

80% OF TOTAL ELECTRICITY USE SELF GENERATED - **THE LARGEST WASTE WATER TREATMENT PLANT IN THE WORLD**

A MEXICAN CASE STUDY

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The Atotonilco WWTP (Mexico) is the largest single-phase facility in the world and the third largest in treatment capacity. It's located within the Municipality of Atotonilco de Tula between the towns of San José Acoculco and Melchor Ocampo (El Salto), municipality of Tepeji del Río, in the state of Hidalgo.

The Atotonilco WWTP has an average treatment capacity of 35 m³/s and a maximum of 50 m³/s, including the final disposal of solid waste and sludge generated. The plant is equipped with a cogeneration system, to take advantage of the biogas produced in during digestion, allowing maximum energy savings and generating 80% of the electricity

it consumes. A clear example of the concept of Circular Economy that is going to be implemented from now on in all other Mexican facilities.

It is at this end point, in the treatment of biogas that is fundamental to the efficiency of the WWTP, where Dimasa Group took a special role. The biogas cleaning is composed of 6 twin lines (of 2 units each) for a treatment flow of 2,700 m³ / h for each line. The supply also includes 120 meters of pipes and accessories, with support and heat insulation, and all the control equipment in the kit.

In addition, Dimasa Group also contributed its bit in this mega construction by providing the following elements:

- 1,220 meters of cover in sectors for channel of supply of sanders, to seal and to contain hermetically the vapors and odors formed in the channel.
- 140 units of GRP lids for fine and thick grids of four waters and angle frame, of different sizes.
- 36 tanks in GRP for storage of chemical components.

- More than 2,000 m. (From 03" to 30") for deodorization, air and buried flanges, gaskets and screws in INOX, connections, flanges, elbows (45° and 90°), piping grafts, sleeves of expansion, eccentric reductions, valves...

IDB AWARD

The Atotonilco WWTP project, which began construction in 2010 and began operating in 2016, is the largest sanitation and purification project in Mexico with notable social, environmental and sustainability benefits.

This project, whose design, construction and management is carried out by the Treated Water Consortium of the Valley of Mexico, and in which the Spanish company Dimasa Group has played a fundamental role, being one of its major suppliers, received in June 2016 the Infrastructure 360° Prize awarded by the Inter-American Development Bank (IDB) in recognition of the integral implementation of a sustainability strategy.

The project has been selected as the winner of this third edition of the 360° Infrastructure Awards among 50 projects from 10 Latin American countries in recognition of the model of excellence in sustainability practices, as well as an example of the impact that infrastructure has on the conditions of life and the development of the communities in which they are built.

The plant will mainly benefit to 700,000 people in the Mezquital Valley (300,000 live directly in the irrigation zones), to sanitize 60% of the wastewater of the Valley of Mexico.

The plant is the largest wastewater treatment plant in the world and which has involved an investment of almost 560 M€,



purifies the waste water of 10.5 million inhabitants. The location of this plant is due to the fact that the wastewater from the Valley of Mexico discharges into the municipality of Atotonilco de Tula, where the irrigation districts of the region also start for about 80,000 hectares of arable land. The treated waters conserve the nutrients of the waste water but eliminates the pollutants. So far, sewage has been used directly for irrigation in farmland, mainly maize and forage crops, with no treatment for more than 100 years.

WASTE

Just as the figures for water production are spectacular so are the production of waste and biosolids. The annual production of compacted wastes and washed sands described by the pretreatment system and sieving systems are estimated at 100,178 t/year, with a sanitary landfill being the final destination. The final

production of biosolids generated by the 28% sludge line is estimated at 837,408 t/year (2,294.27 t/day average). The quality of stabilized sludge produced can be used for forest uses, soil improvement and agricultural uses.

The sludge treatment line aims to sieve, thicken, stabilize and dehydrate the sludge from the three generation sources: Primary Clarification, Biological Treatment and (Physio-Chemical Processes Train) TPQ.

The process consists of: sieving of primary sludge, thickening of primary sludge, thinning of secondary sludge, sludge sieving of TPQ, mesophilic anaerobic digestion of 13,000 m³, sludge heating system (30 exchangers of 26 m²) with 4 boilers of 7,400 kW (only in commissioning) and dehydration with 12 units of 100 m³/H.

The thickening process starts with average concentrations of 5% for TPQ sludge, 2.5% for

primary sludge and 0.85% for secondary sludge. The sludge from the TPQ and goes directly to sieves and to the homogenization tank prior to Anaerobic Digestion. The primary sludge goes to the gravity thickeners and the secondary sludge to thickening by flotation with dissolved air. Gravity thickeners expect a concentration at the exit of 6.8% at the exit of the flotation and a concentration of 4% is expected.

The sludge is mixed and homogenized in two reservoirs of 562.5 m³ capacity from where the sludge is propelled to 30 digestors of 13,000 m³. The mesophilic digesters are heat-insulated and mechanically agitated by a 55 kW turbine that picks up the sludge from the bottom of the digester and then drives it to the top.

The sludge heating is produced by 30 exchangers of 894 kW that receive thermal energy from the cogeneration engines, or in the absence of boilers fueled by biogas or diesel.

ENERGY

In the process of sludge stabilization in the digesters, biogas is generated, which is used for the production of electric energy for the self consumption of the plant and for heating the digesters.

The original project contemplates an annual biogas production of 90,760,238 Nm³/year with an expected PCI calorific value of 20,724 kJ/m³ of which only 3.7% is destined for its torch burning. The thermal and electrical uses reach 82% of the total available energy of which 43.7% corresponds to the recovery as thermal energy and 38.3% as electric energy.

The total installed capacity predicted is 46,258 kW, with a total annual electricity consumption of 245,800,055 kWh, of which 197,291,002 kWh will come from



the electric cogeneration.

COGENERATION

The storage of biogas at low pressure is carried out in 7 gasometers of 8,500 m³ with two torches for surplus. Biogas, in addition to the preventive treatment in ferric chloride digesters, has a system of washing and elimination of siloxanes, consisting of a "cold trap" with cooling and condensation with a final adsorption with activated carbon in grain.

The Atotonilco WWTP has one of the most innovative and efficient biogas siloxane cleaning systems, the BIOCLEAN-EVO. This system, patented by Dimasa Group which won, in 2012, two prizes at the Genera Fair in Madrid in the categories of best cogeneration product and best cogeneration project.

The BIOLIMP cleaning module guarantees the reduction of harmful components (water vapor, particles, H₂S and siloxanes). The equipment that forms the plant are located within a base, forming a technological package of easy operation, maintenance and

installation.

The technology can work both in aspiration and drive conditions. Being in the form of a module (pack) which requires a minimum investment in civil works. They are designed according to the capacity of treatment, composition, level of reduction of humidity, H₂S and siloxanes in the biogas stream.

This accounts for all the fundamental stages: cooling, condensation and adsorption in activated carbon (type of carbon according to the majority component). This guarantees a level of reduction of pollutants below the required requirements for the generation of electricity, or its use in other applications that require it. All these stages act simultaneously guaranteeing a biogas suitable for its application in the production of energy (thermal or electric), as well as for the production of biofuel for the automotive industry.

In the Atotonilco WWTP, the treated biogas feeds 12 blowers of 1,200 Nm³/h, which individually feed the 12 cogeneration engines of a unitary production of 2,717



kWe. These motors have a thermal recovery system by means of several exchangers that finally supply thermal energy to the digestion process.

DIMASA GROUP

The international holding company Dimasa Group, based in Barcelona (Spain), a subsidiary in Puebla (Mexico) and a large commercial network in South America, has more than 30 years of experience designing and manufacturing tanks and equipment in Fiberglass Reinforced Polyester (GRP).

All projects are fully customizable and work under the concept “turnkey”: feasibility study, design, manufacturing, delivery, commissioning and after-sales maintenance.

Dimasa Group meets the most demanding manufacturing standards in the sector, and has two international certifications: Quality Management Systems (ISO 9001) and Environmental Management Systems (ISO 14001).

The constant of the preservation of the environment of the founders and new additions for more than

two decades have made Dimasa Group specialists in the treatment of Water, Waste and Biogas.

With continuous activity in the area of R&D&I, Dimasa Group participates in the SMART Green Gas project, together with another group of companies led by Acciona in developing new technologies to obtain high quality biomethane from urban waste. The study aims to increase the biogas yield and improve the quality of the biogas through a bioelectrochemical system within an anaerobic digester.

The business line of Biogas of Dimasa Group is one of the most successful, with 3 different technologies and services offered: Biogas Cleaning and Conditioning, Biogas Pumping and Burning Plant, and Biogas Enrichment (Upgrading).

Thus, in addition to the great works that support their experience, the professionals of Dimasa Group have given several presentations for companies as big as Aqualia or FACSA.

For Aqualia, and under the title “Pretreatment of biogas for its

energy recovery and enrichment to Natural Gas”, explained the different systems for the production of biogas, the problem of pollutants and their solutions, purification techniques, and existing ways to use them.

For their part, FACSA went a step further by betting on the concept of Circular Economy gave the presentation “Use of biogas as fuel for vehicles.” At the same time it was explained how to save between 25% and 50% of fuel of the collection fleet and heavy machinery, thanks to the energetic valorization of the biogas residue.

CONCLUSION

Among the health and environmental objectives of the Atotonilco WWTP, what stands out is the reuse of treated water and the conservation of most of the nutrients contributing added value to the future development of the area through irrigated raw water from the Valley of Mexico.

In order to achieve these objectives, it has adapted its treatment capacity to the current flow considering the differences between the climatological stations of the area with a drought period of 7 months in a year.

As more significant figures, the Atotonilco WWTP involves: regeneration of more than 1 billion m³ per year (of the order of 3 million m³ per day); the generation of energy of 200 GWh/year and the treatment in the sludge processing area of 837,408 t/year of biosolids, these being the main bets for the sustainability of the Atotonilco WWTP. **BD**

