Press section economic evaluation

Scope

Because of the importance of wet pressing to the overall economics of the papermaking process, the Water Removal Committee of TAPPI saw a need for some guidelines in this area. The purpose of this effort was to provide a uniform method of evaluating the performance of a paper machine press section in terms of economic factors. The following items were to be included in the final result:

1. A list of factors which are of economic importance to the operation of a press or a press section
2. Explanation of the importance of each factor
3. Suggested methods for evaluating or estimating each factor
4. A uniform method for reporting the results.

This TIP is the result of the task group's efforts.

It is recognized that each mill has its own methods of cost accounting, and there is probably no such thing as "typical" in this regard. As a result, the outline shown in the Introduction will need to be adapted by each user to his or her own particular needs.

The example which is attached is intended only to illustrate the use of the suggested procedure and is in no way typical of any given mill. While this particular example deals with evaluating press clothing, the same general techniques can be applied to any process change, equipment change, etc.

It is hoped that these guidelines may prove helpful in putting economic studies of wet pressing on a common footing in order that mill-to-mill comparisons might be more meaningful.

Safety precautions

No specific safety requirements apply to this TIP. Mill safety requirements should be followed when installing monitoring devices or collecting information relative to press section economic evaluation.

Significant Factors Used in Evaluating Press Section Economics

In general, the cost of water removal increases in each successive step as the sheet advances from the headbox to the reel. Thus, drainage on the wire is quite inexpensive, wet pressing costs are more significant, and drying costs represent one of the major expenditures in the production of the sheet.

For the present purposes, the factors of importance to wet pressing economics can be classified as follows.

I. Primary paper related variables

    A. Production rate: speed, trim, basis weight
    B. Sheet dryness: into and out of the press (or press section)
    C. Downtime: loss of production
    D. Fiber source

II.   Operating costs

A.   Press clothing costs

While the cost of a press fabric, in terms of dollars per ton of paper produced, is a relatively easy figure to derive, it also can be quite misleading. There are many factors and many interactions which must be considered to determine the cost benefits of a given fabric design. For example, when determining the cost benefit of a fabric which has a long life, one must consider the dewatering performance over the entire life. The increase cost associated with reduction in dewatering near the end of the long felt life, may out weigh the cost saving realized for running the felt longer. Because of the economic leverage in wet pressing, the cost of clothing must be tied rather closely to production rate or rate of water removal. This is particularly important to those paper machines which are limited in production by their drying capacity.

1.   *Press fabric costs*

The specific cost of a press fabric is derived easily from its total costs, C_f (in \$), its life on the paper machine, L_f (in days), and the average daily production rate P_d (in tons/day) during its life.

$$k_f = \frac{C_f}{P_d \cdot L_f} \text{ (\$/ton)}$$

This basic cost should be modified by the following considerations.

2.   *Fabric installation costs*

Since some fabrics go on the machine quite easily while others are difficult to install, this cost can logically be attributed to the fabric. If the cost of downtime on the paper machine is D(\$/h) and the fabric installation time is T_i(h), the installation costs can be computed as:

$$k_{fi} = \frac{D \cdot T_i}{P_d \cdot L_f} \text{ (\$/ton)}$$

where L_f is the fabric life (in days) and P_d is, again, the average daily production rate (in tons/day).

3.   *Fabric cleaning costs*

Under consideration here are: (a) the cost of chemicals for continuous and batch cleaning and (b) the cost of downtime for special washups attributable to the press fabric. The first factor is simply the average daily cost of cleaning chemicals, C_c (\$/day), divided by the average daily production rate, P_d (ton/day). If the number of special washups, N, lasting an average of T(h) are required during the life of the fabric, L_f (days), then the total fabric cleaning cost can be expressed as:

$$k_{fc} = \frac{C_c}{P_d} + \frac{D \cdot T_c \cdot N}{P_d \cdot L_f} \text{ (\$/ton)}$$

Total press-fabric-associated costs can be calculated as: $k_f + k_{fi} + k_{fc}$

B.   Maintenance costs

The costs of maintenance is often difficult to allocate, but with proper maintenance records a reasonable estimate can be made. Depending on the detail required, it may be desirable to subdivide maintenance labor into categories dependent on the item being serviced, e.g., rolls, vacuum boxes, pumps, etc. In any case, the maintenance cost (in any detail desired) can be computed as:

$$k_{dc} = \frac{(89.5 \text{ kW})(24 \text{ h/day})(\$0.03/\text{kW} \cdot \text{h})}{(200 \text{ ton/day})} = \$0.32/\text{ton}$$

B.   Vacuum costs

$$k_{vc} = \frac{(78 \text{ kW})(25 \text{ h/day})(\$0.03/\text{kW} \cdot \text{h})}{(200 \text{ ton/day})} = \$0.28/\text{ton}$$

Total cost of water removal at press section = $2.69 + $0.32 + $0.28 = $3.29/ton

Potential savings

A.   Drying costs (steam)
      d_s = (1.5 lb steam/lb water evaporated)(1.6-0.05) = 2.325 lb steam/lb paper

B.   Cost of steam
      = (2.325)(2)($2.50/1000 lb steam)
      = $11.625/ton paper)

Example 2

As a second example, consider this same third press position where a new style of press fabric is installed, and it is desired to compare its performance with the case described in Example 1. This new fabric cost $9000 and ran for only 30 days but increased the dryness out of the press section to 40% (moisture ratio = 1.5lb water/lb fiber) and increased the daily average production to 210 ton/day. All other costs are assumed to remain the same on a cost per ton basis. Lost production during this run was two hours. Was the increased press fabric cost justified?

Primary variables

Production rate = 210 ton/day
Moisture out of press section - 100 – 40 = 60% (moisture ratio - 1.50 lb water/lb fiber)
Moisture out of dryers = 4.8% (moisture ratio - 0.05 lb water/lb fiber)

Operating costs

A.   Press clothing

1.   Press fabric

$$k_f = \frac{\$9000}{(210 \text{ ton/day})(30 \text{ days})} = \$1.43/\text{ton}$$

2.   Fabric installation

      k_f = $0.22/ton (same)

3.   Fabric cleaning

      f_c = $0.75/ton (same)

      Total fabric related cost = $1.43 + 0.22 + 0.75 = $2.40/ton

B.   Maintenance costs, k_m = $0.21/ton (same)