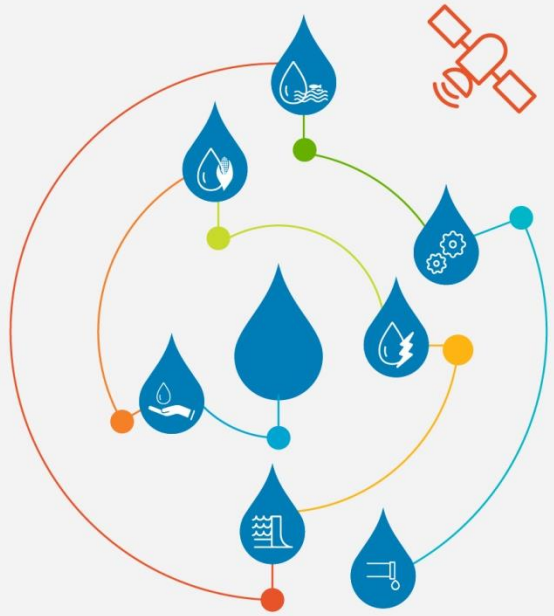
Aerobic Granular Sludge and Micro Screening: New Compact Solution for the Energy Neutral Wastewater Treatment Plant



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CTO, WABAG

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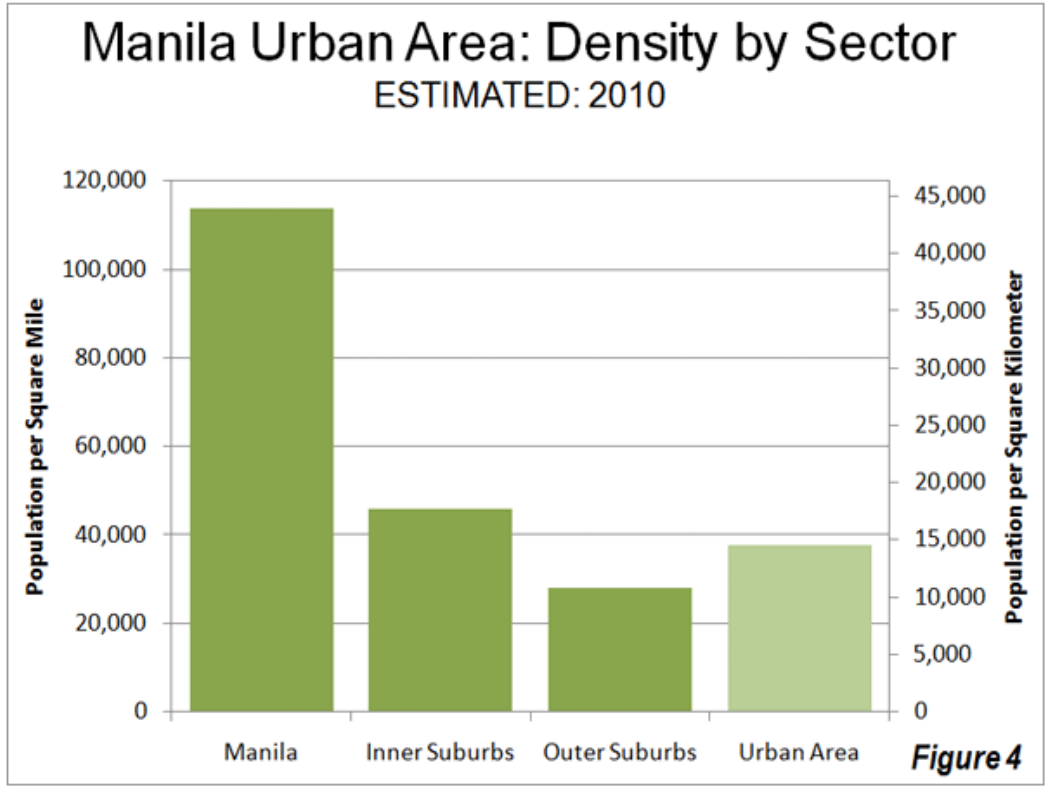
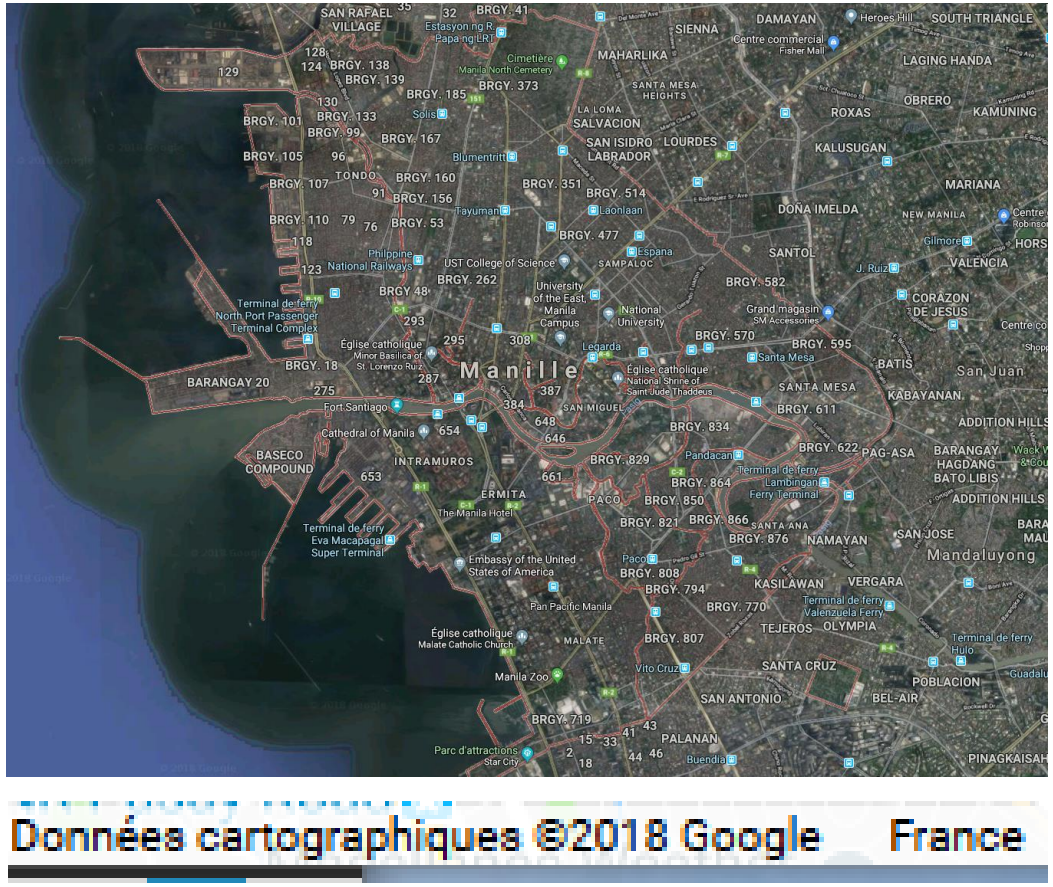
- Introduction
- Micropur®
- Nereda®
- Compact and Energy Neutral
- Conclusion

The need for Compact solutions – Extreme case Manila



http://www.newgeography.com/content/002198-the-evolving-urban-form-manila



MICROPUR® - The smart alternative for primary treatment

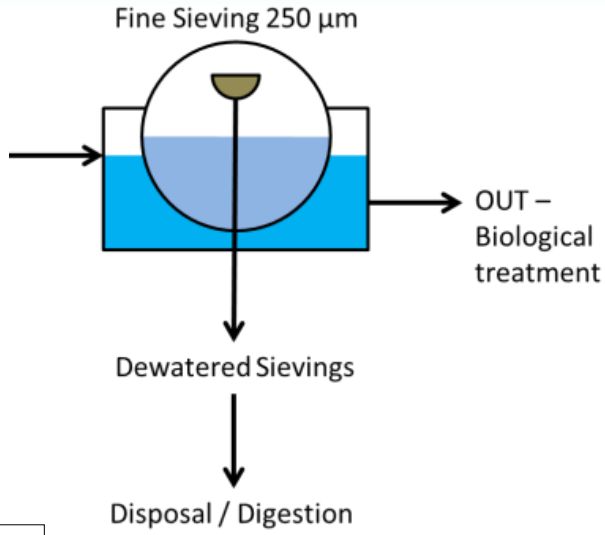
Background – What is Micropur?

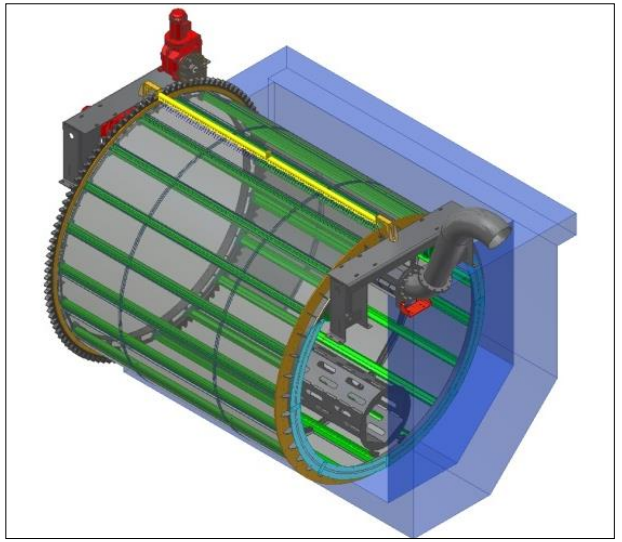
- **compact advanced fine sieving technology with superior solids and organic substances removal and integrated screenings dewatering**
- **a drum sieve with integrated screw conveyor for screenings dewatering and a highly effective cleaning system**
- **typical Micropur application is the mechanical pre-treatment of raw WW**

MICROPUR® - The smart alternative for primary treatment

Micropur Units?

- **Freestanding unit**
- **Installation in a channel**
- **Fine sieve textures 250 µm – 1000 µm**
- **Size varies from 1,6m dia x 3,0m L (freestanding), 2,4m dia x 4,5m L (channel)**
- **Q (depending on mesh size): 50-350 m³/h (free); 350-800 m³/h (channel)**





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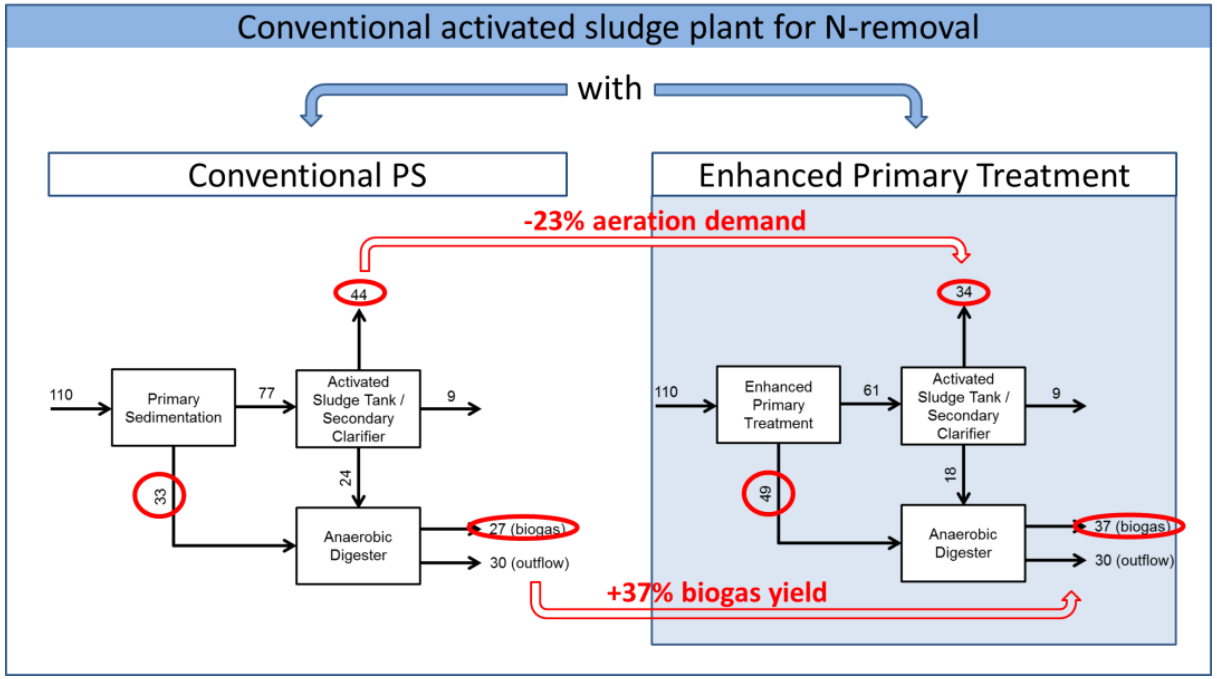
MICROPUR® - The smart alternative for primary treatment

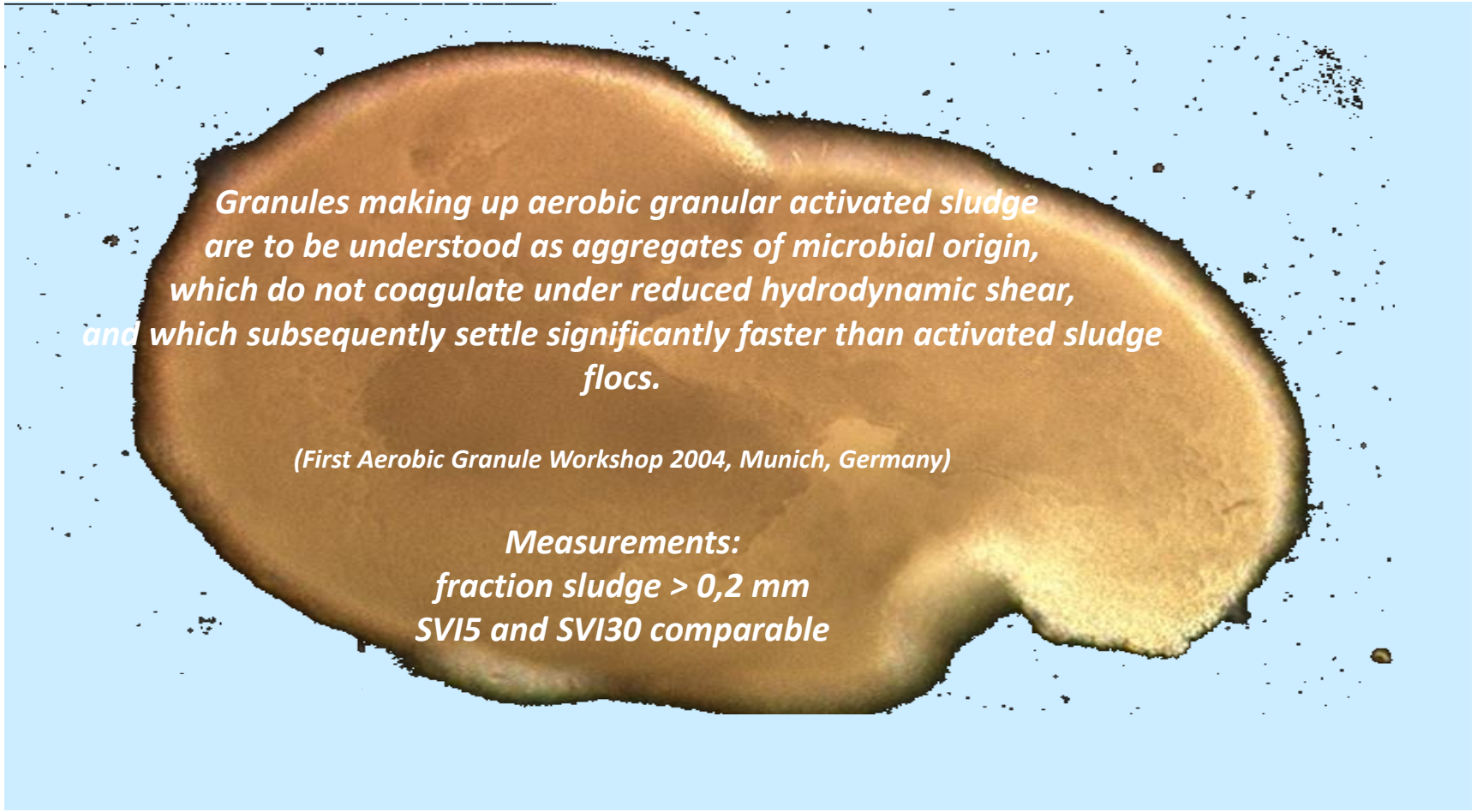
Removal Rates?

- **Depending on mesh size and treatment concept of the WWTP!**
- **Effluent paramter?**
- **Energy optimization!**

Target	Value
Solid removal	50-70 %
COD removal	35-45 %
TP removal	10-12 %
TN removal	10-12 %
Fibres > 1.2 mm	> 95 %
DS content of compacted sievings	3-35 %



Aerobic Granular Sludge



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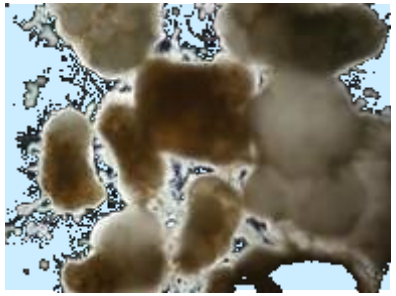
Aerobic Granular Sludge

Activated Sludge

Aerobic Granules



Excellent settling properties

Pure biomass

No support media

High MLSS levels (up to 15 g/L)

Reliable and stable operation

No bulking sludge

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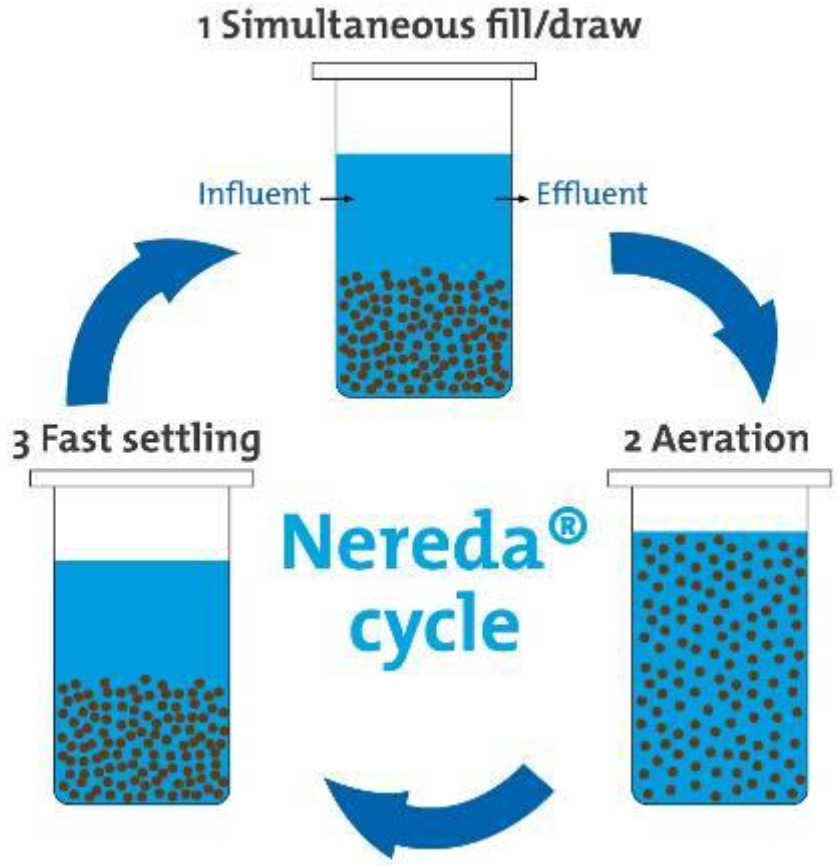
The Nereda®

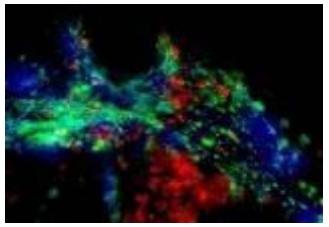
- Simple one-tank concept
- No clarifiers
- No moving decanter
- No mixers
- Extensive biological COD, N- and P-removal
- Low energy consumption
- Easy operation

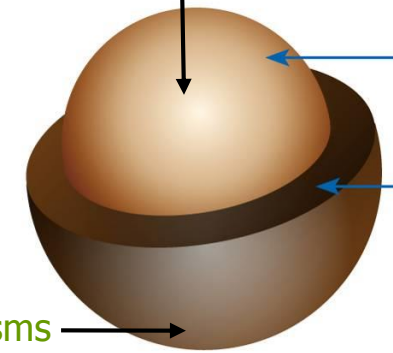


Principle of Nereda®

Oxygen gradient in granule → ***simultaneous COD, P and N-removal***

Heterotrophic organisms





Ammonium oxidising organisms

Anaerobic zone:

- Nitrate reduction to nitrogen gas
- Phosphate removal

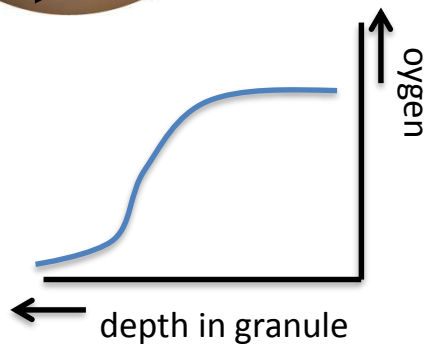
$COD + NO_x + PO_4^{3-} \rightarrow N_2 + CO_2 + H_2O + poly\text{-}P$

Aerobic zone:

- Biological oxidation
- Ammonium oxidation to nitrate

$COD + O_2 \rightarrow CO_2 + H_2O$

$NH_4 + O_2 \rightarrow NOx$



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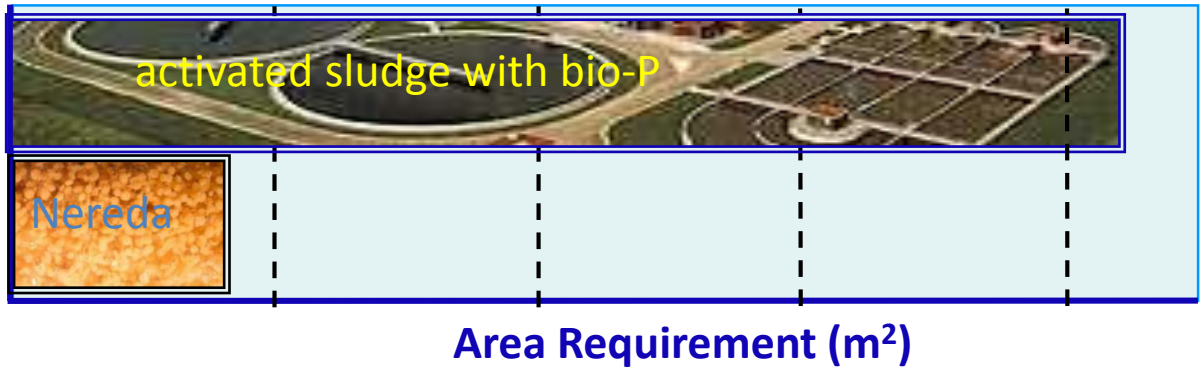
Key advantages Nereda®

- 50-75% smaller footprint:
  - high biomass concentration
  - no selectors, no anaerobic tanks, no clarifiers



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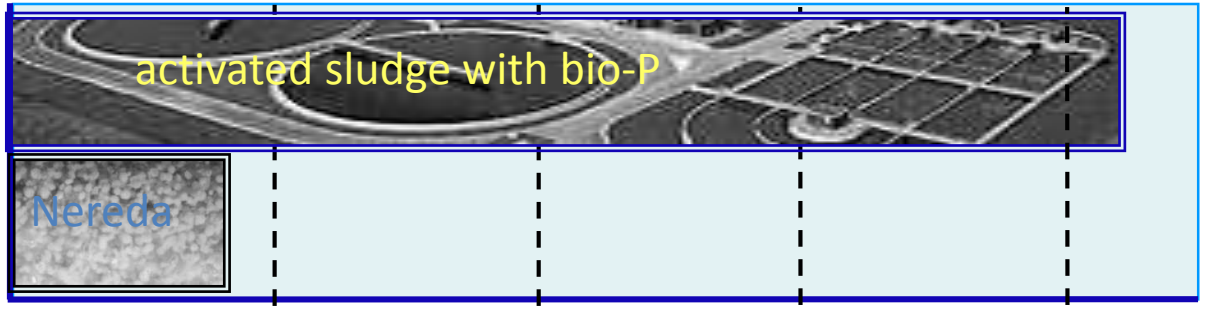
Key advantages Nereda®

- 75% smaller footprint:
  - high biomass concentration
  - no selectors, no anaerobic tanks, no clarifiers



- >20-25% energy savings:
  - less rotary equipment
  - efficient aeration

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Nereda® Energy efficiency example
Municipal wastewaster - full BNR - 100,000 P.E.

TABEL 31 ENERGIEVERBRUIK RWZI GARMERWOLDE

	Eenheid	A/B systeem [1]		Nereda® [2]	
		2014	2015	2014	2015
Specifiek energieverbruik	kWh/(v.e.$_{150}$.jaar)	31,3	28,2	14,8	17,0
idem	kWh/m^3	0,36	0,33	0,17	0,18
Influentbelasting [3]	v.e.$_{150}$	176.000	186.000	116.000	135.000
idem	% influent	60,2	56,5	39,8	43,5

1) Inclusief Beluchtingsenergie Sharon installatie
2) Inclusief energieverbruik tussengemaal
3) Exclusief deel van "externe" stromen

Note that is an example based on a specific plant in Dutch climate achieving full BNR and that energy consumption for both technologies depends on wastewater characteristics, targeted effluent quality, design and equipment selection.

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MICROPUR® + NEREDA® - Combined Space Savings

- Example 140 MLD
  - Traditional Primary Settler footprint 2500 m2 + Gravity Thickener
  - MICROPUR 7 Machine's of 5.5 x 4 m = 154 m2

  - CAS
    - Aeration tank 5000 m2
    - Secondary Settler 5000 m2
  - NEREDA Reactors 4000 m2

  - Total Area Traditional Solution (Primary Settlers + Activated Sludge) > 12500 m2
  - MICROPUR + NEREDA > 4200 m2

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MICROPUR® + NEREDA® - Combined Energy Savings

- Typically a BNR plants with primary Settler having Anaerobic Digesters and CHP will achieve 50 – 70% energy self sufficiency

- MICROPUR will help Gain 10 – 20% more energy
- NEREDA has 20 – 25% less Energy consumption

- This mean that the Combination should achieve from 75 – 110% Self sufficiency

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Conclusion

- MICROPUR® and NEREDA® are compact and energy sufficient technologies
- The combination can potentially reduce the necessary footprint for building a BNR removal plant with 30 - 40% which very relevant when considering new Plants in the SEA Metropoles
- Combining MICROPUR® and NEREDA® with Anaerobic Digestion and CHP has the potential to eliminate the need for external energy for the WWTP's which could reduce the Total National Power Consumption with approx. 1%