Energy Mixed - Solution For COJ Informal Settlements

Presenter: Phetole Moagi

Date: 07 October 2015
Purpose of the Presentation

- Photovoltaic, Grid and Gas (Solution)
- Typical Household Requirements Analysis
- Technology Alternative Analysis and Selection
- Technology Customisation and Application
- Financial Implication
- Qualitative Benefits
- Quantitative Benefits
- Integrated Risk Management
Qualitative benefits in terms of Safety

- Safe living environment in the boundaries of City of Johannesburg (City Power area of supply)

- Open live wires due to electricity theft are a reality and safety risk that can result in the death or serious injury of the residents if not addressed

- Energy mix solution aims at reducing electricity theft in and around informal settlements, safe lives, increase revenue collection, increase supply reliability etc..

- With proper area lighting at night, residents will be able to commute more safely as crime will reduce as policing enhance

- Reduce shack fire (decanting, access roads, one connection per plot/stand – not formal)
Qualitative Benefits in terms of **Health and Environment**

- In the absence of clean and safe energy sources such as electricity and gas, fires are being made to cook food and heat water for personal hygienic purposes.

- Wood is gathered from the trees in the area to use as fire source in this regard.

- Smoke inhalation can be toxic and very unhealthy to the residents, children and adults alike.

- The use of paraffin can also be dangerous to young children who often ingest the clear liquid mistaking it for water.
Qualitative Benefits in terms of Improve the living conditions and quality of life ( Constitutional and Human Rights)

- If mothers have access to clean safe energy such as gas and electricity, and they do not have to spent time looking for fire wood, more time can be spent home to raise children

- Children can study at proper lighting in the house at a desk and not under a streetlight as this is the only way for them to read to learn and educate themselves

- Improve local economy and investment around the areas
# Typical Household Requirement

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<tr>
<th>Description</th>
<th>Quantity</th>
<th>Demand (W)</th>
<th>Sub</th>
<th>hrs/day</th>
<th>Energy (Wh)</th>
<th>Energy (kWh)</th>
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<tbody>
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<td>Lights</td>
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<td>637.5</td>
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**Total Energy Usage per day:** 7.5035
Technology Selection

Solar PV with Storage + LPG
<table>
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<th>Proposed Technology Contribution (kWh/day)</th>
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<td></td>
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<td>LPG</td>
<td>PV + Battery</td>
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<td><strong>Total Energy Usage per day:</strong></td>
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<td>388.00</td>
<td>5.18</td>
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Macro Grid – Structure at Reuven
## Technology Customisation and Application (With Grid)

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**Total Energy Usage per day:**

- LPG: 7.5035 kWh
- PV + Battery: 7010 kWh
- Total: 388 kWh

**Technology Contribution:**
- Grid: 31%
- LPG: 26%
- PV + Battery: 43%
Limitations and Benefit Analysis (No Grid)

- **Limitations:**
  - No electrical stove / geyser / kettle / ironing – Use LPG
  - No high demand electrical devices
  - If capacity management is not done properly, access to energy will be compromised – install a 2A circuit breaker to manage usage

- **Advantages:**
  - Not affected by load shedding or grid power outages
  - Free Basic Energy (Electricity and LPG) – 100kWh electricity or 6kg LPG
Limitations and Benefit Analysis (With Grid)

Advantages:

- Not affected by load shedding or grid power outages
- High demand electricity devices can be used
- Free Basic Energy (Electricity and LPG) – 100kWh electricity or 6kg LPG
CAPEX of approximately R180,000 will provide a 3kWp grid tie Solar PV system with 9kWh of storage

Acknowledging that there is a morning and evening peak, this system can accommodate:

- 3kWp / 400W (rounded) = adequate for six (6) houses
- 9kWh storage / 400W = 22h per day
- 22h for 6 houses = **3.66h per house per day [No diversity]**
- At a diversity factor of 0.5, 22h for 6 houses = **7.33h per house per day**

The intention is to load the battery storage during the day via solar PV panels for both peaks
CAPEX of approximately R180,000 will provide a 3kWp grid tie Solar PV system with 9kWh of storage and 9kWh of grid supply.

Acknowledging that there is a morning and evening peak, this system can accommodate:

- 3kWp / 400W (rounded) = adequate for six (6) houses
- 9kWh storage + 9kWh grid = 18kWh per day
- 18kWh for 6 houses [No Diversity] = 3kWh per house
- 18kWh for 6 houses [50% Diversity] = 6kWh per house
- The intention is to load the battery storage during the day via solar PV panels and to export all additional electricity generated back into the grid
Quantitative Benefit in terms of the management of Technical and Non Technical Losses

- Energy losses due to
  - Technical reasons – poor network infrastructure resulting in high impedance levels and poor quality of supply
  - Non Technical reasons – illegal connections and tampering of meters as example

- results in high financial losses to City Power annually!

- In this case study, if only 3 units per dwelling per day are lost per month for 10,000 houses, then the financial impact to City Power is estimated to be R1million per month of R12million per annum at a cost of R1.20/unit

- By providing access to affordable energy such as gas and electricity, these losses will be curtailed adding to the business case of the proposed project
Quantitative Benefit in terms of excess electricity being fed back into the Municipal Grid

- Assume 3kWp will load batteries over 3h per day and for the remaining period, 3kWh will be fed back into the grid [Possible at a diversity of 50%]

- 3kWp @ R1.20/kWh = Estimated **R3.60 per installation per day**

- Estimated Benefit per month = **R108.00 per installation per month**

- Benefit per annum = **R1,296 per installation per annum**

- For 10,000 dwellings, 1,667 installations will be required

- 1667 installations x R1,296 per installation = **R2,160,432 benefit to City Power per annum**
Integrated Risk Management

- Education in terms of capacity demand management
- LPG safety in terms of installation and usage safety
- Sustainable Maintenance and Operation
- Sustainable LPG depot
- Equipment repair support
- City Power Electricity Generation Asset Creation vs using Eskom assets
THANK YOU