Automation to Intelligence:

Moving from control based towards data driven adaptive systems

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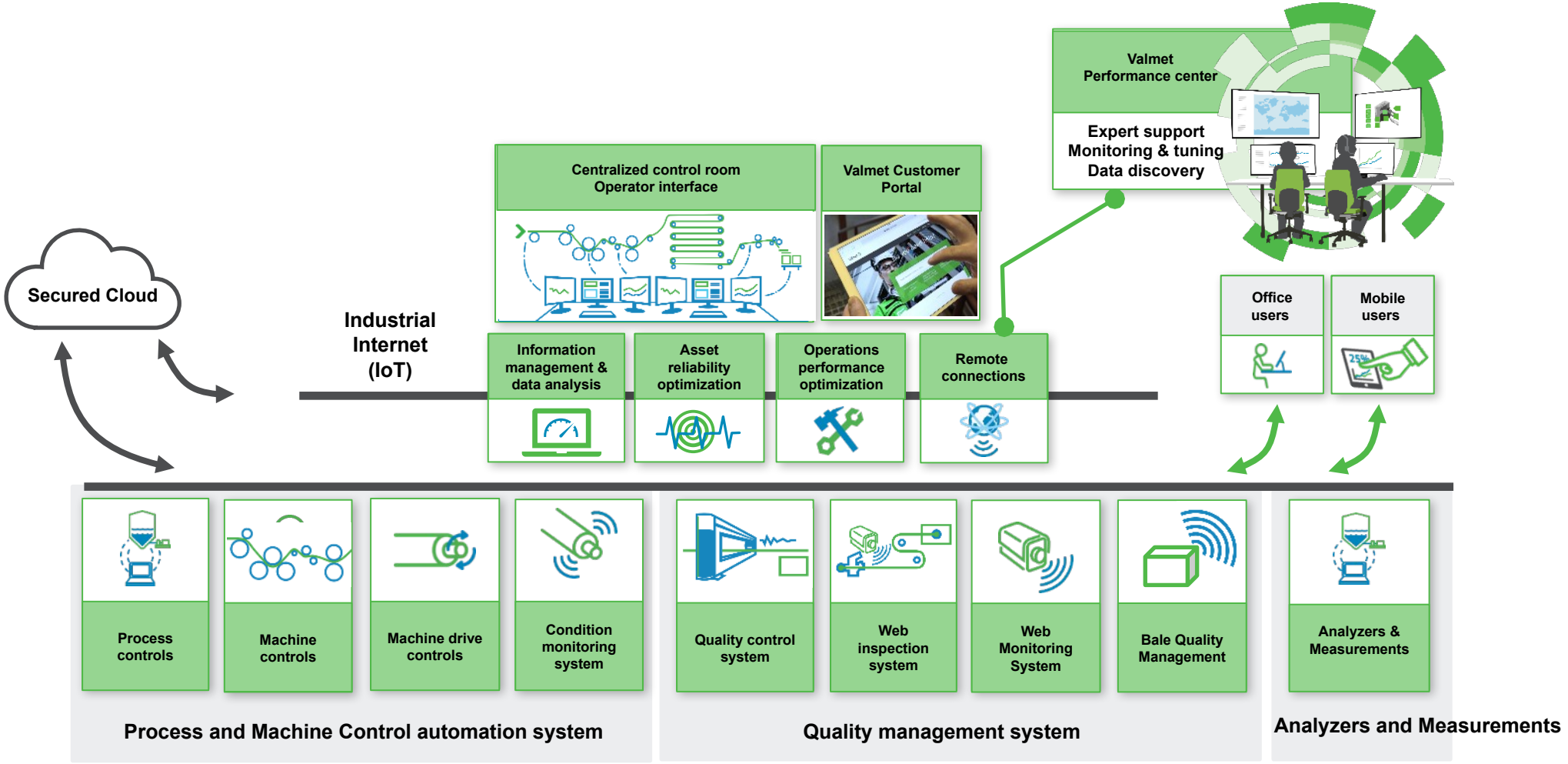
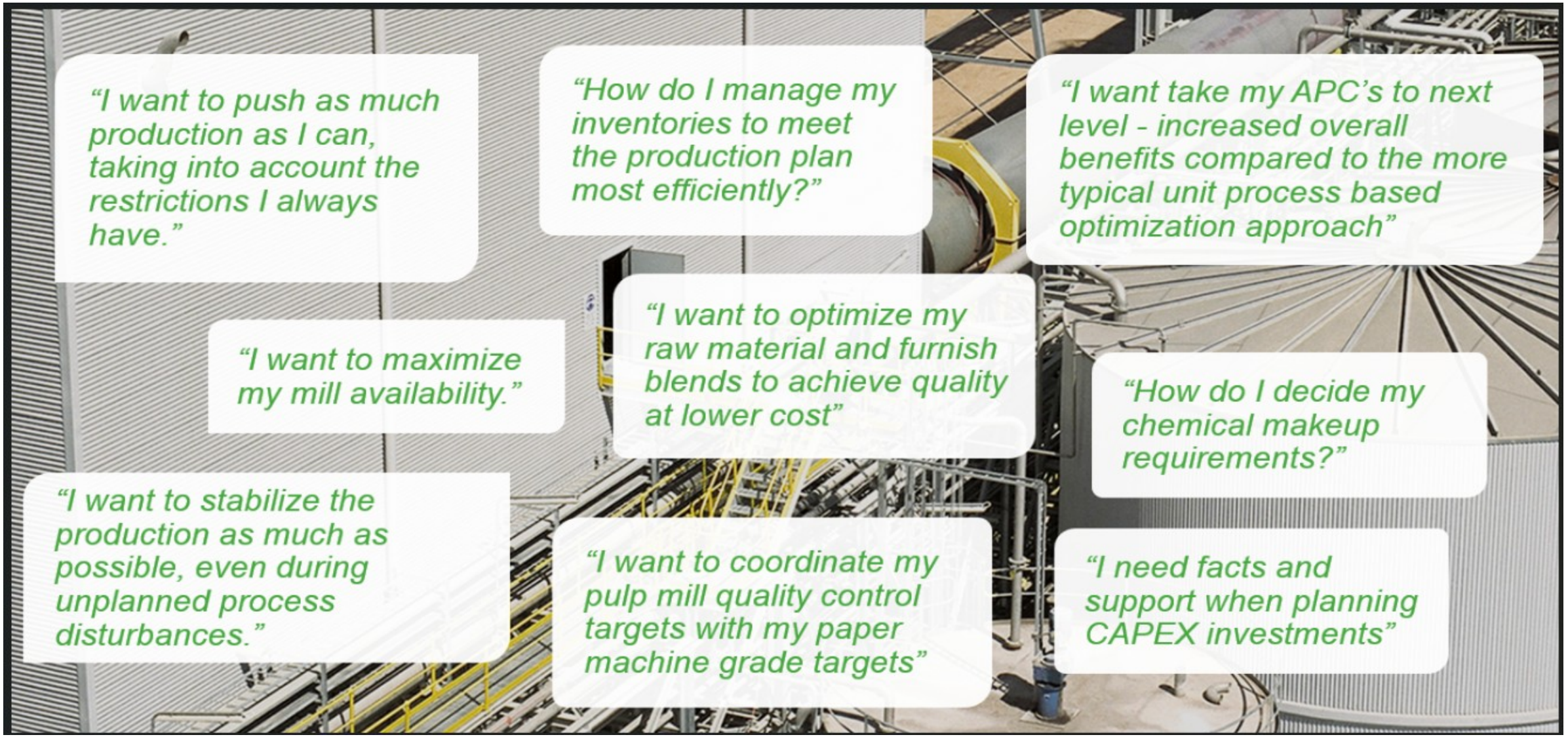
Valmet

Integrated Automation for Smart manufacturing



APC, the step towards semi-autonomous mill operations



Typical framework for autonomous operations

What is your target level of autonomy?

BUILDING BLOCKS

Variable cost data from ERP

"2" operations: Production + End Quality from ERP

Manufacturing system optimization

Mill-wide or cross-value chain optimization

Process optimization

Connected, intelligent process technology

Combined data from MES (+(ERP) and automation systems for production costs, quality and production targets

Mill Wide Optimization
e.g. 02 manual operation points

Advanced Process controls (APC)
e.g 50 manual operation points

a) Process Automation b) Intelligent field equipment
c) Asset performance management d) Connected process equipment
e.g. 500 manual operation points

BUILDING BLOCKS	AUTONOMY LEVELS	1. Partially automated	2. Fully automated	3. Semi-autonomous	4. Orchestrated	5. Autonomous

MWO Production Planning

Mill-Wide Production Planning Demo

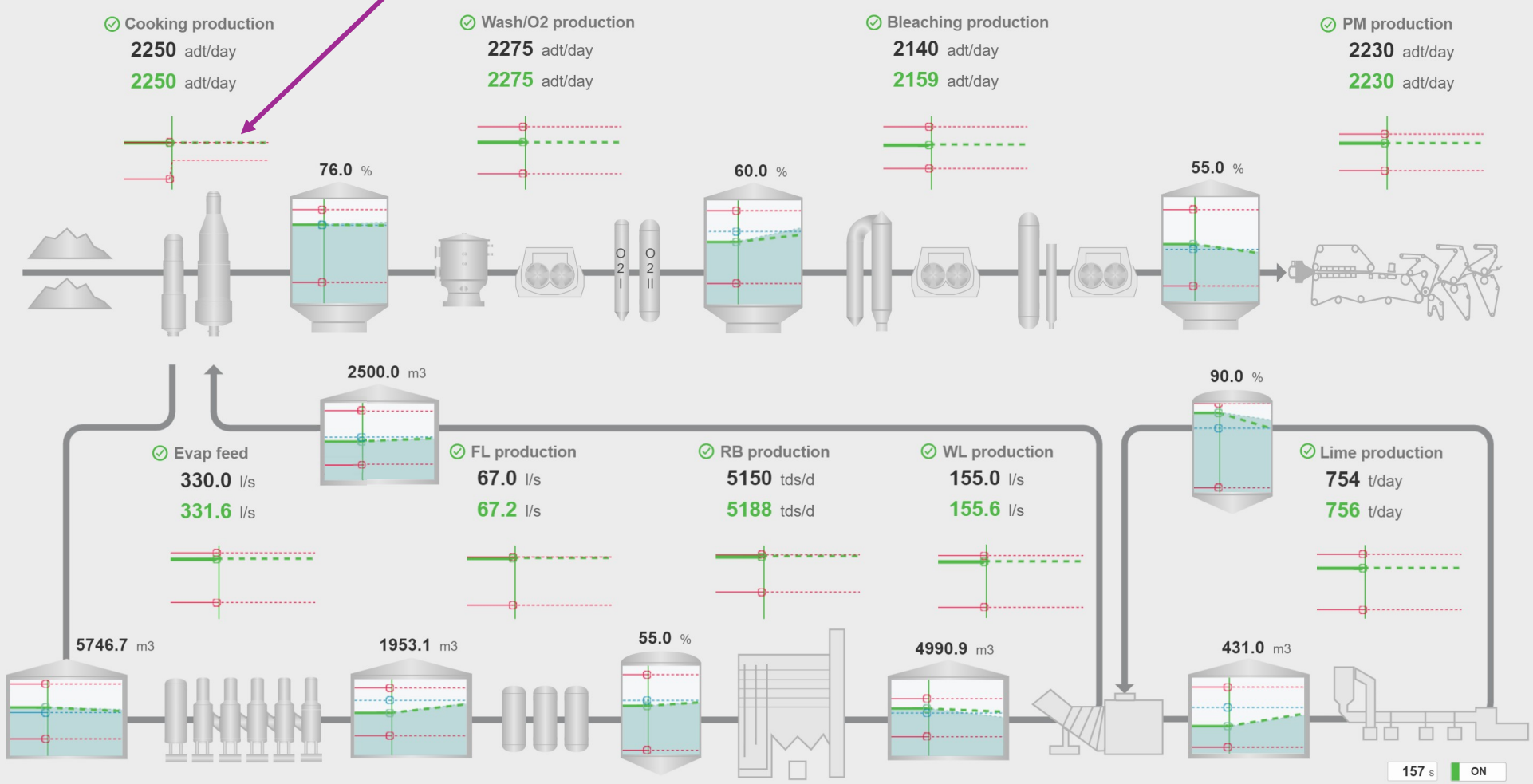
Digester production (maximize production))

Causticizing maintenance scheduled (before opt)

Mill Wide Optimization

Production Planning

Quality Planning | Cost Tracking | Energy Optimization | Grade Scheduling



Simulated mill baseline: Maximized mill production

MWO Production Limits MW1V

WL production
155.00 l/s
Optimize
Feasible

	Value	Start	Duration
High Limit	170.0	0.0	99.9
Low Limit	30.0	0.0	99.9
State	0	12.0	8.0

MWO Storage Limits MW1V049

White liquor storage
2500.0 m3
Optimize
Feasible

	Value	Start	Duration
High Limit	4500.0	0.0	99.9
Low Limit	1000.0	0.0	99.9
Target	1500.0	0.0	99.0

MWO Production Limits MW1V

Cooking production
2250.0 adt/day
Optimize
Feasible

	Value	Start	Duration
High Limit	2250.0	0.0	99.9
Low Limit	1400.0	0.0	99.9
State	1	0.0	99.0

MWO Production Planning

Mill-Wide Production Planning Demo

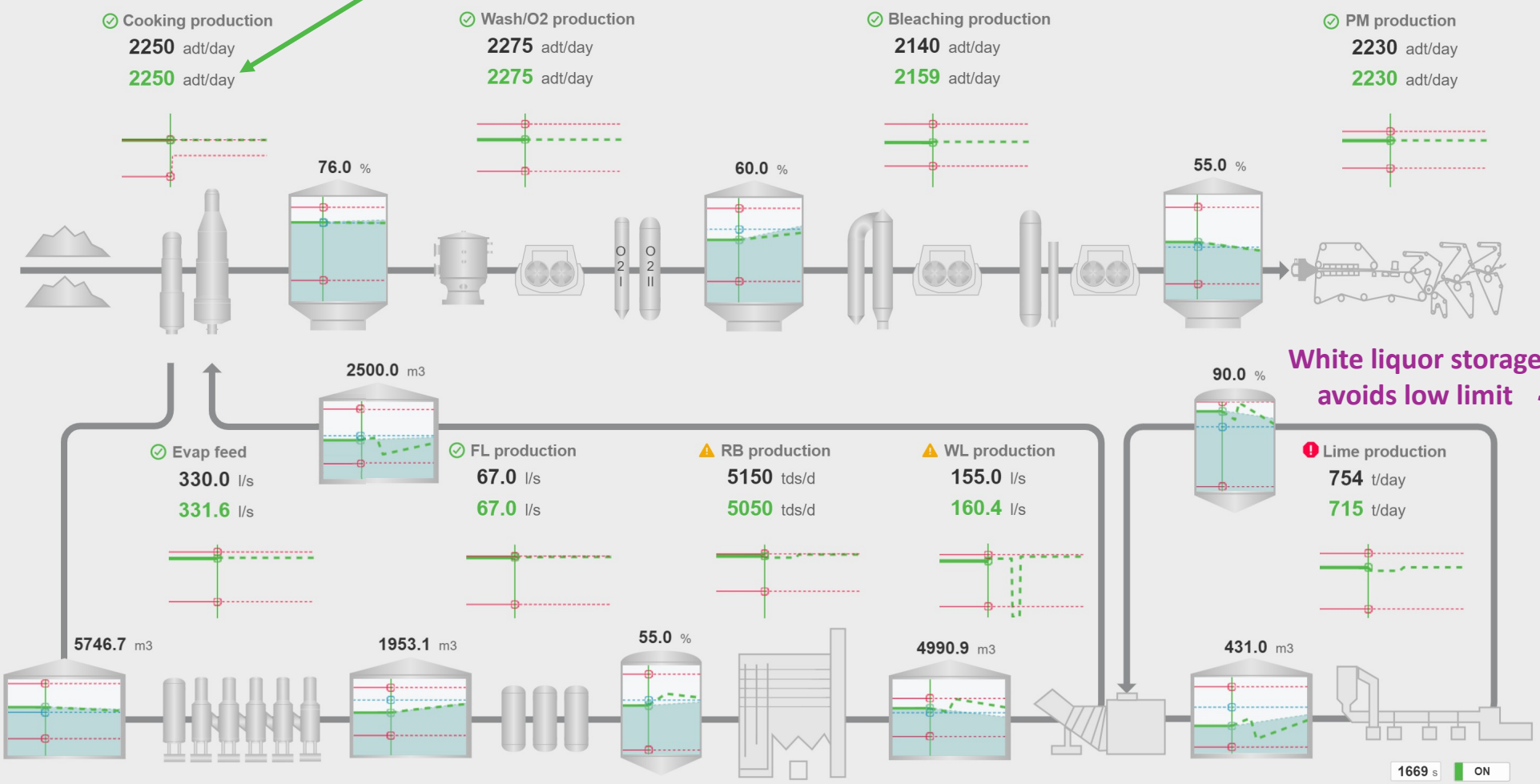
Mill Wide Optimization

Production Planning

Digester production decrease avoided

Quality Planning | Cost Tracking | Energy Optimization | Grade Scheduling

Causticizing maintenance 4-hour duration



White liquor storage avoids low limit

Causticizing maintenance plan #4: Shortened maintenance duration

Digester production decrease avoided

MWO Production Limits MW1V

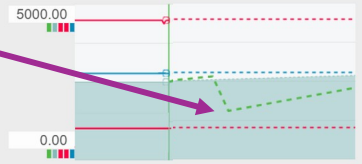
WL production
155.00 l/s
Optimize
Feasible

	Value	Start	Duration
High Limit	170.0	0.0	99.9
Low Limit	30.0	0.0	99.9
State	0	12.0	4.0

MWO Storage Limits MW1V049

White liquor storage
2500.0 m3
Optimize
Feasible

	Value	Start	Duration
High Limit	4500.0	0.0	99.9
Low Limit	1000.0	1.0	99.9
Target	1500.0	0.0	99.0



MWO Production Limits MW1V

Cooking production
2250.0 adt/day
Optimize
Feasible

	Value	Start	Duration
High Limit	2250.0	0.0	99.9
Low Limit	1500.0	1.0	99.9
State	1	0.0	99.0

Quality predictor

Paper strength prediction combined with advanced process controls

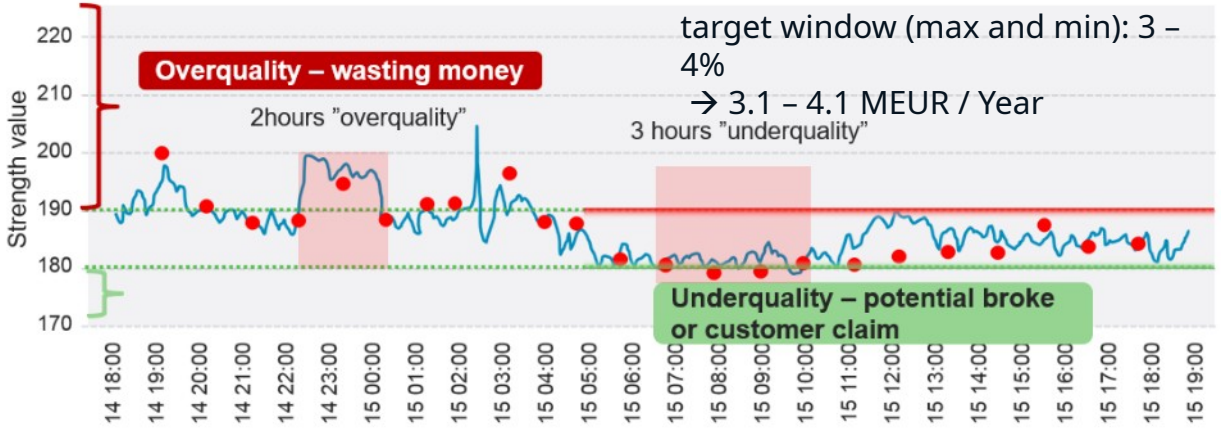
Challenge: In the paper production process operators control paper strength and other quality variables based on laboratory measurements (time delay)

Solution:

- A decision support application for the operator to control paper strength level to minimize raw material cost
- VPC in key role to maintain the application

Example results from magazine paper:

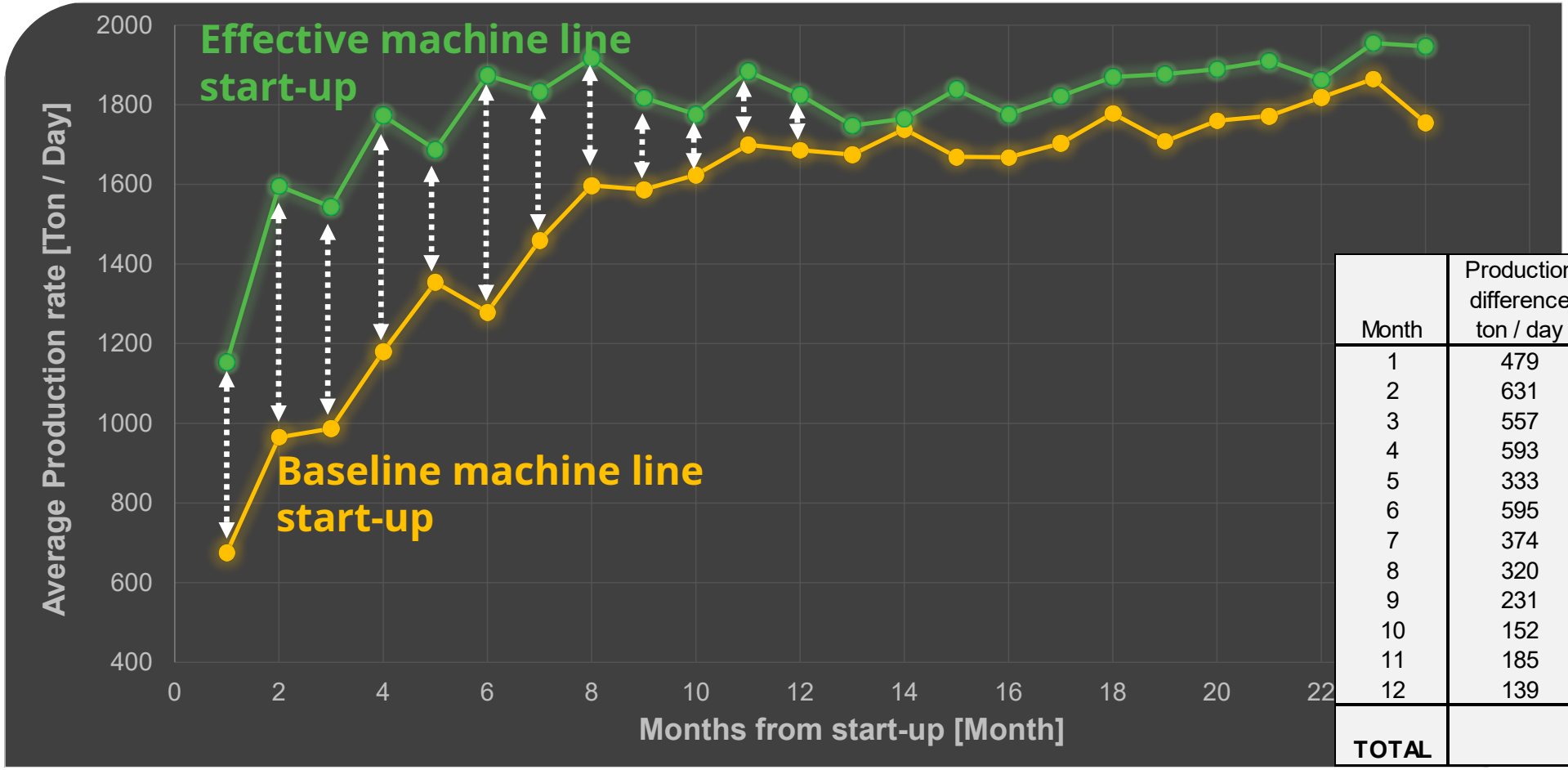
- Real time information on paper strength to operators gave 1-2% savings in raw material consumption (~1M€ per year)



Kraft amount difference inside the target window (max and min): 3 – 4%

→ 3.1 – 4.1 MEUR / Year

Virtual Commissioning

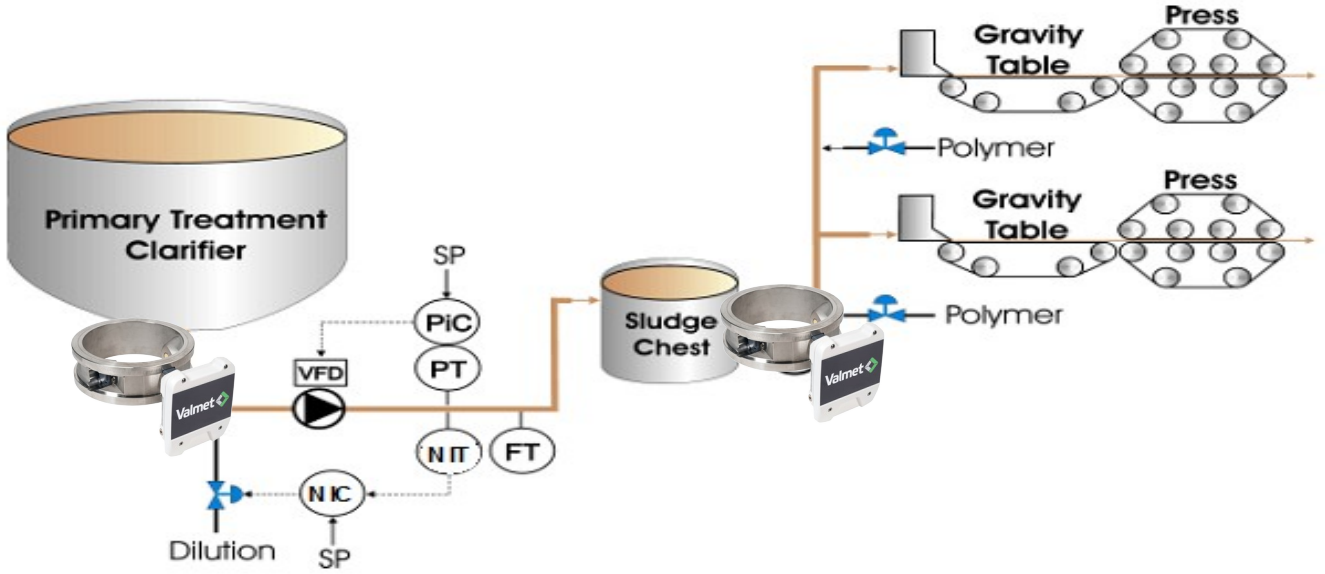


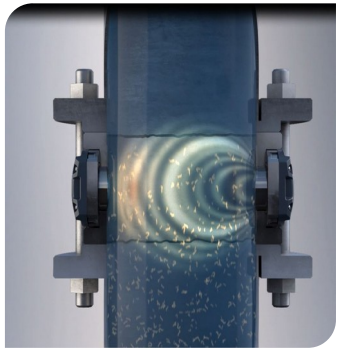
Assumed 150 EUR/ton profit margin

Month	Production difference ton / day	Production difference Monthly tons	Additional profit EUR
1	479	14358	2 153 700 €
2	631	18925	2 838 737 €
3	557	16706	2 505 855 €
4	593	17781	2 667 206 €
5	333	9998	1 499 686 €
6	595	17853	2 677 929 €
7	374	11229	1 684 337 €
8	320	9595	1 439 189 €
9	231	6916	1 037 421 €
10	152	4545	681 813 €
11	185	5552	832 842 €
12	139	4156	623 439 €
TOTAL		**137614**	**20 642 153 €**

ETP: Optimizing flocculant use in dewatering/thickening

Mills are investing here due to tougher discharge regulations.





Total Solids measurement at strategic locations will provide continuous data stream to operator as sludge concentrations change. Tie-in to polymer dosing pump for real time adjustments in automatic.

Benefits include;
- Real time polymer dosing at presses/centrifuges
- Increase press stability/fabric lifetime

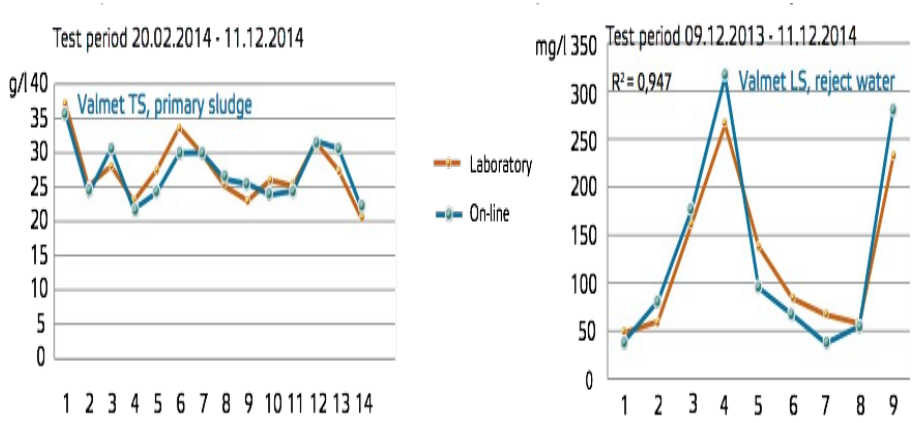
Total Solids and Low Solids measurement at a Paper mill wastewater plant Finland

Goals

- To optimize the sludge intended for combustion by adjusting polymer addition and belt press speed.

Results

- The online measurement allows accurate monitoring and the current target is to keep the solids content to less than 350 mg/liter, whereas earlier it was much higher.



Solution

- Total Solids Measurement
- Low Solids Measurement
- LS system helps avoid excessive solids content in the belt press reject water which would normally circulate unnecessarily over and over again through the plant

"The results have been compared to laboratory tests and match them perfectly. The measurements are reliable and do not require much maintenance.
I wonder how, for example the primary clarifier could be run efficiently without such a measurement?"

Pertti Rongas, Department Manager, Stora Enso Anjalankoski

Quick Summary

- Modern times call for optimized use of resources to remain competitive in the market. Integrated mill wide control systems, APC’s and Mill Wide Optimization applications are spearheading this approach.
- We have witnessed reference cases in this presentation who have taken advantages of this modern approach.
- Indian Pulp & Paper Industry is progressing steadily from traditional process controls and manufacturing towards data driven smart manufacturing using the latest available technologies.

Thank you for your attention !

For any further details, please feel free to contact us:

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