Attaining Sustainable Growth of the Indian Sugar Industry : Through Ethanol - Power Complexes

Sanjay J. Bhayani & Kishore B. Barad***

Abstract

India is the largest consumer and the second largest producer of sugar in the world. Production is seasonal with bulk of sugar being produced between December and April. Maharashtra and Uttar Pradesh are the largest sugar producing states, together accounting for 55-60 In a sugar mill, one hundred tones of cane, on an average, produces ten tones of sugar, four tonnes of molasses, three tonnes of filter-mud, thirty tonnes of bagasse and 1500 kwh surplus electricity. Apart from these, about thirty tonnes of cane tops and leaves are generally left in the field when the cane is cut. Each of these by-products has economic value and if processed further, it can generate substantial revenues. The availability of these by-products has led to the setting up of integrated sugar complexes producing not only sugar, but also alcohol/ethanol/extra neutral alcohol/co-generation of power and organic manure. In the present paper an attempt has been made to study the existing revenue model of sugar mills in India and find out economic advantage that will accrue to sugar mills by value addition to its by-products like molasses and bagasse i.e. integrated by-product model. For the purpose of research researcher has used two models. The result of study indicates use of second model will generate additional revenue for Sugar Industry of India.

Introduction

India has been known as the original home of sugar and sugarcane. Indian mythology supports the above fact as it contains legends showing the origin of sugarcane. India is one of the largest sugarcane producers in the world producing around **300 million tons of cane per year.** Of this about 60% cane is utilized for sugar production, 30% is consumed for producing alternate sweeteners like jaggery and khandsari and balance 10% is used for seed purposes. Therefore, around 180-185 million tons sugarcane is available to the sugar industry, to produce 18.0 to 18.5 million tons of sugar. The internal sugar consumption is estimated to be about 16-17 million tons. Presently, about 4 million hectares of land is under sugarcane with an average yield of 70 tones per hectare. India is also the largest single producer of sugar including traditional cane sugar sweeteners, khandsari and jaggery equivalent to 26 million tones raw value followed by Brazil in the second place at 18.5 million tones. Even in respect of white crystal sugar, India has ranked No.1 position in 7 out of last 10 years. More over the sugar industry is highly cyclical in nature. It is dependent upon monsoons for both production and price realization. Of the country's 450 sugar factories, the majority is located in Maharashtra, Uttar Pradesh, Andhra Pradesh, Karnataka, Gujarat,

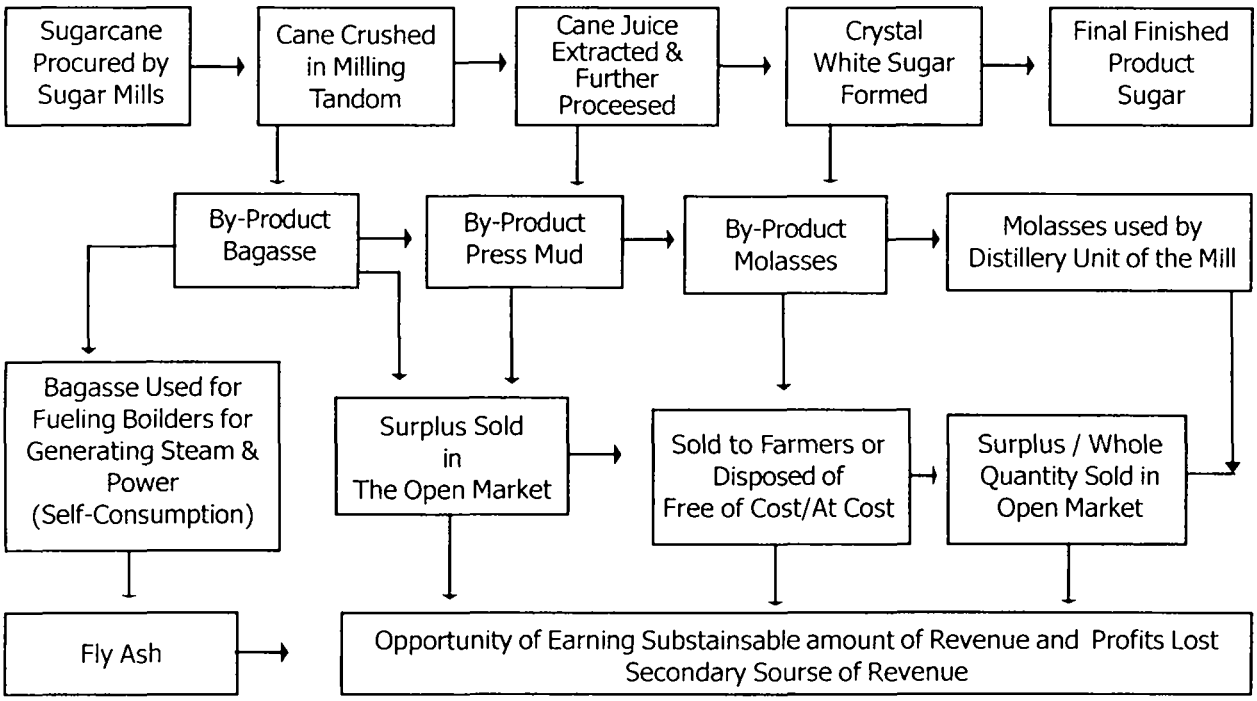
* *Dr. Sanjay J. Bhayani*
Associate Professor
Department of Business Management
Saurashtra University
Rajkot-360005 (Gujarat)
E-mail:sanjaybhayani@yahoo.com
Ph : (R) 0281-2587081 (M) 9427730515

** *Mr. Kishor B. Barad*
Assistant Professor
National Institute of Co-operative Management, M.B.A. Program,
Nr. Indrola Circle, Koba Gandhinagar Highway, Gandhinagar-382007 (Gujarat)
E-mail:kishor_barad@yahoo.co.in
Ph : (M) 9898325353

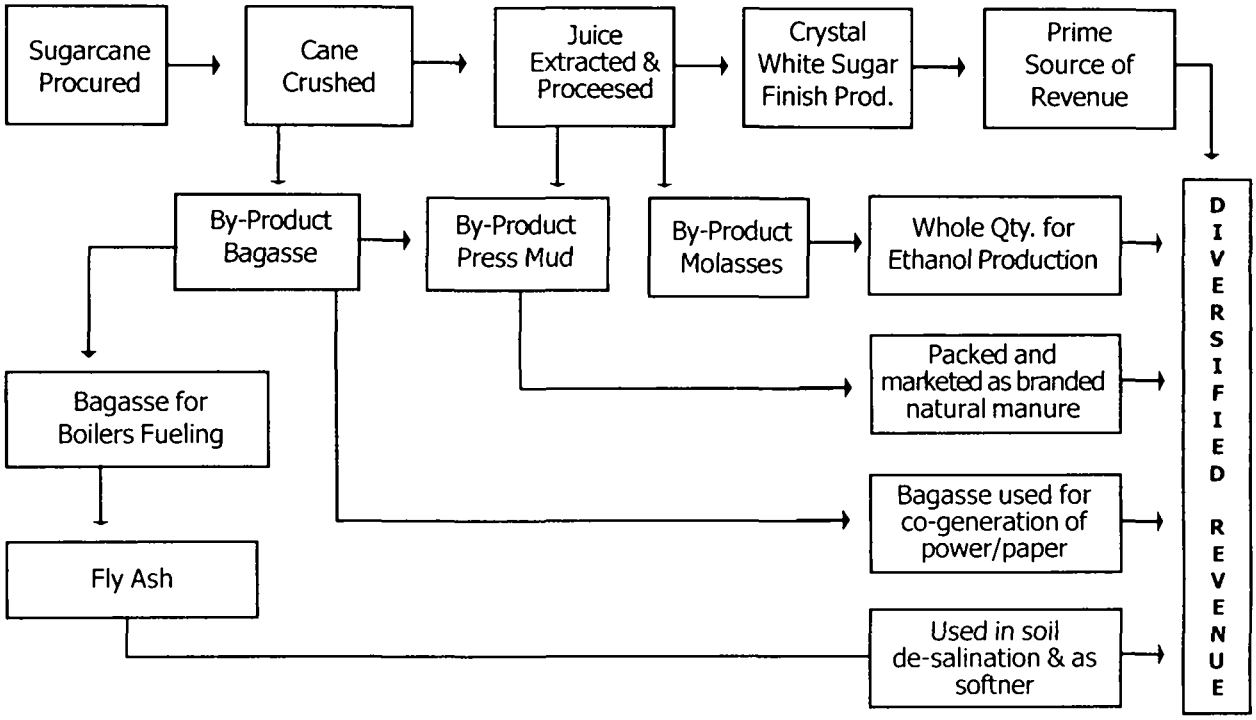
Punjab and Tamil Nadu. The sugar industry with an annual turnover in excess of Rs.30, 000 crores, contributes almost 10% of it to the exchequer. However there are substantial government interventions in sugar industry because it is a part of the common consumption basket and is important to the sugarcane growers.

In a sugar mill, one hundred tones of cane, on an average, produces ten tones of sugar, four tonnes of molasses, three tonnes of filter-mud, thirty tonnes of bagasse and 1500 kwh surplus electricity. Apart from these, about thirty tonnes of cane tops and leaves are generally left in the field when the cane is cut. Each of these by-products has economic value and if processed further, it can generate substantial revenues. The availability of these by-products has led to the setting up of integrated sugar complexes producing not only sugar, but also alcohol/ethanol/extra neutral alcohol/co-generation of power and organic manure. The recent awareness of the advantages of using green fuel for generation of power and use of gasohol to reduce automobile emissions have led to setting up of a number of co-generation plants in various sugar mills and the Government of India is taking steps to encourage manufacture of Ethanol for the purpose of doping motor fuel to reduce air pollution. The Indian sugar industry can therefore, make an intelligent use of this opportunity for value addition in its by-products like molasses and bagasse to create sustainable growth. Presently, there are very few sugar mills in the country that are co-generating power and has distillery to manufacture ethanol from molasses. With steps being taken to rapidly modernize the Indian sugar industry, it is now possible to save large quantities of bagasse for use as fuel to produce power. At the same time the sugar industry in India is faced with the problem of excess capacity for production of alcohol. Against the capacity of 3.2 billion liters, the Indian sugar industry is presently producing 1.3 billion liters of alcohol per year. Table 1 shows the molasses production in India during different periods. As there is no organized market for selling surplus bagasse, statistics pertaining to it could not be obtained. Annexure I and Annexure II shows the traditional revenue model and integrated by-product model respectively for discussions on different by-products and their productive use to enable us to understand the matter more effectively.

The Present Business Model of Sugar Industry - Annexure I



Proposed Integrated by - product Business Model for Sugar Industry - Annexure II



Moulasses

Molasses is an important by-product of the sugar industry constituting about 4.2 to 4.5% per tone on cane utilized for sugar production. During 1998-99, the molasses production was 7.0 million tones. Some factories process the molasses and produce products like de-natured spirit, ethanol. 295 distillery units with a capacity of 27000 lakh liters per annum are operating in the country. Annually about 15,000 lakh liters of alcohol is produced from molasses. Molasses is also utilized in the manufacture of animal feed. About 90% of molasses is utilized for alcohol production and the balance for cattle feed and other purposes. A statement showing molasses production, alcohol production and consumption is given hereunder.

Table 1 Production on Molasses and Ethanol

S.No.	Year	Molases Production (Lakh Tones)	Ethanol Production (Lakh Liters)	Ethanol Consumption (Lakh Liters)
1.	1994-95	64.96	12147	9000
2.	1995-96	82.84	15491	9450
3.	1996-97	57.00	10659	9922
4.	1997-98	67.55	12632	10418
5.	1998-99	70.60	13202	10939
6.	1999-90	73.80	13801	11486
7.	2000-01	77.15	14427	12060
8.	2001-02	80.67	15085	12663

Source: Report of Indian Sugar Mills Association (ISMA) New Delhi

BAGASSE

Bagasse is the other major by-product of the sugar industry. It is used for generation of steam and power required for processing of sugarcane. With energy saving around 5 to 10% of bagasse is saved by a majority of the units and is utilized for production of paper and cogeneration of power. 30% is the bagasse content per every tone of cane sugar

BAGASSE – CO-GENERATION OF POWER

Indian sugar industry is amongst the most diversified industry in the world, with an installed capacity to produce 750 MW co-generated powers against a potential to generate 5000 MW. Every sugar factory has a powerhouse for generating renewable power for its own requirements while some co-generate and export power to the grid.

ETHANOL

Ethanol is produced from the fermentation of molasses. It is sold either untreated or is used as a feedstock for the manufacture of industrial alcohol and potable alcohol. Government's ethanol blending programme announced in December 2002 making the sale of petrol blended with ethanol mandatory has opened up additional revenue stream for ethanol produced by the sugar industry. The ethanol-blending programme is to be implemented in phases. In the first phase, the sale of petrol blended with 5 percent ethanol has been made mandatory in nine states and four Union Territories. In the second phase, the 5 percent blending programme is to be extended to remaining states. In third phase, the proportion of ethanol in the blend is to be doubled to 10 %.

Typically, about 70 liters of ethanol can be produced per tone of cane, although higher yields have been reported from Brazil. Ethanol is being successfully blended with petrol in Brazil since 1931.The benefits from an ethanol programme to India could be the stabilization of sugarcane prices, and benefits in terms of energy security if the programme is expanded significantly. But it would be shortsighted to take this step on a large scale without a detailed study of its macroeconomic and longer-term implications. The use of ethanol as a fuel will have a wholesome impact not only on the sugar economy but also on the national economy. It is a replenishable fuel with great potential to even replace petrol as motor fuel, as established in Brazil. It will have a direct favorable financial impact on the sugar economy. Sugar mills would be able to exploit the full potential of the sugarcane crop, which would help them to not only pay remunerative prices to farmers but also disburse the same speedily, a recurring problem for reasons beyond the control of the industry. Ethanol will have a wholesome impact on the environment too. In fact, besides having fuel value, it is also an oxygenate and can easily replace MTBE which is being currently used as a petrol mix. MTBE has been found to be carcinogenic and many advanced countries like the US have banned its use, although in India it continues to be blended with petrol. In several countries including the US and Brazil, mixed fuel has been in use for the past several decades, but no mechanical problems as such have been reported. If it were so, mixed fuel would not have been acceptable to consumers. The fact that even today in Brazil, law statutorily provides for ethanol mixed gasoline at 22-26 per cent underlines that the fears expressed are unfounded. It will be interesting to note that there is also a great potential for mixing ethanol with diesel. An appropriate mix with 15 per cent hydrated ethanol can satisfy Euro IV emission norm forthwith and the suggested wait for another five years to achieve this high standard norm is unnecessary. Ethanol derived from sugarcane via the molasses route is considered to be the most cost effective.

LITERATURE REVIEW:

Several studies have been conducted with regard to technical and policy aspects of sugar industry, but there is paucity of academic literature in connection with the strategic aspects of sugar industry. Inamdar, N.R (1965) indicated that the institution of co-operative sugar factory represents the rising economic power of the landlord rich peasant class. Kamat, G.S. (1966) has found that want of satisfactory arrangements to economically use by-products is a problem for the sugar units both in the private and co-operative sector. Gehlawat, L.K. (1990) presented a collection of essays on many modernization programmes for the Indian sugar industry ranging from sugar recovery to high-pressure boilers. Singh, Mangal (1994) presented an integrated view of efficient management of water, energy, production and by-products of sugar mills. R.Balasubramanian (1998) studies reveled the need

to restructure the policy and to reorient the administration to reduce administration problems in sugar industry of Tamil Nadu. Ram Naik, ex Union Minister of Petroleum and Natural Gas, NDA government, Government of India was of view regarding use of ethanol, reduce oil imports and help sugarcane farmers. R.K. Pachauri, Director General, Tata Energy Research Institute is of view that in the case of India, there is need to carry out a comprehensive study of sugar production and the conversion of ethanol for use as a fuel on a nationwide basis. S.L. Jain, Director General, Indian Sugar Mills Association in one of his address has favored use of ethanol and said "ethanol will have a direct favourable financial impact on the sugar economy. Sugar mills would be able to exploit the full potential of the sugarcane crop, which would help them to not only pay remunerative prices to farmers but also disburse the same speedily, a recurring problem for reasons beyond the control of the industry. Shobhan Roy, President Bacardi Martini India Ltd, in an interview with Economic Times has said that the time is not right to implement ethanol-blending project without creating the long-term infrastructure with both the sugar industry and the oil companies. Otherwise, this project will be similar to the CNG project of Delhi. Sugar Technology Mission in India in their case study pertaining to Economics of Sugar, Ethanol, and Power mix concluded that diversion of secondary juice for manufacture of gasohol and saving of steam and bagasse to produce additional power for export will result in and additional annual revenue of about Rs.2.0 crores for a 2500 TCD plant. The report of high-powered committee on Revitalization of Sugar Industry submitted to central government in December 2004 has also recommended that in order to improve profitability of sugar industry through value addition to by-products like bagasse and molasses, cooperative sugar mills having potential for setting up of diversification projects may be encouraged and therefore Indian government should make necessary changes in its various policies affecting economic use of all its by-products. The report prepared by United Nations Conference on Trade and Development titled " An Assessment of the Biofuels Industry in India" also revealed the importance of biofuels as an alternate fuel and which is also going to play an extremely important role in meeting energy needs in India. Ethanol produced by the fermentation of sugarcane molasses is an excellent biofuel and can be blended with petrol. As of now, the two significant players in cogeneration, with annual revenues of Rs 125 crore plus, are Balrampur Chini and Thiru Arooran. Triveni Engineering's cogeneration income amounted to Rs 60 crore in 2005-06, while Sakthi Sugars and EID Parry are said to be doing business of Rs 50-60 crore, (Business Line, Saturday February 17, 2007 paper). The task force on the sugar industry for the Tenth Five Year Plan has also suggested the evolution of a national policy on alternative fuels, which would include the use of ethanol-blended gasoline.

From the above discussion, it is evident that different research scholars and research agencies have conducted many studies on sugar industry in India, but most of these studies are related to traditional aspects like policies issues, economic, technological and administration issues pertaining to the Indian Sugar Industry and hardly any research is conducted on lines of strategic issues like business diversification and de-risking traditional revenue model of sugar industry. Therefore an emergent need was felt to undertake a study on the said issue, as it has not received due attention in recent times. More over there is hardly any literature available on the subject. This study will pave the way for generation of new information and data that will help the policy makers like Government Department, Sugar Industry as a whole, Management of various Sugar units, etc. by way of enabling them to make necessary changes in framing up their operational policies and procedures which will in turn enable them to become most competitive and profitable business ventures in the new era of globalisation and liberalization. Therefore an attempt has been made in this paper to compare the revenue flow of a sugar mill without Ethanol Power Complexes and with it.

RESEARCH METHODOLOGY:

Research Statement:

Attaining sustainable growth of Indian Sugar Industry by converting sugar mills into integrated sugar complexes.

Objective:

1. To understand the existing revenue model of sugar mills in India

2. To find out economic advantage that will accrue to sugar mills by value addition to its by-products like molasses and bagasse i.e. integrated by-product model.
3. To find out and compare stream of revenues from both the business model.

Research Design:

This is a case study based research and hence exploratory research design is used to gain further insights and understanding of the problem. The information used is based on the experience and observation of sugar industry executives and the researcher on their respective jobs.

Data Source:

The required data for analysis has been collected from several reliable secondary sources like annual reports of sugar federation. Quantity data used are based on standard input-output ratios furnished in various published literature of the sugar industry. The prices of various sugar industry products used for analysis are the prevailing market prices at a point of time. A conservative approach had been adopted while fixing the price and quantity data. Moreover feedback received from senior industry executives while personal interaction of the researcher with them has also been incorporated in this paper. Moreover some assumptions are also made based on practical aspects of the functioning of the sugar industry in India and also to hold certain factors constant so as to derive meaningful insights.

Method Used for Analysis:

First of all Traditional Revenue Model and Integrated By-product Business Model are explained subjectively by using a flow diagram of sugar mills. Then after simple arithmetic calculations are used for revenue calculations and analysis after finding appropriate input-output norms of the industry. Few assumptions are also made because of volatility of prices of different products in the market. The stream of revenues that can be generated by processing and not processing by-products like molasses and bagasse is shown in Case I and Case II. Many sugar factories do not have integrated processing units, where they can add value to their by-products. Even today factories concentrate mainly on production of crystal sugar, which is main source of revenue of the factories. Below are two cases, which show the revenue flow.

1. ***Case I*** shows the traditional business model of sugar factories. Under this case, by-products are sold in the raw form. Much of the opportunities of extra revenue are lost in this case.
2. Under ***Case II***, by-products like molasses and bagasse are processed in the integrated process complex and final products like ethanol and electric power are sold at the market rates.

Assumptions:

1. Calculations are for 100 tons of cane crushed and given standard input ratio. Calculations are for 2500 TCD plant.
2. Price changes in any of the by-products or final products will affect the total revenues.
3. Sugar recovery is estimated at 10 %.
4. Molasses output is assumed to be 4.5% per tone of cane crushed.
5. 10% bagasse is net saved after meeting internal consumption of the factory.

CASE – I: Total Revenues generated by selling sugar and by-products in raw form for 100 tons of cane crashed are as under.

PRODUCTS	QUANTITY	RATES	REVENUE(Rs.)
SUGAR	10 tons	Rs 22000/- ton	220000
MOLASSES	4.5 tons	Rs 2200/- ton	9900
BAGASSES	3 tons	Rs 900/- ton	2700
TOTAL Rs.			2,32,600

CASE – II: Total Revenues generated by selling sugar and processed by-products for 100 tons of cane crashed as under.

PRODUCTS	QUANTITY	RATES	REVENUE (Rs.)
SUGAR	10 tons	Rs 22000/- ton	220000
ETHONAL	1080 Lit.	RS 16/- LITRE	17280
POWER	2.50 MW	RS 4500/- MW	11250
TOTAL Rs.			2,48,530

Research Findings:

Comparison of both the cases shows that there is additional net revenue generated from ***Case II***, which is substantial. From the above calculations it becomes clear that **Rs.15,930/-** can be generated as additional revenue from every 100 tones of cane crushed in ***Case II.*** In terms of percentage, 6.85% higher revenue is generated in ***Case II***. Therefore, a sugar mill of **2500 TCD** capacity will be able to generate a minimum additional revenue of **Rs.7.0 to 8.0 crores per crushing season on crushing 5 lakh tones of cane per season**. More over, the revenue risk of the factories will be spread and make sugar mills more sustainable and generate maximum economic advantages for both cane growers and sugar mills.

Recommendations:

- Sugar Mills in India should upgrade its existing processing facilities so that lesser quantity of steam and power is consumed for sugar production. This will enable sugar mills to save bagasse for co-generation of power.
- Sugar mills without distilleries and ethanol plants should install these plants instead of selling molasses in raw form. Sugar Mills can finance these projects from Sugar Development Fund created by central government for rehabilitation and modernization of sugar mills.
- Indian government should frame appropriate policies and develop necessary infrastructure required for blending of automotive fuels with ethanol thereby creating appropriate market for ethanol.
- Favourable policies should be framed by Indian government for buy back of power by State Electricity Boards.
- Sugar Mills should develop required infrastructure to store molasses and bagasse as storage facilities is a major problem during crushing season.

References:

- Gehlawat, L.K (1990), *Modernization of Indian Sugar Industry*, Arnold Pub, New Delhi
- Inamdar, N.R (1965), *Government and Co-operative Sugar Factories*, Popular Prakashan, Mumbai.
- Kamat, G.S (1966), *A Study on Management of Co-operative Sugar Factories in Maharashtra*, Federation of Co-operative Sugar Factories, Mumbai.
- Malhotra Naresh (2004), Marketing Research, *an Applied Orientation*, 5th Edition, Pearson Education (Singapore) Pte. Ltd, New Delhi.
- Ministry of Food & Public Distribution, Government of India (1998), *Mahajan Committee Report* on Sugar Industry, Volume II, New Delhi.
- Ministry of Food & Public Distribution, Government of India, Report on *Revitalization of Sugar Industry*, December 2004.
- Report on *An Assessment of the Biofuels Industry in India*, United Nations Conference on Trade & Development, October 2006.
- Report of *The Committee on Development of Bio-Fuel*, Planning Commission, Govt.of India, New Delhi, April 2003,pp 214
- Singh, Mangal (1994), *Efficient Management of Sugar Factories*, Somaiya Pub, New Delhi.
- www.coopsugar.org
- www.ethanolindia.net/sugarind.html
- http://fcamin.nic.in
- www.indiansugar.com
- www.sugartoday.com
- www.tifac.org.in