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Energy in Africa

December 1999

Energy Information Administration
Office of Energy Markets and End Use
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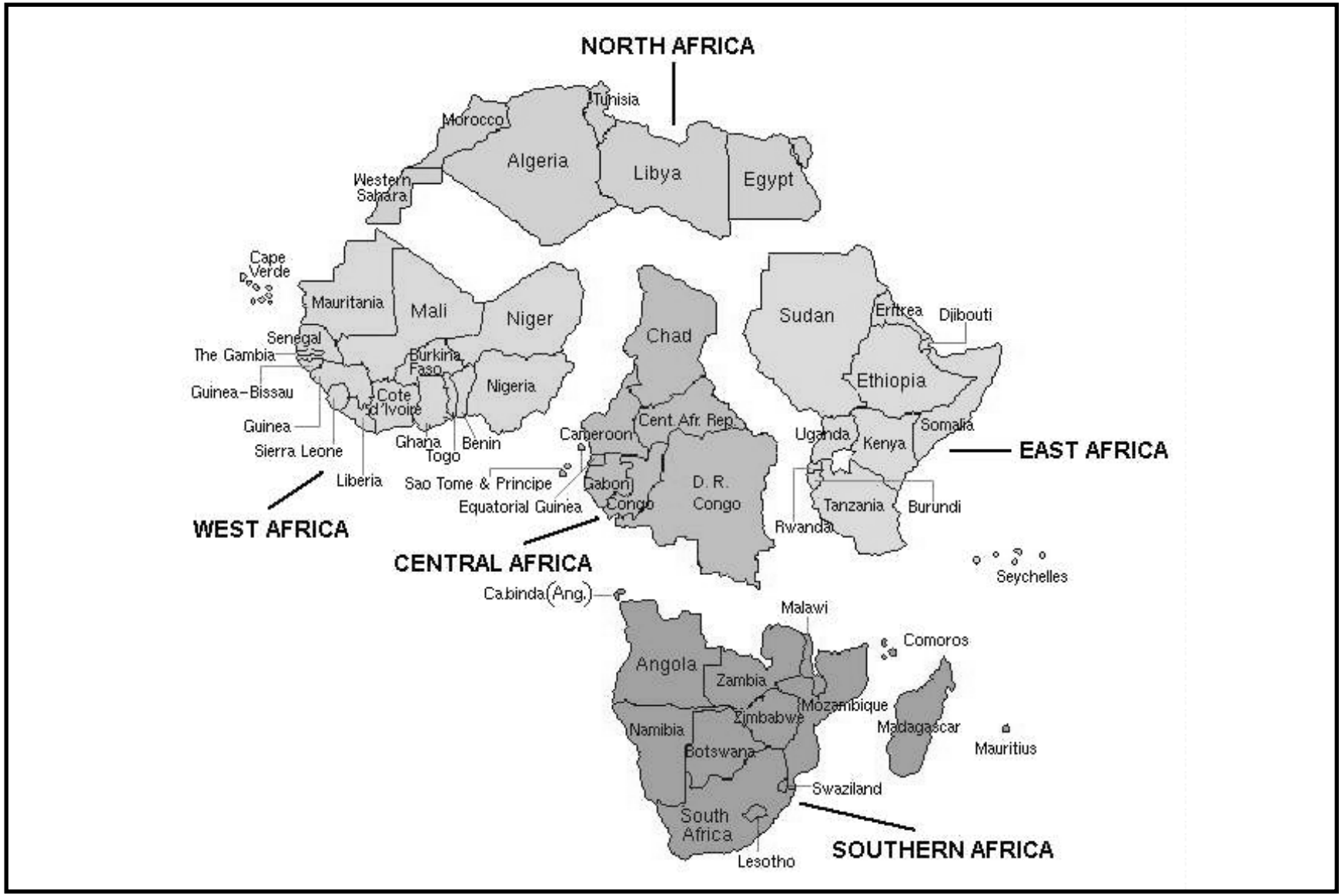
Africa


NORTH AFRICA
Tunisia
Morocco
Algeria
Libya
Egypt
Western Sahara
Cape Verde
Mauritania
Mali
Niger
Chad
Sudan
Eritrea
Djibouti
Senegal
The Gambia
Burkina Faso
Nigeria
Ethiopia
Guinea-Bissau
Cote d'Ivoire
Guinea
Sierra Leone
Ghana
Togo
Benin
Liberia
Cameroon
Cent. Afr. Rep.
Uganda
Kenya
Somalia
EAST AFRICA
Sao Tome & Principe
Equatorial Guinea
Gabon
Congo
D. R. Congo
Tanzania
Burundi
Rwanda
WEST AFRICA
CENTRAL AFRICA
Seychelles
Cabinda (Ang.)
Malawi
Comoros
Angola
Zambia
Mozambique
Zimbabwe
Madagascar
Namibia
Botswana
Mauritius
Swaziland
South Africa
Lesotho
SOUTHERN AFRICA

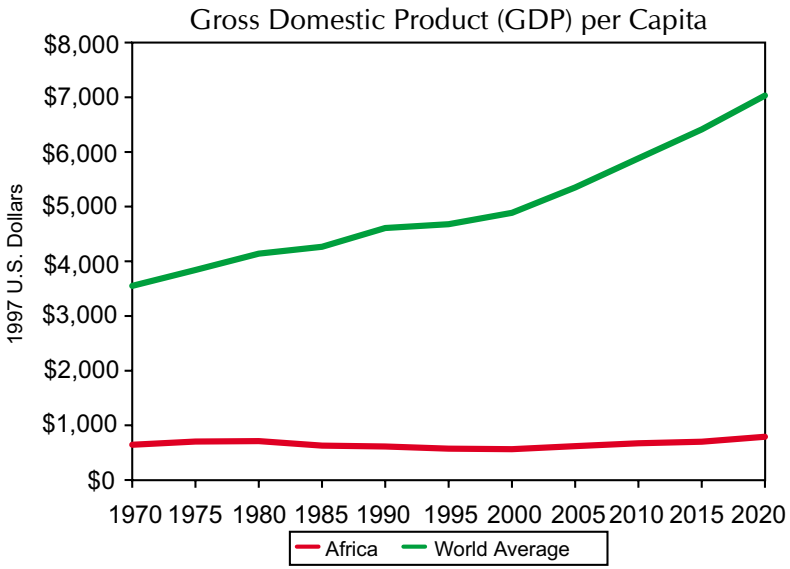
1. Africa in a World Context

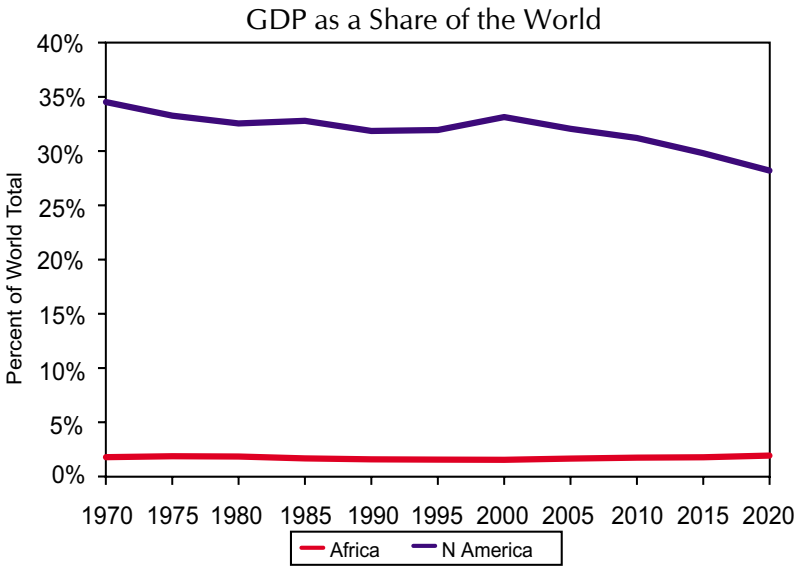
Africa in a World Context

Country	1999 GDP (Billion Dollars)	1999 Population (Millions)	1999 GDP per Capita (Dollars)	1997 Energy Consumption (Quadrillion Btu)	1997 Energy Production (Quadrillion Btu)	1997 Carbon Emissions*** (Million Metric Tons)	1997 Energy/ GDP Ratio (Thousand Btu/1997$)
Africa	$592.8	803.7	$738	11.4	26.5	213.8	19.2
China	$1,038.9	1,267.3	$820	36.6	36.2	821.8	41.3
FSU/E. Europe	$821.8	415.8	$1,976	51.6	59.2	851.8	65.2
Japan	$4,278.7	126.2	$33,904	21.3	4.3	296.7	5.1
Middle East	$627.3	177.6	$3,532	15.2	52.0	252.1	26.3
N. America	$10,060.5	401.8	$25,039	112.2	98.9	1,720.4	12.2
Other Asia*	$1,876.6	1,946.3	$964	38.7	27.7	700.8	19.2
S. America**	$1,172.0	405.7	$2,889	18.9	24.3	234.7	13.2
W. Europe	$9,095.8	452.0	$20,123	68.5	43.6	988.9	7.4
World Total	$29,562.8	6,010.5	$4,919	379.5	381.3	6,179.3	13.6

**Excludes Australia and New Zealand*
***Includes the Caribbean, Central America, and South America*
****Excludes flaring of natural gas*
Sources: WEFA World Economic Outlook (Second Quarter 1999); Energy Information Administration.

Economics and Demographics...



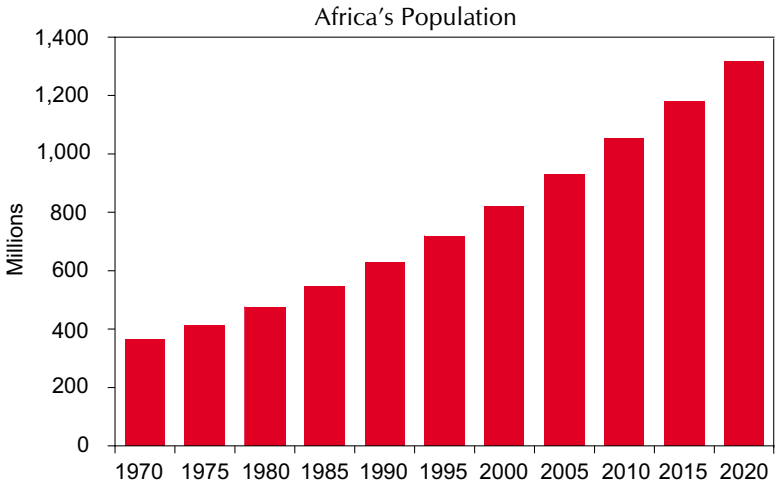


Source: Energy Information Administration.

- **Africa, with about 13% of world population, accounts for about 2% of world economic output. North America, with about half as large a population as Africa, accounts for about one-third of world gross domestic product (GDP).**
  - Real GDP in Africa has remained constant as a share of the world total since 1970 at about 2%, and is projected to remain around 2% through 2020.
  - Africa's population has increased sharply, from 364 million in 1970 to nearly 800 million in 1999, and is expected to increase further, to 1.3 billion, by 2020. As a share of the world total, Africa has increased from around 10% in 1970 to over 13% in 1999, and is expected to grow further -- to more than 17% -- by 2020.
  - Average per capita income (measured in constant 1997 dollars) in Africa fell from $646 in 1970 to $576 in 1998 (around 12% of the world average). By 2020, African per capita income is expected to increase to $792 (about 11% of the world average).

The People of Africa ...

- **Africa is home to around 800 million people (over 13% of the world's total). About 29% live in "West Africa" (see map at beginning of report), 27% in "East Africa," 18% in "North Africa," 17% in "Southern Africa," and 10% in "Central Africa."**
  - Population in Africa has more than doubled since 1970, and is growing around 2.7% per year (the fastest growth in the world). Population growth rates are expected to slow, but to continue above 2% through 2020. The total population of Africa is expected to reach 1.3 billion by 2020.
  - Population density in Africa is highly uneven, although on average most African countries are sparsely populated. Vast desert and densely forested regions are nearly uninhabited, while population density is very high in places like **Nigeria**, the Nile River valley, and the Great Lakes region. Two of the largest cities in the world -- Cairo and Lagos -- are located in Africa.
  - As of the mid-1990s, only around one-third of Africa's population lived in urban areas -- a relatively low rate compared to other world regions. Over the past several decades, however, urbanization has been proceeding rapidly in Africa. North Africa is the most urbanized region in Africa, while East Africa is the least urbanized.

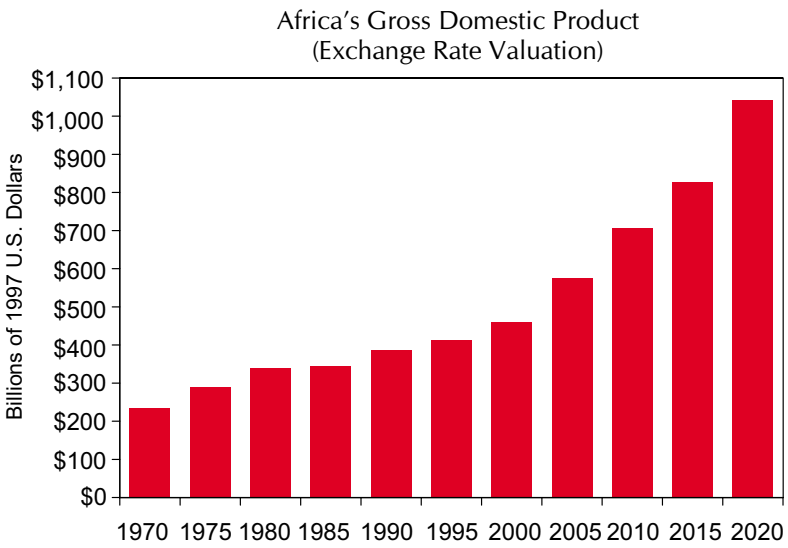


Source: U.S. Census Bureau.

- **Overall, the agricultural and mining sectors employ the largest numbers of Africans and account for the largest shares of Africa's economy.**
  - As of 1995, manufacturing accounted for only a small share of most African countries' economies and labor forces, with exceptions like **South Africa** and **Egypt**.
  - Around two-thirds of Southern Africa's population is dependent on agriculture for employment.
- **Africa is comprised of numerous ethnic and linguistic groups. Estimates of the number of languages range from 700 to 3,000. Major languages, in terms of the number of speakers, include Afrikaans, Akan, Amharic, Arabic, English, French, Fufulde, Hausa, Igbo, Malagasy, Oromo, Portugese, Rwanda, Shona, Somali, Sotho, Swahili, Xhosa, Yoruba and Zulu.**

The Economy of Africa ...

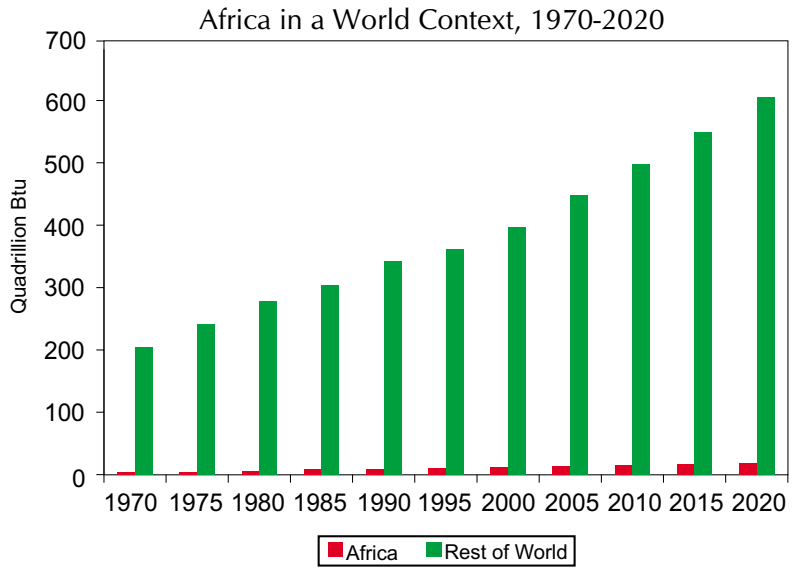
- **Real GDP in Africa is growing slightly faster than population, and as a result real income per capita is generally increasing slowly on average (this varies significantly by country). Still, Africa is the poorest continent on Earth.**
  - In 1998, Africa's real ($1997) GDP grew 3.8% and real GDP per capita was $576, up slightly from $573 in 1995.
  - African real GDP is forecast to grow by about 4% per year through 2020.
  - Since 1980, real GDP has grown much more rapidly in southern Africa than in any other part of the continent. Real GDP actually fell in North Africa between 1980 and the mid-1990s, largely due to a sharp decline in real oil revenues from their peak in the late 1970s and early 1980s. Real GDP also fell sharply in Nigeria, the major oil producing country in sub-Saharan Africa.

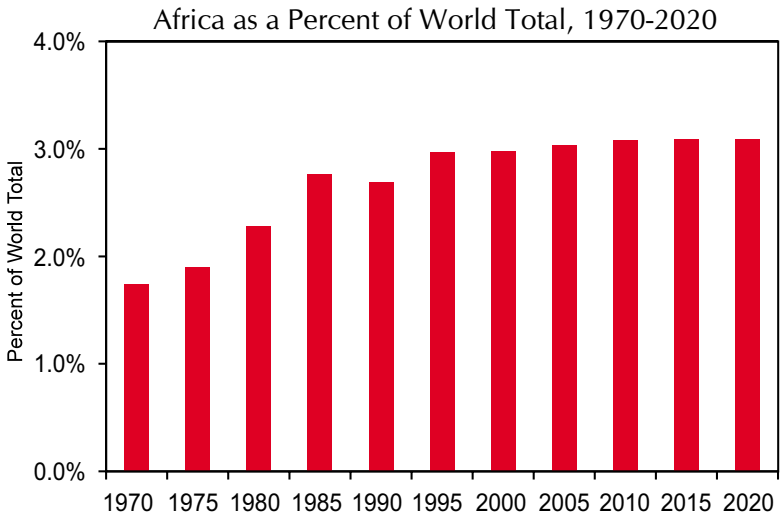


Source: Energy Information Administration.

- **Movement towards privatization of state enterprises has been uneven throughout Africa in recent years. Reform and privatization of inefficient, state-run companies are official priorities in most countries.**
  - Privatization is seen as a means of introducing greater efficiency in the energy sector as well as reducing budget deficits and raising needed investment. Africa must compete, however, with other world regions for limited investment resources.
- **Economic growth in oil exporting countries like Algeria and Nigeria during 1998 and early 1999 was affected adversely due to a sharp slump in world oil prices. The sharp increase in world oil prices during mid- and late-1999 has helped Africa's major net oil exporters, but hurt net oil importers.**
- **Africa's economy is heavily reliant on the export of primary products (i.e., agricultural and mineral) to the industrialized world, and the import of finished goods from the industrialized world. Trade between African countries is low relative to trade outside of Africa, especially with the "developed" countries.**
- **Debt service has been a major problem for many African countries. In late September 1999, President Clinton declared that the United States should forgive $3.5 billion worth of debt to the world's poorest countries, many of which are located in Africa. African indebtedness nearly tripled between 1980 and 1995.**

Commercial Energy Consumption...

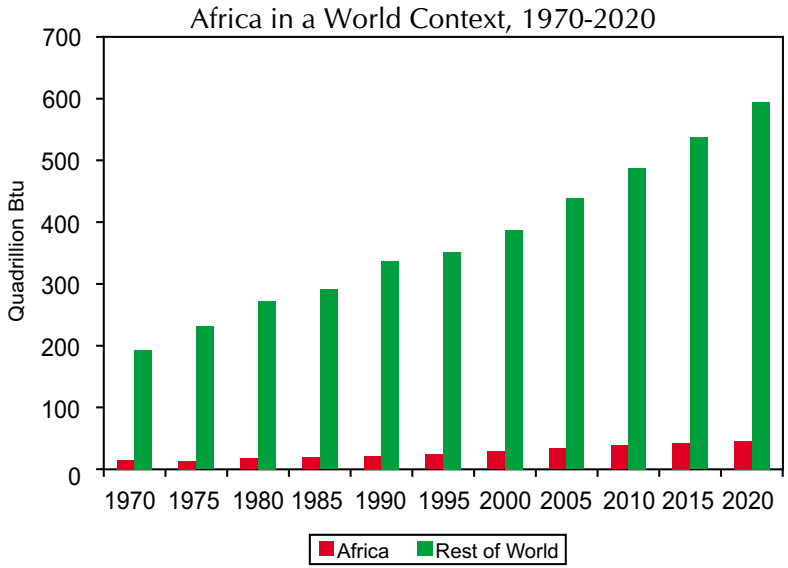


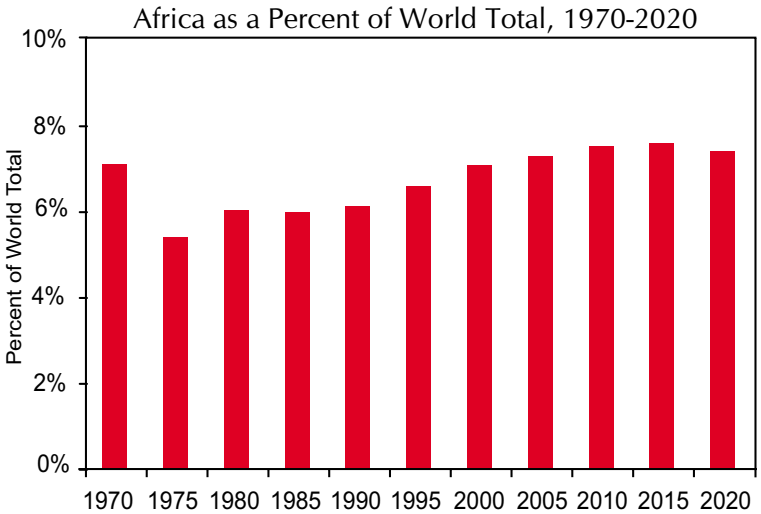


Source: Energy Information Administration.

- **Commercial energy consumption is growing throughout Africa. Energy demand growth in Africa averaged 2.7% annually from 1980 through 1997, and a slightly faster 3.1% annual average from 1990 through 1997.**
  - Between 1970 and 1997, African commercial energy consumption (not including "non-commercial" fuels like firewood, charcoal and animal waste) increased about 220% (from 3.6 to 11.4 quadrillion British thermal units, or quads).
  - As a share of world commercial energy consumption, Africa has increased slightly, from 2% in 1970 to 3% in 1997.
  - Commercial energy consumption in Africa is expected to remain approximately constant as a share of the world total (at about 3%) through 2020.
  - Africa's share of world commercial energy consumption is small for a variety of reasons, including low per capita incomes, levels of industrialization, ownership and usage of automobiles (around 20 cars per 1,000 people), and penetration of appliances like refrigerators, freezers, air conditioning, etc. In addition, Africa also consumes large amounts of "non-commercial" energy.
  - There are several main reasons for the high use of "non-commercial" fuels in Africa. First, Africa's enormous "commercial" energy resources are massively underdeveloped. Second, Africa has poorly developed commercial energy infrastructure, including pipelines and electricity grids, to deliver commercial energy to customers. Third, widespread and severe poverty means that people cannot afford to pay for "conventional" energy resources, and must instead rely on biomass, etc. Fourth, many countries in Africa are landlocked, which makes the import of commercial energy resources even more difficult/expensive.

Commercial Energy Production...

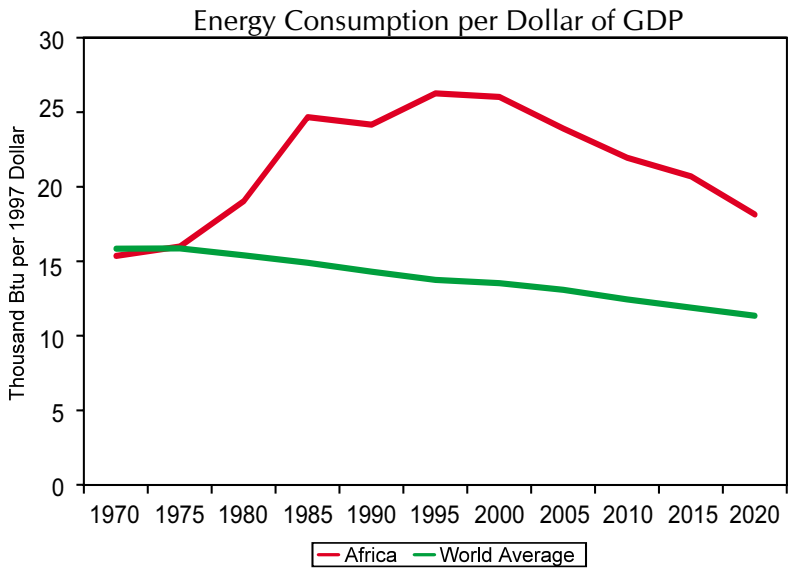


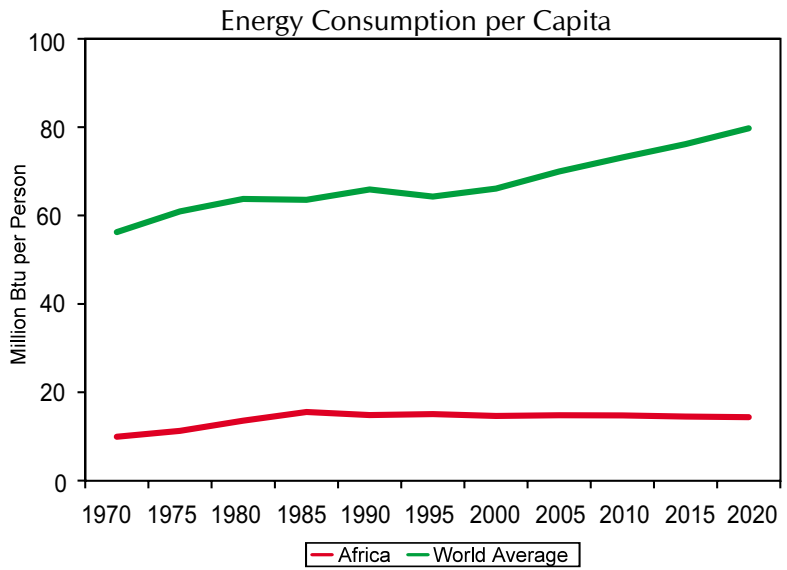


Source: Energy Information Administration.

- **Commercial energy production in Africa has nearly doubled since 1970, and is expected to increase another 68% by 2020. Production has remained about flat (at around 7%) as a share of the world total.**
  - African commercial energy production grew from 14.8 quads in 1970 to 26.5 quads in 1997, and is forecast to reach 45.5 quads in 2020. Natural gas production grew the most, by 3.9 quads, followed by growth in oil and coal (3.8 and 3.6 quads, respectively), hydroelectricity (0.4 quads), and nuclear power (0.1 quads).
  - Oil accounted for over 86% of African commercial energy production in 1970, with coal a distant second at 11%, hydroelectricity at 2%, and natural gas at 0.5%. As of 1997, oil had declined to 63%, while coal had increased to 19%, natural gas to 15%, hydroelectric to 2.3%, and nuclear power to 0.5%.
  - As a share of world commercial energy production, Africa has stayed about constant since 1970 at 7%, and is expected to remain at about this share through 2020.
  - African commercial energy production is distributed very unevenly throughout the continent. Around 99% of Africa's coal output, for instance, is in southern Africa (mainly **South Africa**). Natural gas production, on the other hand, is overwhelmingly concentrated in North Africa (mainly **Algeria** and **Egypt**). Crude oil production is concentrated in North Africa (**Algeria**, **Egypt**, and **Libya**), West Africa (**Nigeria**), Central Africa (**Gabon**), and southern Africa (**Angola**). East Africa produces almost no oil, gas, or coal.

Energy Intensity...

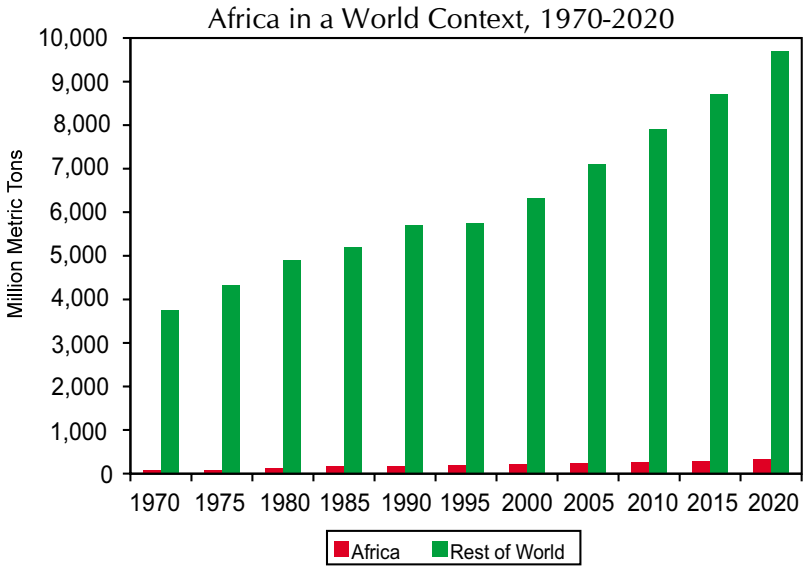


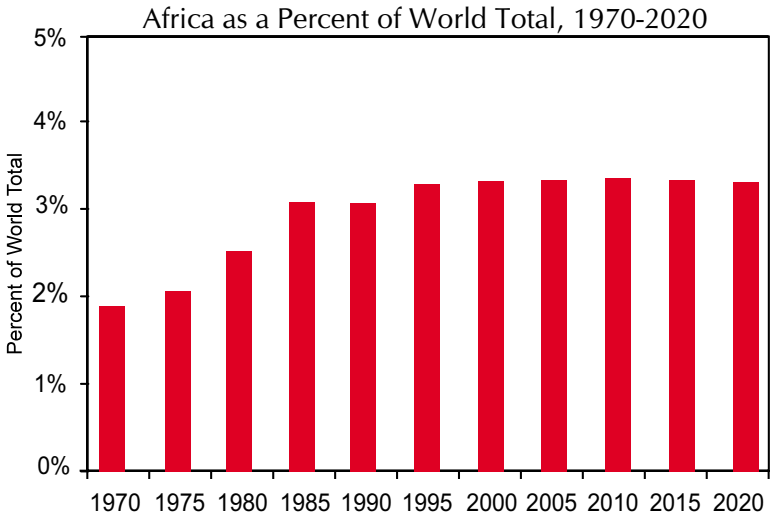


Source: Energy Information Administration.

- **As of 1997, Africa consumed around 26,300 Btu of commercial energy per 1997 dollar of GDP and 14.9 million Btu per person. This compares to world averages of about 13,600 Btu per 1997 dollar of GDP and 65 million Btu per person, respectively.**
  - African energy intensity (energy consumption per 1997 dollar of GDP) increased 71% between 1970 and 1997. This compares to a decline of around 28% in the world average energy intensity.
  - African energy intensity rose steadily between 1970 and 1985, leveled off in the mid-1990s, and is projected to decline slowly through 2020.
  - Energy consumption per person in Africa increased somewhat during the 1970s and early 1980s, but since then has essentially leveled off, and is expected to decline only slightly through 2020.
  - While African energy consumption per dollar of GDP has been consistently far higher than the world average, African energy consumption per capita has been consistently far lower. So, although the average African uses far less energy than the world average, producing a dollar's worth of GDP uses more energy in Africa than the world average.

Carbon Emissions ...

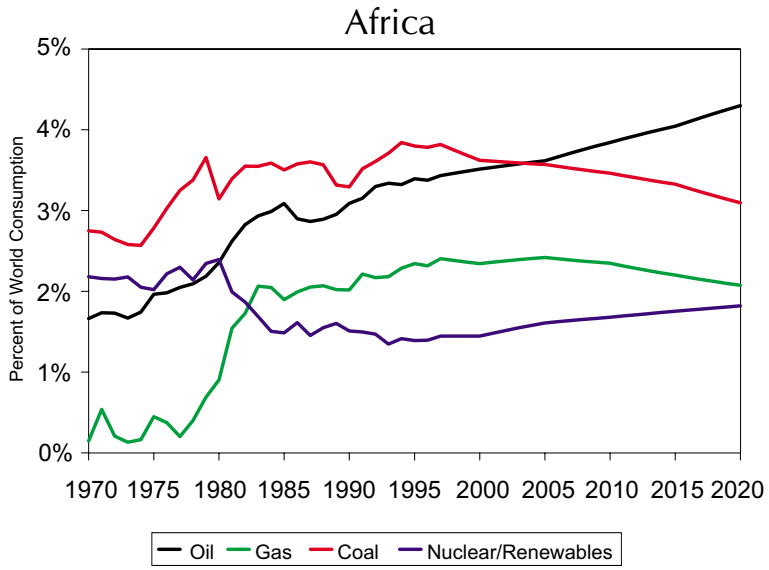




Source: Energy Information Administration.

- **African carbon emissions from fossil fuel consumption (excluding natural gas flaring) are growing rapidly, although from a very small base.**
  - Carbon emissions in Africa roughly tripled, from 72 million metric tons (Mmt) in 1970 to 202 Mmt in 1997, and are projected to reach 325 Mmt by 2020.
  - Africa's share of world carbon emissions has increased slightly from 2% in 1970 to around 3% in 1997, and is expected to remain about constant through 2020.
  - Africa as a whole emitted about the same amount of carbon in 1997 as Germany or India.
  - Africa has the lowest level of carbon emissions from fossil fuel consumption of any continent in the world.

Fuel Consumption in a World Context...

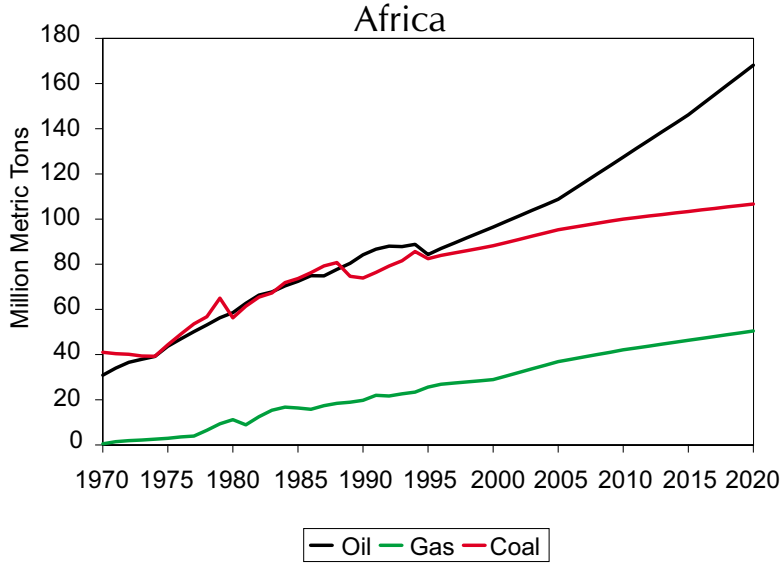


Source: Energy Information Administration.

- **In 1997, Africa accounted for 3% of total world commercial energy consumption. In that year, Africa accounted for 3.8% of world coal consumption, 3.4% of oil, 2.4% of natural gas, and 2.4% of hydroelectricity.**
  - Africa's shares of world oil, gas, and coal all increased between 1970 and 1997. Gas increased particularly rapidly, from 0.1% in 1970 to 2.4% in 1997. Oil's share doubled, from 1.7% in 1970 to 3.4% in 1997. Coal's share grew from 2.7% to 3.8%.
  - Through 2020, Africa's share of world oil consumption is projected to increase (to 4.3% -- largely due to increased transportation usage), while the natural gas and coal shares are forecast to decline to 2.1% and 3.1%, respectively. Nuclear/grid-connected renewables share is expected to increase slightly, from 1.4% in 1997 to 1.8% in 2020.
  - Compared to the rest of the world, Africa has very low levels of electricity consumption per person. This is due mainly to poorly developed power distribution grids and to heavy use of biomass in the residential sector.

Carbon Emissions by Fuel Type...

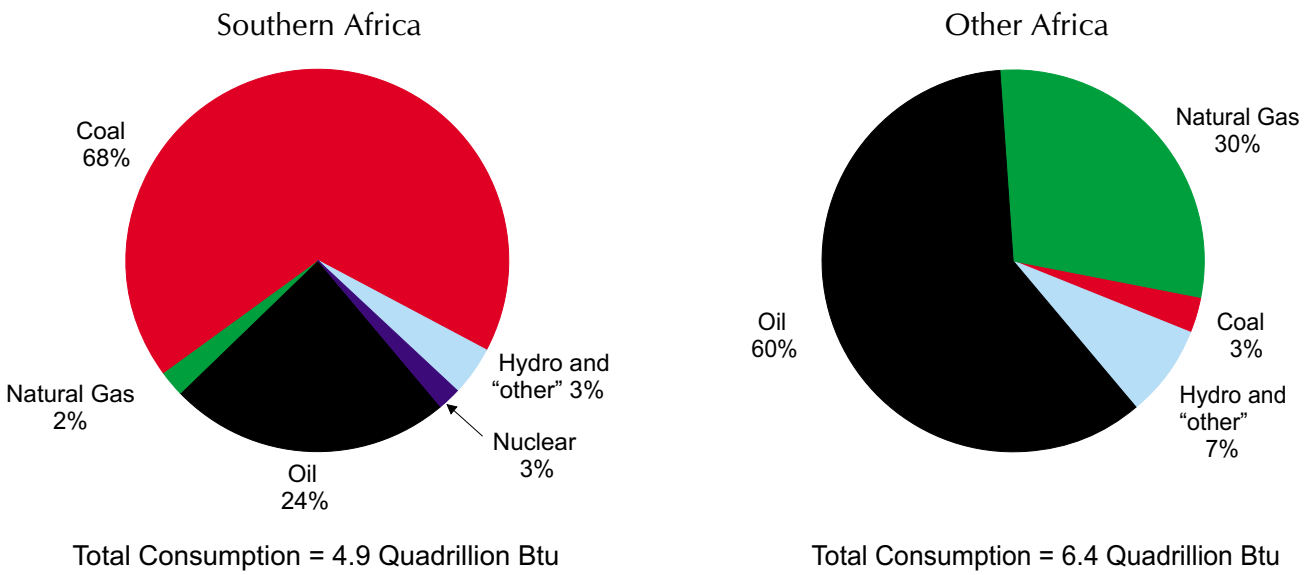
- **Between 1970 and 1997, carbon emissions increased for all fuels in Africa. Carbon emissions from natural gas increased 50-fold, while emissions from oil consumption tripled and from coal doubled. (Coal is the most carbon-intensive fossil fuel, while natural gas is the least.)**
  - Oil is responsible for about 44% of carbon emissions in Africa, followed by coal (42%) and natural gas (14%).
  - Carbon emissions by all three fossil fuel types (oil, gas, and coal) in Africa grew between 1970 and 1997, and are projected to continue to grow through 2020.
  - Oil's share of total carbon emissions is expected to increase from 44% in 1997 to 52% in 2020. The share of carbon emissions from consumption of natural gas is expected to increase slightly, from 14% in 1997 to 16% in 2020.
  - Coal's share of African carbon emissions is expected to fall from 42% in 1997 to 33% in 2020.



Source: Energy Information Administration.

2. Energy Use, Economy, and Carbon Emissions

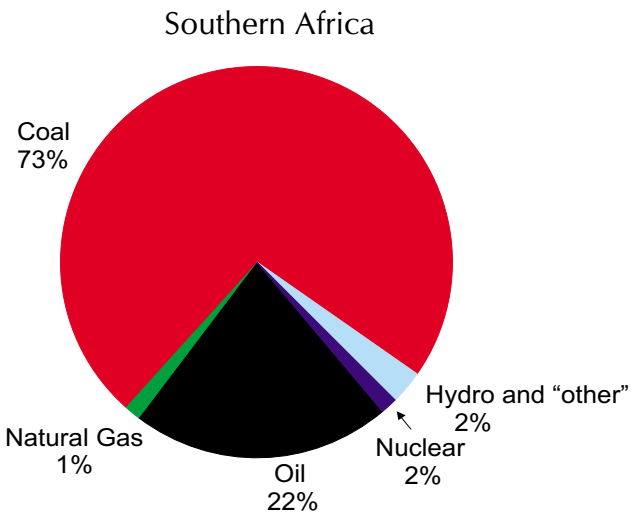
1997 Fuel Consumption Mix …



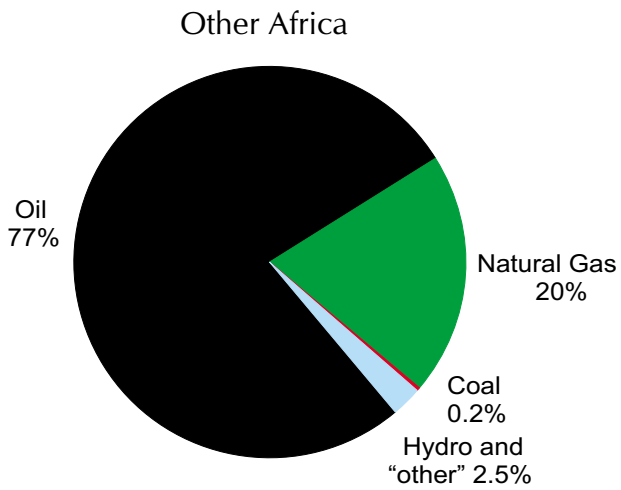
Source: Energy Information Administration.

- **Energy consumption patterns vary greatly between southern Africa and the rest of Africa. Most significantly, southern Africa depends heavily (68%) on coal, while the rest of Africa is dominated (60%) by oil.**
  - Oil makes up about 45% of overall African commercial energy consumption. This share is lowest in southern Africa (24%) compared to 60% in the rest of Africa.
  - Coal makes up the next greatest share (31%) of African energy consumption. Coal's share is by far the highest in southern Africa, particularly **South Africa** (74%) and **Zimbabwe** (57%). Coal also makes up a significant share of energy consumption in **Niger** (27%) and **Morocco** (18%). Coal is used heavily for power generation in southern Africa.
  - Natural gas, the use of which requires extensive pipeline systems, accounts for 18% of African commercial fuel consumption. Gas is used most heavily in North Africa and West Africa, where gas is produced, and lowest (2%) in southern Africa.
  - Hydroelectricity and geothermal electricity account for about 5.5% of consumption in Africa. Almost all of this is hydroelectricity, distributed widely throughout Africa, with the largest single consumer being **Egypt**. Geothermal electricity is used in **Ethiopia** and **Kenya**.
  - Only **South Africa** has nuclear power production. Overall, nuclear power accounts for 1% of African energy demand.
  - Africa's fuel consumption mix is dominated by traditional, "non-commercial" fuels (i.e., wood and animal waste). "Commercial" fuels (oil, natural gas, coal, hydroelectricity, nuclear power) make up only about one-third of Africa's total energy consumption.

1997 Fuel Production Mix ...



Total Production = 7.0 Quadrillion Btu

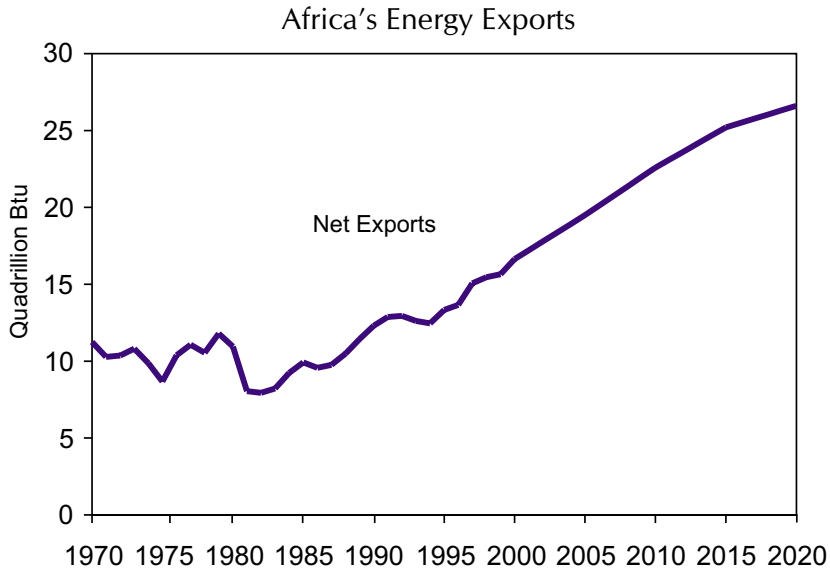


Total Production = 19.4 Quadrillion Btu

Source: Energy Information Administration.

- **Africa produces significant amounts of commercial energy -- about the same amount as South America. Energy production varies greatly by subregion within Africa. Most importantly, oil and gas make up 23% of southern African energy production, compared to 97% in the rest of Africa.**
  - Nearly two-thirds of Africa's commercial energy output is oil. Oil production (including crude oil and natural gas liquids) is heavily concentrated, with 5 countries (**Algeria, Angola, Egypt, Libya**, and **Nigeria**) accounting for 88% of the continent's total oil output.
  - Coal accounts for slightly less than one-fifth of African energy production, with 96% coming from **South Africa**.
  - **South Africa** also produces significant amounts of coal-based synthetic fuels (the only country in the world to do so).
  - Natural gas makes up a little less than one-sixth of Africa's commercial energy output. Almost all (96%) of this is concentrated in only 5 countries (**Algeria, Egypt, Libya, Nigeria**, and **Tunisia**).
  - Hydroelectricity/other account for 3% of Africa's total energy production, spread out widely throughout the continent.

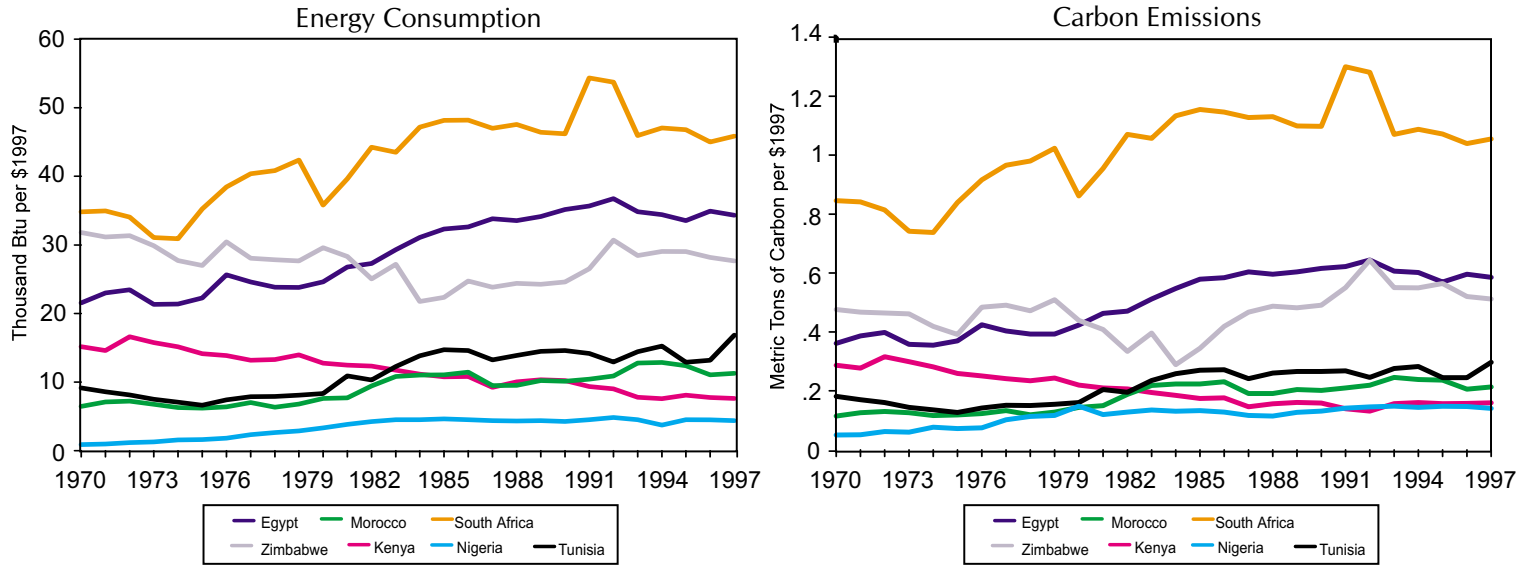
Overall Energy Balance ...



Source: Energy Information Administration.

- **Africa is a major (and growing) net exporter of energy, mainly of oil but also of natural gas and coal.**
  - In 1997, Africa was a net exporter of 15.1 quadrillion Btu (quads) of energy. Of this, Africa was a net oil exporter of 11.5 quads, a net gas exporter of 2.0 quads, and a net coal exporter of 1.6 quads.
  - Africa's net energy exports have been rising rapidly over the past few years. By 2020, Africa is forecast to be exporting around 27 quads of energy on a net basis, nearly double the continent's net energy exports in 1997.
  - Between 1997 and 2020, Africa's net exports of oil are projected to increase by 4.4 quads, or a 38% increase. Net natural gas exports are projected to rise by 4.3 quads (a 192% increase), and net coal exports are expected to increase 2.4 quads (133%).
  - Africa's oil exports come mainly from a few countries (**Algeria, Angola, Cameroon, Congo, Egypt, Gabon, Libya,** and **Nigeria**). Natural gas exports overwhelmingly come from Algeria, and coal exports almost exclusively from South Africa.

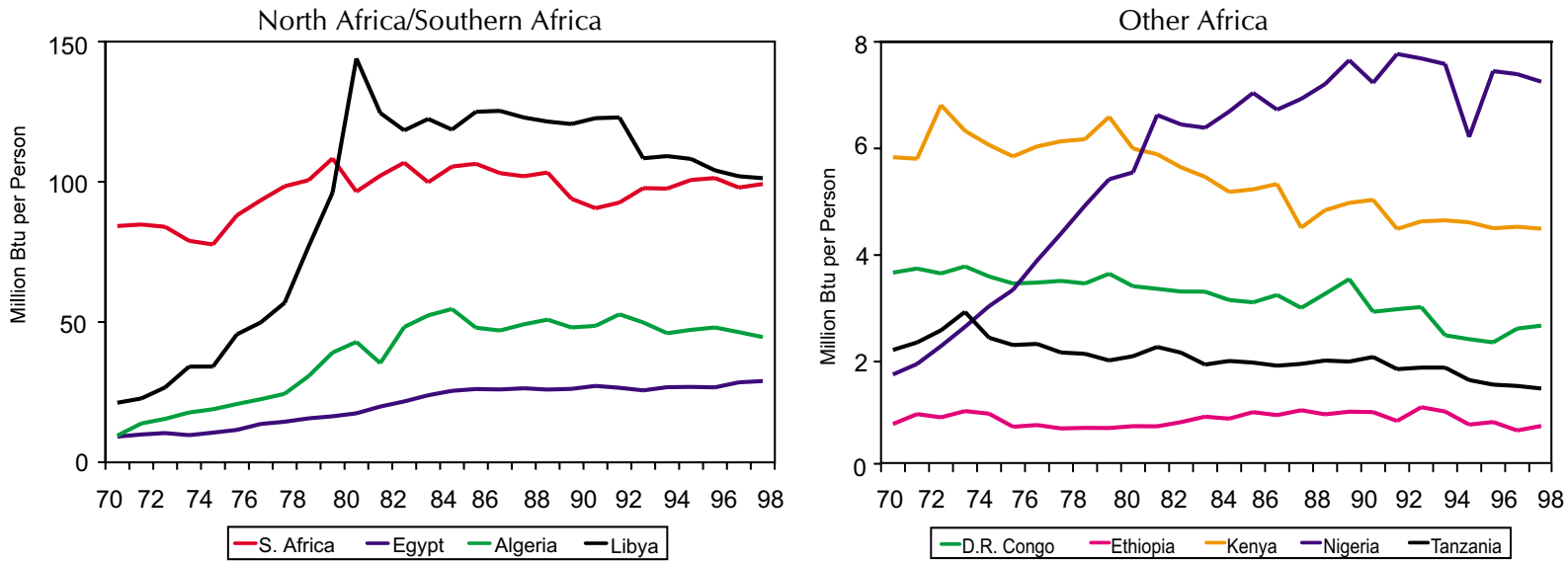
Energy Consumption and Carbon Emissions per Dollar of GDP ...



Source: Energy Information Administration.

- **Commercial energy consumption per constant dollar of GDP generally rose in Africa between 1970 and 1997.**
  - Since 1970, **South Africa** and **Egypt** consistently have consumed the most energy per dollar of GDP among major energy consumers in Africa. **Nigeria** consumed the least energy per dollar of GDP -- around one-tenth of South Africa's energy/GDP ratio in 1997, for instance.
  - In general, energy intensities in Africa tend to be highest in relatively industrialized countries like **South Africa**, and also major energy producing countries like **Libya** and **Algeria**.
  - In 1997, energy intensity was highest in southern Africa, followed (far behind) by North Africa, West Africa, Central Africa, and East Africa.
  - Carbon intensity trends generally mirror those of energy intensity. **South Africa**'s greater consumption of coal leads to a significantly higher carbon intensity than the rest of Africa.

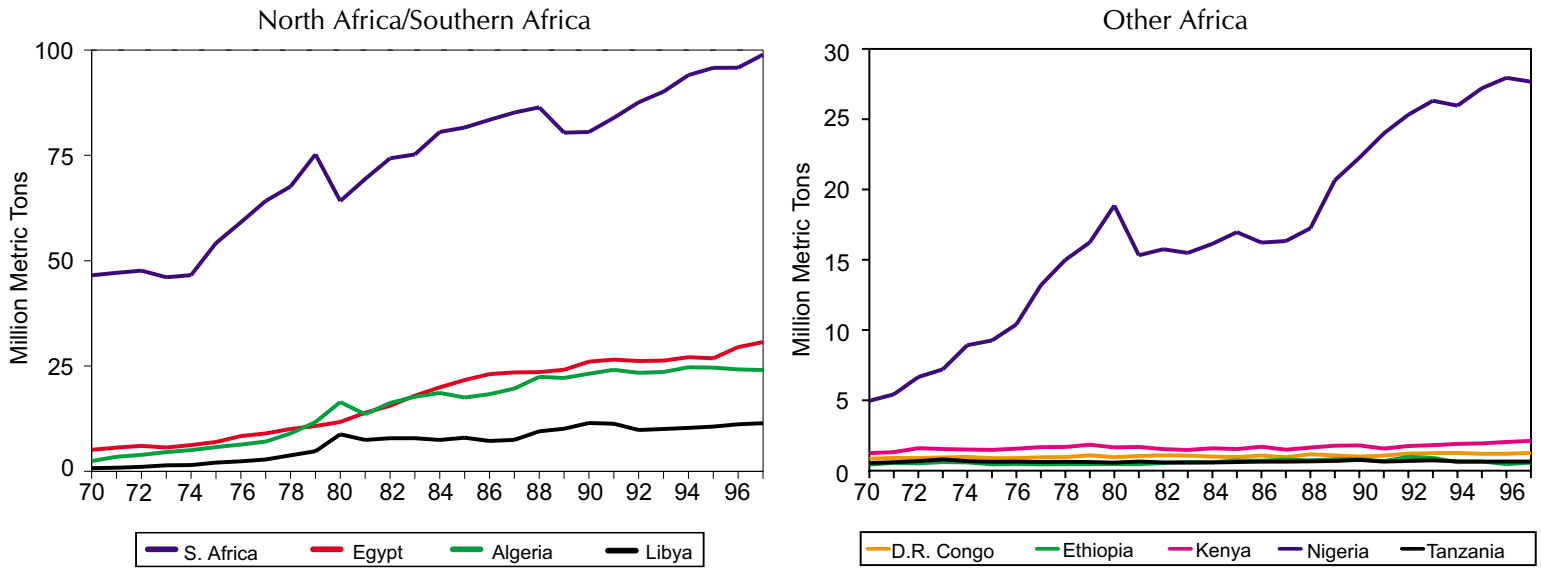
Energy Consumption per Capita ...



Source: Energy Information Administration.

- **With the exception of Algeria, Egypt, and Libya, per capita commercial energy consumption and energy-related carbon emissions in Africa have remained essentially flat for two decades. Energy consumption and energy-related carbon emissions per person in Africa are extremely low compared with the developed world, or even most other developing regions of the world.**
  - Most African countries are relatively non-industrialized, have low levels of automobile and home appliance ownership per capita, and consume high proportions of "non-commercial" energy (i.e., biomass). As a result, per capita levels of energy consumption and energy-related carbon emissions tend to be much lower in Africa than in the United States and other "developed" countries.
  - Per capita commercial energy consumption and energy-related carbon emissions in Africa are projected to remain roughly flat through 2020.
  - Within Africa, per capita commercial energy consumption and energy-related carbon emissions tend to be highest in **South Africa** and **Libya**, as well as in major oil- and gas-producing countries like **Algeria, Egypt** and **Nigeria**. South Africa's relatively high per capita carbon emissions are partly a result of that country's high reliance on coal, a carbon-intensive fuel compared to oil or natural gas.
  - As with energy and carbon intensities, Africa's per capita energy consumption and carbon emissions tend to be highest in southern Africa, followed by North Africa, West Africa, Central Africa, and East Africa.

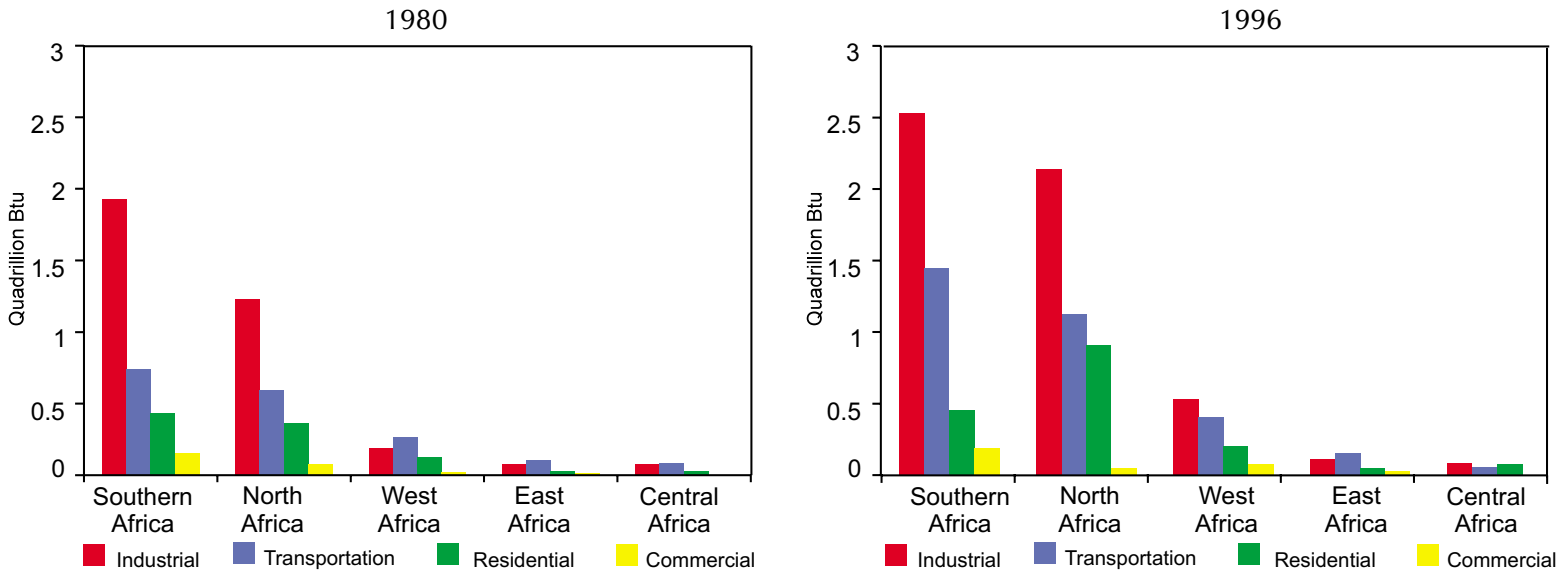
Energy-Related Carbon Emissions Patterns ...



Source: Energy Information Administration.

- **Africa's energy-related carbon emissions increased rapidly between 1970 and 1997, with South Africa alone accounting for nearly half of the continent's total. Other significant carbon emitters include Egypt, Nigeria, Algeria, and Libya.**
  - The greatest increase in carbon emissions between 1970 and 1997 was in **South Africa**. Other African countries with major increases in energy-related carbon emissions between 1970 and 1997 were **Egypt, Algeria, Nigeria**, and **Libya**.
  - **South Africa** and **Libya** emit the most carbon per person in Africa. Even so, per capita carbon emissions from those two countries are far lower than in the United States.
  - Most of **South Africa**'s energy-related carbon emissions come from consumption of coal, which is relatively carbon-intensive compared to oil and natural gas. Nuclear energy, hydroelectricity, plus "renewables" like solar and wind, emit no carbon.
  - Energy-related carbon emissions from North African countries come mainly from oil and gas consumption.

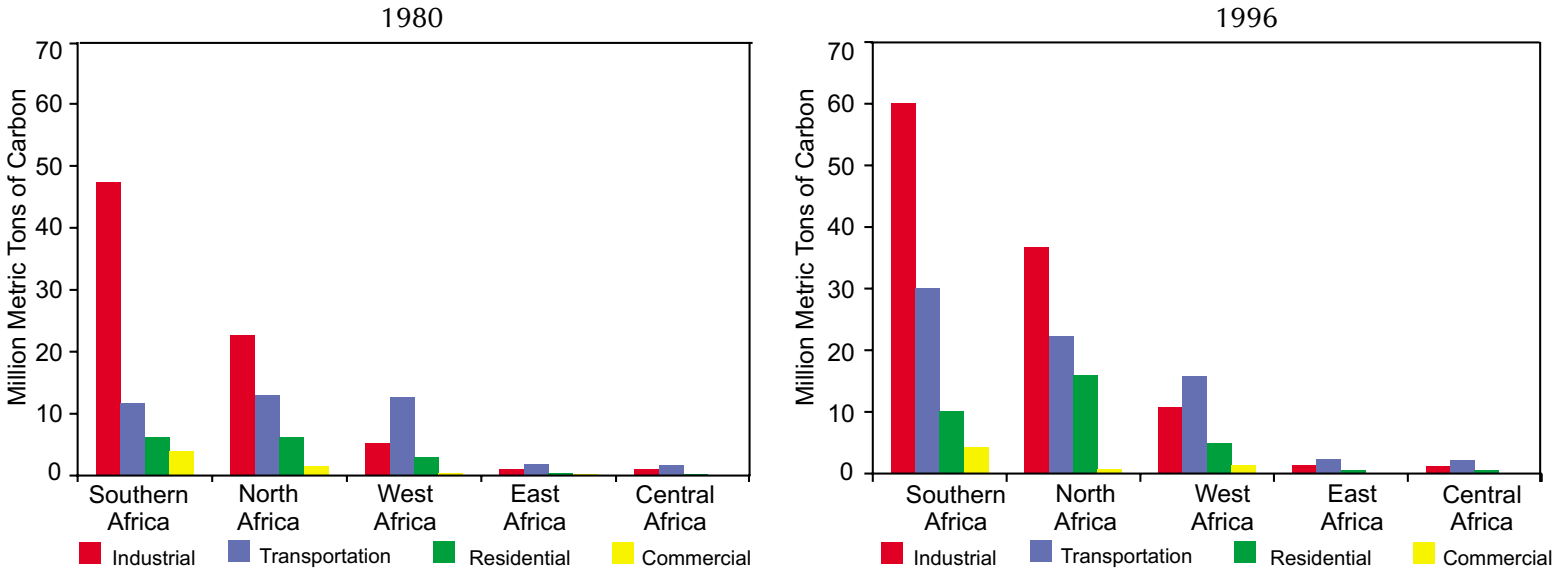
Sectoral Energy Consumption …



Source: Energy Information Administration.

- Commercial energy consumption increased in all sectors and regions of Africa between 1980 and 1996. Overall, the industrial sector consumed the most energy, about twice as much energy as the next highest sector (transportation), and about three times as much as the residential and commercial sectors combined.
- The industrial sector accounted for the greatest share of commercial energy consumption in both southern and North Africa, followed by the transportation, residential, and commercial sectors.
- In West, East, and Central Africa, transportation accounts for a greater share of commercial energy consumption. The industrial sector, which is relatively underdeveloped in these regions and more reliant on biomass, tends to consume a lower share of commercial energy than in North and southern Africa
- Between 1980 and 1996, transportation sector commercial energy consumption nearly doubled in North and southern Africa, while industrial sector commercial energy consumption in West Africa increased two-fold.

Sectoral Carbon Emissions …



Source: Energy Information Administration.

- Energy-related carbon emissions increased in all sectors and regions of Africa between 1980 and 1996. Overall, the industrial sector produced the most carbon emissions, about twice as much as the transportation sector and about three times as much as the residential and commercial sectors combined.
- The industrial sector accounted for the greatest share of carbon emissions in both southern and North Africa, followed by the transportation, residential, and commercial sectors.
- In West, East, and Central Africa, transportation accounts for the greatest share of carbon emissions. The industrial sector, due to a relatively high degree of biomass consumption, tends to be less carbon intensive than in southern and North Africa.
- Between 1980 and 1996, transportation sector carbon emissions in southern Africa doubled. In West Africa, the transportation sector's share of total carbon emissions decreased between 1980 and 1996, while the industrial sector's share of carbon emissions increased. The industrial sector's greater contribution to overall carbon emissions is partially due to the increased percentage of fossil fuels consumed in this sector.

3. Energy Statistics

Primary Energy Consumption and Production, 1997

(Quadrillion British Thermal Units*, Btu)

Country	Consumption	Production	Net Exports*
Cameroon	0.08	0.30	0.22
Central African Republic	0.005	0.001	-0.004
Chad	0.003	0	-0.003
Congo	0.02	0.56	0.54
Dem. Rep. Of Congo	0.13	0.13	0
Equatorial Guinea	0.002	0.10	0.098
Gabon	0.06	0.81	0.75
Sao Tome & Principe	0.001	0	-0.001
SUBTOTAL–C. Africa	**0.29**	**1.89**	**1.6**
Burundi	0.01	0.001	-0.009
Djibouti	0.02	0	-0.02
Eritrea	0.02	0	-0.02
Ethiopia	0.05	0.02	-0.03
Kenya	0.15	0.04	-0.11
Rwanda	0.01	0.002	-0.008
Seychelles	0.01	0	-0.01
Somalia	0.01	0	-0.01
Sudan	0.07	0.02	-0.05
Tanzania	0.05	0.02	-0.03
Uganda	0.02	0.01	-0.01
SUBTOTAL–E. Africa	**0.40**	**0.113**	**-0.307**
Algeria	1.32	5.68	4.36
Egypt	1.80	2.61	0.82
Libya	0.59	3.39	2.8
Morocco	0.36	0.02	-0.34
Tunisia	0.32	0.31	-0.01
Western Sahara	0.003	0	-0.003
SUBTOTAL–N. Africa	**4.393**	**12.01**	**7.627**

Country	Consumption	Production	Net Exports*
Angola	0.09	1.55	1.46
Botswana	0.04	0.02	-0.02
Comors	0.001	0.0002	-0.001
Lesotho	0.01	0.00	-0.01
Madagascar	0.02	0.01	-0.02
Malawi	0.02	0.01	-0.01
Mauritius	0.04	0.00	-0.04
Mozambique	0.02	0.00	-0.02
Namibia	0.03	0.00	-0.03
South Africa	4.30	5.18	0.88
Swaziland	0.02	0.00	-0.01
Zambia	0.10	0.09	-0.01
Zimbabwe	0.25	0.16	-0.09
SUBTOTAL–S. Africa	**4.95**	**7.03**	**2.09**
Benin	0.01	0.01	-0.004
Burkina Faso	0.01	0.001	-0.009
Cape Verde	0.002	0	-0.002
Cote d'Ivoire	0.16	0.08	-0.09
Gambia	0.003	0	-0.003
Ghana	0.11	0.07	-0.04
Guinea	0.02	0.002	-0.02
Guinea-Bissau	0.004	0	-0.004
Liberia	0.01	0.002	-0.01
Mali	0.01	0	-0.01
Mauritania	0.05	0.003	-0.05
Niger	0.02	0.005	-0.01
Nigeria	0.86	5.27	4.41
Senegal	0.06	0.002	-0.058
Sierra Leone	0.01	0	-0.05
Togo	0.01	0	-0.01
SUBTOTAL–W.Africa	**1.349**	**5.445**	**4.08**
Total Africa	**11.39**	**26.47**	**15.08**

**A negative number indicates consumption exceeds production, with the deficit made up from stocks and/or imports; a positive number indicates production exceeds consumption, with the difference either added to domestic stocks or exported. • quadrillion Btu (quad) . about 0.5 million barrels/day of oil equivalent.*

African Energy Overview

- **Overall, Africa is a major net energy exporter. In 1997, Africa consumed 11.4 quadrillion Btu's (quads) of commercial energy (plus even more non-commercial energy) and produced 26.5 quads, making it a net exporter of 15.1 quads of commercial energy (i.e., oil, gas, coal).**
  - Every subregion of Africa except East Africa is a net exporter of energy. North Africa is by far the largest, with significant oil and gas exports going to Europe and other markets. West Africa's exports are almost exclusively oil, and from one country -- **Nigeria**. Southern Africa's net energy exports are oil (from **Angola**) and coal (from **South Africa**). Central Africa is an oil exporting region due to **Cameroon, Congo** and **Gabon**. East Africa is a tiny net energy importer (mainly oil).
- **The countries of North Africa produce slightly less energy than the rest of Africa's regions combined. The vast majority (around 80%) of energy consumption in Africa is either in North or Southern Africa.**
  - In 1997, only five countries **(South Africa, Egypt, Algeria, Nigeria,** and **Libya)** accounted for 78% (8.9 quads) of all energy consumption, and 84% (22 quads) of all energy production, in Africa.
  - Significant (greater than 0.5 quads) net exporters of energy in Africa include **Nigeria, Algeria, Libya, South Africa, Egypt**, **Gabon**, and **Congo**. There are no significant net energy importers in Africa, with the vast majority of African nations importing only very small (i.e., 0.3 quads or less) amounts of energy.
- **Africa is a heavy user of "traditional" (non-commercial) fuels -- primarily biomass. In 1994, according to the World Bank, around 65% of Africa's total energy consumption was made up of biomass.**
  - Within Africa, certain regions consume much more "traditional" fuel than others. North Africa, for instance, consumes very little biomass, due mainly to the lack of wood in the desert climate. Central and East Africa, on the other hand, consume large amounts of biomass.
  - Generally, the consumption of "traditional" fuels is highly labor intensive, inefficient, polluting, and destructive to the environment (i.e., deforestation and desertification).

Fossil Fuel Consumption, 1997

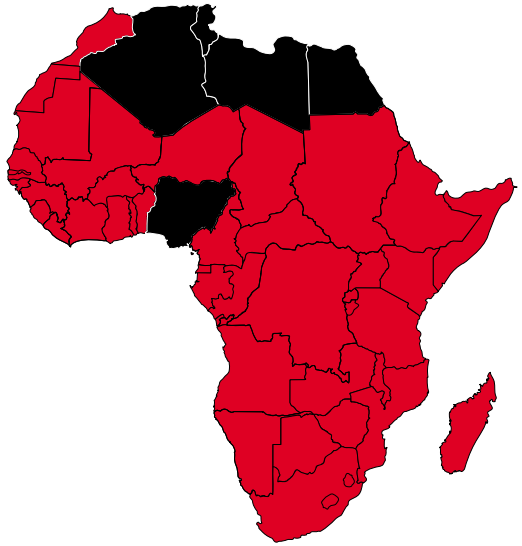
Country	Petroleum (1,000 bbl/d)	Natural Gas(Bcf)	Coal (Million ST)
Cameroon	23	0	0.001
Central African Rep.	2	0	0
Chad	1	0	0
Congo	7	0	0
Dem. Rep. Of Congo	26	0	0.26
Equatorial Guinea	1	0	0
Gabon	22	4	0
Sao Tome & Principe	1	0	0
SUBTOTAL–C. Africa	**83**	**4**	**0.261**
Burundi	2.5	0	0
Djibouti	11	0	0
Eritrea	10	0	0
Ethiopia	14	0	0
Kenya	50	0	0.11
Rwanda	5	0	0
Seychelles	3.5	0	0
Somalia	4	0	0
Sudan	27	0	0
Tanzania	15	0	0.01
Uganda	7	0	0
SUBTOTAL- E. Africa	**149**	**0**	**0.12**
Algeria	230	735	1.35
Egypt	525	477	2.01
Libya	180	193	0.01
Morocco	140	1	2.63
Tunisia	75	128	0.11
Western Sahara	1	0	0
SUBTOTAL–N. Africa	**1151**	**1534**	**6.11**

*bbl/d = barrels per day; Bcf = billion cubic feet; ST = short tons

Country	Petroleum (1,000 bbl/d)	Natural Gas(Bcf)	Coal (Million ST)
Angola	26	20	0
Botswana	8	0	0.85
Comoros	1	0	0
Lesotho	1	0	0
Madagascar	8	0	0.02
Malawi	5	0	0.08
Mauritius	16	0	0.07
Mozambique	7	0	0.07
Namibia	8	0	0
South Africa	466	65	169.59
Swaziland	4	0	0.06
Zambia	11	0	0.38
Zimbabwe	28	0	5.85
SUBTOTAL-S. Africa	**588**	**85**	**176.97**
Benin	4	0	0
Burkina Faso	5	0	0
Cape Verde	1	0	0
Cote d'Ivoire	60	24	0
Gambia	2	0	0
Ghana	28	0	0.003
Guinea	8	0	0
Guinea-Bissau	2	0	0
Liberia	3	0	0
Mali	4	0	0
Mauritania	23	0	0.01
Niger	5	0	0.19
Nigeria	290	194	0.06
Senegal	26	2	0
Sierra Leone	6	0	0
Togo	4	0	0
SUBTOTAL–W. Africa	**471**	**221**	**0.263**
Total Africa	2,442	1,844	183.7

Consumption/Reserves of Fossil Fuels

- **All countries of Africa consume at least some petroleum, regardless of the availability of domestic supplies. Fewer than half of African countries have any domestic refining capacity, and many of these are very small facilities.**
  - Oil, as a relatively easily transportable and usable ("fungible") fuel, is consumed throughout Africa. Coal and gas, on the other hand, are not as fungible as oil. Their use, therefore, depends heavily on the availability of either domestic or nearby resources and the extent to which these resources -- along with the necessary transportation infrastructure -- have been developed.
  - Natural gas is consumed almost exclusively by countries with gas reserves/production. **Algeria, Egypt, Libya**, and **Tunisia** (all in North Africa), plus **Nigeria** (in West Africa), account for 94% of total African natural gas consumption.
  - The absence of natural gas consumption in most African countries results largely from a lack of pipeline infrastructure. This, in turn, is a result of several factors, including cost, terrain, and political factors.
  - **South Africa**, with its own large reserves, is the only country in Africa to consume significant amounts of coal.
  - Oil and natural gas are concentrated heavily in North and West Africa, especially **Algeria, Libya**, and **Nigeria**. Other countries with large oil and/or gas reserves include **Angola, Egypt, Gabon,** and **Congo**.
  - Countries with smaller, but still significant, oil and gas reserves include **Cameroon, Sudan,** and **Tunisia. Mozambique** and **Namibia** (and, to a lesser extent, **Tanzania**) have significant natural gas reserves, but no oil.



Algeria, Egypt, Libya, and Tunisia (all in North Africa), plus Nigeria (in West Africa), account for 94% of total African natural gas consumption.

Fossil Fuel Reserves -- 1/1/9

Country	Crude Oil (1,000 barrels)	Natural Gas (Bcf)	Coal (MMST)
Cameroon	400,000	3,900	0
Central African Rep.	0	0	4
Chad	0	0	0
Congo	1,505,913	3,200	0
Dem. Rep. Of Congo	187,000	35	97
Equatorial Guinea	12,000	1,300	0
Gabon	2,499,000	1,200	0
Sao Tome & Principe	0	0	0
SUBTOTAL–C. Africa	**4,603,913**	**9,635**	**101**
Burundi	0	0	0
Djibouti	0	0	0
Eritrea	0	0	0
Ethiopia	428	880	0
Kenya	0	0	0
Rwanda	0	2,000	0
Seychelles	0	0	0
Somalia	0	200	0
Sudan	262,100	3,000	0
Tanzania	0	980	220
Uganda	0	0	0
SUBTOTAL–E. Africa	**262,528**	**7,060**	**220**
Algeria	9,200,000	130,300	44
Egypt	3,500,000	31,500	24
Libya	29,500,000	46,400	0
Morocco	1,966	50	6
Tunisia	307,560	2,750	0
Western Sahara	0	0	0
SUBTOTAL–N. Africa	**42,509,526**	**211,000**	**74**

Bcf = billion cubic feet; MMST = million short tons

Country	Crude Oil (1,000 barrels)	Natural Gas (Bcf)	Coal (MMST)
Angola	5,412,000	1,620	0
Botswana	0	0	4,754
Comoros	0	0	0
Lesotho	0	0	0
Madagascar	0	70	0
Malawi	0	0	2
Mauritius	0	0	0
Mozambique	0	2,000	265
Namibia	0	3,000	0
South Africa	29,362	780	60,994
Swaziland	0	0	128
Zambia	0	0	61
Zimbabwe	0	0	809
SUBTOTAL–S. Africa	**5,441,362**	**7,470**	**67,013**
Benin	8,210	43	0
Burkina Faso	0	0	0
Cape Verde	0	0	0
Cote d'Ivoire	0	1,050	0
Gambia	0	0	0
Ghana	16,510	840	0
Guinea	0	0	0
Guinea-Bissau	0	0	0
Liberia	0	0	0
Mali	0	0	0
Mauritania	0	0	0
Niger	0	0	77
Nigeria	22,500,000	124,000	209
Senegal	0	0	0
Sierra Leone	0	0	0
Togo	0	0	0
SUBTOTAL–W. Africa	**22,524,720**	**125,933**	**287**
Total Africa	**75,442,049**	**361,098**	**67,695**

Crude Oil Trade, 1996

Country	Crude Oil Imports (1000 bbl/d)	Crude Oil Exports (1000 bbl/d)	Net Crude Oil Exports (1000 bbl/d)
Cameroon	0	90	90
Central African Rep.	0	0	0
Chad	0	0	0
Congo	0	189	189
Dem. Rep. Of Congo	2	23	21
Equatorial Guinea	0	17	17
Gabon	0	349	349
Sao Tome & Principe	0	0	0
SUBTOTAL–C. Africa	**2**	**668**	**665**
Burundi	0	0	0
Djibouti	0	0	0
Eritrea	14	0	-14
Ethiopia	0	0	0
Kenya	36	0	-36
Rwanda	0	0	0
Seychelles	0	0	0
Somalia	2	0	-2
Sudan	21	0	-21
Tanzania	12	0	-12
Uganda	0	0	0
SUBTOTAL–E. Africa	**85**	**0**	**-85**
Algeria	0	783	783
Egypt	0	355	355
Libya	0	1,119	1,119
Morocco	115	0	-115
Tunisia	18	69	51
Western Sahara	0	0	0
SUBTOTAL–N. Africa	**133**	**2,327**	**2,194**

Country	Crude Oil Imports (1000 bbl/d)	Crude Oil Exports (1000 bbl/d)	Net Crude Oil Exports (1000 bbl/d)
Angola	0	683	683
Botswana	0	0	0
Comoros	0	0	0
Lesotho	0	0	0
Madagascar	4	0	-4
Malawi	0	0	0
Mauritius	0	0	0
Mozambique	0	0	0
Namibia	0	0	0
South Africa	266	0	-266
Swaziland	0	0	0
Zambia	11	0	-11
Zimbabwe	0	0	1,699
SUBTOTAL-S. Africa	**282**	**683**	**401**
Benin	0	2	2
Burkina Faso	0	0	0
Cape Verde	0	0	0
Cote d'Ivoire	41	0	-41
Gambia	0	0	0
Ghana	20	0	-20
Guinea	0	0	0
Guinea-Bissau	0	0	0
Liberia	0	0	0
Mali	0	0	0
Mauritania	19	0	-19
Niger	0	0	0
Nigeria	0	1,699	1,699
Senegal	17	0	-17
Sierra Leone	5	0	-5
Togo	0	0	0
SUBTOTAL-W. Africa	**103**	**1,701**	**1,598**
Total Africa	**605**	5,378	4,773

*bbl/d = barrels per day;
Source: Energy Information Administration.

Refining Capacity and Petroleum Product Trade

Country	Number of Plants	Crude Distillation Capacity* (1000 b/d)	1996 Trade (1000 bbl/d)	
			Product Imports	Product Exports
Cameroon	1	35.0	4	0.3
Central African Rep.	0	0	2	0
Chad	0	0	1	0
Congo	1	21.0	0.3	5
Dem. Rep. Of Congo	1	17.0	14	0.1
Equatorial Guinea	0	0	1	0
Gabon	1	17.3	2	1
Sao Tome & Principe	0	0	1	0
SUBTOTAL–C.Africa	**4**	**90.3**	**25**	**6**
Burundi	0	0	3	0
Djibout	0	0	11	0.02
Eritrea	1	18.0	0	4
Ethiopia	0	0	12	0
Kenya	1	90.0	17	8
Rwanda	0	0	5	0
Seychelles	0	0	3	0
Somalia	1	10.0	2	0.3
Sudan	1	21.7	6	1
Tanzania	1	14.9	3	1
Uganda	0	0	7	0.1
SUBTOTAL–E. Africa	**5**	**154.6**	**68**	**14.42**
Algeria	4	502.7	4	401
Egypt	8	577.8	3	111
Libya	3	348.4	1	147
Morocco	2	156.8	25	8
Tunisia	1	34.0	47	13
Western Sahara	0	0	1	0
SUBTOTAL–N. Africa	**18**	**1,619.7**	**81**	**680**

Country	Number of Plants	Crude Distillation Capacity* (1000 b/d)	1996 Trade (1000 bbl/d)	
			Product Imports	Product Exports
Angola	1	39.0	0.4	3
Botswana	0	0	8	0.2
Comoros	0	0	1	0
Lesotho	0	0	1	0
Madagascar	1	15.0	5	0.4
Malawi	0	0	5	0
Mauritius	0	0	16	0
Mozambique	0	0	7	0
Namibia	0	0	8	0
South Africa	4	468.5	21	67
Swaziland	0	0	3	0
Zambia	1	24.5	0.3	1
Zimbabwe	0	0	28	0
SUBTOTAL–S. Africa	**7**	**547.0**	**104**	**71**
Benin	0	0	4	0.2
Burkina Faso	0	0	5	0
Cape Verde	0	0	1	0
Cote d'Ivoire	2	69.0	8	6
Gambia	0	0	2	0
Ghana	1	45.0	5	3
Guinea	0	0	8	0.04
Guinea-Bissau	0	0	2	0
Liberia	1	15.0	3	0.02
Mali	0	0	4	0
Mauritania	0	0	3	0
Niger	0	0	5	0
Nigeria	4	438.8	49	14
Senegal	1	17.0	8	1
Sierra Leone	1	10.0	1	0.1
Togo	0	0	4	0.1
SUBTOTAL–W. Africa	**10**	**594.8**	**109**	**24**
Total Africa	**44**	**3,006**	**387**	**795**

Sources: Oil and Gas Journal; Energy Information Administration.
bbl/d = barrels per day *as of 1/1/99

Electric Generating Capacity, 1997

Country	Capacity (GW)	Type (%)			
		Thermal	Hydro	Nuclear	Other
Cameroon	0.63	15.5	84.5	0	0
Central African Rep.	0.04	48.8	51.2	0	0
Chad	0.03	100.0	0	0	0
Congo	0.12	24.6	75.4	0	0
Dem. Rep. Of Congo	3.19	1.8	98.2	0	0
Equatorial Guinea	0.01	80.0	20.0	0	0
Gabon	0.31	46.5	53.5	0	0
SaoTome & Principe	0.01	66.7	33.3	0	0
SUBTOTAL–C. Africa	**4.34**	**8.9**	**91.1**	**0**	**0**
Burundi	0.04	25.6	74.4	0	0
Djibout	0.09	100.0	0	0	0
Eritrea	0.00	0	0	0	0
Ethiopia	0.49	16.0	77.8	0	6.2
Kenya	0.81	19.8	74.7	0	5.6
Rwanda	0.03	11.8	88.2	0	0
Seychelles	0.03	100.0	0	0	0
Somalia	0.07	100.0	0	0	0
Sudan	0.50	55.0	45.0	0	0
Tanzania	0.54	39.4	60.06	0	0
Uganda	0.16	4.3	95.7	0	0
SUBTOTAL–E. Africa	**2.76**	**33.8**	**63.5**	**0**	**2.7**
Algeria	6.04	95.4	4.6	0	0
Egypt	16.62	83.7	16.3	0	0
Libya	4.60	100.0	0	0	0
Morocco	3.96	74.6	25.4	0	0
Tunisia	1.72	96.3	3.7	0	0
Western Sahara	0.06	100.0	0	0	0
SUBTOTAL–N. Africa	**32.88**	**87.7**	**12.3**	**0**	**0**

Source: Energy Information Administration.
GW = Gigawatts (billion watts)

Country	Capacity (GW)	Type (%)			
		Thermal	Hydro	Nuclear	Other
Angola	0.62	33.2	66.8	0	0
Botswana	0.22	100.0	0	0	0
Comoros	0.01	80.0	20.0	0	0
Lesotho	0.00	0	0	0	0
Madagascar	0.22	51.8	48.2	0	0
Malawi	0.19	21.1	78.9	0	0
Mauritius	0.36	83.8	16.2	0	0
Mozambique	2.38	12.8	87.2	0	0
Namibia	0.00	0	0	0	0
South Africa	35.18	93.0	1.7	5.2	0
Swaziland	0.14	61.3	38.7	0	0
Zambia	2.44	7.8	92.2	0	0
Zimbabwe	2.07	67.8	32.2	0	0
SUBTOTAL–S. Africa	**43.83**	**81.2**	**14.6**	**4.2**	**0**
Benin	0.02	100.0	0	0	0
Burkina Faso	0.08	61.5	38.5		0
Cape Verde	0.01	100.0	0	0	0
Cote d'Ivoire	1.17	23.7	76.3	0	0
Gambia	0.03	100.0	0	0	0
Ghana	1.19	9.7	90.3	0	0
Guinea	0.19	76.9	23.1	0	0
Guinea-Bissau	0.01	100.0	0	0	0
Liberia	0.33	75.6	24.4	0	0
Mali	0.11	100.0	43.9	0	0
Mauritania	0.11	75.6	58.1	0	0
Niger	0.06	56.1	0	0	0
Nigeria	5.88	41.9	39.8	0	0
Senegal	0.24	100.0	0	0	0
Sierra Leone	0.13	98.4	1.6	0	0
Togo	0.03	88.2	11.8	0	0
SUBTOTAL–W.Africa	**9.61**	**52.2**	**47.8**	**0**	**0**
Total Africa	**93.5**	**75.8**	**22.2**	**2.0**	**0.1**

Electric Power in Africa

- **At the beginning of 1997, electric generating capacity in Africa totaled nearly 94 gigawatts, about 3% of the world's total.**
  - Most of Africa's generating capacity (76%) is thermal. This is particularly the case in North Africa (88%) and southern Africa (81%). In North Africa, thermal capacity is a mix mainly of oil and natural gas. In southern Africa, it is mainly coal and oil.
  - Hydroelectric capacity accounts for about 22% of total electric generating capacity in Africa. Hydroelectricity represents the primary source of electricity in East Africa and Central Africa (and nearly half in West Africa). Reliance on hydropower is 80% or greater in **Cameroon**, **the Democratic Republic of Congo, Ghana, Mozambique, Rwanda, Uganda,** and **Zambia.** Hydropower reliance is greater than 70% in several other African countries.
  - Nuclear power accounts for only 2% of total African electric generating capacity, and is located in only one country -- **South Africa.**
  - Geothermal generating plants make up only about 0.1% of total electric generating capacity in Africa. **Ethiopia** and **Kenya** account for all of this capacity.
  - Access to a central power grid is a major challenge for Africa. Outside of southern Africa (and to a lesser extent, North Africa), electrification rates are very low. As a result, per capita electricity consumption is extremely low in Central, East, and West Africa. In those regions, use of biomass largely takes the place of electricity from a power grid.

Hydroelectric capacity accounts for about 22% of total electric generating capacity in Africa. Shown: Victoria Falls located on the Zambezi River.

Central Africa

East Africa

North Africa

Southern Africa

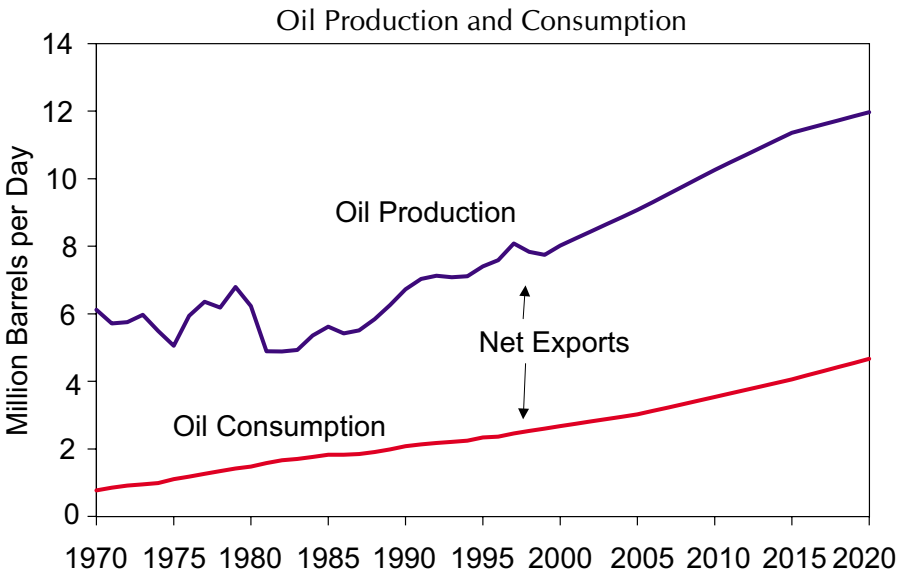
West Africa

4. Oil and Gas

Oil in Africa Overview ...

Africa produced 7.8 million barrels per day (bbl/d) of oil in 1998. The top oil producers in Africa in 1998 were (in descending order of magnitude): ***Nigeria, Libya, Algeria, Egypt,*** *and* ***Angola****. All regions of Africa are net crude oil exporters, with the exception of East Africa. Total African oil consumption in 1998 was 2.5 million bbl/d. The top oil consumers in Africa in 1998 were (in descending order of magnitude):* ***Egypt, South Africa, Nigeria, Algeria*** *and* ***Libya****.* ***South Africa*** *is the largest net crude oil importer in Africa, followed by* ***Morocco.*** *Smaller net crude oil importers include* ***Cote d'Ivoire, Ghana, Kenya,*** *and* ***Sudan.*** *Top net crude oil exporting countries in Africa include:* ***Nigeria, Libya, Algeria, Angola, Egypt, Gabon, Congo,*** *and* ***Cameroon.***

Most African oil producers, like other world oil producers, saw oil revenues fall sharply during 1998 and early 1999 due to a collapse in world oil prices. This had serious implications for budgets, economies, and oil expansion plans throughout the region. Oil prices began increasing in March 1999, and as of October 1999, had recovered to January 1997 levels.



Source: Energy Information Administration.

Oil in Africa Overview ...

CENTRAL AFRICA
Despite political turmoil in Central Africa (in particular, civil conflicts in **Congo** and the **Democratic Republic of Congo**), the region has seen crude oil production rise from 650,000 bbl/d in 1993 to 875,000 bbl/d in 1998. Largest increases in those years were in **Equatorial Guinea** (+97,000 bbl/d), **Congo** (+84,000 bbl/d) and **Gabon** (+48,000 bbl/d). Meanwhile, **Chad** hopes to begin production from its Doba Basin fields, with possible peak production of 250,000 bbl/d, in the next few years, while **Congo** expects the 400-million barrel Moho field to begin production by the end of 2001.

Successful exploration and production activities throughout Central Africa have encouraged several countries (**Cameroon, Equatorial Guinea** and **Gabon**) to offer new licensing rounds for oil exploration blocks.

Mobil will evaluate 22 deepwater blocks covering 12 million acres under an agreement signed with the **Sao Tome and Principe** National Petroleum Company (STPETRO). Following the 18-month technical evaluation, Mobil will have the exclusive option to negotiate with STPETRO for a production sharing contract on the acreage.

A consortium, composed of U.S.-based firms Trinity Gas, Carlton Energy and **Nigeria**'s Oriental Energy Resources, has signed an exploration agreement for **Chad**'s 108-million acre block H. The group plans to spend $59 million on exploration activities on the block, which is roughly the size of Kansas and Oklahoma combined.

Chad plans to construct a pipeline from fields located in the Sedigi basin to a new refinery located in the capital of N'Djamena. The refinery, with planned capacity of 3,000 - 5,000 bbl/d, would produce fuel for transportation and power generation.

EAST AFRICA
Although there are plans to develop oil resources for export, primarily in **Sudan**, East Africa has the smallest proven reserves and production (0.3% and 0.1% respectively of Africa's total) on the continent. As of 1998, **Kenya** was the region's largest oil consumer (overall, Africa's 9th largest) and net oil importer. East Africa's refining capacity (5 plants) of 155,000 bbl/d represents 5.1% of Africa's total refining capacity. In comparison, East Africa's refining capacity is approximately one-tenth of Mexico's.

The **Tanzania** Petroleum Development Corporation (TPDC) has signed several agreements with foreign companies for the rights to explore for hydrocarbons on its territory. Canada's Heritage Oil is currently prospecting in **Uganda**'s Western Rift Valley where surface oil seeps have occurred.

The Greater Nile Petroleum Operating Company (GNPOC) has begun production of 120,000 bbl/d from its fields in southern **Sudan**, and exported its first cargo in September 1999. The oil is transported through a 1,500-kilometer (930-mile) pipeline from the fields to a marine export terminal located near Port Sudan on the Red Sea. GNPOC is a consortium of Sudanese, Canadian, Chinese and Malaysian firms.

The European Investment Bank has awarded a loan to the **Kenya** Pipeline Company to refurbish the petroleum product pipeline that runs from the port of Mombasa to the cities of Nairobi and Eldoret. TPDC is also planning to construct a product pipeline from the port of Dar es Salaam to the Mwanza region in northwest **Tanzania**.

Oil in Africa Overview ...

NORTH AFRICA
North Africa is the continent's most developed oil region. The majority (56%) of Africa's proven oil reserves and refining capacity (54%), as well as 49% of the continent's production (in 1998), are located in North **Africa**. Three countries **Algeria, Libya** (both members of the Organization of Petroleum Exporting Countries or OPEC) and **Egypt** dominate the region's oil sector, but **Morocco** and **Tunisia** are actively pursuing the expansion of their upstream oil sectors.

Algeria's state-owned Sonatrach and its foreign partners have plans to increase **Algeria**'s crude oil production, although Algeria is bound by OPEC quota agreements. **Algeria**'s oil sector, unlike that of most OPEC producers, has been open to foreign investors for more than a decade. At the start of 1999, there were 25 foreign firms from 19 countries operating in **Algeria**.

Egypt, Africa's largest oil refiner (in terms of capacity), will have an additional 100,000 bbl/d of refining capacity when the Egyptian-Israeli joint venture MIDOR (Middle East Oil Refinery Ltd.) refinery begins operation in 2001. In August 1999, **Egypt** invited bids for the construction of a liquefied petroleum gas (LPG) plant near Port Said on a build operate transfer (BOT) basis.

In addition to its role as an oil producer/exporter, **Egypt** has strategic importance because of its operation of the Suez Canal and Sumed (Suez-Mediterranean) Pipeline, two routes for export of Persian Gulf oil.

Morocco is **North** Africa's sole net oil importer (145,000 bbl/d in 1998). Shell and the U.K.-based Enterprise Oil are currently negotiating for exploration/production licenses for blocks offshore **Morocco**. The country's hydrocarbon code has been amended to reduce **Morocco**'s share in oil discoveries from a maximum of 50% to 25%.

SOUTHERN AFRICA
Oil production in Southern Africa is dominated by **Angola**, while the region's refineries are concentrated in **South Africa**. Additional refining capacity in Southern Africa is located in **Angola, Madagascar** and **Zambia**. **South Africa**, the continent's second largest oil consumer, is Africa's largest net oil importer. In 1998, **South Africa** produced about 185,000 bbl/d of synthetic oil from coal and natural gas.

Three member countries of the Southern African Development Community (SADC) **Angola, Mozambique** and **Tanzania** have applied for a $19-million loan from the African Development Bank (ADB) to fund coordinated petroleum exploration projects. SADC members plan to enhance a regional geological and geophysical database. The SADC energy sector currently operates 42 projects totaling over $844 million.

Angola's national oil company, Sociedade Nacional de Combustiveis de **Angola** (Sonangol), plans for the country's crude oil production (735,000 bbl/d in 1998) to reach 1 million bbl/d in 2000, and to nearly double to 1.4 million bbl/d by 2003. **Angola**'s crude oil production has more than quadrupled since 1980. The majority of **Angola**'s current production comes from fields located offshore the enclave of Cabinda, but several significant oil discoveries have been made in deeper waters offshore Cabinda and **Angola** proper. The discoveries, which are estimated to contain several billion barrels of oil reserves, not only have been the impetus for exploration offshore **Angola**, but also have generated interest in areas offshore **Central** and **West** Africa.

Sonangol has announced plans for the construction of **Angola**'s second refinery. The facility, with a capacity of 150,000-200,000 bbl/d would be built near the central coastal city of Benguela.

Oil in Africa Overview ...

SOUTHERN AFRICA (CONTINUED)
Mozambique has signed several agreements for the exploration of hydrocarbons. In early 1998, BP-Amoco (then BP) signed a production sharing agreement (PSA) with Mozambique. Under the PSA terms, BP-Amoco has exclusive rights to explore 25,000 square miles (40,000 square kilometers) of acreage in waters offshore the Zambezi Delta. An international consortium of oil firms, including **South Africa**'s Sasol, signed three exploration agreements with **Mozambique**'s state oil firm, Empresa Nacional Hydrocarbonetos (ENH), covering three exploration blocks: Temane, Sofala and M10.

Plans for a new 100,000-bbl/d refinery, to be located in the central Mozambican city of Beira, have been announced after preliminary studies on the project were conducted. **Mozambique** and the state-oil firms of Iran and Malaysia are seen as the potential investors in the $1.2 billion project. Additional investment may come from the governments of **Malawi, Zambia** and **Zimbabwe**, all of which have expressed interest in the project.

Zimbabwe is considering the construction of a second petroleum products pipeline from Beira, **Mozambique** to the National Oil Company of Zimbabwe (Noczim) depot in Msasa (outside of the capital of Harare).

WEST AFRICA
West Africa is the continent's second largest oil producing region, and the third largest in terms of oil consumption. **Nigeria**, which contains 99.4% of West Africa's proven oil reserves, is Africa's largest oil producer. Excluding **Nigeria**, West Africa is a net oil importer. The largest net importers, in 1998, were **Cote d'Ivoire, Ghana, Mauritania,** and **Senegal**.

Benin, which produces a small amount of crude oil from its offshore Seme field, hopes to expand offshore and onshore exploration. Neighboring **Togo** recently announced the opening of all offshore areas for oil and gas exploration. **Togo**'s offshore area is divided into 15 blocks totaling 2,600 sq. miles (4,100 sq. kilometers).

Mali has awarded exploration rights for three blocks to the U.S.-based Stratic Energy Corporation. The three blocks, which cover approximately 195,000 sq. miles (503,000 sq. kilometers), have similar geologic formations to known oil-containing areas located in **Algeria, Chad** and **Sudan. The Gambia, Ghana, Mauritania** and **Senegal** also have recently granted offshore exploration rights.

Nigeria plans to increase crude oil production by approximately 50% over the next four years, from 2 million bbl/d currently, by providing better funding to develop new oil and gas fields. The Nigerian government is investigating alternative-funding schemes to help meet these production goals. Shell's EA oil field is the first project to utilize a new funding scheme. The field's private partners will finance the $400 million-EA field development. The Nigerian National Petroleum Corporation's (NNPC) share of costs will be carried by Shell, and will be repaid as EA starts production.

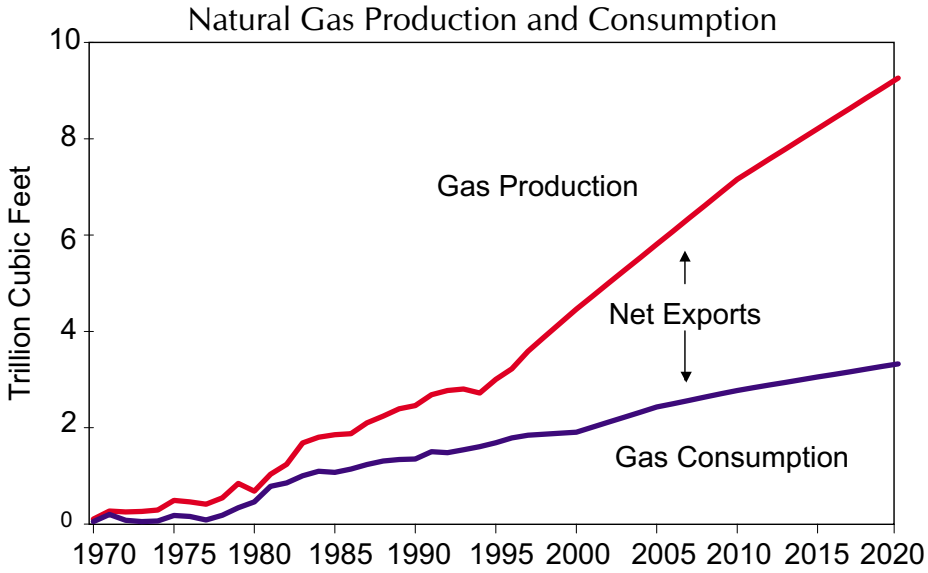
The NNPC has awarded several contracts for the repair and maintenance of **Nigeria**'s oil refineries. Refinery problems have led to fuel shortages and forced the NNPC to import petroleum products. An $84-million expansion, which would increase refining capacity from 59,000 bbl/d to 88,000 bbl/d, was announced in 1998 for **Cote d'Ivoire**'s Societe Ivoirienne Raffinage (SIR) refinery. **Ghana**'s refining capacity was expanded from 25,000 bbl/d to the current 45,000 bbl/d in 1997, and additional refinery upgrades are scheduled to be completed in 2002.

Natural Gas in Africa Overview ...

Total African natural gas production in 1997 was 3.6 trillion cubic feet (Tcf). Major natural gas producers in Africa in 1997 were: ***Algeria*** *(accounting for approximately 69% of total gas production on the continent) and* ***Egypt*** *(13%).* ***Libya, Nigeria, Tunisia*** *and* ***South Africa*** *also produced significant amounts of natural gas in 1997.*

Algeria *(with 36%) and* ***Nigeria*** *(34%) contain the majority of Africa's proven gas reserves.*

Total African natural gas consumption in 1997 was 1.8 Tcf. Natural gas consumption in Africa is expected to grow significantly as domestic and transnational gas-to-power projects are developed. Several of Africa's major oil producers, including ***Nigeria, Gabon*** *and* ***Angola****, are developing projects to utilize associated natural gas, which currently is flared or re-injected for the most part.*



Source: Energy Information Administration.

Natural Gas in Africa Overview ...

CENTRAL AFRICA
Central Africa's proven gas reserves (about 3% of the continent's total), are concentrated in **Cameroon, Congo, Equatorial Guinea** and **Gabon**. Central Africa accounted for only 0.1% of Africa's natural gas production in 1997.

Congo is developing studies on the potential of utilizing natural gas for power generation and mining projects.

A project to utilize gas produced from the **Equatorial Guinea**'s Alba field is currently underway. Plans call for 100 million cubic feet per day (Mmcf/d) of natural gas to be processed into methanol at a plant under construction on the island of Bioko.

EAST AFRICA
East Africa's proven natural gas reserves (approximately 2% of total African reserves) are primarily found in **Sudan** (3 trillion cubic feet - Tcf), **Rwanda** (2 Tcf), **Tanzania** (980 billion cubic feet - Bcf) and **Ethiopia** (880 Bcf).

Feasibility studies are being conducted on the development of methane deposits, which lie in the deep waters of Lake Kivu. The gas, with reserves estimated between 1.9-2.5 Tcf, has been used sparingly in **Rwanda**. Joint development of the gas by **Rwanda** and the **Democratic Republic of Congo**, which share Lake Kivu, is being considered.

Tanzania plans to develop two offshore gas fields to provide fuel for power generation. Gas from the Songo-Songo field will be transported to Dar es Salaam by a 160-mile (250-kilometer) pipeline, where it will be used to generate electricity. The pipeline could be extended to the Kenyan port city of Mombasa to supply gas for industrial usage and power generation. The Mnazi Bay field will supply gas to the southern Tanzanian town of Mtwara. The fuel will be used at a 15-MW generating plant. Plans call for the generating facility's capacity to expand to 50 MW by 2003.

NORTH AFRICA
North Africa contains the continent's largest natural gas sector. The region holds the majority of proven reserves (58%), and accounts for nearly all of Africa's natural gas production (91%) and consumption (83%).

Algeria, the world's second largest exporter of liquefied natural gas (LNG) in 1998, exported 22% of the world's total LNG to Western Europe and the United States. Gas is also exported from **Algeria** via the Trans-Mediterranean (Transmed) pipeline (847.6 Bcf per year - Bcf/y) and the Maghreb-Europe Gas (MEG) pipeline (300.2 Bcf/y).

Egypt's total proven gas reserves, currently 31.5 Tcf, have more than doubled during the past 6 years (15 Tcf of proven reserves in 1993) and production has increased 20% from 1993 to 1997. The rapid increase in **Egypt**'s natural gas reserves and production has encouraged plans for gas exports, either by pipeline or LNG tanker, but **Egypt** currently consumes all the gas it produces. Production from **Egypt**'s largest gas field, Scarab-Saffron, is slated to begin in January 2003 at a rate of 530 Mmcf/d.

Natural Gas in Africa Overview ...

NORTH AFRICA (CONTINUED)
Compressed Natural Gas (CNG) is being used as fuel for taxis in the Cairo metropolitan area. Approximately 15,000 - 20,000 taxis have been converted to run on CNG, and the number has been growing about 30% annually since the project's inception in 1996. The 17 CNG fueling stations currently in operation are owned by two joint ventures between **Egypt**'s state oil company, the Egyptian General Petroleum Corporation, and the foreign firms of BP Amoco and ENI/Agip.

Nigerian LNG

One of the largest industrial projects in Africa, a liquefied natural gas (LNG) plant on the Nigerian coast at Bonny, began production in September 1999. The $3.8-billion facility has the capacity to process 7.15 billion cubic meters (252.4 Bcf) annually of LNG.

The project consortium, Nigeria Liquefied Natural Gas Limited (NLNG), is comprised of the NNPC (49%), Shell (25.6 %), Elf (15%), and ENI/Agip (10.4%).

Initially the facility will be supplied primarily from dedicated gas fields, but the NLNG has stated that half of the input gas will be associated gas (currently flared) within a few years.

Several customers have signed long-term purchase agreements with NLNG: the Italian electric utility, ENEL (49% of the production volume); Spain's Enagas (22%); Turkey's Botas (17%); Gaz de France (7%); and Transgas of Portugal (5%). The first LNG deliveries to customers were to commence in October 1999.

NLNG confirmed in mid-1999 that a third LNG production train with an annual capacity of 3.7 billion cubic meters (130.6 Bcf) will be built, increasing NLNG's overall LNG processing capacity to 10.85 billion cubic meters (383 Bcf) per year. Deliveries from the third LNG train are scheduled to begin in the fourth quarter of 2002.

NLNG announced that Enagas had signed a 21-year agreement to purchase over 70% of the third LNG train's output. Transgas signed an agreement in June 1999 to purchase an additional 1 billion cubic meters (35.3 Bcf) per year of LNG from the third train. With this agreement, NLNG has pre-sold all output from the third LNG train.

NLNG longer-term plans include the possibility of two additional LNG trains at the Bonny complex.

SOUTHERN AFRICA
Southern Africa contains approximately 2% of Africa's natural gas reserves and accounted for 2% of gas production in 1997. **Namibia** (3 Tcf), **Mozambique** (2 Tcf), **Angola** (1.6 Tcf) and **South Africa** (780 Bcf) contain the region's significant reserves, but only **Angola** and **South Africa** currently produce gas.

U.S.-based Texaco has signed an agreement with **Angola**'s Sonangol to plan the development of an LNG project. The project would utilize natural gas reserves located offshore Angola south of the Congo River. Gas supplied to the LNG project will be both associated gas (from current and future oil production) and non-associated gas that has been discovered but not developed.

Natural Gas in Africa Overview ...

SOUTHERN AFRICA (CONTINUED)
Angola Is also studying other plans for associated gas development. Currently, approximately 85% of Angola's gas is flared. Possible uses for the gas include power generation and a gas-to-liquid fuels project.

Enron is negotiating with the government of **Mozambique** to develop the Pande gas project, including exploration and development of the Pande field in southern **Mozambique**, and construction of a 373-mile (610-kilometer) pipeline to transport natural gas from Pande to the planned Maputo Iron & Steel Project.

WEST AFRICA
In 1997, West Africa was the continent's second largest natural gas producer and consumer. **Nigeria**'s estimated 124 Tcf of proven natural gas reserves are the 9th largest in the world.

Cote d'Ivoire, with proven natural gas reserves of 1 Tcf, is poised to become a regional gas exporter. **Cote d'Ivoire** plans to supply gas from its offshore Kudu, Ibex and Eland fields to **Ghana**'s Takoradi power facility.

U.S.-firm Apache and its partners, Electricite de France, Petroci and Saur - Bouygues, announced the signing of a ten-year, take-or-pay gas contract with the **Cote d'Ivoire** government in April 1997. The gas, which is planned to be used in power generation, will be supplied from **Cote d'Ivoire**'s offshore Foxtrot field. Foxtrot has estimated reserves of nearly 600 Bcf.

The **Ghana** National Petroleum Corporation (GNPC**)** is developing the offshore Tano fields in a gas-to-power project. GNPC will drill a series of wells and pipe the gas to two sets of power plant barges. Tano gas reserves are estimated to be sufficient to fuel a 100-MW to 140-MW power plant for at least 15 years.

Chevron and **South Africa**'s Sasol have signed an agreement for the construction of a 20,000 to 30,000-bbl/d gas-to-liquids (GTL) plant in **Nigeria**. The GTL plant, which is scheduled to be operational by 2003, will convert natural gas into synthetic crude oil, and the crude will be further processed into petroleum products. Feedstock natural gas for the GTL plant will be provided by Chevron's Escravos Gas Project, **Nigeria**'s first major associated gas project.

Senegal's natural gas reserves, an estimated 106 Bcf, are located primarily onshore. Gas currently produced on **Senegal**'s Diam Niadio East concession is supplied to Société Nationale d'Electricite (Senelec), the electric utility operating in **Senegal**.

Ocean Energy (United States) has constructed a LPG extraction plant near Abidjan, **Cote d'Ivoire**. The facility will produce 20,000 tons of LPG (butane) annually, from 75 Mmcf/d of natural gas feedstock .

A Snapshot of Oil and Gas in Africa...

Proved Reserves 1/1/99*	**Crude Oil: 75.4 billion barrels (7% of the world total) Natural Gas: 361.1 trillion cubic feet (7% of the world total)**		
Production (1997)	**Total Oil : 8.1 million barrels per day (bbl/d) Crude Oil: 7.6 million bbl/d Natural Gas: 3.6 trillion cubic feet**		
Oil and Gas Production by Region (1997)		**Total Oil (million bbl/d)**	**Natural Gas (trillion cubic feet)**
	Central Africa	**0.837**	**0.004**
	East Africa	**0.006**	**0.000**
	North Africa	**3.964**	**3.280**
	Southern Africa	**0.910**	**0.085**
	West Africa	**2.365**	**0.221**
	Total Africa	**8.082**	**3.589**
Major Oil Producers (1998 Production)		**Total Oil (million bbl/d)**	**% of Africa**
	Nigeria	**2.158**	**28%**
	Libya	**1.438**	**18%**
	Algeria	**1.402**	**18%**
	Egypt	**0.937**	**12%**
	Angola	**0.735**	**9%**
	TOTAL FOR 5 LARGEST PRODUCERS	**6.671**	**85%**
Refining Capacity (1/1/99)*	**Total Africa (44 plants)**	**3.006**	**4% of world total**
Major Refining Countries (Capacity as of 1/1/99)*		**Million bbl/d**	**% of Africa**
	Egypt	**0.578**	**19.2%**
	Algeria	**0.503**	**16.7%**
	South Africa	**0.469**	**15.6%**
	Nigeria	**0.439**	**14.6%**
	Libya	**0.348**	**11.6%**
	Morocco	**0.157**	**5.2%**
	Kenya	**0.090**	**3.0%**

Sources: Energy Information Administration and Oil and Gas Journal (*).

Oil and Gas Privatization in Africa ...

CENTRAL AFRICA
Equatorial Guinea's assets in the local oil distribution firm, GeTotal, were purchased by TotalFina, its former partner in the company.

The final privatization of **Congo**'s Hydro-Congo is expected to be completed by the end of 1999. The company's downstream operations, including refining and distribution, will be assumed by the buyers. Elf and Shell were negotiating with the government on Hydro-Congo's privatization prior to civil war.

EAST AFRICA
The government of **Rwanda** has sold assets from the oil marketing/distribution firm, PetroRwanda, to Shell. Shell announced plans to invest in the rehabilitation of PetroRwanda's distribution network.

NORTH AFRICA
The privatization of **Morocco**'s Samir oil refinery began in 1996 when 30% of the company was listed on the Moroccan stock exchange. Saudi Arabia's Corral Petroleum (Corral) was awarded a tender for Samir and acquired a 61% interest in 1997. Corral acquired an additional 6% of the refinery in 1999. Corral also has acquired a 71% interest in **Morocco**'s SCP refinery.

SOUTHERN AFRICA
Six companies have qualified for the bidding on the privatization of Johannesburg's Metro Gas assets and gas distribution network. The companies, which include Enron and Cinergy, were to have submitted final bids by November 2, 1999. When completed by the end of 1999, the sale will be **South Africa**'s first gas utility divestment.

Malawi's Petroleum Control Commission (PCC) governs the import, distribution and pricing of petroleum. PCC's monopoly on the importation of petroleum products was set to end in March 1999. As a result of preexisting contractual arrangements for the purchase of petroleum products, the private oil companies in **Malawi** chose to postpone contracting for their own supplies. A consortium of private petroleum companies operating in **Malawi** is to negotiate a supply contract for the calendar year 2000.

WEST AFRICA
An $84 million expansion of **Cote d'Ivoire**'s 59,000-bbl/d Societe Ivoirienne Raffinage (SIR) refinery was announced in 1998, and the government is looking for a "strategic partner" willing to invest in the expansion. **Cote d'Ivoire**'s 47% interest in SIR has been scheduled for privatization.

Gestoci, a fuel storage company that supplies petroleum products to central and northern **Cote d'Ivoire**, is set to be restructured. Currently jointly-owned by the government and the petroleum marketers (ENI/Agip, Elf, Mobil, Texaco, TotalFina and Shell) in the country, Gestoci will have its government stake reduced to 34%.

Benin's state-owned oil firm Sonacop (Societe Nationale de Commercialization des Produits Petroliers) has been privatized. The local firm, Continetale des Petrole et D'Invesstissement (CPI), was awarded the tender for Sonacop. The terms of the privatization include 55% of the capital to be sold to the "strategic" investor (CPI), 10% reserved for sale to employees, and the remaining shares retained by the government.

SELECT TRANSNATIONAL GAS/OIL PROJECTS WITHIN AFRICA

OPERATIONAL

East/Southern Africa

Tanzania-Zambia Tazama Pipeline
The 1,069-mile (1,710-kilometer) pipeline transports crude from the oil depot at Dar es Salaam, Tanzania to Zambia's Indeni refinery in Ndola. The pipeline, jointly owned by the governments of Zambia (67%) and Tanzania (33%), has a capacity of 22,000 bbl/d (1.1 million metric tons annually).

North Africa

Algeria-Tunisia-Italy Trans-Mediterranean (Transmed) Natural Gas Pipeline
The 667-mile (1,067-kilometer) Transmed pipeline links Algeria's Hassi R'Mel gas field to Mazzara del Vallo in Sicily. Transmed comprises segments through Algeria, Tunisia and under the Mediterranean to Sicily. An extension of the Transmed pipeline delivers Algerian gas to Slovenia. Tunisia purchases about 39 Bcf/y, Slovenia's Sozd Petrol is committed to 21 Bcf/y and Italy's main gas utility, Snam, is under contract to buy 680 Bcf/y until 2018.

Algeria-Morocco-Spain-Portugal Maghreb-Europe Gas (MEG) Pipeline
The $2.5 billion MEG line, runs 1,013 miles (1,620 kilometers) from Hassi R'Mel to the Iberian Peninsula via Morocco. MEG is made up of five sections: 324 miles (515 kilometers) from Hassi R'Mel to the Moroccan border, 326 miles (522 kilometers) from the Moroccan border to the Strait of Gibraltar, 28 miles (45 kilometers) across the Strait of Gibraltar at a depth of 1,312 feet, 168 miles (269 kilometers) from the Spanish coast to Cordoba, Spain where it ties into the Spanish transmission network, and 168 miles (269 kilometers) to Portugal.

Egypt Sumed (Suez-Mediterranean) Pipeline
The Sumed pipeline is an alternative to the Suez Canal for transporting oil from the Persian Gulf region to the Mediterranean. The 200-mile (320-kilometer) pipeline runs from Ain Sukhna on the Gulf of Suez to Sidi Kerir on the Mediterranean. The pipeline is owned by the Arab Petroleum Pipeline Company, a joint venture between Egypt (50%), Saudi Arabia (15%), Kuwait (15%), the U.A.E. (15%), and Qatar (5%). An extension of the pipeline is being studied. This extension would traverse the Red Sea from Ain Sukhna to the closest point on the Saudi coast near Sharm al Sheikh, and then continue to link up with the terminal of Saudi Arabia's main east-west pipeline in Yanbu.

Southern Africa

Mozambique-Zimbabwe Petrozim Petroleum Products Pipeline
The Petrozim pipeline runs from the Mozambican port city of Beira to Feruka, Zimbabwe and from there to Msasa, which is located near the capital city of Harare. Noczim imports 80% of Zimbabwe's petroleum through the pipeline. Petrozim is a joint-venture between Noczim and the South African-based Lonhro.

SELECT TRANSNATIONAL GAS/OIL PROJECTS WITHIN AFRICA--(continued)

UNDER CONSTRUCTION / PLANNED

Central Africa

Chad-Cameroon Pipeline

The project consists of two primary components, development of oil fields in Chad's Doba basin and the construction of a pipeline and export facilities. The Doba basin's three fields (Bolobo, Kome and Miandoum) will produce an estimated 225,000 bbl/d at their peak. Plans currently call for the drilling of 300 wells in the Chadian oilfields with 900 million - 1 billion barrels of oil produced over the life of the project (25-30 years).

The 655-mile (1,050-kilometer) pipeline will run from the Doba fields in Chad to an offshore export terminal located near Kribi, Cameroon. The Chadian portion of the pipeline, approximately 105 miles (170 kilometers), and the first (located at Kome) of the three pumping stations will be built and owned by TOTCO (Tchad Oil Transport Company). TOTCO is a consortium of the Doba basin field developers -- Exxon (34%), Shell (34%), Elf (17%)-- and the government of Chad (15%). The section through Cameroon, 550 miles (880 kilometers), which also includes the remaining pumping stations and the export facilities, will be built and owned by COTCO (Cameroon Oil Transport Company). COTCO consists of Exxon (34.6%), Shell (34.6%), Elf (17.3%), the Cameroonian government (8.5%) and the government of Chad (5%). The export facilities will consist of an onshore pressure-reducing station, a 12-kilometer (7-mile) subsea pipeline and an offshore floating storage and off-loading facility (FSO). The FSO will have a crude oil storage capacity of 2 million barrels, nearly one week of the pipeline's output at peak capacity.

The total project cost is estimated to be between $3 - $3.5 billion. Exxon, Shell and Elf plan to finance approximately 97% of the project. Approximately 60% will be financed directly, while 37% of the costs will be obtained through loans from the International Finance Corporation, various export credit agencies and commercial banks. The World Bank is financing about 3% of the project's total cost. The $115 million in World Bank loans requested by Chad ($46 million) and Cameroon ($69 million) will be used to fund their equity interests in the oil pipeline. The World Bank has imposed several requirements as prerequisites to the loans approval. The prerequisites include: a credible oil revenue management program; extragovernmental participation (including opposition parties and the private sector) in decisions concerning the use of oil revenues; government commitments to target revenue expenditures on education, health and infrastructure; resettlement of people displaced by the project; and consultation with residents and others affected by the project.

The Revenue Management Plan (RMP), developed by the Republic of Chad with the assistance of the World Bank, has been enacted by Chad's National Assembly and approved by its President. The RMP allocates 86.5% of the revenues to programs for health, education, water, sanitation, roads and agriculture. Allocations for specific programs to benefit the residents of the oil producing area are also contained in the RMP. The remaining portion of the funds, 13.5%, will be allocated for management and expenses associated with the project.

Although no resettlement is necessary along the pipeline route, about 150 households will be relocated in the oil field area. Along the pipeline itself, the vast majority of the land will be affected only for an approximate three month construction period and usage will be returned after completion of construction. The compensation plans for Cameroon and Chad provide monetary and in-kind compensation for loss of crops and other resources. Compensation in Cameroon will be paid by the government, with supplemental compensation (to meet World Bank requirements on compensation) paid by COTCO.

SELECT TRANSNATIONAL GAS/OIL PROJECTS WITHIN AFRICA--(continued)

UNDER CONSTRUCTION / PLANNED **CONTINUED**

Central Africa (continued)

On Tuesday, November 9, 1999, Elf and Shell announced that they were both reviewing their involvement in the Chad/Cameroon oil development and pipeline project. Although neither company stated that they had withdrawn from the project, the Chadian government announced that both firms had informed Chad of their decision to exit the consortium of companies involved in the scheme. On November 16, protests in Chad against Elf left one person dead, and several others injured.

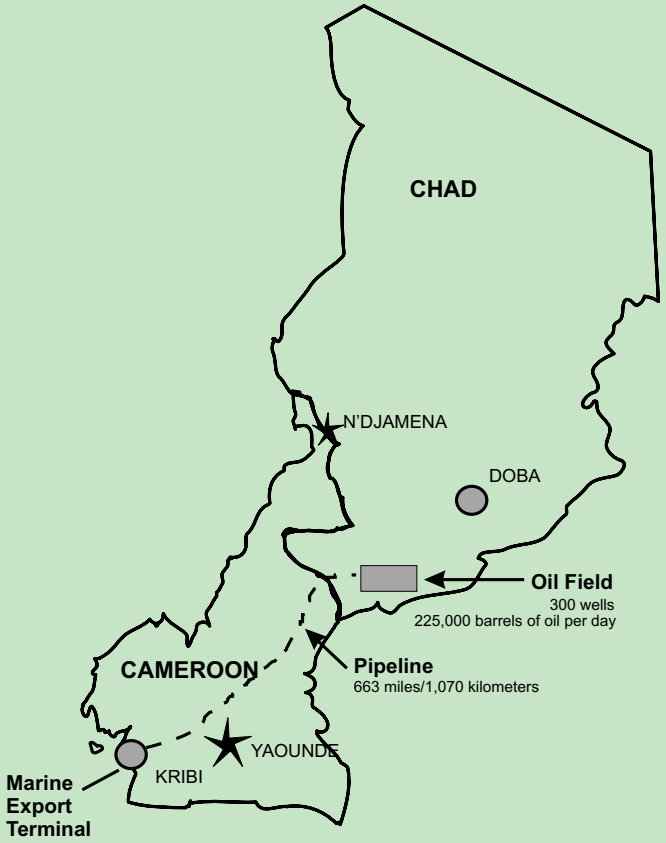


Illustration reproduced from Chad/Cameroon Development Project Web site: http://www.exxon.com/essochad/index.html.

SELECT TRANSNATIONAL GAS/OIL PROJECTS WITHIN AFRICA--(continued)

UNDER CONSTRUCTION / PLANNED

West Africa

Nigeria-Benin-Togo-Ghana West Africa Gas Pipeline
In the 1980's the Economic Community of West African States (ECOWAS), in conjunction with the member governments of Nigeria, Benin, Togo and Ghana, first proposed the idea of a regional natural gas pipeline system to help promote economic growth. An initial feasibility report, prepared for the World Bank in the early 1990's, deemed that a pipeline to transport Nigerian natural gas to Benin, Togo and Ghana was commercially viable. The report's conclusion was based on the U.S.-firm Chevron's associated gas reserves in Nigeria's Escravos region. In September 1995, the governments of the four nations signed an agreement for the supply and transmission of natural gas.

Chevron, in 1997, completed the first phase of its Escravos Gas Project (EGP). The EGP, in which the Nigerian National Petroleum Corporation (NNPC) holds a 60% share and Chevron a 40% share, is one of several projects Nigeria is undertaking to better utilize its natural gas reserves. The first phase of the EGP was completed in six years at a cost of $570 million, and it currently processes 165 Mmcf/d of associated gas. The EGP's second phase, which could be used to supply gas to the pipeline, is expected to come online by the end of 1999.

The El Nino-induced energy shortage (1997-1998) experienced by Ghana, Togo, and Benin renewed interest in the pipeline project. In August 1998, a consortium of Chevron, Shell, NNPC, Ghana National Petroleum Corp. (GNPC), Societe Beninoise de Gaz (SoBeGaz), and Societe Togolaise de Gaz (SoToGaz) signed an agreement commissioning a feasibility study on the West Africa Gas Pipeline (WAGP). The study, which was completed in March 1999, concluded the commercial and technical viability of the WAGP, and it projected that it could be operational as early as 2002. On August 11, 1999, in Cotonou, Benin, a Memorandum of Understanding was signed by the four countries and the consortium establishing the legal framework for the WAGP. The Joint Venture Agreement naming Chevron as the WAGP project manager was signed on August 16, 1999 in Abuja, Nigeria.

The WAGP will run approximately 620 miles (990 kilometers) offshore from the EGP to Effasu in Ghana. Proposed landfall spurs will be at Lagos (Nigeria), Cotonou (Benin), Lome (Togo), Tema (Ghana) and Takoradi (Ghana). The initial capacity of the WAGP will be 200 Mmcf/d, with the capability to expand to 600 Mmcf/d as demand grows. Initial deliveries of 120 Mmcf/d of gas are forecast to begin in 2002. The total cost of the WAGP is estimated at $400 million, with an additional $600 million being spent on the development of power facilities to utilize the gas.

Chevron has signed a 20-year agreement to supply natural gas, via the WAGP, to the 220-MW power plant currently under construction in Tema, Ghana . Under terms of the contract, the plant will receive 40 Mmcf/d of natural gas.

A study, commissioned by Chevron, estimates that 10,000 to 20,000 primary sector jobs will be created in the region. New power supplies, fueled by gas from the WAGP, will stimulate the growth of new industry. The industrial growth has the potential to spawn an additional 30,000-60,000 secondary jobs. In addition to the $1 billion in investment (WAGP and power facilities) already projected, the study sees approximately $800 million in new industrial investment occurring in the region. The World Bank estimates that Benin, Togo and Ghana can save nearly $500 million in energy costs over a 20-year period as WAGP-supplied gas is substituted for more expensive fuels in power generation.

Oil and Gas Integration Within Africa–Recent Developments

Potential increases in regional trade, coupled with growing energy demands and the necessity for regional oil producers to utilize natural gas resources have resulted in the development/planning of cross-border pipelines in Africa. Additional oil pipelines (both crude and product) are planned to supply interior African countries with needed energy supplies. The discovery of offshore hydrocarbon reserves, many of which cross maritime borders, has led to possible joint efforts in the exploitation of these resources. As a result, the energy infrastructure of Africa should become increasingly interconnected over the coming decades.

CENTRAL AFRICA

- On March 6, 1999 **Equatorial Guinea**'s President Obiang Nguema Mbasogo signed a decree unilaterally adopting an equidistant median line to define territorial boundaries as stipulated under the UN Convention on the Law of the Sea. **Cameroon, Sao Tome & Principe** and Nigeria subsequently accepted the decision as an improvement over oft-disputed traditional boundaries.

EAST AFRICA

- The governments of **Kenya** and **Uganda** announced, in May 1999, plans for a petroleum products pipeline from Eldoret in western **Kenya** to Kampala, **Uganda**. The pipeline, with a capacity of 16,500 bbl/d, would supply petroleum directly to **Uganda** and indirectly (transported from the pipeline terminus by road, rail and barge) to **Rwanda, Burundi,** northwestern **Tanzania** and eastern portions of the **Democratic Republic of Congo**. Construction of the 200-mile (320-kilometer), $80-million pipeline is projected to take four years.
- **Uganda** is also investing in the proposed $400-million product pipeline running from Dar es Salaam to Mwanza in **Tanzania**. The 690-mile (1,104-kilometer) pipeline will also indirectly supply **Uganda, Rwanda, Burundi** and the **Democratic Republic of Congo**. Construction of the pipeline is expected to commence before the end of 1999.

NORTH

- **Egypt** and **Libya** have announced plans to build a 375-mile (600-kilometer), 150,000-bbl/d oil pipeline to transport Libyan crude from Tobruk to Alexandria for refining and sale in **Egypt**. The pipeline is expected to cost $300 million, and should take 3-4 years to complete.
- In November 1998, BP-Amoco signed agreements with **Egypt** and Jordan to build a natural gas pipeline across the Sinai and under the Gulf of Aqaba to Amman, Jordan and possibly beyond. Under this agreement, gas from **Egypt**'s Nile Delta was expected to begin flowing to Jordan in 2001.
- The northern part of the Gulf of Gabes, also known as the November Seventh concession, lies on the Libyan-Tunisian border. The area (which contains an estimated 3.7 billion barrels of oil and nearly 12 Tcf of natural gas) is set to be exploited by the Libyan-Tunisian Joint Oil Company (JOC), a 50-50 venture of **Libya**'s NOC and **Tunisia**'s state oil company ETAP. On February 1, 1997, JOC awarded the entire block to a consortium consisting of Saudi Arabia's Nimr Petroleum (55%) and Malaysia's Petronas (45%).
- **Tunisia** has committed to purchase 14 Bcf/y of Algerian gas (via the Transmed pipeline), until 2020, under a deal signed in March 1997. **Tunisia** consumes approximately another 25 Bcf/y of gas from **Algeria**, which is bought on spot basis and received in lieu of transit fees from the Transmed pipeline .

Oil and Gas Integration Within Africa –Recent Developments

SOUTHERN AFRICA

- **Zimbabwe**'s Noczim is planning to construct an additional oil-product pipeline from **Mozambique**'s port of Beira to its depot in Msasa. The 500-mile (800-kilometer) pipeline would help to meet **Zimbabwe**'s growing oil demand. Currently 80% of the oil consumed in **Zimbabwe** is transported through the existing pipeline.
- Natural gas from **Namibia**'s offshore Kudu field is expected to be a fuel source for power and industrial projects in **Namibia** and **South Africa.** A 750-MW power plant will be constructed at Oranjemund, **Namibia** which would supply power to **Namibia** and **South Africa**. A 440-mile (700-kilometer) pipeline would deliver gas to power a new 1,000-MW power facility in Cape Town, **South Africa** and provide fuel for industrial projects in Saldanha (steel mill currently under construction) and Cape Town.
- An agreement to supply natural gas from the Temane Gas field in southern **Mozambique** to **South Africa**'s Gauteng region is expected to be completed soon. The gas would be transported to **South Africa** by a 580-mile (925-kilometer) pipeline. A consortium composed of U.S.-based Arco, **South Africa**'s Sasol and Dubai's Zarara Petroleum are developing the Temane field and the pipeline project. Plans call for natural gas from **Mozambique**'s Pande field to be utilized for new and existing industries in **Mozambique**'s capital of Maputo. Natural gas from the Temane consortium's other Mozambican exploration areas (Sofala and M10, both of which are located offshore) could be used in **Mozambique**'s central industrial area of Beira.

WEST AFRICA

- **Cote d'Ivoire** and **Ghana** have signed an agreement for a feasibility study on the construction of a natural gas pipeline to supply Ivorian gas to **Ghana** for power generation. Negotiations between **Cote d'Ivoire** and **Ghana** to adopt a memorandum of understanding (MOU) on the sale of gas began in the summer of 1997. **Cote d'Ivoire** plans to supply gas from the Kudu, Ibex and Eland fields to **Ghana**. Ghanaian mining concern Ashanti Goldfields also has expressed interest in purchasing gas from **Cote d'Ivoire**.
- In 1995 **Senegal** and **Guinea-Bissau** established the Management and Cooperation Agency (MCA) for the joint-development of maritime resources located in their border area. The countries will split any proceeds earned from oil in the area, with **Senegal** receiving 85% of the profits and **Guinea-Bissau** 15%. In May 1998, Benton Oil and Gas of the United States signed an oil exploration/production agreement with the MCA to drill on the Dome Flore field in the waters offshore the coastal boundary.

5. Electricity

A Snapshot of Africa's Electric Power Industry ...

Region	Highlights	Capacity, 1/1/97			Net Generation, 1997		
		Total* (GW)	Hydro (%)	Thermal (%)	Total* (BKWh)	Hydro (%)	Thermal (%)
Central	**Congo** (at Sounda Gorge) and the **Democratic Republic of Congo** (Inga) are developing projects to tap the regions vast hydroelectric potential.	4.3	91%	9%	10.8	95%	5%
East	Growing power demand has led several countries, including **Kenya**, **Tanzania**, and **Uganda** to utilize Independent Power Producer (IPP) schemes to add needed generation capacity.	2.8	64%	34%	10.4	78%	17%
North	**Egypt**, **Morocco** and **Tunisia** are all developing IPPs to increase generating capacity in their respective countries. The privatization of the region's distribution sectors is also occurring.	33.0	12%	88%	111.6	12%	88%
Southern	Regional integration and cooperation is being developed and expanded to help meet Southern Africa's growing electricity requirements.	43.8	15%	81%	217.6	7%	87%
West	As in North and East Africa, many countries are looking to develop IPP facilities to meet growing power demands. **Benin**, **Cote d'Ivoire**, **Ghana**, **Nigeria**, and **Senegal** are currently in the process of developing/building IPP projects.	9.6	48%	52%	24.8	52%	48%
Total Africa		93.5	22%	76%	375.2	16%	81%

*Approximately 5% of East Africa's generation was from geothermal and 6% of Southern Africa's generation was from nuclear.
GW = Gigawatt (1 million kilowatts)
BKWh = Billion Kilowatthours
Source: Energy Information Administration

Power in Africa Overview ...

Electric generating capacity in Africa in 1997 was concentrated in two regions — North and Southern Africa. Combined, those two regions alone accounted for 82% of total power generating capacity in Africa. The ***Democratic Republic of Congo*** *(Central),* ***Kenya*** *(East), and* ***Nigeria*** *(West) are the leaders in power generating capacity for Africa's other regions.*

South Africa*'s utility, Eskom, is the world's fifth largest utility measured both in electricity sales and nominal generating capacity. Eskom also operates Africa's only nuclear power generation facility (Koeberg) at Capetown.*

South Africa, Zambia *and* ***Ghana*** *are the largest net exporters of electricity in Africa. In 1997, net exports from* ***South Africa*** *were 6.6 terawatthours (Twh) of power,* ***Zambia*** *1.2 Twh, and* ***Ghana*** *0.3 Twh.*

CENTRAL AFRICA

The Canadian firm, Ocelot Energy, and the Societe Nationale des Hydrocarbures (SNH), **Cameroon**'s state-owned oil firm, have signed a memorandum of understanding for the construction of a 175-megawatts (MW) power facility. The gas-powered facility will be supplied with fuel from the Sanaga Sud field which Ocelot is developing offshore southern Cameroon.

The **Democratic Republic of Congo** is planning to develop projects to expand the Inga hydroelectric facility located on the Congo River. The 2,000-MW Inga II plant and the 40,000-MW Grand Inga facility would be utilized primarily for power exports. The combined capacity of these two projects is almost as large as Southern Africa's current installed capacity.

Three firms -- EEF (Switzerland), Infra-Consult (Germany) and Medis (Belgium) -- have signed an agreement to rehabilitate the **Democratic Republic of Congo**'s Societe Nationale d'Electricite (SNEL) electricity system. The rehabilitation will include work on generation facilities in Kinshasa, as well as production and distribution in North and South Kivu provinces.

Equatorial Guinea is proposing to replace an existing diesel plant on the island of Bioko with a 6-MW to 8-MW thermal power plant. The station would utilize gas, which is currently flared, from the Alba field.

EAST AFRICA

Electricite de **Djibouti** (EDD) plans to increase generating capacity by 20 MW with the purchase of four, 5-MW, diesel-powered generators. Purchase of the generators is being funded by a loan from the Kuwaiti Fund. EDD also has plans to construct an 18-MW facility in Marabout.

Studies are being conducted to evaluate the geothermal potential of **Eritrea's** Alid region. Initial results indicated that temperature and permeability conditions were favorable for an electrical-grade geothermal resource. **Djibouti** and **Uganda** are also exploring the possibility of utilizing geothermal resources for power generation.

The Ethiopian Electric Power Corporation (EEPC) has plans to significantly increase the country's electric generating capacity. A 34-MW hydroelectric plant on the Fincha river in western **Ethiopia** has been completed, while existing facilities on the Koka and Tis Abay rivers are being upgraded.

Power in Africa Overview …

EAST AFRICA (CONTINUED)
The EEPC is also constructing hydroelectric facilities on **Ethiopia**'s Gilgel-Gibe (184 MW) and Blue Nile (73 MW) rivers. A 150-MW hydroelectric facility on the Gojeb river is expected to become operational by 2003. Additional hydroelectric facilities are planned on the Tekeze, Tana, Beles, and Halele Werabisa rivers.

Kenya has several independent power projects (IPPs) in various stages of development. The coal-fired Nairobi South plant was completed in 1997, while the 75-MW Kipevu II plant is scheduled for completion by the end of 1999. The first phase of the Olkaria III geothermal project is scheduled to be completed by September 2000. Kenya plans to generate 25% of its electricity from geothermal energy by 2017.

Two Chinese firms, the International Water and Electric Company and the Machinery Export and Import Company, have agreed to finance 75% of the Kajbar hydroelectric facility in northern **Sudan**. The $200 million project will be located on the Nile, and will have a capacity to generate 300 MW.

The 180-MW Owens Falls hydroelectric facility, located in southern **Uganda** on the Nile, is being expanded to include an additional 200 MW of generating capacity.

U.S.-based AES plans to develop the 250-MW Bujagali Falls hydroelectric facility on the Nile. The $450-$500 million project, which could be operational by the end of 2002, is the largest of several hydroelectric IPP projects currently being developed in **Uganda**. Norway's Norpak is heading a consortium which plans to build the 180-MW Karuma Falls hydroelectric project in northwestern **Uganda** and a smaller facility (10-12 MW), financed by the Commonwealth Development Corporation, is planned for the Muzizi River.

NORTH AFRICA
Construction of the Hamma power station is expected to begin in late 1999 and to be completed by the end of 2001. The 450-MW, natural gas-fired facility will provide power to **Algeria**'s capital city, Algiers.

Algeria also has several IPP projects planned including a 1,200-MW plant near Tipasa, the 2X600-MW Terga plant near Oran Tipasa and a 2X600-MW plant near Annaba.

InterGen plans to have **Egypt**'s first Build Own Operate Transfer (BOOT) power project operational by the beginning of 2002. The complex, Sidi Kerir 3 and 4, will consist of two, 325-MW, gas-fired units. When completed, Sidi Kerir-3 and 4 will be one of the largest private power stations in North Africa and the Middle East, as well as one of the largest private infrastructure investments ever made in the country.

The Egyptian Electric Authority (EEA) has signed two additional BOOT agreements with Electricite de France (EDF). Under terms of the agreement, EDF will construct two, 650-MW, gas-fired facilities located near each end of **Egypt**'s Suez Canal. Work on the Suez plant is scheduled to begin in January 2000 and be completed by mid-2002. Construction of the East Port Said plant is slated to begin in July 2000 and be completed by the end of 2002. The estimated total cost of the two power plants is $900 million. The EEA will purchase the power generated from the BOOT facilities.

Power in Africa Overview …

NORTH AFRICA (CONTINUED)
Morocco's state-owned Office Nationale d'Electricite (ONE) plans to invest $900 million in the country's power generation sector. Planned additions to generating capacity include: the Kouida al Baida 50-MW wind farm overlooking the Strait of Gibraltar; a 470-MW station located near Tangiers at Tahaddart; a 200-MW hydroelectric facility at Dchar el Oued; and a 300-MW pumped storage hydroelectric facility near Afourar.

Morocco also plans to expand the Jorf Lasfar plant with the addition of two 330-MW units on a build-operate-transfer (BOT) basis. ONE issued an international tender in August 1999 for the development of a 180-MW hybrid solar-gas power plant. The $200-million facility is expected to be built in the northeastern Jerada province.

U.S.-based PSEG is leading a consortium that is developing **Tunisia**'s first privately run generating facility. The 470-MW combined cycle plant, Rades II, will be located outside the capital of Tunis. The gas-fired facility is expected to be completed by the end of 2001.

SOUTHERN AFRICA
Angola's generation capacity will nearly double when the 520-MW Capanda hydroelectric facility is completed. Scheduled completion of Capanda is for the end of 1999, and **Angola**'s state-owned utility, Empresa Nacional de Electricidade (ENE), is planning to begin construction of an oil-fired power plant in the city of Lubango.

The **Lesotho** Highlands Water Project, which involves the construction of dams, tunnels and pipelines, is designed to include a total of 274 MW of hydroelectric generating capacity. The first phase of the 80-MW Muela hydro facility came online in 1999.

The Compagnie Thermique de Belle Vue (CTBV), a joint-venture composed of Harel Freres (51%) of **Mauritius**, France's Cidec (27%), the Sugar Investment Trust of **Mauritius** (14%) and the State Investment Fund (8%), will build a 70-MW IPP facility north of the Mauritian capital of Port Louis. The CTBV plant, which is expected to become operational in 2000, will utilize bagasse (biomass refuse from the processing of sugar cane) as its primary fuel.

Electricidade de Mocambique (EDM), **Mozambique**'s state utility, and Hidroelectrica de Cahora Bassa (HCB), a joint-venture between Portugal and EDM, have restored the electricity interconnection from the Cahora Bassa dam with **South Africa**, by replacing over 2,000 pylons that were damaged during the civil war. Cahora Bassa, with a nominal capacity of 2,000 MW, also supplies power to neighboring **Zimbabwe**. Plans for a second dam on the Zambezi River, with capacity of 2,000-2,500 MW, are being considered.

The **Zambia** Electricity Supply Corporation (ZESCO) plans to rehabilitate the generation facilities at Victoria Falls. The work is expected to restore the facility to its full generating capacity of 108 MW. ZESCO also began rehabilitation work on its main generation facility, the Kafue Gorge hydroelectric station, in 1999.

Power in Africa Overview …

SOUTHERN AFRICA (CONTINUED)
National Power of the United Kingdom, in conjunction with the **Zimbabwe** Electricity Supply Authority (ZESA), has plans to develop a 1,400-MW, coal-fired plant. The IPP facility, Gowke North, could supply approximately one-third of **Zimbabwe**'s electricity requirements. National Power is to operate the facility, and ZESA is to purchase the power produced.

WEST AFRICA
U.S.-based firms Enron and Abacan are negotiating with the government of **Benin** to develop, construct and operate an 80-MW power generation facility. The proposed project includes building a 20-mile (30-kilometer) pipeline to transport natural gas to the plant, which will be located south of Porto Novo near the coast.

Cote d'Ivoire's CIPREL (Compagnie Ivoirienne de Production d'Electricite) project was one of the first IPP projects undertaken in sub-Saharan Africa. The plant, which is gas fired with a generating capacity of 210 MW, is a joint-development of the French firms EDF and Saur - Bouygues (SAUR). EDF and SAUR are the joint-owners of the Compagnie Electricite Ivoirienne (CIE), the former state utility, which was privatized in 1990.

The Cinergy consortium has won a 23-year BOOT concession to build a thermal power plant at Azito outside of Abidjan, **Cote d'Ivoire**. Cinergy's plan calls for a $223-million, 420-MW gas-fired facility. The first phase of the Azito power plant was inaugurated on January 23, 1999. A second 144-MW gas turbine is scheduled to begin operations in January 2000. A steam-powered turbine will be added to boost the facility's capacity to the planned 420 MW. Cinergy is composed of the Swiss-based Asea Brown Boveri (ABB), Industrial Promotion Services (IPS) -- an affiliate of the Aga Khan Fund for Economic Development -- and EDF.

Ghana has plans for an additional hydroelectric facility to be located on the Black Volta River at Bui. The facility will have a generating capacity of 400 MW and possibly provide power exports to **Burkina Faso**, **Cote d'Ivoire** and **Mali.**

A consortium of American and Japanese firms have agreed to build a 220-MW power station in Tema, **Ghana**. KMR Power (operator), EPDL, and Japan's Marubeni Corporation will build, own and operate the $200-million IPP facility. The facility is scheduled to begin operation in 2000.

The 75-MW Garafi hydroelectric facility was inaugurated in **Guinea** in July 1999. It is the country's largest hydroelectric facility and will supply power to Conakny, **Guinea**'s capital. Plans for a larger (900-MW) facility downstream of Garafi on the Konkoure River are being discussed. A feasibility study for the Kaleta project has been completed, and the project, which would be built on a BOT basis, would supply power to the proposed CIFAK Aluminum Smelter.

Nigeria has signed agreements to develop two IPP projects. Mobil will generate power from a 350-MW, gas-fired facility located at Bonny in southeastern Rivers State. The state-owned National Electric Power Authority (NEPA) will purchase the electricity generated. Enron has also signed an agreement for the construction of a 540-MW power plant. It was announced in early 1999, that Nigeria will spend an estimated $144 million to rehabilitate six generating facilities.

Power Privatization in Africa ...

CENTRAL AFRICA
Cameroon's Societe Nationale d'Electricite (SONEL) and **Chad**'s Societe Tchadienne d'Eau et d'Electricite (STEE) each has been slated for privatization.

In 1997, **Gabon** announced that a 20-year concession to run the state-owned water and electric utility, Societe d' Electricite et d'Eau **Gabon** (SEEG), had been awarded to a consortium consisting of Compagnie Generale des Eaux (CGE) of France and Ireland's Electricity Supply Board (ESB). The privatization is the first in sub-Saharan Africa where the full commitment for future investment comes from the private operator. The CGE/ESB group has pledged to invest $800 million to modernize **Gabon**'s water and electricity systems.

EAST AFRICA
In September 1999, **Ethiopia** announced that its electricity sector would be opened to foreign investment. Licenses granted for power supply would be valid for 50 years, power generation for 40 years, and electricity import/export licenses will cover a 10-year period. All licenses are renewable at the end of the validity period.

NORTH AFRICA
Morocco's northern port city of Tangier has issued a tender for the management of the city's electricity, sewage and water services. Similar 30-year operating concessions have been awarded for the cities of Casablanca and Rabat

Egypt's power sector currently is comprised of seven regional state-owned power production and distribution companies. The government plans to privatize them, starting by selling off minority stakes to private investors through the Cairo Stock Exchange. A 20% stake in Cairo Electricity Company is to be sold off by the end of August 1999, and minority stakes in the six others are to be sold by the end of 1999. This decision follows the February 1998 passage of Law 18, which provides for electricity restructuring and asset sales.

SOUTHERN AFRICA
The government of **Zimbabwe** has signed a deal with YTL of Malaysia to privatize the Hwange power station. Under terms of the agreement, YTL will acquire 51% stake in the facility while ZESA will retain the remaining 49%. YTL plans to exand the generating capacity of Hwange from 920 to 1,200 MW.

WEST AFRICA
In February 1999, U.S.-based CMS Energy (CMS) agreed to acquire a share (at least 50%) and to operate the Takoradi power facility in **Ghana**. The final 110-MW turbine (of the 330-MW station) is expected to begin operation in the second half of 1999. CMS also announced that it would construct an additional 110-MW generating facility at Takoradi. This is the first stage in a 330-MW expansion of Takoradi, which will double its generating capacity to 660 MW.

Senegal's Societe Nationale d'Electricite (SENELEC) was partially privatized in early 1999. A consortium of Hydro-Quebec of Canada and Elyo of France acquired 34% of the company. A 10% interest in SENELEC was set aside for purchase by employees, 15% will be sold to the public and the government will retain the remaining 41% interest in SENELEC.

Electricity Integration Within Africa – Recent Developments

Growing demand for electricity throughout Africa, especially in Southern and Western Africa, has helped to foster the interconnection of Africa's various electricity grids.

CENTRAL AFRICA

- **Cameroon** is studying a possible interconnection to **Chad**'s electricity grid. A 160-mile (250-kilometer) transmission line would connect the cities of Maroua in northern Cameroon with the Chadian capital of N'Djamena.

EAST AFRICA

- **Uganda**, **Kenya** and **Tanzania** have developed plans to create an East African Power Pool by connecting their electricity networks. **Kenya** currently receives power from **Uganda**'s Owen Falls hydroelectric facility.

NORTH AFRICA

- A $239-million link between the electricity networks of **Egypt** and Jordan was completed in October 1998.

SOUTHERN AFRICA

- **South Africa**'s Eskom and **Namibia**'s Nampower are constructing a 400-kilovolt (KV) transmission between the Aries substation in South Africa and the Namibian capital of Windhoek.
- The African Development Fund has approved a loan of $6.5 million to finance the Victoria Falls-Katima Mulilo 132-KV interconnection project in **Zambia**. The project involves the construction of a 120-mile (190-kilometer) line from Victoria Falls (southern **Zambia**) to Katima Mulilo (northern border town in **Namibia**).

WEST AFRICA

- The World Bank/IDA has provided a $39-million credit to install 200 MW of power generation capacity at the Manantali dam, located on the Bafing river in **Mali**, and transmission lines to provide electricity to **Mali**, **Mauritania** and **Senegal**.
- **Nigeria** plans to construct a 330-KV transmission line from Lagos to **Benin**. The line would be a portion of a larger West African interconnection involving **Nigeria**, **Benin**, and **Togo**.

Southern African Power Pool (SAPP)

The Southern African Power Pool (SAPP) was created in 1995 with the signing of two Memoranda of Understanding (MOU). The first MOU was signed by 12 countries in the Southern African Development Community (SADC) and the second MOU was signed by their respective national utilities.

The utilities currently participating in the SAPP are Angola's ENE, the Botswana Power Corporation (BPC), the Democratic Republic of Congo's SNEL, Lesotho Electricity Corporation (LEC), Malawi's Electricity Supply Commission (ESCOM), Mozambique's EDM, Namibia's Nampower, South Africa's Eskom, Swaziland Electricity Board (SEB), Tanzania Electric Supply Company (TANESCO), Zambia's ZESCO and Zimbabwe's ZESA.

SAPP's coordination center is located in Harare, Zimbabwe. Although the power grids of Angola, Malawi and Tanzania are not yet connected with other SAPP member grids, interconnection plans for the three countries are in varying stages of development.

SELECT TRANSNATIONAL ELECTRICITY PROJECTS WITHIN AFRICA

OPERATIONAL

Central Africa

Congo-Democratic Republic of Congo-Zambia Inga Hydroelectric Interconnections

The Inga hydroelectric facility (Democratic Republic of Congo) supplies power to the Congo power grid along a 220-KV connection. The interconnection supplies nearly one-third of the electricity consumed in Congo. Power from Inga is also transmitted to the Zambian grid along a 500-KV DC line from Inga to Kolwezi in southern Democratic Republic of Congo, and a 220-KV line from Kolwezi to Kitwe in northern Zambia.

East Africa

Kenya-Uganda Owen Falls Hydroelectric Interconnection

Power from Uganda's Owen Falls Dam is supplied to Kenya's grid. The interconnection runs approximately 260 miles (420 kilometers from the dam to Kenya's capital of Nairobi.

West Africa

Benin-Ghana-Togo VRA/CEB interconnection

The Volta River Authority (VRA) -Communate Electrique du Benin (CEB) interconnection provides electricity from Ghana's Akosombo Dam to the power grids of neighboring Togo and Benin. The system consists of an 81-mile (130-kilometer) line from Akosombo to Lome, Togo, and a 110-mile (176-kilometer) line to Cotonou, Benin.

UNDER CONSTRUCTION/PLANNED

North Africa

North Africa-Middle East-Europe Mediterranean Power Pool

When completed in 2015, the Mediterranean Power Pool (MPP) will connect the power grids of North Africa (Algeria, Egypt, Libya, Morocco, and Tunisia), Spain and the Middle East (Jordan, Syria, Turkey, and Iraq). The interconnection between Libya, Tunisia, Algeria and Morocco will be upgraded from 220 KV to 400 KV. Morocco will be connected to Spain, and Egypt to the Middle East via Jordan. A link between Egypt and Libya became operational in 1998.

Southern Africa

Angola-Namibia Kunene River Hydroelectric Facility

The $500-million project will consist of a 200MW-380 MW generating facility that would supply power to Angola, Namibia and South Africa. Two potential sites, Epupa Falls and Baynes have been examined. The Epupa project has come under attack from environmental and local groups. Epupa's reservoir would be over 5 times larger than the one created at the Baynes site, and displace over 1,000 people.

Mozambique-South Africa -Swaziland Motraco Transmission Project

Two 400-KV transmission lines will be built to supply a new aluminum smelter, MOZAL, in Maputo, Mozambique. One line will run from Eskom's Arnot power station to Maputo. The other will run from Eskom's Camden power station via Swaziland to Maputo. Eskom, Mozambique's EDM, and Swaziland's SEB have formed a joint -venture for construction, ownership and operation of the transmission lines.

Rural Electrification in Africa

EAST AFRICA
Kenya has the highest penetration rate of photovoltaic systems in the world, with over 80,000 systems in place and annual sales of nearly 20,000 systems.

NORTH AFRICA
Morocco plans to raise the rate of electrification in rural areas to 60% in 2003 from 21% in 1994. The government plans to electrify 550,000 rural households and will spend an estimated $153 million yearly to expand power networks to remote and rural areas. From 1996 to 1998, the country's rural electrification program extended power to 2, 728 villages representing 284,000 households.

The African Development Bank has approved a $63-million loan to finance a rural electrification project in **Tunisia**. Plans call for the electrification of over 1,000 locations supplying power to over 45,000 households.

SOUTHERN AFRICA
Zimbabwe plans to utilize solar power to electrify over 500 districts and rural service points. Each site would receive solar systems with generation capacity of either 100 KW or 500 KW.

WEST AFRICA
The government of **Burkina Faso** plans to have completed electrification in 48 of the estimated 350 communities in the country by 2010. The number of communities electrified increased from 18 in 1986 to 37 in 1998.

Official's from **Cote d'Ivoire**'s government announced in January 1999 that, with the addition of new generation facilities, power would be provided to 200 villages annually.

U.S. Department of Energy (DOE)/National Renewable Energy Laboratory (NREL) Projects in Africa

South Africa: The South African Department of Minerals and Energy (DME) will install at least 2,500 photovoltaic systems in rural areas. Technical and financial consultation is being provided by DOE laboratories. Also in conjunction with the University of Capetown and NREL, DME is pursuing hybrid power systems for villages and farms.

Ghana: Technical, and economic assistance in the installation of photovoltaic and hybrid photovoltaic/diesel systems in rural villages.

Egypt: A collaborative project for placing photovoltaic electricity systems in the Sinai region of Egypt has been proposed by NREL and the Egyptian Rural Electrification Authority.

Uganda: Through its Village Power 2000 project, DOE, in conjunction with private partners, is bringing solar electric power to rural areas of Uganda.

The government of **Ghana** is committed to bringing electric service to every community of 500 or more people by the year 2020. The National Electrification Scheme is planned to proceed in six five-year phases from 1990 to 2020.

Senegal's SENELEC currently has plans to increase electricity availability by 44% in towns and 95% in rural areas by 2004. Under its Program 3000, SENELEC plans to electrify over 150 rural towns. When the project is completed, all Senegalese villages with a population of 3,000 or more inhabitants will be electrified.

6. Trade and Cooperation

Economic and Trade Integration in Africa

There are numerous trade groupings of various types within Africa (see below).

- A total of 39 African countries are members of the World Trade Organization (WTO), while 5 others (**Algeria, Cape Verde, Ethiopia, Seychelles, Sudan**) are observers. The 3rd WTO Ministerial Conference was held between November 30 and December 3, 1999 in Seattle, Washington.
- The largest trading blocs within Africa (see maps) are: 1) COMESA (Common Market for Eastern and Southern Africa), with 21 member states (stretching from **Egypt** in the North to **Madagascar** and **Namibia** in the South) and a population of around 385 million (around half of Africa's total population); 2) SADC (the Southern African Development Community), with 14 member states and a population of around 190 million; and 3) ECOWAS (Economic Community of West African States), with 16 member states (all in West Africa) and a population of around 220 million.
- There is some significant overlap between Africa's trade groupings. For instance, 8 SADC members (**Angola, Malawi, Mauritius, Namibia, Seychelles, Swaziland, Tanzania, and Zimbabwe**) are also COMESA members. All members of the Southern African Customs Union (SACU) are members of the SADC.

TYPES (AND EXAMPLES) OF ECONOMIC/TRADE AGREEMENTS WITHIN AFRICA

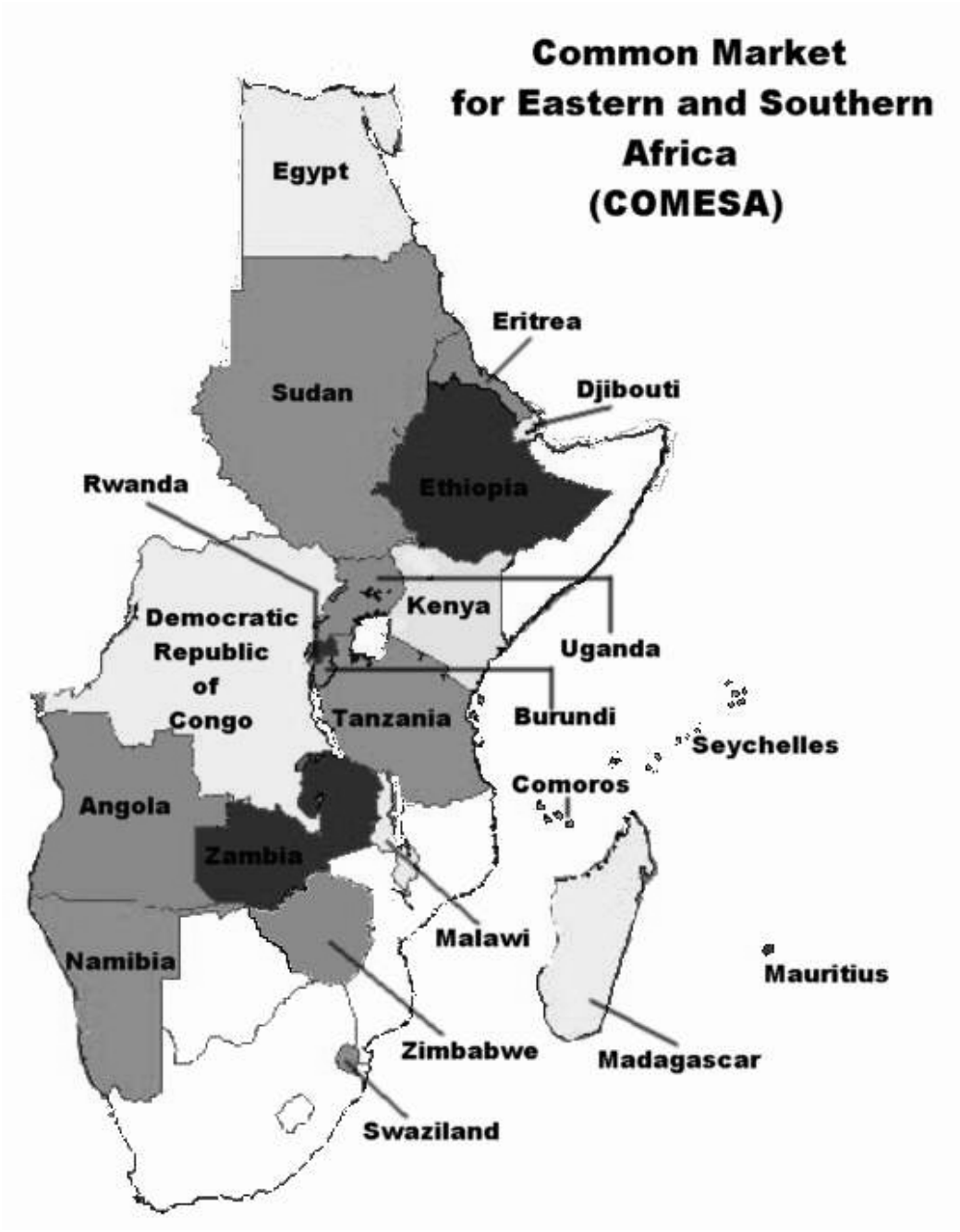
MULTILATERAL
- WTO/GATT

REGIONAL SCOPE
- Arab Maghreb Union (UMA)
- Common Market of Eastern and Southern Africa (COMESA)
- Economic Community of the Great Lakes Countries (CEPGL)
- Economic Community of Central African States (ECCAS)
- Economic Community of West African States (ECOWAS)
- Southern African Development Community (SADC)

CUSTOMS UNIONS
- Central African Customs and Economic Union
- Southern African Customs Union

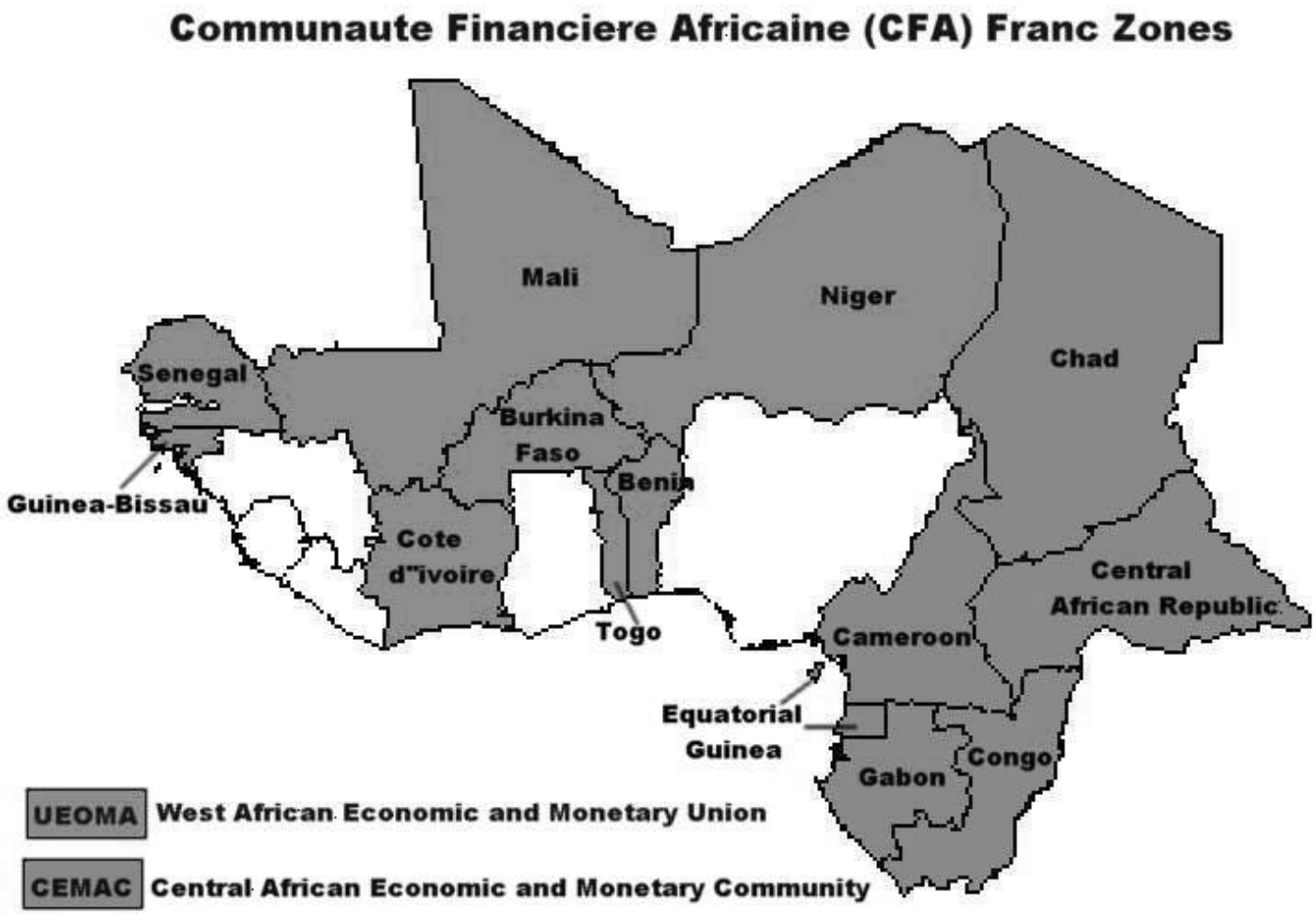
FREE TRADE AGREEMENTS
- None currently, but COMESA hopes to become a free-trade area (FTA) by October 2000.
- SADC also hopes to become an FTA at some point.

Major Regional Economic Groups


Common Market
for Eastern and Southern
Africa
(COMESA)
Egypt
Eritrea
Sudan
Djibouti
Ethiopia
Rwanda
Kenya
Democratic
Republic
of
Congo
Uganda
Tanzania
Burundi
Seychelles
Comoros
Angola
Zambia
Malawi
Namibia
Mauritius
Zimbabwe
Madagascar
Swaziland

Economic Community of West African States (ECOWAS)
Mauritania
Mali
Niger
Cape Verde
Senegal
Gambia
Guinea - Bissau
Guinea
Burkina Faso
Nigeria
Cote d'Ivoire
Ghana
Sierra Leone
Liberia
Togo
Benin

Southern African Development Community (SADC)
Seychelles
Democratic Rep. of Congo
Tanzania
Angola
Malawi
Zambia
Mozambique
Zimbabwe
Namibia
Mauritius
Botswana
Swaziland
South Africa
Lesotho


Communaute Financiere Africaine (CFA) Franc Zones
Mali
Niger
Chad
Senegal
Burkina Faso
Benin
Guinea-Bissau
Cote d"ivoire
Togo
Central African Republic
Cameroon
Equatorial Guinea
Gabon
Congo
UEOMA West African Economic and Monetary Union
CEMAC Central African Economic and Monetary Community

SELECT OTHER TRADE AGREEMENTS

BILATERAL	BILATERAL	BILATERAL
Egypt-South Africa	Botswana-Malawi	Zimbabwe-South Africa
Egypt-Libya	Botswana-Zambia	Zimbabwe-Namibia
Egypt-Morocco	Botswana-Zimbabwe	Zimbabwe-D.R. Congo
Egypt-Tunisia	Malawi-Zimbabwe	Seychelles-Mauritius
Morocco-Tunisia	Malawi-South Africa	Seychelles-Comoros
	Mozambique-South Africa	Seychelles-Madagascar

REGIONAL ECONOMIC/TRADE GROUPS

AEC (African Economic Community)

- Established in 1994; members include all countries in the Organization of African Unity.
- ECA objectives include;
  - Promote economic, social, and cultural development and integration of African economies
  - Achieve self-reliant development
  - Removal obstacles to free trade within the AEC
- Total 1997 GDP: $690 billion

CEMAC (Economic and Monetary Community of Central Africa)

- Formed in 1994; members include **Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea,** and **Gabon.**
- The main goal of CEMAC is to promote harmonious development of member states within the framework of economic and monetary union.
- Total 1997 GDP: $29 billion

COMESA (Common Market for Eastern and Southern Africa))

- Established in 1994; members include **Angola, Burundi, Comoros, D.R. Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Sudan, Swaziland, Tanzania, Uganda, Zambia,** and **Zimbabwe**.
- Goals of COMESA include:
  - "Economic prosperity through regional integration."
  - Promotion of trade within COMESA through removal of all internal trade tariffs and barriers, including a free trade area beginning in October 2000.
  - Introduction of a common external tariff structure for trade outside of COMESA.
  - Eventual economic and monetary integration.
- Total 1997 GDP: $226 billion

ECOWAS (Economic Community of West African States)

- Established in 1975; members include **Benin, Burkina-Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone,** and **Togo.**

REGIONAL ECONOMIC/TRADE GROUPS

ECOWAS (Economic Community of West African States)

- ECOWAS objectives include:
  - Promoting economic integration "in all fields of economic activity."
- Total 1997 GDP: $111 billion

Gambia River Development Authority (OMVG)

- Founded in 1960; members include **Gambia, Guinea, Guinea-Bissau,** and **Senegal**.
- Total 1997 GDP: $13 billion.

IGAD (Intergovernmental Authority on Development)

- Established in 1986; members include **Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Sudan** and **Uganda.**
- IGAD objectives include;
  - Promote joint development and harmonize macro-economic policies and programs
  - Encourage trade and investment
  - Promote programs and projects to encourage sustainable development of natural resources and environmental protection
  - Develop a coordinated and complementary infrastructure in the areas of transport, telecommunications, and energy
- Total 1997 GDP: $84 billion

Organization for the Development of the River Senegal Basin

- Established in 1972; members include **Mali, Mauritania** and **Senegal.**
- Total 1997 GDP: $13 billion

SADC (Southern African Development Community)

- Established in 1992; members include **Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Seychelles, South Africa, Swaziland, Tanzania, Zambia,** and **Zimbabwe.**
- SADC objectives include:
  - Harmonization and rationalization of policies and strategies for sustainable development in all areas.
  - Reduction of trade barriers over 8 years beginning in January 2000.
- In 1998, South Africa ran a $2.8 billion trade surplus with other SADC member states, on exports of $3.4 billion and imports of $600 million. South Africa's trade with SADC represents around 5%-7% of its total world trade.
- Total 1997 GDP: $186 billion

UEMOA (West African Economic and Monetary Union)

- Established in 1994; members include **Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal,** and **Togo.**
- Regional integration -- as of January 1, 2000, intra-UEMOA tariffs are to be lifted and a common external tariff applied to all other imports.
- Creation of a single regional market. The UEMOA countries already share a single currency and monetary policy.
- Total 1997 GDP: $42 billion

UMA (Arab Maghreb Union)

- Established in 1964; members include **Algeria, Libya, Mauritania, Morocco,** and **Tunisia.**
- UMA objectives include:
  - Strengthen all forms of ties among member states
  - Ensure regional stability and enhance policy coordination
  - Gradually introduce free trade in goods, services, and factors of production
- Total 1997 GDP: $223 billion

Africa and International Trade

Africa makes up only a very small share of world trade, and this share has been declining in recent decades. Trade among African countries is low, and terms of trade with the developed countries are generally not in favor of Africa.

Recent Developments in Regional Trade and Cooperation

- In late July 1999, **Tanzania** announced its intentions to withdraw from COMESA and instead concentrate on its membership in SADC. Two other countries **Lesotho** and **Mozambique** – **pulled out of COMESA in 1997, citing the expense of dual membership.**
- There are concerns within several COMESA countries, especially **Zambia**, regarding their degree of readiness for an intra-COMESA free trade area (FTA). The decision to proceed with the FTA was reaffirmed at a COMESA ministerial in May 1999 in Nairobi, **Kenya**.
- In June 1999, **Zimbabwe** and **South Africa** failed to agree on a solution to their trade differences -- particularly on clothing and textiles.
- The **United States** and other G-7 (Group of Seven) industrialized countries have proposed debt relief totaling $70 billion for 36 countries, including several African countries, through the Highly Indebted Poor Countries (HIPC) initiatives.
- The United Nations Conference on Trade and Development (UNCTAD) and the Organization of African Unity (OAU) agreed in May 1999 to intensify their efforts at promoting economic growth in Africa. In this context, UNCTAD encouraged action on regional and sub-regional economic cooperation and integration, debt reduction, and international trade with Africa.
- In early 1999, the European Union (EU) reached an FTA with **South Africa**. The FTA could have a wide-ranging impact not only on South Africa, but on other African countries as well. In recent months, for instance, the EU has been attempting to mitigate any adverse impact of this agreement on the so-called "BLNS" countries (**Botswana, Lesotho, Namibia,** and **Swaziland**), all of whom belong to the Southern African Customs Union (SACU). SACU maintains common external tariffs, which are set by South Africa.
- In September 1999, the EU offered to extend its FTA with **South Africa** to ACP (Africa, Caribbean, and Pacific) countries covered under the Lome Convention. The Lome Convention, originally agreed to in 1975, now includes 15 member states of the EU and 70 ACP countries with 500 million people. The ACP countries are among the poorest in the world.
- On November 4, 1999, the U.S. Senate passed legislation called the Africa Trade and Development Act of 1999 -- which would reduce or eliminate tariffs and quotas on a wide range of goods made in sub-Saharan Africa. The Act also has been approved by the U.S. House of Representatives, and is strongly supported by President Clinton.
- In May 1999, the U.S. Export-Import Bank (Ex-Im Bank) announced a $200-million, 1-year Africa Pilot Program to help make short-term export credit insurance available to 13 sub-Saharan African countries (**Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Equatorial Guinea, Gambia, Guinea, Madagascar, Malawi, Mali, Mauritania, Sao Tome and Principe,** and **Togo**).
- There are concerns within many African countries over the impact of such trade agreements on their economies and/or on specific "sensitive" industries.

AFRICA TRADE FACTS

- Africa is a very small player in world trade. In 1993, for instance, Africa (excluding fuel exports) accounted for only around 2%-3% of world trade (according to the United Nations Economic Commission for Africa -- ECA).
- Africa's share of world trade has fallen sharply since 1950.
- Africa's trade is overwhelmingly with OECD countries, particularly former colonial rulers. Despite efforts at intra-African trade integration and promotion, trade flows among African countries remain very low (below 10% of total aggregate exports). Intra-COMESA trade in 1993 accounted for around 6% of total COMESA trade. In comparison, intra-regional trade averages around 20% among Southeast Asian and Latin American countries.
- Underlying Africa's low share of international trade is the continent's heavy reliance on mainly unprocessed and semi-processed, low-value-added, primary commodities (copper, coffee, cocoa, groundnuts, logs, raw cotton, unmanufactured tobacco, iron ore, raw beet and cane sugar, palm nuts and kernels, natural rubber and gums, fresh bananas, palm oil, etc.).
- Compounding this reliance on low-value-added exports, most African countries rely overwhelmingly on 1 or 2 main export commodities. Coffee, for instance, accounts for around 95% of Uganda's total export earnings, and over 65% of export earnings in Burundi, Ethiopia, and Rwanda. Downward pressure on many primary commodity prices during the 1980s and much of the 1990s has hurt many African countries as well.
- Africa's poor terms of trade relative to developed countries have exacerbated a serious problem with external indebtedness among many African countries. Several African countries -- among the world's poorest -- are faced with heavy debt burdens which will be difficult at best to handle.
- Among the most important factors needed for Africa to improve its competitiveness in the world trade arena include (according to the ECA): a well-educated labor force; an adequate (and more extensive) transportation infrastructure; a cheap and reliable high-capacity telecommunications network; establishment and strengthening (especially in the direction of increased transparency and consistency) of institutions and laws governing private sector activities; simplified tax regimes; harmonized product standards; a well-developed financial sector; a restructured and reformed public sector; privatization, deregulation, and cuts in subsidies; foreign direct investment; reduced trade barriers; and research, development, and adoption of production technologies.
- Over the past decade, most African countries have adopted at least some of the policy reforms listed above. Generally, those countries which have encouraged investment and restructuring in addition to macroeconomic stability have fared relatively well compared to those that have not adopted such policies.
- According to the ECA, African regional trade integration can play an important role in enhancing Africa's international competitiveness. Removal of intra-African trade barriers ideally would be accompanied by reduction of external tariffs (currently among the world's highest at around 28%) and non-tariff barriers (NTBs) to trade.
- Actions taken by Africa's trading partners (especially in the OECD) also could be very helpful. These include such measures as reducing debt and encouraging African exports (i.e., by reducing duties on those exports).

Source: Journal of Business in Developing Nations (1998, Vol. 2), United Nations.

- **Zimbabwe** and **South Africa** have been negotiating changes to a bilateral trade agreement which expired in 1992. Zimbabwe is concerned over its large trade deficit with South Africa. In September 1999, Zimbabwe's President Mugabe announced that Zimbabwe, South Africa, and **Mozambique** were seeking to increase regional integration, including development of the Beira corridor link.
- In May 1999, reports indicated that **Mozambique** was preparing a formal request to **South Africa** for a full-fledged bilateral trade agreement.
- On September 2, 1999, **Mozambique** announced plans for creation of a three-country, integrated economic zone with **Malawi** and **Zambia**. The initiative aims to encourage economic development and trade between Mozambique's Tete province, Zambia's Eastern province, and bordering areas of western **Malawi**.
- **Kenya, Tanzania** and **Uganda** are in the process of reviving the East African Community (EAC), a group which was dissolved in 1977 due to political and economic differences. The EAC would aim to expand trade and improve the trading environment, promote conservation and sustainable development efforts, promote investment codes by protecting property rights, and increase tourism, among other things.
- In April 1999, **Nigeria** and the **Central African Republic** signed a bilateral trade agreement.
- In August 1999, Botswana's President Festus Mogae said that **Botswana** would not support initiatives to merge SADC and COMESA into a single large trading bloc. **Malawi**'s President Bakili Muluzi, on the other hand, pledged his support for such a merger, saying that it would create a stronger regional market.
- **Egypt** and the United States agreed in May 1998 to a Trade and Investment Framework Agreement (TIFA), viewed as a possible stepping stone to future free-trade talks between the two countries.
- In March 1999, **Tunisia** and **Morocco** agreed to create a free trade zone between their two countries. This is to include gradual dismantling of tariff barriers through 2007. Both **Morocco** and **Tunisia** also have signed Association Agreements with the EU with the goal of entering into a FTA by 2010. **Algeria** reportedly is negotiating a similar agreement as part of the Euro-Mediterranean initiative.
- In related news, North African governments are trying to revive the Maghreb Arab Union (UMA), which was founded in 1989 and which aims to create a common market between **Algeria, Libya, Mauritania, Morocco,** and **Tunisia**.
- Meanwhile, **Egypt** (which also is a member of COMESA) is pushing for establishment of a pan-Arab free trade zone by 2007. Egypt is negotiating with several Arab countries, including **Libya, Morocco,** and **Tunisia,** on this idea.
- The fourth Afro-Arab Trade Fair was held in Dakar, **Senegal** in April 1999. Currently, trade between the Arab world and African countries is very low, and mainly concentrated on the export of raw materials (specifically, oil and agricultural goods).

SELECT U.S. GOVERNMENT SPONSORED ENERGY-RELATED PROJECTS IN AFRICA

U.S. Trade and Development Agency (TDA)

- Benin Gas-Fired Power Plant
  - Feasibility Study ($200,000)
- Botswana Coal-Fired Power Plant (Phases I and II)
  - Feasibility Study ($350,000)
- Congo Gas Condensate Study
  - Feasibility Study ($330,000)
- Cote d'Ivoire Refinery Modernization
  - Feasibility Study ($300,000)
- Djibouti Assal Geothermal Power Plant
  - Feasibility Study ($90,000)
- Egypt Suez Petrochemical Complex
  - Feasibility Study ($750,000)
- Ethiopia Rural Electrification-Power Distribution
  - Development ($176,000)
- Ghana Co-Generation Plant
  - Feasibility Study ($184,000)
- Kenya Sugar Bagasse Electric Generation
  - Feasibility Study ($406,000)

U.S. TDA (continued)

- Morocco Oil to Gas Power Plant Conversion
  - Feasibility Study ($350,000)
- Mozambique Alto Malema Hydro Plant
  - Feasibility Study ($300,000)
- Tanzania Coal-Fired Power Plant
  - Feasibility Study ($505,000)
- Uganda Bagasse-Fired Co-Generation Power Plant
  - Feasibility Study ($175,000)
- Uganda Mini-Hydropower Stations
  - Feasibility Study ($564,000)
- Zambia Kafue Gorge Hydro Station
  - Feasibility Study ($620,000)
- Zimbabwe Hwange III Power Facility
  - Feasibility Study ($350,000)

Overseas Private Investment Corporation (OPIC)

- $890 million in ongoing support for 50 projects (including energy and mining) in approximately 20 countries in sub-Saharan Africa, plus additional $350 million equity fund for investment in sub-Saharan Africa -- announced July 22, 1999.

SELECT AFRICAN ENERGY PROJECTS SPONSORED BY MULTILATERAL AGENCIES

World Bank

- *Chad-Cameroon Petroleum Development and Pipeline Project*
  - $90 million in IBRD (International Bank for Reconstruction and Development) financing, $100 million in IFC (International Finance Corporation) "A" funding, and up to $300 million in IFC "B" funding possible

European Investment Bank

- Regional West Africa (Mali, Mauritania, Senegal) - Hydroelectric power plant (30 million euros in loans)
- *Ethiopia*-Hydroelectric power plant on Gilgel Gibe river (41 million euros)
- *Madagascar*-Power station rehabilitation and electricity grid extension (25 million euros)
- *Namibia*-Construction of high-voltage power transmission line to interconnect grids of Nampower and Eskom in South Africa (55 million euros)

ECONOMIC AND POPULATION DATA, 1997

Country	1997 GDP (billions of US$)	1997 Population (in millions)
CENTRAL AFRICA		
Cameroon	14.1	13.9
Central African Republic	1.8	3.5
Chad	2.5	6.7
Republic of Congo	3.4	2.8
Democratic Republic of Congo	6.1	48.0
Equatorial Guinea	0.5	0.4
Gabon	7.1	1.1
Sao Tome and Principe	0.1	0.1
SUBTOTAL–C. Africa	**35.7**	**78.6**
EAST AFRICA		
Burundi	1.4	6.2
Djibouti	0.4	0.6
Eritrea	0.6	3.6
Ethiopia	13.2	60.2
Kenya	14.3	33.1
Rwanda	2.4	5.9
Seychelles	0.5	0.1
Somalia	1.0	10.2
Sudan	38.0	30.9
Tanzania	6.3	31.5
Uganda	16.7	20.4
SUBTOTAL–E. Africa	**94.8**	**202.7**
NORTH AFRICA		
Algeria	91.9	29.5
Egypt	82.8	62.0
Libya	74.3	5.8
Morocco	34.1	27.3
Tunisia	20.6	9.2
Western Sahara	NA	0.3
SUBTOTAL–N. Africa	**303.7**	**134.1**

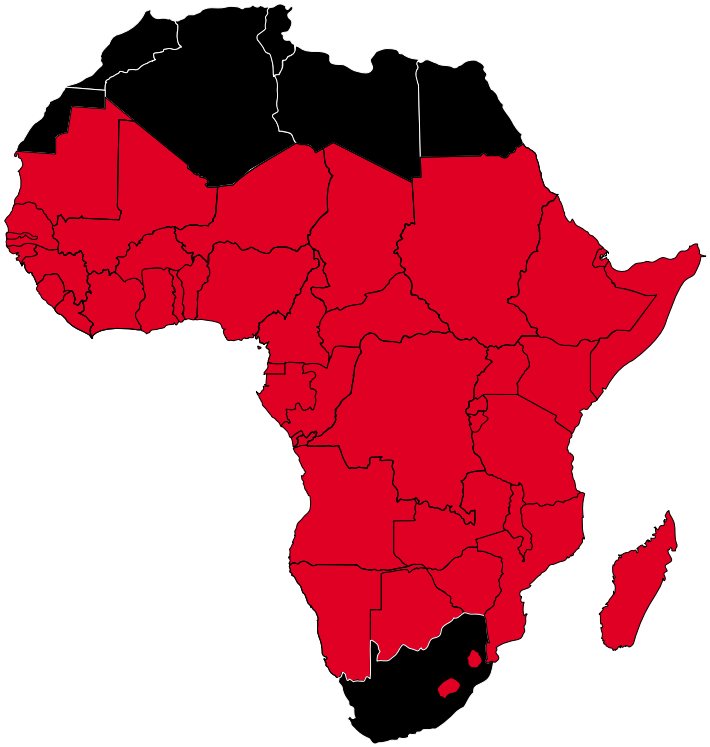
Country	1997 GDP (billions of US$)	1997 Population (in millions)
SOUTHERN AFRICA		
Angola	10.4	11.6
Botswana	4.3	1.5
Comoros	0.3	0.7
Lesotho	1.1	2.1
Madagascar	4.0	15.9
Malawi	2.3	10.4
Mauritius	4.3	1.2
Mozambique	4.2	18.3
Namibia	3.8	1.6
South Africa	127.5	43.3
Swaziland	1.2	1.0
Zambia	3.2	8.5
Zimbabwe	12.7	12.3
SUBTOTAL–S. Africa	**179.1**	**128.3**
WEST AFRICA		
Benin	2.9	5.8
Burkina Faso	4.1	11.1
Cape Verde	0.5	0.4
Cote d'Ivoire	17.2	15.3
Gambia	0.4	1.2
Ghana	10.5	18.3
Guinea	4.2	7.6
Guinea-Bissau	0.4	1.1
Liberia	1.0	2.9
Mali	3.7	11.5
Mauritania	1.7	2.4
Niger	3.5	9.8
Nigeria	49.8	118.4
Senegal	8.0	8.8
Sierra Leone	1.0	4.4
Togo	2.1	4.3
SUBTOTAL–W. Africa	**110.9**	**223.3**
TOTAL	724.2	765.0

Source: Energy Information Administration, World Bank 1999 World Development Indicators

7. Environment & Renewable Energy in Africa

Major African Environmental Challenge: Use of Biomass Energy

- **Africa is the world's largest consumer of biomass energy (firewood, agricultural residues, animal wastes, and charcoal), calculated as a percentage of overall energy consumption.**
  - Biomass accounts for as much as two-thirds of total African final energy consumption. In comparison, biomass accounts for about 3% of final energy consumption in OECD countries.
  - Africa consumed an estimated 205 million tons of oil equivalent (Mtoe) of biomass and 136 Mtoe of conventional energy in 1995, according to the International Energy Agency.
  - Most of Africa's biomass energy use is in sub-Saharan Africa. Biomass accounts for 5% of North African, 15% of South African, and 86% of sub-Saharan (minus **South Africa**) consumption.



Most of Africa's biomass energy use is in sub-Saharan Africa.

- **Wood, including charcoal, is the most common and the most environmentally detrimental biomass energy source. Firewood accounts for about 65% of biomass use, and charcoal accounts for about 3%.**

- **Deforestation is now one of the most pressing environmental problems faced by most African nations, and one of the primary causes of deforestation is wood utilization for fuel.**
  - Deforestation has negative implications for the local environment (increased erosion) and the global environment (acceleration of climate change, threatened biodiversity).
  - Many African nations have had over three quarters of their forest cover depleted.
  - Of the 159 signatories to the Convention to Combat Desertification, 52 are African. Of those 52, nearly all have ratified the Convention, which entered into force in 1997.

One of the primary causes of deforestation is wood utilization for fuel.

- **Women and children suffer disproportionately from negative health effect due to the smoke generated in the use of fuelwood for cooking (smoke is a carcinogen and causes respiratory problems). About 75% of wood harvested in sub-Saharan Africa is used for household cooking.**

- **Production of traditional fuels is often insufficient to satisfy rising demand. Fuel available to the poorest communities is expected to decline, which will intensify environmental degradation in those communities.**

- **End-use efficiency for most traditional fuels is low. A high concentration of fuels is needed to produce a low level of energy, and a significant share is wasted.**

- **South Africa is unique in sub-Saharan Africa; biomass accounts for only 15% of energy consumption. There is a range of energy options available in South Africa: biomass, kerosene, coal, liquefied petroleum gas (LPG), electricity, and solar power. This range of choices reflects the country's high level of economic development, relative to other African countries.**

Climate Change in Africa

Five African countries have signed, but not ratified, the Kyoto Protocol: ***Egypt, Mali, Niger, Seychelles,*** *and* ***Zambia****. Africa contributes only about 3.7% of total world energy-related carbon dioxide emissions. Addressing global climate change has not been a top priority. However, there are compelling reasons for global climate change to be taken seriously in the context of Africa.*

- Sub-Saharan Africa is home to the world's second largest rain forest, in West Africa. It is one of the world's most important carbon sinks. (Carbon sinks capture carbon dioxide from the atmosphere.) Thus, there is world-wide incentive to be interested in Africa in the context of climate change.
- Gas "flaring" is still practiced in Africa. In the process of oil production, natural gas is released. Because the gas infrastructure in Africa is extremely limited, the gas is often burned off rather than captured for use. Not only does this waste a potentially valuable energy source (the World Bank estimates that every day Africa flares gas equivalent to twelve times the energy that the continent uses), but it releases the carbon dioxide directly into the atmosphere. This practice is being stopped, especially in **Nigeria**, through dramatically increased fines for flaring.
- Climate "variability" associated with climate change could have seriously negative implications for the local African environment and African welfare. Climate variability could worsen rainfall and water problems, already prevalent in Africa.
- Desertification and environmental security are important issues in Africa, and climate change would have negative implications for both. Resource conflict is a major risk, both between local communities and across borders.
- Global warming could expand the home range of mosquitos in Africa, and in turn make mosquito-borne malaria an even greater problem than it is today.
- One of the world's major coral reefs, located in **Seychelles**, is already suffering from a slight increase in water temperatures. Climate change could have devastating effect on the reef, and others in the region.

Selected Climate Change Projects in Africa:

- The World Bank and the Global Environment Facility (GEF) operate a $2.5-million climate change project in **Mali**. The goal is to reduce demand for fuelwood through increased end-use efficiency (new stoves) and use of alternative fuels (kerosene, bottled gas).
- The World Bank and GEF operate a $4.7-million climate change project in **Senegal**. The goal is to create participatory sustainable forest management, which will create a carbon sink, stimulate the local economy, and boost biodiversity. Simultaneously, it will promote a shift from charcoal fuel to kerosene and liquid petroleum gas, and supply more efficient charcoal stoves for improved end-use efficiency.
- The World Bank and GEF recently completed a $3.3-million climate change project in **Mauritius**. The project developed a long-term program to generate power from sugar cane waste.
- The World Bank and GEF operate a $4-million climate change project in **Tunisia**. The project promotes solar water heating technology as a long-term, low-cost alternative to fossil fuel-based heat.

- The U.S. Agency for International Development (USAID) is funding the Central African Regional Program for the Environment (CARPE), a five-year, $14-million project to reduce the rate of deforestation in the Congo River Basin **(Cameroon, Central African Republic, Congo, the Democratic Republic of the Congo, Equatorial Guinea,** and **Gabon)**.
- **South Africa** built the Africa Games Village in preparation for the All Africa Games, which it hosted in September 1999. The Village is intended to serve as a model of energy and water efficiency for low cost housing projects, which typically have been poorly designed in terms of efficiency.

The Central African Regional Program for the Environment (CARPE) is a five-year, $14-million project to reduce the rate of deforestation in the Congo River Basin.

Non-Biomass Renewable Energy

Renewable energy demand is expected to grow in the coming decades as renewable energy technology becomes available for more Africans, especially in rural Africa.

Photovoltaic/Solar Power

- **African nations have made considerable advances in the use of photovoltaic (PV) power.**
- **In Kenya, a series of rural electrification and other programs has resulted in the installation of more than 20,000 small-scale PV systems since 1986. These PV systems now play a prominent role in decentralized, sustainable electrification.**

Developed for the World Health Organization (WHO), this solar powered refrigeration unit is used to transport vaccines. This is part of an inoculation program conducted by WHO for the Bedouin tribes of the Sudan, East Africa. The solar powered refrigeration unit is shown here on the back of a camel.

Photo credit: U.S. Department of Energy.

Photovoltaic module installed outside the home of a South African family. In South Africa, solar power has played an important role in rural electrification.

Photo credit: U.S. Department of Energy.

- **Other projects in Africa include:**
  - **South Africa**'s National Electrification Programme has increased electrification from 36% in 1994 to 63% today. Solar power has played an important role in rural electrification, a trend which is expected to continue.
  - A program to supply PV systems to 100 rural homes began in **Namibia** in April 1996.
  - The Independent Development Trust, a rural electrification project in **South Africa**, has installed PV systems for clinics in remote areas.
  - In 1998, Shell International Renewables Ltd. and South Africa's state utility, Eskom, initiated plans to provide stand-alone solar power units to 50,000 homes currently without electricity.
  - In 1998, Sweden and **Zambia** agreed to a PV rural electrification project.
  - The United Nations Development Program (UNDP) started a pilot solar program in **Zimbabwe** in 1993 that was extended beyond its 1998 termination date due to popular demand.

Hydropower

- **In Africa, hydroelectric power is the only significant grid-connected renewable energy source.**
- **In many African countries, hydroelectricity's share of total installed electric capacity is quite high. In Cote d'Ivoire, the Democratic Republic of Congo, Ethiopia, Mozambique, and Zambia, the vast majority of on-grid electricity generation comes from hydropower.**
- **Africa has considerable unexploited hydropower potential. Many new projects are planned or are under construction. The main hydro areas are the Congo River, the Nile River, and the Zambezi River.**
- **Environmental concerns associated with hydropower have been a factor in stalling progress in certain projects. Large dams can have negative implications for biodiversity and can permanently alter river ecosystems.**

Fossil Fuels in Africa

Africa is a major producer and exporter of fossil fuels. Fossil fuel production and transport have extensive environmental ramifications in Africa.

- Oil spills have had devastating effects on local environments, in part because African nations are not as equipped to deal with such accidents as more industrialized nations. Many are just now signing international treaties related to oil pollution, such as the International Convention on Civil Liability for Oil Pollution Damage (1969) and the Oil Pollution Preparedness and Response Convention (1990).
- World Bank loans could help fund a 650-mile crude oil pipeline from **Chad** to **Cameroon**'s port of Kribi, with operations expected to begin in 2004. Environmentalists are opposed to the project, because the pipeline will cross a tropical rainforest and major rivers in **Cameroon**.
- Fossil fuels, mainly in the form of automobile exhaust, are associated with air pollution in many African urban areas. One of the largest-ever USAID projects seeks to alleviate air pollution in Cairo, **Egypt**.
- Increased reliance on coal is considered a viable option for decreasing reliance on traditional fuels in many nations. Because Africa's greenhouse gas emissions are low, carbon emissions from coal have not been a major concern. (**South Africa**, which is ahead of most African nations in addressing climate change, is an exception.)

Trade and the Environment

- The Southern African Development Community (SADC) Trade Protocol has been signed by 11 members of the SADC (**Botswana, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia,** and **Zimbabwe**) and could enter into force in early 2000. The protocol calls for the reduction and elimination of tariff and non-tariff barriers to intra-SADC trade. It is unknown what environmental components the free trade agreement might include.
- Forty-one African nations are party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), signed in 1973. In 1994, the Parties to the Convention established a Timber Working Group to explore in more detail the question of CITES and timber species.
- Nine African countries (**Cameroon, Central African Republic, Congo, Cote d'Ivoire, the Democratic Republic of Congo, Gabon, Ghana, Liberia,** and **Togo**) are members of the International Tropical Timber Organization (ITTO), created by treaty in 1983 to provide a framework for consultation among producer and consumer member countries on all aspects of the world timber economy. ITTO's "Year 2000 Objective" states that by the year 2000 all tropical timber products traded internationally by Member States will originate in sustainably managed forests.
- Thirteen African countries (**Angola, Cameroon, Central African Republic, Congo, Cote d'Ivoire, the Democratic Republic of Congo, Equatorial Guinea, Gabon, Ghana, Liberia, Nigeria, Sao Tome and Principe,** and **Tanzania**) are members of the African Timber Organisation (ATO), formed in 1976 for its members to cooperate in forest trade. The ATO seeks to coordinate optimum use and conservation of forest resources.

Appendix

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