GLOBAL DAIRY PLATFORM

GHG mitigation and the Agricultural Sector

Is the Net Zero model right for Agriculture?

May 24, 2021

Agriculture is at the intersection of climate change and food security. Farmers are experiencing the effects of a changing climate daily. Agriculture and the wider food sector acknowledge the need to mitigate climate impacts and adapt farming systems, though having a robust evidence base to inform strategic 'change' decisions is essential.

This is reflected in Articles 2 and 4 of the Paris Agreement, where it recommends using the ***best available science to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century in a manner that does not threaten food production.***

International commitments and most national targets have typically been expressed as a basket of gases that include CO_2, CH_4 and N_2O. For communications and comparability purposes it was deemed necessary to have these expressed as carbon dioxide equivalent emissions, where each gas is arithmetically converted to CO_2 equivalents through the application of the 'global warming potential' metric GWP100.

GWP100 provided a way for policy makers (and others) to set economy wide targets to combine the gases into '*carbon dioxide equivalents,*' thus simplifying the measurement and associated messaging. However, the science has subsequently evolved, and the agriculture sector is increasingly informed as to how it can play a responsible role in limiting climate change to the desired 1.5 °C above pre-industrial levels. The sector seeks a more nuanced approach on which to make informed strategic decisions and importantly quantify progress.

The broadly adopted Net Zero concept to mitigating climate change is generally being applied to all GHGs, whereas the IPCC's Special Report on Global Warming of 1.5 °C quite clearly differentiates between CO_2 and non-CO_2 greenhouse gases, stating; ***'Reaching net zero global anthropogenic CO_2 emissions and declining net non-CO_2 radiative forcing*** **(i.e. from the non CO_2 greenhouse gases)** ***would halt anthropogenic warming on a multi-decadal time scale (high Confidence).'***

This statement recognizes that not all GHG's are the same and though efforts should be made to reduce emissions of all greenhouse gases, it is carbon dioxide that <u>must</u> reach the net zero target by mid-century in order to achieve the necessary ambition. Carbon dioxide remains in the atmosphere for thousands of years. Methane by comparison is naturally broken down in approximately 12 years, therefore reductions in methane present an opportunity to reverse warming in the short term.

The Special Report on Global Warming of 1.5 °C also indicates that by 2050, for all agriculture to contribute to global pathways that do not exceed 1.5 degrees (relative to 2010), carbon dioxide will need to reduce by 100% and;

CH_4 by 24 to 47%

N_2O by +1 to 26% (see table at conclusion of this briefing)

Depending on the type of agricultural production (e.g. livestock or crop), the level of emissions of the three main agricultural greenhouse gases (CH_4, N_2O, and CO_2) will vary, as will the strategy to maximize reductions within the ranges stipulated in the Special Report. There is a diversity of agricultural systems globally, therefore identifying a range of pathways to mitigate specific greenhouse gases and adapt businesses is paramount.

For agriculture to be part of the solution to climate change it is crucial to understand the evolution, source, and specific behavior of individual gases in the atmosphere. As detailed above, the focus on carbon dioxide or the 'basket of gases' alone is not deemed the most appropriate or effective approach. A more granular and specific model is required to support and enhance the speed of delivery from the different agricultural sectors.

Agriculture requires an alternative and broader concept than Net Zero to maximize mitigation of climate gases and adapt agricultural systems in a way that also recognizes co-benefits for an increasingly sustainable food system. Agriculture is quite different than the fossil fuel sector and other industries where the main focus is on carbon dioxide. Agriculture has a different set of priority gases, all of which must be considered.

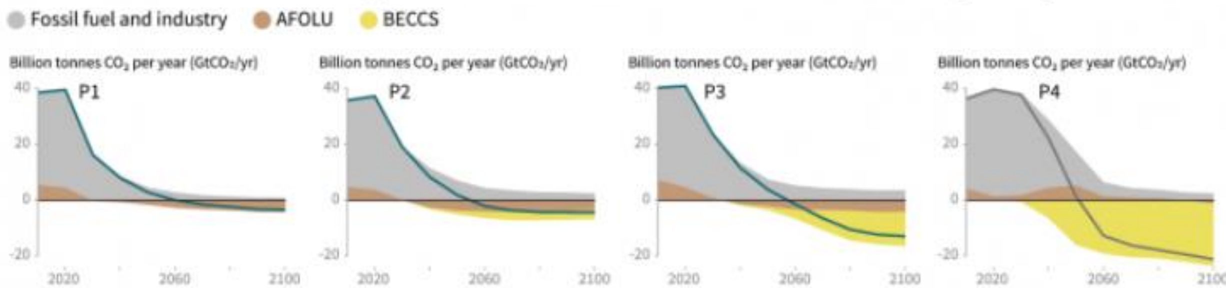
This discussion is not about agriculture denying, delaying, or avoiding its responsibilities, it is about ensuring the sector can fulfill the critical role that is required of it. The recently published UN Global Methane Assessment clearly demonstrates the benefits of short-term reductions in methane to contribute to combatting climate change. Agriculture has the opportunity to tackle climate change from several fronts. To achieve the desired outcome, it needs the support of science and experts to develop more appropriate pathways to guide targeted and impactful action. Any new model will need to ensure existing agricultural sector Net Zero pledges are accommodated.

Consultation with a wide range of stakeholders on this topic is essential to appreciate different views and opinions and to ultimately make an informed decision on the most appropriate way to frame the challenge for agriculture.

Characteristics of four illustrative model pathways

Different mitigation strategies can achieve the net emissions reductions that would be required to follow a pathway that limits global warming to 1.5°C with no or limited overshoot. All pathways use Carbon Dioxide Removal (CDR), but the amount varies across pathways, as do the relative contributions of Bioenergy with Carbon Capture and Storage (BECCS) and removals in the Agriculture, Forestry and Other Land Use (AFOLU) sector. This has implications for emissions and several other pathway characteristics.

Breakdown of contributions to global net CO_2 emissions in four illustrative model pathways



P1: A scenario in which social, business and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A downsized energy system enables rapid decarbonization of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

P4: A resource- and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas-intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

Global indicators	P1	P2	P3	P4	Interquartile range
Pathway classification	No or limited overshoot	No or limited overshoot	No or limited overshoot	Higher overshoot	No or limited overshoot
CO_2 emission change in 2030 (% rel to 2010)	-58	-47	-41	4	(-58,-40)
└ in 2050 (% rel to 2010)	-93	-95	-91	-97	(-107,-94)
Kyoto-GHG emissions in 2030 (% rel to 2010)*	-50	-49	-35	-2	(-51,-39)
└ in 2050 (% rel to 2010)	-82	-89	-78	-80	(-93,-81)
*Final energy demand** in 2030 (% rel to 2010)*	-15	-5	17	39	(-12,7)
└ in 2050 (% rel to 2010)	-32	2	21	44	(-11,22)
Renewable share in electricity in 2030 (%)	60	58	48	25	(47,65)
└ in 2050 (%)	77	81	63	70	(69,86)
Primary energy from coal in 2030 (% rel to 2010)	-78	-61	-75	-59	(-78, -59)
└ in 2050 (% rel to 2010)	-97	-77	-73	-97	(-95, -74)
from oil in 2030 (% rel to 2010)	-37	-13	-3	86	(-34,3)
└ in 2050 (% rel to 2010)	-87	-50	-81	-32	(-78,-31)
from gas in 2030 (% rel to 2010)	-25	-20	33	37	(-26,21)
└ in 2050 (% rel to 2010)	-74	-53	21	-48	(-56,6)
from nuclear in 2030 (% rel to 2010)	59	83	98	106	(44,102)
└ in 2050 (% rel to 2010)	150	98	501	468	(91,190)
from biomass in 2030 (% rel to 2010)	-11	0	36	-1	(29,80)
└ in 2050 (% rel to 2010)	-16	49	121	418	(123,261)
from non-biomass renewables in 2030 (% rel to 2010)	430	470	315	110	(245,436)
└ in 2050 (% rel to 2010)	833	1327	878	1137	(576,1299)
Cumulative CCS until 2100 ($GtCO_2$)	0	348	687	1218	(550,1017)
└ of which BECCS ($GtCO_2$)	0	151	414	1191	(364,662)
Land area of bioenergy crops in 2050 (million km^2)	0.2	0.9	2.8	7.2	(1.5,3.2)
Agricultural CH_4 emissions in 2030 (% rel to 2010)	-24	-48	1	14	(-30,-11)
in 2050 (% rel to 2010)	-33	-69	-23	2	(-47,-24)
Agricultural N_2O emissions in 2030 (% rel to 2010)	5	-26	15	3	(-21,3)
in 2050 (% rel to 2010)	6	-26	0	39	(-26,1)

NOTE: Indicators have been selected to show global trends identified by the Chapter 2 assessment. National and sectoral characteristics can differ substantially from the global trends shown above.

** Kyoto-gas emissions are based on IPCC Second Assessment Report GWP-100*
*** Changes in energy demand are associated with improvements in energy efficiency and behaviour change*

https://www.ipcc.ch/sr15/chapter/spm/
FIGURESSPM.3