The Case for Individual Temperature Control

System Designers need it

System designers need individual temperature control to cope with actual (not design) loads. Actual loads are random in use and random in location. When loads are random, the only way to ensure comfort is with individual temperature control.

Examples of random loads are:

- **Interior loads**
  - **Lights** are random in use. Because of good training or motion sensors, lights are often turned off when leaving the office.
  - **Equipment** is both random in use and in location. It's hard to predict where equipment will be and according to the 2009 ASHRAE Fundamentals Handbook (p18.9), usage diversity ranges between 37 and 78% of peak electrical load.
  - **People** are random in location with meetings, breaks, toilet visits, sales calls, sick time and vacations. Occupancy diversity averages around 60%.
- **Exterior loads** are both random in use and in location. Many things affect them including use of drapes and blinds and various moving shadows across the face of the building.

With actual loads this random, how can a designer at least provide an even temperature? The answer is many small zones. Many small zones will also provide the comfort of individual temperature control.

Building Owners need it

Building people need individual temperature control to resolve their worst problem. Year after year, studies have shown that their worst problem is temperature.

IFMA (International Facility Management Association) 'Top 10 Office Complaints' Survey:

2009	1. It's Too Cold 2. It's Too Hot
2003	1. It's Too Cold 2. It's Too Hot
1997	1. It's Too Cold 2. It's Too Hot
1991	1. It's Too Hot 2. It's Too Cold

BOMA (Building Owners and Managers Association) backs this up. Their study with the Urban Land Institute defines the top three tenants' requirements and preferences as:

1. comfortable temperature;
2. indoor air quality; and
3. acoustics and noise.

"Least Satisfied" of the three "Most Important Features" is comfortable temperatures. What Office Tenants Want, 1999. BOMA.

With reports like these, can you afford to ignore individual temperature control?

Occupants expect it

Office occupants expect individual temperature control because they have it everywhere else. They have it in their:

- Homes
- Automobiles
- Hotels
- Hospitals…and even
- Airplanes

How would you feel about a hotel room where your thermostat was in the next room? In today's world individual temperature control is an expected part of the comfort package.

Random Loads

Prove to yourself that actual loads in your city are random and need individual temperature control. Just look up into your multiple story buildings and examine the pattern of lights in the occupied offices, the drapes and blinds and the shadows. If you have time, watch them move. You will see how random the actual loads are and why individual temperature control is necessary for you to provide comfort.

For dynamic needs like these, the only choice for optimum comfort is individual temperature control. Here's why. With multi-room zones, either people are uncomfortable or energy is wasted – sometimes both. When the multi-room zone thermostat is in an unoccupied office, energy is used over-supplying empty offices. And when the office with the thermostat is empty, the people in the occupied office will be uncomfortable. Averaging is unsatisfactory. Almost nobody wins.

See page 2 for Beyond Comfort – Other Benefits of Individual Temperature Control

Beyond Comfort – Other Benefits of Individual Temperature Control

Save energy because individual temperature control prevents overcooling when spaces are unoccupied. People come and go resulting in occupancy diversity. Occupancy diversity averages 60-70% in most buildings.

Using individual temperature control to prevent overcooling during the 30-40% of the time when spaces are unoccupied should result in a 30-40% energy saving.

This has been proven by several energy studies. One study of a building in Nashville, TN resulted in a saving of 29% for perimeter spaces and 40% in the interior.

Increase productivity of office workers because with individual temperature control they are comfortable and not distracted.

Most people will concede that:

1. Office workers are expensive,
2. Eliminating distractions reduces office cost,
3. Individual temperature control eliminates a major distraction.

While there is agreement that individual temperature control will improve productivity, estimates of the amount have ranged from 2% to 20%. Actual measurement by Carnegie Mellon University under direction from the National Science Foundation proved a 2-3% increase in productivity due to individual temperature control.

Rent un-leased space with individual temperature control. Offer more thermostats per square foot as part of the leasing package. A comparison of your building to that of your neighbors might look like this:

	sqft per Thermostat
Building X - 1 Air handling unit per floor. Constant volume system	5000
Building Y - 1 VAV box for six offices	600
Your building – Individual Temperature Control	100

Use more thermostats to sell prospective tenants on the comfort of your building.

Individual temperature control: Short paybacks offset any additional costs.
Most likely there will be no additional cost for individual temperature control. If there is any additional cost of individual temperature control the payback can be calculated many ways. Each payback is short, even with an assumed additional cost of as much as $1/sqft.

Save energy – Energy payback is two years even when additional installed costs are $1/sqft, if the same 120sqft space is not over conditioned during unoccupied times of a business day. This is base on a power cost of $.10/kWh and a savings of 3532 kWh/year (shown by an independent study comparing individual temperature control and multi-room zones where six interior offices are occupied six hours of a nine hour day. Longer business days result in larger savings and shorter paybacks).

Increase productivity– When a $30,000/year person occupies 120sqft of that space, improved people efficiency of just sixty seconds each day will pay back additional cost assumed as high as $1/sqft in two years. Sixty seconds is less than the time it takes to complain about the temperature or take off a jacket.

Rent un-leased space – If individual temperature control adds as much as $1/sqft to the cost of a multi-room zone, payback is 37 days when an otherwise un-leased space is rented at $10/sqft (low in most cities).

Separately, each of these can pay back any additional cost of individual temperature control in a short time. However, your client may have ***paybacks from all three simultaneously***.

Comfort vs. cost:
All people can agree that individual temperature control increases occupant comfort and satisfaction. When you look at the paybacks that occur year after year in the operating budget, any increased installation costs are easily offset. Why not give your client a better building by designing for both comfort and short operating paybacks.

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