POLICY BRIEF

Low carbon options in the gold mining industry in Ghana

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Abstract

This policy brief describes current and future energy use and CO_2 emissions of the gold mining industry in Ghana. Incentives to increase energy efficiency in mining operations are strongly linked to electricity and fuel prices. As a result of increasing electricity prices, Ghana's large gold mining companies are starting to implement measures to improve energy efficiency in their operations. However, there is significant potential for further improvements which would reduce CO_2 emissions, and benefit the companies and the wider economy.

INTRODUCTION

This policy brief explains what low carbon development could mean for the gold mining industry in Ghana. Generally speaking, low carbon development seeks to promote economic development while keeping GHG emissions low, or lower than without interventions (Würtenberger *et al.*, 2010). Gold mining is a central piece of Ghana's economy, but the industry uses a significant amount of electricity and fuel. This policy brief describes energy use in gold mining today and in the future, and shows possibilities for increasing the energy efficiency of gold production and decreasing the use of fuel.

THE MINING INDUSTRY IN GHANA

Mining is an important sector in Ghana's economy, contributing more than 6% to GDP, and more than 40% to export earnings. Within the sector, gold mining plays a central role. Ghana is the largest producer of gold in the West African region and Africa's second largest producer after South Africa. Production in 2009 was over 3.1 million ounces, up 12% from the previous year. The four major producers, Goldfields, Anglo Gold Ashanti, Golden Star and Newmont, accounted for 79% of the country's total production in 2008 and 76% in 2009 (Minerals Commission, 2010). The remainder of the production comes from a number of medium-sized mining operations as well as small-scale, artisanal operations.

Worker in the Anglo Ashanti gold mine in Obuasi, Ghana (source: World Bank)

Gold Fields Ghana Ltd., Ghana's largest gold producer, has mining operations at Tarkwa and Damang. Anglo Gold Ashanti operates mines at Obuasi and Iduapriem, near Tarkwa. Newmont's operations are at Ahafo, with a new mine planned at Akyem. Anglo Gold Ashanti's Obuasi mine is the country's only underground gold mine to date; the other operations are all open-pit mines.

ENERGY USE AND CARBON EMISSIONS TODAY

The gold mining industry is a significant user of electricity in Ghana. Analysis shows that the four major gold mining companies consumed about 1200 GWh of electricity in 2009 or about 13% of the country's electricity consumption. This electricity consumption implies CO_2 emissions of 317000 tCO_2. by the four companies[1]. Moreover, in 2008, the four major gold mining companies are estimatd to have used about 9% of the country's diesel consumption.

The country's small-scale mining operations are expected to be overall more energy efficient than the large scale operations, as they are less mechanized and rely to a larger extent on manual labour. On the other hand, small scale operations use older and less energy-efficient equipment. Patterns of energy use differ significantly between underground and open pit mining. Underground mining is much more electricity intensive, due to the need for ventilation, cooling and lifting ore to the surface. Open-pit mining is more diesel intensive, due to the need to transport ore in large trucks.

ENERGY USE AND CARBON EMISSIONS IN 2020

Newmont's Ahafo open pit gold mine in Ghana

Looking into the future, gold production in Ghana is likely to increase further, especially if gold prices stay high. Taking into account new mining operations, which have already been licensed and for which construction activities have started, and anticipating moderate increases at some of the existing operations, production volume could increase to 4.4 million ounces[2] in 2020, implying an increase of 41% over 2009. If additional large projects were to be implemented by 2020, which is theoretically possible, actual production in 2020 could be even higher.

Assuming that the additional production would be mined at the same electricity intensity as the current production, this would imply additional electricity consumption of 650 GWh[3] and the need for constructing 93 MW of additional electricity generation capacity by 2020[4]. The CO_2 intensity of electricity production in Ghana is expected to increase by 2020 due to the growth of electricity generated by thermal power plants using diesel, light-crude-oil and natural gas as fuel. The corresponding CO_2 emissions in 2020 would therefore amount to 707000 tCO2, almost twice the 2009 levels[5].

[1] Using an 2006-2008 weighted average grid emissions factor of 265 tCO_2/GWh
[2] Including 500t ounces from Newmont's planned Akyem mine, and 200t ounces each from new operations by Azumah Resources and Sun Gold
[3] In reality, the additional electricity consumption may be lower, as new production is expected to be more efficient than the existing operations. However, it was not possible to quantify how much more efficient new production would be.
[4] Assuming an average load factor of 80%
[5] Assuming a 2020 grid CO_2 emission factor of 383 tCO2/GWh

LOW CARBON OPTIONS

There are a number of technical options to improve the energy efficiency and the fuel demand of gold mining operations. These include improving the efficiency of compressors used for drilling, avoiding leaks in pipelines for compressed air, improving the efficiency of motors in the mills, managing the routing of trucks, replacing trucks with more fuel efficient models, improving the efficiency of the cooling and of the ventilation systems in underground operations and improving the efficiency of lighting in underground operations. Many of these options are not only technically possible, but also economically feasible with payback times of the required initial investment of less than 5 years, depending on the prices for electricity or fuel. However, even economically attractive measures may not be undertaken automatically due lacking knowledge about the technical options and a lack of awareness of the potential benefits.

In Ghana, electricity prices for large industrial users such as the gold mining industry have historically been very low, as they were subsidized by the government. Such low prices posed little incentive to implement energy saving measures. However, the situation has been changing with constant rises in electricity tariffs. The large mining companies often negotiate their tariffs directly with the Volta River Authority (VRA), the country's largest electricity producer, and actual prices are often a political decision. According to their latest financial reports, Goldfields and AngloGold Ashanti pay about 0.10 USD/kWh[6], but expect that prices may further rise in the coming years by as much as 100%. The four large mining companies jointly own their own electricity generation plant, a 80MW back-up plant at Tema. This plant was constructed in a response to the 2007 Ghana electricity crisis, but does not constitute an economic alternative to electricity from the general grid as it relies on costly imported diesel oil.

Today, increasing electricity prices pose an increasingly stronger incentive for Ghana's large gold mining companies to implement measures which reduce their energy consumption. International companies are, to a lesser extent, driven by increasing accountability requirements for their corporate CO_2 emissions and business practices. However, actual implementation of energy effiency measures is only just starting, but is showing some promising first results.

Anglo Gold Ashanti, for example, have reduced electricity demand at its Obuasi mine by roughly 10% after installing a number of energy efficiency measures, such as reducing leakage of compressed air, deploying energy efficient motors and improving cooling and ventilation[7]. The company expects to be able to achieve further reductions in electricity use in the near future. Goldfields expect to be able to achieve a reduction in electricity consumption in Ghana of 10-20%, similar to the improvement the company is currently making in South Africa[8]. These activities are first steps to increasing the efficiency of gold mining in Ghana. Such efficiency increases do not only lower greenhouse gas emissions, but also benefit the companies and the Ghanaian economy as a whole. Increased energy efficiency contributes to the international competitiveness of production, as it lowers production costs. Moreover, reduced electricity demand from the large mining companies

[6] Source: Annual Reports. 0.10 USD/kWh hardly covers today's costs for generating and distributing electricity. Electricity generation costs of the new fossil fuelled power plants currently being built in Ghana are between 0.25-0.30 USD/kWh (Energy Commission, 2010)
[7] Source: company communication
[8] Source: 2010 Annual Report

leaves more electricity generation capacity for other economic activities, and it decreases the need for investments into new power plants. Reduced fuel demand decreases the need for expensive imports of fossil fuels. Increased efficiency of mining operations is therefore in the interest of the Government of Ghana, especially as long as the government subsidizes fossil fuel imports and electricity tariffs. The investment decisions for energy efficiency measures in mining operations are taken by private companies. However, the government may play a supporting role by setting the right regulatory conditions. This could for example imply incentivizing investments into energy saving measures, while at the same time punishing inefficient operations, e.g. by discontinuing electricity subsidies, or requiring the industry to continuously improve the energy efficiency of gold production.

REFERENCES

- Energy Commission (2010a) *Energy Sector Policy Review Paper*, Accra, 2010.
- Minerals Commission (2010*) Mining statistics*, Accra, 2010.
- Würtenberger, L. and X. van Tilburg (2010) *Low Carbon Growth for Ghana*, Amsterdam, December 2010.

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