



Limitations and improvement of the potential utilisation of woody biomass for energy derived from short rotation woody crops in Sweden and Germany

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Abstract

The use of biomass derived from fast-growing trees grown on agricultural land is common practice in parts of Sweden, but not in most other European countries. In the first part of this paper the different conditions for economic use of fast growing trees are analysed in Germany and Sweden. Neither the legal framework nor the natural growing conditions are likely to limit the utilisation of the biomass potential in Germany. Rather, lack of a market for biomass products, poor awareness and little infrastructure for the management of woody biomass plantations are limitations in Germany. The second part offers a possible solution for supporting the market and reducing transaction costs during establishment of the market under German conditions. The proposed solution involves the establishment of 'ecological structures' based on fast-growing trees as a means to compensate for sealed land by roads and buildings. The proposed concept would not only extend the economic potential for producing energy from biomass, but also allow farmers to generate income. The concept can serve both economic and ecological goals. It can reduce municipal budget funding and support the agricultural industry in European countries which need to implement sustainable biomass concepts. © 2004 Elsevier Ltd. All rights reserved.

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1. Introduction

Wood is the type of biomass most commonly used for energy purposes in Europe [1]. The traditional method of burning woody biomass in stoves and open fireplaces can be substituted by

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technologies that enable an efficient and convenient way of using this renewable resource. Technologies to produce heat and power in automatic plants are becoming more and more common. Most of the woody biomass used for energy currently comes from forest and saw mill residuals, but also, to a minor degree, from short rotation woody crops. The utilisation of forest and saw mill residuals, which is usually the first step in the implementation of woody biomass projects, is at various levels of development. In terms of the sustainable use of biomass for energy the potential from easy accessible wood residues is limited and cannot be increased much in future. The rising demand to better utilise the available potential of woody biomass possibly could be achieved by increased production of woody biomass in short rotation forest plantations.

Short rotation woody crops (SRWC) is a term not unequivocally defined in the literature where frequently the term of short rotation forestry (SRF) is used. Here we prefer the term SRWC in order to point out the particular relevance of fast-growing trees for plantation on agricultural land, and the different legal situations for forest and agricultural land. The term SRWC is here defined as fast-growing tree species (e.g., poplars, willows and eucalyptus) grown in high-density plantations on fertile agricultural land to produce woody biomass with rotation periods of less than 30 years (see for example [2]).

The interest in SRWC dates back to the 1970s when the sudden shock of the energy crisis pushed governments to investigate alternatives to fossil fuels [3]. Today SRWC is becoming increasingly important in many countries due to efficient land use, possibilities for environmental impact reduction (e.g. as a vegetation filter) and for additional benefits that these systems give rise to when implemented at various scales. At present, SRWC plantations for energy purpose remain at the experimental stage in most parts of Europe. The largest scale plantations are currently found in Sweden where an area of 14,500 ha is planted with short rotation willow coppice and managed on a commercial basis. Willow is also grown in Denmark and Britain. Austria grows several thousand hectares of energy poplar and many experimental

plantations (poplars and willows) have been established in parts of Germany [4–6]. In Italy *Robinia*, *Populus* and *Eucalyptus* are grown, mostly for industrial purposes. These crops can be considered as regional versions of the same concept, adapted to the local climate and terrain [3].

The focus of this paper will be on the differences between Germany and Sweden, with similar climatic conditions but large and obvious differences in the utilisation of their biomass supplies. While Sweden is already using a large fraction of the exploitable forest residues and is emphasising SRWC to extend the woody biomass resource, Germany is now starting to utilise the residuals more efficiently, but needs to define future perspectives for the utilisation of biomass. Therefore, the example of Germany may be also representative for other European countries, which need to implement sustainable biomass concepts.

The major objective of this study is to identify the main factors limiting the utilisation of biomass uptake in Sweden and Germany and to develop a conceptual solution for their removal. The hypothesis is that there is large potential for SRWC to be used for energy which is currently not utilised. The information could be used by political and economical decision makers to facilitate the removal of existing obstacles for future development towards a more efficient utilisation of biomass.

2. Methodology

An analysis of possible limitations when utilising SRWC was conducted and a concept to improve the utilisation of biomass was developed. The analysis regards the different situations of SRWC biomass utilisation in different countries of Europe based on information retrieved from the literature. It particularly focuses on differences in the utilisation of fast-growing trees between Germany and Sweden. The climatic conditions and plant productivity as well as the legal and cultural frameworks are addressed. From the results of this analysis, a conceptual model for a

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