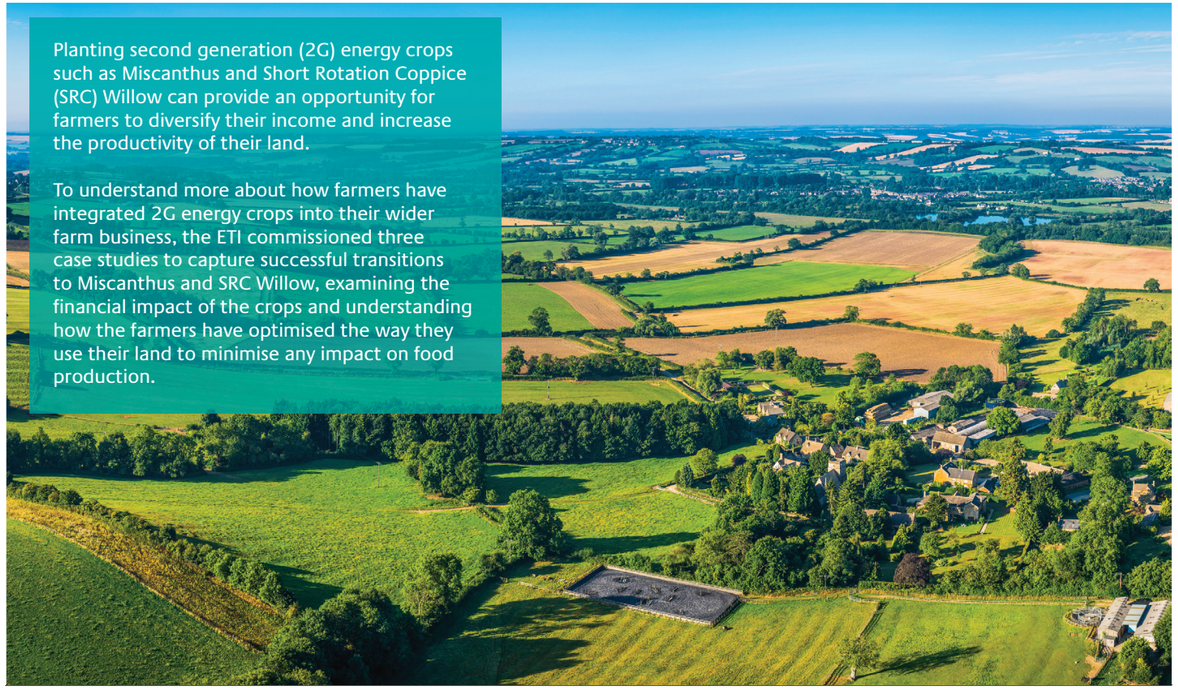
energy technologies institute

An ETI Perspective

Bioenergy crops in the UK. Case studies of successful whole farm integration

INTRODUCTION



Planting second generation (2G) energy crops such as Miscanthus and Short Rotation Coppice (SRC) Willow can provide an opportunity for farmers to diversify their income and increase the productivity of their land.

To understand more about how farmers have integrated 2G energy crops into their wider farm business, the ETI commissioned three case studies to capture successful transitions to Miscanthus and SRC Willow, examining the financial impact of the crops and understanding how the farmers have optimised the way they use their land to minimise any impact on food production.

KEY HEADLINES

- All three case studies demonstrate that planting energy crops can increase the profitability of the land over a 23-year lifetime. The initial investment costs are expected to be paid back within the first six to seven years.
- By optimising the use of land across the farm, the impact on food production can be minimised or avoided. This shows that energy crop planting need not be in direct competition with food production, but instead can complement other farming activities.
- Land which is less suitable for food production or for grazing can be suited to energy crops as they can be successfully planted on poorer quality soils, and land which is more prone to water-logging or weed problems. The farmers in these case studies chose to grow energy crops for a variety of reasons - making better use of difficult or under-utilised land, diversifying income and reducing workload.
- All the farmers cited the importance of obtaining secure, fixed term contracts with buyers, in their decision making.

As the UK Government prepares the framework for the UK exiting the EU, it must decide how farming will be supported outside of the EU's Common Agricultural Policy (CAP). These case studies show that planting bioenergy crops is an opportunity for farmers to increase the profitability and productivity of their land whilst producing biomass feedstock that can help reduce the UK's greenhouse gas (GHG) emissions.

The development of new farming support mechanisms presents an opportunity to join up agricultural and energy policies to support growing sustainable biomass in ways that improve overall land productivity.

The full evidence pack is provided in the accompanying ETI report Bioenergy crops in the UK: Case studies of successful whole farm integration.

CONTEXT

Why bioenergy?

Bioenergy can play a significant and valuable role in a future UK energy system, helping to reduce the cost of meeting the UK's 2050 GHG emissions reduction targets by more than 1% of gross domestic product (GDP).

The ETI's internationally peer-reviewed Energy System Modelling Environment (ESME), a national energy system design and planning capability, suggests that bioenergy, in combination with Carbon Capture and Storage (CCS), could provide around 10% of projected UK energy demand whilst also delivering net negative emissions of approximately -55Mt CO_2 per year in the 2050s. This is roughly equivalent to half the UK's emissions target in 2050 and reduces the need for other, more expensive, decarbonisation measures. Even in the absence of CCS, bioenergy alone is still a cost-effective means of decarbonisation and should play an important role in meeting the country's 2050 emissions target.

How much change is required?

Delivering 10% of projected energy demand in the 2050s will require around three times as much bioenergy to be generated as today[1]. Bioenergy is already the largest source of renewable energy in the UK using a mixture of wastes, UK-grown biomass and imported biomass feedstocks. Historically, waste feedstocks have been the dominant bioenergy feedstock source, but to meet the 2050s target the increase in feedstock is expected to come primarily from imported and domestic biomass.

Currently the contribution of UK-grown 2G energy crops (perennial grasses and woody crops such as Miscanthus, SRC Willow and Short Rotation Forestry) is small, with only 10kha grown in England[2] and 0.5kha grown in other parts of the UK. Including first generation energy crops, such as oilseed rape used to make transport fuels, the total area of energy crops in the UK is 122kha[2]. By comparison, in 2015, the UK grew 1,832kha of wheat[3].The ETI's recent insights paper, 'Delivering greenhouse gas emission savings through UK bioenergy value chains'[4] demonstrated that UK-grown 2G biomass feedstocks can deliver genuine system-level carbon savings across heat, power and fuel production, both with and without CCS.

Our insights paper also suggested that the UK could deliver significant volumes of biomass by the 2050s by planting 30kha of 2G bioenergy crops each year (~1.2Mha of new planting by 2055, which together with the existing area of energy crops, brings the total area to ~1.4Mha); a steady increase which would maximise the opportunity for the sector to 'learn by doing' - developing and sharing best practice knowledge.

1. BEIS (2016). Digest of UK Energy Statistics (DUKES). Available at: https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes
2. Defra (2015). Area of crops grown for bioenergy in England and the UK. Available at: https://www.gov.uk/government/statistics/area-of-crops-grown-for-bioenergy-in-england-and-the-uk-2008-2014
3. Defra (2015). Structure of the agricultural industry in England and the UK at June. Available at: https://www.gov.uk/government/statistical-data-sets/structure-of-the-agricultural-industry-in-england-and-the-uk-at-june
4. ETI (2016) Delivering greenhouse gas emission savings through UK bioenergy value chains. Available at: http://www.eti.co.uk/delivering-greenhouse-gas-emission-savings-through-uk-bioenergy-value-chains/

What drives farmers to plant 2G energy crops?

The ETI's Enabling UK Biomass project[5] surveyed over 100 farmers who had planted bioenergy crops about the motivations behind their decision. This found that farmers most often chose to plant energy crops to make more productive use of low quality land in order to generate a higher profit from that land. The availability of long-term contracts was also often an important factor in their decision making.

The Case Studies

Three farms took part in our study, two from Norfolk (both of which had planted Miscanthus) and one based in Cumbria, which had planted SRC Willow. Each farm had planted between 18-30ha of energy crop on land that had previously been used for a variety of purposes, including arable, sheep and dairy farming.

All three farms have secured long-term contracts with local buyers – the Miscanthus is bought by Terravesta who produce pellets for use in the heat and power sector, while Iggesund buy the SRC Willow for use in the operation of a combined heat and power (CHP) plant at their factory in Workington.

The crops have a lifetime of 23 years and each farm expects to see an increase in the profitability of the land, and for the crop to payback its establishment costs within the first six to seven years. This takes into account the fact that the two Norfolk farms obtained a grant for 50% of their establishment costs from the (now closed) Energy Crops Scheme (ECS).

All three farms sited their energy crops to minimise the impact on food production. In Norfolk, one farm planted Miscanthus on their lowest yielding arable land, whilst the other farm intensified their sheep production (from 600 ewes on 90ha to 500 ewes on 60ha) to free up land whilst minimising the reduction in flock size. In Cumbria, the land had previously been used for dairy but was surplus to requirements at the time of planting due to a change in farming practices.

Whilst none of the farms have carried out specific biodiversity monitoring since planting energy crops, the two Norfolk farms have anecdotally reported that they have seen an increase in wildlife on their land, particularly birds. In Cumbria, it is too soon to see any effects, but the SRC Willow was planted following a successful Environmental Impact Assessment (EIA).

5. ETI (2015). Enabling UK Biomass. Available at: http://www.eti.co.uk/bioenergy-enabling-uk-biomass/

CONCLUSION

Planting 2G energy crops can provide an opportunity for farmers to diversify their income, and increase the profitability and productivity of their land. All three of the case study farms have secured long-term, index-linked contracts for their energy crops, and as a result they have seen, or expect to see, an increase in profitability from their land.

All three farms have also improved productivity by siting energy crops on land which was either 'surplus' (due to changes in livestock management), or of poor quality for arable farming or grazing livestock. This shows that energy crop planting need not be in direct competition with food production, but instead can complement other farming activities. This is an important point when it comes to discussing how land use can be optimised in the UK; a discussion which should take into account all pressures on land use including housing, infrastructure and renewable energy developments, as well as food, feed, fibre and bioenergy feedstock production.

This discussion will be particularly important in the coming years as the UK Government negotiates its exit from the EU and must decide how farming will be supported outside of the EU's CAP. This presents an opportunity to join up agricultural and energy policies to support growing sustainable biomass in ways that improve overall land productivity.

APPENDIX

What are 2G energy crops?

Miscanthus is a perennial energy crop that can grow to heights of 8-12ft. Rhizomes (an underground stem or bulb) are planted in spring at a density of 10,000–15,000 per hectare. After its first year of growth it can be harvested annually for biomass for 20 years or more. New shoots emerge around March each year, growing rapidly in June-July, producing bamboo-like canes. The Miscanthus dies back in the autumn/winter, when the leaves fall off, providing nutrients for the soil, and the dry canes are harvested in winter or early spring. It can be grown successfully on marginal land in all soil types, in both wet and dry conditions[6].

Willow (Salix spp.) is planted as rods or cuttings in spring using specialist equipment at a density of around 15,000 per hectare. The willow stools readily develop multiple shoots when coppiced and several varieties have been specifically bred with characteristics well suited for use as energy crops. During the first year it can grow up to 13ft in height, and is then cut back to ground level in its first winter to encourage it to grow multiple stems. The first crop is harvested in winter, typically three years after the cut back, again using specialist equipment. The crop is harvested every three years subsequently, giving a total of seven harvests over a typical 23-year crop life[7].

Further Information

ETI Bioenergy Programme:

- www.eti.co.uk/programme/bio/

Information on bioenergy crops:

- The Biomass Energy Centre - www.biomassenergycentre.org.uk

Information on case study participants

- Iggesund: www.biofuel.iggesund.co.uk
- Terravesta: www.terravesta.com

Information on rural grants and payments (including the CAP and ECS (now closed):

- www.gov.uk/topic/farming-food-grants-payments/rural-grants-payments

Acknowledgements:

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6. Biomass Energy Centre. Miscanthus. Available at: http://www.biomassenergycentre.org.uk/portal/page?_pageid=75,18204&_dad=portal&_schema=PORTAL
7. Biomass Energy Centre. SRC Willow. Available at: http://biomassenergycentre.org.uk/portal/page?_pageid=75,18112&_dad=portal&_schema=PORTAL

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