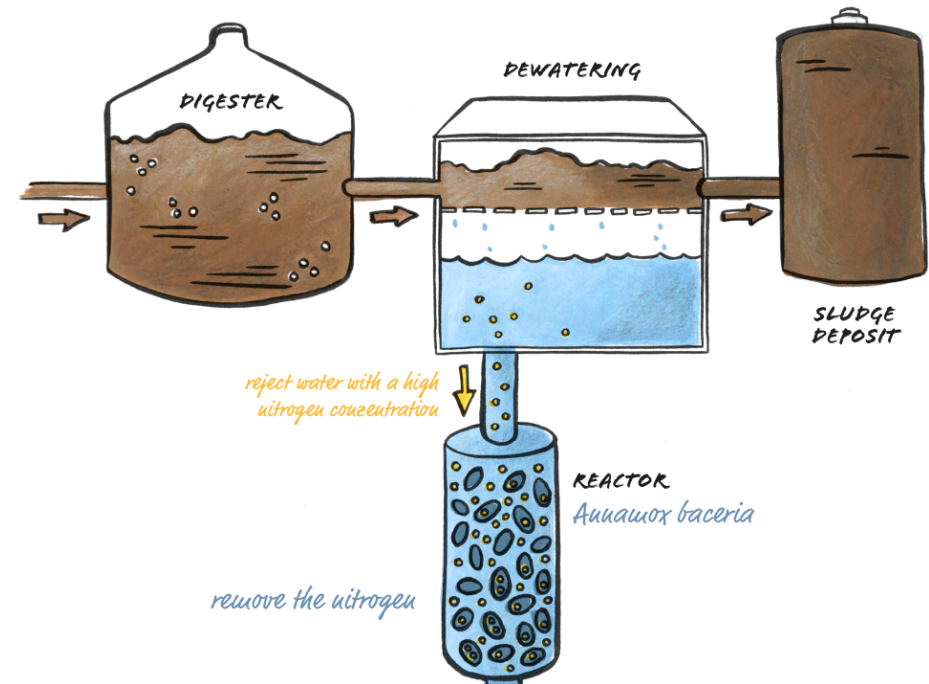




inners

Ir Frans Visser
Policy advisor
Waterauthority Vallei and Veluwe

- Waterauthority
- Energy factory
- Nitrogen removal
- DEMON
- Lessons learned / experience gained

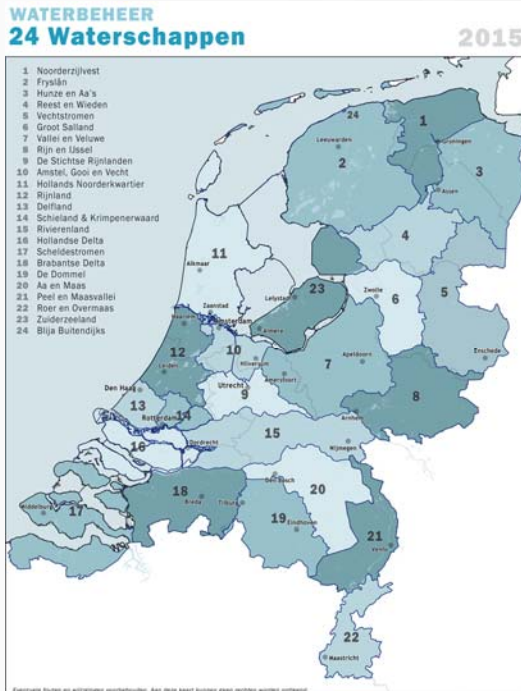


Waterauthorities in the Netherlands



inners

Waterauthority Vallei and Veluwe



Waterschap Vallei en Veluwe



- Hoofkantoor Apeldoorn
- Rioolwaterzuivering
- Gemaal
- Loods



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WWTP Amersfoort

- 300.000 pe
- 9000 m³/h
- Transformation -> [OMZET.AMERSFOORT](https://www.omzet.amersfoort.nl)
- From waste to energy and raw materials
 - Energy (electricity and heat)
 - Raw materials, struvite (phosphorous)



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WWTP Amersfoort

year	Self sufficient in electricity production
2006	30%
2011	55%
2017	100%*

after completing project Omzet.Amersfoort

- an electricity surplus of about 30%, supplied to the grid
- all heat surplus concentrated to one point (easy to use)



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Introduction of Anammox proces

- Central dewatering on WWTP Amersfoort
- Due to extra load of N → effluent requirements not met:
N_{tot} 14 mg/l instead of N_{tot} 10 mg/l
- Choises
 - Enlargement of main treatment plant (aeration volume) and COD dosing
 - Introduction of new side stream proces



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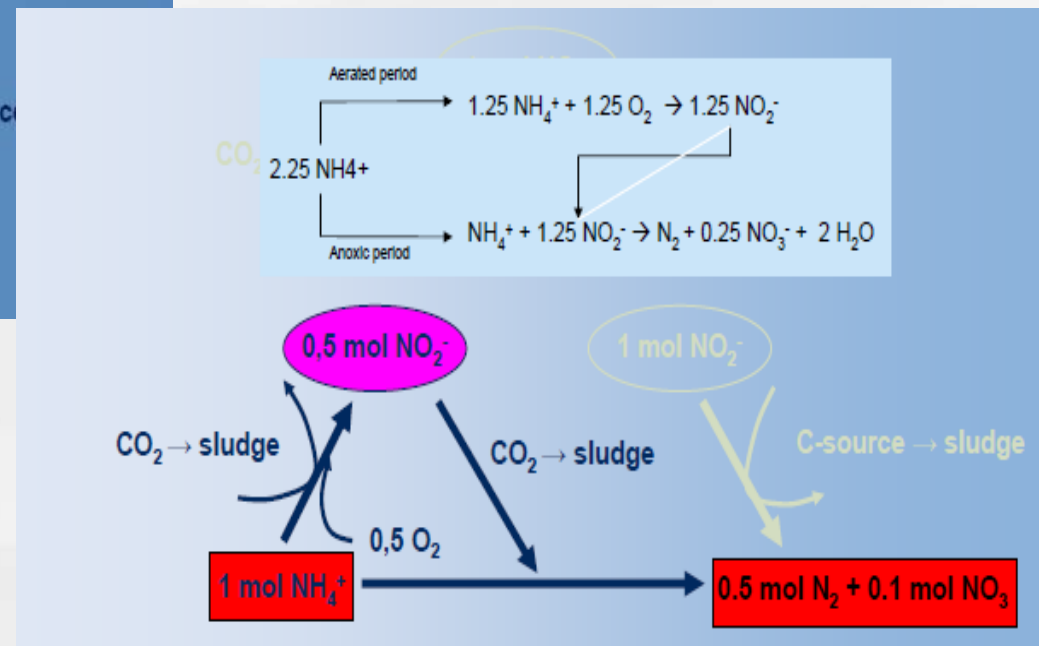
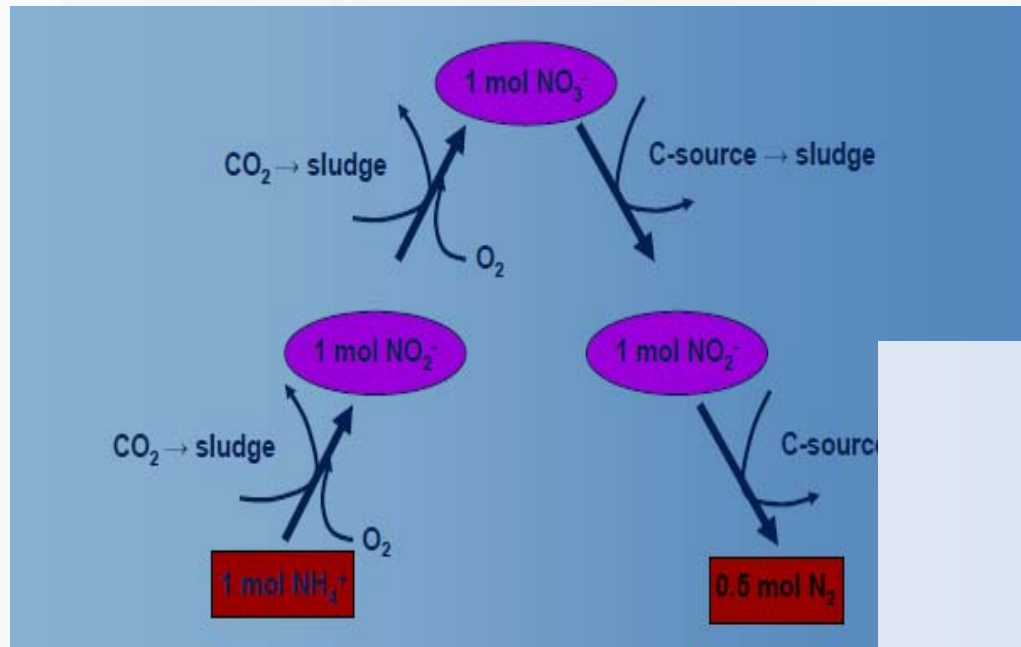
Why anammox proces

- Less contruction volume
 - 780 m³ instead of conventional 10.000 m³
- no COD dosing
- Less energy (30%) due to partial oxidation of NH₄



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Energy friendly anammox process partial nitrification



waterschap
**vallei en
veluwe**

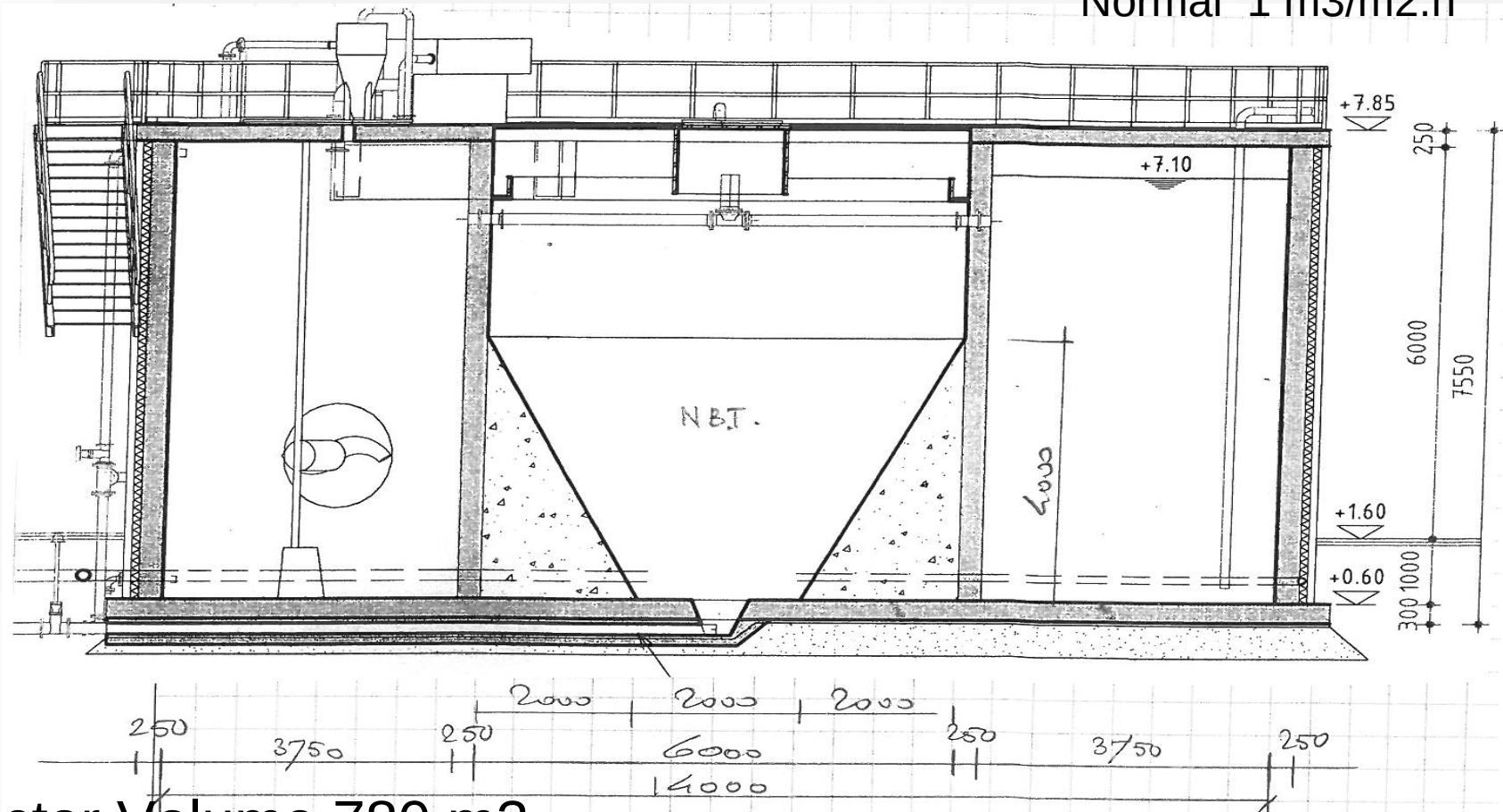
Why Demon?

- Good experiences with batch Demon proces on WWTP Apeldoorn
 - High settlings velocity of anammox sludge
 - Continous fed Demon reactor
 - Saving on contruction volume:
no extra centrate buffer



Dimensions of the reactor

Surface load
max 1.21 m³/m².h
Normal 1 m³/m².h

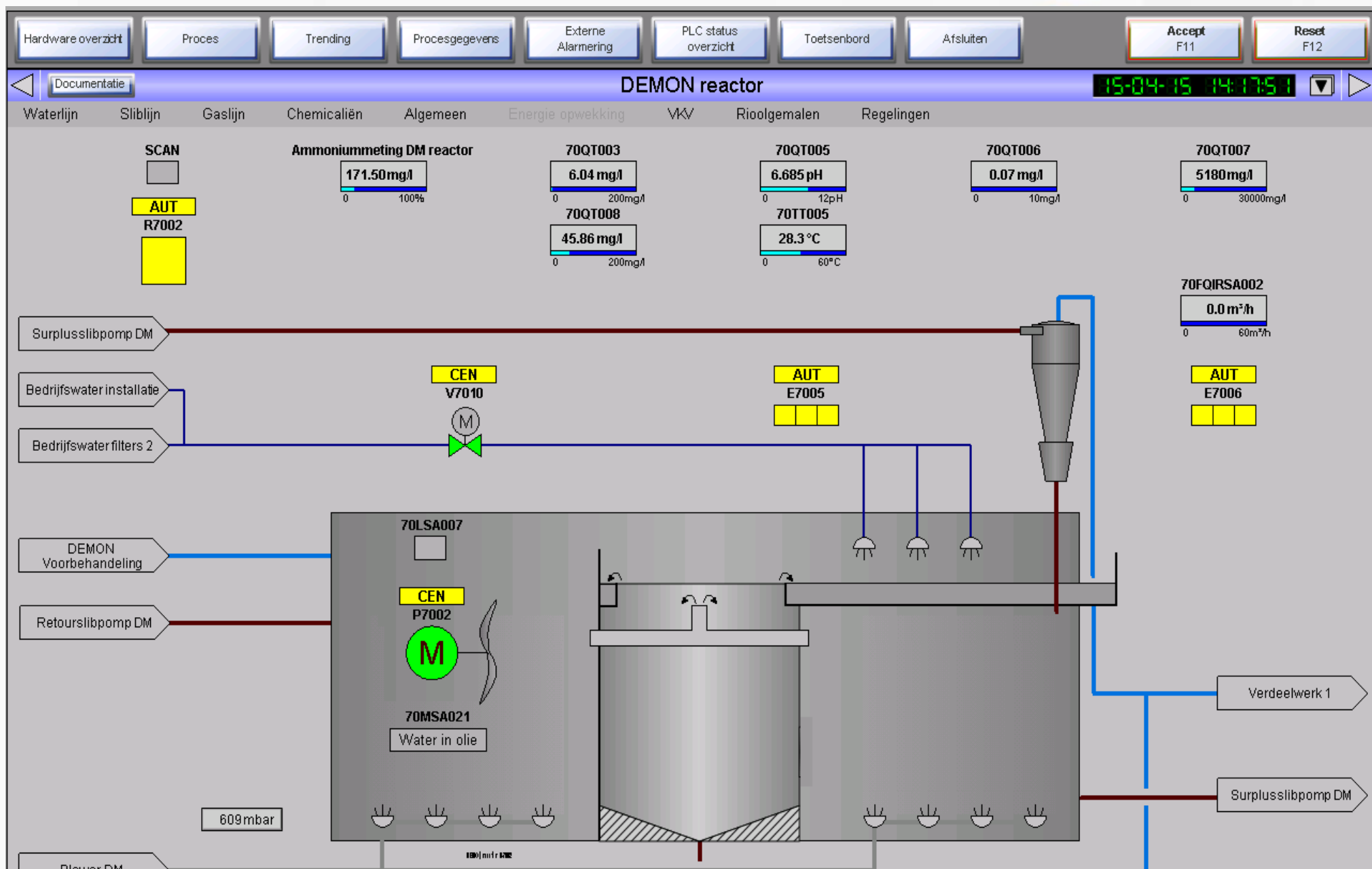


Reactor Volume 780 m³
Nload 510 kg NH₄-N/d





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Efficiency

Parameter	unit	Feed	effluent Demon	effluent	removal efficiency
		After filtration	Incl excess sludge	Demon	on total effluent
				Excl excess sludge	
COD	mg/l	1922	1960	1476	
Kj-N	mg/l	894	307	248	
NH4-N	mg/l	833	210	178	74%
NOx-N	mg/l	0	20	22	
Ntot	mg/l	894	327	270	63%
Ptot	mg/l	169	159	136	
Suspended solids	mg/l	1181	1434	1088	

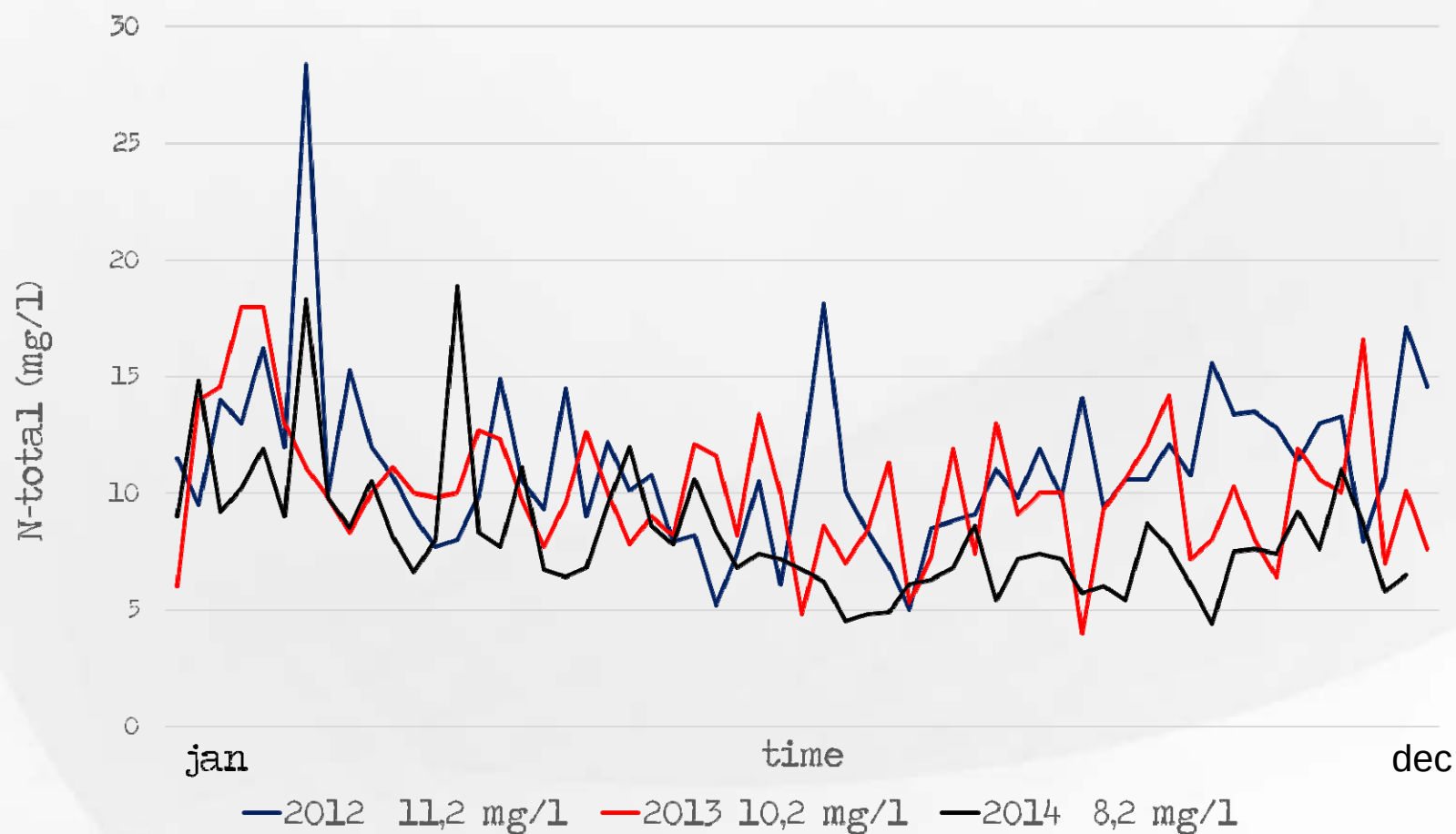
Energy Consumption

Main WWTP		2012	2013	2014
WWTP Load (g BOD/kg SS.d)	kBOD	46	45	33
Energy consumption aeration	kWh	3.721.000	3.807.542	3.328.865
N Removed	kg	1.039.155	900.455	745.695
Specific energy consumption	kWh/kg dN	3,6	4,2	4,5
Demon reactor				
Total energy consumption	kWh		143.184	159.187
N removed	kg		72.422	73.314
Specific energy consumption	kWh/kg dN		2,0	2,2

N-total Effluent concentrations

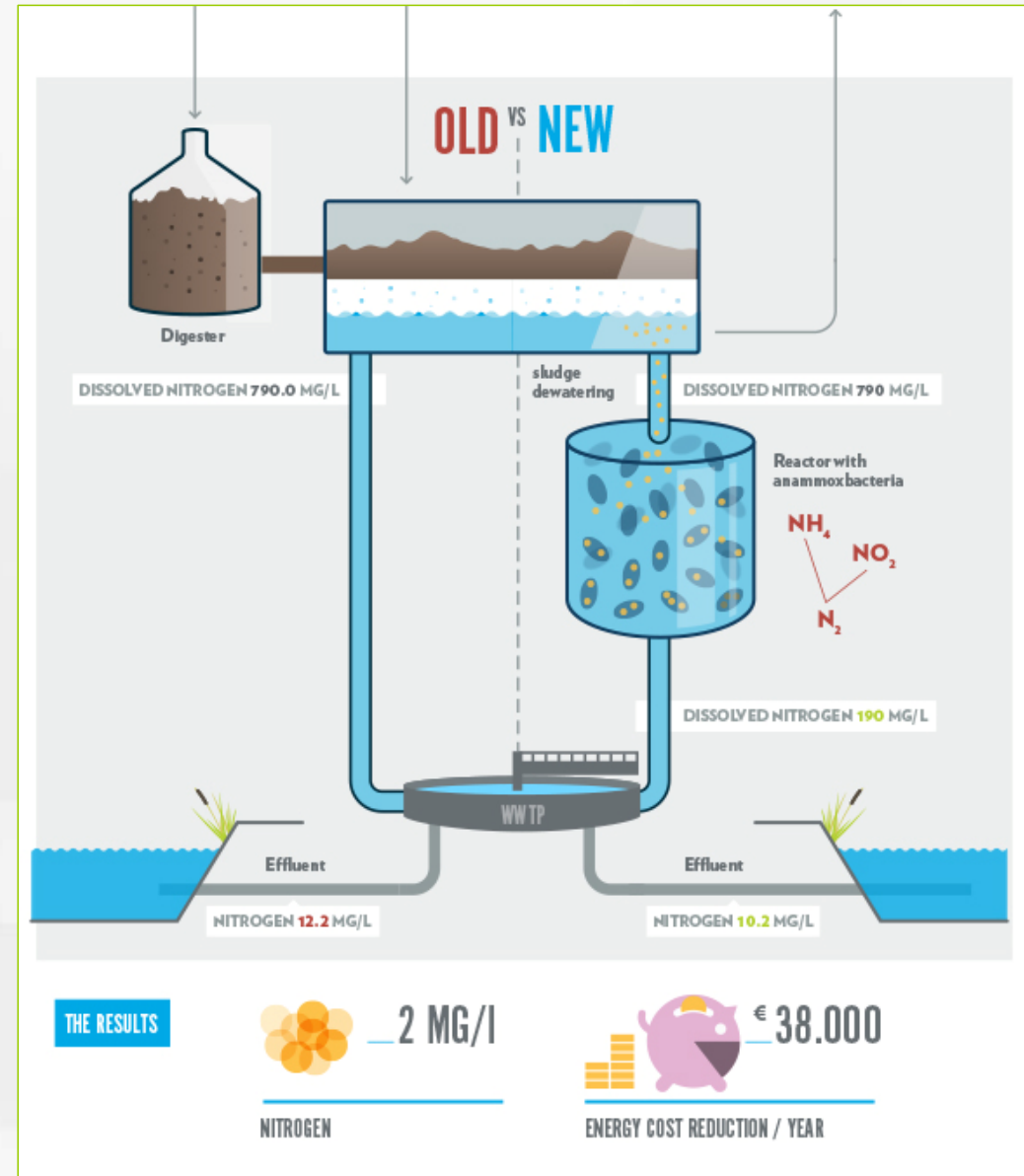


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Experiences

- Slow start up due to no heating
- During summer time temperature too high $> 38^{\circ}\text{C}$
- Suspend solid overloading of the Salsness filter
- Positive effect on effluent quality main plant
N_{tot} from 11,2 mg/l in 2012 to 8,2 mg/l in 2014
- Energy cost reduction of **38.000 €/a**



Thank you for your attention