A framework for

Energy efficient aeration in the Swedish wastewater sector

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ELSA – Efficient aeration at Swedish wastewater treatment plants

Overall aims

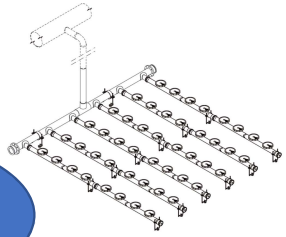
- **Improve knowledge** regarding aeration
- **Recommend** cost-effective remedies for improved energy efficiency at existing wastewater treatment plants
- Facilitate **well designed** aeration systems at treatment plants
- Propose guidelines for **procurement** of aeration systems

Svenskt Vatten The Swedish Water & Wastewater Association (SVU grant 17-112)

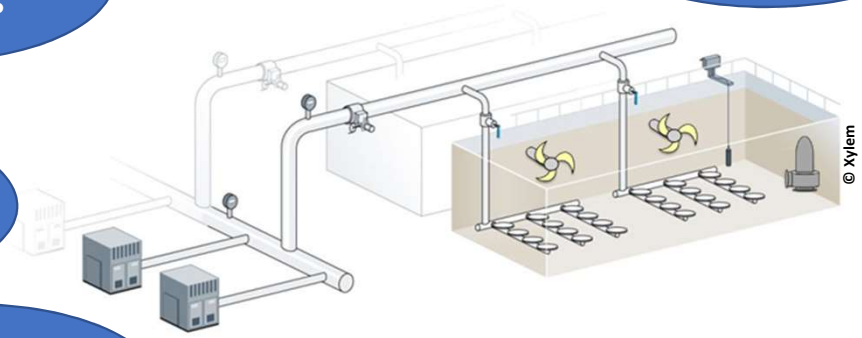
The aeration system

Factors affecting energy usage

Current state and needs

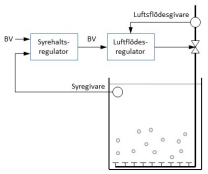


Sizing and design



Case studies

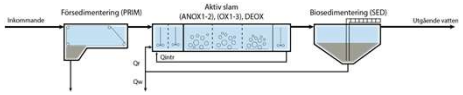
Instrumentation, control and automation



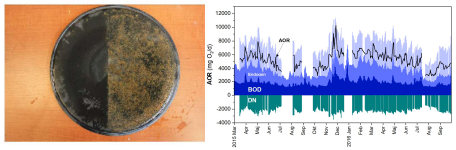
Modelling

Procurement

Operation and maintenance



Contracts, roles, evaluation, performance guarantee, testing (FAT/SAT)

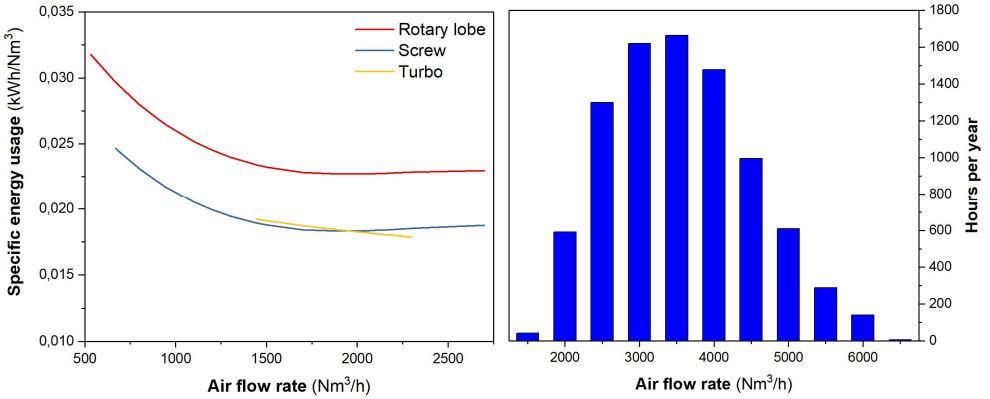


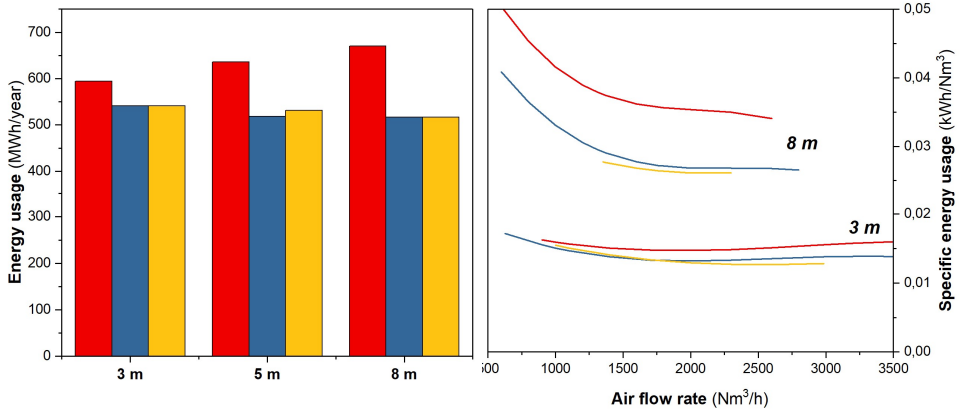
Methods: (1) **Interviews** with stakeholders: water utilities (13; >50 WWTPs), suppliers (>35), contractors, consultants, universities and research institutes, (2) **surveys**, (3) **literature review** (books and research articles), (4) **process modelling**.

Aeration equipment: blowers

Rotary lobe, screw and dynamic (turbo)

- Specific energy usage (kWh/Nm^3)
- Evaluate for the whole control range
- High pressure (water depth) favors screw and turbo blowers
- At large size (PE) increasing incentive for turbo blowers



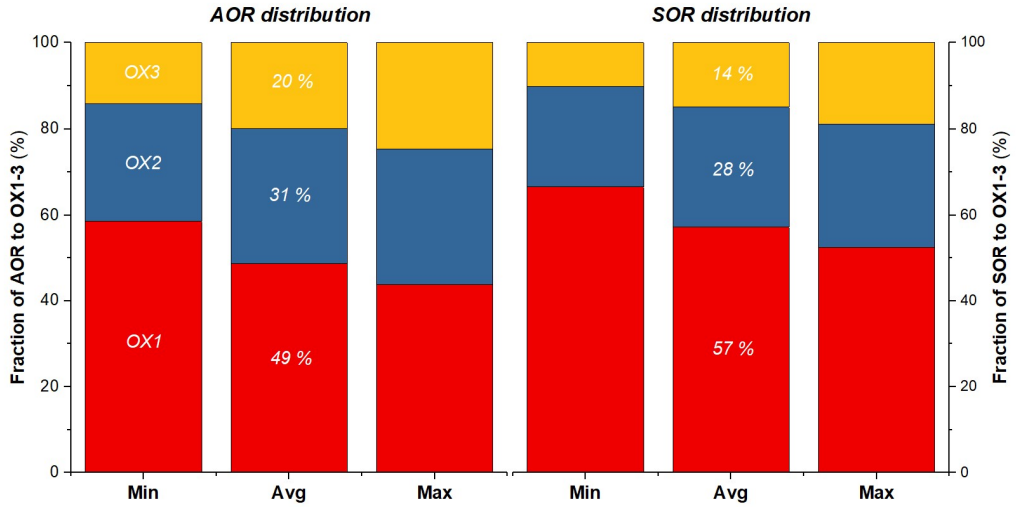


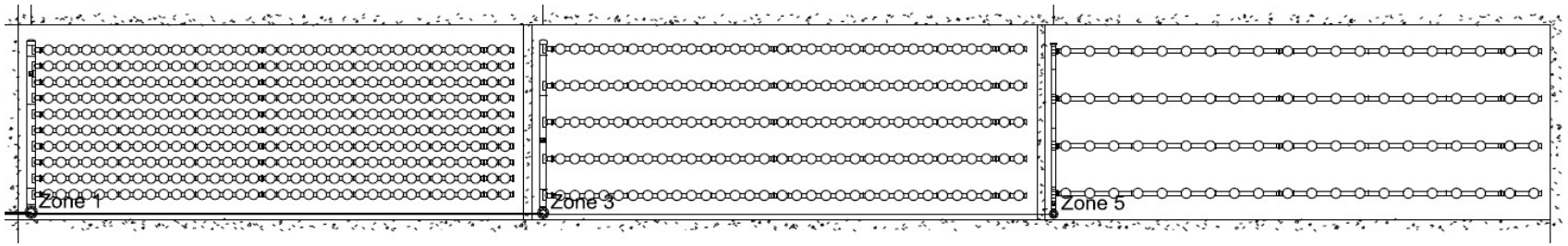
Aeration system design procedure

- Design load and oxygen demand in wastewater (**client**)
- Conversion factors for oxygen demand in clean water: α (**client**)
- Performance in clean water: SOTE, DWP (**supplier**)
  - Performance is a function of design
- Calculate air flow rate
- Evaluation by LCC

Aeration system design

- Number of diffusers
- Tapered design
- In practice: tapered α

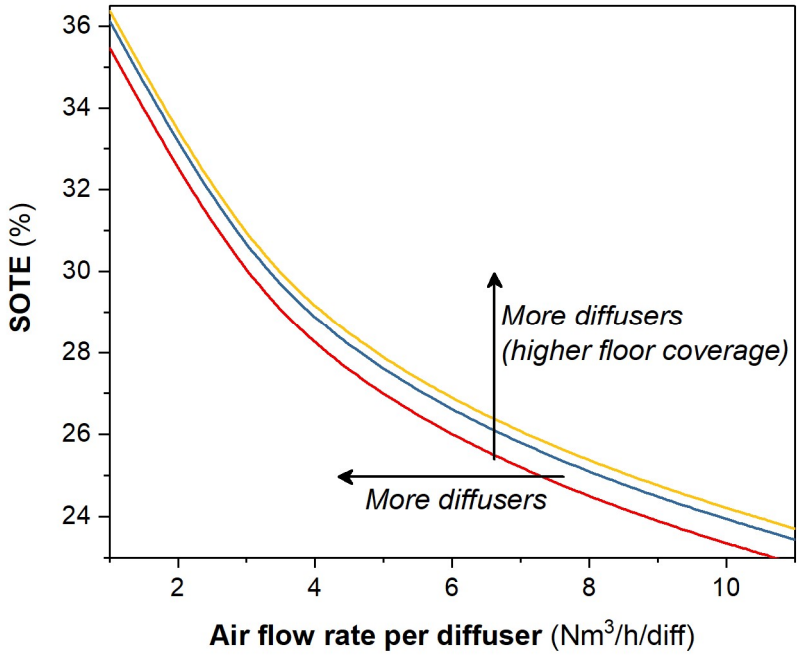




Aeration system design

- Design load min-max span (control range) determines energy efficiency
- Air flow per diffuser (or diffuser area) is critical

	No of diffusers (#)	Min Q_{air} limited (% of time)	Q_{Air} per diffuser ($Nm^3/h/diff$)	Energy usage (MWh/year)
A	374	0	3.0	362
B	542	1.5	1.9	330
C	638	8	1.5	320



Performance testing and compliance

- Blower performance
- Aeration system performance in clean water
- Full-scale or shop-test
- Some differences between standards: EN, ATV, ASCE

Thank you!

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