



International Survey on agriculture-climate change policy instruments

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This study has been conducted on behalf of NL Agency in the framework of its ROB programme on reduction of non-CO₂ greenhouse gases. NL Agency works closely together with and implements climate policies on behalf of two Dutch ministries: Ministry of Economic Affairs, Agriculture and Innovation and Ministry of Infrastructure and the Environment

International Survey of agriculture-climate change policy instruments for reduction of methane and nitrous oxide emissions

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ABBREVIATION LIST

CAP	Common Agricultural Policy of the European Commission
CH ₄	Methane
CO ₂	Carbon Dioxide
GHG	Greenhouse gas
ETS	Emission Trading System
J-Ver	Japanese scheme for offsetting of greenhouse gas emissions
MAF	Ministry of Agriculture and Forestry
NCGG	Non Carbon Greenhouse Gases
NH ₃	Ammonia
N ₂ O	Nitrous oxide
NRCS	Natural Resources and Conservation Service
PEP	Proof of Ecological Performance
REPS	Rural Environment and Protection Scheme, Ireland
UNFCCC	United Nations Framework Conventions on Climate Change
USDA	United States Department of Agriculture

EXECUTIVE SUMMARY

Environmental Resources Management – ERM was commissioned by Agentschap NL (NL Agency) a study to provide an international overview of Agriculture-climate change policy instruments for reduction of methane and nitrous oxide emissions. The aim of this study is to clarify how national and/or international Agriculture-climate-policies could or should be instrumented during the coming three to five years to achieve significant emission reductions of methane and nitrous oxide in the Dutch agricultural sector by 2020.

The study includes an international survey, a quick-scan inventory of useful and inspiring examples of policy and reduction measures to reduce NCGG. ERM used an approach consisting out of three phases. In the first phase countries were selected on the basis of emissions and Kyoto protocol targets. In the second phase policy measures of these countries were listed, based on publicly available national and international sources. In a third phase a sub-set of this selection was analyzed in-depth through communications with local focal points and additional review of policy documents, to enhance the understanding of context, impact and results of each of these policies and measures.

The first impression of the survey is its sheer size. Most countries have a myriad of individual measures, aiming at individual sources and/or sectors and/or multiple agricultural issues and using different levels of impact. The actual number of policy instruments and measures that reduce non-carbon greenhouse gases in agriculture directly or indirectly is in reality even larger than this survey shows.

Climate change policies for NCGG reduction are relatively new. Emission reductions in agricultural sectors over the last two decades are not so much a result of climate change policies but a result of other environmental policies e.g. targeting nitrogen. In particular the Nitrate Directive and Water Framework directive have (had) an impact in member states of the European Union. This does not mean that countries are not developing policies and strategies for reducing NCGG in agriculture. Although this survey does not aim to be complete, the survey revealed a wide range of policy instruments being used for emission reduction ranging from direct payments for sustainable production, subsidies for biogas use and implementation of climate friendly policies, emission-trading schemes and partnerships with the private sector. Financial incentives under the form of direct payments or subsidies for adopting measures and/or technology appear the most commonly used policy instruments, although very little is known about the cost-effectiveness and efficiency of the policies.

Policy instruments to reduce NCGG in agriculture

There are large differences between countries and approaches they take. Countries with a large agricultural sector such as New-Zealand, Australia and Ireland of which the agricultural sector produces a large share of the national greenhouse gas emissions have more to gain from emission reductions in this sector. In general, these countries have developed specific policies and measures. Other national policies (mostly European countries but also US) combine environmental stewardship with emission reduction measures. For again other countries, like Iceland, very little is being done to reduce NCGG. Their focus in agriculture is on carbon sequestration.

Voluntary instruments

Because of the uncertainties and complexity, today most policy instruments are voluntary. The effect of the voluntary policies remains often unclear. Cost-efficiency at farm level is important for the follow up of the measure, whether it is about the installation of a manure fermentation installation or crop rotation measures. For example in Switzerland, farmers depend to a large extent depend on the payments scheme. Mitigation measures that require a large investment by farmers upfront – even with a significant subsidy, have in general a low participation. This has been the case in the promotion of biogas installations in Denmark and the US.

Communication about and stimulation of these voluntary actions are a challenge which will require sustained and tailor-made effort. Demonstration projects were suggested as an effective way to disseminate information and to convince farmers of the economic and practical feasibility of the implementation of mitigation measures. The success of this instrument to uptake mitigation measures depends largely on the presence of (financial) incentives, the practical feasibility and the absence of potential additional risks. Best practices relate to a large range of GHG reducing measures such as grazing management, nitrogen use efficiency, improving use of manure, use of clover to reduce chemical fertilizer use. The UK has taken an industry-led approach but it is too early to draw any conclusions related to this approach.

Direct Payments

Direct payments such as in Switzerland and EU linked to cross compliance ¹and beyond, appears to be successful, in particular when the payment makes up a significant share of the farmer's income. In both cases it involves reduction of emissions from land and soil management. Conditionality and monitoring are important for the effectiveness of the instrument. In the US land set-aside programs exists. According to the government, these are one of the most successful programs in the US.

Subsidies for Biogas – manure management

In the US, Denmark and Germany programs are in place to promote biogas from manure treatment. Although the initial set up of the subsidies was to support farmers financially to set up their own installation, it appeared difficult for farmers

¹ 'Cross-compliance' links direct payments to farmers to their respect of environmental and other requirements set at EU and national levels.

to make the investment. As a consequence, in Denmark third parties are building biogas installations where farmers can bring their manure to. In the US this hurdle has been overcome by encouraging farmers to collaborate, so that several farmers bring their manure to the farmer with the installation.

Emission trading schemes/ Offsetting Programs

Countries with a large agricultural sector are stepping into Emission Trading Schemes (ETS)/ Offsetting programs. These include New-Zealand, Australia, Canada, Ireland and also Japan. New Zealand and Japan are the most advanced. In New-Zealand the inclusion of the agricultural sector is scheduled for 2015. As ETS is a market-based instrument the market will decide what the best mitigation option will be. The effect it will have on the overall emissions is uncertain as the market may choose to pay for additional costs related to the emissions – in particular when there are no ‘easy’ and cost-effective mitigation options available to farmers. This may result in a low incentive to reduce emissions and higher costs for the agricultural sector. The agricultural sector in New-Zealand fears that the ETS scheme will give them a competitive disadvantage compared to the other countries where no ETS scheme will be in place. One respondent commented during the interviews that ETS schemes are more feasible in countries with large farms. Due to the business-minded/entrepreneurial approach of farming in these circumstances the farmers will be more likely to innovate and take (justified) risks to adopt new measures.

The Japanese Verified Emission Reduction Scheme includes already today one agricultural mitigation measure, low-protein feed for swine manure management. It's too early to assess the impact of this domestic offsetting program. Also Canada and Ireland are working towards a domestic offsetting program. Other respondents were convinced it was too early to implement market-based instruments – monitoring and verification of emissions at farm level would be too uncertain, complex and expensive at this point in time to make this a successful policy option in the near future.

Common Agricultural Policy (CAP) of the European Union

Agriculture has been one of most important areas of European collaboration since the early days of the European Community and accounts for almost half of the spending in the European Union, affecting 15 million farmers. This means that a Common Agricultural Policy (CAP) on an EU level can be a powerful tool to reduce non-carbon greenhouse gas emissions in agriculture.

Although payment is not currently linked to GHG mitigation measures such linkage is being considered in the context of next CAP reform which will be discussed in the European Parliament later this year. There is an opportunity to support mitigation measures either under a ‘greener’ pillar one (production support) or an expanded pillar two (rural development). In both cases the key point is whether the conditions are sufficiently tight so that this results in changes in behaviour and follow-up of measures. Linking the CAP to mitigation measures could help to prevent leakage of one member state to the other. Mitigation measures that could be included under the CAP are: improved crop nutrient management practices; use of improved breeding practices; improved feeding practices; manure management measures; and uptake of anaerobic digestion.

Research

There is a significant amount of research being undertaken on greenhouse gas emissions, mitigation measures and calculation of the emissions. The outcome of the research is sometimes contra dictionary – for example, research has indicated that quality of milk was negatively impacted by feed management, while other research indicated there is no impact. More research is needed to fine-tune these results and to come to effective solutions. In addition research focuses largely on technical solutions rather than practical and cost-effective options for the reduction of on-farm levels of greenhouse gases.

General recommendations:

Related to Policy development

- Only few countries have a dedicated policy to reduce non-carbon greenhouse gases from agriculture with specific targets. On the contrary most countries – in particular in Europe - focus their attention on multiple environmental impacts of agriculture (water, biodiversity, soil...) and/or energy which provide positive side effects on NCGG emissions without specific targets. An approach with more specific, measurable, achievable, realistic, and time-bound objectives can increase the (cost-)efficiency in this field.
- Many countries in this study explore a myriad of agricultural policy instruments to reduce emissions. In many cases their mix of policy measures is a reflection of their domestic agricultural situation as much as their governmental philosophy related to the environmental policy (regulations vs market-based approach). Further reflection on the current situation and exploration of innovative approaches towards market penetration and incentives to farmers can bring progress in this area.
- Climate Change is a global problem, which requires international collaboration. Therefore international policies and policy frameworks such as the Common Agricultural Policy offers opportunities. It can provide a framework and incentives for action at the national level.
- The reduction of methane emissions through renewable energy production offers also opportunities. This will require support through demonstration projects but might also benefit from tailor-made financial, technical, logistic and/or organizational support.
- Subsidies can be good instruments at a first stage of introducing new practices and technologies. As more farmers are involved, subsidies may not be the most cost-efficient policy. Other instruments such as covenants, Emission Trading Systems or a larger framework as the Common Agricultural Policy, could provide opportunities for the longer term. At short term there is a need to assess the costs and the emission reduction effects of current and future policy instruments that are being subsidized.
- Countries with a large share of greenhouse gases from agriculture (New Zealand, Australia...) explore emission trading and tax systems. At the same time, it is clear that market-based instruments such as emission trading systems or taxes need a more international approach, as they otherwise may interfere with market mechanisms between countries.

Related to Monitoring, Reporting and Verification

- Most countries struggle with their monitoring, reporting and verification. It is key to track the effectiveness of their policies. Several countries are working on the development of calculation tools. Sharing experience can help to develop an international solid method to monitor, report and verify emission reduction efforts.
- Modeling all bio-processes can be time-consuming. The development of practical NCGG measurement tools which can be used at farm-level can be more cost-effective. The collection of information on relevant farm practices in conjunction with National Farm Surveys offers here a window of opportunity.

Related to Farmers

- Mitigation actions will have to be followed up and sustained by most – if not all farmers, i.e. by a large number of very small businesses, in order to have a significant impact. Farmers take up new approaches more easily when there is a business case to it. Measures that increase the profitability of their farming practices that also reduce GHG emissions have the most chance to be scaled-up by business-minded farmers.
- Several countries have demonstration and pilot projects at farm level. Sharing lessons learnt across country borders can speed up the uptake of new approaches and technologies by farmers.

On Research

- There are still a lot of uncertainties about methane and nitrous oxide emissions in agriculture. Emissions in agriculture have a high degree of uncertainty as farming activities are diverse and involve highly complex and not fully understood natural soil and microbiological processes. Further research and innovation is needed. It is key to validate the findings and conclusions from research at farm-level as soon as possible through implementation at farm-level and to measure and monitor the impact.
- There is also a need for more applied research that takes into account business and farm-level aspects to come to cost-neutral or even profitable measures that result in emission reductions.
- Several countries have research and development programs that end in 2011. The result of this research will be useful in international policy roundtables like NCGG and GRA.
- There is need for international initiatives and platforms that work at the intersection of research, policy development and implementation at farm-level. Combination of GRA and NCGG networks can be one of these initiatives. Expansion of GRA and other networks from R&D and policy to agricultural business networks will also offer a cost-effective solution for climate-smart agriculture business opportunities.

About this study

- Although this survey is a quick scan, it ended as a voluminous study on national, EU and other international progress in NCGG policy. Despite the time and effort that went into drafting this survey, it remains a quick scan: many aspects were left for future in-depth research and policy facilitation towards application of R&D results by experts in their respective fields.

- From this survey it is clear that there is so much going on at the same time in all these countries that better coordination and wider exchange of information on results and practical experience would benefit the world community as a whole. It would be at the same time more time- and cost-effective.
- International meetings (like the upcoming NCGG-6 combined with GRA sessions) provide a platform for this exchange. It is recommended that these meetings are not only used for the exchange of scientific research, but also of experience on the implementation of policies and measures.

SAMENVATTING

Environmental Resources Management - ERM heeft in opdracht van Agentschap NL een internationale studie uitgevoerd naar landbouw-klimaatbeleid instrumenten ter reductie van methaan- en lachgasemissies. Deze studie heeft tot doel te verduidelijken hoe nationale en /of internationale landbouw-klimaatbeleid in de komende drie tot vijf jaar kan of zou moeten geïnstrumenteerd worden om tegen 2020 significante emissiereducties van methaan en lachgas te bekomen in de Nederlandse landbouwsector.

Het onderzoek bestaat uit een quick-scan en inventarisatie van nuttige en inspirerende voorbeelden van beleidsinstrumenten en maatregelen die niet broeikasgasemissie in de landbouw verminderen. De aanpak voor deze studie bestaat uit drie fasen. In de eerste fase werden landen geselecteerd op basis van emissies en Kyoto-doelstellingen. In de tweede fase werden beleidsmaatregelen van deze landen genoteerd op basis van openbaar beschikbare nationale en internationale bronnen. In de derde fase werd dan een sub-set van deze selectie geanalyseerd door middel van diepgaande communicatie met de lokale contactpersonen aangevuld door literatuurstudie van beleidsdocumenten, voor een goed begrip van de context, impact en bereikte resultaten van elk van deze beleidslijnen en maatregelen te verbeteren.

De eerste indruk van het onderzoek is de enorme omvang. De meeste landen hebben een groot aantal individuele maatregelen, gericht op individuele bronnen en/of sectoren en/of meerdere aspecten van de landbouw en het gebruik van verschillende niveaus van impact. Het werkelijke aantal beleidsinstrumenten en maatregelen om niet-koolstof broeikasgassen te verminderen in de landbouw - rechtstreeks of onrechtstreeks, is in werkelijkheid nog groter is dan dit onderzoek laat zien.

Klimaatbeleidsinstrumenten ter vermindering van niet-koolstof broeikasgassen zijn relatief nieuw. Emissiereducties in de landbouwsector tijdens de afgelopen twee decennia zijn niet zozeer een gevolg van verandering in klimaatbeleid, maar wel een gevolg van ander milieubeleid bijvoorbeeld gericht op nitraat. Met name in de lidstaten van de Europese Unie hebben de Nitraatrichtlijn en de Waterrichtlijn hebben een impact (gehad). Dit betekent niet dat er geen beleidsinstrumenten of strategieën voor het terugdringen van NCGG in de landbouw worden uitgezet. Hoewel dit onderzoek niet de pretentie heeft volledig te zijn, blijkt uit de peiling dat er een breed scala aan beleidsinstrumenten bestaat voor emissiereducties, gaande van directe betalingen voor duurzame landbouwproductie, subsidies voor productie van biogas, regelingen voor emissiehandel en partnerschappen met de particuliere sector. Financiële prikkels in de vorm van directe betalingen of subsidies voor maatregelen te nemen en /of technologie blijken de meest gebruikte beleidsinstrumenten, hoewel zeer weinig bekend is over de kosteneffectiviteit en efficiëntie van het beleid.

Beleidsinstrumenten ter vermindering van NCGG in de landbouw

Landen zoals Nieuw-Zeeland, Australië en Ierland waar de agrarische sector verantwoordelijk is voor een groot deel van de uitstoot van broeikasgassen hebben meer te winnen bij emissiereducties in de landbouwsector. In het algemeen hebben

deze landen een specifiek beleid met maatregelen ontwikkeld. Andere landen - vooral Europese landen, maar ook de VS - combineren dan weer zorg voor het leefmilieu met emissiebeperkende maatregelen. Nog andere landen, zoals IJsland, doen op dit moment heel weinig om NCGG emissies te verminderen. Hun focus is op de koolstofopslag in de landbouw.

Vrijwillige instrumenten

Door de onzekerheden en de complexiteit van diffuse NCGG emissies, zijn vandaag de dag de meeste beleidsinstrumenten vrijwillig. Het effect van deze vrijwillige aanpak blijft vaak onduidelijk. Het succes van deze aanpak hangt grotendeels af van de kosten-efficiëntie op bedrijfsniveau, of het nu gaat over een mestvergistinginstallatie of maatregelen met betrekking tot gewasrotatie. Bijvoorbeeld in Zwitserland zijn de boeren sterk afhankelijk van de rechtstreekse vergoedingen. Maatregelen die een grote investering vragen van boeren hebben over het algemeen een lage participatiegraad- zelfs met een aanzienlijke subsidie. Dit is bijvoorbeeld gebleken bij de promotie van biogasinstallaties in Denemarken en de VS.

Communicatie over en stimulering van deze vrijwillige maatregelen vereisen een duurzame en op maat gemaakte aanpak. Demonstratieprojecten kunnen een effectieve manier zijn om informatie te verspreiden en om de boeren te overtuigen van de economische en praktische haalbaarheid van mitigatiemaatregelen. Het succes en handelingsperspectief hangt grotendeels af van de aanwezigheid van (financiële) prikkels, de praktische haalbaarheid en de afwezigheid van mogelijke bijkomende risico's. Reductiemaatregelen die hiervoor in aanmerking komen zijn begrazingsbeheer, maatregelen rond stikstofefficiëntie, het verbeteren van het gebruik van mest, het gebruik van klaver om kunstmest te verminderen. Het Verenigd Koninkrijk heeft een door de industrie geleide aanpak om broeikasgasemissies te verminderen, maar het is te vroeg om conclusies met betrekking tot deze aanpak te trekken.

Rechtstreekse betalingen

Rechtstreekse vergoedingen, zoals in Zwitserland en de EU gekoppeld aan het naleven van milieu-en andere eisen op EU-en nationaal niveau naleving lijkt succesvol te zijn, in het bijzonder wanneer de betaling een aanzienlijk deel uitmaakt van het inkomen van de boer. De voorwaardelijkheid en controle zijn belangrijk voor de effectiviteit van dit instrument. In de VS bestaat een programma waarbij compensaties gekoppeld worden aan 10 jaar uit rotatie nemen van land. Volgens de regering, is dit een van de meest succesvolle programma's in de VS.

Subsidies voor Biogas - mestbeleid

In de VS, Denemarken en Duitsland zijn er programma's zijn om biogas te produceren. Hoewel de initiële opzet was om boeren financieel te ondersteunen bij de opzet van hun eigen installatie, bleek het moeilijk voor boeren om de investeringen te doen. Als gevolg daarvan werd in Denemarken aan derden toegelaten biogasinstallaties te bouwen waar boeren hun mest naartoe kunnen brengen. In de VS werden landbouwers gestimuleerd om samen te werken, zodat er meerdere boeren hun mest te brengen aan de boer met de installatie.

Emissiehandelsregelingen / compensatieprogramma's

Landen met een grote agrarische sector ontwikkelen beleidsinstrumenten in de richting van Emission Trading Schemes (ETS), waaronder Nieuw-Zeeland, Australië, Canada, Ierland en ook Japan. Nieuw-Zeeland en Japan zijn de meest geavanceerde. In Nieuw-Zeeland zal de landbouwsector deel uit maken van het ETS vanaf 2015. Omdat ETS een marktinstrument is, zal de markt bepalen wat de beste optie voor emissiebeperking zal zijn. De impact van dit instrument op de totale emissies is onzeker. De markt kan ervoor kiezen om te betalen voor de extra kosten die verband houden met de NCGG uitstoot - vooral wanneer er geen 'makkelijk' en kosteneffectieve mitigatieopties beschikbaar zijn voor de boeren.

Het Japanse Verified Emission Reduction Scheme omvat een landbouw-mitigatiemaatregel met name, laag-eiwit voeders voor varkens. Het is te vroeg om het effect van het compensatieprogramma te beoordelen. Ook Canada en Ierland werken aan een binnenlandse compensatieprogramma. Andere respondenten waren ervan overtuigd dat het te vroeg was om marktgebaseerde instrumenten in te voeren - monitoring en verificatie van emissies op bedrijfsniveau zouden te onzeker, complex en duur zijn op dit moment om in de nabije toekomst een succesvolle beleids optie te zijn.

Het Gemeenschappelijk Landbouwbeleid (GLB) van de Europese Unie

Landbouw is één van de belangrijkste domeinen van de Europese samenwerking sinds de oprichting van de Europese Gemeenschap en is verantwoordelijk voor bijna de helft van de uitgaven in de Europese Unie, en treft 15 miljoen boeren. Dit houdt in dat een gemeenschappelijk landbouwbeleid (GLB) op EU-niveau een krachtig hulpmiddel kan zijn om de uitstoot van NCGG in de landbouw te verminderen.

Momenteel zijn compensaties niet gekoppeld aan uitstootbeperkende maatregelen. In de context van de komende GLB hervorming wordt overwogen om deze maatregelen te ondersteunen, hetzij onder een 'groener' pijler een (productieondersteuning) of een uitgebreide tweede pijler (plattelandontwikkeling). In beide gevallen is het belangrijkste punt de conditionaliteit zodat dit resulteert in veranderingen in gedrag bij de boeren en opvolging van de maatregelen. Het koppelen van het GLB aan mitigatiemaatregelen kunnen helpen om verschillen tussen de lidstaten te voorkomen.

Onderzoek

Er wordt zeer veel onderzoek gedaan rond de uitstoot van broeikasgassen, mitigerende maatregelen en de berekening van de emissies. Meer onderzoek is nodig om de resultaten te verfijnen en te komen tot effectieve oplossingen. Naast technische oplossingen, is er nood aan praktische en kosteneffectieve opties voor de vermindering van broeikasgassen op het bedrijfsniveau.

Algemene aanbevelingen:

Gerelateerd aan Beleidsontwikkeling

- Slechts weinig landen hebben een specifiek beleid om niet-koolstof broeikasgassen terug te dringen uit de landbouw met vooropgestelde doelen. De

meeste landen - met name in Europa - richten hun aandacht op maatregelen met meerdere milieueffecten van de landbouw (water, biodiversiteit, bodem, ...) en / of energie, die positieve effecten hebben op de uitstoot NCGG leveren zonder specifieke doelen. Een aanpak die specifiek, meetbaar, acceptabel, realistisch en tijdgebonden doelstellingen heeft kan de (kosten-) efficiëntie op dit gebied verhogen.

- Veel landen in deze studie verkennen een resem van landbouwbeleidsinstrumenten om de uitstoot te verminderen. In veel gevallen weerspiegelt de mix van beleidsmaatregelen de landbouwsector. Verdere reflectie over de huidige situatie en de verkenning van innovatieve benaderingen marktpenetratie en stimulansen voor boeren kan vooruitgang brengen op dit gebied.
- Klimaatverandering is een globaal probleem dat internationale samenwerking vereist. Daarom bieden internationale beleid en de beleidskaders zoals het Gemeenschappelijk Landbouwbeleid kansen als kader voor nationale maatregelen.
- De vermindering van de uitstoot van methaan door de productie van duurzame energie biedt kansen.
- Subsidies kunnen goede instrumenten zijn in een eerste fase van de invoering van nieuwe praktijken en technologieën. Naarmate er meer boeren betrokken zijn, zijn subsidies niet langer het meest kostenefficiënt beleid. Andere instrumenten, zoals convenanten, Emission Trading Systems of een groter kader, zoals het Gemeenschappelijk Landbouwbeleid, kunnen kansen bieden op de langere termijn. Op korte termijn is er behoefte om de kosten en de effecten van emissie reducties van de huidige subsidiebeleid te beoordelen.
- Landen waarvan een groot aandeel van de broeikasgassen uit de landbouw komt (Nieuw-Zeeland, Australië, ...) werken aan handel in emissierechten en fiscale systemen. Tegelijkertijd is het duidelijk dat op marktinstrumenten, zoals emissiehandel of belastingen een meer internationale aanpak nodig hebben, omdat ze anders kunnen interfereren met handel tussen de landen.

Monitoring, Rapportage en Verificatie

- De meeste landen worstelen met monitoring, rapportage en verificatie van broeikasgasemissie in de landbouw. Het is de sleutel om de effectiviteit van beleidsmaatregelen op te volgen. Verschillende landen zijn bezig met de ontwikkeling van de rekentools. Het delen van ervaringen kan helpen om een internationale solide methode te ontwikkelen.
- Modelering van alle bio-processen kan tijdrovend zijn. De ontwikkeling van *praktische* NCGG meetinstrumenten die gebruikt kunnen worden op boerderij-niveau zijn meer kosten-effectief is. Het verzamelen van informatie over relevante landbouwmethoden in samenwerking met National Farm Surveys biedt hier een window of opportunity.

Landbouwers

- Mitigatieacties zullen moeten worden uitgevoerd en ondersteund door de meeste - zo niet alle boeren om een impact te hebben. Dit wil zeggen door een groot aantal grote maar ook zeer kleine bedrijven. Boeren nemen nieuwe technieken makkelijker over wanneer er een business case aan. Maatregelen die winstgevendheid zijn en die emissies reduceren hebben de meeste kans om opgeschaald te worden door in te spelen op het zakelijk instinct van boeren.

- Diverse landen hebben demonstratie- en proefprojecten op bedrijfsniveau. Uitwisseling van ervaringen over de landsgrenzen heen kan versnellen de opname van nieuwe benaderingen en technologieën door boeren.

Over onderzoek

- Er zijn nog veel onzekerheden over methaan- en lachgasemissies in de landbouw. Emissies van landbouwactiviteiten zijn divers, diffuus en zeer complex. Verder onderzoek en innovatie zijn nodig om beter microbiologische en natuurlijke bodemprocessen te begrijpen. Het is belangrijk de bevindingen en conclusies uit het onderzoek te valideren op bedrijfsniveau.
- Er is ook behoefte aan meer toegepast onderzoek dat rekening houdt met landbouwbedrijfskundige aspecten om te komen tot kostenneutrale of zelfs winstgevendende maatregelen die leiden tot emissiereducties.
- Diverse landen hebben onderzoek- en ontwikkelingsprogramma's die eindigen in 2011. De resultaten van dit onderzoek kunnen nuttig zijn bij internationale rondetafelconferenties zoals NCGG en GRA.
- Er is behoefte aan internationale initiatieven en platforms op het snijvlak van onderzoek, beleidsontwikkeling en uitvoering op bedrijfsniveau. Uitbreiding van de GRA en andere netwerken rond Onderzoek en Ontwikkeling, naar beleid en de bedrijfsnetwerken bieden een kosteneffectieve oplossing voor klimaat-landbouw kansen.

Over deze studie

- Hoewel dit onderzoek een quick scan is, eindigde het als een lijvige studie over nationale, EU en andere internationale initiatieven rond NCGG beleid. Ondanks de tijd en moeite die in dit onderzoek kroop, blijft het een quick scan: vele aspecten bleven voor de toekomst diepgaand onderzoek en beleid faciliteren naar de toepassing van O & O-resultaten door experts in hun vakgebied.
- Uit deze studie blijkt dat er veel gaande is op hetzelfde moment in veel verschillende landen dat een betere coördinatie en een bredere uitwisseling van informatie over resultaten en praktische ervaring de wereldgemeenschap ten goede zou komen. Het zou tegelijkertijd meer tijd-en kosten-effectief zijn.
- Internationale bijeenkomsten (zoals de komende NCGG-6 en GRA sessies) bieden een platform voor deze uitwisseling. Het is aanbevolen dat deze bijeenkomsten niet alleen gebruikt voor de uitwisseling van wetenschappelijke informatie, maar ook van ervaring over de uitvoering van beleid en maatregelen.

1. GENERAL INTRODUCTION

1.1 OBJECTIVE OF THE STUDY

Environmental Resources Management – ERM was commissioned by Agentschap NL (NL Agency) to provide an international overview of Agriculture-climate change policy instruments for reduction of methane and nitrous oxide emissions aimed at clarifying how national and/or international Agriculture-climate-policies could or should be instrumented in coming three to five years for achievement of significant emission reductions of methane and nitrous oxide in Dutch agricultural sectors before 2020.

Agriculture is an important source of two powerful greenhouse gases: nitrous oxide (N₂O) and methane (CH₄):

- N₂O is released to the atmosphere mainly due to the microbial transformation of nitrogen fertilisers in soils; the generation of N₂O represents over half the total emissions from agriculture;
- CH₄ emissions come mainly from intestinal fermentation by ruminant animals (enteric fermentation);
- Both N₂O and CH₄ emissions are produced from manure storage – decomposition of stored manure in oxygen deprived conditions – and spreading on farmland.

Methane and nitrous oxide's effect on the climate is, respectively, 21 and 310 times that of carbon dioxide (CO₂). The discharge of even relatively small amounts of nitrous oxide therefore has a major environmental impact.

At European level there is increasing interest in understanding and reducing greenhouse gases by agriculture. Various countries have taken initiatives to reduce nitrous oxide and methane in the agricultural sector. Nevertheless roadmaps from policy development to implementation to reduce non CO₂ Greenhouse Gas (NCGG) are partly or entirely lacking in many countries.

The objective of this survey is to provide clarity on how national and international agricultural and climate change policies can be instrumented in the next three to five years to achieve a significant reduction in emissions of methane and nitrous oxide in the Dutch agricultural sector in 2020.

Sub-objectives are:

- Identification of climate change policy instruments and determination of why these are effective (or not) to reduce non CO₂ greenhouse gas emissions in the agricultural sector (focusing on the many and diffuse emission sources such as agriculture);
- Investigation to which extent the policy context is taken into account in ongoing and recently completed animal feed research and / or other initiatives to reduce methane emissions from enteric fermentation;
- Identification of needs and wishes of representatives of the agricultural climate change policy to guide policy-relevant results from amongst others feed research to reduce methane emissions resulting from enteric fermentation ;

- Illustration or quantification of contextual elements that may or may not be part of agricultural research and/or other initiatives, for example in the feed research to reduce methane emissions due to enteric fermentation.

This report describes and analyses policy instruments and mitigation measures, the implementation context, monitoring issues and results.

This study will also feed into the NCGG-6 conference in Amsterdam, 2-4 November 2011 (www.ncgg.info).

The following sections 1.2. and 1.3 describe the different type of policy instruments and mitigation measures to reduce NCGG that are covered in this study.

1.2 *MITIGATION MEASURES TO REDUCE METHANE AND NITROUS OXIDE FROM FARMING ACTIVITIES*

Policy instruments are a range of intervention methods that can be used by governments to achieve a desired effect, in this case the reduction of non-carbon greenhouse gas emissions from the agricultural sector (through encouraged, facilitated and/or enforced implementation of technical mitigation measures or other projects with NCGG climate effect).

Mitigation measures can be grouped into:

- Stock management: measures to reduce greenhouse gas emissions from livestock.
- Feed management: measures to reduce greenhouse gas emissions from animal feed production.
- Manure management: measures to reduce the reduction of emissions during storage and processing of manure
- Fertilizer Use: measure to reduce emissions from application and use of manure and fertilizer.
- Soil management: measures that affect greenhouse gas emissions from the soil.
- Crop management: measures aiming at an optimal crop production (quantity/quality) with the highest resources efficiency and lowest GHG emissions (per kg product).

1.3 *POLICY INSTRUMENTS TO REDUCE NON-CARBON GREENHOUSE GAS EMISSIONS*

Policy instruments are a range of methods which can be used by governments to achieve a desired effect, in this case the reduction of non-carbon greenhouse gases from the agricultural sector (through the implementation of technical mitigation measures or others).

Policy instruments can be categorized into the following broad groups¹:

- Regulatory instruments (legal enforcement and restrictions): require changes in behaviour by introducing penalties for parties who don't comply with the regulatory provisions. Types of regulatory instruments include technical standards, compulsory permits, limits on emissions, licensing, mandatory management plans and covenants.
- Economic (market-based) instruments: policy tools that encourage behavioural change through positive financial incentives rather than through explicit directives. Instruments include trading schemes, offset schemes, subsidies, grants, tax exemptions, accreditation systems, stewardship payments, taxes. The key feature of these measures is that the authorities are involved at one end of the financial transaction. Through another type of economic instrument, the authorities can also set favourable frameworks for financial transactions within the private sector. Such instruments include emissions trading schemes.
- Informative/social instruments: policy tools that encourage voluntary changes in behaviour through the provision of information and organisation of communication or discourse management, such as via general education programs, guidelines and codes of practice, training programs, extension services, research and development and covenants or public-private partnerships.

¹

<http://www.marketbasedinstruments.gov.au/WhatisanMBI/ManagingnaturalassetsusingMBIs/Menuofpolicyinstruments/tabid/118/Default.aspx>

2. SCOPE AND APPROACH

In this chapter the approach to the study is explained. First, ERM identified the potentially most interesting countries with respect to policies and measures to reduce non-carbon GHG in agriculture. In a second step, ERM collected information both from written sources as well as from interviews with policy-makers from agricultural, environmental and/or climate related ministries and researchers in the field of agricultural N₂O and CH₄ emission reduction in the selected countries.

2.1 COUNTRY SELECTION

ERM made an inventory of Annex 1 countries and their status under the Kyoto Protocol (Annex B). All Annex 1 parties were discussed. This section lists and explains the criteria for the country selection.

2.1.1 CRITERIA FOR COUNTRY SELECTION

Based on the discussion with Agentschap NL and on prior ERM experience with country selection and NCGG policy, ERM used the following criteria for its country selection process:

Criterion 1 : Annex 1 UNFCCC / Annex B Kyoto Protocol

In order to be selected, a country needs to be a party to the UNFCCC, listed in Annex 1 of the convention. These parties are developed countries (including former economies in transition) with targets to curb GHG emissions. Their commitments are made explicit in Annex B of the Kyoto Protocol, which basically has the same list of parties. ERM did not use the status of ratification of the Kyoto Protocol as a basis for selection, because ERM felt that such an issue was not decisive on the development and implementation of policies and measures (as the case of USA and Australia clearly states). ERM did not include Turkey, because despite its Annex 1 status, Turkey did not sign or ratify UNFCCC, and subsequently did not obtain emission limitations under the Kyoto Protocol.

Criterion 2 and 3 : Percentage of methane and nitrous oxide compared to overall GHG emissions in base year 1990

ERM calculated the percentage of methane and nitrous oxide in overall GHG emissions from the national emission values reported on the UNFCCC website. ERM used 1990 figures (or other base year, if appropriate). It is an indicator of the importance of methane and nitrous oxide in meeting Kyoto commitments. A higher percentage indicates a country's likeliness to develop NCGG policies and measures.

Criterion 4 : Change of methane and nitrous oxide emissions from 1990 to 2008

This fourth criterion refers to the actual change of NCGG emissions, achieved in a country by 2008 as compared to 1990. This indicator also points in the direction of active national policy to reduce NCGG-emissions. A '-' before a figure indicates a

reduction of NCGG emissions. The data were taken from official UNFCCC databases.

Criterion 5 : International survey on potentially interesting approaches

Using its Global Climate Change Network, ERM was supplied with information on policies and measures to reduce methane and nitrous oxide emissions. Additional sources, like NCGG-4 and 5 papers and posters, country communications to UNFCCC, and climate change websites, enhanced our understanding of national activities on NCGG. Based on this information ERM assessed the potential of countries with innovative approaches towards policy development. ERM used a rating 'high' for definitely interesting, 'medium' for possibly interesting and 'low' for no indication of interest in terms of survey's purposes. ERM understands the relative arbitrary nature of this rating, but in line with the quick scan nature of this study, it is seen as an acceptable, albeit rough method of prioritization.

The results of the application of the five criteria in selecting a shortlist of countries for further analysis are summarized in Table 1. The first column lists all countries. Five criteria are rated in the next five columns.

Amount of Non-Carbon Greenhouse Gas Emissions:

- For criterion 1: 20% or higher methane in total GHG in 1990;
- For criterion 2: 15% or higher nitrous oxide in total GHG in 1990;

Reduction of Non-Carbon Greenhouse Gas Emissions:

- For criterion 3: Above 30% reduction of methane 1990 - 2008;
- For criterion 4: Above 30% reduction of nitrous oxide 1990 - 2008;

Expert knowledge:

- For criterion 5: Rating 'High'

The figures for criteria 1 and 2 are based on official 2008 figures submitted to the UNFCCC Secretariat in national communications, including LULUCF, net emissions as well as removals, noted in Tg-CO₂ equivalents. The final column concludes with a positive (in) or negative (out) conclusion on the inclusion in the country selection for the next phase of the survey.

Firstly, we included every country with a rating 'High' for criterion 5. Secondly, we included every country that scores on both criteria 1 and 3 or both criteria 2 and 4.

Table 1 : Country Selection Overview

Country	Criterion 1 % CH ₄ /total GHG in 1990	Criterion 2 % N ₂ O/total GHG in 1990	Criterion 3 % CH ₄ Reduction 1990-2008	Criterion 4 % N ₂ O Reduction in 1990-2008	Criterion 5 Potentially interesting ¹	Summary
Australia	26%	12%	-1.5	35.5	High	In
Austria	13%	10%	-31.2	-9.5	Low	Out
Belarus	14%	17%	-4.2	-24.7	Low	Out
Belgium	7%	6%	-35.0	-30.5	Low	Out
Bulgaria	17%	15%	-31.4	-61.8	Low	Out
Canada	14%	6%	32.3	4.5	High	In
Croatia	15%	14%	-1.9	-11.8	Low	Out
Czech Republic	10%	18%	-37.0	-36.7	Low	Out
Denmark	8%	7%	1.0	-35.9	High	In
Estonia	8%	10%	-40.9	-43.3	Low	Out
Finland	12%	15%	-31.0	-8.3	Low	Out
France	13%	12%	-16.1	-29.8	High	In
Germany	9%	16%	-53.8	-24.8	High	In
Greece	10%	8%	-10.0	-30.4	Low	Out
Hungary	11%	3%	-28.5	-56.7	Low	Out
Iceland	8%	49%	7.7	3.1	High	In
Ireland	25%	6%	-10.4	-18.1	High	Out
Italy	9%	21%	-13.6	-21.1	Low	Out
Japan	3%	4%	-33.2	-28.8	High	In
Latvia	47%	2%	-46.6	-57.3	Low	In
Liechtenstein	6%	9%	11.6	-0.7	Low	Out
Lithuania	19%	32%	-46.1	-21.3	Low	Out
Luxembourg	3%	12%	-3.8	-1.9	Low	Out
Monaco	0,60%	8%	-9.7	80.3	Low	Out
Netherlands	12%	9%	-33.2	-41.9	High	In
New Zealand	86%	13%	1.5	21.8	High	In
Norway	12%	7%	-7.2	-20.1	Low	Out
Poland	10%	9%	-26.1	-23.3	Low	Out
Portugal	16%	11%	23.7	-10.9	Low	Out

¹ Based on expert knowledge

Romania	19%	11%	-44.6	-50.0	Low	Out
Russian Federation	17%	21%	-15.1	-50.8	Low	Out
Slovakia	7%	7%	-1.6	-35.6	Low	Out
Slovenia	19%	8%	-8.5	-16.8	Low	Out
Spain	11%	7%	36.3	-7.2	Low	Out
Sweden	16%	8%	-24.2	-15.3	Low	Out
Switzerland	9%	6%	-17.1	-7.7	High	In
Turkey	24%	6,2%	62.1	0.0	Low	Out
Ukraine	18%	12%	-52.4	-50.5	Low	Out
UK and Northern Ireland	13%	10%	-53.2	-47.9	High	In
United States of America	12%	17%	-7.5	-1.3	High	In
European Union	11%	6%	-31.0	-29.8	High	In

2.1.2

SELECTION OF COUNTRIES

The application of criteria results in the selection of the following countries:

- Australia;
- Canada;
- Denmark;
- Germany;
- France¹;
- Iceland;
- Ireland;
- Japan;
- Netherlands;
- New-Zealand;
- United Kingdom;
- United States of America; and
- Switzerland.

Additionally the policies and measures within the European Union are listed.

2.2

DATA AND INFORMATION COLLECTION OF SELECTED COUNTRIES

In the second phase of the survey, ERM identified phone and mail contacts, and conducted interviews or received e-mails within the national government² and focal point researchers (See Annex 1).

Questions that were raised in the survey include:

1. Overview of existing measures affecting in NCGG reduction
2. What (other) NCGG affecting policy measures are in the pipeline?
3. Selection of (potentially) successful policy instruments
4. Description of each selected policy instruments
 - a. General objective and expected abatement potential
 - b. (Planned) year of introduction
 - c. Implementation time frame
 - d. Which type of policy (regulation, guideline, financial incentives, taxes, ...)
 - e. Stage of development of the measure (basic research level, proof of function/concept, product development/on- farm testing and technology transfer/implementation)
 - f. What type of research has been done and by which organisation?
 - g. Which organisation is involved in communication and implementation?

¹ France is not further described in this report as they did not respond within the time boundaries of this projects.

² Environmental and/or Agricultural department

6. Effectiveness and cost efficiency of selected policy instruments:

- a. Results of the measure –effective progress made in implementation and reduction of NCGG
- b. What were the government expenditures for each stage of development?
- c. Has the measure been accepted as financial viable for the farmers (costs and benefits per ton reduction)?
- d. What incentives are in place to motivate the farmers?
- e. What are the trade-offs/implications of the policy measure in terms of biodiversity, agriculture...?
- f. What information is still required for evaluation?

7. References

The information obtained from the interviews was further completed through a scan of national communications to the UNFCCC, policy documents, other open sources of country specific information to reduce non carbon greenhouse gas emissions in the selected countries and the European Union.

It should be stressed that this study does not claim to be a complete overview of all policy instruments to reduce non-carbon greenhouse gases from the agricultural sector. Within the limited resources of the project, we focused on the information highlighted by the focal points and relevant to the main purpose of the study, i.e. policies that reduce non-carbon greenhouse gas emission from the agricultural sector, their implementation and lessons learned.

3. **POLICY INSTRUMENTS: IMPLEMENTATION CONTEXT, EFFECTIVITY AND COSTEFFICIENCY TO REDUCE NCGG**

This chapter contains per selected country descriptions of policy instruments, the scope of the instruments, their implementation and current status. Annex 2 gives an overview of the policy instruments in this chapter.

3.1 **EUROPEAN UNION**

3.1.1 **COMMON AGRICULTURAL POLICY (CAP)**

Introduction

In the EU the production of gases from agricultural sources is limited, and decreasing. Currently, about 9 % of total EU greenhouse gas emissions come from agriculture (down from 11 % in 1990).

Agricultural emissions in the 27 EU countries actually decreased by 20 % between 1990 and 2008 [most recent figures] mainly as a result of the significant decline in livestock numbers, more efficient application of fertilizers and better manure management. This is above the average 11 % reduction in emissions in all EU sectors¹.

DG Climate Action works with DG Agriculture and Rural Development to further reduce emissions and to mainstream climate change into the Common Agricultural Policy² (CAP) which will be undergo a major reform for the period after 2013. A number of steps have already been taken to integrate climate change concerns into the CAP.

Scope of the policy instrument

The CAP is structured around two complementary pillars, with annual direct payments and market measures making up the first pillar and multi-annual rural development measures the second pillar.

¹ Note that here are no specific emission reduction targets for agriculture or its major gas emissions, methane and nitrous oxide in the EU. Agriculture is included in effort-sharing decision. Every member state has emission reduction targets but this entails the entire economy (for 2014-2020), and does not specify agriculture. EU leaves Member States the flexibility to deal with agriculture (no targets) in the most cost-efficient way. For example in Ireland where agriculture is a large contributor to the economy and GHG emissions, it will be hard not to deal with agricultural emissions, but there is no obligation.

² EC. 2010. The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future. Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions. 18-11-2010.

Implementation of the instrument

PILLAR 1:

The shift of the financial support to farmers towards direct aids decoupled from production (i. e. not linked to quantities produced) has had the effect of reducing incentives to intensive production and hence less production.

‘Cross compliance’ links direct payments to farmers to their respect of environmental¹ and other requirements set at EU level (for example the Nitrate Directive). In addition beneficiaries of direct cross compliance payments must maintain agricultural land in good agricultural and environmental condition above the legal standards. Cross-compliance has proven useful to reduce Non Carbon Greenhouse gas emissions.

PILLAR 2:

Other opportunities to reduce Non Carbon Greenhouse Gases fall under the Rural Development Policy part. Under this pillar member states take the initiative to submit a rural development plan that has to be approved at EU level and that can include mitigation measures (f.e. biogas installations)

There is also a range of rural development measures that can contribute to mitigation. By offering compensation for the extra costs incurred by farmers who voluntarily contribute to the protection of environment, agri-environmental schemes have significant potential to stimulate adoption of measures to curb emissions.

The Commission encourages Member States to include measures to tackle GHG emissions when designing and implementing their rural development programmes, as climate change is one of the key priority areas defined in the EU’s strategic guidelines for rural development policy.

Further developments

Although payments are not currently linked to measures which would reduce GHG emissions, scope for such linkage is being considered in the context of the next CAP reform either under a ‘greener’ pillar 1 or an expanded pillar 1. The following has been proposed by the European Commission for the period after 2014;

- Pillar 1: mandatory “greening” component of direct payments by supporting environmental measures. Priority should be given to actions addressing both climate and environment policy goals. These could take the form of simple, generalised, non-contractual and annual environmental actions that go beyond cross-compliance and are linked to agriculture (e.g. permanent pasture, green cover, crop rotation).

¹ Such as the Nitrate Directive, Water Framework Directive.

- Pillar 2: It is expected that member states will have to justify in more detail how the proposed Rural Development measures will help them to reach EC objectives such as climate change.

In both cases the key point is whether conditionality is sufficiently tight so that changes in behaviour and the follow up of measures are encouraged.

Although it is being mentioned in discussions, Emission Trading System – or any other market-based instrument are not considered suitable instruments for reducing GHG emissions in the EU agricultural sector. It will be difficult to monitor emissions of 15 million farmers in such a scheme. The current Emission Trading System is now targeting large businesses. There are already complications for smaller businesses to implement to be included in this.

3.1.2 RESEARCH

Two major research initiatives worth mentioning are PICCMAT and the EU joint programming initiative.

The European Commission has funded a research project called PICCMAT (Policy Incentives for Climate Change Mitigation Agricultural Techniques) with the objectives to identify the most cost-efficient (arable) farming practices that reduce GHG emissions (nitrous oxide) and to suggest policy instruments to support the necessary changes in land management.¹

Following policy recommendation resulted from PICCMAT :

- Policy measures for agricultural climate change mitigation need to be tailored to regional circumstances (see PICCMAT practices).
- Supporting climate change mitigation as part of a strategic and integrated approach to sustainable agriculture and protecting existing carbon stocks.
- EU Environmental Directives: Several policy instruments already exist at EU level that control the environmental impacts of agriculture and, usually as a side-effect, influence the emission of greenhouse gases (GHG) from agriculture such as the Habitats and the Nitrate Directives.
- Cross Compliance - Linking agricultural subsidies to environmental services through improving the implementation and enforcement of existing Good agricultural and environmental condition (GAEC) standards, strengthening the protection of permanent grassland, and including mitigation objective in future baseline standards.
- Strengthening Rural Development Policy through increased funding for rural development measures that support agricultural practices with multiple environmental benefits, including GHG mitigation, and a climate screening of rural development measures (in particular of agri-environment measures). Rural development funding can be used to increase knowledge and capacity for mitigation through agricultural techniques, and for awareness raising.

¹ <http://climatechangeintelligence.baastel.be/piccmat/>

- When implementing major CAP reforms, climate change mitigation needs to be a major consideration in designing the system for example a merge of the current cross compliance and rural development instruments can provide an opportunity to implement baseline measures and set more targeted incentives for more ambitious mitigation efforts.
- Economic Instruments can include exploring results-oriented approaches in pilot studies that reward farmers for achieving specific mitigation target. Also the possibility of using voluntary project-based trading of carbon offsets in an EU context should be explored. Besides, Member States might consider taxes on nitrogen as an instrument to be used in national integrated strategies.
- Mitigation can be supported through better information. This can include developing and promoting monitoring tools for farm sustainability, addressing consumption habits, promoting carbon labelling, promoting exchange of experience between Member States and developing measuring and accounting approaches for agricultural greenhouse gas emissions.

The second research initiative worth mentioning here is the EU Joint Programming Initiative (JPI) on Agriculture, Food Security and Climate Change¹. The overall aim of Joint Programming is to pool national research efforts in order to make better use of Europe's precious public R&D resources and to tackle common European challenges more effectively. This initiative involves twenty European countries. It brings together researchers, improve the effectiveness of national funding totalling over a billion euro annually, share existing research results and coordinate future work to avoid duplication and maximise value for money. It will follow a structured strategic process whereby Member States agree common visions and strategic research agendas to address major societal challenges. In addition, contacts with key international initiatives such as Global Research Alliance (see further) ensure coherence The EU contributed 2 million Euros.

3.2

DENMARK

Between 1990 to 2009 the emission of CH₄ from enteric fermentation has decreased 12 % due to the decrease in the number of cattle. However, in the same period the emission from manure management has increased 25.8 % due to a change in traditional stable systems towards an increase in slurry systems in stables. Altogether, the emission of CH₄ from the agriculture sector has decreased by 3.3 % from 1990 to 2009².

3.2.1

AGREEMENT FOR GREEN GROWTH (2009 AND 2010)

Introduction

The purpose of the agreement is to ensure that a high level of environmental, nature and climate protection goes hand in hand with modern and competitive agriculture and food industries. This is an ambitious and long-term plan defining environment and nature policies and the agriculture industry's growth conditions.

¹ http://ec.europa.eu/research/era/areas/programming/joint_programming_en.htm

² NERI. 2011. Denmark's National Inventory Report 2011.

Scope

The Agreement on Green Growth incorporates a strategy for a green agriculture and food industry subject to growth. A collective and focussed initiative will be implemented in order to create better framework conditions for a self-sustaining agriculture industry that will develop dependent on market conditions, will protect the environment and nature, and will deliver green energy.

Some objectives formulated in the Agreement on Green Growth (2009 and 2010) are:

- Less N-loss to the aquatic environment due to higher storage/usability of slurry and reduced use of synthetic fertiliser;
- Establishment of non-cultivated area (buffer strips) along water streams;
- An extension of the biogas production.

The decrease in both CH₄ - and N₂O emission from manure management is in particular due to the increasing amount of slurry used for biogas. The anticipated decrease until 2020 is also a consequence of a decrease in number of dairy cattle until 2013 and change in housing system with the phasing out of the deep litter systems.

Implementation

A total of DKK 13.5 billion¹ is to be invested in Green Growth until 2015, which is around 50% increase in investments compared to previous initiatives.

Concrete initiatives to reduce the discharge of nitrogen and phosphor to aquatic environments include dedicated measures such as permanent spraying-free, fertilizer-free and cultivation-free buffer zones and wetlands, as well as general regulation including neutralisation of nitrogen effect when agricultural land is taken out of production. This initiative will be implemented from 2012.

The role of the agricultural sector as a supplier of green energy is to be strengthened. At the moment 5% of slurry is treated for biogas. That needs to go up to 50% of slurry to be used for biogas before it is applied on the field. There is DKK 85 million annually available for establishment of new common biogas plants and farm unit-related investments associated with connection to a common plant from 2010 to 2012.

The treatment of slurry for biogas is voluntary and farmers receive a premium of 75DKK per m³. Up to 100 farmers can use 1 biogas installation (largest at the moment has 57 farmers). Under this scheme, a plant grant worth up to 20% of the investment can be provided. The remaining funds will be provided by a 60% municipal guaranteed loan and 20% own financing. Initially farmers invested in biogas plants, but because the economical crisis in 2008/2009, farmers are no longer able to invest themselves. Energy suppliers have taken over to invest in biogas plants. Amendments to the Planning Act oblige the municipalities to

¹ Around EUR 1,8 billion

include localisation of biogas plants in municipal planning and the allocation of grants for selling biogas to cogeneration plants and the natural gas net.

Other initiatives to promote the role of the agricultural sector as a supplier of green energy include:

- Planting of perennial energy crops (tax deductible).
- The distance requirements to watercourses and lakes stipulated in the Protection of Nature Act will be changed so that cultivation of perennial energy crops is possible within a protection zone.
- A grant scheme for planting perennial crops totalling DKK 32 million annually from 2010 to 2012. The scheme will be effective from the planting season 2010. The grant can be given to areas in normal operation, in which planting results in a large reduction of nitrogen, and at locations so that the reduction in the nitrogen burden can help to meet the Water Framework Directive.

Remarks

In 2012, the status of the development of the biogas plants will be assessed, including an evaluation of the need for any further initiatives to achieve greater energy exploitation of livestock manure. The grant scheme for perennial crops will be assessed in 2012.

Under the Agreement there was also an option to introduce a methane tax for cattle, but was chosen by the politicians not to be introduced (see also below).

The challenges with increasing biogas production will be the location of these installations. There is very little acceptance of biogas installations by the general public. Nobody wants such installation in their backyard.

3.2.2 RESEARCH

There is a large research agreement in place with the University of Aarhus. They look at diets that reduce methane emissions. So far the results cannot be used as the milk quality suffers from this diet. Another research area includes climate change friendly farming systems.

3.2.3 METHANE TAX

Introduction

The Danish tax commission proposed a methane tax in 2009. Denmark was discussing a levy as high as €80 per cow to offset the potential penalties they face from European Union legislation aimed at combating global warming (cut the farming sector emissions by 20 percent by 2020). The Danish Tax Commission, who proposed the tax, estimates that a cow will emit 4.0 tonnes of CO₂eq a year in burps and flatulence, compared with 2.7 tonnes of CO₂eq for an average car.

Implementation

The tax came into force on 1 January 2011, but methane from agriculture was excluded as it didn't pass the parliament.

Difficulties

The cow tax was not implemented. The proposed system would raise funds to buy allowances from other member states or to invest in technology that might reduce emissions. The proposed levies were opposed vigorously by farming groups. Beef and dairy farmers estimated that the methane tax would increase the operating costs of Denmark's agriculture industry by 2.7 billion DKK annually. Denmark's political parties were lining up on both sides of the issue, with the Danish People's Party and the government's Liberal Party both fearing the tax will increase prices of domestic produce. Moreover, cattle production would move to other countries where no taxes are imposed.

3.3 GERMANY

3.3.1 BIOGAS

Introduction

German agriculture is a significant source of greenhouse gas emissions. The most important sources of German agriculture's greenhouse gas emissions are the enteric fermentation in the digestive tracts of ruminants, animal manure and synthetic nitrogen fertilizer. The reduction of GHG emissions in German agriculture is due primarily to two reasons. One has been the process of reform in the Common Agricultural Policy of the European Union which began in the early 1990s. In the course of these reforms, agricultural markets became more liberal and more emphasis was placed on environmental issues. Both have resulted in reduced input use and lower production. The other has been the process of transformation in East German agriculture after unification which has resulted in a reduction in the number of beef cattle (both for dairy and for meat production) and in fertilizer input.¹

The Federal Government's effort to combat climate change in the agricultural sector is centred on the promotion of biogas installations.²

Scope of the policy instrument

The share of biogas in German electricity is 2,6%³. On 18% of the cultivated area green crops were cultivated. This includes plants for industrial usage and energy crops for biogas and ethanol. The land area for energy crop cultivation for biogas installations grew fastest in 2010, from 530.000ha to 650.000ha. The resulting biogas in Germany is almost always used for heat and power generation. The heat produced with power generation, is used for heating buildings and stables.

¹ WWF.2007. Reduction of Greenhouse Gases Methane (CH₄) and Laughing Gas (N₂O) in German Agriculture:A Framework for Political Action Summary.

² Jesko Hirschfeld, Julika Weiß, Marcin Preidl, Thomas Korbun. 2009. The Impact of German Agriculture on the Climate.

³ 3% in 2011 is expected.

Implementation of the instrument

Promotion of biogas has been regulated in the Erneuerbare Energien Gesetz (EEG, August 2004) and Biomasseverordnung (June 2001). In the EC, fees for the next 20 years are settled for power generation from biomass.

Besides the fixed EEG fee depending on the capacity of the installation also allowances are paid: Nawaro bonus, 7 or 4 cents / kWh (for green resources), Gülle 4 or 1 bonus cents / kWh (for manure), Bonus Technology (2 cents / kWh), Landschaftspflegebonus (2 cents / kWh). The Nawaro and Güllebonus are linked. Through a combination of fixed fee and optimal use of allowances a fee of 30 cents / kWh is possible.

Early 2011, the Federal Government announced to renew the EEG on 1 January 2012. It is expected that by 2012 the EEG-compensation schemes Biogas will be adjusted. This adjustment will be acted upon. There are several opinions and positions on what the adjustments should look like.

Other grant programmes to prompt bio energy are a.o. GAK Rahmenplan 2009-2012, KfW-Programm erneuerbare Energien, Umwelt Innovation Program, Förderprogramm zur Optimierung der Biomassanutzung energetic, EEWärmeG, Energie vom Land programma Rentenbank. There are also various laws / regulations for building and managing installations.

Results to date (including proposed new actions)

Because of the subsidies for bio energy German farmers invest more and more in biogas installations. The trends is to build smaller installations (average of 430 kW/Installation) to receive the maximum amount of subsidies and allowances, in particular de Gülle- and Nawarobonus. The biogas installations that also ferment manure need also corn and grain to produce enough energy. Because of this more and more energy corn is cultivated, including mono-cultures which have a negative impact on biodiversity. In particular in regions with a lot of cattle, land prices increase because of the demand for land to cultivate energy corn¹.

3.3.2

INTERNATIONAL RESEARCH

The governments of Norway and Germany have committed a combined total of \$5 million in support of an FAO programme to improve global information on greenhouse gas emissions from agriculture and more accurately assess farming's potential to mitigate global warming.

The improved data acquired by FAO's Mitigation of Climate Change in Agriculture (MICCA) programme will be made available via an online global knowledge base that will not only profile greenhouse gas (GHG) emissions from agriculture, but will also identify best opportunities for mitigating global warming through improved farming practices (FAO Media Center, 15/02/2011).

¹ Netherlands Embassy in Berlin, department LNV, April 2011

3.4 IRELAND

In Ireland there is no specific legislation for the agriculture sector about NCGG reduction. There is only an international legislation (EU 22 projections to 20%), but this is general and not specific to the agriculture sector.

3.4.1 DOMESTIC OFFSETTING

As a member of the EU, Ireland has implemented the EU ETS Trading scheme. The activities included in the National Allocation Plan for 2008-2012 are all fossil fuel power generation facilities and large industrial energy users such as cement manufacture, paper and pulp manufacture and food processing. Agricultural activities are not included in the scheme.

Under EU 2020 Targets for non-ETS sector emissions, Ireland is required to deliver a 20% reduction in non-ETS greenhouse gas emissions by 2020 (relative to 2005 levels) and keep emissions below annual limits over the period 2013-2020. These non-ETS emissions come from agriculture, transport, residential and waste activities, and exclude main industrial activities which are covered under the EU Emissions Trading Scheme. Projections indicate that Ireland will breach its annual limit by 2016, in the best case scenario, and exceed its EU 2020 target by between 4.1 and 8.8 million tonnes of CO₂eq in 2020.¹

The Irish Environmental Protection Agency (EPA) has carried out a scoping study “Domestic Offsetting Scoping Study for Ireland” to review possibilities and options for introducing a domestic offsetting scheme as an approach to incentivising emissions in the non-ETS sector – including agriculture. This study will be published during 2011.²

3.4.2 RURAL ENVIRONMENT PROTECTION SCHEME - REPS³

Introduction

The Rural Environment Protection Scheme (REPS) and its replacement scheme Agricultural Environment Options Scheme (Under Regulation 1698 of 2005) is designed to reward farmers for carrying out farming activities in an environmentally friendly manner and to enhance environmental improvement of existing farms. It is administered by the Department of Agriculture, Fisheries and Food (DAFF).

¹ <http://enviroireland.com/?tag=eu-2020-targets>

² Remark: monitoring, reporting and verification will be difficult for 130,000 farmers: this is not just a problem in Ireland but is common to agriculture globally. Development and implementation of farm level measures (other than overall efficiency) will be difficult, measurement is hard. This is especially so in an already very efficient systems, where any improvement will be quite small on an annual basis.

³ <http://www.teagasc.ie>

The REPS is a general environmental protection scheme covering a range of environmental parameters: biodiversity, landscape features, heritage aspects, improved fertiliser use efficiency, etc. The latter was achieved through a nutrient management planning requirement under REPS. neither scheme has targeted a specifically quantified reduction in GHG emissions, compared to a baseline, which could be verified through the inventory process.

Scope of the REPS

The scope of the Rural Environment Protection Scheme is:

- Establish farming practices and production methods which reflect the increasing concern for conservation, landscape protection and wider environmental problems;
- Protect wildlife habitats and endangered species of flora and fauna; and
- Produce quality food in an extensive and environmentally friendly manner.

Implementation

The REPS system operates on a five year basis. Farmers' obligations under REPS are confined to the time period covered by the scheme. The total amount paid out to farmers under REPS in the first five years of its existence (REPS 1) was £626,588,463. The total uptake was 44,769 farms. This represented an average payment per farm of £13,996.

Under REPS, an agricultural advisor draws up an environmental plan for each individual farmer. This plan is a legal contract. Failure to carry out the required tasks laid out in the plan results in a reduction in the value of the subsidy paid to the farmer.¹

Results to date

The impact of REPS on NCGG reduction has not been quantified and is considered to be limited. There is a lack of interest in the general, voluntary based procedures by large scale producers.

3.4.3

RESEARCH

Scope of the research programme

There are generally 3 aspects to the research approach:

Research to identify mitigation strategies, which can be subdivided as follows

- Identification of new technologies – e.g. work on feeding strategies, nitrification inhibitors, etc;
- Methodologies to improve quantification including the impact of mitigation strategies: this includes work to improve the inventory but also Life Cycle Analysis research to develop models to validate the actual impact on emissions of various mitigation strategies.

¹

http://vmserver14.nuigalway.ie/xmlui/bitstream/handle/10379/1283/paper_0060.pdf?sequence=1

Research to improve the efficiency of production systems including the following approaches

- Breeding programmes;
- Improving animal health e.g. herd fertility;
- Improving grassland management systems: e.g. improving utilization of forage and improving the efficiency of fertiliser inputs;
- Improving efficiency of use of stored manure – aiming to reduce artificial fertiliser inputs.

Improving inventory data: this includes measurements carried out under the above-mentioned aspects and includes further investigation on changes in nitrous oxide emissions, soil carbon and methane emissions.

Implementation of the research programme

Research programmes carried out are:

- “Projects funded under the Department of Agriculture’s Research Stimulus Fund (RSF)¹”. These projects are mainly related to mitigation of methane and nitrous oxide but also include measurements of emissions for use in inventory improvement. The projects in the 2007 and 2006 calls are ongoing while the projects from the 2005 call are nearing completion. Several papers have been published by researchers involved in all three calls.
- “Ireland Climate Change Adaptation” research projects funded by EPA. They aim to collect information on impacts at national level (temperature, river basin impacts, phenology, etc) and to develop adaptation requirements. While these projects are not focussed on agriculture they develop the basic information required by models in the agriculture sector to define future adaptation requirements. Because of the close link between adaptation and mitigation this work is crucial to long term efforts to reduce non GHG emissions from the sector.
- Improving forage quality for beef cattle: With the research programme for improving the forage quality for beef cattle, Ireland wants to reduce methane emissions for beef cattle over a short period of time. The research programme started in 2008 and will be completed in 2011.
- Lipid implementation (soya oil): the goal of this research programme is to find a way to reduce enteric methane emissions for beef cattle and for dairy cattle over a short term of time. The research programme for beef cattle started in 2008. In 2011 the results will be published. The study for dairy cows started in 2009 and will end in 2011.
- The use of cereals to reduce emissions of enteric might be an option at first sight (it will reduce emissions in the national inventory), but the whole Life Cycle needs to be analysed (including CO₂ emissions associated with the

¹ Research and development as well as on-farm projects.

production of the cereals). Research in Ireland shows that with a life cycle approach increased intensification by feeding cereals will actually increase emissions.

Results to date (including proposed new actions)

Improving forage quality for beef cattle

Results of field studies with perennial rye grass show a methane reduction of 17% per kg live weight for beef cattle. For dairy cows, the reduction of methane emissions is about 16% per kg of milk solids. The outcome of this research programme is also financial viable for farmers because of the increasing volume of milk and the increasing growth rate.

Lipid implementation (soya oil)

Results of field studies with soya oil show that the reduction of the enteric methane emissions for beef cattle can be as high as 50% in short feeding time (28 days). For a longer time (100 days) this can be up to 16%. For dairy cattle the reduction of enteric methane emissions can be as high as 21% in short feeding time (20 and 60 days). Because soya oil didn't work that well for dairy cattle, line seed (flag seed) was used instead.

3.4.4

TEAGASC KNOWLEDGE TRANSFER PROGRAMMES

Introduction

The transfer of knowledge developed in the research centres to farms is considered paramount to the effort to reduce non CO₂ emissions from the sector.

Scope of advisory and training programmes

The ambition is to reduce the GHG intensity of food production.

Implementation of advisory and training programmes

The following approaches are in place:

- Advisory service: the mitigation measures being implemented at farm level all relate to improving production efficiency: better use of manure, use of clover to reduce fertiliser use, the development of better grazing management systems (improved animal diets), and livestock management. While there are no direct incentives (e.g. government payments) to achieve these ambitions, farm practices resulting in mitigation are encouraged through the advisory services – one to one farm visits by professional advisors. These advisors also facilitate the development of discussion groups – knowledge transfer from farmer to farmer.

Generally the discussion groups are facilitated by the advisory service but managed by the farmers – usually a small group – 10 to 20 farmers with broadly similar performance levels but aiming to learn from each other about their approaches to different farm management issues. The Life Cycle analysis initiatives (described below) will be an important feedback channel (and tool to facilitate the work of the discussion groups) to researchers, advisory services and policy makers.

- Access to researchers: this is organised through open days and events at the various research centres with the researchers describing and demonstrating various approaches and techniques.
- Better farms: well managed commercial farms where research recommendations are applied to the main farming system and the results measured and demonstrated at local level. The outcome and benefits of the research is evaluated in terms of practicality for implementation at farm level, impact on efficiency and improvement in profitability. The results are benchmarked against the research demonstration farms, other 'better' farms and farms in the National Farm Survey. The results from these farms are published and demonstrated at regular farm walks and demonstrations. From a GHG perspective best practices relate to grazing management, nitrogen use efficiency, improving use of manure, use of clover to reduce chemical fertiliser use, etc.
- 'Carbon navigator': this is a new initiative being developed by Teagasc. It is a farm advisory tool to enable the advisor, on an individual farm basis, to measure the emissions associated with the production and enable focus on the emissions under the control of the farmer with a view to achieving reductions (e.g. N use efficiency, grazing management, etc and to identify the best options for each farm to reduce emissions).
- Assessment of emissions (on beef farms): Beef Quality Assurance Scheme Pilot Programme: this is a joint initiative by Teagasc (the national agricultural research, advisory and training authority) and Bord Bia – the body charged with marketing Irish food. A pilot programme has been completed on 200 farms to develop a Life Cycle Analysis Model to measure the carbon emissions associated with beef produced on Irish farms. The Model is now accredited by the Carbon Trust. An initiative to carry out an LCA on all farms in the Beef Quality Assurance Schemes now commencing. This initiative that will cover a very large proportion of the beef produced in Ireland.
A pilot programme is commencing to develop an LCA model for dairy production and will continue with a view to achieving coverage of a high proportion of milk produced in Ireland.

Results to date

The process of collecting information on relevant farm practices is developing- in conjunction with the National Farm Survey. The LCA work will also provide further feedback data. More information is required on emissions factors for both methane and nitrous oxide and there is a need to enhance GHG inventory development.

3.5

THE NETHERLANDS

The Dutch policies to reduce non CO₂ greenhouse gases in agriculture can be divided into three categories:

- The implementation of the ROB programme (reduction of non-carbon greenhouse gases) on agriculture and covenant with agricultural sectors;

- (financial) instruments, in particular those focussing on sustainable fermentation (SDE is the most important, others are EIA/ MIA, Vamil)
- The research and outreach activities of the former Ministry of Agriculture and the current Ministry of EL &I and VROM/I&M on various climate mitigation options and renewable energy;

3.5.1 ROB PROGRAMME

NL Agency¹ implements the ROB-programme on NCGG emissions for the Ministry I&M.

Scope

The focus of the ROB programme has been on implementing cost-effective measures in practice. The guiding principle with respect to agriculture was to hitch a ride with the ammonia-mineral policy.

Implementation

ROB uses a variety of instruments to stimulate the agricultural community to invest in new technology.

Results to date

For the agriculture sector, the ROB programme partly contributed to:

- Knowledge development and transfer mechanisms of the formation of greenhouse gases and possible cost-effective measures to reduce emissions of nitrous oxide and methane from agriculture
- Understanding the emission levels from agriculture in relation to the 'autonomous' implementation of measures under the influence of milk quota, efficiency, and the manure policy.
- First phase of implementation of manure fermentation: the encouragement of practical ripe manure fermentation in numerous development and demonstration projects and contribution to removing bottlenecks in regulations / permits for manure digestion (positive list and Guide co-digestion of manure). Second phase of further market penetration has been facilitated by other non-ROB (financial) incentives.
- Intensify research on innovations in cutting emissions from livestock feed.
- Facilitate innovation in manure storage and to explore possible innovations in the acidification of manure and stable air emission measurements.
- Information and transfer of information activities by the agricultural sector itself.
- Advice on emissions monitoring and achieving improvements in the monitoring of emissions by the execution of research.
- Contributed to the agreements on emissions of non CO₂ greenhouse gases from agriculture in the Covenant clean and efficient programme and sectoral covenants.

As part of the “clean and efficient” program, the Dutch dairy chain is aiming to achieve an energy - neutral production and an climateneutral growth of 20% by

¹ The NL Agency is part of the Ministry of Economic Affairs, Agriculture and Innovation.

2020. This new initiative aims at bringing the whole chain, i.e. from the dairy farm to the factory, ultimately to be self sufficient in energy in 2020. This is envisaged to be achieved by building fermentation units to convert manure and food waste into biogas, which can then be used (directly or indirectly) by local dairy factories.

Because of this covenant the dairy industry is motivated to stimulate the uptake low emission technologies as they have committed to reduce emission by 2020. At first voluntary certification programmes will be developed by the industry itself, in a later stage more strict regulations can be expected.

3.5.2

VAMIL

Introduction

The Netherlands has a long tradition of fiscal policy to support environmental innovations in a variety of economic sectors, including agriculture. The VAMIL¹ (and MIA and EIA) regulations provide fiscal incentives through accelerated depreciation of investments in innovative capital goods. Each year a list of selected investment options is published, that follows the latest innovations, stimulating farmers to invest in the most effective measures to reduce their NCGG (as well as CO₂) emissions.

Scope of the policy instrument

The scope of Vamil has changed over the years, following proven innovation techniques and promoting investments to reduce emissions from agriculture through changes to livestock feed, emissions from agricultural buildings, precision farming and fertilising to reduce nitrogen use². In the early years of Vamil underground injection of manure in pastures was one of the most successful measures to eliminate NH₃ emissions of obsolete spraying techniques. More recently Vamil focuses on sustainable stables. Since 2007 eligibility of sustainable stables projects has been extended to stables from pigs, chicken, dairy and rabbits. The objective of VAMIL is to have 5% sustainable stables (6% of intensive cattle and 3% of dairy).

Implementation of the instrument

The annual list is a co-production of the Ministry of Finance (Treasury), the Ministry of Infrastructure and Environment and the Ministry of Economic Affairs, Agriculture and Innovation. Administratively, Vamil applications run through the fiscal system, using the annual corporate tax form.

As a fiscal instrument, Vamil reduces the taxes farmers pay. This implies that the farmer loses its advantage when business doesn't make any profit. This makes the success of the instrument dependent on the profit/loss in the sector. Also it's

¹ Vamil (and MIA) are subsidies for environmentally friendly equipment for entrepreneurs. Vamil stands for arbitrary debit of environmental investments in Dutch. The Vamil regulation offers entrepreneurs a liquidity and interest advantage. MIA stands for environment investment deduction in Dutch, which is a fiscal deduction regulation for entrepreneurs who invest in environmentally friendly equipment.

² International Energy Agency

easier for larger farms to make use of Vamil as they are more likely to build or renovate stables, where smaller farmers only build stables once in while.

Results to date

Vamil is a popular instrument to support investing farmers to buy cutting-edge equipment, not just to reduce NCGG (and CO₂) emissions, but also to promote animal welfare, manure management, sustainable agriculture and other goals of government policy. A sustainable stable could save 20% energy in comparison to a conventional stable.

When Vamil was not available due to budget cuts in several recent fiscal years, the business community argued very much in favour of its reinstatement. Vamil was successful in phasing out old-fashioned manure management and introducing new stables, turning manure into biogas and other changes of agricultural practice, contributing considerably to the reduction of NCGG from agricultural sources in the last ten years.

3.5.3

INCENTIVE RENEWABLE ENERGY

In 2006 the Dutch government decided on a target for the production of renewable energy and for the reduction of CO₂ emissions in 2020. To meet these targets the government developed a new scheme 'Incentive of the Renewable Energy' (SDE). By the production of biogas also targets on NCGG-reduction, especially CH₄ are supported.

Scope of the policy instrument

The scope of the incentive is to promote the production of renewable energy (wind, sun and biomass). The production of biogas on farms is also supported including conversion of biogas into electricity.

Implementation

The scheme can be called a feed-in subsidy. In fact, electricity producers are guaranteed a fixed tariff that would adjust in proportion of fossil fuel energy prices. In cases when the feed-in tariff is higher than the electricity price, the mechanism acts like a premium. On the contrary, if the electricity price/kWh is higher than the estimated generation cost for a determined technology, no subsidy is received from the government.

The subsidy is for 12 subsequent years. Criticism on the instrument is that prices of manure and co-products¹ (f.e. fodder) are increasing, but the subsidy decreases as a result of the higher energy price. In addition the farmers must pay for the disposal of the digestate (per m³), which is considered manure - despite the lower emissions content of the remainder manure.

Results to date

The number of manure digesting facilities is still increasing.

¹ Co-digestion of animal manure with other biomass product (part of) crops, residues from feed-and-food industry

3.5.4 RESEARCH

Introduction

The Netherlands has several research programmes that are relevant to the reduction of NCGG emissions. Wageningen University and Research (WUR) is the main agricultural science institute, working in close relation with other institutes, both domestically and internationally. The government supports this research through a diversity of financial funds, both structural and project-based.

Among its recent subsidy system is a 1 million € programme to research low-emission animal fodder for cows. Project proposals should contribute to concrete improvement measures to reduce the methane production in the digestive system of cows. Measures should look at food additives as well as alterations of fodder components. Proposals are currently being evaluated.

Next to official research institutes and government bodies, the agricultural business community itself is active in a series of projects to enhance knowledge, distribute practical solutions and learn by networking. One of the examples of such initiatives is 'Cows and Changes'. Farmers, researchers and government officials work together in practical application of new ideas and actively spreading successes among the participating farms. Collective 'learning-by-doing' stimulates ownership of solutions and enhances the readiness of participants to change both their fodder management as their stock management.

3.5.5 LAW ON MANURE MANAGEMENT

As in all European countries, the Netherlands benefitted from a reduction of NCGG due to the Nitrate-directive, the milk quota's etc. Under the Nitrate-directive of the EU, the Netherlands has put stricter and stricter standards for manure application and production. The law has significantly reduced N₂O emissions from manure. As the law is already strict, the potential for further reduction of N₂O emissions is limited.

3.6 ICELAND

3.6.1 CARBON SEQUESTRATION THROUGH PLANT AND CROP CULTIVATION

Introduction

The possibilities for reduction of emissions from conventional agriculture are uncertain. In general, it is considered very difficult to reduce emissions from livestock and fertiliser except through reductions in agricultural production; however, changes in land use can sometimes result in reduced emissions. Emissions from conventional farming were considered rather low in Iceland until 2004, when a correction in calculation methods revealed that emissions stemming from agriculture were greater than previously believed. The government considers it necessary to review all aspects of emissions from agriculture and then assess the possibilities for reduction.

Recent research indicates that there are significant CO₂ emissions from drained wetlands, which now are less important to agricultural production than they used to be. These emissions can be stopped and even reversed through the reclamation of wetland areas. At present, such sequestration is not assessed for emission reduction units in the Kyoto system, but measures of this type could possibly be included in a registration system for emissions and sequestration of greenhouse gases in the future¹.

Scope of the policy instrument

At the moment the focus in the agricultural sector, has more been on carbon sequestration than emissions curbing, although there are some small-scale projects or plans for methane collection and utilization.

Implementation of the instrument

An assessment of carbon sequestration has been carried out by the Agricultural University of Iceland (and, previously, by the Agricultural Research Institute), the Iceland Forest Service, and Soil Conservation Service of Iceland.

Results to date

Work has been done to improve sequestration accounting, but it is a complex task and must be fostered if it is to prove successful

3.7 SWITZERLAND

Switzerland does not have any direct agricultural policies in place that targets the reduction of methane and nitrous oxide emissions. There are on the other hand policies that have a positive effect on emission reductions of these gases in agriculture.

3.7.1 DIRECT PAYMENTS AGAINST PROOF OF ECOLOGICAL PERFORMANCE

Introduction

The reform of the Swiss agricultural policy in 1999 introduced a (new) system of ecological direct payments to farmers, independent from agricultural production. Ecological direct payments create an additional incentive to meet particular standards of natural environment and animal welfare.

Scope of the policy instrument

Farmers receive direct payments only if they meet certain requirements against proof of ecological performance (PEP). The key elements of PEP are:

- an appropriate proportion of ecological compensation areas;
- a balanced use of fertilizers, regular crop rotation, suitable soil protection and targeted use of plant treatment products; and
- Animal friendly conditions for livestock.

In particular the second point is relevant for the reduction of N₂O emissions.

¹ Ministry of Environment. 2007. Iceland's Climate Change Strategy.

Implementation of the instrument

The goal of the nutrient balance is to prevent excessive use of nutrients and run-off. The nutrient balance has to show that no excessive phosphorus or nitrogen is being produced; the tolerance is at the 10% level. It involves also a compulsory soil analysis at least every ten years. A reliable use of nutrients has to correspond to the requirements for crops and the amount of manure produced on the farm.

A regular crop rotation aims at maintaining the fertility of the soil and crop health. Farms with more than three hectares of arable land have to have each year at least 4 different crops in rotation; and there is a maximum proportion of the main crops (e.g. maximum 66% cereals, 40% corn, 25% potatoes).

The objective of an appropriate soil protection is to prevent soil erosion, depletion of nutrients and the build-up of pesticide residues. A soil protection index was developed that has to be at least 50 points for arable crops and 30 points for vegetable crops.

The selection and targeted use of plant chemicals has the goal to produce high quality crops with a minimum use of pesticides. Farmers have to have their equipment for plant protection checked at least every four years. Treatments have to be executed according to the guidelines to reduce negative impacts.

To fulfil the PEP farmers have to keep records such as:

- Land-use plan with information on crops, how land is laboured, use of fertilizers and plant protection;
- Necessary documentation for calculating the nutrient balance.

Results to date

While formally, farmers can voluntary apply to general direct payments, the receipt of all payments is contingent upon compliance with ecological standards. Non-compliance with these standards can result in a cut of public payments. Despite the strict requirements the high adoption rate shows, that in practical terms farm operations to a large extent depend on governmental support. Nearly all farmers comply with these standards (95%).

The support of direct payments to farm income, particularly in mountainous areas is essential and is around 30%. The consequence for farmers of not-compliance can be drastic when the payments contribute substantially to the income. ¹

For the next period of agricultural policy (2014-2017) it is proposed to include new direct payment conditions (more strict PEP, change from animal-based to land-based direct payments, new types of direct payments) that promote more sustainable production practices.

¹ Joerin, R. 2007. The Swiss Environmental Payment System and Cross Compliance. University of Bergen.

3.7.2

RESOURCE PROGRAMME

Introduction

In 2007 a new policy instrument called resource programme has been added in the agricultural sector. Through this programme, the Swiss Confederation is subsidizing measures for more efficient use of natural resources in the agricultural sector.

Scope of the policy instrument

The programme provides funding for implementing measures to improve more efficient use of natural resources. The target areas are resources such as nitrogen (f.e. direct injection of manure), phosphorous and energy, optimized pest control, protection and sustainable use of soils (f.e. direct injection of manure) and biodiversity. In order to qualify for subsidies, measures must go beyond legal requirements, or the criteria for other funding programmes.

Implementation of the instrument

Support is given to measures that need financial support in an introduction phase, but that will run without further payments afterwards. These payments are restricted to 6 years, within which new technologies or organizational structures should have reached a state that is self-sustaining.

'Cantons' (Swiss regional administrations) develop the projects and ask farmers to participate (voluntarily). Most farmers participate because the funding they receive to implement the measure, is sufficient to cover the costs. The cantons submit the projects to the federal government who allocates the funding.

Results to date

It's uncertain how much reduction each individual measure has contributed to the reduction of N₂O. Evaluations of the policy measure have not been executed to-date. The agricultural policy for 2014-2017 proposes that an individual farmer can apply for funding.

Remarks

As politicians and the general public become more aware of climate change and environmental impact of agriculture, they are willing to support an agricultural sector that is more environmentally friendly. This has allowed the budget for ecological payments in farming to increase.

3.8

UNITED KINGDOM

3.8.1

GREENHOUSE GAS ACTION PLAN - GOVERNMENT - INDUSTRY PARTNERSHIP

Introduction

The UK Government is committed to a partnership approach in working with industry to reduce Greenhouse gas emissions from agriculture. Representative industry bodies in England have published an Action Plan that aims to deliver reductions in emissions consistent with those recommended by the Government's

advisory body, the Climate Change Committee, and adopted by the Government for agriculture.

Scope

The Greenhouse Gas Action Plan (GHGAP)¹ has been launched by sixteen organisations representing the agricultural industry in England, led by the National Farmers Union, the Agricultural Industries Confederation and the Country Land and Business Association. It sets out how the agriculture industry will reduce greenhouse gas emissions by three million tonnes of CO₂eq. per year from 2018-2022.²

Implementation

The Agriculture Industry GHG Action Plan outlines how reductions could be made through more resource-efficient practices. As well as enabling a reduction in emissions, these practices would also improve farmers' competitiveness. Many measures involve simple changes in farming practices at minimal or no extra cost, such as:

- Better use of nutrients, matching the needs of the crop;
- Improving livestock productivity and efficiency; and
- Better use of on-farm energy and fuel.

Results to date

The first phase has been finalised. The government will review the industry's Action Plan in 2012 to determine whether the industry's voluntary approach to mitigation is on track to deliver its aims and whether additional steps are necessary.

The Government is also committed to supporting these efforts through a programme of investment in research aiming for greater clarity about the environmental fate of greenhouse gas emissions and better information about steps to mitigate these at both national and international level.

- investing £12.6m to improve science base and measurement of on-farm emissions (Agriculture GHG Inventory)³;
- launching a pilot scheme to offer integrated advice to farmers on land management and reducing emissions;
- Working with supply chains to reduce their emissions; and
- Looking at other ways that policy can support the industry, for example through the reform of the Common Agricultural Policy (EU CAP).

¹ www.nfuonline.com/our-work/environment/Climate-change/gHg-emissions---reducing-agricultural-emissions/

² Barclay, C. 2011. How UK farmers could reduce greenhouse gas (GHG) emissions. House of commons library. SN/SC/4340.

³ The government is also working internationally through the global Research Alliance to co-ordinate research and exchange findings.

MIN-NO¹ consortium of 21 organisations, has been awarded almost £2 million of Defra and Scottish Government LINK funds with matching industry contributions over five years². The work will focus on the arable sector with three objectives:

- To determine a more robust relationship between nitrous oxide and the rate of mineral nitrogen fertilisers applied, both during crop growth and from crop residues.
- Through expert estimation and debate, to identify practices which could lower the greenhouse gas emissions footprint of arable products such as bread, sugar, oils, peas, chicken, whisky and biofuels. Also to assess how emissions might be estimated more accurately at farm and at national level.
- To review the findings in the context of parallel work on factors influencing nitrous oxide emissions: organic manures, soil cultivations and soil types.

The agricultural industry's Climate Change Task Force (consisting of AIC, CLA, NFU and AHDB) will play an important part in ensuring the findings are well understood by science bodies and policy makers across the EU.

AGRICULTURE AND THE COMMITTEE ON CLIMATE CHANGE

The Committee on Climate Change is an independent body established under the Climate Change Act 2008 to advise the Government on setting carbon budgets, and to report Parliament on the progress made in reducing greenhouse gas emissions. It published a report, *Building a Low Carbon Economy*, on 1 December 2008. The report made some tentative, but research-based, estimates of the cost of reduction of greenhouse gases in the agricultural sector. These are mostly non carbon, but are expressed in tonnes of CO₂ eq.:

The technical potential that has been identified at up to £40/tCO₂eq comprises:

- 9 MtCO₂eq from measures that decrease N₂O emissions from crops and soils, including:
 - reducing fertiliser application where it is applied in excess;
 - matching the timing of application with the time when the crop will make most use of it;
 - using organic rather than synthetic fertiliser where possible;
 - improving drainage of land;
 - Selectively breeding plants that need less fertiliser.

¹ <http://www.adas.co.uk/Home/Projects/MINNO/tabid/283/Default.aspx>

² Partners are ADAS, Agricultural Industries Confederation, Bayer CropScience, British Sugar, Country Land and Business Association, The Co-operative, Frontier, GrowHow, HGCA, Hill Court Farm Research, NFU, North Energy Associates, North Wyke Research, PGRO, REA, SAC, Scotch Whisky Research Institute, Soil Essentials, Vivergo fuels, Warburtons, Yara.

- 3 MtCO₂eq from measures that reduce methane emissions from livestock, including:
 - Selecting animals with particular traits for breeding, in order to improve the efficiency of milk and beef production or fertility. The impact of selection both reduces the number of animals required to produce a fixed level of output, and decreases the finishing period of animals, therefore reducing emissions per unit of output;
 - Increased use of additives named ionospheres that increase productivity and decrease methane production. These are currently banned in the EU, but are routinely used as growth promoters in some non-EU countries.

- 1 MtCO₂eq from the installation of anaerobic digestion plants (converting agricultural waste to renewable energy) either in a centralised location or on farm.¹

Results to date

In its third progress report published June 30th 2011, the Committee on Climate Change concluded that agricultural emissions fell around 1% in 2009. There is some evidence of underlying progress towards improving emission intensities. However, the existing evidence base is incomplete and should be extended to provide a more comprehensive overview of current and changing farming practice.

3.9 CANADA

3.9.1 DAIRY GREENHOUSE GAS PILOT PROJECT

Introduction

In March 2011, the Government of Canada announced an investment of more than \$950,000 for the Atlantic Dairy and Forage Institute (ADFI). This investment, delivered through the Canadian Agricultural Adaptation Program (CAAP)², will be used to support a dairy greenhouse gas pilot project on 100 dairy farms in New Brunswick and Alberta.

Scope of the policy instrument

The project involves a field-test of the greenhouse gas calculator³ developed by the Atlantic Dairy and Forage Institute (ADFI) to evaluate the potential for new revenue generation for the dairy industry through the offer of carbon offsets in Canada.

¹ Committee on Climate Change. 2088. Building a Low Carbon Economy.

² The goal of the Canadian Agricultural Adaptation Program (CAAP) is to support industry-led approaches and solutions that allow the sector to quickly adapt to changes, respond to emerging issues and seize new opportunities (<http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1286477571817&lang=eng>, last viewed on June 17th 2011).

³ The Holos GHG calculator can be downloaded here: <http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1226606460726&lang=eng>

The project will also help dairy farmers collect and share carbon emission data which will be used to provide estimates of potential greenhouse gas reductions for Canada's entire dairy industry.

Implementation of the instrument

The ADFI has developed¹ a *Greenhouse Gas calculator* for the Canadian farms called Holos. This allows farmers to calculate GHG emissions for their operations and estimate potential GHG emission reductions that may result by various management changes on the farm.

The GHG quantification tool allows any dairy operation in Canada to quickly and easily assess their potential to create carbon offset packages for sale to the market.

The primary focus of the dairy GHG protocol is production efficiency. Getting more milk with fewer animals by adopting improved feed formulation methods, increasing forage quality, etc., is the goal. This brings increased profitability to the farm by providing a carbon revenue opportunity. Along with the improved production efficiencies and changes to manure management strategies, the adoption of advanced technologies, such as solar water heating, liquid-solid separation, or biogas energy systems, can create sizable carbon packages for sale in the carbon market.

Results to date

Holos is currently undergoing a period of testing.

3.9.2 GREENHOUSE GAS MITIGATION PROGRAM FOR CANADIAN AGRICULTURE

Introduction

The 1997 Kyoto Protocol called for a reduction in greenhouse gas emissions over 15 years to a level six per cent below the GHG emissions in 1990. In response to signing the Kyoto Protocol, the Government of Canada created the Climate Change Secretariat which developed a process to assess climate change mitigation options, and initiated the Action Plan 2000 on Climate Change.

Under this plan, Agriculture and Agri-Food Canada² (AAFC) allocated \$21 million to the Greenhouse Gas Mitigation Program to address agricultural GHG emission reduction in the areas of soil, nutrient, and livestock management. The program is a "get started" initiative to contribute towards the goal of reducing agricultural GHG emissions by 5.8 million tonnes per year of CO₂ equivalent during the Kyoto commitment period of 2008-2012.

¹ For the research project see <http://www.adfiresearch.org/en/index-e.html>

² Agriculture and Agri-Food Canada (AAFC) provides information, research and technology, and policies and programs to achieve an environmentally sustainable agriculture, agri-food and agri-based products sector, a competitive agriculture, agri-food and agri-based products sector that proactively manages risk, and an innovative agriculture, agri-food and agri-based products sector. AAFC, along with its portfolio partners, reports to Parliament and Canadians through the Minister of Agriculture and Agri-Food and Minister for the Canadian Wheat Board.

The program objectives are twofold:

- GHG emissions reductions in the agriculture and agri-food sector by reducing GHG emissions in the three primary areas: soil, nutrient and livestock management; and increasing carbon sinks; and;
- Help to meet Canada's Kyoto commitment for reducing GHG emissions.

In order to achieve these objectives, the program measures are targeted at soil, nutrient and livestock management. The GHG Mitigation Program will initiate the long-term process of reducing net GHG emissions by addressing each of the three farm management areas through elements that are common to all three: recommendations, awareness, and measuring and verification.

Implementation

The GHG Mitigation Program's involves the:

- Identification of management practices that reduce GHG emissions or increase carbon sequestration.
- Awareness raising and demonstration to producers of best practices for soil, nutrient and livestock management.

Some of these management practices include:

Grazing management strategies:

- Increase the quantity and quality of forages on pastures and native rangelands;
- Increasing the quantity of forage produced can increase the amount of carbon sequestered in soils;
- Increasing the quality of forage can result in reduced methane emissions from the cow's rumen.

Feeding management strategies:

- Intended to increase the efficiency of feed utilization by beef cattle;
- Methane emissions from the rumen represent a loss of energy;
- Although these emissions cannot be eliminated, they can be reduced, potentially resulting in feed cost savings to producers as well.

Manure management strategies:

- Preserve the nutrient content of manure can also result in decreased GHG emissions in the form of methane and nitrous oxide.

Many of the good management practices producers can implement to increase the production efficiency and thus the profitability of their beef operations also reduce GHG emissions per pound of beef produced, resulting in a win-win situation.

Production efficiency practices currently available to beef producers can often result in a decrease in GHG emissions per pound of beef produced. Testing feed compositions and balancing rations, implementing proper herd health and fertility programs, and avoiding the over-application and loss of valuable nutrients in manure are practices beef producers can adopt to ensure GHG emissions from the beef industry are minimized.

The CCA (Canadian Cattlemen's Association) administered the awareness, communication and demonstration component of the program for the participating national livestock groups. Events are held across Canada to demonstrate the use of good management practices to reduce or remove atmospheric GHG.

Impacts on GHG reduction will be measured by scientists for specific practices and results will be reviewed to improve existing management practices. Practices that reduce GHG emissions in the areas of fertilizer formulation and application, livestock feeding and manure handling, and soil management will be addressed.

3.10 UNITED STATES OF AMERICA

Through a portfolio of conservation, renewable energy, and energy efficiency programs, US Department of Agriculture provides incentives and other support for voluntary actions by private landowners to reduce GHG emissions and increase carbon sequestration. Depending on the program and activity, USDA support can include financial incentives, technical assistance, demonstrations, pilot programs, education and capacity building, and frameworks and tools for assessing success in achieving Greenhouse gas emission reductions.

3.10.1 AGSTAR

Scope and implementation

AgSTAR is a voluntary effort jointly sponsored by Environment Protection Agency, the US Department of Agriculture, and Department of Energy. The program encourages the use of methane recovery (biogas) technologies at confined animal feeding operations that manage manure as liquids or slurries. These technologies reduce methane emissions while achieving other environmental benefits.

Results to date

Although the overall impact of AgSTAR on GHG emissions has been comparatively small on a national scale, livestock producers in the dairy and swine sector have demonstrated that the practices can reduce GHG emissions and achieve other pollution control benefits while increasing farm profitability. There are only 150 biogas recovery digesters at the moment. Farmers are not very eager to install multimillion dollar biogas installations because return on investment has not been proven and maintenance/upkeep of the system can be onerous. Farmers are now combining multiple systems into one digester. Also, the use of companies that offer to build and maintain a digester with a guaranteed income provided to

the farmer. Both of these things are encouraging more development of these types of digesters.

3.10.2 ENVIRONMENTAL QUALITY INCENTIVES PROGRAM (EQIP)

Introduction

The Environmental Quality Incentives Programme (EQIP) provides financial assistance for conservation practices on working farm and ranch lands. The Natural Resources and Conservation Service (NRCS) have provided guidance to its state offices to recognize actions that provide GHG benefits within the EQIP ranking systems.

Scope

A wide array of conservation practices can reduce GHG emissions, including residue management, irrigation and water management, nutrient management, crop rotations, cover crops, restoring wetlands, and grazing land management. However, these benefits are not permanent, as EQIP contracts last for 10 years, and producers retain the right to put land back into production after the contract ends.

Implementation

EQIP offers contracts with a minimum term that ends one year after the implementation of the last scheduled practices and a maximum term of ten years. These contracts provide financial assistance to implement conservation practices. Owners of land in agricultural production or persons who are engaged in livestock or agricultural production on eligible land may participate in the EQIP program. Program practices and activities are carried out according to an EQIP program plan of operations developed in conjunction with the producer that identifies the appropriate conservation practice or measures needed to address the resource concerns. The practices are subject to NRCS technical standards adapted for local conditions.

EQIP provides payments up to 75 percent of the incurred costs and income foregone of certain conservation practices and activities. However certain historically underserved producers (Limited resource farmers/ ranchers, beginning farmers/ ranchers, socially disadvantaged producers) may be eligible for payments up to 90 percent of the estimated incurred costs and income foregone. Farmers and ranchers may elect to use a certified Technical Service Provider (TSP) for technical assistance needed for certain eligible activities and services.

Results to date

End of April 2011, there were 24,866 new contracts registered. The new contracts cover 7,531,845 acres and are worth \$514,060,894.37.

In 2009, NRCS estimated the GHG mitigation benefits associated with 17 conservation practices that it identified as sequestering carbon and/or reducing emissions. For 2007, total GHG mitigation attributable to these practices is estimated at 3.9 Tg CO₂eq. This value is projected to increase to 14.2 Tg CO₂eq in 2020.

3.10.3

VOLUNTARY GREENHOUSE GAS REPORTING IN AGRICULTURE AND FORESTRY

Scope and implementation

In 2006, US Department of Agriculture completed the first phases of its development of comprehensive accounting rules and guidelines for forest and agriculture GHG emissions and carbon sequestration. These technical guidelines enable farmers, ranchers, and forest landowners to construct entity-level GHG inventories that account for emissions and removals from virtually all agriculture and forestry sources and sinks.

By preparing annual inventories, farmers and forest landowners can quantify and track changes in GHG emissions and terrestrial carbon sequestration associated with changes in production activities and land-use practices. Department of Energy (DOE) has adopted USDA's technical guidelines for use in this voluntary GHG reporting program, which was originally established by Section 1605(b) of the Energy Policy Act of 1992.

Results to date

USDA will continue to develop technical guidelines and science-based methods for energy efficiency and quantifying GHG emissions and removals from agriculture and forestry sources and sinks. A 3 year programme has started to develop a GHG calculation tool and associated technical guidelines that can be used to monitor on farm emissions and the impact that on farm measures have on them.

3.11

AUSTRALIA

3.11.1

CLIMATE CHANGE RESEARCH PROGRAM CCRP - AUSTRALIA'S FARMING FUTURE¹

Introduction

The Climate Change Research Program (CCRP) is a research funding program for agriculture which is part of Australia's Farming Future (AFF) initiative. The initiative comprises three complementary programs, the Climate Change Research Program, the Climate Change Adaptation Partnerships Program and the Climate Change Adjustment Program. The programs started in July 2008 and are administered by the Department of Agriculture, Fisheries and Forestry (DAFF). The program ends in December 2011, but a second phase is expected to follow.

AFF forms an important part of the government's future research effort into climate change and is meant to complement, not duplicate, other government initiatives such as:

¹ <http://www.daff.gov.au/climatechange/australias-farming-future/climate-change-and-productivity-research>

- The National Climate Change Adaptation Framework, including the National Climate Change Adaptation Research Facility;
- The CSIRO National Adaptation Flagship;
- Bureau of Meteorology/CSIRO Centre for Australian Weather and Climate Research;
- The Australian Government's Caring for Our Country initiative;
- The Australian Government's Water for the Future initiative;
- Australian Government funding of \$8 million over three years for research into the impact of climate change on forest systems and industries; and
- The N₂O Network.

Scope of the policy instrument

The Climate Change Research Program and its outcomes will improve opportunities for primary producers to respond to climate change and manage emissions while improving their productivity.

Implementation of the instrument

The government's climate change initiative provides funding over four years. The Climate Change Research program funds research projects and on-farm demonstrations to help prepare Australia's primary industries for climate change and build the resilience of the agricultural sector into the future. Research focuses on reducing greenhouse pollution, better soil management and climate change adaptation (Round 1), and involves projects that provide practical management solutions to farmers and industries (Round 2).

The Climate Change Research Program supports large scale collaborative projects that involve a range of organisations such as research providers, industry groups, universities and state governments.

Results to date and difficulties

Round 1: Research

Research has been focusing on following NCGG reduction measures:

- A range of strategies have been explored to reduce methane emissions from ruminants with varying degrees of success:
 - Dietary manipulations, e.g. the use of unsaturated fats in the diet;
 - Management options, like improved growth or reproductive efficiency, to reduce methane emissions per unit of product; and
 - Chemical inhibitors of methanogenesis, vaccines and biological control agents.
- A demonstration program to reduce methane emissions from ruminants will involve a mixture of these strategies tailored to specific components of the industry (e.g. extensive and intensive livestock). Reductions in methane from manure and waste water from farms and food processors will also be an important focus point.

- The current state of knowledge suggests that reductions of nitrous oxide emissions are possible in certain cropping and production systems or regions. Emissions from dry land wheat are low but other crops in the rotation cycle may have higher emissions. Emissions from sugarcane, irrigated cropping and irrigated pasture can be high and there is reasonable potential for some control through management of nitrogen inputs and soil water. For example, targeted nitrogen fertiliser management may reduce emissions in a broad variety of systems. Genetic based strategies to improve the plant uptake of nitrogen and plant-based production of nitrification inhibitors may also be worthy of further investigation.

Round 2: Information and demonstrations

The Round 2 program is focusing on the modelling of farm systems in different regions in Australia and on the development of mitigation assessment methodologies. The extension of the program, foreseen for 2012, will include further research in accurate measuring procedures.

The majority of the Australian farmers do not believe in the fact of Climate Change. An important part of Round 2 will be to inform the farmers on the impact of climate change, prior to encouraging them to implement mitigation measures.

3.11.2 *ETS - CARBON POLLUTION REDUCTION SCHEME*

Introduction

A carbon emission trading scheme, known as the Carbon Pollution Reduction Scheme (“CPRS”) was due to be introduced from 1st July 2010. The proposed scheme failed to gain adequate support in parliament and was deferred.

On 24 February 2011 the Prime Minister announced a new framework of a carbon pricing mechanism to place an explicit price on emissions from stationary energy, transport, fugitives, industrial processes and non-legacy waste. That framework also recognises the importance of abatement outside of those sectors. The Government is currently consulting with the community on this framework and the role that credits created under this bill will have in the scheme.

3.11.3 *AUSTRALIA’S CARBON FARMING INITIATIVE¹*

Introduction

The Carbon Farming Initiative is a voluntary offsetting scheme that enables participants to receive carbon credits for saving or storing greenhouse gases through eligible abatement activities (carbon offset projects). For these activities farmers will receive carbon credits, which can then be traded on the international compliance and voluntary markets, and the domestic market, depending on the nature of the rural activity. Carbon offset projects³ established under the CFI will need to apply government- approved methodologies - the detailed rules for

¹ <http://www.climatechange.gov.au/~media/publications/projections/australias-emissions-projections-2010.pdf>

implementing and monitoring specific abatement activities and generating carbon credits under the scheme.

The Carbon Farming Initiative includes:

- Legislation to establish a carbon crediting mechanism;
- Fast-tracked development of methodologies for offset projects; and
- Information and tools to help farmers and landholders benefit from carbon markets.

The Carbon Credits (Carbon Farming Initiative) Bill 2011 fulfils the Australian Government's commitment to develop legislation to give farmers, forest growers and landholders access to domestic voluntary and international carbon markets. This will begin to unlock the abatement opportunities in the land sector which currently makes up 23 percent of Australia's emissions. The Bill is also an essential step in creating a regime which will measure, verify and credit abatement actions in sectors which will not have direct liability under the proposed carbon pricing mechanism.

Scope of the Carbon Farming Initiative

The first objective is to help Australia meet its international obligations to reduce its emissions of greenhouse gases under the United Nations Convention on Climate Change and the Kyoto Protocol.

The second is to create incentives for people to undertake land sector abatement projects. The ability to generate saleable carbon credits provides an investment incentive, thereby helping to channel carbon finance into land sector abatement.

A further objective is to achieve carbon abatement in a manner that is consistent with the protection of Australia's natural environment and improves resilience to the impacts of climate change. This recognises the important contribution that this scheme can make towards environmental objectives such as improving water quality, reducing salinity and erosion, protecting and promoting biodiversity, regenerating landscapes and improving the productivity of agricultural soils.

Implementation

The Carbon Farming Initiative is currently under consultation in Parliament.

Potential difficulties

In order to motivate farmers to be involved in off-set projects, the cost of carbon should outweigh the costs of investment in the abatement project. These costs are unpredictable since they depend on market mechanisms.

The international compliance market will only be available for credits that are Kyoto-compliant, and these credits are likely to generate higher returns for farmers than non-Kyoto-compliant credits traded on voluntary markets.

3.11.4 N₂O NETWORK¹

The N₂O Network is a collaborative research program established to study nitrous oxide (N₂O) emissions from Australian agricultural soils.

The N₂O Network is the first national effort to synthesise research data about N₂O emissions from Australian agricultural soils. This data will enable the Network to develop resources and tools that will support growers, policy makers and researchers to reduce N₂O emissions.

The N₂O Network researchers are working on agricultural projects across Australia with the shared purpose to:

- Collate soil emissions research data into a national repository;
- Create robust models of soil N₂O emissions patterns; and
- Contribute to evidence-based national policies on soil N₂O emissions.

3.12 NEW-ZEALAND

3.12.1 EMISSION TRADING SYSTEM (NZ ETS) ²

Introduction

The New Zealand Emissions Trading Scheme (NZ ETS) is the price based mechanism for greenhouse gases and is a key part of New Zealand's overall climate change policy. In this way, NZ wants to meet its international commitments on climate change and move towards a low carbon economy.

The principle behind the NZ ETS is that emitters of greenhouse gases must either reduce their emissions or purchase New Zealand Units (NZ ETS) to pay for those emissions. NZ ETS can also be earned through forestry plantings as they sequester carbon.

The NZ ETS is the primary policy measure of the New Zealand government to reduce emissions and sets a price on carbon. The scheme will cover all major sectors of the economy.³ Forestry was the first sector to enter the NZ ETS, from 1 January 2008. Stationary energy, transport and the industrial sector entered in 2010. The inclusion of the agricultural sector is set for 2015.

The NZ ETS for agriculture accounts for methane and nitrous oxide emissions. With some exemptions, participants for agriculture are meat processors, milk or colostrum processors, exporters of live animals, fertiliser importers and manufacturers, and egg producers. Farmers and growers are not required to register and participate directly in the NZ ETS.

Participants in the New Zealand Emissions Trading Scheme (NZ ETS) for agriculture will have to report greenhouse gas emission activities and surrender

¹ <http://www.n2o.net.au/>

² The New Zealand ETS (<http://www.climatechange.govt.nz/emissions-trading-scheme/>)

³ Guide to Forestry in the Emissions Trading Scheme (<http://www.maf.govt.nz/news-resources/publications.aspx?title=Guide%20to%20Forestry%20in%20the%20Emissions%20Trading%20Scheme>)

NZUs to account for agricultural emissions. Agricultural participants can voluntarily report emissions in 2011 and have to report emissions from 2012 though to 2014, but they are not required to pay for emissions in these years. The requirement to surrender emission units under the scheme does not commence until 2015.

NZUs can be earned through NCGG abatement and sequestration projects. They can be purchased through an online exchange, a broker, or direct from the holder of the emission units.

The broad settings of the ETS are currently being reviewed by the 2011 ETS Review Panel. A discussion is ongoing about the possibilities for the agricultural industry to count the emission reductions realised by farmers prior to the implementation of the NZ ETS. This would give an extra financial stimulant to farmers to perform measures to reduce emissions. This topic is also discussed in consultation groups for farmers.

Scope of the policy instrument

The ETS as currently designed will cover all the major agricultural sources of methane and nitrous oxide, such as methane from ruminant animals and nitrous oxide from urine, manure and nitrogen fertiliser applied to pasture.

The ETS will reinforce the current trend in New Zealand agriculture towards a lower emission intensity of products.

Implementation of the instrument

Significant research and analysis of the ETS and its settings has been conducted by

- The Ministry for the Environment, which is the lead agency for the ETS;
- The Ministry of Agriculture and Forestry, which is responsible for development of the regulations for Agriculture and Forestry sectors; and
- The Ministry of Economic Development, which is responsible for the emissions unit register. This will be transferred to the Environmental Protection Authority (EPA) on 1 Jan 2012.

A review of the NZETS has recently been conducted; the report and any decisions related to the review have yet been released. As such, these comments relate to current settings.

By placing a price on carbon, the ETS provides an incentive to reduce the level of emissions for every unit of agricultural output. Reductions can be made by improvements in farming efficiency, increased tree planting, more efficient use of nitrogen fertiliser, increased use of nitrification inhibitors, more effective management of animal waste, and the use of other mitigation technology's as they are developed.

The current settings of the moderated ETS will help address the impact of the NZ ETS on the agriculture sector, providing time for the sector to adjust. In particular Agricultural participants will be eligible to receive an allocation of emission units from the New Zealand Government. Allocation in 2015 will start at 90 percent of an emissions baseline and phase out at 1.3 percent per annum from 2016.

Allocation will also be on an 'intensity' basis, meaning participants receive an allocation that is linked to their output.

It's expect that the net ETS costs (liability minus allocation) will largely be passed to suppliers through lower prices for raw milk and meat and higher prices for nitrogen fertiliser. However, it is left to the processor to determine exactly how much of the costs they pass on, and how. Because both the liability and the allocation are calculated per unit of product we don't think the processors are willing or able to absorb much of an on-going reduction in their margins or pass the cost to overseas customers, because our overseas competitors don't have a liability.

Initially, due to the 90% allocation of units, the price signal will be low. However, lower returns per kg of product and per animal, and higher fertiliser costs, are expected to encourage farmers to look for efficiencies that will tend to reduce emissions. For example, higher fertiliser costs will encourage economies in N fertiliser use (e.g. greater soil testing to ensure that fertiliser is used only when and where it is needed). In some cases there may be changes of land-use, such as changing to less emissions-intensive agricultural outputs or converting marginal farmland to forestry.

The NZETS allows for the benefits of reduced emissions to be further captured through two mechanisms: Removal activities under which participants receive credits for activities that reduce emissions and Unique Emissions Factors (UEF) whereby participant's liabilities can be adjusted to account for behaviours that reduce emissions due to production.

The ETS encourages action by large industry participants (e.g. sector bodies, large processors (which are largely farmer-owned)) to promote behaviour that will result in lower emission factors for the sector. Incentives are also likely to develop over time with refinement of the NZ ETS and with changes in farming practices.

The legislation also allows the government to change the point of obligation to the farmer in the future, having regard to issues of verifiability, effectiveness, and cost.

The rationale behind an ETS is that it allows for the abatement of emissions at least cost. No other financial incentives are provided. However, complementary measures in the areas of research & development and technology transfer seek to facilitate reduced emissions and lessen the impact of the ETS on the agricultural sector (these are outlined in previous correspondence). These initiatives will encourage innovation and the information farmers need to respond to the market signal.

Results to date (including proposed new actions)

Although the inclusion of the agricultural sector is currently set for in 2015, the ETS already has indirect effects on NCGG in agriculture through promoting forestry land-use in marginal farmland (sequestration) and the impacts of pass

through cost of the energy sector being in the ETS¹. Preliminary evidence from the National Inventory and commissioned surveys suggests that deforestation rates have dropped and afforestation has increased.

As the market determines where mitigation is likely to be adopted, it is uncertain what the expected mitigation potential for NCGG in the agricultural sector will be. Moreover, the successful implementation of the program will depend on the emission trading context in the international market. The agricultural sector in New Zealand fears that the ETS scheme will give them a competitive disadvantage compared to the other countries where no ETS scheme will be in place.

3.12.2 RESEARCH

Introduction

Research results have highlighted the complexity of mitigating agricultural greenhouse gases for pastoral systems. However, some areas show significant progress towards practical on-farm mitigation technologies e.g. nitrification inhibitors and breeding schemes for low methane production.

Modelling and benchmarking work has also indicated that practices reducing the emissions intensity of milk and meat production may also increase farm profit.

Some research initiatives are discussed below.

Beside these there are also some Professorships established at Universities to study for example the production and use of biochar² in New Zealand and to build New Zealand Life Cycle Analysis (LCA) capabilities³. An agricultural nutrient management tool, called OVERSEER®⁴, is co-funded by the MAF. This tool assists farmers and their advisers to examine nutrient use and movements and Greenhouse gas emissions within a farm to optimize production and environmental outcomes. The computer model calculates and estimates the nutrient flows in a productive farming system and identifies risk for environmental impacts through nutrient loss, including run-off and leaching, and greenhouse gas emissions.

Sustainable Land Management and Climate Change (SLMACC)¹

Scope of the Research Programme

The Sustainable Land Management and Climate Change research programme wants to provide a comprehensive research programme across adaptation, mitigation in agriculture and forestry, business opportunities and social and economic measures.

Implementation of the Research Programme

¹ Guide to Agriculture in the Emissions Trading Scheme (<http://www.maf.govt.nz/news-resources/publications.aspx?title=Guide%20to%20Agriculture%20in%20the%20Emissions%20Trading%20Scheme>)

² New Zealand Biochar Research Centre (<http://www.biochar.co.nz/>)

³ New Zealand Life Cycle Management Centre (<http://lcm.org.nz/>)

⁴ Overseer® (<http://www.overseer.org.nz/>)

The Sustainable Land Management and Climate Change (SLMACC) research programme administered by the Ministry of Agriculture and Forestry (MAF) has a number of projects on non-price measures to address on greenhouse gas emissions in agriculture. Priority research topic areas are identified through consultation with the sectors and endorsed by sector advisory committees. In particular the programme focuses on funding research not covered by the other research programmes and/or seeks to accelerate research in areas identified as having more near term mitigation potential.

The funds allocated over the last four years cover:

- Impacts and adaptation in agriculture and forestry - NZ\$4.3 million;
- Mitigation of Greenhouse gas emissions in agriculture - NZD14.0 million;
- Enhancement of forest sinks - NZD7.3 million;
- Crosscutting issues in economic, social and systems research related to agriculture, forestry and land use - NZD3.2 million; and
- Biochar and soil carbon - NZD2.6 million.

The research outputs support technology transfer, communications projects and evidence-based policy development. The results are made available to other programmes, are used in policy development and are being made publicly available on the MAF website.

A significant project linked to SLAMACC is the 3 year (2009-2012) National Nitrification Inhibitor Research Programme (NNIR). The programme involves both industry and Government coming together to fund a national evaluation programme on the nitrification inhibitor (DCD) technology at 4-6 sites under pastoral grazing. The trial work is being overseen by the PGGRC and conducted by researchers from three research organisations.

The National Nitrification Inhibitor Research Programme is a NZD10million programme; 50/50 joint funded between Government and the dairy and fertiliser industries over 3 to 4 years.

Results to date

The SLAMACC research program was introduced in 2007. Given the long time horizon of the program, most of the results are still in a preliminary phase.

A key example of a research outcome is the Nitrification Inhibitor, DCD. In 2007, 100,000 ha of dairy land had DCD applied which reduced emissions by 29 Gg CO₂eq or 0.2% of total nitrous oxide emissions. Most of the research so far is based on models and small plot research. Interviewed researchers reported that performing accurate methane and NO₂ measurements on large plot scale will be a challenge. The design of the measurement procedures is still ongoing.

¹ Sustainable Land Management And Climate Change (<http://www.maf.govt.nz/environment-natural-resources/climate-change/research-and-funded-projects>)

Pastoral Greenhouse Gas Research Consortium (PGGRC)¹

Scope of the Research Programme

The PGGRC was established in 2002 under a Memorandum of Understanding (MoU) between the Crown and industry and has the intention to enhance linkages and exploit opportunities between the public and private sectors in mitigation research. The PGGRC target is to decrease emissions by 10% per unit of output by 2013 over business as usual relative to 2005 (estimated to be 4 million tonnes).

Implementation of the Research Programme

The scope of the research work that has been carried out by the PGGRC includes:

- Rumen microbial ecology and rumen microbial strategies to reduce methane emission;
- Methanogen genomics;
- Methanogen vaccines;
- Exploiting animal to animal variation;
- Low GHG emitting farm systems; and
- Nitrous oxide mitigation.

The membership of the consortium includes major companies, industry bodies and research organisations and currently includes: Fonterra Ltd (Chairman), Beef and Lamb NZ, DairyNZ, AgResearch Ltd, Fert Research (NZFMRA) PGG Wrightson Ltd - Observers: DEEResearch Ltd, Landcorp Farming Ltd, MAF, NIWA, NZAGRC.

The PGGRC will be funded till 2012. The current level of annual direct funding for the PGGRC was just over \$7.0 million, of which approximately 50% is industry funding. \$2.735 million has been identified as additional "acceleration" funding from a range of industry and government sources. Its total expenditure since commencement is close to \$30 million.

Results to date

It is difficult to determine the extent to which the current research findings of the PGGRC could lead to reductions in on-farm levels of greenhouse gases. It has recently submitted its seventh annual report.

Preliminary results indicate positive mitigation effects of up to 26% reduction of NO₂ emissions due to nitrification inhibitors, up to 15% of methane reduction due to oil supplements in the diet. Significant methane reduction was also observed with the use of vaccines, but further investigation is still ongoing.

New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC)²

Scope of the Research Programme

¹ Pastoral Greenhouse Gas Research Consortium (<http://www.pggrc.co.nz/>)

² New Zealand Agricultural Greenhouse Gas Research Centre (<http://www.nzagrc.org.nz/>)

The scope of the New Zealand Agricultural Greenhouse Gas Research Centre is to build and sustain ruminant mitigation research capability in New Zealand.

The NZAGRC is focused on research into NCGG mitigation in agriculture. It covers all three main Greenhouse gas emissions: methane, nitrous oxide and soil carbon for the agriculture, horticulture, arable, pig and poultry sectors, but not forestry.

Implementation of the Research Programme

The NZAGRC is managed as a virtual Centre with research done throughout the country by partner members. The Centre has also sought to establish the infrastructure and equipment necessary to ramp up the level of research effort, in particular the commission facilities to measure rumen methane production and nitrous oxide emissions.

The key topic areas being addressed by the centre are presented below.

Methane

- Feeding Microalgae;
- Low methane producing animals;
- Genomic identification of universal targets for methanogen inhibition;
- Enhanced discovery of methanogen-specific inhibitors;
- Vaccine programme;
- Identifying alternative hydrogen utilisers; and
- Methane capture and utilisation from dairy effluent.

Nitrous oxide

- Manipulating N inputs;
- Manipulating nitrification processes;
- Manipulating denitrification processes; and
- N₂O emissions and soil water status.

Soil Carbon

- Limits of soil carbon storage in New Zealand soils;
- Quantifying the carbon currently stored in New Zealand soils;
- Process-based modelling of drivers of soil carbon change;
- Manipulation of carbon inputs, incorporation and retention to protect and enhance soil carbon; and
- Improved soil carbon measurements.

Integrated Systems

- Mechanistic modelling of enteric CH₄ production; and
- Improved N₂O Component Modelling.

The NZAGRC is introduced in 2010 and will be funded till 2020. The Government is investing NZD 5 million per annum for ten years.

Results to date

Since the program have just commenced, it is too early to evaluate results.

Introduction

New Zealand farming and forestry practices will need to change to adapt to climate change. The right information will need to be packaged and delivered in the right way at the right time to help implement changes effectively at a national, regional, catchment, community and individual farm level. The Plan of Action includes a technology transfer implementation programme to encourage and accelerate the uptake of new mitigation technologies and practices by farmers, as they become available.

Scope of the policy instrument

The overall goal for the technology transfer element of the Plan of Action is to transfer knowledge and technologies to enhance the ability of primary industry land managers to adopt land management practices that will:

- Reduce greenhouse gas emissions and improve the efficiency of resource use;
- Adapt to a changing climate; and
- Take advantage of new business opportunities relating to climate change.

The technology transfer programme also provides an important link between the research programme, the policy development and land managers. It is a key component to getting research implemented on farms. It also provides a feedback loop from land managers to policy and research.

Implementation of the instrument

MAF established a Climate Change Technology Transfer Sub-Group (CCTTSG) to develop the action plan. Technology transfer is one element of the action plan. The CCTTSG reports to MAF's Research, Innovation & Technology Transfer Working Group (RITTWG) which is part of a wider climate change programme.¹

A Technology Transfer strategy was developed in 2008 followed by a more detailed Technology Transfer Implementation Plan in 2010. The implementation plan was developed with significant input from the sectors through the Climate Change Technology Transfer Sub-Group (CCTTSG) and farmers.

The Implementation Plan aims to enable land managers to make informed decisions with the best information and tools available to address climate change. For changes to be implemented efficiently and effectively, they will require information to be packaged in the right way and shared across sectors. MAF will:

- Work in partnership with sector organisations; and
- Provide additional resources and up skilling by funding of the series of projects.

¹

<http://www.groundworkassociates.co.nz/workshops/Draft%20climate%20change%20technology%20transfer%20plan%20for%20action%202009-12-15.pdf>

Priority was given to actions that would influence behaviour of land managers and their advisers; provide multiple benefits to sectors and MAF programmes (for example water quality or efficiency); leverage off sector and research programmes; are achievable and provide value for money.

Results to date

The programmes are increasing awareness and understanding by farmers and the industry. There has been reduction in emissions due to nitrification inhibitors but this cannot be attributed to these programmes as yet.

There will be a new baseline monitoring in 2013 to see the effectiveness of the programme which was initially carried out in 2008.

3.13 JAPAN

3.13.1 DOMESTIC OFFSET SYSTEM (J-VER)

Introduction

The Ministry of Environment in Japan established a study group in March 2008 to consider institutional frameworks for a domestic offset credit system, followed by the establishment of the Japan-Verified Emission Reduction (JVER). The scheme became operational in November 2008 with the Certification Center on Climate Change (CCCCJ or 4CJ) serving as the secretariat. The J-VER Certification Committee is responsible for the registration of projects and the certification of credits.

Scope

In May 2011, 24 emission reduction methodologies¹, three forest sink methodologies, and one methodology in the agricultural sector have been approved.

Implementation

Reduction of N₂O emission from swine manure management by using low-protein feed is verified by the J-VER (Japan Verified Emission Reduction) scheme, which is the public certification scheme for carbon offsetting in line with the guidelines introduced by Ministry of Environment Japan.

Current Status

A total of 100 projects have been registered and 88.420 t-CO₂ credits were issued from 48 projects.²

In 2009, a project to mitigate N₂O emissions from tea plantation by applying nitrification inhibitors was proposed. However, the J-VER methodology panel did

¹ Use of woody biomass, use of biodiesel fuel, improved transport efficiency achieved by the use of information technology, micro-hydropower generation, etc.

² Office of Market Mechanisms, Climate Change Policy Division Ministry of the Environment, Japan (MOEJ). 2011. MOEJ Initiatives on Bilateral Offset Credit Mechanism for Mitigating Climate Change.

not accept the proposal. There are few studies that test the mitigation effects in tea plantation fields in which soil properties are quite different from other soils. Although the reduction factors are quantitatively evaluated and published, the factor was not approved by the IPCC Guidelines or the national inventory report. So, the uncertainty of the effects was considered too large to generate carbon credit.

Remarks

It is expected that the nutrition management techniques and techniques to suppress CH₄ fermentation by controlling fermentation in the rumen (such as by the addition of fatty acid calcium and polyphenols to feed) will improve in the future. But estimation methods which can reflect this anticipated emission reductions are not developed (amount of CH₄ inhabitation changes by the composition of feed, quantity and unsaturation degrees of fatty acid calcium, but so far it has not been generalized.). Estimation methods that can reflect measures to control CH₄ generation still need to be developed.¹

3.13.2

BIOMASS NIPPON STRATEGY - BIOMASS TOWNS

Introduction

The Biomass Nippon Strategy promotes the utilization of biomass as an alternative energy source. Several Ministries participated in formulating the strategy including Ministry of Agriculture, Forestry and Fisheries, Ministry of the Environment and Ministry of Economy, Trade and Industry.

Scope

“Biomass Nippon Strategy” (2006) undertakes utilization of livestock manure oriented gas as one of its action plans to promote utilization of biomass, which establishes a set of programmes aimed at recycling more than 80% of biomass waste (which includes livestock manure) and utilisation of more than 25% of unused biomass (carbon equivalent terms) by 2010. The government promotes Biomass Towns² for the achievement of one of the Biomass Nippon Strategy Goals.

Implementation

Part of the strategy is Biomass Town Concepts, ranging from the generation to the utilisation of biomass, with concerned parties within a region collaborating efficiently on plans at the municipal level. If the Biomass-Nippon Comprehensive Strategy Promotion Council approves the plans, the municipality is supported with the necessary subsidies to promote the concept, build collection station, transportation and preparation of biomass. For example Kuzumaki Highland manure produced at the farm is mixed with food scraps from the farm’s restaurant to produce biogas for power generation.

Remarks

¹ Ministry of Environment Japan. 2011. National Greenhouse Gas Inventory Report of Japan.

² A biomass town is a community which utilizes biomass with strong ties among a local community and stakeholders.

There were 5 participating municipalities in 2005. The number had risen to 272 in 2010.

Biomass at local regions is not always utilized sufficiently today. There are two reasons for this. One is the uncertainty of its quantity. The other one is that biomass is left on farmland due to collection cost and labour reasons. For biomass utilization at local communities, it is key to collect /transport and convert them efficiently in their communities.¹

3.13.3 *RESEARCH*

The National Institute for Agro-Environmental Sciences (NIAES) and the National Institute of Livestock and Grassland Science (NILGS) are the key organizations of GHG emission research in the agriculture sector in Japan. NIAES researches GHG emissions from agricultural land. NILGS researches GHG emissions from livestock.

For the GHG emissions of the agriculture sector, NIAES and NILGS communicate with ministries and agencies or the general public as the key organizations conducting frontier research. The Ministry of Agriculture, Forestry and Fisheries and the Ministry of the Environment implement policies and measures and communicate with the general public.

3.14 *GLOBAL RESEARCH ALLIANCE (GRA)*¹²

The Global Research Alliance is a voluntary network to increase international cooperation, collaboration and investment in agricultural greenhouse gas research. It will help improve the understanding and measurement of agricultural emissions.

Scope of the Network

The focus of the Global Research Alliance (GRA) is on research, development and extension of technologies and practices that will help deliver ways to grow more food (and more climate-resilient food systems) without growing greenhouse gas emissions at a global level.

The Alliance aims to deepen and broaden existing mitigation research efforts across the agricultural sub-sectors of paddy rice, cropping and livestock. This includes the cross-cutting themes of soil carbon and nitrogen cycling and inventories and measurement issues.

Implementation of the instrument

A key initial task includes conducting a stock take of research activities to guide the development of research activities. The Alliance promotes an active exchange of data, people and research to help improve the ways that agricultural

¹ Sanuki, A. Irie, M.; Ushikubo, A.2008. Nitrogen cycle in utilizing biomass as resources at rural areas. Faculty of International Agriculture and Food Studies(Tokyo Univ. of Agriculture (Japan)). Environmental Science

greenhouse gas research is conducted and to enhance participating countries' scientific capability.

For example, The Global Research Alliance Senior Scientist (GRASS) Award will support scientists from New Zealand and from other Alliance countries to undertake exchanges on research projects into agricultural GHG mitigation, for up to six months. The GRASS Award complements the existing LEARN full Fellowships programme sponsored by New Zealand since 2007 which supports developing country scientists undertaking research in New Zealand.

\$45 million has been committed over 6 years by New Zealand. Other countries have also committed funding and in kind resources.

Results to date

To date 34 countries have signed up to the Charter. Two governance meetings have been held and three science groups have been formed:

- Livestock chaired by New Zealand and the Netherlands;
- Crops chaired by the US; and
- Paddy Rice chaired by Japan.

Environmental Resources Management – ERM was commissioned by Agentschap NL to do an international survey to provide clarity on how national and international agricultural and climate change policies can be instrumented in the next three to five years to achieve a significant reduction in emissions of methane and nitrous oxide in the Dutch agricultural sector in 2020.

The first impression of the survey is its sheer size. Most countries have a myriad of individual measures, aiming at individual sources and/or sectors and/or multiple agricultural issues and using different levels of impact. The actual number of policy instruments and measures that reduce non-carbon greenhouse gases in agriculture directly or indirectly is in reality even larger than this survey shows.

Climate change policies for NCGG reduction are relatively new. Emission reductions in agricultural sectors over the last two decades are not so much a result of climate change policies but a result of other environmental policies e.g. targeting nitrogen. In particular the Nitrate Directive and Water Framework directive have (had) an impact in member states of the European Union. This does not mean that countries are not developing policies and strategies for reducing NCGG in agriculture. Although this survey does not aim to be complete, the survey revealed a wide range of policy instruments being used for emission reduction ranging from direct payments for sustainable production, subsidies for biogas use and implementation of climate friendly policies, emission-trading schemes and partnerships with the private sector. Financial incentives under the form of direct payments or subsidies for adopting measures and/or technology appear the most commonly used policy instruments, although very little is known about the cost-effectiveness and efficiency of the policies.

Policy instruments to reduce NCGG in agriculture

There are large differences between countries and approaches they take. Countries with a large agricultural sector such as New-Zealand, Australia and Ireland of which the agricultural sector produces a large share of the national greenhouse gas emissions have more to gain from emission reductions in this sector. In general, these countries have developed specific policies and measures. Other national policies (mostly European countries but also US) combine environmental stewardship with emission reduction measures. For again other countries, like Iceland, very little is being done to reduce NCGG. Their focus in agriculture is on carbon sequestration.

Voluntary instruments

Because of the uncertainties and complexity, today most policy instruments are voluntary. The effect of the voluntary policies remains often unclear. Cost-efficiency at farm level is important for the follow up of the measure, whether it is about the installation of a manure fermentation installation or crop rotation measures. For example in Switzerland, farmers depend to a large extent depend on the payments scheme. Mitigation measures that require a large investment by farmers upfront – even with a significant subsidy, have in general a low

participation. This has been the case in the promotion of biogas installations in Denmark and the US.

Communication about and stimulation of these voluntary actions are a challenge which will require sustained and tailor-made effort. Demonstration projects were suggested as an effective way to disseminate information and to convince farmers of the economic and practical feasibility of the implementation of mitigation measures. The success of this instrument to uptake mitigation measures depends largely on the presence of (financial) incentives, the practical feasibility and the absence of potential additional risks. Best practices relate to a large range of GHG reducing measures such as grazing management, nitrogen use efficiency, improving use of manure, use of clover to reduce chemical fertilizer use. The UK has taken an industry-led approach but it is too early to draw any conclusions related to this approach.

Direct Payments

Direct payments such as in Switzerland and EU linked to cross compliance ¹and beyond, appears to be successful, in particular when the payment makes up a significant share of the farmer's income. In both cases it involves reduction of emissions from land and soil management. Conditionality and monitoring are important for the effectiveness of the instrument. In the US land set-aside programs exist. According to the government, these are one of the most successful programs in the US.

Subsidies for Biogas – manure management

In the US, Denmark and Germany programs are in place to promote biogas from manure treatment. Although the initial set up of the subsidies was to support farmers financially to set up their own installation, it appeared difficult for farmers to make the investment. As a consequence, in Denmark third parties are building biogas installations where farmers can bring their manure to. In the US this hurdle has been overcome by encouraging farmers to collaborate, so that several farmers bring their manure to the farmer with the installation.

Emission trading schemes/ Offsetting Programs

Countries with a large agricultural sector are stepping into Emission Trading Schemes (ETS)/ Offsetting programs. These include New-Zealand, Australia, Canada, Ireland and also Japan. New Zealand and Japan are the most advanced. In New-Zealand the inclusion of the agricultural sector is scheduled for 2015. As ETS is a market-based instrument the market will decide what the best mitigation option will be. The effect it will have on the overall emissions is uncertain as the market may choose to pay for additional costs related to the emissions – in particular when there are no 'easy' and cost-effective mitigation options available to farmers. This may result in a low incentive to reduce emissions and higher costs for the agricultural sector. The agricultural sector in New-Zealand fears that the ETS scheme will give them a competitive disadvantage compared to the other countries where no ETS scheme will be in place. One respondent commented during the interviews that ETS schemes are more feasible in countries with large

¹ 'Cross-compliance' links direct payments to farmers to their respect of environmental and other requirements set at EU and national levels.

farms. Due to the business-minded/entrepreneurial approach of farming in these circumstances the farmers will be more likely to innovate and take (justified) risks to adopt new measures.

The Japanese Verified Emission Reduction Scheme includes already today one agricultural mitigation measure, low-protein feed for swine manure management. It's too early to assess the impact of this domestic offsetting program. Also Canada and Ireland are working towards a domestic offsetting program. Other respondents were convinced it was too early to implement market-based instruments - monitoring and verification of emissions at farm level would be too uncertain, complex and expensive at this point in time to make this a successful policy option in the near future.

Common Agricultural Policy (CAP) of the European Union

Agriculture has been one of most important areas of European collaboration since the early days of the European Community and accounts for almost half of the spending in the European Union, affecting 15 million farmers. This means that a Common Agricultural Policy (CAP) on an EU level can be a powerful tool to reduce non-carbon greenhouse gas emissions in agriculture.

Although payment is not currently linked to GHG mitigation measures such linkage is being considered in the context of next CAP reform which will be discussed in the European Parliament later this year. There is an opportunity to support mitigation measures either under a 'greener' pillar one (production support) or an expanded pillar two (rural development). In both cases the key point is whether the conditions are sufficiently tight so that this results in changes in behaviour and follow-up of measures. Linking the CAP to mitigation measures could help to prevent leakage of one member state to the other. Mitigation measures that could be included under the CAP are: improved crop nutrient management practices; use of improved breeding practices; improved feeding practices; manure management measures; and uptake of anaerobic digestion.

Research

There is a significant amount of research being undertaken on greenhouse gas emissions, mitigation measures and calculation of the emissions. The outcome of the research is sometimes contra dictionary - for example, research has indicated that quality of milk was negatively impacted by feed management, while other research indicated there is no impact. More research is needed to fine-tune these results and to come to effective solutions. In addition research focuses largely on technical solutions rather than practical and cost-effective options for the reduction of on-farm levels of greenhouse gases.

General recommendations:

Related to Policy development

- Only few countries have a dedicated policy to reduce non-carbon greenhouse gases from agriculture with specific targets. On the contrary most countries - in particular in Europe - focus their attention on multiple environmental impacts of agriculture (water, biodiversity, soil...) and/or energy which provide positive side effects on NCGG emissions without

specific targets. An approach with more specific, measurable, achievable, realistic, and time-bound objectives can increase the (cost-)efficiency in this field.

- Many countries in this study explore a myriad of agricultural policy instruments to reduce emissions. In many cases their mix of policy measures is a reflection of their domestic agricultural situation as much as their governmental philosophy related to the environmental policy (regulations vs market-based approach). Further reflection on the current situation and exploration of innovative approaches towards market penetration and incentives to farmers can bring progress in this area.
- Climate Change is a global problem, which requires international collaboration. Therefore international policies and policy frameworks such as the Common Agricultural Policy offers opportunities. It can provide a framework and incentives for action at the national level.
- The reduction of methane emissions through renewable energy production offers also opportunities. This will require support through demonstration projects but might also benefit from tailor-made financial, technical, logistic and/or organizational support.
- Subsidies can be good instruments at a first stage of introducing new practices and technologies. As more farmers are involved, subsidies may not be the most cost-efficient policy. Other instruments such as covenants, Emission Trading Systems or a larger framework as the Common Agricultural Policy, could provide opportunities for the longer term. At short term there is a need to assess the costs and the emission reduction effects of current and future policy instruments that are being subsidized.
- Countries with a large share of greenhouse gases from agriculture (New Zealand, Australia...) explore emission trading and tax systems. At the same time, it is clear that market-based instruments such as emission trading systems or taxes need a more international approach, as they otherwise may interfere with market mechanisms between countries.

Related to Monitoring, Reporting and Verification

- Most countries struggle with their monitoring, reporting and verification. It is key to track the effectiveness of their policies. Several countries are working on the development of calculation tools. Sharing experience can help to develop an international solid method to monitor, report and verify emission reduction efforts.
- Modeling all bio-processes can be time-consuming. The development of practical NCGG measurement tools which can be used at farm-level can be more cost-effective. The collection of information on relevant farm practices in conjunction with National Farm Surveys offers here a window of opportunity.

Related to Farmers

- Mitigation actions will have to be followed up and sustained by most – if not all farmers, i.e. by a large number of very small businesses, in order to have a significant impact. Farmers take up new approaches more easily when there is a business case to it. Measures that increase the profitability of their farming practices that also reduce GHG emissions have the most chance to be scaled-up by business-minded farmers.

- Several countries have demonstration and pilot projects at farm level. Sharing lessons learnt across country borders can speed up the uptake of new approaches and technologies by farmers.

On Research

- There are still a lot of uncertainties about methane and nitrous oxide emissions in agriculture. Emissions in agriculture have a high degree of uncertainty as farming activities are diverse and involve highly complex and not fully understood natural soil and microbiological processes. Further research and innovation is needed. It is key to validate the findings and conclusions from research at farm-level as soon as possible through implementation at farm-level and to measure and monitor the impact.
- There is also a need for more applied research that takes into account business and farm-level aspects to come to cost-neutral or even profitable measures that result in emission reductions.
- Several countries have research and development programs that end in 2011. The result of this research will be useful in international policy roundtables like NCGG and GRA.
- There is need for international initiatives and platforms that work at the intersection of research, policy development and implementation at farm-level. Combination of GRA and NCGG networks can be one of these initiatives. Expansion of GRA and other networks from R&D and policy to agricultural business networks will also offer a cost-effective solution for climate-smart agriculture business opportunities.

About this study

- Although this survey is a quick scan, it ended as a voluminous study on national, EU and other international progress in NCGG policy. Despite the time and effort that went into drafting this survey, it remains a quick scan: many aspects were left for future in-depth research and policy facilitation towards application of R&D results by experts in their respective fields.
- From this survey it is clear that there is so much going on at the same time in all these countries that better coordination and wider exchange of information on results and practical experience would benefit the world community as a whole. It would be at the same time more time- and cost-effective.
- International meetings (like the upcoming NCGG-6 combined with GRA sessions) provide a platform for this exchange. It is recommended that these meetings are not only used for the exchange of scientific research, but also of experience on the implementation of policies and measures.

Table.1: Overview of Policy Instruments based on the survey

Country	Emission trading/Offset	Research	EU CAP referral	Accounting tools	Regulations	PPP*	Demonstration/Pilot projects	Financial Incentives
EU	–	X	NA	–	X	–	–	X
Denmark	–	–	X	–	X	–	–	X
Germany	–	–	–	–	–	–	–	X
Ireland	X	–	–	–	–	X	X	–
Netherlands	–	X	–	–	–	–	–	X
United Kingdom	–	X	X	X	–	X	X	–
Iceland	–	–	NA	–	–	–	–	–
Switzerland	–	–	NA	–	X	–	–	X
Canada	(X)	X	NA	X	–	X	X	–
US	–	–	NA	X	–	–	X	X
Australia	X	X	NA	–	–	X	X	–
New Zealand	X	X	NA	–	–	X	–	–
Japan	X	–	NA	–	–	–	–	X

*PPP: Public Private Partnership

Annex 1

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- Tel.: +31 77 465 67 67
- Email: H.J.Smit@minlnv.nl
- Website: www.minlnv.nl

11. **Country: Switzerland**

Focal Point

Federal Office for Agriculture

- Daniel Felder
- Address: Mattenhofstrasse 5, CH-3003 Bern
- Tel: +41 31 325 50 99
- Email: daniel.felder@blw.admin.ch
- Website: www.blw.admin.ch

12. **Country: United Kingdom**

Focal Point

UK Government Department for Environment, Food and Rural Affairs - Climate Change Mitigation for Agriculture and Food Chain

- Andrew McWhir
- Address: 9 Millbank c/o. Nobel House, 17 Smith Square, London SW1P 3JR
- Tel: +44 207 2381579
- Email: andrew.mcwhir@defra.gsi.gov.uk
- Website: <http://www.dfra.gsi.gov.uk>

13. **Country: United States**

Focal Point

US Environment Protection Agency -- Climate Change Division

- Tom Wirth
- Address: 1200 Pennsylvania Avenue Washington, DC 20460
- Email: Tel: +1 202 343-9313
- Email: Wirth.Tom@epamail.epa.gov
- Website: <http://www.epa.gov>

Annex 2

Overview of Policy instruments

Over 140 offices
across the following
countries worldwide

Argentina	Malaysia
Australia	Mexico
Azerbaijan	The Netherlands
Belgium	Peru
Brazil	Poland
Canada	Portugal
China	Russia
France	Singapore
Germany	South Africa
Hong Kong	Spain
Hungary	Sweden
India	Taiwan
Indonesia	Thailand
Ireland	UK
Italy	US
Japan	Vietnam
Kazakhstan	Venezuela
Korea	

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