M2G Preliminary Pilot Study Report
University of Georgia
Center for Applied Genetic Technologies

Pilot Period:
March 28, 2013 – May 6, 2013
Location:
111 Riverbed Rd., Athens, GA 30602
Report Date:
05/17/2013

Summary

The M2G boiler optimization control unit was piloted for the University of Georgia at the Center for Applied Genetic Technologies (CAGT) in Athens, Georgia. The pilot commenced on March 28, 2013 and concluded on May 6, 2013. Greffen Systems managed the pilot, collected and analyzed data, and produced this report. The following table summarizes the M2G's performance during the pilot period.

	Average Run Time per Day	HDD	Run Time/HDD	Energy Savings
Bypass	402.8 min.	111.5	3.6 min.	16.7%
Save	389.1 min.	128.7	3.0 min.	

UGA - CAGT - 2013	
Summary Statistics	
Average Run-time (min.)	
Bypass	1.3
Save	3.0
Average Off-time (min.)	
Bypass	3.4
Save	8.0
Average Cycles Per Day	
Bypass	153.1
Save	64.9
Reduction in Cycling	
M2G Reduction	**58%**

Findings from the data collected to-date include the following:

- Building comfort levels are unaffected by the M2G device.
- A 16.7% energy savings was observed for the Center for Applied Genetic Technologies (CAGT).
- Greffen expects that the M2G will deliver significant energy and carbon savings and has also integrated into the CAGT's existing building operations making the M2G a commercially viable energy saving technology for the University of Georgia.

Introduction

Greffen Technology

The M2G is an advanced intelligent boiler control that optimizes the operation of a boiler. An M2G unit monitors the temperature of the water flowing in and out of the boiler at least every 10 seconds and the information is recorded. The M2G also monitors additional boiler operating data, including heat transfer rates during firing and interval periods when the burner is off.

When a demand on the boiler is made, the M2G microprocessor checks the latest data it has stored and decides whether to allow the control signal to fire the boiler or open a relay which blocks the boiler from firing. Energy savings is only one of the criteria used in the M2G decision making process: (1) building comfort level and (2) protection of the boiler from stresses induced by thermal shock are the other key criteria that are used by the M2G. Also, the M2G preserves the existing system's control over the boiler system. The M2G's built-in intelligence adjusts to changing conditions and operational settings without any requirement for operator adjustment or intervention. From an operator viewpoint all existing controls and procedures remain fully functional.

The result is energy savings while ensuring maximum capacity during heavy load periods; this is accomplished with no impact on building comfort levels. Viewed from a perspective of waste heat, the M2G minimizes the waste heat going up the boiler flue while preserving the transfer of beneficial heat into the building.

Pilot Installation and Methodology

An M2G was installed on each of the boilers that provide space heating for the Center for Applied Genetic Technologies. The boilers were two Weil McLain boilers with an input of 2,713,000 BTU/hr each.

The M2G was installed immediately adjacent to the boiler's primary fire control device. The M2G installation was accomplished without impacting existing controls.

In addition to the M2G, a timer was installed on each of the boilers which allowed the M2G to operate in either of two modes. In the "save" mode of operation, the M2G unit operates normally. In "bypass" mode the M2G is still powered, however, its ability to modify the boiler's firing and timing is blocked electronically. In bypass mode the boiler operates as though the M2G technology were not installed. The timer toggles save and bypass modes alternately on a 24 hour basis.

Data was collected on boiler operations using a Dent data logger which measured the gas valve operation for the boiler. The data was collected with time and date information for each change in boiler status. Each time the boiler turned on or off the event was recorded with the date, time, and action. Temperature sensors were also placed in the building to determine the M2G's effect on the interior building temperature. The collected data was analyzed and a comparison of boiler operation was made with and without the M2G device in operation.

Data Collection, Analysis, and Findings

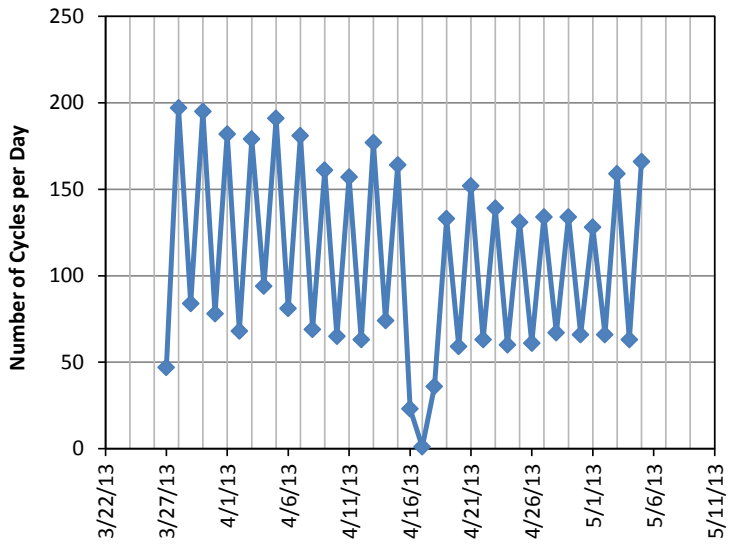
Energy Consumption

Time of use data was collected during the pilot period. Each boiler firing was recorded including start time and end time. Analysis of the time of use data was performed to determine the reduction in run-time, the reduction in run-time was then correlated to gas savings.

Operation of the M2G provided a 16.7% reduction in fuel consumption without any indication of an impact on performance. The reduction in fuel consumption was produced by a 58% reduction in cycling and an increase in average off-time per cycle of 4.6 minutes.

M2G Pilot Summary – University of Georgia	
Parameter	CAGT
Firing Rate drop with M2G active	58%
Increase in Average Off-Time	4.6 min.
Total Energy Savings	**16.7%**

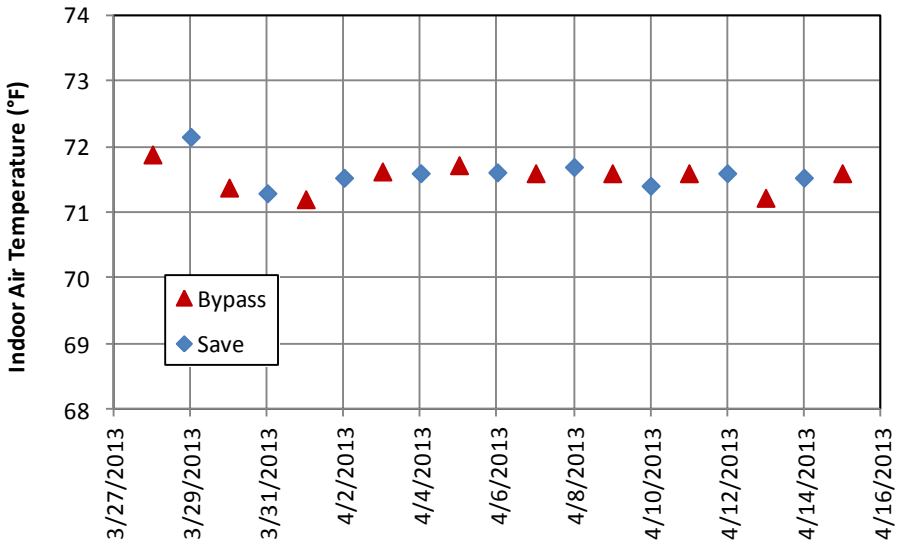
The number of cycles per day can be seen in the graph below for the entire pilot period. The saw tooth pattern on the graph is created by the 24-hour alternating status of the M2G. The low points on the graph indicate the number of cycles while the M2G was active. The high points indicate the number of cycles when the M2G was bypassed. On April 17th the boilers were not operational and, therefore, did not experience any cycling.



Using the indoor air temperature data collected during the pilot it was also determined that the M2G did not affect indoor building comfort levels. From the table it can be seen that the difference between average indoor temperature in bypass and active mode was insignificant.

Average Indoor Temperature		
	Bypass	Active
CAGT	71.5 °F	71.6°F

The indoor temperature profile for the building can also be seen in the graphs below. In the graph the active indoor temperature follows the bypass indoor temperatures closely, indicating that the M2G installation has left the building comfort levels unaffected.



Conclusion

The M2G was successful in delivering natural gas savings during the pilot period. The boiler met demand with less energy consumed, lower carbon emissions, and with no effect on building comfort levels as evidenced by the average indoor air temperatures. The pilot has observed energy savings of 16.7% for the Center for Applied Genetic Technologies. The M2G should also provide additional savings by lowering boiler maintenance costs due to the decrease in wear resulting from the reduction in the boiler's run-time.

This pilot has demonstrated the M2G's delivery of significant energy and carbon savings for the Center for Applied Genetic Technologies at the University of Georgia. This savings was accomplished by the installation of a device that was easily integrated into the building's existing operations. The M2G is therefore a commercially viable and proven energy saving technology for the University of Georgia.