Summary Series

State of the art in sustainable biomass recovery technology / supply chain in forest operations

IEA Bioenergy

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State of the art in sustainable biomass recovery technology / supply chain in forest operations

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Summary

This report provides an **overview of most efficient biomass harvesting technologies and supply chains of forestry biomass** applied in North America, Europe and Oceania. The productivity and cost of selected efficient technologies have been presented for each country covered in this study, with a brief description about the source of the biomass and working method. Expert's opinions on the most successful biomass operations have also been stated briefly for each country. To provide a general road map and guidelines on sustainable biomass harvesting systems this project aimed to:

(a) Identify the most productive and cost effective biomass harvesting machines and supply chains based on local research and development experience in various biomass leading countries;
(b) Provide a summary of machine productivity and operating costs of most efficient biomass harvesting technologies in each country;
(c) Provide concluding remarks and guidelines on efficient biomass harvesting technologies and
(d) Identify future research and development requirements to gain sustainable biomass harvesting operations.

To collect the information for this project, a questionnaire was designed and sent to different international forest biomass harvesting researchers. Expert's knowledge in each region was used to identify the most appropriate biomass harvesting machines/systems. A summary and concluding remarks were written on most useful supply chains/technologies in each region/ country. The machine productivity data has been listed based on the provided information and local reports/publications sent by participants. The productivity (and cost) of best technologies have been reported mostly as Bone Dry Metric tonnes (BDMt) per Productive Machine Hours (PMH) to keep consistency in this report.

The results indicate that the main source of forestry biomass for energy is different in various parts of the world. European countries seem to be utilising the woods from thinning operations as well as harvesting residues while in Oceania or Southern USA the main source for bioenergy is harvesting residues although in southern parts of the USA logs and stems are also used for bioenergy purposes. This may be mainly due to different bioenergy policies applied in different regions as in certain regions in Europe growers are subsidized for biomass production while in Australia there is lack of such government support resulting in focusing on recovering residues from cut-over or landings. Low price of biomass in some countries has led to application of integrated biomass and conventional wood recovery to reduce the cost while in European countries separate biomass recovery is still an economically viable option.

From technological point of view, terrain and availability of the biomass make significant impact on the type of technology to apply and operating costs. Mountainous forests in Central Europe or North-West of USA require cable yarding systems to extract the woods from steep terrain which result in higher costs, however less impacts on forest soils compared to ground-based harvesting systems like forwarders. From New Zealanders' perspective the higher the volume of woody

residues available at the landings the more the chance to operate successfully. This fact was also proved in Sweden that higher yield per ha will result in lower operating cost as a key factor on biomass supply chain management.

A lesson in harvesting residue collection by mobile chippers in Sweden, Canada, Australia and Germany is that although the mobile chippers have been designed to collect the scattered residues on cut over area, to gain higher efficiency, the best practice is to work at road side. The residues can be collected or concentrated into larger piles (using forwarders or any other suitable type of forestry machines) then chipped directly into trucks to reduce operating costs. From Europe, North America and Australia research found that high hourly costs for bundlers tend to make them a high cost option. Machine size is the other factor influencing the productivity and costs of supply chains where machine size needs to be well matched to the task.

Whole tree harvesting using harvester and forwarder in Spain

Main conclusions of the study

Main sources of forestry biomass for energy are different in various parts of the world, varying from thinning wood, harvesting residues to certain types of (small diameter) stems. This is driven by different bioenergy policies applied in different regions, as well as specific subsidies in biomass production.

Low price of biomass in some countries has led to the application of integrated recovery of conventional wood and biomass for energy. In some European countries separate biomass recovery is still an economically viable option.

Terrain and availability of the biomass make significant impact on the type of technology to apply and operating costs. While mobile chippers have been designed to collect the scattered residues on cut over area, to gain higher efficiency, the best practice is to work at road side. Machine size also influences productivity and costs and needs to be well matched to the task.

Application of whole tree extraction or recovering extra volumes of the wood using integrated biomass harvesting may endanger the site sustainability in next rotations due to nutrient removals. Thresholds of maximum allowable biomass recovery in different soils and stands should be examined considering the economic and environmental benefits. In short, forest biomass growers will require a practical guideline/tool on how to manage/recover/retain their harvesting residues.

The full report is available at http://www.ieabioenergytask43.org/wp-content/uploads/2016/05/IEA-Bioenergy-Task-43-TR2016-02i.pdf

IEA BIOENERGY

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The mission of IEA Bioenergy is to increase knowledge and understanding of bioenergy systems in order to facilitate the commercialisation and market deployment of environmentally sound, socially acceptable, and cost-competitive bioenergy systems and technologies, and to advise policy and industrial decision makers accordingly. The Agreement provides platforms for international collaboration and information exchange in bioenergy research, technology development, demonstration, and policy analysis with a focus on overcoming the environmental, institutional, technological, social, and market barriers to the near- and long-term deployment of bioenergy technologies.

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