**Taber International’s Electric Utility Offerings**

(Currently Advertised with existing Implementations)

A High-Level Introduction

**Combustion Optimization System (COS)**

The Combustion Optimization System (COS) application operates in closed-loop control of many aspects of the combustion process within the boiler. The typical COS offering primarily focuses on redistributing air throughout the furnace to better balance staging and improve overall combustion relative to the desired objective (NOx, CO, heat rate, temperatures, etc.). This includes the excess O2 setpoint, windbox differential pressure setpoint, primary air (PA) dampers, secondary air (SA) dampers, overfire air (OFA) dampers, and on tangentially-fired units, the tilt angle of burners and OFA dampers. Expanded COS offerings have been further developed to also act on attemperator spray flows (both superheat – SH – and reheat – RH – steam), fuel flow rates, mill outlet temperatures, and forced draft (FD) / induced draft (ID) fan damper bias.

All control implemented by the COS is realized by adjusting bias settings of the unit, ensuring operation and control is always grounded in proven Distributed Control System (DCS) baselines and that all DCS safety measures remain in full effect. The COS operates using two distinct control methodologies: 1) expert logic and 2) model-based real-time optimization. The combination of these methodologies allows the COS to realize optimized operation and enhanced performance throughout unit ramping, low-load, unsteady, and steady state operation.

Expert logic refers to the ability to incorporate operational best practices and unique, situational-dependent control within the overall decision making and control logic of the COS. Expert logic is beneficial for addressing unique characteristics of individual units and for realizing knowledge capture of years of experience of site operators and engineers, making those best practices automatic in control behavior and consistent across operating crews.

Model-based real-time optimization uses various types of intelligent modeling methods (e.g., neural networks, compound neural networks, regression, first-principles etc.) to generate representative models of combustion performance metrics of interest from site-specific operational data. These combustion performance metrics can be but are not limited to NOx and CO emission rates, process steam and metal temperatures, LOI (loss of ignition), heat rate, opacity, etc. It is necessary for reliable and consistent measurements of the target parameter to be available within the operational data. The developed models are interrogated numerous times to identify optimal operational settings of control parameters to realize improved performance in regards to the identified performance metrics (e.g., reduced emission rates, efficiency, etc.).

These two distinct control methodologies operate harmoniously to realize reliable and consistent operation of the unit while achieving improvements in combustion performance metrics.

Deployments often initially focus on a single metric (commonly NOx emission rates) in order to meet MATS and other emission regulations. However, due to the versatility of the platform, the ease of development, and the open system structure, most projects are quickly expanded to also monitor and automatically act to improve operational practices during load ramps, low load operation, high tube and steam metal temperatures, etc. Improvements of 10 – 20% NOx reduction, 40%+ CO reduction, 0.7% - 1.0% heat rate reduction (efficiency improvement), up to 25% reduced steam temperature variability and 30%+ setpoint realization improvement. These metrics may appear drastic, but the unique combination of multiple solution approaches, customized solution expert logic and development, and the system’s self-learning and self-adapting capabilities make this level of benefits achievable over time.

**Knowledge-based SootBlowing (KSB)**

The Knowledge-based Sootblowing (KSB) application is an intelligent sootblowing program that effectively incorporates system knowledge from years of experience of site operators and engineers into a rule-based unit-wide sootblowing strategy. Together with site knowledge, available sensor data from the unit is used to estimate the effects of soot blowing activity on heat transfer and efficiency throughout the furnace. Depending on the resolution of available data, this may be unique to each individual tube section within the boiler at intermediate steps within the steam cycle, or it may be generalized to just the final measurements. The combination of knowledge-based operation and quantitative information allows for the system to effectively manage soot build-up throughout the individual sections of the furnace where existing sootblowers are located to better control steam temperatures, fouling and slagging, and tube erosion. KSB operation provides uniform and consistent soot management across the furnace leading to improved operation.

**Cooling Tower Optimization (CTopt)**

Many power generators utilize evaporative cooling towers to aid in reducing backpressure on the low pressure (LP) turbine, as well as to provide other cooling needs to the process. The bulk of these cooling towers consist of multiple cells, where each cell promotes water evaporation which results in cooling by forcing (pushing) or inducing (pulling) air across the hot water. Although the design of each cell is usually identical, performance and effectiveness often varies due to numerous subtleties, from differences in fouling rates of cell media to tower water flow and localized stratification. Beyond differences from cell to cell, changing ambient conditions also affect tower performance, where changing wind speeds and directions, temperature, and humidity directly impact tower behavior.

Taber’s CTopt application uses process data collected directly from the relevant tower to learn the varied effectiveness of individual cells within the tower as outside conditions and load demands on the tower change in order to maximize the cooling ability of the tower while minimizing power usage. Depending on the hardware available for control of the tower, this is accomplished by optimally activating and deactivating individual cells when appropriate, or by adjusting motor speeds from cell to cell using VFDs. This practice has been shown to decrease tower power usage as much as 5% - 10% while maintaining cooling capacity. Control of other parameters, such as water flow between cells, would enable additional improvements such as water usage, to be achieved.

**Hydrogen (H2) Pressure Optimization within the Generator (H2Popt)**

See the Taber website description for information on this offering: <https://www.taber-intl.com/hydrogen-optimization/>

**Chemical Additive Injection Optimization**

Numerous chemical additives have been identified for emission control and slagging management which, when injected into the process, can provide benefits. However, many of these have subsequent detrimental impacts on other aspects of the process, or they simply represent a significant expense for consumption within the process. The reactions initiated by these chemicals within the flue gas stream are often complex and their effectiveness varies based on numerous factors, many of which are not always clear or predictable, and some that are entirely unknown.

Artificial Intelligence (AI) and Advanced Pattern Recognition (APR) methods are able to use common process measurements and correlate these to observed performance, effectively “teasing out” an understanding of these relationships and how to exploit them. This makes it possible to improve the effectiveness of these additives and minimize their negative effects by improving surrounding process conditions and decreasing the amount of necessary additive, reducing costs.

Taber then applies the understanding provided by the AI and APR methods through their unique expert knowledge implementation capabilities to develop reliable and effect applications for optimizing. This grounds the advanced algorithms in practices that are proven, which assists with operator acceptance and overall usability and benefit.

This methodology is applicable to areas such as powedred activated carbon (PAC) injection for mercury (Hg) control, selective catalytic reduction (SCRs), selective non-catalytic reduction (SNCRs), halide injection at the pulverizer for Hg oxidation, lime injection for wet/dry sulfur scrubbing – flue gas desulfurization (FGD), and others. When applied to a PAC system, cost savings on additive cost were seen in the range of $500,000 per year, while improving Hg reductions and reducing the number of process disturbances (opacity alarms) by 95%.

**Engineer Workflow**

See the Taber website description for more information on this offering: <https://www.taber-intl.com/engineer-workflow/>

**Predictive Maintenance & Anomaly Detection**

See the Taber website description for more information on this offering: <https://www.taber-intl.com/predictive-maintenance-anomaly-detection/>

**Direct Competitors**

GE (Boiler Optimizer) – they bought Neuco, who was the buyer of the software system that was the predecessor to the Griffin software. GE recently announced they’re not really supporting fossil fuels anymore (not in those words, but effectively) so there are MANY installations of these systems that are no longer receiving very effective support. This is low hanging fruit where Taber can offer to pick up the maintenance on these systems and transition them over to the updated software, providing enhanced benefits and greater effectiveness and reliability.

Siemens (Omnivise) –

Emerson – <https://www.emerson.com/documents/automation/ovation-combustion-optimization-en-1262700.pdf> (they make some pretty high claims on heat rate and NOx, which quite honestly I wouldn’t expect to see them achieve). In practice, Taber achieves superior, long term results. At any given moment a system could get these numbers, but consistently, I highly doubt it.

ABB (COS & Optimax) –

Steinmuller Engineering (PRS) – These guys are more small-time. I’ve never interacted with them myself, just know they exist.