Renewable Energy 114 (2017) 781–793

Contents lists available at ScienceDirect

Renewable Energy

journal homepage: www.elsevier.com/locate/renene

Strengthening the development of the short-rotation plantations bioenergy sector: Policy insights from six European countries

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ARTICLE INFO

Article history:
Received 7 March 2017
Accepted 24 July 2017
Available online 24 July 2017

Keywords:
Short-rotation plantations – SRP
Short-rotation coppice – SRC
Woody biomass
Bioenergy
Bioeconomy
Policy design

ABSTRACT

This paper, based on a participatory methodological framework involving expert stakeholders and researchers from six European countries (Germany, Ireland, Poland, Spain, Sweden and UK), analyses the priority issues for the development of short-rotation plantations (SRP), and proposes a series of policy strategies to strengthen this development. The results indicate that there is a lack of awareness of the multifaceted benefits of SRP at the level of farmers, policy makers and public authorities. More research is required to put a value on the multifunctionality of SRP and justify its public support. Small-scale projects using established technologies are also required with energy crops introduced in a phased manner. The simultaneous dissemination of this knowledge upwards to policy makers and downwards to producers and farmers is critical in the success of SRP. Also, greater financial support on both the supply and demand side is highlighted as being necessary: on the supply side linking multifunctional benefits of SRP and targeted payments, along with increased long-term contractual arrangements between farmers and energy plant operators; demand side incentives should overcome any difference in price between fossil fuels and energy crops. Groups to lobby for the uptake and support of SRP and bioenergy are also of necessary.

1. Introduction

Renewable energy is at the core of EU's long-term energy strategy because it helps to reduce greenhouse gas emissions, diminishes the need for energy imports making Europe more independent, and provides EU countries and their regions with new 'green' jobs and high value-added exports [1]. The European Directive 2009/28/EC on the promotion of the use of energy from renewable energy sources (RES) [2], which is part of the Climate and Energy Package, established a 20% target for the share of

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http://dx.doi.org/10.1016/j.renene.2017.07.098
0960-1481/

energy from renewable sources in gross final consumption of energy by 2020 for the EU. This Directive specifies national renewable energy targets for each country, taking into account its starting point and overall potential for renewables. In order to achieve this, a possible strategy suggested by the Commission was to triple the use of biomass energy compared with 1997 [3]. Biomass is expected to contribute to about half of the EU Renewable Energy target in 2020 and bioenergy is expected to remain the main RES contributor [4]. For this reason, biomass has become a flourishing sector that requires innovative solutions to meet the EU and international demand. It is necessary to ensure that the expected increases in biomass use takes place within a sustainable framework and biomass sustainability is thus a key issue [4,5].

Short-rotation plantations (SRP) are plantations of fast growing trees that are harvested in periods from 2 to 20 years and managed as coppice (short rotation coppice - SRC) or as single stemmed trees (short rotation forestry - SRF) The woody biomass produced can be used in applications such as large scale district heating (in combined heat and power –CHP– plants), small-scale boilers (when processed into more refined forms of wood fuel), and electric power generating stations (in dedicated bioenergy plants or in combination with other fuels such as co-firing with coal). SRP are considered a source of low-carbon fuel, as most greenhouse gas (GHG) emissions released during combustion will be re-absorbed by new growth, and can make a positive contribution to climate change targets [6–13]. Energy generation from SRP is very energetically efficient [7], with an output/input ratio greater than 18 in poplar [14]. SRP can also bring a wide range of other environmental benefits related to biodiversity, soil eutrophication/acidification and quality, reduced soil erosion, air and water quality, land remediation, and flood defence, among others [8,15–19] as long as they are not cultivated in areas of high nature-conservation value [20]. SRP may contribute to locally sourced energy systems which reduces dependency on fossil fuels and improves energy security [16]. The land intensity use of SRP is greater than other renewable energy sources, but it is a stock resource whereas wind and photovoltaics are intermittent [16]. Biomass generation from woody energy crops takes on special importance in farmland with low-productive capacity or deforested and unproductive forest areas with consequent beneficial effects on the environment, and may represent a new economic niche in marginal rural areas [16,21–24]. Integration of biomass crops into agricultural landscapes could stimulate the rural economy, thus counteracting negative impacts of farm abandonment or supporting restoration of degraded land [20].

Despite its potential benefits and demand for bioenergy expected to increase significantly, the development of the SRP sector in the EU has been low and very uneven in the different European countries. Sweden, the leading country, is considered as an example of a relatively successful development and use of woody plantations for bioenergy [25]. Production, pre-treatment and use of SRP was fully developed in Sweden twenty years ago [26]. Subsidy and tax incentives for energy crop production, an increased CO_2 tax on fossil fuel, an already existing biofuel market in the country and ready markets in district heating plants are among the main drivers for plantation of willow during the period 1986–1996 [27–29]. The total acreage of willow reached a peak at about 18,000 ha but has decreased to about 10,000 ha and it is still decreasing due to mismatch between the location of plantations and the market, slow development of the harvest technology and, lately, the competition from imports of cheap waste biomass. The relatively low biomass yields of willow may also be a reason due to a lack of management activities during the early stages of cultivation, the choice of inferior land for plantations, and the level of personal involvement of farmers [30]. In other European countries the share of SRP is lower due to diverse factors. For instance, in Germany the total area of SRP has increased to about 6000 ha in the last decade. In this case the crop of choice is poplar grown over longer rotation cycles on marginal lands with sufficient water supply [22]. In the UK, despite some progress being made in the late 1990's and early 2000s there has been little net growth in the area planted in recent years [31]. In this country, obstacles hindering progress have been identified, including the lack of long-term supportive energy crops policy, the lack of competitiveness of long-term perennial crop options compared to annual crops, and large-scale support schemes tending to favour imported biomass rather than supporting domestic supply [15]. In other countries of the South and East of Europe, the development of the SRP sector is even more nascent. In Spain, for instance, the area devoted to SRP is restricted to experimental plots, which have demonstrated a high potential for biomass production [32]. Critical factors conditioning the spreading of the SRP sector in Spain include lack of information on operating and selling costs and uncertainty of return on investment from long-term plantations; lack of tools to support the production, processing, and use of biomass; and limited supply of woody biomass from SRP and market availability [6,33,34]. Perennial energy crop development is just starting in Poland, with SRP and perennial grasses covering 8700 ha [35]. The main obstacles to the development of SRP are the competitiveness of energy crops compared to grain production [35] and the plentiful reserves of fossil fuel energy sources, especially coal.

Public policies promoting and supporting the development of the SRP bioenergy sector seem to have failed and a lack of coherent policy design at EU level is patent. In this sense, public policies are defined and implemented at national and regional level, but should be further coordinated and planned at EU level. This is because decisions taken by one country inevitably have an impact on other EU countries [36]. The optimum energy mix, including the swift development of renewables, needs a continental market at least; fragmented markets not only undermine security of supply, they also limit the benefits which energy market competition can bring [36]. Lindegaard, Adams, Holley, Lamley, Henriksson, Larsson, von Engelbrechten, Esteban Lopez and Pisarek [37] reviews the history and state of SRP at EU level and highlights some policy recommendations for the development of SRP. However, a more fine-tuned bottom-up approach arising from a deeper analysis of the particularities at country/region level is lacking.

The current research is carried out with such a bottom-up perspective within the EU's Framework 7th programme Rokwood project.[1] This project attempted to increase the market penetration of woodfuel produced from SRP. The project involved a large consortium of partners from six European countries, representative of the uneven development of SRP: Germany, Ireland, Poland, Spain, Sweden and UK. Within each country, a case study region is analysed (Table 1). Each region is represented by a cluster of three partners comprising the R&D&I triple-helix concept: business entity, research entity and local/regional authority. Some of the regions are well developed in terms of SRP planting and infrastructure (e.g. Skåne in Sweden) whilst others are in their infancy (e.g. Midlands & Western in Ireland).

In this context, the aim of this paper is to provide insights on supportive policy measures to strengthen the development of the SRP bioenergy sector in the EU by developing a series of strategies

[1] Project "European Regions fostering Innovation for Sustainable Production and Efficient Use of Woody Biomass (ROKWOOD)". European Commission – Seventh Framework Programme Coordination and Support Action. European Union FP7-Regions-2012-2013-1 (Transnational Cooperation between Regional Research-Driven Clusters), Grant Agreement No. 319,956. www.rokwood.eu.