Viability and Requirements for Biodiesel Implementation in South Africa

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GLOBAL PERSPECTIVE

While global oilseed production is dominated by soya (50% of ~ 260 mtpa), in oil content palm oil lays stake to as a significant player. This bio-oil production should be seen in context of global transportation diesel which consumes just over 500 mtpa (see **Figure 1**).

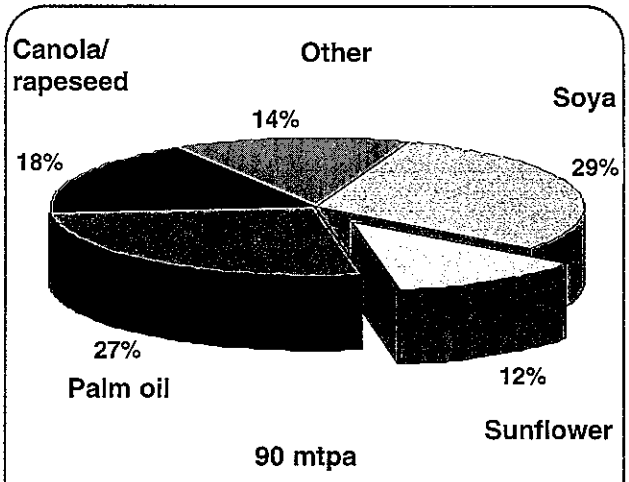


Figure 1. Global bio-oil production 2002 forecast

Biodiesel has a relatively short commercial history, but long "roots":

- The Romans used olive oil for illumination;
- Rudolf Diesel pioneered with groundnut oil in the 1890s.

Germany produced 300 mt in 1991, which is forecast (F) to exceed 1 mtpa this year. European Union (EU) targets vary from 6 to 12 mtpa over the next 10 to 20 years (see **Figure 2**).

South East Asia (SEA) has become the second largest producer driven by excess production of palm and coconut oil, and economic impact of importing crude oil.

Biodiesel generally has favourable properties for diesel (**Figure 3**). Besides being "renewable", it provides lubricity, is sulphur (S) free and low on aromatics, reduces particulate emissions and has modest impact on volatility and cetane value.

The downside is a slightly higher consumption (lower energy content), tendency to increase NOx emissions and pretty difficult to use at very low temperatures.

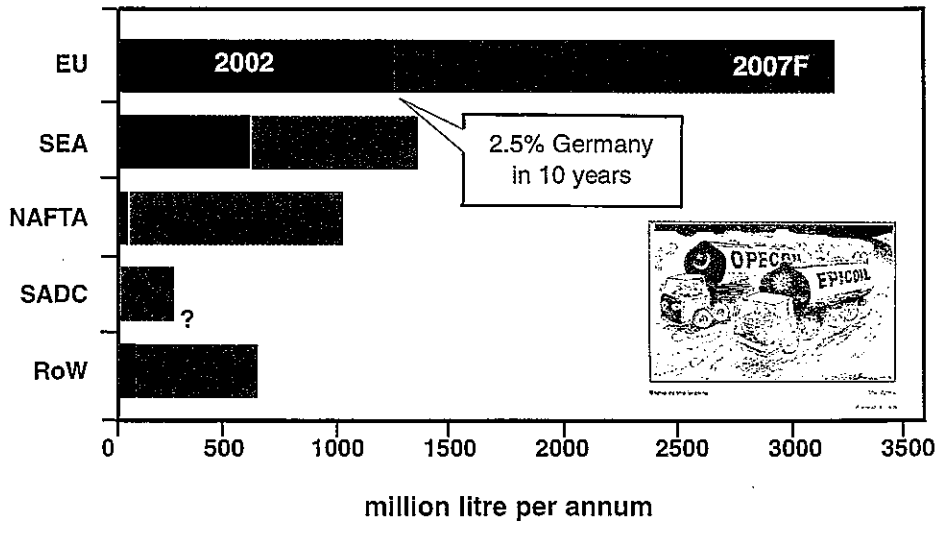


Figure 2. Global biodiesel: growing since 1991

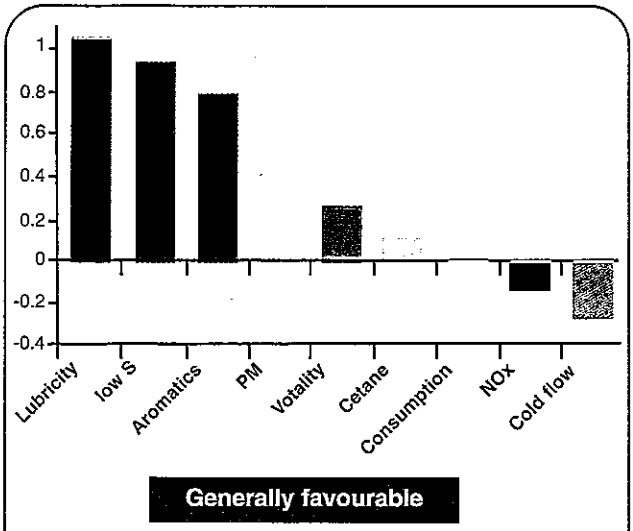


Figure 3. Attributes of biodiesel

The South Africa government's intentions are currently not clear (**Figure 4**).

What is important is that the national gain of a possible biodiesel industry be ascertained up front and agreed to by all players.

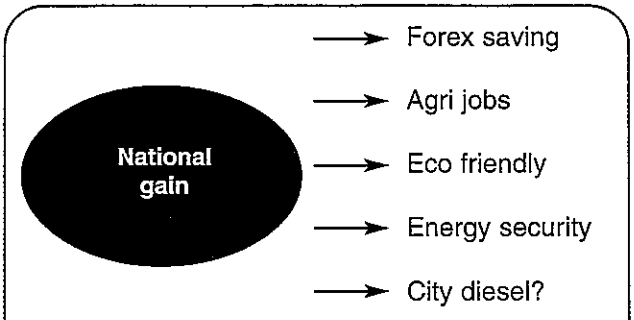


Figure 4. Government objectives with biodiesel?

Nationally South Africa currently exports diesel to mainly neighbouring countries from the coastal refineries.

Government intentions for recapitalising the taxi industry could be expected to increase diesel demand at the expense of petrol, but it is unclear when this will happen (**Figure 5**).

The biodiesel chain involves three key elements, each with their own key drivers (**Figure 6**).

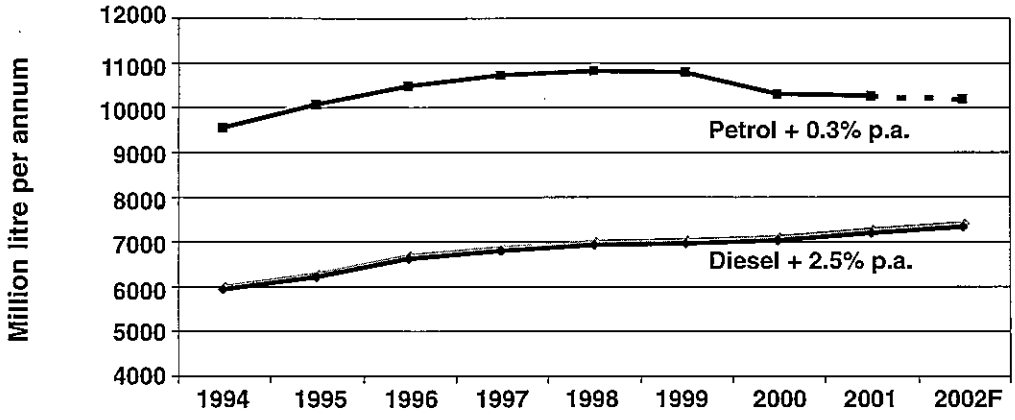


Figure 5. South Africa post 1994: Diesel is gaining ground

Note: Diesel includes diesel and illuminating paraffin (IP) - tax distortions in the past had led to some unfortunate use of IP in the diesel market. *(Source: Sapia data)*

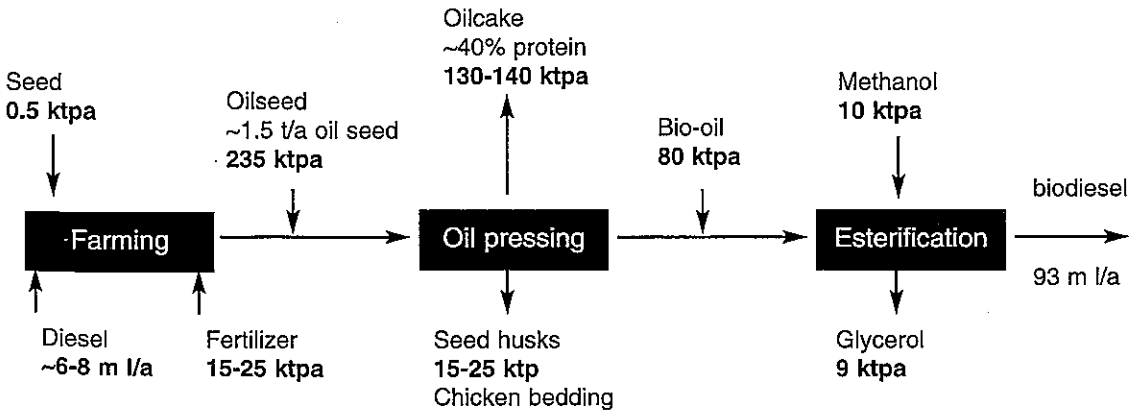


Figure 6. Conceptual biodiesel value chain

The above chain is based on a competitive world scale biodiesel plant - it does not preclude micro plants.

Note the parasitic fuel loss in biodiesel production is estimated as ~10%.

Figure 7 shows historical values for bulk sunflower seed (with 10% discount, in US$) against IBLC inland location diesel (0.05% S).

KEY ISSUES

FARMING

- "Food first" - excess to biodiesel concept; can combine/overlap.
- Require production commitment to down-stream fuel market.
- Rewarded cost needs to be sustainable.
- Consumer barrier: biodiesel cash cost below import parity OLSD (~R2.10/l).

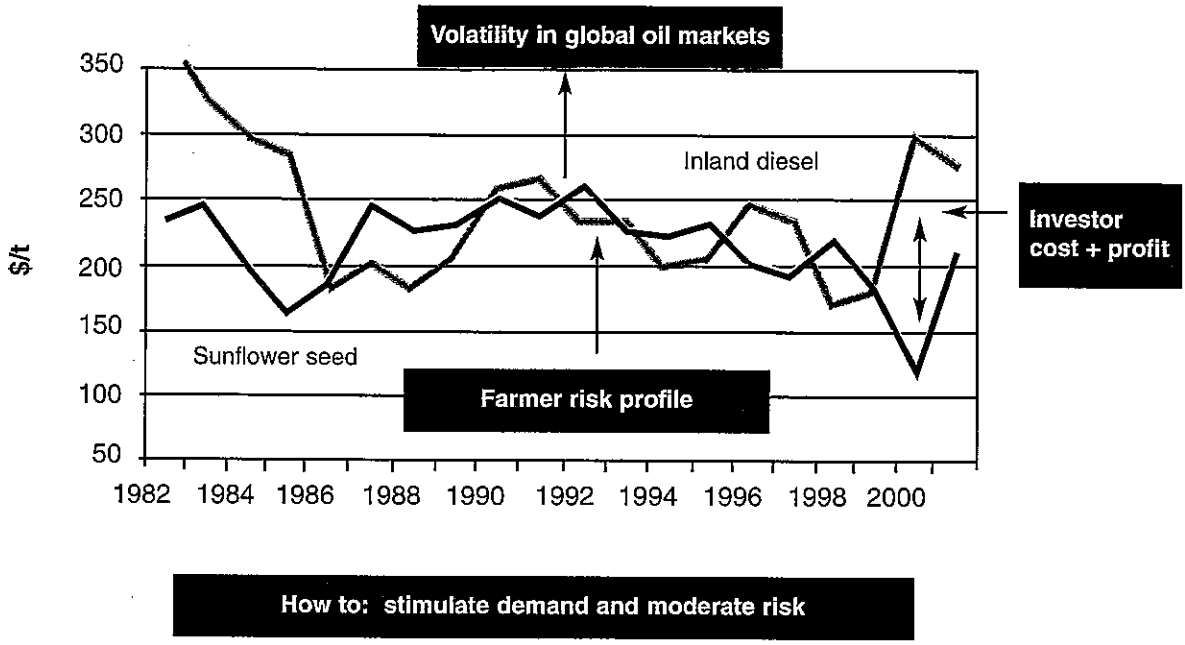


Figure 7. Getting industry to invest in biodiesel

Biodiesel can be produced from various bio-oils. From a business-risk point of view this would be preferred (**Figure 8**). Currently sunflowers are the dominant SA oil crop.

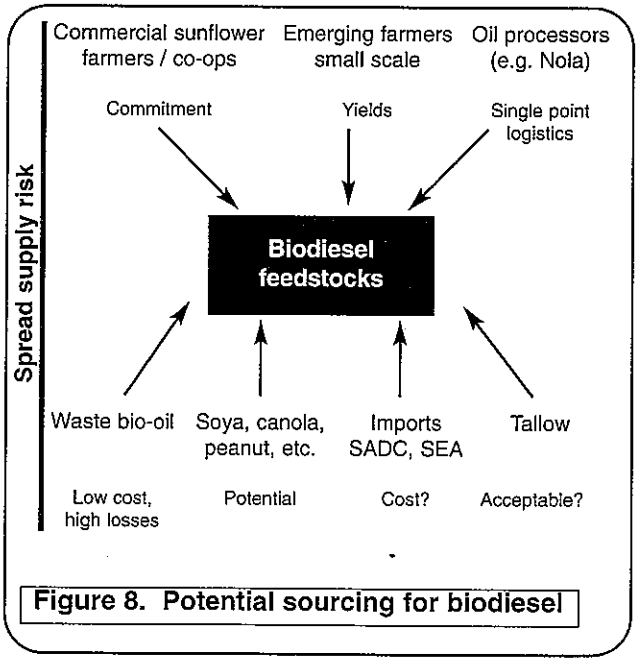


Figure 8. Potential sourcing for biodiesel

- Encourage resilience by promoting other oil crops such as soya, canola, etc.

Remarks:

- USLD = ultra low sulphur diesel;
- South Africa imports food oil;
- Emphasis on sustainable productivity;
- Soya appears interesting from oilcake protein value.

PROTEIN

- Monetising protein co-product value vital.
  - Recognising South Africa is protein deficient;
  - Oil pressing increases cake protein content.
- Encouraging regional use of protein.
  - Distributed pressing of oilseed;
  - (Livestock) farmers most to gain - limits?
- Export parity issue probably only beyond 500 ktpa biodiesel.

Remarks:

- Logistics are important!
- Big impact on potential bio-oil value.
- Limits of use of various oilcake?

BIODIESEL MARKETS

- Blending with mineral/synfuel diesel preferred.
  - 2% optimises lubricity;
  - 5 to 10% "accepted by OEMs";
  - 20% probably practical limit.
- "Neat" uses also possible.
  - On farms and dedicated fleets;
  - Off-grid power generation.
- Maximum benefit probably for city diesel blends.

Remarks:

- Proximity to refinery - logistic costs;
- Tax position on biodiesel?
- National or regional coverage;
- Storage/financing;
- Product price hedging.

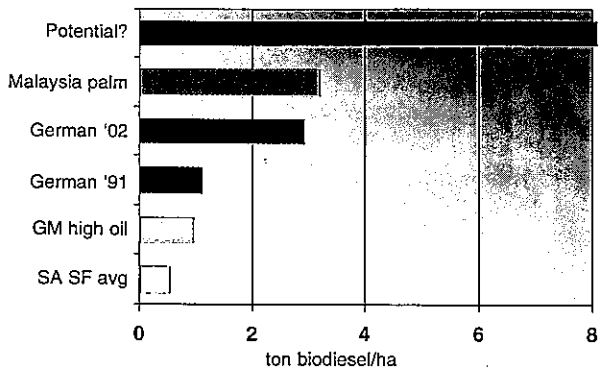
Fertilizer has a significant cost impact on sunflower as illustrated in the table below.

Fertilizer kg/ha	Dryland			Irrigated
N	36	48	54	140
P	18	24	27	30
K	9	12	13	50
R/ha	502	657	735	1859
Yield, t/ha	1.5	1.8	2.0	2.5
R/t	335	365	744	

Source: Glen Agri College

Fertilizer improves yield but does it pay for itself? Sunflower seems to perform "best" on marginal dry land?

Marginal production volumes appear available to get a biodiesel industry "off the ground", but long term sustainability is likely to require significant and ongoing yield improvements in agriculture (**Figure 9**).



Energy farming concept:

- Oil yield
- Genetic modification
- Fertilizer
- Pest control
- Simplified processing
- Off the shelf units
- Co-product credits
- Optimise logistics (share)

Figure 9. Improving yield gets cost down

In EU the concept of "energy farming" has been coined - research to improve the energy output of a given land with focus to maximise usable (renewable) energy output.

Although South Africa's agriculture productivity is climate constrained, the maize farmers are showing that they can produce more maize with less land! (**Figure 10**). The US average maize yield is 10.6 ton per hectare.

CONCLUSION

Sasol is supportive of studying the biodiesel opportunity. The interfaces between various players need to be carefully defined and agreed up-front, before any capital commitments are made. Emphasis on sound sustainable economics.

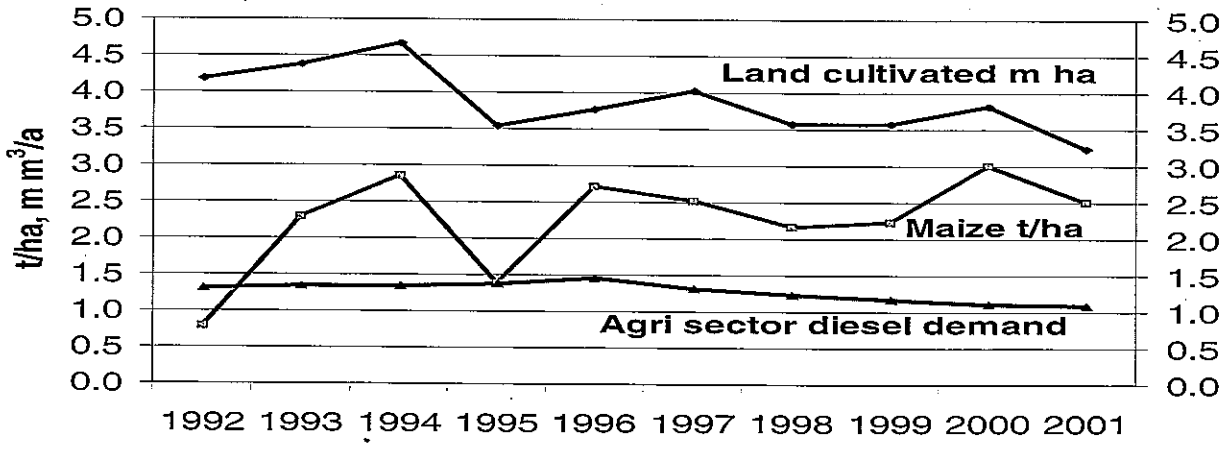


Figure 10. Farmers are getting it right; productivity is improving