

Innovating through partnerships for a clean energy future

BY GEISHA WILLIAMS, PRESIDENT, ELECTRIC, PACIFIC GAS AND ELECTRIC COMPANY

IT'S A STORY WE ALL KNOW WELL: the lone inventor toiling and tinkering away in isolation until one day, like lightning, genius strikes and a great breakthrough is born.

Reality, though, is rarely so romantic. The truth about innovation is that it most often results from the give and take between multiple partners and collaborators, inspired by a common vision, sharing insights and building on each other's hard work, as well as refining their approach through the crucible of trial and error.

At PG&E, we believe that rule will hold just as true for finding the keys to a cleaner energy future as it has in driving the digital revolution.

We also understand that our company's role in helping to bring about that future offers a potential blueprint for others, both in the U.S. and abroad. The answers we come up with will be vitally important in showing not just that a clean energy economy is possible, but how it can be built, and how quickly.

We are rethinking how new technologies such as private rooftop solar, electric vehicles, and energy storage can provide value for everyone who uses the system.

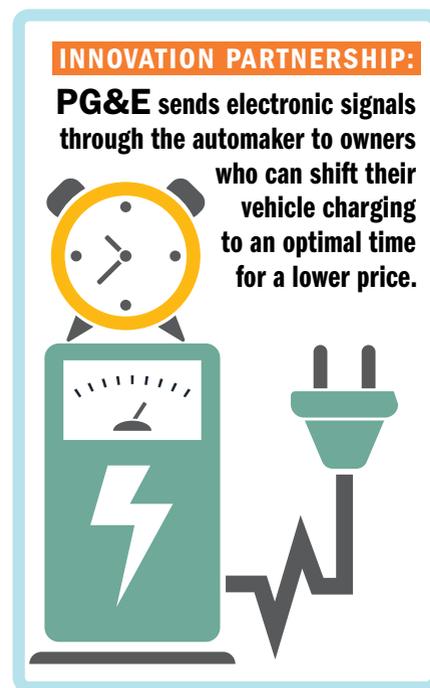
PG&E is investing billions of dollars to create a smart grid that is capable of meeting that challenge. But we are not just replacing the old grid with a modern equivalent. We are also rethinking how the grid should function, and where new

technologies such as private rooftop solar, electric vehicles, and energy storage can provide value for everyone who uses the system.

And we're not doing it alone. In addition to exploring our own innovations, we're testing new ideas with dozens of partners to learn what works best, and which will produce the most economical solutions for our customers.

One such pilot is underway in a neighborhood of southeast San Jose, where we've teamed up with Solar City to evaluate a device that uses private rooftop solar and battery storage to add stability to the grid, while also improving PG&E's ability to manage intermittent power flows as more homes and businesses choose solar energy.

Another example, at the intersection of clean transportation and the grid, is a partnership with BMW to use electric vehicle batteries as a tool to adjust energy use during periods of high demand. PG&E sends electronic signals to the automaker, which then transmits requests to owners to shift their vehicle charging to an optimal time, adding flexibility



to the system and helping customers take advantage of price incentives.

And on the grid itself, we're working with a company called Smart Wires to try out a plug-and-play control module that can be attached to our existing transmission and distribution lines, allowing operators to fine tune the amount of energy they carry, dialing it up and down in response to dynamic fluctuations in demand and supply. That offers the potential to integrate greater contributions from renewable resources, as well as adjust for shifts in load across the network

which might otherwise require constructing power lines in new places—a far more costly alternative.

We see partnerships such as these as essential to PG&E's and California's success in designing the most effective path for transforming our vital energy infrastructure and achieving steep greenhouse gas reductions needed to address climate change.

As the energy provider to 16 million Californians, that's a challenge we're eager to take on. And we're confident that—together with our partners—we will find the breakthroughs able to get us there.

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