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Net Metering
A Municipal Perspective

The Road to Approved Grid Connection

Overview

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Background and context

- Current National RE Policy and Programmes
- Net Metering – Definition
- Legislation
- Distribution Grid Code
- NERSA<100kW “Standard Condition” Municipal Guidelines

What needs to be done

- Technical Specifications
- Metering Solutions
- Other Municipal Requirements
- Tariffs for Net Metering
- Banking rules and Business processes
- Environmental, job and electrical supply issues

Current National RE Policy and Programmes

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- Cabinet decision 5 September 2007 – Eskom designated as the "central buyer of power from IPP's"
- Role of Municipalities regarding RE is undefined- excluded from IPP definition and IRP2010
- DOE New Generation Capacity IPP Procurement Programme (Large Scale > 5 MW)
- DOE New Generation Capacity IPP Procurement Programme (Small Scale 1- 5 MW) (RFI issued) Max 100 MW
- Eskom Integrated Demand Management (IDM) 100 kW- 1 MW "Standard Offer" pilot (R1.20/kWh) Max 10 MW
- NERSA's "Standard Conditions for small scale (< 100kW) embedded generation within municipal boundaries)

Net Metering- definition

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Net Metering refers to the ability of ..small scale generators to be rewarded for the energy that they produce to which goes out onto the municipal network..…… The final bill that will be received is for the Nett quantity of energy that they consume……that is, their total import from the municipal network minus their total exports onto the municipal network (subject to any relevant metering periods in operation)

(from Nersa's "Standard Conditions for small scale (< 100kW) embedded generation within municipal boundaries)

Legislation

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- Electricity Regulation Act and regulations ("Municipal void")
  - New Generation Regulations
  - Distribution Grid Codes
  - IRP 2010
  - Distribution Licenses
- MFMA
- Municipal Supply By laws. (In Cape Town's case, no one may connect in parallel with the grid without prior written consent of the Director of Electricity)

<u>There is no mandate allowing Municipalities or Eskom to purchase excess generated electricity from small scale embedded generators.</u>

IRP2 -2010

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6.15 Net metering, which allows for consumers to feed energy they produce into the grid and offset this energy against consumed energy, should be considered for all consumers (including residential and commercial consumers) in order to realise the benefits of distributed generation. The impact of such a policy on subsidies needs to be considered.

7 RESEARCH AGENDA FOR NEXT IRP

Distributed generation, smart grids and off-grid generation

7.1 An independent study on solar PV technologies suggests that before 2015 the levelised cost of the PV installation (without storage) would be the same, if not cheaper, than residential prices (especially at municipal retail tariffs). This possibility suggests that distributed generation should be seriously considered in future iterations of the IRP with additional research into the technology options for distributed generation and the impact on networks, pricing and residual demand on centrally planned generation.

7.2 The growth of distributed generation has a bearing on the development and operations of the network (predominantly the distribution network), especially if some, if not most, of the distributed generation is variable technology. The development opportunity of smart(er) grids and storage solutions – which can help in integrating variable renewable technologies – should also be considered, alongside the system's balancing capability (and ancillary services). There could be an initial focus on smart metering and the ability to manage demand.

Grid code: Responsibility of Distributors

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8.2 Responsibilities of Distributors to the Embedded Generators

(1) If requested by the *Embedded Generator*, the *Distributor* shall provide information relating to the *Distribution System* capacity and loading to enable the *Embedded Generator* to identify and evaluate opportunities for connecting to the *Distribution System*. The *Distributor* may charge the *Embedded Generator* a reasonable fee for such information.

(2) The *Distributor* shall treat all applications for connection to the *Distribution System* by potential *Embedded Generators* in an open and transparent manner that ensures equal treatment for all *applicants*.

(3) The *Distributors* shall be responsible for the installation of the bidirectional metering equipment between the *Distributor* and the *Embedded Generator*'s generation facility.

(4) The *Distributor* shall develop the protection requirement guide for connecting *Embedded Generators* to the *Distribution System* to ensure safe and reliable operation of the *Distribution System*.

Grid Code: Responsibility of Embedded Generators

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8.1 Responsibilities of *Embedded Generators* to *Distributors*

(1) The *Embedded Generator* shall enter into a connection agreement with the *Distributor* before connecting to the *Distribution system*.

(2) The *Embedded Generator* shall ensure that the reliability and *quality of supply* complies with the terms of the connection agreement.

(3) The *Embedded Generator* shall comply with the *Distributor's* protection requirement guide detailed in this section as well as protection of own plant against abnormalities, which could arise on the *Distribution System*.

(4) The *Embedded Generator* shall be responsible for any dedicated connection costs incurred on the Transmission System *or Distribution System* as a result of connection of the *Embedded Generation* facility to the *Distribution System* in compliance with the Tariff Code.

(5) The *Embedded Generator* shall be responsible for synchronizing the generating facility to the *Distribution System* within pre-agreed settings.

Distribution Grid Code Definitions

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Embedded generator
A legal entity that operates one or more unit(s) that is connected to the *Distribution System*. Alternatively a legal entity that desires to connect one or more unit(s) to the *Distribution System*.

Unit
A turbine alternator and all the related equipment, including the step-up transformer, operated together to produce electricity.

Standard Conditions for small scale (< 100kW) embedded generation within municipal boundaries

- Guidelines only, no consultations held.
- Need clarification and updating
- Connection to the Eskom grid is omitted
- Imply that generator licenses are not required for net metering applications
- “Should” have smart meters with bi directional metering
- Sets guidelines regarding net metering tariffs
- Sets out requirements regarding record keeping and reporting

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So what needs to be put in place in order for municipalities to be able to implement Net Metering……..?

Technical Specifications

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NRS 097	Grid interconnection for embedded generation: Installations <100kW	Standards for connecting to the grid that includes aspects such as safety and protection, metering and utility compatibility.	Published
DST 34-1665	Distribution Standard for the Interconnection of Embedded Generation (DSiEG): Installations 100kW – 1 MW*	Interconnection standard covers legal requirements, operational safety, and network interface. This standard serves to fulfil Eskom Distribution's obligation under Section 8.2(4) of the South African Distribution Code: Network Code.	Published

- Inverter type testing requirements
- Electricity design certified by a professional engineer.
- On-site testing and handover
- Certificate of Compliance

- Status- in progress – Multi-part workgroup- Eskom, Munics, Industry
- Cape Town- interim standards and requirements- at developer's risk.

Technical Specifications- Eskom

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Small-scale Renewable Energy Standards and Specifications
(as published on 1 June 2012)

Eskom

Standard	Focus	Brief overview of content	Status
(DST 34-906)***	Earthing Practice		published
DSP 34-392	Specification for digital transducer based measurement system for electrical quantities		Published
DST 34-462	Standard design for Distribution protection schemes		Published
DST 34-540	Distribution Standard for the application of Sensitive Earth Fault protection		Published
DST 34-542	Distribution voltage regulation and apportionment limits		Published
NRS 057-4	Electricity Metering Part 4 : Code of Practice	The regulatory requirements is applicable to electricity metering in its entirety, including all equipment requirements, design requirements, maintenance requirements, metering data capturing and data retention requirements and service agents requirements	
NRS 097	Grid interconnection of embedded generation	Standards for connecting to the grid that includes aspects such as safety and protection, metering and utility compatibility.	
SANS 1019	Standard voltages, currents and insulation levels for electricity supply	Covers standard voltages and currents for use in a.c. transmission, distribution and reticulation systems (and in equipment for use in such systems) having a nominal frequency of 50 Hz and a nominal voltage exceeding 100 V, based on the standard values given in IEC 60038 and IEC 60059. Also covers standard phase-to-earth insulation levels	

Metering Solutions

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Need separate measurements of imported and exported energy- excludes "in meter off-setting" e.g. Electro-mechanical meters running backward (also not accurate).

Commercial and Industrial

- Bi-directional credit meters (off the shelf)
- In Cape Town's case will use AMR

Residential

- Smart meters required nationally to be provided to all residential consumers using more than 1000kWh per month.
- City of Cape Town- prepayment meter policy- bi directional smart prepayment meter under development

(Current meters decrement units on reverse power flow)

Bi directional meters allow the possibility of dual tariff rates in the future

Other Municipal Requirements

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Approval of generators required from other Municipal Departments:

- Noise (wind turbines, generator exhausts)
- Other interference (flickering shadows from wind turbines)
- Air pollution (bio mass generation/incineration, exhaust gases)
- Waste management
- Building regulations (e.g. small wind turbines, PV panels)

(including sign off of structural design)

- Servitudes for power lines and cables

Nema (EIA), Water,

Tariffs for Net metering

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- Tariffs to be approved annually by Municipal councils and NERSA
- In theory consumers can end up with no net consumption at the end of each month
- There is a cost to provide, maintain and administer the electrical network
- NERSA < 100kW guidelines require monthly fixed service charge to cover network and admin charges, and an energy charge)
- There is an energy cost associated particularly with net metered PV generation-generation takes place at times when it is relatively cheaper to purchase energy from Eskom/and consumption tales place when it is relatively more expensive to purchase electricity from Eskom-vast difference between peak winter (208.53c per kWh) and off peak summer (24.95c per kWh) purchase cost. *"One unit generated on a balmy summer's day is NOT of equal worth to one unit consumed during a peak period winter storm."*
- Can address energy cost by requiring load shifting to coincide with PV generation period , and/or take energy cost into account in the tariff.

Typical Generation and Consumption Profiles

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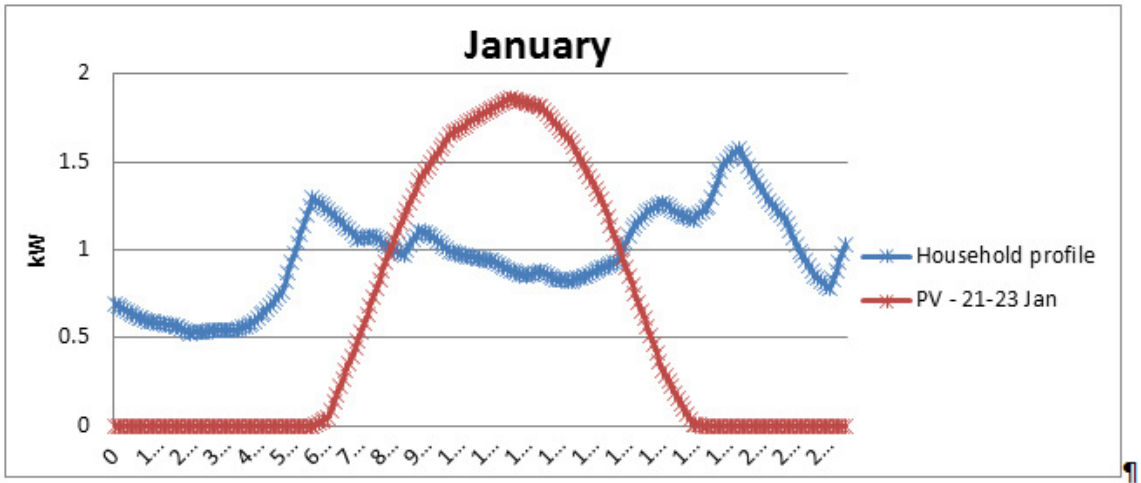

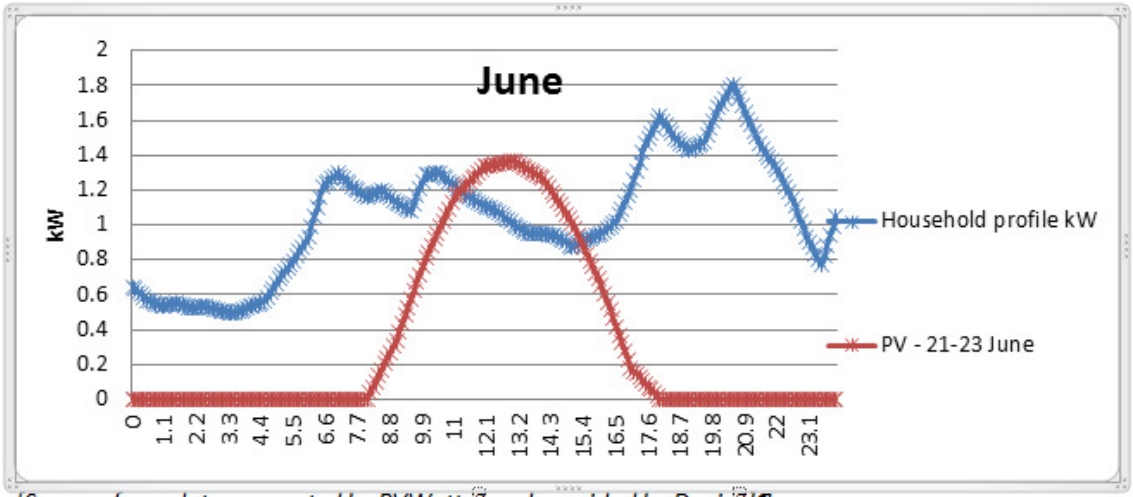

[Source: from data generated by PVWatts and provided by Davis]

Generation: from 2 kW (peak) DC array

Consumption: average of 25 households which use 748kW per month

Time of Use tariff Periods- Megaflex tariff

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		Weekdays			Saturdays			Sundays		
		Off peak	Std	Peak	Off peak	Std	Peak	Off peak	Std	Peak
24:00	01:00	1			1			1		
01:00	02:00	1			1			1		
02:00	03:00	1			1			1		
03:00	04:00	1			1			1		
04:00	05:00	1			1			1		
05:00	06:00	1			1			1		
06:00	07:00		1		1			1		
07:00	08:00			1		1		1		
08:00	09:00			1		1		1		
09:00	10:00			1		1		1		
10:00	11:00		1			1		1		
11:00	12:00									
12:00	13:00									
13:00	14:00									
14:00	15:00									
15:00	16:00		1		1			1		
16:00	17:00		1		1			1		
17:00	18:00		1		1			1		
18:00	19:00			1		1		1		
19:00	20:00			1		1		1		
20:00	21:00		1		1			1		
21:00	22:00		1		1			1		
22:00	23:00	1			1			1		
23:00	24:00	1			1			1		

Net consumer

Net generator

Net consumer

Net Metering Banking

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- How many credit “units” will be allowed?
- How will the “credit” be effected (credit and pre-payment meters)
- Over what period- daily, weekly, monthly bearing in mind:
  - Seasonal variation- net generator in summer, net consumer in winter
  - Tariff changes (seasonal, yearly - to counter arbitrage)
  - MFMA requirements?
- What happens to accumulated credit on change of ownership?
- Time of use tariff complications.
- Pre-paid meter complications (recovery of daily service charge)

Business Processes

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Business Processes to be implemented to :

- Integrate with other supply applications processes
- Initiate Grid capacity studies when required
- Track and record design, testing and handover approvals and Supply Agreements
- Handle reading dual meter registers and manage unit banking rules Provide data for NERSA reporting etc.
- Provide consumer advice

Environmental and Job Creation Benefits

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- Job creation potential: for 100 000 3kWp residential units installed over 10 years : 600?? to 1200?? jobs based on 20-40 (based on German market) jobs per MW installed (residential scale)
- Greenhouse gas reduction:
  - Annual output 1600kWh /kWh peak (Cape Town)

    or 4800 kWh/3kWh peak (Compare with 200l SWH's – on average save a conservative 2400 kWh /year)
  - Eskom electricity- approx 1 kg CO2 emitted per kWh generated
  - CO2 savings per year – 4800 kg per house or

    480 000 tons for 100 000 units.

(Job and PV production Figures from Chris Haw of Aurora Power Solutions)

Contribution Towards System Load and Electricity Sales Income

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- Cape Town has about 550 000 residential consumers (250 000 middle/upper income (non-lifeline)) and a yearly overall consumption of 11 Terawatt hours (11 000 000 kWh)
- Assume 100 000 3kWp units installed
- 100 000 units will generate 0.48 TWh or about 4.4% of Cape Town's consumption
- Impact on electricity sales income will be higher.
- A net metered 3kWpk PV panel together with a 200l SWH will provide all the electricity needs of a middle income household (600kWh/month)!
- PV generation makes little or no contribution towards reducing the evening peak unless accompanied with load shifting to outside peak periods

In Summary

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To be able to implement (approve) net metering, municipalities require:

- To have technical specifications including upstream grid requirements
- An installation approval process
- Other (non-electricity) municipal departmental approvals
- A metering solution
- An appreciation of revenue impacts
- An approved net metering tariff
- Banking rules
- Business processes in place
- A connection agreement for generators
- Clarification on the requirement for generator licenses for small scale embedded generation

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Thank you