University of South Australia

SUMMARY REPORT:

Development of an Evaluation Process for In Situ Measurement of the Impact of Ducting on Air Conditioning Systems

Prepared for:
Ductair Pty. Ltd.
22 Cavan Rd
Dry Creek, SA 5094
Attention: Reuben Kelley
Telephone: (08) 8162 9222
Email: reubenk@ductair.com.au

Prepared by:
Dr Martin Belusko
Barbara Hardy Institute
Sustainable Energy Centre
University of South Australia
Telephone: +618 8302 3767
Facsimile: +618 8302 3380
Email: martin.belusko@unisa.edu.au

Date of issue: 20 January 2012

Report: In situ ducting evaluation summary.pdf

Important Notice

Report Disclaimer

SUMMARY

Minimum Energy Performance Standards (MEPS) for air conditioning units has been in place for more than a decade, providing a guide as to the energy demand from these units. However, ducting is not considered in this process and as a result the actual energy demand from installed air conditioners may be significantly different to that anticipated by the performance standard. In recent times, The Australian Building Codes Board has increased the energy efficiency requirements of ducting in the Building Code of Australia. Research has been completed investigating the impact of existing ducting systems on the energy usage of installed air conditioners in Adelaide.

This project measured the actual thermal losses of installed ducted air conditioning systems due to air leakage and thermal leakage through the ducting. The study investigated the significance of ducting on the energy usage of air conditioners, with a focus on older systems. A number of systems were investigated ranging from 4 to 25 years of age. The results showed that air leakage was significant with most of the systems tested. Thermal leakage through the ducting was also found to be significant in all cases with the average heat losses 5 times that of the Energy Smart™ duct. Overall, the age of the unit marginally affected the measured thermal losses, indicating that the majority of systems have ducting systems with high thermal losses.

From previous research, the Energy Smart™ duct minimises the thermal leakage in the duct, resulting in a negligible impact on the energy efficiency and capacity of an air conditioning system. This research estimated the electricity usage of an inverter air conditioner in a typical Adelaide house. Relative to using Energy Smart™ duct, the thermal leakage of the measured ducted systems translated to an estimated increase in annual electricity usage of 39%. Applying the typical measured air leakage, the estimated increase in electricity usage was found to be 42%. Applying previous and current star ratings this is equivalent to degrading a 6 star MEPS rated air conditioner to 1.5 stars. Furthermore, the impact of older ducting systems is to degrade the capacity of the air conditioner by at least 1.81 times, and more during peak summer periods. As a result, the estimated number of hours existing air conditioners exceed peak capacity is 48 hours.

A number of the houses tested were upgraded with the Energy Smart™ System, and retested. The tests achieved negligible air leakage and the thermal leakage was significantly reduced and matched the anticipated reduction. Therefore replacing an existing ducted system with the Energy Smart™ System can typically achieve a reduction in electricity usage and associated greenhouse gas emissions by the air conditioner by 45%, typically 857 kg of CO_{2e}/year. Correspondingly, the capacity of the air conditioner can be increased by at least 1.81 times. Furthermore, the number of hours peak capacity is exceeded is only 2 hours per year compared to the 48 hours as stated earlier. On this basis, the Energy Smart™ System has a negligible degradation of the energy efficiency, and capacity of the air conditioner unit.

A first generation evaluation process was developed capable of estimating the expected percentage savings in electricity usage, greenhouse gas emissions and energy cost of an air conditioner, through upgrading the ducting system to an Energy Smart™ System. The process includes a method for measurement and estimating the expected savings. The process also incorporates quality control measures to ensure that expected savings can be achieved.

Overall, the majority of existing ducted systems are likely to significantly degrade the efficiency and capacity of the air conditioner. Application of the evaluation process and appropriate upgrading of existing ducting system to an Energy Smart™ System can dramatically and reliably reduce air conditioning energy usage, greenhouse gas emissions and peak power demand as well as increase system capacity.