

# South Africa's Biofuels Strategy: greenwashing agribusiness interests

## contents

Introduction

What are agrofuels?

South Africa's Biofuel Strategy

Key concerns

Inappropriate development intervention for rural poor

Blindly embracing the Green and Gene Revolutions

Agro-fuels = energy intensive industrial agriculture

Undermining food security

The ills of contract farming

The myth of 'under-utilised' land

Where will the water come from?

Conclusion

References

AFRICAN CENTRE FOR BIOSAFETY

Suite 3, 12 Clamart Street, Richmond, 2192 South Africa

<http://www.biosafetyafrica.net>



**“An energy crisis with no foreseeable end in sight is from now on an integral part of the global dynamic of capitalism”**

Jean Claude Debeir, Jean-Paul Deléage, and Daniel Hémerly. In the servitude of power: energy and civilization through the ages<sup>i</sup>

**“Industrial biofuels are not the fuels of the poor; they are the foods of the poor”**

Vandana Shiva. Food, forests and fuel: from false to real solutions for the climate change<sup>ii</sup>

## Introduction

In December 2007, South Africa's Department of Minerals and Energy published its Biofuels Industrial Strategy Paper ('Strategy').<sup>1</sup> The Strategy targets the growing of sugar cane and sugar beet for ethanol and sunflower, canola and soyabeans for biodiesel, on millions of hectares of so called 'under-utilised land' in the former homelands. The Strategy has proposed a 2% penetration level of biofuels in the national liquid fuel supply, or 400 million litres per annum in the next five years.

Although the stated aims of the Strategy include creating jobs in the agrofuels value chain and bridging the gap between the first and second economy, this 'pro poor speak' is a red herring. South Africa's agrofuels craze is fuelled by big capital, and embodies the entrenchment of an agribusiness model based on industrial agriculture, which includes the use of monocultures, genetically modified organisms and agrochemicals.

The Biofuels Strategy and concomitant planned investments in former homeland areas will have devastating consequences through the imposition of large-scale, mono-crop agriculture in these areas. Growing crops for fuel will exacerbate the pressure on land, soil and water. The expansion of croplands under current agri-business models of production will cause biodiversity loss, and impact critically on the quality and availability of water in fresh water eco-systems. In addition, it will distort markets, which will add to the crisis in food security and the poor will lose out.

In this briefing paper, we raise some critical concerns with the Biofuels Strategy. We have drawn heavily on the submission on the Draft Biofuels Industrial Strategy submitted by the African Centre for Biosafety, Earthlife Africa eThekweni Branch, GRAIN, SAFeAGE, Ekogaia and The Third World Investment Gateway Trust, to the Department of Minerals and Energy on 31 March 2007.<sup>2</sup>

### **Snap shot of global agrofuels production by top 2 agrofuel giants**

In 2007, 63 billion litres of bioethanol and 4 billion litres of biodiesel were produced globally. This constituted approximately 0.53% of the world's primary energy demand. Sugar from Brazil and maize from the United States currently dominates global ethanol production comprising approximately 80 per cent of global production. It is projected that agrofuels will meet 2.3 per cent of world road-transport fuel demand by 2015 and 3.2 percent by 2030.

i. Debeir, J.C., Deléage, J.P. and Hémerly, D, 1991. **In the servitude of power: energy and civilization through the ages.** Zed Books

ii. Vandana Shiva. 28 November 2007. **Food, forests and fuel: from false to real solutions for the climate change.** <http://www.agr.unipi.it/labrural/collaboratori/gianluca-brunori/documenti-segnalati/food-forest-and-biofuels-from-false-to-real-solutions-for-climate-change-v-shiva.pdf>

## What are agrofuels?

*We can't call this a 'bio-fuels program'. We certainly can't call it a 'bio-diesel program'. Such phrases use the prefix 'bio' to subtly imply that the energy in question comes from 'life' in general. This is illegitimate and manipulative. We need to find a term in every language that describes the situation more accurately, a term like agro-fuel. This term refers specifically to energy created from plant products grown through agriculture.*

MST, Via Campesina<sup>iii</sup>

The term “agrofuels” has been coined by social movements in Latin America to describe the use of food and oil crops produced in large-scale plantation style systems. These crops are processed and blended with petroleum and used as an energy source, primarily for motor vehicles. Biofuels on the other hand, describe the traditional use of wood, dung and other biological materials for fuel.

Bioethanol is produced predominantly from sugar cane and maize (corn) and, to a far lesser degree, from wheat, sugar beet and cassava. Bioethanol is primarily used as a motor fuel and fuel additive. Internationally biodiesel is mainly extracted from rapeseed (also known as canola) but also from oil palm, soybean and *Jatropha*.<sup>3</sup>

## South Africa's Biofuel Strategy

In 2004 the Southern African Development Community (SADC) initiated a process, which encouraged all member states to examine the feasibility of the production of biofuels in the SADC region. The first SADC country to respond to this call was South Africa and in December 2005, the South African Cabinet approved:

- The development of an industrial strategy targeted at creating jobs in the energy crops and biofuels value chain (acting as a bridge from the second economy to the first economy);
- The establishment of a Biofuels Task Team (comprising national departments, state entities and private sector consultants) to develop the industrial strategy; and
- The authorisation of the Biofuels Task Team to engage with interested stakeholders in the first economy about establishing a modest biofuel industry, and to report to cabinet about the financial implications involved.

The impetus for the establishment of a biofuels industry in South Africa also came from industry lobbyists under the banner of the Southern African Biofuels Association (SABA).

Consequently, the South African government published a feasibility report and a draft Biofuels Industrial Strategy in 2006, which proposed the establishment of a mandatory bioethanol target of 8% and biodiesel blend of 2%, to be derived mainly from maize, although sugarcane also featured prominently.

The draft Strategy was formulated without any public consultation and elicited swift condemnation for this shortcoming from civil society. At the only public meeting held in the Eastern Cape, rural communities there were informed that a project was already underway to clear large tracts of communal land to make way for an oilseed rape mono-crop that would be processed into agrofuels for export to the European Union (EU).<sup>4</sup> In a public statement, communities and NGOs castigated the Strategy as being preoccupied with economic instruments designed to facilitate large corporate involvement with trickle down economic benefits to the poor. They also viewed the Strategy as heralding an intervention that would have disastrous socio-economic and environmental consequences arising from expansion of industrial agriculture into new areas.<sup>5</sup>

iii. Statement by MST (Movimento dos Trabalhadores Rurais Sem Terra), Via Campesina, [www.mst.org.br](http://www.mst.org.br)

Early in August 2007, the Governor of the Reserve Bank, Tito Mboweni questioned the wisdom of using maize – a staple food in South Africa – as a source of bioethanol. Mboweni, pointed to global trends where the price of maize has been pushed up and indicated that the use of maize in ethanol production had not been properly thought through.<sup>6</sup> Mboweni's statements delivered a significant blow to South Africa's plans to use maize as an agrofuels feedstock. During December 2007 the final Biofuels Strategy Paper was published. It specifically excludes the use of maize as an agrofuels feedstock, as well as *Jatropha*.

## Key concerns

**"We are out to make millionaires out of our small industries (farmers)"**

Masiphula Mbongwa, National Department of Agriculture<sup>iv</sup>

### Inappropriate development intervention for rural poor

The Biofuels Strategy seeks to promote industrial production of food crops for fuel, as a key driver for rural development, especially in the former homelands. The logic of the Strategy is that agrofuels production will provide market access for the rural poor that would otherwise not exist. In this regard the Biofuels Strategy paper states that:

*The 2% biofuels scenario will create 25 000 jobs. ... This will reduce unemployment by 0,6% (mainly in rural areas); boost economic growth by 0.05% (or 2.5% of the AsgiSA target increase); achieve a balance of payments saving of R1.7 billion; and a greenhouse gas emissions saving of R100 million per annum. To reach this percentage for biofuels penetration, will require investments of about R4 billion over the 5 year period. ... The jobs-to-investment ratio is about 100 times higher than for crude oil refineries.*

These interventions are simplistic and appear to have been conjured up within a political and economic vacuum, devoid of class or power struggles, or the influence of national and international capital. The Strategy also ignores the problems associated with the country's land reform project and the difficulties experienced by land reform beneficiaries. The state has been unable to date, to support processes and programmes aimed at ensuring that rural communities are able to compete and participate successfully in a competitive commodities market. The ruling party (African National Congress) has publicly stated that the "greatest challenge and opportunity in rural development comes from the empowerment of women."<sup>7</sup> Yet South Africa's land reform programme is showing that even the most progressive legislation with regard to woman's rights does not always result in the desired outcomes.<sup>8</sup> It is highly unlikely that agrarian interventions such as agrofuels production will improve the lot of rural women. It is interesting to note that the Biofuels Strategy does not even allude to the gender discourse. Nevertheless, the FAO has cautioned that "rapid increases in the large-scale production of liquid biofuels in developing countries could exacerbate the marginalisation of women in rural areas threatening their livelihoods" and that "gender inequalities are likely to become more marked and women's vulnerability to hunger and poverty further exacerbated"<sup>9</sup> with the introduction of agrofuels.

Although South Africa has a unique history with regard to its rural economy, any agricultural policies or interventions must still be evaluated within a global context. The nature of world agriculture changed dramatically in the latter half of the 20th century, not only in terms of global integration but also the manner in which production takes place. This has had significant social, economic and environmental impacts on rural communities and has undermined traditional farming systems, traditional crops, social

iv. South African Government Information. **New business model to benefit landowners**. 17 March 2008. Department of Agriculture, Eastern Cape Provincial Government.

relations, and the cultural practices associated with agricultural production. Centuries of colonialism and decades of apartheid rule have virtually destroyed any indigenous agricultural systems. This process of cultural destruction has largely been continued by post-apartheid policies despite a rhetoric, which seeks to celebrate indigenous knowledge systems. The Biofuels Strategy is typical of just such a policy, to the extent that sugar beet, a crop largely unknown in South Africa is being promoted as a crop for rural communities.

### **Dark side of Brazil's agrofuels 'success'**

The much-lauded success of Brazil's agrofuels production from sugar cane hides a darker side. Much of this has to do with the working conditions of cane cutters, most of whom are migrant workers, and who are faced with low pay, long working hours, inadequate safety gear, an absence of sanitary and health services, and exposure to pesticides and other toxic chemicals.<sup>10</sup> It is believed that from 2002 to 2005 some "312 workers in the sugar cane and ethanol industries died on the job, and 82,995 suffered accidents while working in cane fields and ethanol plants."<sup>11</sup> Seeking to defend the growing criticism of Brazil's bioethanol programme Brazil's president Luiz Inacio Lula da Silva recently commented that although sugar cane labor was tough "it's not tougher than labor in coal mines, which was the basis for the development of Europe."<sup>12</sup> While this does not suggest that South African workers do or may face similar working conditions, it does demand a more holistic appraisal of what constitutes a 'biofuels success story', and at whose expense this is being achieved.

### **Blindly embracing the Green and Gene Revolutions**

The Biofuels Strategy demonstrates scant understanding of the pitfalls inherent in embracing the Green and Gene revolutions. These pitfalls include: the removal of productive resources from the control of farmers by the introduction of corporate owned engineered seeds, chemical and mechanical inputs; and displacing biodiversity, seed saving and local knowledge and agro-ecological systems.<sup>13</sup>

The genetic engineering of food crops has, despite corporate arguments to the contrary, done little to produce either greater quantities, healthier, or more sustainable food. Nevertheless, GE (genetically engineered) crops are now being considered as the solution to the world's energy crisis. Multi-national agrochemical company, Syngenta, is developing a GE maize variety that "contains one of the enzymes needed to convert corn starch into sugar before it can be fermented into ethanol." Biotechnology companies are also seeking to increase total starch content and to reduce the lignin content in crops to facilitate greater viability in the agrofuels sector.<sup>14</sup> It is not surprising that Monsanto South Africa, one of the world's key biotech companies, is a member of SABA (South African Biofuels Association).

As made clear in the submission on the Draft Biofuels Industrial Strategy by Earthlife Africa eThekweni Branch, African Centre for Biosafety, GRAIN, SAFeAGE, Ekogaia, The Third World Investment Gateway Trust to the Department of Minerals and Energy, 31 March 2007, current scientific knowledge and understanding of the ecological impacts of GE crops is inadequate.<sup>15</sup> More scientifically rigorous ecological research on their environmental risks is critical, a process that has yet to get underway in South Africa. There are major health and environmental concerns over the use of glyphosate a key component in herbicides applied on GE crops. These and more specific health risks posed by GE crops need further research. SA has approved GE organisms that use old technologies with antibiotic resistant gene markers. These have been banned in many countries in the world. Scientists have warned that the continued use of viral promoters pose unacceptable health and environmental risks. An independent study by French scientists has confirmed that the data submitted in support of market approval for GM maize MON 863 produced by Monsanto gives rise to serious concerns regarding its food safety. This study by CRIIGEN (Committee for Independent Research and Genetic Engineering, based at the University of Caen, France) is said to be the first independent evaluation of data submitted by a



biotechnology company for regulatory approval of a GE organism for food/feed, which is published in a peer-reviewed scientific journal.<sup>16</sup>

There are very few studies that comprehensively investigate the medium to long-term socio-economic impacts of GE crops. Of particular concern are resource-poor farmers who sign licensing agreements for the use of patented GM crops, making it illegal to save and exchange the seeds. Already Monsanto Corporation, which owns 95 per cent of the global GM crop market, has successfully sued farmers for patent infringement. Monsanto has conceived of an ingenious smallholders' programme known as the 'Seeds of Hope Campaign', which targets the 'bottom of the pyramid' – very low-income consumers who have substantial purchasing power as a group. During the 1990s, Monsanto South Africa introduced 'Combi-Packs' – boxes of materials designed specifically for smallholder farmers, having access to anything from ¼ - 5 hectares of land in the Eastern Cape. The boxes contain a package of hybrid maize seed, some fertilizer, some herbicide, and pictogram instructions for illiterate users. The Seeds of Hope Campaign in the Eastern Cape was subsidised with public funds, which enabled Monsanto to penetrate extremely impoverished communities by introducing a Green Revolution type package as an important precursor to the introduction of its GE maize seeds. Monsanto was ably assisted by Bayer Cropscience, amongst other players.<sup>17</sup> In KwaZulu-Natal public funds were also utilised to provide cotton farmers with similar packages.<sup>18</sup>

### Agrofuels = energy intensive industrial agriculture

The Strategy emphasises the need for synergy between the commercial and emerging agricultural sectors. It is highly likely that an energy intensive agricultural model will be adopted in the production of agrofuels. South Africa has long since emulated the modernisation paradigm (mechanisation and industrialisation) that characterize the energy-intensive farming models of Europe and the United States. Under these models, agriculture has been transformed from an energy producer (sugars and cellulose for human and animal consumption) into an energy consumer due to the industrialisation of agriculture and the consumption of energy in the form of oil-based agrochemicals, fertilisers, mechanisation and so forth.

A key consumer of energy is the livestock (feedlot) industry, which requires thirty-five calories of fossil fuel to produce a calorie of beef and sixty-eight calories of fossil fuel to produce one calorie of pork.<sup>19</sup> It is also a model that the rest of the world is rapidly adopting. Already Mexico feeds 45 per cent of its grain to livestock, Egypt some 31 per cent, and China around 26 per cent and rising rapidly. Currently, two-thirds of South African beef is raised in feedlots. It is uncertain as to what proportion of national grain production is consumed by this sector. All of these countries, however, have poor people who could use the grain as food, but can't afford it.<sup>20</sup>



<http://i.treehugger.com/images/2007/10/24/Estill%20Biofuels.jpg>  
Photo credit: Dervaes Institute



[http://i76.photobucket.com/albums/j14/biopact/biofuels\\_forum\\_sugarcane.jpg](http://i76.photobucket.com/albums/j14/biopact/biofuels_forum_sugarcane.jpg)

Inorganic fertilisers contribute substantially to the energy intensiveness of agricultural products. The production of ammonia, for example, is an extremely energy intensive process, requiring between 1 090 m<sup>3</sup> to 1 250 m<sup>3</sup> of natural gas to produce 1 metric ton of anhydrous ammonia (used as a fertilizer).<sup>21</sup> The table below illustrates the total energy incorporated in a kilogram of fertiliser. Free nitrogen undergoes a chemical reaction, called acidification, which contributes to acid rain. One of the compounds produced by acidification is nitrous oxide, which aggravates the greenhouse effect.<sup>22</sup>

**Table 1: Energy requirements to produce, package, transport, and apply inorganic fertilisers.<sup>23</sup>**

	Energy requirement (world average) kj/kg <sup>24</sup>		
	Nitrogen	Phosphate	Potash
Produce	6 9530	7 700	6 400
Package	2 600	2 600	1 800
Transport	4 500	5 700	4 600
Apply	1 600	1 500	1 000
Total	78 230	17 500	13 800

## Undermining food security

*The relations of food security are embedded in the state system, where food security has long been a precondition of political legitimacy. Central to the development era, food security considerations shaped national initiatives such as the green revolution, and the content of multilateral institutional relations, where agriculture was exempt from the GATT. As the development era has metamorphosed into the era of corporate globalization, food security has been redefined, and institutionalized, in the WTO as an inter-nationally managed market relation. As such, it challenges agricultural self-sufficiency in the global South, where 30-70 percent of the labor force is agricultural, as opposed to 4 percent in the global North.*

Philip McMichael. Global development and the corporate food regime<sup>v</sup>

Much of the recent critique of agrofuels has focused on the increase in food prices around the world, the resultant food riots in many countries and the impact on the world's poor. Such price increases are not surprising because the energy and agriculture markets are closely linked. Agriculture both consumes and increasingly produces energy.<sup>25</sup> According to the FAO, because the energy markets are much larger than agriculture markets, movements in the energy market affect agriculture more than vice versa. The rising oil prices have thus contributed significantly to the recent rise in agricultural commodity prices, in particular from energy-intensive inputs such as fertiliser and mechanisation.<sup>26</sup>

The Biofuels Strategy also ignores the fact that per capita agricultural production in South Africa has been in decline for several decades (see table overleaf). Indeed, South Africa is increasingly becoming reliant on food imports to meet local demand. This is due to the growing liberalisation of South Africa's trade regime and the decline in direct state support for farmers.

v. McMichael, P. **Global development and the corporate food regime**. Prepared for Symposium on New Directions in the Sociology of Global Development, XI World Congress of Rural Sociology, Trondheim. July 2004. [www.corporate-accountability.org/eng/documents/2004/corporate\\_food\\_regime.pdf](http://www.corporate-accountability.org/eng/documents/2004/corporate_food_regime.pdf)



**Table 2: Agricultural Production and Yields<sup>27</sup>**

Agricultural Production and Yields	South Africa	Sub-Saharan Africa	World
Cereals, 1999-2001			
Average production (000 metric tons)	11,123	87,715	2,075,387
Percent change since 1979-81	-22%	54%	32%
Per capita production (tons per person)	257	135	343
Percent change since 1979-81	-47%	-11%	-4%
Average crop yield (kg per ha)	2,334	1,221	3,096
Percent change since 1979-81	11%	9%	41%
Variation in domestic cereal production, 1992-2001 (average percent variation from mean)	24.2%	6.5%	3.5%
Net cereal imports & food aid as % of total consumption, 1998-2000	5.8%	13.5%	-
Food aid as a percent of total imports, 1998-2000	-	19.9%	-

There are a host of additional factors that also need to be considered. Urbanisation in South Africa and in most other countries of the South is increasing rapidly. Not only does this put increasing pressure on urban food supply and transport infrastructure but it also leads to a decrease in food production, even if only previously produced at a subsistence level. World food demand is expected to nearly double by 2050 and food security at local, national and international level could be disrupted by extreme weather conditions induced by climate change. It is therefore suggested that by 2030 a number of countries, especially in sub-Saharan Africa, will have to “confront starvation problems.”<sup>28</sup> While many of the localised poor in the world will experience food shortages, the globalised elite, including those residing in the South, will be increasing their demand for meat, and consequently demand for cereals, thus increasing the energy intensiveness of their diet.<sup>29</sup>

Physical limits to arable lands will also increase the competition between food crops and agrofuels. In a liberalised trading environment, demand emanating from the North will invariably shape the dynamic of agriculture in the South. As countries of the North are generally self sufficient in the production of food, it is the demand for agrofuels that will increasingly be met by farmers in the South, thus leading to a possible decline in local food production. According to the Deputy Director General of the Natural Resources Management and Environment Department of the FAO:

*In South Asia and North Africa, almost all arable lands are already under cultivation, and a significant share of available water resources are devoted to agriculture (53% in North Africa and the Near East, about 35% for South Asia). This share will increase in the future; estimated share of water resources that will be put towards agriculture in 2030 are 60% for North Africa and the Near East, and 40% for South Asia. These two regions will be forced to import cereals and other staples in order to feed their populations. As a rule, the strongest demand for water arises from the agricultural sector, and the FAO sees this demand growing until about 2030. Will natural resources, namely water and land, become constraints on world agricultural production?<sup>30</sup>*



## The ills of contract farming

The Biofuels Strategy “envisages that contracts will be signed between farmers’ cooperatives and individual biofuels producers” which will “facilitate sourcing of funding from relevant funding institutions such as the Land Bank and guarantee feedstock supply for the duration of the contract.” The experience of cotton farmers on the Makhathini Flats in northern KwaZulu-Natal is instructive. It demonstrates how poor, under resourced farmers can be locked into debt and dependence through growing a single cash crop in a limited market, facilitated through formal loans. When GE cotton was first introduced on the Makhathini Flats in 1998, the Land Bank extended loans worth R8 million to small-scale cotton farmers in the first growing season. Due to a variety of institutional and climatic constraints, farmers were unable to meet their repayment schedules, resulting in the Land Bank foreclosing 1447 out of the 1648 loans. By 2004, when the Land Bank completely ceased lending to farmers in the Makhathini Flats, the outstanding defaulted loans stood at a whopping R22.7 million.<sup>31</sup>

## The myth of ‘under-utilised land’

The Biofuels Strategy targets several million hectares of marginal land in the former homelands, which it calls “under-utilised”. This land currently performs many functions including providing diverse agricultural, cultural, medicinal and housing related products to rural communities, providing ‘environmental services’ (such as water catchments, water cleansing, flood attenuation) and providing habitats for multiple species. The Strategy is thus extremely disrespectful and dismissive of indigenous and traditional utilisation of land and land practices, as well as the traditional stewards of the land.

The FAO has recently stressed that:

*The growing global demand for liquid biofuels, combined with increased land requirements, could put pressure on so-called “marginal” lands, which provide key subsistence functions to the rural poor and ... The conversion of these lands to plantations for biofuels production “might cause the partial or total displacement of women’s agricultural activities towards increasingly marginal lands,” with negative consequences for women’s ability to provide food, according to the report.*<sup>32</sup>



[http://www.invest-in-kenya.com/images/jatropha\\_plant.jpg](http://www.invest-in-kenya.com/images/jatropha_plant.jpg)



[http://naturalpatriot.org/wp-content/uploads/2007/09/jatropha\\_seeds.jpg](http://naturalpatriot.org/wp-content/uploads/2007/09/jatropha_seeds.jpg)



## Where will the water come from?

It is expected that by 2050 there will be water shortages in more than 70 countries, including 35 in Africa.<sup>33</sup> Currently at least 11 African countries face a water scarcity,<sup>34</sup> with South Africa being considered as water stressed. It is estimated that by 2020 between 120 million to 1.2 billion in Asia, 75 to 250 million in Africa, 12 to 81 million in Latin America may be affected from water stress and water shortages.<sup>35</sup> By 2050 the total may have increased to more than 2.8 billion people.<sup>36</sup> Agriculture, both rainfed and irrigated, is the largest consumer of water with "irrigation using more than two-thirds of the world's available freshwater resources". Agriculture uses 90 per cent of all "freshwater that is economically accessible."<sup>37</sup> The development of an agrofuels industry or a shift from food production to agrofuel production will have direct implications for water resources.

The Strategy paper acknowledges that much of South Africa is water stressed and that there are "severe limitations on the availability of additional water for allocation to new uses."<sup>38</sup> The paper also notes that irrigated agriculture already uses about 60 per cent of the total available resource and that irrigated biofuels will have to find its water from existing allocations, or compete for scarce new water. The most important threat to water, therefore, lies in competition with other uses.<sup>39</sup>

However, other than noting the introduction of Water Allocation Reform by the Department of Water Affairs and Forestry there is little else in the Strategy which proffers any potential alternative to water stressed regions, where water will be sourced, or even considers the impact of climate change on water resources.

Changes in the world's climate will certainly impact on water resources and water availability for human consumption, agriculture and energy generation. This will be due to "changes in precipitation patterns, increasing salinity of groundwater due to increases in sea level and over-exploitation, glaciers melting (and) decreasing river flows."<sup>40</sup> It is highly likely that there will be increases in the frequency of droughts and floods all of which will have an affect on crop production. It is projected that:

*there could be a possible reduction in yields in agriculture of: 50% by 2020 in some African countries, 30% by 2050 in Central and South Asia, 30% by 2080 in Latin America. In Africa, crop net revenues could fall by as much as 90% by 2100, with small-scale farmers being the most affected. This would further adversely affect food security and exacerbate malnutrition.*<sup>41</sup>

## Conclusion

South Africa requires policies and programmes geared towards the establishment of a genuine ecologically sustainable society. What is called for is the "reorganisation of industry, energy, transport, mass consumption patterns, and the massive transfer of clean technology to the Third World." Only a "far-reaching social revolution aimed at replacing the anti-environmental capitalist system can pull the planet back from the brink of disaster."<sup>42</sup>

However, such a solution is highly unlikely under the present conditions where there is a total lack of political consciousness within the global populace and where consumerism runs rampant. Mitigation measures would thus include the adoption of technologies and lifestyle changes aimed at significantly reducing energy use and consumption. These include the following:<sup>43</sup>

- Energy efficient transport systems
- Switching to renewable sources of energy
- Changing consumption patterns – lifestyle changes
- Organic and localised urban agriculture – to enhance food security
- Eco-village type of residential development
- Energy efficient buildings – construction methods and materials.

## References

1. Department of Minerals and Energy. December 2007. **Biofuels Industrial Strategy of the Republic of South Africa**. DME.
2. Submission on the Draft Biofuels Industrial Strategy by: Earthlife Africa eThekweni Branch, African Centre for Biosafety, GRAIN, SAFeAGE, Ekogaia, The Third World Investment Gateway Trust to the Department of Minerals and Energy, 31 March 2007. [www.biosafetyafrica.net](http://www.biosafetyafrica.net)
3. Food and Agriculture Organisation of the United Nations (FAO). 3-5 June 2008, Rome. High-Level Conference on World Food Security: The Challenges of Climate Change and Bioenergy. **Bioenergy, food security and sustainability – towards an international framework**.
4. **R1bn bio - fuels project seen as threat to health, environment**. 23 February, 2007. <http://www.capetimes.co.za/index.php?fArticleId=3696355>
5. **Rural communities express dismay: "land grabs" fuelled by biofuel strategy**. March 2007. [www.biosafetyafrica.net](http://www.biosafetyafrica.net)
6. Africa News. 6 August, 2007. **Central bank chief cast doubt over maize for ethanol**. <http://www.Namibian.com.na/2007/August/Africa/07ABB54031.html> (accessed February 2008).
7. <http://www.anc.org.za/rdp/rural2.html>
8. See for example Walker, C. 2003. **Piety in the sky? Gender policy and land reform in South Africa**. Journal of Agrarian Change. Vol. 3, Nos 1 and 2.
9. <http://www.fao.org/bioenergy/home/en/>
10. McDonnell, P. 16 June 2008. **Human cost of Brazil's biofuels boom**. Los Angeles Times. <http://www.latimes.com/news/nationworld/world/la-fg-biofuels16-2008jun16,0,2605521.story>
11. Brazil's Social Security Administration in Brazil as quoted in Caminada, C. and Smith, M. **Brazil's sugar cane cutters pay the cost of cleaner fuel**. 1 October 2007. <http://www.iht.com/articles/2007/09/30/bloomberg/bxcane.php>.
12. McDonnell, P. 16 June 2008. **Human cost of Brazil's biofuels boom**. Los Angeles Times. <http://www.latimes.com/news/nationworld/world/la-fg-biofuels16-2008jun16,0,2605521.story>.
13. McMichael, P. July 2004. **Global Development and the Corporate Food Regime**. Prepared for Symposium on New Directions in the Sociology of Global Development, XI World Congress of Rural Sociology, Trondheim. [www.corporate-accountability.org/eng/documents/2004/corporate\\_food\\_regime.pdf](http://www.corporate-accountability.org/eng/documents/2004/corporate_food_regime.pdf).
14. Tokar, B. 9 December 2006. **Green Energy: panacea or just the latest hype?** WW4 REPORT.COM.
15. Submission on the Draft Biofuels Industrial Strategy by: Earthlife Africa eThekweni Branch, African Centre for Biosafety, GRAIN, SAFeAGE, Ekogaia, The Third World Investment Gateway Trust to the Department of Minerals and Energy, 31 March 2007. [www.biosafetyafrica.net](http://www.biosafetyafrica.net)
16. Submission on the Draft Biofuels Industrial Strategy by: Earthlife Africa eThekweni Branch, African Centre for Biosafety, GRAIN, SAFeAGE, Ekogaia, The Third World Investment Gateway Trust to the Department of Minerals and Energy, 31 March 2007. [www.biosafetyafrica.net](http://www.biosafetyafrica.net)
17. Submission on the Draft Biofuels Industrial Strategy by: Earthlife Africa eThekweni Branch, African Centre for Biosafety, GRAIN, SAFeAGE, Ekogaia, The Third World Investment Gateway Trust to the Department of Minerals and Energy, 31 March 2007. [www.biosafetyafrica.net](http://www.biosafetyafrica.net)
18. Witt, H., Patel, R. and Schnurr, M. 2006. **Can the poor help GM crops? Technology, representation and cotton in the Makhathini Flats, South Africa**. Review of African Political Economy. No. 109.
19. Manning, R. February 2004. **The oil we eat; following the food chain back to Iraq**. Harper's Monthly. <http://www.harpers.org/TheOilWeEat.html>
20. Manning, R. February 2004. **The oil we eat; following the food chain back to Iraq**. Harper's Monthly. (<http://www.harpers.org/TheOilWeEat.html>)
21. Environmental Technologies. May 2008. [http://www.terrenum.net/agrocarbon/intensive\\_farming.pdf](http://www.terrenum.net/agrocarbon/intensive_farming.pdf)
22. Manning, R. February 2004. **The oil we eat; following the food chain back to Iraq**. Harper's Monthly. <http://www.harpers.org/TheOilWeEat.html>
23. Environmental Technologies. May 2008. [http://www.terrenum.net/agrocarbon/intensive\\_farming.pdf](http://www.terrenum.net/agrocarbon/intensive_farming.pdf)
24. 1,000 joules = 1 kilojoule = 1 Btu.
25. Food and Agriculture Organisation of the United Nations (FAO). 3-5 June 2008, Rome. High-Level Conference on World Food Security: The Challenges of Climate Change and Bioenergy. **Bioenergy, food security and sustainability – towards an international framework**.
26. Food and Agriculture Organisation of the United Nations (FAO). 3-5 June 2008, Rome. High-Level Conference on World Food Security: The Challenges of Climate Change and Bioenergy. **Bioenergy, food security and sustainability – towards an international framework**.
27. Earthtrends Country Profiles. Agriculture and Food: South Africa. <http://earthtrends.wri.org>
28. Müller, A. Deputy Director General of the Natural Resources Management and Environment Department, FAO. 21 September 2007. **Account of the conference "Rising agricultural and biofuel prices: consequences for developing countries"**. Paris.

29. Müller, A. Deputy Director General of the Natural Resources Management and Environment Department, FAO. 21 September 2007. **Account of the conference "Rising agricultural and biofuel prices: consequences for developing countries"**. Paris.
30. Müller, A. Deputy Director General of the Natural Resources Management and Environment Department, FAO. 21 September 2007. **Account of the conference "Rising agricultural and biofuel prices: consequences for developing countries"**. Paris.
31. Witt, H., Patel, R. and Schnurr, M. 2006. **Can the poor help GM crops? Technology, representation and cotton in the Makhathini Flats, South Africa**. Review of African Political Economy. No. 109.
32. <http://www.fao.org/bioenergy/home/en/>
33. Amalu, U.C. 2002. **Food security: sustainable food production in sub-Saharan Africa**. Outlook On Agriculture. Vol. 31, no 3.
34. Amalu, U.C. 2002. **Food security: sustainable food production in sub-Saharan Africa**. Outlook On Agriculture. Vol. 31, no 3.
35. Summary of testimony provided to the House Select Committee on Energy Independence and Global Warming, US Congress, Washington DC by R.K. Pachauri, Chairman, Intergovernmental Panel on Climate Change and Director General, The Energy and Resources Institute.
36. Amalu, U.C. 2002. **Food security: sustainable food production in Sub-Saharan Africa**. Outlook On Agriculture. Vol. 31, no 3.
37. Amalu, U.C. 2002. **Food security: sustainable food production in Sub-Saharan Africa**. Outlook On Agriculture. Vol. 31, no 3.
38. Department of Minerals and Energy. December 2007. **Biofuels Industrial Strategy of the Republic of South Africa**. DME.
39. Department of Minerals and Energy. December 2007. **Biofuels Industrial Strategy of the Republic of South Africa**. DME.
40. Summary of testimony provided to the House Select Committee on Energy Independence and Global Warming, US Congress, Washington DC by R.K. Pachauri, Chairman, Intergovernmental Panel on Climate Change and Director General, The Energy and Resources Institute.
41. Summary of testimony provided to the House Select Committee on Energy Independence and Global Warming, US Congress, Washington DC by R.K. Pachauri, Chairman, Intergovernmental Panel on Climate Change and Director General, The Energy and Resources Institute.
42. Bellamy Foster. December 2000. Monthly Review.
43. Hendler, Holliday, Ratcliffe and Wakeford. 3 August 2007. **Current global challenges and alternative energy futures for South Africa**. Energy Bulletin. <http://www.energybulletin.net/node/33878>

