Economic Benefits of Reducing Process Variability

Introduction

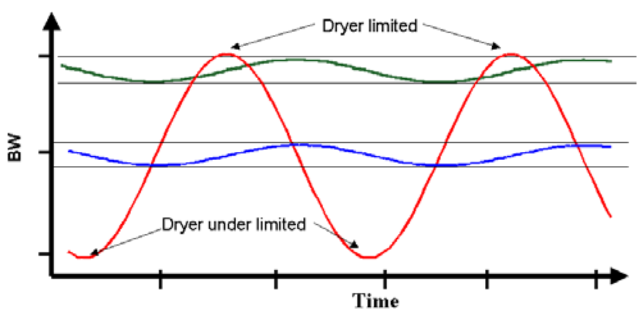
It is widely accepted that reducing process variability will improve product quality. However, unless the mill is able to sell the improved product for a premium or can secure more sales the economic benefits of reduced product variability may be limited and/or difficult to quantify.

The reduction in process / product variability does present opportunities for substantial economic benefit through production rate increases or operating cost reduction. These opportunities for economic benefit are mill specific and understanding the mill economic drivers and area production limitations is required. It is often the case that integrated mills will have different benefits than stand alone operations.

Cyclic Variability

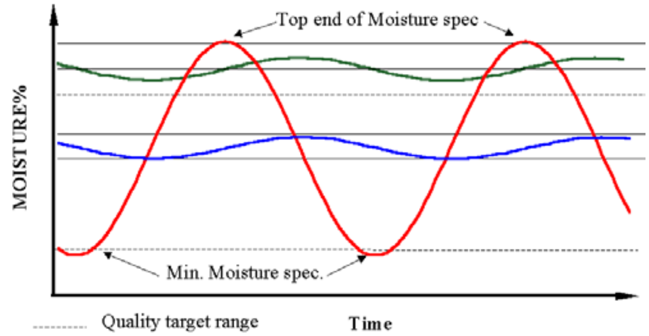
In this case, the process oscillates continuously. The causes of cyclic variability are too numerous to discuss here, but range from process design issues to poor controller tuning. Appreciating the benefits from reducing cyclic process variability is a two-step process. The first step is to reduce variability in key process variables. The second step is to shift the operating targets.

Reducing cyclic variability may enable an overall shift in the *production rate* as shown in the dryer limited pulp machine example below. Decreasing the BW variability from the red line to the blue line allows a Basis Weight target shift to the green line. The increased production rate may represent the most important economic benefit.

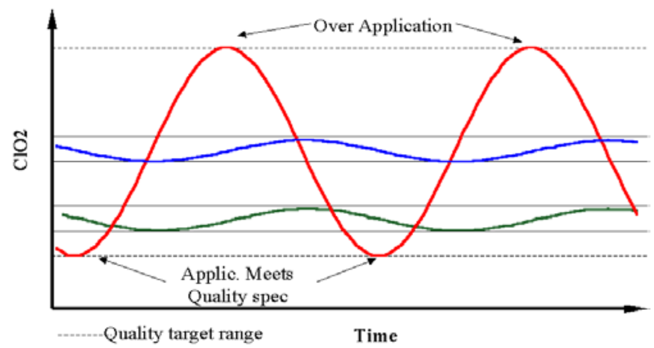


Cyclic variability often results in the over application of chemicals, energy or high-cost fibre. Reducing cyclic variability can therefore decrease *operating costs*, whether the variability originates in the raw material process source (i.e. chemical flow variability, steam pressure variability) or from an external process disturbance that is causing product variability.

In the example shown below, the paper machine moisture variability is caused by variability in the wet end. Reducing the wet end variability reduces the moisture variability from the red line to the blue line. This allows a moisture target shift (green line) to the upper moisture specification that will reduce dryer energy consumption.



In the example below, reducing the ClO2 variability from the red line to the blue line will allow the operator to target shift the ClO2 dosage (to the green line) while still achieving the brightness target.

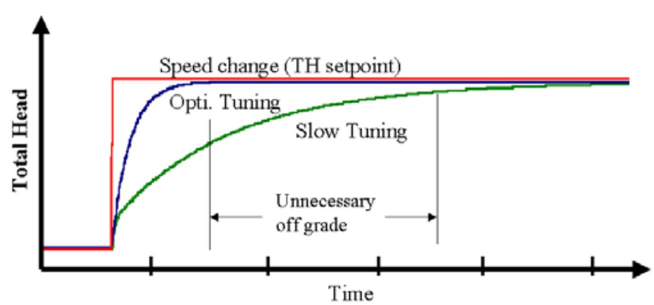


The economic benefits of reducing the process variability can be determined by estimating conservatively the amount of the target shift and calculating the associated reduction in chemical or energy costs.

Process Upset

In this case, the process responds inappropriately during *transitional periods* such as grade & speed changes. This is often due to unnecessarily slow controller tuning that ultimately results in high amounts of off-grade product.

In the example below, the Total Head controller tuning is too slow (green line) and results in off grade production following a speed change. Improving the speed of response of the total head (blue line) will ensure the rush/drag is brought on target as fast as possible reducing off grade.



The estimated economic benefit can be determined by estimating the increase in production due to the increased time to on grade.