

# How smart can the electricity grid be?

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Opportunities will open for European citizens with more and more renewables on the European electricity system.

Traditionally, our electricity grids were designed to move power from large nuclear and fossil fuel power plants to consumers, but renewable energy will see changes to allow smaller [power generation](#) from wind and solar to be hooked up to the grid.

This will enable distributed renewable generation and allow households to sell their renewable energy back to the grid, says Jennie Stephens, who spoke about this topic in Trinity College Dublin, Ireland, this summer.

"It is not just the technology that is changing, but also the management of the flow of power. Also, our institutions that manage power are changing, and there is potential for us all to change our own expectations and assumptions about electricity, too," says Stephens, who is a professor of sustainability science at the University of Vermont, U.S.

Renewables are more intermittent, with peaks and dips in [electricity generation](#) from solar and [wind power](#). So citizens need to start rethinking old assumptions about electricity. Stephens says this is already happening among people who have solar panels on their roofs, as they consider when to use and not to use power. "When households or communities have their own renewable generation, they are interested and engaged, and people can feel empowered to reconsider their energy use," Stephens explains. It can also make people more accepting of changes that are happening to the landscape as we shift to [renewable](#)

[power](#).

Many of us are not used to seeing [energy infrastructure](#) on the landscape. But with renewable energy, there will be more distributed energy infrastructure on the landscape. There will be upsides, such as "lots of opportunities for improving human health, mitigating climate change and creating clean-energy jobs," adds Stephens.

Indeed, it is predicted that by 2050, the majority of Europe's electricity will come from renewables, and the continent's transmission grids will need to be geared to both transporting large quantities of offshore wind-generated electricity and integrating it into micro-grids.

A term we will hear more is that of a "smart grid," meaning how computer technology can assist our conventional electricity system in handling the big shift to [renewable energy](#). Technology and infrastructure needs are being actively researched in Europe. For example, a European project called BEST PATHS looks at issues such as high-voltage direct current links, sort of energy highways.

"Think of the connection between the north of Germany, where a lot of wind power is now being generated, and the south of Germany, which is the biggest load centre [area of consumption]. Right now, there is no direct [strong connection] between the two," notes Pierre Pinson, professor of energy analytics and markets at the Technical University of Denmark and one of dozens of researcher working on BEST PATHS. Pinson is focused on technology and power system management, and getting the best out of what is already in place.

"House and large offices are virtual batteries," argues Sean Meyn, professor of electrical and computer engineering at the University of Florida, U.S., and it is a resource we should tap into.

Energy consumption from heating, air conditioning, and many other activities in buildings is highly flexible. By adjusting power consumption in a controlled way, an [electricity](#) grid can better cope when there is surplus power arriving (as on windy days, in the case of wind power). Similarly, if there is a dip in power generation, buildings can turn down fans by 10 percent, reduce heating marginally, or turn off the water coolers.

Incentives are needed to encourage new behaviors. "You then reward customer each month once they agree to a certain amount of flexibility," Meyn explains. "For example, maybe you are willing to accept any temperature range between [20 and 23°C] in your house. The grid operator can then ramp [power](#) up and down, and that transforms your home into a virtual battery."

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