CARBON READY DAIRY DEMONSTRATION PROJECT

2. CARBON EMISSIONS AT THE MACALISTER DEMONSTRATION FARM

MDF Information Sheet 5
AUGUST 2009

BACKGROUND

In May 2009 the Macalister Demonstration Farm (MDF) made a successful application to the Australian Government for FarmReady Industry Grant funding to undertake the 'Carbon Ready Dairy Demonstration' project. The project will use the MDF as a case study to identify the source and size of carbon emissions generated by normal farm operations. This information will then be used to develop a Carbon Emissions Reduction Plan that includes strategies to minimise and offset carbon emissions and an analysis of the financial impact of the plan on the farm business. The Carbon Emissions Reduction Plan will be completed by October 2010 with a review in March 2012 against any changes in the 'rules' for carbon emissions.

A key to the project is to gather and interpret information in a practical way so that farmers can make informed decisions about their investment in carbon emissions reduction or offset. This is the second information sheet in a series which looks at the level of carbon emissions generated at the MDF and the implications for the farm business under the proposed Carbon Pollution Reduction Scheme (CPRS).

CARBON EMISSIONS AT THE MDF

How are carbon emissions measured?

Carbon emissions are measured in carbon dioxide equivalents (CO_2-eq) with the 'Global Warming Potential' of each gas measured against the impact of carbon dioxide. For the purpose of the CPRS, agricultural emissions are limited to methane and nitrous oxide; carbon dioxide produced by animals is not included. Carbon dioxide represents 1 CO_2-eq, each unit of methane (CH_4) is 21 CO_2-eq, and each unit of nitrous oxide (N_2O) is 310 CO_2-eq.

In developing the CPRS the Government recognizes that the cost of measuring carbon emissions will be very high if all emissions are measured directly so businesses caught up in the CPRS can choose either the default method using emission factors based on Dept of Climate Change research; using a sampling method to test the emissions from inputs or raw materials; or monitoring emissions directly as they are generated. There has been a good deal of work and investment in developing industry-specific models that will provide good estimates of carbon emissions under a range of scenarios.

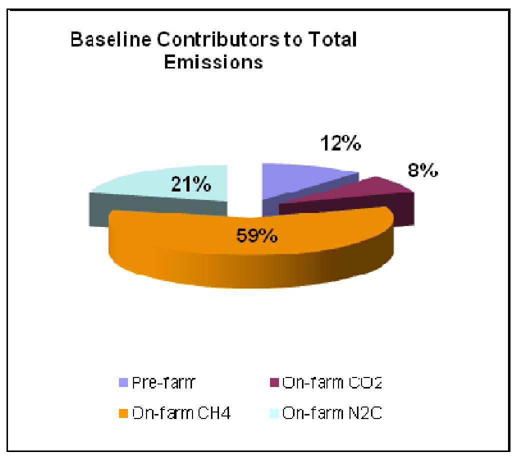
The calculation of emissions at the MDF has used the Dairy Greenhouse gas Abatement Strategy (DGAS) calculator developed in partnership between Dairy Australia, the Tasmanian Institute of Agricultural research, the University of Tasmania and the Dept. of Agriculture, Fisheries and Forestry. This calculator will soon be available on the Dairy Australia website.

The farm data needed to make the calculation is not too difficult to find and is shown in Table 4.

How much carbon is emitted at the MDF?

Based on the level of production and management system in place the MDF generated a total of 1918 tonnes CO_2-eq over the season. The breakdown of these emissions is shown in Fig. 1.

Fig 1: MDF Total Carbon Emissions 2008-09



Less than 12% of emissions are generated in products or feedstuffs before reaching the farm. Under the CPRS these emissions will be the responsibility of the business that generated them, but only if they are caught up in the CPRS net. On-farm carbon emissions are made up of electricity and diesel emissions – this 8% of farm emissions is also counted against refinery and power generation emissions.

That leaves 1539 tonnes CO_2-eq of emissions or 80% of farm emissions as eligible to be included in the CPRS. More than 72% of the eligible emissions are from methane generated by rumen digestion, 14% by indirect losses of nitrous oxide, 10% generated by losses of nitrous oxide in dung and urine and less than 3% generated by nitrous oxide loss from fertiliser (Table 1).

Table 1: MDF Carbon Emissions Breakdown 2006-09

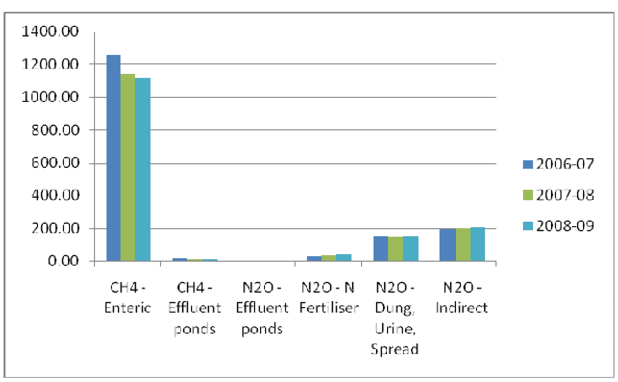
	Tonnes CO_2-eq/yr		
Pre-farm emissions	**06-07**	**07-08**	**08-09**
Fertiliser	38	43	45
Grain	243	205	170
Other feed sources	138	30	11
On-farm emissions – no CPRS liability			
CO_2 –Energy – Electricity & Diesel	262	177	153
On-farm emissions – CPRS liability			
CH_4 - Ruminant	1254	1141	1115
CH_4 - Effluent ponds	21	18	18
N_2O - Effluent ponds	1	1	1
N_2O - N Fertiliser	31	38	44
N_2O - Dung, Urine, Spread	152	147	153
N_2O – Indirect*	193	196	209
Tree plantings	**0**	**0**	**0**
TOTAL EMISSIONS	**2334**	**1996**	**1918**
CPRS obligation	1653	1541	1539

*Indirect emissions include later or off-site losses following runoff, loss to the air and leaching of dung, urine and fertilizer; it also includes estimates of loss following soil cultivation.

Do different seasons and conditions make a difference to emissions?

The past three years have been a good example of the sort of variability that takes place in the dairy industry and provides a good chance to look at the carbon emissions that resulted from what were, at first glance, quite different inputs (Fig. 2).

Fig. 2 Comparison of MDF Carbon Emissions 2006-2009 (tonnes CO_2-eq)



With ruminant emissions the most significant it may be useful to compare the feed ration in each year. Details of inputs for each season can be found in Table 4 but can be summarized as follows:

- 2006-07 was a very dry year; milkers were fed a low level of pasture that was supplemented with up to 7 kg/day of concentrate and 6 kg/day of silage at the peak of the season.
- 2007-08 was a year of high milk prices so purchased feed was used to push production. Milkers were fed a moderate level of pasture that was also supplemented with up to 7 kg of concentrate at the peak of the season.
- In 2008-09 milkers were fed a high level of pasture with up to 6 kg/day of concentrate at the peak of the season.

Analysis of the diet (Table 2) shows that the biggest difference between years was in dry matter intake and this, when balanced against cow numbers, accounts for the most of the increase in methane emissions in 2006-07 and 2007-08 when compared to 2008-09. However, higher fibre levels in 2006-07 would have also raised methane emissions/cow and higher crude protein levels in 2008-09 would have raised nitrous oxide emissions/cow in dung and urine.

Table 2: Diet Analysis 2006-2009

	06-07	07-08	08-09
Total Intake (Kg DM/cow/day)	14.4	16.9	17.2
Average Digestibility (%)	76.9	78.9	78.6
Average Crude Protein (%)	16.5	17.7	18.8

Increased nitrous oxide emissions in 2008-09 have also come from an increase in the use of nitrogen fertilizer but this still represent less than 3% of farm's CPRS eligible emissions.

The variation in the level of total CPRS eligible emissions was just 7% over the three years between 2006 and 2009.

What does this mean under the proposed CPRS for the MDF?

The Government has not yet decided if agriculture will join the CPRS and has deferred a decision until 2013 for possible commencement from 2015. However, the Government has announced that the Scheme will begin in July 2011 for all other sectors and this will have an impact on the cost of some farm inputs.

To get some idea of how the CPRS will impact on dairying let's imagine that the production figures, cost of production and carbon emissions for 2008-09 are exactly the same as in 2011 when the Scheme begins. What impact will the scheme have?

According to the DPI (Vic)[1] the impact of the CPRS on the dairy industry at the commencement of the Scheme (and assuming a carbon price of \$20/t CO_2-eq) will see a rise in feed costs by 1.5%, fertiliser and farm chemicals by 2% and electricity by 16%. However, the cost of permits in the first year has been fixed by the Australian Government at \$10/t CO_2-eq and analysis by the Australian Treasury[2] suggests that the carbon price will be at \$30/t CO_2-eq by 2015. Based on these assumptions the financial impact of the Scheme up to 2015 (with agriculture excluded) is summarized in Table 3. All costs are in 2009 dollars and exclude the effect of inflation.

Table 3: Anticipated financial impact of the CPRS at MDF up to 2015

	Pre-CPRS costs/year In 2010	After-CPRS costs/year In 2015	After CPRS Increase in costs
Electricity	\$19,621	\$24,330	\$4,709
Supplementary Feed	\$307,698	\$314,621	\$6,923
Diesel	\$5,060	?	?
Fertilizer	\$47,247	\$48,664	\$1,417
Farm Chemicals	\$3,707	\$3,818	\$111

A fuel tax adjustment will be introduced at the beginning of the CPRS whereby there will be a 'cent for cent' reduction in fuel excise to compensate for any rise in fuel price due to the sale of carbon permits. Agriculture will be able to access this fuel tax adjustment for three years from the start of the Scheme. This means that there will be no increase in diesel price as a result of the Scheme until July 2014.

[1] Dept of Primary Industries (Vic), Issues Brief *Impact of Emissions Trading on Farm Costs* (Mar 09)

[2] Dept of Treasury, *Australia's Low Pollution Future: The Economics of Climate Change Mitigation*, 2008

There is also likely to be a fall in milk prices as processors drawn into the Scheme. Dairy processors are likely to be classed as Emission Intensive Trade Exposed (EITE) and will receive 95% of permits for free. Detailed emissions data is not available from processors so any estimate would be speculative, but it is unlikely to be a significant cost for each supplying farm.

The total increase in costs as a result of the introduction of the CPRS is likely to be around \$13,160 by 2015. Compared to the 2008-09 cost of production of \$1,100,006 this is equivalent to an increase in costs of 1.2% at the introduction of the Scheme in 2015. This is consistent with an ABARE[3] analysis that suggests an increase in the cost of production in dairying at the commencement of the CPRS by 0.5% and by 1.1% in 2015 if agriculture is not included in the Scheme.

ABARE also suggests that the cost of production will increase by 2.5% if agriculture is included in the Scheme after 2015 (assumes EITE assistance). This is equivalent to a total increase of \$27,500/year based on 2008-09 production costs or a fall in Earnings Before Interest and Tax (EBIT) of 1c/kg MS.

EBIT is also sensitive to the price of carbon permits with EBIT falling by 1c/kg MS for every \$10/tonne CO_2-eq.

Important Note:

Both the DPI (Vic) and ABARE figures assume that farms make no attempt to reduce emissions.

Where to from here?

A decision about whether agriculture is included in the CPRS or not is still a long way off and many decisions have to be made in the meantime. This project is all about creating awareness for forward planning to manage the risk to dairy farm businesses.

The next stage of the project investigates ways to reduce or offset greenhouse gas emissions and to analyse the case for business investment in emission offset or reduction measures.

The variation in emissions at the MDF from one year to the next as a result of management decisions suggests that there will be some immediate, low cost measures to reduce emissions. There are also some new technologies and management approaches that are worth investigating.

[3] ABARE, *Issues Insights Agriculture & the CPRS: Economic issues and implications* (Mar 09)

Table 4: CARBON EMISSIONS CALCULATOR – MDF FARM INPUTS

Whole Farm Details			
Trees planted since 1990 (Ha)	0	0	0
Farmland (excluding tree area)	**2006-07**	**2007-08**	**2008-09**
Irrigated pasture (Ha)	65	68	68
Dryland pasture (Ha)	0	0	0
Irrigated crops (Ha)	0	0	0
Electricity (kwh/yr)	172905	111710	135829
Diesel/Unleaded (litres/yr)	6010	6039	5025
Fertiliser			
Nitrogen (tonnes ELEMENT/yr)	16.0	19.5	22.4
Phosphorus (tonnes ELEMENT/yr)	2.0	1.5	0.4
Potassium (tonnes ELEMENT/yr)	5.4	5.2	2.8
Sulphur (tonnes ELEMENT/yr)	1.7	0.9	0.6
Lime (tonnes/yr)	0.0	0.0	0.0
Purchased Feed Inputs			
Pasture hay (tonnes DM/yr)	413	0	40
Grain/concentrate (tonnes DM/yr)	806	678	566
PKE (tonnes DM/yr)	186	124	219
Grass silage (tonnes DM/yr)	0	27	5
Milk Yields			
Farm milk solids (t/yr)	164.0	161.2	156.9
Av lactation (days)	305	305	305
Av production (l/cow/day)	18	23	24
Av production (% MS/day)	7.55%	7.62%	7.84%
Herd			
Milker numbers	350	305	290
Milker av weight (kg)	550	550	550
Dry cow numbers	0	0	0
Dry cow av weight (kg)	0	0	0
Heifer < 1yo numbers	75	80	79
Heifer < 1yo av weight (kg)	150	150	150
Heifer < 1yo weight gain (kg/day)	0.45	0.45	0.45
Heifer > 1yo numbers	75	75	80
Heifer > 1yo av weight (kg)	400	400	400
Heifer > 1yo weight gain (kg/day)	0.7	0.7	0.7
Bulls > 1yo numbers	0	0	8
Bulls > 1yo av weight (kg)			400

Nutrition							
Cattle Type	**Season**	**Feed Type**	**Digesti-bility %**	**Protein %**	**2006-07 Kg DM/ cow/ dy**	**2007-08 Kg DM/ cow/ dy**	**2008-09 Kg DM/ cow/ dy**
Milkers	Spring	Pasture	79	22	9	12	14
		Con'trates	84	13	4.5	5.5	4.5
		Silage	65	15			
		PKE	55	16			0.5
	Summer	Pasture	79	22	3	8	11
		Con'trates	84	13	6.5	7.5	6
		Silage	65	15	6.5	2	
		PKE	55	16			1.5
	Autumn	Pasture	79	22	4	8.5	9
		Con'trates	84	13	6	6.5	5
		Silage	65	15	4	0.5	1.2
		PKE	55	16			1
	Winter	Pasture	79	22	5	6	9
		Con'trates	84	13	7	7.5	4.5
		Silage	65	15	2		
		PKE	55	16		3.4	1.5
Dry cows	Annual	Pasture	79	22	6	6	6
		PKE	55	16	3	3	3
Heifers <1	Annual	Pasture	79	22	9	9	9
Heifers >1	Annual	Pasture	79	22	10	10	10
Bulls >1	Annual	Pasture	79	22	10	10	10

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