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Energy Quarterly

News and analysis on materials solutions to energy challenges

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Images incorporated to create the energy puzzle concept used under license from Shutterstock.com.

Energy Sector title image: Illustration of an "artificial leaf," an imaginary fully integrated PEC device that will one day convert sunlight, CO_2, and water to HC fuels for transportation. Credit: JCAP/Caltech.

Energy Sector title image: The 2014 Nobel Prize was awarded to the inventors of the blue LED, which is the key to modern energy-efficient lighting. Credit: Shutterstock.

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MRS Bulletin

Engineering research: An underinvested-in weak link in the energy innovation ecosystem

Engineering research, the exploration of new tools and technologies for manipulating and observing our world, has long been vital to humanity. The invention of the blue LED, as discussed in one of this issue's feature articles, is just one recent example—one that, along with many others such as the light bulb, the steam engine, and solar photovoltaics, is transforming humanity's relationship with energy. Perhaps most importantly, engineering research often does not follow from (and the blue LED even contradicted!) the scientific understanding of the time. Engineering research has a way of surprising us, most notably when it provides new windows into nature.

Despite its importance, engineering research is overlooked and under-supported. Why? For two reasons. First, for industry, it is too long-term, uncertain, and high risk. Second, for the public sector, it has suffered from two conflations that have dominated research policy since the 1950s: of science with research and of engineering with development. When engineering is conflated with development, it is logical to protect research by creating boundaries between science and engineering. The US Department of Energy (DOE), the largest investor in energy R&D in the United States, is largely stovepiped into offices that focus on research with a science flavor and development with an engineering flavor.

Here, we call for ending the conflations of research with science and of development with engineering. Research is the exploration of what we don't yet know and what we cannot yet do. Its historical pattern has been interacting cycles of invention (engineering research) and discovery (scientific research), with engineering research at least as often leading scientific research as following it.

Engineering research must be acknowledged as an important flavor of research worthy of public-sector support in its own right. We view the creation of DOE's ARPA-E and Energy Innovation Hubs during the last administration as important steps in the right direction. However, in the current administration's budget request, these changes would be negated due to the mistaken view that such high-risk engineering research would be done by industry with no necessary role for government.

Equally important, the boundaries between scientific and engineering (and between so-called basic and applied) research must be lowered. The 20th century's great industrial R&D laboratories (whose role has now largely been taken up by public sector funding) were prime examples of the importance of the synergies between scientific and engineering research: The iconic Bell Laboratories was home to scientific discoveries and engineering inventions, not to mention Nobel Prizes and economic innovation. We view the creation of a single DOE Undersecretary for Science and Energy during the last administration as an important step in the right direction, and hope that this will enable synergies between science and engineering research, where appropriate.

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