



Testing new tools and innovative operating systems for wood energy harvesting in French Alps

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Some figures about French forests

- ▶ French forest area is 150 000 km², 27% of the total surface of France
- ▶ The wood stock is close to 3,000 million m³

	Total area Mha	Wood stock Mm ³ over bark	Roundwood production Mm ³ under bark
France	15.5	2,465	31.3
Sweden	27.5	3,155	61.4
Germany	11.1	2,880	48.7
Finland	22.5	2,158	49.3
Poland	9.2	1,864	29.3

FAO 2007



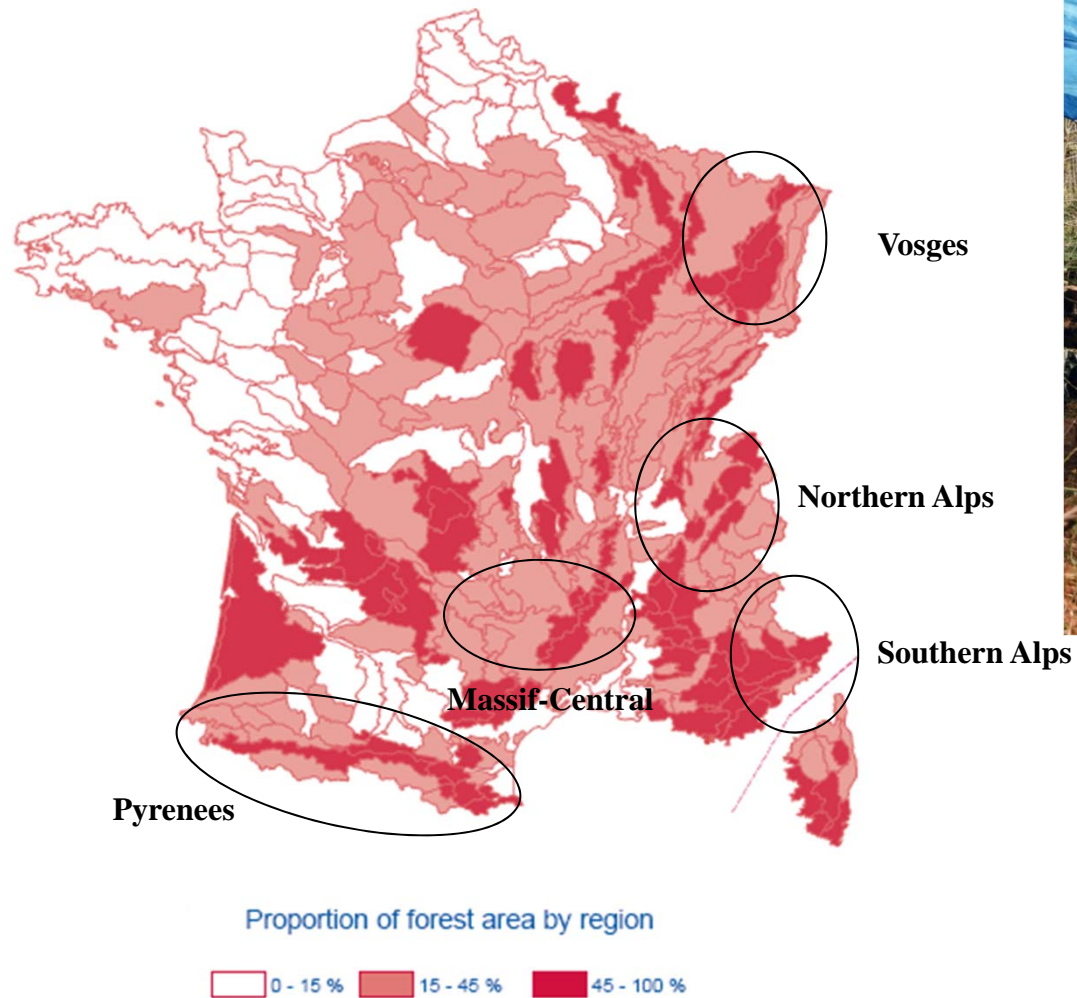
Some figures about French Forests

- ▶ 35% of the wood stock stand is in mountain areas
- ▶ Main species are
 - Spruce
 - Fir
 - Beech is predominant in the Pyrenees



Some figures about French Forests

Distribution of forest areas in France



Reference: IFN database - 2006 ; AFOCEL - 2006.



CONTEXT

▶ In 2008, a vast public debate brings new targets of volume to be harvested with respects to the environmental and societal constraints. The new slogan is

"Harvest more while protecting better (biodiversity, landscape,...)"

Very important and ...unrealistic targets have been fixed : +20 million m³ toward 2020 (from a current 60 Mm³)

▶ The new market to be developed are :

- Forestry chips for bioenergy
- Woody product for building



Objectives of the project

In this context, FCBA launched a R&D program with the following purposes :

- promote the utilization of cable yarding
- determine operational costs of forestry chip production in slope area
- evaluate the environmental conditions of such a production (fertility, safety, ergonomics...)
- make recommendations in the field of forest management

Description of the harvesting systems

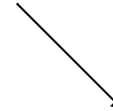
Whole tree system



Logging



Whole tree extraction



Chipping at the road side in forest



Chip delivery

Scenario 0

Logging residues and rotten wood

Scenario 3



Logging residues and rotten wood after processing



Haulage toward a terminal



Bundling in forest



Chipping at the road side



Chipping and stocking



Haulage to a terminal or to the end user



Chip delivery



Chip delivery to the end user

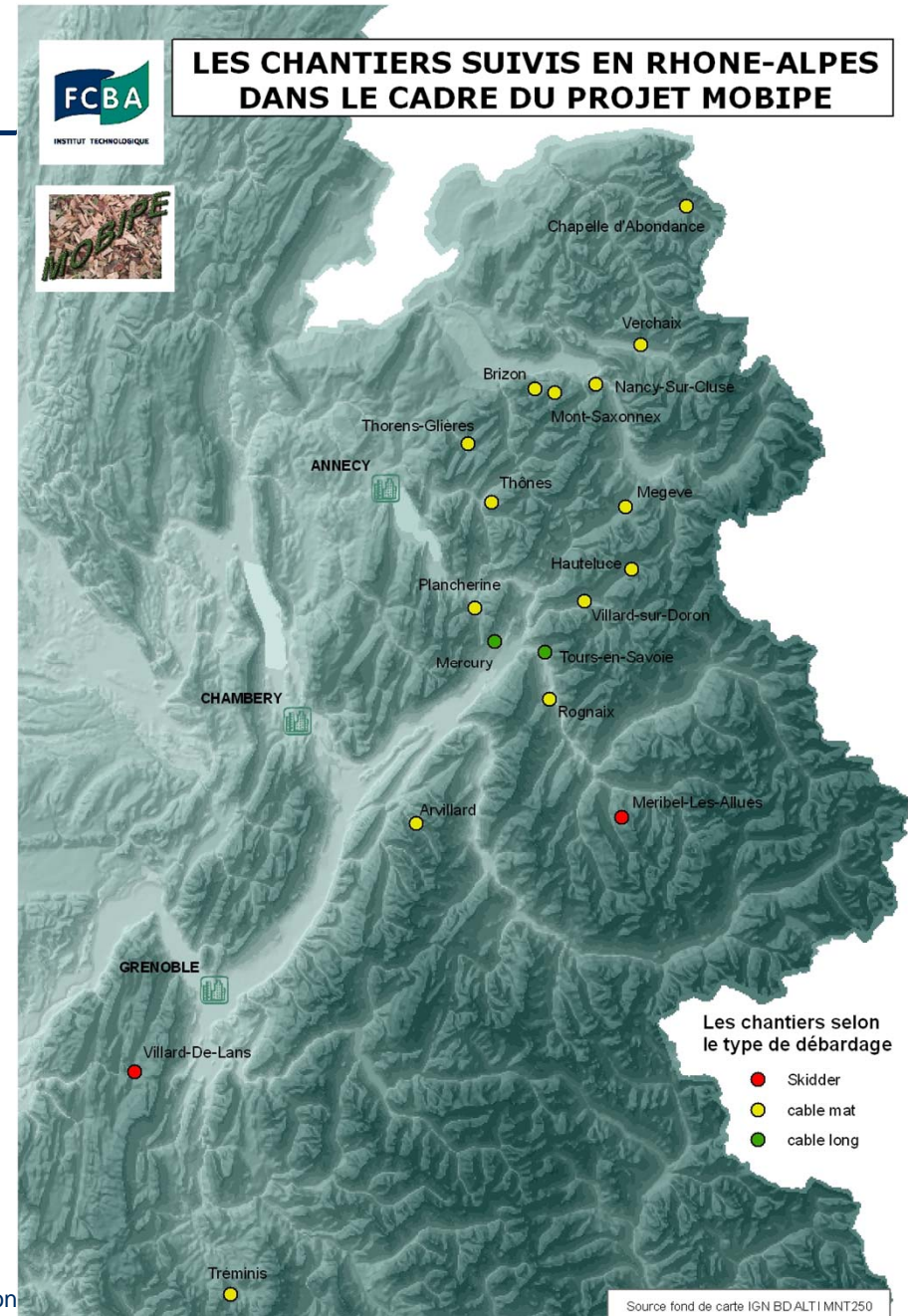
Scenario 2

Scenario 1

Analysis have been made on a pool of 14 timber yards (with one from Pyrenees) extracted by cable yarding

Spruce (*Picea abies*) and Fir (*Abies alba*)

Average line length : 300-350m





Material currently used in French Alps



*Konrad KMS 12U and Liebherr
900 with a Woody 50 felling head*

*Valentini V600M3 with a Wyssen HY2 carriage
Shovel : Case WX185 with a Woody 60 felling head*





Material currently used in French Alps



Jenz 400, 220 kW, max diameter 40cm

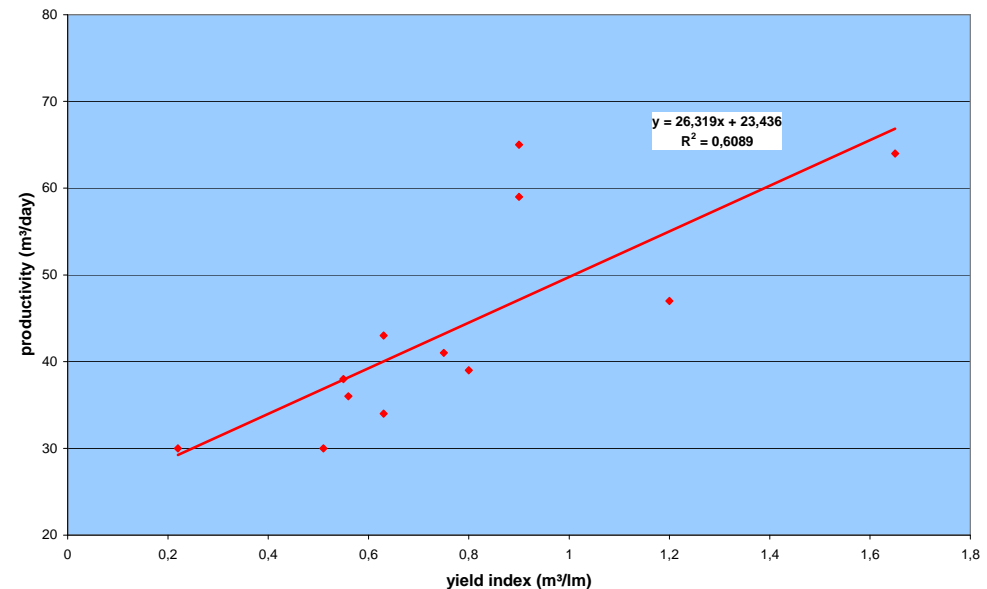
Jenz 600, max diameter 60cm, with a 265 kW tractor





Productivity and operational costs

Productivity of cable yarding ranges between 30 and 75 m³ (of log under bark) per day

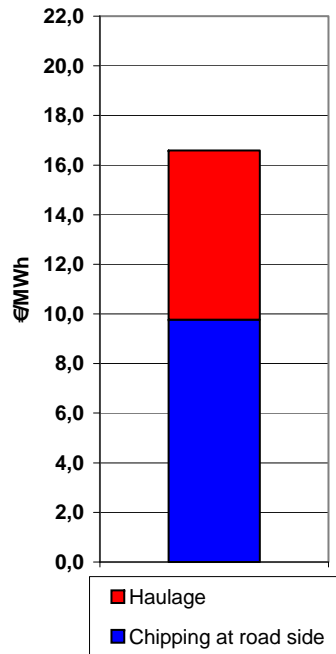


Productivity of chipping:

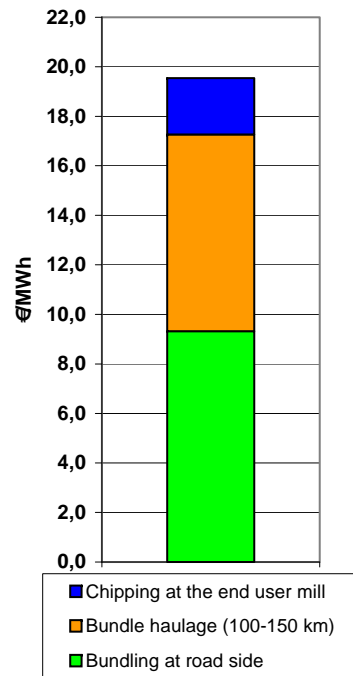
Tops and branches : 45 to 55 t/day

Whole tree (S0) at the road side : 50 to 140 t/day

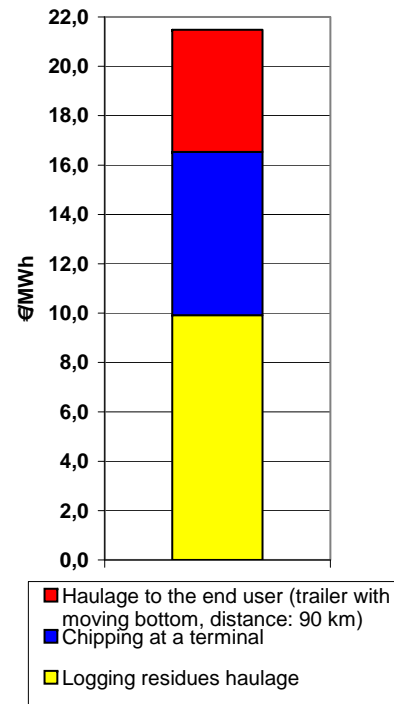
Considering that the value of the residues at the roadside is zero
(Scenario 1,2,3)



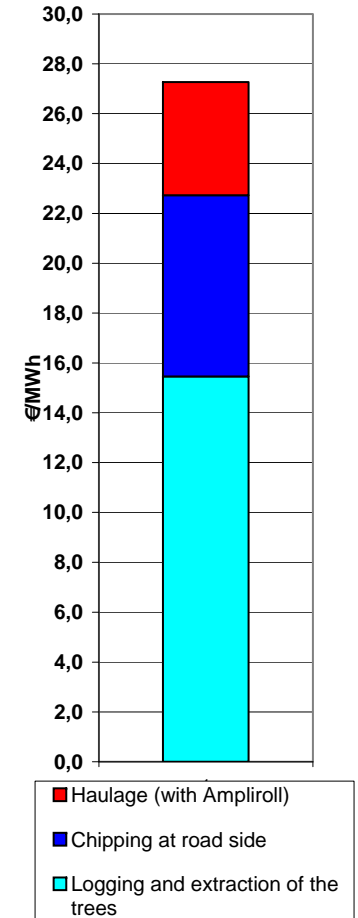
Scenario 1



Scenario 2



Scenario 3



Scenario 0

Results in €/MWh, with PCI : 2,2 Mwh/t

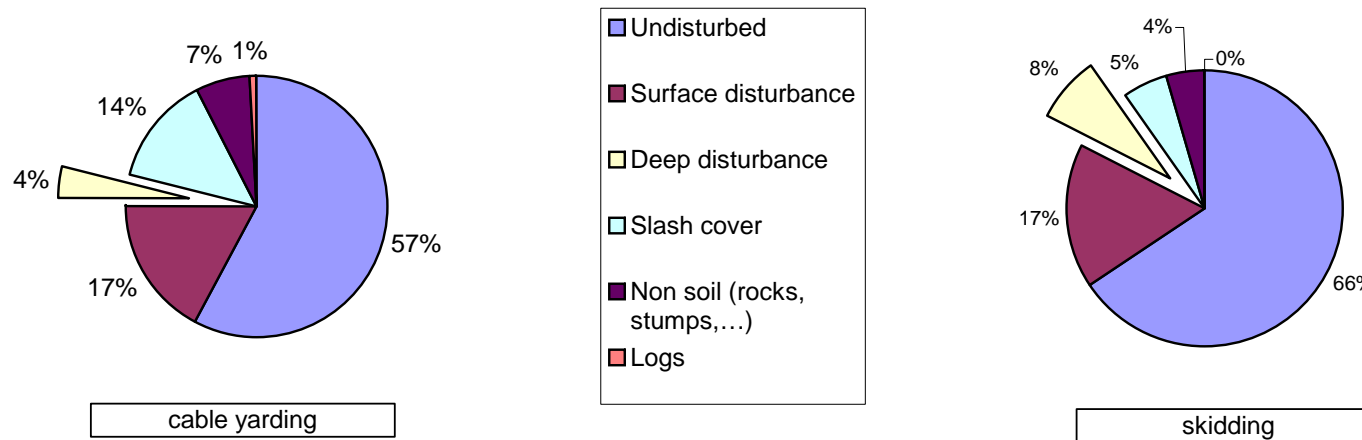


Global operational cost from the forest to the end-user

Discussion on the results

- The costs range between 17 and 22 €/MWh. They are compatible with the market price for green chips
- Chipping at the road side is the most cost effective system
- Bundling system may find a place if the industrial end user is equipped with an very productive comminution machine
- Supply chain based on chipping at the road side is more cost efficient compared to the chipping at the terminal system but additional research are necessary to conclude, considering transportation distances and the payload of trucks (on one hand for the unprocessed material, on the other one for chips)

Soil disturbances

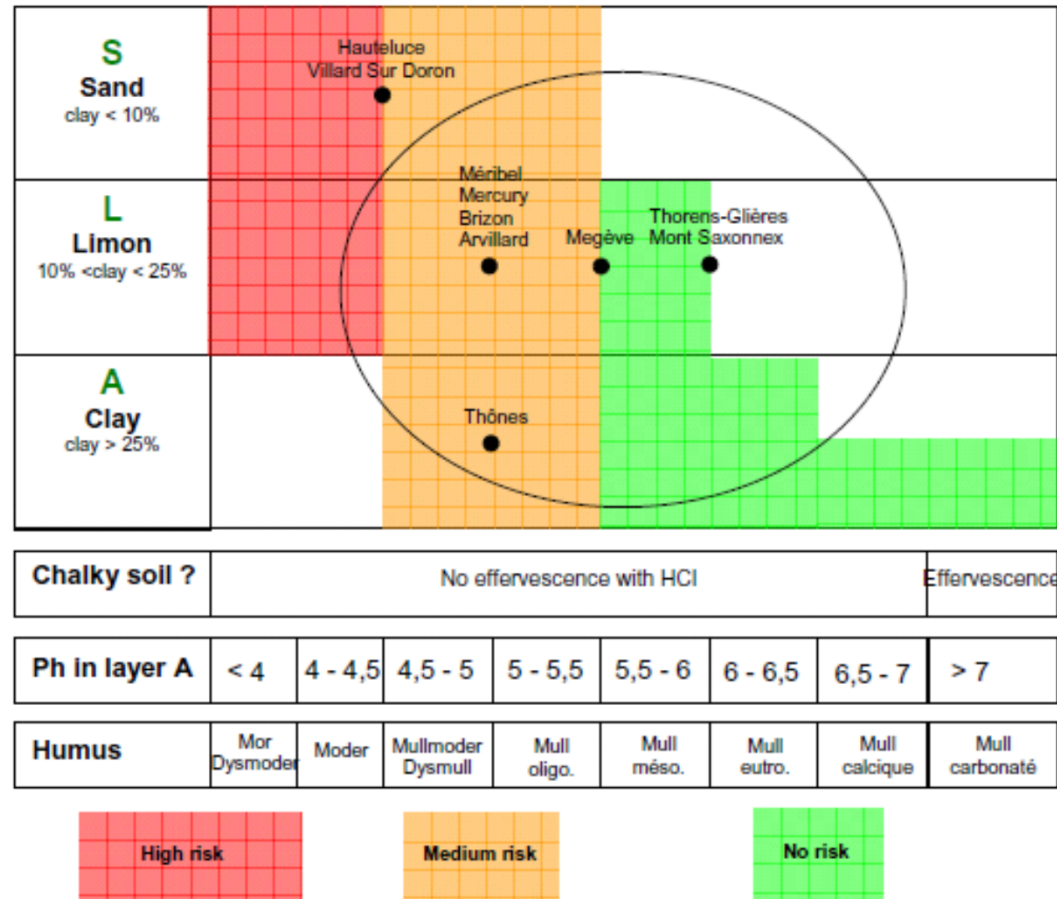


A very low level of soil disturbances with less than 5% of severe impacts (ruts) and almost 60% of undisturbed surface.

Soil fertility : the logging site are located mainly in low sensitive areas

Moreover harvesting in mountain area brings some other insurance because

- Trees are always partially delimbed before extraction



- Rotation duration are longer than in flat area and there is no clear cuttings



How to improve the economic balance ?

Increasing productivity and reducing operating cost

The more we extract saw logs, the more we can produce chips from forest residues. Consequently, cable yarding costs have to be improved so that can harvest wood lot unreachable to skidders.

- utilization rate of cable yarders could be increased if by a better planning of the activity during the year and particularly if the enterprises moved toward regions with less snow during the winter season
- improving the transportation of the logs so that there is enough place to pile the logs all the day long.



How to improve the economic balance ?

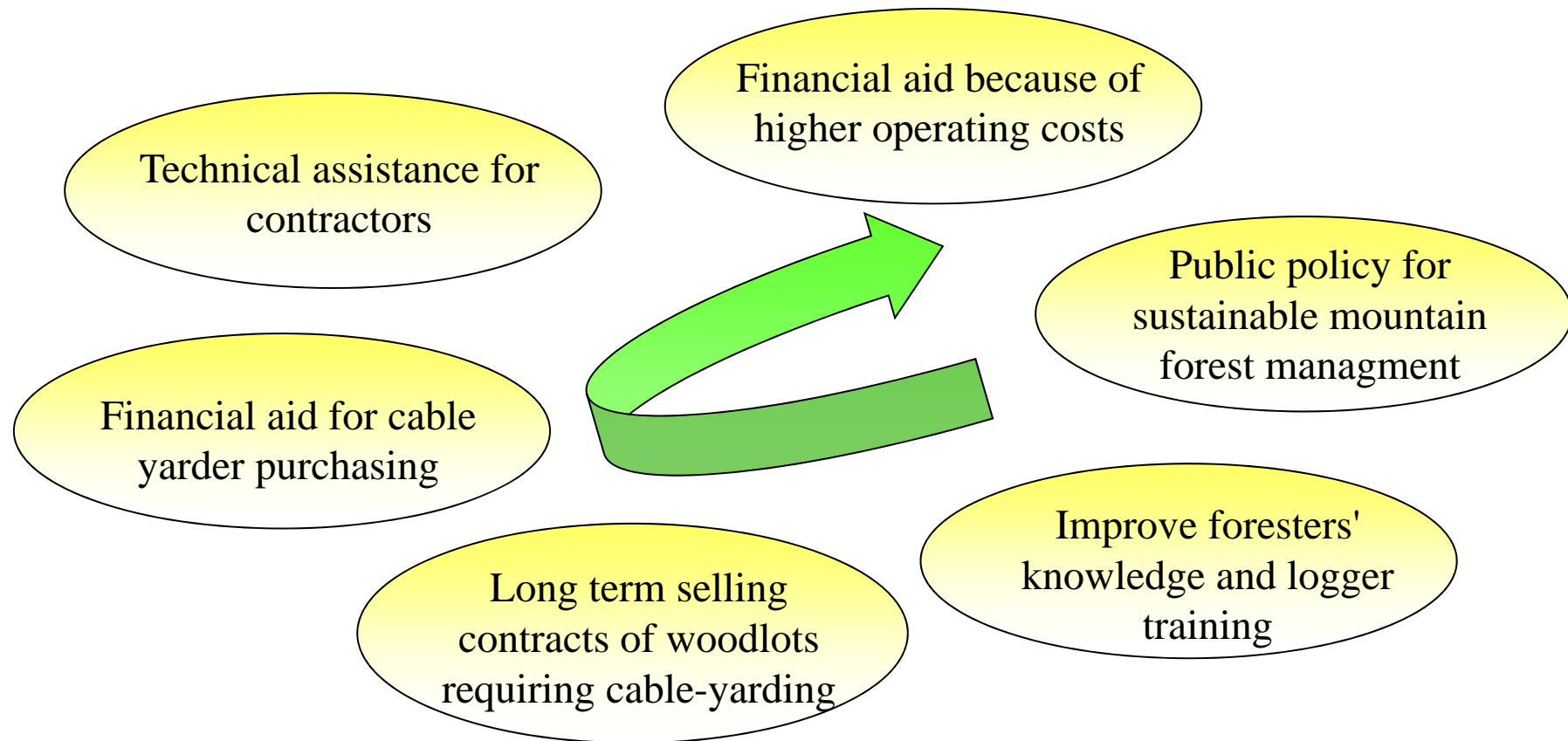
Considering the comminution, lateral feeding devices on small to medium chippers are not suitable for residues. They offer low productivities even when they are used on a terminal outside the forest (cf scenario 3).

Transportation of loose residues : special trucks to be tested

To foster cable yarding of softwood and hardwood with specific problems :

☞ For coniferous : improving the competitiveness of cable yarding, finding new market for chips from residues (vs the current market consuming dried chips from stem for small boilers).

☞ For hardwood: improving the competitiveness of cable yarding because, due to the low quality of the wood, the only product could be chips for energy and the whole harvesting costs have to be supported by this product (scenario 0, with a succinct delimiting ?).





Thank you for your attention !

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