ENERGY ALTERNATIVES REPORT
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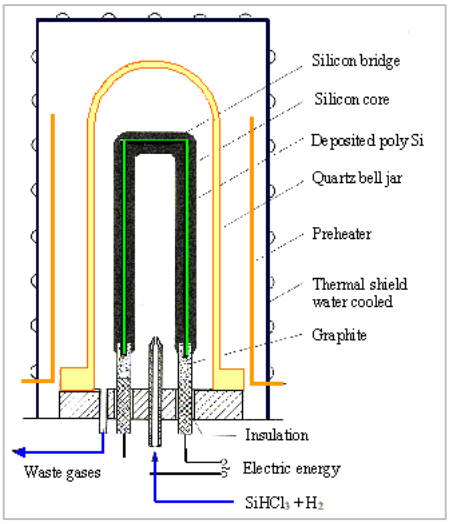
ET TRENDS

BUSINESS NEWS

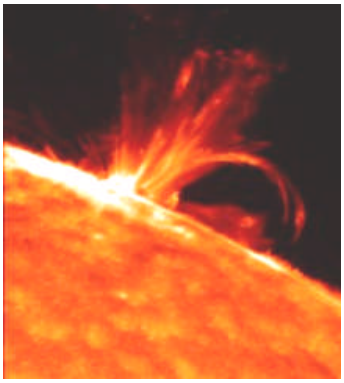
Polysilicon shortages in the booming solar-cell sector are expected to last until 2008 or even extend out to 2012. Leading polysilicon vendors **Hemlock**, **MEMC**, **Mitsubishi**, **Tokuyama** and **Wacker** cannot keep up with the huge demand, despite recent moves to expand capacity. The urgent need for polysilicon material, which is central to the production of conventional solar cells and is used to some degree for thin-film cells as well, has prompted several other companies to enter the market, including **Hoku** Materials (Kapolei, Hawaii) and the world's largest solar-cell maker, Sharp. The market is so ripe that Hoku recently signed two big polysilicon supply contracts with solar-cell makers Sanyo Electric and Solar-Fabrik AG, without first breaking ground on a production facility. The subsidiary of fuel-cell developer Hoku Scientific Inc. plans to build a $220 million polysilicon plant in Pocatello, Idaho, but the site won't move into production until late 2008.



Sharp brought its Toyama site into polysilicon production in January, at an initial investment of $41.1-million. The move gives Sharp an integrated production system ranging from polysilicon to solar cells and solar modules. Sharp is the only solar-cell maker to produce its own polysilicon. While the solar industry has been the first to feel the pinch of the polysilicon shortage, it is not the only volume polysilicon user. The material is the key ingredient of both solar cells and raw silicon wafers for ICs, although different grades of the material are produced for the two industries. Supplies of wafer-grade polysilicon have remained sufficient thus far, and the good news for the solar-cell industry is that growth in the IC industry is expected to be modest in 2007, followed by a possible slowdown in 2008. But if the IC market moves into a steep and unforeseen upswing, the polysilicon supply-and-demand picture could become even more chaotic, if not catastrophic.

SunPower Corp. and its PowerLight Corp. subsidiary have been selected for an award of up to $10.5 million in funding from the U.S. Department of Energy's Solar America Initiative (SAI). The companies said they plan to use the funding to implement cost improvements, including innovations in producing ingots, wafers, high-efficiency solar cells and panels, system design, as well as improved delivery and installation efficiency. The companies plan to work to reduce solar system costs through improvements in the

design and manufacture of integrated photovoltaic systems along with a team of technology and institutional partners.



SOLAR [Clearly the fastest moving alternate energy sector]

Latest Solar Cell Factory

Applied Materials, Inc. will build world's first gen 8.5 thin film solar line - Semiconductor and thin film equipment leader Applied reported that it has been selected by Moser Baer India Ltd. to develop and install what it believes is the world's first Generation 8.5 thin film solar module production line in New Delhi, India. This Gen 8.5 line will manufacture photovoltaic solar modules using ultra-large 5.7-square meter substrates, measuring 2.2 meters by 2.6 meters. These glass panels, four times bigger than today's largest solar panel substrates, are expected to drive down panel production costs and help reduce the overall cost of solar electricity. The contract represents a significant collaboration between companies in the U.S and India to establish the first truly modern solar facility in India using semiconductor manufacturing processes. Because of its extensive experience in providing process expertise to chipmakers and large area substrate manufacturing technology to the flat panel display industry, Applied Materials was selected to build the 200-megawatt factory set to open in 2009.

Applied expects to deliver its thin film solar module production line in the second half of this year. The contract between the companies includes a fully-integrated production line including chemical vapor deposition (CVD), physical vapor deposition (PVD), laser scribing, factory software, automation and other supporting technologies required to establish a solar panel manufacturing facility with a rated initial capacity of 40 megawatts per year. Applied noted that it's Gen 8.5 Line is designed for flexibility because production output can be configured for final product sizes from 1.4 to 5.7 square meters. Current thin film production lines are configured for panel sizes limited to dimensions less than 1.5 square meters. This contract heralds Applied's entry into the delivery of full production lines to solar customers and signals a critical milestone for the solar industry in the drive to reduce the cost of solar cells by using larger substrates. The company added that Moser Baer has extensive experience in high volume manufacturing, which will be key to enabling cost reduction since India holds tremendous potential both as a worldwide hub for solar panel production and as an end market for photovoltaic electric power.

SolarWorld of Germany will invest $400-million in an unused factory in the USA. The German company will turn a high-tech white elephant into the nation's biggest solar plant. State officials hope a new generation of Oregon technology employment will spring from the unused Hillsboro chip factory, where SolarWorld

Group will invest $400 million, hiring as many as 1,000. The publicly held company is buying the plant for $40 million, a bargain in comparison with the $500 million spent by Japan's Komatsu Silicon America, which finished the factory in 1998 but never opened it because of forecasts of declining chip sales. As projections soar for alternative energy demand, more solar companies are scouting the state. Solar manufacturing, ranging from silicon to wafers to cells to panels, could pick up where semiconductors leave off as chipmakers move offshore. Semiconductor workers here have skills that translate easily into solar cell manufacturing. SolarWorld will hire highly skilled workers, ranging from engineers to R&D positions. Only last fall, SolarWorld acquired the solar business of oil giant Royal Dutch Shell, which had taken it over from Siemens AG. The deal gave SolarWorld, founded in 1998, plants in Vancouver as well as in Camarillo, CA. Robust demand for solar panels quickly pushed SolarWorld to expand. The plant will hold at least 1,000 workers by 2010. SolarWorld could receive credits worth 35% of $50 million or more in eligible project costs, depending on how much of the investment qualifies for the tax breaks. Solar industry sales have grown by about 35 percent in each of the past five years, according to the Solar Energy Industries Association. Last year, worldwide sales of photovoltaic cells and modules exceeded $15 billion as prices went up for conventionally generated energy, according to the Solar Energy Industries Association.

Taiwan's - The total production value of Taiwan's solar cell industry is estimated to top

$ 605 million to $757 million by 2010, a four-fold expansion compared with the present value. Officials at the Hsinchu-based Industrial Technology Research Institute (ITRI) said that thanks to a complete upstream-to-downstream production capacity, the solar cell industry has a good opportunity to engage in fast expansion along with the surging global demand for clean, renewable energy. The current production value of solar cells in Taiwan represents about 6 % of the global market. Taiwan's total production capacity will top 280 megawatts by 2010.

China's solar energy industry is poised to enter the world market in a big way 2-years

after China passed a comprehensive renewable energy law. Thin film will be the future in solar energy markets, the emerging type of solar technology that relies on much thinner solar panels than the traditional black panels on many rooftops today. As more and more Chinese solar thin film companies go public, they will drive prices down and shrink margins. The thin film companies will be the big winners, since they can sell product below silicon producers cost and make money. The scarcity of solar-grade refined silicon has driven up traditional photovoltaic prices, and the shortage is not expected to ease until 2008. Today, Suntech is the only significant player from China in the world solar market: its market is outside of China. Many small companies wanted to do that as well. The company signed sales agreements with (Germany's) Conergy AG to provide the German firm with photovoltaic modules for its global projects next year for a total value of around $270 million. China's Solarfun Power Holdings Ltd., which is listed on the NASDAQ, announced a significant new sales agreement. Under the terms of the agreement, Solarfun will sell approximately 140 megawatts of photovoltaic modules to

UB Garanty Project S.L. in Spain over the next three years. The contract is expected to have an estimated value of between $40 million and $50 million in 2007. China gets about 7 percent of its energy from renewable sources today. The 2005 Renewable Energy Law called for the country to increase its renewable energy consumption to 10 percent of the total by 2020.

Nano-Solar - Notre Dame Researchers have demonstrated a way to improve the efficiency of solar cells made using low-cost, readily available materials, including a chemical commonly used in paints. The researchers added single-walled carbon nanotubes to a film made of titanium-dioxide nanoparticles (white paint pigment), doubling the efficiency of converting ultraviolet light into electrons when compared with the performance of the nanoparticles alone. The approach addresses one of the most significant limitations of solar cells based on nanoparticles. Such cells are appealing because nanoparticles have a great potential for absorbing light and generating electrons. But so far, the efficiency of actual devices made of such nanoparticles has been considerably lower than that of conventional silicon solar cells. That's largely because it has proved difficult to harness the electrons that are generated to create a current. The carbon nanotubes collect the electrons and provide a more direct route to the electrode, improving the efficiency of the solar cells. The new CNT and nanoparticle system is not yet a practical solar cell because titanium oxide only absorbs ultraviolet light; most of the visible spectrum of light is reflected rather than absorbed. But researchers have already demonstrated ways to modify the nanoparticles to absorb the visible spectrum. In one strategy, a one-molecule-thick layer of light-absorbing dye is applied to the titanium-dioxide nanoparticles. Another approach is to coat the nanoparticles with quantum dots, tiny semiconductor crystals. Unlike conventional materials in which one photon generates just one electron, quantum dots have the potential to convert high-energy photons into multiple electrons. Several other groups are exploring approaches to improve the collection of electrons within a cell, including forming titanium-oxide nanotubes or complex branching structures made of various semiconductors. But the Notre Dame work could be a significant step in creating cheaper, more-efficient solar cells.

FUEL CELLS

Solid Methanol - Kurita Water Industries Ltd. has presented a direct methanol fuel cell (DMFC) system that uses solid state methanol as a fuel. The system uses solid state methanol and has been further improved. When solid state methanol was actually used as a fuel, it was brought into contact with a small amount of water to be supplied to the fuel electrode. In contrast, water is not necessary in the latest system. The new system doesn't use water. It starts generating power just by adding solid methanol. Kurita aims to develop a cartridge (card) type solid fuel for use in a DMFC system of mobile devices. A clathrate compound is used to hold the fuel. The methanol is probably vaporized to reach the fuel electrode section that caused chemical reactions, but the company has not

revealed the details as to how electricity is generated without using water. Kurita uses a crystal structure called clathrate compound to solidify methanol. The compound stores methanol as guest molecules in a molecular host that has holes. Although the company reports that "a certain organic material" is used for the molecular host, the details have not been revealed. The company explains that the latest DMFC system will not be designated as a hazardous material or deleterious substance because methanol can be treated as a solid state substance. In addition, no restrictions are imposed when carrying it into an aircraft. Meanwhile, the company also exhibited a technology to solidify hydrogen with the use of a clathrate compound.

WIND POWER

FPL Group, Florida's largest utility owner, overtook Spain's Iberdrola SA to become the world's largest owner of wind-power generating capacity in 2006. FPL's capacity, including its new 735-megawatt Horse Hollow project in Texas, totaled 4,016 megawatts, exceeding Iberdrola by 156 megawatts, according to the report by Emerging Energy Research, based in Cambridge, Mass. U.S. activations of mega projects and North America's broader growth prospects will increase competition across the Atlantic in the near future per EER. Iberdrola, based in Madrid, probably will reclaim the top ranking this year when it completes its planned acquisition of Glasgow, Scotland-based Scottish Power Plc, which is ranked as the world's fifth-biggest in wind power, with 1,400 megawatts of generating capacity. Under Iberdrola's method of calculation, the Spanish company remained first-ranked last year, with 4,102 megawatts. Iberdrola counts all the megawatts in jointly owned projects, rather than in proportion to its equity, if the venture is consolidated in the Spanish utility's earnings. The third- through 10th-largest wind power generators, according to EER, were Acciona SA, Babcock & Brown Ltd., Scottish Power, Endesa SA, Energias de Portugal SA, Dong Energy A/S, Eurus and Electricite de France SA. Fourteen of the top 20 generators were utilities, EER said. Among other wind power generators, China's Long Yuan was 12th, Enel SpA 13th, Royal Dutch Shell Plc 17th and E.ON AG 18th. The top 20 wind power generators expanded capacity by more than 5,100 megawatts last year, and those 20 collectively account for about a third of global wind power capacity.

Global wind power capacity increased by a little over 15,000 MW in 2006, setting another annual installation record for the industry. The increase was 29% higher than in 2005 and takes global capacity to more than 74,300 MW, a little short of the 75,000 MW predicted at this time last year.