



Southern African Biofuels Association

Public Private Partnerships

in the bioenergy sector

need and opportunity to co-operate with science

ACP science and technology programme



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Energy mix

1. Energy mix is the best precondition for:

Energy supply security

Energy price stability

2. Energy market is a regulated market

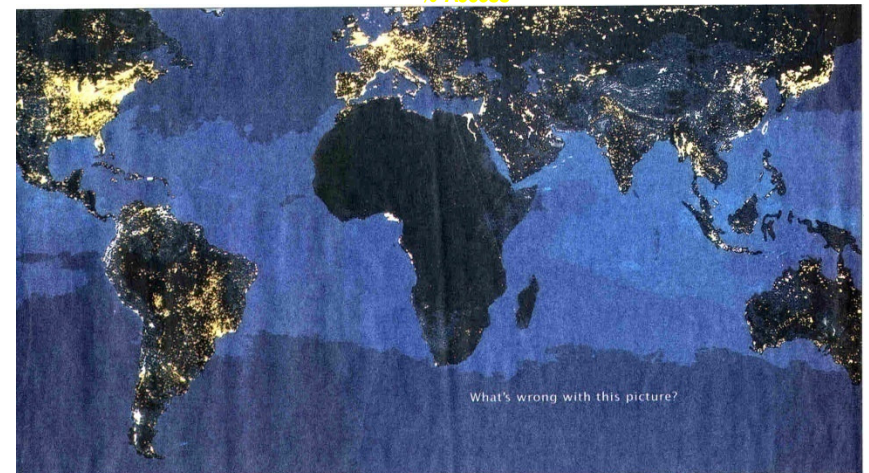
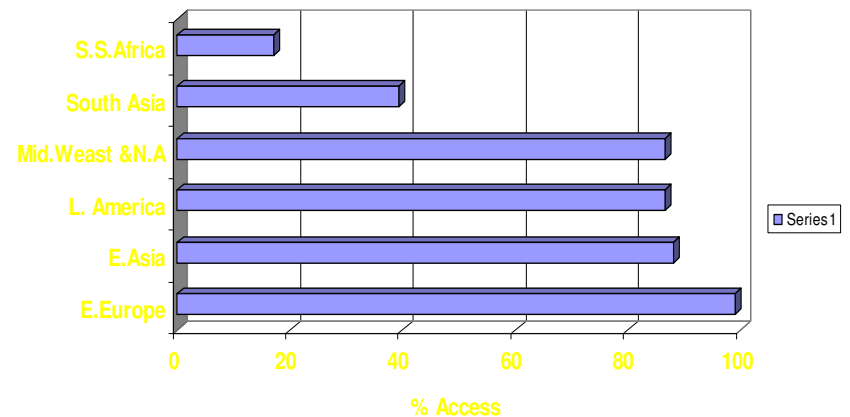
nothing is possible without political support
and new valuation of resources



Electricity Situation of Southern Africa

- ❖ Southern Africa needs 563 billion US\$ during next 25 years investment
- ❖ Electricity access in Africa is the least among developing regions, under 20%
- ❖ 40% of electricity is used each by North & South, while the remaining 46 countries uses 20%
- ❖ Electricity access to rural areas is less than 10%
- ❖ The average price is 0.13 US\$, one of most expensive energies in the world

Population with Access to Electricity in Developing Regions, 2000

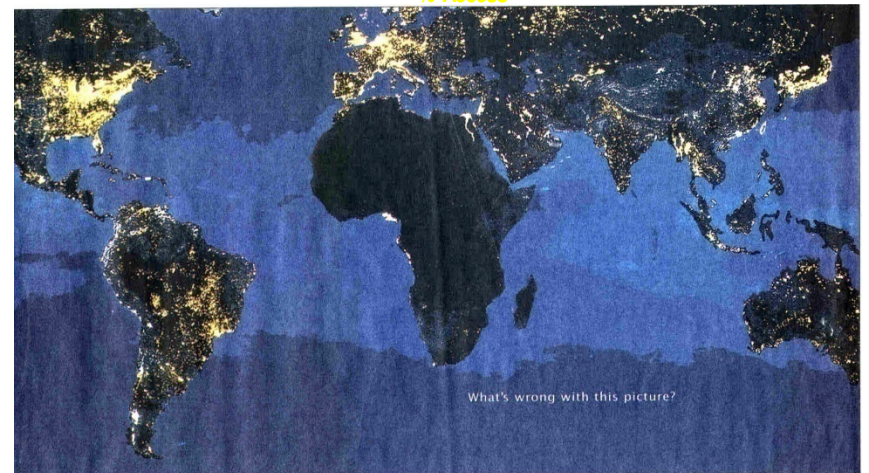
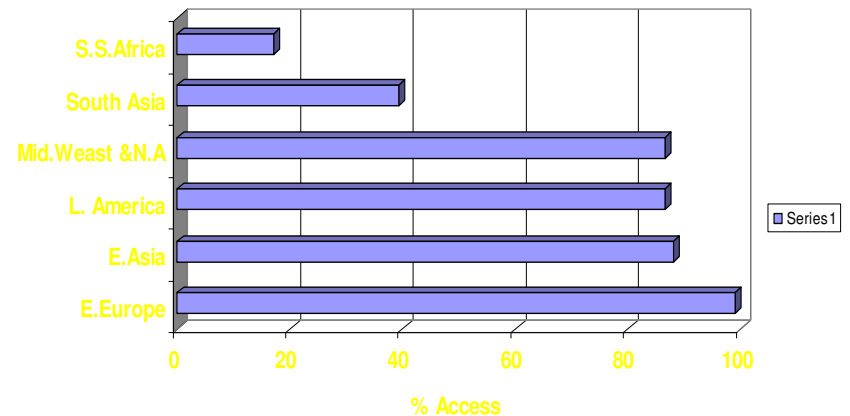




Transport Situation of Southern Africa

- ❖ SA: 19th largest user per capita in the world on crude oil bases
- ❖ 450 – 500 bn Rand consumed for land transport
- ❖ approx. 270 bn for personal transport
- ❖ Approx 14% of GDP is used for transport
- ❖ The situation is undermining **economic growth**: -transport is essential for economic growth -transport is **limiting economic growth**

Population with Access to Electricity in Developing Regions, 2000





Energy mix in Transport

- ❖ The upward trend in crude oil prices and the expected long term crude oil price adjustment as a commodity with limited availability allowing alternative fuels as a feasible option:
- ❖ conventional fuels, electricity, bio fuels, hydrogen, (gas and liquids)
- ❖ hybrid systems, flexible fuels engines, fuel cells

In future:

we have to live with a variety of fuels and propulsion systems, with a mix of public transport and individual transport



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South Africa and GHG emissions

- ❖ 70 % of energy consumption is for transport
- ❖ Transport sector as end user is the largest emitter of GHG emission
- ❖ Kyoto – protocol 1997 commits signatories to reduce GHG emissions by 2012 by 5%
- ❖ SA – is the 5 largest GHG emitter per capita but rated as a developing country (list 2)



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South Africa and GHG emissions

- ❖ Green house gases can be
 - ❖ captured and stored
 - ❖ and or used as fuel for photosynthesis and others
- storage :- geological storage in soil, water and geological formations
 - off shore, on shore in national and international areas
- usage: - photosynthesis in : forestry / agriculture /nature conservation
 - biotechnologies: algae- technologies, bacterial techn.



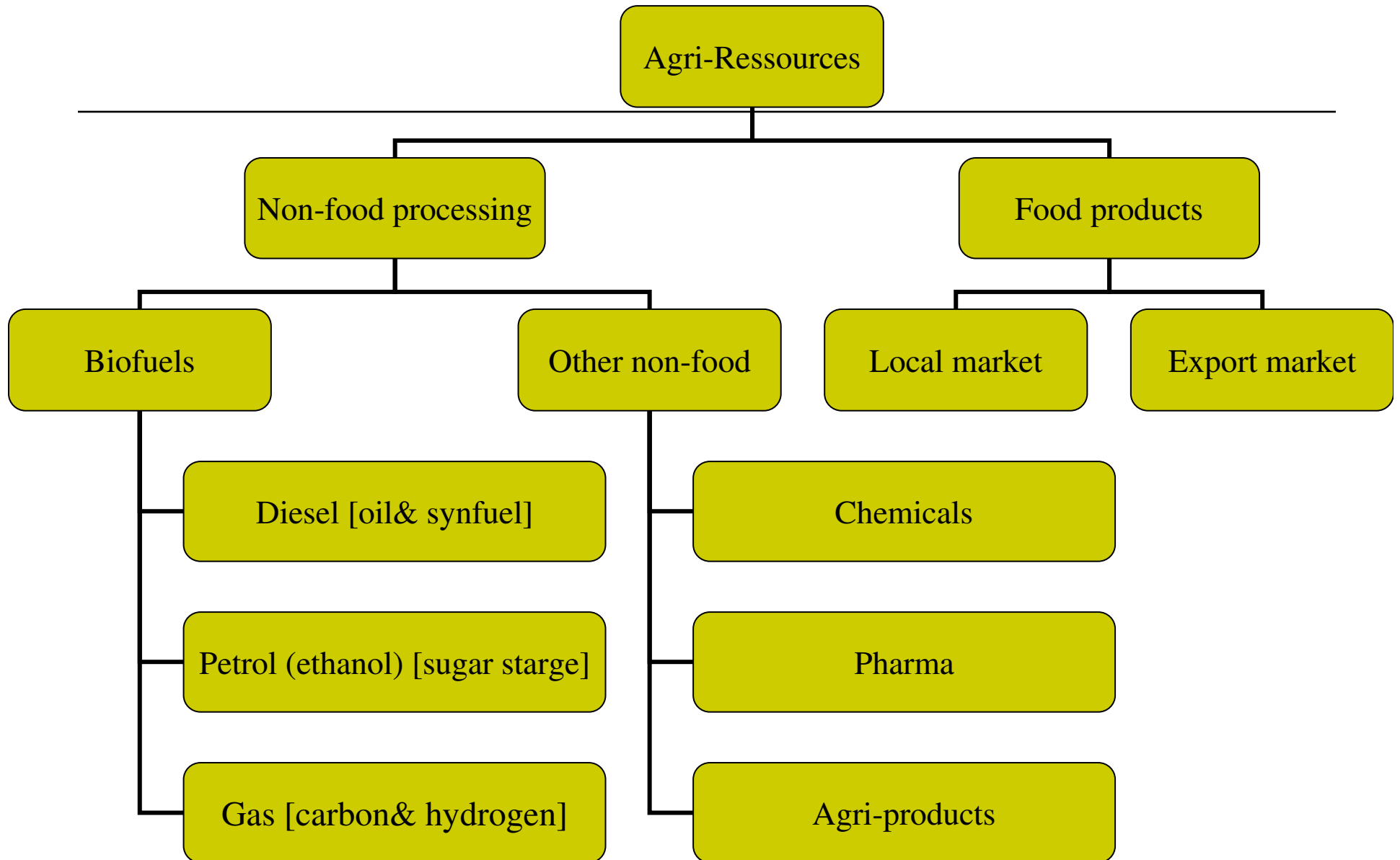
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SA Agriculture and Agro –processing sector

- ❖ is the second largest employer in SA (11%)
- ❖ had a huge structural and technological development in the past 15 years
- ❖ 500 000 jobs lost
- ❖ cost developments: 22,7 fertilizer, 18,2 fuel, 12% wages and salaries
- ❖ Is a business, which requires a return on investment and coverage of cost
- ❖ food prices not determined by SA – agriculture but generating huge fluctuations
- ❖ bio energy offers the largest stable market for agriculture .
- ❖ Available agricultural land underutilized,
- ❖ Positive energy balance in biofuels if sustainable technologies and policies used
- ❖ There is no conflict between food and non-food production in Africa



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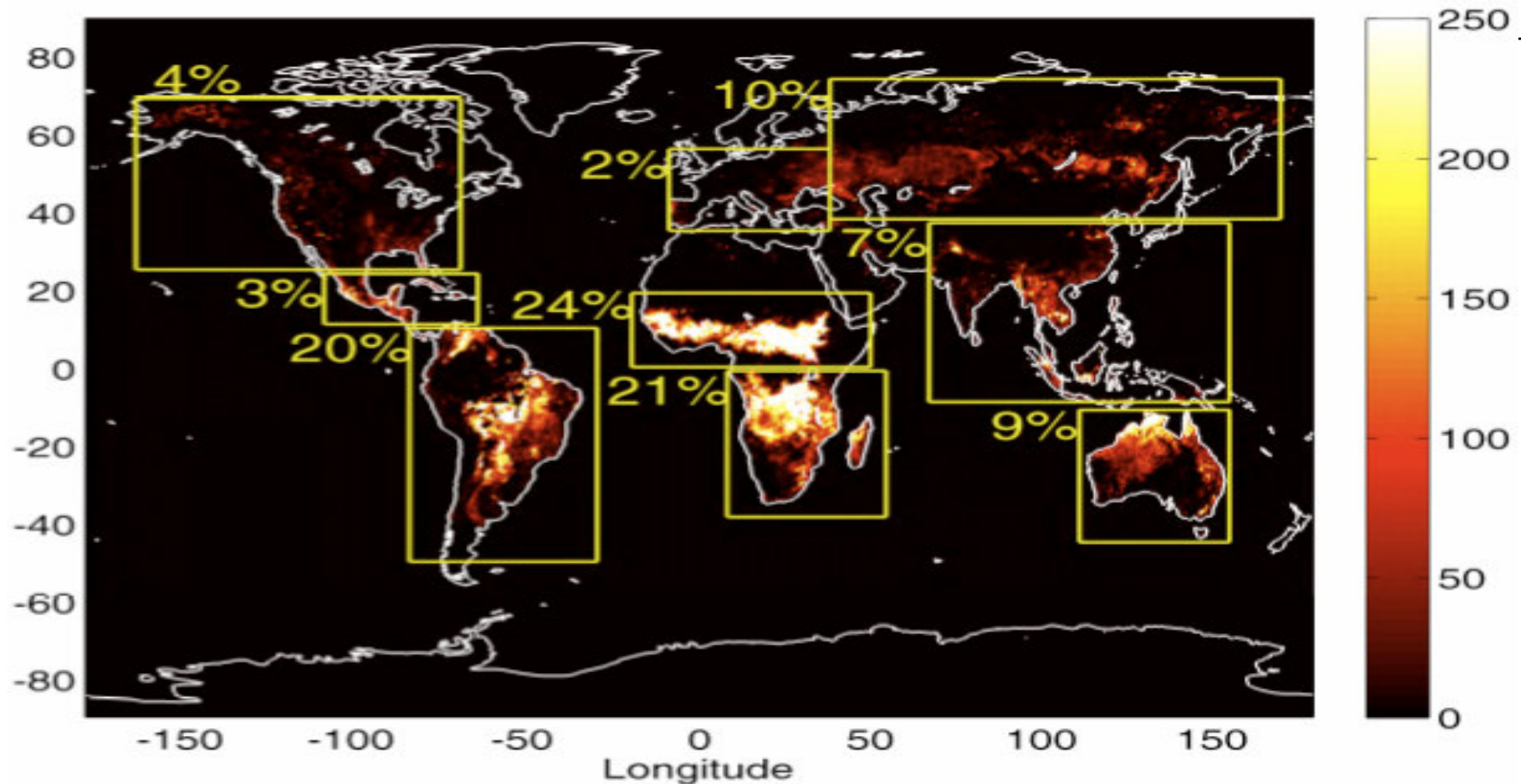
SA Forestry and Wood processing Sector

- ❖ SA has the largest in Southern Africa
- ❖ Provides 1.4 % of GDP and employees more than 170 000 people in SA
- ❖ 1.33 mio Ha in used with huge effect on climate protection
- ❖ Approx. 35% in timber saw milling is waste and only a fraction is used for bio energy
- ❖ Southern Africa is suffering alien plant invasion
- ❖ Cellulose is one of the most important future raw materials for biofuels
- ❖ Has widely underutilized potential



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Total annual fire counts

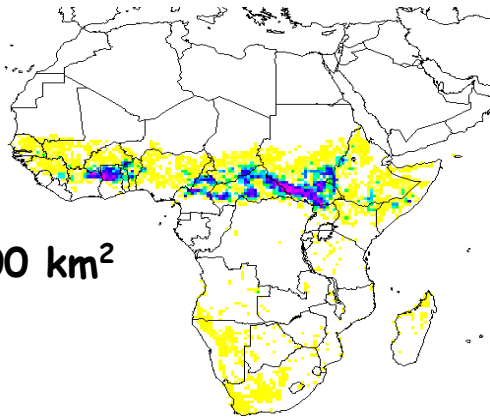


data source: NASA MODIS satellite (<http://modis-fire.umd.edu>)



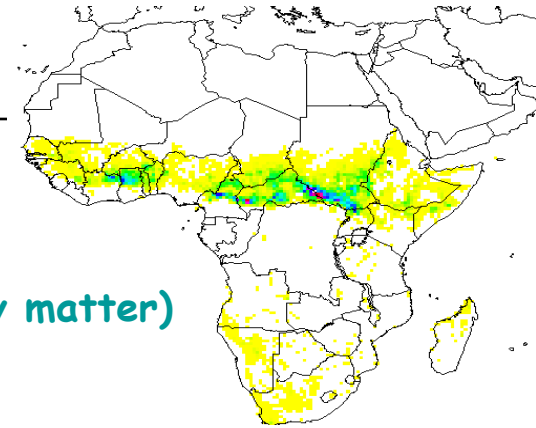
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Burned Areas



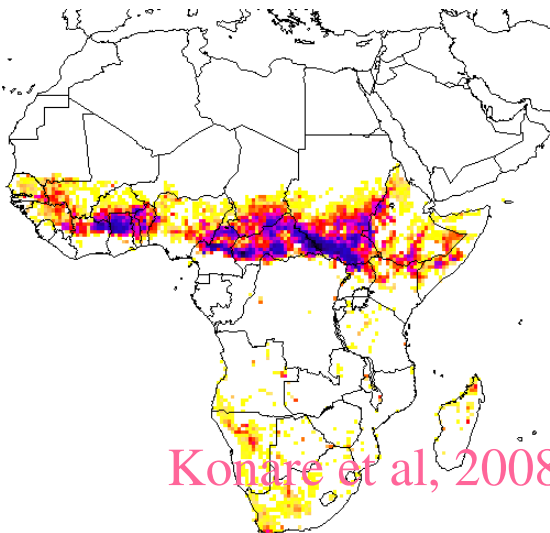
125000 km²

Burned Biomass



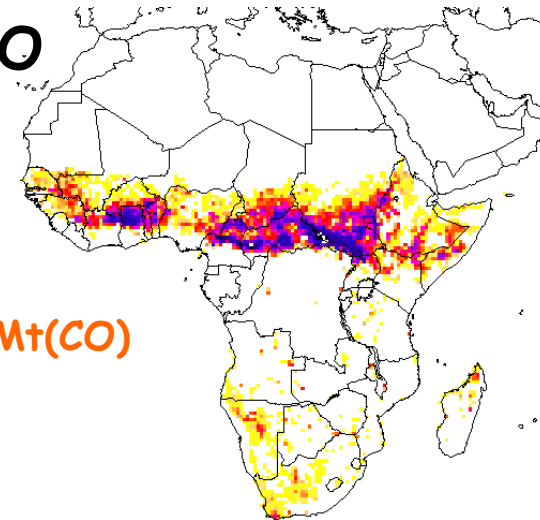
723 Mt(dry matter)

BC



448 kt(BC)

CO



51 Mt(CO)

Konare et al, 2008, ACPD

December 2006



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Generations of bio fuel technologies

- ❖ Raw materials: organic waste and agric. production
- ❖ 1. generation : extraction, separation, fermentation ,digestion , combustion 30 % fuel, 70 % for human consumption, ethanol and diesel,, solid biomass
- ❖ 2. generation : pyrolise, gasification, production of a crude oil, which is than a raw material for processing
- ❖ 3. generation biotechnologies : algae's
- ❖ 50 % crude oil, 50 % biomass for processing
- ❖ 4.generation: integrated bio energy systems, electrical energy, liquid fuels , chemicals, heat : we call it **biorefinery**



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Land availability

- ❖ Not managed land is exposed to erosion and degradation by the elements we have already fire, flood and dust hazards and are exposed to climate change effects
- ❖ The use of land is part and parcel of national resources and the national economy, the regulations to own and use and the control mechanism influences the business environment
- ❖ There is sufficient land available for bioenergy
- ❖ Land without infrastructure and people using it has no value
- ❖ The management and use of land is an obligation not a right
- ❖ Land has to be used on sustainable manner – land use has to be regulated and controlled is a public and private issue



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Size of African Continent Compared to Other Land masses

| Land Masses | Square miles | Square kilometres |
|--------------------------------------|--------------|-------------------|
| Brazil | 3,300,161 | 8,547,378 |
| Japan | 377,727 | 978,308 |
| Australia | 2,966,189 | 7,682,394 |
| Europe | 1,905,731 | 4,935,820 |
| U.S.A (Continental) | 3,120,066 | 8,080,934 |
| Total | 11,669,874 | 30,224,835 |
| Africa (including Madagascar) | 11,715,721 | 30,343,578 |





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Production status of the 7 suggested energy crops (yields
in 000mt; based on FAO, 2004 figures)

| Crop | | | | | | | |
|-------------------|---------------------|-----------------------|----------------------|--------------|----------------|-----------------------|----------------|
| Country | Palm oil | Sun flower | Soya bean | Maize | Sorghum | Sugar cane | Cassava |
| Angola | 280 | 11 | | 510 | | 360 | 5,600 |
| Botswana | | 7 | | 10 | 32 | | |
| DRC | 1,150 | | 14.6 | 1,155 | 54 | 1,787 | 14,951 |
| Lesotho | | | | 150 | 46 | | |
| Madagascar | 21 | | 0.05 | 349.7 | 1 | 2,460 | 2,191 |
| Malawi | | 3,7 | | 1,733 | 45 | 2,100 | 2,559 |
| Mauritius | | | | 0.19 | | 5,200 | 0.13 |
| Mozambique | | 6.3 | | 1,248 | 314 | 400 | 6,150 |



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Production status of the 7 suggested energy crops (yields in 000mt;
based on FAO, 2004 figures(continued)

| Crop | | | | | | | |
|---------------------|-----------------|-------------------|------------------|---------------|----------------|-------------------|----------------|
| Country | Palm oil | Sun flower | Soya bean | Maize | Sorghum | Sugar cane | Cassava |
| Namibia | | 0.05 | | 33 | 6 | | |
| South Africa | | 675.5 | 220 | 9,737 | 449 | 19,095 | |
| Swaziland | | | | 70 | 0.6 | 4,500 | |
| Tanzania | 65 | 28 | 2.1 | 2,800 | 650 | 1,800 | 6,890 |
| Zambia | | 10 | 15 | 1,161 | 19 | 1,800 | 950 |
| Zimbabwe | | 8 | 84 | 1,000 | 80 | 4,100 | 190 |
| TOTAL | 1,516 | 749.6 | 335.8 | 19,957 | 1,697 | 43,602 | 39,441 |



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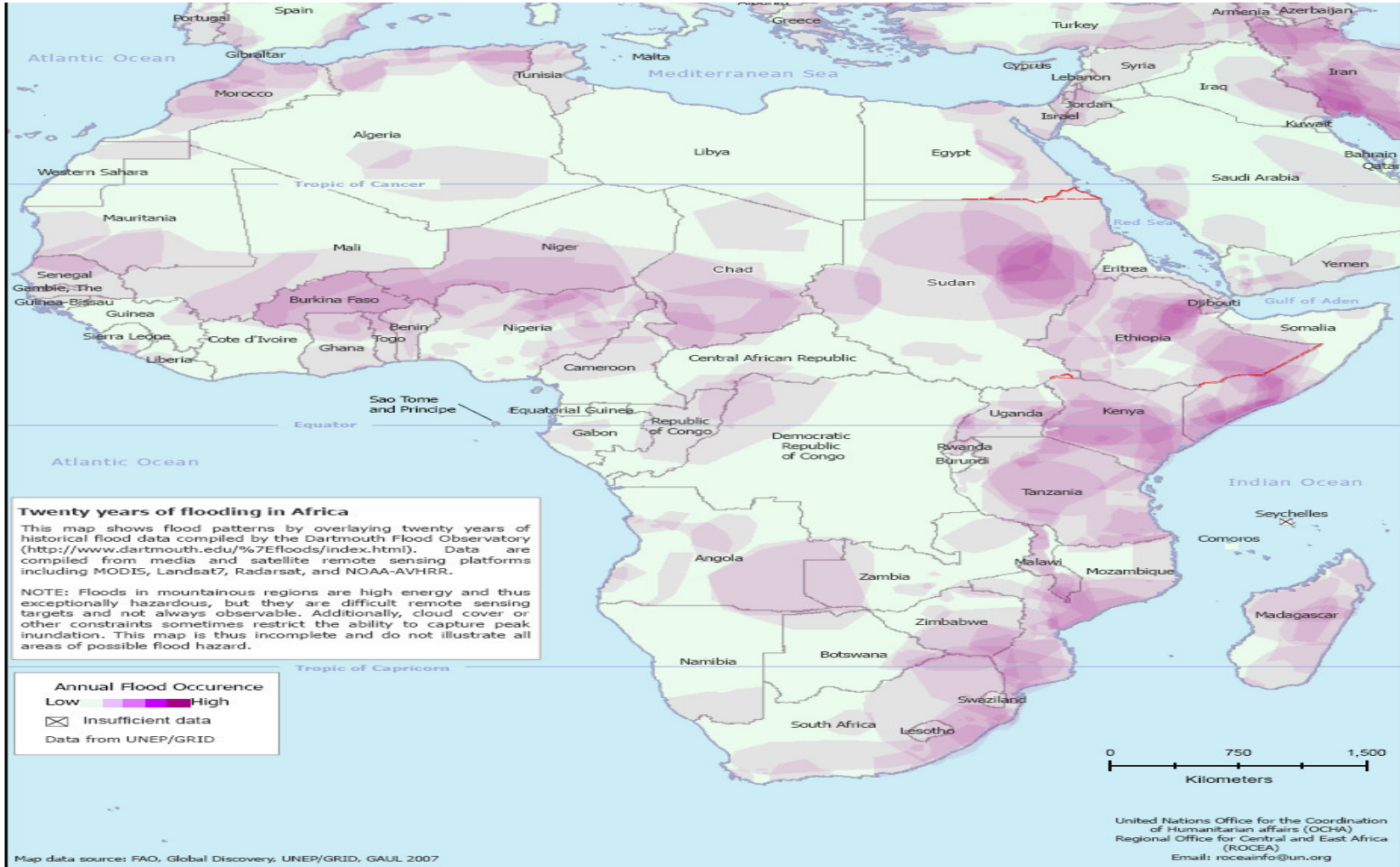
Arable land potential for five selected SADC countries (in mil ha)

| Country | Land area | Suitable cropland (~ 20 %) | Area under crops today | Area required for domestic energy supply |
|----------------|------------------|-----------------------------------|-------------------------------|-------------------------------------------------|
| DRC | 227 | 45 | 8 | 0.2 |
| Angola | 125 | 25 | 4 | 0.6 |
| Tanzania | 88 | 18 | 5 | 0.3 |
| Zambia | 74 | 15 | 5 | 0.2 |
| Mozambique | 78 | 16 | 3 | 0.2 |

Source: FAO-IISA and calculations by Takavarasha, Uppal, Hongo



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The names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

Map: Floods_071219



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Waste Generation in South Africa

| Estimated Municipal Solid Waste Tonnage per Municipality | | |
|----------------------------------------------------------------------------------------------------------------|---------------|-------|
| Recommended order in which Municipalities should be approached (pre-feasibility conducted by C&EO in Feb 2006) | | |
| 1 Municipality | | |
| 2 Eden District Municipality | 200,000.00 | Pilot |
| 3 Buffalo City (East London) | 300,000.00 | |
| 4 Durban Metropolitan Municipality | 800,000.00 | |
| 5 Nelson Mandela Metropolitan Municipality | 500,000.00 | |
| 6 Ekurhuleni Metropolitan Municipality (East Rand, Ga) | 1,000,000.00 | |
| 7 Tshwana Metropolitan Municipality (Pretoria) | 1,000,000.00 | |
| 8 City of Cape Town | 2,100,000.00 | |
| 9 City of Johannesburg | 1,800,000.00 | |
| 10 Others | 2,300,000.00 | |
| TOTAL | 10,000,000.00 | |

(The National Director of Waste (Ms Dee Fischer) will be notified immediately and project will seek endorsement)



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Table 1: Recycling Statistics for South Africa (DEAT, 2000a & 2004b)

| Waste | Percentage Recycled | | | | | |
|----------|---------------------|------|------|------|------|------|
| | 1990 | 1992 | 1994 | 1996 | 1998 | 2004 |
| Paper | 29 | 28.4 | 38 | 38 | 38 | 52 |
| Cans | 21 | 26.3 | 29.9 | 51 | 67 | 85 |
| Plastics | 11 | 14.8 | 17 | 17 | 12 | 14 |
| Glass | 14 | 22.4 | 19.4 | 17.6 | 20.8 | 22 |



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Table 2: Waste received at landfill sites in South Africa (DWAF, 2001)

| Province | Waste Received at Landfill |
|------------------------------------|-----------------------------------|
| | t/annum |
| Eastern Cape | 571,000 |
| Free State | 782,000 |
| Gauteng | 4,297,000 |
| KwaZulu Natal | 1,811,000 |
| Mpumulanga | 481,000 |
| Northern Cape | 262,000 |
| Northern Province (Limpopo) | 153,000 |
| North West | 354,000 |
| Western Cape | 1,487,000 |
| TOTAL | 10,198,000 |



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The South African fuel market (Source: SAPIA)

| Product volumes in million of liters | 2004 | 2005 | Change in % |
|---------------------------------------------|-------------|-------------|--------------------|
| Petrol | 10 985 | 11 165 | + 1.6 |
| Diesel | 7679 | 8115 | + 5.7 |
| Jet fuel | 2076 | 2180 | + 5.0 |
| Illum Paraffin | 797 | 761 | - 4.6 |
| Fuel Oil | 569 | 489 | - 14.1 |
| Bitumen | 277 | 305 | + 10.3 |
| LPG | 563 | 550 | - 2.3 |



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Import/Export South Africa (II)

| Year | Share of total imports | Imports SA in million R | Exports SA in million R | Trade Balance in million R | Exchange Rate R/US-\$ |
|-------------|-------------------------------|--------------------------------|--------------------------------|-----------------------------------|------------------------------|
| 2000 | 13.02% | 186,281 | 209,492 | 23,211 | 6.87 |
| 2001 | 12.34% | 214,331 | 249,338 | 35,007 | 8.38 |
| 2002 | 10.75% | 272,681 | 311,677 | 38,995 | 10.66 |
| 2003 | 11.00% | 256,837 | 276,800 | 19,963 | 7.58 |
| 2004 | 12.75% | 304,773 | 295,192 | -9,581 | 6.48 |



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The fuel market in the SADC - region

- ❖ will be a free trade zone
- ❖ will have homogenized standards
- ❖ SADC consumption in 2006: 724000 bbls/day
- ❖ petrol consumption approx.: 633100 ltr / day
- ❖ diesel consumption approx.: 5180800 ltr / day
- ❖ 50 refineries in Africa, 39 in operation
- ❖ SADC – 4 in SA, 1 in Angola, 1 in Zambia
- ❖ Expected: 2 % blend in diesel, 8 % in petrol plus special fleet solutions
- ❖ **Means we need also a commune market for biofuels**



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Limitations & opportunities of

Fossil fuels

- ❖ Availability
- ❖ Cost exploration
- ❖ Climate change
- ❖ Cost of processing and distribution
- ❖ Fiscal issues
- ❖ Import / export balance

Biofuels

- ❖ Availability
- ❖ Land requirements/regional
- ❖ Social requirements
- ❖ Technological requirements
- ❖ Costs of production, distribution and implementation
- ❖ Fiscal issues
- ❖ No sulphur emissions
- ❖ Quality enhancement
- ❖ CO 2 Certificates



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Bio fuels are an possible partner to fossil fuels:

as an quality agent : lubrication in diesel

ETBE replacing MTBE

blending: in Petrol and Diesel (from 5% to)

pure fuel application:

without technical alterations to engines:

biodiesel, bio ethanol , hydrous ethanol

with technical alterations to engines:

pure plant oil in diesel type engines



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Present situation

SA Bio fuels strategy : 2% blending ratio on total fuel consumption by volume with tax and price regulations

SABS: biodiesel in force,

biodiesel quality management standards in prep.,

bio ethanol standards will follow,

SADC countries developing own strategies and overtaking South Africa

Municipalities: will formulize the climate change policies: BRT – systems, traffic management systems, intermodal public transport systems



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Combined systems

- ❖ gas/diesel
- ❖ ethanol/petrol
- ❖ biodiesel/diesel
- ❖ fuel / electrical batteries with generator
- ❖ hydrogen/fuel cell
- ❖ Ethanol / gel to ethanol gel
- ❖ Biogas (methane) – compressed natural gas CNG



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Co-operation with science

SABA with

-ICSU

- Universities in South Africa, Mozambique, Zambia, Tanzania, Mauritius,
- Universities in Brasilia, Germany, USA, India
- Interest from Angola, Malawi, Namibia, Nigeria, Cameron , Ruanda, Somalia, Ghana



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Subjects for research and development

SABA has identified following important research complexes for Africa with ICSU:

1. Electronic library for Africa – focus agriculture, agro processing, organic waste processing bio energy technologies
2. Pilot projects for the testing of new technologies – Gen. 2
3. Pilot projects for the testing of new propulsion technologies , particular for public transport



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Subjects for research and development

SABA has identified following important research complexes for Africa with ICSU:

1. Pilot projects for testing bio technologies, particular algae technologies
5. Demonstration test for the use of bio fuels – ethanol gel, hydrous ethanol, plant oil with additives etc.
3. International co-operation in identification, testing and development of typical “African plant material” problems are international: salty soils, anti desertification programs, jatropha, stevia, the plant from Paraguay and 200 times sweeter than sugar



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Why do we need the co-operation with science

- knowledge platform by harnessing knowledge,
- new opportunities for local science sector,
- awareness and support for policies and regulation
- new knowledge of resources management,
- new opportunities for entrepreneurs and investors,
- new job opportunities in rural and semi rural area,
- capacity building particular in applied science,

But how can we establish a cooperation with