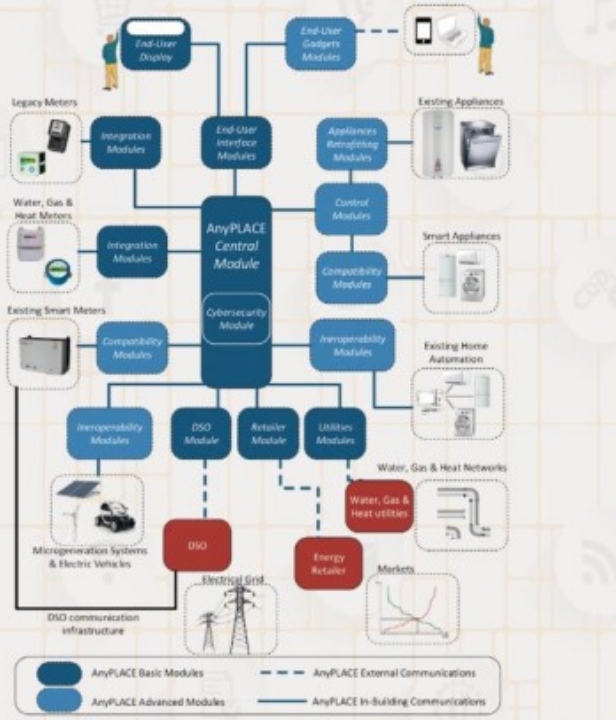
Control is key to our energy future

Providing end-users with more information about their energy usage patterns could help them identify ways to improve efficiency. We spoke to **Dr David Rua** and **Professor João Abel Peças Lopes** about the AnyPLACE project's work in developing a modular energy management system that will give end-users a new level of control over their energy usage

A type of monitoring technology that gives consumers detailed information on their energy usage patterns, smart meters are an increasingly common feature of efforts to improve energy efficiency in both residential buildings and commercial premises. Now researchers in the AnyPLACE project aim to take a step further by developing a modular monitoring and control platform capable of interacting with appliances and smart meters. "The main aim of the project is to develop an energy management system which integrates intelligence regarding energy management and the use of automated systems inside households and buildings," says Dr David Rua, the project's coordinator. This management system – or platform – will be designed to be interoperable, cost-efficient, and capable of being integrated with both state-of-the-art appliances and legacy devices. "One of the key issues in these terms is the use of interoperable hardware and software, that allows the owner of the solution to identify and analyse usage patterns and select the best tariff schemes accordingly," explains Dr Rua.

The goal of enabling cost-effective usage will have a wider impact on the energy market by helping to raise awareness of energy efficiency and thereby change behaviour. This work is very much in line with wider environmental goals, and Dr Rua believes that as the ultimate end-users of electricity, we all have to adapt to a new reality. "In the past, what happened in operating the electric power system is that the supply was adapted to the needs of consumers. Nowadays, we have to understand that we need a different system and a different framework," he stresses. This means that consumption patterns today have to be adapted in line with the availability of primary resources. "Energy suppliers have different prices and different incentives, to encourage energy consumption at specific times of the day," continues Dr Rua. "The platform we are developing in the project will gather data from local users, helping them become more efficient."



AnyPLACE architecture

Hardware and software

Researchers in the project are developing both hardware and software components, as well as integrating existing resources. Residential buildings and offices tend to vary widely in age, and energy management technology has developed significantly over time, to a point where Dr Rua believes it can now be applied more widely. "Nowadays we have the platform and the tools to make energy management more accessible for end-users," he says. The AnyPLACE platform is designed to encourage people to think about the way they consume energy and identify ways in which it could possibly be reduced, with the platform providing a means of interaction between consumers, market representatives, network operators and ICT providers. "This platform can be thought of as an interface with the operation distribution system," explains Professor João Abel Peças Lopes, the project's coordinator, working alongside Dr Rua.

This will help engage end-users more closely in the electricity market, and point them towards more cost-efficient usage patterns. Active control of the electricity network will also help end-users make more effective use of renewable sources of energy like wind and solar photovoltaics (PV); the irregular nature of supply from these sources is widely viewed as one of their major drawbacks, so Professor Peças Lopes believes it's important to use them when they are available. "If we try to store this energy then we typically lose a certain proportion of it. So the right approach is to use it when it is available," he outlines. "This is what the AnyPLACE platform enables – it provides an interface between the end-user and the network, just telling them that there is scope for flexible loads to be connected at those periods and it allows the usage of the appliances at the right moment. This means energy from renewable sources can be used efficiently."

From the point of view of the end-user, this could be on less time-sensitive loads, such as washing. To the end-user, it's not particularly important what time a washing cycle starts, yet benefits could arise from shifting the load; this method of changing energy usage patterns is called flexible peak shaving. "These loads can be postponed and have a fixed duration," says Dr Rua. Researchers are undertaking a cost-benefit analysis of different configurations of the platform, aiming to ensure the overall solution is cost-effective, while different prototype versions of the platform will also be produced. "One version is relatively basic and inexpensive, where there is limited interaction with the end-user. The other is more advanced, and is made from different end-modules," outlines Dr Rua. "We can think of this second version as almost a library solution, in the sense that more pieces can be added in line with local circumstances."

Prototype testing

The two prototypes will be tested at households in Dörentrup, Germany, with researchers looking to exploit different algorithms and different software models. Assessing the performance of the platform will be a complex task, as it is difficult to precisely define the costs and benefits associated with it. "It's not very easy to define the benefits of the platform up-front, by saying: 'this is the amount of cash you will save'. Therefore it needs to be analysed in the previous state, which is why we are developing some monitoring devices. After that we can assess the benefits of the platform on a more realistic basis," outlines Dr Rua. The prototypes will be tested in different application scenarios, and researchers are looking to improve the platform still further. "We have developed the hardware and software modules and are investigating different paradigms. At the beginning of 2017 we should have the first prototype in laboratory conditions," continues Dr Rua.

Researchers are also keen to explore the wider commercial potential of the platform beyond the initial scope of the project. This means both looking at market opportunities and also considering the wider regulatory environment. "We're looking at how to ensure that everybody benefits from this sort of solution," says Dr Rua. The platform itself is highly adaptable, so further elements could potentially be added to it in future to reflect market changes. "Of course we intend to look at what we can add. We are looking at different communication interfaces, so that different communication technologies can be integrated, up to a certain limit," says Dr Rua. "The same rationale applies to the software modules, as they can be added to the platform to implement new functionalities or enhance existing ones making it a highly adaptable and customizable solution."

The main aim of the project is to develop an energy management system which integrates intelligence regarding energy management and the use of automated systems inside households and buildings

AnyPLACE prototype

At a glance

Full Project Title
Adaptable Platform for Active Services Exchange (AnyPLACE)

Project Objectives
The H2020 AnyPLACE project intend to develop an advanced, modular and cost-effective home energy management system that is able to fully engage end-users to better use their energy and improve its efficiency. It will be designed to operate in different physical environments and be compatible with different EU regulatory frameworks so that consumers can become active players in the exchange of energy services with other stakeholders.

Project Funding
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Project Partners
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João A. Peças Lopes is a Full Professor at Porto University (FEUP), where he teaches both undergraduates and post-graduates. His main domains of research are related to large scale integration of renewable power sources, power system dynamics, microgeneration and microgrids, smartmetering and electric vehicle grid integration.

David Rua is a Senior Researcher at the Center for Power and Energy Systems of INESC TEC. His research activities include the design and implementation of communications systems to support hierarchical and distributed management and control schemes for smart grids, as well as the design of solutions for building energy management.

AnyPLACE
Adaptable Platform for Active Services Exchange