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CITY POWER JOHANNESBURG (SOC) LIMITED

ELECTRIFICATION AND ENERGY SOLUTION FOR INFORMAL SETTLEMENTS POLICY

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1 DEFINITIONS

Ampere (A) or amp--The unit for the electric current; the flow of electrons. One amp is 1 coulomb passing in one second. One amp is produced by an electric force of 1 volt acting across a resistance of 1 ohm.

Ampere-hour (Ah)--Quantity of electricity or measure of charge. How many amps flow or can be provided over a one hour period. Most batteries are rated in AH.

Authorized person pertaining to gas - means a person who is registered as competent within the scope of work for which an organization approved by the chief inspector has registered that person

Notes:

- (a) SAQCC (CP) competent persons for in service inspection
- (b) SAQCC (IPE) inspector of pressurised equipment
- (c) SAQCC (Gas) registered gas practitioner in the applicable field
- (d) SAQCC (Fire) registered fire technician

Assembly - system that includes connection by pipe or similar ducts, fittings and valves that operate under gauge pressure and are used for the conveyance of liquid or vapour

Battery storage is accomplished by devices or physical media that store energy to perform useful processes at a later time.

Cell--The basic unit of a photovoltaic panel or battery

Certificate - means a written declaration of conformance to these Regulations

City Power Johannesburg (SOC) Ltd means the utility company registered in terms of the Companies Act responsible for the provision of electricity, in designated areas, to the residents of the City of Johannesburg.

Connection' means the physical connection of the Facility or the Electrical Connection, as applicable, to the Distribution System.

City of Johannesburg (CoJ) is a metropolitan municipality that manages the local governance of Johannesburg.

Direct Current (dc)--Electric current in which electrons flow in one direction only. Opposite of alternating current

Domestic gas installation - gas system installation which is installed on a residential property with the classification H3 or H4

Electrical grid--An integrated system of electricity distribution, usually covering a large area. As in "off the grid".

Energy--The ability to do work. Stored energy becomes working energy when we use it.

Essential electrical loads: in this specification refers to 6W LED lighting and 1 x 2A two pin plug socket for charging of small electrical devices such as cell phones and the like.

Gas appliance - means an appliance as defined in SANS 1539

Notes:

(a) Definition out of SANS 1539: complete operating unit that uses LPG and Natural Gas as operational fuel

(b) Refer also to the definition of gas system and reticulation

Filling area - area that comprises the following equipment:

- a) filling pump,
- b) manifolded containers,
- c) filling point, and
- d) filling scale

Filling container - supply container used for refilling gas containers that are either empty or partially empty

Filling enclosure - enclosure that includes a filling area (which may include a storage area) that is expressly equipped and used for refilling or storage (or both) of gas containers

Filling equipment - all the equipment required for refilling containers that are either empty or partially empty

Filling point - point on the filling equipment to which the empty or partially empty container is connected for the purpose of refilling

Fluid - means gases, liquids, vapours in pure phase and mixtures thereof and may contain solids in suspension;

Gas - means gases, liquefied gases, gases dissolved under pressure, vapours and those liquids whose vapour pressure at the design temperature is greater than 50 kPa above normal atmospheric pressure;

Fixed gas appliance - any appliance that is permanently mounted into a fixture, for example, a stove or a fireplace

Gas installation - single or combination of one or more cylinders connected to a manifold system, including pipework and appliances

Gas system - means an assembly of tubes, pipes or similar ducts, fittings and valves for the reticulation, circulation and conveyance of a gas, excluding a pressure vessel or transportable gas container connected to the system;

Grid-connected (PV system)--A PV system in which the PV array acts like a central generating plant, supplying power to the grid.

Hybrid system--A PV system that includes other sources of electricity generation, such as wind or fossil fuel generators

Kilowatt (kW)--1000 watts.

Kilowatt-hour (kWh)--One thousand watts acting over a period of 1 hour. The kWh is a unit of energy. 1 kWh=3600 kJ.

Liquefied petroleum gas (LPG) - commercial butane, commercial propane, or a mixture of light hydrocarbons (predominantly propane, propene, butane and butene) that is gaseous under conditions of ambient temperatures and pressure, and that is liquefied by an increase of pressure or a lowering of temperature

Load--Anything in an electrical circuit that, when the circuit is turned on, draws power from that circuit.

Manufacturer - means any person who has overall control and is responsible for the construction of the pressure equipment;

Notes:

(a) Where the design, material supply and the installation are done by different parties, a contractual requirement is required to define who the manufacturer is. The intent is that the party that is in overall control of the above mentioned actions will take this responsibility and liability. This party is then responsible for issuing the Certificate of Manufacture. Note: This can be for example the engineering contractor, the user, etc.

Maximum Power Point Tracking (MPPT): is a technique that charge controllers used in PV solar systems to maximize power output.

Megaflex tariff is a time of use differentiated tariff at which City Power procures its power from Eskom.

Modular: refers to a system that all components functionalities and replaceable are independent of each other.

Municipal Owned Entities (MOE) are independent organizations that perform municipal services on behalf of a municipality and the municipality controls the majority shareholding.

National Energy Regulator of South Africa (NERSA) is the regulator for the gas, petroleum and electricity industry of South Africa.

Network Service Provider (NSP) is a legal entity that is licensed to provide network services through the ownership and maintenance of an electricity network

Non electrical Essential loads: in this specification refers to 12W compact fluorescent lighting and 2x 15A socket outlets

Peak load; peak demand--The maximum load, or usage, of electrical power occurring in a given period of time, typically a day.

Point(s) of Connection (POC) The electrical node(s) on the Network Service Provider's network where the supplier electrical equipment is physically connected to the Network Service Provider's electrical equipment.

Photovoltaics (PV) is the name of a method of converting solar energy into direct current electricity using semiconducting materials that exhibit the photovoltaic effect, a phenomenon commonly studied in physics, photochemistry and electrochemistry. Photovoltaic panels convert the sunlight directly into electricity.

Policy means this Electrification and Energy Mix of informal settlements policy.

Pressure regulator - device that reduces the pressure of the gas from a higher pressure to a constant lower pressure

Qualified Gas operator - person who has received training, documented by the employer, in the filling of LPG containers (see SANS 10019)

Registered installer / registered practitioner - person that has the ability, appropriate training, knowledge and experience to carry out the work that is undertaken in a safe and proper manner, and who is registered in accordance with the requirements of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996)

Stand-alone (PV system)--An autonomous or hybrid photovoltaic system not connected to a grid. May or may not have storage, but most stand-alone systems require batteries or some other form of storage.

Time of Use (TOU) refers to the time of day when the electricity is generated. In general for weekdays, Peak times are 07:00 to 10:00 hours and 18:00 to 20:00 hours and Off-peak time is 22:00 to 06:00 hours. The remaining hours fall under standard time. During weekends, there are only standard and off peak times with Sunday being entirely off peak time.

Uninterrupted Power Supply (UPS) is an electrical apparatus that provides emergency power to a load when the input power source, typically mains power, fails.

User - person who uses the equipment for his own benefit, or has the right of control over the use of the equipment, but does not include a lessor or any person employed in connection with that equipment

2 PURPOSE

The purpose of this document is to outline City Power's approach to provide an electrification and energy mix solution to informal settlements within its licensed area of supply.

The Municipality as a local Government holds executive authority over the provision of energy services such as electricity and gas distribution to communities under their jurisdiction.

Section 156 (a) of the Constitution of the Republic of South Africa, Act No.108 of 1996, with regards to Powers and Functions of municipalities, states "A municipality has executive authority with respect of, and has the right to administer:

1. a) The local government matters listed in Part B of Schedule 4 and Part B of Schedule five.
b) Any other matter assigned to it by national or provincial legislation.
2. A municipality may make and administer by-laws for the effective administration of the matters of which it has the right to administer".

Schedule 4 Part B lists electricity and gas distribution as one of the functional areas which are in the competence of local government sphere. In this regard, local government is obliged by the Constitution to provide energy services to its customers.

The provision of electricity to new consumers is a challenge in South Africa due to several factors including electricity supply shortages and grid inadequacy. Informal settlements and backyard shacks are often most neglected with regard to the supply of electricity. Furthermore, there are prevalent issues of illegal distribution of electricity and the lack of a safe environment in these areas.

After 21 years of democracy, there is a growing expectation from these households, especially in informal settlements that local government will not only provide housing, but also the full spectrum of basic services. Households in informal settlements become a unique category of socio economic level in the South African socio economical structure and will not be able to escape from it in the immediate to near future. That these settlements will be formalised via a formal regularisation process in a very short space of time will also not be practical. While waiting for a process to create formal housing, life continues in these informal communities; Families and children are being raised and their development is restricted in the absence of basic services such as energy.

In order for local government to meet these expectations and provide uninterrupted services to these informal households in the light of existing electricity supply constraints and grid inadequacy, an alternative, efficient and cost-effective energy solution has to be considered. Alternative sources of energy are the way forward to ensure that all people in South Africa have access to quality affordable energy sources to guarantee a quality of life. These alternative sources can be a combination of various primary energy sources.

Taking the circumstances and factors above into consideration, it is believed that this merits the provision of energy amenities to the informal settlements. This document thus sets out the policy for the provision of a viable energy mix to the households in the informal settlements within City Power's licensed area of supply.

3 SCOPE

This policy is applicable to all identified informal settlements and existing areas experiencing urban densification (backyard shacks) within City Power's licensed area of supply and details the different viable energy sources available for implementation in the informal settlements.

In formal proclaimed townships, basic energy needs were adequately met by electricity utilisation in the household for all energy requirements. In terms of the "Energy Outlook" published by the Department of Energy in 2013, it is estimated that the energy requirements in a typical household are as follows:

- Cooking – 41%
- Water Heating – 32%
- Space heating – 12%
- Refrigeration – 7% (Income dependant)
- Entertainment – 3% (Income dependant)
- Lighting – 5%

The above statistics indicate that almost two thirds of households energy needs can be met by using efficient thermal (heat) energy sources. It is further estimated that household's energy demand make up approximately 17% of the total national consumption of electricity. In addition, electricity tariffs are expected to continue increasing over the next five years due to the declining consumption, capital costs of new generation capacity and higher costs of Eskom to maintain an old fleet of power stations as well as the increase in the cost of environmental compliance. This is a major financial challenge to households from this socio economic category if securing grid electricity is the only viable energy source for their household activities in the future. It is also a burden to those tariff categories which are expected to cross-subsidize to this socio-economic category.

In terms of the equitable share grant provided to give a measure of free basic energy to the low income sectors, the most cost effective solution is warranted and current tariff calculations shows that a mixture of energy sources must be utilized.

Following months of research, consultation with City Power as well as the affected communities and looking at best practices, an energy combination of Solar (photovoltaic and thermal), battery based storage, gas, grid electricity and energy efficiency is recommended for informal settlements. The combination of these energy sources is inter-dependent due to the fact that limited grid connection size is available in certain areas. This grid limitation must be alleviated by the gas, PV and battery storage systems. Further, City Power's own PV and storage installations can offset the private PV investments that cause a reduction in cross-subsidy revenue which supports the low income sector.

Electricity is a "high grade" form of energy of energy, with a high value to provide lighting, ICT, media and refrigeration services. These services can be provided with a relatively small capacity of electricity supply. Thermal energy is a "lower grade" form of energy but is required at a far greater capacity or volume. Thermal energy is typically needed for cooking, water heating and space heating. Using high grade electrical energy for low grade thermal requirements is costly to the distributor and an inefficient use of this form of energy. Thermal energy may be better provided with gas supply, either reticulated or bottled LPG. Bottled gas requires far less capital investment and is an attractive alternative for energy required for cooking in particular. It has also been found

that the current method of heating through the use of paraffin has various disadvantages like fire hazards and the accidental consumption of the fluid by children.

Moreover, provision of Free Basic Electricity (FBE) in terms of gas is a cheaper option compared to providing peak period electrical energy, where gas can be viewed as an energy storage system.

The ultimate success of a policy such as this is the sustainability, maintenance and operation of the utilities provided. City Power will thus have to evolve from an electricity supplier to an energy supplier to ensure the sustainability of the proposed energy combinations. Creating local employment and empowerment is a key component of this solution.

City Power will have to compile a report, including tariffs, for Council approval with regards to the implementation of Free Basic Energy Vs Free Basic Electricity. All forms of Energy (Electrical and Gas) must be metered/measured.

4 APPROACH

The overall solution approach which encompasses a combination of grid electricity, solar (PV and thermal), gas and energy efficiency is as enlisted below:

1. The provision of a combination of alternative- and renewable energy in an affordable and sustainable manner.
2. Introduction of household appliances that will enable them to use the alternative energy package such as a Two Plate Gas hob assembled in a steel cabinet including one 6 kg gas cylinder. (Assets to remain the property of City Power).
3. Community liaison and participation to introduce training and mentoring to utilise the proposed combination of alternative energy.
4. The creation and/or identification of business entrepreneurs to be trained to function as gas distribution depots through a tendering process.
5. Registration of households of informal settlements as customers on the billing system (not as indigent's households but as vulnerable households in this socio economic category).
6. Payments by household for energy consumption beyond the equitable share allocation as an introduction towards the establishment of a payment culture for services received.
7. Funding from the Capital budget for initial procurement of material, equipment and installation.
8. Funding for the operation and maintenance must be obtained and/or made available in future budgets. Through Jozi@Work initiative, individuals and/or entities will be trained to perform maintenance on new PV assets.
9. As an alternative, operation and maintenance agreement should be in place for a three year period. This can be achieved in two ways:
 - i. A BOT system (Build Operate and Transfer).
 - ii. Appointing a third party to operate and maintain the system, while training the appropriate City Power personnel.

The rate for this must be structured to allow for a calculated monthly overhead cost plus reaction activity breakdown rates for work done plus cost for material and equipment).

A Service Level Agreement must be clear and well defined specifying the IP, involvement and responsibilities of all stakeholders.

10. The establishment and operation of gas depots; created by a tendering process.

The individual approach on different key components of the solution – Grid Electricity, Solar powered electricity, Gas and energy efficiency are detailed further below. It is essential that City Power firstly establish their requirements and objectives (Energy efficiency, service delivery, political, financial restrictions, etc.) for each of the informal settlement. This would assist to develop customized solution for each informal settlement based on the ground realities and constraints of the particular area. For instance, if the informal settlement has no grid access, then other components (solar powered electricity, gas etc.) need to be propped up to counter manage the absence of grid access electricity.

4.1 **Grid Electricity**

4.1.1 **Scope**

The electricity connection from the grid will not be able to accommodate all the household energy requirements. This may be due to the fact that there is limited capacity on the Municipal bulk network infrastructure. Therefore electricity can only be used in collaboration with other sources of energy. The electricity connection must be restricted to prevent overloading on the network and households need to be educated to understand this constraint. Households must also be made aware that the alternative energy sources available must supplement their grid connection.

Extension from the MV (medium voltage) bulk distribution network to the informal settlement and Reticulation of the LV (low voltage) system to make a 30A (7kVA) connection possible from City Power's metering point to the households is required.

Internal house installation can be done by the installation of a small DB ("Ready Board") with a 20A capacity limited circuit breaker. The ready board should also be equipped with a LED light rather than a normal incandescent or Compact Fluorescent light. It is proposed that a LED light connected to a flexible lead and two-point plug is supplied as part of this connection.

4.1.2 **Methodology**

- The grid is reticulated at an ADMD of 2kVA/unit (Dwelling). Grid designed at XXkVA
- A 20A grid connection is installed in a household / dwelling.
- All MV and LV overhead reticulation network be installed.
- Provision will be made to cater for future densification of the informal settlement

4.1.3 **Implementation**

- Grid installations will be done by City Power approved contractors appointed by City Power on a normalised fixed electrification rate structure. Only City Power approved equipment to be used. All new equipment must first be approved by City Power's Technology department.

4.1.4 **Metering and Control system**

A master-slave metering system shall be utilized for metering and load control purposes in these residential areas. It uses a combination of "smart" metering and control system to triple the number of residential customers on existing grids. A "master" meter is configured, capable of monitoring and controlling of up to ten (10) "slave" meters.

The master meter is made aware of energy sources and capacities available; and shares the available capacity to households in the following way –

- a. Each master operates as an independent pre-paid meter with the usual credit control functionality.
- b. Each meter has two control contacts:
 - i. A “grid” supply, up to 20 Amps (4.8kWp)
 - ii. An “essential load” supply, up to 750Watts
- c. The essential load supply is maintained to each household provided a token has been purchased and the purchasing pattern is acceptable
- d. The grid supply contact is turned on whenever (but also subject to point c) sufficient grid and storage capacity is available.
- e. When the grid supply capacity is inadequate or constrained, the grid supply contact is opened on a rotational basis. Each household is provided a “slice” of high capacity grid supply

In this way, each house receives an essential supply to power lights and small appliances (cell charging, tablets, TV sets and fridges). Each house is also given a share of the larger capacity grid supply for short-run appliances such as kettles.

The master meter controls the slaves connected to the grid itself. The master meter is given a default capacity to work with, as a control set point. It operates at a local level to “rotate” supply to each house. This set point can be raised by whatever renewable energy or storage capacity is available.

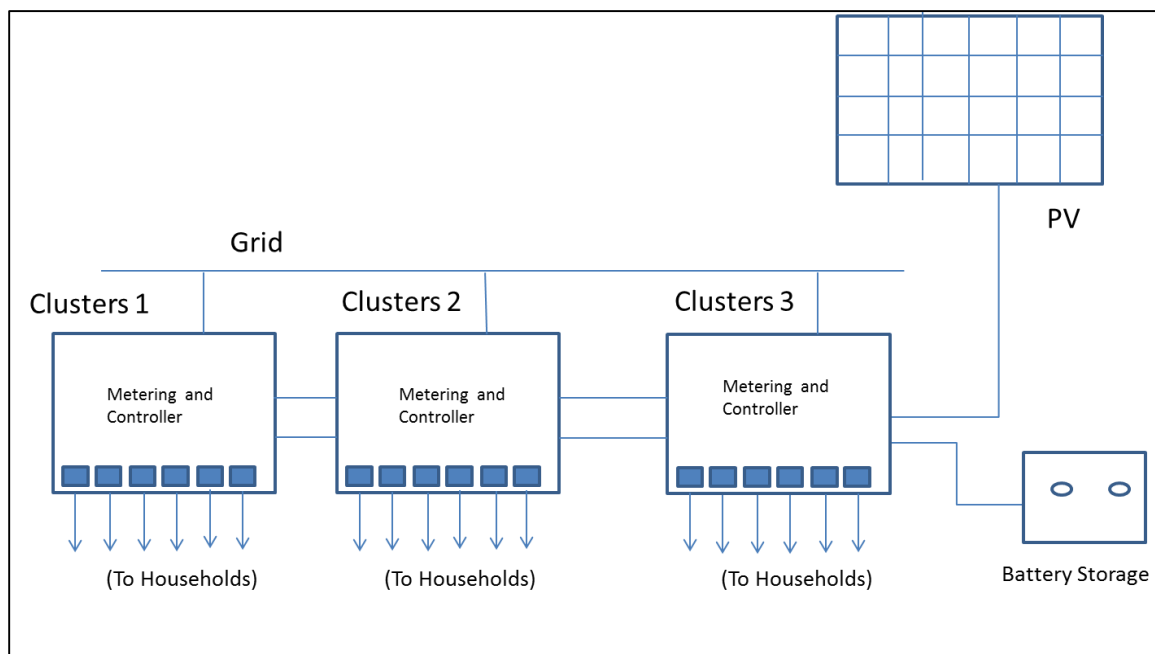


Figure1: Household Clusters connected to a metering and control system

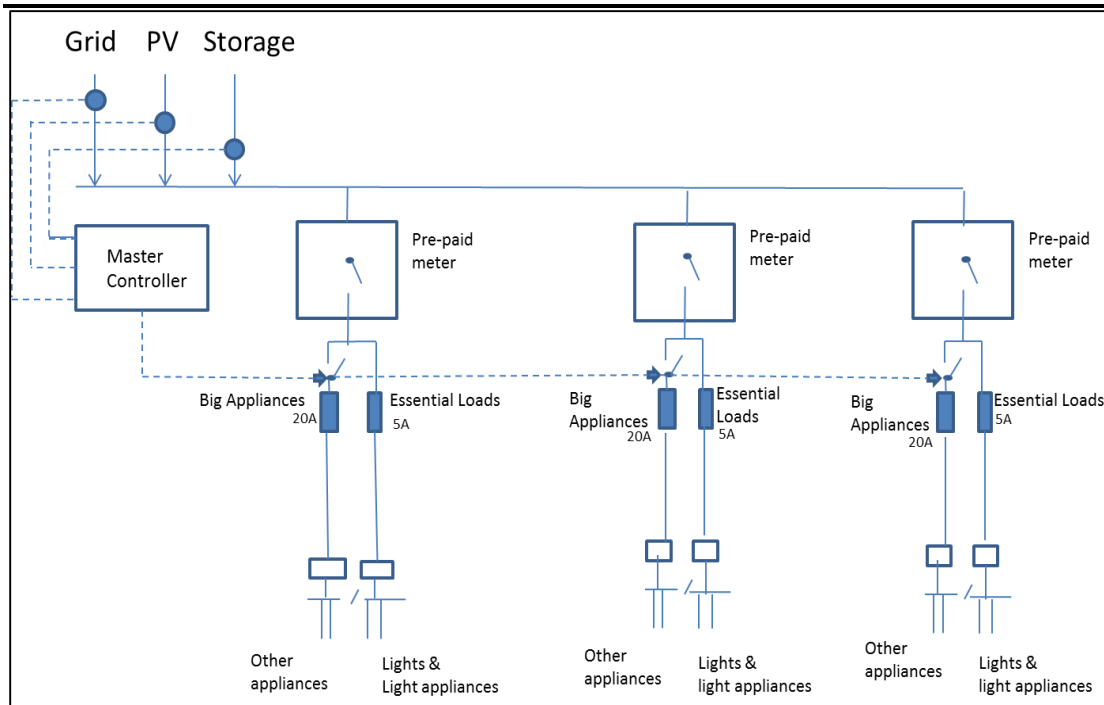


Figure2: Master-Slave metering and controls scheme

4.1.5 Safety

The first priority in consideration of any proposed connection to the network is the safety of the general public, City Power personnel, facilities and equipment. The supplier shall not under any circumstances be allowed to reduce, minimize and/or impair the safety to the general public, City Power staff and equipment.

To ensure safe operation of City Power network, the supplier connections shall adhere to the most current relevant NERSA regulations, the grid codes, the Occupational Health and Safety Act and to all current City Power's safety guidelines and procedures.

There is often a requirement for City Power to de-energise a line or section. The supplier shall allow an electrical isolation from the City Power network necessary, for routine maintenance of the network or under emergency conditions. An isolator switch or breaker shall be installed to allow disconnection from City Power network and this isolation point shall be available to City Power at all times to operate.

City Power shall have the option to inspect the final installation of the supplier and the connection to the City Power network. City Power has the right to refuse to connect the supplier if any defects or problems are found with the connection or if any misapplication of equipment or materials is detected or quality of supply issues become evident.

4.1.6 Standards

All suppliers are required to be compliant with the following standards as applicable:

- Electricity Regulation Act, Act 4 of 2006 and Electricity Regulation Amendment Act, Act 28 of 2007
- Municipal Building Plan Requirements
- South African Grid Code1
- NRS 097-2-1:2010 Grid Integration of Embedded Generation
- NRS 048: Electricity Supply – Quality of Supply
- Occupational Health and Safety Act 1993 as amended
- SANS 10142 Parts 1 to 4: The Wiring of Premises

4.2 Solar PV system

4.2.1 Scope

City Power is committed to use renewable clean energy, among others, PV microgrid solutions to assist the energy needs of all consumers and to alleviate the pressures placed on the local and national grid by providing basic energy needs and alleviating peak demand.

Integrating solar photovoltaic (PV) panels with microgrids will drive rapid growth of distributed renewable energy systems in informal areas in the City Power distribution area, affording greater numbers of communities, agricultural areas, and small businesses access to cleaner, more reliable, and more efficient energy generation. Such growth has the potential to literally and figuratively empower millions to improve their lives and living conditions not only by providing reliable energy, but also in creating local employment.

4.2.2 Methodology

- A pole mounted system to limit the risk of theft and vandalism.
- A 3kW grid tied system will be utilized by City Power.
- This system must be owned and operated by City Power.
- All PV systems considered must have battery storage. (Lead Carbon)
- A total of 8 x 100Ah battery storage is currently provided per 3kw PV system. This storage will be utilized to manage peak demands.
- Via the Jozi@work initiative, individuals will be trained to install and maintain the PV installations/systems. The maintenance will be paid for from a percentage of the income

generated by the sale of electricity. Due to the complexity of these systems, Jozi@Work personnel will be trained and certified by both City Power and the equipment suppliers.

It may be noted that:

- The customer loads can be controlled with smart metering to stay within the limits of the limited capacity availability. This is however a very expensive option.

A 230V system consisting of PV panels, batteries, charge controller and inverter is proposed if City Power have the requirement of putting solar energy back on the national grid. This system can be operated in two configurations:

- a) Shared grid configuration
- b) Micro grid, (independent from the grid)

Where grid is available, a Grid tied system will be used. A grid tied system is a costlier and technically involved option. This system can be used to put excess solar energy back onto the national grid.

4.2.3 Alternative

A combination gas and 12V PV system is also proposed. This system makes use of the existing Gas Cabinet design. The 12V PV system is then incorporated into the cabinet to provide lighting (4 x LED lights), USB charging and a 12V supply for other equipment.

4.2.4 Implementation

All PV equipment must be approved by City Power's Technical Evaluation Committee. A list of approved equipment will be compiled.

Installations will be done by City Power approved contractors appointed by City Power on a normalised fixed electrification rate structure or on a standard City Power tender process basis.

Contractors will train City Power personnel and local community members through Jozi @ Work to assist in maintaining the PV systems. A Built Operate and Transfer (BOT) model can also be used to train the relevant maintenance personnel.

4.2.5 Safety

- The safety requirements listed under clause 4.1.5 shall apply.

4.2.6 Standards

The standards listed under clause 4.1.6 as applicable shall apply herewith. In addition, all suppliers are required to be compliant with the following standards as applicable:

-
- IEC 61727
 - IEC 61215 Design qualification and type approval (Crystalline)
 - IEC 61730-1 & -2 Photovoltaic (PV) module safety qualification

It is understood that some grid-tie inverters technically do not comply with some aspects of the grid code, however these minor items are unlikely to be a practical constraint. A database of compliant grid tied inverters for South Africa is available.

The general requirements, specifications and configuration of the PV system is specified in *CP_TSSPEC_232 Energy Mix technologies*.

4.3 Gas

4.3.1 Scope

The scope of this section of the proposal is to provide gas as an alternative energy to grid electricity as solutions for cooking with a two plate gas stoves suitably manufactured and assembled to fit in the environment and safety risk of the unique socio economic style of living in informal settlements. This will also lower the Peak Demand on the limited capacity on the electricity grid in this particular area.

The following alternative methods are proposal as part of the gas scope described above:

- Cylinder size - 6kg.
- Freestanding steel cabinet to accommodate the gas stove and gas cylinder.
- In areas where no electrical grid is available, the freestanding cabinet will be fitted with a 12V PV system that supply lights, USB power and basic 12V supply for other equipment.
- The scope also includes the establishment of logistical options for the supply of LPG and LPG cylinders to the relevant communities via existing or new entrepreneurs. The proposal needs to be safe and compliant with the relevant standards.
- Utility By-Laws should be updated to accommodate the new gas/energy business.
- A new gas maintenance and management department must be created within City Power to establish and maintain standards and operations.

4.3.2 Methodology:

Gas for Essential household appliances:

Gas Cooking:

A portable steel cabinet with built-in gas stove and stainless steel top be accepted and be a free issue per household.

Household:

- All gas stoves must have an automatic gas cut-off function.

-
- The gas equipment will be issued to the consumer by City Power, but will remain the property of City Power.

Gas depots

- The gas depots will provide for maintenance and repair service to the community.
- The gas depots will be created through a percentage cost of the initial gas cabinet supply & installation.

4.3.3 Implementation

All gas equipment must be approved by City Power's Technical Evaluation Committee. A list of approved equipment will be compiled.

Installations will be done by City Power approved contractors appointed by City Power on a normalized fixed electrification rate structure or on a standard City Power tender process basis.

The community will be informed and educated through a Community information and liason process. A City Power approved Community Consultation company must be used to provide this service. This community education will include information regarding the reason and importance of the energy mix (Electricity, Gas and PV)

The gas cabinet installation will be owned by the user and will be seen as an operational expense to City Power.

The process of the gas rollout must adhere top City Power's asset management procedure.

City Power must compile a policy in the event a consumer relocates outside a Free basic energy area as well as outside the City Power area of supply.

4.3.4 Safety

The following will be done to ensure compliance of each installation:

- The Two Plate Gas Stove will be equipped with a flame-failure device as an additional safety feature. The flame-failure device shuts down the gas supply when the flame of the burners goes out for some reason or another.
- The Two Plate Gas Stove will be placed on top of a custom made free standing cabinet with an incombustible table top
- The cabinet design allows for a well ventilated and designated space for the gas cylinder
- A leak test of installed gas cylinders and two plate gas stoves will be conducted
- A Certificate of Compliance will be issued for each installation
- Home owners will sign the COC to take cognizance of relevant safety standards.
- Label to be installed explaining safety precautions, dangers and first aid?

-
- All gas rollouts will be done in co-operation with the local Fire Departments in order for them to be aware of where gas cabinets are installed, and all relevant safety procedures to be followed.
 - Puzzles with “Do’s and Don’ts” will also be issued with every cabinet for children to learn about gas safety.
 -

4.3.5 Standards

The following regulations are relevant to gas infrastructure and operations:

- SANS 10087-1: 2013 The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations
- SANS 10087-7, The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations – Part 7: Storage and filling premises for refillable liquefied petroleum gas (LPG) containers of gas capacity not exceeding 9 kg and the storage of individual gas containers not exceeding 48 kg
- EN 1762, Rubber hoses and hose assemblies for liquefied petroleum gas, LPG (liquid or gaseous phase), and natural gas up to 25 bar (2,5 MPa)
- BS 3212, Specification for flexible rubber tubing, rubber hose and rubber hose assemblies for use in LPG vapour phase and LPG/air installations
- SANS 1237, Single-stage regulators for liquefied petroleum gas (LPG)
- SANS 1539, Appliances operating on liquefied petroleum gas (LPG) or natural gas (NG) – Safety aspects
- ASME-BPVC 7, Construction of pressure vessels.
- SANS 10019, Transportable pressure receptacles for compressed, dissolved and liquefied gases — Basic design, manufacture, use and maintenance

5 GAS DISTRIBUTION MODEL

Providing LPG to communities is beneficial in many ways. Many people use paraffin as their main fuel, especially for cooking with a primus stoves. This is mainly due to the higher cost for a gas stove and the initial payment towards a gas bottle container. The following are some of the dangers experienced with the use of paraffin:

- Paraffin is highly volatile, much more so than LPG, which means accidents can happen more easily, resulting in devastating burns and fires.
- The unstableness of the small paraffin stove
- Paraffin is also often consumed by children, who mistaken it for water or cool drink, a mistake that cannot happen with LPG.
- Paraffin releases toxins into the environment, unlike LPG which is a far more clean-burning process.

LPG is also becoming an ever-increasing alternative to electricity. Below are some more benefits of using LPG for cooking:

- Reduced load on the country's overburdened supply capacity— especially during peak usage times.
- Acceptably Safe and as safe as Electricity.
- LPG is completely safe like electricity, when used correctly.
- LPG is becoming a more affordable alternative to electricity due to the higher efficiency.
- The gas stove cabinet will reduce emission discharge pollution through cleaner burning compared to other energy sources like paraffin.
- LPG is at minimum 3.6x more CO₂ efficient than electricity

The availability of gas can be quarantined by a reputable gas supplier by means of a Service Level Agreement.

5.1 Cylinder exchange depot and/or cylinder filling premises

The properties of LPG and LPG containers provide a lot of flexibility in the handling, storage and distribution of LPG. Cylinder exchange depots and filling sites, whether large or small, are widely and effectively used in the LPG industry.

Large regional filling sites with bulk LPG tanks are highly regulated and controlled due to the risk of illegal and unsafe filling of gas cylinders. These large filling sites also have more gas on site and pose a bigger threat to the local community when established within residential areas. Large filling sites are normally situated in industrial areas and are more suitable for the filling of 9kg, 19kg and 48kg cylinders on a large scale from a bulk LPG tank.

The nature of exchange depots and small filling sites lends itself positively toward the creating of sustainable SMMEs. As an alternative to large filling sites, smaller filling sites can be included at already existing businesses within the local community. Examples of these can be filling stations, hardware shops, and general dealers. Small filling sites are more suitable to provide a service to small household with containers smaller than 9kgs.

The following are benefits in using existing SMMEs via a tender process:

- The filling sites can be implemented on existing business premises
- Local dealers have already established a client base
- Local dealers that are in accessible areas to the local community
- Local dealers that have already obtain entrepreneurial competency.
- Filling stations that have already obtained the fire department approval and only minor amendments will be required.
- An inclusive selection process can be implemented to identify the best local service providers.

5.2 Cylinder exchange depot

Cylinder exchange depots are widely and effectively used in the LPG industry. The nature of exchange depots also lends itself positively toward the creating of sustainable SMMEs.

Each City Power issued cylinder shall have a unique cylinder and cabinet number. All cylinders will be uniquely color coded for City Power. This cylinder number shall be the same as an electrical meter number. A vending system has been identified that can adequately manage the supply of gas. The proposed system is described below.

Some of the relevant legal requirements for cylinder exchange and storage depots are:

The storage area shall:

- Be inspected and approved if compliant to SANS 10087-7:2011 regarding Gas Depot Layout and Storage.
- Be provided with fire-fighting protection as given in the SANS Guidelines.

Purposely designed containers/structures shall be acceptable, provided that the requirements are complied with. All potentially dangerous activities, such as the use of open flames, welding and cutting operations, the use of electric grinding tools, and smoking, shall be prohibited in the storage area, which will be equipped with symbolic safety signs.

The storage area shall:

- Not be located inside a building, but in an open, well-ventilated area, and shall be used exclusively for the storage of LPG containers,
- be so located as to eliminate, as far as possible, exposure of the containers to any excessive rise in temperature, corrosive substances or vapours, other highly flammable substances, physical damage and tampering by unauthorized persons,
- Be kept clean and free from any accumulation of combustible matter, such as paper. Any possible source of ignition shall not be allowed in a storage area. An area of at least 3 m in all directions round the perimeter of the storage area shall be kept clear of grass, weeds and other combustible matter, including any electrical source of ignition that does not comply with the requirements of zone 2 equipment, and
- Be provided with fire-fighting protection as given in table 1, and where this cannot be achieved, a rational design as given in SANS 10400 shall be applied.

Purposely designed containers/structures shall be acceptable, provided that the requirements are complied with. All potentially dangerous activities, such as the use of open flames, welding and

cutting operations, the use of electric grinding tools, and smoking, shall be prohibited in the storage area, and symbolic safety signs.

5.3 Cylinder filling site

Filling sites are much more regulated and controlled due to the risk of illegal and unsafe filling of gas cylinders. Filling sites also have more gas on site and pose a bigger threat to the local community.

Approval for the establishment and operation of filling premises that fall within the guidelines of this part of SANS 10087 shall be obtained from the approving authority. Guidance on the type, installation and operation of filling equipment shall be obtained from the company that supplies the filling equipment or gas (or both).

- Due to the requirements shown above, the specific filling premises identified will determine the specific requirements for the site and the associated cost for such a filling site.
- It is recommended that once potential filling sites are identified, a detail design and costing can be done in association with the local authorities and gas supplier.

5.4 Training and qualification for filling sites

- Operators must be Qualified, training and experience to be accredited. The employee carrying out the inspection, filling and handling of containers in terms of this part of SANS 10087, shall have had the appropriate technical and practical training for the type of work undertaken, the proof of which both employer and employee shall document.
- It is strongly recommended that **the Jozi@work program** be integrated into these projects for the installation and maintenance of all gas installations.
- Record of operator training: A record shall be kept on the premises of the training undergone by an employee. This record shall contain the training course syllabus, the name of the trainer and the name of the trainee.
- Authority of qualified operators: No one shall inspect, fill or handle a container unless
 - He has been duly trained.
 - His training has been recorded.
 - He has been found competent to fill containers in accordance with this part of SANS 10087
- The Cylinder exchange depot and/or cylinder filling premises can be build and operated by:
 - A third party vendor (Afrox, Easigas, etc.)
 - As a City Power gas energy division.

The SANS 10087-7 highlights some of the requirements in establishing and costing of a compliant and safe exchange depots or filling sites not exceeding 9kg containers It is recommended that small cylinder filling sites be established through already existing SMMEs in the local community. It is important that a reputable gas supplier be appointed to develop and support such filling sites. This will ensure that legal and safety requirements are adhered to.

SANS 10087-7 refers specifically to the storage and filling premises for refillable liquefied petroleum gas containers of gas capacity not exceeding 9kg and the storage of individual gas containers not exceeding 48kg.

5.5 Vending System Concept

1. Indigent Household registers with Local Authorities (including: request for FBAE/ cell number). This registration can be done by the installer of the gas cabinet.
2. Local Authorities sends file to Vending Agent and transfers cash into bank account.
3. Vending Agent validates cash deposit and distributes voucher to registered cell number.
4. Indigent household purchases (redeems voucher) at local LPG gas merchant.
5. Bank settles with LPG gas merchant.
6. Vending Agent report to Local Authorities on distribution.
7. Cross reporting between Gas and Electricity sales and systems.

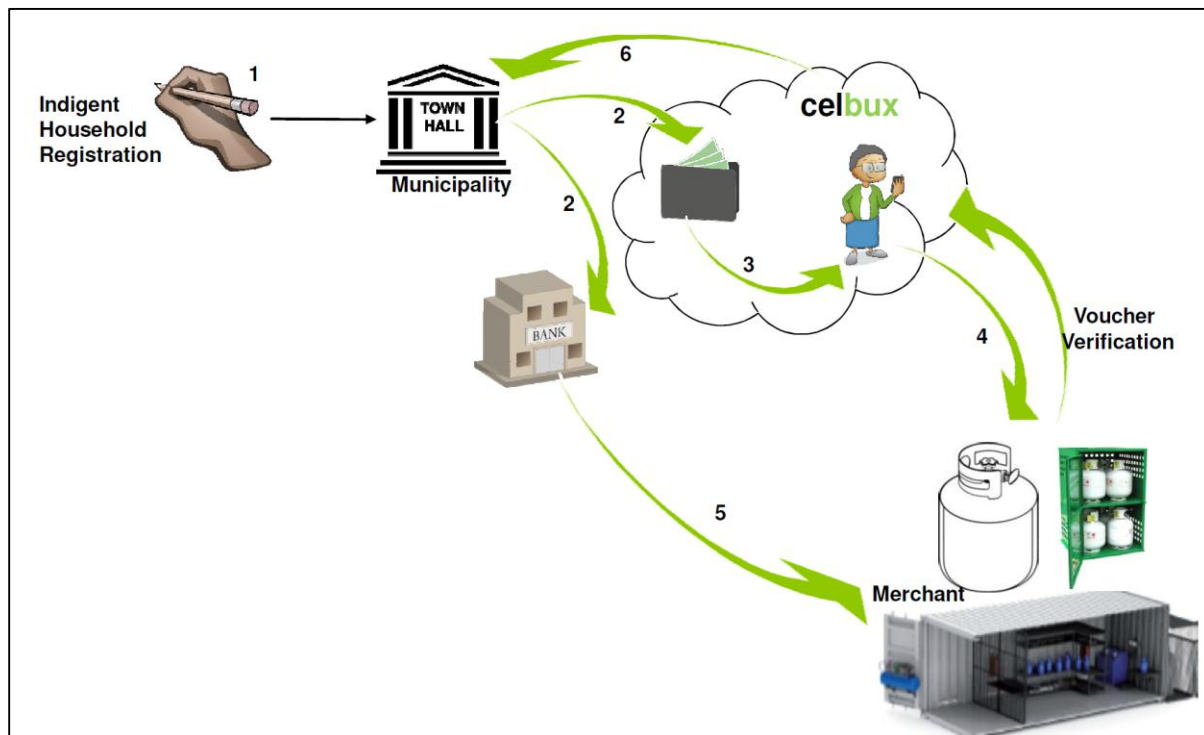


Figure 3: Vending system concept

A private funding model can be used to establish gas depots and to run and maintain the vending system according to City Power tender processes and procedures.

All vending activities and transactions must conform to the existing City Power ITC framework, and must be able to supply the system with adequate reporting information.

6 REVIEW

This policy will be reviewed bi-annually or as and when required taking into account developments in relevant legislations, business sustainability and requirements.

7 RECORD

Manager – DSM & SSM, within the Engineering Services Group will ensure that the latest approved policy is available on the Intranet, policy manual or on request.

Issues raised by the CFO of City Power needs to be addressed and included in the policy where applicable

8 DISPUTE RESOLUTION

Should there be a dispute about the interpretation or the application of this policy, a party to the dispute may refer it to the EXCO for a resolution.

9 CROSS REFERENCES

This policy is intended to be utilized in conjunction with the Embedded Generation and Metering Policy and any other policy as deemed necessary from time to time.