UNCTAD

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Extractive Industries and Sustainable Job Creation

Story of Successful, Sustainable Green Business Model

By

Hassan Hashim Erwa
Sales and Marketing Corporate Director,
Kenana Sugar Company Ltd., Republic of the Sudan

The views expressed are those of the author and do not necessarily reflect the views of UNCTAD.
Story of Successful, Sustainable Green Business Model

By
Hassan Hashim Erwa
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2. Sudan Sugar Production
3. Kenana Business Model
4. Sustainable Business Model
5. Biofuel Experience
About Sudan

Sudan Sugar Production
Kenana Business Model
Sustainable Business Model
Biofuel Experience
About Sudan

Sudan Sugar Production
Kenana Business Model
Sustainable Business Model
Biofuel Experience

Sudan – A Resource Basket

Agriculture
- Priority sector for Govt
- Growth in contribution to GDP 3x from 1986 to 2006

Land
- 3rd largest African country-1.8 mn.sq.mt
- 57% land suitable for agriculture (only 8.5% cultivated)

Soil and climate
- Arable land – sandy, clay, laterite, alluvial
- Suitable temperature and humidity

Ample water supply
- 4,100 cubic metre per person pa
- Rainfall (average), rivers (White Nile & Blue Nile) and underground water

Population:
- Population: 34 million
- Population growth: 2% pa
- Nominal GDP: US$ 56 billion
- GDP growth in 2011: -3%

% of GDP:
- Services and others (47%)
- Industrial (28%)
- Agriculture (25%)
Sudan Sugar Production
Sudan – Sugar Production

(Sugar production MT)

<table>
<thead>
<tr>
<th>Year (Fiscal)</th>
<th>Sugar Production (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970/71</td>
<td>90,584</td>
</tr>
<tr>
<td>1975/76</td>
<td>128,661</td>
</tr>
<tr>
<td>1980/81</td>
<td>207,213</td>
</tr>
<tr>
<td>1985/86</td>
<td>451,900</td>
</tr>
<tr>
<td>1990/91</td>
<td>459,329</td>
</tr>
<tr>
<td>1995/96</td>
<td>692,688</td>
</tr>
<tr>
<td>2000/01</td>
<td>773,625</td>
</tr>
<tr>
<td>2005/06</td>
<td>747,170</td>
</tr>
<tr>
<td>2010/11</td>
<td>703,248</td>
</tr>
</tbody>
</table>

About Sudan

Sudan Sugar Production

Kenana Business Model

Sustainable Business Model

Biofuel Experience

23, November 2015
Kenana Business Model
Kenana Sugar Company

KSC Vision

The renewable green source of food and energy.
Kenana Sugar Company

KSC Mission

Cane & sugar production

Integrated production of food products

Bio fuels production

Knowledge leader in technical solutions & project delivery partnership

Sustainable integrated solutions for agribusiness

Engineering, fabrication & erection

Massive green environment enhancer

Social and development dimensions

Leader in the development of agricultural projects in Sudan,
### History of Innovation and Achievements

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>Establishment of Kenana Cane Research Station</td>
</tr>
<tr>
<td>1975</td>
<td>KSC incorporated between Govt of Sudan &amp; Lonrho UK</td>
</tr>
<tr>
<td>1980/81</td>
<td>First crop TCD 17,000</td>
</tr>
<tr>
<td>1985</td>
<td>Full capacity 35,000 hectares 400,000 MT sugar 116 MT/ha yield</td>
</tr>
<tr>
<td>1986</td>
<td>Diversification starts based on sugar by-products</td>
</tr>
<tr>
<td>2000</td>
<td>Factory upgrade TCD 26,000</td>
</tr>
<tr>
<td>2007</td>
<td>Animal feed 100,000 MT</td>
</tr>
<tr>
<td></td>
<td>Milk 3.7 million lts</td>
</tr>
<tr>
<td></td>
<td>Meat 1.4 million kgs</td>
</tr>
<tr>
<td></td>
<td>Poultry 1.2 million kgs</td>
</tr>
<tr>
<td></td>
<td>Commercia l forest 2,430 ha</td>
</tr>
<tr>
<td>2009</td>
<td>Ethanol 60 million litres</td>
</tr>
<tr>
<td></td>
<td>Certified Seeds 5,000 MT</td>
</tr>
<tr>
<td></td>
<td>Mngt of more than 200,000 ha of land</td>
</tr>
<tr>
<td>2010</td>
<td>KIAS Ethanol plant</td>
</tr>
<tr>
<td>2012</td>
<td>White Nile Sugar project</td>
</tr>
</tbody>
</table>

**Consistent growth and expansion in both sugar and agro-industrial sector to become the worlds largest integrated sugar company.**
Kenana Sugar Cane Model

About Sudan
Sudan Sugar Production
Kenana Business Model
Sustainable Business Model
Biofuel Experience

Cane Juice
- Raw/White
- 1G Ethanol
- Molasses
- Yeast
- Animal feed
- Power
- MDF/Paper
- 2G Ethanol

Trash / Bagasse
- Animal feed
- Bio-fertilizer

Co-Cropping
- Soya Beans
- Bio-diesel

Carbon Credits

Vinasse
- Bio-fertilizer

Gel

Plastic

Yeast

CO₂
Sustainable Business Model
Kenana renewable devplmnt. Role

KSC project is the largest integrated sugar project in Sudan which played great role in Sudan economic development in many areas such as:

- Environmental care
- National Economic Role
- Social Development
KSC great role in social devlpmnt.

KSC played a unique role in social development at KSC site, and it made a tremendous change in both rural & urban areas.

KSC provided the population with different specialties and a huge amount of services and comfort life. Such as
## Sustainable Business Model

<table>
<thead>
<tr>
<th><strong>People</strong></th>
<th>&gt; 4,000 in full time employment</th>
<th>&gt; 7,000 in part time employment</th>
<th>&gt; 30,000 people in Kenana estate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education &amp; learning</strong></td>
<td>58 schools and learning institutes at Kenana site</td>
<td>11,500 children under education (primary &amp; secondary)</td>
<td>8 libraries and sport facilities</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td>Township with Power (3.5MW) regular supply of power</td>
<td>Water Treatment (4.4M m³) provides drinking water</td>
<td>12 Hospitals &amp; Clinics catering to more than 140,000 patients annually</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>4,500 ha under commercial forest</td>
<td>Cane fields effect the entire ecosystem</td>
<td>Economical solution to combat desertification</td>
</tr>
</tbody>
</table>

### Kenana site
- **People**:
  - > 4,000 in full time employment
  - > 7,000 in part time employment
  - > 30,000 people in Kenana estate

- **Education & learning**:
  - 58 schools and learning institutes at Kenana site
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- **Infrastructure**:
  - Township with Power (3.5MW) regular supply of power
  - Water Treatment (4.4M m³) provides drinking water
  - 12 Hospitals & Clinics catering to more than 140,000 patients annually

- **Environment**:
  - 4,500 ha under commercial forest
  - Cane fields effect the entire ecosystem
  - Economical solution to combat desertification

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## Sustainable Business Model

### Positive impact on the economy

<table>
<thead>
<tr>
<th>Contribution</th>
<th>30% contribution to Govt. taxes &amp; duties</th>
<th>Port activity</th>
<th>GDP contribution</th>
</tr>
</thead>
</table>

### Livelihood of communities in adjoining estates

- **Better standard of living**
- **Low infant mortality rate**
- **Higher per capita income**

### Adjoining villages and communities

- **Hospitals & Clinics** built for general public use
- **Water Treatment Plant** Supplied and erected for general public use
- **Schools** Primary & secondary school built

### Industries that benefit from Kenana

- **Transport and logistics (road, rail & air)**
- **Contractors and services providers**
- **Suppliers of equipment & machinery**

### Economy at large

- **Positive impact on the economy**
  - Contribution to Govt. taxes & duties
- **Port activity**
  - Products / inputs export / import
- **GDP contribution**

- **Livelihood of communities in adjoining estates**
- **Better standard of living**
- **Low infant mortality rate**
- **Higher per capita income**

- **Adjoining villages and communities**
- **Hospitals & Clinics** built for general public use
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- **Industries that benefit from Kenana**
- **Transport and logistics (road, rail & air)**
- **Contractors and services providers**
- **Suppliers of equipment & machinery**
Corporate Social Responsibility

**KSC great role in social devlpmnt.**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Sudan average</th>
<th>Sugar industry areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaths of children under 5 year-old (every thousand)</td>
<td>104</td>
<td>10</td>
</tr>
<tr>
<td>Deaths of Moms giving birth</td>
<td>59.9</td>
<td>14</td>
</tr>
<tr>
<td>Assimilation in Elementary education completion of elementary schools</td>
<td>%63</td>
<td>%95</td>
</tr>
<tr>
<td>Assimilation in High school education</td>
<td>%79.5</td>
<td>%95</td>
</tr>
</tbody>
</table>

Ministry of health conducted comparison studies for sugar factory areas to measure the human development average combined with other areas in Sudan.

The Study was conducted by specialists center’s such as University of Khartoum and Beheiry center confirmed social stability on Sugar industry areas because of the availability of essential services.
KSC contributed to push and embrace the rural manufacturing development project and continued its role by supporting poverty eradication with supporting families with limited low income in rural areas. Also by helping them produce the Eucalyptus oil that have high economic value, therefore they would benefit from the Eucalyptus trees that exists around the factory.
The strategic partnership and projects was relied on:

- Value chain concept
- Fair trade concept

These two concepts was adopted for the eucalyptus oil projects and graduates projects for fattening.
Sustainable Business Model

• A cross-cane fields stretching commercial forest safety in confronting the desertification.

• Restore the rainforest ecosystems in areas adjacent to restore vegetation to reverse desertification.

• Reduce the temperature an average of 2°C in the factory locations and impact positively on the environment and reduce losses from evaporation.
Kenana Biofuel Experience
Key Market Drivers

- EU (RED) and USA Regulations.
- Energy security.
- Climate changes.
- Economic viability.
Inputs of Ethanol Production

- POTATOES
- SORGHUM
- CORN
- CASSAVA
- FRUITS
- BEETS
- CANE for Juice & Molasses
Ethanol Feedstock Mix 2012

- Corn: 63%
- Sugarcane: 25%
- Molasses: 5%
- Others: 7%
Ethanol is considered one of the most efficient fuels. Produces no polluting gasses, or gum residues upon combustion in motor engines. It suites all requirements of steam pressures for vehicle usage in cold or worm countries. E-10 achieves 91 Octane No. and E-85 achieves up to 105 Octane No. The conventional vehicles can run on blended Ethanol-gasoline without modification of the engines up to 25% Ethanol (E-25). For higher blending ratios up to E-85, flexi engines are required.
## Ethanol Fuel: Oil Vs Ethanol Risk Analysis

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Oil</th>
<th>Biofuels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Security Risk</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Cost per Mile</td>
<td>Med</td>
<td>Low</td>
</tr>
<tr>
<td>Infrastructure Cost</td>
<td>Very Low</td>
<td>Low</td>
</tr>
<tr>
<td>Technology Risk</td>
<td>Very Low</td>
<td>Low</td>
</tr>
<tr>
<td>Environmental Cost</td>
<td>Very High</td>
<td>Low</td>
</tr>
<tr>
<td>Implementation Risk</td>
<td>Very Low</td>
<td>Low</td>
</tr>
</tbody>
</table>
Ethanol Fuel: World Ethanol (mln litre)

<table>
<thead>
<tr>
<th>Year</th>
<th>Ethanol Production (mln litre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>71,363</td>
</tr>
<tr>
<td>2010</td>
<td>84,910</td>
</tr>
<tr>
<td>2011</td>
<td>83,113</td>
</tr>
<tr>
<td>2012</td>
<td>82,797</td>
</tr>
<tr>
<td>2013</td>
<td>88,145</td>
</tr>
<tr>
<td>2014</td>
<td>93,015</td>
</tr>
<tr>
<td>2015</td>
<td>93,770</td>
</tr>
</tbody>
</table>
### Ethanol Blending Ratio

<table>
<thead>
<tr>
<th>Country</th>
<th>Blend %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>25–85</td>
</tr>
<tr>
<td>Central America</td>
<td>5–25</td>
</tr>
<tr>
<td>Canada</td>
<td>10</td>
</tr>
<tr>
<td>EU</td>
<td>5–10</td>
</tr>
<tr>
<td>USA</td>
<td>10–25</td>
</tr>
<tr>
<td>India</td>
<td>5–10</td>
</tr>
<tr>
<td>China</td>
<td>10</td>
</tr>
</tbody>
</table>
Success Factors for Bio-Fuels in Sudan

Feedstock  Technology  Policy
Ethanol from Sugarcane

- Ethanol is produced in large quantities by fermenting sugar.

- The molasses is approximately 50% sugar content that may be directly fermented.

- An average of 360 kg molasses produce 100 liters of Ethanol.

- This means approximately 270 liters of Ethanol per MT of molasses.

One ton of sugarcane

<table>
<thead>
<tr>
<th>Used in the sugar production yields</th>
<th>Used in the ethanol production yields</th>
</tr>
</thead>
<tbody>
<tr>
<td>118 kg of sugar</td>
<td>85 litres of anhydrous ethanol</td>
</tr>
<tr>
<td>10 litres ethanol</td>
<td>89 litres of hydrous ethanol</td>
</tr>
</tbody>
</table>

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Ethanol from Sugarcane

Sugarcane

Juice Extraction

Baggase

Leaves & Tops

Sugar

Ethanol

Power Generation

Feedstock

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Ethanol Technology

Kenana Ethanol Plant
Ethanol Technology

- Feasibility study by Techserve, South Africa.
- Manufactured & supplied by Dedini of Brazil (January – August 2009).
- Erected by Kenana Equipment Manufacture Business Unit (KEM).
- Commissioned in June 2009.
- Installed capacity 200,000 litres Ethanol per day; 65 million litres Ethanol per year.
- Produces anhydrous Ethanol with a purity of 99.8% w/w.
- Ethanol specification supersedes EU Standards (EN 15376:2007).
Ethanol Technology

- Daily Production Rate: 200,000 Litres
- Ethanol Annual Production: 65 million Litres
- Ethanol By-products:
  - 2nd Grade Alcohol
  - Fusel Oil
  - Yeast
Sudan Government has mandated blending of Ethanol-Benzene through Council of Ministers in March 2008.

**Ethanol Bill** of blending ethanol into benzene has been set by a committee consisted of KSC, Ministry of Industry, Ministry of Petroleum, GIAD and SSMO.

Ethanol Bill has reviewed by the Ministry of Justice.

Next step for the bill is to be approved by Parliament.
Factors of Success

- Political Will
- Government support (Subsidies, tax exemption).
- Enhancing agricultural productivity through investments.
- Improving distribution infrastructure.
- Commitment of Oil Distribution Companies.
- Price Factor (monthly revision of the Benzene price).
- Acceptance of the public (End Users).
Kenana Plans for Ethanol

<table>
<thead>
<tr>
<th>Product</th>
<th>Partner</th>
<th>Target Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>E 10</td>
<td>Nile Petroleum</td>
<td>End consumers</td>
</tr>
<tr>
<td>AVGAS</td>
<td>SAFAT &amp; ARC</td>
<td>Small Airplanes</td>
</tr>
<tr>
<td>Ethanol Gel Fuel</td>
<td>Gum Arabic Board</td>
<td>Rural areas &amp; households</td>
</tr>
<tr>
<td>Expansion Plan</td>
<td>Kenana</td>
<td>200 million by 2020</td>
</tr>
</tbody>
</table>
Nile Ultra E-10 (2010)
Nile Ultra E-10 (2010)
Nile Ultra E-10 (2010)
Kenana Sugar Company Limited
RENEWABLE GREEN SOURCE OF FOOD & ENERGY

مصادر أخضر متجدد للغذاء والطاقة
Renewable Green Source of Food & Energy
Thank You

مصادر أخضر متجدد للغذاء والطاقة
Renewable Green Source of Food & Energy