Net Feed-in Tariff for rooftop PV in South Africa
Presentation at the
Global Renewable Energy Support Programme

CSIR Energy Centre

31 March 2015
Agenda

**Challenge 1: Munics’ Financial Stability**

**Challenge 2: Risk-Return Profile of PV Business Case**

**Option: Net Feed-in Tariff with Munic Compensation**
Residential electricity demand and PV supply generally do not match

One-family residential house
- 12,000 kWh annual demand (actual data)
- 6 kWp PV installation (simulated data)

Value of excess PV energy

- Excess PV power fed into the grid
- Load supplied by the grid
- Load supplied directly by PV

Load shifting

Electricity Tariff

Avoided electricity tariff

Source: CSIR analysis
Status today: An embedded PV generator with 40% of the PV energy being self-consumed on site reduces municipality sales & gross margin.

### Financial Breakdown

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munic revenues</td>
<td>R 15,600 p.a.</td>
</tr>
<tr>
<td></td>
<td>R 10,400 p.a.</td>
</tr>
<tr>
<td>Munic costs of goods sold</td>
<td>R 8,400 p.a.</td>
</tr>
<tr>
<td></td>
<td>R 5,600 p.a.</td>
</tr>
<tr>
<td>Munic gross margin</td>
<td>R 4,800 p.a.</td>
</tr>
</tbody>
</table>

=Gross margin on this specific customer reduces by R2,400 p.a.

40,000 customers → R100 million p.a. gross-margin reduction!

Source: CSIR analysis
Challenge 1: Munics’ Financial Stability

Challenge 2: Risk-Return Profile of PV Business Case

Option: Net Feed-in Tariff with Munic Compensation
Status today: Excess PV energy that cannot be consumed on site by the customer is fed into the grid with no/too little/too risky compensation.

Highly risky “two-revenues” business case for the PV owner. Only PV projects with very quick payback will be implemented (at high effective costs to the system!)

A PV panels

B PV inverter

Source: CSIR analysis

Sum of energy stream A and B equals the total amount of PV energy
Agenda

Challenge 1: Munics’ Financial Stability

Challenge 2: Risk-Return Profile of PV Business Case

Option: Net Feed-in Tariff with Munic Compensation
Proposal: Net Feed-in Tariff with central off-taker and financial compensation for munics

Create a “Central Power Purchasing Agency” (CPPA) as nation-wide sole off-taker for energy from embedded PV generators fed back into the grid, with two roles

A Feed-in Tariff for net energy fed back into the grid (“Net Feed-in Tariff“)
CPPA buys the energy from embedded PV generators that is not self-consumed and thus fed back into the grid from the PV owner at a guaranteed tariff (20 years, predefined tariff path)

B Financial compensation to munics for self-consumed energy
CPPA compensates the electricity distributor (municipality or Eskom Distribution) financially for lost gross margins due to onsite self-consumed energy from embedded PV generators

CPPA de-risks business case for PV owner and makes munics financially indifferent to embedded PV

The average tariff would increase by less than 2 R-cents/kWh or < 3% to fund a fleet of 3 GW of PV under worst-case assumptions – any alternative new-build would increase the tariff at least in same magnitude

With a gas fleet existing in the future, for which the fuel costs are significantly higher than for coal, the tariff effect will likely be negative, meaning that embedded PV would save the power system money

Source: CSIR analysis
“Central Power Purchasing Agency” (CPPA) is aggregator for embedded PV, de-risks the PV business case & makes munic financially indifferent to embedded PV.
Effects of the proposal: lowest costs and fast ramp-up of capacity

“Central Power Purchasing Agency” (CPPA) is aggregator for embedded PV, it de-risks business case for the PV owner – which brings costs down – and makes the municipality financially indifferent to embedded PV.

The embedded PV capacity additions could very quickly reach 500 MW p.a., adding 2-3 GW to the constrained grid by 2020.

The average tariff would increase by less than 2 R-cents/kWh or < 3% to fund a fleet of 3 GW of PV under worst-case assumptions – any alternative new-build would increase the tariff at least in same magnitude.

Funding requirements for CPPA would be ~ R 300 million p.a. for every 500 MW of embedded PV.

With a gas fleet existing in the future, for which the fuel costs are significantly higher than for coal, the tariff effect could even be negative, meaning that installing PV would save the power system money.

Because costs of PV are now so low, it is a no-regret move for South Africa to implement a standard offer for embedded PV.
Renewables projects have inherently very different sizes – but currently only large projects are incentivised through REIPPPP

1. **Large: REIPPPP**
   - PV: 75 MW
   - Wind: >100 MW
   - CSP: 100 MW
   - Biomass / Landfill Gas: >10 MW
   - Biogas: ~2 MW
   - Small Hydro: Typical biogas / small hydro plant too small for cost-efficient participation in REIPPPP

2. **Medium: Distributed Generators**
   - PV
   - Wind
   - CSP
   - Biomass / Landfill Gas
   - Biogas
   - Small Hydro

3. **Small: Embedded Generators**
   - PV
   - Wind
   - CSP
   - Biomass / Landfill Gas
   - Biogas
   - Small Hydro

**Sources:** CSIR analysis

**Notes:**
- 100 MW
- >10 MW
- 0.5...2 MW
- 0.5...2 MW
- Currently not / not properly incentivised
South Africa can benefit from the best of both worlds: Competitive tender and Feed-in Tariff approach

**Competitive Tender / PPAs**

Competitive tender for PPAs (where the tariff is not predefined, but the outcome of a tender process) have the advantage of determining the lowest achievable tariff.

They have the disadvantage however that the transaction costs, money at risk, and uncertainties about the success of the project are relatively speaking higher.

That drives financing costs and therefore tariffs up.

Furthermore, projects are concentrated in the best solar/wind areas only – which is not optimal from a system perspective.

→ Good for very large projects

**Standard Offer / Feed-in Tariffs (FIT)**

Feed-in Tariffs generally give the highest investment security, therefore drive costs of financing down and therefore drive the acceptable tariff by the investor down:

- Predefined tariff to be paid to any investor who has a renewables project ready
- No cap on the annual capacity under the tariff

However, they have one significant disadvantage: the tariff-setting entity (usually government) does not know what the correct tariff level should be and will therefore always (slightly) overcompensate.

→ Good for small to medium projects

RSA has unique opportunity to combine advantages of both worlds by linking level of FIT for small & medium projects to the results of the competitively determined tariffs of the large projects (REIPPPP).
The REIPPPP for large projects is benchmark for Feed-in Tariffs for small and medium projects – this way prevents overcompensation.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Large: REIPPPP</th>
<th>Medium: Distributed Generators</th>
<th>Small: Embedded Generators</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV</td>
<td>75 MW</td>
<td>1...30 MW</td>
<td>0.5...2 MW</td>
</tr>
<tr>
<td>Wind</td>
<td>&gt; 100 MW</td>
<td>1...30 MW</td>
<td>0.5...2 MW</td>
</tr>
<tr>
<td>CSP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass / Landfill Gas</td>
<td>&gt; 10 MW</td>
<td>Possible but technology generally large enough for REIPPPP participation</td>
<td>Embedded projects too small for technology</td>
</tr>
<tr>
<td>Biogas</td>
<td>0.5...2 MW</td>
<td></td>
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<td>Small Hydro</td>
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</tbody>
</table>

Competitive tender, outcome: average tariff per technology

FIT and NETFIT, tariffs linked to outcome of REIPPPP (plus “distributed premium”)

Sources: CSIR analysis
Thank you!