WOOD RESIDUES IN THE TRANSITION TO SUSTAINABLE BIOENERGY

Good practices and recommendations for developing countries

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Traditional use of biomass

Source of data: BP (2021); FAOSTAT, 2020
WOODY BIOMASS STREAMS

Wood product value chain

- Harvesting of industrial roundwood
- Processing of industrial roundwood
- Wood product manufacturing
- Wood product material use
- Wood product end-of-life

Material use

- Primary residues
- Secondary residues
- Tertiary residues

Recycling & cascading

Wood fuel

- Harvesting/collection of wood fuel

Energy use
CHALLENGES, OPPORTUNITIES AND LESSONS LEARNED

• Land tenure and use rights of forest resources
• Consumer preferences
• Economic impact of bioenergy
• Economic role of traditional bioenergy
• Valuation of industrial roundwood and residues
• Cascading use of wood
• Logistics of wood residue supply chains
• International trade of modern bioenergy from wood residues
• Impact of bioenergy development on land use change
• Mitigation of GHG emissions
• Soil, water and air quality
MESSAGE # 1

Encourage systematic changes in land and forest governance to enable the modernization of wood energy value chain
Mobilize wood resources towards the bioeconomy

MESSAGE # 2

Stimulate increased efficiency and added value in the industrial roundwood network
The financial profitability of energy from wood residues depends on the optimal and efficient co-production of material products. We need processes that optimize high-value material products.

Adapted from data in GIZ and GBEP (2015)
MESSAGE # 3

Stimulate the cascading use of wood resources
CASCADING USE

Forest lands, other wooded areas and trees outside of forests

- Harvesting of industrial roundwood
  - Primary residues
  - Energy end-use
    - Processing into secondary energy carriers
  - Secondary residues
    - Internal energy use
  - Recovery
    - Recovery/Recycling

- Processing of industrial roundwood

- Wood product manufacturing
  - Wood product material use
  - Wood product end-of-life
  - Tertiary residues

Recovery
## CASCADING USE

<table>
<thead>
<tr>
<th>Secondary residues, recovered paper</th>
<th>Paper</th>
<th>Can further be recovered for the production of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovered sawn wood, recovered particleboard and oriented-strand board (OSB)</td>
<td>Particleboard</td>
<td>Recycled paper and energy after several cycles</td>
</tr>
<tr>
<td>Industrial roundwood, secondary residues</td>
<td>Medium-density fibreboard (MDF) and OSB</td>
<td>Energy and fraction for reuse in particleboard</td>
</tr>
<tr>
<td>Industrial roundwood</td>
<td>Plywood</td>
<td>Energy and fraction of OSB for reuse in particleboard</td>
</tr>
<tr>
<td>Industrial roundwood</td>
<td>Sawn wood for construction</td>
<td>Energy</td>
</tr>
<tr>
<td>Industrial roundwood, secondary residues</td>
<td>Wood plastic composites</td>
<td>Particleboard</td>
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<td>Industrial roundwood, secondary residues</td>
<td>Biobased chemicals from biochemical conversion</td>
<td>Still in development</td>
</tr>
<tr>
<td>Industrial roundwood, secondary residues, recovered (clean) wood</td>
<td>Biobased chemicals from thermochemical conversion</td>
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</tr>
</tbody>
</table>

Adapted from Vis, Mantau and Allen (2016)
## RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Key categories of stakeholders</th>
<th>Recommendations</th>
</tr>
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</table>
| **1** Governments, International organizations and NGOs | → Encourage systematic changes in governance to enable the modernization of wood energy value chains  
→ Raise awareness of the benefits of modern bioenergy |
| **2** Governments, Cooperative unions, Operators within the value chain | → Develop cooperative solutions that encompass the whole wood energy value chain |
| **3** International organizations, National/regional forest services and agencies, Operators within the value chain | → Improve the tracking and reporting of wood flows from the land base to the end-users to quantify and characterize wood residue potentials |
| **4** Governments, Operators within the value chain and within mills | → Stimulate a cascading use of wood resources and increased efficiency in the industrial roundwood network |
| **5** Policymakers, Producer associations, Cooperatives | → Develop classification and standardization systems and practices for wood residues and wood residue-based energy carriers |
• Achieving access to affordable, reliable, sustainable and modern energy for everyone (SDG7) will require a transition from traditional uses of wood fuel to modern systems of wood fuel production and use.

• In several developing countries, wood residues generated by industrial roundwood production are often considered waste to be eliminated through open air combustion or simply abandoned.

• The use of wood residues plays an important role for sustainable energy access, notably for cooking, heating and power generation.

• The combination of sustainable forest management and the efficient use of harvested roundwood, including the valorization of wood residues, represents an opportunity to develop a modern bioenergy value chain as part of a sustainable bioeconomy which includes substitution of non-renewable materials and energy.

• There is a need to collect site-specific evidence on wood residue availability and to analyze appropriate technologies in order to inform investors, support the development of policies and ensure best practices are implemented.
THANK YOU FOR YOUR ATTENTION
Concepts of biomass potential
Theoretical potential availability of wood residues associated with industrial roundwood value chains

Wood product value chain

- Harvesting of industrial roundwood
  - Primary residues
- Processing of industrial roundwood
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- Wood product end-of-life
  - Tertiary residues

Forest lands, other wooded lands and trees outside of forests
Theoretical potential availability of wood residues associated with industrial roundwood value chains

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<th>World regions</th>
<th>Total theoretical availability or wood residues</th>
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Climate Change 2022
Mitigation of Climate Change

Mitigation options

- Wind energy
- Solar energy
- Biocentrality
- Hydropower
- Geothermal energy
- Nuclear energy
- Carbon capture and storage (CCS)
- Biocentrality with CCS
- Reduce CH₄ emission from coal mining
- Reduce CH₄ emission from oil and gas
- Carbon sequestration in agriculture
- Reduce CH₄ and N₂O emission in agriculture
- Reduced conversion of forests and other ecosystems
- Ecosystem restoration, afforestation, reforestation
- Improved sustainable forest management
- Reduce food loss and food waste
- Shift to balanced, sustainable healthy diets
- Avoid demand for energy services
- Efficient lighting, appliances and equipment
- New buildings with high energy performance
- Ozone production from vehicles and use
- Improvement of existing building stock
- Enhanced use of wool products
- Fuel efficient light duty vehicles
- Electric light duty vehicles
- Shift to public transportation
- Shift to bikes and e-bikes
- Fuel efficient heavy duty vehicles
- Electric heavy duty vehicles, incl. buses
- Shipping – efficiency and optimisation
- Aviation – energy efficiency
- Biofuels
- Energy efficiency
- Material efficiency
- Enhanced recycling
- Fuel switching (electric, gas, bio-energy, H₂)
- Feedstock decarbonisation, process change
- Carbon capture with utilisation (CCU) and CCS
- Conventional material substitution
- Reduction of non-CO₂ emissions
- Reduce emission of fluorinated gas
- Reduce CH₄ emissions from solid waste
- Reduce CH₄ emissions from wastewater

Potential contribution to net emission reduction (2030) (GtCO₂eq yr⁻¹)

Net lifetime cost of options:
- Costs are lower than the reference
- 0–20 (USD KCO₂eq⁻¹)
- 20–60 (USD KCO₂eq⁻¹)
- 50–100 (USD KCO₂eq⁻¹)
- 80–200 (USD KCO₂eq⁻¹)
- Cost not allocated due to high variability or lack of data

Uncertainty range applies to the total potential contribution to emission reduction. The individual cost ranges are also associated with uncertainty.