



Energy Policy Seminar Series, Spring 2013

“Frugal Innovation” for the Power Sector

The artificial leaf was inspired by a hamburger, Patterson Rockwood Professor of Energy at Harvard Daniel Nocera said during a talk at Harvard Kennedy School on March 4, explaining that his research agenda was driven by an overarching goal of making a low-cost, simple to manufacture, bite-size energy technology—one that might trade ambitious scale and performance goals for simplicity, accessibility, and cheapness.

Focusing on the challenge of providing energy for a growing world population and increasing per capita GDP, Nocera argued for the importance of solar energy as the only resource with the potential to meet the full projected future energy needs of the world.

Nocera argued for the importance, as well, of focusing on the developing world as a way to break free of existing technology paradigms and achieve real innovation. Rather than taking prevailing developed-world technology, engineered for large-scale applications, and attempting to make it cheaper, Nocera argued for the value of a kind of “clean slate” approach that focused on low-cost provision of the relatively small-scale energy that could be of immediate benefit in developing countries. This new technology might then, in turn, point in new directions that could also benefit the developed.

Nocera highlighted two innovations he has developed which sprang out of his focus on making technology cheap and accessible: the “artificial leaf” and a water-based flow battery. With the “artificial leaf,” Nocera abandoned a design based on circuits and wires. Instead, his lab developed a novel self-healing catalyst that could use energy from the sun to separate hydrogen and oxygen even in polluted water (producing hydrogen which can then be used as a fuel) and which could then reconstitute itself for continued use. The flow battery technology developed by Nocera uses water (rather than any toxic substances) as the raw material for the bulk of the battery, reducing toxicity and increasing the potential for wide deployment, not only on a small scale in the developing world, but at a larger scale to help large utilities balance electricity supply and demand and manage intermittent resources like wind and solar.

Nocera saw an important role for policy and business research in guiding the further development of such technologies, to answer questions such as what the appropriate scale of implementation for such technology might be and how these systems could be both profitably developed and maintained on an ongoing basis.

Professor Nocera spoke as part of the Energy Policy Seminar Series, which is jointly sponsored by the Energy Technology Innovation Policy research group of the Belfer Center on Science and International Affairs and the Consortium for Energy Policy Research at the Mossavar-Rahmani Center for Business and Government.