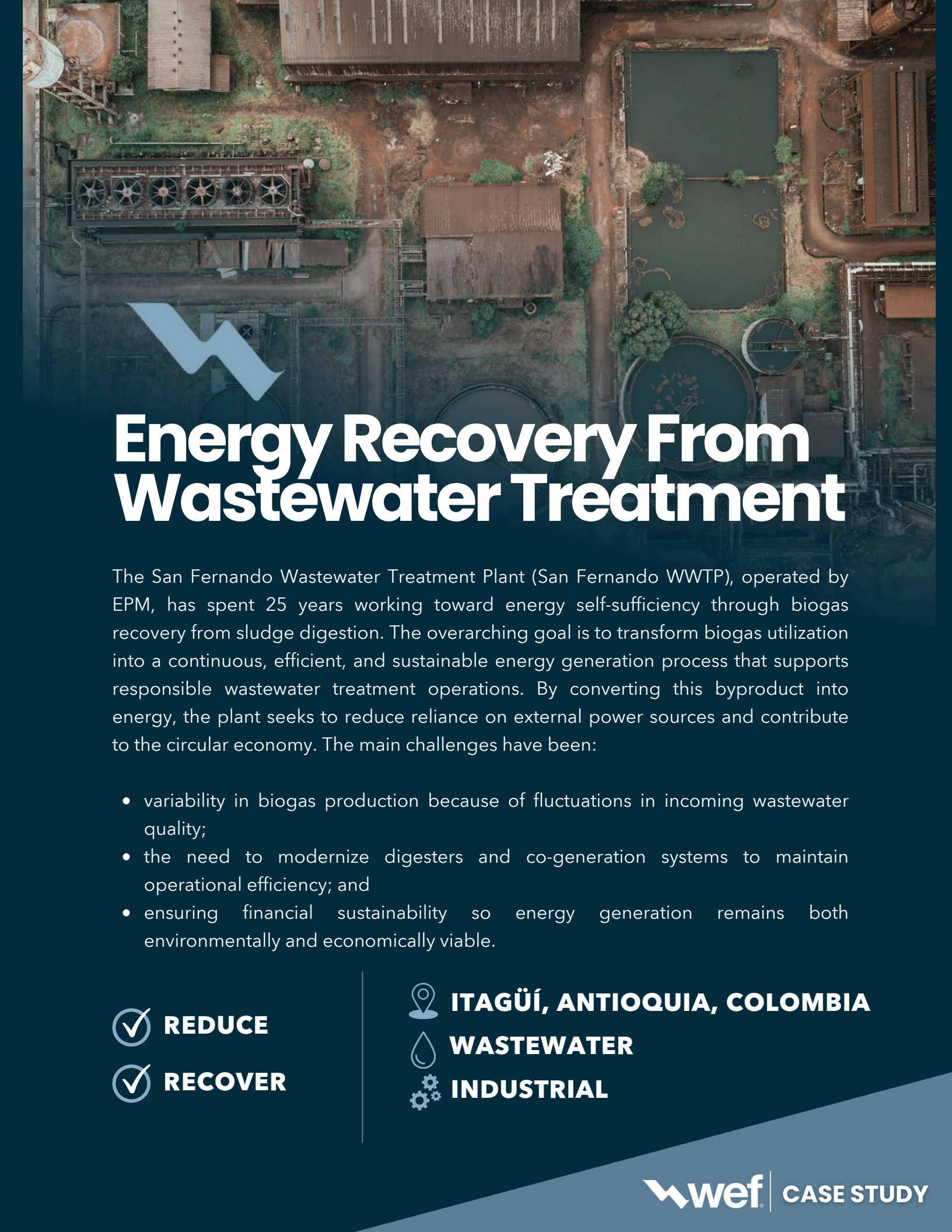




Energy Recovery From Wastewater Treatment

The San Fernando Wastewater Treatment Plant (San Fernando WWTP), operated by EPM, has spent 25 years working toward energy self-sufficiency through biogas recovery from sludge digestion. The overarching goal is to transform biogas utilization into a continuous, efficient, and sustainable energy generation process that supports responsible wastewater treatment operations. By converting this byproduct into energy, the plant seeks to reduce reliance on external power sources and contribute to the circular economy. The main challenges have been:

- variability in biogas production because of fluctuations in incoming wastewater quality;
- the need to modernize digesters and co-generation systems to maintain operational efficiency; and
- ensuring financial sustainability so energy generation remains both environmentally and economically viable.



ITAGÜÍ, ANTIOQUIA, COLOMBIA



WASTEWATER



INDUSTRIAL

CHALLENGES FACED

Variability in biogas production often arises from fluctuations in wastewater quality and sludge organic load, requiring operational adjustments and technological upgrades to sustain anaerobic digester efficiency and stable gas generation. Implementing the biogas upgrading facility demanded highly specialized technical expertise to ensure gas quality. This was particularly significant, as it was the first facility of its kind in the country.

TECHNOLOGIES & SOLUTIONS USED

The San Fernando WWTP combines advanced liquid and solids treatment to ensure regulatory compliance and resource recovery. The liquid line uses activated sludge and Bardenpho reactors, while the solids line processes sludge into biosolids through thickening, anaerobic digestion, and dewatering—reducing pathogens and generating biogas. This biogas is used both to meet part of the facility's energy needs and to supply the Medellín city gas grid. Supported by a Distributed Control System for real-time monitoring and an integrated odor control system, the facility minimizes environmental impacts.

IMPACT & INSIGHTS



Since its commissioning in May 2000, the San Fernando WWTP has treated more than 1 billion m³ of wastewater, generating 140 million kWh of electricity and achieving 30% energy savings. The facility has also produced 720 metric tons of biosolids (wet basis), removed 256 metric tons of biochemical oxygen demand, and eliminated 386 metric tons of total suspended solids. The implementation of biogas-based energy generation has reinforced EPM's commitment to sustainability and innovation by fostering clean technologies, byproduct recovery, and circular economy practices. Organizationally, it motivated staff toward continuous improvement, energy efficiency, and compliance.

LESSONS LEARNED



For future implementations of biogas-based energy generation, priority should be placed on conducting more detailed and continuous sludge characterization from the earliest stages. This would enable utilities to better anticipate fluctuations in biogas production and optimize operational parameters with greater precision. Preventive maintenance of digesters and engine generators would also be strengthened to minimize efficiency losses and ensure process continuity. Equally important is the early integration of multidisciplinary teams, including specialists in process engineering, energy, automation, and sustainability to support a more robust implementation.

“Through efficient wastewater treatment, we not only protect our water bodies but also generate valuable byproducts such as biosolids and biogas, which can be used for soil improvement and energy generation. This comprehensive approach demonstrates that it is possible to combine operational efficiency with lasting social and environmental benefits.”