





Promoting renewable energy and integrated waste management in sustainable industrial parks







The Senegalese Government is prioritizing rapid industrialization to propel economic growth. But as the country's economy grows, so does the demand for power.

This six-year partnership with UNIDO, supported by the Global Environment Facility, has supported Senegal to begin to adopt a sustainable, low-carbon path to industrialization and reduce its green-house gas emissions.

# The Challenges

## Reliable and affordable energy

Despite having abundant solar, wind and bioenergy potential, Senegal remains largely dependent on imported oil and diesel. But energy prices are high, there's insufficient supply, and outdated infrastructure makes power-outages common. Not only does Senegal's over reliance on fossil fuels come at a massive environmental and financial cost, it is harming the performance and competitiveness of its industries. Businesses connected to Senegal's electricity grid currently have to contend with highly unstable and unreliable power supply, which causes revenue and productivity losses for firms and the economy as a whole.

Energy efficiency and renewable energy technologies offer cost-effective, reliable solutions to the challenges Senegalese industries face. Energy efficiency measures are particularly appealing as they reduce energy waste and losses, and they are cheap and relatively easy to implement. The cost of renewable energy solutions has also fallen in recent years. Often, these technologies now have an attractive, commercially viable return on investment, particularly given the high cost of fossil fuels. Enabling industries to stop using ageing and inefficient equipment powered by expensive fossil fuels will make it easier for Senegal to retain, attract and support the growth of businesses – and by extension, its economy.

## Sustainable growth

Around a quarter of the 17 million people who live in Senegal live in Dakar<sup>1</sup>. One of the main reasons for this is that 80 per cent of Senegal's industries are located there. But the city was built to accommodate 300,000 people and it is desperately over-stretched<sup>2</sup>. With the Senegalese Government keen to grow the economy, finding alternative places to house industries and the people who work in them is a priority. Diamniadio Lake City is being built about 30 kilometres from Dakar to do just that. The city, which is due for completion in 2035, includes a new industrial park to attract businesses and people to the area.

Ensuring the industrial park utilizes renewable technologies and energy efficiency interventions will future-proof it and establish a model for coordinated, sustainable industrialization that can be replicated across the country. This will deliver more economic opportunities for the people who move to Diamniadio, and for those who gain employment in future industrial parks. Ultimately, this will reduce the carbon intensity of industrialization and urbanization in Dakar and Diamniadio, and other parts of Senegal that follow suit, and lead to a better quality of life for Senegalese people.

# The Barriers

While renewable energy and energy efficiency technologies have rapidly become cost-effective solutions for overcoming the diverse energy challenges facing the industrial sector, the uptake of sustainable energy and low carbon technology has been slow in Senegal's industrial sector.

Some of the reasons for this are:

- lack of awareness among industry of the benefits, technical feasibility and commercial viability of renewable energy technologies and energy efficiency measures
- low institutional capacity to initiate, support and sustain low-carbon industrialization
- limited information and data sharing about successful implementation of renewable or energy efficient measures and technologies
- an under qualified and uncertified local energy services market, with limited knowledge of the tools available to manage energy more efficiently.



In Senegal, it was crucial to remove the obstacles to the development of capacities in clean production and resilience to climate change. UNIDO's project has effectively contributed to the institutional and technological capacity building of the actors involved in the realization of investments in energy efficiency and renewable energy projects which can be replicated across industrial sites."





- 1. World Bank Data, 'Population total: Senegal' [webpage, accessed March 2023]
- 2. World Bank, 'Senegal overview' [webpage, accessed March 2023].

# Supporting a path to sustainable industrialization

To support Senegal to adopt a sustainable industrialization strategy, the programme focused on four key, interlinked areas.

#### AREA 1:

Integrated urban planning and management, focusing on sustainable industrial parks.

#### AREA 2:

Integrated management of persistent organic pollutants (POPs) and hazardous wastes in industries.

#### AREA 3:

An enabling framework for implementing sustainable and resilient industrialization.

#### AREA 4:

Promoting investments in renewable energy, lowcarbon technologies, energy efficiency and POPs in enterprises in Dakar and Diamniadio Industrial Park.

# This case study focuses on area four

# Promoting investments in renewable energy, low-carbon technologies, energy efficiency and persistent organic pollutants

Through extensive technical assistance, knowledge and capacity building, government officials, plants managers, engineers and other key industry actors have gained valuable insight into how to implement renewable technologies and energy efficiency measures to increase energy security and reduce financial and environmental costs. This has enabled key players to develop the expertise, tools, business models and best practices they need to replicate and scale up similar projects across Senegalese industries as the economy grows.

As part of this, ten companies in Diamniadio Industrial Park have been supported to pilot renewable energy technologies, low-carbon technologies and integrated waste management.

These companies were selected according to the following criteria:

- → Commitment to carry out the diagnostic studies.
- → Located in the Diamniadio industrial park or the industrial estate, or with an advanced project in process of moving to the site of Diamniadio.
- → A relatively high level of energy consumption for its competitiveness.
- → A significant level of production of solid or liquid waste.
- → Had already identified pilot projects of energy efficiency, renewable energies and valorisation of waste.

These pilots demonstrate the technical feasibility and commercial viability for a diverse range of low-carbon and energy efficient technologies and measures, from using solar energy to power a cement factory to making an agroprocessing plant more energy efficient. These projects demonstrate the environmental and financial benefits of moving away from fossil fuels and will encourage other Senegalese businesses to follow.



We are a poor country. We cannot continue to lose energy and water, it's very costly for the country and for the people. And if we, one of the biggest consumers of energy, cannot improve how can we expect others? It is down to us to show how we can impact positively and bring others with us."



**Saliou Diop**Industrial Director at SENICO SA



## How we did it



## Training and know-how

Ten companies in Diamniadio Industrial Park were supported to undertake energy audits and trial small- and medium-scale pilot projects using renewable, low-carbon technologies, energy efficiency applications and resource efficient, cleaner production (RECP) measures<sup>3</sup>. Each company benefited from technical support and skills building during this process. The key objective for these pilot projects was to demonstrate the technical feasibility and commercial viability of a wide range of projects to allow for maximum replicability.

As part of the capacity strengthening provided, UNIDO has trained Senegalese engineers on how to set up, operate and maintain renewable and energy efficient technologies and measures, including how to implement internationally regarded standards (ISO 50001 on energy management and ISO 14001 on environmental management).

A business model and best practices manual has been produced, based on the data from the demonstration projects. This will help to mobilize investment in replication and scale-

Not only do the demonstration projects show what is possible; through their implementation and operation, vast technical expertise has been built within Senegal. This expertise is vital to ensure similar projects can be implemented by local actors, creating a sustainable path to industrialization.



## Advocacy and policy support

UNIDO's technical assistance has supported government bodies to integrate resource and environmental issues in the planning and development of urban and industrial zones in Senegal. This includes a strategy for designing, implementing and managing sustainable industrial parks using an integrated, urban-planning approach.



### Financing solutions

With support from UNIDO, APROSI - Diamniadio Industrial Park's owner and operator - has used evidence generated by the pilot projects to develop a business model to mobilize investments for new, sustainable industrial parks across Senegal. Raising awareness of the benefits delivered by the pilots will boost demand in Senegal for renewable technologies and energy efficiency measures, generating the pull for market creation and encouraging financing institutions to lend.



Our motivation is first environmental.

We have some laws in Senegal, and there are incentives for all companies to reduce greenhouse gas emissions, and we have to respect this. The second reason is financial. In Senegal, energy costs are very, very high. This means there are high costs for the gas and the fuel that we use in our company. and if we have the occasion to reduce this cost we will benefit."



Awa Diallo **HD Industries**' **Environmental Manager** 



UNIDO provided advocacy and policy support on integrated urban planning and management, focusing on sustainable industrial parks. This included providing various research studies for establishing a strategy on new green industrial parks, and training governmental institutions, the private sector and local experts on these aspects."



# Managing energy efficiently: The ISO 50001 standard

An energy management system helps companies better manage their energy use, which improves productivity. It involves developing and implementing an energy policy, setting achievable targets for energy use, and designing action plans to reach them and measure progress. This might include implementing new energy efficient technologies, reducing energy waste, improving current processes to cut energy costs and raising the awareness of staff so they are empowered to participate in saving the company's energy.

The ISO 50001: 2018 Energy Management Standard is one of the frameworks for developing an effective energy management system. To date, industrial companies have saved millions of dollars and tons of carbon emissions as a direct result of implementing the ISO 50001 standard.

<sup>3.</sup> See UNIDO, 'Resource Efficient and Cleaner Production (RECP)' [webpage, accessed March 2023].

# Key partners

The Ministry of Energy: Responsible for the preparation and implementation of sector policies, strategies and standards. It also grants licences and concessions upon the advice of the Commission of Energy Sector Regulation.

The Ministry of Environment and Sustainable Development - Directorate for the Environment and Classified Establishments (DEEC): Responsible for implementing the government's environmental policy and monitoring the actions of organizations working in the environmental sector.

Bureau de Mise à Niveau des Entreprises du Sénégal (BMN): Part of the ministry in charge of commerce and small and medium enterprises. It has a remit to support industrial upgrading activities in Senegal. The BMN selected the ten pilot projects and contributed 50,000,000 FCFA [around US\$80,000] as co-financing to the implementation of this project.

Société Nationale d'Electricité du Sénégal (SENELEC): A state-owned electricity company.

Agence d'Aménagement et de Promotion de Sites Industriels (APROSI): Responsible for the management of industrial parks in Senegal.



We have been operating in Senegal for many years, so other construction companies look at us very closely to see what we are doing. This will influence them. If they see it in our company, they will want to do the same."



Missira Keita Head of Sustainable Development at Eiffage Sénégal



We carried out this project because we understood that it was the only way to ensure the sustainability of the company. On the environmental level it allowed us to manage our waste responsibly, and on the financial level it allowed us to have more control over our production costs and avoid non-quality costs."



**Sylla Mariama** CSIP's Deputy General Manager



# Key achievements

## In numbers

**PROJECTS** on renewable energy, energy efficiency and waste management



**PEOPLE TRAINED IN** RENEWABLE ENERGY and integrated waste management in sustainable industrial parks



**COMPANIES** SUPPORTED ON ISO 50001/14001 certifications



STRATEGY **AND ANALYSIS** reports developed, including an environmental mapping report and a business model on sustainable industrial parks



## **END RESULTS**

50,000 MWh



**5.4** mgTeq of POPs avoided



of renewable energy installed





35,000 TONNES

of greenhouse gas emissions avoided



# The ten industry demonstration projects

These projects showcase the benefits of using renewable, low-carbon technologies, energy efficiency applications and RECP measures.



#### **DESCRIPTION**

Installation of a solar PV power plant on the roof with a metering system for self-consumed energy: monitoring of consumption, production alert system, calculation and reporting of monthly  $CO_2$  emissions over one year.







#### **DESCRIPTION**

Installation of ventilation, lighting and a clay brick building.

PV solar installation and substation transformer with a metering system for selfconsumed energy that enables monitoring of consumption, a production alert system, and the calculation and reporting of monthly CO<sub>2</sub> emissions over one year.



#### **COMPANY**

**RUFSAC Packaging** 



#### **DESCRIPTION**

Installation of a solar PV power plant with a metering system for self-consumed energy, consumption monitoring, a production alert system and CO2 emission reporting.

#### **SAVING OF**

256,500 KWh /YEAR in conventional energy saved



\$37,026/YEAR



renewable energy capacity installed



TONNES CO₂ eq /YEAR in greenhouse gas emissions saved



#### **COMPANY**

**IBS SENEGAL** Food and beverage manufacturing



#### **DESCRIPTION**

Installation of a solar PV power plant on the roof with a metering system for selfconsumed energy, monitoring of consumption, production alert system, calculation and reporting of monthly CO<sub>2</sub> emissions over one year.

#### **SAVING OF**

1,768,661 kWh /YEAR in conventional energy saved



\$255,847/YEAR



renewable energy capacity installed



.207 TONNES CO₂eq in greenhouse gas emissions saved



#### **COMPANY**

**NMA SANDERS** Agri-food



#### **DESCRIPTION**

Insulation of the steam circuit, water treatment by reverse osmosis, installation of high efficiency motors of class IE4 and installation of a compensation battery.

#### **SAVING OF**

in conventional energy saved







#### **COMPANY**

**AFRIC AZOTE** Food and beverage manufacturing



#### **DESCRIPTION**

Purchase of a 6T/h, 10 bar boiler.

Insulation wool for steam circuits.

#### **SAVING OF**

1,617,650 kWh /YEAR in conventional energy saved



\$130,769 /YEAR



POPs released



462 TONNES CO₂ eq in greenhouse gas emissions saved



#### **COMPANY**

**CSIP** Construction



#### **DESCRIPTION**

Installation of a PVC-PE-PP conveyor, a grinder and a fume collection and treatment system on the PVC line.

Installation of an energy consumption control system, plus staff training on clean production techniques.

#### **SAVING OF**

17,640 KWh /YEAR in conventional energy saved





0.533 mgTeq /YEAR

POPs released

rate of waste 5% to be recycled



266 TONNES CO₂ eq in greenhouse gas emissions saved





# Senegalese Industrie et Commerce (SENICO SA)

SENICO SA was founded in 1989 as a tea trading company. It now produces, packages and sells a diverse range of food products, including bouillon seasonings, oil, pasta, vinegar, tea, mayonnaise, butter and chocolate. It has three factories in Senegal and exports to other countries in Africa as well as South America and the United States.

In 2020, SENICO SA used 2,415,385 kilowatts of energy, all generated by fossil fuels.

In February 2022, the programme conducted a feasibility study at SENICO SA's flagship factory in Diamniadio Industrial Park. Of the recommendations made, two energy efficient measures were implemented.

The first energy efficiency measure replaced four industrial air conditioning units, which worked on automatic timers so cooled the air regardless of temperature, to a ventilation system that senses and responds to actual air conditions. This change had made a 30 per cent energy saving, equating to annual energy gains of around 284,700 kilowatts.

The second energy efficiency measure replaced the factory's four air compressors used in bottling processes with one energy-efficient unit. By using a compressor that can vary its power to match demand, rather than one that operates at a fixed speed, an energy saving of 20-25 per cent has been made.

SENICO SA has now set yearly, energy saving targets. All the money saved from the current initiatives will be reinvested in other energy saving measures to meet these goals.



Sustainability is an investment. But we are doing business, so we cannot always put the money we need into it. We should, but at a certain time we have limitations. When we have a programme like this, which brings expertise and support, it helps us to move faster than we would if we were on that iourney alone. We have ideas, but we're not experts."





#### **DESCRIPTION**

Installing an air conditioning ventilation system that senses and responds to air conditions; replacing four air compressors used in the bottling process with an energy-efficient unit that varies power to match demand.



# Eiffage Sénégal

Eiffage Sénégal, formerly known as Fougerolle, is a concrete producer that has been operating in Senegal since 1926. The company is subsidiary of the Eiffage group, one of Europe's leading construction firms, and is influential within Senegalese industry.

Eiffage has four sites in Senegal. Its Diamniadio Industrial Park plant produces 300 tonnes of concrete every hour, which it supplies to the construction projects in Dakar and Diamniadio Lake City.

Before the demonstration project, Eiffage Sénégal was powering the Diamniadio plant with a generator because of regular electricity cuts in the area. This was fuelled by 78,800 litres of diesel each year.

In March 2022, the company installed 84 solar panels on the Diamniadio plant's roof with a capacity of 33.5 kWp. Now around half of the energy needed to power the plant is renewable, saving 1,385 kg of carbon emissions every month. Staff at the plant have been trained on installing and maintaining the solar technology to ensure its longevity. They have also gained skills and knowledge on energy efficiency, environmental management, renewable energy and green financing.

**DESCRIPTION** 

Then the Diamniadio concrete plant was equipped with a concrete residue recycling unit. This system allows to extract dry aggregates from the concrete mixers and to recycle them. They are reintroduced into the concrete manufacturing process. The wash water from the concrete mixers is also recycled in a closed circuit.

A feasibility study conducted in 2020 as part of the UNIDO programme has provided evidence on how other renewable and energy efficiency measures could save Eiffage Sénégal money and reduce its carbon emissions. This will be used to inform the company's future sustainability strategy.



"The sustainable city programme came at a time when we wanted to implement low-carbon projects. This opportunity helped us to go much faster and to materialize the exemplary energy projects. And that's not all, because our employees have regularly benefited from training provided by experts in the field. We hope that these projects can be duplicated in the construction sector."







Installation of rooftop solar PV panels with battery systems.

rate of waste % to be recycled

## **SPOTLIGHT**

# **HD INDUSTRIES**

HD Industries manufactures detergent, soap and other household cleaning products. It is a major exporter to other African countries and has two manufacturing sites in Senegal.

The feasibility report on its Rufisque site conducted through the Sustainable Cities programme made 22 recommendations for environmental and energy upgrades. In 2022, the company implemented three of these recommendations.

The first project analysed the emissions of the site's two boiler burners for hazardous gases. The two chimneys were then modified to ensure the emissions were within regulatory limits.

The second project focused on energy efficiency. This installed a heat exchanger to heat boiler feedwater. This improvement has reduced fuel consumption from 1,800 metric-cube bar/per hour to 1,690, equating to a 6 per cent energy saving.

The third project was another energy efficiency measure. All the steam pipes that serve the production department were insulated, using 116 metres of insulation blankets. This has protected the hottest points of the plant's production process, leading to heat savings of between 20 to 40 per cent.

UNIDO also facilitated two training courses for HD Industries' staff. The first training focused on environmental management, the second on energy management. The company is already ISO 14001 and 9001 registered and is now working towards gaining ISO 150001 certification.



All investors [in Senegalese industry] are looking to save money. And when you do something and the other investors see that you have saved energy, that your electricity bill is coming down, they will follow - now or later. What we are doing now is likely to be done by other companies in the coming years."



# **COMPANY HD INDUSTRIES** Cleaning product manufacturer



#### **DESCRIPTION**

Modifications to reduce hazardous emissions and improve air quality.

Installing a heat exchanger to heat boiler feedwater and insulating steam pipes to protect the hottest points of the production process.



# About the Industrial Decarbonization Accelerator

We are a UNIDO-led network of international initiatives working to accelerate the shift of industrial organizations – both large and small – away from fossil-fuels. Working with governments, the private sector and finance institutions in emerging economies, we enable industry to change the way they think about and use energy. This involves designing solutions tailored to specific country needs and taking what we learn to inspire global action on industrial decarbonization.

# About the Sustainable Cities Initiative

The Sustainable Cities Initiative is an integrated programme working in 27 cities across 11 countries. It is funded by the Global Environment Facility (GEF) and supported by implementing agencies, including UNIDO. The Global Platform for Sustainable Cities, led by the World Bank with GEF grant funding, is the knowledge platform that ties all participating cities together and creates a collaborative space for cities working towards sustainability.





