Three Years Of MABR Operation At The Ejby Mølle WRRF

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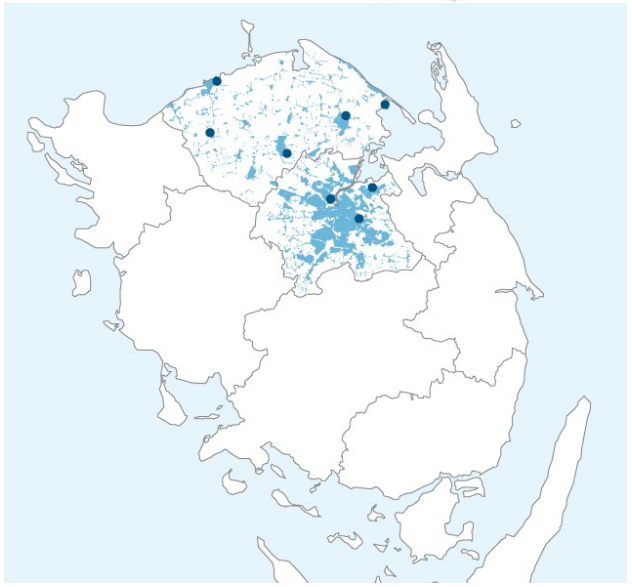
Innovationsfonden

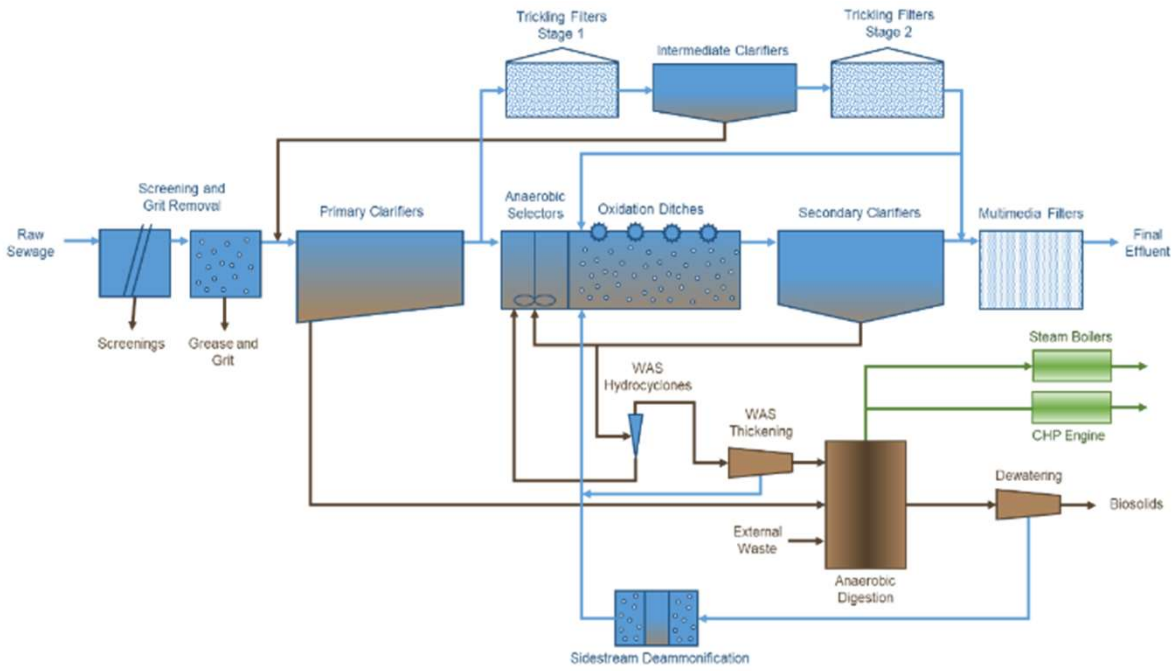
VandCenterSyd
DIT VAND · VORES ELEMENT

VCS Denmark

- VCS Denmark est. 1853
- Staff of 200+ providing water supply and wastewater conveyance/treatment for pop. >400,000
- Operate:
  3,400 km of conveyance
  6 WTPs
  8 WRRFs

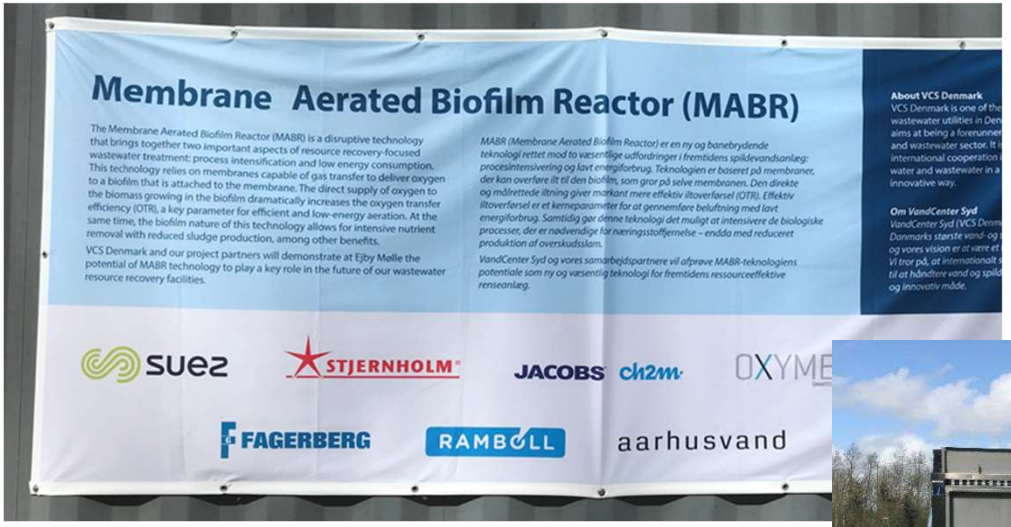


Ejby Mølle WRRF



- Very stringent effluent limits (tax on effluent discharge)
- Energy neutral since 2014

Demonstration Study Initiated in Summer of 2018

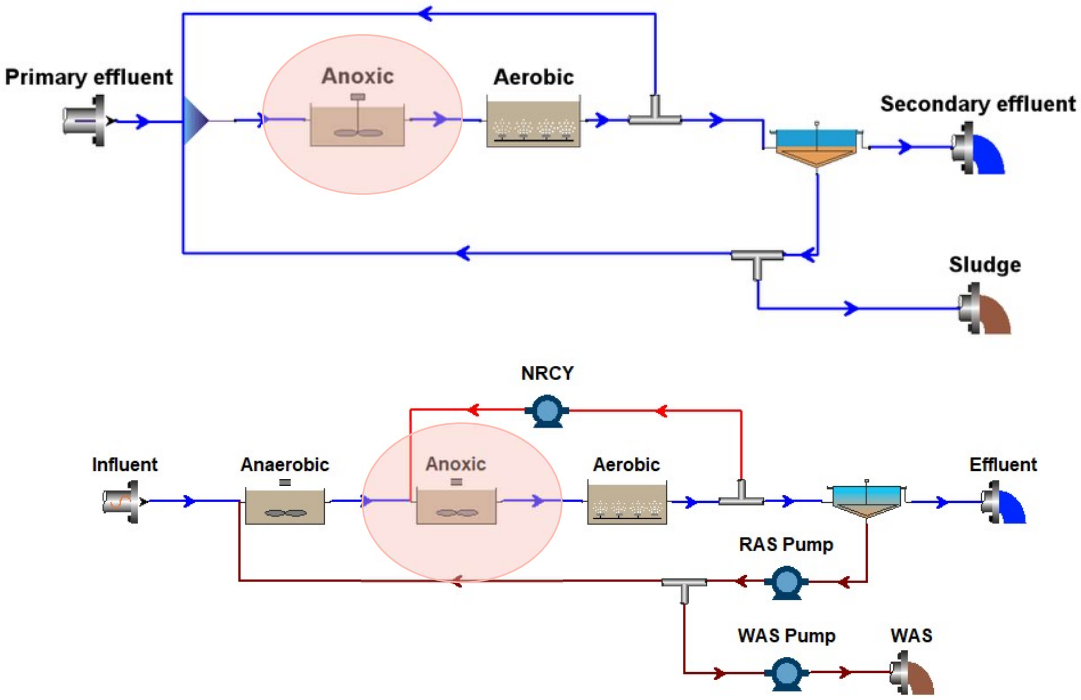


VCS Denmark

Retrofitting MABR into activated sludge

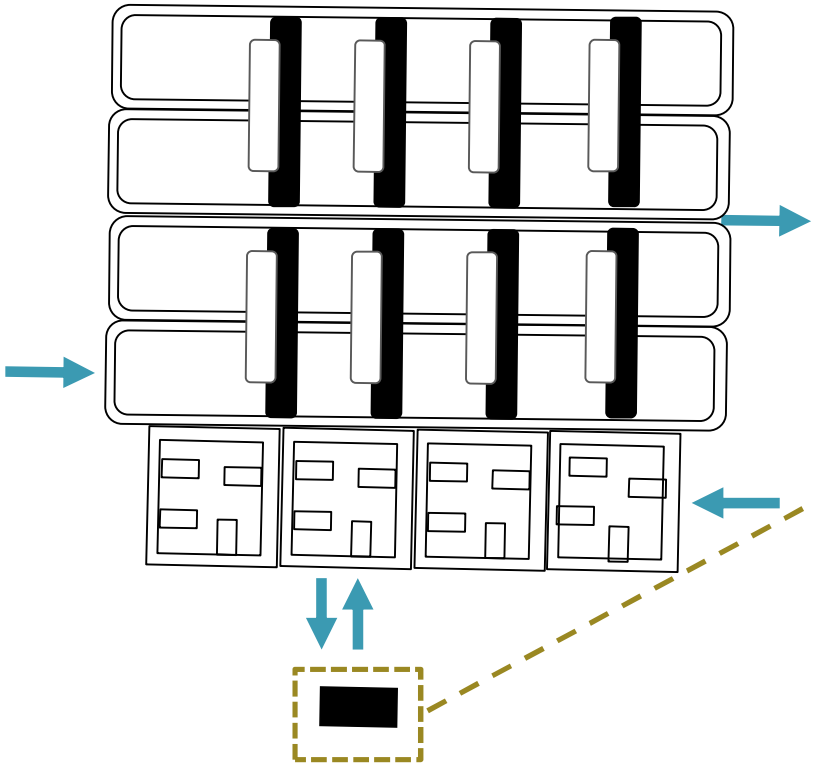
Rules of 👍

- Highest ammmonia conc.
- Lowest COD conc.
- Lowest DO conc.

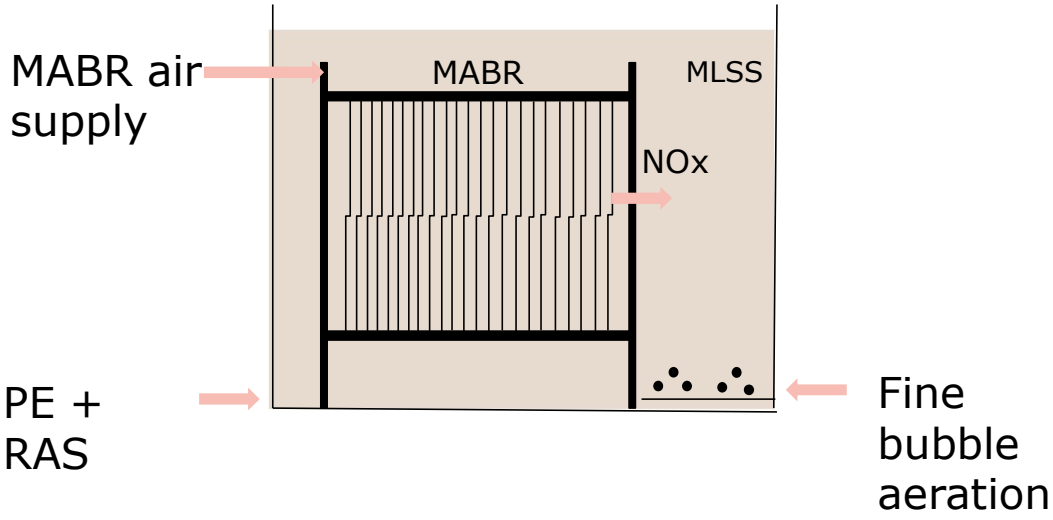


Demonstration at Ejby Mølle

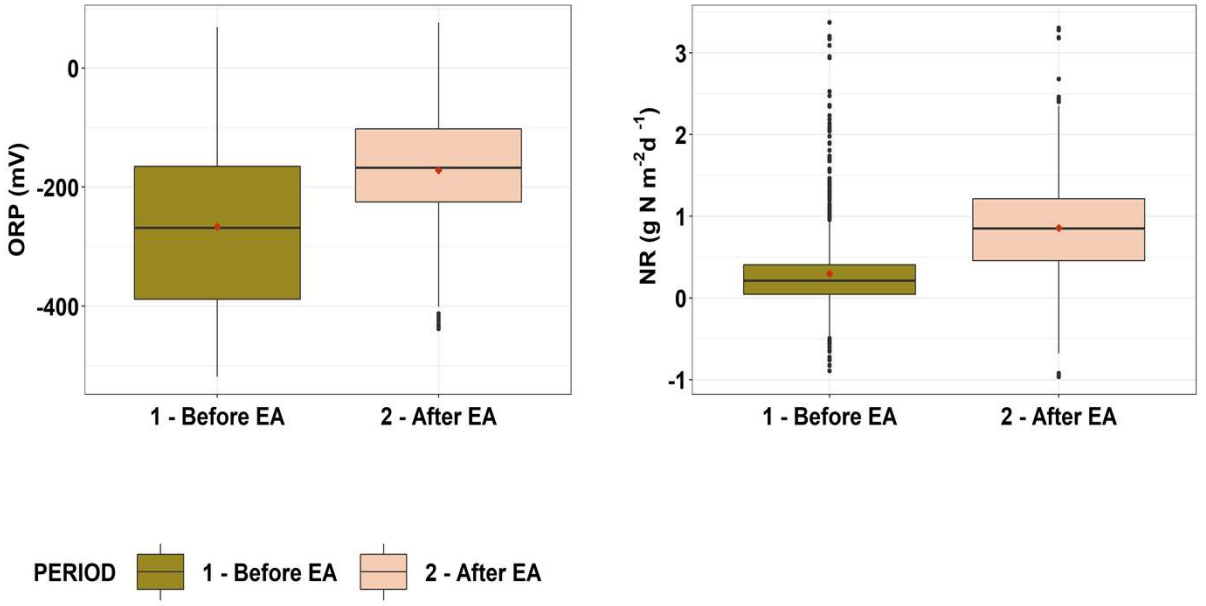
Pilot Configuration



MABR reactors



Two distinct periods of operation



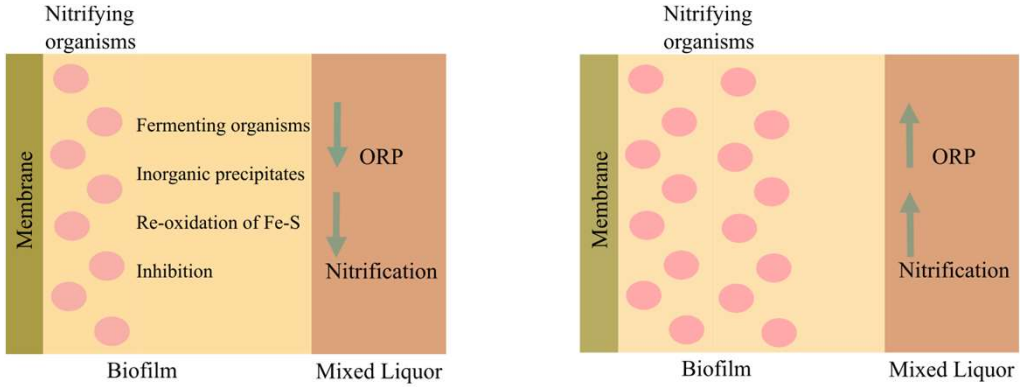
Understanding the effect of low ORP

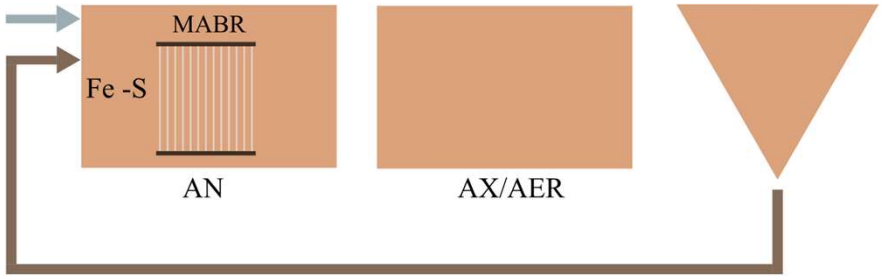
Iron-Sulfur and anaerobic conditions:

a) Competition for space

b) Competition for oxygen

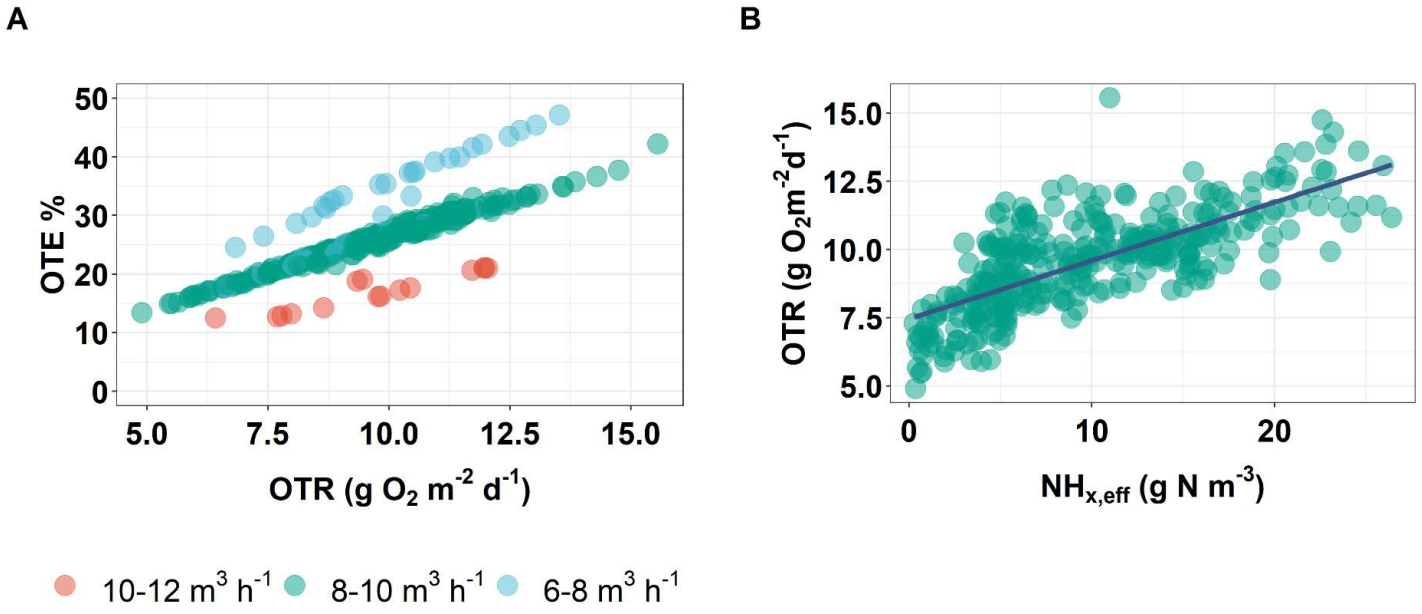
c) Nitrification inhibition





Uri Carreño, N., Nielsen, P.H., Gernaey, K. V., Wang, Q., Gro Nielsen, U., Nierychlo, M., Hansen, S.H., Thomsen, L., Flores-Alsina, X., 2021. The effects of low oxidation-reduction potential in the performance of full-scale hybrid membrane aerated biofilm reactors. Submitted.

Leassons learned 2: 75% energy savings compared to existing



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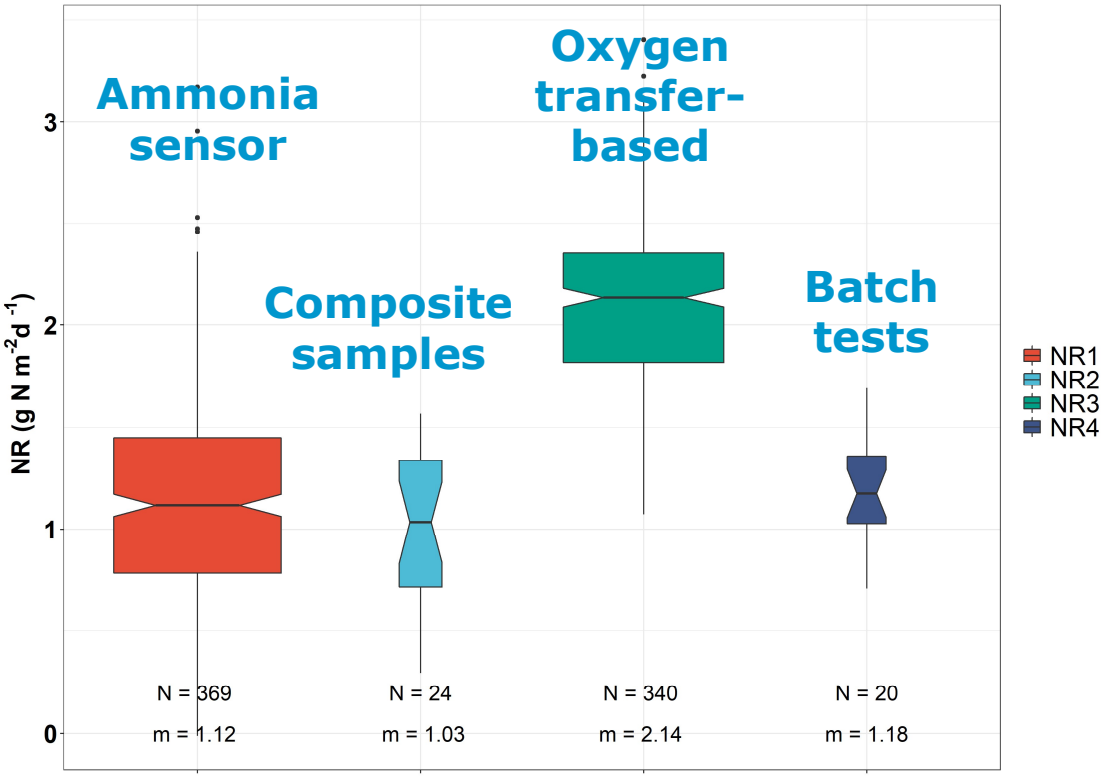
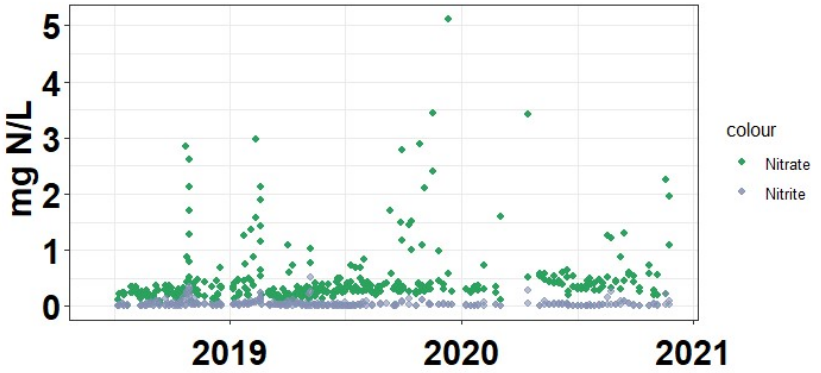
Lessons learned 3: Nitrogen Removal





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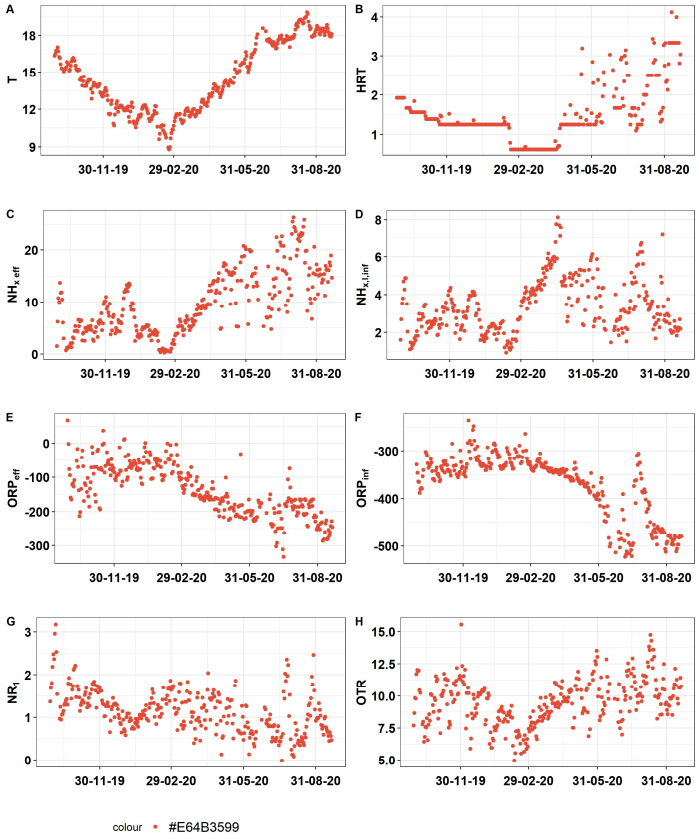
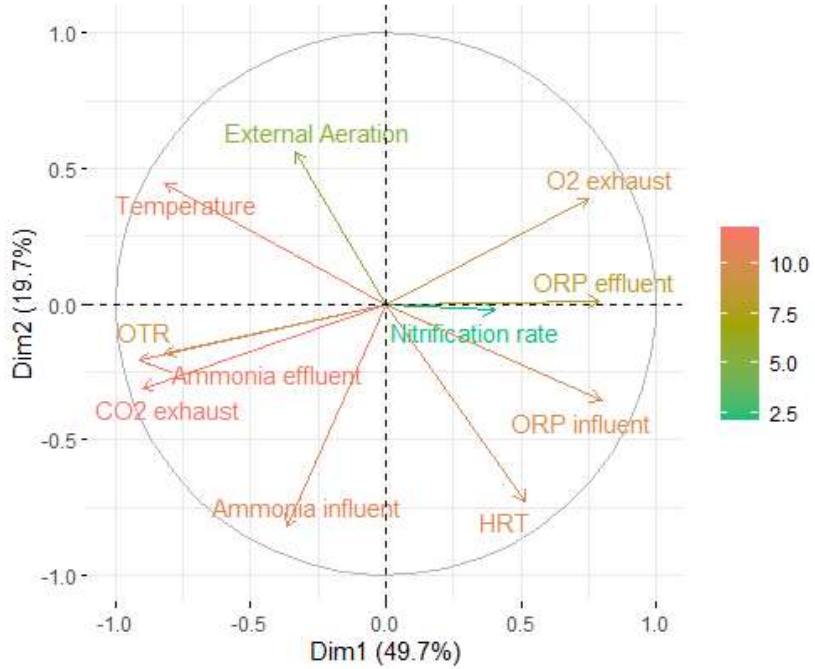
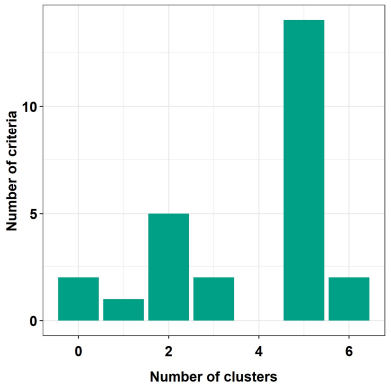
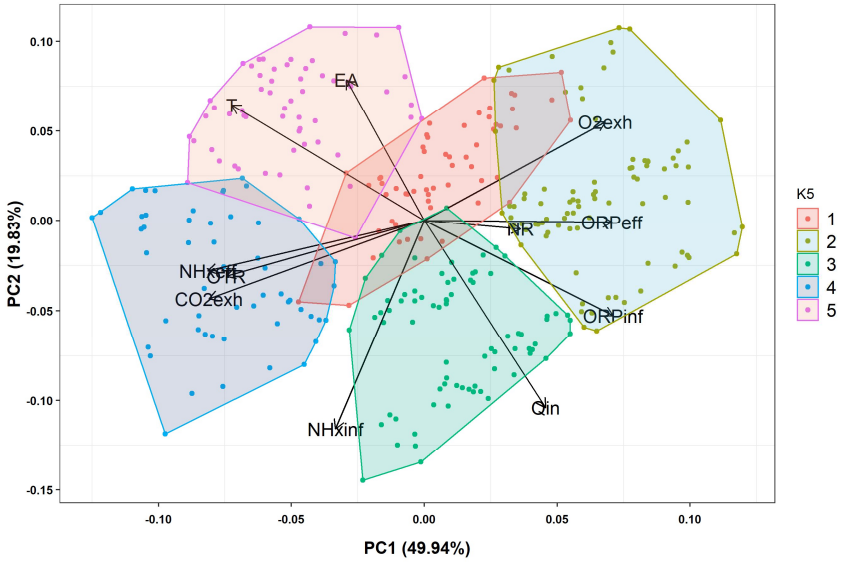
Principal Component Analysis for Dimensionality Reduction

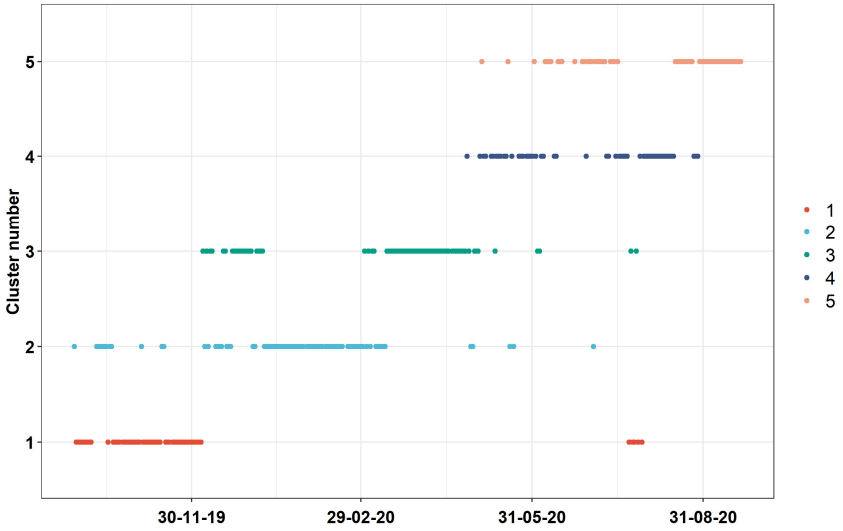




Cluster allocation (k-means)







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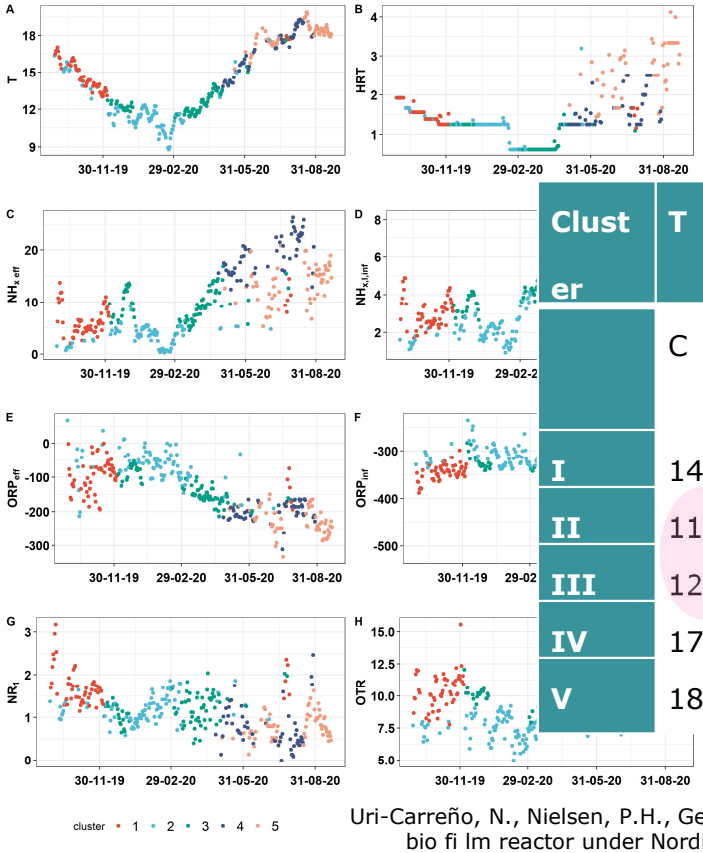
Lessons learned 4: wet weather



Cluster	T	$NH_{x,l,inf}$	$NH_{x,ef}$ [f]	ORP_{in} [f]	ORP_{ef} [f]	EA	Q_{inf}	$O_{2,exh}$	$CO_{2,ex}$ [h]	OTR	NR_1	OTR/N_{R_1}
	C	g N m^{-2} d^{-1}	g N m^{-3}	mV	mV	m^3 d^{-1}	m^3 h^{-1}	%	%	g O_2 m^{-2} d^{-1}	g N m^{-2} d^{-1}	
I	14.4	3.1	6.1	-344	-95	278	17	16.19	2.19	10.17	1.65	6.18
II	11.5	2.1	3.7	-317	-61	0	20	17.42	1.67	7.51	1.18	6.38
III	12.2	4.4	9.3	-340	-148	0	36	16.24	2.44	9.77	1.20	8.12
IV	17.2	4.6	19.3	-395	-199	103	18	15.15	3.18	11.54	0.60	18.99
V	18.1	2.5	14.3	-482	-235	135	9	16.43	2.61	9.79	0.79	12.44

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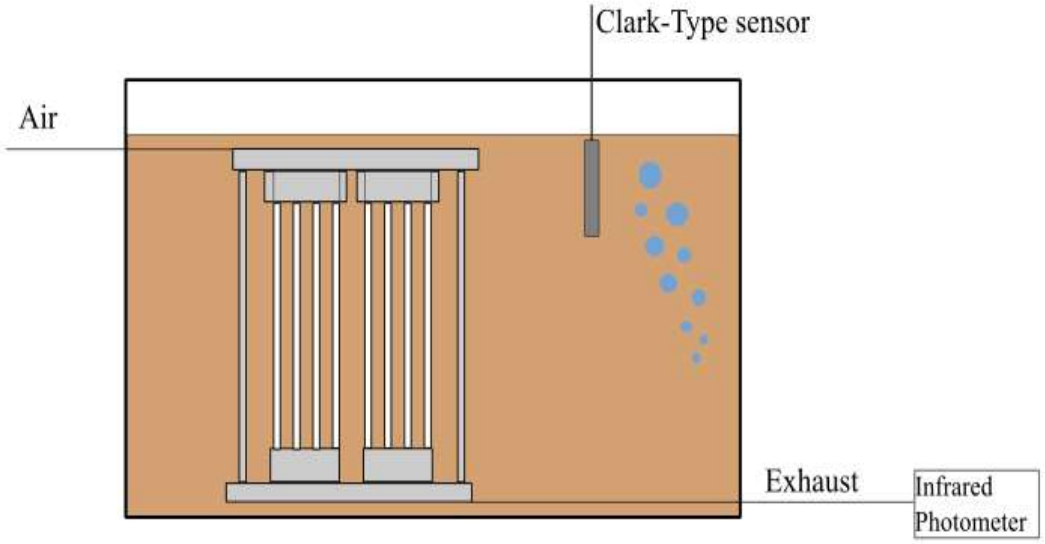
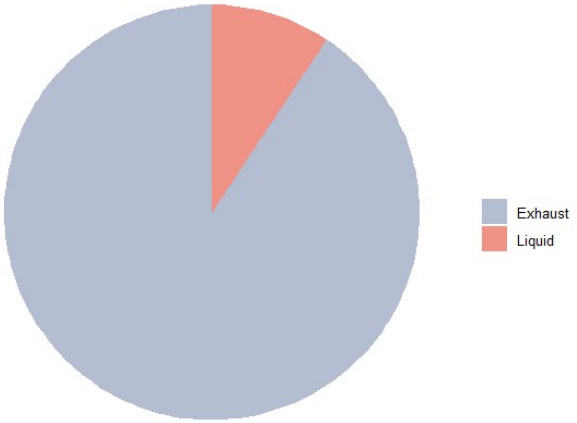
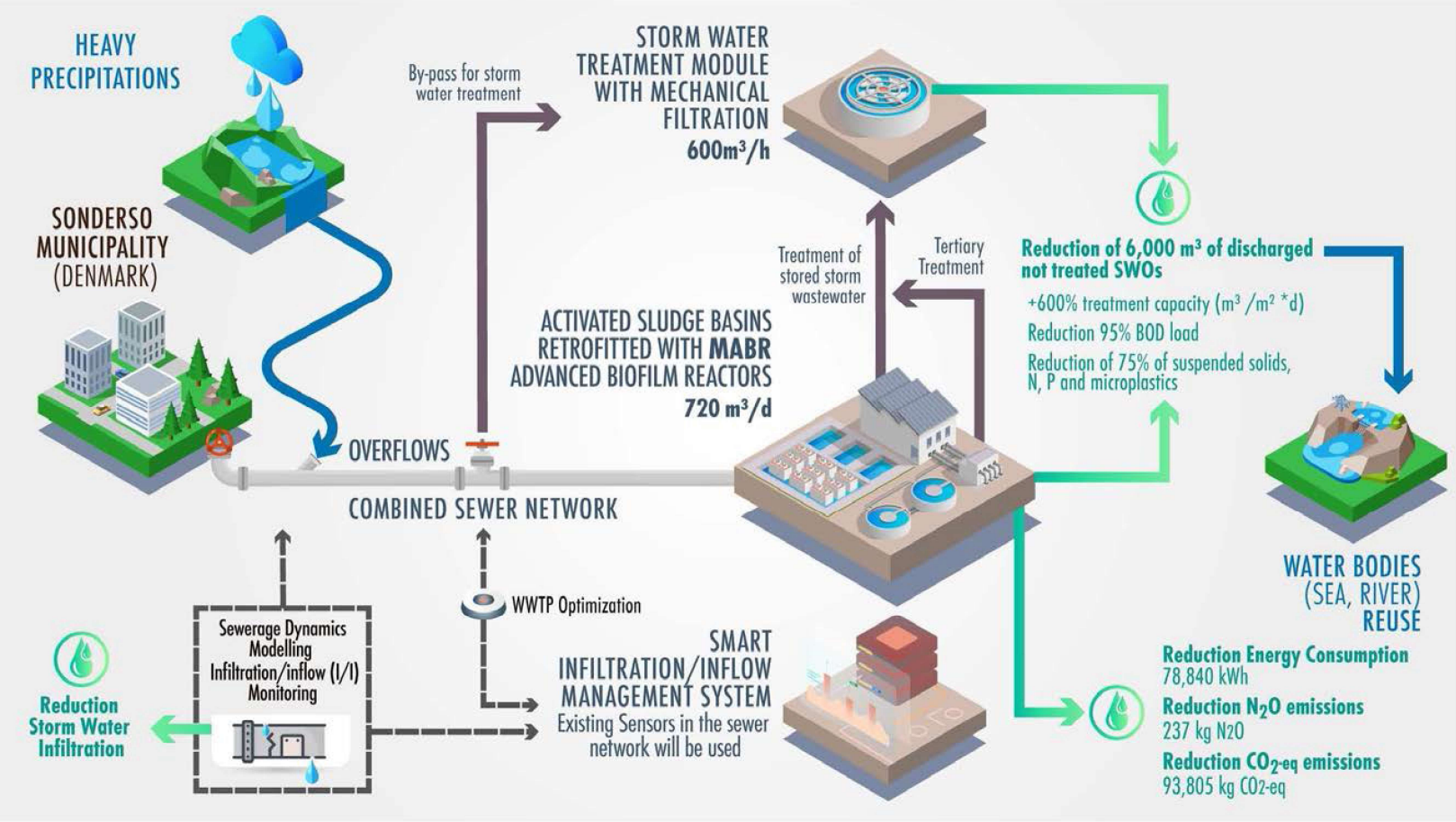
Leassons learned 5: N_2O emissions





RESEAU - LIFE CCA_ES_001706



NACAT

mudp 2021

NACAT - N_2O Abatement by CAtalytic Treatment

VandCenterSyd · Hillerød Forsyning · EnviDan · TÅRNBYFORSYNING · DTU · HALDOR TOPSOE

Conclusions

- Challenges associated to anaerobic sluge feeding
- Significant energy savings
- Stable SND and nitrification rates 1-2 g N/m2/d-1
- Stable operation under wet weather periods
- Potential to achieve significantly lower N_2O emissions
- Future work: Life Reseau Project- larger demonstration

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