Fonds Régional de Développement Européen
European Regional Development Fund

ICE
INTELLIGENT COMMUNITY ENERGY

EUROPEAN UNION

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France (Channel Manche) England

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ICE PROJECT OUTPUTS DESCRIPTION

REMOTE MONITORING WITH CONNECTED OBJECTS: ELECTRIC HEATING MONITORING

JULY 2021

BRETAGNE DÉVELOPPEMENT INNOVATION
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ICE report OUTPUT x:

Remote monitoring with connected objects: Electric heating monitoring

Background information

The island of Ushant consumes around 6 GWh of electricity annually, almost all produced by generator sets with internal combustion engines using fuel oil. The energy transition in Ouessant is underway and the SDEF has to date deployed three photovoltaic plants on the roofs of the gymnasium, technical workshops and the multipurpose room, for a total installed power of 94 kW. As part of the ICE project, the SABELLA company has installed a tidal turbine in the Fromveur passage which will develop a maximum power of 250 kW. These new means of electricity production significantly increase the island's renewable production, but are by definition intermittent. Knowledge of the state of the electrical network allows consumption to be adjusted to production.

As part of the ICE project and using the LoRa infrastructure deployed as part of the Finistère Smart Connect project of the SDEF, the current project aims to deploy informative connected objects to the inhabitants of the island of Ouessant.
These objects are intended to inform a large number of people of the state of the network (maximum power, renewable production rate on the island) through an easy to understand and educational signal in order to encourage them to shift their electricity consumption to more favorable times for grid management and for the integration of renewable energies.

The ability to consume energy when it is produced makes it possible to optimize the consumption of renewable energies, and thus reduce the recourse to the use of fossil means of production. In addition, the automation of the operation of controllable equipment such as radiators and water heaters, based on the presence in the buildings as well as the use of the correct operating instructions, will make it possible to rationalize consumption and save money energy as well as financial.

SYSTEM/TECHNOLOCY SPECIFICATIONS

The technical solution controls the electrical equipment (radiators, water heaters) made connected using actuators, based on an occupancy calendar and / or temperature setpoints that will be measured using sensors connected.
The infrastructure installed in 4 public buildings of Ushant includes local supervision, presence sensors and actuators on the equipment to be controlled.
In addition, a management platform is provided allowing users to connect through an application installed on local supervision or online supervision, and thus to modify the presence schedule.

Two levels of management have been retained:
1. "Energy Manager" level: In this level, the user of the service has access to the planning of use of the building or buildings within its scope of action, as well as to the temperature instructions for the heating of each building. The building occupancy data (occupied or not), as well as the data of the controlled equipment (power and consumption) are displayed on the information page of the building in question. Access is via the local building supervision screen, and allows to view and interact with the data of each building in the perimeter. In this case, the modifications are sent by LoRa and saved on the management platform. Then, the modifications are retransmitted in LoRa for each building.
Remote access is also possible with a computer with internet access to centralized supervision. The modifications are made directly on the control platform on the server, then transmitted in LoRa to each building concerned.

2. "User" level: In this level, the user of the service can fill in an occupancy schedule for the building to which he has access, but he cannot control the heating instructions. Access to the planning can be done via local building supervision, or via an internet application installed on the person's phone / computer (if they have the access).

In practice, equipment management is carried out by local building supervision which is based on the schedule recorded locally, and it uses a communication system named EnOcean, which uses radio

transmission, but on the shorter range than LoRa. The actuators and sensors are using the EnOcean protocol to communicate with the monitoring local supervision.

If the user changes the schedule on local supervision, the schedule is recorded there, then a copy is transmitted via the island's LoRa infrastructure (deployed as part of the Finistère Smart Island project) and recorded on centralized supervision.

If the user modifies the schedule remotely via the internet application, it is the schedule on the server that is modified and saved, the modification of the schedule is then transmitted in LoRa to the supervision of the building concerned and recorded.

ANTICIPATED AND/OR RECORDED IMPACTS/ BENEFITS

Presented results are only concerning the public library and the townhall, as experimentation took place during 3rd COVID-19 lockdown in France (March-April 2021).

The impacts of this solution are:

1) The ability to fill in the occupation of a building and plan the use of electric heaters allows a rationalization of the electric consumption. This contributed to a reduction of consumption measured to 38% for the public library. For the Townhall, the recorded consumption slightly increased (+10%) however it could be due to an improvement of comfort in the building with a good temperature (> 19°C) in the morning (8 a.m.) compared to colder temperature before the experimentation (≈17°C). Also analyses shows a reduction in daily consumption peaks for the two buildings.

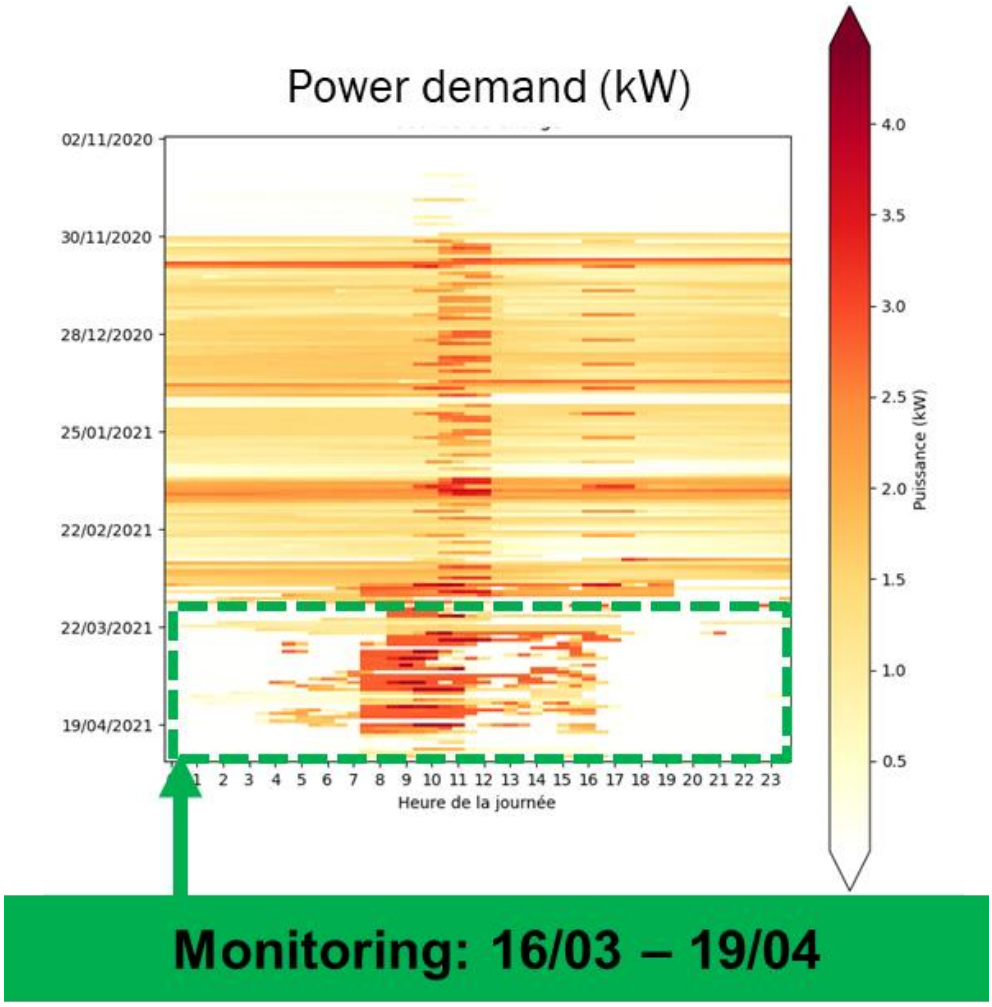

Figure 1 : Electric consumption for the public library - before and after experimentation

2) The infrastructure (connected switches and remote control) could allow to experimentation of consumption erasure. Based on a signal from the production (EDF) transmitted to the platform, it is possible to shut down the electric heaters for a short period of time (10 to 30min) during consumption peak moment (e.g. 20:00 in winter). However, as the experimentation was limited due to COVID-19 lockdown, we weren't able to develop this functionality during the ICE project.

ANTICIPATED AND/OR RECORDED CHALLENGES

The challenges of this solution are:

1) One of the main challenges of this solution is to use the LoRa Network, a low-rate communication infrastructure, to monitor and remotely control electric heaters and hot water boilers. As a result, only occasional modification of schedules are transmitted with the LoRa network. The "normal" schedule is filled on the local supervision, and cannot be modified on the online supervision.

2) The possibility to install remote switches depend on the status of the electrical installation of the buildings (electrical and safety standards)

3) The solution has been developed mainly on the technical point of view resulting in a lack of communication with the municipal staff during the conception phase. This lack of communication is partly due to the remote situation of the island plus the COVID-19 context reducing the possibility of meetings. The municipal staff, although interested and in favor of projects in energy savings, are already busy with their everyday activities. This new experimentation is understandably not the most urgent for them, which do not help to involve them in the experimentation