Energy and Energy Analysis 01.86.26

Description:

The purpose of the section is to highlight the current applicable UMD Design Standards that address the completion of energy modeling assumptions and, measurement and verification for new and major renovation projects at the UMCP campus.

Building design optimization, energy modeling and measurement/verification of facility performance after the completion of a project are critical to achieving the University's goals of reducing energy consumption and greenhouse gas emissions. For our building projects to be fully cost effective, energy conservation measures require careful consideration and are expected to be introduced during the project's early design phase.

Energy modeling, as described in this section, is required for all new construction and/or major renovation projects greater than 7,500 GSF. A major renovation project is defined as a renovation in which the building shell (exterior walls, floors, and roof structure) is to be reused for the new construction and the heating, ventilating, and air conditioning (HVAC), electrical, and plumbing systems shall be replaced.

Related Sections:

- 01.61.13 Building Commissioning
- 01.81.13 Sustainable Design Requirements
- 22.09.00 Meters, Water Flow and Energy (BTU)
- 23.00.04 Energy Efficiency
- 23.00.05 Mechanical Design Standards
- 25.10.00 Automatic Temperature Controls
- 25.13.00 Central Control and Monitoring (CCMS)
- 33.71.33 Utility Metering

Effective Date:

January 1, 2020

Applicable Standards:

- Federal Energy Management Program's Measurement and Verification Guidelines (FEMP M&V Guidelines), Latest Version
- Life Cycle Cost Analysis: NIST Building Life-Cycle Cost (BLCC) Latest Version

General Requirements:

Energy modeling is required to be overseen by a Maryland registered professional engineer or Architect but may be performed by an energy modeler holding either a current ASHRAE Building Energy Assessment Professional certification or an Association of Energy Engineers Certified Energy Auditor certification.

Role of the Energy Analyst shall be to:

- Identify the project Energy Use Intensity (EUI) goal based on current campus energy goals and compared to similar projects in the Energy Star Portfolio Manager's Target finder (if not already identified in the Program documents). The EUI project goal will be confirmed by FM Director of Engineering and Energy.
- Review and coordinate all disciplines within the design team to achieve the optimal energy efficient design.
- Review all architectural, mechanical, and lighting design documentation for compliance with energy guidelines developed by the University, prior to any design milestone submission to the University.
- Perform energy and life cycle cost analysis, to ensure the building design considers both capital and operating and maintenance costs when making decisions of means and methods to achieve the University's reduced first cost and continuing costs.

- Perform energy and life cycle cost analysis based on the University's actual and current rates for net present

values, utility costs, renewable energy certificate (REC) costs, carbon offset costs, maintenance costs and replacement life expectancies.
- Attend early design meetings to confirm building site, orientation, and configuration as factors in energy consumption.
- Calculate the projected energy cost of various design alternatives, as requested by the University.
- Prepare required energy reports at associated project phases.
- Develop monitoring-based procedures, schedule and identify points to be measured and evaluated to assess performance of energy- and water-consuming systems.
- Provide documentation as required to meet state requirements for the High Performance Building Program (i.e. LEED certification).

Energy Analysis/Simulation Model Requirements:
- The Energy Analyst shall develop a whole building energy model using U.S. DOE "Energy Plus Version 8.2 or latest version" and "Open Studio Plug-In" model during the integrated design process. Other modeling software may be used as approved by the University.
- During the integrated design process NIST "BLCC latest version" shall be used to compare various building orientation, building envelope features, and HVACR options including operations and maintenance costs.
- Energy escalation rates shall be calculated using DOE Energy Escalation Rate Calculator plug-in to Energy Plus Model.
- Renewable energy certificate (REC) and carbon offset rates shall be included in all life cycle cost analyses using prices and escalation rates available at https://go.umd.edu/CNND.
- Weather data for calibration shall be provided by DOE plug-in for Energy Plus.
- Use NIST BLCC for the determination of life cycle cost comparisons.
- Identify the people diversity factors used in the energy analysis.

Phase Submission Requirements:
Concept Design – provide a formal written analysis including, but not limited to:
- Identifying the major building energy end uses.
- Identifying the EUI goal for the project and comparing to similar buildings on the campus and/or other comparable buildings with information in the public domain.
- For each major building energy end uses, identifying the design strategies that could be employed toward energy reductions that meet the EUI goal.
- Identifying effects of relative orientation and massing options on the energy end uses.
- Identifying optimal floor plan aspect ratios for the project to meet the EUI goal.
- Identifying reasonable expectation of occupant use patterns.
- Identifying any program adjacencies that could contribute to energy reductions or increases.

Schematic Design – provide a formal written analysis including, but not limited to:
- Identifying the breakdown of energy consumption by fuel type.
- Performing energy and life cycle analyses on building envelope systems, a base HVAC and lighting system plus a minimum of 3 alternate HVAC and lighting systems that have been formally reviewed and approved by the University's FM Energy Performance representative.
- Identifying the source of each fuel type and the annual cost of achieving net-zero greenhouse gas emissions to comply with the University of Maryland's Carbon Neutral New Development Initiative.
- For major energy end uses, identifying how building components, such as envelope, roof and wall, conduction, window solar heat gain/loss, lighting, occupants, plug loads, ventilation, infiltration, etc. contribute to energy consumption and ongoing carbon neutrality costs.
- Identifying design strategies that can be employed to optimize proposed building components.
- Identifying a list of measures that can be employed for greatest impact on lifecycle energy and carbon neutrality costs.

Design Development – provide a formal written analysis including, but not limited to:

- Identifying the most effective environmental control strategies that maintain occupant comfort for this project given the location, climate, occupancy, and building type.
- Ensuring modeling inputs, such as location, set-points, envelope U-values, percent glazing, infiltration, lighting power density, plug load schedules, occupancy schedules, and system types accurately reflect the design.
- Identifying how energy and associated carbon emissions will be managed and accounted for during building operations and ensure metering strategy supports this.

Construction Document – provide a formal written analysis including, but not limited to:
- Comparing the detailed energy model to the EUI goal established at project initiation.
- Ensuring the assembly and system performance requirements from the energy modeling inputs are reflected in the specifications.
- Updating the energy and life cycle analysis on the University's selected HVAC and lighting systems design.
- Ensuring modeling inputs, such as location, set-points, envelope U-values, percent glazing, infiltration, lighting power density, plug load schedules, occupancy schedules, and system types accurately reflect the design.

Construction – during the Construction phase:
- Provide formal written analyses as needed to identify construction substitutions or changes that may affect the energy performance of the building.
- Update the model as needed to provide an "As Built" energy model.

Post-Occupancy – (12) twelve months after final Commissioning:
- Provide a formal, written analysis comparing annual energy consumption to the model results. Identify probable causes for inconsistencies and suggestions for correcting deficiencies.
- A/E shall recalibrate the model using FEMP M&V Guidelines, Latest Version. The final, recalibrated model shall be provided to the Engineering and Energy Department for updating the energy use baseline, energy analytics and maintaining the building at peak efficiency through changes in operations and maintenance.