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FACT SHEET: Climate change adaptation for South African industry

CASE STUDY: Thiele Holdings adaptation – energy supply diversification






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The need for the South Africa Industry Adaptation Project

Background

South Africa is particularly affected by climate change hazards such as recurring and extensive heat waves and dry spells, rainfall increase and storm surges. The associated impacts of these extreme weather events have a bearing on economic and social aspects of the country's development. As the country embarks on a just transition to a low-carbon, climate resilient and environmentally sustainable economy, a clear window of opportunity exists to accelerate the shift to a domestic green economy.

Adaptation to climate change helps to address environmental and health-related impacts, boosts development and is a prerequisite for a prosperous economy. It contributes to reducing strong negative impacts on the economy but also on inhabitants, especially on vulnerable communities.

Climate resilience in an industrial context is the capacity to:

- absorb stresses imposed by climate change and maintain productive functions, and
- adapt, renew, re-organize and develop desirable pathways and more sustainable practices to better prepare for future climate change impacts.

The South African Industry Adaptation Project (SAIA) aims to assist industry in transitioning to more climate-resilient operations and better prepare for future climate change impacts, while avoiding negative impacts on the environment and people. The project is implemented by the United Nations Industrial Development Organization (UNIDO), in collaboration with the National Cleaner Production Centre South Africa (NCPC-SA) and the Technology Innovation Agency (TIA). It is funded by the Government of Flanders.

The Challenge - South Africa climate impacts and vulnerability

Historic weather and climate

- Observations indicate a rise in average annual temperatures of about 1.5°C since the 1960s with more marked increases in arid inland areas.
- Temperature extremes have increased significantly in frequency and intensity.
- Overall annual rainfall has not changed markedly, but the number of rain days has decreased which means an increase in intensity of rainfall coupled with prolonged dry spells.

Projected weather and climate

While predictions for South Africa vary, most climate models suggest:

- Further increases in average monthly temperatures by 2°C by the 2050s with most significant increases in the summer months, and in the western and central interior regions.

- Annual rainfall decline, while winter rainfall is projected to increase along the east coast and eastern escarpment. Southwestern regions are at high risk of severe droughts in this century.
- Rising temperatures and variable rainfall is likely to result in more extreme events like droughts and floods and associated adverse environmental impacts such as soil erosion, deforestation, desertification, land degradation and loss of biodiversity.
- As droughts become more frequent, and as warmer temperatures increase the rate of evapotranspiration, water resources are likely to be increasingly strained and agriculture will suffer. As floods increase, there is a threat of water contamination, affecting water supply and agriculture, as well as affecting biodiversity, homes and infrastructure.
- Rising temperatures already pose limitations to the cooling capacities of South African's coal fired power generating stations, reducing outputs. Rising temperatures are likely to alter future demand for electricity, increasing peak load demands during hotter summers. The country's strategy to increase renewable energy and energy efficiency will help to mitigate some risks.

Livestock and agro-processing vulnerability to climate change

Water and energy are critical resources for agriculture and agro-processing industry. Water is required for livestock and irrigation as well as being integral to most stages of the agro-processing industry. Energy, both thermal and electricity, are needed across the agricultural value chain. These dependencies make the sector vulnerable to climate change water and energy related risks such as thermal stress from increased temperatures and water scarcity. These vulnerabilities are heightened by growing energy and water demand across South Africa.

Unprecedented heat stress is compromising livestock health and reproductive capabilities such as reduced animal weight gain, diminished reproductive efficiency and increased mortality rates in vulnerable livestock populations. High temperatures and water shortages reduce fodder crops' productivity.

Climate change significantly impacts the country's power generation capacity, primarily because its electricity grid depends heavily on water-intensive coal-fired power stations and is vulnerable to extreme weather events. These power plants require substantial amounts of water for cooling and steam generation. However, climate change exacerbates water scarcity, reducing cooling efficiency and increasing the risk of power station shutdowns, which in turn contributes to load shedding.

In addition, climate change affects electricity demand patterns, further complicating energy supply stability. These disruptions, combined with increased operational challenges, drive up energy production costs, which are often passed on to consumers, resulting in higher electricity tariffs and a greater financial burden on households and businesses. This affects industry directly by reducing output due to lack of power and affecting financial sustainability due to high prices. Water and energy efficiency is essential for achieving cost and resource savings, as well as enhancing resilience in the face of climate change and other challenges.

Thiele Holdings Farm, near Paulpietersburg in KwaZulu Natal , runs a 1200 sow piggery operation on a farrow-to-finish basis and a cattle herd as well as growing maize, soya and timber and running a feed mill. As such the farm is vulnerable to the impacts of climate change from increased thermal stress and water scarcity resulting in potential livestock productivity impairment and reduced crop yields as well as reduced availability of electricity affecting the farm operation. Electricity is used to pump water, run the feed mill, to provide heating for the pig housing, for the mechanical workshop and to provide electricity to the on-farm housing for 160 people and their families. Thiele has a base load electricity demand of about 200 kW and needs around 500 kW to run the farm at full capacity.

Operations are already highly affected by rising electricity costs and frequent load shedding. To address this, the farm installed a 125 kWp photovoltaic solar system in 2018. However, the farm is still affected by load shedding and has to increasingly rely on stand-by diesel generators. Although this addresses the electricity needs, it is not financially sustainable and results in significant GHG emissions and local pollution.

The Solution – Adaptation by energy supply diversification

The aim was to increase the farm's resilience by installing a biogas plant to complement their solar system and so further reduce their dependency on the grid, increase resilience against electricity cost increase and increase energy security. Biogas is dispatchable electricity because the biogas can be stored and the biogas generators operated only when power is required, i.e. during the night when the solar is not available. Hence a hybrid system optimises the use of renewable energy without the need for expensive batteries.

***Figure 1**: Farmers' Day at Thiele Holdings*

***Figure 2:** An aerial view of Thiele Holdings, showing the location of the biodigesters*

A modular 160 kW biogas plant has been installed with feedstock based on the effluent from the piggery operations and supplemented by 2.5 tonnes of maize silage per day. The plant comprises four digester tanks and a combined heat and power gas generator. Approximately 50% of the heat is used to heat the digesters. The modular design means that if can be scaled up in the future. In parallel, Thiele is also in the process of expanding its PV system to a total of 341 kW installed.

Figure 3: Digesters being installed

The project was implemented by Thiele Holdings with Resiliant Circular, as project managers and Global Energy Biogas (Pty) Ltd as biogas developer and contractor. Grant support was provided by SAIA for this first South African biogas-PV hybrid. Co-finance was provided by Thiele Holdings.

The plant is able to generate 1,331.5 MWh per year, off-setting diesel generation and coal based Eskom grid power, and reducing GHG emissions by up to 1299 tonnes CO2/year as well as local particulants.

In addition there is the benefit of the organic fertilizer value of the digestate which has the opportunity to reduce the amount and cost of chemical fertilizer and surplus heat could be used to heat the pig housing.

The plant requires a full time operator which means two jobs have been created with the young employees being trained in the operation and maintenance of the plant.

The plant cost R9.3m to install and took nine months to install. Thiele is able to replace electricity purchased from Eskom and most of the diesel generated electricity. This provides a payback of approximately four years and an IRR of more than 20%.

The project is highly replicable at other livestock farms where there is sufficient animal effluent and silage. There are also opportunities where there are existing waste management issues with effluent and opportunities in selling digestate. The project can pave the way, demonstrating how farms may become grid independent at a reasonable cost by installing a PV-biogas hybrid.

The project represents sustainable agro-processing adaptation by increasing resilience and self-sufficiency from the grid. Its replicability, economic advantages and positive environmental impact highlight how livestock farming and agro-processing in South Africa can reach energy independence and financial sustainability in the face of climate related price rises.

Get in touch – get involved

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