Montgomery County Building Energy Performance Standards

Building Performance Improvement Plan (BPIP): Energy Audit and Retrofit Plan Technical Guidance

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1. Scoping the Energy Audit

The energy audit must be scoped to provide a comprehensive assessment of building energy systems in support of developing a technically sound, cost-effective BPIP. Audits should be conducted and documented in alignment with the procedures and reporting outlined in ASHRAE Standard 211 for Level 2 Energy Audits, which provides the baseline standard of care expected. While the exact scope will vary based on building size, type, and system complexity, all audits must meet the applicable requirements of ASHRAE Standard 211 Level 2 Procedures (Section 5) and Reporting (Section 6) and include the following core components to ensure regulatory compliance and actionable outcomes.

The scope of the energy use and equipment for the assessment should be inclusive of the total energy use reported to the County in the energy benchmarking, energy use paid by tenants, and major equipment contributing to that energy use owned or controlled by tenants or third parties.

1.1 System Inventory and Condition Assessment

- Identify and document all major building systems, including:
    - All indoor and outdoor Heating, Ventilation, and Air Conditioning (HVAC) equipment
    - Electrical main service and distribution equipment
    - Building automation and controls systems
    - Service hot water systems
    - Lighting systems, both interior and exterior
    - Building envelope systems
    - Specialty energy-using systems, including but not limited to:
        - Elevators and escalators
        - Swimming pools
        - Commercial refrigeration, cooking, or washing/drying systems
        - Medical imaging or diagnostic equipment
        - Server equipment
- For mechanical and electrical equipment, record:
    - Manufacturer, model number, and serial number (where available)
    - Fuel type (if not electricity)
    - Installation year and estimated remaining useful life
    - Observed operating condition and any visible deficiencies
    - Equipment operating schedules and sequencing

  - End use or service area (e.g., serving residences, common areas, specific tenants, office floor perimeter/core zones)

1.2 Operational Review and Controls Assessment

- Compare equipment control strategies and operating schedules to current building functional use patterns:
  - Identify potentially excessive runtimes, overly rigid setpoints, unnecessary simultaneous heating/cooling, or failure to implement thermostat setbacks
- Assess the control systems in place, whether a formal Building Automation System (BAS) or simpler local controls (such as equipment controllers, timers, or standalone panels), including but not limited to:
  - Which systems, equipment, and points it actively controls and monitors
  - What data is being trended (e.g., temperatures, damper positions, status, alarms)
  - Network connectivity, protocol, and any remote access or cloud integration features
- Identify opportunities to:
  - Retrocommission equipment or retune controls for better alignment with building use and performance goals
  - Recommend control functions as part of a future upgrade measure to achieve energy savings (e.g. demand-controlled ventilation, temperature reset, equipment staging)
    - Include upgrading to IP-based BAS if applicable

1.3 Engagement with Building Operations Staff

- Conduct structured interviews with those most familiar with the day-to-day operation and challenges of the building—whether operations staff, maintenance personnel, or knowledgeable managers—to gather:
  - Functional feedback on system performance
  - Identification of persistent occupant complaints, issues, workarounds, or recent repairs
  - Insights into seasonal or operational challenges not apparent from data alone
- Use this input to inform recommendations and uncover additional opportunities for optimization
- Include tenant operations personnel in interviews if tenant controlled-and-operated systems are part of audit scope

1.4 Equipment Replacement and Upgrade Planning

- Identify systems or components likely to require replacement within the next 10 years based on age, condition, or recurring maintenance issues
- For each such system, recommend:

- Cost-effective replacements, which may include in-kind replacements with higher efficiency or alternative systems
    - For example, consider installing a heat pump RTU when existing gas or electric resistance RTUs need to be replaced
    - Consider opportunities for energy recovery, like ventilation exhaust or simultaneous heating and cooling loads
  - Partial system upgrades or phasing strategies if cost-effective
- Highlight opportunities to integrate upgrades with other planned capital projects or tenant improvements

1.5 Electrification Readiness and Renewable Integration Assessment

Electrification Feasibility

- Evaluate existing electrical service and distribution capacity:
  - Main service size (amps, voltage, number of phases)
  - Subpanel capacity and available breaker slots
  - Existing electrical loads and metered peak demand from utility bills
- Preliminarily identify fossil fuel equipment that could be electrified without requiring upgrades to electrical infrastructure

Onsite Renewable Energy Generation Assessment

- Assess the feasibility of onsite solar photovoltaic (PV) system integration
- Estimate:
  - Available unshaded roof or ground-mounted area suitable for solar PV installation
  - Approximate system capacity (kW) based on usable area
  - Expected annual electricity generation
- Evaluate:
  - Installation cost
  - Annual electricity cost savings
  - Simple payback, calculated as: Simple Payback = Installation Cost / Annual Electricity Cost Savings
- Consider the 25+ year expected service life of PV systems and include systems that are projected to be cost-effective in the BPIP
- Calculations should be provided in the audit documentation

2. Audit Deliverables

The audit report documents the findings and analysis supporting a BPIP. It must be complete, technically sound, and clearly organized to allow both the building owner and the Department to understand the basis for recommended actions. The deliverables should follow ASHRAE Standard 211 Level 2 Reporting (Section 6) and provide enough detail to support cost-effective planning and ensure compliance with audit requirements.

2.1 Required Report Contents

Executive Summary

- Brief overview of the building and audit objectives
- Key takeaways including:
  - Identification of cost-effective Energy Improvement Measures (EIMs)
  - Summary of potential retrofit scope aligned with BPIP development

Building and System Overview

- General building characteristics:
  - Use types, gross floor area, occupancy schedule
- Summary of existing energy-consuming systems and major infrastructure
  - Include tenant-controlled equipment outside of owner's control
- Description of known retrofits, additions, or major renovations since original construction, and any changes in building function or occupancy patterns over time
- Description of known events—planned capital replacements or upgrades, tenant improvements, asset repositioning—to identify opportunities for phased implementation

Energy Use Profile

- Summary of annual energy use by source:
  - Electricity, natural gas, other fuels
  - Renewable electricity generated onsite, if applicable
- Identification of retrocommissioning opportunities to retune operations and reduce energy waste, based on trends or discrepancies in use patterns
- Estimated end-use breakdowns of energy consumption, accounting for aspects of building operation that are typical or atypical of its use types

List of Energy Improvement Measures (EIMs)

- Organized into three groups:
  - Cost-effective measures required for inclusion in the retrofit plan

- Evaluated but not cost-effective measures (to clarify why certain upgrades were not recommended)
- Cost-effective measures not included in the retrofit plan because of circumstances outside of the owner's control (must provide justification including but not limited to legal or technical circumstances and include documentation)

- Each EIM must include:
  - Description and affected system or equipment
  - Estimated first cost
  - Predicted annual energy savings by fuel type
  - Simple payback (in years), calculated as: Simple Payback = First Cost / Annual Energy Cost Savings
- Categorize each EIM as:
  - Operational – no/low capital cost; retrocommissioning, controls optimization, scheduling
  - Capital, targeted upgrades – moderate cost measures that do not require infrastructure upgrades (e.g., RTU replacements, localized electrification, controls upgrades)
  - Capital, comprehensive retrofits – higher-cost measures requiring major infrastructure upgrades (e.g., service-heavy electrification, full HVAC system replacement, or a roof or envelope project)

Controls and Operational Opportunities

- Evaluation of existing control systems, sequences, and remote access capabilities
- Identify opportunities for retrocommissioning of existing equipment and systems:
  - Recalibration, tuning, and recommissioning of controls for HVAC, lighting, and other major systems
  - Optimization of sequences of operation to align with occupancy, loads, and operating schedules
  - Ensuring existing equipment with significant remaining service life is performing efficiently and reliably
  - Implementing no- and low-cost measures that yield energy savings without capital upgrades

Replacement Planning

- Identification of major equipment expected to require replacement within 10 years
- For each, estimate:

- First cost and performance of an in-kind replacement (i.e., similar function, modern energy code efficiency)
- Incremental cost and energy savings of an upgraded or alternative solution
- This analysis should help owners understand the value of upgrading beyond lowest first cost when systems are already scheduled for replacement

- Replacement upgrades where savings pay back incremental cost within service life should be included in the BPIP or implemented before submission. The end of service life of existing equipment is considered a qualifying event for implementation

Electrification Feasibility Summary

- Condition assessment of major fossil fuel equipment (e.g., boilers, water heaters, cooking appliances)
- Estimation of available electrical capacity, based on main service size, panel ratings, connected load, and historical utility demand data
- Preliminary identification of fossil fuel equipment that could be electrified under existing electrical capacity

2.2 Documentation and Supporting Materials

Required Documentation

- Assumptions and Data Sources:
  - All assumptions use broadly accepted industry standards approved by the Director
  - Utility rates and baseline usage data
  - Source(s) of cost estimates (e.g., RSMeans, contractor quotes, manufacturer pricing)
  - Source(s) of useful service life estimates of equipment and measures (e.g., Mid-Atlantic Technical Resource Manual, ASHRAE or Fannie Mae tables)
  - Manufacturer data and field measurements used to estimate existing equipment efficiency and performance
  - Energy models or other computer-based calculations used to estimate energy savings for recommended and evaluated measures
- Onsite Solar PV Estimation:
  - Include area assumptions, system sizing, projected generation, and simple payback calculation based on installation cost and electricity savings
- Auditor Certification:
  - Name and credentials of the auditor
  - Signature and date of completion

Optional Supporting Materials

- Photos of major equipment
- Annotated floor plans or diagrams
- Appendices with sample calculations or data tables
- Interview notes or summary comments from building staff

2.3 Format and Submission Standards

The County will publish a standardized reporting format for energy audits submitted as part of a BPIP. This format will be issued well in advance of the first BPIP deadline in 2029 and will be required for all submissions.

In the interim:

- Reports should be clearly organized and submitted in PDF format
- Terminology and units should align with County definitions
- Editable files and source data should be retained for future clarification if requested

3. Retrofit Plan Requirements

The Retrofit Plan outlines a building owner's commitment to implement all cost-effective EIMs identified in the audit. It is the core component of the BPIP and must clearly demonstrate that the building will maximize energy and emissions reductions consistent with the law, even if it cannot meet the performance standard.

3.1 Required Plan Components

Selected Energy Improvement Measures (EIMs)

- List of all cost-effective EIMs from the audit that the owner commits to implement
- Each measure must be categorized as:
    - Operational
    - Capital, targeted upgrades
    - Capital, comprehensive retrofits
- Include for each:
    - Estimated first cost
    - Simple payback (in years)
    - Projected annual or lifetime energy savings
- If the building owner has used a BPIP to comply with the interim performance standard, all energy improvement measures in the retrofit plan with a simple payback of 5 years or less must

be implemented before DEP will approve a subsequent building performance improvement plan for compliance with the final standard.

Implementation Strategy

- Describe how and when remaining cost-effective measures will be implemented
- Schedule may be based on qualifying events, including but not limited to:
    - Existing equipment reaching end of useful life
    - Tenant turnover or major space renovations
    - Availability of equipment, capital, or financing
- Where applicable, explain dependencies (e.g., permitting, design, phasing constraints) that affect timing

Performance Impact Summary

- Project the building's post-retrofit performance after all cost-effective measures have been implemented
- Compare projected site energy use intensity (site EUI) to the building's baseline
- This summary is intended to show the impact of the BPIP—not to demonstrate compliance with the final performance standard

3.2 Role of Retrofit Plan in BEPS Compliance

- Buildings submitting a BPIP are not required to demonstrate compliance with the performance standard
- Instead, BPIP compliance is based on:
    - Completion of a qualifying energy audit
    - Demonstration that all cost-effective energy improvement measures have been identified and either implemented or planned based on reasonable qualifying events
        - Acceptable proof of implementation will be determined by the Department in advance of the interim deadline
- The Department will review the Retrofit Plan to confirm:
    - Measures with simple payback < 5 years have been implemented or scheduled before the final compliance deadline. The remaining measures are scheduled in good faith
    - No significant cost-effective opportunities were excluded without justification

3.3 Supporting Documentation

- Reference relevant audit sections to justify each measure and its timing
- Include a summary table of EIMs with:

- Measure name and description
- Type/category
- Estimated cost, savings, and simple payback
- Implementation status and planned schedule or qualifying event

- Provide additional attachments as needed to explain plans, phasing, or other considerations

4. Cost Effectiveness Analysis for Energy Improvement Measures (EIMs)

4.1 Purpose and Context

- Cost effectiveness is assessed using simple payback, defined as:
  - Simple Payback = First Cost / Annual Energy Cost Savings
- This metric determines which EIMs are required for inclusion in the BPIP
- Measures with a simple payback under five years must be implemented by the final BEPS compliance deadline

4.2 Estimating First Cost

Cost Estimation Context

Cost estimating is a complex, multi-faceted exercise that must account for variability in market conditions, materials pricing, labor availability, and supply chain dynamics. There is no single standard data source for cost estimation. Practitioners are encouraged to cross-reference multiple sources, including but not limited to professional cost estimators, contractor estimates and subscription-based cost databases such as RSMeans. However, costs may be highly dependent on building-specific factors and prevailing market conditions at the time of audit. Transparency in documentation and rationale for selected cost values is essential.

Included Cost Components

In alignment with ASHRAE Standard 211 (Section 5.4.8), the following cost categories should be considered where applicable in the estimation of first cost:

- Material costs (equipment and supporting components)
- Labor costs (installation, removal, and preparation)
- Design and engineering fees
- Construction management and project oversight
- Site-specific installation factors (e.g., access constraints, phasing)
- Permits and regulatory fees
- Temporary services required during construction
- Testing, adjusting, and balancing

- Utility service upgrades or modifications
- Commissioning or recommissioning services
- Applicable taxes
- Contractor and vendor profit
- Any additional adjustments, such as incentives, that significantly affect the cost estimate and can be reasonably attributed to the EIM

Incremental Cost Considerations

- When equipment is at end of useful life, the cost analysis must be based on the incremental cost of an upgrade, rather than full replacement cost
- The baseline should be an in-kind replacement with modern, energy code-compliant efficiency (i.e., lowest first cost and lowest expected energy cost savings)
- Upgraded alternatives (e.g., higher-efficiency or electrified systems) should be evaluated for both additional (incremental) first cost and energy cost savings over the baseline.

Incremental Cost Example 1: Existing RTU with electric resistance heating is being replaced

	First Cost ($)	Annual Energy Cost Savings ($)	Simple Payback
Baseline Replacement: Electric Resistance RTU with modern cooling efficiency	200,000	5,000	
Upgrade Option: Heat Pump RTU	300,000	40,000	
Incremental Analysis	100,000	35,000	2.9 years

Incremental Cost Example 2: Existing scroll chiller is being replaced

	First Cost ($)	Annual Energy Cost Savings ($)	Simple Payback
Baseline Replacement: Scroll chiller with modern efficiency	800,000	2,000	
Upgrade Option: Maglev chiller with VFD	1,000,000	17,000	
Incremental Analysis	200,000	15,000	13.3 years

Capital, Comprehensive Retrofits and Enabling Projects

- Some measures categorized as comprehensive retrofits may require enabling projects—such as electrical service upgrades—that benefit multiple downstream EIMs
- In these cases, the cost effectiveness of all related measures should be evaluated together, sharing the enabling cost
- This ensures a more accurate representation of simple payback and supports more strategic investment planning for large-scale retrofits

4.3 Estimating Annual Cost Savings

Cost Savings Estimation Context

Estimating energy cost savings is influenced by many interdependent factors like weather, utility rate structures, building operation patterns, and system performance variability. Unlike cost estimating, energy savings projections rely more heavily on calculations and simulation, metering data, and empirical benchmarks. There is no universal method or dataset that guarantees accuracy across all buildings. Practitioners may calculate their savings estimates using a variety of approaches, including but not limited to modeling tools, historical utility data, and relevant ASHRAE guidelines. Clearly documenting assumptions and calculation methods is critical to ensure replicability and transparency.

Quantifying Energy Savings

- Estimate avoided consumption in site units (e.g., kWh, therms, kBtu) per year
- Methods may include:
  - Engineering calculations
  - Annual energy simulations
  - Trend analysis or submetered data
  - Standard savings factors for routine measures (e.g. Mid-Atlantic TRM)

Utility Rates

- Use building-specific utility rate structure at time of audit
  - Separate rates by energy type (e.g., electric, gas)
  - Blended rates are permitted for each energy type

Assumptions and Adjustments

- Full realization of energy cost savings unless partial implementation is clearly documented
- Static (non-escalating) utility rates unless escalation is justified and documented
- Adjust for degradation factors if relevant

4.4 Simple Payback Presentation

Calculation Method

- Provide clear breakdown:
  - First cost: $X
  - Annual savings: $Y
  - Payback: X / Y = Z years

Tabular Summary Format Include the following for each EIM:

- Measure name
- System affected
- First cost ($)
- Annual savings ($)
- Simple payback (years)
- Category: operational, capital/targeted, or capital/comprehensive

Determining Useful Service Life

- Determining whether an Energy Improvement Measure is cost-effective requires comparing its simple payback period to the useful service life of the measure being evaluated.
- Useful service life refers to how long a measure is expected to deliver energy savings—either the full life of newly installed equipment, or for operational measures, the remaining life of the affected system or the typical duration of sustained improvements.
    - For new equipment installations, the useful service life is the expected operational life of the new equipment.
    - For operational improvements or retrocommissioning, the useful life is typically the remaining life of the affected equipment, or the expected duration of sustained impact.
- Auditors should reference industry standards, manufacturer data, and professional judgment to estimate remaining service life values.

Evaluating Cost-Effectiveness

- Measures with a simple payback shorter than the service life of the measure are considered cost-effective.
    - Specially designated buildings are not required to implement any measure with a simple payback of more than 10 years
        - Specially designated buildings mean a qualified affordable housing building, a common-ownership community, a multifamily building subject to rent stabilization, a non-profit owned building, or a local small business owned building.
- For measures that require replacement of equipment near end of life, use the baseline of an in-kind replacement to determine incremental cost and payback.
- Measures applied to relatively new systems may concern operational enhancements in the near-term, and/or system upgrades to be evaluated for the end of service life.

4.5 Documentation Requirements

- Reference all cost and savings assumptions
- Include sources of rate and consumption data

- Attach supporting calculations, model outputs, or assumptions used to estimate savings and payback

5. Review Process and Anticipated Pitfalls

5.1 Department Review Process

- **Initial Screening**
    - Confirm submission includes all required components:
        - Energy audit meeting scope, standard, and recency requirements
        - Retrofit Plan outlining all cost-effective measures identified in the audit
        - Documentation of auditor credentials and signed certification
        - Basic consistency with formatting and submission guidance
- **Technical Review**
    - Evaluate audit completeness, ensuring all major systems—including HVAC, lighting, controls, service hot water, plug/process loads, and building envelope—were assessed
    - Review the Retrofit Plan to ensure:
        - All cost-effective EIMs are included
        - Measures with simple payback under five years are identified and scheduled for implementation by the final compliance deadline
        - Qualifying events are reasonably defined
        - Calculations and assumptions are reasonable, documented, and justified
    - Confirm that electrification feasibility and onsite solar PV were evaluated
- **Follow-Up and Feedback**
    - The Department may request clarifications or supplemental documentation
    - Final BPIP approval will depend on demonstration of a good-faith commitment to all cost-effective improvements

5.2 Anticipated Issues in BPIP Submissions

- Incomplete system assessment, omitting major equipment, or applicable in-unit measures
- Failure to plan for implementation of low-payback measures before the final deadline
- Use of outdated or insufficiently scoped audits (not meeting ASHRAE Standard 211 Level 2)
- Lack of justification for excluding cost-effective opportunities
- Vague or unrealistic implementation plans

- Missing assessments of electrification and onsite renewable energy potential

6. Conclusion

A BPIP provides a structured, technically grounded pathway for buildings that cannot meet the performance standard through energy use reduction alone. By focusing on cost-effective energy improvement measures, the BPIP supports significant energy and emissions reductions while allowing for flexibility in timing and scope.

To support successful plan development and approval:

- Conduct a thorough energy audit aligned with this guidance and County regulations
- Identify all cost-effective EIMs, with supporting analysis and documentation
- Prepare a Retrofit Plan that clearly defines which measures will be implemented, when, and under what conditions
- Ensure measures with a simple payback under five years are planned for implementation before the final BEPS compliance deadline
- Evaluate electrification potential and onsite renewable energy generation, even if upgrades are not currently feasible

The Department is committed to working with building owners to ensure that each BPIP reflects a good-faith effort to comply with the intent of the BEPS law. Early engagement with qualified auditors, proactive planning for capital needs, and clear documentation will help avoid delays and support long-term compliance.