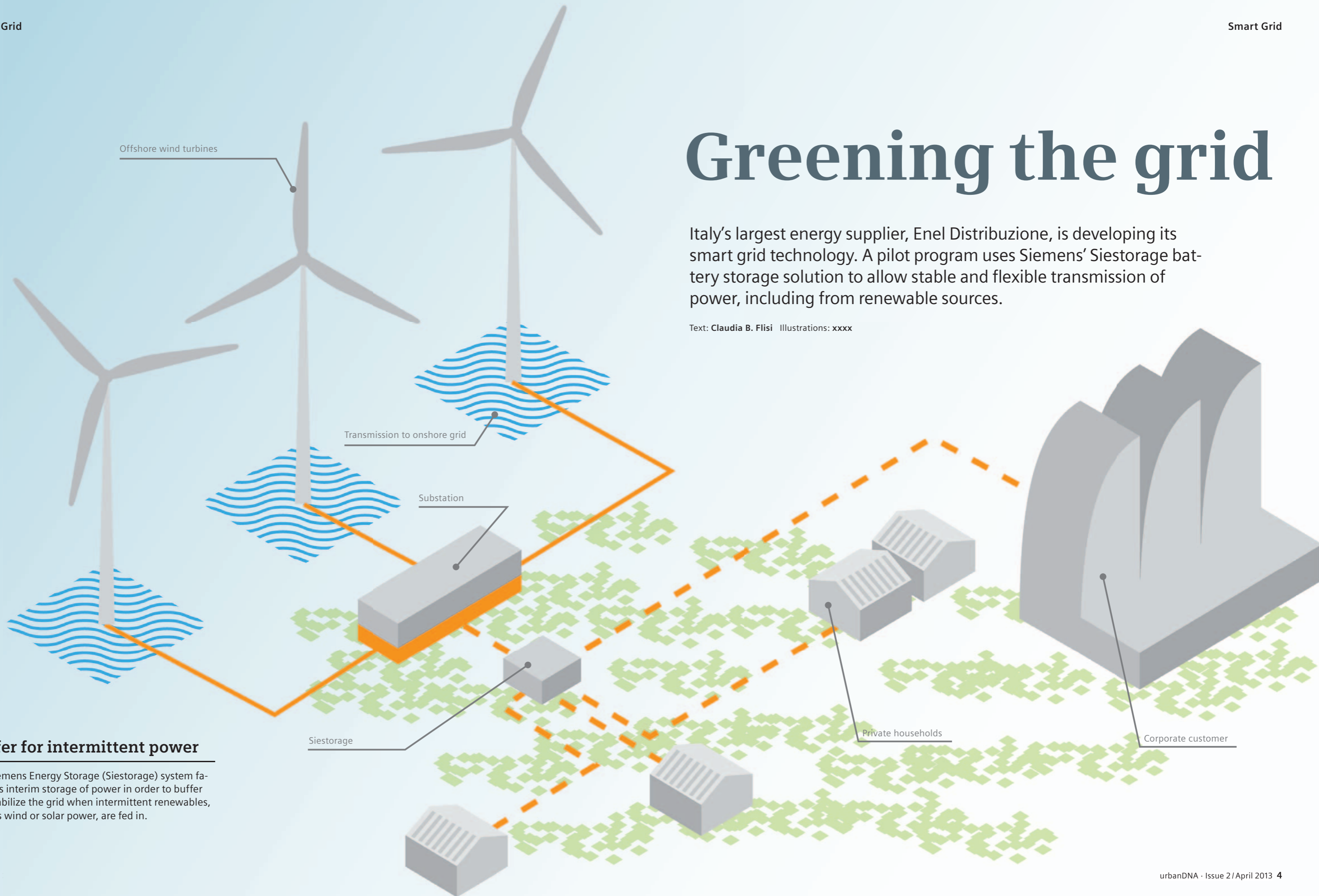


# Greening the grid

Italy's largest energy supplier, Enel Distribuzione, is developing its smart grid technology. A pilot program uses Siemens' Siestorage battery storage solution to allow stable and flexible transmission of power, including from renewable sources.

Text: Claudia B. Flisi Illustrations: xxxx



## Buffer for intermittent power

The Siemens Energy Storage (Siestorage) system facilitates interim storage of power in order to buffer and stabilize the grid when intermittent renewables, such as wind or solar power, are fed in.



## Paola Petroni

### Vice President, Enel

As Head of Network Technologies within the Infrastructure and Networks Division of Enel, Paola Petroni is responsible for R&D of new applications, including IT systems for smart metering.

Before starting at Enel, Paola Petroni developed the IT system for the Italian Power Exchange (IPEX).

With 25 years of experience in automation and control systems in the energy sector, she is also the project coordinator for the European Commission's ADDRESS (Active Distribution network with full integration of Demand and distributed energy RESourceS) project, funded by the Seventh Framework Programme.

What is preventing the widespread adoption of renewable, environmentally friendly energy sources – such as wind and solar – in the industrialized world? A lack of political will is sometimes cited as the major reason. But it is not the only culprit: Storage is also a significant stumbling block. Today's grids lack the capability to transport energy from wind farms or solar clusters, where it is produced, to the cities, where the heaviest consumption takes place. And, at present, storage for renewables is very expensive. For example, Italy has been exploring alternative energy sources for decades, given its lack of domestic petroleum supplies and a rejection of nuclear power since 1987. Enel, Italy's major energy company, invests heavily in renewable energy and has been at the forefront of development of smart grid technology

worldwide, but it has to grapple with the storage dilemma like everyone else. Enel was created by the Italian government in 1962, grouping together a number of existing entities to organize more efficiently the functions of production, import and export, transportation, processing, distribution, and sale of electricity in the country. The name "Enel" is an Italian acronym for Ente Nazionale per l'Energia Elettrica, or "national agency for electrical energy".

### Green mission

For more than 30 years, Enel has been collaborating with environmental organizations; its increasing activity as a source of "green" energy is an extension of that mission. Corporate Social Responsibility is an integral part of its culture. Since 1999, it has been ranked on the FTSE4Good Europe 50, the index of the top 50 Eu-

ropean companies combining business with precepts of social and environmental sustainability. Enel is the only public utility to be admitted. In 2010, the Italian government invited bids for experiments in smart grid development for energy distribution. Enel developed a detailed project that addressed longstanding technical issues. However, as Paola Petroni explains, there was a key obstacle: "We needed improved storage capability," says the engineer and Head of Network Technologies at Enel's Infrastructure and Network division. Because the project represented "a new area of exploration", Enel spoke with several suppliers, including Siemens, about the storage component, notes Petroni. She recalls that Siemens was enthusiastic and eager to invest both human and financial capital in the pilot program, and consequently became Enel's partner in this new adventure.

### Battery-powered buffer for stable grids

Among the challenges were: ensuring maximum flexibility in the system; ensuring stability at very short-term intervals within low- and medium-voltage (LMV) distribution grids; and addressing the issue of reverse energy flow, i.e., when medium-voltage energy flows back "up" to

the distribution network instead of flowing "down" to its intended destination – homes or factories. The tension must remain constant, within specific limits, Petroni emphasizes, "and storage is one tool that helps us achieve that stability."

The Siemens Energy Storage (Siestorage) system became the solution for interim storage of renewable power and a way of buffering and stabilizing the power grid in conditions of intermittent feed-in. It consists of battery storage systems, explains Jean-Philippe Macary, Head of LMV Power Solutions Product Portfolio Management and Marketing for Siestorage at the Siemens Infrastructure & Cities Sector. "These cannot store the daily output of a wind park, for example, but are able to handle short-term peaks and troughs by storing and releasing power at very short notice in order to stabilize the grid. In urban distribution networks, storage units also require space, which is at a premium in built-up conurbations – not to mention the cost of installing storage systems in such areas. That's why a decentralized approach involving a modular storage system with high energy density like Siestorage is required in order to make use of existing space and buildings."

Flexibility is inherent in the design – a modular energy storage system in which batteries and control electronics are plug-in units inserted in cabi-

nets. A combined control and grid connection cabinet is used for up to four modular energy storage units consisting of several cabinets. According to Macary, smaller distributed storage units are a practical alternative to tearing out and rebuilding entire urban grids. Siestorage can be installed either at the level of the distribution grid or with the consumer directly, for instance as part of the building or industrial park. The deciding factor is where load imbalances occur.

He points out that so-called "prosumers" – consumers who also produce power and feed it into the grid – may have a contract with a utility that obliges them to provide certain levels of input or loads in return for more advantageous tariffs. He notes the possibility that regulators or governments may in the future require buffers to stabilize grids. In both cases, he says, Siestorage can help avoid disruptions and ensure that utilities guarantee constant levels of supply. The project took shape in 2011; all preliminary tests were completed by December of that year. The pilot program was fully operational in the Italian region of Molise early in 2012, with functionality and features exactly as projected: a nominal power of 1 megavolt-ampere and a capacity of 500 kilowatt-hours, connected to Enel's medium-voltage grid. Petroni reports "no surprises" in installation or operation – except for



Inside Siestorage's compact modular energy storage unit.

the snow. Molise experienced snow and freezing temperatures during the installation phase, making it somewhat more complicated and costly than foreseen. Nevertheless, none of the subsequent minor tweaks to the system involved the storage unit itself. This pilot program will end in 2013, after which both partners will have enough data to evaluate its operation and efficacy. In the meantime, Siemens is free to conduct its own tests on the storage unit, not only with Enel but independently. "We and Siemens can work to improve it, together and separately," Petroni points out. She emphasizes that the project's objective was not to "save money per se", but to develop new ways to store energy and ensure maximum flexibility to the network, eliminating the destabilizing occurrence of reverse energy flow. What is most important, she summarizes, is that after decades of theory and discussion about storage of renewables, "we now have an operating unit that can use energy from wind and sun." ■

*Claudia Flisi lives in Italy. As a journalist, she writes about technology, business, and culture for the International Herald Tribune and many other publications.*

“Storage is one tool that helps us achieve grid stability.”

Paola Petroni, Head of Network Technologies, Enel

## Enel Distribuzione, S.p.A.

**Founded:** 1962, operational 1963

**Management:** Fulvio Conti, CEO and General Manager

**Location:** Headquarters in Rome, with 20 factories in 11 countries on four continents and sales in 160 countries

**Operations:** Hydroelectric, thermoelectric, nuclear, geothermal, wind, solar, and other renewable power plants in 40 countries. About 42% of the power generated by Enel in 2011 was carbon-free.

**Revenue:** €79.5 billion (2011)

**Number of employees:** 75,000

**Website:** www.enel.com