Drying of wood chips with surplus heat from two hydroelectric plants in Norway

Eirik Nordhagen
The Norwegian Forest and Landscape Institute
P.O.Box 115, N-1431 Ås, Norway
Phone: +47 64 94 89 07
Mobile: 452 83 839
E-Mail: eirik.nordhagen@skogoglandskap.no

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Introduction

- Normally it is reasonable to dry energy wood at the storage site using natural forces such as solar and wind energy.

- The removal of water in a drying process is energy intensive and the weather or climate can limit the drying of energy wood outdoors.

- The objective of study was to find out if excess heat from hydropower plants can be used for drying of wood chips and in seasons not very favorable for drying in atmospheric air.

- In addition it was also interesting to calculate the energy used and gained by drying the chip as well as the costs.

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Istad power station 2.2 MW

Vallestadfossen power station 1 MW

Methods

- The wood was chipped and loaded into the dryer; both a tractor-trailer and a container were used.
- The trailer and the container was roughly 11.5 and 28 cubic meter respectively.
- The effective height at which drying took place was 1.2 meter and 1.9 meter.
- The dryers had perforated floors.
- Air from the plants was funneled into the dryer, using an electric centrifugal fan of 4 kW.
- The chip were weighed before, during and after drying.

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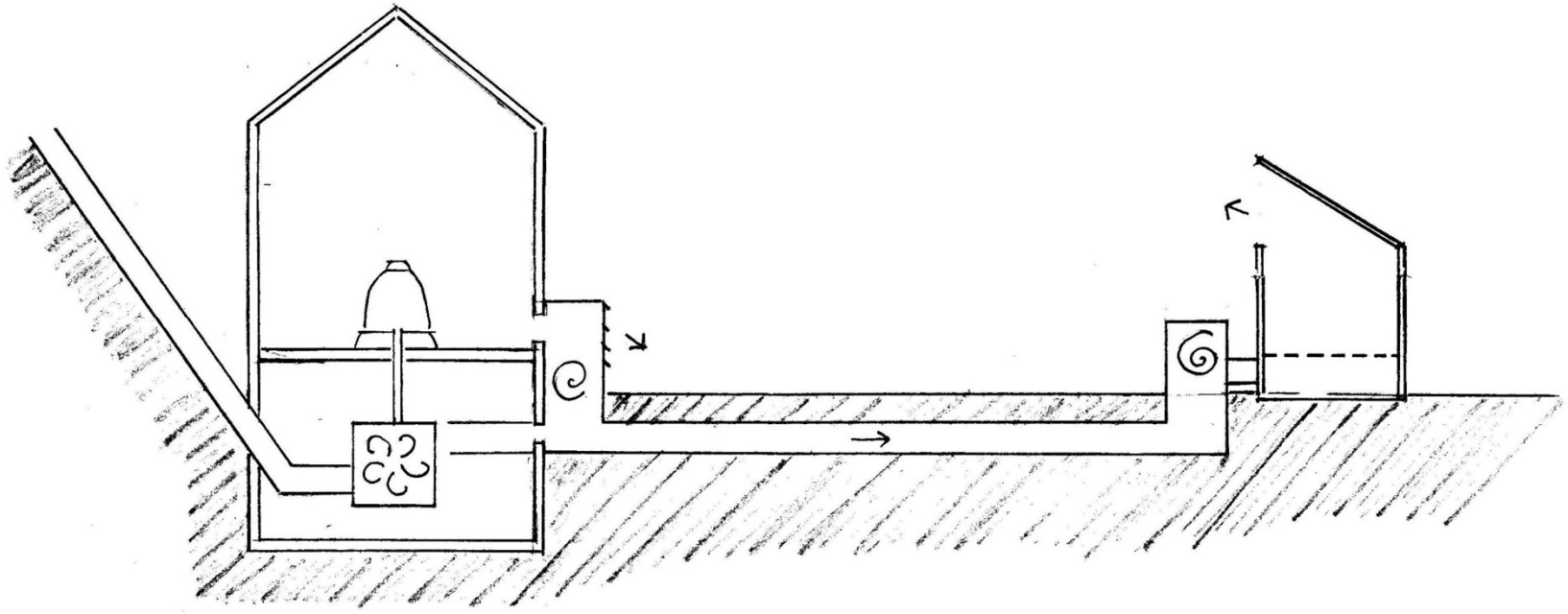

Transfer of heat from the power station to the drying container

The efficiency of the generator is up to 98-99% (Novakovic, 2000).

It means that in a hydropower plant 1-2% of the energy produced is heat.

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Drying container

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Drying container and Power station

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Drying trailer

Photo: Anders Møyner Eid Hohle, ***The Norwegian Forest and Landscape Institute***

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Trailer

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Trailer

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Mean values for air temperature and relative humidity

	Temperature		Relative humidity	
Site	Dryer (°C)	Ambient (°C)	Dryer (%)	Ambient (%)
Container	26.0	11.0	26.3	87.6
	24.4	1.8	23.7	90.7
Trailer	14.9	5.9	43.8	95.8
	18.5	8.4	29.9	64.3

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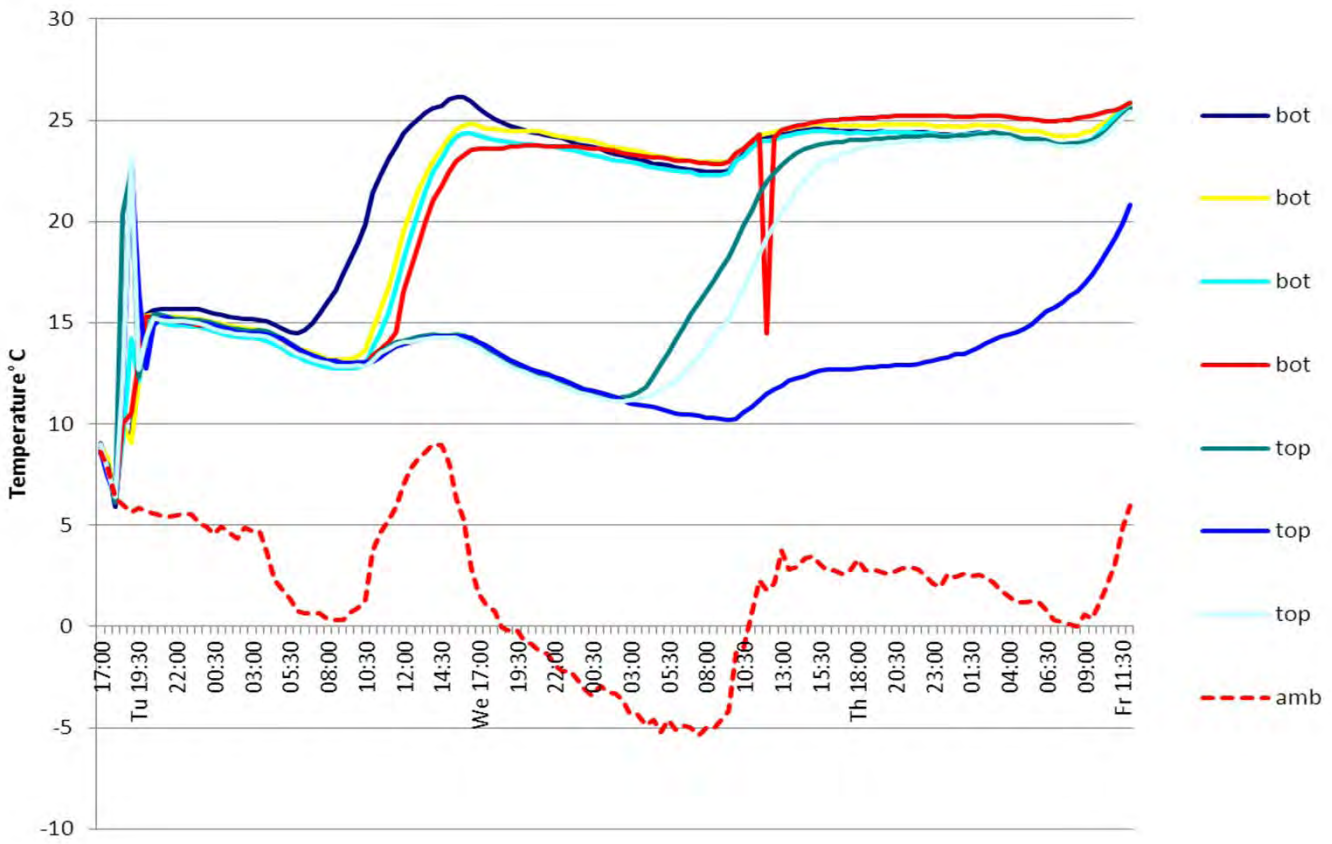
Temperature in the container



Energy is used to evaporate the water and the temperature drops. Later, the temperature rises, first at the bottom of the dryer.

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Chip weight and measured moisture content before and after drying.

	Before drying		After drying	
Site	Chip weight (kg)	Moisture content (%)	Chip weight (kg)	Moisture content (%)
Container	7485	52,7	4010	-
	7045	52,3	4935	6,9
Trailer	5300	66,1	2185	9,6
	5165	61,0	2165	8,7

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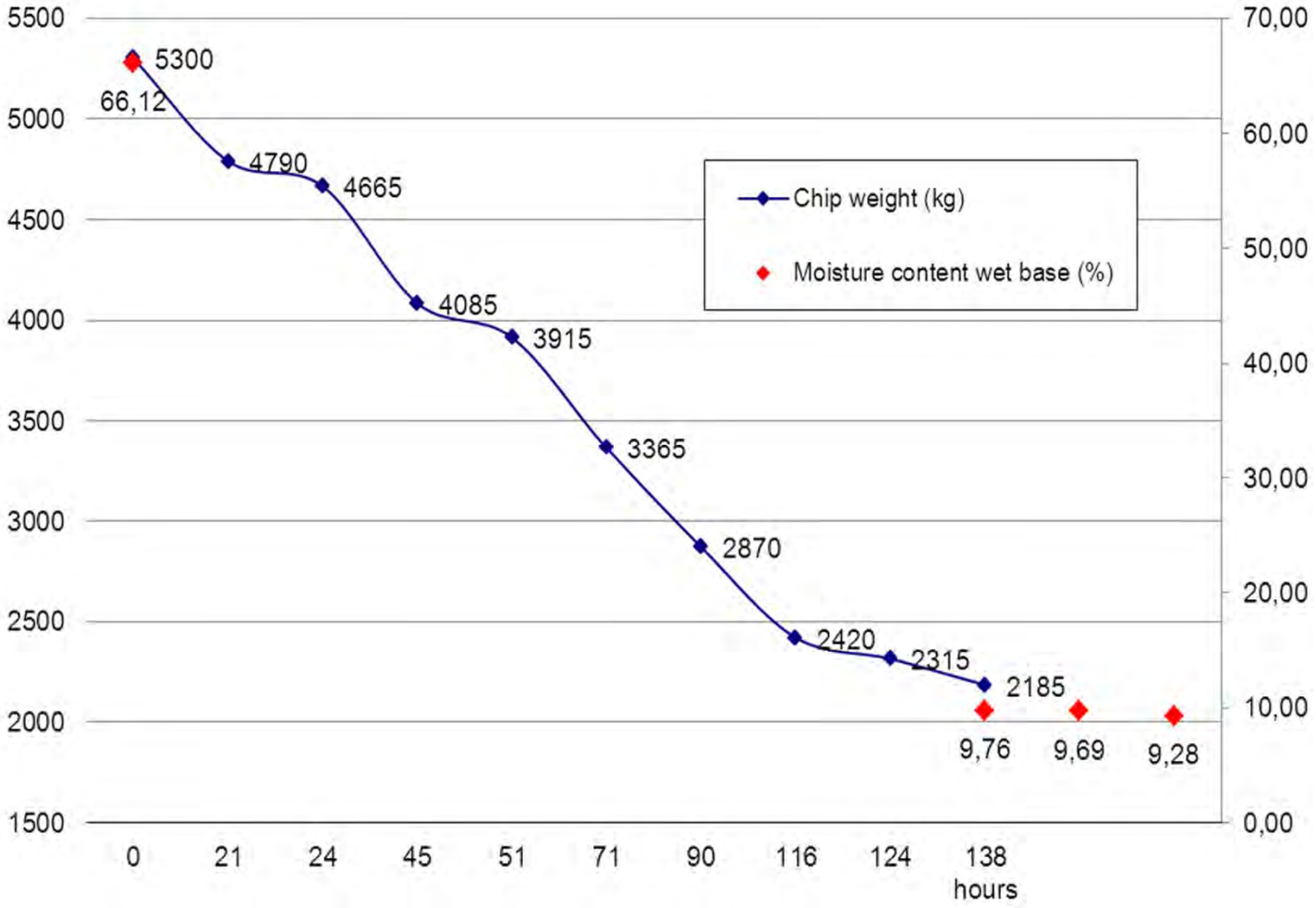
Drying curve tractor-trailer



The net calorific value increased from 7.7 to 10.2 MWh.

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Mean costs and calorific value of drying wood chip

Site	Energy costs (€)	Transport costs (€)	Calorific value (MWh)	Costs (€ per MWh)
Container	24.3	153	18.4	9.6
Trailer	27.8	153	10.2	17.7

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Conclusions

- Drying time approximately 6 days. Energy used by the fan ca. 0.5 MWh.
- The amount of water removed from the container was approximately 28 kg per hour and from the trailer 22 kg per hour.
- The water content was roughly 10% (wet base) after drying. The net calorific value of the chip increased significantly.
- For the container drying costs roughly 9 € per MWh (processing, transport and energy costs). The costs of the trailer was almost twice as much.
- These findings indicate that the drying volume should be as high as technical possible.
- Drying of wood chips is a quality upgrading and should be reflected in the marked for wood fuel chips.

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Thank you!

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