Water and Wastewater Companies for Climate Mitigation

WaCCliM

Case Study - Mexico

How Guanajuato's Water and Wastewater Utilities are tackling Climate Change through Efficiency Optimization and Renewable Energy Production

Activity

Using the WaCCliM approach to improve capacity and lower carbon emissions

Region

State of Guanajuato, Mexico

Sectors

Water and wastewater

Challenges

Political structures and electrcity costs

Good Practice

Climate mitigation measures

Timeframe

2014–2018

Case Summary

In San Francisco del Rincón, two utility companies, SITRATA (Servicio de Tratamiento y Deposición de Aguas Residuales) and SAPAF (Sistema de Agua Potable y Alcantarillado de San Francisco), are collaborating on projects to improve their services and lower their greenhouse gas (GHG) emissions. SITRATA manages wastewater, while SAPAF is responsible for drinking water and sewage. With guidance from the WaCCliM project, both utilities have undertaken a strategizing and implementation process similar to that proposed in the "WaCCliM Roadmap to a Low-Carbon Urban Water Utility".

As a result, SAPAF have increased wastewater treatment coverage from 48% to 81% and improved the energy efficiency of their pumping stations. The magnitude of the increase in treatment coverage was by far the biggest achievement in GHG reduction.

Local artisan with a handmade sombrero. ©Mario Armas

Background

The town of San Francisco del Rincón is located in the west of Guanajuato, Mexico. It has an area of 425.98 km², representing 1% of the total area of the state. According to the Mexico population bureau, Consejo Nacional de Población (CONAPO), the municipality's population was 130,000 in 2016. This is expected to grow to 140,000 by 2030.

The city is famous for its hat and sports shoe industries. These are sold in the local market. Although trade supports the local economy, income from tourism is steadily rising. Agriculture is also essential to the city. This is based in the upper regions of the Turbio River valley, extending to Bajio district. More than 80% of this agricultural land is irrigated from a central reservoir in La Purísima city. Treated and raw wastewater is diluted with freshwater at the reservoir. The San Jerónimo wastewater treatment plant (WWTP) was built to improve sanitation, and therefore the health of people in the area, and to supply water for agricultural production. It began operating in 2013. To improve efficiency, its design included anaerobic digestion of sludge and the ability to generate energy from biogas. A plan to increase treated wastewater reuse in agriculture is currently being developed.

Challenges

Political structures and budget:

There are many challenges in the water and wastewater sector. A changing political culture leads to constant changes in the management of utilities. Federal budget cuts have hampered the implementation of measures to increase the efficiency of service provision.

Electricity costs:

Recent reforms to the national energy law have resulted in highly variable electricity costs. This makes it difficult to assess the viability of energy efficiency measures. On average, energy costs are 25% of total running costs. Lowering these costs is a challenge, as the budget remains low because of the low-cost recovery tariff setup.

Activities

Wastewater collection:

Despite the challenges, SAPAF have greatly increased the wastewater volume reaching the WWTP since it began operating. By focusing on improving and promoting efficiency throughout the organisation, together with complementary federal funds, they have been able to implement pumping efficiency measures.

Baseline assessment:

Using the Energy Performance and Carbon Emissions Assessment and Monitoring (ECAM) Tool, SAPAF and SITRATA conducted a baseline assessment of wastewater processes. This identified all direct and indirect sources of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) emissions in the wastewater collection, treatment, and reuse or discharge chain.

Solutions:

The baseline assessment informed decisions on which measures to implement to reduce energy consumption and GHG emissions most effectively. These measures include increasing wastewater treatment coverage from 48% to 81%, and energy optimisation on pumps and treatment processes. ECAM showed that 94% of the GHG emissions correspond to N_2O and CH_4 from untreated effluent discharged into water bodies. Thus, the increase in treatment coverage contributed significantly to the reduction of GHG emissions, while also increasing the power production capacity of the plant.

At the same time, SITRATA improved the biogas and energy production in the plant, using the organic load contained in the additional wastewater volume received by the WWTP. This, combined with other efficiency measures, has reduced the amount of electricity taken from the grid by approximately 155,000 kWh per year.

Institutions Involved

The WaCCliM project, which aims to reduce water and wastewater utilities' carbon footprint, has supported SAPAF and SITRATA. This project is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the International Water Association (IWA) and Guanajuato State Water Commission, on behalf of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) as part of the International Climate Initiative (IKI).

Financial support from the Comisión Nacional del Agua (National Water Commission, CONAGUA) facilitated the construction of collectors. This increased wastewater treatment coverage.

The State Water Commission has also been very supportive of the project. It has helped to fund energy efficiency measures in pumping.

The National Association of Water and Wastewater Companies in Mexico (ANEAS) has supported the dissemination of the low-carbon approach in the water sector. WaCCliM facilitated SITRATA's participation in network meetings with other utilities that operate WWTPs with co-generation systems that were organised by a GIZ waste to energy programme with support from ANEAS. The Director of SITRATA has also helped to develop standards for the use of biogas and energy generation projects.

Financing

The increased wastewater treatment coverage was financed with a combination of federal, state and local funds (approximately 500,000 EUR). The rest of the measures have been implemented using savings from efficiency measures (7,000 EUR).

To access federal-funded programmes, the executive project must be submitted to CONAGUA. Not all projects are approved: sector demands are high; and there have been significant budget cuts in recent years.

Impacts

The measures have allowed SITRATA and SAPAF to lower operational costs and improve productivity. The immediate impact of increasing wastewater treatment coverage is a **40% reduction in GHG emissions,** equivalent to **2,500 tons of CO_2** per year.

Further measures being considered include the co-digestion of external organic matter in the anaerobic digestor. Organic load would be transported to the plant in trucks and processed in the digestor. This would increase the biogas produced and energy generation potential. The Swiss Agency for Development and Cooperation is interested in exploring this proposal.

Plans to develop treated effluent reuse in agriculture are also proposed. This would further decrease the GHG emissions in two ways. First, the nitrogen remaining in the treated effluent would be used as a fertilizer rather than being partially transformed into N_2O in the river. Second, the nitrogen in the treated effluent would offset fertilizer requirements in agriculture, therefore reducing emissions associated with fertilizer manufacture and transport.

Success Factors

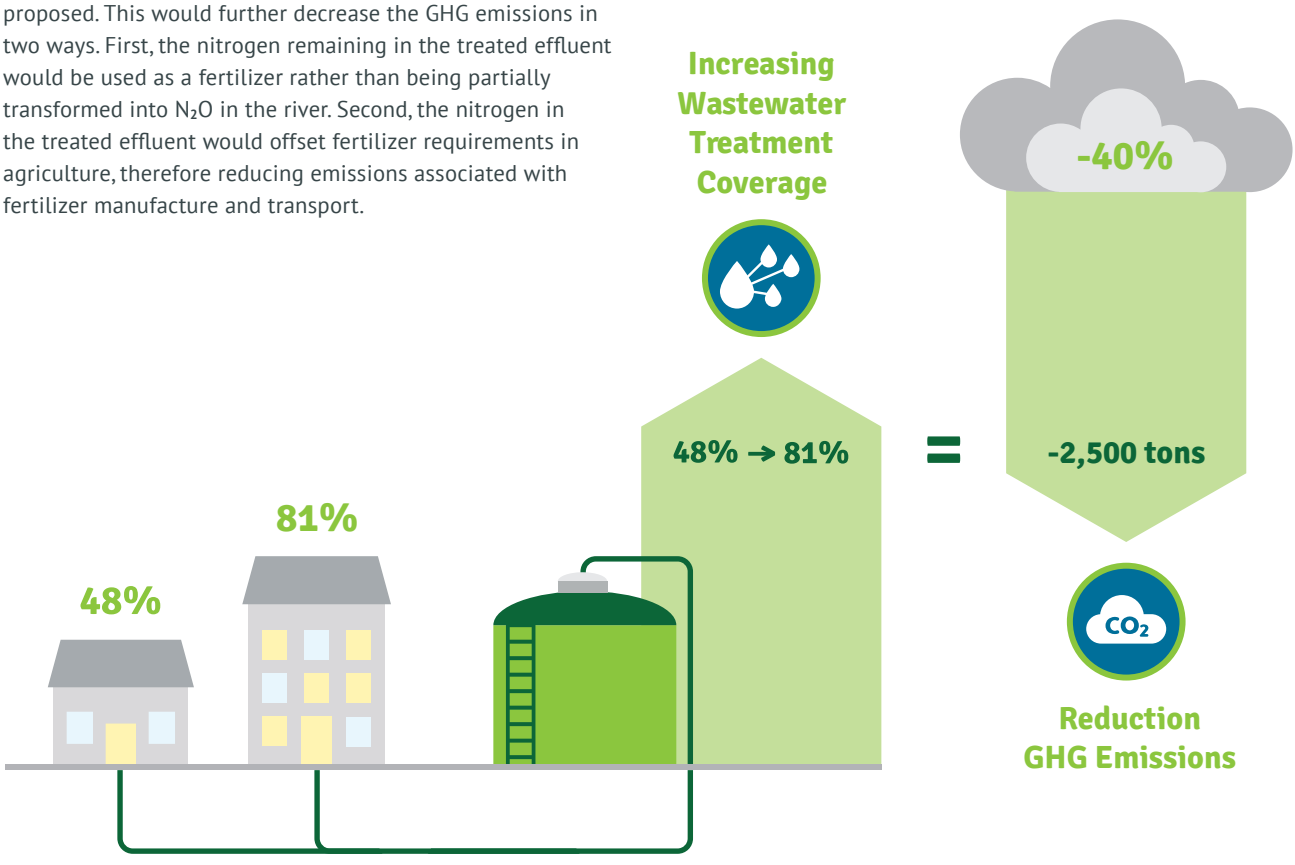
Successful cooperation between the two utilities to reduce emissions and increase efficiency provides a good example for cities with similar conditions.

The engagement and interest from management proved critical to improving efficiency and reducing the carbon footprint. It also effectively changed the organisational culture. This allowed time and effort to be allocated to improving the level of service and efficiency of the entire system.

Obstacles Overcome

The main barrier was frequent changes in management. This restricted long-term planning and outlook. General managers have, on average, less than two years to oversee the utility. There is, therefore, little reward for implementing improvements whose benefit will be obtained a few years down the line.

The low number of WWTPs that actually have biogas installations hinders an effective supply chain structure and increases costs, for example, of replacement parts.



Andrés Rojo (right) has been advising the utilities at San Francisco del Rincón, Guanajuato, Mexico. ©SAPAF

Lessons Learnt

Political commitment is key towards transitioning to low-carbon water utilities. It can take several years to observe the benefits of efficiency measures. In addition, while GHG reduction measures benefit the planet, they cannot be observed directly at a local level.

The Mexican government has set a **framework for GHG reduction goals**. Its mitigation performance is both unconditional and conditional, linked with international support. Through this, the government has created an enabling environment for innovation and collaboration with international organisations.

One of the main lessons learnt from the ECAM assessment is that **untreated sewage discharge** is responsible for a major fraction of emissions. Increasing treatment coverage and implementing treatment processes that produce energy could transform high emissions into a "carbon sink".

The ECAM Tool offers a range of measures, including financial and GHG emission indicators for different scenarios. By following the "WaCCliM Roadmap to a Low-Carbon Urban Water Utility", utilities can reduce their carbon footprint based on a circular economy approach. The tool also provides information on adaptation to water-related impacts of climate change.

Climate variability impacts water availability and storm-water management infrastructure. Extreme climatic conditions have serious impacts in various socioeconomic sectors of Mexico (droughts and flooding). Some initiatives on potential climate change mitigation options are in progress. Trends in water management policies could favour the implementation of such measures.

Replication

Following the pilot in San Francisco del Rincón, the WaCCliM approach is already being replicated in other cities. The water utility in Moroleón, Sistema Municipal de Agua Potable y Alcantarillado Moroleon (SMAPAM), has implemented measures to improve operational energy efficiency and has reduced its energy consumption by 6% in the last two years. WaCCliM is providing SMAPAM with energy diagnostics for their pumping stations and an analysis of the distribution network, including the water balance following the IWA methodology. This will help to reduce water losses, pumping requirements and protect local water sources. On a national level, similar efforts are being conducted on the water system of Parral, Chihuahua.

Best Practice

Both SITRATA and SAPAF have completed the WaCCliM approach to achieve reduction results. They are now climate mitigation trend-setters in the region. The project results have been presented at national and international conferences and received positive feedback.

Next Steps

SITRATA is planning to implement further measures to increase cost effectiveness and reduce GHG emissions and energy consumption. Overall, it aims to achieve a 15% reduction in GHG emissions in the short term. In the long term, the aim is for the WWTP to become energy independent through co-digestion (adding organic waste from other sources to the digester currently processing sludge). Although implementing co-digestion has technical and institutional challenges, it could reduce GHGFs by up to 20% overall.

Training on the Energy Performance and Carbon Emissions Assessment and Monitoring (ECAM) Tool of water utility operators from Mexico. ©GIZ

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