

## Wet end control project leads to cost savings

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### 1. Introduction of Duropack Belisce

Duropack Belisce in Croatia produces high quality testliner and corrugated paper with a basis weight of 90 to 200 g/m<sup>2</sup>. PM2 has seen some major rebuilt in 2013 since Duropack's ownership in 2010. Certain grades at PM2 are produced without surface starch. Due to this it is very important to keep a healthy balance between water consumption and chemical usage. Functional wet end chemicals are of high importance in order to achieve the required paper properties.

### 2. General market situation in corrugated packaging

The current market situation for production of packaging paper in Europe is promising. In some Eastern Europe regions the overall production growth rates in percent are even in a two digit range. Due to this former printing paper machines are converting to board which will increase competition in packaging grades. Not only has the market demand increased and herewith the production volume but also customer requirements. What nowadays is known as "Performance Packaging" reveals itself as a comprehensive challenge to the papermaker.

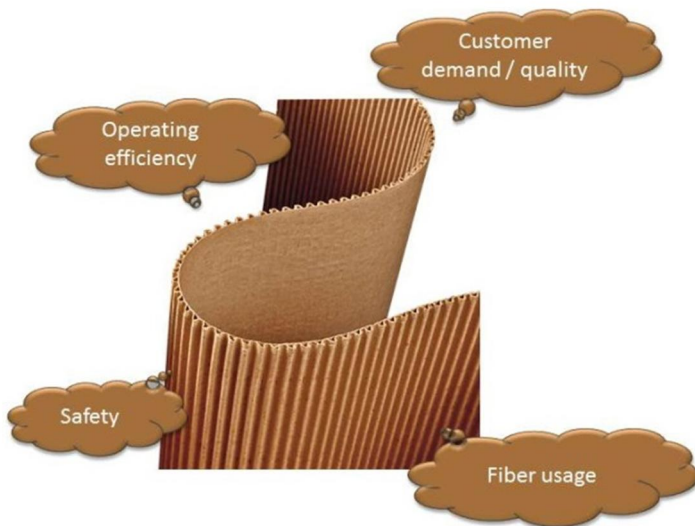


Fig 1: Corrugated paper production challenges

Figure 1 and Figure 2 describe the major challenges of today's testliner and fluting production. The key questions behind these challenges are: Which product will meet customer satisfaction? How can this product be manufactured with lowest costs of operation?



In general, these comprehensive tasks can be divided in four areas:

- **Fiber usage:**  
The trend towards lower basis weights continues. This enables lower weight packaging but requires improvement in sheet strength. A reduction of basis weight variability becomes more crucial. On the other hand raw material availability is getting more difficult and quality is getting worse. Where ten years ago OCC had a maximum of 10 % ash content today corrugated board machines need to operate at ash contents from 15 % to 25 %.
- **Customer demand/quality:**  
Expectations are rising. This includes various cross direction parameters as well as printability demands. Therefore the importance of optimized formation, limited amount of dots and a smooth surface for printing is increasing.
- **Operating efficiency:**  
Breaks need to be limited by improving strength and avoiding deposits. Chemical costs per ton need to be optimized.
- **Safety:**  
Always needs to be addressed in regard to sample taking, housekeeping and handling of operators.

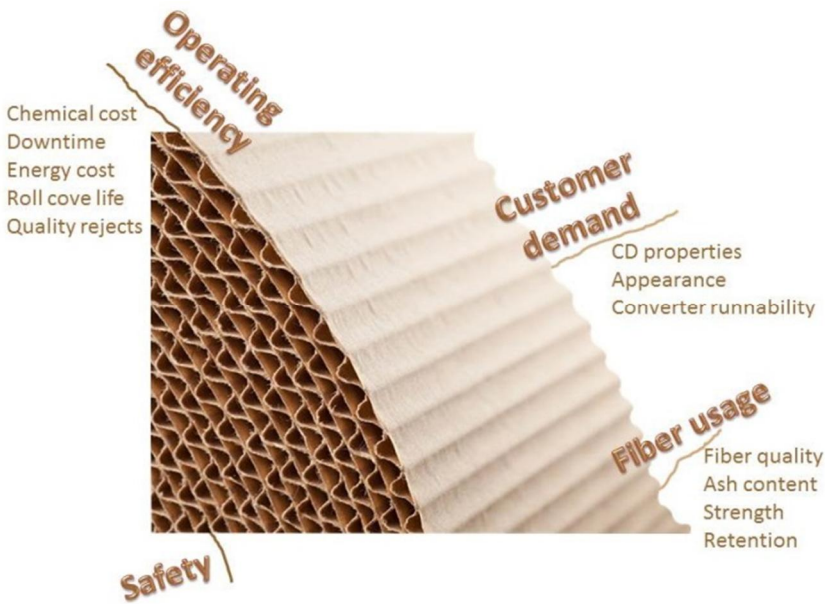


Fig 2: Corrugated paper production challenges



### 3. Challenges and resources

For most paper machines producing printing paper grades, wet end optimization is state of the art. Since years, process engineers have been involved in chemical trials with a solid support from chemical suppliers and measuring equipment showing the most critical process parameters. Many chemicals like retention aid, fixing agents and defoamers have been applied in closed loop control applying appropriate measuring technology. This is not true for packaging grades where this technology is not widely spread yet, however the following reasons might change this:

- New market demands in regard to chemical cost reduction and paper quality increase
- Multilayer paper machines
- Limited resources and know-how

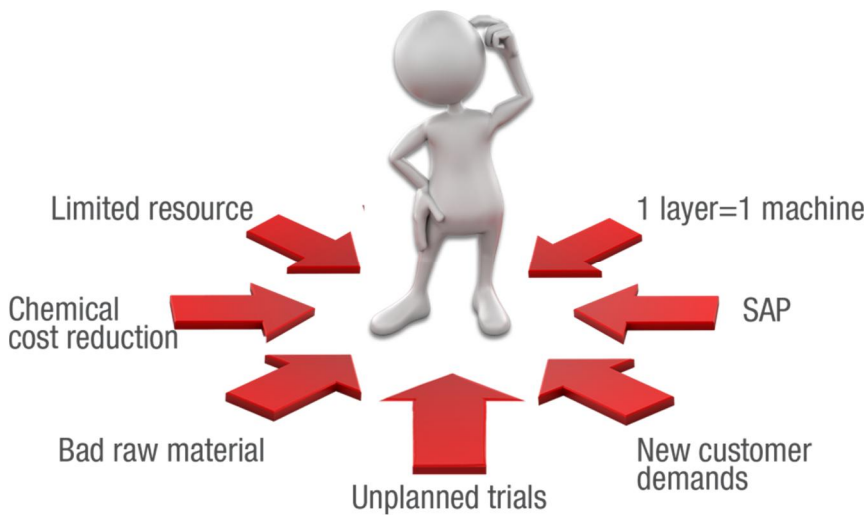


Fig 3: Scarcity of human resources

The demands for surface quality have changed drastically. Today, corrugated material is not only packaging but also advertising surface. Consequently the use of dyes, pigments and the need for improved formation is creating new challenges.

Typically, corrugated paper machines run with two to four layers. Every layer behaves in its own way and needs to be regarded as one paper machine. Every layer has a special demand and is matched with a specific layout of the machine and also of the chemical dosages. This said, each layer requires as much attention as a single paper machine.

Process engineers are occupied with routine tasks whereas the demand for targeted actions is heavily increasing.

Board producers need to extend their knowledge but also require tools to control the process to cope with the changed situation and this is where BTG could fill the gap.

#### 4. BTG solution approach

Beginning of 2014, project “RODA” has been started with an intended runtime of six months. The project is led by an interdisciplinary team including BTG and Duropack Belisce personnel. The defined project goals were increased production and enhanced chemical efficiency. This should be achieved by reducing breaks through increasing initial web strength, raising the speed of the paper machine by controlled chemical additives and saving chemical consumption costs per ton.

CSF	Strategy	Tactics	Outcome
Increase production	<ol style="list-style-type: none"> <li>1. Reduce breaks by increase of initial wet web strength</li> <li>2. Increase speed by controlled chemical addition</li> </ol>	<ol style="list-style-type: none"> <li>1. BW control optimization</li> <li>2. Implementation of Retention/Dewatering aid control</li> <li>3. Consistency survey</li> </ol>	<b>118.000 €/year</b> due to reduced breaks increased production
Reduce chemical consumption	<ol style="list-style-type: none"> <li>3. Optimize chemical layout</li> <li>4. Automatic control of additives</li> </ol>	<ol style="list-style-type: none"> <li>4. Process survey</li> <li>5. Implementation of charge control to optimize fixative dosage</li> </ol>	<b>374.000 €/year</b> due to reduced chemical increased production

Fig. 4: Project goals

BTG’s solution approach comprised:

- A group of experts
- Holistic approach from raw material to final product
- Focus on customer benefits/profitability
- Dedication to help the customer
- Project management

To realize the project goals a comprehensive chemical, process and consistency survey was conducted as a first step. It included stock preparation, water and pulp loops and chemical preparation systems. An independent evaluation of the existing applied chemicals as well as benchmarking was part of this preparation work.

Based on the findings of the surveys the required process control equipment was installed. Control of the complete process had to be initiated with a consistency and flow control. In a second step each functional and process chemical should be automatically controlled by one specific process parameter providing operators with smaller limits to apply chemicals. To understand the interactions of machine runnability, operators’ work and chemical addition, various bump tests were performed, process dynamics were investigated and relationships established.

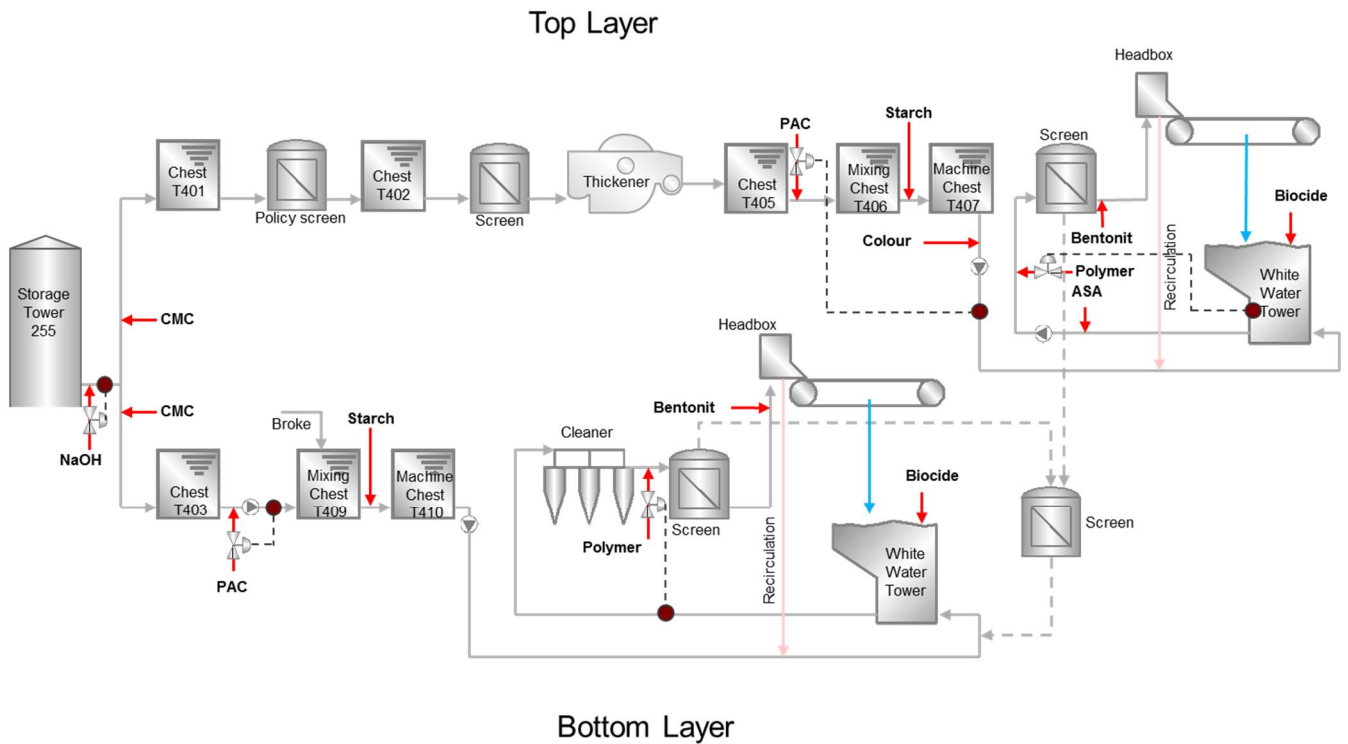


Fig 5: Recommended process layout Duropack Belisce

The next step was to optimize chemical dosage points and select the best performing additives and respectively the best performing dosage points in regard to control possibilities and efficiency. A detailed description of all recommended optimization steps was submitted to the customer based on goals to achieve, process data illustrating the issue and a profound explanation of dependencies.

## 5. Results

This chapter covers two optimization examples including technical details.

### Basis weight control:

Based on the project goals the basis weight on PM2 requires stabilization which shall be addressed by controlling the basis weight (Figure 4, tactis 1). Figure 6 shows the basis weight variability (1) versus the total consistency in the mixing chest (2) and the thick stock flow (3) to the paper machine. The basis weight variability is  $125 \text{ g/m}^2 \pm 2.5 \text{ g/m}^2$  caused by consistency variability. A stable consistency starting at 20:00 o'clock shows a reduction of basis weight variability to  $120 \text{ g/m}^2 \pm 0.5 \text{ g/m}^2$

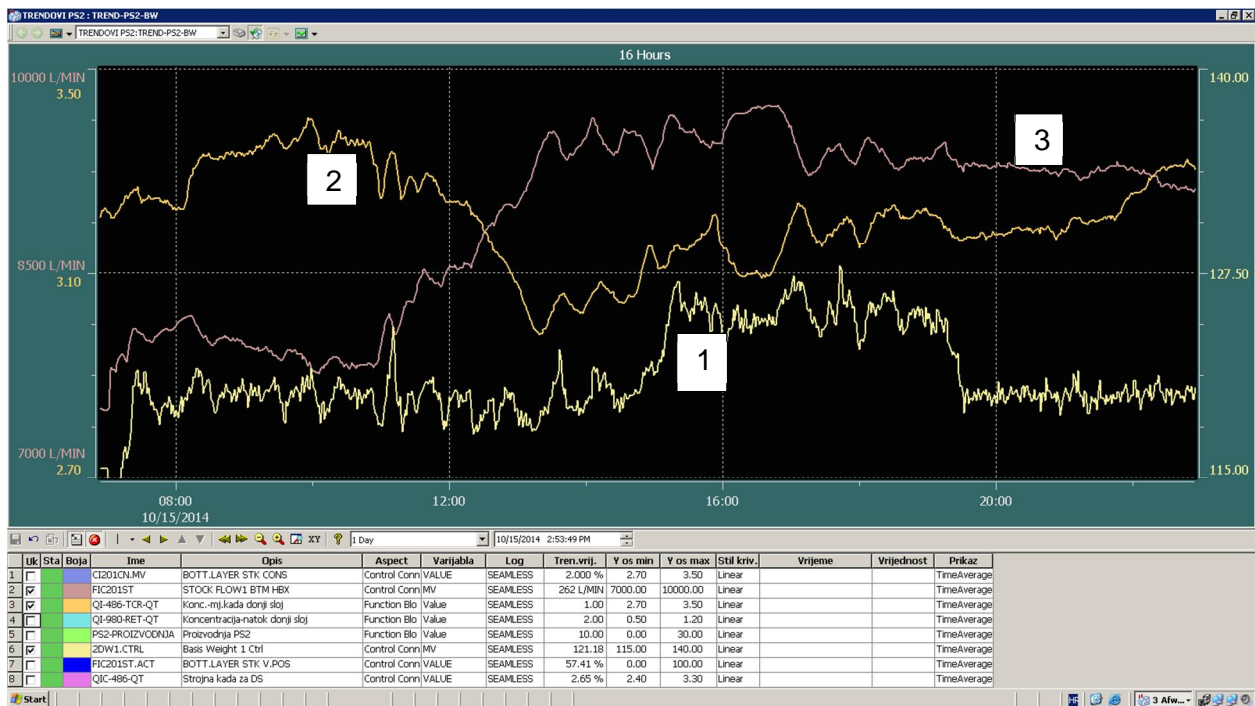


Fig 6: Basis weight control based on total consistency measurement

### Retention control:

This was one of the most crucial topics (Figure 4, tactis 2) as basically it was a stable white water consistency that should be achieved. Filler and fines carry much of the dosed additives like starch and sizing, not retaining these additives means a loss of functional chemical efficiency and a potential for deposits and high COD loads. Applying the polymer amount according to the measured white water total consistency leads to a maximum and stable retention and a dosage based on requirement. Such optimized control allows for additional chemical cost savings. Figure 7 shows a print screen of the polymer control in the bottom layer. The total consistency in the white water (1) was supposed to be kept stable at the set point of 0.2 % consistency. This was achieved by the control of the polymer (2) dosed to the pressure screen of the bottom layer. Different basis weights (3) require different set points of the total white water consistency.





Fig 7: Trend of polymer closed loop control

Although daily challenges keep operators busy, project “RODA” is well under way and the team is very positive to achieve the planned outcome.

## 6. Conclusions

Despite consolidation and temporary overcapacity on the market, smaller board machines like PM2 at Duropack Belisce should have a great future because small mills can react quickly on demand of their retailers. Increasing transportation costs will promote proximity of small mills to converters and final customers. Project “RODA” at Duropack Belisce showed that such optimization projects not only have a short payback but improve the mill’s overall competitiveness.