City Power Johannesburg: Response to Potential Load Shedding

Presented by : Stuart Webb

General Manager : PCM

October 2014

Topics to be discussed

- Background
- Challenges
- Options Available
- Summary

Background

- For any electrical grid to remain stable the generation capacity must match the load demand of the consumers – **supply / demand must balance**
- If the system demand is greater than the available generation capacity the system will become unstable and unless demand can be quickly reduced extensive nationwide blackout may result
- As an electricity distributor City Power procures the vast majority of its power from the national generator and alternative sources of such magnitude are not available
- In 2008 the country experienced a series of forced outages which quickly became known as *'load shedding'*- these outages resulted in extreme inconvenience to the public and adversely affected business, industry and the economy - the country was largely ill-prepared for this situation

Opportunities

- City Power and the City of Johannesburg recognise the impact of load shedding and have made a commitment to avoid a repeat of 2008
- Several mitigating opportunities to improve emergency response load reduction practices have been identified and have been or will be introduced
- The following slides briefly describe several of the initiatives available to diminish the likelihood of load shedding and to minimise the inherent negative impact.

Key Customer Demand Response (DR)

- City Power has a number of top-end key customers whose consumption exceeds 5GWh's per annum
- These businesses have the potential to reduce or shift load without necessarily halting production
- Presently approximately 112 key customers have been identified who have indicated their willingness to participate in a voluntary DR scheme
- The proposed incentive repayment rate for deferred consumption is R1,11 per kWh and certain criteria will be set for companies to participate
- The potential load curtailment is estimated to be around 80 MW's

Geyser Control

- This form of DSM is normally aimed at reducing the city's MD during the peak periods when energy costs are highest
- Geyser control can also be used to reduce demand when system capacity is tight or in an emergency situation
- City Power has been operating a ripple type geyser control system for many years
- The present capacity allows for a reduction of between 50 and 80 MW's depending on the time of day and the season

Gas Turbines

- City Power has three 40MW open cycle Gas Turbine installations situated around the JHB CBD
- The units had not been used for several years and had been mothballed
- Following the 2008 load shedding experience two new refurbished engines were sourced and installed
- It is an option going forward to now upgrade the obsolete control systems allowing City Power to run these units to off-set demand curtailment requests at times of system constraints

Kelvin Power

- City Power has a 20 year PPA with Kelvin Power which commenced in 2001
- Kelvin has a reduced capacity availability of around 300MW's following the recent decommissioning of the obsolete 'A' Station
- The unit price of Kelvin is higher than the Eskom Megaflex tariff and presently Eskom is purchasing the output at the higher rate
- However, CP has an opportunity to utilise Kelvin's full available output as a contribution to its load shedding quota although this clearly has financial implications

Solar Geysers

- A roll-out of solar water geysers was initiated in 2012 and the first phase involved the installation of some 60 000 units in various areas
- It is estimated this reduces the evening peak by 6 MW's of demand and avoids a future potential demand of 45MW's from conventional electric geysers
- It is the intention in the current financial year to continue with the installation of a further 10 000

Photovoltaic Generation

- City Power has received a significant number of applications to connect PV to its grid
- Eskom funded projects amount to some 4MW's alone with further privately sponsored projects in the pipeline
- Fully regulated PV programs could yield tens of megawatts of power
- Application for grid connected PV and surplus power buy-back tariffs has been submitted to NERSA
- Final implementation is dependent on metering facilities and billing system integration

- In addition a number of larger companies have installed generation plant and they could also be contracted to operate their plant at times of system constraints

Smart Metering

- A strategic decision to introduce smart metering has been taken by CP
- Both credit and prepaid options are available to customers
- Generally consumers presently consuming < 1000kWh's p.m. will be offered a prepaid meter
- In addition to automatic reading functionality the meters have a capability for communication and to switch domestic appliances such as geysers and pool pumps
- It is the intention to fully utilise this functionality to control residential demand, where necessary

Residential Time of Use Tariff Incentives

- A residential TOU tariff is now available to CP customers
- The previously installed, older technology domestic meters were not capable of metering TOU consumption
- With the roll-out of intelligent meters the introduction of TOU tariffs is now supported
- The intention is to incentivise residential customers, through tariff signals, to reduce consumption during peak periods
- It is also possible to control the actual consumption, during periods of constraint, by remotely setting a load limit which, if exceeded, would result in disconnection

Summary

- With the options available City Power can accommodate up to a Stage 2 (10%) request but any request beyond this can not be accommodated without deliberately disconnecting customers
- City Power will continue expanding its geyser control systems to all areas – load can be quickly reduced and held off until constraints ease up
- The roll-out of intelligent meters will carry on and the use of these meters to control network loading will also be implemented
- New renewable and energy efficient technologies are being investigated such as PV power and energy efficient streetlighting - the City of Johannesburg, in conjunction with City Power, has initiated a project to generate electricity from the gas produced at two landfill sites
- The Demand Response initiative will be expanded
- It is expected these measures will significantly contribute to the national effort to reduce demand and thereby minimise the need to re-introduce load shedding

Joburg
a world class African city

City Power
Johannesburg

Thank you

Are there any questions ?

Voltage Reduction

- A system of deliberate voltage reduction was previously utilised on the Johannesburg network up until around 1985
- The SCADA system was able to issue a command to transformer AVR's at bulk stations to reduce voltage by up to 2,5% without causing noticeable network impact
- This resulted in an equal reduction in consumption
- Under present system conditions a demand off-set of approximately 35MW's could be achieved at the press of a button

- Load shedding has a significant negative impact on the economic performance of the region and the country as a whole.
- If demand can not be quickly reduced to match the available generation large blocks of load must be intentionally switched off

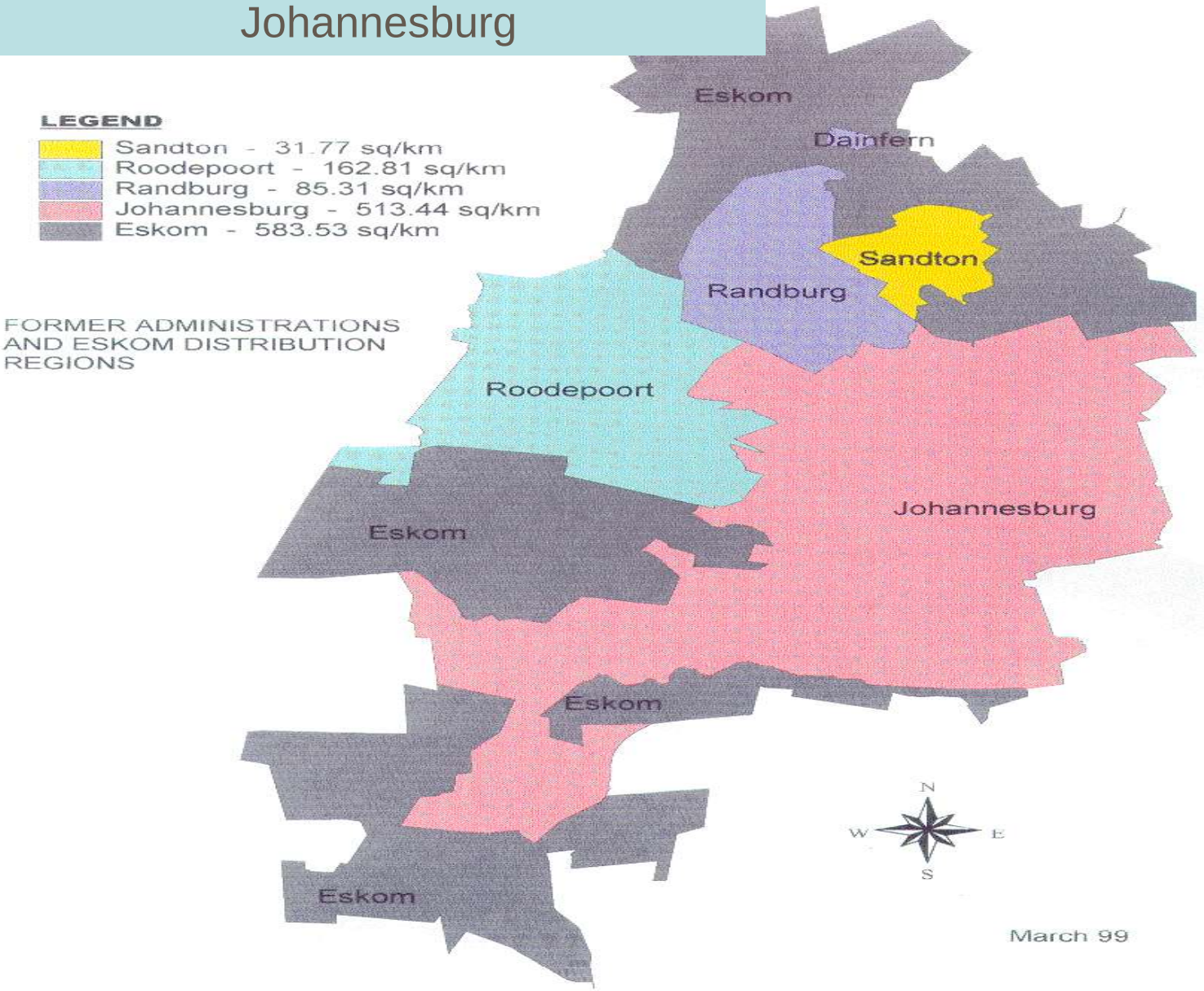
- At any one time the generation capacity of a system will generally be less than the installed capacity as some plant will always be out of service as a result of planned or forced outages
- The difference between the national maximum demand and the available generating capacity is referred to as the 'Reserve Margin' and should ideally be around 15%
- Due to load growth over the years Eskom's reserve margins have been depleted to levels below the ideal internationally accepted norm of 15%
- Eskom's build program has experienced several delays and a significant reduction in grid capacity pressure is only expected in two to three years
- The possibility of having to reduce system load to meet available generation capacity constraints is present at times of peak demand or following a major system event
- Consumers have been made aware of the present situation and have made concerted efforts to voluntarily reduce consumption, however, the threat of load shedding still remains

A Brief History

- When the former Johannesburg Metro Electricity was formed it brought together 5 essentially independent transmission systems.
    - Johannesburg
    - Randburg
    - Roodepoort
    - Sandton
    - Johannesburg South
- There are also a few minor independent intake points such as Alexandra, Dainfern, Lenasia and Brinks Vlakfontein
- Metro Electricity was transformed into the new City Power company in 2001
- More recently Midrand and Modderfontein have been incorporated into City Power's area of supply
- The technical designs and features of the various systems are often diverse and the systems have little interconnection

- Technical differences (such as voltage phase angle) make further interconnection of little benefit

Electricity distribution in the City of Johannesburg



What business are we in?

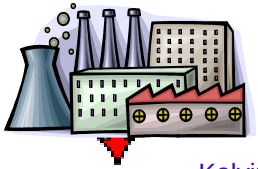
National Energy Regulator (NER)

Generation

Transmission

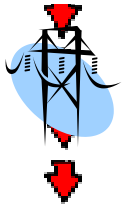
Distribution

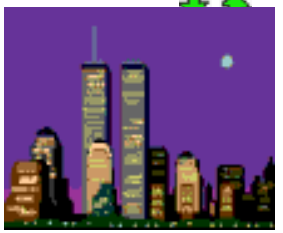
Eskom



Kelvin

City Power Johannesburg





We are in the business of buying electricity from generators and selling it to electricity customers, making a profit from this which is then used to support the City's objectives and goals

Curtailment Stages

- In the event of a load reduction request there are various stages in the process as defined in NRS 048-9
- 'STAGE 1' is defined as a 5% reduction in winter maximum demand
- 'STAGE 2' is defined as a 10% reduction in maximum demand
- 'STAGE 3' is defined as a 20% reduction in maximum demand
- The duration of the reduction period can vary from a couple of hours up until 8 hours or even longer in extreme circumstances
- In the case of City Power these stages would equate to load curtailments of around 130MW's, 260MW's and 520MW's respectively