EnergyWatch

The Journal of the Sustainable Energy Forum Inc.

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

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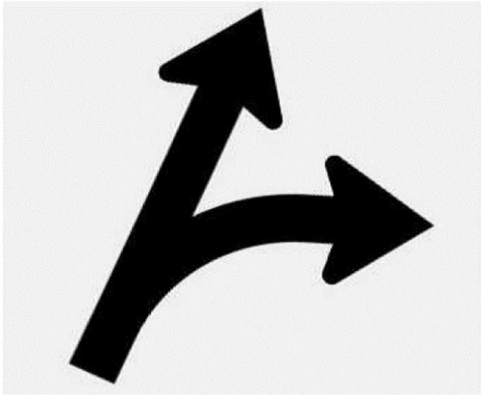
EDITORIAL

A Sustainable Energy Agenda

After 9 years of Business-As-Usual government, New Zealand is now led by a radically different political agenda. This provides an opportunity for the long-term energy future of New Zealand to become economically, environmentally, and socially sustainable.



Climate Change is an inevitable undesirable consequence of global fossil fuel exploitation. Honouring New Zealand's commitments made in the 2016 Paris Accord to short term and long-term greenhouse gas reduction targets must be demonstrated by practical actions that result in real impacts on New Zealand's greenhouse gas emissions profile.

The proposed Zero Carbon Act has the potential to provide a framework within which policies and actions can be developed to meet and exceed NZ's Paris obligations. SEF suggests the following Sustainable Energy Agenda, grounded on addressing Climate Change, as the defining challenge of our time.

1. Transitioning the transport sector from liquid fuel to electricity.
    a. Retaining and extending electrification of public transport;
    b. Effective legislation and permanent taxation regimes to facilitate the widespread transition to wholly electric private vehicles with necessary infrastructure and social acceptability;
    c. Transfer of long-distance freight from road to rail and coastal shipping.
2. Transformation of the electricity industry and its regulators;
    a. Focussing on the provision of an essential, secure service at a realistic cost;
    b. Advancing distributed electricity generation from renewable sources;
    c. Managing the fair redistribution of electrical capacity when the smelter closes.
3. Re-evaluation of the use of energy in the industrial, commercial, and domestic sectors;
    a. Revisiting energy efficiency levels in the Building Code;
    b. Phasing out coal use in the commercial and industrial sectors;
    c. Real support for solar hot water heating, domestic wood burning and PV applications.
4. Change of strategic direction in long term planning for New Zealand;
    a. Cessation of prospecting for new off-shore oil fields;
    b. Containment of urban sprawl and avoidance of car-dependent sub-divisions in rural areas;
    c. Limiting the development of roading infrastructure and expansion of rail infrastructure.

Real progress in decoupling New Zealand's economy and future prosperity from fossil fuel dependence is possible but challenging. The plan to pay others overseas to put in the hard yards to meet NZ's Paris obligations, is neither honourable nor in NZ's economic interest.

The reliance on forest planting, as a get-out-of-jail-free card available in New Zealand, is attractive, but that card can only be played once. The permanent conversion of land from pasture to forest, as is necessary to provide real CO_2 lock-up in perpetuity, could meet the needs of the present generation, but would compromise the ability of future generations to meet their own needs; thus contravening the Brundtland's basic definition of sustainable development. Land is perhaps the most finite and, alongside water, the most contested resource on this planet.

The role of the Sustainable Energy Forum in helping New Zealanders transition from a comfortable, consuming, business-as-usual existence to a challenging, frugal, sustainable lifestyle is a matter that has tested the SEF executive committee for some time. The SEFNZ email discussion forum is effective in facilitating the exploring options and issues. allowing a flexible expression of a range of views from the pragmatic to the philosophical.

The function of EnergyWatch has been, in my view, to try to capture some of the transient discussion on sustainable energy issues, both within the SEF community and in the wider arena, in a permanent form as a historical record. These days, pdf. files on www.EnergyWatch.org.nz are probably more permanent, and certainly more accessible, than bound sheets of paper on a library shelf. The print run of EW for SEF members who don't get EW on-line is less than a dozen.

This is the 25th issue of EnergyWatch that I have edited, and I think it should be my last. As you may have noticed, there has been a long delay since EW79 was produced. I apologise for that delay. It has not only been due to pressure of my other commitments and interests, but also to the lack of a sense of urgency and demand coming from the SEF membership, or feedback on previous articles.

The SEF AGM is due to be held in Wellington on 5th July, when I will retire as editor of EnergyWatch. I will be pleased if someone else comes forward to take up the reins and I will gladly support them. However, I suspect that the time has come for a change of format. It has been suggested that the compiled thoughts of the SEF community might be expressed better through an on-line blog rather than a formatted and printed document. We can discuss that at the AGM in Wellington on 5th July.

This issue of EnergyWatch, includes details of SEF submissions and follow-up and an opinion piece about the incumbent electricity industry. I also include a summary of a radical idea that I have been pursuing for addressing CO_2 emissions. This issue ends with the usual review of oil prices.

Best wishes to all SEF members.

Steve Goldthorpe
Editor of EnergyWatch

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The Sustainable Energy Forum of Aotearoa Incorporated

ANNUAL GENERAL MEETING

Wellington Central Library

Mezzanine Meeting Room

6.00.p.m. Thursday 5th July 2018

Guest speaker

Dr Andrew Alcorn

New national strategies to reduce CO_2-e emissions from New Zealand houses.

Heating for houses has been investigated for many years as an important contributor to atmospheric CO_2-e, with significant potential for emissions reduction. In New Zealand, our focus on reducing heating energy, and neglecting embodied energy in the building fabric, has followed that of Europe, the traditional leaders in environmental research. In temperate climates like New Zealand, however, and with firewood as a major heating energy source still, CO_2-e emissions from heating cause only a small fraction of lifetime emissions from houses, even poorly insulated ones. The embodied emissions from the building materials have always been greater than emissions from heating. As insulation is increased, however, embodied emissions in the building shell become many times more significant than heating emissions. In an optimally insulated house, lifetime embodied materials emissions are over 7 times the lifetimes emissions from heating.

This talk will investigate different strategies to reduce national CO_2-e emissions from houses, including the emissions from several operating energy uses, besides heating; the embodied emissions of materials; and the embodied emissions of new power plants.

There will follow general discussion on the future of SEF and EnergyWatch.

Remote attendance via Skype will be available. Please email neilman@videofoundry.co.nz to make arrangements.

SEF SUBMISSIONS

Submission on the Productivity Commission Report "Low–emission Economy"

Thank you for the opportunity to submit on your Low-emissions Economy report of April 2018.

Your overall objective is aligned to SEF's objectives of *promoting information and supporting action which will help move New Zealand towards a sustainable energy future.*

Market led solutions and direct regulation

SEF supports your finding F12.4 and recommendation R12.3, i.e. integrating distributed energy resources (DER) into the electricity system. Pricing is essential for this, as is competitive access to distribution infrastructure at a reasonable cost. The fact that there will be some stranded network assets, generally owned by incumbent power companies, should not be used as reason to obstruct private investments in efficient sustainable technologies.

Account should be taken of the fact that it is becoming economic for some householders to install PV+batteries and to disconnect from the grid altogether. An increase in the number of consumers for whom being off-grid is a rational economic choice rather than a life-style statement, will have implications for grid demand and the

centralised generation. These scenarios need to be modelled for the long-term.

On direct regulation, today's air quality regulation prevents commercialisation of new-technology home wood burners, which could potentially meet the winter peaks and even dry-year home heating which are still unsolved problems in your six scenarios and even in Transpower's ambitious all-electric scenarios.

SEF supports all three recommendations R15, noting your recognition that energy efficiency reduces peak demands. However, building regulations still encourage cheap hard-to-heat housing and need to be revised to recognise low-carbon policies. Advances in solar water heating, heat pumps, insulation and glazing technologies provide opportunities to update the building code.

Science and Innovation

On science and innovation, development of efficient wood combustion in houses was funded in the late 1970s by DSIR and led to today's "approved" wood burners. Further development is needed for advances in ultra-low emission wood burning, leading to dual-fuel residential and institutional heating appliances using electricity when it is in surplus, and wood, wood chip or pellets at winter peaks or especially in dry years.

Expansion of Forestry

Expansion of forestry is presented in your report as "having to continually plant more and more land in forests." This is wrong because it ignores utilisation. In fact, significant carbon is sequestered in timber-framed buildings – New Zealand is at the forefront of developing wood for commercial buildings and high-rise. For housing, the embodied energy in thick-walled (140mm) fully insulated buildings and the resulting reduction of heating (and cooling) loads is critical to a low-carbon energy system. Utilisation of residues from harvested forests are a neglected resource that can provide both residential and industrial energy to replace fossil-fuel heating with long term CO_2 emission reductions.

Electrification of Transport

Your report's Section 11 on transport, is almost entirely about the vehicles not the planning that provides other options for moving people and freight. Local authorities could be drivers of change, and some cities, including Wellington, have significant "Low Carbon" policies. SEF supports Recommendation R11.5 – working with local councils to use pricing to reduce congestion. But we note that finding F11.15, that rail and coastal shipping, is not taken further to a recommendation is short-sighted. The statement "a large proportion of freight carried by road is not economically contestable" should be challenged from a long-term perspective. SEF considers both rail and coastal shipping to be essential features of a low-carbon economy in the long-term.

SEF doubts that private transport will be electrified to the extent that your scenarios suggest. The attraction of battery electric vehicles (BEVs) is currently the absence of road user charges, subsidised charging stations, and some preferential road use. When consumers must pay full costs, BEVs will be far less economically attractive to consumers buying electricity at retail prices. Limited range BEV's may be used as a second car, but BEVs are inherently unsuited to widespread use in NZ as the primary family car.

In contrast, plug-in hybrid EVs (PHEVs) are ideally suited to widespread use in NZ as the family car. They suit the Kiwi's preference for big SUV vehicles. PHEVs are free from range-anxiety and not limited by the time and location issues of recharging. If PHEVs are also granted preferential road use concessions, they could well become the vehicle of choice for middle income New Zealanders' family cars. PHEVs might supply 80% of the eventual EV market in NZ. Market modelling is needed to determine a more credible figure.

The modelling in your report is flawed in defining PHEVs as *"low-emission vehicles that produce zero or near zero tailpipe GHG emissions"*. PHEVs typically have a range of about 50km on battery before they switch to become a petrol

hybrid vehicle - and a not very efficient one at that. In real-world general use by busy people unconcerned with micro-managing daily cost, the proportion of mileage driven on electricity with a PHEV could well be 50% or less. Behavioural modelling is needed to determine a more credible figure.

Your modelling should be revised to include credible ratios of PHEV to BEV uptake and electricity to petrol use in PHEVs. If these ratios are 80% and 50%, then the GHG emissions from the NZ EV fleet would be 40% of an equivalent fossil-fuel fleet - not 0%.

A problem with the reality of PHEVs is that the vehicle emissions intensity is unpredictable, depending on the user's daily circumstances and lifestyle, so PHEV's are not amenable to vehicle import standards based on emissions intensity.

Energy Storage for Dry Year Energy Supply

Concerns about NZ's history of energy shortages in dry years are questionable given that these were also periods that wind and solar power facilities, if available at the time could well have produced enough energy to maintain hydro storage capacity to ride through a crisis. Therefore, before making recommendations relating to dry year contingency plans to investments in thermal backup storage capability (e.g. in terms of coal stock-piled at Huntly or the construction vast, potentially leaky, gas storage facilities holding costly thermal fuel for prolonged periods) there needs to be a forward-looking study of the prognosis for the coincidence of low availability of rain, sun and wind together over prolonged periods. The study should consider the need for the EA to change the electricity market conditions to appropriately value the use of the existing 4000GWh of hydro reservoir storage. The study should also assume that there will be more wind and solar power along with associated battery storage facilities to mitigate the daily intermittency of the renewables. These batteries could be installed by network grids and householders (possibly with EV batteries connected under V2G arrangements for reserve use) to be available to the grid to support the better use of existing hydro reservoir storage.

Scenarios

The focus on defined scenarios to "calculate" future emissions suffers from the limitations of their underlying assumptions. All "pathways" have near-50% increase in electricity demand (despite the last decade when energy efficiency was the main reason demand was flat). All transport "pathways" are about the vehicles themselves not the urban design that drives the use of vehicles. No scenario puts decentralisation of electricity and fuel supply (e.g. PV and wood heating) as a low-carbon option.

The Government's Climate Change Committee needs to be resourced to study additional scenarios, in particular one or more in which Energy Efficiency First is the driving policy, as is the case of the EU's Directive of November 2016.

Conclusion

The Productivity Commission's Low Carbon Economy is too rooted in the idea of economic growth as a driver of well-being, and too focused on the short-term imperatives of "business" as society's investment decision-makers. We believe that local bodies are a more appropriate focus for low-carbon planning, and that distributed energy including photovoltaic and biomass are the best means of providing resilient energy for households, commerce, and industry.

Submission on the EECA 2018/19 Consultation

Summary

The Levy Consultation documentation offers inadequate evaluation of performance to date or expected outcomes from proposed investments. Effective accountability is essential to facilitate a competent evaluation of the plan and justification for allocation of public funds.

As the proposed activities have implications for private funds, there is a real concern that funded

activities are proposed with no clear insight into implications for private citizens or businesses.

EECA's original focus was energy efficiency and conservation in the residential sector. There has been a recent move to a strong industrial focus accompanied by changes to the EECA Board to include representatives of industry.

A return to a strong residential focus is needed, funded by residential power consumer's Energy Levy, to be consistent with the new Government's commitments to social and environmental outcomes.

The outputs and outcomes from the levy proposal are unclear. At best they are indeterminate, at worst they may have perverse outcomes. Therefore, the levy proposal cannot be supported.

Fundamentals are absent

1. Treasury Guidelines not met: Better Building Case (BBC) guidelines apply as total funding exceeds $15M ($14M levy plus EECA baseline). These are not separately allocated to individual programmes or projects, internal cross-subsidisation occurs. The proposal implies an EECA programme of activities, therefore BBC requirements should apply, and the analysis should be provided.

2. EE&C Act 2000 requirements are not met. There is no evaluation of progress in energy efficiency and renewable energy on which to base assessment of levy (and/or baseline)

3. NZEECS is deficient. The present NZEECS was developed by a process not based on an analysis of progress from previous NZEECS.

4. Levy proposal is inconsistent with accepted activity-based accounting principles. We are asked to provide feedback on a proposal with only high-level budget overview information and no accounting of activity level costs or benefits.

5. This levy proposal doesn't comply with the levy process described in 2016. That process requires a transparent analysis.

6. No report of MBIE review[1]. In 2016, MBIE and EECA completed a review of EECA's programmes. The review assessed whether EECA's programmes are fit-for-purpose and are consistent with changing Government priorities.

Inadequate analysis of programme investment

7. Lack of strategic context and outlook – there is no review or update of EECA's assessment of the strategic energy use landscape and the potentials for achieving improvements in energy efficiency, conservation, and renewables in the medium to long term.

8. Lack of a clear operating model; the proposal lacks a pragmatic and transparent process for qualifying, evaluating, and ranking programme opportunities based on clear criteria and objectives, including the need for Government intervention and rigorous cost/benefit and risk analysis. Specifically:

9. No insight is offered into the baselines used in developing the proposals.

10. No analysis of counterfactuals.

11. No assessment is offered into autonomous improvements in energy efficiency or renewable energy, nor how the proposed programme builds on these to offer an effective and economic investment in energy efficiency and renewable energy.

12. No intervention logic is provided.

13. No assessment of options evaluated has been offered.

14. Lack of a programme portfolio - design of a portfolio of programmes focused on the existing Residential and Business markets and on the Transport market, with at least clear five-year targets for changes in market state and 2025 strategic goals in each market.

[1] http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-efficiencyenvironment/energy-efficiency/2016-review-of-the-eeca-work-programme/

15. It is not clear how the proposal aligns with Government priorities. For example, there is no evaluation of carbon emission mitigation outcomes.

16. Provides no confidence for investments: a clear accounting of public costs, public benefits, private costs, and private benefits over the lifetime of the interventions is required. This is not offered and without this, no one can make an informed response to the levy consultation questions.

17. There is no clear accounting of how the proposed energy efficiency and renewable energy activities contribute to carbon mitigation in New Zealand and how this underpins New Zealand's carbon policies and NDC commitments.

18. The opportunity costs of options that are not included is not clear. In a context where EECA has dropped programmes that were economic (ENERGY STAR was dropped in 2016 despite its global recognition as a high performing market transformation programme). It is now difficult to have confidence that the levy proposal constitutes a programme of economic market transformation projects that can competently implemented.

Inadequate consultation insights

19. No evidence offered into insights gained from consultations undertaken in preparation of this proposal.

20. No insights from recent experiences in implementation of programmes.

21. With no evaluation of the cost benefit performance of previous Low Emission Vehicles Fund (LEVF) projects there is clearly no basis to conclude that a proposal to increase LEVF would be an efficient investment for taxpayers.

NABERS

22. National Australian Built Environment Rating System (NABERS) appears to have had success in Australia where it is linked to increased sustainability of buildings and increased capital value of highly rated commercial buildings.

23. Given this apparent success, no basis is offered for the comparatively small investment made in NABERS.

24. No analysis of progress to date with NABERSNZ activities, nor the attribution to NABERS of any progress in building energy efficiency and renewable energy.

25. Without any context or option analysis, there is no basis for supporting or rejecting this.

26. It is not obvious whether this is the only activity EECA plans to undertake in the commercial sector; it is not included in the programme portfolio. It is therefore impossible to determine if this is an adequate, effective, or prudent use of levy funds.

Concluding Remarks

The information provided in the EECA consultation document is inadequate for submitters to review the effectiveness of past EECA programmes or to assess the likely effectiveness of future EECA programmes. The consultation process provides an opportunity for special pleading for funding to be directed towards specific programmes in which the submitter has a vested interest. However, it does not provide sufficient information or analysis to allow organisations such as SEF, with a broad perspective in energy efficiency and conservation, to make positive feedback commentary. Regrettably, this is a missed opportunity.

Response to SEF from EECA

SEF received a response from the CEO of EECA to this submission, which included these points

- EECA takes into account Treasury's Better Building Case framework and principles in building our strategies and business cases. We have processes in place to periodically review programme performance and ensure outcomes are being achieved
- In regards to evaluating progress in energy efficiency from our activities, you may wish to refer to our annual Statement of Performance Expectations, which sets out EECA's goals and objectives each year. The outcomes (e.g. energy savings) of these goals and objectives are then reported back through our

annual reports. These documents are all available on our website: https://www.eeca.govt.nz/resources-and-tools/research -publications-and-resorurces/corporate-and-strategic-publications

- Please refer to Appendix 2 of the consultation document, which provides comprehensive notes to explain the key financial drivers for our 2018/2019 proposal. We will continue to build on levy consultations, improve engagement with our stakeholders, and provide comprehensive information on our future projects.
- EECA has provided support to improve the performance of residential and commercial buildings for many years, and we intend to continue this support in the future. Where possible, we will endeavour to increase the energy efficiency targets for buildings and will continue to work with the New Zealand Green Building Code (NZGBC) on ways to improve reg effectiveness of NABERSNZ.

Rebuttal from Frank

The EECA reply is much appreciated. However, critically, the EECA response does not reflect best international practice on independent program/project evaluation as developed by the OECD DAC (Development Assistance Committee) in its guidelines for independent evaluations. The OECD DAC criteria are the basis for most evaluations undertaken for the $100's of billions spent per year worldwide on ODA (Official Development Assistance).

Over $10 billion are spent per year internationally in developing countries alone (and more is spent internally in developed countries) on sustainable energy (energy efficiency, renewable energy and GHG reduction/mitigation) projects and programs. The majority of this expenditure is evaluated by fully independent evaluations that report directly to independent evaluation arms of the relevant funding organisation, which in turn directly report to the Board, and not via the CEO of the relevant funding organisation. The independent evaluators are hired under transparent bidding processes and work under comprehensive TOR. The evaluators are tasked with honestly saying what they find, without fear or favour. They can be asked to substantiate their findings with evidence or elaborate their findings, and the implementing agency can provide comments, but the independent evaluators findings cannot be suppressed. Best practice is for the independent evaluation reports to be publicly available on the relevant organisations' website.

The reasons for such a strong international emphasis on fully independent and public evaluation of project and program results is that any self-assessment of results will always provide a positive spin on the results, will not honestly report on problems and deficiencies in the funding agencies role, and will always reflect positively on the organisations management and CEO.

Obviously, any sustainable energy funding and/or implementing organisation's self-assessment of its results will be essentially meaningless. This must also apply to EECA's self-evaluation of its past expenditure. Without strong independent and publicly available evaluations, any future EECA project and programs designs will inevitably not be based on a strong foundation.

Frank Pool (Team Leader of 16 formal evaluations of (and energy expert on another 10) clean energy projects and programs for UNDP, UNIDO, World Bank, ADB, USAID, French Development Agency, Nordic Development Fund and the Government of Finland).

ZERO CARBON BILL

The Government is consulting on the Zero Carbon Bill, which will be an over-arching framework setting long-term commitment to the transition to a low-emission climate-resilient economy. The discussion document is at www.mfe.govt.nz/have-your-say-zero-carbon. Consultation on the Bill runs until 5pm Thurs 19th July.

MAKING THE TRANSITION TO ELECTRIC CARS HAPPEN

By Steve Goldthorpe

The need to disconnect the demand for personal mobility from reliance on climate-changing fossil fuels will require a transition to electric vehicles (EVs) for mainstream motorists, not just a minority of enthusiasts. Making that happen will require honest information and effective explanation of the real and perceived barriers to EV uptake.

Operating cost

The principal selling point used to promote (EVs) in New Zealand is the myth that the running costs are equivalent to buying petrol at 30c/litre; i.e. one sixth of the cost of a running a petrol car. That myth was debunked in EW79, where it was pointed out that a regular consumer paying a current retail price for grid electricity would find an EV fuel bill to be about half of the former petrol bill not one sixth. When the Road User Charge is added to the operating cost of an EV in due course the economic per km advantage of an electric vehicle over an equivalent standard petrol hybrid car would essentially disappear.

It is argued that careful use of time-of-day tariffs could reduce the cost of running an EV, by charging it with cheap electricity overnight. However, that would limit the flexibility of the use of the vehicle. For example, cheap electricity tariffs would not be available for recharging an EV immediately on arriving home from work in the early evening so that the car was ready for use for evening social activities.

Advertising

A check through the motoring section of Weekend Herald will reveal virtually no recognition that cars consume fuel. The descriptor "economical" is used occasionally but fuel consumption figures are rare. The motor trade is not stupid. They know that running costs are almost irrelevant in the emotional relationship between the car owner and his (or her) pride and joy. If the motoring public are generally disinterested in litres per 100 km ratings, then it will be an uphill struggle to get EV car buyers interested in kWh/100 km data.

Recharging

The AA advises "*For many Kiwis, a used EV will likely be your introduction into the EV world. As such it is important to choose carefully. Always ensure the vehicle will fulfil your needs and is right for you and your lifestyle*. This is wise advice. The simplistic assumption that an EV can always do the job of a conventional car can easily turn the relationship between human and machine from love to hate. (See box below).

Beware false promises

Flywheel energy storage is touted as a device that charges 10 times faster than the best EV.

https://www.neri.org.nz/resource/Files/500kW%20Flywheel%20Energy%20Storage%20CFW01.pdf

However, the device has an energy storage density of 12 kJ/kg, which is 4000 less than the energy stored in a tank of petrol and 180 times less than a 600 Wh/kg EV battery, which has 4.5% of the energy density of petrol.

Making the transition to battery-only EVs happen in NZ, rather than the apologist's petrol hybrid version, will take realism, honesty and education, not false promises of 30c/litre.

A lady with her teenage real daughter turned up at about 4.30 p.m. at my backpacker's hostel in Waipu in a Nissan Leaf that was low on charge. She asked to use my 15-amp EV charging point. I asked if they also wanted to stay the night and have a fully charged car the next morning. I was surprised when she said "Oh no! My daughter is due at an event in Auckland (a 2-hour drive) at 7.30 p.m." I explained that even with a fast charger it would take a few hours to get enough juice into her Leaf to get to Auckland. No way was that car was going to get to Auckland by 7.30. p.m. She was under the misguided impression that she could fill up her car with electricity as quickly as filling a conventional petrol car. Her disappointed daughter phoned Auckland to say that she would not attend. They stayed the night and went back up north in their fully charge Leaf the next morning - a bit wiser.

Energy Efficiency First, a path not a bridge to a low-carbon economy

By Molly Melhuish

The Government's initiatives for a low-carbon economy will fail dismally because they all assume that new power stations will be built to meet growing electricity demand. They say seven or eight new gas fired stations will be "needed" to meet winter peaks from home heating. That's wrong![2]

Instead, New Zealand should restore the "warm homes-clean heat" schemes that began a decade ago but were soon cut back to a shadow of their earlier scope. Over 300,000 houses were insulated, and most had efficient wood burners or heat pumps installed. But 600,000 houses remain with poor or no insulation and dependent on plug-in resistance electric heaters.

For new homes, including flats and retirement villages, New Zealand should specify "timber-plus" construction with thick insulated walls, which can sequester much of the carbon emissions from the energy they will require over their lifetime.[3]

The building sector accounts for 20% of New Zealand's carbon emissions every year.[4] Local timber construction provides a market for some of the billion trees needed to offset other emissions. Their residues can replace coal in industrial boilers and schools and hospitals.

Energy Efficiency First has been the theme of countless submissions[5] that have been ignored in favour of Big Electricity's growth agenda. The Low Carbon report of the Productivity Commission,[6] and the personnel of the Retail Price Inquiry,[7] both support the previous government's "electricity growth" scenarios. Only a public campaign can turn the "natural gas bridge"[8] into energy-efficiency paths[9] to a low carbon economy.

The Big Electricity Agenda

Once again, a "beneficial electrification" narrative is being developed by New Zealand's energy businesses, their consultants, and some politicians. This time it is under the guise of reducing climate change. It is designed to ensure government and regulators support steadily increasing charges to electricity users, particularly domestic sector. It is designed to benefit large energy users and the electricity industry.

This narrative supports rapid growth, building new power stations to supply electric vehicles, industrial heat, and a growing population. It is being led by Transpower's "Te Mauri Hiko Energy Futures" report[10] which suggests that today's electricity capacity needs to double or even triple. Wind farms, geothermal stations and

[2] Demand grew steadily until 2008 but flattened suddenly with the global financial crisis. Yet as the economy recovered, demand stayed flat. Those who could afford it invested in energy efficiency; those who couldn't afford it used less power and suffered in cold damp houses.

[3] http://researcharchive.vuw.ac.nz/xmlui/handle/10063/1871

[4] https://www.thinkstep.com/content/hidden-building-pollution-exposed-new-report

[5] http://www.mfe.govt.nz/sites/default/files/media/Melhuish%20Molly%2009152.pdf

[6] https://www.productivity.govt.nz/sites/default/files/Productivity%20Commission_Low-emissions%20economy_Draft%20report_FINAL.pdf

[7] http://www.scoop.co.nz/stories/BU1804/S00394/electricity-reiew-panel-looks-favourable-to-current-market.htm

[8] http://www.scoop.co.nz/stories/PO1805/S00086/research-shows-natural-gas-isnt-a-bridge-fuel.htm

[9] http://www.scoop.co.nz/stories/BU1805/S00274/energy-efficiency-first-a-path-not-a-bridge.htm

[10] (https://www.transpower.co.nz/about-us/transmission-tomorrow/te-mauri-hiko-energy-futures

rooftop PV would all expand, and batteries would shift their output to night-time as necessary.

An Efficiency First agenda

SEF proposes that NZ needs to promote a new "Efficiency First" (E1) narrative. It must begin by restoring the 'Warm Up NZ & Clean Heat' programme to meet the original vision of fixing millions of cold, damp, leaky houses. The embodied energy of much of this investment can be negative! Andrew Alcorn will explain this change of narrative and lead the discussion following the SEF AGM (5th July, 6pm, Wellington Public Library Mezzanine Room & via Skype; see Page 3).

The SEF "Efficiency First" narrative involves high efficiency standards for all new residential and commercial buildings and their key energy using equipment, notably super high efficiency heat pumps, the widespread use of solar water heaters, and moving to high insulation level windows and their frames. It must also facilitate the installation of efficient clean wood burners to support winter peaking electricity concerns and any dry year electricity shortages.

Few if any, new power stations are needed. Support must go to distribution networks to facilitate inter-connection of widespread rooftop solar and inner-city parking lots for the recharging of electric vehicles. Embodied carbon emissions must become a key measure for public policy assessment of new investments in the energy sector. On this basis, Efficiency First wins without question.

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Commerce Commission's "Priorities 2017/18"

Electricity retail consumers will be disappointed that the Commerce Commission (CC) won't take a view on how best to adapt the NZ power market to the rapidly changing world of technology. In November 2017 the CC invited the views of the commercial market stakeholders to help write its annual "Priorities" report. It received 17 submissions: 4 by retailer organisations (including MEUG and ERANZ) and 13 by Lines Companies (LCs), their engineers and their trustee owners (ENA, EEA, and ENTRUST). However, the CC's blasé "Priorities 2017/18" for electricity distribution infrastructure indicates the regulator has a disinterested view on how technological innovation should be regulated. The CC's reports and submissions can be accessed from:

http://comcom.govt.nz/regulated-industries/electricity/our-priorities-in-electricity-distribution/

The opposing stakeholder positions are largely put by (a) the largest NZ Lines Company Vector and (b) ESANZ representing 19 NZ retailers. The latter includes the big five gentailers controlling 90% of the electricity retail market, along with independent retailers gnawing away at their long-standing oligopoly. Both LCs and retailer proponents piously claim to be looking after the interests of customers, but that their actions are severely limited by the others' lack of transparency. Retailers say LCs won't release geographic details of their assets - so retailers and new market entrants can't offer alternative investment solutions; and LCs say retailers are loath to release details of consumer power consumption patterns - which LCs need to assess the impact on their networks of market changes.

Vector's submission makes the point that "… *A traditional approach to asset management will result in assets being commissioned that are not fulfilling the needs and preferences of customers.*

The ESANZ submission notes " W*hat we see emerging now are 'disruptive' technologies – that is they are not simply better 'poles and wires' solutions, but rather technologies that may reduce, defer, substitute, or negate the need for those poles and wires altogether*

CO_2 storage in the very deep ocean as a concept for delivering on the CCS promise

Over the last 3-4 years I have been developing and promoting this radical concept for addressing Climate Change. However, it has failed to gain traction with the CCS community. I share these ideas with the SEF community and I would welcome feedback.

Steve Goldthorpe, EnergyWatch Editor

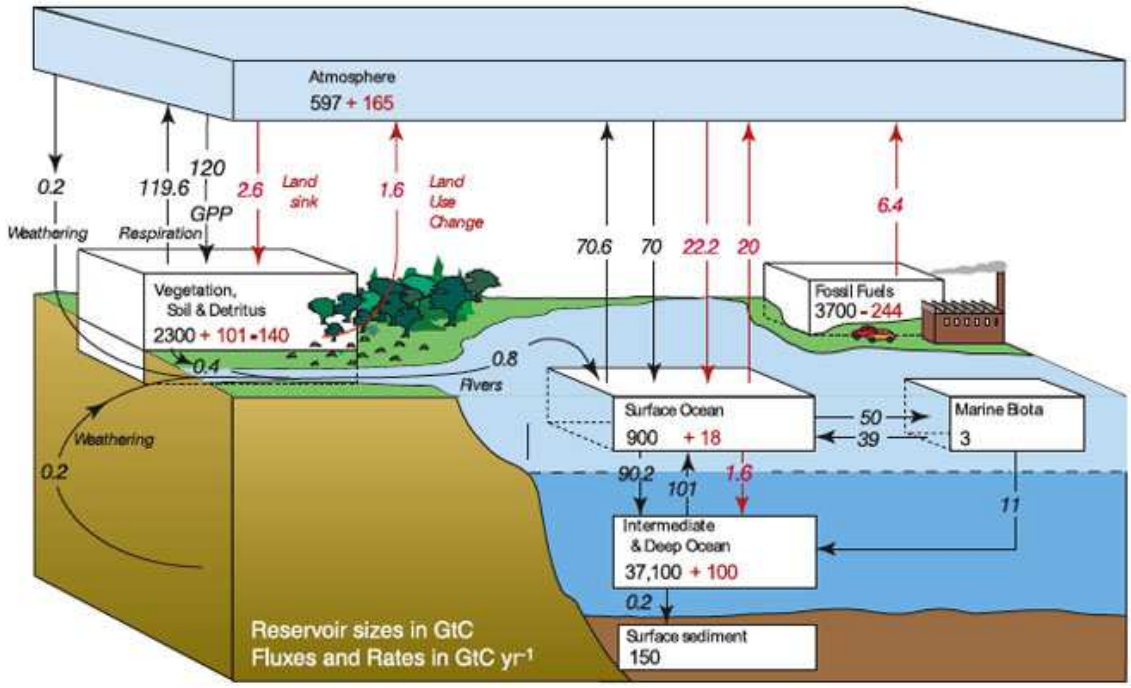


Figure 1 – The global carbon cycle

© Climate Change 2007: The Physical Scientific Basis, Intergovernmental Panel on Climate Change

As well as Climate Change, an adverse environmental effect of the increasing CO_2 content of the global atmosphere is the acidification of the upper layers of the oceans, due to excess CO_2 dissolving from the atmosphere into seawater. Adverse ocean effects, such as coral bleaching, due to ocean acidification by CO_2 are observable at present and are expected to get worse. The Global Carbon Cycle is illustrated in Figure 1.

Carbon Capture and Storage (CCS) is one essential tool in the toolbox of measures to address the multiple environmental problems of Climate Change, Sea Level rise and Ocean Acidification. CCS is one strategy alongside energy conservation, fuel switching, renewable energy development, nuclear power, urban and industrial restructuring, etc. Delivering on the Paris Agreement requires all these measures and then some. The IEA estimate that the lowest cost solution will involve about one sixth of the required global CO_2 emission reduction to be achieved via CCS over the next three decades. That would require storage capacity for 75×10^9 tonnes of CO_2. CCS has been actively researched for the last three decades but has thus far failed to become a practical proposition.

Whilst cost is a major barrier to CCS in the energy free-market, there is also doubt about the ability of geological storage of captured CO_2 to deliver on the promise of permanent CO_2 sequestration. The capacity of depleted

hydrocarbon wells is woefully inadequate to accommodate the vast quantity of CO_2 to be stored. The alternative of drilling into deep saline aquifers to store CO_2 is unlikely to be able to deliver the required certainty, replicability, capacity, and affordability required to achieve permanent sequestration of vast volumes of CO_2.

CO_2 from fossil fuel combustion is at present discharged to the atmosphere from where it dissolves over time into the oceans. CO_2 emission reduction could be achieved theoretically by direct delivery of captured CO_2 into the upper ocean, bypassing the atmosphere and avoiding the Climate Change effect. However, the resulting bringing forward of ocean acidification would mean that shallow ocean storage of captured CO_2 is not an environmentally acceptable solution to the CO_2 storage problem.

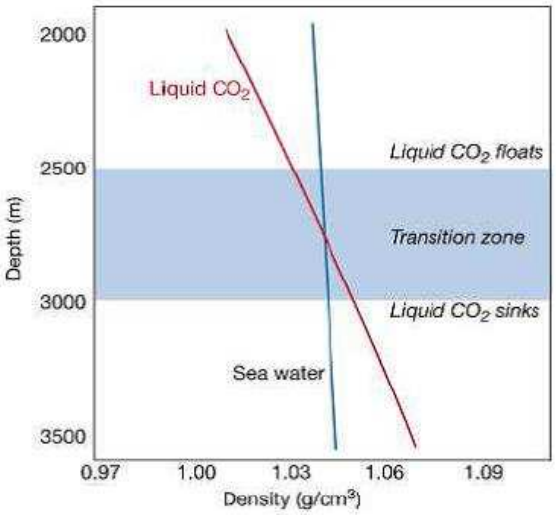


Figure 2 Liquid CO_2 density vs sea water

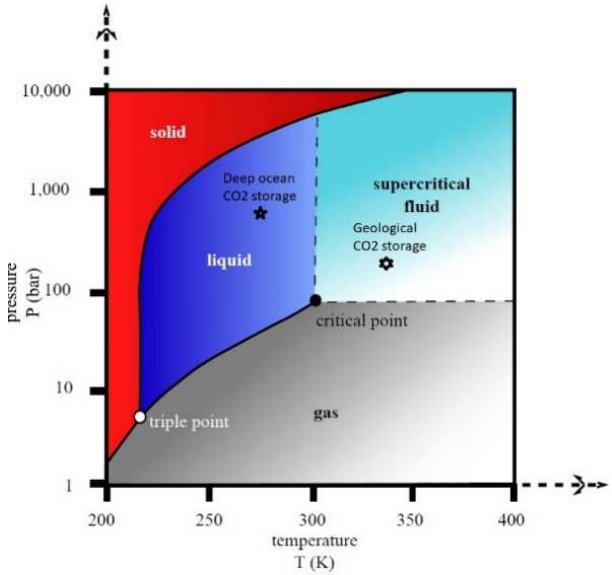


Figure 3 CO_2 phase diagram

A radical solution to this problem

Liquid CO_2 is compressible and is denser than seawater at depths greater than 3000 m, as shown in Figure 2. Figure 3 is a CO_2 phase diagram, which shows that CO_2 would be a stable liquid in the cold Hadal Zone (>4000 m deep and >400 bar pressure) of the ocean, whereas in hot geological formations (~2000 m and 200 bar) it would be a buoyant supercritical fluid, which is difficult to contain.

If captured CO_2 were to be delivered to a deep ocean trench in the Hadal Zone it would be a physically stable liquid layer in an enclosed basin on the ocean floor constrained by the overlying less dense ocean water. A single, observable, limited in-situ trial could prove the general feasibility, replicability, capacity, and environmental acceptability of this CO_2 storage concept. For example, the capacity of the Sunda Trench deeper than 5000 m is sufficient to accommodate all the CO_2 arising from all known fossil fuels.[11] However, the CCS community is unwilling to engage with this radical concept of using the open ocean as a permanent CO_2 storage facility. The international agreements protecting the oceans provide for permitting of specific activities on condition that the absence of adverse effects can be proven, but public acceptability of using the oceans to dispose of a waste presents a big barrier. There is a history of proposed experiments for mid-ocean dispersal of CO_2 off

[11] Potential for Very Deep Ocean Storage of CO_2 Without Ocean Acidification: A Discussion Paper. Steve Goldthorpe, New Zealand. GHGT 13, Lausanne, November 2016.

Hawaii and in the North Sea being cancelled due to public outrage from environmentalists.

There is concern that liquid CO_2 placed on the deep ocean floor would dissolve and migrate up from the deep ocean storage pool through the overlying body of ocean water to the surface water. However, that mechanism for transporting CO_2 to the upper ocean would be much slower than the current mechanism of dissolution of CO_2 from the air into surface water. The Global Carbon Cycle, illustrated in Figure 1, shows that the annual flux of carbon between the atmosphere and the ocean surface is about 12 % of the amount of CO_2 in the atmosphere. Whereas the annual flux of carbon between the Intermediate and deep ocean and the upper ocean is about 0.27% of the amount of carbon dissolved in the deeper water. Therefore, the marginal impact on acidification of the ocean surface water would be more than 40 times less if liquid CO_2 is placed on the very deep ocean floor instead of being released to the atmosphere.

Another concern is the potential impact on any living organisms that might exist on the floor of an ocean trench at 5000-6000 m depth. In the complete absence of light, at extreme pressure and at a temperature of 2°C (275°K), the conditions are not conducive to biological activity. Furthermore, at that depth seawater is undersaturated with carbonate so exoskeletal creatures could not exist. Nevertheless, a visual survey of the potential CO_2 storage location could be carried out with a remote-control submarine to check for any life forms. Another advantage of deep ocean CO_2 storage over geological CO_2 storage is that visual inspection of the storage location would be possible, before, during and after CO_2 placement.

Delivery of captured liquid CO_2 to a deep ocean trench could be by sea-floor pipeline but would more likely be achieved via a vertical neutrally-buoyant pipe from a geostationary floating platform, such as a redundant oil tanker. Transport of captured liquid CO_2 to such a CO_2-delivery platform could be by ship at reduced temperature and high pressure, like the international transport of liquefied petroleum gas (LPG).

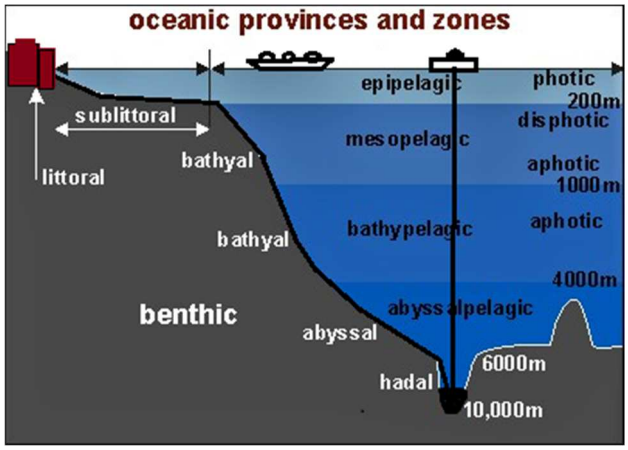


Figure 4 CO_2 transport concepts

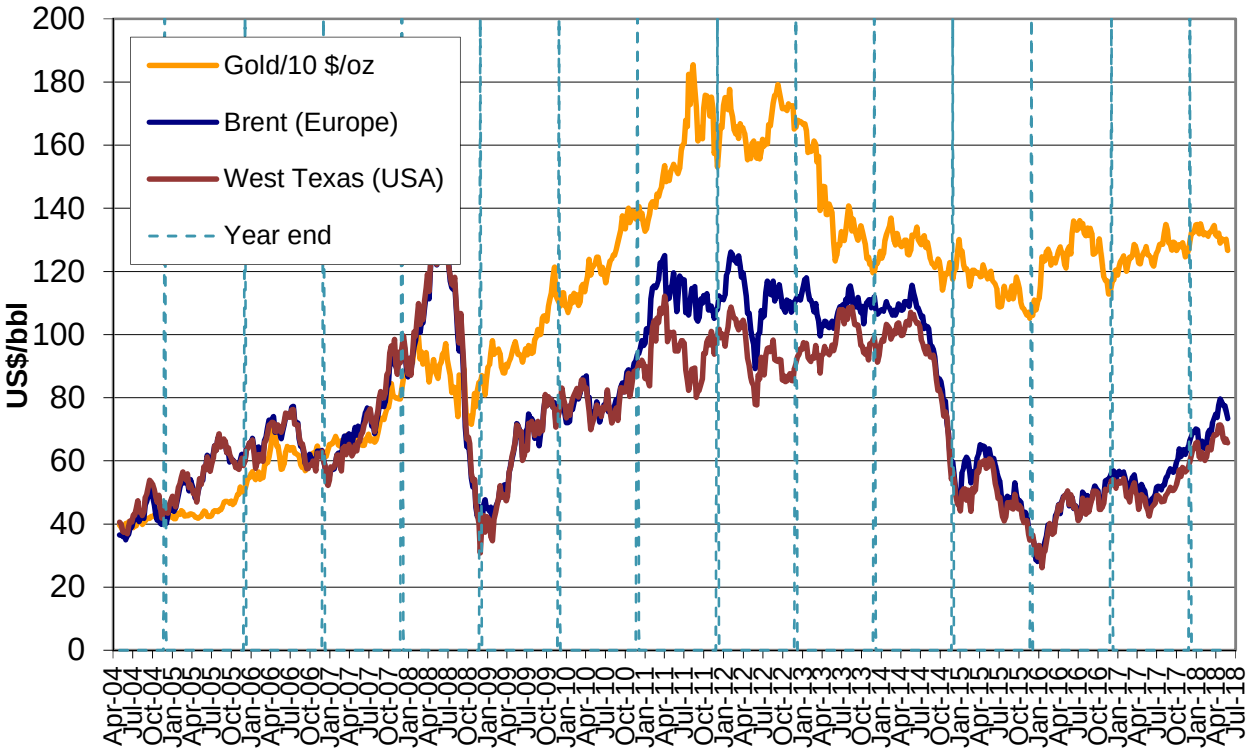
Additional CO_2 sequestration might be achieved by capture of CO_2 from air on the platform using solar energy. That could make the platform an autonomous CCS facility independent of any fossil fuel use. However, the amount of CO_2 that could be captured from air and transferred to the ocean floor would be constrained by the solar energy input. Based on a platform of the size of a redundant super tanker, the potential autonomous CO_2 capture and storage would be limited to about 12×10^4 tonnes per year.

This article suggests that very deep ocean storage of cold liquid CO_2 has greater certainty, replicability, and capacity than geological storage of warm supercritical CO_2. These concept-level considerations are offered to the research community to stimulate discussion of research and development topics that might contribute to addressing both Climate Change and Ocean Acidification in the long term.

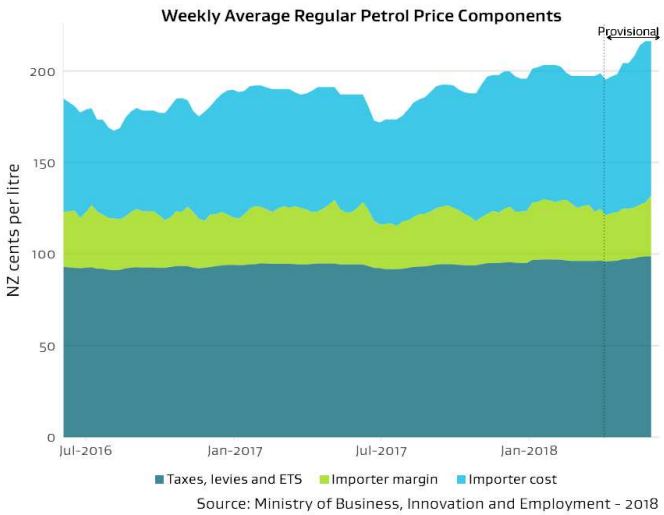
Why not?

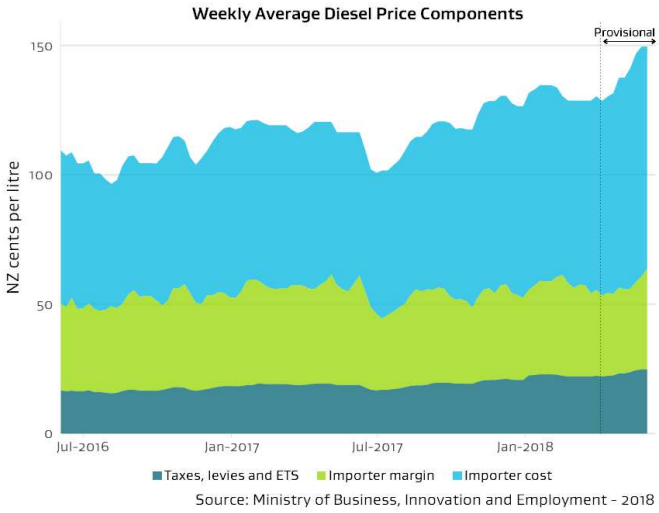
Steve Goldthorpe

Neil's Oil Price Chart



In the last 12 months the internationally traded price of crude oil has shown a steady increase relative to the gold standard. Over the last 12 months the crude oil price increased by 62%, i.e. by US$27/bbl. That is equivalent to an increase of about $NZ6 per GJ of primary energy.





The increase in crude oil price is reflected in NZ retail transport fuel prices in these MBIE charts.

Since this time last year, the discounted unleaded 91 petrol price has increased by 20%, i.e. by 40c/litre. That is equivalent to an increase of about NZ$12 per GJ of retailed energy. Over the same period the retail price of diesel has increase by 50%, i.e. by 50c/litre. That is equivalent to an increase of about NZ$13 per GJ of retailed energy.

If the geo-political pressure on oil production continues the same trend and pushes the crude oil price up to a stabilised price in the region of US$100/barrel, which was sustained from 2011 to 2014, then New Zealanders could expect to see petrol prices settling at about NZ$2.60 per litre and diesel prices settling at about NZ$2 per litre, plus any new regional fuel levies that are added. *Editor*

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EnergyWatch

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