

African, Caribbean & Pacific Group of States
Science & Technology Programme
Sustainable non-food sources of oil



Industrial Development Corporation

Your partner in development finance

Investment Climate and Criteria for Green Fuels in Africa

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Specialist: Green SBU

Industrial Development Corporation

3 March 2011

The Industrial Development Corporation

- The Industrial Development Corporation of South Africa Ltd (IDC) is a self-financing, national Development Finance Institution (DFI). It was established in 1940 to promote economic growth and industrial development in South Africa
- At the IDC we recognise the importance of a dynamic private sector in securing and stimulating rapid and sustainable economic growth, creating employment and reducing poverty
- Aims to maximise **developmental and financial returns** within an acceptable **risk profile**
- Our mandate includes the rest of the African continent and we are active throughout the entire region. We operate in a broad spectrum of industries and with our specialized knowledge and experience, are able to offer valid and appropriate financial assistance to a wide variety of individuals and companies.
- www.idc.co.za

The Role of IDC in the South African Economy

Vision

To be “the primary driving force of commercially sustainable industrial development and innovation to the benefit of South Africa and the rest of the African continent”

Mission

Self-financing national development finance institution whose primary objectives are to contribute to the generation of balanced, sustainable economic growth in Africa & to the economic empowerment of South African population, thereby promoting economic prosperity of all citizens. Promoting entrepreneurship through the building of competitive industries & enterprises based on sound business principles.

Objectives

Supporting industrial capacity development

Sustainable employment

Regional equity (including development of the rest of Africa)

Growing SME sector

Broad-based black economic empowerment

Environmentally sustainable growth

New entrepreneurs entering the economy

Increased localisation

Outcomes

IDC's Positioning as Industrial Development Funder

Greater importance on social and developmental objectives

Greater importance on financial objectives

Government / NGOs

- Non-commercial focus
- Fiscal transfers and grants
- Development objectives (social)

DFIs

- Commercial and development focus
- Sharing risk
- Internally generated funds, government funds, loans

- Industrial Development Corporation (IDC)
- Development Bank of Southern Africa (DBSA)
- Khula
- National Empowerment Fund (NEF)
- Etc.

Commercial Financiers

- High commercial focus
- Private sector capital
- Financial objectives
- Known risks

IDC encourages cooperation with a variety of these institutions to achieve its goals
IDC addresses **market failures / gaps** by supporting investments, which may otherwise not happen, in partnership with private sector companies

IDC Products and Services

- **General industrial finance:**
 - Equity
 - Quasi-equity
 - Commercial debt
 - Export/import finance
 - Short-term trade finance
 - Bridging finance
 - Guarantees
 - Venture capital
 - Wholesale funding through intermediaries
- **Special purpose finance:**
 - Transformation and Entrepreneurial Scheme (TES) (R1 billion)
 - Risk Capital Facility (RCF) (€55 million)
 - Isivande Women's Fund (R50 million)
 - Support Programme for Industrial Innovation (SPII) (R75 million/year)
 - Distressed funding (R6.1 billion)
 - Employment creation (R 10 billion)
 - Clothing and Textiles Competitiveness Programme (CTCP)
 - Pro-Forestry Scheme (R100 million)
 - Pro-Orchards Scheme (R200 million)
 - Green Funds (R500 million concessionary; R 25 bil over 5 years)

Finance is structured according to client's needs – can include moratoria on repayments to enable business growth

Cross sectoral schemes/funds

Sector specific schemes/funds

IDC's Developmental Role

Approach to project development



Role in project development

- Co-sponsors feasibility studies
- Identifies project opportunities
- Provides and **arranges funding** (e.g. export and import finance, equity and loan funding)
- Identifies suitable international and local DFIs, commercial and merchant banks and companies and export credit agencies as potential participants
- **Shares project risk** with the sponsors and financial partners
- Identifies strong operating partners
- Off-take and supply agreements
- Assists with the early negotiations of project agreements to **improve and ensure their bankability** and shorten the funding schedule
- Structures appropriate **limited recourse funding** packages by allocating project risk to the appropriate stakeholders
- Assists with implementation via steering committee
- Serves on board of directors
- IDC **does not** seek shareholding control or management participation



Towards a New Developmental Growth Path

- IDC is the key agency for the development of South Africa's industrial sectors
- New emphasis on the implementation of a new Growth Path for the country underpinned by industrial development
- Drive and facilitate execution of the Industrial Policy Action Plan (IPAP2)
- New reporting line to the Economic Development Department:
 - Department's coordinating role in terms of policy will assist IDC in its ability to drive implementation of policy and achieve long-term development goals;
 - **Assist in removing barriers to the implementation of projects**



Green industries and technologies: *Context*

- **SA one of the higher producers of carbon equivalents**
- **SA lagging behind in carbon credits generation – lost opportunities**
- **Leadership role in Copenhagen, and COP 17 in KZN**
- **Need to lead in implementation – currently behind**
- **Good sun**
- **Some areas of good wind**
- **Single electricity utility – opportunity and constraint**
- **SA developing country – green technologies expensive**
- **Opportunity to develop new industries – because new internationally, SA can catch up and become leaders**
- **Local production opportunities if we become significant buyers**
- **Low cost of local electricity (based on cheap coal) – sometimes makes greening non-viable – but cost growing (for new coal generation capacity and new coal mines), so makes all investments, particularly cogen, waste to energy and energy efficiency more viable**

IDC's green objectives & broad focus

Objective: Support development of green industries & technologies

Drivers

- Security of energy supply
- Social impact of job creation
- Aligned with government strategies: Copenhagen accord & IPAP 2
- Protect the environment: assure sustainable living conditions
- Localisation

GREEN INDUSTRIES & TECHNOLOGIES

Renewable Energy

Energy Efficiency

Special services related to RE & EE

Liquid Biofuels

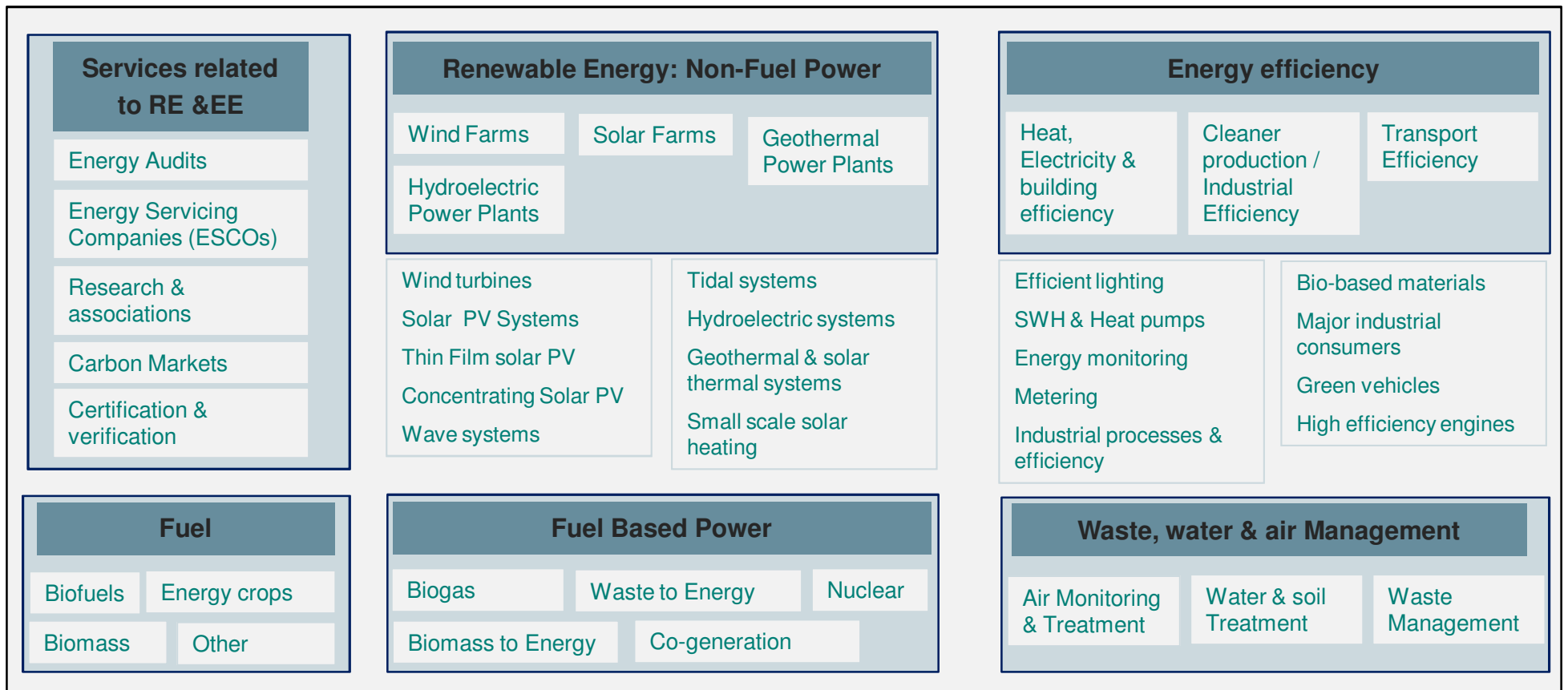
Fuel Based RE

Waste, water & air Management

LOCAL MANUFACTURING & PROCUREMENT

COORDINATING ROLE OF IDC ACROSS AGENCIES

IDC's approach towards green industries



LOCAL MANUFACTURING, PROCUREMENT & CONSULTING

Current focus:

Solar Water Heaters

Wind turbines

PV Panels

Thin Film

Heat Pumps

Green Vehicles

Funding mechanisms and options for green projects

Typical / potential funders

Funding instruments / Type

GREEN INDUSTRIES & TECHNOLOGIES

- Renewable Energy
- Energy efficiency
- Technologies for RE & EE

- Commercial Banks
- Development Finance Institutions
- Carbon buyers
- (Traders of carbon credits)
- Government
- Green Funds (venture capital)

- Equity
- Debt
- Carbon finance (carbon credits)
- REFIT (Renewable feed in tariff)
- Carbon tax and EE tax re
- Subsidies
- Regulatory barriers and support

Challenges for green funding

- Long tenure
- Low margins
- Limits on market (need Power Purchase Agreements)
- Low security
- Oil price volatility

Need to have innovative funding structures and sources of funding, especially DFI & government involvement

South Africa energy challenge

- SA energy consumption: ca 6000 PJ (10^{15}) (1660 Twhpa)
 - **Crude oil and refined products is 20 % of SA energy, but by value R 150 bil (excl tax, distribution, marketing) - all spent on imports (at margin) with few jobs (1000's)**
 - Ca 600,000 bbl per day = 35 mil M3pa (30 mil tpa) = 1200 PJ pa = 330 TWh pa
 - **Coal consumption : 70 % of SA energy, but by value is ca R 50 bil - all spent locally with many jobs (100,000)**
 - Ca 200 mil tpa (ca 100 mil toe pa) = 4200 PJ pa = 1160 TWh pa
 - Electricity : 900 PJ pa = 250 TWh pa (ca R 100 bil delivered)
- COST of Oil: Coal is 3x (10x for same energy)***
- Oil imports = total exports of gold+diamond+coal***
- = more than Platinum***

Electricity vs Oil in SA

OIL

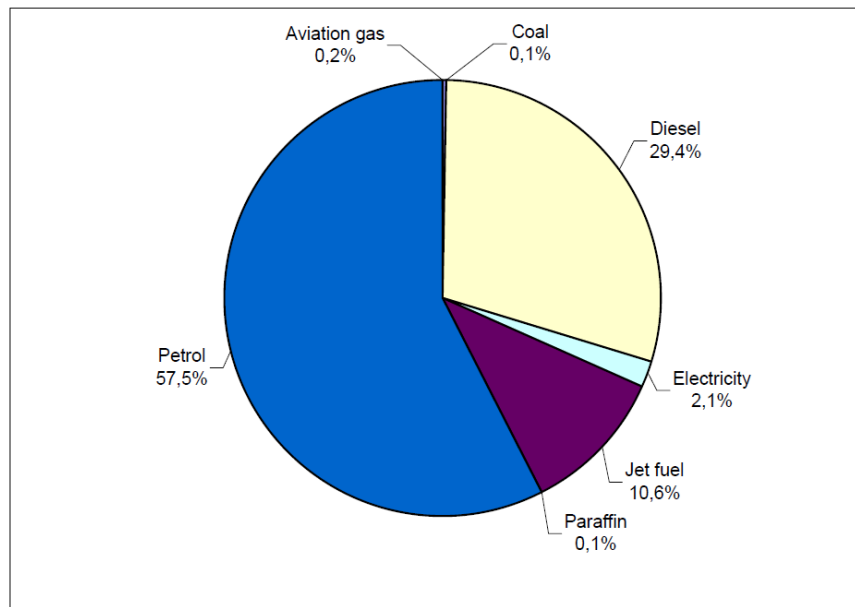
- Imported largely & at margin
- Massive forex cost
- 150 c/kWh (elec)

R 5/L : \$100/bbl @ R8.5/L

ELECTRICITY

- Locally produced with local jobs & value add from coal
- Coal = 10 c/kWh(elec)

Figure 11: Percentage distribution of energy types used in the transport sector in South Africa, 2000



Source: Energy Outlook for South Africa: 2002

OIL cost of energy is 10x COAL for SA (same energy basis)

OIL is imported with massive Forex cost

COAL 300x more job intensive for same spend

SA Renewable Target : Where?

- **Target 10,000 GWh by 2013**
 - 4 % of electricity
 - 0.6 % of total energy
 - 3 % of liquid fuels (petrol, diesel, Jet/IP)
 - **REFIT electricity prices proposed at 5x marginal cost of own electricity from coal (100c/kWh versus 20 c/kWh for coal, manpower, maintenance & operations)**
 - **OIL (DIESEL, Paraffin) is IMPORTED (BoP) at 150 c/kWh equivalent**
- RE (as in other developed countries with high penetration) should target Oil (& imported) energy usage – highest cost*

Technology	REFIT R/kWh
Landfill gas	0.90
Small hydro	0.94
Biogas	0.96
Biomass solid	1.18
Wind	1.25
Concentrated solar	2.10
CSP with storage of 6 hours	2.31
CSP no storage	3.14
PV systems (≥ 1 MW)	3.94

Vehicle fuels Global Trends

- **Based on current technology EVs offer the most energy efficient, lowest cost and most environmentally benign pathway to mobility**
- **Requires clean electricity generation and developments in battery technologies**
- **Natural gas (=biogas) also offers low emissions and affordability**
- **While only at the beginning of commercialisation, government incentives, “green job” targets and bail-out packages stimulating development and adoption of EVs and Gas vehicles**
- **By 2030 EVs/hybrids and gas vehicles are anticipated to constitute a large proportion of the global vehicle park**
- **This could result in electricity and gas price constraining and setting the level of crude oil pricing**

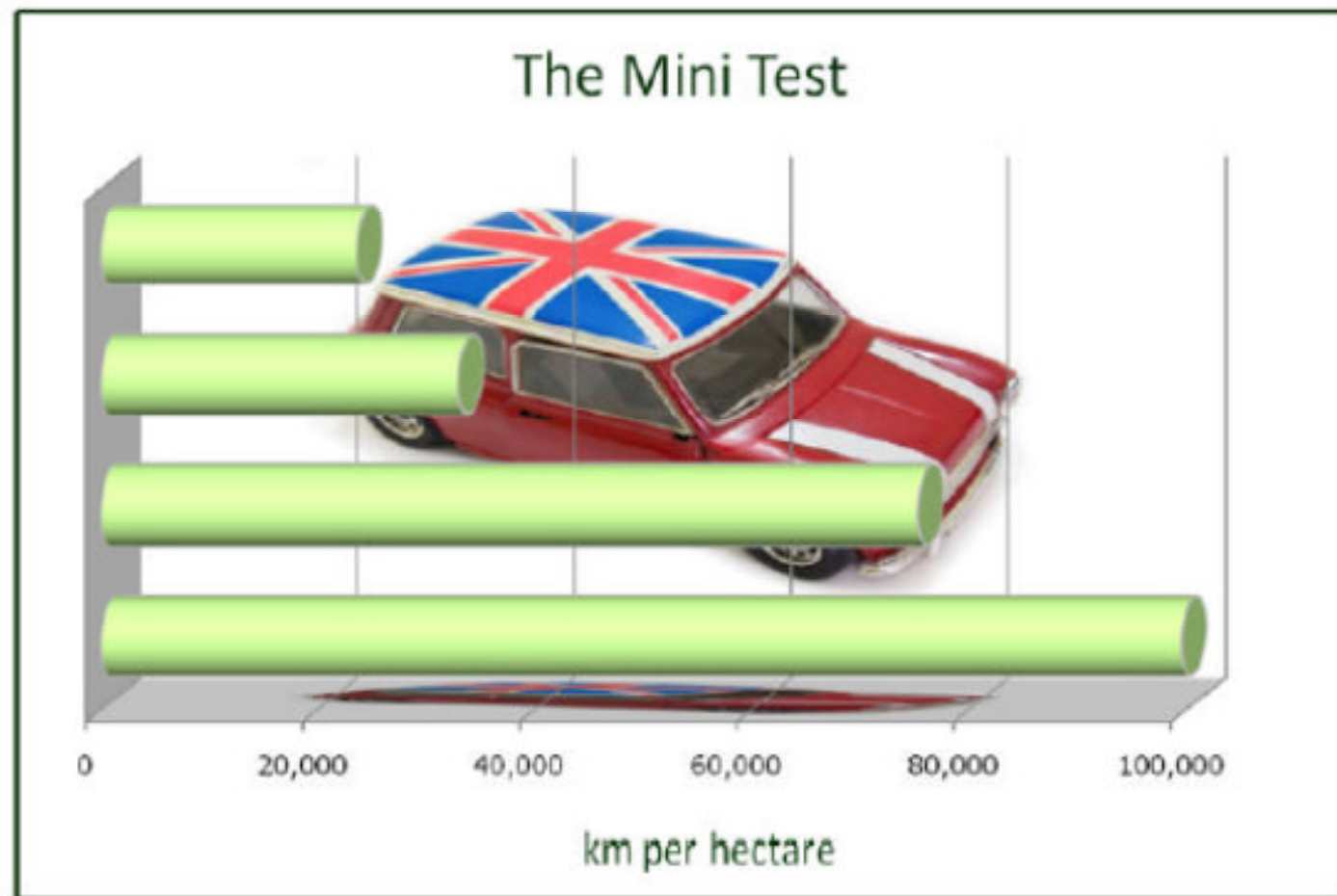
Alternate Fuels that can be developed from Agriculture Residue and Energy Crops

Fuel Product	Feed stock options
BioDiesel	Soya, Rape, Palm oil, Jatropha
Ethanol	Sugar cane, Sugar beet, Maize, Wheat, Cassava
BioGas	Sugar Beet, Sweet Sorghum, Energy Cane, Maize, Sweet corn, Cassava, Rice straw, Wheat , straw, Maize stalks, Manure, Grasses, Algae, Vegetable waste

BIOGAS Compared to other green fuels: yields

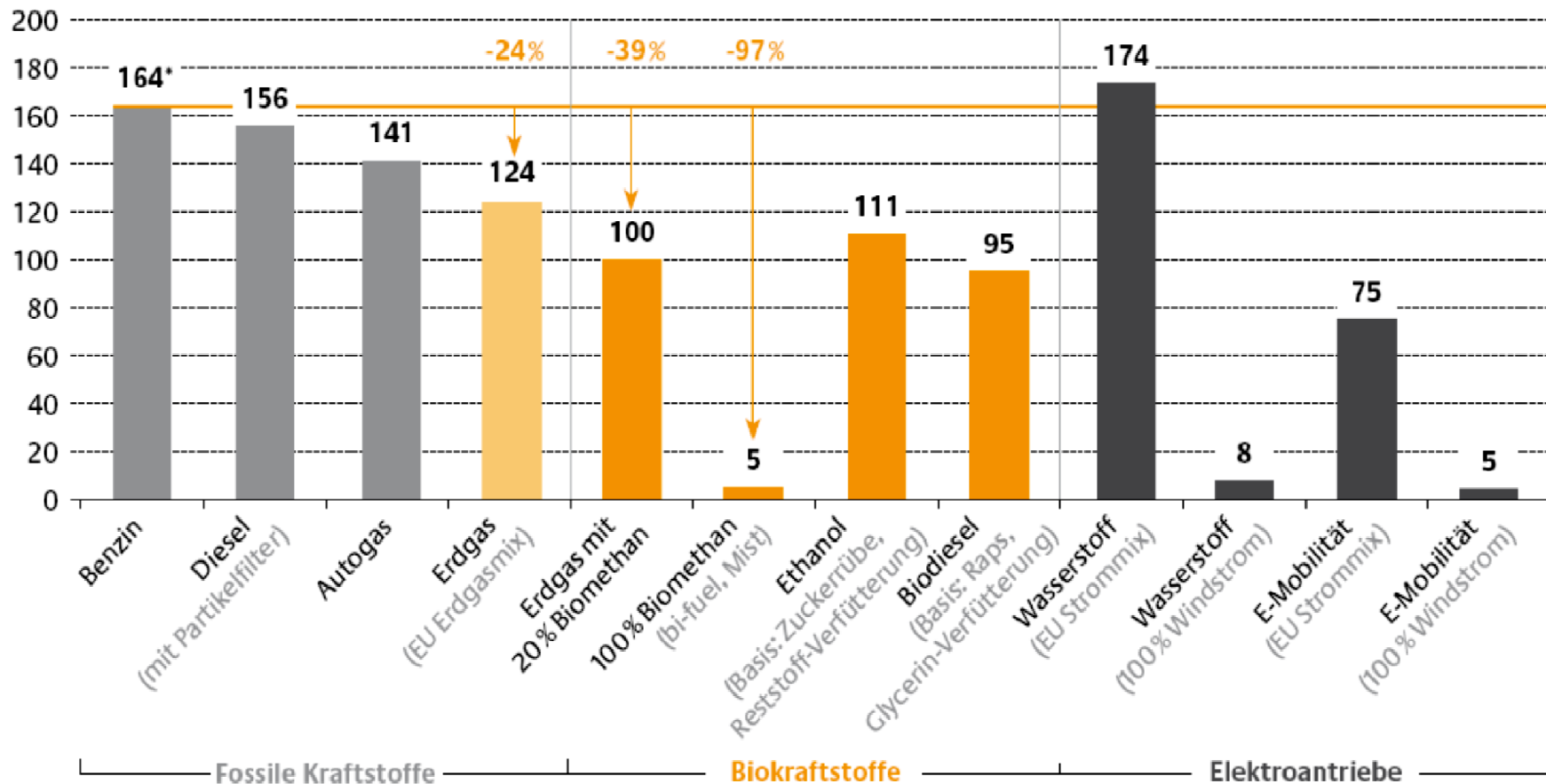
But water usage is most critical in SA

Biofuels vs Biofuels



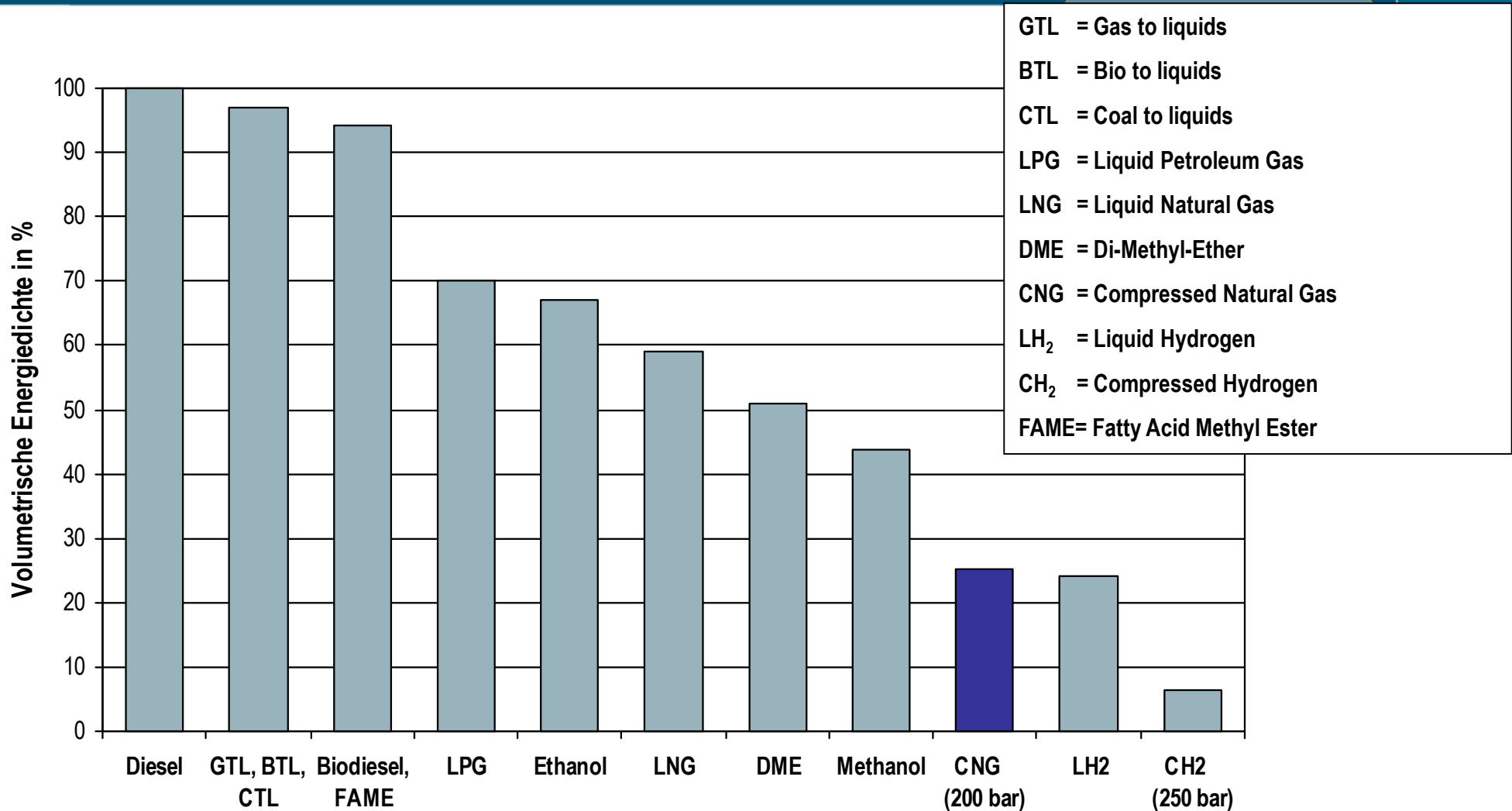
Biogas significantly reduces GHG

THG-Emissionen WTW in gCO₂ äq/km



* Referenzfahrzeug: Ottomotor (Benzin, Saugmotor), Verbrauch: 71/100 km

Energy density of alternate fuels



Biogas/Natural Gas : International Context

- **Natural/Biogas vehicles number in excess of 10 million – technologies proven and fastest growing fuel over past 5 years**
- **Rapid rollouts, such as in Delhi for all buses, taxis and tuk-tuks, lead to massive improvements in air quality**
- **Petrol (spark) conversions are simple and efficient (same fuel consumption) – bi-fuel**
- **Diesel (compression) engine conversions are more difficult, as require major changes and fitting of spark plugs, so best is new vehicles**
- **Can use gas at 30 % in addition to diesel with simple conversion, also can get bifuel engines**
- **Range is 1/5th of diesel/petrol for same volume of CNG (at 200 bar) – can have load reduction due to added weight of gas cylinders**
- **Safety and standards exist internationally & being adopted by SABS for SA**
- **Biogas (from landfills, manure, municipal green waste, food waste, and energy crops) is Bio/renewable so gets subsidy over NG**

Biogas :Labour intensity and Forex per source

– Natural Gas

- Low job creation and currently imported

– LFG (Landfill gas)

- Utilises waste to replace imported diesel and/or crude oil
- In longer term practice will be stopped: recycling (can have high jobs intensity) and direct energy production
- 1 job per 500 liters/day: 25 x crude refining per liter

– Waste (sewage solids;food; abattoir; Manure eg. cattle feedlots, piggery's, chicken)

- Reduces current problem of sludge going into rivers and sea, or used direct on land as fertiliser
- Saves forex
- 1 job per 300 liters per day: 40 x crude refining per liter, or 5000 jobs per 1 % of national liquid fuels

– Energy crops

- High Job creation in rural areas: 2.5 jobs per 300 liters per day (100x crude refining): 125,000 jobs per 10 % of national liquid fuel usage

General: Regulatory and Incentive Issues

- **Renewable Energy Feed-in Tariff:**
 - Selection criteria and procurement process
 - Standardised Power Purchase Agreements
- **Co-generation feed in Tariff (COFIT) regime**
- **Finalisation of Integrated Resource Plan 2 (IRP2010): .**
- **Independent Power Producers framework**
 - Development of legislation for the creation of the Independent Systems and Market Operator
- **Amendment of South African Income Tax Act – Incentives**
- **Treatment of Gas as vehicle fuel (CNG)**
- **Treatment of biofuels (biogas, bioethanol) over fossil equivalents**
- **Incentives for job creation, eg. Biogas from energy crops versus from LFG**
- **EIA's**
- **License application process**
- **Capacity at local Designated National Authority**
- **Public Finance Management Act and Municipal Finance Management Act constraints**

Biofuel main investment risks

Significant upfront capital required (economies of scale plant), so risk high

20 years plus operation of process plant – with sustainable (renewable) feedstocks and revenue

- I. **Crop (feedstock) price & volatility (can be 70% of costs)**
 - differs per producer – they choose
 - Waste seems most attractive, as opposed to grown crops
- II. **Offtake & Oil price volatility and biofuels “quality”, that gives market discount (sets price of biofuels product)**
 - external factor (oil price) **same** for all producers (investors)
 - determined/negotiated discount **differs** per producer based on site of plant, process etc – they choose
- III. **Exchange rate volatility (oil is US\$ denominated)**

Conclusions

- IDC focus on Green Industries as financier and co-developer
- To support the development to support long term sustainable job creation.
- Investment choice and risk must identify comparative strengths:
 - Resources/ feedstock
 - Technology appropriateness
 - Offtake (Market) positioning and attractiveness
 - Overall financial viability and Risk profile
 - Green features, Job creation and other developmental benefits
- Liquid fuels replacement is more price attractive than electricity
- Regulatory uncertainty, as compared to countries that have significant green fuels penetration

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Thank you

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IDC roles

- **IDC direct funding**
- **Leveraging funding from other investors**
- **Development of new projects in green arena**
- **Demonstrating viability of investments – leading the way**
- **Exploring and accessing international sources of green funding**
- **Development and utilisation of carbon credits – assisting in establishing market**
- **Co-ordinating with other agencies**



Need for greater cross-Govt co-ordination/co-operation in Green sector

• Institutional players:

- IDC
- DBSA
- Khula
- SAMAF
- NEF
- ITAC
- Competition Authorities
- PIC
- SARB

Government dept:

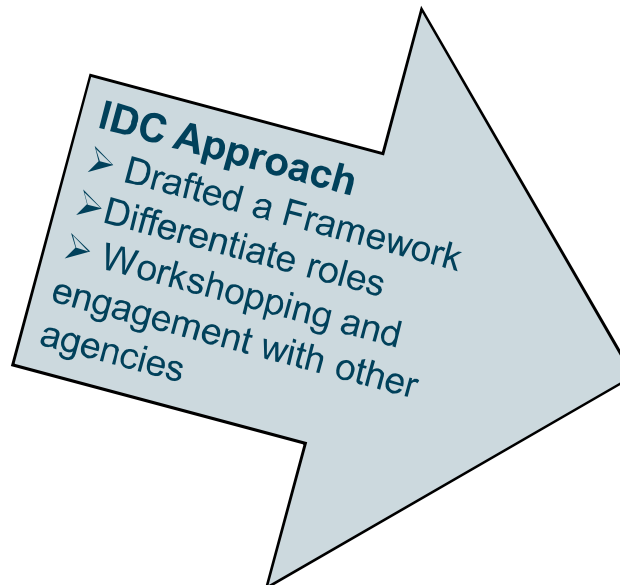
- EDD
- DEAT
- DOE
- DWEA
- DAFF
- DPE
- DST
- DTI

• Energy specific:

- CEF
- Sanedi
- NERSA
- Eskom

IDC's role in coordinating green initiatives:

- Skills development & priorities
- Lead from the front through example
- Assist in clarifying relationships and roles
- Mobilise funding for green initiatives (eg. other DFIs, foreign Governments, etc, tax)



Challenges

- Green economy is not the focus of all players;
- Expectations;
- Some may have conflicting mandates.

Context –Energy usage in SA

- Low cost of electricity (based on cheap coal) – makes green power non-viable in ST
- Transport market is attractive – pricing and local jobs

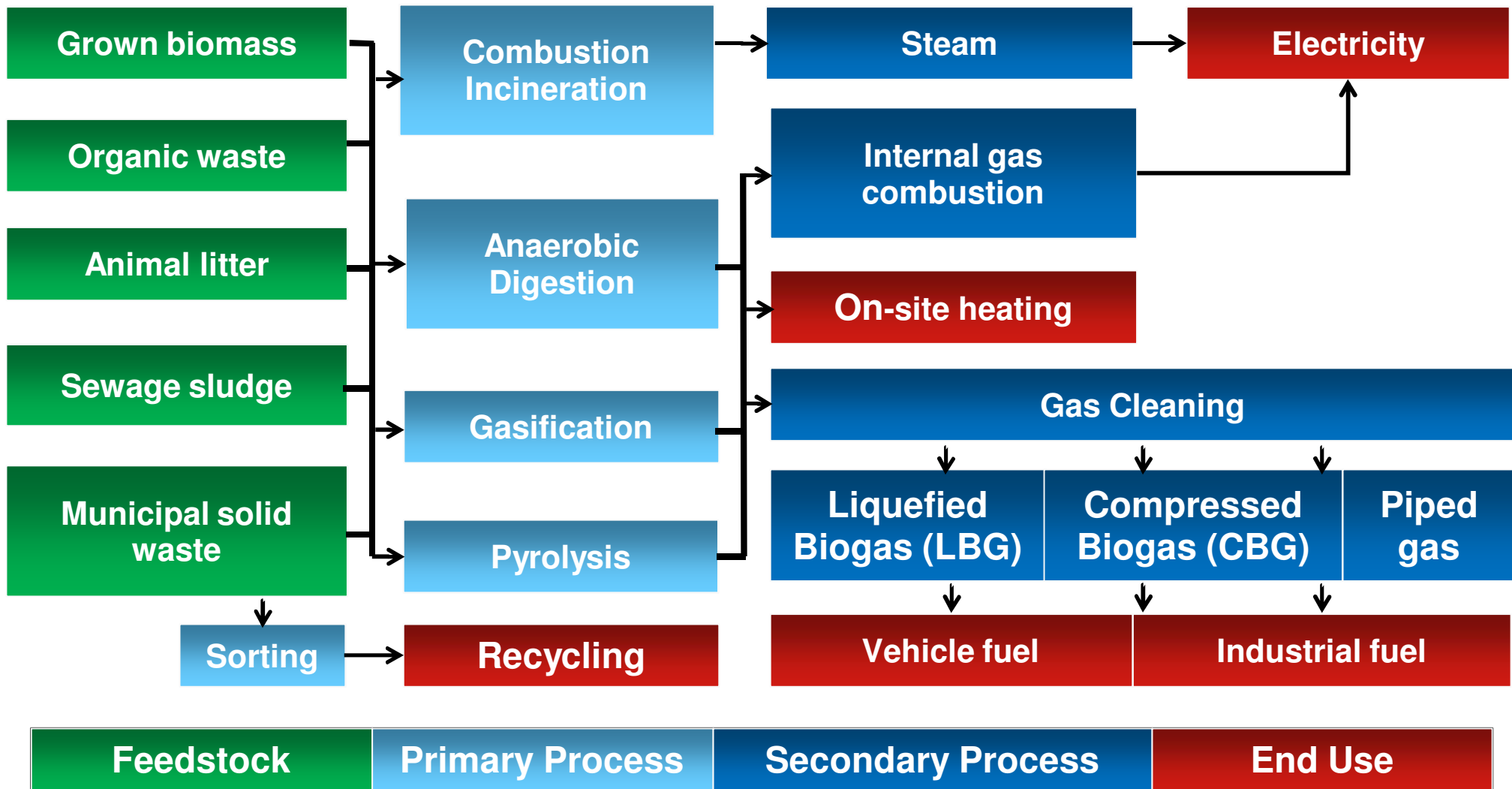
	Coal	Gas (methane)	Diesel (liquid HC)	Comment
R/ton	200	2500	6000+	<i>Coal local new mine – local jobs</i>
GJ/ton	20	50	44	
R/GJ	10	50-100	150-200	
c/ liter (diesel equiv)	—	180-360	490	
c/kWh elec	10	45+	135+	<i>SA should not use Gas or diesel for power. If have engine/turbine run on gas rather than diesel Biogas should go to fuel market not power.</i>
Mil GJ pa use	900 (elec)	240	880 (liquid fuels)	<i>Gas ex Mozambique</i>
SA Usage, R bil pa	30	18	150	<i>Excl taxes, levies, ex works</i>

Waste to Energy: IDC examples of projects

- **Compressed Natural Biogas (CNG) pilot plant**, using Wet Fermentation technology, to produce CNG for use as a fuel and/or electricity substitute; with the plant serving the dual purpose of a training facility as well as being a commercial operation.
- Exploring CNG powered trucks and buses fuelled by Biogas plants
- Opportunity for **municipal solid waste** as a unutilised source of energy
- Biogas from fruit waste and abattoirs
- Biogas from manure (pig, cattle, chicken) and municipal sewage sludges
- Syngas by gasification and conversion to syncrude and electricity



Renewable energy: Waste and Biomass



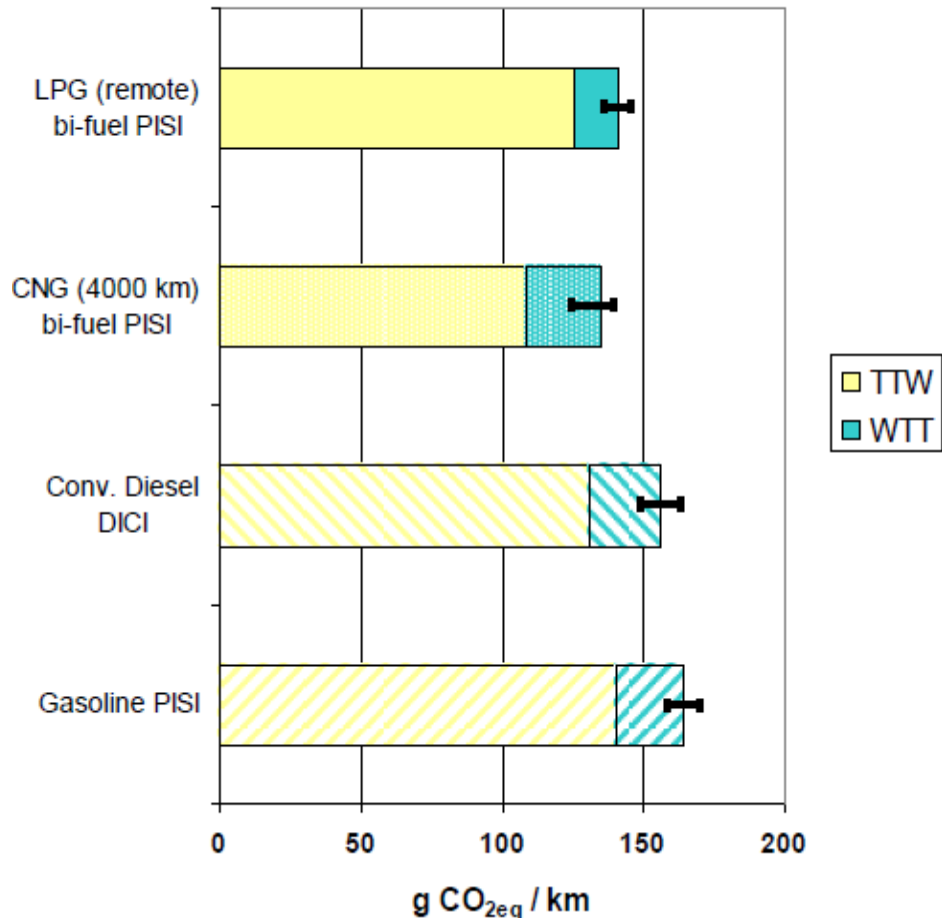
Waste-to-energy Issues

Sector	Main drivers & opportunities	Main barriers
Municipal solid waste	<ul style="list-style-type: none"> ➤ Supply security <ul style="list-style-type: none"> - obligation to reduce - enable expansion 	<ul style="list-style-type: none"> ➤ Municipal procurement process ➤ Slow progress with REFIT implementation
Municipal Sewage	<ul style="list-style-type: none"> ➤ Escalating tariffs ➤ Environmental pressure/responsibility 	<ul style="list-style-type: none"> ➤ Cost of investment ➤ Limited waste availability per site
Municipal and private landfill gas	<ul style="list-style-type: none"> ➤ To develop in-house or by IPPs ➤ Cost of disposal ➤ Renewable Energy Feed-in Tariff (REFIT) 	<ul style="list-style-type: none"> ➤ Long debt tenures required ➤ Not core business for the owner ➤ Projects too small for ring-fencing
Animal waste	<ul style="list-style-type: none"> ➤ Clean development mechanism ➤ Produce methane for electricity generation or for compressed natural gas. 	<ul style="list-style-type: none"> ➤ Lack of market- Corporate off-take ➤ Constraints on sale of electricity ➤ Low financial viability, capital costs, limited awareness
Organic waste	<ul style="list-style-type: none"> ➤ Gasification or incineration of residue ➤ CER revenue for methane destruction and fossil fuel replacement ➤ In addition: Organic compost and organic fertiliser 	<ul style="list-style-type: none"> ➤ Uncertainty over the contractual framework of Power Purchase Agreement (PPA) ➤ Threshold to qualify for REFIT (1 MW) ➤ PPP framework for the municipalities

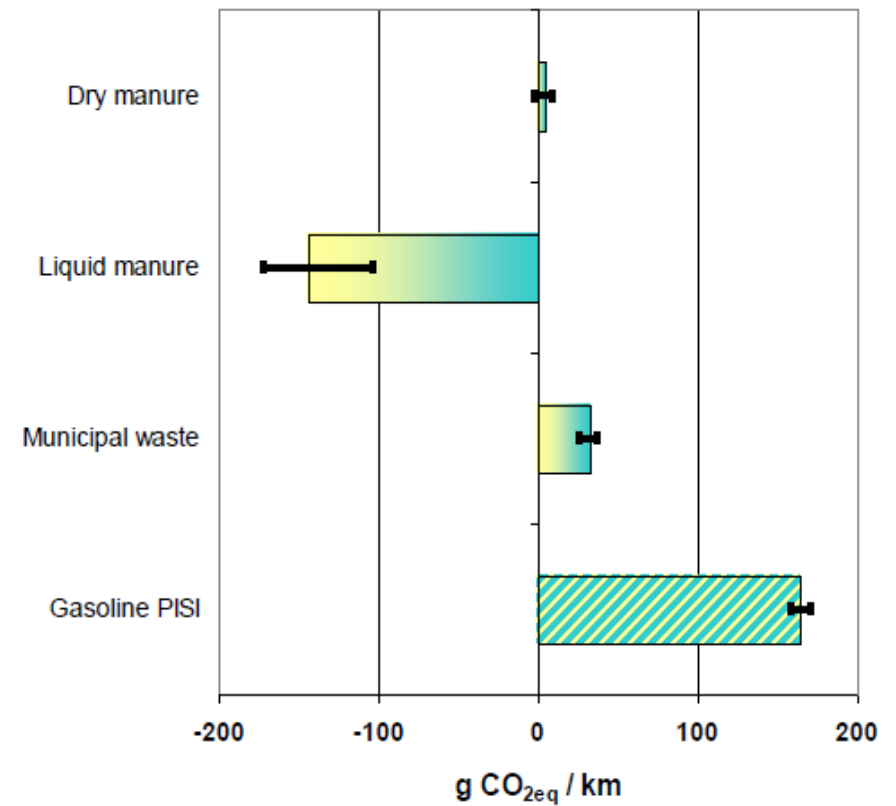
Biogas significantly reduces GHG

Reference: EU Well-to-wheels study, 2007

WTW GHG Emissions for vehicles

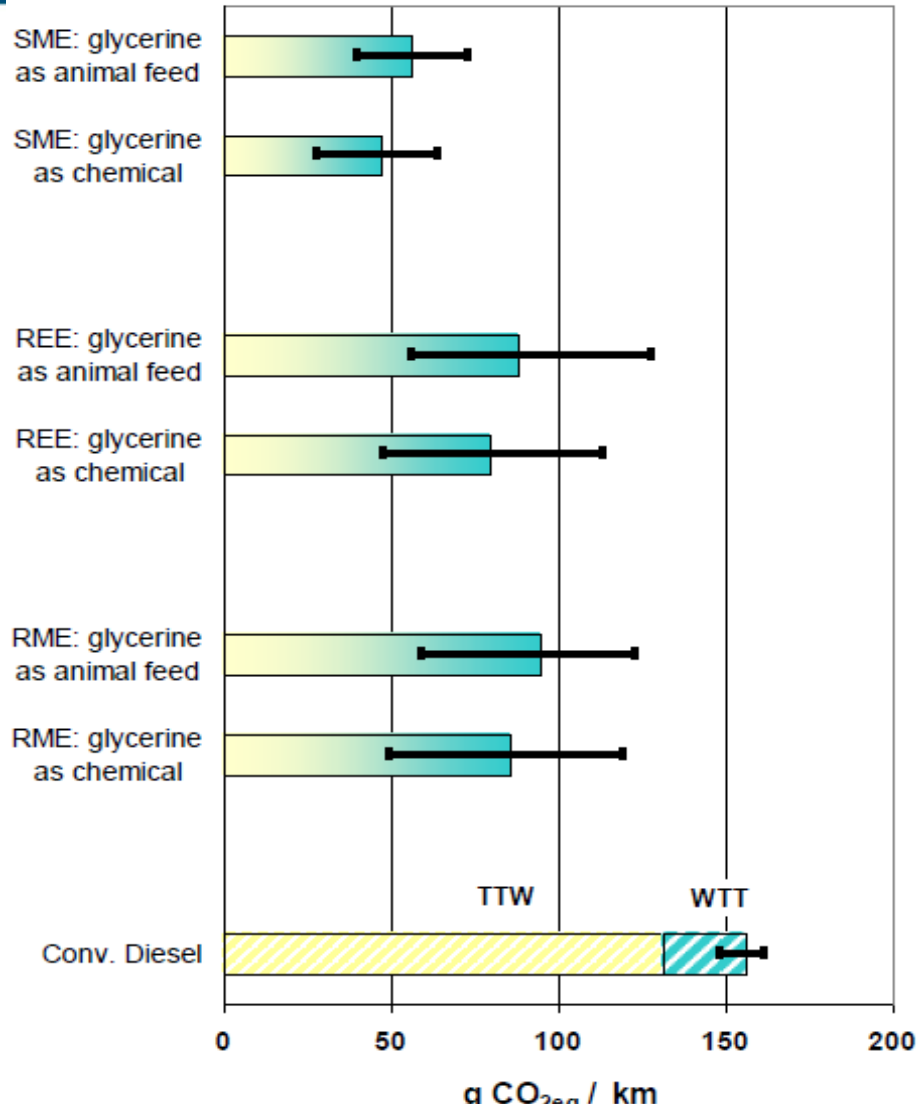


WTW GHG emissions for biogas vehicles

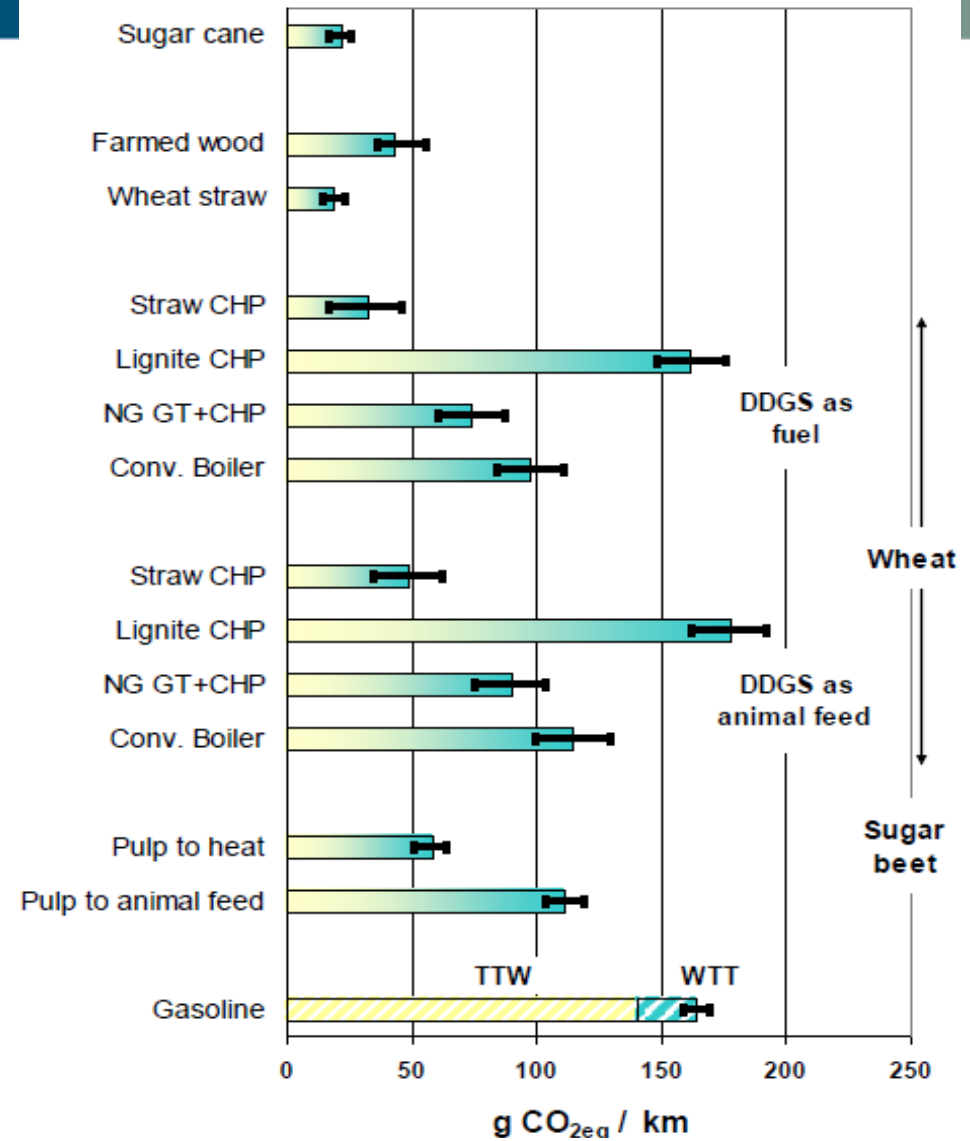


Biodiesels & Bioethanols

WTW GHG



WTW GHG



SA Vehicle: Fuel Options High Level Comparison	Overall Energy Efficiency Cradle-2-grave	CO₂ emissions Ton CO₂ per 10,000km	Water use m³/m³ fuel	Opex Forex for 80 kbpd R mil pa	Cappex For 80 kbpd R bil	Fuel/ Feed stock cost	Jobs for 80 kbpd No.
Crude refinery -Diesel (eg SAPREF)	19%	2.1	0.7	-2330	16	Oil price	500
CTL – Diesel (eg. Secunda)	9 %	6	6	0	150	Coal = 1/4 oil	6000
GTL – Diesel (eg. PetroSA)	13%	3.3	3	0	30	NG = 60 % of oil	1500
Bioethanol eg. grain	14% w. co-product	0	Grain: 11 Cane: 5 (not irrigated)	0	70	Grain, ca 70 % of total cost	150,000
CNG (if local gas, eg. LFG)	22%	1.5	0	0	10 For logistics, vehicles	NG, so 60% of oil	low
CBG (biogas)	17% w. co-product	0	<1	0	80 Incl vehicles, logistics	TBD	30,000 - waste 100,000 - agri
Syngas (bio)	22% w. CHP	0	<1	0	20 excl vehicles, logistics	low	20,000 - waste 70,000 - if agri
Electric vehicle (Eskom elec)	25%	1.8	3	0	Vehicles, batteries?	electricity	low
Hydrogen fuel cell (Eskom elec)	9%	6.4	7	0	logistics	Electricity x3	low