



SUMMARY OF THE ROUNDTABLE ON REGIONAL USE OF EAST AFRICA'S NATURAL GAS

INTRODUCTION

New discoveries create opportunity for East African natural gas to meet local demand

On June 2, Columbia University's Center on Global Energy Policy, Sustainable Engineering Lab, and Global Center-Africa, along with the United Nations' Sustainable Energy for All, hosted a workshop on the potential for the regional use of East Africa's natural gas. The workshop, held in Addis Ababa, Ethiopia, ahead of the U.S.-Africa Energy Ministerial, brought together energy ministers and senior officials from East and South Africa as well as representatives from the government of the United States, NGOs, industry, academia, and leading energy consultancies. The event presented new research by the Sustainable Engineering Lab of Columbia University on the opportunities and challenges for developing East Africa's natural gas and the value proposition for regional utilization of the resource across sectors of demand (power generation, home cooking, transportation, and fertilizer production).¹

With significant natural gas resources recently discovered in the region, especially in Tanzania and Mozambique, the potential now exists for gas sourced from East Africa to meet growing regional demand in a sustainable manner. Natural gas is just one of many important energy resources for Africa, but its ability to support the integration of renewables and the significant lead times for the development of hydropower and geothermal power make natural gas particularly attractive. The sub-Saharan economy has been growing at 5-6 percent annually and future growth has been estimated at potentially 8-10 percent annually. Combined with expected trends in regional population growth and urbanization, energy demand could grow dramatically. Natural gas has the potential to serve as an economically competitive energy resource in meeting this new demand, one with significant ancillary benefits for domestic populations and economies.

The following are among the key points made by participants without attribution to any specific participant in accordance with the Chatham House Rule nature of the roundtable.

OPPORTUNITIES

Strong potential regional demand growth with social benefits

Natural gas can be used for a host of different applications across East Africa including power generation, transportation, fertilizer production, and cooking. If realized, projected growth in aggregate demand across these sectors would create a realistic market alternative for the use of regional natural gas in comparison to more mature international markets.

For residential use, natural gas would be a beneficial alternative to wood fuels for cooking, which cause indoor air pollution and other health problems. For industrial and commercial use, power

¹ Demierre, Bazilian, Carbajal, Sherpa and Modi, "Potential for Regional Use of East Africa's Natural Gas", Sustainable Engineering Lab, The Earth Institute, Columbia University, May 2014 (<http://sel.columbia.edu/wp-content/uploads/2014/05/Potential-for-Regional-Use-of-East-Africas-Natural-Gas-SEL-SDSN.pdf>)



generation, and transport, natural gas could represent a low cost alternative to expensive imported oil products, with indirect impacts throughout the macroeconomy from fuel substitution. According to analysis presented by Columbia researchers, natural gas is competitive across applications at various city-gate prices depending on the country.

- **Cooking:** In rural areas of East Africa, up to 93 percent of the population depends on wood for cooking. In urban areas, the most common fuels for cooking are wood, charcoal and kerosene – only 5 percent of the population has access to clean cooking (i.e. liquefied petroleum gas or electricity). Natural gas is competitive for cooking at a city gate price of \$10-20/mmBtu (British thermal units).
- **Power Generation:** In sub-Saharan Africa, outside of South Africa, power generation is essentially based on hydropower and diesel generators. Moving forward, solar power can and should play a significant role in meeting the continent’s projected electricity demand. Gas-fired combined cycle power plants can provide cost-competitive ramping and back up capacity, compared to diesel generators, at a gas price of \$12-48/mmBtu.
- **Transportation:** Most oil products are imported into East Africa and retail prices are very high, with variation across countries. For example, on an \$/mmBtu basis, diesel costs \$30 in Ethiopia, \$40 in Mozambique, and \$65 in Malawi. Gasoline and liquefied petroleum gas are both more expensive than diesel. As such, natural gas can represent a competitive alternative to conventional transportation fuels at city gate price of \$25-52/mmBtu.
- **Fertilizer Production:** Africa uses significantly less fertilizer than other continents. In 2010, the average fertilizer use in sub-Saharan Africa was 8 kilograms/hectare compared to 303 kg/ha in East Asia and 107 kg/ha in North America. The minimal utilization of fertilizers is mostly a result of high retail prices for farmers, prices that are based on expensive fuel imports and related transportation costs. At a price of \$14-24/mmBtu, regional natural gas could be used as a feedstock for domestic production that would be competitive with imports.

Researchers at the Sustainable Engineering Lab also modeled the aggregate benefits that various pipeline networks would provide the region. The baseline scenario of the modeled pipeline infrastructure system was found to reach 263 major urban areas within eight countries (Mozambique, Malawi, Tanzania, Kenya, Uganda, Rwanda, Burundi and Ethiopia). For those 263 urban centers, the cost of gas at the city gate would be in the range \$4-10/mmBtu, depending on the distance from the source and assuming a production cost of \$3/mmBtu. The benefits of this infrastructure for cooking and transport would reach an estimated 185 million people in 2050. The wider benefits from power generation and fertilizer production could reach up to 461 million and 614 million people respectively.

CHALLENGES

Competition for capital is tough as companies scale back upstream investment

From 2004-2014, major international energy companies increased their global capital expenditures to invest heavily in both large-scale conventional projects and new unconventional plays. However, project costs have more than doubled on average and, in the case of large-scale LNG projects such as the ones currently proposed in East Africa, costs have more than tripled. The result is that energy



CEOs are now managing costs more aggressively and increasing the level of scrutiny for all new investments.

At the same time, companies face a growing number of choices when deciding where to deploy their capital. The energy revolution continues to evolve in North America, drawing heavy investment given the low risk profile. New oil and natural gas discoveries in Latin America, the Eastern Mediterranean, China and across Africa have also increased the global competition for energy capital. Financial markets may begin to allocate capital differently moving forward than was predicted just three to five years ago.

The combination of shrinking capital expenditures and expanding investment opportunities requires governments and industry to do a better job of recognizing each other's perspectives and needs. Industry must understand that governments have responsibilities to their citizens and have often set goals upon which they will be judged. Governments of developing economies are often concerned with one fundamental question - how will energy development change the way of life for someone in a rural area? At the same time, companies must make tough choices in determining where to deploy capital, and governments must work to make local conditions conducive to business operations while benefiting constituents. As one participant noted, it is not just the nature of the resource anymore that matters, but the quality of the decision-making from both a financial diligence and regulatory perspective. Participants agreed that win-win solutions do exist, but that achieving them will take flexibility and continued open dialogue between the public and private sectors.

Regional gas network requires significant capital investment and multilateral coordination

In addition to the changing capital market climate, East Africa faces several challenges to regional resource development and domestic use which must be addressed, including:

- ***Geography and Scale of Investment:*** East Africa is a massive area with difficult terrain. Creating a large, integrated gas transportation network across the region would require significant upstream investment costing nearly \$60 billion. Beside the investment in the gas transportation infrastructure, an additional \$100 billion would be needed to develop the four targeted demand sectors (power generation, transportation, cooking, and fertilizer production). The scale of the financial investment and the physical construction also holds the potential for significant delays and cost overruns.
- ***Multilateral Coordination:*** A project with an international scope such as a pipeline network bears significant risks due to the need for multilateral coordination. Sub-Saharan Africa is a heterogeneous region and the different operating conditions across borders result in a high barrier to development.
- ***Off-Take Agreement Guarantees:*** Given the poor credit rating of many local utilities and the current lack of other major end-users, securing long-term off-take agreements is problematic. In many cases it will be necessary for governments to act as a guarantor for any off-take agreement.



SOLUTIONS

Finding anchor demand is essential; the fertilizer sector may serve that need

The region is in a “chicken and egg” situation. Citywide distribution networks that enable gas use for cooking and transport will not be built without assurance of a reliable, competitive supply at the city-gate. However, trunk networks to bring gas to the city-gate will not be built without guaranteed demand that monetizes the investment. A significant portion of the discussion focused on where and how to break this cycle.

A long-term off-take contract would create the anchor demand necessary to support the initial economics of regional gas. One potential source of anchor demand is the growing industrial sector. In the case of East Africa, fertilizer production could serve that function given the agricultural needs of the continent. India was highlighted as an example where fertilizer manufacturers served as effective anchor demand centers, followed by large cities and other industries.

In addition to supporting initial infrastructure development, anchor demand loads also enable expansion of the gas network over time. As satellite areas of demand develop it is easier for them to be linked with the existing trunk network, developed initially for the anchor customer. This step-wise approach increases the overall cost of the infrastructure build out, but it also enables flexibility that can be used to adapt to evolving demand patterns as a distribution system evolves.

Multiple industry representatives noted that LNG off-take agreements are a prerequisite before investment will be made to develop the resource. Oil and gas companies exploring and producing the hydrocarbon resource are, for the most part, focused solely upstream. Other entities (public and private) with the relevant expertise and technical skill will need to establish the business cases for domestic use, ideally without subsidies, and generate the necessary anchor customers.

North America provides model for integration needed for East Africa gas pipeline

As the regional economy grows and significant investments are made, the energy infrastructure planning processes must focus on integration – both in terms of regional markets and energy systems. Integrated energy markets, whether for power, oil, or gas, expand the customer base accessible to industry, thereby enhancing the economic viability of capital investments. They also allow complimentary needs across energy sources to be allocated effectively within and between countries. The example of North American energy trade and integration between the U.S., Canada and Mexico was highlighted as a success story for regional energy integration.

Integrated energy systems, whether power markets using regional interconnection lines or pipeline networks for oil and gas, enhance the reliability and resiliency of supply, a key consideration for consumers (particularly commercial and industrial clients). Functioning markets and integrated energy systems also support effective and efficient pricing mechanisms that can incentivize investment where it is needed across the industry. This is particularly important when projecting a future where oil and gas resources are integrated with geothermal, hydropower, solar, storage, and other energy sources. The system will need to adapt as various resources are deployed and the production cost curves evolve. Transparent and accurate price signals that facilitate investment decisions throughout the system are essential.



Establishing competitive regulations and anchor demand

After discoveries of large hydrocarbon reserves governments have historically had difficulty managing expectations and balancing the desire for resource development to move forward rapidly while assuring benefits accrue to the local economy and population. Two specific steps were identified that East African countries could take to strike a successful balance and serve as an effective facilitator of development:

- **Support anchor demand creation:** As noted previously, government can play a role in establishing anchor demand. This can be done via industrial policy, as witnessed in the ceramics and fertilizer industry in India, and supporting the conditions that will attract companies which will be end-users of the resource. The government can also serve as an end-user. In both instances, attendees noted concerns over the impact on government balance sheets and the preference for market-forces to drive investment decisions in the long term.
- **Establish competitive above-ground regulatory environment:** In the current competition for limited capital, government transparency and consistency in its regulatory procedures and requirements can dramatically streamline development. While local content requirements are important considerations, they need to be based on a realistic understanding of the technical needs that will support safe and beneficial development. One idea discussed by attendees focused on the possibility for regional content requirements, agreed to among a consortium of countries and industry, as opposed to individually negotiated requirements between a company and multiple countries.

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