

Analysis of Small Business Innovation in Green Technologies

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Purpose

Previous Advocacy-funded studies of small business patenting activity established the existence of a cohort of independent, for-profit innovative small firms with 15 or more patents over a five-year period. The studies also showed that innovative small firms had a higher percentage of emerging technology patents in their portfolios than their larger counterparts. A recent focus on “green” jobs, businesses, and technology led to this study of a subset of these innovative patent holders. This project was designed to highlight differences in the patent activity of small and large firms in green technologies and industries.

Overall Findings

Small innovative firms in this study are even more productive, measured in terms of patents per employee, than was shown in the previous studies. The current study finds that small innovative firms are 16 times more productive than large innovative firms in terms of patents per employee. In green technologies, while four times as many large as small innovative firms have at least one green patent, small firms are more likely than larger firms to have green technology as a core part of their business.

Highlights

- Small innovative firms are 16 times more productive than large innovative firms in terms of patents per employee. Small innovative firms with fewer than 500 employees produced 27 patents per 100 employees, compared with 1.6 patents per 100 employees in large firms with 500 or more employees.
- Patents of the small firms in the study were cited 79 percent more by recent patents than is typical for other patents of the same age and

patent classification. Patents of the large firms were cited just slightly above average. The small firms in the study also outperformed the large firms in patent originality, generality, and growth.

- U.S.-based organizations were responsible for 43 percent of U.S. patents in green technologies in 2005-2009, while Japanese organizations were responsible for 32 percent. No other country had more than 6 percent.
- Green patents form a higher percentage of the portfolios of small firms with at least one green patent (20 percent on average) than of the large firms’ portfolios (1.5 percent).
- Green patents from small firms are cited 2.5 times as frequently as green patents from large firms.
- While small firms account for about 8 percent of all U.S. patents in the U.S. innovative firm database, they account for 14 percent of green technology patents. Small firms account for more than 32 percent of the patents in both smart grids and solar energy, and 15 percent of patents in batteries and fuel cells.
- Eighty percent of the “prolific” inventors—those with five or more recent green patents with a citation index of 1 or more—from small green technology firms had previously worked at large companies, or large government or university labs.

Scope and Methodology

The researchers created a dataset of companies with 15 or more patents in a five-year period, 2005-2009. These 1,279 innovative firms have been granted in total more than 1 million patents. The current study analyzes 532 small innovative firms. Forty-two percent (224 firms) are new entrants and were not part of the previous 2002-2006 analysis.

To further focus on “green” technologies, the researchers chose to cover the following technologies: batteries, clean coal, smart grid/smart metering/ electric grid infrastructure, fuel cells, geothermal energy, generic green technology, hybrid electric vehicle systems, hydro power, solar energy, and wind energy. Although there may be debate about this list, these technologies were selected because the study is technology-based and is designed to assess the role of small entities in green technology developments. For example, mass transit, as an energy efficient implementation, may be considered “green,” but the increased use of mass transit is more likely to be driven by a change in consumer attitudes driven by government policies rather than by technology developments. A second reason given for selecting these technologies is that they have been used successfully in other green energy projects such as the California Green Innovation Index.

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