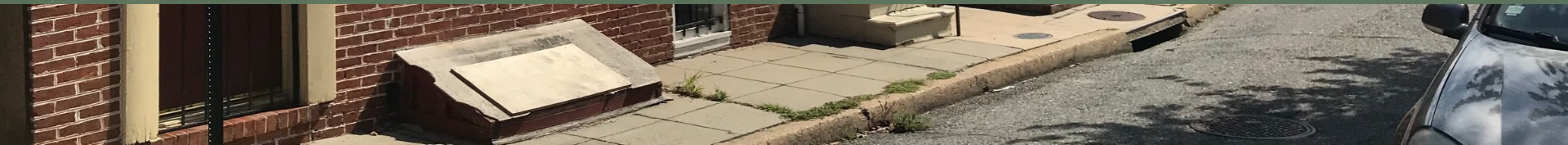
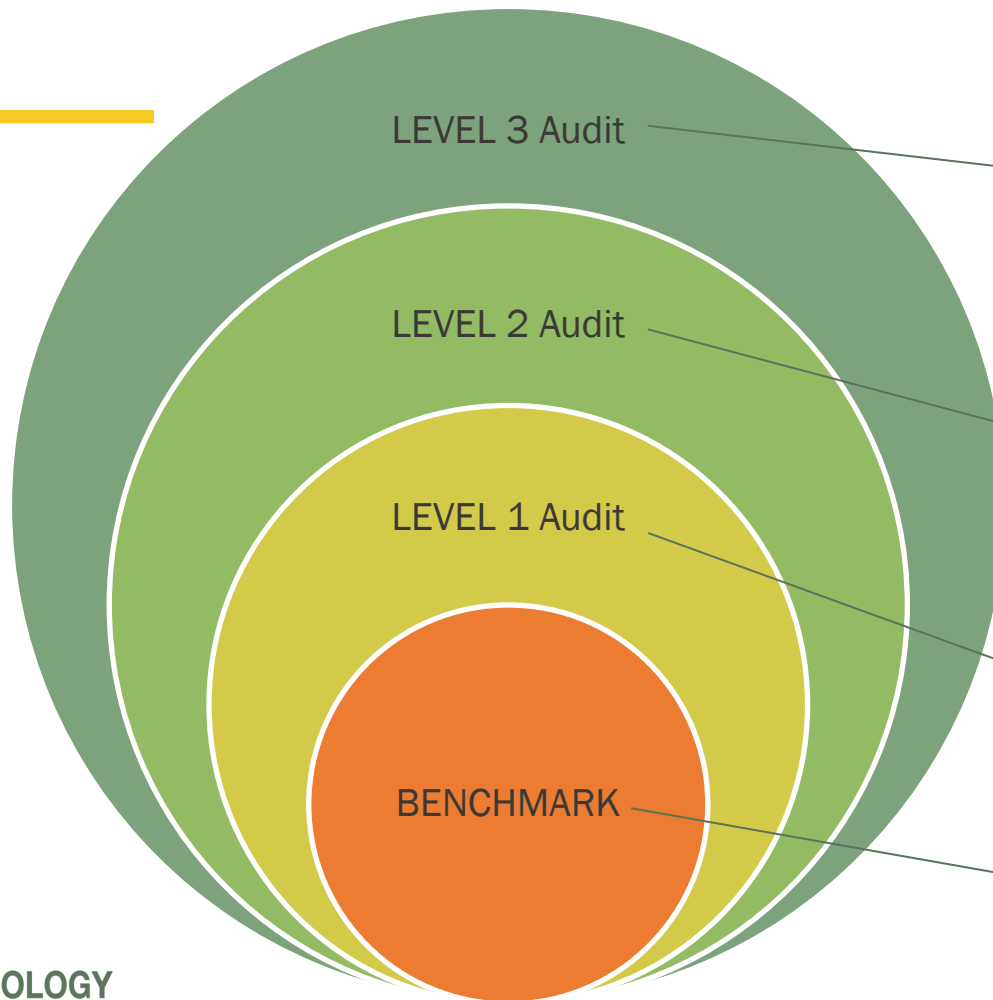




National Housing Trust
PA CDC Cohort

Decarbonization Audit Options



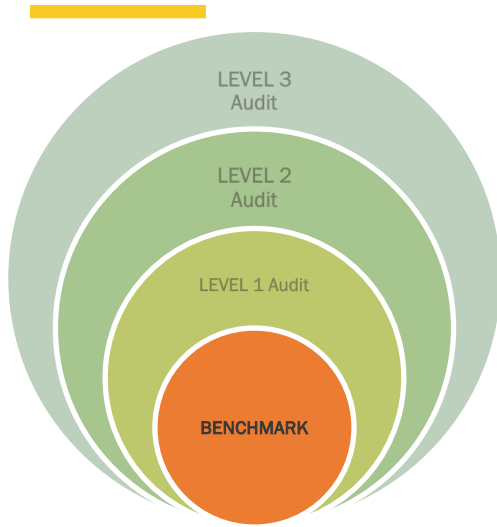


- Expanded Analysis of Specific ECMs
- Vendor Cost (Based on Max 1-yr old Estimates)
- Modeling / Detailed Calculations
- Measurement
- Investment Level – Decision-making support of Capital Measures

- Quantitative ECMs
 - Detailed Costs/Savings/Economics
- Summary of End-uses
- O&M Recommendations

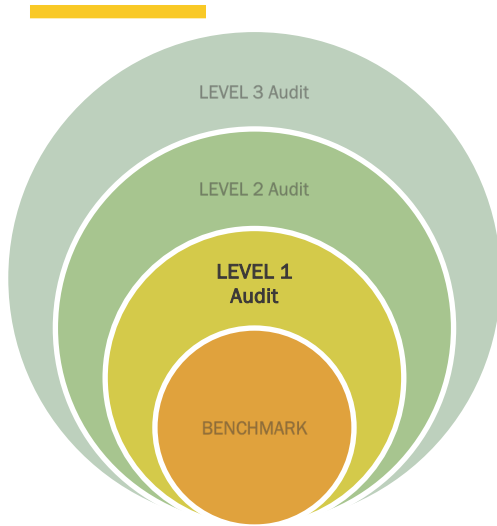
- Walk-through
- Qualitative ECMs
- Identify Capital Measures
- Energy, Carbon, Cost, Priority
 - Low/Medium/High

- Calculates EUI / Emissions
- Compares to Similar Buildings



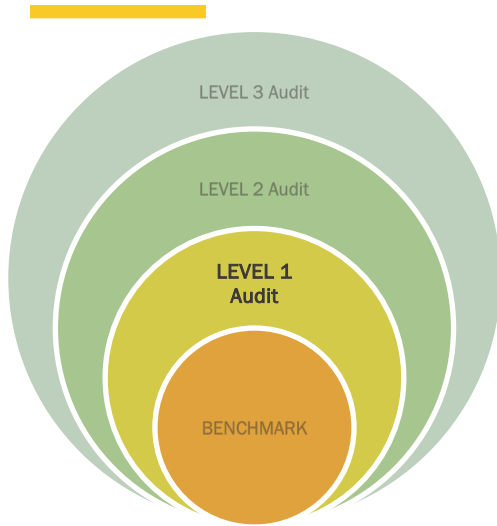
Benchmarking

- *Preliminary Energy Use Analysis – Benchmarking*
 - Min 12mo – Ideal 36-mo
- *Calculate EUI / \$/sf*
- *Compare w/ Comps*
- *Identify Hazardous/Unsafe Conditions*



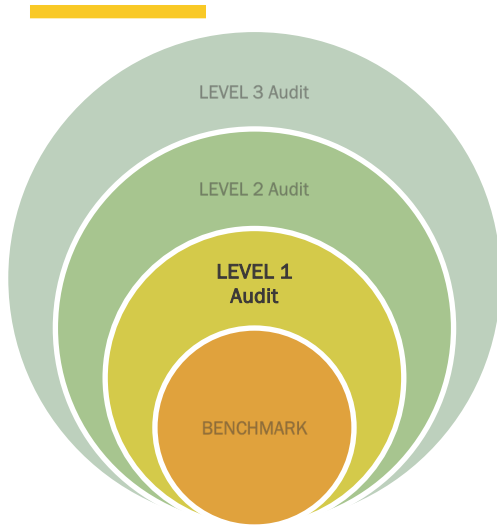
Level 1 Audit

- *Historical Billing Data*
- *Sample Size*
 - <100 Units – 10%
 - 100 – 300 Units – 8%
 - >300 Units – 6%
- *Review Utility Rates*
- *Site Visit*
- *Review O&M Problems*
- *Interview Owner/Manager*



Level 1 Audit

- *Space Function*
 - Type, Hrs/wk, Plug loads, Lighting
- *Identify Low/No Cost Measures*
- *Identify Potential Capital Measures*
 - Outside O&M Budget
 - Preliminary Cost & Savings – Low/Med/High



Level 1 Audit

- *Opportunities to Consider*
 - Description
 - Modification Type
 - Impact on Comfort/IAQ
 - Non-energy Impacts
 - First Cost – L/M/H
 - Energy & Utility Savings – L/M/H
 - Typical Return on Investment – L/M/H
 - Priority – L/M/H
- *Review w/ Owner*



Level 2 Audit

- *Energy Use & Cost Breakdown*
 - Minimum
 - Electric Use Cost
 - Electric Demand Cost
 - Other Energy Use Cost
 - Other Energy Demand Cost
- *Facility Site Survey*
- *Review O&M procedures*



Level 2 Audit

- *Systems comprising 80%+ HVAC/DHW end-uses*
- *Determine Key Operating Parameters*
 - Setpoints
 - Economizer
 - HW/Steam Set Points
 - Condenser Setpoints
 - Supply Air Set Points
 - DHW Setpoints – Delivery & Storage
 - Fan Controls
 - Ventilation Controls
 - Hydronic Loop Flow Setpoint/Controls



Level 2 Audit

- *Determine Key Operating Parameters*
 - Heating/Cooling Enable conditions
 - Major Equipment Operating Schedules
 - Warm/cooldown process
 - Unoccupied settings
 - Lighting controls
 - Equipment Efficiencies



Level 2 Audit

- *Qualitative*
 - Duct/piping leakage losses
 - Duct/piping insulation losses
 - Steam trap losses
 - Over-conditioning



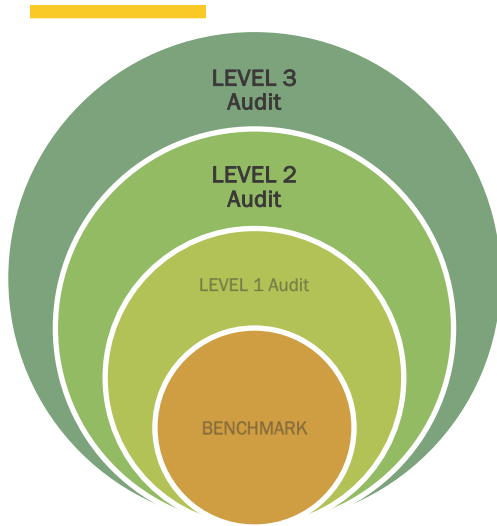
Level 2 Audit

- *Conduct End Use Breakdown*
- *Distributed & Renewable Opportunity*
- *Initial Measures List*
- *Calculate Energy Savings*
 - Energy Use Impacts
 - METHODS
 - Stipulated Values, Engineering Calcs, Building Energy Model
 - Energy Model needs to meet/exceed ASHRAE 140
 - INDIVIDUAL MEASURES
 - INTERACTIVE EFFECTS



Level 2 Audit

- *Estimate Costs*
- *Conduct Economic Analysis*
 - Simple Payback & ROI
 - Ancillary Benefits
- *Review w/ Owner*



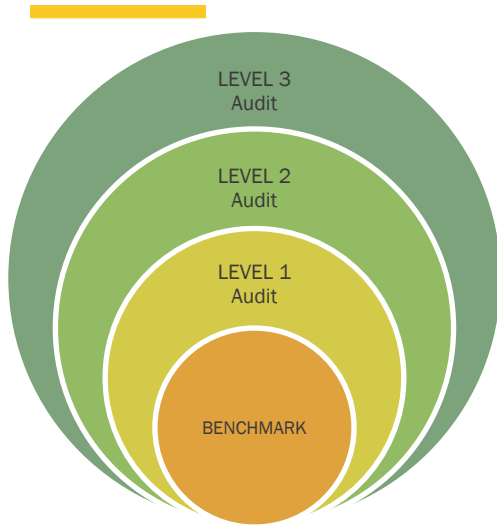
NEI Overlap with Level 3

- *Closer to SD/Placement Level Options*
- *Costing Similar to Level 3 Requirements*
- *Calculations more detailed than Level 2*
 - Still not hourly of Level 3



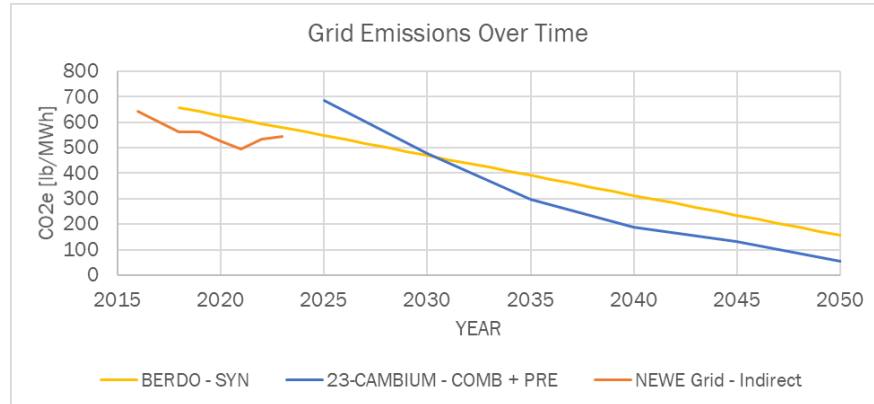
Level 3 Audit

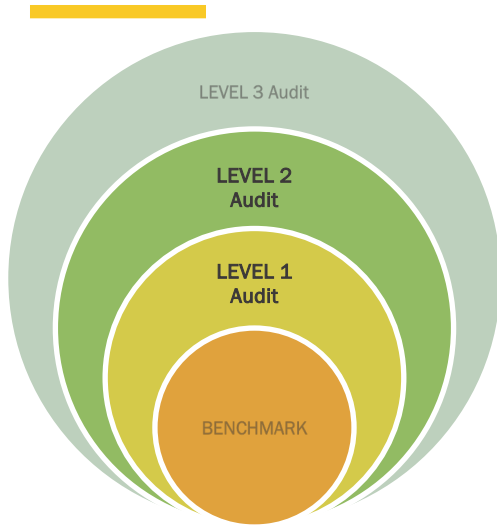
- *Expanded Analysis of Preferred Capital Measures*
- *Investment Grade – DER Level...*
- *Determination of Recommended Measures*
 - Schematic Design of Measures
 - PLACEMENT
 - Analysis
 - ENGINEERING CALCS OR ENERGY MODEL
- *Cost & Cost Savings*
 - Cost from a Vendor or similar projects within past year
 - LCCA
- *Risk Assessment*



ZERO OVER TIME

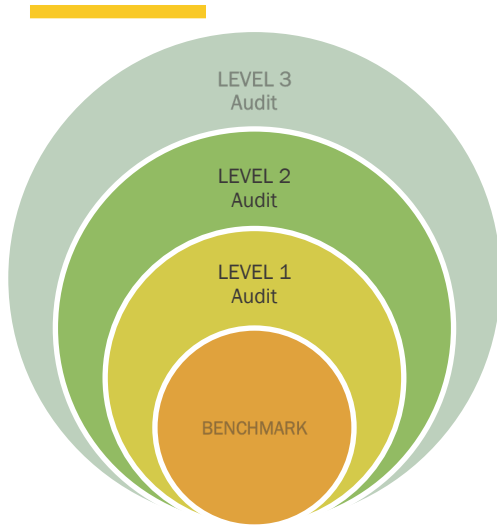
- *Decarbonization pathway with the target of Net Zero Emissions*
 - NO Onsite Fossil Fuel
 - Electrification of **ALL** systems
 - Reliant on a Greening Grid





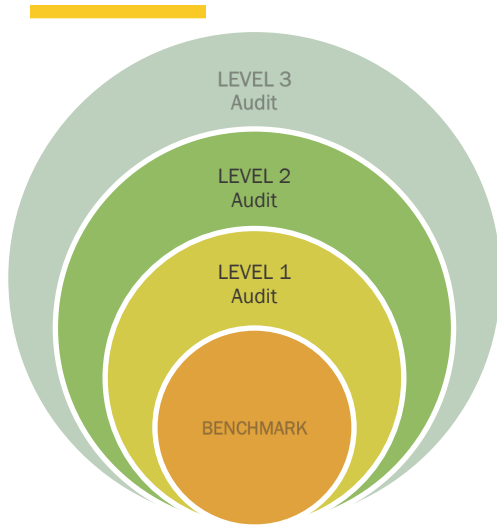
NEI Custom Mix Audits

- *Opportunity Assessment*
 - Overlap with ASHRAE Level 2
 - END USE BREAK DOWN
 - DETAIL OF CAPITAL MEASURES
 - MORE PRECISE SAVINGS – ENERGY/COST/EMISSIONS
 - LOOK MORE CLOSELY AT DESIGN POTENTIAL



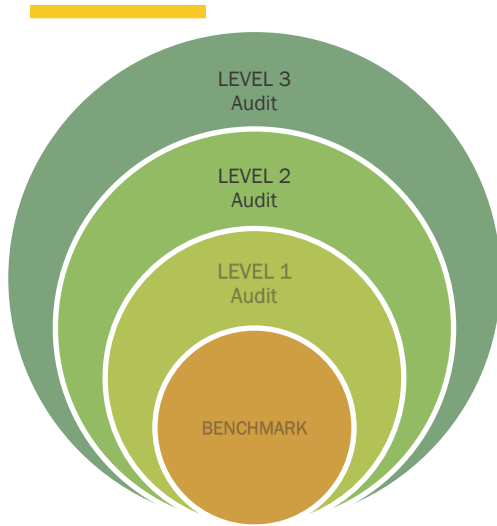
NEI Custom Mix Audits

- *Level 1 + ZOT*
 - Target Building – No Refi within 5-yrs
 - Decarbonization pathway over time
 - In Between Level 1 & Level 2
- Outputs
 - ESTIMATED SAVINGS RANGES
 - BUILDING SPECIFIC ORDER OF IMPLEMENTATION



NEI Custom Mix Audits

- *All Except HVAC + ZOT*
 - Non-HVAC Decarbonization pathway over time
 - Sites Lacking Necessary Electric Capacity for full Electrification
- Focus on Load Reductions
 - ENVELOPE
 - INTERNAL LOADS
 - DOMESTIC HOT-WATER
 - OPTIMIZATION OF FOSSIL FUEL SYSTEMS
- Outputs
 - ANTICIPATED SAVINGS RANGES
 - BUILDING SPECIFIC ORDER OF IMPLEMENTATION



NEI Custom Mix Audits

- *Level 2 + ZOT*
 - Target Building
 - NEAR-TERM REFINANCE
 - DEEP ENERGY RETROFIT TARGET
 - Decarbonization pathway over time
 - In Between Level 2 & Level 3
- Outputs
 - DETAILED ECONOMIC & CARBON CALCULATIONS
 - PROJECTED SAVINGS RANGES
 - BUILDING SPECIFIC ORDER OF IMPLEMENTATION
 - FOCUSED ON NEAR-TERM PACKAGE OF MEASURES