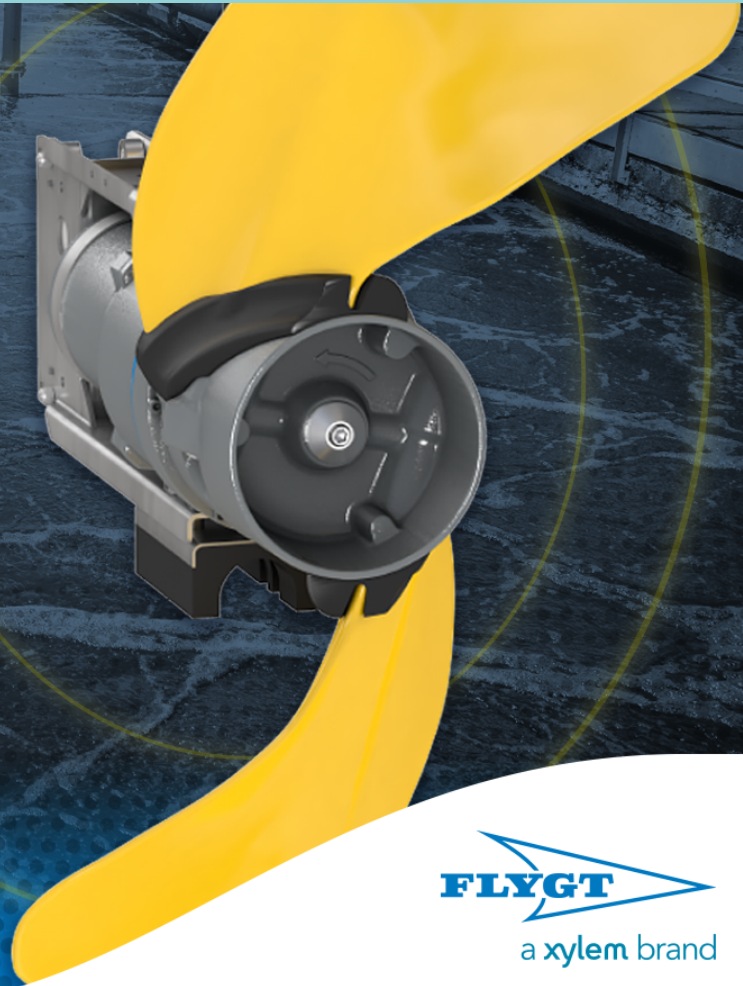




# The Art of Mixing

Flygt Mixers for  
Wastewater Treatment  
and Industrial Facilities



# Today's Topics

1. Introduction
2. Mixers - Mixing Principles
3. Mixers - Our Offerings
4. What is Computational Fluid Dynamics (CFD) and how can it help my facility run better?

## House Keeping

- We are recording!
- A link to the recording & a pdf version of this presentation will be shared in a follow up email
- Ask your question at any time in the “question” section of your Zoom screen
- All questions will be answered at the end of the webinar

# Profiles



**Menar Taffish**  
**Director - Treatment & Product Manager**

Responsible for Product Management and promotion of treatment solutions throughout Emerging markets. Menar Taffish has been with Xylem for 8 years.



**Nils Renman**  
**Global Product Manager**

Has more than 35 years of industrial experience within Sales, Product Management and Business Development, out of which 25 years are for Flygt and Xylem.



**Alex Loubenets**  
**Manager - CFD Biological Treatment**

Master's and Ph.D. in Numerical Analysis, with 15 years of CFD and engineering experience. Worked on Project Management and CFD in the water treatment and automotive industries.



## Our People

More than **16,000**



## Our Customers

Partnering with our customers to build strong, lasting relationships



## Our Solutions

Bringing together **advanced technologies, application expertise** and **smart sustainable** solutions



## Our Brands

Market-leading brands with a legacy of **over 100 years** supported by a solid **TotalCare service** portfolio

## We care for water...



... and beyond

## 2019 Revenue



## Operating in

**~400** locations in more than **50** countries  
sold in **~150** countries

## 2019 Revenue



NYSE Trade Symbol **XYL**

## Global Headquarters

Tel +1 914-323-5700  
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[www.xylem.com](http://www.xylem.com)

## xylem watermark®

Because Every Drop Counts

Our corporate social responsibility program

Providing safe water and sanitation solutions since 2008 to **4.2 million+** people

Responded to **44+** water-related disasters with clean water infrastructure

Grants to non-profit partners **75**

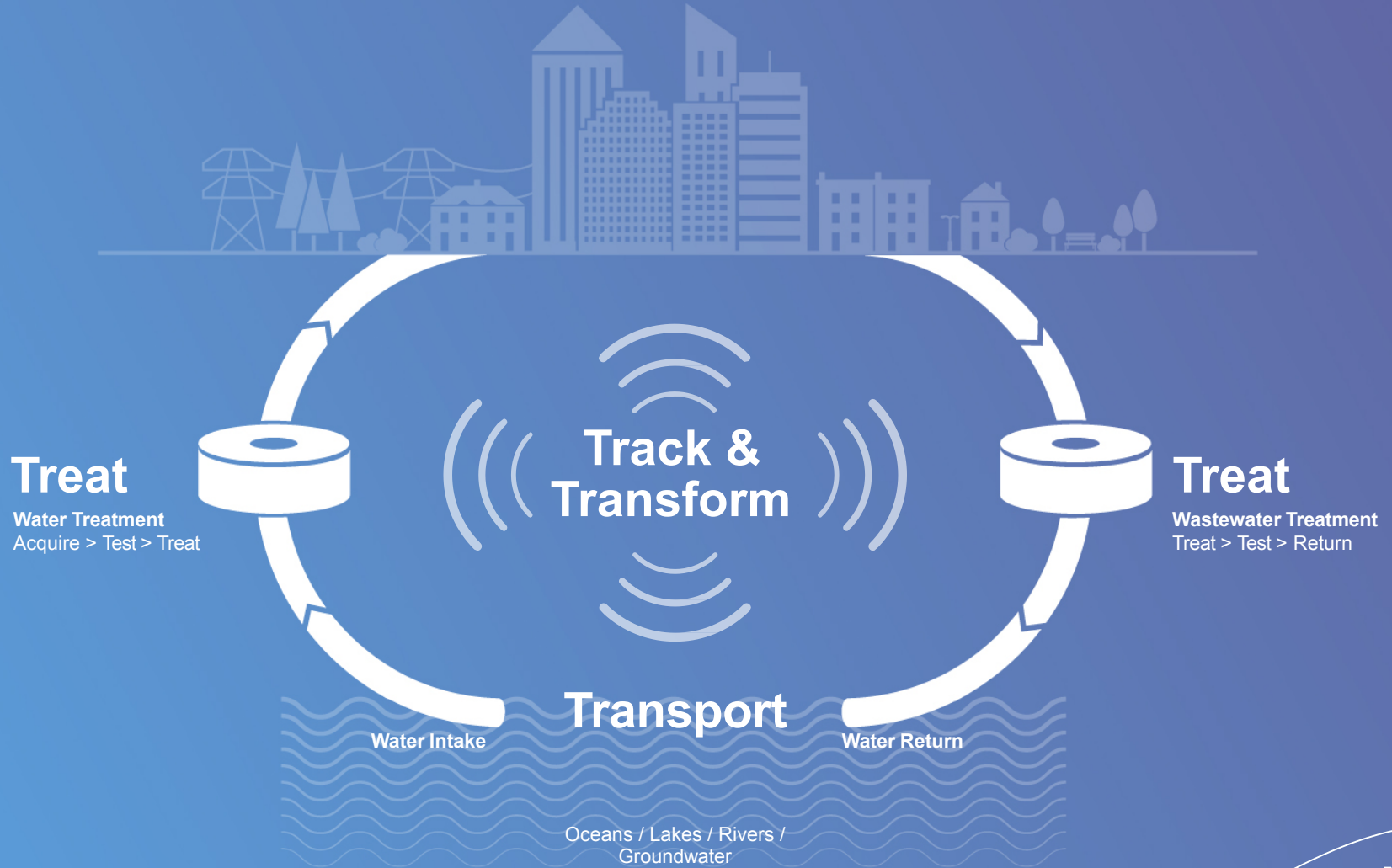
Engaging our employees, customers and partners

**180,000+** hours volunteered (2016-2019)

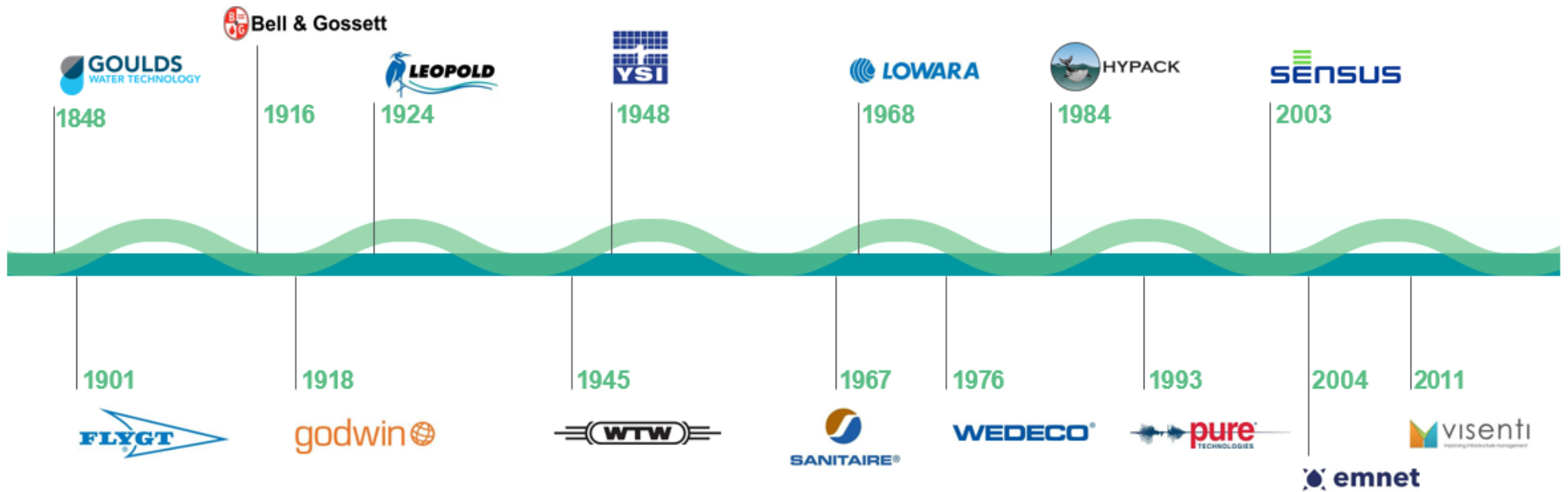
**58%** of employees engaged in **950** events (2019)

**3,500** external stakeholders engaged (2019)

Residential / Industrial / Building Services / Irrigation



We have always brought together the most progressive brands

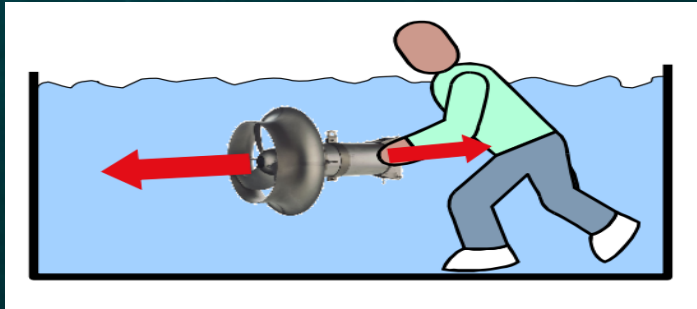


# Mixers

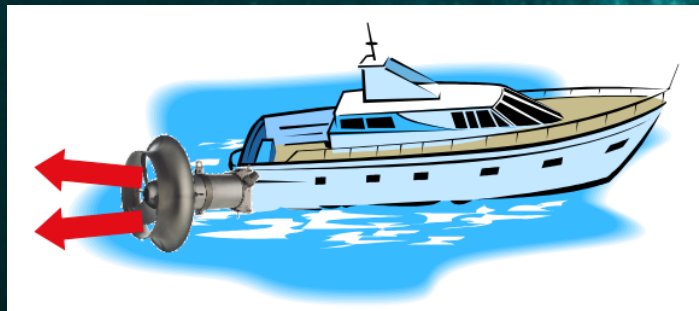
Mixing principles

1

# Understanding Mixing principles – Mixer Capacity ( the thrust )



- *The reaction force you would feel if you could hold on to a mixer in operation*



- *Thrust is the reacting force of the propeller that drives a boat*



- *In a tank, the thrust sets the liquid in motion*
- *Mixing capacity of a jet is best described by the thrust*



# Enabling Mixer Comparison – ISO 21630:2007



“Basic output parameter is thrust”

“Most relevant efficiency related parameter is thrust-to-power ratio”

~~kW/hp~~ ~~m<sup>3</sup>/s~~ ~~W/m<sup>3</sup>~~

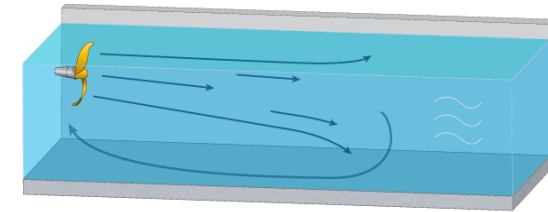
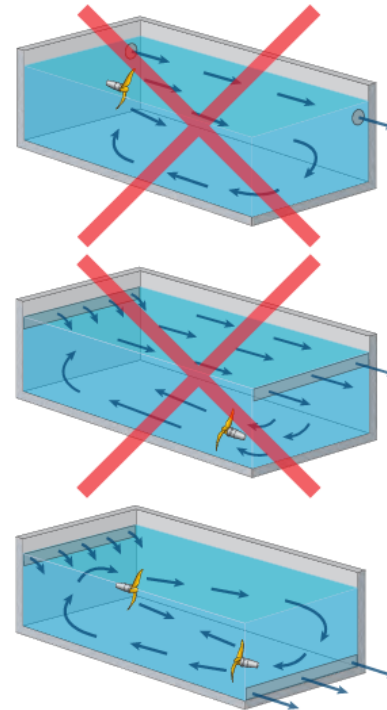
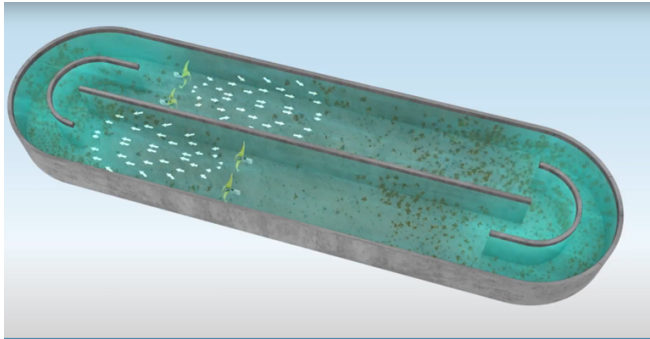
N

$$\text{Mixer efficiency} = \frac{\text{Thrust [F]}}{\text{Power [P}_{in}] } \left( \frac{\text{N}}{\text{kW}} \right)$$

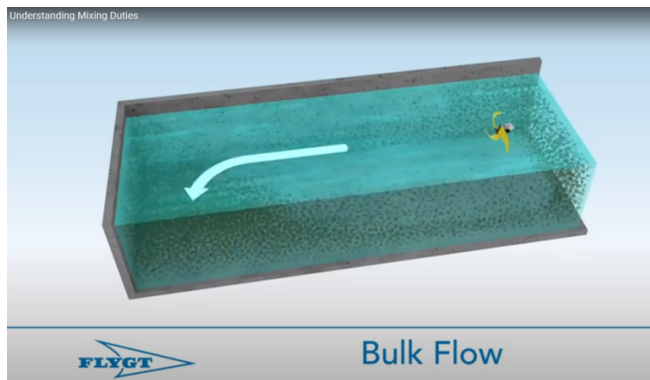
Flygt is transparent with performance in marketing, technical literature, selections, and testing.

The bulk flow required in wastewater mixing applications can be tied directly to the mixer thrust required – just like Q & H for pumping.

# Understand Mixing Principals – Bulk Flow & Mixer Positioning



- Evaluate Inlets & Outlets
- Ensure Jet positioning and Strength



Get advice and recommendations from the Mixing Handbook !

Mixing Duties: <https://www.youtube.com/watch?v=mQBBLMbehFs&t=2s>

# Mixers

Our Offerings

2

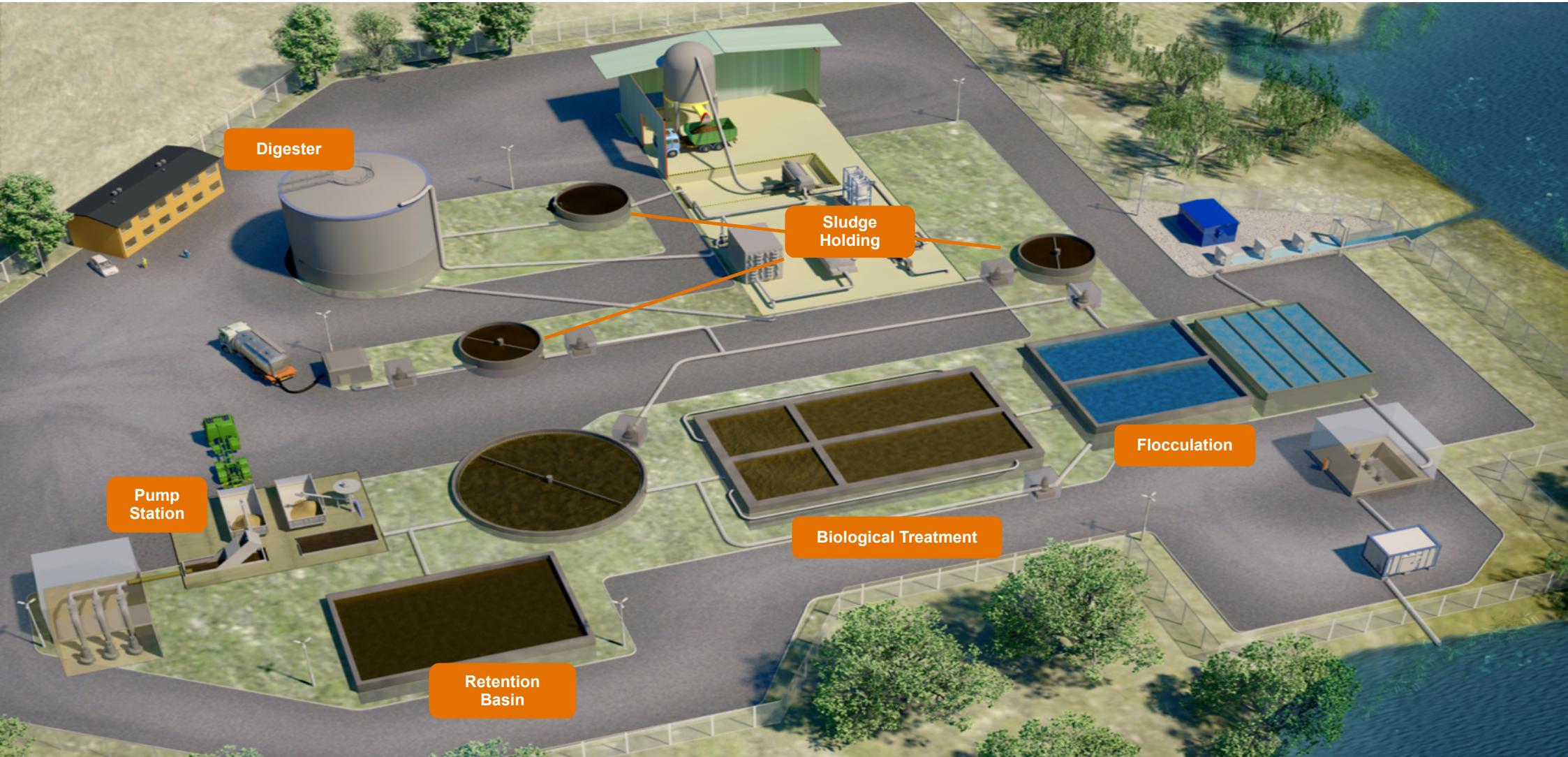
Nils Renman

# Flygt mixer portfolio



- **All Flygt mixers share the same values for:**
  - High quality & Long life time
  - Reliability & Trouble-free operation
  - Serviceability
- **Flygt mixers differ in terms of:**
  - Propeller sizes & Capacities
  - Motor types
  - Mixing efficiencies
  - Positioning flexibility
  - Monitoring & control functions
- **Risk with incorrect mixer selection:**
  - Insufficient mixing or over-mixing not fulfilling process demand
  - Waste of energy consumption
  - Technical issues and down time
  - High service cost

# Flygt Mixers in wastewater treatment processes

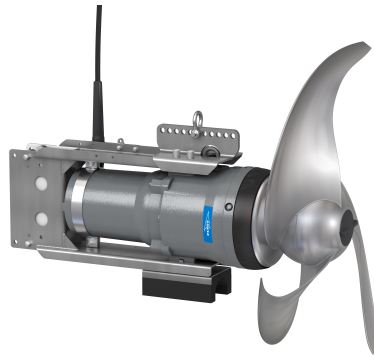


# Categorization of Flygt Mixers



**Small compact mixers**

Up to 900 N



**Mid-Size mixers**

Up to 2500 N



**Large Low-Speed mixers**

Up to 5200 N

Increasing Capacity & Efficiency, Decreasing LCC

Increasing Positioning Flexibility

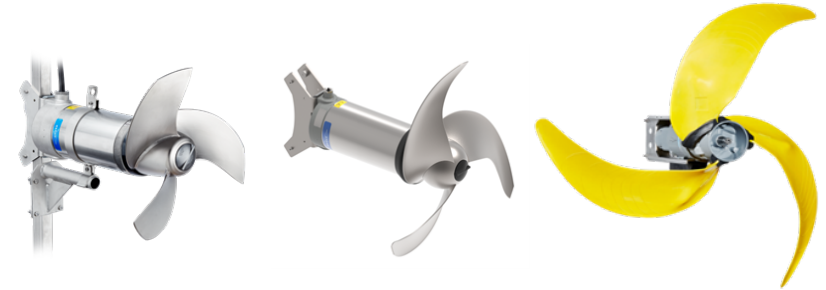
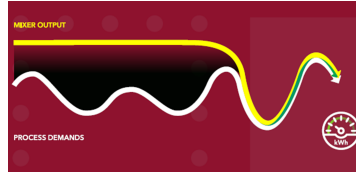
# Different levels for each category of Flygt Mixers

## Flygt Adaptive mixers - Premium offering

- Include permanent magnet IE4 equivalent motor and integrated VFD
- Achieve superior marketing leading efficiency

Available for:

- Small compact mixers
- Mid-Size mixers
- Large Low-Speed mixers

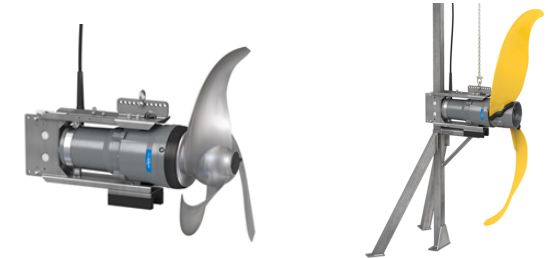


## Flygt IE3 mixers – Value offering

- Include Large induction motors with IE3 equivalent motor.
- Facilitate very high mixing efficiency

Available for:

- Mid-Size mixers
- Large Low-Speed mixers

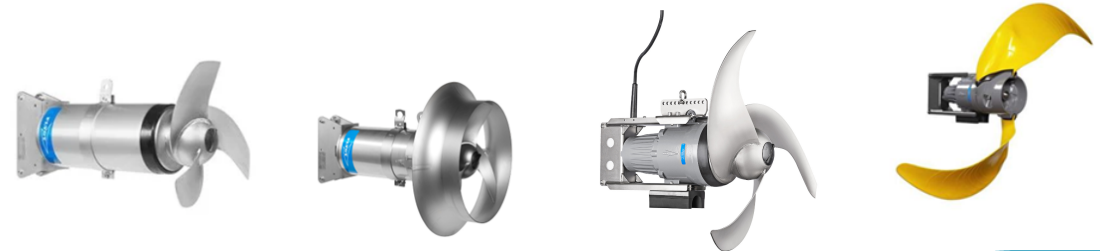


## Flygt Classic mixers – Standard offering

- Include conventional induction motors
- Generate high mixing efficiency

Available for:

- Small compact mixers
- Mid-Size mixers
- Large Low-Speed mixers



# Flygt Low-Speed IE3 mixers in a nut-shell

- Upgraded assortment with higher overall efficiency

- **The Classic range of Flygt Low Speed mixers 4410, 4430, 4460 and 4530 are now available with IE3 motors**
- **Larger motors with de-rated power to fulfill IE3 motor efficiency**
  - Same/similar ratings and thrust range as classic banana blade mixers
  - Other features remain the same
  - No impact on the installation equipment
- **Designed for municipal and industrial treatment applications, especially various Bio-Treatment processes**
- **Improved Performance vs classic banana-blade mixers**
  - Up to 17 % Power savings
  - Up to 7 % Higher thrust capacity ( N )
  - Up to 14 % Higher mixer efficiency ( N/kW )
- **Pricing based on output capacity, i.e.propeller size**
- **Available for 50 & 60 Hz**





# Performance comparison

- 4410.800-2,3 kW vs 4410.011-2,3 kW and 4320-2,2 kW

## 4410 IE3 vs 4410 STD

➤ Up to **12 % lower power consumption** at the same thrust

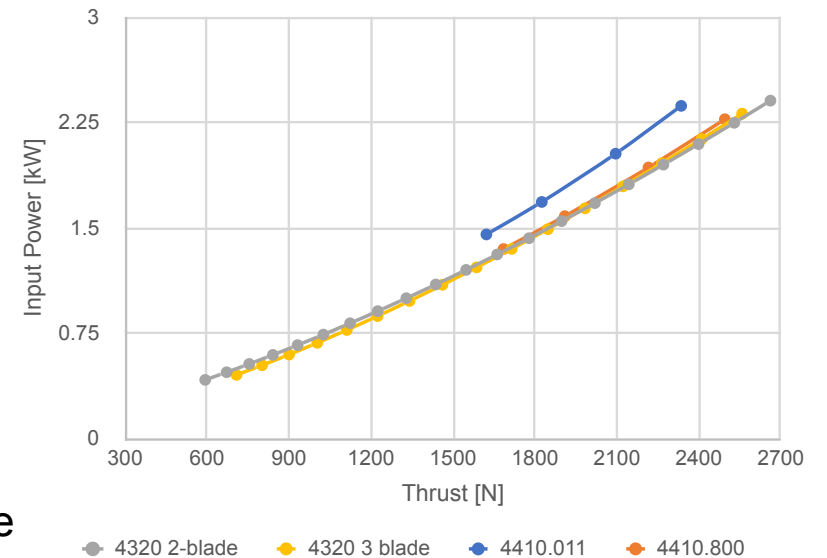
## 4410 IE3 vs 4320-2,2 kW, Adaptive mixer

➤ Up to **2-3% higher power consumption** at the same thrust

➔ **IE3 mixers** and 4320 Adaptive mixer have about the same power consumption when operating with fixed speed.

➔ **4320** offers variable thrust ( output ) to handle process variations – **facilitate superior energy savings**

4410-IE3 vs 4410 STD and 4320,-2,2 kW



# Cost-effective Upgrade of existing installations

- Coming regulations for higher motor efficiency will drive the demand to upgrade existing installations with more high efficient solutions
- Deliveries last 15 years ( 2007-2022 ) =  
Installed base : 34 000 units of 4410/4430/4460/4530
- Much lower price compared to investment for a new installation
- Scope of Bare replacement units :

	IE3-motor	Gear-box	Mixer-stand
4410	YES	YES	NO
4430	YES	YES	YES
4460	YES	YES	YES
4530	YES	YES	YES

- Note :
- \* All Bare replacement units exclude propeller and hub
  - \* The Mixer-stand/Frame of 4410 can be re-used when upgrading to IE3-version of 4410




# Sustainability assessment

## Contribution to Xylem's Environmental goals


Estimated installation of Flygt Low-Speed IE3 mixers 2023-2025 can help to reduce :

 **~69,500 tons** of CO2 equivalent

## 69,500 tons of CO2e:

**172,513,286** miles driven by an average gasoline-powered passenger vehicle ? 

**160,907** barrels of oil consumed ? 

**18.9** wind turbines running for a year ? 

## Case stories & References



### **Le Thuit, France ( Veolia )** ***41% energy savings***

4220 output matched the existing single-speed mixer



### **Cavallino, Italy** ***33k EUR per year savings***

4320 reduced output in low season and reduced sand accumulation issues in high seasons by turning up the speed

# Flygt mixers for biogas and industrial facilities



**Biogas production**



**Manure management**

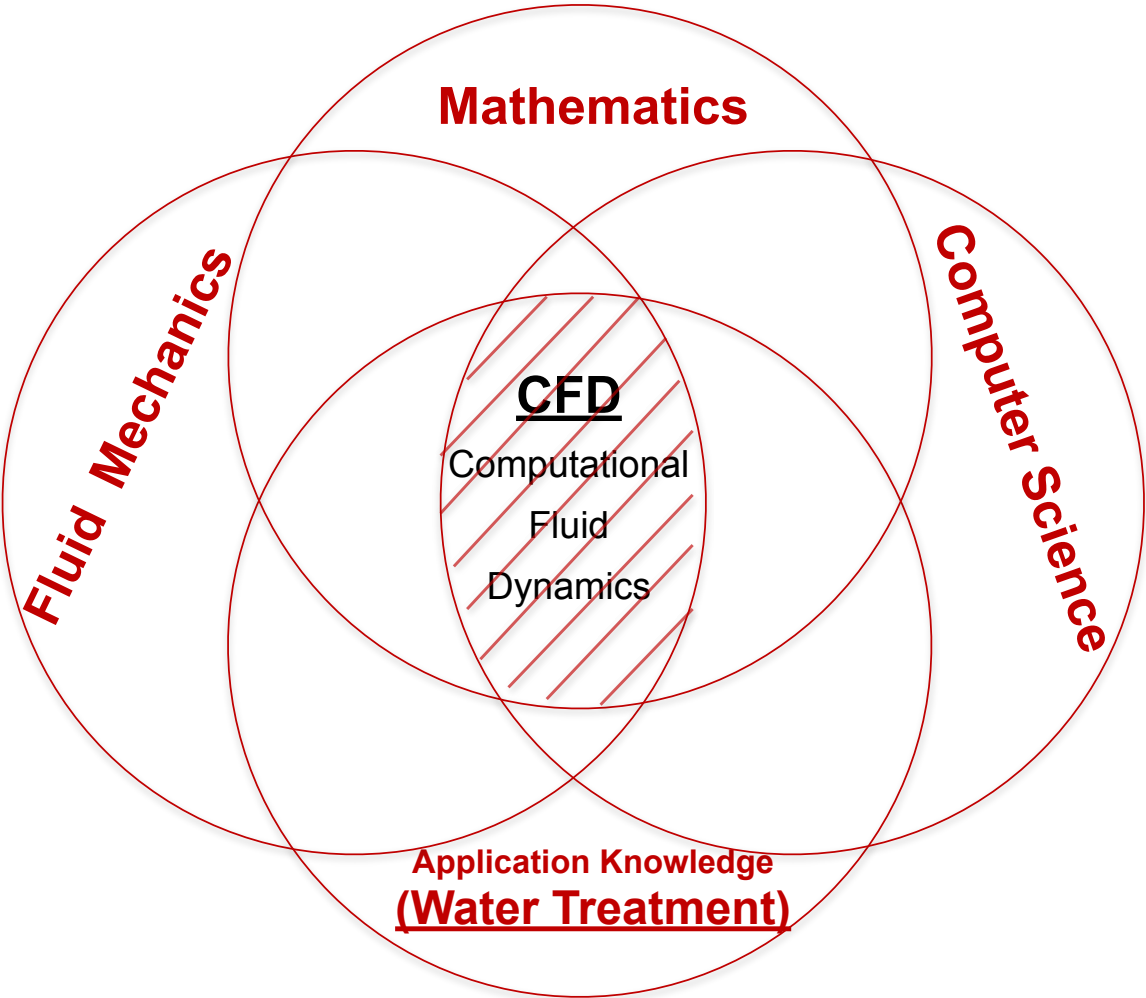


**Aqua culture**

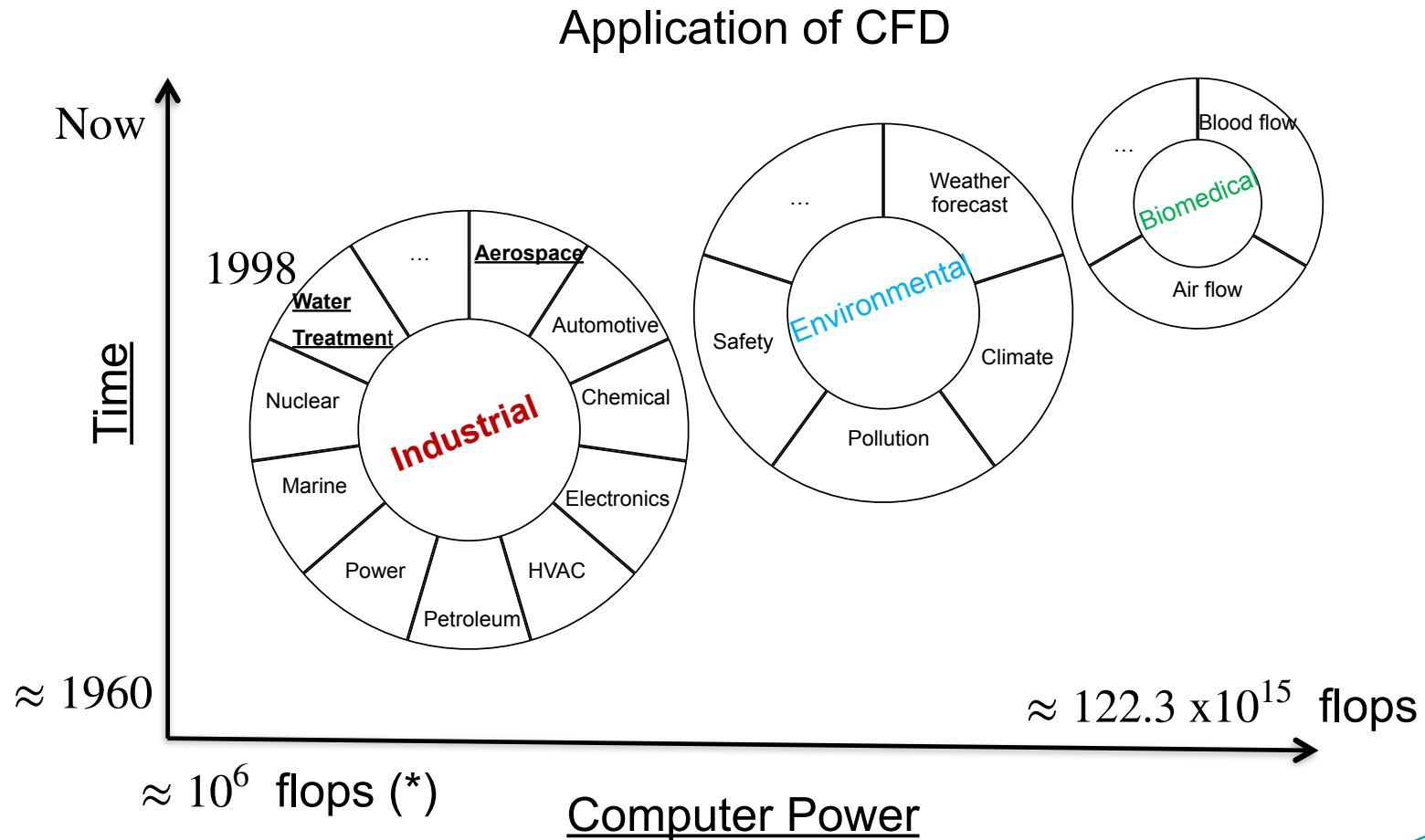
# What is Computational Fluid Dynamics (CFD) and how can it help my facility run better?

# 3

# Introduction: What is CFD



# Introduction: Background and history





# CFD analysis: Typical applications



# CFD analysis: Benefits of CFD

## ➤ Mixer Solution

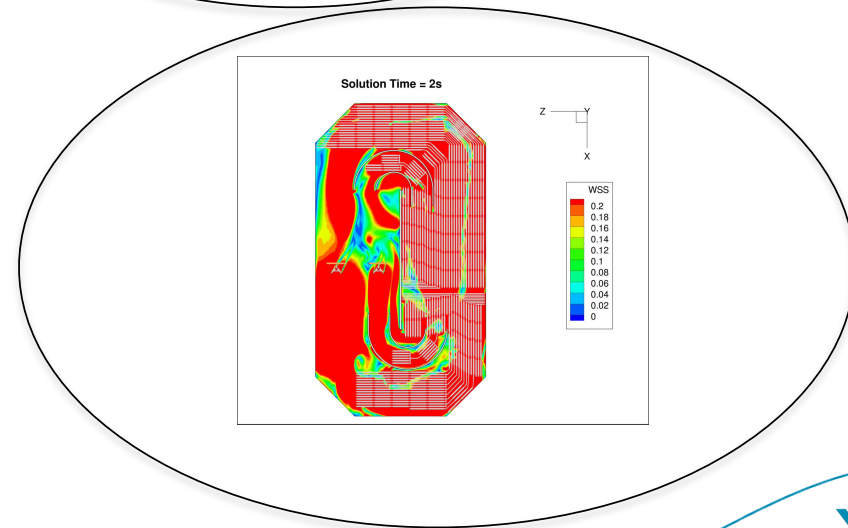
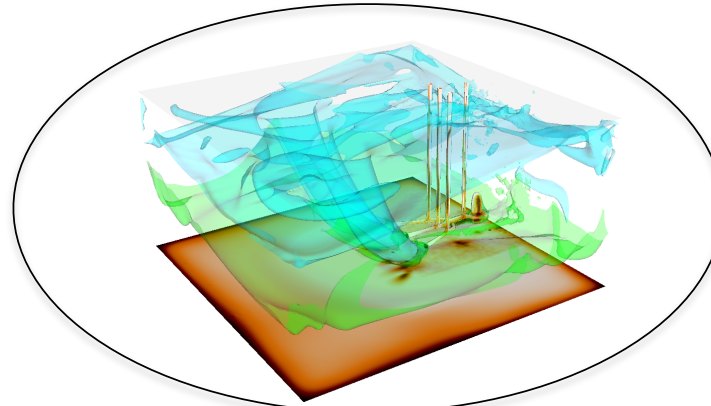
- Sizing, position and orientation
- Various equipment
- Visualization

## ➤ Aeration Layout

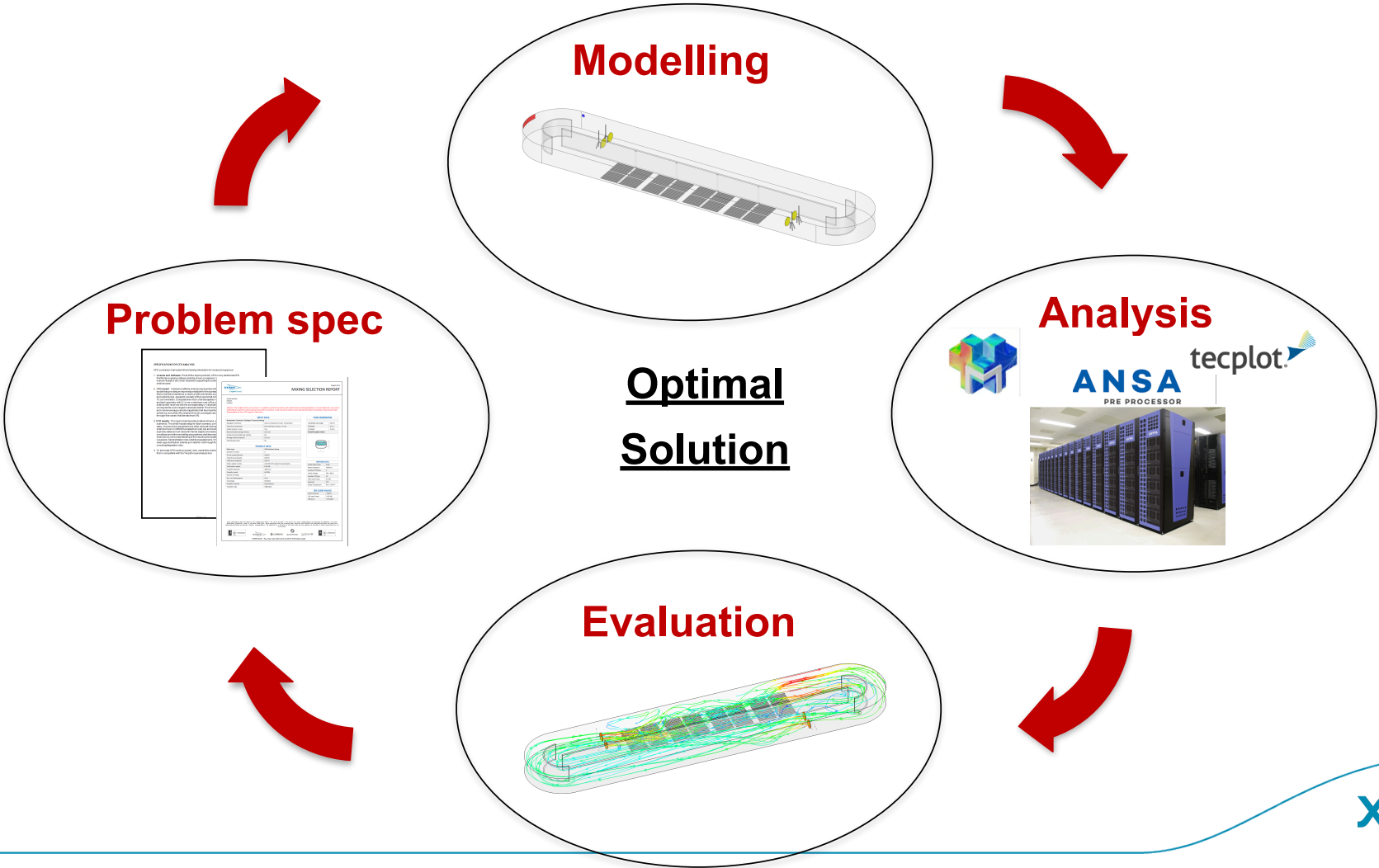
- Various Grid layout
- Different running conditions
- Air bubble variation

## ➤ Risk assessment/ Troubleshooting

- Sedimentation risk
- Air entrainment in the near mixer region
- Excessive turbulence level or force
- Short-circuiting and stagnancy
- Other customer specific requirements

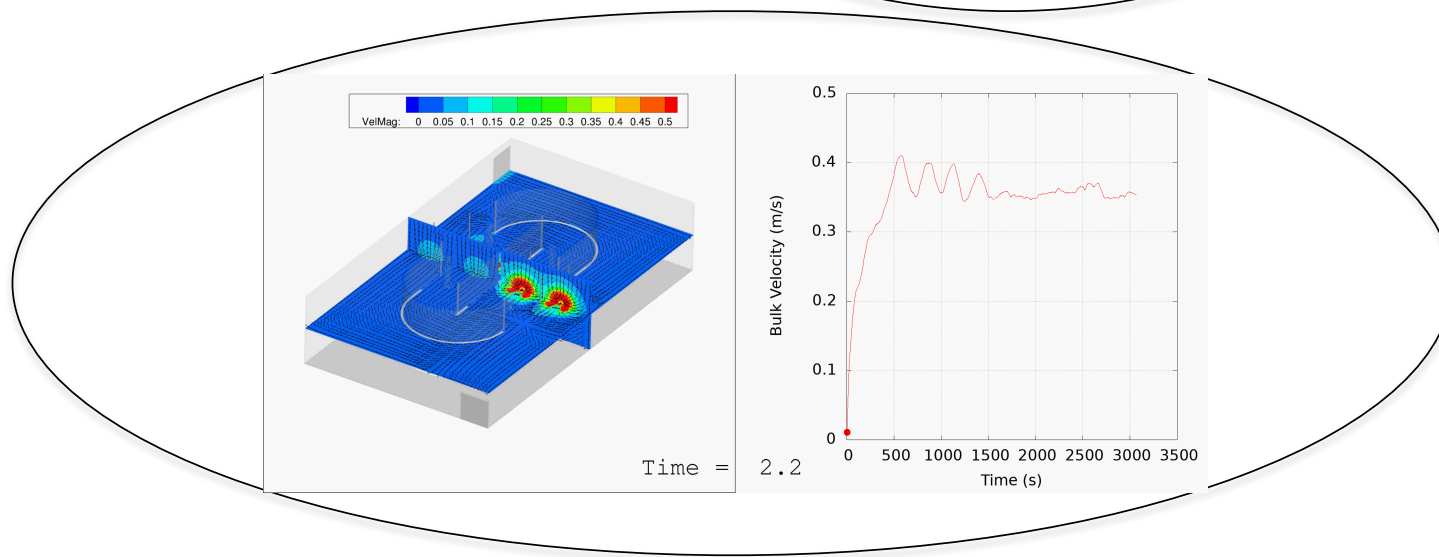
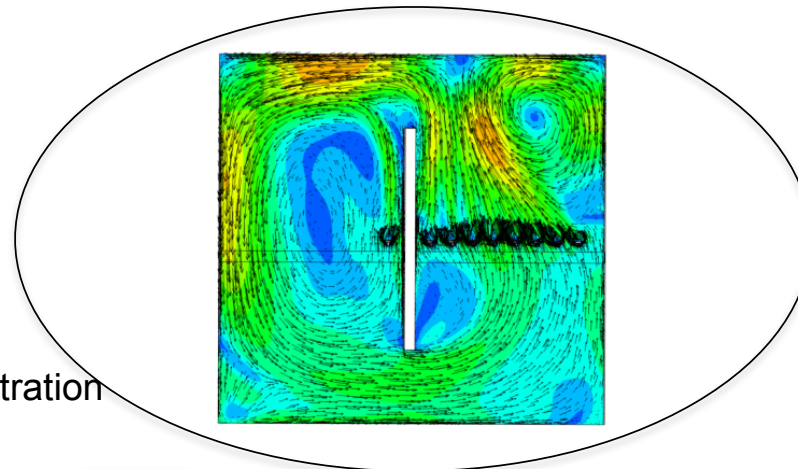


# CFD analysis: Workflow



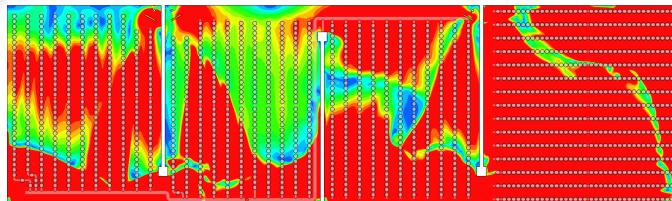
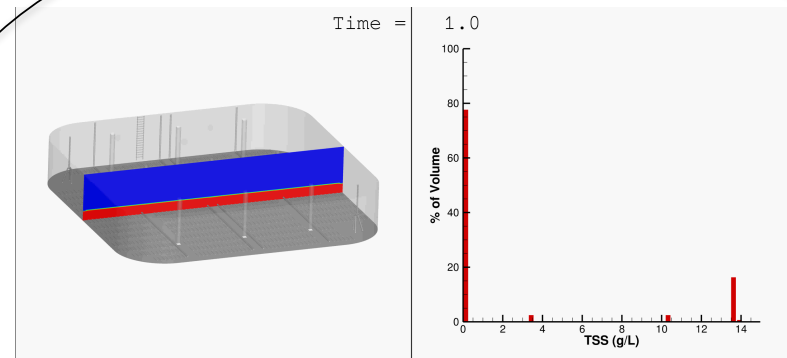
# CFD analysis: Typical results

- **Understanding the flow:**
  - Bulk flow velocity
  - Velocity magnitude
  - Velocity vector plots
  - Streamlines
- **Aeration:**
  - Air flow velocity and concentration
  - SOTR/SOTE evaluation

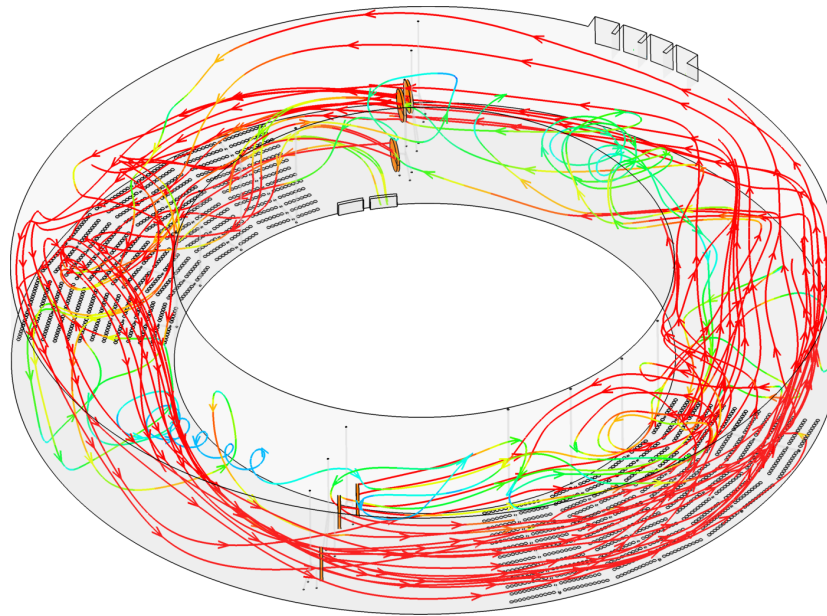


# CFD analysis: Typical results

- **Suspended solids:**
  - TSS concentration profiles
  - Bottom sedimentation evaluation
- **Age analysis**
  - HRT
  - Residence time



## Case Story: Aeration Tank

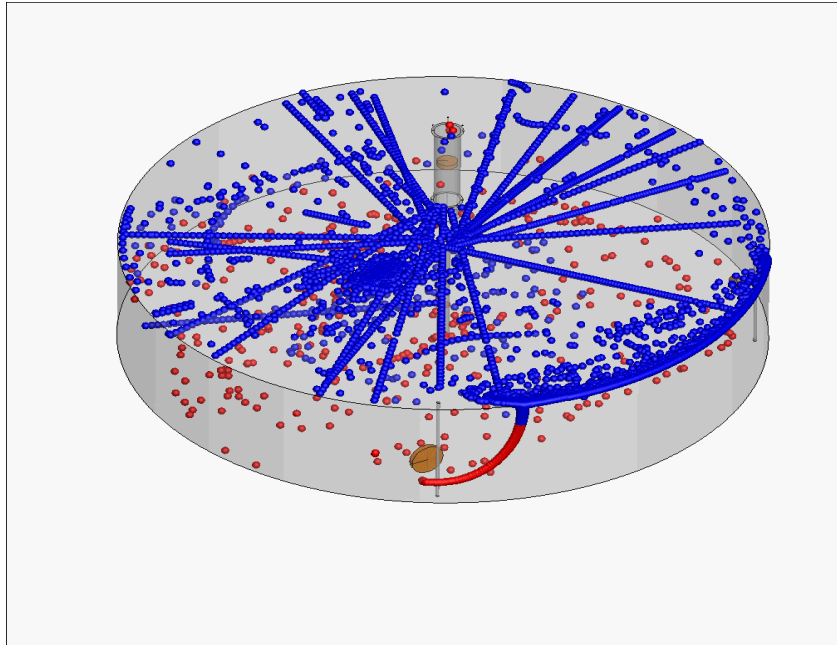


**6 Flygt mixers**

**1600+ Sanitaire diffusers**

- **Three distinct** phases in the project (Original + 2 Iterations)
- Each iteration corresponds to several simulations
- Addressed all short-coming of original design, such as air entrainment, target SOTE/ SOTR and significant recirculation near the mixers

## Case Story: Biogas



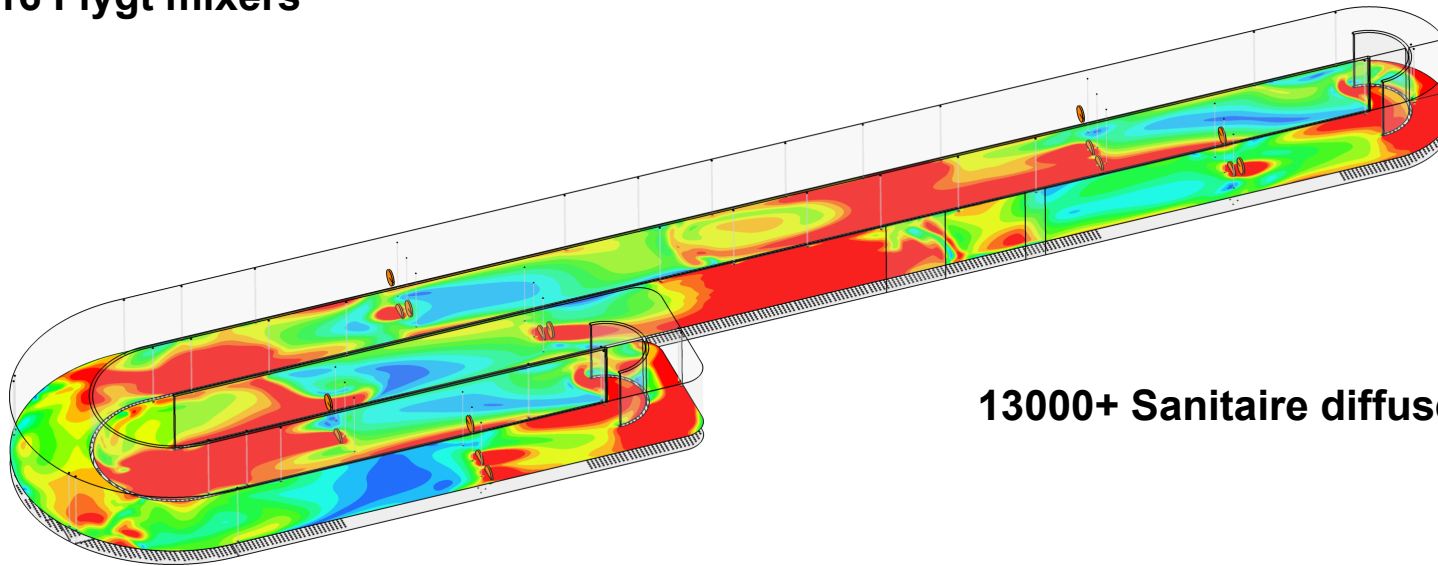
**2 Flygt mixers with  
Vertical pipe solution**

**Non-Newtonian liquid**

- **Four distinct** phases in the project (Original designs evaluation + 3 Iterations)
- Evaluated the 2 proposed design with the focus on reduction of the sedimentation risk and crust formation
- Created better understating of system response to various design choices and suggested optimal solution

# Case Story: Oxidation Ditch

**16 Flygt mixers**



**13000+ Sanitaire diffusers**

- **Four distinct** phases in the project (Original + 3 Iterations)
- Each iteration corresponds to several simulations
- Addressed all short-coming of original design, such as air entrainment, excessive sedimentation risk and recirculation near the mixers





# Q&A Session

## CONTACT US

Xylem General Information  
[info.em@xylem.com](mailto:info.em@xylem.com)



*\*\*An email will be sent out in the next few days that will include a link to the recording*

[www.xylem.com](http://www.xylem.com)