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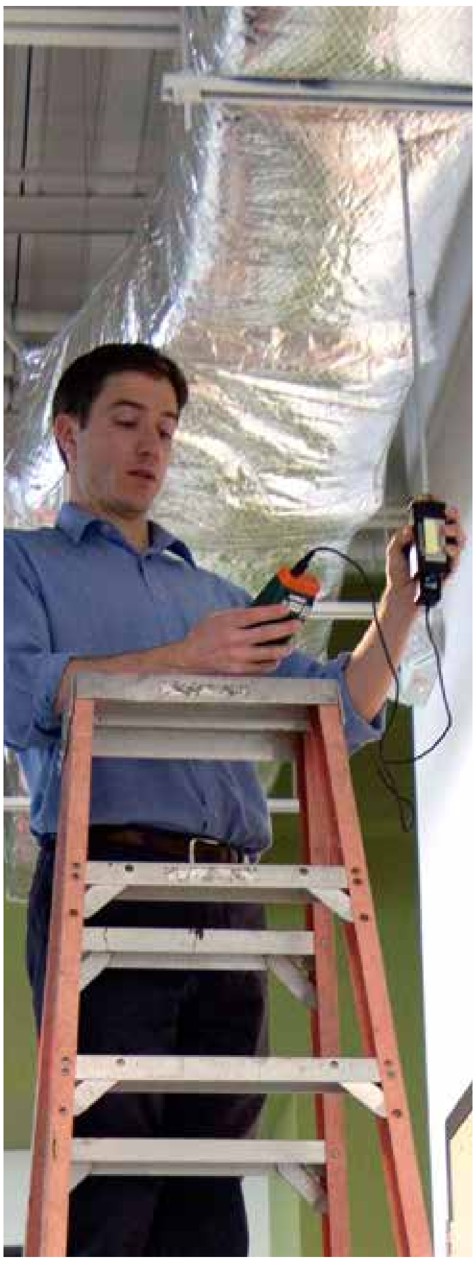
A GUIDE FOR EFFICIENCY PROGRAM LEADERS AND ENERGY ENGINEERS

Implement and commission demand control ventilation to capture significant energy savings

SUMMARY OF FINDINGS FROM A FIELD STUDY OF DCV SYSTEM PERFORMANCE



Demand control ventilation systems use sensors—generally either CO_2 or occupancy sensors—to detect the actual number of people in an area, and then supply only as much ventilation air as is needed at a given time. Results from a field study of DCV systems in Minnesota show that there are cost-effective opportunities in cold climates for utility conservation improvement programs to capture substantial building energy savings through programs to implement DCV.

While DCV has been in use for over 20 years and its impacts well demonstrated, little is known about its performance in real buildings, especially in complex multizone systems. Our field study was designed to fill this knowledge gap.

PERFORMANCE

First, we broadly characterized the use of DCV in Minnesota through observation of 96 different systems and detailed monitoring of a sample of six. We discovered that control sequences varied greatly; there was no single standard practice, let alone best practice. Designs ranged from systems that ensured indoor air quality but did not save energy, to those that aggressively saved energy but at the expense of IAQ. There is room here for CIPs to improve standard practice.

Our detailed monitoring of six systems—all large VAV—covered all seasons of the year, and found the median annual savings from DCV to be $0.50 per cfm of design outside air, with OA being the biggest driver of savings. This and other median results are in Table 1. Note that results varied, up to $1.14/cfm for a system using CO_2 and occupancy sensors. Our results show that savings from DCV are cost-effective and that building owners can afford to spend up to $7,000 per 1,000 cfm[1], suggesting simple paybacks as low as 4–5 years, depending on building size.

Table 1. Summary of key energy savings results.

MEDIAN ENERGY SAVINGS FROM DCV			
	therms	kWh	$
Per ft² of area served	0.11	0.21	$0.09
Per cfm of design OA	0.63	0.96	$0.50

We recommissioned each system after monitoring performance for several months. In half of the cases, there was a significant increase in savings. In those half, savings increased 54% on average (or $0.43/cfm). Recommissioning also appears to be highly cost-effective with paybacks of only about one year.

DCV FOR PROGRAMS

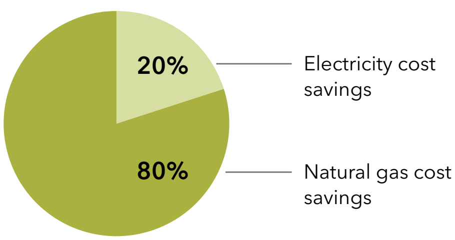
While there are CIPs in Minnesota that actively address implementing DCV, our results suggest significant opportunity to expand and improve efficiency programs promoting this technology.

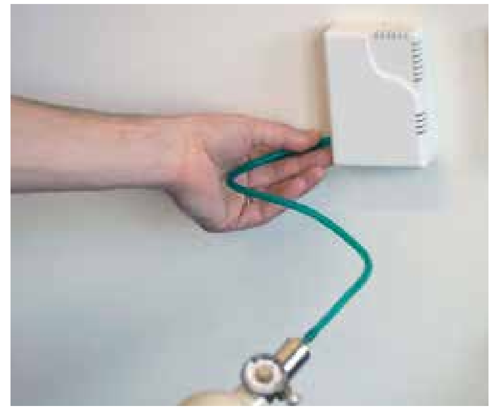
[1]Assumes that most OA is controlled.

OPPORTUNITY #1: **NEW DCV SYSTEMS AND SYSTEM RETROFITS**

All utilities should consider offering an incentive program for implementing DCV in both new and retrofit situations. We recommend a prescriptive offering that establishes incentives based on the rate of design OA in the system—a better indicator than tonnage—and goes beyond just packaged equipment (see the savings documented in our full report). Since DCV primarily saves heating energy, heating fuel type may be an important consideration depending on the program target. Savings can be maximized from DCV by proper setting of an OA lower limit; a separate schedule for the OA damper; and third party commissioning. The first two could be program requirements; bonus incentives could be given for the third.

DCV SAVINGS BY FUEL TYPE
(for sampled buildings)





SELECTED EFFICIENCY PROGRAMS PROVIDING INCENTIVES FOR DCV	
Focus on Energy	Incentives for installing DCV to AHU (per cfm) or for single zone RTU (per ton).
Xcel Energy	Electric incentive for rooftop unit economizer controls (per ton), requiring DCV.
DTE Energy	Gas incentives for installing CO_2-based DCV (per ft^2); retrofit only.
Manitoba Hydro	Incentives for CO_2-based DCV, vary by fuel type. Constraints on building occupancy.

OPPORTUNITY #2: **RECOMMISSIONING**

Existing DCV systems should be targeted for improvement by recommissioning, retrocommissioning, and building tune-up programs. There is evidence that many existing systems are not performing optimally, and the economics of recommissioning such systems are robust. A brief scoping-level look at BAS data could be included in program outreach to maximize cost-effectiveness; it can be quick and easy to determine whether DCV is working at all with a glance at key data. Implementers can follow a very detailed recommissioning checklist given in *Appendix C* of the full report.

OPPORTUNITY #3: **VENTILATION REDESIGN**

Substantial savings can be captured through changes to OA in a building whether DCV is present or not. Redesign of OA operation represents an entirely new program offering. Savings potential exists because of:

- New mechanical codes with lower rates
- Ventilation not designed to code
- Unreasonably high safety factors
- Better current occupant counts
- Airflow measurement problems
- Outside air damper modulation issues
- OA dampers are often not scheduled independently

OPPORTUNITY #4: **MORE EFFECTIVE TRADE ALLIES**

Control implementation varied dramatically in the systems we studied, suggesting an opportunity for additional training for trade allies (contractors, engineers, energy consultants, recommissioning agents). This training should cover DCV design requirements as well as hands-on operation covering different CO_2 sensor and BAS technologies available, measurement of CO_2 concentrations, sensor calibration, and BAS interpretation. Trade allies also need to be made fully aware of the potential impact of DCV. We cover many of the aspects above in our full report; we've also developed a 60-minute how-to video specifically to meet this training need.

FOR MORE INFORMATION

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