EnergyWatch

The Journal of the Sustainable Energy Forum Inc.

"Facilitating the use of energy for economic, environmental and social sustainability"

Published by: - The Sustainable Energy Forum Incorporated, PO Box 11-152, Wellington 6142
Email: -info@sef.org.nz Web: - www.sef.org.nz; and www.energywatch.org.nz

The Sustainable Energy Forum Inc. was registered as a charitable entity under the Charities Act 2005 on 30th June 2008. Its registration number is CC36438.

Issue 74, September 2015

Editor: Steve Goldthorpe

ISSN 1173-5449 (print) ISSN 1179-4054 (online)

SLEEP WALKING TO PARIS

Is there any sign of change in the entrenched direction of New Zealand's Energy Policies?

Politicians discussing global warming

In the last issue of EnergyWatch, which was produced before last year's general election, I was enthusiastic about a range of ten energy policy initiatives that could be taken by a new incoming Government to move New Zealand towards a new energy paradigm.

However, after the election it became increasingly clear that a relentless policy of "more of the same" would be pursued. As editor of EnergyWatch, I was hoping to see signs of change in direction, which might then be reported. I waited and waited, but nothing eventuated. I must therefore apologise to the regular readership of EnergyWatch about the inordinately long delay in summoning up the enthusiasm to put this issue together.

When the recent Climate Change consultation process was announced it provided a ray of hope that the views of the people would be taken into account in determining what New Zealand's Intended Nationally Determined Contribution (INDC) should be. The INDC is a plan of Greenhouse Gas (GHG) emission reductions for putting on the international negotiating table in Paris in December. Alongside many other NGOs, the SEF executive put forward some suggestions in a submission, which is reproduced here.

A team of MfE officials toured the country collecting opinions and ideas. 17,000 submissions, which are summarised on the MfE website[1], have a common theme of wanting NZ to take its fair and ambitious share of responsibility for the changing climate and to take real action to greatly reduce its Greenhouse Gas emissions. Of the 10,600 submissions that nominated a target level, 99% recommended 40% below 1990 levels by 2030 and/or zero net carbon emissions by 2050. The Government has submitted its INDC to the Paris negotiations as 11% GHG reductions on 1990 levels by 2030, leading to 50% reduction by 2050.

[1] http://www.mfe.govt.nz/node/20927/

I sense a groundswell of public opinion that the Government's minimal response is nowhere near enough for New Zealanders who want to be proud of their country's ambitious international profile on Climate Change policy.

Nature 2012

A key requirement of many of the submissions was for a quantified plan of how NZ would achieve intended GHG emission reductions. Whilst there is no published Government policy on the means of GHG reduction, I have obtained, via the Official Information Act, a copy an MfE briefing document that quantifies some measures that could be taken within the existing energy supply paradigm.

That assessment falls well short of even the 11% emission reduction target. It illustrates that a significant change of direction in NZ energy policy is required if NZ is to make a *fair and ambitious*" contribution to reducing global greenhouse gas emissions.

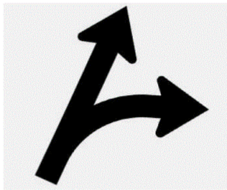
In contrast the Green Party has produced a list of measures that are aimed at achieving the widely demanded 40% reduction on 1990 levels by 2030, which is also reviewed here.

One change in direction would be to permit clean wood burners in Canterbury, rather than effectively outlawing wood burners regardless of their environmental performance. A SEF submission to the Canterbury Air Regional plan is included in this issue of EW.

Another technology that makes a successful contribution to carbon-free energy supply in many countries is Solar Water Heating. Eric Jansseune contributes a review of the demise of the NZ SWH industry.

The announcement of the ending of coal fired power generation at Huntly should signal a move towards a lower carbon future. However, examination of the replacement technology for dry year reserve, i.e. open cycle gas turbines burning gas from leaky (?) underground storage shows that the climate benefit may be illusory.

Finally an update on the oil price history suggests that the global addiction to oil products will not be tamed any time soon by economic drivers acting alone.



It is now 5 years since the Signs of Change conference. Has there been any perceptible shift in NZ's energy ideology?

As New Zealand sleep walks to the Paris Climate Summit without any coherent plan for changing the direction of energy policy, it is ever more critical for the multitude of voices calling for some signs of change to rouse the kiwi from its slumbers.

Steve Goldthorpe, Editor

CONTENTS

SEF SUBMISSION ON CLIMATE CHANGE CONSULTATION

Objectives for the New Zealand Contribution

We agree in principle with the three stated objectives for New Zealand's contribution in order of importance:

- It must guide New Zealand over the long term in the global transition to a low emissions world;
- It must be seen as a fair and ambitious contribution by both international and domestic audiences;
- Costs and impacts on society must be managed appropriately.

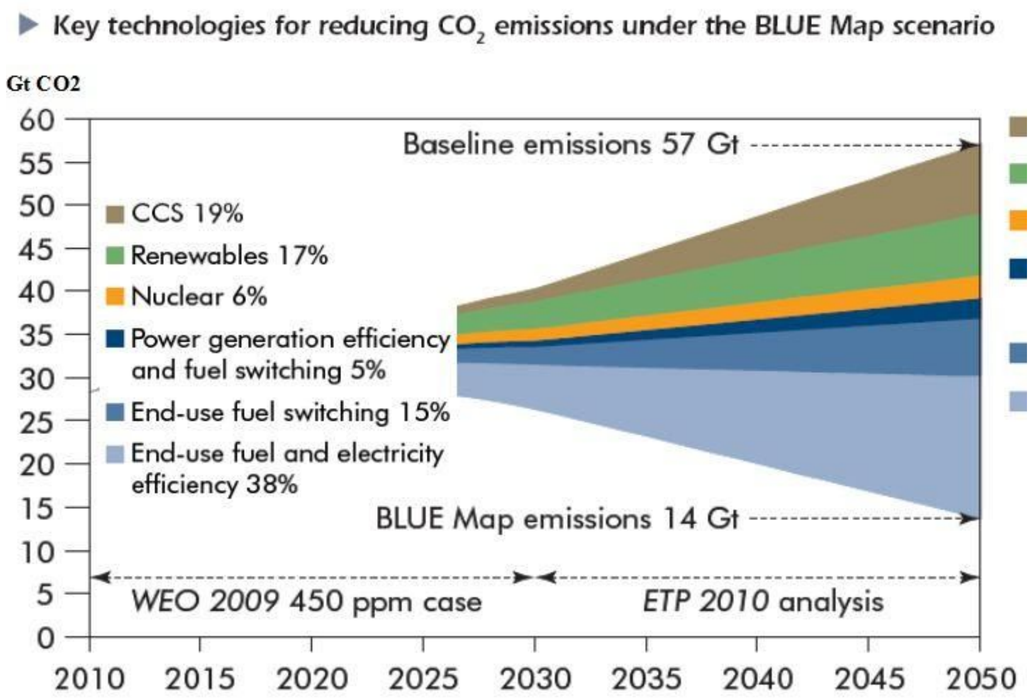
The most important aspect of New Zealand's contribution must be an Action Plan.

We submit that, to inform both domestic and international audiences and also NZ's policy makers, it is essential for NZ to describe, illustrate and evaluate the quantified practical measures over and above Business-As-Usual (BAU) that will be taken by New Zealand to achieve the declared Greenhouse Gas (GHG) emission reduction target. We are most disappointed that the consultation document does not do so. We submit that an assessment of the combination of measures that be taken must be widely disseminated and discussed.

That assessment could be in the form of a chart with the same format as the global plan prepared by the International Energy Agency (IEA), which is presented as Figure 1. The NZ chart should; present, in terms of millions of tonnes of CO_2, historical data of gross CO_2 emissions from 1990 to 2015, and projected emissions from 2015 to 2050, with and without specific classes of CO_2 mitigation measures. That format would provide a clear picture of what has been achieved over the last 25 years and what needs to be achieved over the next 35 years to set NZ on a path to a sustainable low-carbon future. The immediate commitment to progress over the next 15 years to 2030 would be transparent as an interim target.

We note that the IEA chart only quantifies CO_2 emissions from fossil fuel combustion. We submit that the same basis should be used for a quantified CO_2 emission chart for New Zealand. Thus we recommend that the impact on the long term NZ GHG inventory of measures concerning

Figure 1 IEA plan for global CO_2 emissions to limit global temperature rise to 2°C



(from Energy Technology Perspectives 2010)

Land Use Change and Forestry, agricultural methane emissions and other non-energy or non-CO_2 mitigation measures should be dealt with separately from CO_2 emissions due to fossil fuel combustion.

Figure 1 was prepared by the IEA to show in a simple form the combination of deviations from BAU that are necessary to put the world on a path to keep global temperature rise down below 2°C, thereby avoiding the more severe consequences of Climate Change on future generations.

These deviations from BAU are ambitious. The portfolio of measures taken by NZ will differ in extent and type, but the combined effect in terms of deviations from BAU in NZ must be no less ambitious. Such measures are not alternatives. They are all required in combination to meet the serious and difficult challenge of reducing the risk of serious effects of Climate Change.

Specific CO_2 emission reduction measures

End-Use Energy Efficiency. In the IEA global projection, 38% of the necessary deviation from business as usual arises from improved efficiency in the ways that energy is used. Avoiding the waste of energy can be a self-financing strategy. The technology to achieve that change largely already exists. For example, a major programme by central government to encourage home insulation from 2009 helped to decrease the per-household electricity use. Such programs should be extended not cut back. A clear statement should be made by NZ as to the percentage of the required CO_2 emission reduction that can be achieved by end-use energy efficiency improvements.

Carbon Capture and Storage (CCS). In the IEA global projection 19% of the necessary deviation from BAU would be achieved by the implementation of CCS, which is already technically feasible and demonstrated at large scale. However, CCS is a high cost strategy requiring a driver in the range US$50 to US$100 per tonne of CO_2 emission avoided. A clear statement should be made of the scope in NZ for CCS to contribute to CO_2 emission reductions and the corresponding carbon charge level that would need to be in place to make that happen.

Transition to Renewables. Expansion of renewable energy sources is an obvious measure to reduce fossil energy use, which is projected by the IEA to be able to make 17% of the necessary global change. The extent to which that transition can achieved in NZ, beyond what will happen under a BAU pathway, must avoid forcing the renewables technologies beyond their appropriate fit with the natural resources. A clear statement should be made by NZ as to the extent of the required emission reduction that could be realistically achieved by additional uptake of renewables. That must accommodate the increased demand for electricity in the transport sector. Further increases in New Zealand's renewable energy through centralised geothermal and wind electricity generation have a role to play. However, distributed generation, particularly rooftop solar photovoltaic, is only just beginning to be introduced and has a major potential role in NZ.

End Use Fuel Switching. In the IEA global projection 15% of the necessary deviation from business-as-usual is estimated to arise from fuel switching. This is predominantly by switching from coal to gas. However, caution needs to be exercised with that strategy, because when the GHG emissions associated with the production of consumer fuels, particularly methane emissions from natural gas production, are fully taken into account, the benefit of fuel switching can be reduced or even eliminated. A full fuel cycle assessment of fuel switching strategies in NZ should be carried out to identify the real scope for GHG emission reductions. In particular, methane losses from natural gas production must be properly assessed and included in the inventory, so that the scope for improvements can be fully quantfied.

In the short term, fuel switching in the transport sector from petrol engines to high efficiency small diesel engines has a significant role to play and could easily be facilitated through the use of a

Road User Charge suited to small vehicles. In the longer term the transition from internal combustion engines to electric motors in the transport sector has the potential to greatly reduce transport emissions, in conjunction with NZ's low carbon electricity generation potential.

Electricity supply to the transport sector can be enhanced by switching from electricity to firewood for home heating in efficient wood burners, provided they are not banned in some cities by inappropriate application of air quality standards.

Nuclear Power. In the IEA global projection 6% of the necessary deviation from BAU is estimated to result from the expansion of nuclear power generation. That is obviously not an appropriate technology for New Zealand. So the other measures need to make greater contributions to achieve New Zealand's overall CO_2 emission reductions commensurate with the global challenge.

Power Station Fuel Switching. There is limited scope both internationally (5% in the IEA chart) and also in NZ for power station fuel switching to reduce emissions. However, the scope of that measure in NZ should be quantified on a Full Fuel Cycle basis.

A Way Forward

A thorough analysis of the measures described above, plus other measures, should provide an estimated actual CO_2 emissions trajectory for NZ. That trajectory would quantify the practical measures that are achievable. In the first instance that analysis would be independent of the costs or revenues from making those changes. A secondary assesment would then be made of the sensitivity of those measures to economic drivers; in particular the level of carbon charge required to achieve the required level of CO_2 emission reduction relative to 1990 levels.

Only when that quantification of what NZ can actually sensibly do with its domestic CO_2 emissions inventory has been established, publicised and seen to be credible, will it be possible for New Zealanders to determine acceptable economic consequences of a course of action to make its fair and ambitious contribution to the global effort to reduce CO_2 emissions

Success in achieving the necessary CO_2 emission reduction will depend heavily on buy-in from all New Zealanders. The creation of a culture of climate consciousness within the people has been achieved in some other countries and could be achieved in NZ. We call for leadership in enabling the vast majority of New Zealanders to take steps such as: -

- Adopt of a social norm of making climate conscious decisions in our daily behaviour;
- Consider the bigger picture issues when purchasing vehicles and appliances or building homes; and
- Accept the purpose of planning strategies aimed at reducing CO_2 footprints.

We can do the easy stuff by not wasting energy, but that is not enough.

We can do the expensive stuff by changing our energy infrastructure, but that is still not enough.

We must also do the very difficult stuff by changing the energy-using behaviour of the people.

That demands leadership at the highest level

What would be a fair contribution for New Zealand?

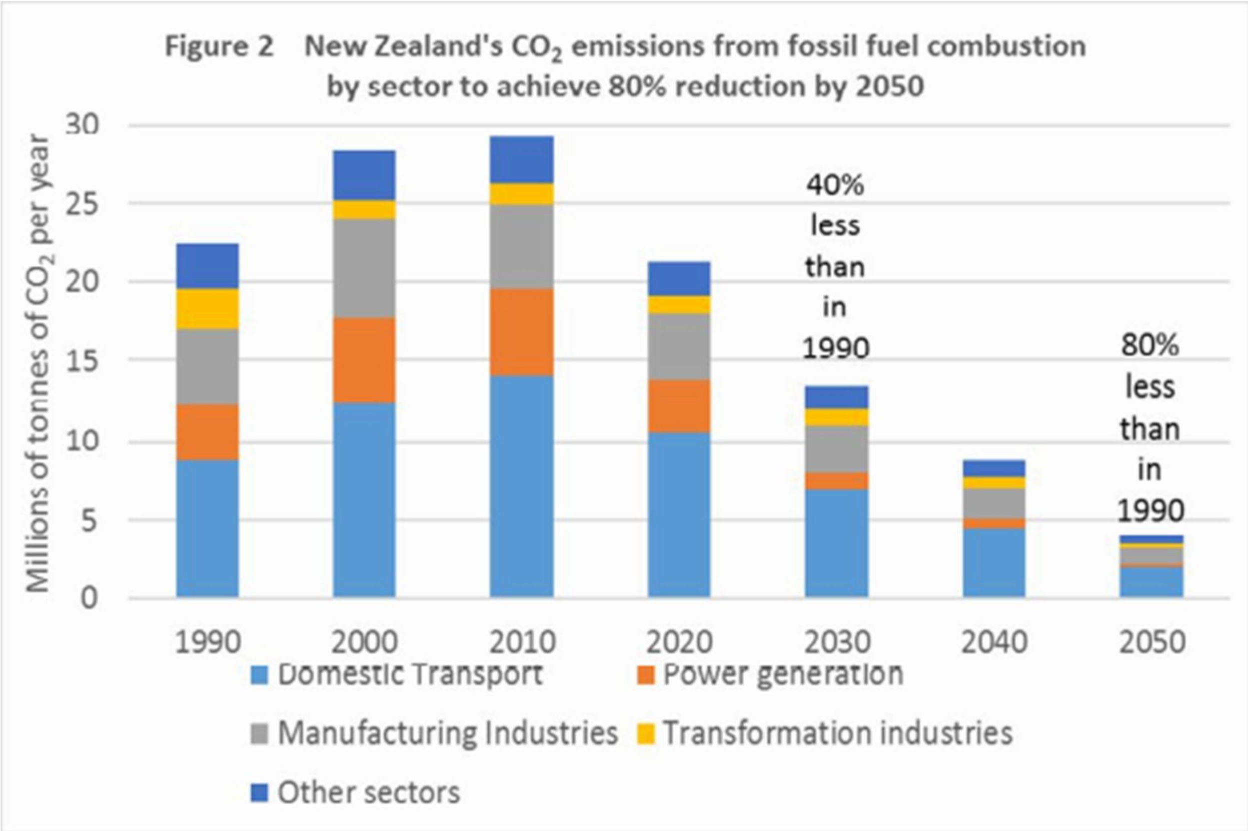
Figure 1 shows that a major reduction in global CO_2 emissions relative to BAU is required to avoid the worst impacts of Climate Change. Many countries recognised that that trajectory requires global CO_2 emissions in 2050 to be no greater than 20% of CO_2 emissions in 1990. In progressing towards that objective, global CO_2 emissions in 2030 need to be no greater than 60% of CO_2 emissions in 1990. To be seen as a fair and ambitious contribution, by both international and domestic audiences, NZ should be set on a path to match that outcome.

We propose the following quantified commitments for NZ:

The emissions of CO_2 in New Zealand from the production and use of coal, oil and natural gas will be no more that 13.5 million tonnes in 2030 (i.e. 40% less than the gross fossil hydrocarbon CO_2 emissions in 1990)

A plan will be put in place by 2020 for further reducing fossil hydrocarbon CO_2 emissions in NZ so that they are no more than 4.5 million tonnes in 2050 (i.e. 80% less than in 1990)

Figure 2 shows what that level of commitment would mean in terms of sectoral use of fossil fuels in NZ.



A specific plan with multiple practical measures and a defined means of implementing those measures is required to demonstrate that the commitments are achievable. The approach presented in the consultation document, which is based on minor CO_2 emission reductions achievable under a BAU strategy combined with purchasing of Carbon Credits from overseas, will not be seen in the international forum as either doing our fair share nor being ambitious.

What is reasonable for other GHG inventory contributors?

Land Use Change and Forestry. Change in land use does not feature in the IEA strategy. Reduction in deforestation and enrichmemnt of biocarbon stores is a separate issue. In the NZ GHG emissions trajectory the extent to which land use change and forestry affects the net greenhouse gas emission inventory over the entire 1990 to 2050 period should be assessed and sustainble effects demonstrated separately from the fossil fuel CO_2 data.

Agricultural methane emissions. The dominant position of agricultural methane emissions in NZ's GHG inventory is not reflected in the IEA global assessment in Figure 1, because it does not have a major potential for change in the global context. A clear statement should be made of the scope in NZ for reduction in agricultural methane

emissions to contribute to greenhouse gas emission reductions. For example through diversification of farming practices, reducing stock numbers or reducing methane emissions per animal. Since the potential for the latter is highly uncertain, such means of influencing the NZ GHG inventory should be presented separately from the fossil fuel CO_2 emission reduction measures.

We propose the following non-quantified commitments for NZ:

- ***The carbon content of the NZ biosphere (i.e. trees, vegetation, soil and vegetation derivatives; including biofuels) will be quantified accurately and will be permanently increased where practicable;***

  Methane discharges to air from all sources in New Zealand will be quantified accurately and will be reduced as far as practicable;
- ***Research on agricultural practices to reduce greenhouse impacts will include practices that increase carbon stored in soils and reduce methane from livestock;***
- ***CO_2 emissions from cement making and other non-combustion sources will be reduced as far as practicable;***
- ***Other greenhouse gas emissions (i.e. N_2O etc.) will be reduced as far as practicable.***

Summary

Setting a credible target for NZ to present to the world in December 2015 must be based on a comprehensive understanding of what is technically achievable in practice by wide-ranging action in NZ. Only when a comprehensive Action Plan has been established will it be possible to determine the legislative, economic and cultural drivers that need to be put in place to make it happen. Only then will it be possible to determine any economic impact of NZ playing its fair part in the international imperative to avoid disastrous Climate Change effects on future generations. *SEFexec*

AN MfE BRIEFING ON A GHG EMISSION REDUCTION PLAN FOR NZ

By Steve Goldthorpe

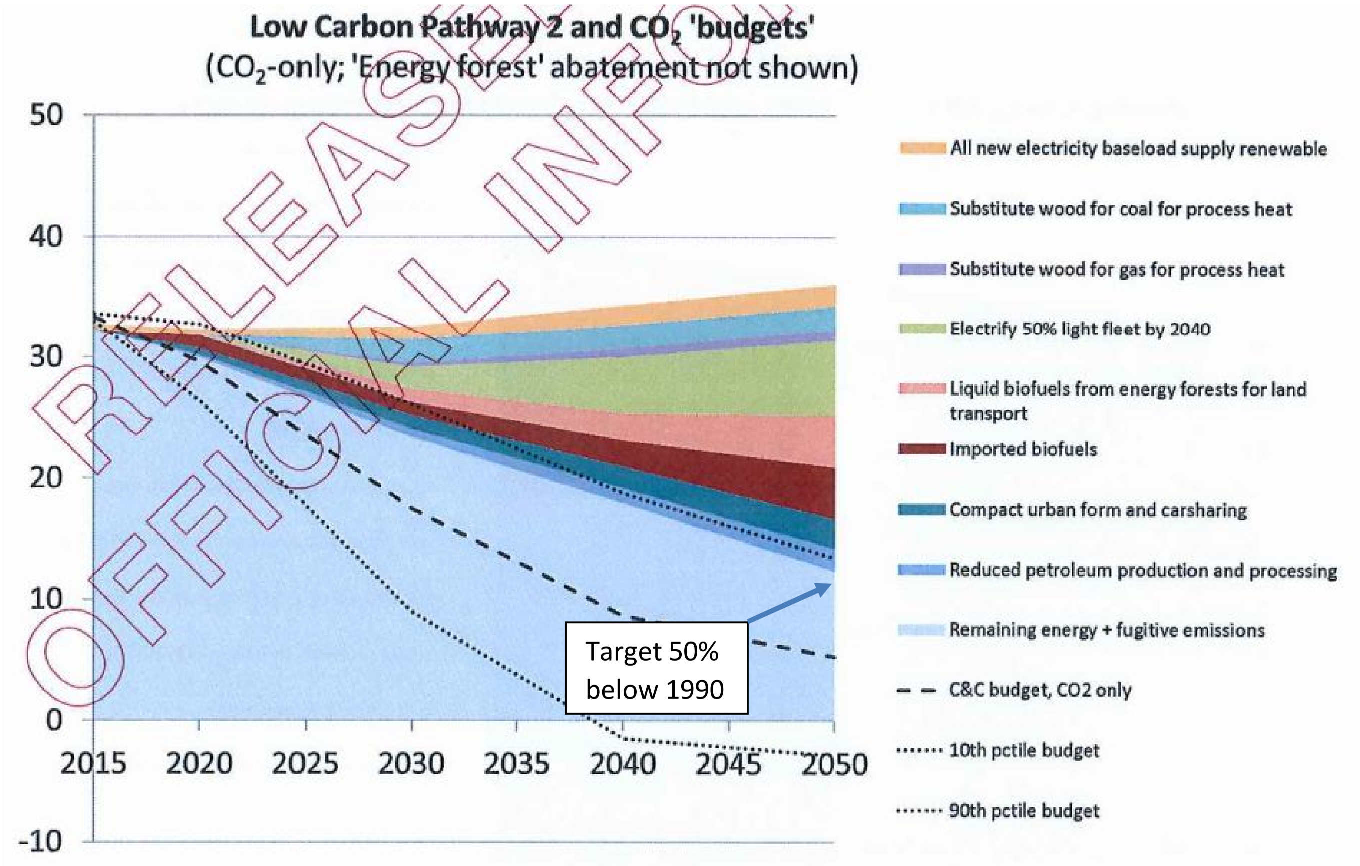
Following the MfE consultation exercise and questions about how GHG reductions would be achieved, a paper *"Potential long-term pathways to a low carbon economy for New Zealand"* was released to me by MfE under the Official Information Act (OIA). This paper is not Government or ministry policy, but is part of the advice prepared to assist the Government with determining the INDC.

The aim of the paper was to estimate what actions by New Zealand would be consistent with a plausible long-term, low-emissions pathway, consistent with a 2°C global climate goal.

The MfE paper discussed the question of a fair emission reduction budget for New Zealand in terms of "Contraction and Convergence" towards a global norm. On this basis, the mid-point of a gross CO_2-only emission target is a 30% reduction on NZ's 1990 emissions of CO_2 by 2030.

However, the paper greatly widens the target by suggesting uncertainty ranging from a 90th percentile to a 10th percentile of a wide range of international scenarios. This wide range is from a 4% increase to a 64% decrease on 1990 levels of CO_2-only by 2030.

The figure at the top of page 8 shows the cumulative effect of a number of emission reduction measures, which would result in about a 4% decrease on 1990 CO_2 levels in 2030. Whilst within the wide range of contraction and convergence targets, this outcome is well short of the 30% mid-point and short of the 40% reduction on 1990 by 2040 suggested by many submitters to the consultation. The Government's INDC figure of 11% reduction by 2030 is on CO_2-equivalent based on a multi-gas pathway not CO_2-only. This is discussed later.



This chart from the MfE's advice paper, which was released under the OIA, shows a quantified assessment of the impact of a number of plausible CO_2 emission reduction measures in comparison with the high, medium and low CO_2 emission budgets to 2050. These measures combined could meet the least challenging CO_2 emission target. The impact of these measures by 2050 is estimated, assuming a 1.25% per annum growth in energy demand from 2010 to 2050 under business as usual.

All new base load electricity is renewable A policy to proscribe the construction of new fossil fuel power stations in New Zealand could avoid 1.8 mtpa (million tonnes per annum) of CO_2. That means about 5% more of NZ's electricity being generated from renewables instead of from natural gas.

Substituting wood for coal for process heat could save 2 mtpa of CO_2. That would require 1.4 mtpa of dry wood to replace 63% of industrial coal demand.

Substituting wood for gas for process heat is estimated to save 0.8 mtpa of CO_2. That would require 1 mtpa of dry wood to replace 22% of industrial natural gas demand.

Electrification of 50% of the light vehicle fleet with EVs by 2050 would save 6 mtpa of CO_2. That could consume 13% of the NZ electricity supply to meet 27% of the NZ transport fuel demand.

Liquid biofuels derived from NZ forests could save 4.5 mtpa of CO_2 by 2050. That could meet 19% of the total NZ transport fuel demand.

Imported biofuel could save 4.2 mtpa of CO_2 emissions. That fuel would supply 18% of the total NZ transport fuel demand.

These three measures combined would supply 64% of transport fuel in 2050, assuming a 1.25% per annum growth rate.

Compact urban form and car sharing could reduce that projected total transport fuel demand by a further 10%, which would save a further 2.4 mtpa of CO_2 emissions.

Reduced petroleum processing could save 2 mtpa CO_2, if the production of oil and gas is proportional to transport demand.

The foregoing analysis presents a plan for reducing NZ's energy CO_2 emissions to 50% less than 1990 levels by 2050 in line with the Government's objective as shown on the above chart. That trajectory would be slight ahead of the 90th percentile curve and would make CO_2 emissions in 2030 4% less than 1990 levels.

The forgoing measures rely heavily on biofuel technology, which is not yet fully developed. Assuming a viable process with 50% thermal efficiency for the conversion of wood to transport fuel, the total NZ demand for dry wood for energy would be 10.5 million tonnes of dry wood per year by 2050.

MULTI –GAS PATHWAY ANALYSIS

The INDC is based on all gases not just CO_2. That is critically important for New Zealand where more than half of the GHG inventory emissions are due to methane and nitrous oxide from agriculture.

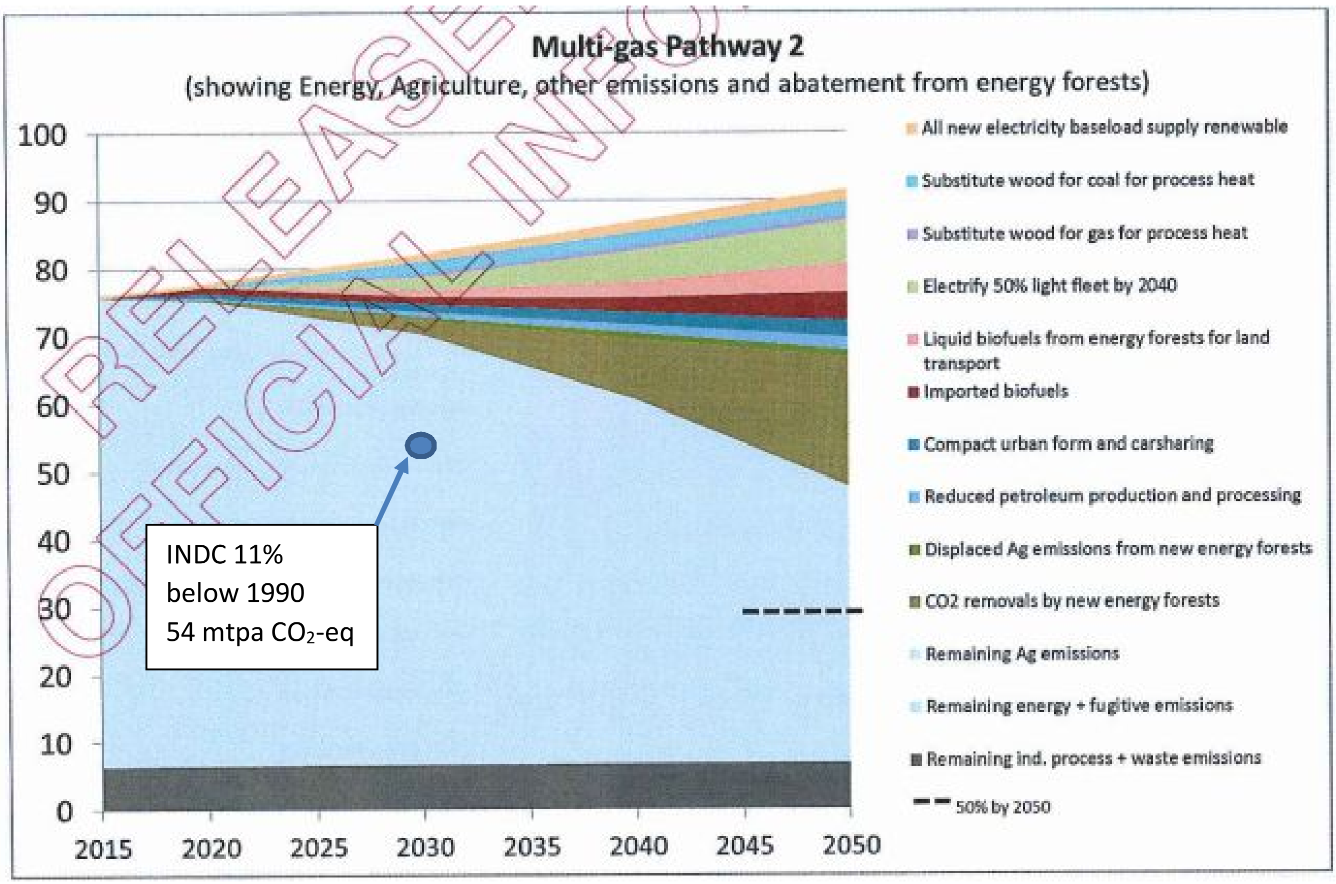
A multi-gas pathway chart from the MfE's advice paper, reproduced below, shows that the CO_2 emissions, described above, fall far short of achieving the INDC of 11% below 1990 levels of CO_2-eq by 2030.

This chart shows the additional CO_2 abatement measure of CO_2 removal by new energy forests achieving 20 mtpa CO_2 capture in 2050. There is also a small saving of 0.9 mtpa of CO_2 eq. due to land use change from agriculture to forest.

However, the processing and use of wood from the energy forests would release captured CO_2. The processing and use of 10.5 million tonnes of dry wood, as required by the emission reductions measures outline above, would result in 16.6 million tonnes of CO_2 emissions.

For the CO_2 removals by the energy forest to be accounted as shown in the multi-gas chart that would need to be the net CO_2 captured. The paper says *"International recognition of this forest sink would depend upon the accounting rules applied [sentences redacted under the OIA] After 2050, the forest sink would no longer be available, assuming new planting rates drop to zero once sufficient energy forest are established."*

Steve Goldthorpe



THE GREEN PARTY EMISSION REDUCTION PLAN

The Green Party has quantified a policy-based plan for NZ to achieve a 40% reduction in CO_2-eq emissions relative to 67 million tonnes per year of CO_2-eq (mtpa) in 1990. The following sector specific measures are proposed.

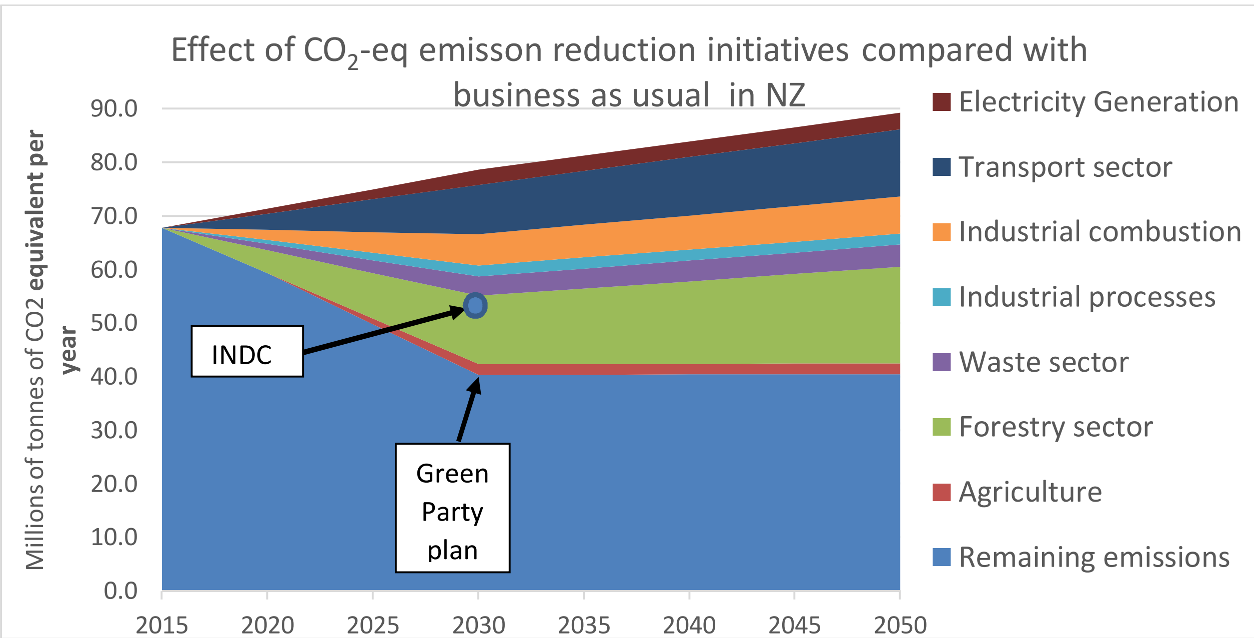
- Cutting 4.8 mtpa of electricity generation CO_2 emissions by achieving 100% renewables (including Geothermal) by 2030;
- Cutting 7.8 mtpa of transport emissions by greater use of public transport, walking and cycling, increasing vehicle economy standards and increasing the uptake of electric vehicles;
- Cutting 3.7 mtpa of combustion emissions from industry by reducing fossil fuel use through improved efficiency and by use of biofuel;
- Cutting 2.1 mtpa of CO_2-eq industrial process emissions by reducing fluorinated gas losses, the eventual closure of the Tiwai Point smelter and using new steel-making technology;
- Cutting 3.6 mtpa of CO_2-eq from the waste sector by regulating farm dumps, reducing biowaste to landfills and improving methane capture;
- Absorbing 3.6 mtpa more than in 2015 by the establishment of new permanent forests and net carbon gain by commercial forestry;
- Cutting 2 mtpa from agricultural emissions of CH_4 and N_2O after a 5 year lead-in period.

The combined impact of these measures is shown in the chart below. I have also projected the Green Party's plan for emissions in 2030 out to 2050 based on the following assumptions.

- All initiatives are sustained but no new types of emission reduction initiative (e.g. in agricultural sector) eventuate;
- Effects of population growth are balanced by incremental efficiency improvements in the road freight, non-road transport and waste sectors;
- 5% of the remaining petrol and diesel light vehicle fleet are replaced by EVs each year;
- Industrial CO_2 emissions increase with a post 2030 GDP growth rate of 0.5% per annum;
- The forest estate continues to expand post-2030 at the same rate as pre-2030 afforestation.

This chart shows that, in the light of population growth and GDP growth, sustaining a CO_2-eq emission rate at 40% below 1990 levels after 2030 will require on-going afforestation. Significant improvement on that rate would require new initiatives, particularly in the agricultural sector.

Steve Goldthorpe



SEF SUBMISSION ON PROPOSED CANTERBURY AIR REGIONAL PLAN (pCARP)

Background

The pCARP identifies a wide range of air quality parameters but only quantifies one parameter; PM10, which is required to be below the National Environmental Standard of 50 µg/m^3 as a 24 hour average. The PM10 parameter is used as a proxy in the plan for all the air pollutants, indoor and outdoor, that may contribute to premature deaths and respiratory ailments. It is estimated that domestic heating with coal and wood contribute more to daily average PM10 concentrations than industrial and transport emissions combined. On the basis of this evidence, a direct cause and effect relationship between wood smoke and excess mortality is concluded, as a foundation for a severe simplistic policy to completely phase out the use of domestic wood burning; including currently approved low emission domestic wood burners (ALEBs). Open fires and uncontrolled log burners are already proscribed.

The pCARP will permit the use of ultra-low emission wood burners (ULEBs) that can achieve less than 38 mg/kJ of PM10 emissions in a standardised test. That is a very severe criterion that can effectively only be met reliably by new advanced designs, including pellet burners and down draught burners. Many, previously approved, wood burner designs would be unable to meet this tight criterion if tested according to the "real life" method, which uses poorly seasoned firewood.

We consider that: -

- This policy is using ALEBs as a scapegoat to address air quality and public health issues;
- Focussing only on PM10 as a quantifiable air quality parameter is a crude means of relating air pollution to averse public health outcomes. The PCE notes that PM2.5 correlates with adverse health impacts better than PM10;
- Focussing on the National Environmental Standard of 50 µg/m^3 PM10 in the sense of a boundary between good and bad is simplistic;
- The relationship between air quality and public health is a gradual trend and is complex, because the chemical composition of inhaled particles has more impact on health than just their weight;
- The evidence that domestic heating dominates PM10 emissions does not distinguish between ALEB's and uncontrolled wood burners, open wood fires or domestic coal fires;
- The production of smoke from wood burners relates more to the behaviour of the operators than to the technology and is better dealt with by education and enforcement than by costly replacing of equipment; (The fact that some people drive too fast is not a good reason to ban all cars from the streets.)
- The community health benefit of a householder's investment in conversion from an ALEB to a ULEB or heat pump may be better served if that investment is instead directed towards home energy efficiency measures such as good insulation, advanced glazing and well controlled ventilation;
- An outcome of the proposed policy is likely to be the mandated replacement of about 18,000 efficient wood burners, at high cost to homeowners or landlords, with uncertainty concerning a net benefit to public health;
- If ALEB's are phased out they are likely to be replaced with less resilient costly all-electric heating;
- For households that can't afford replacement with heat pumps, the use of electric resistance heating would severely impact their budgets, which would result in poorly heated homes with consequent adverse health effects for

vulnerable people, thus offsetting the intended benefit of PM10 emission reduction;

- Heat pumps tend to lose efficiency over time, increasing costs and reducing effectiveness;
- The probability of public health benefits resulting from further reduction of present day particulate concentrations is low and is hard to quantify, however, the economic and renewable energy cost of the proposed regulation is high and is more easily quantified.

In view of these considerations we submit that the proposed extreme policy to eliminate all wood burning, except ULEBs, should be revised to permit the continued use and installation of ALEBs that have a low level of smoke emissions, when operated correctly. Pulling back on the proposed policy direction would be consistent with the precautionary principle as defined in 6.14 of the pCARP.

In particular we submit that: -

The principle must be to ban the smoke not ban the wood-burner

An additional category of wood burner should be defined as in the table below

Rationale: - This provision is moved from the definition of an ULEB, where it is anomalous. The date is removed to allow CRC to approve new designs of satisfactory low-emission burners in the future. The new "smoke-free" criterion is added to provide a simple means of initial screening of the performance of wood-burners without the need for costly particulate emission tests in the first instance. The PCE advises that smoke correlates well with adverse health impacts. This is confirmed by ECAN's December 2014 report on the relationship of visible emissions to particulate emissions.

In Tables 2.1, 4.1, and paragraphs 6.27, 6.32, 6.33, 6.37, 6.38, 6.39, 6.42, 7.76, 7.77 and Schedule 8 replace "ultra-low emission enclosed burner" with "approved low emission burners or ultra-low emission enclosed burners"

Paragraph 6.28 – replace "ultra-low emitting" with "approved or ultra-low emitting" Rationale: - These change would implement the principle that ALEB's be permitted indefinitely.

Paragraph 6.4, **should be deleted.**

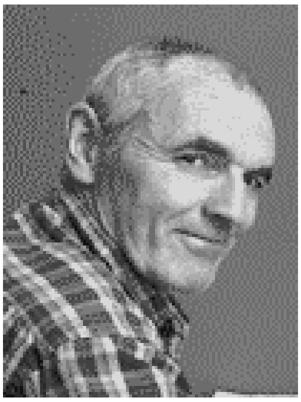
Rationale: - This over-simplistic rule, which requires scrapping wood burners more than 15 years old, takes no account of the extent of use, maintenance, operation by user, quality of original equipment etc. Instead the criterion for decommissioning equipment as it ages should be based, in the first instance, on its visual performance and ultimately on compliance with quantified particulate emission standards.

We submit that this submitted revision to the proposed Canterbury Air Regional Plan is fair and reasonable, economically efficient and fully compliant with the objective of improving public health outcomes via air quality in the Canterbury Region.

Approved low emission burner	*an enclosed solid fuel burning device approved by CRC to the following standards:* *(a) the emissions result in no more than 0.5 grams of total suspended particulate emissions per kilogram of fuel burned; and* *(b) thermal efficiency of 65% or greater* *(c) emit no significant visible smoke during steady state operation (excluding lighting and refuelling)*	*To allow the use of existing and new approved low emission burners indefinitely or until the long term outcomes of the Proposed Canterbury Air Regional Plan have been fully evaluated*

THE ON-GOING SAGA OF THE NEW ZEALAND SOLAR HOT WATER INDUSTRY

Why is New zealand missing the boat in the Solar Hot Water Industry?



By Eric Jansseune*

The most important supplier of energy for people is the sun.

Every day the sun delivers as much energy as the yearly energy consumption of the world, and New Zealand receives 3,000 times more energy than its yearly energy consumption.

Many areas in NZ get over 1,500 $kWh/m^2/yr$, while European countries on average only get 1,000 $kWh/m^2/yr$.

Hot water use in NZ is high and is estimated at 40% of the electricity bill in a normal NZ household. The high solar irradiation and the many sunny hours means that 70 % of these hot water needs could be covered with a Solar Hot Water (SHW) of the latest design generation or state-of-the-art technology.

Unfortunately this has not been demonstrated in most of the SHW systems in NZ so far.

The use of solar energy can contribute significantly to reduce the ecological footprint of every New Zealander. Unfortunately the application of solar energy is not widespread in New Zealand, while the use of solar energy can play a central role to reduce your energy bill and create a better world for all of us.

Worldwide Solar Energy is booming business even in countries that only have half of the sunshine of New Zealand.

The Solar Industry in New Zealand has been struggling for many years to increase the uptake of Solar Energy, in particularly in the field of SHW systems. So what is the typical situation in New Zealand and Solar Industry?

- NZ and the solar industry in particular is far too electrically orientated for water heating and home heating. Some 75 % of all buildings (EECA 2009) use electricity for hot water production and space heating, which is recognised worldwide as the least efficient;
- Lack of education in Solar Energy at all levels;
- Huge scepticism towards the use of Solar Energy in general;
- Too many quality and performance issues with accredited or energy star solar systems (see BRANZ reports and SIA newsletters);
- No comparative evaluation available on different concepts, maintenance, operation costs;
- Systems are oversized and overrated by suppliers because of the funding regime;
- Materials and concepts are not state of the art technology thus resulting in very short life of components;
- Bad industry practice, and poorly trained plumbers, even after attending the 'solar plumbers course' available for the Solar Industry;
- Lack of understanding of issues, state-of-the-art technology and lack of vital information.

*Eric Jansseune is director of EWA-TEC Ltd

Mission statement

"Ensuring the NZ solar industry keeps pace with the rest of the world"

During 7 years of surveying SHW we discovered the many and on-going quality, performance and installation issues with solar hot water. We can demonstrate and show plenty of pictures of situations that we assessed as a Solar Energy Doctor. Here you will find an overview of the many issues that we experienced.

The following concepts and situations demonstrate the ongoing quality and performance issues, not including installation issues such as leaking roofs, piping layout etc.

Retrofitting to existing cylinders

This is a cheaper investment but has many drawbacks:

- Mixing of hot/cold and thus no stratification of heat, thus less performance > 20 % losses;
- Protection from frost is very risky because glycol cannot be used in an open loop;
- Unreliable frost protection when a power cut occurs;
- In frosty cold areas the electrical heated water is pumped during the night to protect the collector;
- High corrosion factor which clogs the pump and valves and creates serious problems within first few years;
- Electrical element at the bottom interferes with solar performance so less savings;
- Position of sensors outside the collector and cylinder reduce solar performance drastically;
- Many controllers do not show temperature or performance data, so the owner has no visual indication of savings.

CONCLUSIONS

- Retrofitting will never produce 70 % of savings, rather 30 %
- Short life span of the solar components
- Very bad investment with very long return on investment

Thermo-siphons on the roof

These are not suited for NZ conditions:

- Horizontal cylinders don't have stratification, which reduces the yearly performance by more than 20 %;
- Electrical element in the cylinder interferes with solar performance;
- Cylinder outside on the roof creates > 30 % heat losses of yearly performance;
- Roof structure must be reinforced (see standards);
- Slow heat transfer compared to pumped systems;
- Very unreliable frost protection (power cut) with electrically heated water at night
- Only to be used in non-freezing areas and sunny climate all year long (i.e. tropics);
- Highly corrosive concept.

CONCLUSIONS

- Thermo-siphons are low performing <30 %;
- Very bad investment with very long return on investment

Evacuated tubes

These are not better performing or not favoured (compared to latest generation reliable advanced flat plate collectors)

- It is a myth that evacuated tubes perform better on yearly base (see tests in Germany-Europe);
- Loss of vacuum (see manuals) is common which means no insulation of the collector so performance drops immediately;
- Annual checking and replacement of failed vacuum tubes is awkward and gives a high operation cost at $ 20-30/tube.

Quote: As soon as borosilicate (glass) is exposed to heat stresses of more than 220 C°, cracks can appear in the material. In evacuated tubes, temperatures of 300 C° and higher can occur. If the "cold" heat transfer fluid flows directly into the hot tubes and there are resulting differences in temperature of more than 220 C°, cracks can appear in the evacuated tubes. This in turn can lead to explosion of the tubes due to differing pressure levels. The greatest danger arises when the system is being filled and at times when no energy is being taken out of the collectors (stagnation operation). In the collectors mentioned above, since the heat transfer fluid flows directly through the tubes, breakage of one tube causes shutdown of the entire solar system. For the system operator, this means considerable losses of potential thermal energy and damage to the system and the building. The appearance of cracks in the tubes and the risk of explosion are worsened by the fact that naturally occurring roof movements are transmitted to the collector, resulting in possible breakage of glass tubes, which can explode in extreme cases.

- The tubes are more fragile on the roof than tempered glass of flat plate;
- The tubes can also explode (experienced in Germany; the home of evacuated tubes);
- In frost areas the tubes will not melt the frost compared to flat plate so the tubes will not perform at all in frosty conditions;
- The tubes overheat too easily in summer, which stops the pump; thus reducing the overall performance while flat plates keep going all day;
- Evacuated tubes only perform better for high temperature application > 60 degrees C , so suitable only for industrial heat applications;
- The manifold needs protection with glycol;
- Glycol needs to be replaced every 3 years which is a maintenance hassle and cost;
- Many overheating problems, damage, failing tubes, loss of mains water on the roof.

So called "solar cylinders" that have the electrical element in the bottom of the tank

- This element interferes with the solar heat transfer thus less performance;
- Electrical element back up and electricity is not the most sustainable option;
- Back up element should be positioned in the upper part of cylinder (see worldwide state-of-the-art)
- Electrical element should not be switched manually, but automatically, because interference from owner reduces performance again.

Solar cylinders that have enameled steel instead of stainless steel (SS)

- These cylinders require anode replacement every 3 years (anti corrosion device);
- Enameled cylinders cannot have more than 75 degrees C hot water, thus performance loss again;
- Shorter lifespan (if maintained), not 30 years like stainless steel;
- Many cylinders don't have the correct length/diameter ratio for stratification;
- Many cylinders in NZ have high standing losses from under insulation, much higher than state-of-the-art cylinders.

Freezing and overheating problems are very underestimated in NZ

- Frost protection valves are very popular but unreliable even within the first year;
- Pump frost protection is very popular but inefficient when electric heated water is pumped to the roof, and very unreliable in areas with regular powercuts;
- Antifreeze (glycol) is not advised by many solar suppliers because of the hassle and regular maintenance cost, but instead the frost protection valve and pump frost system are installed in areas with a lot of freezing days;
- Overheating of collectors ensures systems spout hot water on the roof, via the open air vent, with melting gutters as a result, and waste of water and energy losses;
- Some suppliers even advise to cover the evacuated tubes when leaving on holiday, to avoid overheating problems;
- If owner forgets to activate his electrical element in winter, the risk of frost damage is very high.

The 2 main problems of NZ Solar Industry are Quality of Materials & Low Performance

Low performance: 30-50% less than could be achieved

Due to a combination of shortcomings below, many SHW systems in NZ conditions hardly perform as much as a SHW performs in Europe at, say, 400 kWh/m2

We have monitored some state-of-the-art systems in NZ that have easily performed over 700 kWh/m2, which is also the achieved result of professional modelling.

Complaints of low performance always come after one or more years, when electricity bills have been compared before and after the install.

Some suppliers even confirm in writing that no savings will be expected in winter.

We even have testimonies of accredited suppliers-installers telling the client to wait a few months before the savings will start!

Many households do not save 70% on their hot water bills, some saved less than 10% of electricity after the installation of their SHW.

Amongst the many shortcomings that create low performances we summarise :

- Electrical element on the bottom of the cylinder;
- Electrical element to be controlled daily by the owner;
- Electrical energy used for freezing protection at night on the roof;
- Solar controller with wrong settings;
- Temperature sensors on the wrong spots in the system;
- Horizontal cylinders that are not stratifying;
- Little insulation on cylinders (less than EN standards);
- Poorly insulated solar collectors (less than EN standards);
- Solar collectors with normal glass instead of tempered anti-reflective glass;
- Thermosiphon cylinders on the roof create huge heat loss at night;
- Mixing of hot/cold water in retrofit cylinders instead of stratification;
- Overheating and stagnation of evacuated tubes in summer or in periods of holiday;
- Vacuum failure in evacuated tubes;
- Wrong selection of back-up heat source concepts in general;
- Enameled cylinders with lower max. temperature of 75 degrees C.

Quality issues = short lifetime of the system

We only summarise the most important quality issues that have significant impact on the lifespan and thus cost-effectivness of the investment.

- Freezing and overheating conditions are very underestimated;
- Pump types should be suited for solar systems and resistant to very high temperatures;
- Solar controllers should have the correct settings and temperature indication, additionally thermal performance monitoring i.e. kWh hours produced should be available;
- Pipe insulation should be heat resistant to 150 degrees C;
- Solar flat plate collectors with plastic covers are not durable;
- Solar flat plate collectors with normal glass are not correct, instead tempered antireflective glass should be used;
- Solar absorbers should not corrode within 3 years but stay efficient for 30 years;
- Frost valves should not be used, they mostly fail within 1 year;
- Vacuum tubes can implode and create safety issues;
- Loss of vacuum in evacuated tubes requires yearly replacement of some tubes;
- Enameled cylinders and corrosion anode create high maintenance regime;
- Plastic piping in the solar loop is not heat resistant;
- Glycol systems need replacement of glycol every 3 years or more;
- Open air vent on roof melts gutters and creates stains on the roof.

CONCLUSIONS

The risk for a home owner in NZ to choose the "wrong" system with poor quality and low performance is very high, especially in a cost driven society like NZ where "cheap" is often the first choice.

The risk for freezing and overheating in NZ conditions is high for many accredited concepts and is under-estimated. Frost valves and pump frost protection are not reliable solutions.

The actual accreditation scheme is essentially a public deception and $1,000 EECA loan/funding is wasted money because of on-going quality and performance issues. Low performance and short lifespan is what has created the scepticism towards solar energy.

There is no objective organization/institute in NZ to certify professional SHW, in contrast with Europe where you cannot have funding if your system is not tested by such institute (see Germany and Switzerland on top).

Eric Jansseune

GREENHOUSE GAS EMISSION IMPLICATIONS OF SWITCHING FROM COAL TO GAS AS THE NZ DRY YEAR BACKUP ELECTRICITY SUPPLY SYSTEM

By Steve Goldthorpe

The decision to close down the coal-fired power generating capabilities of Huntly Power station by 2018, risks leaving New Zealand without a large store of energy that can be used to produce bulk electricity in a dry-year scenario, when the hydroelectric schemes are unable to meet the electricity demand. That situation has been exacerbated by the subsequent decision to close the Otahuhu B Combined Cycle Gas Turbine (CCGT) power station.

A scheme that has the potential to provide a back-up base-load electricity supply for several weeks is stored natural gas with peaking gas turbines. Such a scheme is currently in operation in Taranaki, based on the Ahuroa gas storage facility. This scheme is currently used to even out summer and winter demands for natural gas for power generation. The Ahuroa scheme takes natural gas from the gas transmission lines in the summer when gas demand is low, compresses it and injects it into the depleted Ahuroa natural gas field. Then in the winter, when gas and electricity demands are high, the stored gas is drawn from the gas field to supplement firing of two 100MW open cycle gas turbines (OCGT) to produce electricity. The OGCTs are called "peakers" because they are usually used just to meet morning and evening peaks in electricity demand.

However, in the case of high winter demand, particularly in a dry year scenario, when there is a shortage of base load power, that 200 MW peaker capacity can be run 24/7 on stored gas to meet the demand shortfall. The concept of balancing electricity generation from gas between summer and winter could be extended to balancing generation from gas between dry years and wet years. In principle, the Ahuroa scheme could be replicated as necessary to take over the back-up generation role that has been filled by Huntly power station.

From a greenhouse gas (GHG) perspective, switching power generation from coal to gas appears to be beneficial. OCGTs have a high temperature exhaust gas and are less efficient than CCGT schemes, in which additional power is generated from that waste heat. Nonetheless, the CO_2 emission factor of an OCGT at about 500 kg CO_2/MWh [2] which is lower than a coal fired power station, such as Huntly, at about 940 kg CO_2/MWh [3].

When the GHG emissions associated with the production of the consumer fuel is taken into account those emission factors increase. NZ data[4] indicates that methane emissions from coal mines and CO_2 from mining operations increases the coal emission factor by about 5%. In the case of natural gas, processing and flaring and losses during transmission increase the natural gas emission factor by 13%. On an updated Full Fuel Cycle basis[5] the CO_2-eq emission factors become 710 kg.CO_2-eq/MWh for an OCGT, which is still substantially lower than 1080 kg.CO_2-eq/MWh for Huntly power station on coal.

However, that Full Fuel Cycle assessment does not include the leakage of methane from underground natural gas fields, which in the case of the Ahuroa gas storage facility could be sufficient to eliminate the greenhouse gas emission advantage of gas over coal.

---

[2] 38% hhv efficiency and natural gas emission factor of 53 kg CO_2/GJ_{hhv}

[3] 35% hhv efficiency and coal emission factor of 91 kg CO_2/GJ_{hhv}

[4] Energy Data File and Energy Greenhouse Gas Emissions MBIE using CH4 GWP of 25.

[5] Using latest IPCC-preferred Global Warming Potential for methane of 86

The topic of leakage from gas fields is a fraught with difficulties and a dearth of real data.

In theory, natural gas trapped underground in a porous rock structure cannot have a gas migration pathway leading to the surface because if it did then the ancient gas deposits would be long gone. The existence of a natural gas field is primary evidence of a sealed system. However, once holes have been drilled into a natural gas resource to create a natural production field, underground structures are changed and potential new gas migration pathways may be opened up. That potential could be increased if the rock structures are deliberately fractured by hydraulic fracturing to increase hydrocarbon production rates.

Subsurface modelling can identify capping structures of impervious rock. If the cap rock is defined as impervious then the model will determine that the structure cannot leak. However, if the impervious cap-rock is 99.9% fracture-free gas migration pathways can still exist. A slimmer will gladly eat food that is 99.9% fat-free, but would not swim in a public pool that is 99.9% urine-free.

Well-drillers line gas wells with a casing in order to prevent communication of the well contents with the surrounding formations. Well integrity is a key feature of best practice and is demonstrated by bore-hole logging techniques. However, as I was advised by an oil and gas industry consultant *"All wells leak. It is not a question of whether or not leakage occurs, but how much leakage occurs"*. The fact that wells typically have two or three concentric casings implies that one casing may not be sufficient to completely prevent leakage of gas into the surrounding formations.

Safety concerns dictate that leaks of flammable gas must be avoided. However, gas evolving from the ground surface outdoors is well ventilated. Provided the concentration of methane in air is well below the lower explosion limit of 5% then there is no safety hazard.

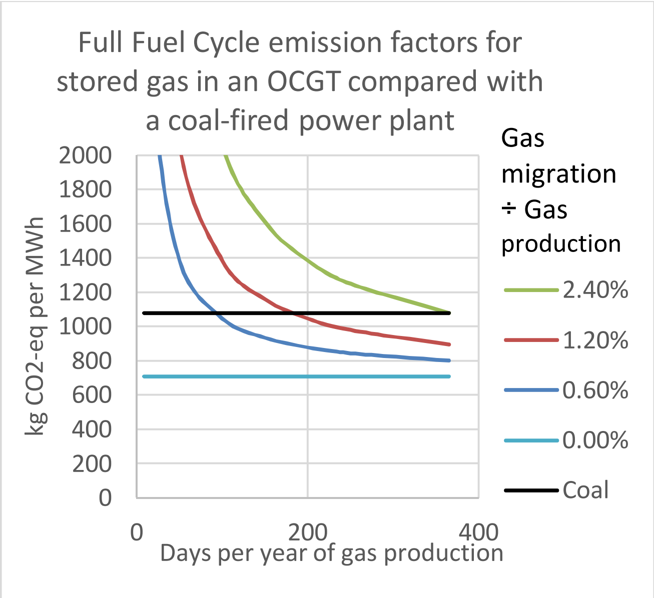
Natural gas is a valuable commodity so there is an economic incentive to avoid losses. However, if the cost of relining a gas well exceeds the value of the gas loss avoided, then there is no commercial incentive to do so.

From a greenhouse gas emission perspective migration of gas from gas fields can be significant. The migration of gas from gas fields was excluded from the NZ gas inventory to 2013, due to the oil and gas industry advising that it is trivial. However, from 2014 a value will be included based on international emission factors.

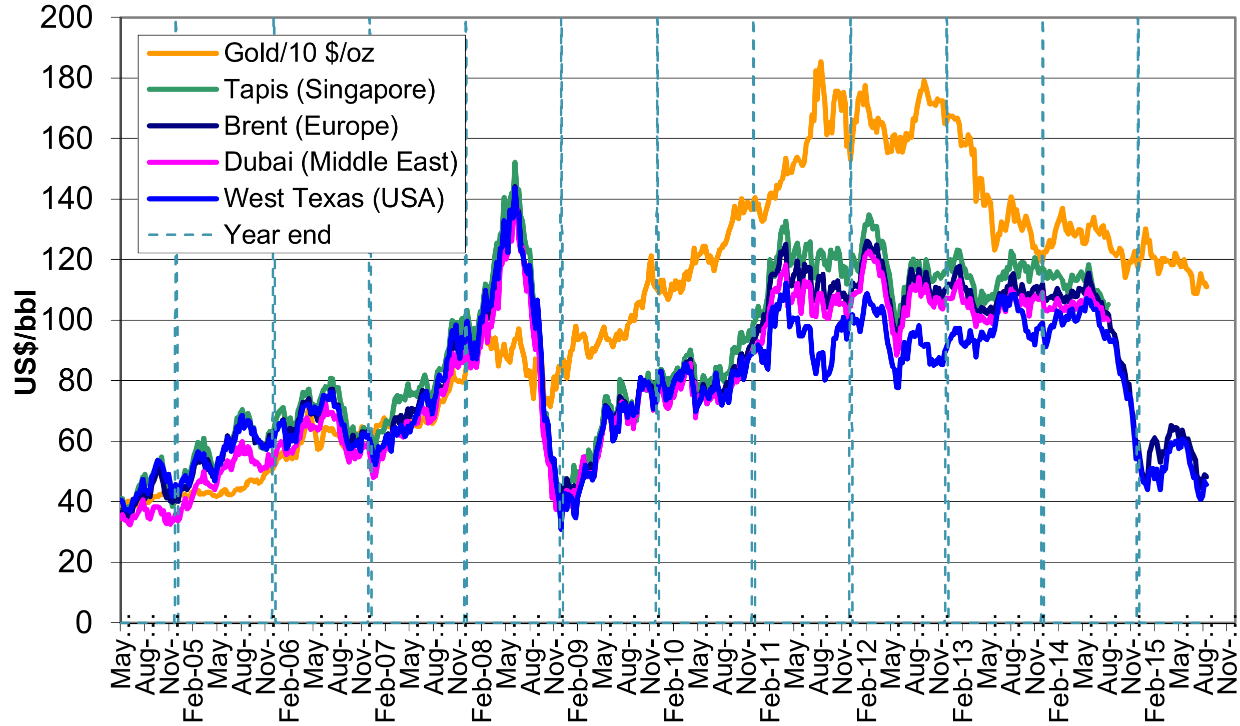
The emissions of fugitive methane from natural gas fields is a controversial topic in the USA. Measurements of fossil methane in air indicate that unmeasured fugitive emissions might range from 1% to 10% of production. In contrast oil industry claims are well under 1%.

If the rate of loss of methane from the Ahuroa storage is 2.4% of the rate of gas production, then during gas delivery the Full Fuel Cycle emission factor for gas, as determined above, would be the same as for coal. However, that facility only produces gas some of the time, whereas leaks would be continuous. Therefore the figure below presents situations where the Ahuroa scheme would be more greenhouse intensive than burning coal in Huntly power station.

Steve Goldthorpe



Neil's Oil Price Chart



The traditional EnergyWatch chart above shows the oil and gold prices as reported in the New Zealand Herald each Saturday. The reporting of the Tapis oil price in Singapore and the Dubai Oil price in the Middle East were discontinued in the Herald data from September 2014.

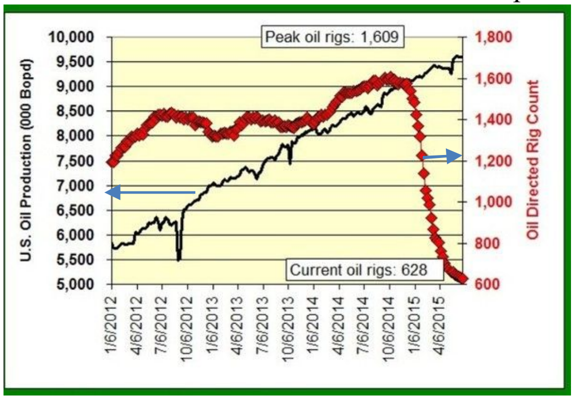
The recent rapid fall in oil price has baffled oil industry experts and pundits alike, who have put it down to oversupply. That oversupply is due to over-investment in production capacity spurred by three years of sustained high oil prices.

I receive the regular blogs of the Oil and Gas Investment Bulletin produced by Canadian Keith Schaeffer and the Oil and Energy Insider that comes from London. Whilst both these blogs are aimed at selling investment advice, their overview messages are informative of the thinking of potential investors in the oil and gas industry.

For example, a recent blog headline was *"Oil to drop again before sanity can return"* After bemoaning market turmoil ranging from Greek debt to Chinese stock woes, the blog explained: -

"Although a slew of Canadian oil sands projects have been cancelled due to incredibly low oil prices, several large projects were already underway before the downturn. With the costs of cancellation too high, these projects continue to move forward. When they come online – several of which are expected by 2017 – they could add another 500,000 barrels per day in production, potentially exacerbating the glut of supplies not just in terms of global supply, but more specifically in terms of the flow of oil from Canada. Canadian oil already trades at a discount to WTI, now at around $15 per barrel" (i.e. ~$30/bbl Ed.)

Likewise data from the USA shows a slow response:-



These examples illustrate that the oil price problem is predominantly timing. Investment in energy infrastructure is based on expected returns from the commodity price. However, the lag between an investment decision and the supply of the commodity is many years, whereas the traded commodity price responds instantly to the supply and demand situation. *Editor*

Join our sustainable energy news & discussion group

SEF Membership provides a copy of our quarterly EnergyWatch magazine. In addition, many members find the SEFnews email news and discussion facility an easy way to keep up to date with news as it happens and views of members. The discussion by the group of sustainable energy "experts" who have joined the SEFnews service offers an interesting perspective.

Non-members are invited to join the SEFnews email news service for a trial. To do this send a blank email to: <SEFnews-subscribe@yahoogroups.com>. To help us stop spammers, non-members need to supply a name and contact details, and a brief statement of their interest and/or involvement in sustainable energy issues, before their trial is approved.

As with all Yahoo groups, SEFnews emails can be received "individually" (as they are sent) or as a "daily digest" (grouped into one email per day). If you have a Yahoo ID you can also switch emails on and off, or read the news on the web – a handy option for travelling Kiwis. YahooGroups saves all of our text emails for later reference, and there is a search function so that you can review the thousands already stored over the last 6 years.

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 <admin@sef.org.nz> can select the 'daily-digest' option for you.

EnergyWatch

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. A receipt will be sent on request.

Name: ....

Organisation:...

Address: ....

....

Home Phone:.............................. ....

Work Phone:.................................. ....

Mobile Phone:...

E-mail:.. ....

Membership type:...

Amount enclosed: $.......................................