

New tech for old buildings means gains for the wallet and climate

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"Smart" technologies in homes reduce energy use and bills, prompting stepped-up European research in the field.

They may lack the environmental wow factor of switching to an electric car or giving up flying, but energy improvements in buildings cut emissions that cause global warming and make life more comfortable for occupants.

Buildings are the biggest consumers of energy in the EU, with many heated by fossil fuels or poorly insulated. Besides being economically wasteful and environmentally harmful, such structures are increasingly unsuitable for workers and families in an age of more frequent and severe heatwaves.

Saving sensibly

As Europe accelerates reductions in [greenhouse gases](#) and efforts to wean itself off once-plentiful Russian oil and natural gas amid the war in Ukraine, energy savings in buildings are getting a boost from the EU on the legislative and research fronts.

"The era of very cheap energy in Europe is over," said Fergal Purcell, managing director of Arden Energy, an Irish company that seeks to lower household and office fuel bills. "The era of smart energy is coming."

The EU this year committed to tougher energy-saving targets as it seeks to slash emissions by at least 55% in 2030 compared with 1990 levels and to become climate-neutral by mid-century.

EU governments and the European Parliament [agreed](#) to reduce final energy consumption in Europe by 38% this decade compared with 2007 projections for 2030. The previous reduction goal for 2030 was 32.5%.

Along with an initiative to double annual building-renovation rates over the coming decade, "smart" technologies being tested and deployed in

European research projects have a role to play in meeting the new EU energy-efficiency target.

Playing it smart

A project called [SMART2B](#) received EU funding to monitor and control existing equipment in buildings—be it new appliances, old heating systems or rooftop solar panels—through connected sensors and switches.

"We're trying to integrate legacy equipment, with no intelligence, as well as smart appliances," said Nuno Mateus, coordinator of SMART2B, which runs for three years through August 2024.

Buildings in various climates and with different characteristics are being used as [test cases](#): a retirement facility in Denmark, foster homes and Airbnb apartments in Portugal, offices in Spain and a shopping center in Sweden.

At the foster homes in Lisbon, around 40 residents whose ages ranged from five to 25 years took part in the preparatory workshops and were particularly enthusiastic, according to Mateus.

"They will be the adults and the decision-makers of the future and it's a good way to start spreading the word," he said. "It's interesting that one approach, one app, can engage kids in Portugal and [older people](#) in Denmark. The main focus should be around the people using the buildings if we want to be successful."

The SMART2B team hopes that, by the end of the project, the set-up will have demonstrated energy-efficiency gains of as much as 40%.

An app for everything

Under the set-up, the users receive a [smartphone app](#) or web-based system to monitor data on energy consumption and performance.

The technique is based on the cloud and the Internet of Things—a network of connected objects such as sensors or measuring devices. It includes the use of artificial intelligence, data modeling and software known as "application programming interfaces" that enables different devices to communicate with each other.

Unconnected legacy equipment such as electric heaters and more [modern technology](#) like solar panels can all be monitored and controlled within the same set-up. The older equipment gets connected through smart plugs and meters.

"We're trying to develop devices that are agnostic to the type of equipment they connect," said Mateus, a project manager at the NEW research and development arm of Portuguese energy company EDP.

Motivating more

Keeping the public engaged has been a key goal of SMART2B as it tackles a challenge typical of many app users no matter what the sector: after an initial burst of enthusiasm, they lose interest.

To keep that from happening, the researchers have fostered a sense of competition through challenges and missions within the app.

In what Mateus describes as the "gamification" of the system, users can earn points with certain kinds of behavior such as lowering consumption or limiting it to off-peak hours.

The idea is that, in comparing performances, participants increase their knowledge of greener consumption patterns and are encouraged to follow them.

Spreading the word

Mateus regards the current energy crunch in Europe as a likely catalyst for more action in the field.

"We need to take this moment to pass the message," he said. "It's the easiest way to see a difference at the end of month in your electricity bill and improve living conditions in your building."

Purcell of Arden Energy agrees.

"The surge in energy prices certainly helps raise awareness and focus attention on energy consumption," he said.

Purcell is part of an Irish test case in another European project—[PHOENIX](#)—that also received EU funding to improve energy efficiency in buildings.

PHOENIX is due to wrap up in August 2023 after three years. Its researchers have shared experiences and information with the SMART2B team.

"Our approach is to facilitate operability between our system and other systems," said Antonio Skarmeta, coordinator of PHOENIX. "We don't expect our system will be the only one."

Taking charge

Digitalization has made interoperability and data sharing possible, helping shift consumers' attitudes to services including energy.

"We used to be clients, now we're becoming prosumers," said Skarmeta, a professor in the department of information and communication engineering at the University of Murcia in Spain. "Users want to be in control."

Besides Ireland, the PHOENIX technology is being tested in Greece, Spain and Sweden.

The sites include homes and the National Center for the Circular Economy in Ireland; four residential apartments and a business center in Spain; a renovated building belonging to the army in Greece; and a dual commercial and residential structure in northern Sweden.

The team is carrying out final tests at the sites and expects the results to show that a reduction in energy consumption of 20% to 25% is feasible using the technology, according to Skarmeta.

The technology brings together data from existing equipment in buildings into one central software platform. It can then analyze the information and offer the building's occupants advice on improving efficiency or energy-management services through a web-based or smartphone app.

The system can be set up to offer incentives such as lower tariffs if users agree to limit energy consumption at peak times, for example. Or it can allow users to sell power generated by solar panels back to the grid.

People can get advice in the form of smartphone alerts, opting to charge their electric car on a windy night when wind turbines are busy and electricity prices are low. Consumers can also hand over control of

decisions about when to charge their car to the app, which will select the cheapest and greenest time based on demand forecasts.

Ensuring consumers can handle new [energy-savings](#) systems at home can be as important as deploying them, according to Purcell.

"People buy [energy](#)-efficient technology, but they're not really told how to use and manage it optimally," he said.

More information:

- [SMART2B](#)
- [PHOENIX](#)

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