

Preliminary Study Report on Muzaffarnagar Paper Industries

From field visit during the period of 10th May to 11th
May and with inputs from EESL



Prepared By:

Project Management Unit

United Nations Industrial Development Organisation

Promoting Market Transformation for Energy Efficiency in MSMEs



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

1. BACKGROUND

Muzaffarnagar is situated in Western Uttar Pradesh and is important industrial town with paper, sugar and steel being the major products. Muzaffarnagar paper cluster has around 29 paper units. The entire paper cluster is geographically divided into three areas, namely Bhopa Road, Jansath Road and Shamli in Muzaffarnagar district. The reason for such high concentration of mills is easy availability of raw



material in the area. Paper units are normally having out-dated technologies characterized by inefficient energy and water management systems. In terms of raw material usage, mills can be broadly put in two categories – waste paper based and agro-waste based. Similarly, for finished products too, though bulk of the mills produces only kraft paper, a few of them have started producing writing paper. These mills are quite closely networked and successful development in one mill is very rapidly replicated in large number of similar mills. The total installed capacity of all the paper mills in Muzaffarnagar is approximately 542700 MTPA.

An important aspect of the mills here is that some of these units have a common business operational structure due to fact that they share the same management. As such the cluster-based advantage is already being derived by most of these units. A large percentage of these mills were set up in 80's and 90's in the small and medium sector. The capacity utilization of all these mills ranges from 20% to 90%. Out of the total mills, 43% are based upon both agro and waste material whereas 57% are waste paper based. Classification can also be done based upon the product. While only 16% are involved in the manufacture of only duplex board, a healthy 66% are into making Kraft paper only & 22% make writing/printing paper along with small quantities of either duplex board or Kraft paper.

2. CLUSTER PROFILE:

2.1 Muzaffarnagar Paper Industries

Muzaffarnagar is located at northern part of Uttar Pradesh. This is one of the important paper manufacturing clusters in India. There are around 25 paper units in the cluster. Most of the units produce kraft paper; other products from the cluster include printing paper, filter paper, grey board, and hard tissue paper. The units vary in capacity from 50 tonnes per day (tpd) to 350 tonnes per day (tpd). The Muzaffarnagar paper units have formed an association, the 'Muzaffarnagar Paper Mills Association', which provides a forum to share experiences and find solutions to various issues in the industry.

A joint team of officials of Office of DC-MSME, UNIDO, Office of GM (DIC) Muzaffarnagar and EESL visited the cluster during 22nd to 23rd May 2018. A Cluster Level Interaction was done with the Industries Association Members on 22nd May 2018. It was followed by the visit to few industries to understand the current scenario of the cluster. It was presumed that most of the units fall beyond the category of MSME, however; a due diligence is required from Office of GM(DIC) before coming to any conclusion.

The paper units use electricity as well as coal and biomass (mainly rice husk, pith and bagasse) to meet their energy requirements. Most of the units have installed biomass/coal-based cogeneration systems to meet their demands for steam as well as power simultaneously.



Muzaffarnagar is located in western Uttar Pradesh and is one of the important industrial towns having 6717 numbers of industries where in sugar and steel are the major type of industries. There are around 4000 manufacturing units account for 60% of total industrial units. A joint team of officials from DC-MSME, UNIDO, GM (DIC) Muzaffarnagar and EESL

visited the cluster during 22nd to 23rd May 2018 to brief the project to the industries association members and understand the current scenario of cluster. Team composition was as follows:

Sl.	Name	Organisation	Designation
1	Mr. Debajit Das	UNIDO	National Project Coordinator
2	Mr. Amit Semwal	EESL	Technical Expert
3	Mr. MK Meena	DC-MSME	Deputy Director
4	Mr. Pramhans Kushwaha	DIC	Deputy Commissioner

A cluster level interaction was done with the Industries Association Members on 22nd May 2018 in the presence of President, Paper Manufacturer's Association, Muzaffarnagar. It was followed by the visit to few units to understand the current scenario of the cluster namely Bindal Paper Mills Ltd, Bindlas Duplex Ltd, DLS Paper Ltd, Silvertan Papers Ltd, Tehri Pulp and Paper Ltd and Tirupati Balaji. An industrial profile of Muzaffarnagar district is as follows:

3. BRIEF CLUSTER PROFILE:

The Indian paper Industry accounts for about 1.6% of the world's paper and paperboard production. The estimated turnover of the industry is Rs approximately 25,000 crore (USD 5.95 billion) and its contribution to the exchequer is around Rs. 2918 crore (USD 0.69 billion). There are about 666 paper industries engaged in the manufacture of pulp and paper of which about 568 units are in operation with a total installed capacity of 7.40 MT per annum. The average capacity of a paper mill in India is about 10,500 tonnes per annum (35 tonnes per day) compared to 85,000 tonnes per annum (260 tonnes per day) in Asia and 300,000 tonnes per annum (900 tonnes per day) in Europe and North America.

Muzaffarnagar paper cluster has around 25 paper units. The entire paper cluster is geographically divided into three areas, namely Bhopa road, Jansath road and Shamli in Muzaffarnagar district. In terms of raw material usage, paper industries can be broadly categorised into in two types- waste paper and agro-waste based. Similarly, for finished

products there are two categories kraft paper and duplex board. The total installed capacity of all the paper mills in Muzaffarnagar is about 4000 Tons Per Day (TPD).

3.1 Product Manufactured:

Majority of paper mills produce kraft paper and duplex board. A few of them have started producing writing paper and newspaper print paper. In addition to kraft paper and writing paper some units also produces printing paper, filter paper, gray board, poster paper and hard tissue paper.

3.2 Raw Material Used:

In terms of raw material usage, mills can be broadly put in two categories – waste paper and agro-waste based. Waste paper includes Indian waste paper as well as imported waste paper whereas Agro-waste includes bagasse and paddy straw.

Production capacity details:

The paper mills in the cluster vary widely in capacity. There are mills with capacities as low as 50 TPD and as high as 380 TPD. The variation with respect to capacity is represented in the chart below.

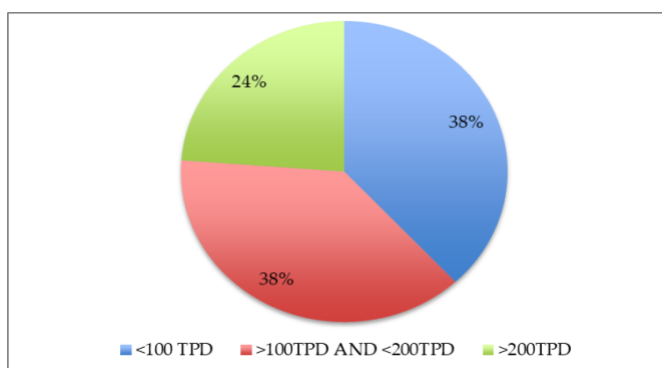


Figure: Share as per production capacity

The production capacities of different units are as mentioned below:

Sl.	Name of Industry	Production Capacity (TPD)
1	Aggarwal Duplex Ltd.	160
2	Aristo Paper Ltd.	70
3	Bhageshwari Papers Ltd	100
4	Bindal Paper Mills Ltd.	300
5	Bindlas Duplex Ltd.	270
6	Disha Paper Ltd.	180

7	DLS Paper Ltd.	80
8	Garg Duplex Ltd,	200
9	Mahalaxmi Paper Mills Ltd.	100
10	Meenu Papers Ltd.	100
11	N S Papers Ltd.	325
12	Parijat Papers Mills Ltd.	110
13	Shakti Kraft Ltd.	80
14	Shakumbari Paper Mills Ltd.	70
15	Siddhballi Paper Ltd.	180
16	Siddheshwari Paper Ltd.	160
17	Silvertoan Papers Ltd.	320
18	Silverton Pulp and Papers Ltd.	200
19	Suyash Paper Mills Ltd.	130
20	Tehri Pulp and Paper Ltd.	380
21	Tirupati Balaji	50

4. ENERGY PROFILE:

Energy is a major cost driver in paper manufacturing process. It accounts for nearly 16-20% of total production cost. One tons of paper production required 380-400 electrical units of power. The consumption of steam is 2 to 5 tons/ ton of paper. The major energy consumption equipment are digester, evaporator and pulper (paper machine). Most of the units have their own generation plant for energy needs i.e. self dependant in terms of electricity. The units have installed biomass/coal based thermal cogeneration systems to meet the steam and its power demand. The installed capacity ranges from 01MW to 20MW. The cumulative power generation capacity of the cluster is around 60MW. The primary fuel used in all the mills is coal and biomass. Rice husk, pith and bagasse are the major biomass used in the cluster. In few mills wood chips are also used as a supplementary fuel. Total annual energy consumption in cluster is around 100,000 MTOE (Metric Tonne of oil equivalent).

4.1 Manufacturing Process:

Wood is the primary raw material for the pulp and paper industry. Wood is made from cellulose fibres that are bound together by a material called lignin. The paper industry in Muzaffarnagar cluster uses either the waste paper or agro residue as a source of lignin needed for paper manufacturing process. Paper is made from the cellulose fibres that are present in hardwood and softwood trees. In a pulp mill, the fibres are separated from one another into a mass of individual fibres. The first step is to dissolve the material into pulp. The wood or recovered paper is broken down into its component elements so that the fibres can be separated. After separation, the fibres are washed and screened to remove any remaining fibre bundles. The pulp may then be used directly to make unbleached papers, or bleached for white papers. The papermaking process can be broadly divided into three stages:

- Pulping
- Paper making
- Paper finishing

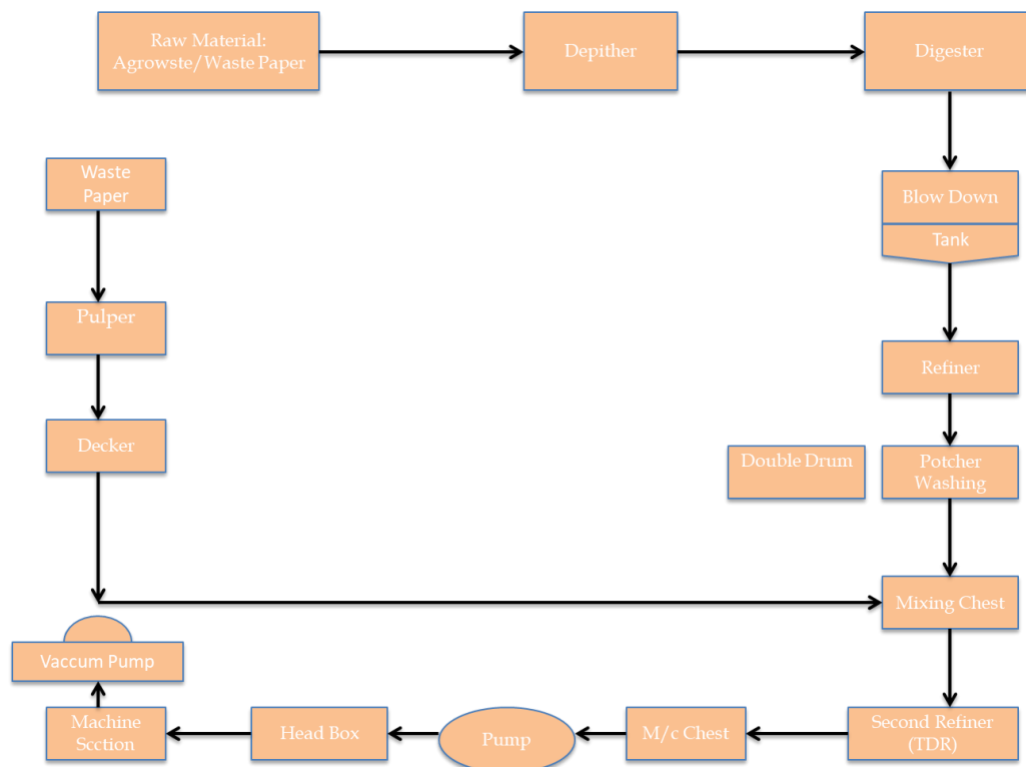


Figure: Paper manufacturing process

5. OBSERVATIONS:

About 25%–30% of manufacturing costs is contributed by energy in the cluster. These units use both thermal and electrical forms of energy to fuel their processes. The consumption of steam in a wood based paper mill is 10 to 11 tons/ton of paper compared to international standards of 6.5 – 8.5 t/t while the power is 1500 to 1700 kWh/ton of paper compared to 1150-1250 kWh achieved in more efficient units. As per various studies conducted by BEE and SIDBI in this cluster at least 20% potential is available for improvement by energy efficiency through innovative technology and financial models.

Units are using inefficient Pulper and they are interested to replace existing pulper with energy efficient Drum pulper, which requires technology import from China/Germany. The energy saving potential by implementing drum pulper is about 20%.

With the increasing cost of power, energy cost is a key concern of today's papermaker. Large liquid ring vacuum pumps have a patented variable porting design that allows the pump to operate continuously at its peak efficiency, reducing power consumption. A vacuum pump operating at off-design conditions may consume enough excess energy to pay for a properly sized, more efficient pump in a short period of time. Uses of vacuum pump may also result in energy savings to the tune of about 15-20%. The total investment potential in the cluster is to the tune of about INR 25.00 Cr considering already somewhat established technologies.

6. OTHER PROSPECTIVE TECHNOLOGIES:

Some other prospective technologies which needs detail investigation are as given below:

6.1 Batch Digester Modifications

It may not be operationally efficient to change to larger batch digesters for the smaller mills. Moreover smaller and speciality mills produce variety of pulp that are less suited for continuous digesters. In such cases, several approaches can be considered to reduce energy consumption in batch digesters, such as indirect heating and cold blow.

In indirect heating, cooking liquor is withdrawn from the digester through a center pipe, pumped through an external heat exchanger, and returned into the digester at two separate locations in the vessel, thereby reducing direct steam loads.

In cold blow systems, hot spent pulping liquor is displaced from the digester contents using brownstock washer filtrate at the end of the cooking cycle. Heat is thereby recovered from the spent liquor for heating subsequent cooks, leading to reduced steam requirements for heating the digester contents. Recovered black liquor can be used for preheating and impregnating incoming wood chips or for the heating of other process inputs, such as white liquor or process water.

6.2 Heat Recovery in Thermo-mechanical Pulping

A substantial amount of steam is produced as a by-product of thermo-mechanical pulping – amounts reaching 0.8 to 0.9 t/t-pulp, or around 2/3 of the power input to the refiner (NEDO, 2008. p. 166). This low pressure steam is usually contaminated but its heat content can be reclaimed for use in other processes. Heat recovery options include:

- mechanical vapor recompression for integrated mills, where the generated clean steam can be used for drying in the paper machine;
- direct contact heat exchangers for generating hot water for use in paper machines and as boiler make-up water;
- reboilers for producing clean process steam;
- other devices such as thermo vapor recompression and heat pump systems.

TMP heat recovery is applicable to any mill that uses pressurized refining and currently does not use heat recovery – which usually means older mills, because most modern TMP mills are designed with heat recovery systems.

Typically, between 1.7 to 2.5 MWh/t of energy is used in refiner main lines. The theoretical maximum values for recoverable energy flows from this is given in the table below:

Typical theoretical maximum heat recovery from total input power in refiner main line

Source of Energy Recovery	Single Disc and Conical Disc Refiners (as %)	Twin and Double Disc Refiners (as %)
High pressure steam recovery	61	79
High pressure steam condensate	11	15
Low pressure heat recovery	20	Not applicable
Low pressure condensate	2	Not applicable
Irrecoverable heat (e.g. due to low value heat in fiber and water, motor cooling losses, radiation losses)	6	6

6.3 Advanced Thermo Mechanical Pulping (ATMP)

Considerable research has been directed to the fundamentals of wood breakdown – specifically defibration (breaking the chips into fiber bundles) and fibrillation (creating the bonding surfaces) – to reduce energy consumption and improve the fiber bonding. While accomplishment of defibration and fibrillation in the same primary refiner is attempted in a traditional TMP plant, the ATMP methodology demonstrates that these two tasks need different conditions in order to succeed and that It is better to separate the two steps. After liberating the S2 cell wall layer of the individual fibers with RTF-pre-treatment, the fibre surface is modified by a low dosage of acid bi-sulfite, which enhances the fibre bonding properties and the brightness, and significantly improves the quality-to-energy ratio.

In the ATMP process, the first stage (RTFibration) is performed in a pressurized Impressafiner (screw press) and a fiberizer (low specific energy refiner) to delaminate the

wood chips into loose structures of fibers. With a large surface area, these bundles are well-suited for a targeted chemical treatment to attack the secondary fiber walls and improve the bonding characteristics in the next stage (high-intensity RTS refining). The high energy efficiency and pulp quality at lower freeness in the primary stage requires less refining energy in the secondary and/or reject refining stages. With the use of energy-efficient LC refiners, further reductions in specific energy consumption of the entire production line are possible.

6.4 Waste Heat Recovery from Paper Drying

There are various possibilities to recover thermal energy from steam and waste heat in the paper drying process. Some of these include the following:

- Replacing the dryers with stationary siphons in the paper machine;
- Mechanical vapor recompression and reuse of the superheated steam in the drying process;
- Use of heat pumps to recover waste heat;
- Recovering heat from the ventilation air of the drying section and using this heat for the heating of the facilities when needed.

On the other hand, the options that can be considered for the direct-fired air dryer hoods, used mainly on tissue and toweling machines, include:

- Recovering the hood exhaust air and using this to preheat the air entering the combustion chamber;
- Employing a cascade system that uses the hood exhaust air to feed the supply fan of the wet section, which will reduce the fuel demand for wet section burners;
- installing an economizer to reclaim heat from hood exhaust air and use it to heat fresh water for high pressure showers of the paper machine felt and wires

Annexure1: Site photographs



Annexure 2: Details captured from the Questionnaire Survey of the representative Industries from Muzaffarnagar Paper Cluster

A. Details of the Unit / Factory

1	Name and Contact Address	DLS Paper Private Limited Meerut Road, Begaraj Pur Ind. Area Muazffarnagar, U.P. Mobile: 9927058212
2	Type of Products	Kraft Paper
3	Total Yearly Production capacity in Tons/Pieces	26400 MT/Year
4	Total Contracted demand of electrical laod (KVA) for the factory excluding domestic use	1250 KVA
5	Total Capacity of generator set (KVA) / own generation	NIL
6	Other Fuel (Gas or Oil or Coal) used per month	Agricultural Residues (Bagasse) 1500 MT/month
7	Electricity form (GRID (Unit)	1250 KVA
8	Total Purchase Electricity from the grid (Electrical board/ Company last year)	6582150 KW
9	Average unit cost of the electricity (purchased)	440
10	Total availability of grid power (%)	100%
11	Power factor (PF)	0.993
12	Process Steps	As attached

- Paper produced type: Kraft paper/writing & Printing / Duplex – Kraft Paper
- Paper Production Capacity: (TPA) 264000
- Raw Material: Agro and waste Based/ Paper Based/ Waste Paper Based/ Agro Based – Waste Paper
- Type of fuels: Coal/biomass/pet coke etc. – Multifuel

E. Major Energy Consuming Facilities

Sl. No.	Retrofit / Utility	Rating / Design Parameter	Make and model	Total no.	Energy Consumption
1.	Retrofit				

Details as captured from the Questionnaire Survey at Muzaffarnagar Pulp & Paper Sector

B. Details of the Unit / Factory

1	Name and Contact Address	Silvertoan Paper Ltd. 9 th KM Bhopa Road Muzaffarnagar
2	Type of Products	Manufacturing Kraft Paper & Board
3	Total Yearly Production capacity in Tons/Pieces	78111 MT/Year
4	Total Contracted demand of electrical load (KVA) for the factory excluding domestic use	2500 KVA (Electric) 6 MWA (Turbine)
5	Total Capacity of generator set (KVA) / own generation	500 KVA & 500 KVA
6	Other Fuel (Gas or Oil or Coal) used per month	12500 MT per month
7	Electricity form (GRID (Unit)	4041201 (KVA)
8	Total Purchase Electricity from the grid (Electrical board/ Company last year)	31225784=00
9	Average unit cost of the electricity (purchased)	7.73/KVA
10	Total availability of grid power (%)	0.94 to 0.96
11	Power factor (PF)	
12	Process Steps	Pulping, Drying paper

- Paper produced type: Kraft paper/writing & Printing / Duplex – Kraft Paper
- Paper Production Capacity: (TPA) 115500 TPA
- Raw Material: Agro and waste Based/ Paper Based/ Waste Paper Based/ Agro Based – Agro and waste paper
- Type of fuels: Coal/biomass/pet coke etc. – Coal / biomass

E. Major Energy Consuming Facilities

Sl. No.	Retrofit / Utility	Rating / Design Parameter	Make and model	Total no.	Energy Consumption
1.					

**Scoping Study of Muzaffarnagar Pulp & Paper Sector for
UNIDO MSME GEF-5 Project**

Sl. No.	Retrofit / Utility	Rating / Design Parameter	Make and model	Total No.	Energy Consumption
3					
4					
5					
6					
7	Moto	List enclosed			
8	Lighting system				
9	Compressors				
10	Others				

B. Other Parameters:

- Burst Factor: 16
- Energy Cost as a share of production cost: (20-30%) – 18%
- Steam consumption per ton of paper: - 2.2 MT
(Wood based 10-11 tons/per ton of paper)
- Power consumption: - 350 KW/Ton of paper production
(1500-1700 kwh/ton of paper)
- Total Thermal Energy Bill/Month: - Rs. 3000000/-
- Total Electrical Energy Bill/Month: - 350 to 40 Lacs
- Total DG Set Capacity/hours of operation: - Nil
- Co-generation plant capacity and fuel:
- Pulping: Sulphate or sulphite process: N/A

C. Table Energy Consumption in Indian Paper Mills

Section Equipment	Steam (T/t of Paper)	Fuel (GJ/t of paper)	Electricity	Final Energy (GJ/t of paper)
Chipper			-	
Digeste	-	-		
Evaporator				
Washing & Screening		N / A	-	
Bleaching	-	-	-	
Soda Recovery	-	-	-	
Stock Preparation			-	
Paper Machine	-	-	-	
Deaerator	-	-		
Utilities and others			-	

Scoping Study of Muzaffarnagar Pulp & Paper Sector for
UNIDO MSME GEF-5 Project

D. Applicable Energy Saving Measures: (pl tick)

- a. Boiler Efficiency Improvement: _____ Yes
- b. Boiler Feed Water Pump Efficiency Improvement
- c. Boiler Feed Water Pump Pressure Drop Reduction
- d. Boiler Fans Efficiency Improvement
- e. Flash Steam Recovery: _____ Yes
- f. Digester Blow Heat Recovery: _____ No
- g. Steam Consumption Reduction by Efficient Condensate: Yes
- h. Evacuation from Dryers: _____ Yes
- i. Energy Efficiency Improvement in Process Pumps: _____ Yes
- j. Installation of Screw Press : _____ No
- k. Installation of High Consistency Pulper: _____ Yes
- l. Installation of Pocket Ventilation System: _____ Yes

E. OTHER:

- a) What is energy share of production cost – 18%
 - b) Typical profit margin –
 - c) Previous energy efficiency interventions and their outcome/ learning (agencies that initiate, volume of funding duration and fate)
 - VFD / LED Bulb/ Condensate Recovery/ Backwater recycling, Insulation
 - d) Please write the specific area where you want to improve the energy efficiency:
Condensate Recovery
 - e) Whether the unit owners are interested for implementation of new EE technologies:
Yes
 - f) What are the major barriers for implementation of EE technologies in the cluster:
Funds / knowledge
-

1. 75-85% of the energy requirement in the paper manufacturing process is in the form of process heat (made available through steam) while 15-25% is needed as electrical power
2. Specific Electricity Consumption 550 to 1080 kWh/MT
3. Specific Fuel Consumption 10.13 to 18.15 GJ/MT

**Scoping Study of Muzaffarnagar Pulp & Paper Sector for
UNIDO MSME GEF-5 Project**

Sl. No.	Retrofit / Utility	Rating / Design Parameter	Make and model	Total No.	Energy Consumption
3					
4					
5					
6					
7	Moto	List enclosed			
8	Lighting system				
9	Compressors				
10	Others				

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(1500-1700 kwh/ton of paper)
- Total Thermal Energy Bill/Month: - Rs. 3000000/-
- Total Electrical Energy Bill/Month: - 350 to 40 Lacs
- Total DG Set Capacity/hours of operation: - Nil
- Co-generation plant capacity and fuel:
- Pulping: Sulphate or sulphite process: N/A

C. Table Energy Consumption in Indian Paper Mills

Section Equipment	Steam (T/t of Paper)	Fuel (GJ/t of paper)	Electricity	Final Energy (GJ/t of paper)
Chipper	NA	NA	NA	NA
Digester	1.5 T	-	50 units/T	
Evaporator	4.5 T/T of Soda Ash		350 units/T	
Washing & Screening	NA		-	
Bleaching	NA	-	-	
Soda Recovery	NA	-	200 units / T	
Stock Preparation	NA		-	
Paper Machine	1.8/T	-	225 / T	
Deaerator	-	-		
Utilities and others			55 units/T	

**Scoping Study of Muzaffarnagar Pulp & Paper Sector for
UNIDO MSME GEF-5 Project**

Sl. No.	Retrofit / Utility	Rating / Design Parameter	Make and model	Total No.	Energy Consumption
3					
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- Total Electrical Energy Bill/Month: - 350 to 40 Lacs
- Total DG Set Capacity/hours of operation: - Nil
- Co-generation plant capacity and fuel:
- Pulping: Sulphate or sulphite process: N/A

C. Table Energy Consumption in Indian Paper Mills

Section Equipment	Steam (T/t of Paper)	Fuel (GJ/t of paper)	Electricity	Final Energy (GJ/t of paper)
Chipper	NA	NA	NA	NA
Digester	1.5 T	-	50 Units/T	
Evaporator	4.5 T/T of Soda Ash		350 Units/T	
Washing & Screening	NA		-	
Bleaching	NA	-	-	
Soda Recovery	NA	-	200 Units/T	
Stock Preparation	NA		-	
Paper Machine	1.8/T	-	22.5/T	
Deaerator	-	-		
Utilities and others			55 Units/T	

**Scoping Study of Muzaffarnagar Pulp & Paper Sector for
UNIDO MSME GEF-5 Project**

A. Details of the Unit / Factory

1	Name and Contact Address	DLS Paper Private Limited Meerut Road, Begaraj Pur Ind. Area Muazffarnagar, U.P. Mobile: 9927058212
2	Type of Products	Kraft Paper
3	Total Yearly Production capacity in Tons/Pieces	26400 MT/Year
4	Total Contracted demand of electrical laod (KVA) for the factory excluding domestic use	1250 KVA
5	Total Capacity of generator set (KVA) / own generation	NIL
6	Other Fuel (Gas or Oil or Coal) used per month	Agricultural Residues (Bagasse) 1500 MT/month
7	Electricity form (GRID (Unit)	1250 KVA
8	Total Purchase Electricity from the grid (Electrical board/ Company last year)	6582150 KW
9	Average unit cost of the electricity (purchased)	440
10	Total availability of grid power (%)	100%
11	Power factor (PF)	0.993
12	Process Steps	As attached

- Paper produced type: Kraft paper/writing & Printing / Duplex – Kraft Paper
- Paper Production Capacity: (TPA) 264000
- Raw Material: Agro and waste Based/ Paper Based/ Waste Paper Based/ Agro Based – Waste Paper
- Type of fuels: Coal/biomass/pet coke etc. – Multifuel

E. Major Energy Consuming Facilities

Sl. No.	Retrofit / Utility	Rating / Design Parameter	Make and model	Total no.	Energy Consumption
1.	Retrofit				

Scoping Study of Muzaffarnagar Pulp & Paper Sector for
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D. Applicable Energy Saving Measures: (pl tick)

- a. Boiler Efficiency Improvement: _____ Yes
- b. Boiler Feed Water Pump Efficiency Improvement _____ Yes
- c. Boiler Feed Water Pump Pressure Drop Reduction _____ Yes
- d. Boiler Fans Efficiency Improvement
- e. Flash Steam Recovery _____
- f. Digester Blow Heat Recovery
- g. Steam Consumption Reduction by Efficient Condensate: Yes
- h. Evacuation from Dryers:
- i. Energy Efficiency Improvement in Process Pumps: _____ Yes
- j. Installation of Screw Press: _____ Yes
- k. Installation of High Consistency Pulper:
- l. Installation of Pocket Ventilation System:

E. OTHER:

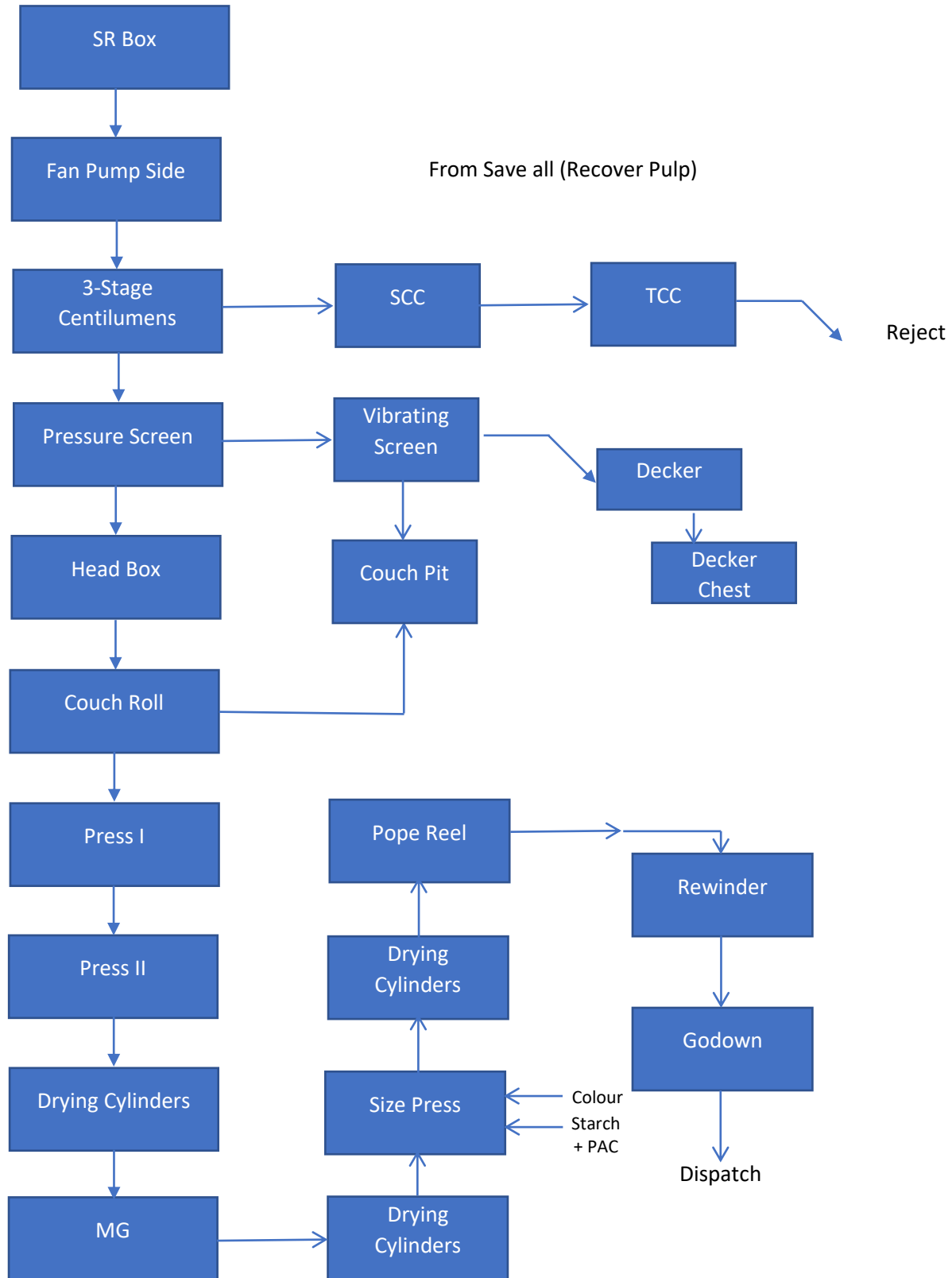
- a) What is energy share of production cost – 16%
 - b) Typical profit margin – 3%
 - c) Previous energy efficiency interventions and their outcome/ learning (agencies that initiate, volume of funding duration and fate)
 - (1) Installation of capacitor, 5 start rating motors, VFD panels, condenser, steam condenser system.
 - d) Please write the specific area where you want to improve the energy efficiency:
Condensate Recovery

Yes
 - e) Whether the unit owners are interested for implementation of new EE technologies:
Yes
 - f) What are the major barriers for implementation of EE technologies in the cluster:
Funds / knowledge
-

4. 75-85% of the energy requirement in the paper manufacturing process is in the form of process heat (made available through steam) while 15-25% is needed as electrical power

5. *Specific Electricity Consumption 550 to 1080 kWh/MT*
6. *Specific Fuel Consumption 10.13 to 18.15 GJ/MT*

Process Flow DIAGRAM



Process Flow

