The Society of Chemical Engineers New Zealand Incorporated
Newsletter No 122, February 2006

Notes from the Chair

February 2006 and a new University year is underway with another near record intake of chemical engineers (ca 50) into first professional in the College of Engineering at Canterbury University. We have no idea yet why our intake into the field has jumped so markedly in the last two years, from 25 in 2004 to 52 in 2005 and approx 50 again in 2006. The first week of term sees numbers still moving but it does seem that 2005 wasn't just a one year perturbation.

Chemeca 2006 this year will be in Auckland in September and this is only a little over six months away, so I hope all chemical engineers in the country who can do so, will make an effort to attend. See elsewhere in this newsletter for the latest report on this event. This year in addition to the existing Awards of Excellence in chemical engineering which are presented at Chemeca, (Rio Tinto, Exxon-Mobil, Alstom Power, Fluor, Shedden-Uhde and the Chemeca Medal) there will be two new Awards being made for the first time. One is sponsored by one of New Zealand's largest processing companies, Fonterra. The other is from Worley Parsons. [The complete specifications for all of the awards are given in an item in this newsletter]. If you can remember back to last year; in September, we congratulated Christchurch chemical engineer Greg Ellis on winning the 2005 Shedden-Uhde Award and Roger Keey on the Chemeca Medal.

Over the past couple of months, our executive secretary, Tony Harcourt and I have been working through the SCENZ and IChemE databases and these are now amalgamated. This promises to simplify the administration, especially for the management of IChemE business. All New Zealand IChemE members automatically have free membership of SCENZ.

I hope that you have all by now availed yourselves of the opportunity to look over the SCENZ web site and sent in comment or criticism to the web page editor or our executive secretary. Note that the web page is now hosted by the College of Engineering, University of Canterbury.

Finally I wish one and all a prosperous, productive and happy 2006.

Brian Earl

2006 Awards of Excellence in Chemical Engineering

These awards provide a showcase for outstanding achievement in the field of Chemical Engineering. The Engineers Australia Chemical College, IChemE in Australia, SCENZ and RACI, in partnership with corporate sponsors, have instituted these awards to encourage and recognise excellence and to highlight the contribution made by Australian and New Zealand Chemical Engineers to the community.

The Chemeca Medal

This is the most prestigious award in the chemical engineering profession in Australia and New Zealand.

It is awarded to a prominent Australian or New Zealand Chemical Engineer who has made an outstanding contribution, through achievement or service, to the practice of Chemical Engineering in its widest sense and who continues to serve the profession.

The recipient of the Award would present an appropriate plenary lecture at the annual CHEMECA conference.

The Alstom Award (A$3000 and Certificate)

Recognises outstanding contributions in the industrial field from a Chemical Engineer **under 30 years of age.**

A candidate must be a member of Engineers Australia, IChemE, SCENZ or RACI.

The ExxonMobil Award (A$5,000 and Certificate)

Recognises significant ongoing contributions to Chemical Engineering through innovations or a series of related publications over a number of years.

The Fluor Award (A$5,000 and Certificate)

Recognises exceptional management and leadership talent that has directly resulted in a sustained corporate success over a significant period.

It can include both line management and project management and can apply to either private or public sectors.

The Fonterra Award (NZ$4500 and Certificate)

Recognises outstanding contributions in the industrial application of novel technology in the bioprocessing field from an individual or group of chemical engineers in Australia or New Zealand. Achievements may be in technical or management fields.

The candidate must be a member of Engineers Australia, IChemE, SCENZ, or RACI and **under 50 years of age**.

The Rio Tinto Award (A$5,000 and Certificate)

Recognises outstanding applied Chemical Engineering.

The Shedden Uhde Medal and Prize (A$4000)

Recognises practical services to the profession and to the practice of chemical engineering in Australia or New Zealand. Achievements may be in technical, marketing or management fields.

Nominations can be made either by individuals themselves or by nomination from others.

A candidate must be a member of Engineers Australia, IChemE, SCENZ or RACI and **must be under 40 years of age.**

The Worley Parsons Award (A$5000 and Certificate)

Recognises personal committment and leadership by a chemical engineer in the area of safety and/or the environment.

Applicants will have demonstrated outstanding leadership and/or committment to safety or the environment during design, construction or operation of process plant.

CHEMECA 2006 Update

Darrell A. Patterson, Su-Ling Brooks, and X. Dong Chen
Department of Chemical and Materials Engineering, The University of Auckland.

CHEMECA 2006, the 37th annual Australasian Chemical Engineering conference, is being organised by the SCENZ and the University of Auckland. You may already know a bit about this event from the "Call for Abstracts" sent earlier through the SCENZ mailing list. This article is a follow-up to that mail-out, updating and expanding the key information, as well as outlining the latest developments, in order to give you a fuller picture on progress made so far.

CHEMECA 2006 will be held at the Langham Hotel in Auckland from Sunday the 17th to Wednesday the 20th of September. The venue is located within the central business district of Auckland City, within easy walk to the harbour, universities, Sky Tower, art gallery, central city shopping areas and museum. The conference dinner is planned to be included as part of the registration fee and will be held at Sorrento in the Park, One Tree Hill. This is a peaceful, spacious and scenic venue where everyone will have a good view of the speakers (for more information go to www.sorrento.co.nz). A variety of accommodation at or near the venue will be available through the conference organisers, ranging from budget student accommodation to rooms near the conference at the Langham Hotel.

The conference theme for CHEMECA 2006 is Knowledge and Innovation. These two concepts are key to ensuring that a world class winning edge is sustained in the industries utilising New Zealand and Australian Chemical Engineers. Therefore to make this applicable and worthwhile to as many of us Chemical Engineers as possible, CHEMECA 2006 will cover the widest range of innovative chemical, process, material and bioengineering applications as possible. This is reflected in the wide range of sessions available at CHEMECA 2006, details of which can be found in the call for abstracts mailed out previously. In addition to these technical streams, a session on Green Engineering has been added. With this plethora of new and innovative information, CHEMECA 2006 should be an excellent continuing education and development opportunity for Chemical Engineers from any specialty.

Due in part to this diversity, CHEMECA 2006 has so far attracted a range of different sponsors. The conference sponsors so far are (in alphabetical order):

- ★ Auckland Uniservices Ltd
- ★ Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- ★ Rio Tinto

A number of premium sponsorship opportunities are still available however. So, if you or your company would like to talk about the benefits of being a sponsor, please do not hesitate to contact the technical secretary using the details at the end of this article.

Aside from the actual conference, the key dates for CHEMECA 2006 are:

Activity / Event	Date
Call for abstracts	November 2005
Abstract submissions deadline	12 February 2006
Abstract acceptance notification and request for papers	17 March 2006
Paper submission deadline	8 May 2006
Notification of reviewer outcome	16 June 2006
Conference registration opens	Late May 2006
Final submission deadline for corrected papers	28 July 2006

This schedule has been keeping the conference committee quite busy. Now that the call for abstracts is officially closed, we have now started the mammoth task of processing and reviewing the submitted material. The local committee members are predominantly from the Department of Chemical and Materials Engineering at the University of Auckland. The members are: Dong Chen (Conference Chair), Darrell Patterson (Technical Secretary), Brent Young, Geoffery Duffy, George Ferguson, John Chen, Margaret Hyland, Mohammed Farid, Monwar Hossain and Wei Gao. Outside of the Department we have Mark Taylor (Light Metals Research Centre, University of Auckland), Tim Dobbie (SKM and SCENZ) and Amanda Holmes (Air Liquide). The national members include Brian Earl, Conan Fee and Chris Williamson from the University of Canterbury and Rebecca Macdonald from Becca Infrastructure in Christchurch. CHEMECA 2006 is being managed by CCE Conference management, which is part of the Centre for Continuing Education at the University of Auckland. Therefore, in the first instance, Lynda Booth from CCE (lynda.booth@auckland.ac.nz) should be contacted for any general enquires regarding the conference. Technical matters should be directed to the technical secretary using the contact details at the end of the article.

Whilst a majority of the abstracts received are from New Zealand and Australian companies and universities, we have also received material from the United Kingdom, Iran, Thailand, Canada, and Austria. This should therefore give this conference a truly international perspective. This is internationality is also mirrored in the range of invited speakers. Briefly, these speakers are:

Professor John C Chen
Prof. Chen recently retired as the Carl R. Anderson Professor of Chemical Engineering at Lehigh University in Bethlehem, Pennsylvania, USA. Prof. Chen has been the pioneer and the unquestioned world leader on boiling heat transfer and other areas involving two-phase flow and heat transfer. Prof. Chen has been the winner of the Max Jakob Memorial Award, the top international prize for achievements in heat transfer, and two top honours from Germany – the Alexander von Humboldt Senior Research Award and the Max Planck Research Prize.

Dr. Jack T Peregrim
Dr. Peregrim is president of Paragon Development, an organisation based in the USA that specialises in assisting clients to successfully develop new business, products, and ventures. He has close to 30 years business and consulting experience. In his consulting career, he has worked with over 400 corporate clients. These assignments have contributed several billion dollars in value to these clients in the forms of new products, applications for technologies and other assets, acquisitions, optimized development portfolios, new value chain strategies, and expansion into new markets.

Professor William Svrcek
Prof. Svrcek is a Professor of Chemical and Petroleum Engineering at the University of Calgary, Alberta, Canada. Prof. Svrcek's teaching and research interests centre on process simulation control and design. He was instrumental in establishing Hyprotech as a leading international process simulation software company as senior partner, a Principal, director, and President. He has also worked for Monsanto Company as a Senior Systems Engineer.

Dr. Raj Rajakumar
Dr. Rajakumar is the Director of CSIRO's Light Metals Flagship Program in Victoria, Australia. Raj Rajakumar's research interests cover extractive and process metallurgy. In the light metals area, his research includes alternative technologies for magnesium, titanium and aluminium production, process metallurgy related to metal production and metal purification, gas-solid reactions, chlorine recovery and technology transfer. He has held several senior and managerial positions at CSIRO and has worked with a number of mining and metal production companies in the application of research results in industrial environments from bench scale to pilot, pre-commercial and commercial plants.

Professor Arun S. Mujumdar
Prof. Mujumdar is Professor of Mechanical Engineering at the National University of Singapore, and Adjunct Professor of Bio-Systems Engineering at McGill Engineering at Montreal, Canada. His research interests include drying and dehydration, time-dependent melting/freezing phenomena, transport processes of impinging and opposing jets, chemical heat pumps for industrial drying, explosive boiling actuated micro-devices. He is the Editor-in-Chief of Drying Technology – An International Journal since 1988. Prof. Mujumdar has authored two books and edited over 50 books in transport processes and drying. He has won numerous major awards and honours.

Dr Peter Lee
Dr. Lee is CEO of Auckland Uniservices Ltd. Prior to this position he was CEO of AgriGenesis, a company applying modern biotechnology to plants. He has had extensive industrial experience in North America. He has held executive positions with the $US30 billion International Paper Company, including Global Director of New Product and Process Development and Vice President, Corporate Research and Product Development. This involved worldwide process and product development, including new ventures and spin-offs. He held a similar role with Mead Paper Company and before that worked for Weyerhaeuser Company and the Institute of Paper Science and Technology.

Prof. Debes Bhattacharyya
Debes Bhattacharyya is Professor of Mechanical Engineering and Director of the Centre for Advanced Composite Materials at The University of Auckland. He is internationally renowned for his work in micro- and macro-modelling of deformation mechanisms in advanced composite systems. His work has contributed to the theoretical understanding and practical development of experimental techniques in the area of the roll forming of composite sheets. Current research and activities include the manufacture of composites from recycled thermoplastics and woodfibre, injection moulding of woodfibre-thermoplastic composites, extrusion of woodfibre-thermoplastic composites and manufacture and thermoforming of bio-composite sheets.

Professor Anton Middelberg
Prof. Anton Middelberg is an ARC Federation Fellow and the Professor of Chemical and Biomolecular Engineering at The University of Queensland. His research focuses on the science of chemical self-assembly processing, with the ultimate aim of defining new products and new process routes for the manufacture of existing products. Professor Middelberg has held academic positions at Adelaide, Queensland and Cambridge Universities, as well as a Fulbright fellowship at Berkeley. He has received a number of awards, has published more than 100 refereed papers at the interface between biology and engineering, and has editorial roles on several journals including *Chemical Engineering Science* and *Trends in Biotechnology*.

Two further speakers are to be announced in the near future.

Beyond the talks and seminars, companies have the opportunity to have trade displays to entice the conference attendees. There will also be ample opportunity for networking and questioning during the scheduled common breaks throughout the conference. Finally, the now traditional Chem-E-car competition will also be run. Teams are expected to design and construct a chemical reaction powered model scale car that can travel a set distance carrying a specified load. The teams do not know the distance they must achieve until the time of the competition, so the objective of the competition is to have a car with the most predictably adjustable controlled chemical reaction. This is a competition for undergraduate chemical engineering students.

Full information and updates can be found on the conference website: www.chemeca2006.auckland.ac.nz. For any further information, please do not hesitate to contact the CHEMECA 2006 technical secretary, Dr Darrell Patterson (darrell.patterson@auckland.ac.nz).

Engineering @ The University of Waikato

2005 has been an exiting year for the Department of Materials and Process Engineering in which the department welcomed several new staff members. Dr. Mike Duke, a specialist in mechanical engineering and product design joined in April 2005; Dr. Mark Lay is as a joined appointment between engineering and co-operative education; and more recently, Dr. James Carson, formerly of AgResearch, joined the Department's Biochemical Engineering research group. In February 2006, Assoc. Prof. Ilanko Sinniah arrives from the Univeristy of Canterubry to join the Mechanical Engineering group in the department. Unfortunately, some staff members have moved on: Prof. Thomas Neitzert now heads up the Engineering School at Auckland University of Technology, Assoc. Prof Conan Fee obtained a professorship at the University of Canterbury, and Dr. Bahy Noureldin has taken up an industry role in the Middle East.

Research in the department is active and ongoing. In the Composites Research Group, work that will help underpin an industry for producing hemp fibre composites is continuing. This includes developing bio-derived matrix materials as well as biological processes for increased environmentally-friendly manufacture. Work includes assessing the long-term capabilities of structural materials, and pushing the capability limits for recyclable materials.

Development of predictive composite models is an ongoing involving collaboration with Shah Jalal University of Science and Technology (SUST) in Sylhet, Bangladesh, a university with a big focus in the natural fibre composites area. Prof. Akhtaral Islam from SUST will visit the Group for three months from February as part of an exchange funded by the Asia 2000 fund.

Mechanical Engineering has seen significant growth over the last year. Last October, five engineering students from Waikato University joined forces with students from Bochum Technical University (Germany) to prepare and race a solar car in the 2005 World Solar Challenge. The gruelling event is a 3000-km journey across the Outback from Darwin to Adelaide in a car powered only by sunlight. The solar cars use the latest technologies in electric motors, batteries, solar cells, chassis materials, electronics, aerodynamics and tyres to maximize solar energy collection and minimize losses and can travel at speeds of 100 km/h on just 2 kW and cover up to 800 km in a day.

Team's car is named HansGo after the main sponsor Hans Gochermann, a leading expert in lightweight, flexible, solar cell encapsulation. HansGo is a single seat car, 5 m long x 1.8 m wide. The top surface (except the driver's canopy) is covered with GaAs solar cells and is rated at 2.3 kWp. Whereas a typical road car has a drag coefficient and frontal area of about 0.35 and 1.8 m^2 respectively, a solar car is about 0.12 and 0.9 m^2. This low aerodynamic drag is essential for travelling at high speed with low power.

The Waikato/Bochum team spent 3 weeks in a hot and humid workshop in Darwin preparing HansGo. Every part of the solar car is checked tested and rechecked to make sure it is reliable and operates at its optimum efficiency. For the students it was a real adventure and engineering challenge to prepare and race the car. They overcame all technical problems, the heat and the flies to complete the race in 5 days and finished 7th.

The technology used in solar cars will eventually be applied to passenger cars. Waikato University is developing a practical electric commuter vehicle (EV) to demonstrate the potential for low power EV's.

The Waikato Energy Group lead by Professor Peter Kamp and Dr Michael Walmsley continues to go from strength to strength. Wicky Moffat successfully produced 13% fuel savings (worth $120,000/yr) for the sponsoring company as part of his MPhil thesis on "Improving the Energy Efficiency of a Lime Kiln". James Neale from the University of New South Wales also joined the group as an air flow specialist. Three new PhD students are focused on improving the energy efficiency of large dairy factories and pulp and paper plants. Projects encompass advanced CFD modelling, experimental validation and industrial implementation in nearby plants.

Several activities are planned for this year including a WaiCAM seminar/workshop in February, an Engineering Open Day in August, a Design Show in November and an International Conference on Advanced Materials and Processing in December. For more details on these events, please visit our web site: http://mape.waikato.ac.nz/.

Johan Verbeek

What's Coming Up? Request for Notices

If you know of any upcoming conferences, seminars or other events that may be of interest to SCENZ members, please forward notices to the Secretary of SCENZ.
Such notices may then be included in the Newsletter and or the SCENZ website.

What's Coming Up

New Zealand Petroleum Conference
Sky City Convention Centre, Auckland 5-8 March 2006
For programme details see **www.crownminerals.govt.nz/petroleum/conference/programme.pdf**

The Road(s) to a Sustainable Energy Future

On October 6 last year, the Canterbury Branch of IPENZ and Engineers for Social Responsibility (ESR) ran an evening seminar entitled "The Road(s) to a Sustainable Energy Future". The speakers at the seminar were Dr Don Elder, CEO of Solid Energy, and Prof Arthur Williamson, former Head of the Dept of Chemical and Process Engineering, University of Canterbury and currently Managing Director of Thermocell Ltd. The seminar was well attended and sparked some lively post-seminar discussion.

Thanks are due to IPENZ and ESR for organising the seminar. The seminar presenters have kindly provided their presentation notes for inclusion in/with the SCENZ Newsletter. ***Dr Elder's presentation is attached as a separate PDF file with e-mailed copies of this Newsletter.***

Notes from Prof Williamson

Apart from geothermal, terrestrial nuclear and gravitational (tidal) energy everything else is traceable to the sun and all of it is renewable. The main differences among the various sources lie in the time scales on which they are renewed and the scale on which they are laid down. For example coal and oil have been laid down over a period of several hundred million years. The result is that we have at the moment quite large reserves of fossil fuels

Initially the rate at which we can use these reserves is determined by the rate at which we can "mine" them, but ultimately for a resource to be renewable it must be consumed at a rate no greater than the rate at which it is laid down

The depletion of an accumulated resource such as oil will follow a path like that shown in the "Peak Oil" curve in Figure 1 with growth in use reaching a peak (usually around the point where about half of the accumulated resource is consumed and then falling off to the level at which it is sustainable). In the case of fossil fuels this is estimated at somewhere between 5 megawatts and 100 megawatts. Thus for oil and coal to be perpetually renewable our total global use should be about enough to light a large city.

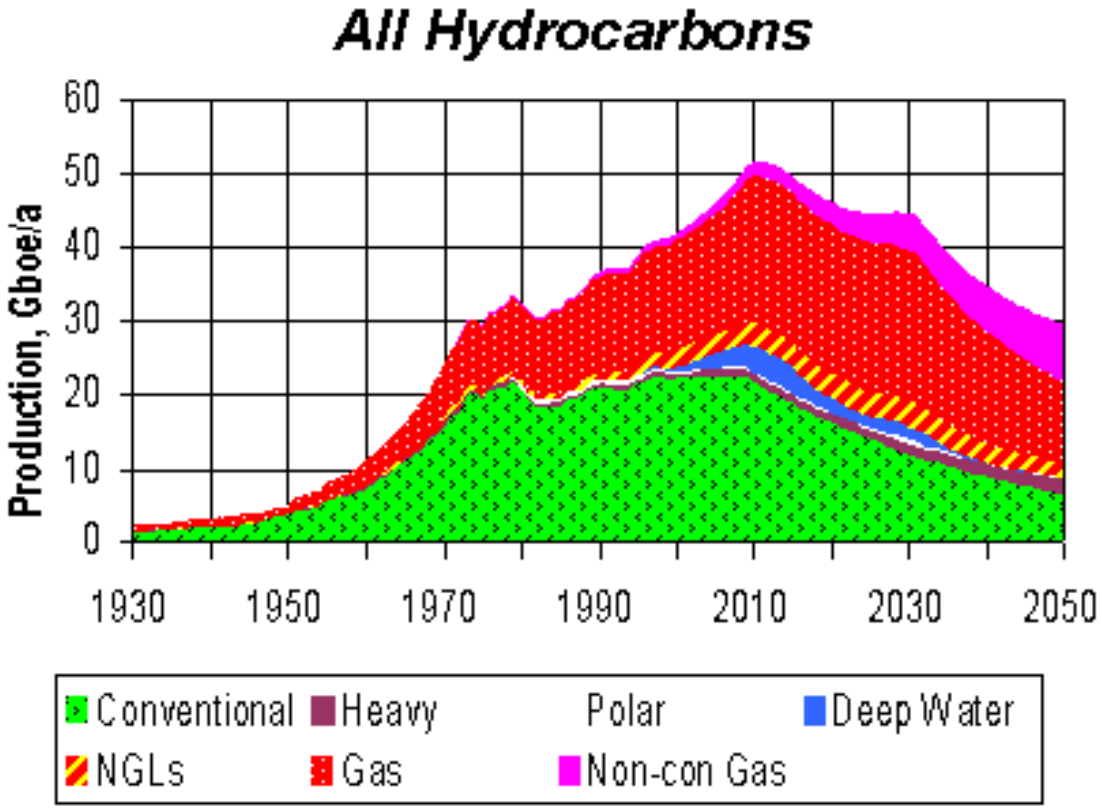

Figure 1

In the case of fossil fuels there is a second factor to be considered. That is the rate at which the products of combustion and in particular the carbon dioxide can be absorbed by photosynthetic and other "earth chemistry'.

Right now we have three factors to consider
1) We have built a civilization which has become heavily dependent on oil (and natural gas)
2) Our present rate of use of this energy source is such that the limitation of the accumulated resource is apparent and we are very close to (or maybe just past) the peak
3) The rate of production of carbon dioxide is such that the atmospheric concentration is rising to the point where it is significantly influencing the so-called greenhouse effect and this in turn is leading to global climate changes which are becoming intolerable to many of the life forms on the planet (including humans).

A fourth significant factor in human behaviour is that we have become "homo economicus" and have developed a civilization in which success is measured by growth of activity of all kinds including the exploitation of our energy resources.

The main problem is that a bit over 100 years ago we came upon that treasure chest of liquid hydrocarbons (oil) and proceeded to develop a civilization based on three principles.

1) Oil is king and a great deal of our technological and economic development is based on it (and natural gas)
2) the only way is UP (growth is good)
3) there exists a place called "AWAY" where we can dump the "waste" products of our activities.

But the free lunch is coming to an end.

Unfortunately all these premises are wrong:

1) oil is limited
2) material resources are limited
3) there is no "away"

In terms of attempting to maintain our condition we are now between the "rock" of oil depletion and the "hard place" of global warming.
Is there a way out? I believe there is and it depends on finding new (and renewable) source of energy. Commentators have touted various energy "sources' as providing the solution to our dilemma of which nuclear power, "the hydrogen economy" and the continued use of fossil fuels (coal) with "carbon sequestration". Each of these has significant complications.

The matter of growth being good has been discussed by people like Herman Daly and is summed up in the accompanying graph (Figure 2) which compares economic and uneconomic growth in terms of the utility (good results) and disutility (bad results) of growth.

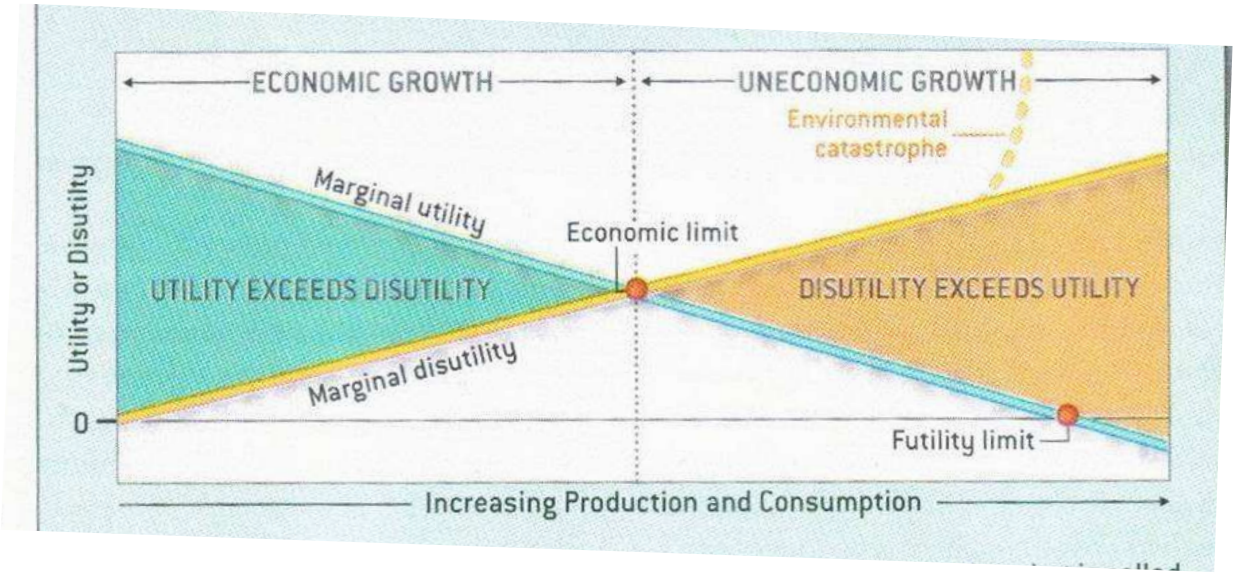

Figure 2

I believe that our energy future lies in the same place as our energy past has lain- namely the sun.

The sun satisfies most of the special interest groups:
You want nuclear energy-the sun is a big fusion reactor
You want a hydrogen economy- the sun runs on hydrogen, fusing initially to helium.
You want carbon sequestration-the end of the solar energy cycle is a white dwarf consisting mainly of carbon.

Basically the earth is a rotating heat exchanger receiving a continuous flux on side from the sun consisting of radiation that corresponds roughly to black body radiation from a source at about 5700K.

The radiation is absorbed, degraded to around 300K and virtually all is reradiated into space. The overall flux is around 10^{17} Watts which is ten thousand times the amount that humanity currently consumes (10^{13} Watts). The total solar energy falling on NZ land surface is about 10^{21} J/yr, over 1000 times our current national needs.

A small amount is used for photosynthesis and a tiny bit of this finishes up as fossil fuel.

Fossil fuels renew on a time scale of a few hundred million years at a rate that is somewhere between 5 and 100 MW. The reason we have had plenty in recent times is that it has accumulated for several hundred million years, mostly as coal.

If we assume, say 100 MW of fixation to fossil fuels for 300 million years this should give us about 3000 years of reserve. How much of this is accessible is arguable but we have only been into it for 200 years so there should be a fair bit left. The trouble with using carboniferous fuel is that we seem to be pouring carbon dioxide into the atmosphere faster than it can cope.

So why don't we use the sun's energy in a more direct manner.

The flux of solar energy (worldwide) is about 10 000 times what we use so we shouldn't really need to be all that clever to harvest enough for our needs.

How do we in New Zealand already use sunshine?

Our economy is already very heavily solar based.

We grow grass and convert it to milk, beef, lamb, and wool. We grow grapes to make wine. We grow trees and process them into timber, pulp and paper. Over 60% of our electricity supply is hydro generation based on water evaporated from the surrounding oceans and we are now augmenting that with wind generation also derived from off-shore solar effects

So what is the problem? The problem is that despite this massive solar input we are still dependent on fossil fuel for over 50 % of our energy supply and most of that is imported.

We still see a primary aim of our economy as growth along the lines of our present activities

I believe that a primary question we should be asking ourselves is not "how can we continue to grow the economy" but "how can we live sustainably-that is in a way minimizes our degradation of the environment. Right now our appetite is exceeding the resource and we have to face up to some tough choices; which can be summed up as:

Curb our appetite for more energy to serve trivial ends and conveniences
or
Adopt more expensive ways of harvesting the fossil energy which still remains and at the same time sacrifice more of the remaining environment.

If we do this who will decide which bits of the environment we sacrifice?

But all is not lost.

From a thermodynamic point of view, given a good energy supply and the appropriate mechanism one can do or undo anything. Indeed a large part of engineering is about devising mechanisms which use one process which occurs naturally like the combustion of a hydrocarbon to drive another which does not occur naturally like getting your car to the top of a hill

Myron Tribus (an eminent thermodynamicist) once claimed in a lecture that one can undo anything that has been done if one can devise an appropriate mechanism and provide the necessary energy- when asked "how would you unscramble an egg" he replied "just follow the rule –in this case I would feed it to a chicken".

I see our energy technology needing to shift from oil and coal dependency towards becoming more and more solar based.

So there is a third option which has two components:

1) Improve the utility of energy use with better efficiency and more appropriate matching of sources to uses

2) Adopt and develop more ways of harvesting solar energy, some of which are for the moment more expensive and difficult than continuing to use fossil fuels.

Curbing our appetite does not mean deprivation. It means not wasting energy on pointless ends (eg the lonely room syndrome), and using appropriate forms of energy for particular uses (we should by now have learned that one doesn't burn gas at 35% efficiency to make electricity to heat water at a net efficiency in terms of delivered showers of about 15%). So step one is a real conservation and efficiency effort. Many of the means are at hand. We simply need to apply them. We have talked about it long enough now: let's do it with better insulated houses better quality refrigerators and so on.

Given that one has done one's best in the way of conservation and efficiency and matching of energy source to use (eg burning wood for domestic heating and indeed for industrial heat and for electricity) one may still wish to harvest sunlight more directly for electricity generation.

Just as fossil fuel renewal occurs on a very long time scale other renewable cycles have different time scales (some with lots of fine structure). The shorter the time scale the more significant is the fine structure.

Wood is on a time scale based roughly on how long a tree takes to grow to maturity (30-600 years). Its efficiency of fixation of sunlight is about 0.1-0.5% or 0.13-0.65 Watts per square metre on a continuous 24 hr basis (NZ). That may sound bad but think of hydro power at around 1-2% based on the rain catchment area and a lot less than this based on the sunshine catchment area which is largely on the oceans surrounding New Zealand. Wood has the advantage that it is storable on a longer term basis than is water.

Cropping is on annual basis. Crops are storable and can be used to generate other fuels which are also storable. In working with biomass based systems one does have to be sure that one develops a process in which there is a net gain. Some systems in the past have absorbed more (fossil) energy in planting tending fertilizing harvesting and processing than they produce but this is not necessarily the case.

Wind is highly variable as are photovoltaics and solar thermal generation which have a regular daily variation as well as shorter term fluctuations. However all these forms have a good long term reliability.

All of the systems with short cycles and wide fluctuations need to be used in synergy with a system which has storage which can be adapted to the collection. In new Zealand we do have the advantage of storage in our hydro systems which can be used to moderate the short-term fluctuations and conversely for which the short term renewables can be used to augment the long term storage of the hydro

Solar water heating is different in that it is generally comes with its own storage and is used on the time scale on which it is collected (daily).

Nowhere have I mentioned hydrogen and/or fuel cells. Terrestrial hydrogen is NOT repeat NOT an energy SOURCE. It is a means of storage and transmission that has to be generated from other real energy sources. Hydrogen is rather less useful in solving our future energy problems than is a goodly supply of copper wire. Fuel cells are about as useful as high loss transformers.

So the picture I would like to see for our energy future is:

a) a major increase in good domestic energy design many of the requirements for which are incorporated in the building code (but not prescriptively) .There is a whole package here which by my calculation could knock about 40% off the average energy consumption of existing houses and up to 60% off the average domestic energy consumption of most new houses.
b) a significant increase in energy savings in industry using "waste" energy both in terms of direct energy recovery and the use of combustible "wastes' in such places as forestry products processing and co-generation in all large and medium fuel users
c) a gradual uptake of highly energy efficient vehicles
d) a rapid shift to bio-fuels for the existing fleet starting with the use of low value by products such as tallow and waste vegetable oils
e) a gradual but not too gradual shift to "farmed" biofuels for diesel and alcohol
f) a rapid uptake of wind generation to the limit which is consistent with the buffering capacity of the hydro system.
g) A gradual growth of small scale distributed energy from such things as PV again in conjunction with things like wind. Planning is needed here to maximize synergies and ensure that one does not pre-empt the other.

We need first to put together the plan (and here I must express my doubts about the efficacy of the NEECS process. The last NEECS did not really take us very far .
We need more than a strategy. We need a strategy AND an action plan AND the political will to implement it. Promoting exploration for more gas and oil is counterproductive because it only causes more problems at the sink end of the energy chain.
I would like to see a study of our needs in terms of ENERGY SERVICES which starts by examining our needs then the possible energy sources which will satisfy those needs then the amounts of those sources available to us and the conversion processes and finally comes up with the overall plan for the transition from where we are now to a sustainable energy future.

The use of coal as a future fuel or even as a transition fuel is dependent on the concept of carbon sequestration. My calculations based on the thermodynamics of the process suggest that this will involve a doubling of the primary energy consumption for a given useful output. The rest has to go into the energy needed for the sequestration itself. Moreover I have serious doubts that world-wide and particularly in New Zealand there is an appropriate "AWAY" to put the carbon dioxide. In our case the likely places are too far from the coal sources.

News from UoA C&M Engng For SCENZ Newsletter February 2006

Compiled by John Chen with assistance from others.

Merv Jones(C&M 1969-first batch of C&M Graduates; PhD, also C&M, 1976)

"TOP 100 Australia's Most Influential Engineers"
(Extracted from *Engineers Australia*, p. 46, June 2005)

Merv Jones, 58, Managing Director of URS Asia-Pacific, Sydney

A chemical engineer from Auckland University, Dr Merv Jones heads up the regional management of San Francisco-based URS Corporation.

URS provides planning, design, environmental and construction services to public and private clients worldwide. The firm has about 27,500 employees, of which 1000 are based in the Asia Pacific offices in Australia, New Zealand, Singapore and China.

He has led the firm through the past few years from a predominantly environmental consultancy (based on the predecessor firms of Woodward Clyde and Dames & Moore) into a broader mix of environmental and other engineering services.

"This means that URS is now able to compete at a regional level with the other larger engineering consultancies for major infrastructure projects, as well as maintaining its pre-eminent position as a provider of environmental services," he said.

Jones was appointed to his present position in 2000 having managed the New Zealand operations of URS since 1996.

He is an expert in air pollution and atmospheric dispersion modelling, and pollution control technology.

Jones enjoys playing golf and stays fit by running every second day.

Professor Wei Gao - James Cook Research Fellow

Sourced from **"*Royal Society Alert 403, 9 December, 2005*"**

Wei is one of the two new James Cook Research Fellows announced in December 2005 by the Royal Society of New Zealand, which administers the Fund on behalf of the New Zealand Government. The Fellowships are for two years and are full-time positions.

Engineering Sciences and Technologies: Professor Wei Gao FRSNZ, Department of Chemical and Materials Engineering, The University of Auckland, for research entitled "Nanostructured porous oxide films and their applications".

The James Cook Research Fellowships are awarded to "forward thinking" researchers who will make a significant contribution to New Zealand's knowledge base. The Fellowships allow them to concentrate on their chosen research for two years.

The Fellows are selected by the James Cook Research Fellowship Selection Committee, chaired by the Governor-General, Dame Silvia Cartwright.

Associate Professor Neil Broom - Sustained Excellence in Teaching

We have previously reported the above University of Auckland award to Neil. The Award was formally presented to Neil at the Graduation Ceremony on 2 May 2005. The following citation was published in the Autumn 2005 Convocation for the Conferment of Degrees and Awards of Diploma booklet.

"Associate Professor Neil Broom is one of the most respected lecturers in the faculty of Engineering. He joined the University in 1989 as a Health Research Council Fellow, and in 1996 he took up a teaching position. Since that time, he has been a regular recipient of teaching awards as voted by undergraduate students. These include two Faculty of Engineering Distinguished Teaching Awards.

Associate Professor Broom's lectures are thoroughly prepared, well-structured and easy for students to follow. He employs innovative methods in his lectures to explain complex issues in a simple and interesting manner that captivates students' attention and allows them to enjoy and understand each lecture. He is able to engage and maintain students' interest and involve them in active learning process. Students always appreciate Associate Professor Broom's humour and ability to put the whole class at ease.

Associate Professor Broom's teaching is underpinned by continuing research. He has also supervised many students at Master's, Doctoral and Postdoctoral levels."

Peter Munro(C&M 1972)

The following is from **"*Royal Society Alert 384, 28 July, 2005*"**

FONTERRA DAIRY SCIENTIST WINS PRESTIGIOUS AWARD

Fonterra dairy scientist Dr Peter Munro FRSNZ has become the sixth New Zealander to win the American Dairy Science Association's highest research and development award for his contribution to the industry.

Dr Munro, Fonterra Dairy Cooperative Group's general manager planning and integration, was presented the 2005 Danisco (formerly called Marschall Rhodia) International Dairy Science Award in Ohio, USA yesterday.

The award, established in 1980, recognises outstanding accomplishments in research and development outside the USA and Canada in chemistry, biochemistry, microbiology, technology or engineering in the dairy foods industries.

Fonterra's Director of Innovation Bob Major says the award is a tribute to Dr Munro s outstanding contribution to the New Zealand dairy industry and to dairy science internationally.

A graduate of The University of Auckland with a Bachelor of Engineering (First Class Honours) in chemical and materials engineering, Dr Munro completed his doctorate at University College, University of London in 1976. He is a Fellow of the Royal Society of New Zealand, a Fellow of the Institution of Chemical Engineers (UK) and a Fellow of the New Zealand Institute of Food Science and Technology.

In 1996, he was appointed an Honorary Professor, chemical and materials engineering, at The University of Auckland, and in 1998 Adjunct Professor, Institute of Food, Nutrition and Human Health, Massey University.

Richard Beal (C&M 2004)

We have previously reported briefly on the award of a Rhodes Scholarship to Richard. The following is from:

The University of Auckland News (Web): *Rhodes Scholar from Auckland, 8 December 2004*

Richard Beal, an engineering graduate from The University of Auckland, is one of the three Rhodes Scholars from New Zealand selected for 2005.

He joined the illustrious list of New Zealand Rhodes Scholars following a selection meeting held at Government House in Wellington yesterday.

Tenable at Oxford University, Rhodes Scholarships constitute the pinnacle of achievement for university graduates wishing to pursue postgraduate study at one of the world's leading universities. Fourteen of the 36 Rhodes Scholars selected over the last 12 years have been from The University of Auckland.

Richard Beal is an engineering graduate who is described as an excellent, all-round, high achieving scholar with strong sporting interests, cultural and community involvement.

A former dux of Rosehill College, he gained an A plus grade in a university calculus paper while still at secondary school, before achieving an outstanding Bursary examination result.

At The University of Auckland, Richard won many scholarships and awards and spent a semester in 2003 at the University of California, Berkeley, as a result of one such achievement. Badminton is his sport, both as player and coach, and he has been a member of a Slazenger Cup-winning Counties Manukau team as well as being selected for the NZ Universities' Men's Badminton Team. Richard's cultural interests span acting, debating, public speaking and music.

He is a member of the University choir Campus Cantoris and completed several music courses as part of his studies. At Oxford, he intends undertaking a DPhil in the Department of Materials Science with a focus on sustainable technologies.

Professor Wei Gao

Professor Wei Gao won his 2nd Marsden Grant on electronic materials research, and has also been awarded a NERF grant and a RFI grant for piezoelectric materials and light alloys in 2004. He (either with the UoA/SoE delegates or himself) visited several top universities in the Eastern Asia region including Beijing, Tsinghua, Zhejiang, Fudan, NUS, NTU and Tohoku Universities, and established research and academic exchange relations with these universities. He has been invited to sit in the Editorial Boards of prestigious journals "Oxidation of Metals" and "Materials Transaction", and has also been invited as an Honorary Professor for The University of Science and Technology Beijing, Wuhan University of Chemical Engineering, and Lanzhou University of Technology in China.

Professor Dong Chen

The following is from: ***The University of Auckland News (Web),*** *Hood Fellow to cement research links with China, 01 June 2005*

Research and teaching links between The University of Auckland and China will be further cemented with the award of a 2005 Hood Fellowship to chemical engineer Professor Xiao Dong Chen, a world authority on food and bioproduct processing.

Professor Chen from the Department of Chemical and Materials Engineering in the Faculty of Engineering, is one of four 2005 Hood Fellows announced by The University of Auckland today.

The University's Vice-Chancellor, Professor Stuart McCutcheon, said the selection criteria for Hood Fellows, who must be international leaders in their fields, were extremely demanding.

"Each of this year's Fellows has made major contributions to global knowledge and is a worthy recipient of this award. The University - and New Zealand - benefit enormously from enabling its top scholars to travel overseas to further their work and, in turn, by hosting leading academics from abroad," he said.

The Hood Fellowships are the second to be awarded by the Hood Fund, a $5.27 million endowment, supported by the Lion Foundation, the Woolf Fisher Trust, Mr Douglas Myers and other prominent business leaders in Auckland and overseas to acknowledge the achievements of the former Vice-Chancellor, Dr John Hood. The annual fellowship programme was established to bring the best intellectual talent to Auckland and to enable Auckland's top academics to advance their work at leading overseas institutions.

Professor Chen will use his Travelling Fellowship to his native China to advance collaborative research on transport phenomena in microstructures at China's Tsinghua University, the country's top engineering and technology university. He will also develop a new collaborative programme between The University of Auckland and the China Agriculture University in Beijing, the country's most prominent agricultural engineering university. The research programme, which will be funded by the China Agriculture University and the Chinese Government, will focus on development of rigorous food manufacturing and safety processes, and biomaterial engineering.

Professor Chen, will also visit Plasma and Ion (P&I) in Seoul to discuss applying the company's novel hydrophilic polymer surfaces to food industry processes in New Zealand.

Professor Chen is widely regarded as a leader in his field and was the founding academic for the establishment of the food and bioproduct processing research cluster and associated laboratories at the School of Engineering. He holds a Personal Chair in Chemical Engineering at The University of Auckland and is the Professorial Principal and Inaugural Chair of Strategic Development at the Riddet Centre of Food Research, a Joint Centre of Excellence between Auckland, Massey and Otago Universities.

He has made significant contributions to industrial applications in many areas including food powder technology and spray drying, industrial fouling and cleaning, freeze concentration system design and operations, flavour compound detection, removal and analysis, and microstructural analysis and structure engineering of food.

He has authored or co-authored about 190 journal publications and 150 conference publications. He has also invented a number of technologies which are being commercialised.

He is a Fellow of both the Royal Society of New Zealand and the UK Institution of Chemical Engineers, president of the Food Engineering Association of New Zealand and a senior member of the American Institute of Chemical Engineers. Professor Chen is on the editorial boards of five international journals. He is founding editor of the International Journal of Food Engineering *powered by Berkeley-e-Press (USA), and this year was appointed as a new international editorial board member of* Comprehensive Reviews in Food Science and Food Safety *published by the Institute of Food Technologists (USA). He is also the Subject Editor of* Heat and Mass Transfer for Transactions of Institute of Chemical Engineers (Part A) *(UK).*

Scott Carpenter (C&M 1996)

It is with great sadness to hear that Scott died as the result of a motor accident on the 5th of January this year. He will be sadly missed by all those who know him. After graduation, Scott worked for Genesis Power at Huntly Power Station as a graduate engineer for 2.5 years. He then went to London for the big OE where he got into accounting! On returning, Scott studied for an Advanced Diploma in Information Systems at Manukau Institute of Technology, after which he got a job in 2001 as a Systems Analyst with Peace Software in Auckland. In 2003 Peace sent Scott to a client site in Toronto where he stayed until last year when he started out on his own. Scott had just finished designing a Dog Management System for Manukau City Council!

A bunch of 2000/01 C&M Grads who are all living in Melbourne working in Oil and Gas, obviously enjoying themselves in this picture taken one Saturday evening in May 2005.

From Left to Right: Adam Morris (ex ExxonMobil, now with Woodside as a Project Scoping Engineer for their Goodwyn asset), Sri Swaminathan (ex-Schlumberger, now Shell Geelong Refinery), James Bullen (ExxonMobil Australia) and Dominic Miocevic (ExxonMobil Australia), Nigel Smith(ExxonMobil Australia). Others in the same group who are in Oil and Gas include Narik Basmajian (Technip in UAE) and Wei-Jian Kong (Shell in Denmark)

Nigel Smith (C&M 2000)

Nigel (see picture above) is with Esso Australia working at Long Island Point as Surveillance Engineer. Nigel has been with ExxonMobil in Melbourne for four years now. For the first 2 years, Nigel was in fire and safety. This is followed by 2 years in a process engineering role at an LPG fractionation plant 1 hr south of Melbourne. Nigel is currently working on product quality.

Alan Raine (C&M 1984)

Alan has been working for Davy Process Technology based in London for some 15 years now and he is a Senior Principal Process Engineer, designing and commissioning plants for producing methanol, LP Oxo, Butane Diol (BDO), Natural Detergents Alcohols (NDA) to name the biggest ones. Alan is currently on assignment in Trinidad heading the licensor team starting up the largest methanol plant in the world (flowsheet = 5400 tpd) for MHTL. "*For me it was a real buzz seeing the original design calcs for Motunui in our office, which we used for our design project at university*".

Pretesh Patel (C&M 2001, and PhD candidate) and Associate Professor Margaret Hyland

Pretest Patel and Margaret Hyland are winners of this year's TMS Light Metals Carbon Award for their paper presented at the TMS Annual Conference in San Francisco in February 2005. The full reference of the paper is:
P. Patel, F. Hiltmann and M. Hyland, "Influence of Internal Structure on Behaviour During Electrolysis Part I and Part II", Light Metals 2005, TMS (The Minerals, Metals & Materials Society), 751-765, 2005

Philip Webster (C&M1972)

Philip is now Head of Mathematics at the American Community School in Cobham, Surrey, England.

Toni Ireland-Hay (C&M 1996)

Toni resigned from her position as Specialist Refractory Engineer with Comalco Research and Technical Services after working for them for four and a half years. She joined Hatch Associates in June as a Process Engineer based in Melbourne.

Warren Churchill(C&M 1988)
Warren is now in Perth working for Genesis Oil & Gas Consultants Pty Ltd as Senior Consultant.

Richard Stretton (C&M 2001)
Richard has recently resigned from his position as process technologist for Fonterra Te Awamutu after working with them for 3.5 years and started out on his OE to England in June 2005.

Deborah Woodward and Chris Shortt (Both C&M 2002)
Deborah and Chris got married in April 2005 and spent their honeymoon in Fiji. All the very best for the future to Deborah and Chris.

Nathaniel Barling (C&M 2003)
Nat is currently working with Westfalia Separator NZ Ltd, the local subsidiary of Westfalia Separator AG, the German separator and decanter manufacturer. Westfalia Separator is part of the GEA process engineering group, which includes sister companies Niro, Tuchenhagen, WestfaliaSurge, Grasso, amongst others. Nat only started about 6 months ago and in a trainee role, working with the sales engineers. Previously, Nat was working in a sales role for a chemical trading company however I found that he was not using his degree in any way.

Niloshree Mukherjee (C&M 2002)
Niloshree is Environmental Officer with New Zealand Dairy Foods Ltd in Takanini.

Bobbi Wong-Nash (C&M 1990)
Bobbi is Market Technologist, PLYCOSELECT, Penrose.

Dave Wrightson (C&M 2003)
Dave is working as a Materials Engineer with HERA, NZ Heavy Engineering Research Association, in Manukau City.

Amelia Rentzios, Sarah Johnson and Michael Burns (C&M Final Year 2005)
The following is from New Zealand Herald 23.09.05

Students cook up biofuel future
By Anne Beston
Waste cooking oil from Waiheke restaurants is helping to power a diesel engine at Auckland University, in a project that could give the island its own biofuel by next year.
Three students have been testing a 500cc single-cylinder Lister engine using a blend of cooking oil and diesel.
The joint project involves the Waiheke Waste Resource Trust and Auckland University.
The engine uses slightly more of the 50/50 oil and diesel blend than conventional diesel for the same power output.
But, more importantly, initial tests showed it emitted fewer atmosphere-polluting gases.
Amelia Rentzios, 22, said the high cost of petrol and the emission of greenhouse gases by diesel meant the project, under the university's Engineering Projects in Community Service programme, was satisfying to work on.
"I definitely think alternative fuel is the way to go."
Sarah Johnson, 22, said this early stage of the project would be followed by development of a plant to start producing enough biofuel to power some machinery at the island's transfer station.
Waiheke Waste Resource Trust spokesman George Blanchard, a former mechanical engineering lecturer, hoped diggers and other machines at the station would be running on the biofuel by next year.
It cost Waiheke restaurants $25 a drum to get the oil off the island, he said, but restaurants on the mainland were being paid $5 a drum for theirs.
"I reckon it's a win-win if we can turn it into something useful and it's a cost saving."
Transport Minister Pete Hodgson said last month that the Government hoped to have biofuels on sale at the pump by 2008.

AMDP 2005 Conference (Advanced Materials Development and Performance), 10-13 July 2005

We have already reported on this conference. The following is from *The University of Auckland News (Web), Auckland hosts international materials conference,12 July 2005*

Common problems which plague a range of industries will be the focus of the 4th International Conference on Advanced Materials Development and Performance (AMDP 05) at The University of Auckland from 11-13 July.

The conference, which has in the past been hosted by The University of Auckland (1997), The University of Tokushima, Japan (1999) and the Kyungpook National University in Korea (2002), is this year being hosted again by The University of Auckland's Faculty of Engineering.

Head of the Department of Chemical and Materials Engineering Professor George Ferguson says a wide range of topics will come under scrutiny, including advanced alloys, surface coatings, electronic materials, polymers and composites, mechanical properties of materials and nanotechnology.

"Materials science and engineering plays a crucial role in advancing the research and development sector in a modern economy. This is evident with materials research becoming more applied and responding to the needs of industry.

"For example, one of the topics to be discussed at the conference is fatigue or failure by repeated stress in materials. This is a serious problem and we have dedicated a session to hear from experts who have looked at the issue in different industrial settings."

More than 250 researchers have registered for the three-day conference and Professor Ferguson says presenters are leading researchers in the advanced materials area.

A full list of speakers and the conference programme can be viewed at: http://www.amdp2005.auckland.ac.nz/

Professor Geoff Duffy was convenor of Leaky Building Symposium, 18-19 July 2005

The following is from ***The University of Auckland News (Web),*** *Auckland hosts leaky building symposium, 14 July 2005*

The symposium aims to increase the understanding of moisture transport in building walls, present research from leading international experts on weather tightness, and offer practical solutions for homeowners and industry to deal with current problems and improve future building construction strategies.

The two keynote speakers are internationally acclaimed Canadian building moisture experts Dr John Straube and Dr Joe Lstiburek, who will offer their latest research findings and experience as well as a global perspective of the leaking buildings syndrome and how it is affecting countries around the world.

Symposium convenor Professor Geoff Duffy from the University's Faculty of Engineering says that many New Zealanders are affected by the leaky buildings syndrome in some way.

"The primary objectives of the symposium are to lay a strong platform of truth on technical issues associated with water ingress and removal from walls and subsequent wood decay, provide strong evidence from case studies here and overseas to assist in establishing clear design, building and maintenance strategies, and show that measurements must be made to ensure the ongoing monitoring and maintenance," says Professor Duffy.

"Without quantitative data obtained at the worst trouble spots, there will be the ongoing generalised opinions that confuse the whole issue. Wood is a sensitive biological material and is a feedstock for fungus and other mould growth if moisture levels remain high.

"There is no single cause and no single solution. We need to work together (industry, researchers, government departments and home owners) for the best possible outcomes for our community."

Professor Duffy says the symposium will increase awareness of best practice from international research and offer practical solutions that people can implement if they have a leaky home.

"New Zealand needs a method of managing the current stock of defective buildings. Some are deteriorating in just a few years but some are 20+ years old with treated wood.

"There is only a 10-year period where those accrediting, designing, and building a house can possibly be held accountable. We need to look at the whole question of maintenance and remediation if we want houses to last their intended and expected 50 years."

Professor Duffy says people looking to fix their own homes will find excellent insights into how they can measure, monitor, manage and maintain their homes to give them a greater sense of security in the current state of events.

"Re-cladding totally may not be the answer once the local 'hot spots' are measured and assessed."

A full list of speakers and the symposium programme can be viewed at: www.cce.auckland.ac.nz/conferences

Welcome to our New Members

Brent Young – University of Auckland
Antony Williams – Engineering Consultant, Process Design
Scott Henderson – Sinclair Knight Merz

Department of Chemical and Materials Engineering Accreditation

The Chemical and Materials Engineering Degree was reviewed for accreditation by IPENZ and IChemE in November 2005. The final reports from both institutions are yet to be presented.

SCENZ Subscriptions – 2006

- Subscription renewal invoices will be sent out shortly to SCENZ members*. The delay in sending these has been due to the need to overhaul the Society's member database, which has now been completed. We apologise for any inconvenience caused to members for this delay.

  * SCENZ members who are not also financial members of IChemE.

- To streamline administration processes we intend, where possible, to distribute future subscription notices to members by e-mail. This method has already been successfully employed for sending subscription receipts, the Society's newsletter and advice of forthcoming events of interest to members. For members who are not "on-line" we will naturally continue with postal communication. Because of the database overhaul, some of our members without e-mail may not have received Newsletter No 121. The secretary apologises to anybody who may have missed out and will gladly send copies on request.

The Society of Chemical Engineers New Zealand Incorporated

Affiliated to The Institution of Professional Engineers New Zealand & The Institution of Chemical Engineers United Kingdom

APPLICATION FOR MEMBERSHIP

Membership is open to Professional Engineers, Scientists, and the others interested in Chemical Engineering

Title: (e.g. Dr, Mrs, Mr, Miss, Ms): _____ **Family Name:** _____

Initials: _____ **Preferred Given Name:** _____

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JOB DESCRIPTION: A brief description of your job and the nature/name of the organisation to which you belong

_____

_____

DECLARATION:

I believe myself to be a proper person to be elected a member of the Society Chemical Engineers New Zealand and do hereby promise that, in the event of my election, I will be governed by the Rules of the Society for the time being in force, or as they may be amended, and that I will promote the objects of the Society as far as may be in my power.

Signed:_____ **Date**_____

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**Note that SCENZ membership is automatic and free to all financial members of IChemE.*

Please send information on IChemE Membership Class: ☐ Affiliate ☐ Associate ☐ Member ☐ Fellow

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Telephone: +64 03 942 1902, Fax: +64 03 942 1999, Email: scenz@canterbury.ac.n