IMPACCT CASE STUDY No. 6

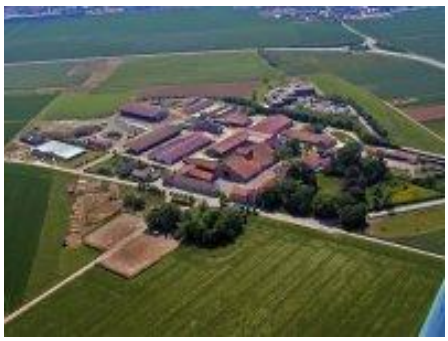
Integrated Management oPtions for Agricultural Climate Change miTigation

AgroParisTech – Ferme de Grignon, France

This case study is based on an experimental farm that is part of the Paris Institute of Technology for Life, Food and Environmental Sciences (AgroParisTech) which was founded in 2007 by merging three Graduate Institutes in Science and Engineering.

The farm is a 541 ha mixed holding comprised of various cereal, oilseed and vegetable crops (356 ha), other crops grown for energy (9.3 ha), dairy cattle (210) and mutton sheep (450). There are also over 77 ha of native grassland, 36 ha of Lucerne and 9.5 ha of fallow land.

The farm sits on a plateau in the Île-de-France in north-central France, the soil is predominately a silty clay and the climate is oceanic.



Aerial view of the farm, Photo owned by the 'Grignon Energie Positive' project.

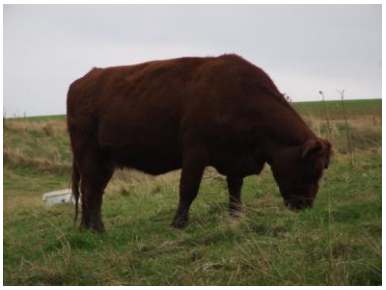
As an experimental site, the farm tries to use the latest technologies and implement best practice. With respect to climate change the farm is engaged in a project to test and evaluate technical options in order to reduce the energy consumption and the greenhouse gases emissions of the farm. The project, known as 'Grignon Energie Positive', began in 2006, with an ecological assessment of the farm following the PerfAgro[†] tool that enabled greenhouse gas emissions and the energy consumption to be estimated. Since then the farm has been active in mitigating climate change impacts and monitoring progress against the 2006 estimates. The project has also been developing an educational programme for children, adults and agricultural professionals to boost awareness of climate change and the challenge of feeding a rapidly growing global population. The steps taken by the farm for mitigating climate change are summarized below.

Significant steps have been taken to improve energy efficiency such as ensuring buildings are double glazed and properly insulated. However, the most important aspect of this farm is the establishment of a biomethanization plant that produces methane gas from farm produced biodegradable substances such as manures and other organic wastes. In a farm of the size of Grignon, about 450 sq m of biogas can be produced daily using 10,000t of waste each year comprised of 4,000t of slurry, 1,000t of manure and 5000t of retail, food industry and catering wastes.

This biogas is collected and used to feed an engine which produces electricity and heat by co-generation. This type of engine is the most commonly used in farm installations. Half of the heat produced is used to maintain the temperature at 38°C in the digester and the other half used to heat buildings, houses etc. Unused electricity can be sold to national grid at a special green energy price. This saves a significant amount of greenhouse gas emissions as the gas is a direct replacement for fossil fuels. However, the capital investment was very high costing over €2 million however, grants were made available and a return on the investment is expected after 8.5 years.

Many other steps are being taken on this farm to reduce energy use and mitigate climate change whilst maintaining yields. These are summarised below.

- Drivers on the farm have undergone training to ensure they drive in a fuel efficient manner. A new, energy efficient tractor has also been purchased that has decreased fuel use on the farm by 15%, equivalent to 10,000 litres of fuel per year. However, there was significant capital outlay and associated finance costs for the tractor.
- Waste management activities focus mainly on the use of organic wastes as feed to the biogas plant. But the farm also recycles as much as possible and feeds whey to heifers when possible.
- Rinse water from the milking machines is also recycled, as is that used in the water baths from a yoghurt making diversification enterprise. This water would otherwise be added to slurry and so less volumes are now produced.



- Since 2000 the farm has changed from conventional tillage to minimal tillage and also uses direct seeding on some plots. As well as reducing the use of fuel (between 10 and 20 litres less per hectare depending on clay content of the soil) this has also reduced ground disturbance and limited the loss of stored carbon in the soil. It has also led to reduced soil erosion and increased biodiversity in the area. There have been some issues to resolve as these changes have reduced flexibility in sowing dates.
- The livestock feed programme has been modified regarding its energy density and average protein content this has reduced methane emissions per litre of milk.
- The farm has adopted a low-input management strategy. Nitrogen balancing has been undertaken to enable improved decision making. Better use is now being made of farm-produced manures and slurry has been made. Crop varieties have been selected based on their tolerance to potential nutrient deficiencies. This has reduced mineral fertilizer inputs, increased nitrogen efficiency and reduced losses of N_2O and CO_2. There is also a reduced risk of nitrate leaching.
- The crop protection strategy has also been adjusted to minimize inputs. Little or no growth regulators are now used and chaff is now collected to reduce the weed seed bank and so reduce the need for herbicides. Whilst there are benefits for climate change mitigation and the environment generally there are risks of run-off and erosion increasing as there is less ground cover in the winter.
- Management of the environmental areas on the farm has been gradually improved since 2003. This has included establishment of new trees, hedges and strips of alfalfa around the manure yard. These activities have increased carbon in the biomass and the population of beneficial insects has also improved. However, there has also been an increase in rabbit populations that have damaged young trees.
- The dairy is a high energy consuming activity. Milk produced is heated for pasteurisation or transformed into yogurt but then must be cooled to preserve it. Heating and hot water used by the dairy is supplied by the biogas plant. Other energy efficient equipment has also been installed. The farm is currently considering the installation of a chilled-water power plant. Whilst this may save money in the long-term it is unlikely to reduce greenhouse gas emissions significantly.

† The PerfAgro P3 tool is a decision support tool designed to provide advice and support regarding economic, energy and greenhouse gas emission on the farm. This model, developed by the CEREOPA, calculates optimal solutions as far as rotation and cattle feeding are concerned.

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