HO 130002 - THE TEXTILE COMPANY – WALKTHOUGH

Welcome to “The Textile Company”, a large textile company which specializes in denim fabric manufacturing. The management of “The Textile Company” has engaged you for helping them in developing their sustainability goals on Energy. To better understand the situation at hand, you are organizing a meeting with the company management and visit to the factory. During the first walk-through of the factory, you have observed and noticed the following:

1. Yarn cones and other raw materials are stored in a Raw Materials Store which is equipped with general exhaust ventilation fans. Only two out of four fans are operational; on asking, the store supervisor informed that belts of the fans broke few weeks ago, but he was unaware of the maintenance schedule.
2. The manufacturing process starts with ball warping process which is carried out to wind the yarn into rope form. The ball warping machine is powered by electricity, and the hall is equipped with positive pressure forced ventilation system to remove yarn fluff and maintain air changes. Ambiance of the hall feels a bit hazy due to suspended fluff particles; some workers are observed cleaning their dresses and machine components using a compressed air flexible pipe to remove the accumulated fluff. There is no compressed air pressure gauge installed at site.
3. The continuous yarn rope dyeing machine has sixteen process baths which include one pre-treatment bath, three pre-wash baths, eight dye baths, three post-wash baths, and one softener bath. Many process parameters are displayed in the machine control room through connected instrumentation. Soft water is used for all wet processes; the water enters into first bath in both pre- and post-washing processes, heated through heat exchangers up to 70^{o}C using steam as mentioned in the recipe, and is drained from third bath. According to the worker, water in dyeing baths is heated up to 90^{o}C using steam heat exchangers. You observe that steam pressure gauge at main header does not display any reading. Contaminated wastewater is drained after completing the dyeing process to make it ready for next processing order. Softening is conducted without any heating. The dyed softened yarn passes through drying drum rollers which are heated using steam. The operator switches off steam supply based on experience to avoid over-drying the yarn. Steam condensate is drained to the wastewater channel; according to the engineer at site, the steam boiler is very far away making the condensate recovery infeasible. You observe live steam coming out of majority condensate traps.
4. Dyed yarn is then rewound on beams using two re-beaming machines equipped with automatic moisture controls.
5. Organic Starch is applied at two Sizing Machines to add strength and smoothness to the yarn. Steam is applied to the Size Bath using heat exchangers while condensate is not recovered from this section as well.
6. The warp beams are then loaded on 50 automatic air-jet looms to weave the denim fabric. You notice air leakage sounds in many looms and also observe oil deposited on many compressed air pipe joints. Pressure regulators are installed at each machine without any display of pressure. Compressed air pressure of 7 bar is displayed at the only compressed air pressure gauge at main header. The loom shed is maintained at a specific temperature and humidity to improve the weaving efficiency and keep the fabric defect free. An electric chiller provides cooling, while water is showered inside the air ducts to maintain humidity in the loom shed. Bag filters are installed at exhaust ducts to collect the fluff. The display of relative humidity (RH) meter has blurred and there is no calibration tag displayed on RH and Temperature meters. The weaving supervisor is unaware of the humidity requirements. Many workers are observed cleaning their dresses and machine components using a compressed air flexible pipe to remove the accumulated fluff. Majority workers do not wear dust mask; on interviewing, the workers inform that they are unable to breathe properly with masks on. You feel sweating while walking through the weaving shed.
7. After weaving, the fabric beams are transported to finishing department where the fabric is de-sized to remove the starch. This process requires heating up the de-sizing and warm washing bath to 70^{o}C using steam heat

exchangers; fabric passes through de-sizing, is allowed to settle on rotating batchers, and then passed through warm washing baths before passing through the steam drying drum roller. Fabric moisture is continuously measured after the washing bath based on which an operator manually controls steam intake at drying rollers. The machine is cooled down using soft water and cooling water is recovered in a tank nearby the machine. Steam condensate is also collected in this tank and whole recovered water redirected to the de-sizing bath using a pump. Flash steam from this tank is released outside the hall using an exhaust pipe. The Finishing Manager informed that this is his own mini-project which he developed in-house using the scrap in the scrap-yard; and that this has resulted in reduced steam consumption and process lead time.

8. The Singeing process is carried out on one natural gas fired Singeing machine which burns extra fibres on surface and sides of the fabric using direct flame. Fabric temperature is monitored and speed of fabric is controlled accordingly to ensure proper treatment of fabric. The fabric then passes through the de-sizing bath where the Size is removed and drained to the ETP. You observe that fabric covers only about one third of the flame and a strong smoke smell is felt near the Singeing machine. The machine rollers facing the flames are cooled down using soft water in an open /once through cooling circuit. This is a water cooled machine and a cooling water recovery system is installed at site. According to the machine supervisor, he has not seen the system operational during his four years' service in the company.
9. The denim fabric is mercerised at one mercerizing machine to improve the lustre and strength. This involves passing the fabric through NaOH bath at a pre-defined caustic strength, washing the fabric, and drying the fabric using steam drying drum rollers. Steam is needed at all stages for process heating requirements. Fabric moisture is monitored at drying drum rollers and steam pressure is controlled by the operator manually. Process wastewater contains weak caustic solution residue, washing wastewater and steam condensate. You do not observe any live steam from the condensate traps in this area.
10. Mercerised fabric is fed to a two Stenter Frames to control the fabric width. For this purpose, the fabric passes through eight drying chambers heated up to 150°-180°C using hot thermal oil circulating through heat exchangers at 300°C. Hot air is exhausted to rooftop from drying chambers using insulated ducts/chimneys with fans. While passing by the Stenters, you notice warm air leaking from chamber sides heating up the environment. This, combined with heat from uninsulated hot oil valves makes it extremely difficult for you to stay in the area for long.
11. The finishing department is equipped with large general exhaust fans and water walls to maintain air temperature which continuously operate throughout the day during summers. Water circulation in water walls is stopped during the winters as informed by the Finishing Manager.
12. Finished fabric rolls are stored in finished goods warehouse after packing as per export order. All transportation from raw material store till the warehouse is done using four diesel fuelled fork lifters.
13. Compressed air demand of all operations is fulfilled by three centrifugal air-cooled compressors located at a central compressor room. During the visit all compressors were running at partial load. The compressors are controlled using a pressure sensor installed at the output of compressed air reservoir which is set at 6.5-7.5 bar
14. Steam demand is fulfilled by two single-pass travelling grate coal fired steam boilers of 10 Tonne per hour steam generation capacity at 10 bar. The pressure gauge on the main steam header is out of order, however the pressure displayed at boiler control room screen is 9 bar. You observe that coal in the feeder contains coarse as well as fine coal particles. You observe heavy flash steam at vents of the condensate recovery tank and blowdown tank. During the visit, you also observed worn-out insulations on steam and condensate pipes; while none of the steam valves were found to be insulated. Steam leakages were also observed at some valves and joints.
15. One coal fired thermal oil heater of 2.5 mkCal heats up the thermal oil to 300°C to fulfil heating requirements of the Stenter. As the oil circulates in a closed loop, the oil returns from Stenter at a temperature of ~295°C. Insulation of oil lines is very neat and clean while none of the valves are insulated.
16. Water is pumped from ground using two deep well water pumps and stored in overhead storage tank. The type plates on both pumps are missing and no one at site could identify the pump capacities. A softening plant

is installed at site to treat the process and boiler water. Dosing of softener is continuous and according to the operator, he only needs to attend to softening plant if there is any problem faced on dosing or pumping systems.

17. All process wastewater streams are treated in a biological effluent treatment plant (ETP). Maintenance Manager seems to be also responsible for running the effluent treatment plant as well. The ETP staffs measure pH and TDS of effluent once a day and dose fixed amounts of neutralising acids, flocculants and nutrients in each shift. A continuously operating air compressor is installed at ETP to fulfil aeration requirements of the ETP. You note that the electrical control panel is quite corroded and hangs on one hinge. It seems that it will fall off any time.
18. Electricity is provided by company's own two natural gas fired engines, each of 2MW capacity, located near the boiler house. Cooling requirement of engines is met by four cooling towers that operate continuously at constant speed. As per the power house manager, natural gas pressure drops in winter which necessitates using electricity from national grid.
19. In the meeting after the walkthrough, the sustainability manager informs that company has a central energy monitoring system which monitors electrical energy generation and consumption at each department. Steam, water and compressed air flowmeters are installed at main headers and manually recorded by respective supervisors; but he is not aware of any plans to include these into the central energy monitoring system. He also informed that data of all energy sources is compiled for Higg FEM reporting on request of a major textile buyer but he is finding it challenging and would require your support in this task as well.
20. On your way home, you stop at the tea stall next to the factory and get in conversation with some local people from the neighbourhood who share their concerns about the black dust in the area and black smoke from the factory.

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Process flow and NPO Exercise

Your tasks

As a first step, your group assists the company in getting a better understanding of the situation by documenting the process flow and systematically identifying and documenting energy flows and wastages as in the organization/company.

For this purpose

1. Review the information provided to you
2. Document the process & energy flow
3. Point out possible NPOs and energy hotspots in an Eco-map (defined as areas which represent energy losses or immediate risk to environment)
4. Identify the internal key stake holders and decide who should be involved into the company`s energy management team
5. What changes would you make to your on-site assessment plan?
6. Point out areas where you need in depth analysis
7. Present your findings to the management (plenum)

Time: 60 min

<u>Further Consideration</u>

- Which inputs (raw materials, energy, water, others) are used in production process?
- Which of these inputs do not end up in the final product (i.e. are Non-Product Output)?
- Who is directly or indirectly involved in the generation and handling of which of these NPOs?
- What are the potential environmental impacts of these NPOs?
- Which types of costs are caused by the NPOs?
- Which information is required inside the company to quantify the costs of NPOs?

<u>Optional additional questions</u>

- What are the causes or reasons for the generation of NPOs?
- Which measures could be adopted to reduce the NPOs in this company and their environmental impacts?
- Which measures are necessary at management level in the company to ensure the full implementation of the improvements - including measures to motivate the employees to join the change process?

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Layout of the company