

# T@W Good Practice Form

## Setting

**Title** Portinho da Costa- A Water Treatment Plant that has a cogeneration system that transforms biogas in electric and thermal energy  
**Country** Portugal  
**Location** Almada Municipality  
**Start date** February 2004

## General description

### Summary:

In the Almada Municipality about 100% of the residual water is treated. This goal was concretized due to a strategy of the municipality to cover all council with treatment systems and a good drainage system, for this, this municipality has four Water Treatment Plants. One of this Water Treatment Plants is the Portinho da Costa, which is ecological and transforms residues in energy.

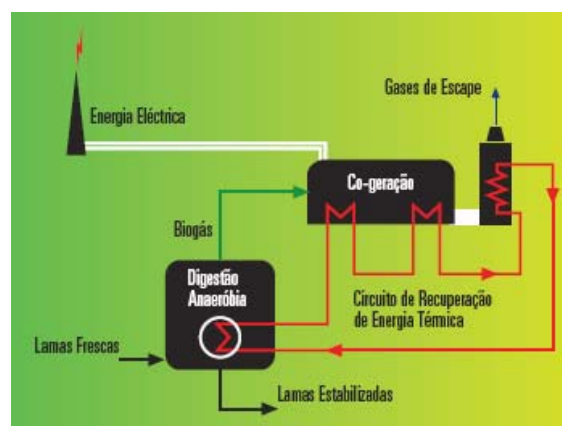
This Water Treatment Plant has the best and more advanced technologies and, at environmental level, it is very efficient - it has a great treatment efficiency, it is important to mention that the percentage to remove organic substance is superior that 96%; it produces biogas, that is used in a cogeneration system to produce electric energy and heat; it uses the mud to fertilize the land for the agriculture and it reuses the residual water for irrigation of green spaces.

### Aims:

Keeping in mind, the energetic efficiency, the use of renewable sources and the need of the municipal intervention to reduce the greenhouse gases effects, Almada Municipality decided, in 2001, to elaborate a "Municipal Inventory of the Emissions of Greenhouse Gases in Almada". With this document it was possible to identify the energetic demand and the greenhouse gases emissions, per economic sectors in Almada.

In the Inventory it was mentioned that the Residues Sector was responsible for 1.2% of the total emissions of greenhouse gases although the existents water treatment plants don't have capacity to treat all the residual water of the council. Thus it was necessary to build a new water treatment plant to cover all council residual water treatment without increase the greenhouse gases emissions.

The Portinho da Costa water treatment plant was built with the installation of a cogeneration system that convert biogas in electricity and heat. The biogas is produced by the anaerobic digestion of the mud comings from the residual water treatment.



This Water Treatment Plant covers 24% of residual water treatment in Almada Municipality. With the construction of this plant the Municipality obtain 100% of the residual water treatment without increase the greenhouse gases emissions.

## Summary of Results

With the use of a cogeneration system, in the Portinho da Costa Water Treatment Plant, the consumptions of natural gas and electric energy was reduced 67%, in terms of watts this is equivalent at a reduction 2000 MWh per year. At environmental level, this reduction is quantified in terms of greenhouse gases emissions, and with the use of this technology the emissions decrease 39% and in terms of CO<sub>2</sub>, that it is equivalent at a reduction of 687 tons of CO<sub>2</sub>.

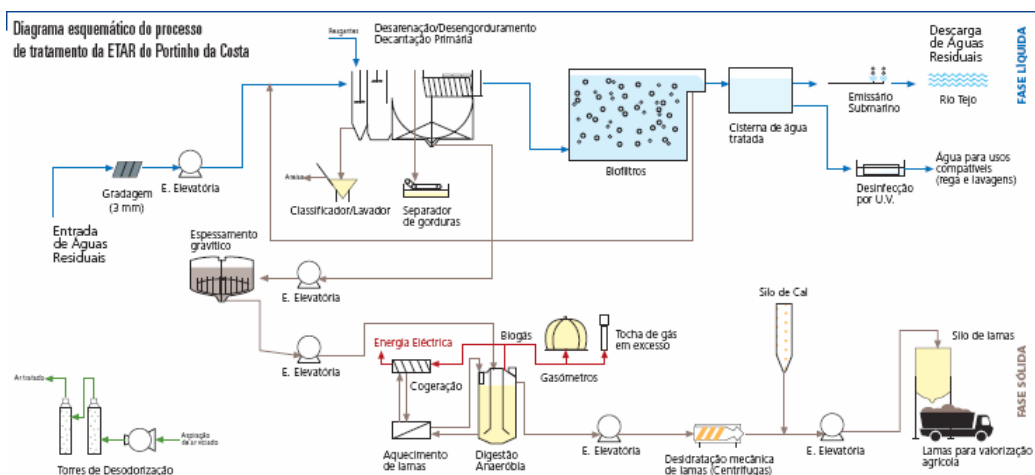
With this Water Treatment Plant the Municipality of Almada has, now, all residual water treated, without more greenhouse gases emissions, due to the installation of a cogenerations systems that transform biogas in electric and thermal energy.

<b>Planning Time:</b>	Conception to end of building in years (not mandatory)
<b>Planning issues:</b>	(not mandatory)
<b>Operation Time:</b>	(not mandatory)
<b>Feasibility Study:</b>	(not mandatory)

## Technical details

### Technical details

The figure below shows the schematic diagram of the treatment process in the Portinho da Costa Water Treatment Plant.



In the Portinho da Costa Water Treatment Plant, the muds, product of the residual water treatment, are used to produce biogas through an anaerobic digestion. After, the biogas is used as a fuel in a cogeneration system to produce electricity and heat.

## *Energy data*

### Energy data

The muds are one of the products of the residual water treatment, in the Portinho da Costa Plant these muds are used to produce biogas. The muds are constituted by organic substance of the initial sewers and they are the best product for the anaerobic digestion (Biological degradation without oxygen). The product of this process is the biogas, a renewable energy, constituted by CH<sub>4</sub> (methane) and CO<sub>2</sub>, that can be used as a fuel.

The biogas composition depends of the residue characteristics and the conditions of the anaerobic digestion process, but in average the biogas has 60% of CH<sub>4</sub> and 40% of CO<sub>2</sub>.

In the Portinho da Costa Water Treatment Plant the composition of the biogas is - 69% of CH<sub>4</sub>, 28% of CO<sub>2</sub> and 3% of N<sub>2</sub> and O<sub>2</sub>.

In the Portinho da Costa Water Treatment Plant the biogas is used in a cogeneration system to produce electricity and heat. The cogenerations system is constituted by two electrogenous groups, whose the fuel is the biogas stored in two double membrane floating gas tanks (2x200m<sup>3</sup>). These electrogenous groups (2x250kW) can convert approximately 33% of the energy contained in the biogas in electric energy and about 60% of the biogas energy is recovered in heat (hot water and vapour) through heat exchangers that use the thermal energy of the exhaust gases and the cooling circuits of the engine.

### Energy saved/generated:

With this cogeneration system it is possible to reduce in 67% the consumption of electricity and natural gas, this value is approximately equivalent at 2000MWh per year, as it is possible verify in the table below:

	Energy Form	Consumption (MWh/year)	Energy (MWh/year)	Energy (%)
Without Cogeneration	Electric Energy	1778		
	Natural Gas	1282		
	Biogas (not used)	3007		
With Cogeneration	Electric Energy	967	812	46%
	Natural Gas	51	1232	96%
	Biogas (used)	3007		

### Monitoring:

Methodology used (who did it)

## *Environmental data*

### Environmental data

The installation of a Water Treatment Plants is almost always associated to greenhouse gases emissions. These emissions are three different sources - energy consumption in the different phase of the treatment, storage of the muds in landfills and the release of the biogas to the atmosphere resultant of the anaerobic

digestion of the mud. With the installation a cogeneration system in a Water Treatment Plant, it is possible to use the biogas to produce electricity and heat that constitutes an excellent opportunity to mitigate the greenhouse gases emissions of the Residues Sector.

The following table summarizes the environmental data, with the use of a cogeneration system and without this system.

	Energy Form	CO <sub>2</sub> Emissions (tonCO <sub>2</sub> equi/year)	Total (tonCO <sub>2</sub> equi/year)	CO <sub>2</sub> Emissions saved (tonCO <sub>2</sub> equi/year)	CO <sub>2</sub> Emissions saved (%)
Without Cogeneration	Electric Energy	959	1223		
	Natural Gas	260			
	Biogas (not used)	4.9			
With Cogeneration	Electric Energy	521	536	687	39
	Natural Gas	10.2			
	Biogas (used)	4.9			

### Project GHG-emissions

Due to the use of the cogeneration system the GHG-emissions are only 536tonCO<sub>2</sub>equi/year.

### GHG-emission reductions

With this system the Municipality reduced its emissions in about 687tonCO<sub>2</sub>equi/year.

“EAU, CER, ERU, AAU”: Number of units...  
**Methodology:** (if applicable) approved baseline methodology or study done - reference to this  
**Baseline** Text description  
**Monitoring:** Methodology used (who did it)  
**Contribution to Sustainable Development:**

### *Economic data:*

Economic data

### Financing

All the costs of the project were supported by the Municipality of Almada.

### Capital cost

The total costs of the construction of the Portinho da Costa Water Treatment Plant had been estimated in 14000000 euros.

Operational Costs: Select a currency (not mandatory)  
Payback: In years (not mandatory)  
Energy Production costs: Select a currency (not mandatory)  
Other savings: Select a currency (not mandatory)

### ***Additional Information***

Printed or electronic reports or other literature available:

Title: ELAC\_2: Sector dos Resíduos - Co-geração a biogás em ETARs Municipais

Address for download of electronic document:

[http://www.ageneal.pt/DirEscrita/upload/docs/ELAC\\_2.pdf](http://www.ageneal.pt/DirEscrita/upload/docs/ELAC_2.pdf)

Project Web site: <http://www.ageneal.pt/>

### ***Contact information***

Type of Organisation: Project management

*(e.g. technology supplier, service provider, host company, financing body, project management)*

Technology keyword(s) specific to this organisation:

Organisation / Agency: SMAS - Water and Wastewater Municipal Services

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Description of the Organisation for inclusion in the database of Technology and Service Providers:

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