



CFF IMPACT BRIEF | Curitiba More Energy

Solar Energy on a Deactivated Landfill and Bus Stations

The C40 Cities Finance Facility (CFF) supported the city of Curitiba to prepare the Curitiba More Energy project. It entails the installation of Solar Photovoltaic (PV) on a deactivated landfill and bus stations. By incentivising the generation and use of clean energy, the project increases the municipality’s renewable energy portfolio and decreases GHG emissions.

In response to a lack of available land, the CFF helped the city to verify the suitability of solar PV systems, and assessed the legal, financial and technical feasibility of these sites. The project will generate up to 8 MW, with the potential to upscale.



The landfill solar PV system is the first of its kind in Latin America and will pave the way for decentralised generation of solar energy by municipalities throughout Brazil.

“The possibility of replicating photovoltaic generation projects for other municipal facilities is, in my opinion, the most lasting legacy. Based on the training received and in view of the strategies related to clean and renewable energy generation, there is the possibility to create protocols for photovoltaic projects incorporating environmental, social and gender elements.”

JOSIANA SAQUELLI KOCH
Public Servant, Curitiba City Hall



Project Profile



PROJECT PARTNER:
City of Curitiba



PROJECT SCALE:
8 MW installed capacity



FINANCE LEVERAGED:
USD 7,500,000

TOTAL CAPEX:
USD 5,212,768.20

ANNUAL OPEX:
USD 224,424



FINANCING SOLUTION:

The project is financed from the city budget and tendered in 2021. On the basis of the business case developed with the CFF, it will generate long-term savings for the municipality. The business case also addresses complex environmental and tax laws, previously a key barrier for interested investors.



The First Solarized Landfill in Latin America

Paving the way for solar energy in cities across Brazil



CUMULATIVE GHG EMISSION REDUCTION

66,206 TCO₂e
(2021 - 2051)



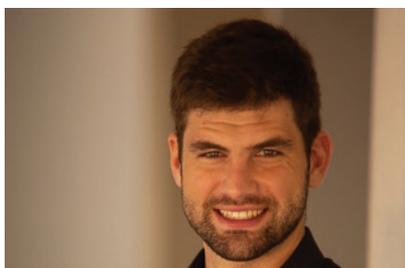
ELECTRICITY SAVINGS FOR THE MUNICIPALITY

USD 1,030,351 per year



SCALE-UP POTENTIAL

2,600 public buildings



"I think the project is special because it has promoted the proper use of renewable energies and their technology. It has changed the local culture and ensured the spread of the technology in the city and throughout the country."

THIAGO AUGUSTO SIELSKI MARQUARDT

Development and
Innovation Manager,
Urbanização de Curitiba (URBS)



"The workflow that CFF brought to the different entities of the city administration is the most lasting impact from their support. We were able to understand the process of the project in its entirety."

DANIELA MIZUTA

Architect, Institute for Research and
Urban Planning of Curitiba (IPPUC)



"CFF presented a very well-constructed and organised plan. Its application quickly proved its usefulness in organising the project."

GUILHERME ZUCHETTI

International Affairs Officer,
Mayor's Office, Curitiba City Hall



"We are now much better prepared for new projects than before. For example, it was great to look at gender-specific impacts. It's not that we didn't have that in mind, but we didn't think about a gender study initially, because we didn't expect any negative gender impacts. But then we realised that it is more complex."

ADILSON MARIN LOPES

Technical Advisor at the Municipal
Secretariat of the Environment, Curitiba

A Business Case for Latin America's First Solar PV System on a Landfill

- As a result of the cooperation with the CFF, a development bank expressed interest in offering a direct loan to the city. The city is implementing the projects in 2021 and 2022.
- The business model for the project establishes the legal feasibility of the project and supported the city to establish a Special Purpose Vehicle for the implementation of the project.
- More than 40 city officials were capacitated on technical, legal and financial topics relating to solar PV systems.
- The project will generate USD 1,030,354/year in electricity savings for the municipality.
- A gender study and accompanying capacity building activities raised awareness for gender-specific barriers in the solar sector and identified measures to mainstream gender in project preparation and implementation.



The Sun Shines for Curitiba – Paving the Way for Solar Power in Brazilian Municipalities

The CFF supported municipalities to implement bold energy projects that can be replicated across Brazil



CFF support entailed the legal and technical structuring of the project, culminating in the development of a business case for the project.

Legal support included integrating a regulation on grid net metering into the municipal legal framework and advice on how to establish the first Special Purpose Vehicle (SPV) arrangement with a utility company in the energy sector with a municipality. As solar PV on landfills is a new and innovative approach, the project required a thorough technical evaluation.



Municipal staff received various training on solar energy technologies, such as an overview of the electric sector, distributed generation rules, photovoltaic project sizing, operation and maintenance, commissioning, performance analysis, tendering and proposal evaluations, as well as legal and financial considerations for solar energy projects.



A gender analysis was carried out for the project and was accompanied with various capacity building measures for municipal staff. The trainings encouraged the debate on gender and social inclusion and contributed to improving the city's legal framework on women.



18 Brazilian cities (15 non-C40 cities) attended a series of four conferences and two in-depth seminars to share the technical knowledge created by the CFF supported project and identify how cities can apply Curitiba's experiences to advance their own projects.



At the outset of the project, the city envisioned a partnership with COPEL, the local utility company, on the project. COPEL participated in various project activities including capacity building measures. However, as a result of the feasibility studies and subsequent negotiations the city decided to internalise the profits generated by the project.



► A GREENER ENERGY MIX

"The legacy that remains is the focus on the environment. Cities need to work on putting climate change mitigation and adaptation projects into practice. The CFF has managed to bring a tangible idea to Curitiba. It is also about financial aspects, saving energy and about local governments putting more pressure on the federal government to zero out the use of fossil fuels. Maybe over time, there will be more cities doing that."

GUILHERME ZUCHETTI
International Affairs Officer, Mayor's Office,
City of Curitiba



► EXPERT INPUTS

"I think the added value of the cooperation with CFF was their organisation and their experience. Both aspects are fundamentally important for a project of this magnitude."

THIAGO AUGUSTO SIELSKI MARQUARDT
Development and Innovation Manager,
Urbanização de Curitiba (URBS)



► LEARNING FROM OTHER CITIES

"Sharing our knowledge with other cities and learning from their experiences helped us making better choices. Additionally, we gained more visibility as a city and attracted potential investors."

DANIELA MIZUTA
Architect, Institute for Research and Urban
Planning of Curitiba (IPPUC)



► GENDER MAINSTREAMING

"The inclusion of gender is more incipient in the city projects and the support of CFF was the seed for this topic to grow and gain relevance in future projects."

JOSIANA SAQUELLI KOCH
Public Servant, Curitiba City Hall



KEY CHALLENGES

- Complex regulatory framework in the energy sector with no precedent for municipalities.
- Decentralised generation modalities focusing on the private sector.
- Complex tendering law requirements for the procurement of solar PV systems.
- Implementing a holistic and technically sound project with limited city staff.

LESSONS LEARNED

- The involvement of different departments from the beginning led to enthusiasm for the project, better engagement, and improved results.
- Identifying land titles and land rights must be one of the first priorities when choosing a project site.
- Working with financially strong partners leads to better interests' rates from potential investors.
- Ground-breaking work on energy distributed generation projects can be used by other municipalities.

BEST PRACTICES

- Identifying “champions” within the city and supporting them to increase the momentum and attention on the project, e.g. with the help of partner governments, was crucial for the project's success.
- Multidisciplinary and inter-departmental collaboration structures, such as the Project Implementation Unit (PIU), were very successful and will be used by the municipality for future projects.
- Following a holistic approach, involving external stakeholders, such as the local utility company, revealed to be very useful in the achievement of project goals.
- Distributed generation projects contribute to achieving the goals of the Curitiba Climate Action Plan by promoting a cleaner energy mix and mitigating carbon emissions.

OUTLOOK

- On December 22nd 2020, Mayor Greca confirmed that the City Council approved a law that allows Curitiba to implement a solar power plant at the Caximba landfill.
- On June 30th 2021, the municipality secured public funding for the project.
- Project implementation begun in the first half of 2021.
- The city's experience is already being shared with other Brazilian cities seeking to replicate the project.



“Speaking of the most lasting impact, the project has two sides: One is in fact the technical, financial support. This will be lasting as long as the operations are functional. But I also see a lasting impact on the cultural side: I am talking here about having a well-defined and structured project with good professionals officially hired. So, I see impacts on both the physical and the cultural side, which is an impact on the way in which the city thinks.”

THIAGO AUGUSTO SIELSKI MARQUARDT
Development and Innovation
Manager, Urbanização de
Curitiba (URBS)



CFF IMPACT BRIEF | E-BUSES IN JAKARTA

100 E-Buses for Jakarta’s Sustainable Mobility Transition

In response to 60% of Jakarta’s residents suffering from diseases linked to air pollution, TransJakarta has committed to improving air quality in the city by deploying e-buses. TransJakarta is a city-owned public transport agency that manages the longest Bus Rapid Transit (BRT) system in the world. The system includes 13 corridors and 155 feeder routes in the Jakarta Metropolitan Area.

The C40 Cities Finance Facility (CFF) supported Jakarta to improve its air quality by deploying a fleet of 100 e-buses for TransJakarta’s network. The e-buses will gradually replace the city’s EURO II diesel buses on selected BRT and non-BRT routes.



Jakarta is leading the electrification of the public bus fleet in Indonesia on three pilot bus routes (non-BRT). Each route is serviced exclusively by e-bus with a service-agreement for 196 kms per day.

“Jakarta faces the problem of deteriorating air quality and pollution through combustion engine vehicles. Together with the CFF, we were able to identify one of the most suitable solutions for Jakarta, which is in accordance with our vision and mission. Most important to us is the analysis of cobenefits of e-bus deployment, e.g. the calculation of GHG emission reductions. In the implementation phase we will measure and monitor, if co-benefits are realized accordingly. This is important for the communication towards the citizens of Jakarta and will be used for future projects as well.”

SYAFRIN LIPUTO

Head of DKI Jakarta Transportation Agency



Project Profile



PROJECT PARTNER:
PT. Transportasi Jakarta (TransJakarta)
Government of DKI Jakarta



PROJECT SCALE:
100 Electric Buses



TOTAL REPORTED GHG EMISSIONS:
3,349 t CO₂e per year



FINANCE LEVERAGED:
USD 37,400,000



FINANCING SOLUTION:
Jakarta’s e-bus project will be funded through a buy-the-service PPP arrangement. The CFF supported TransJakarta to adapt the model from diesel buses to e-buses, creating a business model to ensure adequate allocation of risk across stakeholders, as well as a feed-per-km fee agreement.



“Even amid the great lockdown and city budget cuts, the city government of Jakarta is continuing firmly in the transition to zero-emission buses with the support of the CFF.”

Ibu Sri Haryati, Undersecretary for Economic Affairs and Finance DKI Jakarta



GHG EMISSION REDUCTION
100,461 tCO₂e (2021 – 2050)



DAILY PASSENGERS
45,000 passengers per day



“We are making history! 2021 will be recorded as the year that Jakarta started a new phase on electric vehicles. This is no small issue, this is a big, a gigantic step that we are now undertaking.”

MR. ANIES BASWEDAN
Governor of DKI Jakarta



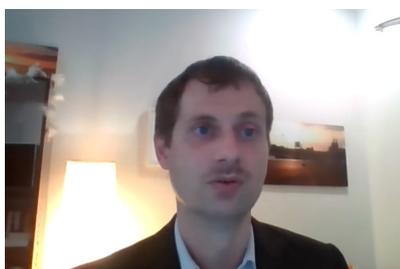
“I would like to thank the C40 Cities Finance Facility for the support given to Indonesian cities to facilitate infrastructure development. Electric buses and other electric vehicles as a means of public transportation deliver a major impact in overcoming air pollution and tackling climate change.”

MR. BUDI KARYA SUMADI
Minister of Transportation



“A moment of fantastic achievement and hope for DKI Jakarta and the country as a whole and indeed for progressive cities everywhere. I welcome the collaborative approach led by the C40 Cities Finance Facility in helping Jakarta address some of the most serious challenges it faces and ensuring that these efforts are finance-ready.”

MR. ROB FENN
The British Embassy of Jakarta,
Deputy Head of Mission to
Indonesia and Timor Leste



“Here and now, we have the first 100 E-Buses, which is a milestone, but we are looking forward for a cooperation on a bigger scale for sustainable mobility.”

DR. DAVID TANTOW
Counsellor for Development
Cooperation, Embassy of the Federal
Republic of Germany

Political Leadership Makes the Difference

- Just as Jakarta started its journey to transition the city's bus fleet, the coronavirus pandemic broke out.
- Even amidst the drastic lockdown and city budget cuts, the city government of Jakarta firmly continued with its transition to e-buses.
- Despite the project being the youngest in the CFF's portfolio, all CFF activities were carried out in a short timeframe, despite the additional burden imposed by Covid-19.
- The Governor is highly committed to the e-bus deployment and actively tracks its progress. The success of e-buses contributes to the achievement of the Regional Medium-Term Development Plan 2018-2022.
- The Governor issued two regulations (no.74/2021, 90/2021) and one instruction (no.17/2021) to accelerate e-bus rollout. For instance, the concession period of e-bus was extended from 7 to 10 years. This will bring down the cost of e-bus deployment by more than 10% accordingly (based on CFF analysis).



Signs of Transformation – planning and guiding the shift towards e-bus deployment in Jakarta

With our partners, the CFF strives for transformative change, supporting systemic shifts in how cities implement climate action and access climate finance!



A technically-sound, finance-ready project and a comprehensive social cost benefit analysis.

Despite taxes on the costs of e-bus deployment, studies conducted with support by the CFF demonstrated that the environmental, public health and economic benefits outweigh the costs. Switching to e-buses is therefore the strategic future-proof choice for Jakarta.



Despite starting the project at the peak of the Covid-19 pandemic in March 2020, the strong commitment by Jakarta and the CFF enabled a seamless transition to virtual formats.

Online sessions with technical and financial experts in the city gave partners the opportunity to, amongst others, acquire the knowledge necessary to analyse existing routes and prioritise routes for e-bus deployment according to passenger needs.



TransJakarta promotes the recruitment of female drivers on the basis of a 30%-quota.

The gender study conducted by the CFF provided further insights for the program and comprehensive recommendations for the implementation process within TransJakarta.



A webinar series on e-mobility attracted ~200 participants from cities, national governments, NGOs, academia and financiers from around the world.

The webinar series inspired and amplified policies, incentives, and support to encourage the adoption of electric mobility. It furthermore gathered diverse views from stakeholders on how to incentivise and accelerate the adoption of e-mobility.



Fruitful city-to-city learning sessions with Auckland Transport, King County Metro, EMT Madrid and Land Transportation Authority Singapore.

E-buses are a new technology for TransJakarta. To kick-start the project preparation, Jakarta interacted with experienced cities around the world to learn key lessons and best practices.



► ACCELERATING E-BUS DEPLOYMENT

“To support battery electric vehicles, the Government of Indonesia has issued Presidential Regulation Number 55 in 2019 for the acceleration of provision of electric vehicles for road transportation. Through the deployment of electric vehicles, we will increase savings and will also reduce greenhouse gas emission...We hope that this E-Bus programme is the foundation of e-bus development in Indonesia.”

MR. ARIFIN TASRIF
Minister of Energy and Mineral Resources



► LEARNING FROM OTHERS

“CFF has supported the planning and trial of e-buses in Jakarta by providing independent technical and financial feasibility studies. These are supported through lessons learned from around the world. CFF also helped us to identify a business model suitable for our context. We are now able to build on this and are introducing the first e-bus fleet in Indonesia.”

MR. SYAFRIN LIPUTO
Head of DKI Jakarta Transportation Agency



► INTERNAL RESTRUCTURING

“The organisational structure of TransJakarta separates between operation and engineering. The momentum of the E-Bus Trial Project was used for internal restructuring: A task force for the pilot was established, with the operational team and engineers working side-by-side. We now have a better understanding across technical, operational and procurement issues when it comes to e-buses.”

MR. YOGA ADIWINARTO
Director of Operation and Safety,
TransJakarta



KEY CHALLENGES

- E-buses and e-mobility as a wider concept are relatively new technologies in Indonesia.
- The lack of capacity related to e-buses is not only due to technical limitations, but due to issues around cost structures and daily operations.
- National policies on energy subsidies, additional taxes on e-buses and legal impediments for the initiation of procurement processes.
- Further mitigation measures must be taken to sustain the positive impact of e-buses. The current mitigation impact is limited, as coal is the main fuel used to generate electricity in Indonesia.

LESSONS LEARNED

- Institutionalising regular coordination with the partner city, transport agency, and consultants helped build trust and identify precise capacity needs and measures.
- A complete set of available data greatly reduces the project preparation time.
- When accounting for environmental and public health benefits, they can offset seemingly higher costs for e-buses.
- City officials suggest that more emphasis should have been put on the financial modelling, e.g. first assessing funding sources and respective timelines as well as requirements.

BEST PRACTICES

- Establishing a permanent and institutionalised decision-making body – such as a Project Implementation Unit (PIU) – is key for leading such a complex transition. The PIU for the e-bus project is now mandated to oversee all e-mobility efforts in DKI Jakarta.

OUTLOOK

- According to the e-bus roadmap from TJ: 60% of the bus fleet will be electrified by 2025, respectively growing to a share of 80% by 2030.





CFF CHILDREN'S
INVESTMENT FUND
FOUNDATION



UK Government

giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

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CITIES**



CFF IMPACT BRIEF | TSHWANE

Tshwane's First Combined Heat and Power Plant in Zeekoegat

The CFF supported the City of Tshwane to plan a combined heat and power (CHP) plant. As Tshwane's Zeekoegat Wastewater Treatment Works (WWTW) produces biogas as a by-product of its sludge treatment, the upgraded facility will use it to produce energy. Previous renovations of the WWTW, built in 1991 and renovated in 2014 and 2016, did not consider other uses for biogas. The CHP plant will produce up to 460 kW (nominal power) of electricity from waste processed at the plant and provide increased security against power outages that can prevent continuous operations. With a capital investment of USD 1.13 million and an operational investment of USD 8 million, the CHP plant is expected to cover up to 20% of the WWTW's own energy needs.



The project serves as a model for cost-efficient technology at WWTWs across South Africa, with 20 potential sites identified for replication. This plant alone will reduce annual emissions by up to 3520t of CO₂.

"The biggest impact of the project might be the successful implementation of a CHP plant in South Africa – constructed and running with proper operational maintenance. Together with the CFF, we got the project ready to be contracted. If all goes according to our plan, we will establish a sustainable renewable energy source, save money, and will reduce our GHG emissions significantly."

KERNEELS C.M ESTERHUYSE

Deputy Director, Wastewater Treatment Operations, City of Tshwane



Project Profile



PROJECT PARTNER:

National Department of Minerals and Energy (DMRE),
South Africa
South African National Energy Development Institute (SANEDI)
South African German Energy Program (SAGEN)



PROJECT SCALE:

85 megalitres of daily sludge processed
for up to 460 kW nominal power



FINANCE LEVERAGED:

USD 1.13 million capital investment
USD 8 million operational investment

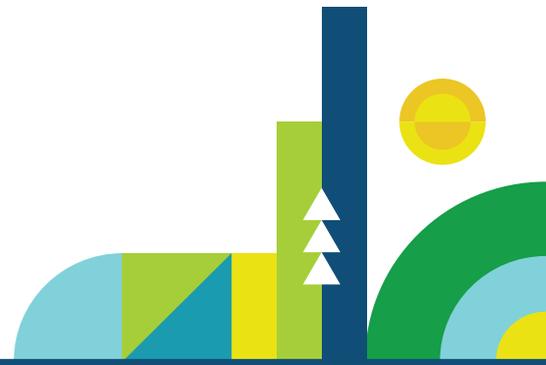


FINANCING SOLUTION:

The project is grant-funded by the National Department of Mineral Resources and Energy, with the city covering the operating costs. Operations run through a Build, Operate, and Transfer Public Private Partnership (PPP) to ensure transfer of expertise and skills to the city.

Creating a Model for CHP Plants Across South Africa

Equipping all WWTWs in South Africa with CHP Plans would generate up to 780 MW of nominal power



CUMULATIVE GHG EMISSION REDUCTION

107,520 tCO₂
(2020 - 2050)



DAILY ENERGY GENERATION

460 kW nominal power



SCALE-UP POTENTIAL

20 WWTW sites across South Africa



ELECTRICITY SAVINGS

20% of the WWTWs overall energy demand



"The CFF supported the project by providing technical advisors as well as an appointed transaction advisory (technical, legal, financial experts) to assist the municipality. Through this, the CFF provided skills that were not available in the municipality. This helped in drafting technical specifications, confirming what is happening in the field outside of Tshwane, and what would be the best in this municipality. Following, the CFF supported the city in drafting a contract by engaging with different stakeholders in the municipality, and the city's different departments such as financial, legal, technical and sustainability departments within the city."

KERNEELS C.M. ESTERHUYSE
Deputy Director, Wastewater Treatment Operations,
City of Tshwane



"I appreciate the manner in which people were brought on board, especially the diversity of participants in the different CFF formats. What we gained from this cooperation is a sort of blueprint, on how to engage key stakeholders in the future and which we will use in similar interventions in the future and which we want to share with others."

SELLO MPHAGA
Head of the Sustainability Unit,
City of Tshwane

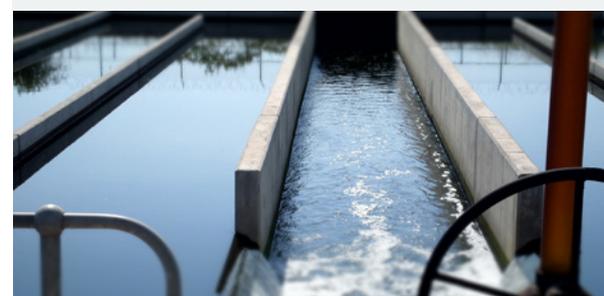


"The process has assisted the city to internally recognize the resources and skills it already has. By not working in silos, we were able to collectively package a program, which is well accepted in the municipality. The CFF helped us to package projects in such a way that when you speak about them, you bring it to a level, which ordinary citizens easily understand. The financial model is instrumental for the CHP project: It is the basis for the decisions we take."

DOLLY MAFA
Sustainability Mechanism Specialist,
Sustainability Unit, City of Tshwane

Establishing a new technology in Tshwane as a model for other municipalities across South Africa and beyond

- Bringing an expert team of engineers, finance experts, and lawyers on board facilitated the understanding of the project with the city team and elevated the process to the next level.
- The process included productive knowledge exchanges with the cities of Cape Town, Johannesburg and Windhoek, which developed similarly complex CHP projects.
- The support from the technical experts and the resulting increased understanding of technical and financial project details made it possible to engage various actors within the city.
- As a result, the national Department of Minerals and Energy came on board and supported the project through the appointment of a project manager.
- The buy-in of national level actors through the deployment of a project manager and their commitment to this project was essential to introducing a new technology that has inspired other wastewater treatment plants throughout the country.



From Wastewater By-products to Heat and Energy – A Sustainable Path for South Africa

The cooperation between Tshwane and the CFF developed capacities across South Africa to access finance and secure the future of innovative projects



The CFF provided expert advice for a public private partnership allowing Tshwane to carry out the envisioned project.

The focus was on supporting procurement, market surveys and financial modelling. City officials have also been equipped to track the CHP plant's performance and to anticipate and mitigate operational risks.



City officials were trained in key areas of conceptualizing, establishing and running a CHP plant through national and international peer learning sessions.

Together with colleagues from Cape Town, the newly established Project Implementation Unit carried out a thorough contextual analysis, which included detailed explorations of legal issues, procurement strategies and contract management.



A state-of-the-art solution to use wastewater treatment by-products to generate heat and power.

Through an international peer exchange, the city administration and the CFF jointly developed a technologically and financially feasible plan to bring the technology to Tshwane. This plan is ready to be implemented and may be used to roll out this approach throughout South Africa.



The CFF helped the Tshwane city administration to set-up a strong support network.

Experienced partners, such as the national Department of Minerals and Energy (DMRE) or the South African National Energy Development Institute (SANEDI), joined the project ensuring financial closure and implementation.

► SCALE-UP

Once the proof of concept has been achieved, the role-out of the CHP technology used at Zeekoegat WWT is planned in several of the city's other WWTWs. Also, a countrywide role-out has been considered by the national Department of Minerals and Energy.



"CHP hasn't had a good track record within South Africa and in the wastewater treatment field. So, transforming this project into a successful model may lead to more such projects in the future. Obviously, in other kinds of projects we have a standard of how we do things – in this case we had to develop another approach first. In that sense, it's a really different project. It could pave the way going forward also for others."

STEPHEN VAN DER MERWE

Deputy Director, Wastewater Treatment Operations, City of Tshwane



KEY CHALLENGES

- The most significant challenge the project faced was to increase capacities to a level that ensures smooth operation of the CHP plant.
- CHP plants are technologically complex and have a long lifespan, which makes it necessary to establish processes of transferring capacities between colleagues over long periods of time.

LESSONS LEARNED

- Conceptualizing a complex and innovative technology requires regular and fully staffed planning sessions, which engage officials on all working levels.
- International and national peer exchange is crucial to learn from each other in similar situations and to prevent the repetition of mistakes.
- The Sustainability Unit located in the mayor's office served as a champion for this technology and was essential in creating a narrative centred on climate change, and not simply accounting for the project through performance targets.
- Establishing CHP plants requires technical personnel to embrace learning and advance their own skills and knowledge.

BEST PRACTICES

- Bringing the technical and financial consultants on board proved to be an accelerator for the entire project.
- The legal, financial and engineering experts facilitated the PIU's processes, which allowed focused and smooth collaboration between all involved parties, including the national Ministry of Energy and Mines (DMRE).

OUTLOOK

- The Zeekoegat CHP biogas project is well on track towards implementation. The city is preparing for procurement and negotiations with the private sector for a Build Operate Transfer contract.
- To ensure continuity and sustain the support into the future, the National Department of Minerals and Energy (DMRE) provided a project manager through SANEDI to assist the city to procure and manage the project.
- Tshwane is committed to disseminating their own lessons learned to other cities in South Africa. Tshwane and SANEDI will also sign an MoU to create a lasting partnership.

