Smart Buildings Facilitating Sustainability in Hybrid-Work Environments

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The post pandemic work environment is a changing landscape that will present many new challenges and opportunities. What has been proven already is that for many organizations, the traditional office environment is much more optional than it ever was. Without increased intelligence and control in our buildings this dynamic environment will cause increased energy use both in the office and at home.

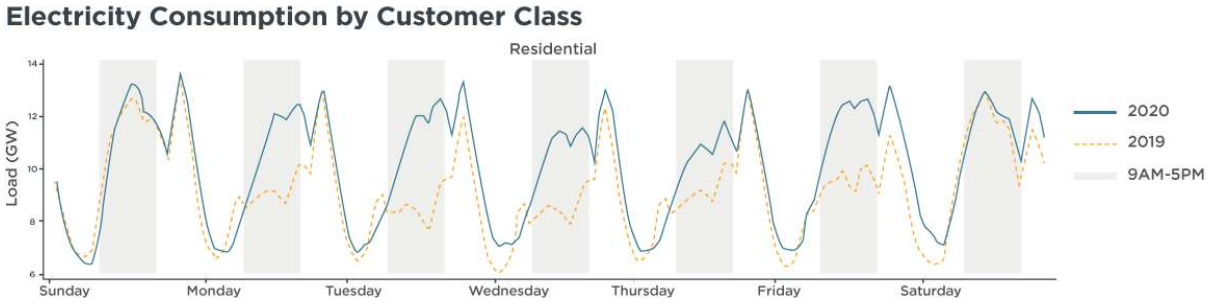
There are many impacts to these hybrid, or flex, work arrangements but unfortunately, reduced energy use has not materialized as one of them. The mechanisms behind this inefficiency started at the earliest stage of building design. **Buildings have historically been designed to operate at peak efficiency at full occupancy levels**. I have personally struggled with building owners and facility engineers attempting to adapt a buildings original engineering to part load conditions and it can be a frustrating experience to say the least. Modern equipment technologies have been introduced that can alleviate part load inefficiency issues, but they typically consist of very expensive equipment retrofits like new chillers or fan walls.

Source: Baikal mechanical

Source: ACHR News

Before we go too far into the engineering, let us back up a bit first to look at why net energy consumption is higher with hybrid work arrangements. In the pre-pandemic paradigm office workers would leave their house, spend the weekday in the office then return home. It was a reliable and stable pattern that was engineered into our buildings. Residential energy use drops when people are at work, while commercial energy use raises and vice versa at the end of the day.

Now we fast forward to our post pandemic hybrid arrangement where a sizable portion of people are working at home and residential energy use does not decline to levels seen previously.*



Concurrently, a small portion of people are working in the office and office buildings remain in occupied states maintaining the same operation as if the building were fully occupied. Now this is not to say that a reduced occupancy building does not use less energy than a fully occupied one, but the **energy reduction is far from proportional to the number of occupants**. Some reports have even seen substantially negligible energy changes between a fully occupied building compared to an empty running building.**

Commercial Building Electricity Reduction

As Compared to Week of March 1st

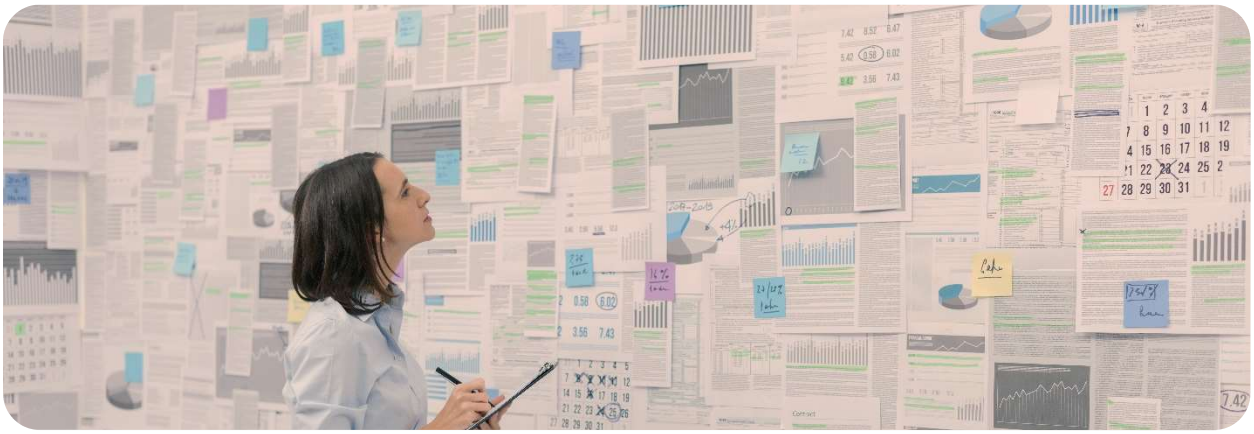
	March 8 - March 14	March 15 - March 21	March 22 - March 28	March 29 - April 4	April 5 - April 11
US Total	**5%**	**12%**	**18%**	**22%**	**25%**
Northeast	7%	16%	21%	23%	26%
Midwest	4%	3%	11%	19%	25%
South	5%	10%	16%	22%	24%
West	4%	14%	21%	22%	27%

hatchdata

Source: www.hatchdata.com

There are two approaches to address these issues without major investments.

The first involves an organizational approach where a business structures in-office time in a coordinated effort so that a building can either be empty or at a larger capacity to capitalize on the full capacity equipment efficiencies. This approach has the strong benefit of low costs to implement. The negatives are unfortunately numerous. **It may be difficult to impossible for some organizations or every group within an organization to operate in this way**. It also lacks the flexibility for changing business needs and requires high level organization and buy-in that might be difficult to achieve. Lastly, since every business will have varying scheduling and the typical household has two office workers, the residential energy drop is likely to be insignificant.



The second approach relies on innovative and strategic control methodologies to operate a building more effectively at part load without major equipment investment. **This is achieved by implementing a Smart Building and integrating IOT systems to coordinate desperate technologies for more precise and granular control of heating, cooling, ventilation, and other systems**.

By adding additional sensors like air flow, CO2, and sub metering and integrating into space reservation systems, occupancy tracking systems, elevators, access control, and employee engagement applications, a Smart Building can provide just the right amount of light, comfort, and fresh air to operate the buildings systems to the amount that the level of occupancy requires. Areas and floors that have no people can be shut down and strategies of isolating areas to consolidate energy use can be implemented. Even equipment limitations can be approached strategically when a Smart Building knows not only how many and where people are, but also what their needs will be.

Imagine a Smart Building that can adjust available seating reservations according to the direction and angle of the sunlight and so that shades can be automatically drawn to lower thermal impact to the building. A Smart Building can also calculate exactly how much fresh air is required for each space and control ventilation to the exact needs of the occupants, saving energy and keeping the occupants healthy.

The residential energy use for this equation is much easier to coordinate on/off days at a single household level and is self-reinforced with existing energy use incentives and home thermostat technologies. **While not *always* possible, it is much more feasible for two office workers to coordinate office days and work-from-home days than an entire organization**.

This described energy reduction for the partially occupied office is the first benefit to be realized from Smart Buildings, but it is not the last. **With more intelligence and integration of data systems further insights can be developed to add even more sustainability objectives**. Where before decarbonization investments seemed out of reach, now with a highly coordinated and efficient use of space, heating loads can be reconfigured for more feasible decarbonization efforts, remember you can't control what you can't measure. Employing incentives to scheduling on-site meetings earlier in the day not only can save energy, but also reduce water usage for buildings with cooling towers that use water evaporation to reject heat from a building (Cooling towers are the largest water consumers in CRE). With the addition of AI patterns of use can be captured that are invisible to the human eye and operations can be modified to take advantage of those insights.

Conclusion

As our communication and productivity tools evolve and we learn to use these new technologies, it is imperative that our workplace evolves with us. The new workplace ecosystem is dramatically more dynamic, and our built environment must adapt and increase in intelligence to increase energy efficiencies. The penalty of not adapting is a reversal of building energy reductions that we have fought hard for over decades. However, the rewards of bettering our buildings help us reduce our energy use and create better places to live and work.

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About the author: Jason Whipple has 20 years of experience with CRE systems engineering and managing integrated building solutions for Fortune Global 500 companies. Jason has worked on designing and building multi-discipline integrated eco-systems capable of meeting customer's short- and long-term needs and has practical experience delivering enterprise-level OT and IT convergent frameworks. Jason prides himself in developing creative ways of combining Edge and Cloud based solutions for optimum systems performance to result in tangible ROI, and architecting integration platforms that are able to quickly adapt to new technologies and ever-changing business needs.

* *https://epic.uchicago.edu/insights/americans-working-from-home-are-using-more-power-and-paying-higher-bills/*

** *https://www.greentechmedia.com/articles/read/how-office-buildings-power-down-during-coronavirus-lockdown*