



CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

City of Cape Town Energy – Loadshedding Mitigation Overview

ENERGY March 2023

Making progress possible. **Together.**

Energy Vision for the City of Cape Town

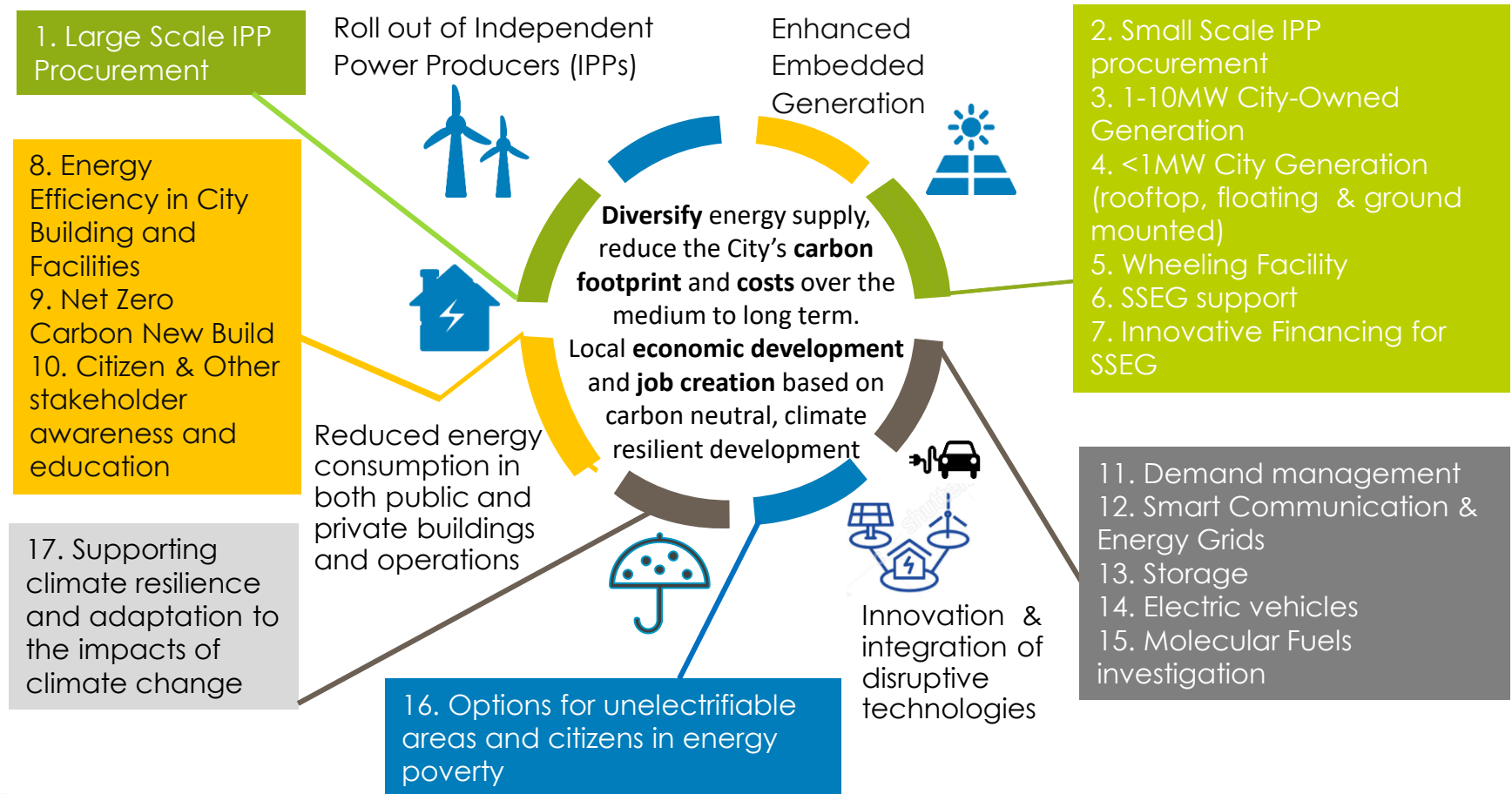
An open, transparent and vibrant energy market characterized by resource efficiency, cost competitiveness and climate resilient options that promotes inclusive economic development and healthy, thriving communities and ecosystems



An energy and climate resilient, carbon neutral future for Cape Town

PLANNING AND RESEARCH:

Energy Planning; Carbon Neutral Modelling & Planning; Feasibility Studies; Data Management; Policy Dev



COMMUNICATION & COLLABORATION



Mayor's Priority Programme: Energy Security for Economic Growth

“Achieve increased energy security that underpins economic growth for poverty alleviation.”

WP1: Energy Strategy

Long term, wide-reaching strategy to ensure a cost effective and cohesive approach to the energy transition

WP1: Load-shedding Mitigation

A programme of specific demand- and supply-side interventions to limit the impact of load shedding within City Supply Areas.

WP3: Power Utility Reform

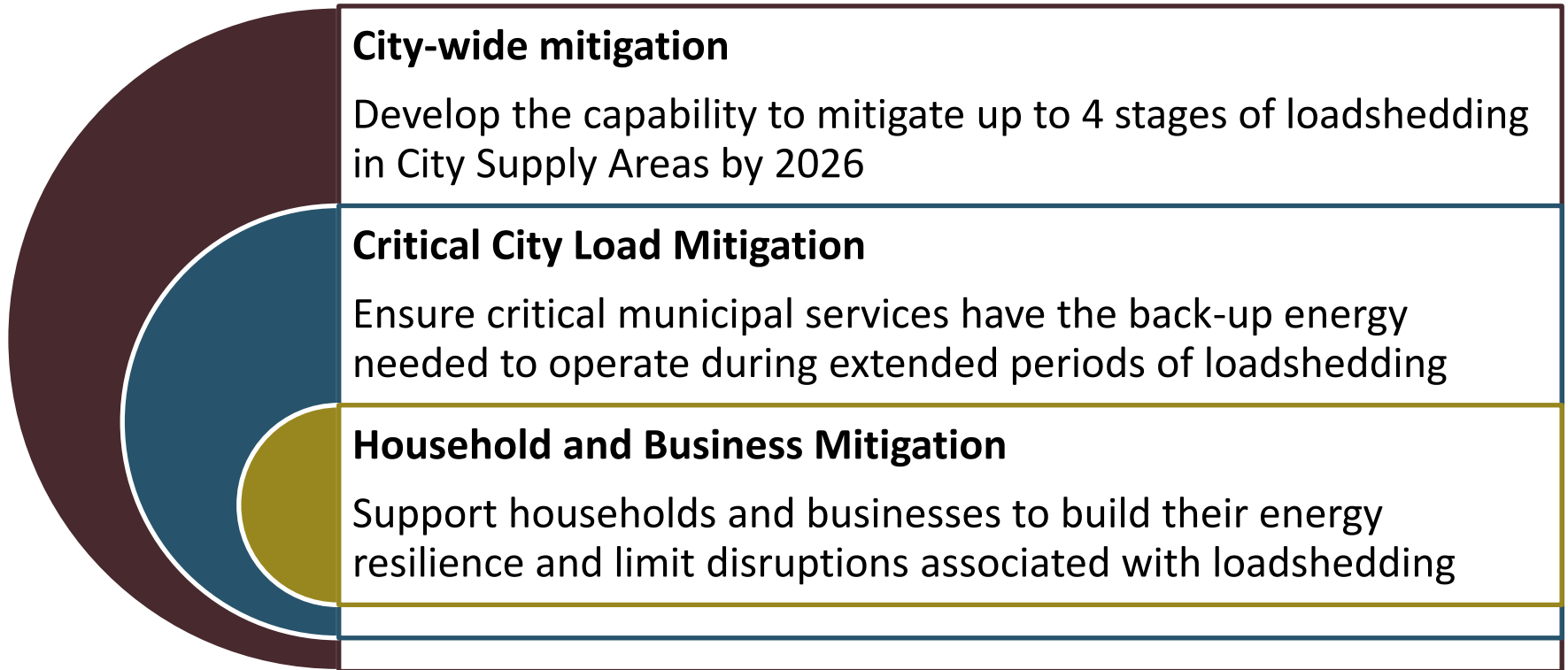
A programme to transform the utility business model for future-fit and financially resilient power utility.

WP4: SSEG Streamlining

A streamlined system for registering SSEG will promote local embedded generation

Goals

Assumption: Loadshedding will continue for at least the next 5 years with an average severity of Stage 4.*



*Likelihood of up to 10 years of LS with increased frequency of loadshedding Stages 6-8

Loadshedding Mitigation Fundamentals

- Eskom technical performance **not** going to improve short/medium term
- **Declining EAF and increasing EUF** of aging Eskom coal fleet pointing towards potential catastrophic collapse of the energy supply/demand balance (Status of Black Start facilities unclear)
- However, SA does not have an installed capacity problem (**~50GW vs ~34GW winter peak**) but an inability to extract required energy from installed generation sources to meet demand over day/week/month
- Adequate response must thus not be constrained to a capacity focused solution (MW only) but focus on broader energy requirement
- National/local response must meet two fundamental criteria:
 - **Dispatchability** (can be switched on when required)
 - **Large Energy Output** (High power output over long periods)

The introduction of additional high energy, dispatchable capacity is a non-negotiable

Energy Strategy: A Framework for Action



Harness new energy supply

Cape Town's energy demand is met by a reliable and cost-effective supply of cleaner energy from multiple energy suppliers, with new energy sources harnessed for the benefit for all energy users and system stability.



Operate a future-fit utility

The City has a financially resilient electricity utility paired with modernised and well-maintained infrastructure to facilitate the provision of energy services in an increasingly competitive energy market.



Enable wise energy use

The economy, households, and municipal services are energy efficient and manage the timing of energy demand optimally to take advantage of renewable energy sources, while opportunities for fuel switching in the transport sector are maximised.



Alleviate Energy poverty

Economically vulnerable Households and communities are supported to access a range of safe energy services to meet their daily needs and increase economic participation.

A culture of learning and innovation | Collaborative and capable government | Action by residents, businesses, & energy services sector



CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

Key Actions

City-wide mitigation

1. Optimise use of Steenbras Hydro Pumped Storage
2. IPP tenders :
 - Dispatchable Energy
 - Low Carbon Embedded Generators
3. Construct City owned:
 - 7MW Atlantis PV System
 - approx. 5MW Rooftop solar
 - 8-10MW of micro-hydro
 - 3-5 MW of Waste to Energy
4. Feasibility assessment of
 - utility-scale PV at Paardevlei (~30MW)
 - Floating Solar at WWTW
5. Enhance Large Power Users Demand Response Programme
6. Activate Residential Demand Response as part of the Power Heroes Programme
7. Explore Energy Trading Platform options
8. Explore PPP for additional regional pump storage scheme

Critical City Load Mitigation

1. Implement a battery energy storage pilot at critical loads,
2. Invest in generators at pump stations, WTP, WWTW, key office sites
3. Develop Stage 8 / black out recovery plans for all departments
4. Expand and invest in energy efficiency, renewable energy, and storage at critical loads

Household and Business Mitigation

1. SSEG Registration Streamlining through an online registration system
2. Loadshedding Communication Campaign
3. Wheeling pilot
4. Enable commercial net generation
5. Potential FBAE subsidy policy



The City's total System Maximum Demand is **1700 MW**

Load shedding is conducted following national guidelines for load shedding as detailed in the NRS 048 – 9 document.

Local generation and network boundaries

Plant	MW	Ownership	In City	Comment
Small-scale embedded generation (SSEG)	~100	Private	Yes	Grid-tied systems, mainly rooftop PV, within the City distribution area.
Athlone gas turbine plant (AGT)	36	City	Yes	Mainly used for loadshedding mitigation in recent years. Runs off jet kerosene. Installed in 1973.
Roggebaai gas turbine plant (RGT)	42	City	Yes	Installed in 1982.
Darling Wind Farm	5.2	Private	No	The City buys a share (not all) of this plant's electricity.
Micro-hydro	2.8	City	Yes	Used to supplement electricity demand of City water treatment plants.
Steenbras hydro pumped storage (SHPS)	180	City	Yes	Commissioned in 1979. Uses more electricity than it generates. Mainly used for arbitrage and (more recently) for loadshedding mitigation.
SSEG City owned	> 1	City	Yes	
Eskom	The rest!	Eskom	No	Intake points: Montague Gardens, Philippi, Tafelbaai+

Steenbras Pumped Storage

Steenbras Optimisation

- Utilisation of Steenbras Pumped Storage is key lever to mitigate against load-shedding
- Energy is limited to the space in the lower dam 3300 MI = **2200MWh**
- Currently can mitigate up to **two LS stages under certain scenarios**
- Additional measures to increase Steenbras LS Mitigation capacity :
 - Additional units reserved for LS Mitigation (implemented)
 - Steenbras Refurbishment (planned)
 - Maximise water draw-down via Firlands and Faure (under investigation), including secure energy supply to water network supporting draw-down
 - Increase lower dam size

- One stage of load shedding in summer is **40 MW**
- One stage of load shedding in winter is **60 MW**
- One Steenbras unit is **40 MW**
- **One unit** can mitigate one stage in **summer**
- **One and a half units** can mitigate one stage in **winter**.



Steenbras Optimisation is single biggest Load-shedding Mitigation lever available to City in short-term

Independent Power Producers

Embedded IPP Program

- Embedded IPP Tender launched in February 2022
- Bids closed July and extended to August 2022
- 2 part evaluation:
 - 1. Technical;
 - internal grid connection assessment and costing; then
 - 2. Financial offer
- PPA & Technical assessment concluded in house (not recommended)
- Contracted CSIR to conclude grid assessment, CELs will be developed internally.
- Uptick of private plants have impacted grid
- Targeting “lower carbon energy” embedded IPPs up to **200MW** of projects no smaller than 5MW - **20 year contract**
- Increase in RE components globally poses risk to meeting tariff cap (Eskom Mega-Flex)
- Proposed tariff regime encourages supply of energy over peaks
- Energy may be available for LS mitigation / peak shaving
- First power expected **end 2025**



Very encouraging response received from market



CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

Dispatchable IPP Program

- Dispatchable technologies include battery storage and gas to power.
- These power sources can be 'switched' on and off when needed and must generate power for a significant portion of the day to support our load-shedding protection efforts.
- Self-build or buy dispatchable, high Capacity Factor energy - CAPEX burden deciding factor
- Tender will be launched by March 2023
- Technology agnostic, but **MUST** be dispatchable and able to generate for extended periods
- Size: **500MW**, with a minimum capacity on a **shorter term** contract
- 1-step process, available connection points identified, TA onboard (appointed in January); PPA prioritised, risk appropriately allocated
- Wheeling will be allowed
- Depending on technologies, various infrastructure enablers may be needed
- First power **expected 2026**



The Dispatchable Energy Program has significant potential to mitigate up to 8 stages of LS (480MW)

Demand Response Programme

Demand Response Programme

- The initiative is based on incentivising residents for voluntary energy saving, so that City-supplied customers can be protected from the impacts of load-shedding.
- Third-party Aggregators will sign up Power Heroes, consisting of residential and small-scale commercial customers
- Aggregators will remotely switch off agreed-to non-essential power-intensive devices of the Power Heroes at peak times
- Aims to reduce demand by up to **60MW** (one stage of LS in winter)
- This “Demand Response” tender was issued **October 2022**, currently in evaluation phase – to be awarded in the coming months
- **7 year contract**

Power Heroes Programme

How it works:



CoCT Energy Efficiency Program Expansion

- City has existing energy efficiency program, mostly lighting and HVAC retrofits
- Thus far mostly grant funded
- Intent to expand program to include facilities with higher energy use
- Focus will be on WWTW and WTP at various locations
- Reduction in overall City demand leads to energy cost savings, but also potentially loadshedding burden
- Energy Efficiency study launched with International Finance Corporation (IFC)
- Comprehensive EE strategy being developed
- Considerations are:
 - Locational analysis
 - Technology selection
 - Funding options
 - Size of program
 - Phasing of roll-out
- IFC Consultants working with Energy Directorate, work to be completed by end 2022



City-owned Generation

Atlantis Solar PV

- **7MW** facility connected directly to the City's network
 - Developed at a time when regulations were restricted
 - First City utility scale Solar PV plant
 - All permitting and preliminary design completed
 - City has taken investment decision to move project into Detail Design phase
 - EPC tender issued September 2022
 - Tender closed November 2022 0
 - No. of tender documents purchased: 52
 - No. of bidder representatives that attended the site clarification meeting: 24
 - No. bids received: 1
 - No. bids responsive: 0
-
- Adapting specs and will go out to tender in Q1 2023



Size does matter. Fine balance between land and grid availability and market dynamics.

Paardevlei Solar PV

- City owned Site in Somerset West area (400ha)
- Potentially suitable land parcels identified for 50 - 60MW Solar PV
- Project may include battery storage, depending on timing
- Depending on operating regime ~ can support LS Mitigation
- City secured support from C40 CFF to assess feasibility in 2022/23
- FID projected in 2024, COD in 2026

**Paardevlei will be significant
“step-up” for City**



SSEG Solar PV

Rooftop and Small Groundmounted PV:

- Three projects of between 100kWp to 999kWp fully developed
- Feasibility studies completed and FID received
- Target COD of last installation June 2023
- Second phase under development



Floating Solar:

- Pilot project at Kraaifontein WWTW
- Assessment of water evaporation reduction, and higher yield due to cooling effect of water proximity
- Pilot and testing period underway until early 2023
- Additional sites under consideration at Bulk Water Facilities



-

BESS is major component of City's energy resilience strategy



Wheeling

Principles of Wheeling pilot

DEFINITION: Wheeling is the financial transactions representing the transportation of third party electrical energy (kWh) over the City's distribution network, which allows for the third party supplier to sell this electrical energy to a City customer at that customer's point of supply.

- Wheeling is being implemented to facilitate the **consumption and supply of renewable energy** in the City of Cape Town
- Wheeled energy is in an **unregulated** environment alongside a regulated environment
- Customers participating in wheeling (market environment) will be treated separately from other City customers (regulated environment) to ensure that there is no cross subsidization of energy costs or arbitrage between these two environments.
- The full network costs, including the civic responsibility of a contribution to rates must be recovered in the Use of System Charges
- Balancing energy in the market environment will effectively be provided by the regulated environment. The City will thus take on the role of supplier of last resort to the market environment by being the supplier of deficit energy and the taker of surplus energy.
- Wheeling will only be implemented at medium and high voltage levels
- Energy will be wheeled ex-green benefits and the City will not be responsible for the verification or certification of green benefits

Waste to Energy

Waste to energy at City landfill sites

- Part of the City's dual efforts to reduce emissions associated with landfill sites and reduce reliance on Eskom
- Landfill **gas extraction system** is operational at the landfill sites at Coastal Park (since 2018), Bellville and Vissershok
 - Methane gas from landfill is diverted and combusted into CO₂, a less potent greenhouse gas
- Coastal Park Landfill site has been fitted with engines which are connected to the extraction system to generate electricity
- Expected generation capacity fed into the grid:
 - Coastal Park: approximately **2MW**
 - Vissershok: approximately **1MW**
- The City earns carbon credits to offset emissions
- The Waste Dept is exploring its 4th site at Athlone MRF for a waste to energy plant.



In addition the City has looked at how it can support the Athlone New Horizons Municipal and Waste to Energy Project

Small-scale Embedded Generation

SSEG Registrations in the City of Cape Town

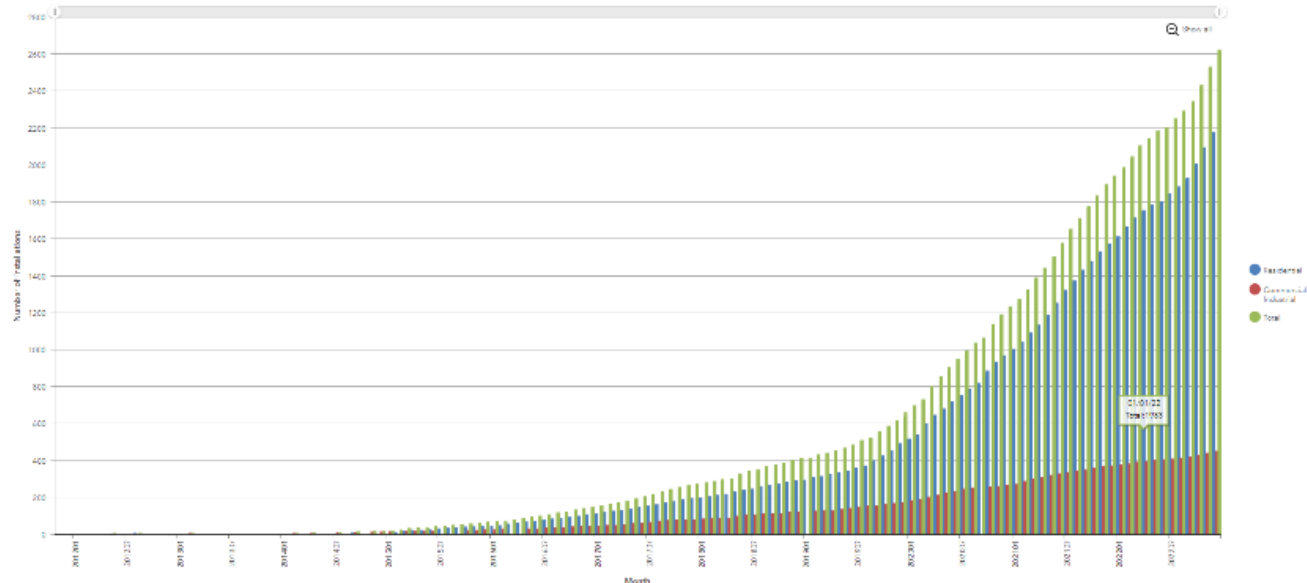
Approved grid-tied installations commissioned (Dec 2022):

- No. of Systems = 2621
- Capacity = 85.8 MVA
- SSEG applications in review = 3607

SSEG Applications

- Experiencing exponential growth
- Primarily from small residential systems
- Aerial study showed about 3000 unauthorized/unregistered mainly 3kW residential systems.

1.1 Approved grid-tied, commissioned, embedded generation | Installations



The graph only represents approved, grid-tied installations, and does not include standby/off-grid and unregistered systems



SSEG uptake facilitation

The City **actively supports** small-scale embedded generation (SSEG) such as rooftop solar through:

- Clear **guidelines** and **authorization** process
- A Feed-in tariff **PLUS** incentive tariff so that customers are credited for excess generation fed into the network

The City aims to facilitate SSEG uptake through:

- **Streamlining** the authorization process through an online registration & standard system design
- **Reducing barriers** to feeding in excess generation
- **Empowering customers** through more communication and education

NB: SSEG + batteries facilitates load-shedding resilience for individual homes and businesses but has limited impact on City-wide load-shedding resilience in the near and medium term

SSEG Buy-back Programme

	Commercial customers	Residential customers
Step 1	Install a grid-tied solar PV system with a City-approved inverter . Installers must apply to the City to authorise the system for grid connection. The City provides authorisation free of charge .	
Step 2	Meter changes and an additional AMI Access fee may be applicable. Cost is quoted during authorisation process if applicable.	City will install an AMI meter at the customer's expense: <ul style="list-style-type: none"> • Meter cost: 2022/23 R12 850.10 • Monthly meter reading fee: 2022/23 R96.20 /month
Step 3	Customer placed on the applicable Non-residential SSEG tariff .	Customer moves to or remains on the Home User tariff .
Step 4	Electricity fed into the grid will be measured and credited to customer's monthly municipal account at 60.91c/kWh + 25c/kWh incentive. This credit is offset against the customer's monthly municipal account.	Electricity fed into the grid will be measured and credited to customer's monthly municipal account at 78.98c/kWh + 25c/kWh incentive. This credit is offset against the customer's monthly municipal account.
Step 5	Cash for Power: Customers with remaining credit after the offset will be paid out in cash once the amount exceeds R5000. Payments will be held back until the credit reaches this amount, and paid out on a monthly basis.	Cash for Power: Customers with remaining credit after the offset will be paid out in cash once the amount exceeds R1000. Payments will be held back until the credit reaches this amount, and paid out once a year.

NOTES:

1. The City is currently looking at how to bring the cost of AMIs down for households.
2. **Cash for Power** is currently only available to **COMMERCIAL** customers, but will be rolled out to **RESIDENTIAL** customers later in 2023.
3. The amount of energy a customer can sell back to the City is limited by the size of the system they have been authorised by the City to install.
4. The application process currently takes 3-6 months. The City is expanding capacity to increase turnaround times.

Resources for Residents & Businesses

- **All energy-related and solar PV information:**

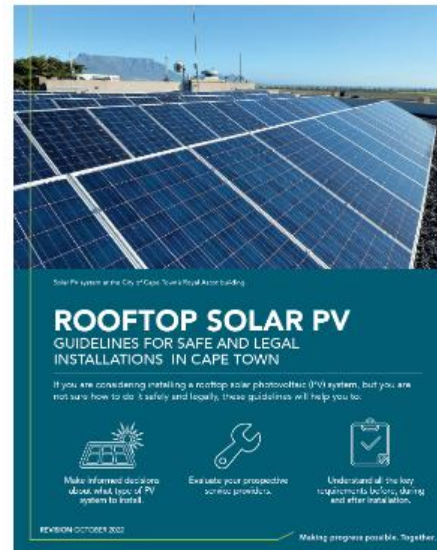
www.capetown.gov.za/energy and
www.capetown.gov.za/solarpv

- **SSEG Resources:**

- [Requirements for SSEG](#)
- [Approved PV Inverter List](#)
- [Guidelines for safe and legal installations](#)
- Solar PV Installers Newsflash

- **Residential resource efficiency:**

- [Load-shedding Resilience Guide](#)
- [Saving Electricity website](#)
- [Smart Office Handbook](#)
- [Smart Living Handbook](#)
- My Clean Green Home



25 November 2022

Dear SSEG Stakeholder,

Welcome to the first edition of the Solar PV Installer Newsflash. We want to provide you, and other installers, with the most up-to-date information regarding our Small-scale Embedded Generation (SSEG) registration process.

If you have received this via one of our partners, you can [subscribe directly](#) and be added to our Solar PV Stakeholder Database.

Help us ensure safe and legal installations

The current energy crisis has seen a significant increase in interest for solar PV and battery storage systems to provide a measure of protection against load-shedding.

We actively support embedded generation, but remember that it is important to register and authorise all SSEG systems, to ensure our electricity grid is safe and legal for all Capetonians.





CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

Thank You

Making progress possible. Together.