



Using Building Information Modeling to Control Lifecycle Costs



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About this Guide



Building information modeling, or BIM, is a sophisticated technology that enables teams to design and manage projects, as well as operate across disciplines using graphic representations. When incorporated as part of the design and construction processes, BIM enables coordination and seamless communication between the owner, design team, and contractors. Once construction is complete, detailed information about the building's equipment and infrastructure systems is available to owners and facilities teams for future operations and maintenance needs.

Even though building information modeling dominates the way owners, architects, engineers, and contractor teams work together, few institutions take advantage of BIM capabilities beyond the construction phase. If used effectively, a technology like BIM would free up resources otherwise committed to operations, maintenance, and management of facilities so these institutions could focus on their core missions (e.g., educating young minds and keeping people healthy).

This guide explains how to uncover more value from BIM technology after construction is completed.

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Market Drivers

Building information modeling is the digital representation of physical and functional characteristics of a facility. As a shared resource for information, it can be a reliable basis for decisions during a building's lifecycle.

Many building owners admittedly use BIM for design and construction activities, but the modeling technology is not widely used for operations and maintenance (O&M) or facilities management (FM) purposes, as shown below:



Two market conditions do motivate institutions and facility owners to consider using BIM beyond the construction phase:

1. The expense of maintaining high performing buildings over their lifecycle
2. The ability to respond quickly to immediate repairs, emergencies, and disasters.



O&M Costs

Maintaining buildings over their lifespan is an expensive proposition. Many elements of the building and its infrastructure contribute to this, including energy costs and equipment repair and replacement.

Energy. Energy is one of the largest operating expenses for buildings, and the average commercial building in the United States wastes about 30% of the energy it uses. According to the Institute for Building Efficiency, properly maintaining a heating, ventilating, and air conditions (HVAC) system can reduce HVAC energy costs anywhere from 5% to 40%.

Repair and Replacement. All equipment requires maintenance. It can be difficult for building owners to quantify or predict the costs associated with maintenance, repair, or replacement, which includes time to identify the problem, outage time, the effect on operations or building occupants.

Emergency Response

Even small issues can result in significant problems for institutions that operate complex facilities or a large number of buildings in a campus-style setting. Utility outages, for example, can close a building, displace building users, and cause sizable financial damages. In addition, such events can damage the reputation of institution if the issue is not resolved quickly.

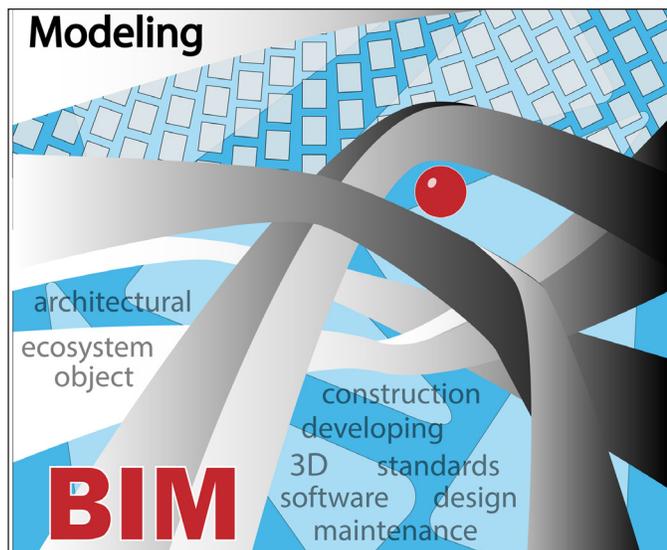
Energy is one of the largest operating expenses for buildings, and the average Commercial building in the United States wastes about 30% of the energy it uses.

2 BIM for O&M and FM

For progressive institutions and owners, the solution is to incorporate BIM into the organization for operations, maintenance, and management of their buildings and facilities over time. This allows owners to take control of the building's full lifecycle.

When considering a BIM solution for operations and maintenance, be sure to consider technical compatibility, integration with existing systems, and a workable training plan.

1. *Technical compatibility.* Look for a provider who works with a system that meets industry standards, as well as your institution's existing standards.
2. *Ability to integrate.* Look for a provider who can help you integrate BIM into your existing operations, maintenance, and management systems and processes.
3. *Training.* Look for a provider who understands how to use BIM for operations, maintenance, and management and can help you create a workable training plan to bring your entire team up to speed.



3 The Benefits of BIM for O&M and F&M

There are two significant benefits when building owners choose to use BIM technology to operate, maintain, and manage their buildings: One-stop access to information about the building and aligning O&M with design and construction.

One-stop access

Data from BIM systems provides everyone in the institution with centralized access to information about the physical and functional attributes of a building's structure, equipment, and systems. Rather than having manuals, drawings, and photos stored in boxes or within individual departments, or allowing departments to have their own information, which may be outdated or incompatible with other information about the same building, BIM data is available electronically across a number of devices, accessible to anyone on the team that needs access.

This data can include information that spans all construction trades. A BIM model can be used to see the airflow in a ductwork system at specific point in the system, or the length of piping or electrical wiring for a specific system type. Quantities and locations of equipment are accounted for in the BIM model as well. This is just some of the information building owners would find valuable. With this data, a building owner would be able to better manage routine maintenance of equipment. Each piece of equipment, whether a mechanical cooling unit or an electrical panelboard, the BIM model has information in it, associated with that piece of equipment. This information includes technical data that would be typically found in an operations and maintenance manual but is not associated with that piece of equipment. The BIM model has all the information in one place. Referencing record drawings and O&M manuals would no longer be required.

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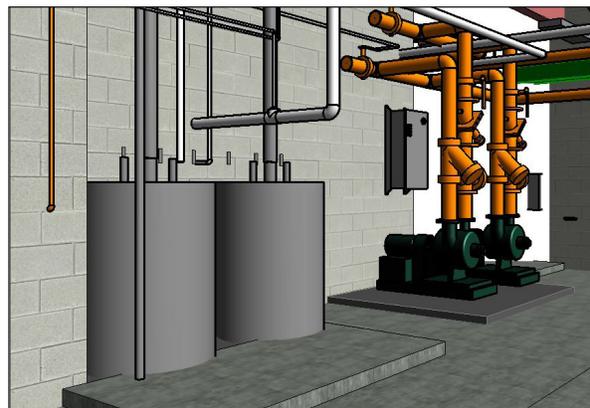
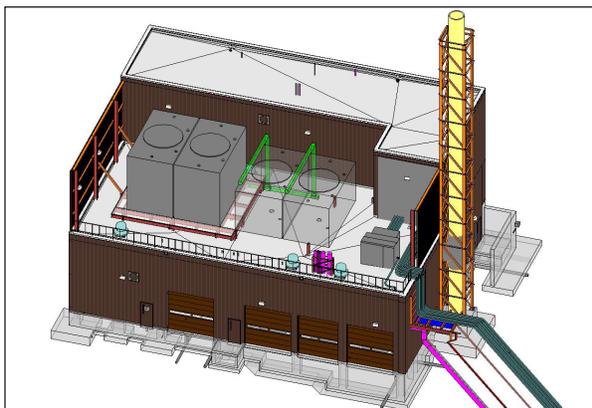
Alignment

Using BIM for O&M and FM aligns the operations and life cycle of the building with the work of the design and construction teams. Today, industry leading architects, engineers, and contractors use BIM for new buildings and renovation projects—to find solutions that result in the most efficient way to construct the buildings. Additionally, those project teams are putting a lot of thought into the sixth dimension—the building’s lifecycle over time—early in the design process with a goal of keeping operating and maintenance costs as low as possible for the building owner.

Owners regularly require BIM in the design process, as it has become an industry standard. When institutions and owners do not use BIM for ongoing operations, maintenance, and management, they are not taking advantage of an investment they have already made and a work product they are already paying for. Using BIM for design and construction, sets owners up for success on the operational side.

Additional benefits include:

- Using existing libraries of your building data
- Consideration of the entire lifecycle of buildings
- Ability to interface with third-party software



4 Obstacles to using BIM for O&M and FM

Institutions face three primary obstacles when considering using building information modeling for operations and maintenance and facilities management:

1. How to deal with legacy buildings
2. How to implement
3. How to ensure full process integration.

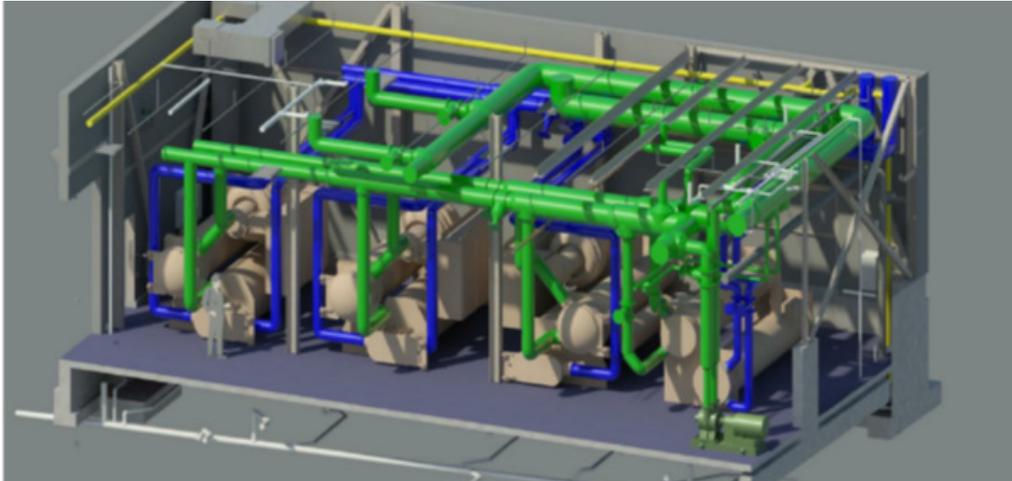
Legacy buildings

For design and construction of most new buildings, architects, engineers, and contractors use BIM software and deliver electronic models and complete data files with information about the building's systems and equipment. Therefore, institutions and owners that wish to use BIM for operations and maintenance and facilities management have access to the data they need. For most institutions, however, new buildings represent only a small percentage of the buildings and total square footage they must operate and maintain. Buildings built a decade ago may have 2-dimensional CAD or PDF drawings, but older buildings only have hard copies of hand-drafted drawings. Operations manuals and other documentation are likewise in 3-ring binders on someone's desk or lost in a storage room.

Today, with a well-managed BIM construction coordination process, the as-built drawings are significantly more accurate (85–90%). In contrast, as-built drawings from the 2-D era often relied on post-construction surveys by contractors who had other concerns during the close-out process. Meaning the drawings often lacked meaningful coding or layering conventions. Even when legacy drawings are available electronically, they typically require substantial translation to bring them up to the current standards.

When an owner contemplates the translation of legacy as-built information into a modern BIM interface, they face a time-consuming and labor-intensive project. If a building is scheduled for renovation, some of the data about systems and equipment can be captured and saved. If there is no renovation plan in the works, the institution must plan to survey and capture data about its buildings for a BIM system. Buildings with only legacy (non-BIM) data require significant time and cost to identify the most valuable data, then clean up or reformat the files to incorporate into the BIM database.

Even when data is captured for legacy buildings, institutions and owners are faced with managing different buildings with different levels of technology—some or all of one building may have useful BIM data, while some or all of many other buildings have only paper-based information about those same types of equipment and systems.



Implementation

Implementing BIM for operations and maintenance and facilities management takes time and money. For many institutions, it can take years to get at least some operations, maintenance, or management functions up and running using BIM. This includes time to plan projects, capture the data, and integrate it into existing systems and processes.

In terms of costs, institutions must consider several factors, including the cost of hardware and buying or licensing the software to operate the system, as well as hardware requirements to store the large files generated by BIM. In addition, institutions must determine how to budget these expenses—as part of capital projects, for example, or operations and maintenance budgets. Many BIM packages are available for building owner use such as Navisworks, Revit and AutoCAD. Each with its own advantages. Quick access to information means faster response time in project management and maintenance, therefore building owners should consider BIM packages that are accessible through mobile devices and tablets. This gives the building owner and facility personnel access to information remotely. Also, these BIM packages can be used to produce drawings at any point in time. Drawings for renovations of areas within the building could be documented during construction. This improves efficiency and accuracy of record drawings. The owner has the advantage of a fully up to date set of building plans.

Process Integration

A significant issue for many institutions is how to integrate BIM into existing operations, maintenance, and management activities. Operations and maintenance staff are increasingly asked to do more work with fewer people and smaller budgets. This leads to reluctance to change processes—the system works as it is, so it's easier to operate the building the same way as always. Leading institutions understand that adoption of a new major technical process like BIM has a three to five-year learning curve.

It takes time to learn how to use BIM data and to integrate it into an existing routine, time that most members of the facilities teams do not have because they are busy maintaining buildings. Another challenge for the operations and maintenance teams is the fact that they will not be able to use BIM data for all buildings. They will still need to operate and maintain some systems and equipment the old-fashioned way, making the overall job more complicated.

5 How to implement BIM for O&M and FM

Consider the following five steps for effective implementation of BIM technology for operations, maintenance, and management:

1. *Define how your organization currently uses BIM.* The first step to implementing BIM is to understand how your institution will use BIM. Consider how you can use the technology for activities beyond design and construction, like project management, digital documentation, and operations and maintenance.
2. *Identify the most significant ROI.* You could fill up databases with details about every aspect of a building, from the operations of the HVAC system down to the specs for the hinges on the doors. However, much of this is data the operations staff will never need or use. Determine what information is most useful, such as data about critical equipment and systems and data about systems that will require regular maintenance or replacement.
3. *Identify work processes and needs.* Consider the information and data you already have about your buildings, and how much work will be required to make that data useful. Then consider existing O&M and FM processes and how you can integrate them with BIM. Also, identify potential needs and learn what data you need to capture now for future operations and maintenance or what data you may need to think about capturing in the future.
4. *Identify champions within your organization.* Everyone who will be impacted by BIM in the organization needs to make BIM a priority. From the owners, directors, and management, to the IT team and technician who will be using BIM data to repair the HVAC system, everyone needs to understand the benefits of BIM. Find champions by looking for individuals (at all levels) who understand BIM and its processes and can advocate for it among their colleagues.

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5. Identify financial resources. Institutions put BIM in the budget in various ways. Sometimes hardware, software, and data costs may be included in a capital budget for new construction products. In other cases, these costs may be included as part of specific renovation or project budgets. In other cases, these costs may be spread out across operations and maintenance budgets.



If you have additional questions or would like BIM assistance, please contact: Jeff Romeo at jromeo@f-t.com or Steve Picariello at spicariello@f-t.com

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