

Report Summary of Energy Savings Validation to The New York State Energy Research & Development Authority

IntelliCon controls, manufactured by Intellidyne, LLC, deliver average energy savings of 13% and reduce pollution by as much as 47%, according to a comprehensive project study commissioned by the New York State Energy Research And Development Authority (NYSERDA). Furthermore, the data from this study conclusively demonstrate that user comfort is maintained with no noticeable difference while achieving savings at a lower cost than other measures that might or might not net the same results. This project validates the energy savings and pollution reduction caused as a direct result of using the Intellidyne control technology on heating and cooling systems. Working together, Brookhaven National Laboratories (BNL) and Intellidyne, LLC, selected eight test sites where boiler, air conditioning and refrigeration system performance with and without the IntelliCon could be measured.

Test results were measured in two ways. In the field, boiler, air conditioning, and refrigeration applications were fitted with monitoring equipment and operated with and without IntelliCon technology in operation. In addition, BNL performed laboratory measurements that studied the impact of the control on boiler air pollutant emissions. The test procedures followed the practice of day-on/day-off measurements.

The selected sites provided a broad range of applications typical of the full spectrum of application areas where IntelliCon technology can reduce energy consumption. These sites were all commercial sector buildings, including schools, libraries, office, hotel and other applications. The IntelliCon control monitors system temperatures to estimate overall heating or cooling load and, in response, varies the operating range of the primary control (thermostat or aquastat), with resultant reductions in energy consumption and system cycling. The field measurements were captured and analyzed, and they showed that cycle time reductions were in the range of 10% to 20% and energy savings ranged from 8.28% to 19.15%. The following table provides a summary of the measured results by site and application.

Energy Savings Summary with Returns On Investment (ROI)

| Test Site | Application | System Size (input) | Raw Savings | Degree-Day Adjusted Savings | Estimated Project Cost | ROI |
|-------------------|------------------|---------------------|-------------|-----------------------------|------------------------|-----|
| Beech St. | Hydronic Heating | 9.6 mmbtu | 11.73% | 12.60% | \$7,800 | 2.0 |
| Estee Lauder | Air Conditioning | 60 Ton | 11.46% | 10.60% | \$1,150 | 3.3 |
| Estee Lauder | Refrigeration | 15 HP | 12.06% | 12.06% | \$550 | 6.8 |
| Estee Lauder | Hydronic Heating | 1.2 mmbtu | 10.71% (8) | 13.70% (8) | \$4,500 | 7.4 |
| Freeport Electric | Steam Heating | 2.9 mmbtu | 9.64% | 10.08% | \$4,900 | 7.0 |
| Lynbrook Library | Air Conditioning | 25 Ton | 9.90% | 11.63% | \$1,150 | 5.8 |
| | Air Conditioning | 25 Ton | 11.78% | 13.37% | \$1,150 | 7.9 |

| | | | | | | |
|-----------------|------------------|---------------|--------|--------|---------|------|
| Marriot Hotel | Dom. Hot-Water | 2.4/1.2 mmbtu | 8.28% | 8.28% | \$7,800 | 9.7 |
| Marriot Hotel | Air Conditioning | 50 Ton | 10.30% | 19.02% | \$2,000 | 1.2 |
| Marriot Hotel | Air Conditioning | 10 Ton | 10.44% | 19.15% | \$1,150 | 19.4 |
| Rohm & Hass | Air Conditioning | 7.5 Ton | 12.05% | 12.84% | \$576 | 4.2 |
| Quinnipiac Club | Steam Heating | 3.5 mmbtu | 11.04% | 14.68% | \$9,400 | 8.0 |
| Krinos Foods | Refrigeration | 10 HP | 10.27% | 10.27% | \$550 | 11.7 |

(1) Operational Months (approximately)

(2) Assume 1 gallon #2 Oil = \$2.00

(3) Assume 1 Therm Nat Gas = \$1.45

(4) Assume 1 KWH = \$0.15 (including all charges), Power Factor = 0.9%

(5) ROI calculation based on 1.2 mmbtu input

(6) ROI calculation based on RAW savings and individual compressor run-times because of the different compressor sizes within the unit. Actual Calculated savings for test period were \$1,713.

(7) Assumes IntelliCon Controls installed on all units, even though some boilers or air conditioners are only used as standby systems. Project cost could be reduced by not installing controls on standby equipment.

(8) Result from this location are not verifiable, due to heating system and data logging equipment problems.

Results of estimates of annual impact on number of cycles and emissions

| Parameter | Units | Cycles per hour | | Reduction due to control | |
|------------------|------------|-----------------|------|--------------------------|------|
| | | 3.2 | 1.2 | Total amount | % |
| Cycles | total/year | 15162 | 5686 | 9476 | 62.5 |
| Particulates (1) | gms/year | 117.7 | 70.1 | 47.6 | 40.4 |
| HC | gms/year | 28.7 | 19.7 | 9 | 31.4 |
| CO | gms/year | 2568 | 1355 | 1213 | 47.2 |
| NO3 | gms/year | 7079 | 7785 | -70 | -10 |

(1) Particulates in this table are measured using a heated filter in accordance with the EPA-5 method.

BNL performed a laboratory evaluation of the IntelliCon controls' impact on cycling rates and air pollutant emissions associated with startup and shutdown transients. BNL had previously established baseline studies in 1986 and 1990 that examined and documented the basic mechanisms affecting emissions based on burner improvements, as well as a comparison of steady-state versus cyclical operation. During startup and shutdown, there are elevated levels of emissions associated with incomplete combustion, including smoke, CO (carbon-monoxide) and

hydrocarbons. Reducing burner cycling rates will reduce the total amount of these emissions. The BNL analysis found that pollutants related to incomplete combustion (CO, HC and filterable particulates) are decreased with lower cycling rates derived from the operation of IntelliCon technology. NOx emissions, however, show a slight increase, as the burner operates longer in a fully hot condition. Newer boilers tend to show smaller increases in NOx when compared with older boilers. Results of one analysis, done for a simulated year, are shown in the following table.

Based on the results described above, carbon monoxide emissions are cut in half, particulates are cut by 40% and hydrocarbons are cut by a little over 30%. As more homes use IntelliCon technology, significant reductions in emissions can be achieved. For example, one million homes using IntelliCon technology with an annual fuel consumption of 1,000 gallons of # 2 heating oil, would reduce filterable particulates and hydrocarbons going into the atmosphere somewhere in the range of 1,000 – 2,000 tons per year.

This exhaustive study provides clear and repeatable evidence that the IntelliCon line of controls reduces energy consumption and systems cycles while saving energy dollars and significantly cutting pollution.