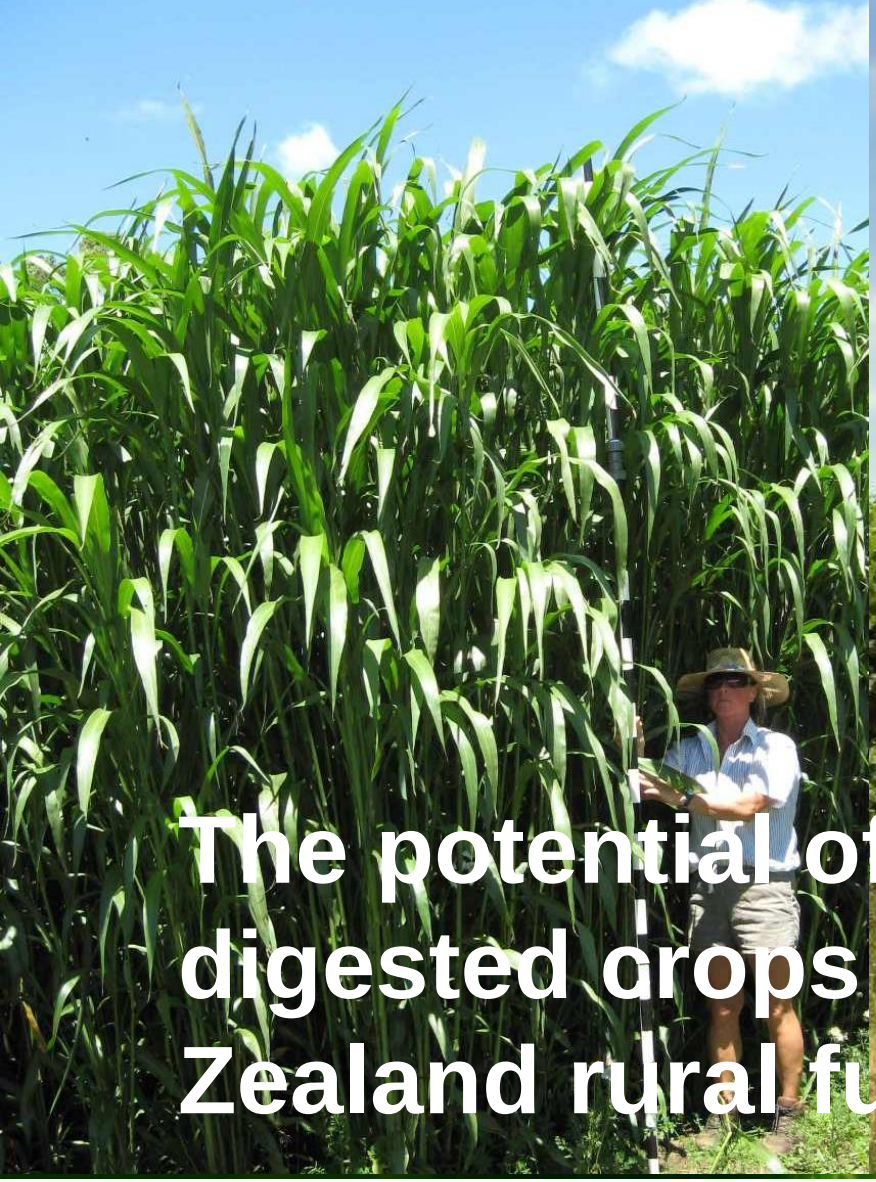

The potential of anaerobically digested crops to supply New Zealand rural fuel requirements

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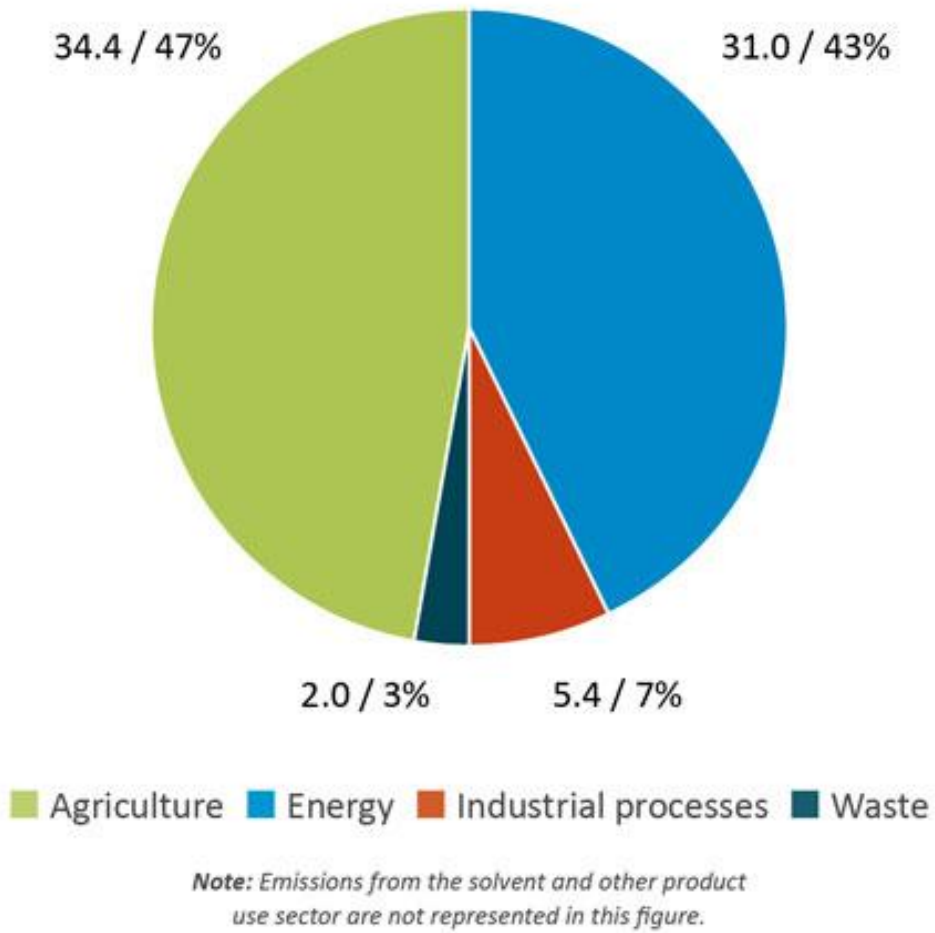
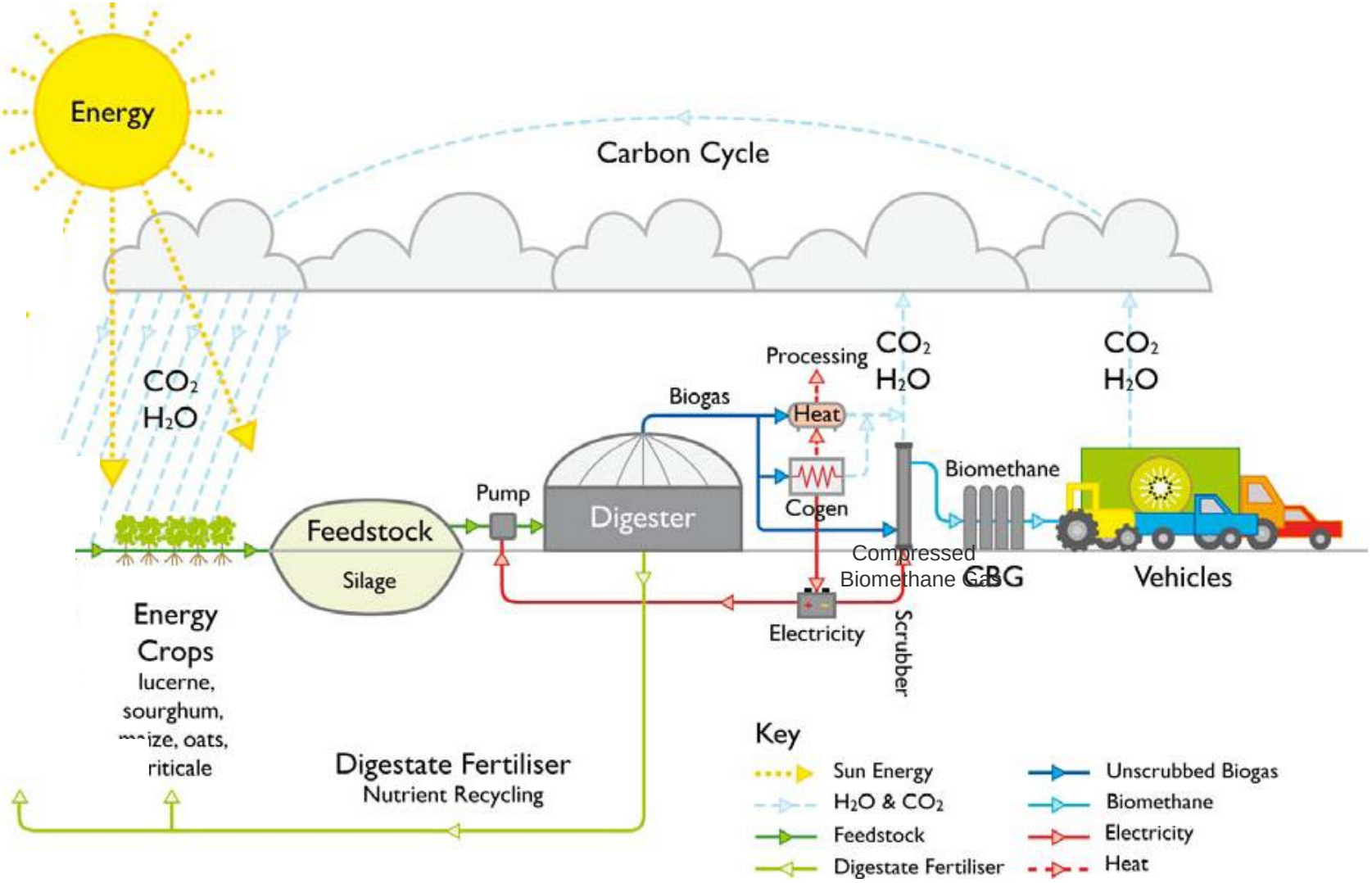
NZ's greenhouse gas emissions (Mt CO_2 equivalent) in 2011

Source: http://www.mfe.govt.nz/publications/climate/greenhouse-gas-inventory-2013-snapshot/



If we plant 5% of NZ's summer dry land in biofuel crops, can we supply the fuel requirements of rural agriculture?

Biogas System Overview



(redrawn from Loren Pole, Bioform Ltd)

Methodology – Estimating biomass production

Select summer dry regions with <10° slope

↓

Divide NZ into 12 regions of similar climate

↓

Northern North Island grow sorghum – wheat rotation
Rest of NZ grow lucerne

↓

Estimate dry matter production in each region using the crop model APSIM

↓

Reduce predicted APSIM yields by 25% to account for suboptimum management

↓

× 0.05 to get yield from 5% of summer dry land

Performance of the APSIM sorghum model

Location	Yield (tDM/ha)
Flaxmere	
Observed	12.8-28.0 (depending on soil depth)
Predicted, original model	16.3 (deep soil)
Predicted, modified model	26.6 (deep soil)
Hastings	
Observed	27.0
Predicted, original model	17.1
Predicted, modified model	27.1
Kerikeri	
Observed	30.0
Predicted, original model	20.4
Predicted, modified model	28.9

Area descriptor	Water deficit (mm/yr)	Annual temp. (°C)	Estimated yields* (tDM/ha)
North Cape	103-121	15.7-15.8	20.0
Northland and northern coastal sands	51-85	14.3-15.3	25.3
Central dry lowlands	62-181	10.7-13.3	28.0
Marlborough	248-261	12.2-12.4	10.0
Central Wairarapa, Southern Hawke's Bay	93-107	12.2-12.7	13.2
Central poorly-drained soils, Marlborough well-drained soils	182-225	11.3-13.8	11.2
Marlborough and lower North Island river valleys	97-130	12.0-12.7	12.6
Southern South Island lowlands	54-114	9.8-10.5	15.8
Canterbury Plains	183	11.3	11.8
Inland Canterbury Plains, South Canterbury, Otago Plains	82-113	9.5-10.5	9.7
Ranfurly, Wanaka, Upper Waitaki, eastern Central Otago	194-238	9.1-9.2	5.7
Alexandra, Cromwell to Luggate	307	10.2	4.0

* These yields are 25% less than the potential yields predicted by APSIM

Area descriptor	Estimated yields (tDM/ha)	Area (ha)	DM produced (Mt)
North Cape	20.0	82,393	1.65
Northland and northern coastal sands	25.3	500,894	12.69
Central dry lowlands	28.0	557,772	15.61
Marlborough	10.0	48,134	0.48
Central Wairarapa, Southern Hawke's Bay	13.2	731,089	9.63
Central poorly-drained soils, Marlborough well-drained soils	11.2	188,697	2.11
Marlborough and lower North Island river valleys	12.6	180,485	2.28
Southern South Island lowlands	15.8	625,705	9.87
Canterbury Plains	11.8	404,783	4.79
Inland Canterbury Plains, South Canterbury, Otago Plains	9.7	1,092,973	10.62
Ranfurly, Wanaka, Upper Waitaki, eastern Central Otago	5.7	273,650	1.57
Alexandra, Cromwell to Luggate	4.0	39,141	0.16
Total		4,725,716	71.45
5% of Total		236,286	3.57

Methodology – Estimating methane production

DM yield from 5% of summer dry land	3.57 Mt DM/yr
↓	
Reduce by 10% to account for transportation losses	3.22 Mt DM/yr
↓	
Convert DM yield to methane production using measured and published values	830 Mm^3 CH_4/yr
↓	
Reduce by 30% to account for the energy consumed while producing the biogas	830×0.7
↓	
Methane production from 5% of summer dry land	581 Mm^3 CH_4/yr

Conclusions

- The biogas potential from 5% of the summer dry arable land in NZ is projected to produce a net yield of 580 Mm^3 CH_4/yr.
- This represents **more than 2×** the amount of diesel fuel used by the Agriculture sector in 2010.

Additional benefits of developing the use of biogas in rural NZ include:

- a decreased risk to production in the event of a global fuel crisis
- a decreased GHG footprint, which should enhance our clean green image and therefore our marketing credibility internationally
- enhanced diversity of markets for crops in NZ, which should enhance the stability of rural incomes.

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