TABEDE

Towards buildings ready for Demand Response

Newsletter Ed. n°2

June 2020

www.tabede.eu

Enclosed in the TABEDE Newsletter Edition N°2 is:

EDITORIAL:

"Welcome from the TABEDE project coordinator"

01 »

Dear readers,

Welcome to the second edition of the TABEDE newsletter. While much of the world population is slowly recovering from the COVID-19 pandemic, important work continues to advance a low-carbon, clean energy future. For the TABEDE project team and its H2020 counterparts, this means continuing to develop solutions that improve building-level flexibility, lower energy costs, increase renewable energy consumption, and relieve pressure on centralized electricity infrastructure.

In the first TABEDE newsletter published in March 2020, we reported on key facts about TABEDE, profiled the project coordinator, provided a technology spotlight on our Building Management Systems-Extender (BMS-E), gave the first of three pilot highlights (Bergamo), and described planned publications and upcoming events which due to COVID-19 are being re-planned accordingly.

Now in its third year, the project team has built and tested all the key TABEDE components and is turning its attention to deploying the integrated solution at three test sites (residential buildings in Bergamo, Italy and Cardiff, UK and an industrial campus in Grenoble, France) and through a simulated, multi-building environment. Future newsletters will highlight how TABEDE performs on the basis of increased flexibility and lower energy costs at these test sites.

Finally, to stay connected please join our mailing list by signing up to receive our newsletters. Meanwhile, any questions you may have regarding the project results can be sent through our website's Contact page.

Happy reading!

Andre de Fontaine, ENGIE Impact

TABEDE Project Coordinator

TECH FOCUS 1: *"AGENT BASED OPTIMISER (ABO)"*

02

»

TABEDE aims at unlocking flexibility in buildings by enabling building management systems (BMS) to maximise the adoption of demand-response schemes. This aim entails, on one hand, minimising building energy bills taking into account the revenues from participating to demand-response schemes, while respecting occupants' constraints and preferences. On the other hand, it allows energy providers to benefit from the building flexibility to maximise the usage of renewable energy and to optimise operational performance. To these ends, TABEDE solution carries out the optimisation to provide optimal consumption and production behaviours for different devices installed in the building and to enable the activation of demand-response schemes. More precisely, this optimisation is performed by the agent-based optimiser (ABO) of the TABEDE solution.

TABEDE covers a wide range of dynamic devices such as shiftable loads, sheddable loads, storage, and distributed generators. Each device possesses its own dynamic constraints and objectives. ABO needs to take into account the constraints of each device and the demand-response requests, while assuring that the constraints of the occupants are satisfied. Performing such an optimisation over a time horizon entails dealing with a large number of variables, making it computationally impractical to solve in a centralised manner.

The devices, whose energy profile is to be optimised, are connected at the building level, forming a network of devices. Optimising the energy flow in such a network is to minimise the network objective function subject to the constraints of each device in the network. The network can be modelled as an energy coordination network, as illustrated in Figure 1, facilitating problem decomposition and agent identification. To solve this optimisation problem in a distributed manner, thereby ensuring efficiency and scalability, ABO has been designed based on a distributed optimisation algorithm and developed following the multi-agent paradigm, facilitating the distributed interactions amongst the components in a scalable fashion.

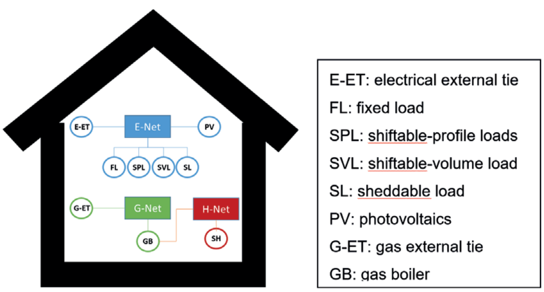

Figure 1. Sample energy coordination network for UK test site

TECH FOCUS 2:
"DEMAND-RESPONSE AUTOMATED SERVER (DRAS)"

03 »

The DRAS is a fully scalable grid wise API module that enables a virtual real-time energy price and DR request generation service. It can collect, aggregate, and standardize valuable information about electricity consumption for electricity stakeholders. The DRAS serves the critical function of forwarding DR information (including explicit DR requests as well as incentives through grid tariffs) to end users that can act on the information to optimize energy costs and provide flexibility services to the grid.

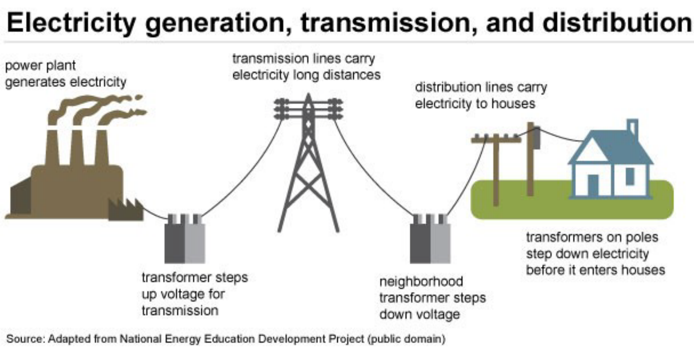

Figure 2. General schematic of energy grid to illustrate the DRAS module

Within TABEDE, DRAS generates the electricity tariffs and DR signals, which are key inputs into the building-level optimization process. DRAS is a flexible service that can simulate a range of energy tariffs and explicit DR schemes. As such, it allows the project team to experiment with different energy prices and see how they impact the optimization algorithms developed through the project, and in turn, device consumption patterns in the residential and commercial building test sites. In short, DRAS provides a key external signal that allows the Agent Based Optimizer to generate control signals to shift device loads from high-to-low energy price periods and/or to take advantage of explicit DR incentives. These signals are then sent to the BMS-E, which directly controls the devices accordingly. In addition to the three test sites, DRAS will be deployed through the simulation environment where it will generate and transmit energy tariffs for 121 simulated buildings in order to test TABEDE's impact at the district level.

PROJECT HIGHLIGHT:

"TABEDE TOOLBOX DESIGN & IMPLEMENTATION"

04

»

Work package 4 focuses on the design and the implementation of the smart energy management components that are the core of the TABEDE toolbox. The architecture of this toolbox is depicted in Figure 2.

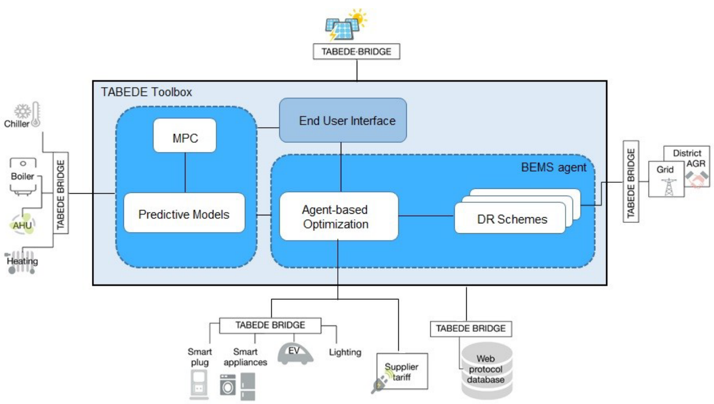

Figure 3. TABEDE toolbox's components

Concisely, the components are:

- **Predictive model**: According to data collected inside the building by an efficient way (real-time, cost-effective and with anomaly detection), these models return forecasted energy consumption for the next 24h (with granularity of 15 minutes).

- **Agent-based optimisation (ABO)**: According to forecasting model, ABO performs an optimisation and proposes the optimised operation plan for the devices in the building, while taking into account the comfort and preferences of the occupants as well as the demand-response schemes.

- **Model Predictive Control (MPC)**: acts as a backup solution when there are issues in connections between BMS-Extender and ABO. The optimisation performed by MPC targets only thermal comfort of the user, and thus the operating schedules MPC provides are limited to thermal devices such as heat-pumps and boilers.

- **End user interface**: Through the interface, the occupants can be informed of everything that is controlled and monitored by the TABEDE solution such as real-time data of the devices and energy savings, to name a few. Their preferences on the operation of various controllable devices can be made known to the system via the interface. Figure 3 illustrates an excerpt of the interface allowing the occupants to visualise the monitored real-time data and to specify their preferences for device activation.

The components in this work package 4 have been developed and tested, both as an individual unit and as an integrated system. The next step is to deploy the components on the test sites and in the Simulation Environment to perform the validation of use-cases and the analysis of their impacts.

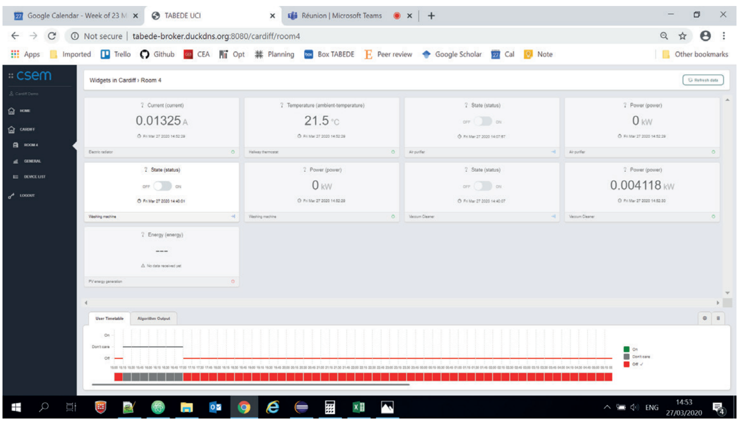

Figure 4. End user interface for site controlling and monitoring

WEBINAR:
"TAKING DEMAND RESPONSE TO SCALE: THE TABEDE SOLUTION"

05

The TABEDE consortium will be delivering a free public webinar, which will be held on Tuesday 23rd June from 14h30 to 15h30 CEST entitled, "Taking Demand Response to Scale: the TABEDE solution"

The webinar will focus on Demand Response (DR), explaining its benefits and current barriers, while providing an overview of the state of the market in Europe through the framework of results achieved within the TABEDE project.

The agenda will be as follows:

- Demand Response: introduction to the topic
- TABEDE approach and solutions to overcome interoperability and other barriers
- The BMS-E (BMS Extender) to enable multi-protocol communication with different devices/appliances regardless of building type
- How TABEDE results could be transferred to the market

Lecturers: Andre Defontaine (ENGIE), Emmanuel Onillon (CSEM), Zia Lennard (R2M)

To register, please click on this hyperlink and complete the application form:
https://register.gotowebinar.com/register/1424475995090286863

The TABEDE project is co-funded by the EU's Horizon 2020 programme under grant agreement No. 766733