WHY WE NEED ENERGY CROPS IN THE UK

During troubled economic times people start to think about self sufficiency, writes Kevin Lindegaard (Crops for Energy).

More and more people are growing their own fruit and vegetables and installing renewable energy technologies to save money and reduce their dependence on bought in food and fuel. Many are also considering the use of their own woodlands or farmland to produce sufficient woodfuel to heat their properties.

As a nation, the UK is committed to trying to produce 15% of our total energy (electricity, heat and transport) from renewables by 2020. This includes a 12% target for renewable heat. There is plenty of undermanaged woodland in the UK but this is not sufficient to meet the demand alone. In addition, much of this resource is remote, with poor access, small in size and in private ownership. As a result extraction costs can be expensive. In many ways it is quicker, easier and cheaper to produce good quality local biomass from woody energy crops such as short rotation coppice (SRC), short rotation forestry (SRF) and miscanthus.

Woody energy crops can produce a very high output from a relatively small area of land. By planting these crops on 1.2%–3.5% of UK agricultural land would help us move towards energy security whilst not affecting food production. However, there are only around 10,000–12,000 hectares planted nationally which is a long way short of the 2020 target of 350,000 ha. Nevertheless, the UK Government continues to recognise the importance of these crops in our energy mix. The latest UK Bioenergy Strategy was published in April and predicts that the greatest increase in domestic bioenergy supply will come from agricultural residues and energy crops but argues that "The potential to upscale is currently restricted by UK planting and harvesting capacity, grower acceptance, economics, technology compatibility and social resistance related to concerns around long-term land use change." Removing these barriers is essential.

WHAT'S IN IT FOR GROWERS

Some of the main issues hindering widespread uptake in the past have been the lack of markets, the modest returns from power station contracts and the poor cash flow in early years. However, farmers should look closer to home for the most lucrative markets. The best returns can be achieved when farmers use their own energy crops to heat their farm buildings. The savings made by replacing expensive fuels such as oil and LPG together with rebates from the Government's Renewable Heat Incentive (RHI) can turn willow and miscanthus into serious cash crops.

A farmer currently using heating oil will be paying around 65p a litre (equivalent to around 6.0p/kilowatt hour). Even considering the lost revenue of taking land out of food production, it should be possible to produce miscanthus chip for around £50/odt or 1.02p/kWh. This provides a massive annual gross margin of £2,533/yr. SRC has lower yields and requires drying to produce a premium chip. Even then it is possible to achieve an effective gross margin of £2,061/yr. No food crop can get near these figures. A winter wheat crop sold for feed yielding 8.35 tonnes/ha and achieving a grain price of £140/tonne would realize a gross margin of £673/ha (John Nix Farm Management Pocketbook, 2012).

Table 1: Production costs and potential gross margin from miscanthus and SRC self supply and sales to third parties. (Assumes production costs are spread over 22 years; realised yields of: 10.4 oven dry tonnes/ha/yr for Miscanthus and 8.4 odt/ha/yr for SRC; establishment costs of £3,000 for miscanthus and £2,500 for SRC minus 50% grant from the Energy Crops Scheme.

Activity	Miscanthus		SRC	
	Self supply (chip)	Sell to end user (pellet)	Self supply (chip)	Sell to end user (chip)
Establishment (£/odt)	£7	£7	£7	£7
Harvesting/ Nutrition (£/odt)	£19	£22	£18	£18
Processing (£/odt)	£0	£50	£10	£10
Haulage to end user (£/odt)	£0	£7.5	£0	£10
Lost revenue (£/odt)	£24	£0	£28	£0
Total cost to produce (£/odt)	£50	£86	£63	£45
Farmer profit from sales	/	£40	/	£45
Total cost (£/odt)	£50	£126	£63	£90
Cost (pence/kWh)	1.02	2.56	1.23	1.75
Cost of oil (pence/kWh)	6.00			
Equivalent oil price for self supply (£/t)	£294	/	£308	/
Farmer profit from self supply (£/t)	£244	/	£245	/
Gross margin (£/ha)	£2,533	£416	£2,061	£378

The potential return to a farm business is even more substantial if the returns from RHI are taken into account. Below are two examples of farmers who are using their own miscanthus chip in the SW of England. Over 20 years the fuel savings and RHI rebates could boost the farm incomes by £328,500 and £520,800 respectively.

Table 2: Farmer case studies of miscanthus chip self supply

		Poultry farmer, Somerset	Holiday cottages, Cornwall
		40,000 indoor reared chickens	8 holiday lets, farmhouse and swimming pool
Fossil fuel replaced		LPG	Oil
Amount used (litres/yr)		32,534	32,000
Amount of miscanthus required	Tonnes at 25% MC	106	89
	Hectares	8	5.7
Boiler size (kW)		130	199
System costs		£78,000	£150,000
Estimated rebate from RHI		£16,578	£21,795
Savings compared to fossil fuel		£3,700	£11,805
Annual savings		£20,278	£33,600
Simple payback		3.8 years	4.5 years

It is also possible to make a fairly good return from selling woodfuel to local heat end users. Local authorities should approach farmers directly to grow energy crops on their behalf. A typical primary school may need 3-4 ha of energy crops whilst an elderly peoples' home may require around 10 ha. This would provide the farmer with a long term market and the end user with a reliable and secure supply that is largely insulated against future price rises brought about by higher transport fuel costs.

CROPS FOR ENERGY

Crops for Energy has produced the first holistic study looking at the potential contribution of woody energy crops to SW regional renewable energy targets, greenhouse gas reductions, economic development and wider environmental benefits. The main findings of the work are that that planting energy crops on 3.5% of SW agricultural land (65,595 hectares) would provide the following benefits:

- 2.64 Terawatt hours of energy per year (37.5% of the regions renewable heat target)
- 780,946 tonnes CO2 equivalent saved each year (offsetting 25% of the emissions from agricultural food production)
- £768 million of investment stimulated in biomass boiler projects
- £55.4 million/yr saved in fuel costs by consumers
- £27.8 million/year in farmer profit
- 3,745 renewable energy jobs (a 134% increase on the current number of jobs in the bioenergy sector)

You can read the full position paper and report at: www.crops4energy.co.uk/why-we-need-energy-crops-sw

WHICH CROP?

Growers need to think about their land, their climate conditions and their end user. Each crop option has pros and cons. For instance miscanthus is high yielding and produces dry fuel but has a much higher bulk density and the fuel has a higher chlorine and silica content. This means you need more space to store it, more journeys to transport it and a compliant boiler that can deal with the high ash and corrosive nature of the fuel.

SRC can be grown on more marginal land and the fuel can be used in a wider range of boilers but the fuel is wet when harvested. This means that you need to find an effective way of drying it. The good news is that you can use the heat from your biomass boiler to do this. SRF produces the best fuel quality and good yields (especially Eucalyptus) but the lead in times are long and there are currently no grants for planting exotic species.

The received wisdom is that miscanthus is higher yielding than willow but there have been few direct comparisons in trials. Recent SRC trial results suggest that the yield of newer varieties are on average 13% higher after the first harvest and 20% after the second harvest. In addition, some varieties such as Endeavour and Endurance have been found to have higher dry matter (and therefore lower moisture content) at harvest, higher calorific values and higher bulk densities. As a result there is scope for significantly increasing the yield and quality of wood chip from new SRC plantations.

	Northern Ireland/Ireland		West of England/Wales		East of England	
	1st rotation	2nd rotation	1st rotation	2nd rotation	1st rotation	2nd rotation
Avg yield odt/ha/yr	11.33	13.32	10.95	13.09	9.01	11.21
Yield allowing for 20% yield losses	9.06	10.66	8.76	10.42	7.21	8.97
Avg. over 22 years (7 harvests)	9.96		9.72		8.32	

Miscanthus is probably higher yielding but not by as much as some suggest. Frequently, experimental harvests of miscanthus have been taken too early (Jan-Feb) so there is leaf litter included in the crop. This should be avoided by growers as leaves have the highest concentration of silica and chlorine and this reduces the quality of the fuel. We've talked to real growers and found that the yield of a good crop in the SW after 5 years is likely to be 10.4 odt/ha/yr. By contrast miscanthus grower William Cracroft Eley, based in Lincolnshire has produced an average yield of 11.7 odt/ha/yr over 10 years.

OTHER BENEFITS

A report produced by Forest Research in 2011 called "Woodland for Water: Woodland measures for meeting Water Framework Directive objectives" [1] suggests that energy crops could provide an effective way of reducing pollution from farmland and providing flood risk management. Energy crops intercept sediment and absorb nitrates from the water and could therefore be deployed in Nitrate Vulnerable Zones (NVZs) to help improve the quality of river and coastal waters. The coppice nature of energy crops provides hydraulic roughness which slows down the flow of flood water reducing the likelihood of floods downstream and increasing the time available for issuing warnings.

A large body of research suggests that energy crops can significantly increase biodiversity on farms. The crops and surrounding headlands provide food and habitats for birds, butterflies and other invertebrates. Unfortunately, despite the benefits to wildlife there has been no incentive made available to growers through environmental schemes. This needs to change. An interim payment following crop establishment and before the first harvest would be highly beneficial as it would reduce the farmers risk and enable an improved cash flow in early years.

The revision of the Common Agricultural Policy (CAP) also offers an opportunity to stimulate energy crop plantings and reward growers for their multifunctional benefits. It is hoped that it will be permitted for energy crops to be grown as part of the 7% of a farmers land set aside as Ecological Focus Areas.

It is clear that energy crops can really punch above their weight in helping deliver on our renewable energy and climate change targets. Unlike many other renewables they deliver the maximum economic benefit in their own back yard.

Crops for Energy can assist land owners in making the right choices for woodfuel growing, supply and use through feasibility studies, turn key management options and training courses.

For further information www.crops4energy.co.uk

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