Research investments, growing markets prompt rise in energy patents, study finds

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Innovation in energy technology is booming, according to a new paper in PLOS One that examines what factors set the pace for energy innovation.

The study finds that investments in research and development, as well as in the growth of markets for these products, have helped to spur this dramatic growth in innovation.

The analysis—co-authored by SFI Professor Luis Bettencourt, SFI External Professor Jessika Trancik of MIT, and graduate student Jasleen Kaur of the University of Indiana (Bloomington)—examines worldwide and regional trends in translating research into technology, and it models the relationship between patent production, funding, and markets.

"Patents reveal early stages of technology development, as they tell of the nature of innovative activity, and who's doing what where," explains Trancik, who notes that energy patents are growing faster than patents overall.

To see what's driving innovation, the researchers examined a dataset from the patent databanks delphion.com that included more than 73,000 energy-related patents issued in more than 100 countries between 1970 and 2009, using keyword searches of the patents themselves, rather than the classifications assigned by patent offices

The analysis yielded four main findings:

- The number of energy patents has risen dramatically over those 30 years.
- Patent rates across technologies vary: the current trend toward renewable technologies, especially solar and wind, now outpaces most fossil fuels despite their decades-long market dominance.
- Regional specialization: Japan has the greatest number of patents filed for all energy technologies other than coal, hydroelectric, biofuels, and natural gas; Europe's fossil fuel patents have clearly declined in the last decade; and China now surpasses Europe in annual energy patents and files the most coal patents of any nation.
- Both research and market growth are significant factors, acting together to drive innovation.

The team uncovered these results by creating a model based on a two-stage process that captures how technology innovation generally develops: the first stage typically depends on fundamental research supported by public R&D investments, and then those technologies that make it are taken up by individuals and firms, spurred on by market expansion.

"Most technological knowledge requires a long incubation period, often relying on public R&D investments, but then things can suddenly take off if 'virtuous cycles' of innovation and market expansion kick in," explains Bettencourt. "This has happened with many familiar tools, such as the internet and cell phones, so we wanted to better understand if it may be about to happen among new energy technologies."

The paper notes that public support for innovation in low-carbon energy technologies is typically required for lengthier time periods than in many other sectors, as carbon emissions are an aspect of performance that is not apparent to consumers nor included in the price of energy.

Perhaps the most important study outcome is the confirmation that knowledge created, either from basic research and development or from market growth, persists for a long time and tends to ripple through new ideas and technologies for many years to come: "A dollar invested early on, even back in the energy crisis in the 1970s, is still useful today," says Trancik.

More information: trancik.scripts.mit.edu/home/w … mission_w_HEADER.pdf

Provided by Santa Fe Institute

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