

FEASIBILITY STUDY ON UTILIZATION OF WOOD RESIDUES IN SERBIA

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Financed by:



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Objectives of the Study:

Actual state:

- review of forests in Serbia
- assessment of wood resource
- utilisation of wood and wood residues
- energy potential of wood residues

Possibility of wood pellets production in Serbia:

- competitiveness to other fuels
- availability of resource
- prospective regions for pellet production
- main stakeholders of pellet production
- economic evaluation of pellet production

Energy potential of RES and consumption of fossil fuels in Serbia

	million toe *
Forest biomass residues	1,0
Agricultural biomass residues	1,7
Small Hydroenergy	0,4
Geothermal	0,18
Coal Consumption in Industry & Residential sector	0,97
Liquid fuel consumption in Industry	0,45
Total energy consumption in Serbia	14,5

(*) 1 toe (ton of oil equivalent) = 41 860 MJ

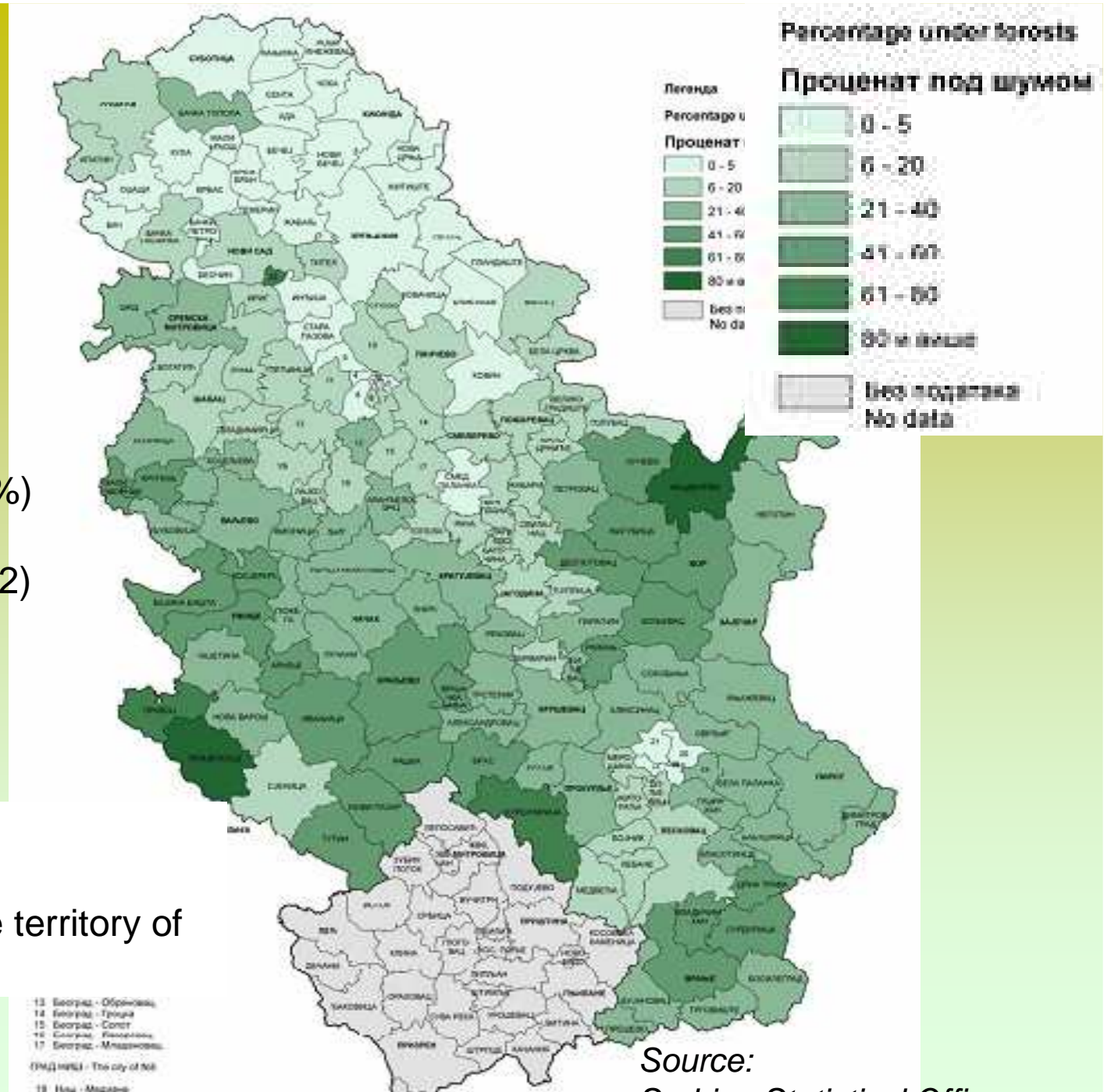
Resource of biomass

North - agricultural area,

Central and South - mountain region rich in forests.

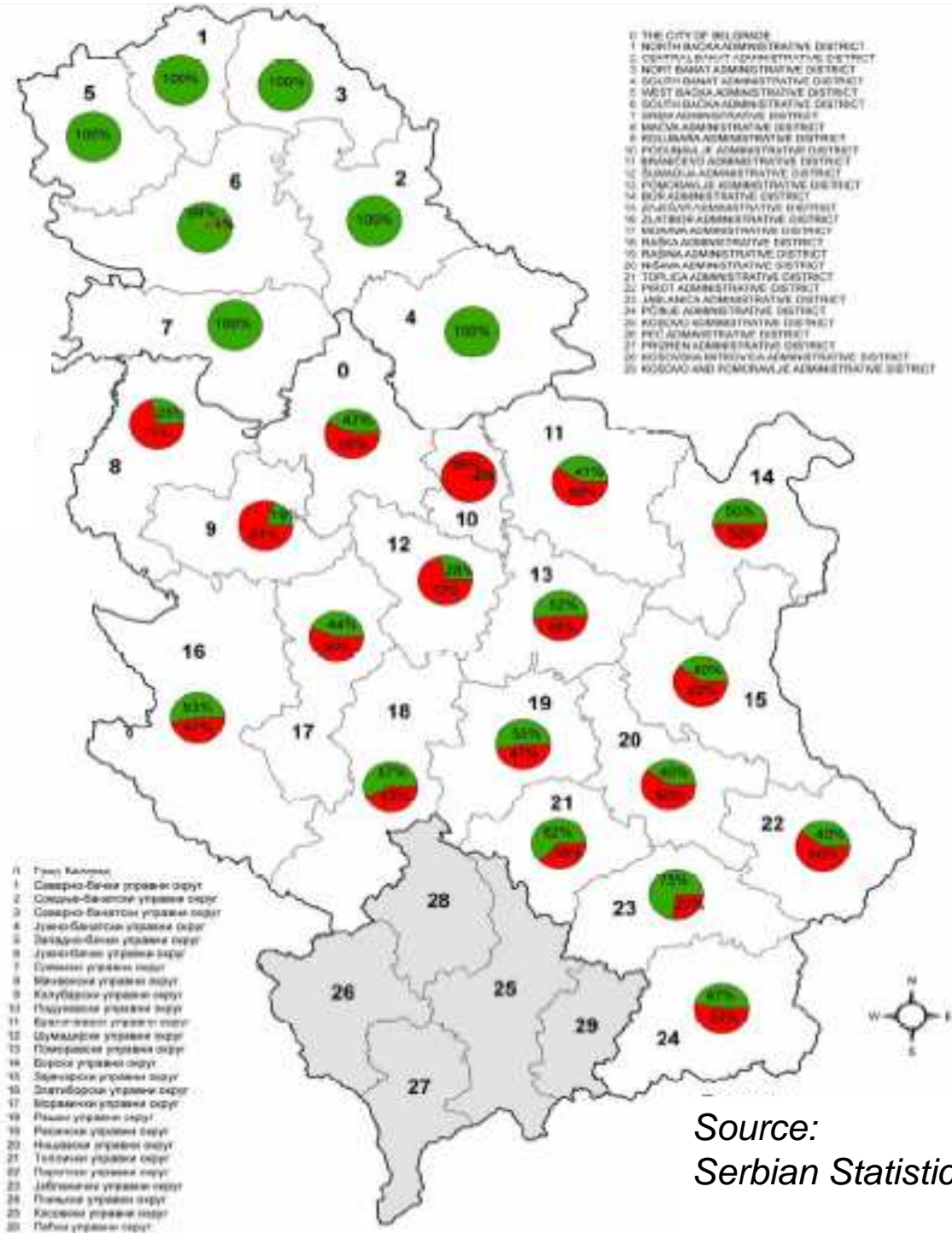
Forests 1.98 million ha (25.6%) forest – area > 0.05 ha (500 m2)

146 total no. of municipalities in 28 municipalities forests cover more 40% of the territory of the municipality



Structure of forest ownership

- State forests
- Private forest
- No data



Source:
Serbian Statistical Office

Wood Residues in Forestry

Average share of different categories of wood in the total volume of tree

technical round wood	16 %	Commercial product
stacked wood	42 %	Commercial product
bark of round wood	4 %	remain in forests
forest residues with bark	9 %	partly used
thin branches with bark*	11 %	partly used
stumps with large roots	18 %	remain in forests
total	100 %	

- Utilization of forests and forest residues in plain region \approx 100% in mountain region less
- Total wood cutting: 2,6 million m³
- Theoretically remain about 1.2 million m³ of wood residues,
- Practically (without stumps) about 600 000 m³ wood residues in forests

Residues for pellet production

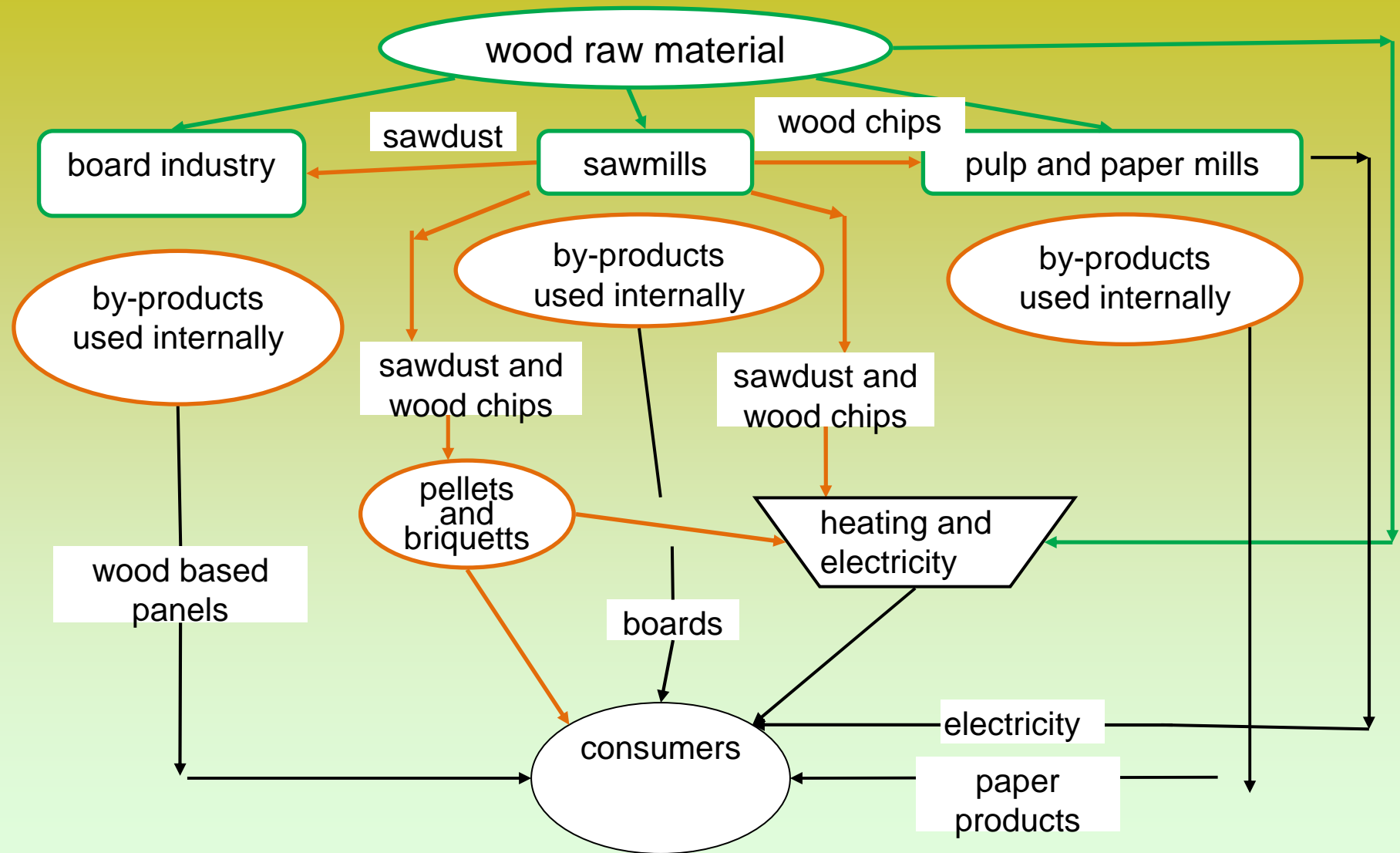
600 000 m³ - forest residues (without stumps)

+ min 60 000 m³ - **unused** wastes in small sawmills

max 350 000 m³ - wood wastes **in all sawmills**

- trade of fuelwood 1.41 million m³

Wood Waste in Wood Processing Industry



- in what extent wood waste will be used for different purposes depends on the market

Energy consumption / prospective consumer

Final energy consumption (toe) of fossil fuels for local heat production only

	industry	residential + agriculture
coal	175 000	444 000
liquid fuel	451 000	125 000
natural gas	436 000	370 000
fuel wood	350 000	
wood pellets (<i>possible production</i>)	210 000 (production 500 000 t/year)	

Final energy consumption – consumption of fuel.

1 toe – ton of equivalent oil = 41,86 GJ/t

18 GJ /t - Heating value of wood pellets

Attitude of main stakeholders towards the production and utilization of wood waste for energy purposes

Resource

- Public (State) Companies Srbijašume and Vojvodinašume
- Private forest owners
- Wood processing companies – to produce more valuable products
 - internally used wastes
 - available wastes

Producers of pellets

- existing wood processing companies
- new investors

Consumers – to have cheap and reliable heating

- Householders
- Public centralized heating systems (schools, hospitals, municipality buildings)
- Private centralized heating systems

Boiler manufacturers

State of wood waste technology applied in Serbia

Technologies for production of solid biofuels:

- NO wood chips – intentionally produced to be fuel
- YES - briquettes and pellets production

Technologies for utilization of solid biofuels (woodchips, pellets, briquettes)

- OLD equipment in operation (boilers, furnaces)
- not modern equipment of domestic manufacturers (standards, rules on eff.)
- few manufacturers of medium boilers for wood residues
- 1 manufacturer of small boilers for pellets with automatic feeding
- no: electricity generation
- yes: co-combustion biomass with fossil fuels

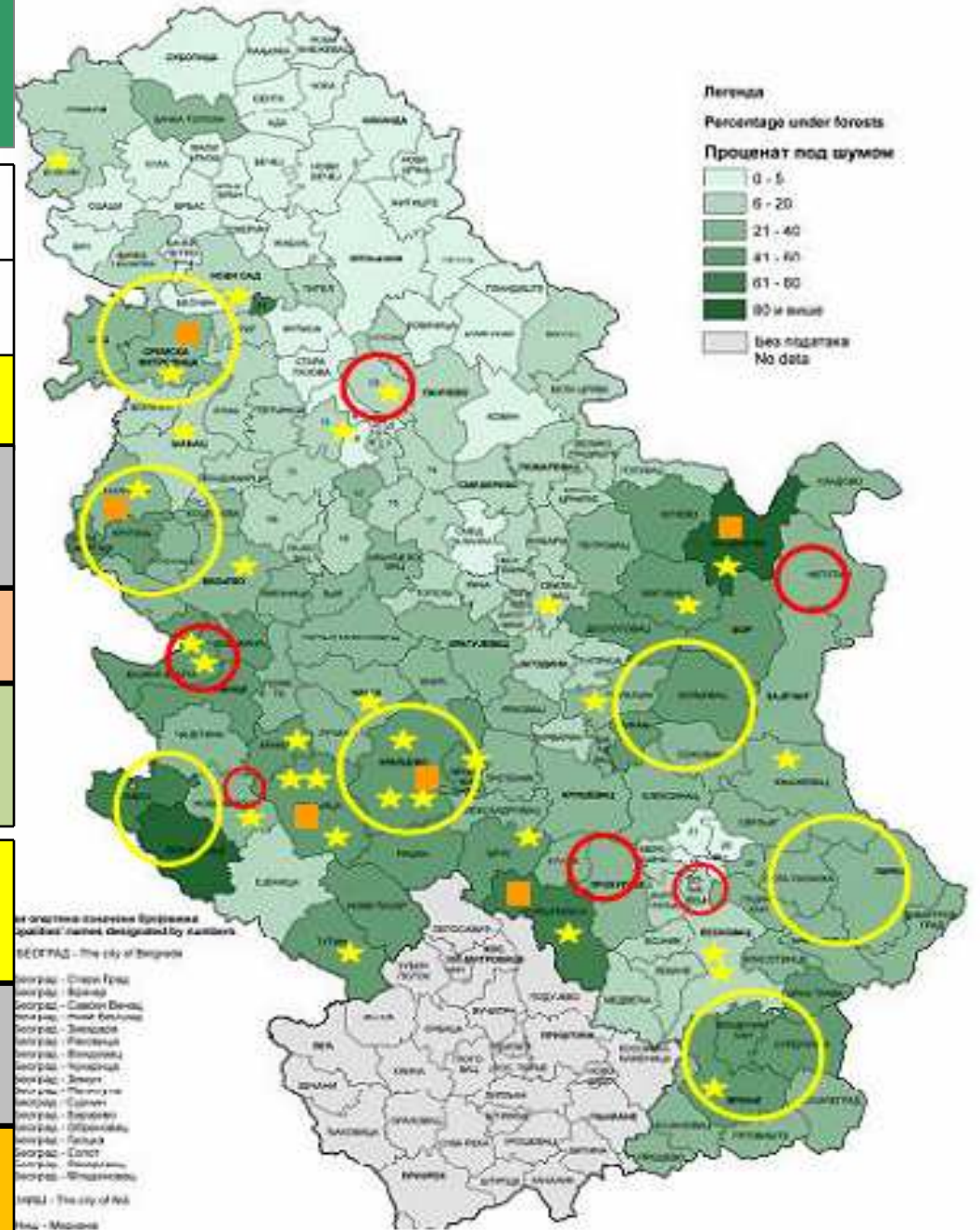
O - Big Pellet plants in 2009

○ - prospective locations for new plants

★ - sawmills (100 out of 1500)

■ - big wood processing companies

Municipality	Forest area (ha)	Possible production of pellets (t/year) based	
		on forest wastes	+ from sawmills
Sr. Mitrovica	40 000	6000	10 000
Šid			
Mali Zvornik	75 000	11 000	18 000
Krupanj			
Loznica			
Prijepolje	105 000	16 000	26 500
Priboj			
Kraljevo	140 000	19 000	24 000
Novi Pazar			
Raška			
Boljevac	146 000	22 000	37 000
Bor			
Despotovac			
Vranje	79 000	12 000	19 500
Vladičin Han			
Surdulica			
Pirot	76 000	13 500	19 000
Babušnica			
Bela Palanka			



Economic analysis of wood pellets production

Parameters:

Production: 20 000 tons /year

Investment cost: 1 million €
(land, buildings, equipment)

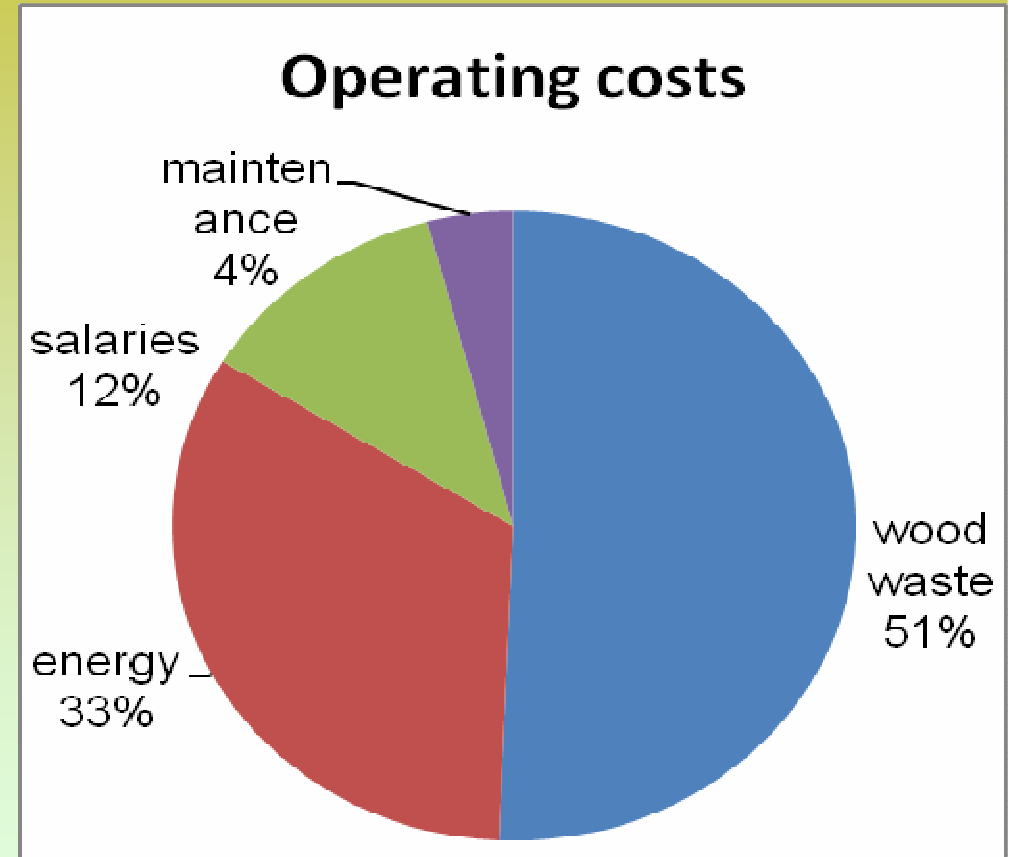
Price of wood waste: 27 €/t (including transport)

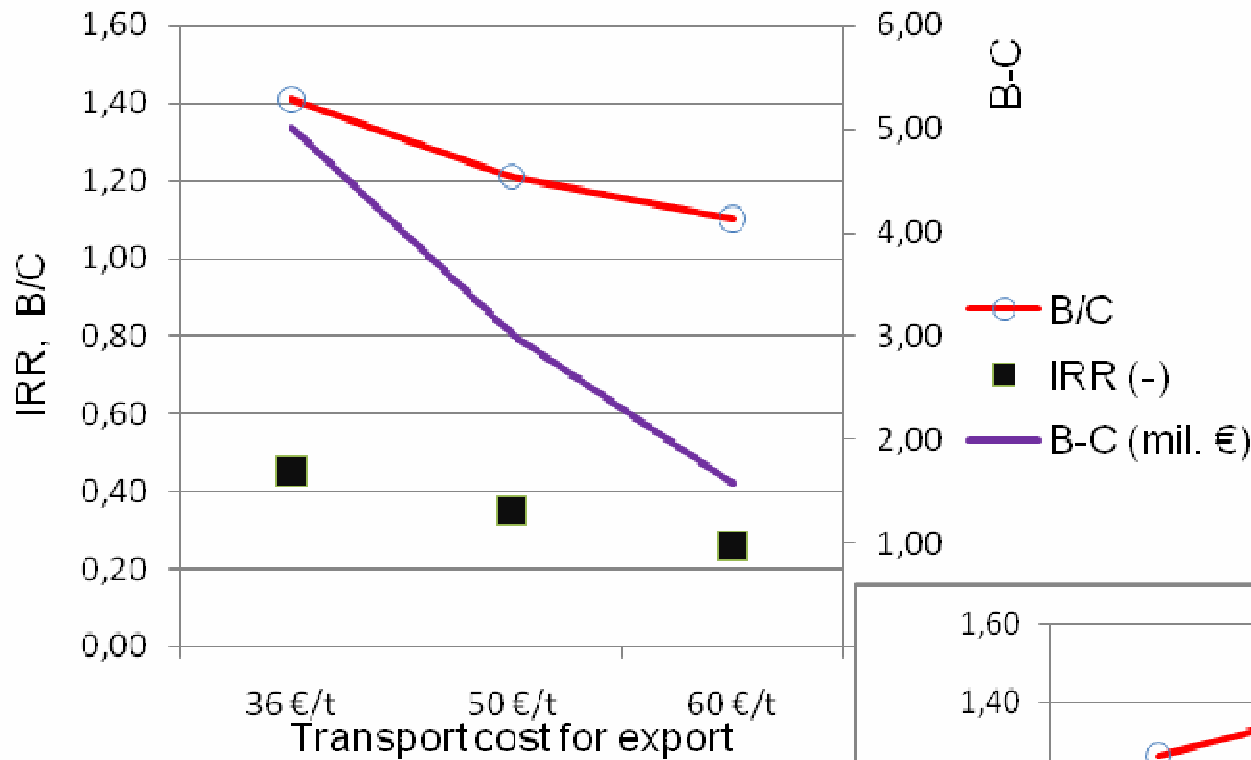
Minimum pellet price (B-C=0,
benefit - costs discounted)

for Serbia: 51 – 66 €/t (VAT excl.)

for EU: 81 – 96 €/t (VAT excl.)

Price of pellets for $B/C > 1,1$
for selling in Serbia: 80 €/t
for export in EU: 120 €/t
(without VAT, transport included)





financial parameters:

not relevant:

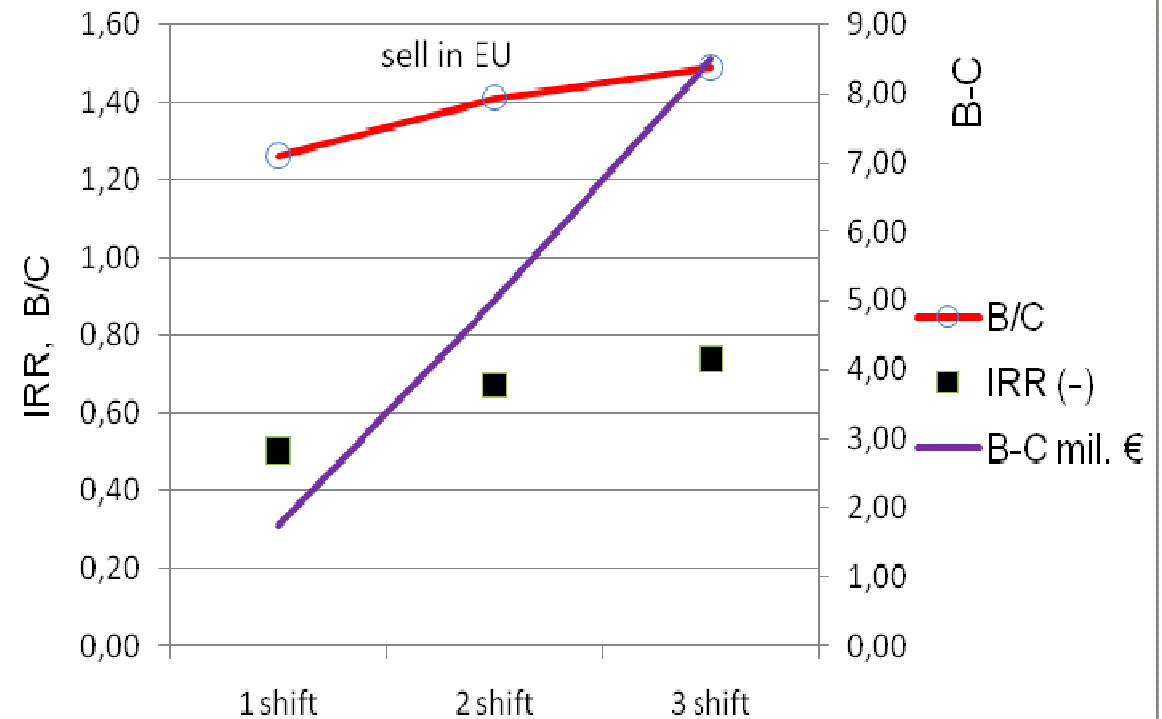
- Simple Pay Back Period,
- IRR

relevant: B-C, B/C

(benefit / costs, discounted)

Influential operating costs:

- costs of raw material
- transport costs (raw material, pellets)
- costs of electricity (shifts)



Number of working shifts

Prices of different fuels in Serbia and cost of heat

	Retail price*	Heating value	Cost of heat **
Brown coal	10 000 din/t	18,2 GJ/t	30,5 (€/MWh)
Lignite dry	8 500 din/t	17,2 GJ/t	28,5 (€/MWh)
Lignite raw	4 600 din/t	9,2 GJ/t	30,0 (€/MWh)
Light fuel oil	76 500 din/m ³	37,9 GJ/m ³	105,6 (€/MWh)
Heavy fuel oil	38 500 din/t	39,7 GJ/t	51,2 (€/MWh)
Natural gas	34 din/m³	0,0333 GJ/m ³	53,8 (€/MWh)
LPG	84 000 din/t	46 GJ/t	89,3 (€/MWh)
Fuel wood in Bgd.	4 000 din/m ³	14 GJ/t	31,2 (€/MWh)
Fuel wood in Pirot	2 000 din/m ³	14 GJ/t	15,6 (€/MWh)
Wood pellet	6 912 din/t	18 GJ/t	22,2 (€/MWh)
Electricity	3,265 din/kWh	0,0036 GJ/kWh	54,9 (€/MWh)

* 1€ = 80 din

** Conversion (combustion) efficiency is included

Prices of electricity and natural gas are not retail prices, since there is a special tariff system for these kinds of energy. VAT is afterwards included for obtaining *cost of heat*. VAT for all energy carriers is 18%, except for natural gas and wood 8%.

Thank you for your attention

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