

Power from Distillery Effluents

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Schemes

- Most common method of treating distiller effluents is anaerobic digestion
- Biogas can be used in cogeneration mode by generating steam and power
- Bio gas can be used to generate power using gas engines and also steam generation using waste heat.

Advantages

- Distilleries operate throughout the year, whereas sugar plant operates around 150 to 180 days
- Distillery needs boiler during off season, and takes the power from Electricity board
- Power trippings have become common, hence distilleries are using high cost option of DG sets to meet the power needs. Spending on steam generation and power generation
- Power generation using 45 bar boiler will solve the problem of steam and power. It will also solve the problem of off season requirement of power for sugar plant.

Pilkhani Distillery

- A) Row- colour - Dark brown
- pH - 4.5
- Temperature - 90 0C
- COD - 1, 30,000 mg/1.
- BOD - 60.000 mg/1
- TDS - 1, 00,000 mg/1
- TSS - 3,000 mg/1
- B) **Quantity** - 432 KL/day

Bio methanated effluent

- Colour - Blackish brown
- pH - 7.6
- Temperature - 38 0C
- COD - 39,000 mg/l.
- BOD - 6,000 mg/l
- TDS - 40,000 mg/l
- TSS - 5,000 mg/l

Final treated as permeate water after R.O. Plant

- Colour - Colourless
- pH - 7.2
- Temperature - 35 0C
- COD - <100 mg/1.
- BOD - <30 mg/1
- TDS - <300 mg/1
- TSS - <30 mg/1

Design Characteristics

- Distillery Capacity : 36 KLPD
- Spent Wash Generation per day : 432 KL
- Spent was generated per hour : 18 KL
- COD of Spent Wash : 1,30,000 ppm
- COD Destruction due to anaerobic digestion : 70%
- Bio Gas Generation : 0.55 M³/Kg.
- Methane content in Biogas : 60 to 65%
- Calorific Value of Bio gas : 5300 K.Cal/M³
- Enthalpy of Superheated Steam : 788 K.Cal/Kg
- Net heat required : 750 K.Cal/Kg
- Boiler efficiency with bio gas : 88%
- Bio Gas generated per hour : $0.7 \times 130000 \times 18 \times 0.55 = 901$ M³/hr
- Bio Gas generated per day : 21,624 M³/day
- Steam generation per hour : $(901 \times 5300 \times 0.88) / 750 = 5.6$ tph
- Steam for Process : 7.4 tph
- Balance steam from bagasse : $7.4 - 5.6 = 1.8$ tph

Means of Finance

Without Capital Subsidy

Promoters Equity	Rs.182.60 lakhs	40%
Term Loan	Rs.273.89 Lakhs	60%
Total	Rs.456.49 Lakhs	100%

With Capital Subsidy

Promoters Equity	Rs.182.60 lakhs	40.0%
Capital Subsidy	Rs.80.00 Lakhs	17.52%
Term Loan	Rs.193.89 Lakhs	42.48%
Total	Rs.456.49 Lakhs	100%

Project Cost

Particulars	Amount
Land & Site Development	7.00
Buildings	46.00
Plant & Machinery	347.00
Contingencies	19.03
Pre-Operative Expenses	29.50
Margin Money for Working Capital	7.96
Total	456.49

Years	1st Year	2nd Year	3rd Year
Capacity Utilization	80%	85%	90%
Cost of Gas per 1000 M ³ Rs.	0.00	0.00	0.00
Gas required in 1000 M ³	5709	6066	6422
Cost of the Gas	0.00	0.00	0.00
Bagasse price taken per tone Rs.	800.00	840.00	882.00
Bagasse required year / tone	5184	5508	5832
Cost of the Bagasse	41.47	46.27	51.44
Cost of the Total Bagasse	41.47	46.27	51.44

Year	1st	2nd	3rd
Units Generated (in Lakhs)	60.19	63.95	67.72
In-house Consumption (10%)	6.02	6.4	6.77
Annual Saleable Power	54.17	57.56	60.94
Unit Price / Unit RS	2.6	2.7	2.81
Revenue from Sale of Power	140.85	155.64	171.39

IRR:

IRR without Capital Subsidy is 12.60%, and with Capital Subsidy is 17.16%

Payback Period:

Payback period without subsidy is 6 Years 6 months and with Capital subsidy is 5 Years 3 months.

Particulars	Without Subsidy	With subsidy
Avg. DSCR	2.13	3.01
BEP	77.42	69.39
Cash BEP	28.60	20.57
Internal Rate of Return (%)	12.60	17.16

Trichy Distilleries

Last 3 years power consumption

Particulars	2004-05	2005-06	2006-2007
TNEB Power (KWH)	36,82,396	44,15,250	45,49,535
Cost Rs.	1,65,37,847	1,89,79,410	1,99,92,737
Cost per unit Rs.	4.5	4.3	4.4
Diesel Genset power (KWH)	21,54,048	12,38,988	24,15,537
Cost Rs.	1,40,52,248	1,29,94,747	2,45,52,569
Cost per unit Rs.	6.52	10.5	10.2
Total Power Requirement (KWH)	58,36,444	56,54,238	69,65,072
Total cost Rs.	3,05,90,095	3,19,74,157	4,45,45,306
Avg. cost per unit Rs.	5.24	5.65	6.4
Percentage of Power Generated from the DG set	37	21.9	34.7

Raw Spent Wash Characteristics

- pH : 3.9-4.4
- COD : 90,000-1, 00,000 ppm
- TSS : 8,000-9,000 ppm
- TDS : 60,000-70,000 ppm
- VA : 1500-2000 ppm
- BOD : 40000-45000 ppm

Design Data

- No. of digesters : 2Nos
- Digester Capacity : 314 KL/day each
- Total Capacity : 628 KL/day
- COD reduction : 65-70%
- BOD reduction : 80-85%
- Bio-gas generation : 0.5-0.6 M³/Kg of COD digested
- Methane : 55-60%
- Quantity of biogas to be generated : Capacity of the digester x COD of spent wash X COD reduction x Biogas generation per kg of COD digested
- Minimum : $628 \times (90000/1000) \times 0.55 \times 0.65 = 20,206 \text{ m}^3/\text{day}$
- Maximum : $628 \times (100000/1000) \times 0.7 \times 0.7 = 30,772 \text{ m}^3/\text{day}$

Generation of Biogas

- Distillery Capacity : 60 KLPD
- Spent Wash Generation per day : 628 KL
- Spent was generated per hour : 26.2 KL
- COD of Spent Wash : 90,000–100,000 ppm
- COD Destruction due to anaerobic digestion : 65-70%
- Bio Gas Generation : 0.55-0.7 M³/Kg of COD digested
- Methane content in Biogas : 55 to 60%
- Calorific Value of Bio gas : 4800 K.Cal/M³
- Bio Gas generated per day (approximately) : 25,000 M³/day
- Biogas to Rice husk ratio based on equivalence of calorific value : 1.5

Year	Capacity Utilization	Bio gas Requirement in 1000 M³
1	80	4346.88
2	85	4618.56
3	90	4890.24
Design	100	5433.60

Particulars	Amount
Land & Site Development	5.00
Buildings	85.00
Plant & Machinery	537.00
Mice. Assets	10.00
Technical Know-how Fees	0.00
Contingencies	33.94
Preliminary Expenses	0.00
Pre-Operative Expenses	33.00
Margin Money for Working Capital	21.00
Total	725.00

Power generated in lakh units

	I Year	II Year	III Year
Gross	90.56	96.22	101.88
Auxiliary Consumption (80 units)	5.12	5.44	5.76
Net Power for sale	85.44	90.78	96.12

Financial Details

- Biogas cost: Rs.2.4 per Cub. Mtr
- Selling Price Of Power :Rs.4.00 per unit
- **DSCR:**
 - DSCR without Capital Subsidy is 1.53 and
 - With Capital Subsidy is 2.07
- **IRR:**
 - IRR without Capital Subsidy is 20.83 %,
 - and with Capital Subsidy is 27.43%
- **Payback Period:**
- Payback period without subsidy is 5 Years 1month and with Capital subsidy is 3 Years 11 months.

Particulars	Without Subsidy	With subsidy
BEP	60.25%	54.51%
Cash BEP	26.61%	20.87%