Modelling the Residential sector in South Africa - SATIM

Mamahloko Senatla

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Residential Sector representation in SATIM

- Households divided into 5 categories, emanating from 3 income categories.

- Low Income Electrified
- Low Income Non-Electrified
- Middle Income Electrified
- Middle Income Non-Electrified
- High Income

<table>
<thead>
<tr>
<th>Category</th>
<th>Electrified</th>
<th>Non-Electrified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Income R0 – R19 600</td>
<td>71%</td>
<td>29%</td>
</tr>
<tr>
<td>Middle Income R19 601- R76 400</td>
<td>83%</td>
<td>17%</td>
</tr>
<tr>
<td>High Income &gt;R76 400</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Why those income bands?

• Must be answered with: what is the importance of this disaggregation?
  • Because of diversity in structural (built)
    – Brought by socio-economic diversity
  • This diversity translates into differing options of
    – what fuel is used and
    – quantity is consumed
  • Which part of diversity can we capture?
    – Housing stock differences?
    – Income vs energy consumption?
Low income households use less electricity, even after 10 years of electrification, the consumption is still below 200kWh/month.

Source: Enerweb, 2010
Load profiles from Enerweb

Peak demand for a low income household is 3 times lower than lowest demand for a high income household.

This difference is brought by the type and number of appliances and used in each households.
Conclusion on categorisation

- Therefore appliance ownership was used as a proxy for energy consumption

All Media Products Survey (AMPS, 2007): Source: SAARF
End uses for all Households

- Lighting
- Cooking
- Space heating
- Water Heating
- Refrigeration
- Other end uses (TV, clothes washing, etc)

The difference lies in type and number of appliances used to achieve each of these end uses.
### Making Projections: Cooking example

<table>
<thead>
<tr>
<th>Cooking</th>
<th>Low Electrified</th>
<th>Low Non-Electrified</th>
<th>Middle Electrified</th>
<th>Middle Non-Electrified</th>
<th>High Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLEKELCHOT-E</td>
<td>RLNKOKKEWI-E</td>
<td>RMEKELCSTOV-E</td>
<td>RMNKOKKEPRI-E</td>
<td>RHEKELCSTOV-E</td>
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<tr>
<td>RLEKOKEWI-E</td>
<td>RLNKOKENEW-WI</td>
<td>RMEKOKKEPRI-E</td>
<td>RMNKCOASTOV-E</td>
<td>RHEKOKEPRI-E</td>
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<tr>
<td>RLEKBIWOPEN-E</td>
<td>RLNKOKETOYO-N</td>
<td>RMEKBIWSTOV-E</td>
<td>RMNKBIWSTOV-E</td>
<td>RHEKBIWSTOV-E</td>
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<tr>
<td>RLEKOLPRING-E</td>
<td>RLNKCOAMBA-E</td>
<td>RMEKOLPSTOV-E</td>
<td>RMNKOLPSTOV-E</td>
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<td>RLEKOKEWICK-N</td>
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<td>RMEKOKEWICK-N</td>
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<td>RLNKOLPRING-E</td>
<td>RMEKOKETOYO-N</td>
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<td>RELKOABNM-N</td>
<td>RLNKCOABNM-N</td>
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<tr>
<td>RLNKBIWMBA-N</td>
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</tbody>
</table>

### Parameters

- **Efficiency**
- **Installed capacity**
- **Bounds in a form of households that use that appliance**
- **Life times**
- **Investment Costs**
- **Operating Costs**

### Making Scenarios for future projections

Change the bounds of each technology
Upper Bounds for 4 scenarios

![Graph showing % of households that use appliance for different scenarios: BAU, LPG, Least Cost, Safe Paraffin Stoves. The graph includes the following results:
- RLEKELCHOT-E: BAU 73%, LPG 10%, Least Cost 100%, Safe Paraffin Stoves 3%.
- RLEKKE-W-E: BAU 22%, LPG 2%, Least Cost 58%, Safe Paraffin Stoves 10%.
- RLEKOLPRING-E: BAU 3%, LPG 2%, Least Cost 51%, Safe Paraffin Stoves 2%.
- RLEKOKETOYO-N: BAU 2%, LPG 2%, Least Cost 50%, Safe Paraffin Stoves 2%.
- RLEKOKABNM-N: BAU 2%, LPG 2%, Least Cost 50%, Safe Paraffin Stoves 2%.
]
Scenario Results

Total Residential by Fuel

- Final Energy (PJ)
- BAU
- Fuel Types: Electricity, Paraffin, LPG, Biomass Wood, Natural Gas, Coal

Energy Demand (PJ)

- LPG Program, Least-Cost, Safe Paraffin Stoves
- Fuel Types: Electricity, Paraffin, LPG, Biomass Wood, Natural Gas, Coal
Future Improvements

• Updating the model with Census 2011
• Aligning our income bands with living standard measures (LSMs):
  – We will still maintain our categories
    - High,
    - Middle and
    - Low

- Understanding of multiple fuel use in high income households, recent study by DOE shows high proportion of high income households use gas for cooking.
THANK YOU!!!