Sustainability On Farms In Orkney

By

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Introduction

While there are many examples where the Orkney agricultural sector has adopted sustainable solutions to develop the industry, there are two particular areas included in the below outline where this is demonstrated – i) the generation of renewable energy and ii) the use of by-products from other industries. The below summary also includes an outline of recent research in Orkney into the use of woody crops as a source of renewable heating fuel, although this has not yet been developed on any significant scale.

Generation of Renewable Energy

The average annual fossil fuel use in Orkney (2009-13) was estimated at 757 GWh (Aquatera, 2015). Renewable energy generation has increased considerably since 2000 and in 2013 reached 40 GWh which meant that the archipelago was virtually self-sufficient in electricity. Most of this was generated by wind turbines, and Orkney has the highest concentration of small and micro turbines in the UK, as well as larger community schemes and commercial wind farms. Although the exact numbers are not available, many farms have installed turbines (of a range of sizes) on their land and therefore contribute to this achievement.

Orkney is connected to the UK national grid by two 33kV (20MVA) submarine cables but the capacity of the distribution grid is currently insufficient to cope with the development of further renewable generation. Consequently, at times, there is an excess of renewable energy generated and this has to be turned off. Transmission reinforcement is now being investigated to allow the export of electricity from further renewables developments, especially marine renewables. Also, a range of switching options (Aquatera, 2015) are being considered to make better use of the abundant supply of renewable electricity – some of these could have major implications for the agricultural sector, if they are developed.

Switching Options Being Considered To Make Better Use Of Orkney's Renewables Capacity

Ammonia As A Fuel Or Fertiliser

Excess electricity could be used to make ammonia which could then be used as a transport fuel and/or as a nitrogen fertiliser. Recent developments elsewhere have focused on using Solid State Ammonia Synthesis (SSAS) as a more efficient alternative to the previously used Haber-Bosch process. The potential impact on the agricultural sector could be considerable since it is a major user of fossil fuels, with an annual consumption of about 113 GWh of gas oil (red diesel) and imports about 5,900 t of nitrogen (total fertiliser imports, about 30,000 t). Nevertheless, a transition to ammonia for fuel and fertiliser would require significant investment and major changes in machinery.

Grain Drying

Renewable energy could also be used for grain drying. Although the very seasonal nature of this activity does not make it a high priority strategic option for using excess renewable electricity, it could nevertheless be attractive for individual growers.

Heated Growing

Polythene tunnels are already commonly used in Orkney for growing horticultural crops. If they are insulated and fitted with supplementary lighting and heating a much wider range of crops could be produced. Important issues, however, would be the cost of production; the market for, and distribution, of such crops; and the development of appropriate growing systems.

Woody Biomass Crops As a Potential Heating Fuel

Since 2002, the Agronomy Institute (AI) has carried out research into the potential of woody species as a source of wood fuel in Orkney. Orkney has a particularly high demand for domestic heating compared with other parts of the UK because of the length of its winter, its cool temperatures and high average wind speeds. With no mains gas supply, most heating is from oil, coal, peat or electricity. Unlike many parts of mainland Scotland, Orkney lacks forestry resources and the AI has therefore carried out research on the potential for establishing fast-growing woody species as a source of local wood fuel for heating.

Short Rotation Coppice (SRC)

Short rotation coppice (SRC) willow is normally planted at a very high density of about 16,000 plants/ha and has the major advantage of producing a harvest of wood chips within about 5 years of planting. Research on SRC in Orkney has identified a number of clones which have a biomass production of about 6-7 oven dry tonnes / ha / year but the lack of suitable small-scale harvesting equipment and end users with wood chip boilers has prevented further commercialisation. Currently, there are also economic constraints on developing SRC as the price for wood chips is not high and the returns from using land for SRC do not compare favourably with livestock production. It is not considered feasible to manually harvest SRC and the relatively small diameter of stems makes them unsuitable for burning as logs. If SRC had been developed in Orkney, producers could now be benefiting from the current excess of renewable electricity in the islands, as this could have been used for drying the harvested chips.

Short Rotation Forestry (SRF)

In spite of a commonly-held belief that "trees do not grow in Orkney", there are several examples of successfully established woodlands on the islands and it is estimated that since 2000, about 127 ha of woodland have been established in Orkney

(http://www.orkneycommunities.co.uk/WOODLAND/index.asp). It is likely that much of this was on farm land. Although mostly planted for amenity or biodiversity purpose, at some stage some of these plantings will need thinning or could be harvested for wood fuel. To allow trees to provide mutual shelter for each other from the wind, most Orkney tree planting is established at a closer spacing than used elsewhere, similar to that recommended for short rotation forestry (SRF). Consequently, the AI is currently investigating suitable species for SRF in Orkney in collaboration with Forestry Commission Scotland (http://scotland.forestry.gov.uk/images/corporate/pdf/energy-forestry-trials-progress-report-2016.pdf).

SRF plantations are established at a higher density (2,000-3,000 trees/ha) than for normal forestry and utilise fast growing species with the objective of harvesting them at about 15-20 years. Several of these species can be coppiced and should therefore regenerate after harvesting. SRF systems are considered to be particularly suitable for the establishment of small areas of woodland on farms, where the wood could have a number of end-uses, including firewood. A major advantage of SRF for small-scale growers in remote areas is that harvesting and processing into a fuel (e.g. split logs) does not need costly, specialised machinery.

As a wood fuel, split logs from SRC would most likely be used for supplementary heating in stoves or open fires and could therefore contribute to reducing the use of fossil fuels, like coal.

Use of By-Products

Wastes From Breweries And Distilleries

Orkney has two breweries and two major distilleries which produce by-products which can be used as feed or fertiliser, helping to increase the sustainability of local agriculture. The materials produced are described below and similar by-products could probably be used by project partners in other countries.

After the mashing process, the remains of the malt (Brewers' grains (BG) or draff) can be used as an animal feed (SAC, 2012). Although this has a high protein content (c. 18% of dry matter), its high lignocellulose content makes it indigestible for many species, so that it is most suited for ruminants – especially dairy and beef cattle. BG can be used fresh or made into silage (http://www.kwalternativefeeds.co.uk/products/view-products/potato-dice-1/). If there is any possibility that BG have been mixed with pot ale from copper stills, these should not be fed to sheep.

Distilleries also produce a liquid waste, pot ale, from the wash stills which, with appropriate guidance (ADAS, 2015), can be applied to land as a useful source of some nutrients. The nutrient content of pot ale varies considerably with source but typical reported values are 2.5, 1.8 and 1.1 kg/m^3, respectively, for total N, P_2O_5 and K_2O. Typically, this is applied at rates between 20 and 50 m^3/ha. Pot ale has a low pH and, where copper stills are used, it is likely to have a high content of copper and perhaps zinc (reported values of 7.1 and 0.8 mg/l, respectively). In Orkney, pot ale is commonly applied to high-pH sandy soils, which are often deficient in copper. The water in pot ale can be evaporated to produce pot ale syrup, a very nutritious animal feed (25-35% protein content), but this is a process which requires a lot of energy and is not done locally in Orkney. Where copper stills have been used, pot ale syrup is also likely to contain high levels of copper and so should not be fed to sheep.

References

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