

# IL FUTURO DELL'ACQUA NUOVA DIRETTIVA EUROPEA: TECNOLOGIE INNOVATIVE E RISPARMIO ENERGETICO

**Biomassa addensata: Indense™ e Cyclor turbo™  
tecnologie innovative per migliorare  
l'efficienza di trattamento**

Relatrice: Ing. Daniela Grassi - SUEZ

27-Oct -23

Engineering & Construction



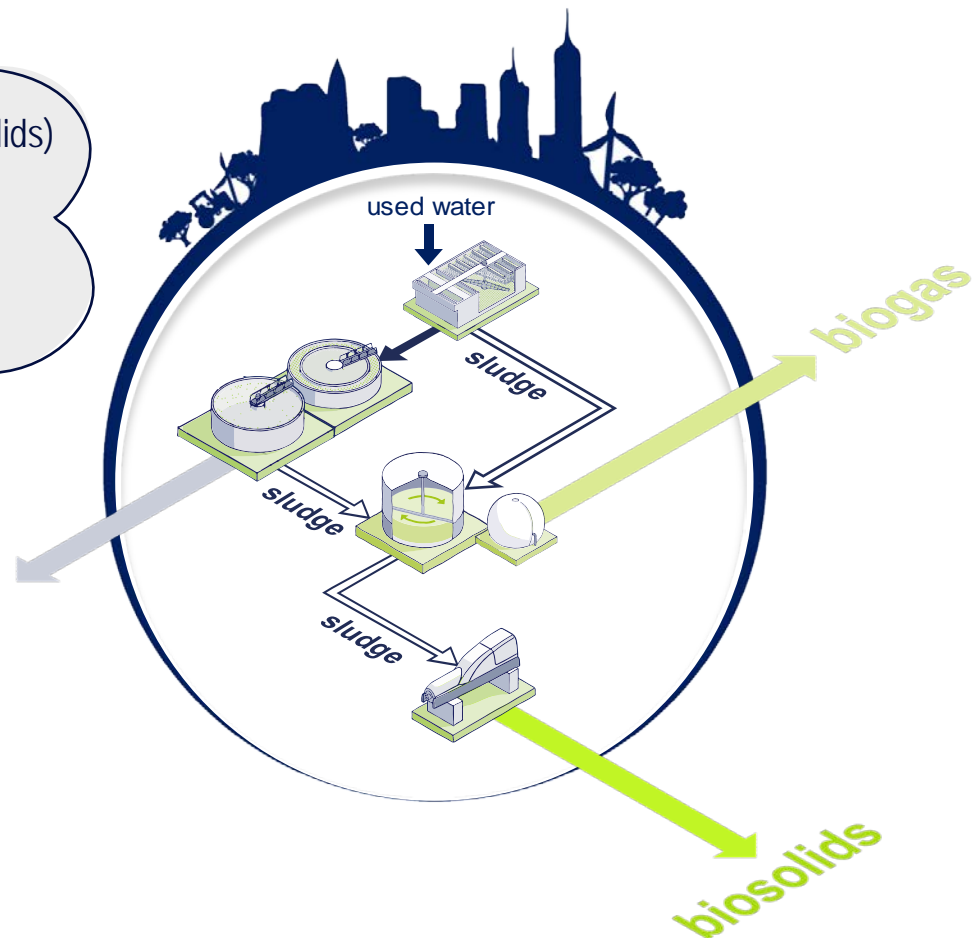
# WHY? Looking for sustainable, compact and resilient WWTP

- Ensure an excellent effluent quality (Carbon, Nitrogen, Phosphorus, suspended solids)
- Enable a positive operational cost (less kWh, reagents, sludge)
- Reduce the environmental footprint (m<sup>2</sup>/EP, GreenHouses Gas)

EP : Equivalent Population

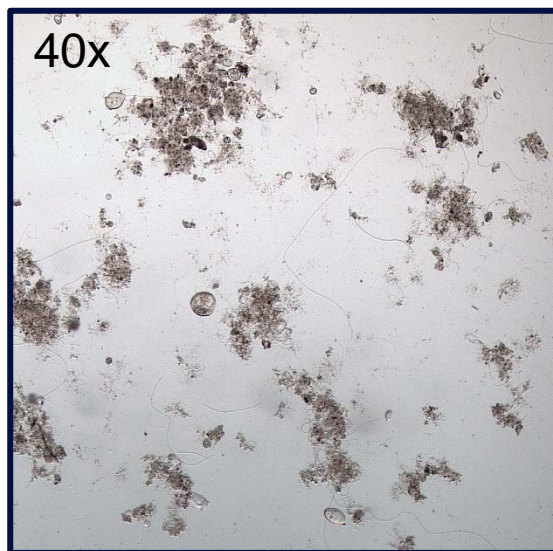
Opportunity

Rethink our biological processes



# HOW?

## Conventional Activated Sludge

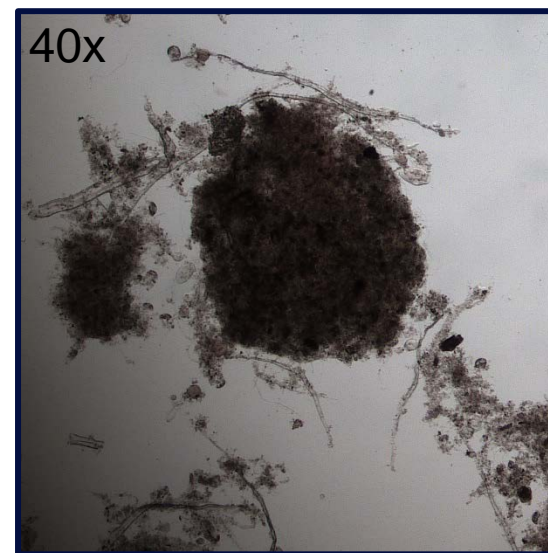


**CONVERT  
INTO**

**Microbiome  
shift**

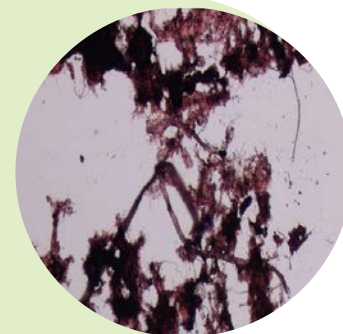


## New Densified Biomass



A consortium of biological flocs and dense biological aggregates is **more robust and resilient** than a biomass with only one type of aggregate and allows to better face in operation:

- load variation
- temperature variation
- salinity variation (from 370 to 580 mg/l of chlorides)



# WHAT? Looking for sustainable, compact and resilient WWTP

n.2 technologies for biomass  
densification in Suez portfolio:

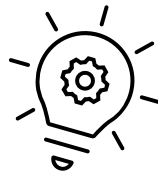
for greenfields: Cyclor® Turbo



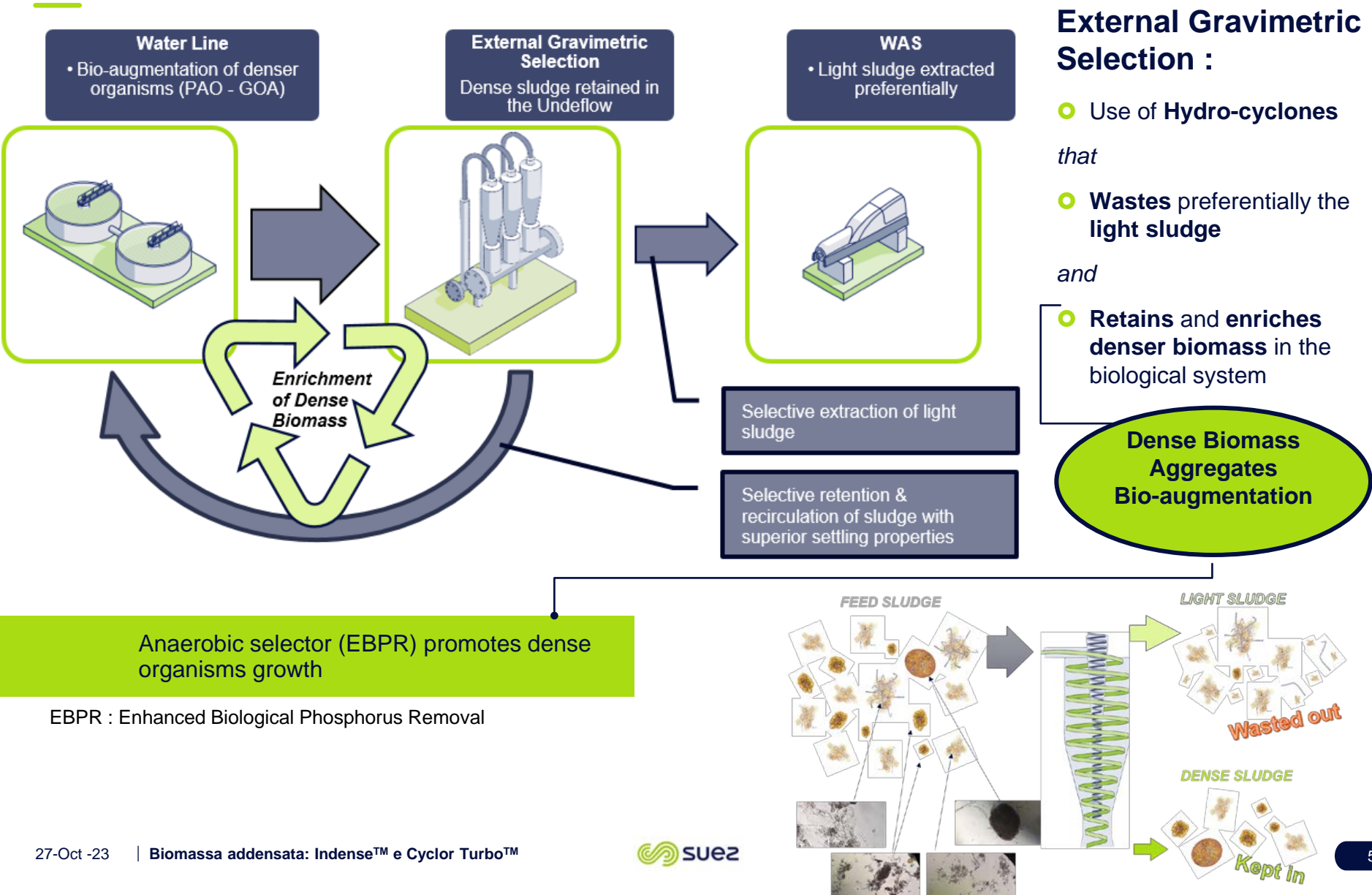
for brownfields: inDENSE®



Interesting..but how to  
implement densified  
biomass in  
full-scale plants?



# WHAT? “doing more<sub>(treatment)</sub> in less<sub>(volume)</sub> with less<sub>(energy & chemicals)</sub>”

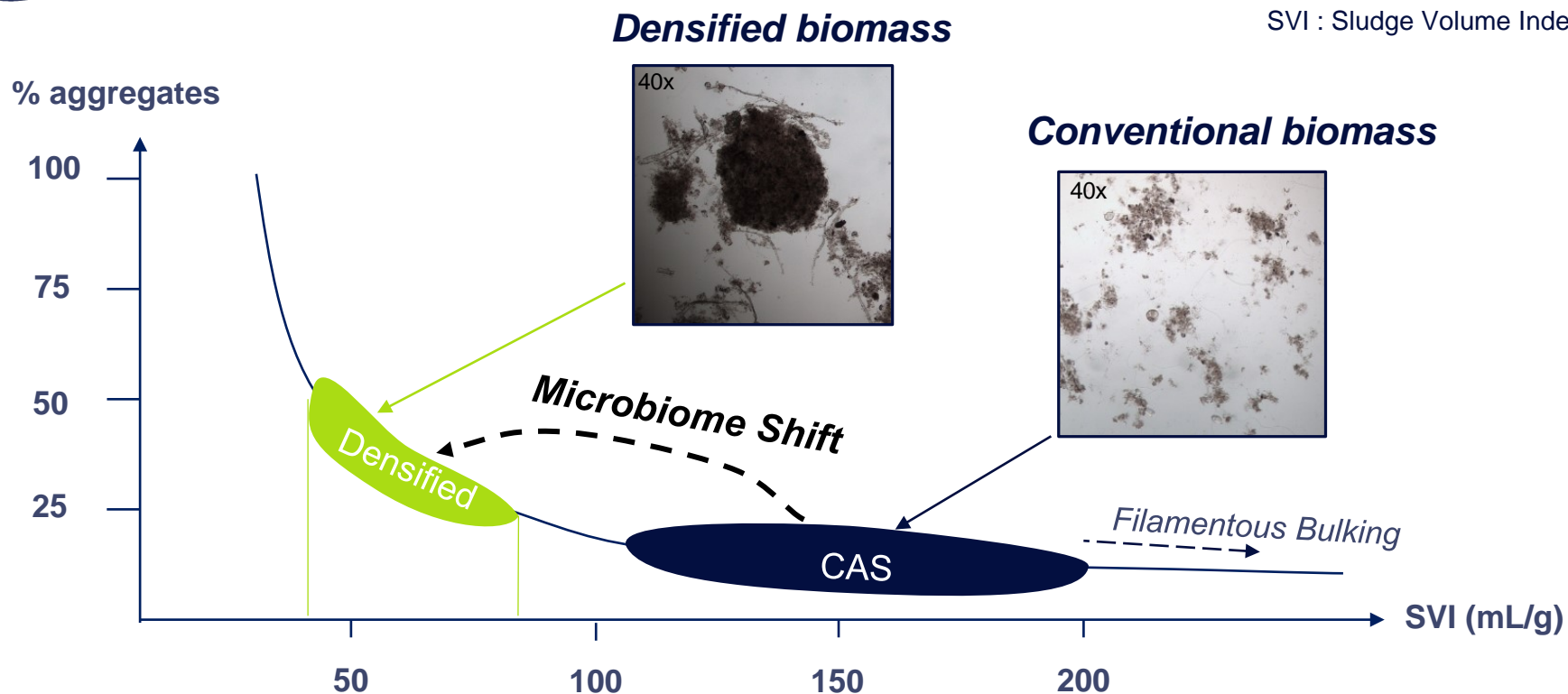




Dense  
Aggregates  
percentage  
**x 2**  
vs CAS

# Patented Controlled Microbiome Shift

SVI : Sludge Volume Index



## MICROBIOME SHIFT :

Strong Increase of aggregate % in the biomass inducing :

- Narrower SVI range
- Increased settling velocities

**Partial  
granulation  
concept**

**Stable  
Low and  
controlled  
SVI values**

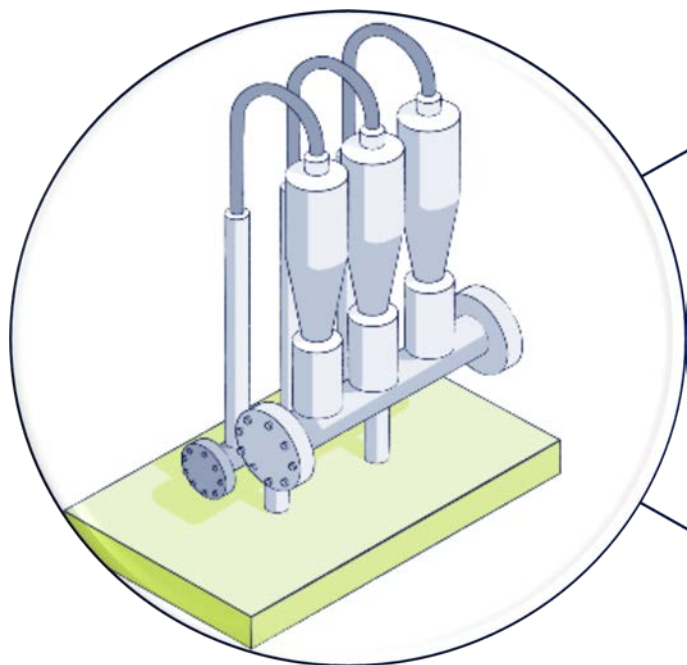
Up to  
**+30%**

nom. capacity w/o  
additional clarifiers  
vs CAS



# Densification enables capacity extension

→ 2 possible cases



Plant <sup>+</sup>  
already  
loaded to  
Nominal

- Organic load extension need
- Both flow and load increase

Plant <sup>+</sup>  
hydraulically  
overloaded  
in storm  
event

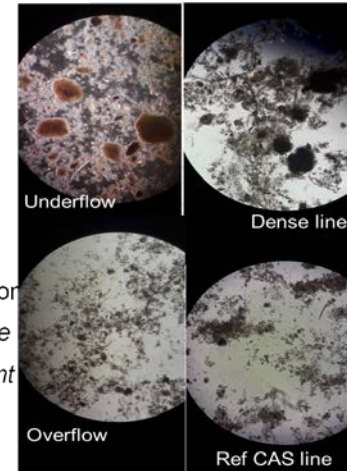
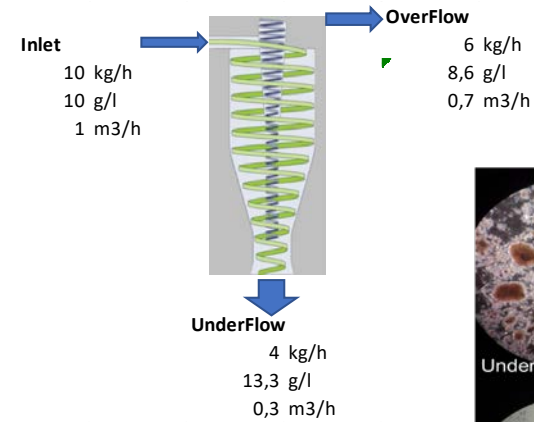
- Hydraulic load extension need only to cope with storm event
- Plant not reaching organic load nominal capacity

# Position in the treatment line

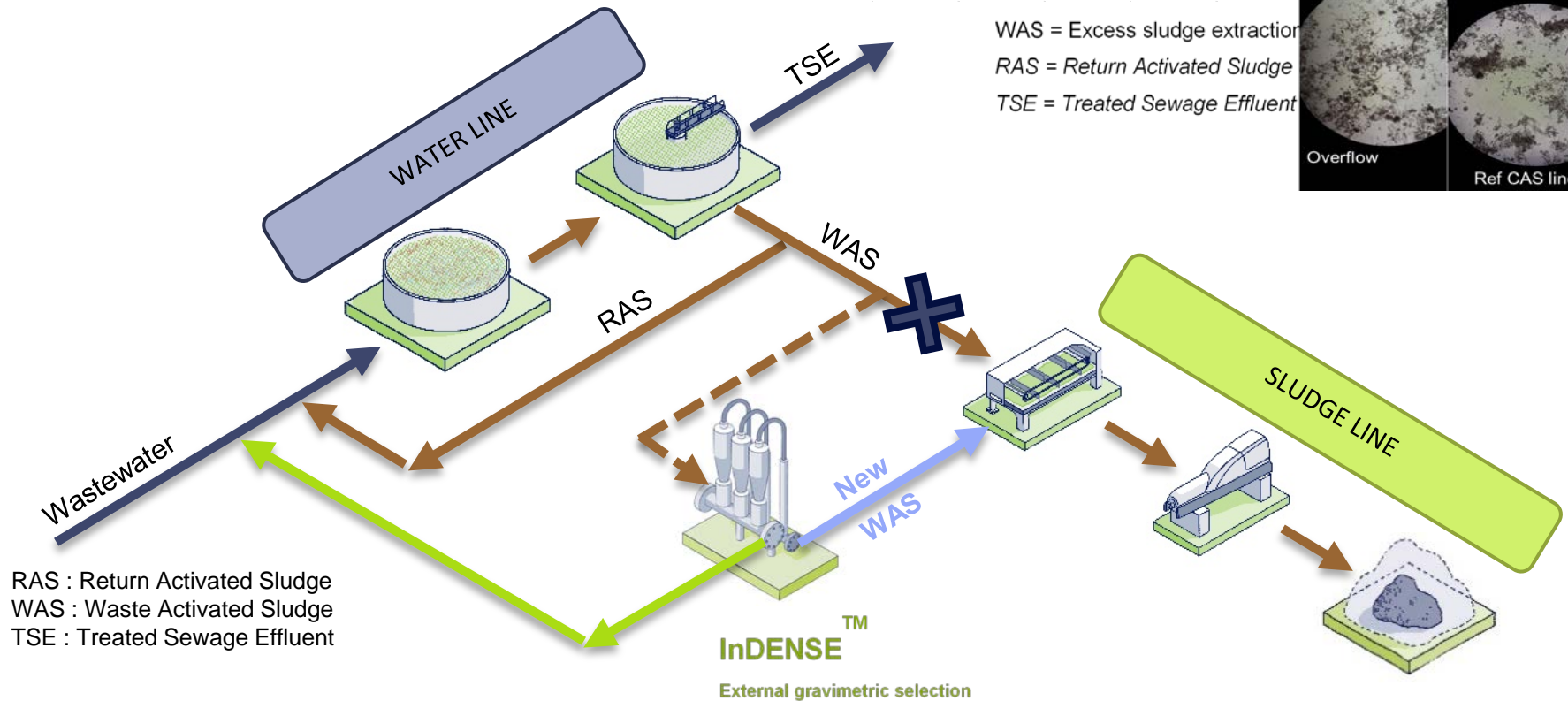
## Application field:

- Any free suspended biomass process
- Any WWTP capacity / hydraulic configuration

*All the WAS stream goes now through cyclone*



WAS = Excess sludge extraction  
 RAS = Return Activated Sludge  
 TSE = Treated Sewage Effluent



RAS : Return Activated Sludge  
 WAS : Waste Activated Sludge  
 TSE : Treated Sewage Effluent



installation  
< 3  
weeks



Scalable technology

**No major works involved, simple and robust**

inDENSE® system « patches » easily onto the existing plant

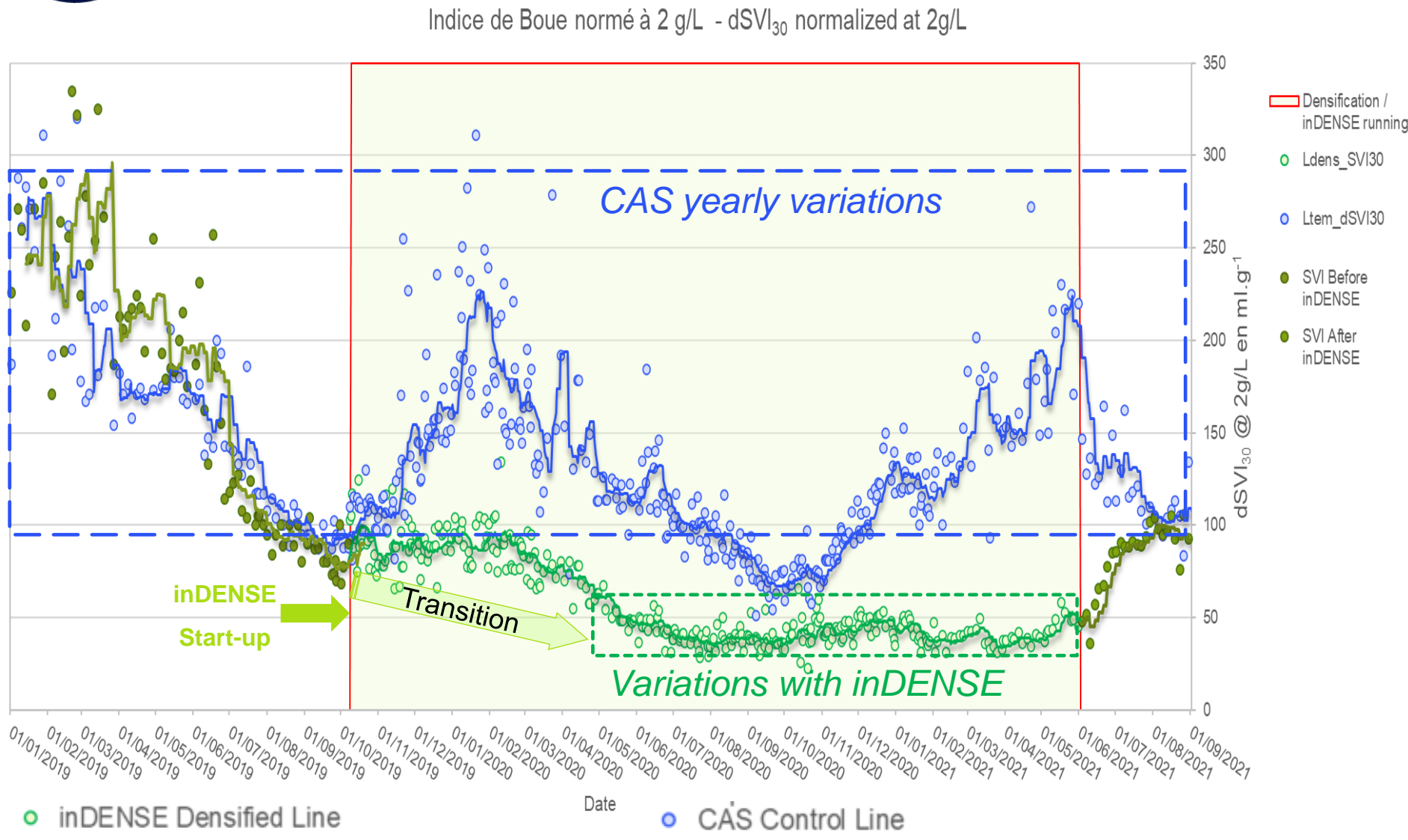


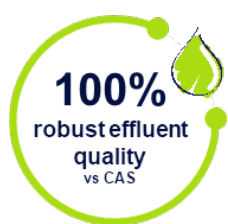
100 000 EH

*Full scale demonstrator*



# Improved Sludge Settling Ability (Sludge Volume Index)

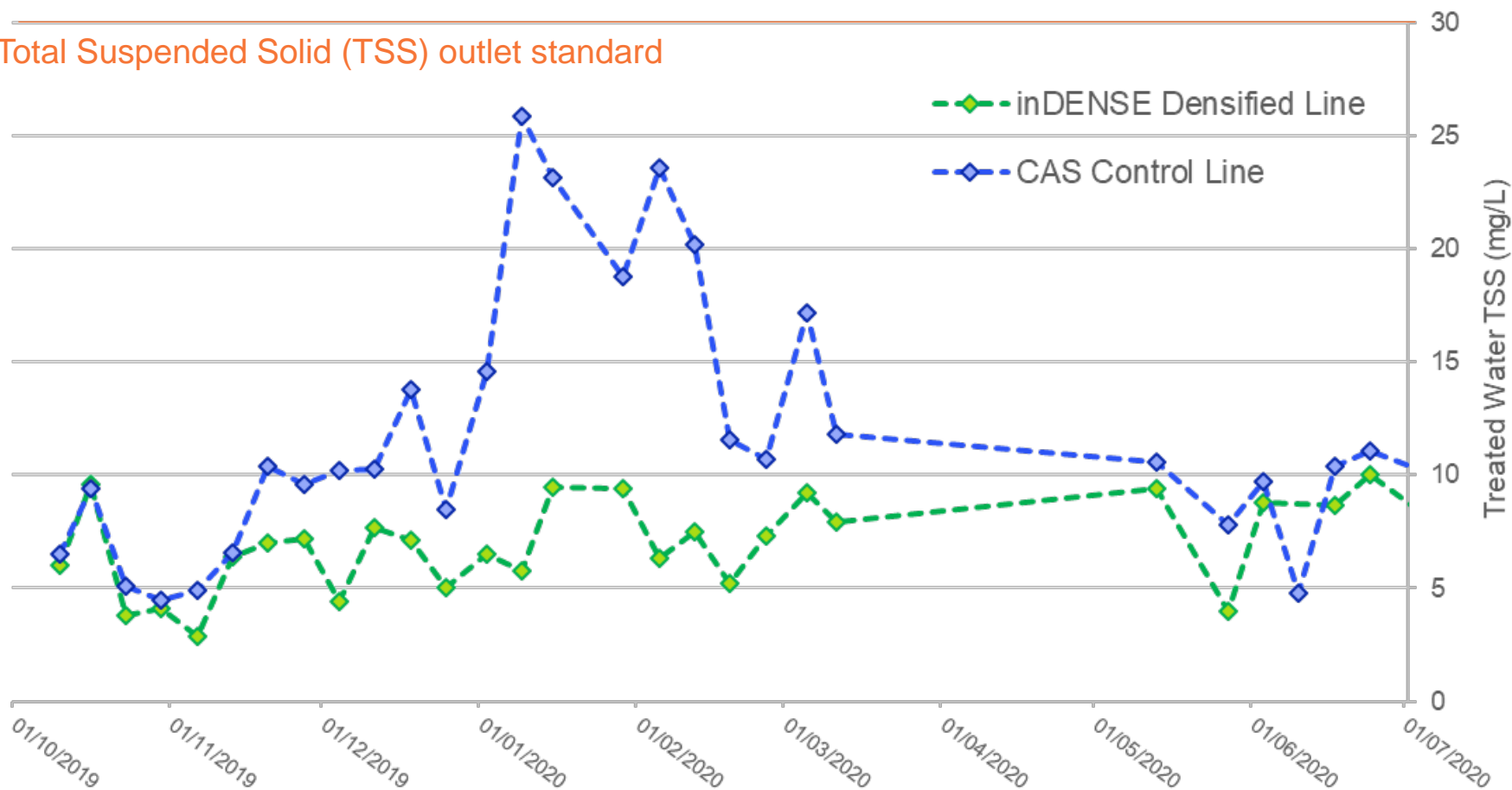




# Performances no longer subjected to climatic conditions

## Resilience & Robustness

Total Suspended Solid (TSS) outlet standard



0  
scum and  
foams

# Bulking suppressed by the densification technology

Ref Line

Aeration



Anaerobic



Dense Line

Aeration



Anaerobic



**Eased operation**  
**Reduced scum extraction volume**



# Key figures

inDENSE®



Open circles are touch zones, click on it to learn more

## ENVIRONMENT

**100%**  
robust effluent  
quality  
vs CAS

Up to  
**+60%**  
storm  
capacity

## ENERGY

Recirculation  
optimisation  
Up to  
**-50%**  
Vs CAS

sludge line  
**0 impact**  
especially on  
thickening ability &  
biogas potential

## ECONOMY

Up to  
**+30%** nom.  
capacity w/o  
additional clarifiers  
vs CAS

Stable BIO-P  
& Reduced  
chemical cost  
with bio-  
augmentation of  
PAO bacterial  
inventory

## OPERATION

installation  
**< 3**  
weeks

**0**  
scum and  
foams

Operating  
flexibility  
with sludge  
concentrations

## TECHNOLOGY

External  
gravimetric  
selection

Dense  
aggregates  
percentage  
**X 2**  
vs CAS

Sludge  
settling  
up to **X 2** vs  
CAS





# Among our references



## 1 industrial demonstrator

**CHEVIGNY SAINT SAUVEUR (France)**  
1 ligne – 80 000 PE – 9 500 m³/d



## 3 industrial references

**DIJON - EAU VITALE (France)**  
100 000 PE - 10 000 m³/d



**MONTBARREY VAL D'AMOUR (France)**  
2 700 PE – 540 m³/d



WWTP name	Contract	Country	Nominal capacity	Q Avg dry weather	Q peak storm
DIJON - 1 line	demo	France	100'000	10'000	1'375
CHEVIGNY - 1 line	demo	France	40'000	4'750	375
MONTBARREY	2021	France	2'700	540	130
DIJON Full Scale	2021	France	400'000	40'000	5'500
CHEVIGNY Full Scale	2022	France	80'000	9'500	750
SOISSONS	2022	France	90'000	10'824	1'200
K&C VALLEY	2022	India	1'000'000	248'000	23'000
SAINT AIGNAN GRANDLIEU	demo	France	4'000	808	80

**BANGALORE - K&C Valley**  
(India)  
248 000 m³/d



# WHAT? Cyclor® Turbo: advanced Sequenced Batch Reactor

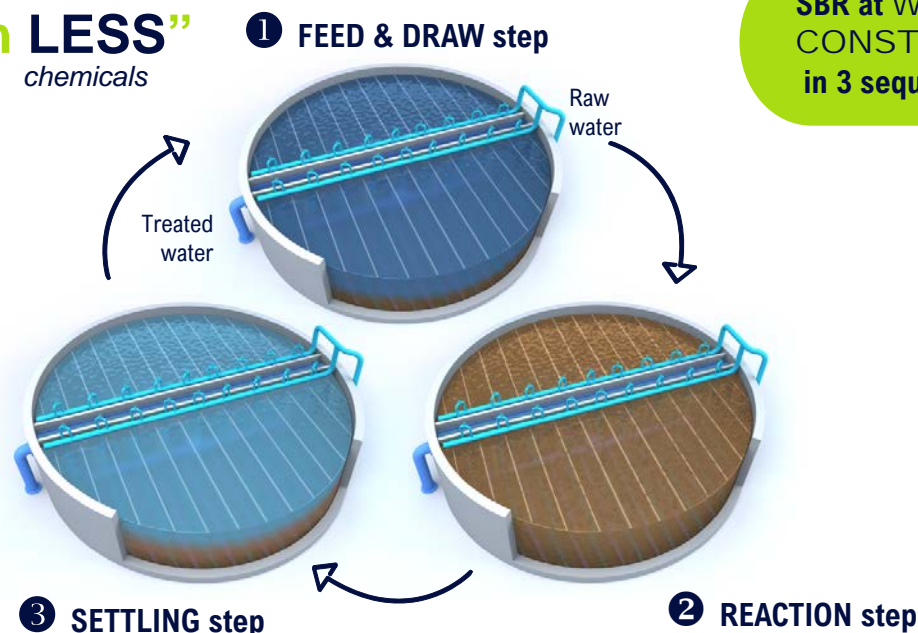
“**doing MORE in LESS with LESS**”  
*treatment volume chemicals*

Enhanced hydraulic engineering combined with process intensification in a compact solution

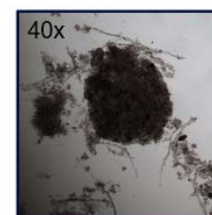
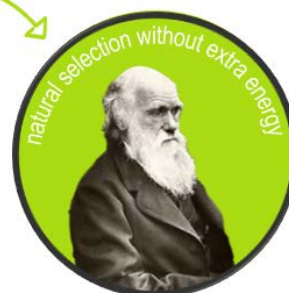
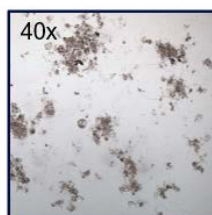


Densification with no additional energy

**SBR at WATER CONSTANT LEVEL in 3 sequences**



**Development strategy** of Phosphorus Accumulating Organisms (PAO)



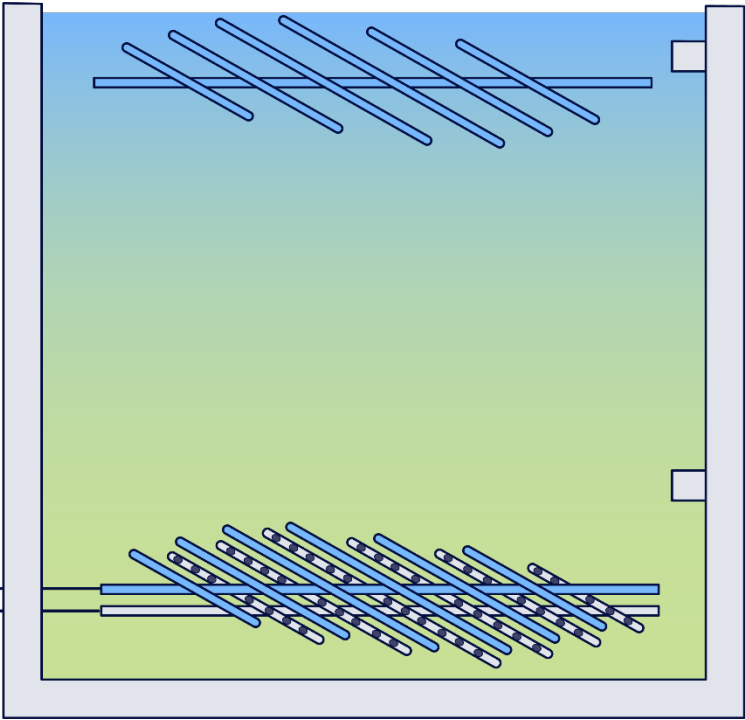
**Specific sludge extraction strategy** (removing of the lightest sludge above the sludge bed level)

# Cyclor® Turbo: feed & draw are simultaneous

Raw water feeding  
through sludge bed

**FEED**

water to be treated  
air process



treated water

Water recovery at  
fix and high level

**DRAW**

excess sludge

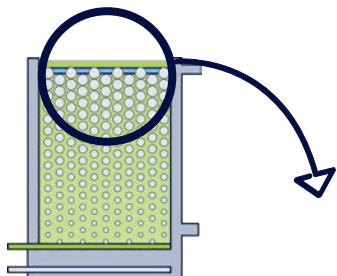
TSS

<15

mg/L  
(less than CAS)



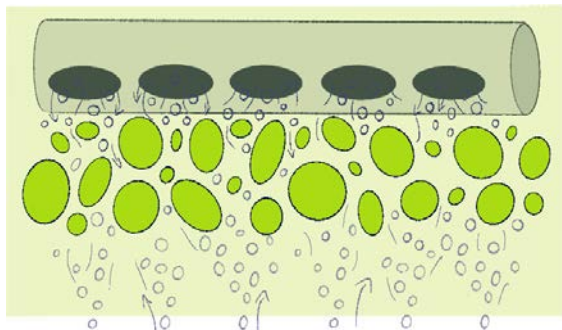
## 2 good reasons for low TSS\* in treated water



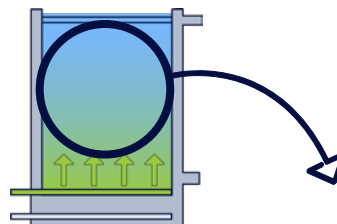
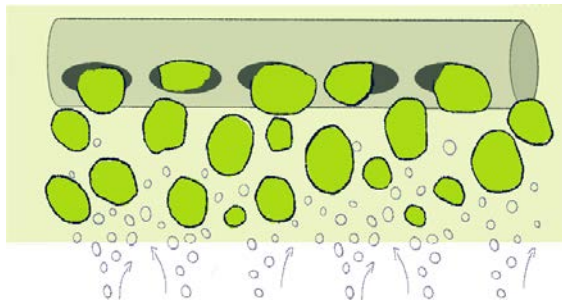
A specific air lock  
patented device

### Air lock (Cyclor™ Turbo)

Air is used to expel  
sludge from the pipe  
and maintain a slight  
air pressure inside  
the pipe...



...to avoid particles  
entering into the pipe  
during aeration



A consortium of granules and  
flocs retains in flocs small particles

### Partial granulation (Cyclor® Turbo)

During Feed and Draw step,  
SS\* capture is improved  
through partial granulation ...



... while SS\* losses occurs  
with full granulation



\*SS : Suspended Solids, TSS : Total Suspended Solids



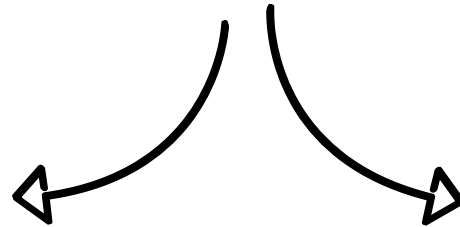
## OPEX reduction

## Cyclor® Turbo: advanced Sequenced Batch Reactor

The global OPEX reduction is due to both reduction in **reagent** and **energy** consumption



Reagent



Energy



Reduction in metallic salt consumption for phosphate removal

Reduction in sludge production due the reduction of metallic salt for phosphate removal

3 meters less of head losses compared with conventional SBR = 10 Watt/m<sup>3</sup> saving

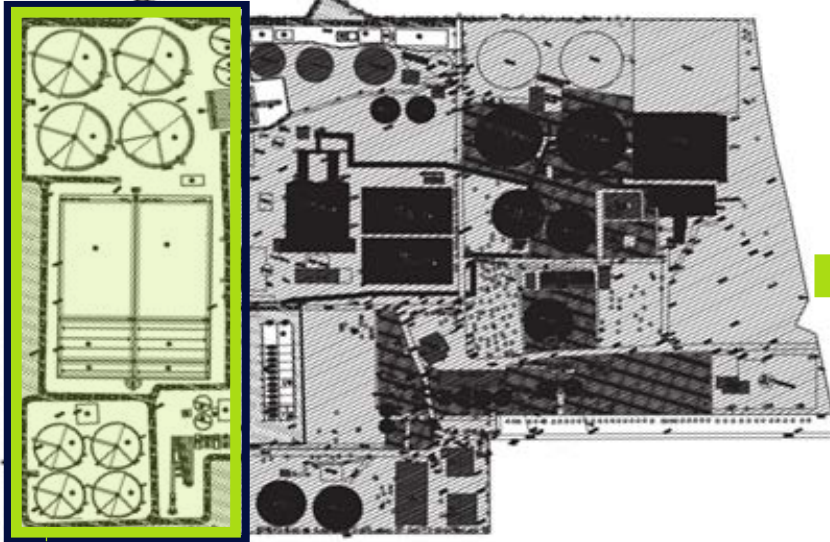


2 x  
less footprint  
than CAS

# Footprint reduction

## Cyclor® Turbo: advanced Sequenced Batch Reactor

Available land  
for extension

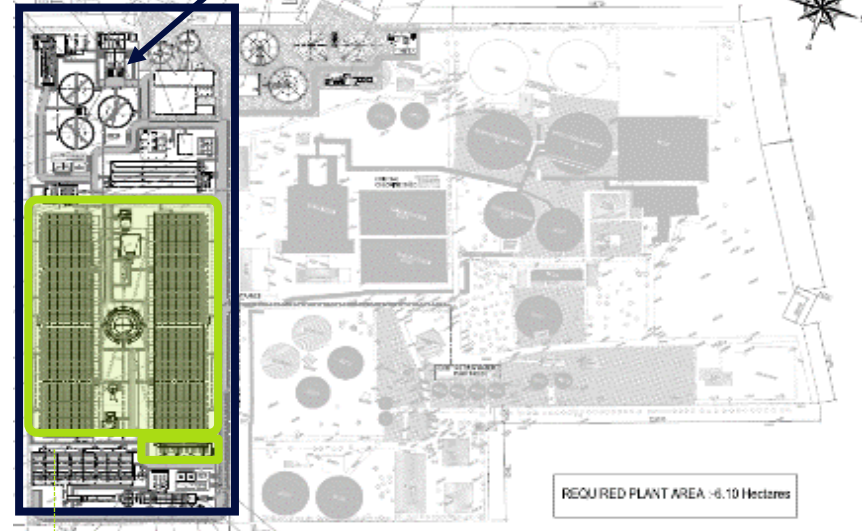


BASIC SOLUTION with CAS\*

→ water line footprint : 21,500 m<sup>2</sup>

No available area for sludge line

Available land  
for extension



OPTIMIZED SOLUTION with *Cyclor® Turbo*

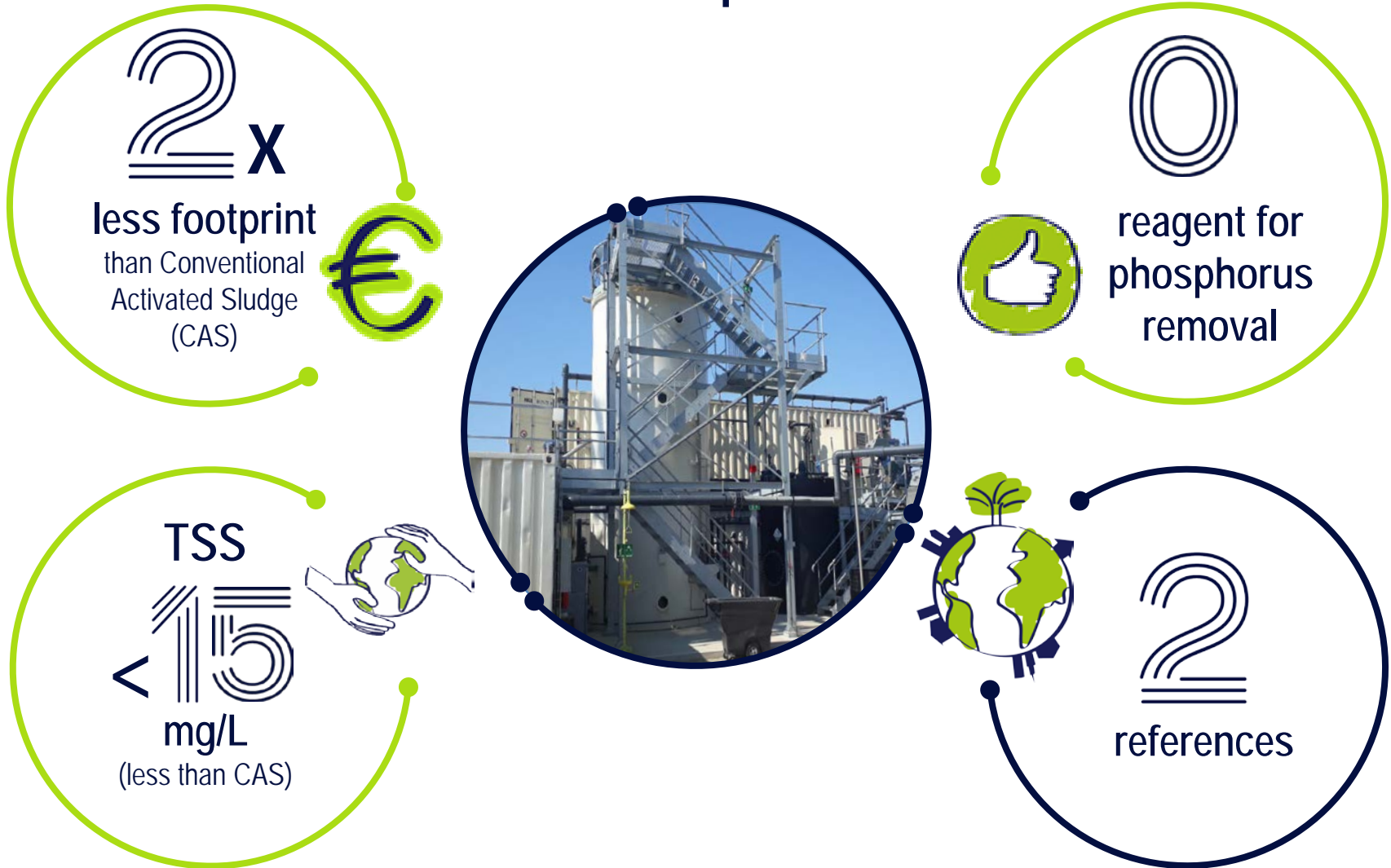
→ water line footprint: 11,280 m<sup>2</sup>

Available area for sludge line

\* Conventional Activated Sludge

# Value Proposition

## Cyclor® Turbo: advanced Sequenced Batch Reactor





# Cyclor® Turbo demonstrator at Nice Haliotis (France)

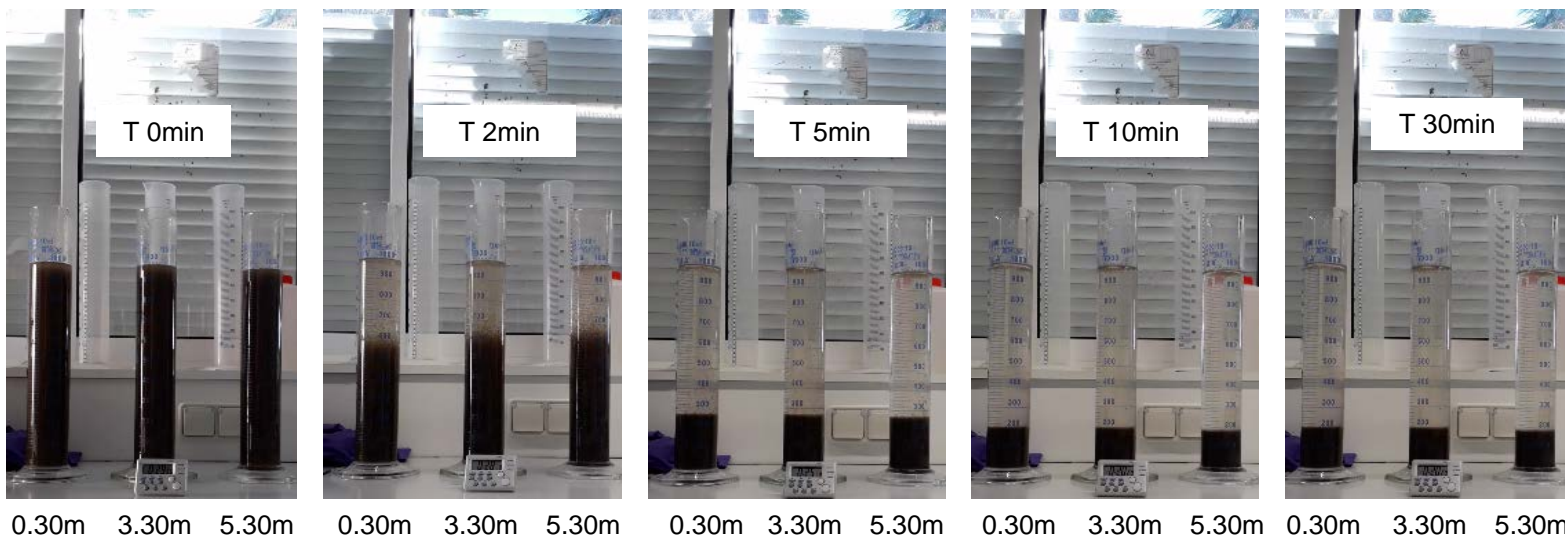
- 24 months of data acquisition
- 150 m<sup>3</sup> per day are treated in a 45 m<sup>3</sup> reactor
- Supported by French governmental agency





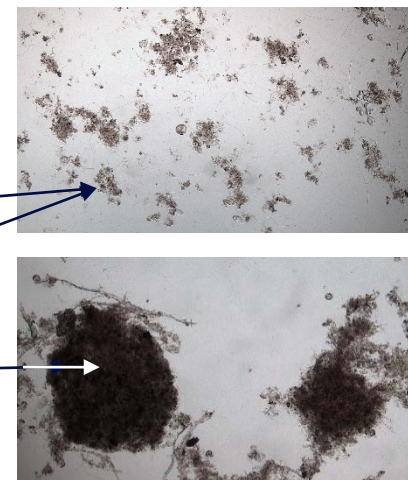
Sludge settling  
velocity up to  
**x4**  
vs CAS

# Sludge settling velocity



Product	SS kg/m <sup>3</sup>	Settling Velocity m/h	LMF* kg/m <sup>2</sup> /h
CAS	4	0,8	4
SBR	3.5	1.7	6
Cyclor® Turbo	3.5	3.5	12

\*LMF = Limit Massic Flux





**Libourne** (France)

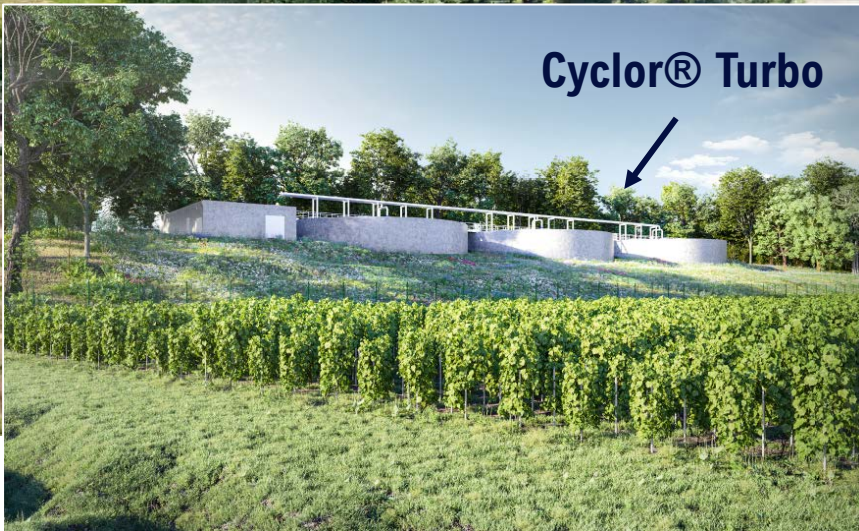
## Cyclor® Turbo: advanced Sequenced Batch Reactor

- Client: CALI Communauté d'Agglomération du Libournais
- 47 000 PE
- 20 M Euros CAPEX

Operating building



**Cyclor® Turbo**





THANK YOU  
FOR YOUR ATTENTION

