DETAILED PROJECT REPORT (DPR)

ON

INTEGRATED SUGAR (5000 TCD), COGEN POWER (30 MW) & ETHANOL PLANT (60 KLPD)

AT

Kapshi, Tehsil Phaltan,
District - Satara, Maharashtra

Prepared for

M/s Lokmanya Sakhar Udyog Ltd.

Kapshi, Tehsil Phaltan,
Dist. Satara

Prepared by

MITCON Consultancy & Engineering Services Ltd. (MITCON)

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Executive Summary

Project at a Glance

Lokmanya Sakhar Udyog Ltd. (LSUL) is registered in the State of Maharashtra under the Companies Act, 1956 on 21st February, 2011 vide registration No U15430PN2011PLC38601.

Now, LSUL proposes to set up integrated 5000 TCD sugar plant along with eco-friendly 30 MW capacity cogen power project for decentralized generation of exportable surplus power, mainly from renewable sources of fuel and 60 KLPD ethanol plant, to be located at Kapshi, Tehsil Phaltan, Dist. Satara of Maharashtra.

The integrated project comprises of a sugar mill for the manufacture of high quality sugar, thereby making available required bagasse for the cogen power plant and molasses for ethanol plant. The command area of the proposed sugar mill has excellent irrigation facilities, potential for sustained cane supply to the sugar mill, molasses and biomass availability.

The aggregated capital investment for the integrated project has been estimated at **Rs. 323.70 crore.**

Project Rationale

The promoters have extensively and carefully analyzed the present and future scenario of sugar, ethanol and power industries. They studied carefully the present irrigation facilities and surplus cane availability in the command area, as well as future potential of irrigation and additional cane availability.

Most of the villages of the command area fall in Phaltan and nearby tehsils like Khandala, Koregaon, Wai etc in the Satara district & Baramati from Pune district. Total area under irrigation under canals & wells is 65221 ha & 113364 ha, respectively. The area under minor, medium & major irrigation project within Satara district is 16666 ha, 5738 ha & 147985 ha, respectively. Total land under irrigation in the command area (Phaltan, Khandala, Wai, Koregaon & Baramati tehsils) is around 214504 ha out of total cultivated area. Major sources for irrigation are mainly canals and major irrigation projects like Dhom, Veer, Neera Devdhar, Dhom Balakavadi, Jihe Kathapur and medium irrigation projects like Kavathe Kenjal, Wasana & Wangana along with wells, ponds, rivers, and tube wells.

At present about 11.43 lakh MT of surplus sugarcane is available in the command area. Due to excellent irrigation facilities in the command area, sugarcane potential is very good. Hence, promoters expect the availability of required sugarcane of 8.00 lakh MT within 30 km radius with sustainable sugarcane development in the command area.

Also in view of shortage of power in the State of Maharashtra and with proposed increase in ethanol blending from 5% to 10 %, the promoters finalized on the bigger capacity of the said project. The promoters and farmers in the command area, having experience in sugar industry and sugarcane cultivation, were able to foresee the cane potential in the command area.

The current policies in Maharashtra and in India are conducive and backed by favorable regulatory framework for generation of eco-friendly power, as well as regarding support for private investment in such integrated project.

The promoters also have acknowledged in depth, the socio-economic and environmental value addition of this integrated project to the local populace, region, State and the Country, as well as its win-win situation to all the stakeholders involved.

Overall, the entire integrated project is proposed to be set up based on the stand-alone commercial viability of each component of the project, ensuring that the integration effort or synergy would enhance individual commercial viabilities of these stand-alone projects.

The Promoters & Project Preparedness

Mr. Shrinivas Pawar has over 24 years' experience in marketing and general management. For the last 19 years, he has been in automobile dealerships.

Mr. Pawar started his career with the Sakal Group of newspapers, in charge of their printing operations in Mumbai. After a few years, he started his own business in automobile retail.

He believes in giving people a lot of independence. He prefers them to learn while on the job His dynamic vision, hard work and determination saw him become a master of the extremely competitive trade of automobile retailing. His success and knowledge has earned him the confidence of some of the world's biggest manufacturers: Hyundai, Honda, Toyota, Al-Nissan.

Mrs. Sharmila Pawar has total experience of around 12 years in the commercial and administrative management in Sharayu Group. She is actively involved in setting up of all our Automobile dealerships.

Mrs. Pawar is also chairperson of Baramati Mitra Mandal, a social service organization and President of Sharayu Foundation, philanthropic foundation of Sharayu Group.

Mr. Amarsinh Patil is a Management Graduate and has around 22 year's hands on experience in General Management. His forte is leading operations for the group and managing Human Resource very successfully.

Mr. Patil started his career with Global Tele systems as a Management Trainee and then moved on to join the family business. He was empowered by the board the task of setting up the family business in Goa in both fronts in Logistics as well as Automobile retailing. Sharayu Group which had its presence only in Maharashtra also found a niche for themselves in Goa. Today we have our Presence in both north & south Goa and flagship store in Capital City of Panjim.

The promoter's rich experience in management and strong leadership qualities is thus of immense help for the growth of LSUL

LSUL already has appointed a technical / managerial team of highly qualified engineers, contract & arbitration experts, agricultural officers and managerial personnel for implementation and operation of the captioned integrated project.

To make the venture commercially viable and financially profitable, the capacity of the sugar plant is decided and fixed at 5000 TCD, cogeneration plant of 30 MW & 60 KLPD ethanol plant.

The suitability of the soil, increased irrigation facilities and previous experience of the farmers in cane growing will be helpful in developing the required area for cane plantation. The Cane trash will act as a support fuel for cogen power plant is easily available in the command area.

Project in Brief

<u>Sugar Mill</u> (estimated capital investment of Rs. 135.89 crore)

A sugar factory of 5000 TCD capacity with state of the art cane diffusion process & 5000 TCD capacity highly efficient & continuously operating boiling & sugar process houses, will be installed to manufacture good quality white plantation sugar. The sugar market in India is quite up-beat and is expected to continue for a foreseeable future. Command area has sugarcane availability with sugar recovery of about 12%.

<u>Cogen Power Plant</u> (estimated capital investment of Rs. 128.60 crore)

The cogen power project of 30 MW capacity will mainly operate on mill bagasse during 160 season days of the sugar mill and saved bagasse, cane trash & imported coal (in exigencies) for 65 off-season days. At designed levels, it will generate about 152.28 million kWh and export about 117.43 million kWh through MSEDCL grid for sale to MSEDCL or to third party consumers, as per prevailing tariff. All steam and power requirements of the sugar mill, ethanol, cogen auxiliaries and colony, both during season and off-season periods, will be met internally from the cogen power plant.

It will employ extra high pressure and temperature configuration (87 Kg/cm^2 and 515° C) Boiler (160 TPH) & steam turbine (30 MW-DEC), as well as ESP for emission control and DCS control system for efficient operation.

The policy for sugar mill cogen plants, both at the Central Government and at the State, Government of Maharashtra are quite conducive. The MNRE has provided several financial incentives in terms of capital grants and interest subsidy till date and the same are likely to continue. The proposed project will be eligible for these incentives as well as other incentives like accelerated depreciation, income tax benefits, reduced import duties for renewable energy projects. Indian Renewable Energy Development Agency (IREDA) Ltd., the lending arm of MNRE, also provides term loan for these projects at soft terms.

The present tariff offered by MERC is Rs. 6.27/kWh.

<u>Ethanol Plant</u> (estimated capital investment of Rs. 59.21 crore)

Ethanol plant having capacity of 60 KLPD will be installed along with sugar and cogen power plant. Plant will operate for 270 days. Own molasses that is generated from the sugar factory will be used for 125 days and molasses required for balance 145 days will be procured from the nearby sugar factories. The Government of India has declared blending from 5% to 10%. Therefore, the demand of ethanol from is almost doubled. Also the rate of ethanol is good, which is around Rs. 38 - 41 per liter.

Single stage evaporation technology will be used to reduce the spent wash generation from about 8 liters per liter of ethanol to 4.5 liters of ethanol in order to reduce pollution. Bio-compost equipments will be used to treat the spent wash generated from the ethanol plant along with the Micro 110 culture. The compost fertilizer thus produced will be sold to the farmers in the nearby villages.

Highlights of the Project

Name and Address	:	**M/s Lokmanya Sakhar Udyog Ltd.** Factory Site: At Kapshi, Tehsil Phaltan, District Satara Maharashtra
Constitution & Type	:	Public limited company
Products	:	Sugar, Ethanol & Co generated Power
Installed Capacities of the Integrated Project **Sugar Plant** **Ethanol Plant** **Cogen Power Plant**	 : : :	 5000 TCD (22 hrs basis) 60 KPLD (270 Operating days) 30.00 MW installed capacity 19.77 MW (Avg. exportable power, Season 160 days) 26.60 MW (Avg. exportable power, Off Season 65 days)

<u>Financial Highlights</u>

Project Cost:

(Rs. in Lakh)

Total Project Cost	**:**	**Sugar**	**Cogen**	**Ethanol**	**Total**
Land		400	240	160	800
Site Development		112	52	36	200
Civil works & Buildings	:	1887	1754	1020	4661
Indigenous Plant and Machinery	:	8885	9281	3918	22084
Miscellaneous Fixed Assets	:	390	350	220	960
Prelim & Preoperative Expenses	:	995	931	434	2360
Contingencies	:	190	189	87	466
Working Capital Margin	:	730	63	46	839
Total	:	**13589**	**12860**	**5921**	**32370**

Means of Finance:

(Rs. Lakh)

Financing Pattern	**:**	**Sugar**	**Cogen**	**Ethanol**	**Total**
1. Promoters' Equity	:	5028	3323	1125	9476
2. SDF Quasi Equity	:	0	1435	1066	2501
3. FI Loan	:	8561	8102	3730	20393
Total	:	**13589**	**12860**	**5921**	**32370**

Parameter		**First Year**	**Fifth Year**
Estimated W/C Requirements	Rs. Lakh	3355	10666
Estimated Annual Turnover	Rs. Lakh	7467	35680
Profit Before Tax	Rs. Lakh	72	7132
Accumulated Cash Surplus	Rs. Lakh	819	7932
Employment Potential	Nos.	445	445
Debt Service Coverage Ratio (DSCR)	Average	1.84	
	Maximum	2.88	
	Minimum	1.57	
Payback Period, Years		5 to 6 years	
Internal Rate of Return on total Investment, %		17.21	

Strengths of the Project

The main strengths of this integrated project include:

- Background and experience of the promoters
- Project location in potential sugarcane area
- Experienced, willing and committed farmers
- Ensured cane availability
- Demand supply gap in power in Maharashtra
- Demand supply gap in ethanol in India & Maharashtra
- Conducive policy / regulatory frame work
- Potential for export of branded sugar
- Sustained availability of raw materials
- Substantial socio-economic and environmental benefits
- Latest technology equipment with highest efficiency and
- Sound techno commercial viability

Risks & Mitigates

Risk	Particular	Mitigates
Performance risk	Ensured sugar cane & fuel availability	Cane development has been in full progress, with experienced senior professionals and staff appointed for the purpose. A full time fuel manager and dedicated staff has been proposed for the cogen power plant. Excellent support from farmers
Marketing risk	Sugar sale / export	Firm marketing tie up in offing. Alternative marketing channels explored. No link with domestic demand. Value added products proposed
Regulatory risk	Conversion / clearances / tariff order	No difficulty envisaged, as various governmental agencies have already expressed their willingness to issue approvals / consents. All the approvals in pipeline. Regulatory process being initiated at MERC will ensure conducive tariff order for purchase of power.
Financial risk	Financial viability of the project	Satisfactory DSCR. Equity participation arranged.

Implementation Schedule

The entire project will be commissioned by February 2016, 11-12 months after the financial closure expected by January, 2015. Meticulous planning and strong project management proposed will ensure this schedule.

Conclusions

Over all, the project is well conceived and conceptualized, with sound commercial viability. The expected financial returns are quite satisfactory. The project is being implemented by promoters having requisite background and experience and with proposed employment of experienced professionals, experts and consultants. All perceived risks have adequate safe guards. The project is recommended for equity participation and lending by financial institutions.

CHAPTER – 1

INTRODUCTION

1.1 Project Background

This Detailed Project Report (DPR) has been prepared for Lokmanya Sakhar Udyog Limited (LSUL), Kapshi by MITCON Consultancy Services Limited (MITCON), Pune, for setting up an integrated sugar (5000 TCD capacity), cogeneration power plant (30 MW installed capacity) and ethanol (60 KLPD capacity), at Kapshi, Tehsil Phaltan of Satara District, in the Maharashtra State

LSUL has gone ahead in implementation of an integrated project & has taken the following steps

1.1.1 LSUL is registered under Companies Act, 1956. **Appendix I** gives certificate of registration & business commencement certificate & **Appendix II** gives Memorandum of Association & Articles of Association of LSUL.

1.1.2 **Appendix III** gives the copies of IEM

1.1.3 **Appendix IV** gives copy of Aerial Distance Certificate issued by Survey of India.

1.1.4 **Appendix V** gives copy of NOC received from Grampanchayat.

1.2 Promoter's Background & Experience

1.2.1 Mr. Shrinivas Pawar has over 24 years' experience in marketing and general management. For the last 19 years, he has been in automobile dealerships.

Mr. Pawar started his career with the Sakal Group of newspapers, in charge of their printing operations in Mumbai. After a few years, he started his own business in automobile retail.

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Mr. Patil started his career with Global Tele systems as a Management Trainee and then moved on to join the family business. He was empowered by the board the task of setting up the family business in Goa in both fronts in Logistics as well as Automobile retailing. Sharayu Group which had its presence only in Maharashtra also found a niche for themselves in Goa. Today we have our Presence in both north & south Goa and flagship store in Capital City of Panjim.

Appendix VI gives detailed bio-data of the promoters and the board of directors of LSUL.

To make the venture commercially viable and financially profitable, the capacity of the sugar plant is decided and fixed at 5000 TCD, 60 KLPD ethanol and a cogeneration plant of 30 MW.

The promoters have a great vision. Sensing the potential of sugarcane in the region and increasing demand of power & ethanol and also keeping in view, the needs of the local farmers, those cultivate sugarcane in the command area.

The integrated project comprises of a sugar mill for the manufacture of high quality sugar, thereby making available required bagasse for the cogen power plant and molasses for ethanol plant. The command area of the proposed sugar mill has excellent irrigation facilities, potential for sustained cane supply to the sugar mill, molasses and biomass availability.

1.2.2 LSUL has now been fully geared up to implement and commission this integrated project, latest before February, 2016. Latest technologies for sugar and ethanol manufacture and generation of power will be employed in this project to ensure optimum efficiency and operating costs for both the products.

1.2.3 A dedicated Project Team of LSUL has been functioning, along with appointed experts and consultants, for speedy and successful commissioning of this project.

1.2.4 LSUL already has appointed a technical / managerial team of highly qualified engineers, contract & arbitration experts, agricultural officers and managerial personnel for implementation and operation of the captioned integrated project.

1.3 Sugar Industry Overview, India & Maharashtra

1.3.1 The origin of Indian sugar industry dates back to 1930, when the first sugar factory was set up in the pre-independence era. Over the last 76 years, the sugar industry has steadily grown and has become the backbone of the agricultural and rural economy in India. Today, sugar is the second largest agro processing industry, next to the textile industry. India is one of the largest producers of sugar in the world, with a production of over 15 million tones. Sugar factories are located mostly in the rural India. They act as centers of development, provide largest direct employment in the rural areas and contribute substantially to the Central and State exchequers. The prospects of earning foreign exchange from export of sugar are also quite high.

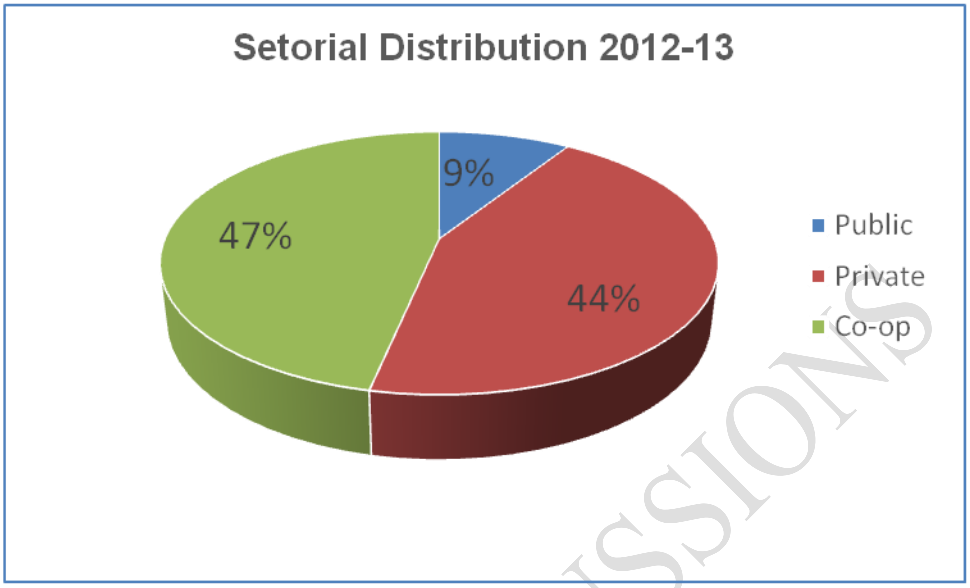
1.3.2 Sugar factories in India have capacities ranging from 1250 TCD to 10000 TCD. The Indian sugar industry has developed indigenous capabilities for design, manufacture, supply, operation and maintenance, R&D and cane development. The major stakeholders of this industry in India are Ministry of Agriculture, Govt. of India, Ministry of Consumer Affairs, Food and Public Distribution, federations of co-operative and private sector sugar factories at the national and the State levels, sugarcane growing farmers, equipment and technology suppliers, research institutions, consultants and service providers, financial institutions and Central / State Governments.

1.3.3 A total of 703 sugar factories are in operation today, with additional sugar factories under implementation in different parts of the nation. The area under sugar cane cultivation, sugar cane production, sugar cane crushing in sugar factories, average season days, sugar recovery and sugar production have increased steadily over the years. The crop yield per hectare and recovery has improved, particularly in the last decade.

1.3.4 Sugar factories in India are spread over the entire country; however 92% of them are located in 9 States viz., Uttar Pradesh, Bihar, Punjab and Haryana in the north, Maharashtra and Gujarat in the west and Karnataka, Andhra Pradesh & Tamil Nadu in the south. More than 80% sugar factories are below 3500 TCD capacity and balance have higher capacities. About 44% of the Indian sugar factories are in the co-operative, 9% in Public sectors and balance 47% in the private sector.

1.3.5 Following Table no 1.1 shows the distribution of sugar factories all over India.

States	Public	Private	Co-op	Total
Assam	-	1	2	**3**
Orissa	-	4	4	**8**
West Bengal	1	1	-	**2**
Punjab	-	8	16	**24**
Haryana	-	3	13	**16**
Rajasthan	1	1	1	**3**
Uttar Pradesh	33	97	28	**158**
Uttarakhand	2	4	4	**10**
Madhya Pradesh	2	12	5	**19**
Chhattisgarh	-	-	3	**3**
Gujarat	-	2	22	**24**
Maharashtra	-	55	168	**223**
Bihar	15	13	-	**28**
Andhra Pradesh	1	29	14	**44**
Karnataka	3	45	24	**72**
Tamil Nadu	3	27	16	**46**
Puducherry	-	1	1	**2**
Kerala	-	1	1	**2**
Goa	-	-	1	**1**
Dadra Nagar & Haveli	-	-	1	**1**
Other	3	7	4	**14**
All India Total	**64**	**311**	**328**	**703**



Source: Sugar India Year book, 2014

1.3.6 The Ministry of Consumer Affairs, Food & Public Distribution, and Government of India revised the standard specifications for sugar plant & equipment, in the year 1987. The special committee finalized specifications for economical capacity of 2500 TCD, expandable to 3500 TCD, employing higher-pressure boiler and turbine configuration and efficient equipment, with a potential to export incidental surplus power to the grid.

1.3.7 The Indian sugar industry was de licensed in the year 1998 vide press note No. 12 issued by the Government of India, Ministry of Industry, Department of Industrial Policy and Promotion, on August 31, 1998. The salient features of de licensing are as follows:

a) The sugar industry stands deleted from the list of industries requiring compulsory licensing under the provisions of Industries Development and Regulation Act, 1951. However, in order to avoid unhealthy competition among sugar factories to procure sugarcane, a minimum distance of 15 km would continue to be observed between and existing sugar factory and a new factory, by exercise of powers under the Sugar Control Order, 1966.

b) The entrepreneurs, who wish to de-license their sugar factory, would require filing an Industrial Entrepreneur Memoranda (IEM) with the secretariat of industrial assistance in the Ministry of Industry, as laid down for all de-licensed industries, in terms of the press note dated August 2, 1991, as amended from time to time.

c) Entrepreneurs who have been issued Letter of Intent (LoI) for manufacture of sugar need not file an initial IEM. In such cases, the LoI holder shall only file Part B of the IEM at the time of commencement of commercial production against the LoI issued to them. It is however open to entrepreneurs to file an initial IEM (in lieu of LoI / industrial license held by them) if they so desire, whenever any variation from the conditions and parameters stipulated in the LoI / industrial license is contemplated.

1.3.8 The statistics on economic and commercial performance for the industry is quite fluctuating. The changes in the agro climatic conditions and sugarcane crop production, as well as the sugar markets have been mainly responsible for these fluctuations. Efficiency, quality, and integration have become order of the day for this industry. The industry has grown till today over the last seven decades. The strength and capacity built so far will surely help meet these challenges. The following are major options to meet these challenges:

a. Effecting substantial improvement in cane development and management, including cultivation practices, varietals and water management, so as to improve yield and recovery, without affecting the average fibre content.
b. Effecting visible improvement in the operational efficiencies and reduction of sugar losses.
c. Effecting and sustaining improvement in energy efficiency, both in steam and power, for saving of additional bagasse, for both sugar and by-products manufacture.
d. Expansion of capacities and diversification into absolute alcohol/ethanol and cogeneration power projects.
e. Effecting adequate capacity building within and without.
f. Maximizing sugar exports for value addition.
g. Effective marketing in the national and international markets.
h. Product quality and diversification.
i. Commercializing the excess power capacity by exporting to utilities or to other bulk power consumers.

1.3.9 Ministry of Consumer Affairs, Food & Public Distribution, and Department of Food & Public Distribution Govt. India has issued a revised order dated 10.11.2006, amending Sugarcane (Control) Order, 1966. The key provisions of this order are outlined below:

a. No new sugar factory shall be set up within a radius of 15 km of any existing sugar factory or another new sugar factory in a State or two or more States.

b. Before filing the Industrial Entrepreneur Memorandum (IEM) with a Central Govt., a certificate from the Cane Commissioner or Director Sugar or specified authority of the concerned State Govt. shall be obtained regarding the distance criteria re-defined as above.

c. Submission of performance guarantee of Rs. 1 crore to Chief Director, Sugar, Dept. of Food & Public Distribution, within 30 days of filing the IEM, as a surety for implementation of the IEM within the stipulated or extended time.

d. The stipulated time for taking effective steps shall be 2 years and commercial production shall commence within 4 years from the date of filing of the IEM, failing which the IEM shall stand de-recognized and performance guarantee shall be forfeited.

e. If an IEM remains un-implemented within the stipulated or extended time limits, the performance guarantee shall be forfeited after giving a reasonable opportunity of being heard.

f. The above clauses will be applicable for IEM already acknowledged as on the date of this notification, but who have not taken effective steps for its implementation, duly defined, shall furnish a performance guarantee of Rs. 1 crore to the Chief Director, Sugar.

Maharashtra

1.3.10 The growth of sugar industry in the State started prior to independence in the private sector and in the co-operative sector since 1950 onwards. The co-operative movement in the State has been witnessed mainly in the sugar industry. The growth of this industry in the co-operative sector has certainly helped improve socio-economic life of the rural parts of the State. The State co-operative sugar factories are directly administered by the office of Commissioner of Sugar, Ministry of Co-operation and Government of Maharashtra.

1.3.11 Maharashtra State assumes a leadership position in India related to sugar industry, in terms of area under sugarcane cultivation, number of sugar factories, sugarcane production, sugarcane crushing by sugar factories, yield, recovery and sugar production. There are 209 installed sugar factories as on date and several entrepreneurs, private companies & co-operative societies have been issued LoIs / IEMs for production of sugar.

1.3.12 The policy for sugar industry in Maharashtra is in line with the Central Government. The State co-operative sugar factories have faced difficulties in the recent past, due to fluctuations in the monsoon and sugarcane availability, competition related to cane prices, inefficient operating and management practices, socio-economic-political linkages, as well as no reserve position and poor credit worthiness of most of them.

1.3.13 Cane Availability, Present & Future

Sugarcane has been the major cash crop grown in the State due to conducive environmental conditions for sugarcane growing, good quality of soil for cultivation and adequate irrigation facilities. New varieties are developed along with modern cultivation and irrigation practices. This has led to increased crop yield & sugar recovery, as compared to the other States. The highest recovery registered in last season was 11.65%, averaging 11.00% for the State, compared to 10.25 % all India average.

1.3.14 Sugar factories are expected to have excess cane availability during coming years, even after fulfilling their own crushing requirements. As of now, there is no alternative arrangement available to crush this excess cane. This would extend the crushing period to 200 days, as against average season days of 160. Surplus sugarcane from bordering States like Karnataka, Andhra Pradesh & Gujarat will be available in addition to the excess cane available within.

1.3.15 Number of efforts has been initiated by the office of the Commissioner of Sugar for improving the physical and financial position of the co-operative sugar factories. The recent decision of liquidation of badly managed and financially poor sugar factories in the State and offering them for outright sale or operation on lease basis is one of the landmark decisions from this office.

1.4 Power Sector Review

<u>All India</u>

1.4.1 The power situation in India is characterized by continued demand supply gap, despite large capacity additions. The installed capacity of 1,350 MW in the year 1947 has increased to 2,34,601 MW, as on January 31, 2014. The generation capacity is expected to add by 88,537 MW, as per the CEA and Planning Commission estimates for the 12th Five Year Plan. We have been able to achieve 25,240 MW (as on Sept 2013.) i.e. 28.71 % of the planned target. (Source-CEA)

The power situation in India particularly during the last five years has been precarious. While the peak demand is anticipated to grow from 81,492 MW in 2001-02 to 144,225 MW in year 2013-14, the energy requirement will from 545,983 Million Units (MUs) to 1,048,533 MUs during the corresponding period. The energy and peak shortages projected for the year 2013-14 are 6.7% and 2.3 % respectively. (Source: LGBR:-13-14)

1.4.2 The Government of India (GOI) has acknowledged the overall deficiency of power supply and quality in India. The importance of decentralized energy generation from renewable sources, for complimenting centralized fossil fuel based power generation, has been accepted way for improving the situation.

1.4.3 As per the estimates of Central Electricity Authority (CEA) and Ministry of Power, the capacity addition requirements by 2012 AD have been estimated at 100,000 MW on all India basis. The identified capacities from Central, State & private sector of about 60,000 MW are in place. The balance 40,000 MW will have to come from additional projects from Central, State & private sectors, as well as from captive and renewable energy sources.

1.4.4 Ministry of Power (MoP), Govt. of India has drawn ambitious plans to meet the demand. The key objectives set before include access to electricity for all by 2012, increase in per capita electricity consumption to 1000 units (from 610 units at present), minimum life line consumption of 1 unit per household per day by 2012 and peak energy demands to be fully met from present shortfall situation. The capacity addition of 100000 MW during 10th& 11th five-year plans has been planned, along with 10000

MW capacity additions from renewable sources, during the same period. The total fund requirement for the planned capacity additions have been estimated at US $ 235 billion. Against a targeted capacity addition of 40,000 MW in the 10^{th} five year plan period, the capacity addition achieved was 37,000 MW.

1.4.5 The Electricity Act, 2003 (the Act) provides for de-licensing of power generation. Sections 61 (h) and 86 (e) of the Act provide provision for the promotion of co-generation and generation of electricity from renewable sources of energy. The functions of the State Electricity Regulatory Commissions (SERCs) in this respect have been defined to promote cogeneration and generation of electricity from renewable sources of energy, by providing suitable measures for connectivity with the grid. The sale of electricity to any persons, as well as purchase of electricity from such sources, with a percentage of total consumption of electricity in the area of a distribution licensee, are also required to be defined by SERCs[1].

1.4.6 The fiscal incentives offered for renewable energy generation are expected to continue in the coming period. They primarily include accelerated depreciation, income tax holiday, customs duty concessions and exemption in excise duty & sales tax.

1.4.7 The Central Electricity Regulatory Commission (CERC) and SERCs have come into force to determine tariffs and oversee the electricity sector. The ERCs have determined tariffs for the purchase of electricity by State Electricity Boards (SEBs) or Electric Distribution Companies (EDCs) from various sources, including renewable based on the guidelines from the Ministry of Power (MoP)/ MNRE, State policies through the public hearings process.

1.4.8 As of January 31, 2014, India’s installed capacity stands at 2,34,602 MW, out of which the contribution of the State sector is 39%, followed by the Central sector at 28% and private sector contributing to the balance 33 %. Out of the total installed capacity, 68 % is contributed by thermal (coal, gas & oil), 17 % by hydro, 2.00% by nuclear and 13 % by renewable sources.

[1] Electricity Act, 2003, Ministry of Power, Govt. of India

1.4.9 During year 2013-14 the anticipated energy & peak demand is 1,048, 533 MUs / 144,225 MW against the anticipated availability of 978,301 MUs / 140,964 MW having a shortfall of 6.7 % in energy and 8.5% in peak demand.

1.4.10 Rural Electrification

Rural electrification is a vital program for socio economic development of rural areas. The objectives are to support economic development and generate employment. By supplying electricity to rural areas, as an input for productive uses in agriculture and rural industries, the main aim is to improve the quality of life of the rural people by supplying electricity for lighting of homes, shops, community centers and public places in villages. The Ministry of Power, Govt. of India has introduced the scheme, Rajiv Gandhi Gramin Vidyutikaran Yojna (RGGVY) in April 2005. This scheme aims at providing electricity in all villages and habitations in four years and providing access to electricity to all rural households. This program has been brought under the ambit of Bharat Nirman. The latest (as on Dec. 31, 2013) results of this program have been tabulated below:

Table No 1.2: Results of Bharat Nirman Program

Total Number of Villages	593732
Number of Villages Electrified	561751
% Villages Electrified	94.60
Total no of Pump Sets	19594000
Pump sets Energized	19014881
% of Pump sets Electrified	97.04

Maharashtra

1.4.11 Maharashtra State has the largest power system (power generation and distribution) in India, with 100% rural electrification (as per the earlier definition of rural electrification with at least one light connection per village) and access to electricity for 78% households. Power situation in Maharashtra is better than many of the other States, but still suffers huge demand and energy shortages.

1.4.12 As of May 30, 2014, the power generation capacity in Maharashtra was 35,167 MW, 35% contributed from the State sector, 46 % contributed by the private sector and balance 19 % from the Central sector.

1.4.13 Maharashtra faces a power shortfall of 1500-2000 MW. The peak demand increased from 13697 MW in 2002-03 to 19276 MW in 2013-14 registering rise of 41%, due to increase in industrial & commercial activities.

1.4.14 The Government of Maharashtra recently has taken several steps to improve power situation in the State. Expansion of existing capacities, setting up new projects including private sector, promoting captive power plants, promoting energy efficiency and of course promoting renewable energy based power generation, have been the major areas.

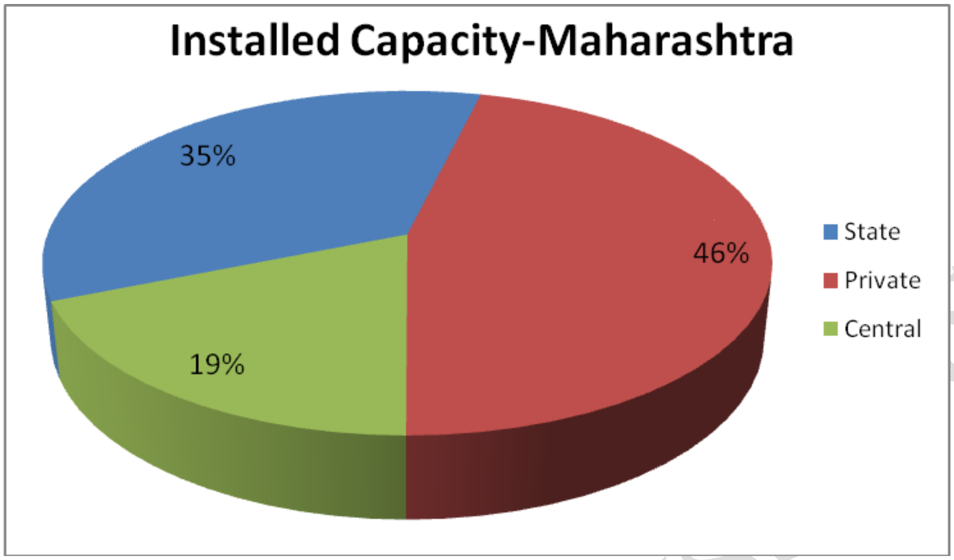
1.4.15 The Government of Maharashtra had drawn plans of creating a situation of surplus power by 2011-12 AD. In order to increase power supply, MSEDCL plans to obtain 750 MW from projects under construction, 2872 MW from projects tied up with National Thermal Power Corporation (NTPC) and inter-State projects and 2144 MW from Dabhol project (now known as Ratnagiri Gas & Power Pvt. Ltd.). MAHAGENCO will supply 7500 MW through various planned projects as above and additional 4000 MW will be purchased through competitive tenders from Independent Power Producers (IPPs). The total additions of 11500 MW are expected to come on stream between next 3-8 years. Apart from these initiatives, Govt. of Maharashtra has signed MoU's with private sector for 12500 MW generation capacity, which are expected to come on stream between next 5-10 years.

1.4.16 With above scenario, the power shortage is expected to last for a foreseeable future. The implementation of Cogen Projects with cumulative exportable capacity of 1000 MW in next three years will help the State to reduce the shortfall in power demand and energy requirements up to certain extent.

MAHARASHTRA POWER PROFILE

(*Source: Central Electricity Authority*)

Maharashtra -Installed Capacity as on May 31, 2014 (MW)								
Ownership Sector	**Thermal**				**Nuclear**	**Hydro**	**RES (MNRE)**	**Grand Total**
	Coal	**Gas**	**Diesel**	**Total**				
State	8400	672	0	9072	0	2885	327	12284
Private	10326	180	0	10506	0	447	5303	16256
Central	3313	2624	0	5937	690	0	0	6627
Sub-Total	**22039**	**3476**	**0**	**25515**	**690**	**3332**	**5630**	**35167**



ACTUAL POWER SUPPLY POSITION-(Source CEA- LGBR - 2014-15)

Period	Peak Demand (MW)	Peak Met (MW)	Peak Deficit/Surplus (MW)	Peak Deficit/Surplus (%)	Energy Require-ment (MU)	Energy Availability(MU)	Energy Deficit/ Surplus (MU)	Energy Deficit/ Surplus (%)
9th Plan	12265	10726	-1539	-12.5	80489	73438	-7051	-8.8
2002-03	13697	10984	-2713	-19.8	87152	75472	-11680	-13.4
2003-04	14503	11868	-2635	-18.2	87933	78966	-8967	-10.2
2004-05	14986	12464	-2522	-16.8	92715	81541	-11174	-12.1
2005-06	16069	12360	-3709	-23.1	102765	84117	-18648	-18.1
2006-07	17455	12679	-4776	-27.4	110005	89138	-20867	-19
2007-08	18441	13575	-4866	-26.4	114885	93846	-21039	-18.3
2008-09	18049	13767	-4282	-23.7	121890	95750	-26140	-21.4
2012-13	17934	16765	-1169	-6.5	123984	119972	-4012	-3.2
2013-14	19276	17621	-1655	-8.6	126288	123672	-2616	-2.1

The power supply situation in Maharashtra shows an increasing deficit in energy and peak demand.

1.5 Ethanol Sector Overview

1.5.1 Industry Overview

Molasses is one of by products of sugar industry which is used to produce rectified spirit/alcohol for making liquor and fuel. Traditionally, molasses has been used in India to produce rectified spirit and alcohol of higher than 95% purity for producing liquor for human consumption and for producing various chemicals. However, with technological developments in the recent past, molasses has been effectively used to produce bio-ethanol for blending with petrol as a fuel.

1.5.2 Global Scenario

Brazil is the second largest producer of ethanol globally after U.S. While U.S. produces ethanol from corn, Brazil manufactures ethanol from sugarcane. Brazil has mandatory blending ratio of ethanol in gasoline ranging from 18% to 25%. The blend rate was as high as 25% before September 2011 and was reduced to 20% due to drop in cane output hence affecting the ethanol production. Currently, flex-fuel cars, which can use either ethanol or blended gasoline, in Brazil account for about 53% of the total car fleet and around 90% of the new vehicles' sales. The proportion of the flex-fuel cars are expected to cross 80% by 2020. Currently, the Brazilian light vehicle fleet has been increasing by 6.7% y-o-y since 2003 with currently 90% of the new vehicles being flex-fuel cars. Thus, there exists an increasing demand in Brazil for ethanol which is encouraging for the sugarcane industry.

1.5.3 Indian Scenario

India has 330 distilleries, which produce over 4 billion litres of rectified spirit (alcohol) a year. Of the total distilleries, about 120 distilleries have the capacity to distillate 1.8 billion litres (an additional annual ethanol production capacity of 365 million litres was built up in the last three years) of conventional ethanol per year which is sufficient to meet requirement for 7-8% ethanol blending with petrol.

Total ethanol production increased from 1,435 million litres in 2009-10 to 1,934 million litres in 2010-11 on account of higher sugarcane and sugar production and the estimated ethanol production in 2011-12 is pegged at 2,130 million litres. Ethanol consumption increased from 1,780 million litres in 2009-10 to 2,010 million litres in 2010-11, owing to improved molasses supply and steady ethanol demand from competing industries.

1.5.4 Government Policy

In 2006, GOI mandated 5% ethanol blending with petrol (EBP) programme to directly benefit the sugarcane farmers by assuring the sugar industry a stable and reasonable return for the molasses and then passing a significant part of the same to the farmers. But since then the programme has been struggling to take off despite the fact that the Cabinet Committee on Economic Affairs (CCEA) in November 2009 directed that a financial penalty be imposed on OMCs for their failure to reach targets.

In August 2010, the CCEA set up the Saumitra Chaudhuri committee for determining the ethanol pricing after a Committee of Secretaries (CoS) failed to reach at a consensus. So far, the OMCs have been contracting ethanol at the provisional procurement price of Rs 27 per litre, fixed by the CCEA that time.

The Ministry of Petroleum and Oil Marketing Companies (OMCs) put a specific condition in September 2010, that ethanol should be produced from domestic molasses only i.e., molasses or alcohol cannot be imported by the ethanol producers and has to be produced only from molasses and not sugarcane juice or food grains.

In November 2012, the CCEA has made it mandatory for Oil marketing companies (OMCs) - Bharat Petroleum, Hindustan Petroleum and Indian Oil Corporation - to blend 5% ethanol with petrol. This is likely to reduce the fuel import bill and lower India's dependence on fossil fuel as the ethanol prices are lower than petrol. OMCs have been blending ethanol with petrol for the past two years but the policy was partially implemented in absence of any clear directive. The Committee, headed by the Prime Minister, has also approved market-based pricing of the biofuel, opening the market for ethanol producers - mostly sugar companies. This shall result in an increased demand for ethanol by OMCs.

The national bio-fuel policy, approved by the Government of India, has plans for a 20% ethanol blending programme by 2017 from the current mandated 5% blending & recently increased to 10%, to reduce India’s dependence on fossil fuel imports.

1.6 Objectives of the Report

The objective of this assignment is to prepare a bankable Detailed Project Report (DPR) for 5000 TCD Sugar Plant, 60 KLPD Ethanol and 30 MW capacity Cogen Power Plant, based on the pre-feasibility evaluation and selected option for implementing this project. The scope of work is detailed in the work order issued by LSUL to MITCON for the purpose.

1.7 Methodology

For preparing this Detailed Project Report, MITCON deputed a task team of in-house coordinators and expert associates. MITCON submitted list of data / information / documents required for preparation of DPR. MITCON's task team undertook several visits to factory site and surrounding areas for collection of data / information / documents, nearby 132 kV substation, sugarcane/biomass assessment, etc., as well as to hold detailed discussions with LSUL management.

CHAPTER – 2

CANE & BIO-MASS POTENTIAL IN THE COMMAND AREA, A REVIEW

2.1 Sugarcane Potential in Command Area

LSUL, sensing the good opportunity to establish in sugar and power sectors along with ethanol in the district of Satara, has approached MITCON for conducting the cane survey in the area related to the proposed sugar factory and assess the feasibility of cane availability on a long term basis.

In the light of the new sugar policy, with almost total decontrol, the cane command area of the proposed sugar factory is expected to fall in Command area of Phaltan and nearby tehsils like Khandala, Koregaon, Wai in the Satara district and Baramati from Pune district. However, LSUL needs to consider economics of the sugarcane transport if they want to procure cane from neighboring districts. Hence, the study has been restricted to the cane command area falling under above-mentioned area of Satara district in general. Evaluation has been also made for the area falling within in and around 30 Km from the existing factory sites. This will provide LSUL flexibility to decide the capacity of the plant.

- Command area lies in the south-western part of the District. The proposed factory site is located at Kapshi village in Phaltan tehsil, is at a distance of 25 km from the Phaltan city, a tehsil headquarter. It is at a distance of about 45 km from the Satara city, which is a district headquarters. The nearest railway station is at Wathar (18 km). The nearest air port is Pune, which is at a distance of 122 km from LSUL site at Kapshi.

- Satara district is well known for its cane cultivation and sugar production. Black soil available in the district is suited for any kind of cultivation and the area is blessed with adequate irrigation facilities. This district and Phaltan tehsil in particular is famous for its rich agricultural production, as it is situated near Nira River.

- The major river in the district is Krishna. Koyana, Venna, Kudali, Urmodi, Yerala and Tarali are its tributaries. Nira is important river which flows on the north border in the command area. The Krishna flows through the centre of the district. Koyana is biggest tributary of Krishna. Koyana meets Krishna in Karad city. Nira river, tributary of Bhima flows on the north border. An area of about 348974 hectares is under irrigation in the district from various sources.

- Total area under irrigation under canals & wells is 65221 ha & 113364 ha, respectively. The area under minor, medium & major irrigation project within Satara district is 16666 ha, 5738 ha & 147985 ha, respectively. Total land under irrigation in the command area (Phaltan, Khandala, Wai, Koregaon & Baramati tehsils) is around 214504 ha out of total cultivated area. Major sources for irrigation are mainly canals and major irrigation projects like Dhom, Veer, Neera Devdhar, Dhom Balakavadi, Jihe Kathapur and medium irrigation projects like Kavathe Kenjal, Wasana & Wangana along with wells, ponds, rivers, and tube wells.

  Traditionally, this region has been a Jowar, Wheat, Maize, Tur, Groundnut and Sugarcane growing belt. Jowar, Tur, Sugarcane and Maize are the main Khariff crops while Jowar, Wheat, and Gram (Harbara) are the Rabbi crops. The climatic conditions and rainfall in this area are ideally suited for their growth and hence these crops have a high yield of growth in the region. Additionally, the rainfall and irrigation are also adequate for the growth of these crops.

- Sugarcane contributes about 13.80% as major crop after Jowar (31.96%) & Bajra (14.45%). Soyabean, paddy, wheat, maize, gram & other crops constitutes approximately 40% of the crops grown in district. During the field study it is observed that farmers are interested in cultivating sugarcane more because of the cash crop. These farmers are willing to grow sugarcane as it offers better returns per hectare.

- Satara is one of the major districts in Maharashtra in sugar industry. There are 11 operating sugar factories in this district having installed crushing capacity of 35750 MT/day. Annual crushing for season 2013-14 was 61.22 lakh MT at the average recovery of 11.90%.

- Sugarcane is one of the major crops in Satara district. About 69999 hectares of the total average land is under cultivation of sugarcane in sowing season 2013-14 which is around 13.80% of the total land under major crops cultivation in the district.

- During the field visit it was observed that at present six operating & two proposed sugar factories are available in the command area.

- From climatic data of the region, it is observed that the maximum and minimum temperatures and relative humidity are quite favourable for growing of sugarcane and for higher recovery.

- The yields of the different varieties of the cane vary, depending on agro-climatic conditions and water availability, from year to year. On an average the yield is expected to be around 89 MT/Ha.

- The command area comprises of five tehsils Phaltan, Koregaon, Khandala & Wai from Satara district and Baramati from Pune distirct. The total area under sugarcane cultivation of these five tehsils is 51091 ha, with total sugarcane production of 4870939 MT.

- The command area of LSUL comprises of six operating sugar mills & two proposed as shown below. The total crushing capacity of six operating mills is 17300 TCD, with total cane crushing of 27.68 lakh MT at 100% capacity utilization. While the crushing capacity of two proposed sugar mills is 6000 TCD, with cane crushing of 9.60 lakh MT at 100% capacity utilization.

- Considering the cane requirement for 5000 TCD average capacity, for maximum 160 days of crushing will require about 8.00 lakh MT of sugarcane at 100% PLF. The surplus cane that is available for the proposed sugar mills will be about 11.43 lakh MT.

- In order to get better sugar recovery the ideal ratio of Early, Mid late and Late maturing varieties should be 40:40:20. In the proposed area of LSUL, this should be encouraged so that farmers, who plant the late maturing varieties, are given necessary incentives.

- It is always advisable for the promoters of the proposed sugar factory to have their own cane fields. Also friends and supporters should also be made to grow cane. This will induce confidence in other farmers for cane growing, as it will show that the management can prove that cane growing is commercially more viable than other crops and that it will fetch the farmers a good price.

- To ensure that the farmers who grow cane get the right type of seed, it is recommended that the proposed sugar factory have a nursery of their own. Apart from providing seeds, the nursery can be used for growing newer and better varieties of cane and then the seed of these newer varieties can be provided to the farmers.

- To encourage farmers and assure continuous and assured supply of cane from them, it is recommended that LSUL should supply all inputs like seed cane, fertilisers etc. to farmers through bank loans, by issuing suitable guarantees for recovery of bank loans.

- It is recommended that LSUL should also sponsor cane development schemes on its own and / or with the help the farmers in its command area, for availing financial assistance. This will help LSUL in ensuring assured availability of cane, on a long-term basis.

It is concluded that the command area has very good availability and potential for cane cultivation and will have surplus cane availability of 11.43 lakh MT/annum of sugarcane.

A 5000 TCD capacity sugar factory working for a 160 days season will require 8.00 lakh MT/annum of cane. The available cane is sufficient for the proposed sugar mill and hence is recommended that LSUL can go ahead with 5000 TCD installed capacity.

The irrigation facilities in the command area are excellent and the availability of surplus cane in the command area and proposed development of sugarcane in the adjoining tehsils is sufficient to meet the cane requirements of the proposed sugar factory of LSUL.

2.2 Surplus Biomass Availability

- In order to assess agro based fuels available in the region and surrounding areas and to suggest ways and means to collect and transport these fuels, LSUL's assigned MITCON the task of conducting a biomass survey and suggest ways and means of collecting and transporting the surplus biomass to LSUL's project site.

- MITCON undertook a biomass survey in the command area to identify surplus biomass available for use in the cogeneration power project. This report presents the outcome of this survey.

- Considering the surplus biomass, and after taking into account 75% collection efficiency for bought out fuels, LSUL can collect the following quantities of surplus biomass from the command area.

Surplus Biomass for JMSPIL's Project after Considering Collection Efficiency of 75 % for Biomass Procured from Outside

(in Ha)

Sr. No.	Tehsil	Rice Husk	Maize Cobs	Tur Stems	G Nut Shells	Cane Trash	Total
Reg 1	**0 - 25**						
1	Phaltan	0	1909	21	10	32514	34455
2	Khandala	155	374	9	197	9041	9777
3	Koregaon	30	635	98	127	42934	43824
	Sub Total	**185**	**2918**	**128**	**335**	**84489**	**88055**
Reg 2	**25 - 50**						
4	Satara	1033	450	113	1195	35291	38081
5	Wai	802	515	53	450	18476	20297
6	Jawali	1548	216	40	458	2630	4892
7	Mann	0	864	3	3	2096	2965
8	Khatav	6	1480	102	77	7569	9234

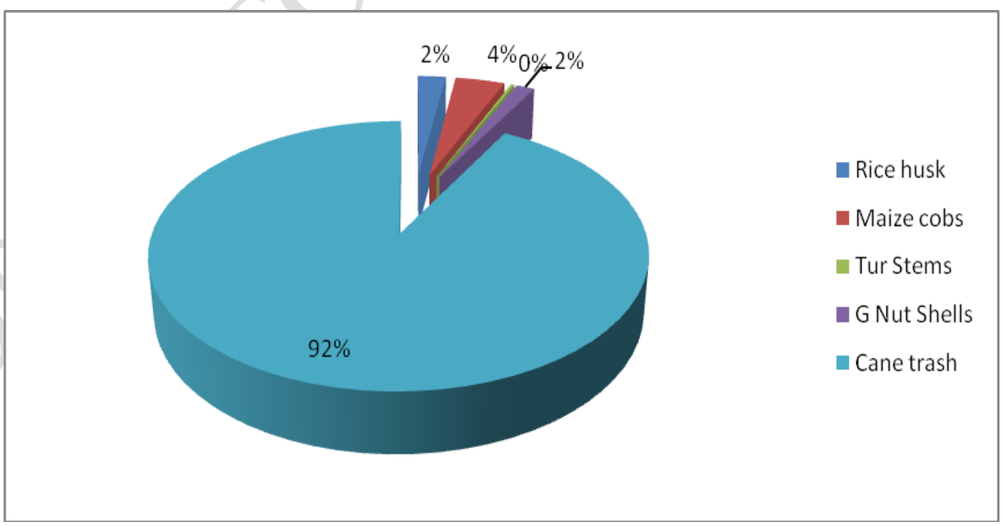
Sr. No.	Tehsil	Rice Husk	Maize Cobs	Tur Stems	G Nut Shells	Cane Trash	Total
9	Bhor	1472	181	55	649	3781	6138
10	Purandar	219	411	23	199	6732	7583
11	Baramati	0	2224	107	44	53261	55636
	Sub Total	**5079**	**6341**	**495**	**3075**	**129837**	**144826**
	Grand Total	**5264**	**9259**	**623**	**3409**	**214326**	**232882**

- MITCON has prepared this report in line with the guidelines that specified by the Ministry of New & Renewable Energy (MNRE), New Delhi and Indian Renewable Energy Development Agency (IREDA), New Delhi and which are now adopted by Maharashtra Energy Development Agency (MEDA), Pune.

- The main advantages of the site are:

  - The site is easily accessible from Satara and Pune
  - The nearest railway station is at Wathar, which is 18 km from the site
  - The command area lies in an important jowar, paddy, sugarcane, soyabean, groundnut, bajra and wheat growing belt.
  - There are ten sugar factories in the region demarcated as the command area and surplus bagasse can be used from these sugar factories.

The contribution of each source of biomass to the surplus biomass available in the command area can be depicted pictorially and is shown below:



Contribution of Various Sources that Yield Surplus Biomass in the Region

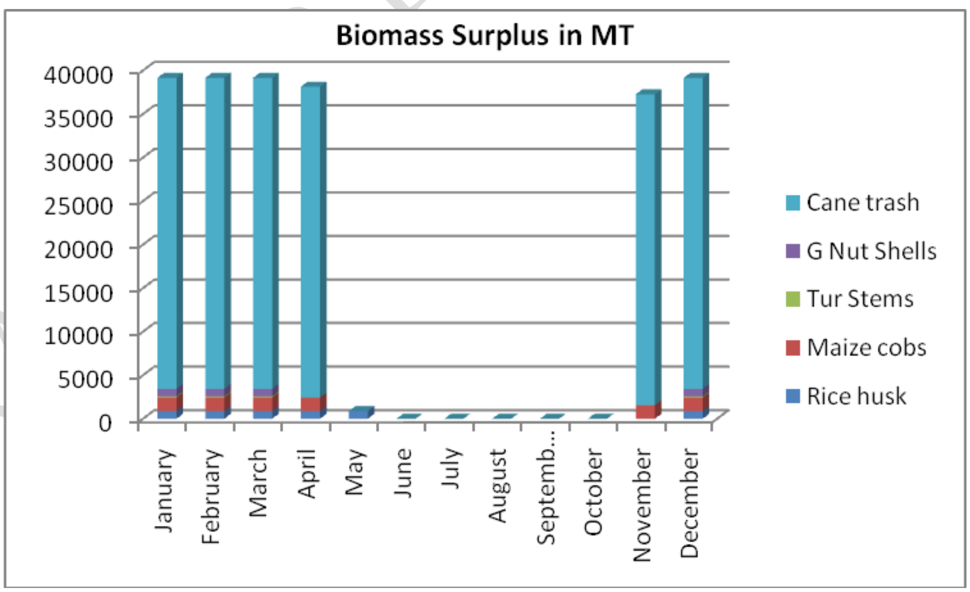
- The average landed price for the various fuels given in Table 1 for the 3 different regions will vary from as follows:

➢ Rice Husk	Rs. 5150/MT to Rs. 5300/MT
➢ Maize Cobs	Rs. 1650/MT to Rs. 1800/MT
➢ Tur Stems	Rs. 1675/MT to Rs. 1825/MT
➢ Groundnut Shells	Rs. 1650/MT to Rs. 1800/MT
➢ Cane Trash	Rs. 1250/MT to Rs. 1400/MT
➢ Bagasse	Rs. 2450/MT to Rs. 2600/MT

- While conducting the primary survey of the command area, *prima facie*, we have noted considerable enthusiasm amongst the local people for supplying surplus biomass to LSUL

- The available biomass is sufficient to meet the present needs of the local population for their fuel and other requirements. The biomass, which is identified as surplus, is that biomass which is in excess of the requirements of the local population.

- The approximate monthly availability of biomass (at 75% collection efficiency for outside fuels) for the power generation plant will vary roughly as given in the figure below.



- In computing the landed price of biomass, all transportation has been considered by road. Any fluctuations in the diesel prices will affect the landed price of the biomass.

- Harvesting, transportation, sizing and drying are some of the important operations to be carried out before the fuel is made ready for use. Depending on the size of operations and relative cost of labor and capital, varying degrees of automation could be adopted for each of the above operations. To carry out these fuel preparation operations successfully and efficiently it is imperative that a consortium is formed and their work content is established.

- The location of biomass banks can initially be in the tehsil towns in the command area. Once these banks become operational and the biomass linkage mechanism gets well established, then other villages can be selected for setting up further banks.

- LSUL has to make special arrangements for collection, preparation, processing and transportation of surplus biomass available in the command area. In this connection, agencies, like NGOs can be contacted, who have an established program of self help groups for the poor and needy rural youths / women in various villages. Under this program rural youths / women are identified and they can be trained for biomass collection, preparation, processing and transport. Through some special schemes of Central and State Governments heavily subsidized biomass processing equipment can be made available to such self-help groups. LSUL can also enter into an agreement for a reasonable period with such groups for purchase of biomass from them at a fixed /negotiated price.

- It is recommended that LSUL generate a part of its own fuel through energy plantations. Such a step will ensure that the cogen plant of LSUL is not entirely dependant on bought out fuel.

- We also feel that LSUL should consider the option of briquetting so as to be able to make maximum utilization of agro-residues in the region. Apart from providing a fuel with uniform characteristics, briquetting will lower transportation and handling costs. The storage space required for briquetted fuel is also less than that required for loose biomass

  The social aspect of encouraging briquetting is that it will generate employment for un-employed youth in the region. Or it will be an additional activity of income generation to the farmers and their families in the region. As LSUL will also benefit by having a more uniform fuel for combustion, briquetting, if encouraged, can be a successful solution to using diverse agro-fuels.

- **With the above study it is concluded that LSUL can collect approximately 2.33 lakh MT/annum of bought out biomass from the command area, which can be made available for proposed cogeneration plant of LSUL.**

- **Additionally, average surplus bagasse up to 62006 MT can be available from 5 out of 10 operating sugar mills within the command area.**

CHAPTER – 3

PROJECT CONCEPT, DESIGN & KEY PARAMETERS

3.1 Sugar Plant

3.1.1 The objectives of the sugar plant of the proposed integrated project are mainly to manufacture quality sugar for national & international markets at optimum operating and energy efficiencies, as well as provide raw materials for cogen power plant. The integrated project will push the product, which has highest realization in the market. The design of the sugar mill would match the latest and modern technologies, being employed for the cogen power plant. At the same time, the flexibility of operation, expansion and diversification, also will be available.

3.1.2 To meet the objectives indicated above, the sugar plant of the integrated agro energy project will have special emphasis on following:

- Highest mill extraction efficiency (more than 97%) and low power consumption
- Lowest steam consumption for the boiling house, lowest boiling house losses and reduction in capital cost
- Lowest power consumption (less than 21 kWh / TCH for electrified fibrizor and mill drives)
- Lowest raw water consumption (practically nil)
- Lowest effluent discharge (practically nil)
- Lowest labour cost and chemical consumptions
- Highest sugar recovery (more than 12% on cane) and sugar quality.

3.1.3 The main parameters of cane crushed from 3rd year onwards will be as follows:

- Pol % cane, average 14.5%
- Recovery, average 12 % on cane
- Fibre, average 14.5 % on cane
- Bagasse generation, average 30 % on cane
- Bagasse moisture, average 48%
- Molasses, 4.00% on cane

3.1.4 The design parameters of the proposed modern sugar plant have been indicated in the following table :

Capacity / hr, TCH	:	227.27
Capacity / day, on 22 hrs basis, TCD	:	5000
Average season days, nos.	:	160
Bagasse generation (30% on cane), TPH, @ 50% moisture	:	68.18
Bagasse available as fuel (29.2% on cane), TPH	:	66.36
Sugar produced (avg. 12% recovery), MT	:	96000 (@ designed capacity level)
Sugar quality	:	ICUMSA color at 420 nm, <100, moisture max.0.01 %
Cane preparatory index	:	90 +
Imbibition water % fibre	:	250 +
Maceration % cane	:	30.00
Mixed juice % cane	:	100
Primary pol extraction, %	:	75
Mill extraction, %	:	95
Reduced mill extraction, %	:	96.00+
Reduced boiling house extraction, %	:	91.00+
Total sugar loss, % cane	:	Max 2.0
Process steam required, TPH		
▪ LP steam at 2.5 kg/cm^2 (40% on cane)	:	90.91
Process power consumption at 21 kWh / TCH	:	4.77
Molasses production (4.00% on cane), MT	:	800000 X 4.0% = 32000 MT (@ designed capacity level)

3.2 Cogen Power Plant

3.2.1 The cogen power plant will have installed capacity of 30 MW and will employ 87 kg/cm^2 and 515°C configurations. Bagasse generated from cane crushing, excluding handling losses and bagacillo requirements will be available for operation of the high-pressure boiler during season of 160 days.

Saved bagasse, cane trash as well as imported coal, will be used during the off-season period of about 65 days.

3.2.2 The auxiliary steam consumption for the power plant will be for soot blowing and other auxiliary consumptions like Steam Jet Air Ejector (SJAE) & Gland Steam Condenser (GSC) at high pressure, for HP heater at medium pressure and for de-aerator at low pressure. The auxiliary power consumption for the power plant will be about 9% & 9.5% of generation during both seasons and off-season periods.

3.2.3 The colony power requirement will be met by the cogen power plant, both during season and off season periods.

3.2.4 The brief design parameters for the cogen power plant will be as follows:

Boiler capacity, TPH	:	1 x 160
Pressure, kg/cm^2	:	87.00
Temperature, °C	:	515
Turbine capacity, MW	:	30
Turbine type	:	Double extraction - cum condensing
Season operation, days	:	160
Off season operation, days	:	65
Operating hours of power plant	:	24 hours basis
Fuels used for season operation	:	Bagasse
Fuels used for off season operation	:	Saved bagasse, cane trash & coal
Boiler efficiency, %		
- On bagasse / bio-mass / cane trash	:	70.00, ±2

- On imported coal	:	80.00, ±2
Feed water temperature, °C	:	165
Captive power consumption, % of generation - Season - Off- season	 : :	 2.47 (9.00%) 2.85 (9.50%)
Turbo-generator efficiency, %	:	96.00
Utilization level, %	:	70 in 1st year, 80 in 2nd year and 85 from 3rd year onwards

3.2.5 While, the steam and power cycle design has been worked out as follows, the heat and mass balances during crushing and non crushing days, balances of steam, water & condensate, fuel & power have been given in the enclosed ***Appendices - VIII***.

Sr. No.	**Item**	**Unit**	**Value**	
	Season Operation			
1	Avg. cane crushing	TCD		**5000**
2	Gross season days	nos.		180
3	Net season days	nos.		160
4	Hrs. / day	nos.		22
5	Normal cane crushing	TCH		227.27
6	Cane crushed	Lakh MT		8.00
7	Bagasse generation	% cane		30
8	Bagasse generation	TPH		68.18
9	Bagasse for bagacillo / handling loss	% cane		0.80
		TPH		1.82
10	Bagasse available for new boilers	TPH		66.36
11	Total equivalent bagasse available for new boilers	TPH		66.36
		MT		233600
12	Bagasse saved for off season	MT		12186
13	Bagasse used by new boilers	Kg steam / kg		2.48
14	Bagasse used by new boilers	TPH		57.66
		MT		221414
15	Steam generation	TPH		143.00

Sr. No.	Item	Unit	Value	
16	Steam consumption	TPH		
16.1	HP steam @ for SJAE & GSC		0.50	0.72
16.2	MP steam @ 8 kg/cm2			
	Distillery / ethanol plant			14.00
	HP heater I		9.00	12.87
	D/s water addition		2.00	0.26
	Sub-total			26.61
16.3	LP steam @ 2.5 kg/cm2			
	Sugar process	% cane	40.00	90.91
	De-aerator		5.00	7.15
	D/s water addition		2.00	1.96
	Sub-total			96.10
16.4	Condensing steam			19.57
16.5	Total			143.00
17	Power generation	MW	5.21	**27.47**
18	Power consumption	MW		
	- Sugar process	kWh/TCH	21.00	4.77
	- Colony			0.10
	- Distillery / ENA / ethanol			0.35
	- Cogen auxiliaries		9.00	2.47
	- Total			7.69
19	Power export			
	MW			**19.77**
	MUs on 24 hrs basis			**75.93**
20	Total no. of days / year	nos.		225
	Off Season Operation			
21	Off-season fuel requirement		TPH	50.40
22	Total no. of off season days	nos.		65
23	No. of hrs / day	nos.		24
24	Steam generation	TPH		125.00
25	Steam consumption	TPH		
26.1	HP steam @ for SJAE & GSC		0.50	0.63
26.2	MP steam @ 8 kg/cm2			
	Distillery/ethanol			14.00

Sr. No.	Item	Unit	Value	
	HP heater I		10.00	12.50
	- D/s water		2.00	0.53
	- Total			25.97
26.3	LP steam @ 2.5 kg/cm2			
	- De-aerator		7.00	8.75
	- D/s water		2.00	0.18
	- Total			8.58
26.4	Condensing steam			89.83
26.5	Total			125.00
27	Power generation	MW	4.17	**30.00**
28	Power consumption	MW		
	- Cogen auxiliaries		9.50	2.85
	- Sugar process			0.10
	- Distillery / ENA / ethanol			0.35
	- Colony			0.10
	- Total			3.40
29	Power export			
	- MW			**26.60**
	- MUs			**41.50**
30	**Boiler size (87 kg/cm2 & 515 deg C)**	**TPH**	**1**	**160**
31	**TG size (85 kg/cm2 & 510 deg C)**	**MW**	**1**	**30**

Appendix-VII & VIII gives the HBDs, Steam, Water / Condensate, Fuel & Power Balances for Cogen plant during both season and off season.

3.2.6 Water & Condensate Balances

While steam, power and bagasse balances both for season and off season operations of the cogen power plant have been indicated in section 3.2.5, the water and condensate balances are given in the following table:

Item	**Value, TPH**	
	Season	**Off season**
Condensate return from sugar process	86.36	0
Condensate from Steam to de-aerator	7.15	8.75
Blow down flash recovery	0.72	0.63
Condensate from condenser	19.57	89.83
Make up water from DM plant	19.7	14.72
Condensate from HP heater	12.87	12.50
Flow from de-aerator	**146.39**	**126.43**

3.2.7 Bagasse / Fuel Balance

The bagasse and fuel balances are indicated in the following table

Sr. No.	Item	Value	
		Season	**Off season**
1.	Crushing rate, TCH	227.27	
2.	Bagasse generation at 30.0% on cane, TPH	68.18	
3.	Bagacillo/handling loss at 0.8% on cane, TPH	1.82	
4.	Bagasse available as fuel at 29.2% on cane, TPH,MT	66.36 (233600)	
5.	Bagasse consumed by new boilers, TPH (MT)	57.66 (221414)	50.40 (78629)
7.	Bagasse saved / available for off season operation, MT		12186
8	Cane Trash requirement, MT (Equivalent bagasse)		21437
9	Imported coal requirement, (MT) (Equivalent bagasse)		45007
10.	Actual cane trash requirement, MT		14616
11.	Actual Imported coal requirement, (MT)		18412
12	Saved Bagasse days		10
13	Days on Imported Coal		37
14	Days on cane trash		18

3.2.8 Power Balance

Following table gives the power balance for the season and off-season:

Sr. No.	Item	Value, MW	
		Season	Off season
1.	Power generation, MW	27.47	30.00
2.	Power consumption, MW		
	- Sugar process (@ 21 kW / TCH	4.77	0.10
	- Colony	0.10	0.10
	- Ethanol Plant	0.35	0.35
	- Cogeneration auxiliaries	2.47	2.85
	- Total	7.69	3.40
3.	Power export, MW	19.77	26.60
4.	Power export at design capacity level, MU	75.93	41.50
5.	Total, season + off season MU at design levels	117.43	

2.2.9 Based on the qualification criteria of the topping cycle under the MERC tariff order, the eligibility of the proposed project in season has been worked out as under:

Sr. No.	Item	Value
1.	Net Energy Input (A), M Kcal/hr	129.74 (57.66 TPH x 2250 kcal/kg)
2.	Electrical power output (B), M Kcal/hr	23.62 (27.47 MW x 860 kcal/kWh)
3.	Useful thermal output (C) (energy in the process), M Kcal/hr	69.77 (90.91TPH x 659 kcal/kg + 14 TPH X 704.5 kcal/kg)
4.	Total energy output (B+ C), M kcal/hr	93.40
5.	20% of total energy output (D), M kcal/hr	18.68
6.	Evaluation condition (C>D)	Yes
7.	Efficiency, % (B+C/2 / A)	45.10

Note: Hence, the proposed project is eligible under the MERC tariff order and qualifies under the same.

3.2.10 Key performance parameters

The key performance parameters for the cogen power plant are given below:

Sr. No.	Description		Value
1	Steam Generator efficiency, %	:	70±2 on bagasse / cane trash & 80±2 on Imported coal
2	Steam to Fuel Ratio, kg bagasse / kg	:	2.48
3	DEC Turbine efficiency, %	:	+90%
4	Average Steam to Power Ratio, kg / kW <u>Season</u> <u>Off-Season</u>	 : :	 5.21 4.17
5	Auxiliary Power consumption, MW (%) <u>Season</u> <u>Off-Season</u>	: :	 2.47 (9.00) 2.85 (9.50)

6	Power Generation / Export	:	
	Season–MW/MU's Generation	:	27.47 / 105.48
	Export	:	19.77 / 75.93
	Off-season–MW/MU's Generation	:	30.00 / 46.80
	Export	:	26.60 / 41.50
	Annual Total - MU's Generation	:	152.28
	Export	:	117.43
7	**Exportable Surplus power** (% Generation)		
	Season	:	71.99
	Off-season	:	88.67
	Total	:	77.11

3.3 Ethanol Plant

3.3.1 The proposed ethanol plant will have manufacturing capacity of 60 KLPD. The ethanol plant will be operated using steam and power that will be generated from the integrated project.

3.3.2 Ethanol plant will operate on molasses as feed stock during season and on saved / purchased molasses as feed stock during off-season. With 42% fermentable sugar in molasses one ton of molasses, will yield 235 lit of total ethanol. Molasses required per day is worked out in the following table

The design parameters of the ethanol plant are given in the following table:

Sr. No.	**Item**	**Ethanol Plant on Own / Procured Molasses)**
1	No. of days of operation	270
2	Ethanol capacity, KLPD	60
3	Molasses, % cane	4.00
4	Molasses MT	32,000
5	Filter cake, % cane	4.00
6	Filter cake, MT	32,000

Sr. No.	Item	Ethanol Plant on Own / Procured Molasses)
7	Ethanol recovery, liters / MT of molasses	235
8	No. of days on	
	- Own molasses	125
	- Procured molasses	145
	- Total	270
9	Quantities	
	Molasses required MT per day	255.32
	Molasses required MT per Annum	68,936
	- Own Molasses, MT	32,000
	- Procured Molasses, MT	36,936
10	MP Steam, TPH (@ 8 kg/cm^2 g)	14.0
11	Power, MW	0.35
12	Water, KL/day @ 12 m3/KL	720
13	Spent wash generation per lit of RS with single stage evaporation	4.5
14	Total spent wash generation / day	270
15	Total spent wash generation per annum	72900
16	**Annual Compost Production, MT (at 1:2.5 ratio of press mud)**	**29160**

3.4 Project Site, Key Features

3.4.1 Site Location (Refer ***Appendix – IX*** for site location)

Site location	:	At Kapshi, Phaltan tehsil
Distance from nearest town / city	:	Phaltan, 25 Km
Distance from nearest airport	:	Pune, 112 Km
Distance from nearest Railway Station	:	Wathar, 18 Km
Distance from nearest water source	:	Nira Cannel,12 Km
Distance from nearest MSEDCL EHV substation	:	15 Km, Lonand at 132 kV substation

The proposed site is ideal for the proposed integrated sugar cogen power and ethanol project, due to following reasons:

- Required land is available at the project site and is owned by LSUL
- The site is easily accessible by road.
- The command area has huge potential for the sugar cane because of the huge irrigation potential in the command area and the farmers have intensive experience in sugar cane cultivation.
- The site is near to the Nira cannel which is about 12 Km from the proposed factory premises.
- The cane potential and irrigation facilities in the command area are excellent and will ensure sustained cane availability for the proposed project.
- The off season non-fossil fuel requirements for the cogen power plant can be easily met by imported coal. The evacuation of exportable surplus power from the cogen plant will have to be made through the substation (132 kV) of MSEDCL, which is 15 km away from the site.

3.4.2 Infrastructure

The site has easy access to latest communication and other social infrastructure facilities, including telecommunication, schools and colleges, medical & health facilities, commercial infrastructure, etc. at Phaltan city, which is a Tehsil Headquarter.

The pattern of rainfall in the Satara district is almost uniform, with average rainfall of about 522 mm / year. The average annual rainfall in Phaltan Tehsil is 456 mm, with an average 38 major rainy days. The rainy season mainly ranges between middle of June to September.The ground water in the area of operation is re-charged every year and is excellent through out the year.

The temperatures in the command area are conducive to sugarcane cultivation and have been proved by existing yield, as well as recovery of sugarcane. The maximum and minimum temperatures respectively are 38°C in summer and 11°C in winter.

The construction power can be easily made available from MSEDCL. The process steam required at 8 kg/cm^2 for ethanol plant and the cogen plant and 2.5 kg/cm^2 for the sugar plant during season will be supplied by the cogen power plant. The high pressure, medium pressure and low-pressure steam required for cogen auxiliaries will also be met. The power requirement for sugar process during season, for cogen auxiliaries and colony will have to be met from the cogen plant. The steam and power cycle has been designed accordingly.

The cogeneration plant requires compressed air, both for instrumentation and for servicing, which is generated by installing the air compressors of the required capacity, as part of the cogen power plant.

3.4.3 Manpower

The skilled manpower required for operation of sugar, ethanol and cogen power plants will be easily available from Phaltan city and also from Satara. LSUL will require about 445 people for operation of proposed integrated project. LSUL is in a process of appointing required manpower and has already appointed key top management positions for the purpose.

3.5 Effluent Treatment

3.5.1 Sugar Plant

The sugar plant effluents will be treated in a separate effluent treatment plant & the discharges will be maintained as per the latest norms of the MPCB & CPCB. The liquid effluents from the sugar process will be mainly waste water from various process equipment in the milling & boiling house sections & the treated water will be used for gardening purposes. The air emissions in the sugar bagging sections will be limited to the acceptable limits due to deployment of dust catchers.

3.5.2 Cogen Power Plant

The cogen power plant effluents will also be treated in a separate effluent treatment plant & the discharges will be maintained as per the latest norms of the MPCB & CPCB. The liquid effluents generated from the cogen power plant will be mainly from boiler blow down, cooling tower & water treatment plant blow downs, wash water & other sewage effluents. The treated water will be used for gardening purposes. The air emissions will be maintained well within the norms due to deployment of the latest design electro static precipitator & the ash generated will be either be sold to brick manufacturer or used in the composting process as a filler material.

3.5.3 Ethanol Plant

The spent wash of a distillery process is a serious problem by way of threat to the environment. Its volume from continuous fermentation plant is as large as 270 KL/day for a distillery of 60 KL/day capacity if distillation technology of multi pressure distillation with integrated evaporator system has been used and it may vary as per different technologies. LSUL proposes to adopt single stage Effluent Treatment process as detailed below:

1) **Multi pressure distillation** – In this steam is utilized in direct way for heating. Hence, spent wash quantity generated is less as compared to traditional distillation technology.

2) **Single Stage evaporation -** The spent wash evaporation technology system is used to concentrate spent wash after biomethanation in evaporator with continuous recirculation of concentrated spent wash with in the system until desired concentration is obtained. This entire concentration process is carried out under vacuum leading to less consumption of steam and maximum concentration of spent wash with in less period of time.

3) **Bio-composting** - Composting is a biological process in which organic matter is degraded under controlled conditions. It involves microbial mineralization.

   The mixing of concentrated spent wash from evaporation plant and press-mud (50-70% moisture) is being carried out in trenches with the help of excavator- cum –loader for mixing, turning, loading and unloading of compost material. Addition of cow dung will provide bacterial culture required for composting. It is observed that in the first five days, fungal activity is predominant and in subsequent days bacterial activity continues until stabilization of organic matter into humus is accomplished.

This bio-compost will be sold to farmers which is good soil conditioner.

3.6 Raw Materials

3.6.1 Sugar Plant

The proposed sugar plant of 5000 TCD will require about 8.00 lakh MT of sugarcane for 160 days crushing season, including sugarcane required for seeding purposes. A detailed cane availability & potential survey was undertaken & the results are summarized in Chapter 2. About 11.43 lakh MT sugarcane is already available within the command area of the proposed factory site. The irrigation & climatic conditions are quite conducive. Considering this situation & long term cane development program being adopted by LSUL, the proposed project will not have any difficulty for making the required sugar cane available for crushing for the proposed capacity & even further expansion.

3.6.2 Cogen Power Plant

- As indicated in the steam / power cycle design, the total bagasse available from the sugar mill, from cane crushing of 8.00 lakh MT, as fuel, will be 2,33,600 MT after bagacillo & handling losses. Out of this, 2,21,414 MT (57.66 TPH x 24 x 160) will be utilized by the cogen plant boiler during season, leaving saved bagasse of about 12186 MT for the off season operation.

- Total bagasse requirement for the off-season is 78,629 MT (50.40 TPH). Out of which 12186 MT saved bagasse will be utilized, leaving net bagasse requirement of 66,443 MT. The use of biomass materials like cane trash available in the command area can meet this requirement. The net equivalent cane trash required for off-season operation has been worked at 21437 MT. The imported coal equivalent bagasse will be used in exigencies upto 15% of total annual requirement which works out at 45007 MT. The actual quantities of cane trash & imported coal required will be 14616 MT & 18412 MT, respectively.

- Procurement of raw materials for off-season operation of the cogen power plant must become a line function of cogen plant operation with appointment of Fuel Manager and competent field staff for the purpose.

- The detailed biomass assessment survey was carried out & results have been indicated in Chapter 2. It is seen that huge quantity of cane trash to the tune of 2.14 lakh MT can be easily procured & made available for off-season operation of the proposed cogen power plant. Considering the requirement & availability, LSUL will not have any difficulty in procuring cane trash.
- Energy plantation on wasteland in the command area will also be evaluated and implemented for long-term fuel linkage for the proposed cogen power plant.
- Therefore no difficulty envisaged in getting fuel for cogen plant for 225 days of operation.

3.6.3 Ethanol Plant

Ethanol plant will be operated for 270 days a year. The total molasses required for the operation at 100% capacity utilization will be 68,936 MT. At 4.00% on cane the net molasses generated from the sugar factory will be 32,000. The outside molasses required therefore will be 36,936 MT. Own molasses will be sufficient for 125 days of operation. For balance 145 days molasses will be procured from nearby sugar factories.

3.7 Utilities & Consumables

3.7.1 Water and power are the main utilities required for operating the integrated project. Water will be drawn from Nira Cannel the source of water at a distance of about 12 km from the site. Therefore no difficulty envisaged in terms of availability of water required for the proposed sugar complex. Power required for construction and in case of shut down of plant will be drawn from the MSEDCL grid.

3.7.2 The consumables required for operation of sugar plant include sugar bags, laboratory and ETP chemicals, oils / lubricants and other chemicals for the machinery and processing, etc.

The consumables indicated above will be available in substantial quantities from nearby Phaltan city, and no difficulty will be envisaged.

3.8 Manpower

The total direct manpower required for the integrated project has been estimated at 445. It is most essential for LSUL to define the organization structure individually for the sugar mill, ethanol plant and the cogen power plant. ***Appendix – XI*** gives recommended manpower charts for each.

It is most essential that the experienced and well-qualified manpower is employed right from the project development / implementation period, through advertisement or through head hunting exercise, particularly for the top and key positions. Manpower training and skill up-gradation must become an integral part of the HRD policy.

3.9 Implementation Schedule

3.9.1 Project Implementation

For implementing this mega and complex project within the desired time and cost schedules, it is essential to undertake meticulous planning, right from the conceptual stages. Following aspects of the project implementation will be crucial:

- Intensifying cane development activities by networking and supporting the farmers from the command area.
- Effecting timely project development activities, including securing various approvals / NoC's / permissions for each component of the integrated project.
- Appointment of pre-investment consultants and experts for preparation of DPRs, approaching select FIs / bankers, rendering required follow up and achieving financial closure, through raising of required equity and providing necessary securities. LSUL already has appointed MITCON, and individual experts / advisors for this work.
- Finalization of mode of project implementation, package route and O&M contracts for individual project components, along with strong owner engineering / consultancy team for effective monitoring of the implementation / commissioning of each component as per the schedule, is recommended, considering the complexities of individual projects.

  LSUL proposes to appoint experienced project engineering management consultancy firm, as well as experienced in-house project team for the purpose.
- Manpower and resource mobilization at required time and effectively
- Interface between the sugar mill, cogen power plant and ethanol plant

3.9.2 Project Schedule

The zero date of the project starts from the date of achieving financial closure, expected to be complete by January, 2015. The integrated project will be commissioned and start commercial production by February, 2016.

The project schedule will have main components as follows

Activities	Expected Completion Date
Project development activities up to financial closure	January, 2015
Sugar plant	February, 2016
Ethanol plant	February, 2016
Cogen power plant	February, 2016
Entire integrated project	February, 2016
Stabilization & development of MIS	February, 2016
Commercial production	February, 2016

The bar chart for implementation of the above components is enclosed as ***Appendix –X.*** The detailed PERT / CPM networks for individual components and overall project will have to be prepared by the time of achieving the financial closure.The major activities after the financial closure for each component will include:

- Appointment of owner engineer / consultant, in-house project team and project architect
- Basic engineering & finalizing outline specifications
- Detailed design engineering and specifications
- Preparation of package bids, bidding, bid evaluation, recommendations and contracting for civil, mechanical, electrical and instrumentation components, as well as BoPs
- Kick off meetings with individual vendors / contractors
- Vendor drawing review and approvals, inspection and expediting and delivery at site
- Site supervision for erection, testing & commissioning
- Bidding, contracting and signing of O&M contracts
- Plant stabilization and development of MIS

CHAPTER – 4

TECHNICAL SPECIFICATIONS

4.1 Sugar Plant:

Appendix-XIV gives the detailed technical specifications for sugar plant covering, technical specifications of the entire plant and equipment such as cane handling & feeding equipment, cane diffuser section, clarification section, evaporation & boiling plant, cooling, curing and grading plant, , technical specifications for energy efficiency improvement equipment, electrical distribution system, control & instrumentation system, etc.

4.2 Cogen Power Plant:

Appendix–XIV gives the detailed technical specifications for cogen power plant covering technical specifications for boiler & auxiliaries, steam turbine & auxiliaries, electrtrial evacuation & distribution system, water treatment plant, cooling tower & auxiliaries, fuel & ash handling, instrumentation & control equipment, power house EOT crane, etc.

4.3 Ethanol Plant:

Appendix–XIV gives the detailed technical specifications for ethanol plant covering technical specifications for molasses handling section, fermentation section, distillation section, ethanol section, evaporation section, biogas, bio-composting, alcohol storage, utilities section, etc.

CHAPTER – 5

PLANT LAYOUT

5.1 Layout Considerations

5.1.1 Layout design issues

Major layout design issues, which have been considered while developing the proposed plant layout, are as follows:

- Available land already acquired for the integrated project at site location
- Topography of the land being acquired and contour limitations
- Area requirements for various plant buildings, storage areas, colony, admin building, miscellaneous areas, etc.
- Direction / velocities of wind.
- Likely ingress of bagasse / bio-mass / coal on to cooling tower, transformers etc. and precautions to be taken to mitigate
- Optimum men and material movement
- Minimum length of high pressure piping
- Minimum lengths of interface systems between the power plant and sugar mill
- Disposal of ash / press mud
- Routing of overhead EHV transmission line
- Vastu Shastra

5.1.2 Area requirement & Layout

The Architect of LSUL has prepared preliminary plant layout based on acquired land. The plant layout is presented in ***Appendix –XIII*** with the details of area requirements for different sections of the proposed plant.

5.1.3 Ash, Effluent & Sewage Disposal

Ash

At 100% capacity utilization of the proposed power plant, around 2.34 lakh MT of bagasse, 14616 MT of cane trash and 18412 MT imported coal will be burnt during season and off-season operations. Annual ash generation from this quantity of bagasse / cane trash / coal will be about 11,847 MT. This ash will be mixed with the press mud and shall be distributed free to the farmers during season & during off-season if coal is used, the ash will be given to nearby brick manufacturers.

Effluent

Wastewater from a power plant does not have any significant BOD / COD level. All wastewater will be neutralized prior to discharging in the existing sugar plant ETP.

Sewage

All sewage will be collected in a common septic tank and discharges as per accepted norms.

5.2 Plant Layout

5.2.1 General

The proposed sugar and cogeneration power plants will be located adjacent to each other. The sugar mill layout will be as shown in the enclosed layout drawing. Ethanol plant will be suitably located separately, but near to the molasses tanks.

The cogen plant will be conveniently located within close proximity to the sugar mill and bagasse storage area and allows optimal arrangement of piping, switchyard, bagasse conveyors, other cogen plant facilities, and access roads. All above ground pipe rack will support steam and feed water piping and cables for instrumentation and control, for the boiler and between the cogen plant building and the sugar mill. All other piping and cables for other outdoor equipment such as tanks, pumps and the cooling tower will be under ground.

5.2.2 Layout of Major Outdoor Equipment

The boiler will be designed for outdoor operation. The boiler will include a electro-static-precipitator and a RCC chimney. The self-supporting chimney will satisfy the environmental norms and will be RCC.

Stack Height Calculation

Stack height is calculated using following formula

$H = 14\ (Q)^{0.3}$

H is height of Chimney

$$Q = \frac{\text{Quantity of fuel (kg/hr) x sulphur content (\%) x 2}}{100}$$

The sulphur content in the bagasse is negligible (around 0.1 %) as compared to imported coal (1%). Therefore, the stack height will be calculated on the basis of imported coal.

The bagasse will be fed to the boilers via the conveyor system from the milling section of the sugar plant. The conveyor system will also transport excess bagasse between the boilers and the bagasse storage yard, through RBC.

During the crushing season excess bagasse, if any from the mill will go directly to the storage yard after feeding the boilers. During the non-crushing season stored bagasse and equivalent biomass or other fuels will be fed to the boilers from the bagasse storage yard/coal yard.

Ash handling will be accomplished by the use of hoppers and screw and belt conveyors. The type, location and number of conveyors will be decided during the detailed engineering stage of the project.

All water and storage tanks will be located outdoors. The tanks will be field erected and constructed of carbon steel typically with an exception of DM tank, which will be stainless steel or epoxy coated carbon steel. The tanks will be located to allow for optimal arrangements of piping and will be accessible by road.

The cooling towers and the circulating water pump house will be located outdoors.

The 132 kV switchyard will be located adjacent to the main co-generation building close to the switch gear area. The switchyard will include the power transformer, insulators, tower structure, circuit breakers, isolators, meters etc.

5.2.3 Co-generation Plant Layout

Cogeneration power plant will house the steam turbine generator and its auxiliaries, the condenser and its auxiliaries, the control room, the boiler feed pumps, the electrical equipment room (distribution transformers, switchgear, motor control centers), battery room, etc.

The steam turbine generator will be supported on a reinforced concrete pedestal. The building superstructure will be RCC construction. Pitched roof will be provided to facilitate drainage.

Control room will be in brick wall construction and the walls will be plastered. The building structure will also be used to support piping, cable trays, conduits, etc. Suitable coating materials will be used for interior and exterior surfaces. A special coating will be provided in the acid/caustic soda storage area and battery room.

Proper air conditioning will be provided for the control room. For all other areas adequate ventilation system will be provided as per the State regulations. Special precautions will be taken for air intake and exhaust for the emergency diesel area and for the battery room.

A 75 MT capacity overhead crane with a 20 MT capacity auxiliary hook will be provided over the turbine generator bay. Its capacity will be adequate to provide lifting capability to meet the needs of all steam turbine generator components including erection. Roll up doors will be located in the steam turbine area and the condenser area, to provide access for maintenance. Single and double doors will also be provided throughout the building for personnel access and maintenance of smaller equipment.

5.3 Approach & Internal Roads

The site is located adjacent to the State highway, with approach road already existing and thereby not requiring any additional approach road. Required internal roads for movement of men and material will have to be constructed within the plant area.

CHAPTER – 6

ENVIRONMENT & SOCIO-ECONOMIC BENEFITS

6.1 The proposed integrated project of LSUL will be a landmark achievement in the country. It will truly become a role model of utilizing the cane crop in the most efficient manner for eco-friendly products like sugar and renewable and decentralized power generation. The optimum production of conventional but quality sugar will cater to value added domestic and international markets. The sound techno-economic and commercial viability of this project, coupled with highest efficiency in all aspects of product manufacture, will pave the way for integration of sugar industry in the country.

Establishment of the latest and most efficient technologies adopted for cane crop development, sugar manufacture, cogen power generation and biomass fuel linkages will also help the Indian sugar industry and equipment manufacturers to grow leaps and bounds, at the national and the international levels.

6.2 The socio-economic benefits arising out of this project for the local populace will include creation of direct and indirect jobs and consequent rise in the income levels, associated commercial and social infrastructure development in the mofussil areas, improved quality and availability of power due to grid benefits (in terms of deemed generation and power factor improvement), better environment and higher returns for the cane crop due to higher yield and cane price.

6.3 At the national and the State levels, the benefits include decentralized power generation, reduction in T&D loss, reduced emissions, reduction in the imports of petroleum products, increased tax revenues and reduction in the transportation costs.

6.4 The project will have excellent multiplier effect and will become truly a win-win situation for all the stakeholders. Thus, the proposed project has substantial socio-economic and environmental benefits at the local, the State, the Regional and the National levels.

CHAPTER – 7

PROJECT PREPAREDNESS

7.1 NoC's / Approvals / Permissions

List of NoC's / Approvals / Permissions required & their status as of October, 2013 is indicated in the following table:

Project Component / Item of NoC / Approval	Status		
	Completed	Under Process	Yet to start
General			
▪ Registration of LSUL	✓		
▪ Excise, sales tax, professional tax & income tax registrations			✓
▪ PF / ESI registrations			✓
▪ Shop act licenses			✓
▪ Consent to establish for integrated sugar, cogen & power plant			✓
▪ Consent to Operate for integrated sugar, cogen & power plant , environmental clearance & consent to operate			
▪ Environmental Clearance for integrated sugar, cogen & power plant			
▪ Import / export licenses			✓
▪ NoC from local gram panchayat	✓		
▪ Factory inspector approval			✓
▪ Electrical inspector approval			✓
Sugar Plant			
▪ IEM license for sugar	✓		
Cogen Power Plant			
▪ IEM license for Cogen	✓		
▪ NoC from MEDA			✓
▪ PPA with MSEDCL/Third party			✓
▪ Chimney height clearance from AAI, if required			✓
▪ SLD approval from EI			✓
Ethanol Plant			
• IEM	✓		
▪ Letter of Intent & various permissions / licenses from State Excise			✓

7.2 Management & Administration

LSUL has already deputed a competent Project Team for developing and implementing this project at Village Kapshi, Phaltan Tehsil. The LSUL Board will take a review of progress of work on a monthly basis, to ensure speedy and successful implementation of this project.

7.3 Technical & Financial Tie Ups

LSUL has the experience and know how for adopting the latest technologies in both the components of the integrated project. Consultants and experts will be appointed, as and when required, during the development and implementation of this project. LSUL already has appointed experts for sugar plants and has appointed MITCON Consultancy & Engg Services Ltd., as Consultant, for preparation of DPR for the integrated project.

LSUL will bring in the required equity, as well as provide the negotiated securities to the bankers and financial institutions. The term loan and working capital loan for integrated project will be taken through nationalized banks / SDF.

LSUL will not face any difficulty for arranging technical and financial tie ups required for the captioned project.

7.4 Project Management

The project management for the integrated project will be under able leadership of promoters/directors, assisted by experienced technical team. The appointed experts, consultants and LSUL, site office staff will together work in tandem and develop / implement this project.

Required top-level manpower will be appointed shortly. Project monitoring / management will be almost on daily basis and as per the final bar chart / implementation schedule, developed after ordering of main plant and equipment.

CHAPTER – 8

ESTIMATED CAPITAL EXPENDITURE

8.1 Land & Site Development (Refer Annexure – 1)

LSUL has already acquired around 17 Ha land in the name of Company & …….Ha of land in the name of Directors at Kapshi, Phaltan Tehsil. The land is sufficient for housing sugar, ethanol and cogen power plant for the proposed capacities.

The cost of land cumulates to **Rs. 800 lakh**. Out of this, Rs. 400 lakh has been allocated to the sugar plant, Rs. 240 lakh to cogen plant and balance Rs. 160 lakh to the ethanol plant. This allocation has been made based on the area required by each component of the project.

The site development expenses include leveling and approach roads, fencing, gates, storm drains and internal roads. The preliminary estimates indicate expenditure of about **Rs. 200 lakh**, Rs. 112 lakh for sugar project, Rs. 52 lakh for the cogen power plant & Rs. 36 lakh for ethanol plant.

8.2 Civil Works (Refer Annexure – 2)

8.2.1 The main civil works for the cogen power plant and their estimated costs are indicated in the following table:

Item	**Cost, Rs. lakh**
1. Power House building (TG hall & maintenance bay)	500
2. Turbo Alternator & other Auxiliary Foundations	200
3. Boiler and Auxiliary Foundations	175
4. Switchyard / SEB substation Foundations	70
5. Water Treatment Plant	60
6. Tanks, fuel & ash handling conveyor foundations	30
7. Coal crusher & shed	75
8. Shed & open bagasse storage yard	40
9. RCC Chimney	120
10. RCC Cooling Tower	200
11. Raw water tank	150
11. Residential Quarters & Admin Buildings	100
12.Architect fees	34
Total	**1754**

Based on the actual civil costs incurred for similar capacity cogen power plants, the civil estimates have been worked out at **Rs. 1754.00 lakh**, including Architect's fees. The appointed architect for the project will work out detailed estimates and civil drawings (based on the inputs received by the equipment suppliers and labour / material rates at the site location).

8.2.2 The main civil work components for the sugar project include the following:

- The main factory building for in-housing all sugar plant equipment including cane carrier, preparation area, mill house, evaporator & clarification house, boiling house & sugar house, estimated cost of Rs. 700 lakh
- Sugar machinery foundations, estimated cost of Rs. 400 lakh
- Miscellaneous buildings & civil works including workshops, stores, injection pump house, weigh bridge, ETP, etc., estimated cost at Rs. 300 lakh
- Raw water tanks at Rs 100 lakh
- Admin & other related buildings, estimated cost at Rs. 100 lakh
- Sugar go-downs of suitable size, estimated cost of Rs. 250 lakh
- Architect fees, estimated at Rs. 37 lakh

Thus, the total preliminary estimates for the civil works have been worked out at **Rs. 1887 lakh.**

8.2.3 The civil works for 60 KLPD ethanol plant includes foundation for storage tanks, central excise office, miscellaneous foundations, molasses storage tanks, storage lagoons for raw spent wash, water supply & lighting arrangements inside the buildings, etc. These costs have been estimated at **Rs. 1020 lakh.**

The preliminary estimates have been made based on the actual civil work costs for similar capacity ethanol plant and labour / material rates at the site location. The project architect will prepare detailed estimates and civil drawings.

8.2.4 The total preliminary civil estimates for the integrated project, accumulates to **Rs. 4661 lakh**.

8.3 Plant & Machinery Equipment (Refer Annexure 3)

8.3.1 The main items of equipment for the cogen power plant and their estimated erected costs are given in the following table:

Item and brief specifications	Estimated Erected Cost, Rs. lakh
Boiler & auxiliaries 1x 160 TPH (87 kg/cm2, 515 deg C)	3200
Steam turbine and generator and auxiliaries (1x 30 MW)	2200
Electrical distribution system	300
Tie line cost	750
Bay at MSETCL	150
Piping, valves, PRDSH, fittings etc.	250
DCS & plant automation	135
Bagasse, coal & Ash handling Equipment including: Belt conveyor, Yard scraper conveyor, Distribution belts etc	500
Cooling towers and auxiliaries excluding civil works	150
WTP Including raw water pumping pre-treatment	150
D.G set	80
Taxes & Duties	1416
Total	**9281**

Based on the discussions with reputed machinery suppliers and possible negotiation margins, the estimated erected cost of plant and equipment for the cogen power plant has been worked out at **Rs. 9281 lakh**.

8.3.2 The specifications for main plant and machinery required for 5000 TCD capacity sugar mill, are elaborated in Appendix XIV.

Based on the discussions with reputed machinery suppliers and possible negotiation margins, the erected cost of the sugar mill equipment have been worked out **Rs. 8885 lakh**.

8.3.3 Based on the discussions with reputed machinery suppliers and possible negotiation margins, the erected cost of the ethanol plant equipment has been worked out **Rs. 3918 lakh**

8.3.4 The total erected cost of equipment for the integrated project has been estimated at **Rs. 22084 lakh**.

8.4 Miscellaneous Fixed Assets (Refer Annexure – 4)

The total miscellaneous fixed assets for the integrated project have been worked out at **Rs. 960 lakh**, Rs. 390 lakh for the sugar project, Rs. 350 lakh for the cogen power plant & Rs. 220 lakh for ethanol plant.

The main miscellaneous equipment for sugar project includes spares, tools & tackles, chemical lab equipment, lab & workshop equipment, vehicles, weighing machines, AC ventilation system, water supply scheme, fire fighting, computers, office furniture & fixtures, walkie-talkies, dishnet, soft water plants & storage tanks & compressed air system etc. The total cost of miscellaneous fixed assets for sugar plant accumulates to **Rs. 390 lakh**.

The main miscellaneous fixed assets for the cogen power plant include office equipments, spares / tools & tackles, chemical lab equipments laboratory equipment weighing machines, Workshop equipment, light & heavy vehicles, walkie-talkies, dish net etc, AC ventilation system, water supply scheme, fire fighting & compressed air system. The total miscellaneous fixed assets for cogen power plant accumulate to **Rs. 350 lakh**.

The main miscellaneous equipment for ethanol project includes spares, tools & tackles, chemical lab equipment, lab & workshop equipment, vehicles, weighing machines; molasses storage tanks computers, office furniture & fixtures, walkie-talkie dishnet, fire fighting systems & compressed air system etc. The total cost of miscellaneous fixed assets for ethanol plant accumulates to **Rs. 220 lakh**.

8.5 Preliminary & Pre-operative Expenses (Refer Annexure – 5)

The preliminary expenses include expenses for preparation of DPRs, appraisal and loan syndication and legal / administrative expenses.

The pre-operative expenses include establishment charges, rent / rates / taxes, traveling expenses, start up expenses including wages / salaries / raw material expenses, project management charges including supervision, project insurance during construction, interest charges during construction, mortgage expenses, banker's charges, stamp duty expenses, other miscellaneous expenses, etc.

The total preliminary and pre-operative expenses for the integrated project have been estimated at **Rs. 2360 lakh**, Rs. 995 lakh for sugar project, Rs. 931 lakh for the cogen power plant & Rs. 434 for ethanol project.

8.6 Contingencies

The contingencies have been worked out at 1.5% of the non-firm items of land, site development, civil structures, plant & machinery, miscellaneous fixed assets & preoperative expenses. They accumulate to **Rs. 466 lakh**, Rs. 190 lakh for sugar plant, Rs. 189 lakh for cogen power & Rs. 87 lakh for ethanol project.

8.7 Stock Levels & Working Capital Assessment (Refer Annexure – 7)

The estimated stock levels for different components of the integrated project have been tabulated below:

Item	**Stocking level, days / project component**		
	Cogen power	**Ethanol**	**Sugar**
Raw materials	30	30	-
Consumables & packing materials	30	30	30
Finished goods	-	30	45
WIP	-	3	3
Debtors	45	-	-

The margin money at 25% works out to **Rs. 839 lakh**, allocated as Rs. 730 lakh for sugar plant, Rs. 63 lakh for cogen power and Rs. 46 Lakh for ethanol plant. This allocation depends on the estimated stock levels and their values, for each project component.

CHAPTER – 9

FINANCIAL VIABILITY

9.1 Basis & Assumptions

9.1.1 The entire financial analysis of the project has been worked out on a computer, using specific project feasibility software developed for the purpose.

Annexures-1 to 19 gives the basis and details of various items of project, along with item wise costs. Schedules-A to I represent results of the analysis in terms of cost of project and means of finance (Schedule-A), project profitability and cost of production (Schedule-B), Debt Service Coverage Ratio (DSCR) (Schedule-C), Cash Flow Statements (Schedule - D), Balance Sheet Forecasts (Schedule -E), etc.

9.1.2 Each item of capital cost is based on the estimated erected costs for various equipment contractors. Annexures-1 to 6 respectively give land and site development costs, civil works, erected costs of indigenous / imported equipment, , erected costs of miscellaneous fixed assets and preliminary and pre-operative expenses. While calculating the cost of site development and civil works, the prevailing rates for labor, material, etc have been assumed.

9.1.3 The contingency provision has been made on all non-firm items of the project cost and has been considered at 1.5% for each component of the project, including pre-operative expenses (Refer annexure 6).

9.1.4 The installed capacities and capacity utilization levels for sugar and cogen power plants and respective annual productions have been shown in the following table:

Item	Year				
	1	**2**	**3**	**4**	**5**
Sugar					
▪ No. of days	60	160	160	160	160
▪ No. of hrs.	22	22	22	22	22
▪ Crushing rate, TCH	227	227	227	227	227
▪ Annual installed crushing capacity, MT	300000	800000	800000	800000	800000
▪ Utilization	70	80	85	85	85
▪ Annual cane crushing, MT	210000	640000	680000	680000	680000
▪ Total sugar recovery, % cane	11.80	11.90	12.00	12.00	12.00
Total Sugar production, MT	24780	76160	81600	81600	81600
Cogen					
Season					
▪ No. of days	60	160	160	160	160
▪ No. of hrs.	24	24	24	24	24
▪ Export capacity, MW	19.77	19.77	19.77	19.77	19.77
▪ Export capacity, MU	28.47	75.93	75.93	75.93	75.93
Off season					
▪ No. of days	0	65	65	65	65
▪ No. of hrs.	24	24	24	24	24
▪ Export capacity, MW	0	26.60	26.60	26.60	26.60
▪ Export capacity, MU	0	41.50	41.50	41.50	41.50
Capacity utilization, %	70	80	85	85	85
Exportable surplus, MU's					
Season	19.93	60.73	64.53	64.53	64.53
Off season	0.00	33.20	35.27	35.27	35.27
Total	19.93	93.93	99.80	99.80	99.80
Ethanol					
Installed Capacity, KLPD	60	60	60	60	60
▪ No. of days	60	270	270	270	270
▪ Annul Installed Capacity, KL	3600	16200	16200	16200	16200
Capacity utilization, %	70	80	85	85	85
Estimated Annual Prodn. of Ethanol, KL	2520	12960	13770	13770	13770
Estimated Annual Prodn. of Bio-compost, MT	4536	23328	24786	24786	24786

9.1.5 The stock levels for various items of working capital for each component of the project have been elaborated in section 7.7 (Refer Annexure-7). The margin money has been considered at 25% of total requirement of the first year and c/c facility at 75% of total requirement. The interest rate on c/c facility is taken at 13.5%, prevailing banking rate for that level of c/c limit.

9.1.6 Project income is based on the quantities of power exported through MSEDCL grid to third party / power trader, sale of sugar and ethanol, as well as from sale of bio-compost fertilizer.

In view of the prevailing rate provided by power traders, the sale of power has been assumed at Rs. 6.27 / kWh.

The avg. sale of free sugar has been taken at Rs. 29500 / MT constant through the year of operation. The sale of ethanol and bio-compost has been considered at Rs 38/litre and Rs 500/MT respectively.

Refer Annexure – 8 for estimated annual production and sales value for all the product streams.

9.1.7 The net cane price has been taken at Rs. 2800 / MT including harvesting and transportation charges and applicable purchase tax.

14,616 MT of cane trash is estimated at 100% capacity utilization at landed cost of Rs. 1800/ MT.

18,412 MT of Imported coal is estimated at 100% capacity utilization at landed cost of Rs. 5500/ MT.

36,936 MT molasses is estimated at 100% capacity utilization at landed cost of Rs. 4500 / MT.

Refer Annexure 9 for particulars of indigenous raw materials explained above.

9.1.8 The consumables for cogen power and sugar respectively have been taken at Rs. 60 / thousand kWh and Rs. 25 / MT cane crushed & Rs.900/KL of ethanol. The packing materials are estimated to cost at Rs. 50/ quintal. (Refer Annexure-10 for details).

9.1.9 The requirement of direct manpower has been estimated based on the equipment / facilities to be operated in each section of the integrated project. Total manpower requirement has been estimated at 250 for sugar, 115 for cogen power plant & 80 for ethanol (total 445). Every year 10% increment and 15% benefits have been provided (Refer Annexure-12).

9.1.10 Repairs and maintenance costs have been estimated at 2% on cost of civil works and on cost of miscellaneous fixed assets and 2.5% on cost of plant equipment (Refer Annexure-13), with 2% increase every year.

9.1.11 Other manufacturing expenses include rent, rates and taxes, electricity charges, insurance charges for fixed assets and stocks, miscellaneous expenses and contingencies (Refer Annexure-14).

9.1.12 Administrative overheads include administrative staff salary and expenses like printing and stationery, postage and telephone, traveling and conveyance, legal and other expenses (Annexure 15). Repairs and maintenance (Refer Annexure-13) and selling and distribution overheads (Annexure –16) have been estimated as detailed in respective Annexure.

9.1.13 The repayments of interests and term loans for each component of the project have been considered based on the means of finance and the terms for debts for each. The term loans for integrated sugar, cogen & ethanol power plants will be at 13.5% rate, payable within 7 years and 2 year moratorium from disbursement. The SDF quasi equity for cogen & ethanol project will be at the rate of 7% and payable from FY-2018-19 and FY-2016-17 year respectively.

9.1.14 Depreciation has been calculated by following methods and rates (Refer Annexure-18 for details).

Item of capital cost	**WDV**	**SLM**
Site development and civil structure	10.00	3.34
Plant & Machinery	15.00	5.28
Miscellaneous assets	15.00	5.28

9.1.15 Annexure-19 gives income tax calculation as per relevant tax laws applicable.

9.1.16 Preliminary expenses have been written off equally in 10 years. For calculating interest during the construction, implementation period, interest charges, quantum of term loan and de-rating factor of 0.3 over the implementation period have been considered.

9.1.17 Based on above assumptions, the detailed project financial analysis for a period of 10 years have been worked out and are presented in Schedules-A to J.

9.2 Cost Summary

Based on the capital cost break up worked out in Chapter 8, the project cost summary for the entire integrated project is given in the following table (Also refer Schedule A):

(Rs. Lakh)

Total Project Cost	**:**	**Sugar**	**Cogen**	**Ethanol**	**Total**
Land	:	400	240	160	800
Site Development	:	112	52	36	200
Civil works & Buildings	:	1887	1754	1020	4661
Indigenous Plant and Machinery	:	8885	9281	3918	22084
Miscellaneous Fixed Assets	:	390	350	220	960
Prelim & Preoperative Expenses	:	995	931	434	2360
Contingencies	:	190	189	87	466
Working Capital Margin	:	730	63	46	839
Total	:	**13589**	**12860**	**5921**	**32370**

9.3 Means of Finance

The proposed means of finance is indicated below. (Refer Schedule – A).

(Rs. Lakh)

Financing Pattern	**:**	**Sugar**	**Cogen**	**Ethanol**	**Total**
1. Promoters' Equity	:	5028	3323	1125	9476
2. SDF Quasi Equity	:	0	1435	1066	2501
3. FI Loan	:	8561	8102	3730	20393
Total	:	**13589**	**12860**	**5921**	**32370**

9.4 Financial Viability Indicators

9.4.1 Schedules A to J establish results of the project financial analysis, in terms of total project cost and means of finance, project profitability, debt service coverage ratio, cash flow statement, balance sheet forecast, analytical and comparative ratio, sensitivity analysis, internal rate of return, payback period, etc. supported by Annexure 1-19.

9.4.2 The above ratios establish sound financial viability of the project for this funding pattern and project income from sale of exportable power to third party / power trader through MSEDCL grid, ethanol and sugar, as indicated.

9.4.3 The financial viability ratios have been tabulated as below and the financial viability analysis does not include the sale of carbon credits in the international market.

(Rs. Lakh)

Particulars	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. EBIT to Capital Employed	5.33	26.04	27.65	27.14	26.71	26.16	25.49	24.80	23.63	21.57
2. Return on Investment										
i) PBT to Capital Employed	0.21	13.25	15.37	15.89	16.48	16.98	17.37	17.69	17.63	16.33
ii) PAT to Capital Employed	0.16	10.48	11.69	11.63	11.67	11.72	11.73	11.74	11.54	10.55
iii) PBT to Net Worth	0.60	37.21	36.03	32.05	29.27	26.93	24.85	23.12	21.57	19.66
iv) PAT to Net Worth	0.48	29.41	27.40	23.45	20.74	18.57	16.78	15.34	14.11	12.70
3. PBT to Sales	0.97	18.62	18.48	19.12	19.99	20.87	21.72	22.56	23.40	23.53
4. Raw Materials Cost to Sales	80.15	68.33	60.95	60.36	60.36	60.36	60.36	60.36	60.36	60.36
5. Operating Ratio	72.74	62.76	66.17	66.73	66.97	67.21	67.45	67.69	67.93	68.18
6. Interest Coverage Ratio	1.81	2.85	3.18	3.52	3.97	4.58	5.40	6.59	8.49	9.44
7. Fixed Assets Turnover Ratio	0.24	1.02	1.28	1.36	1.45	1.54	1.65	1.77	1.92	2.09
8. Debt Equity Ratio	1.69	1.32	0.92	0.65	0.45	0.29	0.16	0.06	0.00	0.00
9. Ratio of N/W + L/T Liabilities to Fixed Assets	1.05	1.18	1.26	1.34	1.43	1.54	1.68	1.84	2.08	2.50
10.Current Ratio	1.60	1.66	1.84	2.03	2.20	2.38	2.59	2.80	3.12	3.68

CHAPTER – 10

CONCLUSIONS & RECOMMENDATIONS

10.1 Project SWOT Analysis

10.1.1 Strengths (S):

- Background and experience of the shareholders, as well as leadership from the promoters
- Excellent irrigation from mainly canals and lift irrigation on Nira along with wells, ponds, rivers, and tube wells. The water available through canal from the government irrigation projects like Nira does most of the irrigation in this area and availability on a long term basis.
- Favorable policy regime for cogen power, at the Central Govt. and in Maharashtra, with defined policies regarding sale of ethanol and exportable power
- Innovation, commitment and vision of the promoters, with backward and forward integration planned right from beginning
- Professional and business like approach of the promoters, with meticulous planning for speedy and successful implementation and operation
- Excellent response to project, at the local farmer level, State Government., national and international financial institutions, and equity partners
- Availability of sugar cane trash in the command area to ensure off season operation of the power plant as envisaged. Availability of imported coal, at reasonable landed price, ensuring fuel linkage
- Sound financial viability and technical feasibility of the integrated project at the estimated project capital cost and prevailing selling prices of sugar, power and fuel ethanol, as well as landed prices of various raw materials and inputs.
- Deployment of latest technologies and equipment for cogen power, ethanol and sugar plants

- A very high order of socio-economic and environmental value to the local populace, Maharashtra State and the country, which not only uses renewable raw material (sugar cane) and fuels (bagasse, cane trash), without any impact on the socio-ecological balance.

10.1.2 Weaknesses (W):

- Complexities and higher investment levels of the integrated project. Employment of experienced and professional teams and consultants, as well as project and equity partners, directors on board will reduce this weakness.
- Fluctuating prices of procured bagasse and may be biomass / cane trash and imported coal.
- Changes in the Govt. policies related to sugar & cogen power
- Delay in project implementation may affect the overall momentum and support

10.1.3 Opportunities (O):

- Excellent opportunity for expansion of individual plants and wheeling and banking of exportable power to third party consumers, for maximizing returns
- Potential for trade of carbon credits from the project in the international market and increased returns

10.1.4 Threats (T):

- Adverse changes in Govt. policies, particularly related to sugar prices and prices of exportable power

10.2 Risks & Mitigates

Risk	Particular	Mitigates
Performance risk	Ensured sugar cane & fuel availability	Cane development has been in full progress, with experienced senior professionals and staff appointed for the purpose. Biomass depots, trash bailers and entrepreneurship development / contracts with biomass traders proposed. A full time fuel manager and dedicated staff has been proposed for the cogen power plant
Marketing risk	Sugar sale / export	Firm marketing tie up in offing. Alternative marketing channels explored. No link with domestic demand. Value added products proposed
Regulatory risk	Conversion / clearances / tariff order	No difficulty envisaged, as various governmental agencies have already expressed their willingness to issue approvals / consents. All the approvals in pipeline. Regulatory process being initiated at MERC will ensure conducive tariff order for purchase of power
Financial risk	Financial viability of the project	Satisfactory DSCR. Equity participation arranged.

10.3 Key Management Features

- Appointment of Project Team, required experts and consultants, as well as top level staff - right from the beginning
- Appointment of Lender's Independent Engineer for monitoring the erection and commissioning activities for timely and smooth implementation of the project.
- Securing all required balance permissions, including IEM licenses / NoC's / approvals quickly and achieving the financial closure at the earliest.
- Selection of right technology and equipment suppliers for both sugar, cogen power & distillery plants.
- Cane development in the command area

10.4 Conclusions & Recommendations

The captioned integrated sugar, ethanol and cogen power project is technically feasible and commercially viable and is recommended to financial institutions for financing term and working capital loans.

The backward and forward linkages of this project / as well as socio-economic and environment benefits to the local populace makes this a win-win project to all the stakeholders.