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- Environmental Engineering and Consultancy focused on Water, Renewable Energy and Environment.
- Two main bussiness activities:
 - ▶ Catalyst, promoter and facilitator of R&D applied projects.
 - ▶ Developer and distributor of eco-innovative wastewater treatment products and technologies.
- Highly experienced team in applied research and project management of industrial and R&D projects.
- Extensive network of contacts.

- **BIOAZUL develops and markets its own eco-innovative product, LODOred – Sludge Reducer for Wastewater Treatment Plants.**
- **BIOAZUL markets advanced technologies in the field of wastewater treatment: Sequencing Batch Reactors (SBR) and Membrane Bioreactor (MBR) for Small - Medium Applications.**
- **Successful participation in several projects within the 6th and the 7th FP. Current participation in 3 projects within EACI programmes, leading 2 of them.**



LODOred-100K – Sludge Reducer



Sequencing Batch Reactor (SBR)



Membrane Bioreactor (MBR)

BIOAZUL Projects examples

- **PURATREAT:** *New energy efficient approach to the operation of Membrane Bioreactors for decentralised wastewater treatment in the Mediterranean region*
- **IWAPIL:** *Innovative Wastewater Treatment Applications for Isolated Locations*
- **PROMEMBRANE:** *Promotion and focussing of current research activities of membrane technology in water treatment in the Mediterranean region*



IWAPIL – Prototype



PURATREAT – Bioreactor



PROMEMBRANE – Membranes

Sequential Batch Reactors as alternative for wastewater treatment in small communities



SBR ADVANTAGES

1. High performance
2. Less space requirement compared to conventional activated sludge systems
3. Less sludge production
4. Improvement of the sludge settleability
5. Flexibility against load fluctuations
6. Possibility of reusing existing tanks
7. Minimum visual impact

OBJETIVES

Phase 1: to achieve effluent quality according to royal decree 11/95

Parámetro	Concentración	Porcentaje mínimo de reducción
DBO₅	25 mg O ₂ /l	70-90%
DQO	125 mg O ₂ /l	75%
SST	35 mg/l (para municipios de más de 10.000 h-e) 60 mg/l (para municipios entre 2.000 y 10.000 h-e)	90% (para municipios de más de 10.000 h-e) 70% (para municipios entre 2.000 y 10.000 h-e)
Nitrógeno Total	15 mg N/l (para municipios de 10.000 a 100.00 h-e) 10 mg N/l (para municipios de más de 100.000 h-e)	80%
Fósforo Total	2 mg P/l (para municipios de 10.000 a 100.00 h-e) 1mg P/l (para municipios de más de 100.000 h-e)	70-80%

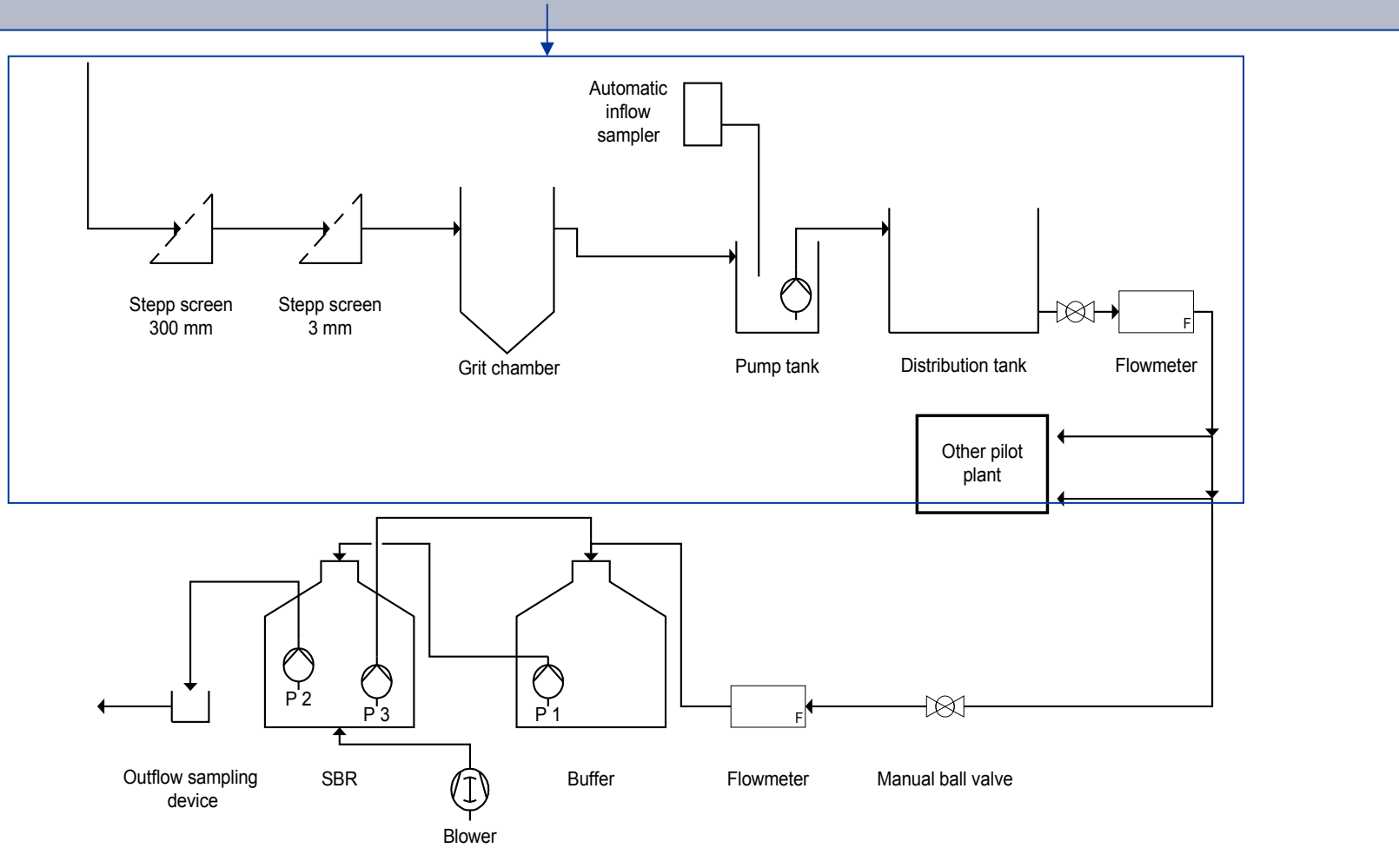
Phase 2: To reduce the power consumption without compromising the effluent quality

SBR DESIGN

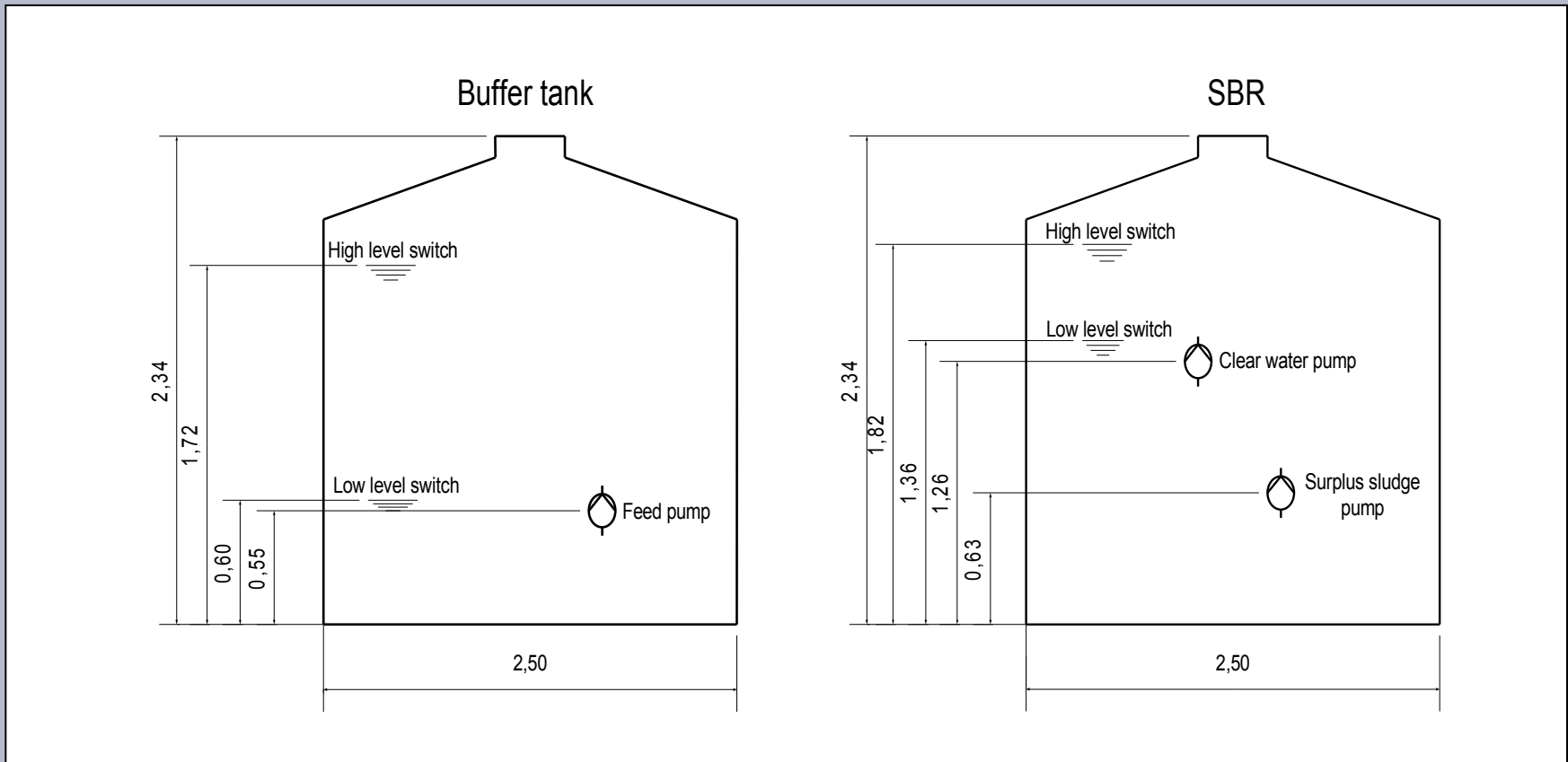
- Treatment capacity of 45 PE (6.8 m³/d)
- Two independent tanks of 9000 litres each one
- First tank working as pre-treatment, homogenizing tank and for the sludge storage.
- Second tank as sequential batch reactor (SBR) where the wastewater is treated biologically.
- Tanks were half-buried, although these can be totally buried, due to the demonstration purposes of the plant.
- System characteristics:
 - ✓ Controlled by a Siemens PLC TD200 LCD screen
 - ✓ 3 pumps Feka 600 of 0.55 kW
 - ✓ 1 Compressor SAH 55 0.75kW
 - ✓ 12 tubular membrane fine bubble diffusers of 0.75 meters and density of 1.83m/m²
 - ✓ Modem for SMS alert of faults and alarms
 - ✓ Remote verification of the operating parameters.

SBR FLOWCHART

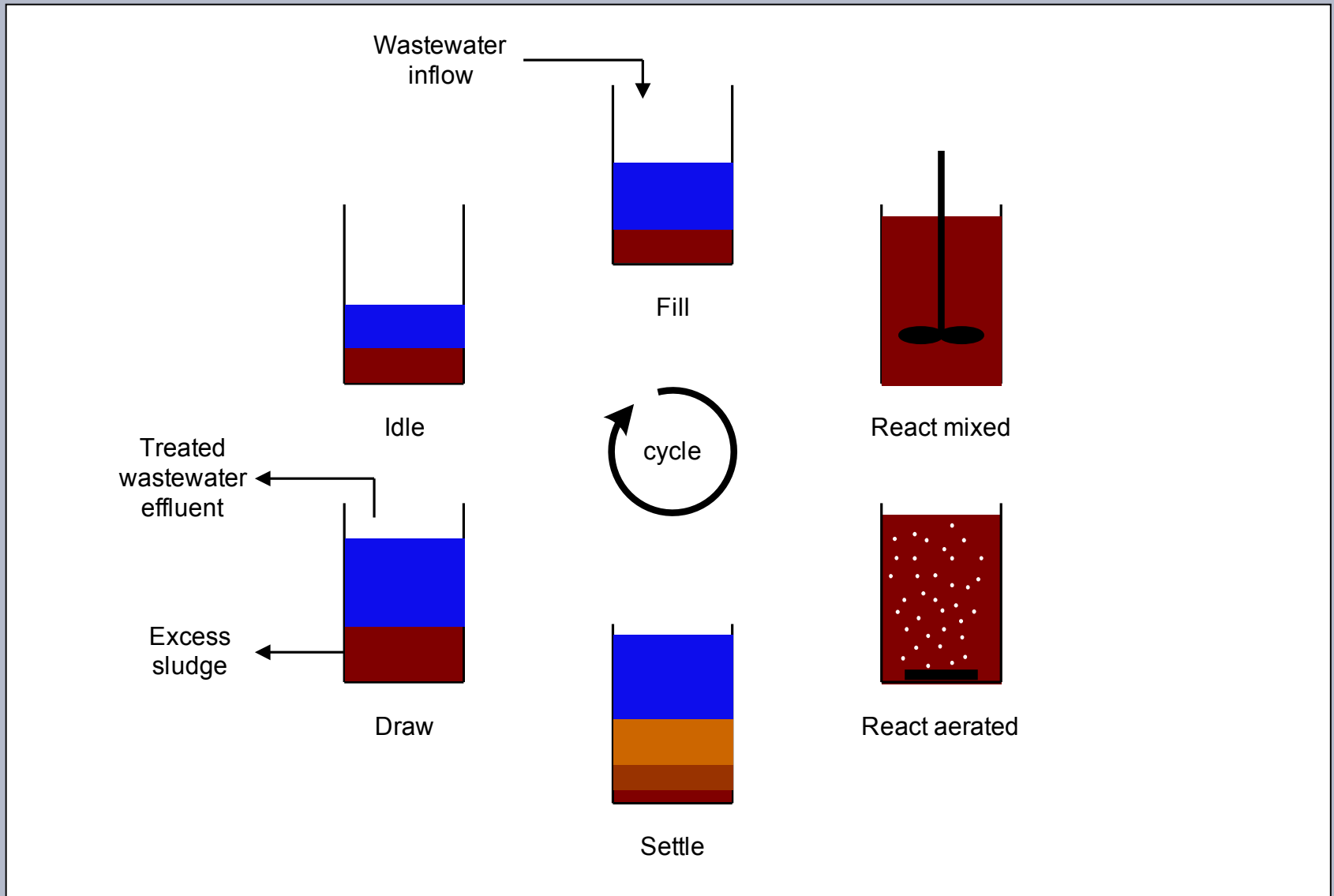
CENTA FACILITIES



SBR LAYOUT



SBR PHASES



SBR INSTALLATION



SBR PARAMETERS

Parámetros		Parameter	FASE 1				FASE 2					
filling phase	max filling time	P15 [min]	60	60	60	60	60	60	60	60	60	
reaction phase	denitrification	duration	P20 [min]	100	100	100	30	30	60	60	60	60
		duration of initial aeration burst for mixing	P21 [sec]	20	20	20	20	20	20	20	20	20
		time between each of the aeration bursts	P22 [min]	10	10	10	10	10	10	10	10	10
		duration of aeration burst for mixing	P23 [sec]	8	8	8	8	8	8	8	8	8
	nitrification	duration	P25 [min]	170	170	170	240	240	210	210	210	210
		duration of initial aeration	P26 [min]	20	60	30	31	55	60	60	45	30
		time between aeration	P27 [min]	10	5	5	5	5	10	10	10	17
		duration of aeration	P28 [min]	10	20	10	7	5	10	8	8	10
		Nº of aeration bursts		7	5	9	17	18	7	8	9	6
		total aerator running time	[min]	90	160	120	150	145	130	122	114	90
	Nº of react cycles	P30	1	1	1	1	1	1	1	1	1	
sedimentation	duration	P36 [min]	90	90	90	90	90	90	90	90	90	
draw phase	max extraction time clear water	P40 [min]	60	60	60	60	60	60	60	60	60	
	time for excess sludge removal	P45 [sec]	60	60	60	60	60	60	60	60	60	

COD REMOVAL

Period	Influent (mg/l)	Effluent (mg/l)	Yield (%)
1 ^{er}	704 ± 272	93 ± 69	87
2°	579 ± 199	47 ± 33	92

BOD REMOVAL

Period	Influent (mg/l)	Effluent (mg/l)	Yield (%)
1 ^{er}	364 ± 106	21 ± 27	94
2°	316 ± 119	11 ± 9	96

SBR RESULTS*

TSS REMOVAL

Period	Inffluent (mg/l)	Effluent (mg/l)	Yield (%)
1 ^{er}	245 ± 84	26 ± 32	89
2 ^o	243 ± 113	9 ± 12	96

N-NH₄⁺ REMOVAL

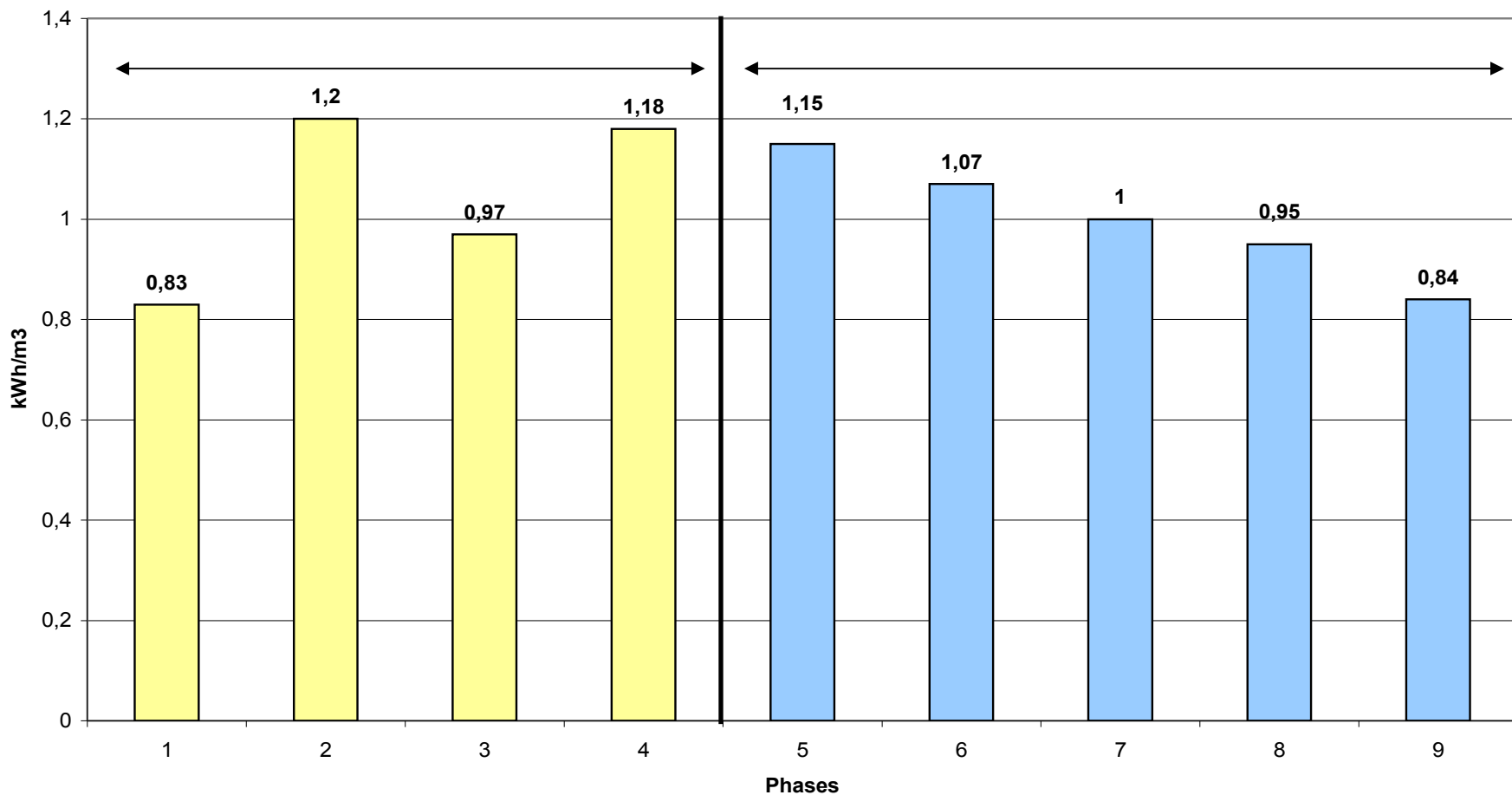
Period	Inffluent (mg/l)	Effluent (mg/l)	Yield (%)
1 ^{er}	44,6± 11,1	18,1 ± 23,5	59
2 ^o	43,1 ± 16,5	6,2 ± 8,4	86

P_{total} REMOVAL

Period	Inffluent (mg/l)	Effluent (mg/l)	Yield (%)
1 ^{er}	10,5 ± 2,2	7,8 ± 4,5	25
2 ^o	7,1 ± 2,0	3,5 ± 2,6	51

ENERGY CONSUMPTION

Energy consumption



CONCLUSIONS

During the two test periods carried out in the Experimental Plant of Carrión de los Céspedes, the Bioazul system 45-T has had a stable performance in terms of yield removal for different control parameters used for the evaluation

Taking the discharge limits set by the Royal Decree 11/95 it was observed that:

- The values of TSS, COD and BOD5 in the effluent are excellent, in absolute values and in elimination percentages, except during the start-up phase
- The BIOAZUL system 45-T also shows a very good yield of nutrients removal (N and P).

In addition:

1. The sludge extracted during the whole period from the first tank was only 5 m³, with a composition of 63% of volatile matter and 37% of mineral matter.
2. The *E. Coli* reduction was between 1 and 6 logarithmic units, where the average is 4 u log.
3. A reduction of 11% in the energy consumption per day compare to normal values (initials ones of the test) was achieved. An even higher reduction per day of 20 % was observed with the last modifications applied.

The system consumed during the last period of the test 0.84 kW/h per m³ of wastewater treated.

- Project: Optimisation of the phosphorous removal in a SBR for the wastewater treatment
- Proyecto de excelencia motriz (convocatoria 2010)
- Project duration 36 months
- Project leader: Centro de las nuevas tecnologías del agua (CENTA)



THANK YOU FOR YOUR ATTENTION

BIOAZUL S.L.

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