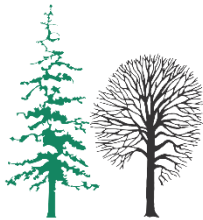


# Case study – Maribor, Slovenia



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# Case study – a story behind

- Maribor – the second large city in Slovenia
- Problem of air quality
- Existing heating network
- Meeting at ministry for environment – how to get better environment
- Pilot project – Maribor – HEATED WITH WOOD



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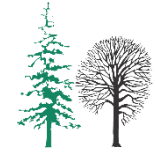


- Specify the availability of wood biomass potential and amount of wood biomass available depending on required quality (moisture, type of wood – deciduous/coniferous, ...);
- Figure out whether there is enough available feedstock in the nearby forests – distance to feedstock with various forms of ownership (state or private forests);
- Prepare recommendations for the storage of wood biomass as roundwood (brief description of storage);
- Analyze the production cost of wood chips;

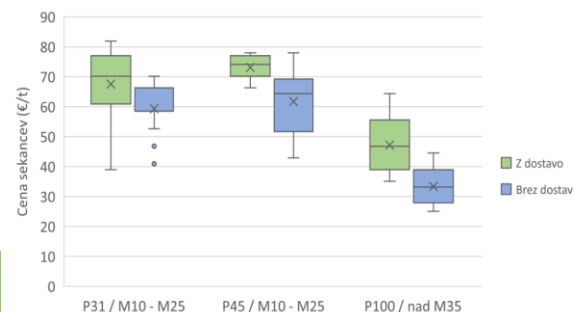
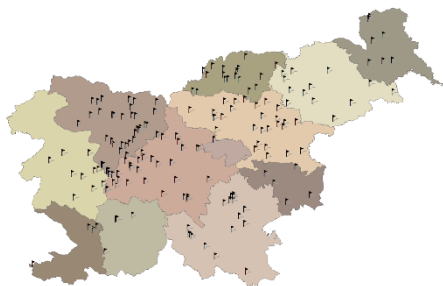


# Steps in case studys

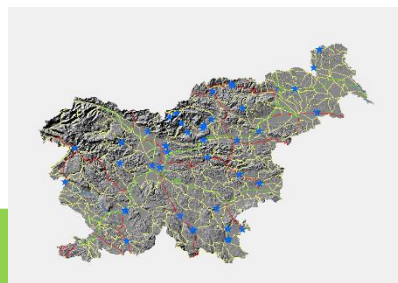
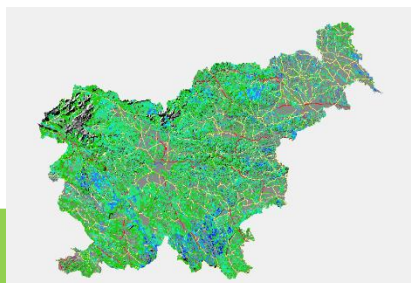
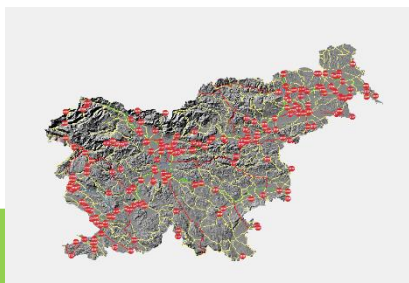
1. Discussions with investors
2. Decision: 5MW district heating system
3. Identification of needs
4. Analysis of wood biomass potentials
5. Logistic model
6. Cost analysis
7. Presentation of study to decision makers in Maribor and at ministry of environment



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- The methodology for calculating quantity and potential estimates of wood is based on the market quantities of round wood, which excluded estimated home use.
- Actual market quantities are actual average annual wood quantities which were harvested in years 2009-2013 and put on the market.
- Theoretical market potential is maximum quantity of wood which could be harvested and offered on market (including home use) and meanwhile also ensuring sustainable forest management.

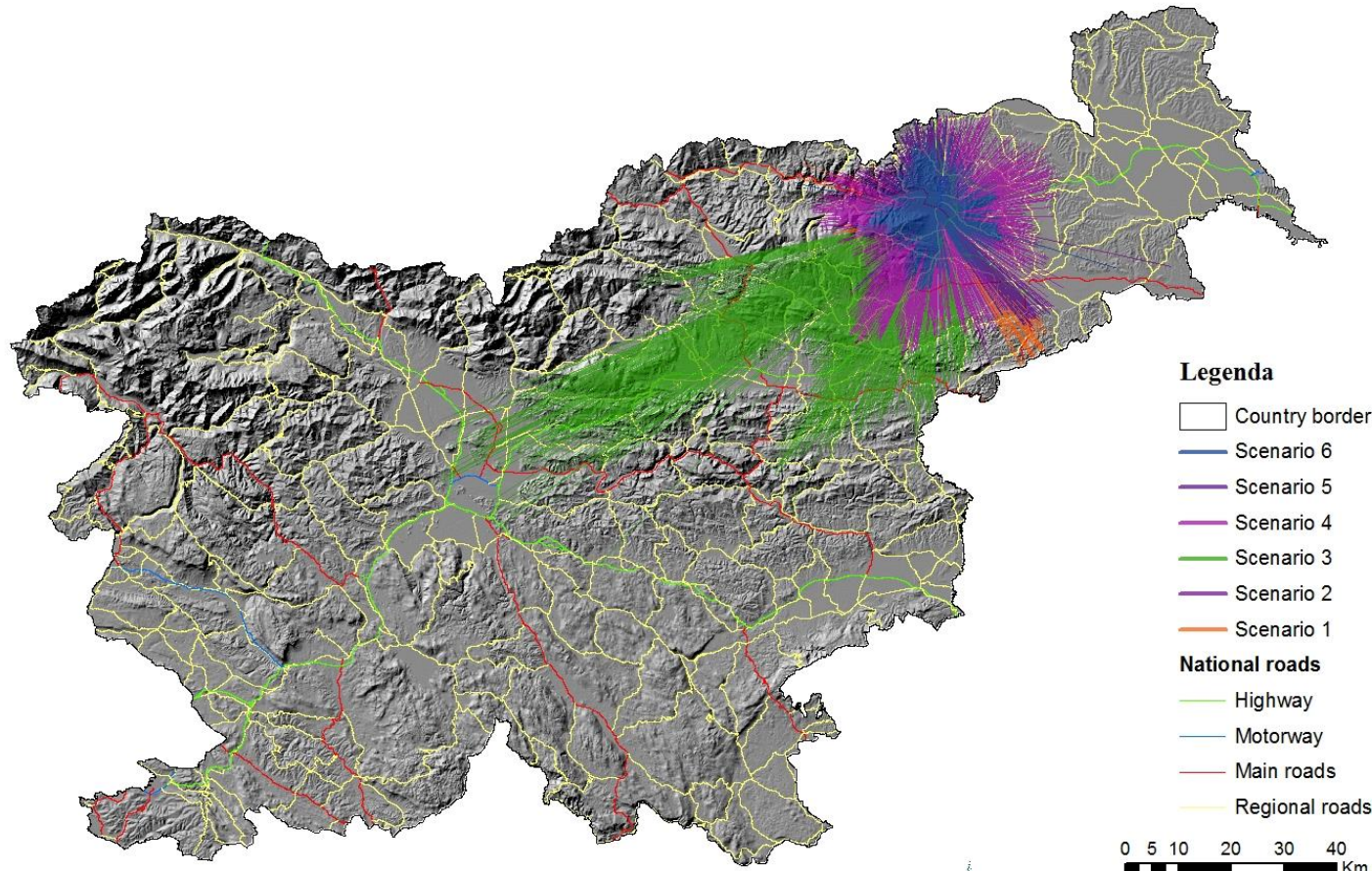


	Scenario
1	State forest (SF) taking competing use into account
2	State forest (SF) without taking competing use into account
3	Private forest (PF) taking competing use into account
4	Private forest (PF) without taking competing use into account
5	Total SF + PF taking competing use into account
6	Total SF + PF without taking competing use into account



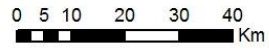
# Location-Allocation analysis

1 - ~~Boštjan Štepec (S2Biom) / Institut za gozdarstvo in obnovljive vire naravnih virov~~



### Legenda

- Country border
- Scenario 6
- Scenario 5
- Scenario 4
- Scenario 3
- Scenario 2
- Scenario 1
- National roads**
- Highway
- Motorway
- Main roads
- Regional roads



Author: Matevž Triplat, GIS

Cartographic layers:  
- Omrežje državnih cest (DRSC), DMV (GURS);



# Estimation of transportation costs

Basic assumptions used to simulate the transport costs.

Equation 1: Calculation of transport costs for each freight

$$C_{i=n} = (t_p * 2 + (t_n + t_r)) * \frac{c_t}{P}$$

Where:

$C_{i=n}$  = transportation cost [€]

$t_p$  = travel times [min]

$t_n$  = time for the loading of truck [min]

$t_r$  = time for the unloading of truck [min]

$c_t$  = truck costs [€/ h]

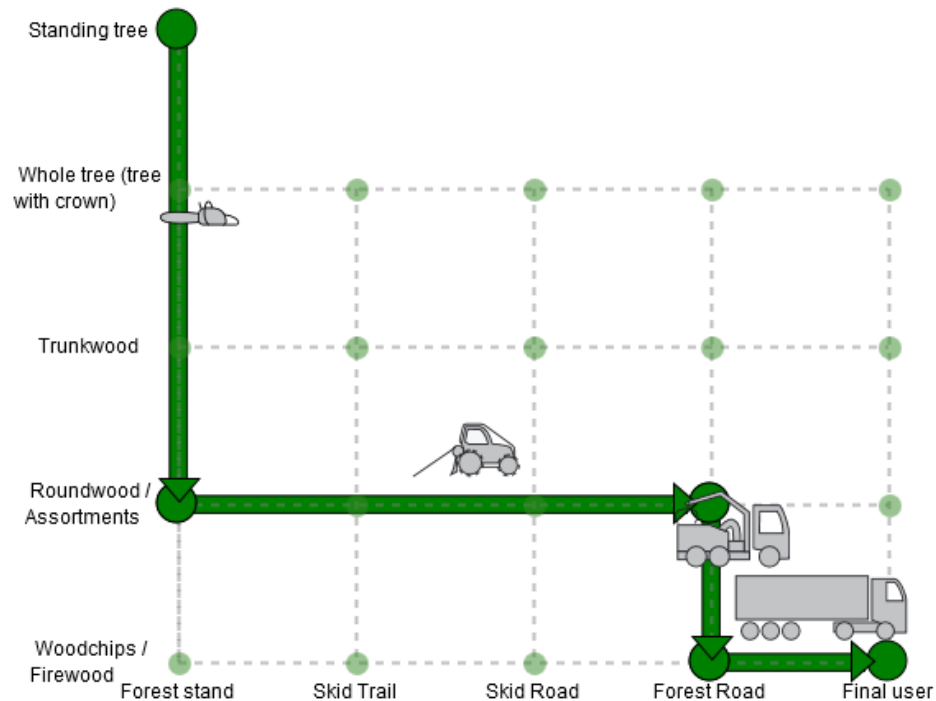
P = maximum allowable load

<b>Time for timber loading</b>	30	min
<b>Time needed for timber unloading</b>	15	min
<b>Material truck costs</b>	84.96	€/ h
<b>Work costs (driver)</b>	7.83	€/ h



- **Most common production chain**

Visualization of supply chain



## Costs of selected processes

WoodChainManager <http://wcm.gozdis.si>

Print

### Simple cost table

Machine	Fixed costs in € / year	Fixed costs in € / hour	Variable cost of fuels and lubricants	Variable costs of maintenance in € / hour	Total cost of supply chain [€ / h]	Productivity
Chainsaw (6 kW)	203.50€	1.85€	1.81€	1.65€	5.31€	2.95€/m3
4WD agricultural tractor (65-74 kW)	4830.33€	9.66€	11.01€	2.70€	23.37€	10.63€/m3
Cabine protection (complete)	2293.33€	4.59€	0€	1.28€	5.87€	
Two drum winch (8 t)	974.67€	3.48€	0€	2.72€	6.20€	
Radio remote control	172.00€	1.27€	0€	0.48€	1.75€	
Chipper mounted on truck with crane (max. Wood diameter 80 cm)	83200.00€	104.00€	47.19€	260.00€	411.19€	27.41€/m3
Truck for carrying bul load (300 kW)	19200.00€	19.20€	47.19€	9.60€	75.99€	8.73€/m3

Fuel prices, which were used for calculation: Diesel: 1.1300 €, Petrol: 1.2380 €

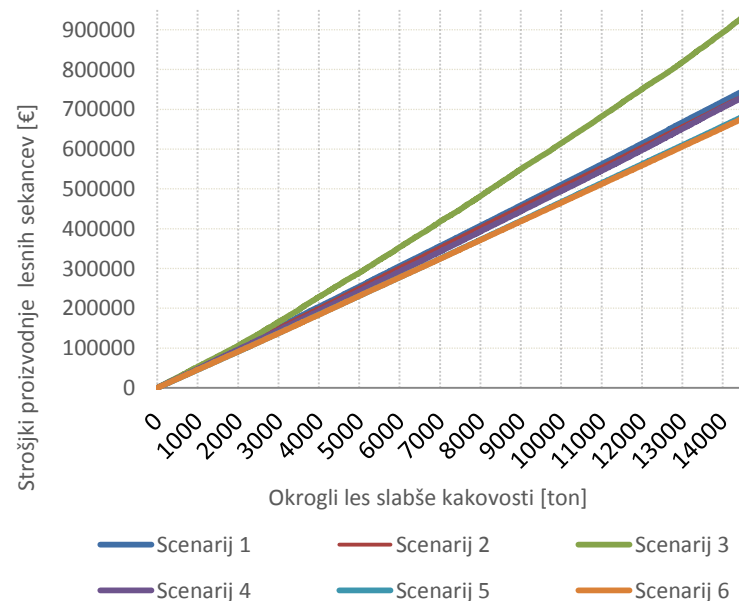
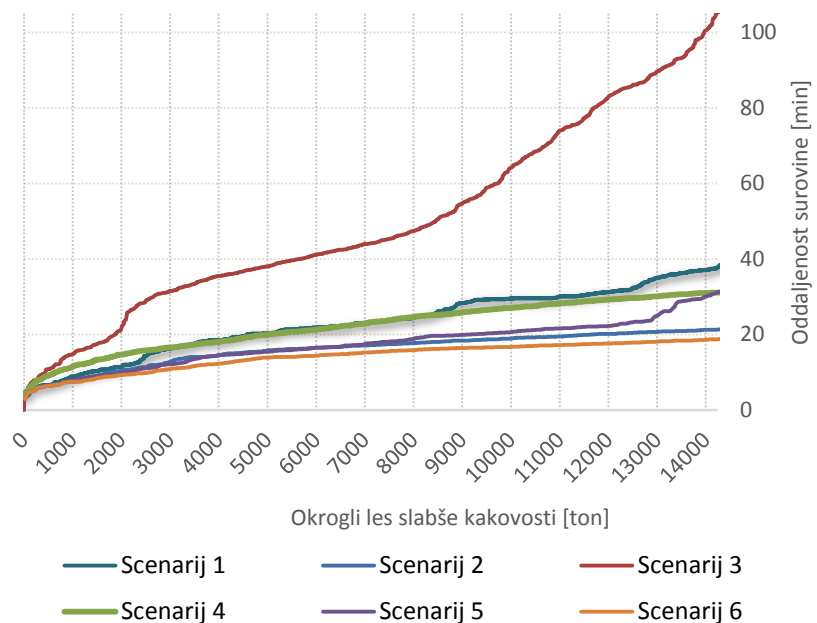
### Detailed cost table

Total production cost: 49.72€/m3

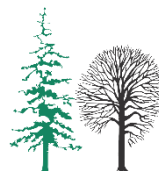
Total cost of supply chain [€ / h]: 529.68 €



# Feedstock vs. distance // Feedstock vs. costs



# Thank you for your attention !!



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