



06 September 2013

Dear CDM Registration Team,

Reference: Review raised for the Request for Registration for the project activity "Golden Sugar 30 MW High Energy Efficient Combined Heat and Power (CHP) System in Apapa, Lagos, Nigeria" – UNFCCC Ref No. 9438

Carbon Check acknowledges the review questions and hereby presents demonstrating evidence of our qualified opinion and justification for all review issues raised. As part of our response, the validation report has been appropriately revised. The PDD, emission reduction spreadsheet and associated investment analysis spreadsheet remain unchanged.

1) The DOE shall further validate the suitability of input values used in the investment comparison analysis, in particular,

Issue 1:

a) The revenue gained from electricity and steam supplied by the project activity to the Greenfield industrial customer. In doing so, the DOE shall justify the price claimed for the electricity and steam given that the owner of the project activity (Golden Sugar) is also the owner of the Greenfield industrial customer as confirmed in the applicability conditions of the methodology;

DOE response:

Carbon Check understands that the issue raised is twofold:

1. Appropriateness of the consideration of price for the electricity and steam as revenue
2. Appropriateness of the considered value for the electricity and steam price.

In response we would first like to reiterate the definition of a Greenfield Industrial Customer as per the applied methodology:

"Greenfield Industrial Consumer: A Greenfield industrial facility which is collocated with the Greenfield project facility and which consumes all the heat/steam and all/part of the electricity produced by the project facility."

As confirmed in the assessment of applicability criteria, Carbon Check hereby reconfirm that the subject project activity fully complies with the all applicability criteria of the applied methodology.

We acknowledge the concern raised on the consideration of price claimed for the electricity and steam given the fact that the owner of the project activity (Golden Sugar) is also the owner of the Greenfield Industrial Customer. We assert that even in situations where the owner of the energy supply equipment is also the owner of the energy consuming facility, there will always be a need to ascribe values for the inputs (in this case, steam and electricity) to establish the financial performance of the investment.

The Project Participant has opted for the use of an investment comparison analysis to quantify the relative financial performance of the project plant compared to the reference plant option. Accordingly, returns from the project plant and two reference plant scenarios have been calculated. Revenues from the supply of electricity and steam to the Greenfield Industrial Customer have been considered in the financial model because the sugar refinery (Greenfield Industrial Customer) and the power plant operations (including steam generation) operate under different cost centres. This was validated and cross checked through the review of



the Budget monitoring sheet for the month of July 2012/11¹/. Hence the Validation team confirms that consideration of revenue (gained from electricity and steam supplied by the project activity to the Greenfield Industrial Customer) in the financial model is an acceptable and accurate approach. During course of validation, it was further assessed by the validation team that the revenue for the steam and electricity supplied to the Greenfield Industrial Consumer has been considered in the investment analysis for both the reference plant scenarios as well as the project plant. Hence the PP adopted a unified approach in the investment comparison analysis and therefore found acceptable to the validation team.

The price of electricity supplied to the Greenfield Industrial Consumer has been taken from the Multi Year Tariff Order (MYTO) /59/, which is the guiding principle recommended by the Nigerian Electricity Regulatory Commission. The steam price however has been estimated using the standard thermodynamic principles /B18/, /79/ usually utilized for steam valuation for a standalone boiler. For this, the PP has used an internationally accepted valuation method (recommended by the US Department of Energy (USDOE)). The price of steam supplied to the Greenfield Industrial Consumer from the Reference Plant has followed this approach. The price of steam supplied to the Greenfield Industrial Consumer from the project CHP plant was estimated from this standalone boiler steam price, taking into consideration the difference in energy efficiencies of the Reference Plant compared to the CHP plant. The DOE validated the methods used in the valuation of the steam from both the Reference Plant and the CHP plant (project) and confirmed that these revenues have been correctly and conservatively considered in the financial model utilized in the investment analysis of the project and the reference scenarios considered.

¹ Note: the reference /XX/ provided throughout the response letter corresponds to the references stated in the revised validation report. These evidences have been validated and cross checked (where applicable) by the validation team and listed in the reference list of Validation Report.



The appropriateness of the applied value of steam and electricity is assessed below:

Input parameter	Value used	Assessment
Cost of electricity supplied to Greenfield Industrial customer	15.8 Naira/KWh	<p>This rate has been Taken from Multi Year Tariff Order (MYTO) /59/ for the period July 2008 to June 2013. This was available to the PP at the time of investment comparison. The DOE confirms that the price remains unchanged if the Greenfield Industrial Customer would have drawn power from the Nigerian Grid.</p> <p>The prices fixed in the Multi Year Tariff Order (MYTO) /59/ is issued by the Nigerian Electricity Regulatory Commission. The Nigerian Electricity Regulatory Commission has fixed the tariff of 15.2 Naira/KWh for the year 2011 and 15.8 Naira/KWh for the year 2012.</p> <p>Hence the price is in line with the market price supplied by Nigerian Power companies. The rate considered for the cost of electricity is the same for the Project plant and Reference plant and the same is considered to be an appropriate assumption by the Validation team.</p>
Cost of steam supplied to Greenfield Industrial Customer	13.01 US\$/tonne of Steam for the year 2013 for the project CHP plant	<p>The price (cost) of steam supplied from a stand-alone boiler was estimated using the following equation:</p> $C_G = a_f \times \Delta H / 1000 / \eta_B$ <p>a_f = fuel cost, (\$/MMBtu) (i.e. natural gas price)</p> <p>ΔH = Enthalpy of steam, Btu/lb - Enthalpy of boiler feed-water, Btu/lb</p> <p>η_B = Efficiency of reference Boiler</p> <p>The price (cost) of steam supplied to Greenfield Industrial Customer from the Project CHP plant is determined by the following equation:</p> $P_{S\text{CHP}} = (R_{P_{\text{eff}}} / \text{CHP}_{\text{eff}}) * P_{\text{SRP}}$ <p>Where:</p> <p>$P_{\text{S\text{CHP}}}$ = Price of steam produced in the CHP and supplied to the Greenfield (US\$/tonne of steam)</p>



		<p>RP_{eff} = Reference Plant (boiler and Power Plant) combined energy efficiency (%)</p> <p>CHP_{eff} = CHP energy efficiency (%)</p> <p>P_{SRP} = Price of Steam produced in the Reference Boiler</p> <p>The DOE validation checked the applicability of the above equation and cross checked it with spread-sheet and found the value of 13.01 US\$/tonne of Steam for the year 2013.</p> <p>The basic relationship between the price of steam produced in a stand-alone boiler and a CHP is that the higher efficiency of the CHP, the unit price of steam is lower as result.</p> <p>The price of steam has been escalated in the financial model on the basis of the Annual Average increase in Natural Gas Prices, which is deemed to be correct and an accurate assumption.</p> <p>The Validation team confirms that the approach of the calculation of steam price for the Project CHP plant and Reference plant boiler is correct /appropriate and hence acceptable.</p>
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Carbon Check hereby submits a revised validation report that transparently reflects the assessment above.



Issue 2:

b) The electricity purchasing price paid by the project customer (22Naira/KWh) given that

i) the data source (power purchase agreement, 01/08/2011) was not available at the time of the project start date (12/07/2011)²;

ii) the DOE has not justified the ownership relation between the project owner (Golden Sugar) and the project customer (Flour Mills Nigeria) and whether or not the price should be considered as an internal price;

DOE response:

Carbon Check understands that the review issue encompasses two components:

1. Suitability of electricity price at the time of project start date and
2. The relationship between the generator of the electricity i.e. PP (Golden Sugar) and project customer i.e. Flour Mill Nigeria PLC (FMNPLC).

Carbon Check would like to start by responding to the second issue. During the course of validation, in order to assess whether the price of electricity should be considered as an internal price or not, the validation team reviewed documents and interviewed personnel to determine the legal and financial aspect of these two companies (PP (Golden Sugar) and project customer (Flour Mill Nigeria PLC).

At first, the validation team confirmed that both the companies are separate legal entities and registered as separate companies under the Nigerian Laws and this was determined by reviewing their respective registration documents with Corporate Affairs Commission /76/,/77/,/78/. Thus the validation confirms that both companies are legally independent entities.

The validation team further investigated the relationship between the two companies and found that the Project customer (Flour Mills of Nigeria PLC) and the Project owner (Golden Sugar Company Limited) is a wholly owned subsidiary of Flour Mills of Nigeria PLC. Upon discover of the above relationship the validation team further cross checked the Board member lists /76/,/78/ for each company and found that each Board is composed of different members, thereby indicating that each company independently seeks their own profit.

Based on the above assessment, the validation team came to the conclusion that these two companies are different legal entities and the price of electricity therefore cannot be considered as internal.

The revised validation report submitted fully reflects the assessment conducted during validation. The following supportive evidences utilised during assessment have also been referenced:

- /76/ Details Of Directors for GSCL dated 26/01/2011 (Refer to section 2.1 of the revised Validation Report)
- /77/ Registration certificate of FMNPLC and Details of Directors for FMNPLC dated 27/11/1990 and 12/03/2013(Refer section 2.1 of the revised Validation Report)
- /78/ Declaration of GSCL on its relationship with FMNPLC dated 14/08/2013 (Refer to section 2.1 of the revised Validation Report)

² Project start date as specified in PDD and Validation Report is 19/07/2011



Furthermore, regarding the appropriateness of the electricity price (Issue 1), Carbon Check confirms that the tariff in the Power Purchase Agreement (PPA) between Golden Sugar Company Limited (GSCL) and Flour Mills of Nigeria PLC (FMNPLC) was agreed upon between the two companies in June 2011, prior to the signing of the PPA. In the process of negotiating and finalizing the PPA, GSCL agreed to sell, and FMNPLC agreed to buy, 13000MWH /month at the price of 22Naira/unit. GSCL's intent to sign the PPA under these pre-negotiated terms was documented in a Letter of Intent (LOI) dated 27th June 2011 /75/. The LOI stated that a formal agreement would be signed within six months. A legal Power Purchase Agreement was signed between GSCL and FMNPLC/35/ and /54/ dated 01/08/2011.

The validation team therefore confirms that the price of electricity was available to the PP, as evidenced in the Letter of intent (LOI) dated 27th June 2011 /75/, at the time of the project start date (19/07/2011).

Based on the above explanatory justification and reference to supporting evidences Carbon Check believe that review issue raised is adequately addressed.

Issue 3:

c) The capital cost assumed for the project activity considering it is not clear what the source of capital cost for items other than the turbine generator sets is, and how the remaining capital investment has been crosschecked;

DOE response:

The project cost includes the following components:

Plant-1 (28,067,830 USD). The DOE validation team validated this cost by reviewing an offer letter/29/ issued by Star Trading Company and Power Plant Budget Sheet /30/. The above offer was for all major equipment required for the plant, i.e.:

- ✓ Gas Turbine set (1set)
- ✓ Fuel gas compressor package(4 set)
- ✓ 11KV Switchgear (56 sets)
- ✓ 33KV Switch gear (4 sets)
- ✓ Natural Gas heat Recovery Steam generator Plant. (1set)

Plant-2 (22,311,374 USD). The DOE validation team validated this cost by reviewing an offer letter/29/ issued by Star Trading Company and Power Plant Budget Sheet /30/. The above offer was for all major equipment required for the plant, i.e.:

- ✓ Gas Turbine set (1set)
- ✓ Fuel gas compressor package(4 set)
- ✓ Natural Gas heat Recovery Steam generator Plant. (1set)

The combined cost of Plant 1 and 2 (as detailed above) is 50,379,000 USD, which is 91% of the total Capital Cost .

The other (remaining) costs included in CAPEX is 755,837,000 NGN = 4,877,000 USD (Calculated @155NGN/USD). The verified /30/ break-down of this cost is detailed in the table below:



Component	Cost(in NGN)
Transportation and Import duty /30/	379,156,000
Foundation and Civil work /30/	91,776,000
Installation and Commissioning /30/	284,905,000
Total	755,837,000

The DOE cross checked the above breakdown with the Power Plant Budget Sheet /30/.

The costs considered in the financial indicator include the major costs of equipment for both Plants, for which the Proforma invoices were presented for cross checking by the validation team. Since these documents were available at the time of decision making, the DOE validation team confirms that the value conforms to Guidance 6 of Annex 5, EB 62 /B05 /. The total cost of project was further validated as per Golden Sugar Board Note /16/,/37/,/41/ dated 22/11/2012 and amended Capex approval dates.

Carbon check therefore confirms that its assessment of the project cost encompassed the entire project cost as detailed above. The revised Validation Report transparently reflects this assessment.

Issue 4:

d) All other input values used to calculate the IRR of the reference plant given that it is not clear when the data source were available and how the input values were crosschecked.

PP response:

The following is a clarification in response to issue 1d in the UNFCCC review of the registration request for the project.

- The investment decision taken by the project proponent was based on market conditions that were applicable at the time of the project start date. At the time, the methodology for developing the project was still under development. Therefore, the specific methodological procedures for *demonstrating what the market conditions were* at the time of project start were not formally approved. One critical aspect of the methodology was the sources from which reference plant cohorts could be selected. The approved methodology differed considerably on this point compared to the proposal originally put forward by its authors.
- The methodology applied for this CDM project – AM0102 – was approved in February 2012 and became valid in March of 2012. Prior to approval of the methodology it was not possible to define what sources of data would be acceptable to the UN for documenting and cross checking Reference Plant data. The procedure for determining the characteristics of the Reference Plant were uncertain (awaiting approval). The PP utilized market conditions current at the time as a basis for the investment decision.
- Soon after the approval of the methodology, the team developing the CDM component of this project began to gather data, in accordance with the methodology, that would be used as input for determining the characteristics of the Reference Plant and calculating its IRR.
- As the first step in this process a survey was conducted, aimed at documenting the market conditions under which the investment decision was made, in accordance with the requirements in the



methodology. This survey targeted existing industrial facilities in the food sector in Nigeria that were operating relevant power plant technologies at the time of the project start date. This survey was initially carried out by telephone and followed up with email exchanges requesting documentation confirming the data collected by telephone.

- The initial survey carried out in Nigeria led to the following conclusions:
 - First, we were unable to identify a sufficient number of companies employing CHP technologies. This is due to the fact that CHP is relatively new to the food sector in Nigeria. We therefore expanded the survey to cover the common stand-alone boilers and turbines utilized in the Nigerian food industries. By doing so we were able to identify the minimum number of 5 power facilities in Nigeria, for relevant stand-alone boilers appropriate for the Reference Boiler determination. However, only 2 appropriate boilers were identified in Nigeria. We therefore expanded the survey to the food sector in Ghana.
 - Second, while the professional network of the CEO of Golden Sugar was sufficient to open the CEOs of other key food-sector companies to share information informally, our requests for data were met with scepticism and suspicion. A number of key oral sources of data were not willing to provide official written responses to our requests. This problem persisted well into the project development process, creating a situation where important inputs to the IRR analysis for the reference boiler could not be substantiated in a way that would enable the DOE to verify our assumptions.
- In the very late stages of validation this problem was resolved by turning to European technology suppliers to source CAPEX and OPEX data for the equipment – considering the time frame of the start date of the project – as input to the Reference Plant IRR calculation, and the original IRR calculations based on earlier informal sources of data were adjusted to reflect the data received. The data provided and subsequently used in the update of the Reference Plant IRR calculation was valid at the time of the investment decision, in accordance with the EB 62 Report, Annex 5 paragraph 6, which states that "Input values used in all investment analysis should be valid and applicable at the time of the investment decision taken by the project participant."
- An extensive collection of survey responses, email exchanges with Nigerian companies and email exchanges with technology providers were supplied to the DOE as evidence that the assumptions made in the IRR calculation for the Reference Plant were justifiable, valid at the time of the investment decision, and traceable to reputable third-party sources.

DOE response:

During the course of validation, the team considered and cross-checked all input parameters for the reference plant and also ascertained compliance with guidance 6 of investment analysis guidelines, annex 05, EB 62 (refer to the table below for a detailed assessment). As explained in the PP response above, the validation team confirms that the PP while conducting the survey for the reference plant (as per the procedure contained in the approved methodology) /11/, /60/ and inviting quotation/61/, /62/ for the reference plant, had ensured that all input parameters remained valid for the period of start date (i.e 19/07/2011, which is also the date of final investment decision as clarified in CAR-08 in the Validation Report) of the project activity and hence complying with the requirements of guidance 6 of annex 05, EB 62. The validation team therefore confirms that all input values used in all investment analysis are valid and applicable at the time of the investment decision taken by the project participant.

Please refer to the assessment below for each cross check method utilised by the validation team for the input parameters of the Reference plant:



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Input parameter	Value used with unit	Cross check method
Capacity of a Single GEJ 620 Chosen as a Reference Power Plant	3,039 KW	The Reference Plant data has been crosschecked through a compiled documents developed by GSLC on the bases of the email interactions _{/60/} and indicative costs quoted by the Clarks energy _{/62/}
Minimum Numbers of GEJ 620 estimated to implement the P1: Full design capacity P2: 50% of Design Capacity	P1: 10 units of 3.039 MW turbines P2: 05 units of 3.039 MW turbines	The Project has identified two baseline scenarios P1 and P2. P1 - 100% of Full design capacity is installed and commissioned - Since the plant capacity is 30MW, ten(10) units of GE 620 are appropriate P2- 50% of Design capacity i.e. 05 units of GE 620 are appropriate The numbers chosen have been cross checked with Reference Plant data _{11/60/}
Capacity of a Single Boiler Chosen as a Reference Boiler	16 T/Hr	The data has been _{11/60/} validated through the Reference Plant data _{/11/} by GSLC
Minimum Numbers of reference boiler	06	The numbers are in line with the steam requirement of Greenfield customer of 80-110/Hr. The data has been validated through the Reference Plant data _{/11/}
Specific CAPEX of GEJ 620 Power Plant	596.05 US\$/KW	The value used was crosschecked from the indicative costs quoted by the Clarks energy _{/62/} for a single GEJ 620 E series Power plant. Cost is arrived by dividing the plant cost (1.811Million USD) by 3039KW.
Specific CAPEX Of LOOS 1 Germany Boiler with Economizer	845.92 Thousand US\$ ≈ € 664,045.93	The Capex value comprises of a. Cost of Boiler (€) 489,045 b. Installation Cost (€) 50,000. c. Commissioning Cost (€) 12,000. d. Boiler Building (€) 113,000. The above value was crosschecked with the indicative cost quoted by Bosch & email communication _{/61/}
Non Fuel O & M Cost for the Reference Power Plant	0.008 US\$/KWh	The value used was crosschecked from the indicative costs quoted by the Clarks energy _{/62/} for a single GEJ 620 E series Power plant and compiled in the Reference Plant data _{/11/}
Non Fuel O & M Cost for the Reference Boiler	0.0891 US\$/Tonne of Steam	The value has been cross checked from the email communication received from Nestle _{/60/} and compiled in The Reference Plant data _{/11/}



Energy Efficiency of Reference Power Plant	38%	The value used was crosschecked from the indicative costs quoted by the Clarks energy/ ^{62/} for a single GEJ 620 E series Power plant and compiled in the Reference Plant data/ ^{11/}
Energy Efficiency of Reference Boiler	88%	The value has been cross checked from The Reference Plant data/ ^{11/} . The value chosen is for Boiler with Economiser for boilers manufactured by LOOS Germany.
Cost of Steam calculated for reference boiler	16.6541 US\$/tonne of Steam for the year 2013	<p>The price (cost) of steam for reference boiler has been calculated from the thermodynamic principles referred in US Department of Energy (USDOE), "How to Calculate the True Cost of Steam", A Best Services Steam Technical Brief,^{18/} /^{79/}</p> <p>Though cost of steam generation includes various running costs toward water and its treatment, Pumping, environmental costs etc. PP has considered the most dominant fuel cost for calculating the cost of steam.</p> <p>The equation</p> $C_G = a_F \times \Delta H / 1000 / \eta_B$ <p>a_F = fuel cost, (\$/MMBtu) (i.e. natural gas price)</p> <p>ΔH = Enthalpy of steam, Btu/lb - Enthalpy of boiler feed-water, Btu/lb</p> <p>η_B = Efficiency of reference Boiler</p> <p>DOE checked the applicability the above equation to cross check with spread-sheet and found value of 16.6541 US\$/tonne of Steam for the year 2013. The price of steam will escalate on the basis Annual Average increase in Natural Gas Prices.</p>
Cost of Electricity supplied to Project Customer	22 Naira/KWh & Maximum demand changes of 21600000 Naira/year	<p>The Project customer is Flour Mills of Nigeria PLC (FMNPLC) and Project owner Golden Sugar Company Limited (GSCL) is the wholly owned subsidiary of the above, however both are separate legal entities and registered as separate companies under the Nigerian Laws. This was validated by review of their respective registration documents with Corporate affairs Commission /^{76/} /^{77/} /^{78/}.</p> <p>In June 2011 GSCL agreed to sell 13000MWH /month at the price of 22Naira/unit to PLC. This intent was documented in a Letter of intent (LOI) dated 27th June 2011 /^{75/}. The LOI stated that a formal agreement will be signed up within six months. A legal Power Purchase agreement is signed between GSCL & FMNPLC/^{35/} & /^{54/} dated 01/08/2011.</p> <p>The price fixed in the LOI and subsequent agreement is higher than the prices fixed in the Multi-year Tariff order (MYTO) /^{59/}. issued by Nigerian Electricity regulatory commission. The commission has fixed tariff of 15.2 Naira/KWh for the year 2011 & 15.8 Naira/KWh for the year</p>



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		2012. Hence the tariff of 22 Naira/KWh as per power purchase agreement is higher than the rate fixed by the commission.
Cost of Electricity supplied to Greenfield customer	15.8 Naira/KWh	This rate has been taken from the Multi-Year Tariff Order (MYTO) /59/ for the period July 2008 to June 2013, which was available with PP at the time of Investment comparison. DOE confirms that the price is kept same if the Greenfield customer would have drawn power from the Nigerian Grid. The prices fixed in the Multi-year Tariff order (MYTO) /59/, issued by Nigerian Electricity regulatory commission. The commission has fixed tariff of 15.2 Naira/KWh for the year 2011 & 15.8 Naira/KWh for the year 2012. Hence the price is in line with the market price supplied by Nigerian Power companies.

The DOE validation team therefore confirms that it has assessed and cross checked all of the input parameters for the Reference plant and ascertained compliance with guidance 6 of annex 05, EB 62. Furthermore, the validation team has cross checked all input parameters for the Project plant and Reference plant in line with the requirements of VVS. The revised validation report has been submitted to fully reflect the assessment above.

We believe that the above response and revised documents adequately address the issues raised during the Request for Review. Carbon Check therefore requests that the project proceed to registration as a CDM project activity.

In case of any further query, the undersigned shall be responsible for answering and can be reached via the contact details provided below.

Kind regards

Vikash Singh

Technical Executive

Reference documents attached:

/01/ Revised Validation Report (clean)

/02/ Revised Validation Report (track change)