Geoengineering

GEOENGINEERING
Invitation to increase emission.

The Beginning
Or
THE END ?

Geoengineering

-Reforestation, greening of deserts, creation of algae lakes to convert CO2 to oxygen.

-Sequestration oif CO2 in deep ocean trenches as dry ice slury.

-Space based mirror arrays.

-Dust and soot dust delivered into atmosphere with high altitude balloons and large guns.

-Aluminum powder and barium oxide is sprayed into troposphere by commercial and private aircraft to increase planetary albedo and cloud cover.

- Ships burn sulphur to increase cloud cover, and add iron oxide to oceans to stimulate mass plankton growth.

Geoengineering

Climate geo-engineering is the large-scale engineering of the environment to combat the effects of climate change – in particular to counteract the effects of increased CO2 in the atmosphere. Geoeither by reducing the absorption of incoming solar (shortwave)
radiation, or by removing CO2 from the atmosphere
and transferring it to long-lived reservoirs, thus increasing
outgoing longwave radiation.

According to Prof Lenton some geoengineering options could usefully complement mitigation, and together they could cool the climate, but geoengineering alone cannot solve the climate problem.

Geoengineering

Some geoengineering techniques are based on carbon sequestration. These techniques seek to reduce greenhouse gases in the atmosphere directly. These include direct methods (e.g. carbon dioxide air capture) and indirect methods (e.g. ocean iron fertilization). These techniques can be regarded as mitigation of global warming. Alternatively, solar radiation management techniques (e.g. stratospheric sulfur aerosols) do not reduce greenhouse gas concentrations, and can only address the warming effects of carbon dioxide and other gases; they cannot address problems such as ocean acidification, which are expected as a result of rising carbon dioxide levels. Examples of proposed geoengineering techniques include the production of stratospheric sulfur aerosols, which was suggested by Paul Crutzen, [1] and cloud reflectivity enhancement. Most techniques have at least some side effects.

To date, no large-scale geoengineering projects have been undertaken.

Some commentators have suggested that consideration of geoengineering presents a moral hazard because it threatens to reduce the political and popular pressure for emissions reduction. Typically, the scientists and engineers proposing geoengineering strategies do not suggest that they are an alternative to emissions control, but rather an accompanying strategy.

[1] Crutzen, P. J. (2006). "Albedo Enhancement by Stratospheric Sulfur Injections: A Contribution to Resolve a Policy Dilemma?". Climatic Change 77: 211–220. doi:10.1007/s10584-006-9101

Geoengineering

Geoengineering

* According to Prof Tim Lenton of UEA's School of Environmental Sciences enhancing carbon sinks could bring CO2 back to its pre-industrial level, but not before 2100 – and only when combined with strong mitigation of CO2 emissions

* Stratospheric aerosol injections and sunshades in space have by far the greatest potential to cool the climate by 2050 - but also carry the greatest risk

* Surprisingly, existing activities that add phosphorous to the ocean may have greater long-term carbon sequestration potential than deliberately adding iron or nitrogen

* On land, sequestering carbon in new forests and as 'bio-char' (charcoal added back to the soil) have greater short-term cooling potential than ocean fertilisation

* Increasing the reflectivity of urban areas could reduce urban heat islands but will have minimal global effect

* Other globally ineffective schemes include ocean pipes and stimulating biologically-driven increases in cloud reflectivity

* The beneficial effects of some geo-engineering schemes have been exaggerated in the past and significant errors made in previous calculations.

[1] Geoengineering could complement mitigation to cool the climate. 28.01.2009
http://www.innovations-report.de/html/berichte/geowissenschaften/geoengineering_complement_mitigation_cool_climate_126189.html
Tim Lenton and Nem Vaughan. The radiative forcing potential of different climate geo-engineering options. Atmospheric Chemistry and Physics Discussions, January 28, 2009.
http://www.atmos-chem-phys-discuss.net/9/2559/2009/acpd-9-2559-2009.pdf
http://www.atmos-chem-phys.net/9/5539/2009/acp-9-5539-2009.pdf

Geoengineering

Injections into the stratosphere of sulphate or other manufactured particles have the greatest potential to cool the climate back to pre-industrial temperatures by 2050.

However, they also carry the most risk because they would have to be continually replenished and if deployment was suddenly stopped, extremely rapid warming could ensue.

Using biomass waste and new forestry plantations for energy, and combusting them in a way that captures carbon as charcoal, which is added back to the soil as ‘bio-char’, could have win-win benefits for soil fertility as well as the climate.

A new combined heat and power plant at UEA is pioneering this type of technology.

Desert Energy Project

Geoengineering

Shortwave geoengineering proposals [1]
Shortwave geoengineering proposals start with reflecting away a fraction of incoming solar radiation by placing objects in a solar orbit..

Alternatively, sunshades could be placed in an Earth orbit. Once solar radiation enters the atmosphere, its reflection back to space could be enhanced by adding sulphate aerosol, soot or manufactured particles to the stratosphere.

Adding sulphate aerosols to the troposphere has been ruled out due to negative impacts on human health, the greater loading required than the equivalent intervention in the stratosphere, and the need for multiple injection locations. However, increasing the reflectivity of low level marine stratiform clouds by mechanical or biological generation of cloud condensation nuclei is being considered.

Finally, the reflectivity of the Earth's surface could be increased, with recent proposals focused on the land surface, including albedo modification of deserts, grasslands, croplands, human settlements, and urban areas.

[1] T. M. Lenton and N. E. Vaughan: The radiative forcing potential of different climate geoengineering options. Atmos. Chem. Phys., 9, 5539–5561, 2009
http://www.atmos-chem-phys.net/9/5539/2009/acp-9-5539-2009.pdf

Geoengineering

US coal-firing power plants have to reduce two million tons of SO2 and Nox/year, says EPA

The total combined sulfur dioxide and nitrogen oxides emission reductions secured from settlements will be about 2 million tons each year once all the required pollution controls have been installed and implemented. Coal-fired power plants are big contributors to air pollution.

Here are some examples:

Westar agrees to install a selective catalytic reduction (SCR) system on one of the three Jeffrey Energy Center coal units by the end of 2014 to reduce harmful emission of nitrogen oxide into the air. To reduce SO2 a cflue gas desulfurization (FGD) for the control of SO_2has to be installed to meet the most aggressive SO2 rates

Depending on the results Westar will decide if they want to update another Jeffrey coal unit by the end of 2016, if needed to meet nitrogen oxide reduction targets. Already scheduled projects to install new low-nitrogen oxide burners and electrostatic precipitators will go forward as planned. Electrostatic precipitators remove emissions of fine particles, mostly of ash, created from burning coal.

EPA News [2]

EPA says that investment of Weststar could be $ 500 millions to reduce 75,000 tons of harmful air pollution from a power plant if the projects will ever become reality.

[1] Westar Energy to invest in environmental upgrades, proposed as settlement of litigation. Westar Energy. Jan. 25, 2010.
http://www.westarenergy.com/corp_com/contentmgt.nsf/resources/2010-1-25/$File/2010-1-25.pdf?openelement

[2] Westar Energy, Inc. Settlement Information Sheet
http://www.epa.gov/compliance/resources/cases/civil/caa/westarenergy-infosht.html

Geoengineering

The United States has reached similar settlements with the following utilities [3]:

- Duke Energy reduction of 35,000 Tons SO2/y equaling 86% reduction to 2008 emission.
- Kentucky Utilities Company reduction of 31,000 Tons SO2 and NOx/y compared to 2007.
- Salt River Project Agricultural Improvement and Power District , reduction of 21,000 Ton/y.
- American Electric Power with 16 plants with a total of 230,000 Tons NOX/y and 828,000 Tons of SO2 = Total 1,058,000 SO2 and NOx Tons emission in 2006. EPA hopes that this emission will drop by 813,000 Ton/y should measures be implemented.
- East Kentucky Power Cooperative emits 85,000 Tons/y NOx and SO2 EPA wants the company to reduce it by 8 ,000 Tons/y of NOx and 54,000 Tons of SO2.
- Nevada Power Company is expected to reduce 2.300 Tons/y of NO2.
- Alabama Power will have to reduce approximately 28,000 tons per year of emissions of harmful sulfur dioxide (SO2) and nitrogen oxides (NOX).
- Minnkota Power Cooperative and Square Butte Power Cooperative has to reduce emission of SO2 by about 23,600 tons per year and NOx by more than 9,400 tons annually.
- First Energy (Ohio Edison Company, W.H. Sammis Power Station) must substantially reduce emissions of SO2 and NOx from current levels and also reduce CO2 emissions from current levels by more than 1.3 million tons a year.
- Illinois Power Company and Dynegy Midwest Generation has to reduce approximately 54,000 tons of SO2 and NOX emissions annually, compared to 2003 emissions, and 341, 000 tons annually compared to 1999 emissions.

Geoengineering

- Southern Carolina Public Service Authority (Santee Cooper). Approximately 70,000 tons of SO2 and NOX emissions have to be reduced annually from ten units at four coal-fired electricity generating plants in South Carolina.
- Southern Indiana Gas and Electric Company Culley Station. Approximately 10,600 tons of SO2 and NOX emissions annually will be reduced from three coal-fired electricity generating plants.
- Wisconsin Electric Power Company. The company must reduce 105,000 tons of SO2 and NOX emissions annually at five coal-fired electricity generating plants in Wisconsin and Michigan.
- Virginia Electric Power Company emitted over 350,000 tons of SO2 and NOx in 2000, which have to be reduced by 67%, to 116,000 tons by 2013.
- Alcoa, Inc. (Rockdale, Texas facility) has to reduce emission of 68,000 Ton SO2and Nox/Year.
- PSEG Fossil, and Tampa Electric Company, under the 2002 consent decree, was required to install pollution control equipment at the Mercer and Hudson plants to reduce sulfur dioxide (SO2), nitrogen oxide (NOx) and particulate matter (PM), and take steps to reduce mercury and carbon dioxide emissions.

The total combined sulfur dioxide and nitrogen oxides emission reductions secured from these settlements will be about 2 million tons each year once all the required pollution controls have been installed and implemented. Coal-fired power plants are big contributors to air pollution.

[3] Coal-Fired Power Plant Enforcement Initiative. EPA.
http://www.epa.gov/compliance/resources/cases/civil/caa/coal/index.html

Geoengineering

The newest generation of solar thermal power plants will store hot water or molten salt to provide several hours or even days of electricity. Batteries or pressurized air in underground formations are also considered viable, if niche, technologies for power grid storage.

But wide-scale distributed power generation in people's homes, combined with hydrogen fuel cells, is mostly just a vision at this point.
During the day, photovoltaic panels power the home.
At the same time excess energy is used to split water into hydrogen and oxygen for storage.

Geoengineering

Cobalt phosphate catalyst to split water in H2 and O2

Commercial electrolyzers are expensive, the challenge is devising a system that efficient enough to make energy inexpensively, says Massachusetts Institute of Technology Professor Daniel Nocera. Nocera uses a catalyst made of a cobalt phosphate that can operate in plain water at atmospheric pressure, giving it more potential than existing methods [1]

[1] MIT researchers split water to store solar energy
http://news.cnet.com/8301-11128_3-10002704-54.html

Geoengineering

Some participants of the atmosphere have a cooling effect. Aerosols such as soot, volcanic ash and dust give rise to cooling effects. Clouds can have a cooling effect as well, reflecting radiation back into space. An important cooling aerosol is sulphate which comes and sulphur dioxide coming from Sulphur of fossil fuels such as coal. These sulphate aerosols reflect sunlight and hence produce a cooling or “dimming” effect. In the rich world, substantial controls exist over sulphur emissions because of damage caused by local air pollution and transboundary acid rain. As a result, sulphur emissions are declining. But in the poorer world, there are still considerable pressures to burn fuels such as coal and lignite, and sulphur emissions are rising. The scenarios of future warming therefore depend in part on what happens to this balance of sulphur emissions.

Geoengineering

The LOHAFEX Experiment (7. January – 17.March 2009)
The German “Polar Star” ship with an international team of scientists on board, distributed 6 tons on iron over 300 square kilometres of the South Polar Sea and observed growth of phytoplancton.

The Southern Ocean encircling Antarctica is rich in the nutrients nitrate, phosphate and silicon but phytoplankton growth is limited by the supply of iron which is a crucial ingredient of all organisms. Iron is highly insoluble in sea water, so, unlike the other nutrients, is quickly lost in sinking particles. Addition of trace amounts of iron to these waters, whether from natural sources (contact with land masses and via settling dust blown of the continents) or by artificial iron fertilization (from a ship releasing dissolved iron sulfate to the surface layer), results in rapid algal growth leading to development of phytoplankton blooms.

http://www.lohafex.com/background.php

Geoengineering

Internationally, marine fertilisation is extremely controversial as there are doubts to the effectiveness of the method. The Intergovernmental Panel on Climate Change (IPCC) and the German Advisory Council on Global Change (WBGU) - the joint scientific advisory body of the Federal Research and Federal Environment Ministry - have repeatedly highlighted in their reports that the risks of marine fertilisation regarding the indirect impacts on marine ecosystems are very hard to assess. They therefore reject this process.

The Indian media in part considers the project to be the launch of a lucrative market worth billions.

The outcomes of the experiment showed only a smal increase of CO2 which was caried to the bottom of the sea. Smal grill crabs increased their number in such enormous quantity that the increase if phytoplankton was harvested by them, says the Alfred-Wegener-Institut for Sea Researche, which was leading the researche.

Federal Environment Ministry regrets approval by Federal Research Ministry of iron enrichment experiment. 26.01.2009.
http://www.bmu.bund.de/english/press_releases/archive/16th_legislative_period/pm/42985.php

Geoengineering

1 - Sulfate aerosols in the Stratosphere

The 1991 eruption of Mount Pinatubo on the Philippine island of Luzon, which injected 20 megatons of sulfur dioxide gas into the stratosphere, produced a sulfate aerosol cloud
that is said to have caused global cooling for a couple of years without adverse
effects. However, researchers at the National Center for Atmospheric Research showed in 2007 that the Pinatubo eruption caused large hydrological responses, including reduced precipitation, soil moisture, and river flow in many regions.

The eight-monthlong eruption of the Laki fissure in Iceland in 1783–1784 contributed to famine in Africa, India, and Japan.

John Latham first raised this idea in two articles that appeared in Nature, vol. 347, no. 6291: “Control of Global Warming,” pp. 330–40, and “Effect on Global Warming of Wind-Dependent Aerosol Generation at the Ocean Surface,” pp. 372–73 (1990). Keith Bower offers a numerical evaluation in “Computational Assessment of a Proposed Technique for Global Warming Mitigation Via Albedo-Enhancement of Marine Stratocumulous Clouds,” Atmospheric Research, vol. 82,
pp. 328–36 (2006).

[1] Robock, Alan: 20 reasons why geoengineering may be a bad idea. B u l l e t i n o f t h e Ato m i c S c i e n t i s t s MAY / J U N E 2 0 0 8 Vol. 64, No. 2, p. 14-18, 59. DOI: 10.2968/064002006
http://www.thebulletin.org/files/064002006_0.pdf

Geoengineering

2 - Continued ocean acidification

If humans adopted geoengineering as a solution to global warming, with no restriction on continued carbon emissions, the ocean would continue to become more acidic, because about half of all excess carbon dioxide in the atmosphere is removed by ocean uptake. The ocean is already 30 percent more acidic than it was before the Industrial Revolution, and continued acidification threatens the entire oceanic biological chain, from coral reefs right up to humans.

3 - Ozone depletion

Aerosol particles in the stratosphere serve as surfaces for chemical reactions that destroy ozone in the same way that water and nitric acid aerosols in polar stratospheric clouds produce the seasonal Antarctic ozone hole. For the next four decades or so, when the concentration of anthropogenic ozone-depleting substances will still be large enough in the stratosphere 3. Ozone depletion. Aerosol particles in the stratosphere serve as surfaces for chemical reactions that destroy ozone in the same way that water and nitric acid aerosols in polar stratospheric clouds produce the seasonal Antarctic ozone hole. For the next four decades or so, when the concentration of anthropogenic ozone-depleting substances will still be large enough in the stratosphere to produce this effect, additional aerosols from geoengineering would destroy even more ozone and increase damaging ultraviolet flux to Earth's surface.

Geoengineering

4 - Effects on plants

Sunlight scatters as it passes through stratospheric aerosols, reducing direct solar radiation and increasing diffuse radiation, with important biological consequences.

Some studies, including one that measured this effect in trees following the Mount Pinatubo eruption, suggest that diffuse radiation allows plant canopies to photosynthesize more efficiently, thus increasing their capacity as a carbon sink. At the same time, inserting aerosols or reflective disks into the atmosphere would reduce the total sunlight to reach Earth's surface. Scientists need to assess the impacts on crops and natural vegetation of reductions in total, diffuse, and direct solar radiation.

5 - More acid deposition

If sulphate is injected regularly into the stratosphere, no matter where on Earth, acid deposition will increase as the material passes through the troposphere - the atmospheric layer closest to Earth's surface.

In 1977, Russian climatologist Mikhail Budyko calculated that the additional acidity caused by sulphate injections would be negligibly greater than levels that resulted from air pollution.10 But the relevant quantity is the total amount of acid that reaches the ground, including both wet (acid rain, snow, and fog) and dry deposition (acidic gases and particles). Any additional acid deposition would harm the ecosystem, and it will be important to understand the consequences of exceeding different

Biological thresholds. Furthermore, more acidic particles in the troposphere would affect public health. The effect may not be large compared to the impact of pollution in urban areas, but in pristine areas it could be significant.

Geoengineering

6 - Effects of cirrus clouds

As aerosol particles injected into the stratosphere fall to Earth, they may seed cirrus cloud formations in the troposphere. Cirrus clouds affect Earth's radiative balance of incoming and outgoing heat, although the amplitude and even direction of the effects are not well understood. While evidence exists that some volcanic aerosols form cirrus clouds, the global effect has not been quantified.

7 - Whitening of the sky

Atmospheric aerosols close to the size of the wavelength of light produce a white, cloudy appearance to the sky. They also contribute to colorful sunsets, similar to those that occur after volcanic eruptions. Both the disappearance of blue skies and the appearance of red sunsets could have strong psychological impacts on humanity.

8 - Less sun for solar power

Scientists estimate that as little as a 1.8 percent reduction in incoming solar radiation would compensate for a doubling of atmospheric carbon dioxide. Even this small reduction would significantly affect the radiation available for solar power Systems - one of the prime alternate methods of generating clean energy - as the response of different solar power systems to total available sunlight is not linear. This is especially true for some of the most efficiently designed systems that reflect or focus direct solar radiation on one location for direct heating.14 Following the Mount Pinatubo eruption and the 1982 eruption of El Chichón in Mexico, scientists observed a direct solar radiation decrease of 25-35 percent.

Geoengineering

9 - Environmental impacts of implementation

Any system that could inject aerosols into the stratosphere, i.e., commercial jetliners with sulfur mixed into their fuel, 16-inch naval rifles firing 1-ton shells of dust vertically into the air, or hoses suspended from stratospheric balloons, would cause enormous environmental damage. The same could be said for systems that would deploy sun shields. University of Arizona astronomer Roger P. Angel has proposed putting a fleet of 2-foot-wide reflective disks in a stable orbit between Earth and the sun that would bend sunlight away from Earth.16 But to get the needed trillions of disks into space, engineers would need 20 electromagnetic launchers to fire missiles with stacks of 800,000 disks every five minutes for twenty years.

10 - Rapid warming if deployment stops

A technological, societal, or political crisis could halt a project of stratospheric aerosol injection in mid-deployment. Such an abrupt shift would result in rapid climate warming, which would produce much more stress on society and ecosystems than gradual global warming.

11- There's no going back

We don't know how quickly scientists and engineers could shut down a geoengineering System - or stem its effects - in the event of excessive climate cooling from large volcanic eruptions or other causes. Once we put aerosols into the atmosphere, we cannot remove them.

Geoengineering

12 - Human error

Complex mechanical systems never work perfectly. Humans can make mistakes in the design, manufacturing, and operation of such systems. Should we stake the future of Earth on a higly complicated arrangement built by the lowest bidder?

13 - Undermining emissions mitigation

If humans perceive an easy technological fix to global warming that allows for “business as usual,” gathering the national (particularly in the United States and China) and international will to change consumption patterns and energy infrastructure will be even more difficult. This is the oldest and most persistent argument against geoengineering.

14 - Cost

Advocates casually claim that it would not be too expensive to implement geoengineering solutions.
The costs of the scheme to launch reflective disks into orbit are estimated at “a few trillion dollars.” British economist Nicholas Stern’s calculation of the cost of climate change as a percentage of global GDP is roughly $9 trillion.
Wouldn’t it be a safer and wiser investment for society to instead put that money in solar power, wind power, energy efficiency, and carbon sequestration?

Geoengineering

15 - Commercial control of technology

Who would end up controlling geoengineering systems? Governments? Private companies holding patents on proprietary technology? And whose benefit would they have at heart?

16 - Military use of the technology

U.N. Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD), but could techniques developed to control global climate forever be limited to peaceful uses?

17 - Conflicts with current treaties

Any geoengineering scheme that adversely affects regional climate, for example, producing warming or drought, would violate ENMOD.

18 - Control of the thermostat

How would the world agree on the optimal climate? What if Russia wants it a couple of degrees warmer, and India a couple of degrees cooler? With geoengineering, will we provoke future climate wars?

Geoengineering

Biochar

Biochar from eucalyptus in the Amazon region [1]

Biochar could be made from residues from plantation forestry harvesting. However, there are costs in collecting diffuse residues, and waste streams from processing are already used directly in process heat or have other valued uses.

Winsley recommend in 2007 the short-rotation growing or coppicing of poplar, willow, or eucalypts on low-value land. Cloned eucalyptus in Brazil can produce 40 tonnes of dry biomass per hectare per year.

Steiner and colleagues 2007 suggests to use biomass for the production of biochar. The authors promote slash and char instead of slash and burn in the Amazon region. [2]

The International Biochar Initiative (IBI) [3]

Fine-grained charcoal used in soils, called 'biochar', is being promoted as a way of mitigating global warming and making soils more fertile, despite scarce and contradictory evidence. The main lobby group, the International Biochar Initiative (IBI) aims to make biochar eligible for carbon credits. A large new demand for biomass will contribute to pressures to convert natural forests to industrial plantations and to harvest from already declining and sensitive ecosystems.
There are several authors which promote slash and char instead of slash and burn of secondary forest in the Amazon region.

[1] Winsley, Peter: Biochar and bioenergy production for climate change mitigation. New Zealand Science Review Vol 64 (1) 2007
http://www.biochar-international.org/images/NZSR64_1_Winsley.pdf

[2] Steiner, Cristoph, Teixeira, Wenceslau Geraldes, Zech, Wolfgang: Slash and Char – an Alternative to Slash and Burn Practiced in the Amazon Basin. Bayreuth, 2007

[3] Rainforest Rescue: US Bill would use trees from National Parks to test dangerous unproven technology.
http://www.regenwald.org/international/englisch/protestaktion.php?id=545

Geoengineering

Biochar, a new big threat to people, land, and ecosystems [4]

Charcoal itself is wrongly called carbon neutral – cutting down large areas of salt cedars, pinyon pines or other trees creates disturbances that result in emissions from soils and vegetation. When burned, a portion of the C contained in the wood is released. The remaining C, retained in the charcoal is then to be applied to soils, where, in theory it will be sequestered safely away from the atmosphere. However, it is not known how much will remain for how long and there is also evidence that charcoal can cause pre-existing soil carbon to be emitted as carbon dioxide. In a recent preliminary study in Canada, no additional carbon was found in soils less than two years after biochar was applied. [6] Furthermore, there is a significant risk that small biochar particles could become airborne in which case they would absorb heat, contribute to global warming and present a health risk when inhaled. For more information about the WECHAR Bill, see www.biofuelwatch.org.uk/docs/wechar_factsheet.pdf

Keep 'biochar' and soils out of carbon trading [5]

Industrial charcoal is very different from Terra Preta, the biochar of indigenous population of Central Amazonia. Biochar advocates ideas that require the use of 500 million hectares or more of monocultures. Serious ecologic risks may result from spreading genetic modified trees adapted for biochar. Industrial charcoal production at the expense of organic matter needed for making humus may not be beneficial to plant growth. Deleterious results are expected using combinations of charcoal with fossil fuel-based fertilisers made from scrubbing coal power plant flue gases. The pyrolysis using temperaures of 500°C and higher, can result in dangerous soil and air pollution. [6]
An international declaration urging caution on biochar can be found at
www.regenwald.org/international/englisch/news.php?id=1226

[4] The International Biochar Initiative (IBI)
http://www.biochar-international.org/

[5] Declaration: 'Biochar', a new big threat to people, land, and ecosystems. Rainforest. 23.06.2009.
http://www.regenwald.org/international/englisch/news.php?id=1226

Geoengineering

Sustainable production of food, feed and fuels in tropics [7]
Preston 2009 advocates the generation of electricity as a by-product of food/feed production by fractionation of biomass into inedible cell wall material that and convert it to a gas used as fuel in combustion engines driving electrical generators. The author claims that his model is highly appropriate for decentralized small scale production of electricity in rural areas and captures carbon as biochar which remains after the gasification.
The biochar would compete which the organic material desperately needed as soil cover and conditioner. Energy from this system is still based on carbon cycle. Tropics are best suited for photovoltaic, wind turbines and hydrogen obtained by electrolysis of water to decarbonise energy and fuel for transportation so as presented by the Desert Energy Project.

Biochar of Eucalyptus as bulking agent of poultry manure [8]
Dias and colleagues 2010 compared the use of Eucalyptus biochar with coffee husk and sawdust as bulking agent for the composting of poultry manure in a proportion of 1:1 (fresh weight). The use of sawdust was found to be the most efficient in preserving the organic matter and nitrogen in the mature compost.

Biochar from wastewater sludge [9]
Biochar from wastewater sludge through pyrolysis at a temperature of 550 degrees improved the production of cherry tomatoes by 64% . The ability of biochar to increase the yield was attributed to the combined effect of increased nutrient availability (P and N) and was best in combination with the fertiliser. In this study Hossain and colleagues stress that the bioavailability of metals present in the biochar was found to be below the maximum permitted concentrations for food.

[7] Preston TR: Environmentally sustainable production of food, feed and fuel from natural resources in the tropics. Trop Anim Health Prod. 2009 Oct;41(7):1071-80.
http://www.ncbi.nlm.nih.gov/pubmed/19728132

[8] Dias BO, Silva CA, Higashikawa FS, Roig A, Sánchez-Monedero MA: Use of biochar as bulking agent for the composting of poultry manure: effect on organic matter degradation and humification. Bioresour Technol. 2010 Feb;101(4):1239-46.
http://www.ncbi.nlm.nih.gov/pubmed/19796932

[9] Hossain MK, Strezov V, Chan KY, Nelson PF: Agronomic properties of wastewater sludge biochar and bioavailability of metals in production of cherry tomato (Lycopersicon esculentum).
Chemosphere. 2010 Feb;78(9):1167-71.
http://www.ncbi.nlm.nih.gov/pubmed/20110103

Selling carbon offsets with ocean iron fertilization

California-based technology startups Planktos and Climos are offering to sell carbon offsets in exchange for performing ocean iron fertilization, which induces blooms of carbon-eating phytoplankton. Funding for Planktos dried up in early 2008 as scientists grew increasingly skeptical about the technique, but Climos has managed to press on, securing $3.5 million in funding from Braemar Energy Ventures as of February.

Urea sea fertilization

Sydney, Australia–based Ocean Nourishment Corporation, which similarly aims to induce oceanic photosynthesis, only it fertilizes with nitrogen-rich urea instead of iron.

Binging deep waters to the surface

Atmocean, based in Santa Fe, New Mexico, takes a slightly different tack: It's developed a 200-meter deep, wave powered pump that brings colder, more biota-rich water up to the surface where lifeforms such as tiny, tube-like salps sequester carbon as they feed on algae.

Baking soda

Skyonic, a Texas-based startup, captures carbon dioxide at power plants and mixes it with sodium hydroxide to render high-grade baking soda.

Carbon capture from ambient air

Global Research Technologies, the only company in the world dedicated to carbon capture from ambient air, recently demonstrated a working "air extraction" prototype.

Carbon dioxide from power plants to algae

Meanwhile, GreenFuel Technologies Corporation, in collaboration with Arizona Public Service Company, is recycling carbon dioxide emissions from power plants by using it to grow biofuel stock in the form of algae.