U.S. Geological Survey Studies of Energy Resources in Sub-Saharan Africa

U.S. Geological Survey Fact Sheet FS-053-97 April 1997

"Petroleum and coal resources in much of sub-Saharan Africa are underexplored and underdeveloped. There is considerable interest in the petroleum potential of coastal areas within the region, yet the overall energy picture is unclear compared to most of the world. Several sub-Saharan countries have mature petroleum industries and are important exporters to the world market, whereas many others have inadequate information on their energy resources. This is especially true for small accumulations of gas and coal in landlocked areas. These local resources are important in-country commodities and, if developed, could help countries formulate new, environmentally sound energy policies."

--Dr. Michele Tuttle
U.S. Geological Survey

The U.S. Government and the American public need access to information on energy resources in sub-Saharan Africa.

Sub-Saharan Africa (mostly Nigeria) produces 5 percent of the world's oil, while supplying the United States with 15 percent of our imports (Energy Information Administration). In the next 10 years, sub-Saharan oil and gas will become increasingly more important to the export market. New discoveries in offshore provinces of West Africa ensure a bright future for the region. Projections indicate that increased oil production in sub-Saharan Africa will far outpace the growth of intraregional consumption, providing greater quantities of oil for export (Forman, 1996). Also, West Africa, although a marginal supplier of liquefied natural gas (LNG) today, will become an important LNG source to the international market by the year 2000 (Oil & Gas Journal, 1996). The United States needs up-to-date information about petroleum resources and the energy balance within the region to predict the future role of sub-Saharan Africa as a major oil and gas exporter. The data required to generate the needed information are often disseminated in archives of oil companies and African geologic surveys, or in obscure publications. For these reasons, the U.S. Geological Survey is collecting data on sub-Saharan energy and constructing a regional energy bibliography. The team of geoscientists will assure that this information is available quickly and from a scientifically based, objective view point.

Explanation

- Q Quaternary (undivided)
- Qh Holocene
- Qp Pleistocene
- QT Quaternary-Tertiary
- T Tertiary
- KT Cretaceous-Tertiary
- K Cretaceous
- Kl Lower Cretaceous
- pEm Precambrian
- Qv Quaternary Extrusive and Igneous Rocks
- Ti Tertiary Extrusive and Igneous Rocks
- Mi Mesozoic Extrusive and Igneous Rocks
- Water (River or Lake)
- Sea

Sub-Saharan Africa and its offshore, an area greater than three times the size of the United States, is underexplored for energy resources.

Historically, political and economic concerns coupled with the lack of infrastructure within many provinces have contributed to underexploration of a large part of the region. Even though these concerns still influence exploration and development in some countries, new technologies such as deep-water offshore drilling, discoveries of petroleum in analogous geologic settings elsewhere, and the increased importance of natural gas in the energy picture appear to be launching the region to a new status in world energy. The U.S. Geological Survey, with its geologic expertise, is in a position to provide public information on underexplored sedimentary basins in the region. This information includes estimates of type of energy resource, quantities and descriptions of both discovered and undiscovered resources, and potential for resource development.

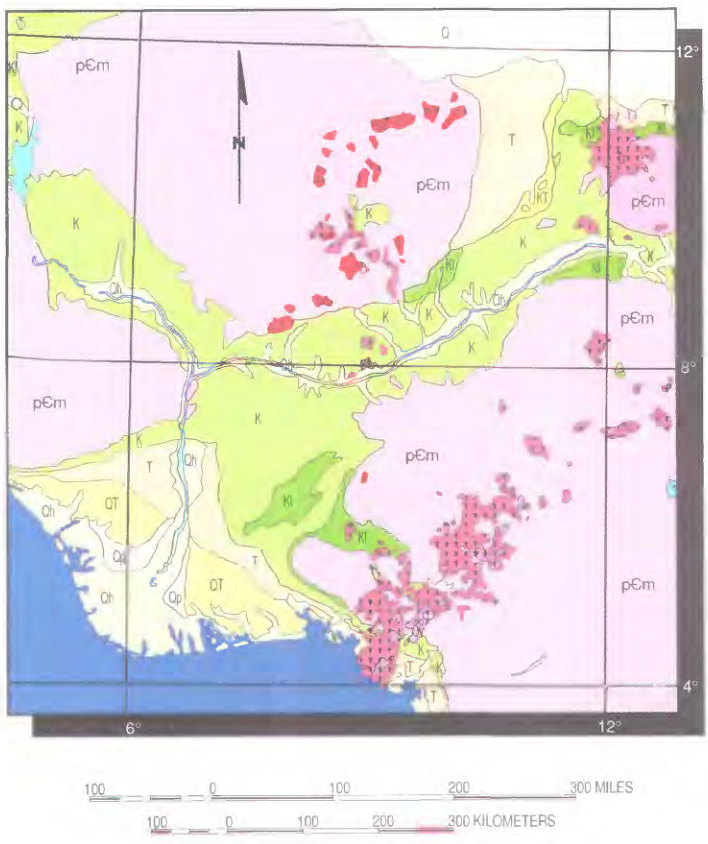

Figure 1. Example of digital geologic map of the Niger Delta and Benue Trough, Western Africa.

The USGS is producing world energy assessments based on the geology and geochemistry of provinces.

Sub-Saharan Africa has been divided into 41 geologic provinces defined using geologic and tectonic maps (figs. 1 and 2). Each province consists of an area that shares similar geologic characteristics. Twenty-one of the provinces (approximately two-thirds of the region) contain sedimentary rocks with potential for energy resources. Currently, 93 percent of known petroleum resources in the region occur in two provinces, covering only 3 percent of the potential area. The USGS World Energy Project petroleum assessment, to be completed by the year 2000, will assess 8 provinces within the region (table 1) that were identified as important to the United States and the energy picture of the region as a whole. Each province assessed will be divided into a number of petroleum systems having a common geochemical history. Assessments based on this type of province-system approach yield a broader understanding of the processes that formed the petroleum resource. This understanding will help identify areas of future geologic investigations critical to energy issues in sub-Saharan Africa. Resources in remaining energy provinces will be summarized by country.

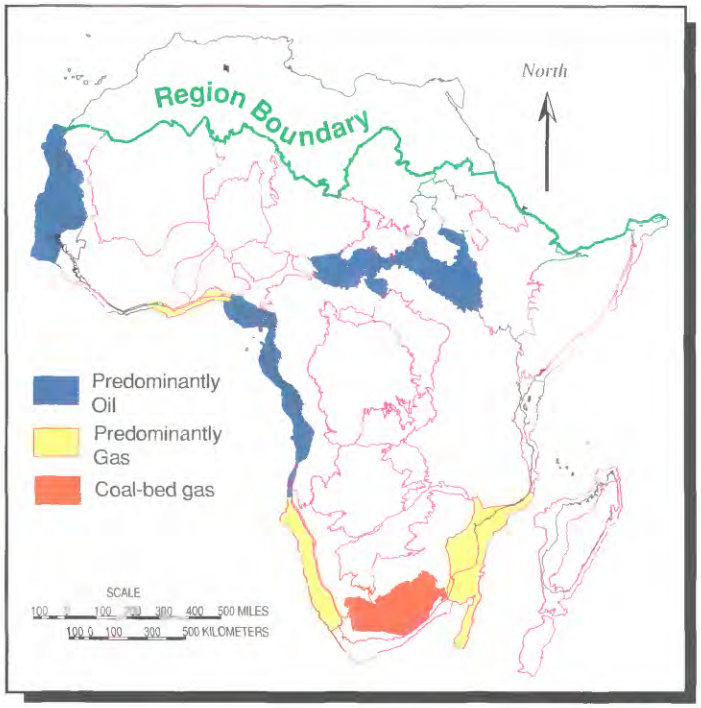

Figure 2. Map showing sub-Saharan African provinces and those that will be assessed for the world petroleum assessment.

Province	Dominant Basin Type	Known Oil Res. (BBO)	Known Gas Res. (BBOE)
Niger Delta	Deltaic	34.79	18.49
West-central Coastal	Divergent Margin	14.51	2.10
Sud	Rift	1.32	0.01
Orange River Coastal	Divergent Margin	0.00	1.00
Mozambique Coastal	Divergent Margin	0.00	0.62
Gulf of Guinea	Divergent Margin	0.24	0.36
Senegal Coastal	Divergent Margin	0.01	0.01
Karoo	Interior Sag	0.00	*

*Coal-bed methane reserves have not yet been evaluated.

Table 1. Resource data on provinces to be assessed. Known resources (Res.) are cumulative production plus proved reserves in billion barrels of oil (BBO) or billion barrels of oil equivalent (BBOE) (The Petroconsultant's Group, 1996).

Development of local gas and coal resources in sub-Saharan Africa would dramatically decrease deforestation.

Sub-Saharan Africa depends on fuel wood for 64 percent of its domestic energy (Perlack and others, 1986), more than any other world region. Shortage of wood is causing serious domestic energy problems. In tropical Africa, increasing pressure to supply wood fuel results in severe destruction of the forest and shrub coverage (fig. 3). Current and developing technologies permit economic development of small local occurrences of coal and gas in sub-Saharan Africa and would involve minimal infrastructure, dramatically decrease dependence on wood fuels, and contribute to solving global problems associated with continued deforestation. The USGS provides information on these occurrences to U.S. Government and international financial agencies committed to helping sub-Saharan Africa develop sound environmental energy policies.

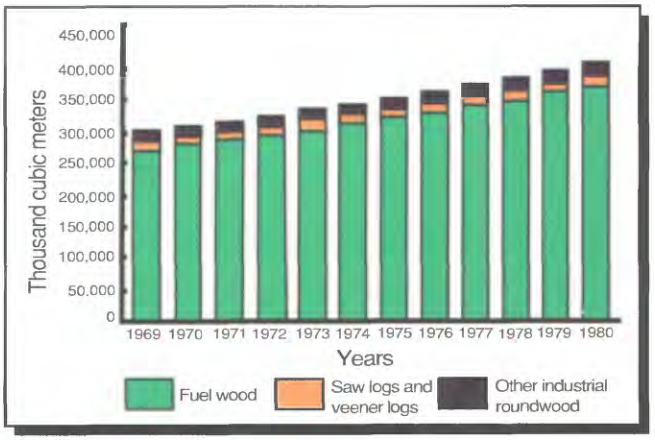

Figure 3. Wood production and use in tropical Africa (modified from U.S. Office of Technology Assessment, 1984).

Products will be available in paper copy, CD-ROM, and through the Internet.

Geologic and province maps of sub-Saharan Africa are nearing publication. The maps will be released on a CD-ROM and will eventually be available through the internet. Energy fact sheets by country will be published in paper copy and through the World Wide Web as available, starting in 1997. These fact sheets will include a summary of the energy picture for each country, emphasizing geologic aspects. The province petroleum assessment will be included in the world petroleum assessment to be released in the year 2000.

References

Energy Information Administration, http://www.eia.doe.gov./emeu/cabs/contents.html.

Forman, N. E., 1996, Global production through 2005: World Oil, v. 217, no. 12, p. 163-168 (December 1996 issue).

Oil and Gas Journal, 1996, Technology, v. 94, no. 53, p. 78-84.

Perlack, R.D., Stevenson, G.G., Shelton R.B., 1986, Prospects for coal briquettes as a substitute fuel for wood and charcoal in the U.S.: U.S. Agency for International Development Assisted Countries, Oak Ridge National Laboratory ORNL/TM-9770, 60 p.

The Petroconsultant's Group, 1996, PetroWorld CD-ROM. Geneva, The Petroconsultant's Group.

U.S. Office of Technology Assessment, 1984, Technologies to sustain tropical forest resources: OTA-F-214, 344 p.

For more information please contact:

Michele L.W. Tuttle, Regional Coordinator
U.S. Geological Survey
Denver Federal Center, Mail Stop 973
Denver, Colorado 80225
303-236-1944; e-mail: mtuttle@usgs.gov

Ronald R. Charpentier
U.S. Geological Survey
Denver Federal Center, Mail Stop 939
Denver, Coloardo 80225
303-236-5766; e-mail: charpentier@usgs.gov

Michael E. Brownfield
U.S. Geological Survey
Denver Federal Center, Mail Stop 939
Denver, Colorado 80225
303-236-7767; e-mail: mbrownfield@usgs.gov