

Expanded Role of the Commissioning Provider for LEED® Projects

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Synopsis

The Leadership in Energy and Environmental Design (LEED®) certification program provides an opportunity for commissioning providers, as fundamental building systems commissioning is a required prerequisite for any project and a credit is available for “additional” or “enhanced” commissioning. More than half of the LEED prerequisites and credits available (for LEED NC) involve the HVAC, plumbing, and electrical systems for a building. When a commissioning provider takes on a LEED project, they often have to provide technical assistance regarding compliance with these LEED credits, beyond their defined scope of work to strictly meet the commissioning requirements.

Many owners hire special LEED consultants to help manage the process and provide technical expertise on LEED. The author has been involved as the commissioning provider or consultant for more than 20 LEED projects. He has seen many shortcomings where project teams fail to properly implement LEED credits related to building systems, leading to missed opportunities for credits at certification time. He has seen that many LEED consultants do not fully understand the engineering-related credits or how to apply them. Since so many of the credits are related to building systems, does it make sense for the commissioning provider to also function as LEED consultant?

This paper will discuss some other services that can be provided by a commissioning firm related to LEED, including acting as the overall LEED consultant. There are definite advantages to packaging these services, but also disadvantages and pitfalls. Some examples of systems-related services include performance of energy modeling, water conservation calculations, ASHRAE Standard 55 analysis, indoor air quality testing, creation of measurement and verification plans, etc.

But what about the remaining LEED prerequisites and credits that are not related to building systems? Does it make sense for the commissioning provider to provide consulting services related to recycled materials, carpet and finishes, site analysis, and other areas? This paper will also discuss the "non-system" credits and how they might be handled by the commissioning provider.

About the Author

Michael K. Mantai, PE, CCP, CEM, LEED AP, is President of System WorCx, a building commissioning firm located in North and South Carolina. He has been performing building commissioning for 16 years. He graduated from Duke University with a degree in Mechanical Engineering and Materials Science. He spent 7 years with Westinghouse performing various commissioning activities for mission critical nuclear facilities at the Savannah River Site. Since then he has worked in the roles of construction administrator for large hospital projects, project manager and mechanical design engineer for various projects, partner and principal for a consulting engineering firm, and commissioning authority for more than 27 projects.

Michael has been a LEED-Accredited Professional since 2003, and started work on his first LEED project in 2002 as a commissioning authority. Since then he has been involved with more than 20 LEED projects in various stages of design of construction. In addition to commissioning, Michael has been involved with other LEED-related consulting activities. These have included acting as the overall LEED consultant, facilitating LEED project certification submittals, energy modeling, plumbing fixture calculations, indoor air quality testing, and development of measurement and verification plans.

Michael is currently a board member of the South Carolina chapter of the U.S. Green Building Council, and participates on the Marketing and Retrocommissioning Committees of the Building Commissioning Association. Michael recently taught Emerging Green Builders at Clemson University about the LEED Energy and Atmosphere section.

Strictly Speaking

LEED (including NC version 2.1 and 2.2, CI version 2, and CS version 2) requires building system commissioning as one prerequisite for a certified project, with one credit available for additional commissioning. Whether or not a third-party is responsible for commissioning, LEED lists certain tasks that must be performed to satisfy the prerequisite and credit.

LEED® Energy and Atmosphere Prerequisite 1: Fundamental Building System Commissioning, and Credit 3: Additional/Enhanced Commissioning

Even with “LEED-savvy” project teams, many parties still fail to really understand the scope of commissioning as it applies to the LEED project. The following paraphrases a discussion that actually occurred during a meeting I attended for a LEED project. Note that for this particular project, our firm was hired shortly after the owner had signed the contract with the General contractor, and this project had an independent LEED consultant involved from the start of the project:

“Who is responsible for ensuring all of our LEED credits are actually attained and documented?” asks one party. “The commissioning provider does that” answers another party.

This is representative of what we have seen on many projects; confusion regarding not only the commissioning provider’s role, but responsibilities for LEED-related activities in general. Some owners believe the commissioning provider does energy modeling (for Energy & Atmosphere Credit 1, Optimize Energy) as part of their basic service. Some owners believe the commissioning provider is the one who assembles all of the certification paperwork at the end of the project for submittal.

In terms of LEED, the commissioning provider is required only to meet the prerequisite commissioning requirements, and additional commissioning requirements if applicable, then sign the one or two LEED letter templates for commissioning. Certainly a good commissioning provider will be looking at indoor air quality, filtration, thermal comfort, and other things that relate to other credits, but does not have direct responsibility for these. Other project team members are almost always responsible for the remainder of activities related to LEED.

Typical Shortcomings and How the Commissioning Provider Can Help

Through experience with numerous LEED® projects, we have seen several typical shortcomings in the way the LEED process is implemented. The examples below have manifested themselves on multiple projects of various sizes and types, with different owners, design teams, consultants, and construction models.

Design Intent and Basis of Design

One of the prerequisite commissioning tasks under LEED for New Construction version 2.1 is to “review the design intent and basis of design documentation.” The problem we have faced with this task on many LEED project is that the team has not created these as discrete documents. Nowhere in version 2.1 does it tell the owner and design team to create these documents, or what their format and content should be. So the commissioning provider’s role in actually creating these documents is unclear. When we are hired during the beginning of the design phase, we at least have the opportunity to alert the team to the requirement for these documents. However, it is still often a struggle to get the other parties to understand the intent of these documents and actually create them in a usable form. Since LEED does not require the commissioning provider to assist in creating these documents, this can be a question of scope and fee for the commissioning provider depending on the level of effort needed.

This has been somewhat corrected in NC version 2.2, which requires the owner to create the Owner’s Project Requirements (new name for Design Intent) and the design team to create the Basis of Design. However, this new clarification is still embedded in the commissioning prerequisite, which may still leave room for confusion as to who creates these documents.

The commissioning provider is clearly in the best position to lead the team in defining and creating these documents. These documents really have emerged from the commissioning process, as outlined in ASHRAE Guideline 0, the Commissioning Process. For this reason, most owners and designers do not fully understand the intent or content of these documents, or processes to use in their development. So unless significant effort is included in the commissioning provider’s scope, these documents may not be created in a way that benefits the owner or meets the intent of the LEED process. An owner or architect that hires a commissioning provider based solely on the scope defined to meet the LEED commissioning criteria may not get this effort from the commissioning provider. See further discussion below under Commissioning Provider as LEED consultant.

Energy Modeling

LEED Energy & Atmosphere Credit 1, Optimize Energy Performance, requires the use of energy modeling and analysis to compare baseline building performance with design building performance. This modeling is generally done with a computer program such as eQuest/DOE-2, Trane Trace, or other modeling program that meets the requirements of LEED. While a number of firms specialize in energy modeling, our experience has been that the energy modeling is typically done by the mechanical engineer. Our experience has also been that this effort accomplishes little more than evaluating and documenting how many points the project has attained by designing an “energy-efficient” building, and we see shortcomings in the way this credit is analyzed.

Having the mechanical engineer perform the energy modeling makes sense in many ways. Many engineers are familiar with the programs used to perform the modeling, and some use the same software to perform their load calculations as part of the design process anyway. The

mechanical engineer can have easier access to some of the information that is input into the model. But one of the values of energy modeling can be to expand energy modeling into life cycle cost analysis, or at least a simple economic evaluation of building and system options. This would allow the team to look at options such as glazing, insulation, roofing, equipment efficiencies, etc. and allow the owner to make life cycle cost choices in energy efficient building and system features. Unfortunately, what we typically see is that the design choices are completed first, then the energy modeling is completed merely to document the number of LEED points.

The issues that contribute to the shortcomings in the way energy modeling is used include:

- “Fast-track” or other rapid delivery requirements hinder good energy modeling or life cycle cost analysis.
- Project teams are not aware of the value of using energy modeling for life cycle cost analysis and/or design decision making.
- Owners/Architects do not define the scope of work and adequately compensate the Engineer for useful energy modeling.
- Mechanical engineers do not have time to properly implement the energy modeling early in the design process.
- Project teams do not use the integrated design process to bring together all the team members with input into the energy modeling goals and use it to help make intelligent choices.

Commissioning Provider as Energy Modeler

If the commissioning provider can be involved in the project early in design, it can make sense for the commissioning firm to also provide energy modeling. One is that the background of many commissioning experts involves energy analysis and energy modeling, and some can be more proficient at it than mechanical design engineers. By removing the burden of this effort from the overloaded mechanical engineer, owners may get more benefit out of the modeling, and be able to make better design choices using the model results. The commissioning provider can help transform the modeling process into a life cycle cost analysis, and useful design tool.

In fact, many commissioning firms frequently do energy modeling and commissioning, and in speaking to these firms, this process has had success. The risk again is whether this additional effort will distract the commissioning authority. But with the energy modeling occurring during design, when the commissioning authority is probably not as heavily loaded as he/she will be during construction, this risk is likely not great.

The commissioning provider should take caution in educating the client as to the energy modeling process. We have seen that owners sometimes expect that the energy model will accurately predict their actual utility bills, which it likely will not. The commissioning provider should not wait until after the owner occupies the buildings and is paying higher utility bills than the model predicted to explain the limitations of modeling.

The advantage to the owner in having the commissioning provider do energy modeling is better value for the energy-modeling dollar, a lower life-cycle cost building, and possibly even more LEED credits. The other advantage can come after occupancy. The commissioning provider will be intimately aware of the predicted energy usage profile of the project. Often, after occupancy, the commissioning provider is the only member of the project team still involved in the project besides the owner, and is doing things such as followup testing and trending, etc. The commissioning provider will now be in a position to compare the energy model with the actual performance of the building.

In fact, this is one of the methods that can be used to implement a measurement & verification plan. And the commissioning provider can continue the effort with periodic recommissioning or ongoing commissioning. The result can be a building that is even better aligned with the design intent for energy efficiency, and persistence of the benefits of both modeling and commissioning.

The advantage to the commissioning provider can be increased revenue on the project, during the phase of the project where the revenue is much smaller than in construction. Increasing commissioning provider design phase fees can help balance revenue streams and cash flows for the firm. It can also facilitate the commissioning providers process by giving them greater insight into the predicted performance of the building. And it may generate more revenue after construction for services related to ongoing commissioning and/or measurement and verification.

IEQ Credits 3.1 and 3.2 Construction Indoor Air Quality

Indoor Environmental Quality Credit 3.1

We have seen this credit pursued by most of our LEED projects. It is typically clearly specified that the contractor implements a construction indoor air quality plan, and contractors typically due a decent job of implementing this plan. During construction this mainly includes protecting building materials from getting wet and/or dirty and protecting the duct system with plastic and MERV-8 filters to keep it clean. The commissioning provider can help during site visits ensure that these measures are implemented.

However, this credit requires that at the end of construction, all permanent filters in the air handling systems be at least MERV-13 rated per ASHRAE Standard 52.2. We have seen several projects where the mechanical engineer failed to specify MERV-13 filters during design. Many engineers also have assumed that this does not apply to outside air filters, including those on packaged Energy Recovery Ventilators (ERVs). But the USGBC has specified, through the credit interpretation request process, that ERVs do in fact require MERV 13 filters to comply with this credit.

Most packaged air handling units and ERVs come with standard 2" flat filter racks. While 2" flat filters are available in MERV-13 rating, they are mini-pleats with typically high pressure drops. For example, a 24"x24"x2" MERV-8 prefilter at airflow of 500 FPM might have a clean pressure drop of .25" w.g. while a MERV-13 has a .75" w.g. pressure drop. If these pressure drops are not accounted for during design in motor sizing, the air handling equipment may not

accommodate the mini-pleat filters. And even if it will, poor planning of filtration could result in higher energy costs for the owner to pay for the increased static pressure drops. Commissioning providers hired for only the fundamental prerequisite commissioning may not review the plans and specifications or contractor submittals, and may not catch this before it is too late to correct.

Indoor Environmental Quality Credit 3.2

Most of our LEED projects have also included this credit on the initial LEED scorecard. On paper, this seems like a cheap and easy credit. It requires a 2-week flush of 100% outside air once construction is completed (a credit interpretation request for NC version 2.1 and NC version 2.2 allows an alternate calculation to use less than 2 weeks). In practice this is extremely difficult to implement, for three main reasons:

1. Owners rarely are willing to wait 2 weeks from the time construction ends until they occupy the building (school and university owners may be forced to move in before construction is finished because of academic schedules).
2. In the southeast and other warm humid climates, the air handling units may not be capable of cooling and dehumidifying 100% outside air at full flow.
3. Often, the building air handling systems are not designed with airside economizers to provide significant outside airflow to meet the intent of this credit.

The flushout requirement also requires MERV-13 filters, so if they are not specified, the credit may be lost.

Projects that cannot accommodate the 2-week outside air flushout to meet Indoor Environmental Quality Credit 3.2, Construction IAQ Management Plan: Before occupancy, have an alternate option of air quality testing. Consultants who can perform indoor air quality testing can be expensive and difficult to find. The normal procedure is to take one to several air samples in various building locations (LEED defines the criteria and acceptable test methods) and send them to a lab for analysis. The analysis results must be compared to the limits established by LEED for Total Volatile Organic Compounds (TVOCs), carbon monoxide (CO), particulates, and formaldehyde (and where certain carpets are used, 4-PCH). This option has nearly as much difficulty to achieve, for the following reasons:

1. Finding a firm that can perform the testing is difficult.
2. Testing can be expensive.
3. The air samples must be processed by a laboratory, which can take 5-7 days to receive results.
4. There is no guarantee the test results will show the air quality is within the limits established by the LEED credit. A failed test means the cost and time of flushing and retesting, which also has no guarantee of success.

Most of our projects have not achieved this credit.

Indoor Air Quality Testing by the Commissioning Provider

In our experience, owners do not like to pursue this option, typically because of cost and risk. The risk is that if the test results do not comply with the LEED limits, then the owner is forced to either flush the building and then pay more for additional testing, or abandon this credit. Another problem can be the delay in receiving test results. Testing cannot start until all building finishes are completed. And placing furniture in the building (which itself will emit contaminants that can cause test failure) may jeopardize the test results. Owners generally do not like to wait to occupy a finished building while test results are analyzed.

We have developed a method to make this credit a little more palatable for owners. By using a portable sensor unit (Optima by Aircuity) that will test for particulates, CO, and VOCs, we have been able to accomplish two things. One is to get near instantaneous results on the contaminant levels required to be tested per LEED. So rather than having to pay for an extended test that may fail, we can alert owners quickly to whether the test should pass or not. The other is to get test results quicker. The Aircuity sensor provides a continuous display of contaminant levels, and will deliver final results as soon as a connection to the internet can be made. The test methods used by the instrument are, at the time of this paper, only acceptable per LEED for particulates and CO. The instrument will test for total VOCs, but not using a “LEED-approved method.” The instrument will not test for formaldehyde. So we still have to send samples to a lab for analysis for VOCs and formaldehyde, but with a greater assurance of success, and quicker turnaround time (less number of samples). The manufacturer is currently working on making their instrument capable of testing for VOCs and formaldehyde to comply with test methods acceptable to LEED.

The commissioning provider is in an excellent position to provide IAQ testing services in this manner. For one thing, it can eliminate another consultant to be coordinated and contracted. For another, the testing must be closely coordinated with the project schedule and other commissioning activities (IAQ testing cannot be performed simultaneously with HVAC functional testing). Most commissioning providers have background in indoor air quality science, and certainly test methods and protocols, to effectively and efficiently deliver IAQ testing. If a portable sensor is developed that will test for all of the required elements, this could be simply another instrument in the commissioning authority’s toolbox and make this service much easier and more cost-effective.

Commissioning providers may not want to take on the additional burden or risk of performing IAQ testing, though again it could be an additional source of revenue.

Energy & Atmosphere Credit 5, Measurement & Verification

This is another credit that we see pursued often but rarely achieved. Many engineers mistakenly believe that this credit revolves around providing meters and sensors to measure building energy usage through the building automation system, and they will often incorporate many of the metering requirements required for this credit into the building automation system design. While this certainly facilitates measurement and verification, compliance with this credit actually

requires development of a measurement and verification plan. The plan must follow the requirements of the International Performance Measurement & Verification Protocol (IPMVP), which outlines several methods for performing M&V. Development of the plan can involve a significant effort.

Under LEED NC version 2.1, this plan must be submitted with the letter template. This plan is often overlooked, and at certification time, the Engineer may not have the expertise, time, or fee to create the plan, and the owner does not wish to pay someone else to create this plan. So owners miss the opportunity for this credit, even though they may have paid thousands of dollars extra for meters and controls to meet this credit.

Measurement & Verification Plans

Commissioning providers use meters, sensors, trending, energy analysis, and other elements of such plans in their everyday work, and are in an excellent position to develop useful plans. For many projects, the owner is simply not staffed to be able to carry out a plan that meets the IPMVP, so the commissioning provider should work with the owner to develop a plan that makes sense and will be useful. A plan can also reduce the need for and cost of extensive permanent metering by allowing field measurements as part of the plan. The commissioning provider could even negotiate services to periodically return to the building and implement the plan as part of post-occupancy services.

Opportunities for the Commissioning Provider

The shortcomings we have seen present several opportunities for commissioning providers to fill needs that owners of LEED projects have, improve the success of attaining these credits, increase their firm's revenues. Besides overcoming the shortcomings described above, below are additional opportunities.

LEED Consulting

What is a LEED consultant? We have seen this consultant fulfill a range of roles and responsibilities, everything from technical assistance during initial design, to oversight of the complete process including assembling and submitting the certification paperwork. The certification process, which can be extremely cumbersome, is basically an organization and documentation process. And it critical to get organized during design, not at construction completion. Many of our projects have struggled with completing letter templates, calculations, and gathering supporting documentation for activities that occurred during design. The certification documentation should be as much assembled during design as possible to avoid the headaches and "amnesia" that occurs by waiting.

Commissioning providers, who must implement these organization and documentation skills in their everyday process, can excel at this task. From a technical advisory standpoint, the engineering related credits can be very tricky and some required detailed calculations and/or technical analysis. The experience of most commissioning providers also can lend a very useful

hand to project teams, who as discussed above, often struggle with the engineering-related credits.

So what about the credits that do not relate to building systems or engineering? The technical expertise required for most of these credits is not nearly as demanding. A commissioning provider experienced in LEED can probably provide technical assistance on most LEED credits. For example, while low-emitting materials deals mostly with architectural finishes (paint, carpet, sealants, etc.), these credits have to do with materials, emissions, and air quality. Materials of construction and indoor air quality are part of the typical commissioning providers expertise anyway. Many other credits require experience with LEED, but no special technical knowledge. Recycled materials, construction waste recycling, alternative transportation, etc. are more a matter of understanding the LEED requirements than the technology behind them.

On the other hand, some credits can be quite complex, including daylighting or stormwater management. But most projects do not pursue these credits, and when they do, the commissioning provider can bring in special expertise.

Besides the opportunity to avoid the shortcomings described previously, a huge advantage to the commissioning provider acting as LEED consultant is the continuity throughout the project design, construction and occupancy, and the close integration of the building system design, LEED requirements, and commissioning scope of work. This also helps to avoid a lot of the confusion as to responsibility for LEED and commissioning. Assuming the commissioning provider is hired early in the design phase, he/she can better facilitate the Owner's Project Requirements and Basis of Design creation, and can assist with the efforts of both by providing templates, conducting meetings, etc.

The downside is that this additional scope of work can distract the individual acting as the commissioning authority if also saddled with overall LEED consulting responsibilities. This arrangement would be best suited to a team of personnel provided by the commissioning firm to complete the total effort. One of the most important things to do as a LEED consultant is to be aware of all Credit Interpretation Requests (CIR). These often significantly change the way a credit can be achieved, and knowledge of these is critical to success. Knowing that a Trane R-123 (an HCFC refrigerant) chiller may still meet the credit requiring no HCFC's, or that the 2004 edition of ASHRAE Standard 55 (which has no lower limit for indoor humidity for thermal comfort) can be used in lieu of the 1992 version stated in the rating system can be the difference between a certified and non-certified project. It takes continual time investment to keep abreast of all CIRs.

As a firm, we do not aggressively market LEED consulting services, as our core business is commissioning. But we have provided consulting services because clients have requested it. When providing total project LEED consulting along with commissioning, we have hired architectural LEED expert firms to assist us, and feel we have provided a very valuable service to those clients.

The biggest challenge to us in providing LEED consulting services is not technical. It is pricing. Pricing of these services, not unlike commissioning, has a wide range. Since this is not part of our core business, establishing fees is not always easy. But it is certainly an opportunity to increase our involvement and revenue on projects.

Other Credits

There are other credits for which a commissioning provider can provide useful services. Water Efficiency Credit 3, Water Use Reduction, requires a straightforward calculation to compute water savings between the baseline case and design case. While straightforward, we have found incorrect computations and inconsistencies between calculated water consumption, design plumbing fixture water consumption, and submitted plumbing fixture water consumption. Since water consumption is not required to be included in the scope of commissioning by LEED, this is another opportunity where the commissioning provider can help ensure successful implementation. This could be a combination of performing or reviewing the calculations, reviewing the plumbing design, and reviewing the plumbing submittals.

Another is EQ Credit 7.1, Thermal Comfort. We have found engineers are quick to claim compliance with this credit (ASHRAE Standard 55) based solely on the temperature and humidity control system. But ASHRAE 55 has as much to do with air distribution, radiant energy, and other factors as it does with simply placing thermostats and providing dehumidification. The commissioning provider may be able to provide a more meaningful comparison of the design with compliance with this standard. Considering comfort complaints are typical issues that arise during occupancy, owners can receive value by extending the commissioning provider's scope to include a more detailed review of compliance with this standard.

Fees

Since LEED is still developing, fees for these various services described in this paper are not very well standardized. We have seen LEED consulting fees range from .1% to 1% of construction costs, though for our firm they have been on the lower end. Energy modeling fees depend highly on the extent of modeling, the number and types of iterations involved, and whether it is expanded to Life Cycle Cost Analysis. IAQ testing depends on the number of samples that will be required. M&V plans depend on the extent of the plan. In general terms, it should be cheaper to add scope to the commissioning provider rather than hire separate consultants, due to economies in integration. For the commissioning provider, these services are probably not a huge opportunity for increased revenue, but may help in overall business goals and smoothing of cash flow over the course of a project. Below are some examples of fees from some of our firm's projects:

- Commissioning and LEED consulting for 150,000 square foot core and shell medical office building (half of two floors upfit) and 5-story parking deck, LEED Silver goal, \$110,000 (we allocated \$30,000 for LEED consulting portion).

- Assemble commissioning certification package and submit to USGBC for 30,000 square foot LEED-certified level classroom and office building, \$4,000.
- Perform energy modeling for 30,000 square foot LEED-certified level Core & Shell renovation, \$5,000 (includes two iterations for different glass types and equipment efficiencies).
- Perform IAQ testing for between 1 and 4 sample locations, \$4,000-\$6,000.
- Write measurement and verification plan for 50,000 square foot classroom building equipped with building automation system and complete package of metering, \$5,000.

Conclusions

Based on our experience with LEED projects, there is a lot of room for improvement when it comes to implementing credits associated with the building's engineered systems. And we see several opportunities for the commissioning provider to expand their scope of work to help in this implementation. Having a third-party commissioning firm act as LEED consultant, energy modeler, IAQ tester, and measurement & verification plan developer could reduce the number of consultants the owner needs, streamline the process, improve success in attaining LEED goals, and ultimately save owners money. For the commissioning provider, it can mean more involvement in the project, better understanding of the commissioning provider's role, and increased revenue for the firm.

While expanding the role of the commissioning provider can help project teams better implement LEED properly, is it too much to expect of commissioning providers to provide all of these different services? Commissioning itself is difficult to implement, and a provider can easily be spread too thin, or the commissioning services diluted by taking on additional responsibilities. A larger role in the LEED process may significantly raise owners' expectations of commissioning providers to deliver a successful LEED project or have commissioning translate directly into measured energy savings. Raising expectations in an unrealistic way could be a detriment to the Commissioning Industry, so the pros and cons require careful consideration by project teams and commissioning providers alike.

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