The MAPS Programme

Mitigation Action Plans and Scenarios

LTMS experience in agriculture mitigation

Sebataolo Rahlao
• Long Term Mitigation Scenarios
• Commissioned by the SA government
• High energy intense economy
• Coal-based electricity production
• Transition to a low-carbon economy
Robust and broadly supported results achieved through technical methodology and extensive stakeholder involvement
South Africa’s emissions by sector

### Sector contribution to total GHG emissions
- **Agriculture, forestry and land use**
  - Emissions 28 592.96, 6%
- **Industrial processes & product use**
  - Emissions 61 469.07, 14%
- **Energy**
  - Emissions 346 535.03, 78%
- **Waste**
  - Emissions 9 413 21, 2%

### Waste emissions
- **Waste incineration** 12.32, 0%
- **Waste-water handling** 1 307.80, 14%
- **Solid waste disposal on land** 6 065.00, 86%

### Industrial processes & product use
- **Metal production** 24 104.32, 33%
- **Mineral products** 6 483.20, 11%
- **Chemical industry** 30 424.14, 50%

### Energy emissions
- **Fugitive emissions from fuels**
  - Emissions 43 135.17, 12%
- **Fuel combustion**
  - Emissions 303 399.87, 88%

### Fuel combustion (sectoral approach)
- **Other** 100.00, 0%
- **Agriculture, forestry, fishing** 3 718.94, 1%
- **Residential** 5 028.40, 2%
- **Commercial/Institutional** 1 911.30, 1%
- **Manufacturing industries & construction** 39 028.91, 13%
- **Transport** 39 348.28, 13%
- **Energy industries** 213,304.04, 70%
<table>
<thead>
<tr>
<th>FOUNDATIONAL PROGRAMMES</th>
<th>2020 TARGET REQUIREMENTS</th>
<th>DEVIATION BELOW BAU, 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions reduction /sinks in land use/forestry – Land Affairs, Forestry – no current programmes</td>
<td>Enhanced fire control, savannah thickening, increased forest cover</td>
<td>LULUCF, 2.4%</td>
</tr>
<tr>
<td>Improved agriculture – DoA – no current programmes</td>
<td>Progs to reduce tillage, reduce enteric fermentation &amp; increase manure management</td>
<td>Agriculture, 1.8%</td>
</tr>
<tr>
<td>Waste minimisation – national &amp; local govt – limited current programmes</td>
<td>Progs to minimise waste, promote composting</td>
<td>Waste, 1.4%</td>
</tr>
<tr>
<td>Industrial process emissions – DTI, DEAT, others – no current programmes</td>
<td>CCS, methane capture for existing synfuel plants, GHG mitigation for aluminium plants, coalmine methane</td>
<td>Ind proc, 3.7%</td>
</tr>
<tr>
<td>Transport options – DoT, local govt, DTI, Transnet – rollout of public transport (Gautrain, BRT)</td>
<td>Vehicle efficiency prog, expanded public transport, shift freight to rail, promote hybrids &amp; electric vehicles, no further CTL plants without CCS for all GHG emissions, promote biofuels</td>
<td>Liquid fuels, 7.9%</td>
</tr>
<tr>
<td>Lower CO₂ electricity supply – DoE, NERSA, Eskom –REFIT RE target</td>
<td>Expanded low-carbon electricity supply prog – regulation / incentives in electricity sector</td>
<td>Adv. transport, 0.6%</td>
</tr>
<tr>
<td>Residential energy efficiency (EE): DoE, local authorities - current DSM prog, EE Strategy, EE Accord, NEEA</td>
<td>Full implementation of current EE strategy, plus other progs, eg sustainable housing facility</td>
<td>Enhanced lower CO₂ electricity, 4.9%</td>
</tr>
<tr>
<td>Commercial EE: DoE, Eskom, DPW, local authorities - current DSM prog, EE Strategy, EE Accord, NEEA</td>
<td>Full implementation of current EE strategy, plus additional accelerated progs</td>
<td>Initial lower CO₂ electricity, 4.9%</td>
</tr>
<tr>
<td>Industrial EE: DoE, Eskom - Current DSM prog, EE Strategy, EE Accord, NEEA</td>
<td>Full implementation of current EE strategy, plus additional accelerated progs</td>
<td>Commercial EE, 0.7%</td>
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<tr>
<td></td>
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<td>Housing EE, 1.1%</td>
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<tr>
<td></td>
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<td>Industrial EE, 8.0%</td>
</tr>
</tbody>
</table>
Agricultural mitigation measures often have **synergy** with **sustainable development policies**, and many **explicitly influence social, economic** and **environmental** aspects of sustainability.

Many options also have **co-benefits** (improved efficiency, reduced cost, environmental co-benefits)

as well as **trade-offs** (e.g. increasing other forms of pollution), and balancing these effects will be necessary for successful implementation (IPCC, 2007)
# SCENARIO BUILDING TEAM

## Government
- DEAT Environment
- DME Minerals & Energy
- DST Science & Technology
- DoT Transport
- Treasury
- Foreign Affairs
- DTI Trade & Industry
- DPE Public Enterprises
- DWAF Water Affairs & Forestry
- Presidency
- SAWS Weather Services
- CEF / SA Nat’I Energy Research Institute
- NERSA Energy Regulator
- W Cape Province (DEADP)
- City of Johannesburg

## Business
- SASOL
- Eskom
- EIUG Energy Intensive Users Group
- Engen
- Grain SA
- Anglo Coal
- BHP Billiton
- Chamber of Mines
- Aluminium – AFSA
- Kumba Resources
- Chemical – CAIA
- Forestry SA
- AgriSA
- Business Unity SA
- Sappi
- Envitech (Waste)

## Civil society
- EcoCity/CURES
- SESSA
- Labour (NUM)
- SEA
- SACAN
- COSATU
- SALGA
- WWF-SA
- Earthlife Africa
For all scenarios, key common drivers were identified, such as GDP, population and technological change and other factors.
• The analysis of **agriculture emissions** could not be conducted through a single model, but in a **series of spreadsheets**.

• The **output** from the models **structured** in the **same format** as the outputs from the **energy sector** model, to allow for **comparison** across all sectors.

• **Each activity** within the sector has a completely **different set of input parameters** and is **modelled using different set of equations**.
Local and international literature was assessed to select the mitigation options available in agriculture sector.

The key general sources were:

- the previous South African GHG inventory and the associated country studies;
- Technology Needs Assessment for South Africa with respect to Climate change;
- IPCC guidelines.
Mitigation actions in agriculture

1. Reduction of enteric fermentation by smaller, more productive herd through move from rangelands to feedlots with improved feed.

2. Improvement of manure management by disposal as dry spread instead of lagoons (80% of manure from dairy and feedlot will be disposed as dry spread).

3. Aggressive adoption of no tillage practice (on 80% of lands).

4. Less aggressive adoption of no tillage practice (40% for wheat and 20% for maize).
Modelling emissions – methodology

**Enteric fermentation**
- Historical data, assumptions and calculations
- Assumptions for baseline and mitigation option
- Calculation of costs for baseline and mitigation option and cost efficiency

**Livestock manure management**
- Data, assumptions and calculations of baseline and mitigated emissions
- Assumptions and calculations for mitigation

**Reduced tillage**
- Historical data, assumptions and calculations for tillage
- Area under cultivation
- Carbon storage
- Capital and variable costs requirements to start a no-till system.
Model structure

Spread sheets:

- **Baseline; Mitigation** and **Summary** (includes costs calculation).

- **General data** (including area, factors, etc.) on the top and then annual data (1990 to 2050).

- Where available, have **historical data** from 1990; then 5-9 years of mitigation implementation till complete uptake, and after that stabilized values till end of the period.
Uncertainty with sector emissions and accuracy of models

Table 1: Uncertainty associated with sector emissions and accuracy of existing models (based on the total national emissions for 1990 of 347346 Gg CO$_2$ eq

<table>
<thead>
<tr>
<th>Sector</th>
<th>1990 emissions (Mt CO$_2$ eq)</th>
<th>% of total (%)</th>
<th>2003 emissions</th>
<th>Average (2003-2050)</th>
<th>Mitigation potential (%)</th>
<th>Mitigation potential (2003-2050) (Mt CO$_2$ eq)</th>
<th>Uncertainty %</th>
<th>Error (Mt CO$_2$ eq)</th>
<th>Error (% of national emission) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>22.34</td>
<td>6.43</td>
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<td></td>
<td></td>
<td>3.26</td>
<td>0.94</td>
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<tr>
<td>Enteric fermentation</td>
<td>19.25</td>
<td>5.54</td>
<td>18.13</td>
<td>18.11</td>
<td>36.06</td>
<td>6.53</td>
<td>50</td>
<td>3.26</td>
<td>0.94</td>
</tr>
<tr>
<td>Manure management</td>
<td>2.17</td>
<td>0.62</td>
<td>1.87</td>
<td>2.00</td>
<td>49.46</td>
<td>0.99</td>
<td>50</td>
<td>0.49</td>
<td>0.14</td>
</tr>
<tr>
<td>Agricultural soils (reduced tillage - 80% adoption)</td>
<td>14.53</td>
<td></td>
<td>-4.72</td>
<td>-3.95</td>
<td>-52.73</td>
<td>2.08</td>
<td>100</td>
<td>2.08</td>
<td>0.60</td>
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<tr>
<td>Waste</td>
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<tr>
<td>Solid waste (S5)</td>
<td>7.53</td>
<td>2.17</td>
<td>13.92</td>
<td>16.32</td>
<td>55.12</td>
<td>9.00</td>
<td>50</td>
<td>4.50</td>
<td>1.30</td>
</tr>
<tr>
<td>Land use</td>
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<tr>
<td>Fire control and savannah thickening (sequestration)</td>
<td>-3.29</td>
<td></td>
<td>-0.55</td>
<td>-1740.55</td>
<td>9.49</td>
<td>50</td>
<td>4.74</td>
<td>-1.37</td>
<td></td>
</tr>
<tr>
<td>Afforestation (sequestration)</td>
<td>-5.42</td>
<td></td>
<td>-4.08</td>
<td>-103.28</td>
<td>4.21</td>
<td>50</td>
<td>2.11</td>
<td>-0.61</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mitigation action</th>
<th>Mitigation cost (R/t CO2-eq)</th>
<th>GHG emission reduction, Mt CO2-eq, 2003-2050</th>
<th>Rank by costs – (lowest cost is no.1)</th>
<th>Rank by emission reductions – (highest reduction is no.1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land use: fire control and bush encroachment</td>
<td>(R 15)</td>
<td>455</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>Waste management</td>
<td>R 14</td>
<td>432</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Agriculture: enteric fermentation</td>
<td>R 50</td>
<td>313</td>
<td>21</td>
<td>24</td>
</tr>
<tr>
<td>Land use: afforestation</td>
<td>R 39</td>
<td>202</td>
<td>19</td>
<td>27</td>
</tr>
<tr>
<td>Agriculture: reduced tillage</td>
<td>R 24</td>
<td>100</td>
<td>18</td>
<td>31</td>
</tr>
<tr>
<td>Agriculture: manure management</td>
<td>(R 19)</td>
<td>47</td>
<td>9</td>
<td>34</td>
</tr>
</tbody>
</table>

*source: SBT, 2007*
FOR ADDITIONAL INFORMATION

Scenario documents
www.environment.gov.za

Technical Summary, Technical Report, Appendix,
5 Input Reports downloadable from the ERC web-site
http://www.erc.uct.ac.za/Research/LTMS/LTMS-intro.htm