Nicor Gas Emerging Technology Program

1036: Commercial Dryer Modulation Retrofit

Public Project Report – Executive Summary

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Full Report

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Executive Summary

Introduction

The Nicor Gas Emerging Technology Program (ETP), a part of the utility's ongoing energySMART Energy Efficiency Program (EEP), assesses new or underutilized technologies that have the potential to provide natural gas savings for the 2.2 million Nicor Gas customers in Northern Illinois. The Gas Technology Institute (GTI) implements the ETP for Nicor Gas. This report summarizes the findings from an evaluation of a modulating valve retrofit for commercial dryers and its potential to provide a new energy efficiency measure to Nicor Gas commercial and industrial (C&I) customers.

Background

The majority of commercial, gas clothes dryers have only one burner firing rate. A temperature sensor in the dryer exhaust regulates the on/off operation of the burner to meet the drying cycle settings ranging from low to high heat (low to high temperature).The single firing rate for the burner is sized large enough to warm up the clothes and drive off moisture quickly during the initial stages of drying at the highest heat (temperature) setting. In the later stages of drying that firing rate is oversized, since less heat is needed when there is not as much moisture remaining in the clothes. The burner must then turn on/off frequently. This can result in less effective drying of the clothes as the temperature fluctuates causing a significant waste of gas during the repeated thermal cycling. Adding modulating capabilities to the gas dryer allows the firing rate to adjust to the changing demand for heat over the drying cycle.

There are modulating dryers available directly from laundry equipment manufacturers, but that would require a large capital investment by users to replace their existing non-modulating dryers. The manufactured product utilized in this pilot is a two stage, modulating gas valve retrofit kit with an installed cost around $525 per dryer, which converts a standard non-modulating dryer to a modulating dryer. Initial demonstrations by the manufacturer indicate up to 40% savings on dryer gas use.

The target market for this new technology is the commercial/institutional sector, specifically laundromat, dry cleaning, hospitality, and healthcare facilities. Additionally, any other facilities with on-premise laundry (OPL) may be a suitable fit, such as a health clubs or multi-family housing. These facilities often have commercial dryers with capacities between 45 and 250 pounds (lbs.) that typically do not have modulating capabilities.

Results

The modulating dryer technology was evaluated at five pilot sites to account for savings from a variety of targeted market end uses and dryer capacities. A total of 11 dryers were monitored at the five pilot sites, including: two hotels with two 170 lb., one 120 lb. and one 75 lb. dryers; one laundromat with two 45 lb. and two 30 lb. dryers; one

healthcare (nursing home) facility with two 75 lb. dryers; and one dry cleaner with one 50 lb. dryer.

The gas and electric usage of the dryer, number of dryer cycles, and dryer room makeup air temperature were monitored. The data was collected by a Logic Beach data logger which recorded the energy usage, cycle count, and temperature on one (1) minute intervals. The data was accessed remotely with a cell modem to periodically download the data and to look live at the sensor readings. One (1) month of baseline monitoring was conducted prior to the installation of the modulating dryer retrofit kit. Then 3 months of monitoring was conducted after the retrofit. It was determined during the monitoring that the dryer room makeup air temperature was largely influenced by the temperature of the outdoor air, which is the source of inlet air for the dryer. This in turn had a large effect on the gas energy usage as a result of greater heat input needed at lower dryer inlet temperatures. As a result, an additional 2 to 3 months of baseline monitoring was conducted after the conclusion of the modulating dryer monitoring. At that time the dryers were placed back into baseline mode and operated at their original high firing rate. This revised approach provided comparable months of data for pre-and-post modulating gas valve retrofit operation based on season to account for dryer room makeup air temperature.

The monitored data from the pilot sites showed an overall trend of gas savings with the technology. The gas savings were derived by comparing monitored data from three months of non-modulating, baseline dryer operation to three months of modulating dryer operation. Overall the results show an average, annualized gas savings per dryer of 13.8%, equating to 333 therms. At $0.752/therm cost for gas, that yields $250 in annual cost savings and a 2.10 year payback at an installed cost of $525 for the dryer modulation retrofit technology.

In addition to the long term monitoring, a more standardized, short term test was also conducted where the exact same load of laundry was washed and dried twice; once in baseline dryer mode and once in modulating dryer mode. Although the load was washed in the exact same washer there is still some variance in the moisture content of the clothes between each drying. This was accounted for by measuring the Btus of gas used per lb of moisture removed during the drying process. The clothes were weighed before and after drying for each mode. The load size was varied with each dryer and its respective capacity. For the laundromat and dry cleaner, a standard load of plain white cotton towels was laundered. At the hotels and healthcare site, the load that was being laundered at the time of the short term test was simply washed a second time. On average, the results were very similar to the long-term monitoring with an average, annualized gas savings of 12.4%, equating to 286 therms. At $0.752/therm cost of gas, that yields $215 in annual cost savings and a 2.44 year payback at an installed cost of $525 for the dryer modulation retrofit technology.

The pilot demonstrated approximately 300 therms average annualized gas savings per dryer as a result of the modulating gas valve retrofit. In practice, based on the pilot site results gas savings depended more on the number of dryer cycles (loads of laundered

items dried and the resulting gas use) and not the dryer size. For implementation as a measure in an energy efficiency program, the best approach to establish a new measure may be to provide a flat rebate per dryer based on the average gas savings as opposed to a rebate based on the capacity of the dryer. For example, Figure 1 shows the annualized gas savings for the 8 dryers versus their respective dryer capacity. The plot shows significant diversity in the potential annual therm savings for a given capacity dryer.

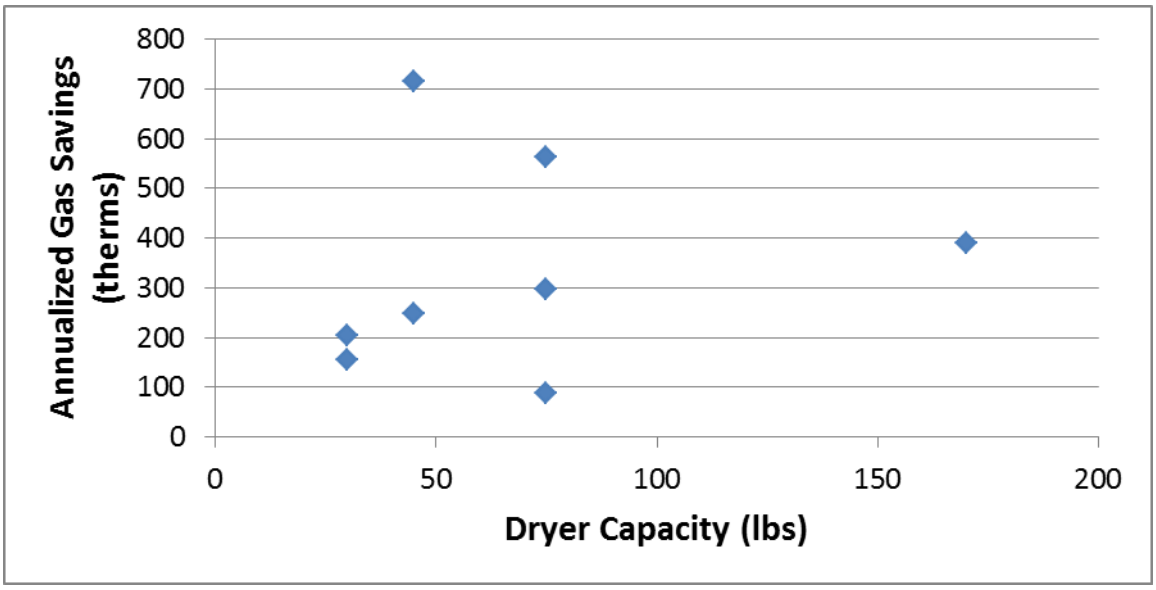

Figure 1: Annualized Gas Savings versus Dryer Capacity