EnergyWatch

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Editor: Steve Goldthorpe

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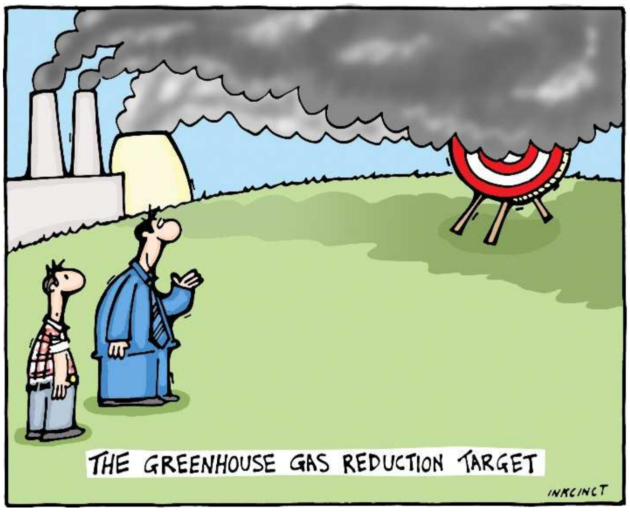
PATHWAYS TO A LOW CARBON FUTURE

Editorial

With the approach of the 21st conference of the Parties to the Framework Convention on Climate Change in Paris in December, the definition of what can be done and what the effects would be is slowly gaining some clarity. It is symptomatic of the complexity and conflicting motives surrounding the Climate Change issue that it has taken over a generation to get from the point when the world decided that something needs to be done, to having some clarity about what that "something" needs to be.



EW 74 included a 2010 example of a wedge chart showing a global Business-As-Usual (BAU) trajectory leading to 57 Gigatonnes/year CO_2 emissions in 2050, consistent with a disastrous global temperature rise of >4°C and rising, by the end of the century. That compares with the IEA Blue Map trajectory leading to 14 Gt/yr CO_2 in 2050 which could lead to a tolerable <2°C long term global temperature rise. That wedge chart showed a list of mitigation measures, all of which would need to combine to fill the gap between those two plausible CO_2 trajectories. The measures comprise: - end use energy efficiency; end use fuel switching; improved efficiency and fuel switching in power generation; renewable power generation; nuclear power; and widespread implementation of carbon capture and storage (CCS). That is a challenging shopping list. Mitigation of CH_4, N_2O etc. is a separate matter.

In the run up to the Paris summit, the International Energy Agency has produced a special report *"Energy and Climate Change"* which provides a more detailed analysis of the type, depth and location of the emission mitigation measures that need to happen globally to meet the <2°C target. That analysis defines two intermediate scenarios (INDC and Bridge) through to 2030 that would fall short of the target, and a longer term "450" scenario which would be consistent with limiting global temperature rise to <2°C.

The INDC scenario is based on the Intended Nationally Determined Contributions that have been published by May 2015 (excl. NZ's late INDC). The INDCs largely reflect the impact of measures that Governments believe they can achieve within the constraint of being politically acceptable and in line with national interests. Those measures might be termed "picking the low-hanging fruit". Extrapolation of the limited INDC measures beyond 2030 would be likely to achieve a global temperature outcome lower than the BAU outcome, but not reaching the <2°C target.

The IEA's Bridge scenario adds a number of short term measures to those of the INDC scenario. Those additional measures are more costly, more difficult, and politically uncomfortable, but are achievable by 2030. These extra measures would lay the foundation for a pathway to a <2°C warmer future, but would need additional long term measures added to build the 450 scenario (i.e. atmospheric CO_2 concentrations peaking at 450 ppm), consistent with hitting the <2°C target.

Those measures won't happen without a strong economic driver. I suggest that a universal carbon price of US$100 per tonne of CO_2 discharged to the atmosphere could provide that driver.

One of those essential additional long term measures is the widespread implementation of carbon capture and storage (CCS) technologies. In this issue of EnergyWatch I include an explanation of the practical issues with CCS, which is a topic that has been a principal focus of my professional studies since the 1980s. I also include a potential suggested radical solution to the intractable CO_2 storage component of CCS.

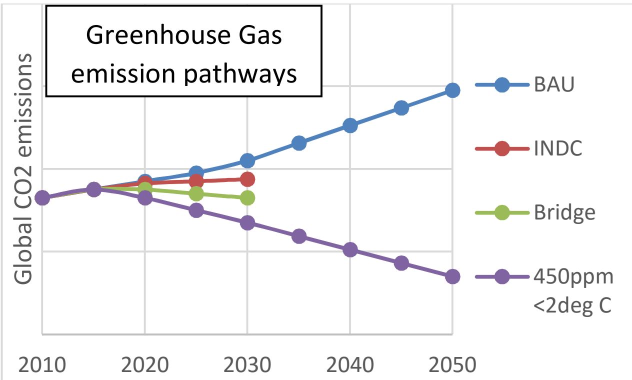
I recently attended the Australia and New Zealand Climate Change and Business conference in Auckland, convened by the Environmental Defence Society. Thankfully, the endless mis-informed mischievous banter of the last two decades about whether any anything could or should be done about the Climate Change threat was absent from that conference. Instead there was an air of concerted desire, at least from that part of the business community represented, to embrace action on Climate Change as a standard part of business planning. The plea was for political direction and certainty in New Zealand on which to build business plans.

However, I was disappointed that the conference appeared to be preaching to the converted and was largely populated by consultants and advisors, with staff from the business entities as observers. I include in this issue of EW my observations on some of the conference presentations.

This issue finishes with an update on the curious phenomenon of declining global oil prices.

This is the 20th issue of EnergyWatch that I have had the priviledge of editing. As readers will note, the content of this issue is essentially all my own opinion, which is far from ideal. I apologise for dominating this issue with my personal views on how to save the world with the help of CCS.

The membership of SEF has a wide experience in many fields, so I again appeal to SEF members to contribute articles, opinion pieces and letters to the editor to sustain EnergyWatch as a wide-ranging representation of the views of the SEF membership. *Steve Goldthorpe, Editor*



CONTENTS

CCS is a vital contributor to achieving the <2°C target

By Steve Goldthorpe

There is a mismatch between the CO_2 emission mitigation that can be achieved by politically palatable measures and the extent of CO_2 mitigation required to keep the long term global temperature rise within 2°C.

This mismatch is manifest in the Intended Nationally Determined Contributions (INDCs) that have been submitted by countries in advance of the COP 21 meeting in Paris in December. The INDCs generally reflect the expected outcomes of a range of measures that Governments believe they can implement in politically acceptable ways. Such measures are sometime referred to as "the low hanging fruit".

Under a scenario developed by the IEA[1] from the INDCs submitted by 14 May 2015 (excl. NZ) the global emissions path would be consistent with an average global temperature increase of around 2.6°C by 2100 and 3.5°C after 2200, if stronger action after 2030 is not forthcoming. In comparison, the long term global temperature rise under Business-As-Usual without any CO_2 emission mitigation action is about 5°C to 6°C.

The IEA has developed the "450 scenario" which would be consistent with limiting global temperature rise to 2°C.

The 450 scenario comprises two elements; an early "Bridge scenario" based on established technologies, supplemented later by additional measures based on developing technologies - principally carbon capture and storage (CCS), which is essential for hitting the <2°C target.

The Bridge scenario depends on five measures that are listed in Figure 1: -

- Reducing methane emissions in oil and gas production.
- Progressively reducing the use of the least-efficient coal fired power plants and banning their construction;
- Increasing investment in renewable energy technologies in the power sector;
- Gradual phasing out of fossil-fuel subsidies by 2030;
- Increasing energy efficiency in the industry, buildings and transport sectors.

Figure 1 shows that the IEA's Bridge Scenario could deliver a peak in global energy-related CO_2

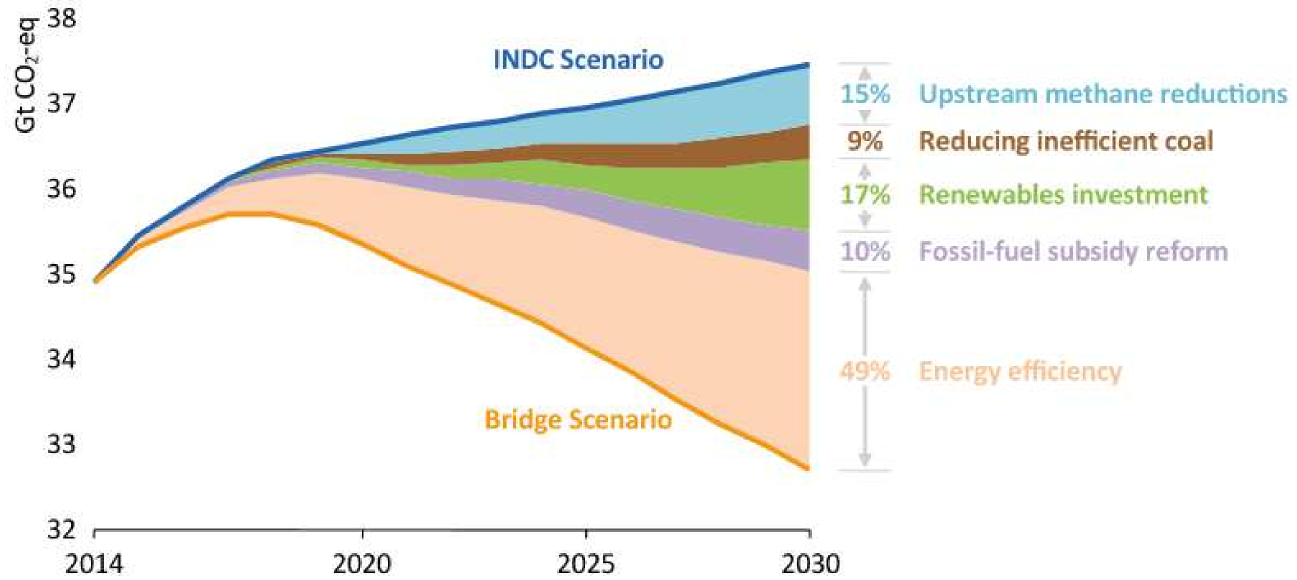
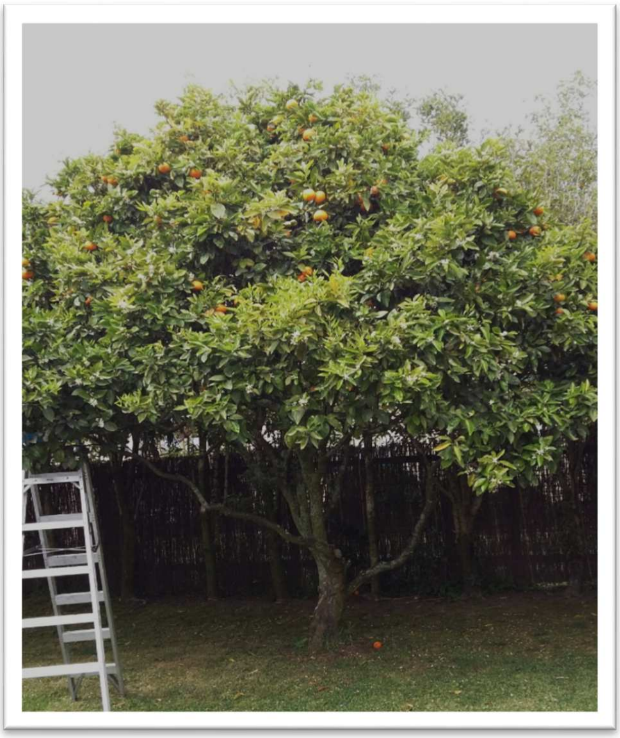


Figure 1 Global Energy-related GHG emissions reduction by policy measures in the Bridge Scenario relative to the INDC Scenario (IEA 2015)

[1] International Energy Agency, Energy and Climate Change – World Energy Outlook Special Report, May 2015

equivalent[2] Greenhouse Gas emissions by 2020 and if fully implemented by 2030 would secure long term decarbonisation of the energy sector and help keep the door open to the <2°C goal.

As each of the pieces of low-hanging fruit is picked, the remaining fruit on the tree is less easily accessed. A ladder is needed to reach it.



The Bridge Scenario measures alone, cannot provide sufficient mitigation of emissions to enable the <2°C limit to be sustainable long term.

Figure 2 shows the relative contributions to 113 Gigatonnes of additional CO_2 abatement measures between 2015 and 2040 that would be required to supplement the Bridge Scenario in order to sustain the <2°C objective under the 450 Scenario.

In economic terms, as the low-cost measures are implemented, the remaining scope for low-cost emission reduction measures (the supply), reduces. At the same time the need for emission reductions to keep on track for a <2°C future (the demand) increases. Hence, by the law of supply and demand, the carbon price must increase.

If the carbon price increases naturally, as demand outstrips supply, then the implementation of CO_2 reduction measures will occur slowly as they become economic. However, if the carbon price is set at an artificially high level early, then many CO_2 reduction measures would become economic and would be implemented early, making it possible to achieve the <2°C pathway.

A carbon price of US$100/tonne would make economically viable many of the additional schemes needed to keep to the 450ppm ceiling.

One such is CCS in industry and in power generation, which contribute about one third of the additional CO_2 abatement measures that require significant economic drivers and/or incremental technology advances to eventuate**.**

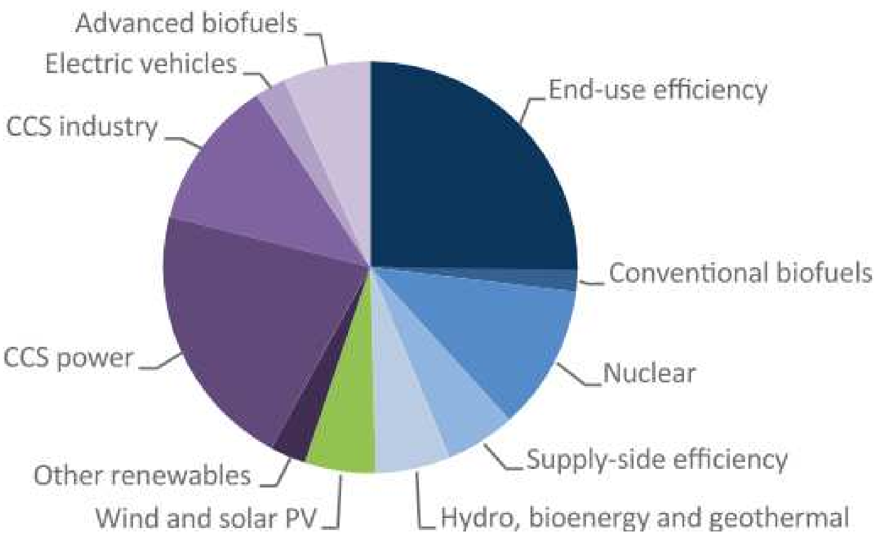


Figure 2 Additional 450 scenario abatement measures using developing technology (IEA 2015)

[2] On the global scene the additional effect of non-CO_2 emissions is minor, so EW75 just considers CO_2 emissions.

THE EXTENT OF CCS REQUIRED

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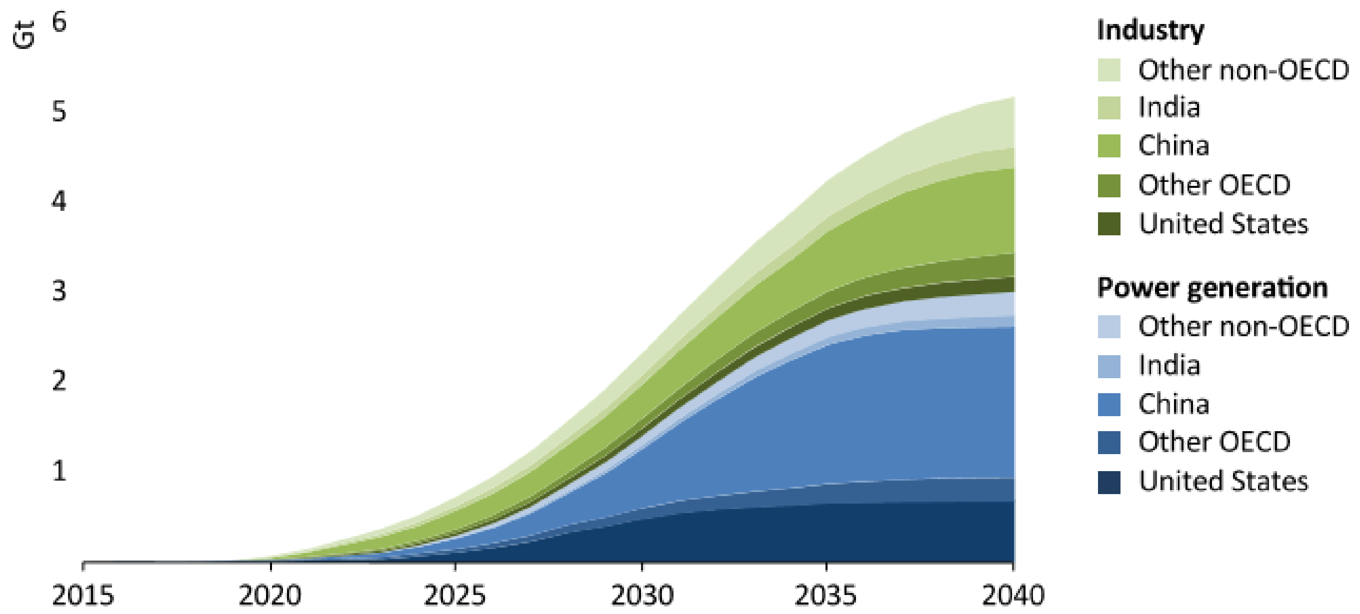

Figure 3 CO_2 capture requirements for the 450 scenario - by sector and region (IEA 2015)

Figure 3 shows the required growth in CCS by 2040 to contribute to the 450ppm pathway to a <2°C future to be facilitated[3]. By 2040 the cumulative amount of CO_2 already stored globally would be about fifty thousand million tonnes (50 Gt) and the on-going CO_2 storage requirement would be 5.2 Gt per year thereafter.

Industry

Industrial CCS opportunities arise in the steel and cement industries and in some large scale chemical and fuel processing operations.

The low-hanging fruit in the industrial sector is collection and storing the CO_2 that has already been separated for some other reason. For example, CO_2 stripped from natural gas to bring it to a pipeline specification of <4% CO_2, which is normally just vented to atmosphere, could be collected and injected into a local depleted gas field.

Such an opportunity exists in Taranaki, home of the Kapuni gas resource with 43% CO_2. I suggest that a carbon charge of less than $50/tonne of CO_2 discharged to air would make such a CO_2 capture and storage scheme economically sensible.

Exactly that concept has been in operation in Norway since 1996 on the Sleipner gas field, where the CO_2 content of natural gas is reduced from 9% to 4% and one million tonnes per year of CO_2 is successfully reinjected beneath the sea floor. That project is the result of Norway unilaterally deciding in the 1990s to impose a high carbon tax.

Power Generation

Figure 3 shows that the extent of CO_2 capture from power generation required by 2050 would be 3 Gt per year.

If a 1000 MW (1 GW) conventional coal fired power station (like Huntly) is operated 80% of the time and has a thermal efficiency of 35% then it would emit 2.3 million tonnes per year of CO_2. At 90% CO_2 capture, the data for 2040 indicated in Figure 3 would correspond to 800 GW of power generation with CCS in China, 320 GW in the USA, 70 GW in India, 120 GW in other OEDC countries and 130 GW in other non-OECD countries. In view of the expected decline in coal fired power generation over coming decades, as renewables increase, Figure 3 corresponds to all new coal fired power plants having 90% CCS.

[3] International Energy Agency, Energy and Climate Change – World Energy Outlook Special Report, May 2015

STATUS OF CCS TECHNOLOGY COMPONENTS

By Steve Goldthorpe

Carbon Capture and Storage is not a single technology with a simple research, development, demonstration and production pathway. Rather CCS is an unconventional combination of a number of conventional technologies.

CO_2 capture

The basic method of post combustion capture of CO_2 has not changed significantly since I was doing feasibility studies of CCS schemes in the 1980s, and as is described as follows.

The flue gas from a coal fired power plant with 15% CO_2 is cleaned and cooled and then contacted with an aqueous solution of amines. 90% of the CO_2 dissolves in the solution. The remaining flue gas is reheated and discharged to atmosphere.

A co-benefit of CO_2 capture is that the gas cleaning required to protect the amine solvent means that the resulting discharged gas has much lower levels of contaminants that would be required to meet local air quality requirements.

The CO_2-rich amine solution is then heated with steam extracted from the power station to strip the CO_2 out of solution. The depleted amine solution is then recycled. The stripped CO_2 is the cooled and compressed to produce a stream of pure liquid CO_2 ready for dispatch to storage.

The extraction low presssure steam from the power station steam cycle and the use of electricity for pumps and compressors, results in the electricity output from the power station being reduced by about 25%.

Alternative power plant CO_2 capture schemes based on combustion of coal in a mixture of Oxygen and CO_2 (Oxyfuel) or the gasification of coal in oxygen and steam (IGCC) have been extensively studied, but not found to have significant energy penalty benefits over post-combustion capture (PCC) via amine scrubbing due to the electricity needs for oxygen production.

There is currently one full scale integrated CO_2 capture at Boundary Dam in Saskatchewan, Canada, which has been in successful operation since 2014. The Boundary Dam plant captures 90% of the CO_2 from a single 150 MW plant unit at Boundary Dam coal fired Power station. The captured CO_2 is dispatched by pipeline for EOR.

Figure 4 - The Boundary Dam CCS facility

CO_2 transport

The delivery of liquid CO_2 from the capture facility to the storage location would be by pipeline. Piping of liquid CO_2 is conventional proven technology and is less potentially hazardous than the piping of natural gas.

CO_2 storage

There are three types of underground storage of CO_2 that are commonly considered for CCS; Enhanced Oil Recovery (EOR), storage in depleted natural gas wells and injection into deep saline aquifers.

I have been considering a fourth possible storage location in the Hadal Zone of the deep ocean. That concept is discussed further on Page 8.

<u>Enhanced Oil Recovery (EOR)</u>

When liquid CO_2 is injected into an aging oil well it can either have the effect of displacing residual oil or mixing with residual oil to make it less viscous. Either way, the effect of injecting CO_2 can be to enhance the recovery of oil. EOR may typically increase the ultimate yield from the oil well by about 10%. Whilst there is large case by case variability, the typical yield of carbon in additional oil is about equal to the net placement of carbon in CO_2 in the oil field formation. Hence there is no direct net CO_2 sequestration. However oil production with EOR is more greenhouse friendly that oil production without EOR.

The use of CO_2 for EOR is by far the largest user of CO_2 and can provide a sufficient revenue stream to finance the capture of flue gas CO_2. Most CCS demonstration plants, including Boundary Dam are currently associated with EOR to make the process economically viable in the current low carbon price situation.

The global production of oil is about 90 million barrels per day containing about 15 million tonnes per day of carbon. If 50% of oil fields are amenable to EOR then, at a 1:1 carbon ratio and 10% yield enhancement, the global demand for CO_2 for EOR could be about 2.75 million tonnes per day or about one Gt of CO_2 per year. Hence EOR may have the potential to utilise about 20% of the long term CO_2 storage requirement.

CO_2 storage in depleted gas wells

When natural gas is produced from a gas field, water usually floods into the vacated porous rock formation. After gas production has ceased, CO_2 could be injected into the formation to displace the water and rely on the original geological sealing of the formation, as confirmation that the CO_2 is permanently sequestered.

The volume of supercritical CO_2 that can be stored is theoretically the same as the original volume of natural gas in place. Due to the difference in physical properties of methane and supercritical CO_2, the volumetric ratio will depend of the depth of the storage formation as shown in Figure 5.

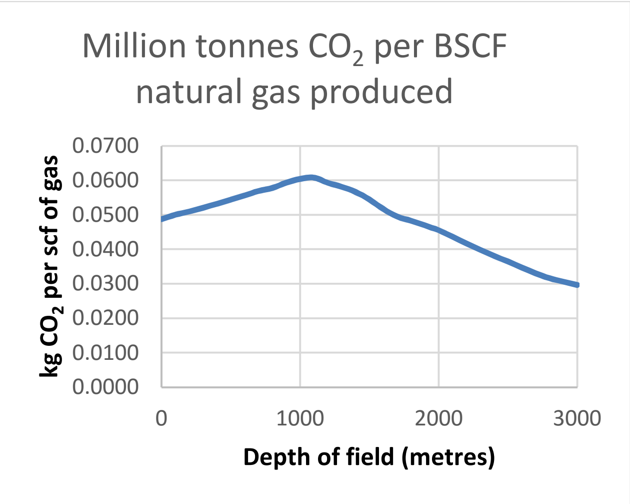

Figure 5 CO_2 storage in gas fields

Since there is no product to provide a revenue stream, the gas field operators would need to charge for CO_2 storage to cover injection and monitoring costs and accepting liability for containment of the captured CO_2.

The timing of CO_2 storage in gas fields would be constrained to occurring soon after natural gas production has ceased, whilst gas handling infrastructure and permits were still available and before the gas field is sealed and abandoned.

Another consideration is whether the gas field is onshore or offshore. In the UK, proposed CCS schemes must be based on offshore geological storage of the captured CO_2. Apart from potential issues with opposition to CO_2 storage below land, an advantage of CO_2 storage beneath the sea floor is that any slow leakage would dissolve in the sea rather than leak directly to atmosphere.

The US EIA estimate that global production of conventional natural gas is projected to remain fairly constant at about 100 trillion cubic feet per year over coming decades. If 20% of those gas fields are both offshore and subsequently amenable to CO_2 storage, then at 0.05 kg CO_2 per scf of natural gas, the natural gas field storage pf CO_2 would have capacity for about one Gt of CO_2 per year. Hence, depleted natural gas fields may have the potential to provide about another 20% of the long term CO_2 storage requirement.

CO_2 storage in deep saline aquifers

The other CO_2 storage option that is considered by the CCS community for accommodating captured CO_2 is injection into deep saline aquifers. The Sleipner facility has successfully used this type of CO_2 storage location under the North Sea for nearly 20 years.

However, the certainty of permanent storage of CO_2 in a deep porous rock depends on the existence of gas tight overlying formations, which must be inferred from extensive case by case geological surveying prior to injection. Again off-shore CO_2 storage would be preferable so that overlying seawater provides a back-up for accommodating any CO_2 leakage.

At underground conditions of elevated temperature and pressure CO_2 will be a supercritical fluid with 0.2 to 0.6 the density of water, which would tend to permeate up though any cracks or fissures that might exist.

POTENTIAL FOR VERY DEEP OCEAN STORAGE OF CO_2

Abstract of a Discussion Paper

by Steve Goldthorpe

Carbon capture and storage is an essential contributor to the mitigation of climate change and will require vast CO_2 storage capacity. At present only geological storage is being considered. This paper suggests a radical alternative CO_2 storage concept, which has yet to gain traction with CCS research institutes.

For example, the Sunda trench south of Indonesia is more than 6 km deep. If liquid CO_2 were to be placed in that trench, it would be 7% more dense than seawater and would remain on the floor of the trench and should, according to theoretical considerations, remain there permanently.

At those conditions of high pressure and low temperature a solid CO_2/water hydrate would form at the interface between the stored CO_2 and the seawater, which could inhibit mixing between the stored CO_2 and deep ocean currents. Hence ocean acidification would be avoided.

At depths greater than about 4-5 km metres, seawater is under-saturated in calcium carbonate, so creatures with a calcium carbonate shell or skeleton cannot exist there and the zone maybe almost devoid of fauna.

There is vast capacity for storage of CO_2 in world's 37 deep ocean trenches. The Sunda trench below 6 km has the capacity to accommodate 6 to 19 trillion tonnes of CO_2, which is greater than the CO_2 yield from all currently known global fossil fuel reserves. Within that trench there are enclosed basins that could accommodate all the CO_2 that could reasonably be captured in Indonesia and neighbouring countries.

The deep ocean CO_2 entrapment mechanism is more certain than the geological CO_2 storage mechanism in hydrocarbon wells or deep saline aquifers. A CO_2 delivery concept by ship and vertical pipe is suggested.

The global CCS community has investigated ocean storage of CO_2 at depths down to 4km on the basis of ultimate dissolution and dispersion of CO_2 in ocean water. Those studies have dismissed ocean storage as environmentally unacceptable due to ocean acidification.

This paper postulates that a deep ocean trench (>6 km) is a very different environment for CO_2 storage, where permanent storage without dissolution, acidification or adverse effects on fauna may be possible.

The purpose of this paper is to pose the question "Why not?" to the CCS community.

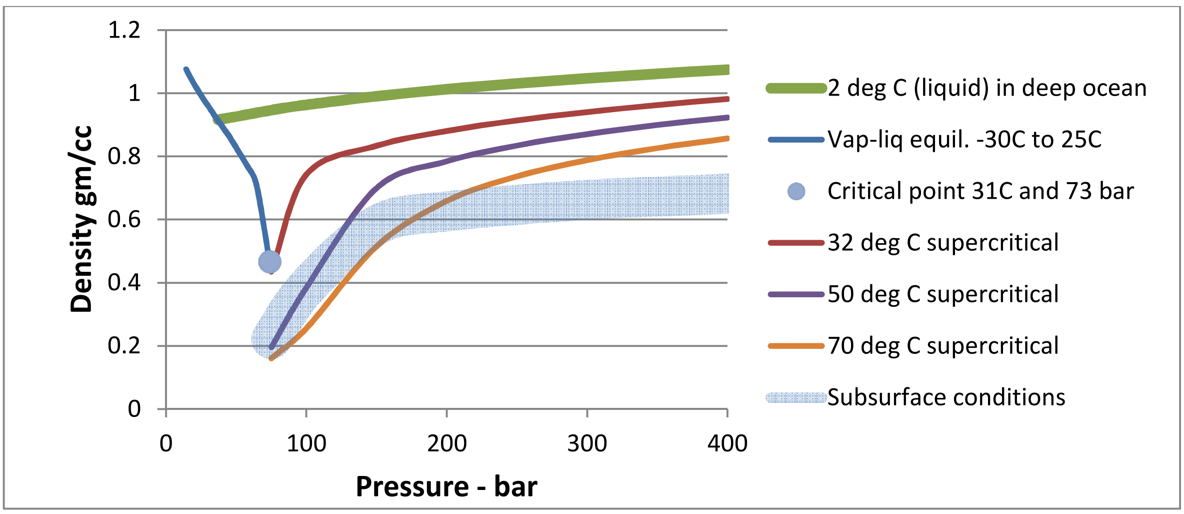

Figure 6 Density vs. pressure for CO_2 at subcritical and supercritical temperatures

A copy of the full discussion paper is available on request from the editor – Steve Goldthorpe

THE AUSTRALIA-NEW ZEALAND CLIMATE CHANGE AND BUSINESS CONFERENCE

October 20th /21st 2015 – Auckland

Organised by Environmental Defence Society

Perceptions by Steve Goldthorpe

The conference was attended by about 150 people in the Rendezvous hotel. It was a high end conference with high profile speakers. However, the audience seemed to comprise mostly observers, advisors and consultants rather than the business leaders, who were the target of the conference. The main outcomes of the conference were the messages sent out to the wider business community.

There were oblique references to the climate skeptic sentiment, as harboured by some influential people in New Zealand. There was some debunking of misinformation. The general sense of the proceedings was that now is the time to consign such banter to history and to move forward with action in the common interests of both the global climate and the country. Nevertheless, the occasional use of the word "if" when referring to anthropogenic Climate Change would give comfort to those harbouring doubts about the need to take any action at all.

The final conference communique by Gary Taylor, President of EDS, is:-

Australia-New Zealand Climate Change and Business Conference, Auckland, Conference Communiqué

A key outcome from the climate change conference that concluded today (21 Oct 2015) in Auckland, New Zealand, was the endorsement by a number of speakers, including key political leaders, of the idea of setting up a Climate Forum.

"There is a strong appetite for a collaborative process that brings together stakeholders from key sectors to discuss the pathway to lower emissions," said Conference Convenor Gary Taylor.

"There is a sense that we have been having a number of disparate conversations that should be brought together to consider a low carbon transition for New Zealand. This should include the review of the Emissions Trading Scheme, which is scheduled shortly.

"Without committing Government, Climate Change Minister Tim Groser indicated personal support for a Climate Forum. He said that he thought we had made good progress and that action on climate change had some real momentum behind it now.

"Energy and Transport Minister Simon Bridges also indicated a willingness to engage with a collaborative process that would focus on the complementary measures that could sit alongside the ETS.

"Green party co-leader James Shaw and Labour spokesperson Dr Megan Woods also indicated support for the Forum or something like it.

"The Climate Forum would bring business, local government and environmental interests together to consider the science and policy challenges and address how we can reach the required reductions over time, measure progress in a credible and responsive way and adjust policy settings to get there.

"EDS will engage with stakeholders over the next few weeks to get the Forum off the ground. It's our view that it should be business-led," Mr Taylor concluded.

Len Brown - Mayor of Auckland

Mr Brown, indicated that Climate Change action was high on the agenda of Auckland Council, particularly with regard to transport issues. They have a CO_2 target of 40% below 1990 by 2040, despite a projected 2.5% per annum growth in population.

Professor David Frame – Victoria University

Prof. Frame presented a summary of the scientific evidence of Climate Change. However, it was complex, so was unlikely to convince people with doubts. Prof. Frame's takeaway messages were that:-

- The world has a finite budget of fossil CO_2 emissions beyond which the release of fossil carbon needs to cease if global temperature rise it to be limited to 2^{o}C;
- Irreversible changes will not be abrupt; and
- Abrupt changes will not be irreversible.

Hon Mark Gilbert - US Ambassador and Rachelle Duval – USEPA

US power plants contribute 1/3 of US emissions, which are planned to be 32% lower than 2005 levels by 2030. Tesla has sold 90,000 up-market Electric Vehicles. Climate benefits were claimed for the TPP, via marine and logging rules. USEPA New Source Performance Standards for power plants require partial Carbon Capture and Storage (CCS) on new coal fired power plants. (http://ww2.epa.gov/carbon-pollution-standards)

Rod Oram – Business Journalist

Rod reported a growing number of businesses and corporates were adopting climate conscious strategies and that China is working towards a 50% reduction in its carbon intensity (CO_2 emissions/GDP) by 2030. He emphasised the businesses need political will and certainty as distinct from dysfunctional market mechanisms.

Hon. Tim Groser, Climate Change Minister

As noted above, Tim Groser acknowledged a change in the mood for climate change action and said that a review of the ETS was on the agenda for next year. When asked why New Zealand could not present its position on climate change action more realistically by expressing it as two separate issues:-

- CO_2 emissions (fossil fuel combustion and forestry offsets);
- non-CO_2 emissions (i.e. agricultural methane and N_2O);

Mr Grosser agreed that logically that approach would be appropriate for New Zealand, but said that the international negotiating framework requires all gases to be combined on the basis of CO_2 equivalent.

Eric Pyle – GM Drive Electric

60% of EV purchases in New Zealand are fleet purchases, which will flow through into the second-hand market in due course. I asked whether the imposition of a road user charge, i.e. removing a subsidy, in due course would slow the uptake of EVs. He thought that that prospect was a long way off. He also said that electric trains were key to decarbonising our transport sector.

Dr Carl Walrond – PCE's office

Dr Walrond talked about a new PCE report due out soon *"Implications of Sea level rise for new Zealand"* The report is largely following the IPCC line to plan on the basis of 1 metre SLR per century. I suggested that it would be prudent for NZ to have contingency plans for the risk of a more rapid rate of SLR eventuating, but that risk is likely to be only briefly noted in the PCE report.

Anthony Healy – CEO - BNZ

Mr Healy spoke on *"What's a bank got to do with it?"* and explained that his banking colleagues were surprised that he had accepted the invitation to speak. However, he expressed the strong view that awareness of the implications of Climate Change was now a key issue for businesses.

Mark Aspin – Pastoral GHG Research

Mr Aspin signalled that reductions in ruminant methane emissions in NZ would only be incremental under our pastoral practices.

In the final panel discussion I posed the question *"What if the Paris conference were to decide that a fast track to emissions reduction needed a universal US\$100/tonne carbon charge? Could business adapt to that?"* Whilst considered most unlikely, the speakers though that it would not be a major problem, provided it was universal.

Steve Goldthorpe

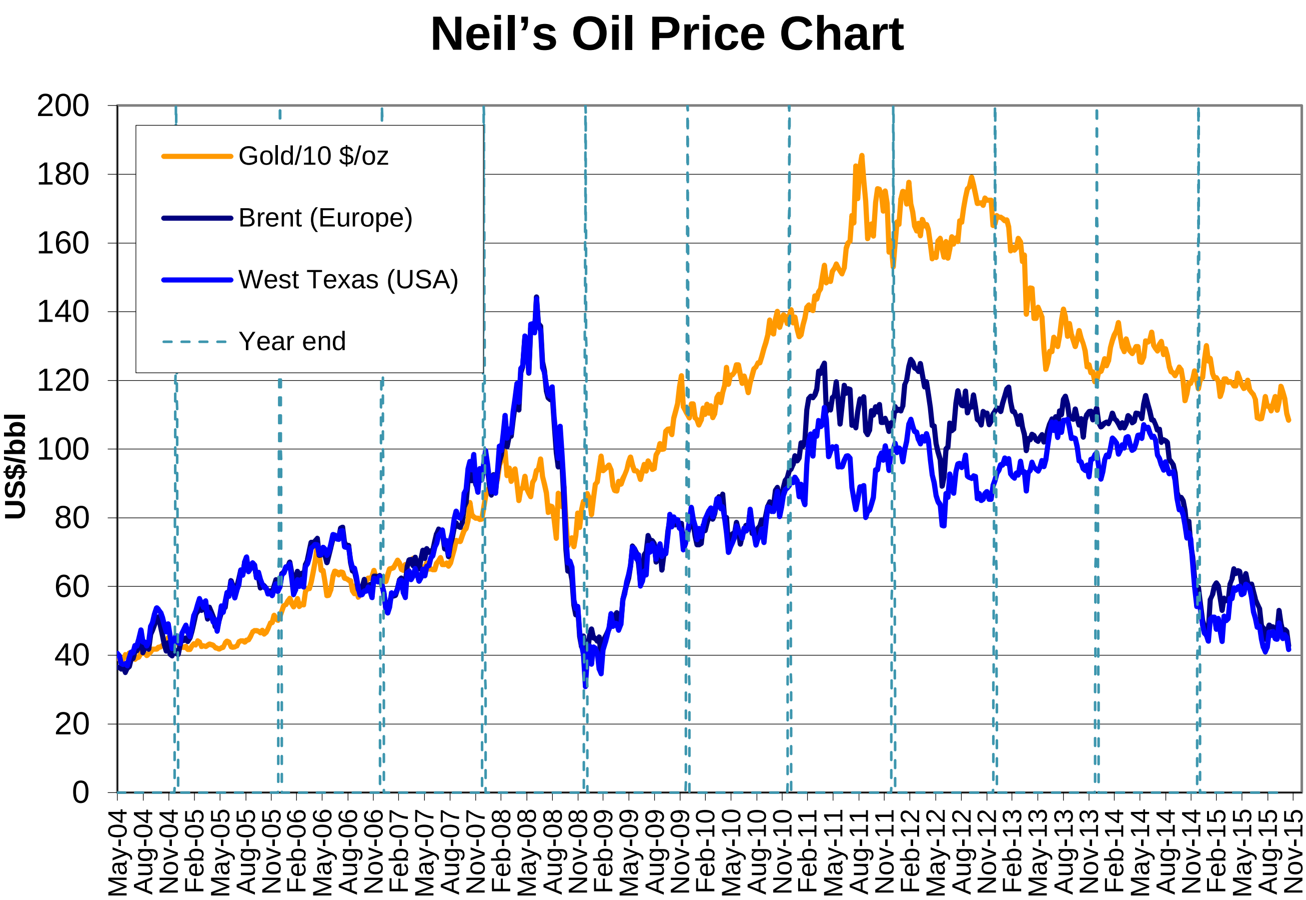

Figure 7 - Historical oil price variation vs gold price

SEF member Frank Pool suggests that the long term sustainable oil price is about US$75/barrel because over US$75/bbl consumers run out of the ability to pay, certainly for discretionary travel, and below US$75/bbl oil producers run out of money to explore and produce future oil. Those realities are compounded by wild unpredictable time lags, particularly the time lag between price-driven new exploration and drilling and delivery of new oil onto the market. Hence we are now in one of the time lags until supply declines to meet reducing demand. Land based oil storage is essentially full and oil is being parked in ocean tankers. Hence low prices are likely to remain low for a while, below the price that makes economic the drilling of new oilfields in difficult places. Is this what Peak Oil looks like?

Nick Cunningham of Oil Price.com commented on 8th November; *"Oil and gas companies have had a tough time over the past year trying to weather the storm of falling oil prices. But the political and financial winds are moving in the wrong direction for the oil industry raising more "above ground" problems at a time that they can ill-afford it. Drilling oil and gas wells requires a lot of money. For companies that have seen their revenues vanish because of collapsing oil prices, access to credit is obviously critically important….Low oil prices are undermining the ability of some companies to pay back their debt….In the political arena, things are not any better….The Attorney General in New York has announced an investigation into ExxonMobil, for what it sees as evidence that the company lied about the dangers of climate change. The probe comes on the heels of reports from Inside Climate News that the oil major's own scientists knew about the threat of climate change ages ago. But, according to the report, ExxonMobil buried the science and instead began funding think tanks and scientific research to sow doubt about climate change. Kenneth Cohen, vice president for public affairs at ExxonMobil, denied the allegations; "We unequivocally reject the allegation the ExxonMobil has suppressed climate change research"*

The other bad news for the oil industry is that President Obama has rejected the Keystone XL pipeline, primarily for reasons of Climate Change, combined with a new Canadian premier being elected who is likely to be much tougher on environmental performance. The oil patch is no longer attractive for investors.

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Some busy people using a work address prefer to use the Rules function in their email software to automatically save SEFnews emails to a separate folder for later reading. If you do not want a Yahoo ID, the administrator <office@sef.org.nz> can select the 'daily-digest' option for you.

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Publication is now quarterly, and EnergyWatch is posted on the SEF website (www.energywatch.org.nz) as a PDF file, shortly after individual distribution to SEF members.

Contributions Welcomed

Readers are invited to submit material for consideration for publication.

Contributions can be either in the form of Letters to the Editor or short articles addressing any energy-related matter (and especially on any topics which have recently been covered in EnergyWatch or SEFnews).

Material can be sent to the SEF Office, PO Box 11-152, Wellington 6142, or by email to editor@sef.org.nz, or by directly contacting the editor, Steve Goldthorpe, at PO Box 96, Waipu 0545.

SEF membership

Memberships are for twelve months and include four copies of EnergyWatch.

Membership rates are:

Low income/student	$30
Individual	$50
Overseas	$60
Library	$65
Corporate	$250

Mail the form below, with your payment or order, to The Sustainable Energy Forum Inc, P O Box 11-152, Wellington 6142. Bank transfers, with your name, can be sent to the SEF account at 03-1538-0008754-00, with a confirming email to office@sef.org.nz.
A receipt will be sent on request.

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