



# New HYBRID™ technology saves more than \$700,000 annually at Gypsum Liner Mill



## MILL OVERVIEW:

Paper Grade:	Gypsum Liner
Machine Type:	4-ply Fourdrinier
System pH:	6.8-7.5
Production:	220,000 tons/year
Machine Speed:	650-750 m/min
Basis Weight:	160-190 gsm
Furnish:	100% OCC/DIP for Top ply, 100% OCC for others
Filler:	No
Retention System:	Co-mixing new HYBRID 61610 with Nalco Water Core Shell™ 01PF067 to post screen through PARETO™ Mixing Technology

## CUSTOMER IMPACT



## ECONOMIC RESULTS

Reduce BOD/COD due to cleaner white water



Annualized saving of US\$17,000 per year in reduction of wastewater volume and water treatment cost per ton

Annualized CO<sub>2</sub> emissions reduction per year of over 11,600 tons, due to save 4,488 tons coal for steam production



Annualized saving of US\$58,000 per year in carbon emission cost (price of carbon emission at US\$ 5/ton)

Annualized steam saving per year of over 29,900 tons



Annualized saving of US\$957,000 per year in steam cost

*eROI is our exponential value: the combined outcomes of improved performance, operational efficiency and sustainable impact delivered through our services and programs.*

## BUSINESS SITUATION

Today's gypsum liner paper machines face many challenges due to the presence of more local recycled raw materials in the furnish, higher ash and closer water recycled system, which brings more anionic trash and high conductivity in the wet end. Good retention and drainage controllability is more difficult to achieve for high shear force to break flocs, strong drainage suction and low reactivity between fibers, fines and chemicals under this challenging wet-end condition.

After using more locally recycled raw materials and increasing machine speed, the customer wanted to improve drainage (vacuum and press section) in order to improve dryness out of the 3rd press nip by creating a bigger slice opening that allowed better formation and retention improvement for stable sizing and ASA usage.

## BACKGROUND

The mill produced 160-190 g/m<sup>2</sup> gypsum liner, typically for 170 g/m<sup>2</sup> grade, at a speed of 740 m/min with a production of 680 tons/day. The machine has four plies, and used OCC/DIP furnish for the top layer and OCC for other layers. The gypsum linerboard machine had limited drainage capacity in the vacuum and press section. The wire load in the filler ply was unstable and ran at a very high level if freeness varied from raw materials. The dry line in the forming wire of the filler ply was long and limited the slice opening.

The dryness out of the 3rd press nip was low at 43%, which caused pick-up difficulty from the 3rd press roll to the 1st dryer group, frequent breaks and high steam consumption at the dryer section. The machine speed was also limited by steam pressure, especially producing high grammage grade. The mill also wanted to improve retention to ensure stable ASA usage.

The previous RDF program used a single flocculant program, which, when increased to 800-1,000 ppm, worsened the vacuum and press drainage.

## ANALYSIS OF BUSINESS SITUATION

### Key Drivers

- Reduce total cost of operations (TCO)
- Improve machine runnability
- Improve quality properties (formation)

### Challenge/Opportunity

- Improve drainage in both vacuum and press sections
  - Being able to adjust slice opening
- Steam saving
- Stabilize sizing by better fiber and fines retention

## PROGRAM DESIGN

New HYBRID technology was introduced to the machine as the second component of the RDF program in order to improve the drainage in both on vacuum and press, co-mixing with Nalco Water Core Shell 01PF067 to post screen with PARETO Mixing Technology. The HYBRID chemistry is designed to make proper flocs size and attain shear force resistance/re-flocculation abilities and open structure flocs to improve retention and drainage without sacrifice on formation, by combining with the flocculant in a dual polymers or triple polymers program.

A lab evaluation for overview RDF chemicals was conducted, and the results indicated that co-mixing new HYBRID and Core Shell could achieve the best vacuum drainage and retention.

## KEY PERFORMANCE INDICATORS

All factors related with drainage, retention, final sheet quality and machine runnabilities were monitored. These KPIs included:

- Vacuum of Forming Wire (kPa)
- Dry Line Position of Forming Wires
- Steam Pressure of pre Size Press (kPa)
- Slice Opening (mm)
- White Water Consistency (%)
- Headbox Consistency (%)
- First Pass Retention (%)
- Sheet Formation
- Sheet Ash Levels (%)
- Wet-End Breaks (#/day)

## RESULTS

A 2-day trial was run to evaluate program performance. With the new HYBRID program, Nalco Water helped the customer achieve the following improvements:

### Retention improvement

Layer	FPR %		Program Comparison Single vs. Dual Components
	01PF067 @600 ppm	01PF067 @550 ppm + 61610 @300 ppm	
Top	61.6%	69.0%	+12%
Under Top	62.1%	68.6%	+10%
Filler	69.7%	78.9%	+13%
Back	67.6%	71.3%	+5%

### WW% reduction

Layer	WW %		Program Comparison Single vs. Dual Components
	01PF067 @600 ppm	01PF067 @550 ppm + 61610 @300 ppm	
Top	0.17%	0.13%	-24%
Under Top	0.20%	0.15%	-25%
Filler	0.22%	0.13%	-41%
Back	0.19%	0.14%	-26%

### Drainage improvement

New HYBRID trial results at steam pressure of pre-size press, reduced from 493 kPa to 450 kPa (reduced by 8.7%)

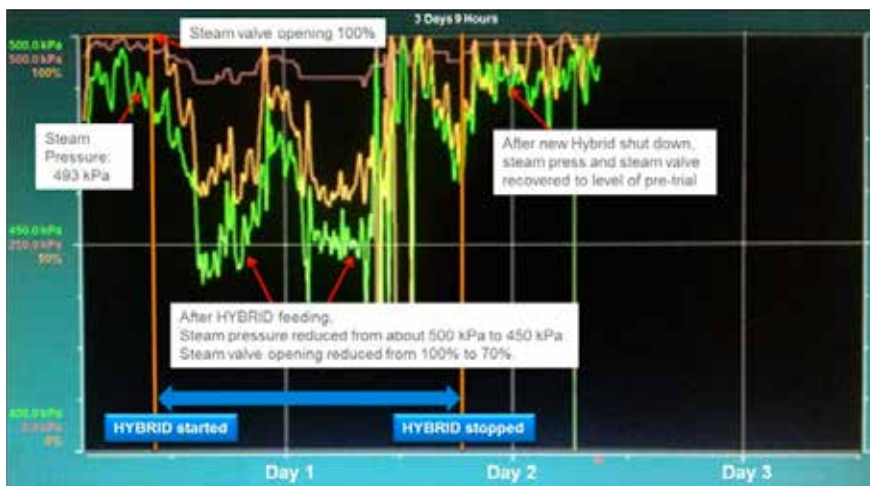


Figure 1 - HYBRID trial results at steam pressure of pre size press

The New HYBRID trial results at vacuum of filler ply wire section, reduced from -35 kPa to -27kPa (reduced by 22.9%)

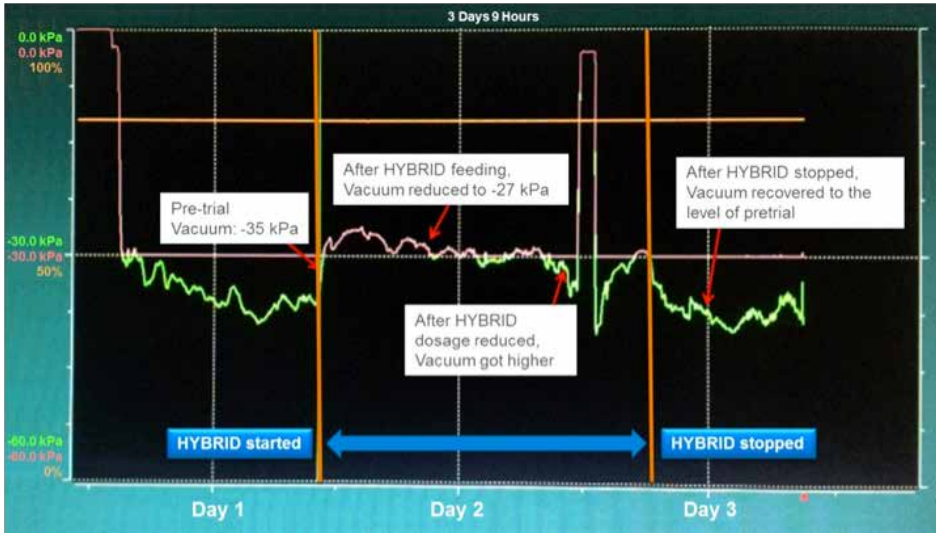


Figure 2 - HYBRID trial results at vacuum of filler ply wire section

**eROI**

Steam saving (US\$4.35/ton of paper x 220,000 TPY)	+	US\$ 957,000/Y
Reduced wastewater volume and treatment cost	+	US\$ 17,000/Y
11,600 Ton of CO <sub>2</sub> Prevented to be released cost	+	US\$ 58,000/Y
RDF program cost increase	-	US\$ 316,800/Y
<b>Net profit to customer</b>		<b>US\$715,200/Y</b>

**CONCLUSIONS**

New HYBRID technology helped the customer gained at least US\$957,000 annual savings on steam consumption. Retention was also significantly improved, which was a benefit to stabilized sizing and ASA usage, less COD/BOD and chemical consumption of wastewater treatment.

Vacuum and press drainage improvement also provided the following opportunities to optimize runnability and final sheet formation:

- Shorter dry line of filler ply in forming wire, which allowed an increase of the slice opening to get HB consistency down for better formation
- Electric power saving and longer work life for forming wire from lower driving load for the wire
- Stronger wet sheet with higher dryness out press section, which would promote less breakage

New HYBRID technology achieved great success for this gypsum customer. As a result the technology was expanded to two other gypsum linerboard machines immediately in China in 2013, which experienced similar cost and performance benefits.

Through many machine trials and commercialized applications, new HYBRID technology has been proven to maximize retention and drainage performance and reduce total operating cost and environmental impact, especially in newsprint, board and packaging, and fine paper featured by mechanical and DIP fiber at a high ash level.

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