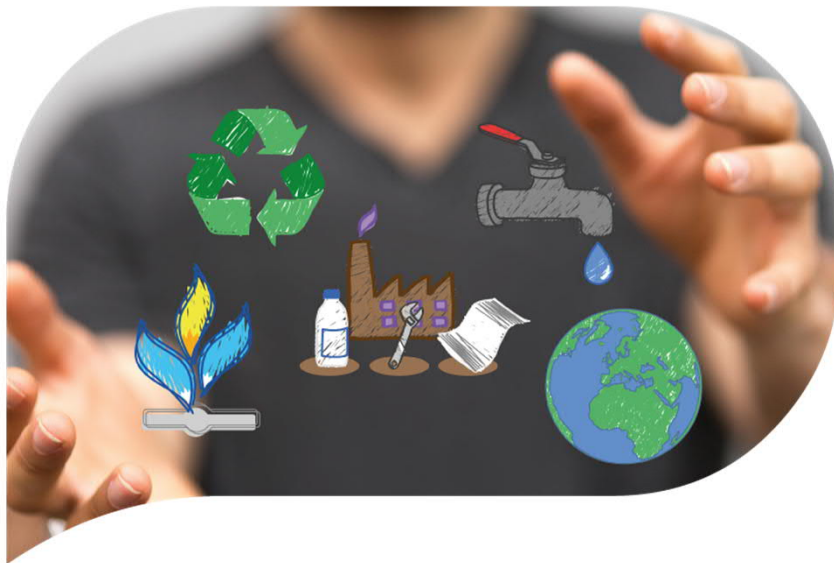


InspireWater - SpotView final web conference:
“Holistic approaches for water and resources efficiency
in process industry”

New Strategies and Technologies for Process Water Recycling in Tissue Paper Industry

March 25th, 2020

Antti Grönroos (VTT Technical Research Centre of Finland Ltd), Jenni Vaino (Essity), Pasi Nurminen (Valmet), Lotta Sorsamäki (VTT)



Spot  View



Horizon 2020
European Union Funding
for Research & Innovation



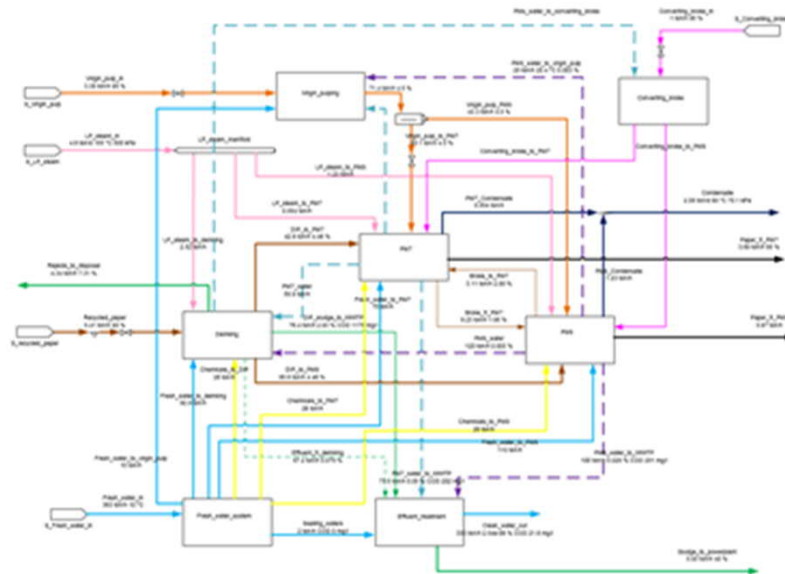
Presentation outline



- Sustainable strategies for process water and reuse in tissue paper industry
- Background of the case mill - Essity Nokia tissue
- Target and scope of the process simulation work
- The process simulation work - Case definitions
- Valmet Ultrafiltration T / High Technology Ultrafiltration
- Process water reuse strategy with kidney technology – How we did it?
- Reuse water production by CR1010/30 – Results of Essity Nokia
- Process simulation work - Results; new water balances of Essity Nokia
- Conclusions

Sustainable strategies for process water and reuse in tissue paper industry

- The objective of the work was to establish **sustainable process water reuse strategies for tissue mills**
- Strategies were created based on process **modelling and simulation** of process circuits
- The **kidney technologies, Valmet Ultrafiltration T**, were the main technologies in the strategies



Background of the case mill - Essity Nokia tissue

- Essity is a global hygiene and health company manufacturing products and solutions such as tissue paper, baby diapers, feminine care, orthopedics and wound care.
- Water usage of Essity Nokia has decreased over the years, however the age of the mill, combined with the prominent deinking and paper making process means that water use is still fairly high.
- **Annual water consumption of fresh water is approx. 2.4M m3/year i.e. around 380 m3/h.**
- Essity Nokia is aiming towards lower total fresh water consumption by
 - realizing rearrangements in water circuits in deinking plant (DIP) and paper machines (PM)
 - implementing a CR-filter to produce clean shower water from white water
- **The target of the work was to decrease the total fresh water consumption by 30%**



Target and scope of the process modelling and simulation work



- To verify mill wide the influence of Essity's predefined and realized water reduction changes on the
 1. **Fresh water consumption**
 2. **TSS-level and**
 3. **Soluble COD level.**
- To evaluate new strategies aiming **for reduced fresh water consumption.**
- **Three cases** were evaluated and compared with **the Reference case** presenting the state of the mill before any water reduction changes were made.
- During SpotView project, four measurements campaigns were performed in Essity Nokia mill to study the operation of the mill before and after the water loop changes.
- Used tool: **Balas® steady-state simulation software**

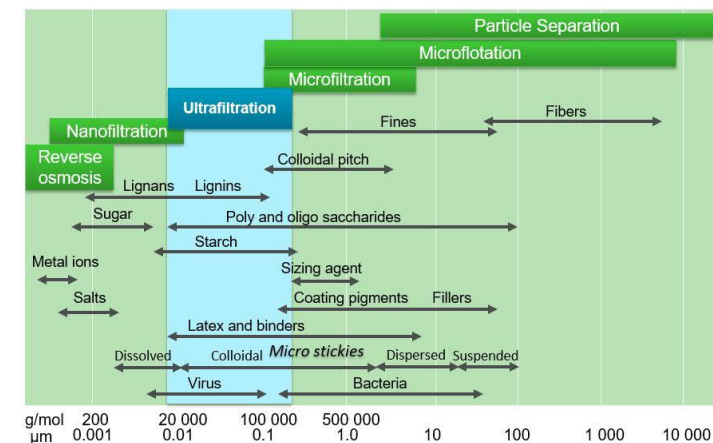
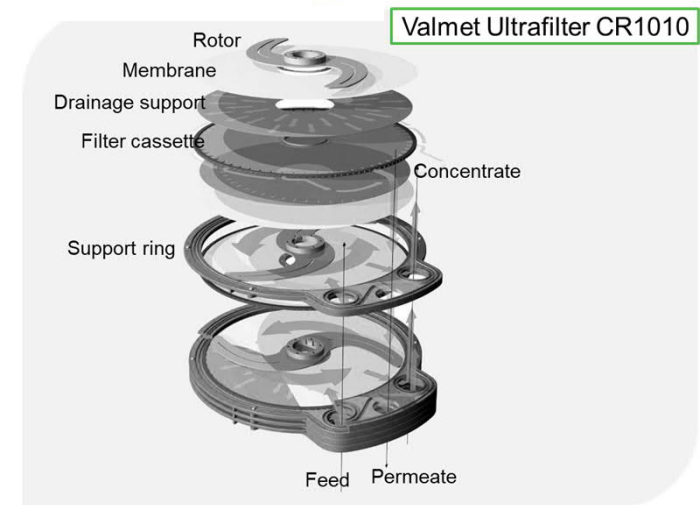
The process simulation work - Case definitions

1. Reference case
 - Essity Nokia mill **until the end of 2017**: no water reduction changes made.
2. Case 1
 - Nokia Essity mill **since January 2018**: Re-arrangements in water circuits both in DIP and in PMs.
3. Case 2
 - Nokia Essity mill **since September 2018**
 - Same process configuration as in Case 1
 - Implementation of one pilot-scale Valmet Ultrafilter to PM7
 - The ultrafilter treats part of PM7's white water → used as shower water
4. Case 3
 - Nokia Essity mill **potential future setup**
 - Same process configuration as in Case 1
 - Implementation of two pilot-scale ultrafilters to PM7 and one to PM9
 - The ultrafilter treats part of PM7's and PM9's white water → used as shower water and in chemical dilutions

Valmet Ultrafiltration T / High Technology Ultrafiltration

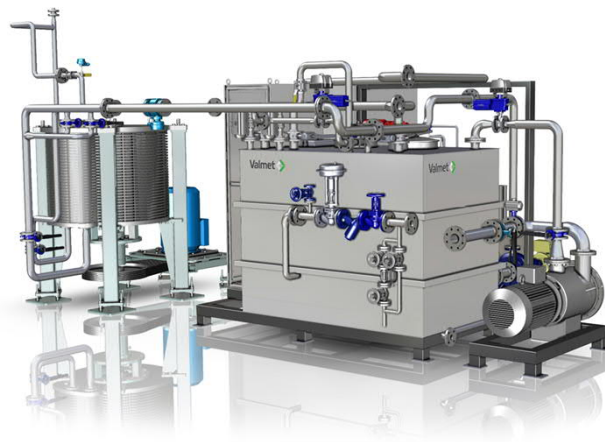
- Valmet Ultrafiltration T process is designed to produce colloidal and bacteria free ultrapure water from Tissue mill white waters to
 - Reduce fresh water consumption
 - Improve tissue machine runnability and efficiency
- Compact and modularized process
 - Includes all needed components for fully operational process
- Based on Membrane Technology with Valmet Ultrafilter CR

Valmet



Process water reuse strategy with kidney technology – How we did it?

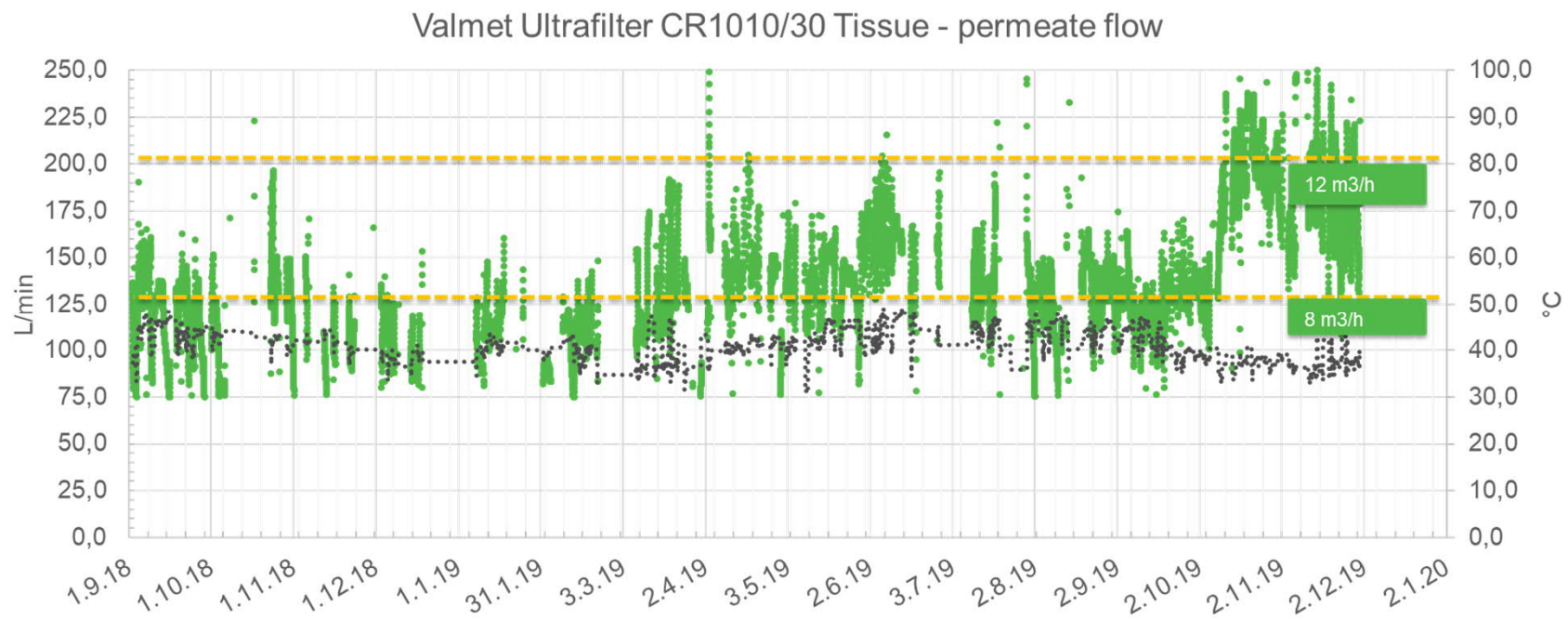
- Semi pilot trials with lab scale Valmet Ultrafilter CR250 for membrane and water selection
- Road map of Valmet Ultrafilter CR1010/30 proto for Tissue
 - Building, testing, construction, updating, ...
 - Installation to mill, ...
 - Long pilot scale trials in Nokia Essity (Sept. 2018 →



Membrane area	42 m ²
Membrane diameter	1 000 mm
Filter cassettes	30 pcs
Membranes	60 pcs
Motor	45 kW (input power < 30 kW)
Size, ca	1,8 x 2,1 x 1,4 m
Membrane pore size	0.02–0.1 µm

Reuse water production by CR1010/30 - Results of Essity Nokia

- Pure water for reuse from clear filtrate 8 m³/h
- Pure water for reuse from cloudy filtrate 12 m³/h
- PM7's high pressure showers need 8 m³/h fresh water – **Great!**



Process simulation work - Results; new water balances of Essity Nokia

	REF	CASE 1		CASE 2		CASE 3	
TOTAL	m ³ /h	m ³ /h	Vs.Ref	m ³ /h	Vs.Ref	m ³ /h	Vs.Ref
Fresh water	375	292	-22%	283	-25%	261	-31%
Effluent	361	276	-24%	267	-26%	244	-32%
DIP	m ³ /h	m ³ /h	Vs.Ref	m ³ /h	Vs.Ref	m ³ /h	Vs.Ref
Fresh water	90	13	-86%	13	-86%	13	-86%
PM7 water	91	102	+12%	102	+12%	102	+12%
PM9 water	95	108	+14%	108	+14%	108	+14%
Effluent	189	118	-37%	118	-37%	118	-37%
PM7	m ³ /h	m ³ /h	Vs.Ref	m ³ /h	Vs.Ref	m ³ /h	Vs.Ref
Fresh water	85	85	0%	76	-11%	67	-21%
Effluent	70	63	-10%	54	-23%	41	-42%
PM9	m ³ /h	m ³ /h	Vs.Ref	m ³ /h	Vs.Ref	m ³ /h	Vs.Ref
Fresh water	110	104	-5.5%	104	-5.5%	95	-14%
Effluent	100	93	-7.2%	93	-7.2%	84	-17%



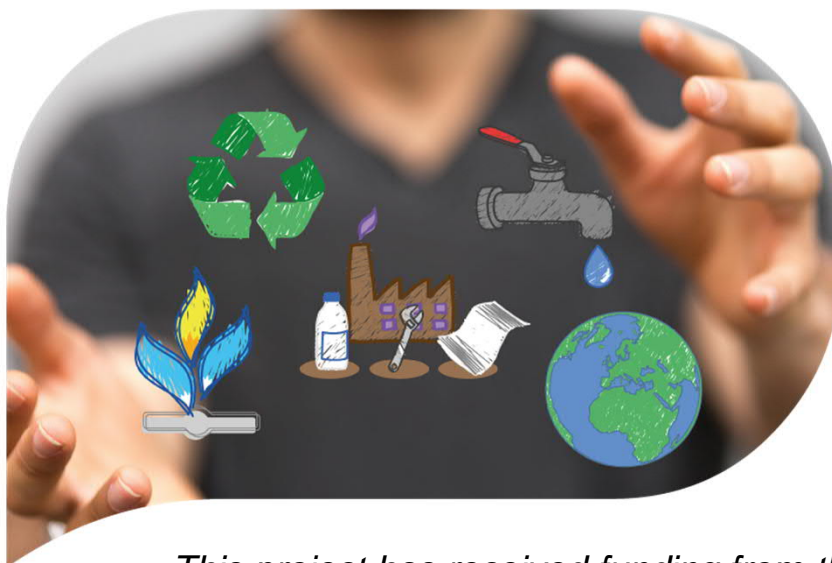
Conclusions



- Sustainable water reuse strategies for Tissue paper industry were done
- The water reuse strategies were created based on process modelling and simulation of process circuits together with kidney technologies
- By exploiting water circuit rearrangements and kidney technology for producing ultrafiltrated process water to substitute fresh shower and chemical dilution water in both paper machines, a reduction of 31% in total fresh water consumption in Essity Nokia tissue mill was achieved
- Used simulation tool “Balas® steady-state simulation software” is a part of VTT’s simulation and modelling platform
- Kidney technology used “Valmet Ultrafiltration Tissue process” is a part of Valmet Water Management portfolio and thus available through on sales activities.
- Both “tools” are available for sustainable water reuse strategies for Tissue paper industry as well as other Pulp and Paper industry all over the Europe/World



Thank You !



Contact:

antti.gronroos@vtt.fi

Spot  View



Horizon 2020
European Union Funding
for Research & Innovation



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723577

Case mill – Essity Nokia tissue mill

- Essity is a global hygiene and health company manufacturing products and solutions such as tissue paper, baby diapers, feminine care, orthopedics and wound care.
- Essity has approximately 90 production sites, 47 000 employees and net sales of ~€11.6bn as of 2018. Sales are conducted in approx. 150 countries under the leading global brands Lotus, Tena, Tork, Plenty and Cushelle among others.
- Essity Finland's Nokia mill operation includes a deinking plant, two paper machines, six converting lines and an effluent treatment plant.
- The BREF Pulp, Paper and Board defines the water consumption of a tissue mill with integrated deinking plants around 10-25 m³/t tissue. Essity Nokia mill is currently in the level of ~35 m³/t tissue.



CR1010/30 proto connection – Case Essity Nokia

