ASAZGUA
Asociación de Azucareros de Guatemala

SUSTAINABLE WATER & ENERGY SOLUTIONS NETWORK

CASE STUDY:

Activities by the Guatemala Sugar Agroindustry supporting the implementation of the Sustainable Development Goal 7 (SDG 7) of the United Nations 2030 Agenda for Sustainable Development.

Asazgua: Association of Sugar Producers of Guatemala | 2023

Cogeneration was the second most important source of electricy in Guatemala between November 2021 and May 2022 representing 27 % of the national matrix.

7 AFFORDABLE AND CLEAN ENERGY

ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE AND MODERN ENERGY FOR ALL

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Ensure access to affordable, reliable, sustainable and modern energy for all / Asazgua

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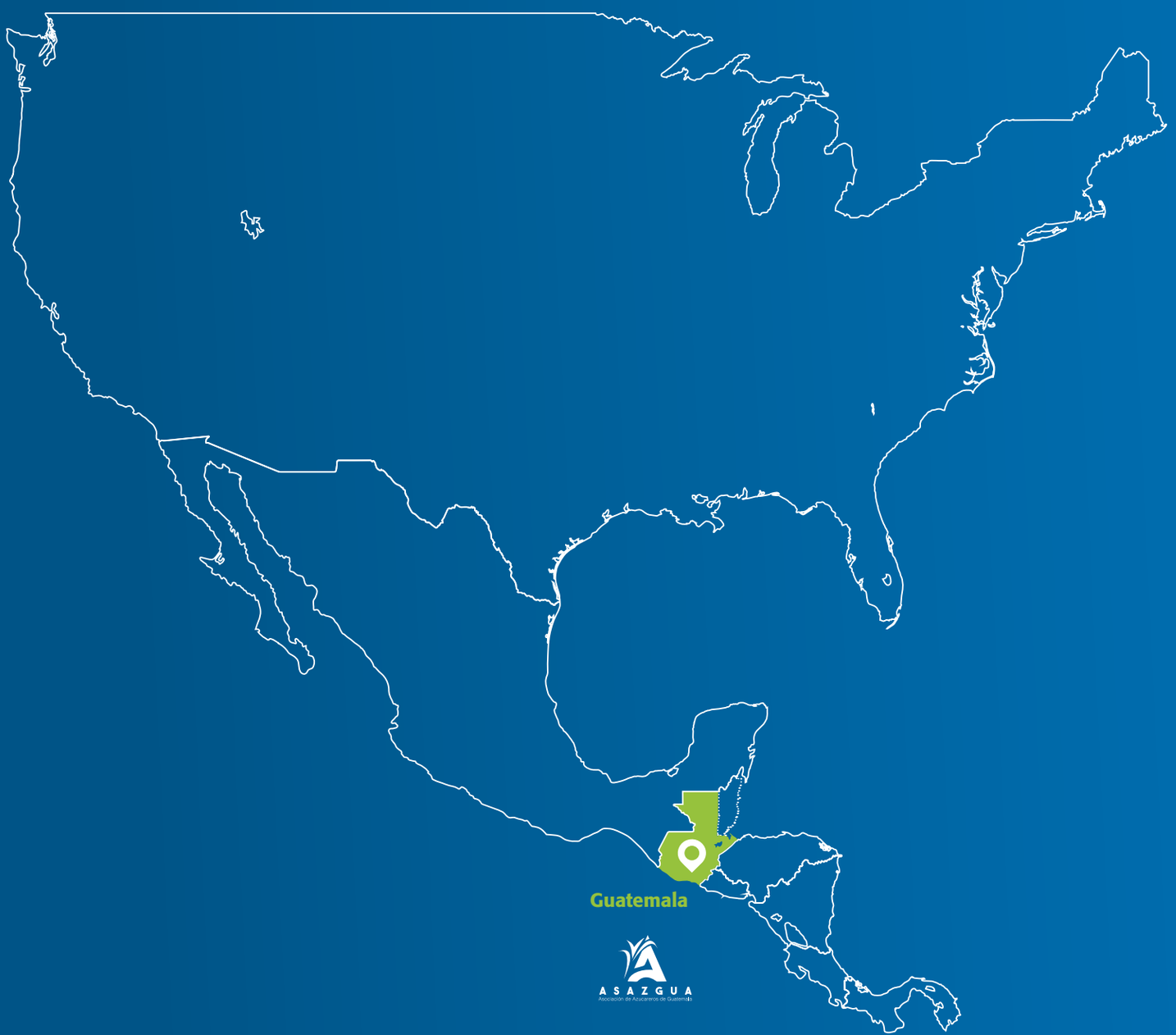


CONTENTS

SDG7: ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE AND MODERN ENERGY FOR ALL

Target 7.1 By 2030, ensure universal access to affordable, reliable, and modern energy services

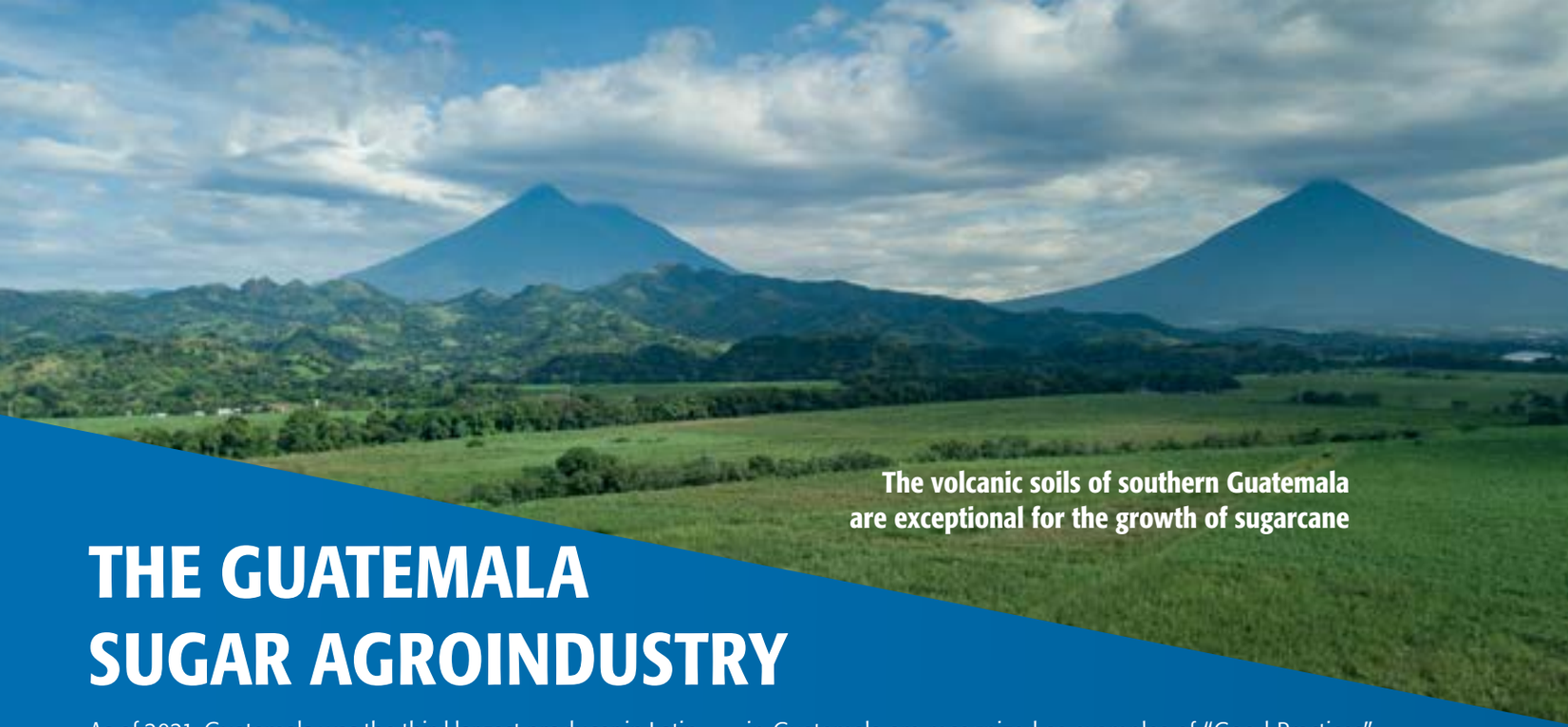
Target 7.2 By 2030, Increase substantially the share of renewable energy in the global energy mix

Target 7.3 By 2030, double the global rate of improvement in energy efficiency

Target 7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technologies, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, and promote investment in energy infrastructure and clean energy technologies

Target 7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support.

Source: United Nations, 2015



The volcanic soils of southern Guatemala are exceptional for the growth of sugarcane

THE GUATEMALA SUGAR AGROINDUSTRY

As of 2021, Guatemala was the third largest producer in Latin America and the sixth largest exporter of sugar in the world. Sugar is the second agroindustrial product most exported of Guatemala. The Guatemala Sugar Agroindustry generates almost US $700 million in foreign exchange annually and provides more than 55,000 direct jobs and 278,000 indirect jobs in the country. Besides, the sector receives products and services from more than 6,000 small, medium-sized and large enterprises, which also generate more employment. Only 2.97% of the cultivable land in Guatemala is used for sugarcane production. Asazgua, the Association of Sugar Producers of Guatemala, was created in 1957 to coordinate the activities of the Guatemala Sugar Agroindustry. It includes 11 sugar producers and five technical organizations specialized in research, climate change, sugar exportation and social responsibility (Asazgua, 2020). In addition, since 2022, it counts with an organization specialized in innovation. The sugar producers that are members of Asazgua include: Pantaleon, Concepción, Palo Gordo, Santa Ana, Magdalena, Santa Teresa, La Unión, Madre Tierra, Trinidad (San Diego), La Sonrisa and El Pilar.

The Guatemala Sugar Agroindustry is committed to generating opportunities and prosperity for the people of Guatemala that support the country's sustainable development. It promotes decent and valuable jobs for the wellbeing of the population, while at the same time promoting environmental protection and conservation.

The Guatemala Sugar Agroindustry follows sustainable development principles as reflected by its strategic objectives and integrated actions and programs, supporting social wellbeing, economic growth, industrialization, and environmental protection. The activities of the sugar industry in Guatemala are recognized as examples of "Good Practices" in the effective implementation of the United Nations 2030 Agenda for Sustainable Development and the Sustainable Development Goals.

Associated organizations supporting specific sustainable objectives of the Guatemala Sugar Agroindustry have been created in the last decades. In 1990 Fundazúcar was launched as the social branch for the development and implementation of programs and projects on health, education and development. In 1992 Cengicaña started research activities to develop new varieties of sugarcane, to have integrated pest management, to study land quality and to implement more efficient processes for the cultivation of sugarcane and for the production of sugar. In 1994 Expogranel, one of the most efficient boarding terminals for sugar export in the world, was launched to cover international markets in a more efficient and competitive manner. In 2010, the Private Institute for Climate Change Research (ICC) was created to perform research, activities and projects related to climate change. In 2022 the Innovation Hub was created to develop a program of innovative projects through the identification and optimization of products, activities, processes and business models of the Sugar Agroindustry.

At the international level, the Guatemala Sugar Agroindustry supports the work of ICC on climate change mitigation and adaptation with other countries of Central America. Also through Asazgua, it participates actively in the Global Network on Sustainable Water and Energy Solutions. This is an initiative led by the Division for Sustainable Development Goals of the United Nations Department of Economic and Social Affairs (UNDESA). The Network promotes integrated water and energy solutions that address climate change objectives worldwide.

SUSTAINABLE DEVELOPMENT STRATEGY

The Sustainable Development Strategy of the Guatemala Sugar Agroindustry is based on its vision, mission and objectives which promote a comprehensive and forward-looking transformative pathway to prosperity and well-being for the people of Guatemala, at the same time supporting a healthy and sustainable planet. It follows an integrated approach based on transformation and adaptation to changes expected in the future due to new challenges. With its inclusive participation policy with multi-stakeholder partnerships, the Sugar Agroindustry, through Asazgua, coordinates the work of enterprises of the guild, governmental entities and civil society to achieve the final goal of prosperity and sustainable development for Guatemala. The Guatemala Sugar Agroindustry is a global example of efficiency and technological advance representing a very relevant factor for the economy of Guatemala with important positive impacts also on the social and environmental dimensions of sustainable development.

Objectives

1. Increase productivity through development and improvements in the field and in factories.
2. Provide technical training and capacity building for human resources.
3. Develop projects and programs that increase the capacity of the production systems in the field and in sugar factories, in distribution and commercialization of products, and of the export boarding systems.

One of the objetives of the Guatemala Sugar Agroindustry is to Increase productivity through development and improvements in the field and in sugar refineries.

Vision

Before 2025 the Guatemala Sugar Agroindustry will be the most respected productive sector of the country due to diversification, competitive efficiency, generation of dignified jobs, and respect for the environment, suppliers and communities with whom it relates.

Given its policy of unified action, proactive attitude and strong socioeconomic support, the Sugar Agroindustry leads as a positive agent of change for integral development, boosting the progress of its members and the country.

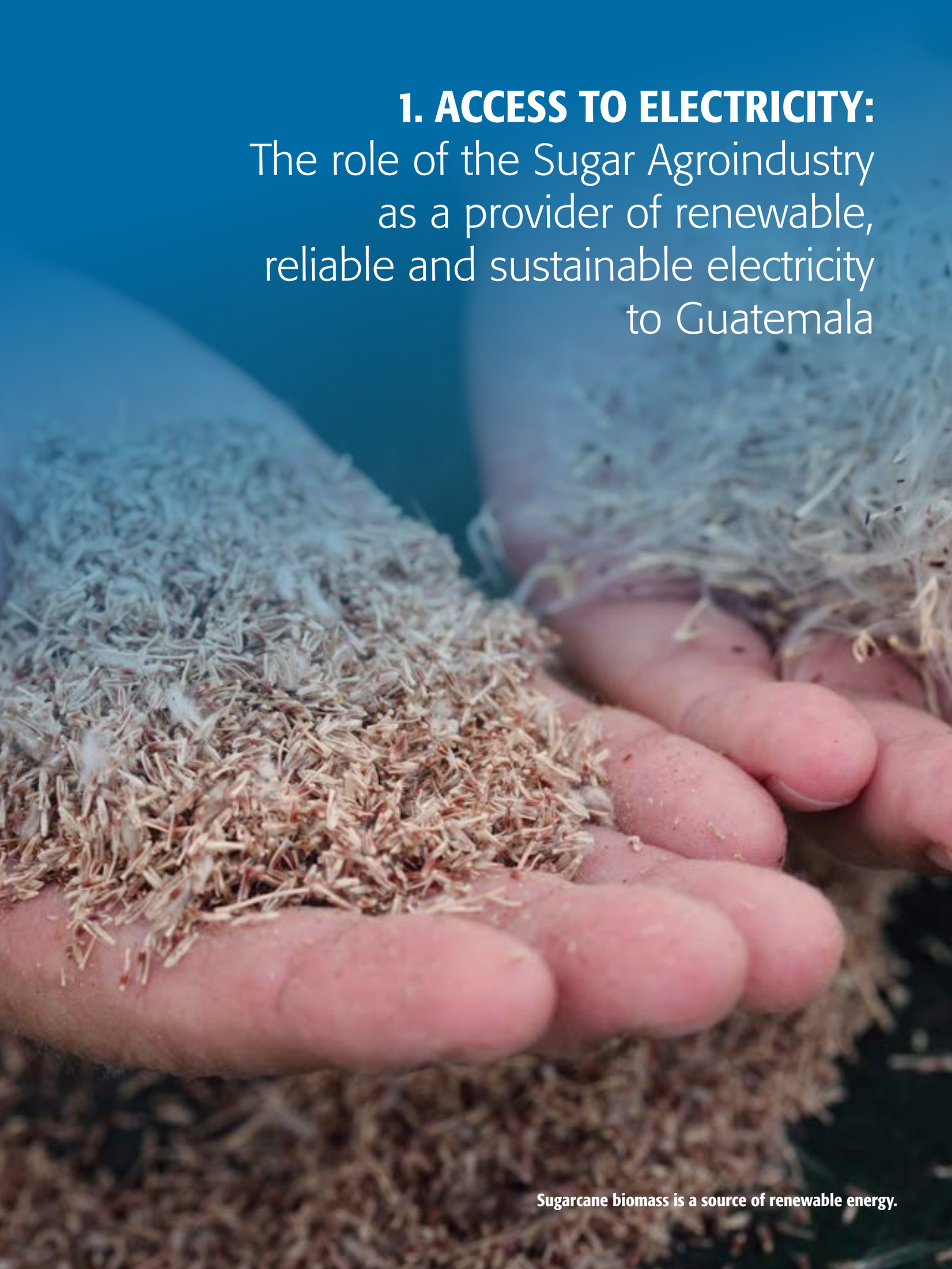
Mission

The Guatemala Sugar Agroindustry mission includes the following: to act in united manner to cultivate and process sugarcane to produce sugar, electricity, ethanol and other products; to undertake other activities to increase the value of the associated enterprises with a positive impact on the integrated development of the country; to innovate constantly improving competitive efficiency; to facilitate national and international commercialization of sugar; and to ensure sustainability while building trust responsibly.

THE GUATEMALA SUGAR AGROINDUSTRY AND THE SDG 7

The Guatemala Sugar Agroindustry conducts important activities in Guatemala supporting the objectives of SDG7 which include ensuring access to affordable, reliable, sustainable and modern energy. In order to achieve these objectives, the Sugar Agroindustry has focused its efforts on the production of clean electricity from sugarcane biomass. The most important activities of the sustainable development strategy of the Sugar Agroindustry supporting the objectives of SDG 7 correspond to three main areas: the role of the Sugar Agroindustry as a provider of renewable, reliable and sustainable electricity in Guatemala, the efforts to increase the share of renewable energy in the national energy matrix, and the efforts to increase energy efficiency. With the combination of this initiatives, the Sugar Agroindustry of Guatemala can generate 14% of the annual national electricity demand and 27% of the electricity demand during the harvesting period using renewable energy, keeping more stable the spot price in the energy market. It also has been able to generate clean and reliable electricity since the 1990s, avoiding annual emissions of 4 million tons of GHGs to the atmosphere, which could represent 6.75% of the national emissions.

1. ACCESS TO ELECTRICITY:
The role of the Sugar Agroindustry as a provider of renewable, reliable and sustainable electricity to Guatemala



Sugarcane biomass is a source of renewable energy.

1.1 Access to electricity: The role of The Sugar Agroindustry as a provider of renewable, reliable and sustainable electricity to Guatemala

Objective and Description

The Guatemala Sugar Agroindustry has played an important role in the growth of electricity access in Guatemala in the last several decades. Guatemala's economy increasingly depends on export-oriented agriculture with sugarcane and sugar production playing a leading role. Sugar mills have used the bagasse from sugarcane for power generation since the 1990s.

The sugar producers have installed electricity generation plants along the south coast of the country in the Pacific Ocean. Asazgua's members operate 11 power plants that generate electricity and heat for both internal consumption and to feed the national grid (Guerra, 2019). Nine of these plants provide electricity to the country's grid interconnected national system. The installed capacity of these nine plants is over 933 MW distributed in units that vary in capacities from 5 MW to 60 MW.

Figure 1 shows the electrification index in Guatemala during the 1996-2020 time-period. The rapid increase in the national electrification index from 61.3% to 91.2% coincides with the beginning of the generation of electricity by the sugar agroindustry and its contribution to the national electricity grid.

Electricity from sugarcane biomass or bagasse in Guatemala is a significant component of the country's energy matrix. Power generation from bagasse is typically seasonal from November to May. Total electricity generated from sugarcane biomass has increased substantially from around 400 GWh during the 1997-1998 harvest season to 2824 GWh in the 2021-2022 harvest season. This increase has resulted from growth in cultivated area, higher yields per hectare, and from achieving higher efficiency in biomass-based power generation. Sugar companies in Guatemala use on average about 34% of the electricity they generate for their own industrial processes, especially sugar production. The remaining which is on average about 66 % contributes to the national electricity grid (Guerra, 2019). Currently about 91% of the electricity used for the sugar agroindustry during the 2021-2022 harvest season was generated using sugarcane bagasse.

During the 2021-2022 harvest, the contribution of the sugar industry to annual power generation accounted for 27%. Cogeneration with sugarcane bagasse represented the second largest generator of electricity only after hydropower. Power generation from sugarcane bagasse complements electricity generation from hydropower, which is typically low during

Figure 1: Percentage of households with electricity

Source: Asazgua / Cengicaña (2020).

About 4 million tons of CO2eq are avoided annually through generating electricity from sugarcane bagasse.

the harvest period. Electricity from the Sugar Agroindustry has covered up to 32% of the national electricity demand during the harvest season (Cordon, 2020). Additionally, the electric generation of the industry has provided in the past 16% of the electricity exports from Guatemala to the Central American market and 7.8% of the electricity exports to Mexico. (Asazgua/Cengicaña, 2020).

During the 2021-2022 harvest season, the agroindustry contributed 1,925 GWH/harvest to the National Electricity Market. This corresponds to about 14% of annual national electricity demand and 27% of the electricity demand during the harvesting period that goes from November until May. During this harvest season, 76% of the electricity generated by the sugar agroindustry contributed to the national electricity grid and 24% was used internally. The energy generated with sugarcane biomass represents only 18% of the overall emissions from the total energy generation by the sugar agroindustry. This allows savings of a considerable amount of foreign exchange since less imported fossil fuel is needed.

It is important to note that the sugar producers are sometimes called by the national electricity market in critical times for the country to generate electricity even during the non-harvest season. This has forced sugar producers to make investments and even to keep coal reserves for national emergencies during years with winters with little rain.

The Guatemala Sugar Agroindustry has as one of its major objectives for the year 2030 to generate all the electricity needed for the operation of the sugar mills and to cover at least 30% of the electricity demanded in the country during the six months of the dry season, all by using 100% of the sugarcane bagasse obtained during sugar production.

Related Targets

The electric generation activities being conducted by the Guatemala Sugar Agroindustry provide strong support for the advancement of Target 7.1 of SDG 7 on ensuring access to affordable, reliable and modern energy services. The contribution is substantial at the national level providing critical electricity during times that the hydropower option might be limited. These activities support Target 7.b given the continuous expansion and upgrading of infrastructure and technologies for supplying modern and sustainable energy services in Guatemala. They also support Target 7.a by enhancing international cooperation to facilitate access to clean energy through electricity exports to other countries in Central America and to Mexico.

Challenges

The Guatemala Sugar Agroindustry became an example in self-generation of electricity after the General Law of Electricity established in the country during the 1990s as a response to the energy crisis. Since that time this vigorous industry has been a major innovator in a field that has not received sufficient attention throughout the industrial history of the country. For over 25 years, innovation in energy technologies has gone through a series of challenges, adaptation and major changes not only in relation to equipment and machineries but also with respect to the commercial and managerial areas.

The managerial strategy of this agroindustry has placed the cogeneration by the sugar producers in second place in renewable electricity generation in the country only after the hydropower industry that has a clear advantage given the country's abundant natural resources. Therefore, the sugar agroindustry has accepted the major challenge of providing considerable electricity access to the country and is committed to continue producing clean, renewable, accessible and sustainable energy for its own consumption and to support the national electricity grid.

This has been a 25-year journey with multiple challenges that had been overcome successfully as a consequence of the vision of the sugar agroindustry of always being sustainable, renewable and responsible in its activities.

Lessons learned

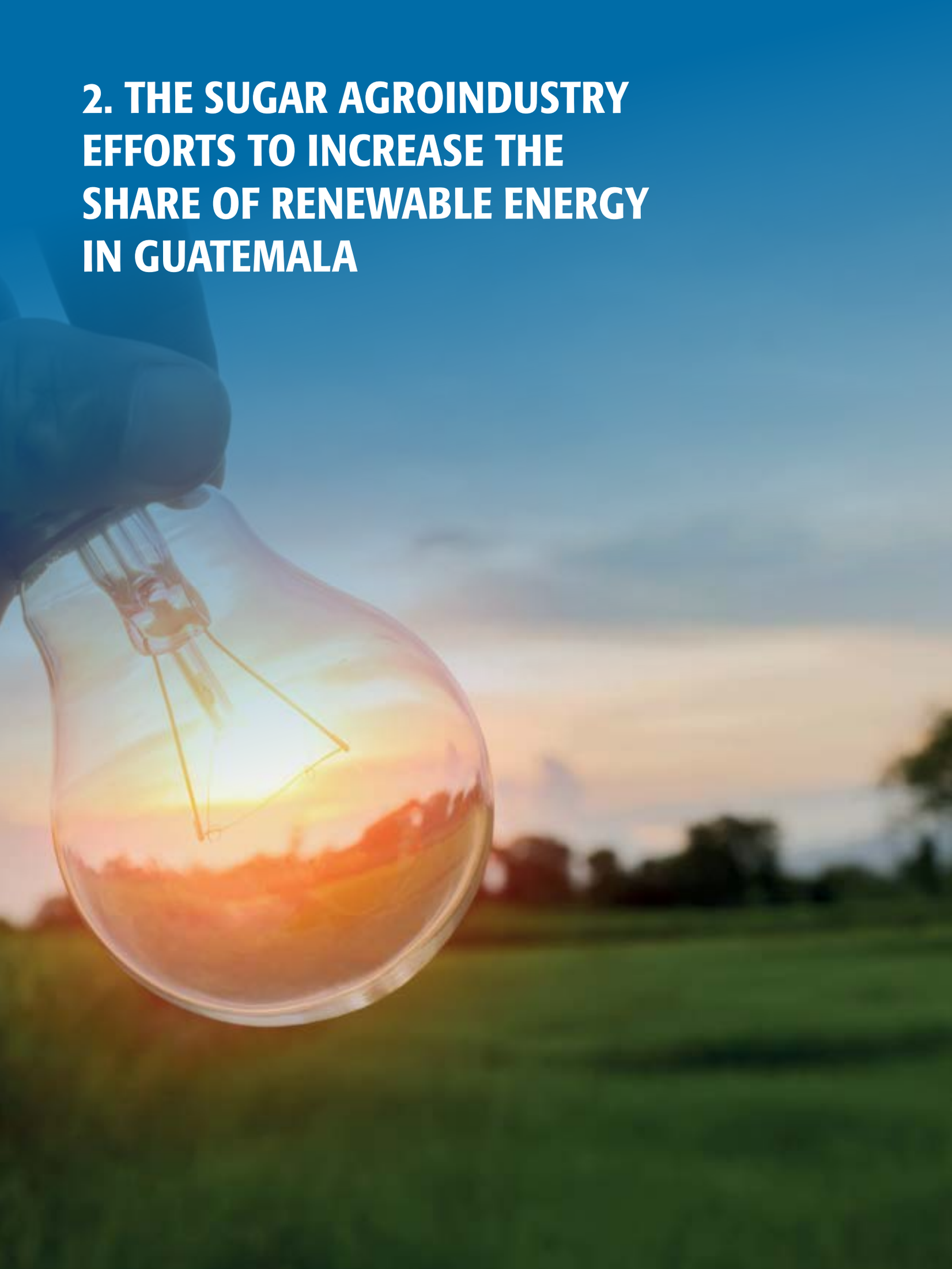
The national cogeneration by the agroindustry has used all the necessary economic resources to innovate, advance and discover better energy processes to be able to cover the system deficit. Bagasse, the biomass resource used for electricity generation, has proved to be an abundant and inexpensive resource that provides a renewable energy fuel that is efficient, clean and cost effective.

The long-term financial and technological efforts have made the cogeneration of the sugar agroindustry an important platform that supports the renewable electricity matrix of the country contributing to stable and low prices of electricity particularly during the summer.

Results

Through decades of work and innovation, the Sugar Agroindustry has been able to prove the extraordinary value of using bagasse for the generation of renewable electricity, allowing electricity access for internal use and for the national grid. Additionally, this access has allowed the reduction of GHG emissions, and has avoided the consumption of fossil fuels. Today, electricity generation from sugarcane bagasse represents one of the most important sources of electricity for Guatemala contributing to the social, economic, and environmental dimensions of sustainable development.

2. THE SUGAR AGROINDUSTRY EFFORTS TO INCREASE THE SHARE OF RENEWABLE ENERGY IN GUATEMALA



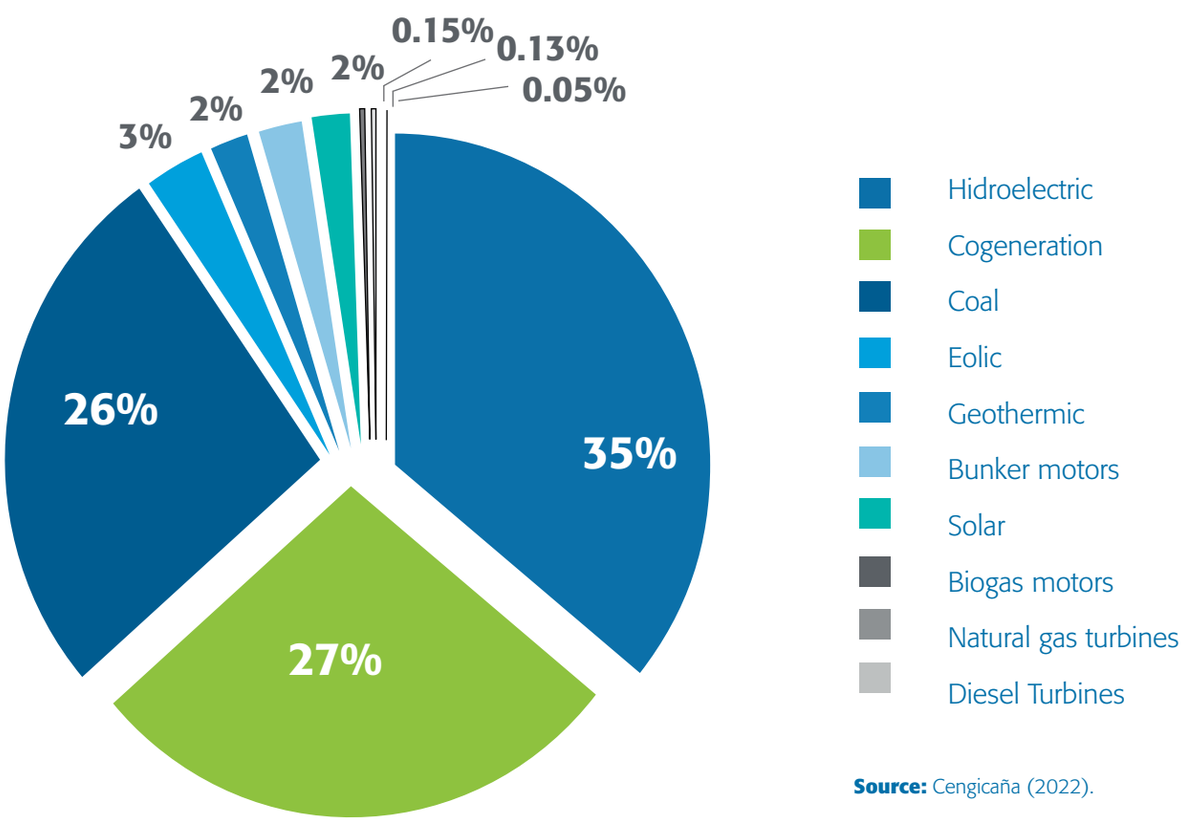
2.1 The Sugar Agroindustry efforts to increase the share of renewable energy in Guatemala

Objective and description

In Guatemala, hydropower plants and the cogeneration based on sugarcane bagasse provide critical energy to the national system during the dry season. The sugar producers have installed generating capacities with alternative fuels replacing thermal technologies that are more expensive. It also complements hydropower generation during dry years.

Since 1997 cogeneration using sugarcane bagasse has grown considerably improving the energy generating capacity year after year and the sales to the national electricity grid. During the 2021-2022 harvest the sugar agroindustry generated 27% of the electricity demand by the country from November to May. It was the second largest generator only after hydropower at 35%. Coal power plants were the third generators at 26%. Other renewable energies (biogas, geothermal, wind and solar) maintained their share in relation to the previous harvest at around 7%. Figure 2 shows the shares of electricity generation in Guatemala according to technologies during the 2021-2022 harvest.

Figure 2: National electric matrix by technology from November 2021 to May 2022



Source: Cengicaña (2022).

The low efficiency of wind and solar systems in Guatemala is allowing cogeneration by the sugar agroindustry to be the most stable and durable option after hydropower in the short and mid-term. Bunker-C was a fossil fuel utilized by the sugar agroindustry in the past, but it has been gradually replaced by the use of bagasse very successfully.

During the harvest season, cogeneration generates energy with the most stable declared variable cost. It represents the second lowest cost only after other renewable energies. The cogeneration controls and reduces the spot price of energy in the market. It does not require reserves, nor forced generation; therefore, it reduces operational costs so that energy reaches the users at a lower price.

Another renewable fuel produced by the Sugar Agroindustry is ethanol. The sugar agroindustry in Guatemala has the capacity to produce up to 250 million gallons of ethanol every year. Ethanol from sugarcane can potentially make an important contribution to reduce national GHG emissions in Guatemala. According to the National Low Emission Development Strategy, a 10 per cent blend of domestically produced ethanol in gasoline may help to reduce emissions from motor vehicles, improve air quality in towns and cities, reduce gasoline imports, and help the country accomplish its commitments to the Paris Agreement. The reduction potential is estimated at some 233,333 tons CO2eq/year (Guerra, 2019).

The Sugar agroindustry is also actively involved in research and development of different agricultural waste that could be used to generate renewable energy. The agricultural wastes of the green harvest have considerable energetic potential not only in Guatemala but around the world where sugarcane is grown and harvested. These biological wastes have the same or more calorific value than sugarcane bagasse. Millions of tons in the world could be collected in an efficient manner in order to be used as an important component of the biofuel matrix.

Research and tests have been conducted with wood splinters from the energy forests planted by the industry. Also, experiments have been performed with the leaves that remain in the field after the sugarcane green harvests. The results have been promising and some of the sugar producers already have experience with these organic waste as efficient and cost-effective biofuels.

The cogeneration controls and reduces the spot price of energy in the market.

Related Targets

The Guatemala Sugar Agroindustry provides active support for the advancement of Target 7.2 of SDG 7 on increasing substantially the share of renewable energy not only for internal use but for the overall country. The contribution of electricity using renewable biomass is substantial at the national level both during the time of the harvest and at other times.

The activities by the Agroindustry related to the production of ethanol provide an option to increase the use of renewable energy in the transport sector. In addition, the research and development activities on other biomass residues with potential application as energy fuels represent a promising alternative to keep increasing the share of renewable energy in Guatemala.

Challenges

In the past, the major challenge has been to keep performing the necessary activities and programs to effectively expand the generation of electricity and heat using renewable sugarcane biomass and securing the necessary investment to implement these activities.

Another challenge is to continue research and development activities to identify other forms of efficient and cost-effective biomass for use in the energy field.

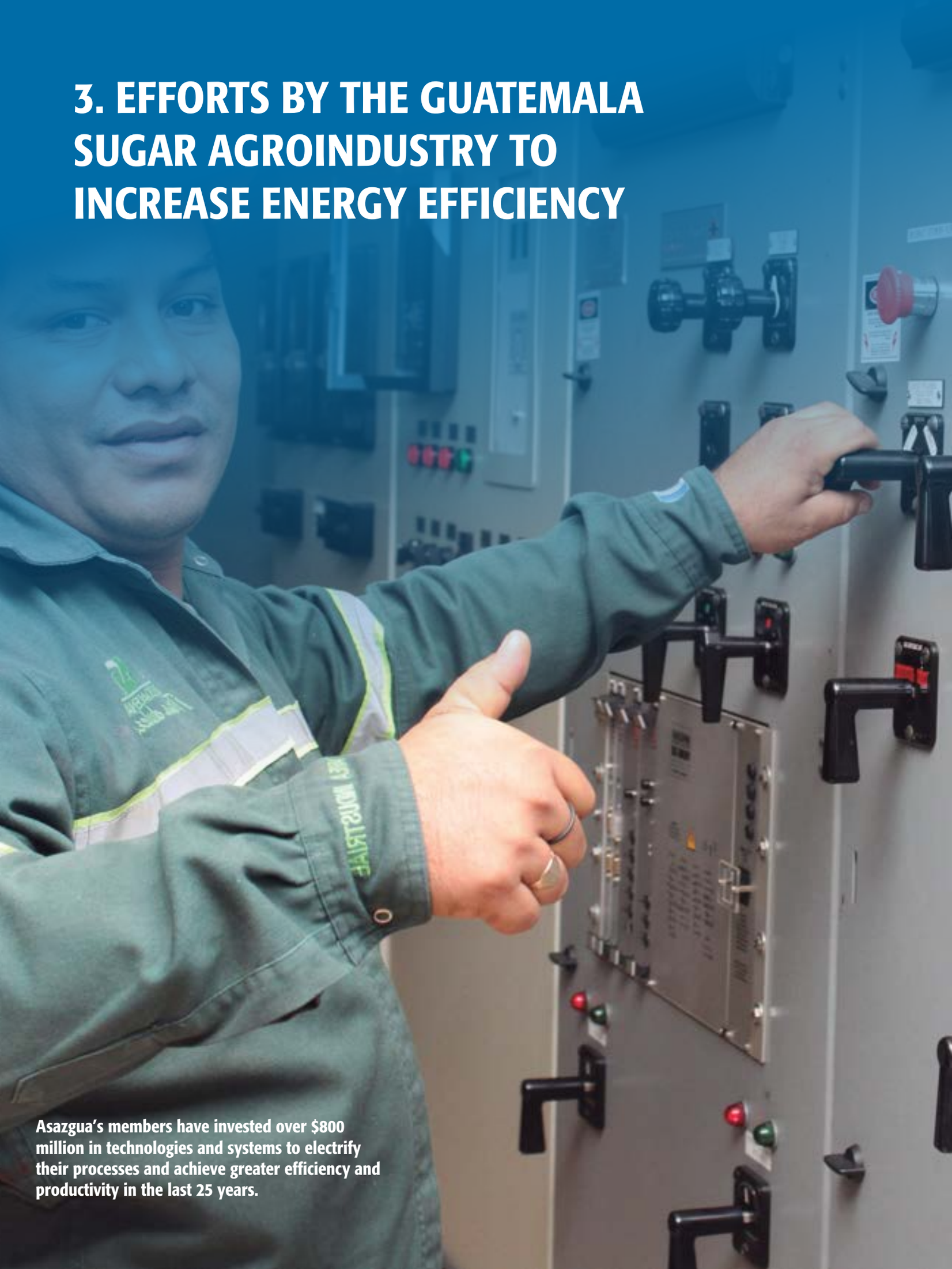
Lessons learned

The Sugar Agroindustry understands the need to follow an integrated approach to sustainable development in which renewable energy plays an important role. Therefore, it has been necessary to have a strong and continued support for activities that help to successfully substitute fossil fuel with renewable energy sources.

Results

The Sugar Agroindustry has been very successful for almost three decades in its effort to replace fossil fuel with sugarcane bagasse. Today, it is able to generate about 14% of annual national electricity demand and 27% of the electricity demand during the harvesting period using renewable energy. Additionally, its activities on research and development continue in the search of other forms of renewable energy based on biomass that could further support the expansion of bioenergy in Guatemala.

3. EFFORTS BY THE GUATEMALA SUGAR AGROINDUSTRY TO INCREASE ENERGY EFFICIENCY



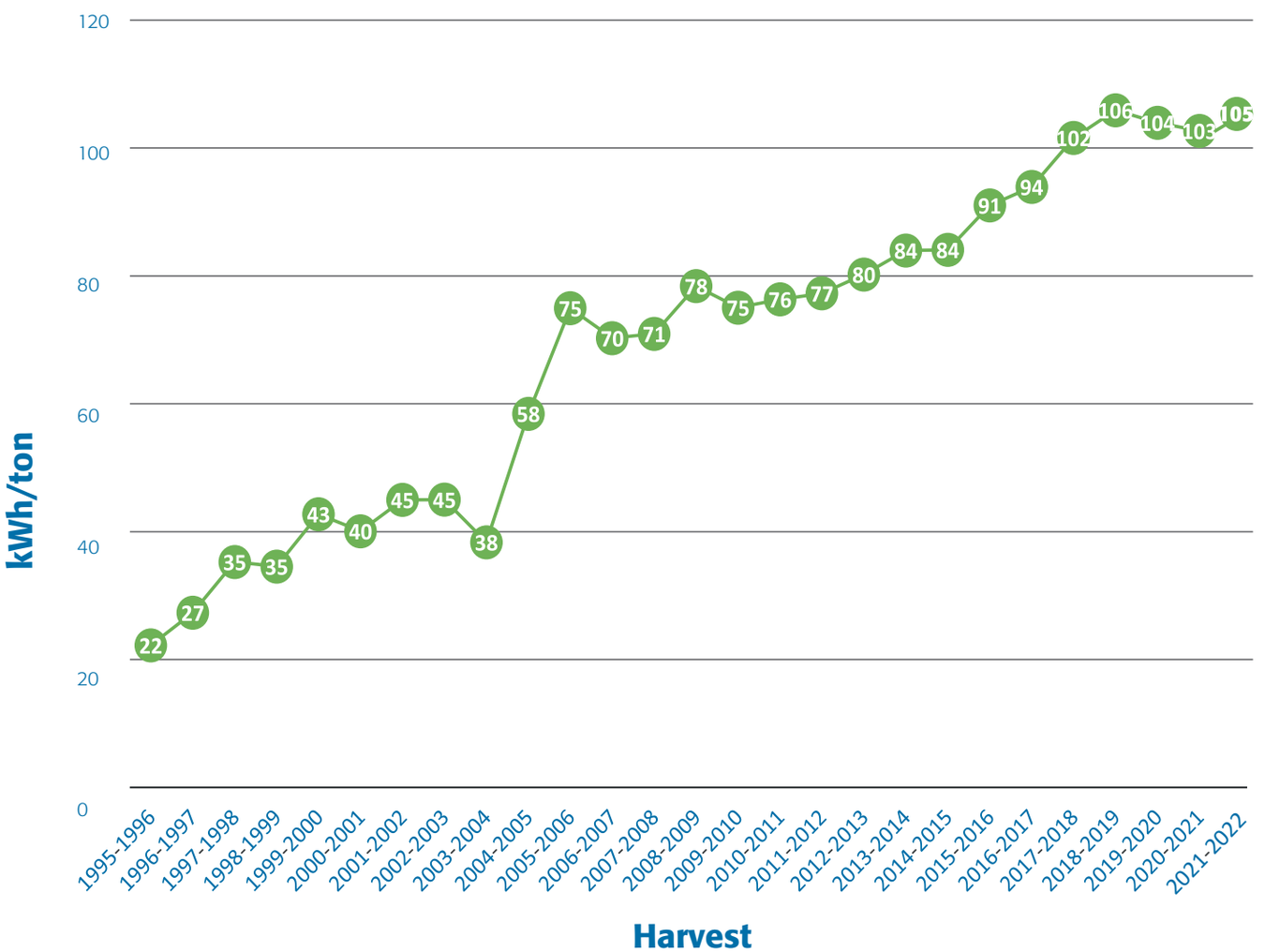
Asazgua's members have invested over $800 million in technologies and systems to electrify their processes and achieve greater efficiency and productivity in the last 25 years.

3.1 Efforts by the Guatemala Sugar Agroindustry to increase energy efficiency

Objective and Description

Asazgua's members have invested over $800 million in technologies and systems to electrify their processes and achieve greater efficiency and productivity in the last 25 years. The efficiency of the power plants has increased on average from 35 kwh/ton of processed sugarcane (1997/1998) to 105 kwh/ton (2021-2022). This is allowing the industry to provide a significant contribution to the national electricity system, which is a model in the region of reliability, sustainability and quality. Figure 3 shows the evolution of efficiency from the 1997/1998 harvest through the 2021-2022 harvest.

Figure 3: Efficiency in terms of electricity generated per ton of processed sugarcane by harvest.



Source: ICC (2020); Cengicaña (2022).
Calculations made by ICC based on Cengicaña records presented at harvest symposiums; and ICC carbon footprint studies.

The cogeneration by the sugar agroindustry in Guatemala is based on a high energy efficient cycle that generates electric and thermal energy simultaneously from sugarcane bagasse. Therefore, cogeneration is an efficient alternative to convert renewable energy into electricity supporting the sustainable development of the electricity sector in Guatemala.

Efforts to achieve a successful and efficient cogeneration using sugarcane biomass include:

- Optimization of electricity generation with bagasse and implementation of sugarcane residues as biofuels
- Electrification of the sugar production processes
- More productivity of grinding and fabrication
- Modernization of the electrical plants (boilers, turbines, grids, substations)
- Improvements in the sugarcane processing
- Recirculation of industrial waters
- Reduction of the electricity consumption in different processes
- Certification of international standards of quality warranty and security
- Investment in technological research and innovation in the field and in the mills
- Collaborative relations with the government, the co-generators and the agents of the National and Central American Electric Market

The sugar producers that operate with condensation and extraction cycles are more versatile and can produce more energy during the time when there is no harvest. Those producers without extraction technologies and little condensation near their turbines are less versatile. The most efficient producers are the ones with strong extraction cycles. As producers replace their "pure escape" equipment with extraction, the efficiency and capacity of the sugar producers continues to increase.

The sugar agroindustry has implemented since the 1990's many technological changes in their electric plants that have allowed their current leadership position in renewable and sustainable energy in the national energy market. At the beginning only small surplus of energy was sent to the national electricity grid at a pressure of 200 psig. Through time, it was necessary to increase the supply and the pressure was increased gradually to 1,500 psig. This has implied: (1) Investment in modern and innovative technologies not only for boilers and turbines but in water treatment, fuels, electric grids, and management of residues and effluents; (2) more efficiency through strategies for improvements in combustion, control and equipment for the transfer of bagasse, new fuels from crop residuals, reductions in the use of fossil fuels like bunker and coal, reductions of losses, reduction on bagasse humidity, electrification of windmills, etc.; and, (3) efficiency in the use of low-pressure steam in the adjacent sweetener factories, with the objective of having additional bagasse for electricity and steam generation in the improved energy plants of condensation and extraction. These measures allowed energy generation for the national grid even during the period of no harvest which translated into increased effectiveness in terms of cost and coverture.

Water is an essential resource for human life and for industrial and agricultural processes. Given the impacts of climate change and the natural phenomena such as El Niño, the Sugar Agroindustry has implemented practices to reduce water consumption and to ensure the rational use of this resource. Water consumption in agricultural processes has been reduced through the implementation of efficient irrigation systems as well as with the use of new innovative technologies and processes such as the dry cleaning of sugarcane which reduces substantially the use of vital liquids.

Due to the sustainable development policies promoted by the sugar agroindustry, major investments have been made in equipment for the recirculation of process water, especially for the use in cooling towers. The cooling towers use a minimum of water. The industrial residual effluents from the production of sugar are treated and include nutrients that are used for fertilization / irrigation systems.

The objective of reducing the use of water in the industrial processes has induced the sugar mills to massively implement water recirculation in cooling towers, ash filtration, dry sugarcane washing, cooling tanks, draining recirculation, fertilization / irrigation, water recirculation for factory vacuum, dry drainage systems, etc.

The Guatemala Sugar Agroindustry is committed to continue generating clean, sustainable and renewable energy and to continue improving efficiency. As part of this commitment, it has supported the creation of the Private Institute for Climate Change Research (ICC). Also, it is supporting the development and use of alternative fuels, optimization of electric generation and energy efficiency practices through the Program on Industrial Research of the Guatemalan Center for Research and Capacity Building of Sugarcane (Cengicaña).

Cengicaña, which is part of Asazgua, created the Unit for Research on Energy Efficiency in 2011. This Unit has developed research projects on optimization of electric and thermic energy processes, characterization of biofuels, and strategies to save energy. Until now, more than 50 articles and 5 guides have been published on the efficient and cost-effective use of energy which had allowed savings of steam and fuel. The studies have included themes such as the improvement of combustion, thermic insulation, use of residuals form agriculture including leaves for biofuels, bagasse characterization, reduction of fuel that is not efficiently burned in the boilers, etc. The area of energy efficiency of Cengicaña includes areas of generation of the sugar mills and of the sweetener factories.

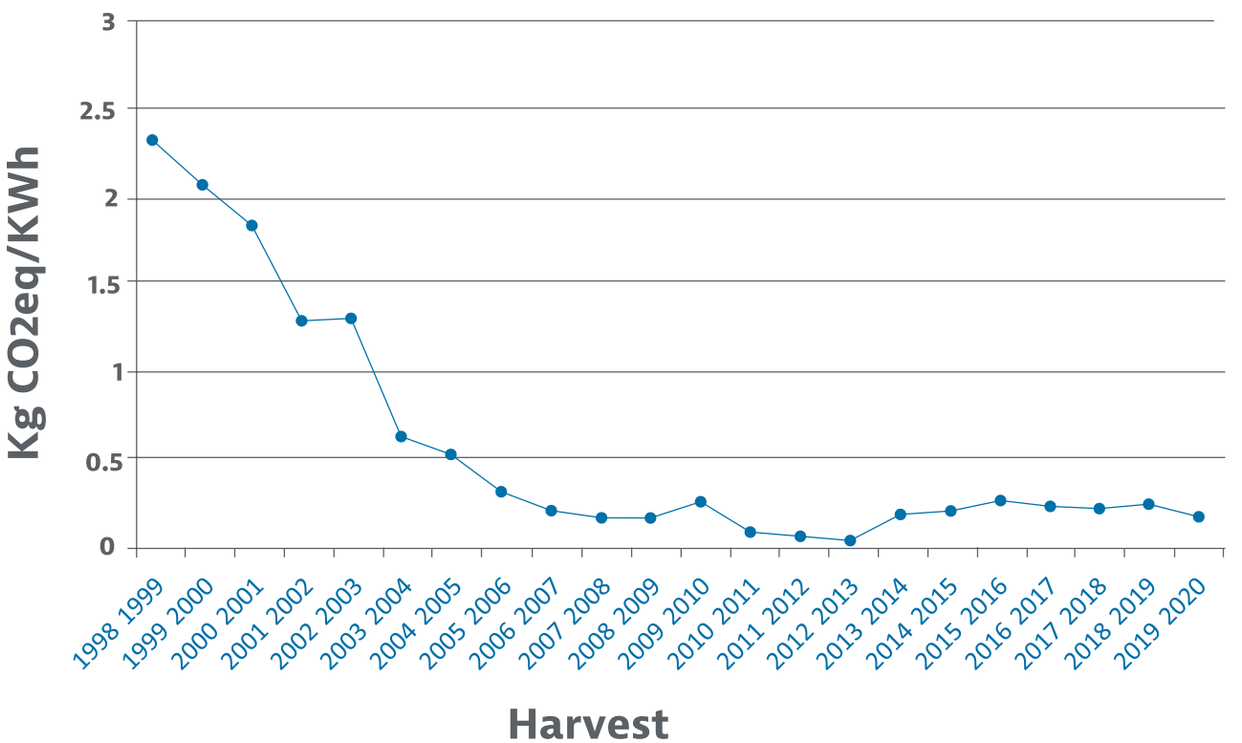
All the boilers that are in operation in the cogeneration plants have installed gas purifiers or electrostatic precipitators where the gases from the combustion of biomass are trapped preventing the contamination of the atmosphere. This is one of the technological changes in which the sugar mills had to make large investments to satisfy the commitment of generating clean energy even though this has represented a loss in thermal efficiency use. The environmental policies consider constant measures of atmospheric emissions from biomass combustion and taking corrective measures as necessary and according to international standards.

The Private Institute for Climate Change Research -ICC- has performed studies to estimate the carbon footprint related to sugar production since 2012. Each year, the use of sugarcane biomass for the generation of electricity allows Guatemala to avoid over 4 million tons of CO2eq that would have resulted if coal were used, considering that this is generated during the dry season. By using sugarcane biomass for electricity generation, the combustion of 316 million gallons of bunker (fuel oil) or of 1.4 million tons of coal were avoided. This represents a major contribution in relation to climate change mitigation for Guatemala and at the world level, so without this renewable energy, the national emissions could be 6.75% higher than the current inventory said.

The emission factor, or the carbon footprint, from energy generated for the 2019-2020 harvest was 0.19 kgCO2eq/kWh, which includes the energy generated by sugarcane biomass, coal, and others. This includes the energy used for internal used and to feed the national grid system. The energy generated only by sugarcane biomass has an emission factor estimated in 0.039 kgCO2eq/kWh. This value is lower than the GHG emissions factor of the national grid system estimated at 0.391 kgCO2eq/kWh, according to the figures published by the Ministry of Energy and Mines of Guatemala in 2020. Figure 4 shows the carbon footprint from electricity generation from the 1998/1999 harvest to the 2019/2020 harvest.

The reduction of emission factor was possible due to the reduction in the use of fossil fuels to generate electricity and by increasing the electricity produced from sugarcane biomass. During the harvest season 1998-1999 around 46% of the energy was generate by bunker, but nowadays this fuel represent only 0.05%. Currently, coal represents around 13%. The use of fossil fuels is related to the request of the Government to generate additional electricity to cover the demand of the Guatemalan people, especially when hydropower is not possible due to insufficient rain.

Figure 4: Emission factor of the electricity generated by the Guatemala sugar agroindustry, through sugar cane biomass and other fuels
(Harvest 1998-1999 to 2019-2020)



Source: ICC (2020)

The reduction in the emissions from electricity is one of the important elements that has contributed to the low carbon footprint of sugar in comparison with other countries. It is important to note that electricity generation in the internal process of sugar production represents only 5% of the sugar carbon footprint.

Related Targets

The Guatemala Sugar Agroindustry allows the effective advancement of Target 7.3 of SDG 7 on increasing the rate of improvement in energy efficient. The energy efficiency of numerous processes has been increased to levels that demonstrate the leadership of this industry worldwide. Additionally, there is complementary efficiencies related to the consumption of water and with respect to the reduction of GHG emissions.

Challenges

For more than 25 years, multiple challenges had been overcome successfully as a consequence of the vision of the Sugar Agroindustry of always being sustainable, renewable and responsible in all its operations. The identification and implementation of innovative technologies and systems to electrify different processes and to achieve greater efficiency and productivity have been very challenging goals. Creating the necessary awareness of the benefits derived from efficient systems and maintaining a long-term perspective have also been key challenges.

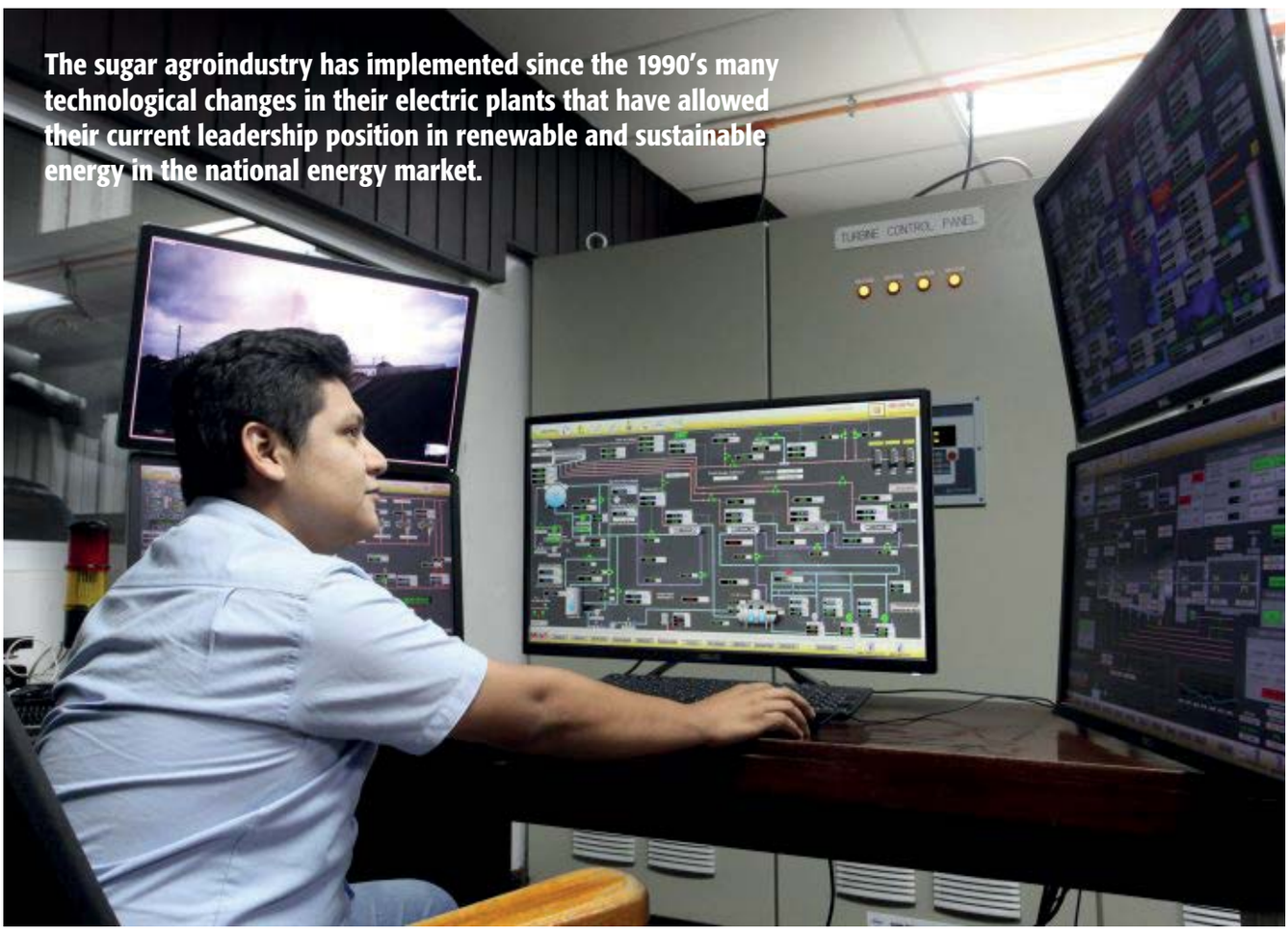
Increasing the efficiency of electricity generation from sugarcane bagasse has been a very challenging task. Nevertheless, through the years of applied research, experiences and lessons learned the Guatemala Sugar Agroindustry has been able to achieve significant increase in the efficiency of this process as reflected by the considerable increase in electricity generation per ton of bagasse.

Lessons Learned

Working together with different stakeholders and keeping in mind a sustainable approach have been necessary to solve many problems and to implement many innovative technologies and models successfully. Through integrated research and hard work important efficiencies have been realized in many processes and systems.

Results

Today, the Sugar Agroindustry of Guatemala is one of the world leaders in the efficient generation of electricity from sugarcane bagasse while at the same time ensuring one of the best water use efficiencies.



The sugar agroindustry has implemented since the 1990's many technological changes in their electric plants that have allowed their current leadership position in renewable and sustainable energy in the national energy market.

Today, the Sugar Agroindustry of Guatemala is one of the world leaders in the efficient generation of electricity from sugarcane bagasse while at the same time ensuring one of the best water use efficiencies.

INTERLINKAGES WITH OTHER SDGs

The interlinkages between energy related activities (SDG 7) of the Guatemala Sugar Agroindustry and other SDGs are considerable. The strongest interlinkages are in relation to climate change (SDG 13), water (SDG 6), sustainable cities (SDG 11) and sustainable consumption and production (SDG12). There is also a strong interlinkage related to economic growth (SDG 8), given the fact that the Sugar Agroindustry is generating renewable energy in the form of electricity and ethanol with positive consequences in relation to the overall economy of the country. Another strong interlinkage is with respect to partnerships (SDG17), since the Guatemala Sugar Agroindustry and Asazgua have many partnerships with national, local, regional and international organizations that support the generation of sustainable energy and to the pursuit of sustainable development in Guatemala and Central America.

CONCLUSIONS

The Sugar Agroindustry has been able to generate clean and reliable electricity since the 1990s, avoiding the emission of 4 millions of tons of GHGs to the atmosphere, which could represent 6.75% of the national emissions.

The Guatemala Sugar Agroindustry has been an example in self generation and supply of renewable energy for decades. Its sustainable development strategy and its program of activities related to the efficient generation of electricity from biomass, optimum integrated management of water resources, and efforts to reduce GHG emissions represent an excellent example of the implementation in the field of the SDG 7 on energy and the UN 2030 Agenda for Sustainable Development.

The Sugar Agroindustry has been able to generate clean and reliable electricity since the 1990s, avoiding the emission of 4 million of tons of GHGs to the atmosphere, which could represent 6.75% of the national emissions.

The innovation of the Sugar Agroindustry has been maintained for over 25 years and has passed through a series of challenges, adaptations and changes not only in equipment and machinery but also in managerial and commercial areas. The sustainable strategy has placed the cogeneration by sugar mills as the second largest generator of renewable energy only after hydropower, which has a clear advantage given the ample availability of this natural resource in the country. The Sugar Agroindustry, which leads the national cogeneration efforts in Guatemala, has used all the necessary economic resources to innovate, advance and discover better options to cover the electricity deficit of the national electricity system. Its fuel is the sugarcane bagasse which is used in an efficient, clean and cost-effective bio-combustion process.

All the financial and technological efforts throughout many years have made cogeneration a renewable base for the electricity matrix of the country. This provides a major contribution to maintain low and stable prices for consumers during the summer seasons.

The Guatemala Sugar Agroindustry has as one of its major objectives for the year 2030 to generate all the electricity needed for the operation of the sugar mills and to cover at least 30% of the electricity demanded in the country during the six months of the dry season, all by using 100% of the sugarcane bagasse obtained during sugar production. With this objective the Guatemala Sugar Agroindustry accepts the challenge of continuing generating clean, accessible, inexpensive, renewable and sustainable energy in the future.

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