Energy optimisation strategy for ZZ2 farming operations

SAIAE/SAILI CPD Event
28-30 September 2010

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Limpopo

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Agenda

1. ZZ2 Energy strategy
2. Extent of energy usage
3. Energy savings
4. Renewable energy projects

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ZZ2 Energy strategy

Reduce the energy usage and the carbon footprint by:

1. **Savings on current energy usage**
2. **Fossil fuel energy generated through renewable sources.**
3. **Independent Eskom power and price hikes.**

Note: Balanced Scorecard used to manage strategy initiatives.

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Extent of fossil fuel derived energy

- **Diesel fuel** **4,7 million litres**
- **Petrol** **0,1 million litres**
- **Electricity** **35 000 MWh**

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Diesel users

67 X Trucks

206 X Tractors

119 X Bakkies

9 X Gensets (> 300kVA)

8 X Construction machines

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Electrical infrastructure and users

308	X	Transformers, 25 MVA
9	X	Gensets (> 300kVA)
218	X	Houses
7	X	Packhouses
450+	X	Borehole installations, pump stations

Ruraflex, Land rate, Municipalities

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“Location challenge!”

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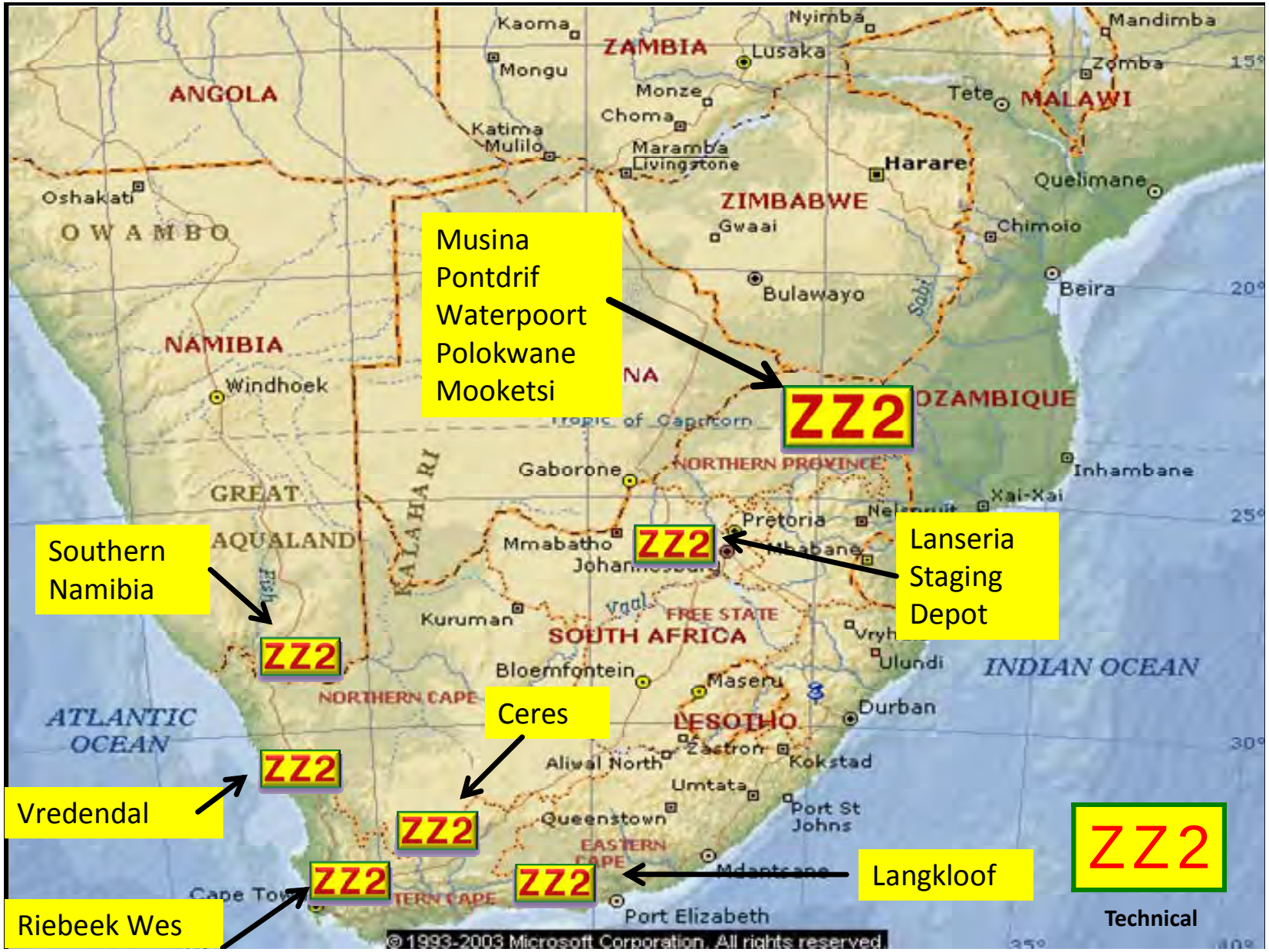
Musina
Pontdrif
Waterpoort
Polokwane
Mooketsi
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Lanseria
Staging
Depot
Southern
Namibia
Ceres
Vredendal
Riebeek Wes
Langkloof
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ANGOLA
ZAMBIA
ZIMBABWE
MALAWI
NAMIBIA
BOTSWANA
MOZAMBIQUE
SOUTH AFRICA
LESOTHO
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Lusaka
Nyimba
Mandimba
Zomba
Monze
Choma
Tete
Katima Mulilo
Maramba
Livingstone
Harare
Quelimane
Oshakati
OWAMBO
Gwaai
Chimoio
Bulawayo
Beira
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Tropic of Capricorn
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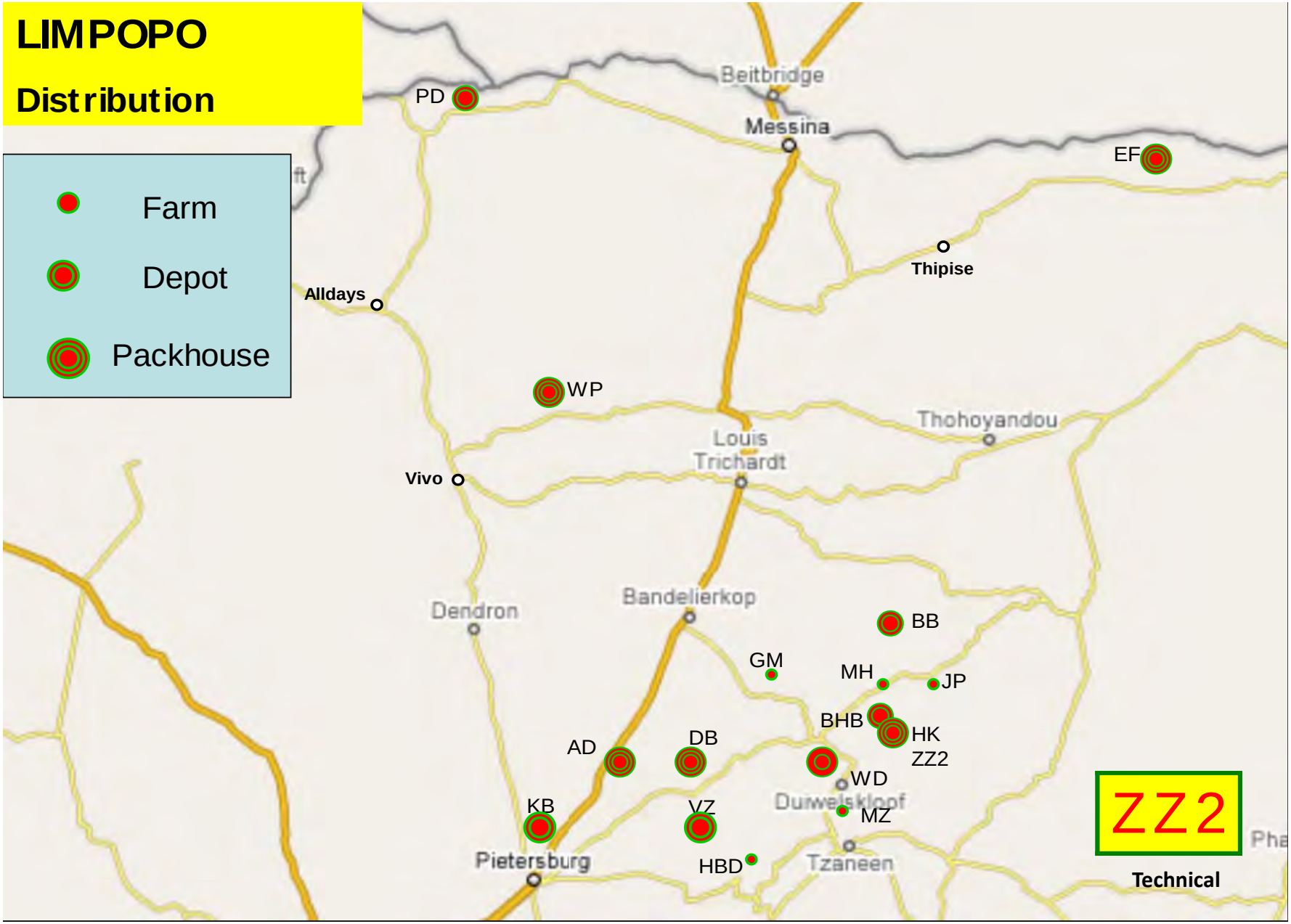
Distribution



ZZ2 Energy strategy

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Energy savings

Trucks
Old generation 52ℓ / 100km
New generation 47ℓ / 100km
Saving = 12 000 ℓ per year
= R 84 000 per year
(240 000km/year)

Super link trailers
Old version = 35 pallets = 35t
New version = 36 pallets = 36t
Saving = 3290ℓ/year

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Energy savings

Trucks (New generation)
With aero kit 44ℓ / 100km
Without aero kit 47ℓ / 100km

Saving = 7 200 ℓ per year
= R 50 400 per year

Trucks (Old generation)
With aero kit 52ℓ / 100km
Without aero kit 52ℓ / 100km

No saving

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Energy savings

Choose the correct bakkie and save 1 ℓ per 100km

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Energy savings

Forklift: Diesel vs electric

Fuel consumption

- **Diesel 24 to 32 ℓ/shift**
- **Electric 30 kWh/shift**

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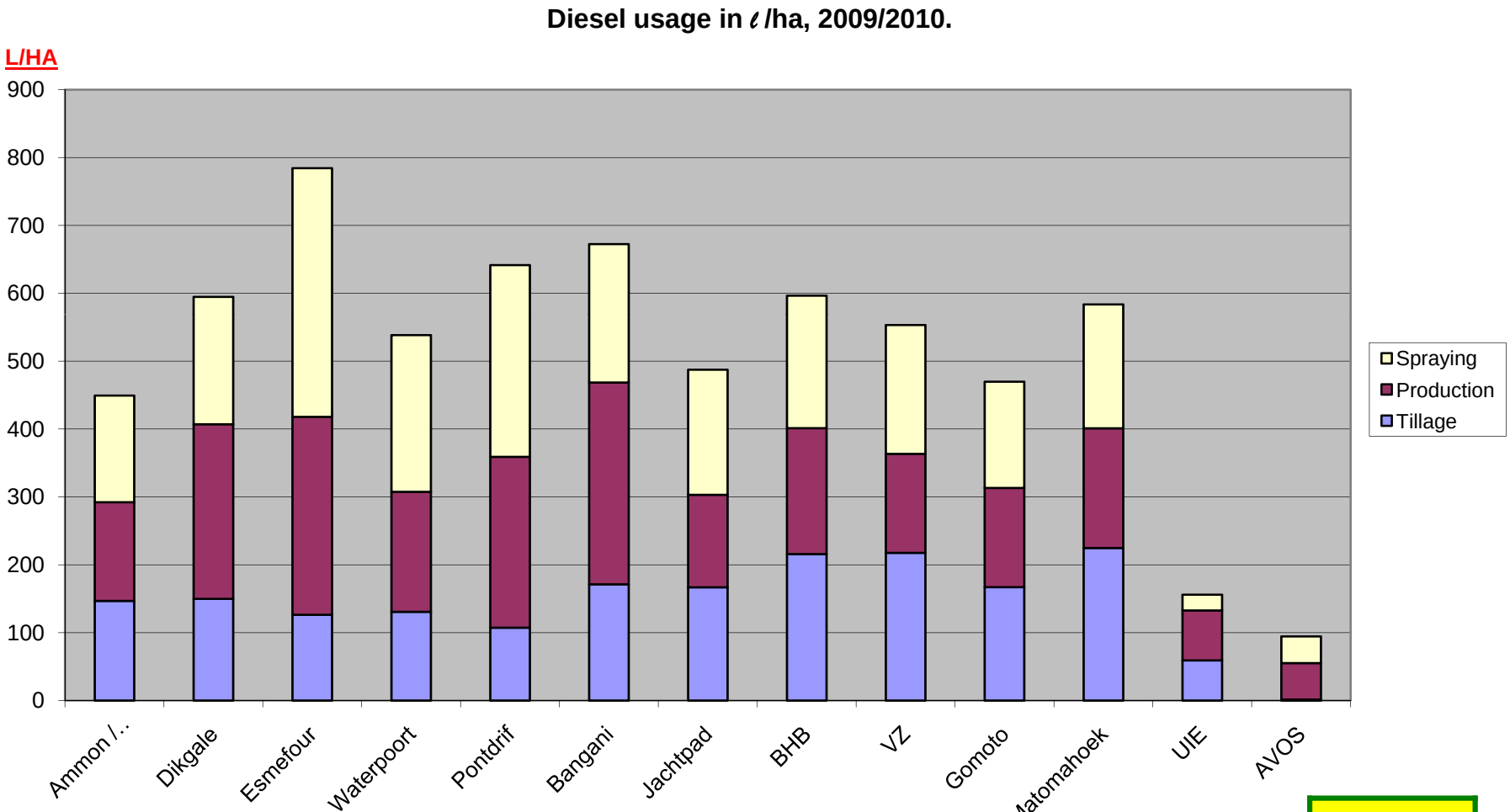
Tractors and field practices



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Soil preparation /tillage

Operation	ℓ/ha
Disc (x2)	16
Rip 450 – 500mm	15
Disc	8
Cultivate	8
Ridge: Ridger	10
Compost spreader	4
Manure spreader	4
Skidsteer	3
Moats and contours	5
Total	70
ZZ2 : Ave	143
Spread	102 - 184
Savings potential	32 - 114

- Reduce operations
- Rip and disc vs. Rip and plough
-Reduce depth of tillage
  250mm vs. 450mm

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Sprayers

Type	ℓ/ha	Total ℓ/ha (2,4 x 20)
Cima	7,0	336
RSM	2,5	120
Agrimaster	4,0	192
ZZ2 : Average		176
Spread		120 - 315
Savings potential		56

Possible savings

- Replace CIMA sprayers
- More use of Agrimaster and RSM
- Filling points next to fields.

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Production / Harvest

ZZ2 : Average Spread	ℓ/ha 101 - 243 ℓ/ha
Savings potential	50 ℓ/ha

Action required:

- "Gear up throttle down"
- Maximum load per
- Tractor not to be used for transport
- Tractor stay at field
- Diesel to tractor
- Tractor to fit operation

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Summary : Savings potential

Operation	Average now (ℓ/ha)	Saving potential (ℓ/ha)
Tillage Spray Production	143 176 163	40 56 50
Total	483	146 (30%)

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Savings through irrigation scheduling

Saving in water use = 100mm/ha/year

Saving in pumping energy = 322 kWh

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Electricity savings

Pack houses

Natural lighting with poly carbonate sheeting

Saving on lights =18kW

Use donut(sponge) rollers for drying of tomatoes instead of hot air.

Saving = 60kW

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Electricity savings

Ecolights (T5) **Saving - 6kW (15 %)**
LED's in packhouses **Saving = 6 kW per packhouse**

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Saving on cooling

- Installed Cooling Power 2000kW$_{ref}$
  - Coefficient op performance 2.8
- Saving of 25% = 220 MWh @ COP of 3,4
  - R110,000 saving p.a.
  - Intelligent electronic capacity control
    - Electronic expansion valves, step loading/unloading, soft start
    - Variable condensing speed control = constant discharge pressure
  - Ambient temperature determines load pressure

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Eskom initiatives for energy saving

Lighting : CFL's for incandescent bulbs.

- Replaced 6 000

- Clients not happy

- **Lumens of CFL's much lower**
- **Short life of CFL**
- **Service provider not sustainable**
- **Back to incandescent in 3 months.**

Heat pumps : Replace 3kW geyser with 0,8kW heatpump

Goals not clear and changed.

Move from 30kW to 15kW saving to undefined differentiated kW.

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Eskom initiatives for energy saving

- Rural electrification : Housing and hostels
  - Eskom initiate and advertise
  - DME paid project
  - Red tape sunk project
- High efficiency motors - Too expensive
- Solar water heaters / Solar PV
  - 5 systems implemented
  - Not feasible
- Variable speed drives — Implemented by ZZ2
- Power factor correction

Energy usage in South Africa

- Agriculture 6,8% of total electricity
- ZZ2 not ranked under in 500 largest users in Limpopo.

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Potential electricity savings (kWh per year)

Packhouses	
Lighting	**518 400**
Drying	**1 058 400**
Cooling	**220 000**
Ecolights	**144 000**
LED's (Sorting)	**64 800**
CFL's	**262 800**
Heatpumps	**1 204 500**
Irrigation scheduling	**506 182**
Total	**3 519 082 (9%)**

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Potential diesel savings (liter per year)

Trucks (old/new)	228 000
Trucks (aerokit)	136 800
Trailers	52 000
Bakkies	5 000
Forklifts(diesel→electric)	56 000
Field practices	116 000
Total	**595 000 (13%)**

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Renewable energy investigation

Solar tower / Green tower

Geothermal

Solar

Wind

Hydro

Bio energy

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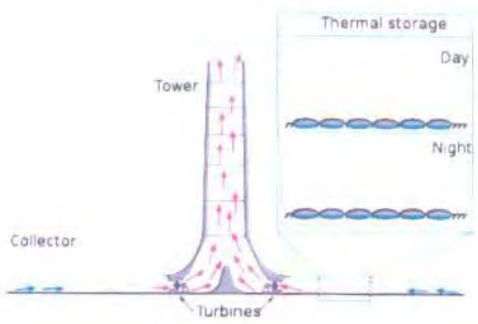
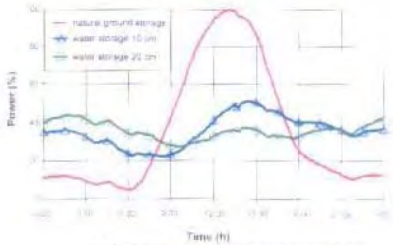


Schematic presentation of a Solar updraft tower


Prototype of the solar tower prototype plant at Manzanares, Spain


Effect of heat storage underneath the collector roof using water-filled black tubes. Simulation results from (Kreetz, 1997).

Solar tower /chimney
(Green Tower)

Advantages
- **"Constant" day/night base load**
- **Incorporate greenhouses**

Challenges
- **High temperatures and wind speeds near hub**
- **Little thermal storage with plants effecting base load.**
- **100m tower**
- **Relative even and flat surface**

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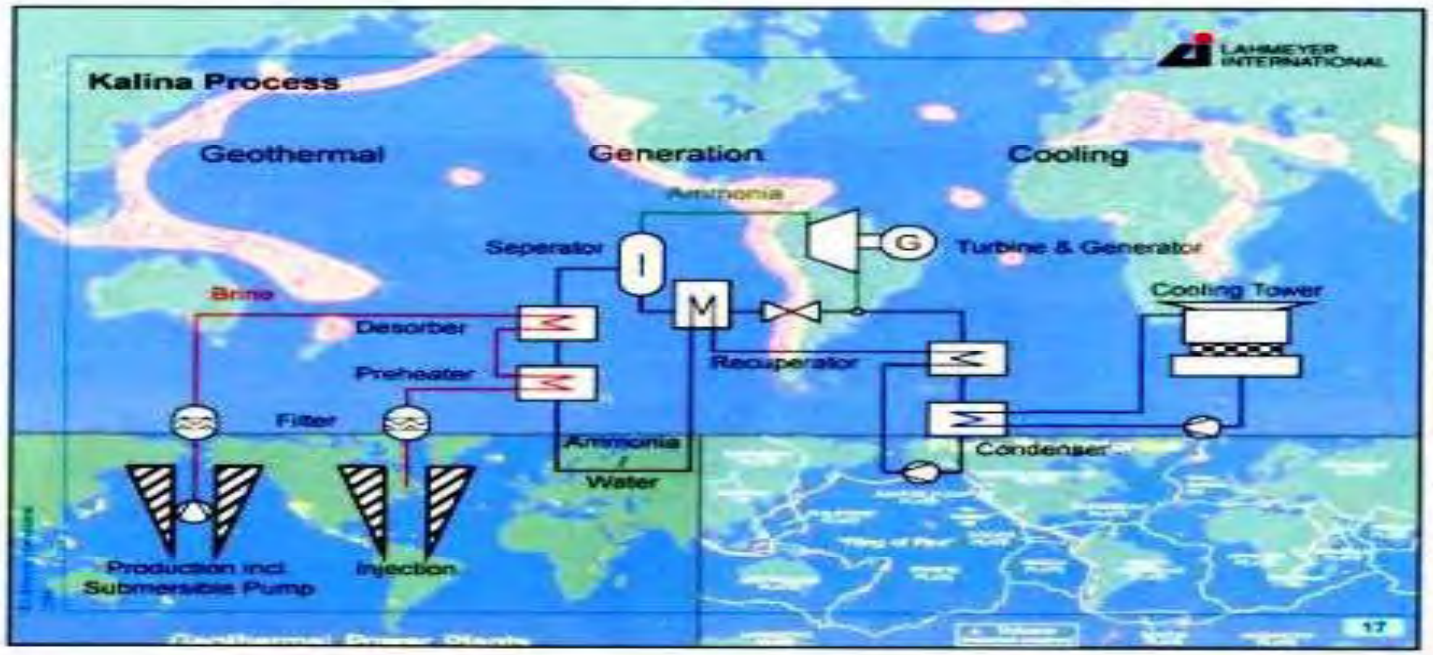
Geothermal energy

2010/03/11



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-Renewable and constant base load

- Feasibility stage very expensive
- High start up costs
- Running cost very low

-Exploration and feasibility

- Pre-feasibility - R 7,5m
  (30% probability of failure)
- Exploration drilling (3 wells) R 40m.

Solar (Heating and electricity)

-Experience with solar
- Reliability
- Need electricity back up
- Economic feasibility

- No base load (Day /night)

- Storage still a challenge

- Western part of country more suitable

- Theft

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Wind energy

- Status
- 4 sites identified and tested for one year (15m height)
- Site at Lutzville feasible
- Next test on 80m mast for one year.
- Neutralize carbon footprint.

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Hydro power

- Investigation (early stage)
- 300 to 400m potential
- Pumps /storage scheme

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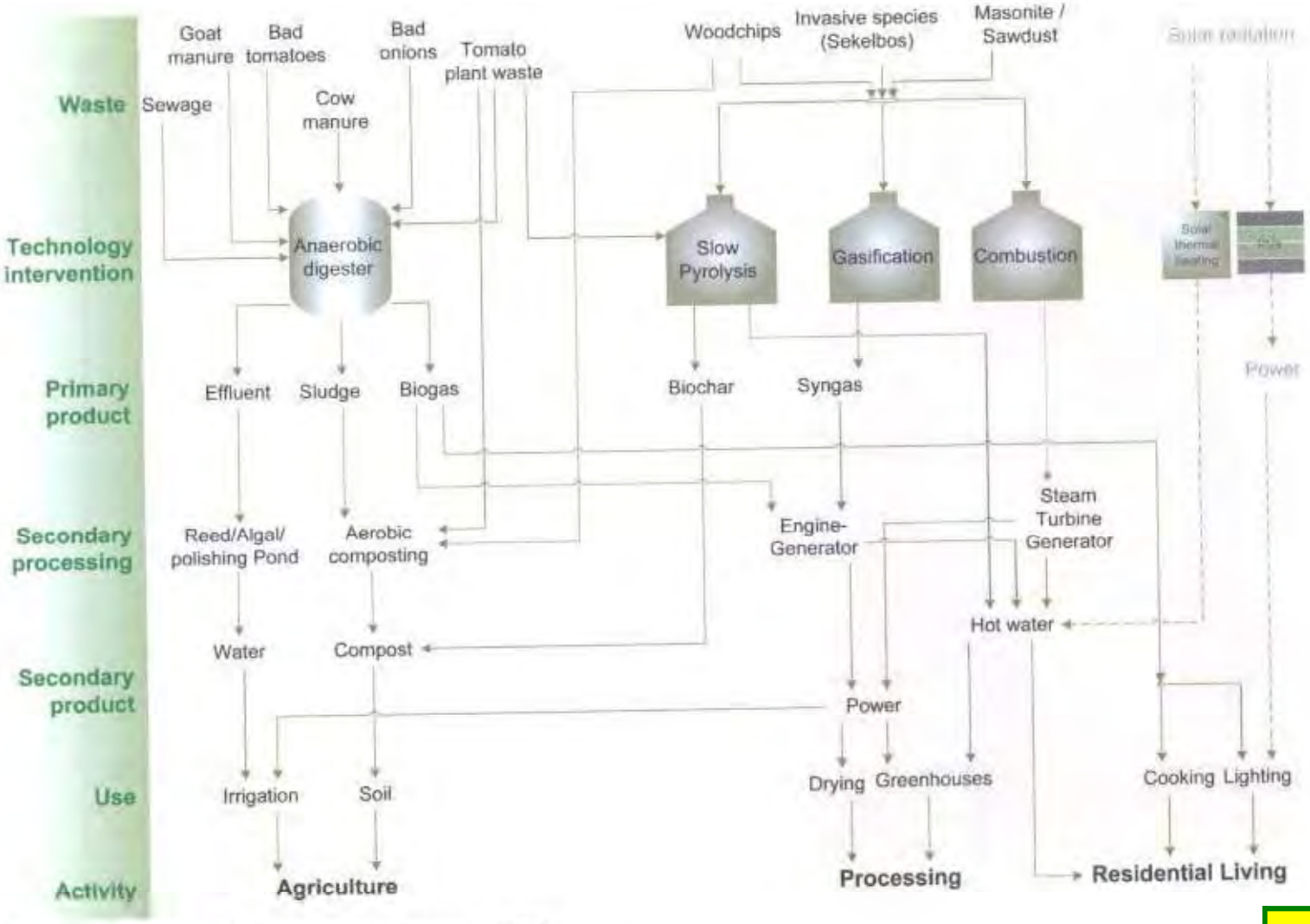

Figure 2 Proposed bioenergy pathways at ZZ2

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Energy optimisation strategy for ZZ2 farming operations

Thank you!

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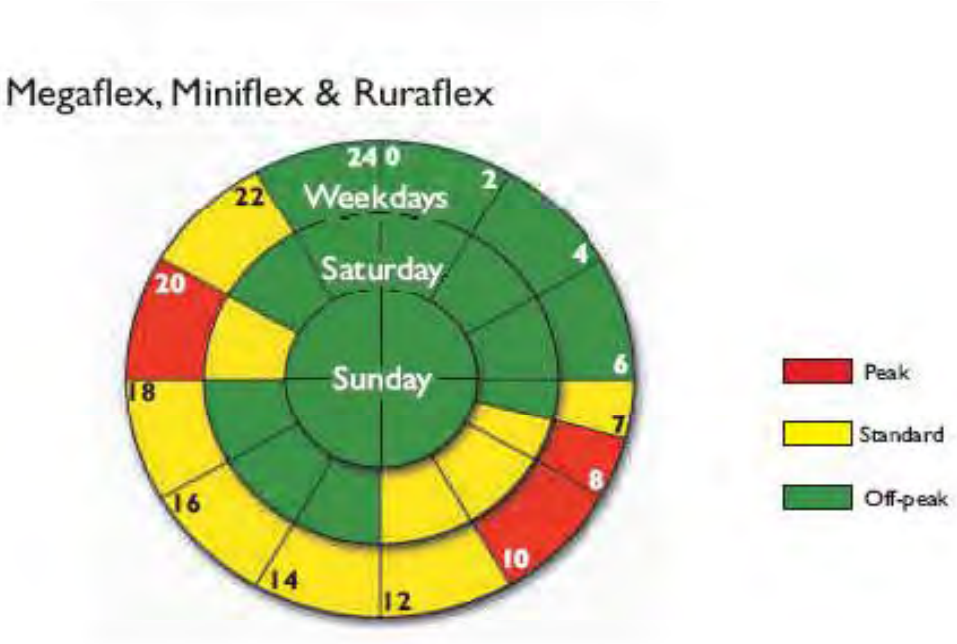
Ruraflex - Do not use peak time (Rooi tyd)

Reduce cycles
Increase delivery – larger pipes
Saving of R130 000 per season
Pays for larger pipes



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