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Renewable Energy Projects Overview
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- Presentation -

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Outline of the Presentation

- Introduction & Background
- Focus Areas
- Renewable Energy Projects Overview
- Project Case
- Conclusions

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Brief Introduction and Background

- Mintek, through MESU initiated renewable energy programme since 2005 when the national government approved the implementation of the energy efficiency (EE) strategy and SA Biofuels Strategy in 2007.
- The EE document geared towards the implementation of energy efficiency and cleaner production practices in the country.
- The Strategy sets a national target for energy efficiency improvement of 12% by 2015.
- Renewable Energy has been considered as one of EE practices.

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Main Focus: MESU's Radius Attention

Biomass resources	*Supply systems*	*Conversions*	*End products*
Oil Bearing Plants Agricultural crops and residues Woody biomass Industrial and municipal waste	Harvesting, Collection, Handling, And storage	Chemical (Transesterification	Transportation fuels (biodiesel, bioethanol)
		Physical chemical (extraction)	Solid fuels (wood pellets, charcoal)
		Biochemical (fermentation)	Heat Electricity
		Thermochemical (gasification)	High Value-Added chemicals (pharmaceuticals, polymers)
Resource assessment, mine water issues, mine rehabilitation, sustainability issues, etc.	***LED scans and implications***		

Bioproducts

Resource (water, energy) efficiency, LCA, bio-products beneficiation, LED scans, economic linkages, business plan development, **etc**.

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Renewable Energy Projects Overview

- In 2006, Mintek initiated a project on making use of biofuels crops as a form of mine rehabilitation. The project focused on the feasibility of using biofuels crops for the rehabilitation of mined land.

- In 2008-2010, through NRF, MINTEK and Szent Istvan University in Hungary initiated the renewable energy research programme. The research pertained to the overview of potential of biodiesel production for the use in South African Mining Industry.

- In 2008-2011, Mintek through AMD conducted a research project into the beneficiation of glycerol. The project involved investigating how to produce useful chemicals through oxidation of glycerol by using gold catalysis.

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Project Case: The Use of LCA to….

"The Use of LCA to evaluate sustainability of emerging industries: Biodiesel Production in Mpumalanga (MP)"

- **In 2011, Mintek through MESU, conducted a study on water efficiency for the production of biofuels. The study initiated to assess the sustainability of developing a medium-size biodiesel plant in a water-scarce province of Mpumalanga.**
- **In 2007, MPG anticipated to develop a medium-size biodiesel plant with a production target of 1080 kt/a.**
- **Considering that MP is in a semi-arid part of the country, falls into OWMA known to be water-scarce, it is assumed that such a development would exacerbate the situation in the already a water-stressed catchment.**

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The Use of Sustainability (Cont'd)

Sustainability Framework of Water Usage

The Use of Sustainability (Cont'd)

Classification of Biodiesel Plants by Production Capacity

Large-Scale Production (>60 000 tons/annum)

Crusher Integration → Raw and Oil Seed Production → Biodiesel Production → Marketing → Blending & Distribution → Petrol Company Integration

Medium-Scale Production (20 000-60 000 tons/annum)

Seed Production → Raw Oil Seed Production → Biodiesel Production → Marketing

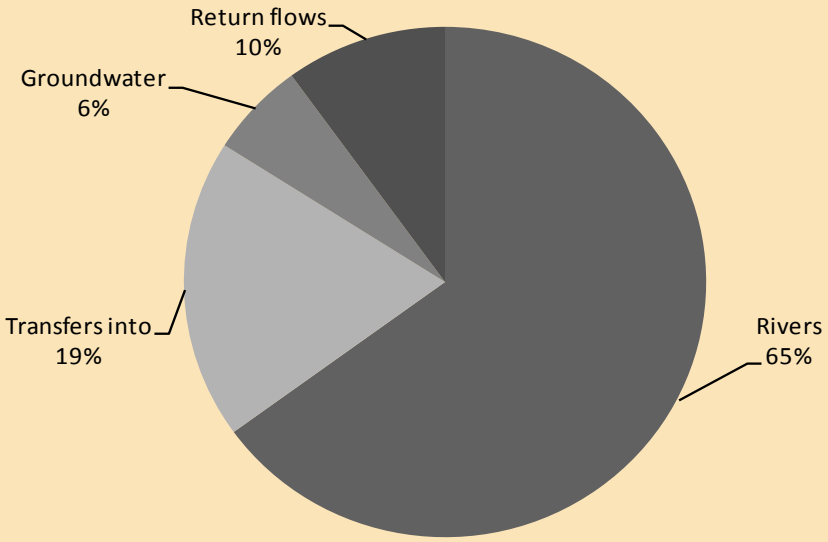
Small-Scale Production (<20 000 tons/annum)

Seed Production → Raw Oil Seed Production → Biodiesel Production → Marketing

The Use of Sustainability (Cont'd)




Source



Usage

Sector	Million m^3 per annum	Proportion
Rural	86	3.4%
Urban	203	8.0%
Afforestation	219	8.6%
Power Generation	220	8.7%
Mining & Industrial	217	8.5%
Transfer out	410	16.1%
Irrigation	1187	46.7%
Total	2542	100.0%

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The Use of Sustainability (Cont'd)

Mean Annual Precipitation of OWMA

Olifants Water Management Area	Mean Annual Precipitation (mm)
Upper	682
Upper Middle	621
Mountain	679
Lower Middle	550
Lower	631

The 1995 baseline and 2025 scenarios development

Water Demand Sector	WSAM 1995 (Mm^3)	2025 Lower Growth Scenario (Mm^3)	2025 Medium Growth Scenario (Mm^3)	2025 Higher Growth Scenario (Mm^3)
Rural	73.37	118.89	145.60	248.68
Urban	77.50	112.02	125.53	208.64
Irrigation	554.27	554.27	554.27	554.27
Mining	93.71	118.71	169.19	226.58
Afforestation	54.15	51.44	54.15	54.15
Total	853.00	955.33	1048.73	1292.32

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The Use of Sustainability (Cont'd)




Climatic Thresholds for potential SA biofuels crops

Crops	MAP (mm)	MMR (mm)	MAT (°C)	T Ave (°C)	T min (°C)	T max (°C)	Planting date	Growth days
Canola	500-1000	-	-	-	>5	<25	01 Jun	140
Sunflower	-	400-600	-	18-25 (Jan T>19)	-	-	-	125
Soybeans	-	550-700	-	20-30	-	-	01 Nov	150
Cassava	>1000	-	20-29	-	-	-	-	-
Sugar beet	550-1500	-	15-25	-	>-1	-	01 Aug	200
Sugarcane	850-1500	-	> 18	-	Jun-Jul >5	-	-	-
Jatropha	500-1500	-	11-28	-	-	-	-	-
Sorghum	-	450-650	-	20-25 (Jan T>21)	-	-	01 Nov	115

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The Use of Sustainability (Cont'd)

Conceptual Framework of the LCA Study

- Collect available LCA data
- Review available literature including OWMA water use and previous scenarios
- Collect feedstock production data

→ **Data collection**

- Work out water estimate for medium-size biodiesel plant (MBP)
- Work out limits for water use in MBP
- Correlate water use and biodiesel production

→ **Water estimates**

- Develop LCI for a 1080t/a MBP
- Consider assumptions
- Develop scenarios for water use and assess implications on the catchment and mining industry

→ **Model run**

- Scenarios patterns for water use, trends and implications on the catchment and mining industry
- Conclusions and recommendations

→ **Visualization**

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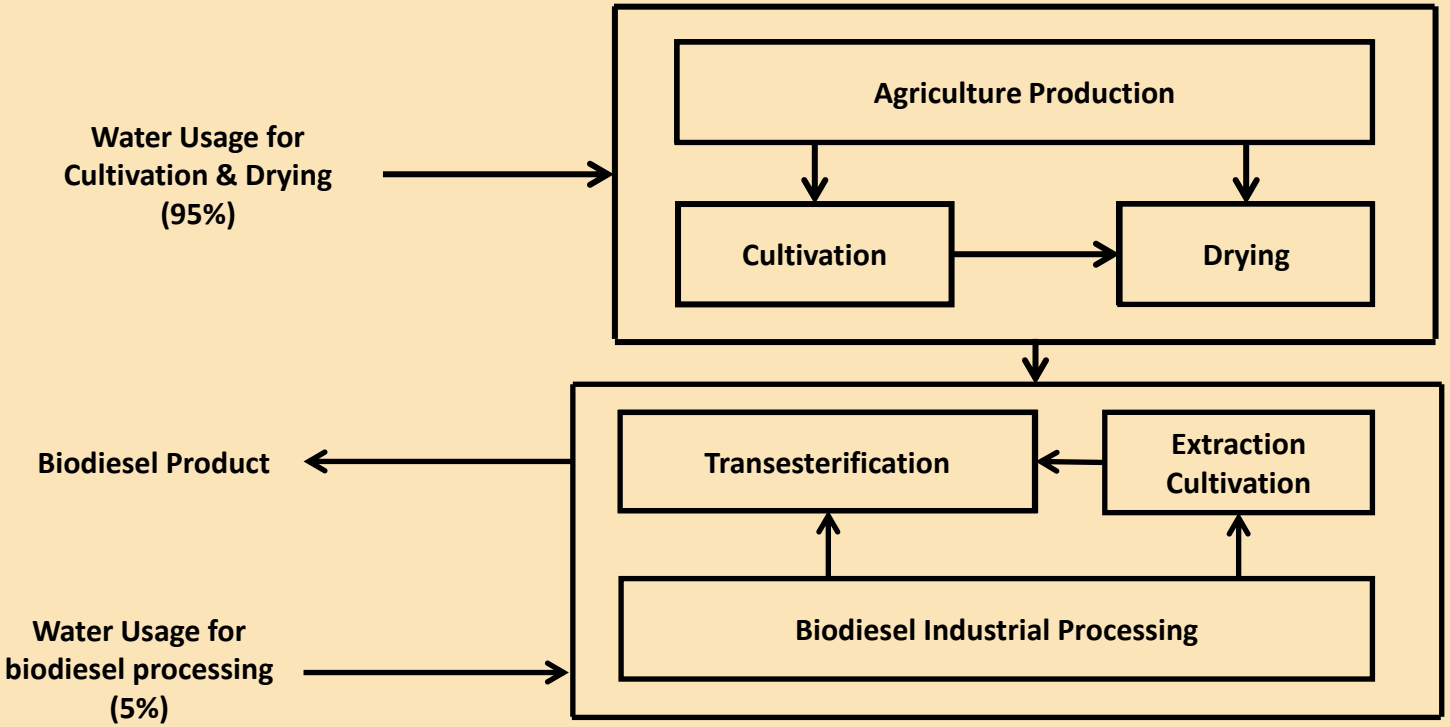
The Use of Sustainability (Cont'd)




Water Use Systems for Biodiesel Production



- The Life Cycle Inventory (LCI) data compiled for 1 t/a of biodiesel product was sourced from the literature (Brent et al., 2010) and used as a baseline to compute a 1 080 kt/a production target.

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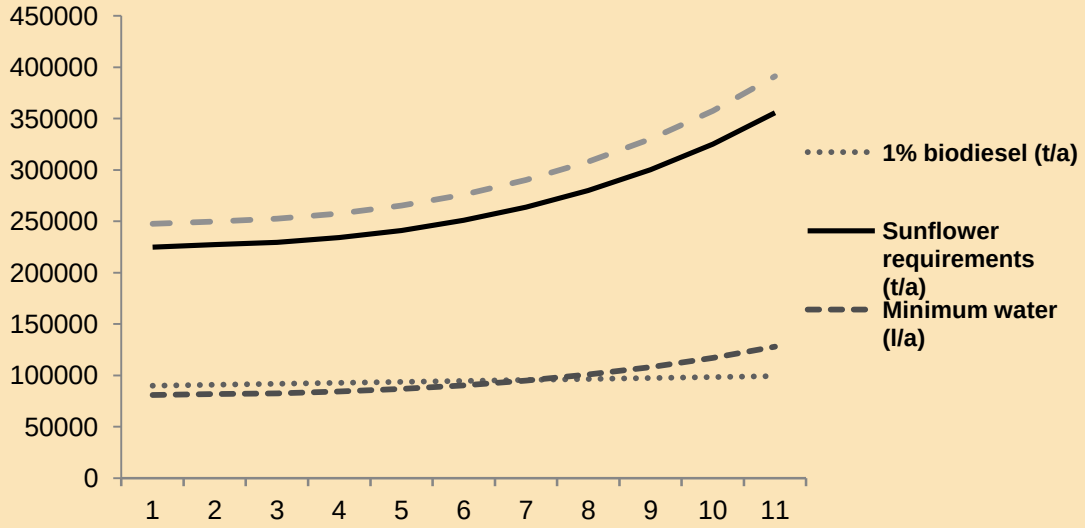
The Use of Sustainability (Cont'd)

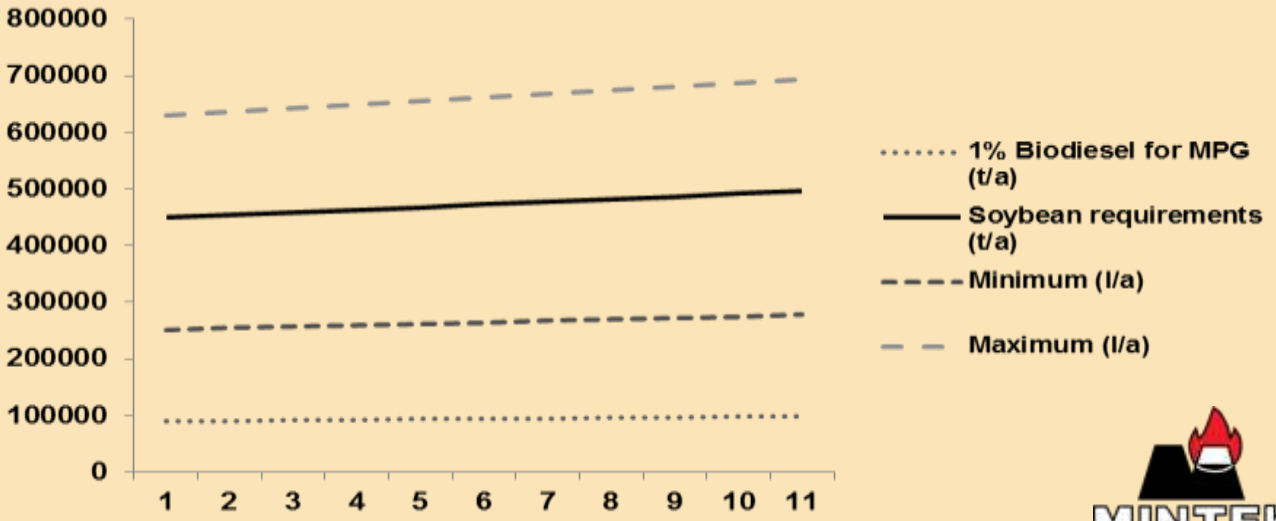



Scenario Development

Sunflower and Water Requirements



Soybeans and Water Requirements



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Conclusions

- Challenges associated to constructing this LCA due to limited data and non-existence of biodiesel operating plant in SA.
- This study should not be viewed as an answer to the challenge, but as an indicator highlighting how various factors must be taken into account.
- Socio-economic: with biodiesel industry is expected to grow in future, hence water management strategy must be designed and different role-players including farmers.
- Environmental: Local conditions on hydrology, moisture and other agro-climatic aspects may differ, hence assessment must be site-specific and local data must be used.
- A more extensive feasibility study of water use for biodiesel production must be conducted.

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Thank you