14 DEMONSTRATION FARM

NFUScotland

Muirhouse Farm: Wind, Heat Pumps, Solar, Biomass & Biodiesel

Muirhouse farm,
Stow,
Selkirkshire
TD1 2QL

Farmer – Iver Salvesen
Date of Farm Visit – 27th January 2015

Background

Iver and his family bought the 600 acre Muirhouse farm in 2003. After two years of working with contract farming arrangements they accumulated their own stock. The hill farm is mostly sheep grazing, the majority of the sheep being Grey Face as well as Texel and Suffolk crosses. The farm also has Highland Cattle/Angus crosses. In the early years the farms struggled to balance the books and as such they looked to diversify their income.

In 2005 they began by renovating the existing cottages, including renovating a redundant granary. This has provided an income from holiday lets. In 2007 they started looking at how they could lower the farm's overheads, with energy being at the top of the list. This was brought into focus in 2008 when the house building industry collapsed, closing many local business, including the one Iver worked for. He decided to go back to university, and in 2009 started a part time degree at the Centre for Alternative Technologies (CAT) in Wales. Undertaking this degree ran in parallel to starting a renewables company-eco2fitter which is based on Muirhouse farm.

Small Wind 2007

Evance R9000 5kW • Hub Height: 16m • Rotor Diameter: 5.5m • Energy Production: 21,400 kWh pa

In 2007 Iver applied for planning for their first wind turbines; two 5kW Evance R9000's. They decided to match the farm's energy demand to the size of the turbines. This strategy substantially increases the rate of return for a renewable technology. The scale of the turbine chosen meant that they did not require substantial leverage from a bank. In 2009 finance for the turbines was secured and they have been operating almost without fault since. However, as the turbines are positioned close to the farm (so that they can make use of the electricity) they are not subject to the best wind speeds. With this in mind, Iver is currently looking at developing 2 x 100kW wind turbines on one of the hills with higher wind speeds.

Financial summary of the two Evance wind turbines	
Capital costs	£71,000
Onsite energy use	12,000 kWh
Income from FiT (@28 p/kWh)	£6,000
Energy savings (assuming imported electricity costs 11 p/kWh)	£1,300
Income from export tariff (@ 3.2 p/kWh)	£390

Ground Source Heat Pumps

In 2008, with the wind turbine in the pipeline, Iver decided it would make sense to use the electricity they generated on site to heat his home with a Ground Source Heat Pump (GSHP). An extension was built at this time allowing them to install underfloor heating in the new part of the house. The lower temperature required for under floor heating is more suitable to heat pumps. At this time he also swapped the families oil AGA for an electric one to make use of the electricity from the wind turbines.

Seasonal Performance factor (SPF) or Co-efficient of Performance (COP)
Iver's heat pump was specified to achieves an SPF of 1:4, this means for every unit of electricity used by the heat pump, 4 units of heat are produced. In order to qualify for RHI a GSHP must achieve a SPF of at least 1:2.5.

The Scottish Government
The European Agricultural Fund for Rural Development: Europe investing in rural areas
savills

Biomass

Following the Wind and GSHP, Iver installed a 200kW biomass boiler to supply heat via a district heating network to the main farmhouse, farm office, mill house and one of the straw bale houses. There are also plans to extend the district heating network to more houses. When the additional houses are added, Iver expects the payback to drop from 11.5 years to four to six years. There is also a 100kW pellet boiler installed on the farm.

The 100 acres of previously unmanaged woodland is planned to provide the fuel for the boiler, helping to release value from a previously untapped asset. Iver has registered as a self-supplying woodfuel supplier. This will be a requirement for everyone who wishes to claim RHI by autumn 2015.

Financial summary of 199kW Woodchip boiler	
Make	Guntamatic
Project Capital Costs(199kW)	£160,000
Energy use pa	130,000 kWh
Woodchip used per year	40 tonnes
RHI income*	£11,200
Fuel savings**	£2,800
Income and savings	£14,000
Payback including labour costs	11.5 years

*at 8.6 p/kWh (Tier 1) and 2.2 p/kWh (Tier 2) (Tier 1 payments stop at 261,486 kWh)
** assumes previous fuel was oil at a cost of 50p/litre and wood chip costs 100/tonne (30/mc)

"From autumn 2015 all biomass fuel used by households, businesses and other organisations claiming the RHI must meet a lifecycle greenhouse gas (GHG) emissions target of 60 per cent GHG savings against the EU fossil fuel average, and land criteria, which for woodfuel are set out in the UK Timber Standard for Heat and Electricity."

Extract from the biomass suppliers website: http://biomass-suppliers-list.service.gov.uk/

Boiler Type	Advantages	Disadvantages
Wood Pellet	• Automated fuel delivery and ignition; • Fuel quality is strictly controlled by the pellet producer; • Smaller fuel store required; • Less building work required compared to woodchip systems; • Longer periods between fuel deliveries; • Fuel can be delivered in bulk and blown into the fuel store; • Lower risk of fuel blockages compared to woodchip.	• Most expensive wood fuel to purchase (approx £200/tn); • Limited fuel suppliers available in Scotland; • Large fuel delivery lorries need access to within 20m of the fuel store.
Wood Chip	• Woodchips are cheaper than pellets; • Woodchip could be produced from Estate grown timber; • Larger woodchip supplier list to choose from compared to wood pellet suppliers.	• Larger fuel store required for storing the wood chips compared to wood pellets; • Fuel deliveries and fuel store location need careful design; • More frequent fuel deliveries compared to pellets; • Higher risk of blockages from poor quality woodchip therefore more interaction than with pellets; • Woodchip moisture content must match boiler manufacturer's specification otherwise efficiencies will drop (normally 35%MC max.).

Bio-diesel

Rape seed is pressed and the collected oil is mixed with Methanol and sodium methylate. The mixture is heated and biodiesel is formed along with a waste by-product. The biodiesel is only used for cars as they are subject to fuel duty. As tractors use red diesel it is not financially viable to run them from bio-diesel. The production of bio-diesel is tax free up to 2,000 litres a year.

The set up costs of the refinery totalled £3,000. The cost of rape seed oil is approximately 50p/litre and the additional cost of turning this into biodiesel is 15p/litre. This makes the payback of producing bio-diesel roughly 3 years. However there are drawbacks; insurance can cause difficulties due to preceived fire risk and small bio-diesel plants fall under the same licensing as oil refineries, although licence applications are fairly straightforward to complete.

Solar PV

Iver has installed two 2kWp solar PV installations. Like the small wind turbines, the energy demand of the site is similar to the energy production of the solar panels. This helps to compensate for the comparatively higher installation costs of small systems. The solar system is a good partner to the wind turbine as you get more solar energy in the summer than winter. The opposite is generally true for wind with higher energy yields in the winter. The financial case for the panels is laid out below.

Financial summary of 2kWp Solar PV	
Total installed capacity	2 kWp
Capital costs	£4,000
Estimated annual generation	1,700 kWh
Estimated onsite energy use (70%)	1,200 kWh
Fit and export income and energy savings*	£500
Payback period	8 years

*Fit at 21 p/kWh & 3 p/kWh and electricity savings at 11 p/kWh

"Rising fuel bills and the need to find more sustainable and greener alternatives should have us all on our toes searching for opportunities that help our farms stay economically viable."

Iver Salvesen, January 2015