

Lifecycle-based bioenergy for cold climate

Project Background

Glommers Miljöenergi AB and Norut Teknologi AS have obtained funding for development of an alternative raw material for bio energy in arctic climate. The project shall develop the concept of cultivation of Reed Canary Grass for energy production, in the form of heat, power or liquid fuels. A central concept in the project is that ash from combustion shall be re-used as fertiliser.



The North Calotte region is currently experiencing that many farms are being abandoned and allowed to grow over with forest. In the long term this has the potential to negatively affect the region's economy and cultivated landscape. At the same time it is desirable for society to increase the use of sustainable energy sources, and reduce the release of greenhouse gases like CO₂. While they are growing, plants take in CO₂ and convert it to hydrocarbon, which is converted to CO₂ again under combustion. By using biomass, such as energy grass, the nett release of CO₂ can be close to zero. Fossil fuels (like coal, oil and gas) took up CO₂ millions of years ago, therefore these give a nett release of CO₂ when burnt.

Project goals

By obtaining and documenting knowledge on cultivation and conversion of "energy grass" to energy contribute to:

- * Establishment of a new, alternative income for farms in the North Calotte region
- * Preservation of the rural landscape
- * Create potential employment opportunities
- * Production of a renewable, environmentally friendly energy source.



Financing

Interreg IIIA Nord Nordkalotten with local government co-financing from Norrbottens länslandsting; Länsstyrelsen i Norrbottenslän; Nordland fylkeskommune, Troms fylkeskommune, Fylkesmannen i Nordland landbruks avdeling; Fylkesmannen i Troms landbruks avdeling. Contributions are also made by the project participants Norut Teknologi A.S. BioForsk, BioEnergiNord A.S., and Dyrøy Energi A.S.

Planned activities

- * Provide recommendations of the most suitable grass type, based on earlier experience from

Sweden together with further field trials (in Northern Norway, amongst others). Productivity and biological diversity shall be taken account of.

- * Create an overview over available/unused agricultural land that could be used for energy grass, based on the demands for soil quality and process demands – again based on earlier experience and field trials.

- * Document the alternatives for processing of energy grass to bio-energy (bales, briquette, pellets, liquid fuels), with special focus on small scale distributed facilities.



- * Perform a lifecycle analysis for the energy production from agriculture, in order to show the complete contribution to CO₂ release together with waste handling and fertilising demand.

- * Obtain data over the yield, production costs and market to allow an economic evaluation of the concept.

- * Document and transfer knowledge that is created in the project.

Advantages of Reed Canary Grass

- * Even though there is a lot of forest in the region, a large part grows in steep terrain relatively far from access roads.
- * Reed Canary Grass occurs naturally in the area and is well adapted to growing in cold climate.
- * Annual yields from Reed Canary Grass are approximately 6 tonne dry matter/ha/year, which is more than obtains from trees.
- * "Energy Grass" can give a secondary income for farms and help preserve the rural landscape
- * Standard agricultural equipment can be used.
- * Reuse of ash from combustion and organic waste for a cheap and environmentally friendly fertiliser.
- * The grass can dry naturally under snow over winter, down to 10% moisture, whereas forced drying is required to dry wood below 18%. Drying is energy intensive.
- * Grass has lower lignin content than wood, which can be advantageous for some conversion processes.

Results to date

Research on the cultivation of Reed Canary Grass for bio energy has been conducted in Sweden for over 30 years. Amongst others, Glommers Miljöenergi A.B. has performed field trials and investigated the production of pellets and the combustion properties.

In Norway Reed Canary Grass has been investigated as a fodder crop, and more recently for bio energy by BioForsk. These trials have taken place in Trøndelag, in middle Norway and had variable success with yield and crop drying. The effect of local climatic conditions needs to be investigated.

In 2006 a trial plot was established by BioEnergiNord A.S. in Vesterålen in Northern Norway. This will be followed up in the course of the trial, along with the trials in Trøndelag. The following

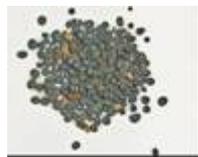
parameters are of interest: the yield; the leaching of inorganic salts back to the soil over winter; the extent of drying over winter; and the calorific value.



Harvesting, Norrbotten

One potential drawback of Reed Canary Grass for solid fuels is the inorganic content and smelting temperature of the ash. The inorganic content depends on the soil type, fertiliser application (and proximity to the sea) and can be reduced by delaying harvesting until spring, due to leaching over the winter. It is also possible to modify the combustion conditions to avoid problems with the ash. These topics will be investigated during the project.

In 2007 trials will investigate the efficiency of fertiliser made from combustion residue ash combined with organic waste. The production process for this fertiliser is being developed within the project by Gabbro A.B. and tested by BioForsk.



Fertiliser granule production unit

Reed Canary Grass is interesting as a raw material for liquid fuel production, particularly because of

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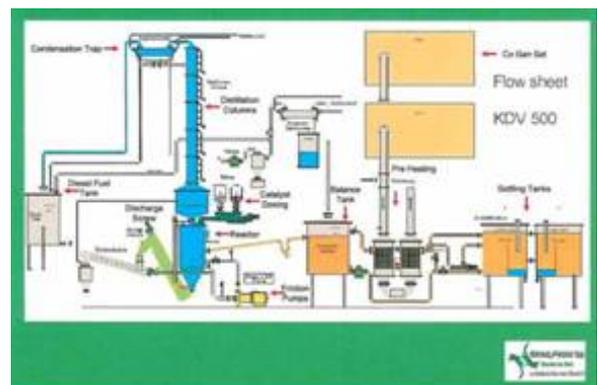
www.bioenerginord.com

the low lignin content, and the ease of achieving a low moisture content and reducing to small particle size.

The low lignin content makes Reed Canary Grass interesting for ethanol fermentation processes. Many of the other Biomass to Liquid processes require low moisture content and small particle size, so Reed Canary Grass gives an advantage for these. Processes being evaluated within the project for the production of liquid fuels include

- * Catalytic depolymerisation
 - Alfakat KDV (www.alfakat.de)
 - Green Power (www.cleanenergyprojects.com)
- * Gasification/ catalytic reforming
 - Range Fuels (www.rangefuels.com)
 - Aviosol (Fischer Tropsch), Över Kalix
 - BCRT-AIST (www.aist.go.jp)
- * Ethanol:
 - Biotech Progress, Czech Republic
www.biotech-pro.com
 - Celunol (www.celunol.com)
- * Microwave pyrolysis UMB (<http://biomotive.no>)

Of special interest are processes that can be implemented on small scale, or as mobile plants in order to reduce transport costs.



Catalytic depolymerisation process

Project Participants

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