), whereby each public building is classified according to their theoretical energy performance.

3.2 Scenario 2: Heating and cooling forecast and alerts

The previous assessment will be then used, together with localized weather forecasts available through interoperable web-services, to ensure optimization of energy consumption of heating and cooling systems through automatic alerts that will be sent to the SUNSHINE App.

User case: January 2013, Schwechat in Lower Austria, located next to Vienna. High-energy consumption was reported in the previous few weeks due to cold weather. Weather forecasts then predicted a sharp and significant increase in daily temperatures from minus ten degrees to around plus eight degrees. The building manager of the Multiversum, a multi-purpose event hall in Schwechat, had previously installed the SUNSHINE App on his smartphone. The App was configured with information on the type of heating system and position of the Multiversum. The building manager had set an alert that would inform him of extreme and unseasonable changes in weather conditions. He receives detailed information on the dynamic rate scheme for the following day which increases significantly costs for energy consumptions. This gives him the possibility to react immediately and to adjust the heating.

The SUNSHINE system receives the weather forecasts predicting the sharp increase in temperature. The system retrieves the list of buildings according to their energy performances and it starts sending notifications, according to the estimated thermal inertia of each single building, warning to turn off the heating system, due to improving weather condition, at a given time of the day to ensure an optimally comfortable transition to higher external temperatures.

The same scenario could be applied both in hot summer days (when air conditioning is at its peak) and during cold winter days to reduce concentration of PM10 due to excessive heating of buildings.

3.3 Scenario 3: Optimization of power consumption of public lighting systems

Lastly SUNSHINE will ensure interoperable control of public illumination systems based on Automatic Meter Reading (AMR) facilities remotely accessible, via interoperable standards, from a web-based client as well as from an App for smartphones or tablets.

User case: An operator of the Municipality of Bassano del Grappa (Italy) wants to optimize illumination (indoor and outdoor) levels of public buildings (e.g. City Council) and building of public interest (e.g. stadium). He starts a 3D web client that shows the map of the city and the public illumination network. The web client operates as a dashboard from which he can control, through an interoperable standard, real time status of public illumination system. This allows him to check, from a single point of access, the functioning of the various parameters of the entire lighting system through an interactive mapping environment, identifying for instance damages, power losses or simply inefficient use (for instance lights being turned on when unnecessary).

The operator can control lighting conditions to avoid unnecessary illumination of common areas whenever not required. He selects one of the lines that surround the local stadium and sets the illumination level down by 50 % in the evening when all activities inside the stadium are finished. Similar optimization is performed for other public buildings. The dimmering (as well as other control) can be performed at control panel level (for the entire line) or at single illumination unit.

4 PILOTS WITHIN SUNSHINE

The three described scenarios will be piloted in the context of nine sites across five countries which includes e.g. for Italy 20 public buildings in Ferrara; 60 technical buildings across the Trentino Province; 4 public illumination lines in the centre of Bassano del Grappa (Italy), 5 public illumination lines in the city of Rovereto (Italy) 3 building complexes in the area of Val di Non (Italy) and their outdoor public illumination systems.

Fig 2: The multipurpose hall “Multiversum” in Schwechat (Source: Multiversum)

For Austria it will be a multipurpose hall "Multiversum" in Schwechat, Austria whose managing director has committed to SUNSHINE. It is a complex opened in 2011 used for sport and cultural events, but also for exhibitions, fairs, congresses, conventions and business events. Within this pilot all three scenarios will be tested. Other pilots are located in Croatia, Greece and Malta.

SUNSHINE will be piloted for a duration of 12 months and it will target at energy and emission savings ranging, within the various pilots, from 10 % to 30 %, with higher savings being foreseen for pilots relying on older buildings, or equipped with older heating, cooling or lighting technologies. Energy savings will be compared to a one-year baseline data acquired, during the first stages of the project prior to the deployment of the pilots.

5 CONCLUSION AND FUTURE WORK

This paper has given details of the initial project plan for the following three years. SUNSHINE is a European project aiming to improve the energy efficiency of public buildings. Local administrations are playing an important role within the project and are constantly involved in the process.

The first step within the project will be to precisely define the use cases to be addressed by the various pilots and collect requirements for the deployment of the SUNSHINE system, including e.g. user, training, service requirements and a definition of the software architecture of the whole SUNSHINE system. Further steps for the SUNSHINE implementation are the identification, collection and harmonization of all available information to support the SUNSHINE pilots.

6 REFERENCES

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