

CLEAN ENERGY PATENT GROWTH INDEX (CEPGI)



Shine-On Solar Edition

2010 Results

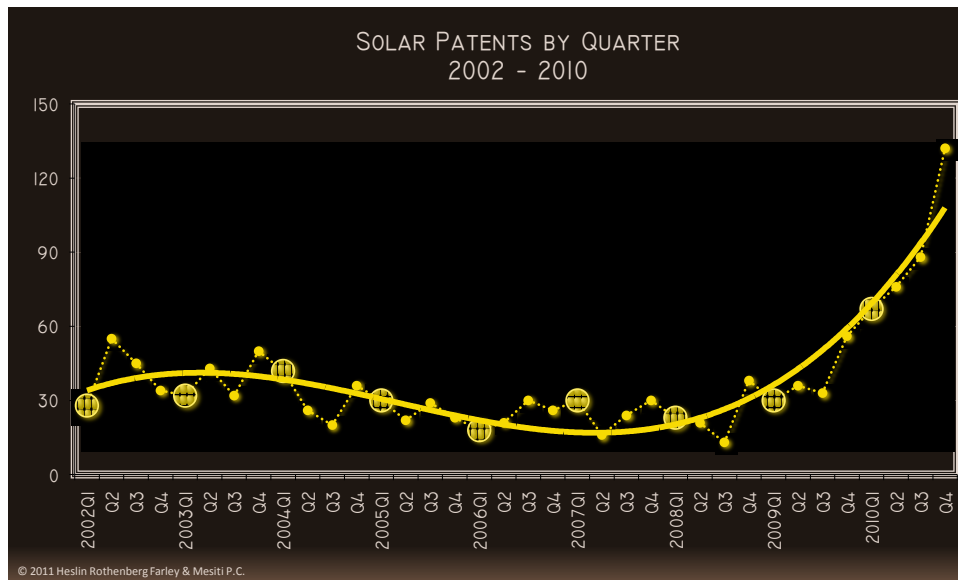
www.ShineOnSolarPatents.com

*Presented by the Cleantech Group -
Heslin Rothenberg Farley & Mesiti P.C.
www.cleantechintellectualproperty.com*

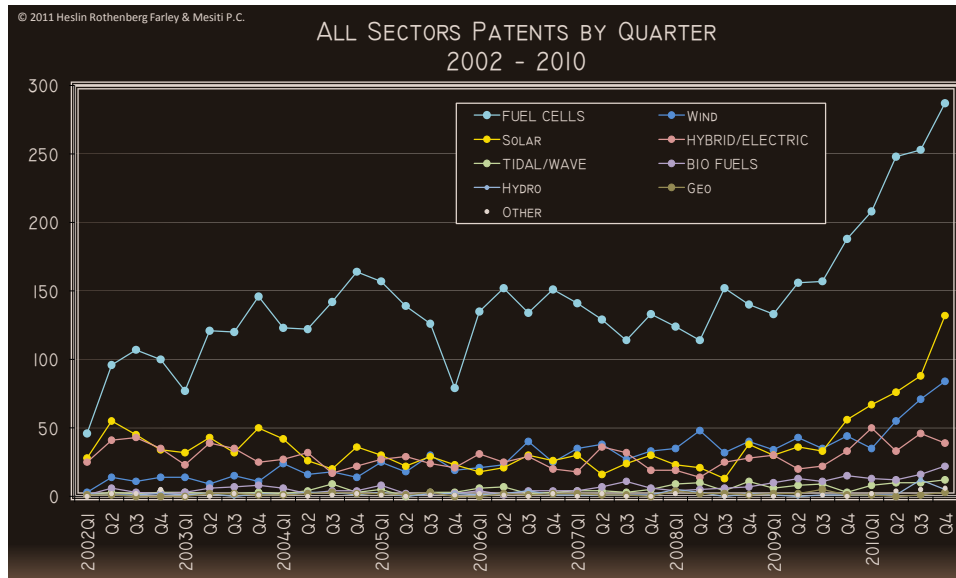
The [Shine On Solar](#) edition of the [Clean Energy Patent Growth Index \(CEPGI\)](#) published by the [CLEANTECH GROUP](#) at [Heslin Rothenberg Farley & Mesiti P.C.](#) provides an indication of the trend of innovative activity in the Solar energy sector. In 2010 Solar patents were second only to Fuel Cell patents in the Clean Energy area. Solar Photovoltaic patents spiked in 2010 to a record level of 339 (up 232 %) with third generation solar PV patents topping the other generations of PV technology. Applied Materials led the other Solar PV patent owners in 2010 over Sunpower and leaving behind overall PV leader Canon. Fu Zhun Precision Industry and Foxconn Technology Co., Ltd. led solar thermal patent owners. Solar thermal patents were granted to 23 other separate entities with only inventor Pitaya Yangpichit even receiving two and Wal-mart Stores being one of the 22 with one patent.

The Shine On Solar edition analyzes the solar sector and illustrates where patents are being granted within the solar arena. This edition of our Shine On Solar edition analyzes solar energy trends in general with an emphasis on solar patenting trends in 2010.

As depicted below, solar technology patents in 2010 built on big gains of the previous year to reach levels over twice that of 2009 and vastly out performed the other non-fuel cell sectors after hitting a record low in the third quarter of 2008.



Solar patents in 2010 reached a level second only to Fuel Cell patents which had led the other sectors since the beginning of 2002. Solar patents reached and exceeded the level of wind patents in 2009 which had been in second place to fuel cell patents in the CEPGI since 2006 as per the trends in the quarterly components of the CEPGI below:



As presented in our previous article (located [here](#)) we have subdivided the solar patents uncovered into Solar thermal and Solar PV categories, along with a hybrid designation. Solar thermal is further divided into technologies directly using collected thermal energy and those that do so indirectly (e.g., for the generation of electricity).

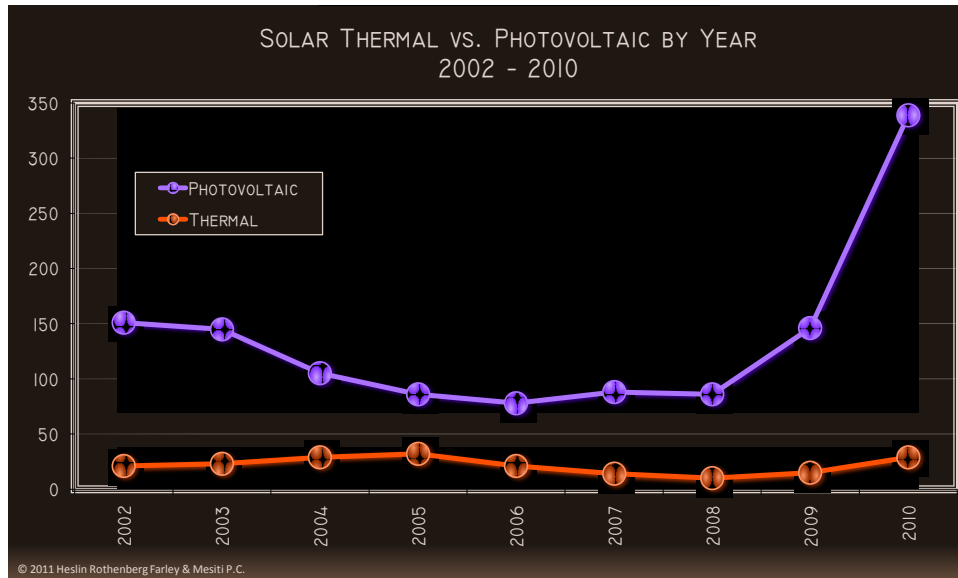
Solar PV includes the following subsectors:

1. first generation (e.g., silicon based) PV
2. second generation (e.g., thin film) PV
3. third generation (dye-sensitized, quantum dots, nano-modified, organic) PV
4. PV enhancement (e.g., multi-junction, CPV, anti-reflective coatings)
5. Enabling technologies (e.g., racking systems, power conversion, heat sinks, bypass diodes, sun tracking)
6. PV applications (e.g., use of PV technology in a product)

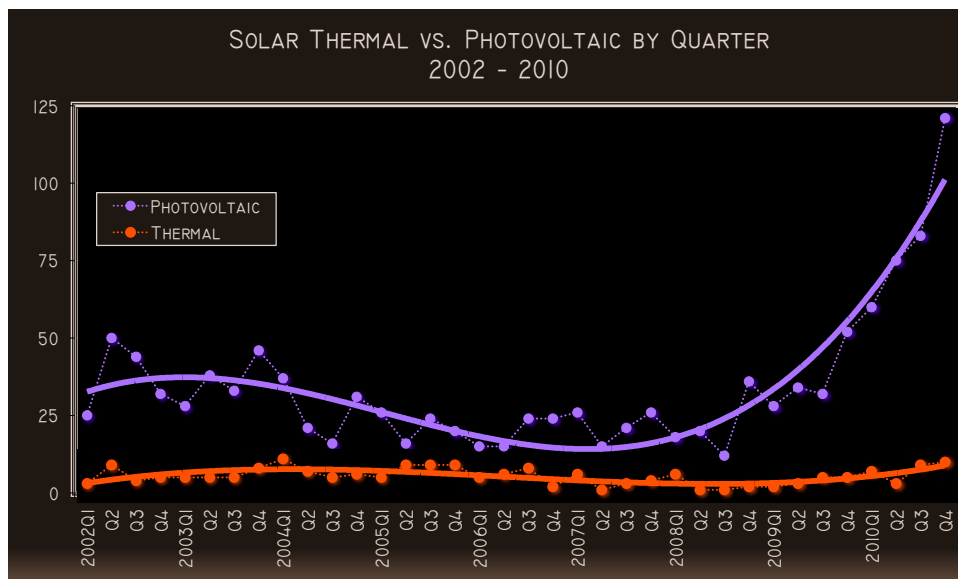
Solar hybrid systems may use both solar thermal and photovoltaic technologies, or one of these solar technologies combined with another type of generation process (wind, hydro, etc.).

Thermal vs. Photovoltaic

As depicted below on an annual basis, granted patents in photovoltaic technology increased dramatically to 339 from 146 in 2009 over the prior year after an increase of 90 in 2009 over 2008. Solar thermal patents were also up 14 patents after only a five patent increase the year before.

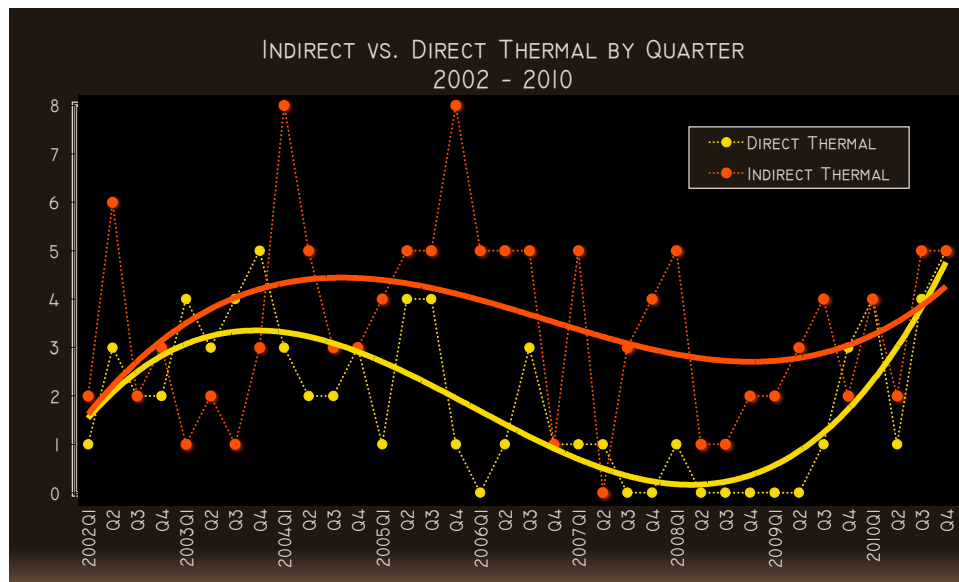


According to the quarterly graph below, Solar PV patents jumped to 60 in the first quarter of 2010 and each quarter after that posted an even larger increase. The fourth quarter of 2010 at 10 patents was the biggest result for solar thermal since 11 in the first quarter of 2004. Comparing the solar energy patent graph (far above) as a whole to the quarterly solar thermal vs. solar PV graph (immediately below), the entire solar technology field closely follows the photovoltaic trends without much pull from the thermal technology trends.



The Thermal Technologies

As depicted below, 2010 brought a record year for solar thermal direct technology patents with 14 patents, up 10 over 2009. In fact, the direct patents tied indirect patents in the fourth quarter and approached the number of indirect patents for the year which were at 16. Generally speaking, indirect solar technology (e.g., the conversion of thermal energy into mechanical or electrical energy) has consistently seen more patents and thus innovation than its direct counterpart.



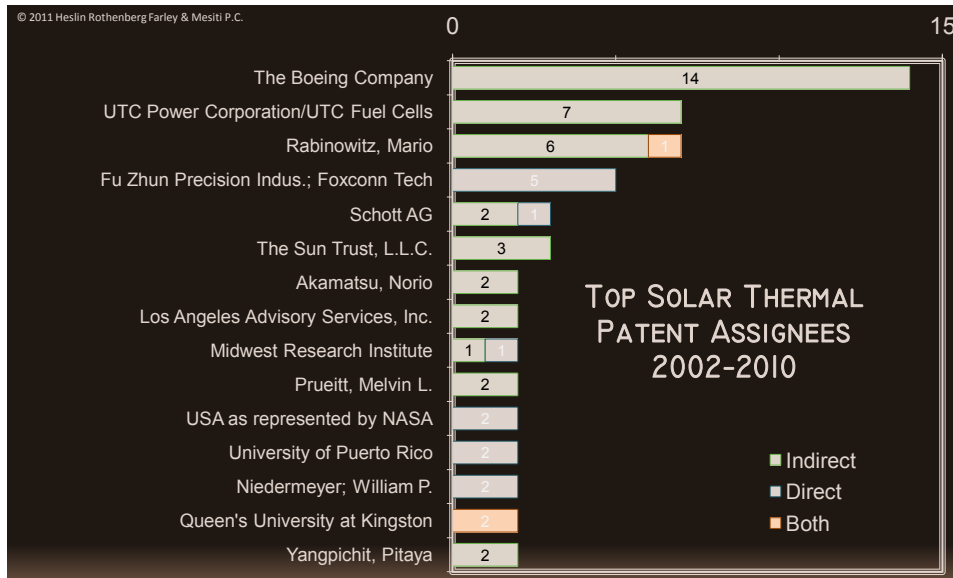
The solar thermal race in 2010 was won by Fu Zhun Precision Industry and Foxconn Technology of China with five solar thermal direct patents in solar air conditioning, vaulting to fourth place overall. Each of the remaining nine solar thermal direct patent grantees in 2010 had one patent each. Foreign entities outnumbered US entities 6 to 4. United Technologies and Walmart (for an air heating system) were the only household names. Other solar thermal patent owners (not mentioned above) for 2010 included:

Diehl AKO Stiftung & Co. KG	Wangen, DE
European Organization for Nuclear Research-CERN	Geneva, CH
Polk, Steven	West Bloomfield, MI, US
Queen's University at Kingston	Kingston, ON, CA
SolFocus, Inc.	Mountain View, CA, US
Staschik, Udo	Winnipeg, MB, CA
Christensen, Hans Jurgen	Hadsten, DK

The solar thermal indirect patent grantees were predominantly American with a ratio of 4 to 1. Pitaya Yangpichit of Bangkok was the leader with two solar thermal indirect patents while the remaining 14 patent grantees had one patent each in the solar thermal indirect area. United Technologies had one as did its corporate cousin, Pratt & Whitney Rocketdyne, and Livermore National Lab. California was the big U.S. winner with 5 patents. The remaining unmentioned patent holders in this area for 2010 are listed below:

Fujisato, Tetsuhiko; Miyao, Shunsuke	Yamaguchi, JP
Tsao, Jason	Torrance, CA, US
Primlani, Indru J.	Renton, WA, US
Marshall, Robert A.	Georgetown, TX, US
Markon Technologies, LLC	Los Alamitos, CA, US
Lin, Wen Chang	Taipei, TW
Le, John O.; Le, Christopher M.; Le, Thomas T.	Anaheim, CA, US
Johnson, Robert Paul	Glendale, AZ, US
Hansen Jr., Howard Otto	Orlando, FL, US
Green, Timmy	Smyrna, TN, US
Solar and Environmental Technologies Corporation	Staten Island, NY, US

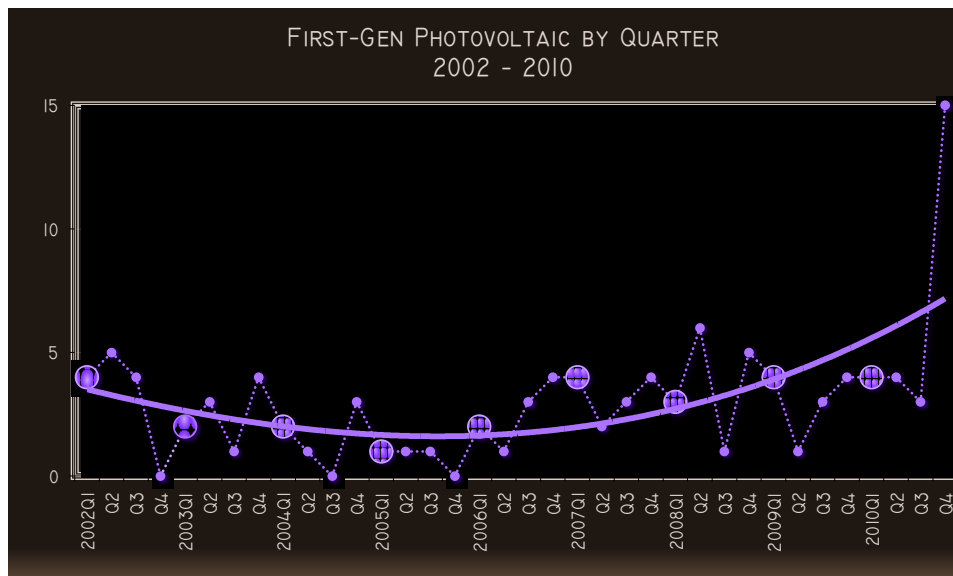
If we look at totals since 2002, as depicted in the chart below, the top 10 patent owners in the Solar Thermal area is dominated by Boeing (14), which has patents directed to indirect solar thermal technologies including aspects of generating electricity via the heating of fluids and solar molten salt technologies. In second place Mario Rabinowitz holds 7 patents with 6 directed to indirect technologies. United Technologies tied for second with 7 patents in the indirect area relating to the heating of fluids via solar thermal to create electricity. Schott's patents are divided two to one in favor of indirect technology. (The addition of one patent to Shott's portfolio in 2010 put it in the top four, tied with The Sun Trust LLC.) Fu Zhun Precision Industry and Foxconn's patent in 2010 moved it to a fourth place finish since 2002 as described above. In contrast to Solar PV, and many other clean energy technologies, the absolute number of solar thermal patents is low and the concentration in the top 10 patent holders is not very high relative to the total number (185) of patents in this area. Of the patents granted since 2002 in the solar thermal area, it is interesting that the top four solar thermal patent owners account for only 31 (or less than 17 percent) of the patents with the rest of solar thermal patent owners owning only 3 or fewer patents each.

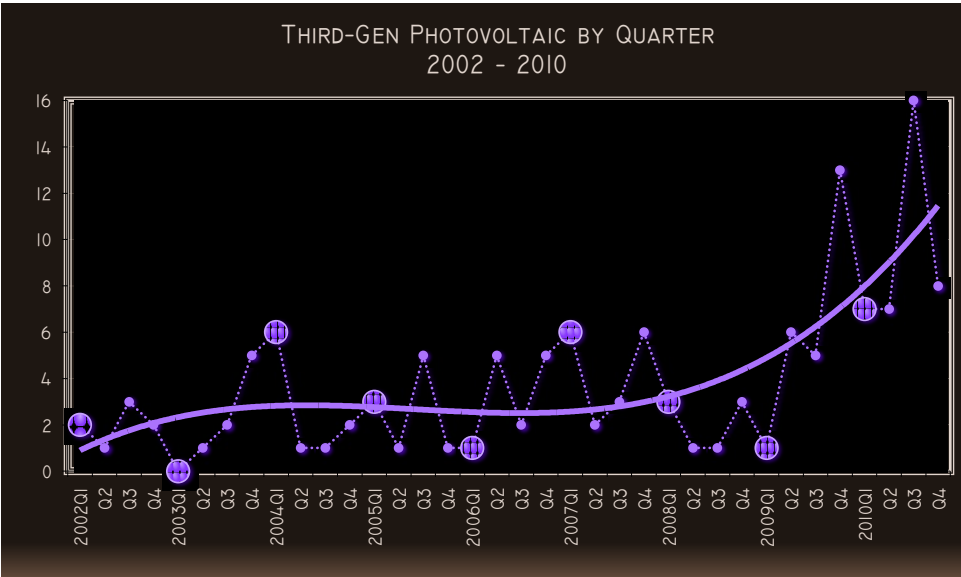
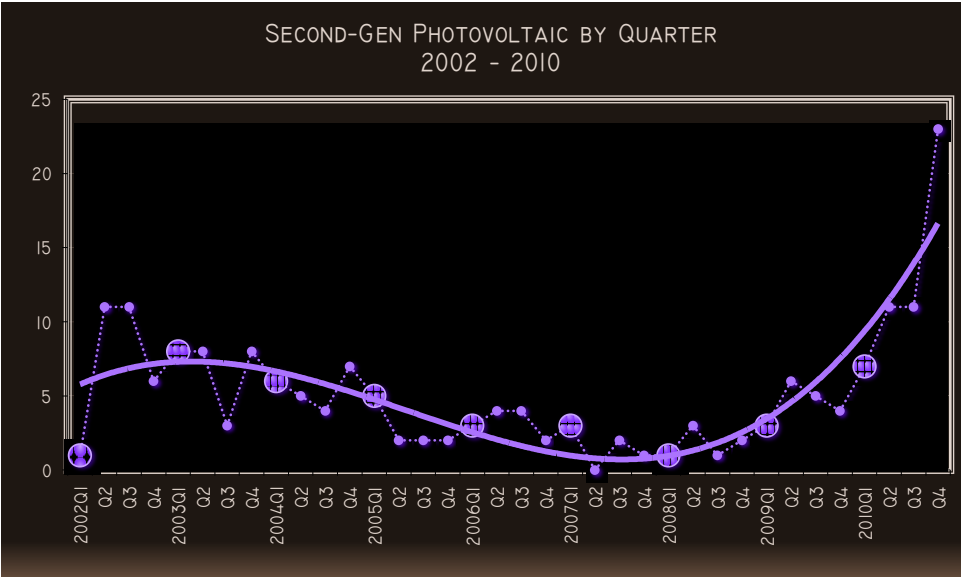


As will also be evident, the top holders of U.S. solar thermal patents are U.S. entities except for Fu Zhun Precision Industries, Norio Akamatsu, the holder of 2 patents, and Schott AG of Germany.

The Three Generations of Photovoltaic

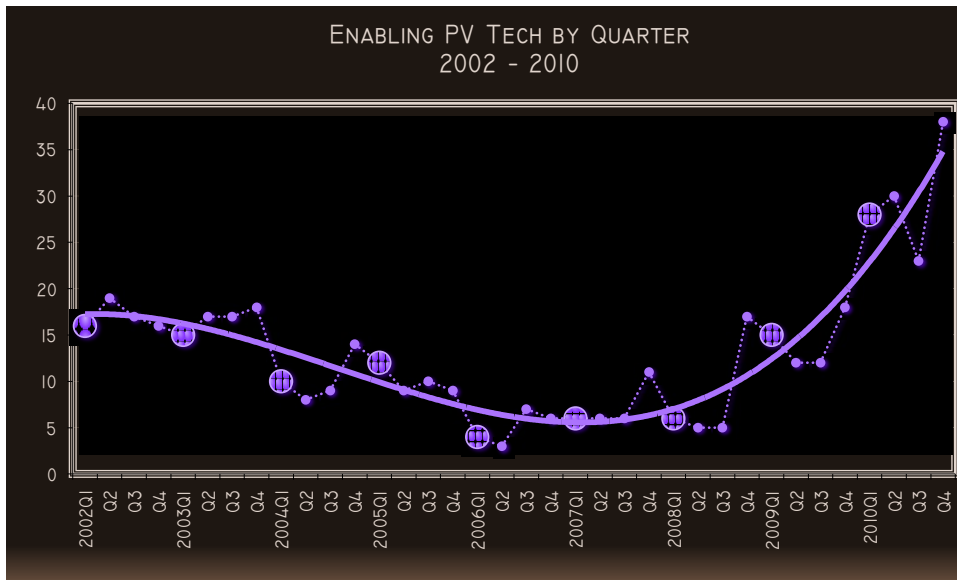
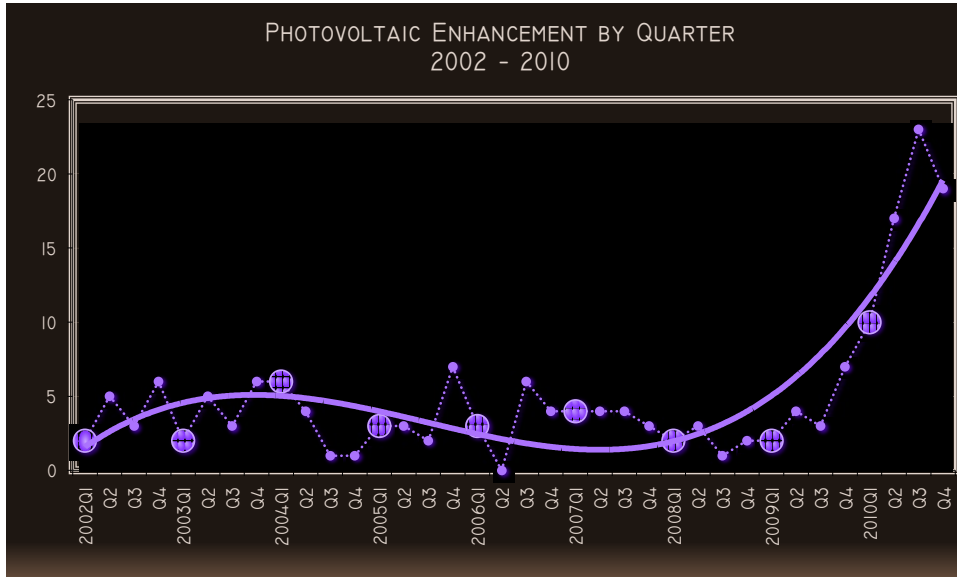
As depicted in the graphs below, second generation technologies led the first and third in 2010 with 52 granted patents (up 34 over 2009) beating out third generation technologies which was the winner in 2009 with 25 patents. Third generation solar followed with 38 patents (up 13) with first generation technologies trailing behind at 26 patents (up 14). All three generations of technology jumped significantly over 2009 and the first and second generations had particularly strong fourth quarters foretelling potential future gains.

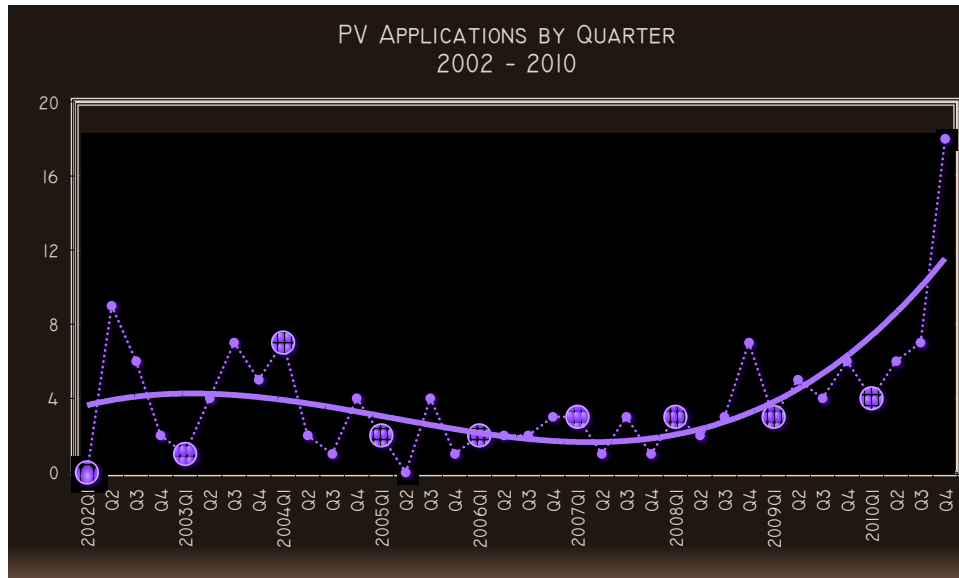




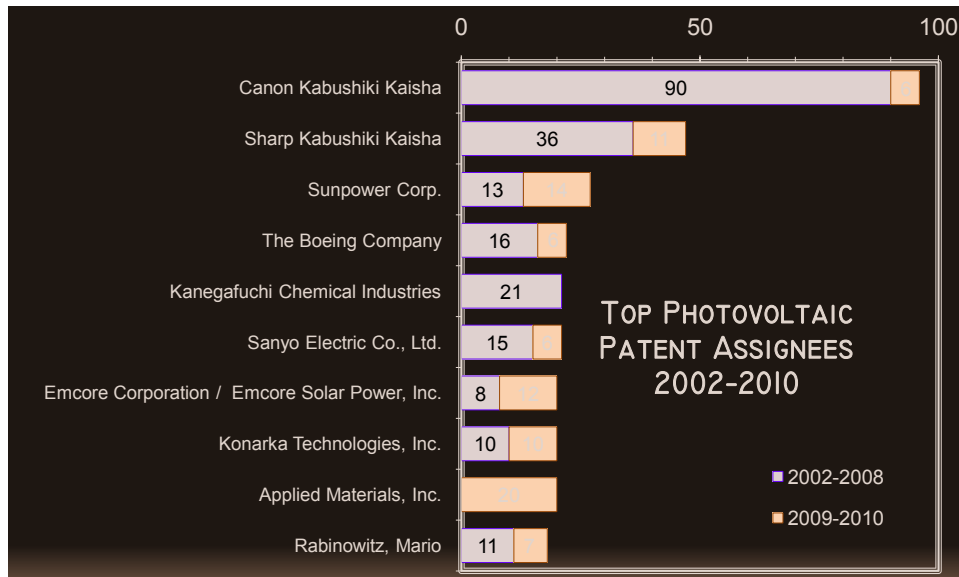
Additional PV Technology

As depicted below, granted patents for PV Enhancement technologies jumped 430 % to 69 up 53 patents in 2010 easily setting an annual record. Enabling PV technology topped all the other sectors at 119 granted patents in 2010, up 62 over 2009, also at a record high. Meanwhile the use of PV in applications jumped 17 patents in 2010 to 35 with 18 of those in the last quarter alone which was the highest quarter on record for PV applications by 11.

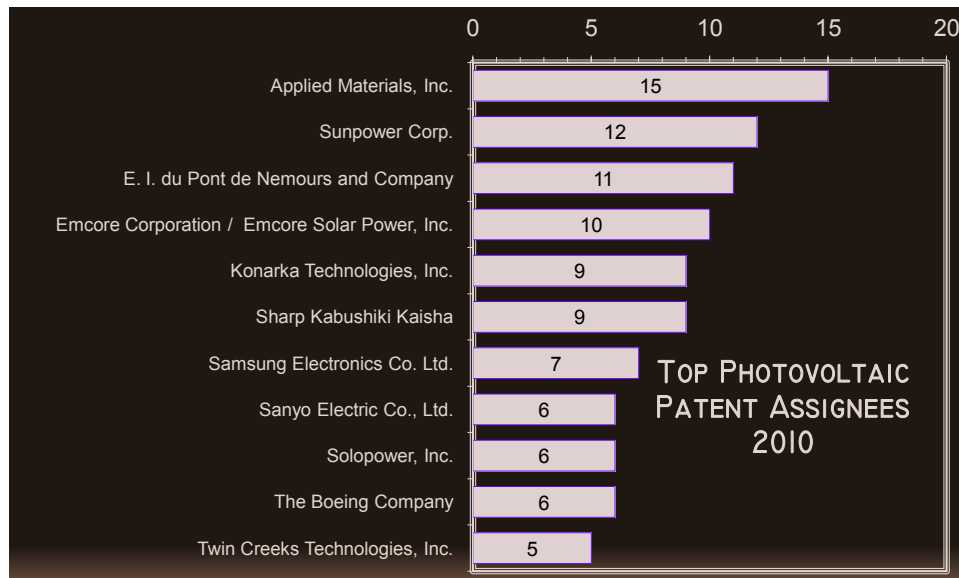




As depicted below, Canon continues to lead the other solar PV patent owners since 2002 with over twice the number of patents held by Sharp, its closest competitor, but was also ran in 2010.



Applied Materials as depicted below was first in PV in 2010 over Sunpower by three patents. Du Pont edged out Emcore by one for third place with eleven patents. Konarka and Sharp tied with nine for fifth place. Samsung had six solar PV patents and another tie existed in eighth place with Boeing, Sanyo and Solopower at six patents. Twin Creeks was in eleventh place at five PV patents. Forty five other entities had at least two solar PV patents in 2010 including Honda, Canon, Miasole, Mario Rabinowitz, GM, and GE.



Relative to total granted solar PV patents since 2002, Canon has patents in almost all PV categories, led by enabling (61), second generation (19), and first generation (9) technology patents. Sharp spreads its patents out among various subcategories including enabling (16), first (6), second (8), third (7) and enhancement (5). Kanegafuchi (13), Boeing (9), and Sanyo (10) also include large numbers of patents in enabling technologies. Mario Rabinowitz has concentrated his efforts in solar enhancement technologies with 14 of such patents. Sunpower has concentrated on first generation PV technologies with 11 patents in this area. Emcore has 5 patents in PV enhancement and 6 in enabling technologies. Konarka has all its patents in third generation technologies. Samsung has 8 of its 10 patents in 1st and 3rd generation technologies. Nanosolar has 7 of 9 patents in third generation technologies. Outside the top 11 patent owners depicted above, BP has half its 8 patents in second generation technologies while GE has 5 of its 8 in third generation PV patents. Honda has its patents spread through the solar technologies with the most (3 of 10) in first generation technology. TDK has most of its 8 patents in second generation and enabling technologies.

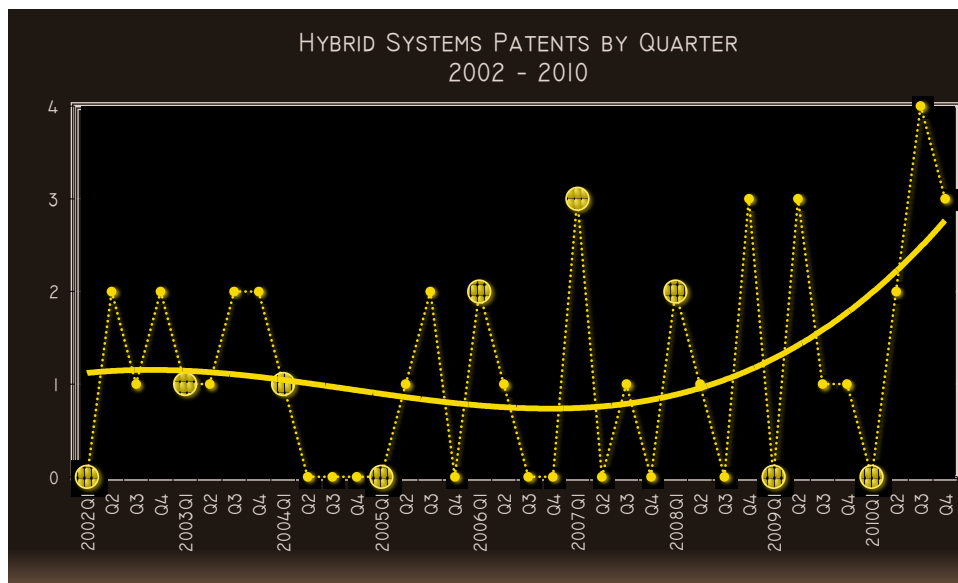
Among the leaders in 2010, Applied materials' patents last year ran the gamut of the different PV generations with 4, 5 and 1 patents in the first, second and third generations, respectively, along with five patents in PV enhancement and one in PV applications. Ironically, Applied materials didn't have a granted patent in the largest PV subsector in 2010, i.e., enabling technologies. Sun Power's patents also were spread among the subsectors excluding PV applications with three each in first generation, enhancement and enabling and two or less in the remaining subsectors. Dupont and Emcore had the largest individual total with seven patents each in PV enhancement. Dupont's other patents were in spread among second generation, third generation (2), enabling and PV applications with all but third generation at one patent each. Emcore also had one patent in first generation technologies and two in enabling technologies. Sharp and Konarka tied at nine patents but got to that level in very different ways. Sharp was spread out among all the subsectors except PV applications with all but the second generation (at one) being at two patents. In contrast, Konarka had patents only in third generation (5), PV enhancement (2) and enabling (3) technologies. Samsung edged the remaining solar PV patent

grantees in 2010 by one patent and was granted 3 patents in third generation and PV enhancement technologies, along with one patent in second generation, enabling and application technologies. Boeing, the overall solar thermal patent leader, tied Sanyo and Solopower at six PV patents. Solopower's patents were all in second generation technologies while Boeing's were mostly in PV enhancement (4) followed one patent each in first generation, enabling and application technologies. Sanyo had three in enhancement followed by two in second generation and a sole patent in application technologies.

Of the top 11 PV patent grantees for 2010, two are based in Japan and one in Korea while the rest are based in the U.S. However, as is evident from the totals chart, especially the showing by Canon and Sharp, Japanese patent holders dominate the top 11 in absolute numbers of patents since 2002.

Hybrid Systems

As depicted below, patents in hybrid technologies have hovered in very low numbers during the tracking period.



Please contact us at info@cleanenergypatentgrowthindex.com if you have any questions or would like us to email you when we have updated the Shine On Solar edition or the CEPGI.

Shine On Solar Patents.com

CLEAN ENERGY PATENT GROWTH INDEX.COM

Heslin Rothenberg Farley & Mesiti P.C.

cleantechintellectualproperty.com

© 2011 Heslin Rothenberg Farley & Mesiti P.C.