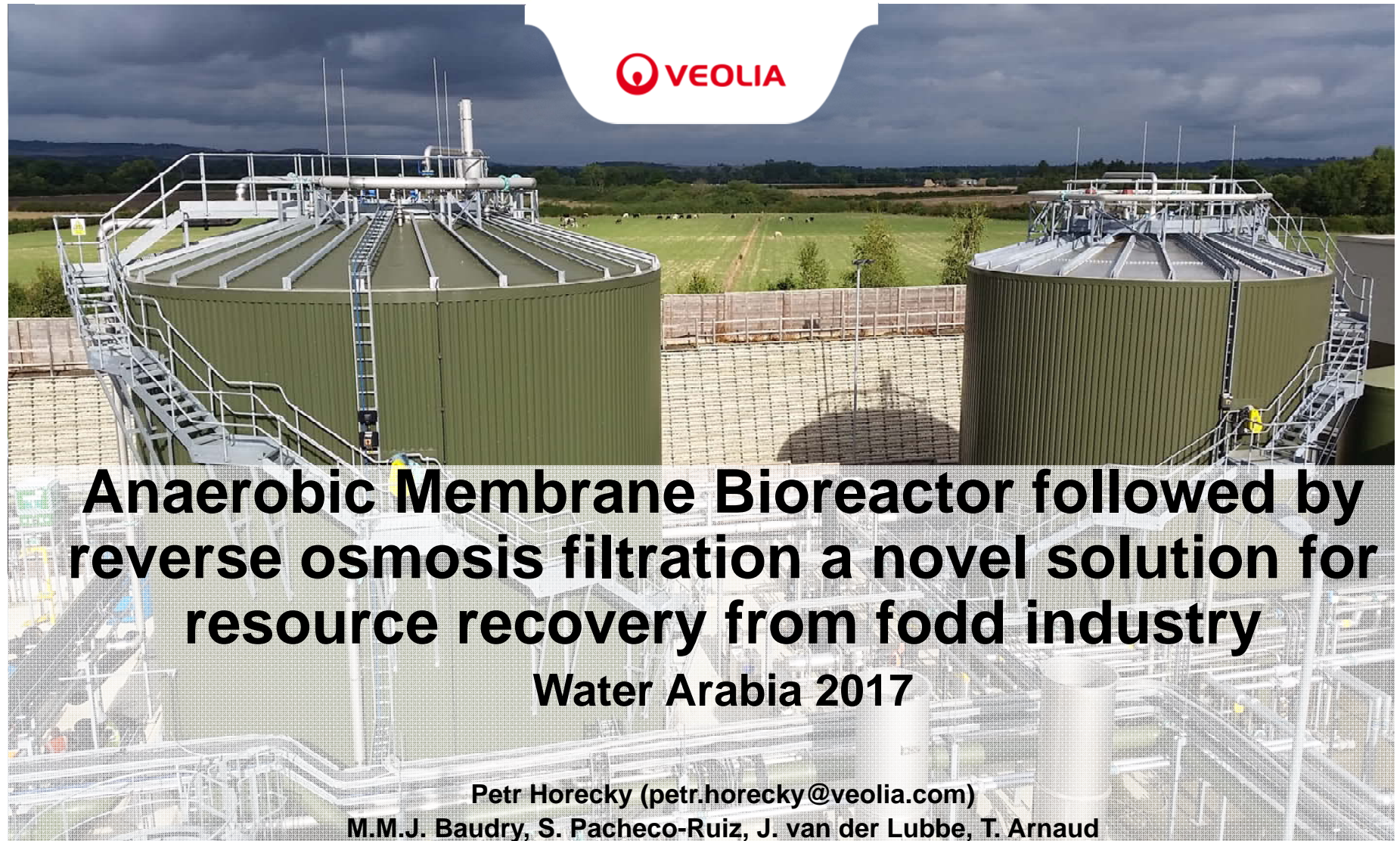


BIOTHANE

Leading Anaerobic Technologies



Anaerobic Membrane Bioreactor followed by reverse osmosis filtration a novel solution for resource recovery from food industry

Water Arabia 2017

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Water Technologies

Contents of presentation

- *Food Industry Wastewater*
- *Anaerobic processes*
- *Anaerobic Membrane Bioreactor*
- *Full scale food industry plant operational results*

Food Industry wastewater

o Origin

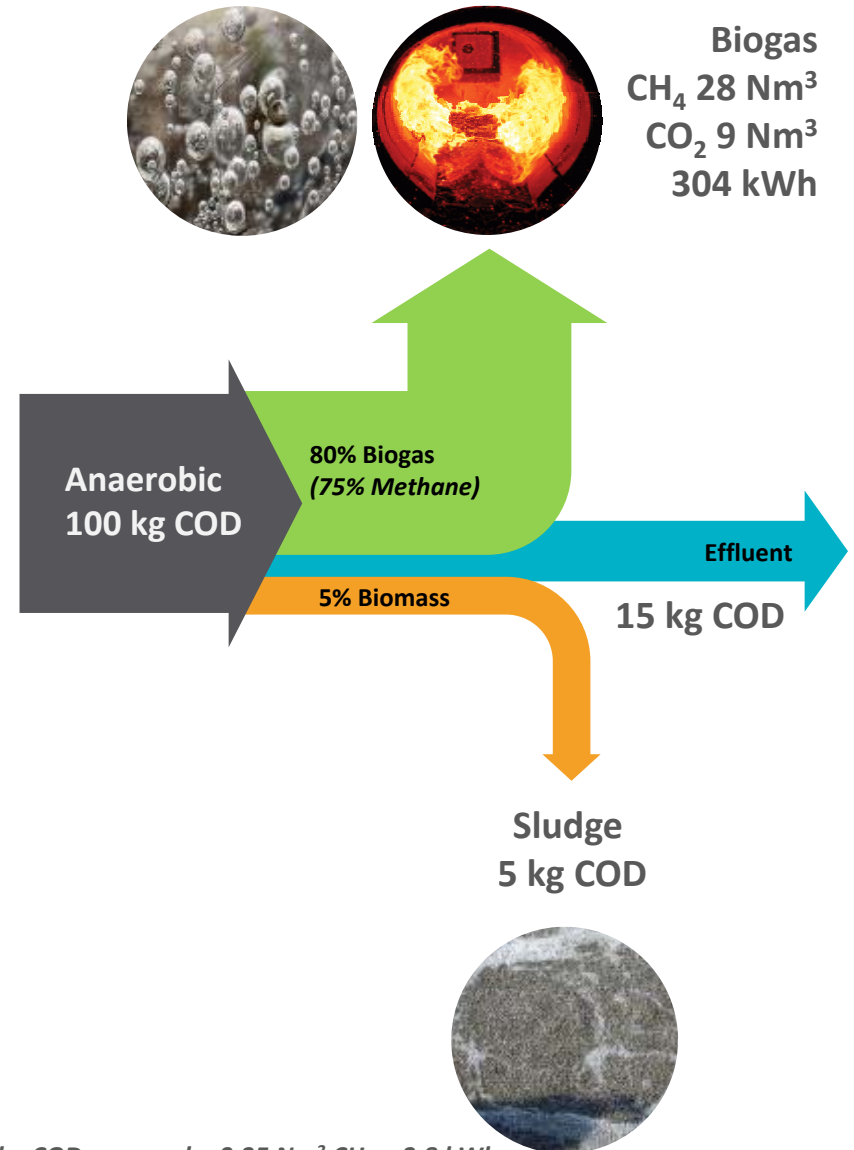
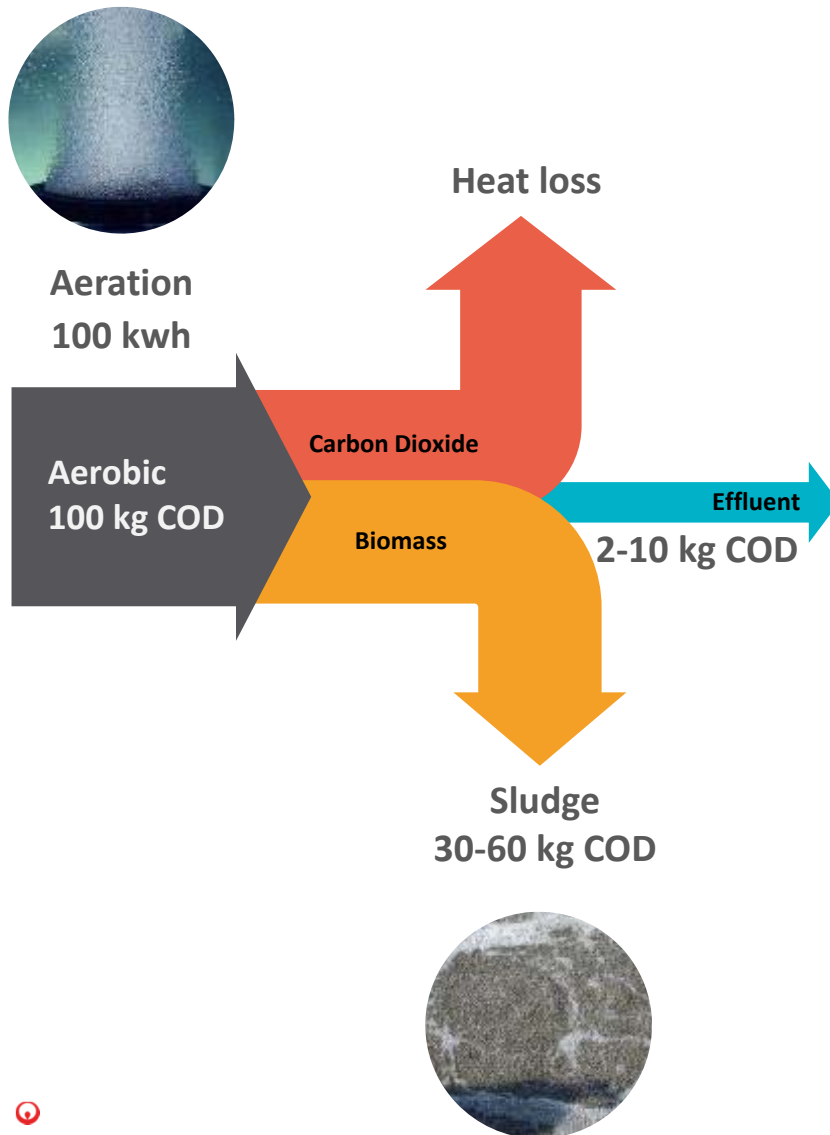
- o *Cleaning water for raw materials*
- o *Transport water*
- o *Products or semi products washing water*
- o *Equipment or pipeworks cleaning - CIP*
- o

o Characteristics

- o *High variations flow, COD, pH*
- o *High content of organic easy degradable COD*
- o *High content of TSS*
- o *High content of FOG*
- o *Can be high in nutrients –N,P*
- o *Higher temperature of wastewater.*



Drivers of Anaerobic Technology



1 kg COD removed \cong 0.35 Nm³ CH₄ \cong 3.8 kWh



Introduction to AnMBR

Anaerobic digestion combined with cross-flow UF membrane separation → Two proven technologies

Key differentiators:

1. Excellent permeate quality, suitable for reuse
2. Very stable and robust anaerobic biological process
3. Treatment of high FOG & TSS streams
4. Compact solution
5. (State of the art technology for biogas production)



2 PROVEN TECHNOLOGIES



Anaerobic biological treatment



Membrane separation



1 INNOVATIVE SOLUTION

Maximizes
COD +
TSS removal

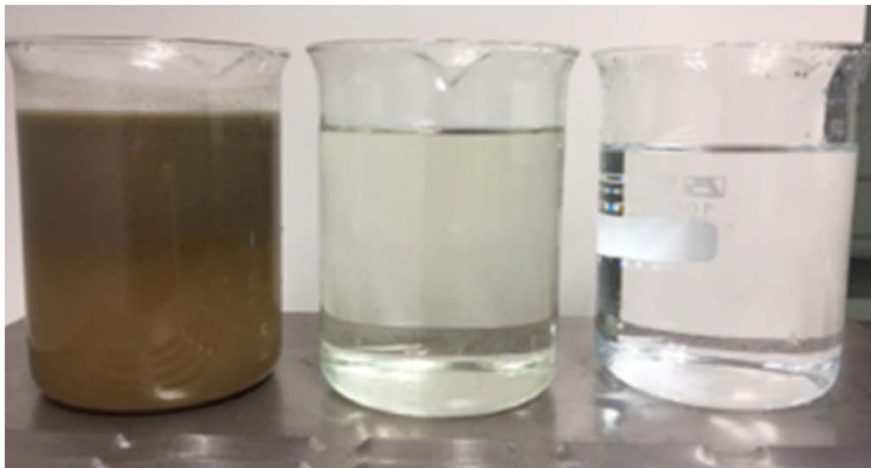
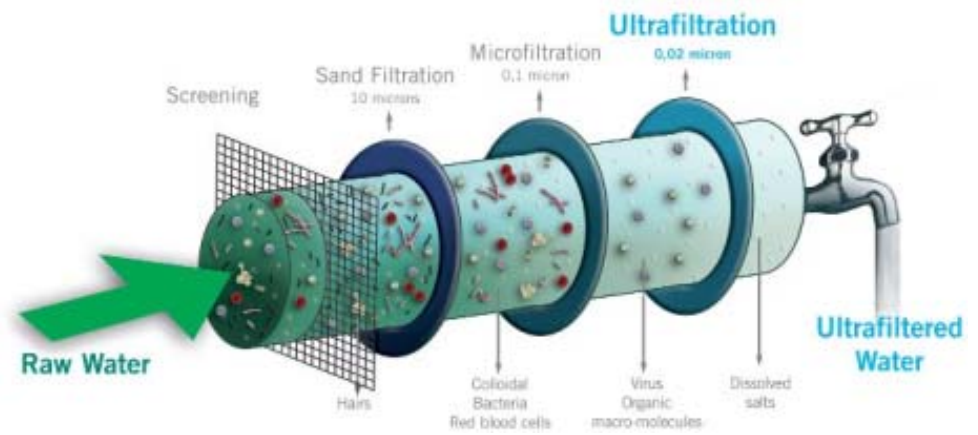
Reduces
disposal
costs

Generates
methane-
rich biogas

AnMBR

1. Excellent permeate quality, suitable for reuse

- *Permeate free of suspended solids*
- *Up to 99+ % of COD removal due to membrane barrier*
- *Permeate suitable for reuse or nutrient recovery applications*



POSSIBLE TECHNOLOGY COMBINATIONS



AnMBR + RO →
water reuse



AnMBR + Anitamox →
N-removal, optimized biogas production

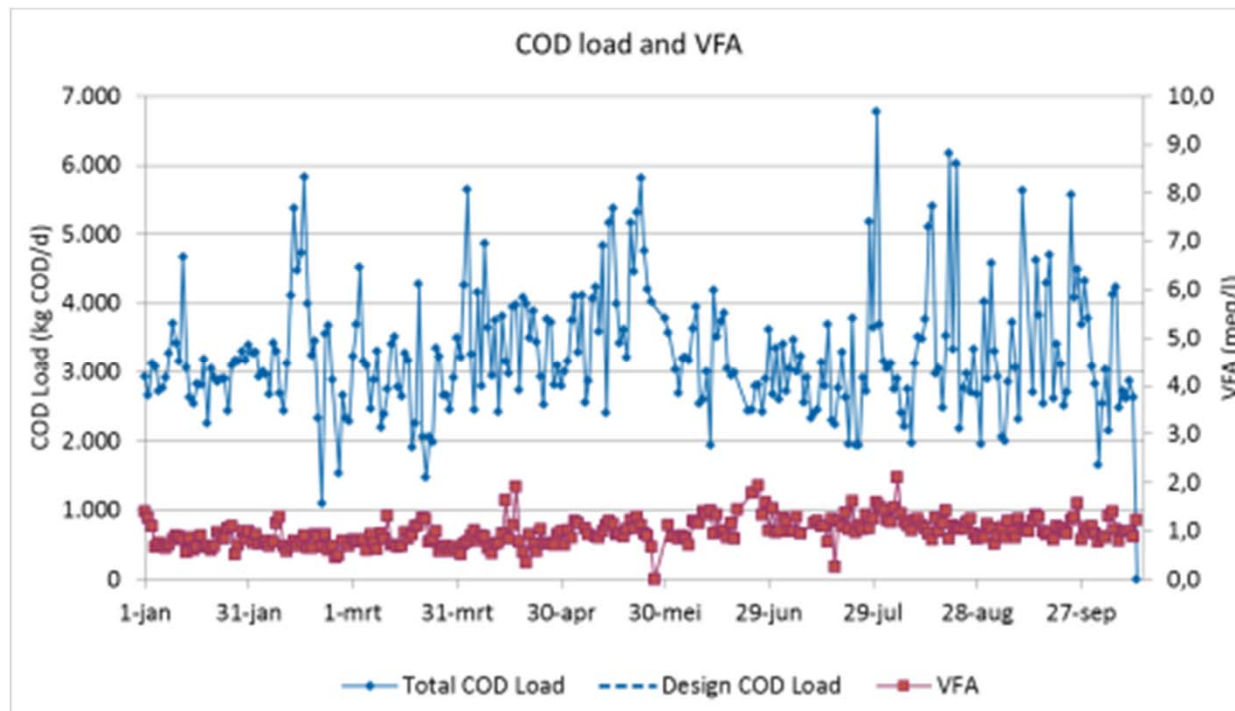


AnMBR + Struvite →
P & N – recovery as fertilizer

AnMBR

2. Very stable and robust biological process

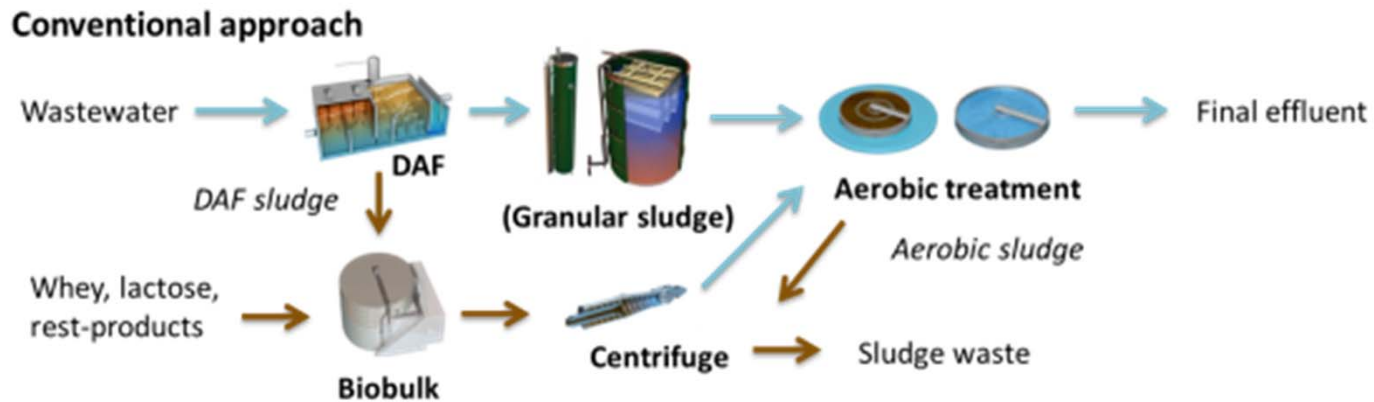
- *100% biomass retention due to presence of Ultrafiltration Membranes*
 - *In existing references hardly any VFA increase in permeate*
- *Increase in VFA is a sign of a disturbed anaerobic process, this often is seen in granular sludge systems!*
 - *Able to cope with relatively large fluctuations in inlet COD concentrations and load*
 - *Although proper buffering and pre-acidification is important*



AnMBR

3. Suitable for treatment of high FOG & TSS

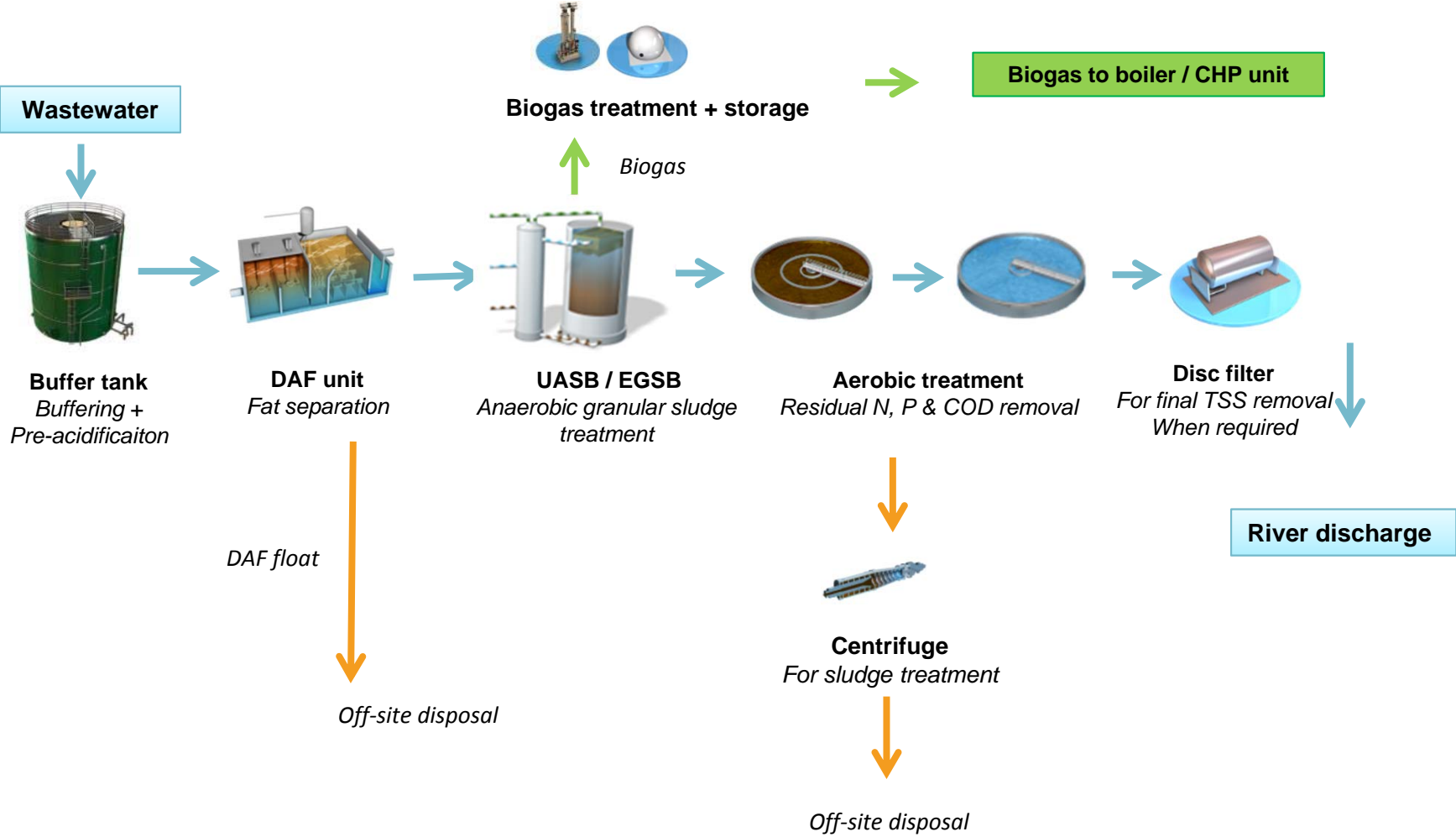
- *No sludge washout due to TSS and FOG in inlet because of membrane barrier*
- *Solid retention time sufficiently long to degrade TSS and FOG*
- *Because of this often the AnMBR scheme results in the highest biogas yield*
- *Example of combined treatment of dairy wastewater and streams:*



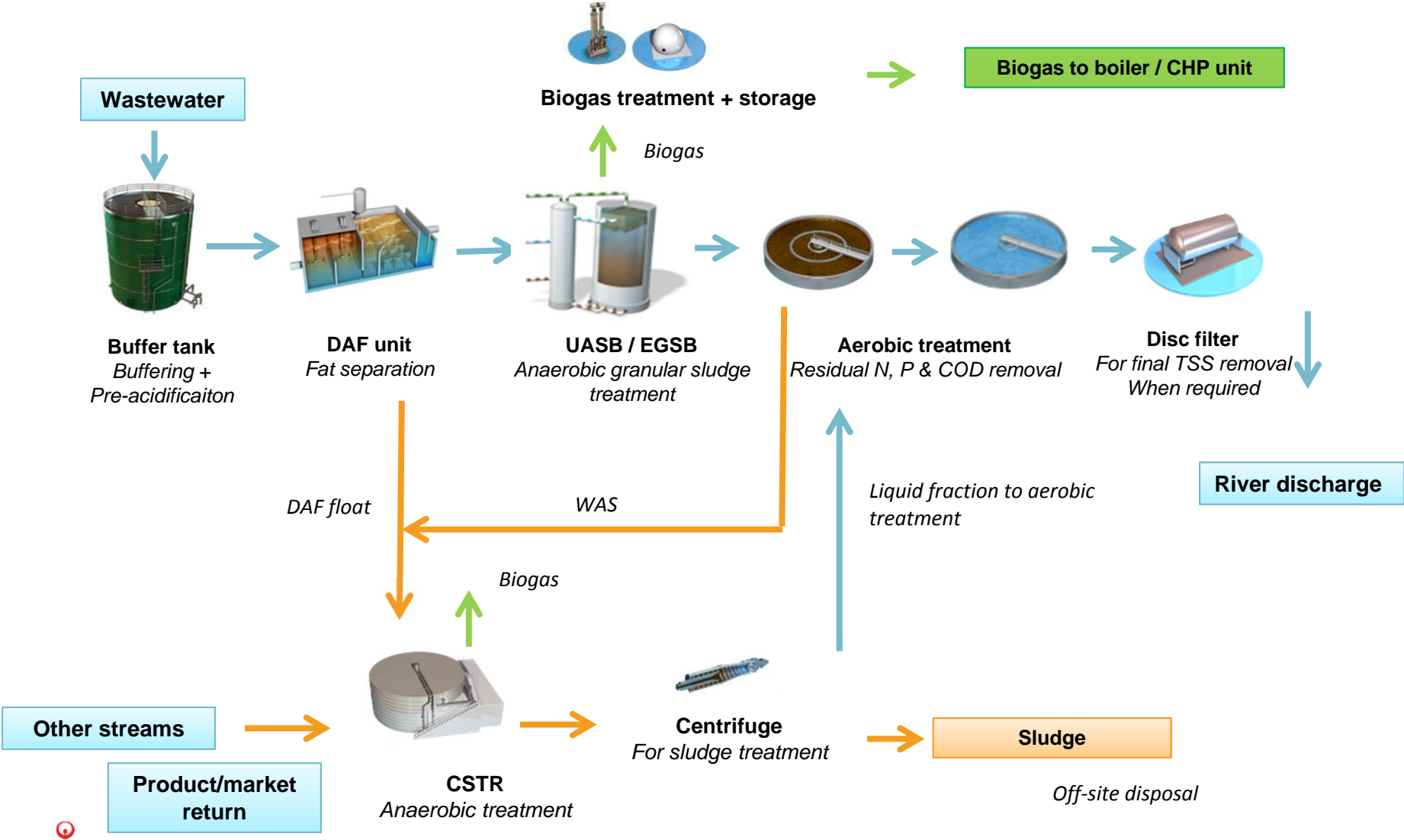
Approach with Memthane



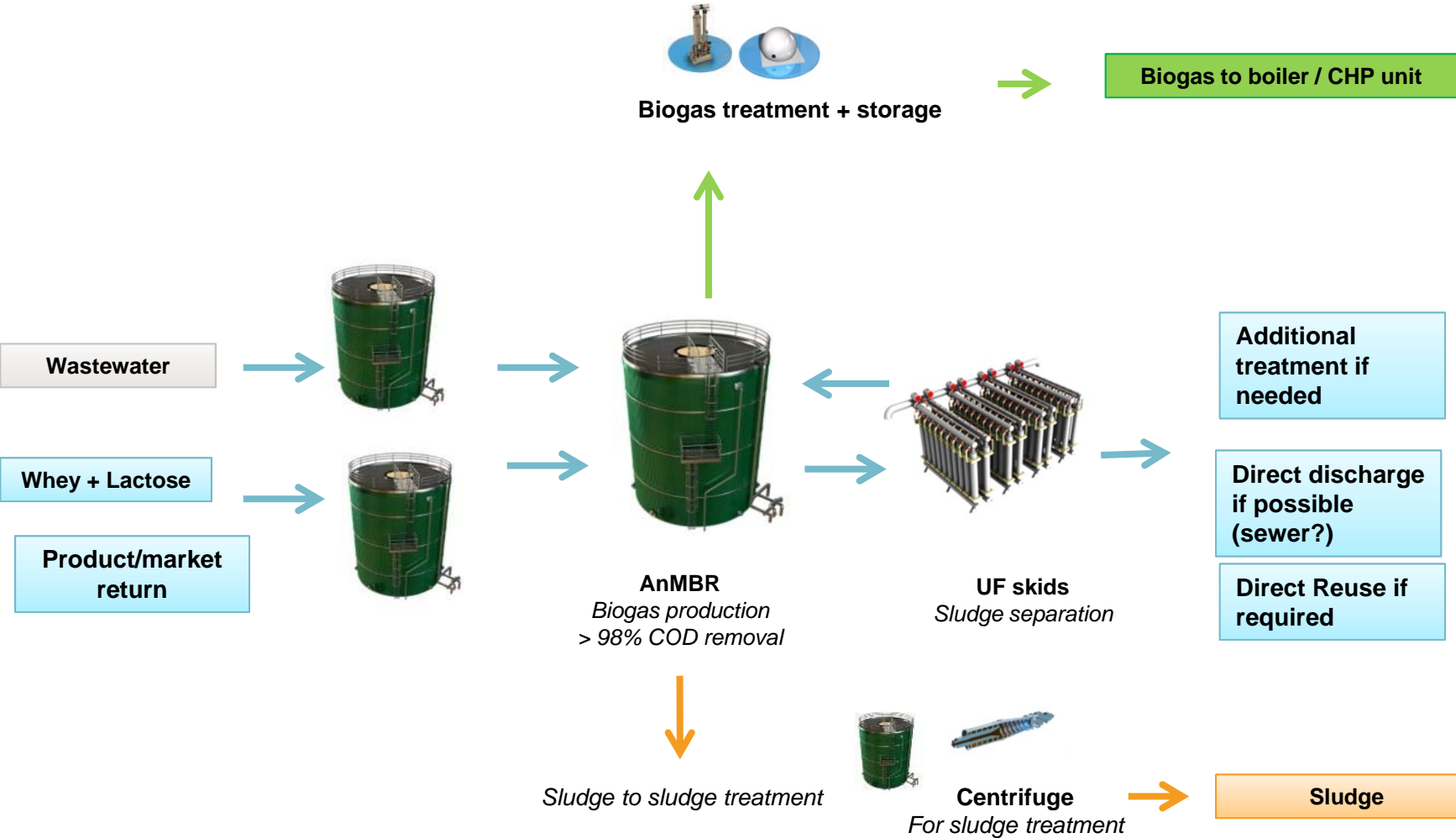
Typical process scheme incl granular sludge technologies



Typical process scheme with CSTR



Typical process scheme AnMBR



Full scale project - Context

- Dairy, South Africa
 - *Milk and cheese producer*
 - *Generation of whey*
- Considerable increase in production
 - *Current wastewater discharged to sewer*
 - *Treated by municipal treatment plant*
 - *Both unable to handle additional flow and COD load*
- Wastewater and whey very suitable for anaerobic treatment



Resource Recovery Plant

Resource Recovery Plant

- Aims of the plant:

1. *Reuse a significant part of the wastewater flow.*

By treating the wastewater by reverse osmosis to reach reuse water quality

2. *Reduce flow and COD load to the sewer*

By reusing part of the wastewater into the factory and converting most of the COD into biogas

3. *Generate energy by converting COD from wastewater into biogas*

By installing a Memthane reactor : anaerobic bacteria transform COD into biogas

Wastewater characteristics

Parameter	Units	Combined feed to Acidification tank
Flow rate	m ³ /d	2000
	m ³ /h	83.3
TSS	ppm	2714
Total COD	ppm	9900
Soluble COD	ppm	6030
Particulate COD	ppm	3870
TKN	ppm N	360
Total Phosphorus	ppm P	62*
Soluble calcium	ppm	60
Soluble magnesium	ppm	95
Sulphate	ppm SO ₄	45
Nitrate	ppm N	250
Nitrite	ppm N	200
WW temperature	°C	31.6 ⁽³⁾
pH	(-)	12

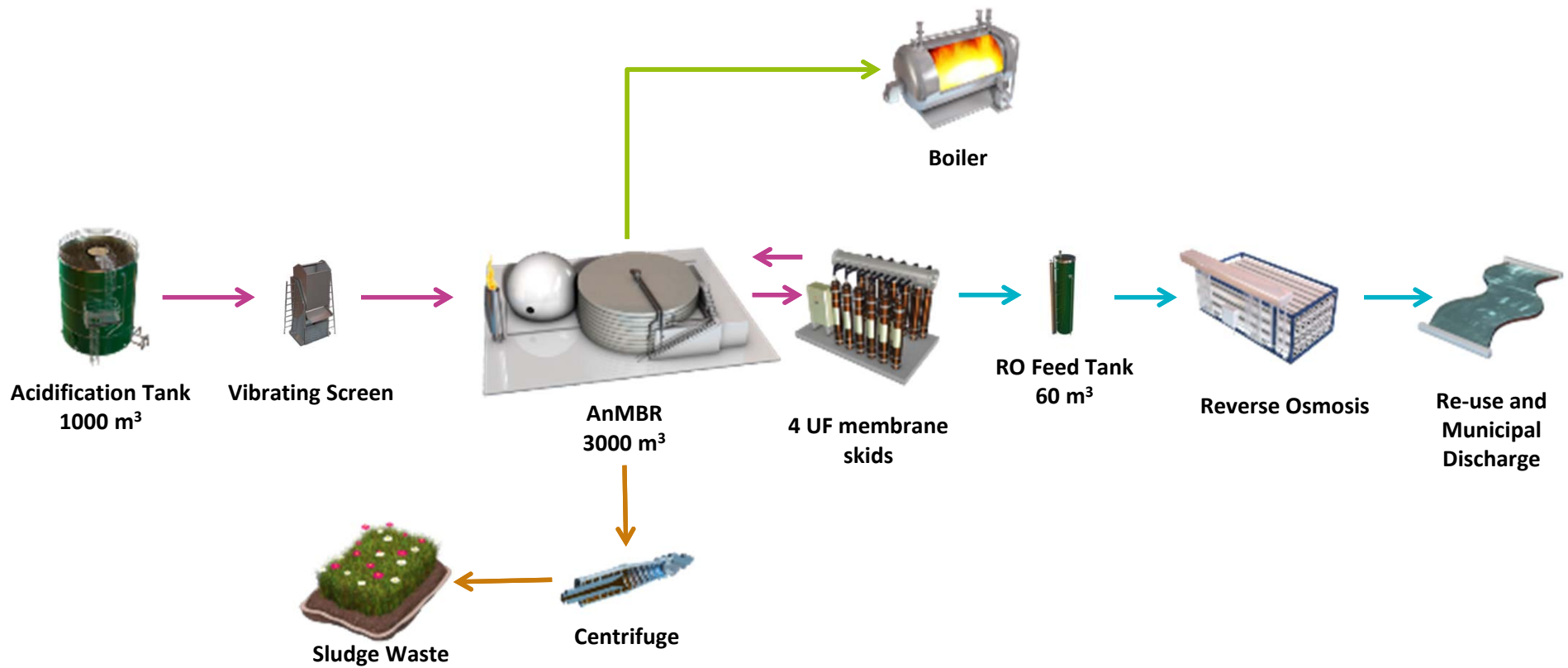
AnMBR solution

- *Often most compact solution*
 - *COD concentration after AnMBR = aerobic effluent quality*
- *CASE DAIRY SOUTH AFRICA*
 - *Surface area extremely tight*
 - *Comparison of required surface area for treatment train including water reuse:*
 - *‘Conventional’ approach including CSTR: 1700 m²*
 - *AnMBR + RO: 575 m²*

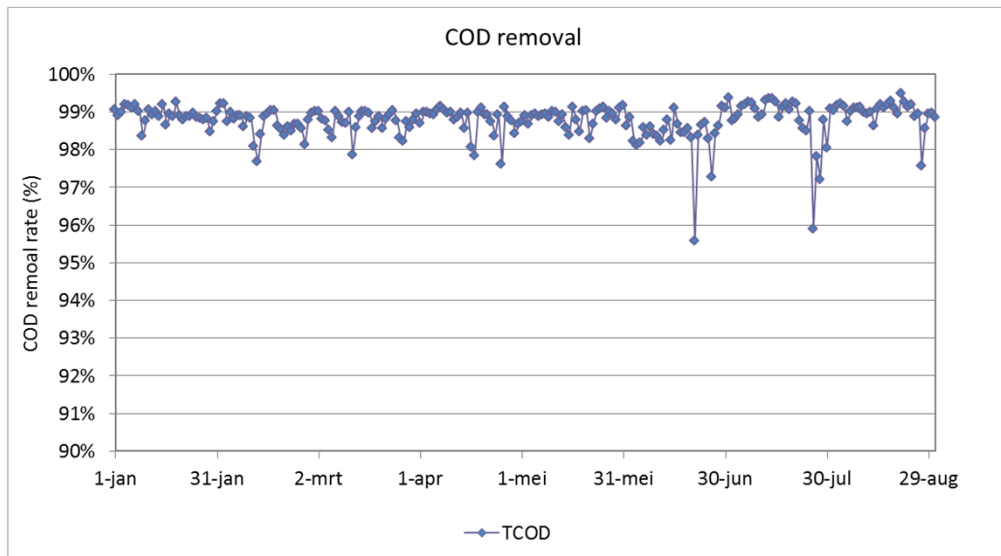
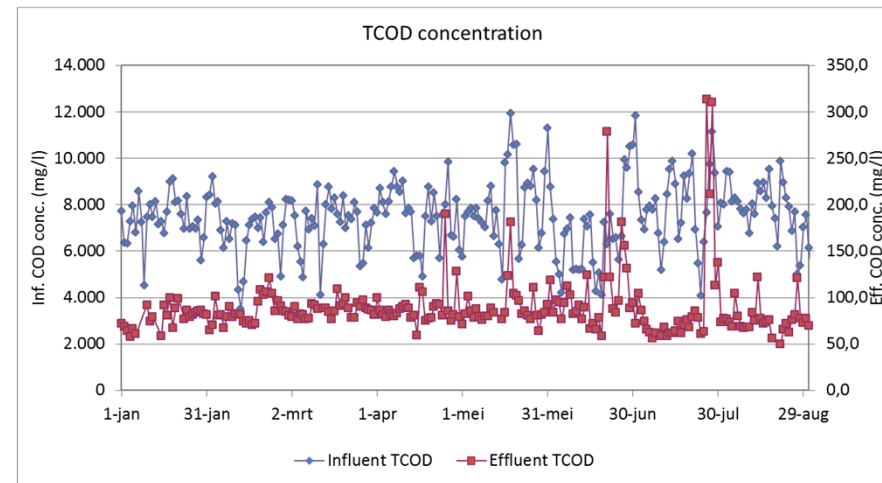
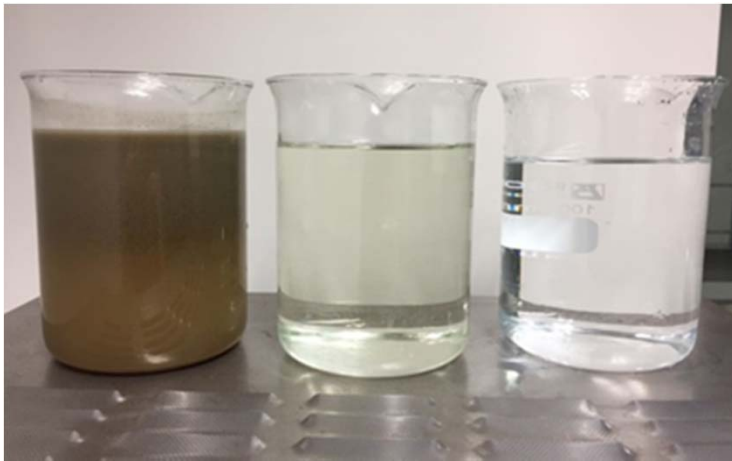


AnMBR + RO full-scale plant at Site 1: (a) Buffer tank & Digester; (b) AnMBR UF skids; (c) RO

Resource Recovery Plant

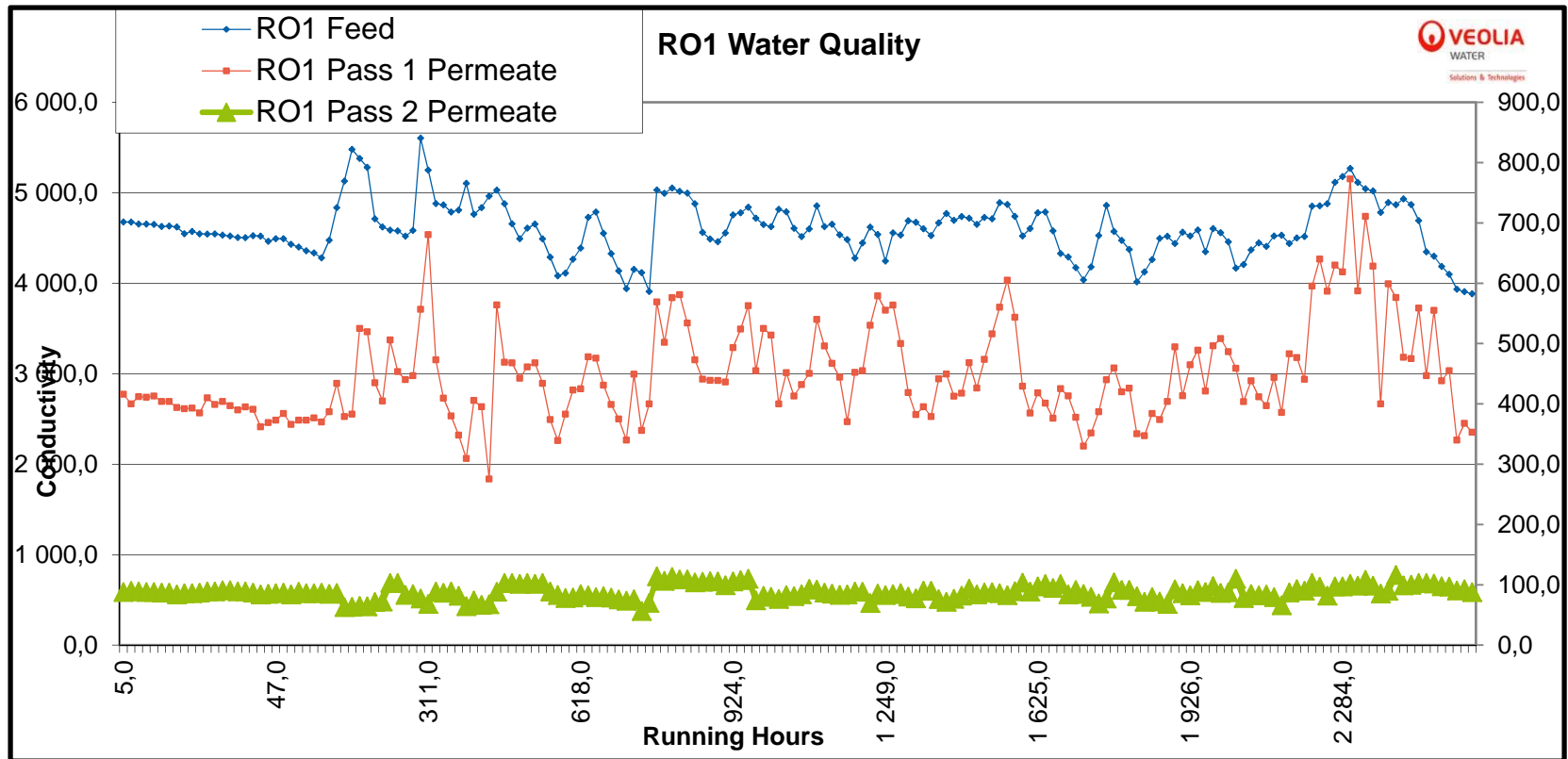


Milk processing & cheese production South Africa operational results

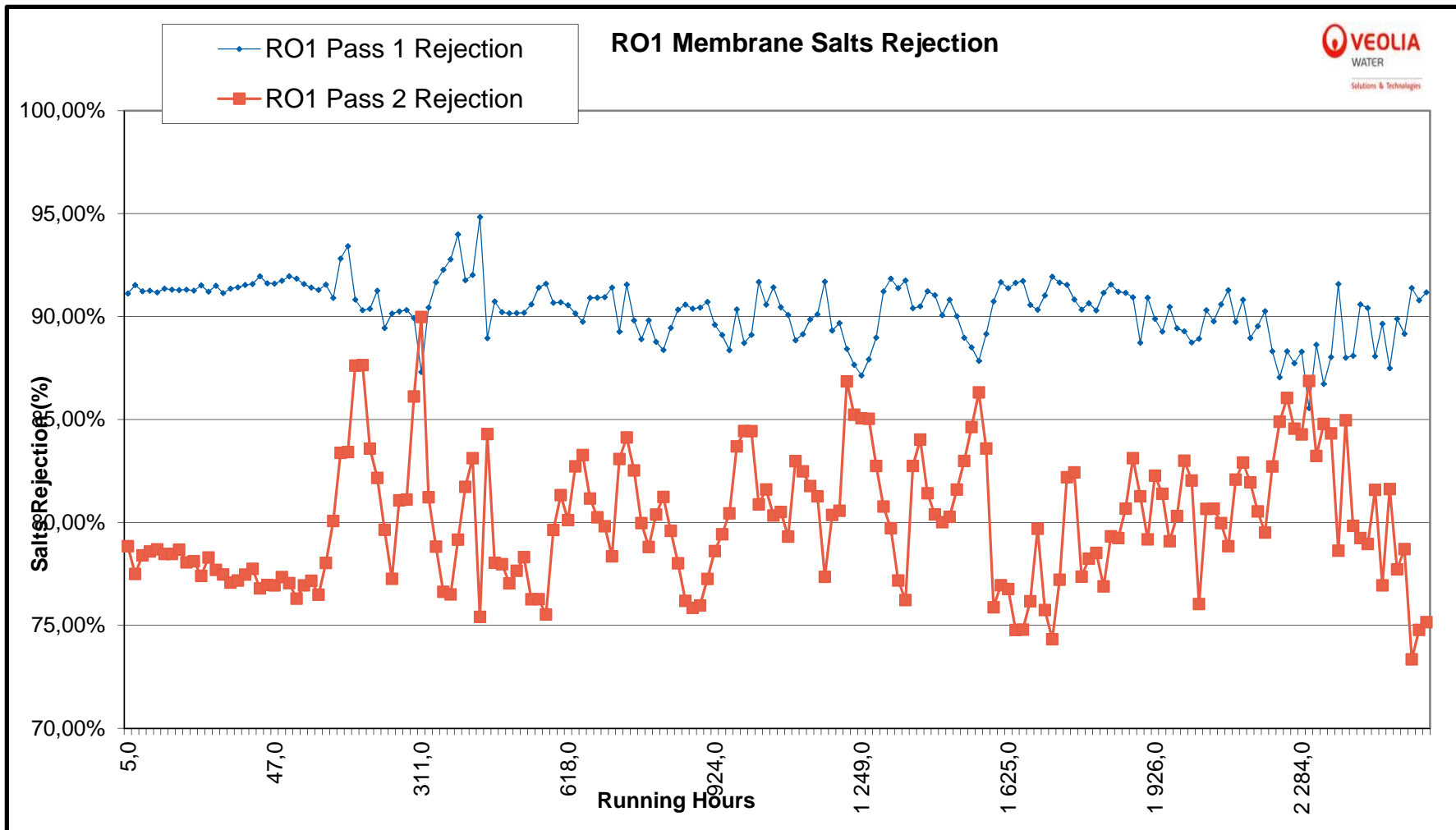


Peaks in VFA due to sudden peaks in load > 2 x

Milk processing & cheese production South Africa operational results



Milk processing & cheese production South Africa operational results



Thank you for your attention!

Any question ?