Forest biomass recovery and improvements

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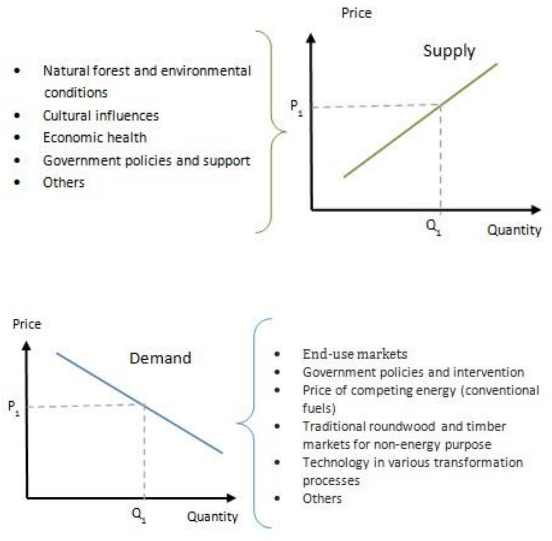
To identify the potential performance of future forest residue recovery concepts and techniques it is indispensable to understand the relationship between existing forestry practices as it relates to the cost of production respective biomass supply chains and the feasibility of intensified biomass recovery from potential reductions in these costs.

The European region shows a wide variation when it comes to forest characteristics, end-use markets and emerging forest energy supply-chains, making recommendations that are applicable across all situations difficult. Therefore a broad knowledge of regional differences is crucial to be able to investigate the opportunities to improve forest biomass recovery through the adaptation of existing forestry practices prevalent throughout Europe.

Determinants of forest biomass recovery

Different factors of supply and demand aspects influence future forest biomass recovery throughout Europe, with different facets being characteristic for different regions.



Supply and demand aspects of biomass recovery

In terms of natural characteristics, North Europe has a dense forest cover in relation to their population density, whereas central and southern Europe also have areas of very dense forest cover but generally higher population density per

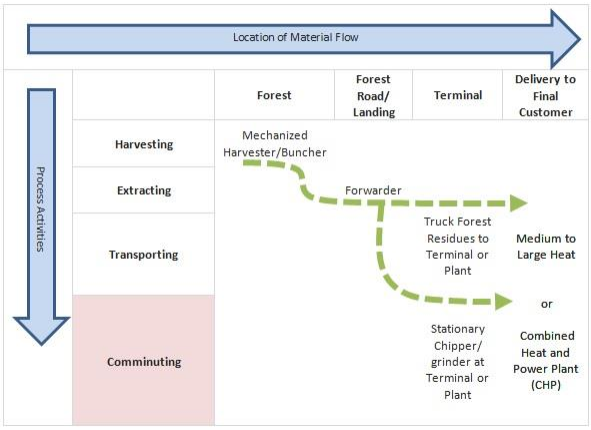
geographical space. Concerning species, the north is predominately characterized by conifers; central and southern Europe by mixed species. Mountainous forest conditions are more pronounced for a broader geographic region across central Europe and the northern parts of South Europe. In terms of forest's productivity, as measured by annual increment, four countries dominate, including Sweden, Finland, Germany and France. As a percent of annual increment, total felling is more pronounced in Austria, Sweden and Switzerland and less pronounced Spain, Italy, Ukraine and Germany.

Regarding economic and cultural characteristics, in the northern EU the forestry/logging sector is a vital component of the economy, compared to all the other regions in the EU. The forestry and logging sector is highly productive, as measured in roundwood removals per employee which is ten times that of many central and southern European countries. The proportion of private owned forest land in the North is very high with relatively large size holdings.

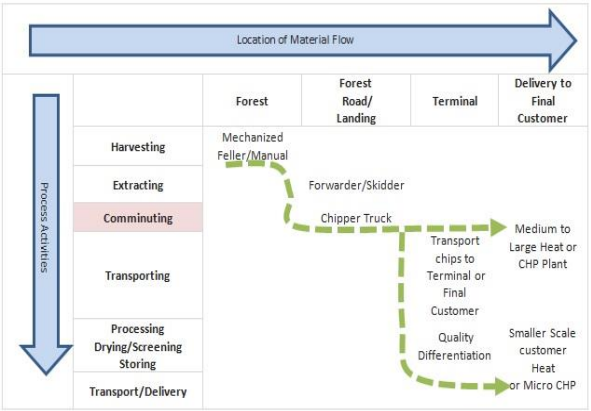
In the central EU, the forestry and logging sector is less important in terms of contribution to gross value added, given the greater industrial and economic diversity of these countries. Except for western France, most central Europe has relatively low proportion of forests in private ownership with relatively small sized holdings, making the efficient coordination of all forest supply chain activities more challenging and costly. The southern EU countries are to some extent similar to the Central EU in terms of high degree of diversity. Nonetheless, the contribution of the forest/logging sector to gross value added, the economic affluence and the productivity of the forestry/logging sector is mostly lower throughout the southern EU.

Supply chain concepts

These aforementioned different characteristics have contributed to the shape of the existing forest biomass supply chains and the costs of production relative to market conditions throughout Europe. But even though the forest biomass supply chains have many variations, they may be generally categorized by the location of the comminution of forest material, resulting in 1) bulk and 2) chipped forest biomass supply chain which in turn can significantly influence costs of production.



Bulk forest Biomass Supply Chain



Chipped forest biomass supply chain

Costs of production

When estimating the costs of production, it turns out that northern European biomass supply chains have the lowest cost compared with other regions. While the supply chains in North Europe have a cost of production below €15/MWh (€4.2/GJ), it also has the lowest market price for wood chips at approximately €22/MWh (€ 6.1/GJ).

The estimation of the central European biomass supply chains varies significantly in total costs of

production, ranging from €34/MWh (€9.4/GJ) for industrial roundwood residues in steep terrain to €10.50/MWh (€2.9/GJ) for industrial roundwood residues in flat terrain. The average market price is approximately €32/MWh (€8.9/GJ). This is partly reflecting the smaller scale end customer with higher quality and lower moisture requirements as compared to the northern regions.

Supply chains in South Europe also have the highest costs of production with steep terrain harvesting at €28/MWh (€7.8/GJ) and the lowest cost of production with the stump/root extraction of under €15/MWh (€4.2/GJ). Felling/harvesting costs play a dominate role for industrial roundwood residues and stump supply chains. The average market price is at €26/MWh (€7.2/GJ).

Improvement potentials

There are many different forest harvesting practices and organizational concepts that could significantly lower costs of production and enhance forest biomass recovery prospects.

Direct Harvesting/Extracting with Harwarder or Synchronized Forwarder does, by streamlining harvesting/extraction, minimize inefficient double-handling of material by harvesting and loading cut-to-length logs directly without creating stacks on the ground. This in turn would require advanced information technology to maximize the coordination between harvester and forwarder.

Geometric thinning can offer cost-effectiveness by highly efficient mechanized harvesting in rows or strips that enhances harvest productivity and lowers forest biomass supply chain costs. Combined with the synchronized loading and direct removal, this may lead to large efficiency gains throughout the biomass supply chain.

In terms of being able to have a consistent and reliable forest biomass supply source into the future, the creation of producer owned forest biomass supply cooperatives could target large scale heating and combined heating and power demand with high volume demands throughout the year. Especially when the surrounding region is comprised of many small to medium sized bioenergy or forestry firms that individually couldn't produce enough volume, a regional supply cooperative could offer the volume security needed by large scale customers. This would improve forest biomass utilization and expand markets throughout central and southern Europe.

In areas where a growing demand for premium, high quality, dry wood chips exists, cooperation between forest bioenergy firms and local agricultural producers with biogas facilities could expand the market for forest biomass. In order to benefit from the large scale availability of excess heat from the biogas facility, specialized wood chip containers with screen floors are connected to heat ducts in order to dry fresh wood chips at a fraction of the cost associated with commercial dryers. These partnerships already exist in parts of Central Europe and could be expanded to other geographical areas.

In terms of price discovery the new market for wood fuels and wood energy has evolved slowly and primarily as a by-product of the traditional roundwood markets with transactions being on an individual "relationship" base. But as the market for wood energy grows, the process for price discovery, relying on localized one-to-one personal relationships now limits or constraints the market leading to prices that don't necessarily reflect market conditions. A potential remedy for this market inefficiency is the creation of a centralized European wide online auction. This would expand the price discovery process to a larger buyer/seller audience and arrive at prices in amore price competitive environment and lead to an organizational structure that provides incentives for adapting existing forest biomass supply chain activities to that which is valued in downstream markets.

For more information and sources, please read the full report "*Adapted forestry practices for improved biomass recovery*" available at www.infres.eu.

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