

**Baltic ForBio**



## Regional Wood Fuel Supply for Small Bioenergy Plants

Baltic ForBio -Workpackage 5

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Webinar 3/3

04/02/2021

16 – 18 h CET

17 – 19 h EET

# Regional Wood Fuel Supply for Small Bioenergy Plants

## Case Study Altlandsberg:

- Requirements of small-scale bioenergy plants regarding forest fuel/wood chips supply from local sources
- Organizational and technical solutions in supply chains
- Challenges and supply/ business models to supply small bioenergy plants with forest fuel



# Case Study „Altlandsberg“

## I. Assessment of Local Pre-Conditions

- Castle Property Altlandsberg
- Background: City of Altlandsberg
- Potentials of woody biomass
- Assets for biomass supply chains
- Interests of Stakeholder Groups

## II. Requirements for the Development of Supply Models

- Wood fuel quality
- Supply logistics
- Cost functions
- Interests of stakeholders

## III. Technical and Organizational Solutions

- Production processes
- Logistics
- Supply chains

## IV. Demonstrations

- Local sources of woody biomass
- Suitable supply chains
- Technical trials
- Quality assessment

➔ Conclusions, Report and Handbook

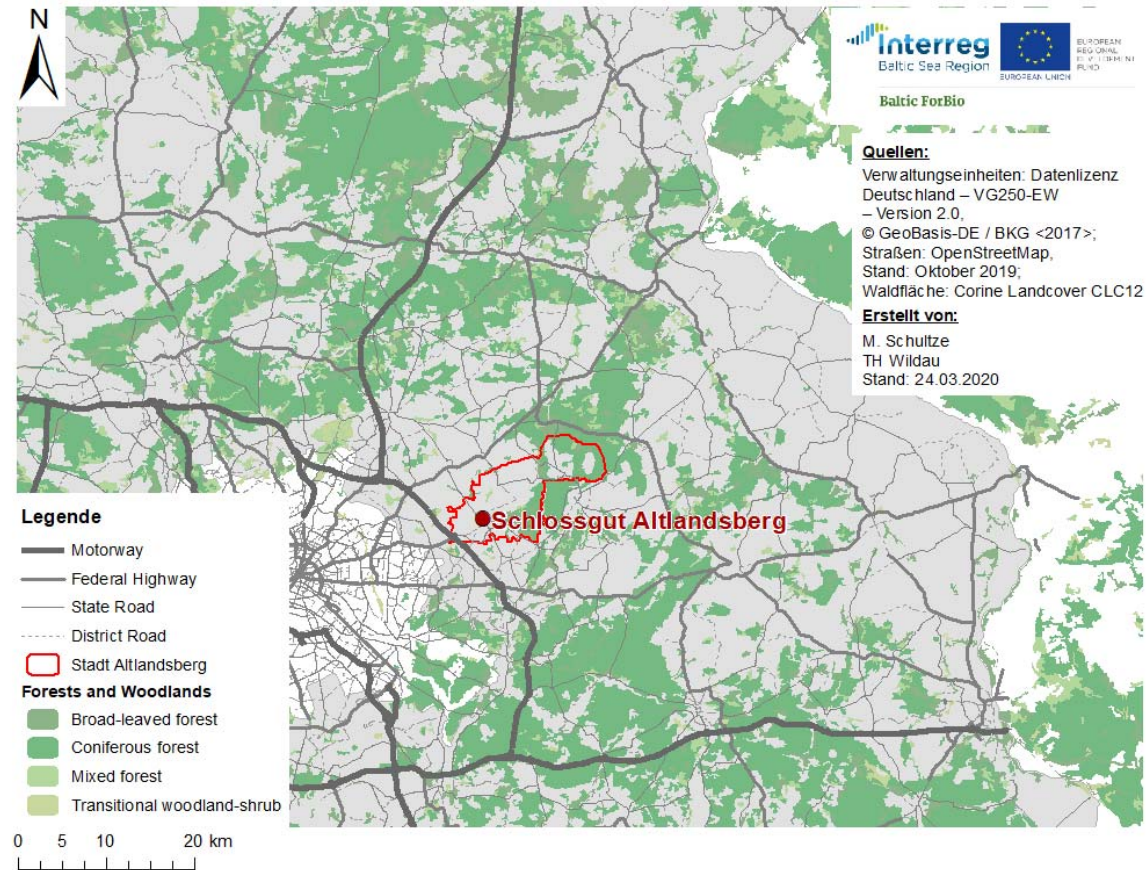
# Requirements – Quantity and Origin of Wood Fuel

Heat production nearly  
300 MWh per year

Wood chip consumption:  
~ 400 bulk m<sup>3</sup> per year

Main sources of wood fuel  
in the Altlandsberg region:

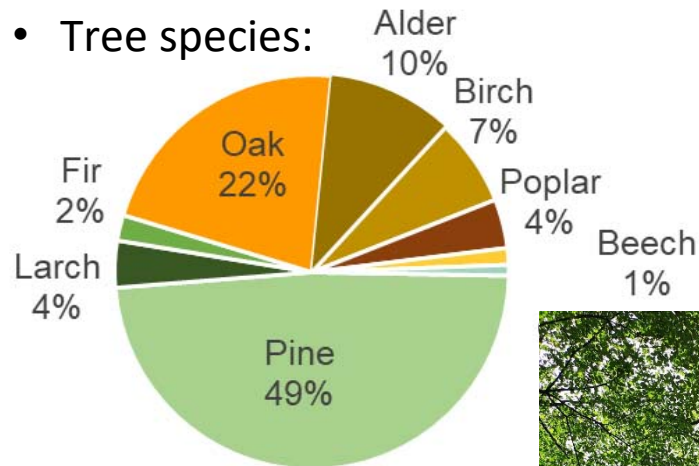
- Landscape preservation measures (incl. maintenance work, parks, gardens)
- Fruit tree plantations
- Forestry



# Requirements – Quantity and Origin of Wood Fuel

## Municipal Forest Altlandsberg

- ~ 950 ha
- Area for tourism and recreation
- Tree species:



Data: LFB 2018



## Requirements – Delivery

- Bioenergy plant in the old depot, part of the historic ensemble restaurant vis-à-vis, tourist shop next door  
→ no storage facility for wood chips on the premises
- Location at the outskirts of the town center near two radial routes  
→ easy access for chip trucks



## Requirements – Delivery



Wood chip delivery in special containers, that can be linked to the conveyer system of the bioenergy plant

When a new chip delivery is expected,

- the empty exchange container will be retrieved by a container truck
- filled at the external biomass storage lot
- brought back and swapped with the current container



Photos: S. Ruebsam

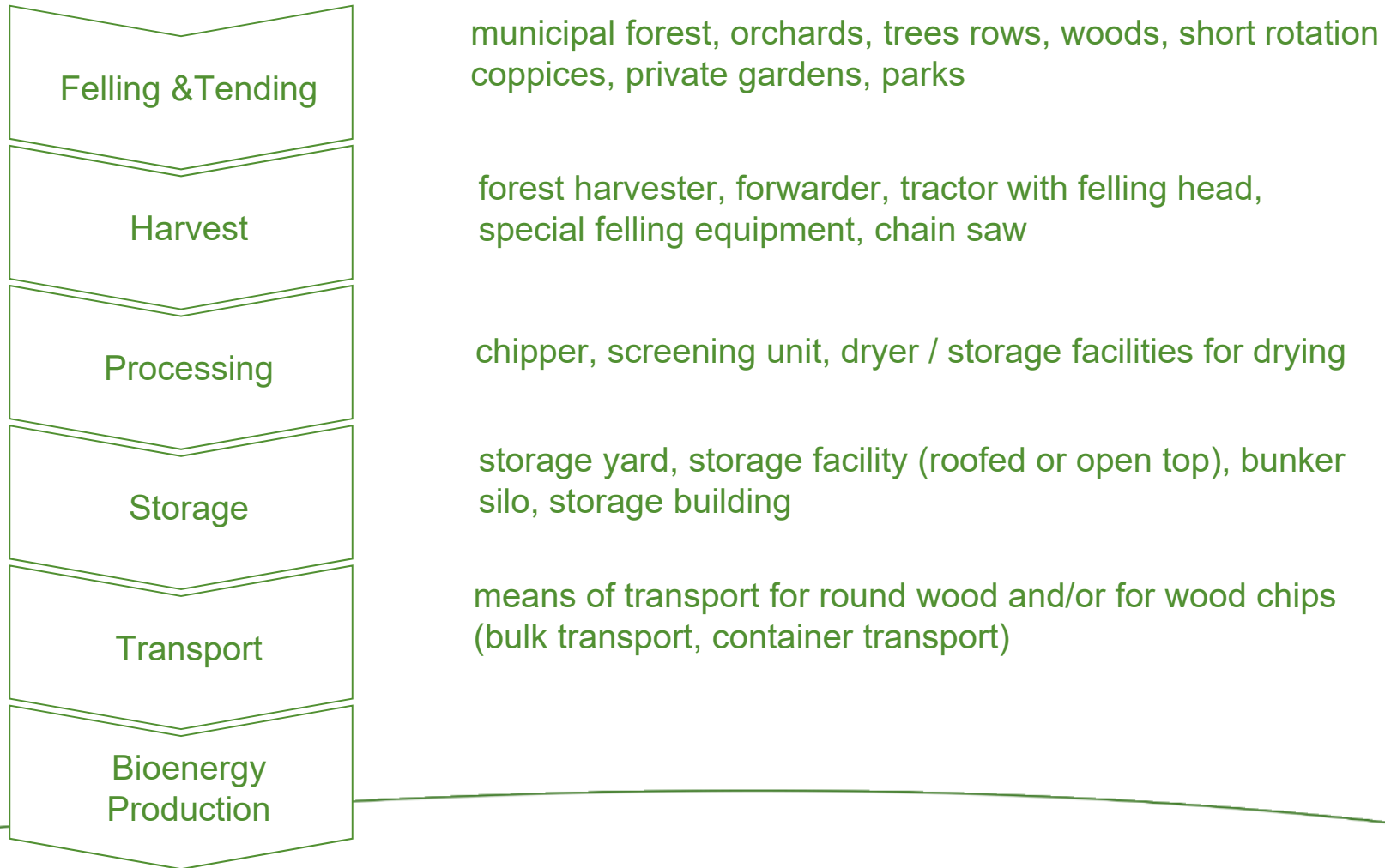
## Requirements – External Storage Place

- Procurement of rawmaterial
- Processing
- Storage
- Quality management
- Secure short-term supply





# Requirements – Use of Available Equipment



# Requirements – Wood Chip Quality

## Specification in the instruction manual

- Wood chips, pellets, wood briquets or saw dust
- Water content: 30% max.
- Ash content: 1% max, 0.5% ideal
- Particle size
  - maximal length of particles: 200 mm
  - main fraction ( $\geq 60\%$ ): between 3.15 mm and 45 mm
  - $<3.15$  mm: 10% max



Photos: A.-K. Osdoba

# Requirements – Wood Chip Quality

## Operating experience

- Water content > 30%
  - bad combustion
  - increased emissions
- Excess length of particles
  - Alarm caused by photo sensor
  - Congested spiral conveyors
- Impurities like stones and metal
  - Congested spiral conveyors
  - Congested conveyor for ash
- Excess ash content
  - Increased quantities of ash
  - Increased wear of plant

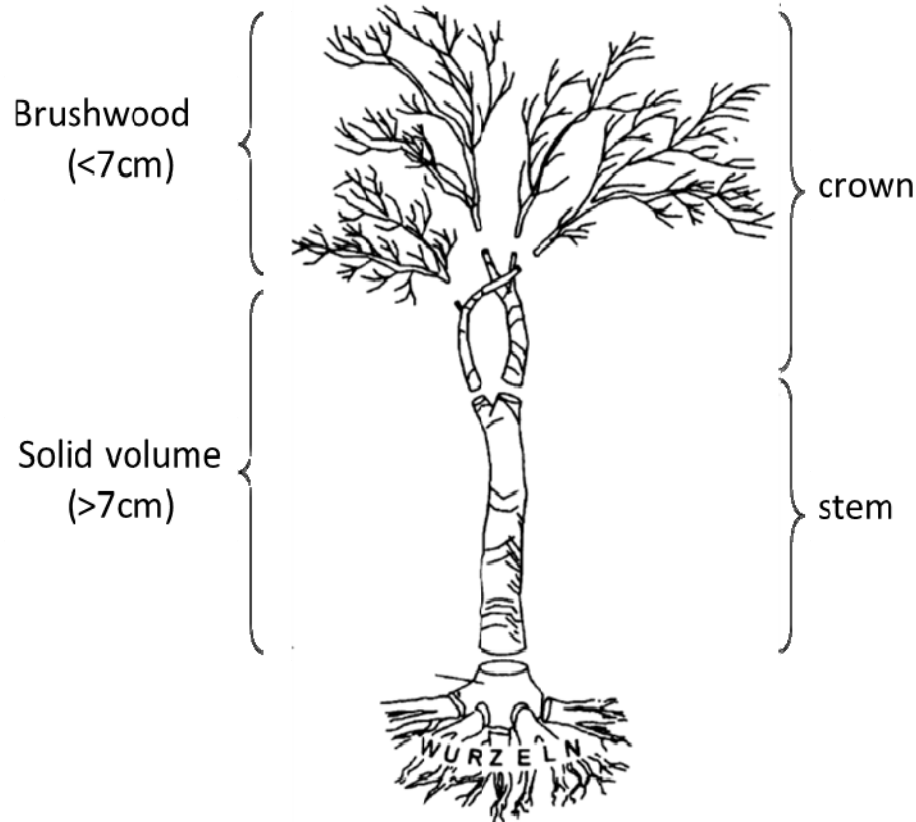


Discharge screw conveyor of the bioenergy plant in Altlandsberg with small particles/dust from low-quality wood chips

# Requirements – Overview

- Logistics
  - External storage place
  - Specific containers for transport and storage at the bioenergy plant
  - Specific delivery process
  - Delivery must arrive reliably in time
- Quality of Wood Chips
  - Bioenergy plant sensitive to
    - Water content
    - Particle size (too small, too large)
    - Impurities
    - High content of bark and green material

# Quality Management – Choice of Rawmaterial



Source: Hartmann, H.; Kaltschmitt, M.; Hofbauer, H. (2009), adapted



wood chips from harvesting small trees under power line near Altlandsberg



wood chips from felling trees for landscape preservation (pictures: H. Hartmann)

# Quality Management – Choice of Rawmaterial



Photo: H. Hartmann



Photo: H. Hartmann



Photo: M. Estler



Photo: M. Schultze

# Quality Management – Choice of Rawmaterial



Photo: M. Estler

# Quality Management – Chipping Technology

## Drum chipper

### Advantages

- Quality of chips
- Size of chips can be influenced reliably
- Chipping of many materials (also large roundwood and brushwood)
- Performance

### Disadvantages

- High investment costs
- Service and maintenance
- Experienced operator required



Photos: M. Schultze



## Quality Management – Drying

- Increase of heating value
  - Improvement of combustion behavior and decrease of noxious emissions
  - Improvement of stability of biomass during storage (lowered decomposition rate)
  - Lowered transport weight
- Natural drying
    - unchipped wood fuel
    - wood chips
  - Artificial drying
    - by air and heat supply
    - by mechanical squeezer



R&D Projekt FH Rottenburg  
Picture: [www.WoodFuelquetsche.de](http://www.WoodFuelquetsche.de)

# Quality Management – Drying

## Natural Drying – Unchipped Wood Fuel

- Piled roundwood or logging residues
- Usually in near the forest road but also on storage yards
- Drying depending on
  - exposition of storage place (wind, sun)
  - diameter and tree species
- Duration of storage and drying > 6 months
- Advantages:
  - Reduction of water content from 50 % to about 30% possible
  - Low biomass decomposition during storage of unchipped wood
  - Dropping of needles, old leaves, dry-sticks/ brush-wood
    - reduction of ash content
    - Increase of storage stability of wood chips
- Disadvantages
  - Forest pest control/infestation of piles

Source: Hartmann 2019

# Quality Management – Drying

## Natural Drying – Wood Chips in Piles

Risk of

- Fast biomass decomposition
- Mould formation
- Spontaneous combustion

Depending on:

- Water content: wood chips should have a water content <40% when putting them into storage
- Particle size: circulation of air better when chips are not too small
- Content of needles/leaves and bark, which increase biological activity
- Aeration of wood chip pile
- Form of wood chip pile and protection against rain

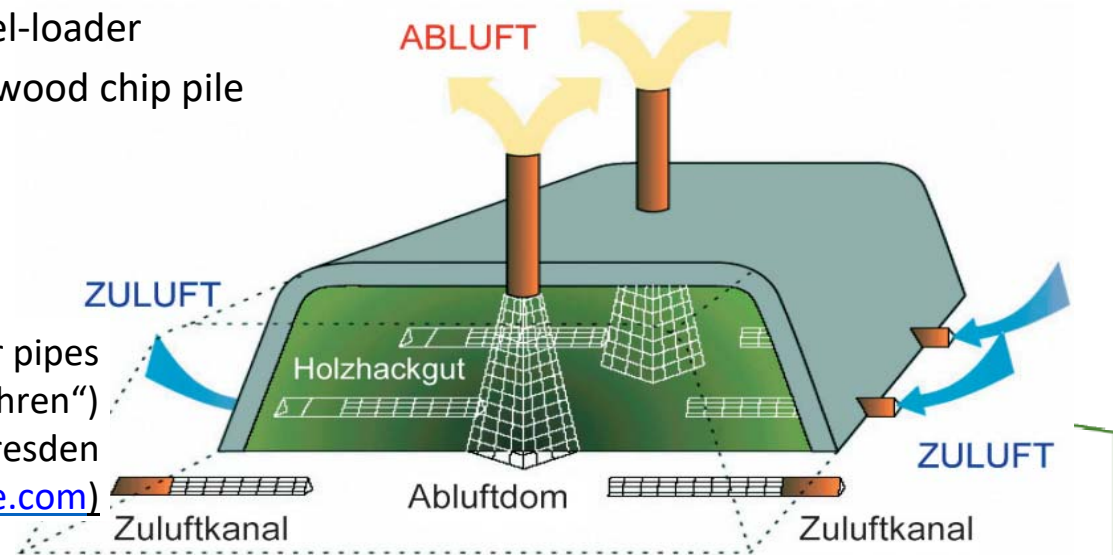
Source: Hartmann 2019:

# Quality Management – Drying

## Natural Drying – Wood Chips in Piles - Storage forms to reduce risks

- Protection against rain
  - storage under roof:
  - coverage with semi-permeable material in a cone-shaped chip pile
- Improvement of air circulation in wood chip pile
  - Exposition and model of storage facility: lean-to roof open for aeration
  - Storage on floor with slits or wholes and space for air circulation underneath
  - Height of wood chip pile limited to 5 m
  - Regular mixing of pile by wheel-loader
  - Installation of air pipes in the wood chip pile

Drying of wood-chips using air pipes in the chip pile („Dombelüftungsverfahren“) developed by the University of Dresden  
(Picture: [www.agrarheute.com](http://www.agrarheute.com))



# Quality Management – Drying

## Artificial Drying by Air and Heat Supply

### Advantages:

- Fast drying , no biomass decomposition
- Avoiding of storage risks (mould, biomass decomposition,...)
- Homogenous and controlled drying to needed water content
- Drying to water content <20 %

### Disadvantage

- Energy use for heat supply and ventilation
- Additional costs
- Logistical expense

batch drying in modified bulk containers using heat from a biogas plants; picture: [www.energieholz-brune.de](http://www.energieholz-brune.de)



Source: Hartmann 2019:

# Quality Management – Natural Drying

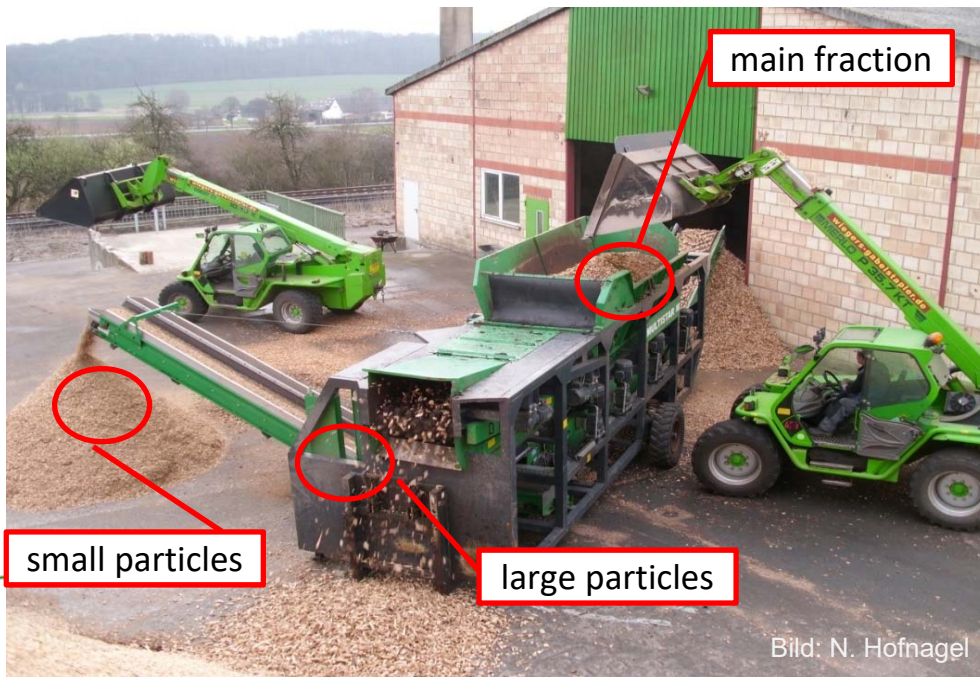


Photos: H. Härtmann

# Quality Management – Screening

- Mobility of screening unit
- Technology

## Mobile Starscreen



## Mobile Drumscreen



# Quality Management – Storage Place, Mixing, Loading





# Quality Assessment

## Water Content



## Size of Wood Chips



Photo: S. Ruebsam

Sieving of wood chips for simplified analysis of particle size – quality assessment on the premises of Castle Property Altlandsberg

# Recommended Literature

<https://mediathek.fnr.de>



## HANDBUCH ZUM QUALITÄTSMANAGEMENT VON HOLZHACKSCHNITZELN



Gefördert durch:



aufgrund eines Beschlusses  
des Deutschen Bundestages



Fachagentur Nachwachstums-Sicherheits e.V.



## HANDBUCH BIOENERGIE-KLEINANLAGEN



Gefördert durch:



aufgrund eines Beschlusses  
des Deutschen Bundestages

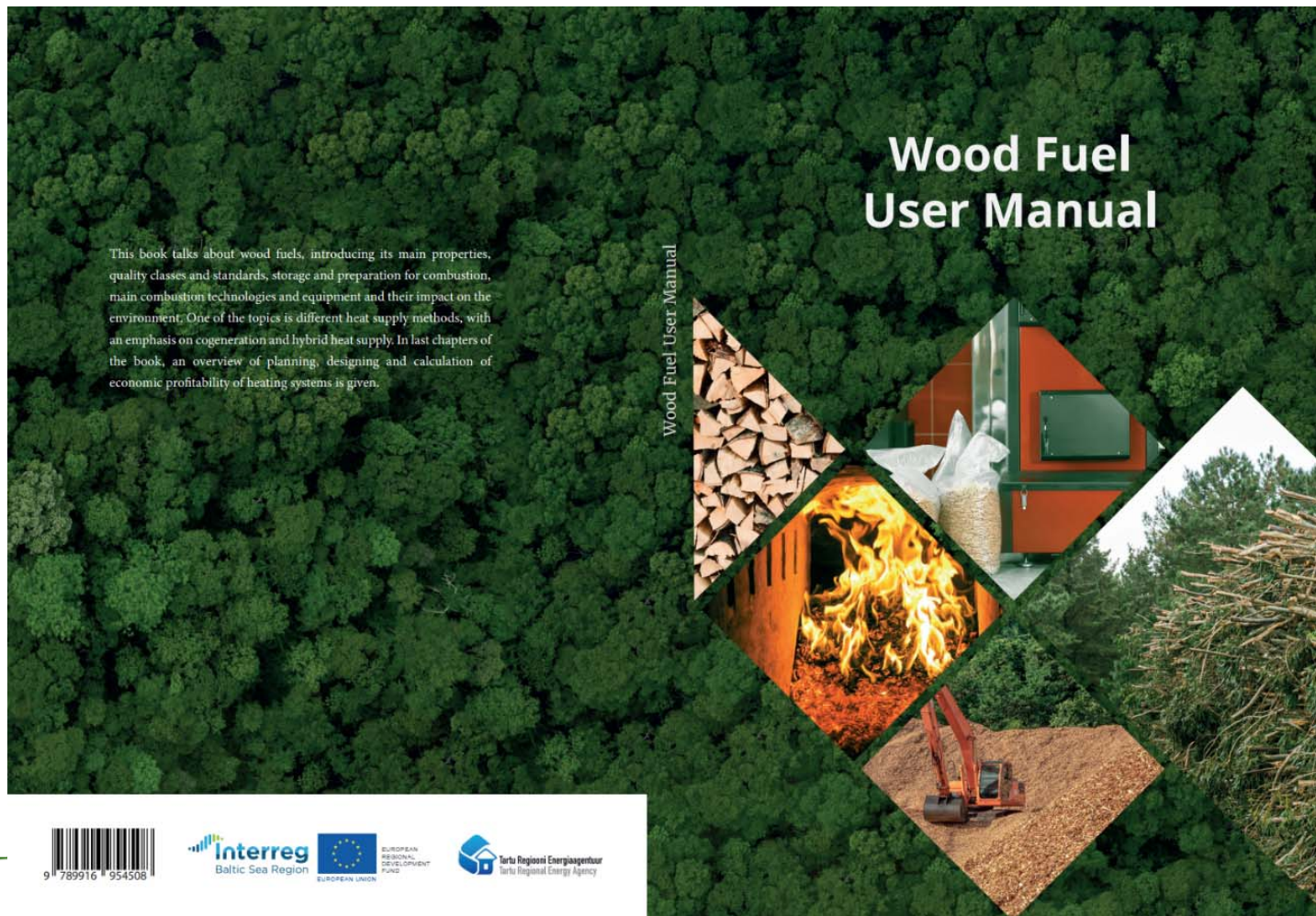


Fachagentur Nachwachstums-Sicherheits e.V.

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# Recommended Literature

[www.trea.ee/eng/wood-fuel-user-manual/](http://www.trea.ee/eng/wood-fuel-user-manual/)



Interreg  
Baltic Sea Region



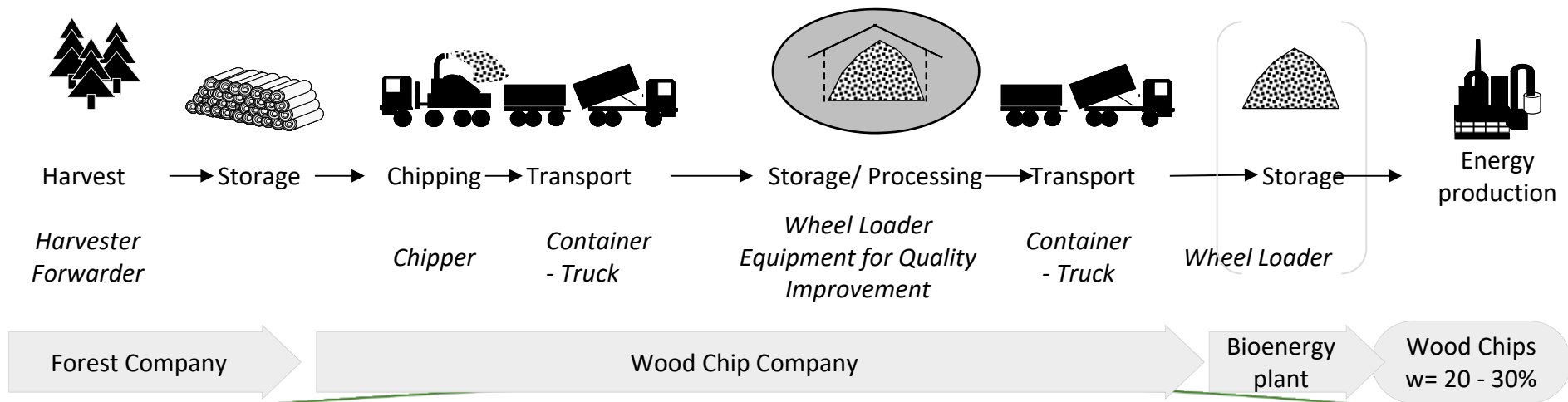
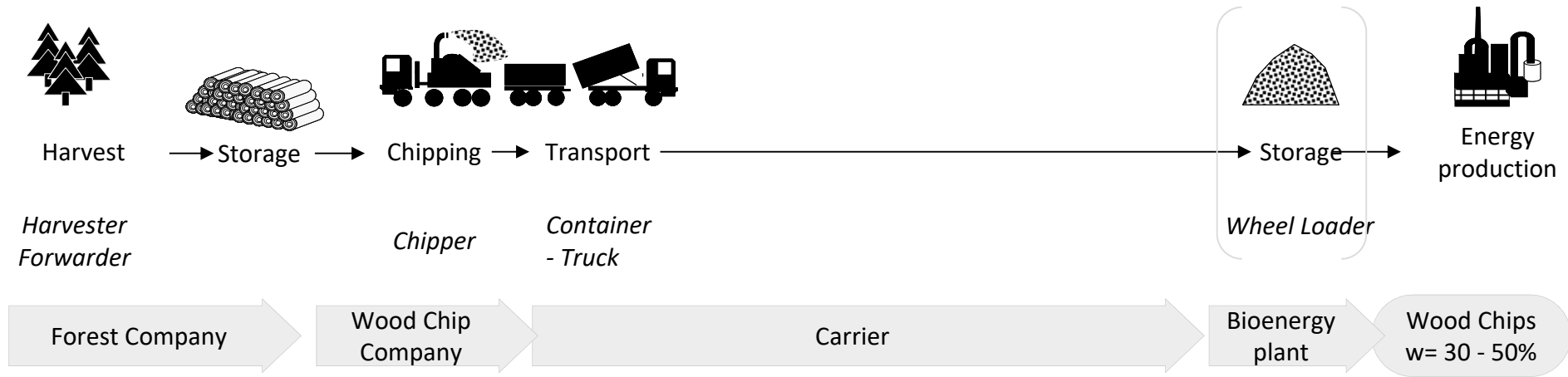
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Tartu Regional Energy Agency

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Baltic Sea Region



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# Wood Chip Supply Chains



## Conclusion: Supply Chain Example Altlandsberg

- Harvest in forest and landscape
- Storage near forest road > 3 - 6 months
- Chipping by drum chipper
- Loading directly into truck
- Transportation to storage place
- Storage and natural drying under roof several weeks – months (depending on season and weather)
- Mixing of wood chips from different raw materials
- Mixing of wood chips before loading into delivery container and quality check by supplier
- Quality check at bioenergy plant (simplified test procedures) and continuous documentation of specific values (heat production, quantity of ash, disruptions of process)
- Long-run contract with local wood chip company



Picture: S. Ruebsam

Chipping of logging residues (above) and roundwood (below) into transport vehicle



Picture: M. Schultze



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