



**Reliance**

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Growth is Life

**Hydrocarbons : Trade and Technology transfer potential across the  
Indian Ocean**

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# India and Africa : A Snapshot



- Surface Area – 30 mil sq km
- Population – 1020 millions
- GDP growth – 5 % annual
- GDP – 1693 US \$ billion
- Primary Energy: 373 mtoe
- Coal production: 145 mtoe
- Electricity Generation: 664 Tw hrs
- Crude Production: 493 MMT
- POL Production: 116 MMT
- Crude Exports: 360 MMT
- POL Imports: 48 MMT

Crude Surplus

- Surface Area – 3 mil sqkm
- Population – 1170 millions
- GDP growth – 7.5 % annual
- GDP – 1729 US \$ billion
- Primary Energy: 524 mtoe
- Coal production: 216 mtoe
- Electricity Generation: 922 Tw hrs
- Crude Production: 34 MMT
- POL Production : 150 MMT
- Crude Imports: 159 MMT
- POL Exports: 51 MMT

Product Surplus

Source: Country Data Profile, World Bank 2009-10, PPAC and BP Stats 2011

Over a billion people on either side of the Indian Ocean could benefit from trade and technology transfer

# Household energy Optimisation:



|                        | Biomass   | LPG                        | Kerosene                                   | Natural Gas                                  |
|------------------------|---|----------------------------|--|--|
| Final Use              | Cooking   | Cooking & transportation   | Cooking & Lighting                         | Cooking & transportation                     |
| Ease of Use            | Difficult   | Good                       | Intermediate                               | Good   |
| Storage Container      | Not required  | Steel:LPG::1:1             | Steel:Liquid::1:10                         | Steel:Gas::5:1                               |
| Safety concerns        | Low   | Stems from potential leaks | Possibility of fires and burns thru misuse | Stems from potential leaks                   |
| Pollution              | High  | Low                        | Intermediate                               | Low  |
| Logistics Cost & reach | Generally available Locally ; Huge manual effort spent in gathering | Rural reach - intermediate | Rural reach - high                         | Essentially an Urban fuel – poor rural reach |
| Cost                   | High (with chimneys, baffles etc.).                                 | High                       | Lowest                                     | High   |

**Transition from biomass to appropriate commercial fuels important for health and social welfare.**

# Criteria for optimisation of household energy:

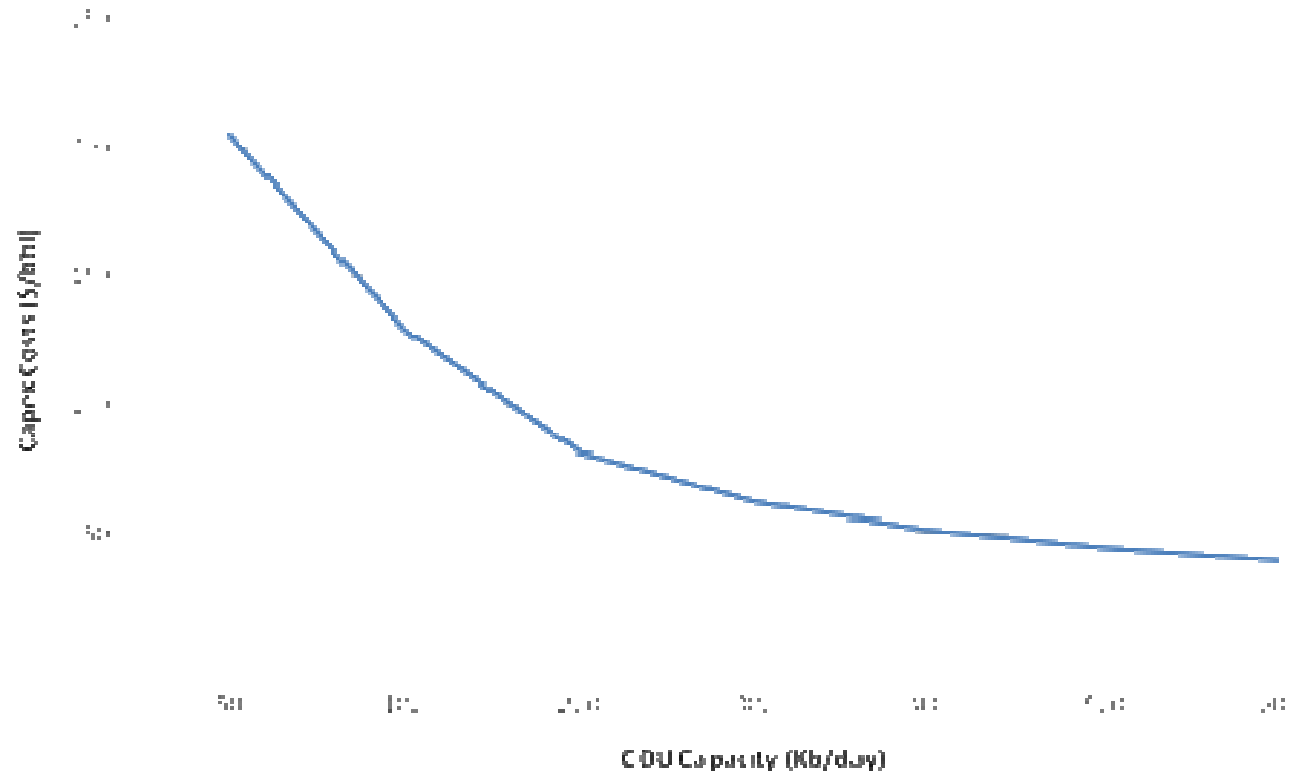


|  |               | Kerosene     | Pressurised LPG | Refrigerated LPG | Natural Gas |
|--|---------------|--------------|-----------------|------------------|-------------|
| <b>Cost Of Imports</b>                 |               |              |                 |                  |             |
| FOB AG                                 | \$/MT         | 995          | 791             | 791              | -           |
| Ocean Freight                          | \$/MT         | 21           | 55              | 30               | -           |
| CIF landing                            | \$/MT         | 1,016        | 846             | 821              | 780         |
| Terminalling and distribution expenses | \$/MT         | 62           | 133             | 117              | 105         |
| <b>Cost to Consumer</b>                | <b>\$/MT</b>  | <b>1,078</b> | <b>979</b>      | <b>938</b>       | <b>825</b>  |
| <b>Min Population Density</b>          |               |              |                 |                  |             |
| Min Population Density                 | Number/Sq. KM | < 100        | > 100           | >10,000          | > 25,000    |
| Total Project CAPEX                    | Million USD   | 43           | 59              | 213              | 115         |
| CAPEX per family                       | USD           | 8            | 68              | 54               | 383         |
| OPEX per family                        | USD/Annum     | 63           | 98              | 94               | 63          |

- Thresh hold population density for city gas distribution is found only in large urban areas and in few pockets.
- LPG prices dropping relative to kerosene

**Africa can and should leapfrog to a gas/LPG based economy from non commercial source of energy**

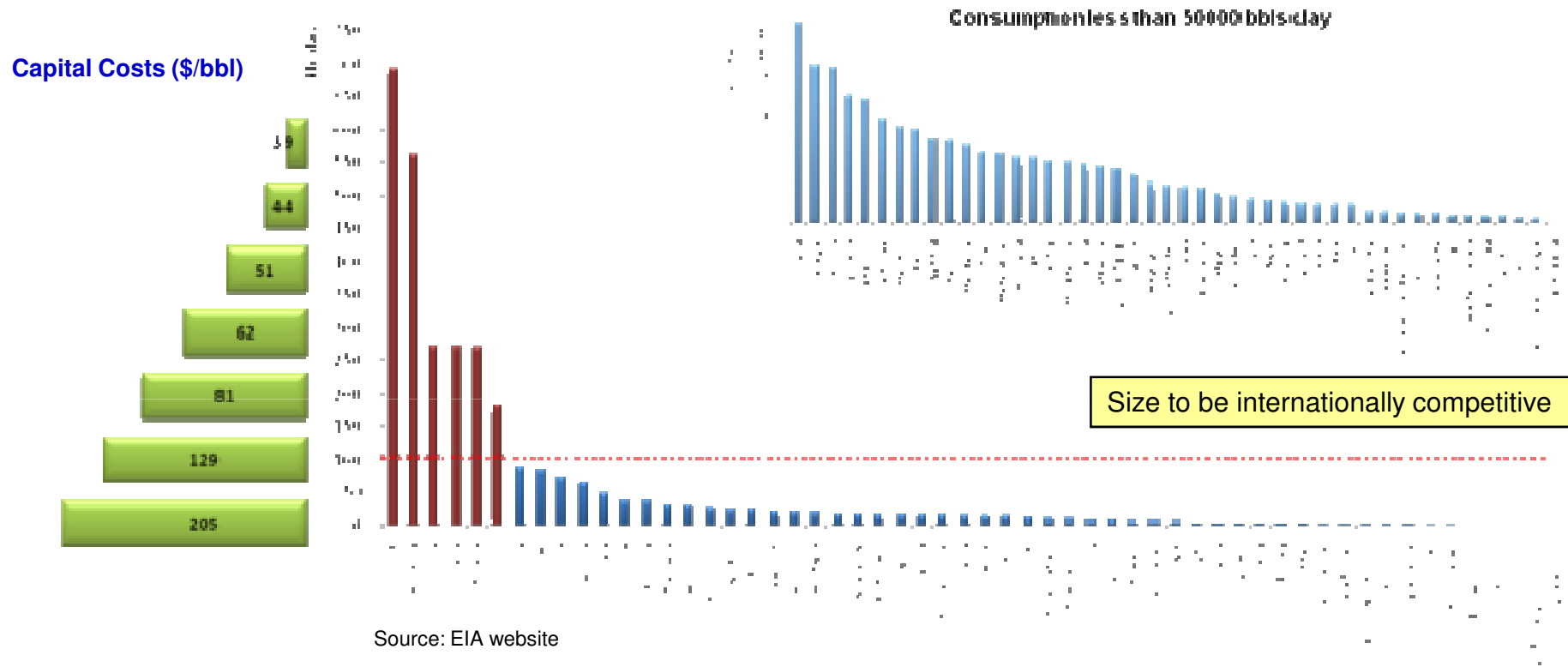
# Economies of scale for refineries



Smaller refineries (< 100 kbpd) are shutting down since return on capital is often negative. Scale and complexity essential for survival of refineries.

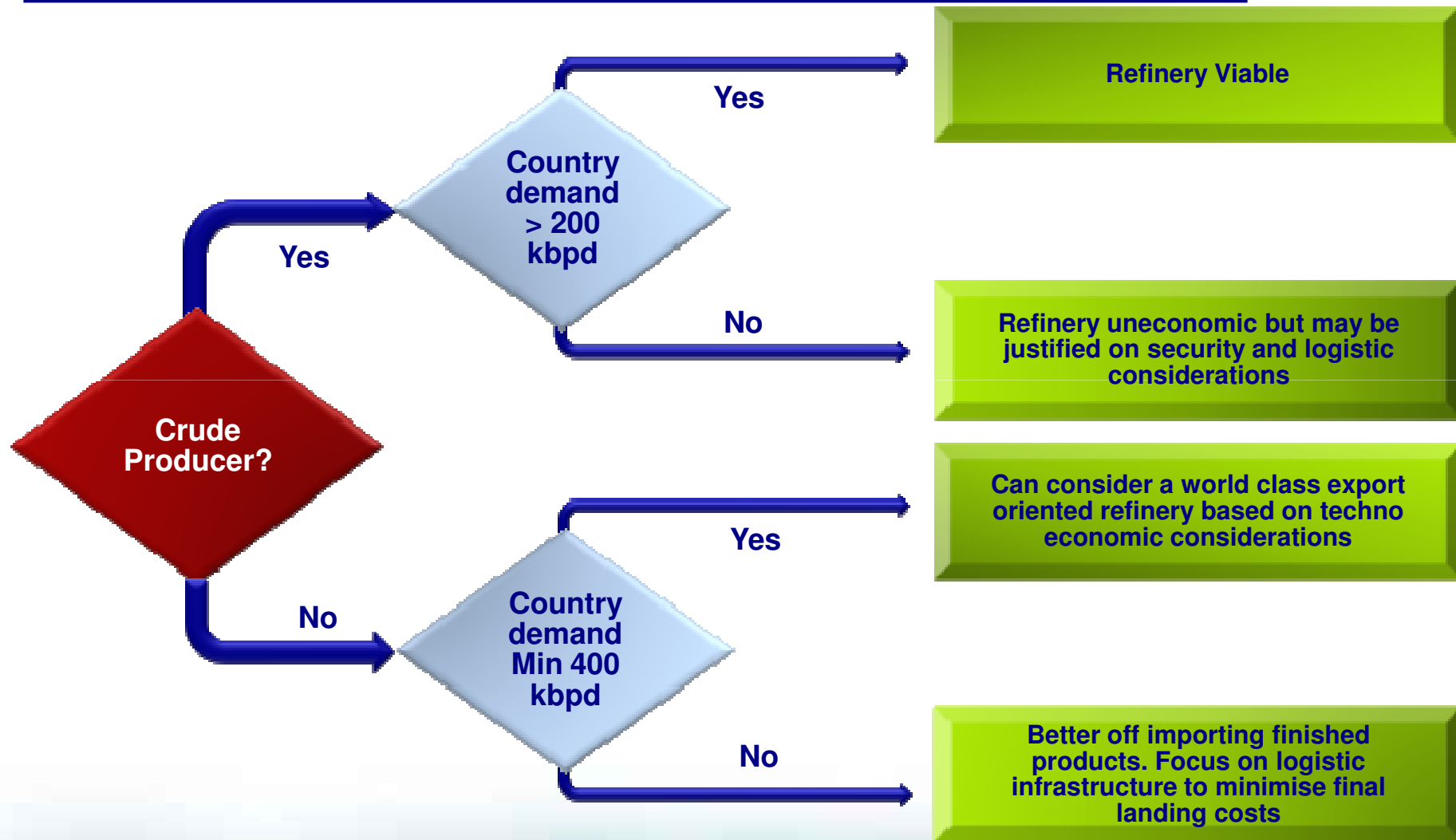


# Does every African country need a refinery?



- Security of supply is better provided by domestic refineries if demand is sufficient, but...
- ... most countries do not have sufficient oil demand to justify having an internationally competitive refinery

# National Strategic Considerations for a refinery



Oil producing countries can get into long term contracts with product surplus countries

# Does every region/cluster need a refinery?



| Region                            | Country  | Port   | Cluster Demand (Kb/day) | Refinery Production (Kb/day) |
|-----------------------------------|--|--|-------------------------|------------------------------|
| West Africa (Senegal Cluster)     | Senegal, Mauritania, Guinea, Sierra Leone, Liberia, Western Sahara                           | Dakar (Senegal)<br>Port Victoria (Seychelles)  | 80                      | 21                           |
| West Africa (Ghana Cluster)       | Ghana, Cote dlvoire, Burkina Faso, Mali, Gambia, Guinea-Bissau, Cape Verde                   | Tema (Ghana)<br>Abidjan (Cote dlvoire)   | 94                      | 98                           |
| West Africa (Nigeria Cluster)     | Nigeria, Benin, Togo, Niger, Chad  | Lagos, Harcourt (Nigeria)  | 316                     | 93                           |
| Central Africa (Cameroon Cluster) | Cameroon, Gabon, Congo (Brazzaville), Central African Rep, Equatorial Guinea, Sao Tome % Prp | Duoala (Cameroon)<br>Owendo (Gabon)  | 59                      | 70                           |
| Central Africa (Angola Cluster)   | Angola, Namibia, Congo (Kinshasa), Saint Helena  | Luanda, Lobito, Cabinda (Angola)<br>Walvis Bay (Namibia)                                     | 98                      | 38                           |
| Southern Africa                   | South Africa, Botswana, Zambia, Mozambique, Zimbabwe, Malawi, Swaziland, Lesotho             | Durban, Cape Town, East London, Port Elizabeth (South Africa)<br>Maputo & Beira (Mozambique) | 632                     | 536                          |
| East Africa (Tanzania Cluster)    | Tanzania, Mauritius, Reunion, Madagascar, Burundi, Comoros                                   | Dar (Tanzania)   | 93                      | -                            |
| East Africa (Kenya Cluster)       | Kenya, Uganda, Rwanda, Seychelles  | Mombasa (Kenya)  | 98                      | 33                           |
| North East Africa                 | Sudan, Ethiopia, Djibouti, Somalia, Eritrea  | Port Sudan (Sudan)<br>Djibouti   | 144                     | 116                          |
| North Africa                      | Egypt, Libya, Algeria, Morocco, Tunisia  |  | 1,508                   | 1,535                        |

Source: EIA website

**In some regions, a regional refinery may be justified and focus should be on logistic infrastructure to minimise costs.**

# Quality Options: Too Much or too little



| Region         | Gasoline          |                       |                     |                             |                |                | Gasoil            |              |               |          |
|----------------|-------------------|-----------------------|---------------------|-----------------------------|----------------|----------------|-------------------|--------------|---------------|----------|
|                | Sulphur (ppm,max) | Aromatics (vol%, max) | Benzene (vol%, max) | RVP at 37.8°C (kPa,min-max) | Octane Regular | Octane Premium | Sulphur (ppm,max) |              | Cetane Number |          |
|                |                   |                       |                     |                             |                |                | On - Road         | Off-Road     | On - Road     | Off-Road |
| North America  | 30                | 29                    | 1.1                 | 44-75                       | 87             | 91-93          | 60                | 1,380        | 40            | 40       |
| Latin America  | 650               | 37                    | 1.8                 | 35-90                       | 87             | 91-93          | 1,550             | 3,990        | 44            | -        |
| Europe         | 15                | 35                    | 1.1                 | 45-90                       | 91             | 95-98          | 17                | 1,010        | 51            | 51       |
| CIS            | 470               | 43                    | 2.8                 | 35-100                      | 80-92          | 95-98          | 590               | 2,650        | 48            | -        |
| Asia - Pacific | 310               | 39                    | 2.2                 | 45-90                       | 90             | 95             | 620               | 4,200        | 46            | -        |
| Middle East    | 770               | 40                    | 2.3                 | 55-75                       | 90             | 95             | 4,500             | 6,900        | 49            | -        |
| <b>Africa</b>  |                   |                       |                     |                             |                |                |                   |              |               |          |
| <b>2009</b>    | <b>840</b>        | <b>50</b>             | <b>5.0</b>          | <b>45-90</b>                | <b>88</b>      | <b>92</b>      | <b>4,400</b>      | <b>6,400</b> | <b>46</b>     | <b>-</b> |
| <b>2020</b>    | <b>290</b>        | <b>38</b>             | <b>2.0</b>          | <b>45-85</b>                | <b>90</b>      | <b>93</b>      | <b>1,020</b>      | <b>2,200</b> | <b>48</b>     | <b>-</b> |
| <b>2030</b>    | <b>100</b>        | <b>36</b>             | <b>1.0</b>          | <b>45-85</b>                | <b>91</b>      | <b>94</b>      | <b>210</b>        | <b>1,000</b> | <b>49</b>     | <b>-</b> |

Source: HART Energy Consulting,2010

- Exporting refineries need to match specs in receiving countries.
- Africa dependent on the rest of the world for product deficits

**As Africa integrates with global markets, African refineries have to catch up with regional and global specs.**



# Scope for India – Africa Co-operation:



## India's Score card

- Expertise in E&P, both on-shore and off-shore including deep water exploration.
- Proven track record in building large, complex, modern, integrated and environment friendly refineries in record time.
- 50 plus years of experience in operating, up-gradation and de bottlenecking of old refineries in cost effective manner.
- Successful in reaching petroleum products, through its retail network, to one billion people in over half a million villages, including LPG supplies to over 120 million customers.
- Expertise in building cross – country logistic infrastructure: Ports & jetties, pipelines, rail & road, storage terminals.
- Knowledge Partner – Human Capital, IT, SCM and Training in the Oil Sector

## Medium term area's of co-operation

- Operation, de-bottlenecking and maintenance of existing refineries
- JVs for Crude imports & product export opportunities with Indian companies .
- JV's for Upstream E&P activities in African blocks
- Mid stream contracts for developing logistic infrastructure.
- Partnerships for setting up retail network in host countries.
- Consultancy services

## Long term area's of co-operation

- Tapping Energy potential of Africa.
- Equity participation in development of fields
- Midstream and downstream JVs and investments
- Energy Security for India in future

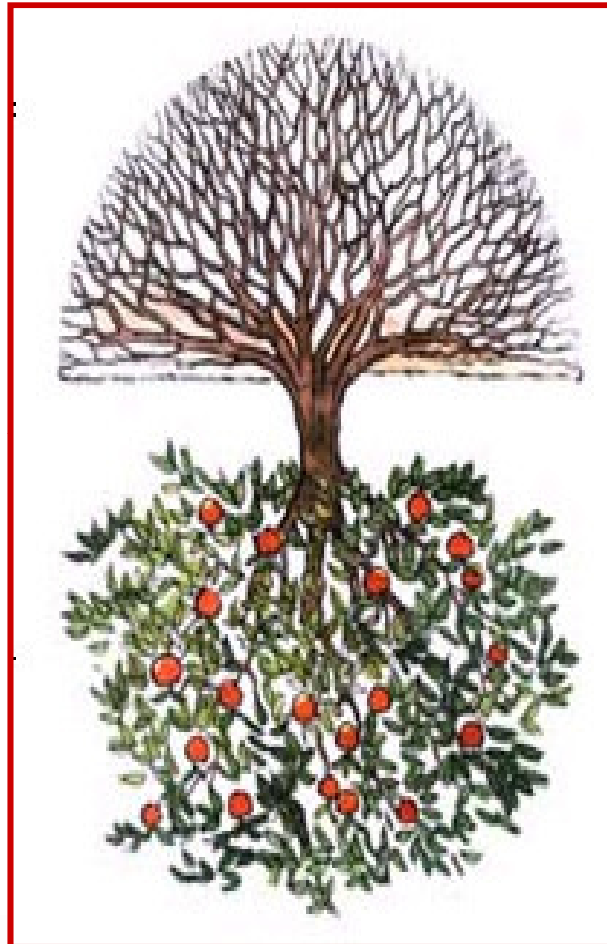
**Africa can safely count on Indian proven skills in the hydrocarbon sector**

# There is Significant Hidden Value in Trans - Indian Ocean Energy Space



South – South co-operation can help:

- Africa to attract scarce investment capital and maximize its energy potential.
- India to increase its energy security



*African and Indian companies can forge win - win partnerships.*

**Cooperate for sustainable growth and development.....Thank You!!**