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Greenhouse Gas Emissions Reductions in France: The Agriculture Sector

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Summary

This report evaluates the current and recent historical policy environment of France with respect to greenhouse gas emissions reductions in the Agriculture sector. Its purpose is to provide policy-makers with relevant information on elements of the French experience that could be considered for incorporation into Scottish policy and strategic planning, as well as elements that may best be avoided.

Introduction

Agriculture in France accounted for roughly 17% of the country's domestic greenhouse gas (GHG) emissions in 2014 - or about 20% if emissions from energy use on farms are included. (This "extra" amount is officially accounted for in other sectors, such as Transport and Industrial Processes.) Different to other economic sectors, GHG emissions from agriculture are about 80%) non-carbon dioxide (CO_2) in origin, namely methane (CH_4) and nitrous oxide (N_2O). The sector accounts for roughly 80% of all such non-CO_2 emissions in the national inventory.

Much of France's GHG emissions reduction effort has been focused on CO_2, specifically in the 5-year journey to enact the Energy Transition Law (adopted in 2015). Due to the nature of the agriculture sector, where biological processes dominate technological ones, it is relatively more difficult to reduce CH_4 and N_20. Coupled with mitigation from land-use and land-use change (LULUC) accounted for in a separate 'sector' – despite mitigation activities potentially occurring on agricultural land – there are few "easy" wins. This is evident in the pattern of historical GHG emissions from French agriculture, as shown in the table below. Lagging behind other sectors in absolute GHG emissions reductions between 1990 and 2014, and being stagnant since 2005, agriculture's proportion of France's national GHG inventory has grown from 15% to 17%.

Given these fundamental differences between agriculture and other sectors, France's focus on absolute emissions reductions rather than proportion of total is appropriate. However, as opportunities for reductions in CO2 emissions wane or are exhausted, France will need to tackle the much harder decisions of how to reduce emissions of CH4 and N2O, both substantially more powerful GHGs that CO2. Whilst out of scope of this case study, altering the types of products demanded by consumers (through behavioural, attitudinal and/or cultural change) is potentially the single most significant lever that ultimately alters the emissions profile of the agriculture sector.

GHG Emissions (Mt CO_2e)	Total Agriculture Emissions	Enteric Fermentation	Manure Management	Soils
1990	83.2 (15.2%)	36.6	7.9	36.7
2005	78.5 (14.1%)	33.7	8.0	34.8
2009	79.1 (15.6%)	34.3	8.1	34.7
2014	78.9 (17.2%)	33.7	8.3	34.7

Table 1: Total GHG emissions attributed to agriculture in France at time key points in time.

The percentage of economy-wide total emissions attributed to agriculture is in brackets. Enteric fermentation is CH4 produced as a by-product of digestion, primarily from ruminants such as beef and dairy cattle. Livestock effluent emissions from manure are primarily CH4, levels of which depend upon management practice. N2O emissions from soils are primarily leakage of nitrogen from mineral fertilisers. Data source: Eurostat.

Policy Description

French policy focus for agriculture to date has been on reducing high-carbon energy use, seen as a key element to secure the long-term competiveness and sustainability of the agriculture sector. However, to achieve the levels of GHG emissions reductions required from agriculture, energy efficiency is not sufficient. The vast majority of agricultural GHG emissions are CH_4 from livestock (enteric fermentation and manure), and N_2O from the use of mineral N fertilisers in soil. As other economic sectors reduce their CO_2 emissions, agricultural CH_4 and N_2O will form a greater proportion of total French GHG emissions. Other frameworks and goals for absolute emissions reductions in agriculture fall into one (or more) of four categories, all but the final one presented here have specific policies that directly or indirectly target emissions reductions. These are: reduced application of mineral nitrogen fertiliser; increased storage of carbon in soils and biomass; reducing CH_4 and decreasing fossil-fuel energy dependency through biogas production; and, reducing CH_4 emissions from livestock digestion via changes in diet. As a result, many of the emissions reductions in agriculture are an indirect consequence of the application of policies to become more energy efficient rather than a driver of operational change.

Targets & Timescales

France has economy-wide GHG emissions reductions targets. These are detailed in several documents and policies, including the nationally determined contributions (NDCs) – agreed at the EU level in time to present at the United Nations Framework Convention on Climate Change (UNFCCC) COP21 meeting in Paris in November 2015 – as well as those in the EU's 2020 Climate and Energy Package of 2009. Objectives of the UNFCCC's other "nested" treaties and agreements, such as the Kyoto Protocol and the Paris Agreement, are also incorporated into French national level legislation.

GHG emissions from energy use in agriculture are about 15% of the sector's total emissions, and the focus of the bio-gas initiative. However, this does not include those emissions from energy use accounted for by other sectors (such as transport and industry) that are expended due to agriculture-related activities (eg. physically moving farm produce along the supply chain, as well as processing it). Agriculture as an economic sector has some GHG emissions-related targets, though there are a greater number of broad, "green growth" objectives. Targets and objectives take the form of a series of policies and programmes, which have been rolled out over time. The National Low-Carbon Strategy (SNBC) sets out an emissions reduction target of 12% by 2030 for agriculture.

Targets have multiple timescales. At the top level are those based upon EU targets: i.e. 2020, 2030 and 2050. Distinct from Scotland's annual targets, but more in line with the UK as a whole, France has mandated the implementation multi-year carbon budgets for the period leading up to 2030. These budgets cover the periods 2015-18, 2019-23, and 2024-2028.

In November 2015, France announced absolute emissions reductions targets for the first three carbon budgets, set by decree, ending in 2028. Only the first budget period has separate expectations for within-ETS and non-ETS sectors. Relative to 2013, the former has its budget reduced 7.5% (from 119 Mt to 110 Mt CO_2e), whilst the latter sees an 11% decline (from 373 Mt to 332 Mt CO_2e). This is equivalent to cut of 8.4% economy wide. The second budget period (2019-2023) targets a 9.7% reduction versus 2018, whilst the third period (2024-2028) anticipates lowering the cap a further 10.3% versus 2023. If these budgets were realised as enacted, France would reduce its GHG emissions by 27% by 2028. This is well short of the EU's 40% target set for 2030.

Despite accounting for nearly 20% of French GHG emissions, within the SCNB framework agriculture has the lowest GHG reduction targets of any sector; 12% by 2028 and 50% by 2050. By implication, other sectors will need to generate greater GHG emissions reductions to compensate for agriculture's lesser short- and medium-term contribution. This recognises the relative difficulty in reducing CH_4 and N_2O emissions. As these emissions largely arise due to biological processes rather than technological ones, there are fewer 'levers' that may be employed in agriculture as compared to the energy-related CO_2 emissions of the other sectors of the economy.

For context, emissions reduction targets in each of the other sectors are as follows: transport (29% by 2028 and 66% by 2050); buildings (54% by 2028 and 87% by 2050); industry (24% by 2028 and 75% by 2050); energy (keep below 2013 levels by 2028; and 96% reduction by 2050); and waste (33% by 2028; no stated target for 2050). This may reflect the challenges of reducing the non-CO_2 emissions that dominate in agriculture relative to the energy-related CO_2 emissions that dominate in the rest of the economy. The particular targets for agriculture are detailed below, including the basis for the target, progress to date, and an assessment of likelihood the target will be achieved within its allocated timeframe.

TARGET: Reduce agriculture emissions 12% by 2028 versus 1990 (SCNB)

Rationale: Agricultural GHG emissions represent just over 17% of France's total domestic emissions (in 2014 - latest available figures from Eurostat) and over 80% of CH_4 and N_2O emissions, gases that are 28 and 280-times more potent than CO_2 with respect to global warming potential.

Progress: Absolute emissions fell 5% between 1990 and 2005. However, despite a variety of targeted initiatives (discussed below) agricultural emissions have since been stagnant.

Assessment: The target **can** still be achieved within the timeframe set out – almost 12 years remain to reduce emissions by 9% from 2014 level. However, renewed efforts will be required to target non-CO_2 emissions, which predominate in this economic sector.

Progress on other, more specific, elements is described below that should help reduce the carbon-intensity of agricultural production (a relative measure of emissions per production unit). These may indirectly support achieving the 12% absolute emissions target.

TARGET: 1,000 biogas plants by 2020 (EMAA Plan)

Rationale: Agricultural waste can be used as a renewable feedstock in the form of biogas. This displaces a proportion of energy otherwise provided by fossil fuels and avoids the emissions from the waste that would otherwise occur. It provides a partial avenue for farms to be less dependent upon fossil fuels. The left-over "digestate" may also be used (subject to regulatory approval) as a fertiliser and lower the amount of mineral N fertiliser applied.

Progress: By September 2015 there were over 400 active biogas plants in France. Nearly three-quarters of these plants have been commissioned since 2011. A total of 740 are expected to be online by 2020 – an investment estimated at €800m. Subsidising exemplar biodigesters (total of €13m in 2009 and 2010), and initiating feed-in-tariffs in 2011 provided a kick-start to the industry.

Assessment: Whilst there has been a great deal of activity in the biogas market since 2005 in France, is seems **unlikely** that the target of 1,000 plants will be met by 2020. However, the 2016 decision to make permanent the tax exemption on biogas plants (originally a seven year exemption to 2022) is a further signal by the French government of support for the industry. The structure of French agriculture, which has the largest number and proportion of large farms (those with a utilised agriculture area (UAA) of over 50 Ha) in Europe, provides additional conditions that are beneficial for biogas plants – logistics are easier with fewer suppliers.

TARGET: Increase organic area to 6% by 2012 and 20% by 2020. (Le Grenelle commitment); Double organic area from 2013 to 2017 (Organic Ambition Programme 2017)

Rationale: Organic farming practices are believed to produce less GHGs (there is not a consensus on this position within the scientific community – more in final paragraph). Use of cover crops and less mineral fertiliser reduces N_2O emissions from soils, and N leakage into water (indirect benefit of it then requiring less treatment). The lack of use of man-made herbicides and pesticides, alternative tilling practices, and the inclusion of elements of agroforestry may also lead to improved biodiversity and soil organic carbon levels.

Progress: Over 400,000 Ha of fully converted organic area has been added since 2009, to an estimated 1 million Ha in 2015 – a near doubling in six years. This is equivalent to 4.8% of the utilised agriculture area (UAA) in France under organic practice in 2015, versus 2.9% in 2010 (and 1.9% in 2009). Unofficial estimates for 2016 by the organic industry body AgenceBio are 1.5 million hectares of farmland under organic production; 300k shy of the "double" target.

Assessment: The *Grenelle* target for 2012 was **missed**, which by 2016 still had not been achieved. There are risks and considerable knowledge transfer required to transition from traditional to organic practices, as well as time to do so. It seems **virtually certain** that France will also **miss** the 2020 target of 20%. With financial support to develop production (€160m per year for the period 2014-2020), demand-pull support (discussed below), and the acreage currently under conversion, it seems **virtually certain** the Organic Ambition Programme 2017 interim target of doubling organic acreage by 2017 versus 2013 will be achieved.

The French position that organic farming is less GHG-intensive than conventional farming is contested (see the following extensive discussion via the Food Climate Research Network). However, it is this position which drives the French targets of increasing organic production and consumption; they may not deliver the GHG emissions benefits sought. Additional detail on this topic is provided in Context-specific Factors section.

TARGET: 20% Organic produce used by institutions by 2020 (Organic Ambition Programme 2017)

Rationale: Create a demand-pull environment to encourage local production of organic produce. In turn, sustained market demand for this type of produce will act as an enabler for the target for organic farming.

Progress: Growth in the number of catering establishments with organic produce options has been rapid, from 4% in 2006 to 58% in 2016. Within this, 71% of public catering outlets offered organic options (led by schools where three-quarters serve organic produce) versus 41% of private outlets. At the same time, the share of organic produce purchased at these establishments rose from 5% in 2008 to 14% in 2015.

Assessment: Growth in production, availability, and consumption of organic produce is clear and has been rapid. Availability has increased almost 15-fold in 10 years and market share in institutions has almost tripled in the past seven years. These trends suggest it is **very likely** that the 20% organic market share target will be met on time, **possibly** early.

TARGET: Doubling of area under legumes by 2020 (Land Objectives Plan)

Rationale: Legumes (pulses) are able to "fix" atmospheric nitrogen, thus providing a natural fertiliser and reducing the need for mineral N to be added to fields to increase/maintain crop yields.

Progress: Whilst the acreage given over to the production of leguminous plants within the EU-28 has been relatively stable since the 1980s (though with greater variability since the mid-2000s), France has experienced a decline. From a high of 750,000 hectares in 1993, acreage fell to a low of 197,000 ha by 2012. However, Eurostat figures for 2015 show an increase back up to 269,000 ha.

Assessment: France is not as competitive with respect to legume production versus other countries within the EU (particularly those in Eastern Europe), or further afield. French agricultural production has shifted from legumes to other produce where it does retain a competitive advantage. Whilst it is **possible** for meet the target of 430,000 hectares under legume planting by 2020, which would be a return to levels last seen in 2005, there is a good deal of uncertainty of whether it would be sustainable over the longer term.

Communication

France's first National Climate Plan in 2000 (then called the National Programme for Tackling Climate Change) required review every two years; the latest being in time for COP 21 in Paris. Local authorities are encouraged to adopt and adapt the plan with respect to local conditions.

Overall, climate policies appear to have had been subject to broad-based consultation, not only from experts and public bodies, but also NGOs, citizenry and other non-state stakeholders. The result appears to have been high levels of buy-in across the spectrum – though not always quickly. A prime example is the Energy Transition Law. This comprehensive legislative package is intended to transform France's economy with respect to energy use and boost "green growth". Enacted in August of 2015, it required four years of negotiation and consultation, and over a thousand amendments, to wind its way through the French National Assembly and Senate.

As the host of COP21, and the headline Paris agreement, effective communication strategies across a range of key stakeholders has been a key focus for France. This has not only been essential for national communication, but also extends internationally. In the agricultural sector specifically, potentially its largest campaign to date has been the "4 per 1000" initiative. The 4‰ Initiative was launched by France under the Lima-Paris Action Agenda (LPAA) at COP21 to demonstrate the important link between carbon sequestration and food security. Since this action is based on voluntary commitments between both private and public entities, effective consultation and engagement across a range of stakeholders (including national governments, local and regional government, companies, trade organisations, research institutes, and NGOs) has been essential. A vital strategy in gaining stakeholder support has been in the promotion of the co-benefits of carbon sequestration techniques (such as agroforestry, conservation agriculture and agroecology) in simultaneously realising food security and agricultural resilience benefits.

In terms of promoting action towards meeting its national agricultural mitigation targets, a key strategy in synthesised policy documents has been clearly outlining the range of mitigation options with analysis and discussion on their relative economic costs and benefits (in the form of mitigation abatement potential curves). These assessments draw on a range of published case studies which review each of the mitigation techniques in detail. France disseminates information about the importance of mitigation and adaptation, and provides a toolkit for farmers to improve performance—these tools and educational resources are deemed to be accessible, user-friendly, and correctly oriented toward key stakeholders.

At present, it's difficult to assess how effective its recent communicative strategies (since COP21) are in driving change, France's approach to agricultural climate policy has been generally well-received. It has been utilised by the OECD as a case-study for the management of synergies and trade-offs in shaping policy action. This review highlights that the Ministry of Agriculture, Agri-Food and Forestry (MAAF) have been effective in *introducing new policies* which promote synergies between economic productivity and climate mitigation. The approach typically relies on compensating farmers (in the form of subsidisation, as evidenced in its biogas programme) for any eventual financial losses which may occur from uptake of mitigation strategies, and highlighting approaches which would reap economic gains at the farm-level.

Whilst the OECD commends France on success in promoting productivity-climate synergies, it suggests its policy framework could be improved through the design of incentives which *discourage* behaviours which undermine these efforts. This could come in the form of reductions in subsidies or payments which fail to promote policy synergies.

Context-specific Factors

In the reduction of non-CO_2 emissions (CH_4 and N_2O), France's approach and targets have been largely focused towards biogas and organic farming promotion to date. These options are considered to hold large mitigation abatement potentials in French agriculture, both at either low or negative costs. Beyond this rationale, there are several contextual

factors which may explain this choice of focus. France's agricultural sector is the largest in the EU, and is among the largest exporting nations in the world (with an estimated value of 86 billion USD). At 30 million hectares, its agricultural land is the largest in Europe, accounting for nearly half of its total country area. Its agricultural strategies for CH_4 and N_2O mitigation will therefore be focused towards achieving emissions reduction without a loss of economic output. This is of particular importance for meat and dairy production, which form its highest value outputs (yet also are the most GHG intensive agricultural products).

In this context, biogas production forms an economically-sensible choice, offering a strategy for CH_4 mitigation without a loss of agricultural, and economic, output. Forming its largest agricultural output, the scale of its cattle industry provides a large and continuous input for biogas, in the form of manure and slurry. This strategy is also cross-boundary, proving effective in not only reducing GHG emissions from agricultural waste, but also supporting France's renewable energy targets. This synergy between the two sectors is seen as integral to the country's overall carbon strategy.

France may have some climatic advantage over Scottish agriculture for its choice of organic farming strategies. The adoption of organic methods, while typically reducing N_2O emissions per unit area (although not always per unit output), can result in yield losses across many crop species. Only a small range of crops—namely fruits and oilseeds—have been shown to almost match yields of conventional practices. France's climatic conditions are well-suited for the production of a wide range of agricultural commodities; oilseeds forms a major agricultural export, and its climatic conditions are also well-suited to fruit produce (acting as a supply for its 9.3 billion USD wine and spirit industry). As a result, France may be able to target increases in organic area towards specific crop types without significant output and economic implications. This approach may be less suitable in Scottish context, where crop outputs are dominated by cereals (which are much more reliant on nitrogen supply).

Beyond these strategies, agriculture has an advantage that most other economic sectors do not. Even without technologies that are yet to be proven at scale (such as bioenergy with carbon capture and storage (BECCS)), it may be possible for the sector to act as a carbon sink through changes in practice. Increases in application of agroforestry techniques and organic principles have the potential to store carbon. The concept of carbon-farming, paying farmers for increasing the store (or reducing losses) of carbon held in the vegetation and soils on their land may be a further avenue to explore.

Conclusions

- Between 1990 and 2014, GHG emissions from agriculture in France decreased 5% from soils (mostly as a result of better mineral nitrogen fertiliser management) and 8% from livestock (primarily methane produced from digestion by beef and dairy cattle).
- France's policy framework is **complex**, with a multiplicity of goals, objectives, and targets.
- **Stakeholder** consultations have been influential to generate broad-based buy-in to the need for action related to GHG emissions, climate change and transitioning away from fossil-fuel based sources of energy.
- Despite a multitude of policies, objectives and targets, GHG emissions from agriculture in France are **little changed** since 2005, with the vast majority of reductions achieved **prior to 2009,** the implementation of the first Grenelle law.
- It is **unlikely** that French agriculture will meet its high level target of a 12% reduction in GHG emissions by 2020 relative to 1990.
- Achieving longer-term targets within agriculture will require tackling **methane and nitrous oxide** emissions. CO_2 emissions are a small proportion for this sector, thus providing less potential to make a meaningful impact.
- Targets **likely** to be achieved are those related to market share of organic produce sold by institutions. The intent is to provide a demand-pull incentive for increased acreage converted to organic methods.