



Potential for regional use of East Africa's natural gas



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HIGHLIGHTS

- Significant reserves of natural gas have been identified in East Africa.
- Natural gas may support economic growth and low-carbon future in the region.
- Main applications include: power, cooking, transport, and fertilizer production.
- The economics of developing a gas transmission system across the region is discussed.
- East Africa's gas may be a very affordable energy source for the whole region.

ARTICLE INFO

Article history:

Received 10 June 2014

Received in revised form 31 December 2014

Accepted 3 January 2015

Keywords:

Natural gas

East Africa

Pipeline

Regional development

ABSTRACT

Recently, significant reserves of natural gas have been identified in Mozambique and Tanzania. These resources may support a pathway to both economic growth and a low-carbon future. This natural gas could be used locally for a host of different applications such as cooking, power generation, transportation and fertilizer production. The aim of this paper is to investigate how the potential future demand for natural gas across sectors and countries might impact the economic viability of an investment in a new regional transmission and distribution gas network in Eastern and Southern Africa. We analyze the economic viability by using future demand and pricing data inferred for biomass, charcoal, LPG and liquid fuels currently being used in the continent. The investment and transmission costs are assessed for various scenarios of transmission pipeline networks. Then, a detailed analysis for a gas transmission network across eight Eastern African countries is presented. Results suggest that the development of a regional gas pipeline network within the continent is an attractive investment (based on internal regional demand as well as co-benefits to economy, environment and health) that can complement LNG export, which is the dominant market option being considered to enable the large upstream investments.

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1. Introduction

With increasing population, urbanization and economic growth expected, the energy demand in sub-Saharan Africa will likely drastically increase over the next decades. How to meet the growing energy demand in a sustainable manner and provide reliable and affordable energy services to support the economic development is a foundational challenge for the sub-continent. The focus of this paper is natural gas, which might play a significant role in sub-Saharan Africa's future energy mix. Currently, the use of natural gas in the region is very limited; in 2012, natural gas accounted for only 4% of total primary energy demand of sub-Saharan Africa [1]. Worldwide, natural gas is gaining more and more importance, and substantial capital investments in infrastructure are made at all levels [2].

Recently, significant recoverable resources of natural gas have been identified in Mozambique and Tanzania [3]. Large reserves of natural gas are now being exploited in: Nigeria, Algeria, Libya and Egypt (see Fig. 1) [6,7]. In East Africa, the recent gas finds in Mozambique and Tanzania could provide benefit to the whole region by using domestically a significant share of the production. Indeed, natural gas can be used for a host of different applications such as cooking, power generation, transportation and fertilizer production. For cooking, natural gas would be a great alternative to wood fuels, which causes indoor air pollution and health problems [8,9]. For industry, power generation and transport, natural gas could represent an interesting alternative to imported oil products.

While in Sub-Saharan countries the share of population living in rural areas is amongst the highest in the world, the high rate of urbanization [5] is changing the demographics at a rapid pace. Because it is generally more cost-effective to develop energy infrastructure in urban areas rather than in rural areas, the growing

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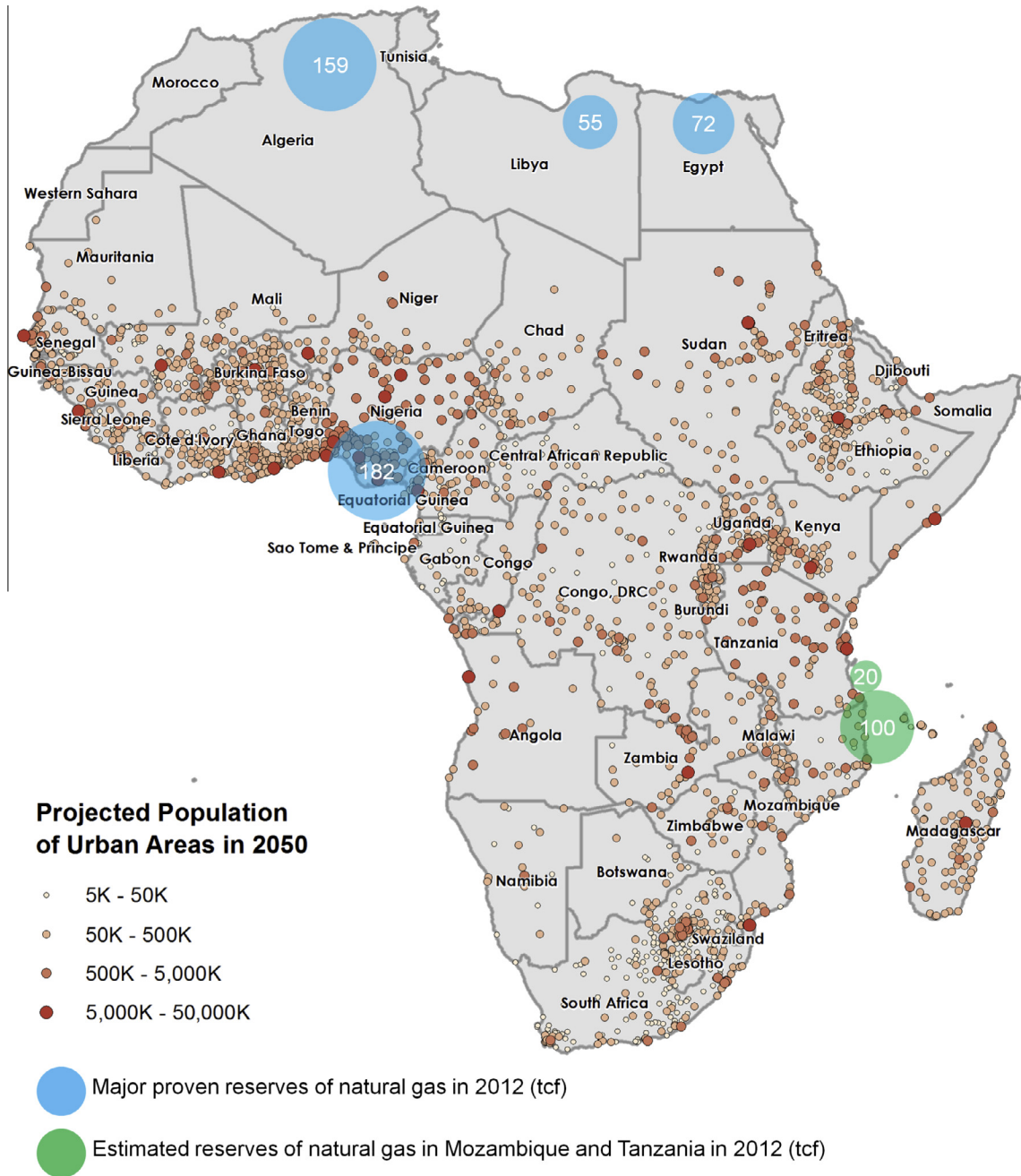


Fig. 1. Projection of the urban population in sub-Saharan Africa by 2050 [4,5], estimated natural gas reserves in Mozambique and Tanzania [3] and major proven natural gas reserves in Africa [6].

share of urban population tends to help increase the proportion of the population with access to modern energy services (although it is recognized that the quality of service is often sporadic, and definitions of “access” vary tremendously). A projection of the urban population in sub-Saharan Africa in 2050 is shown in Fig. 1. Western and Eastern Africa both exhibit areas with high densities of urban centers, which suggests that natural gas transmission networks could be economically viable in these regions. Fig. 2 shows the projected population of the major urban centers of Eastern Africa in 2050. In this paper we focus on Eastern Africa, because the question of how to best take advantage of the large potential recoverable resources of gas is still largely pending. In Western Africa, major gas producers, Nigeria and Equatorial Guinea, have long-term LNG export contracts already in place for the largest part of their production, which makes the scenario of drastically

increasing the internal regional supply unlikely in the medium term.

The originality of this study is to examine the value proposition of using domestic natural gas at a large scale in a whole part of sub-Saharan Africa – East Africa – for energy needs in the different sectors, and to provide cost estimates and present a possible layout for a gas transmission system. The approach that we use here can be easily applied to other regions. It relies on simple models, an open-source software for network planning and publicly available data.

2. Current state of natural gas sector in sub-Saharan Africa

In 2011, the total production of natural gas in sub-Saharan Africa was approximately 1690 Bcf; the top gas producers were

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