EMBEDDED GENERATION: THE CITY POWER EXPERIENCE
1. City Power at a glance
2. Evolution of distributed generation
3. City power approach
4. How to engage?
CITY POWER AT A GLANCE
We are in the business of buying electricity and selling it on to customers.
City Power at a glance

Vision: World Class Electricity Utility

MOE: City of Johannesburg is the single shareholder of City Power

Number of customers: Over 460,000 - LPU: 1%, Prepaid: 62%, Business/Domestic: 37%

Revenue: R13.2bn

Employees: Over 1,700

Only utility in Africa with three ISO accreditations (9000, 14001 and 18001)
City Power at a glance…

- 6 major intake points from Eskom, 32 mixed MV intakes
- Current peak demand of 3.5 GW
- Predicted future peak demand to reach 6 GW by 2030
- R8.5b invested in infrastructure in the past 10 years
- R40b required in the next 20 years
EVOLUTION OF DISTRIBUTED GENERATION
Traditional electricity distribution business

Revenue generated by transporting electricity from Central Power Station to Customers

Brown energy sales

Has been good for 100 years....
Evolving distribution business

Using the grid to support distributed generation

Brown energy sales reduced

New revenues need to be generated through integration of various distributed energy sources and flows
Drivers of grid evolution

Future Networks (Efficiency driven)

- Alternate Technologies (PV, Wind, Energy Storage)
- Distributed, dispatchable Generation (limited by Gas availability)
- Generation constraints & Eskom’s ageing fleet
- Smart Grid to access flexible loads
- Evolving NERSA regulation and policy.
Distributed Generation

Power generation at the point of consumption generating power on-site, rather than centrally

Opportunity? New, greener energy an hedge against Eskom’s power supply constraints

Surplus energy? no transmission loss component but may not reduce peak demand issues

Is this a threat or an opportunity?
CITY POWER APPROACH
City Power Distributed Generation policy overview

Aimed at facilitating, permitting and regulating Own and Private Distributed Generation within the licensed area of supply

Different off-take possibilities – whole plant generation, excess only or combination of both; Different dispatch modes - self-dispatched or dispatched

City Power’s Distributed Generation Categories

- Customer Generation < 1MW
- Customer Generation > 1MW
- Dedicated Independent Power Producer (IPP)
- Municipal Owned Entity (MOE) Generation
- City Power Own Generation
## Distributed Generation Policy catering for...

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Customer Generation < 1 MW         | Residential and commercial customer installations of small scale embedded generation | • PV installations at residential and commercial establishments  
• Application received for 1000kWp PV at Clear water mall – plus many others |
| (Self-dispatch)                    |                                                                             |                                               |
| Customer Generation > 1 MW         | Existing CP large power users installing own generators; searching for off-taker of excess power | • MTN quad generation facility @ 5.8MW  
• ABSA co-generation facility @ 18MW of which 2MW grid connected  
• At least 45MW identified within City Limits |
| (Dispatch / Self-dispatch)         |                                                                             |                                               |
| IPP (> 1 MW)                       | Any independent producer interested in selling power to City Power           | • Co/tri/quad gen plants, fuel cells, PV farms etc.                                            |
| (Dispatch / Self-dispatch)         |                                                                             |                                               |
| MOE generation                      | Other City subsidiaries exploring utilization of their resources to produce power | • JW’s hydro conduit  
• PickitUp’s waste to energy  
• City Theatre’s gas generation |
| (Dispatch)                         |                                                                             |                                               |
| City Power Own Generation          | City Power’s own generating resources under the direct control of city power | • CP’s gas turbine generating sites  
• PV in unused lands of CoJ and leased rooftops  
• Battery Storage Plant |
| (Dispatch / Self-dispatch)         |                                                                             |                                               |
MFMA and NERSA regulation: Two sources of supply

Cost of Eskom Power (d) × Quantity Demanded From Eskom (ve) + Distributor’s Cost of doing business (b) = Regulated Total Cost to Consumer (a)

Cost of Alternative Power (s) × Quantity Demanded From Alternative (va)

To keep the input cost the same for the total quantity of power demanded but sourced from two suppliers (i.e. \( v_{tot} = ve + va \)), the unit price of Alternative Power (s) must be equal to the unit price of Eskom Power (d).
City Power tariff application - A net billing process

Surplus Energy offset against consumption costs @ Avoided Eskom Offpeak period megaflex tariff;
Additional Grid access fee R0.50c/kVA/day

City Power PV tariff Application to NERSA
Grid access fee vs. price increase to high volume consumers

SAPOA reservations about the additional fixed grid access fee
- Fears of a precedent being set, and a price that can be arbitrarily increased
- Perception of penalization although they offer a green energy initiative

City Power justification for the additional fixed grid access fee
- Revenue from grid load balancing and backup services
- Partially offsets energy sales revenue losses

Offer to SAPOA to explore other options
- As alternative to the additional grid access fee, rather increase in the kWh costs for customers consuming >500kWh per month
- 500kWh threshold is to protect the lower income sector
- Would result in a price increase of 1.4 cents / kWh @ penetration of 20% of total energy distributed
Customer Generation < 1 MW or SSEG (Self-dispatched)

1. Allow connections to grid for prosumers or net consumers; export to be encouraged

2. All PV customers should apply for grid connection; City Power shall approve and witness the installation

3. Phase 1 - Approve and facilitate technically verified physical connections to prevent under the radar connections

4. Phase 2 - Metering connections and export approval to follow based on SSEG guidelines and readiness

5. Surplus Energy bought @ tariff guided by NERSA / DoE SSEG guidelines
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Domestic PV customers are more appealing than commercial PV: export available mid-week; element of storage can reduce peak demand issues</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Value to munics: PV + storage + TOU (own cons. during peaks); Only additional power exceeding storage and instantaneous loads to be exported</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Business migration from energy sales services to grid availability for RE system backup and load balancing services</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Traditional Prepaid to be discouraged for long term sustainability; Traditional prepaid permitted only for low income sector (fixed fee subsidy issue)</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Smart meter load profile data (&lt;30-min interval) key to load management to provide ancillary services tools – dispatchable generation or flexible loads</td>
</tr>
</tbody>
</table>
Evolving business model

Eskom’s tariffs are increasing while alternate technology costs are decreasing; the cross over is likely to happen within the next decade.

City Power has an abundance of load and can disperse significant distributed generation as is (owing to its distribution network structure).

Eskom Vs Private generation including SSEG:
- Private distributed generation can be built faster
- Private generation pricing can be escalated by CPI
- Private generation can position as micro-IPPs; provided long term PPAs are be allowed;
- Generally cleaner and can count as greener energy to fulfill the City of Joburg’s environmental commitments.
Customer generation is viewed as future IPP partners; micro-sized and distributed within the City.

The deeper the distributed generation penetration, the higher the revenue impact; CP revenue model and tariffs need to be transformed to more fixed and less variable charges.

Utility service offering is to provide grid for energy balancing and back-up services (grid access, fixed fee).

Net metering cannot be supported without losing revenue; however City Power can offer avoided Eskom cost for the surplus that generators produce.
Dispatched vs Self dispatched

- Self-dispatched power does not eliminate morning and evening peaks
- Most PV installations are self dispatched unless an element of battery storage
- Hybrid Photovoltaic Electricity System is the preferred option and meets customer + utility needs
- Dispatched generation is mainly gas fired but is restricted by the limited availability of gas

City Power is still liable for the morning and evening peak energy costs and excessive network demand charges
Complimenting self-dispatched generation with flexible load

Load Management is enabled by smart metering technology

On demand flexible loads are being created through load limiting and demand response programmes

Load profiles can be shaped by implementing dynamic pricing or time of use tariffs

Flexible load can be sold as an ancillary service in future to enable the emerging electricity trading market

Smart Meter investment today is useful to mitigate load shedding.

In the future, the same functionality will have ancillary services value as more self-dispatched renewable energy is put onto the grid. (16 GW by 2030 – IRP 2010).

There is great potential for a new industry – home automation.
Standards

Applicable Standards and Guidelines

SANS 10142-1, THE WIRING OF PREMISES – PART 1: LOW-VOLTAGE INSTALLATIONS

SANS 10142-2, THE WIRING OF PREMISES – PART 2: MEDIUM-VOLTAGE INSTALLATIONS

NRS 097, GRID INTERCONNECTION OF EMBEDDED GENERATION

NRS 098, GUIDELINES FOR THE INSTALLATION AND SAFE USE OF PORTABLE GENERATORS ON UTILITIES’ NETWORKS
- Currently, numerous customer queries around AC/DC cables across erf’s to sell to neighbours so as to improve their business cases; queries around higher grid feed-in tariffs to make bankable solutions

- As soon as LCOE of PV < LCOE of Eskom, these questions will start to disappear

- With an element of storage and TOU tariffs adopted, customers stand to gain immensely
Opportunity or Threat for the Municipal Distributor?

Municipalities need to see the overall picture; beyond electricity surpluses. Other key aspects as such economic growth, job creation, gas and heat energy reticulation etc. may stand to benefit.

Customers with own generation may remain in the municipality for the next 20 years, especially with a PPA. Examples - a retail mall indicating expansion plans + data centre co-generation precincts.

Map the future: 500MW of PV on the City Power grid in the medium term equates to ~2500MWh per day or 785GWh per annum (excl. 51 overcast days) – 5-10% of total annual consumption of CoJ.
New opportunities for the Municipal Distributor

Different Possibilities

- **Green energy trading (willing seller - willing buyer); Sustainable Wheeling tariffs**

- **Investment in DSM to provide grid availability services (to backup customer PV on 51 overcast Gauteng days); beyond this, provide the access to flexible loads as an ancillary service to the System Operator (Eskom) in support of 16 GW RE by 2030.**

- **See PV customers as micro-IPPs at a price < Eskom with CPI related increases only; Explore options such as rooftop leasing, installation advisory services, etc.**

- **Transition to an energy company rather than just an electricity company**
HOW TO ENGAGE?
Current rules of engagement

Investors must apply to distributors for connection as per the distribution grid code; applies to all forms of distributed generation sources.

NERSA guidelines shall be binding on all parties; Distributors to manage the process and furnish relevant information to the Regulator.

Distributor functions:
- To approve or decline, based on technical issues that may impact QoS
- Use the NRS 097 guidelines for simplified connection, where relevant
- Ability to recover network study costs where such are required
- Recover costs where network modifications are required
- Manage registration process with NERSA and furnish information