How is life if you try to live from developing SRC in Denmark? Experiences, results and recommendations.

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ABSTRACT

This is a joint paper given by two private developers, cooperating in the field of SRC in Denmark and UK. The paper describes experience on strategies of survival and gives recommendations for future legislation concerning SRC, seen from a commercial point of view. Finally, new SRC machinery is presented.

Only few commercial companies survive in the field of SRC due to a very poorly developed commercial market, both in Denmark and other EC countries. The market situation in Denmark is described, and examples are given on how other related trades, eg. designed products in willow, can finance SRC activities and also maintain a development in the field of SRC.

Costs of establishment and harvesting are still high, and this paper presents some of the latest developments of new machinery from NORDIC BIOMASS and Border Biofuels Ltd to reduce these costs. A new planting technique, The Lay-flat planter, and further, a whole stem SRC harvester on rubber tracked belts.

STRATEGY OF SURVIVAL

How is life if you try to live from developing energy crops in Denmark? Only few private companies can survive from working with SRC. A commercial market is not developed for SRC, either in Denmark or in any other EC countries.

Fig. 1. Market situation in Denmark

- No commercial market for SRC
- No subsidies to the farmer except from set-a-side
- Only few heat and power stations take chips – and the farmers compete with chips from the Baltic States, Poland etc.
- Very little political interest in biomass - instead, focus on wind, solar and biogas
- Very little governmental money financing the development, and mostly to a few and selected researchers / research institutions.

Developers in the field of SRC are therefore to be found where governmental money is financing new development – and private companies working with SRC are financed by other commercial activities, e.g. sound-barriers in willow.

Fig. 2. Developers in Denmark

Governmental financed activities in the field of SRC	**Privately financed activities in the field of SRC**
Governmental financed programmes: The Biomass program incorporating research institutions, e.g. Danish Institute of Agricultural Sciences, Danish Forest and Landscape Research Institute, Danish Technological Institute, National Environmental Research Institute.	Farmers associations such as: Danish Farmer Energy Willow growers such as: Agrobrændsel, Nordic Biomass, individual farmers To a limited extent: producers of different willow products such as garden fences.

Today, NORDIC BIOMASS only recommend farmers to establish SRC if the conditions given below are fulfilled.

Fig. 3. Recommended conditions, premising establishment of SRC in Denmark (given by NORDIC BIOMASS)

1. Farmers should never plant SRC "on their own", but join an association of SRC growers
2. Get a contract on delivery of the biomass to a heating plant before planting.
3. Make sure someone can harvest the SRC for you at a reasonable price.

Fulfilling all of the above given requirements happens seldom, the strategy of survival in NORDIC BIOMASS is as a consequence of this situation based on the following:

Fig. 4. Strategy of Survival in NORDIC BIOMASS

Today	**Long term targets**
• Danish activities only based on R&D projects – very few commercial activities • Focus on international development, be ready when something happens elsewhere, eg. Sweden, UK etc. – go commercial whenever you can! • Enjoy the fascinating aspects of R&D projects – and earn your living else where…..	• "Driving down the costs", new machinery on planting and harvesting • Encourage farmers to respect breeders right on new high yielding species • EC standardisation of quality specifications: eg. salix cuttings stored at –4º , no drying of rhizomes etc. • Encourage organisations working with advice and quality standards concerning SRC. • Closer cooperation between practice and theory • Political pressure, aiming at a subsidy equivalent to Danish subsidies for eg. wind and solar

NORDIC BIOMASS has spread it's activities and started a commercial company (PileByg) selling designed willow products. Research and development has been kept in NORDIC BIOMASS.

Fig. 5. Activities divided.

Commercial activities in PileByg	**R&D activities in NORDIC BIOMASS**
• Sound barriers and fencing in living and woven willow. • Playgrounds in living willow • Advice and support to landscape architects etc on use of willow	• Production, planting and advice on SRC, foremost willow and miscanthus • Environmental solutions with outset in SRC, eg. sludge disposal, recultivation of polluted lands. • Machinery and technical solutions to SRC cultivation: Projects: HE All Rounder, The Lay-Flat planter, The Miscanthus Planter, New SRC harvester.

More than 10 years of experience with SRC in Denmark and Europe gives the following, main recommendations to development of a legislation, which can encourage a healthy development of SRC.

Fig. 6. Political recommendations, legislation on SRC

- Subsidies to SRC production - equivalent to solar, power and wind energy.
- But, production related subsidies only. VERY IMPORTANT.
- Market access for chips, straw etc.
- Financial programmes to ensure development of machinery etc. for SRC.
- Environmental legislation coordinated with agricultural legislation, energy policies etc.
- Long term legislation taking perennial crops into account.

NEW MACHINERY –
DRIVING DOWN THE COST OF ESTABLISHMENT AND HARVESTING

New planting technique – the lay-flat planter.
The current method of establishing willow and poplar coppice is to plant vertical cuttings into a pre-prepared agricultural seedbed. In order to allow easy machinery operations such as harvesting, a standard twin row spacing has been adopted. Machines have been developed to carry out this operation using pre-prepared cuttings of 20-25cm in length or carefully selected rods that are cut to length by the planting machine as it plants. The machine most commonly used for establishing large areas is the Salix Maskiner 'Step Planter' and this has become the industry standard planting machine.

Lay-Flat Planter from Nordic Biomass.

This planting method has developed from forestry practice and from the techniques used by research and development practitioners and plant breeders; it may not necessarily be the best way to establish commercial biomass plantations. One of the main drawbacks to the established technique is that it is fundamentally an expensive process. In order to produce cuttings or rods of planting material suitable for the step planter, the material needs to be hand sorted from material harvested from a one year old 'seed' plantation. This is labour intensive and results in the discard of a high proportion of the living material harvested from the seed plantation.

This paper covers a field scale trial on several sites to investigate two alternative techniques with the potential for lower cost. These are:

- The 'layflat' planting technique where all the rods harvested from the seed plantation are 'laid flat', end to end, in a shallow slot made by the coulter of the planting machine, in a tilled seedbed.

- A 'billet' planting method where the planting material is harvested using a sugar cane harvester, which chops the whole of the material in the seed plantation into short lengths (billets); this is planted using a sugar cane planter which drops the billets into the bottom of a shallow trench made by the planting machine, into a tilled seedbed.

Results from the first year of the study are reported in the paper for discussion. Among other findings, these early results suggest the following:

1. Alternative planting techniques show the potential to offer reduced cost planting techniques for willow coppice.
2. The billet planting system tested has serious shortcomings with some of the planted areas failing
3. The lay-flat planting system has given first year yield and canopy heights in excess of those for the step planter.

Developing a whole stem SRC harvester.

Aim
The overall aim is to develop and demonstrate an integrated wood fuel supply system to deliver SRC of the right quality and form from field to biomass power station at minimum cost, at an appropriate scale and in a way that is acceptable to SRC growers.

Whole stem SRC harvester, developed by NORDIC BIOMASS and Border Biofuels LTd.

To build and test a self propelled SRC harvester that will harvest unchipped SRC that can be stored, handled, stacked, transported and presented to feed a power station chipper efficiently.

Rationale for whole stem approach

Although cut-and-chip SRC harvesters have been developed in Sweden and are tried, tested and available, this approach is not easy to transfer to the UK's large scale power plant market. In Sweden, the biomass CHP plants can use wet wood chips straight from the harvester and SRC is only a small part of a large established wood chip supply chain; the cut-and-chip approach is the obvious technique to use in this situation. Storage of wet chips is difficult to manage and can lead to large losses and material of unacceptable quality.

Harvesting whole stems means that storage can be done cheaply on the field headlands and some natural air drying takes place which saves some of the cost of conditioning at the power plant. Loss of material through rotting is minimised when SRC is stored unchipped and there is little danger of fungal spores developing.

At the UK power plants, being developed by BBL, chipping of forest residues will mostly be carried out at the plant where it is cheaper, easier to administer and where quality can be controlled. Forest residues are brought into the plant in many different forms so the handling system will be set up to handle material of all kinds not just in the form of chips.

At present, no reliable machine is available to harvest and present SRC in unchipped form; this fact is now acting as a serious deterrent to growers and developers considering planting the crop.

Under this collaborative project, a whole stem harvester has been built, based on tried and tested principles developed over many years by the Danish firm Nordic Biomass. It is self-propelled and runs on low ground pressure rubber crawler tracks.

Early tests, carrying out summer harvesting, suggest that the machine can operate at a cutting rate in excess of 1 ha/hr on willow up to 4 years old. Extensive field trials will be carried out in the 2001/02 winter in Denmark and in the UK.

The machine produced under the project

A short summary of the machine's specification at this stage:

- Harvests and stacks whole stems of willow coppice
- Works at over 1 ha/hr in mature willow coppice taking two rows
- 5km/hr (60t/hr) work rate as one man operation
- Operates independently with no supporting vehicles
- Light Weight (10t) and low ground pressure allowing harvest in all ground conditions
- Runs on rubber tracks allowing self propelled local transport on roads
- Fits inside standard shipping container for low cost long distance transport