

ENERGY NEWS REPORT

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BUSINESS NEWS

Intel into Energy? - Intel is considering making acquisitions in the solar energy sector but has made no definitive comment. Intel is said to have already made contact with potential target companies, including some in Germany. Earlier in the year, German solar manufacturer SolarWorld said it would bring a large facility in Hillsboro, Ore., online, saying it would be the biggest solar plant in North America. The location of the new plant is near Intel's main factory in the U.S. Japan's Komatsu Group originally invested \$500 million in the facility, outfitting it as a silicon chip plant; the factory never opened due to weak demand in the chip industry. Later, SolarWorld bought the plant for \$40 million. The German company plans to establish silicon wafer and cell production at the Oregon site, reaching a capacity of 500-megawatts by 2009. There has been a trend for semiconductor materials suppliers, equipment makers, and fabs to jump on the solar wagon, so why not Intel. Source: Greentech.



SOLAR SEMICONDUCTOR **Solar Semi/Q-Cell Deal** - Solar Semiconductor (Sunnyvale, CA) has signed a supply contract with Q-Cells AG (Germany) worth \$170-million. Solar, with its manufacturing base in Hyderabad, India, signed a multiyear agreement for the supply of 156-mm mono- and multi-crystalline cells by Q-Cells for use in module production in Solar's photovoltaic module manufacturing plant in India. They have aggressive advanced plans beyond 50 MW for module production, thus doubling capacity for early 2008 and rapidly expanding in the coming years. Source: EE Times.

WIND POWER

China 1.5-MW Wind-Power Generator - China's first 1.5 megawatt (1, 500 kW) wind-power generator with completely independent intellectual property rights has rolled off the assembly line in the southern Guangdong province. The price was at least 20% lower than similar imported products or those manufactured by joint ventures, said the Guangdong Mingyang Wind Power Technology Co., Ltd. The generator was designed for China's climate and is resistant to typhoons, sand storms and extremely low temperatures. The company has received orders for 250,000 kW of its wind power generators valued at \$210. The company's annual production capacity of wind power generators will rise from the current 450 units to 1,000 units by 2010. China's wind power resource exceeds one billion kilowatts, according to official estimates. Source: Peoples Daily.



MagLev Windmill - The common windmill design used to capitalize on air currents, while centuries old, operates at around 1% efficiency in terms of the power it extracts from the wind due to the deflective blade design and friction losses. But a new technology unveiled last year in China seeks to dramatically boost the output of wind-driven generators by using the virtually frictionless advantages of magnetically levitated turbines. Since there's virtually no touching of moving parts, the MagLev wind turbine requires far less servicing than a traditional windmill, which dramatically lowers the operating costs to under 5-cents per kwh. Magnetic levitation uses the repelling properties of magnets to lift an object off the ground. In this case, the object is a wind-harvesting fan. The benefit of having it floating in midair is that it cuts down on the friction that causes so much inefficiency in the traditional windmill-style wind energy harvester we see dotting our coastlines. Friction is also the key factor necessitating frequent maintenance of windmill turbines, adding considerably to the cost of running them. Without rotational friction to overcome, a wind turbine generator can begin to harvest power from air speeds as low as 1.5 meters per second. Chinese researchers unveiled a prototype MagLev wind generator device at the Wind Power Asia exhibition in June 2006. The devices were hailed as a huge breakthrough in a vast and spread-out country that has more than 70 million households with no electricity. One innovative possible use could be to harvest wind energy from passing cars on freeways to power the roadside lighting. American company Maglev Wind Turbine Technologies believes that scale is the answer and has released plans for a massive-scale installation. Pointing out that the low power outputs of current windmill units render them cost-ineffective to install and repair, the company proposes the building of giant 1-gigawatt units, each the size of an office building. The company proposes that a one-unit wind farm of such scale would be less than half the price of windmill generators of equivalent output - it would last longer, be cheaper to build and run and therefore result in higher profits. In ideal conditions, such a plant could have a power output similar to a nuclear power station and a 12-month return on investment. *[Gut feel is that the mechanical resistance factor is overstated, dare I say, "overblown"]*. Source: Gizmag.



SOLAR



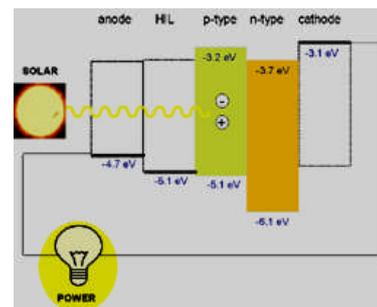
Power Companies Moving into Solar - PG&E signed a contract to buy electricity from one of the world's largest solar plants when completed. The deal provides enough power to serve more than 400,000 homes and is big enough to help the company meet aggressive California rules that demand utilities provide 20% of their power from renewable energy sources by 2010. But it's not possible to say how an increase in

renewable energy use will affect customer bills at this point. But it is clear that new environmentally friendly sources of energy cost more than traditional sources. While natural gas and clean-coal technologies cost about 9-cents per kWh, solar technologies can cost 4X. Even more, renewable fuels provide intermittent power, working only when the wind blows or the sun shines. Solar photovoltaic, which usually uses panels on rooftops, costs about 39 cents per kWh. Solar thermal, the system to be used in the PG&E contract project, uses the sun's heat to create steam energy and costs about 22-cents/kwh; price includes the cost of constructing a new plant. Wind power is cost-competitive at about 7 cents per kWh. The solar plant will be built by Solel Solar Systems (Israel) a 553-megawatt plant in California's Mojave Desert. Construction of the plant will begin in 2009 and finish by 2011. PG&E has signed a 25-year contract for the energy. Thermal is attractive because it provides energy when and where California needs it most: hot sunny days. The U.S. is well situated to build large-scale solar thermal plants because we have an abundance of flat, arid land close to large populations. In California, PG&E said the Solel plant would help increase the company's renewable-energy portfolio of contracts to 18% bringing it another step closer to reaching the state goals and not relying on volatile natural gas prices. Californians already pay some of the highest electricity prices in the nation, about 15-cents per kWh with a U.S. average of about 11 cents. Source: Electronic News



Solar Organic Ups Efficiency - Plextronics claims the organic solar cell efficiency record. Plextronics reported that its organic photovoltaic technology has achieved a world record in the conversion of solar light to power efficiency certified by the National Renewable Energy Laboratory (NREL) at 5.4%. They began

organic photovoltaic development program less than 2-years ago with the support of the Pennsylvania Energy Development Authority, and its Plexcore ink systems for organic photovoltaic cells is meant to allow the low-cost printing of photo-active and charge carrier layers, which together convert light to power in the organic photovoltaic cell. The ability to print organic photovoltaic cells on glass or plastic reduces the cost of energy compared to silicon solar cell technology. Specifically, Plextronics believes its technology has the potential to reduce the cost of solar cells below the commercially important threshold of \$1 per watt, a reduction of up to five times that of crystalline silicon-based solar energy systems. Plextronics was founded in 2002 as a spinout from Carnegie Mellon University, based upon conductive polymer technology. Source: Electronic News



More Printed Solar Cells - New Jersey Institute of Technology (NJIT) claims to have developed an inexpensive solar cell that can be painted or printed on flexible plastic sheets. The new solar cells use a carbon nanotubes (CNT) complex; CNTs are about 50,000 times smaller than a human hair. While the new solar cells are very thin, just one nanotube can conduct current better than any conventional electrical wire; CNTs are

significantly better conductors than copper. The CNTs are combined them with carbon "buckyballs" (fullerenes). Buckyballs are able to trap electrons, but can't make them flow. When the mix is exposed to sunlight, the buckyballs will grab the electrons. The nanotubes behave like copper wires and make the electrons flow. NJIT hopes to use this unique combination in an organic solar cell recipe can enhance the efficiency of future painted-on solar cells. Does it really work? NJIT claims the process is commercially viable, but the cells need improvement in the area of energy conversion efficiency. The NJIT cells currently run at only around 1% efficiency, compared to more than 25% efficiency for the best conventional solar cells. *[OK, all they need is time & money. We have seen increasing activity for organic solar cells, and that's good, but all have low conversions. The record is around presently 6.5%, but this is where early Si-based cells started].*

Source: Journal of Materials Chemistry.



Organic Solar Cell Hits 6.5% - Just when the new 5% efficiency record was confirmed,



it was broken shortly thereafter. The new organic solar cells incorporate two multilayered parts that act together to boost output percent of incoming light into usable power. The new record is a conversion of 6.5%. Researchers from the University of California, Santa Barbara, and from Gwangju Institute of Science and Technology in South Korea, created the more efficient cells by processing each layer from solution with the use of bulk heterojunction materials comprising semiconducting

polymers and fullerene (bucky balls) derivatives. The tandem design essentially conjoins two distinct photovoltaic cells. Each has different absorption characteristics that allows light to be absorbed and converted into energy from a broader range of the solar spectrum. The front cell has a low band gap, whereas the back cell has a higher one. A key design element was the transparent titanium oxide layer that separated and connected the cells and that broke the symmetry of the front cell to create an open-circuit voltage, functioning as an electron transport layer. The team fabricated 20 tandem cells with efficiencies ranging from 6.2 to 6.5%. Dozens of design architectures were built and tested before the final design was chosen. The research team, which also included Alan J. Heeger, a professor at the University of California and a winner of the 2000 Nobel Prize in chemistry, reported that further research with the organic solar cell's design likely would result in still higher efficiency levels. It also expects that the technology could be ready for commercial use within three years. *[Sounds like the universities should compare notes, as they seem to be doing the same stuff].* Source: Photonics.

Nano Boosts Solar; Again - Physicists from the University of Illinois at Urbana-Champaign (UIUC) say they have improved the performance of solar cells by 60%. They've coated the solar cells with a film of 1-nanometer thick silicon fluorescing nanoparticles. The researchers also said that this process could be easily incorporated into the manufacturing process of solar cells with very little additional cost. Integrating a high-quality film of silicon nanoparticles 1-nm in size directly onto silicon solar cells improves power performance by 60 percent in the ultraviolet range of the spectrum. In

conventional solar cells, ultraviolet light is either filtered out or absorbed by the silicon and converted into heat, not electricity. Silicon nanoparticles of 1-nm diameter are dispersed from Si wafers using electrochemical etching. The current-voltage characteristics indicate a photoconductor in series with a diode-like junction with a large enhancement in the forward current under UV illumination. To make their improved solar cells, the researchers began by first converting bulk silicon into discrete, nano-sized particles using a patented process they developed. Depending on their size, the nanoparticles will fluoresce in distinct colors. Nanoparticles of the desired size were then dispersed in alcohol and dispensed onto the face of the solar cell. As the alcohol evaporated, a film of closely packed nanoparticles was left firmly fastened to the solar cell. Solar cells coated with a film of 1 nanometer, blue luminescent particles showed a power enhancement of about 60% in the ultraviolet range of the spectrum, but less than 3% in the visible range. Solar cells coated with 2.85-nm red particles showed an enhancement of about 67% in the ultraviolet range, and about 10% in the visible. *[OK, but what is the effective boost when this is applied to a commercial silicon solar cell?]*

Sources: University of Illinois at Urbana-Champaign news release.



SOLAR MATERIALS

Solar Silicon is on the Way - Most are predicting an end to PV polysilicon shortages in 2008. E-ton says that there will be polysilicon equilibrium in 2008. The persistent shortage of polysilicon may reach equilibrium in the first half of 2008 at the earliest, as both new comers and existing players all plan for expansion in 2008 according to E-ton Solar. M.Setek (Japan) and DC Chemical (Korea) are two new comers in polysilicon production and both plan to offer new supplies in 2008. M.Setek plans to have an annual output of 5,200 tons of polysilicon in 2008 while DC Chemical plans for 3,000 tons/year. More polysilicon supply is also going to be available from some China-based makers.



Besides the anticipated new polysilicon supply from new comers, existing players, including Hemlock Semiconductor, Renewable Energy Corporation (REC), Wacker and MEMC Materials, who all plan expansion in 2008, should help fill expanding demand. Under an optimistic projection, the polysilicon market should meet equilibrium in the first half of 2008. The photovoltaic (PV) industry will see a divergent trend in 2008 along with the anticipated polysilicon market equilibrium. Those companies, who have inked long-term contracts with material suppliers, should find it easier to land materials in 2008 and continue growing rapidly. However, those who fail to secure materials, or those with lower competitiveness and unhealthy structures, will be phased out. These companies should be still subject to high material costs as they can only secure their supply from the spot market. Source: DigiTimes.



SCHOTT WACKER to Produce Solar Wafers - The company will make multicrystalline silicon wafers for solar cells creating at least 700 new jobs; production start-up by end of 2007. The capacity will expand to 1GW/year by 2012. Wacker Chemie and SCHOTT



Solar plan to set up two joint ventures to produce and market silicon ingots and wafers, the starting material for solar cells. This joint venture will be one of the world's 5 largest solar-wafer manufacturers. WACKER is the world's second-largest supplier of hyperpure polycrystalline silicon and a pioneer in the manufacture of solar-grade polysilicon. The expansions of polysilicon will produce more than 22,000 metric tons per year. WACKER will supply SCHOTT WACKER Solar GmbH with the hyperpure polycrystalline silicon it needs to produce wafers. The major part of the joint venture's wafers will be used by SCHOTT Solar to make solar cells. The SmartSolarFab® process manufactures wafers using its advanced EFG process (Edge defined Film-fed Growth). A silicon film, in the form of an octagonal hollow tube, is pulled directly from the silicon melt. A laser then cuts out the wafers. The EFG process delivers several advantages. It greatly reduces material loss, for example, and features a highly efficient use of silicon. Source: Electronic News.

More Solar-Grade Silicon - GT Solar, a major provider of manufacturing equipment to the photovoltaic (PV) industry, has signed a \$171-million contract with Glory Silicon Energy (JiangSu, China) for GT's new and more efficient DSS450 furnaces for the production of multi-crystalline silicon ingots. The contract



is the largest single furnace contract in GT Solar's history and will include deliveries over the next 2-years. The order will equip what is projected to be one of the largest wafer factories in the world - about 1500MW annually. Glory Silicon Energy Co. will be a major player in the growth of the global solar industry and the order is one more indication of the significant growth of the solar industry in China. This is the second major order for new furnaces to produce larger silicon ingots. GT Solar is one of the largest providers of manufacturing equipment across the photovoltaic supply chain and is based in Merrimack, NH (USA). Source: Business Wire.

Even More Polysilicon from Solartech - Solartech Energy has updated its production schedule and is projecting that volume production should be available in 2-3 years as it finalizes plans to establish a polysilicon fab. The R&D team includes both Taiwanese and



overseas experts. The upcoming polysilicon fab will have a total production capacity of 2,000-3,000 tons of polysilicon per year with volume production expected to commence in 2-3 years' time. The company previously named the US as the fab location, but the exact place has not yet been decided. Polysilicon supply is now the most critical criteria for tapping into photovoltaic (PV) industry. There will be a strong consolidation with up- and downstream players. Although industry players generally believe the polysilicon shortage will ease after 2009, extending to upstream material production is vital for long-term competitiveness. Solartech aims to have a complete PV deployment once it was

established. As Taiwan solar applications makers lack sufficient polysilicon supply, the only way to enhance competitiveness is to fill this gap. With its stock now listed on the emerging stock board, Chang said Solartech plans for an initial public offering (IPO) in 2008. Source: DigiTimes.

FUEL CELLS

Fuel Cell Power Plants - Fujitsu recently inaugurated a 200-kW hydrogen fuel cell from UTC that will provide electricity as well as heat to the buildings on its campus in Sunnyvale, CA. The fuel cell sits in the parking lot and provides two types of energy to the facility. First, a unit heats methane with steam to create hydrogen. The hydrogen is passed through a proton exchange membrane (PEM). The electricity produced by the reaction with the PEM runs lights, computers and other equipment. Additionally, the hot water from the methane-hydrogen reaction is cycled through the building to create heat. More waste heat could be recaptured from the PEM unit, but the water is too hot for Fujitsu's internal systems, so it is just vented off. Someday, however, it may be piped into the building.



Although CO₂ is expelled when producing hydrogen, the fuel cell will result in about 35 % less greenhouse gas emissions. That's about 500 tons of CO₂ not emitted a year. It will also save about 800,000 gallons of water a year. Conventional power plants require considerable water. Industrial-size fuel cells won't work well in a lot of circumstances. For example, office buildings that are open five days a week from 9 to 5, it may not be a good application; you need to be running 24-7 for maximum efficiency with this type of unit. You also have to use the heat that comes off the reaction. Fujitsu's fuel cell is about 50% efficient when the recaptured heat is added. At that level, the fuel cell is roughly on par with many gas-powered power plants. Potentially, fuel cells can be made 85% efficient by capturing more of the waste heat. UTC has already installed 280 fuel cells and this includes data centers, hospitals and hotels. Utility credits also help. Pacific Gas & Electric gave Fujitsu \$500,000 in rebates for installing the system. That works out to \$2.50 a watt, or the same amount that homeowners get for installing solar panels. With the subsidy, the fuel cell will pay itself off in around 3.5 years and will last around 15 years, according to Fujitsu. Like many Japanese companies, Fujitsu has set goals for greenhouse gas reductions. Pollution problems and skyrocketing costs of imported energy in the 1970s kicked off a conservation movement in the country that has remained somewhat strong, unlike the USA. The company's goal is to reduce CO₂ emissions to below 1990 levels by 2010. In 2006, it reduced overall waste in its factories 41% from 2003 levels. The company also has tried to integrate more green ideas into its products. In

2005, for instance, it released a laptop in Japan with a biodegradable chassis made of corn starch-based plastic. Source: CNET.

Fast Ford Fueler - The fuel-cell powered Ford Fusion 999 has scorched across the Salt Flats of Utah at the Bonneville Speed Week, clocking 207.297 miles per hour and giving Ford the mantle of the world's first automaker to set a land speed record for a production-based fuel cell powered car. Powered entirely by hydrogen fuel



cells, the collaboration with Ballard, Roush and Ohio State University represents another significant step toward commercially viable hydrogen fuel cell vehicles. The Fusion Hydrogen 999 is one of two vehicles Ford's fuel cell research team is helping prepare to set world land speed records. The second vehicle, dubbed "Buckeye Bullet 2", is being developed in conjunction with Ohio State University student engineers. This streamliner-type fuel cell-powered racer aims to reach 300+ mph. Incidentally the first Buckeye Bullet set the unlimited land speed record for an electric vehicle by hitting 315 mph back in 2004. Its 770hp engine was used by Ford engineers as the basis for the 999 with Ballard Power Systems supplying the 400 kW hydrogen fuel cells. The hydrogen powered Fusion is part of Ford's alternate energy initiative, which includes a flexible array of options such as hybrids, E85 ethanol, clean diesels, bio-diesels, and advanced engine and transmission technologies. The company already has a fleet of 30 hydrogen powered Focus fuel cell vehicles on the road as part of a worldwide, seven-city program to conduct real world testing of fuel cell technology. The 30-car fleet has accumulated more than 540,000 miles since its inception in 2005. Hybrid models of the Ford Fusion will be available in 2008. Source: Gizmag.

CONVENTIONAL

China - King of Coal - Keeps on Digging - *[Let's hope that some climatologist have it wrong about CO₂ and global warming, because generation is going to keep rising].* A



coalfield with estimated reserves of 5-billion tons has been discovered in the Inner Mongolia (Xin Barag Left Banner, Hulunbuir League). The new discovery will mainly produce brown coal (dirty). Earlier in June, a coalfield with reserves of 20.5-billion tons was also discovered in Hunlunbuir. The region had a reserve of 658.3-billion tons of coal. More geological surveys are being conducted in the region, the ministry said. Last year, Inner Mongolia discovered five 10-billion-ton coalfields in Xilin Gol, and one in

Baiyanhua of 6.4 billion tons. China's coal output is expected to be 2.6-billion tons in 2010, as it continues to be the nation's most important energy resource. Today, the nation has coal reserves of 1-trillion tons. Source: China Daily.



Bring Back Diesels - The diesel has floundered for the past two decades in U.S. passenger cars. Volkswagen, which in the past offered diesel versions of its Passat, New Beetle, Golf and Jetta in the U.S., has no diesel passenger cars for the 2007 model year due to tighter emissions regulations. In fact, the only new car available with a diesel engine in the United States is the Mercedes E320 BlueTec, but that vehicle starts at \$51,550. Honda expects to change things with its next generation Accord family sedan. Honda's Accord has been one of the best

selling cars in the U.S. for the past 20 years. Honda will use diesel power instead of hybrid technology for its Accord, which has been redesigned for the 2008 model year. The new Accord will have the option of a new Tier 2 Bin 5 diesel engine for the 2009 model year. Honda showcased the engine back in September 2006 and promised that it be used in U.S. passenger cars within three years. Honda's 2.2-liter i-CTDi uses a revolutionary catalytic converter filled with ammonia to "detoxify" NOx produced by the engine and convert it to nitrogen. Honda isn't the only manufacturer working on Tier 2 Bin 5 diesel engines for the U.S. car market. Volkswagen will come off its 2007 diesel slump with a new TDI engine in 2008 and even performance-oriented Nissan is looking to get into the diesel game in 2010 with its Maxima. Honda's position in the American auto market, however, makes its introduction of diesel passenger sedans a huge turning point for diesel in America and could go a long way to changing American opinion on diesel-powered cars. Source: Daily Tech.

ENERGY STORAGE

Ultra-capacitors - Toyota is testing vehicles with ultra-capacitors instead of batteries for power storage. The car was able to store large quantities of energy quickly from regenerative braking and apply this stored power quickly to its advantage. German car maker BMW has also demonstrated this ability in its "syncap" concept whereby two-thirds of total vehicle torque is generated by the syncaps enabling heavy SUVs to accelerate more quickly than before with improved fuel economy. Capacitors are much lighter than batteries, and do not require the use of toxic materials. Furthermore, ultra-capacitors have a superior charging/discharging cycle lifetime compared to rechargeable batteries. Impending legislation will force carmakers to look at energy saving technologies. Plans are to use ultra-capacitors in stop-start and regenerative braking systems in order to further reduce automobile fuel consumption and emissions and to power additional electrical functions. Full hybrid-power trains are also likely to use ultra-capacitors alongside batteries, bringing a more balanced solution. Effective energy storage and recovery from ultra-capacitors for vehicle electrical systems requires dynamic processor control and power converters, thus creating new opportunities for electronic module and semiconductor vendors. Source: Company websites

