Circular Water Treatment Technologies
The industrial approach

Rainer Haug, Janis Dohe, Hermann Kempen
Kurita Europe GmbH

Agenda

1. Kurita Eco Journey
2. Challenges in Industrial Water Treatment
3. Steps to Circular Water Treatment Products

Kurita Eco Journey

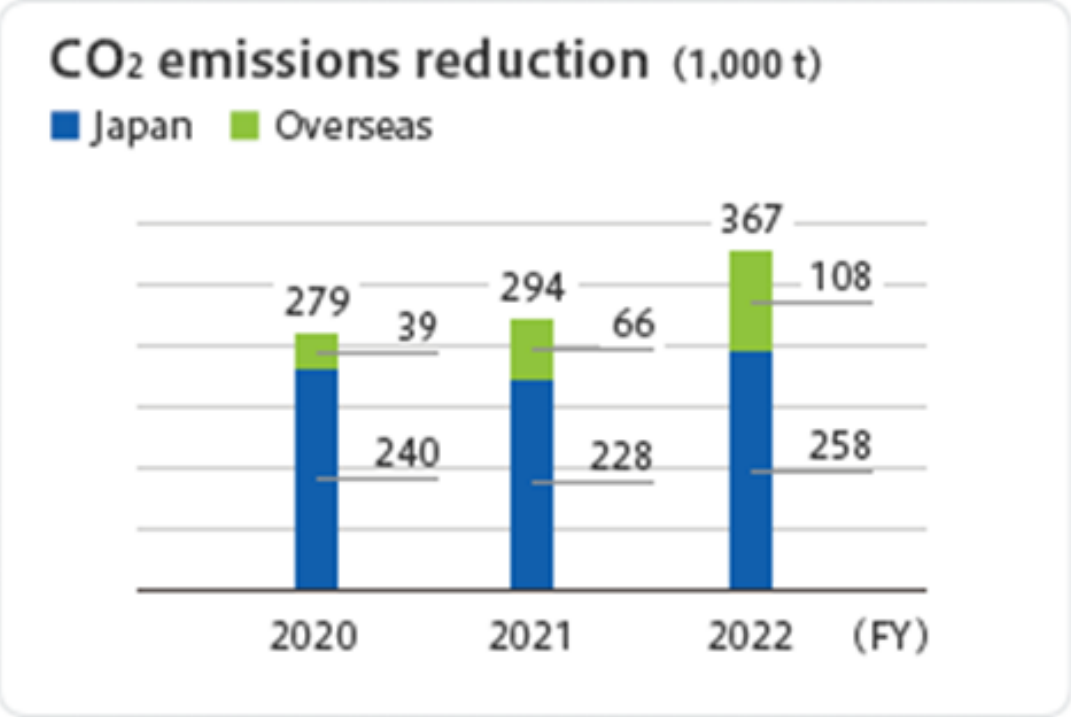
Realize sustainable energy use

- **Reducing** Kurita's **in-house** energy consumption
- **Optimize** energy use at Kurita's **customers'** plants

	Long Term Targets	
Metrics	**FY 2031**	**FY 2051**
Scope 1 and 2 emissions reduction (Reduction rate from FY2020)	27,5 %	100 %
Scope 3 emissions reduction (Reduction rate from FY2020)	27,5 %	.

Realize sustainable energy use

CO_2 emissions reduction at customers through proposals of Kurita



Reduction in fuel use by **improving** heat efficiency in **boiler** and **cooling water** treatment.

Savings by adopting inverters in **water treatment facilities**

Creating Shared Value

The Kurita Group defines:

Products, technologies or business models

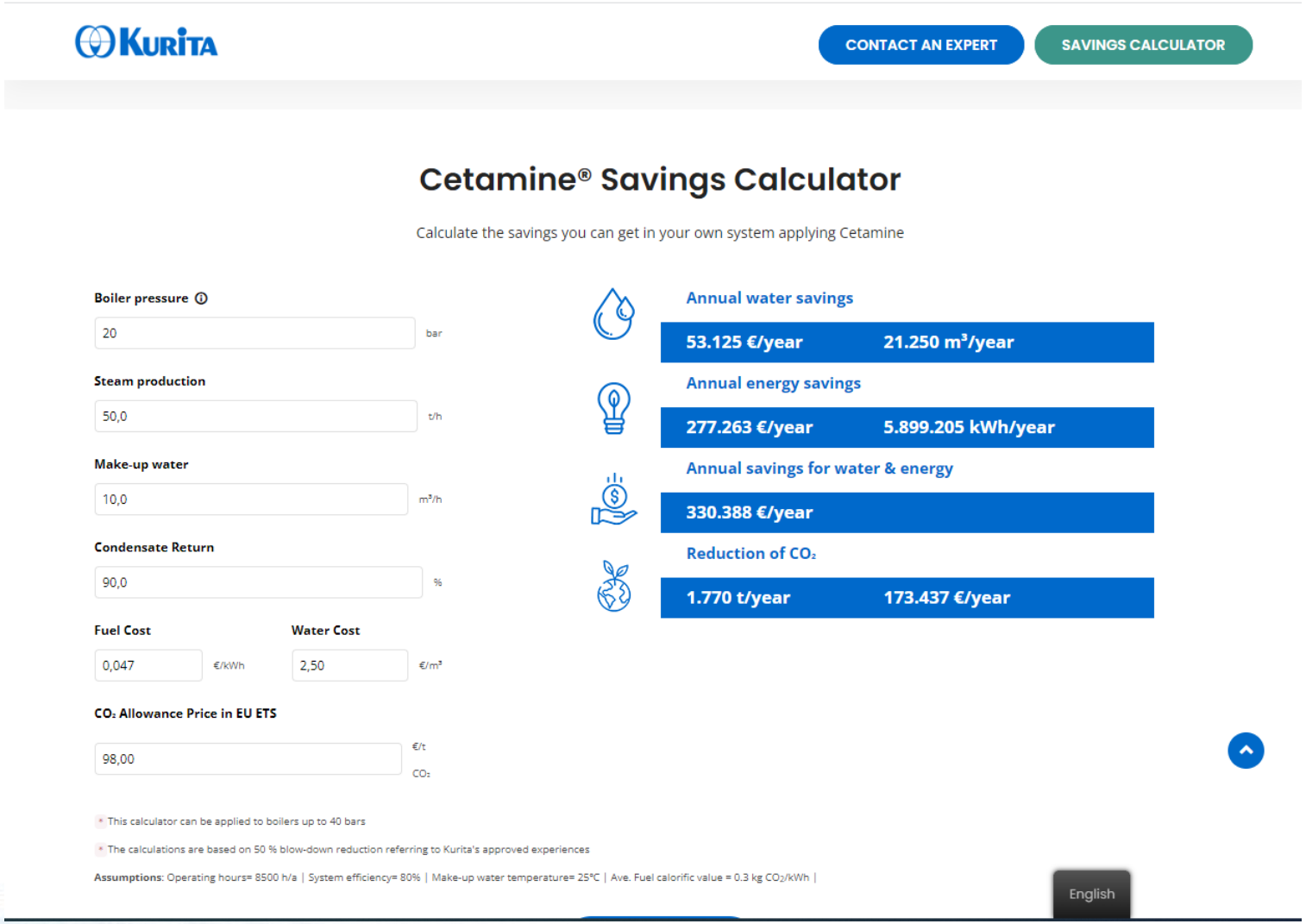
that make significant contributions to

water-savings, CO_2 emissions reduction and waste reduction

compared with previous levels as

“CSV businesses.”

Spreading energy-creating technologies



Corporate (CCF) & Product Carbon Footprint (PCF)

Scope 1

Direct emissions

(i.e. generated in own facilities)

Scope 2

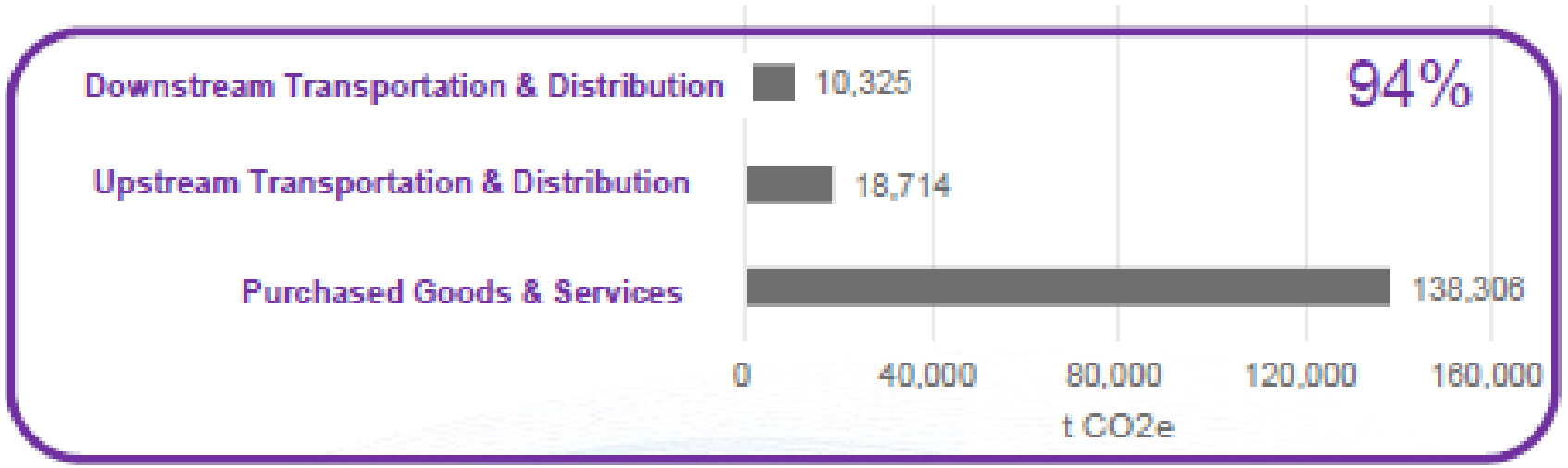
Indirect emissions

(i.e. purchased energy)

Scope 3

Other indirect emissions in the upstream and downstream value chain (> 90 %)

Driver of total emission is Scope 3



Scope 3
Majority of total emissions in most sectors

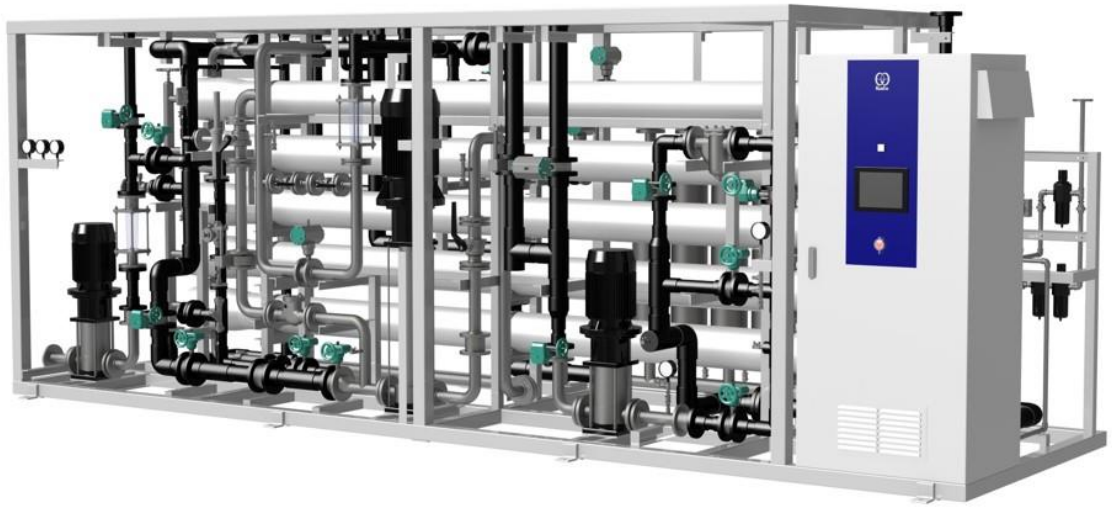
B

Biobased Products can reduce raw material CO_2 footprint

Challenges in Industrial Water Treatment

Industrial Cooling Water Principles

- Drinking water only for human consumption
- Use water according to its quality / Make water usable for intended use
- E.g. Boiler water after use still suitable for applications with lower quality demand
- Reuse Water / Blow Down - CTBR



Cooling System Conditions

- Water Quality
- Suspended Solids
- Bacteria
- Legionella
- Airborne contamination
- Concentration effect – coc
- Holding Time Index
- Temp
- …
- …

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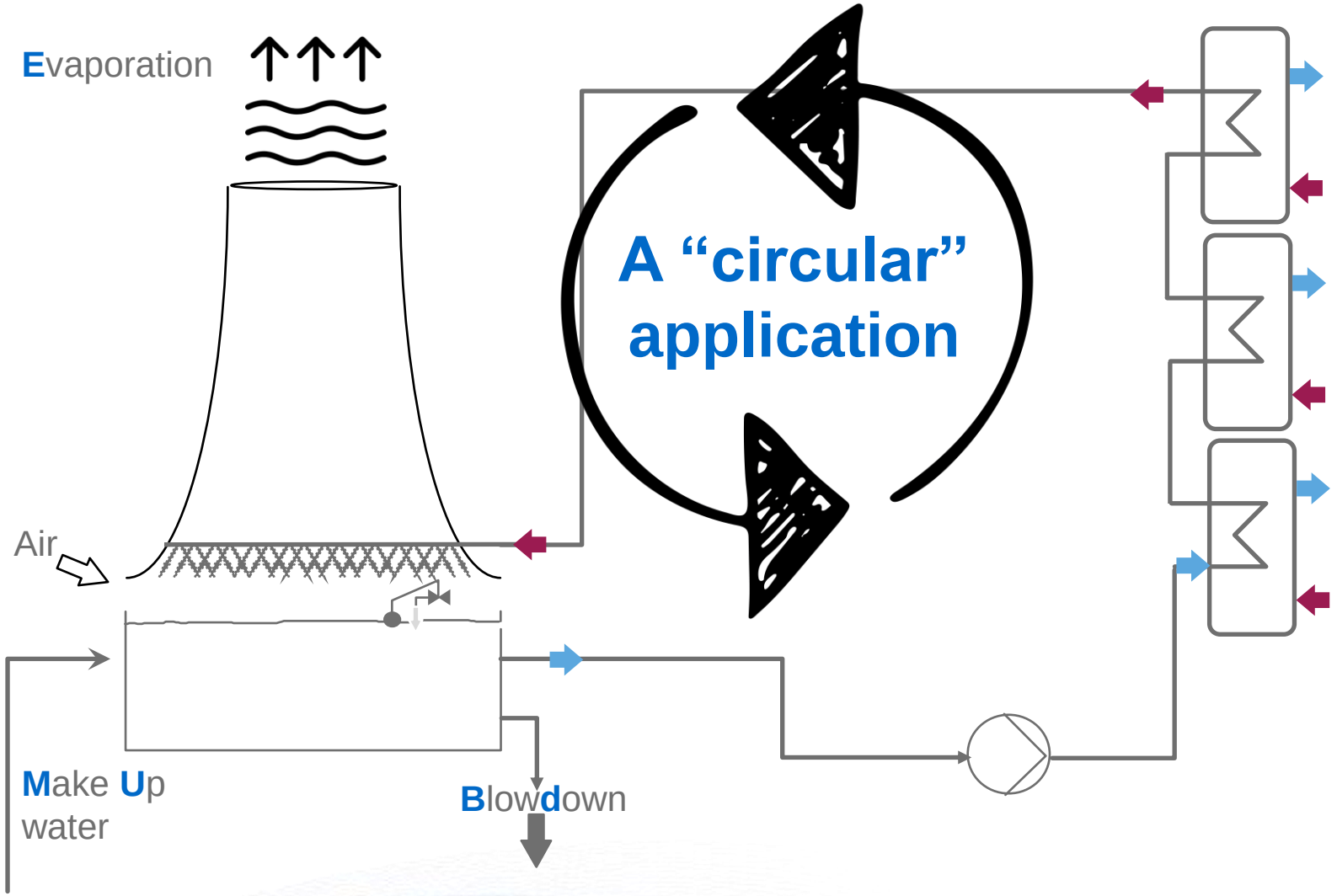
Circular Cooling System



System Parameters

RR = Recirculation

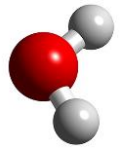
MU = Make-up

BD = Blowdown

E = Evaporation

Increased Salt Concentration due to Evaporation

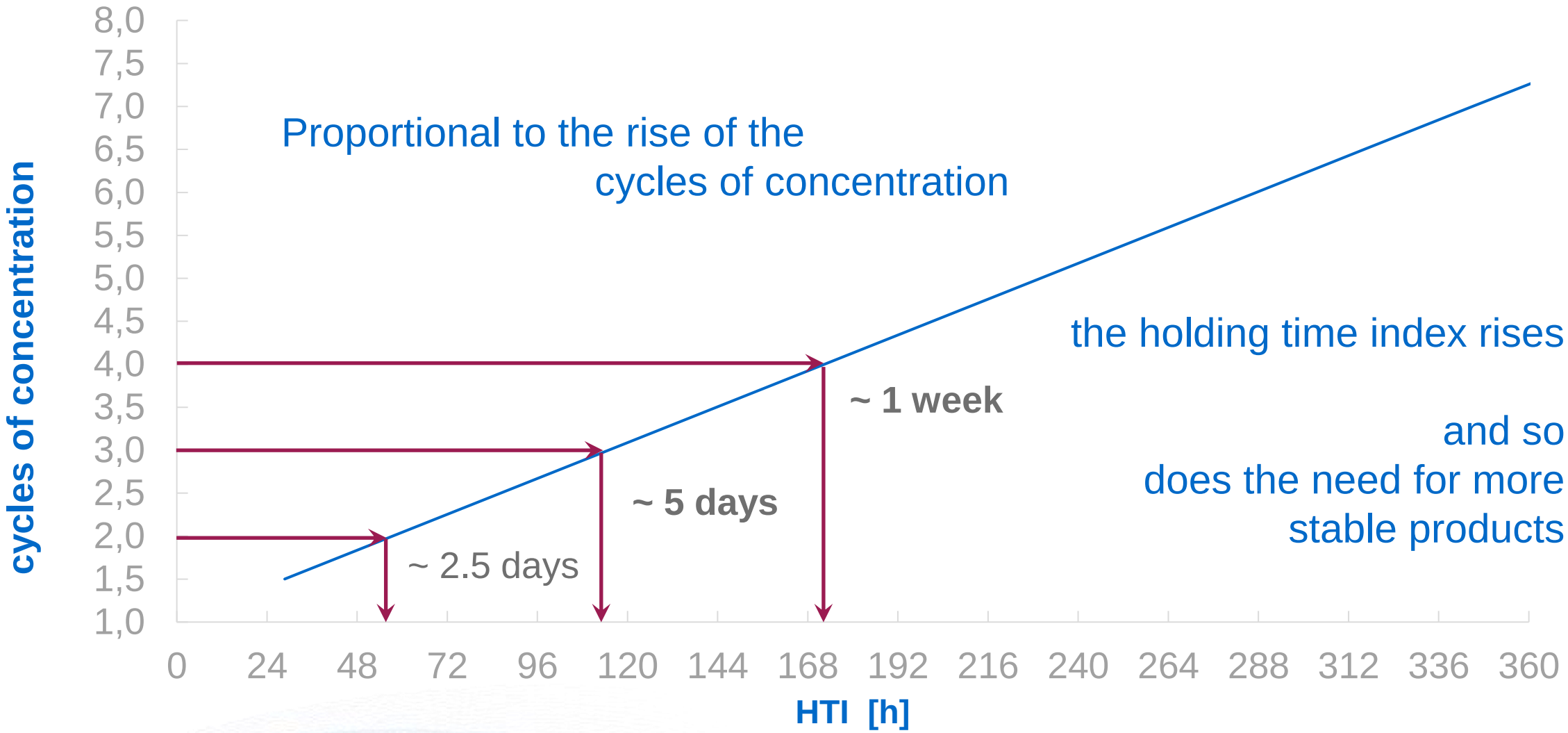
- Only pure water (H_2O) can evaporate
- **E**vaporation causes the cooling effect
- **E**vaporation causes a concentration of salts



Concentration Effect

$$Coc = \frac{MU\ (m^3/h)}{BD\ (m^3/h)}$$

Holding Time Index



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- Water Quality
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- **Bacteria**
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- …
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Microbiology

The growth of microorganisms depends on:

- ✓ Water / humidity
- ✓ Nutrients (water, materials, air)
- ✓ Temperature (psychotropic, mesophilic, thermophilic)
- ✓ pH value
- ✓ Time (stagnation / flow / surface)

Microbiologic categories

ALGAE

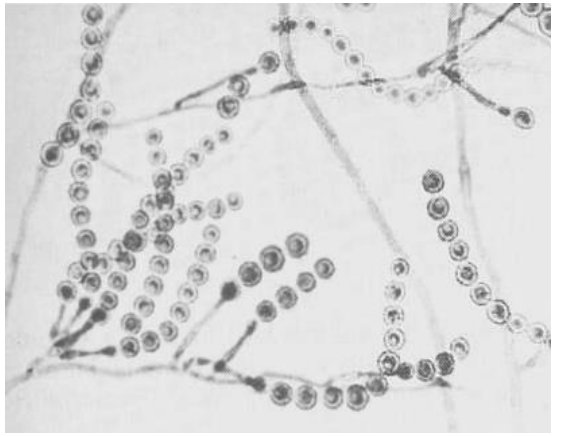
Sources: freshwater

Characteristics: grow in sunny places like cooling tower, open water basins

MOLD + FUNGI

Source: air, water, soil, wood, additives

Characteristics: most grow at acidic pH's, form spores, degrade cellulose



BIOFILM

Sources: initiated from slime-forming bacteria such as Pseudomonas aer.

Characteristics: Natural habitat of microorganisms

BACTERIA

Sources: all over in nature

Characteristic grow:
Aerobic- require O_2
Anaerobic- without O_2
Facultative- both aerobic & anaerobic environments

Steps to Circular Water Treatment Products

R&D bases to create innovations

- Environmentally conscious R&D fundamentals
- Spread of energy-creating technologies
- Biobased Polymers at the Kurita Europe Technology Center (KETC)

KURITA INNOVATION HUB

- Established in 2022 in Akishima, Tokyo, Japan
- The Technical Education Center (TEC) includes the exhibition area and training facilities
- The Technology Innovation Center (TIC) includes R&D facilities and joint research with stakeholders

KURITA EUROPE TECHNOLOGY CENTER

- Established in 2021 in Viersen, Germany
- Cutting-edge research and development facilities
- Equipped with an employee training center and a visitor center for introducing customers and business partners to R&D efforts.

Biodegradable Products

Circular Water Treatment Products

Biodegradable

Biobased

Fit to meet the application demands

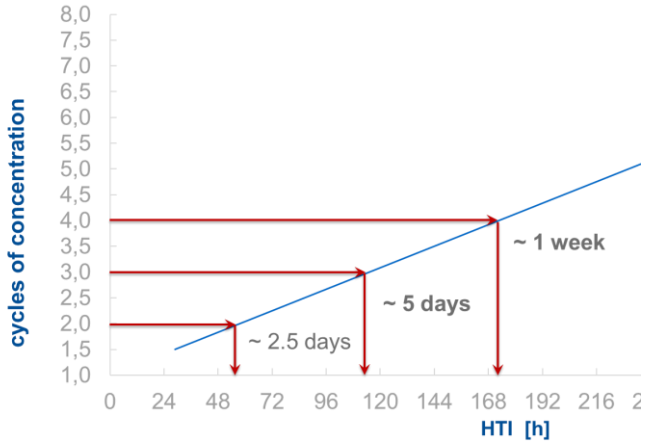
Biodegradable Products

OECD 301 Ready biodegradability

- DOC Method
- Diluted product sample + bacteria suspension
- 70% removal in a 10 days window
- within the 28 days test period

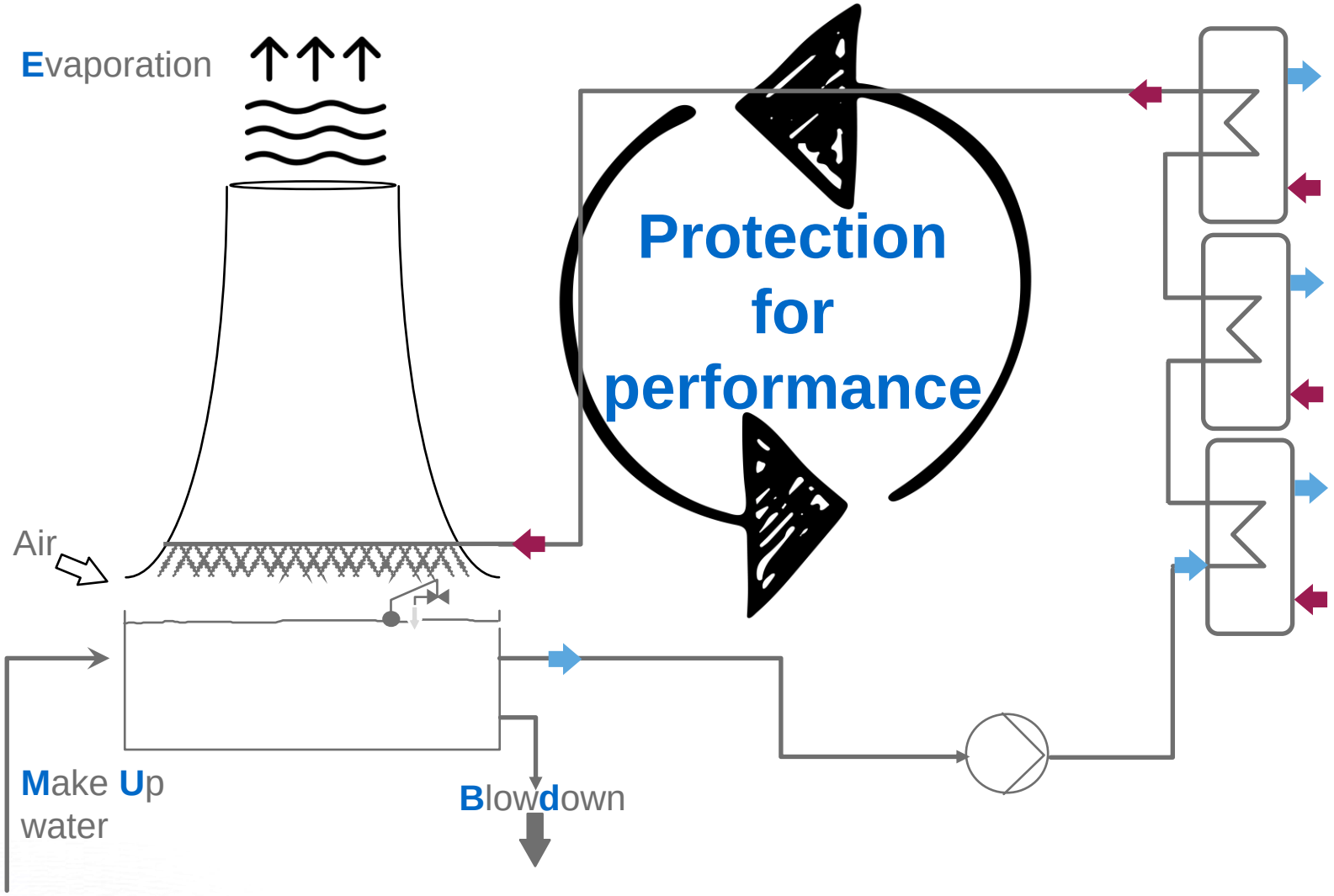
System Parameters

HTI



Biodegradable Products

- Need to protect products during use
- When released to environment no protection → biodegradation



Corrsave® 100 Technology

- The new standard in CW Treatment
- **Environmentally friendly & active corrosion inhibition**
- Low Phosphate - contribution to comply with stricter limits
- **Readily biodegradable**
- Reduction of corrosion and pitting
- Synergistic effect with Zn / phosphonate treatment

Biodegradable Products

Circular Water Treatment Products

Biodegradable

Biobased

Fit to meet the application demands

Biobased Products – First Steps

Biobased Dispersant for organic matter

contains Natural Oils (Orange sweet)

→ Aquatox H 412

Readily biodegradable (OECD Methode)

Biobased Products

- Not automatically environmentally friendly
- Low ecotox
- No Food
- **Aquatox** = environment Fish, Algae, …
  - **48 h, 72 h, 96 h**

SECTION 12: Ecological information

12.1 Toxicity

Harmful to aquatic life with long lasting effects.

Aquatic toxicity (acute) of components of the mixture

Name of substance	*CAS No*	*Endpoint*	*Exposure time*	*Value*	*Species*
Orange, sweet, ext.	8028-48-6	LC50	48 h	1.1 mg/l	daphnia magna
Orange, sweet, ext.	8028-48-6	LC50	96 h	5.65 mg/l	zebra fish (Danio rerio)
Orange, sweet, ext.	8028-48-6	LC50	72 h	~150 mg/l	desmodesmus subspicatus
Reaction mass of 1-Methyl-4-(1-methyleth-enyl)cyclohexene and 1-Methyl-4-(1-methyl-ethylidene)-cyclo-hexene and 1-methyl-4-(propan-2-yl)cyclo-hexa-1,3-diene		LC50	96 h	1.3 mg/l	fish
Reaction mass of 1-Methyl-4-(1-methyleth-enyl)cyclohexene and 1-Methyl-4-(1-methyl-ethylidene)-cyclo-hexene and 1-methyl-4-(propan-2-yl)cyclo-hexa-1,3-diene		EL50	48 h	3.4 mg/l	aquatic invertebrates
Reaction mass of 1-Methyl-4-(1-methyleth-enyl)cyclohexene and 1-Methyl-4-(1-methyl-ethylidene)-cyclo-hexene and 1-methyl-4-(propan-2-yl)cyclo-hexa-1,3-diene		EC50	48 h	0.48 mg/l	aquatic invertebrates
Reaction mass of 1-Methyl-4-(1-methyleth-enyl)cyclohexene and 1-Methyl-4-(1-methyl-ethylidene)-cyclo-hexene and 1-methyl-4-(propan-2-yl)cyclo-hexa-1,3-diene		ErC50	72 h	0.42 mg/l	algae
(R)-p-mentha-1,8-diene	5989-27-5	LC50	96 h	720 µg/l	fish

Summary

- **Cooling** System HTI – typically **> 1 week**
- **Biodegradabilty** → bacteria
- Effect test time **10/28 days**
- **Aquatox** = environment Fish, Algae,
  Effect test time **2-4 days**

Biobased Products

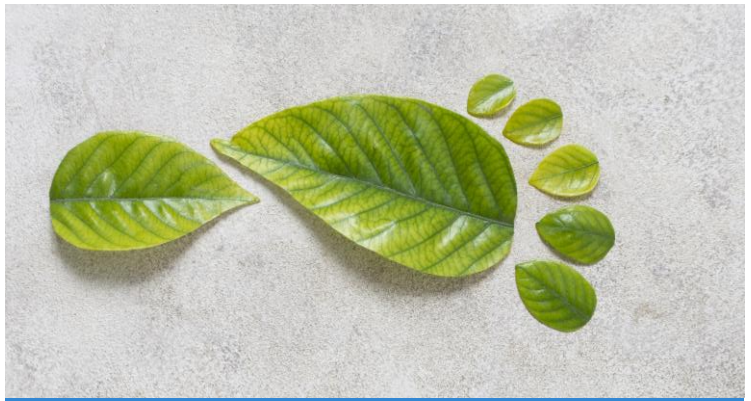
Profile

BIOBASED

ANTISCALANTS

Biodegradable

Performance



BIODEGRADABLE

Preferably natural non food or food waste

Availability

PERFORMANCE

Comparable performance level to currently used products

Stable (protectable) performance in the application

Biobased Products

Profile

BIOBASED

ANTISCALANTS

Biobased

Aquatox

BIOBASED

Preferably natural non food or food waste

Availability

AQUATOX

Low Aquatox:

- **Fish**
- **Algae**
- **Bacteria**

Next Generations Biobased Scale Inhibitors

Hybrid Polymers (some already commercially available)

- Combination of fossil based raw material (polyacrylic) with renewal / natural raw materials (starch)
  - → Flocculants
  - → Cleaning & detergents
  - → …
- Possible adaption for water treatment applications

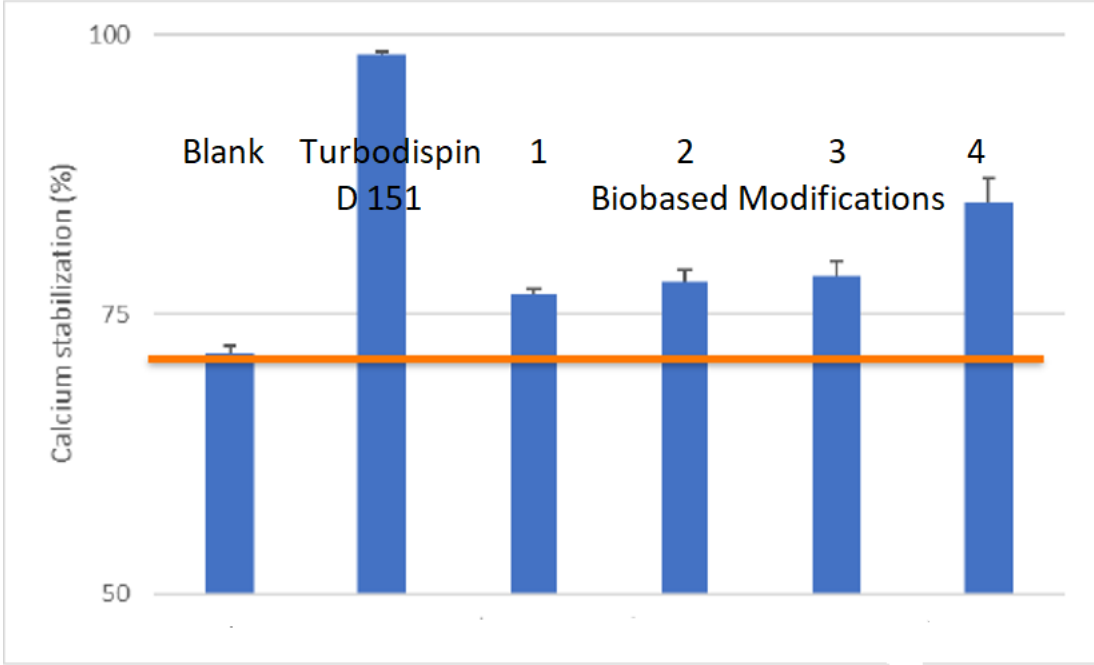
Next Generations Biobased Scale Inhibitors

Bio Polymers (non food)

- Screening
  - → Based on algeas
  - → based on pectins

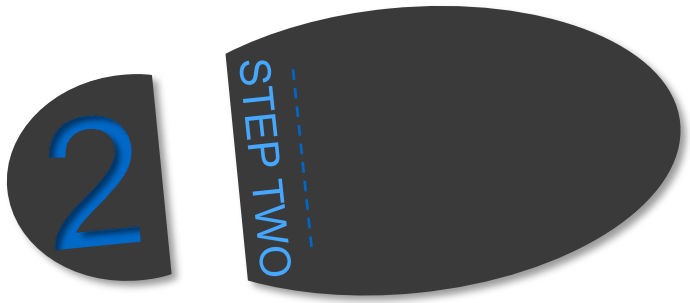
WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018



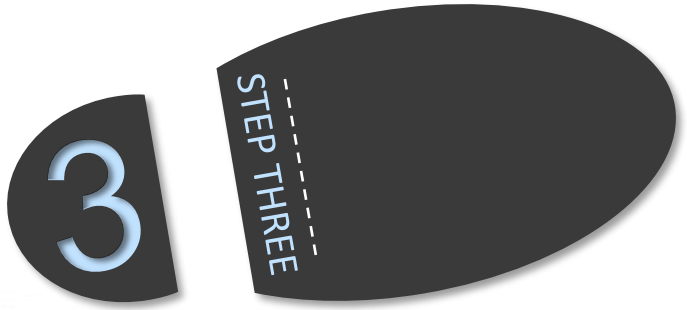
Biobased Products – Next steps

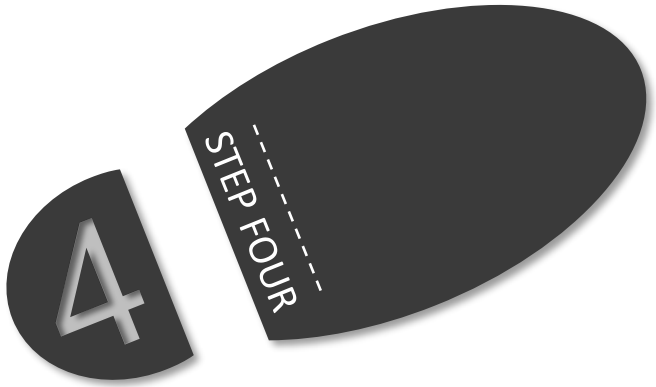
Bio Polymers (non food)



- Biodegradation
- Aquatox

- Modifications
- Performance





- Production facilities
- REACH
- …..

Contact us

Kurita Europe GmbH
Theodor-Heuss-Anlage 2
68165 Mannheim
Germany

+49 621 1218 3000
www.kurita.eu

LinkedIn
YouTube Channel


KURITA