

Cleantech Energy Patent Landscape Report

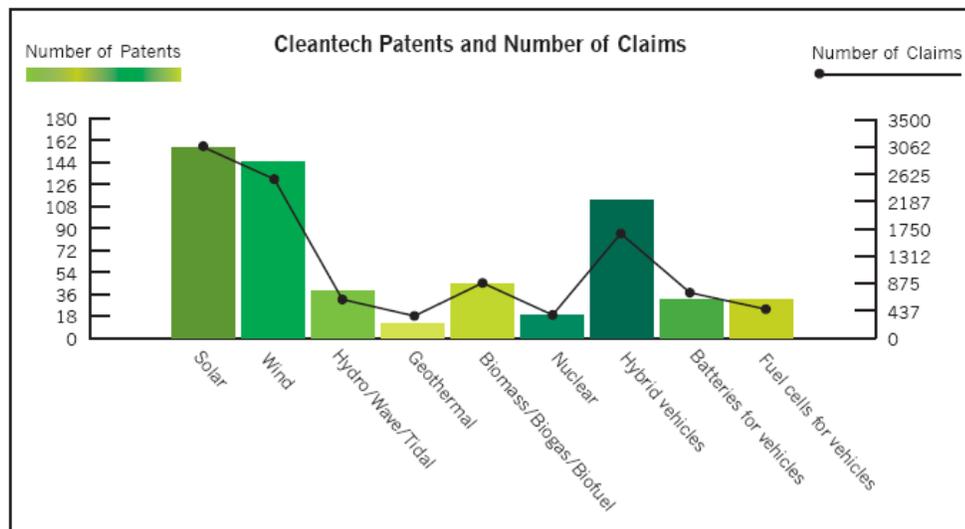
EXECUTIVE SUMMARY



2009: GROWTH PROSPECTS ABOUND IN NEW INVENTIONS AND LICENSING

Solar, Wind, and Hybrid Vehicle Patents Lead the Way

- Among 589 patents issued in 2008 across the nine categories of the Cleantech landscape studied, the categories that produced the most patents and the most claims were solar (156 patents and 2958 claims), wind (144 patents and 2489 claims), and hybrid vehicles (113 patents and 1648 claims).
- The Cleantech categories that produced the fewest patents and the fewest claims were fuel cells for vehicles (31 patents and 392 claims), nuclear (19 patents and 299 claims), and geothermal (12 patents and 275 claims).



- Representing areas of strong interest and investment, the subject matter categories in which the most patent claims were granted were:
 - Photovoltaic solar cell construction and/or materials (1204 claims)
 - Blade/rotors for wind turbine generators (1070 claims)
 - Control systems for hybrid vehicles (694 claims)
 - Drive train or power transmission for hybrid vehicles (464 claims)
 - Upgrading/processing biomass materials (420 claims)



Solar, Geothermal, and Biofuel Draw a Higher Share of Venture Capital Investment Versus Share of Patents

- Relative to the shares of venture capital (VC) investment in comparable technologies, smaller shares of patents were produced in solar, geothermal, and batteries and fuel cells for vehicles, possibly leading to a higher value per patent once secured.

Cleantech Patents and Related VC Investment

Cleantech Energy Category in Relation to VC Investments	Percent Cleantech Patents	Percent Related VC Investments*	Patent VC Index
Solar	27.4	60.2	220
Wind	25.3	6.2	24
Hydro/wave/tidal	6.7	3.4	51
Geothermal	2.1	3.4	164
Biomass/biogas/biofuel	7.7	16.3	211
Hybrid vehicles	19.8	4.8	24
Batteries and fuel cells for vehicles	11.1	5.7	52

* Source: Greentech Media State of Green Business 2009

- The Cleantech Patent Venture Capital Index (Patent VC Index) is the ratio (multiplied by 100) of (a) the percentage of VC investment in a Cleantech technology category to (b) the percentage of patents granted for the Cleantech technology category.
- The highest values of the Patent VC Index are in the categories of solar, biomass/biogas/biofuel, and geothermal, possibly indicating the higher value currently placed in these new technologies by venture capitalists. The high-value Patent VC Index also may reflect the increasing amount of new or start-up companies in these categories that are attracting funding.
- The lowest values of the Patent VC Index are in the categories of wind, hybrid vehicles, hydro/wave/tidal, and batteries and fuel cells for vehicles. The low-value Patent VC Index may reflect developments in technology categories generally dominated by established corporations (e.g., hybrid vehicles and batteries and fuel cells for vehicles). However, the low-value Patent VC Index may indicate an area of opportunity for venture capital investment in other categories that are generally dominated by individual inventors (e.g., hydro/wave/tidal with 74 percent inventor activity) or at least well-represented by individual inventors (e.g., wind with 35 percent inventor activity) looking to overcome market barriers for commercializing their technology.



Patent Activity in Cleantech Categories Having Both High and Low Value Not Limited to East Coast and West Coast

- Patent activity across the Cleantech landscape reflects substantial movement in the Midwest and was not limited primarily to the East Coast or West Coast.

Cleantech Patent Activity by Patent VC Index for East Coast — West Coast

Cleantech Energy Category in Relation to Patent VC Index and U.S. Origin	Percent West Coast Patents	Percent East Coast Patents	Percent Midwest Patents	Patent VC Index
Solar	32.3	37.6	30.1	220
Wind	12	60.1	27.9	24
Hydro/wave/tidal	12.5	45.8	41.7	51
Geothermal	0	40	60	164
Biomass/biogas/biofuel	28	28	44	211
Hybrid vehicles	10.6	14.9	74.5	24
Batteries and fuel cells for vehicles	22.7	13.6	63.7	52

- The comparison of patent activity for Cleantech categories having a high-value Patent VC Index between the East Coast and West Coast shows a relatively balanced approach between solar and biomass/biogas/biofuel, but predominantly in the East Coast for geothermal.
- The comparison of patent activity for Cleantech categories having a low-value Patent VC Index between the East Coast and West Coast shows the East Coast leading in the categories of wind, hydro/wave/tidal, geothermal, and hybrid vehicles, while the West Coast leads in batteries and fuel cells for vehicles.
- Perhaps surprisingly, where VC investments may be typically associated with the East Coast or West Coast, the Midwest accounted for a greater share of the patent activity in the Cleantech categories of geothermal and biomass/biogas/biofuel than either the East Coast or West Coast.

Significant Patent “White Space” Appears 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 20 percent of the patents studied were granted by the U.S. Patent and Trademark Office (USPTO) in 2008 under a first action

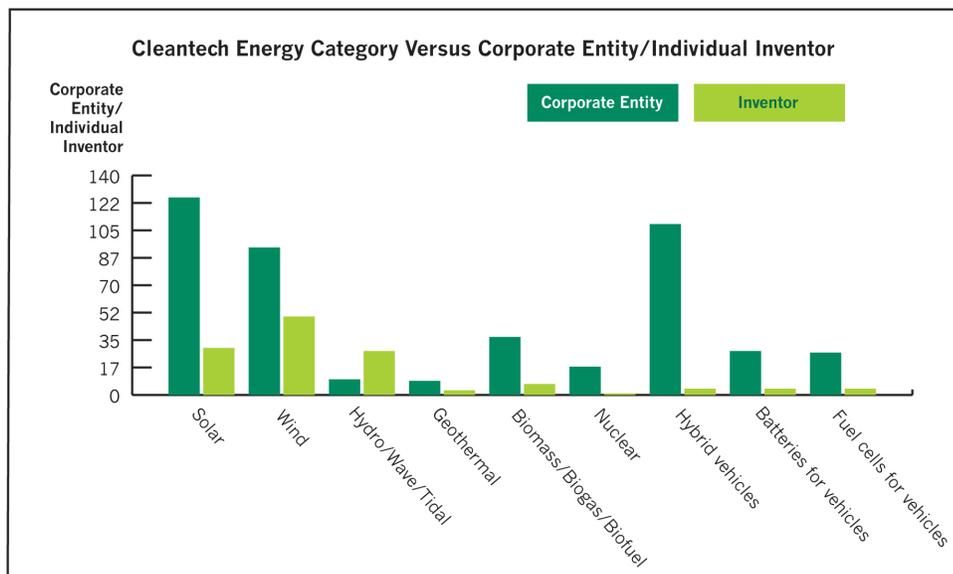


allowance, indicating the possibility that a relatively broad scope of patentable white space in the Cleantech landscape still exists, despite the advances in patents granted over the recent years. The areas having the greatest white space according to this indicator are control systems for hybrid vehicles, photovoltaic solar cell construction and materials, blade/rotor design for wind turbine generators, and operational control of wind turbine generators.

- Another possible indicator of patentable white space may be simply 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, the geothermal technology category 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 nuclear technologies.

Robust New Licensing Pipelines Possible for Corporate Entities

- More than 22 percent of the patents were granted to individual inventors, possibly representing 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.
- The ratio of individual inventors to corporate entities was particularly high in the wind and hydro/wave/tidal categories.
- Not surprisingly, corporate entities hold higher shares of patents in the categories of nuclear and hybrid vehicles, where market barriers to entry are relatively high.





Litigation Outlook “Too Early to Tell”

- None of the studied patents in the Cleantech landscape was the subject of litigation at the time the study was conducted. This result is likely due to the recent issuance of the patents, and is expected to change as funding and investment and competition among owners (and licensees) of the patents continue to increase.

Methodology

- The Cleantech Energy Patent Landscape Report (Report) focused on all U.S. utility patents that issued in 2008 and were directed to one of nine 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 2008. 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 technology 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, efficiency, or conservation were not considered in the Report.
- Each of the remaining 589 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, and whether the patent was granted under a first action allowance.
- Further, certain other technology categories that might be considered “green” in nature were not considered in the Report, including: energy-efficient lighting, smart grid developments, carbon sequestration and renewable energy credits, and “clean coal” technologies, among other possible candidates. These technologies are understood to be relevant in the broader green landscape and may be included in future reports.

For More Information

For more information or a copy of the full Cleantech Energy Patent Landscape Report, please contact John Lazarus at jlazarus@foley.com.