

ENERGY NEWS REPORT

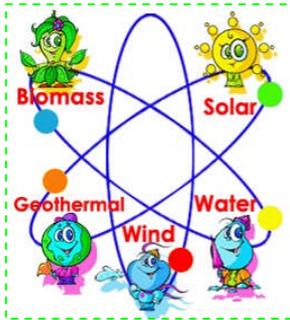
June 2007

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BUSINESS NEWS

Renewable - a Hot (Greenhouse Heated) Investment - Investors worldwide put up



\$71-billion of new capital for renewable energy in 2006, up 43% from the previous year. Drivers are global warming concerns, high oil prices and the growing backing from governments. Today renewable energy accounts for only 2% of the electricity around the world, however, but it makes up 18% of the world's investment in generating power. Though high oil prices are helping drive interest in renewable technologies, the field is growing more independent of fossil fuel prices. The forecast for 2007 is \$85-billion in new capital. The biggest growth has been in venture capital and private equity investments, which hit \$7.1-

billion in 2006, more than twice as much as the previous year. Developing countries are moving deeper into the renewable energy business. Investment in the developing world made up 21% of the total last year. China had 9% of the world investments where large reliance on coal is a world environmental concern and lack of oil in its territory is helping motivate efforts to find other energy sources. India is slightly behind China. Source: Associated Press.

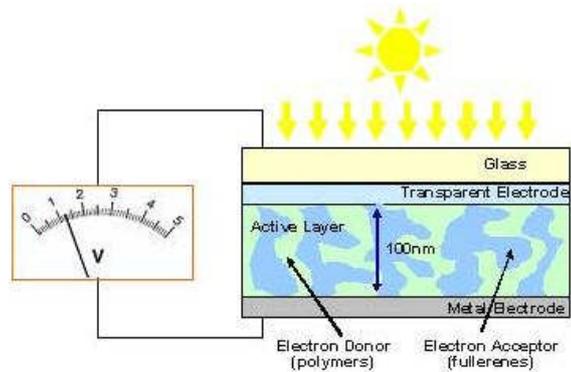
Ban the Bulb? - The leaders of the 27 European Union nations agreed on new energy and emissions cutting guidelines in March, including phasing out the old incandescent lamps. The EU is applying new binding minimum energy efficiency rules for all lights used, either in the home, at work, or in street lighting. The industry group said manufacturers would have 8-years to switch to high-efficiency halogen and compact fluorescent lamps and develop high-efficiency incandescent bulbs. Under the proposal, by 2015, 85% of the total EU traditional incandescent lamp market of 2.1-billion lamps would need to meet new efficiency requirements. According to the Scotsman News agency, the ban will come in 2 years, saving a bungle of money and reducing 100's of tons of CO₂ emissions.



Google Green - Google wants to become carbon-neutral by the end of 2007. The plan to neutralize Google's carbon footprint includes three basic strategies: reduce energy consumption by maximizing efficiency; invest in and use renewable energy sources; and purchase carbon offsets for the emissions that we can't reduce directly. Google first calculated how much carbon it released into the atmosphere by taking into account emissions from purchased electricity, employee commuting, business travel, construction and server manufacturing. Then to

offset those emissions, Google decided to invest in projects in other parts of the world that cut the amount of greenhouse gases released into the air. Google is also committed to finding and developing new environmentally friendly technologies and sources of energy. Google has been adding solar as its main renewable energy.

Organic Photovoltaics (OPV) - A German government agency, and several from industry, will invest in the development of organic photovoltaics (OPV). The initiative has a goal of lowering the price for solar cells and to widening applications; target is to achieve about 1/3 the cost). The initiative will spend about \$80-million over 5-years for research activities aiming at developing OPV materials and process technology. Companies include BASF, Bosch group, Merck KGaA, and Schott AG, who will invest an additional \$110-million for over 10-years. Bosch and BASF will launch collaborative efforts to make solar cell production more cost-effective. In 2006, photovoltaic modules had a global market volume of 18-billion units and are expected to grow by more than 20% annually over the next 12 years. Heliatek, who will also participate, is developing a roll-to-roll production process to manufacture large organic solar modules. BASF's OPV activities presently focus on materials with high thermal and photochemical stability which eventually could replace silicon in solar cells.



SOLAR

Chinese Solar Industry - Trina Solar is a leading vertically integrated manufacturer of solar photovoltaic products founded in 1997. A new 50-MW cell line was under testing during the first quarter of 2007 but is now on-line. Average cell efficiency is 16.3%. Four additional solar PV cell lines are currently planned and are expected to reach its target capacity of 150-MW by the end of 2007. Trina Solar is a manufacturer of high quality monocrystalline modules and has a long history as a solar PV pioneer since it was founded in 1997 as a system installation company in China. Trina Solar is currently one of the few PV manufactures that has developed a vertically integrated business model from the production of monocrystalline ingots, wafers and cells to the assembly of high quality modules.

Solar Power Costs Nearing Par - We've been reporting that solar plants are going up everywhere, and like semi fabs, the new ones are new generation making them more productive. And this, of course, brings cost reductions. Solar energy is fast closing the price gap with conventional U.S. power sources and is



likely to drop to near even in cost in many regions in the next few years according to EDT. Price declines have been driven by both production efficiency and technology improvements, including cheaper types of silicon and thinner cells. Even better, the cell conversion efficiency is increasing. Under current laws that expire in 2008, installation of solar power systems are subsidized by a 30% investment tax credit that helps narrow the gap between the cost of 20 to 40 cents per kwh and typical U.S. retail electricity costs of about 10.5-cents per kwh. Congress is debating a possible extension and expansion of current solar subsidies as part of a broader energy legislation package. Utilities can buy power from low-cost coal-fired plants for around 4-cents per kilowatt, and sell the power to households and business at about 12-cents per kWh and this makes it tough to see excess solar power. But supply-constrained markets, like California, can only buy power at 12 - 23 cents per kWh, making solar nearly competitive. It cost money to move power over great distances due to resistive power loss. In some markets, solar energy is already a cost effective source of power and that trend is set to expand, especially in larger markets. New technologies such as thin film solar modules and the use of nanotechnology should further boost solar energy affordability. Source: Reuters.



Applied Materials Adds Another Acquisition - This major semiconductor materials and equipment supplier will acquire HTC, a privately held Swiss company. HCT is the world's leading supplier of precision wafering systems used principally in manufacturing crystalline silicon (c-Si) substrates for the solar industry. Applied will pay 475-million in cash. The acquisition is part of Applied's strategy to accelerate customers' ability to reduce the costs of photovoltaic (PV) cell manufacturing to make solar energy more competitive with grid electricity. The acquisition helps with an overall strategy to drive down the cost-per-watt of solar power and help expand into the c-Si PV technology sector; currently of 90% of solar panel production. HCT is a pioneer in precision wafering, with technology that also includes products for squaring and cropping ingots and for slurry recovery. HCT has experienced rapid growth, supplying its products to c-Si solar manufacturers worldwide. The precision wafering systems significantly reduce the thickness of wafers used to make c-Si solar cells, decreasing silicon usage. Source: Business Wire.

From PCBs to Solar - Unitech Printed Circuit Board announced that it would invest \$28.8-million to establish a new plant for solar cell production, with small volume production slated Q4-07. Unitech is targeting a capacity of 30 MWp at its production facility to be located at Yilan, Taiwan. Pilot production will begin following equipment installation which is expected to complete in June. Volume production is slated for the first half of 2009 and the company aims to triple its annual capacity within 3-years. Unitech's board of directors approved a \$25-million private placement plan to purchase \$20-million in company bonds and to take one director seat in the future. Unitech anticipates that solar cell production will contribute over NT\$3 billion to sales per year, based on a capacity of 30MWp. This is not the first PCB maker in Taiwan to tap into the solar cell business. Unimicron Technology earlier this year tied up with United Microelectronics Corporation (UMC) over the establishment of solar cell company

NexPower. Using technology from Japan's Ulvac, NexPower houses an annual capacity of 25MWp. Unimicron differs itself from United Printed Circuit Board as it focuses on thin-film solar cell, meaning that its polysilicon and solar wafer concerns are lesser. Source: DigiTimes.



Solar Ship - The Sun21 make a historic visit to NYC. Using solar power only, the catamaran undertook the first motorized crossing of the Atlantic with solar power to promote the great potential of this technology for ocean navigation and covered about 7000 sea miles.



WIND POWER

Wind Turbine Manufacturer In Colorado - Vestas Wind Systems is the world's largest turbine producer. The company built a blade factory in Great Western Industrial Park, Windsor, CO. The company sees a growing need for wind power hardware in the U.S. power market. Vestas decided on the based on the park's central location, as well as the direct access to rail services and a skilled workforce. The total investment in production equipment, land and buildings is expected to amount to approximately \$60 million. Construction of the factory, began in the spring of 2007, and is expected to be completed quickly with in production early 2008. At full production, the plant will have a production capacity of approximately 1,200 blades per year and the factory will employ around 400 people. Source: IW



Floating Windmills - Norsk Hydro (Norway) and Siemens (Germany) reached agreement to develop floating wind turbines that could be installed anywhere, including the high seas. The goal would be to locate the turbines in areas with the strongest winds and that are less likely to mar the visual perspective, the two groups said. Under the agreement

Siemens would provide Norsk Hydro with a demonstration turbine to be tested off the Norwegian coast. Norsk Hydro currently has a concession to install a demonstration turbine off Karmoeey, in southwest Norway, but is also considering locating an experimental turbine near an oil platform that would be powered by "clean electricity," according to the statement.



Spanish Windmills in the USA - Acciona (Spain), the world's largest wind power rights to develop 1300 megawatts (MW) of wind assets in n. Acciona acquired projects from EcoEnergy, an alternative and unit of The Morse Group. Acciona wanted to shore-up a as a long-term owner and operator of wind developments



and renewable energy solutions. Acciona said it plans to install approximately 150 MW in 2008 from its U.S. pipeline, a development it said would help Illinois, Iowa and Wisconsin significantly reduce greenhouse gas emissions associated with traditional electric generation facilities. The firm will be supplying its own wind turbines for the development projects from its new U.S. production facility in Iowa. Acciona noted it had

recently begun construction of its first wind turbine manufacturing plant in the U.S., located in West Branch, Iowa. Due for completion in late 2007, the plant will supply turbines for Acciona wind farms throughout North America. The West Branch facility will be Acciona's fourth wind turbine assembly plant with two already on stream in Spain and one in China. Acciona Energy is the largest wind developer in the world with a portfolio of 4,653 megawatts installed in 173 wind farms in 10 countries. Source: Agence France-Presse, 2007. Source: Agence France-Presse

US Finally Unfurling Sails? - The U.S. is the fastest growing global market for wind

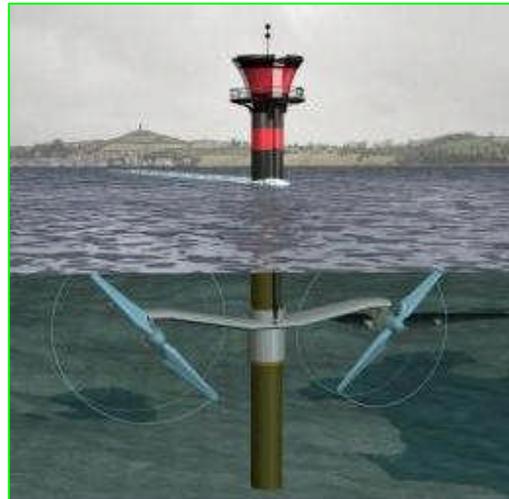


power, according to the Energy Department's first annual report on U.S. wind power installations. *[This is a surprise with all the NIMBY resistance, at least, in New England].* U.S. wind power capacity jumped 27% in 2006, the largest incremental jump on record and the highest incremental capacity in the world per the DoE study. The wind power industry has entered an era of substantial growth, both globally and in the United States," according to Lawrence Berkeley National Laboratory (CA). The U.S. ranked 3rd in 2006 with cumulative wind power capacity with 11,575 megawatts.

Germany was first with 20,652 MW followed by Spain with 11,614 MW. But the U.S. lead with wind power capacity increases, at 2,454 MW, followed by Germany and India. However, the U.S. lags far behind global leaders Denmark, Spain, Portugal and Germany in the percentage of electricity consumption from wind power. The U.S., France and China were all under 1% of projected wind power production as a percentage of overall electricity consumption in 2006. Denmark leads the world with 21.4% of its electricity supplied by wind power. Within the U.S., Texas, Washington and California lead the nation in new annual wind power capacity. The report also noted that the cost of wind turbines has been increasing since 2002, reversing a decline in the cost of wind power projects and raising the price tag for generating wind power. But rising costs have been offset by higher tower heights, improved productivity and technology advances. General Electric's Wind unit is the leading U.S. supplier of wind turbines. *But the really big projects are pending, and some, like Cape Wind have been tied up for years by politics. The Cape Wind project (Nantucket Sound in Massachusetts) has met with local opposition from groups and politicians. The wind power market is entering a new phase and electric utilities are showing increased interest. Local governments, and even departments within them, are may get into the wind power business. A local private school in RI has set up its first turbine and public school districts are looking at options right now. In essence, the school or other entity provides a piece of land and collects rent.* Source: *EE Times, DoE website.* See <http://www.nrel.gov/docs/fy07osti/41330.pdf> for the DoE report.

TIDAL POWER

First Commercial Tidal Wave Turbine - - The tidal motion of water offers us a considerable source of energy, and it's predictable, with very little impact on the environment. Following successful testing off the coast of Devon, Marine Current Turbines is set to begin construction of the world's largest ever tidal turbine system off the coast of Northern Ireland. The 1.2-MW generator will send enough power back into the commercial grid to supply 1000 homes, and will serve as a prototype commercial test of this clean, sustainable energy source. The company confirmed installation of its SeaGen commercial tidal energy system beginning shortly, in Northern Ireland's Strangford Lough. The installation of SeaGen in Strangford Lough will be carried out by A2SEA A/A of Denmark, one of Europe's leading offshore installation contractors. The SeaGen 1.2MW commercial demonstrator has been developed on the basis of the results obtained from SeaFlow, the world's first full-size tidal developed on the basis of the turbine installed by Marine Current Turbines Ltd off Lynmouth Devon in 2003. It has taken the subsequent four years for Marine Current Turbines to design and build SeaGen and secure the necessary environmental and planning consents. SeaGen is a commercial demonstration project with permission to operate in Strangford Lough for a period of up to 5 years. It is intended as the prototype for commercial applications of the technology that will follow. They expect to build on the success of SeaGen to develop a commercial tidal farm, of up to 10-MW in UK waters, within the next three years, but feel they can realistically achieve 500-MW of tidal capacity by 2015. Source: ecoGizmag



MANUFACTURING

Trend Toward Thin Film and Complete Mfg. Technology - Thin-film solar cells continues the penetration of in the photovoltaic (PV) market and equipment suppliers are aggressively acquiring know-how via practical production or recruiting personnel from experienced thin-film solar cell makers and are offering turn-key services to their customers. A persistent shortage of polysilicon is spurring more PV industry players to seek alternative technologies, with thin-film based materials being one strategy. One of the keys to increasing thin-film solar cell penetration is to provide turnkey solutions to vendors besides supplying just equipment, a similar strategy used in the polysilicon-based solar cell industry. During the early stages of the thin-film solar cell industry, thin-film solar cell makers mostly developed their own technology instead of inheriting know-how from equipment suppliers. This trend was widely seen among Japanese thin-film solar cell makers. PV equipment makers are now preparing to supply customers with turnkey services, which include constructing own production lines and passing know-how to

customers via practical production. Switzerland-based Oerlikon is a well-known equipment supplier that adopts this method, having two actual production lines for know-how instruction, industry players pointed out. Besides enhancing their own technology, some equipment makers are also aggressively recruiting personnel from thin-film solar cell makers, aiming to acquire the knowledge in the shortest time. Among the present major thin-film solar cell technologies, thin-film solar cells based on amorphous silicon (a-Si) are now being volume produced and have a market share about 5%. Equipment suppliers, including Applied Materials, Energy Photovoltaics (EPV), Ulvac, Sharp, Ersol and Oerlikon, all offer turn-key services. Source: DigiTimes.

Applied to Equip Taiwan's' New Thin Plant - Solar Green Energy Technology (GET), Taiwan's largest producer of solar wafers, plans to make thin-film solar modules using large, 5.7m² glass panels. GET has awarded Applied Materials the contract to deliver a thin film solar module production line to its planned solar fab in Taoyuan, Taiwan. Applied will deliver a fully integrated line of equipment for a solar panel manufacturing facility with a nominal rated capacity of 40 MW per year. The systems are scheduled to be shipped and installed during the first half of 2008 with production expected later that year.

Solar India Manufacturing - Signet Solar plans to establish significant thin-film solar module manufacturing capabilities in India. Signet Solar is a global company founded to design, develop and manufacture large area, low cost, thin-film silicon solar photovoltaic (PV) modules. Signet Solar's first production line in India will have a capacity of 60 megawatts, expanding to 1 GW in annual production over the next decade. The production facility will tap into India's manufacturing and engineering talent to establish high tech, high volume thin film solar module production. Worldwide solar PV installations have grown at an annual rate of nearly 40% over the last 5-years and demands will certainly increase. The Indian Ministry of Renewable Energy has set a target to produce 10% renewable energy sources by 2012. Electric power demands will continue to increase as India's economic growth accelerates. India is ideal for manufacturing the lowest cost solar modules. Applications for these thin film solar modules include solar farms, large commercial installations, building-integrated photovoltaics, remote habitation, and irrigation. Thin film modules will play a key role in peak power production and stand-alone applications by avoiding massive investments in power infrastructure. Signet Solar was established in 2006 to provide Clean Affordable Renewable Energy worldwide and has HQs in Palo Alto, CA. (www.signetsolar.com). Source: SI

LIGHTING

LED Solar Street Lamps are Coming - Unity Opto Technology is extending its product portfolio to solar street lamps using its LEDs, with orders expected for Q3-07. Unity Opto is one of the few LED makers who exhibited LED-based solar-powered street lamps at the recent LED Lighting Taiwan trade show. The products shown were engineering samples in terms of its height and brightness in comparison to a conventional

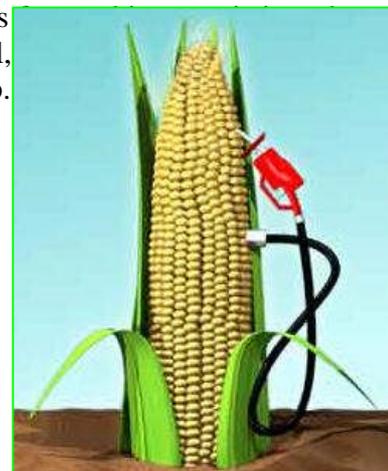
street lamp (see photo). The lighting part is comprised of two key components, a white-LED light source and a solar panel. For the LED part, Unity Opto utilizes 12 high-power white LEDs, generating a luminance of 1,800lm at 36W. The solar panel is the prime source of power for the entire street lamp. Lifetimes for the LED and solar panel are 50,000 hours and 15 years respectively. Customization for all components involved in the street lamp is possible, including sizes of the solar panels and lighting part. If customers require higher wattages, several individual lighting parts could be combined along with more solar panels, the company noted. Conventional street lamps use around 100W. A 36W version can store enough electricity to enable the lamp to light 10-hours per day, but up to 5-days without any sunshine. The LED maker is positive about its deployment, especially in the US market. Canada has already started replacing conventional street lamps with LED ones and the US should follow suit, but a major market will take about 5-years to develop. Source: DigiTimes.



BIO-FUELS

International Ethanol Forum? - Ethanol appears to be a viable alternative fuel, but the industry needs to get organized first. Ethanol has long been used as a motor fuel. The Ford Model T was designed to run on ethanol, petrol, or mixtures, at a time when gasoline was not widely available. Indy cars and top fuel dragsters have found that ethanol can provide a winner's edge. Most vehicles can run on mixtures (gasohol) and many can handle straight alcohol. It's a matter of making sure that none of the fuel system is susceptible to alcohol damage and getting the fuel/air ratio right (see table). But there's considerable confusion and some poor practices in play (technically poor - politically expedient). Corn, the favorite raw material in the USA, is probably the worst raw material. But don't say that in Iowa. We need to consume 1 gallon of fuel (and other energy) to get back the one gallon plus of ethanol; Ethanol has a lower energy/gallon content as shown in the table, so you need about 1.4-gallons of ethanol to match the energy of a gallon of hydrocarbon fuel. When everything is break even, perhaps 1:1.4. Fortunately, other biomaterial, result, up to 14:1. And the politics of agriculture don't help.

The international market/industry for ethanol fuel is embryonic, and searching for identity. Brazil could become the international leader since that country has several decades of experience and appears to have proven the viability of an ethanol automotive economy. Ethanol may also be an opportunity for poorer nations, but industrialized counties must not block trade. Brazil is now working with India, the United States, the European Union and South Africa to create an International Ethanol



Forum to help to create a world ethanol market. One idea is to list ethanol on international exchanges as a commodity. But there are many unknowns, and an ethanol economy might not even work. While petroleum prices can fluctuate for a number of known reasons, ethanol will have its own set of factors including weather during the growing seasons.

Non-alcoholic Fructose Biofuel - Chemists in the U.S. say they have broken new ground in biofuels, transforming plant sugar into a liquid fuel that packs 40% more energy than ethanol and appears to have fewer of its drawbacks. Ethanol is currently the only car fuel made in large quantities from biomass. Biomass sources such as corn, sugarcane and other plants are rich in potential energy, in the form of large chains of carbohydrates. In their plant form, these long sugary molecules comprise 6-carbon atoms and 6-oxygen atoms. But car engines like a leaner form of carbohydrate molecule, one with between five and 15 carbon atoms and with very little oxygen. Most ethanol facilities harness biology, using enzymes to break down starch and cellulose to glucose, which is then fermented by common yeast, *Saccharomyces cerevisiae*, to produce ethanol and carbon dioxide. But the process takes days and the fuel still has relatively high oxygen content (the carbon in a C-O group is not available for burning). Also, alcohols evaporate to easily and absorb atmospheric humidity. Distillation is needed to separate the fuel from water, and this process is energy-intensive. Biofuel engineers at the University of Wisconsin at Madison believe they have found the answer in a process that results in 2,5-dimethylfuran, or DMF, which volume for volume delivers 40% more energy than ethanol. In addition, it is not soluble in water and is stable in storage. Under the process, enzymes rearrange the plant carbohydrates into a highly oxygenated sugar, fructose. The next step is to turn the fructose into an intermediate chemical, hydroxymethylfurfural, or HMF, by using an acid catalyst and a solvent with a low boiling point. This expels three oxygen atoms. Under the final phase, the HMF is converted to DMF by exposing it to a copper-ruthenium catalyst that kicks out two more oxygen atoms and converts the gas to a liquid at a lower temperature, thus making it easier to use as a general fuel for transport. More research is needed before the technology can be commercialized, but this work shows that we can produce a liquid transportation fuel from biomass that has energy density comparable to petrol. Source: Agence France-Presse.



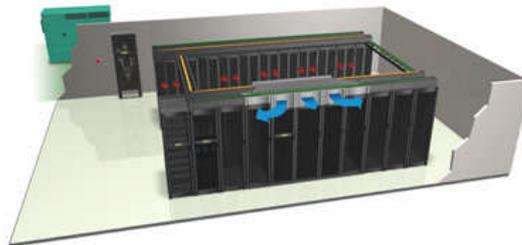
Gasohol for Jets - The United States Air Force will push development of a new type of fuel to power its bombers and fighters by mixing conventional jet fuel with fuels from non-petroleum sources to help limit military dependence on imported oil (New York Times). The plan will challenge the industry to produce a jet fuel composed of no more than 50% petroleum. The target is to have the entire fleet flying with a 50-50 mix by 2010. The Air Force burned 3.2-billion gallons of aviation fuel in the 2005 fiscal year, or 52.5 percent of all fossil fuel used by the government.



Corn for People and Cattle, Not Cars - China will not use basic food crops, especially corn, to make biofuels. Most see this as a sound decision. The US is seeing the apparent ramifications of using corn for fuel (a very inefficient source) with sky-high milk prices for a start. Non-staple crops, like sorghum, batata and cassava, will become the new sources for ethanol as China has decided to stop ethanol production from corn. Don't expect the US to follow suit, but do expect tariffs on imported ethanol to continue.

FUEL CELLS

Fuel Cell Backup for IT - APC demonstrated a fuel-cell unit that fits into a standard data center rack aimed at displacing traditional diesel generators whose job is to supply backup power. The fuel cell is targeted at installations where environmental concerns outweigh cost. It could also be a pointer for greener data centers. Slotted into a black box that fits visually into APC's InfraStruXure product line, its data center cooling and management system, the fuel cell that was demonstrated puts out 30 Kwh. A pair of racks stuffed with blade servers could approach this level of power consumption. The system consists of three modules in the lower portion of the rack, with cooling units above for the inverters that convert the cells' native 192V DC to 240V AC. Attached to the fuel cell is a 15mm pipe from a pressurized hydrogen tank that sits outside the facility. When running, the system emits a moderately loud hum but is quieter than a generator by several orders of magnitude. In the event of a main power failure, the fuel cell takes about 30 or 40 seconds to kick in, about the same as a standard generator. It then keeps the data center's uninterruptible power supply batteries supplied until either main power is restored or the hydrogen runs out. The main drawback right now is the cost of being an early adopter; cost is around \$70,000, an amount that would pay for a traditional generator with 10 times the output.



COAL

King Coal is Back - *[Coal fueled the industrial revolution and was called "King Coal" as the main energy source. But easier to extract and use, petroleum took the crown. But coal is making a comeback as petrol prices rise. But since coal is nearly pure carbon, it's the king of CO2 generation so that every 12 tons (C12) gives back 44 tons of CO2 (C12 + 2O16 = 44). Everyone seems to be digging more coal lately and use keeps going up.]* Vietnam will export 16.1-million tons of coal valued at about 1/2-billion dollars, just in the first half of this year; an 18.7% boost. The country plans to export about 20-million tons of coal in 2007. Major customers are China, Japan, South Korea and Europe. Last year, Vietnam exported roughly 29.8-million tons of coal to over 20 markets, including China, Japan, South Korea, Thailand, Malaysia, India, Brazil and the European Union. Source: Xinhua.