THIELSCH ENGINEERING

A Brief Look at the Effects of Cycling

Thielsch Engineering, Inc. provides planned, unplanned, and emergency services to over 150 power plants across the U.S and internationally each year. Our experts understand the complexity of managing power production and the factors associated with it such as demand, cost controls, and mechanical difficulties. One major issue that we often encounter is the effects of unit cycling.

Most power generation facilities were designed on the assumption that they would be operated in a baseload mode or infrequently cycled. However, in response to local power market conditions and the terms of their power purchase agreements, many plants are now cycling their units more frequently than designers had intended. Ultimately this can result in greater thermal stresses, more pressure cycles, more cyclic fatigue damage and overall faster wear and degradation to the critical components due to both the mechanical and corrosion processes.

In brief, baseload is the minimum amount of power that a utility or distribution company **must** make available to its customers, or the amount of power required to meet minimum demands based on reasonable expectations of customer requirements. Baseload plants are devoted to the production of baseload supply. These plants are used to meet some or all of a given region's **continuous** energy demand. They are to produce energy at a constant rate-usually at a low cost relative to other production facilities available to the system. They tend to run at all times with the exception of repairs or scheduled maintenance.

Cycling may be defined as the operation at varying outputs or the switching on and off of electricity generating units. This cyclic operation results in thermal transients and fluctuating pressure levels, which has proved to cause fatigue damage, chemical corrosion and various other forms of impairment to the generator’s components. Certain types of units, called peaking units

and some combined-cycle units are specifically designed for this mode of operation and do not have as adverse effect as those designed for baseload operations. This is because baseload units are designed for continuous operation, close to their maximum rated output. When operated in a cyclic manner they often suffer great physical damage to the various components in the generating unit.

As a general comment, cycling service has an adverse effect on the life expectancy of a unit. This is due to the fact that cycling results in fatigue loading (alternating cyclic stresses) whereas; baseload operation results in creep (sustained stresses). Depending on the severity of the stresses, and the number of cycles, fatigue loading can result in cracking, particularly at restraint locations.

Many utility owners and investors of combined-cycle plants are now rethinking the concept of baseload operation to cycling operation. Since current combustion turbines do not have low turndown while maintaining emissions, the ability to cycle a unit is the alternate solution. Such cycling plants are designed to optimize plant operations by providing rapid startups, partial loading, and short shutdowns. A combined-cycle plant having operating flexibility can definitely provide start, stop, and partial load operation to match changing demand for power. However, these benefits can bring on added costs due to wear and tear on equipment through thermal cycle fatigue.

It is critical for plant owners and operators to understand the impact of cycling. To achieve cycling plant operations, owners must consult with engineering experts to determine cycling flexibility, availability, and reliability. All plants start and stop as a result of planned outages or unexpected trips. For cycling, the plant superintendent and load dispatcher have the daily latitude to call for daily on/off and partial load operation within any given 24-hour period. There are no longer limitations with eight hours, 12 hours, and longer restarts that used to justify or force a unit to stay on line.

Whether dealing with an already operating unit or a newly proposed one, plant owners must again work with experienced engineers to consider the severe wear and tear that the unit will be subjected to as a result of frequent starts and stops. Cycling is more demanding than running a unit at baseload. It subjects the unit to persistent stopping, starting, and load changing that could drastically reduce service life expectancy.

To learn more about our experience with baseload and cycling units, please contact Robert Smoske at rsmoske@thielsch.com or by phone at our Florida office at (561) 353-5804.