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June 17, 2021

Process & Treatment Manager, North Asia
Dr. Tao Su

Saving Energy with Ammonia Control at Wastewater Treatment Plants

Thank you for joining. We will begin shortly!

Wastewater Treatment Plant Monitoring and Control

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House keeping

Audio Settings
Make sure you can hear us loud and clear

Ask Questions
We'll try to answer as many as we can during the presentation

Chat
You can also use the Chat panel to ask questions or contact us if you're having technical difficulties

Yes! We are recording
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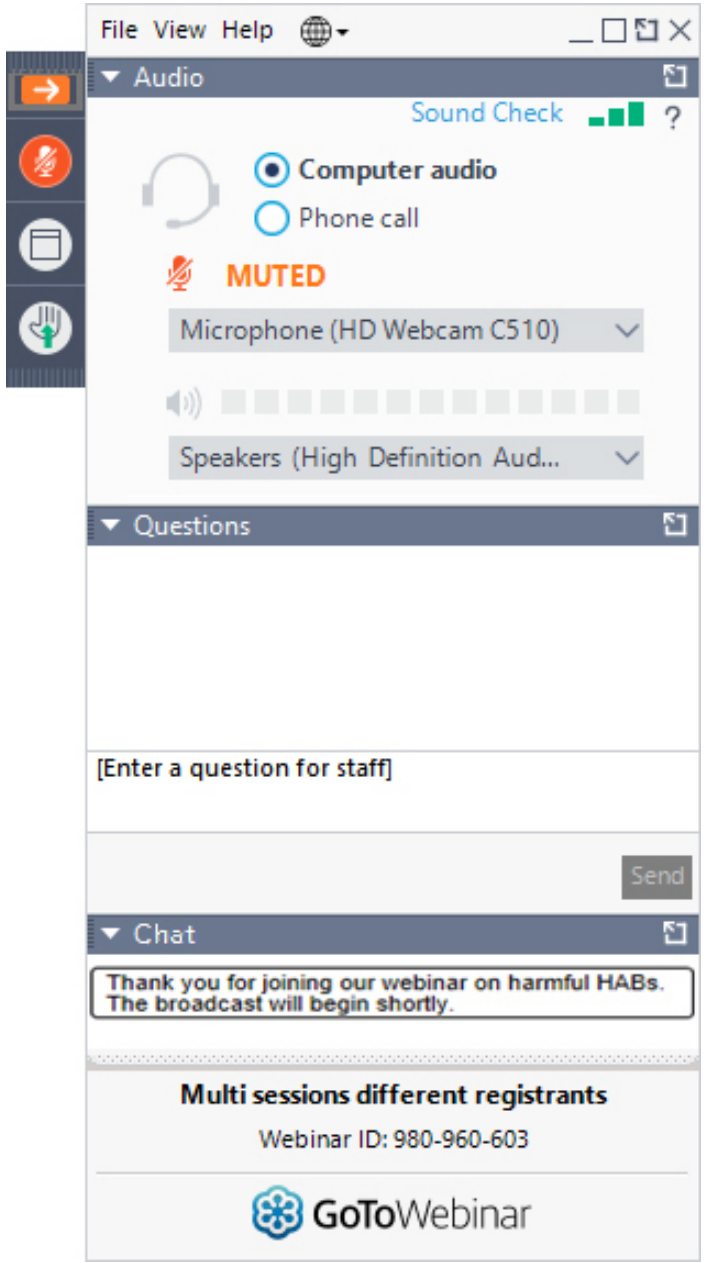

Modify Audio Settings

Please Ask Questions!

Chat for help

Dr. Tao Su

BACKGROUND

PhD in Environmental Sciences
University of Tokyo

- Xylem Product Manager of Online Instrumentation
- Responsible for product sales and promotion of WTW online products throughout North Asia.
- 3 years with Xylem (Analytics) and 6 years in the water treatment market.

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1. Background: WWTP energy consumption
2. Aeration control system
3. Energy-saving Principle
4. Practical Examples for energy saving

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1

Background

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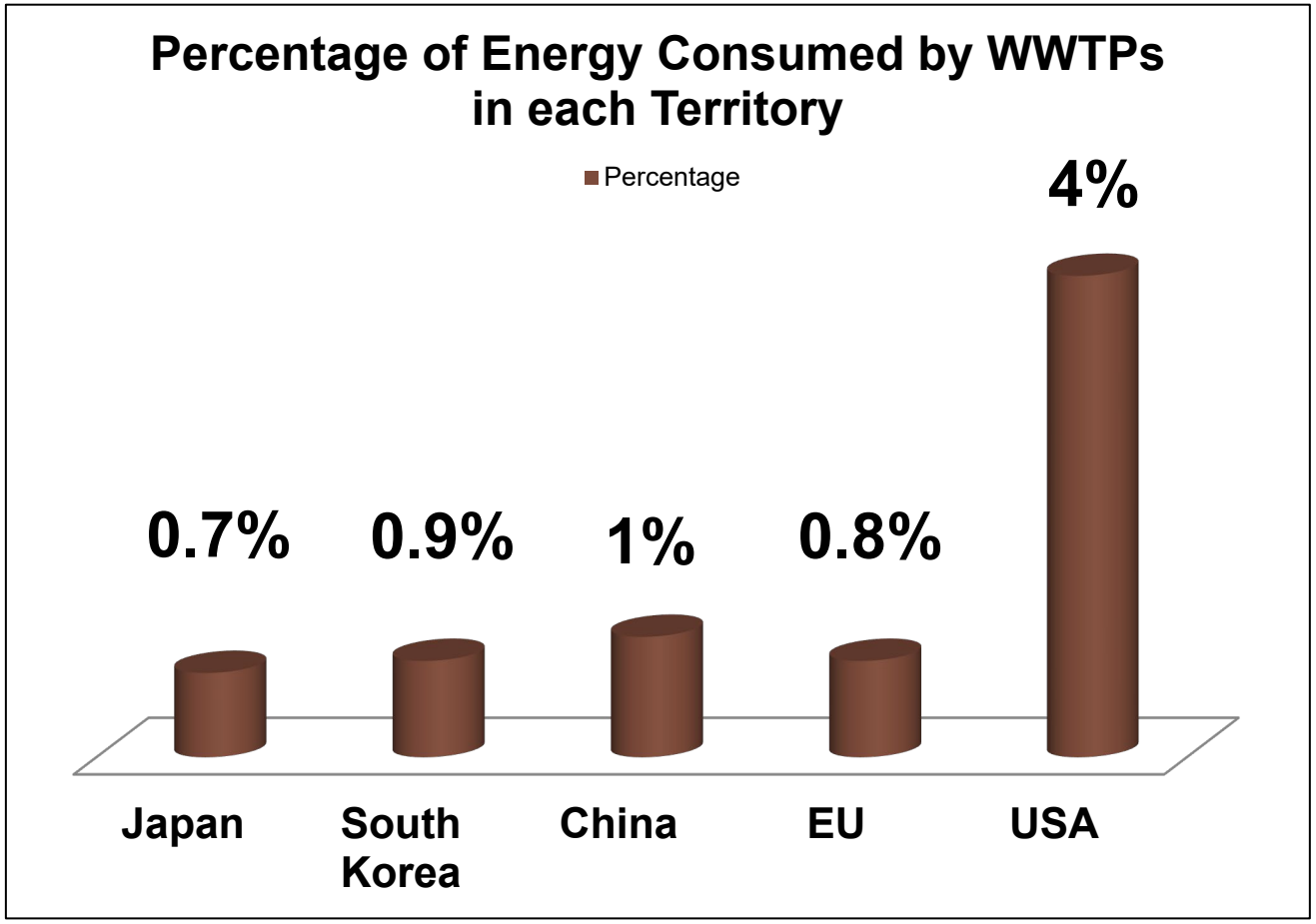
Global WWTP Energy Consumption

Wastewater Treatment Plants (WWTPs) play a key role in protecting natural water bodies, however they are also one of the largest energy consumers in most countries.



Top 10 energy consuming countries in the world

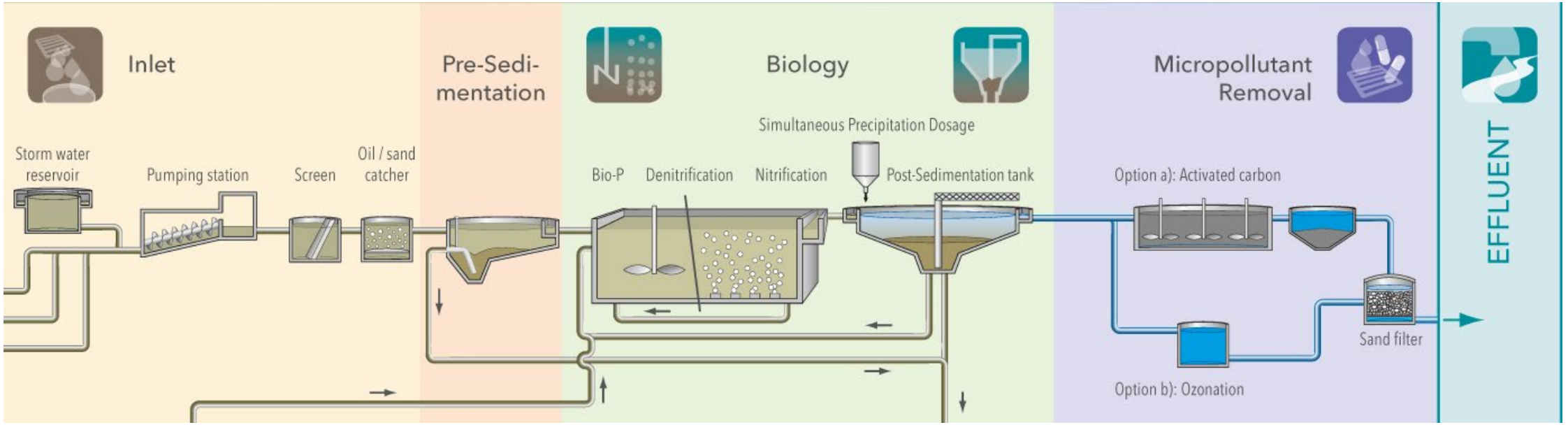
Rank	Country/Region	Electricity consumption (GW·h/yr)	Year of data
—	World	23,398,000	2018 est.
1	China	7,500,000	2020
2	United States	3,989,566	2019 est.
3	India	1,547,000	2018 est.
4	Russia	965,156	2019 est.
5	Japan	902,842	2019 est.
6	Brazil	597,234	2019 est.
7	Canada	549,263	2019 est.
8	Korea, South	527,035	2019 est.
9	Germany	524,268	2019 est.
10	France	449,422	2019 est.

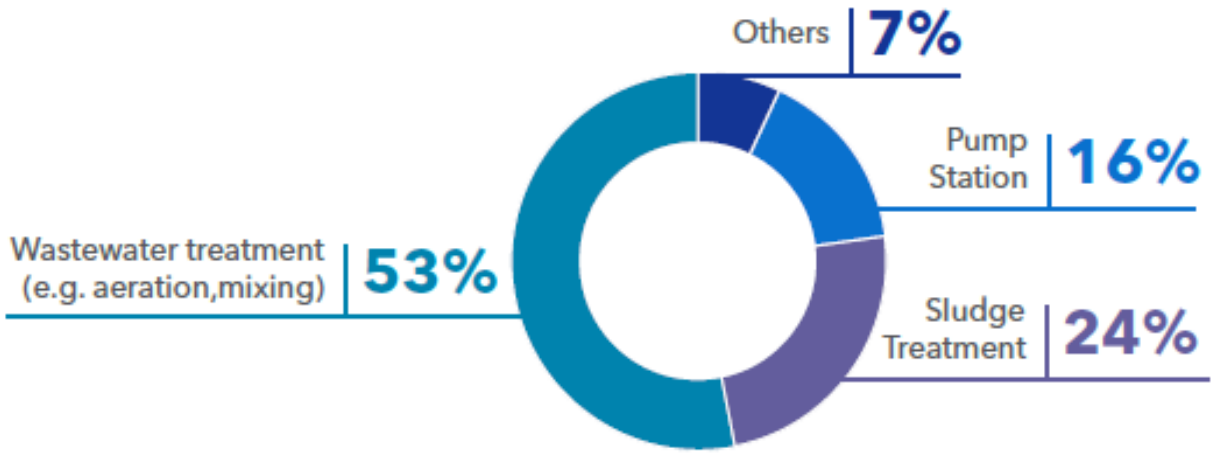
Reference:https://en.wikipedia.org/wiki/List_of_countries_by_electricity_consumption

Poll Question #1

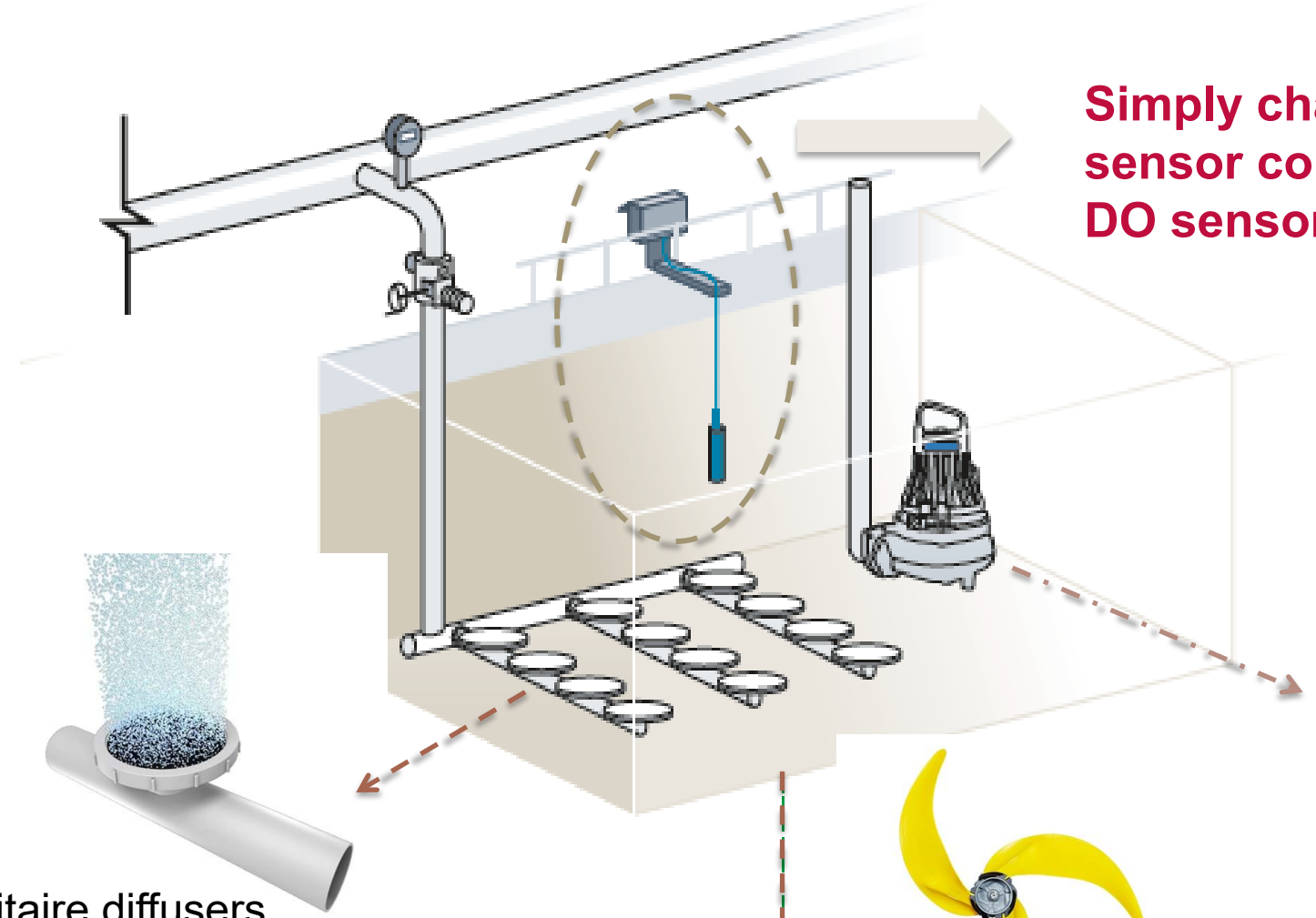
Which part of WWTPs have the largest opportunity to save energy?

The breakdown of energy consumed at WWTPs





Measures for energy-saving at WWTPs



Simply change the sensor control system!!
DO sensor ➔ Ammonia sensor

Flygt pump
High Efficiency

Sanitaire diffusers
Lower energy consumption

Flygt Mixers
High-efficiency

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Aeration control system

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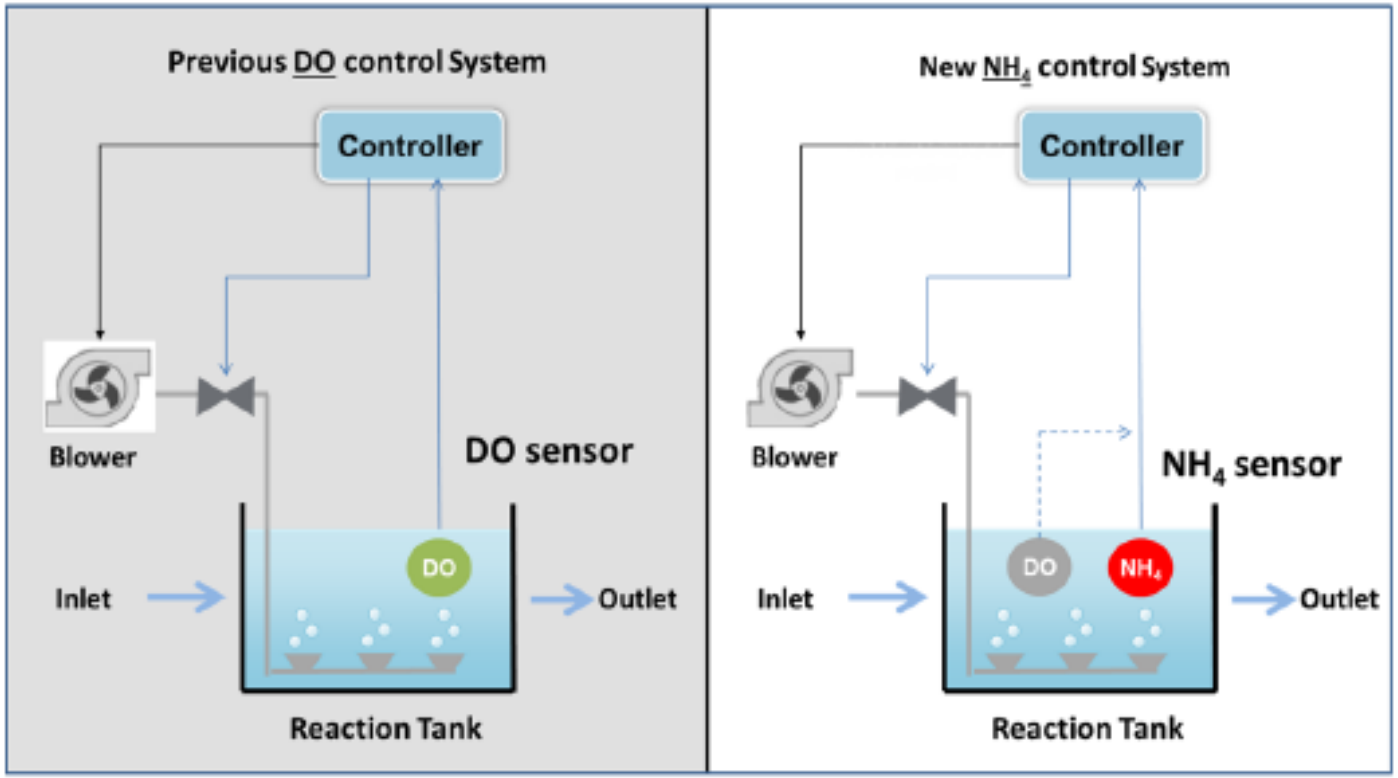
Poll Question #2

Which control system are you
or your customer currently using?

Aeration control system

- Dissolved Oxygen (DO) sensor aeration control
- Ammonia sensor-based aeration control, including in combination with DO sensors.



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Energy-saving Principle

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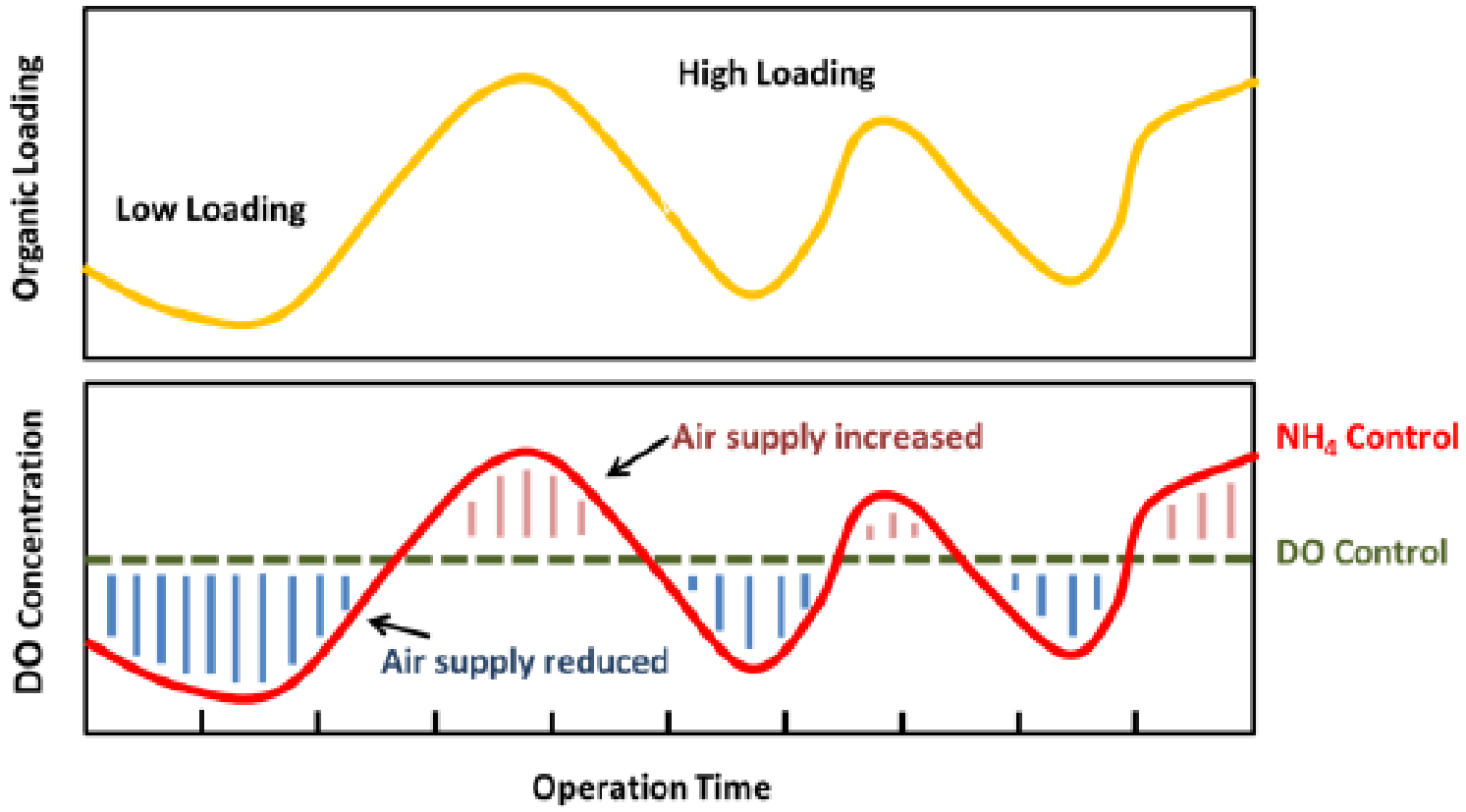
Energy-saving Principle

- When ammonium is used as the parameter to evaluate oxygen demand then we are given a much more sensitive and accurate reflection of the real oxygen demand in an aeration tank.



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Practical Examples for saving energy

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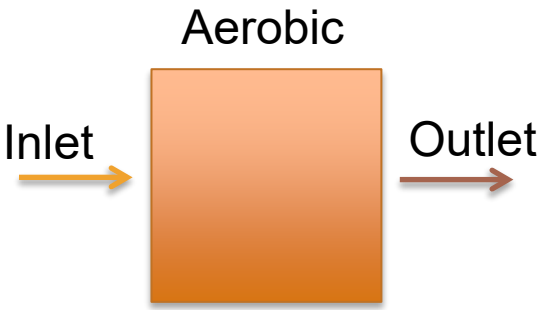
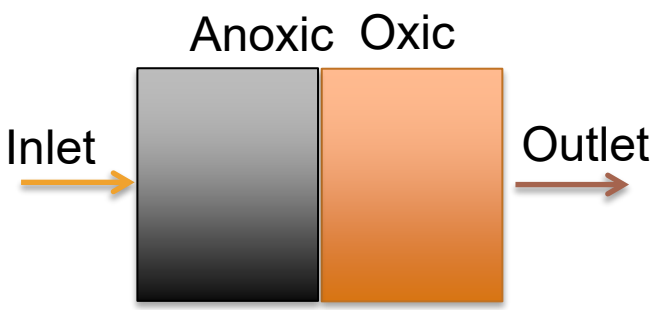
Poll Question #3

Which treatment process are you or your customer currently using?

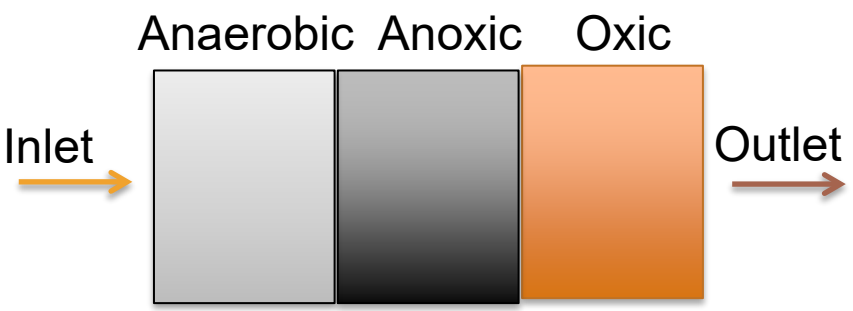
Practical Examples for saving energy



Standard AS process



AO process (N removal)



A2O process (P, N removal)

Treatment Process	WWTP Capacity	Energy Reduced	Reference
Anaerobic -Anoxic-Oxic	40,000 m^3/d	**16%**	(小原卓巳、足利伸行、山中理、山本勝也, 2004)
Anoxic -Oxic	200,000 m^3/d	**10.4%**	(遠藤和広、田崎敏郎, 2010)
Standard AS process	68,700 m^3/d	**8.7%**	(榎木辰彦、平岡由紀夫、安部裕宣, 2014)
Anoxic- Oxic	Not showed	**2.3~8.9%**	(山中理、海老原聡美、難波諒, 2015)
Anoxic- Oxic	107,000 m^3/d	**16.9%**	(道中敦子, 2016)
Standard AS process	44,000 m^3/d	**10~15%**	(長塩尚之、田端隆雄、宇代晋也、 竹原輝巳, 2017)
Anoxic- Oxic	7,200 m^3/d	**9.9~17.2%**	(島田光重、熊田浩英、石山明, 2018)
Anaerobic-Anoxic- Oxic	830,000 m^3/d	**10~25%**	(葛西孝司、曽根啓一、鈴木重浩, 2015)
Anaerobic-Anoxic- Oxic	700,000 p. e.	**18%**	(Thunberg, Sundin and Carlsson, 2009)
Anoxic- Oxic	205,000 m^3/d	**25%**	(Rieger, Takács and Siegrist, 2012)

Energy and cost savings with VARiON NH4 measurement

SBR wwtp Glueckstadt: 20.000 PE

Till 2008: Time based process control only

High energy saving potential in aeration control during nitrification process

Tests lead to change from time based control to dynamic process control over NH_4-N & NO_3-N measurement

Time based D.O. control → Dynamic control based on D.O., NH_4, NO_3

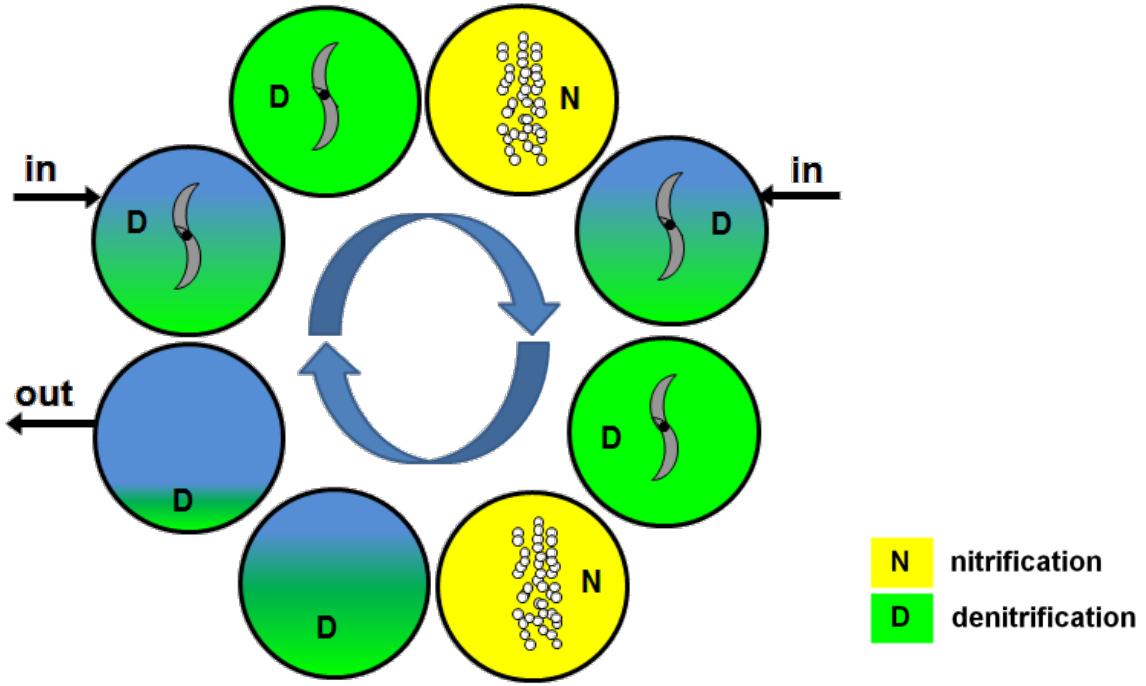
Energy and cost savings with VARiON NH4 measurement

Past: O_2 and time based control

Fixed process times
(based on several years of experience)

1. Filling1 & Denitrification: 60 min
2. Denitrification1 & Bio-P: 45 min
3. Nitrification1: 110 min
4. Filling2 & Denitrification: 30 min
5. Denitrification2: 75 min
6. Nitrification2: 120 min
7. Sedimentation: 130 min
8. Decanting cleaned water: 40 min
9. Pause

approx. 10 h per cycle



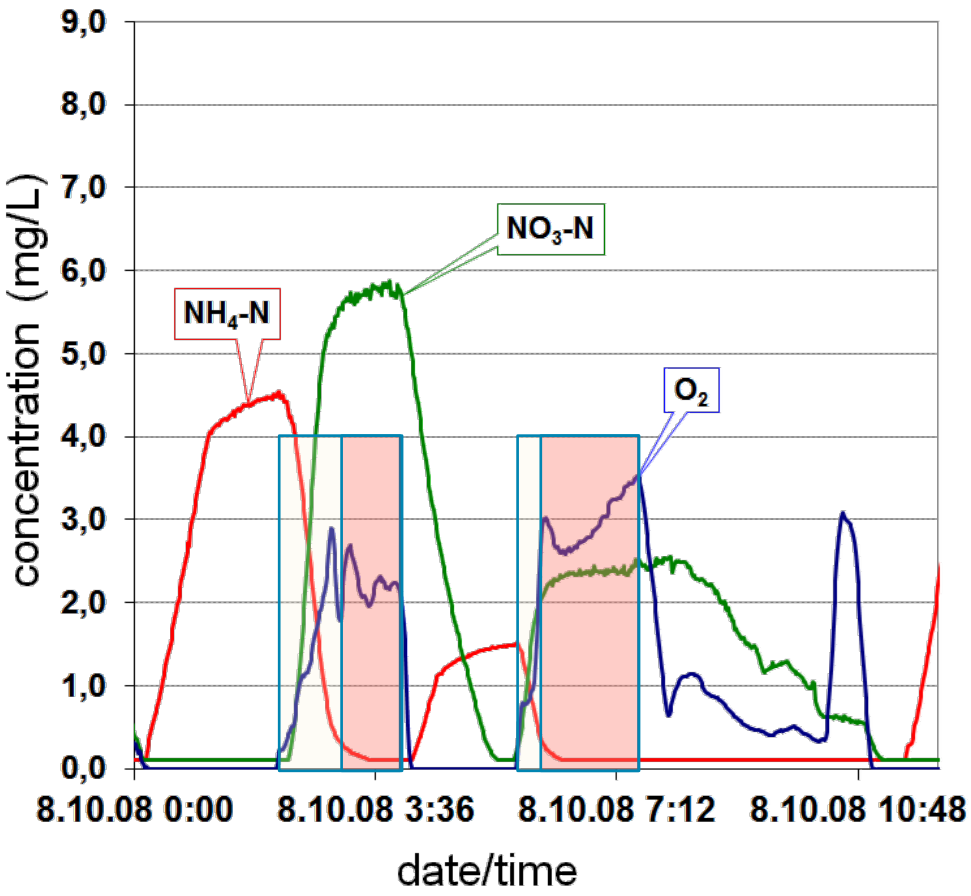
Energy and cost savings with VARiON NH4 measurement

Past: O_2 and time based control

Nitrification times very long

-> can be shorter

-> in average ~50%



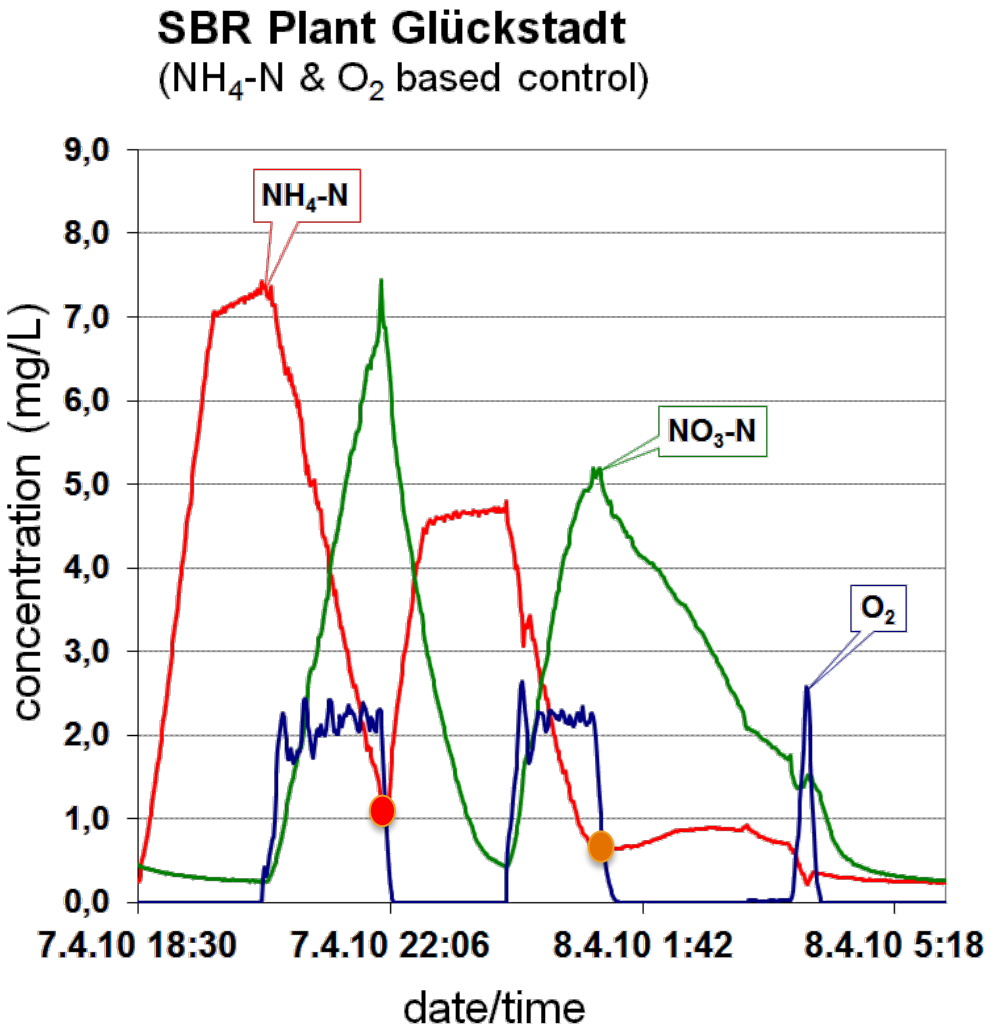
Energy and cost savings with VARiON NH4 measurement

Today: dynamic O_2 and NH_4-N based control

Nitrification1 is stopped when:
- 1.3 mg/L NH_4-N is reached
- or time (110 min) is exceeded (old time interval)

Nitrification2 is stopped when:
- 0.7 mg/L NH_4-N is reached
- or time (120 min) is exceeded (old time interval)

Nitrification times reduced by
- 4 h per day
- or 1.500 h per year



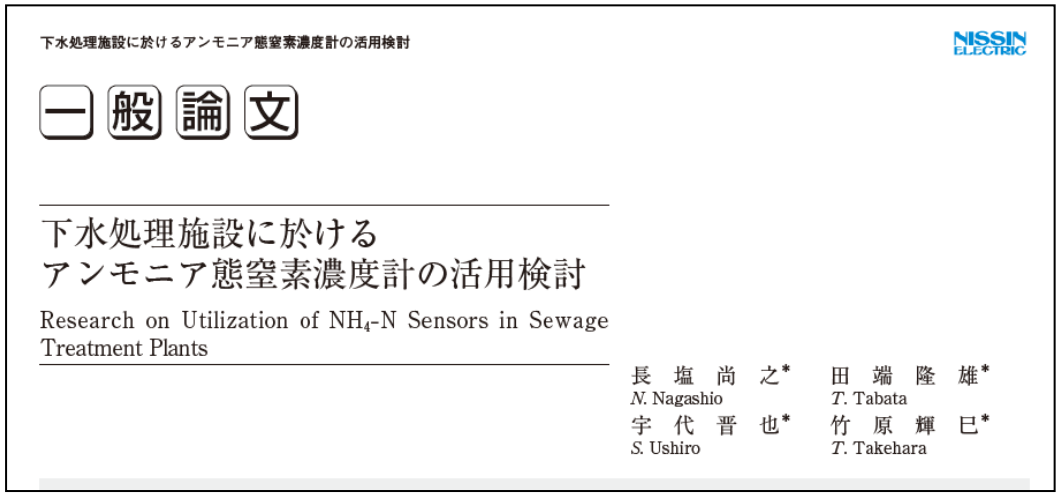
Energy and cost savings with VARiON NH4 measurement

- Lower energy consumption
- Less wear-out of aerator
- Savings of this particular plant approx. 20.000 € / year

Japan practical example, Standard AS process

日新電機技報 Vol.62, No. 3 (2017.10)

N. Nagashio, T. Tabata, S. Ushiro, T. Takehara



下水処理施設に於けるアンモニア態窒素濃度計の活用検討

NISSIN ELECTRIC

一般論文

下水処理施設に於ける
アンモニア態窒素濃度計の活用検討

Research on Utilization of NH_4-N Sensors in Sewage Treatment Plants

長塩尚之* N. Nagashio　田端隆雄* T. Tabata

宇代晋也* S. Ushiro　竹原輝巳* T. Takehara

神奈川県大和市北部浄化センター

Kanagawa Prefecture, Yamato city, North WWTP

Treatment process	Standard AS process
Capacity	44,000 m3/d
P. E	62,216
Discharge	River

Ammonia sensor control system

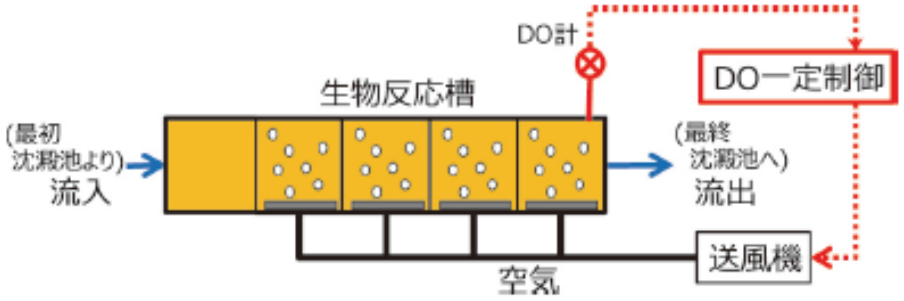


図２　既設反応槽処理フロー

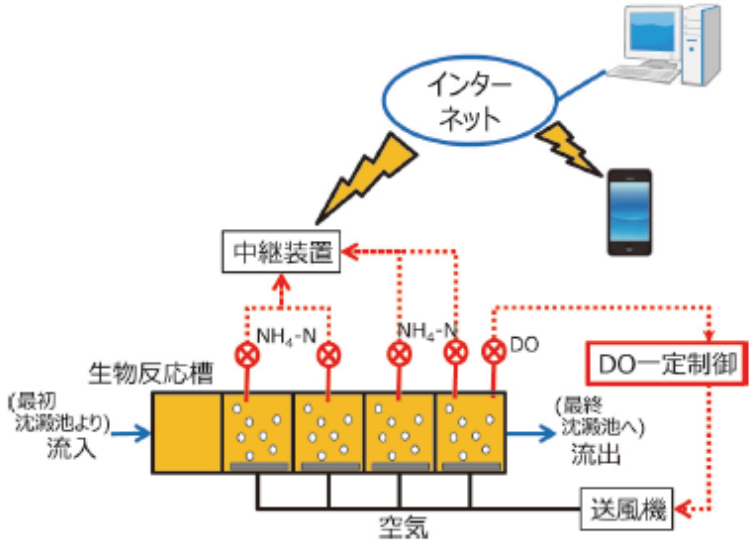


図３　調査系の反応槽処理フロー

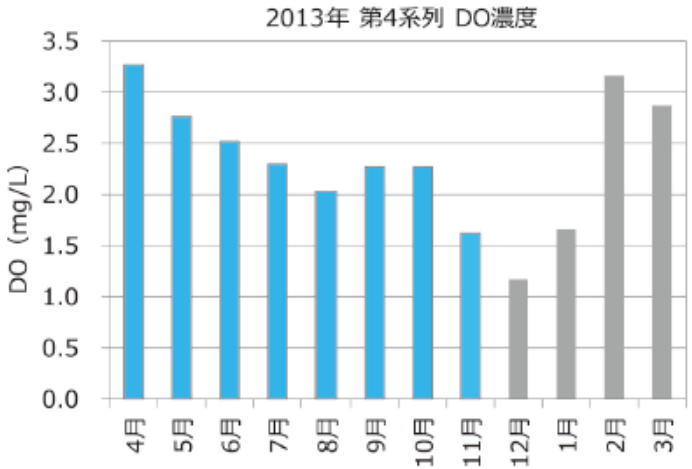
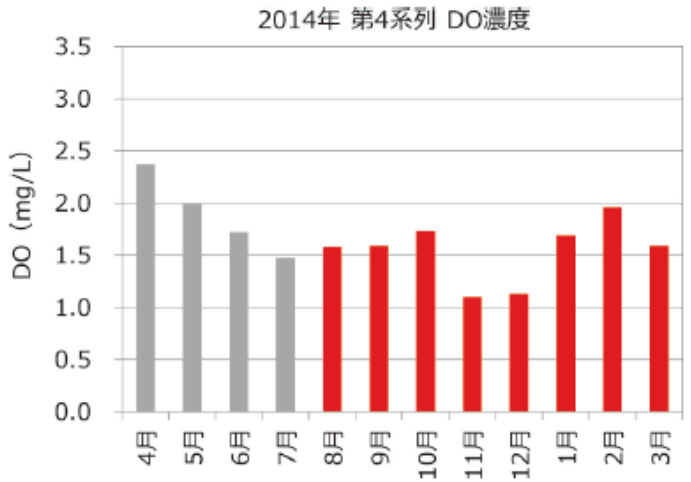


図７　アンモニアセンサ設置前の月平均DO



Results

1. Based on NH4 concentration, average DO demand decreased from 2.4mg/L to 1.6 mg/L
2. 10~15% reduction in use of electrical power.
3. Effluent water quality met regulations.

WTW Ammonia Sensor

Features of AmmoLyt® Plus 700 series

- ✓ High Accuracy with K+ Dynamic compensation
- ✓ Economical by stability over long periods of time
- ✓ User friendly with electrode, simple cable exchange
- ✓ Maintenance simplified with compress air auto-cleaning.

Poll Question #4

Would you like a WTW product specialist to contact you with more information?

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Questions?

CONTACT US

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Saving Energy with Ammonia Control at WWTPS

ISE Sensorvs Wet Chemistry Analyzer for Ammonia/Ammonium

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