

Impact of biological methane emissions on the atmospheric concentration of greenhouse gases.

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This paper is an analysis of expert comments made in two reports released in 2016.

Climate change and agriculture: Understanding the biological greenhouse gases.

Parliamentary Commissioner for the Environment Dr Jan Wright.

Cows, Sheep and Science: A Scientific Perspective on Biological Emissions from Agriculture.

Prepared by by Motu Economic and Public Policy Research

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Background; Why is methane important?

New Zealand's emission profile is unusual amongst developed countries because biological emissions make up almost half our gross national carbon emissions. Methane is the main biological emission and accounted for thirty five percent of New Zealand's carbon emissions in the last NZ Inventory of Greenhouse gases. This means that in terms of public policy response to climate change and the financial impact of international obligations that require carbon emissions to be reduced, biological emissions of methane are a significant factor.

Implications for Paris Agreement.

Under its obligation to the Paris Climate Agreement New Zealand has undertaken to ensure that our net carbon emissions are thirty percent below the level of our gross carbon emissions in 2005. With current net carbon emissions over thirty percent below the level of gross emissions in 2005 this commitment allows New Zealand to increase our net emissions slightly but will then require net carbon emissions to stop increasing.

What Motu and The Parliamentary Commissioner have confirmed in their report is that carbon in the form of CO₂ that is sourced from fossil fuel, is different to carbon in the form of CH₄ that is produced as part of a biological cyclical process. Carbon emissions sourced from CO₂ need to reduce to net zero whereas carbon emissions sourced from methane do not need to reduce at all.

This means the effect of any reduction in carbon emissions in terms of the stated objective of the Paris agreement cannot be determined unless the source of the carbon emissions that are being reduced is known. NZ's commitment under the Paris Agreement is environmentally meaningless for this reason.

The environmental impact of any carbon emission cannot be ascertained without establishing the source of that carbon emission. This for all intents and purposes makes the use of the carbon unit to quantify the impact of any greenhouse gas emission a meaningless action.

The purpose of this paper is to analyse statements made by Motu and the Parliamentary Commissioner about the impact enteric (from livestock) methane emissions have on the atmospheric concentration of methane and the environmental credibility of New Zealand's policy response to global warming.

The Motu report **Cows, Sheep and Science: A Scientific Perspective on Biological Emissions from Agriculture** was commissioned by the Parliamentary Commissioner for the Environment (PCE) in the context of the Commissioner's investigation into the merits of an 'all-gases, all-sectors' Emissions Trading Scheme. The PCE then wrote her report called 'Climate change and agriculture: Understanding the biological greenhouse gases'.

The Parliamentary Commissioner for the Environment (PCE) asked Motu to answer five questions; Four of which are used for this paper.

1. What is the current state of understanding of the climate impacts of each greenhouse gas (CH₄, N₂O, and CO₂)? Where is there consensus and divergence?
2. Putting aside feasibility, which greenhouse gases should be the central focus of short-, medium- and long-term mitigation efforts? Why?
3. Considering issues of feasibility, how much emphasis should be placed on mitigation of agricultural non-CO₂ gases? Why?
4. This question related to technical aspects of gas emission measurement which are not contentious or relevant to the argument this paper advances.
5. What methods are used to determine CO₂ equivalencies for other greenhouse gases? Where is there consensus and divergence on how best to do this?

Motu response to Parliamentary Commissioner's questions.

(Direct Quotes from *Motu Report in Bold Italics* and referenced to relevant page with Comments in White).

Question 1. What is the current state of understanding of the climate impacts of each greenhouse gas (CH₄, N₂O, and CO₂)? Where is there consensus and divergence?

In Motu report Abstract. *The paper finds that the overriding need to reduce carbon dioxide emissions is scientifically uncontroversial. For the climate to stabilise, net carbon dioxide emissions must ultimately be cut to zero. There is debate about whether, when and how much action to take on other gases.*

Motu are confirming that the need to reduce methane emissions (amongst other short lived gases) has not been established. The Motu report did not conclude that present understanding of the climate impacts of methane was that any action should be taken on short lived gases including methane.



Page 2 ***The overriding need to reduce carbon dioxide emissions is scientifically uncontested. There is a strong, direct relationship between cumulative emissions of CO₂ and global warming; ultimately, net CO₂ emissions have to decline to zero for the climate to stabilise. In this sense, therefore, CO₂ must always be the “central” focus of mitigation efforts in the short, medium and long term.***

By contrast emissions of CH₄ and other short-lived climate forcers do not have to decline to zero for the climate to stabilise; they only have to stop increasing.

Page 15 ***To stabilise the climate, it is necessary to reduce the overall (net) emissions of long-lived climate forcers to zero. By contrast, emissions of short-lived climate forcers do not have to decline to zero; they only have to stop increasing. If the world caps emissions of CH₄ at current levels, the atmospheric concentration of CH₄ – and its effect on global temperature – would stabilise over the course of a few decades.***

Here Motu confirm that methane emissions do not need to reduce at all to stabilize the climate, they only have to stop increasing. What this means is that according to Motu’s findings, current levels of methane emissions are not responsible for an unstable or changing climate. In other words global warming.

Despite saying this Motu do explain that it is incorrect to say methane is not a problem.

Page 12 ***It is sometimes claimed that agricultural CH₄ is not a concern because livestock farming essentially recycles carbon (from the atmosphere into grass, from grass into livestock, and from livestock back into the atmosphere through respiration, enteric fermentation, dung and decay of livestock products). This belief does not account for the fact that some of the carbon consumed by livestock is transformed into CH₄ in the animal’s rumen. Since CH₄ is a much more powerful GHG than CO₂, albeit a short-lived one, the farming of ruminant animals has a significant global warming effect. Reducing the emissions of any GHG makes a real difference.***

Motu are mistaken here because those who claim that CH₄ is not a concern because it is cyclical (such as Pastoral Farming Climate Research Inc) do account for the transformation of CO₂ to CH₄ during the digestive process of the ruminant, but they also account for the oxidation of CH₄ back to CO₂ which completes the cycle. It is Motu which has not accounted for the transformation of CH₄ back to CO₂ to complete the carbon cycle.



Motu state clearly in their report that methane does not need to reduce at all to stabilise the atmosphere (page 2), but this can only be true if the methane is part of an atmospherically neutral cycle. So for them to then deny this cycle exists is contradictory to their own report. It is as if they did not understand the significance of their own statement *emissions of CH₄ and other short-lived climate forcers do not have to decline to zero for the climate to stabilise; they only have to stop increasing.*

They also appear to not understand that carbon cannot be transformed in to methane because methane is in fact carbon. Or they might be referring to CO₂ when they talk of carbon in which case they are not inaccurate, just careless in their terminology.

Question 2. Putting aside feasibility, which greenhouse gases should be the central focus of short-, medium- and long-term mitigation efforts? Why?

Page 15 *If the international community wants to limit warming at any level, then the close relationship between cumulative emissions of CO₂ and overall levels of warming suggests that a CO₂-first focus is the place to start since any delay in emission reductions would require an even more rapid reduction later to achieve the same climate outcome. There is, however, debate about whether CO₂ should be the sole focus.*

Motu were not able to settle the debate and did not conclude whether or not any action should be taken to reduce CH₄ emissions. Motu have already concluded that CH₄ does not need to reduce to stabilise the atmosphere but the question is whether or not there may be a benefit in reducing CH₄ as a stop gap measure until ways are found to reduce CO₂ emissions. Motu did not come to a conclusion on this and were unable to answer the question.

Question 3. Considering issues of feasibility, how much emphasis should be placed on mitigation of agricultural non-CO₂ gases? Why?

Motu discuss reasons for and reasons against placing any emphasis on reducing CH₄. Motu conclude though that there is no consensus and state;

Page 24 *There is no consensus amongst New Zealand scientists as to how much emphasis should be put on mitigation of agricultural non-CO₂ gases beyond continuing to improve emissions intensity, although it is recognised that there are substantial co-benefits for water quality of reducing leaching and nitrate runoff. The divergence of views reflects the arguments traversed in Section 4 of this report, which arise from differences about policy goals and processes, and how science is seen to interact with policy.*

This is significant because Motu is stating quite clearly that NZ scientists cannot concur there should be any emphasis placed on mitigation of agricultural non-CO₂ gases. The global warming industry places great store on scientific consensus and on whether or not any action should be taken on methane emissions Motu confirm there is no consensus. The reasons given for reducing methane are not because current emissions are causing global warming but because reducing them can temporarily offset CO₂ emissions until such time as something more can be achieved with CO₂. If that is the case methane emissions are more part of the solution than the problem. Reducing them is a benefit but maintaining them is not creating a problem. The reasons Motu cite for not placing an emphasis on reducing CH₄ are stated on page 18 of the report.

Page 18 *Action now on CH₄ makes no difference to the peak temperature. It is important to focus resources (money and political effort) where they will more likely bring the biggest benefit.*

Question 5. What methods are used to determine CO₂ equivalencies for other greenhouse gases? Where is there consensus and divergence on how best to do this? And in addition why use metrics at all?

Page 5 In explaining difficulties determining what impact different greenhouse gases have Motu say *Attempts to compare CH₄ and N₂O with the most important GHG produced by human activity, CO₂, are a matter of comparing apples and oranges.*

The key word is 'attempts' because Motu explain that it is not possible to compare these gases without context and purpose, and this context and purpose is not defined or certain. This is important for two reasons;

1/ Comparisons are made between gases in order to determine what policy initiatives are put in place to manage different greenhouse gas emissions;

2/ It is the comparative analysis of methane and CO₂ which determines how many CO₂ equivalents are theorized to have been produced for every tonne of methane produced.

Because the gases are not comparable (apples and oranges) it is therefore not possible to accurately quantify methane emissions in terms of its comparative analysis with CO₂, yet the current system tries to do this. It is also not possible to come up with one environmentally credible management regime for all the different greenhouse gases.

With no purpose or context to the choice of metric, as is the situation now, it is not possible to determine policy initiatives for each greenhouse gas and it is not possible to determine how many tonnes of carbon are produced with the emission of one tonne of methane. This means that all government policies are based on an inaccurate measure.

Page 28 *Because different metrics reflect different policy goals, and take account of different factors, no metric can be said to give 'the right answer' regardless of context: metrics can only be said to be more or less useful for a stated purpose.*

Motu are saying that the context or purpose determines whether a metric is right. Motu go on to state that if the *policy goal is to cost-effectively limit global average warming to 2 degrees above pre-industrial levels, then the value of CH₄ should be less than the GWP100 value of 28 until global CO₂ emissions have begun to decline steadily towards zero.*

Motu are saying that the current equivalence system of GWP (global warming potential) is not right for this purpose.

According to the United Nations Framework Convention on Climate Change the central aim of the Paris Climate Agreement is to keep global temperature rise this century well below 2 degrees. This means Motu are saying that the NZ Government's treatment of methane in the National carbon accounting system is not fit for the purpose of the Paris Agreement.

Motu should have concluded that because we have the Paris agreement our context and purpose for a metric should be to achieve the central aim of the agreement and that the current metric is the wrong one. This means also that our carbon emissions under GWP are not an accurate unit for use in the Paris Agreement.

While Motu found agreement that if the policy goal is to cost effectively limit global average warming to 2 degrees then the GWP metric value of 28 is wrong they conclude that *there is no agreement beyond this on the best value to use; the arguments reflect judgments about politics, economics, and the intersection of policy and science.*

The choice of metric determines the equivalence value of methane, so it effectively determines how many carbon emissions New Zealand produces from methane. Motu are saying therefore the quantity of carbon emissions produced by methane is not a matter of science but one of judgements about politics, economics and the intersection of policy and science. It is subjective not certain. Major economic and environmental government policies and policy responses use this unreliable and uncertain measure as their foundation. In addition the level of NZ's carbon emissions, both in total and per capita emissions, is determined not by the scientific measurement of our emissions but by a system which is not science based and relies on making judgements about politics, economics and the intersection of policy and science. Importantly also farmers are pilloried by politicians and environmentalists based on a measure which is not accurate or scientific.

On the question of why use metrics at all? Motu say;

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Internationally, metrics are needed to compare effort between countries. Multiple country targets are difficult to manage in negotiations, and there needs to be some basis for comparison between targets.

They then contradict themselves and say if a metric was not used the targets would be set for each gas, but qualify that by saying; *but even if targets were set for each gas there would still be an implicit weighting across gases when comparisons are made across countries.*

Metrics are also needed if emissions of different gases are traded within an Emissions Trading Scheme domestically or across countries.

The reasons Motu give are all about the need for metrics to help compare emissions or to trade emissions but they do not give any environmental reasons. This is ironic to some extent because treating each gas individually might pose challenges for trading schemes etc but would inevitably provide better environmental outcomes because the management regime and policy setting for each gas could be optimal.

Statements by Parliamentary Commissioner for the Environment (PCE) in her report

‘Climate change and agriculture: Understanding the biological greenhouse gases.’

Page 5

Methane in the atmosphere is short-lived, in contrast with nitrous oxide and carbon dioxide. If the flow of methane into the atmosphere stopped rising, and there were no other greenhouse gas emissions, the temperature of the atmosphere would stabilise in a few decades.

This statement is clearly and unambiguously stating that methane emissions, when in constant flow, (neither increasing nor decreasing) are not causing global warming because they are not changing the atmosphere. Motu made the same point when it said that methane emissions do not need to reduce at all to stabilize the atmosphere. These statements by the PCE and Motu are significant and unambiguous. The theory of global warming is that human activities are increasing the concentration of greenhouse gas and that is increasing the greenhouse effect and causing global warming. Both the PCE and Motu confirm that this does not occur from methane when in constant flow. The PCE however then attempts to undermine the importance of this statement by saying;

Nevertheless, methane emissions are damaging. For instance, while methane molecules disappear relatively rapidly from the atmosphere, they do leave some damage behind. Most of the heat that they trap is absorbed into the ocean, contributing to sea level rise.



The PCE is saying that even though methane when in constant flow is not causing global warming because it is not responsible for altering the composition of greenhouse gas in the atmosphere, it is responsible for sea level rise. This is not possible scientifically so clarification was sought under the Official Information act. The PCE responded that her statement reflects the fact that the energy being accumulated by our planet is going in to the oceans and she quoted an IPCC report. However what the PCE does not understand is that energy that is accumulated by the planet is a result of the increasing greenhouse effect not from activities which maintain it. If the atmosphere was stable and methane emissions were maintaining that stability, as described by the PCE in the report, then there would be no energy accumulation. So the PCE is mistaken here because the methane emissions she refers to in this statement are in constant flow and so do not cause an accumulation of energy to be absorbed in the sea.

Page 32 ***About a third of the warming impact of methane is not caused by methane itself. Under the influence of sunlight, most of the methane emitted into the atmosphere breaks down into carbon dioxide, ozone, and water vapour. The ozone and the water vapour contribute to the warming of the atmosphere.***

The PCE does not state that the ozone and water vapour are a problem. It must be remembered that greenhouse gases are essential to warm the planet to support human life, or any life. So warming is an essential requirement when it relates to activities which maintain our atmospheric concentrations of greenhouse gas. However warming is not ideal when it relates to activities which increase the warming effect as in the term 'global warming'. The PCE uses the term 'warming' without clarifying whether she is referring to the essential job our greenhouse gases do to warm the planet, or to an increase in the greenhouse effect from increasing greenhouse gases. This makes her statements difficult to analyse. It is not stated whether the warming by ozone and water vapour she refers to is essential warming or undesirable warming. Whichever it is it is insignificant as the concentration of water vapour is almost entirely determined by temperature and only survives for a matter of days.



Page 7 ***The Government has recently established a Biological Emissions Reference Group. It is critical that this time progress is made on reducing the methane and nitrous oxide that together form such a large part of our greenhouse gas emissions.***

Nowhere in the report does the PCE give a reason why we need to reduce methane emissions, nor does the Motu report the PCE commissioned. Motu state emphatically that methane emissions do not need to reduce at all to stabilize the climate, which is a direct contradiction to this statement by the PCE. Motu can justify its statement and does so in its report. The PCE in her report makes this statement which is contradictory to her own position that methane emissions need to reduce...

If the flow of methane into the atmosphere stopped rising, and there were no other greenhouse gas emissions, the temperature of the atmosphere would stabilise in a few decades.

Page 34 ***A tonne of methane creates a strong pulse of warming in the atmosphere, but is a lesser force overall than carbon dioxide - there is much less of it and it only persists for a short time in the atmosphere.***

Most of the methane released this year will be gone in twenty years. But each strong pulse of warming is being replaced by another slightly bigger pulse.

In response to an OIA request the PCE confirmed this only related to increases in methane emissions and not emissions that are in constant flow, which is almost all our methane emissions.

Methane is different. If the flow of methane into the atmosphere became constant, and there were no other greenhouse gas emissions, the temperature of the atmosphere would stabilise over a few decades. But the higher the level of methane, the higher the temperature would be when it stabilised.

What she is saying here is that it is only methane emissions which cause the atmospheric concentration of methane to rise which are a problem. The methane emissions which do no more than maintain a level of atmospheric methane are not a problem. The proper policy response would be to cap or at least reduce the growth in methane emissions. There is certainly no need to reduce them.

Page 36 ***Carbon dioxide is the main problem, but methane is doing damage and cannot be ignored.***

The PCE does not clarify to which methane emissions she refers in this statement, those in constant flow or those that increase the atmospheric concentration of methane. Based on her own statement that *If the flow of methane into the atmosphere stopped rising, and there were no other greenhouse gas emissions, the temperature of the atmosphere would stabilise in a few decades* the damage she refers to can only be caused by increases in methane emissions.

Page 77 ***There will need to be reductions in methane from rice paddies in Asia, and from burping sheep in New Zealand.***

Nothing in her report justifies this statement. It is also contrary to the advice she received from Motu when it said that methane emissions do not need to reduce at all to stabilize the atmosphere. It is disturbing that the PCE can write a report in which she says that if methane emissions remained constant and there were no other greenhouse gas emissions the atmosphere would stabilize and then make a contradictory statement, which is not backed by anything in her report, that there will need to be reductions in methane.

Page 32 ***Methane is a more powerful greenhouse gas than carbon dioxide – each molecule of methane traps about 26 times more heat than each molecule of carbon dioxide.***

The PCE is simply wrong here. It is a tonne of methane that traps 26 times more heat than a tonne of CO₂ (over 100 year time horizon using the carbon unit her own report and many others discredit) The atomic weight of CO₂ is 44 while that of CH₄ is 16, so there are 2.75 times more molecules of CH₄ in a tonne than there are CO₂ molecules in a tonne, so just because a tonne of CH₄ is 26 times more potent than a tonne of CO₂ it does not mean each molecule is 26 times more potent. It is in fact about 9 times. It is very hard to believe that the PCE can produce a 100 page report in to the science of biological emissions and then fail to understand one of the more basic aspects of the science of them.



Summary

The PCE and Motu are consistent in one aspect and that is they both confirm that methane has a different impact on the atmosphere than CO₂. What both Motu and the PCE failed to comprehend is the significance of these two statements.

Motu- Emissions of CH₄ and other short-lived climate forcers do not have to decline to zero for the climate to stabilise; they only have to stop increasing.

PCE- If the flow of methane into the atmosphere stopped rising, and there were no other greenhouse gas emissions, the temperature of the atmosphere would stabilise in a few decades.

Both reports confirm that emissions of methane do not need to reduce at all to stabilize the atmosphere whereas emissions of CO₂ do, in fact they have to reduce to zero. Neither report though draws the inescapable conclusion that if a carbon emission created by methane is different to a carbon emission created by CO₂ then it is nonsensical to talk about the impact of carbon without distinguishing between the sources of the carbon.

That being the case there is no point or integrity to the carbon unit. It is in fact a nonsensical thing. It is however this nonsensical thing that the New Zealand Government relies on for major policy such as the ETS and uses to make its Paris Agreement commitment in.

Agricultural methane contributes thirty five percent of our carbon emissions and according to both reports these emissions do not have to be reduced because at current levels that are not contributing to global warming. This is because these emissions do not correspond to an emission of a real gas that increases the atmospheric concentration of greenhouse gas. That is the nonsense that are carbon emissions.

Problems

The reports by Motu and the Parliamentary Commissioner are just two more that highlight fundamental problems with the current carbon accounting system. New Zealand is severely disadvantaged under a system where thirty five percent of our carbon emissions don't exist in reality. The result of this is that our farmers are unfairly victimized, we as a Country are unfairly criticized for our high per capita carbon emissions and policy responses to the challenge of global warming have little environmental integrity.



Solution?

Quantifying each gas individually would pose some challenges in terms of international reporting and international agreements but would produce a greenhouse gas management regime which reflects what is happening in the atmosphere. It would allow for an approach which was optimal for each greenhouse gas and had some environmental integrity. A commitment to cap or minimise increases in enteric methane emissions and reduce CO₂ emissions for example.

Is it more important to have a government policy response which was focused on facilitating international agreements and treaties or one that had some environmental integrity?

Pastural Farming Climate Research Inc requests that the Minister for Climate Change Issues investigates ways to address the issues raised by the reports. We are aware that there are many groups and individuals who recognizes the farcical nature of Government's carbon accounting rules and while there are many positions advocated, they all advocate for a change. It is the contention of PFCR that the carbon unit is not fit for purpose and needs to be discarded.