

Brewery 4.0

A transformational journey towards
the brewery of the future

VLB BREWING CONFERENCE BANGKOK 2019

ROLAND W. SCHLENKER












Brewery 4.0

A transformation
towards the brewery of the future








Motivations to drive Brewery 4.0

Consumer Driven

-  Personalized & occasion driven
-  Sophisticated - premium
-  Healthy, sugar/alcohol free, natural
-  Online, available and at home
-  Transparency – quality & price
-  Environmentally responsible products
-  Socially responsible products

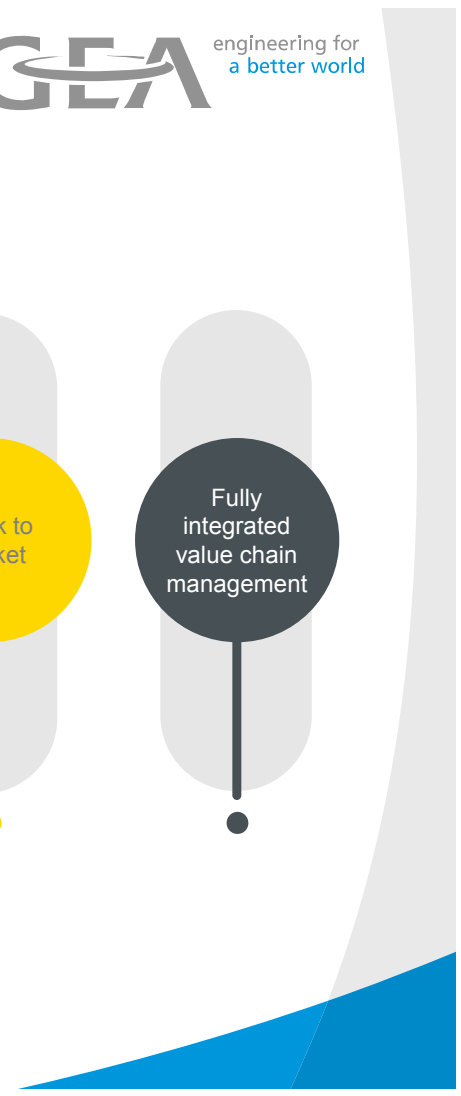
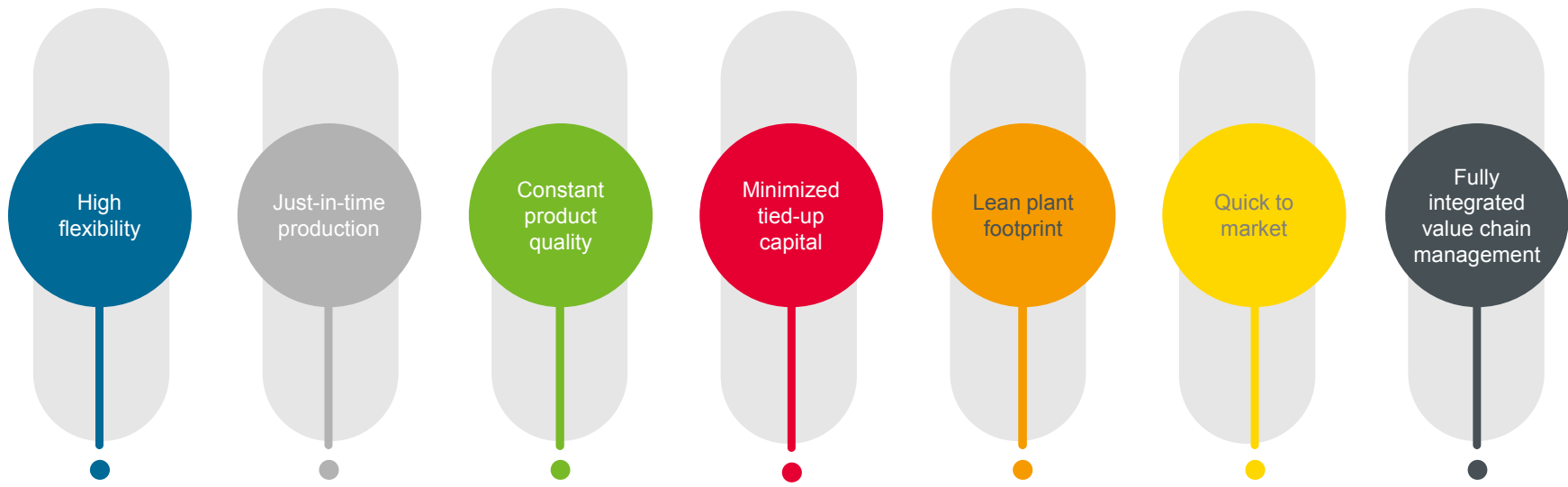
VLB Bangkok 2019

Industrial Challenges

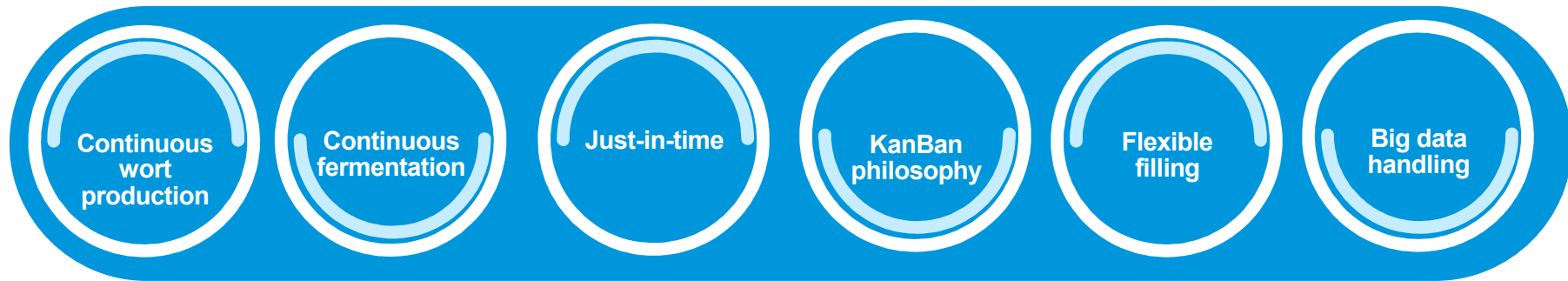
-  Proliferation of SKUs
-  Shortening lead times
-  High tied-up capital
-  Large footprint of plant
-  Risk for on-shelf availability – sales losses
-  Quality impact at warehousing & distribution
-  High level of stocks in BBT and warehouse

What's in the package?

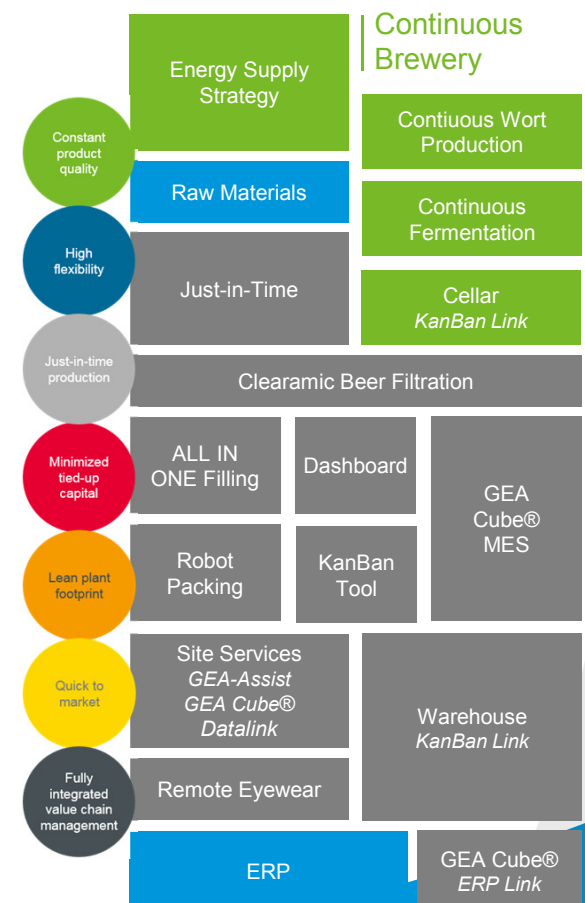
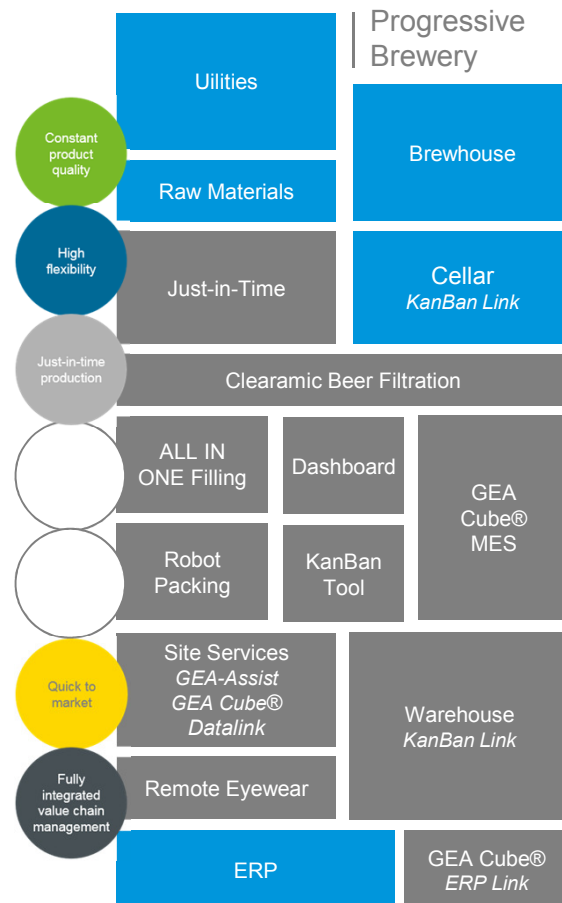
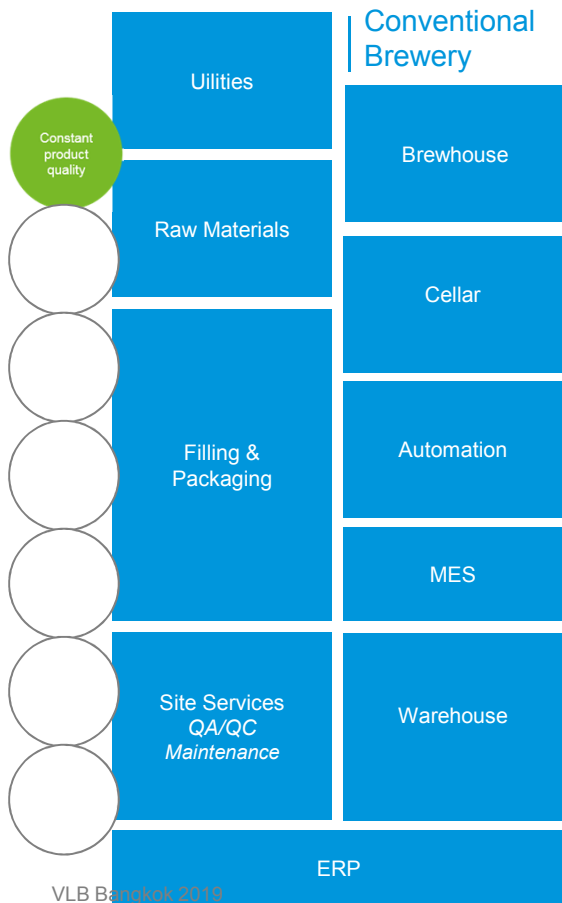
Brewery 4.0



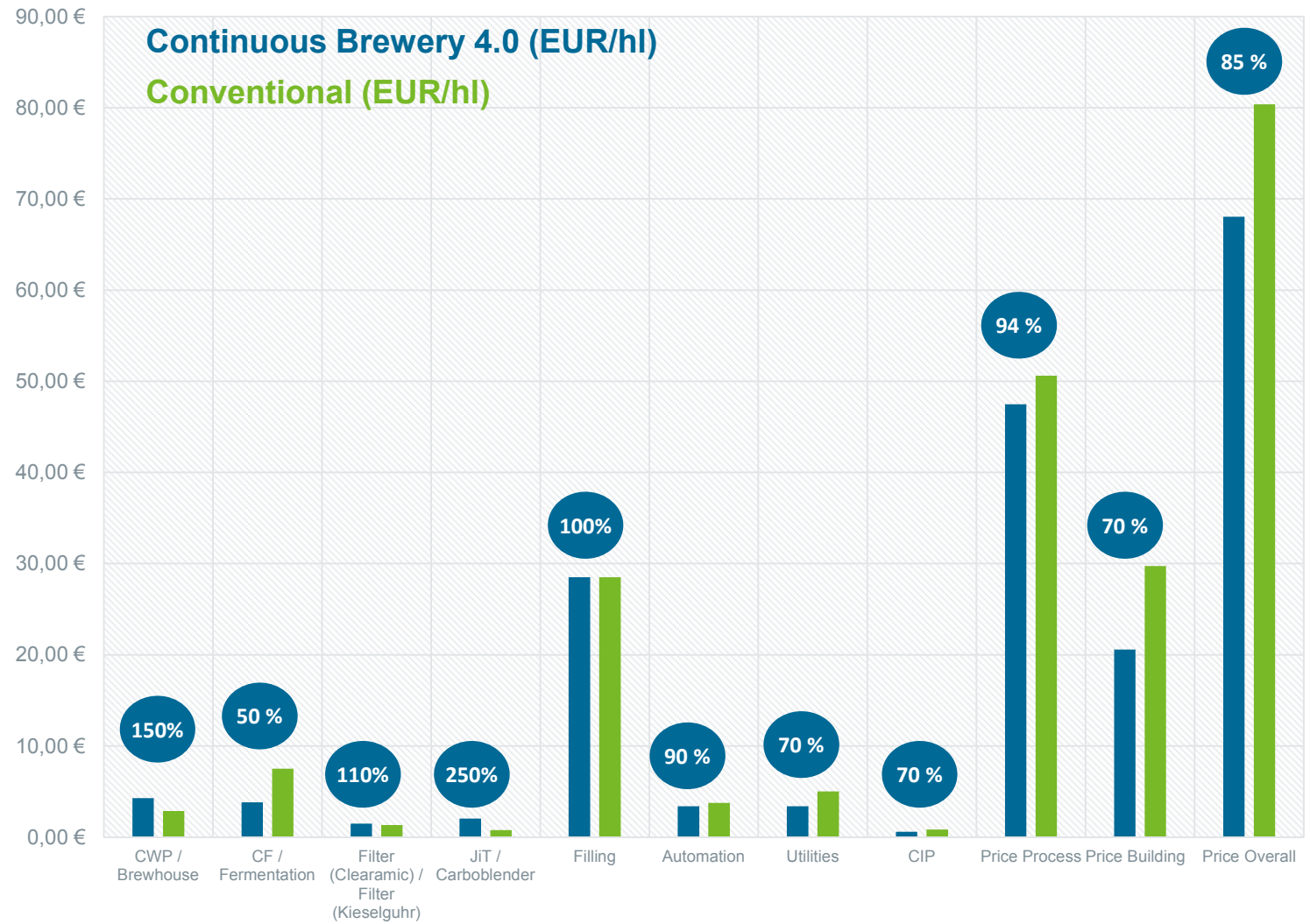
The 6 elements of Brewery 4.0



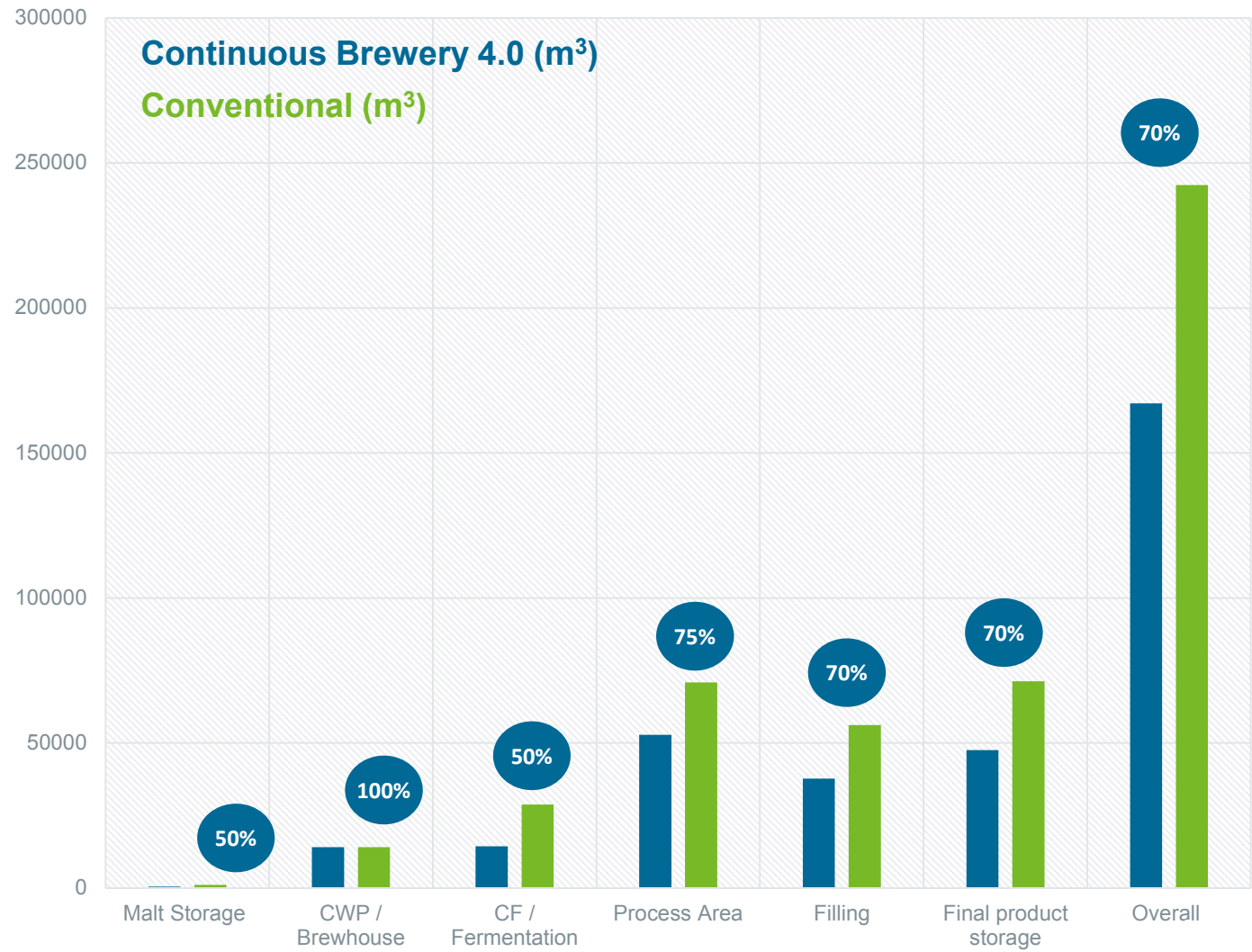
The journey towards Brewery 4.0



CAPEX Brewery 4.0



Building Space Brewery 4.0



The advantages towards Brewery 4.0

WATER @ 75% returnable / no recycling

Conventional	3.8 hl/hl
Conti 4.0	3.7 hl/hl

THERMAL ENERGY

Conventional	19 kWh/hl
Conti 4.0	17 kWh/hl

ELECTRICAL ENERGY

Conventional	7.0 kWh/hl
Conti 4.0	6.0 kWh/hl



WATER @ 75% returnable / no recycling

Conventional	65 m ³ /h	↓ -8%
Conti 4.0	60 m ³ /h	

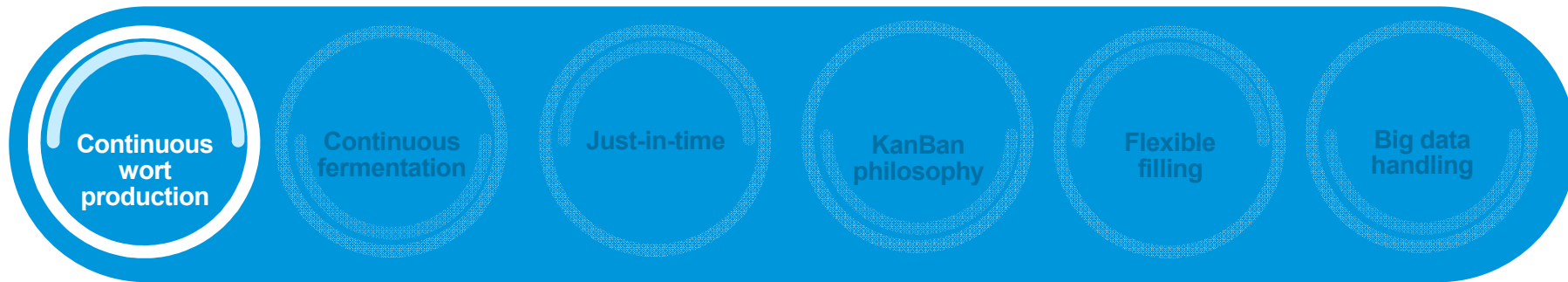
STEAM BOILER

Conventional	20 ton/h	↓ -50%
Conti 4.0	10 ton/h	

ELECTRIC FEED

Conventional	2000 kW	↓ -20%
Conti 4.0	1600 kW	

The 6 elements of Brewery 4.0



Low footprint



Low OPEX



No energy peak



Continuous wort flow to fermentation



Infusion and decoction mashing

Continuous Wort Production (CWP) Brewery 4.0

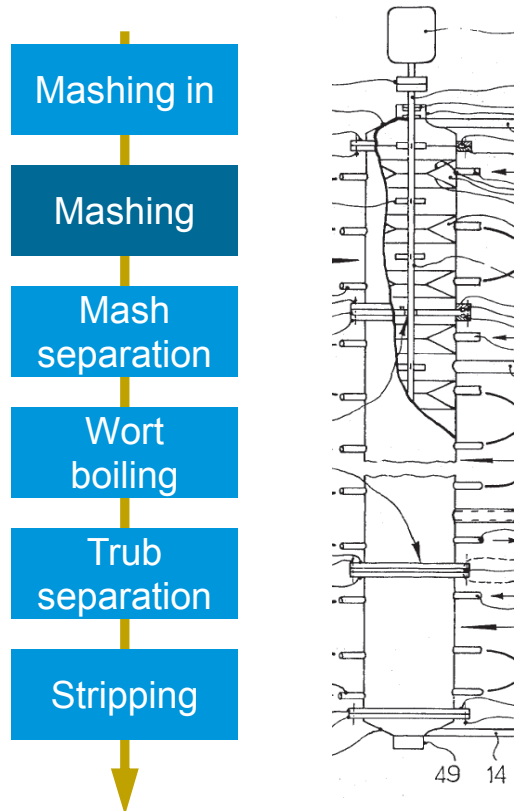
Continuous brewing of beer instead of batch, designed for malt, can be adapted to multiple raw materials. System consists of 2 x mashing inline, 1 x conversion column, 2 x decanters, 1 x hold column, 1 x trub centrifuge, 2 x strippers, 2 x wort coolers

Features:

- For breweries looking to increase production by 1 Mio hl/a and with dominant mother beer which can be transferred to either a CF plus JiT (continuous) or conventional processes (batch)
- Start/stop operation is critical for CF combination (2 hr changeover)
- Less CIP cost (expected 1 full CIP per week + stripper/wort cooler every 8 hours)
- Less energy consumption (with stripper, smaller boiler running at high efficiency saves fuel)
- Higher productivity (24/7), lower footprint. No loss volume and quality

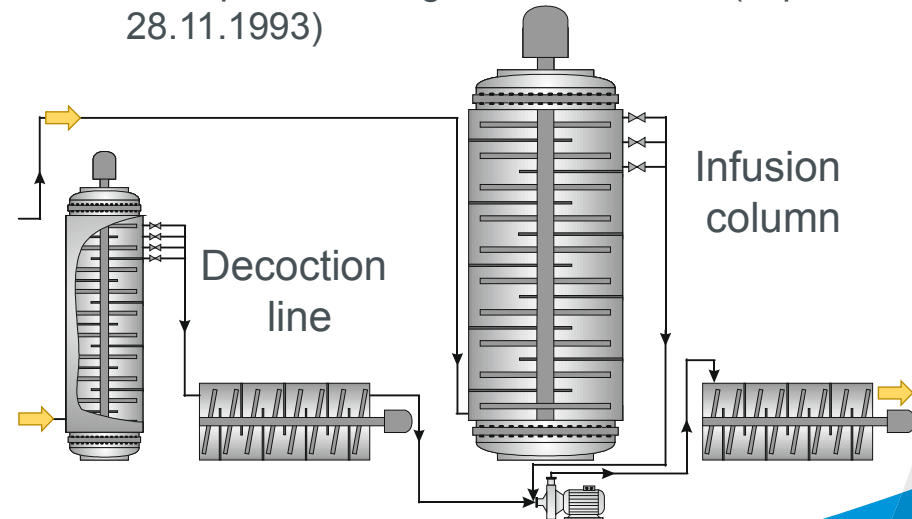
No energy peaks, much less
CIP, optimal energy recovery

The Brewing Process

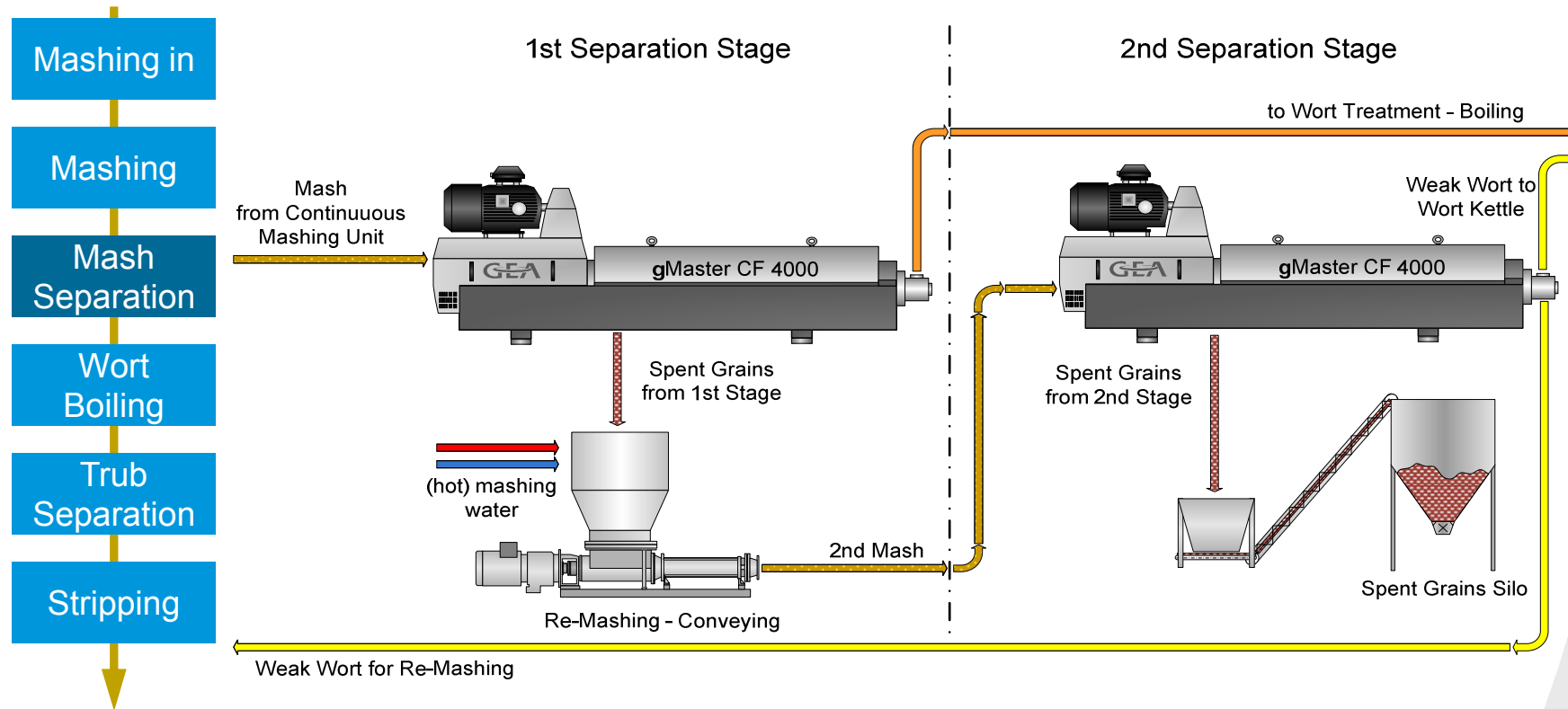


Mashing column

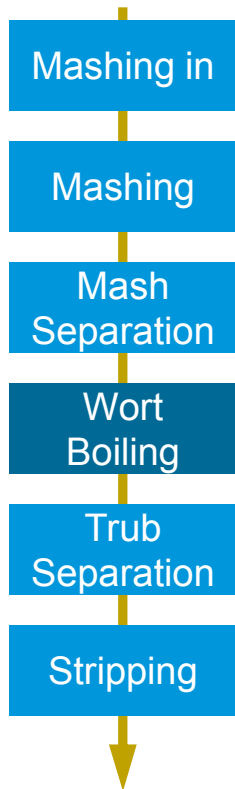
- Plug flow reactor
- Heated with direct steam injection
- Multiple-stage disc agitator
- Principle according to US 3.989.848 (expired 28.11.1993)



Continuous 2-step operation

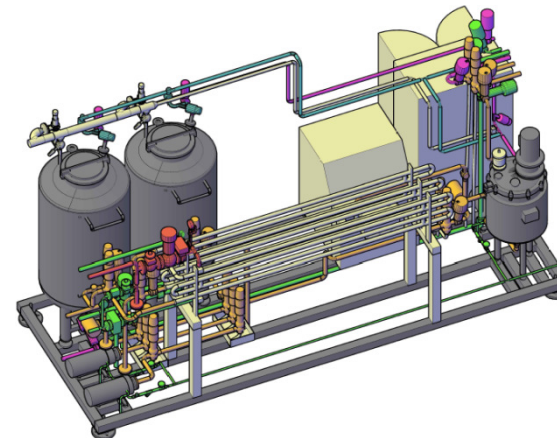


Improvement with HOPSTAR™ Iso

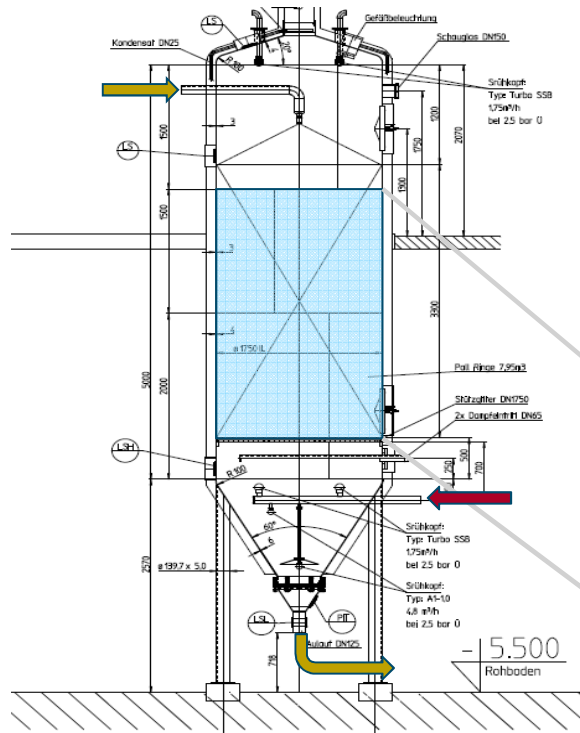
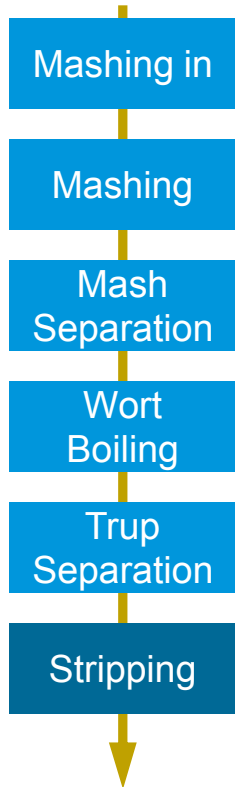


Wort Boiling with HOPSTAR™ Iso

- Hop isomerization in a parallel stream
- Hop treatment independent to residual time and temperature in the column
- Raw material savings up to 30 % due to process design



Brewing Process

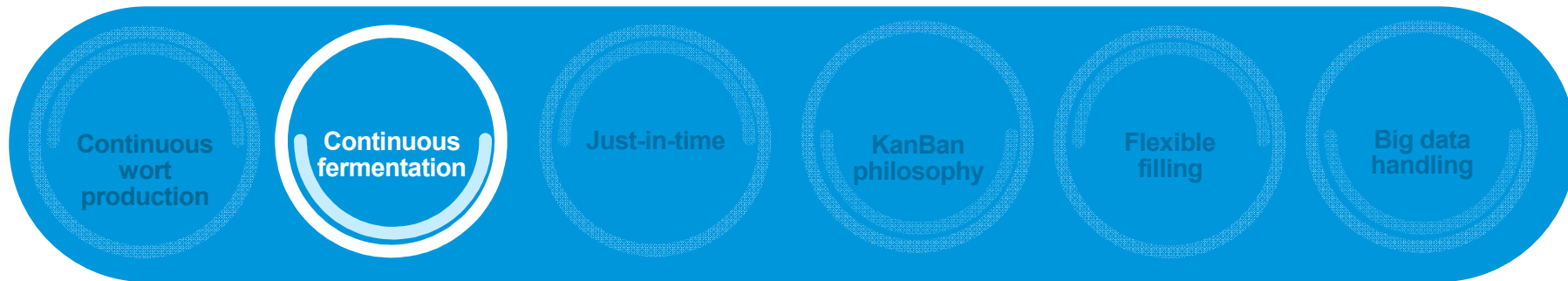


Removal of volatiles

- Removal of volatiles with direct steam (clean steam)
- Energy efficiency due to low evaporation rates of 0.5 – 1.5 %
- Flash evaporation at inlet nozzle possible (depending on upstream process conditions)



The 6 elements of Brewery 4.0



Low footprint



Low OPEX



Reduced CIP efforts



Low CAPEX



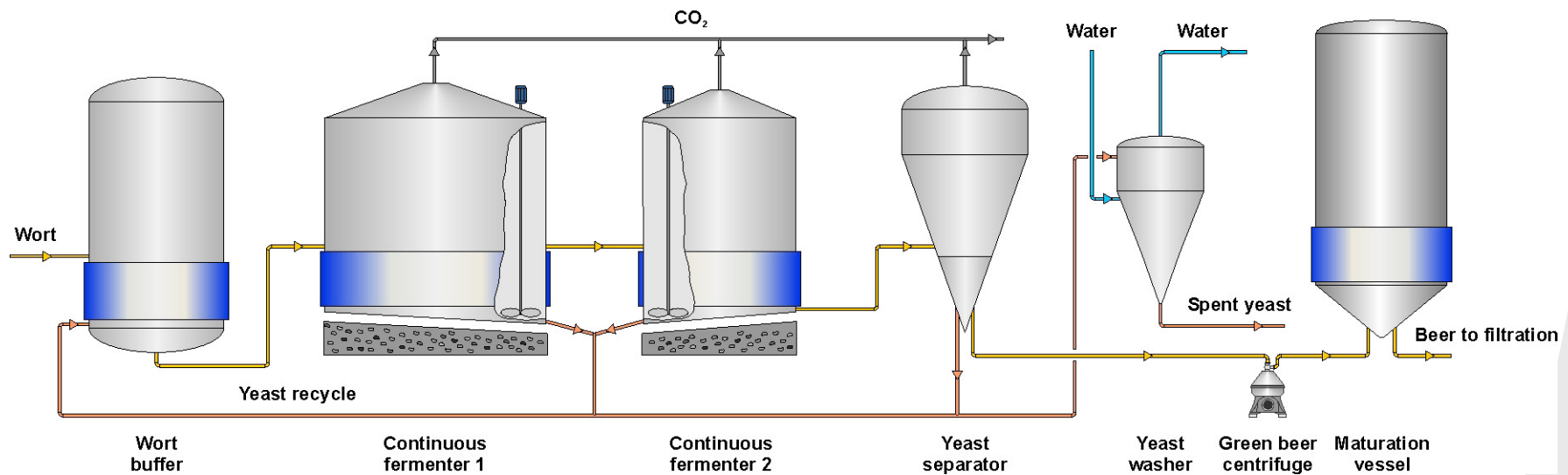
Improved yeast monitoring



Short residual time

Continuous fermentation

- The complete FV area consists of four vessels only
- Constant feed flow rate of pitched wort
- One dedicated vessel per process step



Clearamic Beer Filtration System Brewery 4.0

Fully automated beer filtration system with ceramic membranes. Consists of one or more filter blocks, a buffer tank and a CIP with dosing stations

Features:

- Sustainable system with long lifetime → low maintenance efforts
- Inert material, yeast free product, easy to clean → good quality
- No filter aids, no special cleaning agents → low OPEX



Dry Hopping with HOPSTAR™ Dry Brewery 4.0

Fluidized bed extractor for hop pellets

Features:

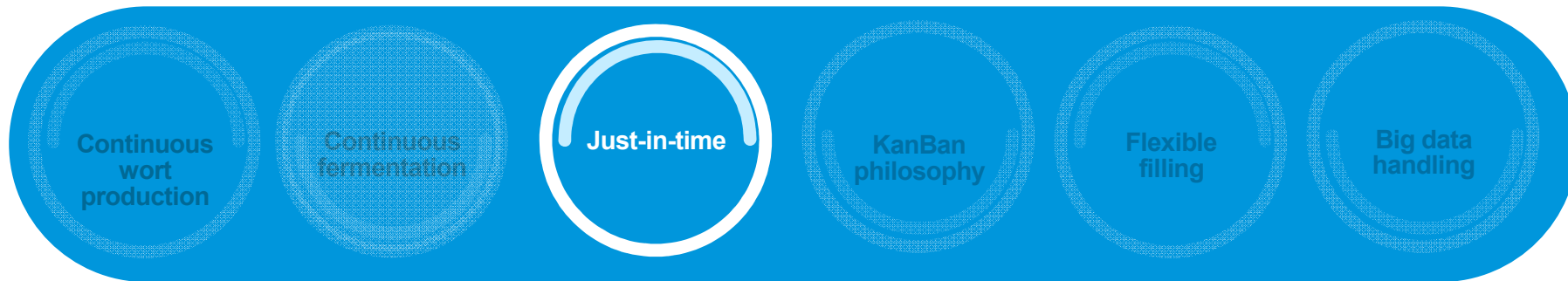
- Fully automated system of both production and CIP
- Highly flexible concept with regard to hop and product characteristics
- Homogenous distribution of enriched hop aroma in the storage tank
- Skid-mounted system simply integrated into the process of the cold block area
- Low product losses due to minimum amount of solids transferred to CCT
- Raw material savings up to 50 % of the hop pellet bill



HOPSTAR™ Dry

VLB Bangkok 2019

The 6 elements of Brewery 4.0



Late differentiation



Right-first-time



High flexibility



Reduced working capital



Just-in-time delivery to packaging line



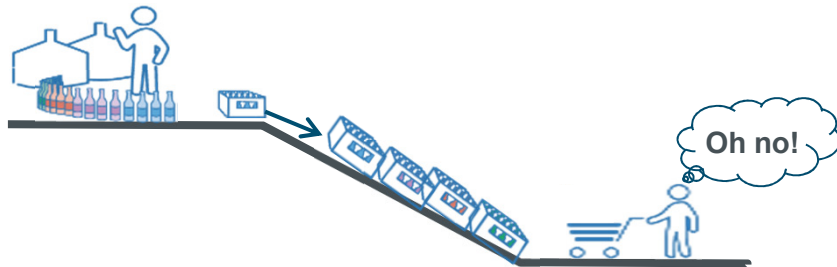
High on-shelf availability



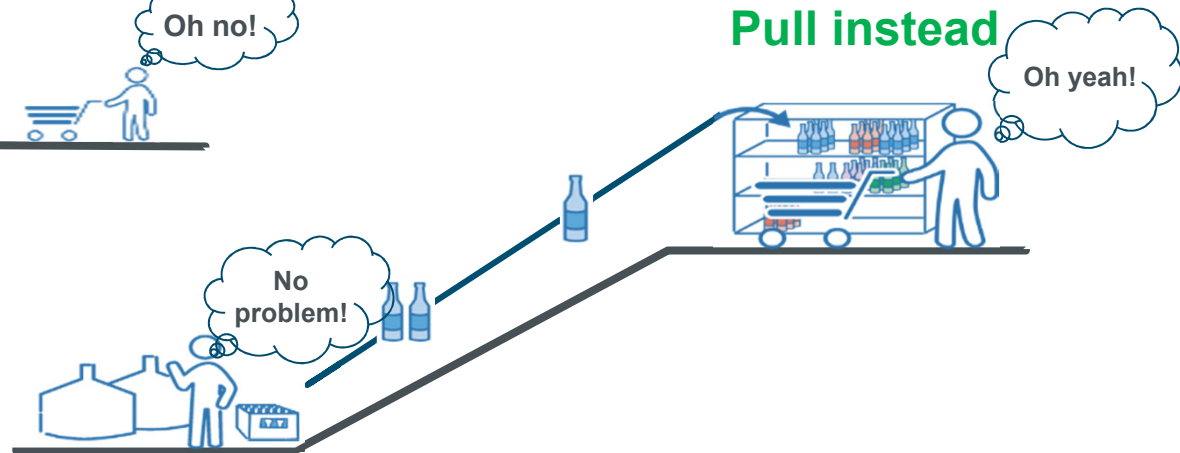
Quick change over of brands

Just-in-Time production – the solution

Don't push

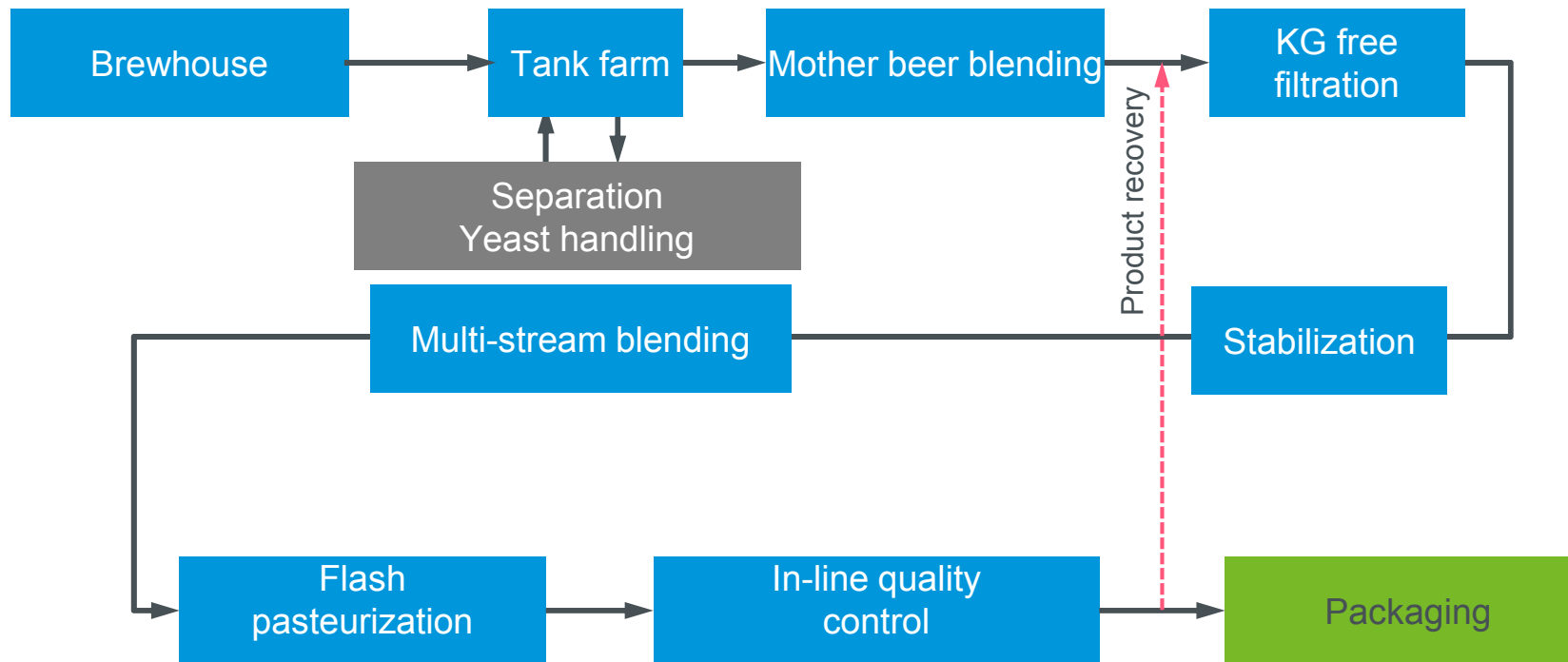


Pull instead



Innovative production method – end consumer oriented!
Due to use of GEA KanBan automation

Process overview

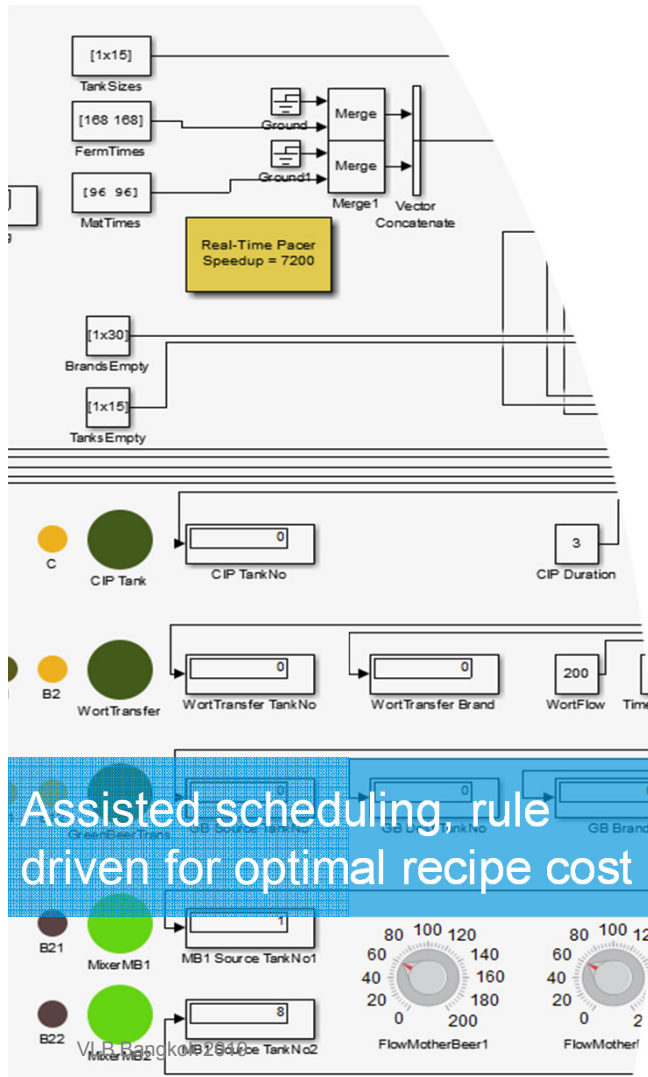


KanBan Scheduler Brewery 4.0

Automatic production-order generation according to analysis of overall stock situation and production capacity based upon GEA Cube® MES.

Features:

- Assisted/automated schedule optimisation incl. CIP scheduling
- Optimized order handling for raw materials
- Calculation of real time stock value under consideration of storage costs
- Enables demand driven fully automatic production process without operator intervention
- Production simulation to define necessary plant capacities under different circumstances
- Use of alternative recipes for costs optimization



Just-in-Time System Brewery 4.0

Technology for late stage differentiation of beer and other beverages. The system consists of tailor made multicomponent blending module with optional DAW, carbonator and flash pasteurizer modules (complete JiT System)

Features:

- In-line additions to create a big number of SKUs from a small number of mother liquids as needed.
- Modular design: blender, carbonator, flash pasteurizer, DAW, multi-component blender
- Ready to handle various raw materials from powder bags, container or bulk
- High accuracy digital blending with in-line measurement of quality parameters
- Minimization with batch sizes and significant reduction of storage/buffering.
- Shortest possible production lead times within the brewery (from warehouse order until start of production) when combined with KanBan system.



SKU flexibility, smart planning
with Kan-Ban tool

The 6 elements of Brewery 4.0



On demand production steering



Supply chain management from supermarket shelf to raw material intake

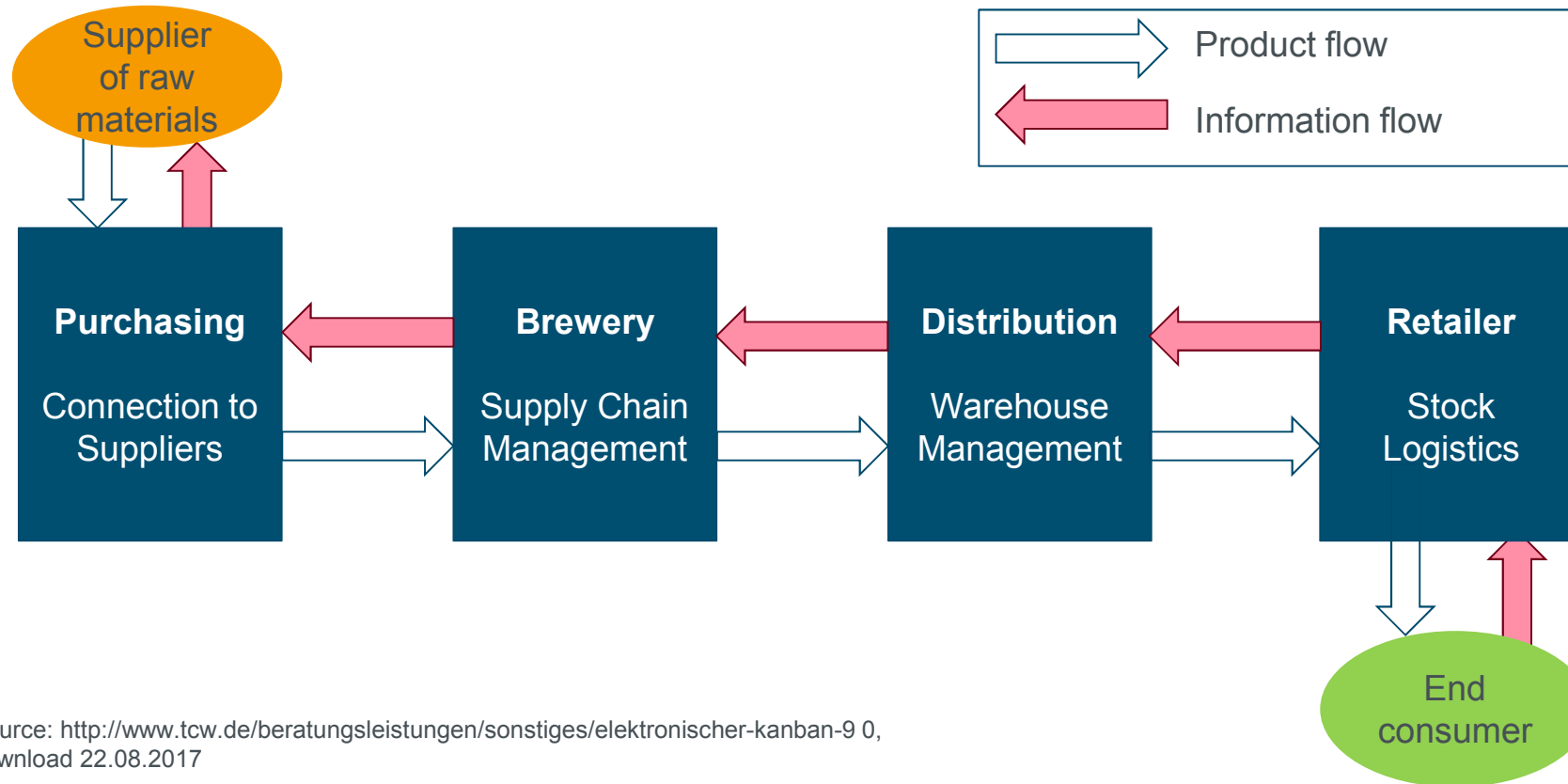


Single control loops used to manage KanBan properties



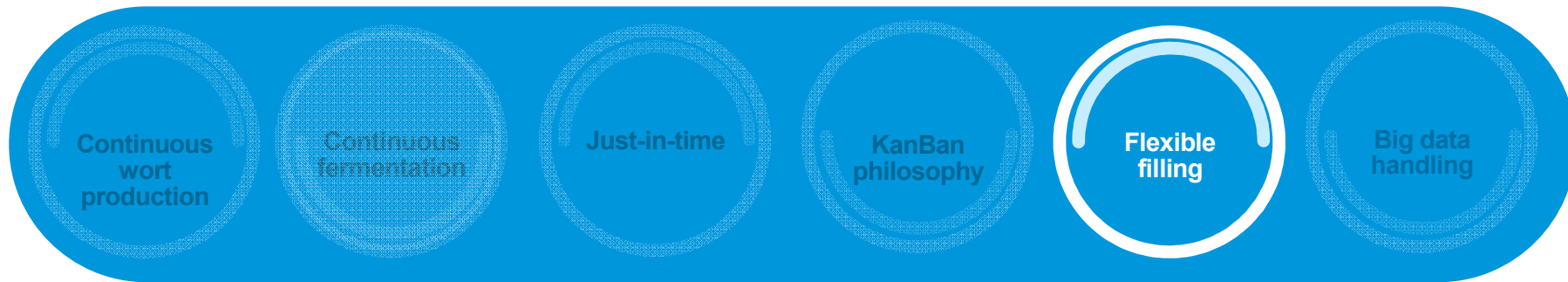
Lean plant layout

KanBan supply chain management



Source: <http://www.tcw.de/beratungsleistungen/sonstiges/elektronischer-kanban-9-0>, download 22.08.2017

The 6 elements of Brewery 4.0



ALL IN ONE Rinsing/Filling/Capping/Seaming Brewery 4.0

A robust and multifunctional carousel-type system for filling cans, glass and PET bottles on one machine – from 3.000 up to 20.000 cans and/or bottles per hour.

Features:

- Low infeed into the rinser/filler/seamer/capper block
- Single or double air evacuation for all containers (low O₂ pick-up)
- Universal rinser grippers for glass and PET bottles and cans (no change necessary)
- Unique capper/seamer combination on one turret
- No or minimal product loss during seaming operation
- Possibility of lid disinfection or cap sterilization (reducing the need for tunnel pasteurizer)

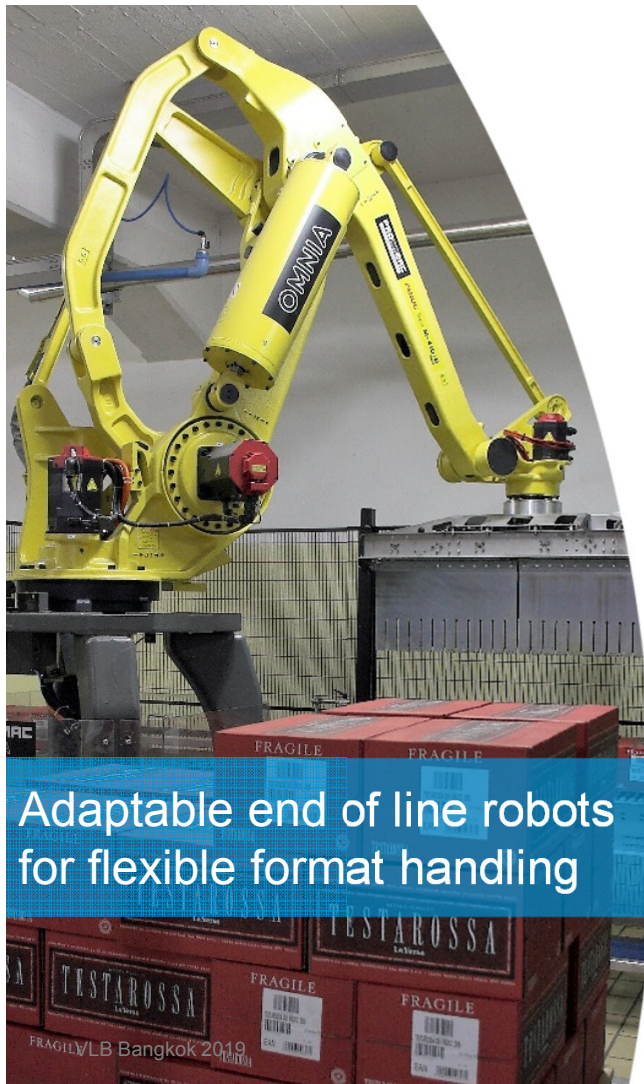


Robotized Packing & RFID Brewery 4.0

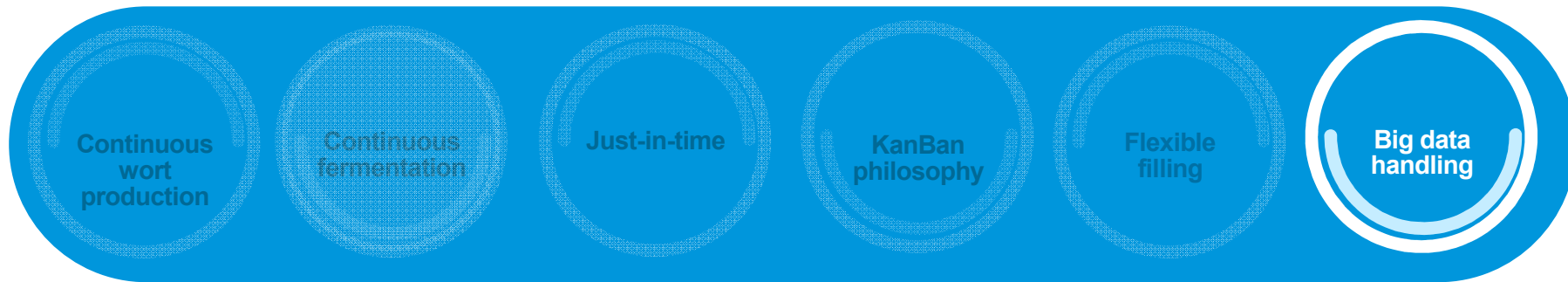
Perfect match to ALL IN ONE machine, flexible end of line packing for multiple formats and sizes. New adhesive type RFID tags can be integrated for full traceability.

Features:

- Key element of Industry 4.0
- Robotise line, flexible and adaptable
- Palletising, de palettizing, boxing, crating, labelling, RFID tagging
- Inline bottle & sample analytics with 3rd party systems
- RFID tagging enable – verify, control, track and trace



The 6 elements of Brewery 4.0



Extraction of available data for management decisions



KPI management



Long term trending



Smart manufacturing



Improved plant availability

Edge Computing

Sensor
Data

Cloud Storage

Databases

ERP

CRM

PDM/
PLM

PDMS

...

Data Lake

Analytics
Infrastructure

AI

ML

BI

MPC

...

Big Data, collaboration, data
driven improvement

Front-End User

Visualization
Tools

Web

Mobile

VLB Bangkok 2019



GEA Cloud Brewery 4.0

Big data system for GEA and GEA Customers

Features:

- Safe Environment
- Microsoft Azure based
- Front End platform for user visualisation
- Tools for data analysis and AI applications
- Platform for client and GEA engineers to explore new opportunities

GEA-Assist Brewery 4.0

GEA-Assist is a secure web-based application designed to host and manage a variety of online services relating to project and plant maintenance.

Features:

- Documentation hosting
- Online training
- Asset register
- Spare parts
- Project / maintenance tools
- Reports / analysis

Cloud based plant
documentation management



VLB Bangkok 2019





VLB Bangkok 2019

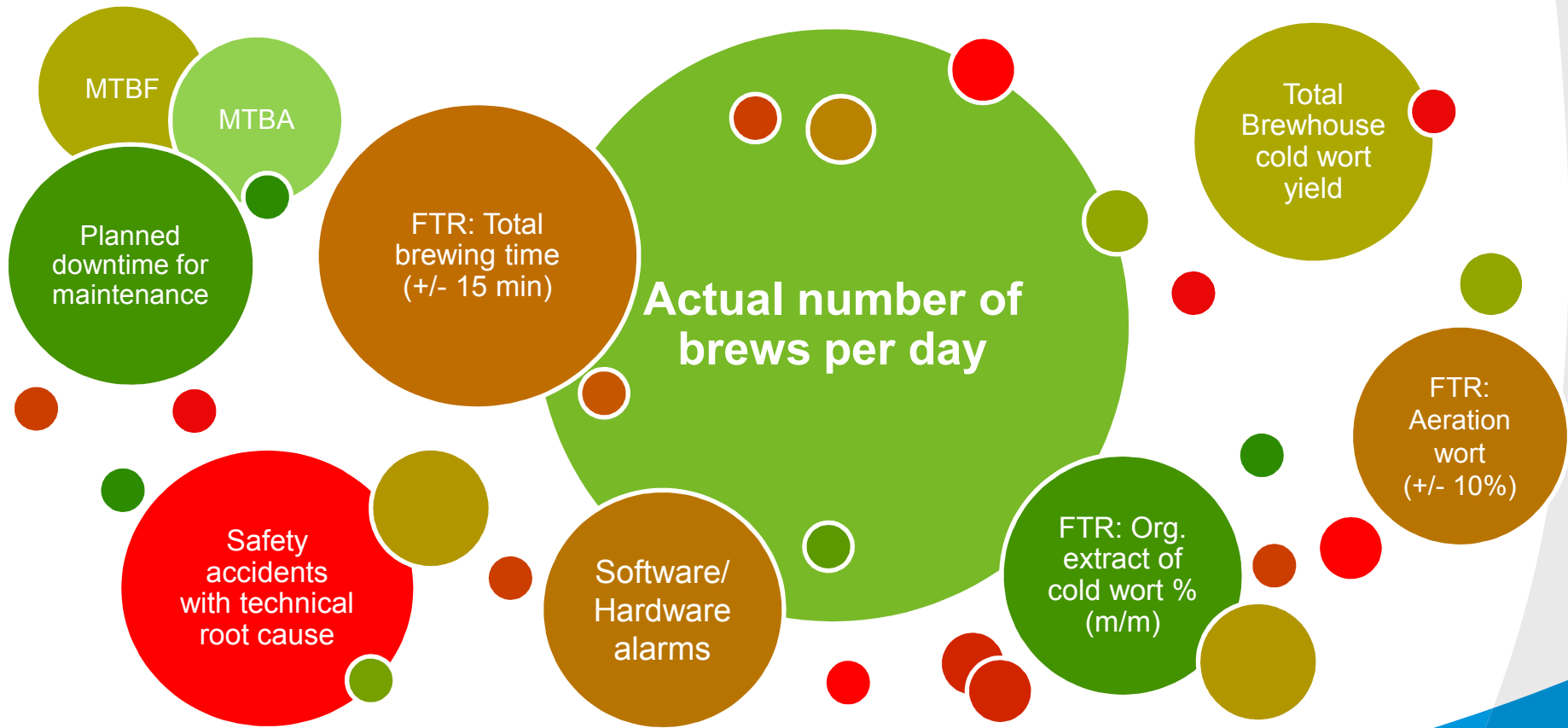
GEA Remote Eye Wear Brewery 4.0

For plant inspections, providing support during commissioning and in the event of technical problems, we have developed GEA Remote Eye Wear. By projecting images onto the screen, repairs, process optimization and inspections can be carried out at the speed of the internet.

Features:

- Quick support without any physical effort
- Available for use with all GEA equipment
- Simplifies production assistance and visual inspections
- Maximizes production time and reduces operational costs
- Extends equipment life
- Ensures safety and motivation
- Increases quality of service

KPI Targets



EE	96 %	Gesamt
Qual.	94 %	08:00 Uhr
Perf.	96 %	
Verf.	100 %	

Maischpfanne
EE 98%

Läuterbottich
EE 96%

Vorlauf tank
EE 100%

	Güte	Ist	Diff.
gungszeit	97,6 %	03:35 h	+00:05 h
	88,9 %	1,6 K/min	-0,2 K/min
auerqut	95,0 %	2,1 l/hl	+0,1 l/hl
aCl	98,3 %	2,8 l/hl	-0,2 l/hl
avwindigkeit	95,8 %	1,5 m/s	-0,1 m/s
tur	99,7 %	76,8 °C	-0,2 °C
stemperatur	99,5 %	62,3 °C	+0,3 °C

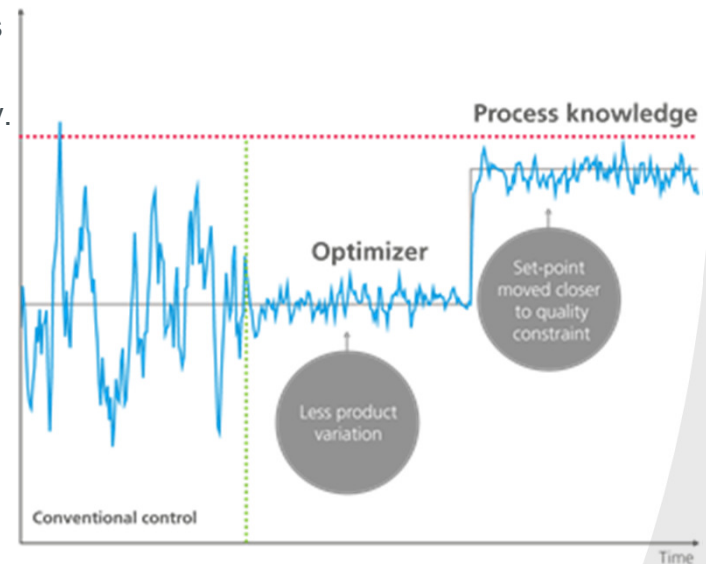
Visibility, anytime, anywhere.

Dashboard 4.0 Brewery 4.0

Identification of data that really matters

Features:

- Based on GEA Cloud Solutions
- Start at brewhouse. Later expansion for full brewery.
- Overview of plants from OEE point of view
- Identification of anomalies and correlations
- Makes plant data comparable
- Online optimization of process



GEA OptiPartner Brewery 4.0

Remote support from GEA specialists, keep your plant working at its maximum capacity and capability.

Features:

- Cloud based system
- Support from GEA technologists
- Remote tuning
- KPI Reports / analysis





engineering for
a better world