An alternative perspective on 'two baskets': Accounting for 'Biological' and 'Fossil' emissions

Submission to Draft Productivity Commission Report on a low-emissions economy

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Motivation for an alternative approach:

This submission seeks to expand the discussion in the draft report regarding 'two basket' targets and accounting for the proposed Zero Carbon Act, or in general in transitioning to a low-emissions economy. The premise of this submission is that while distinguishing separate targets and accounting rules for short-lived and long-lived gases is a positive step, New Zealand could go further to establish greater transparency, ambition, accountability and fairness at a domestic level.

The underlying principles and policy/accounting needs that sparked this thought processes include:

- The need for both *fair* and *effective* mitigation in the land/agriculture sector in particular
- The potential benefits of a whole systems approach to land/agriculture mitigation, especially where multiple GHGs flow in multiple directions with complex and as yet poorly understood relationships
- An approach that incentivises mitigation efforts that also support adaptation

Given this context we believe that the currently suggested two baskets approach has some shortfalls and problems.

Problems with current approach

- N_2O emissions are highly variable between different farms yet current proposals would have them accounted for beyond the farm gate based on national averages, thereby reducing incentives for individual farmers to improve practises and reducing likely mitigation.
- Soil carbon is a potentially significant source or sink of carbon, that is poorly understood in New Zealand agricultural landscapes currently.
- Soil carbon flows and stocks are not considered in accounting
- Fossil methane and biological methane have a different impact in the atmosphere due to the carbon atom from biological methane being part of the carbon cycle, while the fossil methane adds carbon dioxide to the atmosphere as it degrades.
- On the whole this creates an unfair approach that also lacks effectiveness for the agriculture/land sector, which could and should be improved.
    - This perceived unfairness also contributes to the current push back in terms of fair and effective policy design between the agriculture/land sector and government, and therefore also limits mitigation ambition

An alternative 'two baskets' approach

We suggest a 'two baskets' approach based on **"biological"** and **"fossil"** emissions, for both budget and target setting, and accounting. With this approach different gases that contribute to each budget would also be distinguished.

In this context the **biological basket** would include sources and sinks of greenhouse gases that are part of the carbon cycle, or have a biological origin, but is not releasing ancient stores of greenhouse gases into the atmosphere. In practise, this basket would be the whole or primary basket concerning the agriculture/land sector, as fossil emissions will all be accounted for closer to source.

The **fossil basket** would include sources of greenhouse gases that are releasing ancient stores of greenhouse gases into the atmosphere. Because greenhouse gases released from fossil sources can only release ancient carbon into the atmosphere, there are no **direct sinks** available for fossil sources once the gases are released (at least currently).

We suggest the Productivity Commission considers the benefits of a two basket approach that distinguishes biological emissions from fossil emissions.

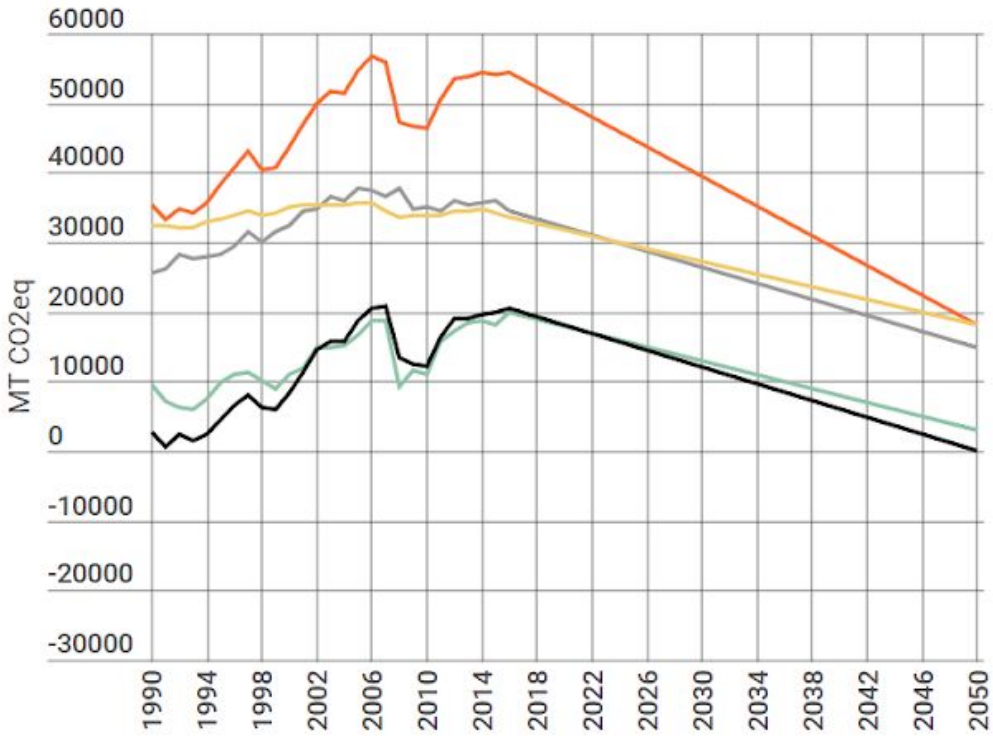

Figure 1: A hypothetical example of different identified mitigation trajectories for biological and fossil emission baskets, based on a net zero long-lived by 2050 target. The top orange line represents all gases net emissions. The yellow line is methane emissions. The black line is net long-lived emissions (CO_2 + N_20). The gray line represents gross CO_2 emissions from fossil fuel sources (CO_2 + CH_4). The green line represents net biological emissions (CO_2 + N_2O + CH_4). Note that the sum of the black and yellow lines is the same as the sum of the grey and green lines. (Data up to 2016 sourced from MfE NZs Greenhouse Gas Inventory 1990-2016 - Biological and

Fossil emissions were constructed by adding sources from the GHG Inventory, and is for illustrative purposes only).

Figure 1 illustrates possible trajectories of the proposed baskets, including the ability to account for total emissions in an equivalent manner between the biological/fossil baskets approach, and the long-lived/short-lived gases baskets approach. For overall reporting the conversions between the different baskets could be carried out.

Biological baskets

This basket would include sources and sinks of CO_2, sources of N_2O, and sources of CH_4. Given that a majority of New Zealand's anthropogenic biological emissions are from agriculture, this approach seeks to design the domestic GHG accounting to focus on measuring the net balance of GHG emissions at a farm level, thereby giving farmers flexibility to determine where and how to reduce/offset their emissions on farm.

Key aspects of this approach include:

- **Greater fairness and more effective mitigation incentives**
    - Currently the differences in N_2O emissions between farms (that might have identical livestock numbers but very different N_2O profiles) are not recognised and therefore better performing farmers are not rewarded for being better than the average (and vice versa for poor performers).
    - Soil carbon is not currently accounted for either way, yet there may be farmers that are sequestering large amounts of carbon that is going unrewarded, while poor soil management practices that release large amounts of carbon are also going unnoticed
    - Methane (especially biological) as a short-lived gas has a significantly different impact on warming (and changes over time) to long-lived gases. However the GWP100 accounting metric is considered by many to unfairly penalize methane emissions at the current time, and doesn't acknowledge the increasing importance of reducing methane emissions as we near peak temperatures globally. GWP100 lacks the scientific and economic nuance of reality and contributes to currently proposed unfair and ineffective policy/accounting rules.
- **Enabling complementary policy measures**
    - Unfairness currently surrounds soil carbon, N_2O and CH_4 for landowners and farmers. It may be more practical and effective to adopt complementary measures to incentivise climate action in this sector, while accurate and cost effective measuring and monitoring processes can be developed for future use.
    - Such complementary measures could include those targeted to stocking rates, specific practises, and/or inputs such as nitrogen fertilisers where we have sufficient evidence that certain practices or inputs are likely to increase emissions.
    - Similarly NZ could develop interim proxy measures such as soil health and topsoil depth that are likely to lead to reduced N_2O emissions and increased soil carbon sequestration, where farmers that improve their soil health and topsoil depth are rewarded, or exempt from other regulatory penalties.

        - These could tie into other closely related policy goals such as freshwater quality

Key benefits of a biological basket include:

- Working with farming systems at a whole systems level, which aligns with how farmers manage their systems and gives them flexibility to decide how best to mitigate GHGs within their context.
- Greater fairness for farmers and landowners, where complementary measures can be used to drive mitigation while measurement and monitoring protocols are developed that can assess all biological emissions at farm level.
    - These measures and techniques could also have a wider international impact, as the protocols can be exported and adapted to other regions that have significant biological emissions
- As mitigation targets are set for both biological and fossil emissions, government's expectations are clear in terms of mandatory minimum gross fossil CO_2 reductions and minimum net long-lived biological reductions and methane reductions.
- Carbon from forest sequestration can still be rewarded under the existing ETS framework
    - However, forest sequestration that leads to loss of soil carbon capacity - a negative overall outcome, would be fairly assessed - ensuring the most robust emissions reduction mechanisms.
- Provision for biological methane to be differentiated from fossil methane in terms of its total warming impact, and also the value that New Zealanders place on reducing one faster than the other.
    - It also does not prevent adopting an adaptable methane metric that places higher value on methane reductions as we approach peak temperature globally.
- There is an argument for viewing biological carbon emissions more like a flow than a stock pollutant (compared with fossil CO_2) and good future policy may involve placing different values (prices) on the two, to prioritise gross fossil CO_2 emissions reduction.
- By isolating biological emissions and creating transparency in terms of mitigation expectations and pathways, you create a clear opportunity to align the climate change goals for agriculture/land use with others such as water quality and biodiversity.

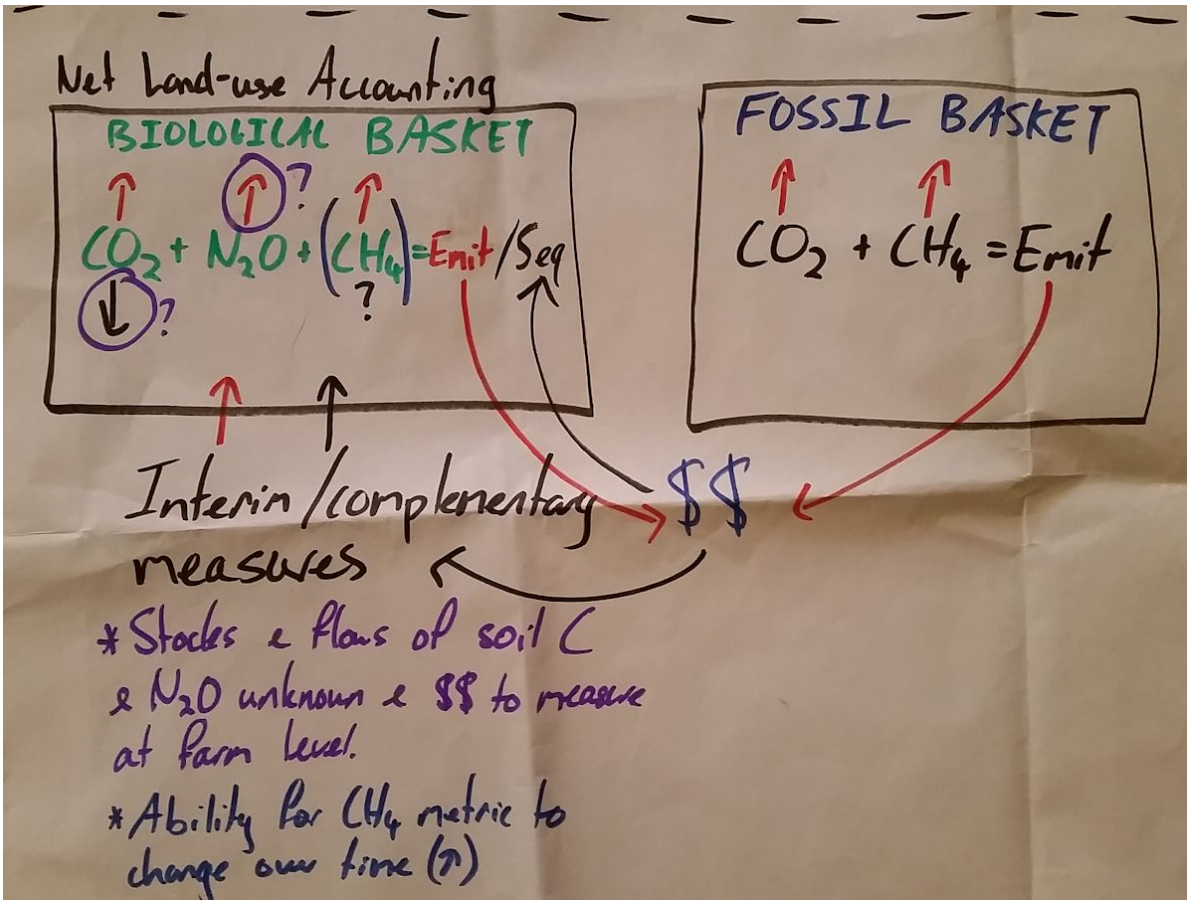

Figure 2: Diagramatic example of biological and fossil baskets. Red arrows indicate emissions, black sequestration. Purple circles highlight areas where current measurement and accounting systems are currently unfair for farmers/landowners and miss opportunities to more effectively target mitigation.

Fossil basket

This basket would include sources of fossil CO_2 and CH_4 and any other relevant gases. The fossil basket would recognize that all fossil based emissions are purely additive and would thus compel any offset funding to be directed to sequestration initiatives within that are accounted for within the biological basket. This basket would operate similar to the current measurement and accounting system (e.g. in the ETS).

The key aspects that define the value of a 'fossil basket' include:

- Setting a clear and transparent domestic target for gross fossil CO_2 and CH_4 emissions, rather than allowing uncertainty in terms of how much gross CO_2 emissions must reduce by 2050 versus sequestration. This prevents a reliance on offsets at the expense of real reductions.
- Being transparent that fossil CO_2 emissions are the most important greenhouse gas to reduce in terms of cumulative emissions and contribution to warming.
    - Biological CH_4 reductions and CO_2 sequestration are important but can theoretically occur later, and still allow for same the overall long-term temperature.
- In a climate mitigation sense, these emissions are a priority in terms of long term targets and **more importantly budgets,** because all fossil CO_2 is additive to the atmosphere

- Fossil methane has a different impact on the atmosphere to biological methane, because the CO_2 that results from the atmospheric breakdown of CH_4 is additive, rather than being part of the carbon-cycle. Thus it should be valued (priced) differently.

Two baskets, but four parts

With the proposed fossil/biological approach there is still a need treat short-lived and long-lived gases differently, within the two baskets. This is because of the vastly different impact different gases have on the overall long term warming of the atmosphere. Therefore, the approach results in a four piece budget:

- Under the fossil/biological breakdown, the short and long-lived emissions will have different accounting and mitigation mechanisms.
    - Each of the baskets will require accounting of short-lived and long-lived gas emissions and budgets
    - The fossil basket will still require continuous overall reductions in its gross levels of emissions for both types of gases
    - The biological basket will have a sustainable level of emissions for short-lived gases
- The budgets are convertible to gas based reporting if required
- All gas type stocks and flows should be reported

Converting between gases, and adding up to overall emissions

Conversion factors between gases play a significant role in the relative importance assigned to a given amount of emissions of a particular type. This is hugely important in assessing the overall impact of human activity upon the climate system. Currently, GWP100 is used as the conversion of gases to CO_2-equivalent measures.

The latest research[1] suggests that this is an inappropriate measure when dealing with short-lived gases. GWP100 overestimates the effect of short-lived emissions when emitted far from peak temperature occurring, and underestimates the effect of short-lived gases when emitted near peak temperature occurring.

In addition, when specifically dealing with methane conversion factors for biological methane =/= fossil methane. This is because the carbon atom in the biological methane was sequestered from the atmosphere to grow the energy source (be it feed, or food waste) that resulted in the methane being emitted. Thus the carbon atom has no additional impact once the methane breaks down to CO_2 through atmospheric processes.

Overall benefits of this sort of two baskets approach

- Carbon budgeting is easier, and account for the different impacts of the emission sources

[1] "A solution to the misrepresentations of CO_2 -equivalent emissions of short-lived climate pollutants under ambitious mitigation, Allen et al - Nature 2018." https://www.nature.com/articles/s41612-018-0026-8. Accessed 18 Jun. 2018.

    - There could be a strictly cumulative budget of fossil emissions, as they not part of the carbon cycle, and emissions result in a pure increase in stock of atmospheric carbon. These emissions **must rapidly** decrease (i.e. fossil sources must see **gross** reductions for effective mitigation action, because net emissions = gross emissions for fossil sources).
- Establishes clear expectations and policy pathways in budgets for reductions of **gross emission**s and **net emissions**.
- Biological/cyclic emissions can be treated as a whole system budget (with appropriate scientifically informed conversion factors between gases as required for reporting purposes)
- The overall budget (e.g. **total** GHG budget) still impacted via reductions
- Fair accounting framework for biological emissions that is more likely to get the support of the agricultural and forestry sectors (although there will still be debate over the targets and various policy measures)

Benefits via policy alignment with the accounting and budgeting system

While the accounting is slightly more complex, the **policy levers are more directly aligned** to specific baskets, and therefore emissions budgets

- Specific policy will act at a functional level, for example, transport policy will act on fossil emissions, so having a direct fossil emissions budget makes the policy levers easier to assess, implement, and measure
- More direct options for each government in terms of addressing budgets
- Say a particular government wants to leave farming completely out of the budgeting, having a separated biological budget means it's really clear which budget they are tackling, and still having an overall impact
    - It is also clear which budgets they are neglecting, makin the process far more transparent
    - An assessing body (such as the Independent Climate Commission) can then advice, and publicly communicate the successes and failures of addressing budgets directly related to the policies of the government(s).

Requirements for the approach to be successful/sustainable

We believe that initial work and funding is required to ensure the success and sustainability of this, or for that matter any, approach to greenhouse gas accounting and measurement - with the overall goal of reductions in emissions. Some important requirements are:

- Research and Development in setting up the measurement systems at farm level
- Initial capital funding for programmes to address this
- Development of good proxy measures after the research is completed with the use of local knowledge of agricultural/forestry communities

It is critical that funding for this work is provided early. They should be well in development before the 5 year budgets kick off.

Risks of the alternate two basket approach

- Takes too long to develop the relevant research

    - The solution to this is a question of political will and economic commitment
    - Better than the risk of political division and societal resistance by perceived unjust, unfair transitions
- New approach in terms international reporting, and may not be readily accepted
    - We have conversion mechanisms that allow us to report via the UNFCCC guidelines
    - We may be able to demonstrate a more robust accounting system for wider adoption

Going beyond New Zealand - wider benefits of this approach

While the Zero Carbon Act is a critical piece of legislative infrastructure, ultimately for it to be effective we must show that aspects of what happens because of it can scale and translate across different nations.

This accounting approach can give New Zealand an opportunity to improve the current accounting methods globally, and provide policy mechanisms that are adaptable in a wide variety of societies and markets.

For example consider an internationally equitable transition, where the fossil budgets are normalized against historic fossil emissions. This can be used as a mechanism for driving fossil emissions down in countries that can afford it, while not imposing large costs on say, their agricultural sectors, which haven't necessarily benefitted from the fossil emissions to date.

For nations that haven't had that benefit, this provides a different and clear budgeting system for the available fossil stocks that can be used to aid their transitions in a manner that is cost-effective for those nations.

Similarly, nations that have well developed farming systems will benefit from this accounting method, giving them an incentive to further innovate, and it will provide incentives for less developed systems to be fast followers. The production systems of the world will then see a multitude of co-benefits of better farming practices.

This is particularly important for New Zealand, as a transition in agricultural practices here can be world leading and influence the global food production system, which is a significant source of GHGs. This means New Zealand will

1) Have a competitive advantage in terms of the co-benefits
2) Be a world leader, meaning benefits from exporting knowledge and technology
3) Value added to the agriculture system of New Zealand beyond bulk production

New Zealand can predominantly influence the world through two mechanisms. Firstly through policy innovation, incubation, and trialling. Secondly through our agriculture sector. This approach allows us to maximise the likelihood of influence through both mechanisms.

Contact:

While we have tried to detail as best as possible our proposed approach the authors welcome any opportunity to further discuss the proposal with the Productivity Commission.

Primary contact can be made via:
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Appendix 1:

Full visualisation of baskets and targets for different gases. The conventions follow those set in Figure 2.