Chapter 4: Supply chains of wood biomass

Supply and energy use of lignocellulosic biomass
(6 ECTS) 3513129
Dr Blas Mola Yudego
School of Forest Sciences
University of Eastern Finland

blas.mola@uef.fi
Why MC, density, heating value... matters?

BIOMASS

BIOENERGY
Wood fuel: supply

Figure 3.2-4. Transport flow patterns for separate, dual and full combinations of industries. In reality, industry layout is often a mix of separate and integrated industries, and transport flows form extremely complex, web-like patterns.
Wood fuel: supply chains

**BUNDLING METHOD**
- Bundling of logging residues
- Forest haulage by tractor equipped for log haulage
- On-road transportation of loose logging residues
- On-road transportation of forest chips

**CHIPPING IN ROAD SIDE-METHOD**
- Chipping of residues on road-side terminal
- Crushing of bundles or loose residues in the plant
- On-road transportation of forest chips

**LOOSE RESIDUES**

**TERRAIN CHIPPING-METHOD**
- Logging residue compacting truck trailer

Wood fuel: supply chains

**BUNDLING METHOD**
- Bundling of logging residues
- Forest haulage by tractor equipped for log haulage
- On-road transportation of loose logging residues
- On-road transportation of forest chips

**CHIPPING IN ROAD SIDE-METHOD**
- Chipping of residues on road-side terminal
- Crushing of bundles or loose residues in the plant

**LOOSE RESIDUES**

**TERRAIN CHIPPING-METHOD**
- Logging residue compacting truck trailer

Wood fuel: supply chains
Choice of technology

Figure 3.3-2. Factors influencing the choice of technology and methods for harvesting forest-derived fuel.
Wood fuel: supply chains

- Organizing the supply
  - Harvesting and forwarding of roundwood to roadside storage
    - Logging residues/ cut-to-length method
      - Bundling
        - Chipping in the field
          - Chipping at roadside
            - Transporting of the chips
              - Comminution at terminal
                - Comminution at end use facility
                  - Transporting of the chips
                    - End use facility
  - Whole tree method
    - Transporting of whole trees
      - Comminution at terminal
        - Comminution at end use facility
          - Transporting of the chips
            - End use facility
Wood fuel: supply chains

Figure 4.7.3  Production of forest wood chips after seasoning raw material either on landing site or at a biomass trade centre\[13\]

1. felling
2. loading woodlogs along roadside
3. open-air drying wood logs
4. chipping at roadside
5. delivering wood chips to plant

1. felling
2. processing, cross-cutting and bridling
3. transport of logs to the BL&TC
4. chipping and storing on the BL&TC
5. delivering wood chips to plant

Wood fuel: logistics

Wood fuel: logistics

Cost structure

Laitila et al. 2011
Supply chain

Finland

Supply chain


blas.mola@uef.fi
Conclusions of chipping and transportation

- Roadside chipping is a typical hot deck operation, which means that chipper’s productivity and machine failures effect on the trucking and vice versa.

- Chipping at use place (power plant) can be done separately from transportation

- Low solid content in transportation is a problem in chipping at plant; baling was one trial

- Chipping at plant is suitable only for big plants, roadside chipping is good all-purpose method

- Terrain chipping (in forest) is rare in Finland, but typical method in Denmark
Transportation

Figure 56. Space requirement of selected fuels in truck transport.
Wood fuel: logistics and moisture

Figure 3.2-8. Cost functions for two transportation systems. The intercept of cost function with the value axis represents direct cost at the terminal; increment with distance represents the variable direct cost of transportation.
Wood fuel: logistics and moisture

EFFECT OF MOISTURE CHANGE ON TRANSPORTATION COST

Total costs transportation, €

Moisture content %
Conclusions

• Well documented cost comparison is a good basis to develop supply chains

• The assessments for choosing supply chain should be modified according to case in which decisions are needed

• Assessments in general might lead to incorrect conclusions

• Limitations at power plant might exclude some technologies in supply chain

• Effect of annual workload is big on competitiveness of supply chains which bind a lot capital