IDS Automation Consultant Services
Hanlon Elementary School

Smart Building Assurance Program™
Experience Better Automation

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August 17, 2021

Introduction

IDS is an automation consultant, focused solely on assuring the building automation software is designed and delivered so that the school operates according to the engineer's design intent for the life of the building. With districts committing to aggressive sustainability goals, it's critical to assure long-term operational efficiency. This proposal is designed to provide scope and pricing guidance for our automation consultant services for the Hanlon Elementary School of Westwood.

Districts expect their new schools to be delivered without problems; to operate as expected, be easy to maintain, and to meet their designed energy goals for the life of the school. But, as architects, engineers, and the districts themselves know, the environmental system is the most difficult part of delivery and there are nearly always problems. With demands for low EUI, on demand high ventilation rates (aka pandemic mode), optimal lighting, after school hours use, etc. engineers are required to use the latest equipment technology. This results in complex operational strategies, frequently exceeding the experience levels of district staff.

For schools in MSBA's Schematic Design or Design Development, IDS proposes our Smart Building Assurance Program. IDS' automation consultant services map into the MSBA phases as follows:

- Design Development – Services span Design Development and Construction Documents. We provided guideline information to MEP engineers during design development with detailed input during construction document creation. Note for this proposal we have separated our Design Development recommendations from our Construction Document recommendations priced separately.
- Construction – Begins with submittal reviews early in construction, control contractor support throughout construction including automation software reviews (a unique capability), and prior to substantial completion analytics system is configured. IDS' construction phase spans MSBA's bid, construction, acceptance.
- Warranty – Concentrates on two areas: a) verification of operations consistent with design intent, and b) training of facilities staff. Our continuous use of operational data is essential to verify operations while providing case study training curriculum. IDS' warranty phase spans MSBA's project closeout and first year operation.
- Ongoing Monitoring – A separate service to keep all system operating consistent with the districts sustainability commitment contracted with the district post warranty. A high value-add for facilities directors and staff.

Design Phase
Design Development

During design development we'll provide the following:

- Layout the plan for Hanlon to operate consistent with design intent so that all parties can review and provide input.
- Get commitment to follow ASHRAE High Performance Sequences of Operation as a standard to follow for design, controls implementation, verification and training. Expectations of building performance are defined.   IDS is a voting member of the ASHRAE G36 committee and actively drives advancement of the guideline.

- Reach agreement on a metering approach that meets the owner's needs. This will include a discussion about the cost (and value) of pursing the LEED point. At a minimum the architect, electrical engineer and mechanical engineer need to be part of the discussion. The intent is to determine the most cost-effective approach to providing useful owner information.
- Start the discussion about needed integration of the BMS and the LCS so that both the mechanical and electrical engineer are on the same page. Also, the LCS could be part of the metering approach since you can use it to reduce meter count.

Design Development Deliverable Summary

- Review of ASHRAE Guideline 36 High-Performance SOO with mechanical engineer in preparation of SOO/Section 23 recommendations.
- Metering trade off presentation/discussion on approaches to make meter data useful to district.
- Specification recommendations for the integrations of lighting control system and BAS.

Construction Drawings

During the construction phase documents, IDS adapts the engineer's Section 23 specification, with ASHRAE Guideline 36 (High Performance SOO), improving the sequences themselves as well as the level of detail and specificity of the programming instructions for the Controls Contractor. This approach is supported by the latest research from ASHRAE. IDS also standardizes the structure and language and adds a variety of charts and tables to clarify the written sequences (e.g., operating state diagrams visually show how all components of an air handler operate across temperature ranges). The results are construction bid documents that are far more detailed and clearer so that the controls contractor understands exactly what they need to deliver.

Updates to the SOO do not alter the engineer's design intent, rather they improve the sequences so that the delivered controls code meets the intended design. All changes are reviewed and approved by the engineer before they become part of the final construction bid documents. Review meetings with the engineers are recorded on video. Facilities staff are encouraged to attend these meetings.

Confirm that bid documents are consistent with metering layout/approach defined in the Design Development.

Confirm that bid documents are consistent with Lighting Controls/HVAC integration approach defined in Design Development.

IDS reviews instructions related to the operator's user interface design to improve the ability of the district's staff to understand and monitor the school's operation. This includes how informational components such as equipment graphics and alarms are organized and displayed, and how often used functions such as space scheduling operate.
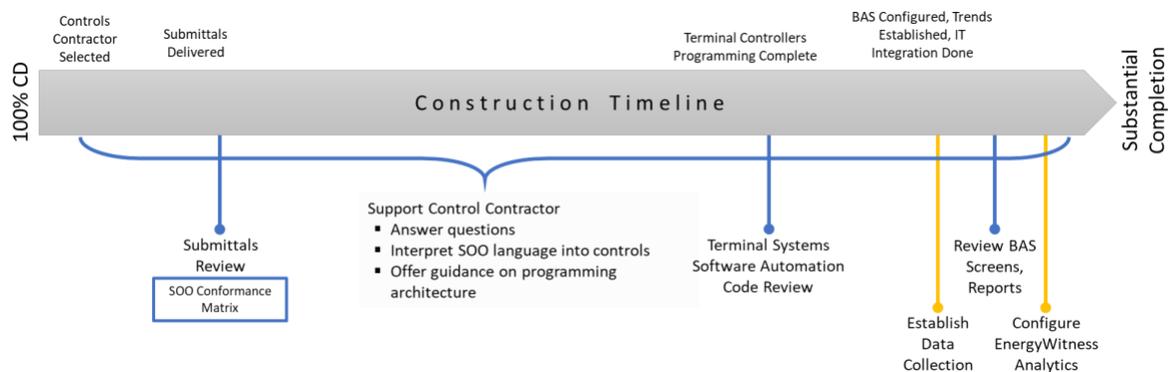
A formal set of operational acceptance criteria is developed during design. This allows it to become part of the bid package so that the controls contractor can see how their work will be assessed.

Construction Documents Deliverable Summary

- Division 23 Update Recommendations—updated SOO, user interface specs, and any integration with meters or lighting control systems.
- Division 26 Update Recommendations—recommendations related to electric metering and lighting control integration.
- Operational Acceptance Criteria

Construction

The overall goal during construction is to assist the controls contractor in any way needed to deliver automation software that is well-designed, maintainable, and meets design intent.

During the construction project phase IDS will answer questions from bidding vendors as requested by the OPM. After selection, we will respond to questions from the selected contractor throughout the submittal development and programming phases. IDS can also offer guidance on programming approach/architecture, especially on newer G36 concepts and sequences that the contractor may be less familiar with.

IDS reviews controls submittals to check that the contractor has represented the school's design and SOO properly. The review process includes flow and wiring diagrams, schedules, and most importantly, the SOO. We recommend that controls contractors not be allowed to simply copy/paste the engineer's SOO to the submittals so that the submittal review will reveal the contractor's level of understanding of the intended sequences. IDS works with the controls contractor to assure their understanding of the SOO and will provide assistance with architecting the controls as needed/requested. Recommendations also include suggestions to make the submittals a better resource for building operators during training and beyond.

One service, unique to IDS and unheard of in the industry, is software automation code reviews done for terminal systems controls prior to installation either by reviewing actual code or through a detailed walkthrough with the contractor if that isn't possible. This is done to catch and fix potential errors during the development cycle, when corrections are faster and less expensive to make, reducing the likelihood of needing to redeploy the terminal systems code to all controllers if errors are discovered later.

Towards the end of construction, when BAS screens, graphics, and reports are available, IDS will review them for conformance to specifications. A similar review will take place for metering systems, if separate from BAS. This review is typically done via a presentation of findings to facilitate a discussion with all concerned parties.
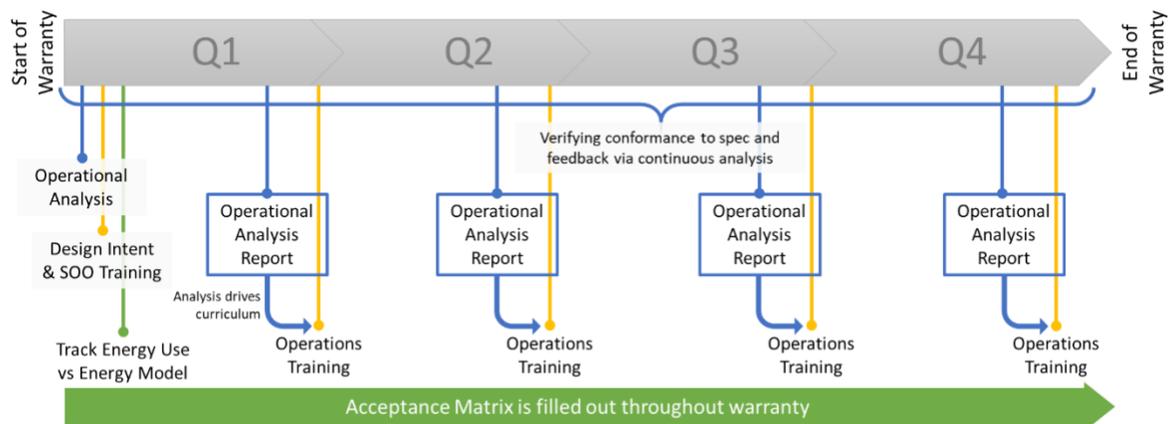
IDS works with controls contractor and the district's IT personnel to establish data collection for the EnergyWitness monitoring and analytics system. As soon as data flow is established, IDS will configure EnergyWitness to make all trend data available to everyone involved, including the owner, architect, engineer, controls contractor, and commissioning agent. Note that if there are issues with either the BAS's trend or export function, or IT/network issues preventing data flow, this task may occur during the beginning of warranty.

Construction Phase Deliverable Summary

- Controls Assistance—interactive or written responses to controls contractor questions.
- SOO Conformance Matrix—detailed review and documentation that submittal sequences meet or exceed design intent.
- Software Automation Code Review—programming review of terminal systems code. This deliverable may be in the form of a presentation or report, depending on the nature of the review done.
- BAS Screens/Reports Review—presentation of findings and recommendations related to the operator's user interface.
- Data Collection and EnergyWitness Configuration—online access to BAS and metering data within EnergyWitness.

Warranty Phase

The school's warranty period is used to confirm proper operation of the automation software in the BAS throughout all seasons and operating conditions. Facilities staff is trained throughout the year on how the school is designed to operate and how to address actual operational issues.

Assuming data availability allowed EnergyWitness to be fully configured at the end of construction (if not, configuration is completed here, at the start of warranty), IDS begins to monitor the school's operation and will report any issues found as soon as they are discovered so that issues can be addressed quickly. This is an ongoing activity during warranty.

Additionally, IDS will perform two formal operational reviews (additional reviews are optional) and present findings in a recorded session to all interested parties. Throughout this operational analysis process, the Acceptance Matrix, developed during design, is filled out. Deficiencies are tracked and the matrix is updated as those issues are resolved.

IDS will import data from the school's energy model as the basis of ongoing energy tracking reports showing how actual energy consumption compares to the model. If energy use exceeds the modelled EUI, the underlying causes will be investigated as an operational deficiency. Note that importing the model data into EnergyWitness may occur earlier, during construction, if the model data is available.

IDS complements the control vendor's training with a curriculum geared towards understanding the design of the school and how to operate/manage it on a daily basis. The training is designed to address the shortcomings that MSBA has discovered during their post-occupancy evaluation studies.

An initial training session is focused on reviewing the design intent for the school and explaining the SOO so that staff understands how the facility (likely more complex than they have experienced before) should operate. This is followed up with operational training where the curriculum is driven by the operational reviews. Training staff using their own building and their own data is much more engaging and effective than canned content. In addition, IDS will respond to questions from the operations staff as they come up during the warranty period.

Warranty Phase Deliverable Summary

- EnergyWitness Configuration—all details related to EnergyWitness reports, fault detection routines, or diagnostics are finalized, and all stakeholders have access. EnergyWitness makes data constantly available to measure school conditions and performance (e.g., comfort, ventilation, EUI vs model).
- Ongoing Operational Analysis—building operational performance is monitored throughout the warranty period so issues can be identified and addresses quickly.
- Operational Analysis Reports—formal review sessions are done quarterly via a presentation that is recorded.
- Design Intent Training—initial training session focused on how the school is designed to operate and how sequences are designed.
- Operational Training—training sessions (recorded) that use actual operational data as the basis to teach how to manage the school.
- Operational Data Record – IDS captures all operational data during warranty in 15-minute increments, which serves as a permanent record of operations. Depending upon the size of the school that will be approximately 55 – 80 million data records per year. EnergyWitness will also automatically track energy usage against energy model.

Ongoing Monitoring

IDS' Ongoing Monitoring Service (OGM) provides Facilities Staff with unparalleled expertise. Since IDS possess detailed familiarity with SOO, control system programming, and operational verification through data and analytics there is no one more qualified to provide OGM.

OGM commences upon completion of the warranty period. IDS will provide operational assessments three times a year. Findings and recommendations are included with each operational assessment. Typically, we'll identify unknown operational issues which will be traced back to origin date with corresponding resolution recommendation. For owner identified issues we will provide root cause determination with fix recommendation. For hot/cold call IDS will identify root cause. IDS fields inbound calls and emails and will respond usually within 24 hours. We encourage facilities staff from director to technician to custodian to take advantage of our knowledge and detailed familiarity of Hanlon.

Ongoing online training (12 hours/year) will cover reviews of seasonal operational changes, addresses any areas of difficulty, and refresh design intent topics and EnergyWitness use.

IDS supports the ongoing data collection from the BAS and meters and coordinates with internal IT staff for the transfer of data from the control system to IDS.

Pricing

Final pricing determined after review of draft MSBA SD submittal. Pricing is on a square foot basis and our primary cost driver is complexity of building. The table below maps into the deliverables described herein.

Project Phase	Price
Design	
Design Development	$ 4,000
CD Creation Review/Feedback	$ 30,500
Construction	
Submittal Reviews	$ 5,500
Construction Closeout	$ 20,000
Warranty	
Total Semi-Annual Summary Reports	$ 8,000
Total Formal Training Sessions (2)	$ 6,000
Total Ongoing Evaluation/Support	$ 30,000
Total Project Cost	$ **104,000**

For Hanlon Elementary to extend the program beyond construction and warranty, IDS offers its Ongoing Monitoring service for $18,000/year. This includes the use of the EnergyWitness analytics system as well as the operational analysis and training services described above. It's recommended for the first 2-3 years and particularly useful to support personnel changes.

Appendix 1—Automation Consulting versus Commissioning

The question frequently arises, "How is this different from commissioning?" The table below compares a standard commissioning scope to IDS' Automation Consulting services. There may be minor differences in the MSBA Cx scope versus what is described below, but only minor. There is a substantial difference in depth of service in SOO input, automation code review, data and analytics provided, and operator training. We have a detailed presentation comparing the two services.

	Standard Commissioning	IDS Automation Consulting
Objective	Ensure the building operates per the Owner's Project Requirements (also known as Design Intent) **at the time of commissioning**.	Ensure the building operates per the Design Intent **over the entire one-year warranty period (and beyond)**.
BAS System Knowledge & Understanding	**General** understanding.	**In-depth** understanding.
BAS System Proficiency	Able to view and control the system through **Graphical User Interface**.	Can understand, read (and write) **underlying code that controls all system operations**.
BAS Sequence of Operations	Reviews and comments.	Reviews, comments, **recommends enhancements and adds standardization, diagrams & graphs to effectively communicate the intent**.
BAS Training	**Verify** that the contractor has provided the specified training.	**Develop and deliver** project specific training **based on the actual operations** of the building and control system.
BAS Training Frequency	**At Substantial Completion** when operators have little or no experience with the building control system.	**On a quarterly basis** after Substantial Completion to ensure operators have a degree of familiarity with the control system and can get the most out of the training.
BAS Warranty & Occupancy Period Testing	Perform **one-time seasonal testing** for equipment and modes of operation that were not tested during the initial Cx process.	Compilation of **all operating data in 15-minute increments for one year** with analysis and verification of proper operation on at least a quarterly basis
Operational Data Record	BAS trend data **collected as needed** for functional testing.	**All operational data**, in 15-minute intervals, for **entire warranty period** (one year, and beyond with ongoing monitoring). Approx **55M+ data records** per year, accessible for life of school including energy use tracking compared to energy model.
BAS Operator Support	None.	Provide support via **phone and/or email** with data and analyst.
Discovery of Operational Deficiencies	If apparent **at time of testing**.	Discoverable **at any time during first year** of operation (and beyond).
Documentation of Operational Deficiencies	Deficiencies List.	Acceptance Matrix.
Verification of Operational Deficiency Resolution	May require **retesting**.	Verification through **ongoing monitoring** of operation.

Appendix 2—EnergyWitness™ Energy Management and Analytics System

IDS is the creator of EnergyWitness, an enterprise-level building analytics software platform that includes fault detection, detailed diagnostics, meter analysis, energy tracking, and ECM tracking. Our expertise in software engineering discipline and how it should be applied to controls automation software comes from our experience as software developers.

The energy and metering data give an overall picture of efficiency. The fault detection provides an easy-to-understand scoring system showing how aspects of the building function and point maintenance personnel to the problem areas. The diagnostics allow a deep dive into how each system and piece of equipment operates. EnergyWitness is the key tool IDS uses when providing operational analysis and recommendations. A small sampling of analytics screens from EnergyWitness are shown below.
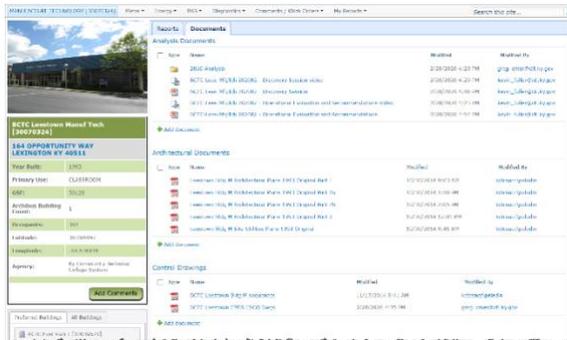

Figure 1: A document management system keeps all analysis reports and drawings immediately available, right from the building homepage.
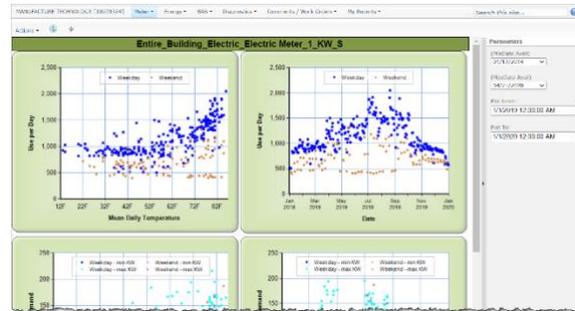

Figure 2: One of several meter analytics shows daily consumption and demand by outside temperature and across time.
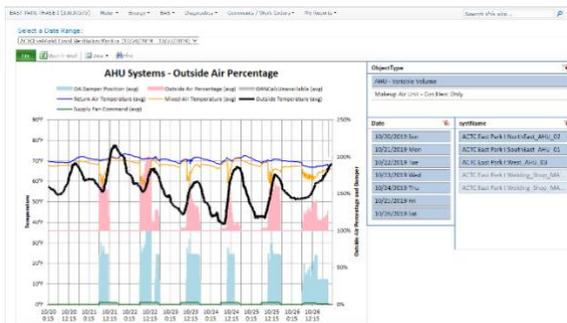

Figure 3: The Ventilation Monitor diagnostic shows what percentage of outside air is being brought into the school. Ventilation levels are of heightened concern due to the COVID-19 pandemic. All diagnostics are custom configured to reflect the mechanical design of the school. They cover primary heating/cooling systems, secondary systems (AHUs, HRUs, exhaust), and terminal systems (VAVs, etc.)
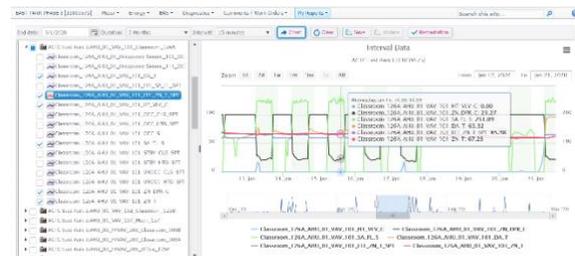

Figure 4: My Reports provides a full ad hoc trend reporting capability where any data can be combined and the user can easily move through time, looking at up to a year of data at a time and zooming in to just a few hours of detail. Reports and data can be exported, and report definitions saved for future use.

Figure 5: The Comfort report is one of the fault detection reports that instantly shows how well comfort is maintained across all zones served by an AHU. Outliers are easily identified, temperature consistency is easily seen, and a simple scoring system provides an objective measurement of how well comfort is maintained. These reports can be subscribed to so they automatically appear in your inbox on a weekly basis.

Figure 6: The Low Scores fault detection report summarizes all faults to provide a summarized view of what units are exhibiting problems that require maintenance staff attention.

EnergyWitness is included with our solution and will become operational near the end of the construction phase or beginning of warranty, capturing a permanent record of operation. A permanent record of operations is always valuable in the Close-Out/Warranty period to facilitate resolution of operational issues. EnergyWitness will be made available to commissioning, engineering, facilities, and any other personnel stipulated by the district.