Saving potential with Digitalization

less Fibers — 7%

less Energy — 10%

less Materials — 10%

less Labor — 20%

less Maintenance Cost — 10%

8.5 M€ Savings*

88.7 M€/a*
Op. Cost

Up to
10% lower
operating costs

*example 300.000 tpa B & P, estimation by Voith   3
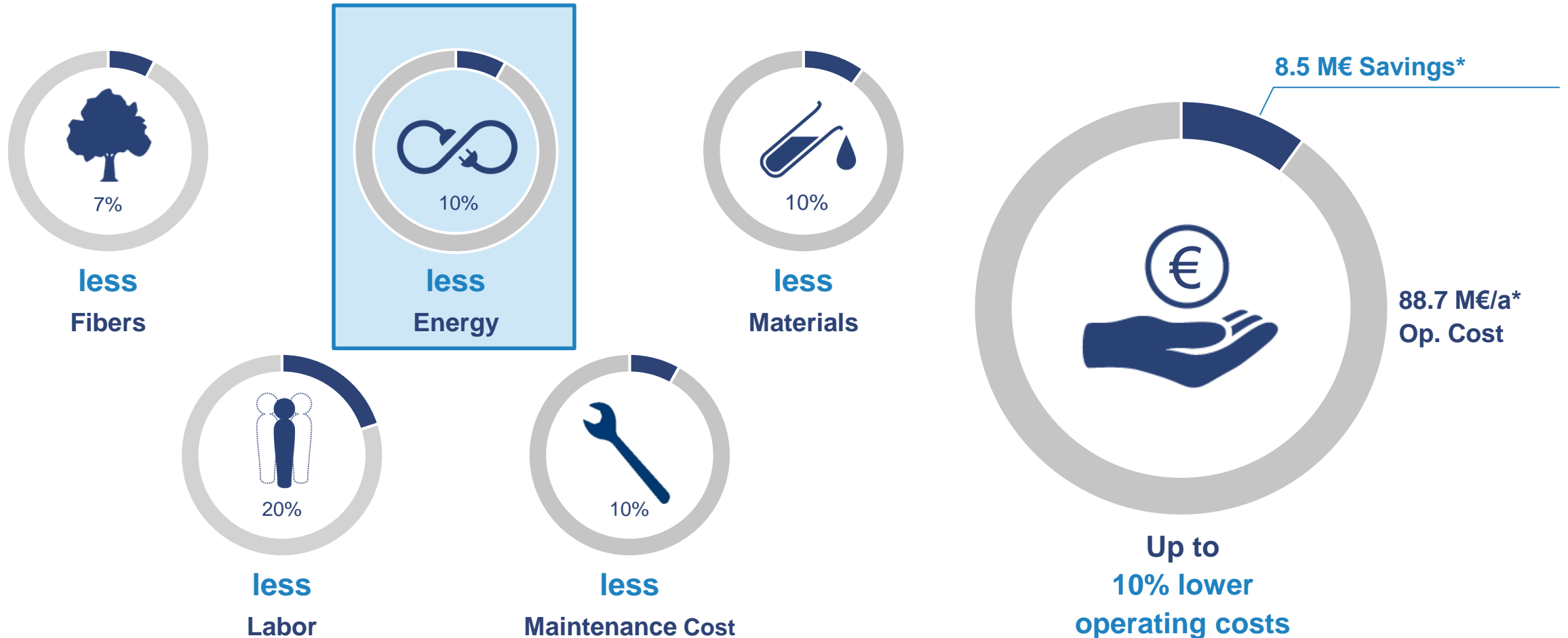
Saving energy with Digitalization
Data pipeline steps

PaperONE

Modules (OnEfficiency)

measure, generate & control

Automation Field instruments

collect, store & transform

Data historian & platform

visualize

explore

operationalize

Analytics, visualization and operations management

optimize

autopilot

Advanced process controls / Advanced process optimization
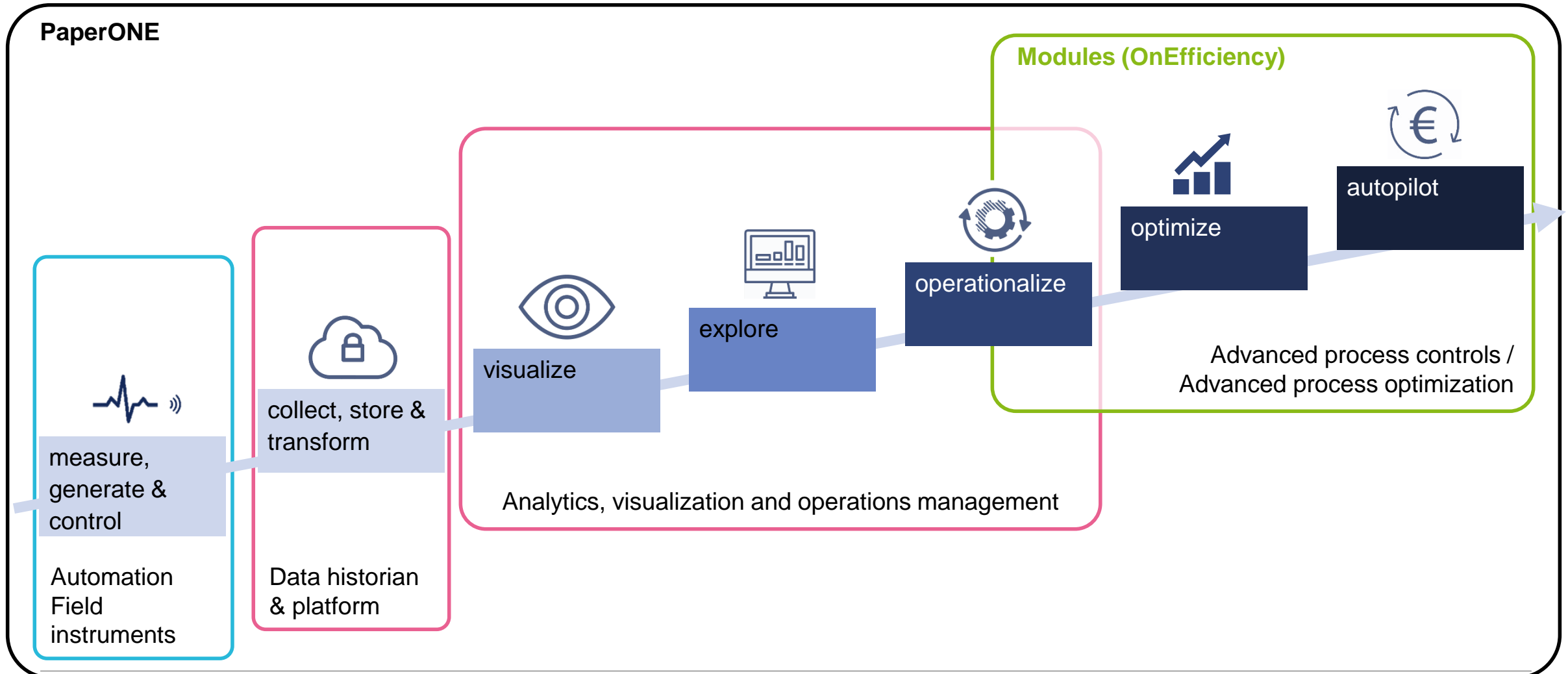
Saving energy with Digitalization
Content

Topic	Application area	Objective
Dewatering module	**Vacuum system**	**Stable ply dryness** **Vacuum pump energy saving**
DIP module	**Flotation cell**	**Optimum ash, Brightness and sticky** **Pump energy & Chemical saving**
Strength module	**Wet end section**	**Optimum strength properties** **Fiber and Steam energy saving**
Web break prevention module	**Overall Machine**	**Break reduction → increase production** **Specific energy consumption reduction**

Optimize ply dryness with
Dewatering Module (OnControl.Dewatering)

Dewatering module
Optimized ply dryness at lower cost

Stable dryness

- Stable dryness at couch point

- Eliminate fluctuations in ply dryness

- Quick adaption to pulp properties

Optimized ply bond

- Ply bond is stabilized and optimized to always reach target

- Reduction of off-spec production
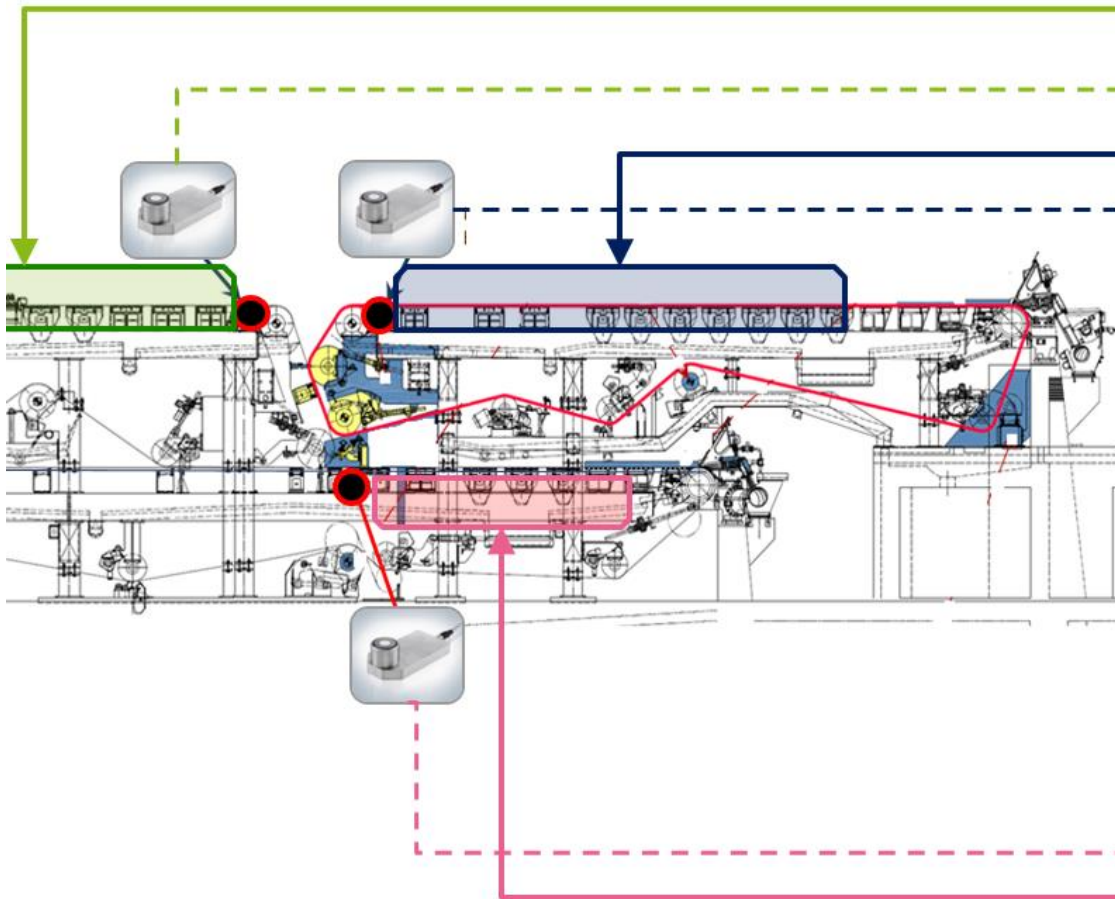
- Quick adjustment during grade changes

Reduced cost

- Vacuum is automatically controlled – only as high as really needed

- Lower vacuum means also lower drive load

- Lower vacuum means reduced fabric wear / longer fabric lifetime

# Dewatering module
Our proposal

- ➢ Typically, one **FormingSens** for every ply – installed, calibrated and maintained by Voith

- ➢ Customized vacuum application dependent on equipment – supported by Voith's papermaking knowledge

- ➢ Easy integration into the control system (DCS) performed by Voith

- ➢ **FormingSens XR** can measure also high water weight (e.g., middle ply or at couch)

Dewatering module
Field results

OnControl.Dewatering, Gap former, newsprint, 320 ktpy

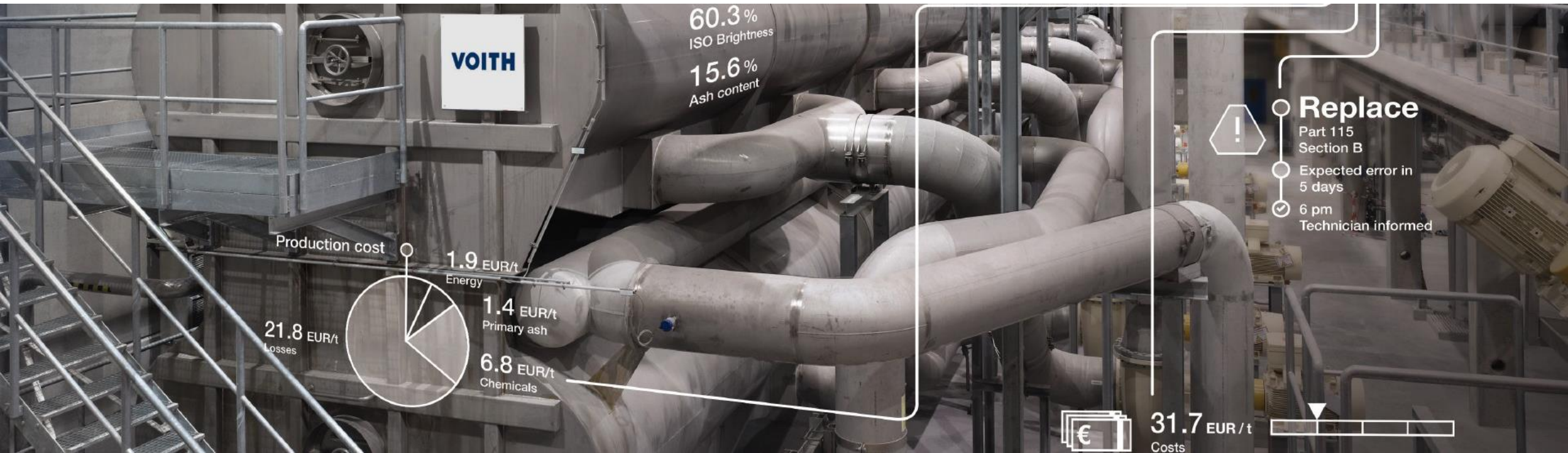Machine data
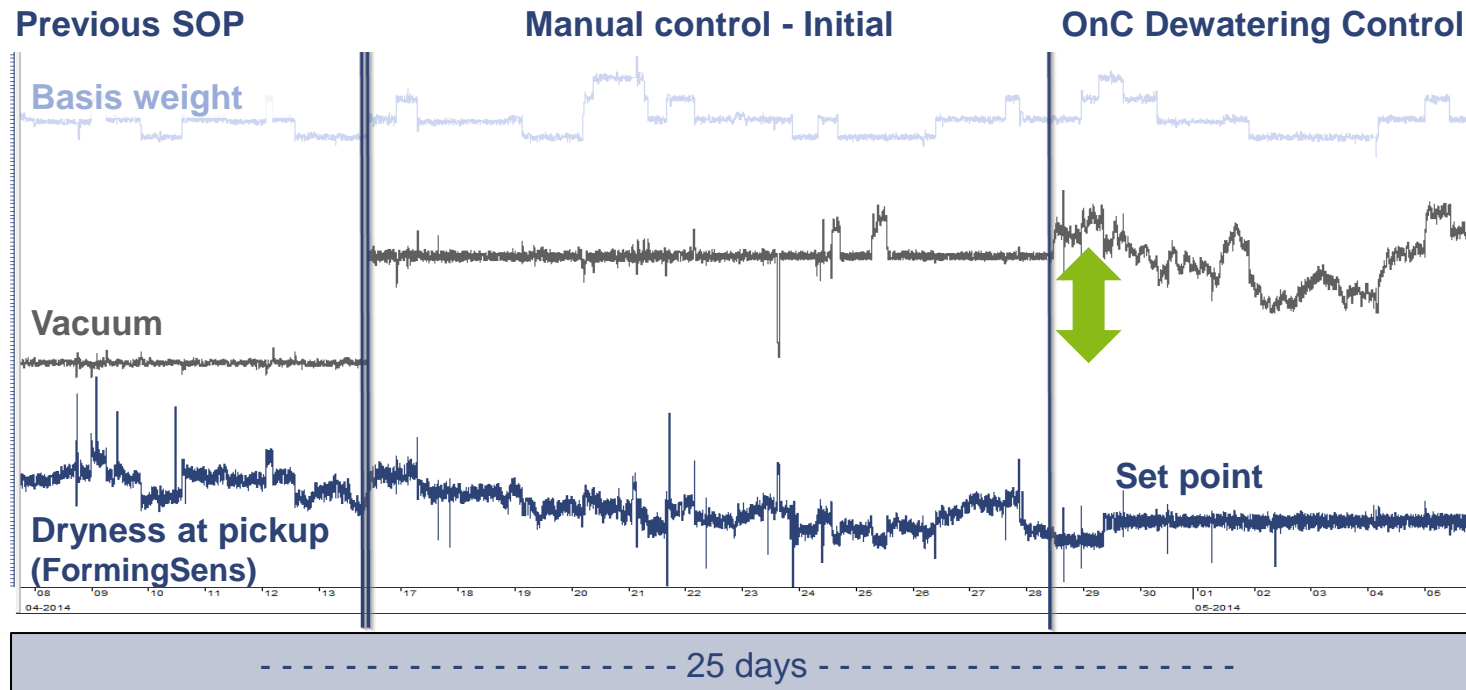
Results

- Dry content is on set point and stable

- Vacuum is used as actuator

Savings

- ~ 10% less energy consumption of the former
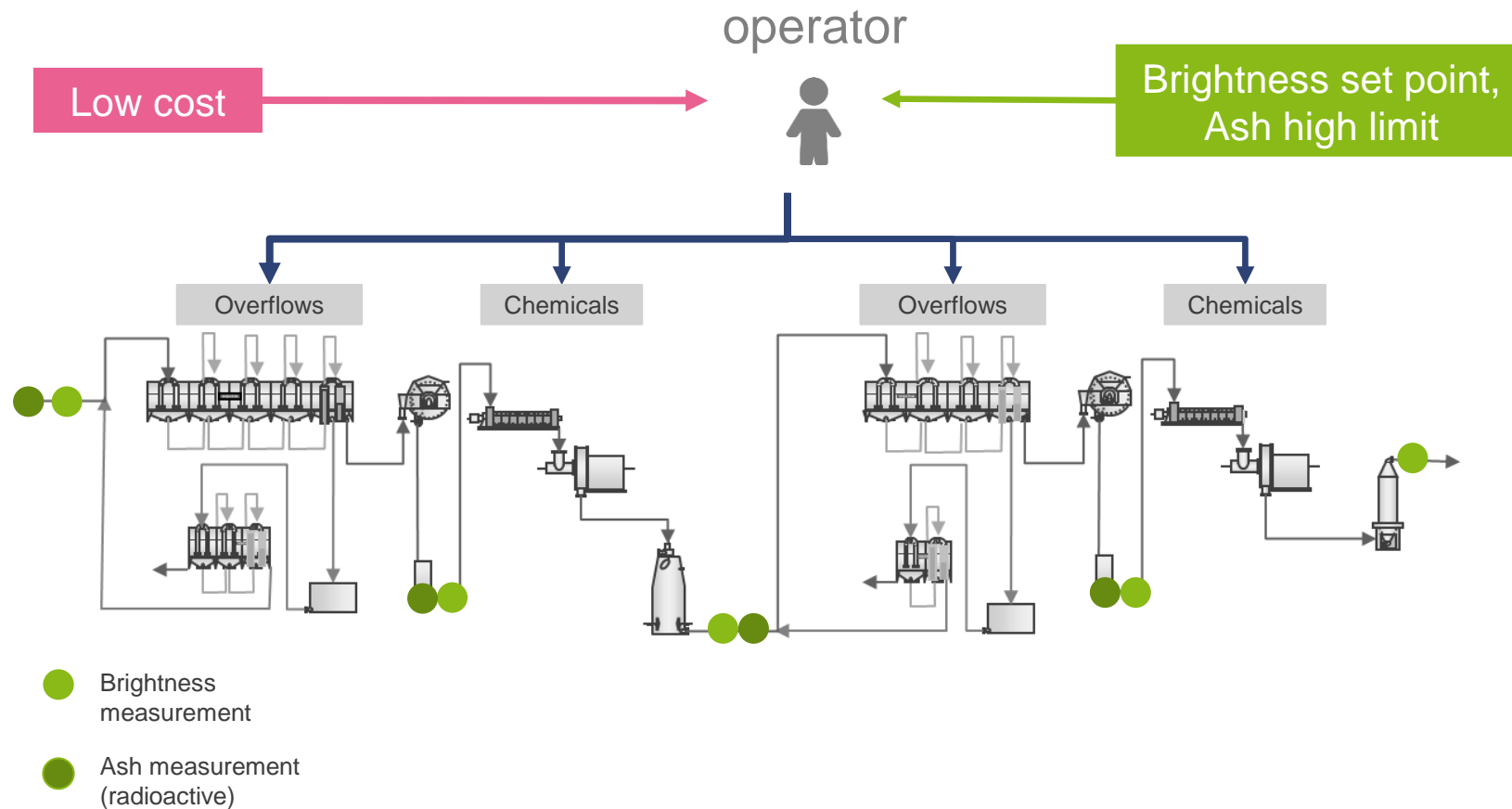
- ~ 10% longer fabric life time

Without DIP module
Today's situation

operator
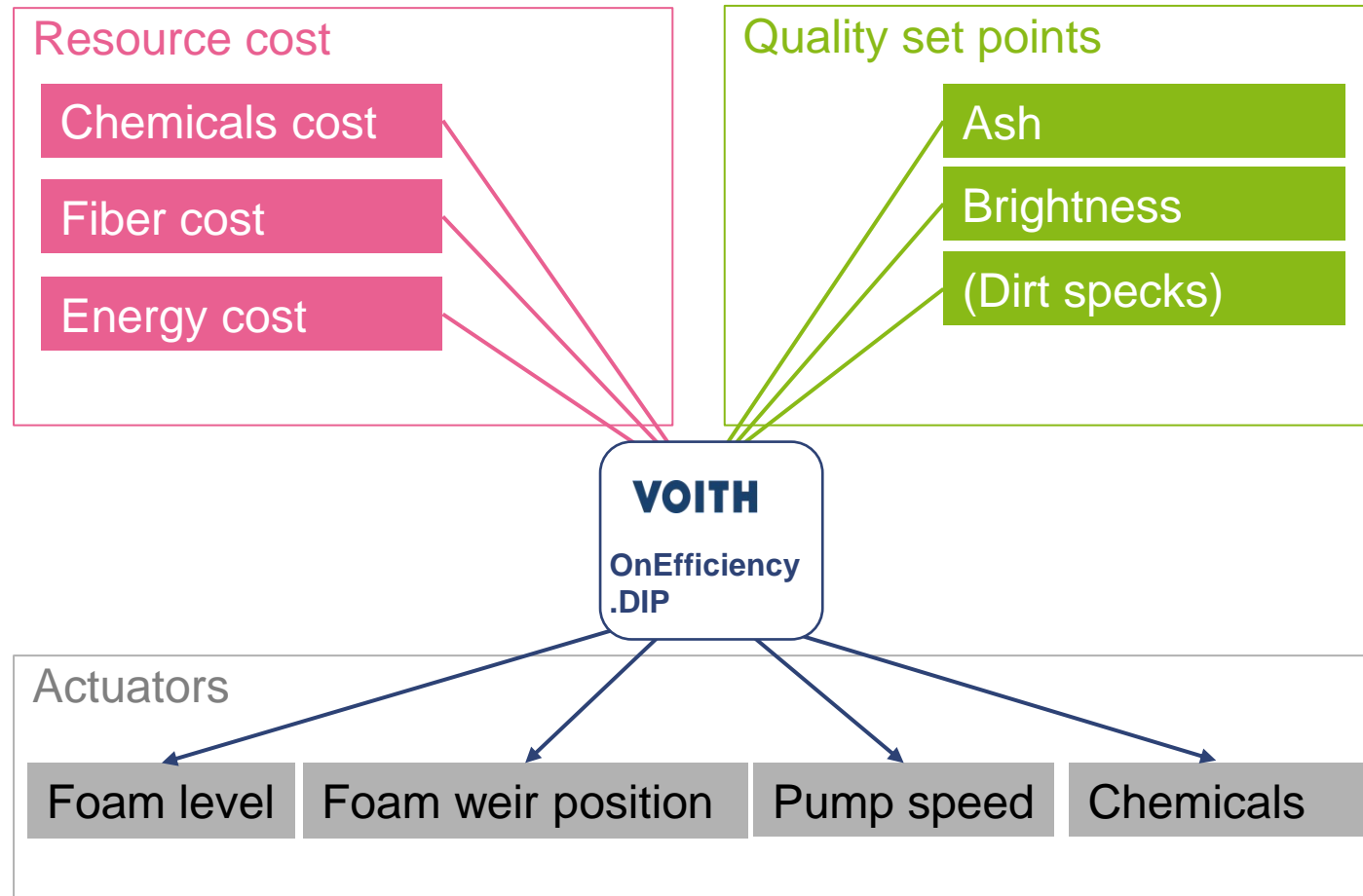
Low cost →

Brightness set point, Ash high limit →

Tasks of operator

➢ Keep ash and brightness (and grade specific dirt specks) in specification

➢ Reduce cost and increase yield

→ **Finding the optimum is a complex task**

Overflows   Chemicals   Overflows   Chemicals

● Brightness measurement

● Ash measurement (radioactive)

With DIP module
Steady DIP quality at minimum cost

Resource cost

- Chemicals cost
- Fiber cost
- Energy cost

Quality set points

- Ash
- Brightness
- (Dirt specks)

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OnEfficiency .DIP

Actuators

| Foam level | Foam weir position | Pump speed | Chemicals |

Tasks of DIP module

- Keep ash and brightness in specification

- Reduce cost by reducing losses (pump speed + foam level + foam weir) and bleaching chemicals
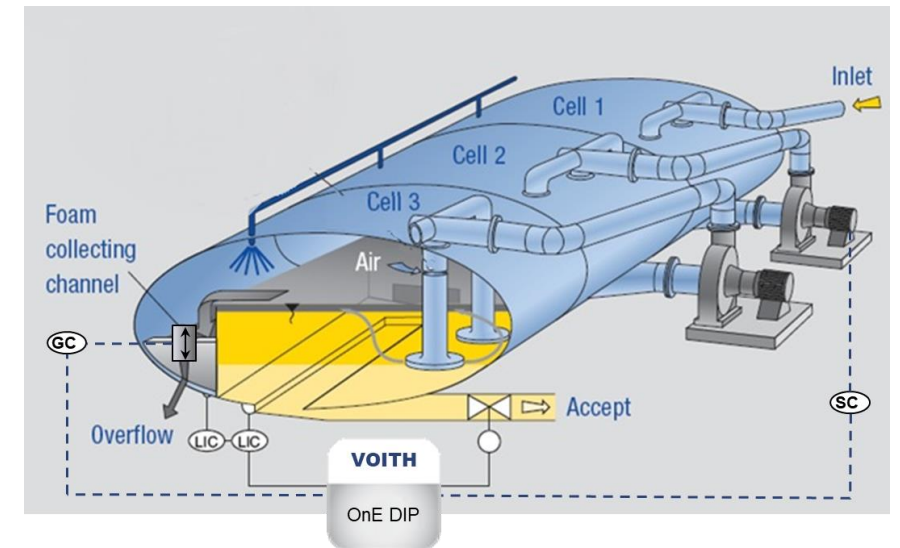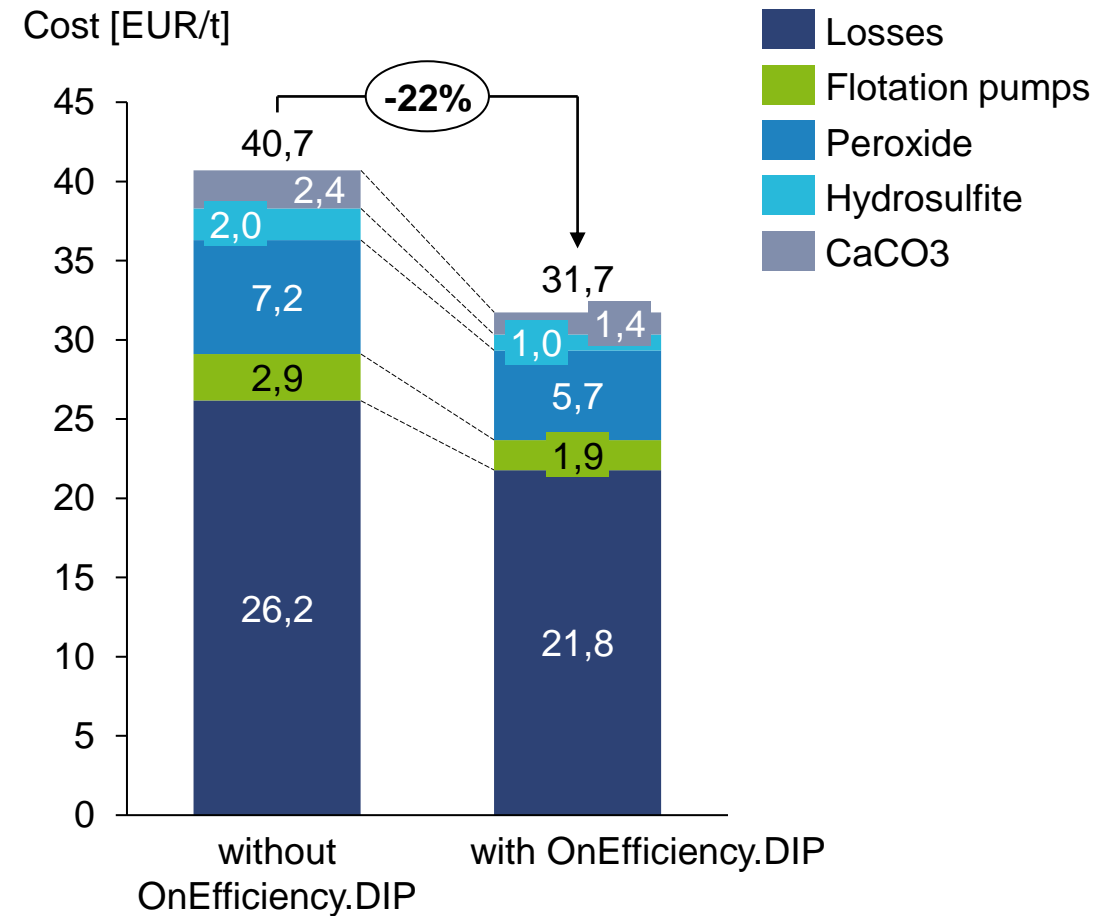
DIP module
Field results (350 ktpy DIP for NP)

	w/o DIP module	With DIP module
Yield (ash balance)	85.7%	88.1%
Energy flotation pumps	42 kWh/t	27 kWh/t
Peroxide (incl. caustic)	0.99%	0.78%
Hydrosulfite	0.12%	0.06%
Primary ash	40 kg/t	23 kg/t

15 kWh/t (34%) savings in flotation pump energy

Cost [EUR/t]

-22%

- Losses
- Flotation pumps
- Peroxide
- Hydrosulfite
- CaCO3

without OnEfficiency.DIP: 40,7 (2,4 / 2,0 / 7,2 / 2,9 / 26,2)
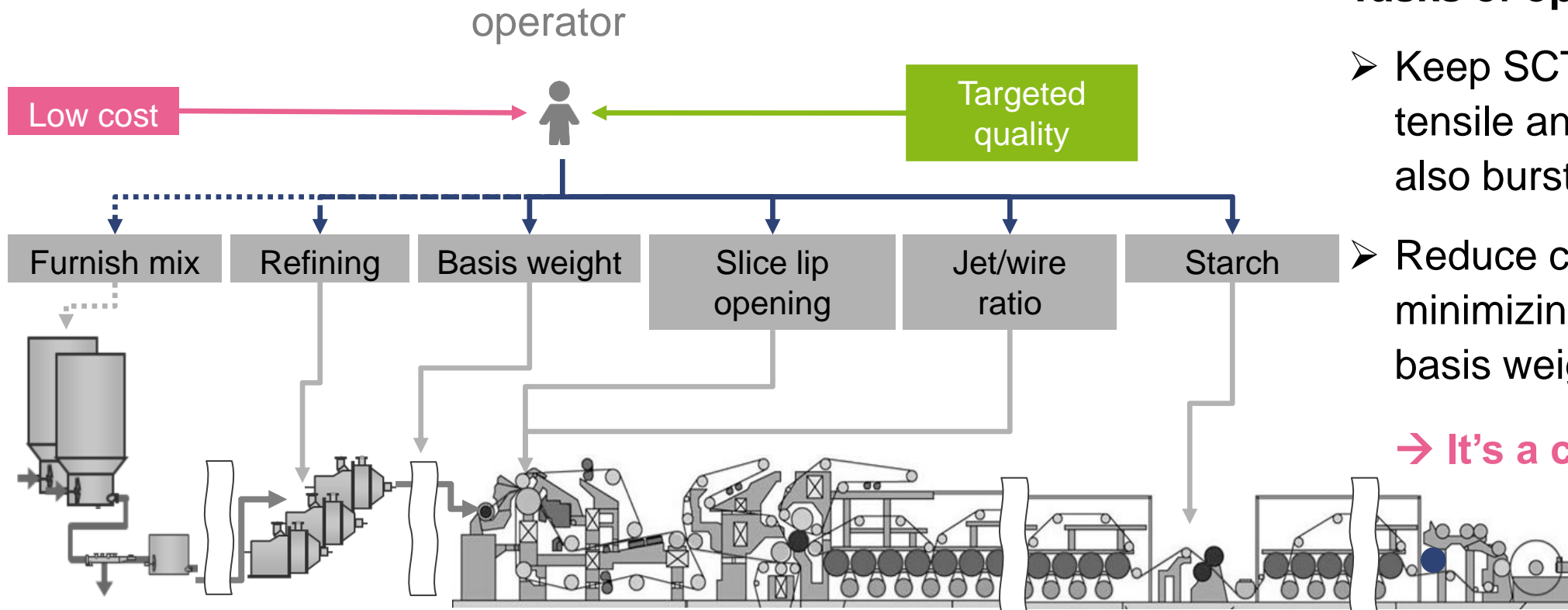
with OnEfficiency.DIP: 31,7 (1,4 / 1,0 / 5,7 / 1,9 / 21,8)

Increase quality & reduce cost with Strength module (OnEfficiency.Strength)

Without strength module
Today's situation

operator

Low cost

Targeted quality

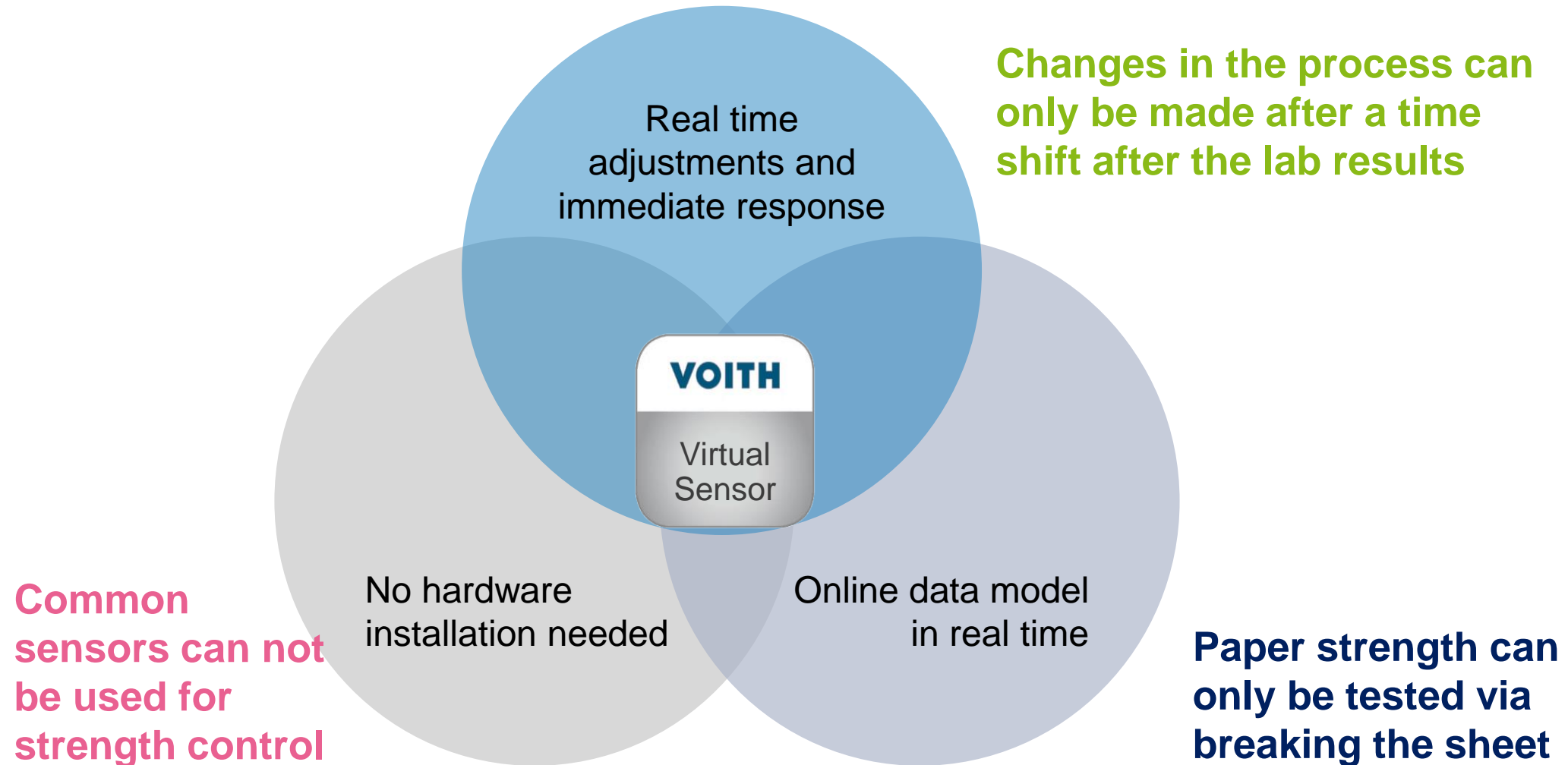| Furnish mix	Refining	Basis weight	Slice lip opening	Jet/wire ratio	Starch

Tasks of operator

➢ Keep SCT, CMT (for CM), tensile and for Testliner also burst in specification

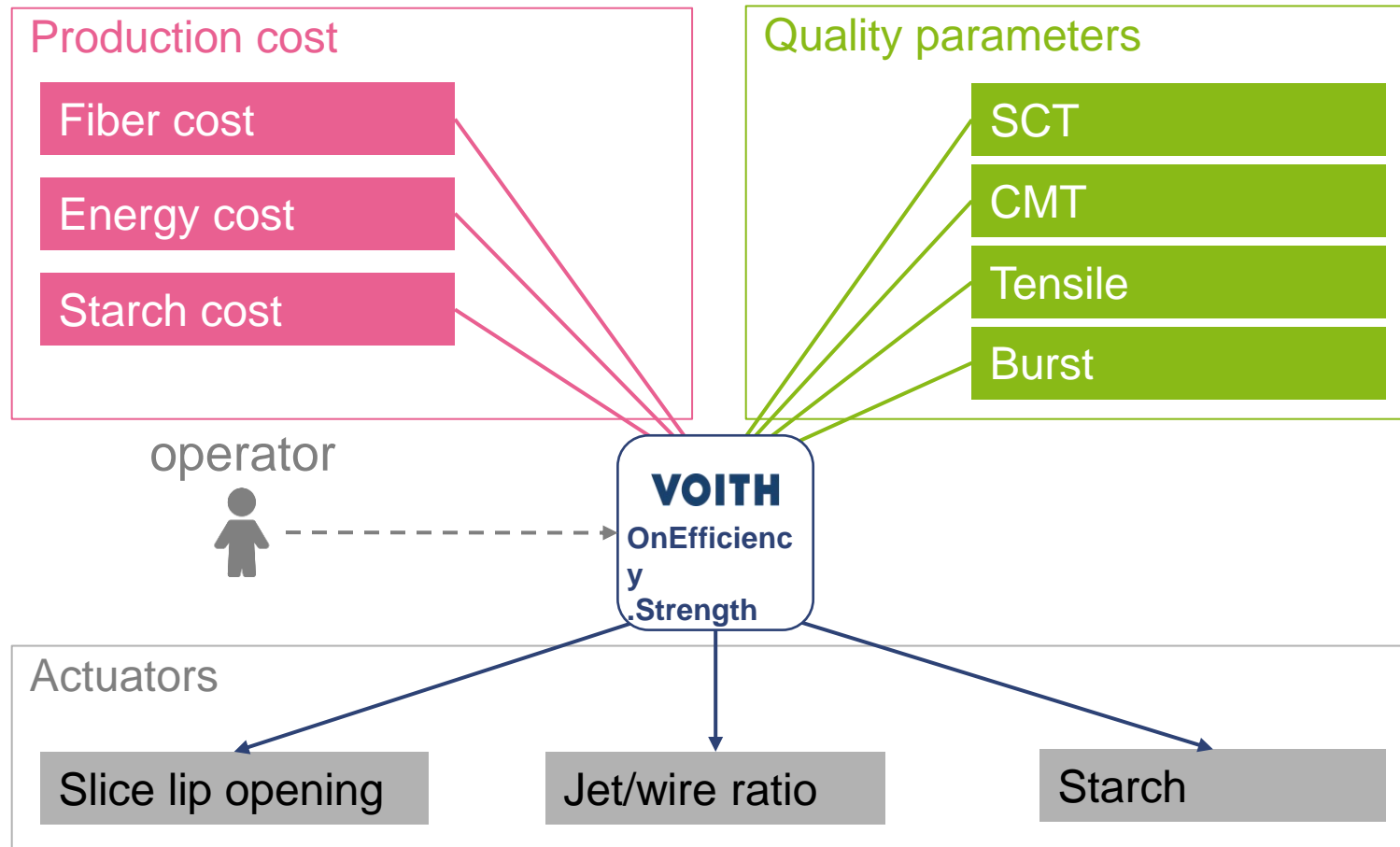➢ Reduce cost by minimizing starch usage & basis weight

➔ **It's a complex task!**

With Strength module
Virtual sensor answers current pain points

Changes in the process can only be made after a time shift after the lab results

Real time adjustments and immediate response

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Virtual Sensor

Common sensors can not be used for strength control

No hardware installation needed

Online data model in real time

Paper strength can only be tested via breaking the sheet

Strength module – a closed loop control
Ensures the right quality at lowest cost

Production cost

- Fiber cost
- Energy cost
- Starch cost

operator

Quality parameters

- SCT
- CMT
- Tensile
- Burst

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OnEfficiency.Strength

**Actuators**

- Slice lip opening
- Jet/wire ratio
- Starch

Closed loop control

- ➤ Keeps quality in specification
- ➤ Reduces cost and minimizing starch usage
- ➤ The operator supervises the correct function and, if necessary, adjusts the settings

Strength module
Field results TL/CM

OnEfficiency.Strength results, TL/CM 450 ktpy,

up to 4.5% lower steam consumption (estimated) in after dryer section
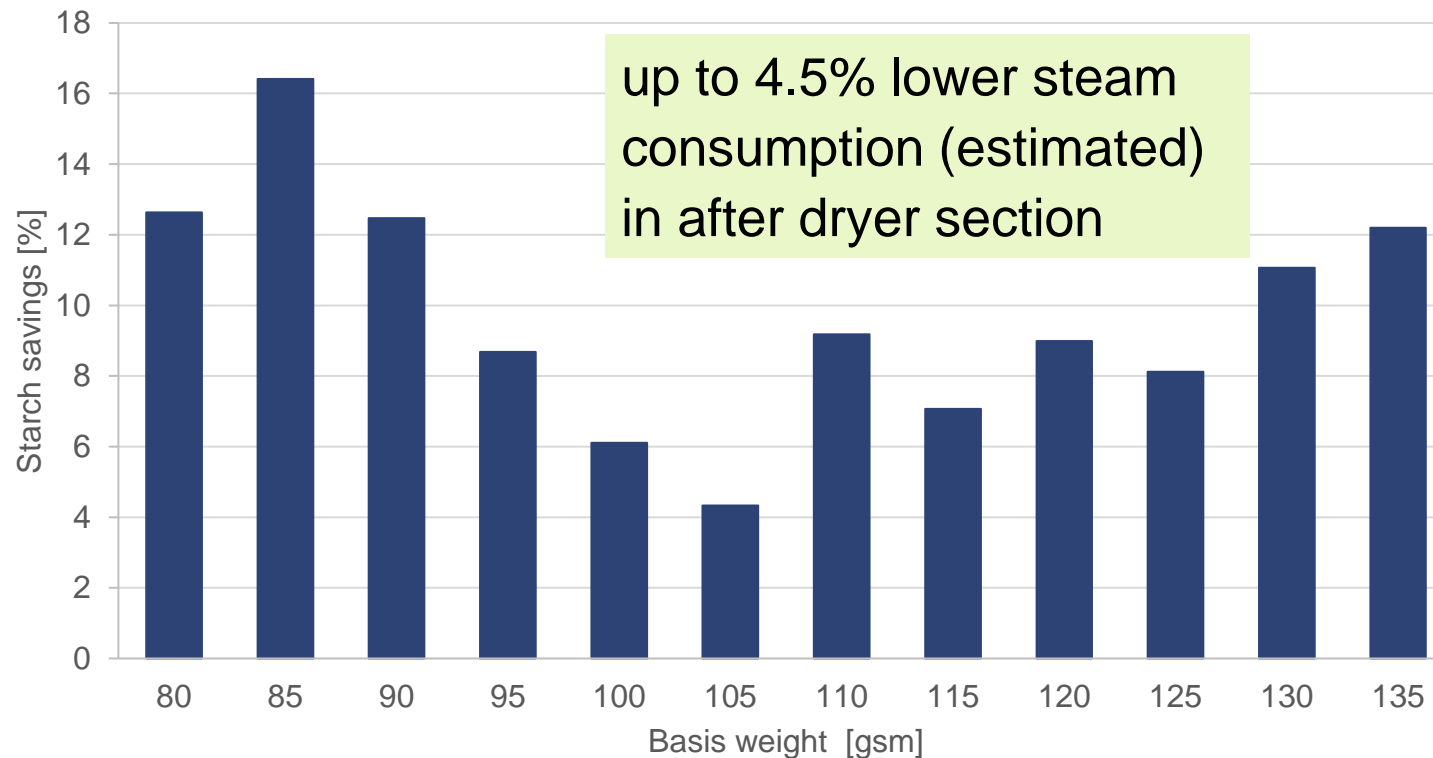
➢ Consistent quality requirements

➢ Stabilized process fluctuations

➢ Same strength quality with lesser starch application quantity

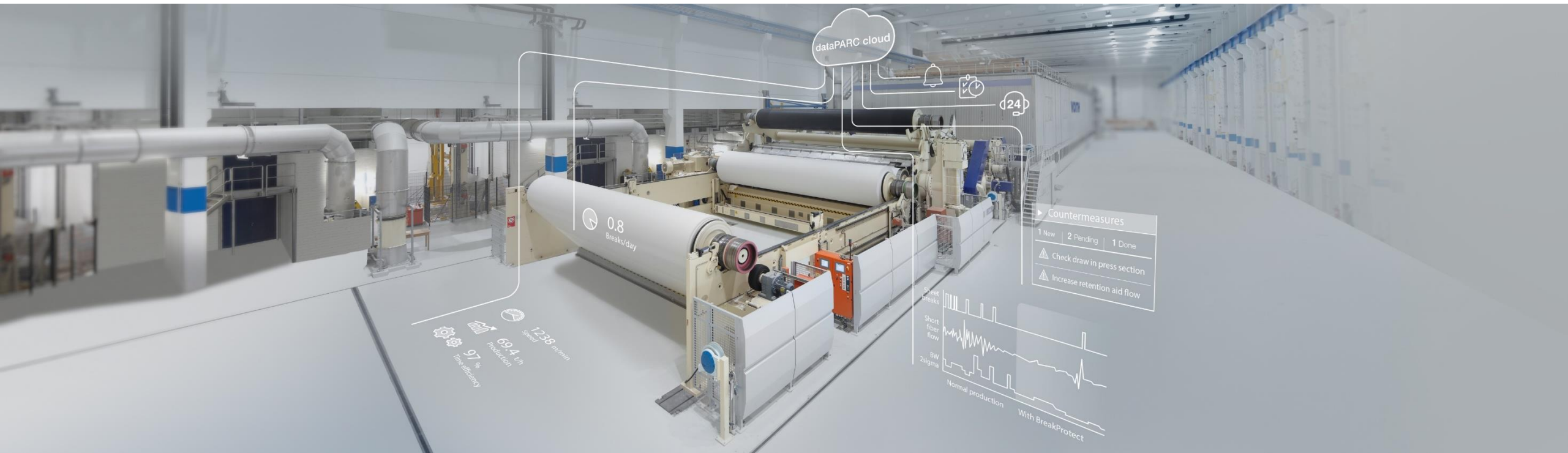➔ **Steam energy saved at After Dryer section**

Strength module
Field results Copier

OnEfficiency.Strength results, WFU 540 ktpy

- Optimization phase
- OnEfficiency.Strength
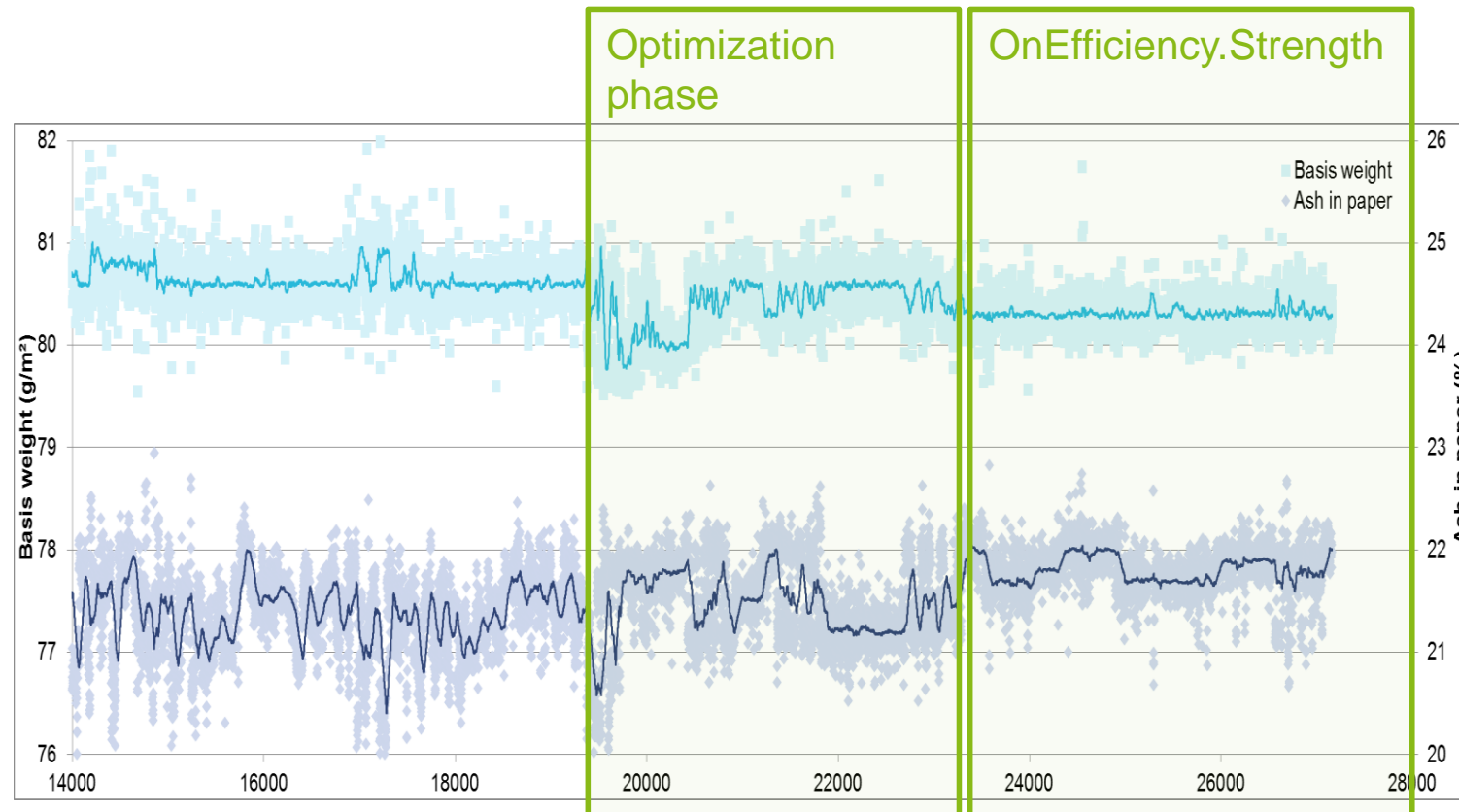
➢ Fiber replaced with ash

➢ the basis weight and the ratio of fiber to ash improved

➢ Same quality with higher ash content
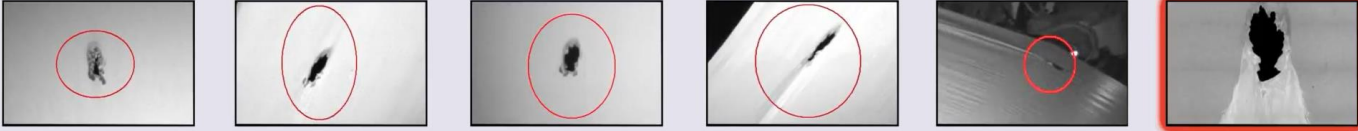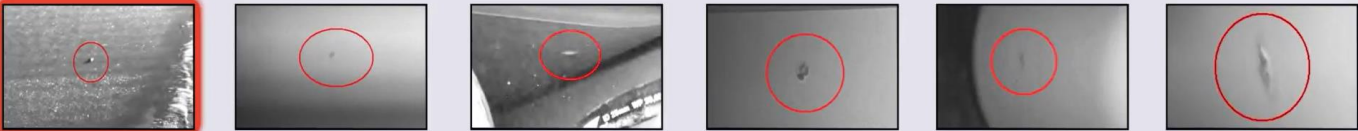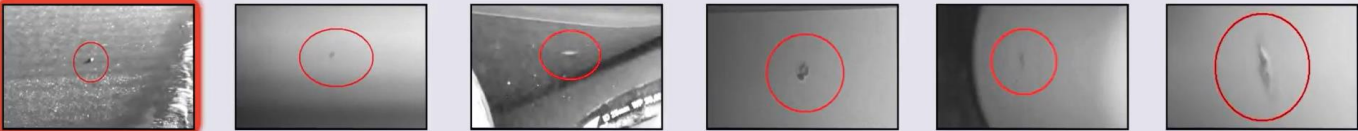
➔ **Steam energy saved at After Dryer section**

Today's SOTA
Break Analysis with web monitoring

Indicative distribution

Break report (symptoms)	Breaks
Dirt from top ply HBX	10
Lump at top wire turn roll	25
Dirt from bottom edge master	12
Unknown	25
Hole in size press	24
Wrinkles size press	40

So far, paper makers basically identify symptoms and try to fight them – with moderate success.

Without Web Break prevention module
Real break reasons are seldom understood

Indicative distribution	Segments in Break prevention module (root cause / "illness")			
Break report (symptoms)	Retention aid	Broke dosage	Shrinkage	Fiber recovery
Dirt from top ply HBX	3	1	0	6
Lump at top wire turn roll	15	2	0	8
Dirt from bottom edge master	2	6	0	4
Unknown	5	6	7	7
Hole in size press	10	4	2	8
Wrinkles size press	0	11	25	4

So far, paper makers basically identify symptoms and try to fight them – with moderate success.
Break prevention module allows to understand the underlying root cause (the "illness") and cure it - sustainably and sometimes forever.

Web Break prevention module
Field results : reduction of breaks by > 70%
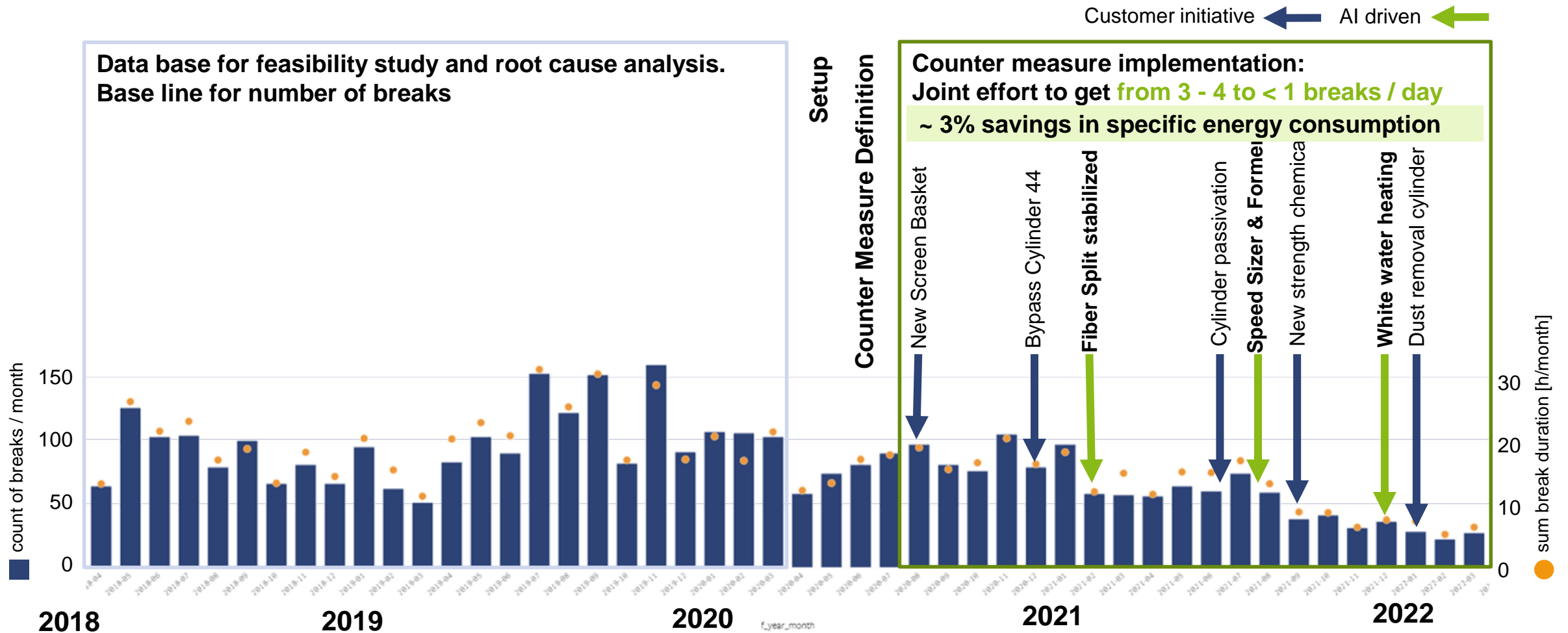
Summary
Energy savings achieved with digitalization

Modules	Sensors	Actuators	Energy savings resulted
Dewatering Module (OnControl.Dewatering)	FormingSens (Water weight)	Vacuum set point (Vacuum pump RPM)	Up to 10% vacuum energy savings in former section
Deinking Module (OnEfficiency.DIP)	Ash, Brightness, Dirt specks	Foam level, weir height and flotation pump RPM	Up to 30% pump energy savings in flotation cells
Strength Module (OnEfficiency.Strength)	Virtual Sensor (depending on grade) (for packaging typically SCT, CMT and burst)	Depending on basis weight, for packaging grade typically jet / wire ratio and starch addition	Up to 4.5% less steam consumption (estimated) in ADS
Web break saving module (OnEfficiency.BreakProtect)	Statistical correlation for multivariate process	Depending on break reasons countermeasures	up to 3% specific energy reduction

![VOITH]

Let's make our world better with paper

Let's make paper better with Papermaking 4.0