

CASE STUDY 1

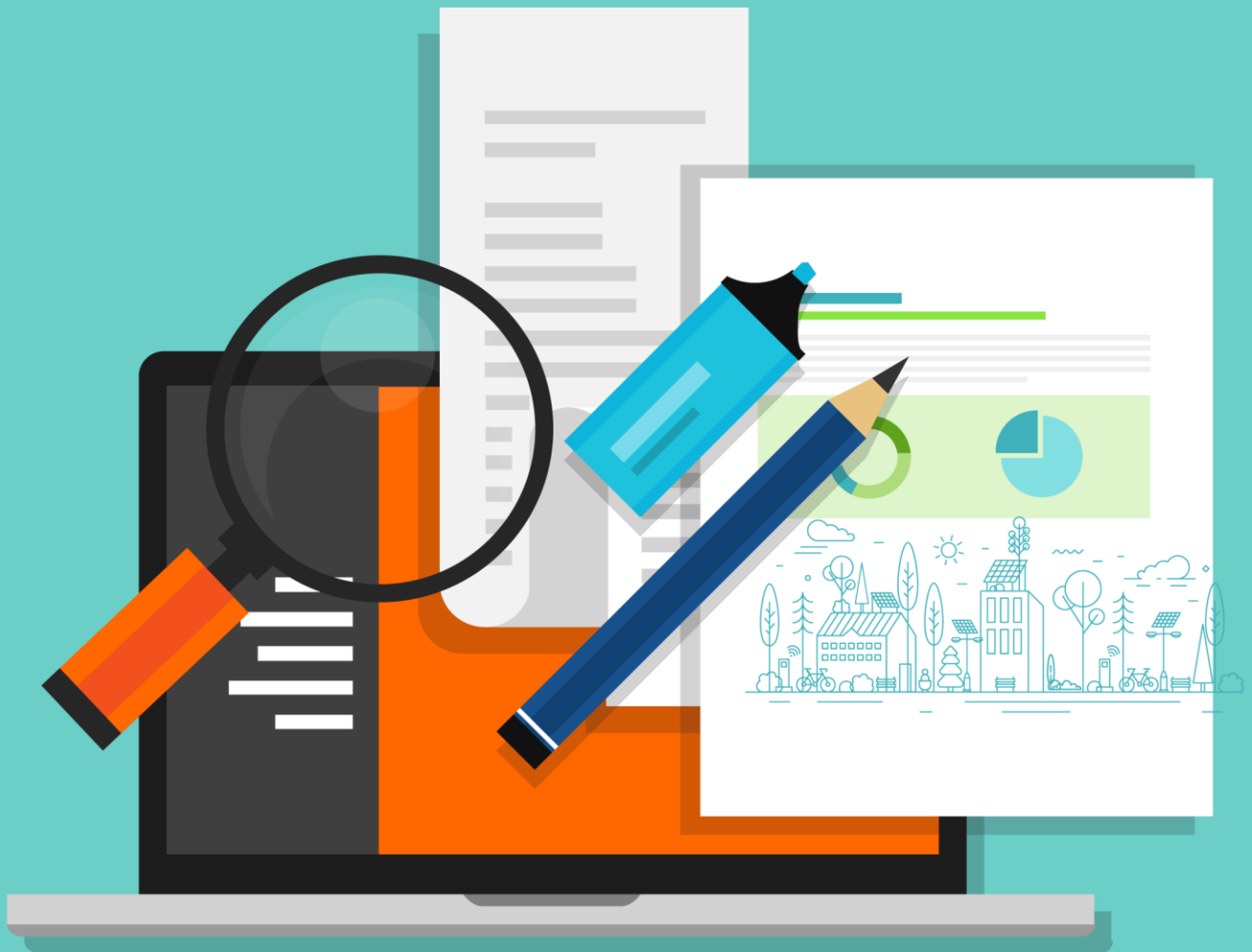
City: Naucalpan, State of Mexico

Project: Organic Waste to Energy Management System

Financial Mechanism: Public-Private Partnership



GREEN FINANCE
FOR SMART CITIES



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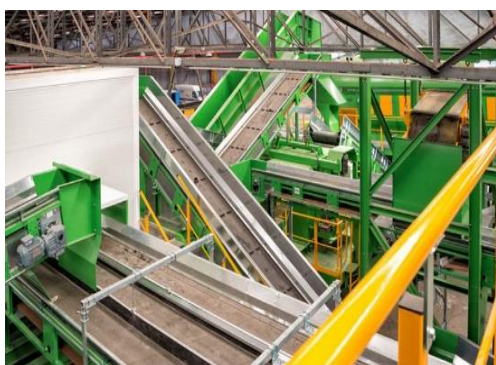
Case study 1

Naucalpan, State of Mexico

Project: Organic Waste to Energy Management System

Sector: Waste management

Responsible Institution: Climate Change Office at the Presidency of the Municipal Government of Naucalpan of Juárez, State of Mexico



OBJECTIVE

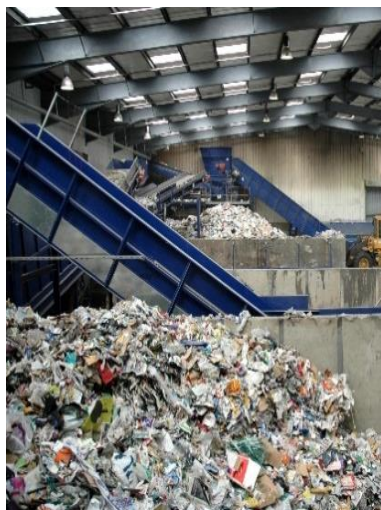


Manage in a sustainable way the municipal solid waste, and promote a circular economy, through a mechanical-biological treatment plant (MBT), which allows to value waste, generate electricity, reduce carbon emissions; as well as reducing municipal costs for final disposal of waste, and electricity use of public lighting and municipal water pumping.

TECHNICAL AND TECHNOLOGICAL COMPONENTS



Infrastructure: mechanical separation plant to take advantage of recyclable waste with a capacity of 1,300 tons per day; anaerobic digestion recovery plant for the treatment of organic fraction of waste and energy recovery system with electric generation capacity of up to 6 MW; and interconnection to the electricity grid.



STRATEGIC ALIGNMENT AND POLITICAL COHERENCE



National objectives. Contributes to the national goal of producing 35% of electrical energy from clean sources by 2024, provided for in the General Climate Change Law and the Energy Transition Law, and to the goal of reducing GHG emissions from climate change commitments of Nationally Determined Contributions (NDC) for the period 2020-2030.

- **State of Mexico Development Plan 2017-2023.** Aligned with the goal of "Orderly, sustainable and resilient State of Mexico", which aims to consume energy from renewable sources, reduce the carbon footprint, achieve sustainable management of solid waste and expand coverage for wastewater treatment in the State.
- **Naucalpan municipal development plan.** Alignment with Objective 3.1 of and Objective 3.3: Guarantee access to affordable and non-polluting energy.
- **Municipal commitment.** Consume 75% clean energy.

PARTNERS AND STRATEGIC ACTORS



- National Bank of Infrastructure (BANOBRAS): financial structuration and public investor under a PPP
- Inter-American Development Bank (IADB): Sustainable infrastructure evaluation and sustainability sheet methodology for the *Proyectos México* platform.
- The German Agency for International Cooperation for Sustainable Development in Mexico (GIZ), IDOM with support from UK PACT, KfW Development Bank, U.S. Environmental Protection Agency (EPA): technical assistance and preparation of studies.



ENVIRONMENTAL AND SOCIAL SUSTAINABILITY



- Annual reduction of emission: 58 thousand tCO₂ equivalent and avoid sending to landfill 109.5 thousand tons of waste, which will be revalued. Annual generation of 17 GWh of clean energy and reduction of the negative impact on the aquifers by lixiviate.

Direct impact on the following Sustainable Development Goals:



- **SDG 7. Affordable and clean energy:** generation of electricity from organic waste, for self-supply in public lighting or municipal water pumping.
- **SDG 8. Decent work and economic growth:** the operation of the plant will promote formal employment, as well as gender integration policies for people who currently work in precarious working conditions within the municipal landfill.
- **SDG 11. Sustainable cities and communities:** Reduction of the negative environmental impact in the city of Naucalpan and promotion of the circularity of materials through better public waste management.
- **SDG 13. Climate action:** Mitigation of climate change by direct and indirect reduction of GHG emissions.

FINANCING



- **Financing mechanism:** Public-Private Partnership - BOT (Build – Operate – Transfer), through a concession of 20 years of operation
- **Total investment:** MXN \$ 1,274.5 million (30% BANOBRAS grant, 70% private equity)
- **Operation & Maintenance:** approx. MXN \$ 82.83 million annually
- **Annual income:** approx. MXN \$ 330.3 million. The project includes a mixed income structure: municipal tariff per ton of waste treated in the plant, sale of electricity generated and sale of recovered valuable waste (PET, aluminum, paper, cardboard, HDPE, LDPE glass and waste derived fuel).

KEY LESSONS LEARNED



- Due to the complexity of the project and its different edges, **periodic communication** with different operational and planning teams of the municipality, as well as, with external institutions has been essential to ensure good development of the project.
- **High-cost pre-feasibility studies** are required and low or no assigned budget, in this project **the technical studies' cost are equivalent to 2%** of the total capital investment. Financing has been obtained from the national development bank, the municipality itself, and diverse types of development cooperation.
- To plan the activities and times of all those involved, it is of great support to develop in advance a schedule of procedures, authorizations and permits in terms of environmental impact, social impact and electrical interconnection, among others. The schedule should identify milestones, costs, and responsible parties.
- Giving continuity to the projects of past administrations is favorable, since the project preparation processes are very long.

GOOD PRACTICES



- A key factor has been the appointment of **promoter and person responsible of the project (Project Manager)**, in charge of monitoring and complying with the planned times, coordination of the various actors involved and the internal information management.
- An **early approach with financial institutions** to guide efforts and meet the requirements of funding sources on time.
- Generate **formal employment opportunities** that will benefit vulnerable groups and promote the local circular waste economy.
- Estimate the volume of GHG emissions reductions before and during project operation.

CONTACT INFORMATION



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CASE STUDY 2

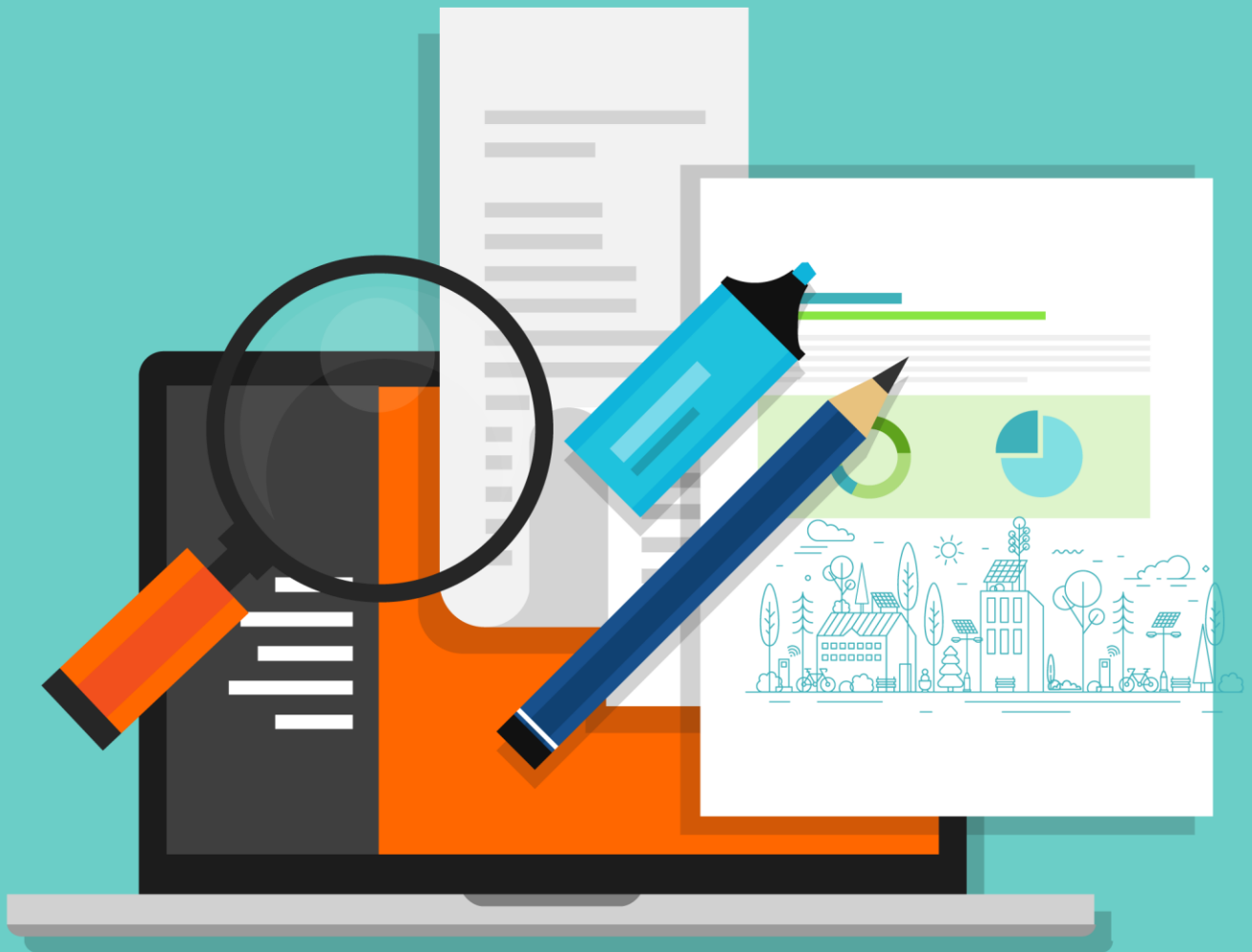
City: Zapopan, Jalisco

Project: Smart Cycleway System

Financial mechanism: Public investment, collection through green fees for shared mobility and social currency



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CASE STUDY 2

Zapopan, Jalisco

Project: Smart Cycleway System

Sector: Mobility

Responsible Institutions: Non-Motorized Mobility Unit at the Zapopan Mobility and Transportation, Public Works and Municipal Treasury.



OBJECTIVE:



Promote the use of non-motorized mobility with zero emissions to the atmosphere, through a network of interconnected bicycle lanes, (regulated) private offer of shared electric mobility solutions, and a digital platform for users, which includes interactive maps, economic incentives with local commerce (Social Coin), a communication channel with the community and monitoring of cyclists.

TECHNICAL AND TECHNOLOGICAL COMPONENTS



- **Infrastructure:** 6 segregated bi-directional bike lanes with a total of 39 km.
- **Technological:** Development of API (Application Programming Interface) that integrates a digital solution focused on promoting sustainable mobility, maps and an exchangeable social currency in local commerce.
- **Regulation:** on the access and deployment of non-motorized individual mobility services on the network (bicycles and electric skates).
- **Financing:** Mechanism that earmarks the income from regulation to private mobility services for the implementation of sustainable mobility actions of the municipality.



STRATEGIC ALIGNMENT AND POLITICAL COHERENCE



- **State Development Plan.** Objective 6. Move towards a sustainable mobility model that promotes the use of mass and collective transportation systems, that promote integrality among other types of transportation, including non-motorized ones, that guarantee a safe, efficient and quality mobility for the people.
- **State Plan and Program for Action for Climate Change.** Strategy M1. Sustainable cities, urban mobility and air quality. M1. 13 increase points and routes in the public bicycle service.
- **Municipal Development Plan.** ODZ 7. Promote a sustainable and equitable mobility policy that guarantees the quality, availability and efficiency of trips, through an integrated communication and transportation system.
- **Master Plan for Non-Motorized Urban Mobility of Guadalajara's Metropolitan Area.** Develop a comprehensive mobility system that favors non-motorized modes of transport and contributes to the development of a sustainable city.

PARTNERS AND STRATEGIC ACTORS



- Center for Innovation in Smart Cities of the University of Guadalajara, Campus CUCEA: design, programming and launch of API and social currency
- IDOM with support from UK PACT: technical assistance and project management.





ENVIRONMENTAL AND SOCIAL SUSTAINABILITY



Considering a benefit to 177,378 inhabitants of the active population, an annual reduction in GHG emissions of 8,843 tCO₂eq is estimated, and an improvement in air quality avoiding the emission of 895 tons of PM, 156 tons of SO₂, 48,643 tons of NO_x, and 2,452 tons of NH₃. Promotion of the local economy of more than 600 small businesses and the health of over 17,736 active users.

Direct impact on the following Sustainable Development Goals:



- **SDG 9. Industry, innovation and infrastructure:** the project promotes the development of sustainable infrastructure to offer new emissions-free shared mobility services, as well as the use of innovative digital solutions at the service of the community, local commerce and mobility in the municipality.
- **SDG 11. Sustainable cities and communities:** the new bicycle lanes infrastructure contributes to the development of healthier and more resilient human settlements, improves urban management and reduces the environmental impact of the city.
- **SDG 13. Climate action:** the transition towards a sustainable mobility is promoted, which would reduce GHG emissions from mobile sources in the transport sector of the municipality of Zapopan.

FINANCING



- **Financing mechanisms:** public investment (municipal, state and federal funds), collection through green fees for shared mobility, and social currency as a promotion scheme with local commerce (private incentives).
- **Total infrastructure investment:** MXN \$ 262,125 million for the construction of 39 km of cycling network.
- **Annual revenue** (from green fees to shared mobility companies): an estimated MXN \$ 1,464 million net in the first year of operation and up to MXN \$ 148,184 million during its optimal useful life, with a penetration of 2,600 bicycles and 2,600 electric scooters.

KEY LESSONS LEARNED



- It is important to design a **long-term sustainable mobility plan**, integrating different modes of transport and other public infrastructure, as well as integrating metropolitan or regional planning. Planning for the cycling network requires projecting new constructions, investment and maintenance costs, in as much detail as possible with economic growth scenarios.
- **Periodic communication** between different operational and planning areas of the municipality, i.e. Mobility and Public Works Direction, and with relevant external institutions, is essential to ensure that long-term sustainable mobility planning is developed successfully.
- It is essential to plan public **resources dedicated to sustainable mobility**, through some budget mechanism (specific item) or financial vehicle (fund or trust), which can also capture and label the income generated.

GOOD PRACTICES



- It promotes innovation and local technological development, under a government-academy collaboration with the University of Guadalajara.
- It combines the benefit of sustainable mobility in health, with the promotion of the local economy, through a social currency that involves both small businesses and municipal markets and large companies or corporations in the area.
- The generation and management of data has been an indispensable factor for the planning and analysis of the program's performance.

CONTACT INFORMATION



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CASE STUDY 3

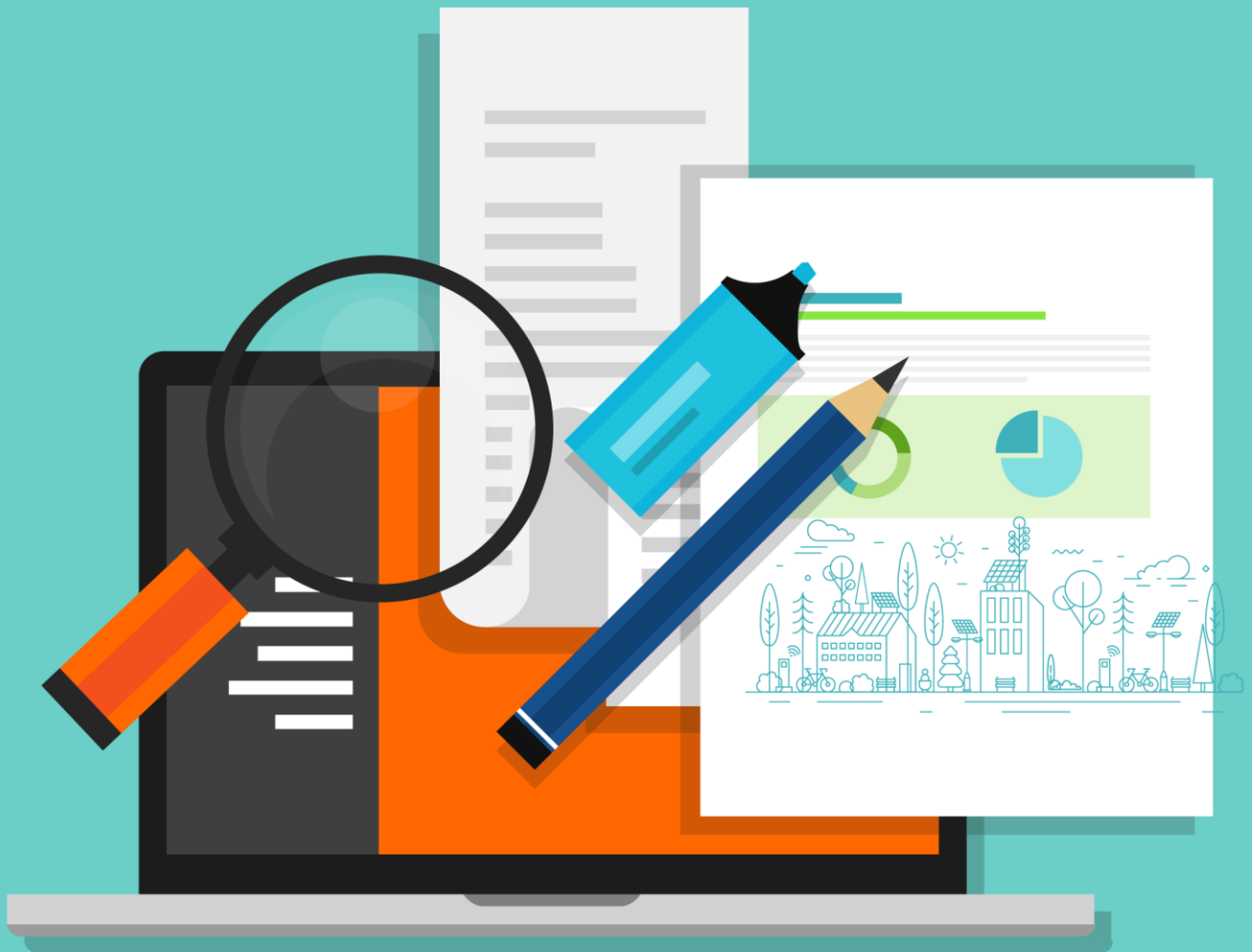
City: Zapopan, Jalisco

Project: Zapopan Solar

Financial mechanism: Municipal public contribution,
potential fund FORTAMUN



GREEN FINANCE
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Zapopan, Jalisco

Project: Zapopan Solar

Sector: Renewable Energy

Responsible institutions: Coordination of Economic Development and Fight against Inequality of Zapopan and Municipal Treasury



OBJECTIVE:



Promote solar distributed energy generation in Zapopan's homes, through a program that reduces the payment of electricity consumption contributing to the family economy, avoids public spending on electricity subsidies, and reduces the environmental impact of the municipal energy matrix. The program foresees the installation of 300 photovoltaic systems for domestic self-supply, which provide access to clean and affordable energy to the inhabitants of Zapopan and that promote business competitiveness and local employment in the solar energy sector.

TECHNICAL AND TECHNOLOGICAL COMPONENTS



- **Infrastructure:** Installation of solar photovoltaic systems at 300 homes in Electricity Tarif 1 within the Districts "El Colli" and "Vallarta - Patria", with 990 W capacity per home (297 kW total) and digital monitoring.
- An annual renewable energy generation of 550.8 MWh is estimated for the whole project.
- **Operation & Maintenance:** The program includes a free monitoring and maintenance plan during the first 5 years, an evaluation period and technical analysis of the program for its escalation.



STRATEGIC ALIGNMENT AND POLITICAL COHERENCE



- **Jalisco Infrastructure and Public Works Sectorial Program.** Objective 10. Reduce the lack of alternative energy generation.
- **State Sectorial Environment Program.** Objective 6. Mitigate greenhouse gas emissions.
- **Zapopan Municipal Development and Governance Plan 2018-2021**
 - SDG 7. Promote projects for the generation of Affordable and Non-Pollutant Energy.
 - SDG 9. Attract new Industry and promote high-value Innovation by improving Zapopan's competitiveness through the development of adequate Infrastructure.

PARTNERS AND STRATEGIC ACTORS



- Mexico Climate Initiative (*ICM, Iniciativa Climática de México*): Collaborator for implementation by sharing good practices and lessons learned from the Solar City (*Hogares Solares*) program in CDMX, as well as technical and legal recommendations.
- CSolar: Technical advice in the national photovoltaic sector.
- IDOM with support from UK PACT: technical assistance in design and project management.



ENVIRONMENTAL AND SOCIAL SUSTAINABILITY



Annual indirect emissions reduction of 285 tCO₂eq, 0.42 ton of PM, 1.64 ton of SO₂, and 2.11 ton NO_x are estimated, due to the avoided demand for electricity from the national grid.

Savings potential for the 300 homes of a total of MXN \$ 23,943,647.2 during the via lifespan of the systems (20 years of operation), approximately MXN \$ 79,812 per beneficiary.

Direct impact on the following Sustainable Development Goals:



- **SDG.7 Affordable and clean energy:** The project analyzes technically and economically, the scalability potential of a Clean Distributed Generation domestic network as part of the State generation, providing Mexican homes with affordable energy with zero polluting emissions into the atmosphere.
- **SDG. 9 Industry, innovation and infrastructure:** The transition towards a sustainable electric energy service infrastructure is promoted with current photovoltaic technology and constant digital monitoring.
- **SDG. 11 Sustainable cities and communities:** Distributed Generation systems for the self-supply of electricity provide the community with resilience to fluctuations in the energy sector and the economy through a renewable and safe resource such as sunlight, avoiding GHG emissions and positively impacting the quality of life.
- **SDG 13. Climate action:** The transition to a sustainable energy matrix is promoted, which reduces the GHG emissions generated in the energy matrix of the municipality of Zapopan.

FINANCING



- **Funding source:** Municipal public contribution, from the potential national fund: FORTAMUN
- **Total infrastructure investment:** MXN \$14,103,122.24
 - Solar Photovoltaic instalations: MXN \$11,712,056 (MXN \$39, 000 per home)
 - Guarantee fund for monitoring and maintenance during the first 5 years of operation: MXN \$ 2,391,066.24
- **Annual savings:** Savings from MXN \$3,000 to MXN \$5,000 per year are estimated for each family, during 20 years of operation of the systems.

KEY LESSONS LEARNED



- Communication material on renewable energy, and Solar Photovoltaic systems for homes to provide citizens with basic information and engage them, during the diagnosis and technical data gathering phase, to select an urban delimited area and list of potential users of the program.
- Carry out continuous coordination meetings with Treasury to review the public account, funds and potential access mechanisms for funding.

GOOD PRACTICES



- Holding informative meetings with the representatives of the neighborhood associations to communicate the main objective and carry out diagnosis and technical data collection.
- Share of knowledge generated by ICM based on its previous experience with Solar City program in CDMX (*Hogares Solares*): contracting and operation mechanism, administrative structure, technical annexes and communication strategy.

CONTACT INFORMATION



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CASE STUDY 4

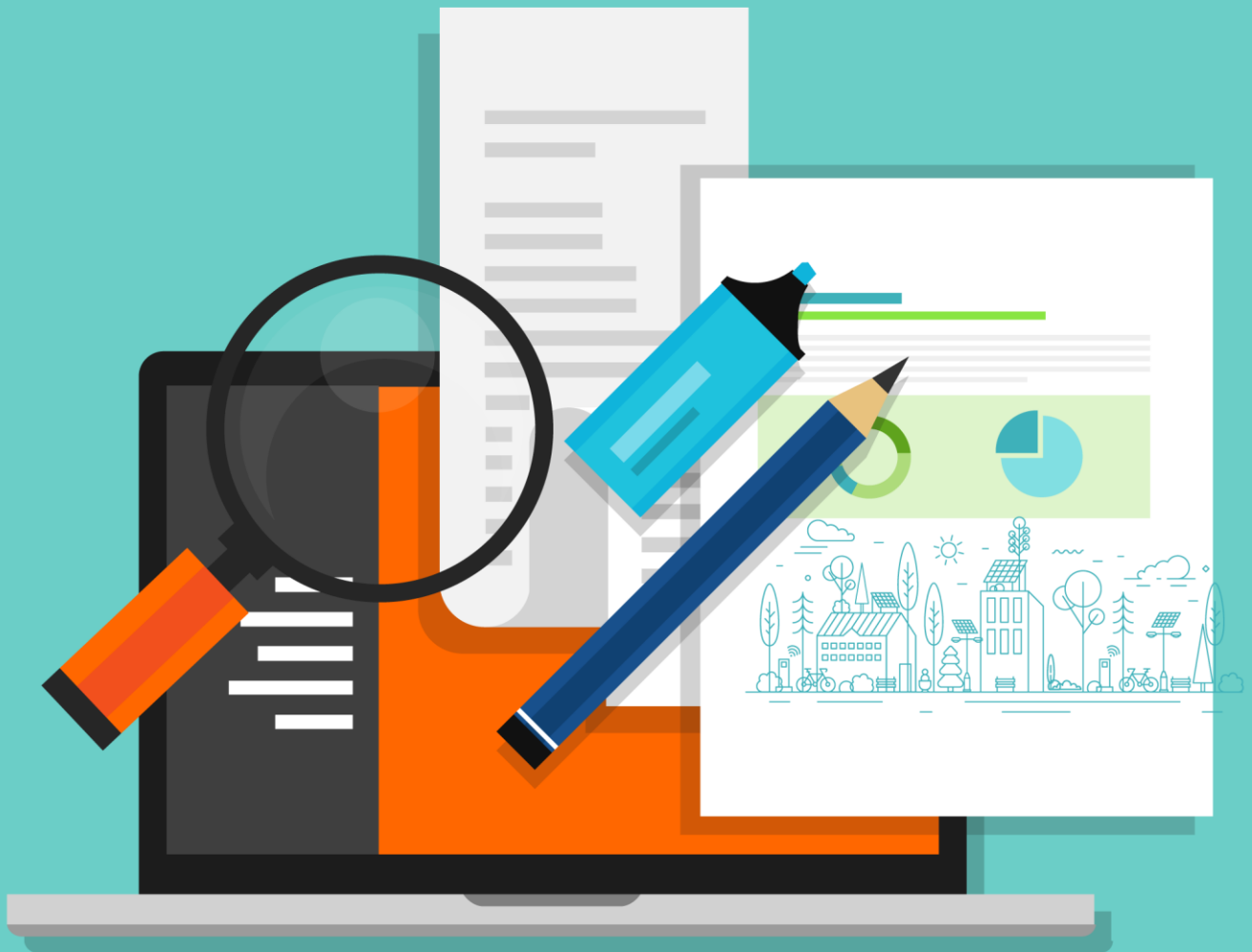
City: Hermosillo, Sonora

Project: Energy efficiency and renewable energy generation in academic and research institutions, through an ESCO model

Financial Mechanism: Energy Performance Contracting (EPC), Power Purchase Agreement (PPA)



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Hermosillo, Sonora

Project: Energy efficiency and renewable energy generation in academic and research institutions, through an ESCO Model.

Sector: Renewable energy

Responsible institutions: Aquaculture Institute of the State of Sonora (IAES, in spanish), CONALEP Hermosillo II, Commission for Ecology and Sustainable Development of the State of Sonora (CEDES, in spanish)



OBJECTIVE



Provide both a public education institution (CONALEP Hermosillo II) and a research institution (CREMES) with a financing model based on a Power Purchase Agreement, and an Energy Performance Contract (EPC). The foregoing to invest in energy efficiency measures and in the generation of renewable energy, which will allow generating savings in electricity consumption costs, promoting energy self-sufficiency and reducing greenhouse gases emissions. The project is intended to be replicable in similar public institutions.

TECHNICAL AND TECHNOLOGICAL COMPONENTS



- **Technological:** Installation of Solar Photovoltaic energy generation systems for a total of 326 kW (CREMES: 226 kW, CONALEP: 100 kW). Technological changes of energy consuming devices to achieve up to 20% savings, among which the following stand out: high-efficiency luminaires and high-efficiency cooling equipment.
- **Applicable regulation:** Electricity generation permit (CFE) with bilateral connection, contracting of an Energy Service Company (ESCO).
- **Financing:** Medium-term Power Purchase Agreement (PPA), and an Energy Performance Contract (EPC) for energy efficiency measures.



STRATEGIC ALIGNMENT AND POLITICAL COHERENCE



- **Sonora State Development Plan 2016-2021.** Strategy 6.2. Promote the attraction of investments in electric power generation projects from clean and renewable sources.
- **Green Growth Strategy of the State of Sonora.** Objective 1. Move towards decarbonization and energy independence.
- **Municipal Development Plan of Hermosillo 2019-2021.** Line of action 4.4.1.2. Actions that contribute to good air quality in the city must be carried out. Line of action 3.3. Design and implementation of an energy efficiency and renewable energy program in the municipal facilities.

PARTNERS AND STRATEGIC ACTORS



- Renewable Energy Laboratory, Technological University of Hermosillo (UTH, in spanish). Preliminary energy audits.
- Sonora State Energy Commission (COEES, in Spanish). Coordination, accompaniment and dissemination.
- IDOM with support from UK PACT. Technical assistance.





ENVIRONMENTAL AND SOCIAL SUSTAINABILITY



- Annual reduction of indirect emissions: 408 tCO₂eq, and 5.37 tNO_x due to the avoided demand for electrical energy from the national grid for a total of approximately 757,000 MWh/y.
- Improvement in the health and safety of users and employees of the institutions, as well as the community in general.
- Living laboratory and creation of knowledge for students of CONALEP and UTH.
- Improvement in the education and research sector of local public administration.
- Direct impact on the following Sustainable Development Goals:



- **SDG 7. Affordable and clean energy:** The project promotes the implementation of affordable and clean solar energy generation.
- **SDG 13. Climate Action:** Reduce GHG emissions through generation of clean energy and measures for the rational use of electric power.
- **SDG 14. Life below water:** Currently CREMES has programs for the cultivation of an endemic species of the Gulf of California that is in danger of extinction: the Totoaba.

FINANCING



- **Financing mechanisms:** Private investment. The Municipality will tender the hiring of an ESCO company under an Energy Performance Contract (EPC) for energy efficiency measures, and through a Power Purchase Agreement (PPA) for the generation of solar renewable energy. The ESCO carries out the investment and operation in both cases and guarantees a certain saving and a price for the power supply lower than the current one.
- **Total investment:** MXN \$11.3 million. (CREMES facilities MXN \$ 7.8 million, CONALEP facilities MXN \$ 3.5 million).
- **Annual savings:** An economic saving of 50% is estimated for each of the parties from the beginning of the contract and for 10 years, and a saving of 100% for the institutions at the end of the contract and until the end of the useful life of the installed systems.
- **Operation & Maintenance:** MXN \$ 140 thousand annual approximate. Monthly payment of electricity at a lower cost than the current one during the contract period (repayment of the investment). To be accurately estimated between the parties during the preparation of the contract.

KEY LESSONS LEARNED



- It is important to have a sufficiently robust energy audit to quantitatively define the project and design the technical and bidding aspects.
- The legal, juridical and administrative area of the institution or body that wishes to implement EPC or PPA contracts must carefully review any laws or regulations that could prevent the agreement of a **medium-term contract** of this type. For public institutions (decentralized), some budget autonomy is required.

GOOD PRACTICES



- The project promotes innovation, and local academic and technological development under a government-academy collaboration with the Technological University of Hermosillo (UTH), institution that provided preliminary energy audit services for the design of investment projects.
- It provides benefits from low-carbon technologies to academic and research institutions for the protection and reproduction of marine endangered species.
- Replicable and scalable material to other similar public academies and research institutions **was designed**.

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