



# COMINO FOUNDATION

## Newsletter - Developments in technology to address environment issues Issue 08/2 - May 2008

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The Comino Foundation is concerned to help address current issues regarding the environment. To address these issues the Foundation encourages people to modify their lifestyle but it is the Foundation's view that advances in technology will eventually provide the solutions. This newsletter seeks to highlight advances in environment technologies in the last 2 months that will have a part to play.

### **Moving towards central electricity generation with near zero green house gas emissions**

Worldwide electricity generation generates 40% of green house gas emissions with worldwide demand for electricity increasing at 3½ per annum. The technology already exists to near eliminate these emissions by 2050 although it is likely that emissions from central electricity generation will increase before 2020 before progressively falling thereafter. This section of the newsletter highlights current developments in moving towards electricity generation with near zero green house gas emissions.

#### **A zero emissions city is the desert**

**(<http://www.technologyreview.com/Energy/20740>)**

Construction has started on a city that will house 50,000 people and 1,500 businesses in Abu Dhabi. It will use extremely little energy, and what it does use will come from renewable sources.

The city, which is expected to cost \$22 billion, will implement an array of technologies, including thin-film solar panels that serve as the facades and roofing materials for buildings, ubiquitous sensors for monitoring energy use, and driverless vehicles powered by batteries that make cars unnecessary. The developers hope that it will serve as a test bed for a myriad of new technologies being proposed to reduce greenhouse-gas emissions.

Water use will be kept to a minimum and reduce the energy needed for desalination. And sensors throughout the city will also keep residents informed of their energy use. The city's designers predict that efficiency improvements will result in a 75 percent reduction in energy consumption compared with a conventional city of the same size. The energy that is used will come almost entirely from solar with wind and power from technology that converts garbage into fuel contributing smaller amounts.

#### **Floating platforms to take wind turbines away from coasts**

**(<http://www.technologyreview.com/Energy/20500/>)**

Offshore wind-farm developers would love to build in deep water more than 32 kilometres from shore, where stronger and steadier winds prevail and complaints about marred scenery are less likely. But building foundations to support wind turbines in water deeper than 20 meters is prohibitively expensive. Now, technology developers are stepping up work in floating turbines to make such farms feasible.

Several companies are well on their way to demonstrating systems by borrowing heavily from oil and gas offshore platform technology. If these efforts succeed, they could open up a resource of immense scale. An analysis led by the US Department of Energy indicated that the offshore wind resources on the Atlantic and Pacific coasts exceed the current electricity generation of the entire U.S. power industry.

### **US to provide developing nations with small nuclear power**

<http://technology.newscientist.com/article/dn13459-disposable-nuclear-reactors-raise-security-fears.html>

The Bush Administration has allocated \$20m in the US Department of Energy's 2009 budget to design nuclear power plants in the 250 – 500MW range as part of the Global Nuclear Energy Program (GNEP) to help spread nuclear power, which is free of greenhouse gas emissions, to developing nations, safely. GNEP now includes 21 countries and hopes to begin construction of the first such power plant by 2015.

These plants will be deployed in a safe and secure way which offers the lowest possible risk of proliferation. Countries that build reactors will have to agree to use nuclear power for civilian uses only and forego nuclear enrichment. Fourth generation plants might be built with a sealed load of fuel that lasts the lifetime of the reactor – a bit like a disposable gadget with a non-replaceable battery.

### **Liberating hydroelectric power from dependence on dams**

[http://www.economist.com/science/tq/displaystory.cfm?story\\_id=10789262](http://www.economist.com/science/tq/displaystory.cfm?story_id=10789262)

Hydroelectric dams provide the infrastructure to generate power that is renewable and free from greenhouse gases but there are many disadvantages. Blocking a river blocks the movement of fish to spawn upstream and blocks the formation of silt downstream to fertilize fields. People are often displaced initially and the vegetation covered by the rising water decays to form methane which is also generated by subsequent algae. This is a greenhouse gas that is 21 times more powerful than CO<sub>2</sub>.

Scientists have been seeking to develop free-standing turbines that can be placed underwater to generate electricity for several decades but these proved relatively inefficient and difficult to reach for maintenance, given a high level of wear and tear. New designs use the power of computers to align turbines with the water flow so that that 35% of the energy is extracted from a stream and enable the electric generator to be located above the surface.

The Gorlov Helical Turbines have now been commercialised by Lucid Energy Technologies. Two other designs have been developed and are now being deployed. Investment in free-standing turbines has increased from \$13m in 2004 to \$156 in 2007 with a wide variety projects. Proponents of the technology believe this is the beginning of a new industry where investors will search for treasure on the sea, or river, bed – or to be precise, in the water flowing just above it.

### **Japan planning to extract unexploited type of natural gas**

<http://www.timesonline.co.uk/tol/news/environment/article3740036.ece>

Over six days Japan has managed to extract industrial quantities of natural gas from underground sources of methane hydrate - a form of gas-rich ice once thought to exist only on the moons of Saturn.

The seabeds around the Japanese coast have been found to conceal massive deposits of this elusive sorbet-like compound in their depths, and a country that has long assumed it had virtually no fossil fuels could now be sitting on energy reserves containing 100 years' fuel. Japan imports 99.7 per cent of the oil, gas and coal needed to run its vast economy and the energy-filled ice offers the prospect of some energy independence.

Environmentalists, though, are concerned by the idea of releasing huge quantities of methane from under the seabeds. Although methane is a cleaner-burning fossil fuel than coal or oil some believe that this source of greenhouse gases should remain locked under the sea. The mining of methane ice could also damage marine ecosystems.

The potential of methane hydrates as a source of natural gas has been known scientifically for some time, though how much was located off the Japanese coast has been confirmed only in the past couple of years. Methane hydrates are believed to collect along geological fault lines, and Japan sits atop a nexus of three of the world's largest.

#### **Australia outback town plans world first in solar power**

**(<http://www.forumforthefuture.org.uk/greenfutures/articles/SunDownUnder>)**

The Queensland town of Cloncurry is aiming to transform itself into the world's first fully solar-powered community. The centerpiece of the plan will be a 10MW solar thermal power tower, generating around 30 million kilowatt-hours of electricity each year.

A total of 8,000 mirrors will track the sun, reflecting its rays on to a graphite block at the top of a central tower. Water pumped through the block will be heated by it and turned to steam, which will drive a turbine to generate the electricity. One big advantage of this graphite block technology, developed by an Australian company, is that the block can store enough solar heat to go on producing steam through the night.

#### **Developing solar power at the local level**

There is 10,000 times more sunlight than we need to meet 100 percent of our energy needs. The technology to collect and deploy solar energy it is about to advance exponentially in a similar way to the development of silicon chips for computers. It is possible that 50% of domestic and commercial buildings, worldwide, could be generating their own energy from solar panels by 2050.

There is already an exponential progression in the use of solar energy. Installations are doubling every two years. This section of the newsletter highlights current developments in solar panel manufacture and deployment which is an important aspect of moving towards electricity generation with zero green house gas emissions.

#### **Portable light for isolated communities**

**([http://www.economist.com/science/tq/displaystory.cfm?story\\_id=10789282](http://www.economist.com/science/tq/displaystory.cfm?story_id=10789282))**

For those who live in remote areas obtaining electricity can be a problem. A partnership in the US has developed a cheap, practical and portable way to capture the sun's rays and release them by night as useful light, wherever it is needed.

'Portable light', as the invention is called, combines solar cells with light emitting diodes attached to the surface of a fabric that can be made into bags and carried around during daylight hours. In sunlight the cells generate electricity that is stored in batteries stitched into the material. When dark the batteries power light emitting diodes that are also sewn into the cloth.

The first beneficiaries of this technology are the Huichol, a group of Amerindian people who live in the Sierra Madre mountains of Mexico, but if all goes well the inventors hope to sell its invention to rural communities in Africa and Australia. At \$50 per bag, which is less than the average Huichol spends on candles and torch batteries each year – it seems a bargain.

## **Technology to cool computer chips could benefit solar cells**

(<http://www.technologyreview.com/Energy/20782/?a=f>)

By using a technique used to cool high-performance computer chips, IBM researchers have found a way to make concentrated photovoltaic cells that are more efficient in converting the sun's energy into electricity. The researchers have shown that it is possible to increase the concentration of light on photovoltaic cells by about ten times without causing them to melt. This, they say, makes it possible to boost the amount of usable electrical energy produced by up to five times.

The principle behind concentrated photovoltaic cells is to use a large lens to focus light onto a relatively small piece of photovoltaic semiconductor material. The benefit is that only a fraction of the semiconductor material is used, thereby reducing costs. There are a number of companies marketing such technologies, but one of the main challenges is in coping with the vast amounts of heat produced by the focused sunlight. To address this IBM adapted an IBM-developed material currently used for chips to improve the heat transfer between the photovoltaic cell and a water-cooled heat sink.

## **More powerful solar cells**

(<http://www.technologyreview.com/Energy/20476/>)

Following research to significantly improve the efficiency of silicon solar cells while keeping costs about the same new technology is being commercialized by a start-up in Lexington, Massachusetts. The technology claims to improve the amount of electricity generated from a given amount of light from the cheaper multicrystalline silicon solar cells by 27 percent compared with conventional silicon cells.

When manufactured at a commercial scale, the first cells incorporating his new technology will cost \$1.65 per watt. Planned improvements will bring down this cost to about \$1.30 a watt, he says. To compete with coal, the cost will need to come down to about \$1 a watt, something that is predicted to be achieved by 2012 with further improvements in antireflection coatings and other anticipated advances.

## **Even cheaper solar cells**

(<http://www.technologyreview.com/Biztech/20737/?a=f>)

A California-based solar start-up says that it will soon be able to produce electricity from the sun at costs that are competitive with fossil-fuel generation. The key is the company's dramatic improvement in the performance of concentrated photovoltaic technology.

This new company has created a concentrated photovoltaic system that uses a lens to focus sunlight up to 2,000 times onto tiny solar cells that can convert 37.5 percent of the sun's energy into electricity. Stronger concentrations of sunlight allow engineers to use much smaller solar cells, making it more economical to use higher-efficiency but higher-cost cells. The cells will use gallium arsenide and germanium substrates. The company claims that the system uses four times less photovoltaic material than other approaches, which typically aim for 500 times sun concentration.

Everything has been miniaturized leading to reduced cost production systems will enable further savings through high-volume production. The higher efficiency also means that a solar park built with this company's modules could use one-sixteenth of the space needed with conventional thin-film solar cells. It is estimated that the solar panel system will be capable of producing electricity at a wholesale cost of five cents per kilowatt-hour. Prototypes have been built and tested both in the laboratory and in the field, and the company expects to start commercial production in 12 to 15 months.

## **Reducing green house gas emissions from transport**

25% of green house gas emissions come from transport and it is important that the internal combustion engine is replaced with a form of energy that is free of emissions. This section of the newsletter highlights current developments in moving towards transport that is powered with zero, or near zero, green house gas emissions.

### **Tomorrow's Car**

**(<http://www.technologyreview.com/specialreports/specialreport.aspx?id=9>)**

Worries over the future of gasoline supplies and the effects of carbon dioxide emissions are driving innovators in the automobile industry to rethink how we get around. All the major car manufacturers are engaged in developing the next generation of cars. This special report covers the following key issues

- Developments in hybrids, plug-ins, and extended-range electric cars;
- Do hydrogen cars offer a real solution and BMW progress;
- Changing fuel efficiency standards in developed economies;

### **Shell invests in producing biofuel from algae**

**(<http://www.telegraph.co.uk/money/main.jhtml?xml=/money/2007/12/12/cnshell112.xml>)**

Energy giant Royal Dutch Shell is to invest in a new plant in Hawaii to grow marine algae that can be turned into biofuel. The companies' joint venture, Cellana, with HR Bio petroleum will build a facility off the Hawaii Island coast that will cultivate ponds of algae in seawater. The vegetable oil will then be converted into a high quality diesel-type fuel.

The pilot project with a 2.5-hectare facility will initially be expanded to a 1,000-hectare facility and then to a full-scale commercial 20,000-hectare plant. The thick green algae can produce on average about 60 tons of oil per hectare, against about 4 tons of oil per hectare from jatropha plants.

### **Renault and Nissan make a major commitment to electric vehicles**

**([http://www.economist.com/business/displaystory.cfm?story\\_id=11332425](http://www.economist.com/business/displaystory.cfm?story_id=11332425))**

Renault and Nissan have announced their intention to lead the car industry in developing profitable zero-emission vehicles. In recent months Renault-Nissan has teamed up with Project Better Place, a Silicon Valley start-up, to introduce all-electric vehicles and a network of charging points in Israel and Denmark by 2011.

Now Nissan is going further. Speaking at a media event in Portugal this week, the Chairman said that the time has come for the mass-market zero-emission car. 'We must have zero-emission vehicles. Nothing else will prevent the world from exploding!'

Nissan plans to launch a battery-powered car in America in 2010 and by 2012 the Renault-Nissan alliance will offer a complete range of electric vehicles in every large car-market. And these new battery-powered cars, it claims, will work out less expensive than equivalent petrol models. New lithium-ion battery technology will push range of these vehicles from 50 to 200 miles, and fast-charge systems promise to provide a 70% top-up in only a little more time than it takes to fill a tank with petrol. Nissan is intending to initially target fleet users. It is also developing a plug-in hybrid vehicle similar to the Chevy Volt.

### **Lithium-ion battery underpin electric car development**

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The quickest electric motorcycle in the world is a black dragster cycle. This bike accelerates to 60 miles per hour in less than a second, crossing the quarter-mile mark at 168 miles per hour seven seconds later. It is quick enough to compete with petrol-powered dragsters.

What powers the "Killacycle" is a new lithium-ion battery developed by A123 Systems, a start-up in Watertown, MA. This is one of a handful of companies working on similar technology. The company's batteries store more than twice as much energy as nickel-metal hydride batteries, the type used in today's hybrid cars, while delivering the bursts of power necessary for high performance. A123's batteries have attracted the interest of General Motors, which is testing them as a way to power the Volt, an electric car with a gasoline generator; the vehicle is expected to go into mass production as early as 2010.

### **Car hybrid technology find an application in rail transport**

**([http://www.forumforthefuture.org.uk/greenfutures/articles/on\\_the\\_rails](http://www.forumforthefuture.org.uk/greenfutures/articles/on_the_rails))**

The world's first diesel hybrid railcar has been developed by the East Japan Railway Company. The New Energy Train uses electricity stored in rechargeable batteries every time it starts and stops, with its diesel generator only kicking in when the railcar picks up speed. The system reduces harmful emissions by almost 60%.

### **First battery powered aircraft completes first flight**

**(<http://www.timesonline.co.uk/tol/news/environment/article3672029.ece>)**

The first aircraft to use only a hydrogen battery for power in the air has successfully completed a test flight. The US company Boeing said that the flight, in Ocaña, central Spain, was "a historical technological success for Boeing [and] full of promises for a greener future". The aircraft, which is capable of carrying two people and has a wingspan of 16 metres (52ft), flew at 100km/h (62mph) for 20 minutes.

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