



# COMINO FOUNDATION

## Newsletter - Developments in technology to address environment issues Issue 09/2 - April 2009

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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 recent months that will have a part to play.

### **Developments in understanding and combating climate change**

The scientific principles which underpin climate change are not understood to the levels that are necessary to predict the impact of high carbon dioxide levels on the future climate, temperature and topography of the world and the action being taken, globally to combat global warming is only just emerging. This section of the newsletter highlights current developments in scientific principles and international action to combat climate change.

### **US debates how to address climate change but initiates many new projects**

([http://www.economist.com/displaystory.cfm?story\\_id=13272099](http://www.economist.com/displaystory.cfm?story_id=13272099))

(<http://www.businessgreen.com/business-green/news/2239594/house-ups-ante-draft-climate>)

President Barack Obama was part elected on a promise to address climate change.

Following taking office he has swiftly increased government spending on environmental causes, instructed civil servants to increase the fuel-efficiency of America's cars, promised to double America's output of renewable energy and urged Congress to pass the greenest measure of them all - a cap on the country's emissions of greenhouse gases. Whilst Congress is generally in favour of a cap-and-trade system there are conflicting views on how the proceeds of auctioning emissions permits will be spent. This legislation will take some months to be pass both Houses but significant spending on a variety of issues is already taking effect. The development of a US climate change bill entered a new phase at the beginning of April with the House Energy and Commerce Committee seeking to set even more ambitious emission reduction targets than those being proposed by Barack Obama.

### **Global sea levels expected to rise by double, or more, than previous forecasts**

(<http://news.bbc.co.uk/2/hi/science/nature/7935159.stm>)

([http://www.economist.com/science/displaystory.cfm?story\\_id=13277407](http://www.economist.com/science/displaystory.cfm?story_id=13277407))

A team of researchers has suggested that the global sea level looks set to rise far higher than forecast because of changes in the polar ice-sheets. Scientists at a climate change summit in Copenhagen said earlier UN estimates were too low and that sea levels could rise by a metre or more by 2100. The UN's Intergovernmental Panel on Climate Change (IPCC), in its 2007 Fourth Assessment Report, said that the maximum rise in sea level would be in the region of 59cm but the scientists stated that these projections did not include the potential impact of polar melting and ice breaking off. They did warn, however, that the implications of higher sea levels for millions of people would be "severe" since ten per cent of the world's population - about 600 million people - live in low-lying areas.

**[Geo-engineering continues to attract serious consideration by scientists](http://www.timesonline.co.uk/tol/news/uk/science/article5908376.ece)**  
**(<http://www.timesonline.co.uk/tol/news/uk/science/article5908376.ece>)**

The threat of devastating climate change is now so great that some scientists say it is time to investigate a Plan B - geo-engineering on a planetary scale. They believe that such methods of altering the world's climate may become necessary unless emissions of greenhouse gases fall within five years.

Ideas that were once the realm of science fiction - such as creating artificial trees to absorb carbon dioxide, or reflecting sunlight away from the Earth - are coming under serious scrutiny as temperatures and CO2 emissions continue to rise. The issue has become so pressing that the Royal Society is preparing a report on the feasibility of geo-engineering options. The study aims to separate the science from the science fiction and offer recommendations on which options deserve serious consideration.

Whilst some of the options offer real possibilities for reducing global warming critics maintain that some schemes might lower temperatures swiftly and anything that alters the climate in a different way from reducing carbon has inherent dangers in that the factors that govern the climate are not yet well enough understood.

**[One geo-engineering option produces unexpected results](http://www.economist.com/science/displaystory.cfm?story_id=13361464)**  
**([http://www.economist.com/science/displaystory.cfm?story\\_id=13361464](http://www.economist.com/science/displaystory.cfm?story_id=13361464))**

Indian and German researchers gave their first report on a large experimental expedition in geo-engineering to pour iron into the Southern Ocean to stimulate a giant bloom of phytoplankton which are tiny algae that absorb carbon dioxide when they grow and then lock up some of the greenhouse gas when they die and sink to the seabed. The experiment created a bloom of phytoplankton by fertilising an area of 300 square kilometres with six tonnes of iron sulphate, which dissolves in water. In two weeks the bloom's mass doubled. But it also proved to be extremely tasty for small crustaceans called copepods, which eat the phytoplankton so quickly that even with further iron fertilisation the bloom stopped growing. As a result, only a small amount of CO2 was dispatched to the ocean floor.

**[100 of the world's richest individuals have invested in green technology](http://business.timesonline.co.uk/tol/business/specials/article5816774.ece)**  
**(<http://business.timesonline.co.uk/tol/business/specials/article5816774.ece>)**

The Sunday Times has published its first 'Green Rich List' which shows the enthusiasm of the world's wealthiest people for investing in green technology. The list of 100 individuals shows that individuals worth £265 billion are investing significant amounts in a wide range of technologies. The bulk of their investment is in renewable energy but there is also significant investment in electric cars and alternative fuels.

**[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 3% 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.

**[The world's first retrofit of a power plant with CCS starts operating](http://www.guardian.co.uk/environment/2009/apr/08/first-carbon-capture-power-plant-lacq)**  
**(<http://www.guardian.co.uk/environment/2009/apr/08/first-carbon-capture-power-plant-lacq>)**

The world's first retrofit of a power plant with carbon capture and storage (CCS) technology will begin operating in April 2009 in the south of France. At a power plant at Lacq, Total has upgraded an existing gas-fired boiler with CCS technology – a crucial step towards reducing carbon emissions from fossil-fuel power plants worldwide.

The €60m Lacq project will transport and store 60,000 tonnes of carbon dioxide every year in the nearby depleted gas field at Rouse – a large onshore natural gas field in Europe, which is now almost empty. It is the first project to link together all parts of the carbon capture chain from burning natural gas to isolating CO<sub>2</sub> from flue gases and burying it underground. Reusing an existing pipeline that had transported natural gas from Rouse to Lacq for 50 years, Total engineers plan to push the carbon dioxide from the power plant in the other direction, injecting the gas into the Rouse reservoir at a depth of around 4,500m. The Lacq project will run for two years, after which engineers will monitor the Rouse gas field to demonstrate that the carbon dioxide remains safely trapped inside.

Last year, the Schwarze Pumpe power station in north Germany became the first demonstration power plant with CCS. A new 12MW fossil fuel-fired boiler was constructed with full CCS. This plant will bury 100,000 tonnes of CO<sub>2</sub> a year 3,000m below the surface in the depleted Altmark gas field.

### **US plans a major investment in 'smart grid' electricity**

**([http://www.economist.com/world/unitedstates/displaystory.cfm?story\\_id=13337902](http://www.economist.com/world/unitedstates/displaystory.cfm?story_id=13337902))**

The US's power system has changed very little over the past century, with centralised utilities delivering electricity to consumers. A smart grid would use digital technology to collect, communicate and react to data, making the grid system more efficient and reliable. For example, sensors would help utilities locate problems and fix them quickly—power cuts now cost businesses more than \$100 billion each year in the US. A nimble grid could also integrate electricity from various sources, such as the predictable source of coal, and the unpredictable sources, such as the sun and wind. A 'smart grid' will reduce CO<sub>2</sub> emissions. To harness these benefits the US now plans \$4.5 billion in grants for smart grid investments and regional demonstrations.

### **A new carbon-capture method could scrub CO<sub>2</sub> cheaply**

**(<http://www.technologyreview.com/energy/22259/>)**

A new process for scrubbing CO<sub>2</sub> from coal power-plant exhaust gases could make carbon capture a more affordable option for the energy industry. The process, which is to be tested in Germany in August at a pilot facility near Frankfurt built by Siemens and E.ON this summer, promises to remove up to 90 percent of CO<sub>2</sub> from flue gases while using far less energy than other methods.

Existing carbon-capture methods reduce a plant's efficiency by about 11%. The new process, developed by Siemens, could reduce this efficiency loss to just 9.2%. Although this is a small improvement it could be a significant benefit. Capturing CO<sub>2</sub> will always consume a certain amount of energy and the aim is to find ways to keep losses to a minimum. In theory, 99.9 percent of the CO<sub>2</sub> emitted from a power plant could be removed using the process, but Siemens advise that 90 percent is the economic optimum in terms of infrastructure costs and the energy is required.

### **'Air capture' technology being developed to scrub carbon from the atmosphere**

**([http://www.economist.com/science/tq/displaystory.cfm?story\\_id=13174375](http://www.economist.com/science/tq/displaystory.cfm?story_id=13174375))**

Researchers at the Palo Alto Research Centre (PARC) in California are developing air capture machinery to propose to process the atmosphere and extract the CO<sub>2</sub> for industrial use or underground storage. Such machines already exist to "scrub" CO<sub>2</sub> from the air on board submarines and spacecraft where too much CO<sub>2</sub> can cause death. Air capture has the advantage that it can be used anywhere — not just in places where CO<sub>2</sub> is being emitted, such as power stations. An air-capture plant could, for example, be set up at a site where CO<sub>2</sub> can be easily stored, such as an empty oilfield. And air capture would open the way to capturing emissions produced by millions of cars and aircraft.

If air capture is to get anywhere, however, it must overcome three sets of objections - technical, financial and political. The process is no good if it produces more CO<sub>2</sub> emissions than it removes from the atmosphere. Nor is it of any practical value unless the cost of removing each tonne of CO<sub>2</sub> is lower than the alternatives. Air capture appears to be technically feasible but the economics are still unclear, and the politics murkiest of all. Will developing countries build enormous air-capture plants, powered by coal, to offset the emissions associated with industrialisation? Will the technology discourage efforts to improve energy efficiency, or might it be a valuable tool in the fight against climate change? At the moment, air capture is merely experimental and actual use could pose some tricky questions.

#### **Nuclear fusion technology moves a step closer**

**(<http://www.timesonline.co.uk/tol/news/uk/science/article5908490.ece>)**

**(<http://www.technologyreview.com/energy/22347/>)**

Scientists are about to use the world's most powerful laser system to replicate the core of the sun in experiments that may ultimately offer a clean source of energy. After more than 50 years of experimentation, physicists are hoping to develop the first form of nuclear fusion technology that produces more energy than it consumes.

Within the next fortnight, researchers at the National Ignition Facility (NIF) in California will fire 192 separate laser beams capable of generating 500 trillion watts - 1,000 times the power of the US national grid - for a fraction of a second. The energy pulse will be concentrated on a tiny pellet of hydrogen in an attempt to mimic the reactions that take place inside the sun. The scientists hope to refine the process over the next year until they trigger a nuclear reaction capable of producing large amounts of energy.

#### **General Fusion recognised for new development in fusion technology**

**(<http://www.earthtimes.org/articles/show/general-fusion-recognized-for-excellence-in-environmental-technology.767133.shtml>)**

General Fusion is working on a new, patent-pending concept based on recent fusion research called Magnetised Target Fusion (MFT). This technology is an innovative re-engineering of previous hot fusion reactor concepts built on the foundation of 50 years of fusion research and development. General Fusion's goal is to demonstrate this new, clean, safe and economical technology by 2013.

Fusion is the process that powers the sun. On earth, hydrogen isotopes, found in abundance in seawater, are heated to extremely high temperatures allowing them to contact and form helium and consequently release vast amounts of energy. The fuel and the by-product of the reaction are safe for the environment and the process emits no greenhouse gases.

General Fusion has recently been recognised with an award for Excellence in the Field of Environmental Technology Research at the Clean Equity Conference in Monaco on March 24 – 26 2009.

#### **Developing microgeneration at the local level**

There is 10,000 times more sunlight than we need to meet the world's energy requirements. 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.

This section of the newsletter highlights current technology developments in microgeneration and, in particular, solar panel manufacture and deployment which is an important aspect of moving towards electricity generation with zero green house gas emissions.

### **Researchers develop cheap, non-silicon solar cells**

**(<http://www.technologyreview.com/energy/22279/>)**

Dye-sensitised solar cells have the potential to make solar power more affordable. Whilst they are cheaper to make than conventional silicon solar cells they can easily be printed on flexible surfaces. However, creating efficient cells of this type has required dyes made of the precious metal ruthenium and volatile electrolytes. Researchers at the Chinese Academy of Sciences have replaced both of these materials in a new kind of dye-sensitised solar cell that is not only highly efficient, but also promises to be even cheaper and more durable.

### **A solar powered cardboard box cooker wins Forum of the Future competition**

**(<http://www.forumforthefuture.org/FT-climate-challenge>)**

A solar-powered cardboard cooker which aims to transform the lives of hundreds of millions of villagers in developing countries won the 2009 Forum of the Future global competition for innovation to tackle climate change. The Kyoto Box is targeted at the three billion people who use firewood to cook and has the potential to deliver huge environmental and social benefits. The \$75,000 prize will fund large scale trials in 10 countries

The competition generated worldwide interest and received nearly 300 entries from around the world with the five finalists came from four continents. In addition to the cardboard cooker they included: a feed additive which reduces the methane produced by cows and sheep; hollow tiles cooled by evaporation which can replace air conditioning systems; covers for truck wheels which reduce fuel use by reducing drag; and a giant industrial microwave which turns biomass into charcoal which can be buried or used as fertilizer.

### **Balloons offer a new form of solar cell**

**([http://www.economist.com/science/tq/displaystory.cfm?story\\_id=13174508](http://www.economist.com/science/tq/displaystory.cfm?story_id=13174508))**

Traditional solar cells are expensive and must be used efficiently. One way to do this is to concentrate sunlight onto them so that a smaller area of cell can be used to convert a given amount of light into electricity. This, though, imposes the cost of the mirrors needed to do the concentrating. Traditionally these are large pieces of polished metal, steered by electric motors to keep the sun's rays focused on the cell.

Cool Earth Solar of Livermore, California, has recently come up with potentially a better, cheaper alternative using metal-coated plastic balloons. Cool Earth's methodology was to coat only one half of a balloon, leaving the other half transparent with the inner surface of the coated half acting as a concave mirror. If a solar cell is placed at the focus of that mirror and you have an inexpensive solar-energy collector.

Cool Earth plans to open a 1-megawatt demonstration facility this summer. There is an expectation that the device will cost \$1 per watt of generating capacity to install. That is about the same as a large coal-fired power station. The fuel (sunlight) is free and Cool Earth estimates that his company will be able to sell electricity to California's grid for 11 cents a kilowatt-hour, the state's target price for renewable energy, while still turning a tidy profit.

### **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.

### **Lithium-ion batteries may be able to be charged quickly**

**([http://www.economist.com/science/displaystory.cfm?story\\_id=13277371](http://www.economist.com/science/displaystory.cfm?story_id=13277371))**

**(<http://www.sciam.com/article.cfm?id=better-battery-lithium-ion-cell-gets-supercharged>)**

<http://www.abc.net.au/news/stories/2009/03/12/2514848.htm>  
<http://news.bbc.co.uk/2/hi/science/nature/7938001.stm>

New research on lithium ion batteries has yielded power-storing material that charges and discharges at lightning speed. This development could offer a boost for plug-in hybrid and electric vehicles and possibly allow cell phone batteries to regain a full charge in seconds rather than hours.

Scientists at the Massachusetts Institute of Technology (M.I.T.) report that they have devised a way for lithium ions in a battery to zip in and out about 100 times faster than previously demonstrated. Rechargeable lithium ion batteries are small and light, yet can store large amounts of energy, making them ideal for use in everyday electronic devices such as iPods and laptops. This valuable property, called energy density, has the potential to be scaled up for hybrid cars as well as for all-electric cars, for example the Tesla that relies on lithium ion batteries (6,831 individual cells) and the similarly powered Chevy Volt plug-in electric car which is about to be marketed.

#### **Developments indicate longer life and lower cost for lithium-ion batteries**

<http://www.technologyreview.com/energy/22351/>

A new generation of lithium-ion batteries, based on solid polymers, may be possible. Seeo Inc. a start-up in Berkeley, California says that its lithium-ion cells will be safer, longer-lasting, lighter, and cheaper than current batteries. Seeo's batteries use thin films of polymer as the electrolyte and high-energy-density, lightweight electrodes. Lawrence Berkeley National Laboratory is now making and testing cells designed by the University of California, Berkeley spin-off.

#### **Progress is emerging in developing 'green engines' for aviation**

[http://www.economist.com/science/tq/displaystory.cfm?story\\_id=13174439](http://www.economist.com/science/tq/displaystory.cfm?story_id=13174439)

Jet engines have consistently evolved over the past few decades. Early jet engines had narrow inlets and were very noisy, but as the diameter of the fans at the front increased, the engines became quieter. Compared with a noisy 1960s jet engines, a modern turbofan is some 80% quieter and burns as little as half as much fuel—thus producing fewer greenhouse gases which will be necessary to meet the likely requirements of aviation emission regulation.

All who manufacture aviation engines are striving for reduced CO<sub>2</sub> emissions, greater fuel efficiency and less noise and developments indicate that progress is being made. For example, the aviation has set a target to reduce fuel consumption by 50% by 2020 which will reduce emissions by a similar amount. Not only are manufacturers working on improving the efficiency of existing engines, they are also researching completely new engine designs.

#### **Wheel motors fitted to buses save fuel**

<http://www.technologyreview.com/energy/22328/>

e-Traction, a company in the Netherlands has developed a new kind of hybrid bus that uses in-wheel electric motors to improve efficiency and a GPS system to reduce pollution in congested areas of a city. The hybrid bus has a diesel generator which charges a battery, which in turn supplies electricity for two motors, one in each rear wheel. Due to its in-wheel motors, the bus can travel twice as far as a conventional bus on a litre of diesel which translates into a reduction in fuel consumption of 50 percent. The company has been awarded contracts to retrofit seven commercial buses with its technology, with the first being completed in May 2009.

#### **Shell maintains its investment in developing bio-fuels from algae**

[http://business.timesonline.co.uk/tol/business/industry\\_sectors/natural\\_resources/article5949992.ece](http://business.timesonline.co.uk/tol/business/industry_sectors/natural_resources/article5949992.ece)

Recently a small company backed by Royal Dutch Shell provided the first batch of a locally made oil to the American government for testing as aviation fuel. It is the result of the research project in Hawaii to make bio-fuel from algae with combustion properties which are similar to fuels derived from crude oil.

The advantages of algae derived fuel over conventional biofuels are clear. Firstly it is not made from crops grown on agricultural land and cannot be blamed for driving up food prices, secondly it does not use scarce fresh water and thirdly it is also a very productive source. The fast-growing algae are native to the seas off Hawaii and are cultured in tanks fed with sea-water. The pilot plant is run in collaboration with the local firm HR Biopetroleum. If scientists can perfect the algae-to-oil process, Shell says it will fund an industrial facility of 20,000 hectares, built by Cellana, the Shell-HR Biopetroleum joint venture, on coastal land unsuitable for farming. A facility of that size could produce 16,000 barrels of oil equivalent a day. At that rate, seven such plants would be needed to generate as much oil as one reasonably productive offshore platform. The good news is that algae can double their mass several times a day using sunlight alone and the supply would never run dry.

#### **International Agencies call for a 50% cut in vehicle emissions by 2050**

**(<http://news.bbc.co.uk/2/hi/business/7924080.stm>)**

**(<http://www.thegreencarwebsite.co.uk/blog/index.php/2009/03/04/international-agencies-launch-global-fuel-economy-initiative/>)**

**(<http://www.50by50campaign.org>)**

The UN Environment Programme (UNEP), the International Energy Agency (IEA), the International Transport Forum (ITF) and the FIA Foundation have jointly stated that vehicle emissions should reduce by 50% by 2050. Achim Steiner, United Nations Under-Secretary General and executive director of UNEP predicted that the world's car fleet is expected to triple by 2050 with 80% of this in developing economies. These agencies are urging the world's car and component makers to get on board to prove that they too are part of the solution to global warming and climate change. Broadly speaking, automotive industry executives say such emission cuts are perfectly feasible, though they would come at a cost.

The 50 – 50 Global Fuel Economy Initiative report sets out a path to reduce fuel consumption per kilometer by 50 per cent by 2050 – with intermediate goals in 2020 and 2030 - in line with suggestions made by the Intergovernmental Panel on Climate Change (IPCC).

#### **Other issues in reducing green house gas emissions**

In addition to reducing greenhouse gas emissions by switching to energy sources that have no emissions there are other sources of greenhouse gases that mankind needs to address. De-forestation, melting permafrost and emissions from agriculture and livestock being the main issues which are addressed in this section.

#### **Fish oils reduce emissions from 'flatulent cows'**

**(<http://www.telegraph.co.uk/earth/earthnews/5070830/Fish-oils-reduce-greenhouse-emissions-from-flatulent-cows.html>)**

**(<http://www.sciencedaily.com/releases/2009/03/090329205457.htm>)**

**([http://www.theregister.co.uk/2009/03/30/cow\\_fart\\_armageddon\\_thwarted\\_by\\_fish\\_oil/](http://www.theregister.co.uk/2009/03/30/cow_fart_armageddon_thwarted_by_fish_oil/))**

More than a third of all methane emissions, around 900 billion tonnes every year, are produced by methanogen bacteria that live in the digestive systems of ruminants such as cattle, sheep and goats. By volume, methane is 20 times more powerful at trapping solar energy than carbon dioxide making it a potent greenhouse gas. Researchers from University College Dublin reported that by including 2% fish oil in the diet of cattle, they achieved a 20% reduction in the amount of methane released by the animals.

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