

# The pulp and paper industry turns to duplex



The pulp and paper business is a huge consumer of stainless steel. Demand for paper and packaging is rising, which is good news for stainless steel suppliers - but factors such as the nickel shortage and the need to reduce emissions are affecting patterns of consumption. Stainless Steel investigates.

*By James Chater*

## **Introductory**

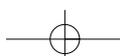
Civilisation has an ambivalent attitude towards paper. On the one hand, it is the medium of many of the finest things in life, such as poetry and watercolours; also, we rely on it to write letters, jot down telephone messages and compile shopping lists. On the other hand, paper is often associated with bureaucracy and

red tape: "paperwork" has become a dirty word. Also, paper-making is seen as environmentally unfriendly, consuming trees, energy and water in large quantities.

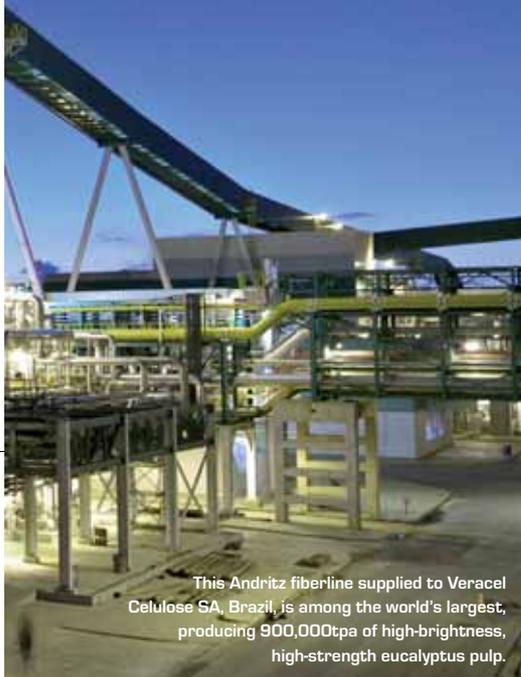
## **Growing demand**

And demand for the stuff is growing. In 1980, at the start of the IT revolution, world demand for paper

stood at 170 million tons; in 2010, according to SPG Media, it will have risen to about 401 million tons; and by 2015 it will have reached 453 million tons ([www.allbusiness.com](http://www.allbusiness.com)). It seems that the advent of computers has spurred demand rather than reduced it, and that expectations of the "paperless society" have proved unfounded. The market is growing



# Industry



This Andritz fiberline supplied to Veracel Celulose SA, Brazil, is among the world's largest, producing 900,000tpa of high-brightness, high-strength eucalyptus pulp.

ects for new pulp mills and capacity additions [for 2006] continued to be focused in the southern hemisphere (South America, South Africa, Australia, and Southeast Asia) and China," whereas in Europe and North America the focus is on modernisation and refurbishment of existing mills (<http://reports.andritz.com>). In 2006 China achieved an astonishing growth rate: in Shanghai, for instance, paper production increased 14 per cent in 2006 alone. The country's packaging industry is now the largest in the world after the USA and Japan ([www.researchandmarkets.com](http://www.researchandmarkets.com)).

Recently, South America has emerged as a major global player in the forestry, paper and packaging industries. PricewaterhouseCoopers predicts that five of the top 10 pulp producers will be based in South America by 2011, compared with just two at the end of 2006. Chile, Argentina, Columbia, and Uruguay are all active in the pulp and paper sector, but the dominant player is Brazil. Here the world's largest pulp mill is being built at Três Lagoas in the state of Mato Grosso do Sul; Andritz and Metso Paper, both of whom have built a global presence in pulp and paper refurbishments and newbuilds, are among the contractors (see table).

In Europe, pulp and paper makers are under considerable pressure to

improve efficiency and cut costs. According to Frost & Sullivan Research Analyst Ambika Kolangarakath, growth in the European ACS (automation and control systems) market will mainly be driven by "the growing need to improve the efficiency of existing pulp- and paper-making processes for better profitability." The drive to replace obsolete technology has led to a number of refurbishments, especially in Finland and Sweden, but also in France, Spain, Portugal, UK, Germany and Poland. In North America, paper and paperboard capacity actually declined by an average yearly rate of 0.7 per cent between 2000 and 2006, though a small increase is expected for the period 2007-9. Here, as in Europe, efficiency and cost considerations have led to several refurbishments being announced of mills in the USA and Canada, while Kimberly-Clark has announced a USD 350 million investment for Mexico for the period 2007-8.

## Stainless steel use

Lena Wegrelius of Outokumpu has estimated that a large pulp and paper complex can use up to 10,000 tons of stainless steel ("LDX 2101® Steals the Show", [www.outokumpu.com](http://www.outokumpu.com)). A wide variety of alloys are used in many phases of the manufacturing process, including the cooking (sulphate digesters),

at the undramatic but steady rate of around 2.1 per cent a year ([www.paperage.com](http://www.paperage.com)). World demand for paper and board grew by 3.3 per cent in 2006, driven by strength in Asia, Eastern Europe and Latin America ([www.risiinfo.com](http://www.risiinfo.com)). One of the chief areas of growth is packaging, driven by increasing demand for "fancy" foods, especially dairy products ([www.tappi.org](http://www.tappi.org)).

## Project trends

Production is gradually moving away from the traditional paper-producing countries like North America, Western Europe and Japan towards low-cost developing countries where demand is growing fastest, such as Russia, India and China. According to Andritz, "proj-



Paper machine, Oulu Mill, Finland. Source : Stora Enso.

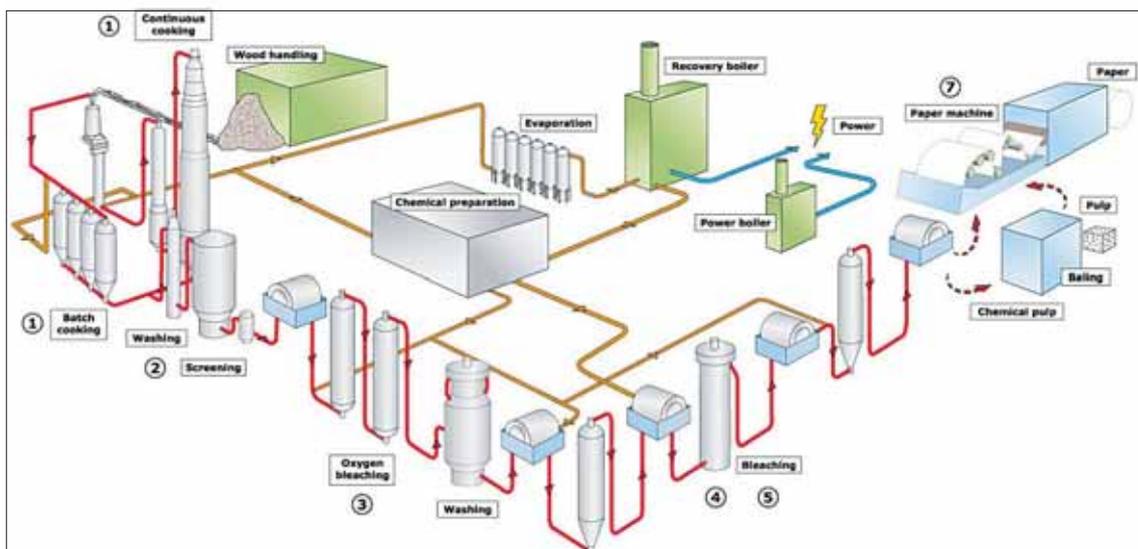


Diagram showing where stainless steel is used in the pulp and paper industry. Source: Outokumpu.

washing and screening, bleaching, chemical recovery, pulp recycling and paper machines. In sulphate digesters and at the washing and screening stages, closed systems have been adopted to reduce emissions, making conditions more aggressive. There has therefore been a shift away from unalloyed steel towards stainless (316L or duplex in the first case; 304L or 316L in the second). In the  $\text{Cl}_2$  and  $\text{ClO}_2$  bleaching stages too, the high-molybdenum austenitic 254 SMO® was introduced to solve the corrosion problems caused by closed process systems; depending on the circumstances, duplex SAF 2507 or 2205 can provide a good al-



Voith Paper's newly developed grooved stainless steel roll cover, the G-Flex, suitable for any type of press rolls. This new cover is already in use at the PM2 paper machine at Holmen Paper, Madrid, Spain.

ternative. Another place where stainless (austenitic or duplex) has replaced carbon steel is the liquor tanks used in chemical recovery, again because of corrosion leading to high maintenance.

### Pumps

Process pumps are an essential part of the paper-making process, and it is therefore no surprise that pump manufacturers are intensely interested in special metals as a means to combat both corrosion and erosion. For instance, the Goulds Model 3175, standard in the industry, is available in cast iron or 316 stainless, or in any machinable alloy including 317, 317L, 316L, Alloy 20, CD4MCu, 904L, 254 SMO®, titanium and Hastelloy B&C. Flowserve, which offers a wide range of pumps for the pulp and paper industry, has been at the forefront of alloy development. Among the alloys it has used are Alloy 20 (CN7M), a highly corrosion-resistant austenitic; X-Cavalloy, a proprietary cavitation-resistant material; Durcomet 100 (CD4MCuN), the first duplex stainless steel; and DC8, a proprietary cobalt-based alloy. Flowserve also designed the industry's first epoxy pump and the first fully PTFE-lined pump.



Metso Paper's continuous digester, installed in a plant in Brazil. Duplex materials are typically used in pulp mill fibre lines and particularly in pressurised vessels in cooking and oxygen delignification systems etc. Normally the material used in such digester systems is EN 1.4462, which is equivalent to North American S3 2205 standard. Source: Metso Paper.



The hydrogen peroxide reactor under construction at Smurfit Kappa Kraftliner Piteå in Sweden at the end of August 2006 is the first industrial pressure vessel built out of LDX 2101®.

### Duplex on the rise

Austenitics are probably still the most commonly used alloys in the pulp and paper industry, but this could change if the price of nickel and molybdenum remains high. Duplex was first used in the industry in 1988 in kraft digesters in a New Zealand plant. Today, duplex is being used in digesters for cooking chips and reactors used in the oxygen delignification and bleaching processes. It is also finding increasing use in the all kinds of process equipment. In a fiercely competitive industry, cost-cutting is imperative. Duplex offers a high strength-to-weight ratio and wall reduction of 50 per cent compared to carbon steel and 35 per cent compared to clad steel, so it is no surprise that paper mills are seeking to cut costs by replacing austenitics by duplex

grades in a number of applications. For instance, in the sulphate process, 316L is widely used, but duplex grades 2205, LDX 2101 and 2304 provide greater corrosion resistance. In the washing and screening processes, the superior surface hardness of duplex 2304, 2205 and LDX 2101 can reduce maintenance costs. Duplex 2205 and 2304 are the most popular material for oxygen reactors because of the protection they afford against external stress corrosion cracking (SCC). Duplex grades are also finding increasing use in chemical recovery, mechanical and recycled pulp processing and in the head boxes and suction roll shells of paper machines. 2205 is popular for batch and continuous digesters, and also suitable for oxygen delignification and pressurised peroxide reactors.

Outokumpu's LDX 2101 is highly resistant to SCC, pitting and crevice corrosion. It is used in paper machines (in the head boxes and in the frames and lining as an alternative to cladding). It is corrosion-resistant in alkaline environments, so can be used in the alkaline section of kraft mills. Also, its high strength (similar to 2205) makes it suitable for hollow sections and for railings, walkways, stanchions and stairs.

### Repair and maintenance in pulp mills

By Peter Fetchko,  
JVD Installations Inc.

I am responsible for QA/QC, pulp mill maintenance and boiler repair at JVD Installations Inc. My day-to-day work is divided between four mills, where I carry out boiler repair, paper machine maintenance, lime kiln repair, and installations of new or upgraded plant. We cover civil and mechanical engineering, piping and boiler-making, and we are progressing towards electrical.

My involvement with stainless steel and CRAs consists mainly in welding training tests, devising work plans and developing procedures. I enjoy trying out new materials and getting into the mechanics of machinery. However, it is not easy to convince the engineers in our client companies to adopt new materials and new systems, such as robotics. There is resistance, especially among the older generation. But as a repair company, we are responsible for the success of any component or design change: if it fails, we bought it.

316L and duplex are the CRAs of choice in pulp mills. They are used in pulp slurry systems, black liquor tanks, digesters and so on. The re-engineering of older systems (dating back 20 years or more) poses special problems because of the defects in the piping, which are prone to significant amounts of corrosion and embrittlement. Aging digesters are a particular problem.

## Recent project news

Date announced	Description	Capacity	Completion	Operators/Owners	Contractors and suppliers
<b>N. AMERICA</b>					
1/2007	Paper machine conversion at Pensacola, Fla., USA	From 350,000tpy to 500,000tpy		International Paper	
1/2007	Kimberly-Clark de Mexico announces it will invest USD 350 million in the next two years			Kimberly-Clark de Mexico	
1/2007	New coater and machine upgrade at mill in West Carrollton, Ohio, USA		Complete mid-2008	Appleton	
1/2007	Rebuild of paper machine for coreboard production at Wisconsin Rapids, Wis., USA		2008/Q1	Stora Enso	Pöyry Forest Industry
2/2007	Deinking plant at pulp mill in Trois-Rivieres, Quebec, Canada	Rebuilt to 342,000tpy		Kruger	
3/2007	Deinking line in mill in Memphis, TN, USA			Cascades Tissue	
3/2007	Tissue machine at mill Barton, Ala., USA		Start-up summer 2008	SCA Tissue North America	
4/2007	Linerboard machine rebuild at packaging and newsprint mill in DeRidder, Louisiana, USA		Start-up March 2008	Boise Cascade	Metso Paper
7/2007	Second tissue machine at mill Barton, Ala., USA	Increase from 100,000 to 170,000tpy	Start-up summer 2008	SCA Tissue North America	Andritz
<b>S. AMERICA</b>					
3/2007	Specialty paper production JV at the Jacarei mill, near São Paulo, Brazil	110,000tpy		Ahlstrom and Votorantim Celulose e Papel	
6/2007	World's largest pulp mill to be built at Três Lagoas in Mato Grosso do Sul state, Brazil	1,250,000tpy	Start-up scheduled for first half of 2009	Chamflora (subsidiary of International Paper Co.)	Contractor: Pöyry Empreendimentos Industriais; subcontractors: Andritz Group (fibrelines, pulp drying/baling plant, white liquor plant); Metso Paper (recovery boiler, evaporation plant, power boiler); Eka Chemicals (part of Akzo Nobel (supply, storage and handling of chemicals))
7/2007	TMP 3 system for Pisa mill in Brazil	665tpd	Start-up 2009/Q1	Norske Skog	Andritz
7/2007	Pulp line for processing OCC at Barbosa plant near Medellin, province of Antioquia, Columbia	50tpd	Start-up 1/2008	Papelsa (subsidiary of Smurfit Kappa)	Andritz
<b>EUROPE</b>					
1/2007	Rebuild of paper machine at Varkaus mill in Finland			Stora Enso	Metso Paper
2/2007	New tissue machine at mill in Hernani Guipuzcoa, Spain	70 tpd	Start-up 8/2007	Celulosas de Hernani	Toscotec
2/2007	Thermo-mechanical pulping line for mill in Braviken, Sweden		To be commissioned spring 2008	Holmen Paper	Metso Paper
3/2007	Tissue machine rebuild at Edet Mill in Lilla Edet, Sweden		Start-up 11/2007	SCA Hygiene Products	Metso Paper
3/2007	Offset printed micro-flute packaging plant in Komarom, Hungary		Completion 2008/Q3	Stora Enso	
3/2007	Corrugated box production facility in Lodz, Poland		Completion 2008/Q1	Stora Enso	
5/2007	PM1 newsprint line for mill in Teesside, UK		Start-up 2009/Q1	Ecco Development	Metso Paper
5/2007	Expansion of Veitsiluoto Mill in Finland	Expansion by 140,000tpy to 510,000tpy	Complete 2008	Stora Enso	
5/2007	Recovery, and pulp drying systems for mill in Navia, Asturias, Spain		Start-up late 2008	Celulosas de Asturias	Andritz Group
5/2007	Modernisation and expansion of mill in Figueira da Foz, Portugal	Increase to 550,000tpy	Start-up 2009/Q4	Celulose Beira Industrial (Celbi - owned by Altri Group)	Andritz Group; Groupe Laperriere & Verrault
6/2007	Production line at its Chapelle Darblay mill in Grand-Couronne, France	250,000tpy	Start-up 1/2008	UPM	
6/2007	New service centre in Spain			JV between Metso Paper and SAICA (S.A. Industrias Celulosa Aragonesa)	
6/2007	3 sludge dewatering lines for mill in Eltmann, Germany		Operational end of 2007	Papierfabrik Palm	Andritz
6/2007	Wet-end rebuild in Sweden			Billerud Gruvön	Metso Paper
6/2007	Upgrade of two board machines and the chemi-thermomechanical pulping (CTMP) plant at Fors Mill, Sweden		Complete 1/2009	Stora Enso	
7/2007	Metso expanding its production premises in Lapua, Finland		Ready beginning of 2008		Metso Paper
7/2007	Corrugated board plant outside Nantes, France		Operational 2009	SCA	
7/2007	Upgrade of board manufacturing at Imatra mills in Finland	Increase from 240,000 to 250,000 tpy	Complete 9/2008	Stora Enso	
<b>CIS</b>					
3/2007	Offset printed micro-flute packaging plant in Balabanovo, Russia		Completion 2008/Q2		
4/2007	Tissue machine rebuild at Naberezhniye Chelny Paper Mill, Naberezhniye Chelny, Russia		Start-up 2008/Q1	Naberezhniye Chelny	Metso Paper
5/2007	Tissue machine rebuild in mill in Naberezhniye Chelny, Russia		Start-up 2008/Q4	Naberezhniye Chelny Paper Mill	Metso Paper
6/2007	Rebuild of production line for extensible sack kraft paper in Segezha, Russian Karelia		Start-up early summer 2008	JSC Segezha Pulp and Paper Mill	Metso Paper
7/2007	Pre-feasibility study for pulp and paper mill in in Nizhny Novgorod, Russia			Stora Enso	
<b>ASIA - CHINA</b>					
1/2007	Stock preparation system to produce linerboard from recycled corrugated containers in Haiyan, Zhejiang province	1,200tpd		Zhejiang Ji'an Paper and Package	Black Clawson (subsidiary of Kadant)
1/2007	Packaging board capacity added at mill in Surat, State of Gujarat, India			JK Paper Ltd	
1/2007	Expansion at mill in Village Barbhodhan, Gujarathas, India	From 132,000tpy to 332,000tpy		Rama Newsprint and Papers Ltd	
1/2007	OptiConcept papermaking line for mill in Japan	More than 400,000tpy	Start-up in late 2008		Metso Paper
2/2007	Paperboard machine rebuild at Ningbo mill in Zhejiang Province, China			APP Ningbo Zhonghua Paper Co.	Voith Paper
2/2007	Particleboard line in Sakai, Osaka, Japan	250,000cum py	Start-up in 2008	Japan Novopan Industrial	Metso Panelboard
3/2007	Coated board line for mill in Yanzhou, Shandong province	400,000tpy	2008/Q2	Shandong International Paper & Sun Coated Paperboard Co.	Metso Paper
5/2007	Land acquired for future mill at Beihai City, Guangxi			Stora Enso	
5/2007	Four new paper machines for Dongguan mill		Complete 2009	Nine Dragons Paper Co.	Voith Paper
5/2007	Metso Paper opens second service center in China, in Guangzhou, Guangdong province		Operational 2008		
5/2007	Kraftliner board machine for new mill near Ho Chi Minh City, Vietnam	400,000tpy	Start-up 6/2008	Lee & Man Paper Co.	
6/2007	Deinking line in Tirunelveli, southern Tamil Nadu, India		Start-up mid-2008	Subburaj Papers Private	Metso Paper
6/2007	Lightweight-coated papermaking line in Puyang city, Henan province		2009/Q1	Henan Puyang Longfeng Paper	Metso Paper
6/2007	Packaging paper machine for mill at Tangshan, Hebei Province, China	400,000tpy	Start-up late 2008	Hebei Yongxin Paper Co.	Andritz
7/2007	Tissue machine for mill in Dammam, Eastern Province, Saudi-Arabia	+60,000tpy	Start-up 2008/Q4	Saudi Paper Manufacturing Co.	Metso Paper

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