

East Knockbrex Anaerobic Digestion Plant



*East Knockbrex,
Newton Stewart,
DG8 6QE
Farmer – Iain Service
Date of Farm Visit – 26th February 2014*

Background

East Knockbrex is a new build dairy farm complex with capacity for 600 cows, located to the west of Newton Stewart for which a planning application was approved by Dumfries and Galloway Council on the 15th of July 2011. The farm unit will support 600 milking cows and has an anaerobic digestion (AD) plant integrated into it's design.

The AD plant at East Knockbrex has a designed capacity of 150kW and will be central to the functioning of the dairy operation, supplying both electricity and heat from its combined heat and power (CHP) engine to the dairy unit building and processes. Planning permission and grid connection for the plant have been secured.

Construction of elements of the plant such as groundworks and prefabrication of the tanks is already underway at the time of writing, and the plant is planned to be operational by mid to late 2014.

Proposed Scheme

The plant equipment will be designed, supplied and built by Fre-energy, a specialist technology provider who build AD plants specifically designed to process farm manures and wastes. Capital costs for the construction of the plant are currently estimated by

Fre - energy at approximately £750,000. However, these initial costs are relatively fluid because Iain Service is undertaking some of the required works himself including laying foundations and prefabricating a number of plant components. The planning consent for the scheme was achieved as part of the application for the rest of the term.

FIT Pre-accreditation

Feed-in-Tariff (FIT) pre-accreditation for the project was started in the summer of 2013. The general process has been protracted but pre-accreditation for the 2013/14 FIT has been achieved. This process fixes the tariff that will be paid for electricity generation from the plant at the current rate of 15.16p/kWh for a period of one year, and will allow Iain until October 2014 for construction and commissioning of the scheme to be completed at this FIT rate. The AD plant will also be eligible for payments under the Renewable Heat Incentive (RHI) at 8.6p/hour for Tier 1 and 2.2p/hour for Tier 2. However, it is only possible to apply for the RHI subsidy once a scheme is fully commissioned and operational and so at this stage this process has not yet been started.

Supply of Feedstock

Each head of cattle will produce around 450 litres (or kilograms) of slurries per week, which equates to approximately 14,000 tonnes of slurry feedstocks annually. Cattle slurry will be the main feedstock used in the AD plant, some supplementary feedstocks such as silage may be added but Iain Service would like to keep this to a minimum.

Our calculations indicate that if the cattle are kept indoors all year round in order to maximise the capture of slurries and are fed on grass silage at 50kg per head per day. This equates to an annual use of just under 11,000 tonnes of feed annually. The land required to produce this tonnage of feed will be approximately 750 acres, based on growing grass silage with a yield of 15 tonnes per acre. Two to three cuts of grass silage would be made per year.

AD Process

The sumatic below sets out the designed AD facility at Knockbex Farm which will be a mesophilic digester. The input of 14,000 tonnes of slurry will generate about 80kw output and 515,000 kWh per year. The remaining capacity will be achieved by the input of solid feedstocks such as manures, grass silage or failed crops. These feedstocks have higher calorific value than cow slurry as such 2,500 tonnes of grass silage will allow the plant to achieve full capacity and generate 954,000 kwh per year.

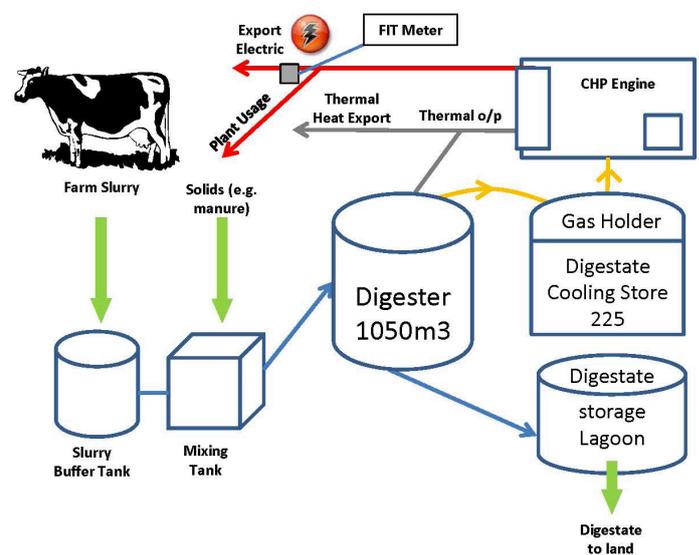
A by-product of the AD process is a semi-solid residue known as digestate which can be used as a fertiliser. Figures from tests conducted in Holland suggest that the amount of available nitrogen contained in digestate can be up to 40% more than that of the content of cattle slurries because the AD process fixes nitrogen, which can also help in reducing NVZ issues. Digestates can produce an increase of 33% in grass growth in comparison to untreated slurries, and digestates from the plant can therefore be used to replace about 50% of the fertilisers that would otherwise be used to grow the grass silage feed for the dairy cattle herd on the farm, resulting in significant financial savings.

Financial Figures

Our calculations indicate the net electricity output from the plant for slurries only (80kw capacity), is estimated to be in the region of 515,000kWh annually after parasitic losses from the operation of the plant are accounted for. This level of generation would result in an annual income of £102,000 from the current FIT tariff and export tariff. Heat output from the plant could be in the region of 460,00kWh annually after parasitic losses which could result in RHI payments of £33,500 if a use is found for this heat.

These returns, along with an allowance for operational and maintenance costs would result in a payback time of 7.6 years if both the FIT and RHI are secured. If only the FIT is secured then the payback period would extend to 11.5 years. These payback periods do not allow for making use of the additional 70kw of capacity that the plant holds as the cost of feedstocks is currently unknown. However, utilising this spare capacity is likely to improve payback periods.

As the project is a bespoke design and there are a limited number of small AD plants in the UK, Iain is projecting a longer payback period to allow for any breakdown and maintenance periods which may occur.



AD is a holistic solution that allows us to process slurry to improve fertiliser while generating electricity and heat.

Iain Service, February 2014

