Get with the Program: Methods of engaging occupants for energy-conscious behavior.

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ABSTRACT

To meet state legislation guidelines for clean and efficient building operations, every effort to reduce energy consumption is critical, and building occupants can become increasingly valuable players in building operations. Occupant engagement interventions offer a low-cost behavioral solution to reducing energy use in buildings while also maintaining comfort and productivity. To meet these lofty goals and recent state legislation, our team designed an occupant engagement campaign that uses behavioral interventions to decrease energy use, promote sustainable advocacy, and enhance the health and well-being of building occupants.

After working with the facilities department of a large land grant university, we identified target buildings to engage with based on metered data, surveys and interviews, post occupancy comfort evaluations, and occupant typologies to determine the most effective engagement strategies for those within the program's reach. Some of these interventions include training for building occupants, seasonal newsletters, curated in-person activities, timely reminders, frequent check-ins, as well as technological interventions that mitigate power during non-business hours. These interventions over the last three years have contributed to the energy savings and building culture needed to achieve the stringent climate and efficiency goals that will come into effect through state legislated buildings performance standards in the coming years.

This paper will outline behavior-based program strategies and approaches used in a small-scale university campus's energy and comfort engagement campaign to illustrate the opportunities for energy savings made available through direct behavioral interventions and communications with building occupants, as well as the impacts of behavior-based programs when considering legislation-driven building performance standards today.

Introduction

The built environment—meaning the structures, features, and facilities viewed collectively as the areas in which we live and work—must transition to clean, affordable, and reliable energy systems while engaging individuals, as well as small and large organizations, to participate in resource education and conservation—to steward them for ourselves and those who succeed us. This has been recognized globally, most notably through the United Nations Sustainable Development Goals, which have been developed as a call for action to promote values of prosperity and sustainability while not compromising on global equity (Nations 2015). As these goals point out, particularly Goal 7 on *Affordable and Clean Energy*, Goal 11 on *Sustainable Cities and Communities*, and Goal 13 on *Climate Action*, buildings (including how they operate and how the people within them use the building) play a significant role in the energy our planet consumes and the quality of environment in which we live. Building owners

and operators need to ensure that building energy use and emissions are lowered, which in turn saves money, while also making building occupants more comfortable people.

Impact of State Legislation

In the United States, whole regions, states, and municipalities have adopted progressively strict building energy codes highlighting efficient building performance, reduced greenhouse gas emissions (GHG) and standardizing metrics supporting clean building environments and healthy building occupants. On a legislative front, different legislative bodies have responded with their own approach to buildings and infrastructure to maintain and construct the built environment that carries us into the future. For example, establishing codified standards for building performance and clean operations are a critical component of meeting Washington state's energy efficiency goals. Washington State Energy Code (WSEC) is one of the most stringent and progressive energy code models in the nation, which is requiring building owners, operators, and developers to seek innovative ways to enhance building electric efficiency, decarbonize, and limit pollution through both prescriptive and performance-based building codes. In Washington state, the building sector (industrial, commercial, residential) is the state's second largest carbon polluter, accounting for roughly a quarter of statewide greenhouse gas emissions (Sandlin 2021). In response to this, significant pieces of legislation have been ratified.

The Clean Buildings Performance Standard (CBPS), developed by the Washington State Department of Commerce, develops regulations that encourage greater energy efficiency in all aspects of new and existing buildings. This legislation focuses on reducing greenhouse gas emissions from the built environment by putting a cap on energy consumption for buildings over 50,000 square feet. Compiling building information and data for resources and energy end-uses can be challenging if building control systems are not up to date with modern standards. On many university campuses, the facilities departments often do not have the disposable budget (without donations) to update, renovate, or operate the increasing building stock, leading to millions of kWh potentially wasted. This issue is compounded as municipalities adopt stringent energy codes and standards which require lower energy use intensity (EUI) for buildings. One current solution to this issue is to defer maintenance of buildings, which compromises the overall quality of service to the public, their comfort, and energy implications of many buildings. Without baseline data, accurate metering, and the continual need to defer maintenance on buildings, energy efficiency goals are difficult to reach by state and federal buildings and university facility managers alike.

The goals of these performance standards are to lower costs and pollution from commercial buildings' fossil fuel consumption and operations and to improve the energy performance of the built environment. Despite various entities providing resources, support, and information regarding legislation, owners, operators, and members of the construction industry are not equipped to make the necessary changes to meet the strict guidelines There is a need to better understand these challenges through measurement of the attitudes, perceptions, and opinions of industry players affected by this legislation, as well as the operators and occupants of affected buildings to seek insights that will help define appropriate solutions.

Role of the Occupant

Building occupants play a large role in helping or hindering a building from meeting its performance goals. High performance buildings that incorporate emerging or sustainable

technologies require significant occupant engagement in order to operate as modelled, but occupants themselves may not know how their behaviors impact the overall performance if not trained or given feedback (Brown et al. 2009; Bull and Janda 2017; Janda 2014).

Additionally, energy consumed by appliances and equipment plugged into electrical outlets, or Plug and Process Loads (PPLs), can account for nearly a third of office electrical use, and in buildings with already efficient lighting and HVAC systems, it can be upwards of 50 percent (GSA 2019; Sheppy et al. 2013). Building occupants, and the ways they interact with their environment, are typically the contributors to all building PPLs. As PPL percentages rise in total energy consumption of a building due to increasing performance efficiency, occupant-focused interventions become a critical piece of the built environment's comfort and total energy performance.

The following section defines occupant engagement programs, as well as several proven methods to increase pro-environmental and energy efficient behaviors through social-behavioral occupant interventions. We then present the rationale and development of our case study engagement program, as well as the program's approach and limitations. Lastly, we conclude with an overall discussion on strategies and occupant-focused engagement opportunities that leverage behavior change to reduce electricity consumption.

What are Occupant Engagement Programs? Within the context of building operation and maintenance, a tenant or an occupant engagement program is defined as a campaign or social intervention that encourages positive behavior and sustainable strategies to achieve a common goal (Pivo 2010; Ross and Drehobl 2016; SBER 2012). In high-performance or certified buildings with strict energy requirements, engaging occupants through education, behavioral change, and technical intervention is important to reaching and maintaining energy efficiency. Typical goals of an occupant engagement program are to reduce operational costs by increasing efficient use of resources (Boks, Berker, and Valle 2018).

Policy makers, building owners, and building operation professionals historically overlooked the power and opportunity presented by occupants who engage with their building more directly. Occupant engagement programs may seem challenging to implement when there are other substantial capital improvements and automation options available to reduce energy use. When other measures are already in place to reduce usage (or those other measures are not possible because of existing infrastructure, costs, or otherwise), customized, flexible, and innovative occupant engagement becomes an important part of efficiency planning for codified performance requirements. Engaging with building occupants is a relatively underutilized, low-impact, and effective energy reduction strategy that either occupants or building operators can champion to contribute to overall building efficiency measures. More specifically, occupant engagement programs can be implemented to reduce energy or resource use, develop a building community, encourage healthy lifestyles and wellness in occupants, and for other purposes.

Understanding Occupant Behaviors in Buildings. There are many models of behavior change that help understand how occupants might behave in buildings, and in turn, how to change their behaviors to those we might desire. For instance, Michie, Stralen and West's COM-B model for behavior change points to capability (C), opportunity (O), and motivation (M) as three critical factors needed for changing behavior (B). This model enables people to understand the context of behaviors and what types of interventions can be used to effectively shift behaviors. COM-B is commonly used in conjunction with the behavior change wheel (BCW), which outlines several methods for intervention including education, training, persuasion, restrictions, environmental

restructuring, and more. This framework, and many of the behavior change intervention tactics cited, were used to understand how to best engage with building occupants (Michie, van Stralen, and West 2011). It is important to note that our occupant engagement program specifically focuses on the "M" (or motivation) aspect of this COM-B framework, and respective intervention strategies, largely due to budget limitations and the inability to make capital improvements through our program. For example, because of the lack of control of building interfaces – and the lack of capability (C) and opportunity (O) in many buildings – behavior change was targeted through motivation (M). The next section further defines motivation, behavior change, and different interventions that can be used to drive change.

Motivating Behavior Change

Oftentimes, engagement programs are employee health and productivity-focused to deliver lifestyle benefits that improve worker wellness, the incentive for which is fairly intuitive; however, if occupants do not feel responsible for, or are not paying for their direct energy use, they may not be motivated to conserve energy in the same ways they may at home (Frederiks, Stenner, and Hobman 2015; Staddon et al. 2016). Depending on the type of program and methods of execution, many building owners or operators can find it challenging to implement if occupants lack motivation to reduce personal usage, often due to their own disconnect from utility bills (Schantz and Langner 2016).With each stakeholder interested in their own needed outcomes, it is critical that an engagement program considers and is inclusive of all perspectives, to achieve a set goal. Removing barriers for participation and applying user-relevant techniques will result in a higher chance of success of an engagement program.

While some programs will leverage relationships and engage with building occupants to achieve goals, proficient social-based occupant engagement programs utilize both in-person and virtual strategies (Colligan, Ruiz, and Day 2023; Gao et al. 2022). This community involvement could include engagement on topics around health, environmental quality (including indoor environmental qualities such as air quality, temperature, etc.), and energy efficiency (Day and Ruiz 2020). Within operations of a standard program, tactics could include online training courses, seminars, and engagement activities that teach occupants how to save resources (Day and Gunderson 2015). When implementing occupant engagement opportunities, it can also be helpful for occupants to learn how their behaviors may impact the environment and their own health. These personal connections also often increase exchange, response, and exposure of dispersed materials related to the individual plan.

In the case study discussed later in this paper, person-to-person relationships are heavily leveraged to motivate building occupants to participate in sustainability initiatives and develop social norms that steer occupant behaviors in a university setting.

Understanding Motivations. Many studies argue the importance of understanding the determinants of individual occupant motivations and the impact of such behaviors on the performance of a building (Azar and Menassa 2015; Gandhi and Brager 2016; Happle, Fonseca, and Schlueter 2018; Kim, Schiavon, and Brager 2018; Zhao et al. 2015), however, methods of truly understanding occupant behaviors from a motivational standpoint are not well established. Intrinsic motivation has been classically defined as the individual performing certain behaviors because they are enjoyable to the individual and they view the action as personally pleasing (APA 2020b). For example, something that an individual may be intrinsically motivated to do is opening their blinds to allow a nice view. Extrinsic motivation is defined as completing an action

because it leads to a specific outcome and is otherwise associated with necessity, whether it be positive or (Deci, Koestner, and Ryan 1999; APA 2020a) negative. Conceptual frameworks such as the motivation/opportunity/ability (MOA) approach exist to explain how individual occupant personality and type affect user behaviors but are not discussed at length in this paper. It should be mentioned that encouraging to the point of exhaustion or overwhelming occupants with directions could negatively impact the intended behavior changes.

While individually discovering, leveraging, and balancing occupant motivations in one or more buildings would be a challenge, understanding basic motivations behind common human-building interactions—such as why someone would turn on a space heater or close their blinds—is universal. The same thinking applies to the main driving factors of comfort: lighting, privacy or distraction concerns, or intrinsic motivation to have a natural view. It is one thing to understand occupant behavior, or even why they interact with their environment, but to carefully steer those choices in a direction that satisfies a larger sustainability goal, is important to identify patterns in occupant behaviors and address anything that is not supporting those goals.

If training is provided on how to operate their environments and conserve energy, occupants are more likely to be satisfied, due to their ability to make themselves comfortable when needed (Brown and Cole 2009; Day and Gunderson 2015). Furthermore, other contextual factors such as interior design and limiting social constraints may have an effect on an occupant's ability to make adaptive, or energy saving, changes (O'Brien and Gunay 2014). Conducting building surveys or interviews, observing occupant behaviors, and directly speaking with people in a building can provide insights on how and why occupants are behaving the way they are. Collecting feedback on and addressing areas of concern from occupants not only helps a facility manager better understand those they are hoping to serve but creates a dialogue and an opportunity for further discussions between operators and occupants.

Creating a Program to Influence Occupant Behaviors in Buildings

The first step in developing a social engagement campaign within a building is identifying where there are inefficiencies and common issues to determine how and what the goals of the campaign should be. *Do occupants know how to manage their own comfort? Do they have the power to do so? Do they understand what to do or who to go to in case of facility issue?* Despite the rise in number of high-performance buildings that naturally have lower energy usage, it is often still necessary to engage occupants and train them on the interfaces they must interact with that (if used correctly) allow for higher levels of both occupant comfort and energy savings (Day, Moore, and Ruiz 2020). Facility managers are often aware of primary issues in their buildings if there are any forms of feedback from occupants established, but it is unlikely that they know about every problem or that every issue is reported to them in the first place. An effective approach to better understand what is happening in any given building is by conducting post occupancy evaluations that look at occupant comfort, perceptions of their energy use, and relationship with their building interfaces, then using that data to identify gaps in knowledge.

Even if occupants have little to no control over their environments, either through automated temperature control, lighting or otherwise, informing them of that reality and why the strategy is used goes a long way. Transparency between building operation decisions and occupants can help building users contextualize why their environment is the way it is, regardless of how they feel about it. Asking occupants directly what they want to know about how their building operates may not result in very fruitful discussions, as the likelihood they

understand how said building works is low, unless they have previous experience in facility management or the building industry.

Role of Education. There are several pre-existing frameworks for ways of interacting with and training occupants (Karatas, Menassa, and Stoiko 2015; Karatas, Stoiko, and Menassa 2016), developing educational content for building-users (Day 2014; Konstantakopoulos et al. 2019; Steinberg et al. 2009), as well as for building professionals (BOC 2020; Brizendine et al. 2012; Price 2006; Putnam and Mulak 2001), all of which offer unique approaches to educating individuals about the built environment. The goal for building occupant education is to provide easy-to-understand content that educates occupants on how and why their building works around them, so that they can better understand or contextualize their role in building system operation and building performance.

As an example, tactics within an occupant engagement plan could include displaying a variety of ways to save energy or water and how to contribute to established resource management goals, through activities like seminars, online training courses, and engaging workshops. Occupants could also learn sustainable behaviors and associated impacts on the environment, health, utility costs, and about the surrounding community at building events or more social settings. Making these activities and engagement opportunities accessible to all building occupants, and available as a resource later, is another way to ensure that the campaign materials reach as many people as intended. Ideally, because of a successful program, occupants will take lessons and tools learned in their experience and implement sustainable behaviors in their own homes, and other work environments, promoting energy efficient habits outside the initial reach of the engagement program.

As many occupant engagement programs are educationally focused, understanding the sometimes-complex ways that people already perceive their environment is an important consideration when developing a curriculum for a campaign. Sympathizing with where occupants are coming from, potentially reshaping their perceptions based on environmental processes they may not have formerly understood, and doing so with care, is important in managing an occupant and operator relationship or when developing an occupant engagement strategy (Ruiz et al. 2022). Managing perceptions of how things work in their environments is important. The less occupants are aware of, the faster they establish behaviors or habits to deal with what they deem as unsatisfactory, whether the operator hears about it or not. Although some studies show that employees with higher educational levels will be more interested in contributing to environmental initiatives (Torgler and Garcia-Valinas 2007) and in receiving training courses (Lynch and Black 1998), it need not be a prerequisite for occupant education. Often, people will require a sense of purposeful learning, as well as an understanding how the new concept will benefit them in some way, to dedicate time, resources, or attention to a cause (Day, 2014). With that consideration, all material and educational content should be accessible to all knowledge, skill, and comprehension levels.

Many systems related to the effective operation of a building, district, or campus can be challenging to relate to the experience of an individual occupant. For this reason, decisions made by building operators and facility managers can have an adverse effect on the comfort of a staff member, resulting in a counter-intuitive effort to regain control of one's space. The goal of education is to explain the role of the occupant within the greater system, to inform them of when and why changes might occur, and to offer low-energy solutions to maintaining one's comfort and well-being. Increasing the ability for the user to comprehend what the benefits of energy-efficient behavior are to them will help reinforce the importance of making such changes.

It is the job of an engagement program coordinator to provide best practice behaviors, reasonable explanations as to why certain behaviors are preferred, and communicate common messaging to all participants of an engagement program so that everyone can be on the same page to make the space as comfortable as possible for the occupant, while reducing energy consumption for the organization.

Role of Comparative Feedback. Using comparative feedback is a strategy of engagement that provides occupants with easy-to-understand equivalents that reference their energy consumption metrics and compares that information to historical data, such as the conversion of energy usage in kWh to the number of smartphones charged (EPA 2018). An example of comparative feedback could be a building operator identifying someone using a space heater and equating their individual energy use from heating their singular office to a typical household's energy use. There have been instances where the implemented feedback program does not create long term behavior improvements, but the method has been shown to have short-term benefits for improving energy-efficient behavior and campaign interest. Although comparative feedback methods can raise awareness of energy metrics for occupants, understanding and receiving information alone often does not provide enough incentive to change. Shaming occupants by making them feel poorly or bad about what they need to do to be comfortable may backfire if applied with aggression, malintent, or frequency. When users or occupants can fully understand the implications, it helps to reinforce the importance of changed behavior.

Taking comparative feedback a step further, using social nudges, encouraging discussion among occupants, and relying on organizational norms can help influence behavior change through leverage of social feedback. In application, an energy campaign could investigate the variety of desktop electronics used within their organization and compare the highest and lowest users of electricity to standard household usage. Publishing these findings anonymously but broadly may help individuals contextualize their behaviors as compared to others. According to Paone and Bacher, when occupants can compare their individual use to that of a greater social network, their energy use reductions are greatly increased (Paone and Bacher 2018).

For the most success, an engagement program needs to reach all members of a community with consistent and firm communication from a respected and recognized source. If not established intentionally as a part of an organizational structure, in part with that organization's leadership, the development and implementation of such a campaign may be more difficult to establish.

Occupant engagement campaigns or employee-led sustainability programs (depending on the size and scale of organizations) can often fit nicely into the duties of human resources, marketing professionals, environmental health, and safety departments, and are often within the duties of various sustainability committees that cover more than one responsible category of people. When developing a social engagement campaign, one must consider where the efforts are best focused, and where any messaging is coming from. The structure of any occupant engagement program must be well suited to a company's structure, fit within existing organizational communication channels, and not create unnecessary burden on individuals who may or may not be aware of the motivations of such responsibilities.

Examples of Occupant Engagement on a University Campus

This section documents the approach implemented in a specially curated occupant engagement program at a land grant university in Washington, USA. The *Energy and Comfort*

campaign used at this institution was developed to address utility use reduction goals, overarching budget concerns, changes in occupancy and operations due to pandemic impacts, as well as a historic lack of investment in building controls and comfort measures. The university's Facilities Services department reached out to the authors of this paper in 2019 to evaluate how savings could be achieved through behavioral and technical interventions in campus-managed buildings. Since capital improvements and infrastructure investments take time to be implemented in academia, the university was interested in behavioral approaches to capture savings anywhere they could on the ground—while they fought for funding to make more substantial infrastructure and energy grid improvements with the state. Because of ongoing fiscal challenges, much of the university-owned building stock has accrued extensive deferred maintenance, comfort complaints, and generally poor conditions; the facilities team recognized they did not have the bandwidth, nor the resources, to address occupant complaints themselves.

With recent state legislation that requires all commercial buildings over 50,000 square feet to report energy and emissions within a codified standard, the university must make significant infrastructure improvements and reductions in most facilities statewide. The *Energy and Comfort* Campaign was developed as a pilot study to address occupant interactions with buildings to foster a community of energy efficient occupants who are mindful of their behaviors, how they impact others, and how they impact the overall energy profile of the institution. The needs of the program were informed by a system-wide survey of all university staff, faculty, and students, as well as over 30 interviews with occupants of targeted buildings (Day and Ruiz 2020).

The campaign was developed by the authors of this paper to address these needs and is operated today on a growing scale by research staff, students, and departmental representatives, using both social-behavioral and technical approaches. While not system or organization wide, significant savings have been captured within a selected number of buildings on campus and expands annually as the team learns more about the best ways to go about in-person interactions. This campaign was conceived in the early months of the COVID-19 pandemic work-from-home guidelines, and has been curated since, in the active and post-covid workplace environments where occupant behaviors and occupancy has dramatically shifted. Eventually, it is the intention of the authors to scale this approach system-wide and to integrate campaign principles into the organizational goals of the institution as a unified community norm and to establish a new understanding of occupant behavior and consumption for new and existing construction. The featured occupant engagement program features two hemispheres of intervention: both behavioral and semi-behavioral interventions to reduce electricity use from PPLs.

Semi-Behavioral Intervention Strategies

Timed surge protectors, referred to as 'smart' or 'advanced' power strips, have demonstrated another opportunity to mitigate *phantom plug loads*, which are defined as the unintentional or idle draw of energy by equipment or appliances when not in use, in university workstations. To complement the goals of encouraging occupants to reduce their consumption during the workday, additional efforts focus on consumption before and after a typical work schedule. The selected device utilizes an integrated digital timer that can reduce the idle energy consumption of non-essential office equipment such as monitors, lamps, and chargers. This contrasts with essential devices such as computers, which are required to maintain power over the course of the week for updates and remote access.

The timed surge protectors still require occupant interaction to function properly over the course of the year. As a result, one's willingness to participate in the program must endure occasional interaction and inconvenience on behalf of the strip. For example, the chosen device must be manually adjusted in accordance with daylight saving time twice a year. If a participant works beyond their typical schedule, a manual override procedure must be implemented.

While the inconvenience of this semi-behavioral intervention has turned some participants away, this aspect of the program has also served as a talking point and conversation starter when meeting new building occupants and seeking additional insight into the perceived comfort and energy-related attitudes of the targeted population.

Behavioral Intervention Strategies

Social interventions in this example are implemented both digitally and in-person with the purpose of informing energy-positive behavior via education from campaign coordinators and facilities representatives, peer-to-peer interactions, reminders, and frequent check ins from campaign staff. Any physical or digital materials all follow a consistent, university-branded graphic design standard, employing recognizable and familiar coloring, logos, and messaging as they are used to receiving from university communications. Educational or otherwise informative content is regularly disseminated to a building's occupants through a variety of materials including seasonal newsletters/posters, in-person engagement activities with an educational component such as trivia or raffles, and an online training curriculum to standardize the delivery of key strategies and methods for regaining control over one's personal comfort without sacrificing energy efficiency. The dissemination of information, materials, and reminders can occur both digitally and physically through existing workplace networks such as email and word-of-mouth. As with breaking any habit, the introduction and maintenance of novel energy-positive behavior to one's daily routine can benefit from the support of advocacy and encouragement from peers, especially those who you see and work with every day. 'Energy Champions,' serve as the medium through which this transfer of information can occur.

Energy Champions & Advocacy. Energy Champions are volunteers who serve within university office suites to disseminate energy efficiency-related solutions and materials to their coworkers in the various departments of the targeted buildings. These friendly faces are both advocates for sustainable behavior and a resource for guidance when questions arise. At this time, 50 departmental energy champions have volunteered themselves or been recruited to help maintain traction within university departments.

Energy Champions communicate valuable information to their respective departmental teams in many ways. They are responsible for posting physical reminders to turn off lights, equipment, and posters in workspaces (that the program helps them curate), as well as verbally reminding peers about ongoing energy-saving topics such as proper space heater use, shutting down electronics at the end of the day, or upcoming long weekends or holiday energy procedures to follow. They are also the champions of inner-departmental email communications to the respective group, getting people excited about saving energy and resources in their local setting, and helping colleagues learn how to reduce their energy use and be more comfortable in their workspaces. These designated and helpful individuals are the conduit between the campaign developers, Facilities Services, and the occupants of any given building, and essential to the success of the campaign thus far.

Incentives. One of the most significant obstacles described in a survey of staff, faculty, and students occupying the target buildings, was motivation related to energy conservation in a commercial setting. Incentives play a key role in keeping occupants motivated and enthused to save energy. Many of this program's strategies include low-cost, low-impact solutions for saving energy. The merchandise shared to incentivize behavioral change include university-themed apparel such as beanies and gloves, as well as other items like blankets, electronic heating pads, and energy-efficient space heaters—mainly to replace older, high-draw, often unsafe space heating equipment. Other methods employed to initiate a conversation about ecologically conscious behavior include wildflower seed packet giveaways—paired with information about local conservation organizations, planting and care instructions, and educational information regarding pollinators and native species.

Organization & Management

The program has continued to grow over time to add at least three target buildings a year, and thus, establishing a network for delivering reminders becomes crucial to effective operation. As a result, each building is overseen by at least one staff member (typically student, staff, or graduate student support employees) per academic term who is responsible for the routine engagement of the various departmental Energy Champions and the many building occupants present in those departments. Scheduled check-ins are utilized to ensure the program is running smoothly at various scales—from the technical interventions at an occupant's workstation, to building operators and the broader occupant engagement campaign.

Building occupant types (or user types) also played a significant role in the campaign's design and approach to intervention. Initially, the program focused on administrative staff with full, consistent schedules who routinely employ a series of non-essential devices at their workstation, such as lamps, phone chargers, personal heaters, or other high-draw devices, like coffee makers and printers. In time, the program began to target part-time staff as well, given that their space is inactive for longer periods of time, and elements of the intervention strategies could be more effective in those scenarios. As the program grew to include new buildings, it also sought to engage new occupant types and spaces, such as faculty, their offices, and their lab spaces. These new uses require new protocols, as their schedule is similar to a part-time employee but subject to change each semester. Graduate students working as quasi-staff and/or faculty generally utilize fewer devices, often sporting only a laptop and charger. In addition, their schedules can be atypical and often unpredictable. Students often do not depend on an office space to complete work but rely instead on personal space, making it more difficult to alter on-campus behavior or be deeply involved in one physical location's energy use.

Discussion and Conclusions

When developing an engagement campaign that is well suited to a given population or community, one must consider how to combine approaches in a complementary manner. The initial goals of the featured occupant engagement campaign were to save an estimated whole building annual electricity energy percentage (1.5-10%) which has been consistently met through the social/behavioral measures and more direct technical interventions like timed plug load management. Combined, savings as a result of this sustainability campaign come in around 5-8 percent of overall building energy savings, and as much as 40 percent of overall PPL usage reductions (Colligan, Ruiz, and Day 2023). While it has been difficult to quantify this to a more

accurate degree due to lack of isolation of data from each individualized strategy and changes in building usage due to a university schedule, the University has recognized the meaningful impacts of the approaches being implemented.

At an organizational level, especially within higher education, the scalability of occupant engagement programs can be a challenge, as many departments within a university system operate independently, interdependently, or completely enmeshed within other areas of academia, let alone vast geographic, climate, and use-case variables that must be considered system wide for universities with more than one campus location. The *Energy and Comfort* program featured in this paper has been gradually scaled over three years to include a percentage of campus building square footage (roughly 950,000 sq. ft. of 11.3 million sq. ft. university wide), which consists of just nine buildings on one of five physical campuses of the university. Of the estimated 11.3 million square feet of facilities owned and managed by the university, this is a tiny but mighty approach to achieve significant energy savings that can be scaled and adapted to suit the needs and capacity of other organizations.

Often, college campuses are operated as large, self-sourced grids where energy efficiency impacts can be seen on a large scale. Sustainability concepts are a significant part of many aspects of higher education, and because high caliber research is widely available through academia, it serves as a resource and potential space to apply content of an engagement campaign. However, due to the privilege and access to knowledge that higher education provides, one must consider how the content delivered can be made accessible to all despite educational status. Translating concepts that could be difficult to understand and having varying levels of comprehensive information for target groups (i.e., STEM student tours, adult learners, community groups, etc.) may be a method of ensuring equity throughout the program's content. The training approach and methods identified in the example provided may need to shift depending on organizational cultures, existing knowledge, building types, and even geographical location, as they may not be effective for all organizations or buildings.

Giving control, education, and opportunities to improve wellbeing to the occupants will not only help improve their satisfaction, but it will additionally motivate them to positively participate in the building's community and operations (Day et al. 2018). An occupant engagement program must engage with more than just the performance of the building, prioritizing health and offering additional strategies for occupants to maintain the path to energy efficiency. Furthermore, understanding the unique motivations and effective incentives is key to implementing a successful program.

It can be concluded that teaching users both how to use the building and the *reasoning* behind proper use is critical to appropriate engagement. If the occupants do not understand the importance of the outlined goals or do not directly benefit from them, the building likely will not live up to its potential. Providing resources that allow occupants to positively participate in the building goals while still retaining comfort, health, and productivity is equally important.

It can be determined through the literature and existing precedence of occupant engagement that there is no ideal formula to develop engagement strategies, but rather decisions are made to suit and best enable occupants to take the lead. Early engagement is essential to a positive start, but there is an undetermined point when user-driven engagement becomes necessary. Understanding what occupants need for comfortable work environments will help steer programs to deliver the most suitable content. Additionally, a better understanding of interest in sustainable programs, as well as their contribution in the commercial building sector in terms of energy saved, is needed.

Considering the Sustainable Development Goals outlined by the United Nations, we are obligated as designers, researchers, program implementors, and policy makers to understand and control the role that building occupants have in meeting energy efficiency performance standards. Both large organizations, such as public universities, and small organizations and businesses should prioritize the conservation of resources and education of the built environment. In Washington State, leveraging the behaviors of those who occupy the largest sector of energy consumption and emissions (buildings) could help optimize building performance while ensuring that people within buildings have the best possible comfort and health outcomes. Developing involved occupant engagement strategies is a method of building relationships with those in control of these spaces, bettering the indoor environment for everyone, and meeting building energy and emission performance standards.

The authors recommend that each occupant engagement program is developed with clear intentions and occupants in mind. Buildings cannot, and do not, operate well without engagement from the people that occupy them. This elusive human-building interface is a topic that is alluded to in behavioral science, architectural design, and MEP engineering fields, but requires significantly more attention as the world shifts to stricter and stricter energy performance requirements. More research and building data to understand the success rate of various engagement strategies, development, and assessment of occupant training resources, as well as any research concerning occupant behaviors can contribute to the growing body of knowledge of human-building interfaces in future high-performance buildings.

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