

# ENERGY NEWS REPORT

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## BUSINESS NEWS



**Venture capitalists in Silicon Valley** have been searching for the next big thing in high tech for years and energy is looking like opportunity. Although a pay-off could take years, venture capitalists are pouring cash into solar power, fuel cells, wind energy, bio-fuels, solid-state lighting, "smart" power grids and other innovative forms of energy. The best brains in the country want to work on energy according to Silicon Valley venture capitalists. But energy is under-researched. Oil companies spend no money on research, especially outside of how you discover more oil; all their efforts are token or nominal

and the same is true for the coal business. A lot happening right now is an R&D wave for individual technologies, Silicon Valley and industry itself. More than two-thirds, or \$883.6-million, of all clean-technology investments last year were made by U.S. investors. Cleantech Venture Network, an industry trade group, estimates that clean-energy investment in Silicon Valley topped \$500-million last year, including not just venture capital, but also corporate and some debt financing. The group estimates \$3.6-billion was invested across the U.S. and Europe. Among the largest clean-tech investments were \$75-million in solar cell maker Nanosolar (Palo Alto, CA) and \$50-million for renewable bio-fuels producer Altra (Los Angeles, CA). Bio-fuels, wind power, solar photovoltaics and fuel cells are likely to pace new energy growth, according to consulting and research firm Clean Edge Inc.

While new spending on clean technology is growing far faster than classic venture capital sectors, such as computers, health care or retail start-ups, it remains a small fraction at 3.7% of the overall market. A growing sense of urgency to reduce the use of carbon-based fuels, blamed for global warming, is helping drive the move in Silicon Valley. Governor Schwarzenegger's efforts to launch a "green rush" in his state with a law to fight global warming have also focused more attention on Silicon Valley. Business can make more money by switching to energy-efficient systems and developing clean technologies. New jobs will sprout from a burgeoning service industry to cater to companies' green demands. Beyond the buzz about environmentally friendly technology, Silicon Valley's most important contribution could be to shift existing managerial talent from Web and computer companies into building new energy businesses. Echelon Corp., a developer of "smart" electric meters to measure energy efficiencies, taps hardware and software managers and engineers who have built digital communications networks at earlier Silicon Valley companies. Applied Materials added solar cell manufacturing to its repertoire last year and is equipping its Sunnyvale, CA., research center with one of the

largest sun-powered energy systems in the U.S. [Google will be #2 will solar-powered offices, or maybe #1].

### **Solar Electricity Predicted to Reach Cost parity by 2010 - (Electronic Business) - By**



2010, leading solar electricity providers in Spain will be able to produce solar electricity for as low as \$0.10/kWh, the same costs as from a new coal power plant per Photon Consulting (Boston). These economics will result in a large market opportunity for solar energy, but the photovoltaic (PV) industry is not likely to pass on decreasing production costs to its customers, instead choosing to expand their earnings in the coming years. In 2006, the production of solar electricity from a typical 4-kilowatt (kW) rooftop system in Germany cost \$0.30/kWh, in Spain, it was \$0.19/kWh, and in California, it was \$0.22/kWh. By 2010, Photon Consulting estimates that solar electricity will be \$0.18/kWh (Southern Germany), \$0.12/kWh (Spain), and \$0.13/kWh California. Typical production costs including system installation were approximately \$3,600 per kW last year, with particularly efficient companies producing for costs of less than \$3,000 per kW. By 2010, this price is expected to plummet to \$2,500. The firm noted that it based its work on PV companies that integrate the entire value added chain, specifically, those that can manage the production of silicon, cells, and modules all the way to the operation of PV power plants. In a recent study, the firm names 13 examples of companies that are developing in this direction, among them U.S.-based Sunpower, German-based Solarworld AG, and Suntech Power Co. Ltd., located in China. Solar is only economic for installation on rooftops because of the feed-in tariffs for solar electricity of 60-cents per kWh. However, when it comes to competitiveness, Photon Consulting believes that the decisive factor isn't the system's market price, or the feed-in tariffs, but rather the production and installation costs. Photon found that around 1,150 MW, or almost half of all PV systems installed worldwide in 2006, were installed on German roofs and undeveloped areas. By the end of 2006, PV systems with nearly 6,000 MW of power have been installed worldwide. Of those systems, about half, i.e. around 3,000 MW, are located in Germany, and contributed only 0.4% of German electricity production. Since the majority of PV systems in Germany are installed in Bavaria, solar electricity production equaled 1 percent of total electricity demand in this state, the firm concluded.

### **New German Solar Venture - (Electronic News) - Renewable energy investor Good**



Energies and mono crystalline ingot and wafer supplier to the solar industry NorSun, recently established Sunfilm AG to manufacture the world's first 5.7-square-meter tandem thin film photovoltaic modules on glass substrates on a production line of equipment from capital equipment giant Applied Materials Inc. The newly established operating company is

located in Grossröhrsdorf Saxony, Germany. Sunfilm hopes to open new frontiers beyond what today's industry is projecting in size and in performance. Focus is on bringing the cost down. This venture aims at cost parity and Applied Materials' technological leadership is the key element for us in this project. The Applied production line will contain new tandem cell technology, which is a dual-junction approach that combines an amorphous silicon top film to absorb short wavelengths of light with a microcrystalline silicon bottom layer to absorb longer wavelengths. These tandem cells are expected to deliver significantly higher energy conversion efficiencies at a cost per watt that is comparable to that of single junction technologies. By coupling tandem technology with these ultra-large substrates, Sunfilm said it expects to substantially reduce the cost of solar panel manufacturing. Sunfilm said it is currently designing the building and facilities for its first PV line with construction to begin in Q2-2007. This project is to be supported with grants from the State of Saxony and is expected to employ approximately 180 people when the line is fully operational in 2008 or 2009. The contract with Applied is for a fully-integrated equipment line for an ultra-large panel tandem module factory with a nominal rated capacity of 60 megawatts per year, approximately three times the capacity of conventional thin film solar facilities.

**Plastic Solar Cells** - Wake Forest University's Center for Nanotechnology and Molecular Materials have pushed the efficiency of plastic solar cells to more than 6%. They have achieved record efficiency for organic plastic solar cells by creating "nanofilaments" within light absorbing plastic. This allows for the use of thicker absorbing layers in the devices, which capture more of the sun's light. Efficient plastic solar cells are inexpensive and lightweight, and easy to process. Three percent was the highest efficiency ever achieved for plastic solar cells until 2005 when Wake Forest nanotechnology center announced reaching 5 percent efficiency. A year later, the group has surpassed the 6% mark. But they probably need to hit 8% to be viable for commercial use. But, Wake Forest researchers hope to reach 10% next year. A large part of Carroll's research is funded by the United States Air Force, which is interested in the potential uses of more efficient, lightweight solar cells for satellites and spacecraft.



**US Air Force Building the Largest Solar Power Plant in NA** - The solar site in the Nevada desert will soon provide electricity to an Air Force base. With 140 acres dedicated to a massive photovoltaic array, the solar plant will produce 15-MW of power (30% of Nellis AFB's needs). Projected savings in energy costs: \$1 million. The Nellis installation will only serve as a daytime energy source and not have battery storage capacity.



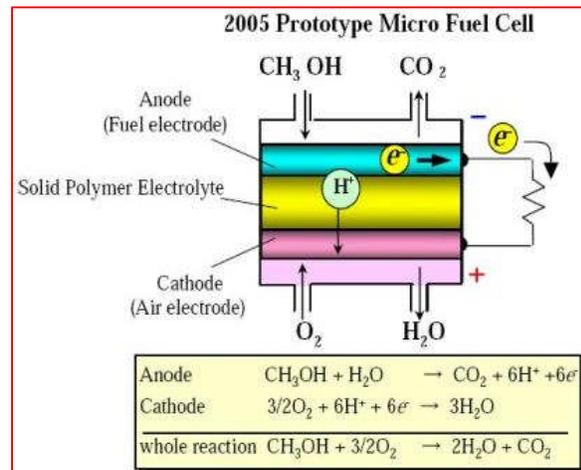
## WIND

**China Wind - Installed Wind Power to Hit 4-Million Kilowatts** - The secretary-general of the China Association of Resource Comprehensive Utilization said that

China's installed wind power capacity was growing rapidly, and is expected to reach 4 million kilowatts by the end of 2007. The 2010 target of 5-million kilowatts is expected to be reached in 2008.

## FUEL CELLS

**Micro Fuel Cell Status** - Micro fuel cells have just entered consumer electronic products phase and are likely to see large growth rates in the next 5-years (Innovative Research and Products). They estimate the 2006 market to be about \$12-million but will reach \$112 million by 2011; AAGR of 55.7% from 2006 to 2011. Micro fuel cells (MFC) convert the chemical energy of fuel, such as hydrogen or methanol or other fuel, into electrical energy. Fuel cells can continuously produce electricity as long as there is a fuel supply. Though no universally accepted definition exists for micro fuel cells, the term typically describes small fuel-cell systems that provide *less than 50-watts of power*. Fuel cells have potentially a much higher energy density than batteries and promise a significant increase in power availability for portable electronics. However, developing a fuel cell system for portable electronics presents several engineering challenges. The fuel itself is a problem, since ideal hydrogen gas, is not an option.



Hydrogen sources, like methanol, cut down on fuel value; energy/weight. High conversion efficiency also presents a challenge to portable electronics designers to provide high efficiency electronics that support fuel cell operation. But, there is a potentially enormous market for fuel cells in the area of portable electronics. However, to become mainstream product, micro fuel cell systems must have superior performance and competitive cost with batteries. They must be safe to transport and environmentally friendly. Among portable power sources, however, micro fuel cells are not likely to replace batteries in all applications. Achieving an attractive cost-to-power ratio (cost) and providing a viable weight-to-power ratio (energy density) are the two major challenges driving commercial research and development efforts in fuel cell technology. Among different technologies, direct methanol fuel cells will capture the largest share followed by hydrogen-based fuel cells and fuel cell using proprietary methods that may include H<sub>2</sub> traps. In 2006, North America had the largest share of the market followed by Europe and Japan. More than 60 companies and institutions worldwide are currently active in the field of miniaturized fuel cell systems.

**Another View on Micro Fuel Cells** - Micro fuel cells for portable devices are not expected to become a mainstream product until 2010 in spite of all of the press releases. The technology has been held back by high costs, lack of standards, financial losses and bad publicity. Medis Technologies Ltd. (New York) was recently sued by shareholders

after it was revealed the firm only shipped a few products to Microsoft were give away at trade shows. The micro fuel cell 'industry has been long in promises, but short on deliveries. The worldwide micro cell fuel market is projected to range from \$50-to-\$100 million in sales by 2010, jumping to \$100-to-\$200 million by 2011, according to Angstrom Power. Until that time, there is expected to be a major shakeout in micro fuel cells, which consists of some 30 to 40 players in the arena right now; today's major players are Angstrom, Aquafairy, Teckion, Millennium Cell, MTI, Toshiba and others.

## **BIO-FUELS**

### **Corn Makes Better Whiskey than Fuel -**



New technology to make ethanol from crops such as grasses and trees instead of corn could ease price spikes of the grain within a

decade according to the U.S. Energy Department. Output of U.S. ethanol, mostly made from corn, is expected to jump in 2007 from 5.6-billion gallons per year to 8 billion gpy, as 80 bio-refineries go on steam. The corn prices, the highest in a decade, have spurred thousands of people in Mexico to protest

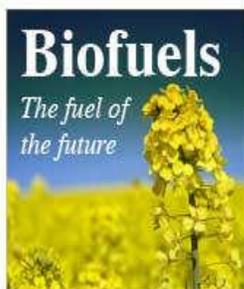
over the price of tortillas, a national staple made from corn. The spike has also lead to worries that meat and dairy prices could eventually rise. But the future of biofuels is

cellulosic ethanol, made from microbes that break down woody bits of non-food crops into sugars that can be fermented into fuel. Cellulose, and other new biofuels, such as biobutanol, which can be made from petroleum and biomass, could begin to feed the commercial fuel market within 6 to 10 years. They could also be part of a larger program to cut greenhouse gases. Amid growing pressure to cut emissions in the world's biggest producer of greenhouse gases, the USA is also putting research and investment money into clean coal, and energy efficiency.



Crop	litres ethanol/ha	US gal/acre
Miscanthus	14031	1500
Switchgrass	10757	1150
Sweet Potatoes	10000	1069
Poplar Wood (hybrid)	9354	1000
Sweet Sorghum	8419	900
Sugar Beet	6679	714
Sugar Cane	6192	662
Cassava	3835	410
Corn (maize)	3461	370
Wheat	2591	277

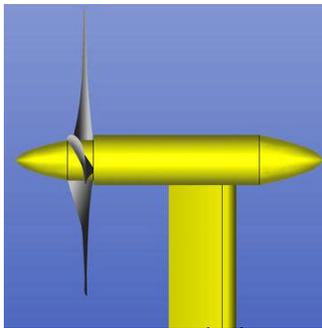
### **Malaysia Will Build 80 Biofuel Plants -**



Malaysia plans to build 80 biofuel plants for commercial production. The government approved 90 licenses for the establishment of biofuel plants; 6 are already operational with a capacity of 352,000 tons/yr. Some other biofuel plants are in various stages of construction and at least 7 are expected to be operational by the end of 2007. From August 2006 to February 2007, Malaysia exported 52, 654 tons of biodiesel to the United States, the European Union and Japan, earning \$37.7 million in revenue (Xinhua).

## TIDAL

**New York City's Roosevelt Island - first major tidal-power in USA.** The project involves a set of 6 submerged turbines that are designed to capture energy from the East River's tidal currents. The triple-bladed 5-m diameter turbines resemble wind turbines and are made by Verdant Power (Arlington, VA). Tidal power is already economically competitive, producing electricity at prices similar to wind power, according to the Electric Power Research Institute. The big advantage over wind and solar is a highly predictable source of energy.



Developers in the United States have selected the

best sites up and down the Atlantic and Pacific coasts. In the past 4-years, the Federal Energy Regulatory Commission in Washington, DC, has issued preliminary permits for tidal installations at 25 sites and there are another 31 applications. Current-harvesting turbines represent a sharp break from the first tidal power, so-called "barrages" in which impoundments installed across estuaries or bays created hydroelectric reservoirs refilled twice daily by rising tides.



The **La Rance Barrage** in Normandy has produced up to 240 megawatts of power--as



much as many natural-gas-fired power plants--since 1966. Halifax utility Nova Scotia Power has been generating up to 20-MW of power since 1984 at a tidal barrage in the Bay of Fundy, whose funnel-shaped inlet produces the world's largest tides; 16 meters at its head. But these constructions have fallen out of favor because of their outsize impact on ocean ecosystems. But in-flow turbines, such as Verdant's, have less impact on waterways and the environment. The first two turbines in the East River were

installed on 12/2006. One has been delivering a maximum of 35-KW of power to New York City, swiveling to generate power as the river swells with the high tides and empties with the low. The other turbine delivers performance data that will be crucial to refining the blades and gearbox, generator, and control system to optimize power generation. This month, Verdant added four more 35-KW turbines. Verdant is now working on a next-generation design that will be cheaper to mass-produce, in anticipation of installing a farm of at least 100 turbines at the East River site. Before the company proceeds, however, it must monitor the first six turbines for 18 months to assuage concerns of

federal and state regulators that the turbines, whose tips cut through the water at up to nine meters per second, won't injure the river's fish. Such qualms have already delayed the first-of-its-kind project by several years. But few fish venture into the strong currents flowing past the turbines.

Marine Current Turbines of Bristol, England, has operated an 11-meter, 300-kilowatt



turbine off Devon for four years and plans to install a one-megawatt turbine in Northern Ireland's Strangford Lough this year. Marine Current's design resembles Verdant's but uses two rotors, each with two blades. Other competitors are scaling up so-called ducted turbines, which are surrounded by a power-boosting shroud to guide water flow. Nova Scotia Power recently signed up Dublin's OpenHydro to install a 1-Megawatt ducted

turbine in the Bay of Fundy, while Vancouver-based Clean Current Power Systems is working on a 2-MW version of the 65-kilowatt ducted turbine it installed off the coast of British Columbia in December.

## NUCLEAR

**Northeast China's First Nuclear Power Plant** - Construction will begin in September



2007 on two concrete bunkers that will house the core of a nuclear power plant near Dalian, a port city in northeast China's Liaoning Province (Source: Xinhua). The China Guangdong Nuclear Power Group Holdings Co. Ltd (CGNPG), one of the developers, said a panel of more than 200 specialists examined and approved a feasibility study for the project at a meeting held in Dalian last weekend. The approval paves the way for start of construction on the nuclear power plant located in Wafangdian, 104-km north of Dalian in Liaoning

Province. The power station will have six generating units, each with an installed capacity of 1- million KW. It will be the first nuclear power plant in northeast China with the first phase coming on line by 2012. The project will cost \$2.88-billion shared by the China Power Investment Corporation, the China Guangdong Nuclear Power Group Holdings Co. Ltd (CGNPG) and two Liaoning companies. The power plant is expected to play an important role in efforts to rejuvenate China's old industrial northeast. The government plans to increase the country's nuclear power capacity to 40-million KW by 2020, but it will account for only 4% of the country's total electric power.

**Russia building first floating nuclear power plant** - Russia began construction of the world's first floating nuclear power plant. The plant will be aboard a barge where two reactors will be manned by a crew of less than 60. The \$300-million project is expected to be completed in 2010. The plant was designed to satisfy the energy needs of the

country's north and far east region but will also be sold to other countries. The Russian nuclear energy agency Rosatom and the military shipbuilding company Sevmash signed on Sunday an agreement to produce six floating plants. They may have orders from other countries in the Asia-Pacific region where such stations will desalinate seawater. (Source: Xinhua). *[Floating and submerged nuclear power is as old as the USS Nautilus, so surprising that marine power plants aren't prevalent. Let's add floating windmill plants, too]*



## OTHER ENERGY

Honda and Climate Energy announced the **Freewatt Micro-CHP** (heat + power) cogenerator for homes, claimed to save money on heating bills and have a small "environmental footprint". The cogeneration by Honda that produces 3.26-KW of heat and 1.2-KW of electric power. The unit can be paired with a furnace or a boiler by Climate Energy. The Micro-CHP approach to delivering energy to homes can reduce overall energy usage and lower environment impact by higher total efficiency. The electric power is a by-product the heating function. Estimated savings for the average home are estimated at \$500 to \$1,000 per year on their electric bills. More savings come from utilizing the freewatt system with net metering, a simplified method of metering the energy consumed and produced at a home or business with its own renewable energy generator. Net metering allows homeowners to sell unused electric power back to the grid in their communities. For now, the target is the Northeastern U.S. due mainly to the region's greater heating demands. The freewatt system for Massachusetts has a list price of \$13,500.



**Running on Empty - Sooner or Later** - Global oil output will peak between 2008 and 2018 and then decline per new research from Sweden. The Uppsala model uses a "bottom-up" approach based on field-by-field analyses of the 333 giant oil fields in use today. These together, account for more than 60% of today's oil production. They predicted how production would decline after peaking by incorporating rates of drop-off observed at other fields, ranging from 6% (best case) to 16% (worst-case). They added forecasts for new field developments from sources such as the deep ocean and oil sands in Canada, but say that these are unlikely to offset the upcoming declines from the giant fields—and there is little chance that new giant fields will be discovered in the future. Even if another major oil field is found, it will only offset the predictions by 1 year. Others, such as Cambridge Energy Research Associates, speculate that oil will peak sometime after 2020. Still others, predict it will happen much sooner. *[We can argue endlessly about oil, but the day of cheap petro is long gone].*

