Opportunities for farms to offset biological emissions under the NZ ETS through bioenergy

Farm animals produce methane which is a greenhouse gas and a potential liability under the NZ Emissions Trading Scheme (NZ ETS). However, farms can also be a significant contributor to the reduction of greenhouse gases which can be an offset to biological emissions produced on the farm.

As we transition into a post-petroleum era the farmers of our land are in a position to:

- grow plants which act as a carbon sink but also will be the future feedstocks for the bio-based chemicals and materials that will replace current petroleum-based products. The biomass can be a significant source of revenue thus improving farm business resilience;
- adopt circular economy practices to their farming operations by using organic crop residues and wastes to produce energy and reduce farm operating costs; and
- embracing greenhouse gas emission reduction opportunities which can improve business resilience and achieve net zero carbon.

These opportunities assume that farm net emissions are going to underpin the way in which the NZ ETS will be applied to farming.

The period out to 2025 when the proposed legislative measures are going to take effect is adequate time for transition to low carbon farming.

Farm GHG emissions are around 65% methane, the balance are N_2O and CO_2. Farmers can take a number of immediate actions to minimise the latter, while offsetting methane emissions is longer term.

There are a broad range of options to minimise all emissions CH_4, N_2O and CO_2 - so the initiatives by each farmer will be highly site specific and depend on the nature of the farming operation

Cropping is under some threat from the "Essential Water" programme - so following other countries and encouraging the switch to crops as a source of biomass is not necessarily going to be applicable in New Zealand, so focusing on using the 7-9% of a farm which is often not able to be used productively should underpin sourcing of biomass. Other biomass can come from farm wastes and residues. GHG emission reduction needs to be integrated with the whole of farm operations and incorporated into Farm Management Plans which are now being developed on many farms.

There are a number of current regulatory rules around the claiming of carbon offsets etc from trees which need to be challenged as otherwise large amounts of offset credits are likely to be limited by the rules - size of the forest, cover etc. Historically, the costs of quantifying the carbon sequestered on small plots has outweighed the benefits of claiming carbon credits. If a farm-based recording is able to aggregate these small gains into a farm credit then this will overcome some of the regulatory issues.

Supply chains for providing feedstocks for bioprocessing outside the farm are immature and currently not readily identifiable. Farmers will therefore need to work collectively to improve the efficiency of the supply chain so that selling biomass for fuel is as easy as selling animals to a stock agent who has the cheque book ready now.

An immediate focus on reducing nitrogen fertiliser leaching and the N_2O contribution to atmosphere can incorporate new planting. If the species and design of riparian strips etc are done so that biomass for energy can be extracted later there is a potential revenue offsetting current costs. Focusing on nitrogen can meet any short term GHG emission targets for agriculture/farms. This a good short-term approach and has multiple benefits to farmers in the short and medium term. Along with this, for dairy farms, effluent can be processed by anaerobic digestion into a high-grade fertiliser for use where spreading raw effluent is not appropriate. Adopting a fully holistic nutrients management across the farm to add and build the soil organic content will assist with nitrogen retention.

Shelterbelts

A well-designed shelterbelt can be a source of revenue as well as providing best practice shelter for stock and crops. Traditional one row shelterbelts of long rotation species such as macrocarpa are inefficient and become a cost at their end of life. When an old shelterbelt is removed there is then at least a 10-15 year wait before new trees can provide shelter. With a well-designed three row managed shelterbelt using a mix of short and long rotation species can turn the shelterbelt into a revenue stream. This assists farmers to become fuel plus food producers with improved farm business resilience because the food and energy products are in different markets.

Fast growing species such as *miscanthus gigantus* make an ideal shelterbelt on farms with elevated mobile irrigators. The miscanthus is low enough that it doesn't interfere with the boom irrigator. Miscanthus is also an annual so can be cropped each year to provide biomass for energy production.

Agricultural Crops

Most agricultural crops have harvest or processing residues which can be used as a source of energy. Maize or corn stover is used extensively in the United States of America as a source of liquid or solid biofuel. The Maize stove can be processed to be a fuel for use in process heat boilers or can be used as a feedstock for the production of a transport biofuel.

Energy crops

Farmers can grow woodlots on parts of the 8% of a farm that is often not productive or suitable for normal farm operations. If this is steep slopes then the species will be a long rotation one as harvesting is often costly because of the difficult terrain. If the land is flatish then crops such as miscanthus can be grown as an energy crop. The miscanthus can be processed into a solid biofuel to replace coal in process heat boilers or it can be used as a feedstock for the production of transport biofuels.

Dairy effluent

The effluent from dairy cows that accumulates in milking sheds or standoff pads is normally collected and spread back on the farm as a bio-fertiliser. If this disposal method can't be used then the effluent can be processed by anaerobic digestion to produce biogas and high value bio-fertiliser. The biogas can be used on a farm to produce electricity, heat. cooling or used as a fuel in diesel vehicle engines. The bio-fertiliser can be dried and sold as a high value revenue stream.

Riparian planting

Most farms abut waterways and are planting riparian strips to absorb nitrogen run off to stop it going into the waterway. If planted so that some plants can be selectively harvested then this can be a source of revenue.

Producing feedstock for new business

As we reduce the use of petroleum to produce plastics and many other products, including vehicle fuel, the replacement products will be produced from biomass. This is often referred to as moving from a petroleum-based economy to a bio-economy. Internationally[1] there are many new businesses[2] emerging which are producing bio-based materials to replace plastics etc. Because of New Zealand's fast-growing trees and extensive plantation forestry this is an untapped goldmine for new business. Farmers have the opportunity for being part of this revolution as around 7% of a farm is often not used productively and could be used for growing biomass. This biomass can be sold as a feedstock for new business.

Providing economies of scale for community initiatives

As communities move to use organic waste instead of disposing to landfill much of the organics will be used to produce energy such as biogas via anaerobic digestion equipment. Farmers who live near these communities or food processors etc., can provide supplementary feedstock to allow the community facility to be optimally scaled and operated. Not only is this a revenue stream for farmers but it assists land to be used optimally.

[1] https://gbs2020.net/fileadmin/gbs2020/documents/bioeconomy_Netherlands.pdf

[2] https://www.nweurope.eu/media/4663/180369_biobase4sme_2luik_netherlands_v4_lr.pdf