Availability of agricultural biomass in the Free State Province of South Africa and feasibility of converting it to renewable energy.

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Different technologies can be applied to produce different forms of energies from different agricultural crops. The forms of energies or fuels vary from gases and liquids to solid matter. Different processes are required to produce these fuels and the fuels on their part can then be utilized for different applications. Applications may vary from road transport to domestic heat to electricity generation. Technologies that may be considered for application in the Free State are as follows:

- Biodiesel from a range of plant oils to be used for road transport or electricity
- Bio-ethanol from a number of crops high in sugar or starch or both to be used for road transport.
- Electricity from the burning of crop stubble or wood.
- Domestic heat from bio-ethanol gel, charcoal, wood pellets or biogas.

The feasibility of these different resources was analyzed in terms of availability, cost and expected outputs. It was found that the Free State has a limited amount of invasive trees. Unless species such as the Black wattle is grown under control, because the energy ration in the current situation is negative, it cannot be recommended as a sustainable manner to generate renewable energy. However it was found that the advantage of stubble over trees as an energy source is that the external energy input required to produce pellets, is less than the energy generated by the pellets, which makes this proposition sustainable. The number of feedlots and dairy farms make it feasible to produce biogas, at least for own energy consumption. It was also clear that charcoal presents a sustainable way of harvesting wood and to use it in domestic stoves as a replacement for paraffin in informal settlements. Biodiesel is technically very difficult to manufacture to correct standards. Due to the cost of mineral diesel and the price of oilseed crops (e.g. sunflower), the only way that biodiesel can be manufactured at reasonable cost is to utilize soybeans. The Free State is not regarded as an optimal province for soybean production (±18% of total SA production), unless new cultivars that are tolerant to eelworm can successfully be released.

Wherever bio-ethanol is implemented, governments have to provide incentives until the industry has grown to such a size that it can stand on its own feet. This is also the case in South Africa with its relative low agricultural potential. The utilization of bioethanol together with gelling agents to produce ethanol gel, however, has so many social advantages that it warrants further investigation. Ethanol gel is much safer to use than paraffin and has the potential to replace paraffin as a source of heat for cooking. Available land must therefore be utilized in an effective and efficient manner in order to produce surplus agricultural produce. This implies that the farm management practices in South Africa should be developed so that all farmers will be at a very high level.