

Internship Report on
Energy efficient brick kilns for sustainable environment



Inspiring Excellence

Internship Report on
Energy efficient brick kilns for sustainable environment

Submitted To

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Submitted By

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Acknowledgement

At first I would like to express my intense thankfulness to the almighty Allah for preparing this internship report.

It was a great enjoyment to prepare an internship report on the various aspects of brick sector in our country. I would like to thank and convey my gratitude to honorable supervisor, Mr. Dr. Salehuddin Ahmed, Professor, School of Business Studies, BRAC University, for giving me to prepare this report. I would also like to express my appreciation to him for support and guidance.

I am also very grateful to the honorable Manager, Mr. Md. Nurul Alam of Bhuiyan Trading Corporation for his advice and kind effort, which help me a lot to collect information and data about this Topic. And i want to give thanks those persons who always support me.

Letter of Transmittal

Date: 15 April, 2019

To

Dr. Salehuddin Ahmed
BRAC Business School
BRAC University

Subject: Submission of Internship Report

Dear Sir,

I am grateful to you for the submission of the report on Energy efficient brick kilns for sustainable environment in the completion of the requirement for internship. This is an excellent opportunity for me to communicate more closely with the organization. The association and coordination of all respective officers & staffs with me are full of exciting, re-discovering and entertainment. During the period of doing this report I have discovered and gained new & practical feelings, observations and learning.

I have my utmost effort to reflect experience, skill and knowledge, which I acquired at the time of working at Bhuiyan Trading corporation. All of my efforts will be successful if the report can serve its purpose. I have tried my best to explain everything related with the topics.

Yours sincerely

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Executive Summary

Brick remains the most important construction material in our country as we've lower supply of construction rocks. Different topsoil from agricultural lands, river floodplains are used for making the green bricks that's burnt later at the kilns particularly using the imported coal and domestic fire wooden. Most of the owners of brick kiln especially use imported Indian poor high-quality coal for burning bricks in the seasonal brick kilns operated for the duration of November to May each year. A current UNDP research suggests that approximately 33% fire wood share according the fuel used in the seasonal brick kilns.

There are about 8,000 brick fields that manufacture bricks of various grades in the country claimed by Bangladesh Brick manufacturing Owners association (BMOA). Approximately 60% of the produced bricks in our country used by government departments, which include the Roads and Highways branch, Public Works department and local government Engineering department yearly. The rest is consumed by private sector users.

Bhuiyan Trading Corporation has one improved zigzag kiln that is situated in Senbag, Noakhali. Currently they are supplying three different districts in our country. It has been operating since 2009. However, sometimes it creates some problem to the local people because of air pollution. Furthermore, there are lots of trucks are going in and out from kiln it may creates some problem to school children and cannot operate throughout the whole year. Now it wants to set up new kiln so that it can produce whole year and may lead to reduce environmental pollution.

Brick kilns are the main source of greenhouse gas in Bangladesh, 6 to 9 million tons of CO₂ emitting annually. These high levels of emissions are a result of the use of age-old technologies and substandard fuels. For example, high sulfur coal, tires and wood used in the kilns

Financial feasibility analysis is a must to implement environment friendly brick manufacturing project. As this technology is capital intensive, this reports main objects to identify the parameters to implement a green brick technology.

Chapter: 1

Introduction

Since the beginning of human advancement, bricks have been assuming an important role for development of houses and other framework and are a noteworthy catalyst for monetary advancement. In Bangladesh bricks are the most essential structure material in urban territories. However, with income rising, it has turned into a critical structure material in rural area. Quick urbanization and related rural to urban movement has made an expanding interest for private, business, mechanical, open structures and different frameworks. With the rising demand for development materials to cater to the structure development, the brick producing industry in Bangladesh has risen drastically. In this manner, brick fields have flourished and mushroomed everywhere throughout the nation with substantial fixation at the edges of urban areas and towns. The brick making industry in Bangladesh is changing gradually towards mechanization, they are to a great extent utilizing wasteful, filthy innovation, casual regular business strategies and aimless development. The spontaneous improvement of the brick business is totally unsustainable. Hence, it is emergency to set up country's strategy for clean and sustainable brick production.

1.1 Origin of the Report

This report is submitted to the BRAC Business School, BRAC University, under the supervision of Dr. Salehuddin Ahmed, Professor, BRAC Business School, BRAC University, as part of the internship program. This is a requirement for the Masters of Business Administration (MBA) Degree.

I did three months internship in Bhuiyan Trading Corporation. Their head office situated in Chattogram. Basically I worked in bricks and coal sector of that organization. First two months I worked in Sylhet then I went to Chattogram.

1.2 Objectives:

Broad Objective:

To know the existing technology used in brick kiln and which method is the most efficient and sustainable for our environment.

Specific objectives:

- Identify level of pollution from our existing brick kiln.
- Estimate capital required for environment friendly bricks.
- To assess the available financing sources.
- To identify the desired period for successful project implementation and clean reimbursement of borrowed cash;.
- Perform the comparative analysis with the competitors.

1.3 Limitations:

Lots of information and experience is needed to prepare a good report. The limitations for making the report complete and perfect may include:

- Due to business secrecy and confidentiality, some information will be held back.
- Time constraint is a major issue.
- There are only few automatic brick manufacturing projects are running in the country.

1.4 Methodology:

Both primary and secondary information sources used to complete this study.

The primary sources are:

- Survey of entrepreneurs who have or are being implementing automated brick project;
- Interview with some machinery suppliers from abroad
- Practical deskwork.
- Interview with employee of our existing brick kiln.

The secondary sources are:

- Different manuals published on Efficient Brick Manufacturing.
- Publications obtained from internet.

Chapter: 2

Organizational Overview

Company Name:	Bhuiyan Trading Corporation
Nature of Business	Manufacturing, Processing, Retail.
Managing Director	Md Belal Hossain
Address	Ala Mia Chamber, Majhirghat, Chattogram
Phone	+8801771104317
Email	Bhuiyantradingcorporation14@gmail.com

2.1 Bhuiyan Trading Corporation

Bhuiyan Trading Corporation started its journey in 2014. It is SBU of Bhuiyan group. It has many business unit namely Yeasin Traders, Bhuiyan Traders, Bhuiyan Brick Kiln. It has started its journey in 1965 as Yeasin traders. At first it was involved only in cement and steel business. Furthermore, they set up Zig Zig Brick Kiln in 2008 at Senbag Noakhali. It is producing approximately 80 lakh bricks yearly. Now it has coal business in Chittagong, Sylhet and Narayanganj that is imported from India, Indonesia and South Africa. In addition, it has license for doing different governments and LGED project. At early years the company had to pass through very difficult time. It has survived and grown only for its honesty, integrity, moral scruples and for its business ethics. Bhuiyan Trading Corporation is managed by an two-member independent Board of Directors comprising two senior officials.

2.2 Vision

Bhuiyan Trading Corporation vision is "To help ensure monetary advancement of the nation and improve living of standard of the general population through sustainable and eco friendly bricks producing."

2.3 Mission

Bhuiyan Trading Corporation mission is to provide bricks in low cost and maintain its outside atmosphere pollution free.

2.4 Our Values

- Quality
- Customer Focus
- Fairness
- Transparency
- Continuous Improvement
- Innovation

2.5 Distribution Network

- The organization focuses its sales on three five different district. It has built up a propelled dissemination framework through its talented and prepared labor and a huge fleet more than 20 vehicles.

2.6 Quality Policy

- Bhuiyan Trading Corporation's central goal is to accomplish business acceptance through quality by understanding, tolerating, meeting and surpassing client desires.
- The administration of Bhuiyan Trading Corporation submits itself to quality as the prime thought in all its business choices.

2.7 Social Responsibility:

Bhuiyan Trading Corporations are doing many things as part of their corporate social responsibility. For instance, they planted approximately 500 hundreds trees in different area. It takes responsibility of 5 poor children until their graduation level. It provides clothes to the poor people during eid.

2.8 Employee:

Currently more than 150 employee are working in different business unit of Bhuiyan Trading Corporation in different places.

Chapter: 3

Overview of Brick Sector

Fired clay bricks are the most essential development materials in Bangladesh. Bangladesh remains as the fourth biggest brick maker in the world. The nation has in excess of 7,000 brick kilns, creating around 23 billion bricks every year. The business represents around 1% of the nation's GDP and producing work for in excess of a million people. Bangladesh has a population of 159.9 million and at current development rate, Bangladesh will require constructing estimated 4 million new houses yearly to satisfy the need for the growing population and that, thus, will lead the development for the brick division. The Table 3.1 below gives a preview of brick sector in Bangladesh.

	Value
Estimated total number of coal-fired kilns	7100
Annual brick production	23.1 billion
Estimation of output	USD 2.72 billion
Contribution to GDP	~1%
Coal consumption	6.68 million tons
Emission of CO ₂	15.80 million tons
Coal consumption	3750 million cubic feet
Total employment (including supply of coal)	>1.3 million
Projected future growth rate over the next ten years	2-3%

Table 3.1: Bangladesh's Brick Sector at a Glance

3.1 Characteristics of brick kiln

The brick business in Bangladesh can be classified as SME size activities characterized by two sorts of firms with high benefit structures and owing three or four production modules, the more prominent larger part by, typified by low wages and little production units.

Despite the fact that there are various brick making units utilizing improved innovations, working round the year, most brick plants use dirty technologies with low low energy efficiency and high emissions, depending on single raw material i.e., coal and product (strong brick). The proceeding with utilization of low-tech fixed chimney kiln to physically created,

sun- dry bricks and clustering designs have joined to cause huge crumbling in air quality around these clusters and the neighboring urban regions.

Brick production in Bangladesh is occasional, limited to five to six dry months of the year. Because of seasonal nature of activity and work, brick making has not named an industry in the Industry Policy of Bangladesh. In brick sector, labor productivity is low, capitalization non-existent, for the most of part depend on equity capital and casual administration. The majority of the brick producers face extreme trouble with working capital and that push them to rely on casual financial channels, for example, family, companion and cash moneylenders to continue their production. Moreover, high loan costs, these channels are awkward, time consuming and mostly, inadequate.

3.2 Brick making technology:

There are various types of technologies has been using in Bangladesh. For example, Fixed-Chimney Kiln (FCK), Zigzag, Hybrid Hoffman (HHK), Vertical Shaft Brick Kiln (VSBK) and Tunnel Kiln. Among them kiln technologies, the FCK has the low production capacity and most polluting one. Tunnel is the most effective and less contaminating. Several types of technologies, for example, Improved Zigzag and HHK are significantly cleaner, consuming low energy and transmitting much lower emissions.

Classification of kiln	2010				2018			
	Number	Percentage of total proportion	Yearly Production (billions)	Percentage of total proportion	Number	Percentage of total proportion	Yearly Production (billions)	Percentage of total proportion
FCK	4,900	92.21	13.5	89.46	3730	35.19	7.1	31.16
Zigzag	200	3.07	0.5	2.98	4247	62.97	12.7	55.76
HHK	35	0.61	0.5	3.58	61	0.90	1.1	4.81
Tunnel	0		0.0	0.00	60	0.86	1.7	7.62
Others	300	4.1	0.6	3.98	7	0.07	0.2	0.66
Total	5435		15.1		7444		22.8	100.00

Table 3.2: Brick production using various types of technologies

3.3 Fixed Chimney Kiln (FCK)

FCK is basically a modified Bull's Trench Kilns with a 120 ft long fixed chimney. It has circular shape molded burrow area. The base and the sidewalls of the furnace are fixed with blocks keeping the top open. Sun dried bricks are sacked in the oven in a methodical manner leaving enough space for fuel stirring and air course. After arranging the bricks in the furnace, the highest point of the kiln is secured with terminated bricks and stones. The bricks are fired from the top and the flame pushes ahead towards the smokestack. The air opening and the smokestack are situated at the two finishes so that burning air is preheated by taking warmth from the fired blocks and the green blocks to be fired are preheated by the vent gas on out of the smokestack. The blocks fired all around the furnace, which implies that the stack and the air gap must be progressively pushed ahead, until all bricks in the channel are fired. The tall chimney makes a more grounded draft along these lines improving the burning procedure and discharges the vent gas at a tallness 120 ft over the ground in this manner giving quicker and better dispersion. The kiln has underground funneling to jumper the vent gas from anyplace in the furnace to the fixed smokestack. The FCK has better protection over BTK in the sidewall, which diminishes heat loss to the environment. The expense of development of the smokestack is almost half of the absolute expense of a FCK.



Picture: 3.1 Fixed Chimney Kiln (FCK)

3.4 Improved zigzag kiln

The Zigzag kiln used in Bangladesh are replications of comparative Indian kiln created by the Central Building Research Institute (CBRI) in Roorkee, India during the 1970s. They are genuinely like Habla kiln once broadly used in Germany and Australia. In Bangladesh, the Zigzag kiln are established in the Cumilla area. If accurately constructed and operated, zigzag kilns would result in better energy effectiveness and lower outflows. The energy efficiency gains are because of good insulation and improved warmth transfer to the green blocks. The discharge decreases are because of low fuel use, better block stacking, zigzag air stream over longer way and flue gas scouring in a water filled pipe interfacing with the outlet fireplace.

A Zigzag kiln is basically rectangular and regularly measures around 250 ft long and 80 ft wide. It has a 55 ft high fixed fireplace situated on one side of the kiln. An induced draft fan situated at the base of the smokestack draws the flue gas from the kiln and releases it into the environment. The prompted draft fan guarantees an all around controlled air flow through the kiln. The kiln is partitioned into 44 to 52 chambers, isolated from one another by green blocks such that the hot gas moves in a zigzag path through little openings.



Picture: 3.2 Improved zigzag kiln

3.4 Hoffman kiln (natural gas)

Hoffman Kiln (HK) is the most efficient technology that was introduced in Germany by Friedrich Hoffman in the mid-nineteenth century and was once generally used in Europe for block, pottery and lime Production. Flammable gas fired Hoffman kiln were presented in Bangladesh in the 1980s. Generally a Hoffman kiln is rectangular shape and measures 300-400 ft long and 60 ft wide. HK have brilliant protection given by the thick kiln dividers in this way heat loss is incredibly diminished. The emanations are likewise low because of the utilization of natural gas as fuel.

Building this sort of kiln requires extraordinary designing aptitude. The primary contrast among Hoffman and the conventional kiln is that HK is based on high land, which does not get flooded and thus can deliver consistently. Likewise, the HK has a rooftop which makes it workable for the plant to work in the rainy season. Within top of the kiln is curved and has a firebrick lining within surface. The thick dividers give great protection that limits heat loss.



Picture: 3.3 Hoffman kiln

3.5 Hybrid Hoffmann Kiln (HHK)

The hybrid Hoffmann kiln developed in China, the HHK illustrates a hybrid version of the Hoffmann kiln technology that was developed in Germany in the mid-nineteenth century. Dissimilar to the gas-based Hoffmann kiln, the HHK uses coal as fuel. The HHK consolidates fuel infusion and outer firing in very insulated kiln, prompting lower energy use, fantastic blocks, and diminished pollution. It was presented in Bangladesh in 2006 under a GEF supported venture (UNDP– GEF, 2006). Currently nine HHKs are working in Bangladesh, and more than eight are going to start their operation soon.

The HHK configuration joins a very efficient kiln innovation, known as Forced Draft Tunnel Kiln (FDTK), with a special strategy of forming green blocks: Granulated coal is injected for inside burning. Almost 80 percent of the all out energy required is injected into the blocks, while the rest of nourished remotely into the firing chamber. A large portion of the fuel infused into the green blocks is totally burned during firing. This innovation improves energy productivity in two different ways.



Picture: 3.4 Hybrid Hoffman kiln

3.6 Tunnel Kiln

In a tunnel kiln, that's a horizontal transferring ware kiln, bricks to be fired are moving on cars through a big horizontal tunnel. The firing sector stays stationary near the center of the tunnel, whilst the bricks and air move in counter-current paths. Cold air is drawn from the auto go out end of the kiln, cooling the fired bricks. The combustion gases travel toward the auto front, transferring a part of their warmth to the incoming green bricks. The cars may be driven both constantly or intermittently at fixed time durations. The tunnel kilns have provisions for air extraction and deliver at several points alongside the length of the kiln.

Tunnel kilns are the favored era for firing bricks in developed international locations. The benefits of tunnel kiln technology lie in its potential to hearth a selection of products; better control over the firing procedure; ease of mechanization, for this reason lowering the hard work requirement; and large manufacturing extent. normally the ability of a single tunnel kiln between 60,000 to two hundred,000 bricks according to day. while there are fewer than 10 tunnel kilns running in South Asia for brick firing, the era has turn out to be very popular in Vietnam, in which more or less seven-hundred tunnel kilns are in operations.



Picture: 3.4 Tunnel kiln

3.7 Environment pollution and Energy-efficiency Issues:

Maximum brick kilns in Bangladesh are considerably polluting on the grounds that they use crude technology and low- quality coal for burning. Burning of coal within the kilns releases numerous pollutants into the environment,

The principle environmental effects of running brick kilns, which are in particular evident for the FCKs, are as follows:

3.7.1 Health:

Pollution from different brick kiln may creates different diseases to human body. For instance, it may lead to lung cancer and adult mortality. Furthermore, it includes infant and child mortality from respiratory diseases.

3.7.2 Global Warming:

Burning of low quality coal may contribute to global warming and climate change. In addition, energy inefficient is high in low quality coal.

3.7.3 Agricultural yields:

Air pollution in certain areas where brick kilns are situated may contributes to the decline of Agricultural yields.

3.7.4 Forest:

Firewood use is not legal in Bangladesh. However, some evidence indicates that a large amount of firewood is still used for brick-making. This will cause deforestation or forest degradation, with lack of environmental offerings (e.g., watershed safety) and biodiversity.

3.7.5 Child labor:

Child labor is the main problem in many kilns where every kiln employs about 150 workers, migrant families generally convey a few 30–50 kids to live close by. despite the fact that banned from running by way of law, older youngsters often join in kiln to enhance their circle of their relatives' earnings and families.

Chapter: 4

Strategies and policies for energy efficient brick kilns for sustainable environment

6.2% on an averaged economic growth in Bangladesh since 2006. The healthful economy with excessive charge of migration to the urban regions as well as a unexpectedly growing population in Bangladesh have created an increasing demand for residential, commercial, business, public homes and different infrastructures. With the rising call for creation substances to carter to the infrastructure growth, the brick production industry in Bangladesh has mushroomed everywhere in the Bangladesh.

The brick enterprise in Bangladesh is characterized through inefficient, low technologies with excessive emissions; reliance on manual labor and low technology; dominance of small-scale brick kilns with restricted economy, technical and managerial capacity; informal, seasonal employment; and a single raw cloth (clay) and product (strong clay brick).

in order to address the environmental problem related to brick region, the authorities of Bangladesh has issued successive government orders and promulgated guidelines and acts seeing that 1989.

4.1 Basis for strategy:

The proposed procedure for sustainable brick production in Bangladesh throughout the following ten years goes for changing the brick segment towards feasible venture socially, ecologically and economically. In this way, brick sector procedure has following four policy:

- Improving general wellbeing is the driving explanation behind taking these activities;
- Environmental improvement can convey enduring advantages to brick segment and wellbeing and different advantages to individuals of the nation.
- Economic improvement of the business visionaries is critical towards advancement of cleaner brick making industry in Bangladesh.
- Investing time and endeavors in institutional improvement will augment the accomplishment of approach objectives.

4.2 Social Improvement:

The brick business is generally very labor intensive and uses more than 1 million of unskilled and semi-skilled workers. Most of the employments related with brick production should be possible by anyone who is happy to carry clay, blocks and coal. However, some specific works such as kiln making and firing require talented laborers.

4.2.1 Selective Mechanization of Brick Making:

Our country has some long time experiences with FCK and Zigzag kilns. However the experience has been restrained to the use of old methods of designing and building kilns and the usage of time-old molding and firing manner. They need nowadays is for a extraordinary manner of creating bricks with versatile design, size and color. This may simplest be carried out through mechanization in brick production. On the other hand, the mechanization method should be innovative and selective given our restricted understanding and skilled team of workers in brick sector. in this condition, importance should receive on enhancing the occupational health and protection of workers. And consequently, all responsibilities related to heavy work desires to be mechanized, specially the molding of clay and transportation, loading and unloading of bricks, clay and coal.

4.2.2 Moderate the firing process:

Better feeding, firing, and working practices can improve the overall performance of the kiln and reduce emission of particulate subjects. High degrees of excessive emissions particulate in particular matters and black carbon arise in Zigzag and FCK for the duration of fuel feeding. Maintains feeding of properly sized coal, stake emissions may be reduced by the use of coal stocker. Scrubbing procedure inside the Zigzag kiln can appreciably reduce particulate emission into surroundings.

4.2.3 Replacing Traditional Kilns with Small and Medium-sized Industries:

One of the strategies diagnosed for cleaner brick manufacturing is through acquire of small and medium sized modern kilns. because brick making technology that require high upfront capital investments compared to FCK or Zigzag, regularly making the funding out of attain to local entrepreneurs.

4.2.4 Small-sized Kilns:

Stepped forward Zigzag Kilns and Vertical Shaft Brick Kilns are smaller scale technologies, requiring smaller investments but by no means the less enormous in terms of their affects on energy use and emission discounts.

4.2.5 Medium to large-sized Kilns

The HHK and Tunnel Kilns are strong industrial scale technologies broadly used in China. these kilns have constant roofs that enable bricks to be fired for the duration of the full year. On the other hand, at some point of the rainy seasons, the manufacturing decreases notably due to common rain, high humidity and greatly reduced daylight.

4.3 Environmental improvement

The brick business consumes a lot of coal and in this manner produces emanations that are hurtful to the nearby and the worldwide condition. The uncontrolled consuming of coal in wasteful ovens and the high measures of sulfur in coal has prompted critical crumbling of air quality around close-by towns and urban areas. Harmful flue gases discharged during the activity of the furnaces harm the encompassing yields.

4.3.1 Decrease in flue gas outflow:

Energy-efficient brick kiln technologies have lower Specific Energy Consumption, estimated in kilojoules required per kilogram of fired block, and along these lines consume less fuel and discharge less GHGs per unit of yield. Furthermore, energy-efficient innovations give administrators more authority over the fuel burning procedure, which results in an increasingly total ignition of carbonaceous fuel and diminished emanations of dark carbon and other SPM. These innovations can give monetary returns through reserve funds in fuel cost per unit of output. These are several kiln types that can reduce emissions:

- Improved Zigzag Kiln
- Vertical Shaft Brick Kiln (VSBK)
- Hybrid Hoffman and
- Tunnel Kilns

4.3.1 Keep up Correct Coal Quality

The use of the right coal quality, with perfect raw materials, for a kiln technology is basic. The primary coal properties that are essential while choosing coal as outside fuel incorporate

ash content, calorific value, dampness substance, sulfur, unpredictable issue, molecule size and ash combination temperature.

A sensible substance of coal is somewhere in the range of 0.5% and 1%. Coal having Sulfur >2 % ought not be uses in light of the fact that higher substance of sulfur causes Sulfur Dioxide (SO₂) contamination which has an immediate negative impact on the soundness of people and harms vegetation, heart attack and human population in the encompassing condition.

4.3.2 Asset Efficient Brick Production:

Using resource-efficient bricks, decreases in assets being used for block making and consuming can be accomplished. One sort of AEB incorporates punctured or hollow bricks and blocks made of compressed fly ash that don't require firing. Other kind of AEB substitutes stream river clay and sand and reduce the size of brick to make them resource efficient.

4.4 Economic development

No matter the emissions reduction capability of firing procedure modifications and adoption of REBs, it is tough to quantify the advantages. There are sizeable environmental and social advantages from investing in emissions-decreasing technologies, in spite of the upfront capital prices. but, environmental blessings alone are not sufficient incentive for brick kiln entrepreneurs to adopt easy technologies or approaches. The enterprise and economic advantage could be the key motivation of brick makers for kiln switching.

4.4.1 Industrialization of the Brick sector

The enterprise-as-typical method and exchange-resistance are the principal attitudes of the kiln owners in the country. On this supply restrained enterprise, aforesaid attitudes are fostered and maintained is a end result of the quick manufacturing season, the small scale size of the production units and the non-availability of replacement merchandise.

Chapter: 5

Financial performance analysis of estimated environmentally sustainable bricks kiln

Bhuiyan Trading Corporation has one improved zigzag kiln that is situated in Senbag, Noakhali. Currently they are supplying three different districts in our country. It has been operating since 2009. However, sometimes it creates some problem to the local people because of air pollution. Furthermore, there are lots of trucks are going in and out from kiln it may creates some problem to school children and cannot operate throughout the whole year. Now it wants to set up new kiln so that it can produce whole year and may lead to reduce environmental pollution. Following is the estimated project cost for set up a tunnel kiln brick manufacturing concern with a capacity of around 70,000-110,000 bricks per day.

Energy efficient brick has already started running in some areas of our country; i.e., Savar, Dhaka, Ashulia, Mymensingh, Khulna and Norshindi. Manufacturing of such bricks recommended that they want only 40% of human intervention than that of the traditional one and because the production keeps for the whole year it keeps each person active without any streamlining. Coal and clay are mixed routinely after which poured into a gadget.

	energy efficient Brick	Traditional Brick
Setup cost for Brick kiln	8-10 Crore (TK.)	2 crore
Price (per brick)	Tk. 9	TK. 8.50 – TK. 8.80
Production (annual)	1.5 crore	1 crore
Coal required for 100000 bricks	8-8.80 ton	25 ton

Table 5.1: An assessment between Traditional Brick and energy efficient Brick

5.1 Automatic technique

The production method is completely automated. After the production for drying the bricks a few quantity of humans are needed; i.e., for monthly manufacturing of 50,000 bricks, it takes 50 to 60 labors maximum

5.2 Assistance from Govt. and Private Banks

To encourage the owners, govt. loans are provided with a payback period of 5 long years which is really convenient in practice.

5.3 Extremely High Demand

The initial high cost gets absolutely justified with the high production and sales as demand for such bricks and with the flourish of real estate business in Bangladesh, the per day demand of such brick is only increasing, and green brick is always the priority as it saves the environment protecting forests.

5.4 Earning through Carbon Credit

For the clause of emitting less carbon in the air, 2 crore of taka are to be received annually from the developed countries.

5.5 Quick & Secured Recovery of Investment

According to Auto Green Brick Field in Ashulia, with the scheduled production and quick selling the cost of setting up the green brick kiln is recovered within just one year.

Primarily based on the above information, shifting from the FCK to progressed or new technologies is expected to result in the subsequent environmental influences:

5.6 Health

Ambient air pollutants levels are anticipated to reduce may leads to advanced fitness of the population exposed.

5.7 Crop yields

The decline in emissions could be beneficial for crop yields. In addition assessment wishes to be undertaken to higher understand the effect of reduced chimney height (in new and stepped forward kilns) on localized pollution (in particular agriculture).

5.8 Crop yields (from use of agricultural topsoil)

Use of advanced or new kilns might no longer affect the usage of topsoil, unless efforts are made to replace it with river sediment or different assets of clay.

5.9 Forests

The stepped forward and new technology do not use firewood; as a result their adoption could put off the bad results that FCKs presently have (e.g., deforestation or woodland degradation).

Particulars	Cost (TK)
Land	20,000,000
Vehicles	50,0000
Machinery	55,000,000
Working capital	150,00000
Generator	150,00000
Building	30,000,00
Operating expense	100,0000
Foreign engineers	1,000,000
Security deposit	2,000,00
Total	10,98,00000

Table: 5.2 Estimated total cost

5.10 Land & Land development:

For a tunnel kiln undertaking, there are approximately 500 decimal of undivided land is needed. charge of land varies in various parts of the country. As a result, it is hard to estimate the price for land and land improvement

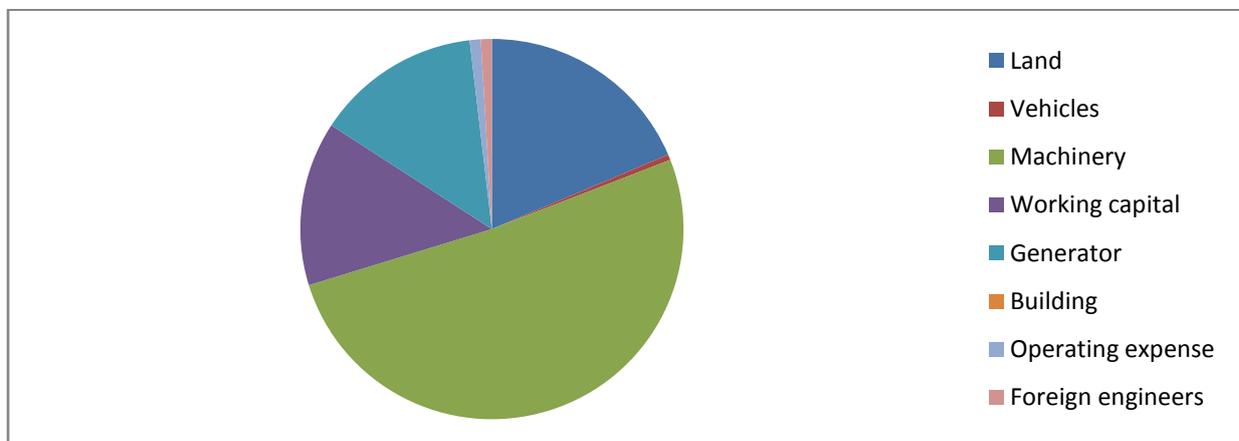


Chart: 5.1 Estimated total cost

5.11 Revenue Assumptions

5.11.1 Capability utilization

To estimate the revenue over the life cycles of the venture calls for the projection of potential utilization. In this example, although a regular tunnel kiln can run for 30-40 years, we are considering the simplest 10 years for hypothetical cause.

Following are the anticipated ability usage over the ten years:

Anticipated capacity utilization	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Yearly production (%)	55%	67%	76%	85%	88%	86%	80%	78%	90%	88%

Table: 5.3 estimated production

5.11.2 Estimated revenue:

Considering the fee of brick as TK 8.00 per brick in the base year and inflation rate of 6.4% in line with year and rated capacity of a 100,000 brick per day, the envisioned revenue from the projects stands as follows:

Anticipated revenue	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Yearly revenue (tk)	19564000	23612288	26495350	28843760	28502120	27856800	27473550	32127300	32055760

Table: 5.4 estimated revenue

Item	1	2	3	4	5	6	7	8	9
Raw Material	4695360	5666949.12	6358884	6922502	6840508.8	6685632	6593652	7710552	7693382.4

Wages	3521520	425021184	4769163	5191877	5130381.6	5014224	4945239	5782914	5770036.8
Manufacturing Ovh	3521520	4250211.84	4769163	5191877	5130381.6	5014224	4945239	5782914	5770036.8
Total	11738400	14167372.8	15897210	17306256	17101272	16714080	16484130	19276380	19233456

Table: 5.5 Cost of Goods Sold

Item	1	2	3	4	5	6	7	8	9
Salaries	469536	566694.912	635888.4	692250.2	684050.88	668563.2	659365.2	771055.2	769338.24
Admin Exp	469536	566694.912	635888.4	692250.2	684050.88	668563.2	659365.2	771055.2	769338.24
Travelling	156512	188898.304	211962.8	230750.1	228016.96	222854.4	219788.4	257018.4	256446.08
Advertisement	313024	377796.608	423925.6	461500.2	456033.92	445708.8	439576.8	514036.8	512892.16
Miscellaneous Exp	156512	188898.304	211962.8	230750.1	228016.96	222854.4	219788.4	257018.4	256446.08
Total	1565120	1888983.04	2119628	2307501	2280169.6	2228544	2197884	2570184	2564460.8

Table: 5.6 Operating Expense

Projected Income Statement

Item	1	2	3	4	5	6	7	8	9
Sales Revenue	19564000	23612288	26495350	28843760	28502120	27856800	27473550	32127300	32055760
(-)COGS	11738400	14167372.8	15897210	17306256	17101272	16714080	16484130	19276380	19233456

60%									
Gross Profit	782560 0	944491 5.2	105981 40	1153750 4	1140084 8	111427 20	1098942 0	128509 20	12822 304
(-) Op Exp 20%	156512 0	188898 3.04	211962 8	2307501	2280169 .6	222854 4	2197884	257018 4	25644 60.8
(-) Interest 10%	626048	755593 .216	847851. 2	923000. 3	912067. 84	891417 .6	879153. 6	102807 4	10257 84.3
EBT	563443 2	680033 8.94	763066 1	8307003	8208610 .6	802275 8	7912382	925266 2	92320 58.9
(-) Tax 10%	563443 .2	680033 .894	763066. 1	830700. 3	820861. 06	802275 .8	791238. 2	925266 .2	92320 5.89
Net Income	507098 9	612030 5.05	686759 5	7476303	7387749 .5	722048 3	7121144	832739 6	83088 53

Table 5.7 Projected Income statements

Chapter: 6

Findings and Recommendation

Energy saving automatic brick kiln is advantageous each for humanity and surroundings. Lower use of fire woods, less burning of coals, demand for clay is low, low intervention of human bodies and so on. Any electricity saving automatic brick kiln generating 70,000 bricks every day want maximum 40 labors. Bangladesh can achieve Tk. 200,000 for 5 years' production of grin brick for lowering carbon emission. As electricity saving computerized Brick kiln guarantees complete 12 months productiveness rather than seasonal productivity. It is able to cope with increasing needs of bricks in Bangladesh. Beside Bangladesh bank is properly aware of the environment degradation situation as mentioned above and has already given time to time directions to all commercial banks for green finance. They now required to makes certain important measures to save environmental pollutants while financing a new energy saving project like as energy saving automatic brick kiln.

Bangladesh's brick sector can be characterized with the aid of old technology with low energy efficiency and excessive emissions; low mechanization charge; dominance of small-scale brick kilns with restrained economic capability; and dominance of single uncooked material (clay) and product (solid clay brick). Adopting gas-based cleaner technology is hampered by way of serious electricity shortage and land scarcity.

How long can the nation producing bricks in this manner? The current popularity is not sustainable. Bangladesh has each cause to improve its brick area to be able to save natural resources, reduce air pollutants, and for increasing energy efficiency. Some change has set up by the government. That makes restrictions of the usage of firewood and has reconsidered the place and top of brick kiln chimneys. On the other hand, transformative improvement of the brick industry has yet to occur. This report shows that the improvement of the brick industry in Bangladesh over the next 20 years have to intention at: (i) moving from conventional brick-making technology (e.g. FCK) to cleaner ones (e.g. HHK, VSBK); (ii) create product variation (e.g. hole and perforated bricks) and domestically available raw material; (iii) growing the proportion of huge-scale ventures with higher potential to conform to cleaner technologies. To attain these, a summary of concrete guidelines is furnished.

6.1 In the short term:

- At first we have to understand brick kilns as a formal industry. This will permit simple access to economic sources (which in flip will enable funding in cleaner technology and get entry to flood loose land) and stepped forward operating conditions.
- To create awareness among people in our country about the benefits of cleaner technologies at first we have to set up Create a Brick Technology Center. The center must: (a) disseminate statistics at the social advantages provided by way of cleaner technologies, new wall substances (e.g. perforated and hole bricks) and opportunity raw material; (b) promote pilot initiatives of latest technologies with improved provisions (e.g., mechanized, better hard work productiveness and larger product traces); (c) enhance use of current dissemination channels (e.g., area visits to pilot plants, video demonstrations of the technologies, use of the Bangla language) and introduce new channels (e.g., newsletters, industry journals, conferences, and internet blogs).
- Research and development should support aiming at: (a) exploring alternative raw materials which can be domestically available, brick diversification, and use of better stage of mechanization; (b) carrying out new research such as energy related research, land surveys, and brick generation surveys.
- Should provide training to several stakeholders with regard to the blessings of adopting purifier technology (e.g. brick owners, employees and the financial sector).

6.2 In the medium term:

- Put in force the present rules and regulations, including the ban of traditional high polluting kilns (e.g. FCK, BTK), in particular those positioned near massive population area, upstream of the wind (north) within the dry season (November to April).
- Create some policy and procedures that encourage adoption of cleaner technologies. For instances, (a) revise emissions requirements for brick kilns under ECR97 to make them independent and to inspire brick diversification (e.g., perforated or hole bricks for partition walls); (b) Set up proper emission monitoring for brick kilns.
- Industrial parks should be developed to accommodate a large number of industries on flood-free land. These parks may create less cost for kiln owners, this is because

economy of scale achieved by providing the basic infrastructure for all kilns (e.g. roads, electricity, water) and other facilities (e.g. schools for the employees children). They would also require less land for kilns set up compared to the current conditions.

- Improve operating conditions via introducing better degrees of mechanization, social programs to lower child labor, occupational protection and health measures in kilns

Conclusion:

Due to seasonal productiveness, outdated technology, low productiveness of labor, non-existent capitalization and casual control management the brick making industry in Bangladesh is defined as "footloose" enterprise. However, the UNDP hosted new green brick idea can provide Bangladesh a spirit of vow from the brick industries. Even though the conventional brick kilns pollute the environment heavily; maximum of the brick makers or entrepreneurs choose it for its low capital requirement and high potential as well as easy set up. Only 10 million tk needs to establish a single unit traditional brick kiln , whereas investments in Tunnel Kiln costs approximately 350 million. Hence, people will not be motivated to set up such a new brick kiln. Most of the case they are unable to afford them will result in an increase in price of brick.

Government need to push human beings by creating focus towards conventional kilns and make the technology available to the brick producers. Digital and print media have to come forward to encourage human beings for the use of such varieties of bricks. More advertising and marketing is needed to familiarize humans with green bricks. To encourage entrepreneurs, banks should provide long-term loan. However, the problem is in receiving mortgage from banks, an entrepreneur has to finish a large range of formalities which includes verification of certificate and licenses. To avoid such unfairness policy makers must make the manner smooth and have to modernize the policies and rules with demand of time. Several banks have already started providing loan for energy efficient brick kiln set up with payback period of 5-6 years.

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