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Title: Giving Occupants Control of their Thermal Comfort to Enable Deep HVAC Savings

Abstract: Approximately 30-40 percent of commercial building energy use is from HVAC systems designed to maintain indoor environments within a narrow range of temperatures considered to be comfortable as prescribed by ASHRAE Standard 55 (Indoor Environment and Human Comfort). However, decades of thermal comfort research has shown great variance in people's thermal preferences, a primary reason that conventional HVAC systems are failing to provide satisfactory thermal comfort for many building occupants. An emerging solution is giving occupants individual control of their environment, for example, using apps linked to HVAC controls, low-energy 'personal comfort systems,' and Internet-of-Things (IoT) connected devices, with a goal of improving comfort while also reducing HVAC energy use. This poster will highlight key research findings on innovative approaches to control commercial building HVAC conducted at UC Berkeley's Center for the Built Environment. Through a series of simulations, laboratory studies and field studies, CBE has demonstrated that giving building occupants individualized control of their thermal comfort, while widening the range of setpoint temperatures of HVAC systems, may provide significant energy savings while providing equivalent or improved levels of comfort. The poster presentation will include recent innovations in personal comfort devices, emerging technologies designed to promote bespoke thermal environments, and the advantages of overlooked low-energy comfort solutions such as fans. More specifically: * Building science research that led to the development of Comfy, an app that lets office occupants drive the HVAC system according to their temperature preferences. * Results of a 6-month field study showing significant comfort improvements from office chair prototypes with integrated heating, cooling and sensors. * Research and an online tool that estimates HVAC energy savings from wider temperature ranges. * How the 'Internet of Things' and distributed sensing will lead to innovations in thermal comfort using occupant-in-the-loop HVAC control. * Revisions to ASHRAE Standard 55 (Indoor Environment and Human Comfort) incentivizing the use of personal comfort systems by occupants. The overarching goal is to move away from the conventional engineering practice of providing narrowly-defined static environments â€“ which carries a heavy energy penalty - towards creating places that permit moderate variations in thermal environments but give occupants control of their spaces. This approach allows new and exciting design paradigms that shift focus from thermal neutrality to thermal delight and afford connections to emerging themes like biophilia in the built environment.