CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Fuel Switch in a textile unit at Vapi, Gujarat

Version: 1.0
Date: 07/05/2008

A.2. Description of the small-scale project activity:

The project activity entails displacing use of furnace oil with natural gas in energy generation at the Vapi unit of Alok Industries Limited (ALOK) in Gujarat. Natural Gas (NG) is a cleaner fuel as compared to FO and displacement of use of Furnace Oil (FO) for NG will result in reduced GHG emissions in energy generation.

ALOK has a continuous processing textile unit at Vapi in Valsad district and it requires energy in the form of steam and power. In the pre-project scenario, ALOK generate steam and power in a Furnace Oil (FO) based cogeneration plant at the plant site. The existing boiler capacity is 36TPH and it generates steam at a pressure 45kg/cm^2 and temperature 440°C. In the project activity ALOK has switched from current FO combustion to NG combustion. NG (IPCC default[1] carbon emission factor 15.3 kg C/ GJ) is a cleaner fuel compared to FO (IPCC default carbon emission factor 21.1 kg C/ GJ) and so the fuel switch would result in reduced emissions. Total volume of emission reductions estimated over the chosen crediting period is 142,400 t CO_2.

The existing FO fired boiler has been retrofitted to accommodate combustion of NG.

The project activity faces a number of barriers to its implementation *e.g.* uncertainty in gas prices and gas supply, regulatory issues, capital investment and the project proponent seeks CDM benefits to overcome these barriers.

The project is a small scale CDM project activity and is based on Appendix B of "Simplified Baseline and Monitoring Methodologies for Selected Small Scale CDM Project Activity Categories"

Sustainability aspects of the project activity:

The project activity shall contribute to sustainable development of host country in following ways:

1. The project activity shall help in GHG emission reduction associated in energy generation
2. Reserves of fossil fuels are depleting with increasing demand for energy in the country, the project activity shall help in conservation of carbon intensive fossil fuels.
3. This shall encourage other similar industries to adopt fuel switching in steam and power generation.
4. Adoption of the technology would encourage technology providers to further their efforts in R&D and bring in more investments in this direction.

[1] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

5. It generates employment during construction/ commissioning and later on operation & maintenance of the plant.

A.3. 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)
Government of India (host)	Alok Industries Ltd. (Private Entity)	No

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Host Country: India

A.4.1.2. Region/State/Province etc.:

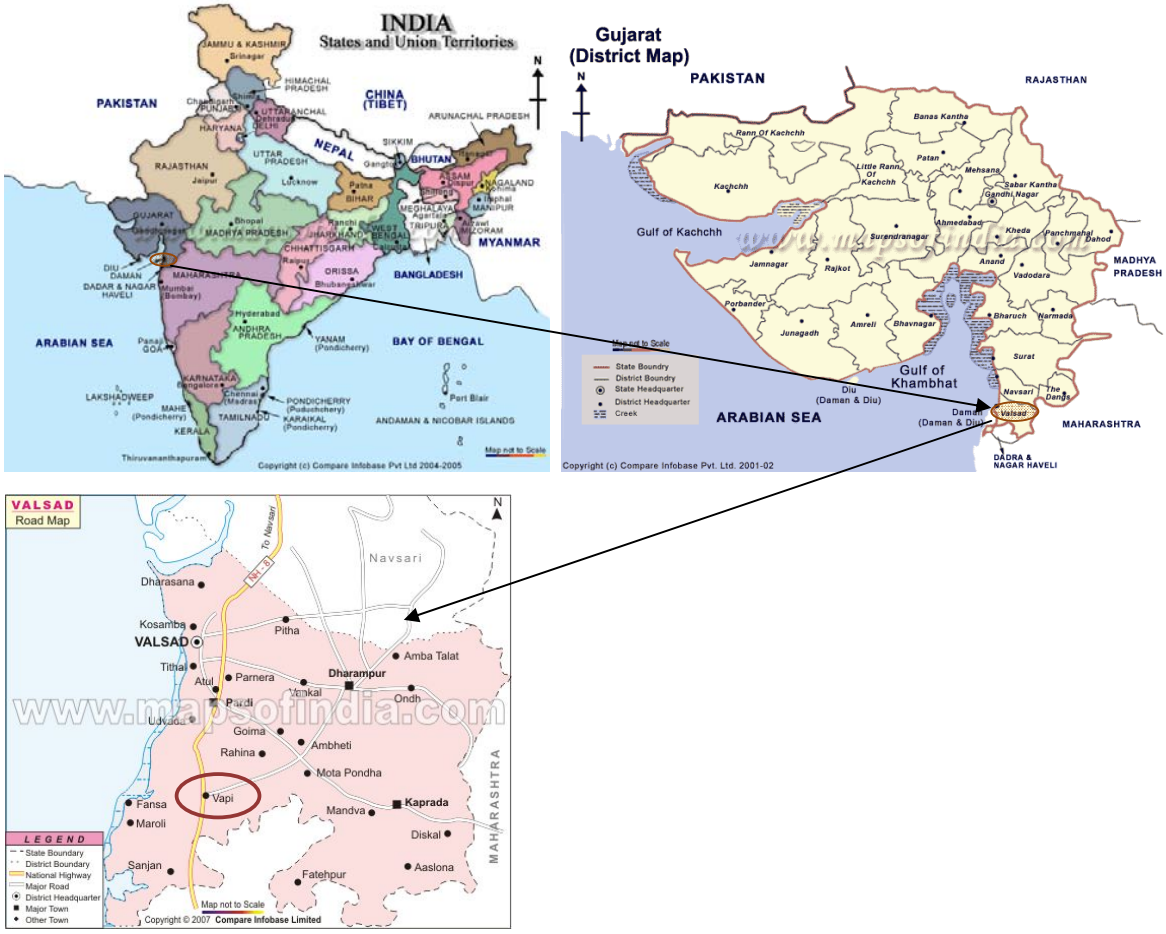
District: Valsad
State: Gujarat

A.4.1.3. City/Town/Community etc:

Village: Balitha
Post Office: Vapi

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The project activity is located in Valsad district in the Indian state of Gujarat. The project site is nearly ~5 km from Champa Railway Station. Plant site is located at Latitude: 22°-04´ N & Longitude: 82°-44´ E. The physical location is depicted in the maps below –



A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

The project is a small scale CDM project activity. The project activity belongs to the category III B- Switching Fossil Fuel of the project type- III- Other Project Activities of the Appendix B of the simplified modalities and procedures for small-scale CDM project activities. As per category IIIB, the project activity should directly emit less than 60 kilo tones CO_2e per annum. The proposed CDM project activity results into direct emissions of CO_2e below 60 kilo tones per annum *i.e.* 20,886 t CO_2/year. Approved methodology for small scale activities *i.e.* AMS **III-B: Switching fossil fuels"** has been applied.

In the project activity, existing FO fired steam generating unit has been retrofitted to facilitate combustion of NG. Following is the unit configuration –

Boiler Specifications	**Details**
Boiler Installed Capacity	18 TPH
Steam Pressure	45 kg/cm2
Steam Temperature	440 deg C
Units	02 No.

Turbine Specifications	Details
Turbine Rated Capacity	3.1 MW
Steam Pressure	45 kg/cm2
Steam Temperature	440 deg C
Back Pressure	4.5 kg/cm2
Units	01 No

The technology used in the project activity is environmentally sound and safe.
No technology transfer has taken place from Annex I parties.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Years	Estimation of annual emission reductions in tones of CO_2 e
2008-09	14,240
2009-10	14,240
2010-11	14,240
2011-12	14,240
2012-13	14,240
2013-14	14,240
2014-15	14,240
2015-16	14,240
2016-17	14,240
2017-18	14,240
Total estimated reductions (tonnes of CO_2 e**)**	142,400
Total number of crediting years	10 years fixed crediting period
Annual average of estimated reduction over the crediting period (tonnes of CO_2e**)**	14,240

A.4.4. Public funding of the small-scale project activity:

No public funding from Annex 1 countries or through ODA for the project activity is involved.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

As per Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities *"A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:*

- *With the same project participants;*
- *In the same project category and technology/measure; and*
- *Registered within the previous 2 years; and*

- *Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point"*

The project activity is not a de-bundled component of a large project activity as –

There is no small scale CDM project activity or an application registered by ALOK, in the same project category and technology/ measure in the last two years within 1 km of the project boundary of the proposed small-scale project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

The project is a small scale CDM project activity. It is based on "**AMS III-B: Switching fossil fuels"**

Reference: Version 12, Sectoral Scope 1, EB 35

B.2 Justification of the choice of the project category:

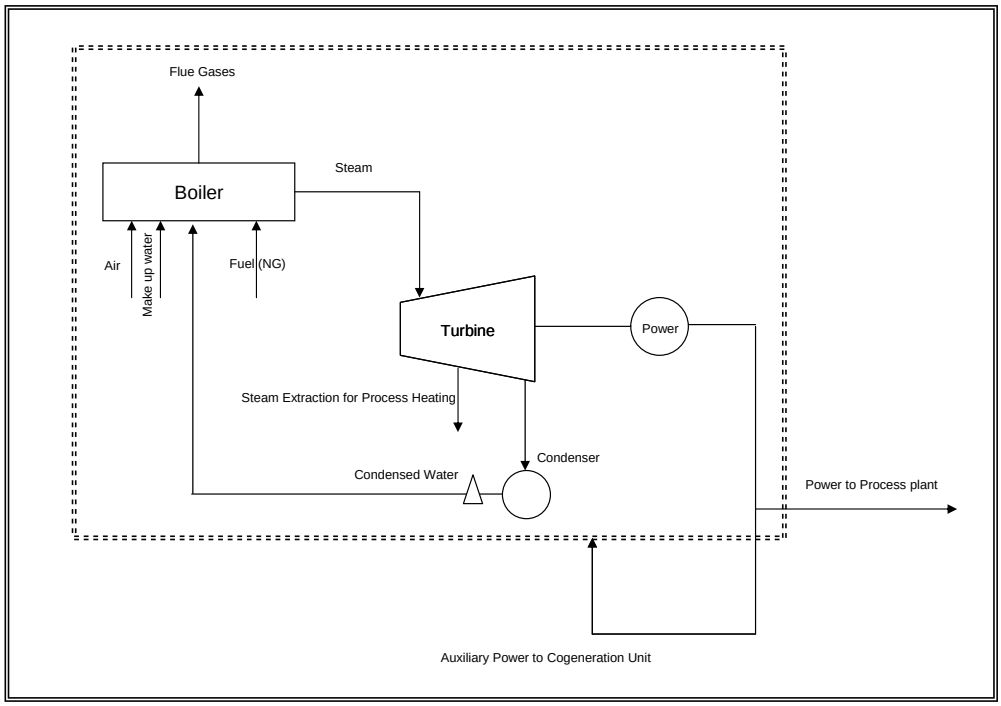
The project status is in line with the methodology AMS IIIB; specific features of project and applicability of methodology AMS IIIB are discussed below-

Applicability Criteria for AMS IIIB	Project Status
This category comprises fossil fuel switching in existing industrial, residential, commercial, institutional or electricity generation applications. Fuel switching may change efficiency as well. If the project activity primarily aims at reducing emissions through fuel switching, it falls into this category. If fuel switching is part of a project activity focussed primarily on energy efficiency, the project activity falls in category II.D or II.E.	The project activity is one of fossil fuel switching from FO to NG in energy generation in an industrial facility with primary aim of reducing emissions.
This category is not applicable to project activities that propose switch from fossil fuel use in the baseline to renewable biomass, biofuel or renewable energy in the project scenario. A relevant type I methodology shall be used for such project activities that generate renewable energy displacing fossil fuel use.	The baseline of the project activity is use of fossil fuel FO which is being displaced with another fossil fuel NG. No renewable biomass usage is involved in the project activity.
Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.	Measures result in emission reductions less than 60 kt CO_2 per annum.

B.3. Description of the project boundary:

"The project boundary is the physical, geographical site of the industrial facility, processes or equipment that is affected by the project activity".

This project boundary includes the cogeneration plant, auxiliaries, and connected energy and fuel meters.



B.4. Description of baseline and its development:

Baseline development:

As per the methodology III.B "*The emission baseline is the current emissions of the facility expressed as emissions per unit of output (e.g., kg CO_2e/kWh). Emission coefficients for the fuel used by the generating unit before and after the fuel switch are also needed. IPCC default values for emission coefficients may be used.*"

Baseline to the project activity is the continued use of FO in energy generating unit. For estimation of baseline emissions, the weighted average (3 years data) of specific FO consumption in the plant for per unit of steam energy generation in the boiler prior to the start of project activity has been considered as per the methodology.

Following summarizes the fuel consumption and energy generation at ALOK in past 3 years.

Parameter	Unit	2004-05	2005-06	2006-07
Quantity of steam generated	tonnes/yr	**82979.5**	**143509.7**	**187112.0**

Steam Pressure	kg/cm^2	45	45	45
Steam Temp.	deg c	440	440	440
Total energy output from Boiler	TJ of steam/ annum	237.3	410.4	535.2
FO consumption	kg/ annum	6146629	10709679	14068571
Fuel Energy Input	TJ/ annum	245.4	427.5	561.6
Sp. FO consumption	t FO/ TJ steam energy output	25.9	26.1	26.3
Weighted average of Specific FO consumption for the 3 years	t FO/ TJ steam energy output	26.1		
Baseline emission factor	**tCO_2e/TJ of steam energy output**	**81.71**		

Baseline emissions for per unit of steam energy generation are 81.71 tCO_2e/ TJ of steam energy output from the boiler.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

Establishing Additionality

Additionality of the project activity has been established as per the guidelines suggested in Attachment A to Appendix B of the Modalities and Procedures for small scale CDM project activities.

In contrast to continuation of existing practice of FO use *i.e.* the business as usual scenario, use of NG faces a number of barriers as described below:

Technological barrier:

Stable and reliable combustion of NG in boiler can be problematic at times due to its variable calorific value, moisture in NG carried over and fluctuation in NG pressure at the delivery end. Quality specifications as per the contract with Gujarat Gas Company Limited (GGCL) is limited to NCV of the fuel to be between 8000-9000 kcal/scm while no other parameters like pressure and moisture content are assured. Further, there is no security against the non compliance with this specification from the gas supplier. This may lead to erratic operation of the system due to this inconsistency in the quality of NG and problems of poor flame control in the burner and at times flame getting switched off at low pressure etc. The problem of inconsistent supply of NG adds to the system underperformance. Any leakage or breakdown of pipelines may also lead to cut-off of its supply to ALOK plant.[2]
Due to uncertain quantity and quality of NG, plant operation might suffer leading to production problems. On the other hand, use of FO causes no such problems to plant operations making it the natural choice for use as fuel. But the use of FO leads to GHG emissions.

[2] For instance, a leak in the pipeline at Indonesia's Arun field in Aceh province led Exxon Mobil, leading US Oil Company, to cut the flow of gas to the plant. Exxon has reduced the supply to pt Arun ngl, Indonesia's oldest liquefied natural gas plant, by 300 million cubic feet a day from December 9, 2005, http://www.downtoearth.org.in/full6.asp?foldername=20060115&filename=news&sec_id=49&sid=65

Thus, the main technical troubles can be listed as –

- Operational problems due to inconsistent NG quality *i.e.* low gas pressure, presence of moisture in NG.
- Uncertainties related to quality NG supply

Barriers due to prevailing practice:

This is the first such project for ALOK and it has no prior experience in running this kind of operations. Also, it was not a common practice in the region to use Natural Gas for industrial operations at the time of project conceptualization in 2006. Data unavailability on such successful operations in textile plants added to apprehension about the success of the project activity.

In contrast to FO, Natural gas is a non storable and continuous delivery fuel. Natural gas, unlike other more conventional fossil fuels *e.g.* FO needs a network of pipelines for gas transmission and a local distribution to the end use.ALOK had come in contract with Gujarat State Petronet Limited (GSPL) for gas transmission to the project site. Project proponent paid a Bank guarantee of Rs. 12 million and a security deposit of Rs. 10 million with no interest accruing. Investments of Rs. 23.4 million have been done for retrofitting the systems for NG use. Project proponent also had to pay a Bank guarantee of Rs. 42.3 million for coming in contract with GGCL for NG supply. In total, an extra investment of Rs. 90.2 million has been done for NG based system to shear the cause of reducing GHG emissions. Extra investments and efforts in retrofitting the changes in the existing system have been done. They had to employ advisors and agencies for obtaining gas, recruit additional engineers to monitor, coordinate and implement all gas based programme.

Regulatory Barriers: The regulations on NG supply and use is still not very clear in India. There are examples when even central and state government regulations with regard to NG contradicted. This happened in Gujarat too which pulled ALOK back from switching and relying on NG as primary energy source. In April 2001, the Gujarat state assembly had enforced the Gujarat Gas (Regulation of Transmission, Supply and Distribution) Act empowering the state government to provide for "regulation of transmission, supply and distribution of gas, to promote gas-based industry in the state". The Supreme Court of India ruled that only the Union government can enforce laws on mineral oil resources, which include natural gas (NG) and liquefied natural gas (LNG). It decreed that states couldn't regulate the supply of gas through pipelines laid on their territory. Affirming the Centre's exclusive legislative competence over this issue, a constitution bench of honourable Supreme Court nullified the Gujarat legislation.[3] Uncertainty of this kind lead to apprehension among the potential NG users and any change in policy at any point of time may impact the business of the users.

Instead of the earlier pricing formula for gas purchase, now pooling has come into force and Gujarat will have to take the Centre's approval for purchase of gas. The state government had passed a CNG Bill in February 2005, which is yet to be approved by the Centre. Instead of clearing the Bill, the Centre brought in the Petroleum and Natural Gas Regulation Act, whereby a state has to take approval from the authority for purchasing gas. The rules of the said Act are yet to be framed.

[3] http://www.downtoearth.org.in/full6.asp?foldername=20040430&filename=news&sec_id=49&sid=14

Alok has contracted GGCL for gas supply. GGCL is a subsidiary of state owned GSPL (Gujarat State Petronet Limited). GSPC had entered into an agreement to source 1.3 mmscmd gas from the PMT gasfields. Also, GSPC had entered into an agreement with Petronet LNG for 3 million standard cubic metres of gas from Qatar and the agreement was inked for 15 years. However, the Centre has cancelled both the agreements. Following cancellation of the agreement, Gujarat will have to source gas at spot prices, which are on the edge of around $18 per standard cubic metre as compared to earlier contract price of $6.78 per standard cubic metre.[4]

Scrapping of the gas purchase agreement to supply gas to Gujarat from the Panna-Mukta-Tapti (PMT) gasfields and cancellation of gas sale agreement between the Gujarat State Petroleum Corporation and Petronet LNG have led to a situation where it would be a tough task for the state to manage gas for its industries.

Source: http://in.rediff.com/money/2008/feb/26gas.htm

ALOK has come in Gas Sales Agreement with Gujarat Gas Company Limited (GGCL) for NG supply and for supply from delivery point to plant site with Gujarat State Petronet Limited (GSPL). Uninterrupted supply and delivery of NG to ALOK is subject to availability with the GGCL and GSPL's ability to supply the same. There are a number of issues in the gas contract that are additional burden on ALOK. Apart from it, due to the monopoly of gas supplier, ALOK is wholly dependent on it (not a good sign for a growing industry).

The quality of NG is of utmost importance as it may affect the operation of energy generating system. Due to total dependence on one supplier ALOK is forced to accept conditions of contract which can't be termed as positive. An example of these issues is that ALOK is bound to pay even if it has disagreement on gas quality. If payment is delayed, GGCL charges an interest rate of SBI PLR+1%. In addition, GGCL may terminate gas supply on a 30 days notice on ALOK on defaults.

Other Barriers:

Prices of Natural Gas

There are a number of factors that affect the price of natural gas. These are gas volumes, upside availability, location (transaction cost), quality, demand- supply gaps etc. Gas prices are linked with the crude oil prices too which is highly variable and volatile. Apart from that, the market of NG is not homogeneous: different sectors face different cost economics for NG.The market for NG in India is an evolving market. Price volatility is a natural condition of natural gas markets because natural gas supplies cannot quickly adjust to demand changes. The lack of timely and accurate data about the overall natural gas market adds to the uncertainty about supply and demand conditions, further intensifying price volatility.
The global NG market has been witnessing tight demand-supply levels over the past one year and is likely to continue doing so over the medium term. The tightness has been brought about primarily by rising demand from the US and Europe, following a steady fall in domestic gas production prompted by the natural decline of mature fields, the absence of any major gas discoveries in recent times, and a sharp rise in crude oil prices. Long-term NG contracts were being signed at US$4-6/MMBTU as against the

[4] Source: http://in.rediff.com/money/2008/feb/26gas.htm

earlier level of $2-3/MMBTU. Spot prices of NG were also firmed up to cross US$10/MMBTU[5]. ALOK purchased Gas from Gujarat Gas Company Limited (GGCL) at the rate of US$9.074 per MMBTU which terminated by April 2008. Central government has recently decided to increase Administered Prices[6] which has further impact new gas sales agreements of ALOK in 2008. New gas supply agreement has been done with GSPCL for supply in the month of May 2008 on spot price of US$15.54 per MMBTU. The price of gas under this agreement is 71% higher than the earlier agreement.

Effective cost of NG (contract price of supply cost plus transmission cost) to ALOK was Rs. 409 per MMBTU as per the earlier contracts which have now become Rs. 672 per MMBTU.

Gas prices have been volatile as evident from above, these prices may further go high and apprehensions of the same did not encourage Alok to implement the project activity.

Short Term Supply Barrier

NG takes longer to meet the increased demand for natural gas as sudden increase in supply is constrained. There are several barriers to instant supply which affect the short term availability of natural gas supply. They include:

- **Delivery Disruptions** - Weather patterns and anomalies can have a significant impact on natural gas supply. Malfunctions and accidents may occur that disrupt the delivery of natural gas. For example, a compressor failure in a large pipeline could temporarily disrupt the flow of natural gas through that important market centre. Recently power generation at the Dabhol power plant in Maharashtra has dipped after a reduction in gas supply to the unit. There have been cases of erratic supply of NG in India. For example the total requirement of Regassified Liquified Natural Gas (RLNG) for operation was 5.7 million scm per day (mscmd). But in December 2007, suppliers of RLNG— GAIL India Ltd Ltd, Indian Oil Corp. Ltd, Bharat Petroleum Corp. Ltd— disbursed only 4.51 mscmd- an abrupt reduction of 21%. The reason for this cut in gas supplies was not immediately known since Petronet LNG Ltd, the firm importing LNG for the Dabhol power plant, said it had not reduced the flow of gas to GAIL.[7]

- **Land Access –** General idea that LNG is supplied on a high pressure and there are associated certain risks with it, it is felt difficult to get accessibility of land for laying down the pipe lines.

- **Pipeline Infrastructure** - The ability to transport natural gas from producing regions to consumption regions affects the availability of supplies. The interstate and intrastate pipeline infrastructure can only transport so much natural gas at any one time, and in essence provides a 'ceiling' for the amount of natural gas that can reach the ALOK plant. GGCL supplies gas to more than 150,000 households, 900 small and medium industries and 55,000 CNG vehicle owners in the industrial belt of Ankleshwar and Surat in south Gujarat. GSPC serves around 300 small and

[5] The tariff commission on NG in its interim report has recommended that the price of ONGC and OIL to be raised by around 8% and 26% respectively, from the current levels of Rs. 3,200/tcm each. As a result, it is likely that core sector consumers would witness a further rise in gas prices, http://www.naturalgas.org/business/analysis.asp#short

[6] http://www.livemint.com/2007/12/19000144/9A35AF32-3E50-40F1-B475-033A8257992BArtVPF.pdf

[7] http://www.livemint.com/2007/12/20230336/Power-generation-at-Dabhol-dip.html

medium enterprises, 25,000 residences and 12,000 CNG vehicles. The two companies have served notices to their consumers saying they might face difficulties with the regular gas supply operations[8].

- **Unavailability of NG-**
  GSPL, the agency contracted for gas transmission, according to news, will witness a minor reduction in the volumes transported through its network. As no alternative sources of gas are likely to be available in the near future, this will hamper its growth in the near term[9].

  The cap on network tariffs and compression charges will also have a negative impact on GGCL[10]. Thus, the short-term outlook for natural gas transporters has turned somewhat negative.

Summary
A comparison of baseline and project activity fuel based systems is given below:

Particulars	Baseline Fuel-FO based system	Project activity fuel-NG based system	Remarks
Storage	Storable at plant site	Not storable	Dependence on immediate supply of NG unlike FO. Any disruption in NG supply can impact the project activity negatively.
Supply system	In containers, through road/ship	Via pipelines	NG being based on pipeline system, prone to disruption[11]
Check on Quality	Controllable	Moisture, NCV and pressure needs to be maintained, not controllable at delivery	Option of checking/controlling quality not available before supply in case of NG which leads to acceptance of diverted quality of gas
Operation history	Proven	First experience	Extra efforts were put in to implement the project activity
Investments	Nil	Rs. 90.2 million	High initial investment
Regulations	Established	Not firm	Central and state policies contradict
Suppliers	Many	Single	NG market is monopolized
Price	Stable	Volatile	Prices are revised frequently
GHG emissions	High	Low	NG is less GHG emitting fuel

The proposed project activity is not a business-as-usual scenario and faces barriers as described above and thus is additional. These barriers are due to inconsistent quality and quantity of gas availability. Gas price volatility and unsure availability add to the risks. The project activity is first of its kind for ALOK and

[8] http://www.livemint.com/2007/12/11224857/Gujarat-consumers-fear-gas-wil.html

[9] http://economictimes.indiatimes.com/Features/Investors_Guide/Investors_can_consider_GAIL_Gujarat_Gas_and_Gujarat_State_Petronet/articleshow/2950036.cms

[10] http://www.thehindubusinessline.com/2008/03/13/stories/2008031351200200.htm

[11] For instance, a leak in the pipeline at Indonesia's Arun field in Aceh province led Exxon Mobil, leading US Oil Company, to cut the flow of gas to the plant. Exxon has reduced the supply to pt Arun ngl, Indonesia's oldest liquefied natural gas plant, by 300 million cubic feet a day from December 9, 2005, http://www.downtoearth.org.in/full6.asp?foldername=20060115&filename=news&sec_id=49&sid=65

also not mandated by law. In the absence of the project activity ALOK would have continued with FO to meet its thermal energy requirement. This scenario faces no barrier in its implementation and is already in practice, but would result in increased GHG emissions. Thus, the project proponents seek CDM benefits to mitigate unforeseen risks involved in the project.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Project Emissions:
Project activity emissions consist of those emissions related to the use of fossil fuel after the fuel switch. IPCC default values for emission coefficients have been used.

$$PE_{y} = Q_{steam,y} \times (E_{steam,y} - E_{FW,y}) \times EF_{steam\,y}$$

Where;
PE_{y} = Project emissions in year y, tCO_2
$Q_{steam,y}$ = Quantity of steam generated in project activity in year y, tones
$E_{steam,y}$ = Enthalpy of steam in project activity in year y, TJ/ tonne
$E_{FW,y}$ = Enthalpy of feed water in project activity in year y, TJ/ tonne
$EF_{steam,y}$ = Emission factor for steam generated in project activity in year y, tCO_2/ TJ

$$EF_{steam,y} = (\sum Q_{NG,y} \times NCV_{NG} \times EF_{NG} \times 44/12 \times OXID_{NG}) / (Q_{steam,y} \times (E_{steam,y} - E_{FW,y}))$$

Where;
$Q_{NG,y}$ = Mass unit of NG consumed in project activity year y, tonnes
NCV_{NG} = Net calorific value of NG (GJ/ tonne); IPCC default value
EF_{NG} = Carbon emissions factor per unit of energy of*I* NG (tC/TJ), IPCC default value
$OXID_{NG}$ = Oxidation factor of NG, IPCC default value

Baseline Emissions:
The emissions in baseline is the current emissions of the facility expressed as emissions per unit of output i.e. kg CO_2e/TJ of steam energy. Emission coefficients for the fuel used by the generating unit before and after the fuel switch are also needed. IPCC default values for emission coefficients have been used.

$$BE_{y} = Q_{steam,y} \times (E_{steam,y} - E_{FW,y}) \times EF_{steam,BSL}$$

Where;
BE_{y} = Baseline emissions in baseline, tCO_2
$Q_{steam,y}$ = Quantity of steam generated in project activity year y, tonne
$E_{steam,y}$ = Enthalpy of steam generated in project activity year y, TJ/tonne
$E_{FW,y}$ = Enthalpy of feed water in project activity year y, TJ/ tonne
$EF_{steam,BSL}$ = Emission factor for steam generated in baseline in year y, tCO_2e/ TJ of steam energy

$$EF_{steam,BSL} = (\sum Q_{i,BSL} \times NCV_{FO} \times EF_{FO} \times 44/12 \times OXID_{FO}) / (Q_{steam,BSL} \times (E_{steam,BSL} - E_{FW,BSL}))$$

Where;
$Q_{i,BSL}$ = Mass unit of FO consumed in baseline, tonne
$Q_{steam,BSL}$ = Quantity of steam generated in baseline, tonne
$E_{steam,BSL}$ = Enthalpy of steam in baseline, TJ/ tonne
$E_{FW,BSL}$ = Enthalpy of feed water in baseline, TJ/ tonne
NCV_{FO} = Net calorific value of FO (GJ/ tonne)*;* IPCC default value
EF_{FO} = Carbon emissions factor per unit of energy of FO (tC/TJ), IPCC default value
$OXID_{FO}$ = Oxidation factor of FO IPCC default value

Leakage
No leakage is required to be considered and hence have not been calculated.

Emission Reduction

$ERy = BEy - PEy$

Where:
ER_y = Emissions reductions of the project activity year y, tonnes of CO_2,
BE_y = Baseline emissions due to displacement of electricity in year y, tonnes of CO_2,
PE_y = Project emissions during the year y, tonnes of CO_2

B.6.2. Data and parameters that are available at validation:

(Copy this table for each data and parameter)

Data / Parameter:	**$Q_{steam,BSL}$**
Data unit:	Tonne
Description:	Quantity of steam generated in baseline
Source of data used:	On-site measurements
Value applied:	82979.5, 143509.7, 187112.0 for years 2004-05, 2005-06 & 2006-07 respectively
Justification of the choice of data or description of measurement methods and procedures actually applied:	The data is based on daily monitoring and recording of data on plant operation prior to the implementation of project activity. Steam meters are installed for this purpose.
Any comment:	-

Data / Parameter:	**$E_{steam,BSL}$**
Data unit:	kJ/ kg
Description:	Enthalpy of steam generated in baseline
Source of data used:	Estimated
Value applied:	3299.7

Justification of the choice of data or description of measurement methods and procedures actually applied :	Estimated on steam tables for steam pressure and steam temperature.
Any comment:	-

Data / Parameter:	**$E_{FW, BSL}$**
Data unit:	kJ/ kg
Description:	Enthalpy of feed water in baseline
Source of data used:	Estimated
Value applied:	439.6
Justification of the choice of data or description of measurement methods and procedures actually applied :	Estimated based on feed water temperature
Any comment:	-

Data / Parameter:	**$P_{steam, BSL}$**
Data unit:	kg/cm^2
Description:	Average pressure of steam generated in baseline
Source of data used:	On-site measurement
Value applied:	45
Justification of the choice of data or description of measurement methods and procedures actually applied :	Three years average of data measured directly using on-line pressure gauges
Any comment:	-

Data / Parameter:	**$T_{steam, BSL}$**
Data unit:	Deg C
Description:	Average temperature of steam generated in baseline
Source of data used:	On-site measurement
Value applied:	440
Justification of the choice of data or description of measurement methods and procedures actually applied:	Three years average of data measured directly using on-line temperature gauges
Any comment:	-

Data / Parameter:	**$Q_{i,, BSL}$**
Data unit:	kg/yr
Description:	Quantity of fuel (FO) i consumed in baseline
Source of data used:	On-site measurements
Value applied:	6146629, 10709679, 14068571 for years 2004-05, 2005-06 & 2006-07 respectively

Justification of the choice of data or description of measurement methods and procedures actually applied:	Directly measured data
Any comment:	-

Data / Parameter:	$EF_{steam, BSL}$
Data unit:	tCO_2e/ TJ of steam energy
Description:	Emission factor for steam generated in baseline in year y
Source of data used:	Calculated
Value applied:	81.71
Justification of the choice of data or description of measurement methods and procedures actually applied:	Weighted average of last three years data
Any comment:	-
Data / Parameter:	NCV_{FO}
Data unit:	GJ/ tonne
Description:	Net calorific value of FO
Source of data used:	IPCC default
Value applied:	40.4
Justification of the choice of data or description of measurement methods and procedures actually applied:	Most recent and reliable data as available in 2006 IPCCC Guidelines for National GHG Inventories.
Any comment:	-

Data / Parameter:	NCV_{NG}
Data unit:	GJ/ tonne
Description:	Net calorific value of NG
Source of data used:	IPCC default
Value applied:	48.0
Justification of the choice of data or description of measurement methods and procedures actually applied:	Most recent and reliable data as available in 2006 IPCCC Guidelines for National GHG Inventories.
Any comment:	-

Data / Parameter:	EF_{FO}
Data unit:	tC/TJ
Description:	Carbon emissions factor per unit of energy of FO
Source of data used:	IPCC default
Value applied:	21.1

Justification of the choice of data or description of measurement methods and procedures actually applied:	As per the applied methodology AMS III-B, IPCC default values for emission coefficients may be used.
Any comment:	-

Data / Parameter:	EF_{NG}
Data unit:	tC/TJ
Description:	Carbon emissions factor per unit of energy of NG
Source of data used:	IPCC default
Value applied:	15.3
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per the applied methodology AMS III-B, IPCC default values for emission coefficients may be used.
Any comment:	-

Data / Parameter:	$OXID_{FO}$
Data unit:	Fraction
Description:	Oxidation factor of FO
Source of data used:	IPCC default
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied:	Most recent and reliable data as available in 2006 IPCC Guidelines for National GHG Inventories.
Any comment:	-

Data / Parameter:	$OXID_{NG}$
Data unit:	Fraction
Description:	Oxidation factor of NG
Source of data used:	IPCC default
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied:	Most recent and reliable data as available in 2006 IPCC Guidelines for National GHG Inventories.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

Parameter	**Unit**	**Value**
Quantity of steam generated	Tonne per annum	194400

Enthalpy of steam	kJ/ kg	3299.7
Baseline emission factor	tCO2/ TJ of steam	81.71
Project emission factor	tCO2/ TJ of steam	56.1
Emission Reduction	tCO2/ annum	14,240

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

Year	Estimation of project activity emissions (tonnes of CO2e)	Estimation of baseline emissions (tonnes of CO2e)	Estimation of leakage (tonnes of CO2e)	Estimation of overall emission reductions (tonnes of CO2e)
2008-09	45,432	31,191	0	14,240
2009-10	45,432	31,191	0	14,240
2010-11	45,432	31,191	0	14,240
2011-12	45,432	31,191	0	14,240
2012-13	45,432	31,191	0	14,240
2013-14	45,432	31,191	0	14,240
2014-15	45,432	31,191	0	14,240
2015-16	45,432	31,191	0	14,240
2016-17	45,432	31,191	0	14,240
2017-18	45,432	31,191	0	14,240
Total (tonnes of CO_2e)	454,320	311,910	0	142,400

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	**$Q_{steam,y}$**
Data unit:	Tonne
Description:	Quantity of steam generated in the project activity in year y
Source of data to be used:	On-site measurements
Value of data	285120
Description of measurement methods and procedures to be applied:	The data is based on daily monitoring and recording of data on cogeneration plant operation in the project activity
QA/QC procedures to be applied:	Flow meters are calibrated regularly
Any comment:	-

Data / Parameter:	**$E_{steam,y}$**
Data unit:	kJ/ kg

Description:	Enthalpy of steam generated in the project activity in year y
Source of data to be used:	Estimated based on steam pressure and steam temperature
Value of data	3299.7
Description of measurement methods and procedures to be applied:	Estimated on steam tables
QA/QC procedures to be applied:	Fixed value on a certain temperature & pressure of steam
Any comment:	-

Data / Parameter:	**$E_{FW, y}$**	
Data unit:	kJ/ kg	
Description:	Enthalpy of feed water in project year y	
Source of data to be used:	On site measurements	
Value of data	439.6	
Description of measurement methods and procedures to be applied:	Estimated based on feed water temperature, 105^{o}C and Heat Capacity on constant pressure for water Cp 4.18 j/kg/^{O}C	
QA/QC procedures to be applied:	-	
Any comment:		

Data / Parameter:	**$P_{steam, y}$**
Data unit:	Kg/cm^2
Description:	Average pressure of steam generated in project activity in year y
Source of data to be used:	On-site measurement
Value of data	45
Description of measurement methods and procedures to be applied:	Measured directly using on-line pressure gauges
QA/QC procedures to be applied:	Pressure gauges are calibrated regularly.
Any comment:	-

Data / Parameter:	**$T_{steam, y}$**
Data unit:	Deg C
Description:	Average temperature of steam generated in project activity in year y
Source of data to be used:	On-site measurement
Value of data	440
Description of measurement methods and procedures to be applied:	Measured directly using on-line temperature gauges
QA/QC procedures to be applied:	Temperature gauges are calibrated regularly
Any comment:	-

Data / Parameter:	$Q_{i,,y}$
Data unit:	Mass or volume unit
Description:	Quantity of NG consumed in project activityyear y
Source of data to be used:	On-site measurements
Value of data	11841 tonne of NG
Description of measurement methods and procedures to be applied:	On line gas flow meters are installed at the project site. The quantity can be cross checked with gas bills from the gas suppliers.
QA/QC procedures to be applied:	These meters are calibrated regularly.
Any comment:	The value applied is theoretical, based on NCVs of the replacing and replaced fuels

B.7.2 Description of the monitoring plan:

ALOK has procedures for monitoring and recording data on operation & maintenance of the plant/ equipments. The equipments used for CDM project are part of these procedures and document on maintenance and rectification done on all the equipments are maintained.
Unit President is responsible for the overall functioning of the sponge iron plant & power plant. ALOK adopts following procedures to assure the completeness and correctness of the data needed to be monitored for CDM project activity.

Formation of CDM Team:
A CDM project team is constituted with participation from different sections at the unit. This team is responsible for data collection and archiving. This team meets periodically to review CDM project activity, check data collected, emissions reduced etc. On a monthly basis, the monitoring reports are checked and discussed by the senior CDM team members/managers. In case of any irregularity observed by any of the CDM team members, it is informed to the concerned person for necessary actions. Further these reports are forwarded to the management monthly basis.

- *President:* Overall responsibility of compliance with the CDM monitoring plan.
- *Cogeneration plant In-charge:* Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation
- *Shift In-charge:* Responsibility of daily report generation

Day to day data collection and record keeping:
Plant data is collected on operation under the supervision of the respective Shift-in-charge and record is kept in daily logs.

Checking data for its correctness and completeness:
The CDM team is overall responsible for checking data for its completeness and correctness. The data collected from daily logs is forwarded to MIS (miscellaneous) section after verification from respective departments.

Reliability of data collected-

The reliability of the meters is checked by testing the meters on yearly basis. Documents pertaining to testing of meters are maintained.

Frequency-
The frequency for data monitoring shall be as per the monitoring details in Section B.7.1 of this document.

Archiving of data-
Data shall be kept for two years after the crediting period or the last issuance. The data shall be kept electronically and/ or in paper for verification.

Calibration of instruments:
ALOK has procedures defined for the calibration of instruments. A log of calibration records is maintained. Electrical department in the company is responsible for the upkeep of instruments in the plant.

Maintenance of instruments and equipments used in data monitoring:
The operation department is responsible for the proper functioning of the equipments/ instruments and informs the concerned department for corrective action if found not operating as required. Corrective action is taken by the concerned department and a report on corrective action taken is maintained as done time to time along with the details of problems rectified.

Internal audits of CDM project compliance:
CDM audits shall be carried out to check the correctness of procedures and data monitored by the internal auditing team entrusted for the work. Report on internal audits done, faults found and corrective action taken shall be maintained and kept for external auditing.

Emergency preparedness:
The project activity does not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

Report generation on monitoring:
After verification of the data and due diligence on corrective ness if required an annual report on monitoring and estimations shall be maintained by the CDM team and record to this effect shall be maintained for verification.

Parameters used to calculate emission reductions of project activity are monitored regularly and data on baseline shall be kept safely for the entire crediting period plus two years after the end of crediting period.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date of determining the baseline: 12/12/2007

Developed by:
P. K. Das - President
Alok Industries Limited (Also the Project participant)

CDM – Executive Board

Survey No. 43
Village Balitha
PO Box No 43, Vapi
Gujarat – 396 191
Phone: 0260 2437108, 2437109
Fax: 0260 2437125
Email: pkdas@alokind.com

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

08/10/2007 (Date of contract with GGCL)

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

20 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

NA

C.2.1.2. Length of the first crediting period:

NA

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/07/2008, but not before the date of registration as a CDM project activity

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

Environment Impact Assessment study is not required for the project activity as per the regulations defined by Central Pollution Control Board in India (EIA notification S.O. 1533, 14th September, 2006). The plant adheres to the guidelines and norms stipulated by State Pollution Control Board for operating the plant and had acquired required approvals.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The project activity is a fuel switch project with introduction of natural gas usage in energy generation which is a cleaner fuel compared to FO (baseline) and hence will only help in better environmental conditions inside and outside the plant with lower emissions in energy generation.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

Following stakeholders are identified for the project activity:

1. Local people
2. Gram Panchayat
3. Gujarat State Pollution Control Board
4. Employees of Alok Industries Limited

Process for stakeholder consultation adopted:
Letters informing about the project were sent and their views were invited on project activity from Gram Panchayat and District Collector office on 26 March 2007. A newspaper advertisement was published informing general public about the project on 27 March 2007 in vernacular newspaper *Divya Bhaskar*. Similarly it was advertised on Gram Panchayat notice board informing about the proposed general meeting.

Follow up meeting was conducted with Gram panchayat and ALOK personnel on 29 March 2007 at ALOK premises in the village Balitha of Valsad. Mr. SC Goyal, Director (projects) explained them about the project activity that how it implements fuel switch from high to low emitting fuel resulting emission reduction and overall positive impact on environment. Mr. P K Das, President told that the project activity is a good initiative and should be done by other industries in the region. He then explained all about the project, its role in fuel switch, he also explained about CDM and greenhouse gases and their impact on climate change globally. People enthusiastically participated and asked questions and offered further suggestions which can result in greenhouse gas emission reduction.

The general meeting with local people was presided over by Mr. S.C. Goyal from ALOK and attended by Mr. PK Das, Mr. A Mukharjee and Mr. D Singh of ALOK and gram panchayat members and/ or villagers.

Mr. Digvijay Singh, Manager (P&A) proposed thanks to one and all for their participation and suggestions offered.

E.2. Summary of the comments received:

People in general appreciated efforts from ALOK towards GHG emission reduction and adoption of environment friendly technology in its plant.

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

No adverse comment was received on the project activity from any of the stakeholders consulted.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Alok Industries Limited
Street/P.O.Box:	G. K. Marg, Lower Parel
Building:	Peninsula Towers, Peninsula Corporate Park
City:	Mumbai
State/Region:	Maharashtra
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URL:	www.aloktextile.com
Represented by:	K H Gopal
Title:	President
Salutation:	Mr.
Last Name:	Gopal
Middle Name:	H
First Name:	K
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Annex 1 and / or ODA for the project activity.

Annex 3

BASELINE INFORMATION

Parameter	Unit	2004-05	2005-06	2006-07
Quantity of steam generated	tonne/ yr	82979.5	143509.7	187112.0
Steam Pressure	kg/ cm^2	45	45	45
Steam Temp.	Deg c	440	440	440
Total energy output from boiler	TJ of steam/ annum	237.3	410.4	535.2
FO consumption	Kg/ annum	6146629	10709679	14068571
Fuel Energy Input	TJ/ annum	245.4	427.5	561.6
Sp. FO consumption	t FO/ TJ steam energy output	25.9	26.1	26.3
Weighted average of Sp FO consumption for the 3 years	t FO/ TJ steam energy output	26.10		
Baseline emission factor	tCO_2e/ TJ of steam energy output	81.71		

Annex 4

MONITORING INFORMATION

As per the methodology, the emission reduction achieved by the project activity will be calculated as the difference between the baseline emissions and the project emissions.

Monitoring involves:

Monitoring of the fuel use and output for an appropriate period (3 years in the project activity) prior to the fuel switch being implemented – *i.e.* FO use and steam energy output from the cogeneration plant.

Monitoring fuel use and output after the fuel switch has been implemented – *i.e.* natural gas use and steam energy output from the cogeneration plant.

Monitoring and recording of the above information shall be as per the plan described in section B.7.1 and B.7.2 of this document.

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