Climate change: let's not confuse likelihood with consequence – or why I reluctantly support the carbon tax

The specifics of Australia's carbon tax were recently released. Many Australians will now need to answer some tough questions. For example, what is the probability that climate change is real? What is the economic impact of the carbon tax on Australia, my family and me? What are the long-term consequences of not doing CO_2 abatement? At the next election should I vote for a party that wants to reverse the carbon tax?

Let me share with you my view of the climate debate and the carbon tax. Many geoscientists – myself included – are 'grumpy' with climate models that predict climate change due to anthropogenic CO_2. There are emotional and rational parts to this grumpiness. The emotional part is that we feel ignored. The climate modeling community – and the public in general – have tended to ignore the very relevant input geoscientists could and should have to the climate debate. Climate modelers are predicting global warming and sea level rise in the mid-term (5–100 years). Geoscientists have an intellectual ownership of long-term climate and sea-level data that should be included in any discussion and validation of climate models. But the climate modelers and public ignore us.

What is the rational part of the geoscientists' grumpiness? We know that over the long-term (geologic time scale) our planet has had many swings in CO_2, temperature and sea level far larger than changes predicted by mid-term climate models – and those swings occurred without anthropogenic influences. We also know that because of Milankovitch cycles, our climate is nearing the end of a warm period and will soon (in geologic time) return to its normal colder state. And we know that mid-term geologic and climate processes are very complex and therefore difficult to model accurately. For these reasons the *likelihood* that the warming climate models are correct is – in my opinion – at best 50%.

But the *likelihood* of climate change should not be confused with the *consequences* of climate change. The predicted consequences are more extreme weather like the recent floods, tornadoes, heat waves and fires seen in Australia, Europe and North America ... but if the climate is warming, these severe weather events will increase in frequency and severity. The consequences of climate change include loss of crop land, food shortages and population relocations (more boat people). As mentioned above, I think the likelihood of these events becoming worse is less than 50% – but due to the severity of these consequences, I am willing to pay a price to protect against them. And this is why I support the carbon tax.

Above, I have discussed likelihood and consequence of climate change. But there is another issue: the cost associated with achieving CO_2 abatements. The carbon tax kicks off with a cost of $23/tonne in 2012, but the plan is to switch over to an emissions trading system (ETS) in 2015. Under the ETS the total permitted amount of CO_2 Australia can emit is lowered each year and polluting companies will need to purchase ever more limited CO_2 emission permits at government-run auctions. ETS plans rely on technical innovation and financial investment by third parties to curb CO_2 emissions. ETS plans would seem to have a very uncertain cost – for example, can we safely assume that our ETS scheme will foster new technologies that economically lower CO_2 emissions? Below I discuss some reasons why there is optimism on the ETS cost front.

Peak Oil: petroleum geologists have been predicting since the 1950s that the world will run out of oil. Oil production in certain parts of the world – most notably North America and Europe – has already 'peaked' and is now in decline. Over the next 20–100 years, the world will suffer from decreasing oil supplies and from increasing demand due to growing third world economies. The world will need to develop alternatives to petrol and diesel fuelled transportation. The most likely alternatives are electric or hydrogen or compressed natural gas powered vehicles – all of which emit less CO_2 than petrol. This search for alternatives to oil will certainly have a cost, but because of peak oil, this cost is inevitable. We will pay for this cost with or without a carbon tax and ETS.

Coal and the shale gas 'revolution': natural gas-fueled electricity plants generate about half as much CO_2 as coal-fired electricity plants. Why aren't all power plants powered by natural gas? Consider the dilemma of an electricity provider in North America that needs to build a new power plant (and Australian operators have faced similar issues). Electricity companies and regulators prefer to build gas-fired plants because they are cheaper to build and cleaner to operate than coal-powered plants. But the price of gas in North America over the past 10 years has had wild swings between $2/MMBTU and $13/MMBTU – so coal has been the chosen fuel. But now the shale gas revolution in North America has added 200 years of additional gas supply to the North American market and stabilized the price at $3–4/MMBTU. Similarly, in Eastern Australia, coal seam gas supplies have grown by a tremendous amount in the past five years and a recent well in the Cooper Basin by Beach Energy hints that Australia's shale gas supplies could also expand like North America's. This expansion of Australia's natural gas supplies – combined with an ETS scheme – can minimize the cost of CO_2 abatement.

My guess is that most of the politicians in Canberra are very aware that the fastest and least expensive path to significantly reducing our CO_2 emissions is to switch from coal to natural gas. They wish to drive us in that direction but are reluctant to publically emphasise that gas should or will replace coal because that statement would alienate key constituencies, i.e. organized labor associated with coal mines and environmentalists that want coal to be entirely replaced with solar and/or wind power.

So Australia's coal industry is likely to suffer the most under the carbon tax. But the coal industry and coal workers have some room for optimism: the emerging technology of CO_2 capture and sequestration (CCS). Australia is one of the world leaders in studying CCS and has a demonstration project underway in the Otway basin. There are some estimates that CCS will cost between $25 and $50/tonne of coal (see the most recent AAPG Explorer). With a carbon cost starting at $23/tonne and increasing under an ETS plan, within a few years it becomes cheaper for coal-powered utilities to pay for CCS than to pay the carbon tax.

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In summary, I – like many geoscientists – have concerns about the accuracy of climate models. Despite these concerns I support the carbon tax. I do so because the consequences of global warming are severe, and because the cost of CO_2 abatement is not that high.

My reluctant support of the carbon tax does not mean that the ASEG, or its other officers or its members support the carbon tax. Additionally, my support of the carbon tax should not be interpreted as support for any political party.

Dennis Cooke
Email: dennis.a.cooke@gmail.com

New Members

The ASEG extends a warm welcome to 10 new members to the Society (see table). These memberships were approved at the Federal Executive meetings held on 29 May and 30 June 2011.

Name	Organisation	State	Member grade
Drew Allan Breen	Moultrie Database and Modelling	QLD	Active
Richard Barnwell	Terrex Seismic	QLD	Active
Fargana Exton	Schlumberger Oilfield Services	WA	Active
Andrew McMahon	Geodynamics	QLD	Active
Alison Carol Langsford	University of Adelaide	SA	Student
Timothy Jones	Geoscience Australia	ACT	Active
Romney Rayner	Coffey Geotechnics	NSW	Active
Roger Miller	Fugro Airborne Surveys	WA	Active
Jonathan Fairlie Ross	Heathgate	SA	Associate
David Ronald Tassone	University of Adelaide	SA	Student

We would also like to welcome **Terrex Seismic** as a new corporate member of the ASEG. The Terrex group provide onshore 2D and 3D seismic acquisition, contracting and spatial services. With over 30 years of domestic and international experience, Terrex utilise a variety of acquisition techniques including vibroseis and dynamite shot-hole operations to provide geophysical exploration and data capture on behalf of oil and gas companies, CSG, shale gas, coal and mineral exploration companies and government agencies.

Terrex Seismic is supported by two additional business units to address industry demand for a 'one stop shop' of seismic acquisition services. These are Terrex Contracting (TC), which completes seismic line preparation and restoration and Terrex Spatial (TSp), their surveying branch administering requirements for their 2D and 3D seismic programs. Terrex Spatial also offers a full range of surveying services to mining, local council and engineering clients including LiDAR aerial surveillance, GIS Applications, Geodetic Control Surveys, Gravity Surveys, Pipeline Routing, DCDB (Digital Cadastral Database) Updates and As-built Surveys.

Terrex Seismic have completed more than 600 programs, investing in the latest equipment and most experienced people to produce quality, high resolution seismic and subsurface information across all geological formations for the following applications:

- Oil, Gas, Coal Seam Gas, Coal and Minerals Exploration
- Groundwater Mapping
- Underground Carbon Storage Projects
- Vertical Seismic Profile
- Microseismic Monitoring
- Research Seismic including Regional and Deep Crustal Mapping

Terrex HQ is located in Perth, with operations administered from Brisbane. The Terrex fleet of seismic vibroseis equipment ranges from low environmental impact 15 000 lb Peak Force 4x4 Buggy 'EnviroVibes' through to 62 000 lb Peak Force 4 × 4 Buggy Vibrators. They complete programs in tough and diverse terrain, with heliportable and shot-hole dynamite operations, six Terrex seismic crews, two Terrex contracting crews and nine Terrex (TBC) spatial surveying crews, complete with full support vehicles and on-site camp accommodation.

For more information, go to http://www.terrexseismic.com.

Release of journal Impact Factors

Exploration Geophysics' editorial board and authors can be very pleased with the latest international rating.

International recognition for academic journals is difficult to achieve and is measured by an Impact Factor (IF). The ASEG joined a fortunate group when the journal received its first rating last year. In late June of this year the journal received a rating of 0.619. This is a major boost, a rise in IF of 53% in only one year.

The journal citation report is calculated by Thomson Reuters and is based on the average number of times published papers are cited in academic literature for a period after publication. Impact Factors have a huge influence on the way published scientific research is perceived and evaluated.

The number of papers submitted to *Exploration Geophysics* is also steadily increasing, with submissions in the first half of 2011 numerically two-thirds of the submission for 2010. *Exploration Geophysics* shows every indication that it is entering into a virtuous cycle, in which improving citation rates lead to more submissions, which lead to a better publication, which leads to improving citation rates.

Preliminary calculations suggest *Exploration Geophysics* will track higher still next year. The journal is now sitting ahead of *Applied Geophysics* (IF 0.38), while *Marine Geophysical Research* (IF 0.76) and the *Journal of Environmental and Engineering Geophysics* (IF 0.84) are not far ahead in the ratings.

The Editor-in-Chief of *Exploration Geophysics*, Mark Lackie, said, 'We are delighted that the successes of *Exploration Geophysics* have been acknowledged in this way. This result will further endorse the journal as a worthy place for quality research in applied geophysics, and ensure that we will attract high quality authors and reviewers'.

Richard Hecker

Nominate a colleague for an ASEG Honour or Award for 2012

An important role of the ASEG is to acknowledge the outstanding contributions of its individual members both to the profession of geophysics and to the ASEG. The society has a number of different Honours and Awards across a range of categories. The next Awards are scheduled to be presented at the ASEG Brisbane Conference from 26–29 February 2012.

The ASEG awards are made through nominations of the membership at large, as well as through State and Federal executives. A list of the various available awards is set out below and all members are therefore invited to submit nominations for the next round according to the 'Nomination Procedure' set out below. Some of the awards carry considerable prestige in the eyes of the ASEG and therefore require detailed documentation to support the nomination. Please contact the Committee Chairman, Andrew Mutton, if you require further guidelines on what is required.

Recipients selected from these nominations will be presented with their award at the forthcoming Brisbane conference.

ASEG Gold Medal

For exceptional and highly significant distinguished contributions to the science and practice of geophysics, resulting in wide recognition within the geoscientific community. The nominee must be a member of the ASEG.

Honorary Membership

For distinguished contributions by a member to the profession of exploration geophysics and to the ASEG over many years. Requires at least 20 years as a member of the ASEG.

Grahame Sands Award

For innovation in applied geophysics through a significant practical development of benefit to Australian exploration geophysics in the field of instrumentation, data acquisition, interpretation or theory. The nominee does not need to be a member of the ASEG.

Lindsay Ingall Memorial Award

For the promotion of geophysics to the wider community. This award is intended for an Australian resident or former resident for the promotion of geophysics (including but not necessarily limited to applications, technologies or education), within the non-geophysical community, including geologists, geochemists, engineers, managers, politicians, the media or the general public. The nominee does not need to be a geophysicist or a member of the ASEG.

Early Achievement Award

For significant contributions to the profession by way of publications in *Exploration Geophysics* or similar reputable journals by a member under 36 years of age. The nominee must be a member of the ASEG and have graduated for at least 3 years.

ASEG Service Awards

For distinguished service by a member to the ASEG, through involvement in and contribution to State Branch committees, Federal Committees, Publications, or Conferences over many years. The nominee will have been a member of the ASEG for a sustained period of time. All nominations will be considered for the award of an ASEG Service Certificate. Where the nomination details outstanding contributions to the shaping and the sustaining of the Society and the conduct of its affairs over many years, consideration will be given to the award of the ASEG Service Medal to the nominee. Honorary Members are not eligible for nomination.

Nomination procedure

Any member of the Society may nominate applicants. These nominations are to be supported by a seconder, and in the case of the Lindsay Ingall Memorial Award by at least four geoscientists who are members of an Australian geoscience body (e.g. GSA, AusIMM, AIG, IAH, ASEG or similar).

Nominations must be specific to a particular award and all aspects of the defined criteria should be addressed. To gain some idea of the standard of nomination expected, nominees are advised to read past citations for awards as published in *Preview*. If required, proforma nomination forms are available from the Chairman, Andrew Mutton.

Nominations including digital copies of all relevant supporting documentation are to be sent electronically to:

Andrew Mutton
Chairman, ASEG Honours and Awards Committee
Email: andrew.mutton@bigpond.com.au

The deadline for applications is 15 December 2011.

ASEG News

New South Wales

In May, Julian Vrbancich, from the DSTO, gave a talk on marine seismic profiling and marine sand resistivity investigations in Broken Bay and Jervis Bay (NSW) and how that data assists the interpretation of airborne electromagnetic data for bathymetric studies. Julian explained how airborne electromagnetic (AEM) methods are being investigated as a means to determine water depths in shallow coastal waters, but that instrument calibration errors and EM noise will affect the bathymetric accuracy. In order to support this work, a marine continuous seismic (CSP) profiling study and a resistivity study of vibrocore samples of shallow marine sands were undertaken in both Broken Bay and Jervis Bay (NSW) to characterise the seabed.

In June, Clive Foss from the CSIRO gave a presentation on an Australian Database of Remanent Magnetization Anomalies – a new web-based resource for mineral exploration. Clive explained that they have started to populate the database, and are planning the facilities required to make the database available as an interactive, web-based resource. Clive explained that the key objectives are to facilitate interpretation of magnetic field data, increase reliability in developing deep drilling targets from magnetic field interpretation, and to better establish the spatial range of magnetizations related to igneous, metamorphic, thermal, alteration and mineralization events. Many questions were directed at Clive.

An invitation to attend NSW Branch meetings is extended to interstate and international visitors who happen to be in town at that time. Meetings are held on the third Wednesday of each month from 5:30 pm at the Rugby Club in the Sydney CBD. Meeting notices, addresses and relevant contact details can be found at the NSW Branch website.

The speaker for September will be Bruce Dickson who will be speaking on geophysical indicators of global climate changes.

Mark Lackie

South Australia/Northern Territory

The South Australian and Northern Territory branch has held several successful events over the last few months. On 31 May we held a networking night, inviting students to meet with industry, government and consulting geophysicists. The event was a great success, with everybody making the most of the opportunity to meet some new people.

On 14 June we welcomed the SEG Distinguished Lecturer, Andrey Bakulin. Andrey presented the talk 'Virtual Source Method for Imaging and Monitoring Below Complex Overburden'. An enthusiastic audience received his talk and many stayed afterwards to ask questions. Unfortunately due to the volcanic ash cloud from the Puyehue volcano in Chile, Andrey's flights from Adelaide were delayed and his scheduled talks in Perth were cancelled. As it was his first trip to Australia, he was lucky enough to visit Kangaroo Island and went sightseeing in Adelaide.

On 12 July, Tim Keeping from the Geological Survey of South Australia presented 'Geophysics of the Tallaringa Trough, Officer Basin'. A crowd of 25 people attended to hear Tim present his geophysics honours work. Enthusiastic discussion followed late into the evening.

Future events include the SEG/EAGE Distinguished Instructor Short Course (DISC) in August, a talk on magnetotellurics in September, our annual industry night in October and student night in November. Look out for the new wine offer adverts in this – and future – editions of *Preview*.

The SA branch holds technical meetings monthly, usually on a Tuesday or Thursday night at the Coopers Alehouse beginning at 5:30 pm. New members and interested persons are always welcome. Please contact Philip Heath (philip.heath@sa.gov.au) for further details. If you are an ASEG member and are not receiving emails please ensure your contact details are up to date by contacting aseg@casm.com.au.

Philip Heath

Victoria

On Friday 20 May, Richard Lane from Geoscience Australia provided an impressive encore of the ASEG Distinguished Lecture 'Building on 3D Geological Knowledge through Gravity and Magnetic Modeling Workflows at Regional to Local Scales' to the geoscience staff and student body at Monash University.

On Tuesday 24 May the ASEG Victorian Branch hosted the technical presentation 'Potential Field Searchlights' by Mark Dransfield, Chief Geophysicist and AGG Manager, Fugro Airborne Surveys. Drawing parallels to seismic wavefronts and TEM smoke ring diffusion Mark convincingly introduced the audience to the mental framework in which a potential field measurement is imagined to illuminate the earth in a manner analogous to a light beam. The presentation was well received and sparked a series of questions and discussions.

On Wednesday 22 June, Tim Rawling, Associate Professor at The University of Melbourne, presented 'Development of Complex Basin Management Systems from 3D Geology and Geophysics' to a large member turn-out at the Kelvin Club. With great visuals Tim showed how 3D geological models assist when managing multiple uses of Victorian basins for CO_2 sequestration, petroleum production and geothermal energy extraction. Tim also demonstrated how 3D geological models can be used, not only in basin management, but also to help explore for gold resources in Victoria.

We are looking forward to seeing many ASEG Victorian branch members at the upcoming technical meetings, social functions and short courses.

Asbjorn Christensen

Western Australia

In essence the Western Australian committee has identified the need to better our services to WA members and as a result we came up with an action plan to help us fulfill this commitment. Some of the initiatives put forward include a combination of one-day workshops/symposia and a number of field trips per year to nearby mines. We also recognized the importance of continuous interaction between academic institutions, service providers in the industry, smaller businesses and those who are employed by these parties. As a result we would like to offer our members the opportunity to meet other scientists and engineers, interact with other professionals and experience not only the workplace of others but also technologies, techniques and applications.

Furthermore we want to encourage scientists from across Australia and overseas to participate in our technical talks and workshops. We therefore extend our warmest welcome to those people who are interested to contact us as soon as possible. Our intention is to tackle this task by getting ASEG members, businesses and institutions involved and through this involvement we hope to accomplish our goals.

On an administrative level, feedback was given on the re-development of the ASEG webpage and we are looking forward to the modernised version. We understand that some of the new attributes will include functionalities to help link professionals as well as making the process of registration and updating personal information more convenient.

We would also like to remind our students of upcoming events including the student careers evening, student night and a soon-to-be social event – all of which are places where they can meet scientists or if you like 'likeminded' people. Details on ASEG's scholarship program will soon be circulated and expressions of interest from our students at this early stage are welcomed.

Riaan Mouton

Website Update: www.aseg.org.au

Have you visited our website lately?

The current website has been undergoing some improvements and much needed maintenance:

- All members should now be able to login, update their details and pay their fees online.
- Branches are now entering content about upcoming workshops and meetings.
- Job advertisements can be found under the employment section.

Corporate members can advertise for free. Other companies can advertise for a fee.

THE NEW WEBSITE is coming…

The ASEG Federal Executive has been working hard, in collaboration with PESA, to bring its members a new, exciting, state of the art website. The website is currently in the planning stages and is due to go online in early 2012. The website will be officially launched at the 22nd International Geophysical Conference and Exhibition in Brisbane and will bring to the members a powerful tool for information about the society and its events but also tools for networking, education and resources.

Contact the new webmaster, Carina Kemp, for more information on the current or planned website.
Email: c.kemp@geomole.com.