# CONTINUAL IMPROVEMENTS KEEP TASMAN PULP AND PAPER COMPETITIVE

DONALD G. MEADOWS

***INNOVATION IS A HALLMARK OF NEW ZEALAND PULP AND PAPER MILL.***

TASMAN PULP AND PAPER'S INTEGRATED NEWSPRINT mill in Kawerau,NZ,is undergoing a transplant that should keep it strong and healthy for several more years.

Key pieces of equipment from the pulping side of Avenor's defunct Gold River newsprint mill in British Columbia, Canada, are being dismantled and shipped to the South Pacific. They are being refurbished as needed before installation at the mill site in New Zealand.

Tasman, a wholly owned company of the Fletcher Challenge Group,began its NZ$ 151 million (about US$ 104 million) mechanical pulp mill modernization project earlier this year. The project includes an upgrade of an existing pulp machine and construction of a thermomechanical pulping (TMP) plant. The pulp machine is scheduled for commissioning the end of this year; the TMP mill should be in operation by May 1997.

The goals of the modernization include improved printability, reduced linting, increased sheet strength, improved paper machine and printing press runnability, increased mechanical pulping capacity, and reduced operating costs.

Upon completion, the modernization will increase production on the No. 2 pulp machine from 125,000 a.d.tons/year to 200,000 a.d.tons/year. The wet end of one of the mill's pulp machines is being rebuilt, with a new former and press section. The new TMP mill will have 185,000 a.d. tons/year new capacity. Production of refiner mechanical pulp (RMP) will also increase by 25,000 a.d. tons/year to 150,000 a.d. tons/year. Production of stone groundwood (SGW) will then drop from 200,000 a.d. tons/year to 70,000 a.d. tons/year as a large portion of that old, labor-intensive facility is decommissioned.Likewise,newsprint kraft consumption will decrease from 100,000 a.d. tons/year to 30,000 a.d.tons/year. Surplus kraft pulp will be dried and sold. The modernization is designed to reduce effluent volume and contamination overall.

Major components salvaged from Avenor's Gold River newsprint mill in Canada include the chip washing sys-

*Tasman Pulp and Paper's Kawerau mill*

*Chris Bertram, paper division manager for Tasman*

*Cut radiata pine logs*

*One of Tasman's pulp machines*

*One of the mill's control rooms*

tem; presteaming vessels; impregnators; screw conveyors; hydraulic drive systems; cyclones and disc filters;plus six primary, secondary, and reject refiners. Partial use will be made of Gold River's process pumps, in-line instrumentation, electrical switchgear, and HVAC equipment.

Strictly speaking,the new mill will actually produce pressurized refiner mechanical pulp (PRMP) heated to 90°C.The *radiata* pine it uses would discolor if heated to the plus-100°C temperatures of a true TMP, said Alexander P.C. Smith, project manager for the mechanical pulp mill modernization.

Because of differences in North American and New Zealand/Australian electrical and construction standards, some of the equipment from Gold River—such as transformers—simply couldn't be used. Modifications are being made to adapt other equipment so that it will operate using 50 Hz power rather than 60 Hz common to North America, Smith said. In addition, the TMP plant will use thin wall/ID piping consistent with what was used at Gold River, although schedule piping is used throughout other parts of the Tasman mill.

"You really have to go around the decision circle a lot of times to see if you want to do that because you're introducing nonstandard equipment and materials into your mill,and you don't take that decision lightly," Smith said.

The local geology also imposes certain constraints on construction.The ground is largely composed of volcanic ash,which can be very fine, and buildings must conform to strict earthquake codes, Smith noted. An earthquake caused a temporary shutdown at the mill as recently as 1987,he said.

## PRELUDE

Tasman has a history of innovation.During a 1987–1990 mill modernization,a large portion of the 500 tons/day fiber line was "modularized," according to Tony Johnson of Simons Consulting Group in Vancouver, BC,Canada. "Even the continuous digester was built off-site and hydraulically tested, heat treated, and fully equipped before being brought onto site and lifted in place," he said. "It put the project ahead of schedule and budget significantly."

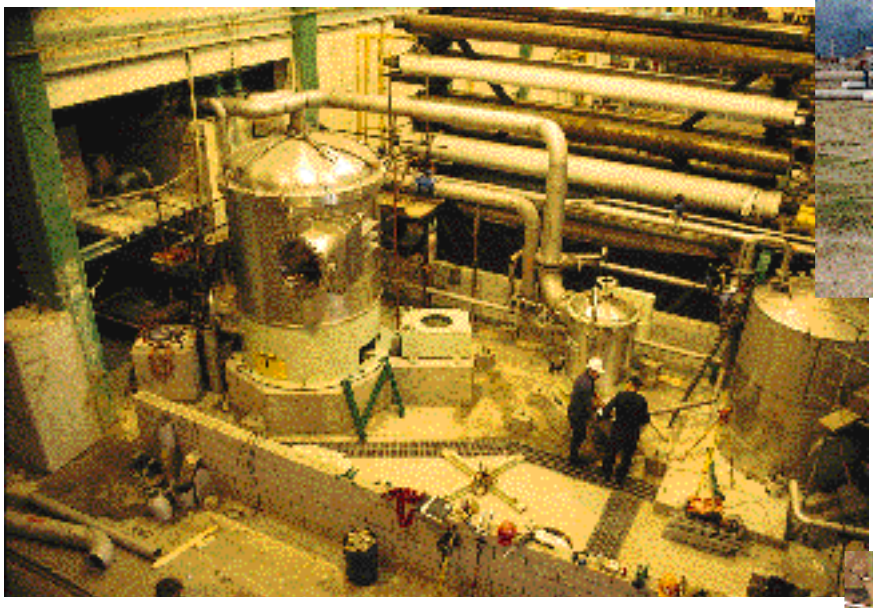
Engineering for the project was provided by H.A.Simons Ltd.

The NZ $200 million (about US$ 138 million) modernization consisted of several major projects:a drum debarking and chipping operation, a chip handling facility, an additional chemical recovery boiler precipitator, a continuous digester and fiber line (including oxygen delignification and enzyme prebleaching), expanded chemical plants, enlarged bleaching operation, replacement pulp dryer, and a new baling line.

The largest module—the 500-ton Kamyr continuous digester—was completed off-site and transported complete with piping, cabling, platforms and instrumentation. It took three days to transport the 55-m-long digester the 55 km from Murupara,where it was assembled. A 44-axle, 352-wheel truck-trailer was used to haul the load,assisted by as many as four other vehicles on the steeper hills. It took five hours to lift it into position using four specially constructed lift towers.

The new dryer was prebuilt on-site in a new warehouse extension. "The existing cutter layboy was braced and removed in one piece and taken away for overhaul," Johnson explained.Meanwhile, the old dryer was cut into three sections and removed in 100-ton sections.The new dryer, weighing 400 tons, was then slid into place and fitted, after which the reconditioned layboy was installed.

*Joe Hotson, technical superintendent*



*Part of the modernization*

*Finished rolls at Tasman*

*One of the mill s geothermal well sites*

Although a four-week shutdown was planned for the dryer replacement, the actual removal and installation only took 16 days.

A complete screening system for the fiber line area, representing three bays of the main building,two floors high, was built,delivered,and slotted in.The main motor control center for the fiber line was built complete in a room that was delivered to the mill and became a part of the main building. Various other modular components were fabricated and at least partially preassembled off-site.

## NEWSPRINT PRODUCTION

Along with approximately 200,000 metric tons of kraft pulp, the Kawerau mill now produces about 415,000 tons/year of newsprint, enhanced brightness newsprint, and telephone directory paper. Most of the paper is delivered to markets in Australia and New Zealand. Included in the production mix is about 20,000 tons/year of high-brightness grades (up to 71 GE).

Over the past few years,newspaper publishing companies in Australia and New Zealand have spent billions of dollars to replace their letterpress printing machines with high-speed offset presses. That has resulted in greater demands for quality and runnability on Kawerau and other newsprint producers down under.

Along with the projects already in progress, Tasman has responded in several ways.

During the past three years, new process control and cross-directional control equipment has been installed on each of the mill's three machines, "from the slice to the reel," noted Chris Bertram,newsprint division manager. "The whole focus on capital expenditure has been improvement in quality," he said.

Earlier this year, the mill installed NZ$ 4.5 million (US$ 3.1 million) screening systems on the three machines to replace what was essentially obsolete equipment, Bertram said. The new screening system has provided better machine runnability and performance and fewer splices,he said.

In response to one local newspaper, the mill changed the type of splice it uses,from iron-on to double-sided.The newspaper uses 1270-mm-diam. reels on a five-year-old press and reports having almost zero breaks using Tasman's paper, Bertram said.Another company, which produces telephone directories, has averaged only about one break in 100 reels, resulting in added value to the customer through reduced production time,he said.

With all the new printing presses being installed, there is increased demand for larger-diameter reels.Consequently, Tasman is installing an NZ$ 18 million (US$ 12.4 million) Jagenberg "Jagfloat" winder on its No. 3 machine,with startup planned for this month.

In other areas, the mill overhauled its electrical systems and underground sewer system as part of a millwide annual maintenance shutdown this past March.The local electrical authority also upgraded the Kawerau substation during the shutdown.A new 2200-kW chipper motor was installed in the woodprep area. Tasman has also announced plans to install new control systems on the No.1 recovery boiler and the No.2 recovery boiler.

Over the past 10 years, from 1986–1995, Tasman has spent NZ$ 53.3 million (about US$ 36.8 million) on a variety of environmental projects. Major projects were designed to reduce odor, gaseous and particulate emissions, and effluent color and organochlorine content. They've succeeded in reducing particulate and odor emissions by 95% each.Mill AOX was brought down by 65%, while discharge water color came down 60%. BOD removal increased by 60%,despite an increase in production,the mill notes.In addition,dioxin in the effluent has been reduced by 54%,to "nondetect"levels and water use has been reduced by 27%.

The most recently announced project will strip odors from effluent. The NZ$ 10 million (about US$ 7 million) project includes a scrubber to improve the efficiency of existing gas collection and incineration systems.

According to company reports, feasibility studies were also being conducted on possibly converting one of Kawerau's newsprint machines to printing and writing grades.

## FOREST RESOURCES

The mill at Kawerau owes its existence, in part, to the depression that hit the country in the 1920s. As a make-work program,and to counter dwindling wood supplies, the New Zealand government began planting the Kaingaroa Forest southeast of Rotorua at that time. By the 1930s it was the largest "man-made" forest in the world. It now comprises about 188,000 hectares of mostly *radiata* pine.

To make use of the resource, Tasman Pulp and Paper Co.Ltd. was formed in 1952. Three years later, its Bay of Plenty mill at Kawerau began producing kraft pulp and newsprint,with one pulp and one paper machine.

For the most part, Tasman uses *Pinus radiata* thinnings,top logs,and mature wood from plantation forests, along with slabwood from sawmills. Pine used for pulpwood is typically ready to harvest at about 25-30 years, with thinnings available at 15 years. Researchers such as R. Paul Kibblewhite, working at the Pulp and Paper Research Organization (PAPRO) of the New Zealand Forest Research Institute in Rotorua,have noted that *radiata* pulp characteristics can differ considerably. The age of the tree at harvest;the longitude,latitude and elevation of the growing site;and the location of the fiber within the tree all influence the characteristics of the wood.

In general, fiber from top logs and whole trees of age less than 20 years will yield low-density pulp of less than 390 kg/m$^3$. Chips from the outer portions of mature trees used for lumber produce medium- to high-density pulps of 390 kg/m$^3$ and greater, with coarser and larger fibers than from younger trees,according to mill reports.

To make use of such differences in fiber characteristics, Tasman's modernization project of the late 1980s enabled the mill to segregate and store chips in three separate piles. A typical division might be a blend of high-density split mature wood chips and medium-density chips in one pile;medium-density chips from top logs in the second pile;and high-density chips from sawmill slabwood in the third pile. As needed, the second, medium-density pile is cleared and replaced with low-density chips from thinnings.

Tasman Forest Industries Ltd.,a subsidiary of Tasman Pulp and Paper, was formed recently to create a plantation resource for the mill.The aim has been to plant 2000 ha of *Eucalyptus nitens* and *E. fastigata* each year on land ranging from the Bay of Plenty down to Lake Taupo. Based on a 10-year rotation, the plantations should provide a sustainable yield of half a million cubic meters of short fiber annually, according to company projections.

"Obviously to have an integrated pulp and paper mill, I think it's a strategic advantage,especially in this part of the world, just [based on] the size of the resource required to maximize the value of this plant," Bertram said.

## STEAM POWER

Along with the forest, the Kawerau mill site was chosen because of another significant resource: geothermal steam. The mill started using geothermal energy for power generation toward the beginning of the 1960s, according to G.W. "Joe" Hotson,technical superintendent for the pulping division.

Initially, there were two main lines from the bore field, a high-pressure and a low-pressure line. The high-pressure line was to produce some of the 10.3-bar process steam for the digesters. The low-pressure line was to produce 3.4-bar steam for the paper machine.

Currently,the mill obtains about 30% of its steam from geothermal taps, though only for 3.4-bar process steam. "Over the years, it's proved to be a reliable source of energy," Hotson said. Total steam flow into the mill from geothermal bores is around 270 tons/hour, he said; it's used for electrical and process steam generation. Geothermal steam that feeds to an 8-MW turbine generator was initially exhausted to the air but now series a pre-evaporator which concentrates the weak black liquor used for process water heating. That's made the unit more efficient, so that only about 30% of the thermal energy is lost.

The process steam generators are simple tube exchangers based on refiner/boiler exchanger designs. The three later models were designed by Weso of the United Kingdom,but the two originals came from Franco Tussie in Italy. They're not quite as productive but have held up well,Hotson said.

The geothermal heat exchangers are all managed from a central control room through a distributed control system installed toward the beginning of the 1990s.The system controls the steam plant as well as the power boiler and turbines. "We have 45-bar steam being generated in the recovery and hog-fired boilers and 3.4-bar being produced from the heat exchangers," Hotson noted. "To control the stability of it we ramp up and down the heat exchangers to maintain the 45-bar main steam header," he said. "So you're sort of punching it up from the bottom to maintain the top."

The mill has also experimented with a replacement for boiler water treatment using geothermal condensate produced in heat exchangers,Hotson noted."The only significant contaminants in the condensed geothermal steam are carbon dioxide, hydrogen sulfide, and ammonia—about 3% by mass. So, with heat exchangers, a certain amount of blow-through is needed. Otherwise the noncondensable gases from the condensing process coat the heat exchanger tube surfaces, in effect becoming an insulator," Hotson explained. The mill controls the heat exchangers now by venting just enough on the geothermal side to get just the amount of steam desired.

In the late 1980s the mill put in a plant to collect all the geothermal condensate previously discharged into the river and processed it to form boiler feed water. The idea at the time was to put the condensate back into the heat exchangers, because the mill didn't have enough demineralizer plants to provide the full amount of water required.So it ended up with a mixture of raw, softened, and demineralized water. Mixes varied all the time, making it difficult to maintain chemical treatment in heat exchangers without causing scaling,Hotson said. "Consequently, to keep any chemical treatment in these heat exchangers at a level that wouldn't cause scaling and so forth was a horrendous job," he said.

The mill got a steady reduction in fuel-oil consumption by improving the quality of feed water to the heat exchangers. That's resulted through a process of flashing the geothermal condensate first and then pumping it through a stripping vessel to remove the carbon dioxide and hydrogen sulfide.

The condensate also contains a certain amount of ammonia, which serves as a conditioner for the feed water;no other condensate treatment is needed. "So over the years it's really paid off, and we're really quite pleased with it," Hotson said.What had been seen as a waste product that was just being dumped is now being used as part of the process,and the whole mill process has benefited.

The geothermal condensate treatment plant can produce about 3600 L/min of boiler feed water. If needed,the mill could almost get by without a demineralizer plant for the recovery and power boilers, using the geothermal condensate recovery for all the make-up and feed water.

## HUMAN RESOURCES

Like most mills,Kawerau has reduced staff as technology has made certain jobs obsolete. About 1200 people now work at the mill. Down the road, Bertram expects that number will drop to about 1050 people.

And like most mills, Kawerau has gone through changes in workplace management styles. In 1993, for example,the mill's paper warehouse department took the first steps in developing self-directed work teams. (The results to date were presented at the 50th Appita Annual General Conference in Auckland, NZ, this past May.) The team approach has eliminated the need for a foreman and reduced in-line supervision. An innovative "portfolio" management system gives individual team members specific areas of responsibility, such as safety and quality.

The mill has initiated an extensive training program,as well. Tasman expects to spend about NZ$ 5 million (US$ 3.5 million) on training and development during 1996. The company has published a 120-page training and education catalog for employees that describes the available courses and lists training manuals,videos,and computer-based learning programs employees can use.

"Tasman Pulp & Paper believes that well planned and targeted training is an investment and not an expense," the catalog states. "For Tasman,it comes down to a basic matter of survival.We know, by looking around the world, that our survival will in the long term depend on our ability to change, and this in part depends on our ability to learn quickly."

The training system is designed so that:

- All training is carried out according to agreed training plans which are linked to business plans and therefore "add value."
- Internal customers get a reliable and quality training service.
- Tasman Pulp and Paper establishes relationships with preferred training suppliers to regulate the quality of training.
- Training inputs are measured.
- Correct budgets are allocated and costs contained. **TJ**

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*Meadows is editor of* TAPPI JOURNAL.

# TASMAN KAWERAU PULP AND PAPER MILL EQUIPMENT AND CAPACITIES—1995

**KRAFT MILL**

**No. 2 fiber line**

| | |
|---|---|
| Digester | Kamyr single vessel hydraulic 500 tons/day design capacity |
| Washing | Single stage atmospheric diffuser |
| Screening | Pressure knotter followed by three-stage open screen room |
| Pulp recipient | a) No.1 bleach plant for newsprint @ 250 tons/day<br>b) No.1 pulp machine @ 200 tons/day unbleached |

**No. 3 fiber line**

| | |
|---|---|
| Digester | Single vessel hydraulic,500 tons/day design capacity |
| Screening | Pressure knotter followed by three-stage pressure screens |
| Oxygen delignification | Kamyr—medium consistency |
| Washing | Pre-oxygen—pressure filter<br>Post-oxygen—pressure diffuser followed by wash press |
| Pulp recipient | No.2 bleach plant for market pulp |

**No. 1 bleach plant**

| | |
|---|---|
| Sequence | Two-stage hypo (HH) |
| Capacity | 300 tons/day |
| Brightness | 56–65 (newsprint) |

**No. 2 bleach plant**

| | |
|---|---|
| Sequence | OD C EoD Dn D |
| Capacity | 500 tons/day |
| Brightness | 86+ ISO |
| *Modernized in 1990* | |

**No. 1 pulp machine**

| | |
|---|---|
| Capacity | 200 tons/day (unbleached) |
| Maximum speed | 36 m/min |
| Width | 3.05 m |

**No. 2 pulp machine**

| | |
|---|---|
| Capacity | 500 tons/day (bleached) |
| Maximum speed | 48 m/min |
| Width | 3.81 m |
| | *New dryer in 1989* |

**Baling lines** Two parallel

**No. 1 lime kiln**

| | |
|---|---|
| Capacity | 60 tons/day burnt lime |
| Dimensions | 50 m long,2.5 m diam. |
| Installed | 1954 |

**No. 2 lime kiln**

| | |
|---|---|
| Capacity | 170 tons/day burnt lime |
| Dimensions | 75 m long,3.0 m diam. |
| Installed | 1974 |

## POWER AND STEAM

**Power boilers**

| | |
|---|---|
| Fuel | Wood waste |
| Installed | 1963 and 1977 |
| Capacities | No.2—68,000 kg/m/h steam |
| | No.3—79,000 kg/m/h steam |
| Standby | One oil-fired |

*Precipitators installed in 1992*

**Recovery boilers**

| | |
|---|---|
| Capacities | No.1—225 tons/day pulp equivalent |
| | No.2—800 tons/day pulp equivalent |
| Installed | 1955 (No.1) and 1968 (No.2) |

**Turbines**

| | |
|---|---|
| Power | No.1 (1955)—12.5 MW |
| | No.2A (1975)—18.7 MW |
| | No.3 (1963)—8.0 MW (geothermal steam) |

## PAPER MACHINES

Wire width for all three machines—7.2 m

| | |
|---|---|
| **No. 1** | Installed 1954 |
| | Modernized to twin wire July 1990 |
| Maximum speed | 925 m/min |
| Daily tonnage | 360 tons (48.8 g/m$^2$ standard newsprint) |
| | *Also produces lightweight directory paper and newsprint* |
| **No. 2** | Installed 1962 |
| | Modernized to twin wire 1988 |
| Maximum speed | 980 m/min |
| Daily tonnage | 400 tons (48.8 g/m$^2$ standard newsprint) |
| | *Also produces high-brightness and lightweight newsprint* |
| **No. 3** | Installed 1975 |
| | Modernized to twin wire 1985 |
| Maximum speed | 1075 m/min |
| Daily tonnage | 445 tons (48.8 g/m$^2$ standard newsprint) |
| | *Also produces lightweight newsprint* |

**Finishing line**

| | |
|---|---|
| Production | 2200 customer reels/day average |
| | 2550 reels/day maximum |
| Reel diameter | 1.145 m maximum |
| Labelling | Automated |

**Effluent treatment**

| | |
|---|---|
| Primary | Clarifier, solids dewatering to land fill |
| Seconary | via aerated lagoons |
| Retention | 5–7 days |
| BOD removal | 90% |