Fra energineutral til klimaneutral

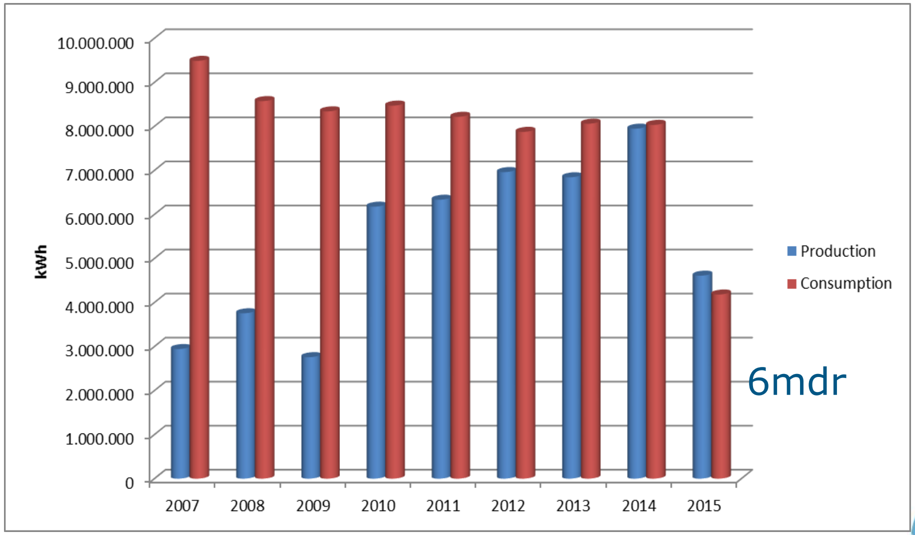
Per Henrik Nielsen
30 November 2015

VandCenterSyd

Energineutral med konsekvenser

Spildevandsindustrien står overfor et paradigmeskift

- Fra rensning til ressource udnyttelse
- Fra energi forbruger til energi producent
- Nye typer behandlingsanlæg – meget mere fleksible.
- Væsentligt større kompleksitet
- Introduktion af nye udfordringer
  - CO_2 neutralitet – VandCenter Syd 2014
  - Energineutralitet,
  - Bæredygtighed
  - Fodaftryk



Energi balance - el

Baggrund

- VandCenter Syd besluttede tilbage i 2010 at arbejde mod CO_2 neutralitet i 2014
  - Fokus på emissioner
  - Fokus på forbrug
  - Fokus på produktion

- Lattergas og metan kan være væsentlige faktorer og de høre derfor naturligt hjemme i et overordnet regnskab for samlede emissioner

10					
11					
12					
13					
14					
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19					
20					

- Lattergas emissioner baseret på meget løst grundlag!!!

Erfaringer

- Variationen i lattergas emission er meget betydelig

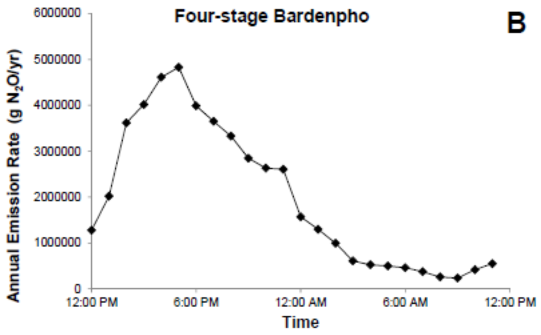


Table 4-2. Summary of N_2O Fluxes and Emissions Measured at Full-Scale WWTPs.

Plant Configuration	Temp (°C)	Reactor influent TKN load (g-N/day)	Reactor effluent TN load (g-N/day)	Q (MGD)	% Influent TKN emitted as N_2O	% TN removed emitted as N_2O
Separate-stage BNR	15 ± 0.48	1.8×10^6	3.6×10^5	23	0.03	0.03
	23 ± 0.28	2.3×10^6	4.3×10^5	27	0.01	0.01
Four-stage Bardenpho	14 ± 0.26	8.6×10^5	1.7×10^5	7.8	0.16	0.19
	23 ± 0.20	7.4×10^5	7.6×10^4	8.1	0.60	0.66
Step-feed BNR 1	19 ± 0.22	3.1×10^6	1.4×10^6	29	1.6 ±	2.9
	25 ± 0.28[4]	2.9×10^6	$9.4\ 10^5$	30	0.62 ±	0.90
Step-feed BNR 2	23	1.8×10^6	1.3×10^5	11	1.6	1.8
	29 ± 0.18[3]	2.2×10^6	2.9×10^5	14	1.5	1.7
Step-feed BNR 3[1]	20 ± 1.8	4.5×10^6	7.3×10^5	40	0.14 ± 0.02	0.17 ± 0.03
	24 ± 0.78	7.8×10^6	8.6×10^5	57	0.05 ± 0.03	0.06 ± 0.03
Step-feed non-BNR[2]	17 ± 0.12	8.6×10^6	4.4×10^6	71	0.18 ± 0.18	0.37 ± 0.36
	26 ± 0.81	8.9×10^6	4.2×10^6	93	1.8 ± 0.79	3.3 ± 1.5
Plug-flow 1	11 ± 0.20	1.8×10^6	1.0×10^6	18	0.40	0.92
	23 ± 0.46	1.8×10^6	7.3×10^5	15	0.41	0.70
Plug-flow 2	11 ± 0.41	6.3×10^5	4.0×10^5	8.7	0.62	1.7
	22 ± 0.58	6.6×10^5	4.0×10^5	6.6	0.09	0.22
MLE 1	22 ± 0.28	7.3×10^5	1.3×10^5	4.0	0.44	0.54
	26 ± 1.8	6.8×10^5	1.9×10^5	4.0	0.07	0.09
MLE 2	21 ± 0.72	5.9×10^5	1.2×10^5	3.3	0.07	0.09
	26 ± 0.17	6.9×10^5	1.5×10^5	4.1	0.06	0.07

[1, 2] These two plants have covered aeration tanks, which facilitated the acquisition of the composite emissions from different spatial locations in these tanks. On the other hand, spatial variability could not be inferred for this reason.
[3] This was the first sampling campaign of this study and as such used a different off-gas flow measurement technique, which was nevertheless validated using independent He tracer measurements (Figure 3-3).
[4] During this campaign, off-gas flow measurements were conducted in one zone of the aerated portion of the step-feed BNR process.

- Vi bruger 7g N_2O pr PE – og det er forkert!!!
- VTU projekt indikere tal fra 9 -28g
- Vi ved det er meget dynamisk
- Vi ved at lattergas emission er afhængig af kulstof mængden i forbindelse med kvælstofomsætningen. Mindre kulstof kan give anledning til mere lattergas produktion.
- Vi ved det er svært at måle emission – men ikke svært at måle koncentrationer i væskefasen!

Hvorfor reducere lattergas emission?

- Lattergas er en kraftig drivhusgas.

Science for Environment Policy
DG Environment News Alert Service
European Commission

17 December 2009

Nitrous oxide is now top ozone-layer damaging emission

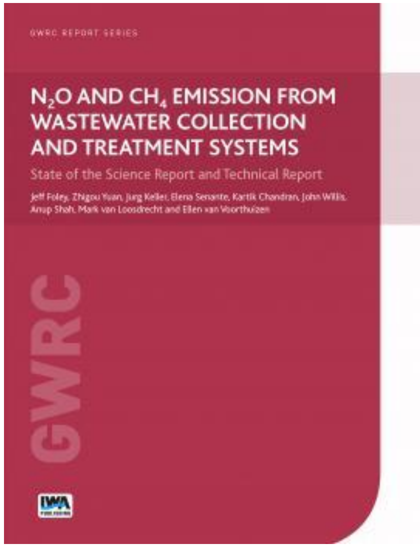
According to new research, emissions of anthropogenic nitrous oxide (N_2O) are now causing more damage to the ozone layer than those of any controlled ozone depleting substance and this is projected to remain the case for the rest of this century. The study suggests that limiting N_2O emissions could help both the recovery of the ozone layer and tackle climate change.

Many ozone-depleting substances (ODS) have been phased out as a result of the Montreal Protocol[1] and are regulated by EU legislation[2]. N_2O is emitted from natural and anthropogenic sources, the latter including as a byproduct of agricultural fertiliser use and from fossil fuel combustion. Its role in ozone depletion has been known for some years and it is similar to CFCs in that it is stable when it is near the earth's surface but releases ozone-destroying active chemicals when transported into the stratosphere (between 10 and 50 km from the surface). However, N_2O is not defined as an ODS under the Montreal Protocol and, although it is a greenhouse gas (GHG) included in the basket of gases under the Kyoto Protocol, its emissions remain unregulated.

- Emissioner fra renseanlæg er muligvis en lille brik i det store spil – men det retfærdiggøre ikke manglende tiltag.

Udfordringer

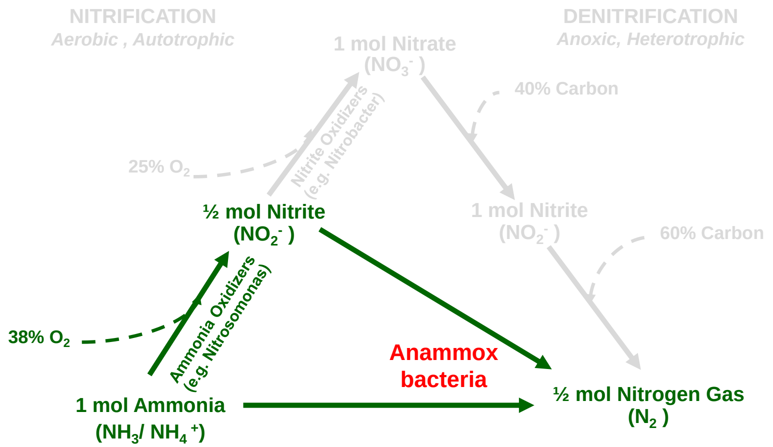
- Det er væsentligt at der skabes muligheder for ikke at blive økonomisk straffet når emissioner (fx lattergas) minimeres.
- En tilskyndelse til øget bæredygtighed vil åben op for en mængde at hensigtsmæssige tiltag.
- Der findes meget viden – men ikke nok



- Hvad skal der til?
  - Fuldskala implementering – vi skal flytte os fra laboratorier til fuldskala for at virkeliggøre vores indsigt
  - Endnu mere samarbejde mellem forsyninger – videns institutioner – virksomheder
  - Der skal være vilje til - og muligheder for innovation

Hvad kan vi gøre og hvad gør vi?

- Eksempler på tiltag:
- Unisense – Aarhus Vand – VandCenter Syd i samarbejde om udvikling af online lattergas sensor – støtte at VTU.
- Nyt driftsprincip i sidestrømsbehandlingen (Anammox) styret af lattergas måling med ønske om nedbringelse af emissioner
- Vi ved at lattergas produktion sker i et meget centralt i kvælstof omdannelsen – lattergas er oplagt paramter for meget bedre kontrol og optimering af biologisk kvælstof omsætning. Det åbner et meget stort potentiale



Opsummering

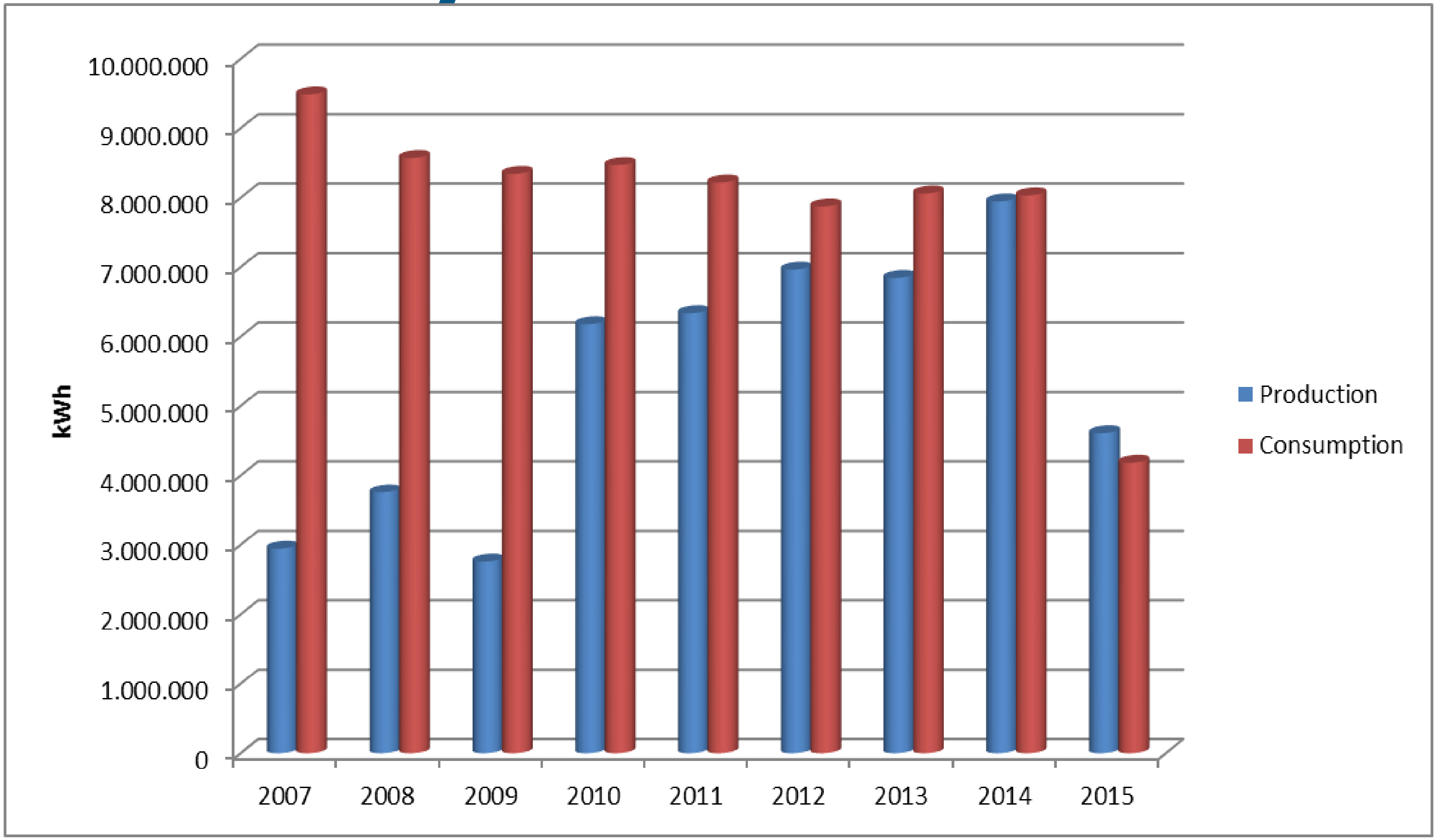
- Energineutralitet kan ikke stå alene – vi er nød til at forstå konsekvenserne og gøre noget ved dem. Mere energiudnyttelse kan betyde større N_2O udledninger hvis vi ikke tænker os om.

- Der er ingen incitamenter for at gøre noget reelt ved lattergas emission – det er billigere at lade være med at reducere lattergas emission!

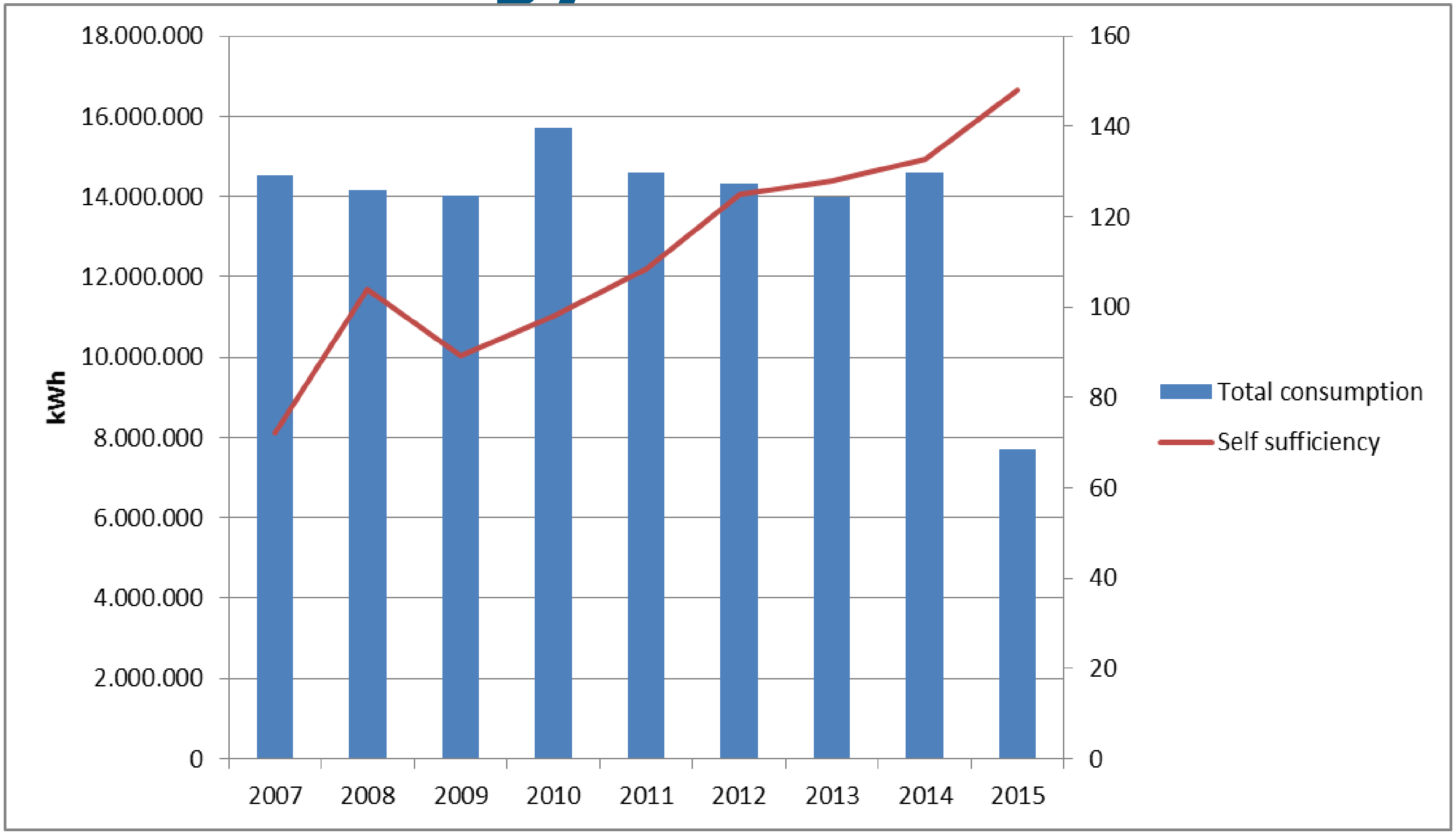
- VandCenter Syd ønsker at arbejde mod bæredygtighed – også selvom det ikke kan betale sig. Vi gør det fordi vi kan og derfor er forpligtet.

Tak

Electricity balance



Total energy balance



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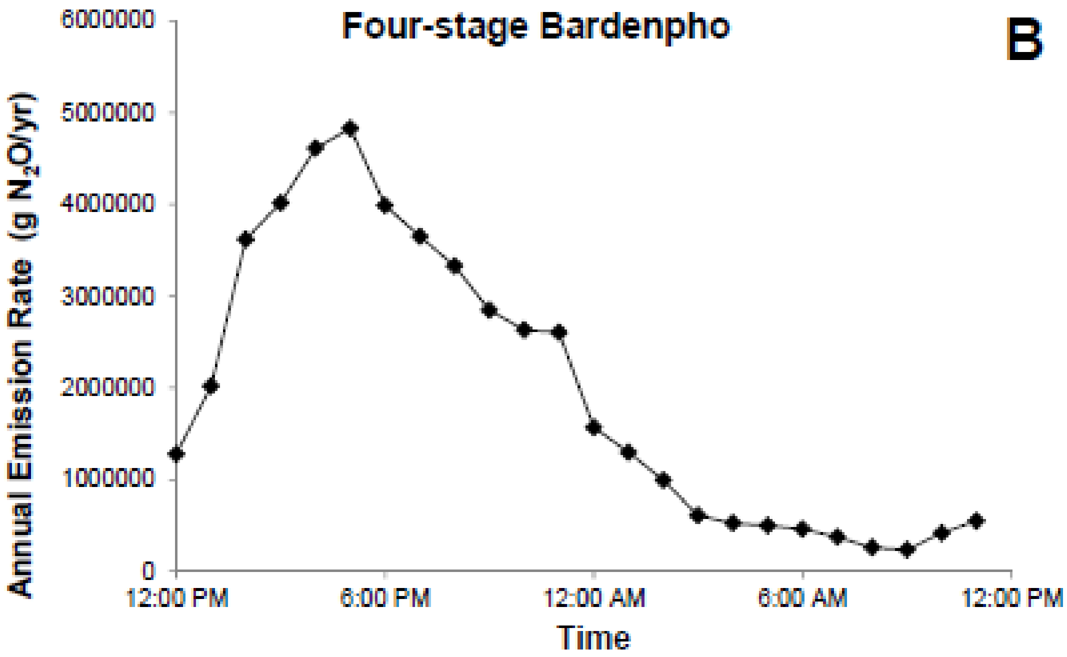

Four-stage Bardenpho
B
Annual Emission Rate (g N_2O/yr)
6000000
5000000
4000000
3000000
2000000
1000000
0
12:00 PM
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6:00 AM
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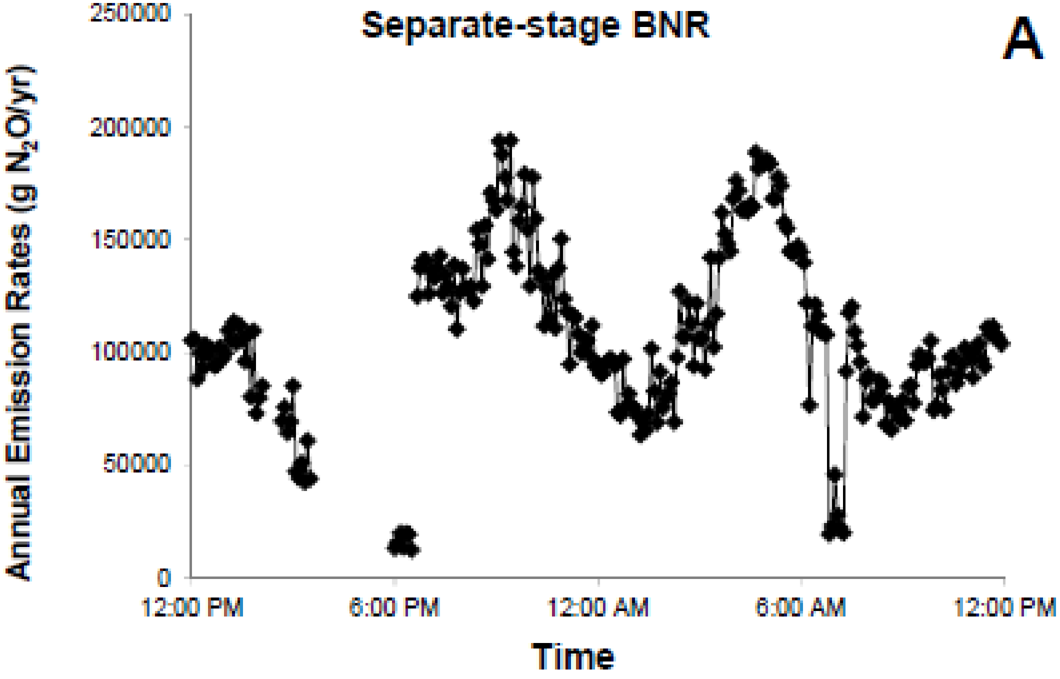
Time


Separate-stage BNR
A
250000
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150000
100000
50000
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Annual Emission Rates (g N_2O/yr)
12:00 PM
6:00 PM
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12:00 PM
Time

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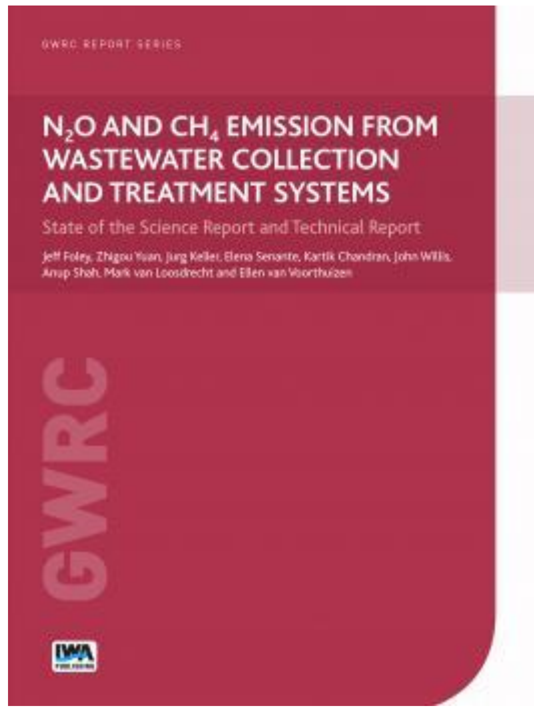
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