SMALL SCALE ON-GRID SOLAR PHOTO VOLTAIC EMBEDDED GENERATION IN SOUTH AFRICA – METHODOLOGIES TO STIMULATE THE MARKET

Paul Tuson
Introduction

• IRP 2010-30: estimates that residential and commercial Embedded Generation (EG) PV could reach 22.5GW by 2030
• Increased electricity prices
• Reduced Eskom reserve margin
• Opportunities for consumer export income
• Obstacles to roll-out of small scale PV
  • Decrease in municipal revenues
  • Risk of LV/MV system overloading
  • Safety
  • Absence of approved standards/legislation
• SSPVEG installations are occurring (next slide)
## Current SSPVEG installations in SA

<table>
<thead>
<tr>
<th>Project</th>
<th>Location</th>
<th>Province</th>
<th>Installed capacity (kWp)</th>
<th>When completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kriel Mine</td>
<td>Kriel</td>
<td>Mpumulanga</td>
<td>240</td>
<td>Aug 13</td>
</tr>
<tr>
<td>Med</td>
<td>Woodmead</td>
<td>Gauteng</td>
<td>31</td>
<td>Jul 13</td>
</tr>
<tr>
<td>BMS</td>
<td>Woodmead</td>
<td>Gauteng</td>
<td>36</td>
<td>Jul 13</td>
</tr>
<tr>
<td>BT</td>
<td>Woodmead</td>
<td>Gauteng</td>
<td>36</td>
<td>Jul 13</td>
</tr>
<tr>
<td>WTP</td>
<td>Witbank</td>
<td>Mpumulanga</td>
<td>30</td>
<td>2013</td>
</tr>
<tr>
<td>Mitchells Plain Hospital</td>
<td>Mitchells Plain</td>
<td>Western Cape</td>
<td>64</td>
<td>2013</td>
</tr>
<tr>
<td>Solar Irrigation System</td>
<td>Montagu</td>
<td>Western Cape</td>
<td>24</td>
<td>2013</td>
</tr>
<tr>
<td>GreenPeace Africa</td>
<td>Johannesburg</td>
<td>Gauteng</td>
<td>10</td>
<td>2013</td>
</tr>
<tr>
<td>Vodacom</td>
<td></td>
<td>Western Cape</td>
<td>500</td>
<td>2012</td>
</tr>
<tr>
<td>Dube Trade Port</td>
<td>Century City, Cape Town</td>
<td>Western Cape</td>
<td>220</td>
<td>2011</td>
</tr>
<tr>
<td>Pick n Pay distribution centre</td>
<td>Philippe, Cape Town</td>
<td>Western Cape</td>
<td>300</td>
<td>2013</td>
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<tr>
<td>Vrede en Lust Wine Farm</td>
<td>Franschoek</td>
<td>Western Cape</td>
<td>218</td>
<td>2013</td>
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<tr>
<td>Novo Packhouse</td>
<td>Paarl</td>
<td>Western Cape</td>
<td>200</td>
<td>2013</td>
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<tr>
<td>Leeupan Solar PV project</td>
<td>OR Tambo Precinct, Wattville,</td>
<td>Gauteng</td>
<td>200</td>
<td>2012</td>
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<tr>
<td>Pick n Pay Distribution Centre</td>
<td>Longsmead, Johannesburg</td>
<td>Gauteng</td>
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<tr>
<td>Villera Winefarms Stellenbosch</td>
<td>Cape Town</td>
<td>Western Cape</td>
<td>132</td>
<td>2011</td>
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<tr>
<td>Standard Bank PV Installation</td>
<td>Kingsmead, Durban</td>
<td>KwaZulu Natal</td>
<td>105</td>
<td>Unknown</td>
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<tr>
<td>Pick n Pay Store</td>
<td>Hurlingham, Johannesburg</td>
<td>Gauteng</td>
<td>100</td>
<td>2010</td>
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<tr>
<td>BP Offices</td>
<td>V&amp;A Waterfront, Cape Town</td>
<td>Western Cape</td>
<td>67</td>
<td>2011</td>
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<tr>
<td>Cavalli Wine &amp; Stud Farm</td>
<td>Stellenbosch</td>
<td>Western Cape</td>
<td>51</td>
<td>2013</td>
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<td>Oldenburg Vineyards</td>
<td>Stellenbosch</td>
<td>Western Cape</td>
<td>45</td>
<td>2013</td>
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<td>Coca Cola water bottling plant</td>
<td>Heidelberg</td>
<td>Western Cape</td>
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<td>Glaxo Smith Kline</td>
<td>Cape Town</td>
<td>Western Cape</td>
<td>30</td>
<td>Unknown</td>
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<td>Impala Clothing</td>
<td>Maitland</td>
<td>Western Cape</td>
<td>30</td>
<td>Unknown</td>
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<td>Khayelitsha District Hospital</td>
<td>Cape Town</td>
<td>Western Cape</td>
<td>25</td>
<td>2011</td>
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<tr>
<td>Stellakaya Wine Farm</td>
<td>Stellenbosch</td>
<td>Western Cape</td>
<td>10</td>
<td>Unknown</td>
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<tr>
<td>Leifontein wine cellar and Groenfontein admin offices</td>
<td>Stellenbosch</td>
<td>Western Cape</td>
<td>88</td>
<td>2013</td>
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<tr>
<td>Eskom Megawatt Park Rooftop PV</td>
<td>Sunninghill, Johannesburg</td>
<td>Gauteng</td>
<td>358</td>
<td>2013</td>
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<td>Eskom Megawatt Park carport PV</td>
<td>Sunninghill, Johannesburg</td>
<td>Gauteng</td>
<td>398</td>
<td>November 2011</td>
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<tr>
<td>Eskom Kendal PV (ground-mounted, fixed)</td>
<td>Eskom's Kendal coal-fired power station</td>
<td>Mpumulanga</td>
<td>620</td>
<td>November 2011</td>
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<tr>
<td>Eskom Lethabo PV (ground-mounted, 1-axis tracking)</td>
<td>Eskom's Lethabo coal-fired power station</td>
<td>Free State</td>
<td>575</td>
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<td>Eskom Megawatt Park CPV</td>
<td>Sunninghill, Johannesburg</td>
<td>Gauteng</td>
<td>26</td>
<td>November 2011</td>
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<td>Cronimet Chrome Mining SA (Pty) Ltd</td>
<td>Thabazimbi</td>
<td>Limpopo</td>
<td>1,000 (PV)</td>
<td>November 2012</td>
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<td>Black River Park</td>
<td>Cape Town</td>
<td>Western Cape</td>
<td>700</td>
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<td>Bosco Factory PV Plant</td>
<td>Edenvale</td>
<td>Western Cape</td>
<td>304</td>
<td>2013</td>
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<td>Ceres Koekamers</td>
<td>Ceres</td>
<td>Western Cape</td>
<td>505</td>
<td>2013</td>
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<tr>
<td>Rooibos Storage Facilities</td>
<td>Clanwilliam</td>
<td>Western Cape</td>
<td>511</td>
<td>2014</td>
</tr>
</tbody>
</table>

**TOTAL** 7 MWp
CURRENT SITUATION

Several standards, grid codes, acts and guidelines in place or in the process of being implemented:

- Draft NRS097-2-1:2013, Edition 2
- Grid connection code requirements for renewable power plants (RPPS), 2012
- Distribution Network Code, Version 6, 2011
- Distribution standard for interconnection of embedded generation, DST 34-1765, 2008
- SABS (2012), SANS 10142-1:2012, The wiring of premises
- Small-scale Renewable Energy standards and Specifications, June 2012
- Standard Conditions for Embedded Generation within Municipal boundaries, NERSA, 2011
- Constitution of the Republic of South Africa
CURRENT SITUATION (contd.)

- Municipal Structures Act 1998, Section 84 (1) page 32 states:
  “A district municipality has the following powers: [...] Bulk supply of electricity which includes for the purposes of such supply, the transmission, distribution and where applicable, the generation of electricity.”
- Generation license from NERSA?
- Prevailing meter technologies:
  - Electromechanical
  - Digital
  - Pre-paid
- No compensation for surplus of export power
SSPVEG Mechanisms

• 1 - Self-consumption solar PV EG
• 2 - Net metering
• 3 – Feed-in tariffs
1 – Self-consumption
1 – Self Consumption

• Solar PV electricity is self-consumed
• SSPVEG installation conservatively sized to supply portion of Prosumer load only
• Inadvertent export is not compensated
• NRS097-2-3 recommends 25% of NMD for individuals EGs will support penetration level and safeguard system without complex approvals/analysis
• Prosumer notifies municipality
2 – Net-metering
3 – Feed-in tariffs (FITs)
Two-part tariff

• **Fixed network/service charge applied when EG:**
  • Notifies utility of intention to self-consume
  • Requests bi-directional meter (Net)
  • Requests 2 x bi-directional meters (FIT)

• **Calculated:**
  • Pro-rata return on assets based on NMD or circuit breaker size
  • Pro-rata O&M costs based on NMD
  • Capital charge on bi-directional meters
  • Connection charges
  • Sales and customer service charges
  • Subsidies for Life-Line or low-income consumers
Two-part tariff (contd.)

- **Energy or kWh charge**
  - Recover electricity charges from Eskom as incurred (pass-through charge)
  - Compensate Prosumer for kWh purchases from Prosumer at same blended Megaflex energy tariff from Eskom
Advantages of two-part tariff

- Municipality compensated for UoS costs even if no energy is imported by Prosumer
- Municipality compensated when Prosumer uses utility network to export power
- Energy or kWhs are recovered as incurred
- Non-Prosumer customers not affected
- Municipality or utility is aware of the SSPVEG installations
Disadvantages of two-part tariff

• Lower import kWh charge may encourage inefficiency
• Revenue shortfalls to municipality (unless surplus calculated and included in the fixed charges)
“Net Feed In Tariff” (NFIT) – Tobias Bischoff-Niemz

- Proposes a Central Power Purchasing Agency (CPPA) – nation-wide sole off-taker for all surplus energy from EGs
- EG or Prosumer installs 2 x bi-directional meters
- When self-consuming, Prosumer saves R1.20/kWh
- CPPA compensates Prosumer with a FIT of R0.70/kWh
- CPPA compensates municipality for lost revenue at R060/kWh
- Funding for the NFIT based on R0.002/kWh on all nationwide energy sales for customers larger than 200kWh/month
- Only registered NFIT Prosumers will be compensated for surplus energy
Advantages of NFIT

• Munics are compensated for fixed costs and revenue surpluses from CPPA at R0.60/kWh
• R1.20/kWh versus R0.70/kWh differential may incentivise load-shifting behaviour
• Munic and utility operators will be ware of embedded SSPVEG installations
• Socialised tax on all electricity users (R0.002/kWh)
• Subsidies to Life-Line users maintained
Disadvantages of NFIT

- Increased tariff for all consumers (R0.002/kWh)
- Setting up of another government run structure
- Municipalities are subsidised by society for lost revenues or to maintain their revenue surplus
Net-metering versus FIT

- Net-metering simpler: 1 x bi-directional meter, no Time of Use (ToU) metering
- Aggressive implementation of FITs (e.g. Italy) can put strain on entire economy
- Paper proposal: compensation to Prosumers = energy kWh purchase price from Eskom e.g. R0.60/kWh
Conclusions

- SSPVEG installations are being carried out in the absence of a finalised regulatory and legal framework
- Degree of frustration that not enough is being done to encourage SSPVEG industry
- One obstacle: revenue risk to municipalities
- Three types of SSPVEG connections mechanisms:
  - Self-consumption
  - Net-metering
  - Feed in Tariffs (FITs)
Conclusions (contd.)

- Two financial approaches to compensate Prosumers:
  - Two-part tariff (Fixed and Energy charge)
  - “Net Feed In Tariff” (NFIT)
- Fixed charge covers UoS costs, not dependent on kWh usage
- Energy charge can be calculated using a blended Megaflex energy tariff
Recommendations

• All three SSPVEG connection mechanisms are introduced:
  • Self-consumption
  • Net-metering
  • Feed in tariffs (FITs)
• Finalisation of standards e.g. NRS097-2 to be expedited
• Self-consumption and Net-metering can be implemented immediately?
• Feed-in Tariffs can be introduced after industry experience and where metering systems are sophisticated to manage ToU metering
• SSPVEG roll-out can actually expedite the uptake of ToU metering
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