Ambiente
Ingegneria
S.r.l.

Alternate Cycle Process

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www.ambienteingegneria.com

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The evolution of treatment water in europe

…Past

- Removal of COD
- Removal of BOD
- Removal of TSS

…Present

- Removal of COD
- Removal of BOD
- Removal of TSS
- Removal of Nitrogen
- Removal of Phosphorus

…Future (?)

CIRCULAR ECONOMY: Energy and Mass Recovery

Consolidated | *Consolidated with innovative technologies* | Ingegneria Ambiente S.r.l | *…In progress*

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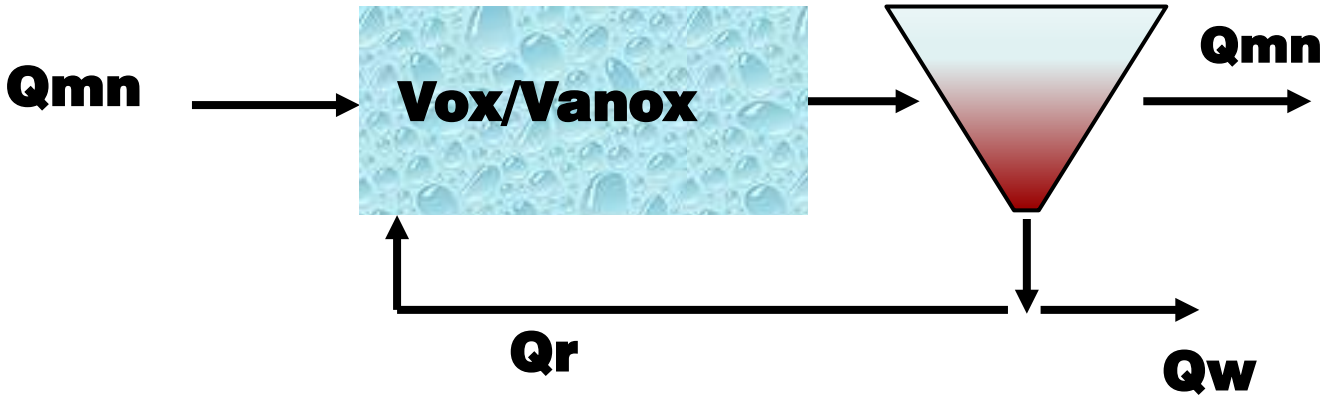
WHAT IS?



AC (Alternated Cycles) is a software control for the biological process of WWTPs, based on the automatic alternation of oxic and anoxic phases into the same reactor

I. Process in continuous – No SBR
II. Using the existing biological volume
III. No chemical for remove Total Nitrogen

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WHAT CAN YOU OBTAIN WITH AC?

TN Removal

≥ 80%

Energy saving

≥ 35%

P reduction

≥ 25%

Sludge reduction

≥ 10%

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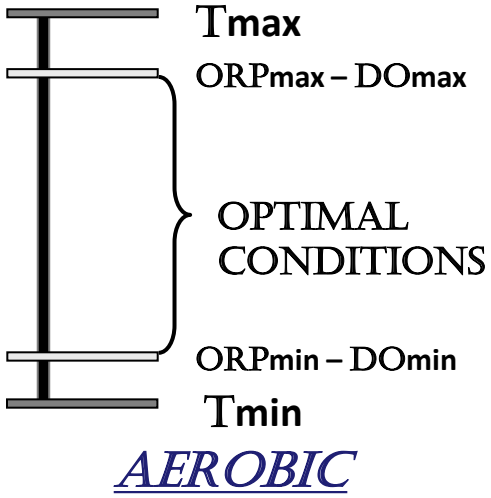
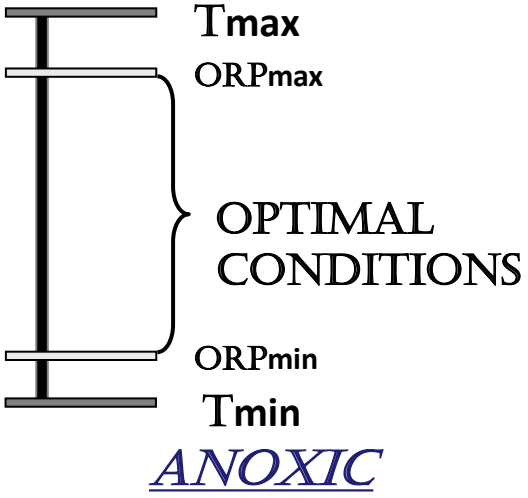
WHAT DO YOU SET?

According to AC process it's possible to set the length of the phase changing:

- **The lenght** of the alternating oxic and anoxic phases (Tmin e Tmax)
- **Set-point** of OD and/or ORP probes (OD min – OD max – ORP min – ORP max)
- **Optimal conditions** for the aerobic or anoxic phase; once the optimal condition is achieved, the automatic control device switches phase from aerobic to anoxic and vice versa.





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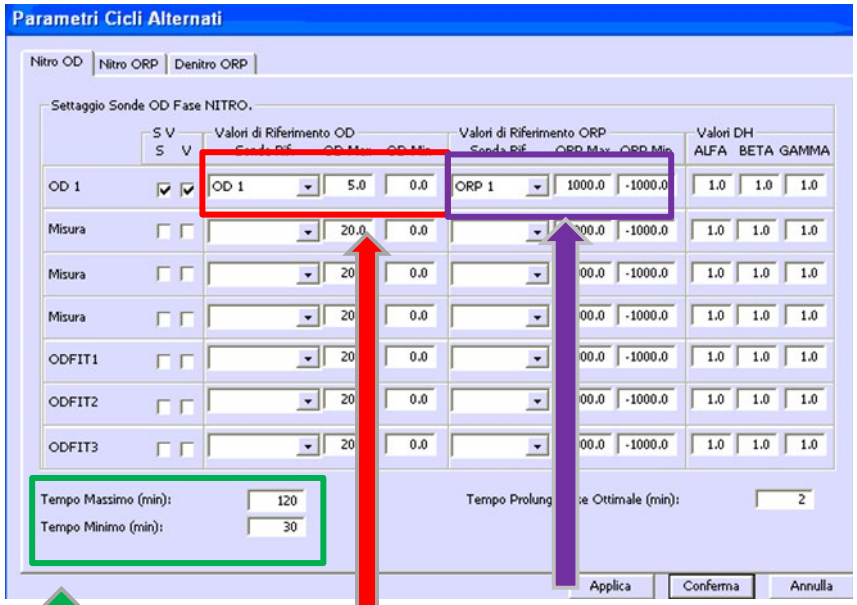
WHAT DO YOU SET?

Aerobic panel

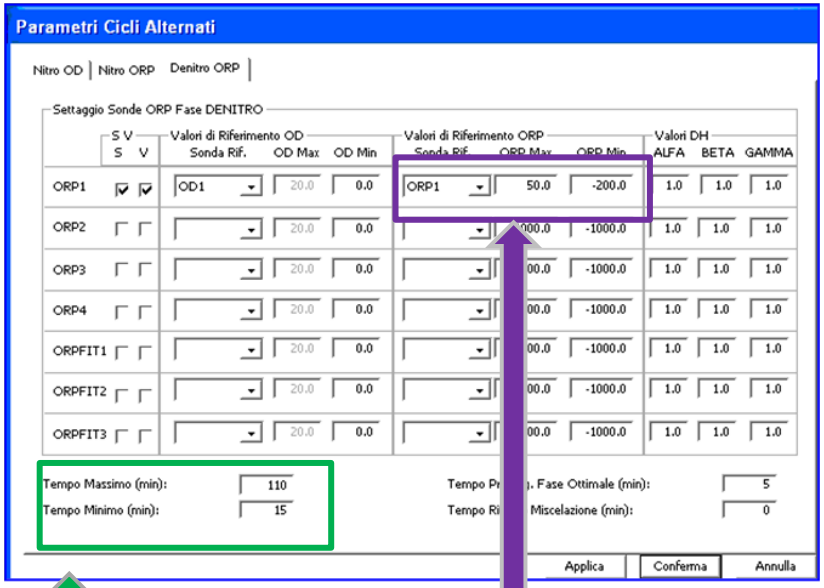


Set point ORP Probes

Set point OD Probes

Minimum and Maximum Time

Anoxic panel



Set point ORP Probes

Minimum and Maximum Time

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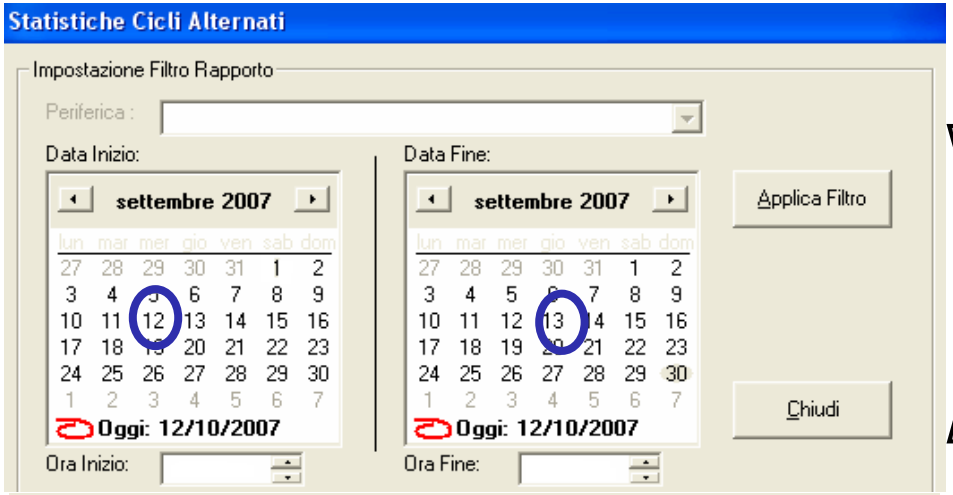
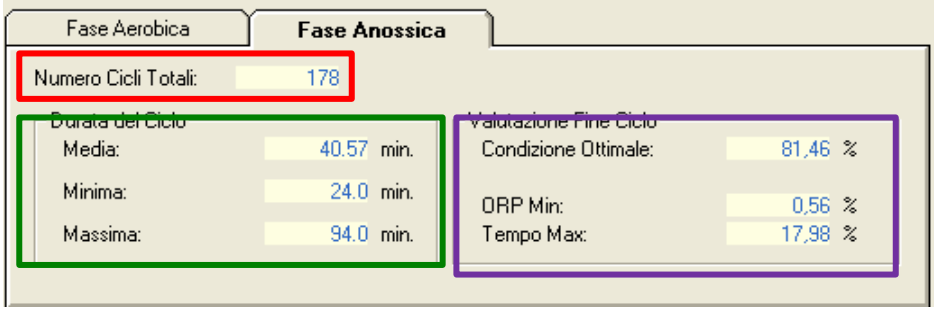
IS IT SMART OR NOT?

On line and in running time you can control the process using the statistic panel (upload in the software) for control the percentage of optimal conditions of end cycle



Select a period

Num.	Data / Ora	Causale	Durata ciclo (min.)	Stumento
85	05/09/2007 9.32.08	C.Ottimale Nitro OD.	45	OD2
86	05/09/2007 10.36.29	C.Ottimale Denitro ORP.	64	ORP1
87	05/09/2007 11.42.55	C.Ottimale Nitro ORP.	66	ORP2
88	05/09/2007 12.50.36	C.Ottimale Denitro ORP.	68	ORP1



You know in Aerobic and Anoxic phase:

- **Number of cycles**
- **Lenght of the phase (med-min-max)**
- **Results of End cycle**

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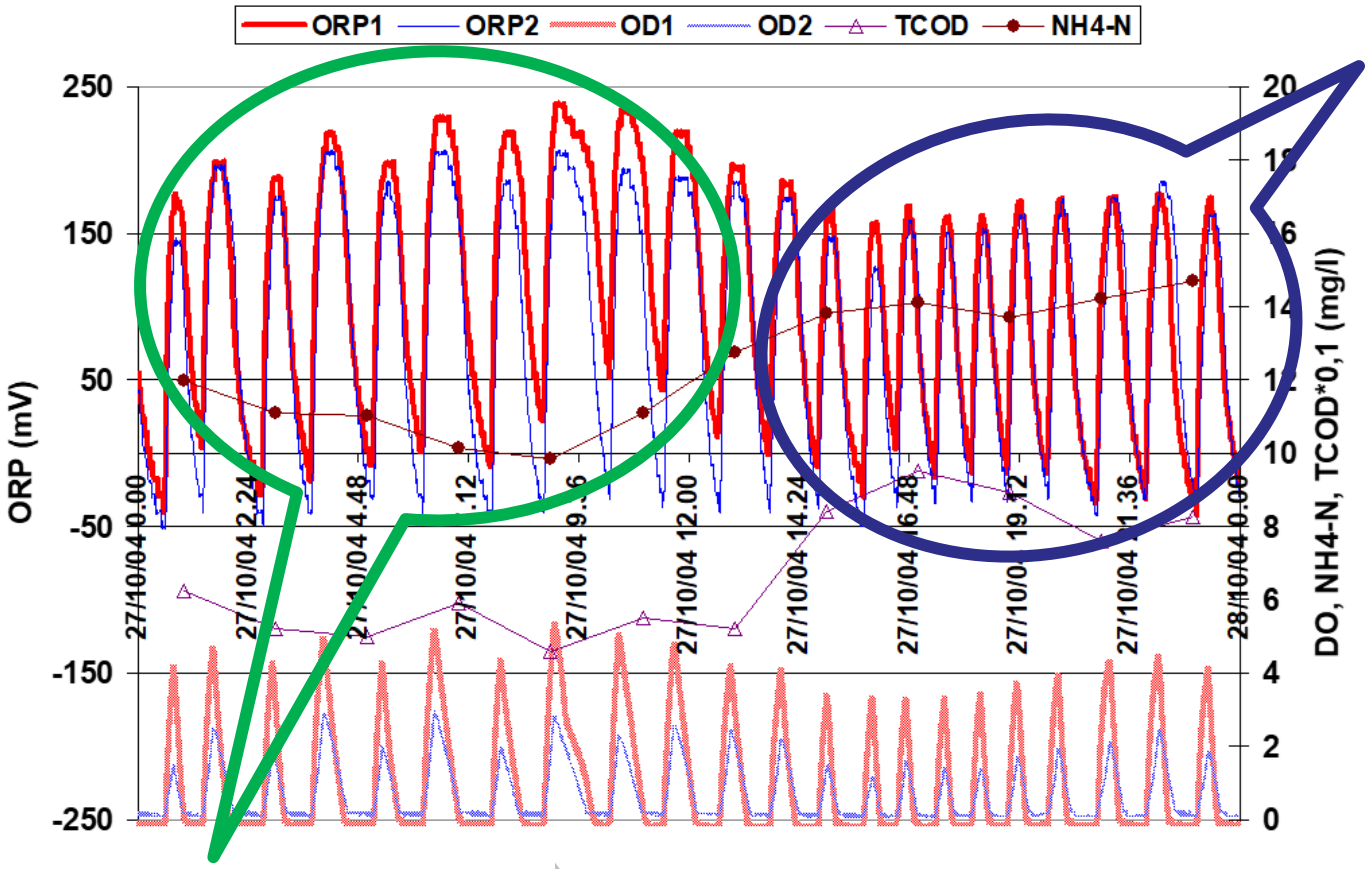
WHAT MEANS OPTIMAL CONDITIONS?

The length of a phase depends from the Nitrogen load in the reactor…Ammonia in Aerobic phase and Nitrates in Anoxic phase



High Ammonia ppm

Fast oxic and anoxic phase

High Nitrogen removal

Low Ammonia ppm

Short oxic phase Long anoxic phase

High Energy Saving

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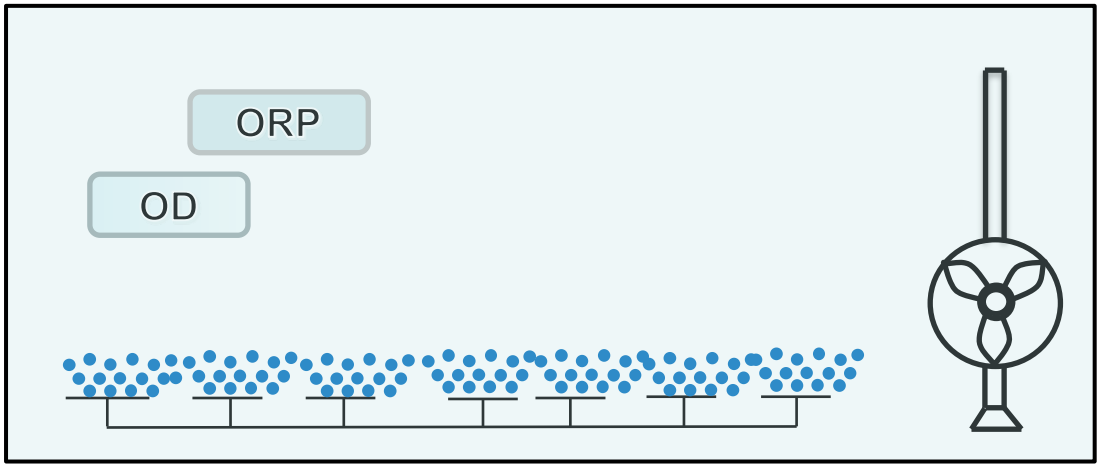
WHAT YOU NEED IN THE REACTOR

Mixer

Probes: OD & ORP

BIOLOGICAL TANK



Air supply

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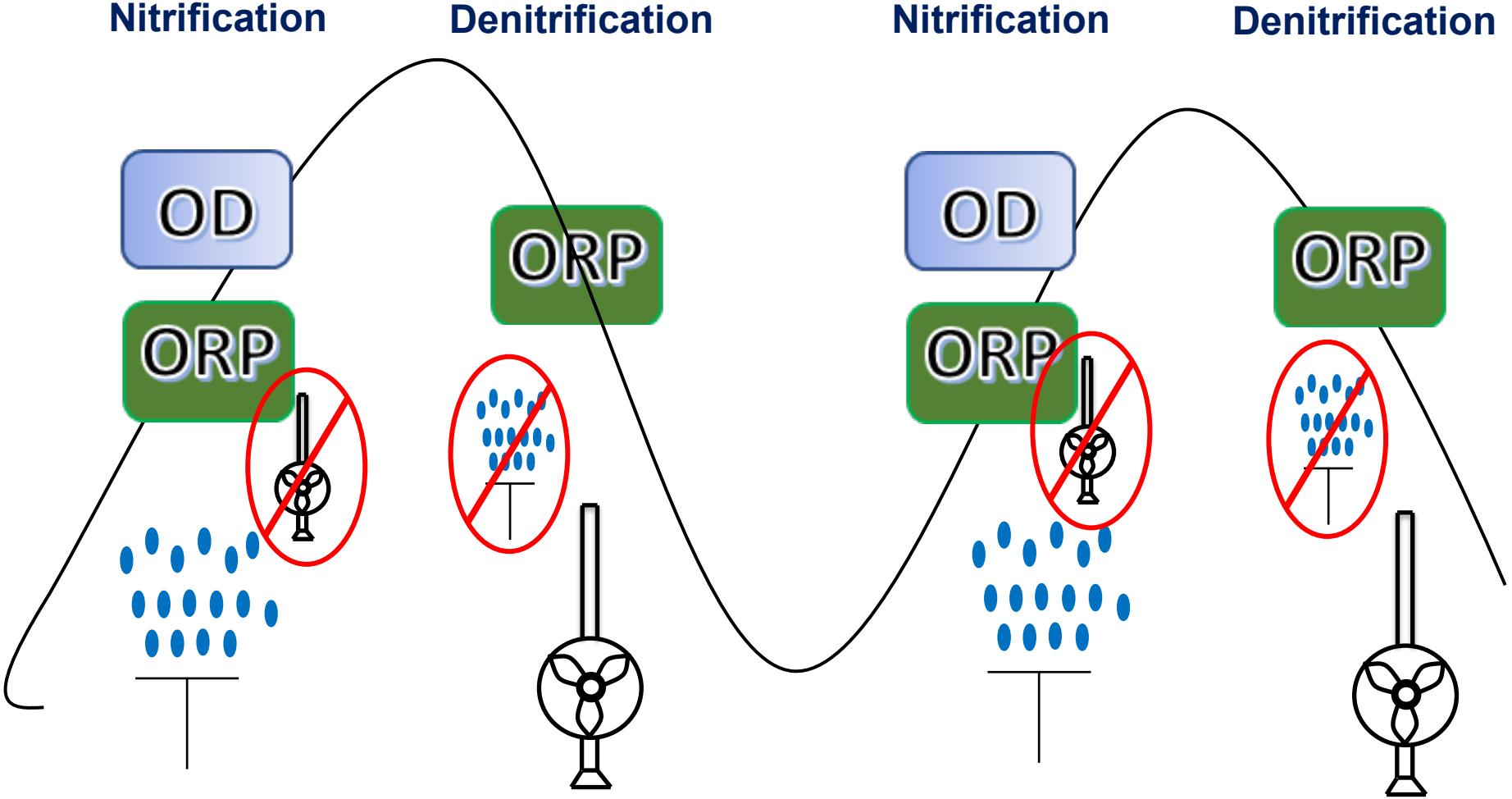
WHAT YOU NEED IN THE REACTOR



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WHICH PROCESS UPGRADE

A	O

A	A	O

.....Everyone!

Carrousel tank

Activated sludge

MBBR

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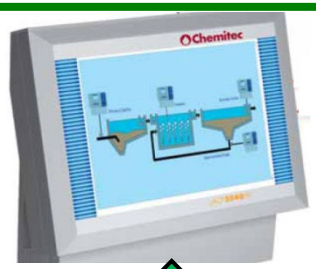
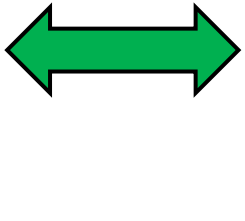
SOFTWARE ARCHITECTURE

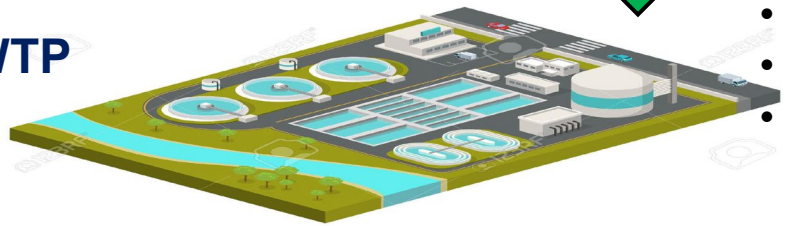
PLC/PC Slave with AC process





PLC Master in STP

STP/WWTP



Remote control from Italy

Supervisory Control in remote system using VPN free software to:

- Set the AC parameters control
- Monitor the biological process
- Change the process parameters (Tmin – Tmax – Probes Set point) in case of necessity

TRAINING ON SITE

Training coursers for the operators to:

1. Explain the AC control logics implemented for the automatic operation
2. Explain the procedures to be followed in the event of a change
3. Educate about the correct interpretation of the analog measurement system installed, in order to obtain information for the management;
4. Carry out the required periodic maintenance / calibration of the on-line probes
5. Discuss the results achieved and the performances of the system
6. Examine the functions of the various utilities monitored from the local and the remote control system.

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…. REFERENCES IN ITALY

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Ingegneria Ambiente Srl

- **320** *Sewage treatment plant designed*
  - ❑ *The smaller: 200m3/d*
  - ❑ *The biggest: 195000m3/d*

13.700.000 PE

INHABITANTS EQUIVALENT SERVED

185 **SEWAGE TREATMENT PLANT RUNNING**

❑ **NEXT YEAR MORE THAN 10 PLANTS WILL BE ACTIVE**

…. RESULTS OBTAINED

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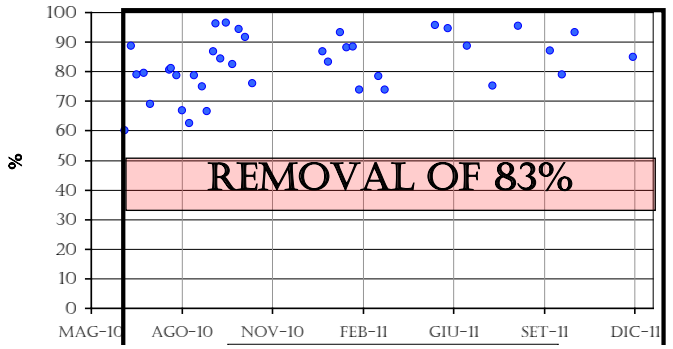
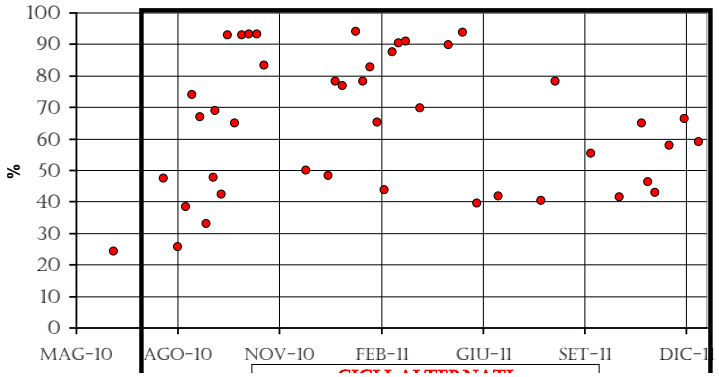
180.000 PE – 36.000 m3/d

NITROGEN REMOVAL



	Before Alternate Cycle	After alternate Cycle
Ntot influent (ppm)	27	30
Ntot effluent (ppm)	10	5
Reduction (E%)	64	83

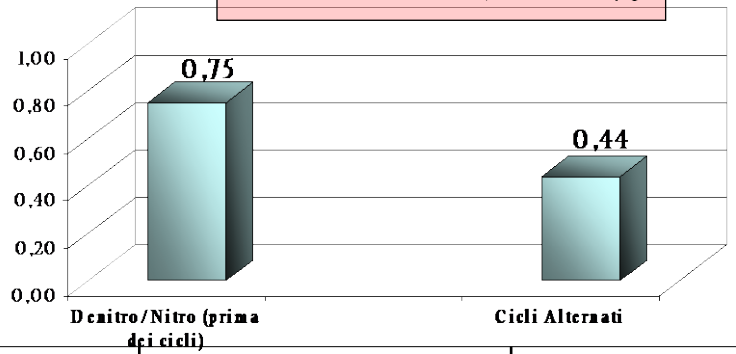
PHOSPHORUS REMOVAL



	Before Alternate Cycle	After Alternate Cycle
Ptot influent (ppm)	3,7	4,3
Ptot effluent (ppm)	2,8	1,4
Reduction (E%)	28	65

ENERGY SAVING

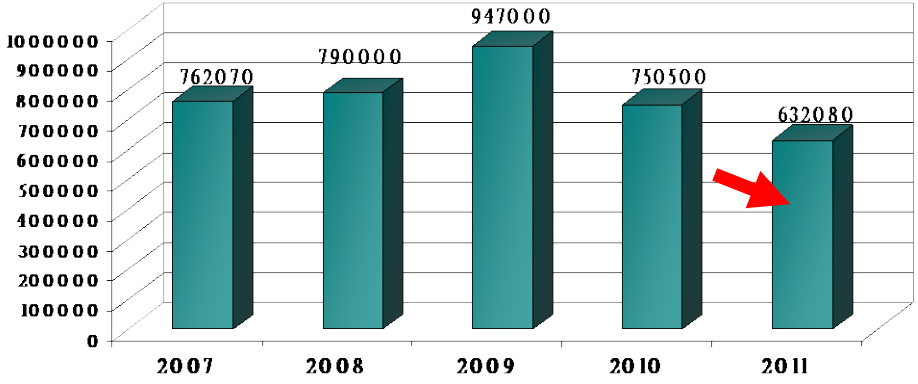
REDUCTION OF 41%



Specific Consumption	Before Alternate Cycle	After Alternate Cycle
kWh/m³	0,75	0,44

SLUDGE REDUCTION

REDUCTION



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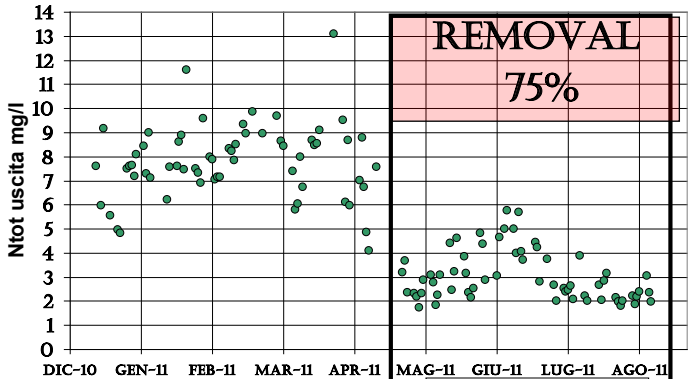
700.000 PE – 140.000 m3/d

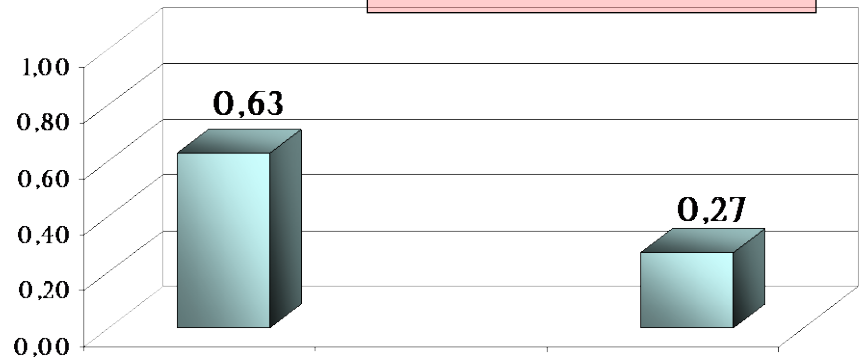
NITROGEN REMOVAL



	Ntot influent (ppm)	Ntot influent (ppm)
Ntot influent (ppm)	12	11
Ntot effluent (ppm)	8	3
Reduction (E%)	50	75

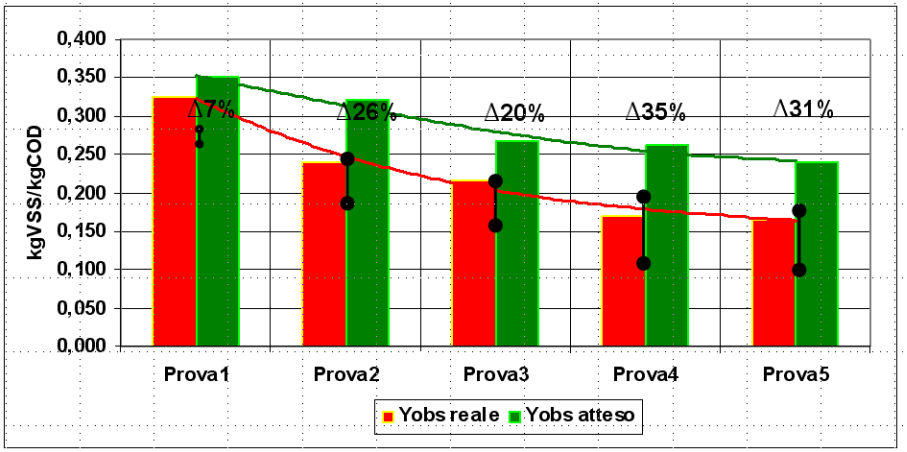
ENERGY SAVING

REDUCTION OF 57%

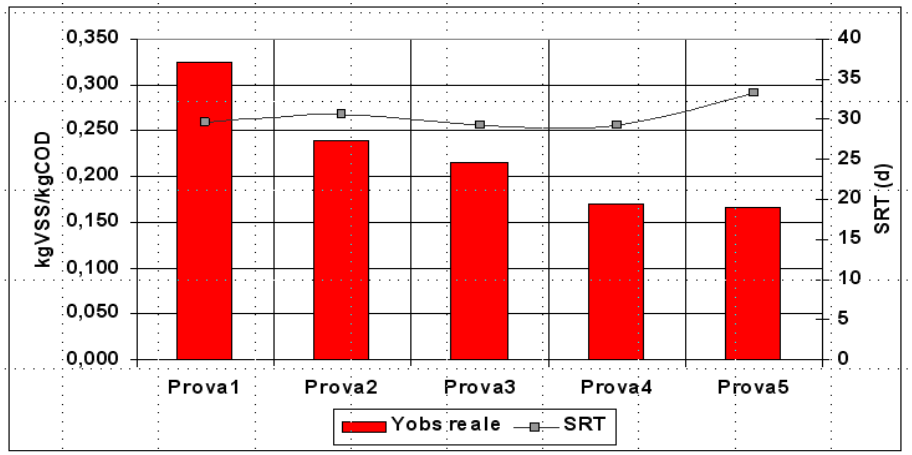


SLUDGE REDUCTION

COMPARISON BETWEN REAL YOBS AND EXPECTED YOBS



REAL YOBS



YOBS REDUCTED OF 51%

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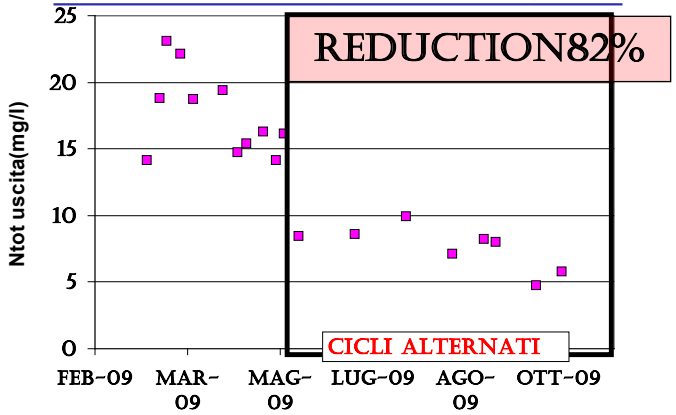
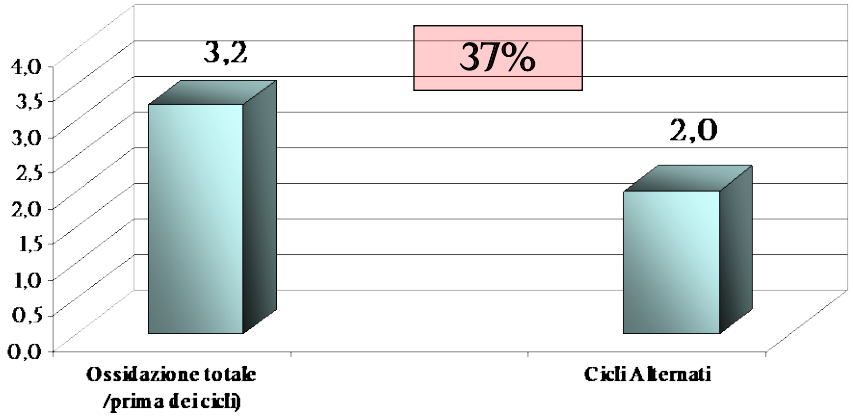
30.000 PE – 6.000 m3/d

NITROGEN REMOVAL

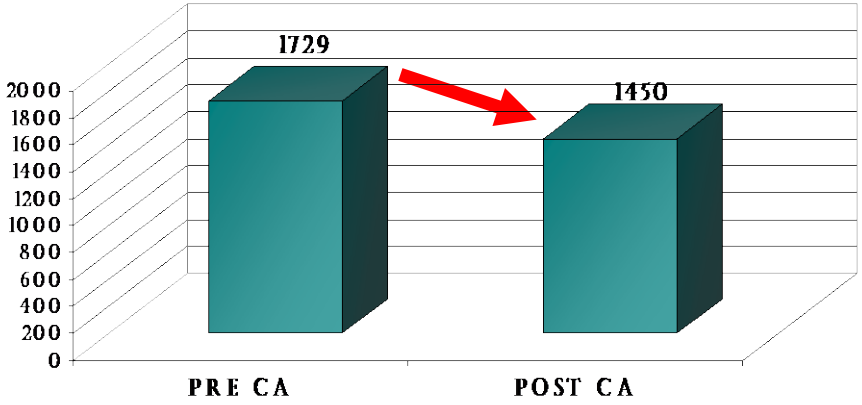


	Prima Cicli Alternati	Con Cicli Alternati
Azoto totale medio ingresso (mg/L)	42	38
Azoto totale medio uscita (mg/L)	18	6.3
Rendimento medio rimozione (%)	60	82

SAVING ENERGY



SLUDGE REDUCTION



SLUDGE REDUTCION 16%

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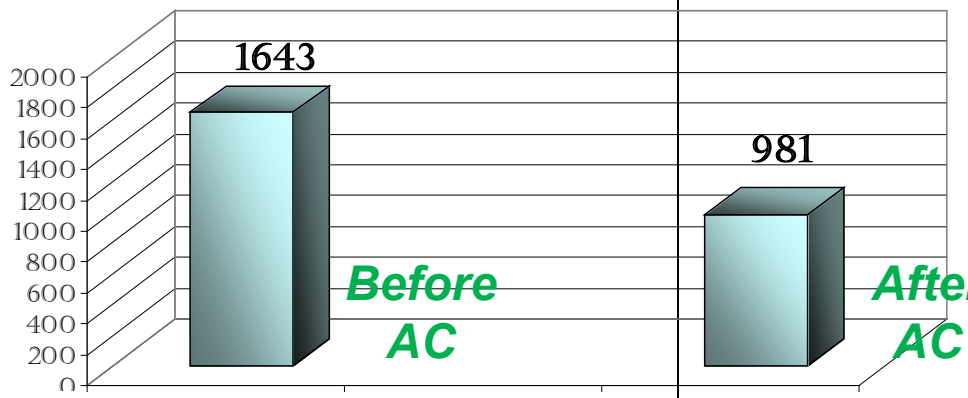
55.000 PE – 11.000 m3/d

NITROGEN REMOVAL

	Before AC process	After AC process
Total Nitrogen influent (ppm)	72	75
Total Nitrogen effluent (ppm)	25	7
Medium Removal percentage (%)	65	90

REDUCTION 90%

SAVING ENERGY



REDUCTION 40%

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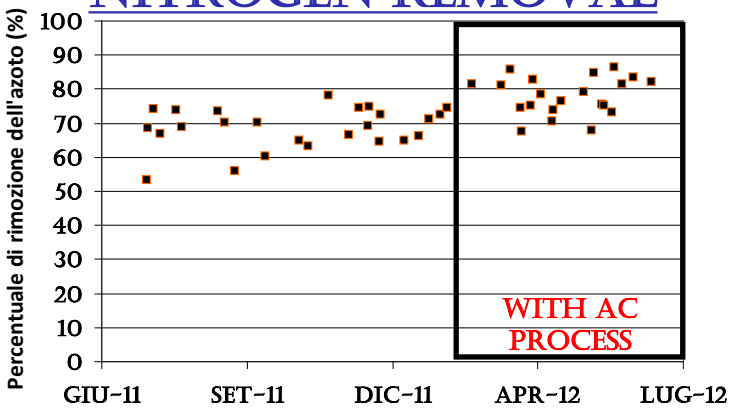
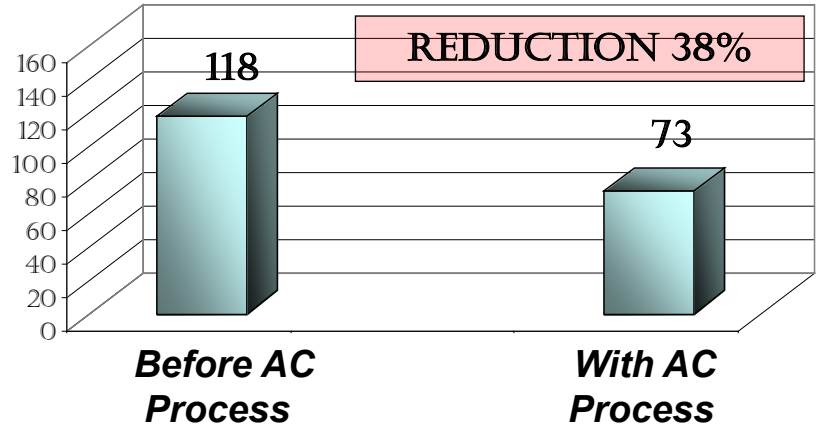
250.000 PE – 50.000 m3/d

NITROGEN REMOVAL



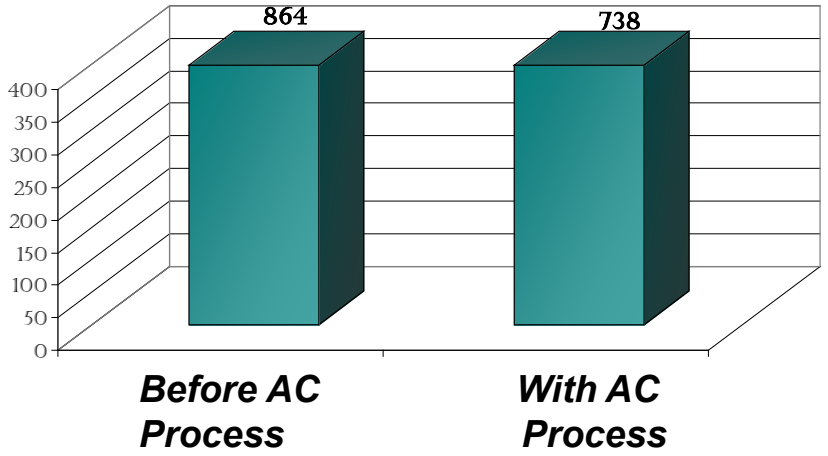
	Before Alternate Cycle	With alternate Cycle
Ntot influent (ppm)	43	49
Ntot effluent (ppm)	14.3	8.8
Reduction (E%)	67	83

ENERGY SAVING



Total consumption	Before Alternate cycle	With alternate cycle
Wh/AEd	118	73

SLUDGE REDUCTION



REDUCTION 15%

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…Thank you!!!

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