THE ART OF BALANCE



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Around the nation, aging infrastructure, shrinking operating margins and growing demand are requiring hospital executives and facility leaders to explore solutions to deliver safe, cost-effective care. As they pursue resilient and sustainable strategies to support growth and manage costs, they walk a fine line.

Successfully walking that line is more art than science, however. Finding the right mechanical, electrical and plumbing design approach requires a skill set that goes beyond technical expertise. The outsized role MEP systems play in ensuring resiliency, flexibility and patient comfort demands the ability to navigate competing priorities and strike a balance between redundancy and efficiency, sustainability and simplicity and first-cost and lifecycle costs.

FRONT COVER | *Modular prefabrication streamlined a hospital's chilled water system upgrade in Indianapolis, Indiana with off-site construction and a design that facilitates future relocation.* AT RIGHT | *Healthcare infrastructure design requires creativity and expertise to balance competing project priorities.*







Redundancy vs. Sustainability

The complexity of mechanical infrastructure is growing at an unprecedented pace, and for good reason: opportunities for cost-efficiency gains are equally unprecedented. According to a 2021 U.S. Department of Energy report on energy efficiency in healthcare buildings, healthcare facilities have an energy intensity use three times greater than the average commercial building. Comprising only 5% of total commercial floor space, these buildings consume 10% of total U.S. energy, spending more than $8 billion annually on energy. Even as energy use has gradually moderated or decreased in recent years, rising energy costs continue to weigh on healthcare expenses, equating to $10,900 per staffed bed, according to the report.

Yet, the desire for better cost control often runs against the need for greater operational resiliency and flexibility. Recognizing the possibility of the next pandemic, leaders seek the ability to switch an inpatient unit or emergency department from positive to negative airflow quickly and efficiently. Beyond communicable diseases, natural disasters like hurricanes, flash floods and tornadoes, coupled with man-made disasters such as mass-casualty events — even in small communities — put flexibility and adaptability at the forefront of a more holistic design solution.

The challenge is that such resiliency comes with a cost at a time that healthcare organizations are not only looking to trim costs, but are also being pushed to operate more sustainably. In some parts of the country, geothermal systems have opened doors for organizations to pursue more sustainable strategies, but the upfront costs, along with the knowledge to operate the systems, have been obstacles to adoption for many organizations.

Even with federal tax credits available under the Inflation Reduction Act making geothermal systems more affordable, uncertainty around continued federal support, along with shrinking reimbursement rates, gives pause to even the most ardent of supporters.



But to say that engineering design must choose between competing priorities is a mistake. The key is gathering the project stakeholders early to discuss goals and ask the right questions. What issues and pain points can this project resolve? How can we achieve the project's goals while incorporating sustainable, resilient and flexible design? How can engineering systems complement the architectural and operational goals of the project while remaining within financial constraints?

The science is in the technical design, while the art is in the balance — taking the goals and answers that emerge from early planning conversations and weaving them into a concept that responds to priorities as a whole, and the answer must be shaped by all the voices at the table. The ability to engage those voices, ask probing questions and approach the discussions with a sense of curiosity and an open mind, will help uncover what is both viable and valuable to each organization and project.

Cost Controls vs. Shortages

Costs are not limited to operations. While sustainable systems have shown a net positive for balance sheets — with the time for payback dramatically shrinking for most systems, including solar, wind and geothermal — the unpredictability of other costs make selection and installation an orchestrated dance to achieve desired results.

While post-pandemic supply chain disruptions are less of a factor in cost inflation, other issues ranging from tariffs to labor shortages are now impacting budgets. Although the former offers limited options to control beyond pre-ordering equipment, addressing labor concerns can take a more creative and concerted approach.

Phasing projects and embracing either onsite or offsite prefabrication can help manage some of those costs while maintaining quality. By breaking large projects into smaller, manageable phases, hospitals can spread costs over time and prioritize spending.

Modular prefabrication design can also make a project more cost-effective and successful. In one case for a hospital in Indianapolis, Indiana, such a solution was used to modernize its chilled water system by prefabricating the plant in shipping containers built offsite, then installing the separate containers in a configuration that created a unified system capable of being disconnected into individual units to facilitate future relocation. At a second Indianapolis hospital, patient room headwalls and restroom pods were prefabricated offsite to respond to labor concerns and expedite the project schedule.

As with those solutions, thinking outside the box can uncover opportunities not previously considered for project delivery.

ABOVE LEFT | *Modular prefabricated bathrooms can help reduce project costs while streamlining construction.*

Immediate Payback vs. Long-Term Value

Labor is more than a delivery challenge. Like all industries, architects, engineers and facilities managers working in healthcare are growing older. Attracting younger generations to the field is becoming challenging on the design side as it is on the construction side. The expertise and knowledge associated with professionals who have spent 30 or 40 years in the field are leaving with the retirement of those leaders.

Automation, programming and controls are starting to fill the gap, but MEP systems are becoming more complicated at a time when staffing levels are decreasing. This forces engineers to design for simplicity alongside sustainability and efficiency.

Finding the right solution can mean stepping outside one's discipline and embracing a collaborative approach to generate ideas and options that benefit both the client and the project. For example, in an Integrated Project Delivery model, project funding is distributed into buckets allocated to project scopes such as envelope, interior finishes, mechanical, electrical, plumbing and technology. The team must work collaboratively to advance the project and create positive experiences for patients and staff.

For instance, if a building envelope could use more natural light to enhance the patient experience, stakeholders at the table must evaluate their buckets to identify opportunities to reduce costs or reallocate funds to support broader project goals.

It's about how people discuss the project — and who is invited to the table. There must be buy-in from all the right stakeholders on both the client and design team sides.

The future of healthcare infrastructure depends not only on technical systems, but also on the ability of design teams to navigate competing priorities with creativity and expertise. By embracing both science and art — informed analysis alongside stakeholder collaboration — projects can deliver resilient, sustainable and human-centered outcomes that create value beyond costs.

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