To Hon James Shaw, Minister for Climate Change			Tracking #: 18-B-04702
Security Level	UNCLASSIFIED	Number of Attachments	NA
Date Submitted:	26 June 2018	Response needed by:	N/A
MfE Priority:	Non-Urgent	Action Sought:	N/A

The role of methane emissions in mitigating climate change

Context

1. This briefing provides you with information on the scientific basis for reducing methane emissions, as requested on Friday 22 June.
2. In determining New Zealand's approach to its emissions targets, there are a range of considerations to be made from a policy perspective which are not discussed here.

The 'two baskets' approach recognises that different gases affect the climate differently

3. Different greenhouse gases (GHGs) have different potency and atmospheric lifetimes, and therefore different impacts on the climate. For mitigation purposes, including setting targets and policies, it is useful to compare the effects of different gases. This involves making value judgments about the relative significance to humans of greenhouse gas impacts over time, which is fraught with uncertainty.
4. Different gases can be compared in "one basket" by using a "metric" or factor that expresses emissions of each gas as a "carbon dioxide-equivalent". This is described in paragraphs 13 to 18 below.
5. An alternative to a single type of metric for all gases is to adopt a 'multi-basket' approach in which gases are grouped according to their contributions to short and long term warming. This may solve some problems associated with using a single metric, but the question remains of what relative importance to attach to reducing GHG emissions in the different groups.
6. Separating short-lived and long-lived gases can be considered a 'two baskets' approach. Methane is a short-lived greenhouse gas. More than half the methane in the atmosphere decays after 12 years, and after 50 years about 98% is gone. In contrast, about half of each carbon dioxide emission is removed within a few decades, but the remainder stays in the atmosphere for much longer. About 15 to 40% is still in the atmosphere after 1000 years.

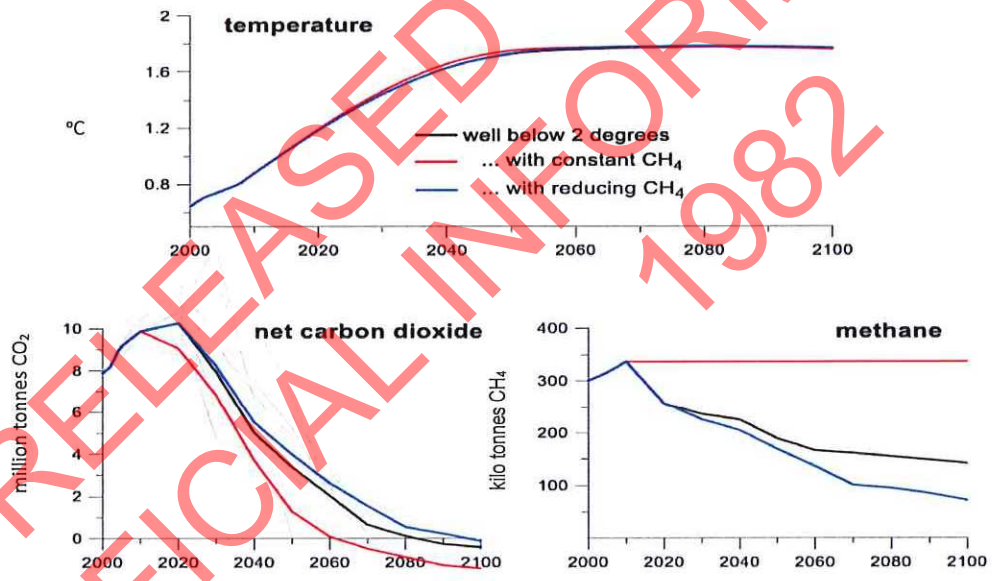
A reduction in methane is expected to be necessary to limit warming to 2 or 1.5 degrees

7. To limit warming below 1.5°/2°C, emissions of short-lived GHGs must stabilise at a 'sustainable' level and emissions of long-lived gases must be reduced. There is no consensus on what that 'sustainable' level is, and it is not a scientific question - it depends on political, economic and social choices, as well as technological developments and progress on reducing long-lived GHGs.
8. The published literature on mitigation of non-CO_2 gases is relatively sparse, but because agriculture and related land use change contributed about 23% of global anthropogenic GHG emissions in 2010 (based on the existing one-basket approach), reduction below current emissions levels is widely agreed to be necessary for meeting the Paris Agreement's temperature goals.

9. For example, one of the future emissions scenarios assessed by the IPCC, RCP2.6, is consistent with the goals of the Paris Agreement. With 66% likelihood, it would limit warming in 2100 to below 2 °C above pre-industrial, or with about 50% likelihood, below 1.5 °C. It should be emphasised that this is not a prescriptive scenario, but represents a group of scenarios with similar climate outcomes. In this scenario, global methane emissions from agriculture in 2050 are about 25% below 2010 levels, and continue to decline until 2100. This is in strong contrast to global fossil methane emissions from the energy sector, which decrease by about 65% below 2010 levels in 2050, and 85% in 2060.
10. The scenario provides regional, but not country-level detail, and OECD90 countries' agricultural emissions in 2050 are reduced more than the global average, to 35% below 2010 levels. It should be noted, however, that New Zealand is an atypical member of this group, as far as methane emissions are concerned.

There are trade offs between reductions of methane and carbon

11. If strong reductions in methane are made, this could allow more time for reducing carbon dioxide and vice versa – strong reductions in carbon dioxide could allow for a higher flow rate of methane. However, a focus on reducing methane could result in carbon dioxide emissions growing while reducing methane emissions, which would ultimately lead to a warmer world in the long term.
12. *Figure 1:* Different pathways (combinations of methane and carbon dioxide emissions) consistent with 2°C. [1]



The GWP_{100} metric is used to compare greenhouse gases in international accounting

13. To enable comparison of emissions targets and to prioritise policies, greenhouse gases are converted to their carbon dioxide equivalent values using metrics.
14. Although metrics are based on science, the choice of which one to use is not a purely scientific decision. They all have strengths and weaknesses, and the suitability of a particular metric depends on what it will be used for.
15. The 'GWP-100' (Global Warming Potential) metric compares the amount of heating caused by different gases over 100 years. Specifically, it is a measure of how much energy the emissions of 1 tonne of a gas will absorb over a given period of time, relative to the

[1] Source: https://motu.nz/assets/Uploads/Andy-Reisinger-Mitigation-in-the-Land-Sector-Challenges-and-choices6.pdf

emissions of 1 tonne of carbon dioxide. It takes into account the different lifetimes of gases.]A criticism of GWP is that it focuses on cumulative warming effect rather than the temperature outcome.

16. The GWP_{100} is used to calculate and account for New Zealand's emissions as required by international agreements. The GWP_{100} is likely to remain the internationally agreed metric for the foreseeable future, although there has been and will continue to be discussions around and proposals for alternative metrics.

17. A recent study introduces a new method to compare how methane and other gases contribute to greenhouse gas emissions budgets. Compared to the currently adopted metric, this new method reduces the significance of methane in all-gases budgets or targets proposed to achieve the goals of the Paris Agreement. It also supports stabilisation targets for short-lived gases and zero-emissions targets for long-lived gases. The study was co-authored by Professor Dave Frame (VUW) with colleagues from the UK and Norway.

18. These issues have been discussed in both the Productivity Commission report and the discussion document for the ZCB consultation, and the separate treatment of methane is already a key component of the consultation on New Zealand's approach to its domestic target. The new study adds academic support for a methane stabilisation target. It will also likely be used to argue against inclusion of agriculture in the NZ ETS, or to argue that it should be included in a different manner from other ETS sectors if it is included.

Feedback from ZCB consultation process

19. The role of the different greenhouse gases in the global and New Zealand context and implications for choice of a 2050 target has featured prominently in ZCB consultation events (including the DairyNZ led climate workshops) to date. Discussion of the "net zero long-lived gases and stabilised short-lived gases" target option has seen some understanding of the environmental and economic implications (for other parts of the economy) of stabilising methane at a reduced level. Opinions differ as to what an appropriate level of reduction for stabilisation would be.

Signature

Mark Storey
Manager, Climate Change Policy
Climate Change Directorate

Ministry for the Environment contacts

Position	Name	Cell phone	1st contact
Principal author	Alice Ryan	9(2)(a)	
Responsible Manager	Mark Storey		X
Director	Roger Lincoln		