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GSA Green Building Advisory Committee
Advice Letter on Data-Integrated Building Systems

December 9, 2019

Kevin Kampschroer
Chief Sustainability Officer and Director,
Office of Federal High-Performance Buildings
U.S. General Services Administration (GSA)

RE: Data-Integrated Building Systems Recommendations

Dear Mr. Kampschroer:

This letter summarizes recommendations of the Green Building Advisory Committee (the Committee), based on the work of its Data-Integrated Building Systems Task Group (DIBS TG). (Please see list of Task Group members and observers below.) This task group identified opportunities and challenges in leveraging DIBS to improve the performance of federal buildings, including reduced energy use and enhanced indoor environmental quality, occupant health and performance and organizational effectiveness. The task group also evaluated case studies from both federal and non-federal facilities, identifying best practices and barriers to successfully implementing data-integration strategies. Finally, recommendations for additional work by the Committee or other organizations were suggested in order to accelerate the successful implementation of DIBS.

Data-Integrated Building Systems Background:
Data-integrated building systems improve building performance by providing advanced sensing, monitoring and controls through the automated exchange of data from building automation, energy management, lighting, security, life safety and other building systems, equipment and devices. Key enabling technologies include wireless sensing, data analytics, machine learning, device integration, systems interoperability and cybersecurity. Common DIBS applications include fault detection and diagnostics, on-going commissioning, building energy optimization, IEQ management and occupant-based control.

Data-Integrated Building Systems Example
The following smart conference room scenario integrates real-time data and implementing automated control from conference room scheduling, building management, life safety, HVAC, lighting and plug-load building systems.

1. A meeting organizer searches for a conference room in the scheduling system with the required amenities and invites the required attendees.
2. The building management system releases the conference room temperature controls from setback mode so that the room will be comfortable 15 minutes before the meeting starting time.
3. 15 minutes before the meeting start time, the lighting control system adjusts the motorized blinds to allow daylighting without glare using an ambient light sensor. Dimmable ballasts are adjusted to a low level to allow the meeting organizer to prepare for the meeting.
4. The light level increases when the room occupancy sensor detects an occupant entering the room and the plug-load control system turns on the switchable outlets.
5. 15 minutes before the meeting start time, the ventilation rate is adjusted to match the number of confirmed attendees.
6. If more attendees participate in the meeting than expected, a carbon dioxide sensor overrides the ventilation rate setting. If fewer attend, the ventilation rate is reduced. If no one shows up for the meeting, the building management system releases the meeting time in the scheduling system so others can use the room.
7. In a fire/life safety emergency, the lighting controls turn up the light level and the color to red.
8. When the room is unoccupied and the next meeting is more than 15 minutes in the future, the blinds are closed (during the cooling season), the lights are turned off, the temperature controls are set back, ventilation controls set to minimum and the power outlets turned off.

Key Task Group Findings:

- The primary drivers for adoption of data-integrated building systems include improvements in energy and resource efficiency, increased comfort, health and occupant/organizational productivity as well as optimization of facility layout, workflow and employee collaboration.
- Data-integrated building systems (DIBS) are in a nascent phase with very few examples outside of high profile corporate headquarters and institutional facilities. These buildings are one-off, highly customized projects requiring specialized expertise to plan, design, install, commission and maintain the systems and infrastructure.
- The healthcare sector is the most mature in the adoption of DIBS due to the requirement of integrating and storing data from a myriad of clinical, patient and facility devices. Remote monitoring and telemedicine are driving the use of data analytics and machine learning while patient safety and convenience are driving integration of building and clinical systems.
- Federal implementation of DIBS is lagging due to procurement guidelines that favor standalone systems, the lack of

documented life cycle cost data, risk aversion in the contracting chain and cybersecurity concerns. Initial projects include GSA Link, ION smart meters, Building Systems Network and wireless integration of lighting, occupancy and HVAC controls with space use mapping and device tracking.

- Designing buildings for DIBS requires an integrated, multi-disciplinary approach including data prioritization, functional programming, infrastructure planning and interoperability testing. Most DIBS projects select a master systems integrator to work with the project consultants in designing the wireless and wired building systems infrastructure, verifying system and device interoperability and installing and integrating low-voltage building systems.
- There are many challenges to accelerating the adoption of DIBS in federal buildings. The first is the lack of training, education and development of a workforce with specialized systems and data integration skills. The next is the lack of interoperability standards including system communication protocols and common metadata/schema required for "plug-and-play" installation. There is also a lack of systems specification and procurement guidelines for DIBS installations. Finally, the lack of life cycle cost and impact data and a specific budget for data integration and analysis limits the implementation of DIBS in federal and other buildings.

Key Task Group Recommendations:

1. Initiate demonstration projects in federal buildings and quantify the costs and benefits of these installations, such as GSA's Central Office building, which is being renovated to increase density by an additional 1,000 occupants.
2. Prepare DIBS specification, implementation and procurement guidelines, leveraging industry efforts from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), National Electrical Manufacturers Association (NEMA), U.S. Green Building Council (USGBC), Green Building Initiative (GBI and others.
3. Define the required competencies for federal building development and operations personnel to support DIBS facilities and add to the Federal Facilities Skills Assessment Tool (FEDSAT) building personnel gateway on the Sustainable Facilities Tool (SFTool.gov).
4. Support systems interoperability standards development and testing in federal facilities and laboratories.
5. Develop guidance for including DIBS in Energy Savings Performance Contracts (ESPCs)/Utility Energy Service Contracts (UESCs) taking advantage of energy and non-energy benefits, based on an analysis on benefit tradeoffs, incentives and the business case.
6. Investigate cybersecurity concerns specific to DIBS and provide guidance for system specification, maintenance and security.
7. Assure that DIBS are designed to be resilient with simple operating logic, fail-safe functionality, manual overrides and individuals responsible for failure detection and prevention.
8. Circle back with stakeholders and organizations working in this area to share our findings and recommendations.is a rapidly evolving field.

GSA is in a unique position to help shape the future of smart buildings and advance a future where federal buildings are designed, operated and maintained to share data between building systems in ways that improve building performance.

Thank you for your careful consideration of this package and for the opportunity to recommend these important policies to GSA. On behalf of the Green Building Advisory Committee, I respectfully submit these recommendations for your consideration.

Sincerely,

Projjal Dutta, Chair
Green Building Advisory Committee

Clay Nesler, Co-Chair
DIBS Task Group

Andrew Persily, Co-Chair
DIBS Task Group

TASK GROUP MEMBERS & OBSERVERS

Task Group Members or Designees

Clay Nesler, Johnson Controls, Co-Chair
Andrew Persily, NIST, Co-Chair
Jennifer Frey, Sellen Construction
David Kaneda, Integral Group
Kent Peterson, P2S Engineering
Jane Rohde, JSR Associates

GSA Attendees

Michael Bloom, GSA
Don Horn, GSA
Ken Sandler, GSA

Other Attendees

Patrick Cigole, Schneider Electric
William Livingood, NREL
Taw North, TLC-Engineering

Green Building Advisory Committee
Data-Integrated Building Systems Task Group (TG)

September 12, 2019 Task Group Presentation

(Embedded and online at www.gsa.gov/gbac)