

Kinknockie Farm Anaerobic Digestion Plant



*Kinknockie Farm,
Udny, Ellon,
Aberdeenshire
AB41 7RL*

*Farmers – Magnus & Alastair Sinclair
Date of Farm Visit – 12th May 2015*

The Sinclair's have installed a 500kW Anaerobic Digester at their farm in Aberdeenshire. The main feedstock is grass silage and the biogas is used in a CHP engine onsite.

Background

The Sinclair family farm 800 acres, 300 of which has been connected to forestry for pulping or biomass use. They started expanding their farming operation in the 1990s to include contracting work. since then they have continued expanding, moving into waste recycling, harvesting, wrapping and loading for transport Christmas trees and most recently Anaerobic Digestion. In the last few years they have been an arable farm after giving up dairy farming in 2006/2007.

The Formative area in Aberdeenshire is a highly productive farming area. Most of the arable land is used to grow crops for livestock. To maintain incomes, farmers have increasingly intensified their activities. By doing so they are placing additional burden on the local environment (principally with the spreading of slurry on the land which causes NVZ issues). With the dairy industry also facing severe economic problems in recent years, this has forced an increasing number of dairy farmers to leave the industry.

By investing in AD the Sinclair's have addressed the rising business risks of volatile crop prices and increasing fuel and fertiliser costs, creating a reliable income stream through the creation of a high quality bio fertiliser and energy.

Project Scoping

As with any investment the Sinclair's focused very carefully on making sure there was a viable project. In assessing if AD offered the right future for the business the Sinclair's considered the following:

- Availability of feedstock that will produce sufficient biogas to ensure a profitable operation, primarily from the sale of electricity
- Long term commitment to feedstock supply ('security of supply')
- Availability of grid connection at a reasonable price
- Planning consent and environmental permits to identify a site that had no significant adverse environmental effect (e.g. odour, noise, visual intrusion, spillages) which can't be mitigated
- The ability to distribute the resulting digestate within a relatively close area, preferable to those who contributed input materials in the first place
- Access to local domestic/commercial/industrial users of electricity and heat so that the maximum amount of energy can be utilised

The Sinclair's Aims with AD

Maximising yields whilst also protecting the land for future generations has always been a core principle for the Sinclair's. AD helps them to achieve this significantly in the following ways:

- Reducing slurry odours
- Reducing increasing fertiliser costs through the application of quality controlled digestate to farm land
- Improved slurry nutrient uptake by plants
- Elimination of nitrates from slurries impact on ground waters in Nitrate Vulnerable Zones
- Avoidance of impacts associated with manufacture of artificial fertiliser
- Generation of renewable energy, thus reduction in fossil fuel consumption
- Generating a sustainable long term income for the landowner/farmer
- Disposing of farm slurry in an environmentally friendly way
- Build a showcase for AD plants in the region
- Safeguard existing jobs at risk due to the economic downturn and financial challenges faced by the farming community in Aberdeenshire
- To generate new jobs in the local area and up and down the regional supply chain.

The Scheme

The plant consists of a single anaerobic digester tank, with an outer ring of 30 meters in diameter and an inner ring of 22 meters in diameter. It is a double tank, meaning there is a second tank placed concentrically within the first. The inner tank is for secondary digestion with most of the initial AD programme undertaken in the outer tank. A separate building houses a combined heat and power engine that can produce 500kW of electricity and 500kW of heat. The electricity from this is partly used on site with the majority being exported into the national grid. Due to grid connection constraints there is only an export of 400kW available. The remaining 100kW is used to power the plant and for other on-site electricity needs. The heat will be transported to the farm houses, cottages and existing buildings. Lower grade heat might be used in on-site glasshouses or woodchip drying at a future point in time.

As the table opposite shows, a significant additional income can be made from using the heat in a RHI eligible way. At present none of the heat is used on site apart from for parasitic loads within the AD unit. The potential to maximise returns by claiming the RHI and selling the heat has led the Sinclair's to consider many possible future business expansions. These include growing vegetables and office lets.

Capex of AD plant & CHP engine	£1.65m
Total project Capex	£2.15m
FiT rate	14.4p/kWh
Export (inc. LEC etc) rate	6.2 p/kWh
RHI rate (not yet secured)	5.9 p/kWh
App. Electrical income *	£771,000
App. Heat income (90% use)*	£199,000

* Based on 95% availability of CHP engine

Feedstocks

Additional feedstocks for the plant will come from nearby farms. The additional inputs of slurries will come from farms within a 10km radius of the site. 100 acres of land is rented for growing grass and the Sinclair's undertake all of the work involved with the growing and silage cutting. When they first looked at AD in 2010 the banks were insistent on all the feedstock being grown on land owned by the Sinclair's for fuel security reasons, they have since relaxed on this, however fuel security remains a critical issue when securing funds for an AD plant.

Summary of Feedstock Inputs

- Grass silage has 30 to 36% Dry Matter content
- 90% of total feedstock is grass silage
- 10% slurries and FYM
- Short cut grass (10mm as opposed to the traditional 19mm)
- Enzymes are added to help break down grass
- 3 year grass cycle for grass because in year four 50% of grass has been replaced by weeds
- Only 3 variations in grass are used in seed mix
- Experimenting with 12 to 15 kilograms of seed per acre

Digestate

The Sinclair's have the digestate tested weekly for its nutritional content. The average results of which are shown below.

NPK	Content per tonne of Digestate	Availability
Nitrogen	5.45	5-55%
Potash	4.3	90%
Phosphate	1.6	50%



Choose the right type of AD plant for your feedstock

Magnus Sinclair, 2015

