Reducing New Zealand's agricultural greenhouse gas emissions:

HOW WE ARE GETTING THERE

NEW ZEALAND AGRICULTURAL GREENHOUSE GAS Research Centre

PGgRc® PASTORAL GREENHOUSE GAS RESEARCH CONSORTIUM

WORKING TOGETHER

1990

The greenhouse emission levels of 1990 provide a baseline. By 2020, New Zealand has committed to lowering its emissions to 5% below 1990 levels. By 2050, the goal is 50% below or taking responsibility for any excess emissions.

2014

Where greenhouse gas emissions would be now, based on New Zealand's increased production, but if there were no on-farm efficiency gains.

Where greenhouse gas emissions are right now, thanks to on-farm efficiency gains.

2050

Where greenhouse gas emissions need to be heading by 2050. How? By continuing to farm more efficiently and using new technology.

50,000

40,000

30,000

20,000

AGRICULTURE EMISSIONS (Mt CO^2-eq)

THE SITUATION

The emissions intensity of New Zealand agriculture – that is, the gases generated per unit of meat or milk produced on farms – has declined on average by about 1% per year since at least 1990. How? Simply because farm businesses have become more efficient over the past 20 years. Improved animal genetics and management, combined with better grassland management and feeding practices mean that farms are using resources more efficiently to increase their outputs. This has happened across all sectors of the pastoral industry.

On-farm practice: What's changed between 1990 and 2012?	**Effect on farm productivity**	**Net effect on emissions intensity**
DAIRY		
• Consistent supply of high quality feed and increased use of supplements (like maize silage, PKE and brassicas) • Improved pasture management, including more targeted use of fertilisers and irrigation • Continued improvement in genetic merit of animals, through breeding and herd testing	• Increased milk yield per cow (kg MS/cow) and per hectare (kg MS/ha) • Actual milk yields are closer to the genetic potential of cows	• Greater proportion of feed going into milk production, rather than maintenance
BEEF		
• More finishing cattle and reduction in the breeding cow herd • Increased use of dairy origin livestock for beef finishing • Better feeding and management of animals	• Faster growth rates, increased weight of finished animals and of kg meat/ha	• Greater proportion of feed going into meat production, rather than maintenance
SHEEP		
• Increased genetic merit of sheep for growth and reproduction, and increased use of pregnancy scanning • Increased hogget mating • Improved pasture production and quality, resulting in faster growth • Optimised stocking rate to fit pasture growth	• Increased lamb weights at slaughter • Increased kg meat/ha • Increased lambing percentage; greater number of offspring per ewe carried	• Reduced ewe population needed to produce equivalent amount of lamb meat at slaughter
DEER		
• Increased carcass weights • Shorter time to slaughter	• Increased weight of finished animals and kg meat/ha	• Greater proportion of feed going into meat production, rather than maintenance

However, the reduced emissions intensity has been more than offset by the increased overall product generated by the sector. As a result, New Zealand's total agricultural emissions have risen – by 15%. Without the efficiency gains on farms, emissions would have grown much more, by more than 30%. So, while New Zealand farmers' efficiency gains are addressing a large portion of the problem, they are not enough to counter the extra greenhouse gases being produced overall.

WHY IS THIS IMPORTANT?

As part of the UN Framework Convention on Climate Change (UNFCCC), New Zealand has made a commitment to lower its greenhouse gas emissions by 2020 – to 5% below 1990 levels – and it is currently considering targets that would apply further into the future. Most people agree that, even though New Zealand makes only a very small contribution to global emissions, our reputation as a trading nation implies an obligation to contribute fairly towards the global effort to reduce greenhouse gas emissions and the risks from climate change.

WHAT'S THE SOLUTION?

Farmers are already part of the solution. By continuing to improve their farm efficiency, they will also continue to reduce the intensity of emissions per unit of product.

But that will not stop New Zealand's total agricultural emissions from rising. The country needs practical and cost-effective tools to help it achieve economic growth targets, as well as its environmental, social and international aspirations and obligations. That's where the Pastoral Greenhouse Gas Research Consortium (PGgRc) and New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC) fit in. Government, industry and researchers are working together – pooling resources to identify and develop additional interventions that will provide effective and practical results by 2020 and beyond.

While the most straightforward solution would be to simply reduce agricultural production or forego growth targets, that's not in the sector's nor the nation's interest – so the goal is to enable the sector to reduce its absolute emissions without sacrificing production gains.

WHAT WILL THE SOLUTION LOOK LIKE?

New Zealand's research into reducing livestock greenhouse gas emissions – namely, methane and nitrous oxide – and increasing soil carbon sinks to absorb emissions concentrates on six possible solutions.

1. Low-methane animals

Identify genetic markers of naturally low methane-emitting sheep and cattle

Methane emission varies between animals. The level of emission is a heritable trait, so it can be included in a selection index. Lower emissions appear not to affect other production traits, so selecting for lower methane emission would not impact negatively on a farm's production.

2018

Identify sheep markers by 2016 and cattle markers by 2018 and embed in breeding indices.

2. Low-methane feeds

Investigate feed options that can help reduce greenhouse gas emissions

Some feeds can help reduce methane emissions and increase nitrogen utilisation. Identifying and confirming these feeds will mean recommended feeding regimes can be developed – based on current and new feed options – for use in different farm systems.

2017

Develop decision-making tools for farmers by 2017.

3. Methane vaccine

Produce a vaccine to inhibit methane production

New Zealand scientists are working on a world-leading vaccine programme, which could reduce emissions by up to 20%, without reducing productivity. The vaccine stimulates antibodies to counter key methane-generating microbes within the rumen in livestock.

2015

Engage with commercial partner by 2015.

4. Methane inhibitors

Identify suitable inhibitors against methane-generating microbes

Inhibitors (chemical compounds that target molecular activities) can knock out methane-generating microbes. Researchers are looking for substances that work in the rumen without side-effects across a range of microbes. Successful inhibitors could be delivered in feed, in a bolus, drench, mineral lick or within the water supply.

2015

Engage with commercial partner by 2015.

5. Reduce nitrous oxide and nitrate leaching

Develop new and support existing technologies, and develop on-farm management options

Research focusses on novel interventions and on-farm management guidelines that help reduce nitrous oxide losses. DCD (dicyandiamide) has been shown to reduce nitrate leaching and nitrous oxide emissions, but its use has been suspended while future options to meet trade requirements are being considered.

2014

Next phase of research begins July 2014.

6. Increasing soil carbon

Identify ways to measure and increase the carbon content of New Zealand grassland soils

Increasing carbon in the soil could offset greenhouse gas emissions. Research is looking at soil carbon levels across New Zealand and techniques to verify changes in carbon content. Work is also exploring management practices that increase carbon sinks.

2014

Next phase of research begins July 2014.

An "integrated systems programme" runs alongside the detailed research work. Its role is to help quantify the positive contribution farmers are already making to reducing greenhouse gases via increased efficiency – while also making sure any new solutions are practicable and cost-effective to implement on New Zealand farms. This programme therefore ensures farmers are recognised for their current efforts – and can build on them.

WHAT CAN FARMERS DO?

At this point, the biggest impact on greenhouse gas emissions intensity comes from New Zealand farmers continuing to increase the efficiency of their operations as much as possible. Farmers can also get a farm-level greenhouse gas report when they have their farm analysed using the nutrient budgeting tool Overseer™. But, aside from that, there is not a lot else most farmers can do to substantially reduce their greenhouse gas emissions, if they want to maintain or increase their overall production levels.

That is why the research underway is so important. Additional tools are needed – and they are needed soon.

WHO'S INVOLVED?

The jointly industry/government-backed Pastoral Greenhouse Gas Research Consortium (PGgRc) and Government-funded New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC) are working together to create opportunities for farmers to further reduce farm emissions.

Internationally, New Zealand is working collaboratively with other countries, through the Global Research Alliance on Agricultural Greenhouse Gases.

www.pggrc.co.nz

www.nzagrc.org.nz

www.globalresearchalliance.org

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PGgRc
Pastoral Greenhouse Gas
Research Consortium
PO Box 121
Wellington 6140
New Zealand
T: +64 4 4716031

NZAGRC
New Zealand Agricultural
Greenhouse Gas Research Centre
Private Bag 11008
Palmerston North 4442
New Zealand
T: +64 6 351 8334