

WASTEWATER STATIONS BASED ON CONSTRUCTED WETLANDS, POWERED BY SOLAR ENERGY, IN SEVERAL VILLAGES OF LUBRÍN, PROVINCE OF ALMERÍA (SPAIN).

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Abstract

The town of Lubrín is located in the area of Campo de Vera. Center of the capital is far, approximately, about 75 km and the municipality is composed of a total of 26 small villages distributed in more than 138 km². In 2009 developed the study and implementation of the treatment plants 2 of those districts, El Pocico and Jauro of 105 and 45 inhabitants respectively. With the aim of having reliable infrastructure, economic and integrated into the rural environment that characterizes the area, was chosen as the purifying system based on constructed wetlands supplemented by solar connections for their electricity supply. The total duration of the implementation of the stations was 4 months (1 month design and 3 implementation) and its design is derived directly from the developed by Optimia medio ambiente in the Centro de Nuevas Tecnologías del Agua (CENTA) in 2007. Their functional results and the purifying performances achieved are the subject of this communication.

Introduction

The lack of technical, human and economic resources are a constant in small Spanish municipalities, reasons why when designing a public service infrastructure has to be countered with others to achieve the ultimate goal. Therefore, in deciding which system to install on 2 of the districts of the municipality, the Agencia Andaluza del Agua with the knowledge of experience, chose in both cases the implementation of systems based on energy self-powered constructed wetlands. The availability of plots of different sizes for the installation of two water treatment plants, 2 different systems were designed to fit the area indicated although both based on the same active ingredient in constructed wetlands. In the case of "El Pocico" the system is installed dual-stage vertical flow with electrical pumps, in the case of "Jauro" this is a single-stage vertical flow combined with a recirculation system and secondary

treatment horizontal flow. In both cases, incorporating a solar energy system with a autonomy of 10 days, looking to get a reliable and cost-functional 24 hours a day, 365 days a year.

Methods

The plant designed to "El Pocico" consists of a primary stage vertical flow wetland supplemented by a secondary with the same characteristics, both powered by a double electric pumps. As pre-treatment with a grid of simple slab of 20 mm air gap. The output of the filter features a venturi channel calibrated to measure the treated water. The solar station includes an area of 8 photovoltaic panels producing 1560 Wp and 2700 Ah batteries. The installation is complemented by a microprocessor device which manages the supply of each of the stages and the overall system power consumption. The main technical features are:

Treatment process		Energy system	
Population (p.e.)	105	Photovoltaic panels	Policristaline 195Wp
Surface 1ª stage	120 m ²	Solar surface	1560 Wp
Surface 2ª stage	80 m ²	Solar cover	Integrated
Daily flow	18,9 m ³	Battery	2700 Ah
BOD5 in	310 mgO ₂ /l	Autonomy	10 days
COD in	754 mgO ₂ /l	Management	Microprocessor
SS in	264 mg/l	Voltage generated	24 Vdc
TKN in	52,31 mgN/l	Voltage produced	3 x 220 Vac
Pumps	Electric	Consumption	2274,45 Wh



A schematic drawing of "El Pocico" plant is shown above

The plant designed to "Jauro" consists of a primary stage vertical flow wetland oversized to 1.90 m²/PE that departure is recirculated by gravity and selectively in steps of 20% towards the entrance, and supplemented by a refining horizontal linear wetland, in this case as opposed to "The Pocico" there is a unique electro-pump for the provision of the influent. As pre-treatment with a grid of simple slab of 20 mm air gap. The output of the filter features a venturi channel calibrated to measure the treated water. The power station includes an area of 4 photovoltaic panels producing 780 Wp and 900 Ah batteries. The installation is complemented by a microprocessor device which manages the supply of each of the stages and the overall system power consumption. The main technical features are:

Treatment process		Energy system	
Population (p.e.)	45	Photovoltaic panels	Policristaline 195Wp
Surface 1 ^a stage	88 m ²	Solar surface	780 Wp
Surface 2 ^a stage	15 m ²	Solar cover	Integrated
Daily flow	8,1 m ³	Battery	900 Ah
BOD5 in	185 mgO ₂ /l	Autonomy	10 days
COD in	525 mgO ₂ /l	Management	Microprocessor
SS in	158 mg/l	Voltage generated	24 Vdc
TKN in	47,52 mgN/l	Voltage produced	3 x 220 Vac
Pumps	Electromecánico	Consumption	895,75 Wh

The implementation of both treatment plants was performed by direct excavation in the field, waterproofing and reinforcement using synthetic and natural sheets and underground pipes carrying water.

Results and discussion

The results obtained during the first year of operation of both plants are very similar in terms of performance treatment, although there is a difference between them in the start up to the implementation and the reach of traditional denominations. In the case of "El Pocico" nominal values were reached at the end of the first month showing the experience with this type of configuration of distinct stages, whereas in the case of "Jauro" these same values were reached after more than three times, continuing very stable in both cases during the first year of life of the plant. Regarding the solar stations and considering that the past winter have been

very rainy and sunless periods up to 8 days, there has been no lack of performance. The following tables we can see the results of work on both levels:

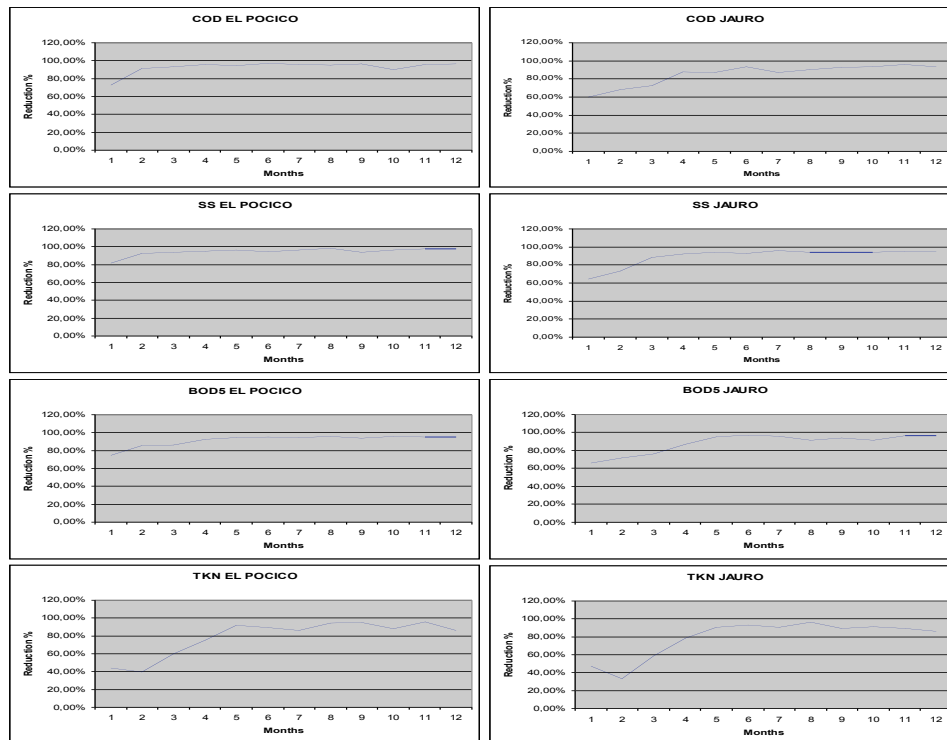


Table 1. Periodic analytical results

Conclusions

The operation of both plants is stable and reliable with a noteworthy performance in the most important parameters, maintenance so far has been very low (monthly cleaning grid roughing) and an excellent performance of the clean energy system. The most important conclusion we can draw is that wastewater plant system is highly recommended for this type of population villages and their operating cost is very low in absolute terms.

References

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