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Futurewatch

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An information service of current international perspectives about our futures, prepared by futures scanner, **Jennifer Coote**. Annual dates in last two digits.

Economics/ Business

Rethinking economics

Freefall: America, Free Markets and the Sinking of the Global Economy, J. Stiglitz, Norton/Allen Lane, 10. This Nobel Prize winner and strong critic of market imperfections provides an in-depth analysis of the fundamental flaws which underlay the global financial crisis. He starts with the emergence of the aggressive form of free-market capitalism of the past three decades and the resulting enormous increase in both wealth for some and stagnant or regressive incomes for many. After an analysis of the results, he offers a course for reform. In the present climate where it appears that little has been learnt, little will be effectively achieved.

The Idea of Justice, A Sen, Bellnap Press, 09 is a politely-toned, but authoritative confrontation with the major twentieth century philosopher Rawls on the economic reasoning underlying the analysis and measurement of human well-being. The two predominant themes are economic rationality and social justice. Economic theory needs to be thoroughly grounded, appreciating the complexity of human behaviour. The complexities are nevertheless observable and measurable, and linking them all are the values and moral constraints which are fundamentally at one with economics, as Adam Smith noted long ago.

The Nobel Prize in Economics was recently awarded to **E. Ostrom** for finding a new way to address the old issue of over-exploitation of "the common pool of resources," *Financial Times, 17/18 Oct 09, p.7*. The usual solution is either privatisation or government control, but the new discovery suggests that stakeholders in the commons can sometimes find positive outcomes without resorting to either. She focuses on the variety of rights involved:-access, withdrawal, exclusion, and alienation. It is a breakthrough in the paradigm of the "Tragedy of the Commons."

Ecological Economics: Principles and Applications (2nd Ed), H E Daly, J Farley, Island Press, 09. A basic text which addresses the flaws in conventional economics, including biophysical and social systems, and the linkages between economic growth, environmental degradation and social inequity.

G Tett, P Garnham, *Financial Times, April 30 10, p 7*, report that UK's senior regulator, Lord Turner, has expressed strong concerns about the explosive growth in foreign exchange dealing, "the

carry trade", which he considers of zero value and would like to curb as a business activity. Financiers involved in trade are derisive of, or horrified by his proposals, since the view the trade as a cornerstone of their strategies and necessary to help restabilise the global economy.

Trading their way

The Economist Survey, 3 April, explores the rebalancing of the US economy as it shifts from debt and consumption towards exports and saving. This will put it through one of its biggest transformations in decades, affecting lifestyles, with a major shift in the places and character of work. While the financial meltdown weakened the usual bounce back from recession, the higher cost of oil will change the economic geography, curbing the flow of jobs and people to the southwest and to the suburbs. Buildings for work or for residence will be constrained, while the demand for equipment is likely to be strong. Growth in exports is coming from the already strong exporting areas of high-end service software and engineering and highly-skilled manufactures. The imbalances will remain for some time but already the elements are falling into place. Problems could develop if the rest of the world cannot adjust to a US which is no longer a voracious consumer but rather a keener competitor.

Pew Charitable Trusts report, June 09, on the development of the clean energy economy in US. Jobs and businesses in this have grown much faster than other areas of the economy overall and are poised for even greater growth. This is driven by consumer demand, venture capital from eager investors and policy reforms from federal and state lawmakers. Every state has a piece of the action. While Federal assistance through the Recovery and Investment Act is helping, the nation needs a comprehensive, economy-wide energy plan, a market-based system which will drive the US economy and significantly reduce greenhouse gas emissions.

The Economist, 7 April, 10: Survey, examines the innovative development of emerging markets. Over twenty-one thousand multinational companies in these areas are keenly developing ways to climb the value chain, driven by ambition and fear of cheaper competitors. Cheap labour is not their only advantage, they are reinventing systems of production and distribution adapted to their environments and customers as well as experimenting with entirely new business models. Their best companies are as good as any others worldwide. Western multinationals are linking into the strengths of these emerging markets for customers and for high-quality brainpower. It is expected that over the next few years 70% of global growth will come from this area and 40% of this from China and India.

NZ Business advocate **S. Jacobi**, *NZ International Review, Nov/Dec 09*, considers that the very significant role Asia Pacific Economic Council (APEC) for New Zealand has not been realised because of the conflicts over its direction. APEC needs to resist calls for protectionism, encourage the completion of the WTO's Doha negotiations, accelerate the facilitation of trade and investment in the region and encourage the development of the Free Trade of the Asia Pacific (FTAAP).

Australasian perspectives

NZ economist **G. Nana** completed a stocktake of the national assets, *Food Technology NZ, March 10, p 1,* see also www.nzte.govt.nz.

He found four broad groups:-physical resources and endowments; people; the NZ Brand; and structure and processes. The heart of productivity lies in how these are mixed and the relationship between them. There are risks involved in maintaining any or all of these, for example the physical environment may be too conducive to a commodity-based, high volume, low-value economy.

The Independent reports, 1 April 10, p 14 that a banking trend emerging strongly in Australia is likely to cross the Tasman, as UBank utilises overseas software to enable customers to bypass physical banks completely and rely entirely on their iPhones, Blackberry's and other mobile phones. Calls can be made to the service centres round the clock. Banks are evolving from being guardians of money to guardians of customer information, as UBank pioneers use of voice biometric. Although it is two years behind trends in US and Europe, UBank is also leveraging the use of social networking sites on Twitter, Facebook and YouTube.

D Grimmond, *Dominion Post, 19 June 10, p C2,* highlights a recent report for Ministry of Economic Development on the performance of NZ managers, focused on the manufacturing sector, which raises serious questions about how NZ can raise its level of productivity and improve its viability. The methodology replicates that use by McKinsey and London School of Economics. The results are similar to those in Australia and some European countries, including France and UK, higher than that for many emerging economies but behind the leaders Japan, Germany, Sweden, Canada and US. People management skills are a serious weakness, with poor ratings in addressing and correcting poor performance, and rewarding and retaining high performers, especially in single owner/manager firms. Those with dispersed shareholders are as good as any overseas.

Food/Fibres

Facing the food crisis

German economics Professor **J von Braun**, *Nature, 3 June, 10, pp.548-549,* calls for a new strategic body, independent and nimble and with the necessary authority to take action, to lead in the face of the gathering crisis over global food supplies. Strategic directions and programmes are needed and networks co-ordinated in face of the lag in agricultural productivity behind shortage of food reserves, the billion people undernourished, the increasing shortages of water, the degradation of farm land ands trade disruptions and speculation. An embryonic body for such a role already exists, the Committee on World Food Security within FAO.

The Economist, 21 Nov 09, pp.61-63, reports that while calls for new or reformed institutions at global level to foster food security languish, many poorer nations are taking steps already to help farmers and encourage local production. Budget promises to increase spending on agriculture are being met, seed banks and seed fairs established, plus subsidies for farm inputs, minimum wages for labourers on public works

in rural areas which stimulates demand, and even food export bans are among the measures.

Science, 12 Feb 10, Special Section, provides a wide range of news and specialist studies on Food Security, with focus in this in depth from **H C J Godfray et al**. The challenge will continue for forty years or more, but it can be met. A multi-faceted strategy is needed to ensure that food can be produced and shared equitably. Getting the most from the various inputs will require innovation, which **M Herrero et al** and **R.Gebbers, V I Adamchuk** explore in their respective articles on mixed crop-livestock systems and precision agriculture. **M Tester, P Langridge** examine breeding technologies to increase crop production while **N V Fedoroff et al** examine radical developments in molecular agriculture techniques and adaptations to saline water and integrated nutrient flows. Provocatively, among the News Items is a study on the effects if rich nations cut their meat consumption. Prices would fall and poorer nations could eat more, but not more grain, because grain production used to feed animals in the rich world would fall too.

P Roberts The End of Food: the Coming Crisis in The World Food Industry, Bloomsbury, 09, backs his case for heightening concern about the failings of industrial agriculture, its facilitation of disease, and its independence on oil.

The Environmental Food Crisis: The Environment°¶s Role in Averting Future Food Crises, Ed. C Nelleman, UN Environment Programme, 09, explores authoritatively the issue of waste in food production systems. There is plenty of food, even for rising populations, but it is wastefully managed and distributed. Consequently the traditional method is clearing unutilised land, especially tropical rainforest. Natural habitats and their endangered species are the victims of this waste.

A. Evans, The Feeding of the Nine Billion: Global Food Security for the 21st Century, Chatham House, 09, tackles issues of increase in both population and consequent demand, but consider the present measures adequate. This is a view challenged by a number of other international commentators who are deeply concerned about the inevitable vicious cycle of population pressure on natural environments.

Seedling (GRAIN), Oct.09, builds a case against the international food system and its damaging role in the climate crisis, drawing on range of reputable sources and studies. It highlights a tragic massacre of protesting indigenous Amazonian peoples by the Peruvian government forces, on behalf of the interests of mining, oil drilling and monocultures of forestry and cropping corporations. This is symbolic of two very different concepts of the present and future of humanity. On the one hand, the economic interests, with social and environmental destruction, use of force and violation of rights. On the other, a world of peoples, indigenous and otherwise, who aspire in solidarity to respect and work with nature.

Third World Resurgence No 230, 09, **S Sharma** reports on an organic practioners' Conference in Bangalore, India, which illustrates the way by which organic farming in S. Asia and other developing countries can be a viable alternative to the current Green Revolution techniques. The focus is not on feeding plants, but feeding the soil which nourishes the plants, with composting, diverse cropping systems, saving and reusing traditional, locally suitable and diverse seeds. This fosters maximum diversity on the smallest but most efficient parcel of land and also reduces carbon emissions.

Financial Times, 27/28 Jan 10, **Special on food sustainability**, reports on a market-led approach to improving food nutrition in Kenya. A special vitamin-fortified porridge is being prepared locally and then sold at low cost by small local entrepreneurs. The scheme is a pilot for further approaches to malnutrition being devised by large companies and aid funds.

Appropriate Technology, Vol.36/4, 09, reports on an award winning Ultra Rice pioneered by an international non-profit organisation focused on sustainable solutions to health problems in poor communities. Ultra Rice has been intensively tested to ensure it is effective, shelf stable and acceptable to a variety of communities. Two types have special characteristics, one to combat Vitamin A deficiency in children and a second to combat anaemia in adults and children.

K Steir, *Time (NZ), 28 June 10*, reports that Monsanto is achieving a stranglehold on the global plant food chain. Most of The Americas are planting is its seeds. Elsewhere more nations are adopting biotech crops for fibre, animal food and human consumption. Even the EU has some 120 genetically modified plants approved or in process. The biotech industry claims that after fifteen years there are no well-documented food safety problems, and no threat to biodiversity. In fact, by reducing pesticide use, biotech plants may be environmentally beneficial. Plants engineered to use less water are next for widespread commercialisation. Monsanto is also licensing its special traits to competitors, thus leveraging an existing stock of elite germplasm held by other companies as well as their supply chains. China has decided to allow nationally developed biotech crops, rice and corn.

Science,16 April 10, p.295, reports on an exhaustive study in peer-reviewed literature by the (US) **National Research Council of the National Academies**, which concludes that the shift from conventionally grown crops has paid off environmentally and commercially. There are concerns that existing gains may not hold, for example, if insect or weed resistance develops, and by the stifling of competition as the dominant agribusiness firms merge.

Union of Concerned Scientists, www.ucsusa.org April 09, released a report from their Food and Environment Program which strongly questioned the performance of genetically engineered crops, and especially the increased yield promised by this technology. Corn and soyabeans in USA were researched, their prospective improvement for the next decade examined, together with performance of other agricultural aspects, such as improved traditional breeding and improved agricultural practices.

Two significant factors need to be noted. Potential yield, how the plants perform under ideal conditions, and the operational yield which is achieved after all the constraints from pests, biotic stresses and inadequate inputs. The report aggregated GE yields of the past twenty years. Overall the GE crops are failing to show higher yields than crops raised by alternative methods.

Revaluing soil and good pasture

A major study by **AgRearch**, *Country-Wide, May 10, p.28*, has assessed the carbon footprint for NZ lambs, showing that each 100 grams of exported lamb creates 1.9 kg of carbon dioxide equivalents, much of which is generated on the farm. Despite the

huge efficiency gains in reducing carbon footprints as pasture is converted to meat, there is much which can be improved, especially in pasture management to maintain clover content to reduce used of nitrogen based fertiliser, and processing meat more efficiently. The study sets a benchmark for overseas producers to match.

Country-Wide reports, March 10, p.57, that by using a type of high-sugar ryegrass, which reduces nitrogen levels, one farmer has repeatedly won environmental awards, and intensified sheep and beef production by rotating stock on this prime pasture which speeds their growth to their terminal weight. More farmers could have incentives to do likewise, and the Emissions Trading Scheme would work more successfully if farmers were given greater credits for using crops which reduce livestock emissions as well as improving animal production.

R MacFie, *NZ Listener, 14 Aug 10*, discusses the critical state of NZ dairying, caught between demand for high-growth production and the intensifying damage to the environment. There is a whole toolbox of approaches which can turn this around. Innovative equipment, though expensive, can raise both environmental quality and improve production. Environmental damage from animal wastes can be managed with attention to new approaches to pasture and to sheltered special housing for animals in cold winter regions. Legislation and farm licensing could impel farmers to change, while educational support in applying best practices would be a softer approach. Surprising, far better production results come, not from intensifying stock numbers, but from carrying medium density numbers and attending to better quality conditions for the animals.

J Morgan, *Dominion Post, 11 May 10, C3*, reports on farm use of lucerne which has enabled drought prone land to cope profitably through six dry years. This plant also sends roots deep into the soil, by as much as ten metres, and improves the soil carbon and moisture content. But farmers are not given credit under the Kyoto agreement for this contribution. NZ Government needs to develop adequate recognition in its Emissions Trading Scheme and argue the case for Kyoto revision.

Professor **J Rowarth**, *NZ Listener, 12 Dec 09*, explores the case for applying similar credits for soils, as for trees, as sequesters of carbon. There are problems in applying such schemes internationally. Countries such as NZ with long-time carbon rich soils may receive low credits while another country which radically improves degraded soils receives high credits. More research is needed on the processes which cause soils to gain and lose carbon.

J Morgan, *Dominion Post, 25 Nov 09, C5*, reports that a Massey University PhD student has developed a unique framework for assessing a farm's natural capital. This covers the soil and the services it provides for the farm and the environment. These may be practical, economic, environmental and spiritual. All have a cost for society. The next stage is to cost the resources needed to lift a poor sample farm to a level with a very good one.

S Goldson et al, Emerging Issues-GM Forages, Royal Society NZ, April 10, contributes to the debate on these crops, which are needed to maintain NZ leadership in pastoral industries. Two types are involved:-cisgenic modification alters genes within a species and transgenic sources genes from elsewhere. It's the latter which arouses greatest resistance. Overseas concerns about GM crops may be changing because of

concerns about climate change and security of food supply concerns. Meanwhile scientists are getting to the point of testing in the field with GM forages.

Ocean bounty?

Seafood NZ, April 10, reports on an extensive literature study by international expert, US Professor **R Hilborn**, which compares the environmental damage caused by different types of protein production. On average, commercial fishing has least environmental impact compared with various types of land-based animal farming. Comparisons on use of energy also favour fishing.

B. Worm, R Hilborn et al, *Science, 31 July 09*, contribute a comprehensive research article on rebuilding global fisheries. While efforts are already underway to restore overexploited fisheries, 63 % of assessed fish stocks still require attention, and vulnerable stocks close to collapse require even more care. Fisheries and conservation objectives need to merge their management systems, including catch restrictions, gear modification, and closed areas. Many poorer regions are also threatened by international fleets and lack of alternatives to fishing. Overall a global perspective is needed.

An international working group on tuna species, *Nature, 20 May 10, pp.280-281*, has concluded that the Pacific bluefin tuna populations may be going the way of their endangered Atlantic cousins. Evidence regarding the reliability of the replacement rate of juveniles is doubted, especially as recently fishing boats have been targeting the spawning grounds. Japan, the principle market for the lucrative catch, is taking measures to obtain better data, restrict boat catches and use of encircling nets, but these may be too little, too late.

Seafood NZ, Aug 09, pp.20-21, reports on an award-winning invention, the Smart Hook, which can be used to prevent seabirds and sea turtles becoming hooked as longlines are set in the ocean. The Smart Hook has a shield which is placed over each hook as the crew prepare the lines, and this dissolves after the line is dropped into the water, at a level beyond which other animals can reach the bait. The design has already been successfully trialled in Australasia and USA.

Futures Thinking

What's in a name?

Futures April, 10 Vol. 42/3 includes a series of articles around the terminologies variously used for Futures Studies/Futures Thinking. Journal editor **Z Sadar** outlines the issues. Futurology, futuristic, foresight, Futures Studies:-What do these terms mean? How do they define and describe the work of the academics, professionals and students involved? Responses from eminent practitioners **E B Masini, B Tonn, M Marien** and others take the issues further. The term "futures" and its variants affect the legitimacy which should be given in public policy circles and have restricted the acceptance of Futures Studies in academia. Branding, quality, and even identity, of those involved are all at stake.

S M Millert, D J Staley, *World Future Review (World Future Society), Vo1.1/5 Oct/Nov 09*, consider that the field of futures thinking requires a philosophy to provide a strong foundation and contribute to the unity, coherence and credibility of the field

and its practitioners. They outline the questions which such a philosophy would need to answer.

The irational human

Special report, *New Scientist, 15 May 10,* looks at the phenomenon of apparently rational people who refuse to accept evidence for a variety of assessments and policies affecting health, external events and many other issues. Denial is not scepticism, which is an integral part of the scientific process, testing both evidence and conclusions. Denial is fundamentally emotional, a belief which the holder has developed and seeks to uphold by sifting evidence for any grains of confirmation. Many deniers use similar tactics, by setting themselves up as courageous underdogs to expose a conspiracy which subverts "the truth". They may have limited capacity to cope with probability. They may also have an ideological bias such as religious or political conservatism. Spreading plausible falsehoods is common tactic, which can be magnified through by modern media, and the basic willingness to select evidence which fits a preconceived bias. To combat this, rather than attack deniers personally, patient and constant rebuttal of false claims and a vigorous refusal to allow deniers to subvert free speech based of factual information is necessary.

Requiem for a Species: Why We Resist the Truth about Climate Change, C. Hamilton, Allen & Unwin, 10. Australian ethics professor and former Director of Australia Institute takes strong issue with the constellation of politicians, business executives and deniers who resist taking action against global warming.

Science, 14 August 09, pp.804-809, reports on research and innovations in US on ways to leap the efficiency gap as policy makers realise that this is starting point in reducing the national power demand. There are great technologies available but the challenge of human response is still being researched. People do not seem to make rational decisions about energy use. They may avoid decisions completely and see energy costs as an Act of God, but when there is crisis which demands a response such as a city- or state-wide call to save power the responses can be dramatic. Research suggests that people consider that the other person wastes power but they are fatalistic about their own. Only if they feel that they are in the majority can they take action. Various types of social conversations can build new attitudes as people develop a common culture that this is the right thing to do. Smart meters, which allow customers to view their energy use and control it can open a lot more possibilties.

Minerals/Energy

Getting costlier

Financial Times, 31 March 10, p.1 & p.25, report that global steel prices are set to rise by a third after miners and steelmakers agreed to a historic change in the iron ore price system which will be linked to its spot price system. Huge profits can be expected for the ore producers. This follows a standoff in 2009 between the producers and Chinese steel makers, and reflects the pressure exerted on the market by China's hunger for iron ore. As steel prices rise to compensate, consumers everywhere will ultimately pay more, while marginal producers will be lured to bring higher-cost

mines into production. Meanwhile bankers and brokers are preparing exploit the changing pricing system by developing a multibillion dollar derivatives market to hedge against expected volatility in prices.

Power for the electric vehicles which are key to a mobile but low emission society depends batteries made from a little know mineral, lithium. *Technology Review, Photo essay, Jan/Feb 10*, indicates that demand for this rarer mineral is expected to double in the next decade. Bolivia could potentially become the "Saudi Arabia" of lithium, which flows in the salt water channels beneath the surface of its massive salt flat high in the Andes. While technical expertise comes from outside companies, the Bolivian government, strong on indigenous rights, insists it must retain control as it hopes to build a full scale lithium extraction plant.

New Scientist, 12 Dec 09, p.23, reports that a new lithium extraction technique is being developed to utilise hot waste water from a geothermal power plant near the Salton Sea, California, one of the principal lithium production areas. The environmental impacts of this method are comparatively minimal.

A Florida company has developed a method to produce solid state lithium core batteries, http://technologyreview.com/energy (downloaded 1/0810), which are larger that present ones, thus storing three times the energy and provide power for electric vehicles.

L. Lewis, *Dominion Post, 30 May 09, C5*, highlights the robust international trade in rare-earth metals, whose supply is largely a Chinese monopoly. There are lot of technologies for which supplies of these metals, though modest per item, are essential, such as green cars and solar panels. Japan is the leading importer, with a good portion of its supply probably illegal. Within three years a bottleneck will exist as demand outstrips existing refinery supply.

J. McCrone, Dominion Post, 19 April 10, C3, that while the lucrative payoffs from the possible discovery of rare earth metals in New Zealand's conservation estate is matter of public controversy, there is another lucrative resource to hand which is also more marketable in the current environment-the ironsands on the Western coast of the North Island. There are technologies available, and more which can be developed readily, to extract and process the ironsands cost effectively. Concerns about erosion are offset by the return of the waste sands to the ocean floor while Maori claims to foreshore and seabed can be accommodated.

Nature, 8 Oct, 09, pp.716-718, reports on rising concerns that phosphate rock is becoming a global strategic material for fertiliser. Estimated supplies include rock heavily contaminated with impurities, while estimated demand for such fertiliser is predicted to growth up to 3% in the next five years. Already states such as US are developing free trade agreements with key supply areas such as Morocco. China, a major new user, is accused of applying too much phosphate to its crops. New technologies are being developed to explore and mine off shore supplies, and also to process or utilise it more efficiently. Finally, a precipitate from waste water pipes, struvite, containing phosphate, magnesium and ammonium, is being developed commercially as a green fertiliser.

Carbon capture and storage

Science, Special Section 25 Sept, 09, offers a selection of expert studies on how carbon capture and sequestration (CCS) is being developed and, in places such as China, utilised to minimise or reverse unwanted emissions of carbon dioxide. Favoured methods are capturing the gas, and either injecting it into oil wells to pump up more oil up, or liquefying and storing it underground. **R S Haszeldine** examines the prospects of turning "Black" to "Green". Commercialisation of CCS seems logical, given the demand and the huge supplies, but many political, technological and commercial hurdles remain. **G T Rochelle**, considers that amine scrubbing, which removes carbon dioxide from the other gasses, is a mature technology, ripe for wide application. **D W Keith** examines an emerging technology, capturing the gas from ambient air around power plants, which is more costly but can be applied to small scale sources. **F M Orr Jnr** examines the current stage of injecting carbon dioxide into on-shore, porous rock formations, but avoiding near-surface leakage, a method ready for major application. **D P Shrag** considers that CCS is a critical technology, as more than 80% of the world's energy comes from fossil fuel. Off-shore repositories for the emissions should be considered closely.

Univ Canterbury specialists **S Page et al**, *e.nz, May/June 09*, examine the possibilities for application of CCS in NZ, which has substantial coal deposits. They argue that economically and environmentally there are more sustainable energy options to pursue.

High tech solar

The Economist: Technology Quarterly, 6 June 09, pp.18-19, illustrates a new solar-powered energy programme in California. A series of fourteen such plants will supply over 2.6 gigawatts of electricity, from concentrated solar-thermal technology. Giant mirrors concentrate sunlight to produce heat which creates steam to drive turbines. These systems have lower costs, can produce much more power reliably and can be stored rather than used at once, giving them considerable advantages over photovoltaics. They work best in regions where temperatures are high and demand greatest. Developed over several decades, the technology is benefiting from more sophisticated designs and materials.

Science, 11 December 09, pp.1472-1475 reports that US research labs are producing liquid fuels from energy rich feedstocks created from intense solar concentrators, huge parabolic dishes which concentrate sunlight into a reactor which contains an iron oxide catalyst to split either water or carbon dioxide and created solar liquid fuels. To scale up to commercial application will require much greater efficiency and reduced cost. It is hoped that by 2020 such solar thermo-chemical systems could convert 20% of the incoming heat to fuel.

Watch these spaces

A Regalado, *Technology Review, March/April 10*, reports on a move to commercially produce biofuels by synthetic biology. A Californian firm is basing it prototype in Brazil to utilise sugarcane, whose juice, when genetically modified yeast cells are

applied, converts to farnesene, which in turn can be turned into diesel. Such fuel is from a renewable source, produces fewer emissions than fossil fuels and is expected eventually to be cheaper. For many synthetic biologists this is just the beginning, because in principle they believe it is possible to create replacements for any petroleum product.

Big investments, and the US navy as a customer, are fuelling the push to develop commercial scale fuel from algae, *Nature, 17 Sept 09, pp.460-461*. There are constraints to very large scale commercial production, such as finding types of algae which can reliably produce high yields, ensuring the resource is free of contamination, developing cost-effective growth chambers and efficiently harvesting oil from algal cells. Genetic engineering is being utilised to boost desirable algal traits.

Science, 21 Aug 09, p.957, reports that technological advances and the search for new fuel resources are opening up the possibilities for once unobtainable gas hydrates. These form from methane and water at low temperatures and moderate pressures. They occur in permafrost, but more widely in marine sediments on the outer continental shelves. Such reserves form a pyramid of extractability. At the top are sandy sediments in the Arctic and in marine sediments, then various types of muds. The larger layers of undeformed, but extremely difficult to extract, muds, form the large base of the pyramid. Two major challenges to be overcome are:-determining the extent of the gas hydrates reserves and then how good the yield may be compared with the extraction costs.

D Hocking, *Country-Wide, Jan 10, p.38*, reports on five recent volumes of research and analysis from **Scion** (formerly **NZ Forest Research**) who are working with a number of international centres on the various aspects of bioenergy, and its future in NZ. Utilising wood for fuel (including the considerable quantities of waste wood) is already well established in a number of industries and could be further improved. Turning wood into liquid fuels requires considerable technical development and its net energy yield (compared with energy invested) needs careful analysis. Wood has very considerable advantages as a bioenergy crop compared with other purpose grown crops, and plantation timber could profitably produce both high value saw logs and lower value energy logs, which can also be stored till used. Techniques for degrading cellulose to extract usable liquid fuels require considerable development, but the prospects are good. Such biomass will never be a cheap successor to oil, but it could supply NZ fuel needs.

Listings

Sustainable Energy: Without the Hot Air, D J C MacKay, Cambridge Univ. Press, 09, provides an authoritative analysis of the physics and engineering required, presented with wit, and much hard to find data. Shifting away from fossil fuels will require substantial investment in research, development, demonstration and deployment, and turning around the negative public responses.

Free downloads, **CSIS Energy and National Security Program**, http://csis.org **Geopolitics of Russian Energy: Looking Back, Looking Forward, R E Ebel, 09, Energy and Politics in China: Mixing Oil and Politics, R E Ebel**, 09. Useful monographs for data, analysis and forward possibilities.

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