

Cleantech Energy Patent Landscape

Executive Summary



A Guide to Navigating Cleantech

Cleantech innovations accomplished significant milestones throughout 2010, seeing both an increase in investments and patent activity, despite the challenging market. While solar, wind, and hybrid vehicle technologies held their ground overall as the most dominant of the cleantech technologies for the third year in a row, all of the technology categories studied in this report showed an increase in patent activity level. This coincides with findings that cleantech experienced a 7.6 percent increase in U.S. cleantech investments¹ and an overall 30 percent increase in global investments from 2009 to 2010.² As a result, the cleantech sector moved further beyond the lab and into the mainstream, providing a significant increase in opportunities for innovation and investments.

To aid industry executives, start-ups, individual inventors, and investors in identifying trends and, in turn, leveraging market opportunities in this continually changing landscape, Foley annually identifies the top clean energy technologies within the major cleantech categories that are patented in the United States and provides the results of the research via our *Cleantech Energy Patent Landscape Report* (Report). The analysis provides contrasting activity levels between corporate entities and individuals, the specific technology areas that are being pursued, remaining areas for potentially patentable white space, and the green technology areas where untapped licensing and investment opportunities may still exist.

Our analysis of 2010 highlights trends for the following leading cleantech innovations:

- » Solar
- » Hybrid vehicles
- » Wind
- » Fuel cells for vehicles
- » Hydro/wave/tidal

- » Utility metering
- » Geothermal
- » Smart grid technologies
- » Biomass/biogas/biofuel
- » CO₂ storage or sequestration
- » Nuclear

On the following pages, we provide an in-depth look at the patent trends in these sectors to serve as a guide for industry leaders evaluating business opportunities in cleantech. While the conclusions to be drawn from this research will vary depending on the experience and perspectives of each reader, the observations and analysis with regard to patentable white space, R&D investment trends, and licensing opportunities are intended to serve as a useful reference and guide for those navigating the cleantech landscape.



The Cleantech Core

Top Innovation Comparison: Solar, Wind, and Hybrid Vehicles Led the Way Again

Among the 1,167 patents issued in 2010 across the 11 cleantech categories studied, the top three innovations that produced the most patents and the most claims were (for the third year in a row) solar, wind, and hybrid vehicles. In contrast, the innovations with the lowest patent and claim productions for 2010, and which illustrate areas of possible opportunity, were smart grid technologies, geothermal, and CO₂ storage.

The Top Contenders

- » Solar: 354 patents and 6,074 claims
- » Wind: 252 patents and 4,009 claims
- » Hybrid vehicles: 211 patents and 3,108 claims

Fewest Patents and Fewest Claims

- » Smart grid technologies: 33 patents and 649 claims
- » CO₂ storage: 17 patents and 430 claims
- » Geothermal: 13 patents and 267 claims

Investment Strength Comparison

Representing areas of strong interest and investment, the top five innovation categories in which the most patent claims were granted were:

- » **Photovoltaic solar cell construction and/or materials**, with 2,843 claims; remains the first place category from 2009 and 2008
- » **Control systems for hybrid vehicles**, with 827 claims; remains the second place category from 2009, and up from the third place category in 2008
- » **Wind turbine generator operational control**, with 740 claims; up from the fifth place category in 2009
- » **Mounting systems for solar panels**, with 579 claims; was not in the top five categories in 2009 or 2008

- » **Wave-driven hydropower generation**, with 538 claims; was not in the top five categories in 2009 or 2008

Within cleantech venture funding in 2010, solar showed additional strength as the top leader per invested dollars, while energy efficiency represented the highest number of deals. Lighting and home energy management were the two most active subsectors within energy efficiency. Contrasting its patent activity, wind ranked among lowest in terms of venture funding.³

Patent activity may lag behind venture investment, considering that funding is needed to pursue patents. In addition, certain sectors may lend themselves to more aggressive patent prosecution, depending on the nature of the technology and the applicable competitive landscape. In general, however, a review of patent activity proves useful when comparing innovation sectors against each other, and when assessing the cleantech sector to other investment areas.

Significant Patent White Space Continues to Exist in Hybrid Vehicles, Photovoltaic Solar Cells, and Wind Turbine Technologies

First action allowances of subject matter claimed in recently granted patents can be used as one indicator of potential patentable white space in the cleantech landscape. Generally, the more first action allowances that are issued for a given type of claimed subject matter, the more reliable this indicator of potential white space may be.

More than 22 percent of the patents studied were granted by the U.S. Patent and Trademark Office (USPTO) in 2010 under a first action allowance (down from approximately 23 percent in 2009, but up from approximately 20 percent in 2008), indicating the possibility that a relatively broad scope of patentable white space in the cleantech landscape may still exist,



despite the advances in patents granted over the recent years. The top five areas having the greatest white space according to this indicator are:

- » Photovoltaic solar cell construction and materials (ranked first in 2009 and second in 2008)
- » Control systems for hybrid vehicles (ranked second in 2009 and first in 2008)
- » Operational control of wind turbine generators (ranked third in 2009 and fourth in 2008)
- » Operating systems for a hybrid vehicle (not in top five in 2009 or 2008)
- » Drive train or power transmission in a hybrid vehicle (ranked fourth in 2009 and fifth in 2008)

Another possible indicator of patentable white space is the level of patent activity in a particular category (i.e., less “crowding” or the least “dense” area within the cleantech landscape for new technology developments). Based upon this indicator, geothermal technologies reflects the least crowding of the cleantech landscape and perhaps an area of opportunity for taking advantage of potential patent white space. The next category having the least crowding under this indicator is CO₂ storage and sequestration.

Robust Potential in Licensing Pipelines Continue for Corporate Entities

More than 17 percent of the patents were granted to individual inventors (down from approximately 18 percent in 2009 and approximately 22 percent in 2008, but still notably more than the 7.5 percent representation of individual inventors for all U.S. patents granted in 2010). The continued relatively higher rate of patents to individual inventors in the cleantech landscape continues to represent an area where new technologies may be available for licensing by corporate entities or others looking for an entry point in the cleantech field, or companies looking to expand an existing cleantech presence.

Consistent with the results from 2009 and 2008, the ratio of individual inventors to corporate entities was particularly high in the hydro/wave/tidal, geothermal, and wind categories.

Not surprisingly, again in 2010, corporate entities hold higher shares of patents in the categories of nuclear and hybrid vehicles, where market barriers to entry are relatively high.

Patent Pendency

The total number of days from filing of an application until grant of the patent for the U.S. patents in the cleantech landscape ranged from a low of approximately 835 days for hydro/wave/tidal patents to a high of approximately 1,339 for nuclear patents, with a total average pendency of approximately 1,090 days or 36.3 months (assuming 30 days per month). This result is slightly better (i.e., shorter) than the 40-month average for cleantech patents recently announced by the USPTO. In view of the long pendency and relatively high first action allowance rate, it may be worthwhile for patent applicants to seek accelerated examination of their patent applications.

Synopsis

- » Solar and wind held their lead as dominant technologies in the cleantech landscape throughout 2009, based on most patents granted.
- » Utility metering, biofuel, geothermal, and hydro technologies all reveal potential for licensing opportunities in addition to solar and wind, given their respective levels of patenting by individual inventors.
- » For companies and start-ups looking to patent clean energy innovations, solar, wind, hydro, utility metering, and CO₂ storage are all showing room for expansion as indicated by first action allowance rates.
- » For those leveraging VC funding, hydro, biomass, hybrid, solar, wind, smart grid, meter reading, and fuel cell technologies are receiving continued interest from investors, based on the 2009 Patent VC Index.



Methodology

The Report focused on all U.S. utility patents that issued in 2010 and were directed to one of 11 different cleantech energy categories. Keyword searching for each of the cleantech categories that were studied was conducted in the USPTO's database of patents granted during 2010. The searches were not limited to any particular patent classification(s) assigned by the USPTO; rather, the Report searched for applicable keywords in the abstract of each patent.

The patents identified by the search were then individually screened for applicability to the relevant cleantech category. They also were cross-referenced among the other categories to eliminate any duplicate results and to more accurately categorize any patents that appeared under two or more categories.

In addition, patents that were directed to relatively small-scale items (e.g., small consumer electronics and so forth) or that were not primarily directed to energy production, conversion, efficiency, storage, transmission, or conservation were not considered in the Report.

Each of the remaining 1,167 U.S. patents was studied to determine its ownership and origin, number, type, and subject matter of claims, whether the application was prosecuted under accelerated examination, whether the patent was granted under a first action allowance, and the pendency of the application within the USPTO.

Further, certain other technology categories that might be considered "green" in nature were not considered in the Report, including energy-efficient lighting and "clean coal" technologies, among other possible candidates. These technologies are understood to be relevant in the broader green energy landscape and may be included in future reports.

For More Information

For more information on or to obtain a copy of Foley's *Annual Cleantech Energy Patent Landscape Report*, please contact your Foley attorney or the author of this Report:

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¹ Ernst & Young analysis based on Dow Jones VentureSource data.

² Bloomberg New Energy Finance.

³ Cleantech Group LLC.



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