

Challenges when reducing water usage in industrial processes

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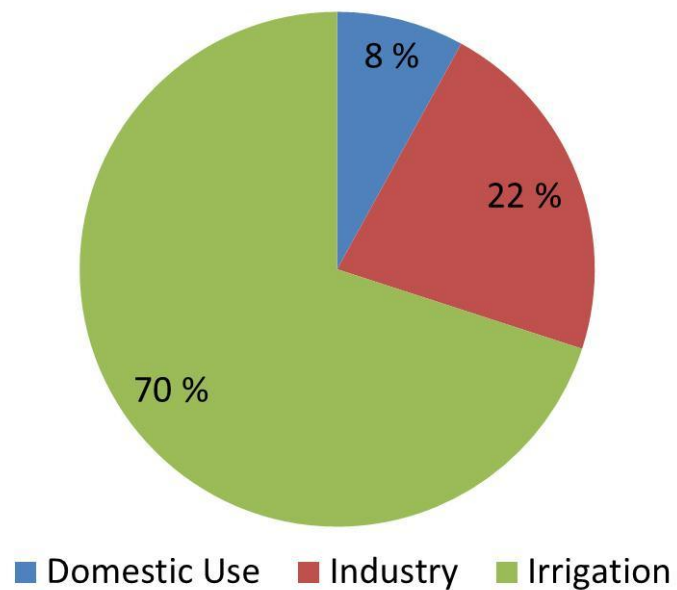
Outline

- Introduction
 - Advantages and disadvantages when reducing water usage in process industry
- Examples
 - How water system closure affect the process
- Summary and Conclusions



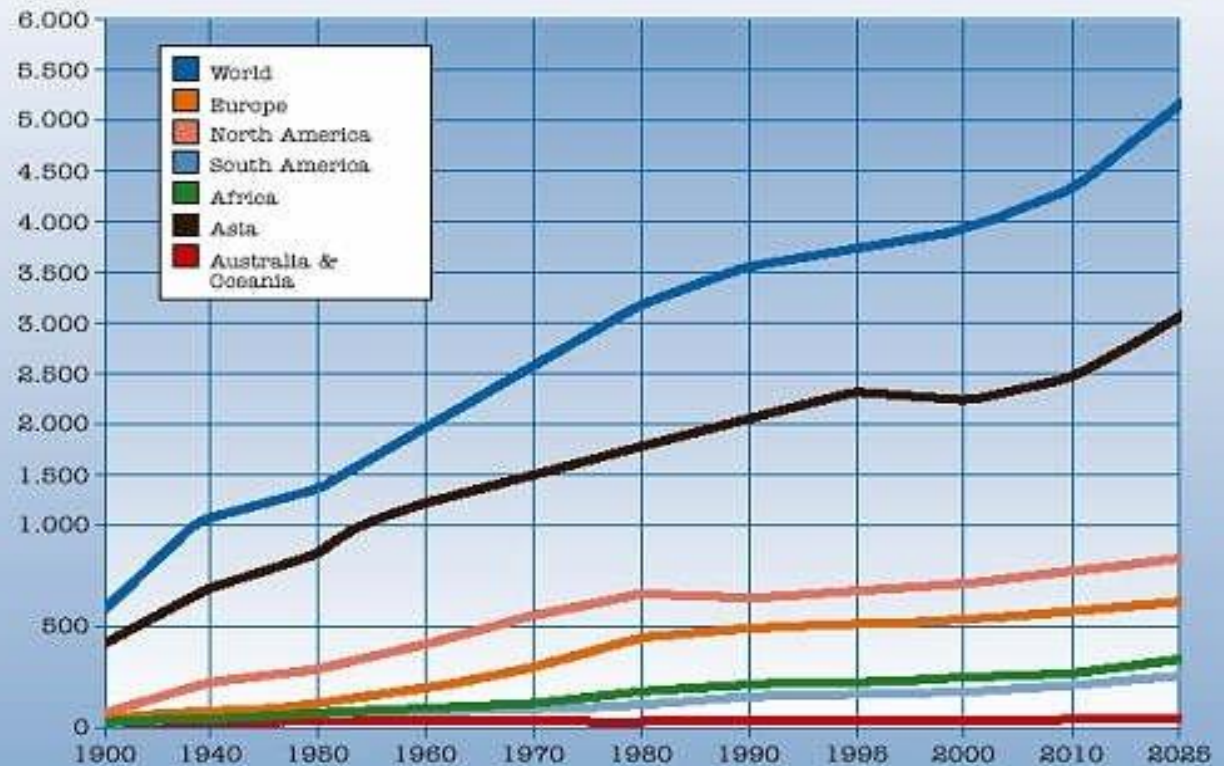
Use of Water

Breakdown of freshwater use



Global Water Consumption 1900 - 2025

(by region, in billion m³ per year)



Use of Water in Process Industry

- Process water (transport, dilution)
- Water for showers (wetting, trimming, cleaning, cooling, antifoam)
- Cooling water
- Boiler water (steam production)
- Sealing water
- Cleaning water



Advantages of closing-up of water systems

- Economic
 - Lower feeding water costs
 - Lower costs in the treatment of feeding water and effluent
- Process
 - More stable operating conditions
 - Lower material losses
 - Drainage improvement (productivity)
- Environmental
 - Lesser need of natural resources
 - Lower effluent emission
 - Energy savings



Challenges associated with water system closure

- Suspended solid increase
- Dissolved and colloidal substance increase
- Temperature increase

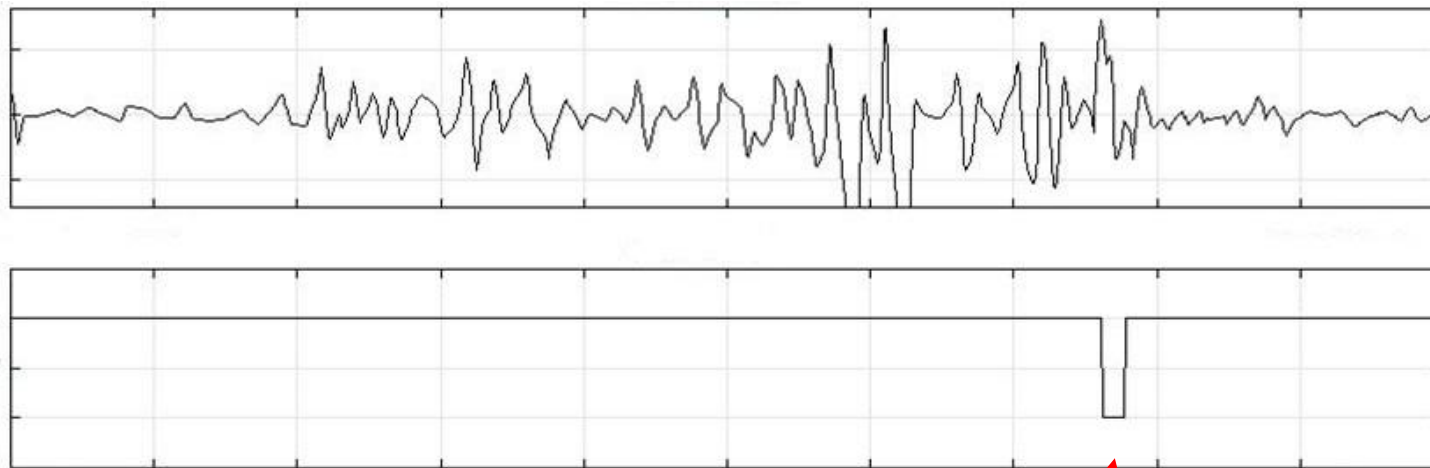


- Effects on productivity
- Effects on additive efficiency
- Effects in water quality

Examples

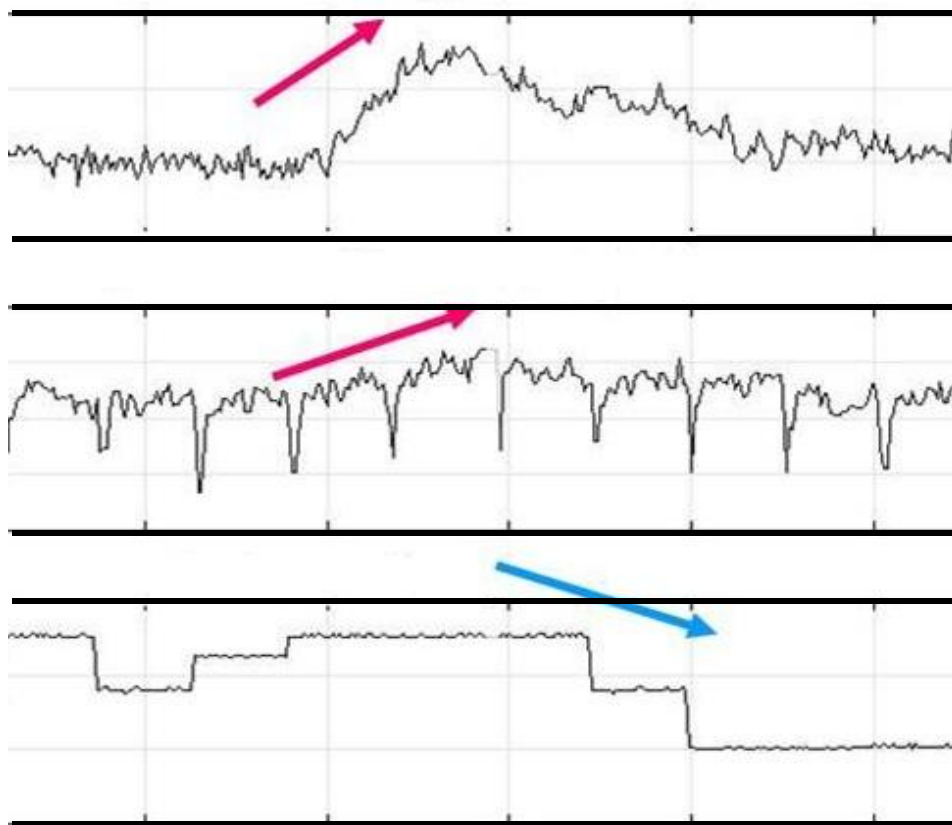
Water recycling multiplies the effects of process variation and disturbances

Increasing oscillation of a physical process parameter...



...may lead into a production break.

Process is more difficult to control and chemical interactions are complex



CONDUCTIVITY

DISSOLVED CALCIUM
CONTENT

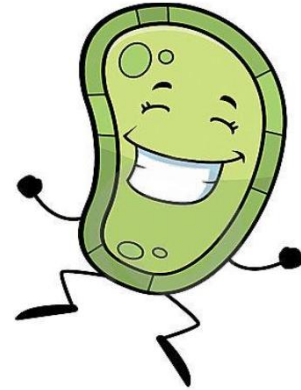
CHARGE



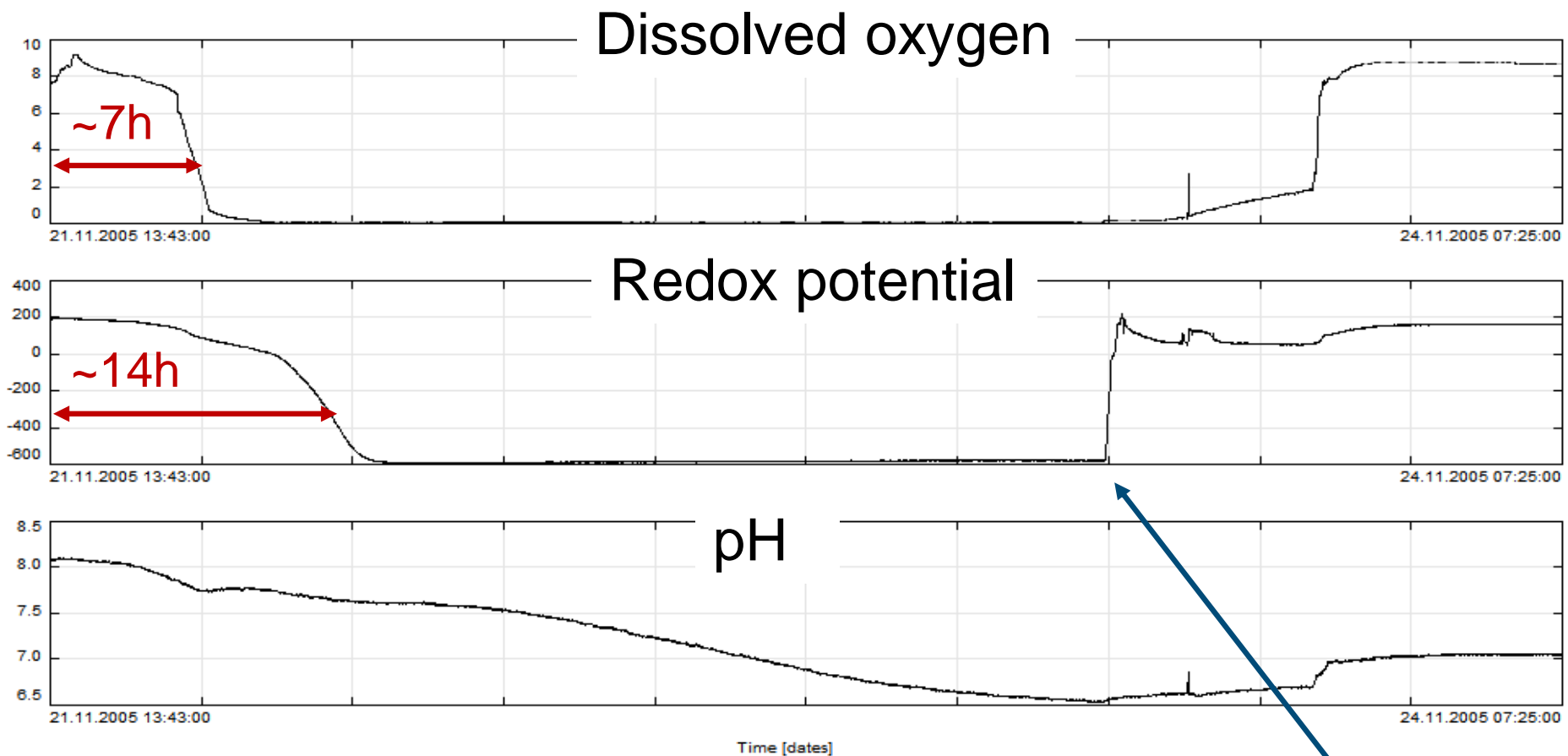
CLOSURE OF WATER SYSTEM

Harmful effects due to temperature increase when closing-up process water systems

- Increase in microorganism built-up and dissolved oxygen decrease
- Increase in speed of reactions which cause corrosion
- Increase of deposit formation reactions
- Change in material characteristics such as decrease of stickiness in some deposits, which increases mobility and causes detachment later in the process
- Salt solubility increase
- Vacuum capacity decrease in suction boxes, pumps, etc.





Development of anaerobic conditions – micro-organism build-up



Biocide

Summary

Why is it worth to optimize the process and reveal hidden phenomena when closing the water loops?

- Optimization of the process may be difficult because of severe variations 
control variables have no effect on product properties / process parameters
- New optimum for the process after minimizing variations
 Better runnability and product quality
- Fluctuations and sudden changes decrease process efficiency
- Poorly understood cause-effect relations lead easily into wrong conclusions and actions
 - Chemical interactions are often complex
 - Almost all the variables are coupled and it is difficult to figure out which is an effect and which should be adjusted as a cause

**POTENTIAL TO INCREASE PRODUCTION AND DECREASE COSTS
→ CHALLENGES OF THE WATER USAGE REDUCTION CAN BE TURNED
INTO ADVANTAGES**

How to overcome the challenges and take the next step?

- Process optimization (combination of measurements, analysis, modeling and expertise)
- Development of new technologies
 - Separation
 - Chemical systems
 - Monitoring
 - New unit processes
 - Etc.

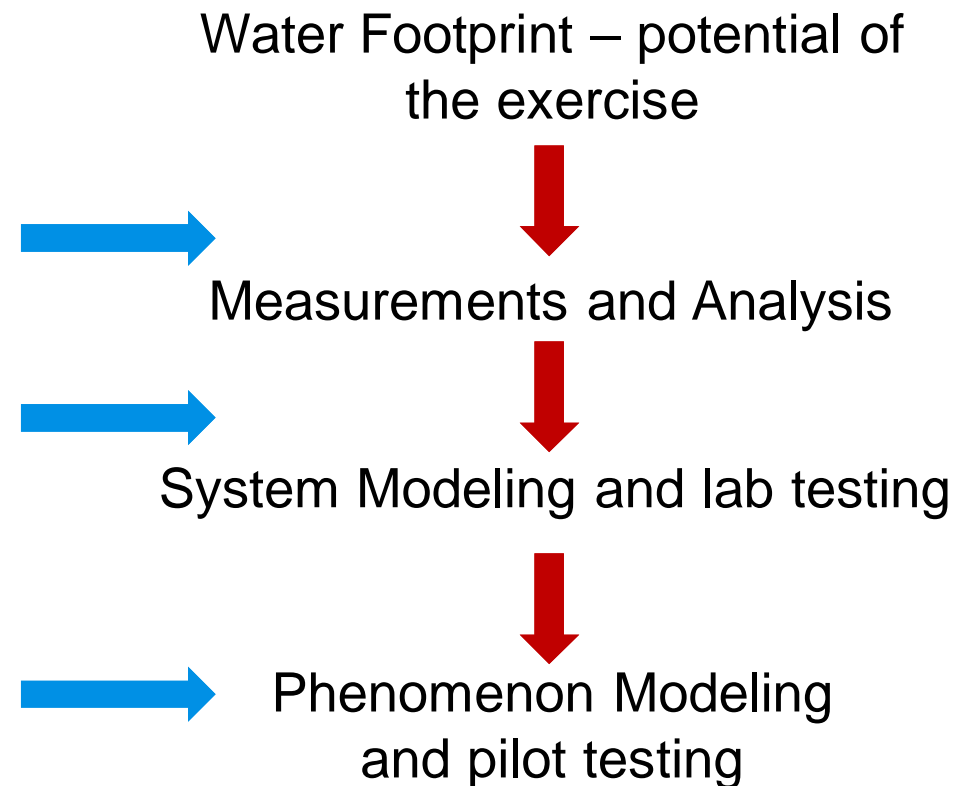
RESEARCH



In Conclusion

- In order to devise plans for water reusage we should take into account

1. Pollution introduced in the different circuits.
2. Possible treatments for each stream.
3. The specifications or water quality necessary for different uses in the process.



Reduction of water consumption without affecting product quality or process. This will mean significant economic and environmental advantages.

Thank you for your attention!

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