

Title: Eucalyptus, Challenge for Wood Preparation

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Processing of eucalyptus

The first chipping plants for Eucalyptus were built in the beginning of 70'. At that time the logs were manually debarked in the forest. The first debarking plants were built in the beginning of 80' for short eucalyptus. In 80' many of the companies started to harvest and transport soft- and normal hardwoods to the mill as long wood or "in free length". At the same time there was also expectation to process also eucalyptus as long wood. It was known that short eucalyptus could be debarked as fresh wood or aged enough, but at the same time also the troubles in separation of fresh loose bark from logs was seen to be a big problem to solve, and especially when the debarking capacity was high.

The debarking tests in 90' showed that it was possible to debark fresh or properly stored long eucalyptus, but separating of loose fresh bark from the logs seemed to be only a big challenge at that time. It was understood that the existing drum-to-chipper lines could not manage to do the job in the right way, and therefore something new and more effective systems should be developed. The tests in StoraEnso Celbi Mill in 2000 using a special type of roll in the existing roller conveyor (case) to shake the log flow revealed that this type of roll helps to separate loose bark and logs from each others. The additional tests in Arauco Mill, Chile in 2002 utilizing the shaking roll and an effective bark separation section in the roller conveyor verified that this type of roller conveyor could manage to do the job in an effective way.

Wood receiving

Receiving decks combined with belt conveyor have been the most common equipment in wood receiving both for logs with bark and the logs debarked in the forest. However, high wearing of chains and especially in barrels and pins resulted that many of the mills started to despise the chain conveyors. Afterwards reputation of chains could be mainly returned by using the chains where barrels and pins can be lubricated afterwards and thus keep the wearing on acceptable level.

As an alternative for receiving decks is e.g. receiving table, which does not include any chains and also step feeder, which has been used e.g. in Canada. There must always be some kind of deck in the line before the chipper to meter the logs regularly enough into the chipper, or then the grabble of the loader must be very small in size to unload the logs into the line evenly enough.

If there is a debarking drum in the line, in many cases logs are unloaded as bundles directly on the large chain type conveyor or equal, and logs are forwarded into the drum in bundles. This is an easy and cost-effective way to build the debarking lines for high capacities.

Annex 1 ("Log loading manually")

Annex 2 ("Log loading low capacity")

Annex 3 (PowerFeed infeed)

Annex 4 (VOTORANTIM CELULOSE E PAPEL S.A., Jacarei Mill, Brazil)

Annex 5 (New Feeding Deck - without chains)

Debarking

The logs are debarked in the mill, or then manually or by special type of harvesters in the forest. At the moment it looks like that in Brazil nearly all the new mills have chosen the debarking in the forest, and e.g. in Chile still most of the mills are still debarking the logs in debarking drums.

Debarking in the forest reduces the needed investments in the mill, but on the other hand it requires a good organization and scheduling to transport the logs on the right time / as fresh to the mill. In this case, the bark can't be normally used as fuel in bark boilers, and depending on the roads there is always a danger that a lot of fine sand is on the logs after transporting. On the other hand, one can save a little bit in wood losses if the logs are debarked in the forest.

Chipping

Nowadays there is a real possibility to make the choice between horizontal and drop feed chipper, because it is possible to use the same chipping geometry in both type of chippers. This means a possibility to meet high continuous capacities (until 400 m³sub/h) also by using horizontal fed chippers, and of course, the best chip quality can be naturally met by chipping the logs as long as they can be only fed into the chipper. Horizontal chipper is the best choice also for all large diameter logs, which have the length 2 m or more.

Annex 6 (Pulp quality starts in the woodyard)

Annex 7 (Aracruz Celulose S.A., Brazil)

Annex 8 (Aracruz Celulose S.A., Brazil)

Chip storing

Big chip storages, volume more than 80,000 m³ loose are normally open type storages, where chip stacking is made by different type of stackers and reclaiming by a chain conveyor, by screw reclaimers or by a long combined screw conveyor. At the moment it looks like that in projects in warm climate area it's favored reclaimers, which are located above the ground. In cold climate area screw reclaimers located under the chip pile seem to be a more reliable solution.

Nowadays, one chip silo can be c. up to 40,000 m³ loose in volume. By installing 2 ... 3 silos side by side it's possible to supply enough large chip storage for mechanical (TMP or equal) pulp mill, or a small sized chemical pulp mill. In chip silo moisture content of chips can be equalized, there can't occur a big variation between different chip fractions, and the chips can be kept free of sand and smut.

Annex 9 (Stacker/Reclaimer "blending bed")

Chip screening

Traditionally chips are screened using vibratory, gyratory, disc or bar screens. Today, when the capacities of new pulp lines can be 2000 or even 3500 ADt/d, it means that a mill must furnish 2 ... 4 pcs traditional screens, or even more, to meet the required screening capacity of 1200 ... 2000 m³ loose / h. However, the new type of screen called JetScreen can alone meet the capacity 2000 m³ loose / h or even some more.

Annex 10 (JetScreen™ Thickness Screening)

Eucalyptus

Eucalyptus presents all woodyard suppliers with unique challenges. The bark is long and stringy like rope – very unique. Instead of coming out of the debarker at designated slots, it comes out with the logs. *Eucalyptus nitens* is even more difficult than *Eucalyptus globulus*. It bends like rubber and knots like dreadlocks. Bark strips can form big "bark balls" around the logs, which are very difficult to eliminate from the log flow.

Storage time of eucalyptus has to be controlled carefully. Most of the eucalyptus species can be easily debarked when fresh (up to 4 weeks from felling), but dry eucalyptus (up to 6 months) from felling can be difficult to debark.

Annex 11 (Special Features in the Processing of Eucalyptus")

History and some feedback from Valdivia Mill after one year's operation

Annex 12 (Celulosa Arauco y Constitución S.A., Valdivia Mill, Chile)

Annex 13 (Celulosa Arauco y Constitución S.A., Valdivia Mill, Chile)

Annex 14 (Celulosa Arauco y Constitución S.A., Valdivia Mill, Chile)

The relationship between Andritz and Arauco began in 1991 when Andritz supplied to pine debarking lines. In preparation for the Valdivia project, Arauco allowed Andritz to conduct experiments on the eucalyptus line. These trials formed the basis for the Valdivia successful solution.

Andritz Wood Processing sold to Arauco Valdivia mill its' first long wood line for eucalyptus in the beginning of 2002. The delivery consists of two debarking and chipping lines, bark shredding, water treatment in woodyard area, and also chip storages, screening and control system for the woodyard. The second order of eucalyptus long wood line to Arauco's Itata Mill in Chile was received in 2004.

Log Feeding and Debarking

Logs are loaded onto the PowerFeed conveyor by hydraulic grabble crane. After that the logs are fed into the debarking drums in bundles size 4 ... 6 sq. meters through PowerFeed conveyor. The mud and sand is being effectively washed out of the logs in washing section located inside the conveyor.

The two debarking drums use a normal "tumble" debarking method for 2.44 m logs and a parallel debarking format for 6m logs. The debarking drums (5,5 x 35 m) have enough capacity to debark even dry eucalyptus logs at required capacity and to cleanliness high enough. For logs, which are easy to debark, the rotation speed of the debarking drum and filling degree in the drum are kept on the right /quite a low level. Rotational speed can be adjusted according to wood quality and species from 3-7 rpm. Idea is to debark the logs well enough but not create unnecessary wood losses in debarking.

Bark Separation

Between c. 20-30% of eucalyptus bark is removed through the bark outlets. The remainder loose bark coming out with the logs and is removed by the special EucaRoller™ after the debarking drum. The shaking rollers on the EucaRoller™ get the log flow jumping upwards and then moving sideways, which allows the loose bark first to fall on the rollers and then to fall through the gaps between the spiked and flat rollers. And, unexpectedly, short E. nitens logs have been the biggest challenge in bark separation. The totally debarked and de-stoned logs are washed before chipping.

Annex 15 (Bark Separation with EucaRoller Conveyor)

Chipping with horizontal fed HHQ-Chipper™

Chip quality is produced by the chipper. The logs are processed by horizontal fed chippers. This type of chipper is ideal for longer wood (6 m), but it produces good or excellent chips also from short wood (2.4 m).

Eucalyptus is again a challenge for the wearing parts in the chipper, since it is a very hard, rough wood. In addition, eucalyptus has a low ph-value (acidic) which promotes corrosion in open-air conditions. Sand content in eucalyptus is also higher. It was expected that in processing eucalyptus the chipper knives should be changed after 4 ... 6 hours, but because of effective log washing systems the same knives can be used at least twice that time.

"Recovery" Short ends separator for returning the wood stumps back to the chipper

The system for fiber recovery; the breakage and log recovery system, minimizes wood losses. The system filters out the bark on its way to the shredder and can rescue wood over 0.5 m long for chipping by a special arrangement of wood recovery rollers. The recovered wood is then sent to the chipping line to re-join the process. About half of our broken wood, which is mainly caused by the tumble debarking process, can be recovered and recycled for chipping.

Chip Storing and Screening

The chip storages are 100 % live and thus there is not any need for bulldozers or equal machinery to take care of the chip piles.

After the piles the chips are screened by two CS 1000 gyratory screens and the oversizes are sliced by the HQ-Sizer. Based on experiences until now the perforation of the upper screen decks could be changed to smaller one and thus take a bigger portion of larger pine chips into the HQ-Sizer in the future.

At Valdivia, rectangular chips are screened by two CS 1000 screens with a combined capacity of 2,000 loose m³/hour. Each screen has decks for "oversize," "overthick," "accepts," "pins," and "fines." The latter are sent to the boiler. The "overs" are sent to the HQ-Sizer™ for processing into the correct size for cooking. More than 95% of the chips are forwarded directly from the screens to the digester.

The HQ-Sizer™ replaces re-chippers, crackers, slicers, and conditioners with one unit. With one level of 10 cutting knives and four bedknives, it splits the larger chips horizontally into the required size. In practice, 80% of the "overs" are converted into accepts with minimal pins and fines.

Bark Processing

As known eucalyptus bark is quite difficult to process to good quality of fuel. The existing heavy bark hogs have run quite well in these demanding conditions.

Control system

The woodyard has control system, which is based on PLC / WinCC. In the beginning the number of cameras and monitors was not on an adequate level, nowadays the system can be easily controlled from the control room.

Annex 16 (High-Capacity Eucalyptus Debarking Plant)

Annex 17 (Achievements in Improving the Utilization of Eucalyptus)

Annex 1

“Log loading manually”

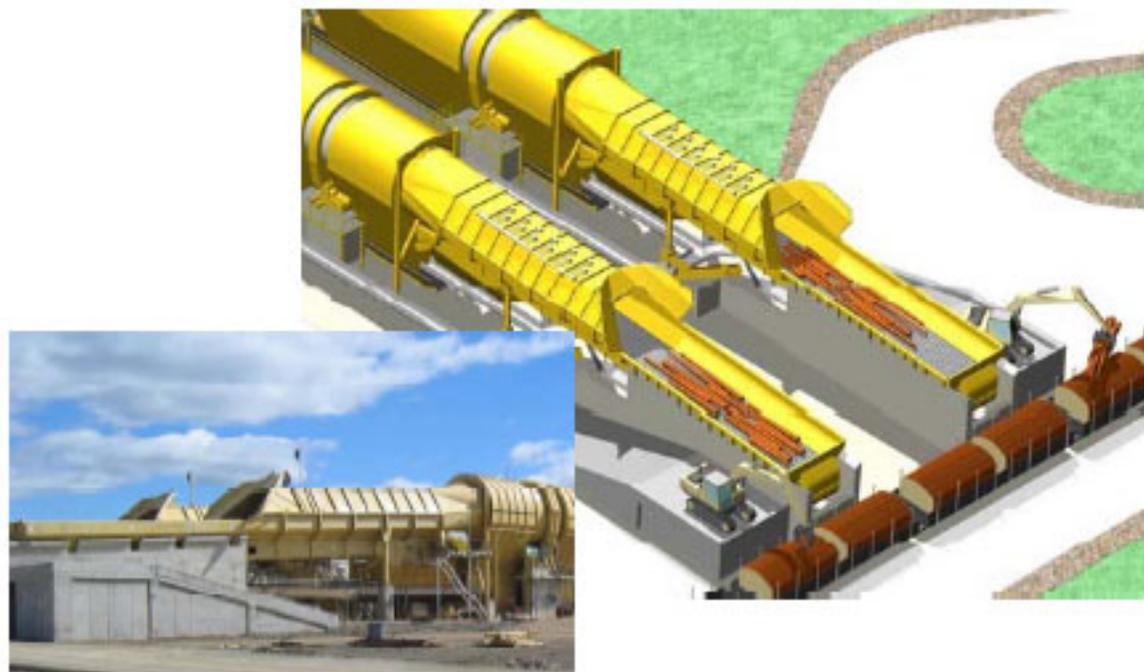


Annex 2

“Log loading low capacity”



PowerFeed™ infeed



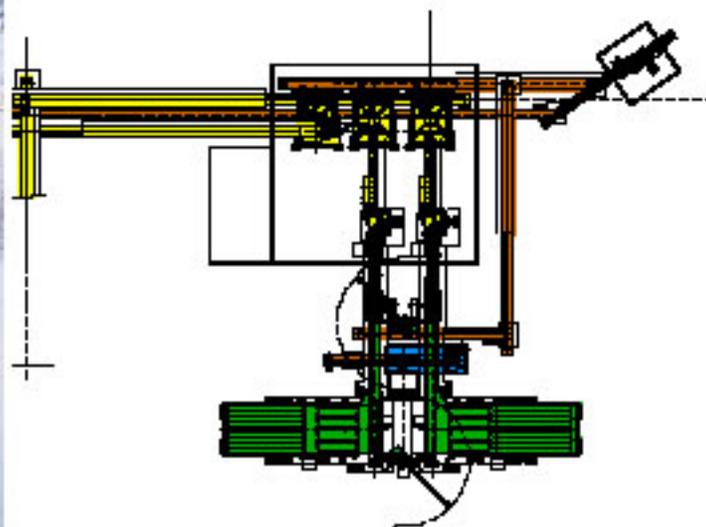
VOTORANTIM CELULOSE E PAPEL S.A., Jacarei Mill, Brazil

Process: Pulpwood
Delivered: 2001

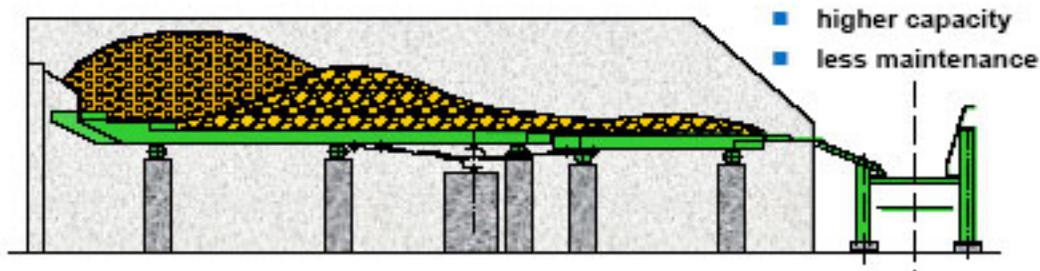
Delivery: Woodyard
Capacity: 2 x 285 m³ sub/h

Wood species: Eucalyptus

WOODYARD

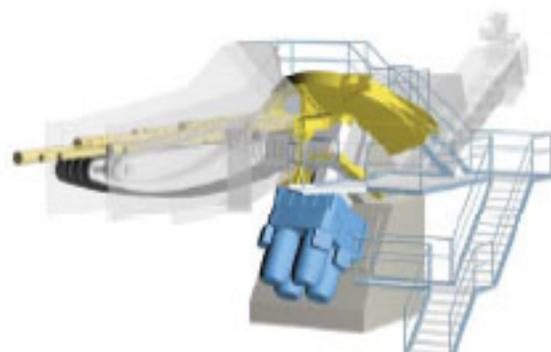


New Feeding Deck - without chains



Pulp quality starts in the woodyard

- Chip quality is produced by the Chipper
- HHQ-Chipper™ with horizontal feed: excellent runnability at high capacity for 6 m logs
- Most uniform chip quality
 - Higher pulping yield: Aracruz performance test showed >92% of accept chips (99% including pins and overthick); conventional chippers give 85-87% accepts
 - Lower wood loss through less fines: Aracruz screens away about 1% of the total wood amount (fines+overs)



Over 80 HHQ/HQ-Chippers™ supplied.

Annex 7

Aracruz Celulose S.A., Brazil

Process: Pulpwood
Delivered: 2001

Delivery: Wood chipping plant
Capacity: 2 x 320 m³ sub/h

Wood species: Eucalyptus

WOOD CHIPPING PLANT



Annex 8

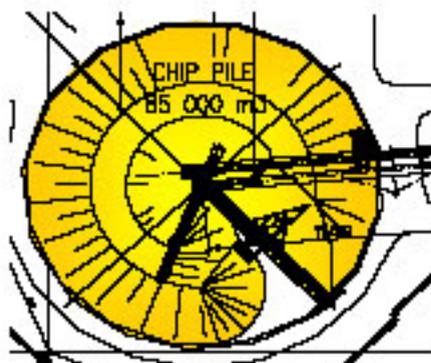
Aracruz Celulose S.A., Brazil



- HHQ-Chipper™ horizontal fed chipper
- Two chipper infeed lines with washing station

Stacker/Reclaimer "blending bed"

- Automatic 100 % First-in / First-Out
- Perfect homogenization of chips to cooking
- Fully live pile volume, no dead areas
- Gentle treatment of chips, no damage
- Perfect chip mixture
- Gentle treatment of chips
- Rigid and uncomplicated construction
- Low maintenance cost
- Low installed power
- Free access for maintenance
- All mechanical drives, no hydraulics required



JetScreen™ Thickness Screening

- Chip separation with air impulse based on chips size, thickness and chip density
- Efficient removal of "scrap" and dust from the whole chip flow
- No moving mechanical parts inside the screen
- Completely closed dust free unit



Special Features in the Processing of Eucalyptus

- All eucalyptus species have their special characteristics and may require different type of processing
- Most of the eucalyptus species can be easily debarked when fresh (up to 4 weeks from felling)
- Dry eucalyptus (up to 6 months) is difficult to debark in the debarking drum
- In debarking drum only 20% of bark pass through the bark openings
- Main part of the bark comes out of the drum mixed with the logs
- Bark strips can form big "bark balls" around the logs, which are very difficult to eliminate from the log flow
- The separation of loose bark strips from the log flow is always a challenge

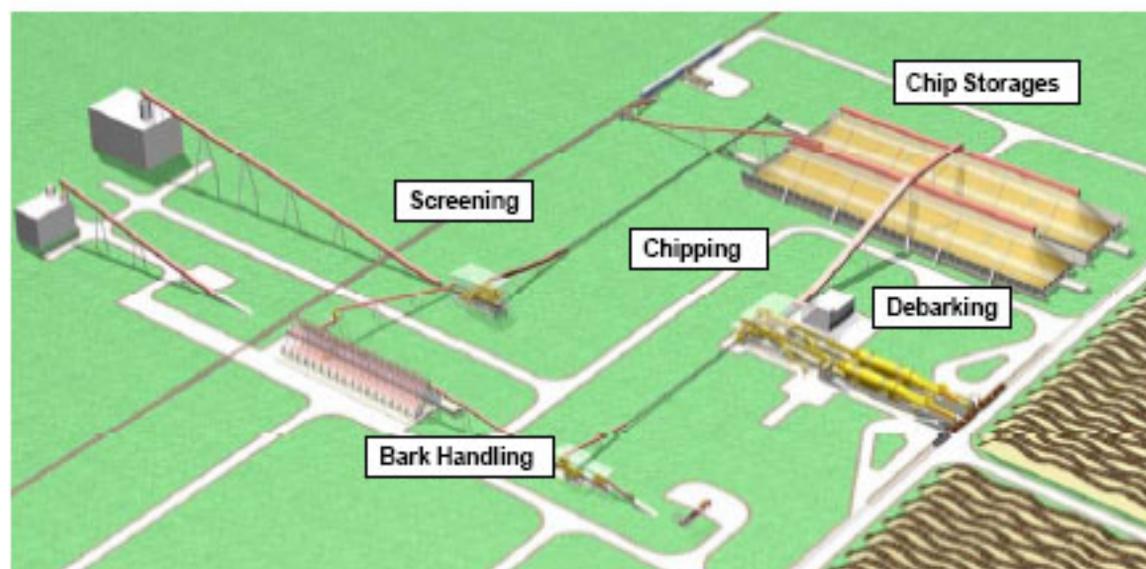


CELULOSA ARAUCO Y CONSTITUCIÓN S.A. Valdivia Mill, Chile

Process: Pulpwood Delivery: Wood Preparation Plant
 Delivered: 2003 Capacity: 2 x 270/310 m³ sob/h

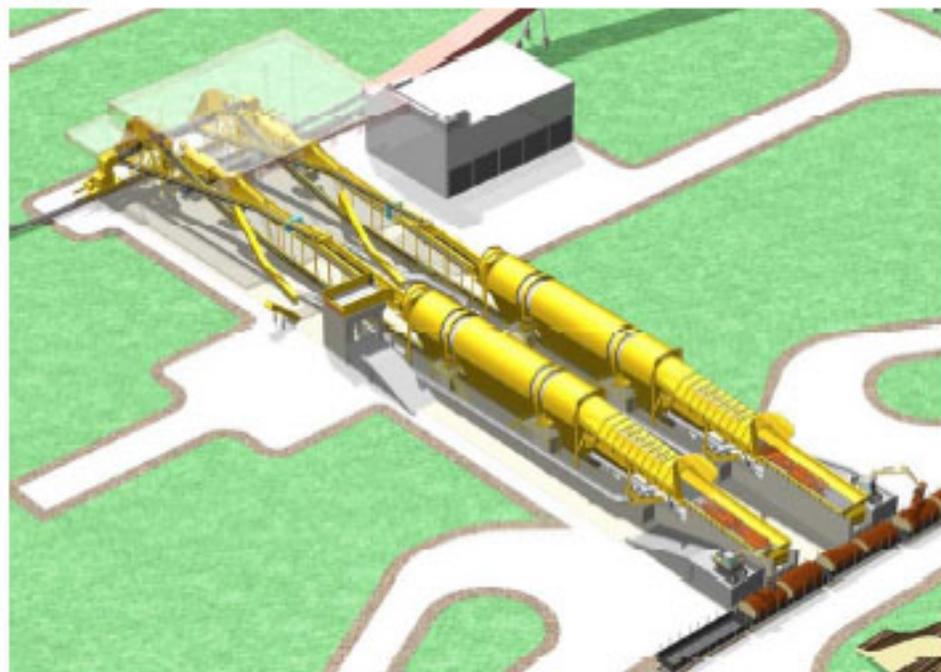
Wood species: Pine, Eucalyptus

WOOD PREPARATION PLANT



Celulosa Arauco y Constitución S.A., Valdivia Mill, Chile

WOODYARD



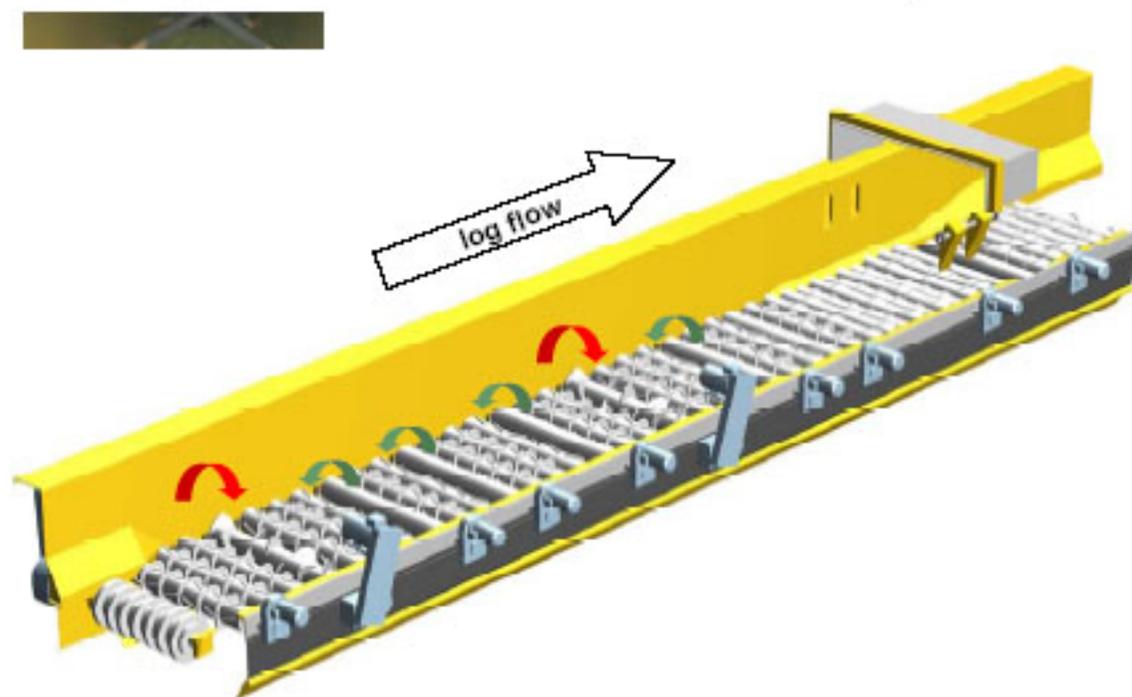
Celulosa Arauco y Constitución S.A., Valdivia Mill, Chile

WOODYARD

- Wood Infeed, Debarking and Chipping
 - PowerFeed™ infeed and steel wheel supported Debarking Drum (Dim. 5,5 x 35 m)



Bark Separation with EucaRoller™ Conveyor



High-Capacity Eucalyptus Debarking Plant

DRUM INFEEED

- o Bundle infeed to PowerFeed™ infeed conveyor
- o Efficient washing of sand and clay before drum

DEBARKING

- o Efficient debarking of Eucalyptus with minimized wood loss
- o 55/45 mm wide bark outlet slots (7.2 % open area of the drum shell)
- o Stone & sand removal in the beginning of the drum

BARK SEPARATION

- o Special Euca Roller Conveyor

CHIPPING

- o Horizontal fed HHQ-Chipper™
- o Uniform chip quality (less pins and fines -> minimum fiber loss)

Achievements in Improving the Utilization of Eucalyptus

- Less fiber losses in forest
 - 6 m long logs (normally 2.4 m)
- Less fiber losses in debarking
 - wood losses < 1% (normally 2-3%)
- Lower chemical consumption in bleaching
 - bark content with chips < 1% (normally 2-5%)
- Improved yield in cooking
 - homogenous chip quality
 - accept chips > 90% (normally 85%)
 - fines < 0,5% (normally 1%)
- Reduced capital employed
 - Higher capacity of the line 300 s-m³/h (normally max. 250 s-m³/h)

