

Modeling Energy and Climate Policy in the Finnish Forest Sector

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*Forest Sector Modeling Conference, 17-20 November 2008,
University of Washington, Seattle, USA*

Background

- Research team:
Lauri Hetemäki, Hanna-Liisa Kangas, Jani Laturi, Jussi Lintunen & Jussi Uusivuori (PL) (all at Metla)
- Objective: To build a simulation model for analysing the impacts of climate, energy and forest policies to Finnish forest and energy sectors
- 3 Ph.D. theses
- Work started at Metla 2007-2008
- The project runs until the end of 2010

Outline

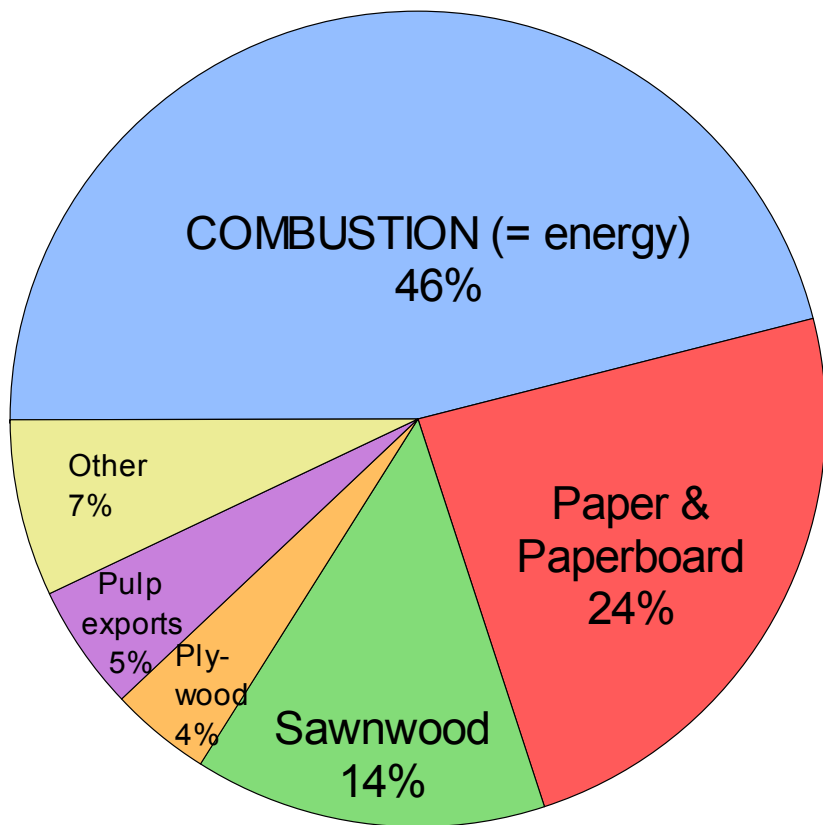
1. Introduction – motivating the model
2. Model features
3. Model structure
4. Discussion and open issues

Motivation for the Model

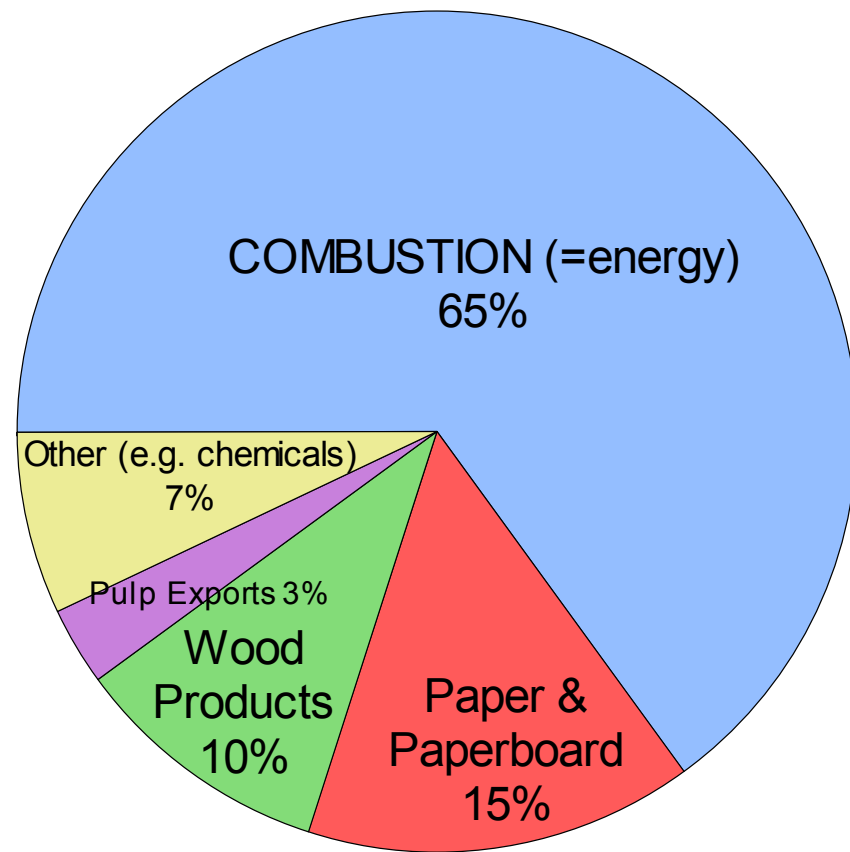
- Metla assists government forest policy planning processes
- Forest and energy sector is changing because of demands for climate services and bioenergy from forests (not only gradual, but structural change)
- Decision makers will need to know how to design efficient climate, energy & forest policies (mutual dependence between policies)
- Forest sector needs to be analyzed simultaneously with the energy sector and climate policies, and at the rather detailed sectoral (and regional) level
- Linking the NIPFs utility maximization behavior to wood fiber demand

Ongoing Structural Change in Finnish Wood Consumption

2004



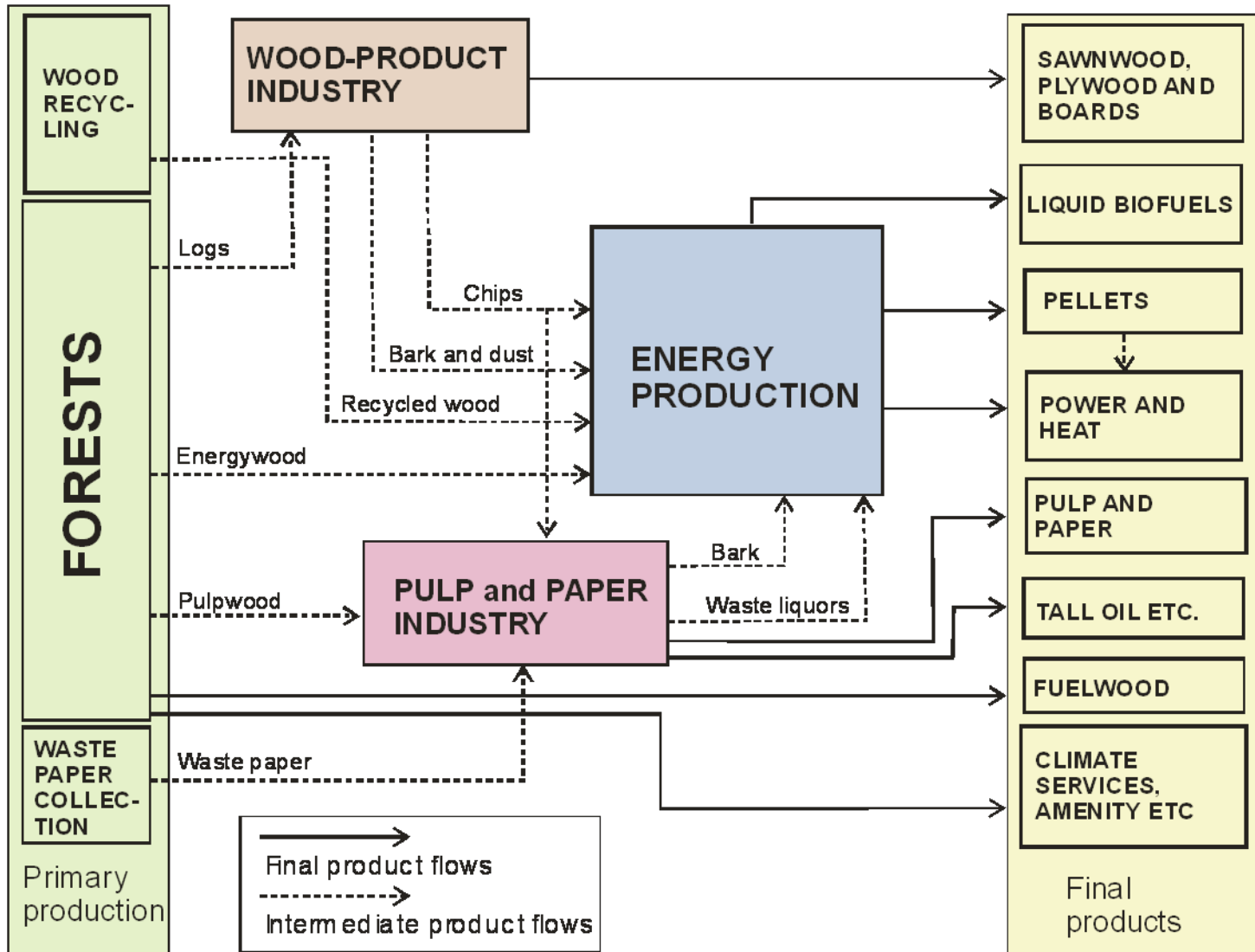
"Conceivable" outlook 2020



Model Features (targets)

- Partial Equilibrium Simulation Model
(macroeconomic background and final product demands are exogenous)
- "Hybrid model" (behavioral optimization, but realistic technology choice)
- Finland (and at regional level)
- Incorporates a wide range of domestic and EU policies
- Around 10-15 final products (\approx sawnwood, plywood, paper & board, **chemical pulp**, **mechanical pulp**, power & heat (**total**), pellets, fuelwood, liquid biofuels & climate services)
- Inputs and intermediate goods (logs, pulpwood, forest chips, industrial chips, bark, sawdust, black liquor), labour, capital & fossil fuels
- Dynamic model

Flows of Forest Goods



Supply Side

- Derived from behavioral optimization → Forest owners maximize utility
- NIPFs' supply = f (wood prices, interest rate, replanting & thinning costs; wealth of owner, amenity preferences; forest structure; policy parameters)
- Clearcutting and thinning harvests, logging residue collection from age-structured forests
- Logwood, pulpwood, small-sized trees, stumps and roots and logging residues
- + Wood imports
- + State and industry forests

Demand Side

- Derived from behavioral optimization → profit maximization
- 1. Demand for pulpwood:** prices of end-products, pulpwood, chips, labor, electricity and heat, other costs
- 2. Demand for logwood:** prices of end-products, logwood, labor, other costs
- 3. Demand for energywood:** prices of electricity and heat, energywood, transportation costs, substitutes, CO₂ emission price

Policy Instruments

- **Climate policy:** emission trading, carbon taxes and carbon rentals
- **Energy policy:** feed-in tariff, green certificates, investment subsidies, transportation subsidies and other subsidies
- **Forest policy:** harvesting and forest management subsidies, NIPF taxation
- Import/Export levies on timber

Model Characteristics

- Linking energy & forest sector
- Rich description of energywood markets and intermediate goods
- National and regional analyses
- Utility maximizing NIPF modeling
- "Sufficiently realistic" description of technologies and economic behavior (e.g. co-firing*)
- Policy relevancy for decision makers — includes major policies influencing the sectors (simultaneous analysis of multiple policies; e.g. how emission trading and feed-in tariff interact*)

**Kangas, Lintunen & Uusivuori "The Cofiring Problem of a Power Plant under Policy Regulations", submitted*

Discussion and Open Issues

- Dynamics:
 - technological change (e.g. "learning-by-doing")*
 - investments
 - time horizon (five-year periods, long-run)
 - intertemporal wood supply decisions
- Production function specification (functional form)
- Data and aggregation level (at what level the different industries are included?)
- International trade?

**Gillingham, Newell & Pizer (2008) "Modeling endogeneous technological change for climate policy", Energy Economics*

Thank you!

Project home-page:

<http://www.metla.fi/hanke/50168/index-en.htm>