Trucost ESG Analysis
S&P Global

IFU INVESTMENT FUND FOR DEVELOPING COUNTRIES

HFO power plant in Mali, Africa

SUMMARY

Trucost, part of S&P Global was commissioned to conduct analysis of the potential CO_2e savings relating to a heavy fuel oil (HFO) power plant installation in Mali (Africa).

This African HFO project can feasibly provide GHG savings based on detailed analysis and materiality of carbon savings. These are considered 'low' with an associated net benefit of 15 tCO_2e/DKK million invested. With social cost of carbon incorporated, this is equivalent to 0.012 DKK/DKK invested.

DATA AVAILABLE

- The maximum working capacity of the new HFO power plant in Kayes, Mali is 81 MWe (IFU, 2016b)
- The actual working capacity is 81% of maximum capacity for the HFO power plant in Mali (IFU, 2016b)
- The guaranteed output for Mali power plant is 578,160 MWh/annum (IFU, 2016b) and based on this it was calculated that the plant operates for 24 hours/day
- Kayes, Mali HFO plant is a greenfield project, thus construction emissions are included
- The project life considered for the analysis is 20 years
- Ecoinvent factors were used for calculating the lifetime emissions of both alternative and baseline scenario (EcoInvent, 2016)

RATIONALE OF FUNDING

In Mali as well as generally in Africa, there is an increasing demand for electricity, which needs to be met. The annual demand for energy is increasing at the rate of 10% per annum in Mali (African Development Bank, 2015). IFU is considering an investment developing a HFO power plant to help meet this need.

The optimal opportunity for carbon reductions relates to renewable energy rather than continued development of fossil fuel based power generation. However, given that the energy demand is increasing at a high rate and it is easier and reliable to expand the energy generation from thermal

power plant, HFO electricity generation is investigated as an alternative to current private generator and carbon intensive grid generation.

INTRODUCTION

Mali Investment:

The developer of the Mali HFO plant is Albatros Energy Mali SA. It made a concession agreement with the Government of Mali back in 2011 that has later been amended and now covers the construction and operation of an 81.5 MWe HFO thermal power plant with a guaranteed output corresponding to 66 MW.

Burmeister & Wain Scandinavian Contractor (BWSC) has been selected as Engineering, Procurement and Construction (EPC) supplier as well as Operations & Maintenance (O&M) contractor with a 13-year full O&M contract.

Table 1: Details of Investment made in Mali HFO power plant

	Units	Investment
City		City of Kayes
Location		Western Mali
Power Type		HFO thermal power plant
Maximum Capacity	MW	81
Actual working capacity	%	81%
Guaranteed output	MWh/annum	578,160
Working Hours/day	hours	24
Working Hours/annum	hours	8,760
Total MWH	MWh/annum	578,160

METHODOLOGY

The focus of the proposed HFO power plant is to increase the current capacity rather than replace it. Therefore, the impacts from alternative and baseline scenarios were compared with respect to providing electricity to satisfy a part of unmet demand from the individual national grids. In the absence of a HFO power plant, it is assumed an equal amount of electricity would have been provided by thermal power plants (50%) and private generators (50%), based on current energy mixes.

To capture impacts arising from both supply chain and operations of alternative and baseline scenarios, carbon impacts were derived from LCA values from EcoInvent (EcoInvent, 2016) to account for entire upstream activities associated with different electricity producing technologies. All EcoInvent records used in this study have been mentioned in detail in the reference section.

Life expectancy of the project is estimated to be 20 years. The results have been consequently contrasted with the proposed fund participation in an effort to get a more holistic view of the carbon savings of the project with respect to the investment.

Mali Project GHG emissions profile

The proposed plant in Mali has a capacity of 81 MW and its output is 66 MW which translates to a working capacity of 81%. The LCA factor identified was scaled appropriately to fit the detail of the Mali plant.

Mali Baseline GHG emissions profile

Mali gets its electricity on-grid from thermal power plants (47%) and hydro power (53%) installations as of 2013 (African_Development_Bank, 2015). The unmet demand is fortified with off-grid energy from private diesel generators and representing 40% of energy from EDM's grid electricity supply (Mali_Minstry_Of_Energy_and_Water, 2011). Using Ecoinvent factors, the total emission from the Mali grid is determined to be 0.582 $KgCO_2e$/KWh (EcoInvent, 2016).

The HFO electricity is unlikely to replace the grid generated electricity due to unmet demand, so it is assumed energy will be in addition to the grid, replacing in part the private generation of energy through diesel generators. The baseline scenario is therefore electricity generation through thermal power plants (50%) and private generators (50%) to produce power equivalent to alternative scenario (578,160 MWh/year). Hydro power generation is excluded as this is unlikely to be further expanded and comparison is against unmet demand not current practice.

Table 2: Baseline energy scenario in Mali

Country	Power type	Fuel type	Estimated contribution %	Kg CO_2e/KWh) (Anon., n.d.)	Kg CO_2e component of total baseline
Mali	Thermal	HFO + Diesel	50%	0.9200	0.460
	Private. generators	Diesel	50%	0.9475	0.474
				Total	0.934

(African Development Bank, 2015)

Assumptions:

- It is assumed that while there is current unmet demand, should the project not take place, 50% of additional electricity would be provided by thermal power plants as grid production and the other 50% would be catered for by private generators assumed to be operated by diesel combustion.
- A size appropriate LCA for the construction of a HFO plant was not identified, and therefore the GHG emissions associated with the construction phase were scaled down accordingly. The emission from combustion is considered appropriate.
- GHG emissions from combustion of HFO at power plant were used as a proxy for the thermal plant output within the country's grid mix.

RESULTS

The total emissions were calculated per typical year and total project life for both alternative and baseline scenario. Using the client provided investment details (in table1) the GHG savings or emissions avoided per million Danish Krone (DKK) invested in to HFO plants were found. IFU investment was provided in Euros (EUR) and converted to DKK[1].

[1] Converted using UKFOREX (Average value for year 2015)

Table 3: GHG savings from investment made in Mali HFO power plant

	Typical Year	Total Project Life
Project emissions (tCO_2e)	**527,120**	**10,542,392**
Baseline emissions (tCO_2e)	**539,837**	**10,796,746**
GHG savings (tCO_2e)	**12,718**	**254,354**
GHG savings (tCO_2e per Total DKK mn Investment)	**N/A**	**294**
GHG savings (tCO_2e per IFU DKK mn investment)	**N/A**	**15**
IFU saving (DKK/DKK invested)	**N/A**	**0.012**

For every million DKK[2] IFU is investing in the Mali HFO power plant, 15 tonnes of GHG could potentially be avoided. When considering the social cost of carbon, this is equivalent to 0.012 DKK/DKK invested, considered low materiality for carbon saving.

Mali relies upon hydro installations for its grid power and the energy output depends on the water availability. Also expanding its potential would take more investment and time (African_Development_Bank, 2015), suggesting expansion of this renewable technology would be challenging. Hence HFO is being proposed as a short term solution rather than using other high emission alternatives such as diesel generators. For a long term, sustainable solution, increasing the renewable potential to achieve a less carbon intensive energy scenario would be preferable.

Limitations:

- The EcoInvent records used in the study are only a proxy which are very comparable to the power production technologies of interest. The values are global as country specific data was not available, however they are adjusted based on regional grid mix.
- Literature and online information available on Mali energy is limited, conflicting and in places, outdated.

[2] Converted using FOREX, at an exchange rate of 7.44DKK per EUR, as per average rate of 2015

REFERENCES

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