Energy management at WWTPs in the Baltic Sea region - Gdańsk case study

Gdańsk Water Utilities Ltd

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Interreg Baltic Sea Region

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

GIWK

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Plan of my presentation:

- Wastewater treatment and sludge handling
- Energy efficiency
- Electricity balance
- Heat balance
- Possibilities to improve energy efficiency

Layout of the Wschód WWTP

SLUDGE PROCESSING:

- excess sludge disintegration
- 3 double-belt filter presses (3×150 m^3/h)
- 4 digesters (4×7,000 m^3)
- 4 centrifuges (20-35 m^3/h)
- chemical P removal
- STTP (49 t DS/d)
- biogas treatment
- 2 biogas tanks (2×2,500 m^3)
- CHP (4×290 Nm^3/h)

BIOLOGICAL TREATMENT:

- 6 A^2O-based bioreactors (26,350 m^3 each)
- 12 final settling tanks (∅ 44 m)

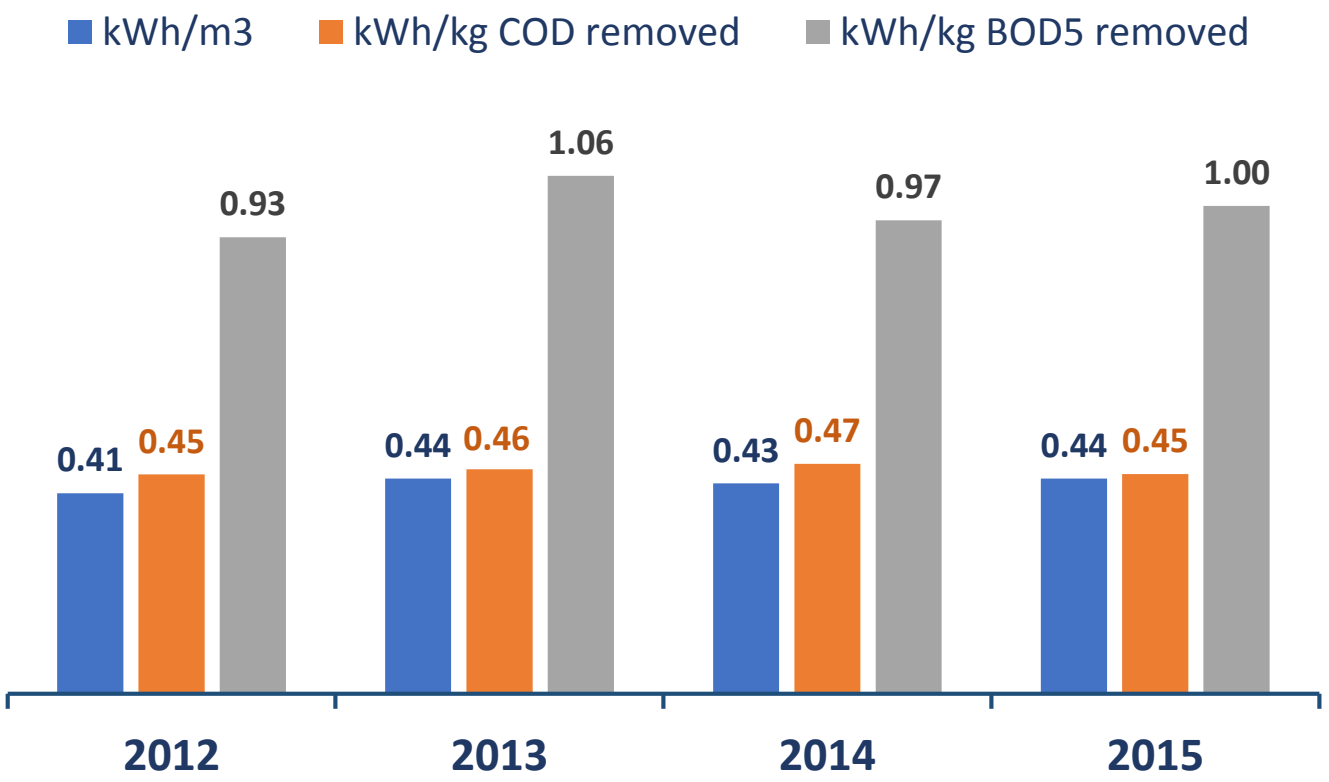
MECHANICAL TREATMENT:

- 4 screens (6 and 10 mm)
- 3 aerated grit chambers (30 m)
- 4 primary settling tanks (∅ 46 m)

Wastewater treatment efficiency

Parameter	Requirements		Average values in 2015	
	Concentration	Reduction	Concentration	Reduction
	g/m^3	%	g/m^3	%
COD	125	75	33	97
BOD_5	15	90	2.8	99
TSS	35	90	5.6	99
TN	10	70 – 80	**7.5**	**92**
NH_4-N	10	-	0.6	99
NO_3-N	-	-	5.1	-
TP	1	80	**0.4**	**97**

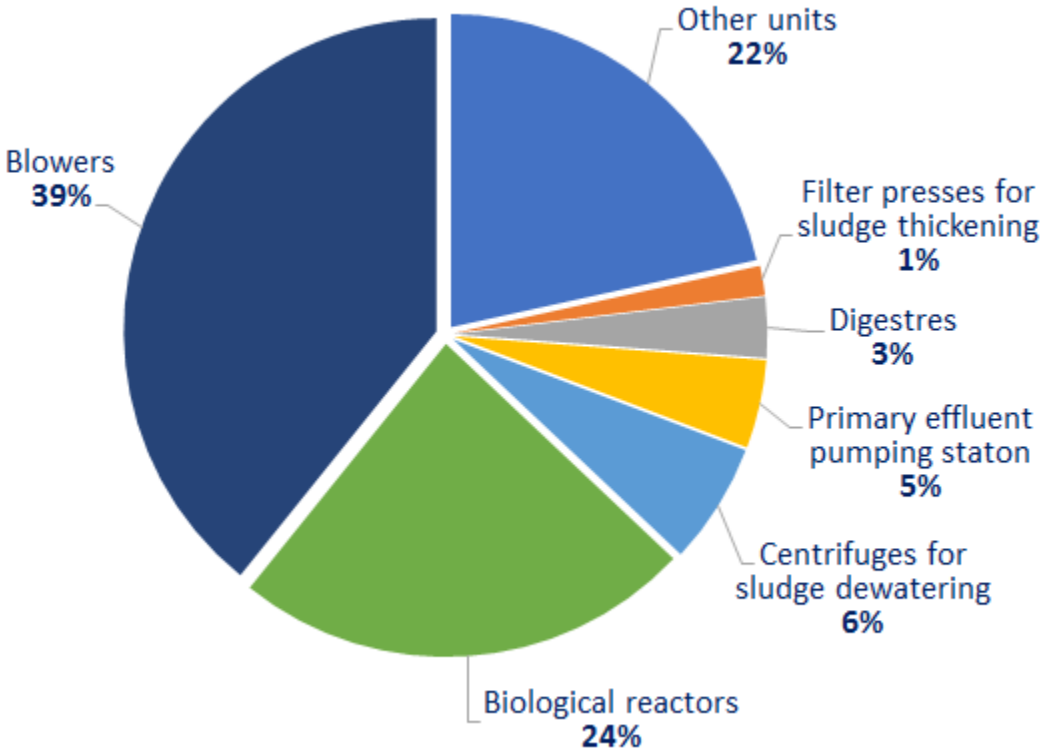
Energy efficiency of the WWTP



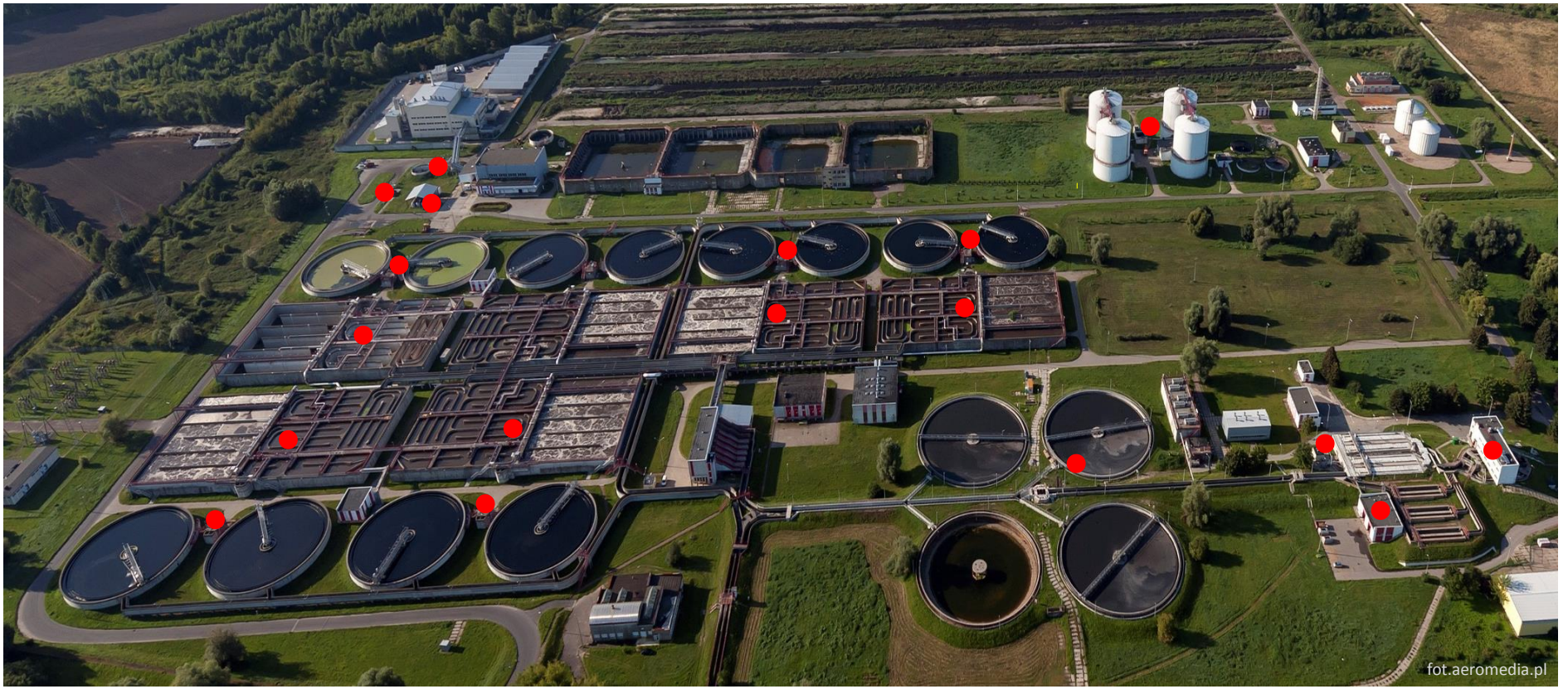
Electricity consumption in the WWTP

Electricity consumption in 2013:

- 44 MWh/d
- 16,060 MWh/a



Energy measurements at the WWTP



18 additional energy meters:

- screens
- grit chamber blower
- grit washing station
- primary settling tanks
- biological reactors (5)
- return and excess sludge pumping stations (5)
- fermented sludge pumping station
- system of chemical P removal from reject water
- $Fe_2(SO_4)_3$ dosing station
- wastewater disposal station

Electricity balance 2016

INCINERATION PLANT

60 MWh/a
purchase

4,400 MWh/a

CHP

P_{gross} = 15,300 MWh/a
Cons = 770 MWh/a
P_{net} = 14,600 MWh/a

10,200 MWh/a
power network

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WWTP

15,000 MWh/a
purchase

10,200 MWh/a

Electricity gap = 4,800 MWh/a

How to plug the gap?

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Heat balance 2016

Total excess heat = 75,380 GJ/a
i.e. 20,940 MWh × 20% (η ORC) = 4,200 MWh/a

64,710 GJ/a
loss

INCINERATION PLANT

198,720 GJ/a

68,720
fluidizing air

65,290
thermal oil

134,005

CHP

10,670 GJ/a
loss

50,790 GJ/a

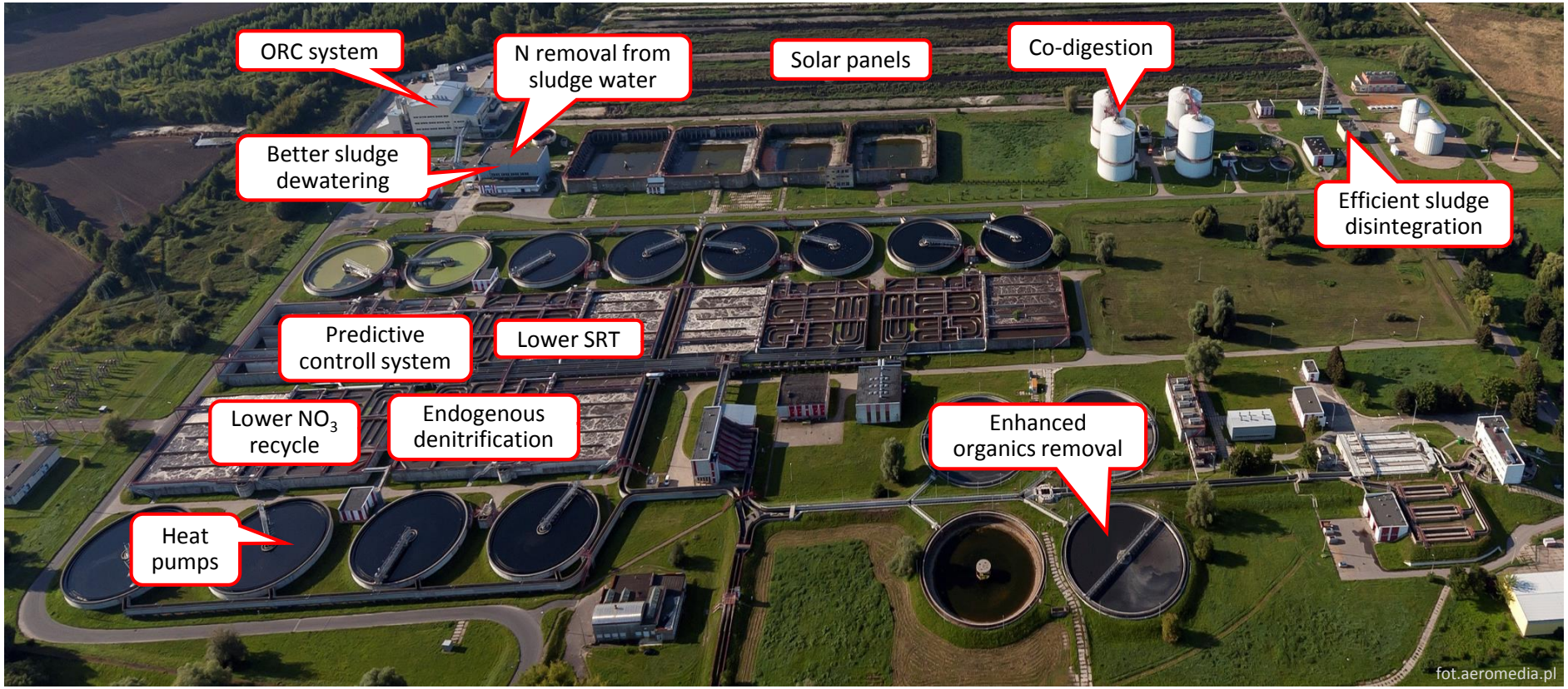
GIWK

SNG

WWTP

40,120
sludge digestion

Main ideas to improve energy efficiency



Thank you for your attention!

Feel invited to the IWAMA workshop on sludge management in our beautiful city of Gdańsk