BEACON Bridging European & Local Climate Action

NAVIGANT

adelphi

THE AGROCOVENANT IN THE NETHERLANDS

Study

On behalf of:

Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

European
Climate Initiative
EUKI

of the Federal Republic of Germany

The Agrocovenant in The Netherlands
3 September 2018
Alexander Eden (adelphi)

BMU AZ: IK II 5 – 42206-2/1.5

Project number: 200771

Contact us at BEACON_HelpDesk@navigant.com

Visit us at https://www.euki.de/beacon

The project Bridging European and Local Climate Action is financed by the European Climate Initiative (EUKI). EUKI is a project financing instrument by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). It is the overarching goal of the EUKI to foster climate cooperation within the European Union in order to mitigate greenhouse gas emissions. It does so through strengthening cross-border dialogue and cooperation as well as exchange of knowledge and experience.

On behalf of:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
of the Federal Republic of Germany

Abbreviations

BMEL	Federal Ministry of Food and Agriculture
BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
CH_4	Methane
CHP	Combined heat and power
CO_2e	Carbon dioxide equivalent
DEI	'Demonstration projects energy innovation' instrument
EIA	Energy Investment Allowance
ESD	Effort Sharing Decision
ETS	Emissions Trading System
EU	European Union
EUR	Euro
EZ	Ministry of Economic Affairs ('Ministerie van Economische Zaken')
EZK	Ministry of Economic Affairs and Climate ('Ministerie van Economische Zaken en Klimaat'), formerly EZ
GHG	Greenhouse gas
ha	Hectare
IRE	'Investments in energy saving' instrument
kg	Kilogramme
LULUCF	Land use, land-use change and forestry
MACC	Marginal abatement cost curve
MEI	'Market introduction of energy innovations' instrument
MIA	Environmental Investment Rebate
MJ	Megajoule
Mt	Million tonnes
N	Nitrogen
N_2O	Nitrous oxide
N_3	Ammonia
OECD	Organisation for Economic Cooperation and Development
P	Phosphorus
PIT	'Project implementation transition management' instrument
PJ	Petajoule
RD&D	Research, development and deployment
RVO	Netherlands Enterprise Agency ('Rijksdienst voor Ondernemend Nederland')
SDE+	'Stimulation of sustainable energy production' instrument
TPES	Total Primary Energy Supply
UAA	Utilised Agricultural Area

UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
Vamil	Arbitrary Depreciation of Environmental Investments

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 Summary

The Agrocovenant is a voluntary public-private agreement between the government of the Netherlands and a variety of agricultural sector organisations. It sets a policy framework for energy efficiency, renewable energy and greenhouse gas (GHG) emission reductions for specific agricultural sectors including agro-food industry, agro-logistics and a range of primary agro-producers.

While the Dutch agricultural sector has seen a steady reduction of GHG emissions since 1990, evaluations of the Agrocovenant cannot distinguish the impact of measures under the agreement from other broader policies related to nutrient management and milk production quotas. The impact of such an agreement in the German context is therefore difficult to estimate.

The Dutch and German agricultural sectors are comparable in their structure and production, except for a few key points. The Dutch agriculture is more energy-intensive than the German, meaning there is limited transferability potential of energy-related mitigation measures. However, several measures outlined in the Agrovovenant could drive moderate reductions of methane (CH_4) and nitrous oxide (N_2O) emissions from manure management, fertiliser optimisation and bioenergy from agricultural residues. An overall increase in productivity also has the potential to stabilise GHG emissions per unit of production.

The Dutch agri-food industry is also more export-oriented than the German. However, there are similarities in high-quality agricultural technology exports, indicating there is potential for such an agreement in Germany to engage agri-food businesses and research actors in developing innovative approaches to increasing the sustainability of the agriculture sector throughout the production chain.

While there are few technical barriers, negotiating an agreement would need to be evidence-based, and require a great deal of analytical work, for example, to establish target baselines and cost-benefit analyses, together with intensive stakeholder engagement over an extended period to build trust and establish networks. To strengthen the certainty of meaningful emissions reductions, the agreement should be set within a broader legislative framework that enables the government to implement regulatory reform including more stringent measures if necessary.

The Agrocovenant approach offers a flexible, cost-efficient and politically feasible way of achieving emission reductions in Germany by fostering activities that increase the efficiency and sustainability of the sector while also aiming at higher productivity. Cost efficiency stems from the voluntary implementation of measures in response to market forces, as farmers are encouraged to pursue measures that bring financial benefits, while simultaneously reducing emissions. The approach draws on diverse actors under a comprehensive framework that establishes common goals and objectives and would be an effective way to share information, develop good practice models and foster innovative approaches suited to the German context. However, the overall impact on GHG emission reductions are uncertain, and implementation of such a voluntary agreement should be weighed against more direct, but potentially more difficult and costly regulations. Discussions on coupling an agreement with more stringent regulations could be a part of initial negotiations, potentially forming a kind of back-stop that would be implemented if voluntary targets are not met.

2 Introduction to the instrument

The Agrocovenant ('Convenant Schone en Zuinige Agrosectoren'; 'The Clean and Efficient Agro Sectors Covenant') is a formal voluntary agreement between the government of the Netherlands and key parties in the agricultural and agro-food sectors. It was implemented in December 2008 and runs until 2020.

The Agrocovenant is a public-private cooperative partnership. Through the covenant, the Dutch government aims to create enabling conditions for the agro-sectors to develop cost-effective and innovative approaches to climate change mitigation and energy issues. The explicit role of the government is to actively reduce regulatory barriers, as well as to subsidise the research, development and deployment (RD&D) of sustainable technologies.

All the main agricultural sub-sectors are represented in the agreement: the covenant has been signed by organisations representing the food and beverage industry; the animal feed industry; agro-logistics; glasshouse horticulture; the livestock and arable farming sector; the flowers, bulbs and mushrooms sector; and the forest, nature, landscape and wood product sector. The Netherlands Enterprise Agency of the Ministry of the Economy and the Climate is the central organising government body.

The Agrocovenant outlines targets for emission reductions, energy efficiency and renewable energy production across the relevant sub-sectors up to 2020. Broad measures and approaches are outlined in the agreement. However, businesses are free to implement approaches in a flexible manner that improves their productivity and competitiveness while also reducing emissions.

3 National context

3.1 Sector context

The agricultural sector is integral to the Dutch economy: The Netherlands is one of the world's largest exporters of agricultural products, exporting around EUR 75 billion annually and employing one–tenth of the population (Polman & Michels, 2017). As an exporter of high-value products, the Netherlands ranks second in the world in income produced from agricultural exports, behind only the United States (Simpson, 2010). Area used for agriculture covered 45% of land in 2010. Although its role in the Dutch economy is shrinking due to soil exhaustion, cost changes, and restrictions on fertilisation, overall agricultural production is still increasing (Eurostat, 2012; Stoorvogel, 2009). Meanwhile, 75% of Dutch agricultural land is classified as requiring high input per hectare (ha) (regarding fertiliser inputs), compared to an average of 26% among the European Union (EU)-28 (Polman & Michels, 2017). The Netherlands also leads in non-food agricultural production of flowers and starting materials.

GHG emissions from agricultural activity (including CO_2 emissions from fossil fuel combustion) declined from 32.8 million tonnes CO_2e ($MtCO_2e$) in 1990 to 26.3 $MtCO_2e$ in 2016 (Polman et al., 2017). Combustion related CO_2 emissions in agricultural activity dropped from 7.7 $MtCO_2$ in 1990 to 7.2 $MtCO_2$ in 2015 largely due to a decrease in gas consumption for stationary combustion (Government of the Netherlands, 2018b; Polman et al., 2017). In this same period, nitrous oxide (N_2O) emissions dropped by 38% (from 10.2 $MtCO_2e$ to 6 $MtCO_2e$) and methane (CH_4) emissions dropped by 13% (14.7 $MtCO_2e$ to 12.8 $MtCO_2e$), largely from strict manure policies that decreased pork production (Government of the Netherlands, 2018b). However, since 2014, N_2O and CH_4 emissions have increased by 3.2%, due in part to the retirement of EU milk quotas (more cows) and increased application of manure and synthetic fertilisers (EZK, 2018; RIVM, 2018). Generally, nitrogen fertiliser use has been decreasing over the past decade, but it still remains higher than the OECD average (OECD, 2015). The decrease in CH_4 emissions from agriculture has also largely been neutralised by an increase in leakage of unburnt methane during combined heat and power (CHP) cogeneration (termed methane slip), which provides heat for glasshouses (Polman & Michels, 2017).

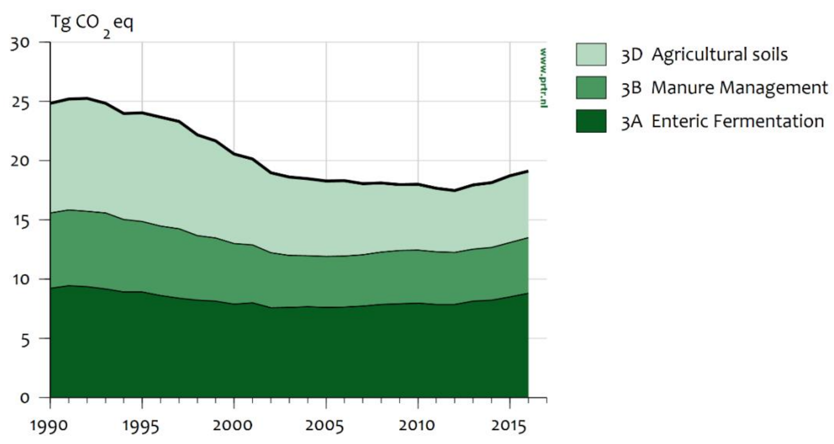

Figure 1: Agriculture – trend and emission levels of source categories (Dutch National Inventory Report (RIVM, 2018)
The Netherlands reports emissions from the agricultural sector based on four source categories: agricultural soils,

which contribute to N_2O emissions; manure management, which contributes to CH_4 and N_2O emissions; and enteric fermentation, which contributes to CH_4 emissions. The graph does not include CO_2 emissions from combustion.

A large source of emissions related to the agricultural value chain – but not attributed directly to the agricultural sector – is heat generation used to warm glasshouses, which represents 85% of the agricultural sector's energy consumption (EZK, 2017; Polman & Michels, 2017). In 2015, energy consumption by this process had decreased 17% below 2010 levels largely because of a decrease in glasshouse cultivated area, and is projected to continue falling as innovative greenhouse technologies are developed (EZK, 2017). The Dutch electricity sector is notable for its large share of CHP plants, which, alongside boilers, provide a majority of the heat required by glasshouses (EZK, 2017). As of 2017, 91% of energy used by the agricultural sector came from natural gas (EZK, 2017), either through CHP or used for heating or electricity alone. The use of biomass boilers and geothermal sources has increased to 8% of this energy share, and is projected to increase to 12% by 2020 (EZK, 2017). Electricity production from CHP generators may also feed into the national electricity grid, and accounts for 9% of national electricity consumption (EZK, 2017).

3.2 National climate policy

The main climate and energy policy framework in the Netherlands is the 'Clean and Efficient Work Programme' ('Nieuwe energie voor het klimaat, werkprogramma Schoon en Zuinig', 2007), which in 2007 established national targets of 30% reduction in GHG emissions from 1990 levels and 20% renewables by 2020 (OECD, 2015). However, in 2010, the Dutch government relaxed these ambitions down to the EU level: By 2020, the Netherlands aims to reduce emissions inside and outside the EU Emission Trading System (ETS) by 21% and 16% compared to 2005 levels, respectively (OECD, 2015). More recently, the Dutch government implemented the Energy Agreement for Sustainable Growth ('Energieakkoord', 2013) which calls for 14% sustainable energy by 2020 (SER, 2013), However, they are currently not on track to meet this target, with overall GHG emission reductions of only 12.4% below 1990 levels realised by 2016, making it unlikely that the 2020 targets will be met (RIVM, 2018). However, the Dutch Cabinet was one of the members to advocate for the EU to raise its commitment to at least a 40% overall reduction below 1990 emissions levels (Government of the Netherlands, 2016).

More recently, in July 2018, the Dutch government has proposed an ambitious climate change law that mandates 49% reduction in GHG emissions (relative to 1990 levels) by 2030 and a 95% reduction by 2050; carbon-neutral electricity by 2050 and a complete coal phase-out by 2030; and an update of climate plans every five years (Groen Links, 2018). This puts the Netherlands in the upper range of European countries' ambition. The targets are particularly ambitious given that coal still plays an important role in Dutch energy supply, unlike for other European climate leaders such as Sweden, France and the United Kingdom. Decarbonisation of the energy system — and particularly the coal exit — is expected to be the major source of emission reductions in the near-term for the Netherlands (EZK, 2017).

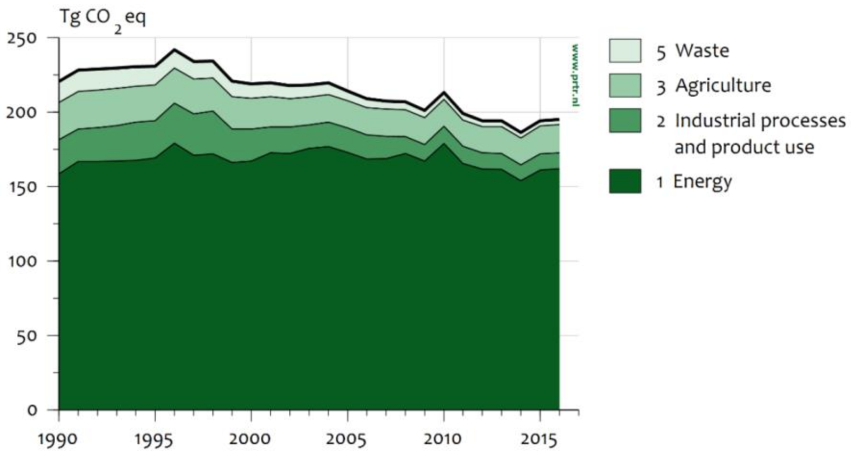

Figure 2: Aggregated GHGs — trend and emissions levels of sectors (excl. LULUCF), 1990-2016 (from Dutch National Inventory Report; (RIVM, 2018))

The energy sector, including all combustion of fossil fuels (e.g. for electricity, mobility and heat), is the largest contributor to GHG emissions in the Netherlands and was responsible for 80% of GHG emissions in 2016 (RIVM, 2018). This sector's emissions actually increased by 2% between 1990 and 2016 due in part to increased coal use. Heat is mainly provided by natural gas-powered CHP plants, while renewables (biomass) provide a small share.

The carbon intensity of the energy sector has been decreasing, but the Netherlands still has the fifth highest fossil fuel share of its energy mix of all OECD countries (OECD, 2015), with natural gas, coal, and oil accounting for 39%, 38%, and 15% of Total Primary Energy Supply (TPES), respectively. This is compared to Germany's TPES of 23% natural gas, 24% coal, and 32% oil (EZK, 2017; IEA, 2017). The relatively high carbon intensity of Dutch energy supply provides a rationale to also emphasise energy efficiency and fuel switching to lower-carbon fuels in agricultural activities where energy is an important input.

4 General description of the policy instrument

4.1 History

In the late 1990s, concerns about fossil energy security and climate change led policymakers in the Netherlands to adopt a transition approach for sustainable energy, mobility, agriculture and natural resource use. The Dutch energy transition process officially started in 2002 with the project implementation transition management (PIT) of the Ministry of Economic Affairs (Ministerie van Economische Zaken - EZ).

The Dutch approach was considered novel and innovative because of its focus on transformative change, its emphasis on bottom-up cooperative processes and the full engagement of business leaders and other non-state actors from science and civil society. It involves both private and public investors and the initial use of strategic learning projects (called transition experiments). It is intended to generate a portfolio of options and potential pathways that give emphasis to system innovation, with both the technology and policies developing over time.

In 2004–2005, four platforms were established, including the Platform for Green Resources. The EZ took the initiative and persuaded business leaders to join the platforms, together with experts and civil society groups. The platforms were tasked with providing advice on potential pathways, policies and technologies for the transition. The recommendations and transition paths put forward by the Platform Green Resources were then taken up by the new Dutch government of 2007 in the 'Government vision on the bio-based economy in the energy transition' ('De overheidsvisie op de bio-based economy in de energietransitie'). The no-regret policy agenda of the Platform Green Resources formed the basis for the options outlined in the Agrocovenant and are included in the text of the agreement.

The newly elected Dutch government of 2007 also set climate targets for 2020 in their coalition agreement. Public concerns about climate change led the new government to set ambitious targets for emissions reductions, as much as 30% less GHG emissions in 2020 compared to 1990. The level of ambition is shown by the fact that most EU Member States had set targets of no more than 20% reduction by 2020.

In September of 2007, as part of the traditional 'Prince's Day' speech, the climate goals of the new government were elaborated in the 'New Energy for the Climate, Clean and Efficient Work Programme' (Nieuwe Energie voor het Klimaat, Werkprogramma Schoon en Zuinig). The work programme outlined how the various sectors such as housing, industry, transport and also agriculture should contribute to the climate target, and also established the approach: There were to be no laws, but rather 'voluntary mandatory' agreements. The government thereby opted for cooperation with the main stakeholders (government, citizens and businesses) rather than regulation, to realise the work plan objectives. In 2008, agreements were then concluded with the major economic sectors, such as the built environment, agri-sectors, industry, transport, and energy. These agreements are referred to as covenants: although they are voluntary agreements, they are signed by both government and private actors, and are therefore not without obligation for participating parties.

The covenant approach fits both the cooperative approach of the Dutch energy transition and the 'Polder Model' of consensus decision making that has long been a cornerstone of Dutch politics and society. The approach has historical roots in the 17th century, where parcels of land (polders) were reclaimed from the sea, and all parties needed to cooperate to maintain the expensive system of dykes and windmills that kept the land from being swamped, even if at times they were at war with each other. In modern times, the approach is characterised by tri-partite cooperation between private sector industry bodies, labour unions and governments of different levels.

4.2 Legal basis

The Agrocovenant takes the form of a formal agreement between all parties, in particular between the central government and representatives of the different agro-sub-sectors. Umbrella organisations that represent groups of individuals and firms, as well as individual companies, can subscribe to the covenant through a written process and formal signing. An acceding party must accept the obligations arising from the covenant.

The text of the Agrocovenant defines the different agro-sectors and outlines the approaches, measures and instruments to be applied in each sector. Each sector is expected to take cost-effective measures that contribute to emission reductions on a voluntary basis. It does not establish any specific laws and regulations, and where appropriate, it refers to existing laws and agreements. This means here are no immediate 'external' legal consequences for non-compliance. The Agrocovenant specifies that, in case parties do not meet their obligations, dispute resolution should first take the form of consultation among the parties.

The main obligations exist between the central government and the organisations/companies of the various agro-sectors. The text of the covenant states that different sectors are only responsible for their own sector-specific targets and obligations. Furthermore, parties from the agro-sectors can terminate their participation when they choose, after a process of consultation.

4.3 Functioning

The Agrocovenant frames the agricultural sector from an integrated economic perspective that takes into account not just primary agricultural production but also value chain integration, including the associated logistical transport networks, the agro-industrial producers, and the streams of materials and energy that connect them via production chains and material flows. This approach is designed to bring all the relevant actors on board, as well as to find potential synergies and interlinkages between the sub-sectors. For example, crops may be grown using synthetically produced fertilisers, which are then transported across the country and processed into animal feed for livestock, which are in turn processed into a range of food and non-food products, with production waste and manure used to produce energy together with residues from the timber industry. At each stage, there is potential to find interlinkages that can gain energy efficiency; produce and consume renewable energy; and reduce emissions.

The covenant is a public-private cooperative partnership. Through the Agrocovenant, the Dutch government aims to create enabling conditions for the agro-sectors to develop cost-effective and innovative approaches, also through knowledge exchange between actors. The explicit role of the government is to actively reduce regulatory and other barriers, as well as to subsidise the research, development and deployment (RD&D) of sustainable technologies. The Ministry of Economic Affairs (EZ) functions as a hub between the parties to the covenant via the Netherlands Enterprise Agency ('Rijksdienst voor Ondernemend Nederland', RVO).

As agreed in the Agrocovenant, a committee was formed for each agro-sector, in which both the government and sector associations participate, which outlines the specific measures and approaches the sector will take to contribute to the policy targets. Each year, via the committee, the government and agro-sector parties draw up an annual work programme, which elaborates the sub-sectoral approaches written in the covenant. The covenant also obliges annual monitoring and evaluation to be undertaken, to evaluate whether objectives are being met and to decide on any adjustments, which are then recorded in the annual work programmes.

The overall targets, established by the government's Clean and Efficient Work Programme, are at least 30% fewer GHG emissions in 2020 than in 1990, as well as a share of 20% renewable energy in 2020 and an energy saving rate of 2% per year. In order to meet these targets, or go beyond them, the Agrocovenant stipulates separate emission reductions, energy saving and renewable energy targets for each agro-sector. It should be noted that although the policy was formulated for the period 2008–2020, targets are based on 1990 levels, the implications of which are discussed in section 5.1.

The Agrocovenant establishes several overarching and cross-sectoral approaches:

- Energy efficiency and energy savings measures are a cornerstone of approaches across all agro-sectors that target reductions in energy-related CO_2 emissions.
- Agro-logistics: transport optimisation of material flows between all sectors with targets for reducing 'road kilometres'.
- Renewable energy is promoted across several of the agro-sectors and includes on-farm decentralised wind and solar energy, as well as the use of various forms of biomass energy from agro-industrial waste, manure and woody biomass.
- Reduction of non-CO_2 GHG: this mainly applies to the livestock and arable farming agro-sectors where CH_4, N_2O and N_3 emissions (the majority of agricultural emissions) result from enteric fermentation, fertiliser use and manure management.

The Agrocovenant also frames the approaches for each agro-sector:

- Agro-food industry: production of food and non-food products including animal feed; approaches focus on energy efficiency, the use of residual flows and by-products for bioenergy and other innovative 'bio-based economy' applications1;
- Glasshouse horticulture: a major economic sector with high energy use for heating and lighting. Approaches focus on energy efficiency and renewable energy use;
- Livestock and arable farming: the sectors are interlinked, yet approaches are distinct for three sub-sectors:
    - Intensive farming of livestock for meat (mainly pork and chicken): energy efficiency and manure management for fertiliser and bioenergy;

[1] The covenant directly refers to the 'Government vision on the bio-based economy in the energy transition'. In particular, the 'cascading' principle is emphasised, whereby materials, wastes and residues of all agro-sectors should be used first for their most value-added purpose before finally becoming feedstocks for bio-energy.

  - Dairy farming: manure management for fertiliser and bioenergy; optimisation of fertiliser and manure application; animal feed practices and additives to reduce CH_4 emissions from enteric fermentation;
  - Arable crops on open fields: optimisation of fertiliser and manure application, use of residual flows for bioenergy, on-farm wind energy;
- *Flowers, flower bulbs and mushrooms:* focus on energy efficiency and the use of renewable energy;
- *Forest, nature, landscape and wood product sector:* focus mainly on the supply of woody biomass and residues for bioenergy in a sustainable manner.

The government uses a broad array of existing publicly funded instruments to support businesses engaged in the Agrocovenant. Various research and development (R&D) support programmes, subsidy programmes and fiscal instruments are available. These include both agro-industry specific and generic instruments and are mainly managed by RVO. The main instruments are outlined here:

- 'Topsector Agri&Food' and the 'Topsector Horticulture & Starting Materials' programmes provide knowledge sharing and R&D investment in the agri-food and horticulture sectors (Topsector Agri&Food, 2018);
- 'Demonstration Projects Energy Innovation' (DEI) provides financing for investment in innovative technologies that conserve energy or generate renewable energy (Netherlands Enterprise Agency RVO, 2018a);
- 'Investments in Energy Saving' (IRE) and 'Market Introduction of Energy Innovations' (MEI) offer subsidies to promote energy efficiency in glasshouse horticulture (Netherlands Enterprise Agency RVO, 2018c);
- 'Stimulation of Sustainable Energy Production' (SDE+) is an operating grant, whereby producers receive financial compensation for the renewable energy they generate (Netherlands Enterprise Agency RVO, 2018e);
- 'Energy Investment Allowance' (EIA) is a fiscal instrument enabling companies that invest in energy efficient technology to pay less income tax or company tax (Netherlands Enterprise Agency RVO, 2018b);
- 'Environmental Investment Rebate' (MIA) and 'Arbitrary Depreciation of Environmental Investments' (Vamil) are fiscal instruments that allow tax deductions for environmentally friendly investments (Netherlands Enterprise Agency RVO, 2018d).

4.4 Interlinkages with other policy instruments

The main emission reductions approaches of the Agrocovenant target energy efficiency and renewable energy promotion, which achieve CO_2 emissions reductions by reducing or substituting fossil-based energy. These approaches overlap with emission reductions in the energy and transport sectors, as well as the buildings sector, which are at least partly covered by the EU ETS. Generally, medium-scale heat and power, as is typically used in the Dutch glasshouse horticultural sector, are covered by the EU ETS[2]. Transport fuels and small-scale heat generation from municipal gas supplies are allocated to sectors under the Effort Sharing Decision (ESD) but are

[2] Whether energy efficiency and renewable energy substitution of fossil-based heat and power contributes to emission reductions in the EU depends on assumptions about the EU ETS as discussed in section 2.3 of the Policy Paper.

rather accounted for outside of the agricultural sector. Furthermore, GHG emission sinks and sources in the forestry sector fall neither under the EU ETS nor the ESD. Therefore, given the overall project focus on policies incentivising emission reductions in the ESD sector, many of the approaches of the Agrocovenant fall outside of the scope of this study, and will thus not be the main focus of the analysis.

The majority of emissions from the Dutch agricultural sector are related to CH_4 and N_2O emissions from manure management, fertiliser use and enteric fermentation from dairy cattle. The Agrocovenant also outlines targets and approaches to reduce these emissions. There are, however, other national environmental policies focused on limiting the impacts of agricultural nutrients such as nitrogen (N) and phosphorus (P) which also inadvertently drive GHG emission reductions in the livestock and arable farming agro-sectors and thereby support the objectives of the Agrocovenant. This includes the following policies (Grinsven & Bleeker, 2017).

Dutch manure and fertiliser act (since 1991): The core of the Act is a system of soil and crop specific application standards for N and P. It sets quality standards for fertilisers, application standards and restrictions for the use of manure as fertiliser, requirements for storage, transportation and distribution, and restrictions on production and application.

Ammonia policies (since 1991): aim to reduce air pollution and atmospheric deposition of N_3 (mainly from the management and application of manure and other fertiliser), which apart from being toxic is also a precursor to GHG emissions.

Milk quota system (from 1984 until April 2015): Although it is not a nutrient policy, it limits manure production as well as CH_4 emissions from dairy cattle indirectly by reducing cattle numbers. Since the milk quota has been removed, the number of dairy cattle has increased, affecting both nutrient loads and GHG emissions (see Figure 1).

Dutch nutrient policies have generally been implemented and adapted over time in response to a range of European environmental directives:

- the Nitrates Directive introduced in 1991 to reduce nitrate emissions from agriculture;
- the Water Framework Directive introduced in 2000 with the aim of improving the ecological status of waterways;
- the National Emission Ceilings Directive introduced in 2001 to reduce ammonia emissions.

Ongoing discussions between the Dutch government and the European Parliament regarding the Netherland's official derogation from the Nitrates Directive, in light of repeated breaches of manure application limits as well as fraudulent manure and livestock accounting practices, will likely continue to influence Dutch nutrient policy and thereby indirectly impact GHG emissions from the Dutch agricultural sector in the coming years.[3]

[3] In December 2017, the European Commission allowed the Netherlands to establish a phosphate rights trading system (European Commission, 2017) designed to limit the amount of manure spread on farms, and therefore indirectly limit the number of animals. Considering this regulation, together with other measures taken by the Dutch government, the European Commission has further granted the Netherlands a temporary derogation from the Nitrates Directive until 2019 (ESPP, 2018; European Commission, 2018), which is shorter than the Dutch requested period to 2021. With the derogation, Dutch farms can continue to apply up to 250 kgN/ha on grassland, instead of the 170 kgN/ha limit determined by the Nitrates Directive.

5 Impacts of the policy instrument

5.1 Effectiveness

In 2014, six years after the Agrocovenant came into effect, an official evaluation was published by RVO in collaboration with all parties. The evaluation outlines the progress made towards the energy saving, renewable energy and GHG emission reduction targets of the covenant, and provides an overview of the measures so far implemented and under development (Moerkerken et al, 2014). According to the Netherlands National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) (EZK, 2018), the Agrocovenant was due to be re-evaluated in 2015, including a re-assessment of its objectives, and a new document was expected to be published in 2018. However, this document has not yet been produced.

The following Table 1, based on the 2014 evaluation, shows overall progress on the targets outlined in the Agrocovenant. It should be noted that the main targets are related to renewable energy and energy efficiency. Emission reductions from the substitution of fossil fuels by renewable energy are not included in the assessment. Agro-sectors that have explicit GHG emission reduction targets and track emission reductions are glasshouse horticulture and the sub-sectors of the livestock and arable farming sectors: dairy, pigs, poultry, veal and crops. Emissions from glasshouse horticulture are mainly CO_2 from energy use, as well as CH_4 emitted during the use of natural gas in CHP generators (termed methane slip). Emissions of non-CO_2 gases are primarily CH_4 from enteric fermentation primarily in the dairy sector, N_2O emissions from soils, and both CH_4 and N_2O emissions from manure management and use (see Table 2).

Table 1: Targets and results of the Agrocovenant (Moerkerken et al. 2014)

Sector and theme	Target 2020	Situation in 2012
Energy saving		
Efficiency improvement, all sectors	>2% per year	2.9% per year realised (average 1990-2012)
Renewable energy		
Biomass supply: agro-food industry	75–125 PJ	11.5 PJ
Biomass supply: forest and timber sector	32 PJ	27.4 PJ
Biogas supply: livestock and arable farming sectors	48 PJ*	5.5 PJ
Glasshouse horticulture sector	25 PJ	1.2 PJ
Poultry sector	2 PJ	1.3 PJ
Wind energy		

Livestock and arable farming sectors	12 PJ**	11.2 PJ
Greenhouse gases		
CO_2: Glasshouse horticulture	Reduction 3.3 Mt (1990–2020) Maximum 6.2 Mt in 2020	3.3 Mt reduction (1990–2012) 7.2 Mt emission in 2012
Others (CH_4 and N_2O): Livestock and arable farming	Reduction 4–6 Mt (1990–2020) Maximum 16.0 Mt in 2020	5.6 Mt reduction (1990–2012) 16.9 Mt emissions in 2012

* Target corresponds to approximately 1.5 billion m³ of natural gas (ca. 3% of current Dutch natural gas consumption)

** Target corresponds to 3.5 billion kWh per year from wind turbines on agricultural land

Table 2: Other GHG covered under the Agrocovenant (Dutch emissions register, published in Moerkerken et al. 2014)[4]

Other GHG emissions (CH_4 and N_2O)	$MtCO_2e$ 1990	$MtCO_2e$ 2012	Percentage change
Animals	***Subtotal – 7.7***	***Subtotal – 6.6***	
Enteric fermentation - CH_4 (ca. 70% dairy cattle)	7.7	6.6	-14.3%
Manure	***Subtotal – 5.0***	***Subtotal – 4.7***	
Stables and manure storage - CH_4	3.0	2.6	-12.7%
Manure storage - N_2O	1.2	1.0	-11.0%
Use of manure - N_2O	0.8	1.1	+30.6%
Soil and crops	***Subtotal – 9.3***	***Subtotal – 4.5***	
Cattle grazing - N_2O	5.8	2.5	-57.5%
Crops -N_2O	0.6	0.5	-6.4%

[4] The historical emissions data provided here differ from those of the latest emissions reports (see section **Error! Reference source not found.** and Figure 1). The Dutch Emissions Register (Government of the Netherlands, 2018b) notes that emissions data has been updated retroactively due to changing methodologies and new information. The trend of reductions until 2012 remains consistent.

Other GHG emissions (CH_4 and N_2O)	$MtCO_2e$ 1990	$MtCO_2e$ 2012	Percentage change
Indirect ammonia deposition – N_2O	3.5	1.5	-56.5%
Other	***Subtotal – 0.0***	***Subtotal – 1.0***	
Methane slip from CHP in glasshouse sector – CH_4	0	1.0	
Total other GHG	**22.5**	**16.9**	**-25.5%**

An initial view of the results is promising: Many of the agro-sectors are on track to meet their renewable energy and energy efficiency targets, with notable exceptions for glasshouse horticulture and biomass supply from agro-industry, livestock and arable farming. Glasshouse horticulture is considered to be on track due to large investment in geothermal energy projects for the sector that were still to be completed at the time of the evaluation[5]. Biomass supply from the livestock and arable farming sectors and the agro-industry sector are far from target. The evaluation identifies two main issues with these sectors – there are already more valuable uses for agro-industry biomass and it is difficult to make the business case for bioenergy from manure (Moerkerken et al. 2014).

The results also show a reduction of GHG emissions of more than 25%, mainly from the notoriously 'hard-to-tackle' agricultural sources of CH_4 from enteric fermentation and N_2O from soils and crops. However, a closer look at the evaluation shows that, at the time of the evaluation, **very little, if any, of these emission reductions can be attributed to the Agrocovenant**. This can be seen by looking at the baseline for the emission reduction (1990) and the development of emissions up until the Agrocovenant was established (2008), which show that the majority of reductions resulted from nutrient policies (see section 4.4) and the EU milk quota policy, as well as a steady increase in productivity, and fluctuations in the global price of agricultural commodities. Furthermore, methodologies for calculating the emission reductions of specific measures taken under the Agrocovenant are not provided. The evaluation does, however, examine in depth some of the approaches taken, as well as other factors that have influenced the outcomes of the Agrocovenant, which are summarised below.

Impressive energy efficiency figures have been demonstrated in the glasshouse horticulture sector. While part of this can be attributed to energy efficiency measures promoted by the Agrocovenant, a large part is due to the deregulation of the electricity market in 2005 and the resulting boom in CHP application. This meant that natural gas for heating glasshouses could be also used to generate electricity, which could then be used both on site or sold into the electricity grid.

Developments in the **cultivation of crops for animal feed** have resulted in yield increases and increasing efficiency in the use of fertilisers including manure. This has resulted in greater productivity, being an increase in yield with the same or lower nutrient input and N_2O emissions from soils. However, it is unclear how much of

[5] The evaluation indicates that more than EUR 1 billion was invested from the SDE+ mechanism in geothermal energy projects in the glasshouse sector in 2008–2012, with 15–20 PJ of energy from these projects still to be realised at the time of this report.

this effect is due to the Agrocovenant as compared to other nutrient policies. Another approach that was originally proposed in the Agrocovenant was advanced technology for the precision application of fertiliser. This technology had not yet been implemented at the time of the evaluation, but was recently the subject of a pilot research progamme.[6]

One area in which the Agrocovenant has been effective is the **promotion of biogas production** via methanisation of manure in co-digestion plants. In 2012, 5.5 PJ of biogas was supplied by 99 manure digesters, increasing from around just 0.5 PJ in 2006. Approximately 1.4% of all manure from livestock farming was fermented in 2011. However, although methanisation expanded quickly until around 2010, it then stagnated. This is likely due to the economic barriers identified in a supporting study (Peene, Velghe, & Wierinck, 2013). These include increasing prices for biomass feedstocks due to broader demand, as well as limited options to market the co-products (digestate) as fertiliser. As a result, operators often changed feedstock mixes leading to malfunctions, and plants have not been running at full capacity, affecting their profitability.

The original Agrocovenant outlines concrete approaches to **reducing CH_4 emissions from enteric fermentation in the dairy sector**, in particular changes in cattle feed and the use of feed-additives. It is not surprising that these measures have not been implemented; a technological solution to enteric fermentation emissions is considered a ‘magic bullet’ and is beset with fundamental challenges related to animal health, milk quality, productivity and price. Several approaches are currently the subject of R&D around the world[7]. However, the Agrocovenant effectively initiated this research in the Netherlands through cooperation between the agro-food industry, the dairy sector, and the government. It now stands to place Dutch nutritional firms, such as Royal DSM, at the forefront of this innovative technology. According to DSM, they have developed a synthetic feed additive that can reduce CH_4 emissions by 30% in intensive farming systems, which is now being developed for commercial production (DSM, 2018).

Aside from immediately reducing emissions, the Agrocovenant has been very effective in engaging private actors from the agro-industry and farming sectors in the interrelated issues of climate, energy and sustainability of food production, including manure and mineral issues, animal welfare and health. The Dutch agricultural sector is characterised by many small companies and entrepreneurs that are typically hard to reach individually. The working groups of the covenant have successfully brought together a wide range of actors in a spirit of cooperation. It has framed the issues with clear goals and approaches and built up awareness of the starting situation. Information has been disseminated and communication networks have been established. Expertise has also been developed across themes and sectors and demonstration projects have been implemented. The Agrocovenant has thereby built up knowledge and expertise that can improve prospects for innovation, competitiveness and productivity, as well as future emission reductions.

5.2 Cost efficiency

The approach of the Agrocovenant to support voluntary measures (rather than command-and-control regulations) means that businesses and farmers have the flexibility to decide which measures to implement

[6] A pilot programme for precision agriculture using innovative technologies such as GPS data and drones was implemented in 2017 (Government of the Netherlands, 2017).

[7] Approaches include cattle feed changes and additives, selective breeding for low-emission cattle and a methane inhibiting ‘vaccine’.

based on their own assessment and market factors. In principle, this should result in overall cost-effective mitigation.

No specific cost-benefit analysis of the Agrocovenant was done as part of the evaluation. However a supporting study focusing on the Dutch dairy sector has provided a cost-benefit analysis and marginal abatement cost curve (MACC) of climate change mitigation options based on modeling, surveys of farmers and expert opinions (Pol-Dasselaar et al., 2013). These results give an indication of mitigation options, estimates of the mitigation potential (approximately 1–2 MtCO_2e using proven approaches), and estimates of their net costs.

The results indicate that there are very few options that provide clear net benefits. However, many options, making up around 60% of the abatement potential, are relatively cost-effective (within +/- EUR 100/tCO_2e); these options mainly relate to the optimisation of animal feed and cropping cycles that can increase productivity per nutrient and energy input (and therefore per tCO_2e), as well as on-farm energy efficiency measures, and wind and solar energy applications. Table 3 outlines the most cost-effective potential measures for reducing non-CO_2 GHG emissions.

Table 3: Relatively cost-effective measures to reduce GHG emissions in the Dutch dairy sector (Pol-Dasselaar et al. (2013))

Animal management	Manure management	Soil and crop	Feed/Other
More milk per cow through productivity gains Fewer young stock per 10 dairy cows (from 8 to 7)	Spreading less fertiliser per ha of grassland Manure processing and separation Change manure storage Apply spring fertiliser	Overseed instead of resowing Increase maize cover Heavier cut during harvest Apply grass clover	Replace concentrated feed with grain or corn Change the composition of feed or use additives Greater use of by-products

The measures with considerable net costs, making up around 40% of the abatement potential, include many of the manure management and fertiliser application options. In particular, the co-digestion of manure in methanisation plants is considered costly (at around EUR 700/tCO_2e). It should be noted that the cost-benefit analysis deals only with the Dutch dairy sector; the cost profile is likely to be different for other sectors such as pigs and poultry.

As the Agrocovenant is a non-regulatory instrument, it stands to reason that the most cost-effective measures will be favoured and implemented first, particularly if these measures also improve productivity and competitiveness for the individual firms. The cost-benefit analysis of the Dutch dairy sector gives an indication of which measures are likely to be voluntarily taken up by dairy farmers, and which measures would require financial incentives (such as start-up subsidies) or eventually regulation.

5.3 Co-benefits and side-effects

The aims of the Agrocovenant are not just focused on GHG emission reductions, but primarily on energy efficiency and renewable energy. Thus, aside from the climate benefits there are also co-benefits associated with energy efficiency that relate to improving the competitiveness of the agro-sectors through lowering energy costs and improving transport logistics. Renewable energy and energy savings can also make a small contribution to national energy security.

Similarly, when implementing measures to reduce N_2O emissions from the livestock and arable farming sectors, nutrient efficiency can be improved, also lowering costs per unit of production. Optimisation of fertiliser inputs can also result in reduced CH_4 air pollution and less offensive odours.

Potentially the largest co-benefit of the Agrocovenant is the promotion of sustainable economic development and diversification in the agro-sectors. The approach is rooted in the primary productive sectors, and it has the potential to drive rural development through improving business models, greater efficiency and productivity, diversifying economic activities, and over the longer term through the development of innovative technology. These developments can also increase the competitiveness of Dutch agro-products on the global market. In particular, biomass (including crop residues and manure) is considered to have major potential for farmers to generate alternative income streams, both through renewable energy and new value-added co-products, such as improved natural fertilisers from manure.

However, these co-benefits may in many cases actually represent trade-offs with broader sustainability objectives, particularly when reducing costs is a factor. For example, high demand for biomass can lead to pressures on natural landscapes as well as conflicts with food production. Here, the Agrocovenant take care to frame biomass demand as being dependent on sustainability criteria and secondary to food production, emphasising the cascading principle and prioritising residual flows. However, this limits the cost-effectiveness and growth capacity of biomass energy. A second example is improving animal welfare, which can mean larger area, greater energy needs, and thereby lead to more emissions.

5.4 Success factors and challenges

Over the twelve-year timeframe of the Agrocovenant, a basic objective is to support innovative approaches through funding of demonstration projects and R&D efforts. Measures are developed through cross-sectoral cooperation in an iterative approach together with the government. The aim is to discover and develop new approaches in a bottom-up manner that are both effective and workable. This means that many measures are still likely in the development stage, and their effect on emissions, their cost-effectiveness and the co-benefits are not yet realised. However, over time, the most promising of these new approaches may be fruitful. Thus, while clear emission reduction benefits have not yet been demonstrated, the Agrocovenant may still be effective in finding ways to reduce 'hard-to-tackle' emissions in the future.

The approach of the Agrocovenant needs to be viewed in the context of the main partners (being agro-industry actors and the Ministry for the Economy) and their objectives. The Netherlands is a major exporter of agri-food products and in this context the lifecycle emissions, together with broader sustainability criteria of specific products or groups of products, are considered paramount. The main focus of the Agrocovenent and subsequent communications is therefore framed relative to unit of output (e.g. CO_2e/kg of milk produced; emission intensity) in comparison with other countries. This puts an emphasis on increasing productivity, so that more can be produced with the same inputs and the same GHG emissions. However, the methodology used makes it difficult to assess the absolute emission reductions from particular measures given that it is unclear how incentivised efficiency gains (lowering emission intensity) affect overall competitiveness and, consequently, production levels in the Netherlands[8]. Furthermore, this framing does not fit the perspective of national, sectoral or GHG specific approaches to measurement (typically followed by the EU and UNFCCC), because the agricultural production chain is interlinked with the energy, transport, land use and industrial sectors.

As the approach is voluntary, it can be assumed that approaches will be chosen that have overall benefits for businesses. It is the market that thereby determines which measures are implemented and it is expected that emissions will decline as a result of innovation, improved productivity and competitiveness. This approach has the advantage of maximising the cost-effectiveness of the measures, as businesses have the flexibility to decide what options are best for them. However, to be effective, the Agrocovenant approach requires a great deal of trust between the government and industry. This meets major challenges if targets become difficult to reach within a given timeframe. Once the 'easy' options have been implemented, there is little incentive for businesses to go further. The approach does not provide a price signal for GHG emission reductions, so businesses cannot realise gains solely from emission abatement activities. Furthermore, there are no regulatory mechanisms in the Agrocovenant that could oblige all parties to undertake certain measures. More stringent regulations may eventually be necessary, but their implementation may risk a break in trust between the parties.

As part of the Agrocovenant agreement, the government is obliged to consult with agro-sector representatives in developing a suitable and enabling regulatory framework. This ensures that industry is consulted before regulations are altered or introduced in a fair and transparent manner. While the threat of regulation is not a part of the formal agreement, an OECD analysis (Ignaciuk & Boonstra, 2017) clearly finds that if the private sector fails to reach the agreed targets, the Agrocovenant can enable the government to enact more stringent regulatory measures. The following example of this has been highlighted in an analysis by the OECD (Ignaciuk & Boonstra, 2017): The authors find that after the removal of the milk quota from 2015, growth in the dairy sector has resulted in increased emissions of CH_4 and N_2O from more dairy cattle, which threatens the Agrocovenant targets for GHG emissions in the livestock and arable farming sectors. It has also increased N and P deposition to levels that breach nutrient limits imposed by Dutch and EU policy. Considering both the GHG targets of the Agrocovenant and other nutrient policies, the Dutch government has decided to implement stricter nutrient regulations (e.g., tradable P rights) that will effectively limit dairy cattle numbers and thereby reduce GHG emissions. However, it is unclear to what degree the Agrocovenant targets have influenced these negotiations, as it is one policy factor among many.

[8] For example, it could be the case that efficiency gains that reduce emission intensity also make the Netherlands more competitive for agricultural production, raising production levels and Dutch emissions while still reducing global emissions. This is a form of reverse carbon leakage, which makes examining absolute emissions trends an incomplete measure of policy success.

6 Transferability

6.1 General comparability of the context

There are broad similarities in the economic, institutional and political contexts of the agricultural sectors between the Netherlands and Germany, which indicate a general transferability of the Dutch Agrocovenant approach to the German context. However, there are also some specific characteristics of the Dutch agricultural sector that are different. In particular, the importance of the Dutch agri-food industry in the overall economy, the high level of export-oriented production, and the dominance of glasshouse horticulture are points of difference between the Netherlands and Germany.

In absolute terms, the agricultural sector is much larger in Germany that has a total utilised agricultural area (UAA) of 16.7 million ha in 2013, compared to the Netherlands with 1.8 million ha. In relative terms, a larger share of land area is under agricultural cultivation in the Netherlands (55% in the Netherlands and 47% in Germany). There are many more farms in Germany, with 285,000 agricultural holdings compared to 67,000 in the Netherlands. Also, the average farm size is much larger in Germany (57 ha) compared to the Netherlands (27 ha). Despite the difference in overall scale (around nine times greater UAA in Germany), the standardised agricultural output in Germany was only 2.4 times greater (EUR 47 billion in 2013 compared to the Netherlands EUR 20 billion) (Eurostat, 2018). This indicates that the Dutch agricultural sector is more intensive and/or productive. It also plays a relatively greater role in the economy: in the Netherlands, the primary and secondary agricultural sectors (basic and processed agricultural products) contributed 1.9% to GDP in 2016, whereas they accounted for just 0.6% in Germany (World Bank, 2018).

The Dutch agricultural sector, as well as the broader agri-food industry, plays a much greater role in international trade in the Netherlands than it does in Germany. Despite its small size, the Netherlands is the world's second largest agricultural exporter behind the United States of America. It is also home to global agri-industrial giants such as Unilever and Royal FrieslandCampina, which belong to the world's largest dairy cooperatives and that also have operations in Germany (Polman & Michels, 2017).

In 2016, the export value of agricultural products from the Netherlands was EUR 85 billion (horticultural products are the main exports) (CBS, 2017). The Dutch agro-sectors are large net exporters, with a positive trade balance of 31 billion in 2016. This was the largest factor in the overall Dutch trade surplus, accounting for around 55%. On top of this, Dutch agri-food and research companies are major exporters of agricultural technology (advanced, knowledge-intensive tertiary agro-products), which were estimated at EUR 9 billion in 2016 (Government of the Netherlands, 2018a).

Germany is also a major agricultural exporter, albeit not to the same level as the Netherlands. In 2016, Germany exported an estimated EUR 60 billion in agricultural products (the main products being confectionary, cheese and meat). However, Germany imports more agricultural products than it exports, having a negative trade balance of around EUR 7 billion in 2016 (Knoema, 2018). Importantly, Germany is also a major exporter of agricultural technology, with estimates for this sector of around EUR 7.4 billion in 2016 (BMEL, 2016).

Trade between the countries is also important: Germany remains the largest single agricultural trading country of the Netherlands, accounting for around 25% of Dutch agricultural exports, and around 19% of imports (CBS, 2017). Trade also occurs in agricultural by-products — in particular, Germany is a major importer of Dutch livestock manure — a factor which has helped the Netherlands reduce nutrient overload and therefore GHG emissions (WUR, 2014).

The type of agricultural production and use of agricultural land is similar with regard to the livestock and arable farming sectors, with dairy, meat and cereal production featuring highly in both countries. Germany also has a relatively large and well-established energy crop sector, which is similar to the Dutch animal feed sector. However, glasshouse horticulture is a highly important sector in the Netherlands with around 10,000 ha of cultivated area in 2010, as compared to around 3500 ha in Germany (BMELV, 2010). A particular feature of the Agrocovenant focuses on energy use and production in the glasshouse sector. While there may be some lessons that can be learned, this would not be directly transferable to the German context.

More broadly, Germany already has comprehensive renewable energy and energy efficiency policies in advanced stages of implementation. This reduces the transferability of some of the energy aspects of the Agrocovenant (in particular the energy efficiency, wind and solar energy measures), though there may be lessons that can be learned. The biomass energy sector is also already well developed in Germany. However, biomass energy from the co-digestion of livestock manure and other biomass flows is still highly relevant to the German context, due to its potential abatement effect on CH_4 emissions from manure management and other interaction effects with nutrient balances (these issues are discussed in depth in the study 'Bio-methane support policy in France').

Regarding trends in GHG emissions from the agricultural sector, Netherlands counts relatively higher CO_2 emissions from energy use than Germany, largely due to the intensive glasshouse horticulture sector. Excluding energy-related emissions, German agriculture emitted 67 $MtCO_2e$ in 2016, or around 8% of national emissions, a very similar share to the Netherlands. The main sources were also very similar to those of the Netherlands' non-CO_2 agricultural emissions, being CH_4 and N_2O from fertiliser use, manure management and enteric fermentation. This reflects the similarities in the livestock and arable farming sectors of the two countries. Both countries have had a trend of decreasing emissions from the sector since 1990. However, the drivers of the trends have been very different: In Germany, this has mainly been the result of reducing animal numbers from structural changes after reunification (UBA, 2018). In the Netherlands, policy factors have also played a major role in limiting GHG emissions: nutrient policies (see section 4.4) together with the EU milk quota system have reduced manure production and animal numbers, and also helped to achieve productivity gains through genetic improvements in livestock, greater resource efficiency and changes in livestock management (RIVM, 2018).

Table 4 outlines further indicators of comparability between the two countries.

Table 4: Comparability indicators for the Netherlands and Germany

	Germany	The Netherlands	Comparability
Overall economic factors			
GDP per capita (USD, 2017) CIA World Factbook, 2017	$50,200	$53,600	**Comparable**

	Germany	The Netherlands	Comparability
Total exports (billion USD, 2017) CIA World Factbook, 2017	$1,401 (33.8% of GDP)	$526.4 (63.8% of GDP)	**Not comparable**, Netherlands more trade-exposed
Features of the agricultural sector			
GHG emissions			
Agricultural contribution to CH_4 emissions ($MtCO_2e$; 2016) [9,10]	32.3 (58%)	12.8 (67%)	**Comparable**
Agricultural contribution to N_2O emissions ($MtCO_2e$, 2016)[11],[12]	31.6 (80%)	6.3 (66%)	**Comparable**
Sub-sector of agricultural sector that contributes greatest amount to GHG emissions (excl. energy use) [13], [14]	Agricultural soils (58.88%) (2012)	Enteric Fermentation (46%) (2016)	**Not comparable**, enteric fermentation signals higher dairy livestock-intensity of Dutch agriculture
Nitrogen fertiliser consumption (kgN/ha; 2015)[15]	10.15	12.81	**Roughly comparable**, somewhat higher in Netherlands
Economic structure and significance			
Share of agricultural products in total exports (billion USD, 2015)[16], [17]	65.4 (4.9% of total exports)	82.9 (17.5% of exports)	**Not comparable**, greater export exposure makes carbon leakage and other trade concerns more pressing in the Dutch context

9 Umweltbundesamt, 2015

10 RIVM, 2018

11 Umweltbundesamt, 2015

12 RIVM, 2018

13 UN Climate Change Secretariat, 2012

14 RIVM, 2018

15 Eurostat, 2018a

16 World Integrated Trade Solutions, 2018

17 OECD, 2015

	Germany	The Netherlands	Comparability
Agriculture, forestry, and fishing, value added (as % of GDP, 2017) [18]	0.60%	1.9%	**Not comparable**, agriculture far more significant in Netherlands
Livestock density (livestock unit/unit of utilised agricultural area; 2013)[19]	1.0	3.5	**Not comparable,** extreme difference points to importance of animal agriculture in the Netherlands
Energy intensity of agricultural sector (MJ/USD, 2006)[20,21]	0.0143	14.1	**Not comparable,** extreme difference points to the important role of Dutch glasshouse horticulture

6.2 Properties of the instrument

The Agrocovenant represents an integrated approach that involves a broad range of public and private actors: not only primary producers but also key actors from the agri-food industry, agro-logistics, R&D and government. This approach provides flexibility for industry to develop and implement measures in a cross-sectoral forum that fosters bottom-up innovation, development and deployment with the support of the government. A fundamental part of such an agreement, therefore, is establishing a broad and inclusive network of engaged actors that provides for information flows and empowers participation, also regarding access to public funding mechanisms.

While there is no functional equivalent to the Agrocovenant in Germany, there are government institutions and instruments that could be built upon. In the German Environmental Ministry (BMU), the environmental innovation programme ('Umweltinnovationsprogramm') supports the deployment of new technologies with positive environmental impact. While the structure of the programme is applicable, the current foci do not include agriculture but rather material and energy efficiency in industry, Green IT, as well as energy efficient urban lighting (BMU, n.d.). In principle, however, the programme could be extended to include support for energy efficiency and other emissions abatement investments in large scale agricultural facilities (the programme is focused on large facilities).

Albeit in a different ministry than in the Dutch case, the German Ministry of Food and Agriculture (BMEL) potentially provides a closer analogue to the Netherlands Enterprise Agency (RVO) with regard to forming the central government hub of the agreement. Climate change has been made a new grant-making focus in the

[18] World Bank, 2018

[19] Eurostat, 2018a

[20] Trading Economics, 2018a

[21] Trading Economics, 2018b

BMEL with over 1,200 projects for mitigating the climate impact of agriculture in 2016 alone (BMEL, n.d.). Building on this programme as well as related innovation-oriented programmes in the agriculture ministry could provide a fertile ground for building an institutional structure similar to the Agrocovenant.

The instrument itself is fundamentally flexible and adaptable, so that there would be no major technical barriers to implementing such an agreement in Germany. However, the details of the agreement, in particular the agro-sectoral emissions reduction targets, preferred abatement measures, and government support mechanisms, would need to be negotiated between multiple parties. The basis of these negotiations would require a great deal of analytical work, for example, to establish target baselines and cost-benefit analyses, together with intensive stakeholder engagement over an extended period to build trust and establish lines of communication.

In order for the agricultural sector to accept emission reduction targets, they need to be based on sound scientific evidence and in line with emissions trajectories and proven technological pathways. The critical evaluation of progress made, together with data collection and provision of information are essential tasks for government bodies, in this case the Federal Ministry of Food and Agriculture (BMEL).

There is also no clear precedent for such covenants within the German agricultural sector. However, in principle, the legal implementation would be relatively straightforward (as a voluntary agreement, there are no new laws or regulations required). If an agreement is to remain a purely voluntary measure, with no legal obligations to implement measures or meet targets, then a legal basis is less of a priority. However, under this ‘soft’ approach there would be little motivation for parties to set realistic and ambitious targets or to invest in developing abatement options. It also reduces the capacity of the government partners to work towards creating an enabling regulatory environment or to eventually implement more stringent regulations in support of the agreed targets in a consistent and transparent manner. A clear legislative framework that provides a mandate to achieve real emission reductions in the sector would therefore provide a stronger basis for a German Agrocovenant-type agreement. An opportunity to establish a legislative context in Germany comes with the planned climate change law (‘Klimaschutzgesetz’) to be developed in 2019.

Public-private cooperative approaches can facilitate engagement at many levels of industry, especially when logistical, organisational and financial support is provided by the government. Furthermore, voluntary agreements are generally easier to implement and face less opposition from industry actors than regulatory interventions or economic instruments resulting in immediate cost burdens. However, the effectiveness of such a voluntary instrument in meeting specific targets remains questionable, since a voluntary measure by definition does not involve regulatory limits or enforcement mechanisms. To strengthen the environmental outcomes of the agreement, it should define a common set of objectives, targets, guidelines and supporting instruments, and be set within a wider legislative framework that gives the government the mandate to implement supporting regulation when necessary. Based on this framework, a consensual agreement can be reached that balances flexibility for industry with a higher degree of certainty for the government and broader public.

Broadening participation to agro-food industry groups is also fundamental to the Agrocovenant, and such groups are potentially strong supporters of such an approach in Germany. Considering the export-orientation of the German agricultural sector, the Agrocovenant approach makes sense for these industries. The approach places climate change mitigation and broader sustainability concerns within a framework of economic productivity and competitiveness. It involves industry actors throughout the production chain, from the small and large scale primary producers to intermediate processors and agri-food companies. Major agri-food businesses face strong consumer pressure to track and improve the sustainability of their products throughout the production chain.

The approach of the Agrocovenat is therefore appealing, as it not only targets increased productivity; it also provides a basis for driving sustainability up and down the production chain with the ability to communicate benefits to consumers. The high export value of German agricultural products and technology indicates that there is already a high level of scientific knowledge and expertise in these fields, meaning that there is further potential to engage these sectors in the development of innovative solutions adapted to the German context.

6.3 Potential impacts

Estimating the potential impact of an Agrocovenant on emissions in Germany is not possible based on the evaluation from 2014 laid out in section 5.1. In general, it is difficult to estimate the impact of dispersed, voluntary measures, as it is hard to know exactly which measures have been implemented, by how many actors, and what the baseline for measuring their impact was. In the Dutch case, most of the emission reductions reported in the evaluation seem to be the result of factors outside of the Agrocovenant, while the impact of the measures stemming from the agreement has not yet been quantified. However, several measures outlined in the cost-benefit analysis in section 5.2 would be transferable to the German context and could potentially drive moderate reductions of CH_4 and N_2O emissions from the optimisation of manure management and fertiliser application as well as the expansion of bioenergy from agricultural by-products and manure.

The emission reduction potential of a similar agreement in Germany would be dependent on many factors relating to the specific German context. Compared to the Netherlands, Germany has lower productivity and intensity of agricultural production, and only relatively recently implemented stricter nutrient control policies (e.g. via the 2017 reforms to the 'Düngeverordnung'). Therefore, there is potential for some of the measures already implemented in the Netherlands to be able to drive emission reductions over the short- to medium-term in Germany. Considering the low energy intensity of German agriculture, as well as existing 'Energiewende' policies and interactions with EU ETS, it is unlikely that the energy efficiency measures of an Agrocovenant-like agreement would have any impact on emissions in Germany. This would be similar for renewable energy measures, except potentially those that target bioenergy from the burning or co-digestion of manure. The multiple measures, subsidies and fiscal incentives that target increased productivity per unit of livestock or arable land could potentially help to stabilise emissions; while they may not reduce absolute emission levels, they would still have a positive effect on the trajectory, allowing the sector to grow without increasing emissions.

More generally, an Agrocovenant-like agreement in Germany could potentially create the enabling conditions for context-specific measures to be discussed, developed and implemented. Its strength lies not in the implementation of specific measures, but rather in the ability to overcome political barriers and bring relevant stakeholders into a positive and proactive dialogue that can set the foundation for concerted action and potentially provide a political forum for the development of accompanying regulatory measures.

An important and unknown factor that would determine the impact in Germany is the potential for context-specific innovative technologies and approaches to be developed. This is a major aspect of the Agrocovenant approach, in that is brings together diverse actors from farms, industry and R&D to foster new and innovative approaches. The original timeframe of the Agrocovenant was twelve years, which allowed time for demonstration, development and eventually deployment of new technologies and some of these are now close to fruition. In the German context, it can be expected that a similar timeframe would be required for innovation to take effect, and in the end, the potential for emission reductions is unknown. However, there is also the potential for a German Agrocovenant to foster international cooperation, in order to build on research already underway and adapt it to the German context.

Beyond climate policy, there are also other policy windows, which could favour the establishment of an institution similar to the Agrocovenant. For example, in June of this year the European Court of Justice denounced Germany for its non-compliance with the EU Nitrate Directive. Nitrate levels in German water bodies exceed the EU maximum limits and further measures must be taken to reduce those levels. The European Commission will release a new report evaluating the status of compliance with the Nitrate Directive in 2020.

6.4 Conclusion

Adapting the Agrocovenant approach, being a voluntary agreement combined with financial and fiscal incentives, could be a viable option in Germany for several reasons. The benefits of such a voluntary agreement, however, would need to be weighed against the costs, benefits, effectiveness and feasibility of a direct regulatory approach, or an approach that couples a voluntary agreement with regulations, potentially in a step-wise manner.

First, the Agrocovenant approach offers a flexible and cost-efficient way of achieving emission reductions without significantly constraining the options of farmers. Instead it would facilitate activities that increase the efficiency and sustainability of the sector while also aiming at higher productivity. The instrument’s cost efficiency is achieved through market forces: Farmers and agri-businesses are encouraged to implement measures that bring financial benefits, while simultaneously reducing emissions. Offering investment subsidies, R&D support and fiscal incentives also make such an agreement both more acceptable and effective.

Second, such an agreement could form a basis for meaningful long-term climate action across the whole agricultural production chain. It brings together diverse and relevant actors under a comprehensive framework that establishes common goals and objectives. It would be an effective way to share information and develop a common understanding of good practice. Furthermore, it can tap into knowledge from practice and enable cross-sectoral discussions that can foster new and innovative approaches. An agreement would thereby establish a joint forum to discuss climate action in agriculture, create a common understanding of the challenges and potential solutions, and could effectively build trust between government and industry actors.

Negotiating the terms of a German Agrocovenant agreement, particularly regarding the setting of targets, would need to include a range of analyses to assess the feasibility of measures, their cost-benefit balance and their potential impact on emissions. This would set a common understanding of what can be achieved via individual voluntary measures and establish enabling conditions for R&D investment and continued cooperative action. However, on its own, such an agreement would not be a measure to achieve definite and specified short-term emission reductions. In fact, the overall mitigation effect of such an agreement is currently unknown and would depend on many factors. Over the medium- to long-term, however, there is potential for an agreement to foster new and innovative abatement options that could have a significant effect on emissions.

The Dutch experience shows that regulations limiting manure production and livestock numbers have so far been most effective at reducing GHG emissions. However, as these measures would impact the profitability and competitiveness of individual producers, they would not likely be voluntarily taken up, and would require government intervention. By coupling an Agrocovenant agreement in Germany with such regulations, policymakers could be more assured of emission reductions, while producers would have the chance to contribute to the design of regulations, ensuring they are fair, transparent and workable. Discussions on the role of regulations could be a part of initial negotiations, potentially forming a kind of back-stop that would be implemented if voluntary targets are not met. If targets are set and met through voluntary action, regulations could eventually be eased.

To incentivise ongoing action and information sharing after the implementation of the agreement, regular monitoring and independent policy evaluations should be conducted. The evaluation process should be an integral part of the agreement, and ideally be set within a broader legislative framework that enables the government to implement regulatory reform if deemed necessary. An Agrocovenant-type agreement could thereby serve as a first step towards meaningful emission reductions in a sector where diverse and 'hard-to-tackle' emission sources make regulatory intervention difficult to implement and monitor.

7 References

BMEL. (n.d.). Climate Protection and Climate Change: Neuer Förderschwerpunkt Klimaschutz, Think Tanks & Forschungsprojekte des BMEL für Klimaforschung. Retrieved July 12, 2018, from https://www.bmel.de/DE/Landwirtschaft/Nachhaltige-Landnutzung/Klimawandel/_Texte/Klimaforschung-BMEL.html?nn=310028

BMEL. (2016). Facts and figures on German agricultural exports. Federal Ministry of Food and Agriculture. Retrieved July 12, 2018, from https://www.bmel.de/EN/Agriculture/Market-Trade-Export/_Texte/Zahlen-Fakten-Agrarexport.html

BMELV. (2010). Horticulture Facts and Figures. Federal Ministry for Food, Agriculture and Consumer Protection.

BMU. (n.d.). Funding priorities and funding initiatives. Retrieved July 12, 2018, from https://www.umweltinnovationsprogramm.de/foerderschwerpunkte-und-foerderinitiativen

CBS. (2017). Agricultural exports up by over 4 percent. Central Bureau for Statistics Netherlands. Retrieved July 12, 2018, from https://www.cbs.nl/en-gb/news/2017/03/agricultural-exports-up-by-over-4-percent

CIA. (2017). The World Factbook. Retrieved July 12, 2018, from https://www.cia.gov/library/publications/the-world-factbook/geos/us.html

DSM. (2018). More sustainable farming through lower methane emissions. Retrieved July 12, 2018, from http://www.dsm.com/corporate/science/challenges/climate-energy/methane-reduction.html

ESPP. (2018). Netherlands Nitrate Directive exemption renewed. *European Sustainable Phosphorus Platform ENews N°24 July 2018*. Retrieved from https://www.phosphorusplatform.eu/images/eNews/ESPP-eNews-024-July-2018.pdf

European Commission. (2017). State aid: Commission approves introduction of tradable phosphate rights for dairy cattle in the Netherlands. Retrieved July 6, 2018, from http://europa.eu/rapid/press-release_IP-17-5362_en.htm

European Commission. (2018). COMMISSION IMPLEMENTING DECISION (EU) 2018/820 of 31 May 2018: granting a derogation requested by the Netherlands pursuant to Council Directive 91/676/EEC. Official Journal of the European Union L 137/27.

Eurostat. (2012). Agricultural census in the Netherlands. Retrieved July 12, 2018, from http://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_census_in_the_Netherlands

Eurostat. (2018). Farm Structure Statistics. Retrieved July 12, 2018, from http://ec.europa.eu/eurostat/statistics-explained/index.php/Farm_structure_statistics

EZK. (2017). The Netherland's Third Biennial Report under the United Nations Framework Convention on Climate Change. Den Haag: Ministerie van Economische Zaken en Klimaat. Retrieved from https://unfccc.int/sites/default/files/resource/7654123_Japan-BR3-2-Japan_BR3_rev.pdf

EZK. (2018). Seventh Netherlands National Communication under the United Nations Framework Convention on Climate Change. Ministry of Economic Affairs and Climate Policy. Retrieved from http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/seventh_netherlands_national_communication_under_the_unfccc_update_2018.pdf

Government of the Netherlands. (2016). Dutch Goals within the EU for Climate Change. Retrieved July 12, 2018, from https://www.government.nl/topics/climate-change/contents/eu-policy

Government of the Netherlands. (2017). Staatssecretaris Van Dam kondigt Nationale Proeftuin Precisielandbouw aan. Retrieved July 12, 2018, from https://www.rijksoverheid.nl/actueel/nieuws/2017/02/13/staatssecretaris-van-dam-kondigt-nationale-proeftuin-precisielandbouw-aan

Government of the Netherlands. (2018a). Agricultural exports worth nearly €92 billion in 2017. Retrieved July 12, 2018, from https://www.government.nl/latest/news/2018/01/19/agricultural-exports-worth-nearly-€92-billion-in-2017

Government of the Netherlands. (2018b). *Emissieregistratie - Netherlands Pollutant Release and Transfer Register*. Retrieved from http://www.emissieregistratie.nl/erpubliek/erpub/default.en.aspx

Grinsven, H. van, & Bleeker, A. (2017). Evaluation of the Manure and Fertilisers Act 2016: Synthesis Report. PBL Netherlands Environmental Assessment Agency. Retrieved from http://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2017-evaluation-of-the-manure-and-fertilisers-act-2016-2779.pdf

Groen Links. (2018). The Netherlands presents ambitious Climate Law. Retrieved July 12, 2018, from https://groenlinks.nl/nieuws/netherlands-presents-ambitious-climate-law

IEA. (2017). Germany - Energy Systems Overview. Paris: International Energy Agency. Retrieved from http://www.iea.org/Textbase/npsum/germany2013SUM.pdf

Ignaciuk, A., & Boonstra, C. (2017). Synergies and trade-offs between agricultural productivity and climate change mitigation and adaptation: Netherlands case study. Paris: OECD. Retrieved from https://www.oecd.org/tad/sustainable-agriculture/NE-case-study-final.pdf

Knoema. (2018). World exports and imports of agricultural products. Retrieved July 12, 2018, from https://knoema.com/cduhihd/world-exports-and-imports-of-agricultural-products

Moerkerken, A., Gerlagh, T., Jong, G. de, & Verhoog, D. (2014). Energie en klimaat in de Agrosectoren. Utrecht: Rijksdienst voor Ondernemend Nederland; LEI Wageningen UR. Retrieved from https://www.rvo.nl/sites/default/files/2014/05/energie-en-klimaat-in-de-agrosectoren.pdf

Netherlands Enterprise Agency RVO. (2018a). Demonstratie energie-innovatie (DEI). Retrieved July 12, 2018, from https://www.rvo.nl/subsidies-regelingen/demonstratie-energie-innovatie

Netherlands Enterprise Agency RVO. (2018b). Energy Investment Allowance (EIA). Retrieved July 12, 2018, from https://english.rvo.nl/subsidies-programmes/energy-investment-allowance-eia

Netherlands Enterprise Agency RVO. (2018c). Marktintroductie energie-innovaties. Retrieved July 12, 2018, from https://www.rvo.nl/subsidies-regelingen/marktintroductie-energie-innovaties-0

Netherlands Enterprise Agency RVO. (2018d). MIA (Environmental investment rebate) and Vamil (Arbitrary depreciation of environmental investments). Retrieved July 12, 2018, from https://english.rvo.nl/subsidies-programmes/mia-environmental-investment-rebate-and-vamil-arbitrary-depreciation-environmental-investments

Netherlands Enterprise Agency RVO. (2018e). Stimulation of Sustainable Energy Production (SDE+). Retrieved July 12, 2018, from https://english.rvo.nl/subsidies-programmes/sde

OECD. (2015). OECD Environmental Performance Reviews: The Netherlands. Paris: Organization for Economic Cooperation and Development.

Peene, A., Velghe, F., & Wierinck, I. (2013). Evaluatie van de vergisters in Nederland. Agentchap NL, Ministerie van Economische Zaken.

Pol-Dasselaar, A. van den, Blonk, H., Dolman, M., Evers, A., Haan, M. de, Reijs, J., … Wemmenhove, H. (2013). Kosteneffectiviteit reductiemaatregelen emissie broeikasgassen zuivel. *Agricultural Economics*. Livestock Research Wageningen UR. Retrieved from http://edepot.wur.nl/274864

Polman, N., & Michels, R. (2017). Agricultural policy objectives on productivity, climate change adaptation and mitigation. Policy assessment for the Netherlands. Wageningen University. http://doi.org/10.18174/410390

RIVM. (2018). Greenhouse gas emissions in the Netherlands 1990–2016: National Inventory Report 2018. National Institute for Public Health and the Environment (RIVM). Retrieved from https://www.rivm.nl/dsresource?objectid=58855e19-8066-40db-8120-89dd9b2a143e&type=PDF

SER. (2013). The Agreement on Energy for Sustainable Growth. Den Haag: Sociaal-Economische Raad. Retrieved from https://www.energieakkoordser.nl/doen/engels.aspx

Simpson, S. (2010). Top Agricultural Producing Countries. Retrieved July 12, 2018, from http://www.investopedia.com/financial-edge/0712/top-agricultural-producing-countries.aspx

Stoorvogel, J. J. (2009). Adapting Dutch agriculture to climate change Adapting Dutch agriculture to climate change. Utrecht: Knowledge for Climate. Retrieved from http://edepot.wur.nl/13379

Topsector Agri&Food. (2018). TKI Agri & Food: fundamenteel en toegepast onderzoek, plus valorisatie. Retrieved July 12, 2018, from https://topsectoragrifood.nl/kennis-en-innovatie/

UBA. (2018). Lachgas und Methan. Retrieved June 24, 2018, from https://www.umweltbundesamt.de/themen/boden-landwirtschaft/umweltbelastungen-der-landwirtschaft/lachgas-methan

Umweltbundesamt. (2015). *Environmental Trends in Germany: Data on the Environment*. Dessau-Roßlau.

US CIA. (2017). The World Factbook.

World Bank. (2018). Agriculture, forestry, and fishing, value added (% of GDP). Retrieved July 12, 2018, from https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS

WUR. (2014). Manure: A valuable resource. Wageningen UR Livestock Research.

BEACON Bridging European & Local Climate Action

NAVIGANT

adelphi

On behalf of:

Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

European
Climate Initiative
EUKI

of the Federal Republic of Germany