

# Determining Forest Energy Potential in Europe

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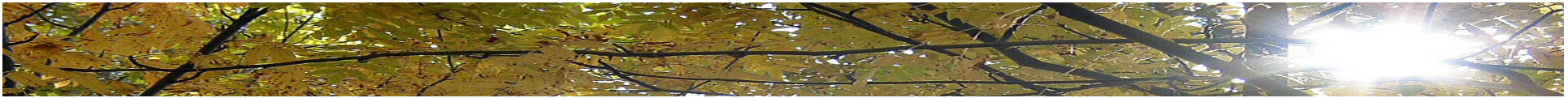


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Economics and Statistics, 02.04.2008, Geneva

**METLA**

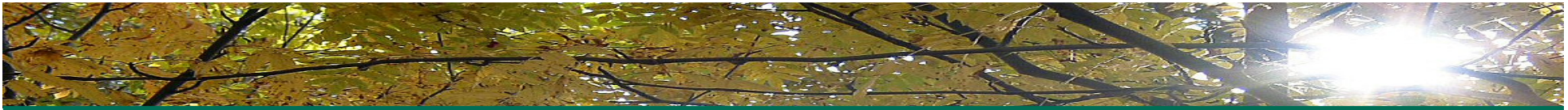
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[www.metla.fi](http://www.metla.fi)

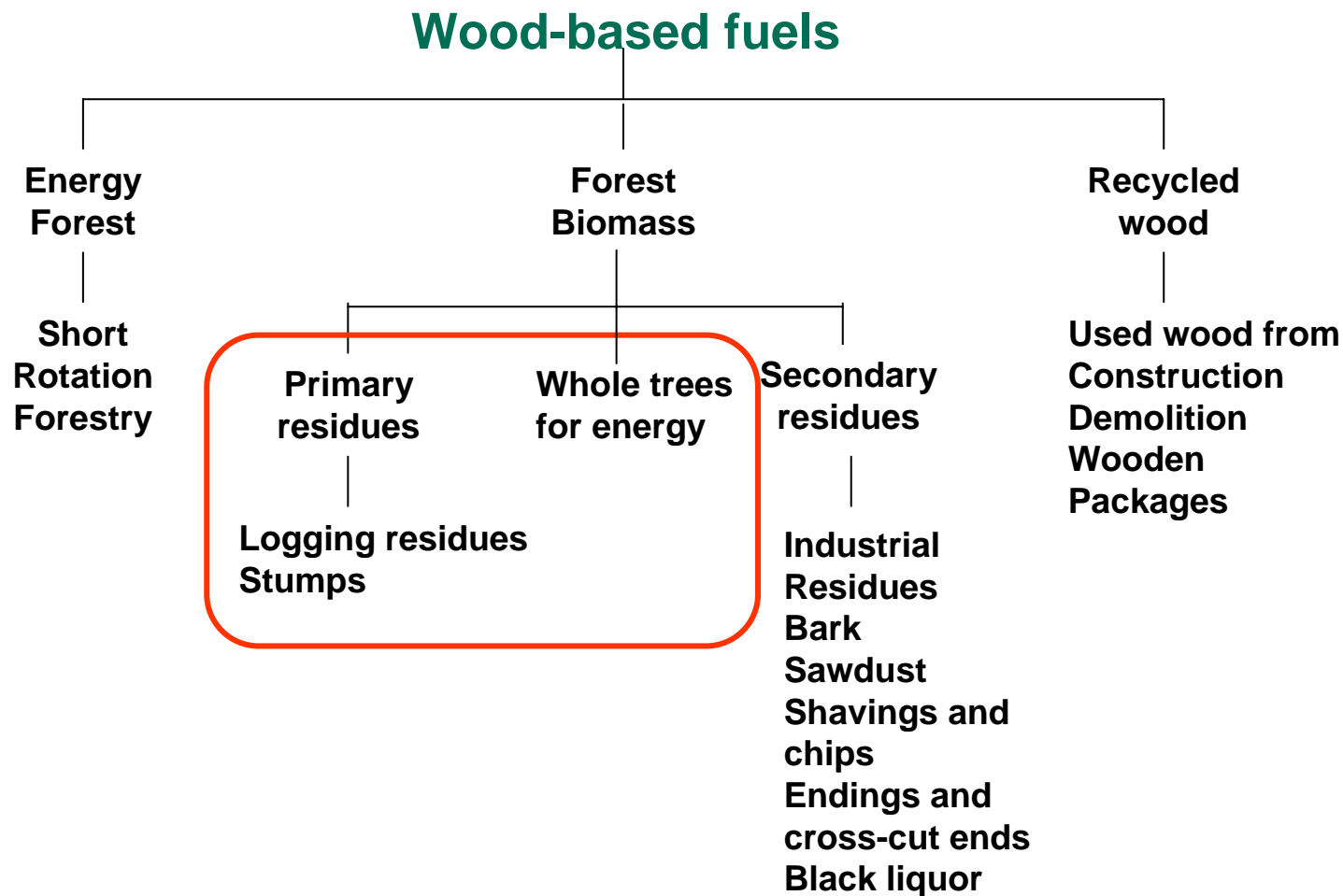


# Contents

- **Classification for wood-based fuels**
- **Estimation of**
  - **total biomass for energy**
  - **harvestable biomass for energy**
- **Cost – Supply curves for logging residue chips**
- **Bottlenecks of supply**
  - **location of harvestable resources**
  - **selection of harvesting technology**
  - **Investment needs for machinery**
- **Concluding remarks**



# Classification of wood-based fuels





## RAW MATERIAL SOURCES

### Roundwood



# Logging residues





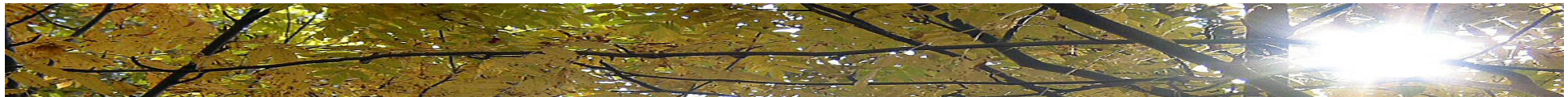
## Small wholetrees





# Stumps





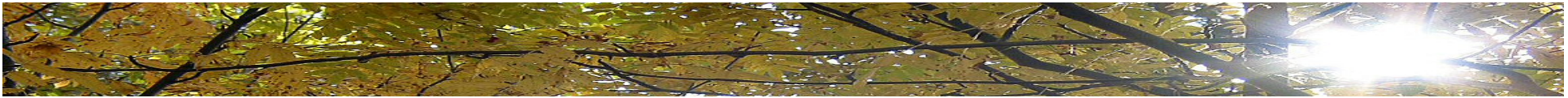
## Estimation of biomass components

- Statistics for removals & NAI for stem wood
- Shares for biomass components

Table 6. Proportions of biomass components used in the volume estimation. Above ground biomasses are based on equations presented by Marklund (1988) and volumes of root estimates are based on Eggers (2001)

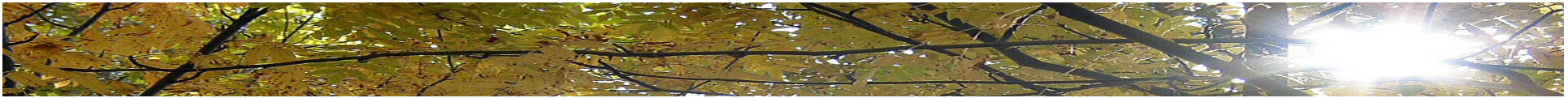
	Stem + Stembark	Stem wood loss	Branches	Needles	Tops	Total	Stump wood estimation (Nordic and Baltic countries)	Stump wood estimation (rest of Europe)
Spruce group	55%	8%	24%	11%	2%	100%	21.9%	19.1%
Pine group	67.7%	8%	17.7%	4.7%	2%	100%	19.8%	19.3%
Broadleaved group	78.2%	8%	12.1%	--	1.7%	100%	22.4%	14.7%





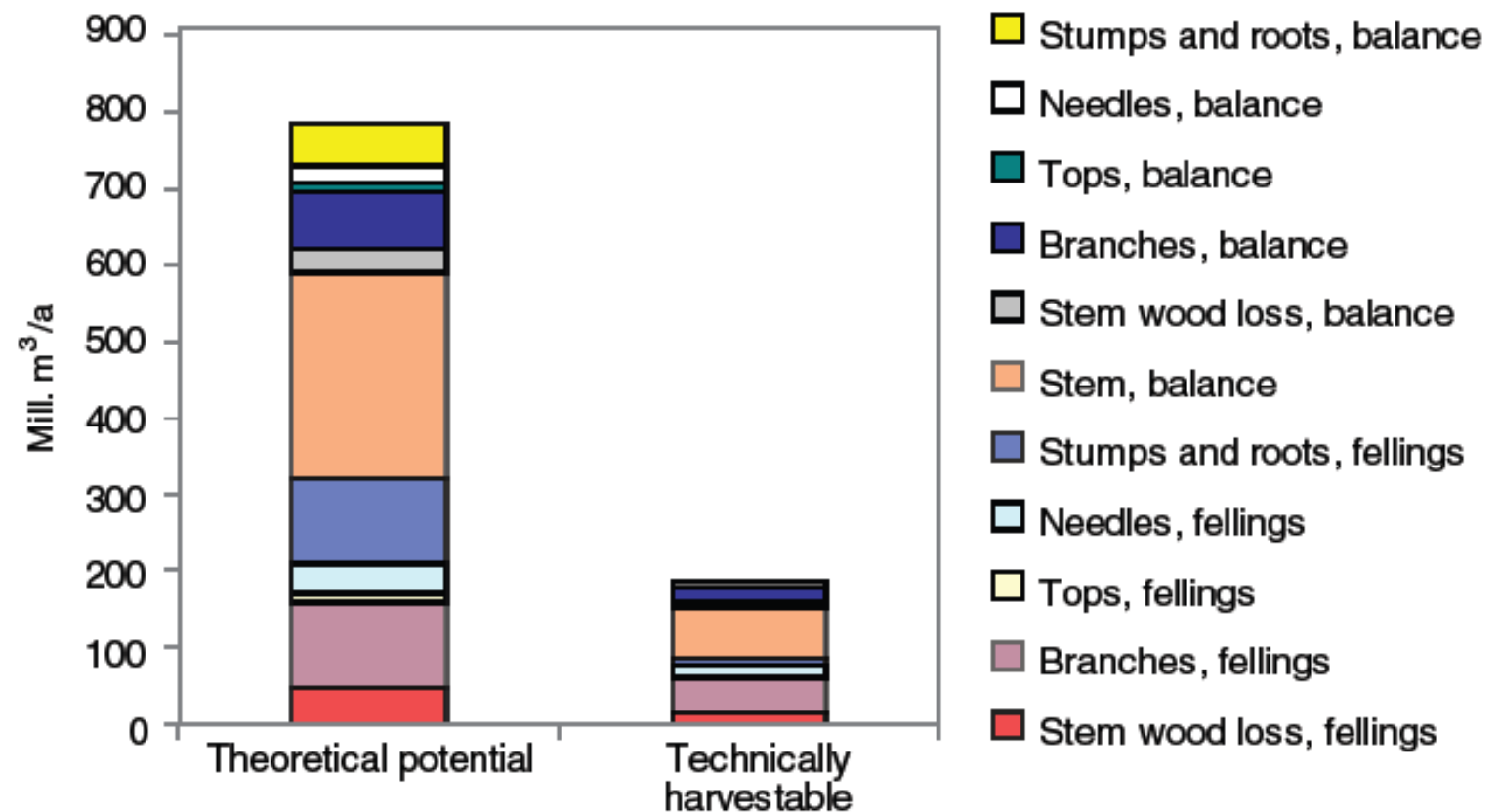
## Estimation of harvestable volumes

- 75% of clear cut areas and 45% of thinnings harvestable
- Recovery rate of above ground biomass
  - 65% after mechanized cutting
  - 50% after manual cutting
- Recovery rate for stumps
  - only clear fellings of spruce dominated stands
  - recovery rate:  $33\% - \text{mountain}\% \times 0.33$ 
    - in flat lands 33%, in very mountainous lands a few %

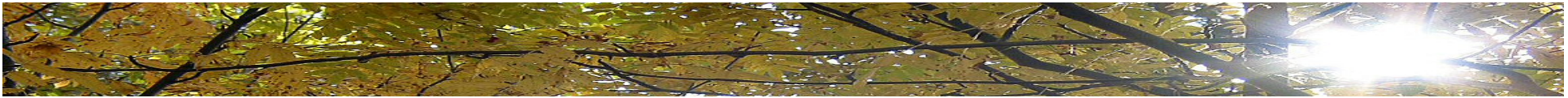


## Forest energy resources of the EU27

- Net growth – Current use of forest biomass = 785 mill. m<sup>3</sup>/year
- Annually harvestable volume = 187 mill. m<sup>3</sup>/year = 411 TWh = 36 Mtoe

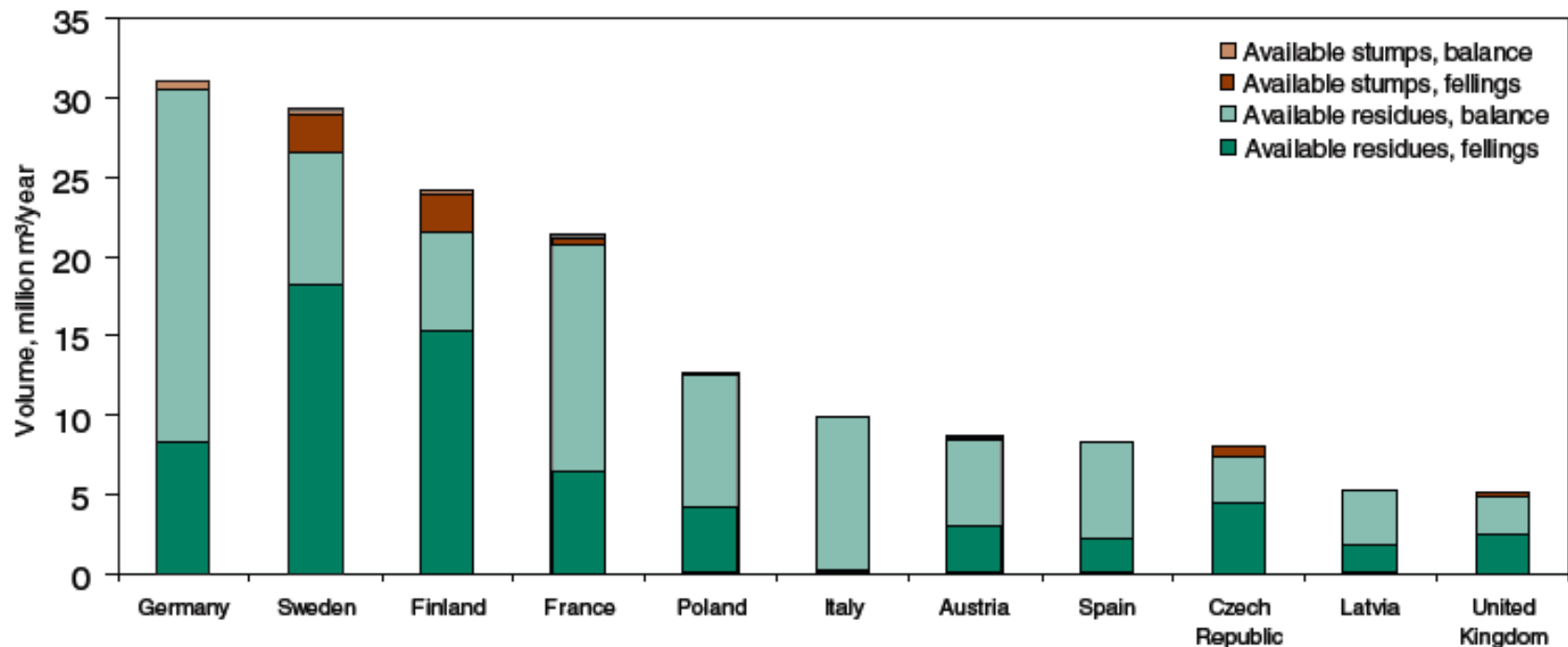


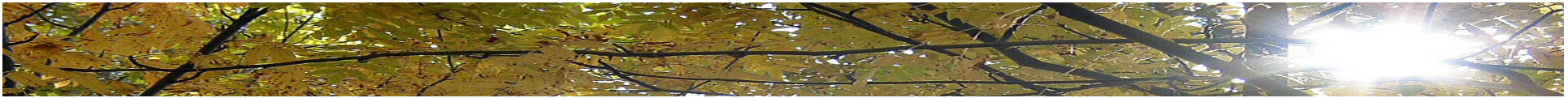




## Forest energy resources of the EU27

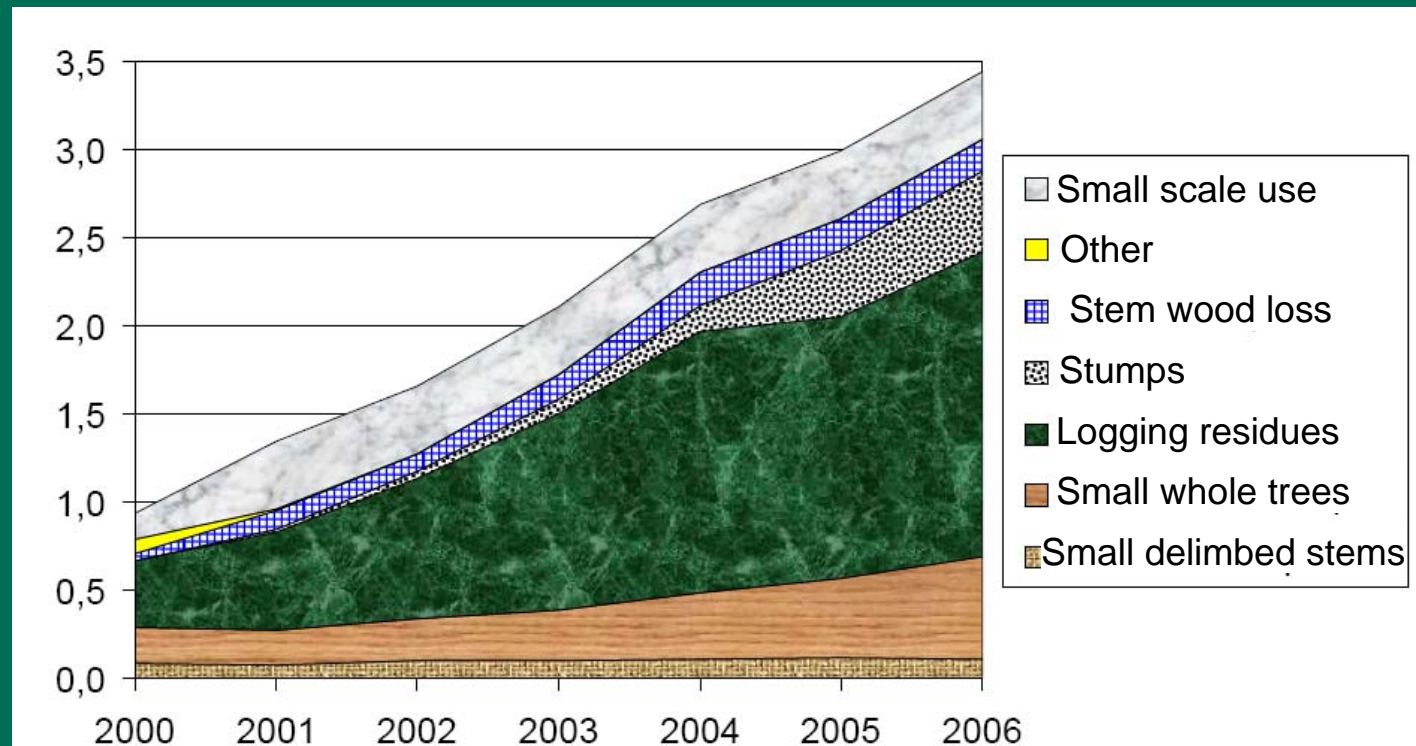
- Largest forest energy resources can be found in Germany, Sweden, Finland and France
  - Finland & Sweden: logging residues from current fellings
  - Germany and France: biomass from balance



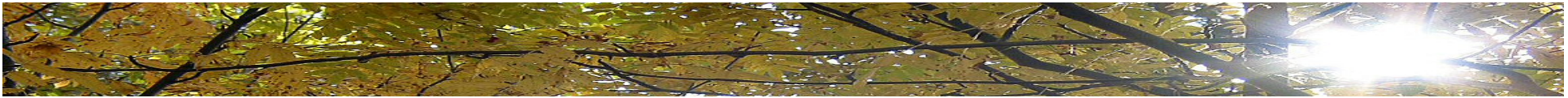


## Forest energy in Finland

- Rapid growth in 2000's, 3.4 mill. m<sup>3</sup> in 2006
- Wood energy harvest: 10% of forest operations, in the future 30-35%
- Goals in national forest programme: 8 mill. m<sup>3</sup> in 2015 for energy





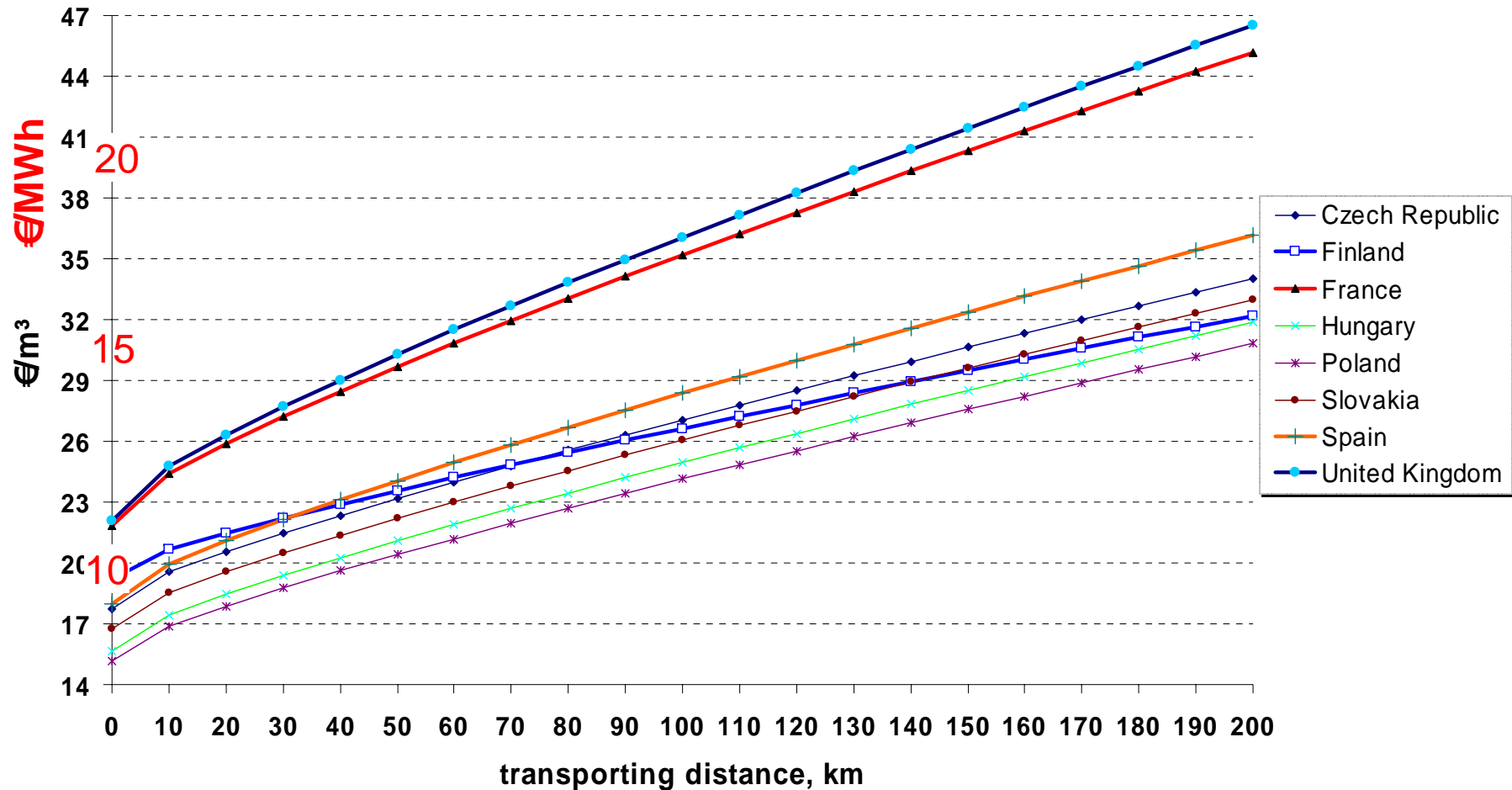


## Estimation of costs for supply

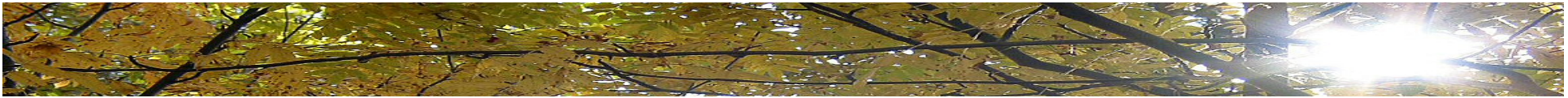
- Selection of harvesting and transport technology
- Hourly cost estimation for machines, €/hour
- Productivity estimation, m<sup>3</sup>/hour
- Unit cost estimation,
  - hourly cost/productivity = €/m<sup>3</sup>

# Cost of wood fuel, chips from logging residues in selected EU countries

Cost of chips at plant, €/m<sup>3</sup>





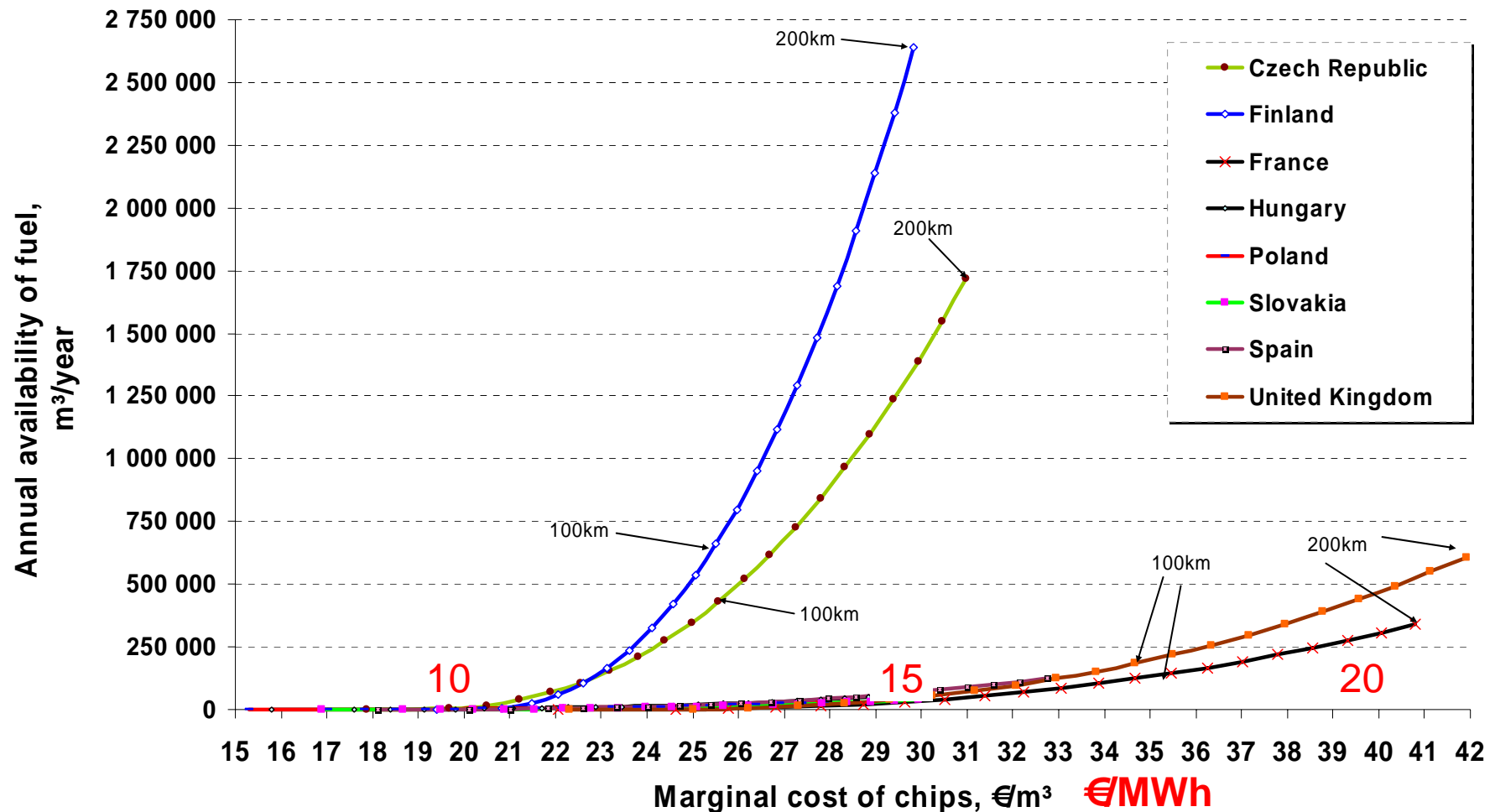


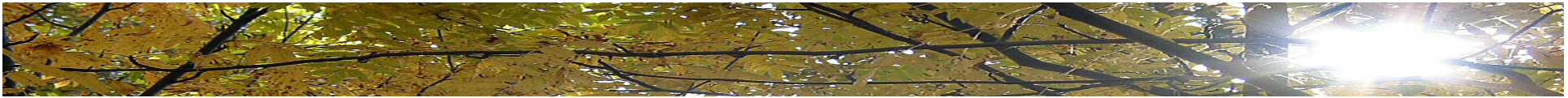
## Estimation of cost supply curves

- Estimation of forest biomass availability,  $\text{m}^3/\text{km}^2/\text{year}$ 
  - residue volumes/land area
  - cumulative residue volumes around the plant as function of road transport distance
- Estimation of volumes at plant at given price, delivered at plant

# Availability of chips at given price at plant

Cost of chips at plant

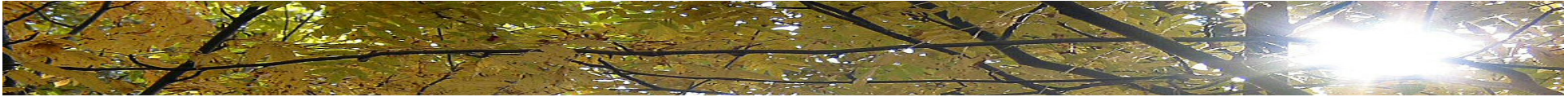




## **Bottlenecks of supply**

- **Information on harvestable stands and biomass components**
  - **Current fellings (logging residues + stumps)**
    - Information on stands is a by product of roundwood harvest
    - Reliable estimation of biomass volume still lacking
- **Balance (annual change rate, standing trees)**
  - Not very good tools exist to FIND SUITABLE STANDS
  - Satellite based survey with land owner databases
  - Forest management plans
    - PINPOINT suitable stands in planning phase
    - Include ENERGY BIOMASS ESTIMATE in stand information





## **Bottlenecks of supply**

- **Lack of suitable and competitive harvesting technology**
  - **Growing but still small business**
    - Big investments in machinery call for long term supply contracts
    - Using of normal forest machines as base machine reduces investments and risks
  - **Plethora of supply chains**
    - Confusion about appropriate harvesting systems
    - One system works in whole Europe in terrains below 40% slope

# All purpose supply chain for forest chips in the EU

- Felling bunching of trees with a harvester
- Forwarding with a forwarder
- Chipping at roadside
- Road transport of chips by a truck with a trailer



# Investment needs in supply chains, capacities of machines (EU27)

- feller-buncher: 10 000 m<sup>3</sup>/a
- excavator: 17 000 m<sup>3</sup>/a
- forwarder: 30 000 m<sup>3</sup>/a
- chipper: 30 000 m<sup>3</sup>/a
- chip truck in Sweden and Finland: 25 000 m<sup>3</sup>/a
- chip truck in other countries: 15 000 m<sup>3</sup>/a

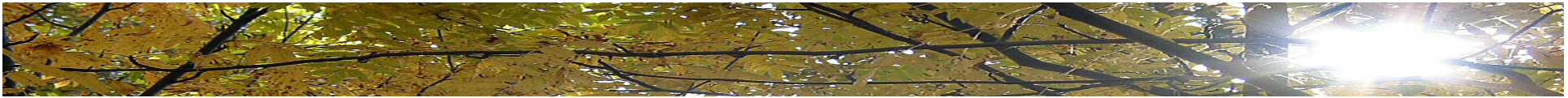


## Investment needs in supply chains, number of machines, 5 years life time

- feller-buncher: 2032
- excavator: 247
- forwarder: 1327
- chipper: 1327
- chip truck in Sweden and Finland: 439
- chip truck in other countries: 1923

## Investment needs in supply chains, volume of machine market

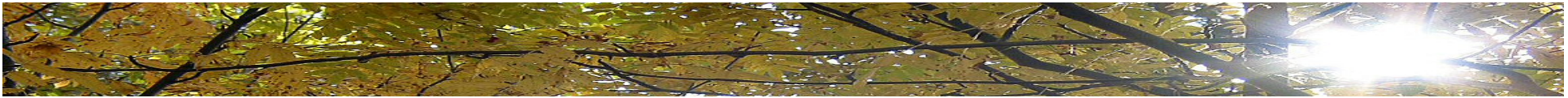
- total market: ~2 000 mill. €/a (whole EU's forest energy potential mobilized)
- market now: ~200 mill. €/a



## Discussion

- **Fire wood utilisations vs. firewood statistics**
  - e.g. France: official 2.8 mill. m<sup>3</sup>, estimated over 10 mill. m<sup>3</sup>
  - Italy: official 5.4 mill. m<sup>3</sup>, estimated over 10 mill. m<sup>3</sup>
- **Part of wood plantations are outside forest statistics (poplar plantations in Italy)**
- **Biomass models: Best available models should be used for each country**





## **If I could decide...**

- **Each country makes own estimates**
- **Principles of calculation are harmonized**
  - **Growth and removals basic data**
  - **Biomass models**
  - **Cost estimation for harvesting and transport**
- **Harvestable volumes should be effected by**
  - **recovery rates by tree species**
  - **silvicultura and harvesting practises**
  - **natural conditions**
- **Only forests available for wood supply**



A yellow robotic arm, identified as Metla, is shown in a forest setting. The arm is positioned to harvest a tree branch. The background consists of many tall, thin trees, likely pines or spruces, with some green foliage visible. The text "Metla : Future of forest energy through research" is overlaid on the image in a white, bold, italicized font.

***Metla : Future of forest energy  
through research***

**METLA**