System Analyses of Forestry, Forest Products and Recovered Wood – Activities and Results from COST Action E9 and E31

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Overview

Introduction

Results of COST Action E9

Activities in COST Action E31

Outlook

Scope & Goal

Recovered Wood

Allocation

Energy Aspects in LCA

Waste Treatment Option
What is COST?
- European Co-operation in the field of Science and Technical Research
- Support from European Commission
- Networking activity

1. Production: energy, carbon, and other material cycle
2. Land use
3. End of life: recycling, disposal and energy production
4. Methodology

1. European Management of Recovered Wood
2. Treatment Option for Recovered Wood
LCA-Wood Product: Example Newspaper

- Forestry
- Harvesting
- Transport
- Pulp & Paper Production
- Consumer
- Use
- End of Life
- Combustion
Linkage: LCA-Wood Products and LCA-Bioenergy

- Biomass production
- System boundary
- Material use of wood
- Energetic use of wood
- Production
- Use
- End of life
- Internal biomass
- Internal energy
- Recycled biomass
- Wood product
- Construction
- Operation
- Dismantling
- Energy
Results of COST Action E9

- Guidelines, recommendations and conclusions
- Allocation in LCA for forest products
- Energy aspects in LCA for forest products
- Waste management options for wooden products
Avoid Allocation by Combining LCA Wood Products and LCA Bioenergy

LCA bio-energy + LCA wood-product = LCA non-wooden product + LCA conventional energy

product & energy
In LCA of Wood Products
Substitute Bioenergy

LCA bio-energy + LCA wood-product = LCA non-wooden product

- LCA conventional energy

Describe criteria for the substitution of energy!
Criteria for Energy Substitution

Substitution of fossil energy

- Kind of energy output
- Quality of energy output
- Energy supply/demand characteristics
- State of technology
- Kind of fossil fuel substituted
- Socio-economic and other factors
- Costs

substitution rate \leq 100\%
Aspects of Energy Generation in LCA

- External costs
- Technology
- Internal costs
- Nutrient recycling
- Ash treatment
- Legislation
- Carbon balance
- Energy balance
- Auxiliary energy
- Fuel handling
- Logistics
- Substitution of conventional energy
- Comparison other biomass use

- Fuel handling
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Energy Balance of LCA Bioenergy-District Heat

All units in kWh

- Energy losses
- Auxiliary energy: fuel
- Energy in biomass
Cumulated Primary Energy Demand
LCA of Bioenergy for District Heat

Cumulated primary energy demand [kWh/kWh heat]

- Wood chips: 1.51
- Natural gas: 1.42

91% renewable
97% non-renewable

- Oil
- Natural gas
- Water
- Coal
- Others
- Biomass
Cumulated Primary Energy Need in LCA of Wooden Product - Newspaper

- Electricity need: Sweden/fresh fibres 3.4 MWh/t, Germany/recycled fibres 0.95 MWh/t
Carbon Balance of LCA Wooden Product - Plywood

Atmosphere +280 kg C (1,025 kg CO₂)

Lithosphere -280 kg C (with landfill + 220 kg C)

Fossil carbon flow in auxiliary energy: kg C (kg CO₂)

Biomass carbon flow: kg C
Waste Wood Treatment Options:

- Landfill
- Recycling
- Energy generation

waste wood, waste paper or waste particle boards
Waste Wood Treatment Options: Input Related Comparison

- Landfill
- Recycling
- Energy generation

Inputs:
- Waste wood
- Waste paper
- Waste particle boards

Impacts:
- Landfill
- Recycling
- Energy generation

Outputs:
- Fibres
- Energy
In- and Output Related Comparison

- waste wood, waste particle boards, waste paper
  - landfill
  - recycling
    - fibres
  - energy generation
    - energy
In- and Output Related Comparison

waste wood, waste particle boards, waste paper

system 1: landfill

energy generation

acquisition fresh fibres

recycling

other resources

impacts landfill

landfill

energy generation

fibres

energy
In- and Output Related Comparison

waste wood, waste particle boards, waste paper

system 1: landfill
landfill energy generation acquisition fresh fibres

system 2: recycling
recycling energy generation

system 3: energy generation energy generation acquisition fresh fibres

impacts landfill
impacts recycling
impacts energy generation

fibres
energy

other resources

energy generation

acquisition fresh fibres
Paper Recycling Versus Energy Generation - Austria

**Current situation in Austria**

- More paper recycling leads to less CO₂ emissions.
- More energy generation leads to higher CO₂ emissions.

**Graph:**
- CO₂ emissions in Mio t/a.
- Use of collected waste paper for recycling in %.
Energy Generation Versus Landfill and Recycling of Waste Wood

Greenhouse gas emission factor [g CO₂-eq/kWh]

- CO₂:
  - Energy generation avoiding waste wood recycling: 24 g CO₂-eq/kWh
  - Energy generation avoiding waste wood landfill: 487 g CO₂-eq/kWh
  - Fuel oil: 396 g CO₂-eq/kWh

- CH₄:
  - Energy generation avoiding waste wood recycling: 2 g CH₄/kWh
  - Energy generation avoiding waste wood landfill: 476 g CH₄/kWh
  - Fuel oil: 396 g CH₄/kWh

- N₂O:
  - Energy generation avoiding waste wood recycling: 29 g N₂O/kWh
  - Energy generation avoiding waste wood landfill: 476 g N₂O/kWh
  - Fuel oil: 476 g N₂O/kWh
What is „Recovered Wood“ in COST Action E31?

- Recovered wood includes all kinds of wooden material that is available at the end of its use as a wooden product ("post-consumer" or "post-use" wood).

- Recovered wood mainly comprises
  - packaging materials,
  - demolition wood,
  - timber from building sites and
  - fractions of used wood from residential, industrial & commercial activities.

- Therefore not in the scope of COST E31 are
  - forestry residues (tops, thinnings and branches) from forest operations and
  - black liqueur from pulp production.
Origins of „Recovered Wood“

Main focus of COST Action E31

**Wood processing side**
- saw mill
- wood manufacturing industry
- particle board industry

**Wood utilisation side**
- construction and demolition activities
- residential and commercial sectors
- packaging collection
Objectives

Analysis of management approaches for recovered wood in European countries

Improvement of databases on technical, economical, ecological and statistical information

COST Action E31 „Management of Recovered Wood“

Examine potentials of recovered wood as
- secondary raw materials
- energy sources

Identify promising approaches for implementation of advanced systems for the management of recovered wood
The Working Triangle

Multi-disciplinary Seminars, Workshops and Conferences

Workgroup 1
„European Management of Recovered Wood“

Workgroup 2
„Treatment Options for Recovered Wood“
Countries Participating in COST Action E31

16 Countries signed Memorandum of Understanding (MoU)

3 Countries interested

http://www.ctib-tchn.be/coste31
Benefits of COST Action E31

- Expand the relevant data base
- Provide strategic information for stakeholders
- Bring together a multi-disciplinary and multi-cultural ‘team’
- Establish a European forum for the management of recovered wood
- Give an overview of the different management options for recovered wood
Motto of COST Action E31
„Management of Recovered Wood“

„Improvement of the management of recovered wood towards a higher common technical, economic and environmental standard“

Source: Memorandum of Understanding from COST Action E31
"Management of Recovered Wood - Recycling, Bioenergy, and Other Options" 1st Conference of COST Action E31

http://www.ctib-chn.be/coste31
22 – 24 April 2004
Amphitheatre of the Museum of Ancient and Byzantine Musical Organs
Thessaloniki, Greece, Europe