

PROJECT PERIODIC REPORT

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Project acronym: DAREED

Project title: Decision support Advisor for innovative business models and user engagement for smart Energy Efficient Districts

Funding Scheme: Small or medium scale focused research project (STREP)

Date of latest version of Annex I against which the assessment will be made:

Periodic report: 1st 2nd 3rd 4th

Period covered: from 01/09/2015 – 14/12/2016 and 15/03/2016 - 31/12/2016

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¹ Usually the contact person of the coordinator as specified in Art. 8.1. of the Grant Agreement .

² The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

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3.1 Publishable summary (M40)

3.1.1 Introduction

Cities across Europe are forerunners in the transition towards a low carbon and resource efficient economy. They are starting planning and acting for a more sustainable future characterised by investments in innovative, energy efficient, integrated technologies and services for buildings, district heating/cooling, mobility, public lighting, and other utilities to name a few. A number of challenges are being faced concerning energy management at city and district level, micro-generation from renewable energy sources, CHP integration, the provision of effective tools for citizens to better understand their consumption and to reduce them, or to have independent information on the economic advantages that can be achieved with the implementation of measures for energy saving and efficiency.

3.1.2 Project Objectives



DAREED has delivered an integrated ICT service platform and specific tools to foster energy efficiency and low carbon activities from neighbourhood to district level, with an Energy Decision Support System for Smart Cities. The key success factor for effective energy efficiency initiatives at community level is to involve all the stakeholders who have an active role in decision-making and provide

them with the right information at the right time to take informed decisions.

Three main stakeholders are the target groups of DAREED platform:

- Citizens; the project involves them as concerned inhabitants or workers that want to live in a better and more energy efficient district both collectively and as individual homes.
- Policy Makers and local Authorities at district and city level are able to raise energy efficiency awareness among their citizens and to analyse how the installation of particular technologies can affect their district energy profile and identify concrete measures for supporting the citizens to take energy improvement actions.
- Energy Providers, both Utilities and Energy Services Companies (ESCOs), have been active users of the service platform

DAREED integrated platform covers the complete cycle of decision-making for improvements on energy efficiency in Smart Districts and Cities by providing:

- **Information and awareness** in energy consumption and generation at building and district level. The information of the platform is continuously being updated based in the District Model, tracking the district progress and providing a view of the situation at district and building level.
- **Simulation**, on a “what if” base, of renewables introduction both at district and building level or changes at buildings, that provides the users decision support to evaluate new alternatives of improvement on energy efficiency.
- **Action**, through an Energy Marketplace that open communication channels among stakeholders to cover the gap between simulation and real implementation, and through Demand-Response programs that become the users in active citizens in the improvement of the energy behaviour of the district.

The actions taken in buildings and districts trigger an impact is traced by the district model, visualized through the information tools. These phases form a closed loop where at each cycle we can evaluate the impact of the preceding cycle on energy saving, conduct new simulations taking savings into account, and come up with new business models, policy guidelines and

increased user involvement. A set of main use cases have been defined for the different stakeholders:

Table 1 DAREED use cases

For district’s Citizens
<i>Analyse Consumption Patterns.</i> Analyse consumption patterns, compare it to similar users and send suggestions based on measurements.
<i>District Energy Overview.</i> Information on citizen’s consumption reflects the overall district energy balance.
<i>Discover Measures to Increase Efficiency.</i> The platform promotes the usage of energy efficient solutions by offering custom-tailored services through a common marketplace.
Take part in <i>marketplaces and demand/response programs.</i> Through the integration of Policy Makers and Energy Providers, the platform enables the participation in a Demand/Response system.
For Policy Makers and Local Authorities
District Efficiency Monitoring. View district energy efficiency indicators and compare them with other districts and over time.
Provide mechanisms to raise energy efficiency awareness among citizens.
Making simulations on the effect of the introduction of renewables at district level.
Provide effective communication mechanisms for special situations or contamination scenarios.
For Energy Providers
Communication channel with potential clients. Offer new energy services through a marketplace with tailored services based on consumption measurements and profiles.
Reduce grid congestion without investment through the promotion of the active participation of district consumers in demand management programs.
Raising energy efficiency awareness among citizens and provide them good practices recommendation.
Increase competitiveness. Support the definition of new tariffs and determine convenient and profitable pricing scheme.

The service-oriented approach of the platform allows easy adoption, overcoming technological, financial and knowledge barriers. The involvement of service providers from different activity fields: Energy (as Enel, Endesa and Cleopa), ICT (Isotrol), Research (KIT, IAT, Unibo, Brunel University and Cetma) and Public Administrations (Lizzanello, Seville Municipal Companies, Emasesa and Cambridgeshire County Council) facilitate the development of the solution and its wide acceptability.

3.1.3 Description of the work

To reach the goals and the expected results, the DAREED project has been structured in work packages structured as below. The next image shows the works performed during the project following the work packages structure mentioned.

Figure 1 Work-flow



All these activities were supported during the complete project by dissemination and exploitation activities. The previous years of the project were concentrated in WP1 to WP5. During the last year, the last developments have been finished and the activities of integration,

demonstration and validation completed. As main result of DAREED project, DAREED concept was demonstrated and validated via DAREED web based and integrated platform containing the next sub-components:

- DAREED tools
- Knowledge Manager
- Data manager Big Data Storage
- Quality evaluation framework

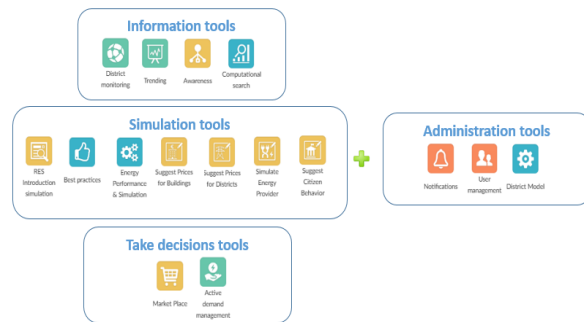
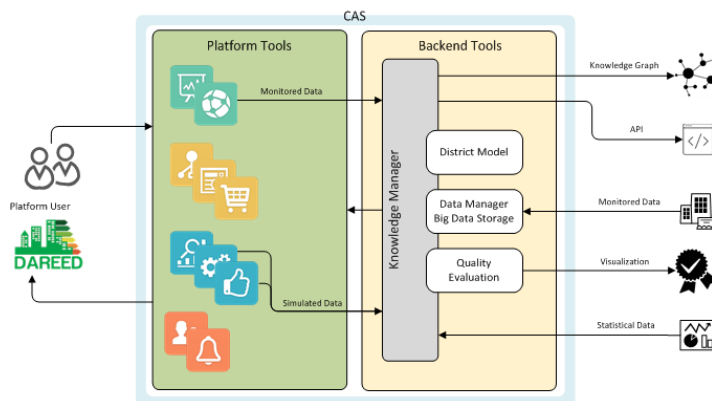


Figure 2 DAREED tools

From integration point of view, the delivery of a tight data integration, inclusion of more monitored buildings in the platform, and provision of the platform management interfaces and the integration of the simulations to the district KPIs, which was also the highest challenge in the project. Moreover, it was analysed and implemented improvements in the District Model by adaptation of its values and parameters. From validation point of view, Y3 rely the basis of the analysis for commercial exploitation of the results and impact assessment. The validation phase has been focused on using the developed functional prototypes to validate the whole concepts as well as the integration interfaces developed in WP 6. The demonstrator was used to support the assessments of how DAREED solution could improve the energy efficiency and low carbon activities in pilot districts.

Figure 3 DAREED integrated platform



3.1.4 Current development of the DAREED tools and interfaces

Y3 has been the last stage of the project where all the tasks have been completed. As results, this last stage has provided the entire functionality of all tools and ensured their proper functioning even at prototype level of DAREED platform and demonstrated the added value for homes and district managers to further use DAREED. The prototype has been successfully validated via pilots in three different districts: Seville (Spain), Cambridgeshire (UK) and Lizzanello (Italy), and their different contexts, thus granting the possibility to extrapolate results and ensure replicability throughout Europe and beyond.

3.1.5 Final results: potential impact and use

DAREED is proposed in first place as a convenient system for **Energy Smart Cities Decision Support System** due to its integration of consumption data from different sources capacity. The ability to merge statistical data with simulation and real time monitoring may make the DAREED approach particularly attracting, for both larger and smaller cities. Larger cities may find that the system can easily benefit from the data coming from already installed equipment. Smaller cities may be able to install the system even if they lack an extensive (and expensive) monitoring infrastructures. Since many existing smart city projects emphasize IoT (Internet of Things) aspects, it seems worthwhile to offer DAREED as a service platform to facilitate the communication between local policy makers and citizens, which can also operate on top of existing data: in such way, it would be possible to avoid competition with the existing projects, and take instead advantage of the work that has already been done.

Figure 4 District KPIs

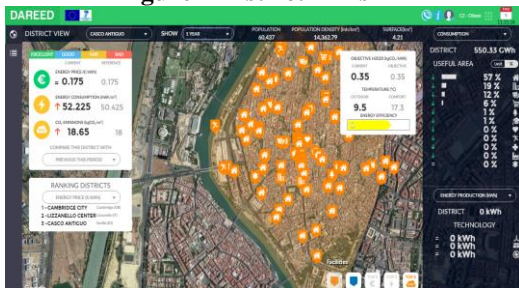


Figure 5 District energy trends



Savings have been achieved between the 10 and 15% during validation phase, as result of measurements of consumption, sensitization and detection of anomalous consumptions. This figure can be increased through the implementation of the customized recommendations made by the platform in the incorporation of renewables or the incorporation of efficient systems in buildings (insulation, trimming more efficient, etc.). This applies both, at district level and in each individual building. The achievements reached during the validation shows positive trends that evidence that further achievements can be reached, both building and district level, supported by an extended use of the DAREED platform, as they are:

- 20-30% energy consumption reduction
- 30-35% costs savings
- More than 30% CO₂ emissions reduction

Two commercial exploitation modes for the DAREED Project have been defined as an open source solution: DAREED Platform as a product and DAREED Platform as a service. The three pilot district that have participated in DAREED project have already expressed their interest in further exploit the DAREED platform after the project ends, based in the good results obtained during the project. This fact is just one but a very clear evidence of the usefulness of the solution developed and support the positive perspective of DAREED platform and services for commercialization.

3.1.6 Project public website and contact details

- Public website : www.dareed.eu
- Twitter : @DAREEDProject <https://twitter.com/DAREEDProject>
- LinkedIn : <https://www.linkedin.com/groups/6530510>
- Facebook : <https://www.facebook.com/DAREEDProject>
- YouTube : <https://www.youtube.com/watch?v=r4lmTmdpico>