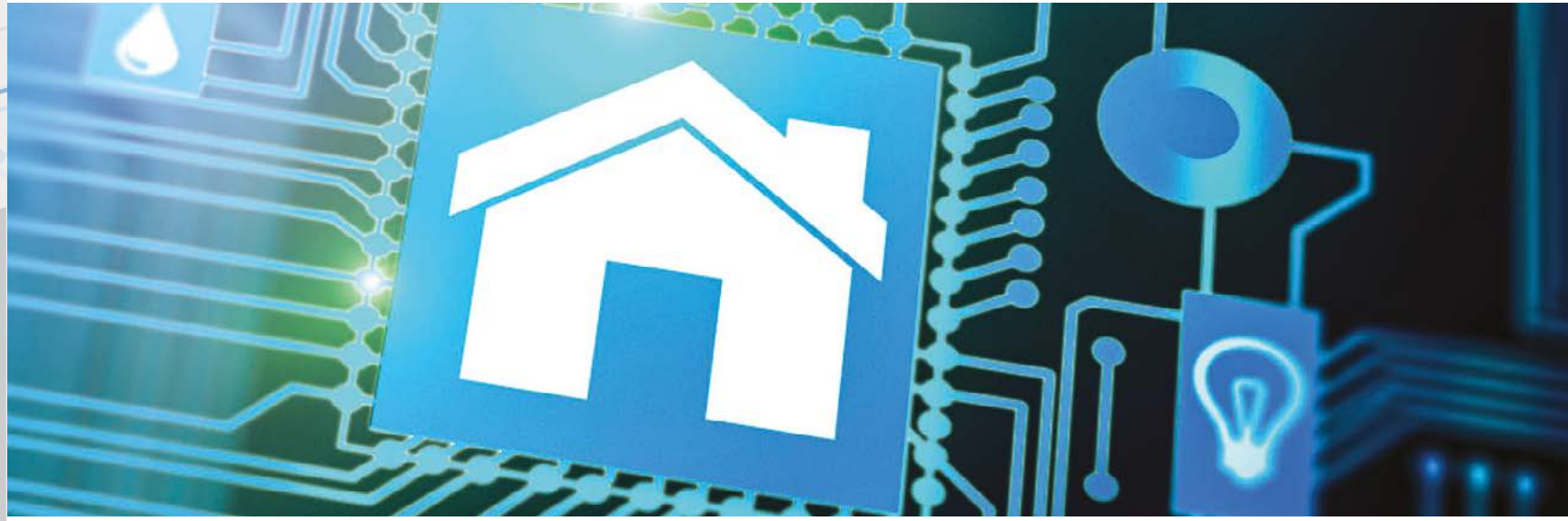
www.tabede.eu

A **Horizon 2020** project

TABEDE

Towards buildings ready for Demand Response

For integration and optimisation in the field of **BUILDING ENERGY MANAGEMENT**



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Introduction

THE HORIZON 2020 PROGRAM

HORIZON 2020 is a European Research & Innovation program with the highest budget ever allocated: **€ 80 billion allocated for 2014-2020**, which will attract private investments due to the program's strong appeal.

The program supports innovative solutions, transferring them from research laboratories to the market, with the aim of:

- ensuring Europe's global competitiveness;
- driving European economic growth;
- promoting smart, sustainable and inclusive growth;
- creating jobs.

ENERGY EFFICIENCY for URBAN REGENERATION

HORIZON 2020 promotes and supports policies that identify crucial changes in the way of building, managing and maintaining existing buildings, with the aim of safeguarding the environment as well as personal health and well-being.

One of the areas of intervention regards the energy upgrading of existing structures, combined with the sustainability of new buildings.

The goal is to identify savings criteria that will allow for consistent energy efficiency parameters to be achieved.

The scenario

In order to efficiently tackle Europe's increasing demand for energy, buildings will need to be equipped with advanced management systems capable of offering grid operators and electricity distributors a sufficient level of flexibility.
This flexibility is referred to as "Demand-Response (DR)", and it denotes a building's ability to "answer the call" of the energy supplier by decreasing its energy consumption: the buildings in a D/R district must be capable of receiving/responding to the energy supplier's requests, and independently regulating their electrical and heating/cooling systems accordingly.

In particular, this scenario poses several limitations to be overcome in terms of what the market has to offer:

- There are major interconnection problems associated with the various communication technologies, protocols and data used in building automation and energy system management.
- Considering the time required and the relative costs, it often turns out to be more expensive to adapt an existing Building Management Systems (BMS) than to install a new one.
- Current BMSs do not support pre-configured applications for demand-response management and for improving comfort inside buildings.

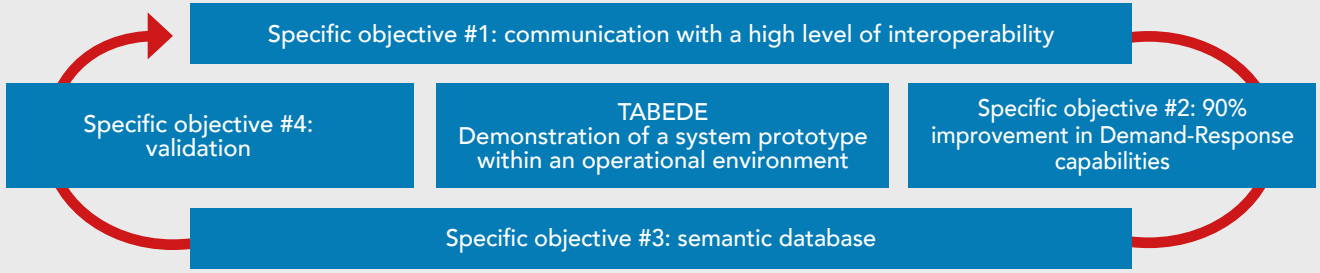
THE ANSWER: BMS-E

The heart of the **TABEDE** project is the development of a gateway called the **BMS-E**, which allows a building to connect to a Demand/Response system. This **EXTENDER** is capable of communicating with many of the main home automation communication protocols, and even works as excellent control system for residential and commercial buildings.

Goals

The three-year **European TABEDE** project is part of the H2020 program, and was launched in 2017 at the behest of the European Commission in order to allow:

- the building's occupants/stakeholders to lower their energy-related costs, without compromising their standards of comfort;
- energy providers to take advantage of the potential for flexibility, maximizing the use of renewable energy sources and ensuring high supply standards;
- the Building Management System to integrate and control the new devices, by ensuring their communication with the network.

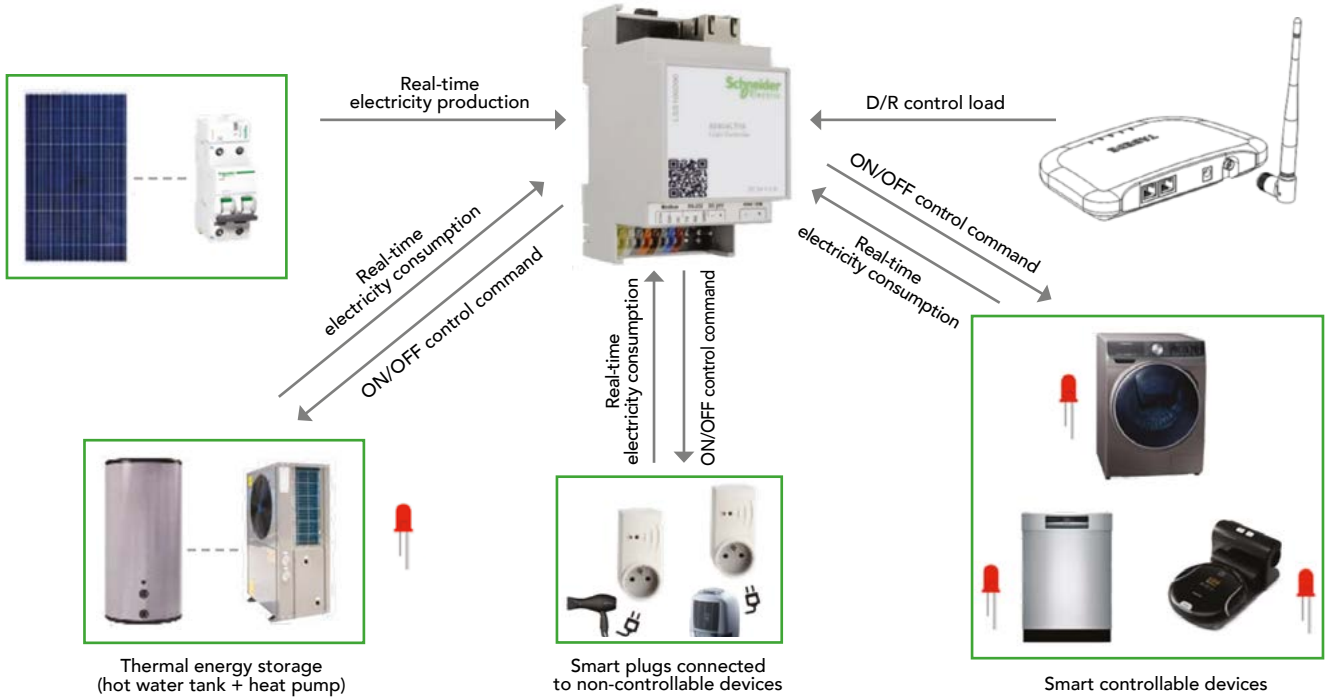


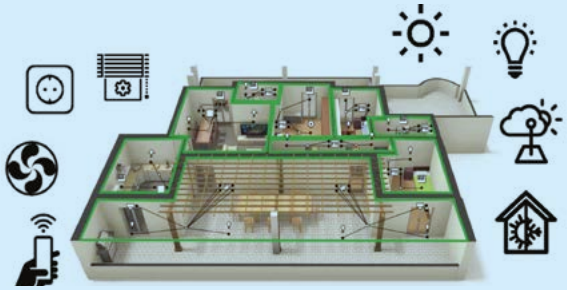
The **BMS-E** is therefore an advanced control system that, in working with the home automation components, determines the best possible Demand/Response strategy based on the user's consumption profile, the data received from the network, and the renewable energy production forecast (where available). All this while always taking into account the occupants' comfort levels and the devices' usage limitations.

TABEDE and KNX technology

TABEDE makes use of a technology based on the KNX building automation standard for building automation and control. This type of system can be integrated with:

- Emergency and standard lighting
- Shutter control
- Controllable outlets and utilities
- Heat regulation
- Motion sensors
- Weather sensors
- Remote control





GRAPHICAL USER INTERFACE

Thanks to the **eConfigure** configuration software by Schneider Electric, the graphical control interface for the user can be automatically created without any additional programming. The function is implemented through the **Wiser for KNX** web service function. In this manner, the users are able to:

- manage all the functions controlled by the KNX system, either directly or through pre-set scenarios;
- control the system in extremely convenient ways, via smartphone or tablet, or using the wall-mounted touch panels;
- access their system anywhere and anytime, either locally or remotely.

The **eConfigure** configuration software uses simple drag-and-drop functionality to allow the user to load the control and programming functions of the system's KNX components into default and editable interfaces, via widgets.

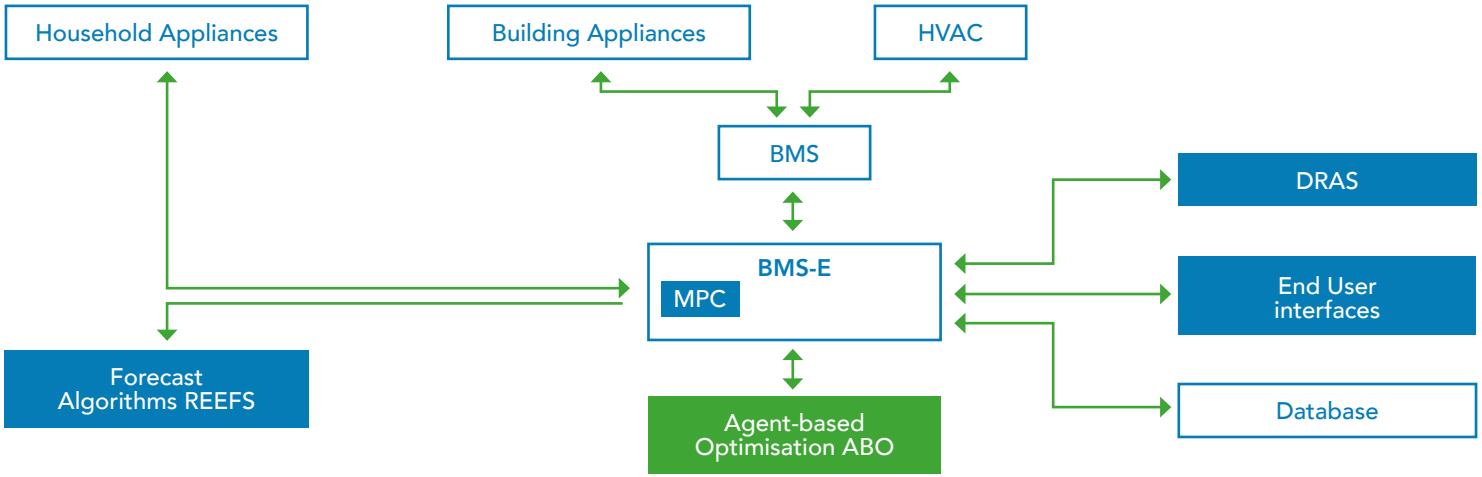
The project and its technological features

The TABEDE project will conclude in April 2021 following its demonstration in an operational environment, after which the technology will be available on the market.

BMS-E TECHNOLOGY, THE KEY TO FLEXIBILITY

This is a Building Management System that monitors and controls the mechanical and electrical devices within the building. In terms of Demand-Response, a BMS typically cannot be controlled externally by the network service provider. **TABEDE**, on the other hand, has developed an innovative technology known as the **BMS-E**, which is capable of creating flexibility at the building level: thanks to its ability to integrate and utilise the main communication protocols available on the market, it can quickly exchange information with various devices, regardless of their manufacturer.

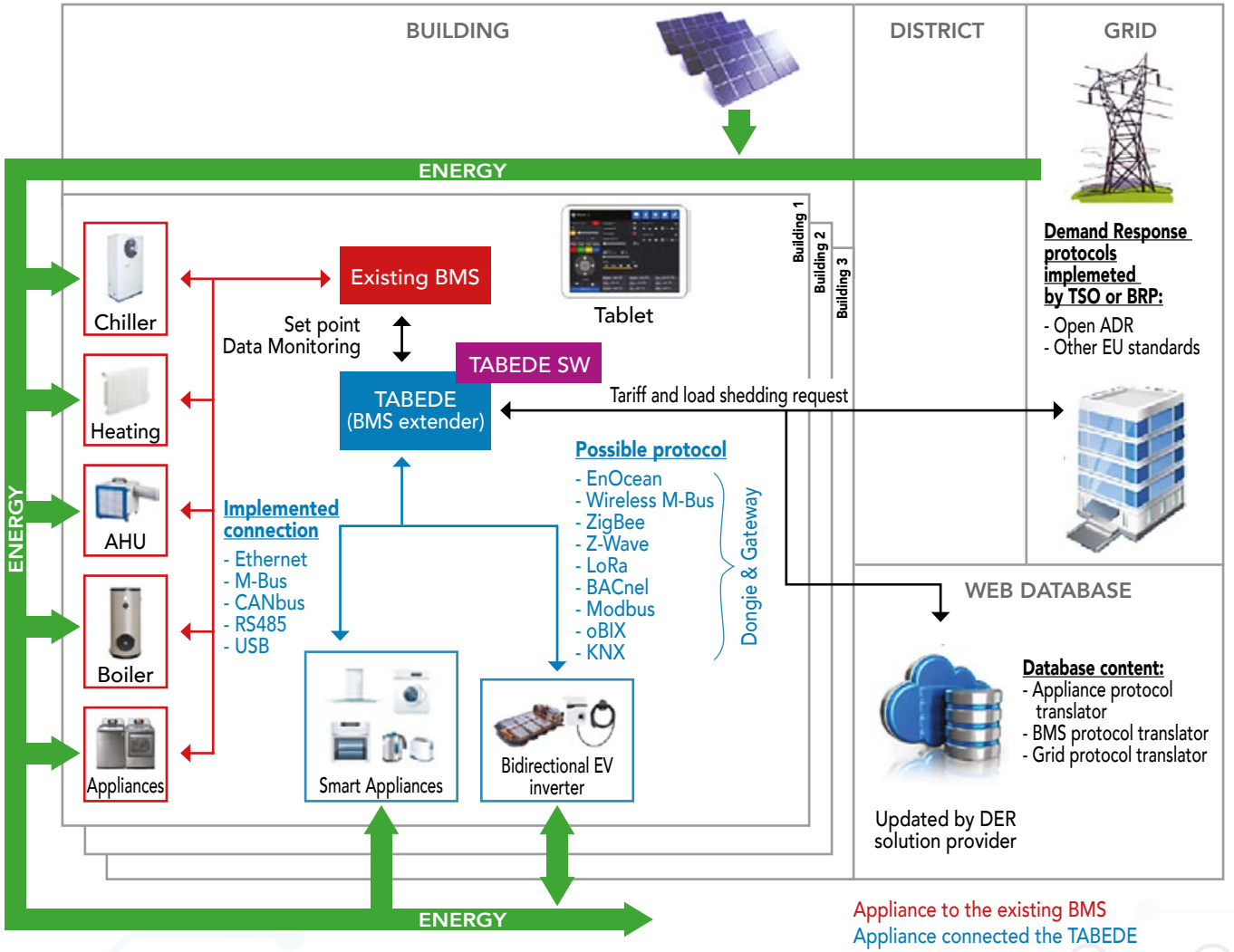
The way the **BMS-E** functions in buildings equipped with energy management systems (EMSs) is quite simple: the building's owner and/or occupant enters their preferences; the **BMS-E** processes the energy consumption data collected by the devices, and uses them to generate 24h forecasts and to create optimised circuit profiles.



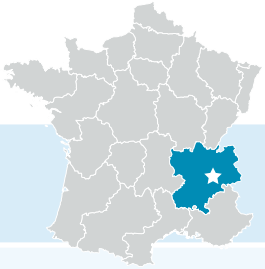
Expected results

TABEDE expects to achieve the following key results:

- energy cost savings of at least 30% in buildings;
- a 25% increase in the use of renewable energy sources for generating electricity;
- the Reduction/Deferral of investments in the reinforcement and balancing of the electricity grid by Distribution System Operators (DSOs), thanks to a better use of both the resources and the grid itself;
- the opening up of the energy markets to new players.



The practical applicability of the **TABEDE solution** is being validated through its implementation at three test sites, which are considered representative in terms of climate, building size, and energy infrastructure



FRANCE
Industrial campus in **Grenoble**

Building T11 is part of the Green Ovalley project, which aims to optimise the number of buildings of the Schneider Electric Industry/Energy Business Research and Development offices in the Grenoble area, at the 38TEC site. The goal of building T11 is to be a high-efficiency building (with all utilities at 45kWh/m/y), through the generation of solar power, and the pursuit of high comfort levels for the operators who work therein.

UNITED KINGDOM
Smart house in **Cardiff**

Tŷ Smart is a recent smart home prototype developed by the Cardiff University team. The construction of the house is representative of contemporary homes built in the UK. The house's energy efficiency is rated level A (specifically, according to the UK Standards Assessment Procedure-SAP, score: 96), the highest rating that can be obtained, as opposed to a rating of D for the average UK homes (score: 60). The relatively high energy efficiency was achieved using high-performance envelope (thermal transmittance: 0.2, 0.11 and 0.16 W/m2K respectively for the walls, roofs and floors) and technological equipment: efficient gas boilers and radiators, Smart BMS systems based on the use of time and temperature-based control, low consumption LED lighting, heat recovery ventilation (HRV) throughout the whole house, a 3.9 kWp solar photovoltaic system, and low permeability of 4.8 m3/m2hr at 50 Pa. Four people live in the house, which will allow for a realistic representation and investigation of user behaviour and interaction in demand response, both before and after the modification of the energy and environmental systems.

ITALY
Residential building in **Bergamo**/1

The selected demonstration site is a recently refurbished residential building with a basic home automation system. This building represents one of the most common types on the Italian and European residential markets. It is therefore an important demonstration site for the extensive replicability of the TABEDE solutions. At the start of the project, the building's thermal power equipment consisted of a boiler for hot water, a chiller for air conditioning, and 4 pumps; in addition, there was: a 6.4 kWp photovoltaic system installed on the roof and a power meter. The original technologies and the new systems installed during the project will both be integrated into the BMS-E, which will allow the users' behaviour and the integrated Demand/Response strategies to be studied.

ITALY
Residential building in **Bergamo**/2

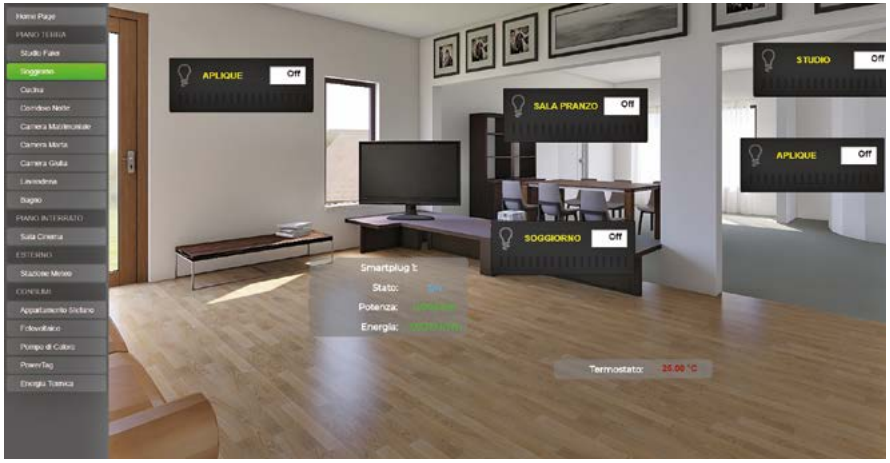
During the course of the project, several improvements were made to improve the building's efficiency and "smartness".
- The implementation of an advanced home automation system based on the KNX protocol and on the Wiser for KNX multi-protocol controller.
- The creation of 3D graphics for the room control unit.
- The enabling of voice control on the home automation system
- The upgrading of the heating and air conditioning system with a connected heat pump and condensing boiler
- Advanced algorithms and management system to maximise the use of renewable energy.

Smart Readiness Indicator (SRI)

Before TABEDE 20%

Energy savings on site	22%
Maintenance & fault prediction	18%
Comfort	18%
Convenience	8%
Wellbeing and health	0%
Information to occupants	10%
Flexibility for the grid and storage	33%

SRI (Smart Readiness Indicator) is an European ranking system for buildings interaction capability with occupants and electricity grid, which allows an efficient management of energy, all thanks to ICT technologies.
Derived by the latest EU Directive on building performance, it aims to improve the value of smart technologies and make it more tangible for users, owners and service's providers.



After TABEDE 76%

Energy savings on site	81%
Maintenance & fault prediction	67%
Comfort	100%
Convenience	58%
Wellbeing and health	0%
Information to occupants	77%
Flexibility for the grid and storage	77%

TABEDE: technological partners

ENGIE Impact is a leading consultancy that applies data analytics, multi-disciplinary expertise and global reach to accelerate sustainability transformation of organizations around the world. Tractebel's Advisory and Advanced Analytics Team is now a part of ENGIE Impact. ENGIE Impact handles the project's coordination and the simulation of the electrical grid.

https://www.engieimpact.com

A multidisciplinary company dedicated to technological innovation.
R2M is responsible for disseminating information about the project and its valuation; it is also involved in the economic valuation of the solution and the business development model.

http://www.r2msolution.com/home-it/

The French Commission for Atomic and Alternative Energy (CEA), a leader among European Technological Research Organisations, with over 16,000 employees and 10 centres throughout France.
Operating in the areas of advanced control and testing, the CEA is responsible for the system's modelling and energy flexibility.

http://www.cea.fr

The Swiss Centre for Electronics and Microtechnics (CSEM), a private Swiss non-profit organisation dedicated to applied research.
The CSEM is responsible for the development of the BMS-E hardware and software.

https://www.csem.ch/Home

Schneider Electric Spa is a global specialist in the management of energy and integrated solutions for multiple market segments.
Schneider Electric SPA handles the activities associated with the TABEDE solution's integration, and manages the demonstration site in Italy.

https://www.se.com/it/it/

Cardiff University was ranked 5th amongst UK universities in the 2014 Research Excellence Framework (REF) based on quality, and is a member of the Russell Group, a group of 24 leading UK research intensive universities.
The team brings its experience in environmental simulation, artificial intelligence and forecasting to enable high resolution forecasting of thermal and electrical demand at various scales – from individual homes to districts.

https://www.cardiff.ac.uk

For more information you can contact us at the following address: **info@tabede.eu**