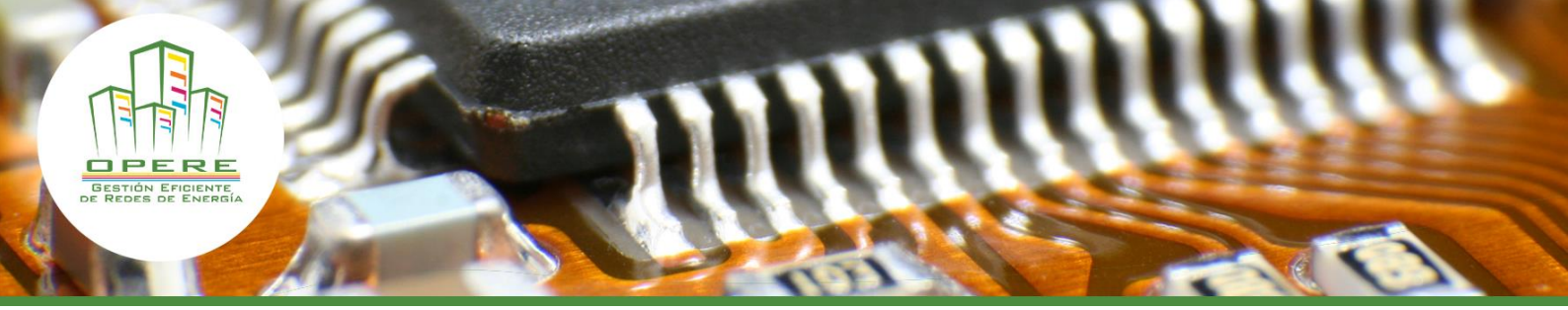


Opere Project

ASPECTS OF INTEREST

Life Programme + Governance and Environmental Policy

Total budget: €1,190,479

Project duration: 45 months

July 2013 - March 2017

PARTNERS

University of Santiago de Compostela (Leader)

EnergyLab

www.life-opere.org

With the contribution of the European Commission's financial instrument LIFE

Newsletter no. 4

March 2017

1 THIRD PANEL DISCUSSION

The third meeting with the panel of experts was held on November 23, 2016 as part of the activities carried out in the C.1 action called 'Monitoring the project's socio-economic impact'.

The panel discussion took place in Santiago de Compostela, in the facilities of the Technological Research Institute. It was attended by fourteen experts in the areas of energy management and new technologies, coming from entities that have achieved a high level of knowledge in the implementation of energy management systems by their field of activity: SERGAS (Galician Healthcare Service), Itelsis, Clece, CHUS (University Hospital Complex of Santiago de Compostela), Coinges Engineering and the Infrastructure Department of the University of Santiago de Compostela. This meeting was organised to discuss the optimisation work carried out in the design and development of the sensor network, as well as the monitoring system of the Campus Vida buildings, in order to create an appropriate digital environment for efficient energy management.

The discussion began with the presentation of the general characteristics of the OPERE project, followed by a visit to the energy facilities of the Monte da Condesa Residence Hall. Afterwards, a round-table discussion was held to cover aspects related to the future vision of energy management in large-consumption buildings, smart grid and monitoring system requirements, as well as the selection of key indicators to monitor energy management.

2 AULA OPERE

Aula OPERE, or the OPERE Classroom, is a space designed to publicize the OPERE project and to disseminate its actions and results between teachers and students of vocational training courses on electricity, electronics and energy. Within this framework, the OPERE project was presented in IES Universidade Laboral, A Coruña (Technical College) and in CIFP Politécnico de Santiago (Polytechnic School) in order to present the method of analysis and study of the building, the energy efficiency measures implemented, the analysis procedure followed and the optimisation measures included in the project.

The aim of this action is to familiarise the future professionals of the energy industry with the advances and innovations in the sector through their application in real cases.

3 Data Analysis and Optimization of the Energy System

After the installation and implementation process of the energy efficiency measures (December 2015), a comprehensive study was carried out regarding the different aspects and elements involved in the associated systems by using the software tools of the project's energy management system. This way, based on the processing of the stored monitoring data, it was possible to conduct an initial assessment concerning the operating mode of the different elements: energy sources, power generators, and storage and consumption areas.

During this process, the functioning of the systems was found to be, in general, satisfactory. However, some problems were detected and had to be solved or optimised:

1 The control loop of the boilers was not working properly, so they could not reach the set-point temperature. Among other things, this resulted in a reduction of the comfort level in the facilities since the radiators did not reach the required temperature to establish this level when it was needed the most.

2 The temperature of the water from the cogeneration engine was reduced while the engine did not reach its optimal state. This interfered with the functioning of the boilers, causing their excessive use and thermal waste of the cogeneration.

3 The constant operation of the boiler pumps caused them to be switched on and off a greater number of times. It also increased the boiler-engine interferences.

4 Some inhomogeneities were detected in the buffer tanks regarding their temperatures at different levels, caused by the suction of the cogeneration pump. This leads to a loss in the use of their storage potential and disrupts the functioning of the boilers (higher spending).

In order to solve these problems, two optimisation improvements were introduced in May 2016:

- The replacement of the cogeneration engine's plate exchanger with a three-way valve.
- The reprogramming of the boilers.

Three-way valve

Three-Way Valve

In order to solve problems 2 and 4, it was decided to replace the plate exchanger, which transferred heat from the engine's cooling circuit to the circuit associated with the buffer tanks through a three-way mixing valve. In this way, the valve combines the water from the cooling circuit with that of the heating return in varying proportions so as to always obtain the highest outlet temperature of the water that enters into the tanks, even when the water level is low.

On the other hand, the suction effect of the pre-existing pump on the closest tanks (which moved the heat from their highest part to the lowest) disappeared after its removal. This way, after the improvement, the temperature of the tanks will be correctly stratified and it will be possible to store more energy from the cogeneration.

Reprogramming

The aforementioned problems 1 and 3 were addressed by reprogramming the boilers. This resulted in a consumption reduction and also in an improvement of the comfort conditions in the facilities.

4 Predictive Models of Thermal Dynamics in Buildings

As another system optimization measure, the OPERE project worked on the application of artificial intelligence techniques to develop predictive models of thermal dynamics in buildings with a double purpose:

- The generation of predictive models of the indoor temperature for each floor.
- The generation of models to predict the evolution of temperature in a group of buffer tanks used to store hot water.

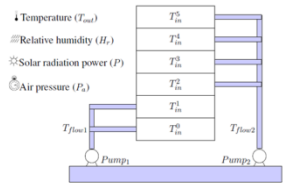


Diagram of the 'CMdC' with its associated variables

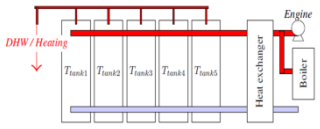


Diagram of the buffer tanks and cogeneration engine

During the developmental process of the models, it was noted that one of the most important issues is the generation of models of interpretable and precise fuzzy rules within a reasonable period of time due to the great quantity of data generated in a building. This required the use of scalable techniques to overcome the increased complexity. To this end, it was decided to use S-FRULER, a distributed algorithm for learning fuzzy rules that can be scaled with the size of the problem. Its functioning was compared with that of FRULER, the original undistributed version of the algorithm.

These models will be used to predict the performance of the pilot building under different conditions in order to find new strategies that would lead to greater energy savings.

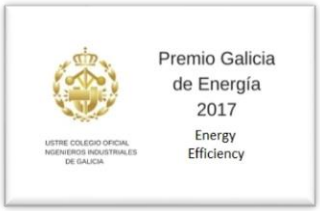
5 Technical Conference in GENERA 2017

On Friday, March 3rd, the OPERE project organised the conference 'The public sector as a dynamising agent of energy efficiency in buildings for tertiary use' within the framework of the technical conferences organised by the Feria Internacional de Energía y Medio Ambiente (International Fair of Energy and Environment) - GENERA 2017.

During the conference, several leading experts analysed the challenges faced by public administrations in the application of energy efficiency measures in buildings for tertiary use. Thus, Marta Gudiol, on behalf of the Instituto Catalán de Energía (Catalan Energy Institute), explained the contract model of energy yields with a guarantee of savings that the Government of Catalonia is implementing for the energy renovation of its buildings. Likewise, Miriam Navarro, from the Instituto Valenciano de la Edificación (Valencian Building Institute), showed how the IMPULSE project would allow for the development of supporting tools for the establishment of Sustainable Energy Action Plans (SEAP) by the public administrations.

From the academic sphere, Gabriel Cardeñosa discussed the different energy efficiency measures implemented in the Autonomous University of Madrid, while Javier Orellana showed the process followed by the King Juan Carlos University to implement the UNE-ISO 50001:2011 standard. Moreover, Elena Parpal, from the Consorcio de Servicios Universitarios de Cataluña (Catalonia University Services Consortium), presented the process and methodology of the aggregate purchase of energy supplies. She highlighted the achievement of more than €3.5 million savings within a period of 2 years. Within this framework, the researchers of the OPERE project, both from the USC and EnergyLab, introduced the different stages of the project execution as well as a preview of its first results.

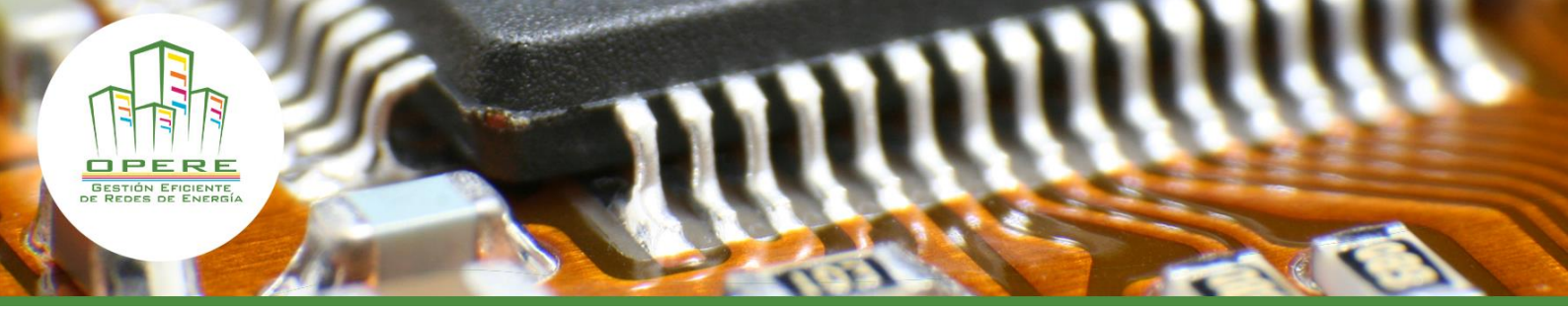
6 OPERE Project, Winner of Galicia Energy Award 2017



The Ilustre Colegio Oficial de Ingenieros Industriales de Galicia (Galician Association of Industrial Engineers) awarded the Galicia Energy Award 2017 in the category of best energy efficiency project, to the Efficient Management of Energy Networks - OPERE initiative, led by the University of Santiago de Compostela in cooperation with the Energylab technological centre.

With a total of seven categories, the Galicia Energy Awards are aimed at recognising the best initiatives in the promotion and implementation of good practices in the field of energy, as well as the contributions made by professionals or entities from the sector over the last year.

For more information, click here.



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