

The Journey of Bitou Local Municipality in Accepting Embedded Generation on the Distribution Network



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ABSTRACT

South Africa is experiencing an exponential increase in the uptake of embedded generation on municipal distribution grids. This is driven by increased electricity prices, a drop in the price of solar PV and South Africa's ongoing load shedding crisis. The Presidency's Energy Action Plan to end load-shedding calls upon municipalities to accelerate the uptake of embedded generation on their grids. Municipalities need to be proactive and develop procedures and standards to integrate embedded generation into the grid and avoid an unregulated expansion of these systems. This case study investigates the journey of Bitou Local Municipality in developing procedures to integrate embedded generation into their distribution grid. Bitou Local Municipality has approved 1.3MW of grid-tied rooftop solar. The paper describes the municipality's policy framework for embedded generation and details the process of obtaining council approval on the embedded generation policy. The municipality's embedded generation operations are described, including how smaller systems are processed, and how grid impact studies are approved for larger systems. The municipality's approach to net billing is discussed, including bi-directional meters and billing system updates. While Bitou Local Municipality is considered amongst the leaders in the embedded generation space, the municipality still faces a range of challenges in this new area of operations. The municipality's strategy to manage unregistered and non-compliant systems is discussed in detail. The paper concludes with recommendations for new municipalities starting on their embedded generation journey.

Keywords: embedded generation, distribution grid, bitou local municipality, municipalities, solar PV

Background

South Africa is experiencing an exponential increase in the uptake of embedded generation on municipal distribution grids. This has largely been driven by increasing electricity tariffs, energy security (load shedding) and the decreasing costs of solar PV. The Presidency's Energy Action Plan to end load shedding calls for municipalities to accelerate the uptake of embedded generation on their grids. Data from Eskom shows that renewables are helping to alleviate load shedding by at least two stages¹. An astounding amount of 4.4GW of rooftop solar on the distribution network had been installed by June 2023, and the rate of installation is still increasing rapidly². Therefore utilities i.e., municipalities need to be proactive and develop procedures and standards to integrate embedded generation into the grid, as well as appropriate tariffs. This will help avoid an unregulated expansion of these systems which poses associated safety and power quality risks as well as ensuring they remain revenue neutral.

Definitions:

SSEG	Small Scale Embedded Generation.
PV	Photovoltaic.
SALGA	South African Local Government Association.
SEA	Sustainable Energy Africa.
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit.
AMEU	Association of Municipal Electricity Utilities.

1. Introduction.

As early as 2014, the small but growing number of Small-Scale Embedded Generation (SSEG) installations was increasingly a concern for many municipal distributors who were not prepared for the imminent surge of installations. In response, support programmes initiated various measures to regulate the boom in grid-tied solar PV systems. Research was conducted, training programs were developed for distributors, and a host of resources were created to guide municipalities in crafting their own SSEG policies. These initiatives aimed not only to facilitate the safe and effective deployment of embedded solar PV systems but also to create a tariff framework that would keep municipalities financially stable. To accomplish this, guidelines were put in place for developing processes, contracts, standards and specifications, as well as balanced SSEG tariffs, which included consumption, fixed, and export charges. Industry organisations and local government support agencies like SALGA, SEA, GIZ, GreenCape and AMEU have played pivotal roles in offering technical support and capacity development on SSEG to municipal distributors for the past decade. This case study describes the journey of Bitou Municipality of how they were able to implement SSEG using the support they received.

Bitou Municipality - formerly known as Plettenberg Bay Municipality, is a local municipality within the Garden Route District Municipality, in the Western Cape province of South Africa. It is a small urban town with an estimated population of over 60 000 and over 20 000 households. It has close +19 435 customers and is characterised as the 'playground for the rich' with many super-rich choosing to buy holiday houses in the area³. The distribution grid has a maximum demand of 26MVA and capacity of 32.5MVA.

Faced with increasing customer inquiries and uncontrolled SSEG installations, primarily from the residential sector, Bitou Municipality quickly embraced SSEG systems and was one of the early adopter municipalities. The municipality was concerned about the impact this would have on grid stability and safety of its workers as well as damage to infrastructure – luckily there were no safety incidents or infrastructure damage. Reversing conventional meters by these customers were the first clear signs of SSEG being installed without being registered. The decreasing consumption also posed a challenge in electricity billing because the municipality did not know how to deal with month-on-month lower consumption, and eventually resorted to estimating consumption based on historical data. There were numerous disruptions to the billing processes, and the municipality was noticing revenue loss from a few customers they were monitoring.

2. Proactive Steps towards SSEG Integration.

Recognising the burgeoning challenges and opportunities presented by SSEG Bitou Municipality chose a forward-looking approach. Instead of sidelining or obstructing the SSEG technology, the municipality took measures to understand and regulate it effectively. This initiative began when representatives from the Electricity Department underwent a SEA-SALGA-GIZ Support Programme sponsored general SSEG training in April 2019. Following this foundational step, the department continued to build its expertise by participating in a series of training sessions covering diverse topics such as grid stability, bi-directional metering, and tariff determination. Armed with this knowledge, Bitou Municipality launched a 3.68kVA pilot project with one of the LV residential customers to test and adapt SSEG systems.

3. Institutionalisation.

Spurred by the insights gained through training, the municipality was inspired to formalise its SSEG policy. The municipality highlighted to Council the challenge of unregulated SSEG installations feeding into the grid, and using their knowledge gained from the training, proposed a way forward. Utilizing the SEA's guidance and drawing on resources from the Support Program AMEU-SALGA resource pack, Bitou Municipality confidently crafted a comprehensive draft SSEG policy that was accepted in principle by Council. The policy underwent a successful public consultation process with zero objections, and after further engagement with Council, it was officially adopted in May 2020. The policy, standards and specifications closely followed that recommended by the AMEU-SALGA resource pack with no deviations. The value of such a resource pack that has the necessary technical expert input and due diligence review cannot be underestimated, as it is not feasible for a municipality to learn or find the necessary expertise to develop these for themselves. Following this, the SSEG tariffs were also developed and approved during the 2020/21 financial year.

These were the first institutional steps to readying the municipality. Recognising the importance of laying a strong foundation for SSEG integration, the municipality took incremental steps. This 'learn-by-doing' approach proved to be beneficial, as it enabled the municipality to gradually scale its capacity to accommodate larger SSEG installations. To bring the policy to operational status, the municipality once again turned to the AMEU-SALGA SSEG resource pack. This trusted resource guided them in the creation of SSEG application forms, as well as the establishment of key parameters, adoption of specifications and standards (including the NRS097 series and SANS10142), specifications for bi-directional meters, commissioning process and contracts.

4. Tariff development.

The process of setting the SSEG was relatively easy. The tariffs were formulated following participation in the SEA training on SSEG tariffs, and by using the resource pack with tools to establish the various tariffs required. The municipality's objective was to establish tariffs that preserved revenue neutrality, ensuring there was neither a deficit nor a surplus. To achieve this, a tariff structure was devised according to the SSEG tariff tool, comprising a fixed charge, energy consumption charge, and energy export charge. This structure effectively separated energy usage costs from connection expenses while also providing SSEG customers with a fair and favourable reimbursement rate for the energy they contributed to the distribution grid. These tariffs received approval from the Chief Financial Officer, Council, and the National Energy Regulator of South Africa.

5. Processing of applications.

Despite the onset of the COVID-19 pandemic in 2020, Bitou Municipality received its first SSEG applications during that year. While the initial wave comprised only three applications due to lockdown restrictions, the municipality has since seen a steady uptick, with an average of 10 applications coming in each month. Processing these applications is currently done by one person due to staffing limitations, resulting in an approximate one-month waiting period for approvals. To ensure compliance and consistency, the municipality adheres to a rigorous checklist provided in the AMEU-SALGA resource pack. To date, the municipality has approved and commissioned 37 SSEG installations, contributing to a total of 1.27MW of grid-tied rooftop solar energy. Notably, there have been no outright rejections of SSEG applications. However, the municipality often requires the forms to be correctly completed or requires minor modifications to the proposed systems, such as the inverter. In the future Bitou will shift SSEG applications and permitting process to the Online Application portal developed by the Municipal SSEG Support programme. This simplifies and speeds up the whole process for customers, installers, and time-constrained municipal staff.

Due to the municipality being small, there are only three large SSEG customers, two MV customers (shopping centre) and one LV customer (commercial) – all of which are approved SSEG customers. In 2021, approvals were granted to two Medium Voltage (MV) customers, with installations rated at

600kVA and 440kVA, respectively. These particular applications necessitated grid impact studies, which confirmed that the existing electrical infrastructure could accommodate the new installations. In addition, a Low Voltage (LV) commercial customer received approval for a 100kVA system, which did not require any grid impact studies. The remaining residential installations vary in size but generally fall within the 2- 4 kVA range.

6. Billing.

Upgrading the billing process and software was a significant obstacle to implementing the policy. It took almost 2 years for the billing system to be upgraded to allow for a credit allocation of the exported energy by the customer. At present, crediting the customer entails a manual calculation to determine the units that were exported; however, the system provider is in the process of upgrading the software to automate this calculation.

7. Strengthening Communication and Compliance

Despite initial public enthusiasm for the SSEG, Bitou Municipality faces challenges in ensuring full compliance - particularly among existing but unregistered SSEG customers. While both the public and private sectors largely supported the policy during its inception, a significant number of SSEG customers have yet to formally apply for approval. The municipality identifies a couple of key factors for the low registration: a lack of awareness among customers about the need to register their SSEG installations, the use of non-compliant inverters which would mean an expensive replacement to comply, and the financial burden associated with purchasing bi-directional meters which is for the customer's account.

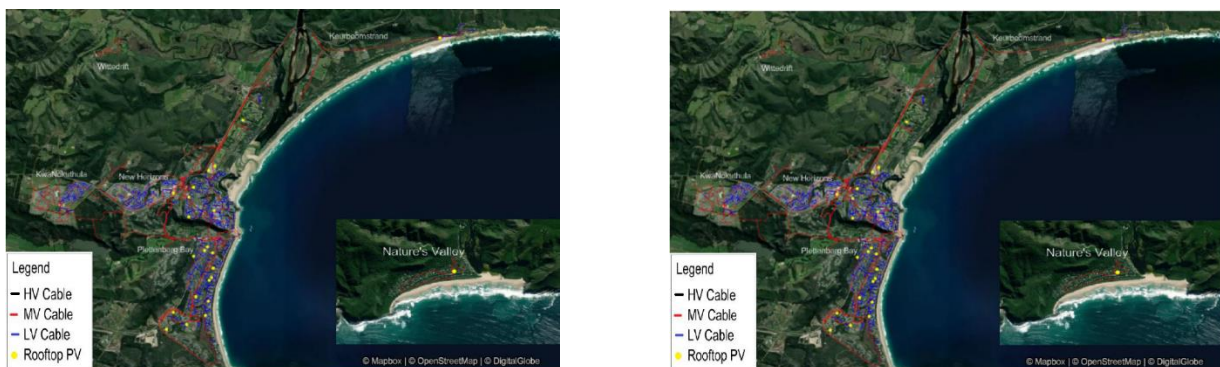


Figure 1: SSEG registered installations (left) and total registered and suspected unregistered (right) as of April 2022⁴.

In April 2022, Bitou suspected approximately 125 SSEG installations which included 16 registered SSEG customers⁴. The municipality suspects that many installations are still happening without approval with the meter being bypassed. This has repercussions for both the customer and the municipality – the customer does not benefit from any electricity that is exported to the grid, if any, while the municipality remains in a precarious position due to potential revenue loss and unknown safety and power quality issues.

The municipality is currently gearing up to undertake a large awareness campaign which aims to educate SSEG customers about the importance of registration and compliance. A multimedia approach will be taken, featuring a short video to be disseminated across various platforms, succinctly explaining the need for formal registration. Furthermore, the municipality plans to include an informative letter in upcoming rates bills to reach customers directly, reinforcing the urgency and benefits of complying with SSEG regulations.

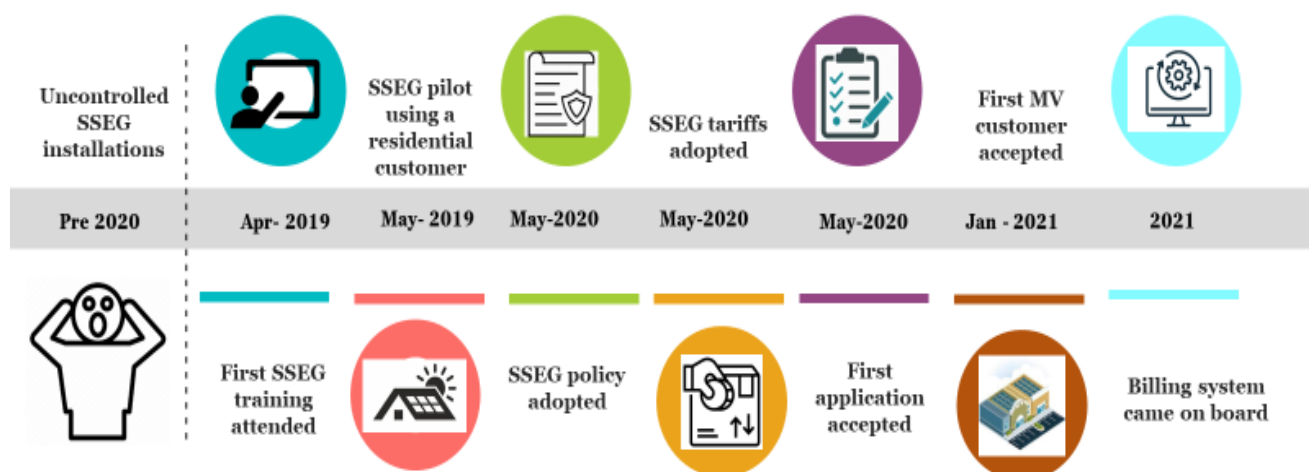


Figure 3: Bitou Municipality's SSEG journey

8. A Multi-Faceted Approach.

While the municipality has made substantial progress to date and with the minimal resources available, there are many challenges some of which have already been discussed:

- **Regulatory Hurdles and Customer Reluctance:** A significant issue is the reluctance of customers to register their SSEG systems. To tackle this, the municipality is contemplating the adoption of a bylaw that would make registration a legal requirement (although the Occupational Health and Safety Act already makes municipal approval legally necessary). Such a regulation could pave the way for penalties and fines for non-compliance and hold installers and customers accountable. However, the municipality must first exhaust awareness-raising measures before the penalties are imposed.
- **Insufficient staff to process or approve applications** poses another major bottleneck, with just one staff member available for processing applications—and even then, not on a full-time basis. This naturally extends the duration required to approve applications. To address this, there is an urgent need to allocate additional personnel to SSEG-related tasks. Additionally, Key Performance Indicators (KPIs) for SSEG need to be incorporated into the Electricity Department's goals and aligned across other relevant departments like Finance and Environment and included in the key documents of the municipality such as the Integrated Development Plan. In addition, Bitou is planning to adopt the Online Application Platform developed by the Municipal SSEG Support Programme which other municipalities are finding streamlines the whole permission process.
- **Installers who do not follow the application process** – similarly a bylaw would make it illegal for non-compliant systems to exist and would hold the installers/competent persons accountable.

9. Charting the future.

As Bitou Municipality moves forward, there are essential milestones on the horizon. One immediate task is the full integration of the billing system with SSEG, a vital step for effective record-keeping and reporting of system numbers, export volumes, and grid hosting capacities.

Tariffs will also need to be reviewed regularly, as more data becomes available and the context changes to keep the tariffs favourable to the customer while maintaining revenue neutrality.

In line with broader environmental and social concerns, the municipality is committed to a just energy transition. This entails making electricity more affordable and accessible for all residents. Ambitious targets have been set, including the generation of 50 MW of low or zero-carbon electricity in the Garden Route district within the next decade. Additionally, the municipality aims to derive 50% of its energy from green or low-carbon sources and double its investment in sustainable technologies within the same timeframe.

10. Recommendations for Strengthening SSEG.

Bitou Municipality's journey into SSEG regulation and implementation offers the following enhanced recommendations for other municipalities:

- **SSEG training:** Municipalities with no existing processes must participate in SSEG training programs offered by SALGA and SEA, and other relevant courses. This is not just for those at the policy-making level but should also include technical staff who will handle operational aspects.
- **Pilot programs:** Before fully implementing SSEG, a small-scale pilot program involving a limited number of customers can provide invaluable insights into potential challenges and solutions.
- **Inter-departmental collaboration:** the Electricity and Finance departments must engage with each other from the inception of the initiative to ensure that billing systems are reviewed and requirements for upgrade are established in parallel to policy and tariff development. This will also allow systems to be tested timeously.
- **Inter-municipal collaboration:** Engage with other municipalities that have already implemented SSEG to share insights, challenges, and best practices.
- **Staff Allocation:** Given that processing applications can be time-consuming, municipalities should plan for adequate staffing levels, perhaps hiring or training additional staff for this purpose.
- **Customer awareness:** Municipalities need to run awareness campaigns to inform potential SSEG customers about the application process, benefits, and responsibilities to encourage customers to register their existing systems.
- **Bylaws and legal Framework:** Develop or strengthen bylaws making it a legal requirement for all SSEG systems to be registered, complete with penalties and fines for non-compliance.
- **Resource packs and checklists:** Make full use of existing resource packs and checklists, such as those provided by AMEU-SALGA, to ensure that all compliance requirements are met.
- **Infrastructure Readiness:** Invest in proper metering infrastructure and integrate SSEG considerations into the billing system for a seamless operational experience.

11. Conclusion.

The Bitou Municipality's journey in adopting and implementing SSEG stands as a testament to its proactive commitment as well as the transformative power of training and comprehensive technical resource packs. The guidance provided through training sessions and the AMEU-SALGA resource pack has been essential. This case study underscores that proper training and a well-structured resource pack can significantly de-risk the complicated process of SSEG adoption. These tools not only aided in the development of institutional frameworks but also streamlined application processing and helped in managing system complexities, like grid stability and bi-directional metering. For other municipalities standing at the threshold of SSEG integration, the Bitou Municipality's experience sends a clear message: Invest in quality training and make full use of the AMEU-SALGA resource packs. These foundational elements pave the way for a responsive, adaptive approach that can address the inevitable challenges that arise during the SSEG transition. While Bitou Municipality has made significant strides to institutionalise and operationalise SSEG, challenges persist. From issues of compliance to staffing limitations to revenue considerations, the journey can have some complexities. Yet, with continued support and a focused approach, the municipality is optimistic about realising its goals. The lessons learned and the methodologies employed by Bitou provide a roadmap for other South African municipalities facing similar challenges in integrating SSEG into their energy mix. In a larger context, Bitou's experiences serve as a microcosm of the broader challenges and opportunities that confront South African municipalities. Sustained and collaborative efforts at the municipal level are imperative to fully unlock the potential of SSEG in shaping South Africa's future energy landscape.

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