Testimony of John Wallace

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Hearing to:
"Examine Opportunities for Efficiency in Building Management and Control Systems"

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Good morning Chair Murkowski, Ranking member Cantwell, and distinguished members of the committee. Thank you for the opportunity to appear before you and provide testimony related to smart building technologies.

My name is John Wallace, and I am the Director Innovation for Emerson Commercial and Residential Solutions located in Kennesaw, GA.

I also serve as the Chair for the Air Conditioning, Heating and Refrigeration Institute (AHRI) Electronic Controls Section, the North American Food Equipment Manufacturers (NAFEM) Data Protocol Standardization Committee, and am a member of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). In all, I have been involved in the development of technologies related to building equipment and systems (HVAC, Refrigeration, Lighting) for over 20 years.

Emerson background

Emerson is a $14.5 billion global manufacturing and technology company founded in the United States 127 years ago. Emerson has over 80,000 employees and operations in more than 150 countries. We pride ourselves on providing innovative products and solutions for customers in industrial, commercial and residential markets. Emerson's Automation Solutions business helps manufacturers maximize production and protect personnel and the environment, while optimizing their energy and operating costs. Emerson's Commercial and Residential Solutions business helps ensure human comfort and health, protects food quality and safety, advances energy efficiency and creates sustainable infrastructure.

We also provide products and services for commercial buildings, including automation systems which manage HVAC, Refrigeration, Lighting (HVAC/R/L), compression, and control technologies, as well as other infrastructure within buildings. Emerson's customers use our products and services to manage and optimize their operations, including $7 Billion in energy costs and $2 Billion in food inventory monitored and safeguarded every year.

Current State

HVAC/R/L systems account for most of the energy consumption for a typical retail building. Depending on the type of facility, refrigeration is typically 30 to 40% of the energy used while HVAC generally accounts for 20 to 30% and lighting 15 to 20%. Providing effective optimization and management of these systems is critical to the success of building operators, particularly for retail operators facing thin operating margins and increasing competition. Our multi-site retail customers face many challenges including providing a safe, comfortable environment for shoppers, ensuring the safety of perishable food, and minimizing their energy and maintenance cost across a broad portfolio of buildings. Through further development of smart buildings, Emerson is addressing these issues in a comprehensive strategic plan I will highlight shortly.

While more efficient equipment can be incorporated into new buildings - providing an easy way to lower energy costs - newer buildings are typically a very small part of a multi-site operators' overall portfolio. To have the most impact, technologies must be developed that can easily be applied into existing buildings, and provide an acceptable payback based on energy, maintenance or other savings. Additionally, smaller commercial buildings (10,000-20,000 square feet and below) typically have lower overall energy costs, which makes creating a payback based on energy savings alone very difficult.

Key Challenges in the Market

There is a growing expectation in industry that buildings should be operated in a more sustainable manner. Nearly every member of this committee has stated that they are looking to improve efficiency and lower energy costs for their constituents, and Emerson shares these concerns. Through the development of smart buildings, Emerson is working with customers to lower operating costs, while improving sustainability. The following strategies are being implemented to improve the viability of smart buildings:

a) Incorporating CO2 and other natural, environmentally friendly refrigerants in refrigeration systems,
b) Constructing (or planning to construct) buildings that leave clients with a net-zero or near net-zero energy bill as a test or learning prototype. These buildings are known as "net-zero" buildings,
c) Installing on-site electric generation as well as energy storage methods to provide the ability to shift electric demand to non-peak hours,
d) Incorporating remote monitoring strategies using data analytics and diagnostics to identify issues or malfunctions quickly before they materially impact operations,
e) Applying variable speed technologies to more closely match operation of HVAC systems to the actual conditions, and
f) Utilizing internet, cloud-based services to ensure that perishable food is being kept at the proper temperatures.

Increasingly, various building equipment (including HVAC/R/L) is being integrated into a building automation system (BAS) that can optimize energy use as well as other operational characteristics across equipment. The BAS serves as a "gateway" that can coordinate operation of various equipment *within* the building, as well as provide a pathway to access *remote*

services for the equipment from *outside the building*. For example, Emerson's BAS (trade named Site Supervisor) integrates the equipment control, provides sensors to monitor key metrics within the building (such as energy consumption, food temperatures, HVAC/R performance, etc.) and utilizes Internet of Things (IoT) technologies to connect buildings to cloud based services.

Key needs related to smart buildings

Traditional equipment control approaches have tended to focus on optimization of the control algorithms that determine the operation of buildings systems (for example, a better control algorithm that would operate an HVAC system in a more efficient manner). With the introduction of new technologies such as IoT, cloud-based remote services, and machine learning, new possibilities are emerging that enable smart buildings to not only optimize operations within the building but also react to and coordinate with other services outside the building. Examples of these types of services include Demand Response (DR) programs, typically implemented by utilities, which provide some type of incentive to a building operator in exchange for the ability to lower the instantaneous "peak" demand for electricity. While DR programs have existed for many years, adoption of these programs (especially in the retail) has been somewhat limited.

Some of the challenges to broader adoption include the mismatch between the load a typical building can shed (as measured in Kilowatts, or KW) (i.e. by temporarily turning off lights, HVAC, etc.) versus the minimum shed amount (measured in Megawatts, or MW) established by utilities as a threshold to participate in these programs. Additionally, building operators typically must maintain normal operations during a shed event, thus choosing which equipment to turn off can be a difficult task. Newer technologies that provide building operators the ability to autonomously aggregate peak demand reductions across multiple buildings, as well as shifting demand peaks, can provide smarter buildings and more intelligence on the way these types of programs are implemented.

These technologies, coupled with proper incentives for the building operator, could help with the adoption of DR and other smart grid programs, and lead to a more efficient way to manage buildings as well as facilitate the incorporation of renewables and on-site generation capabilities. Emerson has participated in research programs with both Pacific Northwest National Lab (PNNL) and Oak Ridge National Lab (ORNL) to help research and test some of these new technologies -- generally referred to as transactive control.

Conclusion

The availability of new technologies as noted above will increasingly enable our buildings to be managed in a smarter, and more sustainable manner. Providing the ability for smart buildings to be "connected" with outside services offers new, potentially more effective ways to optimize buildings and respond not just to the conditions within the building but other conditions (such as real-time utility pricing) as well. As an industry, we look to incorporate these new technologies, and we need to ensure that we maintain the appropriate balance between local control of the building equipment and the external services that can optimize operations - not only of an individual building, but of a portfolio of buildings.

As noted above, Emerson's partnerships with the national labs help to ensure that the technologies are developed in a manner that makes deployment possible to existing as well as new building stock and meets the changing needs of the markets we serve. Emerson has shown a commitment to industry stewardship, and will continue to work with customers, national labs, universities, and others to successfully develop and maintain smart buildings. I believe new technologies are key to meeting market needs, and helping the nation's buildings become more efficient and sustainable.

Thank you for providing me this opportunity to testify before you today. I will be happy to answer any questions you may have.