Scale-up of low-carbon footprint material recovery techniques
in existing wastewater treatment plants
"SMART-Plant"

Treviso, 08 Febbraio 2018

L'azione di innovazione Horizon2020 SMART-Plant: focus su valorizzazione fanghi per rimozione azoto via-nitrito, recupero di fosforo o biopolimeri

Francesco Fatone and SMART-Plant Consortium

Co-funded by the Horizon 2020 programme of the European Union

Supported by the Horizon 2020 Framework Programme of the European Union

www.smart-plant.eu
smart_plant_eu

SMART-Plant

Scale-up of low-carbon footprint material recovery techniques in existing wastewater treatment plants "SMART-Plant"

Co-funded by the Horizon 2020 programme of the European Union

THANK YOU !

www.smart-plant.eu

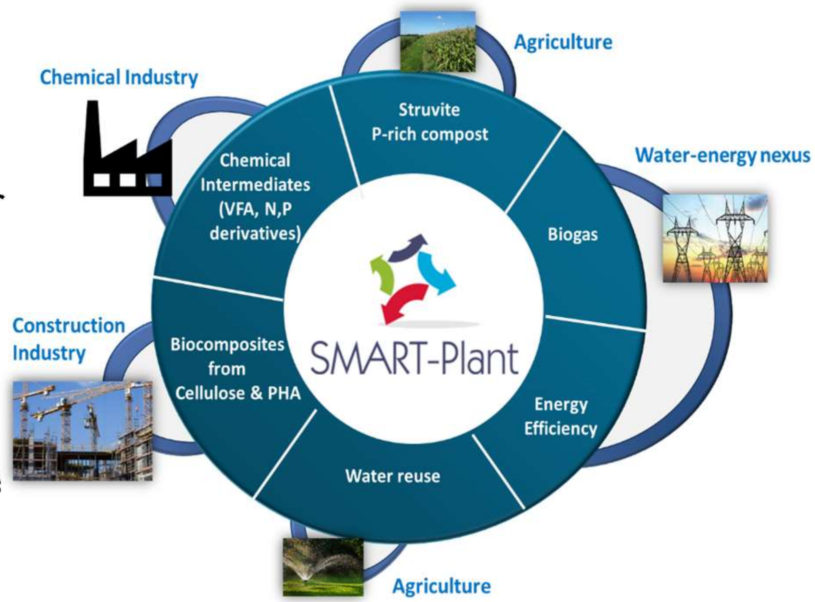
Chapters of the presentation

1. SMART-Plant: Scale-up of low-carbon footprint MAterial Recovery Techniques for upgrading existing wastewater treatment Plants → overview of the Innovation Action
2. Focus on the Carbonera SMARTechs: S.C.E.N.A. and S.C.E.P.P.H.A.R. systems

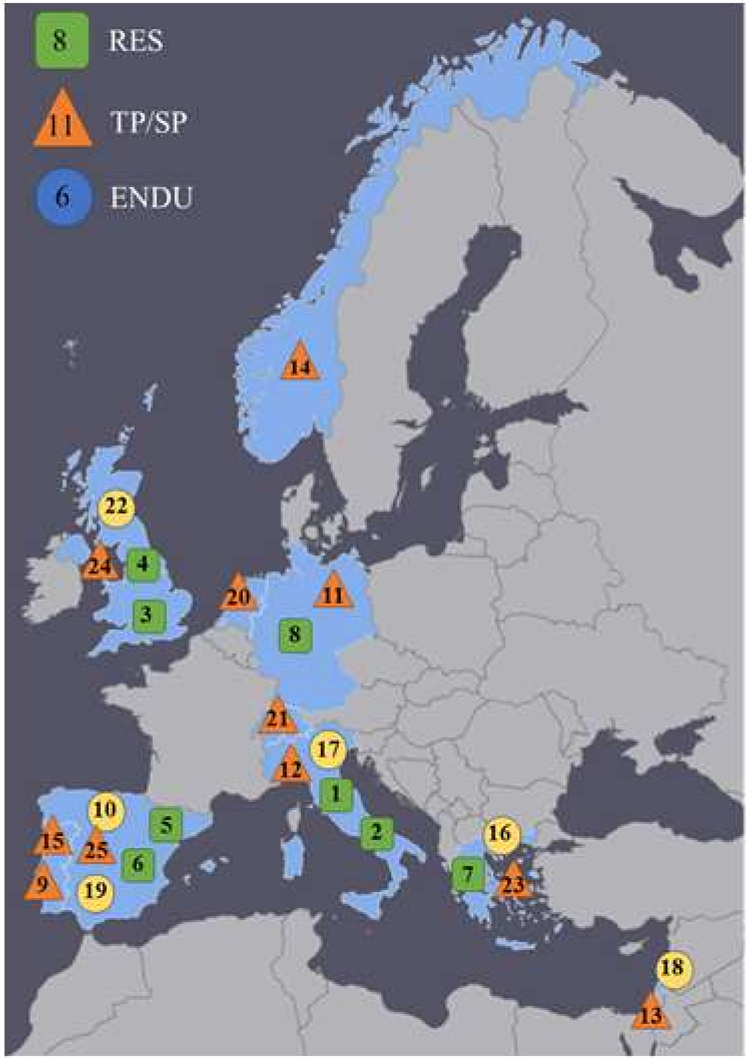
Co-funded by the Horizon 2020 programme of the European Union

SMART-Plant general objective and vision

To validate and to address to the market a portfolio of **n.9 eco-innovative solutions** (the SMARTechnologies) that, singularly or combined, can renovate and upgrade existing municipal wastewater treatment plants (WWTPs) to water resource recovery facilities (WRRFs). In particular, SMART-Plant aims at **reducing the energy and environmental footprint and, contemporary, at recovering valuable materials** (the SMART-Products: water, cellulose, biopolymers, nutrients) **that are valued in construction, chemical and agriculture supply chain**



Co-funded by the Horizon 2020 programme of the European Union



SMART-Plant partners

- 8 Research Organisations
- 11+1 Technology/Service Providers
- 6 Water utilities

Main SMART-Plant interactions in Europe

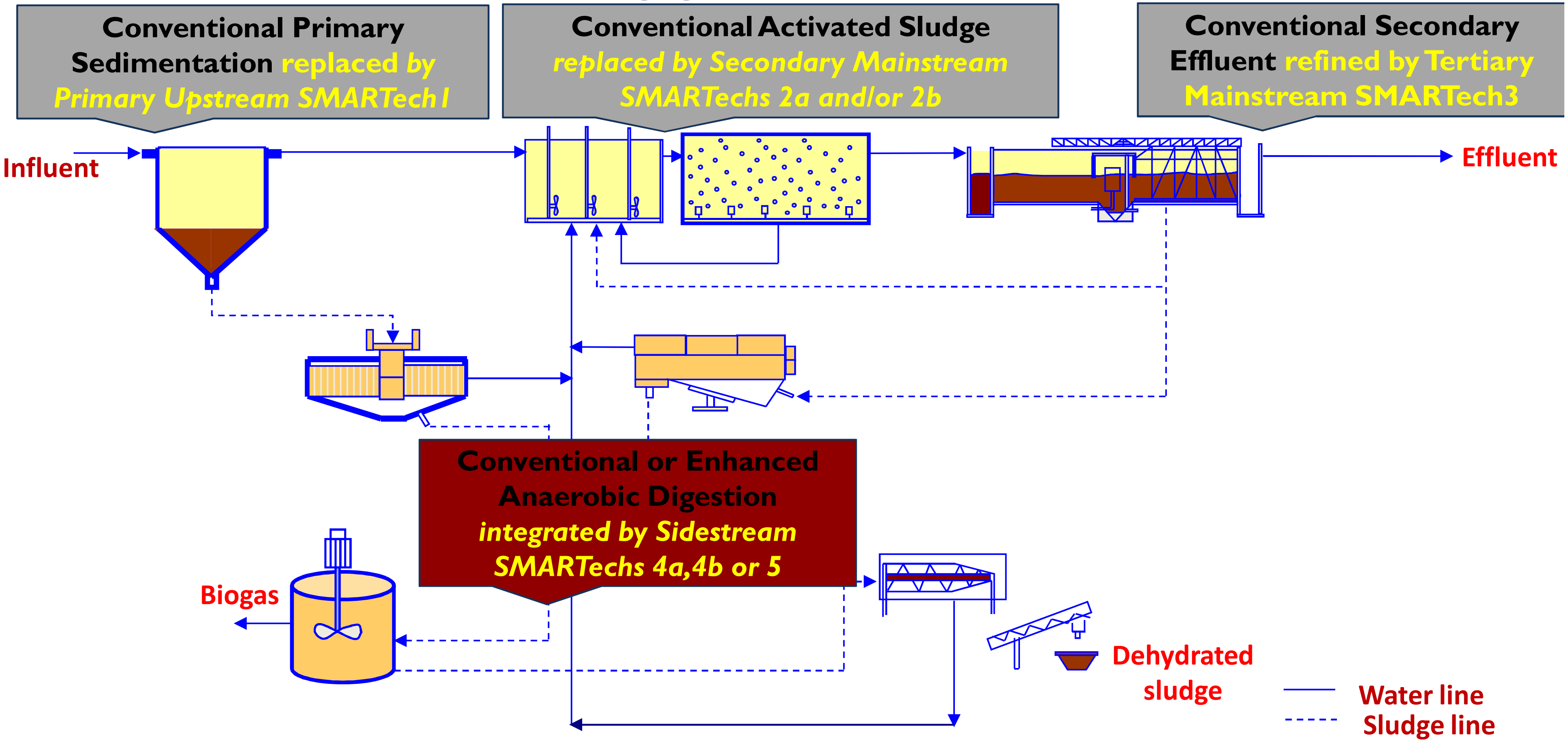
European Sustainable Phosphorus Platform

WssTP

ict4water.eu

Co-funded by the Horizon 2020 programme of the European Union

SMART-Plant approach and SMARTechs



Co-funded by the Horizon 2020 programme
of the European Union

The existing WWTPs upgraded to WRRFs

SMARTech n.	Integrated municipal WWTP	Key enabling process(es)	SMART-product(s)
1	Geestmerambacht (Netherlands)	Upstream dynamic fine-screen and post-processing of cellulosic sludge	**Cellulosic sludge, refined clean cellulose**
2a	Karmiel (Israel)	Mainstream polyurethane-based anaerobic biofilter	**Biogas, Energy-efficient water reuse**
2b	Manresa (Spain)	Mainstream SCEPPHAR	**P-rich sludge, PHA**
3	Cranfield (UK)	Mainstream tertiary hybrid ion exchange	**Nutrients**
4a	Carbonera (Italy)	Sidestream SCENA	**P-rich sludge, VFA**
4b	Psyttalia (Greece)	Sidestream Thermal hydrolysis – SCENA	**P-rich sludge**
5	Carbonera (Italy)	Sidestream SCEPPHAR	**PHA, struvite, VFA**

Co-funded by the Horizon 2020 programme of the European Union

SMART-Plant

Scale-up of low-carbon footprint material recovery techniques
in existing wastewater treatment plants
"SMART-Plant"

Primary dynamic sieving and clean cellulose recovery

2009-2015: Several pilot scale implementations at real environment

SMART-Plant →

2016-2020: Development and optimization of demo with capacity of 8400 m^3/d producing approx 2,00 360 kg/d cellulose

BBC WORLD NEWS

AQUATECH INNOVATION AWARD AQUATECH AMSTERDAM 2017

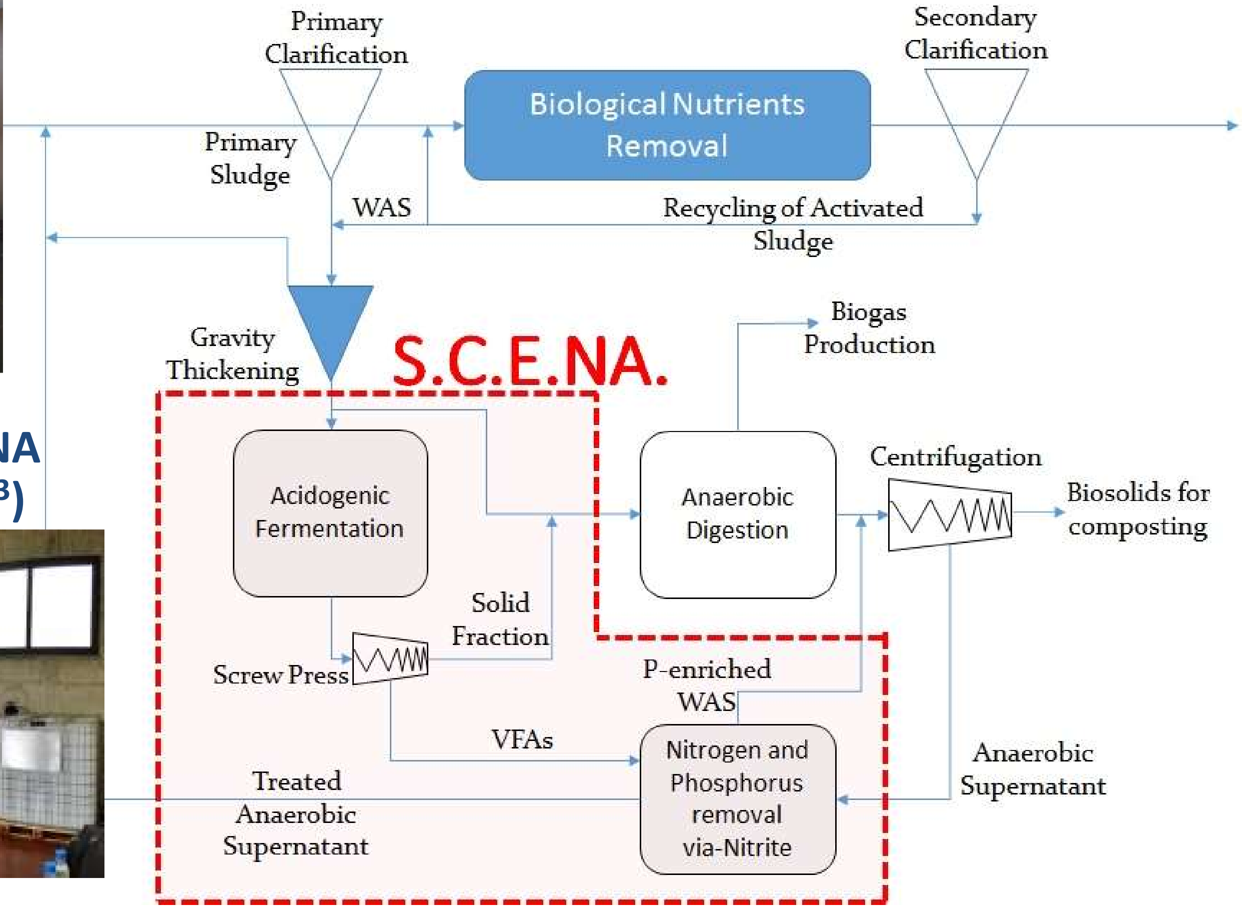
- Create a constant stream of re-used cellulose, by a validated process
- Validated application of sustainable re-use
- Develop other applications (Bio-composites, insulation material)

Co-funded by the Horizon 2020 programme of the European Union

Short-cut enhanced nutrients abatement to treat sludge liquors

2011-2013: Lab scale SCENA process in Verona (30 L)

2014-2016: Pilot scale SCENA process in Carbonera (3 m^3)



Co-funded by the Horizon 2020 programme of the European Union

SCENA application at demo scale

Carbonera WWTP
100 m^3/d reject water

SCENA bridging the gap between small pilot application and large demo or even full scale application in real environment

- Validate and demonstrate that SCENA is an effective and low carbon footprint process for nutrient removal/recovery

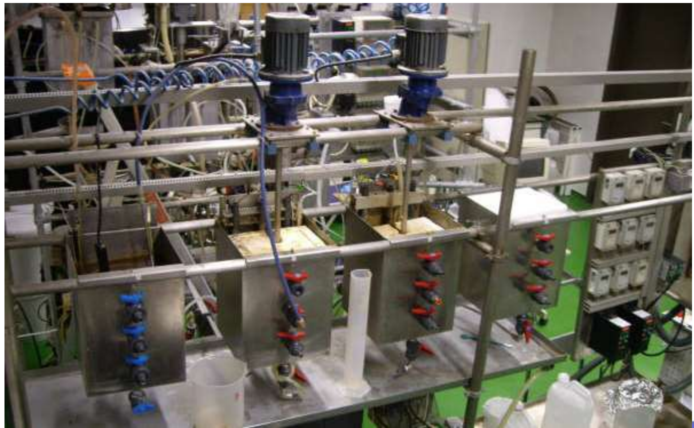
Psyttalia WWTP
2-3 m^3/d reject water

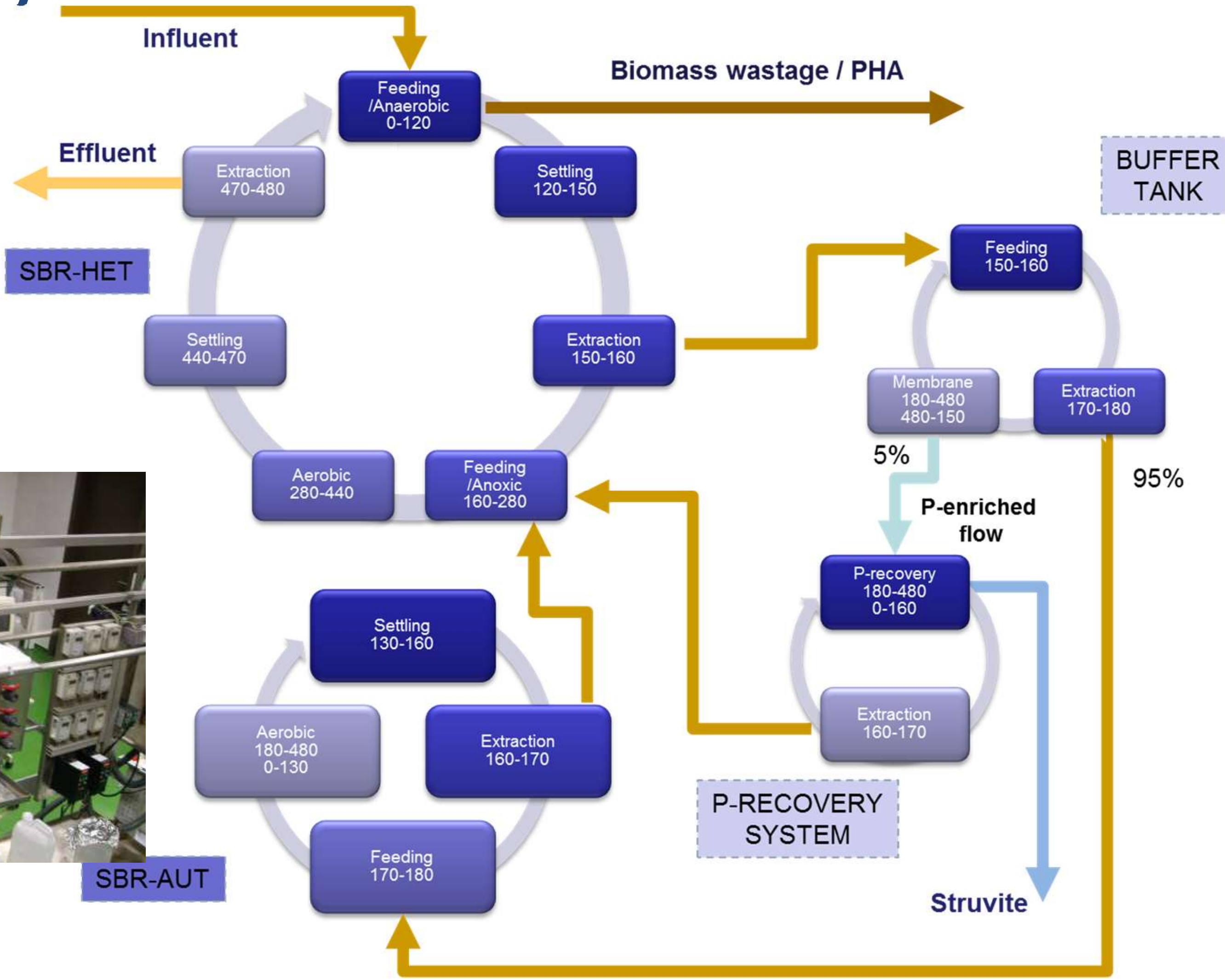
Co-funded by the Horizon 2020 programme of the European Union

Secondary mainstream SCEPPHAR

- Two SBR
- Buffer tank
- P-recovery system

2004-2010: Lab scale testing (10 L & 100 L)

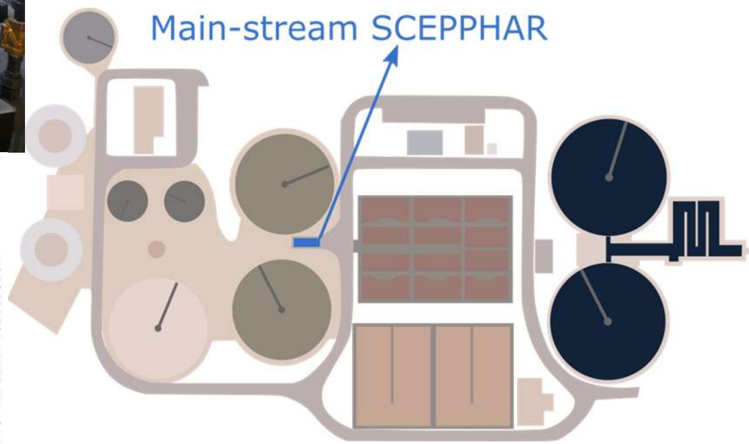




Co-funded by the Horizon 2020 programme of the European Union

Mainstream SCEPPHAR application in SMART-Plant

- Implementation in a full-scale WWTP
- Much higher volume
- Real WWTP operation (temperature, sewage)
- Full-scale equipment and automation



Manresa participa en un projecte europeu per dissenyar les depuradores del futur

▶ L'equipament d'Aigües de Manresa generarà productes de valor afegit que extraurà de l'aigua al mateix temps que es depura

Jordi Morros
MANRESA

■ Les depuradores del futur no tan sols seran equipaments per tractar aigües residuals i tornar-les netes al riu. També recuperaran components que hi ha a l'aigua i es convertiran en productors de materials nous i de valor afegit.

A Manresa aquest procés ja ha començat. La depuradora d'Aigües de Manresa participa en un projecte pilot pioner al món que la Unió Europea ha finançat amb gairebé 10 milions d'euros per generar aquests nous productes a la vegada que depura l'aigua. El projecte, Smart-Plan, el lidera l'Autònoma de Barcelona.

S'hi ha instal·lat una planta pilot per poder dur a terme aquest procés. En el cas de la capital del Bages l'objectiu és aconseguir fòsfor per a adobs i bioplàstics que hi ha en microorganismes de l'aigua, material que es podria destinar per a components de l'automòbil o objectes de decoració.

Ahir es va fer la presentació del projecte a les mateixes instal·lacions de la depuradora. A l'acte hi van intervenir el vicerector d'Innovació i Projectes Estratègics de la UAB, Javier de la Fuente; el director d'Operacions d'Aigües de Manresa, Ricard Tomàs; la cap d'explotació de l'Agència Catalana de l'Aigua, Elisabet Mas, i el primer tinent d'alcalde de l'Ajuntament de Manresa, Marc Aloy.

De la Fuente va explicar que una universitat pública té l'obligació de dur a terme accions que impactin en la societat. Aquesta n'és una, va assegurar, perquè permet avançar cap a les depuradores del futur. «Canviem el paradigma: volem que permeti recuperar productes i a més a més generar energia en lloc de consumir-ne».

Mas va donar suport a la iniciativa en nom de l'ACA , i Tomàs va recordar que Aigües de Manresa sempre ha apostat per la investigació i la innovació.

Aloy, per la seva part, va destacar que es tracta d'un projecte científic en el qual participa una empresa municipal. En aquest cas Aigües de Manresa. «No només fa la gestió bàsica d'un servei públic sinó que afronta nous reptes de desenvolupament». Durant la seva intervenció va assegurar que gràcies a l'evolució científica, tecnològica i de recerca, un equipament que es va concebre amb una missió determinada, el tractament d'aigües residuals, es converteix en una fàbrica de recursos. Ho va posar com a exemple del nou concepte d'economia circular, basada en el reaprofitament de matèries i, per tant, la reducció de residus.

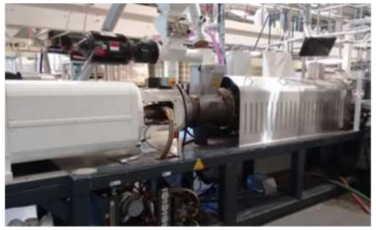
A l'estudi hi participen 26 socis de 10 països, entre els quals Holanda, Regne Unit, Itàlia i Israel. En cadascun d'aquests països hi ha una planta pilot com la de la depuradora. La investigació a Manresa s'endú 600.000 euros dels 10 milions de la Unió Europea. 200.000 són d'Aigües de Manresa, que és qui ha fet la planta pilot i qui en fa el manteniment. La resta, 400.000 euros, la gestiona la Universitat Autònoma de Barcelona per contractar el personal que s'encarrega de la investigació.

J.M.G.

El cap del projecte, Joan Baeza, mostra la planta pilot al vicerector de la UAB i als regidors Aloy i Sala

Co-funded by the Horizon 2020 programme of the European Union

Post-processing of recovered cellulose and PHA for bio-composites production



Cellulose /Plastic Composites

+

Wood/PHA Composites

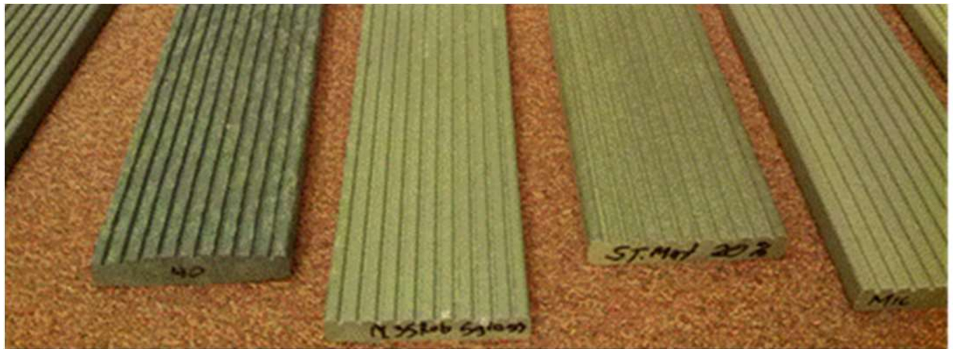
Stiffening/Toughening
Compatibilisation
Plasticisation
Functionalisation

Optimal Formulation

Cellulose/PHA Composites

- Chemical structure & bonding
- Crystalline structure
- Microstructure
- Bulk mechanical property
- In situ mechanical property
- Thermal property
- Barrier property
- Hydrophilicity/hydrophobicity
- Biodegradability

Development of lignocellulosic PHA biocomposites



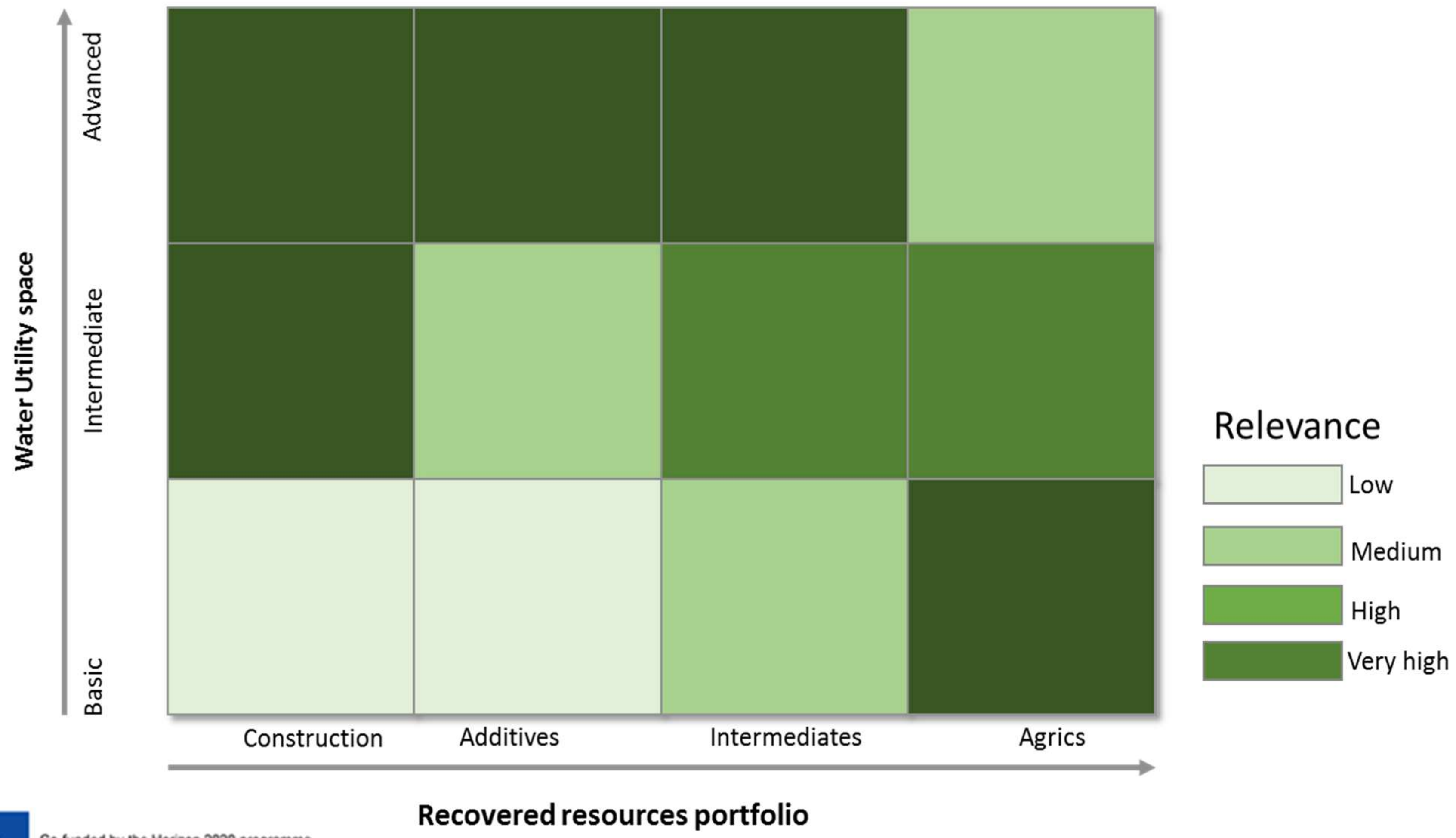
Co-funded by the Horizon 2020 programme of the European Union

SMART-Plant benefits

Category	Main Benefits
Technical	• Validate and demonstrate that technologies are working well at real conditions and at demo scale • Technology Verification • Solving real operating problems
Environmental	• Low carbon footprint through online recording of energy and GHG emissions
Social	• Social acceptance of derived materials • Improved water utility reputation through the use of advance technologies and '*green and circular feedstock*'
Financial	• Cost-efficiency • Impact on water tariff • Circular inter-sectorial value chain with chemical, agricultural and construction sectors

Co-funded by the Horizon 2020 programme of the European Union

SMART-Plant exploitation matrix and heat map



Co-funded by the Horizon 2020 programme
of the European Union

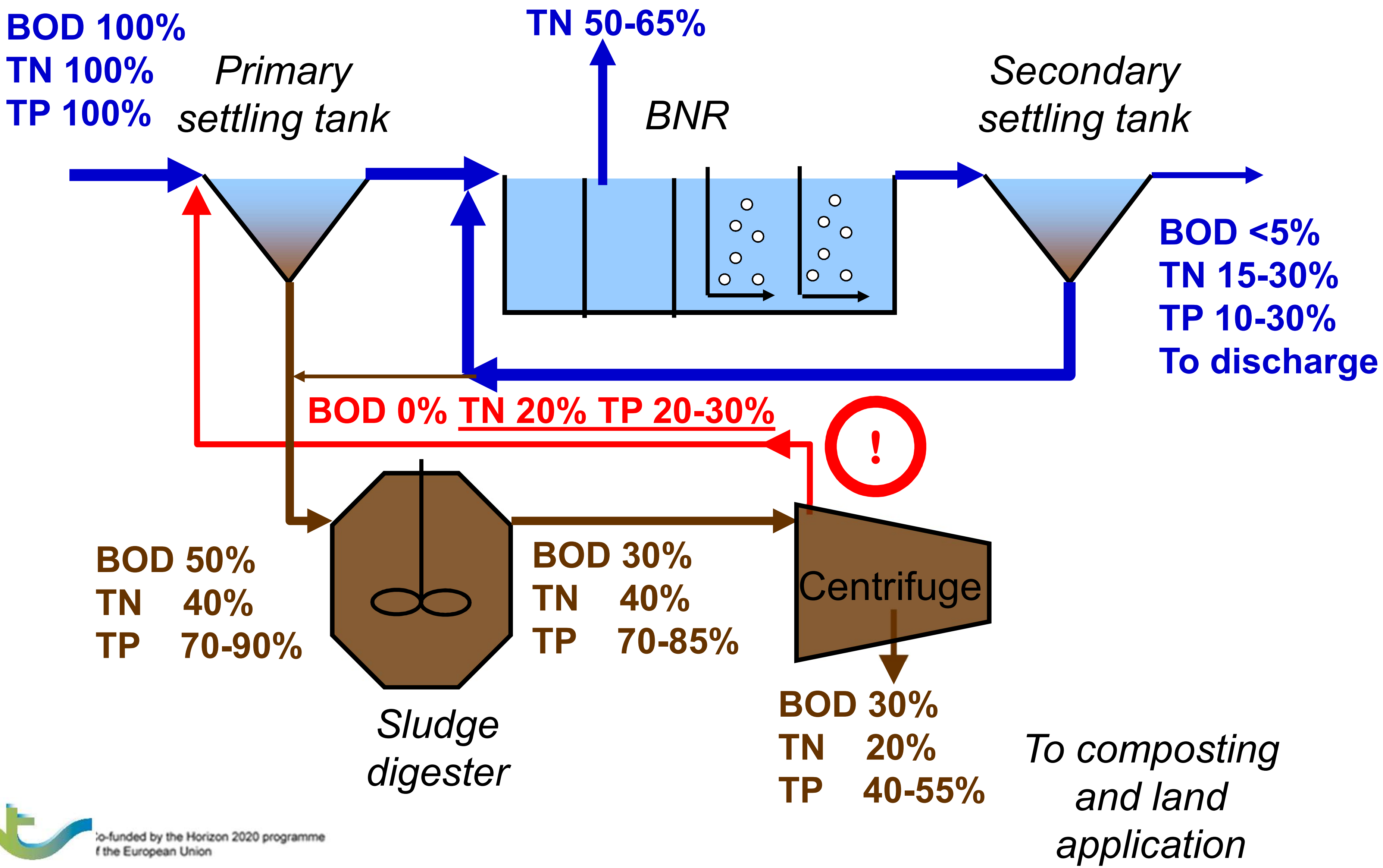
Focus on via-nitrite nitrogen removal, phosphorus or biopolymers recovery in Carbonera sewage sludge treatment line

Co-funded by the Horizon 2020 programme
of the European Union

Nutrient recovery from wastewater: opportunities & challenges of EU regulatory context

Kimo van Dijk, European Sustainable Phosphorus Platform (ESPP)
kimovandijk@phosphorusplatform.eu

BNR AND ANAEROBIC DIGESTION



Co-funded by the Horizon 2020 programme of the European Union

ALTO TREVIGIANO SERVIZI

WHEN SLUDGE THERMAL HYDROLYSIS IS APPLIED…

AMMONIA CONCENTRATION IN DIGESTERS

DIGESTER FEED DRY SOLIDS % w/w	DIGESTER AMMONIA CONCENTRATION (mg/l)															
VS DESTRUCTION	50%	51%	52%	53%	54%	55%	56%	57%	58%	59%	60%	61%	62%	63%	64%	65%
3.5	850	850	850	900	900	900	950	950	950	1,000	1,000	1,000	1,050	1,050	1,050	1,100
4.0	950	950	1,000	1,000	1,050	1,050	1,050	1,100	1,100	1,100	1,150	1,150	1,150	1,200	1,200	1,250
4.5	1,050	1,100	1,100	1,150	1,150	1,150	1,200	1,200	1,250	1,250	1,300	1,300	1,300	1,350	1,350	1,400
5.0	1,200	1,200	1,250	1,250	1,300	1,300	1,300	1,350	1,350	1,400	1,400	1,450	1,450	1,500	1,500	1,550
5.5	1,300	1,300	1,350	1,350	1,400	1,450	1,450	1,500	1,500	1,550	1,550	1,600	1,600	1,650	1,650	1,700
6.0	1,400	1,450	1,450	1,500	1,550	1,550	1,600	1,600	1,650	1,650	1,700	1,700	1,750	1,800	1,800	1,850
6.5	1,550	1,550	1,600	1,600	1,650	1,700	1,700	1,750	1,750	1,800	1,850	1,850	1,900	1,900	1,950	2,000
7.0	1,650	1,700	1,700	1,750	1,800	1,800	1,850	1,850	1,900	1,950	1,950	2,000	2,050	2,050	2,100	2,150
7.5	1,750	1,800	1,850	1,850	1,900	1,950	1,950	2,000	2,050	2,050	2,100	2,150	2,200	2,200	2,250	2,300
8.0	1,900	1,900	1,950	2,000	2,050	2,050	2,100	2,150	2,150	2,200	2,250	2,300	2,300	2,350	2,400	2,450
8.5	2,000	2,050	2,050	2,100	2,150	2,200	2,250	2,250	2,300	2,350	2,400	2,450	2,450	2,500	2,550	2,600
9.0	2,100	2,150	2,200	2,250	2,300	2,300	2,350	2,400	2,450	2,500	2,550	2,550	2,600	2,650	2,700	2,750
9.5	2,200	2,250	2,300	2,350	2,400	2,450	2,500	2,550	2,600	2,600	2,650	2,700	2,750	2,800	2,850	2,900
10.0	2,350	2,400	2,450	2,500	2,550	2,550	2,600	2,650	2,700	2,750	2,800	2,850	2,900	2,950	3,000	3,050
10.5	2,450	2,500	2,550	2,600	2,650	2,700	2,750	2,800	2,850	2,900	2,950	3,000	3,050	3,100	3,150	3,200
11.0	2,550	2,600	2,650	2,700	2,800	2,850	2,900	2,950	3,000	3,050	3,100	3,150	3,200	3,250	3,300	3,350

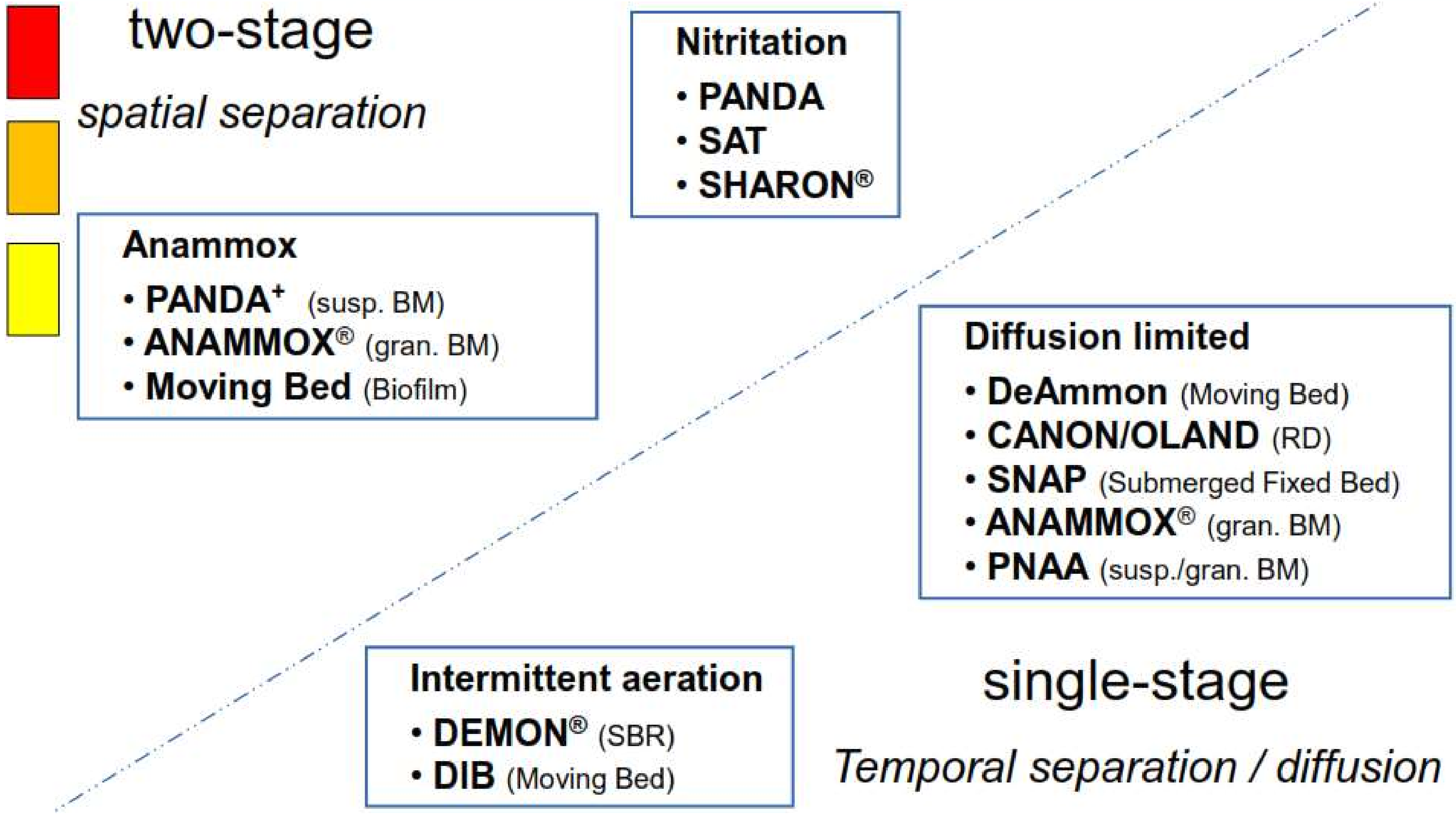
CONVENTIONAL

THP

Co-funded by the Horizon 2020 programme of the European Union

2.500 – 3.000 mgN-NH4/l

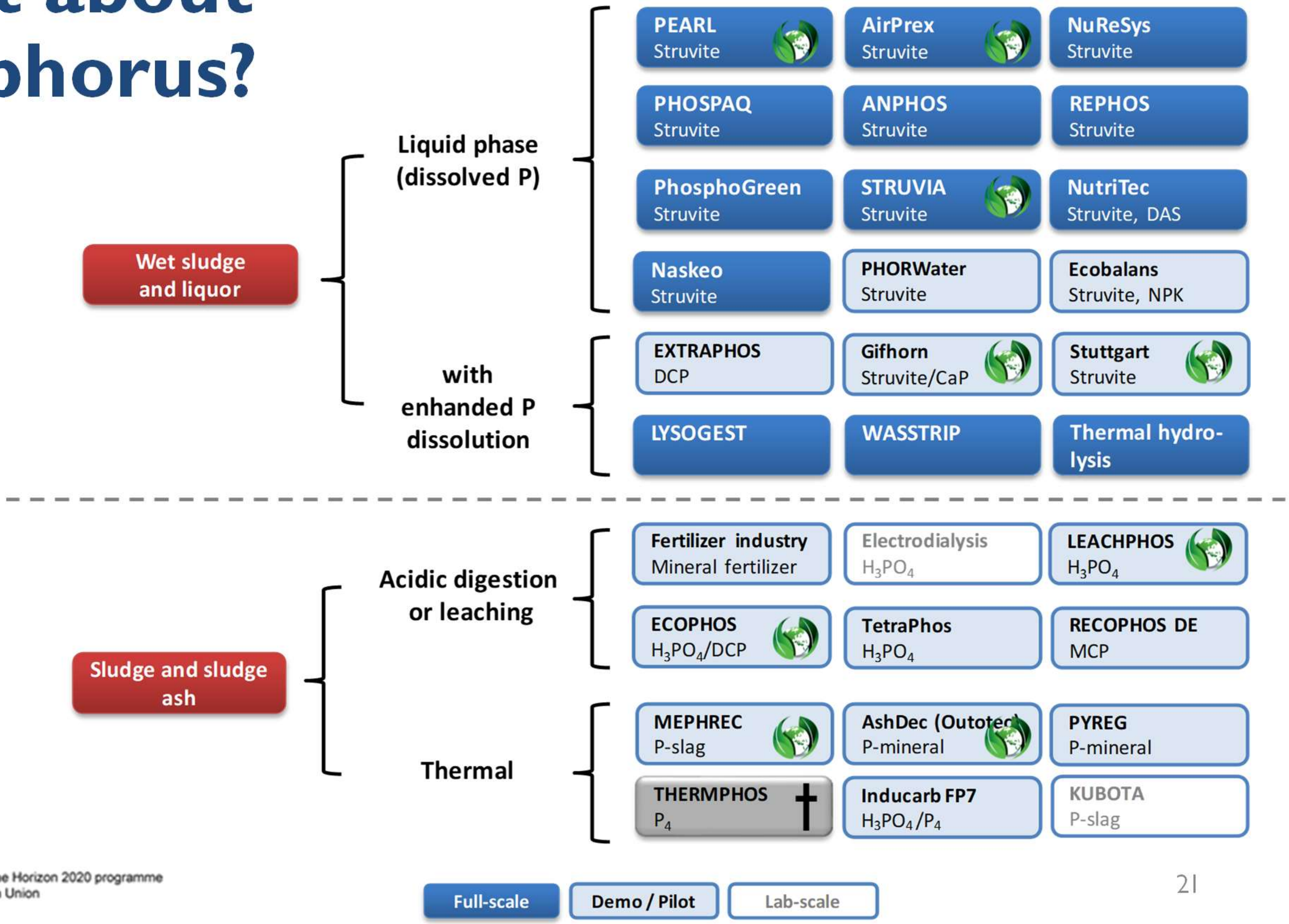
NITROGEN AUTOTROPHIC REMOVAL? OFTEN THE BEST SOLUTION.



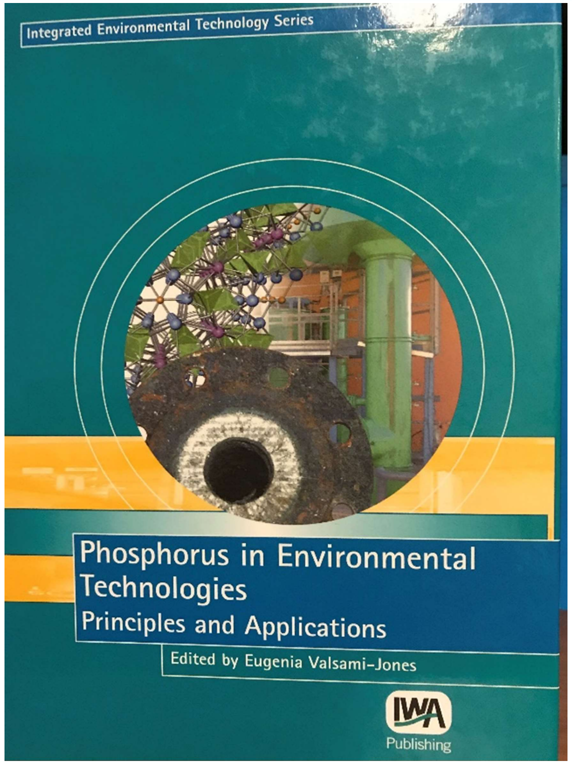
More than 100 full scale plants for side-stream treatment

Courtesy Yvonne Schneider

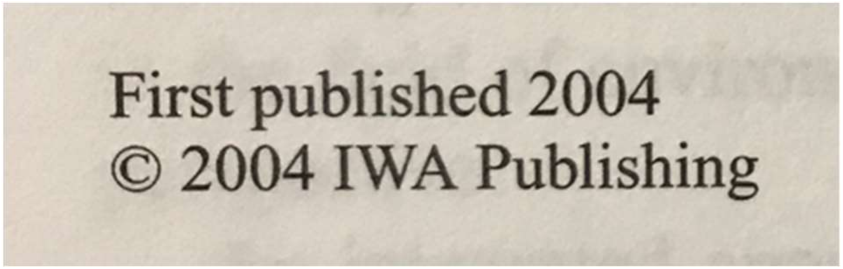
What about phosphorus?



Co-funded by the Horizon 2020 programme of the European Union



Once upon a time…

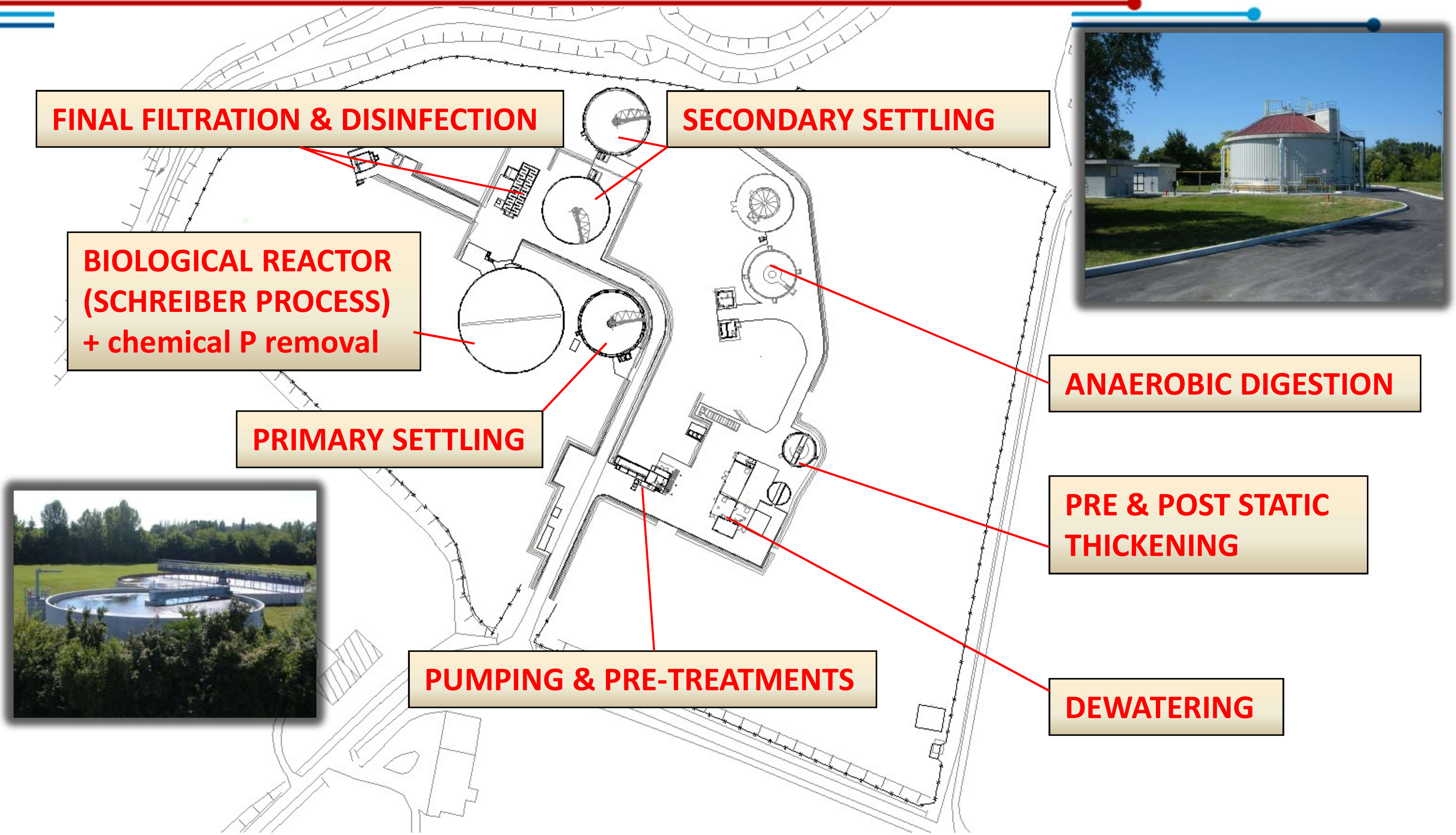


The P recovery full scale plant in the cover is located in TREVISO municipal wastewater treatment plant

CONSTRUCTED AND COMMISSIONED ABOUT 15 YEARS AGO

MADE IN ITALY

Co-funded by the Horizon 2020 programme
of the European Union



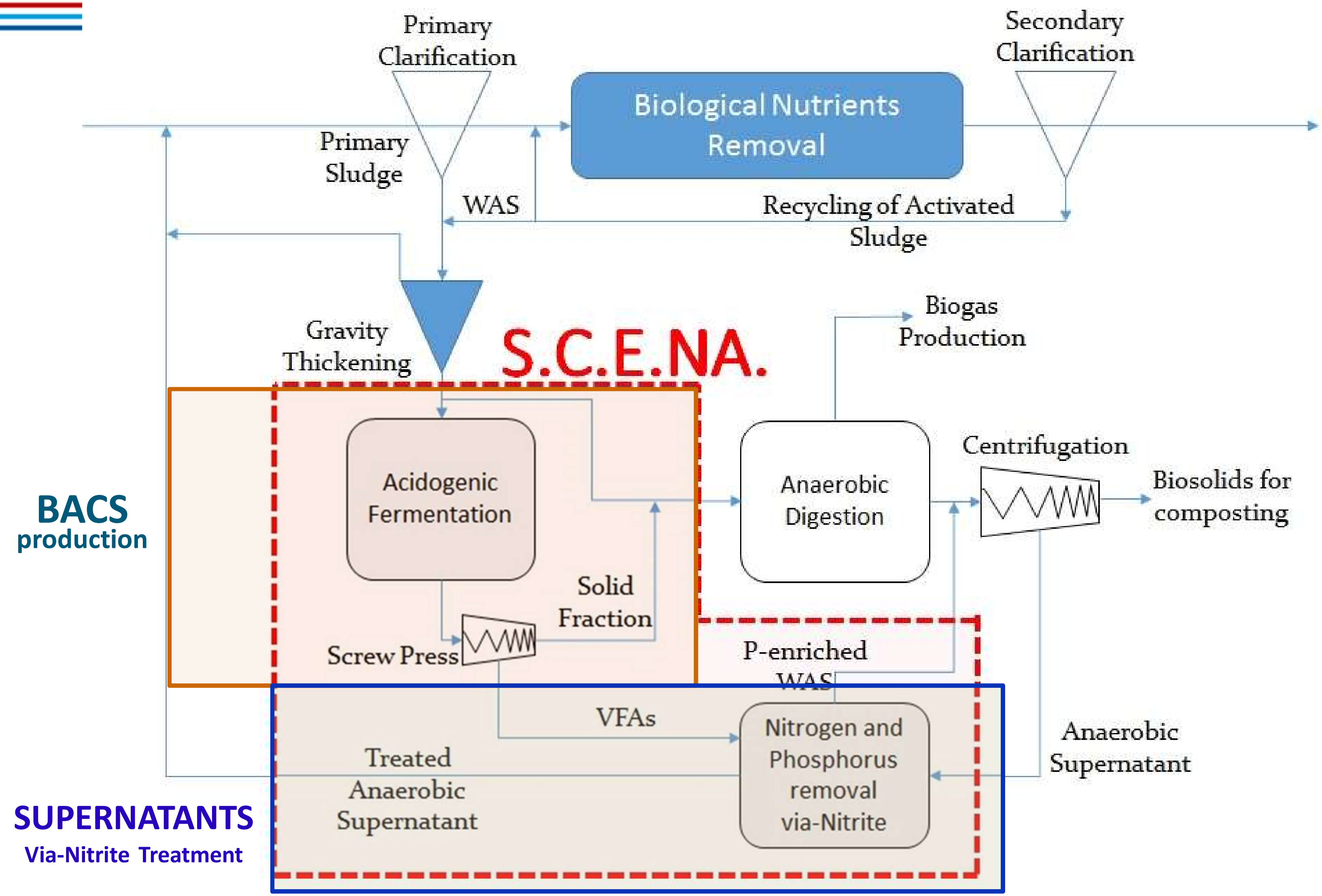
CARBONERA WWTP – 40.000 PE

Co-funded by the Horizon 2020 programme
of the European Union

The SMART bioprocesses in the Short-Cut Enhanced Nutrients Abatement (S.C.E.N.A.) for P recovery and N removal

- **Production of propionate-rich SCFA from cellulosic sludge**
- **Nitritation in aerobic conditions** (so as to also minimize N_2O emissions)
- **Denitritation and anoxic EBPR**
- *Sequencing Batch Reactor*
- *Control Automation on the basis of pH, ORP and conductivity*

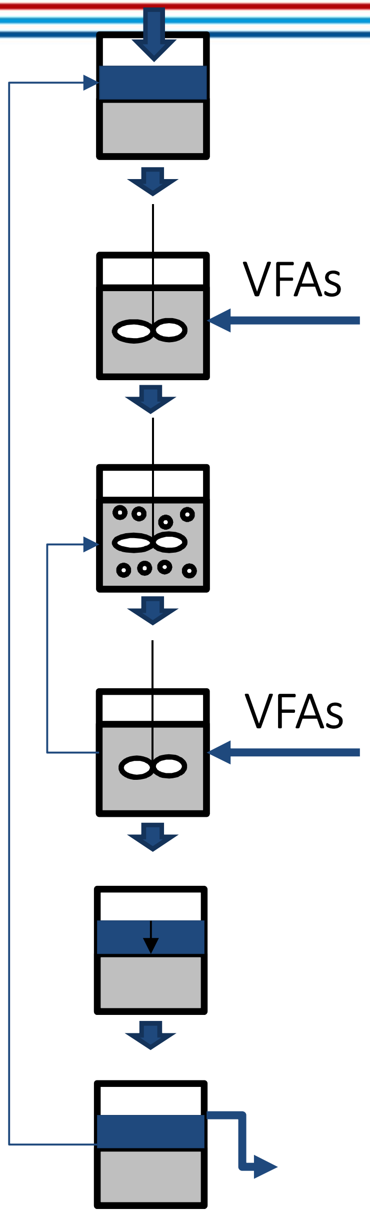
S.C.E.N.A. SYSTEM



Co-funded by the Horizon 2020 programme
of the European Union

S.C.E.N.A. SBR BASIC CYCLE

Nitrogen & Phosphorus Biological removal



1- Filling (5 min)

2- Anaerobic (60 min)

BACS Carbon source addition

3- Aerobic (180 - 200 min)

4- Anoxic (45 min)

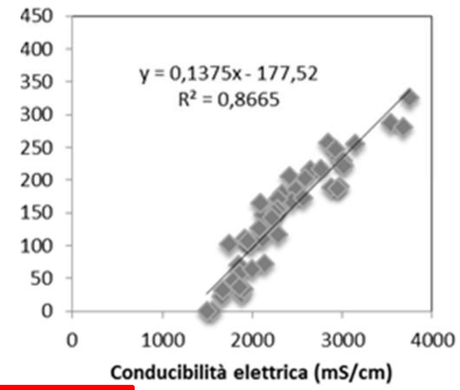
BACS Carbon source addition

5- Settling (40 min)

6- Discharge (10 min)

Co-funded by the Horizon 2020 programme of the European Union

SC-SBR VIA-NITRITE OPTIMIZATION LOGIC CONTROL



DATA CYCLE

IDENTIFICATION OF FAULTS

PROFILES SIGNAL PROCESSED

INTELLIGENT CONTROL SYSTEM

- ELECTRICAL CONDUCTIVITY
- DISSOLVED OXYGEN
- pH

% Ntot removal

N-N0$_2$ production

Dosage BACS for N&P biological removal

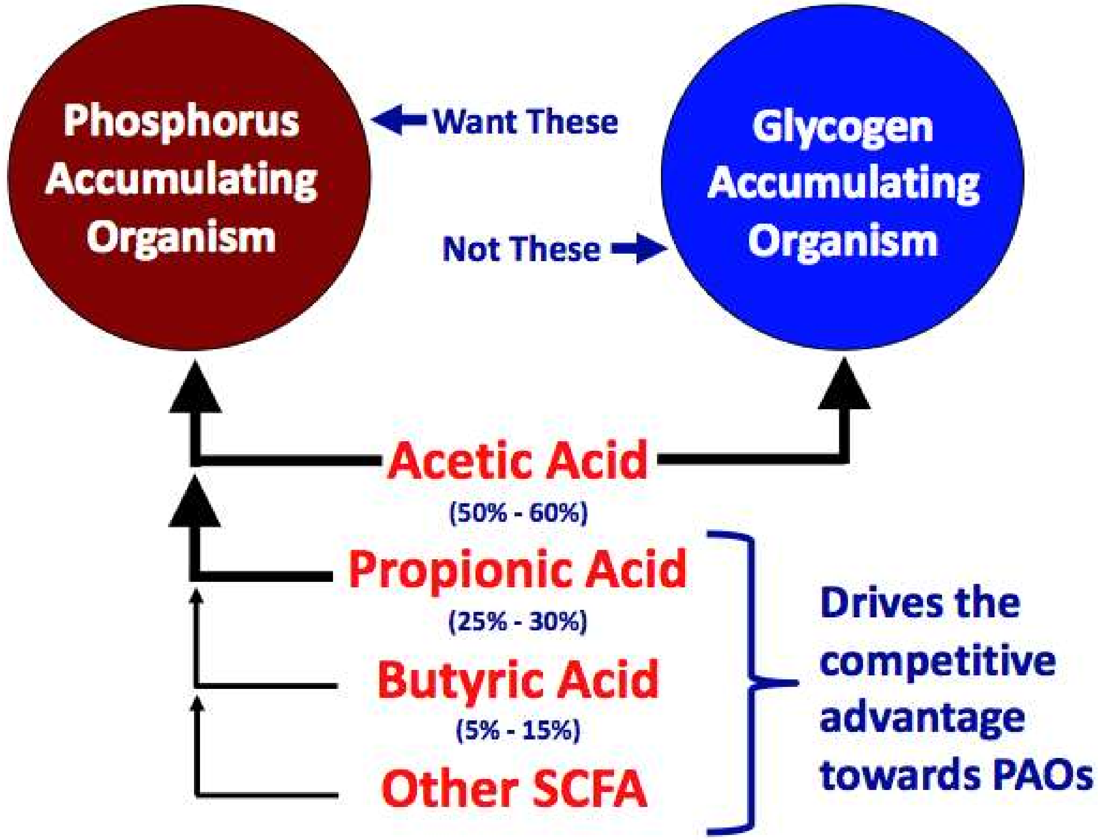
RESULTS: CONTROL POINTS OF IDENTIFICATION

MOVE TO THE NEXT STEP

Co-funded by the Horizon 2020 programme of the European Union

BACS: A MIXTURE OF SCFAS FOR DENITRATION&EPBR

PHOSPHOROUS REMOVAL



CH_3COOH

CH_3CH_2COOH

$CH_3CH_2CH_2COOH$

$CH_3CH_2CH_2...COOH$

Fermentation promotes production of acetate <u>and</u> propionate as primary by-products

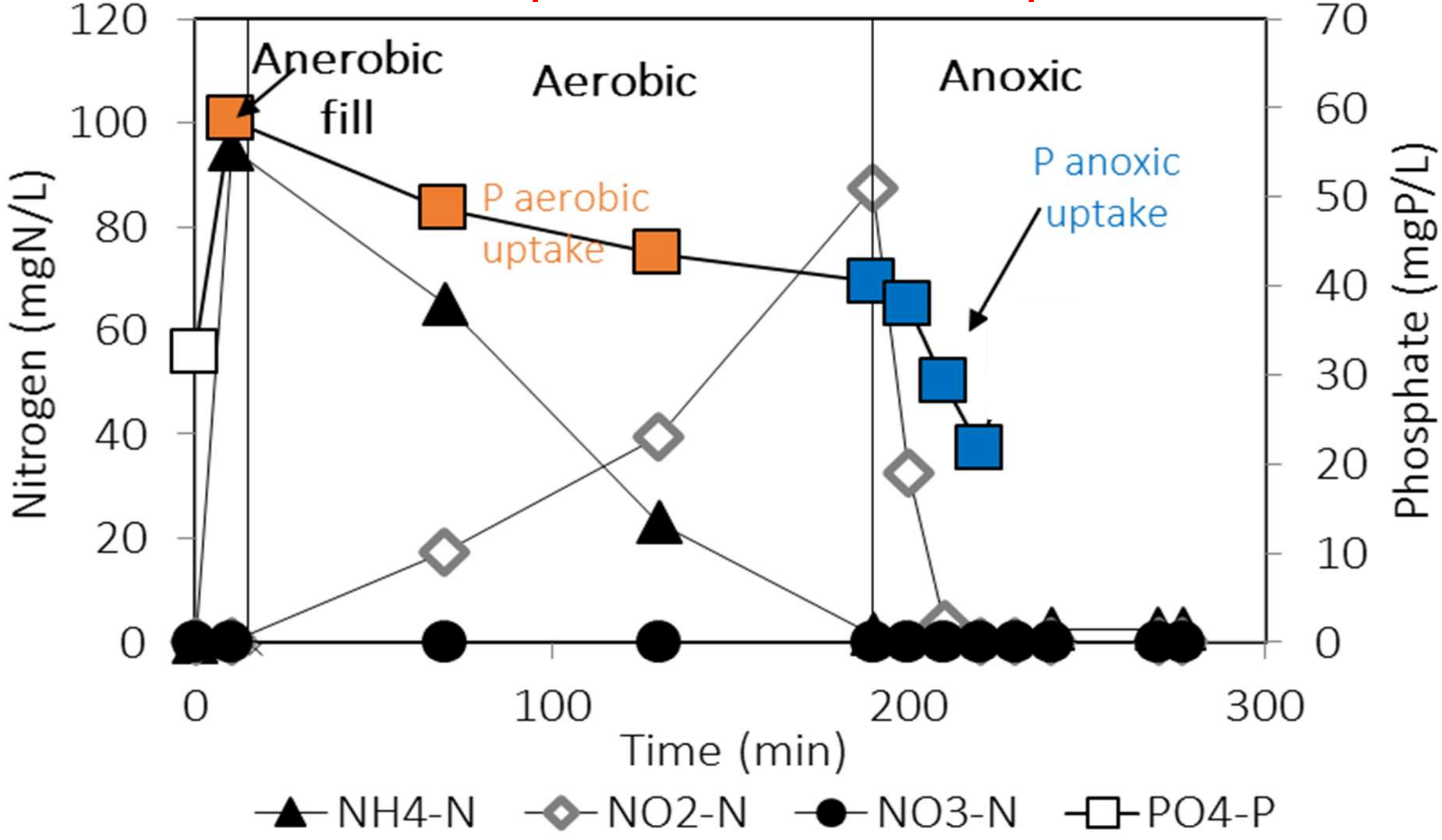
Zeng, et al (2006)
Bouzas, et al (2000)

Co-funded by the Horizon 2020 programme of the European Union

S.C.E.N.A. NITROGEN & PHOSPHORUS REMOVAL CYCLE

3 mgP/gMLVSS*h
Aerobic Uptake

15 mgP/gMLVSS*h
Anoxic Uptake



Co-funded by the Horizon 2020 programme of the European Union

S.C.E.N.A. NITROGEN REMOVAL KINETICS

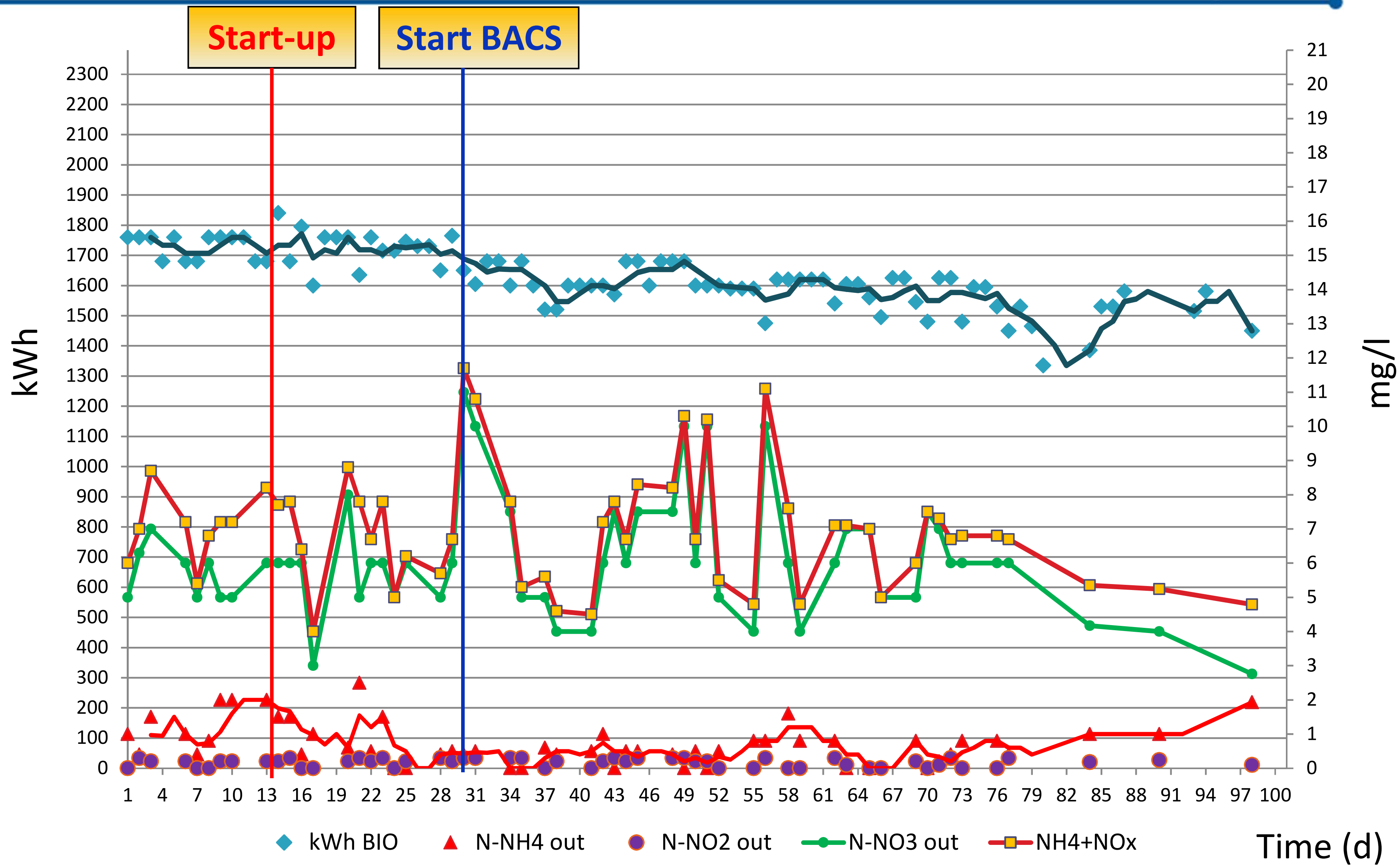
BACS dosage is automatically dosed during ANEROBIC phase and than during ANOXIC phase: the denitritation phase of the scSBR operation to remove nitrite and in the same time phosphorus.

CARBONERA S.C.E.N.A. SBR	
SPECIFIC NUTRIENTS REMOVAL RATES - (T = 20 °C)	
sAUR (mgN/gVSS*h)	12 - 15
$sNUR_{BACS}$ (mgN/gVSS*h)	35 - 40

CARBONERA WWTP MAIN LINE	
SPECIFIC NUTRIENTS REMOVAL RATES - (T = 20 °C)	
sAUR (mgN/gVSS*h)	1.5 – 2.5
sNUR (mgN/gVSS*h)	5 - 6

Co-funded by the Horizon 2020 programme of the European Union

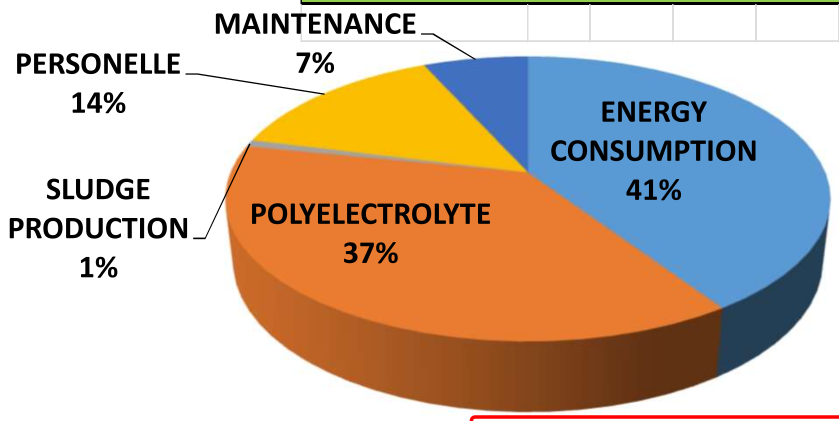
CARBONERA WWTP MAIN LINE....FIRST RESULTS



Co-funded by the Horizon 2020 programme of the European Union

SPECIFIC OPEX FOR SUPERNATANT TREATMENT AFTER 9 MONTHS OPERATION

LOAD = 29 kgN/d									€/kgN rem ...+ Prem
ENERGY CONSUMPTION						**kWh/d**		**90**	**€ 0,61**
STORAGE SUPERNATANT						**kWh/d**	**9,6**	**11%**	**€ 0,06**
Storage mixer	kW	1,6	h/d	6	kwh/d	9,6		11%	€ 0,06
SBR						**kWh/d**	**59**	**65%**	**€ 0,39**
Load pump	kW	1,8	h/d	0,4	kwh/d	0,8		0,8%	€ 0,01
Discharge pump	kW	1,35	h/d	0,8	kwh/d	1,1		1,3%	€ 0,01
Mixer SBR	kW	1,4	h/d	7,3	kwh/d	10,3		11,4%	€ 0,07
Air Blower	kW	3,7	h/d	12,6	kwh/d	46,6		51,7%	€ 0,31
FERMENTER						**kWh/d**	**12**	**13%**	**€ 0,08**
Fermenter Mixer	kW	0,5	h	24	kwh/d	12		13,3%	€ 0,08
Heating System	kW	0	h	24	kwh/d	0		0,0%	€ 0,00
S/L SEPARATOR						**kWh/d**	**10**	**11%**	**€ 0,07**
Sludge load pump	kW	0,35	h/d	6	kwh/d	2,1		2,3%	€ 0,01
Screw Press	kW	0,3	h/d	6	kwh/d	1,8		2,0%	€ 0,01
BACS pump to storage	kW	1	h/d	2	kwh/d	2		2,2%	€ 0,01
Poly pump	kW	0,32	h/d	6	kwh/d	1,92		2,1%	€ 0,01
BACS dosage pump	kW	1,4	h/d	1,4	kwh/d	1,9591837		2,2%	€ 0,01
POLYELECTROLYTE DOSAGE						**kg/d**		**9,5**	**€ 0,56**
Dosage solution poly-water	lt/h	300	h/d	6	lt/d	1800			
Dosage poly	% vol	0,5%	kg/l	1,05	kg/d	9,45			
SLUDGE PRODUCTION						**kg/d**		**4,0**	**€ 0,01**
PERSONELLE									**€ 0,21**
MAINTENANCE									**€ 0,10**
									€ 1,49



1,49 €/kgN rem...+ Prem

Carbonera WWTP
3,4 €/kgN rem
reduction of supernatants OPEX – 56%

Optimizing at 50 kgN/d → 1,0 - 1,2 €/ kgN rem...+ Prem

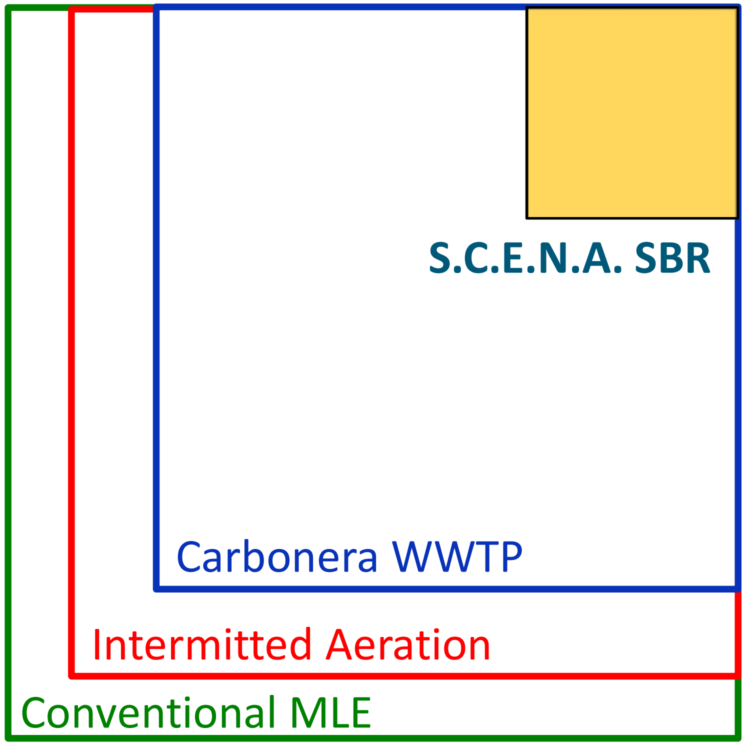
Co-funded by the Horizon 2020 programme of the European Union

FOOTPRINT : S.C.E.N.A. VS. CONVENTIONAL

How much VOLUME of Biological Reactor to treat the same Load?

	lt Reactor/P.E.	OTHERS/S.C.E.N.A.	VOLUME (mc)
Conventional MLE	180	12	**840**
Intermittent Aeration	150	10	**700**
Carbonera WWTP Main line	114	7,6	**533**
Carbonera S.C.E.N.A. SBR	15	1	**70**

- ✓ Less impact on the landscape
- ✓ Lower costs of costruction



Co-funded by the Horizon 2020 programme of the European Union

S.C.E.N.A. FULL SCALE 1.0 –
WATER RESEARCH PAPER (2017)

Water Research 125 (2017) 478–489

Contents lists available at ScienceDirect

Water Research

journal homepage: www.elsevier.com/locate/watres

ELSEVIER

Is SCENA a good approach for side-stream integrated treatment from an environmental and economic point of view?

CrossMark

Stefano Longo [a, *], Nicola Frison [b], Daniele Renzi [c], Francesco Fatone [d], Almudena Hospido [a]

[a] Department of Chemical Engineering, Institute of Technology, Universidade de Santiago de Compostela, 15782 Santiago de Compostela, Galicia, Spain
[b] Department of Biotechnology, University of Verona, Strada Le Grazie 15, 37134 Verona, Italy
[c] Alto Trevigiano Servizi Srl, Ufficio Ottimizzazione Processi depurativi, Via Schiavonesca Priula 86, 31044 Montebelluna, Italy
[d] Department SIMAU, Faculty of Engineering, Polytechnic University of Marche, Via Brecce Bianche 12, Ancona, Italy

A R T I C L E I N F O

Article history:
Received 14 March 2017
Received in revised form
1 September 2017
Accepted 2 September 2017
Available online 6 September 2017

Keywords:
Short cut enhanced nutrient abatement (SCENA)
Side-stream treatment
Life cycle analysis (LCA)
Life cycle cost (LCC)
Monte carlo analysis
Sludge phosphorus availability

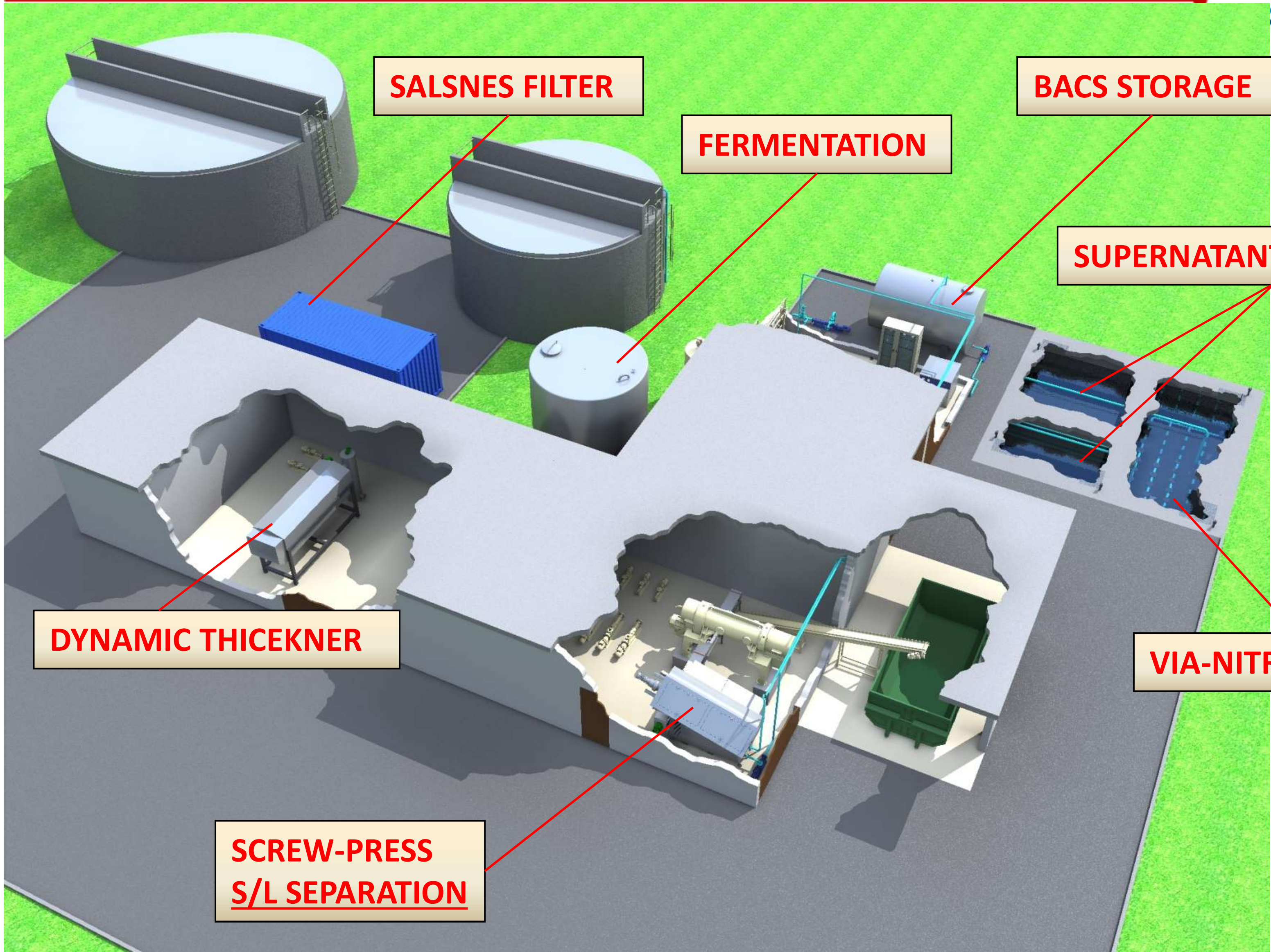
A B S T R A C T

The environmental and economic benefits and burdens of including the first Short Cut Enhanced Nutrient Abatement (SCENA) into a real municipal wastewater treatment plant were evaluated using life cycle assessment (LCA) and life cycle cost (LCC). The implications of accomplishing nitrogen (N) removal and phosphorus (P) recovery via nitrite in the side stream were assessed taking into account the actual effluent quality improvement, the changes in the electricity and chemical consumption, N_2O, CO_2 and CH_4 emissions and the effects of land application of biosolids, among others. In addition, a case-specific estimation of the P availability when sludge is applied to land, therefore replacing conventional fertilizer, was performed. Furthermore, to account for the variability in input parameters, and to address the related uncertainties, Monte Carlo simulation was applied.

The analysis revealed that SCENA in the side stream is an economic and environmentally friendly solution compared to the traditional plant layout with no side-stream treatment, thanks to the reduction of energy and chemical use for the removal of N and P, respectively. The uncertainty analysis proved the validity of the LCA results for global warming potential and impact categories related to the consumption of fossil-based electricity and chemicals, while robust conclusions could not be drawn on freshwater eutrophication and toxicity-related impact categories. Furthermore, three optimization scenarios were also evaluated proving that the performance of the WWTP can be further improved by, for instance, substituting gravitational for mechanical thickening of the sludge or changing the operational strategy to the chemically enhanced primary treatment, although this second alternative will increase the operational cost by 5%. Finally, the outcomes show that shifting P removal from chemical precipitation in the main line to biologically enhanced uptake in the side stream is key to reducing chemicals use, thus the operational cost, and increasing the environmental benefit of synthetic fertilizers replacement.

Co-funded by the Horiz
of the European Union

SCENA 2.0 WITHIN SMART-PLANT



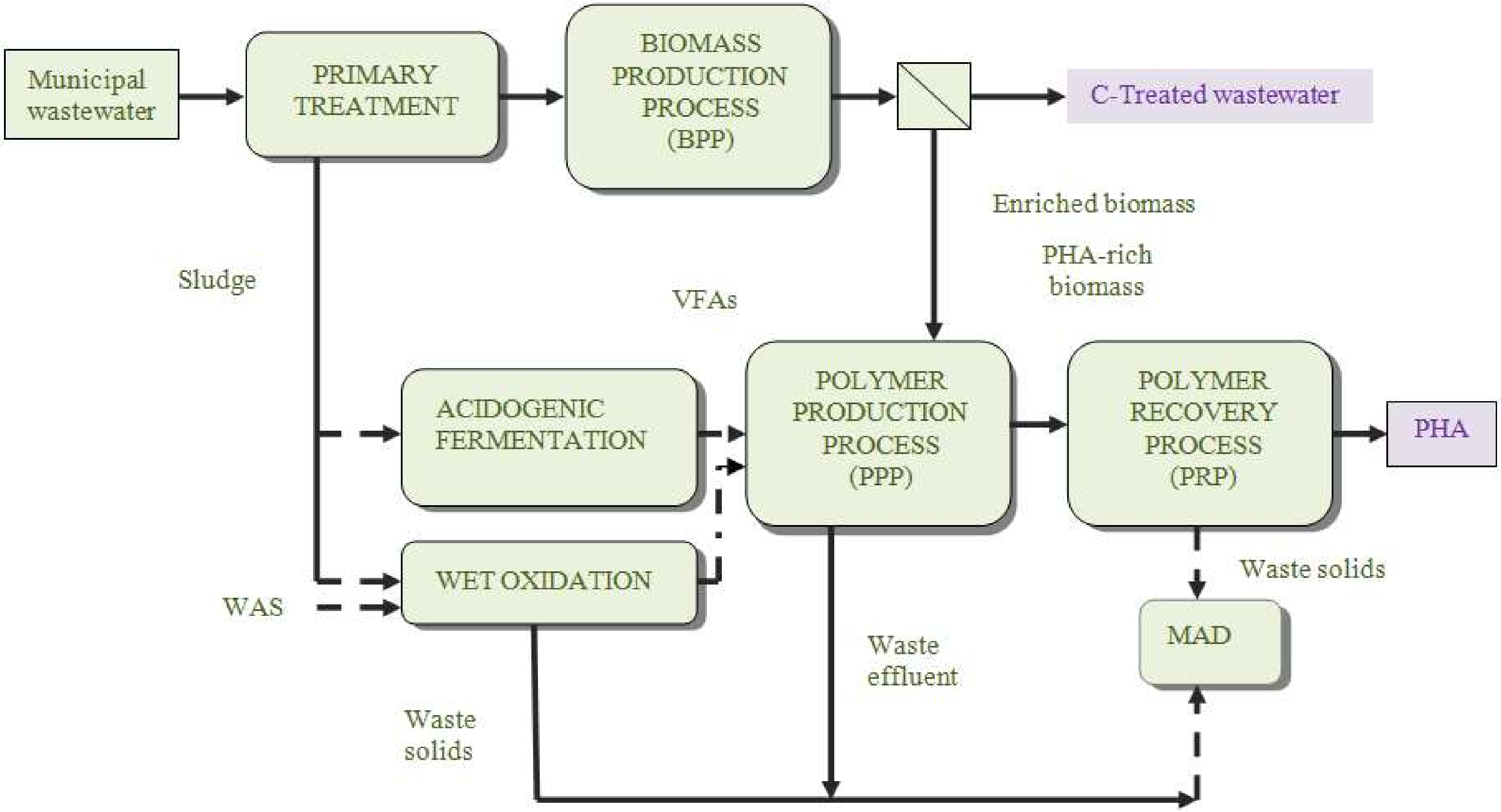
SMART-Plant

Co-funded by the Horizon 2020 programme of the European Union

ALTO TREVIGIANO SERVIZI

SCEPPHAR: via nitrite nitrogen removal and PHA recovery from cellulosic sludge

Co-funded by the Horizon 2020 programme
of the European Union



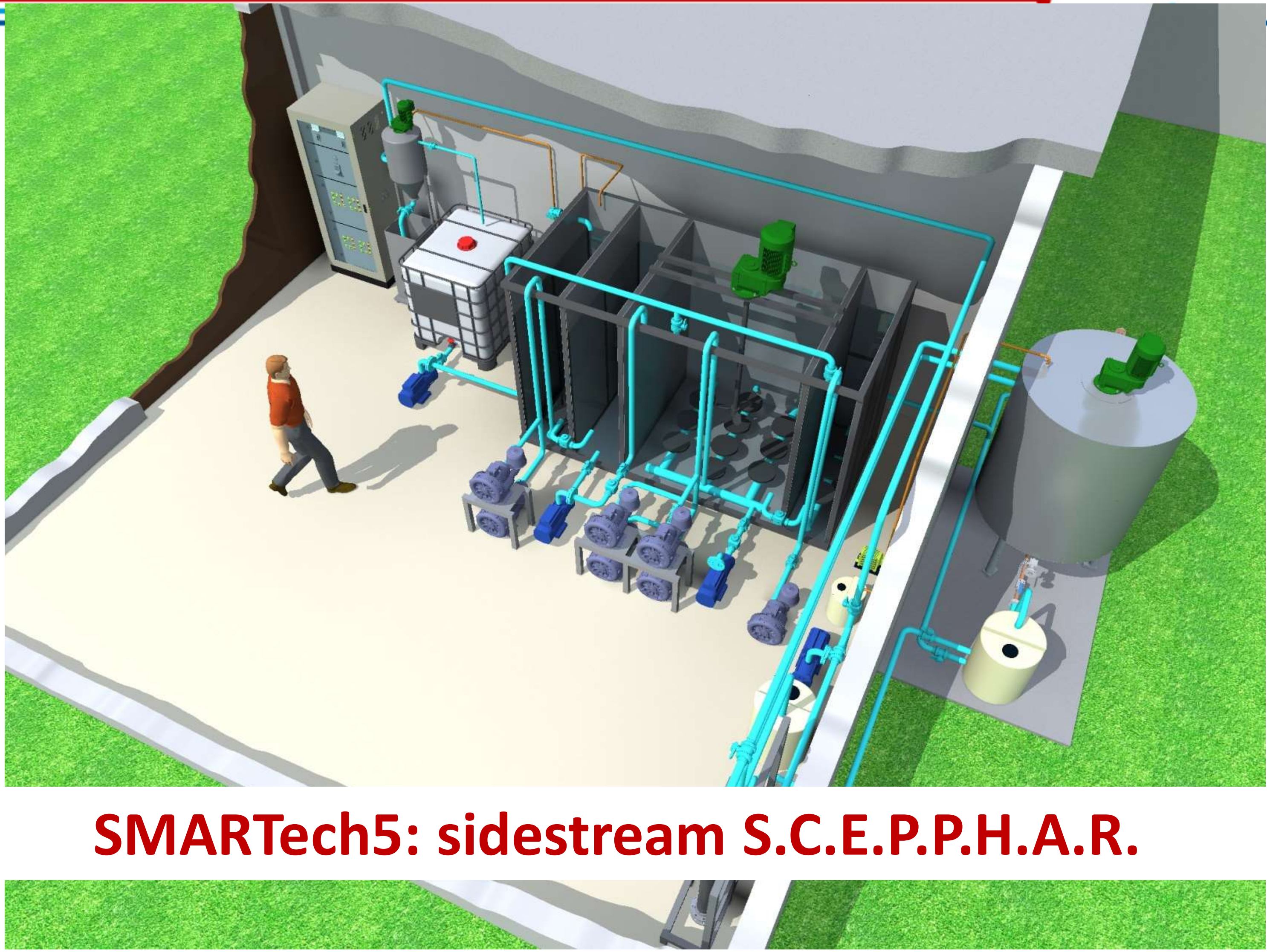
Our benchmark: Anoxkaldnes Cella™

Co-funded by the Horizon 2020 programme of the European Union

The «short-cut» SMART innovation:

- Integrate the via-nitrite nitrogen removal with the PHA recovery → major interest of the water utility
- Adopt anoxic (via-nitrite) conditions to optimize energy consumptions
- Phosphorus (struvite) recovery even to support the balance of nitrogen and phosphorus to the PHA recovery
- Use of cellulosic sludge from upstream concentration

Co-funded by the Horizon 2020 programme
of the European Union



SMARTech5: sidestream S.C.E.P.P.H.A.R.

Co-funded by the Horizon 2020 programme
of the European Union

Pilot Scale SCEPPHAR

LA STAMPA TUTTOGREEN

SEGUICI SU ACCEDI

SMART-Plant, dai rifiuti la fabbrica di nuova materia

Un progetto europeo da 10 milioni di euro che a convertire gli impianti di trattamento delle acque reflue urbane in "fabbriche" di nuova materia prima subito riutilizzabile

f 318 in 107

0.7-0.8 kgPHA and 0.3 kgStruvite per day

Co-funded by the Horizon 2020 programme
of the European Union

SMART-Plant

Scale-up of low-carbon footprint material recovery techniques
in existing wastewater treatment plants
"SMART-Plant"

Co-funded by the Horizon 2020 programme of the European Union

THANK YOU !

www.smart-plant.eu