**PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
VERSION 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Efficiency Improvement by Boiler Rehabilitation in fossil fuel-fired (Natural Gas) Steam Boiler System
Version number of the PDD	1.0
Completion date of the PDD	23/09/2013
Project participant(s)	1. Al Jubail Fertilizer Company (Al Bayroni) 2. Saudi Basic Industries Corporation (SABIC)
Host Party(ies)	Kingdom of Saudi Arabia
Sectoral scope and selected methodology(ies)	*Approved baseline and monitoring methodology AM0056:* "Efficiency improvement by boiler replacement or rehabilitation and optional fuel switch in fossil fuel-fired steam boiler systems"
Estimated amount of annual average GHG emission reductions	41831 tCO2e/yr

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SECTION A. DESCRIPTION OF PROJECT ACTIVITY

A.1. Purpose and General Description of Project Actvity

Al Jubail Petrochemical Company (Al Bayroni) (Project Owner), an affiliate of the Saudi Basic Industries Corporation (SABIC) and joint venture with Taiwan Fertilizer Company (TFC) is in the business of manufacturing ammonia, urea, 2 Ethyl Hexanol and DOP. Al Bayroni operates three Mitsubishi designed and supplied package boilers to produce medium pressure steam at a name plate capacity of 129.25 MT/H rate, 39 BarG pressure and 399 degC temperature. The two boilers with tag nos. 2008-U and 2008-UA are in operation since 1983. The third boiler 2052-U has been in operation since 1995. The two boilers 2008-U and UA are designed to fire natural gas only as fuel. The third boiler 2052-U is designed to fire natural gas and waste liquid fuel and gases generated in process plant. All the three boilers were revamped in year 2005-2008 with low NOx burners to comply with local environmental regulations. The two boilers 2008-U and 2008-UA are designed with thermal efficiencies of 83 % on LHV. The third boiler 2052-U is designed with thermal efficiencies of 85 % on LHV. All three boilers have extendable life time with regular maintenance (i.e. planned turn around).

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The potential for energy savings and in turn reduction of GHG emissions have been evaluated through an independent study in 2007-2008 by M/S Mitsubishi, Japan. Based on the findings of the study, the following modifications have been proposed to realize energy and GHG savings at Package Boilers:

- New Economizer
- New modified super-heater
- Soot blower
- Associated modifications in convection ducts

The proposed modifications will reduce CO2 emissions by around 15% as a result of a proportionate lower fuel consumption (See baseline calculations).

The Project will contribute to sustainable development in the Jubail area as summarized below:

1. **No additional negative environmental impact**: The proposed modifications will not increase any negative effects on the local environment. Conversely the reduction in CO2 emissions will contribute to reducing GHG emissions.
2. **Job Creation**: Project will benefit local contractors whose participation will be required for the modification and commissioning phases only.

TABLE A.1 POTENTIAL GHG REDUCTIONS AND TRADEABLE VOLUMES

Daily CO2 Emission Reductions	114 tCO2e
Annual CO2 Reduction	41831 tCO2e
Reduction over 7 years	292820tCO2e
Reduction over 10 years	418315 tCO2e

A.2 Location of the project activity:

The proposed Boiler Rehabilitation Project will be carried out inside Al Bayroni, in Jubail Industrial City, Eastern Province, Kingdom of Saudi Arabia (49° 33′ 27.98″ E and 27° 3′ 54.64″ N)

A.2.1 Host Party(ies):

Kingdom of Saudi Arabia

A.2.2. Region/State/Province etc.:

Eastern Province

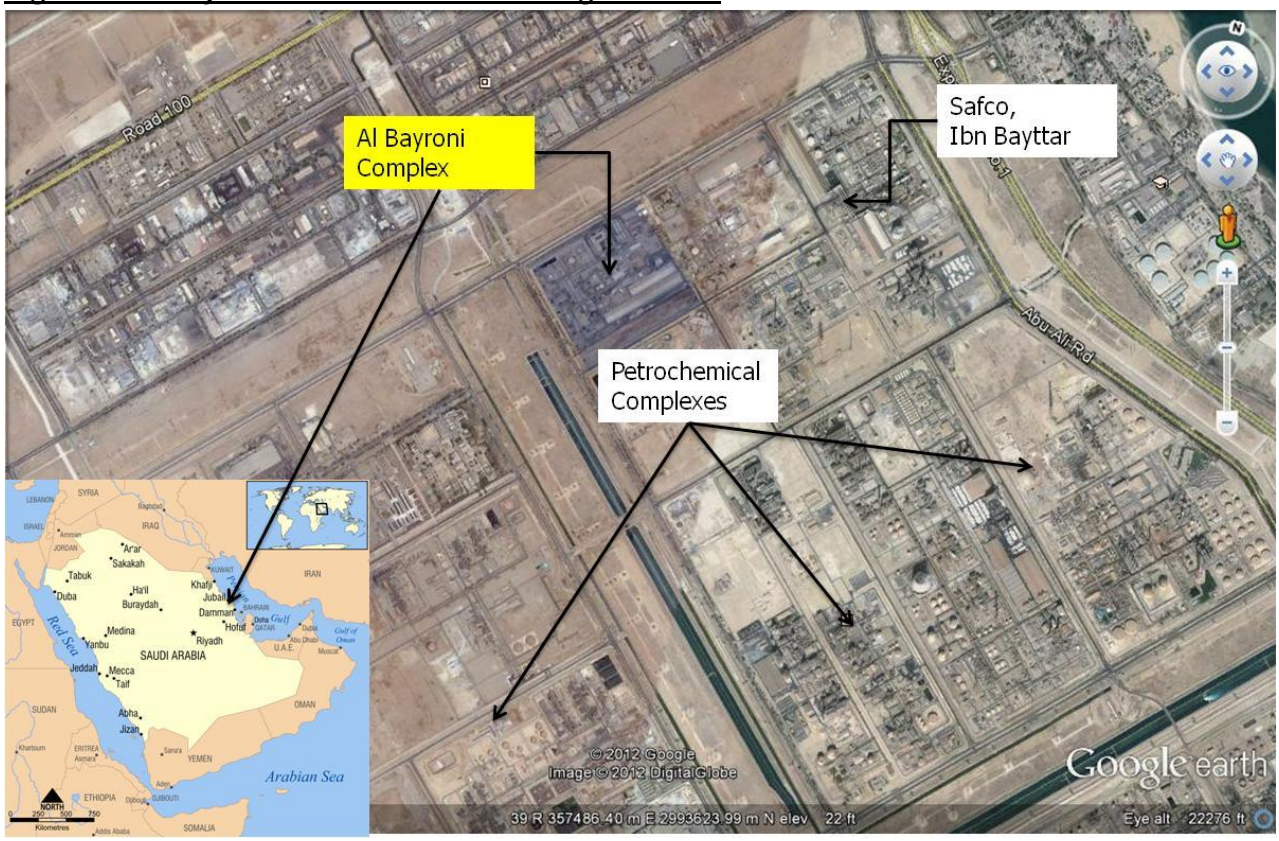
A.2.3 City/Town/Community etc.:

Jubail Industrial City

A.2.4 Physical/ Geographical Location

The Jubail Industrial City, is managed by the Royal Commission for Jubail and Yanbu and specifically caters to the Petroleum and Petrochemical Sector and associated support industries. SABIC operates 3 facilities in the fertilizer sector in Jubail, namely Safco, Al Bayroni and Ibn Bayttar. See figure A-1 below for a map showing the location where the proposed project will be carried out. The proposed rehabilitation project will be within the Bayroni Complex

Figure A-1: Project Location and Surrounding Land Use



A.3 Technologies and Measures

As already stated previously, Project Owner operates three Mitsubishi designed and supplied package boilers to produce medium pressure steam at a name plate capacity of 129.25 Tons/hr rate, 39 BarG pressure and 399 degC temperature.

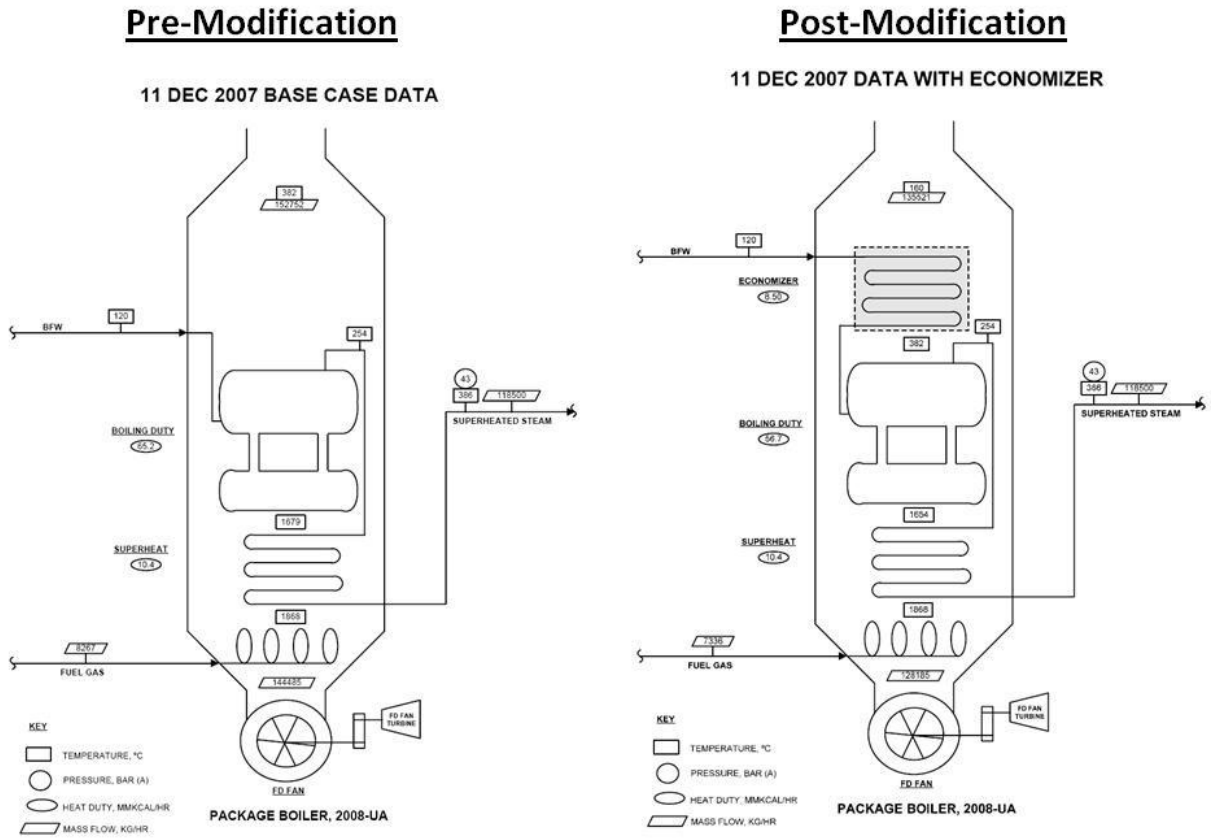
Two boilers with tag nos. 2008-U and 2008-UA have been in operation since 1983 and are designed to fire natural gas only as fuel while the third boiler 2052-U has been in operation since 1995 and designated to fire natural gas as well as waste liquid fuel and gases generated in the process plant.

All the three boilers were revamped in year 2005-2008 with low NOx burners to comply with local environmental regulations for NOX emissions. The two boilers 2008-U and 2008-UA are designed with thermal efficiencies of 83 % on LHV. The third boiler 2052-U is designed with thermal efficiencies of 85 % on LHV. All three boilers have extendable life time with regular maintenance (i.e. planned turn around).

The potential for energy savings and in turn reduction of GHG emissions have been evaluated through an independent study in 2007-2008 by Kellogg Brown Root (KBR). Based on the findings of the study, the following modifications have been proposed to realize energy and GHG savings at Package Boilers (see Figure A-2 below):

- Soot blower
- Superheater tube and header
- Economizer
- Soot blower valves
- Fuel, S/B, Economizer Piping, Fuel Valves
- Economizer Operation Floor

Figure A-2: Pre Modification and Post Modification Case



A.4. Project participants:

Name of Party involved (*) (host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Kingdom of Saudi Arabia (host)	Private: Al Jubail Fertilizer Company (Bayroni) a subsidiary of Saudi Basic Industries Corporation	No
Kingdom of Saudi Arabia	Private: Saudi Basic Industries Corporation (SABIC)	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.5. Public Funding of Project Activity

There is no source of public funding for the proposed Boiler Rehabilitation Project. It is expected that the Project Owner will recover costs incurred through sale of certified emission reduction credits.

SECTION B: Application of selected approved baseline and monitoring methodology

B.1. Reference Methodology

The Baseline and Monitoring method has been established for the proposed project following the approved methodology AM0056 / Version 01 "***Efficiency improvement by boiler replacement or rehabilitation and optional fuel switch in fossil fuel-fired steam boiler systems***".

B.2. Applicability of Methodology

The methodology is applicable as the following conditions are complied with:

- Steam generation in the project activity is carried out through the use of fossil fuel fired steam boiler(s);
- Saudi/local regulations do not require the replacement or retrofit of the existing equipment;
- There are no enforced Saudi/local regulations/standards on minimum efficiency ratings for the boiler(s) included in the project boundary;
- Saudi/local regulations/programmes do not constrain the facility from using the fossil fuel being used prior to fuel switching;
- Steam quality (i.e. pressure and temperature) is the same before and after the start of the implementation of the project activity;
- The existing steam generating system in the facility where the project activity is implemented may consist of more than one boiler;
- Only one type of fossil fuel is used in all boilers included in the project boundary;
- The owner of the boilers implement all rehabilitation/installation of the boilers included in the project boundary
- The project activity is limited to rehabilitation/installation of the boilers to improve efficiency and no fuel switching is undertaken within the project boundary

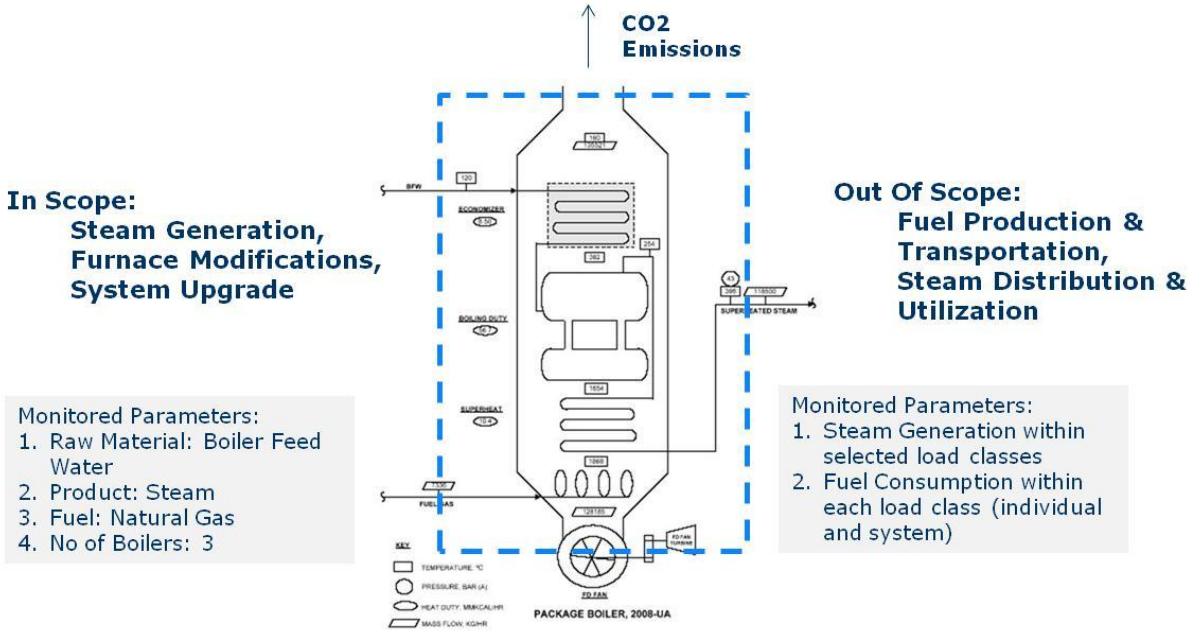
B.3 Project Boundary

The emission sources in the Baseline case are the emissions from fossil fuel combustion in the three boilers, using natural gas (of the same grade for all boilers). The same grade of natural gas would be used in the Project case for the back-up fuel oil boiler (See Figure B-1 below). Emission sources included in the baseline scenario and project activity are summarized in Table B-1 below.

TABLE B.1: EMISSION SOURCES INCLUDED IN OR EXCLUDED FROM PROJECT BOUNDARY

	Sources	Gas	Included	Justification/Explanation
Baseline	Fossil fuel consumption in the boilers	CO_2	YES	Main Source of GHG Emission
		CH_4	NO	Minor Source, Negligible
		N_2O	NO	Minor Source, Negligible
Project Activity	Fossil fuel consumption in the boilers	CO_2	YES	Main Source of GHG Emission
		CH_4	NO	Minor Source, Negligible
		N_2O	NO	Minor Source, Negligible

Figure B-1: Project Boundary following AM0056



B.4. Establishment and Description of Baseline Scenario

The version 04.0.0 of the "Combined tool to identify the baseline scenario and demonstrate additionality" has been used to identify the baseline scenario.

Step 1. Identification of alternative scenarios:

The alternative scenarios to the proposed boiler rehabilitation project that are considered are as described in Table B-2 below.

TABLE B-2: ALTERNATIVE SCENARIOS

Scenario	Description	Analysis
1	Boiler Rehabilitation being carried out without CDM	• Unlikely given the boiler can operate for atleast 15 years or longer with regular maintenance
2	No investment by Project Participants/ Source steam supply from third party	• Unlikely and not feasible given that Al Bayroni is an independent petrochemical complex with the boilers being an integral component of the process. Third party supply is not feasible
3	Continuation of current situation with no investment	• Favorable given the remaining lifetime of boiler of 15 years and which can be extended further with regular maintenance
4	Continuation of current situation with investment	• Not applicable as no investment in technology or design changes is required to maintain current situation.
5	Common Practice in Other Industries	• Boiler Rehabilitation of similar scales is undertaken in other regions. However cost savings from lower fuel consumption is a major incentive. No incentive from fuel savings as payback is not favorable (see Table B.4.b)

Scenario	Description	Analysis
6	Boiler Rehabilitation to be undertaken at a later stage because of regulations, end of life, financial aspects.	• No foreseeable regulations governing greenhouse gas emissions or cap in CO2 emissions from the regulator (i.e. Royal Commission) • Remaining life of the boiler is 15 years however this can be further extended through regular maintenance

Step 1(b). Consistency with mandatory laws and regulations – The environmental regulator in the Kingdom prescribing standards applicable to the project is the Royal Commission for Jubail and Yanbu (RCJY) in coordination with the Presidency of Meteorology Environment (PME). In all scenarios, compliance to applicable laws and regulations are achieved, namely the source emission standards prescribed for combustion products of NOX, SOX, Particulates and CO.

Step 2. Identify Barriers that would prevent the implementation of alternative scenarios

An analysis of investment and technology barriers is presented in Table B-3 below for the alternative scenarios to the proposed Boiler Rehabilitation project.

TABLE B.3: INVESTMENT AND TECHNOLOGY BARRIER ANALYSIS ON ALTERNATIVE SCENARIOS TO THE BOILER REHABILITATION PROJECT

Scenario	Description	Investment Barriers	Technology Barrier Analysis
1	Boiler Rehabilitation being carried out without CDM	Cost to company with significant investment in redesign, rehabilitation and EPC	Boiler rehabilitation parts and components to be sourced from outside the Kingdom
2	No investment by Project Participants/ Source Steam Supply from 3rd Party	Not feasible given the nature of operations	Not feasible given the nature of operations
3	Continuation of current situation with no investment	Favorable No Investment Required	Favorable No Technology change required
4	Continuation of current situation with investment	Not applicable (See Table B-2)	Not applicable (See Table B-2)
5	Common Practice in Other Industries	Implemented in other regions where fuel costs are significantly high. Requires investment in redesign, rehabilitation and EPC	Boiler rehabilitation parts and components generally sourced from EPC and Technology providers
6	Boiler Rehabilitation to be undertaken at a later stage because of regulations, end of life, financial aspects.	Not applicable (See Table B-2)	Not Applicable (See Table B-2)

From the above analysis it is evident that the favorable alternative is the continuation of the current situation as there are no investments required in technology upgrade, no violation of applicable regulations and standards and the boilers have sufficient life time which can be further extended with

regular maintenance. The proposed Boiler Rehabilitation project is therefore affected by the following barriers:

1. Investment Barriers: This is a cost to company given the following that there is no financial incentive or reasonable payback through fuel savings or increase in downstream urea production.
2. Technology Barriers: The project will require use of expertise from outside the Kingdom and sourcing components and EPC to undertake the project.

Step 2. Eliminate Alternative Scenarios prevented by the Barriers

As evident from Table B-2 above, the only alternative to the proposed project, is the continuation of the current situation with no investment. All other alternatives are presented by the investment and technological barriers presented in Table B-2. Hence continuation the current situation represents the baseline scenario.

Step 3. Investment Analysis

The economic and financial attractiveness for the two scenarios – namely Boiler Rehabilitation Vs Continuation of current situation is presented in Table B.4. (a) and (b) below. The internal rate of return (IRR) and NPV are presented in Table B.4 (b).

TABLE B.4 (a): INVESTMENT ANALYSIS: BOILER REHABILITATION VS CONTINUATION OF CURRENT SITUATION

Sl. No	Boiler Rehabilitation	Continuation of Current Situation with No Investment
Asset Lifetime	Minimum 15 Years (extendable) (Post Implementation)	15 years (extendable)
Investment (US$)	13,846,902.00	None
Operation and Maintenance Cost over remaining lifetime (US$)	276,938/Annum	110,171/Annum

TABLE B.4 (b): NET PRESENT VALUE AND INTERNAL RATE OF RETURN ON INVESTMENT

Analysis Assumptions					
1	Pre-Rehabilitation Fuel Consumption			230,163,111	Nm3/Annum
2	Post Rehabilitation Fuel Consumption			207,837,289	Nm3/Annum
3	Fuel Savings			22,325,822	Nm3/Annum
4	Calorific Value			0.037	MMBTU/Nm3
5	Fuel Supply Cost (Saudi Aramco)			0.75	US$/MMBTU
6	Project Life Time			15	Years
7	Escalation in Fuel Price			Not Considered	
8	Regular O&M Cost			2%	2% of Investment, Annually
9	Annual Depreciation			5%	5% of Original Investment
				10%	
Year	Outflow	Inflow	Cash Flow	PV at Discounted Rate	PV at IRR
0	(13,846,902)	0	(13,846,902)	(13,846,902)	(13,846,902)
1	-276938.04	619,542	342,604	311,458	364208
2	-276938.04	619,542	342,604	283,143	387175
3	-276938.04	619,542	342,604	257,403	411591
4	-276938.04	619,542	342,604	234,003	437546

Analysis Assumptions					
1	Pre-Rehabilitation Fuel Consumption			230,163,111	Nm3/Annum
2	Post Rehabilitation Fuel Consumption			207,837,289	Nm3/Annum
3	Fuel Savings			22,325,822	Nm3/Annum
4	Calorific Value			0.037	MMBTU/Nm3
5	Fuel Supply Cost (Saudi Aramco)			0.75	US$/MMBTU
6	Project Life Time			15	Years
7	Escalation in Fuel Price			Not Considered	
8	Regular O&M Cost			2%	2% of Investment, Annually
9	Annual Depreciation			5%	5% of Original Investment
				10%	
5	-276938.04	619,542	342,604	212,730	465138
6	-276938.04	619,542	342,604	193,391	494470
7	-276938.04	619,542	342,604	175,810	525652
8	-276938.04	619,542	342,604	159,827	558800
9	-276938.04	619,542	342,604	145,297	594038
10	-276938.04	619,542	342,604	132,088	631499
11	-276938.04	619,542	342,604	120,080	671321
12	-276938.04	619,542	342,604	109,164	713656
13	-276938.04	619,542	342,604	99,240	758659
14	-276938.04	619,542	342,604	90,218	806501
15	-276938.04	619,542	342,604	82,017	857359
16	-276938.04	619,542	342,604	74,561	911425
17	-276938.04	619,542	342,604	67,782	968900
18	-276938.04	619,542	342,604	61,620	1030000
19	-276938.04	619,542	342,604	56,018	1094953
20	-276938.04	619,542	342,604	50,926	1164001
		IRR	**-5.93%**		
		NPV	10%	(10,930,125)	

B.5. Demonstration of Additionality

The baseline scenario of continuing in the existing situation has been shown above, to be more favorable than undertaking the boiler rehabilitation (also see Table B.5 below). The proposed modifications are being carried out as part of the company's commitment to reduce GHG emissions where feasible. Implementation of the project under the CDM, alleviates the barriers posed by lack of incentive for investment. Funding acquired over the crediting period will allow for payback on investments in technology and expertise required for the boiler rehabilitation. Hence the proposed rehabilitation project is additional.

TABLE B.5: DEMONSTRATION OF ADDITIONALITY

Sl. No	Additionality Consideration	Boiler Rehabilitation	Comments
1	Alternatives	Boiler rehabilitation not favorable. Continuation of current situation more favorable	See B.4 above
2	Investment Analysis	No financial incentive to undertake project given the unfavorable rate of return (Refer Table B. 4 (b)	
3	Barriers	Proposed project affected by barriers in investment (no financial incentive) and technology (i.e. need for off-shore expertise and components and EPC as local resources in Kingdom is in adequate)	See B.4
4	Regulatory Requirements	No regulations in the Kingdom with limits prescribed for GHG emissions from industrial facilities. No foreseeable regulations expected concerning GHG emissions	Ref: RCER 2010 PME GER 2002 (Updated 2012)
5	Common Practice Analysis	Boiler rehabilitation of the scale proposed at Bayroni is not common practice within the petrochemical sector in the Kingdom.	

=> The proposed project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline emissions were estimated following the steps and equations 1 to 7, prescribed in AM0056/Version 1, namely:

1. Step 1: Baseline capacity of the boilers were estimated based on results from actual measurements, independent third party technical assessments and upper range of boiler load class
2. Step 2: Load classes of the boilers were determined. In establishing the load classes, the baseline capacity as determined in Step 1 and boiler operating modes were determined
3. Step 3: Specific fuel consumption (SFC) and for each boiler in the system under each load class was determined. The SFC is a function of average fuel consumption for a load class and the average observed amount of steam produced within the load class. Using the net calorific value of the fuel, the specific energy consumption of the system was then determined for each load class.
4. Baseline emissions were then calculated using equation 7 in the methodology.

In calculating the Project Emissions, a net reduction of around 9.7% in fuel consumption was considered. Equation 7 in the methodology was considered in estimating the Project Emissions assuming a proportionate reduction in fuel consumption

For estimating leakages, since the facility will not utilize LNG, equation 8 of the assumes on fugitive upstream emissions of methane, which was calculated using equation 9 of AM00056. Since there is no change in the fuel source as a result of the project, the same upstream emission factors have been used. As required 21TCO2/TCH4 has been assumed for GWP for the 1st year

Net reductions have been estimated using equation 12 where Project emissions and leakages were reduced from the baseline estimation.

B.6.2. Data and Parameters fixed en ante

The following data and parameters have been considered in the baseline assessment but are not considered for monitoring in the crediting period as stated in the methodology. The Project Owner has extensive hourly data archived at the facility and which can be extracted. Monitoring data in excess of 3 months is available for validation.

Data / Parameter:	**CAP**
Data unit:	Tons/Hour (steam)
Description:	Maximum long term load (capacity) of the boiler or steam system (tonnes of steam output per hour at full load).
Source of data used:	Hourly Measurement Data
Value applied:	100-120Tons/Hour for each of the three boilers
Justification of the choice of data or description of measurement methods and procedures actually applied :	Boiler load classes have been selected based on review of third independent assessments of boiler performance, name plate capacity and historical data. All measurements shall comply with ASME PTC 4-1998
Any comment:	All Measurements are in compliance to ASME PTC 4-1998

Data / Parameter:	**Boiler load class, i and j**
Data unit:	Range Tons/Hour
Description:	Boiler load classes in the case of multi-boiler installations. For each boiler ‘j’ load classes ‘i’ are introduced.
Source of data used:	Hourly Measurement Data
Value applied:	See Section 6.3 (Table 1)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The proposed methodology requires the project developer to choose at least two boiler load classes per boiler freely.
Comments	

Data/ Parameter	**System Load Class “K”**
Data Unit	(Tons/Hour) Tons/Annum
Description	System Load Classes
Source of data used	Hourly Measurement Data
Value applied	See Table B.6.5
Justification of the choice of data or description of measurement methods and procedures actually applied	Facility operates 24 hours continuously over the calendar year. Hence hourly measurements and annual totals are available
Comments	

Data/ Parameter	FC_{BLi}
Data Unit	M3/h
Description	Fuel Consumption in each load class (Data available hourly/annually)
Source of data used	Hourly Measurement Data
Value applied	See Table B.6.2
Justification of the choice of data or description of measurement methods and procedures actually applied	Information from steam system operator based on measurements following strictly international or national acknowledged norms and guidelines.
Comments	

Data/ Parameter	PB_{Li}
Data Unit	Tons/Hour (Tons/Annum)
Description	Average Hourly Steam Production in each load class
Source of data used	Hourly Measurement Data
Value applied	Tons/Hour
Justification of the choice of data or description of measurement methods and procedures actually applied	Information from steam system operator based on measurements following strictly international or national acknowledged norms and guidelines.
Comments	

Data/ Parameter	$NCV_{FF, BL}$
Data Unit	GJ/m3
Description	Net Calorific Value of Fossil Fuel Used (Natural Gas)
Source of data used	Analysis Report
Value applied	0.04 GJ/Nm3
Justification of the choice of data or description of measurement methods and procedures actually applied	Information from steam system operator based on measurements following strictly international or national acknowledged norms and guidelines.
Comments	

Data/ Parameter	$EF_{C,FF,BL}$
Data Unit	tC/GJ
Description	Carbon Emission Factor for fuel used in the boiler system
Source of data used	IPCC
Value applied	0.056tCO2e/GJ
Justification of the choice of data or description of measurement methods and procedures actually applied	Regional/local emission factors are not available, hence IPCC factors have been used.
Comments	

Data/ Parameter	$OXID_{FF,BL}$
Data Unit	Fraction
Description	Oxidation factor for the fossil fuel used in the baseline boiler
Source of data used	IPCC/ Industry Practice
Value applied	1
Justification of the choice	Regional/local emission factors are not available

of data or description of measurement methods and procedures actually applied	
Comments	

Data/ Parameter	**$PRESS_{BL,MIN}$**
Data Unit	bar
Description	Lowest measured pressure of the generated steam during determination of the specific energy consumption.
Source of data used	Measurement. Use test result for calculations.
Justification of the choice of data or description of measurement methods and procedures actually applied	Measurement strictly following international acknowledged norms and guidelines such as ASME PTC 4-1998 .
Comments	

Data/ Parameter	**$PRESS_{BL,MAX}$**
Data Unit	bar
Description	Highest measured pressure of the generated steam during determination of the specific energy consumption.
Source of data used	Measurement. Use test result for calculations.
Justification of the choice of data or description of measurement methods and procedures actually applied	Measurement strictly following international acknowledged norms and guidelines such as ASME PTC 4-1998 .
Comments	

Data/ Parameter	**$TEMP_{BLMIN}$**
Data Unit	K
Description	Lowest measured temperature of the generated steam during determination of the specific energy consumption.
Source of data used	Measurement. Use test result for calculations.
Justification of the choice of data or description of measurement methods and procedures actually applied	Measurement strictly following international acknowledged norms and guidelines such as ASME PTC 4-1998 .
Comments	

Data/ Parameter	**$TEMP_{BLMAX}$**
Data Unit	K
Description	Highest measured temperature of the generated steam during determination of the specific energy consumption.
Source of data used	Measurement. Use test result for calculations.
Justification of the choice of data or description of measurement methods and procedures actually applied	Measurement strictly following international acknowledged norms and guidelines such as ASME PTC 4-1998 .
Comments	

B.6.3. Ex-ante calculation of emission reductions:

Baseline Emission

Project emissions were calculated using the Approved baseline and monitoring methodology AM0056. Baseline emissions are calculated via the degree of efficiency of the overall steam generation system of the 3 boilers. The following detailed calculation procedures are based on the specific fuel consumption (SFC) for steam generation.

Step 1: Determination of the capacity of the baseline equipment
To determine the steam capacity of the boilers the following were considered:

- The name plate capacity for each boiler from the manufacture: 129.25 metric tonnes of steam per hour (MT /H)
- Technical analysis carried out by Kellog Brown Roots (KBR) for the modification of the boilers determined that the capacity of each boiler to be 120 MT/H
- Measurements carried out established an operating range for the boilers. The measurements methods have been reviewed and determined to be in accordance with the ASTM standards. The facility being a 24hour continuously operating petrochemical plant, the boilers are designed and maintained to operate at near constant loads. Hence based on the review of measurement data, the operating ranges were identified as summarized below:
  1. 2008-U: Operating Range: 100-120 Tons/hr
  2. 2008-UA: Operating Range: 100-120 Tons/hr
  3. 2052-U: Operating Range: 100-120 Tons/hr

From the above considerations, 100-120 Tons/hr was selected as the representative steam capacity for the boilers.

Step 2: Determination of the load classes of the boilers:
Based on hourly measurement data available at Al Bayroni, it has been observed that the facility operates at near constant load in the range of 100 - 120 Tons/hr. For representation purposes, however, a range of load classes have been evaluated and these are represented in the table below.

Table B.6.1: The selected boiler load classes

Boiler Load Class (Tons/hr)	2008-U Load Classes	2008-UA Load Classes	2052-U Load Classes
0-20	1	1	1
21-40	2	2	2
41-60	3	3	3
61-80	4	4	4
81-100	5	5	5
101-120	6	6	6
>120	7	7	7

Step 3: Determination of the specific fuel (energy) consumption of each boiler (per load class) within the steam system:

Step 3 b.1: Determination of the specific fuel consumption for each boiler 'j'per load class 'i' within the steam generation system

The specific fuel (energy) consumption of each boiler per load class within the steam system is determined using the following formula:

$$SFC_{i,j} = \left(\frac{FC_{BL,i,j,x}}{P_{BL,i,j,x}} \right)$$

Where

$SFC_{i,j}$ Specific fuel consumption within load class 'i' for each boiler 'j' as observed from performance tests (Nm^3/tSteam)

$FC_{BL,i,j,x}$ Average observed fuel consumption for load x, using repeated performance test for that load, within load class 'i' for each boiler 'j' (Nm^3/hr)

$P_{BL,i,j,x}$ Average observed amount of produced steam for load x, using repeated performance test for that load, within load class 'i' for each boiler 'j' (T/hr)

Table B.6.2: SFC estimation per load class

Boilers	Load Class	Range (MT/H)	FCBL,i	PBL,i	SFCi,j
			Fuel (Nm3/Hour)	Steam(Tons/hr)	Nm3/Tsteam
2008-U	1	0-20	310.41	11.06	28.07
	2	21-40	3863.73	26.14	147.81
	3	41-60	4422.36	54.54	81.08
	4	61-80	6451.83	75	86.02
	5	81-100	7376.16	92.8	79.48
	6	101-120	9496.69	114.53	82.92
	7	>120	10269.65	129.27	79.44
2008-UA	1	0-20	637.49	7.42	85.92
	2	21-40	3054.14	39.99	76.37
	3	41-60	3592.46	50.59	71.01
	4	61-80	6819.45	70.51	96.72
	5	81-100	7930.26	92.15	86.06
	6	101-120	10183.06	114.15	89.21
	7	>120	10870.4	125.79	86.42
2052-U	1	0-20	Not Operational	Not Operational	Not Operational

Boilers	Load Class	Range (MT/H)	FCBL,i	PBL,i	SFCi,j
			Fuel (Nm3/Hour)	Steam(Tons/hr)	Nm3/Tsteam
	2	21-40	Not Operational	Not Operational	Not Operational
	3	41-60	Not Operational	Not Operational	Not Operational
	4	61-80	8070.34	77.26	104.46
	5	81-100	7600.61	96.35	78.89
	6	101-120	7725.27	108.45	71.23
	7	>120	Not Operational	Not Operational	Not Operational

Step 3 b.2: Determination of the specific energy consumption within the capacity of the boiler system for each boiler 'j' per load class 'i'

$SEC_{ij} = SFC_{ij} \cdot NCV_{BL,FF}$

Where

$SEC_{i,j}$ Lowest specific energy consumption within load class 'i' for each boiler 'j' (GJ/t)

$SFC_{i,j}$ Lowest possible specific fuel consumption within load class 'i' for each boiler 'j' (Nm^3/t)

$NCV_{BL,FF}$ Net caloric value of fossil fuel used in the baseline boiler (GJ/m^3): 0.039GJ/Nm3

Table B.6.3: SEC-Calculation

Boilers	Load Class	Range (MT/H)	FCBL,i	PBL,i	SFCi,j	Calorific Value	SEC
			Fuel (Nm3/Hour)	Steam(T/Hour)	Nm3/Tsteam	GJ/Nm3	GJ/T Steam
2008-U	1	0-20	310.41	11.06	28.07	0.039851562	1.12
	2	21-40	3863.73	26.14	147.81	0.039851562	5.89
	3	41-60	4422.36	54.54	81.08	0.039851562	3.23
	4	61-80	6451.83	75	86.02	0.039851562	3.43
	5	81-100	7376.16	92.8	79.48	0.039851562	3.17
	6	101-120	9496.69	114.53	82.92	0.039949238	3.31
	7	>120	10269.65	129.27	79.44	0.039951207	3.17
2008-UA	1	0-20	637.49	7.42	85.92	0.039851562	3.42
	2	21-40	3054.14	39.99	76.37	0.039851562	3.04
	3	41-60	3592.46	50.59	71.01	0.039851562	2.83
	4	61-80	6819.45	70.51	96.72	0.039851562	3.85
	5	81-100	7930.26	92.15	86.06	0.039851562	3.43
	6	101-120	10183.06	114.15	89.21	0.039931908	3.56
	7	>120	10870.4	125.79	86.42	0.040046125	3.46
2052-U	1	0-20	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational
	2	21-40	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational
	3	41-60	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational
	4	61-80	8070.34	77.26	104.46	0.039851562	4.16
	5	81-100	7600.61	96.35	78.89	0.039851562	3.14
	6	101-120	7725.27	108.45	71.23	0.039955145	2.85
	7	>120	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational

Step 3 b.3: Determination of the specific energy consumption of the steam generation system (per load class)

$SEC_{sys} = SEC_{ij} \cdot PB_{L,i}$

Where

SEC_{SYS}	Lowest of all calculated values of the specific energy consumption within each steam generation system's load class (GJ/hr).
$SEC_{ij,j}$	Lowest specific energy consumption within load class 'ij' of boiler 'j' (GJ/t) where 'i' corresponds to load class 'ij'
$P_{BL,i,j,x}$	Average observed amount of produced steam for load x, using repeated performance test for that load, within load class 'i' for each boiler 'j' (T/hr)

Table B.6.4: SEC of steam generation system calculation

Boilers	Load Class	Range (MT/H)	FCBL,i	PBL,i	SFCi,j	Calorific Value	SEC	SEC Sys
			Fuel (Nm3/Hour)	Steam(Tons/hr)	Nm3/Tsteam	GJ/Nm3	GJ/T Steam	GJ/hr
2008-U	1	0-20	310.41	11.06	28.07	0.039851562	1.12	12.37
	2	21-40	3863.73	26.14	147.81	0.039851562	5.89	153.98
	3	41-60	4422.36	54.54	81.08	0.039851562	3.23	176.24
	4	61-80	6451.83	75	86.02	0.039851562	3.43	257.12
	5	81-100	7376.16	92.8	79.48	0.039851562	3.17	293.95
	6	101-120	9496.69	114.53	82.92	0.039949238	3.31	379.39
	7	>120	10269.65	129.27	79.44	0.039951207	3.17	410.28
2008-UA	1	0-20	637.49	7.42	85.92	0.039851562	3.42	25.40
	2	21-40	3054.14	39.99	76.37	0.039851562	3.04	121.71
	3	41-60	3592.46	50.59	71.01	0.039851562	2.83	143.17
	4	61-80	6819.45	70.51	96.72	0.039851562	3.85	271.77
	5	81-100	7930.26	92.15	86.06	0.039851562	3.43	316.03
	6	101-120	10183.06	114.15	89.21	0.039931908	3.56	406.63
	7	>120	10870.4	125.79	86.42	0.040046125	3.46	435.32
2052-U	1	0-20	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational
	2	21-40	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational
	3	41-60	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational
	4	61-80	8070.34	77.26	104.46	0.039851562	4.16	321.62
	5	81-100	7600.61	96.35	78.89	0.039851562	3.14	302.90
	6	101-120	7725.27	108.45	71.23	0.039955145	2.85	308.66
	7	>120	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational	Not Operational

Step 4: Determination of the load classes of the steam system

The steam system load classes in Table B.6.5 below are the result of any possible combination of the boiler load classes given in Table B.6.1 above using the On-Off-Operation. Figure B.1-B.3 below present an analysis of the steam generation from the three boilers from which the following is evident:

1. Steam generation from all three boilers is largely within 100-120T/hour
2. Steam generation below 100 Tons/Hr is an occasional standalone occurrence and may represent downtime

3. Similarly steam generation above 120 Tons/hr is a rare occurrence and not sustained

Table B.6.5: Steam generation system load classes

System Load	2008U	2052U	2008UA
0-20	Rare Occurrence/ Possible Downtime	Rare Occurrence/ Possible Downtime	Rare Occurrence/ Possible Downtime
21-40	OFF	OFF	ON
41-60	ON	OFF	OFF
	ON	OFF	ON
	OFF	OFF	ON
61-80	ON	OFF	OFF
	OFF	ON	OFF
	OFF	OFF	ON
81-100	ON	OFF	OFF
	OFF	ON	OFF
	OFF	OFF	ON
	ON	ON	OFF
	OFF	ON	ON
	ON	OFF	ON
	OFF	ON	ON
101-120	ON	ON	OFF
	OFF	ON	ON
	ON	OFF	ON
	OFF	ON	ON
121-140	ON	OFF	OFF
	OFF	ON	OFF
	OFF	OFF	ON
	ON	ON	OFF
	OFF	ON	ON
	ON	OFF	ON
	OFF	ON	ON
	ON	ON	ON
141-160	ON	ON	OFF
	OFF	ON	ON
	ON	OFF	ON
	ON	ON	ON
161-180	ON	ON	OFF
	OFF	ON	ON
	ON	OFF	ON
	ON	ON	ON
181-200	ON	ON	OFF
	OFF	ON	ON
	ON	OFF	ON
	ON	ON	ON
201-220	ON	ON	OFF
	OFF	ON	ON
	ON	OFF	ON
	OFF	ON	ON
	ON	ON	ON
221-240	ON	ON	OFF
	OFF	ON	ON
	ON	OFF	ON
	OFF	ON	ON
	ON	ON	ON
241-260	ON	ON	OFF
	OFF	ON	ON

System Load	2008U	2052U	2008UA
	ON	OFF	ON
	OFF	ON	ON
	ON	ON	ON
261-280	ON	ON	ON
281-300	ON	ON	ON
301-320	ON	ON	ON
321-340	ON	ON	ON
340-360	ON	ON	ON
>360	ON	ON	ON

Figure B.1: Boiler Performance Analysis: 2008U

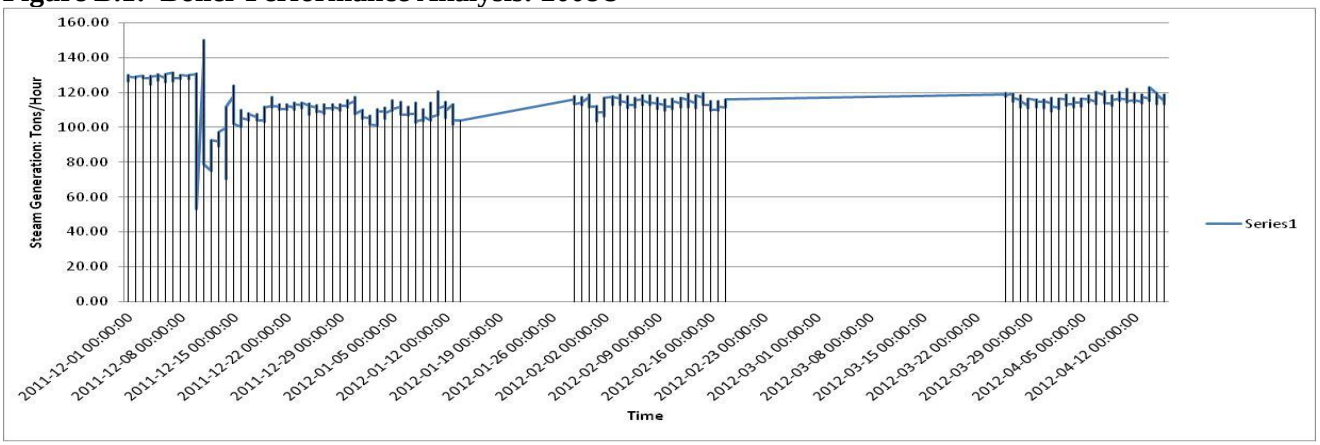


Figure B.2: Boiler Performance Analysis: 2008UA

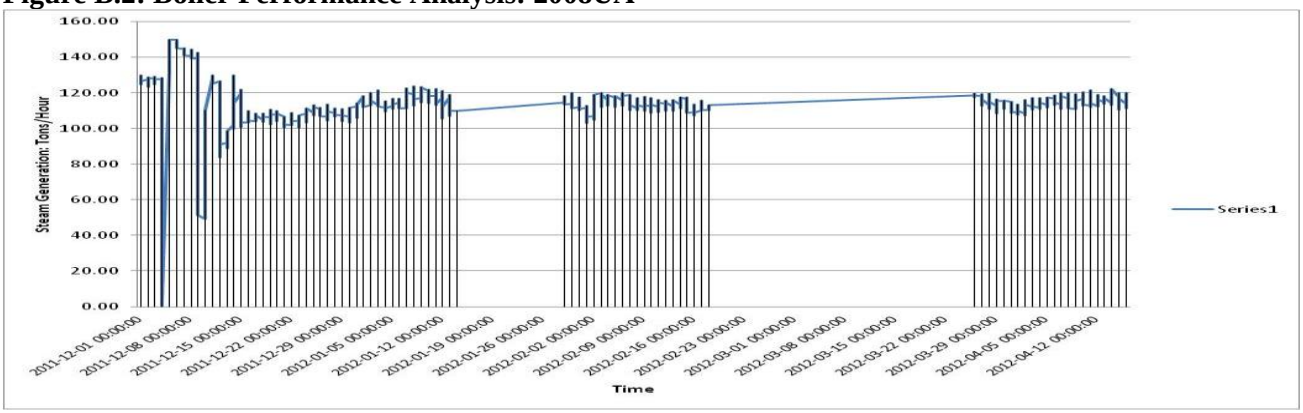
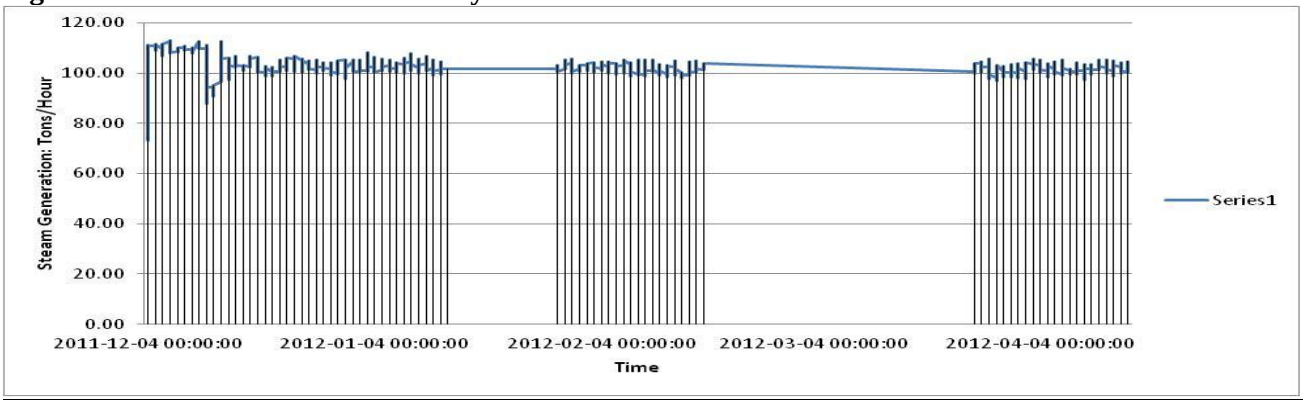


Figure B.3: Boiler Performance Analysis: 2008UA



Step 5: Determination of the specific fuel consumption of the steam system (per load class):

The specific fuel consumption of the steam system for different combinations is provided in the table below.

Table B.6.6: Specific Fuel Consumption & Energy Consumption

System Load Class	System Load	2008U	2052U	2008UA	Average Stem Production (Tons/hr)	Net Calorific Value of Fuel (GJ/m3)	NG Fuel (Nm3/h)	Specific Fuel Consumption (Nm3/T)	Specific Energy Consumption (SEC)(GJ/t of steam	Specific Energy Consumption System (SEC system)(GJ/hr)
1	0-21	Rare Occurrence/Possibly Downtime.								
2	21-40	OFF	OFF	ON	39.99	0.0399	3054	76.37	3.04	121.71
3	41-60	ON	OFF	OFF	54.54	0.0399	4422	81.08	3.23	176.24
		ON	OFF	ON	52.57	0.0399	4007	76.23	3.04	159.70
		OFF	OFF	ON	50.59	0.0399	3592	71.01	2.83	143.17
4	61-80	ON	OFF	OFF	75.00	0.0399	6452	86.02	3.43	257.12
		OFF	ON	OFF	77.26	0.0399	8070	104.46	4.16	321.62
		OFF	OFF	ON	70.51	0.0399	6819	96.72	3.85	271.77
5	81-100	ON	OFF	OFF	92.80	0.0399	7376.16	79.48	3.17	293.95
		OFF	ON	OFF	96.35	0.0399	7600.61	78.89	3.14	302.90
		OFF	OFF	ON	92.15	0.0399	7930.26	86.06	3.43	316.03
		ON	ON	OFF	94.58	0.0399	7488.39	79.18	3.16	298.42
		OFF	ON	ON	94.25	0.0399	7765.44	82.39	3.28	309.46
		ON	OFF	ON	92.48	0.0399	7653.21	82.76	3.30	304.99
		ON	ON	ON	93.77	0.04	7635.68	81.43	3.25	304.29
6	101-120	ON	OFF	OFF	114.53	0.0399	9496.69	82.92	3.31	379.39
		OFF	ON	OFF	108.45	0.0400	7725.27	71.23	2.85	308.66
		OFF	OFF	ON	114.15	0.0399	10183.06	89.21	3.56	406.63
		ON	ON	ON	112.38	0.04	9135.01	81.29	3.25	364.90
		ON	ON	OFF	111.49	0.0400	8610.98	77.24	3.09	344.03
		OFF	ON	ON	111.30	0.0399	8954.17	80.45	3.21	357.66
		ON	OFF	ON	114.34	0.0399	9839.88	86.06	3.44	393.01
7	121-135	ON	OFF	OFF	129.27	0.0400	10270	79.44	3.17	410.28
		OFF	ON	OFF	Not Operational	Not Operational	Not Operational			
		OFF	OFF	ON	125.79	0.0400	10870	86.42	3.46	435.32
		ON	ON	OFF	129.27	0.04	10269.65	79.44	3.17	410.28
		OFF	ON	ON	125.79	0.04	10870.40	86.42	3.46	435.32
		ON	OFF	ON	127.53	0.04	10570.03	82.88	3.32	422.79
		ON	ON	ON	127.53	0.04	10570.03	82.88	3.32	422.79
8	136-160	ON	ON	OFF	144.05	0.0399	21817	151.46	6.04	869.46
		OFF	ON	ON	154.02	0.0399	22672	147.20	5.87	903.51
		ON	OFF	ON	144.05	0.0399	21817	151.46	6.04	869.46

System Load Class	System Load	2008U	2052U	2008UA	Average Stem Production (Tons/hr)	Net Calorific Value of Fuel (GJ/m3)	NG Fuel (Nm3/h)	Specific Fuel Consumption (Nm3/T)	Specific Energy Consumption (SEC)(GJ/t of steam	Specific Energy Consumption System (SEC system)(GJ/hr)
		ON	ON	ON	Not Operational	Not Operational	Not Operational			
9	161-180	ON	ON	OFF	169.48	0.0399	14125	83.34	3.32	562.87
		OFF	ON	ON	174.94	0.0399	14239	81.40	3.24	567.44
		ON	OFF	ON	176.38	0.0399	14776	83.78	3.34	588.83
		ON	ON	ON	Not Operational	Not Operational	Not Operational			
10	181-200	ON	ON	OFF	189.80	0.0399	15086	79.48	3.17	601.16
		OFF	ON	ON	190.41	0.0399	15699	82.45	3.29	625.59
		ON	OFF	ON	187.77	0.0399	15352	81.76	3.26	611.77
		ON	ON	ON	Not Operational	Not Operational	Not Operational			
11	201-220	ON	ON	OFF	217.18	0.0400	16741.18	77.08	3.08	669.65
		OFF	ON	ON	216.43	0.0399	17331.79	80.08	3.19	690.85
		ON	OFF	ON	215.90	0.0398	18519.86	85.78	3.42	737.65
		ON	ON	ON	Not Operational	Not Operational	Not Operational			
12	221-240	ON	ON	OFF	225.28	0.0400	17240	76.53	3.06	688.93
		OFF	ON	ON	226.18	0.0400	18058	79.84	3.20	722.87
		ON	OFF	ON	231.33	0.0400	19926	86.14	3.44	796.45
		ON	ON	ON	Not Operational	Not Operational	Not Operational			
13	241-260	ON	ON	OFF	248.84	0.03985	19953	80.18	3.20	
		OFF	ON	ON	251.98	0.03985	16363	64.94	2.59	652.06
		ON	OFF	ON	245.03	0.04011	20753	84.70	3.40	832.41
		ON	ON	ON	252.91	0.0399	21187	83.77	3.34	844.31
14	261-280	ON	ON	ON	265.15	0.0396	21011	79.24	3.14	831.61
15	281-300	ON	ON	ON	286.79	0.0399	23171	80.79	3.22	923.37
16	301-320	ON	ON	ON	315.50	0.0398	25764	81.66	3.25	1025.39
17	321-340	ON	ON	ON	332.92	0.0399	26986	81.06	3.24	1077.56
18	340-360	ON	ON	ON	345.85	0.0400	27945	80.80	3.23	1118.65
19	>360	ON	ON	ON	395.99	0.0390	20087	50.73	1.98	783.38

Step 6: Calculation of baseline emissions

Baseline Emission for the system is calculated using the formula:

$$BE_y = 44/12 \cdot EF_{C,FF,BL} \cdot OXID_{FF,BL} \cdot SEC_{syst}$$

Where

$BE_{,y}$	Baseline emissions resulting from steam generation within the capacity of the baseline equipment in the year 'y' (tCO_2/yr)
SEC_{syst}	Specific energy consumption (GJ/t) of the multi boiler steam generation system
$EF_{C,FF,BL}$	Carbon emission factor of baseline fossil fuel (tC/GJ)
$OXID_{FF,BL}$	Oxidation factor of baseline fossil fuel
44/12	Ratio of the molecular weight of CO_2 to the molecular weight of carbon

Given the steam generation capacity for all three boilers has been determined to be 100-120Tons/hour and considering that boiler operations are predominantly within this load range, the following has been considered in estimating annual baseline emissions.

Table B.6.7: Annual Baseline Emissions Calculation

Steam Generation & Energy Consumptions	
Annual Steam Production (2011) (T/Annum) (from all load classes)	2860778
Boiler Load Classes considered for baseline emissions	100-120 (Individual Boilers)
Annual Steam Generation within selected load class - 2008U (Tons/Annum)	*867724.6383*
Annual Steam Generation within selected load class - 2052U (Tons/Annum)	*870759.8582*
Annual Steam Generation within selected load class - 2008-UA (Tons/Annum)	*915398.3884*
Total Steam Generation within selected load class (3 boilers) (Tons /Annum)	2653882.885
Average Fuel Consumption (Nm3/Ton)	81.17366021
Annual Fuel Consumption within representative load classes (Nm3/ annum)	215638525.4
Average Energy Consumption (GJ/Ton)	3.240419058
Annual Energy Consumption (GJ/Annum) (SECsyst)	8613546.002
Carbon Emission Factor (Fossil Fuel) (tc/GJ) ($EF_{C.FF.BL}$)	0.056
Oxidation Factor ($OXID_{FF.BL}$)	1
Baseline Emission (Tons/Annum)	482358.5761

Project Emissions

The proposed rehabilitation project is expected to achieve up to 9.7% savings in fuel consumption annually. Therefore the anticipated fuel consumption after implementation of project is expected to be 194721588.4 Nm3 per annum for the representative system load classes (100-120T/h).

To estimate the project emissions, the '**Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion' (version 2)** was used . Project emissions have been estimated as presented in Table B.6.8 below.

Table B.6.8: Project Emission Calculations

Representative System Load Classes considered	100-120 (Individual Boilers)
Baseline Fuel Consumption within representative load classes (Nm3/annum)	215638525.4
Project Fuel Savings (%)	9.70%
Revised Fuel Consumption within representative load classes (Nm3/annum)	194721588.4
Average Calorific Value of Fuel (GJ/m3)	0.03992
Annual Energy Consumption (GJ/Annum) (Post Rehabilitation)	7773285.809
Project Emissions (Tons/Annum)	435304.0053

LEAKAGE

Emissions due to leakage have been calculated using equation 9 of the AM0056:

$$LE_{CH4,y} = \left(FC_{PJ,y} \cdot NCV_{PJ,y} \cdot EF_{PJ,upstream,CH4} - FC_{BL,y} \cdot EF_{BL,upstream,CH4}\right) \cdot GWP_{CH4}$$

Quantity of fossil fuel combusted in the project plant during the year 'y' (t or m³), monitored as described in the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (FCpjy)	194721588.4
Average net calorific value of the fossil fuel combusted during the year 'y' (GJ/t or GJ/m³) monitored as described in the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (NCVpjy)	0.03992
Emission factor for upstream fugitive methane emissions of fossil fuel used in the project activity from production, transportation, distribution, and, in the case of LNG, liquefaction, transportation, re-gasification and compression into a transmission or distribution system, (t CH4 per GJ fuel supplied to final consumers) tCH4/GJ $_{(EFPJ, UPSTREAM CH4)}$	0.000296
Fossil fuel that would have been combusted in the absence of the project activity during the year 'y' (GJ) ($FC_{BL,Y}$)	8613546.002
Global warming potential of methane valid for the relevant commitment period.	21
Leakage (Tons/Annum)	-5223.057362

Note: There will no change in the source of fuel supply or mode of delivery as a result of the project. Therefore emission factor for upstream fugitive methane emissions remains same prior to and post project.

EMISSION REDUCTIONS

Emission reductions are calculated using equation 12 of AM0056 as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where

ER_y	Emissions reductions of the project activity during the year 'y' in tCO_2e
BE_y	Baseline emissions during the year 'y' in tCO_2e
PE_y	Project emissions during the year 'y' in tCO_2e
LE_y	Leakage emissions in the year 'y' in tCO_2e

Emission reductions from the above equation is 41831.51 MT/Annum

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Baseline emissions (t CO2e/annum)	Project Emissions (t CO2e/annum)	Leakage (t CO2 e/ annum)	Emission Reduction (t CO2 e/annum)
2014	482358	435304	-5223	41831
2015	482358	435304	-5223	41831
2016	482358	435304	-5223	41831
2017	482358	435304	-5223	41831
2018	482358	435304	-5223	41831
2019	482358	435304	-5223	41831
2020	482358	435304	-5223	41831
2021	482358	435304	-5223	41831
2022	482358	435304	-5223	41831
2023	482358	435304	-5223	41831
Total	4823585	4353040	-52230	418315
Total No of Crediting Years			10	
Annual Average over the Crediting Period			41831 Tons/Annum	

B.7. Monitoring Plan

B.7.1 Data and parameters monitored:

Data/ Parameter	**$P_{PJ,i,y}$ (Individual Boilers)**
Data Unit	(Tons/Hour) Tons/Annum
Description	Generated steam in the year 'y' subdivided into load classes in the case of single boiler installations
Source of data used	Hourly Monitoring Data measured and archived at the Facility
Justification of the choice of data or description of measurement methods and procedures actually applied	Facility operates 24 hours continuously over the calendar year. Hence hourly measurements and annual totals are available
Monitoring Frequency	Hourly Data
QA/QC Procedures	Measuring instruments should be subject to a regular maintenance and testing regime in accordance to appropriate national/international standards.

Data/ Parameter	$P_{PJ,k,y\ (System)}$
Data Unit	(Tons/Hour) Tons/Annum
Description	Generated steam in the year 'y' subdivided into load classes in the case of Multi boiler installations
Source of data used	Hourly Monitoring Data measured and archived at the Facility
Justification of the choice of data or description of measurement methods and procedures actually applied	Facility operates 24 hours continuously over the calendar year. Hence hourly measurements and annual totals are available
Monitoring Frequency	Hourly Data
QA/QC Procedures	Measuring instruments should be subject to a regular maintenance and testing regime in accordance to appropriate national/international standards.

Data/ Parameter	$PRESS_{BL,MAX}$
Data Unit	bar
Description	Pressure of the generated steam
Source of data used	Measurement. Use test result for calculations.
Justification of the choice of data or description of measurement methods and procedures actually applied	Measurement following international acknowledged norms and guidelines such as ASME PTC 4-1998
Monitoring Frequency	Hourly
QA/QC Procedures	Measuring instruments should be subject to a regular maintenance and testing regime in accordance to appropriate national/international standards

Data/ Parameter	$TEMP_{PJ}$
Data Unit	K
Description	Temperature of the generated steam
Source of data used	Measurement. Use test result for calculations.
Justification of the choice of data or description of measurement methods and procedures actually applied	Measurement following international acknowledged norms and guidelines such as ASME PTC 4-1998
Monitoring Frequency	Hourly
QA/QC Procedures	Measuring instruments should be subject to a regular maintenance and testing regime in accordance to appropriate national/international standards

B.7.2 Sampling Plan

All sampling and measurements follow instructions as detailed in Al Bayroni's Standard Operating Procedure (SOP) for utilities in BQMS-UTL-SOP-12 (Version 2.6, updated on 18/09/2013) (See Table B.7.1 below)

Table B. 7.1: Sampling Plan summary

Boiler 2008-U	Natural Gas flow	Steam flow	Steam temp.	BFW flow
Tag #	FIC-2509	FIC-2506	TI-2520-1	FIC-2507
Log sheet #	BQMS-UTL-LOG-12/06	BQMS-UTL-LOG-12/06	BQMS-UTL-LOG-12/06	BQMS-UTL-LOG-12/06
SOP #	BQMS-UTL-SOP-12	BQMS-UTL-SOP-12	BQMS-UTL-SOP-12	BQMS-UTL-SOP-12

Boiler 2008-UA	Natural Gas flow	Steam flow	Steam temp.	BFW flow
Tag #	FIC-2609	FIC-2606	TI-2620-1	FIC-2607
Log sheet #	BQMS-UTL-LOG-12/07	BQMS-UTL-LOG-12/07	BQMS-UTL-LOG-12/07	BQMS-UTL-LOG-12/07
SOP #	BQMS-UTL-SOP-12	BQMS-UTL-SOP-12	BQMS-UTL-SOP-12	BQMS-UTL-SOP-12

Boiler 2052-U	Natural Gas flow	Steam flow	Steam temp.	BFW flow
Tag #	FIC-4664	FIC-4662	TI-4646	FIC-4663
Log sheet #	BQMS-UTL-LOG-12/08	BQMS-UTL-LOG-12/08	BQMS-UTL-LOG-12/08	BQMS-UTL-LOG-12/08
SOP #	BQMS-UTL-SOP-12	BQMS-UTL-SOP-12	BQMS-UTL-SOP-12	BQMS-UTL-SOP-12

B.7.3 Other Elements of Monitoring Plan

Same as above

SECTION C. DURATION AND CREDITING PERIOD

C.1. Duration of the project activity:

C.1.1. Start date of the project activity:

25/08/2011

C.1.2. Expected operational lifetime of the project activity:

Twenty years

C.2. Crediting Period of Project Activity

C.2.1. Type of Crediting Period

Fixed (10 Years)

C.2.2. Starting date of the first crediting period:

15/06/2013

C.2.3.Length of the first crediting period:

10 Years

SECTION D. ENVIRONMENTAL IMPACTS

D.1. Analysis of Environmental Impacts:

The proposed boiler rehabilitation project is not expected to cause additional adverse impacts on the environment in comparison to the baseline scenario, as detailed below:

- Air Quality: This project is not expected to cause any additional emissions and affect ambient air quality from current levels caused by emissions from the existing boiler system.
- Soil and Groundwater: As the proposed project largely involves replacement within the boilers and as no new construction and commissioning of facilities is required, no impact on soil and groundwater is expected from the project.
- Flora and Fauna: There will be no displacement of flora and fauna as the site for the project is already developed and accommodates the existing boiler system
- Socio-Economic: The local economy will be benefited through contracts to in Kingdom contractors for labor supply and logistical support to implement the rehabilitation.
- Noise: The proposed project is not expected to elevate noise levels above current levels.
- Energy Savings: There will be considerable energy savings from the project (estimated to be around 9.7%)

D.2. Environmental Impact Assessment

As per the RCER 2010, an Environmental Impact Assessment (EIA) for modification of facilities would have to be carried out only if required by the Royal Commission which shall decide on a case to case basis. For the proposed rehabilitation project, the Royal Commission has not required a formal EIA to be carried out, hence the assessment is excluded.

SECTION E. LOCAL STAKEHODLER CONSULTATION

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E.1. Solicitation of Comments from Local Stakehoders

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Formal consultations with local stakeholders were held on September 30, 2013 at the Al Jubail Intercontinental Hotel, in Jubail Industrial City. An open invitation was issued to the public soliciting their participation in the consultation session in local newspaper "Arab News dated 8th September, 2013.

E.2. Summary of Comments received

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In total 33 participants took part in the meeting representing various stakeholder groups:

- Royal Commission for Jubail (local government)
- ALBAYRONI Employees
- Employees of other companies
- Local residents
- DNA representatives
- Media representatives etc..

The meeting participants were requested to provide their feedback on the proposed CDM project through Stakeholder Consultation Feedback Form. They were asked to rate the quality of the project design, the adequacy of the information provided, project benefits, impact of the project, concerns, suggestions or criticism. The results of the survey are as follows:

- 22 respondents stated that they had received adequate information about proposed CDM project
- 1 respondent did not receive adequate information
- 14 rated the design of the project as excellent
- 6 rated the design as good
- Respondents stated that the project in their opinion would result in environmental (21), social (7) and economic (7) benefits
- 13 participants stated that the project impact would be significant
- 6 stated that impact would be fair

Table E.1 below presents concerns and criticisms about the project expressed by participants and the way they are addressed:

Table E.1: Summary of Comments Received from the Stakeholder Consultations

	Response
the monitoring processes of the project not very clear	The project will strictly follow monitoring procedures outlined by the applied methodology.
economic aspect of the project not very clear	Financial estimations (cash flow, IRR etc..) are currently being developed by team and will be explained in details in PDD
UNFCCC rules for CDM are over complicated	The team agrees with the concern however rules must be followed to complete CDM project
project being limited to only one SABIC Affiliate	Other companies within SABIC are currently investigating opportunities to implement CDM projects including the similar one (as part of PoA)
proposed technologies not being the most advanced.	The project design is based on the tested technology.

In general, the comments were positive and supportive, recognizing the importance of sustainability agenda in the Kingdom of Saudi Arabia. Most comments urged the roll out of similar projects across entire SABIC (i.e. in other Affiliates) and other companies.

E.3. Report on how due account was taken of any comments received:

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See Table E.1 above

SECTION F. APPROVAL AND AUTHORIZATION

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Appendix 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	AL-BAYRONI (Al-Jubail fertilizer Company)
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Appendix 2

AFFIRMATION REGARDING PUBLIC FUNDING
(NOT APPLICABLE)

Appendix3

Applicability of Selected Methodology

(REFER SECTION B.2)

Appendix 4

Further Background Information on ex ante calculation of emission reductions

(Not Applicable)

Appendix 5

Further Background Information on Monitoring Plan

(To be discussed)

Appendix 6

Summary of Post Registration Changes