



Netherlands Commission for  
**Environmental Assessment**

# Review Scoping Report for an EIA for a Coal Fired Power Plant

Memorandum by the NCEA

## GHANA



28 January 2016



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## Advice of the Secretariat

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**To** Environmental Protection Agency (EPA) – Ghana  
**Attn** Ms Andriana Nelson  
**From** The Netherlands Commission for Environmental Assessment (the NCEA)  
**Date** 28 January 2016  
**Subject** **Review Scoping Report for an EIA for a Coal Fired Power Plant in Ghana**

By: the Secretariat of the Netherlands Commission for Environmental Assessment – Mr Sjoerd Harkema and Ms Ineke Steinhauer, with expert input from Mr Hubert Stassen

Advice 2016-02

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# Introduction

The Ghanaian government intends to develop a 700MWe Super Critical Coal Power Project following the initiative by Shenzen Energy (China) and by the Ghanaian Volta River Authority (further the proponents). The proponents contracted a consortium of consultants who prepared and submitted a scoping report for review by the Environmental Protection Agency (EPA). The latter has requested the Netherlands Commission for Environmental Assessment (NCEA) to assist in the reviewing this scoping report and the subsequent Environmental Impact Statement (EIS)<sup>1</sup>. The NCEA inputs will be used by the review team of the EPA that will collate all comments and finalize them for the proponents.

The NCEA performed a short desk review of the scoping report for this purpose. Which is a so-called NCEA 'Advice of the secretariat'. It has been prepared by technical secretaries of the NCEA, with input provided by an external expert. The external expert engaged is Mr Hubert E. Stassen (expert in thermal energy conversion technologies).

The NCEA does not express an opinion on the project itself, but focuses on the quality and completeness of the scoping report. In the case of shortcomings, recommendations are given for supplementary information needed to include in the scoping report<sup>2</sup>.

Given the short time available to produce a report, and the existing budgetary limitations, it has not been possible to produce a tailor made report which takes the local situation and the specific design fully into consideration. Therefore the NCEA's review has not included the following elements:

- a visit to the proposed site of the plant;
- consultation with the EPA, Volta River Authority, Ministry of Energy Affairs and other stakeholders;
- analysis of obligations under: legislation of Ghana, national and international treaties;
- environmental and social baseline and site specific information. The NCEA has therefore not been able to check whether the site-selection process was properly done from an environmental and social point of view.

The NCEA trusts that these elements will be properly addressed by the EPA review team.

Given the above mentioned limitations, the NCEA chose to focus in this review on the proposed technology choices 1) in light of Ghana's energy and climate policies and 2) given the wide availability of cleaner technology to produce electricity.

In the next three chapters the NCEA discusses the proposed scoping report. In chapter one the place of the proposed coal plant in the Ghana energy-system is discussed. Chapter two elaborates on technology alternatives for coal fired power plants, emissions and mitigation. Chapter three addresses briefly a number of other subjects namely environmental effects associated with 1) marine life (cooling water and the construction of a new shipping lane), 2) the fly ash yard 3) the sulfur content of the coal to be used and 4) social impacts.

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<sup>1</sup> In this advisory report the abbreviation EIS stands for the environmental impact assessment (EIA) and the environmental impact statement (EIS).

<sup>2</sup> For an overview of the documents that can be used as a reference framework, see annex 1.

# 1. Place in the Ghana energy–system

## Ghana energy and climate policy

The NCEA advises to describe the Ghana energy and climate goals as an addition to the scoping report, thus forming a good starting point for the EIS. This description offers a context to evaluate new proposals for electricity generation.

The scoping report mentions that this plant is one of the first steps on the road to Carbon Capture and Storage (CCS) and zero emission of CO<sub>2</sub>. However CCS is not part of the proposed content of the EIS. The NCEA advises to clarify this in the EIS. If CCS is indeed a realistic option for the proponents and the site characteristics, the NCEA advises to fully include this technology in the EIS (environmental effects of capture, transport and storage facility).

## Ghana electricity generation and power grid

To evaluate a power plant of this magnitude, insight in the national power grid, current electricity generation and power demands is vital, following experiences of the NCEA.

For this insight a general outlook on the desired future of the Ghanaian power grid and what place coal fired plants should have in this future is needed. Therefore the NCEA recommends to include in the EIS a summary of the Ghanaian energy system. Explain in this summary:

- the place of the Volta river dam in the Ghana power grid. In case the Volta dam can supply insufficient power – because of increasing power demand and low water levels – the new plant will function as a back-up facility. Argue whether there is a demand for a flexible or for a baseload power plant as an addition to the baseload supplied by the dam;
- the expected increase in electricity demands and the capacity characteristics of the present and future grid;
- to what extent the proposed coal plant has the flexibility to cope with the load fluctuations that are stated to occur in the grid. In general coal plants are used in baseload and not for fluctuating load situations. The feasibility of a coal fired plant should be assessed in this light;
- the opportunities for gas fired power plants.<sup>3</sup> Gas turbines with combined cycle offer a flexible high efficiency electricity production option with lower CO<sub>2</sub>-emissions per MWh. Gas prices are presently low and due to technical and political factors are expected to stay low at least this decennium.<sup>4</sup>

As the next step the EIS should provide a short comparison of possible futures of the Ghana power grid. Include in this comparison the two most obvious scenario's, i.e. a scenario with the proposed coal plant and a scenario with a gas fired power plant. Compare these scenario's in terms of 1) stability of power supply, 2) CO<sub>2</sub>-emissions per MWh and 3) their contribution to energy and climate policy goals of Ghana (see above).

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<sup>3</sup> The scoping report (p.32/p33) mentions (coal) gas fired plants as an alternative but states these plants are not suitable because load fluctuations. The arguments for this statement are unclear to the NCEA. In general gasification plants are better able to cope with load fluctuations than combustion plants.

<sup>4</sup> Fossil fuel price projections 2015, Department of Energy and Climate Change (UK), 18 November 2015.

It might prove valuable to include in the above outlook 1) other types of electricity production technology or variants on the mentioned coal or gas fired technologies (see also chapter two of this advice) or 2) use additional criteria in the comparison (for example human health, social impact etc.). The NCEA leaves this to the judgement of the EPA.

## 2. Technology alternatives, emissions and mitigation

### Technology alternatives coal plant

The scoping report offers a good insight in the proposed technology choices, namely a supercritical pulverized coal-fired power plant of 2 x 350 MWe output is proposed. This technology is characterized by a lower electric efficiency than the ultra-supercritical technology, that is also referred to in the scoping report. Although the latter is generally employed in somewhat larger units, the proposed plant produces for the same power output (much) more CO<sub>2</sub> than a comparable ultra- supercritical plant.

Since the adoption of the new climate goals at the recent Paris Climate Conference cost consideration is no longer the decisive factor in technology choice that it used to be. The NCEA therefore recommends that the EIS report compares MWh production for both technologies on basis of a detailed analysis of capital and operational costs. Another option to decrease the CO<sub>2</sub> emissions of the plant is the co-firing of biofuels / bio wastes<sup>5</sup>. The EIS report should pay attention to and evaluate these possibilities. Discuss these on basis of availability of local biomass (for example agricultural byproducts) and practical experiences in comparable plants elsewhere. The scoping report also mentions the possibility of a coal gasification plant. The EIS should elaborate on the arguments for dismissal of this high-efficiency option.

The NCEA advises to compare the biomass co-firing possibilities and the different characteristics of the emissions and residues from gasification and combustion in the EIS. Goal of this comparison is to give an insight in the environmental and social consequences<sup>6</sup> that are associated with the technology choices and the feasibility.

The comparison should be based on net overall efficiencies taking into account fuel transport, handling and preparation.<sup>7</sup> Costs of electricity per MWh of the technologies should be calculated for 100 % and for 70 % of full capacity. Present detailed mass and energy balances of all systems / technologies that were compared and/or evaluated to support the described environmental and social consequences and their feasibility.

### Emissions

The scoping report indicates that the impacts in the construction and operational phase will be described in the EIS. No detailed information is presented regarding the exact parameters that will be judged and the data that will be gathered and evaluated.

It is nevertheless important that the EIS presents detailed and as much as possible

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<sup>5</sup> Co-firing of biofuels / bio wastes is a common technique to reduce carbon emissions around the world.

<sup>6</sup> The local economy might benefit by use of agricultural byproducts in terms of revenues and employment.

<sup>7</sup> See also chapter three of this report with regard to sulfur content of coal fuel.

quantitative data on all i.e. concentrations (mg/Nm<sup>3</sup>) and absolute amounts (tonnes/year) of all mayor emissions to the air (SO<sub>x</sub>, NO<sub>x</sub>, particulates, F, Cl, HCl, CO, CO<sub>2</sub>) as produced in full load operation by the proposed activity and the identified alternatives. Prove that resultant concentrations comply with local Ghanaian standards and World Bank thresholds<sup>8</sup>, and show which further improvements are possible with mitigation (see below).

With these data it is possible to identify and elaborate upon health and environmental consequences.

### **Mitigation**

In chapter 8 of the scoping report impact mitigation is described. The NCEA sees some promising opportunities for further mitigation of emissions to the air of SO<sub>x</sub>, NO<sub>x</sub> and advises to include these in the EIS (see below). Describe for all mitigation options (also for mitigation options of particulates) resultant concentrations and annual output in tonnes/year at full load conditions. This information enables balanced technological choices based on health and environmental concerns and practical considerations.

#### *Desulfurization of Flue Gas*

The scoping report proposes a Sea Water Flue Gas Desulfurization system of 86 % efficiency. This efficiency is rather low. Wet or dry limestone desulfurization techniques show sulfur removal efficiencies over 95 %. This would largely prevent aerial pollution by SO<sub>x</sub> and resultant human health deterioration as well as acidification of habitats. The NCEA advises therefore to include these other techniques in the assessment and comparison.

#### *Denitrification of Flue Gas*

The scoping report proposes low NO<sub>x</sub> burners. There are common more effective techniques available, namely SNCR (selective non-catalytic reduction) and SCR (selective catalytic reduction). NO<sub>x</sub> emissions affect human health (also at low concentration levels below thresholds) and affect habitats through acidification and nitrification. The NCEA advises to include these techniques in the EIS and demonstrate to what extent further emission reduction is reasonable. The World bank<sup>8</sup> also advises to research ecosystems and estimate damages to vegetation by NO<sub>x</sub>, the NCEA supports this approach.

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<sup>8</sup> IFC Environmental, Health, and Safety Guidelines for Thermal Power Plants of 2008.

### 3. Other

#### Marine life

The scoping report and the addendum stress the importance of the selected locations for marine species (among others turtles and migrating whales) as well as for local fishery.

The proposed plant may affect the marine life in several ways:

- dredging and construction works of a shipping route<sup>9</sup> and harbor facilities will result in destructions of habitats, dispersion of sediments<sup>10</sup>, and disturbance of nature values, among others through (underwater) noise;
- shipping (for example disturbance, oil spills or pollution associated with collision risks);
- intake of cooling water will lead to fish killing associated with this intake; and to effects on the marine environment associated with cooling water contaminants and temperature rises.

Because of lack of local knowledge the NCEA does not provide an in-depth advice on these issues and leaves this to the judgement of the EPA.

Nevertheless the NCEA advises – in addition to the scoping report – to assess ways to mitigate negative effects associated with the above. For example:

- avoid working in seasons and at times that the damage to species and eco-systems is largest;
- present an optimal designed cooling water system to prevent fish intake and avoid high water temperatures;
- assess alternatives for the dispersion of dredged sediments:
  - disposal techniques which cause less dispersion offshore and/or;
  - site comparison to select an optimal site for dispersion and/or ;
  - alternatives in which the sediment is used elsewhere as a natural resource / building material and dispersion is unnecessary.

#### Fly ash yard

The scoping report offers little detail for the design and operation of the fly ash yard and is optimistic on sustainable management of the waste ashes (re-use of ashes in construction industry) and reversal of effects (changing the yard back to farmland). Because of this lack of information it is difficult for the NCEA to give detailed advice.

Ash yards can be associated with large risks of heavy metal pollution of ground(water) and surrounding lands (aerial dispersion). This poses risk for population health, agriculture and ecosystems. A proper design of the facility can reduce these risks. In general the EIS report should therefore present detailed analyses of the different compounds (heavy metals, etc.) that may be present in the (fly) ashes, identify the dangers they present to health and

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<sup>9</sup> Bathymetry and hydrodynamic flow: Actual and future (with project) erosion and sedimentation patterns in the project area should be assessed on the nearby coastal stability and present nature values. Given the importance of this issue, a modelling exercise in coming to conclusions on expected changes in the physical system as a result of project implementation could be recommendable (not only on erosion and sedimentation, but also waves and currents).

<sup>10</sup> Insight in the quality of the sediment is relevant to assess possible consequences of re-suspension and dispersal of the sediments on the water quality, and ultimately the biotic environment. Probably pollution is no issue here, but just to be sure, the EIS could provide this information.

environment and suggest ways to mitigate / overcome those. Describe costs associated with the operations of the yard, especially for an adequate monitoring system.

#### **Sulfur content coal**

The scoping report states that the proposed coal fuel will have a low sulfur content. It is unclear for the NCEA whether coal fuel with a higher sulfur content (close by available and at lower cost) might be used in this facility. If so it is important in the EIS to describe the worst-case environmental consequences of the fuel type and additional ways to mitigate SO<sub>x</sub> emissions.

#### **Social impacts**

The scoping report mentions assessment of the baseline economic situation in the EIS. As an addition it seems relevant to present an indication of the number and type of jobs for Ghanaian workers that will be created in the local community, on a national level and internationally.

The scoping report stresses the importance of assessment of effects on local fishery. Nevertheless no detailed information is presented regarding the exact parameters that will be judged and the data that will be gathered and evaluated.

The NCEA advises to present detailed and as much as possible quantitative data in the EIS to illustrate above social impacts.

# Annex 1: Overview of documents as reference framework

For a reference framework for EIA for coal plants below documents can be used:

- the IFC Environmental, Health, and Safety Guidelines for Thermal Power Plants of 2008;
- sector specific guidelines notably the Ghanaian EIA sector guidelines for energy projects (2008);
- the EIA Guidance for Coal Fired Power Plants in Pakistan (2014)<sup>11</sup>.

In this advice the NCEA used experiences from similar projects, notably recent EIA reports for coal fired power plants in The Netherlands and elsewhere.

## Authors

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<sup>11</sup> <http://niap.pk/docs/publications/NIAP%20-%20Coal%20Fired%20Power%20Plants.pdf>