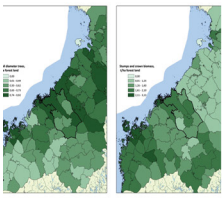
Newsletter from Forest Refine

Here you can find summary about the results from our two year project. All the results from this project are compiled on our redesigned web page: www.forestrefine.se

Forest Refine

The project Forest Refine was finalized in autumn 2014. It is the fourth cross border project between partners in Sweden and Finland with the overall focus to analyze and improve the forest fuel supply chain. The borders crossed are between the two countries and the research disciplines; Forestry and Chemistry. It is time to present the results.

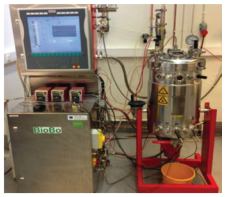

forest biomass potential and chemical balances


innovative harvesting


terminal development


storage


fractioning


pretreatment and fermentation

Overall objective

Forest Refine's overall goal has been to develop more efficient supply chains for emerging biorefineries. More specifically, the project was set out to answer what types of biorefineries have the best possibilities to succeed in the BA region depending on as an effective supply chain as possible. The results were also expected to show the possible production capacity of such establishments and their possible locations based on the size and geographical distribution of the raw material base.

Forest biomass resources

There are vast forest biomass resources in Sweden and Finland, and it is known that annual forest increments substantially exceed demands of existing forest industries (sawmills, pulp mills, heating plants and pellet mills). Thus, there is scope to build new biorefineries without risking shortages of forest biomass. Available forest biomass resources in the BA have been mapped and have also covered those biomass assortments that are not extensively used today. This will make it easier to take new assortments into use.

Supply chain management

This project has provided important knowledge of the supply chain management for future biorefineries, which can be used when developing plant-specific supply chains in which factors such as demand for raw material volumes and qualities, possible raw material surpluses available for use, harvesting and transportation costs of conventional and innovative systems, effects of storage on the chemical composition of various assortments, possible comminution, fractionation and sorting methods, and the chemical composition and fermentability of different fractions play an important role.

Supply cost can be significantly reduced

An overall conclusion from the studies is that supply costs can be significantly reduced by integrating supplies of pulpwood and residual assortments rather than like today providing them via separate supply chains. Available amounts of feedstock can also be increased by pre-treatment operations, which can make previously non-viable assortments available.

New practices could potentially reduce supply costs by around 10%, compared to current best practices, under certain conditions. Added value from high value green chemicals in the product portfolio can create substantial extra value and make biorefineries profitable in the near future.

Focus on green chemicals!

The project has also shown that besides bulk production of biofuels, biorefineries should focus on added value from high value green chemicals and in this way be more profitable. However, results acquired in this project show that ca. half of the high value green chemicals are lost after only a few weeks of storage. Thus, it is vitally important to transport extractive-rich fractions to appropriate processing sites rapidly after felling the trees in order to exploit the valuable chemicals.

Storuman, Umeå, Örnsköldsvik and Kokkola

Supply curves for new assortments from the forest to potential biorefineries located in Storuman, Umeå, Örnsköldsvik and Kokkola have been calculated.

Terminals

Terminals can play a key role in developing the use of forest biomass in the BA region. As most of the unexploited forest biomass resources are located in inland areas, particular attention should be paid to developing terminal-refinery-integrated supply chains in these areas for supplying industry-dense areas for further refining or direct use in processes.

Forest Refine, 2012-2014 Synthesis report

This report describes the research and development efforts during the Forest Refine project, discusses practical implementations and limitatins of the results, and considers aspects that require further attention to stimulate ongoing development of the forest biomass supply chains. It is electronically available from:

SLU's Epsilon database.

New info sheet published

Sub-project 1,3 and 4 published new info sheet. You can find all info sheets here: www.forestrefine.se

1.12 Potentials of biomass from pine, spruce and birch for three locations in the Swedish part of Botnia-Atlantica region
The establishment of new biorefineries depends on the availability of forest biomass and good transport options. In this report, the available potentials of various forest biomass assortments around potential biorefinery locations are presented.

3.10 Pretreatment and fermentation of stumps and small trees
The objective of the study was the pretreatment, hydrolysis and fermentation of new rarely used assortments for biorefining, e.g. for the production of ethanol. The raw materials tested were spruce stumps and small spruce trees.

3.11 Decrease in extractives of tree bark during storage
Wood bark is a rich source of extractives, but many of them are rather volatile or chemically unstable. This study focuses on changes in the chemical composition of industrial softwood and hardwood bark during storage.

3.12 Decrease in extractives of stumps
Stumps are readily available, underutilized source of forest biomass which is rich in chemical composition. Forest Refine studied the effects of logistical choice and 24 weeks storage time on the chemical changes in two stump feed stocks.

3.13 Decrease in extractives of chain-flail residue
Branches, stem, bark and small diameter stem tops can be mechanically removed from stems by chain-flail technology. The studied material was Scots pine and the amount of extractives was halved during the first 4 weeks of storage.

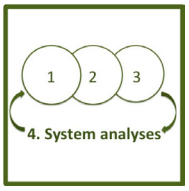
3.14 Introduction to biomass gasification and the relation to biomethane
The demand for biofuels for transport is projected to increase rapidly. Gasification enables the transformation of forest biomass into biofuels for transport. Gasification, digestion and power-to-gas are three methods for producing methane and may be used complementarily to ensure a cost efficient use of infrastructure.

3.15 Swot analysis for bioSNG market in the BA region
Gasified biomass, syngas, can be refined to several types of vehicle fuels. The practical and economical value of a specific fuel depends on regional conditions. The purpose of this info sheet is to give a brief overview of the pros and cons of production of bioSNG in Botnia Atlantica region.

3.16 Specific opportunities for forest industries and green gases
In this info sheet the overall opportunities as well as the two green gas production units that already exists are briefly described. If the political and environment for biofuel production changed, gasification of black liquour and forest residues would be a great potelntial for a fossil free vehicle fleet.

3.17 The Effect of Fractioning of Forest Biomass on Cellulose, Lignin and Fermentable Sugars Contents
When fermenting biomass into ethanol and similar products the content of cellulose, lignin and fermentable sugars in the feedstock is important for the product yield. This experiment on stumps and small trees shows that the the sieving to small fractions improves the feedstrock quality from the point of view of fermentation.

4.4 Forest feedstock supply curves
The supply curves show the amount of feedstock that can be offered to the market at a given market price. The methodological approaches used in the calculation of the supply curves are presented in this info sheet.



4.5 Supply curves for tree sections and long tops
The supply of innovative assortments from forest to biorefineries was considered. Tree parts that were delimbed in a terminal shows to have significantly lower cost then conventional supply of logging residues.

4.6 Supply curves for whole trees from early energy thinning and stump cores
An innovative forestry regime including early energy thinning can provide about 80 thousand OD t/year, three potential biorefinery in Sweden. The whole tree bundling at the harvesting stage can lower the supply costs and energy demand, compared to the supply of loose small trees. The harvesting of stump cores integrated into the supply of sawlogs can provide up to 100 thousand OD t/year per facility.

New work reports published

Quality Improvements by Sieving and Fractioning.
Two main methods for fractioning and sieving of forest biomass have been evaluated.

Pretreatment and Fermantation of Two New Assortments
Described in this report is the pretreatment, hydrolysis and fermantion of new and/or rarely used assortments from the forest for biorefining purposes, e.g. for the production of ethanol.

This is the last newsletter and you can find all results and other project material from our web page: www.forestrefine.se

We sincerely hope that the results presented here will play an important role in developing the bio-based economy in the Botnia-Atlantica region.