PRIFYSGOL ABERYSTWYTH UNIVERSITY

Final Report

Helyg i Gymru

Willow for Wales

1 March 2004 - 31 December 2008

The Development of Sustainable Heat and Power fuelled by Biomass from Short Rotation Coppice Willow in Wales.

http://www.willow4wales.co.uk/

The Development of Sustainable Heat and Power Fuelled by Biomass from Short Rotation Coppice Willow in Wales

An Objective 1 project funded by the European Regional Development Fund (ERDF) provided through the Welsh European Funding Office.

Project Reference: 55263
NAfW (National Assembly for Wales)
Reference A-W55263-11-001

When citing this report, the full reference is

Valentine J, Duller C J, Hinton-Jones M, Tubby I, Fry D A, Slater F M, Sherborne A, Jones E, Heaton R, Farrell J, Horne B, Green C G, Powell H, 2009. The development of sustainable heat and power fuelled by biomass from short rotation coppice in Wales. Aberystwyth University Report of the Helyg i Gymru / Willow for Wales 2004-2008 project. 92pp. http://www.willow4wales.co.uk/

The report, together with updates and a related report on 'The biodiversity of short rotation coppice in the Welsh landscape' by Danielle Fry and Fred Slater of Cardiff University, will be available on the above website.

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[1] IBERS was formed in April 2008 following the merger of the Institute of Grassland and Environmental Research with Aberystwyth University's Institute of Rural Studies and the Institute of Biological Sciences, with the support of BBSRC and WAG.

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ACKNOWLEDGEMENTS

This project was funded by European Regional Development Funds and the Welsh Assembly Government Pathways to Prosperity and SMARTCymru funds as part of the EU the Economic Regeneration of West Wales and The Valleys Objective 1 Programme through the Welsh European Funding Office.

The support of RWE npower, EGNI, Renewable Fuels Ltd, Senova Ltd, bP Biofuels, Pembrokeshire Bioenergy, the Mid-Wales Energy Agency and Horne Energy Consultancy is much appreciated.

We also thank the farmers involved in the commercial blocks of willow for their goodwill and patience. Thanks are also due to Peter Randerson, Cardiff University, for his collaboration on the economics of willow.

The project co-ordinator wishes to thank the consortium for sustaining its enthusiasm throughout the five year project.

Special thanks are due to Joanna Spikes who managed the financial side of the project.

EXECUTIVE SUMMARY

"We will harness the sun and the winds and the soil to fuel our cars and run our factories." (Barack Obama 21st January 2009).

While the primary drivers of bioenergy are concerned with climate change and to a lesser extent energy security, bioenergy offers many opportunities for business development and job creation and for sustainable forestry and agriculture. Several studies have shown that more local jobs are created by biomass technologies than by any other renewable energy technologies. It has been estimated that 300,000-550,000 jobs could be created in the biomass supply chain in Europe by 2020, though these estimates probably need revising.

It is clear that a range of biomass resources, including energy crops, will be required if there is to be a continuous supply meeting projected demand. The high potential for job creation upstream of primary production of biomass suggests that policy makers need to take account of the needs of the whole economy, the needs for renewable energy and sustainable rural and urban development. Even so, the agricultural sector itself may benefit by greater diversification in the face of risks faced by the industry

It is against this background and the realisation of the need to diversify Welsh agriculture in the wake of a devastating foot-and-mouth epidemic that the Helyg i Gymru – Willow for Wales project was set up in 2004 to demonstrate and monitor production from short rotation coppice willow across Wales.

CHAPTER 1 considers the factors affecting suitability of SRC for growing in Wales. It describes the selection, establishment and management of commercial farm sites, their harvesting, drying and storage and the monitoring of yields. It highlights that willow is suited to a wide range of land conditions across Wales and explains that there are few insurmountable technical barriers to willow production. Local planting and harvesting machinery would reduce costs and make logistics easier. It emphasises that good weed control is essential to maximise yield. It discusses the logistical and financial implications of not having a local source of planting material or planting and harvesting machinery and highlights the potential benefits of developing co-operative groups.

Most respondents in an anonymous survey of growers involved in the project found involvement in the project very useful and intended to maintain the willows planted on their farms. Furthermore, they would increase their involvement with energy crops if there were a planting grant and technical support. Even though SRC willow is not currently rewarded by current agri-environmental schemes, respondents saw environmental value as the main attraction of growing willow. Half of the respondents saw home energy use as an attraction. All respondents considered difficulties with

Single Farm Payment as a drawback of growing SRC willow, even though such difficulties should not exist.

The chapter highlighted that further research and development would be justified on

- weed control based on reduced herbicides, minimal cultivation and the use of mulches or cover crops
- harvesting machinery and systems better suited to marginal areas and small fields
- Drying and storage

CHAPTER 2 considers the environmental impacts of production of SRC in Wales. It highlights significant reductions of carbon emissions through the use of biomass for heat and power and for next generation lignocellulosic biofuels. It can be calculated that 0.461-0.646 Mt of C equivalents, about 30-40% of the total emissions from Welsh agriculture, would be saved per 100,000 ha of energy crops in Wales. This does not take into account the substitution of methane from animals (about 40% of total agricultural emissions). These are much higher reductions than those that could be obtained from annual biofuel crops.

SRC plantations could effectively be used to reduce nitrogen runoff, particularly if plantations were used as buffer strips along watercourses. The use of energy crops (particularly willow) in phytoremediation of contaminated soil and water is an important environmental benefit.

Monitoring of biodiversity on the farm sites by the Wales Biomass Centre demonstrated SRC in Wales to be an important resource for invertebrates, birds and mammals. Inclusion of SRC in any future agri-environmental schemes could be justified by its value for carbon mitigation and sequestration, the delivery of environmental goods and services such as clean water and air and positive impact on biodiversity.

CHAPTER 3 addresses the identification of the best varieties adapted to Welsh conditions such as low temperatures, higher rainfall, greater wind speeds and lower fertility. If only those few varieties that have been developed for lowland England are tested, the best varieties for Welsh conditions are likely to be missed.

Sixty-three native willow clones have been collected from various altitudes. These represent a major Welsh resource in terms of adaptation to cold, wet, windy and marginal conditions. It opens up the possibility of developing breeding populations for selection for greater adaptation to Welsh conditions, in partnership with an existing willow breeder.

CHAPTER 4 considers wider supply chain issues**.** It presents the results of a new economic model for SRC willow production based on levels of actual inputs obtained in the Willow for Wales project costed at 2007 levels (Valentine et al, 2008), showing that attractive returns can be obtained but a kickstart is needed to overcome the

initial high costs of establishment. The importance of fair and transparent production contracts to supply chain members is also considered in this chapter.

CHAPTER 5 outlines the scale of demand for energy crops for heat and power, in particular the needs of end-users at different scales involved in the Willow for Wales consortium.

It has been estimated that by 2010, there will be a demand for 130MWe and 285MWh, requiring 1.5 M t of biomass, rising to 230MWe and 500MWh requiring 2.5 Mt of biomass in 2020 (Jones, 2007). These amounts cannot be met by forestry and recycled timber alone and will either have to be imported or grown on Welsh farms. A recent assessment of the Welsh wood fuel industry's views on the current market concluded that competition between energy customers for biomass materials is beginning to take place (Horne & MacDermott, 2007).

CHAPTER 6 summarises the project's technology transfer activities and its participation in consultations.

Farms were used for real 'touch–and–see' demonstration events to inform farmers and others on the role of renewable energy sources in mitigating CO_2 emissions, how to grow willow, likely returns, end-uses and benefits to biodiversity. The balance of attendees at Open Days switched from being dominated by people with a general interest in green energy when we held events in 2004 to later being dominated by land owners.

During the life of the project, the team gave nine presentations at national and international conferences.

CHAPTER 7 A number of issues that act as barriers to take-up by farmers and the development of robust supply chains are highlighted in the concluding chapter. Good scope is identified for industry to develop supply chains and for supply chain participants, particularly heat and power generators and crop developers, to seek Convergence or government support for planting and harvesting machinery and infrastructure.