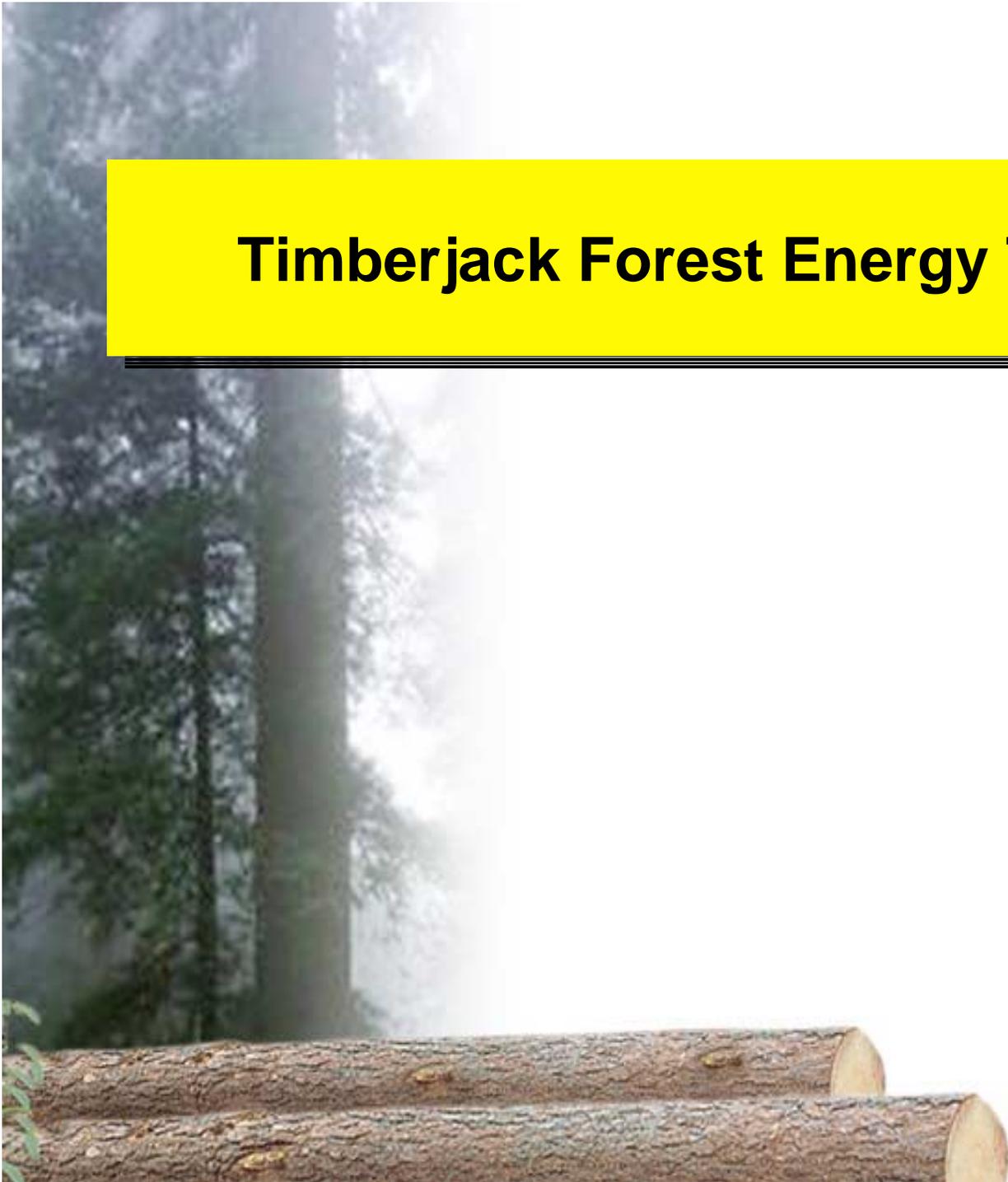


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International Agreements

KYOTO Agreement 1997:

Countries should reduce CO₂ emissions 8% by 2010 compared to the level of 1990

EU White Paper 1998:

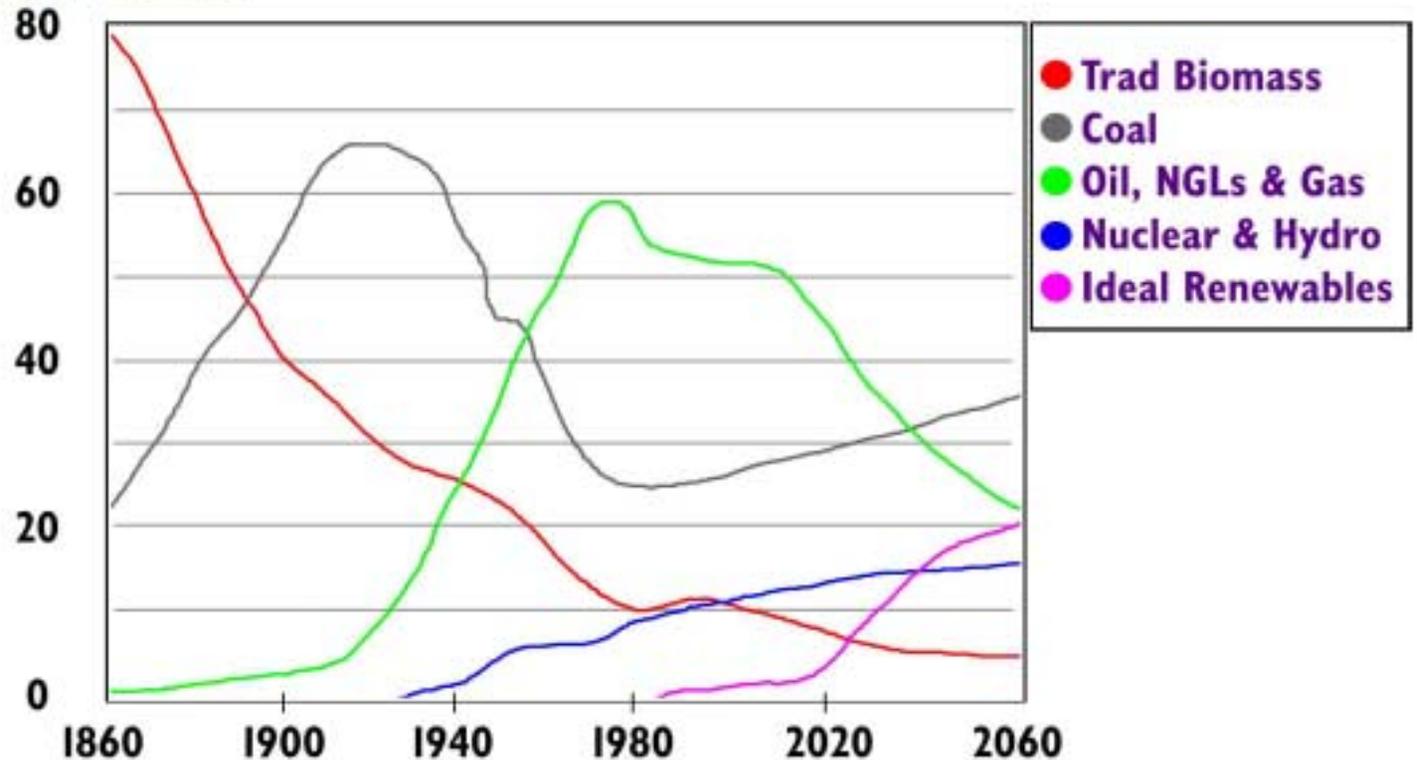
Double the share (6% to 12%) of renewable energy sources by 2010

USA Dept. of Energy June 2000:

Increase the share (3% to 10%) of renewable energy sources by 2010

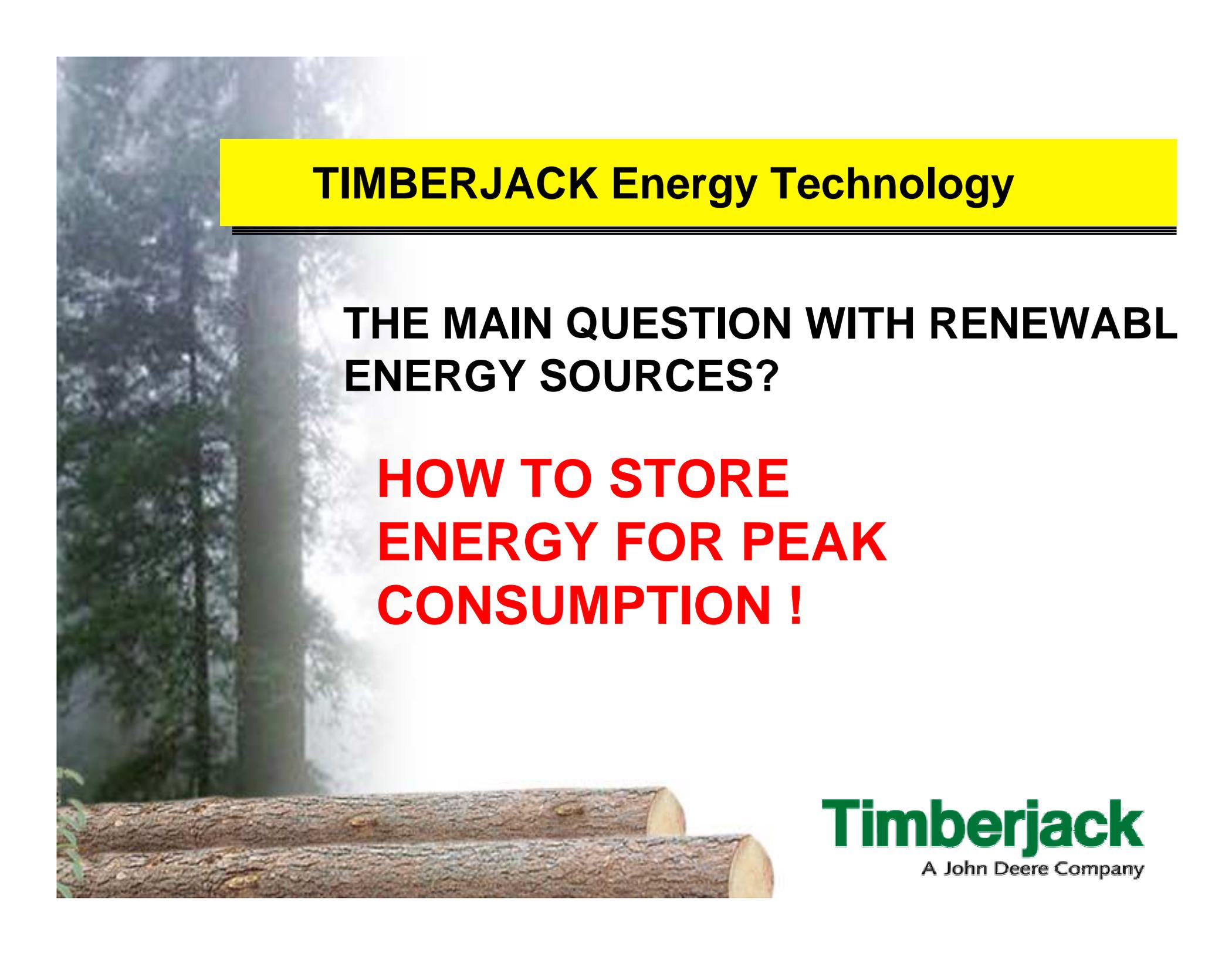
Shell: Consumption of Different Energy Sources

% of total
Energy Demand



www.shell.com

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**THE MAIN QUESTION WITH RENEWABLE
ENERGY SOURCES?**

**HOW TO STORE
ENERGY FOR PEAK
CONSUMPTION !**

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Issues with Bio mass transportation:



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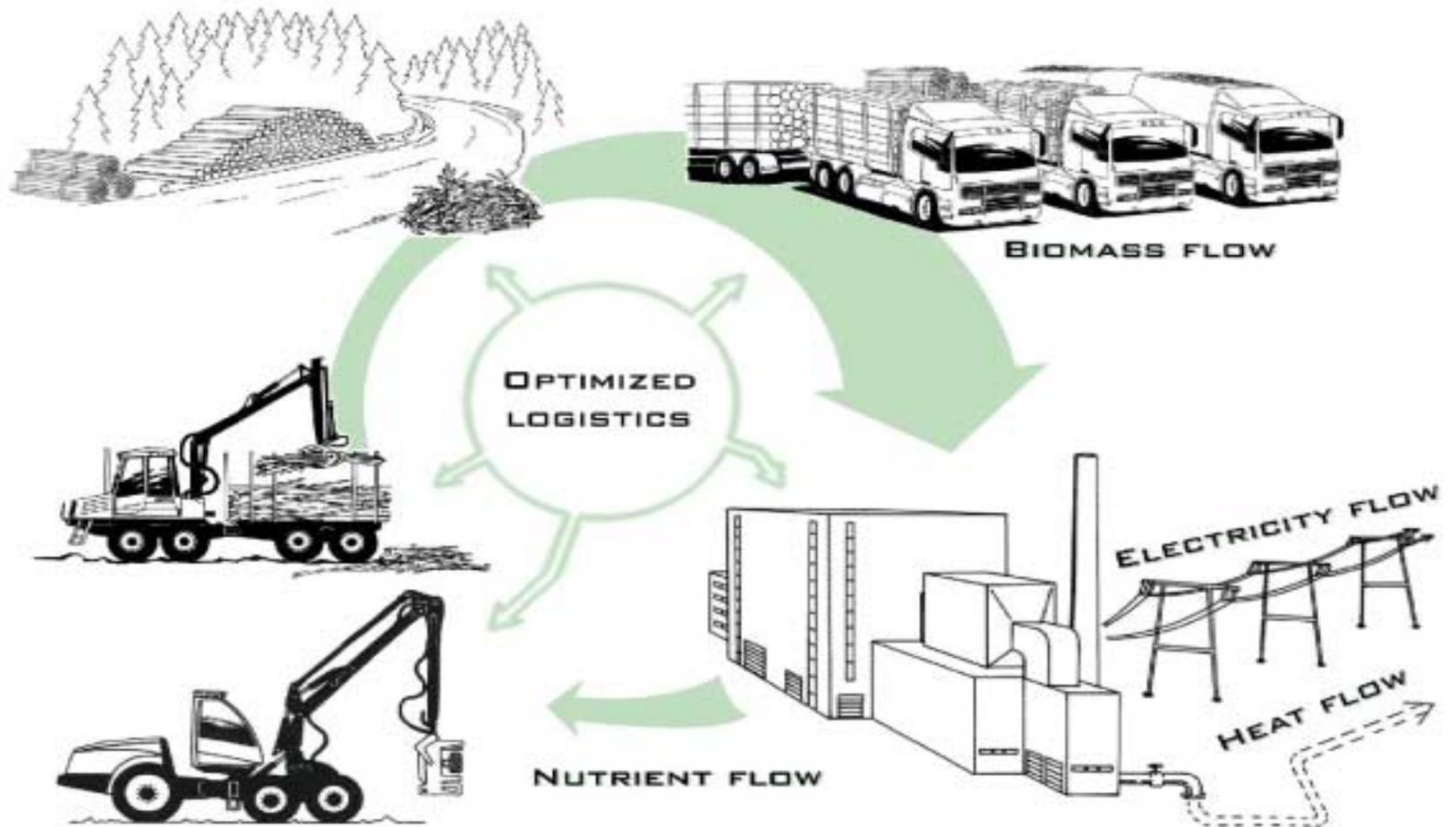


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Energy Wood chain based
on Timberjack wood
bundling technology

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Energy Logistic Systems



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Harvester Working for the Bundle Technology

- Limbs and tops (slash) in larger piles - faster input into bundling machine.
- Slash piling slows harvester operation
- Harvester contractor receives additional \$.15-\$.32 per cubic meter

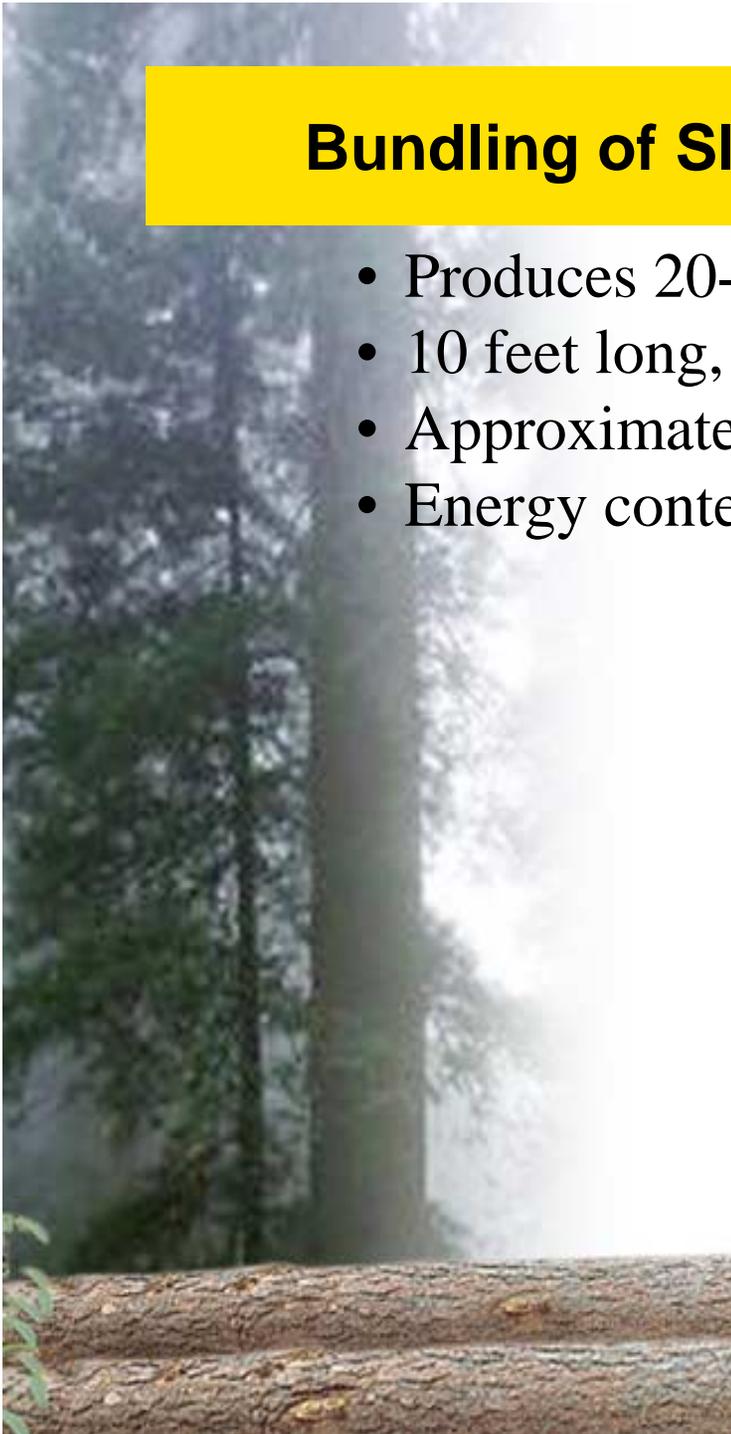


Harvester Preparation for Slash Bundler



Bundling of Slash – Timberjack Bundler

- Produces 20-30 bundles per hour
- 10 feet long, 23 - 32 inches in diameter, string wrapped
- Approximate bundle weight of 880-1500 lbs.
- Energy content equivalent to 21-26 US. gal. of oil)



Old Stems Bundling in France



Bundle Transportation (in forest)

- Transported by a standard forwarder.



Bundle Storage

- Stacked on roadside landings.
- Slow to deteriorate
- Low sensitivity to moisture



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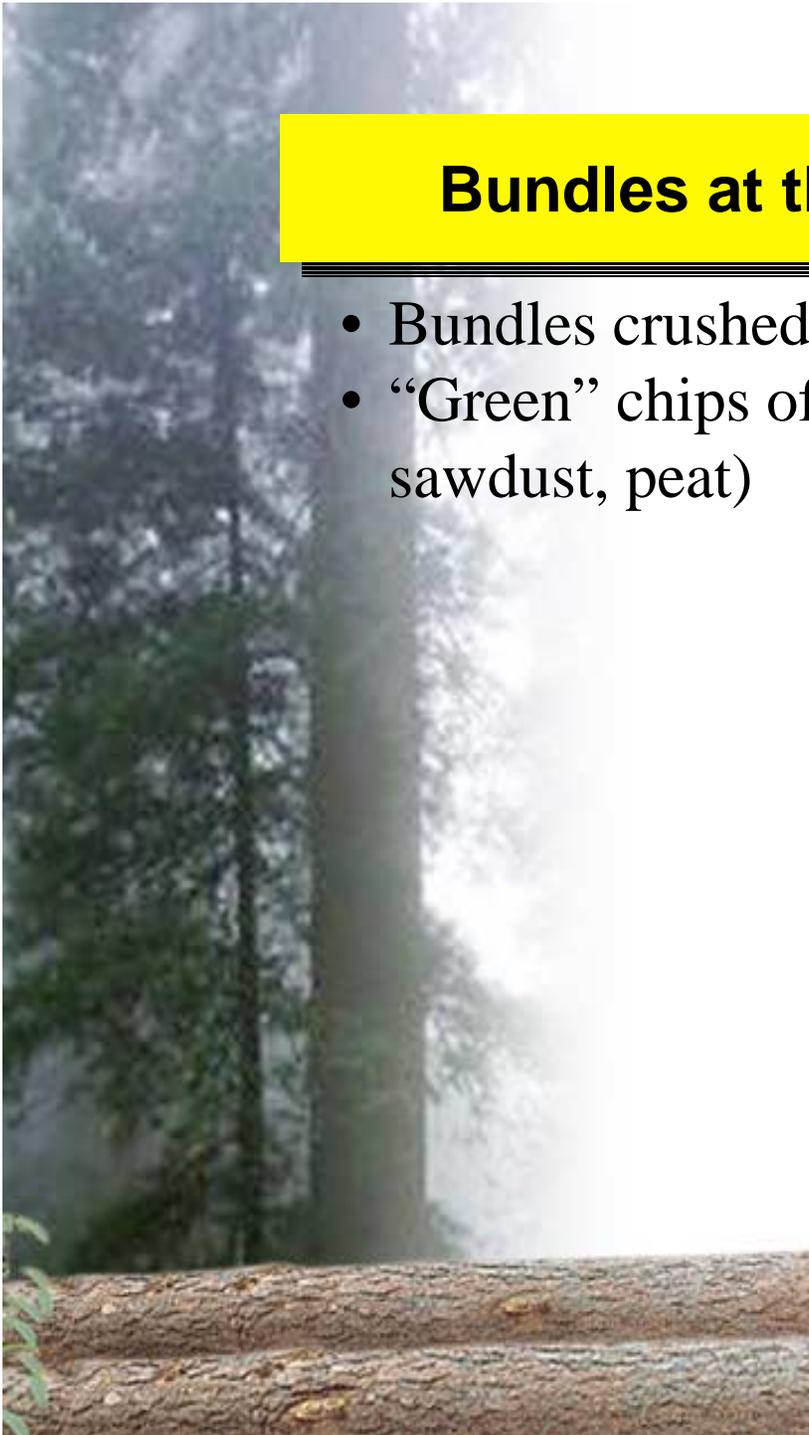
Bundle Transportation (forest to plant)

- Standard on-road trucks.

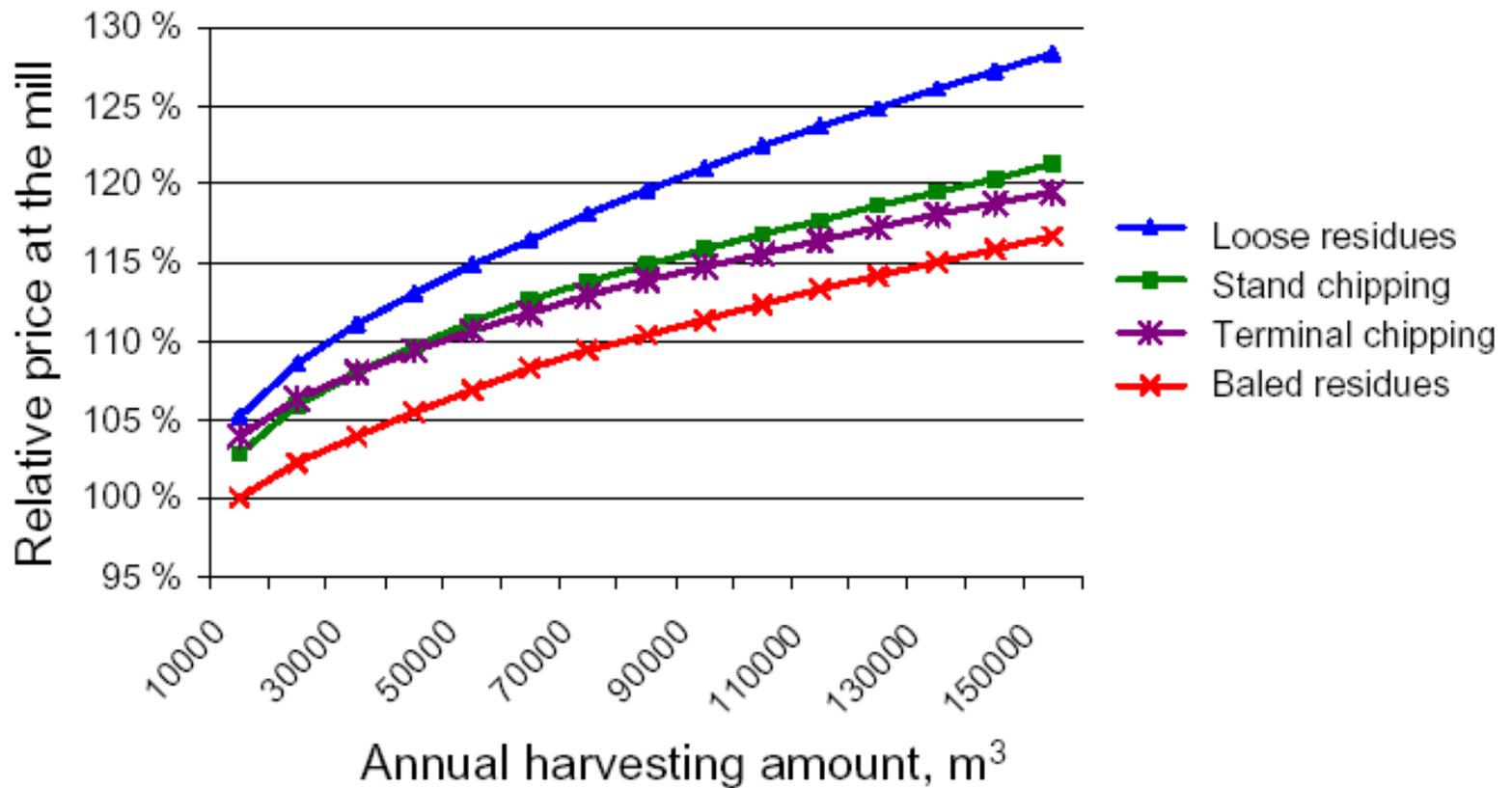


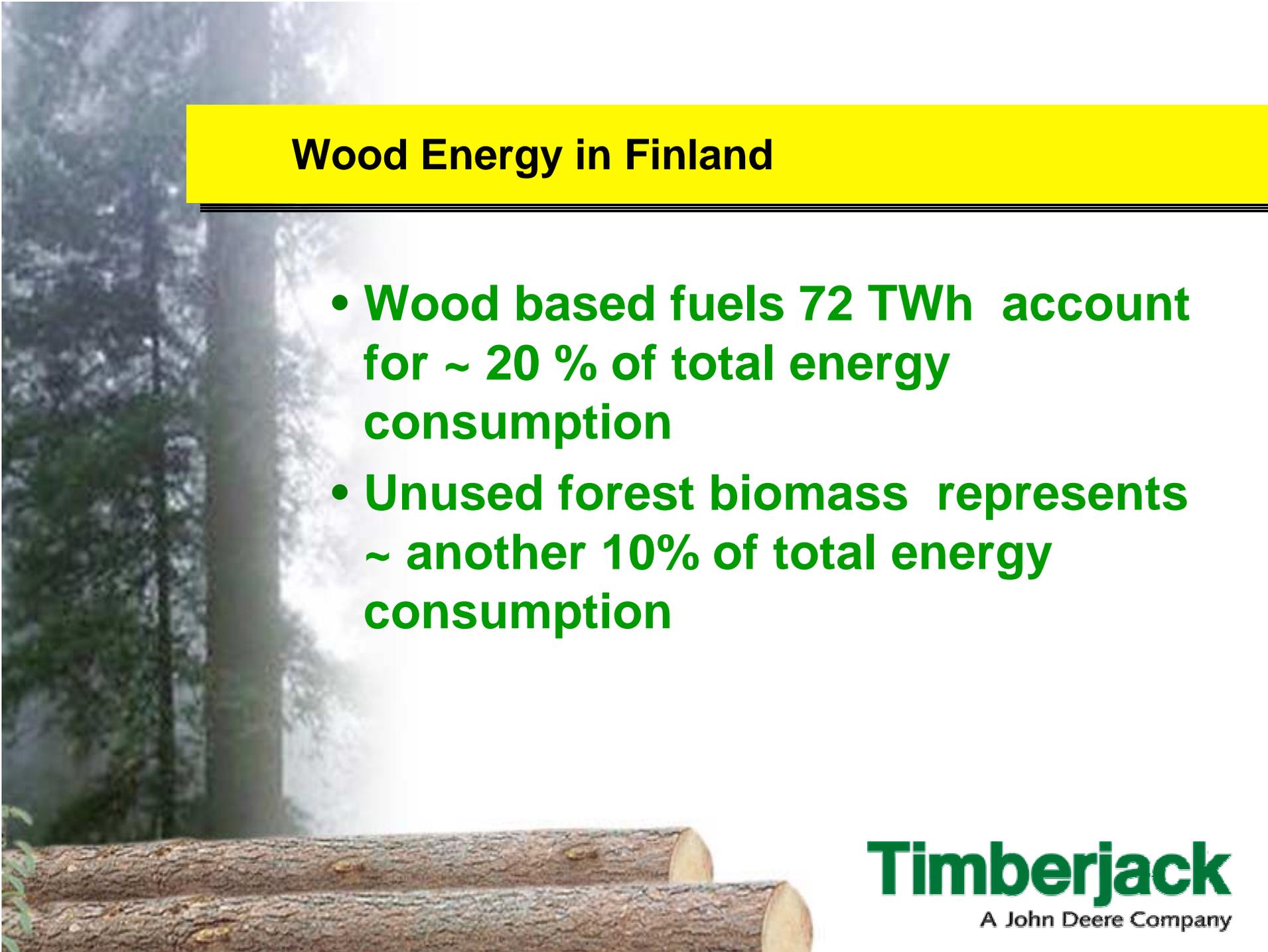
Bundles at the Plant

- Bundles crushed or chipped to improve combustion
- “Green” chips often mixed with other material (bark, sawdust, peat)



Relative Price of Wood Energy by Method



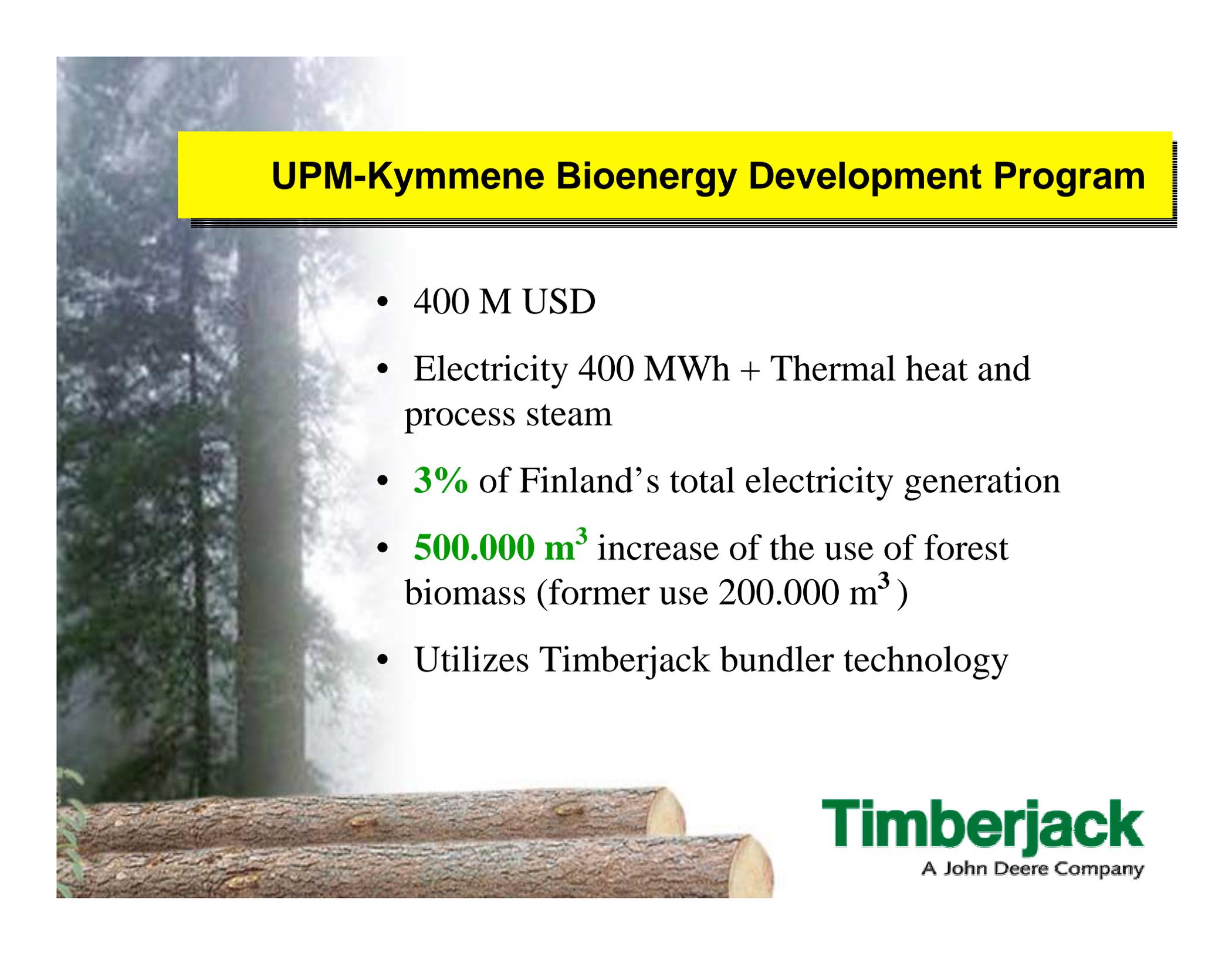


Wood Energy in Finland

- **Wood based fuels 72 TWh account for ~ 20 % of total energy consumption**
- **Unused forest biomass represents ~ another 10% of total energy consumption**

Bioenergy Program: Investments 2001-2003

<u>Location</u>	<u>Boiler Capacity</u>	<u>Status</u>
• Pietarsaari	--- 550 MWh	in use, Jan 02
• Kokkola	--- 90 MWh	in use, Oct 01
• Jämsänkoski	--- 185 MWh	in use, May 02
• Kuusankoski	--- 225 MWh	in use Sept 02
• Ristiina	--- 80 MWh	in use, May 02
• Savonlinna	--- 100 MWh	September 03
Total	1.23 GWh	

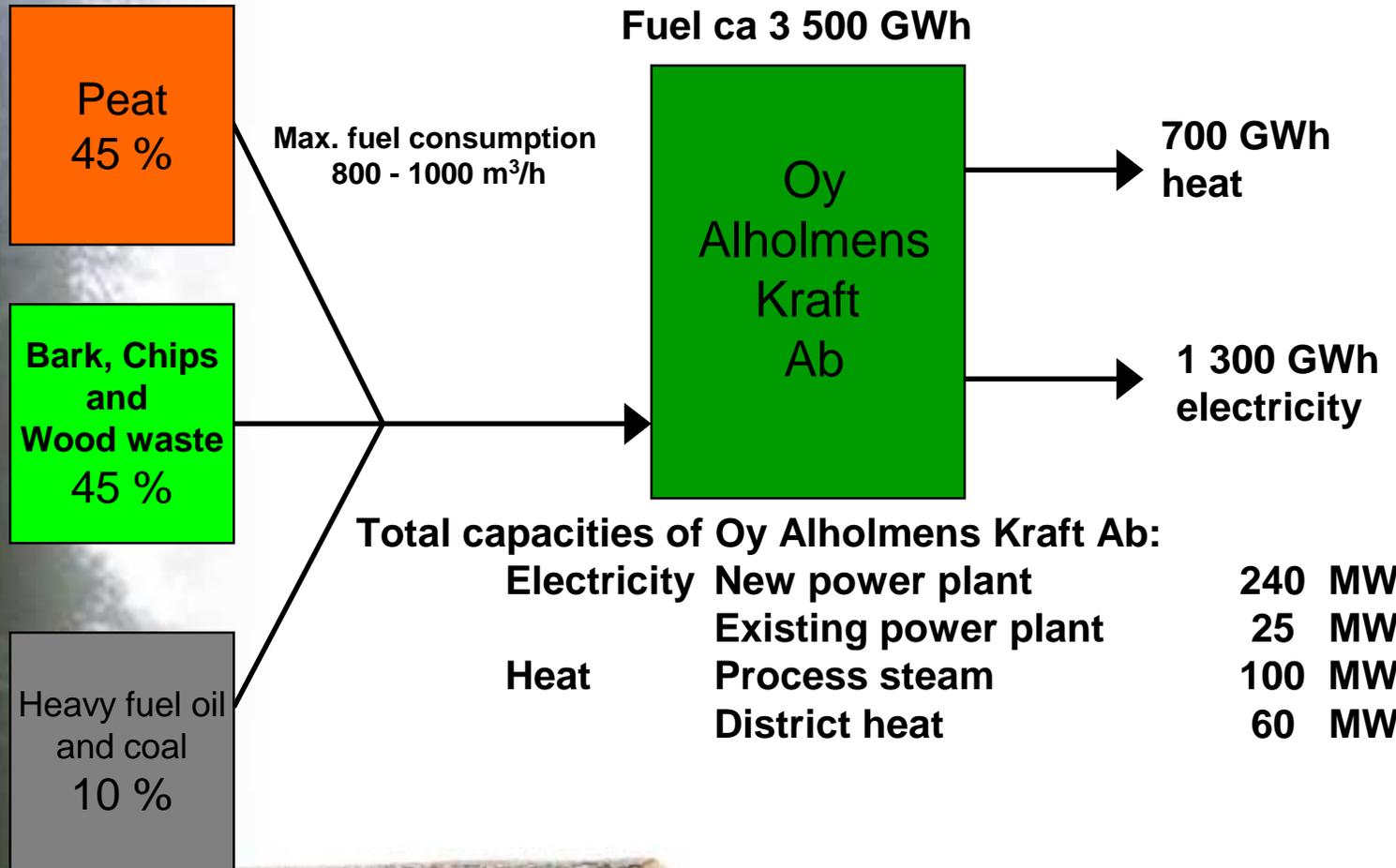


UPM-Kymmene Bioenergy Development Program

- 400 M USD
- Electricity 400 MWh + Thermal heat and process steam
- **3%** of Finland's total electricity generation
- **500.000 m³** increase of the use of forest biomass (former use 200.000 m³)
- Utilizes Timberjack bundler technology

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Annual Production/Consumptions of Pietarsaari Power Plant



Alholmens Kraft, Opening 2001.10.12



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Pietarsaari Power Plant – Bundle Consumption

- 4,000 bundles / 24hours
- 65 truck loads / 24 hours
- 2,000 metric tons / 24 hours
- Peak - 400 bundles/hour



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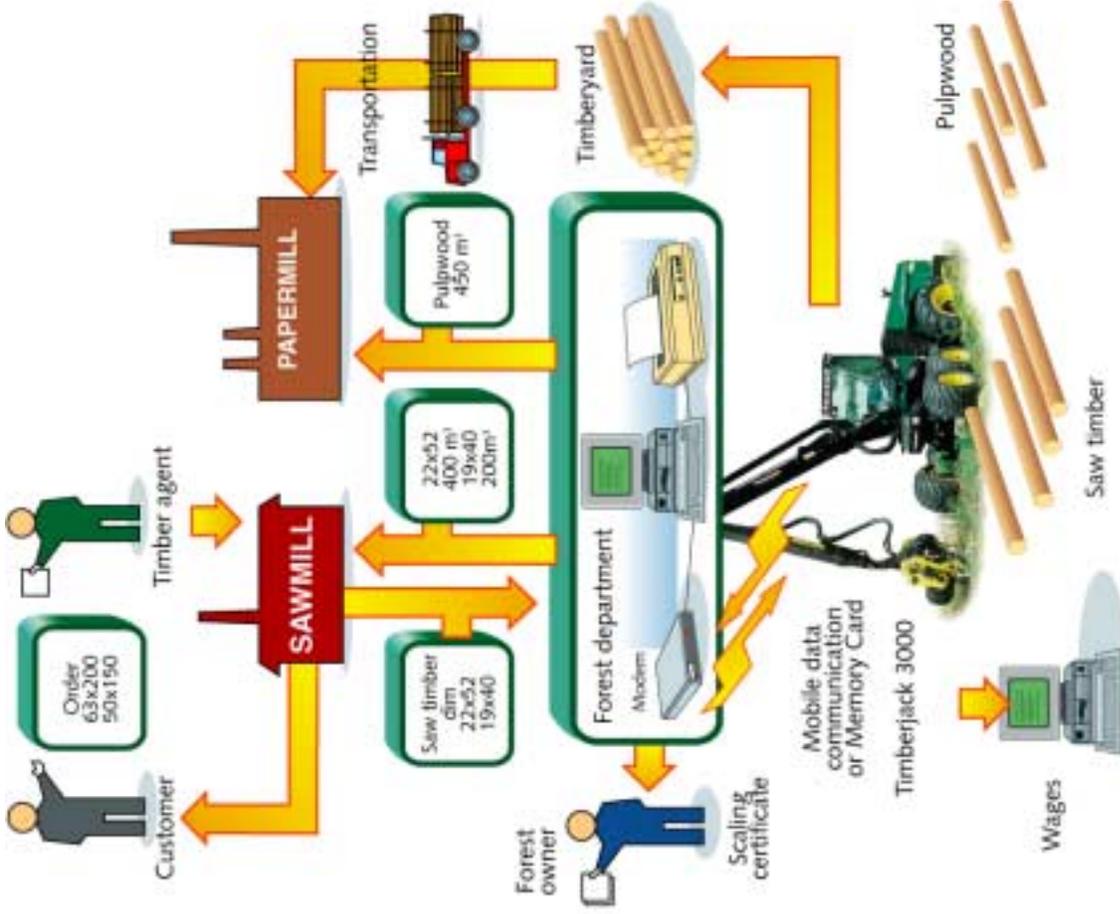
2002 World Energy Globe Awards

Alholmens Kraft – PVO + UPM-Kymmene + Timberjack



2nd Prize

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Bundler - Northwest Demonstration Program



- Gather production data in a variety of conditions
 - Tree species
 - Harvest treatments

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Demonstration Program – Work Plan (Draft)

	Duration	Start	Finnish
Ship ex Joensuu (wk13)	1 day	2003.Apr.28	2003.Apr.28
Ship to Tacoma, Customs (wk19)	30 days	2003.Apr.29	2003.Jun.09
Papé Eugene	6 days	2003.Jun.10	2003.Jun.17
Ship Tacoma/Eugene (254 mi.)	1 day	2003.Jun.10	2003.Jun.10
Dealer prep and package	5 days	2003.Jun.11	2003.Jun.17
Medford BLM	18 days	2003.Jun.18	2003.Jul.11
Ship to Medford (167 mi.)	1 day	2003.Jun.18	2003.Jun.18
Medford BLM work study	17 days	2003.Jun.19	2003.Jul.11
Western Governors Conf	7 days	2003.Jul.14	2003.Jul.22
S Medford to Seely (500 mi.)	2 days	2003.Jul.14	2003.Jul.15
W. Governors	5 days	2003.Jul.16	2003.Jul.22
Bonnars Ferry	18 days	2003.Jul.23	2003.Aug.15
S Seely to Bonners (300 mi.)	2 days	2003.Jul.23	2003.Jul.24
Bonnars work study	16 days	2003.Jul.25	2003.Aug.15
Darby School	10 days	2003.Aug.18	2003.Aug.29
S Bonners to Darby (300 mi)	2 days	2003.Aug.18	2003.Aug.19
Darby work study	8 days	2003.Aug.20	2003.Aug.29
Boise/Idaho City	11.5 days	2003.Sep.01	2003.Sep.16
S Darby to Boise (450 mi)	1.5 days	2003.Sep.01	2003.Sep.02
Boise work study	10 days	2003.Sep.02	2003.Sep.16
Bend - Deschutes	10 days	2003.Sep.16	2003.Sep.30
S Boise to Bend (350 mi)	1 day	2003.Sep.16	2003.Sep.17
Bend work study	9 days	2003.Sep.17	2003.Sep.30
Tahoe	10.5 days	2003.Sep.30	2003.Oct.14
S Bend to Tahoe (450 mi)	1.5 days	2003.Sep.30	2003.Oct.01
Deschutes work study	9 days	2003.Oct.02	2003.Oct.14
End at Papé Eugene	1 day	2003.Oct.15	2003.Oct.15
Bend to Eugene (150 mi.)	1 day	2003.Oct.15	2003.Oct.15

Why Renewable Energy from Forest Residuals?

- Way to store the solar energy
- 100% renewable energy
- Neutral CO₂ balance
- Low emissions of Co-generation plants - second only to natural gas
- Local energy source for smaller co-generation plants
- Integrates with CTL harvesting
- Employment potential in rural areas
- Improves reforestation
- **MINIMIZES RISK OF FOREST FIRES**

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The future is green!



Timberjack Energy Technology