

The Short-lived Gas

Throughout 20 years of parliamentary debate about climate change policy, all participants have at all times proceeded on the basis of certain assumptions that:

- (i) The science was settled in regard to the warming effects of methane.
- (ii) Long-lived and short-lived gases were fungible and could be bundled together.
- (iii) The global warming potential of methane was 21 (later 28).
- (iv) New Zealand as a whole contributed significantly to global warming.
- (v) Methane comprised about 40% of New Zealand's annual contribution.

In the past couple of years, we have discovered that all five of those assumptions were quite wrong. These new insights are still being absorbed and this is no time to be enshrining untested and tentative methane-related opinions into statute law.

Instead, there needs to be a wide-ranging public enquiry into both the net warming attribution and the annual impacts of steady-state methane production and the current realistic means available to minimise those impacts.

First game-changer

A peer-reviewed research paper referenced as *Steinkamp et al. (2017)* disclosed for the first time that *“the terrestrial biosphere in New Zealand is estimated to be a net CO₂ sink, removing 98 (±37) Tg CO₂ per year from the atmosphere on average during 2011–2013.”* During the two years that have since passed, these research findings have not been challenged or called into question in any way.

The “terrestrial biosphere” is a collective description for all the farms and forests (LULUCF) in the country. Those farms and forests can act as both sources and sinks of CO₂ but this top-down study found that they jointly removed far more of the greenhouse gas than they produced *and* more than offset all the CO₂ generated by the burning of fossil fuels.

This was a surprise. The same period's National Inventory Report (NIR) compiled by the Ministry for the Environment found a net sink of only 27 (±14) Tg per annum. Part of the 71 Tg disparity (about 26 Tg) could be reconciled but most could not. The researchers note that:

“Carbon sequestration by grassland and soil carbon could also play an important role in causing differences between the two methods, as these processes are not included or fully resolved in inventory reporting but would be seen by the inversion.”

It is obviously possible that our pastoral farms may be providing a sink for all of our net annual CO₂ emissions without the necessity to plant any further pines. Until these figures are reconciled, it is difficult to offer any firm conclusions regarding the global warming (if any) attributable to New Zealand farmland.

Second game-changer

Only a year ago, a further research paper, *Allen et al. (2018)*, appeared in a leading scientific journal: *“A solution to the misrepresentations of CO₂-equivalent emissions of short-lived climate pollutants under ambitious mitigation.”* This research took the legs out from under the anti-livestock rhetoric that has permeated the New Zealand climate change debate since the days of resistance to Helen Clark’s “fart tax” in 2004. In particular, it established two key new facts:

- No herd of cattle or flock of sheep will delay the “global peaking of greenhouse gas emissions” (the target of the Paris Agreement) unless the head-count of animals increases.
- The global warming potential of methane is best calculated by a mathematical formula dubbed GWP* which is only about *one-quarter* the GWP from the previous formula.

The ramifications of these two facts are profound. Effectively, steady-state livestock herds are best seen as both sources and sinks¹ of methane that contribute virtually zero additional CO₂ equivalents to the atmosphere over the medium term. New Zealand’s aggregate livestock units have been perfectly stable for many years.

It now turns out that the volume of greenhouse gases attributed to New Zealand have been grossly exaggerated. Once the 40% previously put down to methane disappears, New Zealand is seen as having very low per-capita emissions of CO₂-e and the country’s share of global emissions is reduced from 0.16% to an even more trivial 0.09%.

The authors of this seminal paper include two distinguished New Zealanders – Climate Ambassador Adrian Macey and leading climate scientist Professor David Frame – while three of the remaining five are from the Environmental Change Institute at Oxford University. Despite the paper’s dramatic impact on the science of methane warming, it can no longer be regarded as controversial. Its reasoning has not been questioned and it is explicitly recognised by the IPCC’s use of GWP* in its *Special Report 1.5*.

Incentives for livestock farmers?

The lead author, Professor Myles Allen, [says](#) a stable herd can still have tiny residual warming effects. However, if the herd’s digestive efficiency is improving by only “*one third of one percent per year... then that herd is no longer adding to global warming.*”

He then says in [a further speech](#) that if New Zealand reduced methane emissions by 30% over the next 30 years, that would actually contribute to global cooling:

“If a farmer is providing a service to the rest of the country by compensating for other people’s global warming, then that farmer might want to make a case that they should be compensated for that.”

This suggestion is already accommodated under the ETS by s 64(1) of the Climate Change Response Act, which provides that:

¹ Because for every new molecule of enteric methane produced a forerunner molecule expires. Sources are matched by sinks.

A participant is entitled to receive 1 New Zealand unit for each whole tonne of removals from the participant's removal activities, as calculated in accordance with this Act.

In my submission, this existing incentive should be reinforced by the Bill. Where parts of hill country farms are subject to erosion or otherwise suited to forestry, the landowner should be motivated to reduce his flock and receive NZUs equivalent to the estimated tonnage of CO₂-e that is thereby permanently removed from the atmosphere.

The new Commission should be requested to assess the economic cost of such flock or herd reductions, in various categories, and measure that cost against yardsticks for the per-tonne cost of alternative climate action. Specific policies can then be designed based on full information.

To the extent that livestock-cleared land is subsequently afforested, the forest owner will, of course, remain entitled to the usual NZU incentives for that activity.

Paris Agreement

It has been argued that, in order to achieve the long-term temperature target of 2°C above pre-industrial levels set out at Article 2 of the Paris Agreement, it will not be enough for countries to stop increasing emissions but they will also have to find ways to reduce the extant atmospheric concentration of greenhouse gas. A reduction of livestock numbers could contribute to that longer term objective.

Article 4 of the Paris Agreement addresses this question directly:

*“In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible ... and to undertake rapid reductions **thereafter** in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century.” (emphasis added)*

The intention of this Article is unmistakable. *First*, parties to the agreement must reach global peaking – and only *then* will they turn to reductions. The object is to achieve a source/sink balance *after* 2050.

The New Zealand Parliament has already ratified Article 4 and now needs to honour its unequivocal requirements. Doing so will also help abide by the injunction in Article 2(1)(b) to “*foster low greenhouse gas emissions development, in a manner that does not threaten food production.*”

Unsettled science

In little over two years, both the method of methane accounting and the science of methane warming have been shaken to the core by new research. *Allen et al.* note that most of the developed world is focussed on the production and impacts of CO₂, so that enteric methane has been relatively neglected. How much more is there to be discovered or corrected?

There remains far too much scientific and other uncertainty to form a solid foundation for any first-of-a-kind legislation. The IPCC's Sixth Assessment Report is in draft but will not be

finished with its peer-reviewing timetable until 2022. Other relevant recent papers are published or in the pipeline but are yet to be absorbed and/or challenged by the very deliberate process known as “the scientific method”, as follows.

- *Allison and Sheahan (2019)* find that the infrared re-radiation capacity of both methane and nitrous oxide is confined to narrow sections of the spectrum that are already saturated by water vapour and CO₂ and therefore make no contribution to warming.
- *Reisinger, A (2019)* has produced a ‘note’ of some modelling he has undertaken for the Parliamentary Commissioner for the Environment (PCE) which suggests that some methane breaks down into ozone, which can have a warming effect in the troposphere. He argues that 10-20% of methane warming arises post-decay.
- *Van der Lingen (2009)* points out that we have no idea why New Zealand atmospheric methane measurements were static while livestock numbers were rising but have increased after the numbers stabilised.
- *McKinlay, J (2018)* finds the atmospheric half-life of methane is 6.25 years over a hundred-year horizon.
- *Flood, W (2011)* shows it would take about 360 years for the atmospheric concentration of methane to double and it would then give rise to about one thirtieth of the warming caused by a doubling of CO₂.

As far as I am aware, none of these papers (except Flood) have yet been independently peer-reviewed or accepted for publication by a scientific journal.

In my submission, the new Commission should establish a hearings committee to undertake a public enquiry into the reasons, if any, why New Zealand should be the first country to regulate emissions of biological methane, and whether any such emissions should be included in the National Inventory Report. The terms of reference should include the current science relevant to methane production, suppression and accounting (reconciling the disparity between top-down and bottom-up inventories found in *Steinkamp et al.*).

Methane and ETS

The purpose of “putting a price on methane” is to incentivise a farmer to reduce her output of the gas. This implies that when reduction occurs she will be rewarded by a levy reduction. But this can work only if the output of every farm is accurately measured and reductions (say by successful use of a vaccine) are quantified and recorded. This is administratively impossible.

This quandary has been the subject of an April report by the Government’s Interim Climate Committee, but the report is being held secret until after the date that submissions on the ‘Zero Carbon Bill’ have closed. Perhaps a solution has been invented.

All official advisers appear to have advised against including short-lived gases in the ETS including the PCE and the Productivity Commission. Professor Allen has [added](#) his voice to the chorus.

Target?

At first blush, it might be thought that a target should be fixed for the stabilisation of methane at current levels. On further examination, however, it becomes clear that such action will only tend to delay the global peaking of greenhouse gas emissions.

As there is no proven technology for reducing livestock methane other than improving efficiency, any regulation or reduction plan is likely to lead to a reduction in New Zealand livestock numbers. Such a result should be avoided at all costs because:

- (a) Ninety percent of production is exported to other countries.
- (b) New Zealand is the world's least methane-intensive supplier of livestock products, by a wide margin².
- (c) Any production lost from this country will be replaced by products from a more methane-intensive supplier.
- (d) Such substitution would be wholly counter-productive to the common global aim of "global peaking" as soon as possible.

New Zealand legislation already recognizes that re-location of commodity production to less efficient geographical areas can only exacerbate global warming. This principle must be consistently applied.

Farm forestry

The PCE has recommended that all credits for new forest sinks should be channelled to offset methane rather than long-lived gases. But if livestock numbers are stable and there are no net additions to atmospheric methane, reduction of methane will have much lower priority (at least until 2050) than reduction of CO₂.

Farmers should be encouraged by issue of NZUs to contribute to the national CO₂ sink by planting a non-plantation copse of trees wherever they may choose. This should be achieved by amending the narrow definitions of "forest land" and "forest species" that appear in section 4 of the Climate Change Response Act.

² New Zealand methane emissions per tonne of dairy products are less than half the volume of Ireland's, the second-most-efficient supplier to world markets.