

3. Adjustments to the Delivery Process

Using an integrated design process is one of the Federal Mandates and is foundational to success in achieving sustainable, energy efficient, high performing buildings. An *integrated design* process is different from the typical linear project delivery methodology where technical decisions by the design team are made independently, such as when the architect determines the building floorplate and exterior skin of the building and then hands it to the mechanical engineer to place the mechanical systems to fit within it.

An integrated design process requires a true collaborative effort between technical disciplines, one where from the beginning of the project there is interactive dialogue and interaction to find the most appropriate design solution. The ability to identify synergies across systems when the design solution is still flexible, to bring in divergent viewpoints to solve problems, and to seek inter-relationships between technical disciplines in formulating solutions, is key to lower cost, high-quality sustainable designs that provide long-term value to the facility and occupants.

3.1 TEAM COMPOSITION AND WORK FLOW

In order to fully integrate sustainability into the design process, participation of a diverse representative project team is required. The team should include traditional A/E and VA project team members, potential new design and construction team members such as cost estimating, VA architects and interior designers, environmental and energy program managers, and the VA asset manager. For VHA projects, this could also include medical and operating staff.

In addition to these new team members, work flow and project solution formulation between technical disciplines will also need to be adjusted. Traditionally, decisions are made somewhat independently by the technical disciplines. To truly achieve an integrated solution, design decisions must be made collaboratively with all disciplines at the table, so that implications of those decisions will be fully evaluated for their effectiveness.

To achieve the Federal Mandate goals, some VA projects will necessitate additional work that will provide information for decision making, such as:

- **Energy Modeling:** Provides the project team with critical information to measure and guide design decisions against the energy reduction Mandates. The energy modeling should begin at early concept design, be used to evaluate which design alternative provides the best energy performance, and be used to refine the design solution during the project delivery process. The complexity of the energy model should be in keeping with the design stage, progressing from simple¹ during schematic design to a final analysis in DOE2 for the final design development design. The energy modeling can be provided by specialty consultants or within the scope of the MEP consultant.

¹ For BIM projects, the use of Green Building Studio (greenbuildingstudio.com) or similar software will be acceptable for early concept energy modeling.

- **Daylight Modeling:** Provides the opportunity to verify and test the design to maximize daylighting while reducing glare.
- **LEED Management/Documentation and Energy Performance Tracking:** Coordinates tasks across all team members to assure that the appropriate focus on meeting the Federal Mandates is followed throughout project delivery. Tracks LEED requirements and energy performance metrics against goals. Where LEED certification is being pursued, this should include coordination and preparation of documentation for submittal to the U.S. Green Building Council. For teams new to LEED, use of an outside LEED consultant can speed this process and assist the project team with the LEED rating system contents and process.
- **Commissioning:** The Federal Mandates require total building commissioning for all new construction and major renovations in order to verify performance of building components and systems and to ensure design requirements are met. It requires a designated commissioning authority to develop a commissioning plan, inclusion of commissioning requirements in construction documents, verification of installation and performance of commissioned systems, and a commissioning report. A/E teams will work with the commissioning agent throughout the design and construction process to assure all sustainable objectives are met. For further information, reference the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (<http://www.va.gov/facmgt/standard/etc/moufinal.pdf>).
- **Life-Cycle Cost Analysis:** The Federal Mandates state that the energy efficiency measures required to meet the 30 percent energy cost reduction goal must be life-cycle cost effective. In order to demonstrate this, the project team will need to undertake a life-cycle cost analysis of the proposed energy efficiency measures. See Section 3.4.

3.2 USE OF BUILDING INFORMATION MODELING

There is a natural synergy between the complexity of buildings, the integrated design process, and the use of Building Information Modeling (BIM). Unlike CAD, which uses geometric shapes to represent three dimensional objects, BIM uses a relational, parametric database to link information about the building together. The information can be then viewed in any form desired: in the 2D traditional way with elevation views, plan views, and schedules; or as a 3D model with associated attributes; or as a spreadsheet. Changes made in one view will automatically be reflected in all views. The flexibility provided by BIM fosters an integrated, collaborative approach to problem solving, particularly enhancing the ability to evaluate various design solutions against sustainable goals such as targets for energy, daylighting, and material usage, as well as functional and programmatic objectives such as roll-ups of department square footage and room types.

The ability to view the building in three dimensions also helps solve construction coordination conflicts (building structure with mechanical ducts, for instance) which decreases or eliminates change orders, thereby providing additional cost control.

A team with a sophisticated expertise in BIM and related tools will be able to provide a higher degree of confidence early in the project execution process that the proposed design solution will achieve project goals. For these reasons, VA strongly encourages the use of BIM for VA construction projects, especially those buildings with complicated healthcare infrastructure.

3.3 SURVIVABILITY

VA medical facilities must remain operational and survive a four day power supply disruption and an uninterrupted water supply in the event of a natural disaster, pandemic or bio-chemical attack (see the VA Physical Security Design Manuals). VA encourages design teams to consider survivability and sustainability as mutually supporting goals and to explore possible ways to use sustainable practices to accomplish the survivability goals. Possible options may be the use of rain water harvesting, potable water storage, well water, photovoltaics, fuel cells, natural lighting, natural ventilation, co-generation, geothermal, wind sources, etc. If survivability goals are merged with sustainable goals at the outset of a project and carried forward using an integrated design process the result can be the ability to accomplish both with little or no cost premium.

3.4 ESTIMATING PROCESS

It is essential for the project cost estimating team to understand and incorporate the sustainability goals within the estimating process in order for the project to meet the requirements for sustainability and energy performance in a cost effective manner.

The cost estimator must be involved in the design process from the start of the project and, as part of an integrated design process, provide dynamic cost modeling and control as opposed to static end of phase modeling only. The estimator must also be familiar with sustainable design strategies, and their cost implications.

- **Dynamic Cost Modeling versus Static End of Phase Estimating**

The design team is responsible for managing the total scope within the project budget. The budget should not be viewed as one amount for the building and a separate amount for sustainability, but rather as a total to be achieved through integrated design.

In the schematic phases of the project, it is essential to develop high quality cost models that provide a sufficient level of detail to allow the project team to make informed decisions regarding the overall scope relative to the established project budget.

The cost modeling process should include the following specific steps with respect to incorporation of sustainable design elements:

- Establish sustainability and energy goals and expectations.
- Identify sources of information and team expertise, particularly with respect to advanced strategies.
- Include specific goals in the program.
- Align program with budget. Address program to budget conflicts as early as possible.

- **Life-Cycle Cost Analysis**

VA policy requires that projects use the current Building Life-cycle Cost program (BLCC 5.3) developed by the National Institute of Standards and Technology (NIST). This program contains several sophisticated tools that will allow for evaluation of alternative design

solutions. Other tools can be used to supplement the BLCC program, particularly with respect to communication of the results to the project team.

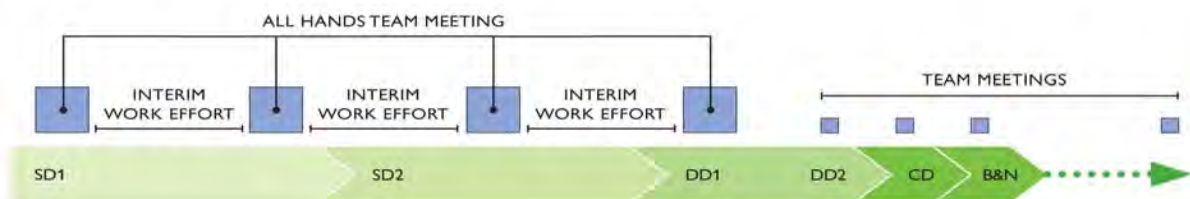
Building the alternative models within the program requires careful attention to a wide range of parameters and costs. Project teams should include sufficient time within the design schedule to allow for comprehensive life-cycle cost analysis.

VA and Federal Mandate energy requirements state that the energy efficiency measures required to meet the 30 percent energy reduction goal must be life-cycle cost effective. In order to demonstrate this, the project team will need to undertake a life-cycle cost analysis of the proposed energy efficiency measures. The analysis should take into account energy, operations and maintenance, and periodic replacement cost impacts, and should include sensitivity analysis reflecting uncertainty in escalation and energy performance. Where 30 percent energy reductions are not life-cycle cost effective, analysis should be undertaken at decreasing increments of 25 percent and 20 percent. It should be noted that there is no similar exception for the Executive Order's agency-wide requirement to reduce overall energy use by 3 percent per annum. Until such time as this discrepancy between is resolved A/E firms shall follow the requirements of EPA/DOE Interim Final Rule and provide a life-cycle cost analysis for energy cost reductions ranging from the target 30 percent down to the achievable range.

3.5 SCHEDULE

The integrated design process has the greatest impact at the earliest stages of design. More frequent coordination should take place early in the process, particularly during pre-design and schematic design phases. These early meetings take advantage of the opportunities to make decisions that have the greatest benefit at least cost. The following diagram illustrates this approach.

INTEGRATED DESIGN PROCESS MEETINGS



Source: Bill Reed, *Integrative Design*

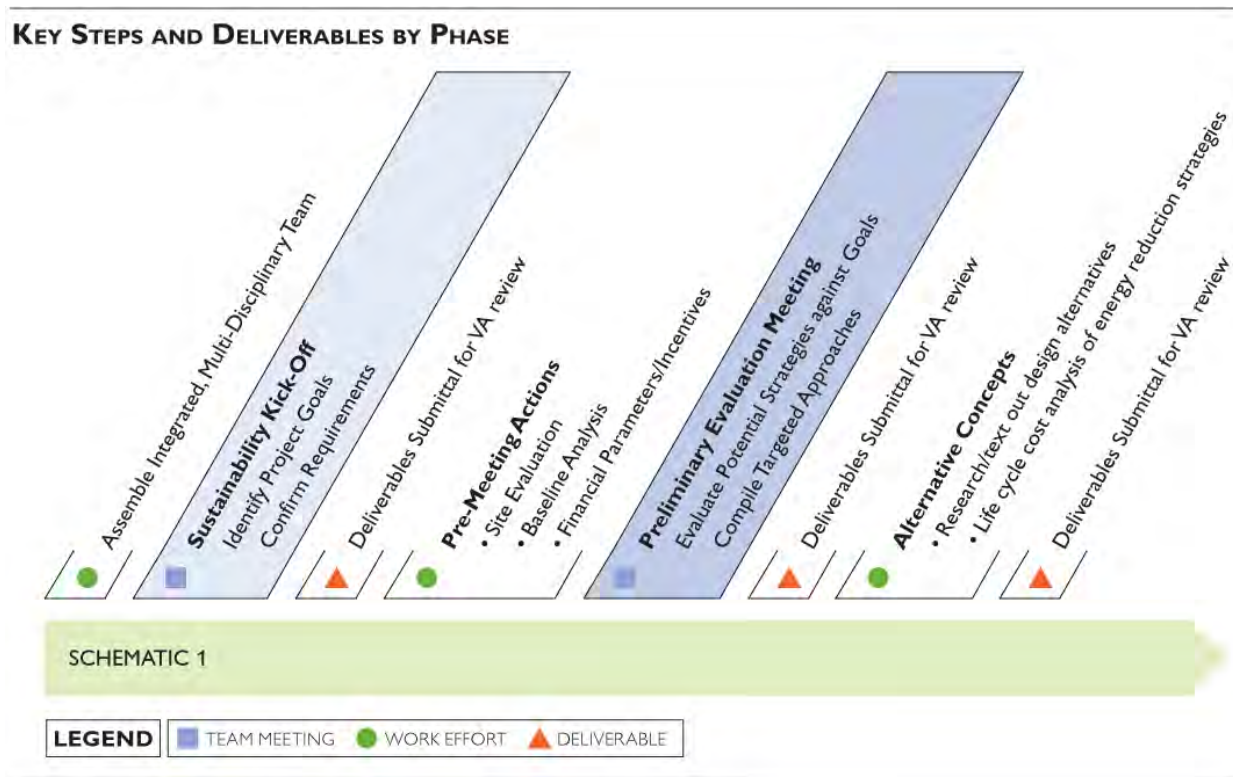
Each large square represents a meeting with broad project representation. The meetings should cover the following key topics:

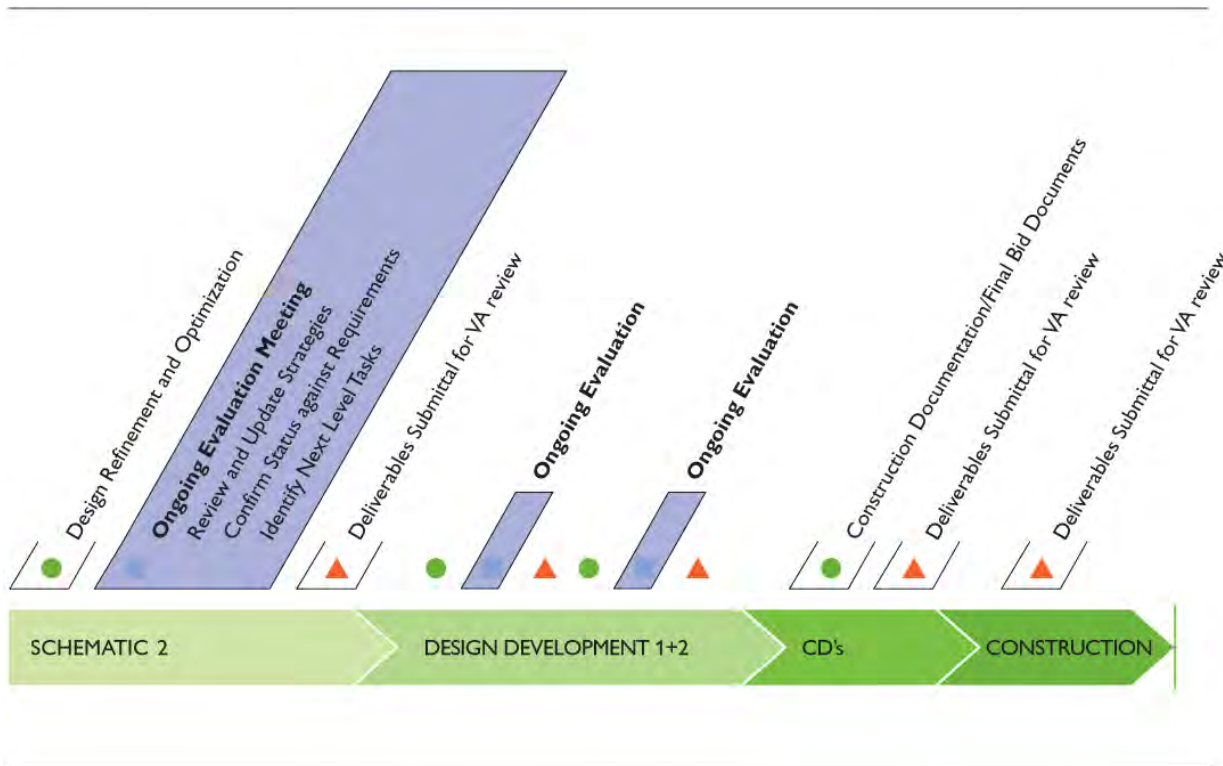
1. **Sustainability Kick-Off Meeting** – Goal setting
2. **Preliminary Evaluation Meeting** – Identify potential strategies, target energy reduction
3. **Ongoing Evaluation Meetings** – Confirm strategies, confirm energy reductions

The goal in an integrated design schedule is to balance out the total number of project meetings by increasing the number and type in the early phases and reducing those for resolving issues that traditionally take place later in design, since potential conflicts and problems have already been addressed through early collaboration.

3.6 KEY STEPS AND DELIVERABLES BY PHASE

The diagrams and descriptions on the following pages illustrate in more detail the integration of sustainable design meetings and deliverables into VA's existing design process.





3.7 SCHEMATIC 1

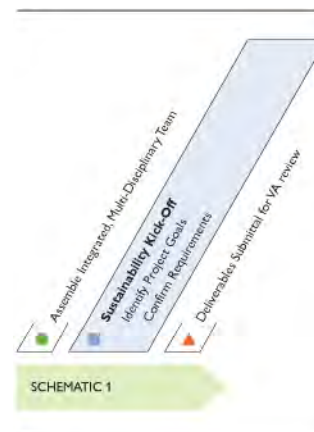
VA requires the A/E team to provide alternative approaches during Schematic 1. (A/E Design Submission Instructions - http://www.va.gov/facmgt/ae/des_sub.asp).

3.7.1 SUSTAINABILITY KICK-OFF MEETING

Held at the beginning of Schematics 1, the Sustainability Kick-Off Meeting is a collaborative goal setting session where the full team identifies project specific requirements, priorities, and measurable goals.

This broad-based team meets and discusses:

- VA sustainable goals/requirements, including the specific requirements based on the Federal Mandates and the LEED points that apply.
- Project-specific goals based on specific challenges and opportunities for project type, scope, location, and program.
- Regional/local environmental goals based on specific challenges and opportunities.



SUSTAINABILITY KICK-OFF DELIVERABLES

The following results of the Kick-Off meeting should be submitted to the VA Project Manager:

1. Identification of five to ten project-specific priority environmental goals and target measurements (e.g. 100 percent of stormwater to remain on site).
2. Life-cycle cost parameters for decision making. These will include establishment of the key analysis metrics, such as discount rate, inflation rates, analysis time horizon etc.

3.7.2 PRELIMINARY EVALUATION MEETING

PRE-MEETING ACTIONS

In order to make informed decisions, the following actions at minimum should be taken prior to the Preliminary Evaluation Meeting:

- **Site Base Conditions Analysis:**
 - Sun conditions: Study site sun path, shading conditions, average number of sunny days, latitude, and technical potential for solar harvesting.
 - Wind conditions: Develop wind rose diagram for site and study potential for wind harvesting.
 - Geo-thermal energy: Study soil types and site geology.
 - Climate: Study high/low temperatures, humidity, unusual conditions, and hazards.
 - Site hydrology: Determine rainfall, natural topography flow, and groundwater.
 - Habitat: Identify animal and plant types and conditions on site and in the general locale.
 - Cultural context.

- **Base Case Analysis:**
 - Begin core project programming, including identification of basic areas, functions and adjacency requirements.
 - Evaluate energy requirements including building base, receptacle and process loads.
 - Evaluate water requirements for building and site use.
 - Define program areas suitable for daylighting.
 - Develop and test a simple base case massing model to understand optimal site orientation/massing, daylighting, and wind opportunities for energy load reductions. For buildings over 8000 GSF, perform preliminary energy analyses.
- **Financial Assessment/Incentives:**
 - Identify local utility companies' rates, including peak load rates and load shedding arrangement opportunities
 - Utility Energy Service Contract (UESC) opportunities
 - Energy Savings Performance Contract (ESPC) opportunities
 - Enhanced use leasing opportunities
 - Ratepayer incentive opportunities
 - Investigate co-generation partnership opportunities
 - Research utility rebate/ potential partnerships/sell back rates
 - Research incentives potential for renewables and energy efficiency (see DSIRE website - www.dsireusa.org)

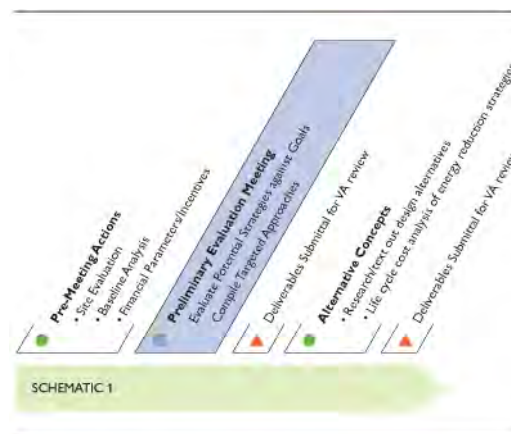
PRELIMINARY EVALUATION MEETING

The full project team should be in attendance at the Preliminary Evaluation Meeting to participate in an integrated, collaborative work-session to identify a preliminary set of sustainable strategies that they will pursue towards meeting the Federal Mandates and LEED requirement. Each discipline should be present in order to share expertise and explore strategies that seek synergies across requirements and goals. Team members should include key client decision makers, including cost estimating, facilities, VA energy and environmental managers, and operations personnel, in order to benefit from diverse experience.

This meeting should take place early in the Schematics 1 phase before development of alternative solutions.

The team should identify strategies to achieve the goals:

- **Federal Mandates:** Design/construction approaches to meet Federal Mandates as mapped to LEED credits. These are described in Section 2.
- **Energy Efficiency Strategies:** Solutions to help reach the 30 percent energy reduction goal. Some strategies must be considered at earliest phases of design while others will be applicable at later stages. Some suggested strategies are outlined in Section 4.
- **Integrated Strategies:** Solutions that work across systems to achieve multiple benefits in terms of energy savings, resource use reduction, survivability, occupant health and productivity, and so forth. These strategies require early assessment and analysis by the



team in order to be incorporated into the design with minimal cost impacts. Selected strategies are outlined in Section 4.

PRELIMINARY EVALUATION MEETING DELIVERABLES

The following deliverables should be submitted to the VA Project Manager:

1. A preliminary VA sustainable checklist for the project identifying targeted solutions to the Federal Mandates by LEED credit.
2. The results of the site base conditions analysis
3. An integrated budget estimate incorporating the planned sustainable strategies.

3.7.3 ALTERNATIVE CONCEPT DEVELOPMENT

The design team should research and test out targeted sustainable strategies as alternative design solutions are being developed, always seeking those solutions that will give the greatest benefit through integrated system strategies.

Alternative solutions to reach the 30 percent energy consumption reduction requirement should be tested through energy modeling and life-cycle costing to determine the best solution. In order to meet VA requirements, solutions should be evaluated at successive decrements below 30 percent, (e.g. 25 percent, 20 percent, etc.).

3.7.4 SCHEMATIC 1 DELIVERABLES

The following documents must be submitted before a final decision is made on the preferred design concept at end of Schematic 1.

1. A preliminary VA sustainable checklist for the project identifying targeted solutions to the Federal Mandate by LEED credit.
2. Preliminary energy models for alternative schemes indicating at least relative percent reductions. Green Building Studio, Trane, or other similar software may be used for this stage.
3. An integrated budget estimate incorporating the planned sustainable strategies

NOTE: The energy calculations and backup material for each alternative shall be presented at the Central Office concept presentation.

3.8 SCHEMATIC 2/ DESIGN DEVELOPMENT 1 AND 2

The integrated team should continue to work together on the solutions for sustainable strategies during Schematic 2 and Design Development 1 and 2. After selecting a design, the design team will continue refining the plans, optimizing the design and testing the solutions, moving from larger scale to smaller scale systems decisions. The team should work with different combinations of members depending upon issues being addressed, always seeking the maximum benefit across systems by involving team players from relevant design, construction, operations, and maintenance as needed.

The entire integrated team should meet before commencement of Design Development 2 to verify the final design and sign off on all decisions that will have impact on the project's sustainable strategies. A decision on the final Energy Efficiency Measures (EEMs) to be incorporated into the project must be made with VA approval, by the applicable VA

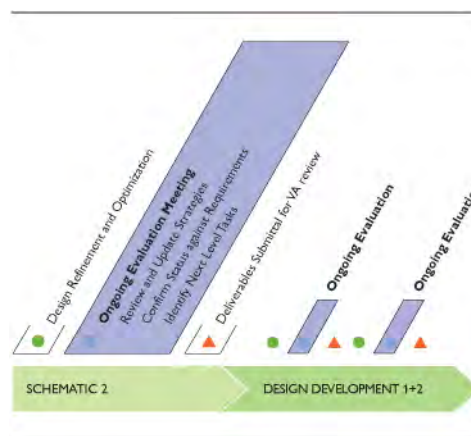
Administration's office responsible for standards, prior to finalization of design, based on the life-cycle analysis results.

Beginning in the Schematic 2 phase, the consulting design team should register the project, based on criteria outlined in Section 2, on the USGBC LEED website. This will give the team access to the LEED online site which can be used to track the status of LEED credits and documentation requirements. Documentation based on LEED requirements will be submitted to VA in later phases for Federal Mandates linked to LEED credits. A designated team member should be responsible for keeping the LEED-related information up to date for credits being pursued by the project.

3.8.1 ONGOING EVALUATION MEETINGS

At each meeting the following agenda items should be covered:

1. Confirmation of VA requirements and project goals.
2. Review of environmental standards that should be incorporated into the sustainable strategy
3. Review an update of sustainable and energy reduction strategies to meet requirements:
 - a. Status of strategy refinement – what's working, not working, next level of tasks.
 - b. Review of any new or alternative approaches to meet requirements and agree on next steps.
 - c. Review of energy reduction status based on above.
 - d. Confirm project budget and life-cycle cost analysis.
4. Reconfirm LEED target certification level status and documentation requirements, where applicable.
5. Identification of next level tasks and responsibilities for team refinement.
6. Coordinate decision making against larger schedule so that design opportunities are not lost.



3.8.2 SCHEMATIC 2 DELIVERABLES

1. An updated VA sustainable checklist for the project with written narrative summarizing status of meeting full Federal Mandates.
2. Refine the energy model of the design building
 - Generate an ASHRAE 90.1-2004 Appendix G compliant base case to compare with the design case, for all buildings over 8000 GSF.
 - Use the energy model to simulate Energy Efficiency Measures (EEMs) for the proposed design and show the associated energy consumption and cost savings for each
 - Prepare an energy model report describing all assumptions used in creating the model and summarizing the energy and cost savings associated with each EEM simulated, as well as summarizing the projected savings vs. the ASHRAE 90.1-2004

Appendix G base case. The savings vs. the ASHRAE case will be summarized based on the following comparisons:

- **Consumption:** BTU/GSF/year, including receptacle and process loads.
- **Energy Cost:** \$/GSF/YR for regulated energy (excluding receptacle and process loads)
- **LEED:** \$/GSF/YR for total energy (including receptacle and process loads)

NOTE: For calculating energy for acute care projects, 30% shall be used as the receptacle and process loads in determining the baseline building performance rating.

3. Document showing life-cycle cost analysis against varying levels of energy reduction target levels.
4. Updated cost estimate.

NOTE: The energy calculations and backup material shall be presented at the concept presentation at Central Office.

3.8.3 DESIGN DEVELOPMENT 1 + 2 DELIVERABLES

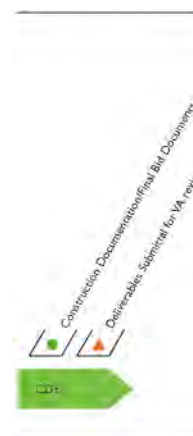
The deliverables for Schematic 2 phase should be continually updated and submitted for VA Project Manager review at the end of each Design Development phase. In particular, the energy model requirements are to:

1. Update the energy model based on design changes and added design detail
2. Use the energy model to simulate any additional EEMs considered
3. Update energy model report, summarize the energy and cost savings of each EEM simulated. Update the projected savings vs. the ASHRAE 90.1-2004 Appendix G case, using the same comparison metrics as in the Schematic 2 phase.
4. Identify percentage of energy savings achieved
5. Document showing life-cycle cost analysis against varying levels of energy reduction target levels.

3.9 CONSTRUCTION DOCUMENTATION

Sustainability-related meetings should occur during Construction Documentation as needed among related team members to finalize details on sustainable strategies. Careful attention to final project drawings and specifications to incorporate requirements for identified sustainable strategies is critical. Existing VA specifications may need modifications to incorporate these requirements until such time that standard specifications are modified.

By the end of Construction Documentation phase, the Federal Mandates linked to LEED credits that are based on design solutions will be finalized. The construction project team will use the LEED online website to prepare documentation for the VA Project Manager for those design phase credits to confirm compliance. For those project teams choosing to pursue official LEED certification, documentation for all design phase credits can be completed at this time and submitted to the USGBC for review. See the VA Project Start Point charts in the Appendix for designation of LEED credits by design and construction phase.



3.9.1 CONSTRUCTION DOCUMENT DELIVERABLES

1. An updated VA sustainable checklist for the project with written narrative summarizing status of meeting full Federal Mandates.
2. For each design phase LEED credit mapped to a Federal Mandate, submit documentation per requirement on USGBC LEED online website.
3. Final energy model report as follows:
 - Update the energy model during the Construction Document phase based on the final design documents. Provide final information regarding the three energy measurements to Central Office.
 - Update energy model report, summarizing the projected savings vs. the ASHRAE 90.1-2004 Appendix G case, using the same comparison metrics as in the Schematic 2 phase.
4. Updated cost estimate.

3.10 CONSTRUCTION PHASE

During the construction phase the A/E team should coordinate with the VA Resident Engineer, the commissioning agent, and the contractor to insure that sustainable requirements are realized in the final construction. The following areas require particular attention:

- Care to assure that the design intent, especially of those that cross systems, are fully employed and operational
- Review of submittals against specifications:
 - Review submittals, samples, and product literature to meet specified standards.
 - Substitutions must meet specified recycled, bio-based, and IAQ, and other requirements.
 - Ensure that special installation requirements are being met.
- Observation of Construction Waste Management Plan execution.
- Documentation and warranties of all systems is provided to VA to operate the building
- Observation of Indoor Air Quality Guidelines execution.



After completion of construction, documentation for the Federal Mandates linked to construction-based LEED credits should be submitted to the VA Project Manager to confirm compliance. For those project teams choosing to pursue official LEED certification, documentation for all construction phase credits should be completed at this time and submitted to the USGBC for final review and certification.

3.10.1 CONSTRUCTION PHASE DELIVERABLES

1. Final VA sustainable checklist for the project with written narrative summarizing status of meeting full Federal Mandates.
2. For each construction phase LEED credit mapped to a Federal Mandate, submit documentation per requirement on USGBC LEED online website.



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