



# M2G Pilot Study Report

## Yahoo! Inc.

### in Sunnyvale, California

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Pilot Period:  
February/March 2011

Location:  
Sunnyvale, California

Report Date:  
July 19, 2011

## Summary

The M2G boiler optimization control unit was piloted at Building D on the Yahoo! Campus at Sunnyvale, California. The pilot at Building D commenced in February 2011 and concluded in March 2011. Greffen Systems managed the pilot, collected and analyzed data, and produced this report. The following statistics summarize the M2G's performance during the pilot period.

Yahoo Building D Pilot — 2Q 2011		
Summary Statistics		
Energy Use per day		
M2G Inactive	709	CCF
M2G Active	594	CCF
<b>M2G Savings</b>	<b>16.2%</b>	
Average Run-time		
M2G Inactive	3.7	minutes
M2G Active	7.0	minutes
Average Off-time		
M2G Inactive	3.9	minutes
M2G Active	9.8	minutes
Average Cycles Per Day		
M2G Inactive	192	
M2G Active	85	
Reduction in Cycling		
<b>M2G Reduction</b>	<b>56%</b>	

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

- ❖ Building comfort levels are unaffected by the M2G device.
- ❖ An average of 16.2% natural gas savings was produced during the pilot period.
- ❖ The average boiler run-time was reduced by 3.3 minutes.
- ❖ There was a 56% reduction in boiler cycling that will produce additional savings by lowering boiler maintenance costs.
- ❖ Greffen expects that the M2G will deliver significant energy and carbon savings and integrate into Yahoo!'s existing building operations making the M2G a commercially viable energy efficiency technology for the Yahoo! campus.

## Introduction

### Grefen Technology

The M2G is an advanced intelligent boiler control that optimizes the efficiency 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 of thermal shock are the other key criteria that are constraints used by the M2G. Also, the M2G preserves the existing system's control over the boiler and 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

The M2G was installed immediately adjacent to the boiler's primary fire control device. Gas consumption was determined from measurement of the gas control valve operation on the boiler. It was noted that the boiler room systems are a mixture of controls, some subsystems are original, others have been added more recently. The M2G installation was accomplished without impacting existing controls.

In addition to the M2G, a timer was installed which allowed the unit to operate in either of two modes. In the "save" mode of operation the M2G unit operates normally. In "bypass" mode the M2G is powered, but its ability to modify boiler firing and timing is blocked electronically. In bypass mode the boiler operates just as it would were the M2G technology 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 turns on or off the event was recorded with the date, time, and action. 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 gas consumption.

Operation of the M2G provided a reduction in fuel consumption with no effect on building temperature or any other indications of any impacts on performance.

M2G Pilot Summary – Yahoo!	
<u>Parameter</u>	<u>Building D</u>
Firing Rate drop with M2G active	56%
Increase in Average Off-Time	5.9 min.
Total Energy Savings	<b>16.2%</b>

The pilot result validates the technology’s performance with these installations. The M2G operated well under a wide range of loading conditions including “normal” loading conditions for the given seasonal period.

## Conclusions

The M2G did deliver natural gas savings for the pilot period. This was accomplished by a reduction in the number of boiler firings by 56%, a reduction in waste heat going up the flue, and in more efficient heat transfer for use in the building. The boiler met demand with less energy consumed, lower carbon emissions, and with no effect on building comfort levels as evidenced by measured temperature and confirmed with tenant reports (or lack thereof). Expected annual energy savings are estimated to be near 16.2% for Building D. The M2G should also provide additional savings by lowering boiler maintenance costs due to the decrease in wear resulting from the reduction in boiler firings.

This pilot has demonstrated the M2G’s delivery of significant energy and carbon savings for Yahoo!. This savings is accomplished by the installation of a device that is easily integrated into Yahoo!’s existing building operations. The M2G is therefore a commercially viable and proven energy efficiency technology for Yahoo!, Inc.

